Puget Sound Regional Council

Regional Aviation Baseline Study

Final Report *May 2021*

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Acronyms

AFB ..... Air Force Base
FAA ..... Federal Aviation Administration
HCT ..... High-Capacity Transit
JBLM ..... Joint Base Lewis-McChord
KCIA ..... King County International/Boeing Field
MSA ..... Metropolitan Statistical Area
NPIAS ..... National Plan of Integrated Airport Systems
PSRC ..... Puget Sound Regional Council
SAF ..... Sustainable Aviation Fuel
SAMP ..... Sustainable Airport Master Plan
Sea-Tac ..... Seattle-Tacoma International Airport
TNC ..... Transportation Network Company
UHSGT ..... Ultra-High-Speed Ground Transportation
WSDOT ..... Washington State Department of Transportation

1. Introduction

1.1 STUDY BACKGROUND AND PURPOSE

The central Puget Sound region plays a pivotal role in aviation in the Pacific Northwest. The region serves as the hub for the 5th largest airline by enplanements (Alaska Airlines), serves as the West Coast gateway for the nation's 2nd largest airline by enplanements (Delta Air Lines), contains the 8th busiest airport in the nation (Seattle-Tacoma International Airport [Sea-Tac]), and hosts major manufacturing and operations activities of the largest aerospace company in the world—the Boeing Company. The aviation system is a critical part of an ecosystem that supports high paying jobs, housing, and economic development.

In March 2020, COVID-19 struck the United States and severely affected air travel worldwide. However, by March 22, 2021, U.S. airline executives saw concrete signs of a domestic leisure travel recovery as a slowing pandemic and 21% of the U.S. population (having received at least one dose of a vaccine) drove spring and summer bookings. According to Transportation Security Administration data, more than 1.3 million passengers were screened in U.S. airports on that Friday and Sunday, the highest number since the pandemic crushed air travel in 2020. Airports and airlines estimate a recovery to 2019 levels by 2023 to 2024.[1]

The Regional Aviation Baseline Study (the Baseline Study) provides a clear picture of the different roles and purposes of each aviation activity at each of the region's airports, describes how these activities interact, and identifies future needs in the central Puget Sound region (King, Pierce, Snohomish, and Kitsap Counties) to set the stage for future planning. This study will provide a common baseline for policymakers about the region's aviation needs and options to consider for meeting those needs in the future. This study is the first phase of potentially more focused studies on specific areas of emphasis.

Recent rapid growth is likely to affect the quality and level of aviation service. State and regional leaders need solid and reliable information about the current usage and projected regional growth to adequately plan and provide for future aviation needs. The desired outcomes of the Baseline Study follow:

- Identify the roles of each airport and the aviation activities within the region.
- Provide a regional perspective on how aviation activities at airports in the study area interact with each other, the community, and the broader economy.
- Obtain input from stakeholders about their needs and build a common understanding about aviation and airspace constraints.
- Identify future aviation needs within central Puget Sound region and set the stage for future planning.

[1] Lexi Lonas. "TSA screens over 1.5 million passengers heading into holiday weekend", The Hill. April 3, 2021. https://thehill.com/policy/transportation/tsa/546313-tsa-screens-15-million-passengers-heading-into-holiday-weekend

The study provides a regional understanding of the aviation system. In addition to data gathered about the system and from aviation stakeholders, the study leverages data from current airport master planning efforts and other regional/statewide aviation studies.

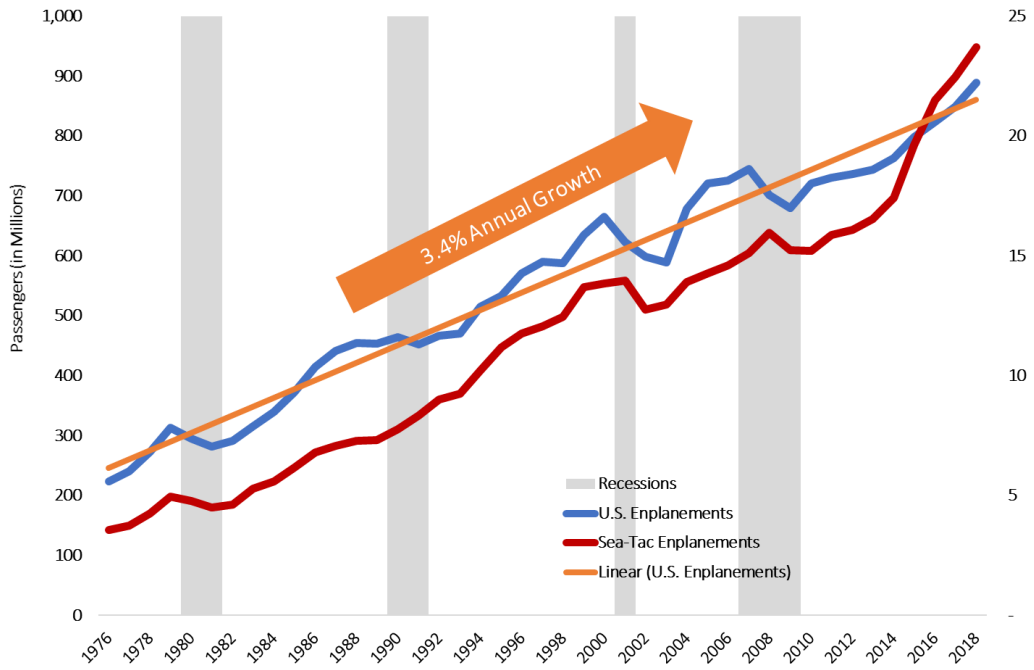
1.2 COMMERCIAL AVIATION COORDINATING COMMISSION

In a separate effort, in 2019 the state legislature created the Commercial Aviation Coordinating Commission. The Washington State Department of Transportation (WSDOT) manages the commission, which will develop recommendations to meet Washington state's critical aviation system capacity needs. The commission has been tasked with recommending a new primary commercial aviation facility and additional ways to accommodate capacity needs at other facilities. You can learn more about this effort on WSDOT's website.

1.3 COVID-19 IMPACTS ON AVIATION

This study began in 2019, before the COVID-19 pandemic affected aviation. Many of us are staying close to home right now, and passenger traffic at Sea-Tac has slowed as a result. Aviation has experienced dips in growth over the past 40 years, particularly during economic recessions, but long-term aviation growth has remained consistently positive. **Figure 1-1** shows the passenger boardings, or enplanements, for both the United States and Sea-Tac over the past 40 years. These trends are discussed in detail later in this report. We expect the long-term forecasts outlined in this study to remain representative of the long-term demand of the region.

Figure 1-1. United States and Seattle-Tacoma International Airport Enplanements (1976 to 2018)



1.4 ORGANIZATION OF REPORT

Following this introduction, the report is organized as follows:

- Chapter 2 provides an overview of the study.
- Chapter 3 describes existing conditions and presents the trends and forecasts affecting aviation.
- Chapter 4 outlines metrics and benchmarks used to analyze the future needs by aviation sector.
- Chapter 5 presents an assessment of the future requirements by aviation sector, including access to the airports.
- Chapter 6 describes several scenarios that were developed to address the future needs and summarizes the benefits and challenges of each.
- Chapter 7 presents criteria and an evaluation of the potential of existing airports in the region to meet the future needs.
- Chapter 8 summarizes the study public engagement process and findings.
- Chapter 9 provides an overview of several separate studies that are relevant to this effort.
- Chapter 10 outlines conclusions and suggested next steps.

2. Study Overview

2.1 GOALS AND OBJECTIVES

The study team conducted a review of relevant plans and policies at the start of the study and identified certain goal areas from the Washington Aviation System Plan, completed by WSDOT Aviation in 2017, as relevant for use in this study. The team developed objectives associated with each goal area. Table 2-1 shows the study goal areas and objectives.

Table 2-1. Regional Aviation Baseline Study Goal Areas and Objectives

STUDY GOAL AREAS	STUDY OBJECTIVES
Economic Development and Vitality	▪ Identify aviation needs of growing population. ▪ Support meeting aviation needs to support economic growth now and in future. ▪ Support needs of aerospace industry for manufacturing and cargo that must be on, or in the immediate vicinity of, the airport. ▪ Quantify the economic impacts of each airport using Federal Aviation Administration guidance.
Education, Outreach, and Community Engagement	▪ Understand community perceptions about regional aviation needs. ▪ Provide information that is credible and provides a consistent base for stakeholders and decision makers regarding the aviation system and constraints. ▪ Obtain feedback from the general public regarding aviation needs and scenarios to address them.
Infrastructure Improvement, Preservation, and Capacity	▪ Develop a set of benchmarks that identify what each airport needs to fulfill its role. ▪ Determine the aviation demand and capacity at each airport based on airport master plans and other existing plans. ▪ Assess the existing and future regional aviation airspace configurations and constraints, taking into consideration Federal Aviation Administration NextGen airspace improvements.
Modal Mobility, Capacity, and Accessibility	▪ Provide adequate ground access to/from airports. ▪ Support road capacity and access improvement alternatives. ▪ Support and improve multimodal connections, including multiple transportation options for users. ▪ Support adequate vehicle parking at airports.
Stewardship	▪ Protect the continued operation of airports from encroachment by limiting incompatible uses and development on adjacent lands.

2.2 STUDY ORGANIZATION

2.2.1 Project Sponsors/Management Team

The Puget Sound Regional Council (PSRC) led this study with a grant from the Federal Aviation Administration (FAA). PSRC develops policies and coordinates decisions about regional growth, transportation, and economic development planning within King, Pierce, Snohomish, and Kitsap Counties. PSRC is composed of over 80 jurisdictions, including all four counties, cities and towns, ports, state and local transportation agencies, and tribal governments within the region. PSRC's Executive Board is overseeing the study. The FAA participated throughout the project and provided technical review and guidance. A project management team comprising representatives of both agencies and the consultants met bi-weekly throughout the study period and provided review and comment on all products.

2.2.2 Technical Working Group

To support study transparency and ensure timely stakeholder input during each phase, the study team consulted stakeholders so that their perspectives were considered in developing findings and recommendations. As a part of this effort, a Technical Working Group—comprising representative airports, airlines and other major stakeholders in the aviation industry—was established. The group met at three points during the study to review draft technical papers.

Participating organizations included the following:

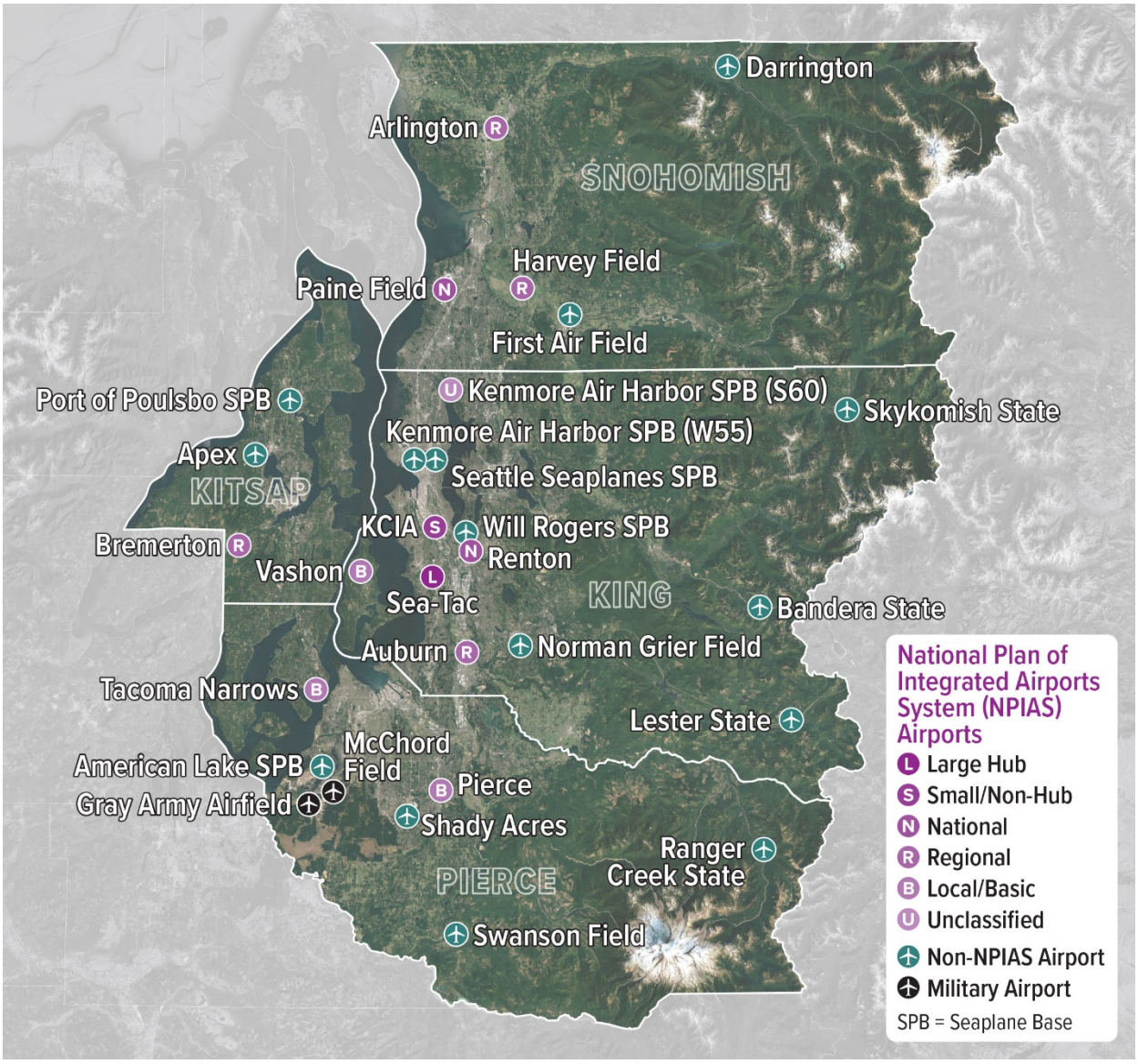
- Alaska Airlines
- Boeing
- Delta Air Lines
- King County International Airport (KCIA)
- Lynden International
- Paine Field/Snohomish County Airport (Paine Field)
- Port of Bremerton
- Renton Municipal
- Seattle-Tacoma International Airport (Sea-Tac)
- TransGroup
- Washington Airport Management Association
- WSDOT, Aviation Division

2.3 STUDY AREA AND AIRPORTS

The central Puget Sound region covers four counties: Snohomish, King, Pierce, and Kitsap. As shown in **Figure 2-1**, the aviation system in the study area consists of 27 public-use airports and two military base airports—McChord Field and Gray Army Airfield—which are on Joint Base Lewis-McChord. The following three airports are considered regionally significant, and play a critical role in the commercial passenger, air cargo, and commercial jet aircraft production markets:

- Sea-Tac
- KCIA
- Paine Field

Figure 2-1. Regional Aviation Baseline Study Area and Relevant Airports



Source: WSP based on Federal Aviation Administration, National Plan of Integrated Airport Systems (2019–2023)

The region's public-use airports are vital to their communities and support the region's economy and air transportation network.

While outside of the central Puget Sound region, because of their importance to the Washington state airport system and/or proximity to the region, the following four airports were considered for their influence on study area airports:

- Bellingham International
- Spokane International
- Grant County International
- Olympia Regional

These airports are not analyzed in a similar manner to the regional airports but are included because their influence affects the region/airspace.

2.3.1 Agency Jurisdiction

The FAA works closely with state aviation agencies and local planning organizations to identify public-use airports that are important to the system for inclusion in the National Plan of Integrated Airport Systems (NPIAS). The NPIAS identifies nearly 3,330 existing and proposed airports that are included in the national airport system, the roles they currently serve, and the amounts and types of airport development eligible for federal funding under the Airport Improvement Program over the next 5 years. The FAA is required to provide Congress with a 5-year estimate of Airport Improvement Program-eligible development every two years. The Secretary of Transportation transmitted the 2021 to 2025 NPIAS to Congress on September 30, 2020. The NPIAS contains all commercial service and reliever airports, and selected public-owned general aviation airports.

Airports are grouped by statute into two major categories: primary and nonprimary. Primary airports are defined in the FAA's authorizing statute as public airports that receive scheduled air carrier service with 10,000 or more enplaned passengers per year. Primary airports are further grouped into four hub categories defined in statute: large hub, medium hub, small hub, and nonhub.

Nonprimary airports include commercial service airports (public airports receiving scheduled passenger service and between 2,500 and 9,999 enplaned passengers per year), general aviation airports, and reliever airports. General aviation airports are further grouped into five FAA defined roles: national, regional, local, basic, and unclassified.

2.3.2 Hierarchy of Airports

Table 2-2 lists the airports in the study area. The NPIAS includes 12 airports in the central Puget Sound region that are federally obligated.[2] This includes three primary airports, three reliever airports, and six general aviation airports. In addition, 15 non-NPIAS airports comprise general aviation airports and seaplane bases. Finally, the study area includes one military base that comprises two airfields.

In sum, the study area includes the following:

- One large-hub primary airport (Sea-Tac)
- Two nonhub primary airports KCIA and PAE
- Nine NPIAS-general aviation airports
- Fifteen non-NPIAS airports
- One military installation with two airports

Among the civilian facilities are the following:

- Commercial service and air cargo airports (KCIA and Sea-Tac with Paine Field initiating passenger service in March 2019)
- Three industrial airports involved with large aircraft manufacturing (KCIA, Paine Field, and Renton Municipal)
- Six seaplane bases
- Multiple general aviation facilities

2.4 STUDY SCOPE

The Baseline Study sought to support future planning efforts by collecting information about the following:

- Existing conditions and recent trends in aviation, including the roles of each airport and the aviation activities within the study area.
- Economic contributions of regional aviation sectors and the factors that affect different market sectors.
- A conceptual level of analysis of primary airspace flows and relevant airspace constraints. The airspace was analyzed whether the current airspace system can deliver future demand scenarios.
- Relationships and dependencies between airports within the region and with the National Airport System.
- Landside access to the region's airports and adequacy to meet future demand.
- Community perspectives, concerns, issues, and impacts identified through a robust stakeholder engagement process.

[2] Federally obligated airports are public airports where the airport sponsors have accepted federal assistance, either in the form of grants or property conveyances.

Table 2-2. Airports in the Study Area

S. NO.	AIRPORT NAME (NAME USED IN FINAL REPORT)	FAA I.D.	CITY	COUNTY	DESIGNATION	SERVICE LEVEL
1	Seattle-Tacoma International (Sea-Tac)	SEA	Seattle	King	NPIAS	Primary
2	King County International/ Boeing Field (KCIA)	BFI	Seattle	King	NPIAS	Primary
3	Paine Field/Snohomish County International (Paine Field)	PAE	Everett	Snohomish	NPIAS	Primary
4	Renton Municipal	RNT	Renton	King	NPIAS	Reliever
5	Auburn Municipal	S50	Auburn	King	NPIAS	Reliever
6	Harvey Field	S43	Snohomish	Snohomish	NPIAS	Reliever
7	Kenmore Air Harbor Seaplane Base (SPB)	S60	Kenmore	King	NPIAS	General Aviation
8	Vashon Municipal	2S1	Vashon	King	NPIAS	General Aviation
9	Bremerton National	PWT	Bremerton	Kitsap	NPIAS	General Aviation
10	Pierce County	PLU	Puyallup	Pierce	NPIAS	General Aviation
11	Tacoma Narrows	TIW	Tacoma	Pierce	NPIAS	General Aviation
12	Arlington Municipal	AWO	Arlington	Snohomish	NPIAS	General Aviation
13	Bandera State	4W0	Bandera	King	Non-NPIAS	General Aviation
14	Lester State	15S	Lester	King	Non-NPIAS	General Aviation
15	Skykomish State	S88	Skykomish	King	Non-NPIAS	General Aviation
16	Norman Grier Field	S36	Kent	King	Non-NPIAS	General Aviation
17	Kenmore Air Harbor SPB	W55	Seattle	King	Non-NPIAS	General Aviation
18	Seattle Seaplanes SPB	0W0	Seattle	King	Non-NPIAS	General Aviation
19	Will Rogers—Wiley Post Memorial SPB	W36	Renton	King	Non-NPIAS	General Aviation
20	Apex Airpark	8W5	Silverdale	Kitsap	Non-NPIAS	General Aviation
21	Port of Poulsbo SPB	83Q	Poulsbo	Kitsap	Non-NPIAS	General Aviation
22	Ranger Creek State	21W	Greenwater	Pierce	Non-NPIAS	General Aviation
23	Swanson Field	2W3	Eatonville	Pierce	Non-NPIAS	General Aviation
24	Shady Acres Airport	3B8	Spanaway	Pierce	Non-NPIAS	General Aviation
25	American Lake SPB	W37	Tacoma	Pierce	Non-NPIAS	General Aviation
26	Darrington Municipal	1S2	Darrington	Snohomish	Non-NPIAS	General Aviation
27	First Air Field	W16	Monroe	Snohomish	Non-NPIAS	General Aviation
28	McChord Field	TCM	Tacoma	Pierce	Non-NPIAS	Military
29	Gray Army Airfield	GRF				
AIRPORTS TO BE CONSIDERED DUE TO THEIR INFLUENCE ON THE CENTRAL PUGET SOUND						
	Bellingham International	BLI	Bellingham	Whatcom	NPIAS	Primary
	Olympia Regional	OLM	Olympia	Thurston	NPIAS	General Aviation
	Grant County International	MWH	Moses Lake	Grant	NPIAS	General Aviation
	Spokane International	GEG	Spokane	Spokane	NPIAS	Primary

2.5 STUDY PHASES

The study included the following key phases:

- **Airport and Aviation Activity Analysis Phase –** During this phase, the study team examined existing conditions, regional demand forecasts, goals, objectives, and metrics for the system, and analyzed socioeconomic conditions, market trends, airspace flow, and multimodal connections. Working Paper 1, "Airport and Aviation Activity" was the key deliverable.[3]
- **Future Aviation Issues Analysis Phase –** During this phase, the study team analyzed the feasibility of airports in the region to accommodate demand. Working Paper 2, "Airport Needs Analysis" was the key deliverable along with a separate analysis of the regional airspace system.
- **Scenarios Definition and Evaluation Phase –** During this phase, the study team defined and evaluated scenarios for accommodating future aviation demand as well as the regional economic and high-level environmental effects of the aviation industry. Working Paper 3, "Development and Evaluation of Scenarios" was the key deliverable.
- **Final Report and Project Completion –** The key findings are published in this report.

2.6 LIMITATIONS

This study provides a regional overview of needs and offers some perspectives about different approaches to addressing projected aviation gaps. However, it is not a master plan or a siting study. An airport master plan is a comprehensive study of an airport and usually describes the short-, medium-, and long-term development plans to meet future 20-year aviation demand. Sometimes an existing airport cannot be expanded to meet the future demand and a new or supplemental airport is required. In these cases, a new airport site may be selected as part of an airport's planning process or as identified through a siting study.

The Baseline Study builds on master planning processes underway at many of the region's airports. The study provides empirical data and describes potential scenarios to accommodate future demand, but it is not a siting study and will not offer recommendations or solutions. The study is intended to provide a comprehensive view of the existing regional aviation system and inform follow-up actions by policymakers.

[3] All working papers referenced in this report are on the Regional Aviation Baseline Study website.

3. Existing Conditions and Aviation Demand Forecast

3.1 OVERVIEW OF REGIONAL AVIATION SYSTEM

Aviation activity is concentrated in King and Snohomish Counties within the central Puget Sound region. King County is home to 13 public-use airports and several major Boeing facilities, including the final assembly lines for the 737 and P-8 aircraft at its Renton plant, final delivery preparations, and test flights at KCIA. Snohomish County is home to five public-use airports and the Boeing facility in Everett. It is the final assembly site for the 747, 767, the new 777X (including the composite wings), composite-based 787 Dreamliner, and the Air Force's KC-46 aerial refueling aircraft, built on a 767 platform. The county also hosts suppliers and related companies. Pierce County is home to six public-use airports and two military airbases and has a smaller aerospace sector than King and Snohomish Counties, but is an important center for suppliers and related industries. Kitsap County has three public-use airports and aerospace-related companies.

The three commercial service airports are discussed along with their contributions to the region. Sea-Tac connects the central Puget Sound region to the world, by serving approximately 50 million passengers annually. Thirty-four airlines serve 91 nonstop domestic and 28 international destinations. Sea-Tac is in King County, with the entire airport covering an area of 2,500 acres or 3.9 square miles—which is much smaller than other U.S. airports with similar annual passenger numbers—and is severely constrained by urban development and existing topography. Sea-Tac is one of the region's leading economic engines. From airport workers who live in neighboring communities to cherry farmers in central Washington, and from shops in tourist destinations like Pike Place Market to corporate giants like Microsoft and Boeing, Sea-Tac touches nearly every aspect of the economy in the central Puget Sound region. Sea-Tac's economic impact totaled $22.5 billion in business revenues in 2017. [4]

KCIA is one of the nation's busiest primary nonhub airports and is in King County. The airport averages 200,000 takeoffs and landings each year. The airport serves small commercial passenger airlines, cargo carriers, private aircraft owners, helicopters, corporate jets, and military, and other aircraft. It is also home to Boeing Company final production aircraft services and flight testing operations as well as The Museum of Flight. This airport is severely land constrained with ongoing urban encroachment. The airport is confined by the Duwamish River and Boeing Complex to the west and major railway and interstate to the east. Due to its strategic location just four miles south of downtown Seattle and close to other business centers, it frequently hosts celebrities, dignitaries, and sports teams, and supports $3.5 billion in local business.[5]

Paine Field is a unique airport located in Snohomish County, particularly with the recent change in status with commercial and Part 139 certification.[6] The airport has 24 daily flights by Alaska and United Airlines

4 https://www.portseattle.org/page/airport-basics
5 https://www.kingcounty.gov/services/airport.aspx
6 Part 139 certification includes requirements for airports serving scheduled air carrier operations in aircraft designed for more than 9 passenger seats but less than 31 passenger seats.

and is home to over 650 aircraft, including small, single-engine recreational aircraft, corporate jets, vintage Warbirds, and Boeing Dreamliners. Located about 30 miles north of downtown Seattle, the airport has become a major tourist destination with the opening of the Future of Flight Aviation Center & Boeing Tour, the Flying Heritage & Combat Armor Museum, and the Historic Flight Foundation. Other attractions include the Legend Flyers-Me-262 Project and the Museum of Flight Restoration Center. The airport's economic impact is estimated at $20 billion annually.[7]

Airports in the central Puget Sound region serve different sectors and roles, such as business, recreation, flight instruction, medical, search and rescue, and law enforcement. The four counties that make up the central Puget Sound region are unique in their demographics, economics, and geographic terrain, thus, requiring the airports to serve a diverse need within the region.

3.1.1 King County

The population of the county is 2,188,649 (based on the 2017 census) and the county seat is Seattle, which is the largest city in the state. The county has a total area of 2,307 square miles; land makes up 2,116 square miles and water makes up 191 square miles. Sea-Tac and KCIA serve the population and businesses of this county. Additionally, this county has two general aviation reliever airports: Renton Municipal and Auburn Municipal.

Renton Municipal is home to Boeing 737 production and is co-located with Will Rogers-Wiley Post Memorial SPB, supporting economic vitality and tourism to the area. Auburn Municipal is a general aviation reliever airport and is the third-busiest in Washington state for average daily operations. This airport has limited room to expand, and future redevelopment will depend on rerouting major arterial roads. Kenmore Air Harbor SPB S60 on Lake Washington is a privately owned SPB classified as a commercial service airport. Vashon Municipal has a single turf runway that provides year-round access/exit to Vashon island and is particularly important when ferry service is disrupted.

Additionally, three state-owned airports—Bandera State, Lester State, and Skykomish Airports—are within the county. These airports are at relatively higher altitude—above 1,600 feet (except Skykomish, which is at 1,002 feet)—and are open seasonally between June 1 and October 1. The airports support emergency management functions, emergency medical operations, firefighting, law enforcement and recreational activities. Norman Grier Field is family owned and provides flight school and training for the nearby Green River community. In addition to Kenmore Air Harbor SPB S60 on Lake Washington, the county also has three additional SPBs to connect various island communities to the region. Kenmore Air Harbor SPB W55, Seattle Seaplanes SPB on South Lake Union, and Will Rogers-Wiley Post Memorial on Lake Washington are in King County. Kenmore Air Harbor SPB W55 is at Lake Union in Seattle and connects Washington state and Vancouver Island. Seattle Seaplanes SPB is privately owned and offers scenic flights and pilot training.

[7] https://www.painefield.com/27/About-Our-Airport

3.1.2 Snohomish County

The population of the county is 801,633 (based on 2017 census data). Everett is the county seat and largest city. The county has a total area of 2,196 square miles; land comprises 2,087 square miles and water comprises 109 square miles. Paine Field is in this county. Additionally, Snohomish County hosts one privately owned, public-use general aviation reliever airport—Harvey Field—which is family owned and is 8 miles from Paine Field. Arlington Municipal is a general aviation airport located strategically at the economic center of Arlington and could be expanded into a reliever airport. The City of Arlington recognizes this importance and opportunity and continues to support the airport through city planning, financing, and development. Snohomish County also houses Darrington Municipal (co-owned) and First Air Field (privately owned).

3.1.3 Pierce County

The population of the county is 876,764 (based on 2017 census data). Tacoma is the county seat and largest city. The county has a total area of 1,806 square miles; land comprises 1,670 square miles and water comprises 137 square miles. Pierce County is notable for being home to Mount Rainier (the tallest mountain in Washington state) and a volcano in the Cascade Range. General aviation airports Pierce County and Tacoma Narrows are located within the county. Pierce County Airport is the sixth-busiest airport in the state, is 25 miles northwest of Mount Rainier, and serves as the base for search/rescue operations and emergency response. Tacoma Narrows has a control tower, thus, making it an ideal training facility for student pilots and military operations and provides for corporate aviation serving the Greater Tacoma region.

Ranger Creek State is a state-managed airport that is seasonally open between June 1 and October 1. This airport is at 2,650 feet in the White River Valley not far from Mount Rainier, and supports emergency management, forest fire fighting, emergency medical operations, and recreation. Swanson Field is a public airport 25 miles from Mount Rainier. Shady Acres Airport is privately owned and American Lake SPB serves as a seasonal aircraft charter and provides emergency medical aircraft operations. Pierce County also serves as the home for two military base airports: McChord Field and Gray Army Airfield that are located on Joint Base Lewis-McChord.

3.1.4 Kitsap County

The population of the county is 266,414 (based on 2017 census data). The county seat is Port Orchard and the largest city is Bremerton. The county has a total area of 566 square miles; land comprises 395 square miles and water comprises 171 square miles. Bremerton National is a general aviation airport owned by the Port of Bremerton that supports regional business activities through its connected business park as well as military activities. In cases of emergency or natural disaster, Bremerton National provides a corridor of transportation. Apex Airpark is privately owned and has recently opened to the public. This airpark is located 2 miles south of the prohibited airspace over the Bangor naval submarine base and intercontinental ballistic missile base. Port of Poulsbo SPB is a popular destination for seasonal recreational flights. The Port

of Bremerton is making plans to explore and expand seaplane operations to build a commercial seaplane terminal.

3.2 TRENDS AND FORECASTS BY AVIATION SECTOR

3.2.1 Commercial

Overall, local population and economy growth is providing a catalyst for the increase in the central Puget Sound region's aviation demand. From 2010 to 2017, population in the four PSRC counties grew at a faster rate than Washington state and the United States. Additionally, the proximity to Canada and its third-most-populous metropolitan area—Vancouver, British Columbia—has further served as a catalyst for additional demand for transporting people and goods in this region. Comparatively cheaper air fare options, lower airline taxes in the United States, differences in airline competition at airports, lower costs for domestic flights, and the presence of discount airlines in the United States make it appealing to the residents in bordering Canadian cities to utilize Sea-Tac and other airports within reasonable proximity to the Canadian border. Finally, Delta Air Lines' development of Sea-Tac as its West Coast hub and its primary gateway to Asia—in addition to the increased competition between Delta and Alaska Airlines—has further driven growth of aviation demand in the region. Commercial enplanements in the central Puget Sound region are forecast to grow between 2.4% and 2.8% annually between 2017 and 2050 while aircraft operations are forecast to increase between 2.1% and 2.4% annually for the same period. This study began in 2019, before the COVID-19 pandemic began to affect aviation, and growth in passenger traffic at Sea-Tac has slowed as a result in 2020-2021. There have been dips in aviation growth over the past 40 years, particularly in line with recessions, but long-term aviation growth has remained consistent. We expect the long-term forecasts outlined in this study to remain representative of the long-term demand of the region.

3.2.2 General Aviation

General aviation airports in the central Puget Sound region serve different sectors of the aviation community based on the location and local demand. The unique geographic terrain of the region is a mix of coastal land, Puget Sound low lands, and the Olympic and Cascade mountain ranges, and is home to Mount Rainier, and a volcano in the Cascade mountain range. It is characterized by a complex array of saltwater bays, islands, and peninsulas carved out by prehistoric glaciers. Thus, the geographic terrain presents unique opportunities for recreational flight and tourism, in addition to business, flight instruction, medical, emergency management, law enforcement, local transportation (air ferry), and search/rescue operations. Depending on the needs of the user, several different airports meet the needs of the varying interests within the region as outlined in the discussion of the four counties previously.

In the central Puget Sound region, the overall pilot population is remaining steady while the private pilot population is experiencing a slow decline, which is similar to trends at the state and national levels. This trend will likely affect the user-base at many of the noncommercial service airports in the central Puget Sound region. Aircraft-maintenance technician numbers in the region are also declining, affecting the services and necessary time for repairs to general aviation aircraft. Finally, a decrease in nationwide

personal flight hours stems from the decline in pilots and mechanics available to service and fly general aviation aircraft—an important trend that could affect the future of central Puget Sound region airports.

The technological trends that are affecting general aviation are important qualitative areas of the industry that are also highly unpredictable, with new regulations and improvements affecting how they are implemented. The FAA has mandated that all aircraft be outfitted with Automatic Dependent Surveillance–Broadcast Out, which provides air traffic controllers with information that is critical to ensuring aircraft separation via satellite rather than ground-based radar. This could result in a portion of the general aviation fleet being denied use of certain airspace starting January 2020, although, that denial should last only until the avionics industry can catch up with Automatic Dependent Surveillance–Broadcast installation requests.

In the central Puget Sound region, the replacement of avgas and the advent of electric-powered aircraft could lead to an increase in the types of aircraft and number of pilots, with cheaper and more user- and environmentally friendly options becoming available.

3.2.3 Air Cargo

Air cargo services enable global marketing of goods and services, providing a competitive transportation medium, especially for time-sensitive products and trade with distant markets. Economic growth, international trade, and air transport are inextricably linked. Specifically, air cargo service:

- Provides fast and reliable delivery of high-value products especially relevant to central Puget Sound region industries, such as the pharmaceutical, technology, aircraft assembly, and aerospace equipment sectors.
- Supports the express carrier industry, which provides guaranteed, rapid, and door-to-door delivery services, and increasingly offers logistics support for companies.
- Facilitates the development of e-commerce, enabling companies to transport online shopping orders quickly and reliably between regions and countries and allowing products to be stored in large warehouses, which reduces retail and distribution costs.
- Allows improved stock management and production techniques, reducing companies' storage costs, losses due to stock outages, and disruption caused by failure of machinery on production lines.
- Improves companies' handling of returns and complaints, allowing a quick turnaround of repairs or delivery of replacement parts.

Air cargo in the central Puget Sound region is generated primarily by activity at Sea-Tac and KCIA, which, combined, account for over 85% of the total Washington state market. Sea-Tac handles two-thirds of the cargo tonnage and has the greatest variety of cargo offerings in the central Puget Sound with a mix of domestic and international belly cargo, domestic and international freighter cargo, as well as integrator/express cargo generated by FedEx, DHL, and Amazon Air.

The integrator all-cargo carrier, UPS, almost exclusively generated the air cargo at KCIA. Paine Field generated approximately 19,300 metric tons of air cargo in 2017. Almost all the air cargo at Paine Field was entirely related to the Boeing aircraft assembly process and for all intents and purposes should be considered general aviation rather than commercial air cargo activity.

According to the recently completed Washington State Air Cargo Goods Movement Study, fresh cherries and seafood together represented over one-quarter of the region's air cargo exports, by metric tons, in 2016. Sea-Tac is a significant gateway to East Asia for footwear parts, electronic integrated circuits, and machines and apparatus for manufacturing semiconductors. Most of the growth in air cargo within the region is driven by the increase in international wide-body aircraft air service at Sea-Tac and the growth of e-commerce. Air cargo at Sea-Tac increased by 16% from 2016 to 2017, although preliminary data from 2018 indicates a moderation of this growth to less than 2% year-over-year due to a significant drop in the cherry export season.

The robust regional economy will serve as a catalyst for both domestic and international air cargo demand in the long term. The air cargo forecast anticipates average annual growth of 2.75% for the 33-year period between 2017 and 2050.

3.3 KEY MULTIMODAL CONNECTIONS AND ACCESS

The central Puget Sound region has invested in a strong multimodal connection to the interstate highway system, state highways, and public transportation that are necessary to connect airports to the four-county region and beyond. Interstate and state route access and transit connect the three commercial service airports—Sea-Tac, KCIA, and Paine Field. Overall, 24 out of the 26 active, nonmilitary system airports are within 2 miles of an interstate, U.S., or state route, indicating that most airports are easily accessible by automobile for local trips. However, only 12 of these airports are within 5 miles of an interstate, which provides an important connection to the rest of the state for recreational, business, and freight operations. The relatively limited number of airports within close proximity to an interstate places additional emphasis on this group for current and future charter, commercial, and cargo operations.

Rental car companies are present at four airports: Sea-Tac, Paine Field, KCIA, and Tacoma Narrows. Shuttle service is also available at Sea-Tac to and from nearby hotels. Kenmore Air Harbor SPB W55 offers a special ground-service option at Lake Union to Sea-Tac to connect passengers flying to and from remote areas.

Automobile parking is a challenge. Many of the parking spots at Paine Field are now dedicated to commercial service, which began in March 2019. Renton Municipal, co-located with Will Rogers-Wiley Post Memorial SPB, also noted a strain on parking, especially for tenants near the Boeing production facilities where there is limited area to expand. Harvey Field (in Snohomish County) indicated that an overflow gravel lot was often used when the 105-space parking lot was full. Considerations for additional parking could be made in future master plans while also considering the context of the future regional transportation system.

Congestion is a serious problem throughout the metropolitan area that particularly affects Sea-Tac and KCIA. According to the 2018 PSRC Regional Transportation Plan, the region is expected to see 16.6 million more vehicles miles per day by 2040—an increase of 21% from the base year. Hours of delay are also projected to increase dramatically, with 233,000 hours added daily to the region by 2040. Traffic growth will put pressure on roads, which underscores the need for additional transit and other alternative modes. Working Paper 1, "Airport and Aviation Activity" Chapter 7, Multimodal Connections and Access, discusses anticipated improvements and new service trends that should be considered in future planning.

4. Airport Needs

4.1 BENCHMARK EVALUATION OF PERFORMANCE BY AVIATION SECTOR

Working Paper 1, "Airport and Aviation Activity" identifies a series of metrics and Working Paper 2 establishes benchmarks for each aviation sector. Working Paper 2, "Airport Needs Analysis" Chapter 2, Benchmarks, reports the performance of each aviation sector against these industry benchmarks. Table 4-1 summarizes the commercial service benchmarks and how well the region meets these benchmarks now and predictions for meeting them in the future.

Table 4-1. Benchmarks for Commercial Service Airport Coverage and Access (Seattle-Tacoma International and Paine Field)

	BENCHMARK	SEA-TAC		SEA-TAC AND PAINE FIELD	
		2017	2050	2017	2050
Percentage Population within 60 minutes	80%[1]	62%[2]	42%[2]	83%[2]	70%[2]
Percentage Employment within 60 minutes	90%[1]	74[3]	57%[3]	90%[3]	80%[3]
Interstate Highway or Major Expressway within 5 miles	100%[4]	100%[5]	100%[5]	100%[5]	100%[6]
Highway or State Route within 2 miles	100%[4]	100%[5]	100%[5]	100%[5]	100%[6]
Direct Access to 4-lane Arterial Road	100%[4]	100%[5]	100%[5]	100%[5]	100%[6]
High-Capacity Transit Access at the Airport	100%[4]	100%[5]	100%[5]	50%[5]	100%[7]

[1]Based on analysis of relevant statewide aviation system plans
[2]Drive sheds from PSRC travel model for 2014 and 2050 and population for 2017 and 2050
[3]Drive sheds from PSRC travel model for 2014 and 2050 and employment for 2017 and 2050
[4]Desirable for commercial service airports based on subject matter expert knowledge
[5] Determined from Google Earth analysis and SoundTransit website
[6]Assumes no changes in roadway access from the current conditions
[7]As of 2017, Paine Field did not yet have high-capacity transit. Service started in 2019.

4.1.1 Multi-Airport City Analysis and Conclusions

Many regions across the country are home to multiple commercial service airports, with each airport contributing to a specific role to meet the needs of the system. As demand at Sea-Tac continues to grow and with Paine Field opening with tightly limited commercial service, it is important to look at other cities as a way of understanding potential strategies to meeting future aviation needs within the central Puget Sound region.

Sea-Tac is the largest airport in the region and has been the only commercial service airport for the Seattle metropolitan statistical area (MSA)[8] until March 2019, when Paine Field started passenger service. Sea-Tac is a connecting hub for two airlines and, as an international gateway, has a variety of domestic and international destinations. As Working Paper 2, "Airport Needs Analysis" Chapter 2, Benchmarks, further details, the Seattle metropolitan area was compared to nine other metropolitan areas:

- Los Angeles
- Chicago
- Dallas
- Houston
- Washington, DC
- Miami
- Boston
- Phoenix
- San Francisco

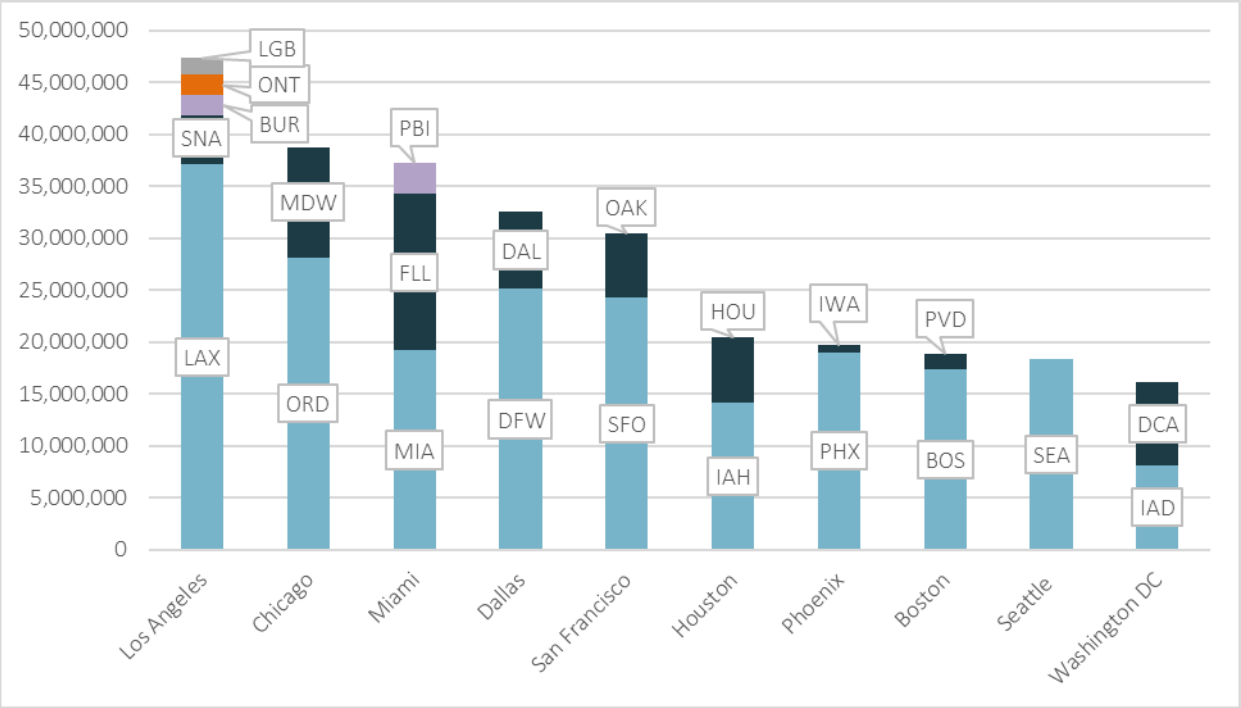
The initial purpose of this comparison was to determine if one or more catalysts prompted the justification/need for an additional commercial service airport in other regions. The data collected did not support this hypothesis. However, it did highlight several interesting comparisons between the central Puget Sound region and other regions with multiple commercial service airports.

This multi-airport city benchmarking analysis identified several factors that appear to drive the need for an additional airport(s) within a region. While the Seattle MSA is smaller in terms of population than the other cities, its high per-capita income and the presence of two airlines having connecting hub operations at Sea-Tac make it comparable with the multi-airport cities studied. **Figure 4-1** and **Figure 4-2** present the Seattle MSA's rankings for both 2017 enplanements (six of nine) and 2017 air carrier departures (eight of nine), respectively. Working Paper 2, "Airport Needs Analysis" Chapter 2, Benchmarks, details these and other findings.

Chapter 2 concludes that differences in geography and historical development among the cities or regions—such as population density—make it impossible to make straight-line comparisons and that a more detailed analysis of aviation demand and supply in the central Puget Sound region is required to ascertain the local needs for growth at these or potentially another airport. The following sections summarize the challenges and opportunities in meeting these benchmarks going forward.

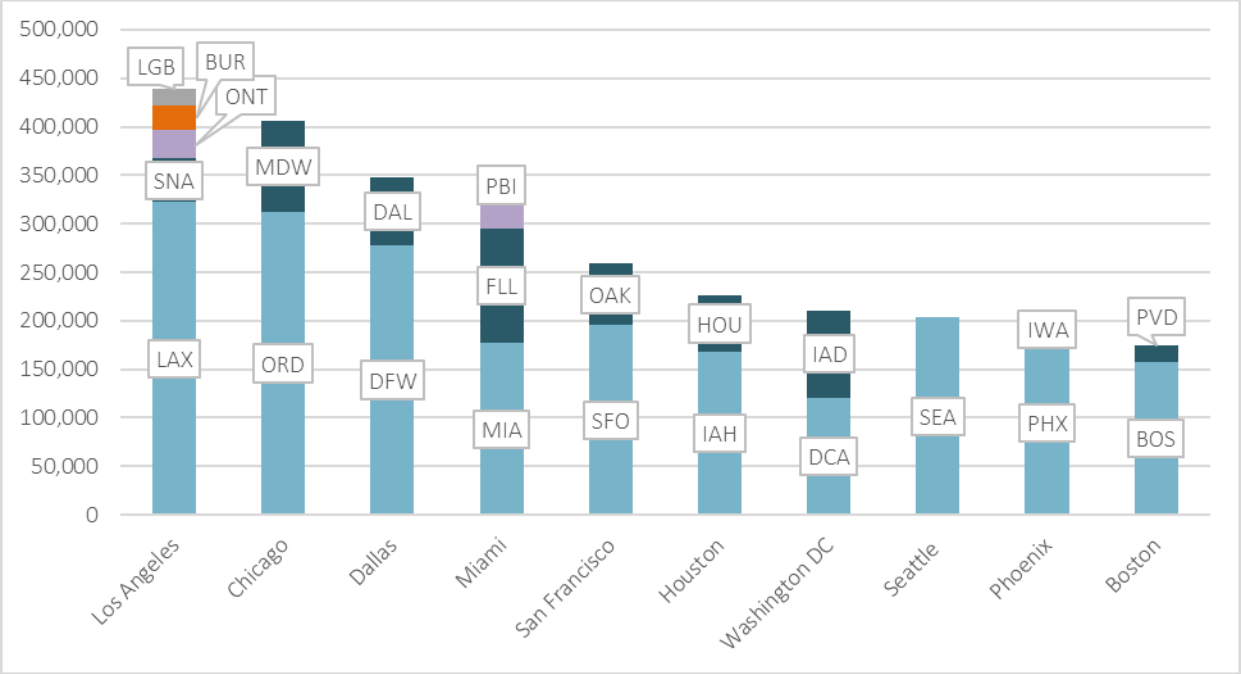
[8] An MSA is a core area containing a substantial population nucleus, together with adjacent communities having a high degree of economic and social integration with that core. https://www.census.gov/programs-surveys/metro-micro/about.html

Figure 4-1. Enplanements by Airport (2017)



Source: Federal Aviation Administration Enplanement Data, 2017
Note: Only Air Carrier Activity is included. Enplanements are departing passengers.

Figure 4-2. Airline Departures by Airport (2017)



Source: Federal Aviation Administration Air Traffic Activity System, 2017
Note: Only Air Carrier Activity is included. Departures include all air carrier takeoffs.

4.2 CHALLENGES AND OPPORTUNITIES

Many challenges face airports and aviation in general. Two important issues are replenishing the retiring pilot population and accessing limited funding to address deteriorating airfield pavements. For airports other than Sea-Tac, the Pavement Condition Index for the airports within the state continues to decrease. This is an infrastructure and funding issue. WSDOT does not have enough funding to assist airports with this issue, which affects many of the airports covered in this study.

4.1 COMMERCIAL SERVICE

4.1.1 Challenges

Working Paper 2, "Airport Needs Analysis" illustrates that the region's 60-minute commercial passenger service coverage meets the established benchmarks for population and employment coverage in 2017. However, given the limited air service available at Paine Field, the long-term coverage provided by Sea-Tac is poor, particularly for western Snohomish County and the central area of Kitsap County (**Figure 4-3)**. Providing better coverage for Snohomish County would require either adding a strong lineup of commercial service at another airport in Snohomish County or increasing commercial service at Paine Field. Coverage for central Kitsap County could be provided by commercial service at nearby airports. Overall, Sea-Tac reliever possibilities also exist but have limitations. (See Section 4.3, General Aviation, for more information.)

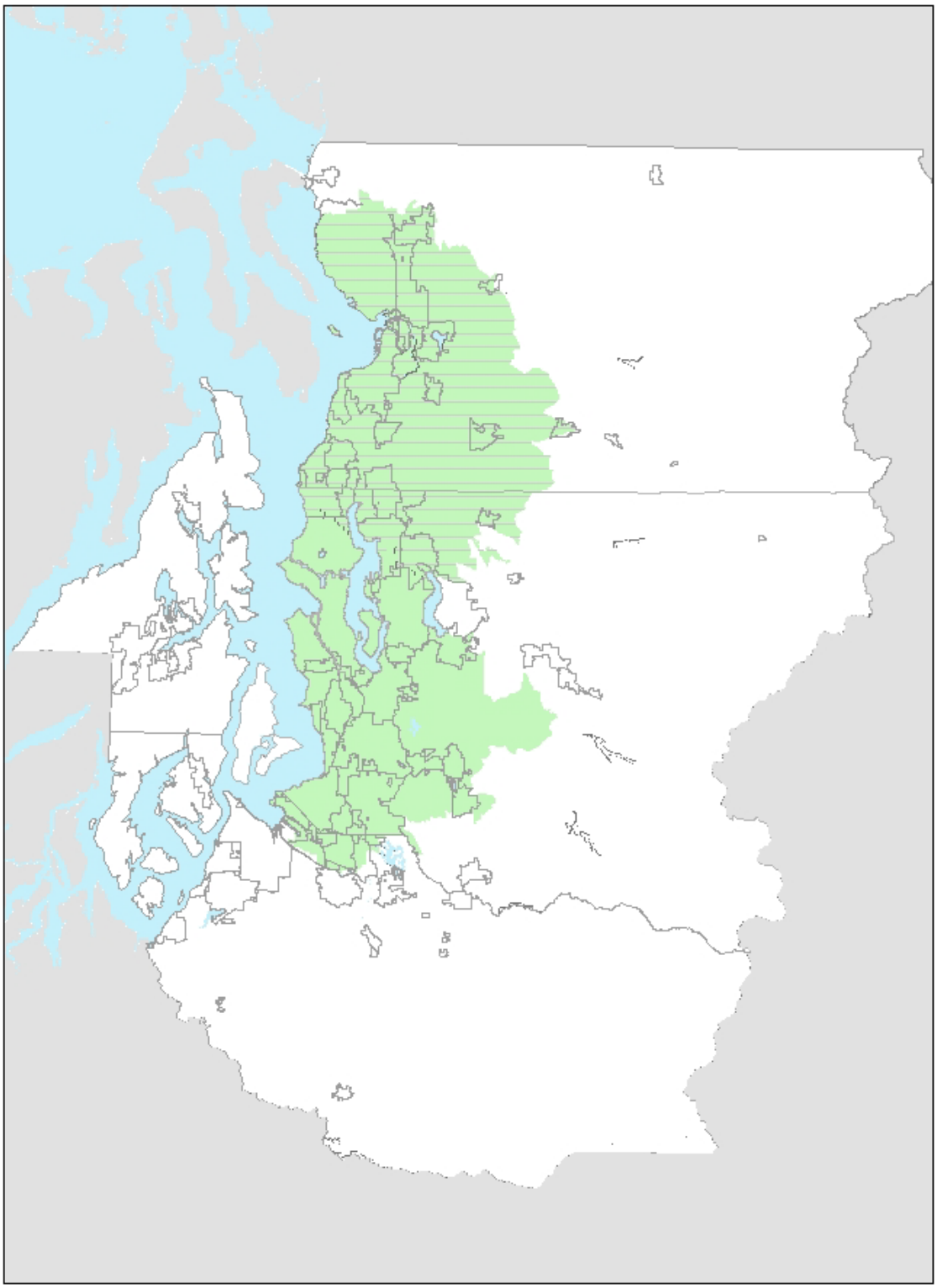
The 2018 Sustainable Airport Master Plan (SAMP) for Sea-Tac projects that if future demand levels materialize and no procedural improvements or capacity enhancements to the existing airfield are made, aircraft delay would become significant around 2029 and intolerable around 2034. The SAMP concludes that the airfield/airspace system—as currently configured and operated—can support the proposed Near-Term Projects[9] for the passengers forecast for 2027 (28 million enplanements). However, the airport would have insufficient capacity to meet the unconstrained 20-year forecast demand at a sustainable level of delay with the improvements identified in the SAMP Long-Term Vision[10] that were developed to meet requirements associated with the forecast activity of 33 million enplanements.

The issues and potential solutions involving the airfield/airspace system are complex and involve benefit-cost trade-offs. Therefore, the Port of Seattle concluded that additional study is required to address long-term capacity enhancements beyond 2027.

[9] The SAMP identifies a program of improvements referred to as "Near-Term Projects" to allow the airport to accommodate more than 28 million enplanements that are projected to occur at Sea-Tac around 2027.

[10] SAMP identifies a Long-Term Vision to accommodate approximately 33 million enplanements in 2034.

Figure 4-3. 60-Minute Drive-Time Access to Commercial Passenger Service (Seattle-Tacoma International and Paine Field) in 2050



Notes:
1 The drive time is derived from Puget Sound Regional Council's travel model for 2050.
2. Cross-hatching indicates Paine Field coverage.

KCIA depends on the aircraft arrival and departure streams from Sea-Tac. Currently, KCIA is under the Sea-Tac flight pattern, resulting in operations at the airports that are not always independent of each other. During busy periods, Sea-Tac is the priority, and KCIA can experience delays. NextGen flight procedures can ultimately resolve many of these issues. Also, when the airspace is operating in north flow—a condition that occurs only about 5% of the time—KCIA approaches conflict with operations at Sea-Tac departing to the north. Air traffic control must separate operations from the two airports in a manner that generally reduces operations and creates delay.

Southwest Airlines considered establishing a mini-hub at KCIA but abandoned the idea due to the airspace dependency. In addition, KCIA has very limited expansion capability.

Although Paine Field started commercial service in early 2019, according to the supplemental environmental assessment,[11] the airport's terminal facility can accommodate only 500,000 annual passenger enplanements with its two airline contact gates and one remote aircraft stand, which limits it growing this service further.

Accommodating the region's projected 55 million passenger enplanements in 2050 will be a challenge. Beyond the Near-Term Projects proposed by Sea-Tac that the SAMP analysis demonstrates can accommodate approximately 28 million enplaned passengers, further growth would need to rely on the following:

- Potential improvements that would be identified through additional study that the Port of Seattle would conduct as recommended by the SAMP
- Any combination of additional efficiency and capacity gains achieved by utilizing larger aircraft, higher passenger load factors, scheduling more flights during non-peak hours, and gains in airspace improvements with FAA's NextGen technologies, etc.

Sea-Tac and Paine Field have potentially limited opportunities to expand their airports to accommodate passengers beyond about 29 million enplanements. This translates to a gap of around 27 million annual enplanements for the region. Thus, if this demand cannot be accommodated at the existing commercial service airports, then it would need to be accommodated elsewhere.

[11] https://www.painefield.com/223/2019-Air-Service-Environmental-Assessmen#:~:text=2019%20Commercial%20Air%20Service%20Supplemental%20Environmental%20Assessment&text=20%2C%202019%20that%20it%20has,Snohomish%20County%20Airport%2FPaine%20Field

4.1.2 Opportunities

FAA's NextGen program is continuing to improve the complex airspace in the central Puget Sound region. The following is a summary of recent and future improvements in airspace/runway capacity:

- Recent Air Traffic Control/NextGen Capacity Improvements at Sea-Tac:
  - Time-based flow management helps to improve the flow of arrivals to the runways.
  - Reduced diagonal spacing for arrivals of 1 nautical mile for runways with centerline spacing of 2,500 feet or greater provides an increase in arrival capacity.
  - Wake Recategorization Phase 2 assigns aircraft to new wake turbulence classifications based on their wake turbulence characteristics, such as wake generation, wake decay, and encounter effects. This results in closer longitudinal separation for certain aircraft types without sacrificing safety. However, no real benefit occurred for Sea-Tac but the benefit was felt by KCIA and other airports.
- Future Air Traffic Control/NextGen Improvements at Sea-Tac:
  - Improved Runway Delivery Accuracy: The combined effects of several new capabilities—including Automatic Dependent Surveillance–Broadcast Out, Cockpit Display of Traffic Information, and Terminal Sequencing and Spacing in the terminal area—will improve the controllers' ability to deliver aircraft to the runway with the desired separation from the preceding aircraft. This will reduce the average spacing between arrivals and boost arrival capacity.

4.1.3 Multimodal Access

Sound Transit Stride bus rapid transit service at Tukwila International Boulevard Station (one station north of the Sea-Tac station on Link Light Rail) will extend to the eastern suburbs, creating a new connection with communities that lack high-capacity transit. This new service will provide an alternative to personal-car use or taxi and Transportation Network Company (TNC) connections, which add congestion to roadways and require areas for pickups and dropoffs or long-term parking. In addition, Sound Transit will be expanding the Link light-rail system to the north of Seattle (to Lynnwood and eventually Everett), to the east (to Bellevue, Redmond and Issaquah), and south to Tacoma, providing expanded direct rail service to Sea-Tac and Paine Field. Depending on the trends for taxis and TNCs, more areas may need to be dedicated to these services at all commercial service airports. Overall, alternative modes to private car transportation provide an opportunity to alleviate congestion and reallocate landside space to other uses.

4.2 AIR CARGO

4.2.1 Challenges

Within the context of this study, the term air cargo congestion is commonly used to describe situations when demand increases beyond what an airport can efficiently handle. Effects of congestion can usually appear long before annual capacity is reached due to the cyclic nature for air cargo demand. For example, air cargo handling capacity can be significantly stressed at Sea-Tac during the summer cherry season and the winter holiday season. Yet, during other times of the year, air cargo facilities may be sufficient or even underutilized.

There is also a need to account for the fact that the air cargo system is complex and comprises both on-airport facilities and services (airlines, ground handlers, cargo terminals, aircraft parking, on-airport parking, terminal parking, etc.) and off-airport facilities and services (freight forwarders, trucking terminals, warehouses, sort facilities, customs brokers, shippers and receivers, etc.). Capacity constraints at any one of its components can cause congestion.

The 50-year forecast for air cargo in the central Puget Sound region anticipates air cargo tonnage to increase from 539,574 metric tons in 2017 to 1,319,262 tons in 2050—a 2.7% compounded average annual growth rate. Air cargo freighter aircraft operations are projected to increase almost 75% in 20 years from 19,200 in 2017 to approximately 33,445 by 2037 and to approximately 46,000 by 2050.

Sea-Tac is the dominant commercial airport in both the state and the region. It has more than 35 scheduled airlines that offer nonstop narrow-body and wide-body service to over 90 domestic and 30 international destinations. In 2017, the airport accommodated 45.7 million air passengers (up 2.6% from 2016) and processed 425,856 metric tons of belly cargo and freighter cargo (up 16.2% from 2015).

KCIA (locally known as Boeing Field) is the other regional airport with commercial air cargo activity. It acts as regional gateway for the integrator/express airline for UPS and serves as a center for business aviation and an industrial aerospace facility for the Boeing Company.

Paine Field shares the same market area as Sea-Tac and KCIA but has traditionally operated as an industrial general aviation airport that supports the assembly of aircraft for the Boeing Company. In this role, the airport has not developed the facilities and services to attract scheduled air cargo service. In general, air cargo service—because so much of it goes in bellies of passenger flights—is tied to commercial passenger service. So, when locating commercial passenger service, the need of air cargo should be considered as associated.

Sea-Tac will face a deficit of on-airport cargo buildings starting in 2022 that will reach 75,000 square feet by 2026 if no capacity improvements are made. The Port of Seattle's 2018 Air Cargo Growth Potential and Facility Requirements Assessment determines that the Cargo 4 South and L-Shape warehouse development projects proposed in the SAMP Near-Term Projects can accommodate growth in on-airport cargo demand through 2027. Another 400,000 square feet of on-airport cargo buildings are contemplated in the South

Aviation Support Area; however, they are not included in the Near-Term Projects and hence would require further study after 2027. A major issue facing Sea-Tac is that potential future development of air cargo facilities in the South Aviation Support Area would be expensive to develop and cargo facilities contemplated in the SAMP Near-Term Projects proposed for development on the existing airport footprint must compete for scarce Port of Seattle resources being used for overall airport expansion.

KCIA appears to be slightly congested with a deficit of cargo ramp space based on the estimates of land needed to support the future forecasts compared to the existing available land. Aerial views confirm this assessment, with UPS occupying approximately 11 acres available for its operations. If forecasts are realized, additional land may be required by 2026. Because UPS is the primary carrier, UPS may be able to adjust its operations and support the forecasted growth within the same ramp footprint. Near the UPS ramp, on the other side of Perimeter Road (currently on the landside), 2 to 3 acres appear available. The relatively high RWY 14R/32L IFR minimums limit air cargo activities in poor weather. Indeed, KCIA operates a Category I ILS at both ends of its main runway. Diversions of KCIA cargo traffic to Sea-Tac occur when weather conditions are below these minimums, creating potential capacity impacts to Sea-Tac.

4.2.2 Opportunities

Opportunities for additional air cargo capacity in the central Puget Sound region exist both within the region and with utilizing other aviation and logistics resources around the state.

According to the Port of Seattle's 2018 Air Cargo Growth Potential and Facility Requirements Assessment Report, additional air cargo capacity at Sea-Tac can be accomplished by the following:

- Replace old and inefficient cargo buildings with newer and more modern facilities.
- Redesign the North Cargo Area ramp area.
- Shift certain non-cargo handling activities away from the airport ramp area.
- Relocate other non-ramp dependent activity to nearby off-airport properties (also designated as "L-shaped property" in the SAMP).

The report suggests that the redesign of existing facilities and development of nearby off-airport properties can expand the Sea-Tac air cargo facilities from approximately 400,000 square feet in 2018 to almost 650,000 square feet by 2024.

Air cargo capacity at KCIA, particularly ramp space, is limited. However, UPS is using off-airport facilities to leverage limited on-airport cargo terminals. KCIA will examine opportunities for additional cargo aircraft parking as part of its master plan update currently underway.

As outlined in the Washington State Joint Transportation Committee's Washington State Air Cargo Movement Study (published December 21, 2018), additional air cargo capacity that can benefit the region could also be achieved by developing commercial air cargo facilities at Paine Field and using Grant County Moses Lake International Airport as a cargo reliever airport during the Washington state cherry season. The

integrator airlines (such as Amazon, DHL, FedEx, and UPS) also have the option to shift more of their peak-season traffic to Spokane International Airport, which is already operating as a Pacific Northwest transshipment center for the integrators today.

Finally, the Washington State Legislature can work to implement the findings of the Washington State Air Cargo Movement Study, which recommends developing non-urban airports into centers for regional ground-based logistical operations. Developing airport-related logistics/distribution centers, airport logistics parks, or inland ports helps small and nonhub commercial service airports (such as Skagit Regional Airport, Ellensburg Bowers Filed, Yakima Air Terminal, etc.) to generate non-aviation revenue while building up the facilities and services necessary to attract air cargo services. Logistics facilities and services located strategically within the state could take some of the pressure off the Port of Seattle and Sea-Tac, by accommodating activities that traditionally take place at, or near these facilities today.

In the longer term, additional air cargo capacity for the region can be increased by encouraging and using multistory logistics facilities—both on- and off-airport—that can increase the usable floor space for handling air cargo with a limited ground floor footprint. A good example of a local multistory off-airport logistics facility built recently is the Prologis Georgetown Crossroads Warehouse located 2.4 miles from KCIA. It is a 590,000-square-foot, three-story facility on 13.7 acres of land that typically would require 47 acres for a single-story facility.

On-airport, multistory cargo facilities are more common in Asia than North America. The Hong Kong Air Cargo Terminal Limited facility at Hong Kong International Airport is a good example of an on-airport cargo facility. It is a two-story express center and seven-story cargo handling facility with a floor area of 4,251,745 square feet and 313 truck docks on 43.1 acres (**Figure 4-4**).

Figure 4-4. Air Cargo Terminal (Hong Kong)

Incentives for creating multistory logistics facilities could require revised building codes and zoning requirements. Support should also be given to creating a regional cargo community system, defined as a neutral and open electronic platform, that would enable intelligent and secure information exchange between public (Port of Seattle) and private stakeholders (airlines, forwarders, warehouse operators, trucking companies) to improve the competitive position of the central Puget Sound region as a global logistics hub.

The following typical services are part of an airport cargo community system:

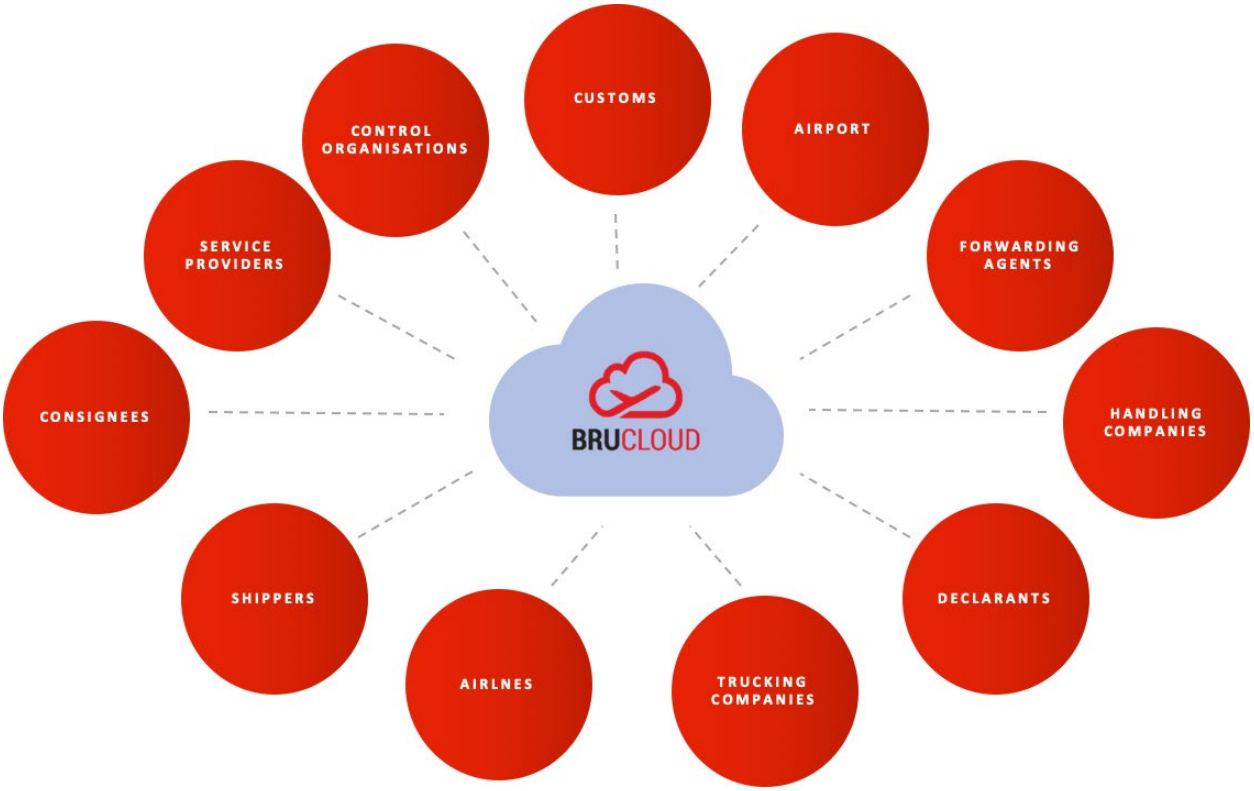
- Information exchange between the transport operators in the airport and for the hinterland connections, the airport users, customs, airport and other authorities
- Electronic exchange of customs declarations and customs responses, and cargo releases between private parties and customs
- Electronic handling of all information regarding import and export of cargo for the airport community
- Status information and control, tracking and tracing goods through the whole logistics chain
- Processing declarations of dangerous goods with the responsible authorities

Brussels Airport in Belgium is an example of an airport making use of a cargo community system to manage the flow of trucks to and from their land-locked cargo campus and provide slot booking for trucks accessing the cargo terminals, among other things. Brussels Airport utilizes a system branded as BRUcloud, which is the umbrella name for the open-data-sharing platform with multiple collaborative applications, operational within BRUcargo and based on a third-party data sharing technology (Figure 4-5).

Utilizing multistory cargo terminals and warehouses, combined with a cargo community system such as BRUcloud, would allow maximum efficiencies for the limited land available within the central Puget Sound region for air cargo and allow the region to grow its logistics industry and other air cargo dependent industries such as aerospace, pharmaceuticals, high-value agriculture, etc.

Regarding the need to add runway capacity for the takeoff and landing of freighter aircraft, it should be noted that within the span of 50 years the state of technology will most likely have advanced to the point where the use of pilotless aircraft will be common. Fully autonomous aircraft will allow for significant efficiencies in the airspace system with smaller in-space aircraft separation requirements and all-weather landing capabilities, thereby increasing the region's runway capacity.

Figure 4-5. Brussels Airport BRUcloud



4.2.3 Multimodal Access

KCIA handles major deliveries to Boeing facilities on the airport. The operation of this facility has set up the airport with good access for cargo, because many of the nearby roads can accommodate large vehicles used in delivery. At Sea-Tac, multimodal access related to cargo could be expanded by adding the proposed South Access Highway. The project is in planning stages and is estimated for completion by 2030, per WSDOT.

Other opportunities include working with local municipalities and transportation agencies to identify problem areas related to cargo transport as well as using intelligent transportation system capabilities to streamline freight operations on local roadways around these airports. Technology offers a cost-effective method for increasing efficiency and operations without intrusive infrastructure improvements.

4.3 GENERAL AVIATION

4.3.1 Challenges

The preceding sections identified areas where it is anticipated general aviation airports will face future challenges. This includes airports where landings and takeoffs are expected to grow to a point where demand for airfield capacity is stressed, resulting in growing delays unless airfield capacity enhancements are undertaken. Based on future activity (where data were available), four of the regional airports (Arlington Municipal, Bremerton National, Renton Municipal, and Harvey Field) should be planning to enhance their airfield capacity.

A lack of aircraft parking and hangar storage space at airports where there is greater demand for hangar space than is currently available is another challenge general aviation airports face. Growing numbers of based aircraft at these airports will only exacerbate the situation. Based aircraft owners frequently want to store their aircraft inside hangars to keep them secure and protect them from the elements. However, not all airports have sufficient land space to make hangar space available to all that want it. Nearly all of the regional airports are facing hangar shortages, as evidenced by the abundance of aircraft hangar waiting lists at these airports. The other categories of airports also face this issue to some degree. Three out of five of the community airports have hangar waiting lists, and a third of the local airports do as well. The only airports that do not report hangar waiting lists are general use airports.

Urban Air Mobility[12] is a potential challenge for the air system, for which general aviation airports will be most affected. Based on current research and draft regulations, Urban Air Mobility "air taxis" that may start to operate in the 2025 to 2030 timeframe will most likely follow the same regulations and concepts of operations than helicopters, with potential slight changes to take into consideration their specificities.

4.3.2 Opportunities

Despite the challenges, a number of opportunities exist at the general aviation airports, especially in terms of providing reliever capacity for the commercial service airports in the region. The airports with the greatest potential for this are the regional airports. Each of the following regional airports was assessed for its potential to accommodate future growth in Working Paper 2, "Airport Needs Analysis":

- Arlington Municipal
- Bremerton National
- Harvey Field
- Pierce County
- Renton Municipal
- Tacoma Narrows

[12] Urban Air Mobility encompasses the operation of small unmanned aircraft systems for delivery and new electrical "air taxis" in dense, urban environments. In the United States, both are still in a research and development stage.

While there are opportunities for commercial use at some general aviation airports, those uses—including the use of ramp space and not limited to operations (takeoffs and landings)—typically constrain the growth of general aviation when airports are land constrained. Commercial use of facilities at both Renton Municipal Airport and Paine Field are projected to increase; this use includes airfield land leases associated with Part 121 manufacturing, and direct use of the airfield and airspace for both Part 121 and Part 135 operations.

At Renton Municipal Airport, aircraft manufacturing necessitates that aircraft parking occupy large portions of airport-controlled land adjacent to the airfield, limiting the expansion of general aviation facilities such as hangars or aircraft tie-down spaces.

At Paine Field, increases in Part 121 commercial operations will constrain general aviation through intangible means. One intangible impact might be administrative (Code of Federal Regulation) and/or legislative (United States Code) changes resulting in altered Transportation Security Administration policies, procedures, and practices concerning the access and use of airport facilities. Even if those policies are not specifically borne of a general aviation conflict or directly consequential to general aviation operations, the convenience of airport access and access to adjacent airspace are strong considerations for many general aviation pilots.

A decline in general aviation operations at an airport is a precursor to a reduction in available noncommercial passenger service as fixed-base operators[13]—unable to service Part 121 operations even if they service large Part 135 aircraft—face a shrinking market. Even if a significant number of general aviation aircraft remain at Paine Field, a loss of convenient access and the subsequent reduction in operations would alter airport activity. This would in turn affect funding models and projections that businesses use to determine the viability of an airport. Both direct and indirect consequences will lead to the lack of investment for new general aviation-related businesses and, in some cases, the failure of existing businesses—fixed-base operators, in particular.

4.3.3 Multimodal Access

Roadways are the primary access for general aviation airports, with many of the airports in the region meeting the project benchmark of being located within 2 miles of a state route. Several general aviation airports could expand their services to help meet the aviation needs of the region.

However, congestion and available land present challenges for some airports that could see a change in service. Potential improvements to make these airports more accessible for commercial passengers include the addition of high-capacity transit, dedicated space for pickup and dropoff by taxis and TNCs, as well as rental car services or shuttles for travelers.

[13] A fixed-base operator is a commercial business granted the right by the airport sponsor to operate on an airport and provide aeronautical services such as fueling, hangaring, tie-down and parking, aircraft rental, aircraft maintenance, flight instruction, etc.
https://www.faa.gov/airports/resources/publications/orders/compliance_5190_6/media/5190_6b_appC.pdf

General aviation airports with opportunities for multimodal access upgrades include Auburn Municipal and Renton Municipal, which are near interstates and a mix of land uses. Rapid Ride F is already in service near Renton Municipal, and Rapid Ride I is planned to connect the cities of Renton and Auburn in 2023.

5. Assessment of System Requirements

5.1 COMMERCIAL SERVICE

The commercial service passenger demand is estimated to grow from 22 million enplanements in 2017 to between 49 million and 56 million enplanements in 2050, as discussed in Working Paper 2, "Airport Needs Analysis" Chapter 4, Challenges and Opportunities. As described in Section 4.1.1, Challenges, of this report, existing space available to accommodate the 2050 commercial service demand is limited at Sea-Tac and Paine Field. That section also outlines the SAMP's Near-Term Project and Long-Term Vision plans that attempt to address the gap. As previously stated, due to airside capacity and financial constraints, any improvements outside of the Near-Term Projects would require further evaluation as part of a future airfield/airspace study.

The previous chapter also explains the limitations at KCIA from both landside and airspace perspectives. As such, KCIA is unlikely to be able to accommodate significant commercial passenger growth.

Paine Field's existing passenger terminal can accommodate 500,000 annual passenger enplanements with space for three aircraft positions. Although there is no plan to expand this facility at this time, the airport has commenced an airport master plan that will address the success of the new airline service initiated in March 2019.

Table 5-1 compares the high forecast for passenger enplanement to the plans and potential growth for Sea-Tac and Paine Field. The high forecast is used to answer the study's question: Can all the forecast passengers be accommodated in the future? Two capacity scenarios were prepared to assess future needs based on the airports' vision plans:

- Scenario 1. Sea-Tac can accommodate up to the SAMP Near-Term Project capacity of 28 million enplanements plus Paine Field is limited to its existing terminal building.
- Scenario 2. Sea-Tac can accommodate up to the SAMP Long-Term Vision capacity of 33 million enplanements plus Paine Field is limited to its existing terminal building.

Table 5-1. Commercial Service Passenger Needs through 2050

CENTRAL PUGET SOUND REGION	FORECAST OF PASSENGER ENPLANEMENTS				
	2017	2022	2027	2037	2050
Passenger Enplanements (High Forecast)	22,450,500	25,400,000	31,100,000	38,000,000	55,600,000

Source: Working Paper 1, "Airport and Aviation Activity", WSP, KPA, CDM
Note: Low forecast for 2050 is 49,300,0000 enplanements

PAINE FIELD + SEA-TAC	2017	2022	2027	2050
Constrained to Near-Term Project SAMP Scenario[1,2]	23,050,000	25,655,000	28,600,000	28,600,000
Constrained to Long-Range SAMP Vision Scenario[1,3]	23,050,500	25,655,000	28,600,000	33,600,000

Source: Sustainable Airport Master Plan (2018), Federal Aviation Administration Terminal Area Forecast (2018)

CENTRAL PUGET SOUND REGION	2017	2022	2027	2050
Constrained to Near-Term Projects SAMP Scenario[1,2]	0	0	-2,500,000	-27,000,000
Constrained to Long-Range Vision SAMP Scenario[1,3]	0	0	-2,500,000	-22,000,000

Note:
[1] Assumes Paine Field accommodates only 600,000 annual enplanements, per supplemental environmental assessment.
[2] Based on Sea-Tac SAMP Near-Term Projects, accommodating up to 28 million annual enplaned passengers.
[3] Based on Sea-Tac SAMP Long-Term Vision, possibly accommodating up to 33 million annual enplaned passengers.

These two capacity scenarios were combined into a single baseline scenario and compared to other future scenarios as to how well they address future needs later in the study. Chapter 6 of this document describes the future scenario development and evaluation process.

5.2 AIR CARGO

The space available for warehouses (and their landside component) with direct access to the airfield is a scarce resource at both Sea-Tac and KCIA. Considering the redevelopment of cargo facilities planned for Sea-Tac in the SAMP Near-Term Projects (SAMP) and the facility requirements for the two airports, the central Puget Sound region system will fall short in supplying enough warehouse space to air cargo beyond 2027, as the Air Cargo Growth Potential and Facility Requirements Assessment (September 2018), prepared for the Port of Seattle by Logistics Capital Strategy (LCS report) confirms that the SAMP Near-Term Projects satisfy demand for on-airport cargo facilities through 2027. As described previously, while the South Aviation Support Area identified in the SAMP Long-Term Vision would provide substantial additional on-airport cargo capacity, the South Aviation Support Area is not included in the SAMP Near-Term Projects, is subject to further study, and would not address the long-term demand for new off-airport cargo and logistics facilities.

Developing off-airport facilities on the Port of Seattle's L-Shape property (SAMP projects C02 & C03 Off-Site Cargo Phases 1 & 2) and the on-airport warehouse redevelopment at Cargo 4 South (SAMP project C01 Cargo 4 South Redevelopment) addresses the near-term needs at Sea-Tac. KCIA has one air cargo operator (UPS) that does not use on-airport warehousing but trucks the freight in and out the airport for sorting at an off-airport distribution center.

Sea-Tac and KCIA combined have enough airside ramp space to accommodate the 2050 demand (aircraft parking and GSE/container storage). Locally, Sea-Tac will compensate for the loss of ramp space available to air freight operations caused by the expansion of the passenger terminal complex to the north by reorganizing the northern part of the existing air cargo area. **Table 5-2** presents the air cargo needs for the PSRC Central Region, and **Table 5-3** depicts the planned capacity for Sea-Tac and KCIA. Although Sea-Tac consultants used two different methodologies for the SAMP and LCS report, the Port of Seattle's LCS report confirms that the SAMP Near-Term Projects satisfy demand for on-airport cargo facilities through 2027.

Table 5-2. Air Cargo Requirement Needs through 2050 (Seattle-Tacoma and King County International Airports)

		FACILITY REQUIREMENTS (SQUARE FEET)			
	EXISTING	2017	2027	2037	2050
Cargo Apron	4,473,612	1,171,764	1,825,164	2,347,884	3,219,084
Warehouse & Landside[1,2]	577,421	1,269,020	1,692,359	1,873,130	2,561,321

Source: SAMP Executive Summary (2018), Air Cargo Growth Potential and Facility Requirements Assessment (2018), Google Earth

(1) Landside comprises truck parking and maneuvering areas.

(2) Warehouse square feet based on the Port of Seattle's Air Cargo Growth Potential and Facility Requirements Assessment report through 2027; landside square feet based on Airport Cooperative Research Program.

Table 5-3. Air Cargo Planned Capacity Areas through 2037 (Seattle-Tacoma and King County International Airports)

	AREA (SQUARE FEET)
Existing (2017) Apron	4,473,612
Existing (2017) Warehouse & Landside	577,421
Near-Term Vision (2027) Capacity for Apron	4,833,612
Near-Term Vision (2027) Capacity for Landside & Warehouse (LCS report)	1,739,545
Long-Term Vision (2034) Capacity for Apron	4,184,612
Long-Term Vision (2034) Capacity for Landside & Warehouse	2,024,784

(1) Based on Sea-Tac SAMP, the Near-Term Projects will improve the existing North Cargo Area, with two additional off-airport warehouses and then loss of existing cargo apron will occur due to Long-Term Vision passenger facility expansion.

(2) Warehouse square feet based on the Port of Seattle's Air Cargo Growth Potential and Facility Requirements Assessment study report through 2027; landside square feet based on Airport Cooperative Research Program.

While Sea-Tac and KCIA can maintain their respective roles of major international gateways for air freight and regional hub for UPS, Working Paper 2, "Airport Needs Analysis" Chapter 3, Aviation Needs Analysis, identifies potential challenges in addressing the 2050 demand for warehousing. **Table 5-4** describes the "gap" between the need and what is planned to accommodate some of the demand. The combination of both airports' cargo aircraft apron areas will meet demand while warehousing and associated landside facilities will be needed in 2037 and 2050. Additional off-airport warehousing and other opportunities to accommodate air cargo, including outside of the region should be considered.

Table 5-4. Air Cargo Facility Gaps through 2050 (Seattle-Tacoma and King County International Airports)

	GAP (SQUARE FEET) [1]			
	2017	2027	2037	2050
Existing vs. Required Apron	3,301,848	2,648,448	2,125,728	1,254,528
Existing vs. Required Warehouse & Landside	-691,599	-1,114,938	-1,295,709	-1,983,900
Near-Term Vision (2027) Capacity vs. Required Apron	3,661,848	3,008,448	2,485,728	1,614,528
Near-Term Vision (2027) Capacity vs. Required Landside & Warehouse (LCS report)	470,526	47,187	-133,585	-821,776
Long-Term Vision (2034) Capacity vs. Required Apron	—	—	1,836,728	965,528
Long-Term Vision (2034) Capacity vs. Required Landside & Warehouse	—	—	-133,585	-821,776

[1] Gaps compare planned capacity areas of Table 5-3 with the required needs of Table 5-2.

5.3 GENERAL AVIATION

A key study goal related to general aviation in the central Puget Sound region is to identify the aviation requirements of the system and individual airports. This was accomplished by developing performance measures and benchmarks that gauged whether airports were performing as expected in various areas. General aviation services were evaluated for the coverage they provided the population and employment of the region. Individual general aviation airports were assessed for their suitability to provide adequate facilities and capacity in terms of airside, landside, and ground access. Forecasts of future activity were used to determine if any airports were likely to experience capacity constraints.

The airport system performance measures and benchmarks consisted of coverage by business-aircraft-capable airports (i.e., those airports with jet fuel, de-icing, or a precision instrument approach). These system analyses identified shortfalls in population coverage by airports capable of handling business aircraft, and employment coverage of airports with de-icing capabilities, indicating a need for these services at general aviation airports in the region.

The analysis of adequate capacity found a need for more airfield capacity in the region. Three airports—Arlington Municipal, Renton Municipal, and Harvey Field—were found to be approaching their airfield capacity limits by 2050. Arlington Municipal would need to implement airfield capacity improvements to accommodate its anticipated growth in aviation activity, while Renton Municipal and Harvey Field would need to commence planning for such improvements to avoid capacity issues before the end of the planning period. Other airports in the region were identified as having excess capacity that could be used to accommodate aviation operations from other airports in the region.

5.4 SUMMARY OF INTERMODAL NEEDS AND OPPORTUNITIES

As the central Puget Sound region continues to grow, multimodal access to the different airports in the area will change and be influenced by a multitude of factors. At the time of this analysis, current connections and planned projects were considered to gauge the needs and opportunities related to access.

5.4.1 Commercial Service

At commercial service airports, high-capacity transit modes connect passengers at Sea-Tac and Paine Field with planned high-capacity access planned near KCIA, allowing all three airports to provide affordable and alternative connections to many areas throughout the region. All three airports also have adequate roadway access provided by I-5 and various state routes.

The creation of direct connections to airports from limited-access highways is a potential area that can be evaluated in future planning efforts and a second such access is already in planning stages at Sea-Tac. Providing direct access allows for efficient pickups and dropoffs or direction to parking lots and structures. Areas for taxi and TNCs may also need to be expanded, with the inclusion of more curb space for these uses as well as staging areas. Overall, the region is well connected and accommodating for commercial service passengers, but growth and mode share should be monitored to ensure that proper connections are being provided for.

5.4.2 Cargo

Of the three airports in the region capable of accommodating wide-body air cargo operations, two operate within the context of major Boeing facilities and the third is the main source of international freighter service and belly cargo through commercial passenger aircraft operations. Paine Field and KCIA, with current Boeing operations, are set up with good access from wide roadways and locations near interstates and state highways that can manage freight vehicles. Paine Field has rail freight access that operates to the Boeing facilities and could be an incentive for attracting cargo logistics companies to the airport. KCIA has rail access on either side of the airport including a spur line to the west and mainline and major yards to the east. Sea-Tac is the third airport with air cargo operations and is the primary center for air cargo in the aviation system. Multimodal access for cargo vehicles is maintained through roadways that offer good connections for freight vehicles to interstates and state highways. Since the airport is experiencing rapid growth on the passenger side, air cargo access is constrained due to congestion on arterial and local roadways. The south airport access road, which is in planning stages, could alleviate potential congestion and offer a new connection for air cargo at Sea-Tac.

5.4.3 Other Airports

Several airports in the region that might have potential for an expanded role were considered for their vehicular access. The results are detailed in Working Paper 2, "Airport Needs Analysis" and summarized below:

- Arlington Municipal Airport: Good
- Auburn Municipal Airport: Good
- Bremerton National: Fair
- Renton Municipal Airport: Good
- Harvey Field: Poor
- Tacoma Narrows: Fair

Working Paper 2, "Airport Needs Analysis" summarizes access potential at several area airports. To the extent these airports are considered for a larger aviation role, a series of other considerations related to airport infrastructure, available land, market demand and airspace restrictions would need to be applied, depending on the particular use.

6. Development of Scenarios

The 2018 SAMP for Sea-Tac proposed facility expansion to accommodate growing passenger and cargo demand that requires significant financial investment and reconfiguration/relocation of existing facilities. The SAMP identifies a program of improvements referred to as Near-Term Projects to allow the airport to accommodate more than 28 million enplanements that is projected to occur at Sea-Tac around 2027. The SAMP also identifies a Long-Term Vision developed to accommodate facility requirements associated with forecast activity of approximately 33 million enplanements; however, due to airside capacity and financial constraints, any improvements outside of the Near-Term Projects would require further evaluation as part of a future airfield/airspace study (**Table 6-1**).

Table 6-1. Commercial Service Passenger Needs through 2050

CENTRAL PUGET SOUND REGION	ACTUAL	FORECAST OF PASSENGER ENPLANEMENTS			
	2017	2022	2027	2037	2050
Passenger Enplanements (High Forecast)	22,450,500	25,400,000	31,100,000	38,000,000	55,600,000

Source: Working Paper 1, "Airport and Aviation Activity" WSP, KPA, CDM
Note: Low forecast for 2050 is 49,300,0000 enplanements.

PAINE FIELD + SEA-TAC	2017	2022	2027	2050
Constrained SAMP Near-Term Projects Scenario[1,2]	23,050,000	25,655,000	28,600,000	28,600,000
Constrained SAMP Long-Term Vision Scenario[1,3]	23,050,500	25,655,000	28,600,000	33,600,000

Source: Sustainable Airport Master Plan (2018), Federal Aviation Administration Terminal Area Forecast (2018)

CENTRAL PUGET SOUND REGION	2017	2022	2027	2050
Constrained SAMP Near-Term Projects Scenario[1,2]	0	0	-2,500,000	-27,000,000
Constrained SAMP Long-Term Vision Scenario [1,3]	0	0	-2,500,000	-22,000,000

Notes:
[1] Assumes Paine Field accommodates only 600,000 annual enplanements, per supplemental environmental assessment
[2] Based on Sea-Tac SAMP Near-Term Projects, accommodating up to 28 million annual enplaned passengers
[3] Based on Sea-Tac SAMP Long-Term Vision, possibly accommodating up to 33 million annual enplaned passengers

Based on forecast aviation demand, additional airports would need to accommodate the additional future demand of the region, which is nearly double the current demand. This final report provides an overview of potential scenarios to accommodate that future demand. Each airport that was previously identified in the study area was analyzed to determine its ability to accommodate future commercial service needs. The construction of a new airport at a greenfield site was not analyzed nor was an element of the study. Technical criteria were developed to evaluate each airport to determine the airports that, with economic investment and infrastructure development, could reasonably accommodate additional regional aviation passenger demand by 2050.

As PSRC, state, and local leaders consider next steps of exploring how to accommodate all or a portion of the projected passenger demand for the central Puget Sound region, it should be noted that other cities have multiple airports serving their constituents in various levels of passenger and cargo activity. Whether

the central Puget Sound region decides to explore additional airports in addition to Paine Field's growing passenger service that supplements Sea-Tac's offerings, several factors should be considered. In the United States, airports and communities do not decide what airline service will be provided.

Airlines are private businesses and are market driven, and they decide what airports they will serve in order to be the most profitable. Just because an airport in a large metropolitan area has adequate facilities for this type of service does not mean an airline will provide service.

Airlines consider several factors, such as demand, the availability of aircraft, connectivity to their hubs, and potential competition when determining what routes to serve. Airlines are in the business to fill the aircraft seats and are less profitable when aircraft are not in the air. One of the choices related to choosing markets includes whether to serve a lesser-served route rather than a route where airlines could provide additional competition. The airlines closely analyze these choices, because the equipment used to serve them are a large investment. These decisions are made on a route-by-route basis and have much less to do with the facilities than other factors.

As an example, the Los Angeles metropolitan area had 56 million passenger enplanements travel out of its airports in 2018, which is what this study forecasts for the central Puget Sound region in 2050. This multi-airport system offers some interesting lessons for the central Puget Sound region. Five airports serve the Los Angeles region: Los Angeles International Airport, Hollywood Burbank Airport, Long Beach Airport, Ontario International Airport, and John Wayne Airport.

Los Angeles International Airport is the largest airport with four parallel runways (from 9,000 feet to 13,000 feet) and serves as a major connecting hub for 67 United States and international air carriers. While the regional airports provide important supplementary service and access to other parts of the region, Los Angeles International Airport serves the largest share of passengers (78%) and service options with 43 million enplanements in 2018 and 132 aircraft gates to 202 nonstop destinations.

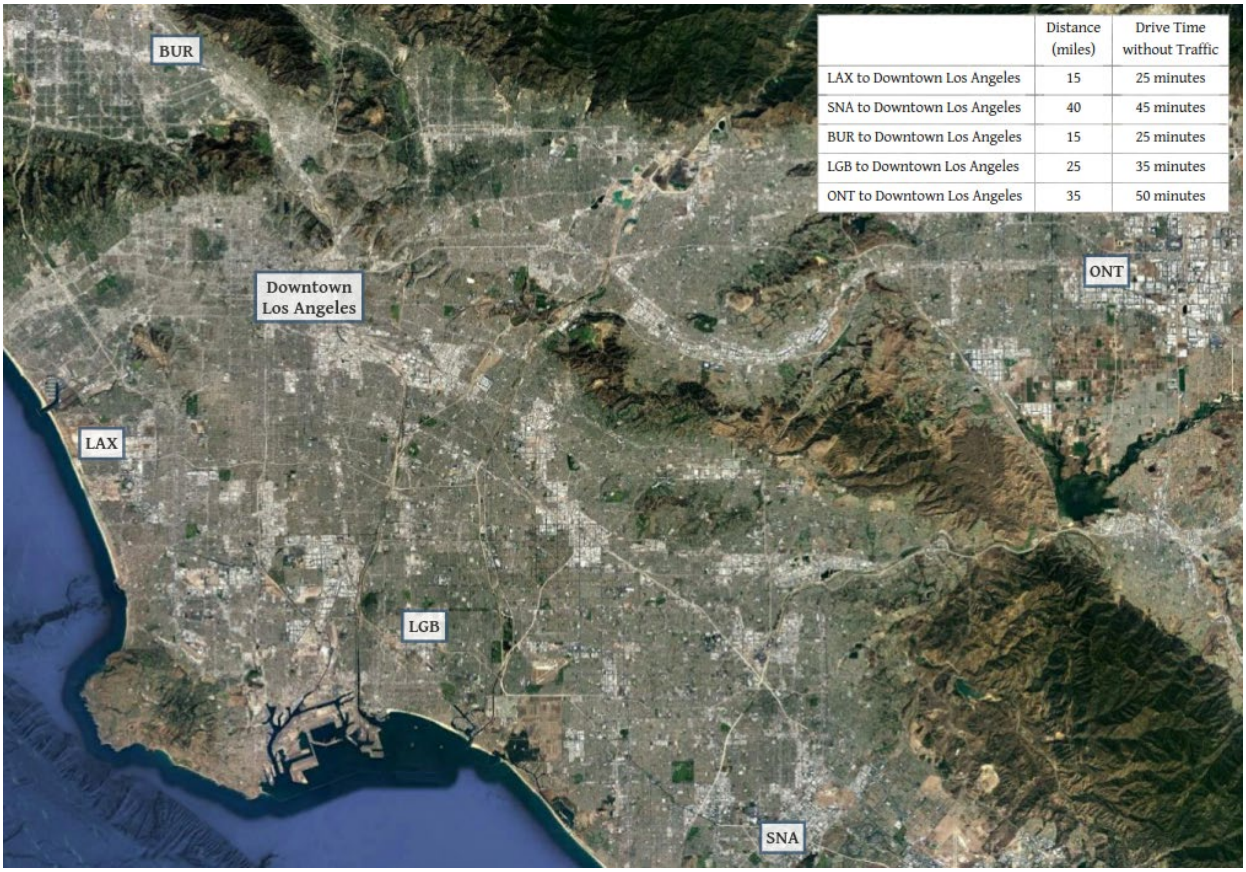
Ontario International Airport has 26 gates and two parallel runways (12,000 feet and 10,000 feet). Yet even though it was served by nine airlines going to 25 destinations, Ontario International Airport had only 1.9 million passenger enplanements in 2018. Ontario International Airport has the space to add up to nine more gates if demand ever required it. While the airfield has capacity of about 300,000 annual aircraft operations, in 2018, only 100,000 total aircraft operations occurred, including air carrier, military, and general aviation. Ontario International Airport has excess capacity to accommodate millions of additional passengers. Therefore, policy leaders need to understand that particularly with aviation, "Build it and they will come" does not "fly" with the FAA or airlines.

On the other end of the spectrum, while Ontario International Airport is the second-largest airport in the Los Angeles region, John Wayne Airport is the second-busiest airport in the region, operating with just one commercial service runway that is only 5,700 feet in length, which is shorter than most commercial service runways. The airport also has a short (2,887 feet) parallel general aviation runway. General aviation operations account for 68% of the airport's activity. Similar to Ontario International Airport, the airfield capacity for John Wayne Airport is around 300,000 annual aircraft operations. Both airports are

approximately 35 miles from downtown Los Angeles, with Ontario International Airport to the east and John Wayne Airport to the south. Yet in contrast to Ontario International Airport, John Wayne Airport serves nearly 5 million enplaned passengers with 20 gates and with seven airlines going to 24 domestic and international destinations. The airport is the closest airport to Disneyland and is convenient for passengers who live between Los Angeles and San Diego. As the population of Orange County grew, demand for airline service to the area grew, with commercial service beginning in 1952.

Figure 6-1 shows Los Angeles International Airport, Hollywood Burbank Airport, Long Beach Airport, Ontario International Airport, and John Wayne Airport locations in relation to downtown Los Angeles, along with drive times without traffic from each airport to the downtown area.

Figure 6-1. Los Angeles Vicinity Map



	Distance (miles)	Drive Time without Traffic
LAX to Downtown Los Angeles	15	25 minutes
SNA to Downtown Los Angeles	40	45 minutes
BUR to Downtown Los Angeles	15	25 minutes
LGB to Downtown Los Angeles	25	35 minutes
ONT to Downtown Los Angeles	35	50 minutes

Notes: LAX = Los Angeles International Airport; BUR = Hollywood Burbank Airport; LGB = Long Beach Airport; ONT = Ontario International Airport; SNA = John Wayne Airport

Ontario International Airport and John Wayne Airport bookend the success of regional airports in the Los Angeles region. Even without a much larger investment, Ontario International Airport serves many fewer flights and customers than John Wayne Airport not because of airport facilities but due to airline market decisions. For the central Puget Sound region, the types of airports that could "fill the gap" beyond what Sea-Tac and Paine Field can achieve by 2050 would most likely be regional airport facilities versus providing significant international passenger service. Most multi-airport regions, like Los Angeles, can support only a

single airport offering broad international destinations. These airports would be similar to existing Washington state airports: Bellingham International (10 nonstop destinations by three airlines) and Spokane International Airports (19 nonstop destinations by six airlines). Some of their airlines offer flights to Canadian airports, which means that Customs and Border Patrol are staffed there for passport control, etc., and thus are designated as international. Most of their flights are to large-hub airports (i.e., Sea-Tac, and Los Angeles, San Francisco, Denver, and Chicago International Airports) but also serve some point-to-point destinations (i.e., to San Jose, CA, and San Juan Islands).

Paine Field was originally envisioned to be a commercial service airport when it was built in 1936. It was diverted for military operations during World War II and when the county took over operations, Sea-Tac was already the region's primary airport, so Boeing established a production facility at Paine Field. Then 80 years after the airport opened, construction on the commercial service terminal began and multiple airlines expressed interest in providing commercial passenger service. Paine Field served its first 1 million passengers (500,000 enplanements) on February 26, 2020. It is served by two airlines, utilizing two gates opened in December 2019 with 18 daily nonstop flights to 10 destinations on one runway.

Even though the service opened recently, the commercial service offered at Paine Field is already a success in that the airport is utilizing 15 of its 24 maximum departures allowed per day, per the 2019 Record of Decision.[14] Thus, it is likely if the airport were approved to expand commercial service, more airlines, flights, and destinations would occur to meet the demand.

The type of airports that could accommodate the future needs and 2050 gap in capacity for the central Puget Sound region are similar to those serving the city of Los Angeles: from a major international connecting hub like Los Angeles International Airport to regional airports like Ontario International Airport and John Wayne Airport.

6.1 SCENARIO 1: BASELINE MEET 50% TO 60% OF 2050 DEMAND

Scenario 1 assumes that current planned airport expansions would be accomplished. That means that Sea-Tac would implement its SAMP plan to its 2027 potential, and Paine Field would maintain its current passenger services (up to 600,000 annual passenger enplanements). In addition, Scenario 1 maintains the possibility that Sea-Tac would implement its Long-Term Vision should funding and approvals be obtained. This scenario would result in a projected 2050 gap of 22 million to 27 million enplanements and 450,000 to 540,000 operations. This gap would be similar to the number of passengers at Sea-Tac in 2019 with its three runways.

Based on the information contained in the WSDOT Aviation Economic Impact Study (2020), if this need is not accommodated in the region, the opportunity cost would be similar to the current economic contribution by Sea-Tac, which is over 150,000 jobs and nearly $22.5 billion total economic activity. In addition to the economic impacts, residents and businesses would be hindered in their ability to access

[14] https://www.painefield.com/DocumentCenter/View/1022/Final-Environmental-Assessment-FONSI-ROD-February-2019-PDF

commercial passenger and air cargo services to meet their needs, and it would make the region less competitive because drive-time coverages would decrease.

Depending on whether the Sea-Tac Long-Term Vision is realized, Scenario 1 would result in $4 billion to $9 billion in added annual economic activity over today. On the other hand, while aircraft operations are forecast to increase, the growth is what has already been planned and the amount of aircraft operations that could be accommodated with the implementation of the SAMP 2027 plan (and, possibly, the 2037 Long-Term Vision) would be consistent for all scenarios. Thus, scenarios that would accommodate more of the projected aircraft operations would also have more noise impacts and greenhouse gas emissions than Scenario 1. Simply stated, this scenario would have the least amount of added noise and greenhouse gas emissions because it would accommodate the fewest aircraft operations.

6.2 SCENARIO 2: MEET 80% OF 2050 DEMAND

The study team analyzed an intermediate scenario that would accommodate some but not all of the regional aviation demand in 2050. Because most airports in the region would need to be enhanced to allow for commercial service operations, and there would be associated environmental impacts, there are potential limitations on the amount of future demand the region could accommodate. Therefore, the study team analyzed a scenario that would meet about half of the future gap should the Sea-Tac Long-Term Vision be realized. The PSRC board posed the question, "Should the Region try to accommodate all this demand or not?" To this end, Scenario 2 explores the pros and cons of meeting 50% of the future 2050 gap of 22 million enplanements and approximately 450,000 operations after the Sea-Tac Long-Term Vision, meaning approximately 11 million additional enplanements and 225,000 additional aircraft operations would need to be accommodated by 2050.

To accommodate this demand, significant development would need to occur at one or multiple airports, as it would require at least two air carrier–capable runways (at least 7,000 feet in length). This scenario builds on Scenario 1, and the two together would accommodate 80% of the total 2050 demand. This constrained scenario would generate an estimated increased economic benefit for the region of about $20 billion beyond today.

Overall, environmental impacts would increase but would be about half (compared to Scenario 1, "Baseline") than if 100% of the future gap were met. Development at regional airports would be required to meet this limited need. The need could be met at multiple airports or potentially one airport with parallel runways, and the trade-off of those scenarios are described in the following subsections.

6.2.1 Scenario 2-1: One Airport

For one airport in the region to handle 50% of the 2050 gap (11 million enplanements), two parallel runways of at least 7,000 feet would be required with a separation of at least 4,300 feet to allow for simultaneous independent arrivals under Instrument Flight Rules (i.e., poor weather conditions)

operations.[15] The approximate number of annual aircraft operations that a two-parallel-runway airfield with a separation of 4,300 feet or greater could accommodate is 320,000, based on the FAA AC 150/5060-5 Airport Capacity and Delay, which is greater than 50% of the 2050 gap for aircraft operations (225,000). An example of this type of airport would be Fort Lauderdale-Hollywood International Airport, which serves 18 million enplaned passengers with 63 gates with its parallel runways.

Scenario 2-1 would concentrate both the benefits and impacts compared to scenarios where multiple airports would provide the additional service. Thus, the noise and environmental impacts—as well as the access to commercial service and jobs associated with expanded operations—would be focused around one airport rather than spread around the region.

6.2.2 Scenario 2-2: Two Airports

Two single-runway airports with runways of at least 7,000 feet in the region could accommodate the 11 million enplanements, depending on the mix of general aviation versus commercial service operations occurring at the airport. A single runway could handle about 195,000 aircraft operations. Therefore, two single-runway airports could easily handle the annual aircraft operations estimated for accommodating 50% of the 2050 gap (roughly 7 million annual enplanements and 112,500 aircraft operations at each airport). The infrastructure needed to accommodate 7 million annual passenger enplanements would be slightly more than what John Wayne Airport near Los Angeles offers today.

Scenario 2-2 would spread the benefits and impacts to multiple airports in the region in order to provide the additional service. Thus, the noise and environmental impacts—as well as the access to commercial service and jobs associated with expanded operations—would be spread around the region. In addition, two smaller airports would not be able to provide the concentration of service options and would be more expensive to operate than a single larger airport.

6.3 SCENARIO 3: ACCOMODATE 100% OF 2050 DEMAND

The Baseline Study's unconstrained forecast projects the region's future demand to reach 55 million enplanements and 450,000 aircraft operations by the year 2050. Scenario 3 assumes one or more airports would accommodate 100% of this demand by 2050.

This scenario would offer the greatest economic benefit of the scenarios or approximately equal to an additional Sea-Tac, which currently offers over 150,000 jobs and nearly $22.5 billion total economic activity, compared to Scenario 1, "Baseline" and $31 billion added annual benefit over 2018 conditions.

In addition to the direct benefits, Scenario 3 would allow residents and businesses to access commercial passenger and air cargo services to meet their future needs and allow the region to remain competitive.

[15] Note that the 4,300-foot runway separation is based on standard FAA design criteria and subject to change due to site characteristics.

On the other hand, there would be more noise impacts and greenhouse gas emissions than the other scenarios because aircraft operations and local vehicle trips would increase to meet demand.

6.3.1 Scenario 3-1: One Airport Meeting 100% of 2050 Regional Demand

Theoretically, a single airport in the region could accommodate 100% of the 2050 gap with three sufficiently spaced, 7,000- to 9,000-foot parallel runways (for 450,000 annual aircraft operations).

The future gap is similar to Sea-Tac's current operations, in which the airport is operating three parallel runways. John F. Kennedy International Airport and San Francisco International Airport both operate with two dual parallel runways, and in 2018 both handled over 450,000 operations; however, both airports are constrained and are operating at maximum capacity. Airports like George Bush Intercontinental/Houston and Charlotte International Airports (with triple, widely spaced parallel runways) would be the most efficient airfield layout.

Scenario 3-1 would limit the noise and environmental impacts associated with expanded operations to one additional airport in the region and the associated community(s), and only one airport would require resources to handle the future gap (including parking, road infrastructure, landside support facilities, terminal infrastructure, etc.). However, this scenario would concentrate noise impacts into a smaller geographic area versus spread over multiple areas, as in the multi-airport scenarios.

The approximate number of operations that a single, triple-parallel runway airfield with a separation of 4,300 feet or greater could accommodate is over 500,000 aircraft operations, based on the FAA AC 150/5060-5 Airport Capacity and Delay, more than the estimated 450,000 aircraft operations gap in 2050.

6.3.2 Scenario 3-2: Multiple Airports Meeting 100% of Regional 2050 Demand

As stated in Scenario 3-1, three runways should be planned for to accommodate the 450,000 annual aircraft operations in 2050. Two airports in the region could accommodate 100% of the future gap, if at least one of the airports has parallel runways spaced at least 4,300 feet apart. Otherwise, three airports with a single runway would be necessary. The ability to meet the demand would also depend on the existing number of operations occurring at the airport and the ability of the surrounding airspace to accommodate this increase activity.

6.4 BENEFITS AND CHALLENGES OF MEETING DEMAND

This Baseline Study evaluated several scenarios as to how the region could address accommodating the projected 2050 demand for passengers and cargo. Due to scope limitations discussed in Chapter 1, Introduction, this study cannot provide a detailed economic or environmental evaluation of the various scenarios. Chapter 9, Related Studies, summarizes several related studies with bearing on these and other relevant aviation impacts. This chapter provides a regional overview of the some of the major potential impacts of these scenarios. Table 6-2 presents a summary of the four scenarios.

Table 6-2. Projected Demand Accommodating Scenarios

SCENARIOS FOR YEAR 2050 PASSENGER ENPLANEMENT DEMAND (55M)	2050 PASSENGER DEMAND/ CAPACITY MET	RESULTING ANNUAL PASSENGER ENPLANEMENT GAP	ESTIMATED ANNUAL ADDED ECONOMIC ACTIVITY	ESTIMATED ADDED JOBS TO THE REGION
Scenario 1: Baseline, Meet 50% to 60% of 2050 Demand	28,000,000 to 33,000,000	27,000,000 to 22,000,000	~$4 billion to $9 billion	~27,000 to 61,000
Scenario 2: Meet 80% of 2050 Demand	44,000,000	11,000,000	~$20 billion	~135,000
Scenario 3: Accommodate 100% of 2050 Demand	55,000,000	0	$31 billion	209,000

Note: The 2020 WSDOT Airport Economic Impact Study estimated Sea-Tac to contribute 151,400 jobs, $7 billion in labor income, and $22.5 billion in business revenues.

Achieving these levels of passenger demand would be challenging and require significant funding, so the converse should also be considered. Scenario 1, Baseline, which accommodates 28 million to 33 million enplaned passengers by 2050, would result in a lost economic opportunity of approximately $22 billion in annual business revenues and approximately 150,000 jobs. So, if the region cannot or chooses not to accommodate all or half of the projected 55 million enplanement demand, the potential economic impact and jobs will be affected accordingly as shows in Table 6-2.

Table 6-3 summarizes "Pros and Cons" of these demand scenarios from a very high level. If 100% of the demand could be accommodated—basically doubling what Sea-Tac could achieve with its Near-Term Projects—both the economic and the environmental impacts could double, based on aircraft operations, vehicles traveling to airports, etc., doubling as well. This is a conservative estimate, assuming the worst case, that aircraft engines would not be improved (no reduction in noise, no improvement in fuel efficiency or new non-hydrocarbon fuels) and there would be no "cleaner" way to transport passengers to the airports.

As shown in Table 6-3, the scenarios have trade-offs. Scenarios that would increase economic impact and jobs would also increase noise and carbon dioxide emissions. Conversely, limiting noise and carbon dioxide emissions at airports by not accommodating passenger demand would directly affect the economy and jobs, and passenger access would increase beyond a 60-minute drive time. In addition to the direct economic impact of not meeting forecast demand, businesses and passengers would not be able to access the level of air service that they need (as discussed in Chapter 2).

Table 6-3. Scenario Pros and Cons Compared to Existing Conditions and Other Scenarios

SCENARIOS FOR YEAR 2050 PASSENGER ENPLANEMENT DEMAND (55 MILLION)	PROS	CONS
Scenario 1: Baseline, Meets 50% to 60% of 2050 Demand	▪ The lowest (5% to 24%) increase in activity related to potential 2050-level noise and aircraft carbon impacts, single-occupancy vehicle trips to airports.[1]	▪ The lowest increase in airport economic impact ($4 billion to $9 billion and 27,000 to 61,000 jobs) by 2050. ▪ Reduces business and consumer choices compared to other scenarios.
Scenario 2: Meet 80% of 2050 Demand	▪ Generally, increases potential 2050-level noise and aircraft air quality and carbon impacts, single-occupancy vehicle trips to airports by ~65% compared to today.[2] ▪ Increases business and consumer choices compared to Baseline.	▪ Generally, increases potential 2050 airport economic impact ($20 billion and 135,000 jobs) compared to today.
Scenario 3: Accommodate 100% of 2050 Demand	▪ Increases 2020 potential airport economic impact ($31 billion and 209,000 jobs) over current conditions.[3] ▪ Provides the most business and consumer choices compared to other scenarios.	▪ Generally, increases potential 2020-level noise and aircraft air quality and carbon impacts and single-occupancy vehicle trips to airports by ~106%.[4]

[1] Assumes worst-case no improvements in current aircraft/engine efficiency, noise emissions and fuel types.
[2] Assumes percentage of demand increase roughly relates to the percentage increase/decrease of impacts and benefits.
[3] Assumes doubling of existing airport passengers is related to doubling the 2019 economic impact in dollar output and job creation.
[4] Assumes doubling the existing airport passengers in the future would double the noise and carbon impacts.

6.5 AIRPORT DEVELOPMENT PROCESS

Expanding existing airports or building a "greenfield" airport to accommodate future commercial service operations involves many steps to obtain FAA approval and funding consideration.

6.5.1 Existing Airport Expansion

For existing airports that want to expand their role from serving general aviation to include commercial service operations, the following steps (and estimated timelines) outline the major items to accomplish this:

- Statewide Airport System Plan (WSDOT) is updated and recommends change in role. (~2 years)
- An Airport Master Plan would be conducted and its Airport Layout Plan would require approval by FAA and WSDOT, including commitment by at least one airline that would serve the airport(s). Airline aircraft types and destinations would justify the runway length that could be built initially and how many gates terminal would require, etc. (~2 years)

- FAA would determine the appropriate level of National Environmental Policy Act review required for expanding an airport, which could be either an Environmental Assessment or Environmental Impact Statement. At the end of the National Environmental Policy Act process, the FAA would issue a final decision (a Finding of No Significant Impact or Record of Decision). (~2 to 4 years, assuming no litigation)
- FAA Benefit-Cost Analysis may be required since millions of federal dollars would be needed to fund the necessary airport capital improvements, but only those eligible for FAA funding (runway, taxiway and aprons, but not non-revenue-producing projects, like vehicle parking and exclusive-use terminal functions). (~1 year)
- Federal and state funding grants, financing, engineering, land acquisition, construction, commissioning, etc. (10+ years)

6.5.2 Establishing a New Airport

Generally, the search for a new airport site is started if it is determined that existing airport(s) cannot be expanded to meet the long-term future demand. In the United States, the cost of constructing a new airport is generally prohibitive without FAA funding participation, and it is extremely rare for commercial service airports to be built without FAA funding assistance. Because federal funding will be needed, the focus is on describing the FAA's process for establishing the need for a new airport, selecting a site, and implementing a new airport. The general steps that apply to developing new airport projects with FAA funding assistance follow:

- Airport Master Planning (~2 years)
- Site Selection Study (~2 to 3 years)
- Airline Support (variable)
- Detailed Site Planning and Feasibility (~2 to 3 years)
- Environmental Review (EIS 2 to 4 years, assuming no litigation)
- Benefit-Cost Analysis (~1 year)
- Land Acquisition (variable)
- Environmental/Construction Permitting (variable)
- Engineering Design (~2 years)
- Construction (~5 years)

Appendix E of Working Paper 3, "Development and Evaluation of Scenarios" provides more details on each of these steps for constructing a new airport in the United States.

The next chapter reviews existing airports in the study area for the ability to fill the gap. Airports are screened for their potential to fulfill this role by meeting criteria that include potential runway length, space for terminals, multimodal access, and airspace constraints, among other factors.

7. Evaluation of Airports for Scenarios

7.1 EVALUATION CRITERIA

The study team evaluated each of the 28 airports in the study area for the potential to accommodate the future aviation demand and then rated with a simple color by each criterion. Each criterion has a green, yellow, or red rating to indicate the ability of an airport to meet the specified criterion with green meeting the criterion, yellow potentially meeting it with difficulty, and red not meeting it. For critical criteria, a red rating excludes the airport from further analysis as noted under the rating definitions for the vital criteria. This chapter outlines the criteria by which the airports in the study airport were evaluated. Working Paper 3, "Development and Evaluation of Scenarios" presents the evaluation and results details.

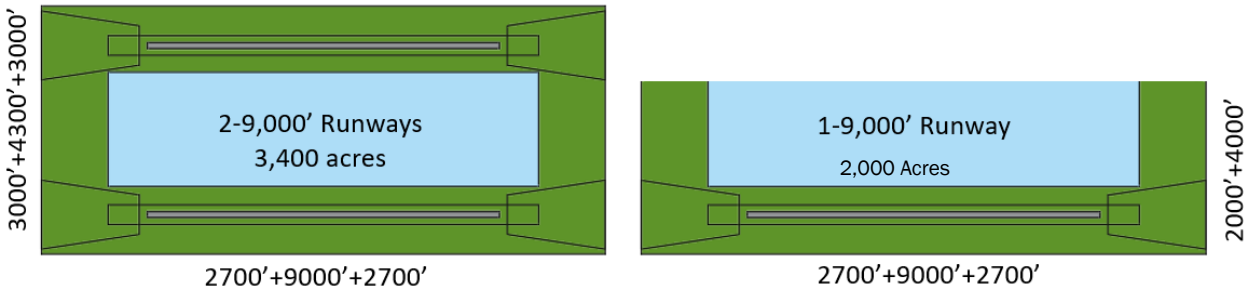
7.1.1 Ability to Accommodate Single or Parallel Runways (7,000 or 9,000 feet)

To accommodate the significant amount of commercial passenger service identified previously, a minimum runway length of 7,000 feet would be needed, which would allow for regional service along the West Coast and the Midwest. A 9,000-foot runway would be ideal and would allow for increased range of service, including the East Coast and Hawaii. Additionally, an airport that has or could accommodate a parallel runway would increase the number of aircraft operations than a single airport could handle, therefore reducing the number or airports needed to meet the future gap.

The study team also considered the potential to accommodate commercial service and domestic (or narrow-body) belly cargo needs. For an airport to accommodate commercial service, space would be needed for the operations, which would include belly cargo, aircraft catering trucks, terminal, etc. The study also analyzed other airports, with annual enplanements comparable to the future gap, to determine the potential amount of space needed for an airport to have commercial service operations.

Figure 7-1 depicts the idealized airport layouts to meet the 2050 gap with one or multiple airports, depending on how many runways could be built at the airport site.

Figure 7-1. Ideal Airport Layouts



These layouts were then used to analyze the area surrounding the study area airports to determine whether sufficient space exists to accommodate commercial service and cargo needs with limited impacts to existing developed areas.

7.1.2 Existing Airspace Constraints or Conflicts

The study team evaluated each of the potential airport sites with respect to potential airspace constraints that could impede the full use of runways and the ability to operate efficiently at the maximum level of aircraft operations. The evaluated time period was assumed to be post 2035 where advancement in technology could improve operational constraints; however, these potential improvements were not considered in the analysis at this time.

7.1.3 Impact to Sea-Tac Aircraft Operations

The impact to flight operations at a potential airport at the upper levels of capacity was also reviewed with respect to its impact to operations at Sea-Tac. It was considered a negative if an airport's future flight operations affected the operational efficiency of Sea-Tac.

7.1.4 Flood Zone Hazard

If an airport is in an area that is prone to flooding, expansion potential of the airport is limited because commercial service operations would likely be affected during significant rain events. The regional airports on current Federal Emergency Management Agency flood zone maps were evaluated if they were within the 100-year flood zone or flood zone hazard area.

7.1.5 Current and Future Roadway and Transit Access

The characteristics of each airport's multimodal access influence each scenario even as planning for multimodal access is a derivative of scenario outcomes. Each airport was previously assessed[16] based on the benchmarks, including proximity of an interstate highway or state highways (using 5 miles as a criterion), direct access to a four-lane arterial road or highway, and access to high-capacity transit (HCT). In addition, the airports were evaluated for potential improvements to access where access is not available. Several factors and data sources were considered when assessing each airport:

- Roadway improvement feasibility (e.g., improving a state highway to a limited-access freeway that could be designated as an interstate)
- Availability of developable land
- Need or demand for transit expansion
- Existing highway and transit planning by federal, state, and local agencies

[16] In Working Paper 2, "Airport Needs Analysis"

Each airport was assigned a rating for its current or potential access.

7.1.6 Incompatible Land Use within A mile of Runway Ends

Assuming a 7,000-foot or 9,000-foot runway(s), the area 1 mile from each existing runway end was evaluated for incompatible land use, which according to the FAA consists of residential areas, schools, and churches that are sensitive to high levels of aircraft noise. Compatible land uses around airport consist of industrial and commercial development.

7.1.7 Ability to Accommodate Additional Aircraft Operations

As aviation demands grow, the ability for an airport to accommodate increase aircraft operations will be required to allow growth of commercial service and cargo operations. Because existing airports are being evaluated, the current operations at the airport considered to determine if the airport would have the ability to handle the full projected gap between future demand and capacity in regional aircraft operations.

7.1.8 Impact to Aerospace Manufacturing

Because aerospace manufacturing is a significant industry and prevalent at several airports in the central Puget Sound region, there is a desire to limit impacts to existing or planned expansion for aerospace manufacturing at airports in the region.

7.1.9 Population and Employment within 60-Minute Drive Time

The study team analyzed each airport for drive-time coverage of population and employment based on 2050 congestion projections. Each airport was combined individually with Sea-Tac and Paine Field to determine the ability of the multi-airport system to meet the original benchmarks for 80% of the population and 90% of employment to be within a 60-minute drive time to a commercial service airport.

7.1.10 Airport Ownership

Ownership of an airport is important because ownership determines available funding sources for capital improvements, maintenance, and operation. A privately owned airport could be open for public use; however, it is generally funded and maintained by its private owners since there is no guarantee that federal investment would be repaid if the sponsor becomes insolvent. A public airport is open to the public and owned by public entities (generally a city, county, state or authority). A publicly owned airport is eligible for, and ranks higher for, FAA Airport Improvement Program funding that provides grants to airports for planning, development, and noise compatibility mitigation. A military airport, while owned by a public entity, differs in that it is owned by the federal government, in particular the U.S. Department of Defense. It is not open to the public, unless it is designated as a joint civilian/military airport. Changing existing military airfields to public use requires an act of Congress and/or agreement by the U.S. Department of Defense, which can be very difficult and time consuming.

7.2 FURTHER ANALYSIS OF REMAINING AIRPORTS

Most of the airports were eliminated for failure to meet one or more of several evaluation criteria described in the previous sections. Working Paper 3, "Development and Evaluation of Scenarios," Chapter 4, Airport Evaluation analyzed the remaining five airports—Arlington, Bremerton, Paine Field, McChord, and Tacoma Narrows—based on the remaining criteria to determine the feasibility of the airport to accommodate the future 2050 demand of the region.

7.2.1 Arlington Municipal Airport

7.2.1.1 Airport Layout Analysis

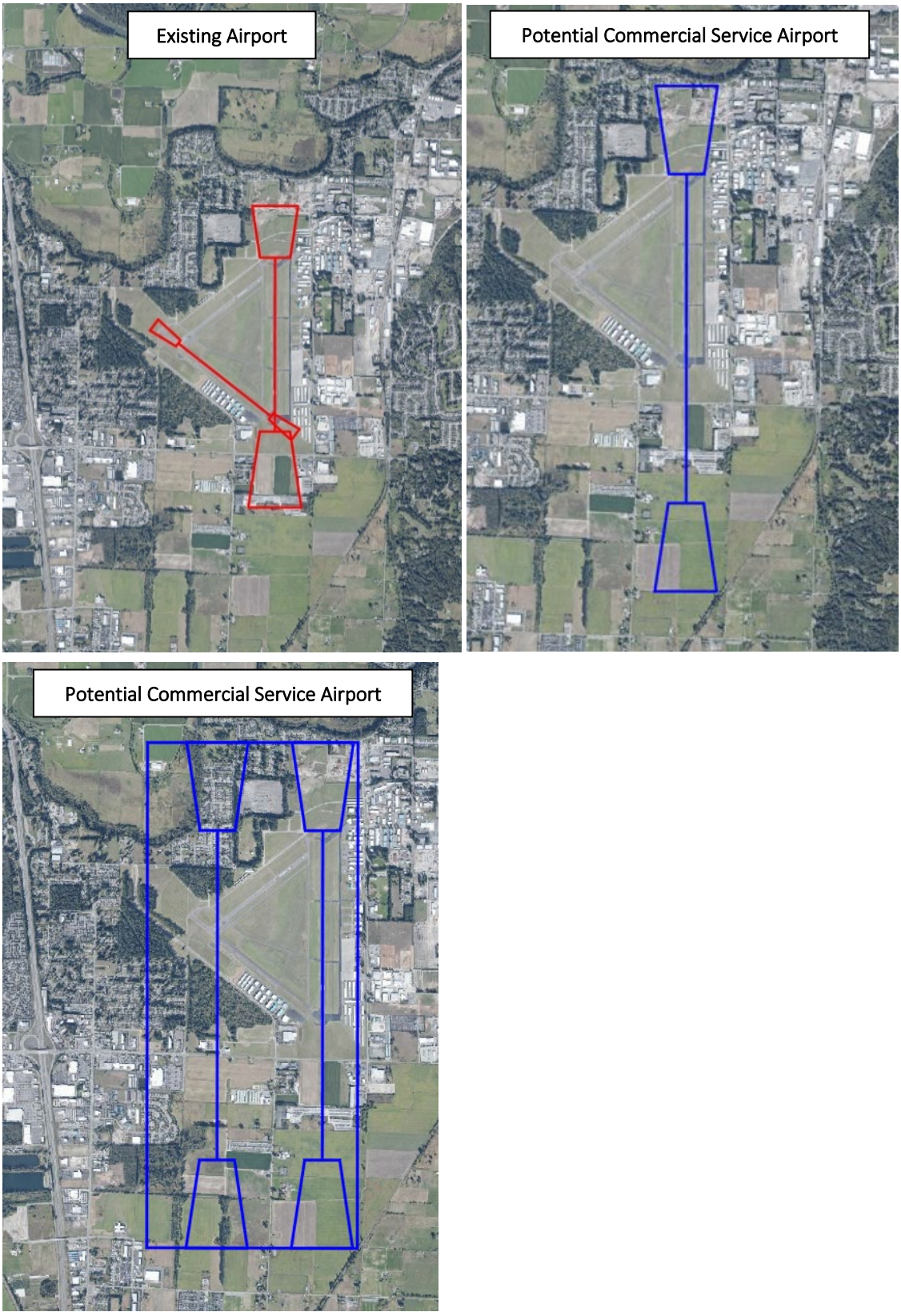
Arlington Municipal Airport is a publicly owned airport in northeastern Snohomish County. Arlington Municipal Airport has two existing runways that are 3,498 feet and 5,332 feet in length. Based on visual analysis, there is potential space for expansion to single or parallel 9,000-foot runways. The area needed to accommodate commercial service operations was determined based on analysis of commercial service airport size at airports with similar operations to the future forecast gap. Within this area, there is sufficient space to accommodate two 9,000-foot parallel runways, which would allow for transcontinental and Hawaii air service. There would be an impact to surrounding developed areas in order to accommodate parallel runways; however, it does not appear to be significant. Land use within 1 mile from the runway end was evaluated for incompatible off-airport land uses. One church is east of the airfield, along with residential areas, which are considered an incompatible land use. Based on the current Airport Layout Plans, the airport could accommodate an additional 92,000 operations. **Figure 7-2** depicts Arlington Municipal Airport's general ability to accommodate the idealized parallel runway system necessary to meet a portion of the 2050 commercial service demand.

Table 7-1 summarizes the Arlington Municipal Airport's evaluation.

Table 7-1. Arlington Municipal Airport Evaluation

AIRPORT	7,000-FOOT RUNWAY	9,000-FOOT RUNWAY	PARALLEL RUNWAYS	OFF-AIRPORT LAND USE	COMMERCIAL SERVICE AND CARGO NEEDS	ADDITIONAL OPERATIONS	IMPACT TO AEROSPACE MANUFACTURING
Arlington Municipal	Green	Green	Yellow	Yellow	Yellow	Yellow	Green

Figure 7-2. Arlington Municipal Airport Existing and Potential Commercial Service Layout



7.2.1.2 Population and Employment within a 60-minute Drive Time

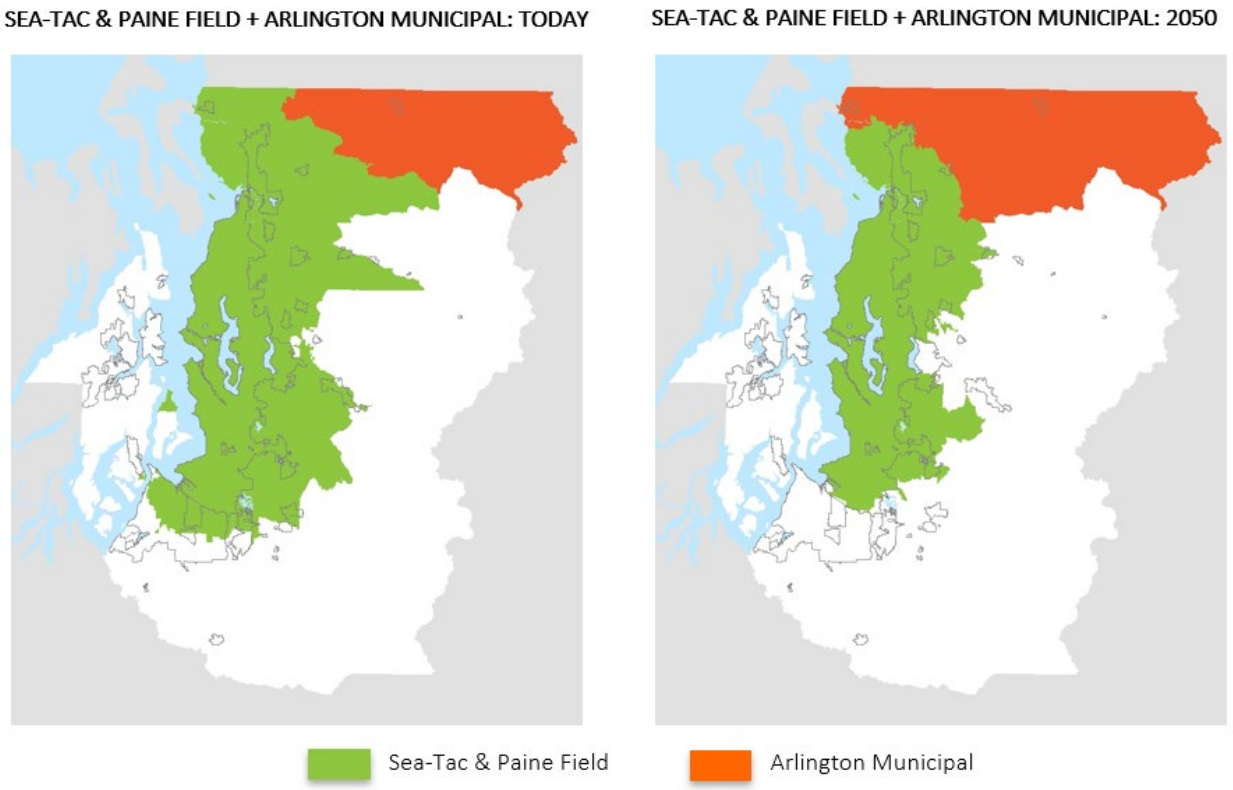
The population and employment within a 60-minute drive time was analyzed to determine the amount of coverage an additional airport would add in the future based on future congestion highway data, as depicted in **Figure 7-3**. Combined with Sea-Tac and Paine Field, the population coverage is 71%, an increase of only 1% from just Sea-Tac and Paine Field combined, and the employment coverage is 80%, which is no additional coverage from just Sea-Tac and Paine Field combined. The airport does not meet the benchmarks (80% for population and 90% for employment) for either criteria. **Table 7-2** summarizes the airport's drive-time evaluation

Table 7-2. Arlington Municipal Airport Population and Employment Drive-Time Coverage

AIRPORT NAME	POPULATION WITHIN 60-MINUTE DRIVE TIME*	POPULATION NET BENEFIT	EMPLOYMENT WITHIN 60-MINUTE DRIVE TIME	EMPLOYMENT NET BENEFIT
Arlington Municipal	71%	1%	80%	0%

*Includes Sea-Tac and Paine Field

Figure 7-3. Arlington Municipal Airport Existing and Future 60-Minute Drive-Time Coverage



7.2.1.3 Current and Future Roadway and Transit Access

The Arlington Municipal Airport benefits from close proximity and straightforward access to both the interstate and state highway systems. The airport is just 2 miles east of Interstate 5 (I-5), which is directly accessible from the airport via SR 531.

While the airport does not benefit from direct access to a 4-lane arterial road or highway, WSDOT has plans to widen SR 531 between 43rd Avenue NE and 67th Avenue NE. This project is in the preliminary design and environmental review phases, with construction expected to take place in 2023 and 2024. In addition, 59th Avenue NE could be widened to the east of the airport, because the airport owns the land on the west side of the road. This would require significant redevelopment of airport property, however, making it less feasible. The widening of SR 531 will provide the airport tenants and users with four-lane arterial access.

There is no HCT service to Arlington Municipal Airport. Community Transit Routes 220 (Arlington to Smokey Point) and 230 (Darrington to Smokey Point) both stop at the northwest corner of the airport property in the 4700 block of 188th St NE. Hourly headway routes operate seven days a week. The nearest transit facility is Smokey Point Transit Center, approximately 1.3 miles away. The airport is not in the vicinity of planned expansion of SWIFT services (Community Transit's Bus Rapid Transit system), but there is potential to add a route providing service between the Smokey Point Transit Center, the airport, and downtown Arlington via SR 531 and 67th Avenue. **Table 7-3** summarizes the airport's future transit and roadway access evaluation.

Table 7-3. Arlington Municipal Airport Current and Future Transit and Roadway Access

AIRPORT NAME	INTERSTATE ACCESS		STATE HW ACCESS		4-LANE ARTERIAL STATUS		HIGH-CAPACITY TRANSIT	
	Current Access	Potential for Access	Current Access	Potential for Access	Current Access	Potential for Access	Current Access	Potential for Access
Arlington Municipal	Yes	Green	Yes	Green	No	Green	No	Yellow

7.2.1.4 Airspace Analysis

Arlington Municipal Airport is 43 nautical miles north of Sea-Tac and 16 nautical miles north of Paine Field. The airport is north of the primary arrival and departure paths for Sea-Tac and one of Arlington Municipal Airport's existing runways is parallel to Sea-Tac and Paine Field. The development of this airport is not anticipated to be constrained by the existing airspace, with the greatest issue being the proximity to Paine Field and Whidbey Island military operations. Development of a commercial airport at this site is not anticipated to have significant constraints on the operation of Sea-Tac. **Table 7-4** summarizes the airspace ratings. Working Paper 3, "Development and Evaluation of Scenarios" Appendix C, Airspace Analysis, presents the location of Arlington Municipal Airport with respect to Sea-Tac, Paine Field, and the other potential airport sites.

Table 7-4. Arlington Municipal Airport Airspace Analysis

AIRPORT NAME	EXISTING AIRSPACE CONSTRAINTS OR CONFLICTS?	IMPACT TO SEA-TAC AIRSPACE OPERATIONS
Arlington Municipal	Green	Green

7.2.2 Bremerton National Airport

7.2.2.1 Airport Layout Analysis

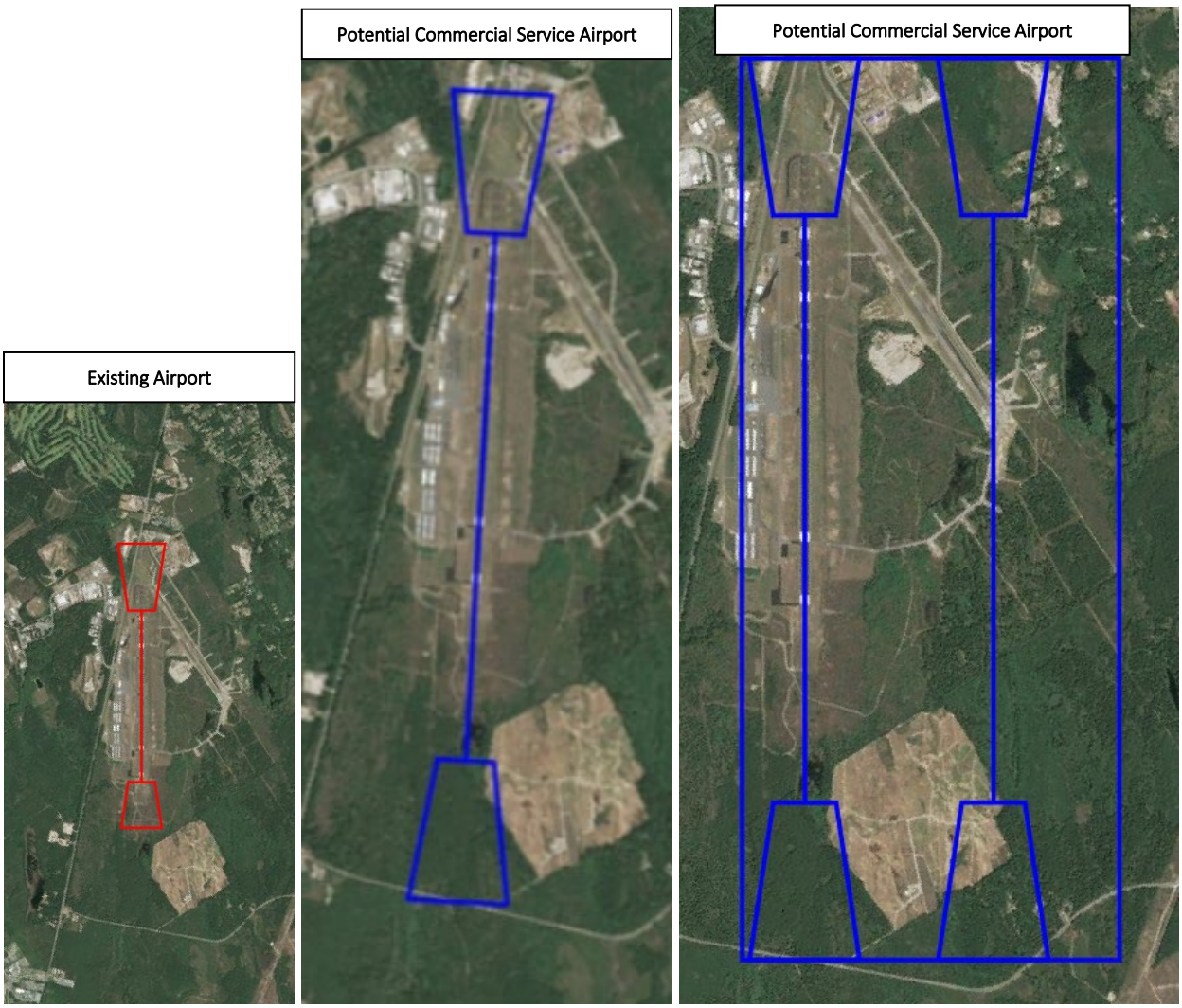
Bremerton National Airport is a publicly owned airport across Puget Sound from Seattle in Kitsap County. It has one existing runway that is 6,000 feet in length. Based on visual analysis, there is potential space to expand to single or parallel 9,000-foot runways. The area needed to accommodate commercial service operations was determined based on analysis of commercial service airport size at airports with similar operations to the future forecast gap. Within this area, there appears to be sufficient space to accommodate two 9,000-foot parallel runways, which would allow for transcontinental and Hawaii air service. Table 7-5 summarizes the airfield evaluation.

Table 7-5. Bremerton National Airport Airfield Evaluation

AIRPORT	7,000-FOOT RUNWAY	9,000-FOOT RUNWAY	PARALLEL RUNWAYS	OFF-AIRPORT LAND USE	COMMERCIAL SERVICE AND CARGO NEEDS	ADDITIONAL OPERATIONS	IMPACT TO AEROSPACE MANUFACTURING
Bremerton National	Green	Green	Green	Green	Green	Yellow	Green

There would be some impacts to surrounding developed areas in order to accommodate parallel runways. Land use within 1 mile from the runway ends was evaluated to determine any potential incompatible off-airport land uses. There are no incompatible land uses based on visual analysis. Based on 66,000 operations and an airfield capacity of 230,000 operations in 2017, the airport has an additional 164,000 operations capacity. Figure 7-4 depicts the airport's general ability to accommodate the idealized parallel runway system necessary to meet a portion of the 2050 commercial service demand.

Figure 7-4. Bremerton National Airport Existing and Potential Commercial Service Layout



7.2.2.2 Population and Employment within a 60-minute Drive Time

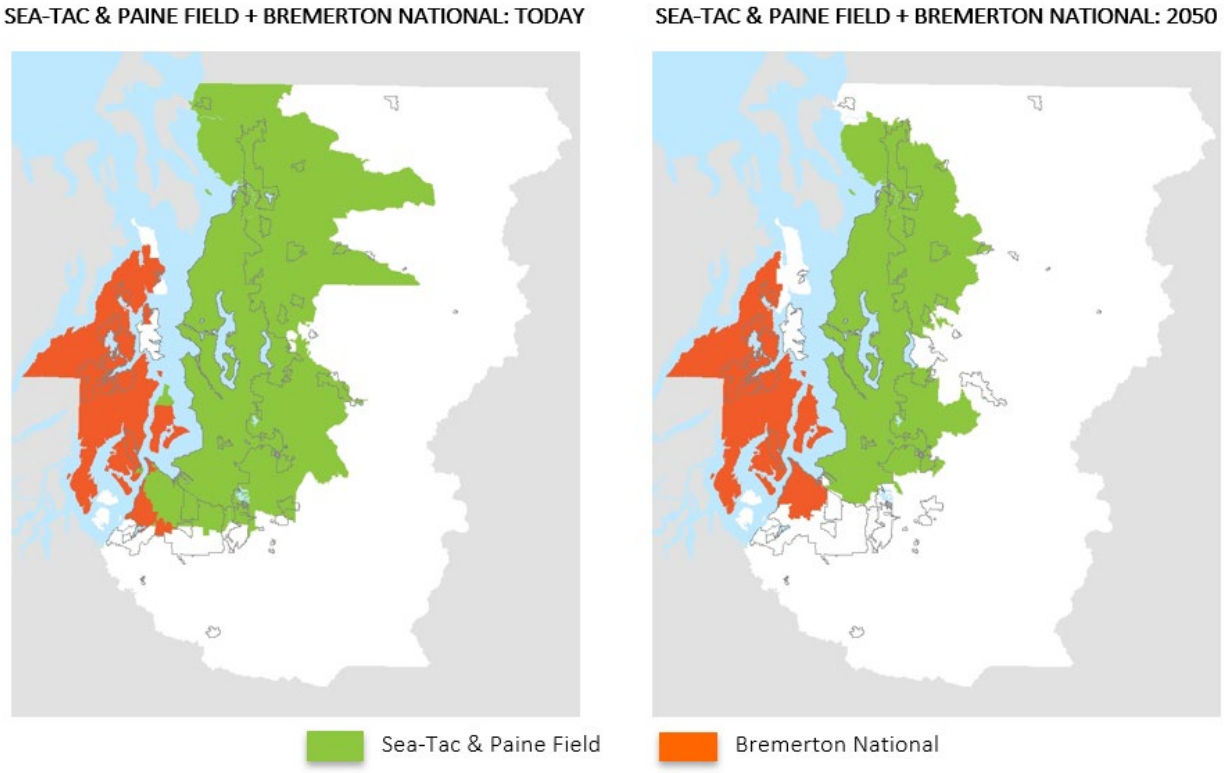
The population and employment within a 60-minute drive time was analyzed to determine the amount of coverage an additional airport would add in the future based on future congestion data. Table 7-6 summarizes Bremerton National Airport's drive-time evaluation. Combined with Sea-Tac and Paine Field, the population coverage is 84% and the employment coverage is 92%, with both criteria exceeding the respective benchmarks of 80% for population and 90% for employment, as depicted in Figure 7-5.

Table 7-6. Bremerton National Airport Population and Employment Drive-Time Coverage

AIRPORT NAME	POPULATION WITHIN 60-MINUTE DRIVE TIME*	POPULATION NET BENEFIT	EMPLOYMENT WITHIN 60-MINUTE DRIVE TIME	EMPLOYMENT NET BENEFIT
Bremerton National	Green (84%)	Green (14%)	Green (92%)	Green (12%)

*Includes Sea-Tac and Paine Field Airports

Figure 7-5. Bremerton National Airport Current and Future 60-Minute Drive-Time Coverage



7.2.2.3 Current and Future Roadway and Transit Access

Bremerton National Airport is on the Kitsap Peninsula, which is west of Seattle, across the Puget Sound and located in Kitsap County, WA, which is the least populated county in the study area. The airport is adjacent to SR 3, a designated National Highway System link with access control to adjacent property. Access to I-5 is 30 miles from the airport via SR 3 and SR 16, a limited-access facility described above. The designation of SR 16 between Gorst and Tacoma as an interstate is unlikely but feasible. SR 16 access is more than 5 miles from the Bremerton National Airport. WSDOT does not plan to upgrade SR 16 in the vicinity of the SR 3 access and there are presently no plans to provide a new limited-access highway in the vicinity of Bremerton National Airport.

Bremerton National Airport has excellent, direct access to the state highway network via SR 3, which runs nearly parallel to the runway just north of the airport. Bremerton National Airport lacks direct access to a four-lane arterial road. Despite growing traffic volumes on SR 3 (and despite its designation as an National Highway System facility), WSDOT has no plans to widen SR 3 at this time. Kitsap County has plans to construct a new 4-lane arterial in the vicinity of the airport.

Bremerton National Airport is not served by HCT. The airport is in the Kitsap Transit SK Ride service area, which includes McCormick Woods, Sunnyslope, Olympic View Industrial Park, The Ridge, and McCormick Meadows. SK Ride is a shared-ride service operating within the service area by rider request only. There are no designated stops or routing. A proposed regional route along SR 3 is shown on the Kitsap Transit

long-range vision map. This route would connect Bremerton to the Puget Sound Industrial Park. The route could be implemented as or upgraded to HCT service levels.

In some cases, the lack of a nearby motorway (typically a freeway) designated as an interstate does not mean that there is no nearby access to a limited-access multilane divided highway with no at-grade intersections. Furthermore, SR 16 connects directly to I-5 in Tacoma and provides a motorway corridor to Bremerton, where access is available to nearby U. S. Navy facilities. Interstate access does not exist within 5 miles, but a motorway designated through the National Highway System meets the access criterion, an asterisk is provided in Table 7-7.

Table 7-7. Bremerton National Airport Current and Future Transit and Roadway Access

AIRPORT NAME	INTERSTATE ACCESS		STATE HW ACCESS		4-LANE ARTERIAL STATUS		HIGH-CAPACITY TRANSIT	
	Current Access	Potential for Access	Current Access	Potential for Access	Current Access	Potential for Access	Current Access	Potential for Access
Bremerton National	No	Red*	Yes	Green	No	Yellow	No	Yellow

* Interstate access does not exist within 5 miles, but a motorway designated through the National Highway System provides access.

7.2.2.4 Airspace Analysis

Bremerton National Airport is 19 nautical miles west of Sea-Tac. The airport is west of the primary arrival and departure paths for Sea-Tac. The runway is not parallel to Sea-Tac, with approximately a 33-degree angle to the west in south flow. The development of this airport may be challenged or constrained by the existing airspace, with the greatest issue being the proximity to Sea-Tac traffic over the busy flight area of the sound when operating in south flow and the closer proximity to military operations. Development of a commercial airport at this site is not anticipated to have significant constraints on the operation of Sea-Tac with the biggest challenge from activity over the sound to the north. Modern navigation technology may be able to minimize conflicts between the two airports in the future. Table 7-8 summarizes the airspace ratings. Working Paper 3, "Development and Evaluation of Scenarios," Appendix C, Airspace Analysis, presents the location of Bremerton National Airport with respect to Sea-Tac, Paine Field, and the other potential airport sites. The Seattle Terminal Area and location of the restricted airspace is also shown in this appendix.

Table 7-8. Bremerton National Airport Airspace Analysis

AIRPORT NAME	EXISTING AIRSPACE CONSTRAINTS OR CONFLICTS?	IMPACT TO SEA-TAC AIRSPACE OPERATIONS
Bremerton National	Green	Yellow

7.2.3 Paine Field

7.2.3.1 Airport Layout Analysis

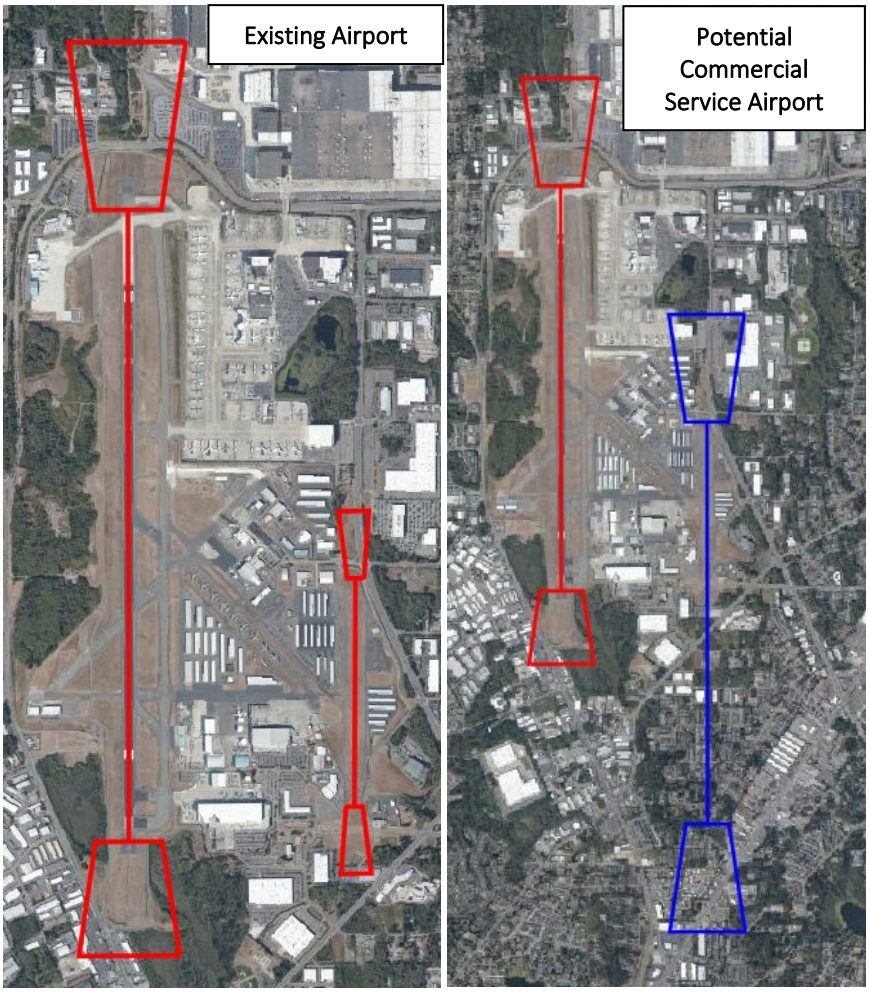
Paine Field is a publicly owned airport in Snohomish County north of Seattle. It has three existing runways that are 3,004; 4,504; and 9,010 feet in length. The parallels are depicted as red (**Figure 7-6**). Extending the 3,004-foot parallel runway to a 9,000-foot runway (blue) would affect the Boeing manufacturing facilities to the north and developed areas to the south. There is a 9,000-foot runway, but further expansion is not feasible due to the impact to Boeing manufacturing operations and dense development surrounding the airport. **Table 7-9** summarizes the airfield evaluation.

Table 7-9. Paine Field Airfield Evaluation

AIRPORT	7,000-FOOT RUNWAY	9,000-FOOT RUNWAY	PARALLEL RUNWAYS	OFF-AIRPORT LAND USE	COMMERCIAL SERVICE AND CARGO NEEDS	ADDITIONAL OPERATIONS	IMPACT TO AEROSPACE MANUFACTURING
Paine Field	Green	Green	Red	Red	Green	Yellow	Red

Land use within 1 mile from the runway ends was evaluated to determine potential incompatible off-airport land uses. Currently, there are multiple churches, a school, and residential areas within a mile of the runway ends, which are considered incompatible land uses. **Figure 7-6** depicts the airport's general ability to accommodate the idealized parallel runway system necessary to meet a portion of the 2050 commercial service demand.

Figure 7-6. Paine Field Existing and Potential Commercial Service Layout



7.2.3.2 Population and Employment within a 60-minute Drive Time

The population and employment within a 60-minute drive time was analyzed to determine the amount of coverage an additional airport would add in the future based on future congestion data. Combined with Sea-Tac, Paine Field provides a population coverage of 70% and an employment coverage of 80%. Neither criteria meets the respective benchmarks of 80% for population and 90% for employment, as summarized in Table 7-10.

Table 7-10. Paine Field Population and Employment Drive-Time Coverage

AIRPORT NAME	POPULATION WITHIN 60-MINUTE DRIVE TIME*	POPULATION NET BENEFIT	EMPLOYMENT WITHIN 60-MINUTE DRIVE TIME	EMPLOYMENT NET BENEFIT
Paine Field	Red (70%)	Red (0%)	Red (80%)	Red (0%)

*Includes Sea-Tac

7.2.3.3 Current and Future Roadway and Transit Access

Paine Field is already very accessible via interstate highways, state highways, four-lane arterial roadways, and HCT. The airport is accessible from I-5 via SR 526 (itself a limited-access, four-lane highway) and via the

four-lane Airport Road. As it loops around the airport, SR 526 becomes SR 525, which is not limited access but maintains four lanes and eventually connects directly with I-405 at I-5. The airport is also close to the four-lane SR 99, which intersects with Airport Road. HCT serves Paine Field by Community Transit's SWIFT Green Line (Table 7-11). However, the access road to the current passenger terminal is limited with little opportunity to expand without impacts existing aviation development.

Table 7-11. Paine Field Current and Future Transit and Roadway Access

AIRPORT NAME	INTERSTATE ACCESS		STATE HW ACCESS		4-LANE ARTERIAL STATUS		HIGH-CAPACITY TRANSIT	
	Current Access	Potential for Access	Current Access	Potential for Access	Current Access	Potential for Access	Current Access	Potential for Access
Paine Field	Yes	Green	Yes	Green	Yes	Green	Yes	Green

7.2.3.4 Airspace Analysis

Paine Field is 27 nautical miles north of Sea-Tac. The airport is north of the primary arrival and departure paths for Sea-Tac. The existing runways are near parallel to Sea-Tac. The development of this airport is not anticipated to be constrained by the existing airspace, with the greatest issues occurring in weather conditions where the two airports are in opposite flow. Developing a commercial airport at this site is not anticipated to have significant constraints on Sea-Tac operations. Table 7-12 summarizes the airspace ratings. Working Paper 3, "Development and Evaluation of Scenarios," Appendix C, Airspace Analysis, presents the location of Paine Field, with respect to Sea-Tac and the other potential airport sites. The Seattle Terminal Area and location of the restricted airspace is also shown in this appendix.

Table 7-12. Paine Field Airspace Analysis

AIRPORT NAME	EXISTING AIRSPACE CONSTRAINTS OR CONFLICTS?	IMPACT TO SEA-TAC AIRSPACE OPERATIONS
Paine Field	Green	Green

7.2.4 Tacoma Narrows Airport

7.2.4.1 Airport Layout Analysis

Tacoma Narrows Airport is a publicly owned airport located across the Tacoma Narrows Bridge from Tacoma and is surrounded by water on three sides. The airport has one existing runway that is 5,002 feet. Based on visual analysis, there is potential space for expansion to single or parallel 9,000-foot runways. It is potentially limited due to surrounding water. The area needed to accommodate commercial service operations was determined based on analysis of commercial service airport size at airports with similar operations to the future forecast gap. **Table 7-13** summarizes the airfield evaluation.

Table 7-13. Tacoma Narrows Airport Airfield Evaluation

AIRPORT	7,000-FOOT RUNWAY	9,000-FOOT RUNWAY	PARALLEL RUNWAYS	OFF-AIRPORT LAND USE	COMMERCIAL SERVICE AND CARGO NEEDS	ADDITIONAL OPERATIONS	IMPACT TO AEROSPACE MANUFACTURING
Tacoma Narrows	Green	Green	Yellow	Green	Green	Yellow	Green

With some impact to surrounding development, the airport could accommodate a single or parallel 9,000-foot runways within the area needed for commercial service operations. Land use within 1 mile from the runway ends was evaluated to determine potential incompatible off-airport land uses. Currently, there are no incompatible land uses. **Figure 7-7** depicts the airport's general ability to accommodate the idealized parallel runway system necessary to meet a portion of the 2050 commercial service demand.

Figure 7-7. Tacoma Narrows Airport Existing and Potential Commercial Service Layout

7.2.4.2 Population and Employment within a 60-minute Drive Time

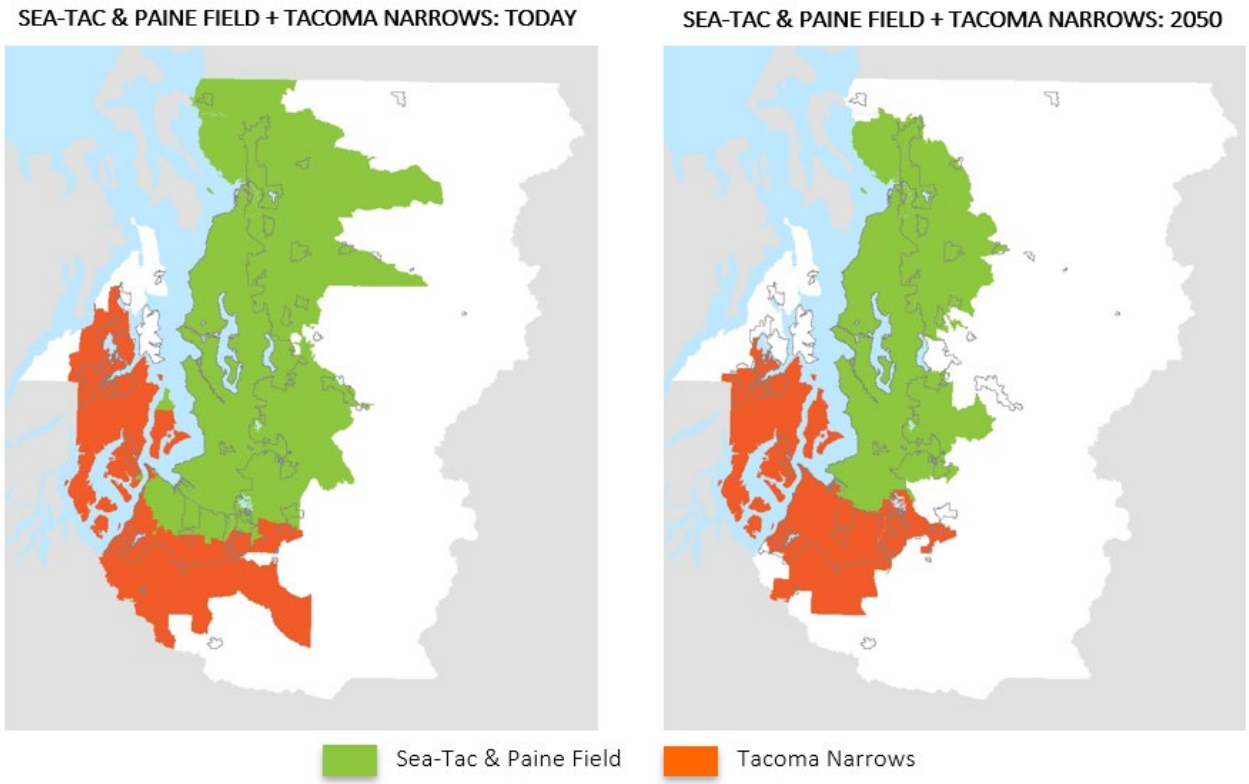
The population and employment within a 60-minute drive time was analyzed to determine the amount of coverage an additional airport would add in the future based on future congestion data. Combined with Sea-Tac and Paine Field, the population coverage is 92% (an increase of 22% from Sea-Tac and Paine Field alone) and the employment coverage is 95% (an increase of 15% from Sea-Tac and Paine Field), as summarized in Table 7-14. Both criteria exceed the respective benchmarks of 80% for population and 90% for employment, as depicted in Figure 7-8.

Table 7-14. Tacoma Narrows Airport Population and Employment Drive-Time Coverage

AIRPORT NAME	POPULATION WITHIN 60-MINUTE DRIVE TIME*	POPULATION NET BENEFIT	EMPLOYMENT WITHIN 60-MINUTE DRIVE TIME	EMPLOYMENT NET BENEFIT
Tacoma Narrows	Green (92%)	Green (22%)	Green (85%)	Green (15%)

*Includes Sea-Tac and Paine Field

Figure 7-8. Tacoma Narrows Airport Current and Future 60-Minute Drive-Time Coverage



7.2.4.3 Current and Future Roadway and Transit Access

The airport does not have interstate highway access within 5 miles. The closest interstate is I-5, just 7 miles to the southeast via the limited-access SR 16, which includes the Tacoma Narrows Bridge. This nearby connection to I-5 makes SR 16 the best candidate for providing interstate access to the airport. However, it is likely not infeasible to upgrade highway to an interstate due to its prominence in connecting Tacoma and Bremerton. Medium to highly dense residential development in the airport's vicinity, in addition to various water bodies, makes the construction of new interstate highways very unlikely. Furthermore, U.S. Department of Transportation has no plans to construct an interstate highway in the vicinity of the airport.

The airport also has excellent access from the state highway network on SR 16, which is a limited-access route from I-5 in Tacoma to Gorst farther north, a span of approximately 30 miles.

Despite excellent access from a limited-access highway, the airport lacks direct access from a four-lane arterial road. Widening 26th Avenue NW to four lanes is feasible due to the potential availability of airport property to the west and undeveloped land to the east. Another potential candidate is Stone Drive NW, which runs along the northern edge of the airport. However, part of this road already runs through a tunnel underneath the threshold of Runway 17, drastically increasing the cost of the widening. Pierce County does not have plans to construct a four -lane arterial in the vicinity of the airport.

HCT does not serve the airport. Pierce Transit Routes 100 (Gig Harbor) and 102 (Gig Harbor-Tacoma Express) and Sound Transit Express Bus Route 595 (Gig Harbor-Seattle) are accessible within a mile of the airport. The Pierce Transit routes operate on hourly headways seven days a week. The Sound Transit Express Route operates northbound trips in the morning peak and southbound trips in the afternoon peak. Multiple park-and-ride lots are nearby that are served by the existing routes. It would be possible to modify one or more of the existing routes to serve the airport with HCT.

In some cases, the lack of a nearby motorway (typically a freeway) designated as an interstate does not mean that there is no nearby access to a limited-access multilane divided highway with no at-grade intersections. In the case of Tacoma Narrows Airport, for example, SR 16 is a fully access-controlled multilane divided highway that serves a network function identical to that of an interstate. In cases where interstate access does not exist within 5 miles but a motorway designated through the National Highway System meets the access criterion, an asterisk is provided in Table 7-15.

Table 7-15. Tacoma Narrows Airport Current and Future Transit and Roadway Access

AIRPORT NAME	INTERSTATE ACCESS		STATE HW ACCESS		4-LANE ARTERIAL STATUS		HIGH-CAPACITY TRANSIT	
	Current Access	Potential for Access	Current Access	Potential for Access	Current Access	Potential for Access	Current Access	Potential for Access
Tacoma Narrows	No	Yellow*	Yes	Green	No	Yellow	No	Green

*Interstate access does not exist within 5 miles, but a motorway designated through the National Highway System meets the locality criteria.

7.2.4.4 Airspace Analysis

Tacoma Narrows Airport is 15 nautical miles southwest of Sea-Tac. The airport is under the primary west side arrival and departure paths for Sea-Tac. The existing runway is near parallel to Sea-Tac. The runway is oriented 7 degrees to the west from Sea-Tac, when operating in south flow. Traffic from Sea-Tac and KCIA to the north, military restricted use to the south, McChord Airfield military traffic to the south, and a military route in the area to the west create conflicts due to the large volume of aircraft in a relatively small area of the airspace. Development of a commercial airport at this site is anticipated to have moderate constraints on the operation of Sea-Tac with the biggest challenge being from the large volume of traffic from multiple airports. Modern navigation technology could minimize conflicts between the two airports in the future.

Table 7-16 summarizes the airspace ratings. Working Paper 3, "Development and Evaluation of Scenarios," Appendix C, Airspace Analysis, presents the location of Tacoma Narrows Airport, with respect to Sea-Tac, Paine Field, and the other potential airport sites. The Seattle Terminal Area and location of the restricted airspace is also shown in this appendix.

Table 7-16. Tacoma Narrows Airport Airspace Analysis

AIRPORT NAME	EXISTING AIRSPACE CONSTRAINTS OR CONFLICTS?	IMPACT TO SEA-TAC AIRSPACE OPERATIONS
Tacoma Narrows	Yellow	Green

7.2.5 McChord Field Airport

7.2.5.1 Airport Layout Analysis

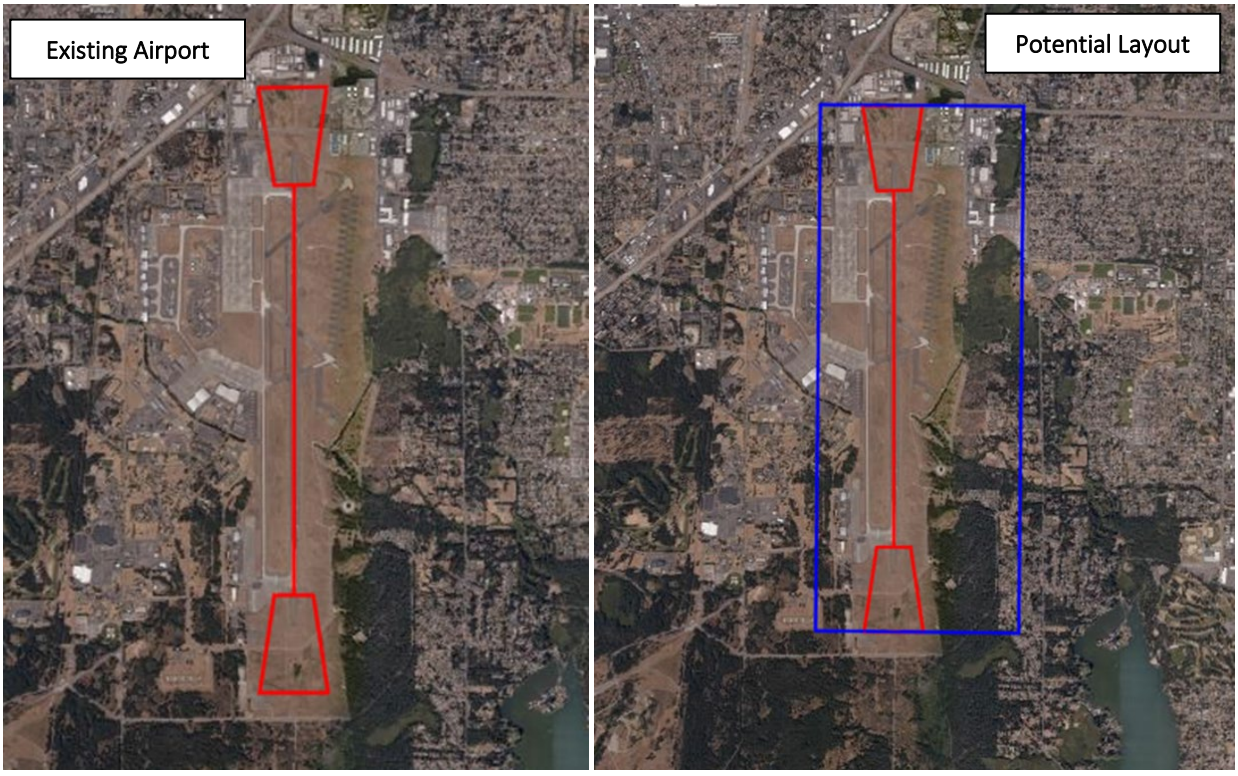
McChord Field, part of McChord Air Force Base (AFB), is a military airfield south of Tacoma in Pierce County. It has one existing runway that is 10,108 feet. Due to the military development surrounding the runway, there is insufficient space to add an adequately spaced parallel runway. The area needed to accommodate commercial service operations was determined based on analysis of commercial service airport size at airports with similar operations to the future forecasted gap. **Table 7-17** summarizes the airfield evaluation.

Table 7-17. McChord Airfield Evaluation

AIRPORT	7,000-FOOT RUNWAY	9,000-FOOT RUNWAY	PARALLEL RUNWAYS	OFF-AIRPORT LAND USE	COMMERCIAL SERVICE AND CARGO NEEDS	ADDITIONAL OPERATIONS	IMPACT TO AEROSPACE MANUFACTURING
McChord Field	Green	Green	Red	Green	Green	Yellow	Green

With some impact to surrounding development, the airport could accommodate a single 9,000-foot runways within the area for commercial service operations. Land use within one mile from the runway ends was evaluated to determine potential incompatible off-airport land uses. Currently, there are no incompatible land uses. **Figure 7-9** depicts the airport's general ability to accommodate the idealized parallel runway system necessary to meet a portion of the 2050 commercial service demand.

Figure 7-9. McChord Airfield Existing and Potential Layout



7.2.5.2 Population and Employment within a 60-minute Drive Time

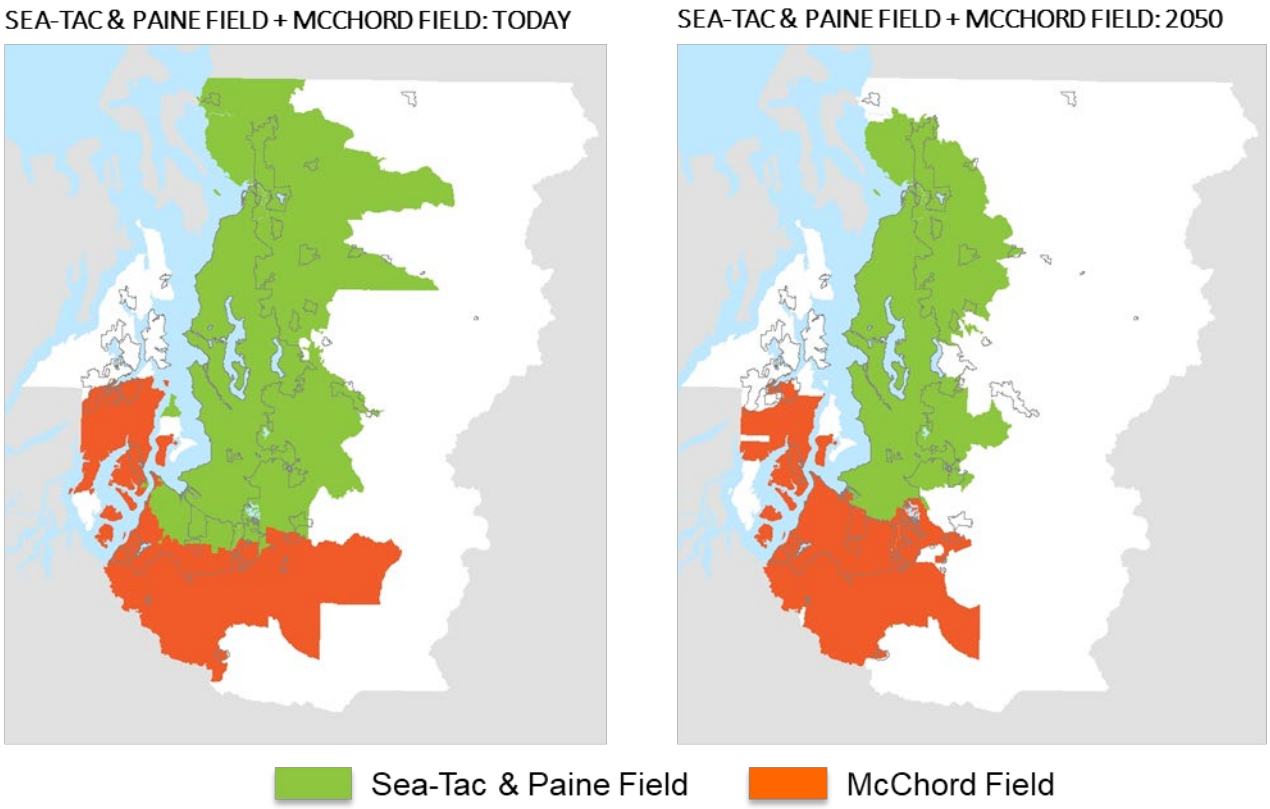
Combined with Sea-Tac and Paine Field, the population coverage is 90%, an increase of 20% from Sea-Tac and Paine Field alone, and the employment coverage is 93%, which is an increase of 13% from Sea-Tac and Paine Field. Both criteria meet the respective benchmarks of 80% for population and 90% for employment.

Table 7-18. McChord Field Population and Employment Drive Time Coverage

AIRPORT NAME	POPULATION WITHIN 60-MINUTE DRIVE TIME*	POPULATION NET BENEFIT	EMPLOYMENT WITHIN 60-MINUTE DRIVE TIME	EMPLOYMENT NET BENEFIT
McChord Field	Green (90%)	Green (20%)	Green (93%)	Green (13%)

*Includes Sea-Tac and Paine Field Airports

Figure 7-10. McChord Airfield Current and Future 60-Minute Drive-Time Coverage



7.2.5.3 Current and Future Roadway and Transit Access

While the proximity of the airport to both the interstate and state highway networks is excellent, low-capacity, low-speed streets inhibit efficient access to the field, which is wholly contained within the boundary of Joint Base Lewis-McChord (JBLM) and approximately 1 mile from the northwestern boundary of the base. Additionally, access to JBLM is controlled by the U.S. government and flight operations at the airfield require the permission of the U.S. Air Force. Direct arterial access to I-5 is provided within 2 miles of the airport's western gates.

The portion of the base from which the airport is directly accessible is served by a four-lane arterial road, Bridgeport Way SW, which is designated as Col. Jackson Boulevard within JBLM. To the north, 112th Street S features a center turn lane in most sections and further capacity enhancements are highly feasible. The northeast corner of the base is adjacent to S Steele Street (a four-lane undivided arterial) and SR 512, a regional freeway designated as part of the NHS. However, base access is not currently provided to either of these two facilities. Were a commercial terminal built to the east of the airport, the four-lane section of Steele Street could be extended to the south to serve new terminal.

HCT does not serve McChord Field. The configuration of the roadways on the AFB makes the direct provision of transit services difficult without redevelopment. Access could be provided via Pacific Highway S and S Tacoma Way or SR 512 and S Steele Street. Pierce Transit is planning a bus rapid transit corridor along Pacific Avenue (SR 7) between downtown Tacoma and Spanaway. This corridor is approximately

2.8 miles east of the airport. It is unlikely this planned corridor would be extended to McChord Field due to the lack of ridership and the impracticality of providing access to trip generators on the base from the east side of the airfield.

Table 7-19. McChord Field Current and Future Transit and Roadway Access

AIRPORT NAME	INTERSTATE ACCESS		STATE HW ACCESS		4-LANE ARTERIAL STATUS		HIGH-CAPACITY TRANSIT	
	CURRENT ACCESS	POTENTIAL FOR ACCESS	CURRENT ACCESS	POTENTIAL FOR ACCESS	CURRENT ACCESS	POTENTIAL FOR ACCESS	CURRENT ACCESS	POTENTIAL FOR ACCESS
McChord Field	Yes	Green	Yes	Green	Yes	Green	No	Yellow

7.2.5.4 Airspace Analysis

McCord Field is 19 nautical miles south-southwest of Sea-Tac. The airport is south of the primary arrival and departure paths for Sea-Tac or where these aircraft are at a high altitude. The existing runway is near parallel to Sea-Tac. The development of this airport is not anticipated to be constrained by the existing airspace, with the greatest issue being the proximity to other military operations. Development of a commercial airport at this site is not anticipated to have significant constraints on the operation of Sea-Tac. Working Paper 3, "Development and Evaluation of Scenarios," Appendix C, Airspace Analysis, presents the location of McChord Field, with respect to Sea-Tac, Paine Field, and the other potential airport sites. The Seattle Terminal Area and location of the restricted airspace is also shown in this appendix.

Table 7-20. McChord Field Airspace Analysis

AIRPORT NAME	EXISTING AIRSPACE CONSTRAINTS OR CONFLICTS?	IMPACT TO SEA-TAC AIRSPACE OPERATIONS
McChord Field	Green	Green

7.2.6 Ownership of Remaining Airports

Airports that were not eliminated due to previous criteria were evaluated based on ownership, because ownership of an airport is important for funding. A publicly owned airport is eligible for federal grants for development at the airport. Four of the remain airports are publicly owned: Arlington Municipal, Bremerton National, Paine Field, and Tacoma Narrows. Private airports are privately owned, and the owners maintain the airport, which can lead to complications in funding significant improvements, such as expansion to accommodate commercial service. Because McChord Field is a federally owned military airport, Department of Defense agreement and Congressional approval would be needed prior to commercial service operations. Lacking support of these entities, further consideration of the commercial use at McChord Field was not recommended at this time. Thus, the airport ownership analysis was rated red. Table 7-21 summarizes the ownership challenges.

Table 7-21. Airport Ownership Analysis

AIRPORTS (FAA CODE)	AIRPORT OWNERSHIP ANALYSIS
Arlington Municipal Airport (AWO)	Publicly owned
Bremerton National Airport (PWT)	Publicly owned
McChord Field (Joint Base Lewis-McChord) (TCM)	Federally owned
Paine Field Airport (PAE)	Publicly owned
Tacoma Narrows Airport (TIW)	Publicly owned

7.3 EVALUATION CONCLUSION

Overall, after evaluating each remaining airport, Arlington Municipal, Bremerton National, Paine Field, and Tacoma Narrows could expand and accommodate commercial service and therefore could help meet the growing demand of the region through 2050. The following summarizes the results of the analysis:

- Arlington Municipal Airport, while it does not add to the population and drive-time coverages for the region, does have expansion capabilities to potentially accommodate commercial service to help meet the future gap in the region through 2050.
- Bremerton National Airport has potential to expand to accommodate commercial service operations as well. There is potential for the airport to accommodate single or parallel 9,000-foot runways with limited impacts to developed areas. It also exceeds the benchmarks for population and employment drive-time coverages.
- Paine Field, which offers limited commercial service, is operating in the northern area of the central Puget Sound region. It is limited in the number of additional commercial service operations that can occur each day (24 departures) based on the environmental analysis (2018 Environmental Assessment) conducted when the airport began accommodating commercial service operations. However, with additional planning and environmental review, it could accommodate more.
- The analysis shows that Tacoma Narrows Airport could expand to meet the commercial service operational needs for some of the 2050 gap and would also meet the benchmark for population and employment drive-time coverage. However, during the fall of 2020, significant concerns were raised by Pierce County (the airport sponsor) and the City of Gig Harbor regarding previous agreements that would make it difficult to extend the length of the runway.

8. Public Engagement

The project team developed engagement strategies to support the study's following communication objectives:

- Clearly communicate the scope and findings of the study to diverse audiences.
- Provide transparency and create confidence in the study findings as a consistent foundation about the aviation system and constraints for stakeholders and decision makers.
- Obtain feedback from stakeholders and the larger public regarding aviation needs and scenarios to address them.

Major public engagement activities included convening a Technical Working Group, briefing the PSRC Executive Board, communicating with PSRC stakeholders via email updates, fielding a public opinion survey and focus groups, and holding public meetings and an online open house. As the COVID-19 pandemic emerged in spring 2020, the project team altered some of the planned engagement strategies to be conducted in line with social distancing requirements, such as shifting to in-depth interviews instead of focus groups and holding the public meetings through Zoom Webinar. For more detail on planned engagement activities and how they were adjusted due to the COVID-19 pandemic, refer to the Stakeholder Education and Engagement Report.[17]

8.1 PSRC EXECUTIVE BOARD

During each study phase, the study team presented an update to the PSRC Executive Board. In addition, the team provided an update after the study survey and other major deliverables were completed. PSRC Executive Board members are appointed by their General Assembly constituents to represent the member governments. The board is chaired by PSRC's president, meets monthly, and carries out delegated powers and responsibilities between meetings of the General Assembly.

8.2 WEBSITE

PSRC maintained a section of its website for the study. The webpage includes a project overview, frequently asked questions, copies of public materials and presentations about the study, a study timeline, and an option to sign up for email updates or contact PSRC. Starting in fall 2020, the site also included a link to the online open house.

[17] This report is on the Regional Aviation Baseline Study website.

8.3 EMAIL UPDATES

PSRC provided regular updates about the study to its project email list. As of September 2020, the list had 713 subscribers. Between October 2018 and November 2020, news about the Regional Aviation Baseline Study was shared in 14 issues of PSRC's email newsletter, which was distributed to nearly 4,000 subscribers.

8.4 SURVEY

The study team conducted a statistically valid public opinion survey of the four-county region to provide regional decision makers a representative view of how the wider public perceives aviation needs and issues. The study's objectives follow:

- Explore awareness and understating of the existing aviation system.
- Outline aviation needs and concerns of the general public.
- Provide regional decision makers with input from a broad cross-section of the public.

The study team mailed invitations to participate in an online-only, statistically representative survey to 20,000 randomly selected households across the four-county region (5,000 households per county). The survey was open from June 23 to July 8, 2020. During that time, 1,416 people completed the survey (7.2% response rate, +/- 2.6% margin of error).[18] Overall, the sample was representative regarding gender, income, and Latinx ethnicity. The sample skewed slightly toward white respondents (in King County) and those over 55 years of age.

The survey questions addressed the importance of passenger aviation to the region, how to address increasing demand on the passenger aviation system, and basic demographics of respondents, including where they live, typical travel behavior, and socioeconomic factors.

A large majority—between 91% and 95% of respondents, depending on county—thought the region should meet aviation demand.

Participants were asked to rank importance of nine features of the aviation system; participants ranked each of the features as important, but across all four counties they ranked cost of flying, access to the airport, getting through security lines, and on-time performance as the most important. Participants ranked amount of service to a variety of destinations, parking availability, environmental impacts, noise impacts, and economic benefits as less important.

[18] The final sample had 32% King County (margin of error +/- 4.8%), 18% Pierce County (margin of error +/- 6.4%), 26% Snohomish County (margin of error +/- 5.3%), and 25% Kitsap County (margin of error +/- 5.4%) respondents.

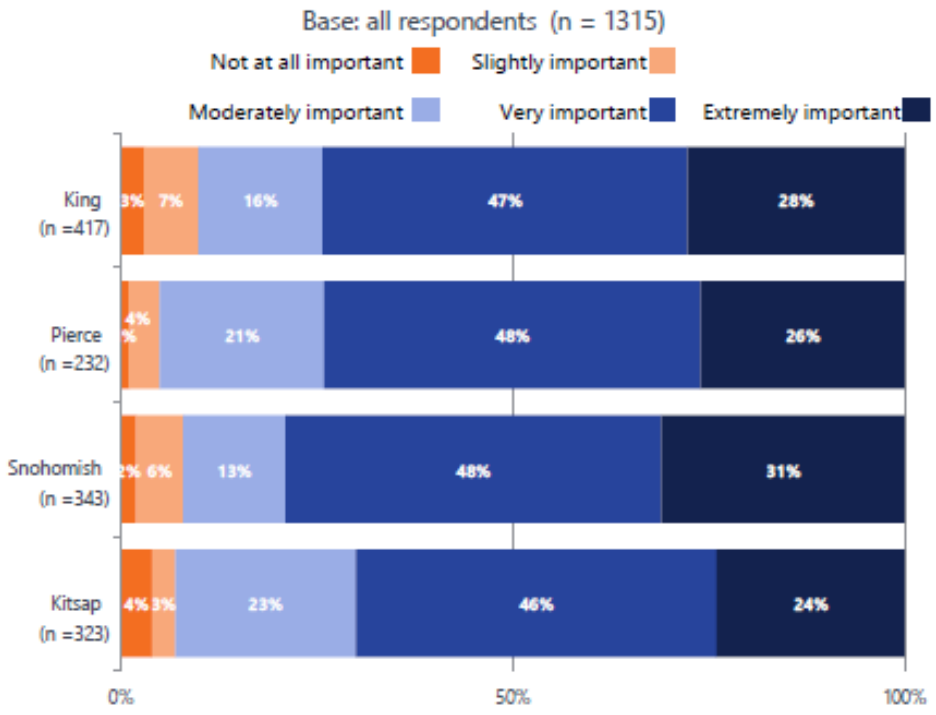
Figure 8-1. Top Features for the Aviation System (by county)

King	Pierce	Snohomish	Kitsap
1. Getting through security lines	1. Cost of flying	1. Cost of flying	1. Cost of flying
2. On-time performance	2. Getting through security lines Access to airports	2. Access to airports	2. Access to airports
3. Cost of flying	3. Amount of service to a variety of destinations	3. Getting through security lines	3. Getting through security lines
4. Amount of service to a variety of destinations	4. On-time performance	4. On-time performance	4. On-time performance
5. Access to airports		5. Economic benefits	5. Amount of service to a variety of destinations

We selected the top-ranking features based on respondents' average ranking of importance. The differences within the top-ranking features are minimal (between 0.1-0.2).

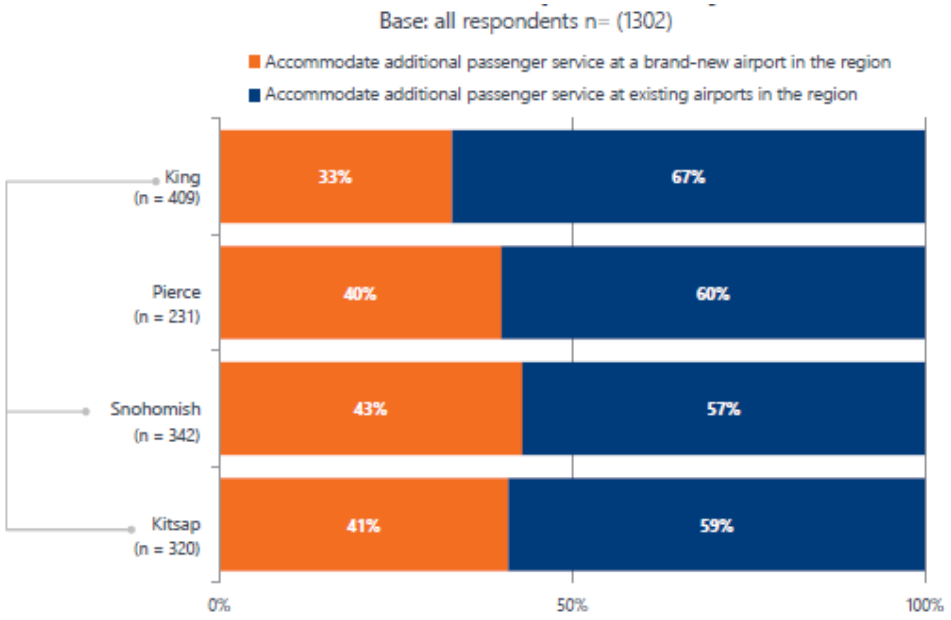
When asked directly about the priority of environmental impacts versus economic benefits, respondents were fairly split in Pierce, Snohomish, and Kitsap Counties. (King County respondents prioritized minimizing noise and environmental impacts.) Participants in every county thought it was important to improve transportation options to airports (Figure 8-2).

Figure 8-2. Importance of Meeting Demand for Aviation



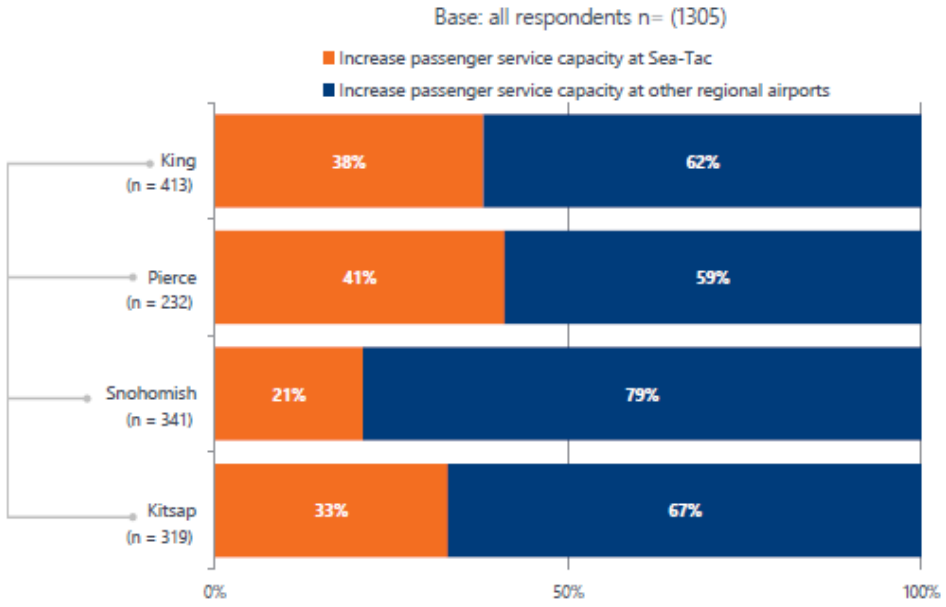
Between 57% and 67% of respondents, depending on county, thought new passenger service should be added to existing airports rather than building a new airport (**Figure 8-3**). Respondents also prioritized expanding service at regional airports rather than at Sea-Tac (**Figure 8-4**).

Figure 8-3. Importance of Accommodating Passenger Service at Existing Airports (by county)



The % differences among counties indicate the actual proportion differences within trade-off.

Figure 8-4. Importance of Increasing Passenger Service Capacity at Regional Airports versus Sea-Tac (by county)



- *The % differences among counties indicate the actual proportion differences within trade-off.*
- *Paine Field in Snohomish newly opened for passenger service*

For complete survey results, including details on the survey questions, method, and respondent demographics, refer to the Stakeholder Education and Engagement Report.

8.5 IN-DEPTH INTERVIEWS

The study team conducted one-on-one interviews to elaborate on the feedback received through the public opinion survey. The study team conducted 22 interviews between October 6 and 16, 2020, with people who had previously responded to the public opinion survey.

As with the survey, most participants said it was very important for the region to meet growing demand for aviation. Most participants cited jobs and the economy and travel experience as the primary reasons for meeting the growing demand. Environmental impacts were the top concern for participants, but when asked to weigh different benefits and impacts, most participants said the issues were not mutually exclusive and explained that they thought as capacity for air travel in the region increased, there would also be advances in dealing with pollution and noise. Most participants favored expanding service at airports around the region rather than concentrating service at one airport.

The full interview report is available in the Stakeholder Education and Engagement Report.

8.6 REGIONAL PUBLIC MEETINGS

PSRC hosted three virtual public meetings over a two-week period. Virtual public meetings were hosted live on Zoom Webinar. Meetings consisted of a roughly one-hour presentation that included several poll questions and a 30-minute question-and-answer session in which participants asked questions via chat, and the study team responded verbally. The first meeting had 65 participants, the second had 76 participants, and the third had 35 participants.

The study team notified community members in the four-county region about the public meetings through postcards, online ads, the PSRC email listserv, and direct outreach from PSRC to specific jurisdictions and interest groups.

The study team asked polling questions at the virtual public meetings, which most participants responded to in the following ways:

- Use Sea-Tac for air travel.
- Prioritize minimizing noise and environmental impacts of aviation.
- Maximizing benefits of the aviation industry was less important than on-time, easy-to-access passenger services or minimizing noise and environmental impacts.
- The region should prioritize meeting all or some of the future demand for aviation.
- Disperse new aviation service at multiple airports.

The full virtual public meeting summary is available in the Stakeholder Education and Engagement Report.

8.7 ONLINE OPEN HOUSE

The online open house included similar information to what was presented in the virtual public meeting, with greater detail on some technical topics. While the virtual public meetings were held at specific times, the online open house was available any time between September 21 and October 30, 2020; users could visit the website at a time that was convenient to them to review information about the study.

The online open house experienced 14,253 page views, lasting an average of 2 minutes 31 seconds. The online open house included a comment box and four questions, matching the polling questions asked at the virtual public meetings. In total, 390 users left a comment and/or answered the questions.

The study team notified community members in the four-county region through the same postcards, online advertising, and email detailed above for the regional public meetings.

The online open house included poll questions similar to the virtual public meetings:

- Most respondents use Sea-Tac for air travel.
- Most respondents prioritized minimizing noise and environmental impacts of aviation.
- Respondents were split on consolidating new aviation service or dispersing service across the region.
- Most respondents thought the region should not expand aviation capacity.

Most open-ended comments expressed concern about environmental impacts (close to 200 comments) and concerns about noise (more than 100 comments). Other comments expressed the following comments:

- Opposition to meeting demand (more than 50)
- About a specific airport (close to 50)
- The impact of COVID-19 on the forecast
- Support for expanding service at Sea-Tac
- Support for dispersing service
- Concern about access issues
- Support for prioritizing demand
- Support for high-speed rail as an alternative to flying (each less than 50)

The full online open house summary is available in the Stakeholder Education and Engagement Report.

8.8 STAKEHOLDER BRIEFINGS

PSRC held briefings with local jurisdictions and elected officials, aviation-related businesses and airports, and aviation interest groups. PSRC conducted 56 briefings between January 2018 and December 2020.

8.9 KEY FINDINGS

Using multiple methods to collect input helped ensure the study team received as complete as possible a picture of regional opinion related to the future of the aviation system. Across the board, members of the public who shared feedback through any of the engagement methods detailed above recognized the importance of the aviation industry to the region while also recognizing the noise and environmental impacts the industry causes, but the study team saw different themes in input across the survey, focus group interviews, online open house, and virtual public meetings.

Survey participants indicated a stronger preference for meeting the demand for aviation than participants in the online open house and virtual public meetings. The survey, which was statistically representative of the region, found that 91% to 95% of respondents, depending on county, thought meeting the demand for passenger aviation was moderately to extremely important. Because the survey used random sampling and was statistically representative of the region, the survey findings provide a good sense of the general public's attitudes toward aviation.

Survey respondents also ranked noise and environmental impacts as important: 70% to 79% of respondents, depending on county, ranked environmental impacts as somewhat to very important, and 51% to 64% of respondents ranked noise impacts as somewhat to very important.

Interview participants showed a similar priority for meeting demand but also addressed environmental issues. They ranked noise impacts as less important. Interview participants emphasized that these issues were not mutually exclusive: They thought it was possible to meet demand while also improving aircraft and supporting services to decrease environmental and noise impacts.

In spite of the overall support for meeting the region's aviation capacity needs expressed in the survey and focus group interviews, noise, public health, and environmental impacts continue to be of significant concern to the public. People interested in the topic also continued to question the process for environmental study and potential mitigation associated with siting a new airport or expanding service at an existing airport, and who would drive any future airport expansion.

9. Related Studies

This chapter outlines several recent, local studies that have particular relevance to this effort. It also highlights key findings that bear on this study.

9.1 MOBILE OBSERVATIONS OF ULTRAFINE PARTICLES STUDY

The University of Washington research team led the Mobile ObserVations of Ultrafine Particles Study (MOV-UP),[19] which assessed ultrafine particle concentrations (UFPs) in the directions of aircraft flight within 10 miles of the airport. The study was designed to:

> "investigate the implications of aircraft traffic at Sea-Tac by (1) assessing the concentrations of UFPs in areas surrounding and directly impacted by aircraft traffic; (2) distinguishing and comparing UFP concentrations attributable to aircraft-related and other sources and; (3) coordinating with local governments, and sharing results and soliciting feedback from community stakeholders."[20]

The MOV-UP study distinguishes aircraft-related UFPs from roadway-related UFPs and distinguishes the pollution from the two sources using measurements of particle size and black carbon concentration.

This study finds that the highest UFP counts were nearest major roadways, including I-5. The study also finds that UFPs derived from both roadway traffic and aircraft sources, though total concentrations of UFP alone did not distinguish roadway and aircraft features. Key differences for roadway and aircraft features exist in the particle size distribution and the black carbon concentration. The study notes that "these differences can help distinguish between the spatial impact of roadway traffic and aircraft UFP emissions using a combination of mobile monitoring and standard statistical methods."[21] The study notes several knowledge gaps including the potential health effects from aircraft-related UFP exposure, effective short- and long-term approaches to reduce human exposures to UFP, and uncertainties in the impacts of future UFP exposures. Although the study suggests that some neighborhoods in proximity could be more exposed to UFPs than others, there are uncertainties in the impacts of future UFP exposures due to roadway and aircraft traffic volume changing emissions over time.

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19 University of Washington Department of Environmental & Occupational Health Sciences. Mobile ObserVations of Ultrafine Particles: The MOV-UP study report. Seattle; 2019. Available online at https://deohs.washington.edu/mov-up. Accessed December 2020

20 Ibid.

21 Ibid.

9.2 AVIATION ECONOMIC IMPACT STUDY

WSDOT Aviation completed a new statewide Aviation Economic Impact Study for the Washington Aviation System.[22] With support from the FAA, the WSDOT Aviation Division completed the study to, "measure the economic impacts of each public-use airport in Washington"; "assess the economic value that airports create for communities"; and "show airports and the state aviation system contribute to the state's economy and economic competitiveness."[23]

The study finds that Washington's 134 public-use airport system contributes $107 billion in total economic impact (business revenues) to Washington state's economy and communities, providing 407,042 jobs and $26.8 billion in labor income. These airports support community, economic, and transportation needs. The study highlights that Washington state's 134 public airports act as "an essential link to the nation's airspace, commerce, and emergency services and are an important part of Washington state's transportation system and economy", developed a new Online Aviation Economic Impact Calculator, and developed a new Airport Economic Mapping Tool.[24]

The potential economic benefits of sustainable aviation fuel (SAF) in Washington state are a key focus of the study. The study notes that although SAF is more expensive than conventional avgas, costs will decrease as levels of supply and demand shift with commercial adoption. Environmental impacts will be positive, because carbon dioxide emissions are likely to decrease an estimated 41% to 89% compared to conventional fuels. Additionally, alternative jet fuels and electric aircrafts can promote mobility between regions, particularly for connecting rural and urban populations, and can also lead to a reduction in the industry's greenhouse gas emissions. The benefits associated with emerging technologies in the industry include "new business partnerships, improved access to jobs and educational opportunities, and more productive hours as less time is spent in transit"[25] Despite potential financial impacts and obstacles, Washington state is well positioned to optimize on opportunities for emerging technologies due to the strong aviation and aerospace manufacturing industry.

9.3 AVIATION BIOFUELS INFRASTRUCTURE FEASIBILITY STUDY[26]

The goals of this study were to "identify sites that could support the receipt, blending, storage, and delivery infrastructure required to supply Sea-Tac Airport with up to 50 million gallons per year (and to double to 100 million after 2025) of aviation biofuel (also known as sustainable alternative aviation fuel)."[27] This study supports the goals set by the Port of Seattle, Alaska Airlines, and the Boeing Company to eventually power all flights fueled at Sea-Tac with aviation biofuel, reducing the lifecycle carbon footprint approximately 50% to 80% compared to regular jet fuel. To identify potential aviation biofuel sites, the study used a multi-

22 Washington State Department of Transportation. Aviation Economic Impact Study. 2020. Available online at https://wsdot.wa.gov/aviation/Planning/WAEconomicStudy.htm. Accessed December 2020.
23 Ibid.
24 Ibid
25 Ibid.
26 Aviation Biofuels Infrastructure Feasibility Study. Final report submitted to Port of Seattle. November 2019.
27 Ibid

phase screening process, which included identifying suitable properties in the central Puget Sound region, eliminating those least likely to meet study goals, and further evaluating a short list of six remaining candidate properties. The evaluation included identifying existing infrastructure connections, current and future capacity requirements, and property ownership and zoning. For the most feasible properties, the study completed a comprehensive evaluation and scorecard by developing short- and long-term infrastructure requirements and associated cost estimates.

The Aviation Biofuels Infrastructure Feasibility Study found three properties (out of the 29 properties screened) as the most likely to meet the goals of the study and deliver up to 50 million gallons of aviation biofuel per year (doubling to 100 million gallons after 2025) into the hydrant delivery system at Sea-Tac:

- The Sea-Tac Airport Fuel Farm, either through the existing roadway or the future SR 509 connector, would meet the goals of the study. The Sea-Tac Airport Fuel Farm options would be the most cost-effective in the short term and would fulfill existing critical need for fuel receipt and storage that is not dependent on the Olympic Pipeline.
- The Phillips 66/Olympic Pipeline Renton Terminal has three options that would meet the goals of the study, including both off-site and on-site blending. The Phillips 66/Olympic Pipeline Renton Terminal could potentially accommodate receipt and blending facilities for moderate-to-large biofuel volumes over the long-term.
- The Tesoro Anacortes Refinery was used as a proxy for the Jet-A fuel refineries in Whatcom and Skagit Counties as the most cost-effective options for receipt and blending of large biofuel volumes over the long-term.

9.4 WASHINGTON STATE AIR CARGO MOVEMENT STUDY[28]

The Joint Transportation Committee of the Washington State Legislature initiated the Washington State Air Cargo Movement Study to evaluate the current and future capacity of the statewide air cargo system. Air cargo is a crucial function in the state's logistics; in 2015, the state's gross domestic product was $452 billion when Washington state airports moved $47.6 billion in freight. The objectives of the study follow:

> "educate policy makers about air cargo movement at Washington airports, explore possibilities for accommodating the growing air cargo market at more airports around the state, and identify the State of Washington's interest and role in addressing issues arising from air cargo congestion."

The study examined opportunities and constraints at existing airports to meet the increasing demand of air cargo operations in Washington state. The study relied on input from legislative and agency staff members,

[28] Joint Transportation Committee. *Washington State Air Cargo Movement Study, Final Report*. December 21, 2018. https://leg.wa.gov/JTC/Documents/Studies/AirCargo/JTCAirCargoMovementStudy_FinalReport.pdf

industry representatives, and the largest Washington state airports. The existing conditions and future air cargo forecast were updated and used as an input to this study.

9.5 ULTRA-HIGH-SPEED GROUND TRANSPORTATION

The Ultra-High-Speed Ground Transportation (UHSGT) study was prepared to review how UHSGT could provide a fast, frequent, reliable, and environmentally responsible transportation system to connect Vancouver, British Columbia, to metro Seattle, Washington, to Portland, Oregon. For the purposes of this study, ultra-high speed is defined as a maximum operating speed of greater than250 miles per hour (mph). The Washington State Governor's Office and state legislature asked WSDOT to study UHSGT for enhanced interconnectivity to better manage population and economic growth potential by maximizing public transportation benefits. Regional business and government leaders believe UHSGT could also result in better access to jobs, affordable housing, shared resources, increased collaboration, and economic prosperity. The study states that, "Ultra-high-speed ground transportation is not intended to replace the Amtrak Cascades intercity passenger rail system managed and funded by WSDOT and Oregon Department of Transportation; it would be an additional travel option and would serve to supplement ridership."[29]

The following three technologies could potentially meet the required operating speed for UHSGT:

- The high-speed rail (steel wheel) technology—based on principles similar to early railways—has a current maximum speed of 220 mph and a maximum seating capacity of 1,500.
- The magnetic levitation (maglev) main feature is the magnetic field technology that allows the vehicle to levitate above the guideway without making contact; maglev has a current maximum speed of 270 mph and a maximum seating capacity of 824.
- Hyperloop technology uses magnetic propulsions to carry vehicles through evacuated tubes, and the concept is to reduce the air resistance to enable high speeds The Hyperloop current maximum speed was track tested at 200 mph, though this was limited by the length of the test track. The maximum design speed for Hyperloop is 760 mph with a maximum seating capacity of 28 per capsule.[30]

The Ultra-High-Speed Ground Transportation Business Case Analysis completed in July 2019 demonstrates that UHSGT would transport over 3 million passengers per year and would support sustainable growth as a travel mode.[31] The report found that this would increase reliability and capacity compared to highway or airport options. The report also stated that reliability on high-speed rail services can reach 99% on-time performance compared to less than 80% for air services. The study suggests that travelers would shift to a new UHSGT system and away from auto and air travel for 16% to 18% of intercity trips, thereby reducing

[29] Washington State Department of Transportation. Ultra-High-Speed Ground Transportation Study. 2020. Available online at https://wsdot.wa.gov/planning/studies/ultra-high-speed-travel/ground-transportation-study. Accessed December 2020.
[30] Ibid.
[31] Washington State Department of Transportation. Ultra-High-Speed Ground Transportation Business Case Analysis. 2019. Available online at https://wsdot.wa.gov/sites/default/files/2019/07/12/Ultra-High-Speed-Ground-Transportation-Study-Business-Case-Analysis-Full-Report-with-Appendices-2019.pdf. Accessed December 2020

the regional aviation demand by 500,000 trips per year.[32] Because UHSGT would capture a significant share of trips within the corridor, this would compete against the need for some highway and airport improvements, reduce the future need for expanded terminals, and allow new airfield capacity to be more efficiently deployed in serving longer-distance markets.

[32] Washington State Department of Transportation. Ultra-High-Speed Ground Transportation Business Case Analysis. 2019. page 45. Available online at https://wsdot.wa.gov/sites/default/files/2019/07/12/Ultra-High-Speed-Ground-Transportation-Study-Business-Case-Analysis-Full-Report-with-Appendices-2019.pdf. Accessed December 2020.

10. Conclusions and Next Steps

The central Puget Sound region plays a pivotal role in aviation in the Pacific Northwest. The aviation system is a critical part of an ecosystem that supports high paying jobs, housing, and economic development. This Baseline Study attempted to provide a deeper understanding of the different roles and purposes of aviation activities at each of the region's airports, to identify future needs in the central Puget Sound region (King, Pierce, Snohomish, and Kitsap Counties), and to set the stage for future planning.

The study found that anticipated growth will affect the quality and level of aviation service. Commercial passenger service demands, in particular, are expected to exceed capacity in the near future. Even with currently planned improvements, by 2050 the unmet passenger demand is anticipated to equal the current operation at Sea-Tac.

The region's existing airports were reviewed for their potential to play a role in meeting the additional demand for commercial passenger service in Chapter 4, Airport Needs. None of the airports individually could meet all or even 50% of the demand. However, as detailed in Chapter 4, Arlington Municipal, Bremerton National, and Tacoma Narrows Airports could expand and accommodate some of the commercial service needs and therefore could help meet the growing demand of the region through 2050. Building one additional major commercial airport to accommodate the full demand would require a greenfield site. The siting of a greenfield site was outside of the scope of this study. Further analysis would be needed to understand if there is a viable location to site a greenfield airport that would meet the criteria.

As stated in Chapter 6, Development Scenarios, airlines decide where, when, how often, and what aircraft to serve airports, not the FAA, airports, or the community. The challenge for policymakers and the region's airport owners will be to convince an airline to serve another airport(s), other than Sea-Tac and Paine Field, even if runways, terminals, etc. are built. The business case must be convincing in order for the airlines to move an expensive aircraft from a known revenue-producing route to an additional airport(s) in the central Puget Sound region and be profitable. If there is regional interest in pursuing additional commercial passenger service at an existing or new airport there are a number of planning, environmental review, funding and approval steps needed. Section 6.5, Airport Development Process, outlines these steps.