Appendix B.

Aircraft and Activity Forecast

This Appendix includes technical reports referenced in preparation of this Part 150 Study:

- Appendix B-1: Forecast and Operational Assumptions
- Appendix B-2: Operational Data

B-1 Forecast and Operational Assumptions

TECHNICAL MEMORANDUM

AVIATION ACTIVITY FORECAST UPDATE

Seattle-Tacoma International Airport

Prepared for

Port of Seattle
Seattle, Washington

September 2023

CONTENTS

The purpose of this memorandum is to assist Port of Seattle staff in developing updated aviation forecasts for Seattle-Tacoma International Airport (the Airport or SEA). The forecasts described in this memorandum (the 2022 Forecasts) are developed using 2022 as the base year.

The 2022 Forecasts were initially developed in September 2022 using estimates for 2022 based on eight months of actual data. This update is based on complete calendar year data for 2022 for enplaned passengers, air cargo, aircraft operations, and aircraft operations by aircraft body and equipment type.

The forecasts presented in this memorandum are "unconstrained" and, therefore, do not include specific assumptions about physical, regulatory, environmental or other impediments to aviation activity growth. The unconstrained forecasts were used as a basis to develop a constrained demand scenario that reflects the Airport's ability to accommodate demand. The analysis of a constrained scenario indicated that SEA would experience a constrained operating environment from 2027 through 2037 due to a shortage of gates and airfield constraints. Therefore, it was determined that the unconstrained forecast of aircraft operations at SEA exceeds the constrained forecast and the Airport's ability to accommodate demand, even with implementation of the Proposed Action in the Environmental Assessment. The updates to the unconstrained forecasts presented in this memorandum do not change the constrained demand scenario which is based on an evaluation of SEA facilities and used as a basis for the Environmental Assessment.

1.0 THE 2022 FORECASTS

The impact of the COVID-19 pandemic and the speed of recovery of both the economy and public confidence in the aviation system will significantly affect aviation activity levels at the Airport. As the Airport predominantly serves origin and destination activity (O&D passengers accounted for approximately 71% of SEA's passengers in 2019), future long-term growth in aviation activity at the Airport (subsequent to recovery from the COVID-19 pandemic) will occur largely as a function of the growth in the population and economy of the Seattle region, as well as regional, national, and international economic performance.

2.0 ENPLANED PASSENGERS

The 2022 Forecasts of enplaned passengers are developed in two parts: (1) short-term (2-year) forecasts and (2) long-term forecasts through 2038 based on forecast growth in the Seattle Region economy and the cost of travel and the role of the Airport as a connecting hub and international gateway.

2.1 Short-Term Passenger Forecasts

The near-term forecasts are based on an analysis of the recovery of passengers at SEA to pre-pandemic 2019 levels including a review of year-to-date passenger traffic, the airline outlooks for Delta and Alaska, SEA's two connecting hub airlines, and recent seat capacity trends.

2.1.1 Recovery to Pre-pandemic Levels

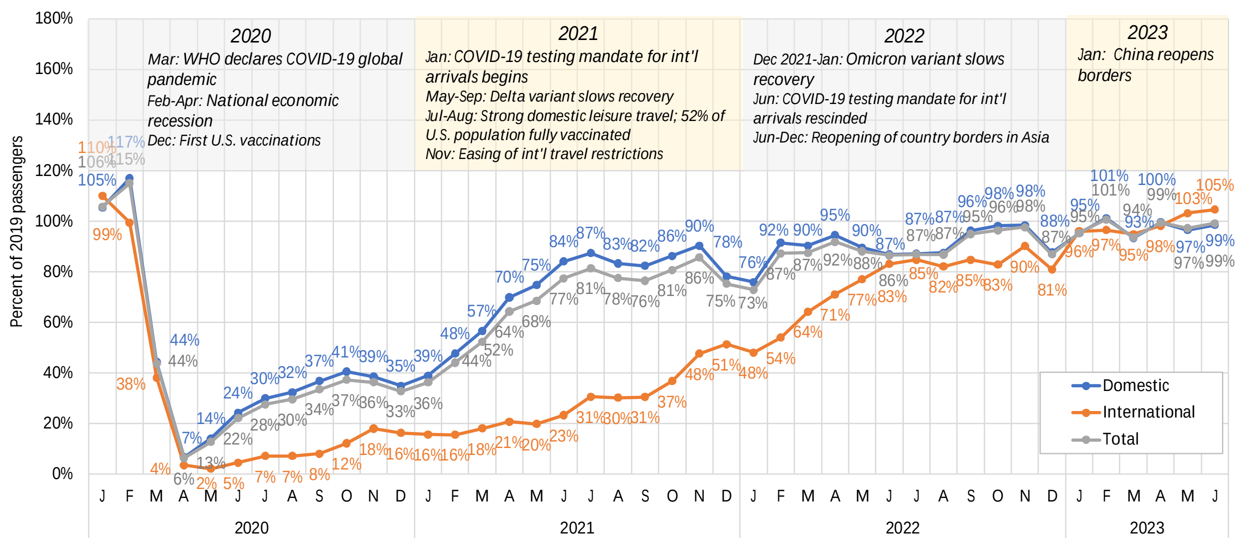
The domestic sector has driven passenger traffic recovery at SEA largely due to strong demand for leisure travel and the substitution of domestic airline trips for international trips given country border closures and international travel restrictions. The recovery of international passenger traffic at SEA accelerated in 2022 following the initial lifting of international travel restrictions in November 2021. The recovery of pre-pandemic passenger levels at SEA is described below and shown on Figure 2-1.

- *In 2020, total passenger traffic at SEA accounted for 39% of 2019 levels.* Regional and state lockdowns and social distancing policies combined with an increasing trend in COVID-19 cases resulted in a 3.4% decrease in U.S. real GDP (adjusted for inflation) and a 61% decrease in U.S.

passenger traffic between 2019 and 2020.* Domestic passengers at SEA accounted for 41% of 2019 levels in 2020, while international passengers accounted for 23%.

- *In 2021, total passenger traffic at SEA accounted for 70% of 2019 levels.* The availability and rapid distribution of approved COVID-19 vaccines contributed to a significant decrease in new COVID-19 cases in the United States, notwithstanding the increase in new cases caused by the Delta variant in July through mid-September and the Omicron variant in December. Domestic passengers at SEA accounted for 75% of 2019 levels in 2021, while international passengers accounted for 29%.

Figure 2-1
RECOVERY OF PRE-PANDEMIC PASSENGER LEVELS
Seattle-Tacoma International Airport



Source: Seattle-Tacoma International Airport records.

- *In 2022, total passenger traffic at SEA accounted for 89% of 2019 levels.* Strong passenger traffic growth in 2022 reflects improved economic conditions, continued pent-up demand for domestic leisure travel, the reopening of U.S. businesses and accelerated corporate travel demand, the easing of international travel restrictions, the rescinding of the COVID-19 testing requirement for international passengers entering the United States in June 2022, and the reopening of country borders in Oceania and Asia including Hong Kong, Japan, the Philippines, Singapore, South Korea, and Taiwan—all of which are key international markets for the Airport. Domestic passengers at SEA accounted for 90% of 2019 levels in 2022, while international passengers accounted for 76%.

- *During the first six months of 2023 (January through June), total passenger traffic at SEA accounted for 98% of 2019 levels.* Domestic passenger traffic increased 10.3% during the first six months of 2023 compared with the same period in 2022, reflecting continued economic growth and strong leisure demand. The reopening of country borders in Asia, including China in January 2023,

* U.S. Bureau of Economic Analysis, Table 1.1.6. Real Gross Domestic Product, Chained Dollars, November 24, 2021, www.bea.gov. U.S. Department of Transportation, Schedule T100 and TSA Throughput Passengers, online database, accessed November 2021.

resulted in a 46.3% increase in international passenger traffic at SEA during the first six months of 2023. Domestic passengers at SEA accounted for 97% of 2019 levels during the first six months of 2023, while international passengers accounted for 99%.

2.1.2 Alaska's Outlook

Alaska's outlook for Q3 2023 and full year 2023 includes capacity increases (in terms of Available Seat Miles or ASMs) of 10% to 13% and 11% to 13%, respectively, compared with the same period in 2022. "Demand remains very strong, even as we've come off the peak of historically high fares, a trend we knew would happen at some point. Notwithstanding this evolution, yield is still meaningfully above 2019 levels on industry capacity that has now surpassed 2019 levels by an estimated 6% for the second half of 2023."*

Domestic Demand. During the first 5 months of 2023 (the most recent period available), Alaska's systemwide mainline domestic passengers accounted for 98% of 2019 levels (an 14.3% increase over the same period in 2022), according to USDOT T100 data. In comparison, Alaska's mainline domestic passengers at SEA accounted for 112% of Alaska's 2019 levels at the Airport during the first 6 months of 2023. Alaska's mainline domestic passengers accounted for 86% of Alaska's total domestic passengers during the first 6 months of 2023, with the remaining 14% accounted for by its regional affiliates (Horizon with 10% and Skywest with 4%).

International Demand. Alaska is primarily a domestic airline with international passengers accounting for a small share of total passengers (mainline and regional)—7% systemwide and 3% at SEA during the first 5 months of 2023. Alaska primarily serves destinations in Canada and Mexico at SEA.

Aircraft Fleet. In Q1 2022, Alaska announced aircraft fleet transition plans, including the removal of all A320 and Q400 aircraft from operating service (completed in January 2023) and the transition to an all-Boeing fleet and all-Embraer fleet. Alaska continues to operate 10 A321neo aircraft until the end of Q3 2023.** As of June 2023, Alaska had orders for 199 B737 narrowbody aircraft and 24 E175 regional jets to be delivered between 2023 and 2030. On its Q2 2023 earnings call, Alaska management noted that "Boeing has also continued to be a great partner, delivering according to expectations despite continued disruptions within their supply chain."

Staffing. In March 2022, Alaska launched its pilot development program, the Ascend Pilot Academy, with an enrollment of 500 pilots. In addition, Hillsboro Aero Academy is training another 200 pilots for Horizon. As of Q2 2023, Alaska employed 23,300 people, a 3% increase compared with the same period in 2022 and an 11% increase over 2019. On its Q2 2023 airline earnings call, Alaska indicated that the airline was maintaining "elevated staffing levels to support operational integrity" and are "carrying a significant amount of surplus pilots on the Airbus" to facilitate the transition to an all-Boeing fleet.

SEA's Role in Alaska's System. SEA ranks first in Alaska's system in 2023 with 29.5% of scheduled departing systemwide seats, followed by Portland with 7.6%. Between 2010 and 2023, the number of Alaska's scheduled departing seats at SEA increased an average of 3.9% per year during the period when Delta was building its connecting hub and gateway at the Airport.

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* Alaska Airlines, 2Q 2023 Earnings Transcript, July 25, 2023, www.alakaair.com.

** Alaska Airlines, SEC Form 10-Q, July 25, 2023, www.alakaair.com.

2.1.3 Delta's Outlook

Delta's outlook for near- and longer-term growth is positive with record revenue reported in Q2 2023 driven by domestic and international demand. "Robust demand is continuing into the September quarter where we expect total revenue to be similar to the June quarter, up 11 percent to 14 percent compared to the September quarter 2022 on capacity that is 16 percent higher."*

Domestic Demand. During the first 5 months of 2023 (the most recent period available), Delta's systemwide mainline domestic passengers accounted for more than 100% of 2019 levels (an 11.4% increase over the same period in 2022), according to USDOT T100 data.* In comparison, Delta's mainline domestic passengers at SEA accounted for 106% of Delta's 2019 levels at the Airport during the first 6 months of 2023. Delta's domestic demand is being driven by leisure and business travel. Delta's recent corporate survey showed that businesses expect to increase travel in the second half of 2023 which was also reflected in Morgan Stanley's recent Global Travel Survey where respondents indicated travel was expected to grow 9% year over year in the second half and 8% into 2024.

International Demand. During the first 5 months of 2023, Delta's systemwide mainline international passengers accounted for 93% of 2019 levels (a 42.5% increase over the same period in 2022), according to USDOT T100 data. In comparison, Delta's mainline international passengers at SEA accounted for 117% of Delta's 2019 levels at the Airport during the first 6 months of 2023. Transatlantic passengers to Europe accounted for the largest share of Delta's passengers systemwide and at SEA during the first half of 2023 and represented 108% and 136%, respectively, of 2019 levels systemwide and at SEA. Delta's transpacific passengers to Asia benefited from the re-opening of country borders for Japan (late 2021) and China (January 2023) as well as Delta's joint venture with Korean Air. Transpacific passengers to Asia accounted for 52% and 71%, respectively, of 2019 levels systemwide and at SEA during the first half of 2023.

Aircraft Fleet. As of June 2023, Delta had orders for 290 narrowbody aircraft (70 A220-300s, 120 A321-200neos, and 100 B737-10s) and 33 widebody aircraft (17 A330-900neos and 16 A350-900s). On its Q2 2023 earnings call, Delta management noted that "the industry continues to face multiple constraints across the supply chain, aircraft delivery delays, and training needs. As a result, we see a significant gap between the supply that is in place and what demand could sustain, and we expect this gap will remain for an extended period of time."

Staffing. As of Q2 2023, Delta employed 90,000 people, a 13% increase compared with the same period in 2022 and 2019. In Q1 2023, Delta pilots ratified a new four-year Pilot Working Agreement effective January 1, 2023, including work rule changes and pay rate increases. On its Q1 2023 airline earnings call, Delta reported "putting 600 pilots into production. So, it's really the first time over the last 18 months that are actually -- school house will step down here during the second quarter."

SEA's Role in Delta's System. SEA is the eighth busiest airport in Delta's system in 2023 in terms of scheduled departing seats with 3.4% of systemwide seats. (Atlanta ranked first with 21.2% in 2023.) Between 2010 and 2023, the number of Delta's scheduled departing seats at SEA increased an average of 10.2% per year—the fastest rate of any of Delta's busiest 25 airports, reflecting the buildup of SEA as a West Coast connecting hub and international gateway in Delta's system. In 2023, SEA accounted for the fifth largest share of international scheduled seats in Delta's system, up from its sixth place ranking in 2019 and eighth place in 2010.

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* Delta Air Lines, 2Q 2023 Earnings Transcript, July 13, 2023, www.ir.delta.com.
* U.S. Department of Transportation, Schedule T100, online database, accessed August 2023. During the first 5 months of 2023, Delta's systemwide regional domestic passengers accounted for 71% of 2019 levels (an 2.2% decrease over the same period in 2022), reflecting, in part, the shortage of regional airline pilots.

2.1.4 Key Factors Affecting the Short-Term Passenger Forecasts

The short-term passenger forecasts (i.e., 2023 through 2024) are driven by the pace of recovery from the impacts of the COVID-19 pandemic. The following summarizes several factors that are expected to have the largest impact (both positive and negative) in the short-term.

Positive Impact	Negative Impact
Resumption of Business Travel	Higher than average inflation, sustained by high fuel prices
Continued strong demand for leisure travel	Reductions in airline seat capacity due to airline labor shortages, including pilots
Easing of international travel restrictions	Aircraft delivery delays due to supply chain issues \
The rescinding of the COVID-19 testing requirement for international passengers entering the United States in June 2022	Potential for a "technical" recession, i.e., two consecutive quarters of negative U.S. GDP growth
Country borders reopening in Asia including Hong Kong, Japan, the Philippines, Singapore, South Korea, and Taiwan—all of which are key international markets for the Airport	Emergence of additional COVID-19 variants
	Geo-political conditions, particularly the war in Ukraine and the impact of sanctions on Russia

2.1.4.1 Positive Impact Factors

Resumption of Business Travel. According to Morgan Stanley's June 2023 Global Corporate Travel Survey, business travel budgets are expected to increase 9% year-over-year in the second half of 2023 and 8% in 2024, with 30% of survey respondents indicating that business travel had returned to pre-COVID travel levels.* During Q2 2023 earnings calls, U.S. airlines reported continued improvement in business travel, with recent increases driven primarily by international travel. Unmanaged business travel by small- and medium-sized businesses continues to lead the recovery, although upside growth is expected as business travel by large corporations gradually returns to pre-pandemic levels. Airlines continue to see "blended" travel for both business and leisure purposes, particularly by small- and medium-sized businesses. *Strong bookings for September travel point to an increase in business travel as the peak summer period ends and continued growth in SEA passenger traffic.*

Strong Leisure Demand. According to the Downtown Seattle Association's September 2023 recovery report, "Downtown welcomed nearly 3 million visitors in August 2023, representing 91% of the visitors in August 2019."** Downtown Seattle hotel room demand reached 399,000 in August 2023, representing 99% of the rooms sold in August 2019. CBRE, a U.S. commercial real estate services and investment form, forecasts a recovery in Seattle's hotel market by 2024.*** Continued growth in Seattle's cruise industry has supported passenger traffic growth at SEA with more than 1.4 million passengers expected in 2023 (a 15% increase over 2019 levels) **** and an extension of the cruise schedule from mid-April to the end of

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* Markets Insider, Analyzing Corporate Travel Trends: Key Insights From Morgan Stanley's Global Survey, June 12, 2023, www.markets.businessinsider.com.

** Downtown Seattle Association, Downtown Recovery Dashboard, September 2023/August Data, www.downtownseattle.org.

*** Coldwell Banker Richard Ellis (CBRE), Seattle Lodging Market on Pace for Recovery by 2024, June 10, 2022, www.cbre.com.

**** Port of Seattle, 2023 Cruise Season Underway in Seattle, April 15, 2023, www.portofseattle.org and Cruise Industry News, Seattle Expecting Robust Cruise Year, January 27, 2023, www.cruiseindustrynews.com

October. *Continued strong recovery in the Seattle tourism market is expected to positively impact SEA passenger levels.*

Easing of International Travel Restrictions. On November 8, 2021, the U.S. lifted international travel restrictions to allow foreign nationals who provide proof of full vaccination against COVID-19 and a negative pre-arrival test result to travel to the United States (which was rescinded in June 2022). At the end of 2022, the CDC followed the lead of several other countries, implementing a requirement for a negative COVID-19 test from air passengers arriving from China, Hong Kong, and Macao, and rescinded the requirement on March 15, 2023. As a result, scheduled service from SEA to China restarted in March 2023. *The easing of international travel restrictions had a positive impact SEA international passenger traffic. In June 2023, international passengers at SEA accounted for 105% of 2019 levels, up from 83% in June 2022, as shown previously on Figure 2-1.*

Country Borders Reopening in Asia. On September 23, 2022, Hong Kong, Taiwan, and Japan announced the elimination of border restrictions, while China remained as one of the last countries in Asia with strict border controls due to its zero-COVID policy. On January 8, 2023, China opened its borders to foreigners for business travel or family visits and Chinese nationals living abroad. During the first 6 months of 2023, SEA passengers from Asia accounted for 91% of 2019 levels, up from 41% during the same period in 2022. *Since passengers from Asia accounted for 37% of SEA's international passengers in 2019, these border openings are expected to have a positive impact on the rate of recovery of SEA's international passengers.*

2.1.4.2 Negative Impact Factors

Higher Than Average Inflation. Inflation negatively impacts passenger traffic levels by putting upward pressure on airfares and limiting the amount of disposable income available for travel due to the higher cost of other expenditures. Higher energy costs and pent-up demand for air travel during the summer of 2022 put upward pressure on airfares, as shown on Figure 2-2. However, strong demand for summer air travel together with savings during the pandemic prevailed over higher airfares and other travel costs in the short-term. By July 2022, increases in energy prices and airfares had started to moderate. *Although inflationary pressures are expected to ease over the long-term, continued high inflation rates in the short-term could have a negative impact on passenger demand.*

Airline Seat Capacity Reductions. Airline seat capacity reductions in 2022 reflected underlying issues with pilot and other staffing shortages that resulted in increased irregular operations and ATC delays. The current pilot shortage is most closely linked to early retirement packages offered by airlines during the pandemic but also with longer term changes in the pilot supply chain. For example, fewer pilots are available to be recruited from the military because of the increased use of drones in modern warfare and increased emphasis on training drone pilots rather than aircraft pilots. In addition, the high cost of pilot training is a barrier to expanding the pilot workforce, so much so that airlines are subsidizing training costs and/or establishing their own flight schools to meet the need for pilots. The two airlines accounting for the largest shares of passenger traffic at SEA—Alaska and Delta—have reported large increases in staffing and training programs. Alaska expects all pilot training to be completed by the end of 2023, including the transition and training of its A321 pilots to B737 aircraft.* Delta expects to put 600 pilots into production and step down its pilot training program.** *Continued pilot and other staffing issues in the short-term may have a negative impact on passenger traffic recovery.*

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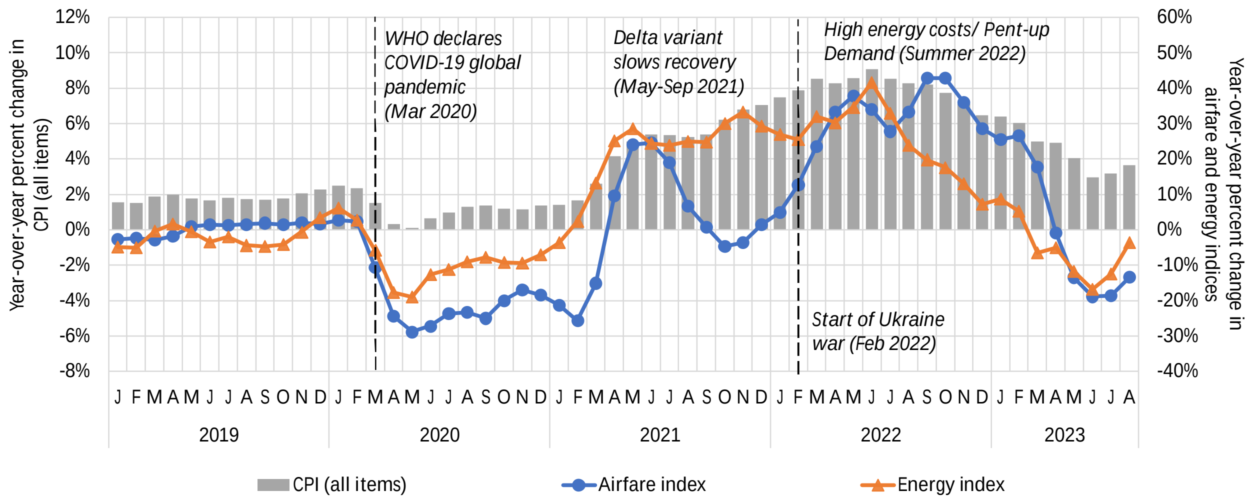
* Alaska Airlines, Q1 2023, Earnings call transcript, April 20, 2023.

** Delta Air Lines, Q1 2023, Earnings call transcript, April 13, 2023.

Figure 2-2
PRICE CHANGES: ALL CONSUMER ITEMS, AIRFARES, AND ENERGY COSTS
Seattle-Tacoma International Airport



Source: U.S. Bureau of labor Statistics, online database, www.bls.gov, accessed September 2023.

New Aircraft Delivery Delays. In 2022, several airlines including American, Delta, Southwest, Spirit, and United reported delays in the delivery of new aircraft. In February 2022, American Airlines announced the removal of certain routes from its 2022 schedule due to delayed B787 deliveries. Airbus and Boeing cite supply chain issues as the primary reason for the delay. Boeing has also faced a slow FAA certification process for the B787, B737 Max7 and Max 10, and B777x. On its Q2 2023 earnings call, Alaska reported that "Boeing has also continued to be a great partner, delivering according to expectations despite continued disruptions within their supply chain."* On its Q2 2023 earnings call, Delta noted that "the industry continues to face multiple constraints across the supply chain, aircraft delivery delays, and training needs. As a result, we see a significant gap between the supply that is in place and what demand could sustain, and we expect this gap will remain for an extended period of time."** *Continued delays in the delivery of new aircraft will have an impact in the short-term which is already reflected in capacity reductions.*

Emergence of COVID-19 Variants. According to the CDC, new variants of the COVID-19 virus are expected to occur with some variants disappearing and others persisting. The CDC's capabilities for monitoring, testing, and developing vaccines and treatments for new variants are in place. *The 2022 Forecasts do not incorporate assumptions on any future variants; however, the expectation is that the negative impacts would be minimal should there be future variants.*

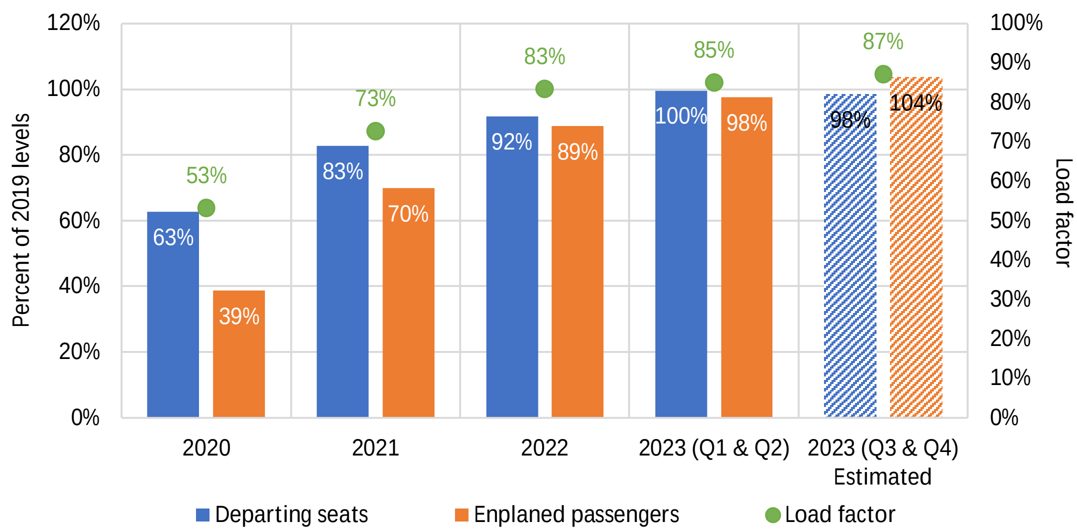
2.1.5 Short-Term Passenger Forecasts: 2023 - 2024

In 2023, SEA passenger traffic is expected to account for 97% of 2019 levels based on actual passenger traffic for the first six months of 2023 and seat capacity for the remainder of the year published in advance airline schedules, as shown on Figure 2-3 and Figure 2-4. Passenger traffic at SEA is expected to recover to 2019 levels in 2024 and total 25.9 million, as shown on Figure 2-6. Similarly, the number of domestic and

* Alaska Airlines, Q2 2023 Earnings call transcript, July 25, 2023.
** Delta Air Lines, Q2 2023 Earnings call transcript, July 13, 2023.

international passengers are expected approximate 2019 levels in 2024. *The 2022 Forecasts of enplaned passengers at the Airport is shown in Table 1 in the Appendix.*

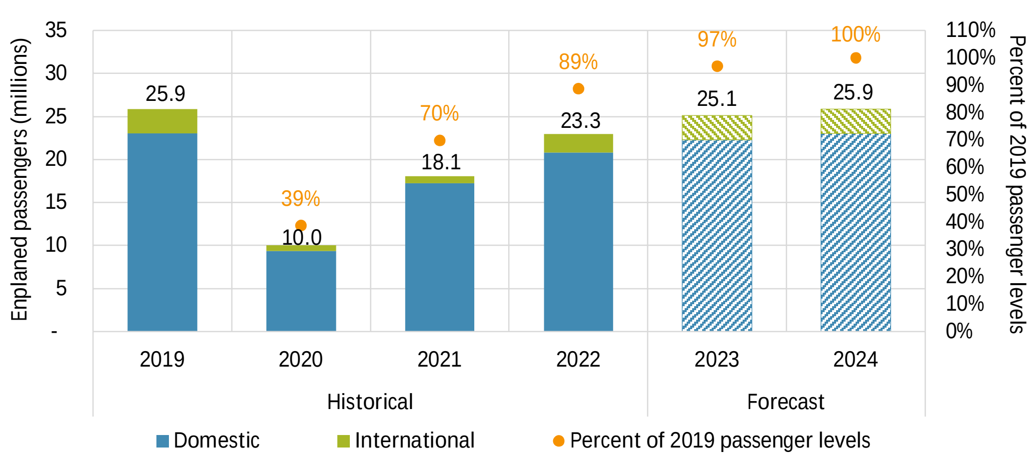
Figure 2-3
RECOVERY OF PRE-PANDEMIC PASSENGER AIRLINE ACTIVITY
Seattle-Tacoma International Airport



Note: Advance airline schedules are subject to change.

Sources: Seattle-Tacoma International Airport records and Airline Data Inc., airline schedules online database, accessed August 2023.

Figure 2-4
SHORT-TERM FORECASTS OF ENPLANED PASSENGERS: 2023 AND 2024
Seattle-Tacoma International Airport

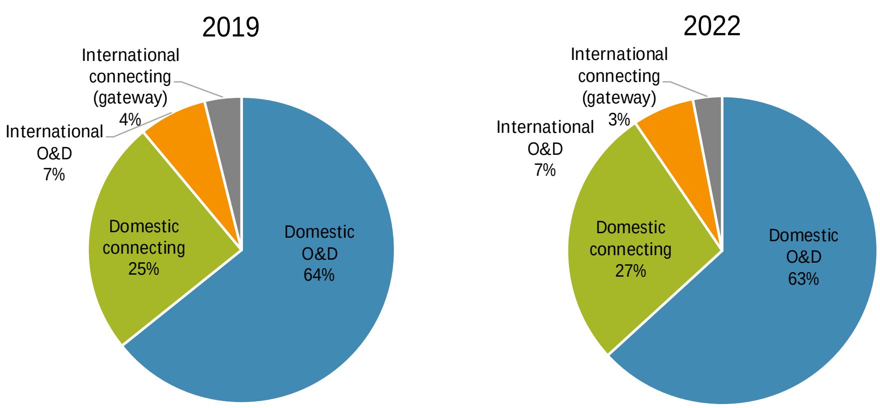


Sources: Historical—Seattle-Tacoma International Airport records. Forecast—LeighFisher, June 2022, updated August 2023.

2.2 Long-Term Passenger Forecasts Through 2038

The long-term forecast approach included a review of the key components of demand in 2019 before the pandemic and 2022 (the most recent calendar year available), as shown on Figure 2-5, and an evaluation of the key drivers of each component.

Figure 2-5
KEY COMPONENTS OF PASSENGER DEMAND IN 2019 AND 2022
Seattle-Tacoma International Airport



Sources: Historical—Seattle-Tacoma International Airport records and U.S. Department of Transportation, Origin-Destination Survey, online database, accessed August 2023.

2.2.1 Domestic Origin-Destination Passengers

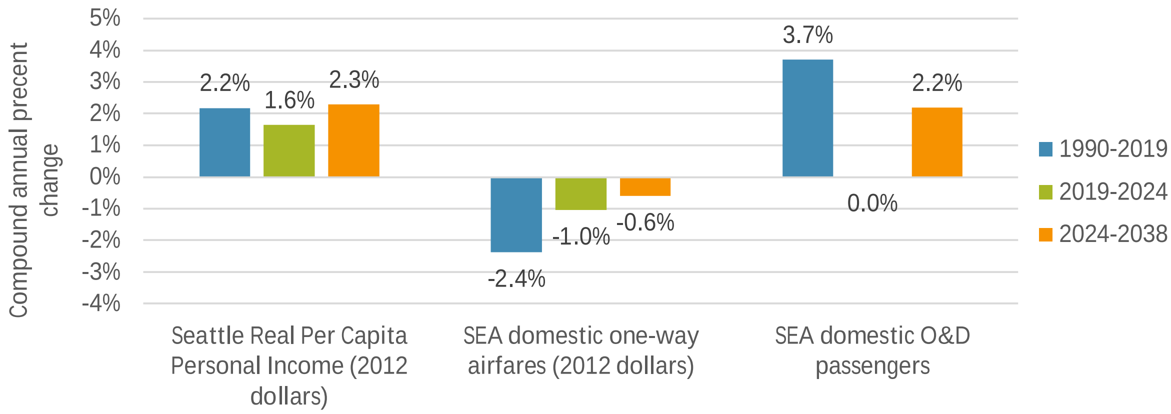
As the largest demand component, domestic O&D passengers at SEA accounted for 64% of total enplaned passengers in 2019. Historically, the key drivers of SEA domestic O&D passengers have included an income variable such as per capita income and a cost of travel variable such as SEA domestic airfares.

- As shown on Figure 2-6, historical and forecast growth rates for Seattle per capita personal income are similar—an average increase of 2.2% per year between 1990 and 2019, 1.6% per year between 2019 and 2024 during the COVID-19 pandemic and recovery, and 2.2% per year between 2024 and 2038.

- SEA domestic airfares, in constant dollars, are forecast to continue to decrease through 2038 but at slower than historical rates, based on the FAA's 2022 National Aerospace Forecast assumptions for domestic yield.

- SEA domestic O&D passengers increased an average of 3.7% per year between 1990 and 2019. No growth in SEA domestic O&D passengers is expected between 2019 and 2024 during the COVID-19 pandemic and while passenger traffic recovers to 2019 pre-pandemic levels. Between 2024 and 2038, the number of SEA domestic O&D passengers is forecast to increase an average of 2.2% per year based on the analytical framework from previous econometric analyses.

Figure 2-6
HISTORICAL AND FORECAST PER CAPITA PERSONAL INCOME,
SEA DOMESTIC AIRFARES, AND SEA DOMESTIC O&D PASSENGERS



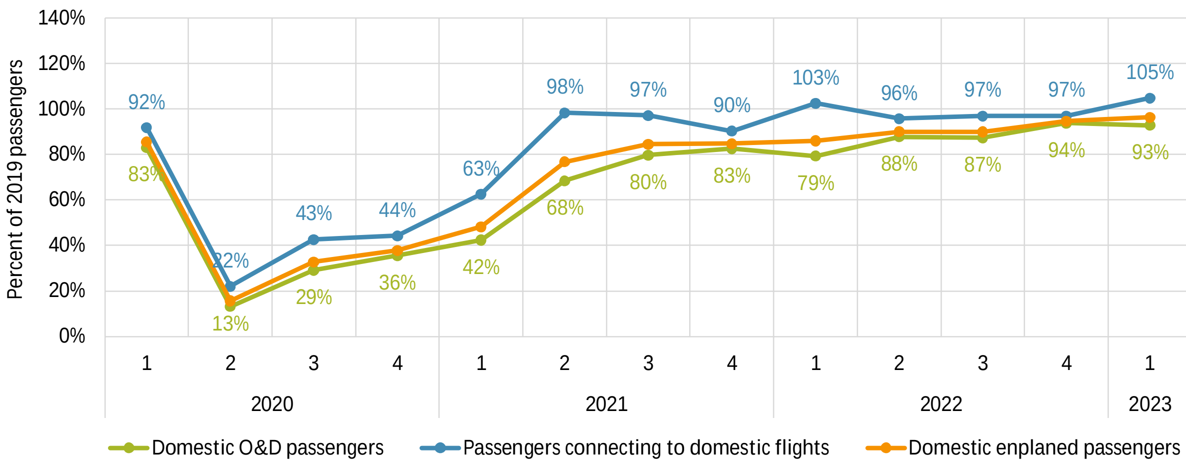
Note: Per capita personal income data area for Seattle-Tacoma-Bellevue Metropolitan Statistical Area (MSA). Forecasts of SEA domestic airfares were based on the FAA's forecast growth rates for domestic yield.

Sources: *Per Capita Personal Income*—I HS Markit Economics, June 2022 Forecast.
SEA Domestic Airfares—U.S. Department of Transportation, Origin-Destination Survey, online database, accessed June 2022 and Federal Aviation Administration, FAA Aerospace Forecast FY 2022–2042, www.faa.gov, June 28, 2022.
SEA domestic O&D passengers— Seattle-Tacoma International Airport records and U.S. Department of Transportation, Origin-Destination Survey, online database, accessed June 2022. Forecast—LeighFisher, June 2022.

2.2.2 Domestic Connecting Passengers

Domestic connecting passengers at SEA accounted for 25% of total enplaned passengers in 2019 and include domestic passengers boarding another domestic flight and international passengers boarding a domestic flight. The increasing base of domestic connecting passengers reflects the ongoing role of the Airport as a primary connecting hub in Alaska's system and the development of the Airport as West Coast connecting hub and international gateway in Delta's system. Domestic connecting passengers at SEA are recovering at a faster pace than domestic O&D and total domestic enplaned passengers, as shown on Figure 2-7. It is expected that SEA's domestic connecting passengers will recover to 2019 pre-pandemic levels in 2024 and increase at a slightly faster rate than domestic O&D passengers between 2024 and 2038, increasing an average of 2.4% per year.

Figure 2-7
RECOVERY OF DOMESTIC O&D AND CONNECTING PASSENGERS BY QUARTER
Seattle-Tacoma International Airport



Sources: Seattle-Tacoma International Airport records and U.S. Department of Transportation, Origin-Destination Survey, online database, accessed August 2023.

2.2.3 International Origin-Destination Passengers

International O&D passengers at SEA accounted for 7% of total enplaned passengers in 2019. The number of international O&D passengers at the Airport is related to the strength of the Seattle economy and the location of global companies and strong international communities of interest in the Seattle area. In addition, the level of international service provided at the Airport is supported by shorter flight times to Asian destinations compared with other West Coast gateways, the increasing presence of oneworld and SkyTeam members at SEA, and the cost advantages of Delta's Pacific gateway at Seattle compared with Asian gateways.

- In 2019, international airline service was provided from SEA to three world regions—Asia, Canada, and Europe. Asia accounted for the largest share of international enplaned passengers at the Airport in 2019, with 40%, followed by Canada and Europe, each with 30%.

- International O&D passengers at SEA accounted for 65% of total international enplaned passengers in 2019, international connecting passengers accounted for the remaining 35%.

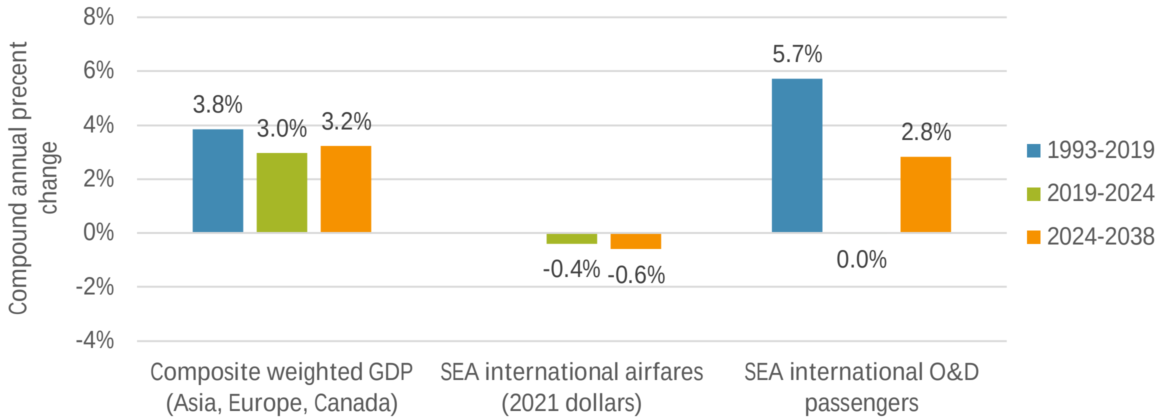
- In 2019, 22 foreign-flag airlines served the Airport and accounted for 55% of international enplaned passengers; U.S. airlines accounted for the remaining 45%.

- Historical and forecast growth rates for composite weighted GDP for Asia, Canada, and Europe are developed to represent the three international regions served at the Airport and are based on each region's share of international enplaned passengers at SEA in 2019. As shown on Figure 2-8, composite weighted GDP for Asia, Canada, and Europe increased an average increase of 3.8% per year between 1993 and 2019 and is forecast to increase 3.0% per year between 2019 and 2024 during the COVID-19 pandemic and recovery, and 3.2% per year between 2024 and 2038.

- SEA international airfares, in constant dollars, are forecast to decrease through 2038 but at slower than historical rates, based on the FAA's 2022 National Aerospace Forecast assumptions for international yield. Historical data for international airfares are not available for 1990 through 2019.*

- SEA international O&D passengers increased an average of 5.7% per year between 1990 and 2019. No growth in SEA international O&D passengers is expected between 2019 and 2024 during the COVID-19 pandemic and while passenger traffic recovers to 2019 pre-pandemic levels. Between 2024 and 2038, the number of SEA international O&D passengers is forecast to increase an average of 2.8% per year based on the analytical framework from previous econometric analyses.

Figure 2-8
HISTORICAL AND FORECAST COMPOSITE WEIGHTED GDP,
SEA INTERNATIONAL AIRFARES, AND SEA INTERNATIONAL O&D PASSENGERS



Note: Forecasts of SEA international airfares were based on the FAA's forecast growth rates for international yield.

Sources: *Composite weighted Gross Domestic Product (GDP)*—I HS Markit Economics, June 2022 Forecast. Data are weighted based on each region's share of international enplaned passengers at SEA in 2019 prepared by LeighFisher.
SEA International Airfares—OAG Worldwide Aviation Ltd, online database, accessed June 2022 and Federal Aviation Administration, FAA Aerospace Forecast FY 2022–2042, www.faa.gov, June 28, 2022.
SEA international O&D passengers— Seattle-Tacoma International Airport records and U.S. Department of Transportation, Origin-Destination Survey, online database, accessed June 2022. Forecast—LeighFisher, June 2022, updated August 2023.

2.2.4 International Connecting Passengers

International connecting passengers at SEA accounted for 4% of total enplaned passengers in 2019. The number of international connecting passengers at the Airport is related to the development of the Airport as an international gateway by Delta and foreign-flag airlines. It is expected that SEA's international connecting passengers will recover to 2019 pre-pandemic levels in 2024 and increase at the same rate as international O&D passengers between 2024 and 2038—an average of 2.8% per year.

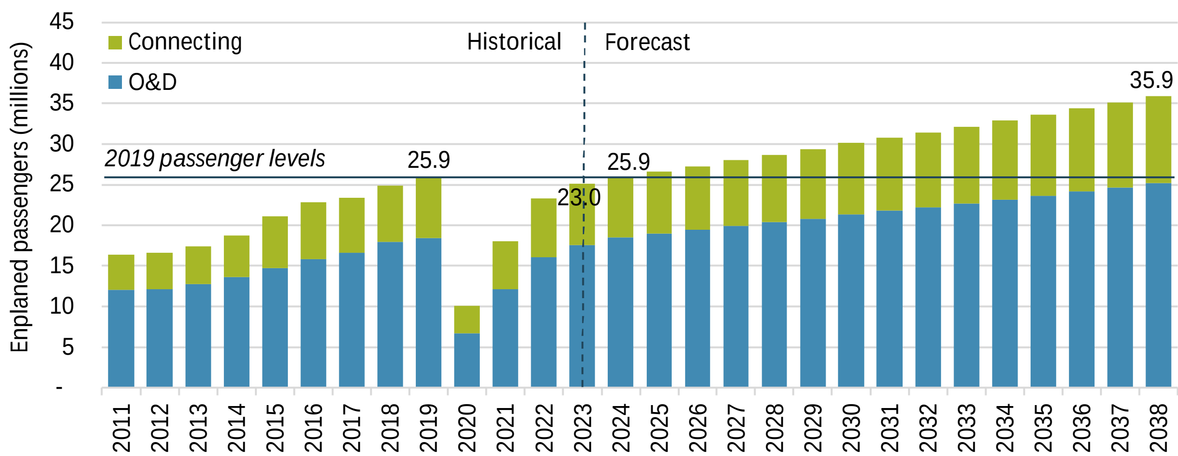
* Although the USDOT O&D Survey collects data for international airfares, only U.S. airlines are required to report; therefore, the data do not include airfares for foreign-flag airlines. Bookings data for international airfares are available which include both U.S. and foreign-flag airlines; however, a historical data series back to 1990 is not available.

2.2.5 Total Enplaned Passengers

As shown on Figure 2-19, the number of total enplaned passengers at SEA is expected to recover to 2019 levels in 2024 and increase to 36.3 million in 2038. The percentages of O%D and connecting passengers are expected to return to 2019 levels (71% and 29%, respectively) by 2024. Between 2024 and 2038, the share of O&D passengers is expected to decrease slightly to 70% but continue to increase an average of 2.2% per year.

The 2022 Forecasts of enplaned passengers at the Airport is shown in Table 1 in the Appendix.

Figure 2-9
HISTORICAL AND FORECAST ENPLANED PASSENGERS: 2023-2038
Seattle-Tacoma International Airport



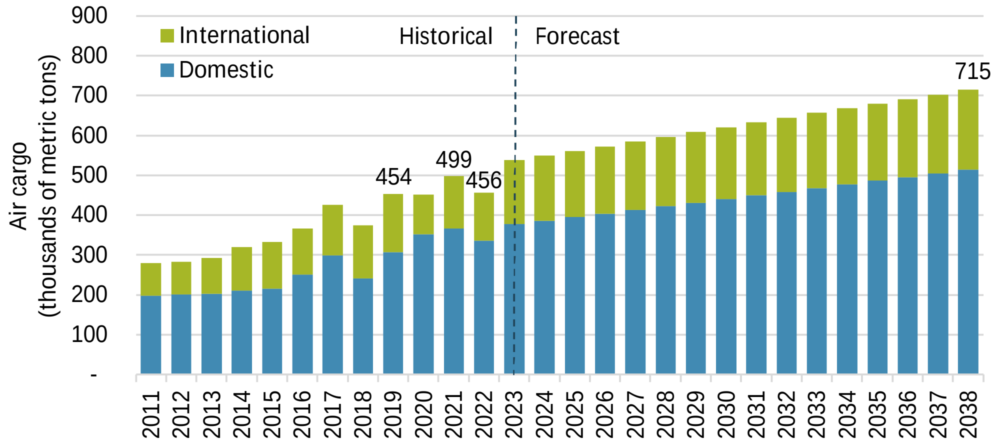
Sources: Historical—Seattle-Tacoma International Airport records and U.S. Department of Transportation, Origin-Destination Survey, online database, accessed June 2022. Forecast—LeighFisher, June 2022, updated August 2023.

3.0 AIR CARGO

Total air cargo at SEA decreased 0.2% in 2020, driven by a 31.1% decrease in international air cargo as the COVID-19 pandemic closed international borders and resulted in the loss of long-haul passenger belly capacity on widebody aircraft fleets. In contrast, domestic air cargo increased 14.6% in 2020 and 4.3% in 2021, reflecting strong growth in e-commerce as consumers increasingly relied on online sales and delivery and reduced in-store visits to limit their exposure to the coronavirus. As shown on Figure 3-1, air cargo at SEA is forecast to increase to 715,000 metric tons in 2038, representing an average increase of 2.4% per year between 2019 and 2024 during the pandemic and recovery, and an average increase of 1.9% per year between 2024 and 2038.

The 2022 Forecasts of air cargo at the Airport is shown in Table 2 in the Appendix.

Figure 3-1
AIR CARGO FORECASTS
Seattle-Tacoma International Airport



(a) Includes general aviation, military, and other unscheduled operations.
Sources: Historical—Seattle-Tacoma International Airport records. Forecast—LeighFisher, June 2022, updated August 2023.

4.0 AIRCRAFT OPERATIONS

As shown on Figure 4-1, total aircraft operations at SEA are expected to recover to 2019 levels in 2024 and increase to 574,100 in 2038, with passenger airlines accounting for 95% of total aircraft operations.

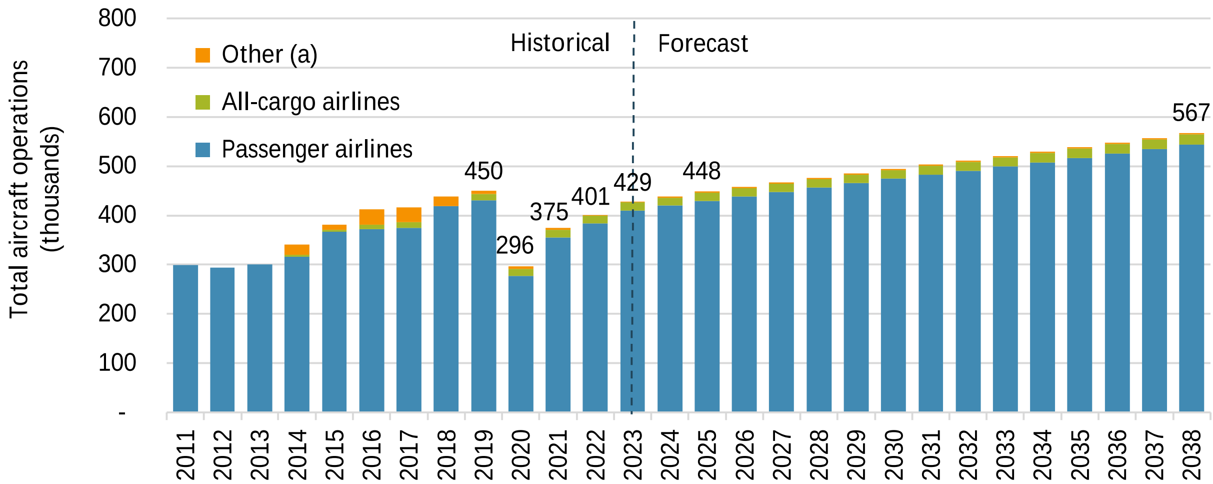
The forecasts of passenger airline operations are derived from the enplaned passenger forecasts and based on assumptions for average seats per departure and load factor (the percentage of occupied seats).

- Average seats per departure for the Airport as a whole are forecast to increase from 143.2 in 2022 to 155.3 in 2038.
  - Domestic seats per operation at SEA are forecast to increase from 141.2 in 2022 to 153.0 in 2038, consistent with the assumptions for the 2018 Hybrid Forecast. The domestic aircraft gauge reflects the large share of passenger airline operations by Alaska Airlines (58% in 2021) with a predominantly narrowbody fleet (averaging 136 seats at SEA in 2021) and the increasing number of regional jet operations related to the continued development of the Airport as a connecting hub.
  - International seats per operation at SEA are forecast to increase from 162.0 in 2022 to 172.7 in 2038, consistent with the assumptions for the 2018 Hybrid Forecast.* The international aircraft gauge reflects the large share of short-haul Canadian operations (27% of total passenger airline operations in 2021) served primarily with regional jet aircraft and an all narrowbody aircraft flown from SEA to Mexico.

* In 2021, the average seats per departure for international flights increased to 181.4 (from 155.9 in 2020) which reflects the substitution of narrowbody aircraft for regional jets (primarily by Alaska and Delta) and the restoration of narrowbody aircraft service.

- SEA load factors for the Airport as a whole are forecast to approximate 85% through 2038. Domestic load factors are forecast to increase from 84% in 2022 to 85% in 2038, while international load factors are forecast to increase from 83% in 2022 to 85% in 2038.

Figure 4-1
TOTAL AIRCRAFT OPERATION FORECASTS
Seattle-Tacoma International Airport



(b) Includes general aviation, military, and other unscheduled operations.
Sources: Historical—Seattle-Tacoma International Airport records. Forecast—LeighFisher, June 2022, updated August 2023.

Tables 3 and 4 in the Appendix present the forecast assumptions for load factor and average seats per departure and total aircraft operations at the Airport for 2023 through 2038.

5.0 AIRCRAFT FLEET DISTRIBUTION

The analysis of the aircraft fleet distribution at SEA was based on:

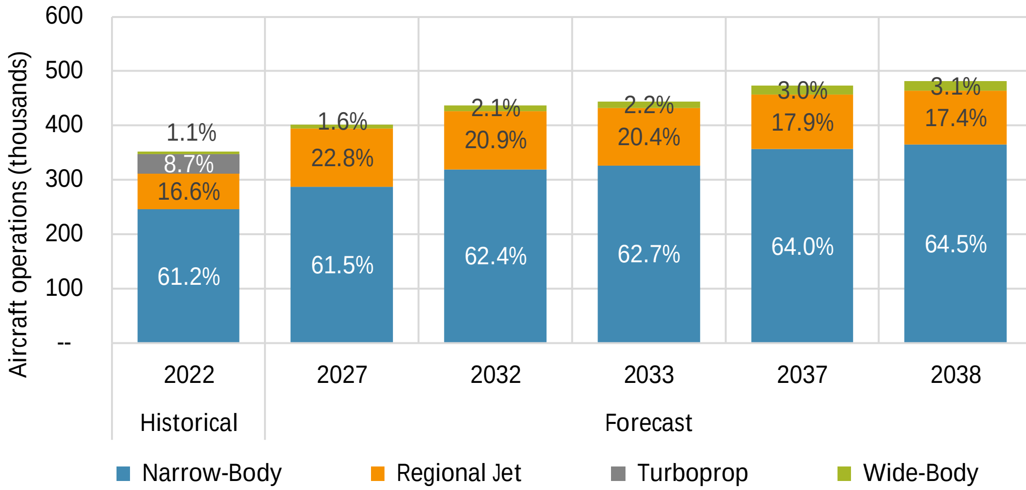
- An evaluation of the current fleet serving the airport using SEA aviation records, published airline schedules, and the FAA's Traffic Flow Management System Counts (TFMSC)
- A review of individual airline fleets, orders for new aircraft, new aircraft delivery schedules, and airline plans for retiring aircraft using airline SEC filings and the Aviation Week Intelligence Network (AWIN) commercial aviation database
- A maximum useful life of 30 years for air carrier aircraft and 25 years for regional aircraft plus a 5-year buffer period as older aircraft are phased out of service
- Airline plans for replacement of retired aircraft as available

The September 2023 update of the fleet distribution for the 2022 Forecasts was revised to include full calendar year data for 2022 from the Port of Seattle's Noise Office and reconciled with domestic and international landings submitted by the airlines serving SEA.

5.1 Domestic Passenger Airline Fleet

Narrowbody aircraft accounted for the largest number of domestic passenger airline operations in 2022, with 61.2% of total aircraft operations, and are forecast to gradually increase to 64.5% in 2038, as shown on Figure 5-1.

Figure 5-1
ACTUAL AND FORECAST
DOMESTIC PASSENGER AIRLINE OPERATIONS BY AIRCRAFT BODY TYPE
Seattle-Tacoma International Airport



Sources: Historical—Seattle-Tacoma International Airport records. Forecast—LeighFisher, June 2022, updated August 2023.

Narrowbody aircraft expected to reach their maximum useful life during the forecast period include:

- Airbus A319 with an average age of 20 years in 2022
- Boeing B757-200 and B757-300 with average ages of 26 and 21 years, respectively, in 2022

In addition, the percentage of Airbus A320 aircraft are expected to decrease in the short-term with Alaska's transition to an all-Boeing fleet and the retirement of the airline's A320s by early 2023. Alaska also plans to remove the A321neo from its fleet by the end of 2023.

New aircraft expected to account for an increasing share of the narrowbody fleet used in domestic service include:

- Airbus A220-100 and A220-300 operated by Delta
- Boeing 737MAX 8/9/10 operated by Alaska, American, Southwest, and United

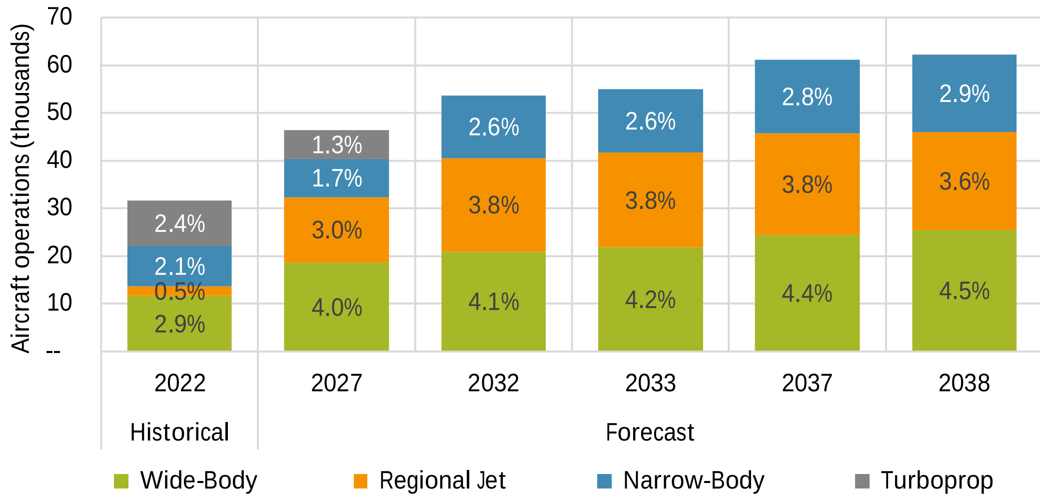
Regional aircraft, regional jets and turboprops, together accounted for the second largest number of domestic passenger airline operations in 2022, with 25.3% of total aircraft operations, are forecast to decrease to 17.4% in 2038. In the short-term, changes in the regional aircraft fleet reflect the retirement of the Q400 by Alaska in early 2023 (replaced with the E175) and the shortage of regional pilots. The increasing number of operations by small narrowbody aircraft such as the A220-100 may also limit the share of regional aircraft operations.

Widebody aircraft accounted for the smallest number of domestic passenger airline operations in 2022, with 1.1% of total aircraft operations, are forecast to gradually increase to 3.1% in 2038.

5.2 International Passenger Airline Fleet

Widebody aircraft accounted for the largest number of international passenger airline operations in 2022, with 2.9% of total aircraft operations, and are forecast to gradually increase to 4.5% in 2038, as shown on Figure 5-2.

Figure 5-2
ACTUAL AND FORECAST
INTERNATIONAL PASSENGER AIRLINE OPERATIONS BY AIRCRAFT BODY TYPE
Seattle-Tacoma International Airport



Sources: Historical—Seattle-Tacoma International Airport records. Forecast—LeighFisher, June 2022, updated August 2023.

Widebody aircraft expected to reach their maximum useful life during the forecast period include:

- Airbus A340 with an average age of 21 years in 2022
- Boeing B747-400 and B767-300 each with average ages of 24 years in 2022
- Boeing B777-200 and B777-300 with average ages of 22 and 23 years, respectively, in 2022

New aircraft expected to account for an increasing share of the widebody fleet used in international service include:

- Airbus A330-300/900 and A350
- Boeing 787-8/9/10

Regional aircraft, regional jets and turboprops, together accounted for a similar number of international passenger airline operations as widebody aircraft in 2022, with 2.9% of total, are forecast to increase to 3.86% in 2038 as the number of E175 aircraft are added to the regional fleet. In 2022, the Q400 was used in international service by Alaska, Air Canada Jazz, and WestJet.

Narrowbody aircraft accounted for the smallest largest number of international passenger airline operations in 2022, with 2.1%, are forecast to gradually increase to 2.9% in 2038.

The 2022 Forecasts of the aircraft fleet distribution in terms of total aircraft operations by aircraft type at the Airport is shown in Table 5 in the Appendix.

6.0 COMPARISON WITH THE FAA 2022 TAF

Table 7 in the Appendix presents a comparison of the 2022 Forecasts prepared for Seattle-Tacoma International Airport with the FAA 2022 TAF for the Airport. The forecasts are compared for the components of total enplaned passengers, commercial aircraft operations and total aircraft operations.

As noted on page 1, the forecasts presented in this memorandum are unconstrained and were used as a basis to develop a constrained demand scenario that reflects the Airport's ability to accommodate demand. The analysis of a constrained scenario indicated that SEA would experience a constrained operating environment from 2027 through 2037 due to a shortage of gates and airfield constraints. Although it was determined that the unconstrained forecast of aircraft operations at SEA exceeds the constrained forecast, the updates to the unconstrained forecasts presented in this memorandum do not change the constrained demand scenario which is based on an evaluation of SEA facilities and used as a basis for the Environmental Assessment.

The format of Table 6 is based on the template provided by the FAA for the comparison of airport planning forecasts and the FAA TAF.* As required, the results are presented for the base year of 2022 and forecast horizons years which are equal to the base year, plus 1, 5, 10 and 15 years (2022, 2023, 2027, 2032, and 2037).

The key findings of the comparison of the updated aviation demand forecasts with the FAA 2022 TAF are:

- The forecast of enplaned passengers for SEA varies from the 2022 TAF by:
  - 4.6% in 2027
  - 6.4% in 2032
  - 8.1% in 2037
- The forecast of commercial operations for SEA varies from the 2022 TAF by:
  - 7.5% in 2027
  - 10.7% in 2032
  - 13.8% in 2037
- The forecast of total aircraft operations for SEA varies from the FAA 2022 TAF by:
  - 7.7% in 2027
  - 10.9% in 2032
  - 13.9% in 2037

*U.S. Department of Transportation, Federal Aviation Administration, *Forecasting Aviation Activity by Airport*, July 2001, and *Review and Approval of Aviation Forecasts*, June 2008, http://www.faa.gov.

- Overall, the 2022 Forecasts are similar to the FAA 2022 TAF for the Airport and "differ by less than 10 percent in the 5-year forecast period, and 15 percent in the 10-year forecast period", as stipulated in the FAA forecast guidance.

Table 8 in the Appendix presents a summary of the 2022 Forecasts using a second template provided by the FAA.

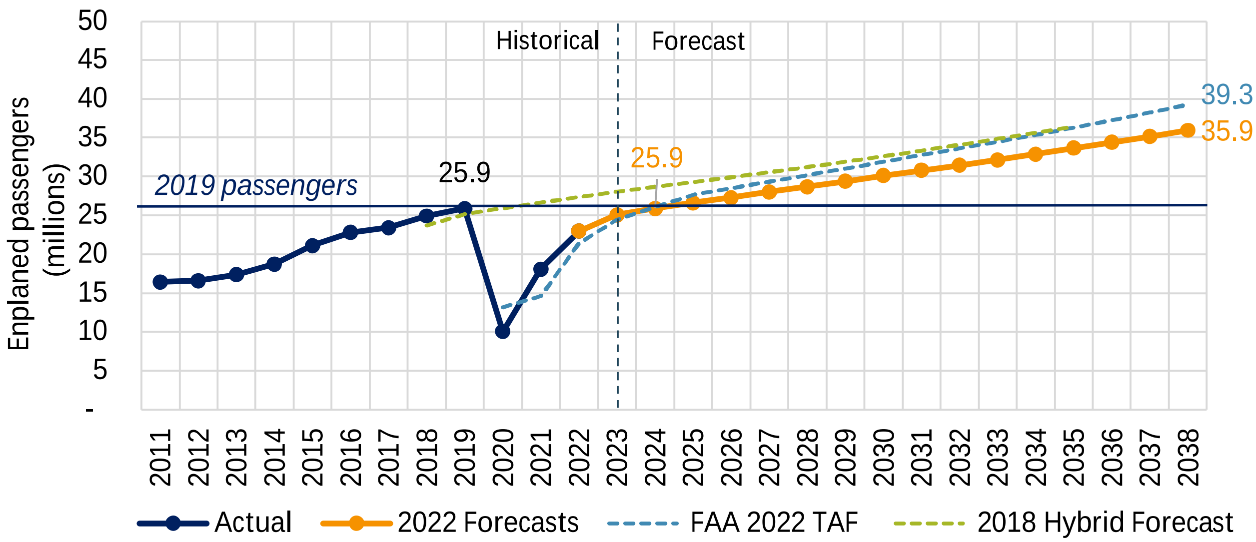
7.0 FORECAST COMPARISON

Table 8 in the Appendix present a comparison of the 2022 Forecasts with the 2022 TAF for SEA, the 2018 Hybrid Forecasts, and the 2014 Sustainable Airport Master Plan (SAMP) in terms of enplaned passengers, air freight, and total aircraft operations. Figure 7-1 presents a graphical comparison of the enplaned passenger forecasts.

The 2022 Forecasts of enplaned passengers are somewhat higher than the FAA 2022 TAF in the short-term but lower in the long-term; but as noted earlier, are within the allowed variance of the TAF. In the short-term, the forecasts for 2022 through 2024 differ, reflecting:

- Significant differences in the historical reporting of SEA enplaned passengers in 2021. In the FAA 2022 TAF, SEA enplaned passengers total 14.6 million in 2021, compared with 18.1 million in SEA actual traffic counts, for a difference of 23.8%. Although part of the difference may be attributable to data for a Federal Fiscal Year compared with a calendar year, the historical difference between FAA TAF and SEA data during pre-pandemic years averaged 5%.

Figure 7-1
COMPARISON OF ENPLANED PASSENGER FORECASTS
Seattle-Tacoma International Airport



Sources: Historical—Seattle-Tacoma International Airport records.
2022 Forecast—LeighFisher, June 2022, updated August 2023.
FAA 2022 TAF—Federation Aviation Administration, March 2022, www.faa.gov.
2018 Hybrid Forecast (FAA 2018 TAF)—Federal Aviation Administration, March 2018, www.faa.gov.
2014 SAMP Forecast—LeighFisher, September 2015.

- As a result of the significantly lower 2021 data and the strength of the recovery in 2022, the FAA 2022 TAF estimated a 46.5% increase in SEA enplaned passengers between 2021 and 2022, compared with a 27.1% actual increase in the 2022 Forecasts.
- Significant differences in SEA enplaned passenger base year data for 2022. In the FAA 2022 TAF, SEA enplaned passengers are estimates (i.e., 21.4 million enplaned passengers, representing an estimated increase of 46.5% between 2021 and 2022). In contrast, the 2022 base year data for the 2022 Forecasts are actual (i.e., 23.0 million enplaned passengers, representing an actual increase of 27.1%).
- The 2022 Forecast for 2023 is based on 6 months of actual data. The FAA 2022 TAF forecasts a 14.2% increase in enplaned passengers In 2023, compared with a 9.3% increase in the 2022 Forecasts which is based on six months of 2023 actual data.

In the long-term, SEA enplaned passengers are forecast to increase:

- An average of 2.8% per year between 2023 and 2038 in the 2022 Forecasts for a total of 35.9 million in 2038, reflecting short-term growth rates of 2.9% per year between 2023 and 2025 and long-term growth rates of 2.3% between 2025 and 2038
- An average of 3.9% per year between 2023 and 2038 in the FAA 2022 TAF for a total of 39.3 million in 2038, reflecting short-term growth rates of 6.4% per year between 2023 and 2025 and long-term growth rates of 2.7% between 2025 and 2038

The 2018 Hybrid Forecasts, adopted from the FAA 2018 TAF, are significantly higher than both the 2022 Forecasts and the FAA 2022 TAF due to the negative impacts of the COVID-19 pandemic on SEA passenger traffic.

The 2022 Forecasts of enplaned passengers are consistent with the 2014 SAMP Forecasts.

Appendix

FORECAST TABLES

Table 1
HISTORICAL AND FORECAST ENPLANED PASSENGERS
Seattle-Tacoma International Airport
In millions, except as noted

	Domestic			International			Total enplaned passengers			Percent of total	
Year	O&D	Connecting	Total	O&D	Connecting	Total	O&D	Connecting	Total	O&D	Connecting
Historical											
2019	16.6	6.4	23.0	1.9	1.0	2.9	18.5	7.4	25.9	71.4%	28.6%
2020	6.3	3.1	9.4	0.4	0.2	0.7	6.7	3.3	10.0	66.7%	33.3%
2021	11.6	5.7	17.3	0.6	0.2	0.8	12.2	5.9	18.1	67.4%	32.6%
2022	14.5	6.3	20.8	1.5	0.7	2.2	16.0	7.0	23.0	69.6%	30.4%
Forecast											
2023	15.9	6.5	22.3	1.7	1.0	2.8	17.6	7.5	25.1	70.1%	29.9%
2024	16.6	6.4	23.0	1.9	1.0	2.9	18.5	7.4	25.9	71.4%	28.6%
2025	17.0	6.6	23.6	1.9	1.1	3.0	19.0	7.6	26.6	71.3%	28.7%
2026	17.4	6.7	24.2	2.0	1.1	3.1	19.4	7.8	27.3	71.2%	28.8%
2027	17.9	6.9	24.8	2.0	1.2	3.2	19.9	8.1	28.0	71.1%	28.9%
2028	18.3	7.1	25.4	2.1	1.2	3.3	20.4	8.3	28.7	71.0%	29.0%
2029	18.7	7.3	26.0	2.1	1.3	3.4	20.8	8.5	29.4	70.9%	29.1%
2030	19.2	7.4	26.6	2.2	1.3	3.5	21.4	8.8	30.1	70.8%	29.2%
2031	19.6	7.6	27.2	2.2	1.4	3.6	21.8	9.0	30.8	70.7%	29.3%
2032	19.9	7.8	27.7	2.3	1.5	3.8	22.2	9.2	31.5	70.6%	29.4%
2033	20.3	7.9	28.3	2.4	1.5	3.9	22.7	9.5	32.2	70.5%	29.5%
2034	20.8	8.1	28.9	2.4	1.6	4.0	23.2	9.7	32.9	70.4%	29.6%
2035	21.2	8.3	29.5	2.5	1.7	4.1	23.7	10.0	33.6	70.3%	29.7%
2036	21.6	8.5	30.1	2.5	1.7	4.3	24.2	10.2	34.4	70.2%	29.8%
2037	22.1	8.7	30.8	2.6	1.8	4.4	24.7	10.5	35.2	70.1%	29.9%
2038	22.5	8.9	31.4	2.6	1.9	4.5	25.2	10.8	35.9	70.0%	30.0%

	Percent change								
2019-2020	-62.2%	-51.6%	-59.3%	-76.8%	-76.0%	-76.5%	-63.7%	-54.9%	-61.2%
2020-2021	84.9%	82.4%	84.0%	35.9%	-1.4%	22.5%	81.7%	76.4%	79.9%
2021-2022	25.1%	10.9%	20.5%	153.3%	197.6%	166.0%	31.3%	18.4%	27.1%
2022-2023	9.3%	3.1%	7.4%	17.8%	45.9%	26.9%	10.1%	7.4%	9.3%
2023-2024	4.8%	-1.1%	3.1%	7.4%	-2.4%	3.8%	5.1%	-1.2%	3.2%
2024-2025	2.5%	2.9%	2.6%	2.9%	5.2%	3.7%	2.5%	3.2%	2.7%
2025-2026	2.4%	2.4%	2.4%	2.8%	5.1%	3.6%	2.4%	2.7%	2.5%
2026-2027	2.5%	2.7%	2.6%	2.7%	5.0%	3.5%	2.6%	3.0%	2.7%
2027-2028	2.3%	2.5%	2.3%	2.6%	4.9%	3.4%	2.3%	2.8%	2.5%
2028-2029	2.2%	2.4%	2.3%	2.5%	4.7%	3.3%	2.3%	2.8%	2.4%
2029-2030	2.4%	2.6%	2.5%	2.4%	4.6%	3.3%	2.4%	2.9%	2.6%
2030-2031	2.1%	2.3%	2.1%	2.3%	4.5%	3.2%	2.1%	2.6%	2.2%
2031-2032	1.9%	2.1%	2.0%	2.3%	4.5%	3.2%	2.0%	2.5%	2.1%
2032-2033	2.0%	2.2%	2.0%	2.3%	4.5%	3.2%	2.0%	2.5%	2.2%
2033-2034	2.1%	2.3%	2.2%	2.3%	4.5%	3.2%	2.1%	2.7%	2.3%
2034-2035	2.1%	2.3%	2.2%	2.3%	4.5%	3.2%	2.1%	2.6%	2.3%
2035-2036	2.1%	2.3%	2.1%	2.3%	4.4%	3.2%	2.1%	2.6%	2.3%
2036-2037	2.1%	2.2%	2.1%	2.3%	4.4%	3.2%	2.1%	2.6%	2.2%
2037-2038	2.0%	2.2%	2.1%	2.3%	4.4%	3.2%	2.1%	2.6%	2.2%

Note: The forecasts presented in this table were prepared using the information and assumptions described in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

Sources: Historical--Seattle-Tacoma International Airport records. Forecast--LeighFisher, June 2022, updated August 2023.

Table 2
HISTORICAL AND FORECAST AIR CARGO
Seattle-Tacoma International Airport
Thousands of metric tons

Year	Domestic	International	Total
Historical			
2019	306.7	146.9	453.5
2020	351.3	101.2	452.5
2021	366.3	132.4	498.7
2022	335.5	120.8	456.3
Forecast			
2023	378.2	160.3	538.5
2024	386.6	163.0	549.6
2025	395.3	165.7	561.0
2026	404.1	168.5	572.6
2027	413.1	171.4	584.4
2028	422.3	174.3	596.5
2029	431.5	177.1	608.6
2030	440.7	179.9	620.6
2031	449.8	182.7	632.5
2032	458.9	185.4	644.4
2033	468.0	188.1	656.1
2034	477.0	190.7	667.7
2035	486.0	193.3	679.3
2036	495.1	195.9	691.0
2037	504.4	198.5	702.9
2038	513.9	201.1	715.0
	Percent change		
2019-2020	14.6%	-31.1%	-0.2%
2020-2021	4.3%	30.9%	10.2%
2021-2022	-8.4%	-8.8%	-8.5%
2022-2023	12.7%	32.7%	18.0%
2023-2024	2.2%	1.7%	2.1%
2024-2025	2.2%	1.7%	2.1%
2025-2026	2.2%	1.7%	2.1%
2026-2027	2.2%	1.7%	2.1%
2027-2028	2.2%	1.7%	2.1%
2028-2029	2.2%	1.6%	2.0%
2029-2030	2.1%	1.6%	2.0%
2030-2031	2.1%	1.5%	1.9%
2031-2032	2.0%	1.5%	1.9%
2032-2033	2.0%	1.4%	1.8%
2033-2034	1.9%	1.4%	1.8%
2034-2035	1.9%	1.3%	1.7%
2035-2036	1.9%	1.3%	1.7%
2036-2037	1.9%	1.3%	1.7%
2037-2038	1.9%	1.3%	1.7%

Note: The forecasts presented in this table were prepared using the information and assumptions described in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

(a) Includes enplaned and deplaned tonnage.

Sources: Historical--Seattle-Tacoma International Airport records. Forecast--LeighFisher, June 2022, updated August 2023 (2022 base year).

Table 3
2022 FORECAST ASSUMPTIONS
Seattle-Tacoma International Airport

Year	Load factor			Average seats per departure		
	Domestic	International	Total	Domestic	International	Total
Historical						
2019	86.0%	85.4%	85.9%	138.2	154.2	139.8
2020	53.2%	54.8%	53.3%	131.9	155.9	133.2
2021	74.1%	55.0%	73.0%	138.2	181.4	140.2
2022	84.2%	78.6%	83.7%	141.2	162.0	143.2
Forecast						
2023	85.2%	81.6%	84.8%	142.0	162.6	144.1
2024	85.3%	83.6%	85.1%	142.7	163.3	144.7
2025	85.3%	83.6%	85.1%	143.4	163.9	145.5
2026	85.3%	83.6%	85.1%	144.1	164.6	146.2
2027	85.3%	83.6%	85.1%	144.8	165.2	146.9
2028	85.3%	83.7%	85.1%	145.5	165.9	147.7
2029	85.3%	83.7%	85.1%	146.3	166.6	148.4
2030	85.3%	83.7%	85.1%	147.0	167.2	149.2
2031	85.3%	83.7%	85.1%	147.7	167.9	149.9
2032	85.3%	83.7%	85.1%	148.5	168.6	150.7
2033	85.3%	83.7%	85.1%	149.2	169.2	151.4
2034	85.4%	83.7%	85.2%	150.0	169.9	152.2
2035	85.4%	83.7%	85.2%	150.7	170.6	152.9
2036	85.4%	83.7%	85.2%	151.5	171.3	153.7
2037	85.4%	83.7%	85.2%	152.2	172.0	154.5
2038	85.4%	83.8%	85.2%	153.0	172.7	155.3
	Percent change					
2019-2020	-38.1%	-35.8%	-37.9%	-4.6%	1.1%	-4.7%
2020-2021	39.3%	0.4%	36.8%	4.8%	16.4%	5.3%
2021-2022	13.6%	42.9%	14.6%	2.2%	-10.7%	2.1%
2022-2023	1.2%	3.8%	1.4%	0.5%	0.4%	0.6%
2023-2024	0.0%	2.5%	0.3%	0.5%	0.4%	0.5%
2024-2025	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%
2025-2026	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%
2026-2027	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%
2027-2028	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%
2028-2029	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%
2029-2030	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%
2030-2031	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%
2031-2032	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%
2032-2033	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%
2033-2034	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%
2034-2035	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%
2035-2036	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%
2036-2037	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%
2037-2038	0.0%	0.0%	0.0%	0.5%	0.4%	0.5%

Note: The forecasts presented in this table were prepared using the information and assumptions described in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

Sources: Historical--Seattle-Tacoma International Airport records. Forecast--LeighFisher, June 2022, updated August 2023 (2022 base year).

Table 4
HISTORICAL AND FORECAST TOTAL AIRCRAFT OPERATIONS
Seattle-Tacoma International Airport
In thousands

Year	Passenger airlines	All-cargo airlines	Other (a)	Total
Historical				
2019	431.3	13.2	5.9	450.5
2020	277.1	14.6	4.4	296.1
2021	355.2	15.3	3.9	374.5
2022	384.2	14.9	2.3	401.4
Forecast				
2023	410.7	15.5	2.5	428.7
2024	420.6	15.8	2.5	438.9
2025	429.9	16.2	2.5	448.5
2026	438.4	16.5	2.5	457.4
2027	447.9	16.8	2.5	467.3
2028	456.6	17.2	2.5	476.3
2029	465.3	17.5	2.5	485.3
2030	474.7	17.9	2.5	495.1
2031	482.9	18.2	2.5	503.7
2032	491.0	18.5	2.5	512.0
2033	499.1	18.9	2.6	520.5
2034	507.7	19.2	2.6	529.4
2035	516.6	19.5	2.6	538.7
2036	525.6	19.9	2.6	548.0
2037	534.7	20.2	2.6	557.5
2038	543.7	20.6	2.6	566.9
	Percent change			
2019-2020	-35.7%	10.0%	-26.3%	-34.3%
2020-2021	28.2%	5.1%	-9.7%	26.5%
2021-2022	8.1%	-3.0%	-40.7%	7.2%
2022-2023	6.9%	4.4%	6.0%	6.8%
2023-2024	2.4%	2.1%	0.3%	2.4%
2024-2025	2.2%	2.1%	0.3%	2.2%
2025-2026	2.0%	2.1%	0.3%	2.0%
2026-2027	2.2%	2.1%	0.3%	2.2%
2027-2028	1.9%	2.1%	0.3%	1.9%
2028-2029	1.9%	2.0%	0.3%	1.9%
2029-2030	2.0%	2.0%	0.3%	2.0%
2030-2031	1.7%	1.9%	0.3%	1.7%
2031-2032	1.7%	1.9%	0.3%	1.7%
2032-2033	1.7%	1.8%	0.3%	1.7%
2033-2034	1.7%	1.8%	0.3%	1.7%
2034-2035	1.8%	1.7%	0.3%	1.7%
2035-2036	1.7%	1.7%	0.3%	1.7%
2036-2037	1.7%	1.7%	0.3%	1.7%
2037-2038	1.7%	1.7%	0.3%	1.7%

Note: The forecasts presented in this table were prepared using the information and assumptions described in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

(a) Includes general aviation, military, and other unscheduled operations.

Sources: Historical--Seattle-Tacoma International Airport records. Forecast--LeighFisher, June 2022, updated August 2023 (2022 base year).

Table 5
FORECAST COMPARISON
Seattle-Tacoma International Airport

	Enplaned passengers (millions)				Air freight (thousands of metric tons)			Total aircraft operations (thousands)			
Year	2022 Forecast	FAA 2022 TAF	2018 Hybrid Forecast	2014 SAMP	2022 Forecast	2018 Hybrid Forecast	2014 SAMP	2022 Forecast	FAA 2022 TAF	2018 Hybrid Forecast	2014 SAMP
Historical											
2019	25.9	24.6	25.1	22.4	453.5	457.8	351.5	450	445	454	399
2020	10.0	13.4	25.9	23.2	452.5	485.3	358.0	296	330	466	411
2021	18.1	14.3	26.7	23.9	498.7	515.0	364.3	375	358	476	421
2022	23.0	17.7	27.4	24.6	456.3	547.3	370.5	401	379	484	430
Forecast							-				
2023	25.1	22.2	28.0	25.2	538.5	560.0	376.8	429	436	493	439
2024	25.9	24.1	28.7	25.9	549.6	572.9	383.0	439	457	500	449
2025	26.6	25.1	29.3	26.6	561.0	586.2	389.2	448	479	506	458
2026	27.3	25.9	29.9	27.3	572.6	599.8	395.4	457	501	512	468
2027	28.0	26.7	30.6	28.0	584.4	613.8	401.6	467	522	519	478
2028	28.7	27.5	31.2	28.7	596.5	627.7	407.7	476	535	527	487
2029	29.4	28.3	31.9	29.5	608.6	641.7	413.8	485	547	534	497
2030	30.1	29.1	32.6	30.2	620.6	655.7	419.7	495	559	542	507
2031	30.8	29.8	33.3	30.8	632.5	669.7	425.4	504	568	549	515
2032	31.5	30.6	34.1	31.5	644.4	683.7	431.0	512	578	557	524
2033	32.2	31.4	34.9		656.1	697.6		521	587	566	
2034	32.9	32.2	35.6		667.7	711.5		529	598	576	
2035	33.6	33.0	36.4		679.3	725.3		539	609	585	
2036	34.4	33.8			691.0			548	620		
2037	35.2	34.6			702.9			557	630		
2038	35.9	35.4			715.0			567	641		
	Percent change										
2019-2020	-61.2%	-45.5%	3.1%	3.7%	-0.2%	6.0%	1.8%		-25.9%	2.5%	3.1%
2020-2021	79.9%	6.8%	2.9%	2.9%	10.2%	6.1%	1.7%		8.7%	2.2%	2.3%
2021-2022	27.1%	23.6%	2.6%	2.8%	-8.5%	6.3%	1.7%	7.2%	5.7%	1.7%	2.2%
2022-2023	9.3%	25.3%	2.4%	2.7%	18.0%	2.3%	1.7%	6.8%	15.0%	1.8%	2.2%
2023-2024	3.2%	8.9%	2.2%	2.7%	2.1%	2.3%	1.7%	2.4%	4.8%	1.3%	2.1%
2024-2025	2.7%	4.1%	2.2%	2.7%	2.1%	2.3%	1.6%	2.2%	4.8%	1.3%	2.1%
2025-2026	2.5%	3.2%	2.1%	2.6%	2.1%	2.3%	1.6%	2.0%	4.6%	1.3%	2.1%
2026-2027	2.7%	3.1%	2.2%	2.6%	2.1%	2.3%	1.6%	2.2%	4.2%	1.4%	2.1%
2027-2028	2.5%	3.0%	2.2%	2.6%	2.1%	2.3%	1.5%	1.9%	2.5%	1.4%	2.0%
2028-2029	2.4%	2.8%	2.2%	2.5%	2.0%	2.2%	1.5%	1.9%	2.2%	1.4%	2.0%
2029-2030	2.6%	2.7%	2.2%	2.5%	2.0%	2.2%	1.4%	2.0%	2.2%	1.4%	2.0%
2030-2031	2.2%	2.6%	2.2%	2.1%	1.9%	2.1%	1.3%	1.7%	1.7%	1.4%	1.6%
2031-2032	2.1%	2.6%	2.2%	2.1%	1.9%	2.1%	1.3%	1.7%	1.7%	1.3%	1.6%
2032-2033	2.2%	2.5%	2.2%		1.8%	2.0%		1.7%	1.7%	1.7%	
2033-2034	2.3%	2.5%	2.2%		1.8%	2.0%		1.7%	1.8%	1.7%	
2034-2035	2.3%	2.5%	2.2%		1.7%	1.9%		1.7%	1.8%	1.6%	
2035-2036	2.3%	2.5%			1.7%			1.7%	1.8%		
2036-2037	2.2%	2.3%			1.7%			1.7%	1.7%		
2037-2038	2.2%	2.3%			1.7%			1.7%	1.7%		

Note: The forecasts presented in this table were prepared using the information and assumptions described in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

Note: Areas highlighted in gray are estimates or forecasts prepared on a base year before 2022.

Sources: 2022 Forecast--Historical--Seattle-Tacoma International Airport records. Forecast--LeighFisher, June 2022, updated August 2023 (2022 base year).
FAA 2022 TAF for SEA—U.S. Department of Transportation, Federal Aviation Administration, www.faa.gov, accessed March 2022.
2018 Hybrid Forecast-- Passengers: FAA 2018 TAF for SEA—U.S. Department of Transportation, Federal Aviation Administration, www.faa.gov,
2014 SAMP Forecast—LeighFisher, September 2015.

Table 6
FORECASTS OF TOTAL AIRCRAFT OPERATIONS BY AIRCRAFT TYPE
Seattle-Tacoma International Airport

Sector/Aircraft type/Equipment	Average age (years) (a)	Seat configuration	Historical 2022	Forecast 2027	2032	2033	2037	2038	Historical 2022	Forecast 2027	2032	2033	2037	2038
PASSENGER AIRLINES														
DOMESTIC														
Air carrier														
Narrow-Body														
A220-100	2	109	9,132	18,393	20,149	22,976	28,899	30,476	2.3%	3.9%	3.9%	4.4%	5.2%	5.4%
A220-300	1	133	--	4,210	4,412	4,488	9,439	10,263	0.0%	0.9%	0.9%	0.9%	1.7%	1.8%
A319	20	127	3,247	2,778	1,375	899	--	--	0.8%	0.6%	0.3%	0.2%	0.0%	0.0%
A320-200	13	151	19,922	14,581	8,612	6,260	2,433	1,387	5.0%	3.1%	1.7%	1.2%	0.4%	0.2%
A320 NEO	2	185	1,679	3,108	9,293	11,941	17,072	18,449	0.4%	0.7%	1.8%	2.3%	3.1%	3.3%
A321-200	11	191	8,049	8,875	9,231	7,887	3,107	2,072	2.0%	1.9%	1.8%	1.5%	0.6%	0.4%
A321 NEO	1	195	6,397	12,162	22,647	25,515	33,223	35,416	1.6%	2.6%	4.4%	4.9%	6.0%	6.2%
B737-300	30	124	8	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B737-700	16	143	19,936	7,959	4,888	3,788	1,069	544	5.0%	1.7%	1.0%	0.7%	0.2%	0.1%
B737-800	12	162	61,003	70,662	72,010	70,706	51,183	43,895	15.2%	15.1%	14.1%	13.6%	9.2%	7.7%
B737-900	9	178	9,874	9,416	9,345	8,494	5,917	3,934	2.5%	2.0%	1.8%	1.6%	1.1%	0.7%
B737-900ER	9	178	75,615	110,000	120,000	118,000	112,000	110,000	18.8%	23.5%	23.4%	22.7%	20.1%	19.4%
B737-7 MAX	1	138	--	1,000	1,200	1,400	2,000	3,000	0.0%	0.2%	0.2%	0.3%	0.4%	0.5%
B737-8 MAX	2	171	2,381	8,921	18,115	21,906	46,462	54,315	0.6%	1.9%	3.5%	4.2%	8.3%	9.6%
B737-9 MAX	2	178	20,699	13,886	18,156	21,948	43,833	51,642	5.2%	3.0%	3.5%	4.2%	7.9%	9.1%
B757-200	26	171	5,958	--	--	--	--	--	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%
B757-300	21	234	1,753	1,356	--	--	--	--	0.4%	0.3%	0.0%	0.0%	0.0%	0.0%
Narrow-Body Total			245,653	287,306	319,435	326,210	356,637	365,393	61.2%	61.5%	62.4%	62.7%	64.0%	64.5%
Wide-Body														
A330-200	13	273	1,510	2,449	2,682	2,727	2,922	2,972	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%
A330-300	11	282	1,331	774	848	862	924	940	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%
A330-900	2	281	--	282	309	314	337	342	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%
A340-300	20	250	2	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
A350-900	2	290	198	681	746	758	1,347	1,370	0.0%	0.1%	0.1%	0.1%	0.2%	0.2%
B767-300ER	24	241	1,039	408	--	--	--	--	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%
B767-400ER	21	238	263	808	394	401	--	--	0.1%	0.2%	0.1%	0.1%	0.0%	0.0%
B777-200ER	22	287	48	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B777-300ER	23	355	4	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B787-10	1	262	--	--	491	499	535	544	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%
B787-8	7	182	4	1,792	2,944	2,993	5,346	5,980	0.0%	0.4%	0.6%	0.6%	1.0%	1.1%
B787-9	3	257	--	448	2,454	2,993	5,346	5,436	0.0%	0.1%	0.5%	0.6%	1.0%	1.0%
Wide-Body Total			4,400	7,642	10,869	11,547	16,756	17,583	1.1%	1.6%	2.1%	2.2%	3.0%	3.1%
Regional Jet														
CRJ-200	20	50	6	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CRJ-700	17	65	143	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
E175	8	76	66,541	106,742	106,949	106,222	99,934	98,364	16.6%	22.8%	20.9%	20.4%	17.9%	17.4%
Regional Jet Total			66,691	106,742	106,949	106,222	99,934	98,364	16.6%	22.8%	20.9%	20.4%	17.9%	17.4%
Turboprop														
DH8-400	13	76	35,107	--	--	--	--	--	8.7%	0.0%	0.0%	0.0%	0.0%	0.0%
DOMESTIC TOTAL			351,851	401,689	437,252	443,979	473,327	481,340	87.7%	85.9%	85.4%	85.3%	84.9%	84.9%

Table 6 (page 2 of 4)
FORECASTS OF TOTAL AIRCRAFT OPERATIONS BY AIRCRAFT TYPE
Seattle-Tacoma International Airport

	Average	Seat	Historical	Forecast					Historical	Forecast				
Sector/Aircraft type/Equipment	age (years) (a)	configuration	2022	2027	2032	2033	2037	2038	2022	2027	2032	2033	2037	2038
PASSENGER AIRLINES (continued)														
INTERNATIONAL														
Air carrier														
Narrow-Body														
A220-100	1	109	638	600	900	800	1,000	1,200	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%
A220-300	1	133	2,278	2,376	4,642	4,732	5,997	6,459	0.6%	0.5%	0.9%	0.9%	1.1%	1.1%
A319	16	127	2	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
A320-200	13	151	932	1,200	1,200	1,200	1,200	1,200	0.2%	0.3%	0.2%	0.2%	0.2%	0.2%
A320 NEO	2	185	79	227	364	390	504	532	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%
A321-200	11	191	2	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
A321 NEO	2	196	--	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B737-300	31	126	6	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B737-800	12	163	2,011	1,678	1,639	1,669	1,603	1,537	0.5%	0.4%	0.3%	0.3%	0.3%	0.3%
B737-900	20	179	47	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B737-900ER	9	179	1,474	1,336	1,412	1,419	1,449	1,456	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%
B737-8 MAX	2	171	237	296	1,554	1,494	1,673	1,718	0.1%	0.1%	0.3%	0.3%	0.3%	0.3%
B737-9 MAX	2	178	229	242	1,472	1,696	2,004	2,131	0.1%	0.1%	0.3%	0.3%	0.4%	0.4%
B757-200	26	171	567	108	--	--	--	--	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Narrow-Body Total			8,502	8,064	13,182	13,400	15,429	16,233	2.1%	1.7%	2.6%	2.6%	2.8%	2.9%
Wide-Body														
A330-200	13	273	351	78	86	87	94	95	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
A330-300	11	282	1,436	2,296	2,515	2,557	2,740	2,786	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%
A330-900	2	281	2,659	4,808	5,206	5,300	6,172	6,277	0.7%	1.0%	1.0%	1.0%	1.1%	1.1%
A340-300	21	279	52	0	0	0	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
A350-900	2	290	566	1,146	1,318	1,331	2,494	3,080	0.1%	0.2%	0.3%	0.3%	0.4%	0.5%
A350-1000	--	350-410	4	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B767-300ER	24	241	650	464	--	--	--	--	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%
B777-200ER	22	287	822	933	1,022	1,038	--	--	0.2%	0.2%	0.2%	0.2%	0.0%	0.0%
B777-300ER	23	355	1,386	1,266	1,387	1,409	--	--	0.3%	0.3%	0.3%	0.3%	0.0%	0.0%
B787-10	1	262	562	980	1,073	1,091	1,704	1,732	0.1%	0.2%	0.2%	0.2%	0.3%	0.3%
B787-8	7	182	776	3,307	4,604	4,680	5,550	5,644	0.2%	0.7%	0.9%	0.9%	1.0%	1.0%
B787-9	3	257	2,404	3,289	3,736	4,296	5,673	5,769	0.6%	0.7%	0.7%	0.8%	1.0%	1.0%
Wide-Body Total			11,667	18,568	20,946	21,791	24,427	25,384	2.9%	4.0%	4.1%	4.2%	4.4%	4.5%
Regional Jet														
CRJ-700	18	66-70	18	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CRJ-900	12	76	22	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
E175	8	76	1,992	13,817	19,552	19,875	21,299	20,573	0.5%	3.0%	3.8%	3.8%	3.8%	3.6%
Regional Jet Total			2,032	13,817	19,552	19,875	21,299	20,573	0.5%	3.0%	3.8%	3.8%	3.8%	3.6%
Turboprop														
B99	51	15-17	607	--	--	--	--	--	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
DH8-400	11	76	9,480	5,889	--	--	--	--	2.4%	1.3%	0.0%	0.0%	0.0%	0.0%
S KING AIR 200	33	13	20	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Turboprop Total			10,108	5,889	--	--	--	--	2.5%	1.3%	0.0%	0.0%	0.0%	0.0%
INTERNATIONAL TOTAL			32,309	46,337	53,680	55,066	61,155	62,190	8.1%	9.9%	10.5%	10.6%	11.0%	11.0%
TOTAL PASSENGER AIRLINES			384,160	448,026	490,932	499,044	534,482	543,530	95.7%	95.9%	95.9%	95.9%	95.9%	95.9%

Table 6 (page 3 of 4)
FORECASTS OF TOTAL AIRCRAFT OPERATIONS BY AIRCRAFT TYPE
Seattle-Tacoma International Airport

Sector/Aircraft type/Equipment	Average age (years) (a)	Historical 2022	Forecast 2027	2032	2033	2037	2038	Historical 2022	Forecast 2027	2032	2033	2037	2038
ALL-CARGO AIRLINES													
DOMESTIC													
Air carrier													
A300F	25	242	378	379	348	--	--	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%
B747-F/BCF/ERF/LCF	21	255	179	147	89	--	--	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
B757-200F	30	200	173	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B767-200F/300F	3-10	6,707	8,038	8,961	9,739	11,471	11,634	1.7%	1.7%	1.8%	1.9%	2.1%	2.1%
B777F	9	--	917	1,548	1,670	2,815	2,897	0.0%	0.2%	0.3%	0.3%	0.5%	0.5%
MD10	42	65	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
MD11	28	2,271	2,049	1,908	1,332	--	--	0.6%	0.4%	0.4%	0.3%	0.0%	0.0%
Air Carrier Total		9,740	11,734	12,944	13,179	14,286	14,531	2.4%	2.5%	2.5%	2.5%	2.6%	2.6%
Air taxi/Regional feeder													
ATR72-600f	2	--	101	204	226	323	349	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
B99	50	--	129	185	196	239	251	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
C208	30	2,308	2,303	2,309	2,305	2,277	2,268	0.6%	0.5%	0.5%	0.4%	0.4%	0.4%
C408 SkyCourier	1	--	101	204	226	323	349	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
Total air taxi/regional feeder		2,308	2,633	2,902	2,954	3,163	3,217	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%
DOMESTIC TOTAL		12,048	14,368	15,846	16,133	17,449	17,748	3.0%	3.1%	3.1%	3.1%	3.1%	3.1%
INTERNATIONAL													
Air carrier													
A300F	27	2	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B747-F/BCF/ERF/LCF	10-20	1,048	910	1,034	1,082	1,154	1,179	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%
B747-8F	6-10	597	558	615	637	671	682	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
B757-200F	31	2	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B767-200F/300F	3-10	--	106	138	150	168	174	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B777F	6	1,081	885	925	940	963	971	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%
Air Carrier Total		2,730	2,460	2,711	2,809	2,956	3,006	0.7%	0.5%	0.5%	0.5%	0.5%	0.5%
Air taxi/Regional feeder													
S KING AIR 300		72	--	--	--	--	--	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
INTERNATIONAL TOTAL		2,803	2,460	2,711	2,809	2,956	3,006	0.7%	0.5%	0.5%	0.5%	0.5%	0.5%
TOTAL CARGO AIRLINES		14,851	16,828	18,557	18,942	20,405	20,754	3.7%	3.6%	3.6%	3.6%	3.7%	3.7%
OTHER (b)													
Air carrier		548	600	600	600	600	600	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Air taxi		365	400	400	400	400	400	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Subtotal--OTHER		913	1,000	1,000	1,000	1,000	1,000	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%

Table 6 (page 4 of 4)
FORECASTS OF TOTAL AIRCRAFT OPERATIONS BY AIRCRAFT TYPE
Seattle-Tacoma International Airport

Sector/Aircraft type/Equipment	Average age (years) (a)	Historical 2022	Forecast 2027	Forecast 2032	Forecast 2033	Forecast 2037	Forecast 2038	Historical 2022	Forecast 2027	Forecast 2032	Forecast 2033	Forecast 2037	Forecast 2038
GENERAL AVIATION													
Business Jet	--	838	1,190	1,235	1,244	1,281	1,290	0.2%	0.3%	0.2%	0.2%	0.2%	0.2%
Turboprop	--	535	219	210	208	201	199	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Subtotal--GENERAL AVIATION		1,373	1,409	1,445	1,452	1,481	1,489	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
MILITARY													
Jet	--	40	72	72	72	72	72	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Turbine	--	14	26	26	26	26	26	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Piston	--	1	2	2	2	2	2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subtotal--MILITARY		55	100	100	100	100	100	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL		401,351	467,363	512,033	520,538	557,468	566,873	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Totals may not match Table 4 due to rounding.
(a) Aviation Week Intelligence Network, Commercial Aviation, online cdatabase, accessed August 2023.
(b) Includes unscheduled, empty, ferry flights. No detail available on aircraft types.
Sources: Historical—Federal Aviation Administration, ATADS, accessed March 2023 and Seattle-Tacoma International Airport Noise Office. Forecast--LeighFisher, September 2022, updated August 2023.

Table 7

FAA TAF FORECAST COMPARISON

Seattle-Tacoma International Airport

2022 – 2037

	Year (a)	SEA 2022 Forecasts	FAA 2022 TAF	SEA 2022 Forecasts vs. 2022 TAF (percent variance)
Passenger enplanements				
Base yr.	2022	22,966,119	21,385,264	7.4%
Base yr. + 1yr.	2023	25,097,659	24,428,087	2.7%
Base yr. + 5yrs.	2027	28,004,000	29,339,819	-4.6%
Base yr. + 10yrs.	2032	31,471,000	33,632,579	-6.4%
Base yr. + 15yrs.	2037	35,169,000	38,250,886	-8.1%
Commercial operations *(b)*				
Base yr.	2022	399,923	395,644	1.1%
Base yr. + 1yr.	2023	427,200	427,449	-0.1%
Base yr. + 5yrs.	2027	465,800	503,661	-7.5%
Base yr. + 10yrs.	2032	510,500	571,906	-10.7%
Base yr. + 15yrs.	2037	555,900	644,556	-13.8%
Total operations *(c)*				
Base yr.	2022	401,351	397,095	1.1%
Base yr. + 1yr.	2023	428,700	428,942	-0.1%
Base yr. + 5yrs.	2027	467,300	506,372	-7.7%
Base yr. + 10yrs.	2032	512,000	574,684	-10.9%
Base yr. + 15yrs.	2037	557,500	647,404	-13.9%

(a) The SEA 2022 Forecasts were prepared on a calendar year basis and the FAA 2022 TAF was prepared on a U.S. government fiscal year basis (October through September).

(b) Commercial operations include operations by passenger airlines, all-cargo airlines, and air taxi operators.

(c) Total operations include commercial operations plus operations by general aviation and military.

Sources: Base year 2022 (actual)—Seattle-Tacoma International Airport records.

FAA 2022 TAF for SEA--U.S. Department of Transportation, Federal Aviation Administration, www.faa.gov, accessed February 2023.

Forecast--LeighFisher, June 2022, updated August 2023 (2022 base year).

Table 8
SUMMARY OF SEA SAMP PLANNING FORECASTS USING FAA TEMPLATE
Seattle-Tacoma International Airport
Sustainable Airport Master Plan

		Forecast				Average annual compound growth rates			
	Base year 2022	Base year + 1 year 2023	Base year + 5 years 2027	Base year + 10 years 2032	Base year + 15 years 2037	Base year to +1 year 2022 - 2023	Base year to +5 years 2022 - 2027	Base year to +10 years 2022 - 2032	Base year to +15 years 2022 - 2037
Passenger enplanements (millions)									
Air carrier *(a)*	19.9	20.9	23.3	26.2	29.3	4.8%	3.2%	2.8%	2.6%
Commuter *(b)*	3.0	4.2	4.7	5.3	5.9	38.9%	9.2%	5.7%	4.5%
Total	23.0	25.1	28.0	31.5	35.2	9.3%	4.0%	3.2%	2.9%
Aircraft operations (thousands)									
Itinerant									
Air carrier	395,997	423,200	461,500	505,900	550,900	6.9%	3.1%	2.5%	2.2%
Commuter/air taxi	3,926	4,000	4,300	4,600	4,900	1.9%	1.8%	1.6%	1.5%
Total commercial operations	399,923	427,200	465,800	510,500	555,800	6.8%	3.1%	2.5%	2.2%
General aviation	1,373	1,400	1,410	1,440	1,500	2.0%	0.5%	0.5%	0.6%
Military	55	100	100	100	100	81.8%	12.7%	6.2%	4.1%
Local									
General aviation	--	--	--	--	--	--	--	--	--
Military	--	--	--	--	--	--	--	--	--
Total operations	401,351	428,700	467,310	512,040	557,400	6.8%	3.1%	2.5%	2.2%
Cargo/mail (enplaned + deplaned tons)	456,281	538,500	584,400	644,400	702,900	18.0%	5.1%	3.5%	2.9%
Operational factors									
Average aircraft size (seats)									
Air Carrier *(a)*	177	178	181	186	191				
Commuter *(b)*	74	75	76	78	80				
Average enplaning load factor									
Air Carrier *(a)*	0%	85%	85%	85%	85%				
Commuter *(b)*	0%	84%	84%	84%	84%				

Note: The SEA Sustainable Airport Master Plan forecasts were prepared on a calendar year basis and the FAA 2014 TAF was prepared on a U.S. government fiscal year basis (October through September).

(a) Includes mainline and low cost airline activity as summarized in the previous tables in this report.

(b) Includes regional affiliate airline activity, which includes flights using regional aircraft with more than 60 seats.

Sources: Base year 2022 (actual)—Seattle-Tacoma International Airport records.

FAA 2022 TAF for SEA--U.S. Department of Transportation, Federal Aviation Administration, www.faa.gov, accessed March 2022.

Forecast--LeighFisher, June 2022, updated August 2023.

APPENDIX A

Forecast and Airport Operational Assumptions

Constrained Operating Growth Scenarios (COGS)

Sustainable Airport Master Plan – Near-Term Projects

Constrained Operating Growth Scenario

September 2023

PREPARED FOR

Port of Seattle

PREPARED BY

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1. Constrained Operating Growth Scenario

The forecasts prepared as part of the Sustainable Airport Master Plan (SAMP) for the Seattle-Tacoma International Airport (SEA or Airport) were completed in 2015 using 2014 as the base year.[1] The SAMP used this forecast to develop and evaluate alternatives to satisfy activity associated with the 20-year unconstrained demand. The alternatives analysis resulted in a Long-Term Vision (LTV) for airport development. Modeling of the LTV airfield using Total Airport and Airspace Modeler (TAAM) software determined that, with no other changes to how the airfield/airspace is operated, simulated average aircraft delays at the Airport would exceed 20 minutes with activity forecast for 2029. FAA benefit cost and planning analysis has historically used 20 minutes of delay as an indicator of unacceptable levels of delay, whereby airlines would significantly reduce growth at that airport. The delay would be even greater in 2034, with projected delays of 37 minutes.[2] SAMP implementation planning determined that substantial gate, hardstand and terminal capacity could be constructed by 2027 to alleviate portions of the projected delay. Additional TAAM modeling of these improvements (included in the “Near-Term Projects” or NTPs) determined that, with an assumed medium level of efficiency improvement[3] to the airfield, average delay per aircraft operation would be 16.6 minutes in 2027. This level of average delay is considered to be within the range of what has been shown to be viable at congested airports in operation today. Consequently, without the NTPs, the 2027 projected aircraft operations demand could not be accommodated due to unsustainable levels of delay. The delay in the near term is primarily a result of a lack of aircraft gates and resulting congestion on the ramps. Delays due to departure procedure constraints and taxiway congestion will increase with traffic growth, but will remain secondary factors until gate capacity is increased.

In 2019, as part of the initiation of the environmental review for the Proposed Action, the FAA and the Port of Seattle reviewed the SAMP forecasts for use in the studies. Since the SAMP forecasts were prepared, actual passenger traffic at SEA had exceeded the SAMP forecasts, reflecting strong economic growth, decreases in domestic airfares, airline competition, the continued development of Delta Air Lines’ hub, and strong growth in both origin-destination and connecting passengers. The Port, in collaboration with the FAA, determined that an updated forecast was warranted given the faster than forecasted economic and passenger growth. The Seattle-Tacoma International Airport Aviation Demand Forecast Update (2019 Updated Forecast) was approved by FAA for use in the National Environmental Policy Act (NEPA) Environmental Assessment (EA). The analysis conducted to prepare the 2019 Updated Forecast indicated that the resulting level of aircraft operations could exceed the Airport’s ability to accommodate the demand, even with implementation of the Proposed Action.

In March 2020 the Covid-19 pandemic began to have a significant impact on air travel, resulting in unprecedented reductions in passengers and aircraft operations worldwide. In 2022 passenger and aircraft operations approached 2019 levels at many airports in the US, including SEA. Due to the

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[1] Sustainable Airport Master Plan, Technical Memorandum 2, prepared by the Port of Seattle.
[2] Average delay per aircraft operation is determined by through annualized weighting values applied to models run to simulate specific airfield operating conditions. The weighting values represent the proportion of the year that the airport operates under the conditions simulated in the individual models.
[3] Medium level of efficiency improvement assumes that various future NextGen technologies will increase runway throughput by 3-4 additional operations per hour (roughly a 5% increase in throughputs) over the calibrated Maximum Sustainable Throughput (MST) (SAMP Technical Memorandum No. 6, Appendix G, page 56)

reduction in activity between 2020 and 2022, the Port of Seattle re-evaluated the projected passenger and aircraft operations demand for SEA, as well as the timing of opening year for the Proposed Action.

The Port of Seattle prepared the 2023 Updated Forecast to capture the impact of the Covid-19 pandemic on future passenger and aircraft operations at SEA. Based on the projections of activity in the 2023 Updated Forecast and the time it will take to construct the Proposed Action, the Port of Seattle has determined that the opening year for the Proposed Action should be shifted from 2027 to 2032. Similar to the analysis conducted for the 2019 Updated Forecast, the resulting level of aircraft operations under the 2023 Updated Forecast could exceed the Airport's ability to accommodate the demand, even with implementation of the Proposed Action.

As a result, the FAA and Port of Seattle decided to consider the activity levels that could be accommodated in the opening year and five years beyond opening year under both the No Action and Proposed Action cases. The process for conducting this assessment included:

1. Considering the capability of the Airport to accommodate the projected demand in the 2023 Updated Forecast and at what point the constraints result in unacceptable aircraft operational delay (Section 2).
2. Developing estimated annual growth rates for aircraft operations and passengers for the years beyond the point where the unsustainable aircraft operational delay would occur under No Action and Proposed Action conditions. This would include an evaluation of opportunities airlines and the Airport may reasonably undertake to add incremental service during the constrained periods (Section 3) that does not exacerbate delay levels.
3. Applying the annual growth rates and calculating constrained annual aircraft operations and passenger levels for use in the NEPA EA. This is particularly important for the assessment of environmental impacts for categories where the number of passengers and/or operations is a primary driver of the impacts. The categories where this is directly relevant include noise, air quality, climate, and traffic impact studies. Other categories, including Department of Transportation Section 4(F), environmental justice, and historical, architectural, archeological, and cultural resources, incorporate the results of these primary assessments directly or indirectly to determine impacts (Section 4).

The following describes the results of each of the steps in the process.

1.1 2023 Forecast Update

The SAMP NTP environmental review will include a discussion on the 2023 Updated Forecasts. **Table 1** presents the aircraft operating and passenger levels for 2032 and 2037 from the 2023 Updated Forecast.

TABLE 1: 2023 UPDATED FORECAST

Year	Aircraft Operations	Passengers
2032 (Opening Year)	511,800	63,000,000
2037 (Five Years Beyond Opening)	557,300	70,400,000

Source: Seattle-Tacoma International Airport Aviation Demand Forecast Update, Table 5, Forecast Comparison and Table 6 Forecasts of Total Aircraft Operations by Aircraft Type, prepared by Leigh Fisher for the Port of Seattle (2023).

1.2 Capability of Airport to Accommodate Demand

The SAMP included detailed simulation modeling of airport capacity and delay based on peak month average day activity levels. The peak month average day activity was converted to annual activity levels for future years to approximate annual activity levels for master planning purposes. Based on the simulation modeling of peak month average day activity and subsequent annualization of delay, the SAMP concluded that in order to accommodate the 2027 annual demand of approximately 477,000 aircraft operations and 56 million annual passengers (56 MAP), and to improve level of delay, the Airport would need to implement the NTPs. In addition to addressing the unsustainable level of delay, the NTPs are also anticipated to provide an improved level of service for these volumes. It should be noted that the annual activity levels (from which simulations of peak day activity are estimated) are approximations and should not be considered caps or maximum activity levels for an airport. Passengers and operations can continue to grow at capacity constrained airports, as evidenced by activity at other airports that continue to grow (e.g., DCA, JFK, and LGA).

Because the Proposed Action is in large part an expansion of passenger terminal facilities, an assessment of the average turns per gate per day was conducted to identify where constraints would occur due to lack of passenger gates. A ‘turn’ can be defined as an aircraft unloading and then loading passengers for the next departure. In general, passenger gates can reasonably accommodate 8 to 10 turns per day based on ACRP Research Report 163, *Guidebook for Preparing and Using Airport Design Day Flight Schedules* (2016). While it is possible to exceed 8 to 10 turns per day at an individual gate, beyond this number of turns airport-wide is considered a sign of excessive congestion and likely a point where the airport has reached a constraint point. For example, in 2019 SEA experienced turns per gate per day that approached 8 and airlines reacted by changing schedules and using more ground loading and hardstand operations, which resulted in a lower level of service for passengers.

To calculate average turns per gate per day, the total number of projected daily passenger aircraft departures was divided by the available passenger gates for 2023 through 2037 (daily aircraft departures/available gates=turns per gate per day). The number of available passenger gates for each year took into consideration gate outages due to planned terminal and apron redevelopment programs independent of the SAMP NTP. For the Proposed Action, an additional 19 passenger gates were assumed to be available in 2032 and remain available through 2037.

Based on the resulting turns per gate per day, it was identified that SEA would reach 8 turns per gate per day in 2027. Under the No Action the turns per gate per day would continue to reach 8 through 2037 meaning that from 2027 through 2037 the No Action would experience a constrained operating environment. Under the Proposed Action the turns per gate per day would drop below 8 in 2032 due to the additional 19 gates. Based solely on the turns per gate per day evaluation, the turns per gate per day would not exceed 8 through 2037. However, as discussed above, the Airport will experience airfield constraints with the additional aircraft operations that are expected to occur after the 19 gates become available. When that is considered, it is projected that the Airport would return to a constrained operating environment under Proposed Action in 2036 due to lack of airfield capacity, rather than lack of gate capacity. **Table 2** provides the year by year turns per gate per day results.

TABLE 2: SEA TURNS PER GATE PER DAY ANALYSIS

Year	Passenger Airline Landings (or Departures)	No Action Number of Gates/Hard Stands/Parking Positions	No Action Total Turns Per Gate Per Day (All PAX Airlines)	Proposed Action Number of Gates/Hard Stands/Parking Positions	Proposed Action Total Turns Per Gate Per Day (All PAX Airlines)
2023	205,371	83	7	83	7
2024	210,313	82	7	82	7
2025	214,926	83	7	83	7
2026	219,193	83	7	83	7
2027	223,970	78	8	78	8
2028	228,303	80	8	80	8
2029	232,632	83	8	83	8
2030	237,369	83	8	83	8
2031	241,459	83	8	83	8
2032	245,353	83	8	102	7
2033	249,408	87	8	106	6
2034	253,841	87	8	106	7
2035	258,298	87	8	106	7
2036	262,776	87	8	106	7
2037	267,277	87	8	106	7

Note: Green shading represents periods of unconstrained growth. Tan shading represents periods of constrained growth.

During periods of constrained operating environments, the assumption is that without additional capacity, airlines will significantly reduce adding new service at the Airport because the expected added delays will significantly impact their ability to maintain network and schedule integrity.

1.3 Annual Constrained Growth Rates

During periods where the Airport would experience constrained operating environments there are strategies that airlines and the Airport can reasonably use to allow additional growth in passengers and aircraft operations. These strategies include:

1.3.1 Use of Additional Hardstands and Overnight Aircraft Parking Positions

Observations of other airports that experience constrained operating environments indicate that a small amount of growth in aircraft operations can be expected (See **Table 3**). When the constraint is related to lack of gates/aircraft parking positions, airports can take actions to provide incremental capabilities. Historically at SEA, these actions have included designating taxiways for parking aircraft overnight and designating cargo aircraft positions as passenger hardstands where bus loading/unloading can occur.

SEA has incorporated these approaches over the years as the situation has warranted and could do so again to accommodate some of the demand. For example, overnight aircraft have parked on Taxiway A near the terminal area. Other areas on the Airport that have been used for overnight passenger aircraft parking include: Taxiway T, the northern portion of Taxiway A (as noted above), various cargo parking positions, and the tri-taxilanes around the North Satellite. Using these areas for overnight parking would be at the expense of cargo operations, requiring increased operational coordination, and forcing cargo to be pushed back to non-peak times as their parking space would be overtaken by passenger operations. It is anticipated that using cargo parking spots for overnight parking would occur on a limited basis and would likely affect cargo operators that are not shipping next day packages. Overall, overnight parking on any movement area is not ideal due to complexities that occur from aircraft repositions, aircraft pushbacks onto taxiways, deicing, and general traffic flow north and south. While none of these areas are currently preferred overnight parking locations, if the situation warranted, they could be used again in the future.

Similarly, other areas on the Airport could be used for hardstand operations, including: various cargo parking positions, various general aviation parking positions, and the Alaska, Delta, and United Airlines maintenance areas. As with the overnight parking positions, these areas are not ideal from an operational perspective and would be used on a limited basis. The same types of tradeoffs in activities would occur as described above and would provide a poor level of service to passengers requiring bussing, ground boarding of the aircraft, extended minimum connection times, and exposure to varying weather conditions. However, if the situation warranted, they could be used to provide incremental hardstand capability. More recently, the airline scheduling strategy has been to add additional evening revenue flights to other nearby airports and flying those aircraft back to SEA in the morning.

TABLE 3: SIMILARLY CONSTRAINED AIRPORT ACTIVITY

DCA

Enplanements					Operations					Local Operations			Total Operations	
Year	Air Carrier	Commuter	Total	Percent Growth	Air Carrier	Commuter	GA	Military	Total	Civil	Military	Total	Total OPS	Percent Growth
2010	5,860,238	2,678,537	8,538,775	N/A	174,353	88,716	5,151	2,040	270,260	0	0	0	270,260	N/A
2011	6,161,824	2,903,545	9,065,369	6.167%	194,831	84,268	5,099	601	284,799	0	0	0	284,799	5.380%
2012	6,227,743	3,074,409	9,302,152	2.612%	190,311	89,912	6,183	1,460	287,866	0	0	0	287,866	1.077%
2013	6,485,558	3,366,228	9,851,786	5.909%	195,295	92,624	5,435	2,082	295,436	0	0	0	295,436	2.630%
2014	6,482,557	3,393,224	9,875,781	0.244%	197,859	82,072	4,230	2,806	286,967	0	0	0	286,967	-2.867%
2015	7,828,412	3,170,011	10,998,423	11.368%	222,103	67,612	3,163	3,372	296,250	0	0	0	296,250	3.235%
2016	8,215,871	3,260,187	11,476,058	4.343%	230,188	62,950	3,261	3,500	299,899	0	0	0	299,899	1.232%
2017	7,993,630	3,483,109	11,476,739	0.006%	241,993	49,033	3,844	3,255	298,125	0	0	0	298,125	-0.592%
2018	7,706,640	3,704,728	11,411,368	-0.570%	232,124	59,324	3,290	2,797	297,535	0	0	0	297,535	-0.198%
2019	7,825,300	3,681,209	11,506,509	0.834%	239,639	52,557	2,829	2,818	297,843	0	0	0	297,843	0.104%
2010 - 2019 Compound Average Growth Rate:				3.80%										1.22%
2014 - 2019 Compound Average Growth Rate:				3.89%										0.93%

JFK

Enplanements					Operations					Local Operations			Total Operations	
Year	Air Carrier	Commuter	Total	Percent Growth	Air Carrier	Commuter	GA	Military	Total	Civil	Military	Total	Total OPS	Percent Growth
2010	21,003,452	1,566,765	22,570,217	N/A	327,598	68,158	7,013	325	403,094	0	0	0	403,094	N/A
2011	21,841,550	1,706,320	23,547,870	4.332%	341,874	63,390	7,506	310	413,080	0	0	0	413,080	2.477%
2012	22,900,922	1,564,623	24,465,545	3.897%	352,109	51,655	7,755	354	411,873	0	0	0	411,873	-0.292%
2013	23,305,418	1,433,101	24,738,519	1.116%	353,389	47,992	6,860	518	408,759	0	0	0	408,759	-0.756%
2014	24,326,331	1,574,357	25,900,688	4.698%	374,668	43,307	7,332	313	425,620	0	0	0	425,620	4.125%
2015	25,904,178	1,488,418	27,392,596	5.760%	401,737	32,782	7,462	649	442,630	0	0	0	442,630	3.997%
2016	27,262,869	1,734,087	28,996,956	5.857%	419,274	30,912	8,274	370	458,830	0	0	0	458,830	3.660%
2017	27,729,638	1,774,008	29,503,646	1.747%	414,743	30,829	8,224	403	454,199	0	0	0	454,199	-1.009%
2018	28,120,424	1,919,896	30,040,320	1.819%	417,966	29,819	8,152	440	456,377	0	0	0	456,377	
2019	29,257,150	1,841,199	31,098,349	3.522%	423,230	30,903	10,501	369	465,003	0	0	0	465,003	
2010 - 2019 Compound Average Growth Rate:				4.09%										1.80%
2014 - 2019 Compound Average Growth Rate:				4.68%										2.24%

LGA

Enplanements					Operations					Local Operations			Total Operations	
Year	Air Carrier	Commuter	Total	Percent Growth	Air Carrier	Commuter	GA	Military	Total	Civil	Military	Total	Total OPS	Percent Growth
2010	8,800,460	2,999,395	11,799,855	N/A	209,318	147,957	7,028	349	364,652	0	0	0	364,652	N/A
2011	8,911,019	3,111,017	12,022,036	1.883%	242,305	121,170	6,401	311	370,187	0	0	0	370,187	1.518%
2012	9,287,598	3,350,963	12,638,561	5.128%	265,301	104,339	6,535	344	376,519	0	0	0	376,519	1.710%
2013	9,509,944	3,730,246	13,240,190	4.760%	299,500	64,766	6,903	271	371,440	0	0	0	371,440	-1.349%
2014	9,410,339	4,020,193	13,430,532	1.438%	313,952	49,364	6,831	228	370,375	0	0	0	370,375	-0.287%
2015	10,232,320	3,835,472	14,067,792	4.745%	311,016	51,921	6,024	463	369,424	0	0	0	369,424	-0.257%
2016	10,546,044	4,236,488	14,782,532	5.081%	313,818	54,384	6,344	174	374,720	0	0	0	374,720	1.434%
2017	10,025,632	4,413,153	14,438,785	-2.325%	307,642	52,853	5,474	278	366,247	0	0	0	366,247	-2.261%
2018	10,265,435	4,787,946	15,053,381	4.257%	309,327	53,444	4,954	212	367,937	0	0	0	367,937	0.461%
2019	10,842,835	4,517,629	15,360,464	2.040%	317,158	52,183	4,853	203	374,397	0	0	0	374,397	1.756%
2010 - 2019 Compound Average Growth Rate:				3.35%										0.33%
2014 - 2019 Compound Average Growth Rate:				3.41%										0.27%

Source: FAA Terminal Area Forecast, accessed online 2/1/2023.

1.3.2 Upgauging of Aircraft

Airlines make choices about the size of aircraft and the overall number of seats available at an airport based on passenger demand, the capability of the airport to accommodate the aircraft, and alignment with their network strategy. Over time, airlines have been 'upgauging'; that is, replacing regional jet aircraft with narrowbody aircraft that offer more seats, as well as replacing smaller narrowbody aircraft with larger narrowbody aircraft that offer more seats.

Most airports, including SEA, experienced the upgauging prior to the Covid-19 pandemic. The 2023 Updated Forecast projects upgauging will continue to occur based upon the airline's aircraft orders and retirements. Upgauging would not exclusively occur at SEA. In fact, it is observed at most large hub airports as airlines are choosing to operate larger aircraft versus a greater number of smaller aircraft due to the financial performance of those aircraft.

At airports with high demand but limited capability to accommodate more flights, airlines could, in theory, quicken the pace at which they use larger aircraft at that airport. Some airlines at SEA, like Alaska Airlines, do not have the number of larger aircraft to notably upgauge their fleet at SEA. Other airlines at SEA, like Delta Air Lines, have the aircraft and the capability to somewhat quicken the pace at which they upgauge aircraft. However, the airlines may also be experiencing capacity constraints at other airports, which limits their ability to increase the pace of upgauging at a specific airport. Accordingly, this forecast scenario does not assume a notably higher pace of upgauging at SEA, but rather a continuation of the expected system-wide upgauging trend.

1.3.3 Increasing Load Factors

During periods when growth in aircraft operations is constrained, the demand for air travel is expected to continue to increase. One result of this situation may be an increase in 'load factor' or the average percentage of an aircraft's seats that are filled by passengers. This results in fewer empty seats per aircraft, which allows for overall passenger growth even without additional aircraft operations. Like most airports, SEA experienced increasing load factors prior to the Covid-19 pandemic. The 2023 Updated Forecast projects load factor increases will continue to occur. If passenger demand continues to grow as predicted in the 2023 Updated Forecast and if growth in aircraft operations and size of aircraft cannot provide the seat capacity, it is possible that the load factors will increase at a quicker pace during constrained growth periods. However, airlines could opt to increase fares and adjust their yield management programs in the constrained environment. Accordingly, because SEA has relatively high load factors already, there is limited potential for this trend to result in a substantial increase in total passengers.

Based on the strategies described above an estimate of aircraft operations and passenger annual growth rates for constrained growth periods at SEA was prepared. For the purposes of the constrained scenario analysis, it is assumed that the Airport could accommodate additional, incremental flights during non-peak times by utilizing all or some of the locations discussed above for overnight parking and hardstands. No increase in passengers was assumed in this analysis based on a higher pace of upgauging or load factors during constrained periods.

1.3.4 Constrained Annual Growth Rates

Passenger – 0.89%

Aircraft Operations – 0.27%

These constrained growth rates were compared to several other airports that experience constrained operating environments (JFK, LGA, and DCA). While the constraints at each of these airports are unique to their situation, the growth rates offer the best examples of how activity changes in constrained operating environments. Table 3 shows the recent and average growth rates for these airports.

- Annual passenger growth rates ranged from 3.35 percent to 4.09 percent with an average growth rate from 2010 through 2019 of 3.75 percent.
- Annual aircraft operations growth rates ranged from 0.33 percent to 1.8 percent with an average growth rate from 2010 through 2019 of 1.12 percent.

Comparing these individual and average growth rates to the constrained growth rate scenarios for SEA indicates that the constrained growth rates for SEA are lower than the other constrained airports. This is a more conservative approach so as not to overestimate the capability of the Airport.

1.4 Resulting Constrained Growth Aircraft Operations and Passengers

1.4.1 No Action

The constrained growth rates were applied to the 2023 Updated Forecast level of activity from 2027 and beyond to calculate the annual aircraft operations and passengers for the 2032 and 2037 No Action scenario. **Table 4** below compares the unconstrained aircraft operations and passenger levels from the 2023 Updated Forecast to the constrained aircraft operations and passenger levels for the 2032 and 2037 No Action scenario. The resulting number of passengers under the 2032 No Action scenario are higher than what the SAMP projected for 2027 (original opening year). While that level of activity can be accommodated, it comes at a lower level of service to passengers and airlines than what the Port of Seattle prefers to offer.

TABLE 4: NO ACTION AIRCRAFT OPERATIONS AND PASSENGERS

	2032 (Opening Year) Aircraft Operations	2032 (Opening Year) Total Passengers	2037 (5 Years Beyond Opening) Aircraft Operations	2037 (5 Years Beyond Opening) Total Passengers
SAMP Forecast (unconstrained)	477,000	56,000,000	527,000	63,000,000
2023 Forecast (Unconstrained)	511,800	63,000,000	557,300	70,400,000
No Action Constrained Scenario	466,901	57,171,652	474,874	59,483,817
Unmet Demand (2023 Forecast)	44,899	5,828,348	82,426	10,961,183

Note: SAMP Forecast operations and passengers are 2032 (opening year) and 2037 (5 years beyond opening) for comparison of similar conditions.

1.4.2 Proposed Action

Implementation of the Near-Term Projects, with full build-out completing in 2032, will increase the Airport's ability to accommodate increased aircraft operations and passenger activity at an acceptable level of delay by adding aircraft gates and passenger processing facilities. As a result, it is assumed that after implementation, the number of aircraft operations and passengers will increase toward the projected unconstrained levels identified in the 2023 Updated Forecast. This higher growth rate (known as latent demand) is expected to occur for three years after implementation (2032 to 2035) as airlines adjust their schedules to the additional gate availability. However, because the airfield and airspace also have constraints in regard to the level of aircraft operations, it is not anticipated that the Airport will be able to accommodate the projected unconstrained aircraft operations and passengers from the 2023 Updated Forecast, even with the implementation of the Near-Term Projects. Therefore, it is assumed that the Airport will again experience constrained growth rates between 2036 and 2037 as airfield and airspace capacity, exhibited through departure delay, then become the primary constraining factors. **Table 5** below compares the unconstrained aircraft operations and passenger levels from the 2023 Updated Forecast to the anticipated aircraft operations and passenger levels for the 2032 and 2037 Proposed Action scenario.

TABLE 5: PROPOSED ACTION AIRCRAFT OPERATIONS AND PASSENGERS

	2032 (Opening Year) Aircraft Operations	2032 (Opening Year) Total Passengers	2037 (5 Years Beyond Opening) Aircraft Operations	2037 (5 Years Beyond Opening) Total Passengers
SAMP Forecast (unconstrained)	477,000	56,000,000	527,000	63,000,000
2023 Forecast (Unconstrained)	511,800	63,000,000	557,300	70,400,000
Proposed Action Constrained Scenario	475,655	58,294,388	509,892	64,093,41
Unmet Demand (2023 Forecast)	36,145	4,705,612	47,408	6,306,588

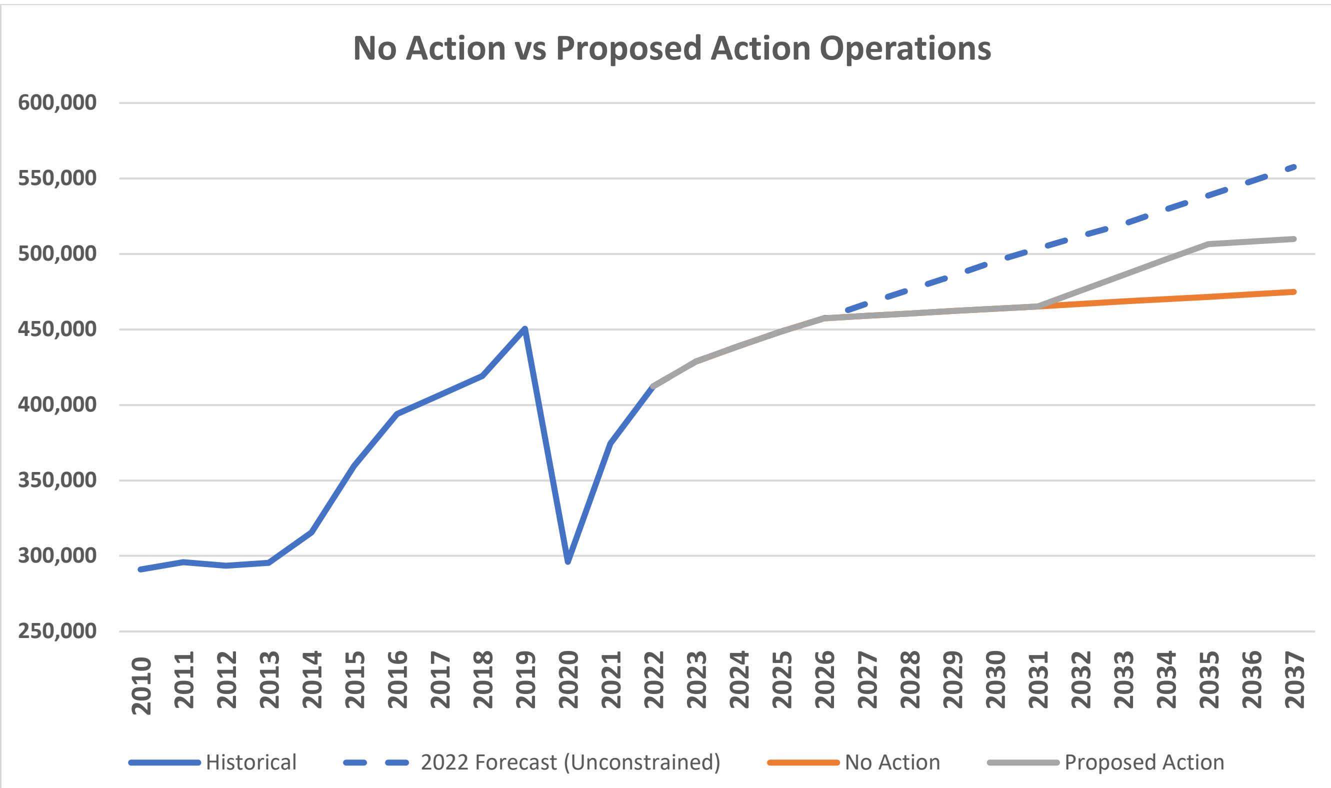
Note: SAMP Forecast operations and passengers are 2032 (opening year) and 2037 (5 years beyond opening) for comparison of similar conditions.

Table 6 below and the graph that follows compare the No Action and Proposed Action aircraft operations and passenger levels for 2032 and 2037. As discussed above, the comparison of these activity levels will be an important input into several different environmental impact categories.

TABLE 6: PROPOSED ACTION AND NO ACTION AIRCRAFT OPERATIONS AND PASSENGERS

	2032 (Opening Year) Aircraft Operations	2032 (Opening Year) Total Passengers	2037 (5 Years Beyond Opening) Aircraft Operations	2037 (5 Years Beyond Opening) Total Passengers
No Action	466,900	57,171,652	474,874	59,483,817
Proposed Action	475,655	58,294,388	509,892	64,093,412
Difference Between Proposed Action and No	8,755	1,122,736	35,018	4,609,595

Note: SAMP Forecast operations and passengers are 2032 (opening year) and 2037 (5 years beyond opening) for comparison of similar conditions.



APPENDIX A

Forecast and Airport Operational Assumptions

FAA Approval of 2023 Forecast Update and COGS

U.S. Department
of Transportation
Federal Aviation Administration

Northwest Mountain Region
Colorado · Idaho · Montana · Oregon · Utah
Washington · Wyoming

Seattle Airports District Office
2200 S. 216th Street
Des Moines, WA 98198

April 1, 2024

Steve Rybolt
Senior Environmental Program Manager
Port of Seattle
Sea-Tac International Airport

RE: Seattle-Tacoma International Airport, Seattle, WA Forecast Approval

Dear Mr. Rybolt:

The Federal Aviation Administration (FAA) approves the Seattle-Tacoma International Airport Aviation Activity Forecast Update, dated September 2023, and the Sustainable Airport Master Plan (SAMP) Near Term Projects (NTPs) Constrained Operating Growth Scenario, dated September 2023. The review included coordination with APP-400 in FAA Headquarters. We found the unconstrained forecast to be generally consistent with the FY23 TAF (see Table 1). The forecasts use current data and are supported by generally accepted planning methodologies. We understand the primary use of these forecasts will be in support of the SAMP NTP environmental process. Accordingly, derivative forecasts that incorporate specific fleet mix trends and the average annual day schedule used for NEPA analysis must align with these approved forecasts.

Justification for future projects will be made based on activity levels at the time the project is requested for development, rather than this forecast approval. Further documentation of actual activity levels reaching the planned activity levels may be needed prior to FAA participation in future funding for eligible projects. Finally, the approved forecasts are subject to re-validation prior to use in other environmental or Part 150 noise planning purposes or if the fundamental rationale of the forecast changes materially.

Sincerely,

Kandice Krull
Environmental Protection Specialist
FAA - Denver Airport District Office

Table 1: TAF Comparison to SEA Unconstrained Forecasts

Enplanements			
	SEA Forecast	**2023 TAF**	**Difference**
2022	22,966,119	21,387,052	7.10%
2023	25,097,659	24,274,222	3.30%
2027	28,004,000	28,261,940	-0.90%
2032	31,471,000	32,106,737	-2.00%
2037	35,169,000	36,165,615	-2.80%
Commercial Operations			
	SEA Forecast	**2023 TAF**	**Difference**
2022	399,923	395,644	1.10%
2023	427,200	415,264	2.80%
2027	465,800	473,170	-1.60%
2032	510,500	530,798	-3.90%
2037	555,900	590,974	-6.10%
Total Operations			
	SEA Forecast	**2023 TAF**	**Difference**
2022	401,351	397,095	1.10%
2023	428,700	416,651	2.90%
2027	467,300	475,694	-1.80%
2032	512,000	533,385	-4.10%
2037	557,500	593,626	-6.30%

APPENDIX A

Forecast and Airport Operational Assumptions

Environmental Review Airside Modeling Documentation (TAAM)

The Total Airspace and Airport Modeler (TAAM) analysis was prepared to support the noise and air quality modeling in this Environmental Assessment (EA) by providing information on the runway use, taxi times (including delay and taxi distance), and operations by time of day (day (after 7am and before 10pm) and night (after 10pm and before 7am)). The TAAM analysis in the attached report relied upon the 2019 Aviation Activity Forecast Update and Constrained Operating Growth Scenario (COGS) developed in 2019 and approved for use in the EA by FAA in 2020. Due to the reduction in activity between 2020 and 2022 from the COVID-19 pandemic, the Port of Seattle (Port) re-evaluated the projected passenger and aircraft operations demand for SEA by preparing a 2023 Aviation Activity Forecast Update. Based on the projections of activity in the 2023 Aviation Activity Forecast Update and the time it will take to construct the Near Term Projects (NTPs), the Port determined the opening year for the NTPs will be 2032. Similar to the analysis conducted for the 2019 Aviation Activity Forecast Update, the resulting level of aircraft operations under the 2023 Aviation Activity Forecast Update could exceed the Airport's ability to accommodate the demand, even with implementation of the NTPs. Therefore, the 2023 COGS were developed for use in the EA.

The following tables present a comparison of the 2019 and 2023 COGS operation levels on an average annual day (#annual operations/365). As shown, the operation levels for 2032 and 2037 in the 2023 COGS are lower than the operations levels for 2027 and 2032 in the 2019 COGS.

	2019 COGS	2019 COGS	2023 COGS	2023 COGS	Difference	Difference
Year	2027	2032	2032	2037		
No Action	1,367	1,386	1,279	1,301	(88)	(86)
With NTPs (Proposed Action)	1,392	1,436	1,303	1,396	(89)	(39)

Sources: Sustainable Airport Master Plan – Near Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, January 2020
Sustainable Airport Master Plan – Near Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023

The results of the TAAM analysis, using the 2019 COGS operation levels, was reviewed and it was determined the runway use assumptions, taxi distance, and day night split would remain approximately the same regardless of the number of operations. Delay times would more than likely be lower due to the decrease in operations. Therefore, it was determined to continue using the runway use, taxi times, and operations by time of day developed using the 2019 COGS for the 2023 COGS in the EA noise and air quality analysis.

ENVIRONMENTAL REVIEW AIRSIDE MODELING

Seattle-Tacoma International Airport

1 BACKGROUND AND OBJECTIVES

The Port of Seattle is currently preparing an Environmental Assessment (EA) as part of the National Environmental Policy Act (NEPA) process for the Near Term Projects at Seattle-Tacoma International Airport (SEA, or the Airport) proposed in the Sustainable Airport Master Plan (SAMP). The Proposed Action includes various improvements to Airport facilities. For the purposes of this analysis, which focuses on airfield operational considerations, the following elements of the Near-Term Projects were included:

- Constructing a new Second Terminal to the north consisting of 19 narrow-body equivalent aircraft gates
- Relocating Taxiway S, which connects Runway 16L-34R and Taxiway B, approximately 300' to the south
- Realigning a portion of Taxiway B to achieve 500' of separation from Runway 16L-34R
- Extending parallel Taxiways A and B to the Runway 34R entrance, enabling additional departure queueing space and a dual departure queue in North flow
- Constructing a new high-speed exit from Runway 34L between Taxiways E and J
- Extending Taxiway D from Runway 16C-34C to Taxiway T
- Constructing new aircraft holding and parking positions in portions of the north cargo area and north of Concourse D

The objective of this Environmental Review Airside Modeling was to generate simulated airfield operational metrics for use in the environmental team's NEPA analyses.

2 APPROACH

LeighFisher developed models using Jeppesen's Total Airspace and Airport Modeller (TAAM) for previous SAMP airside modeling efforts. TAAM is a fast-time airfield and airspace simulation program that enables the user to model gate-to-gate aircraft operations. TAAM is an industry-accepted tool widely used by aviation modelers for a variety of uses. It produces performance metrics that are well understood and adequately suited to airport planning efforts, including environmental review.

LeighFisher calibrated the previous TAAM models to 2016 airfield performance metrics at SEA. These models were the basis for the development of new TAAM models to support the environmental effort. Several key factors changed since the SAMP and pre-NEPA modeling, including the demand forecasts, the daily demand profile, and the acceptable operational growth parameters. LeighFisher updated these assumptions accordingly for the Environmental Review Airside Modeling.

2.1 Forecasts and Constrained Operating Growth Scenarios

As part of the SAMP, LeighFisher prepared unconstrained forecasts of aviation activity for SEA through 2034. The first iteration of these forecasts—which drove much of the facility programming in the SAMP—were based on 2014 activity at SEA. Rapid growth in activity at SEA after 2014 and changes to airline operating profiles necessitated subsequent updates to the near-term SAMP forecasts, using base years of 2016, 2017, and 2018. In the first two updates, the out-year SAMP forecasts (i.e., through 2034/2035) were not changed from the 2014 out-year SAMP forecasts. Each of these forecasts were unconstrained, meaning that demand was forecast to grow predominantly following forecast regional economic growth and other explanatory factors irrespective of potential airport capacity limitations.

For the EA, LeighFisher updated the forecasts with 2019 as the base year, as shown in Table 1 on the following page. In addition, two Constrained Operating Growth Scenarios (COGS) were produced—one for the No Action scenario and one for the Proposed Action scenario. The SAMP revealed several potential capacity limitations at the Airport, and the scenarios prepared for the EA took these facility limitations into account. Accordingly, both the No Action and the Proposed Action scenarios were constrained, with the Proposed Action scenario accommodating more growth than the No Action scenario, representing the potential capacity enhancement benefits of the Proposed Action.

LeighFisher and the Port's environmental team developed the constraint assumptions in the No Action and the Proposed Action scenarios based on discussions with the FAA, summarized as follows:

- An average of four Average Day Peak Month (ADPM) passenger airline aircraft operations were added per year between 2019 and 2032, with increased additions during the period after the new north terminal opens in 2027.
- The percent distribution of total aircraft operations in the No Action and the Proposed Action scenarios remained unchanged from the unconstrained scenario. Specifically, passenger airline operations accounted for 96% of total operations, followed by cargo airline operations with less than 4%, and general aviation operations with less than 1%.
- The ratio of annual to ADPM total aircraft operations remained relatively unchanged through 2032.

Completion of the near-term projects is expected by 2027, so 2027 was selected as the Date of Beneficial Occupancy (DBO) for the EA. Accordingly, 2032 was the "DBO + 5" year. The No Action and Proposed Action constrained scenarios for these years are shown in Table 1 on the following page, which also includes the unconstrained SAMP forecasts for comparison.

Table 1
Summary of Aviation Activity Forecasts and Forecast Assumptions
Seattle-Tacoma International Airport

	2019	2027	2032	2035
Total passengers (millions)				
SAMP (2014 base)*		56.0	63.0	
SAMP (2019 base)*	50.3	61.1	68.2	72.9
No Action Scenario**		58.1	60.7	
Proposed Action Scenario**		59.2	63.1	
Total annual aircraft operations				
SAMP (2014 base)*		477,000	524,000	
SAMP (2019 base)*	454,470	519,360	556,540	584,880
No Action Scenario**		499,000	506,000	
Proposed Action Scenario**		508,000	524,000	
Average Annual Day (AAD) total operations				
SAMP (2014 base)*		1,307	1,436	
SAMP (2019 base)*	1,245	1,423	1,525	1,602
No Action Scenario**		1,367	1,386	
Proposed Action Scenario**		1,392	1,436	
Average Day Peak Month (ADPM) total operations				
Total aircraft operations				
SAMP (2014 base)*		n.a	n.a	
SAMP (2019 base)*	1,247	1,427	1,529	1,607
No Action Scenario**		1,372	1,396	
Proposed Action Scenario**		1,398	1,444	
Passenger airline aircraft operations				
SAMP (2014 base)*	1,225	1,459	1,604	
SAMP (2019 base)*	1,196	1,354	1,466	1,464
No Action Scenario**		1,310	1,332	
Proposed Action Scenario**		1,334	1,380	
Cargo airline and general aviation aircraft operations				
SAMP (2014 base)*		n.a	n.a	
SAMP (2019 base)*	52	64	64	64
No Action Scenario**		62	64	
Proposed Action Scenario**		64	64	
Ratio of Annual to ADPM total operations				
SAMP (2014 base)*		n.a	n.a	
SAMP (2019 base)*	364	364	364	364
No Action Scenario**		364	362	
Proposed Action Scenario**		363	363	

Note: *Unconstrained; **Constrained; n.a. = not available
Sources: OAG Aviation Worldwide Ltd, OAG Analyser database, accessed December 2019; LeighFisher, January 2020. Flight track data for 2019 provided by the Port of Seattle.

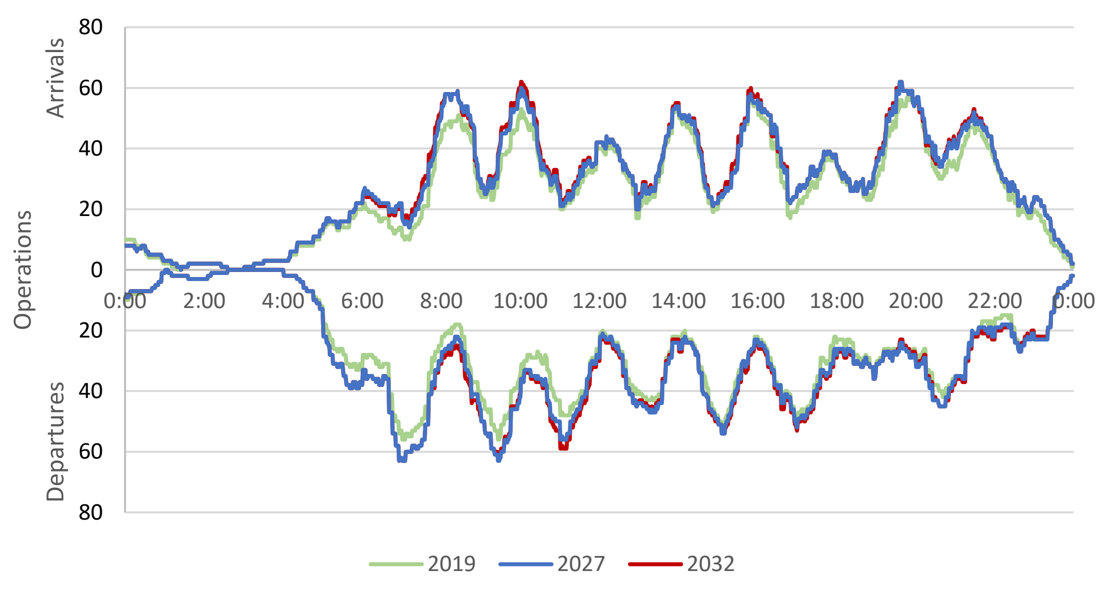
2.2 Design Day Flight Schedules

Based on the constrained scenarios, LeighFisher created four design day flight schedules (DDFS) for use in the Environmental Review Airside Modeling: 2027 No Action, 2027 Proposed Action, 2032 No Action, and 2032 Proposed Action. Conforming to guidelines for NEPA analyses, the DDFS were representative of an Average Annual Day (AAD) flight schedule in 2019.

LeighFisher developed the DDFS using standard methods consistent with previous forecasting efforts. The future-year flight schedules consisted of a base-year flight schedule—in this case, a 2019 AAD—with activity added on top of the base. Historical scheduled passenger flights sourced from the Official Airline Guide and historical air cargo and general aviation operations sourced from Port data comprised the base-year flight schedule. LeighFisher applied professional judgment and experience to identify future markets served, future airline entrants, airline fleet changes and upgauges, and the scheduled times of added flights. Generally, the characteristics of the base-year flight schedule (e.g., peaking) were preserved in the future-year schedules.

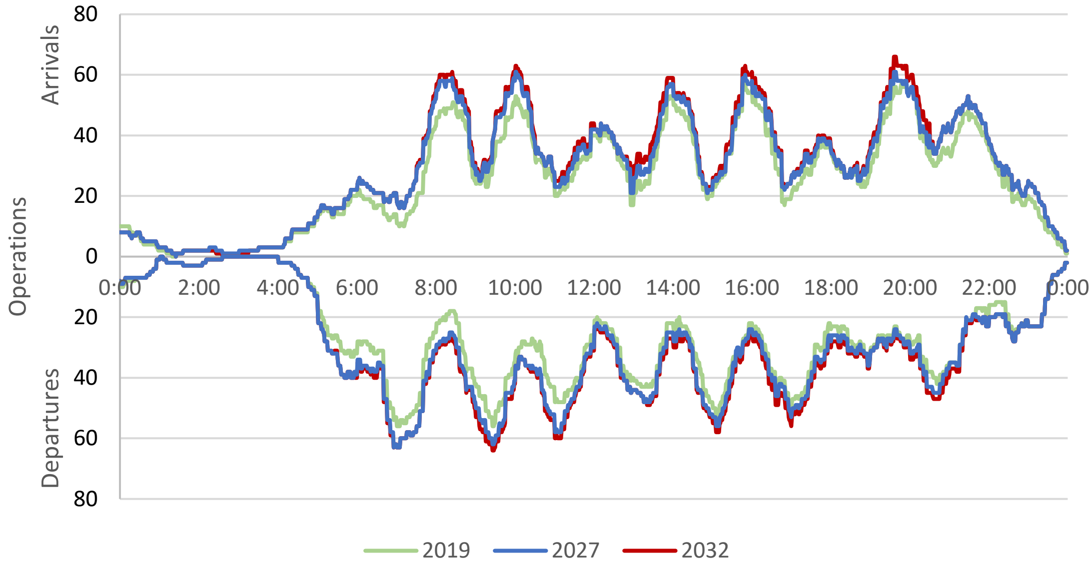
Figures 1 and 2 show the rolling hour arrival and departure profiles for the four DDFS. Figures 3 and 4 show the rolling hour total operations profiles for the four DDFS. Each of these figures also includes the base-year 2019 AAD rolling hour profiles for comparison. Table 2 presents summaries of the four DDFS.

Figure 1
Rolling Hour Profiles: No Action Design Day Flight Schedules (Arrivals and Departures)
Seattle-Tacoma International Airport



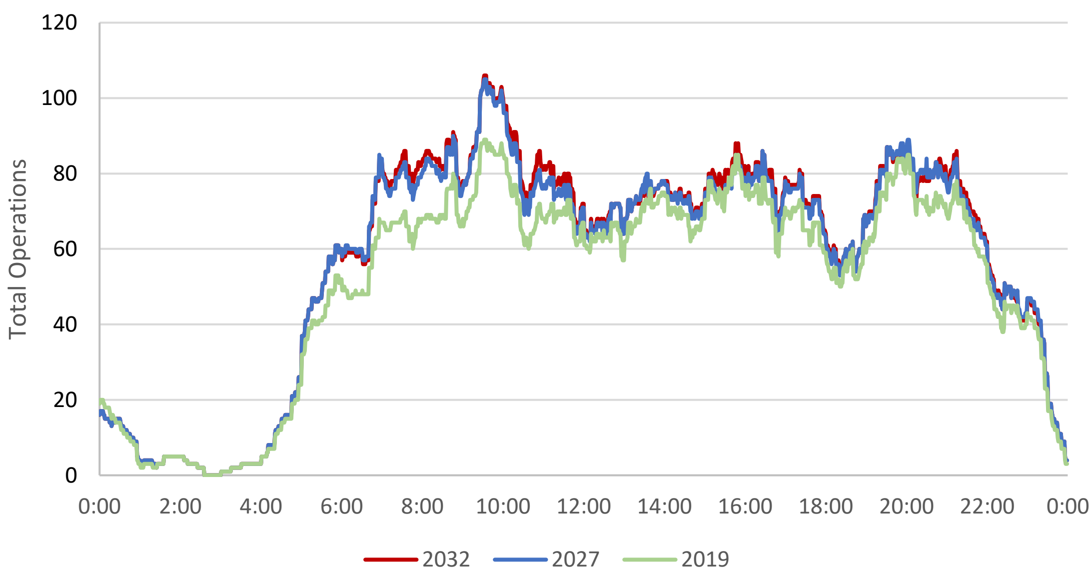
Source: LeighFisher analysis of LeighFisher AAD DDFS.

Figure 2
Rolling Hour Profiles: Proposed Action Design Day Flight Schedules (Arrivals and Departures)
Seattle-Tacoma International Airport



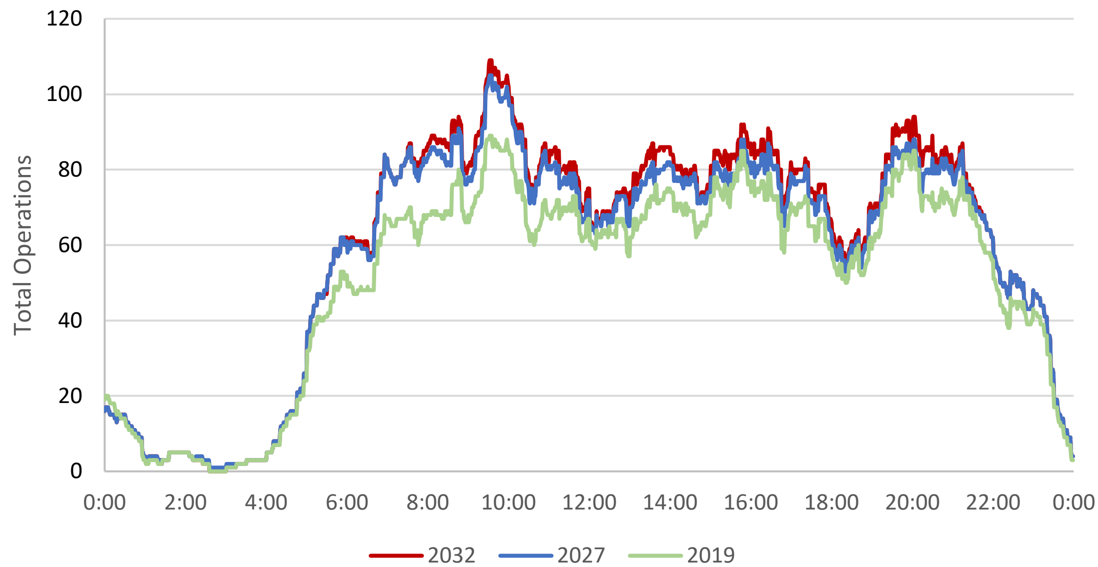
Source: LeighFisher analysis of LeighFisher AAD DDFS.

Figure 3
Rolling Hour Profiles: No Action Design Day Flight Schedules (Total Operations)
Seattle-Tacoma International Airport



Source: LeighFisher analysis of LeighFisher AAD DDFS.

Figure 4
Rolling Hour Profiles: Proposed Action Design Day Flight Schedules (Total Operations)
Seattle-Tacoma International Airport



Source: LeighFisher analysis of LeighFisher AAD DDFS.

Table 2
Summary of Design Day Flight Schedules
Seattle-Tacoma International Airport

	2027 No Action			2027 Proposed Action			2032 No Action			2032 Proposed Action		
	Arrivals	Departures	Total	Arrivals	Departures	Total	Arrivals	Departures	Total	Arrivals	Departures	Total
Operations												
DDFS Operations	684	684	1,368	693	693	1,386	696	697	1,393	718	719	1,437
Peak Hour Operations	62	63	105	62	63	106	61	63	105	66	64	109
Peak Hour Start Time	19:36	6:56	9:32	10:01	6:56	9:32	10:01	6:56	9:32	19:36	9:26	9:32
Fleet Mix												
Wide-body jet	7.3%	7.0%	7.2%	7.3%	7.0%	7.2%	7.1%	6.8%	6.9%	7.4%	7.2%	7.3%
Narrow-body jet	64.3%	64.5%	64.4%	64.1%	64.3%	64.2%	64.4%	64.5%	64.4%	64.1%	64.1%	64.1%
Regional jet	20.6%	20.6%	20.6%	21.1%	20.9%	21.0%	23.4%	23.4%	23.4%	23.5%	23.4%	23.5%
Turboprop	7.0%	7.0%	7.0%	6.9%	6.9%	6.9%	4.6%	4.6%	4.6%	4.5%	4.5%	4.5%
Propellor	0.7%	0.9%	0.8%	0.6%	0.9%	0.7%	0.6%	0.7%	0.6%	0.6%	0.8%	0.7%
Airplane Design Group												
I	0.6%	0.6%	0.6%	0.4%	0.6%	0.5%	0.4%	0.4%	0.4%	0.4%	0.6%	0.5%
II	0.4%	0.6%	0.5%	0.4%	0.6%	0.5%	0.4%	0.6%	0.5%	0.4%	0.6%	0.5%
III	90.2%	90.4%	90.3%	90.4%	90.4%	90.4%	90.6%	90.8%	90.7%	90.4%	90.3%	90.3%
IV	3.9%	3.7%	3.8%	4.0%	3.7%	3.9%	3.8%	3.5%	3.6%	3.6%	3.5%	3.5%
V	4.7%	4.7%	4.7%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	5.0%	5.0%	5.0%
VI	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Market Segment												
Domestic	89.9%	89.6%	89.8%	89.8%	89.4%	89.7%	89.8%	89.6%	89.7%	89.4%	89.2%	89.3%
International	5.1%	5.1%	5.1%	5.3%	5.3%	5.3%	5.3%	5.3%	5.3%	5.4%	5.4%	5.4%
Precleared	5.0%	5.3%	5.1%	4.9%	5.2%	5.0%	4.9%	5.1%	5.0%	5.2%	5.4%	5.3%

Notes: Includes all AAD operations, including passenger, air cargo, and general aviation. Peak hours are based on rolling hour profiles with 1-minute intervals.

Source: LeighFisher analysis of LeighFisher AAD DDFS.

2.3 Experiment Design

The framework of the Environmental Review Airside Modeling effort was designed to enable comparison of the No Action and the Proposed Action alternatives for the DBO (2027) and the DBO + 5 years (2032). The No Action alternative included no physical improvements to the Airport from the SAMP NTP, but included projects that were recently completed or will be completed by the time the EA is complete—including the International Arrivals Facility (IAF) in Concourse A and the North Satellite Redevelopment Program (NorthSTAR). These projects were also included with the Proposed Action. The Proposed Action alternative assumed the No Action layout and the SAMP near-term projects listed in Section 1.

The effort assumed that the 2016 calibration remained valid, or that any changes in airfield operations between 2016 and 2019 were negligible[1]. Consequently, the five operating scenarios used in the previous modeling effort were retained, which are described below[2].

- South flow, Visual Meteorological Conditions (South VMC): Aircraft primarily arrive and depart from Runways 16L, 16C, and 16R. The Airport has a cloud ceiling of at least 5,000 feet and visibility of at least 5 miles.
- South flow, Marginal Meteorological Conditions (South MMC): Aircraft primarily arrive and depart from Runways 16L, 16C, and 16R. The Airport has a cloud ceiling below 5,000 feet but at least 3,000 feet or visibility less than 5 miles but at least 3 miles.
- South flow, Instrument Meteorological Conditions (South IMC): Aircraft primarily arrive and depart from Runways 16L, 16C, and 16R. The Airport has a cloud ceiling below 3,000 feet or visibility less than 3 miles.
- North flow, Visual Meteorological Conditions (North VMC): Aircraft primarily arrive and depart from Runways 34L, 34C, and 34R. The Airport has a cloud ceiling of at least 5,000 feet and visibility of at least 5 miles.
- North flow, Instrument Meteorological Conditions (North IMC): Aircraft primarily arrive and depart from Runways 34L, 34C, and 34R. The Airport has a cloud ceiling below 5,000 feet or visibility less than 5 miles.

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[1] To validate the use of the previously calibrated models, LeighFisher analyzed data from the FAA's ASPM Taxi Times Report for SEA from 2016 to 2019 to confirm historical runway use. The analysis showed that historical runway use in each of the five operating scenarios was largely consistent from 2016 to 2019. Runway use statistics from 2018 were skewed because Runway 16L-34R was minimally or not used from September 10 through November 29, 2018 due to a runway maintenance project.

[2] Per guidance from the FAA Air Traffic Control Tower (ATCT) staff at SEA during the SAMP planning process, the percentage of time that SEA operates in North flow, Marginal Meteorological Conditions is negligible. Therefore, the North MMC operating scenario was excluded from the modeling effort.

Using the Taxi Times Report from the FAA's Aviation Systems Performance Metrics (ASPM) database and hourly weather observations from the National Oceanic and Atmospheric Administration's National Climatic Data Center (NOAA NCDC), LeighFisher estimated the relative frequency of each of the five operating scenarios between January 1, 2016 and December 31, 2019. These frequencies were used to estimate composite simulated, or annualized, airfield performance using a weighted average. Table 3 presents the relative frequencies of each operating scenario.

Table 3
Relative Frequencies of Operating Scenarios
Seattle-Tacoma International Airport

Operating Scenario	Relative Frequency (%)
South VMC	37.94
South MMC	12.85
South IMC	20.05
North VMC	26.12
North IMC	3.04
TOTAL	100.00

Source: LeighFisher analysis of hourly ASPM and NOAA NCDC data, January 2016—December 2019.

LeighFisher created one model for each combination of operating scenario, demand level, and layout alternative. Thus, 20 TAAM models in total were created. The model parameters, including rules, from the pre-NEPA 2027 models were initially assumed and were adjusted as necessary to accommodate the updated airfield layouts and flight schedules.

2.4 Operational Efficiency Gains

Future changes in airfield and airspace standards, procedures, or technologies could enhance airfield performance in the future. No single standard, procedure, or technology is guaranteed at SEA, nor are the benefits to airfield capacity certain. Therefore, for simulation purposes, LeighFisher modeled enhanced airfield performance by permitting approximately a 5% increase in hourly runway throughput (generally 3-5 operations/hour) over the calibrated runway throughput, which could represent the effects of one or more future changes.

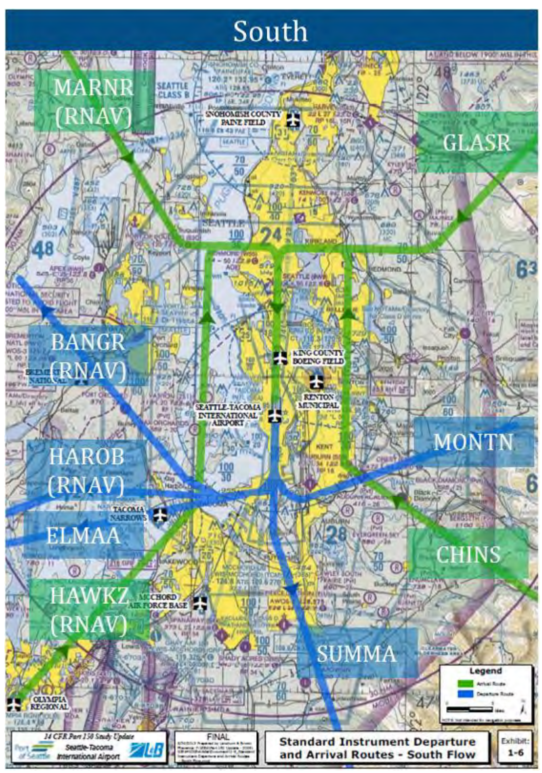
This modeling approach had been employed in the SAMP and pre-NEPA airfield simulation. It was coordinated, verified, and validated with FAA staff and was deemed appropriate for long-range planning efforts for SAMP and this modeling used for the NEPA analysis. However, this approach should not be considered replicable in subsequent airfield capacity or simulation studies without prior FAA coordination.

3 KEY INPUT ASSUMPTIONS

3.1 Airspace Structure

Airspace operations were simulated within the terminal airspace area around SEA. Outside the terminal area, simulated flights traveled directly to their destination airport or from their origin airport. Flights in the schedule were assigned to arrival fixes (Standard Terminal Arrival Routes, or STAR's) and departure fixes (Standard Instrument Departures, or SID's) based primarily on the airport of origin or destination. Four STAR's were used: MARNR for arrivals from the northwest, GLASR for arrivals from the northeast, CHINS for arrivals from the southeast, and HAWKZ for arrivals from the southwest. The SID's used included BANGR for departures to the northwest, MONTN for departures to the northeast, SUMMA for departures to the southeast, and HAROB for departures to the southwest. In South flow, the additional SID ELMAA was used for some departures to the southwest. In North flow, the additional SID's KTSAP and KMORE were used for some departures to the northwest and the northeast, respectively. The airspace routes for South flow and North flow are shown in Figures 5 and 6, respectively.

Figure 5
Simulated South Flow Arrival and Departure Routes
Seattle-Tacoma International Airport



Sources: Part 150 Noise Compatibility Study, Seattle-Tacoma International Airport (October 2013); LeighFisher analysis of published STAR's and SID's (May 2015).

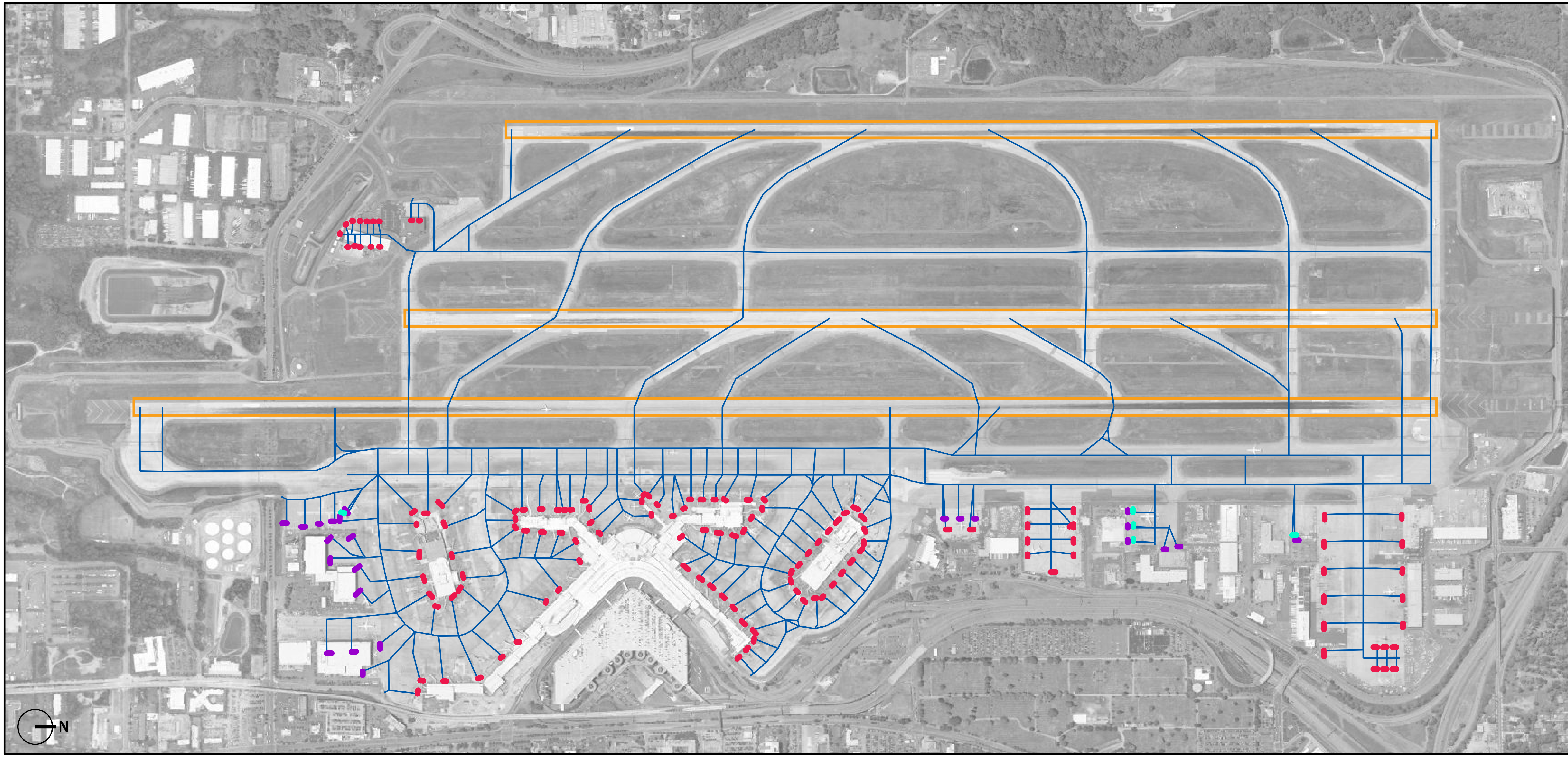
Figure 6
Simulated North Flow Arrival and Departure Routes
Seattle-Tacoma International Airport

Sources: Part 150 Noise Compatibility Study, Seattle-Tacoma International Airport (October 2013); LeighFisher analysis of published STAR's and SID's (May 2015).

Jet noise-abatement procedures confine departures to narrow corridors in both North flow and South flow. The FAA, in cooperation with the SEA Airport and local communities, established the procedures to take advantage of existing geographical and compatible land use conditions wherever possible. Both conventional (land-based) and area navigation (RNAV) SID's require all jet departures to converge on a single departure fix, regardless of the departure runway used. As a result, successive jet departures from parallel runways were dependent because jets must maintain the required separation until they could diverge onto different departure paths. Turboprop aircraft departures were exempt from passing over the single waypoint and could make an immediate, divergent turn.

3.2 Airfield Layout

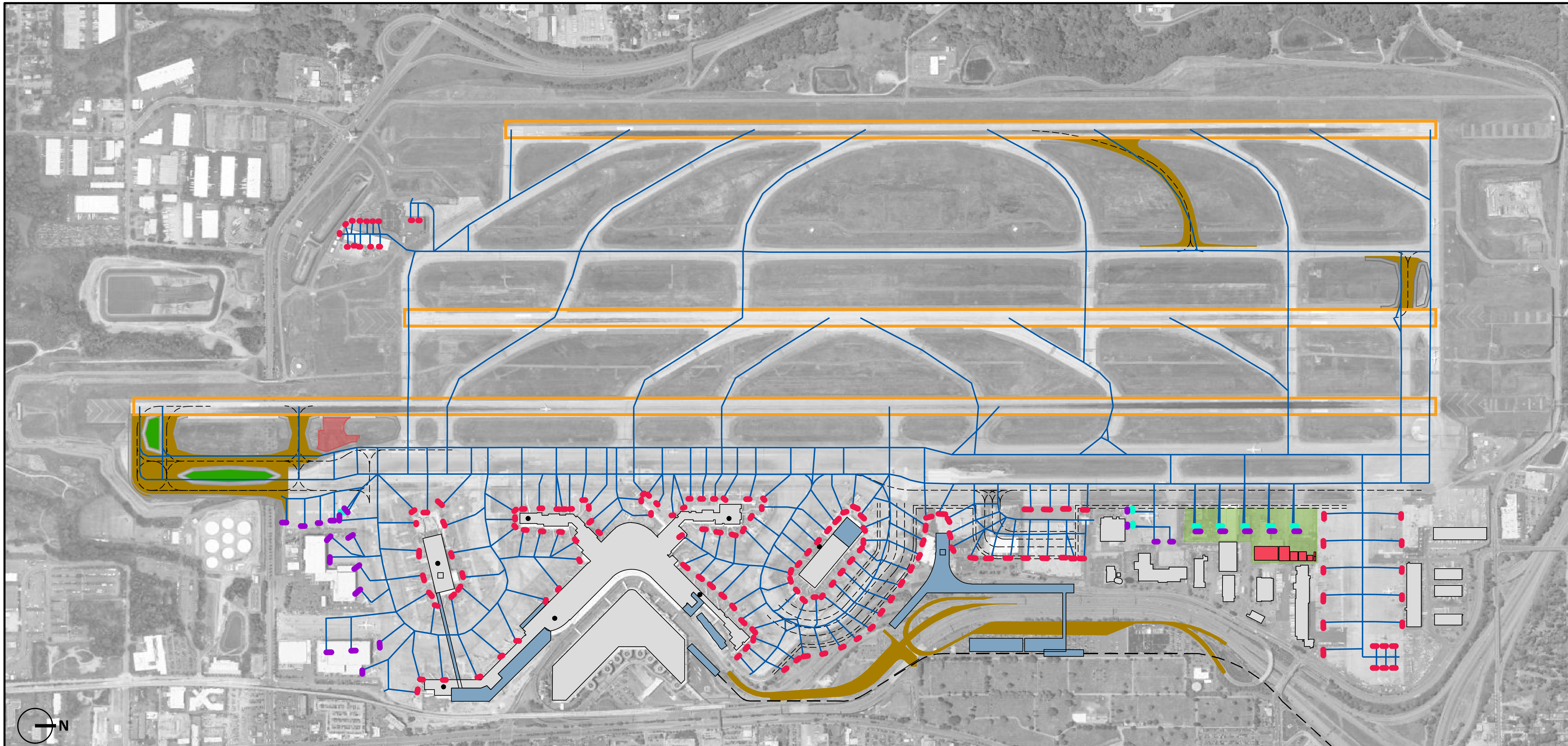
Subsequent pages depict the airfield layouts simulated in TAAM overlaid on a satellite image of SEA. Figure 7 shows the No Action layout, and Figure 8 shows the Proposed Action layout.



Gates
Long-term parking positions
Stand-off positions

Figure 7
Simulated No Action Airfield Layout
Seattle-Tacoma International Airport

TAAM layout overlay not to scale.
Source: LeighFisher; satellite imagery from Google Earth, January 2021



Gates
Long-term parking positions
Stand-off positions

Figure 8
Simulated Proposed Action Airfield Layout
Seattle-Tacoma International Airport

CAD layout overlay included for reference. Received from Port of Seattle, October 2017.
TAAM layout overlay and CAD overlay not to scale.
Source: LeighFisher; satellite imagery from Google Earth, January 2021

3.3 Runway Use

Simulated aircraft were assigned to runways in TAAM based on pre-defined rules. These rules, developed during previous modeling efforts, were consistent across demand levels (2027 and 2032) and layout alternatives (No Action and Proposed Action) for each of the five operating scenarios.

Tables 4 and 5 summarize the input assumptions used for runway assignment in TAAM for the South flow and North flow models, respectively. “Heavy jet” aircraft are those which have maximum take-off weight (MTOW) capabilities of at least 300,000 pounds.

Table 4
South Flow Runway Use Input Assumptions
Seattle-Tacoma International Airport

	Arrival			Departure		
	16L	16C	16R	16L	16C	16R
VMC						
Heavy jet	75%		25%	100%		
Other			100%	40%	60%	
MMC						
Heavy jet	75%		25%	100%		
Other			100%	75%	25%	
IMC						
Heavy jet	75%		25%	100%		
Other			100%	100%		

Note: In VMC and MMC, all general aviation departures used 16C.
Source: LeighFisher, based on input from SEA ATCT staff (January 2017).

Table 5
North Flow Runway Use Input Assumptions
Seattle-Tacoma International Airport

	Arrival			Departure		
	34R	34C	34L	34R	34C	34L
VMC						
Heavy jet	75%		25%	100%		
Other			100%	100%		
IMC						
Heavy jet	25%		75%	100%		
Other			100%	100%		

Source: LeighFisher, based on input from SEA ATCT staff (January 2017).

Historically, when SEA operated in South IMC, approximately 15% of departures used Runway 16C. ATCT staff occasionally assign departures to Runway 16C in South IMC during specific operating conditions, such as a temporary closure of Runway 16L. During South IMC, ATCT staff would ordinarily avoid assigning departures to Runway 16C because it would introduce a dependency between departures on Runway 16C and arrivals on Runway 16R or Runway 16L, potentially resulting in departure delays. These conditions do not occur frequently enough to notably change the results of the overall simulation results.

Similarly, when SEA operated in North VMC, approximately 4% of departures used Runway 34C. As in South IMC, ATCT staff occasionally assign departures to Runway 34C in North VMC during specific operating conditions, such as a temporary closure of Runway 34R. During North VMC, departures on Runway 34C would not introduce a dependency with arrivals on parallel runways. However, aircraft departing from the passenger terminal and cargo areas assigned to Runway 34C would be required to cross the active Runway 34R. Departing aircraft waiting to cross Runway 34R to reach Runway 34C could block the Runway 34R departure queue, potentially resulting in departure delays.

In the South IMC and North VMC TAAM models, departures were not assigned to Runway 16C-34C primarily due to the dependency, taxiing, and queueing challenges described above. Additionally, the conditions under which ATCT might assign departures to Runway 16C-34C during South IMC or North VMC are not reliably replicated in TAAM. Specifically, TAAM is limited in its ability to make runway assignments based on conditions such as facilities closures or periods of low demand. Therefore, to avoid the risk of producing potentially misrepresentative results, departures were not assigned to Runway 16C-34C in the South IMC or North VMC models.

When an aircraft arrives on Runway 16L-34R (the inboard runway) at SEA, ATCT staff indicated that the arrival's runway occupancy time occupies the capacity to serve approximately 3-4 departures on that runway. The arrival must decelerate to taxiing speed on the inboard runway and use a distant runway exit to prevent back-taxiing on the parallel Taxiway B, resulting in high runway occupancy times and the consequent loss of departure capacity. Most arrivals on the inboard runway are heavy jet aircraft, but this loss of capacity also applies when non-heavy jets arrive on the inboard runway.

Because TAAM instantaneously selects a runway exit upon simulated arrival touchdown and adjusts its deceleration speed accordingly, it cannot simulate an aircraft traveling at taxiing speed on a runway. Therefore, the following rules were imposed when an inboard arrival occurred in the models:

- Hold the arrival at its runway exit for 100 seconds, after which it may continue taxiing
- Release the next departure on the inboard runway 120 seconds after the arrival began its hold at its exit
- Separate consecutive arrivals to the inboard runway by a minimum of 11.0 nautical miles (nmi)

The models only simulated heavy jet arrivals on the inboard runway.

3.4 Runway Dependencies

The following runway dependencies were assumed in the models:

- South VMC models
    - Visual approaches are independent of each other
    - Departures on 16L are independent of arrivals on 16R
    - Departures on 16C are independent of arrivals on 16R and 16L
    - Jet departures from 16L and 16C are fully dependent on each other
    - Mixed operations runway
        - A departure on 16L cannot begin its takeoff run if the next 16L arrival is within the capture distance of 2 nmi
        - A departure on 16L cannot begin its takeoff run until the previous arrival has cleared that runway

- South MMC models
    - Arrivals to 16L and 16R are dependent and must maintain a minimum 1.0 nmi diagonal separation
    - Departures on 16L are independent of arrivals on 16R
    - Departure on 16C are independent of arrivals on 16R and 16L (no "2-increasing-to-3" rule)
    - Jet departures from 16L and 16C are fully dependent on each other
    - Mixed operations runway
        - A departure on 16L cannot begin its takeoff run if the next 16L arrival is within the capture distance of 2 nmi
        - A departure on 16L cannot begin its takeoff run until the previous arrival has cleared that runway

- South IMC models
    - Arrivals to 16L and 16R are dependent and must maintain a minimum 1.0 nmi diagonal separation
    - Departures on 16L are independent of arrivals on 16R
    - Mixed operations runway
        - A departure on 16L cannot begin its takeoff run if the next 16L arrival is within the capture distance of 2 nmi
        - A departure on 16L cannot begin its takeoff run until the previous arrival has cleared that runway

- North VMC models
    - Visual approaches are independent of each other
    - Departures on 34R are independent of arrivals on 34L
    - Mixed operations runway
        - A departure on 34R cannot begin its takeoff run if the next 34R arrival is within the capture distance of 2 nmi

        - A departure on 34R cannot begin its takeoff run until the previous arrival has cleared that runway

- North IMC models
    - Arrivals to 34R and 34L are dependent and must maintain a minimum 1.0 nmi diagonal separation
    - Because of the adverse stagger between the two runways, departures on 34R are dependent on arrivals to 34L
        - A departure on 34R must begin its takeoff run before the next 34L arrival reaches the capture distance of 2 nmi plus the 3,401-foot runway stagger
        - A departure on 34R may begin its takeoff run after the preceding arrival on 34L has touched down
    - Mixed operations runway
        - A departure on 16L cannot begin its takeoff run if the next 16L arrival is within the capture distance of 2 nmi
        - A departure on 16L cannot begin its takeoff run until the previous arrival has cleared that runway

3.5 Taxiway Use

Figures 9 through 12 on subsequent pages depict the taxiway flow patterns that were simulated for the South flow No Action, North flow No Action, South flow Proposed Action, and North flow Proposed Action models.

3.6 Taxiway Speeds and Restrictions

Consistent with previous modeling efforts, LeighFisher set simulated aircraft taxiing speeds according to the different airfield areas where taxiing occurs or the different types of taxiing activity. West of Runway 16L-34R, aircraft taxied at 20 knots; east of the runway, aircraft taxied at 15 knots in the movement areas and 7 knots in the non-movement (i.e., apron) areas. Aircraft pushed back from the gates at 3 knots and towed at 5 knots.

Due to required aircraft wingspan clearances from aircraft parked at adjacent gates, certain aircraft types were restricted from using Taxilane W. North of Taxiway N, aircraft with wingspans greater than 135 feet (i.e., larger than a Boeing 757-300 with winglets) were not permitted. South of Taxiway N, aircraft with wingspans greater than 167 feet (i.e., larger than a Boeing 767-300 with winglets) were not permitted. Furthermore, aircraft with a wingspan greater than 118 feet (i.e., Airplane Design Group [ADG] III) on Taxiway B cannot pass an aircraft pushing back on Taxilane W with a wingspan greater than 167 feet.

In TAAM, the “pushback time” input is defined as the time between the completion of pushback and the forward motion of an aircraft during which the tug is detached, flaps are checked, and pilots perform other pre-flight checks. For B747, B777, and B787 aircraft, the pushback time was set at 210 seconds; for other wide-body aircraft, 180 seconds; for B757 aircraft, 120 seconds; and for all other aircraft, the default value of 90 seconds.

The “runway crossing time” input is defined as the “start-up” time it takes for an aircraft before it moves forward to cross an active runway. For wide-body aircraft, the runway crossing time was set at 14 seconds; for B757 aircraft, 10 seconds; for ADG III aircraft, 6 seconds; and for smaller aircraft, 2-4 seconds.

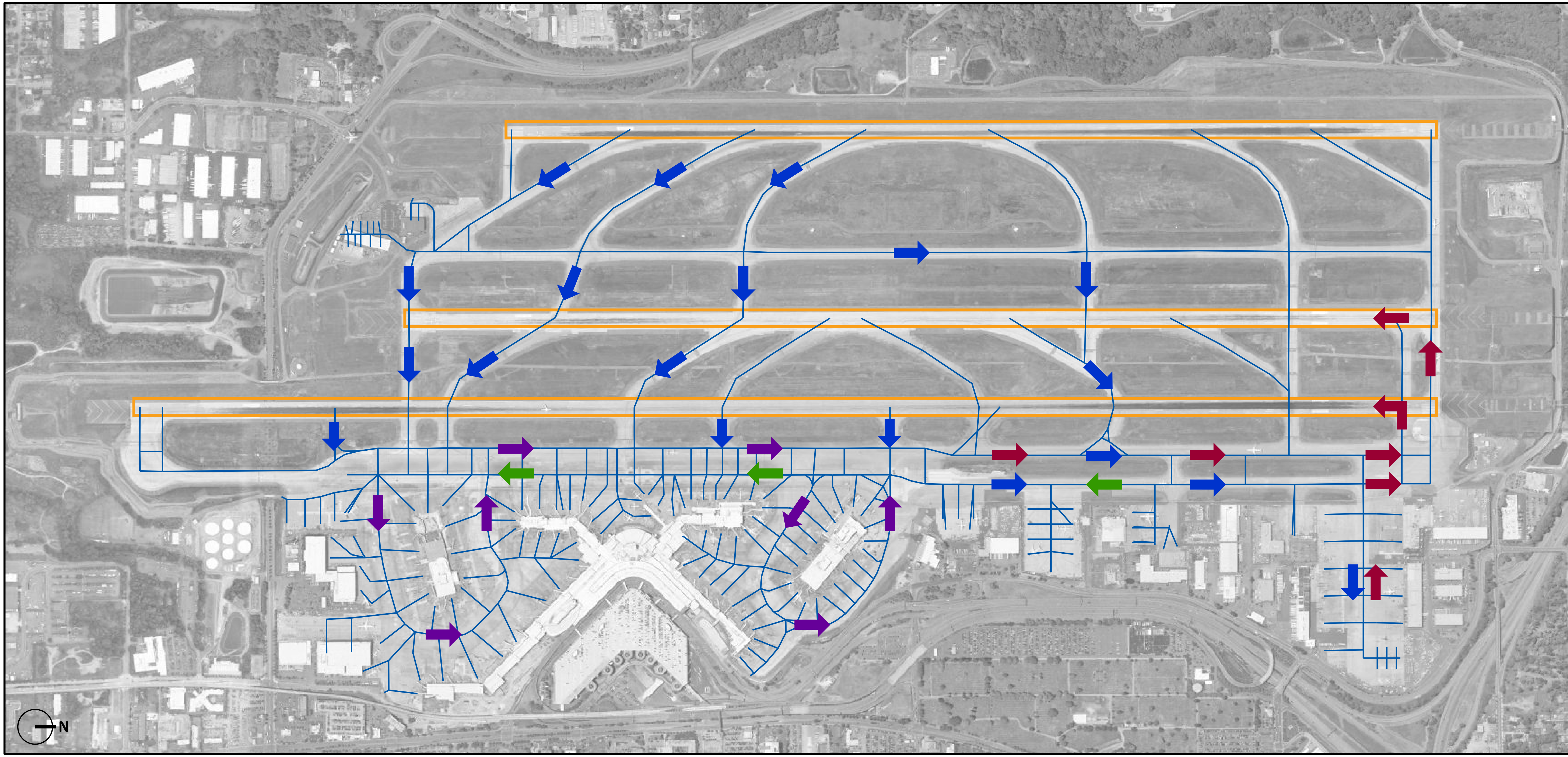


Figure 9
South Flow No Action Taxi Routes
Seattle-Tacoma International Airport

TAAM layout overlay not to scale.
Source: LeighFisher; satellite imagery from Google Earth, January 2021

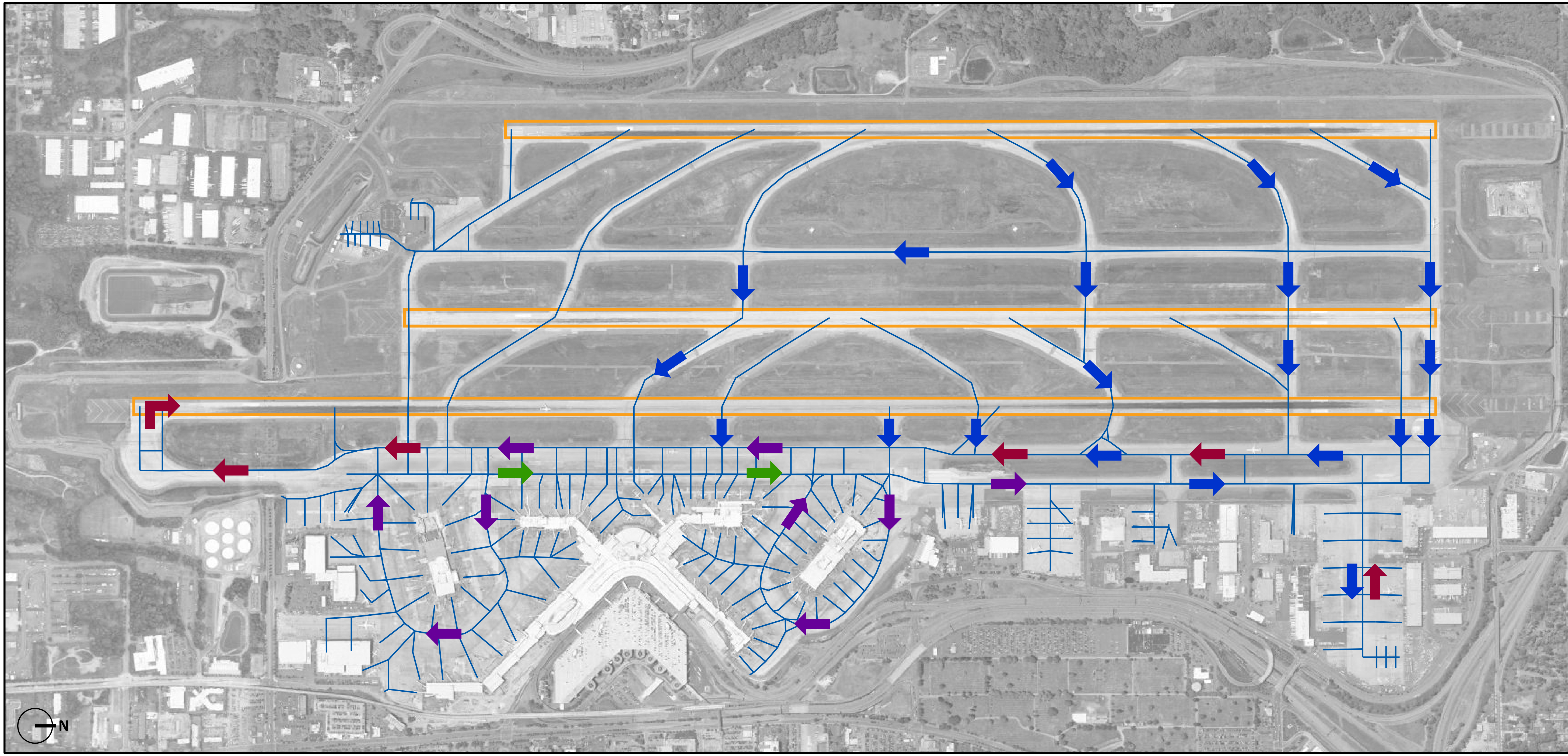


Figure 10
North Flow No Action Taxi Routes
Seattle-Tacoma International Airport

TAAM layout overlay not to scale.
Source: LeighFisher; satellite imagery from Google Earth, January 2021

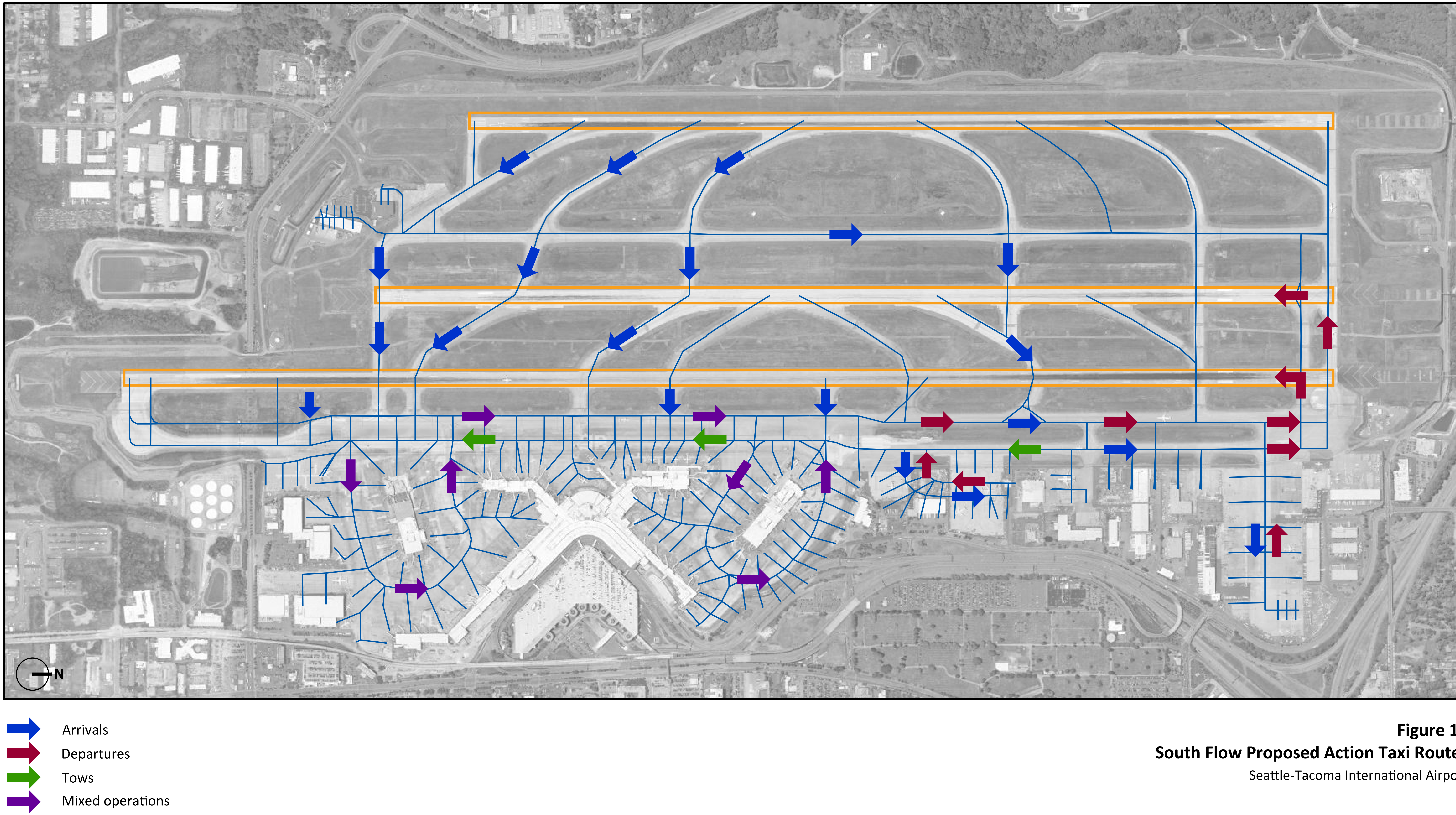


Figure 11
South Flow Proposed Action Taxi Routes
Seattle-Tacoma International Airport

TAAM layout overlay not to scale.
Source: LeighFisher; satellite imagery from Google Earth, January 2021

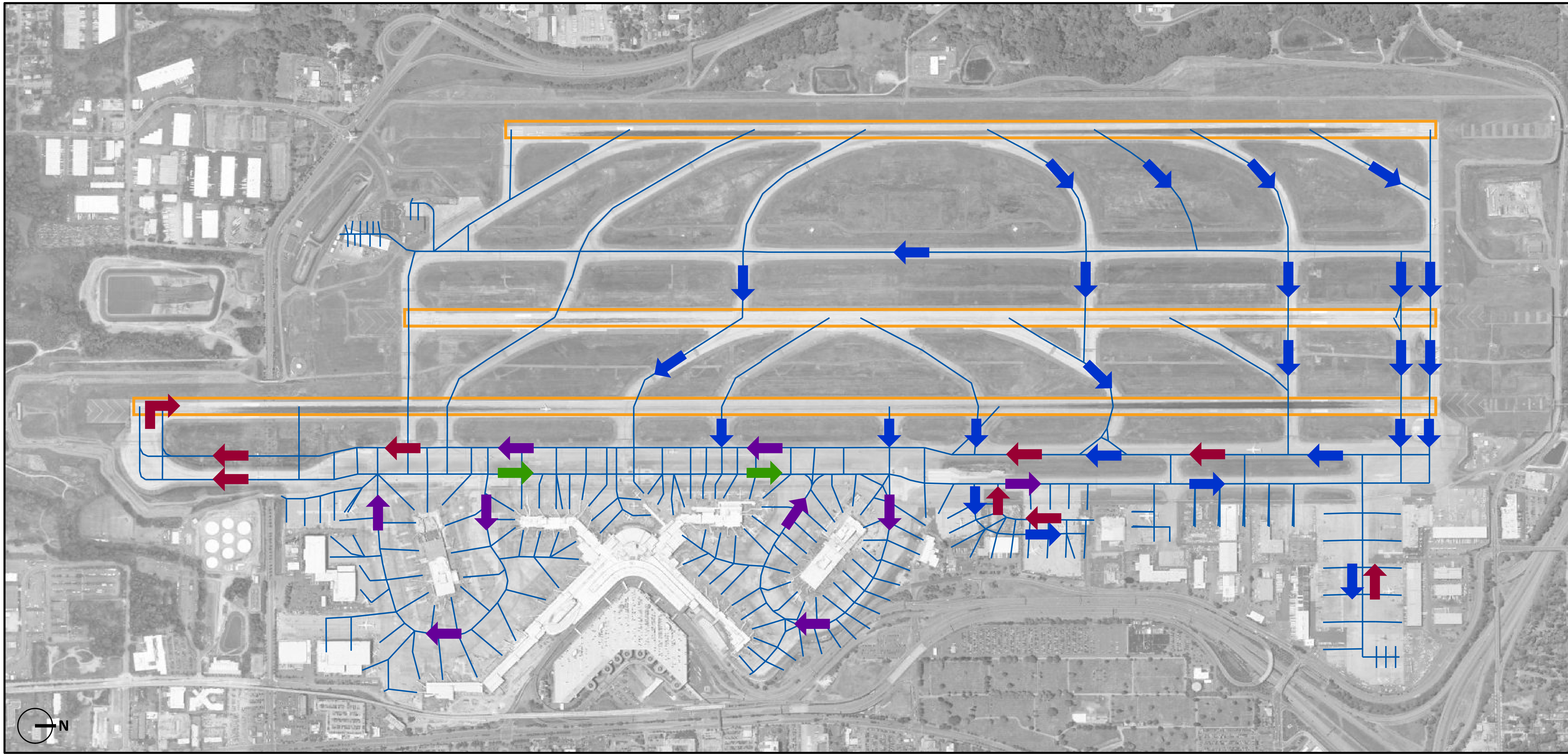


Figure 12
North Flow Proposed Action Taxi Routes
Seattle-Tacoma International Airport

TAAM layout overlay not to scale.
Source: LeighFisher; satellite imagery from Google Earth, January 2021

3.7 Departure Sequencing

TAAM contains a parameter to identify when a departing aircraft is entered into the departure queue and is sequenced for departure. If the parameter is set to “Early”, an aircraft is sequenced for departure when it reaches the runway hold line or when it stops taxiing behind another aircraft which has been sequenced for departure, whichever occurs first. If the parameter is set to “At runway hold line”, an aircraft is always sequenced for departure when it reaches the runway hold line. This setting primarily affects how TAAM accounts for taxi-out delay versus queueing delay.

In the Environmental Review Airside Modeling, this parameter was set to, “At runway hold line” because it was more favorable for runway crossings for arrivals. Under this setting, departure queueing delay may be underreported while taxi-out delay may be equivalently overreported.

3.8 Gate and Remote Overnight Use

Because the TAAM models simulated future years with facilities that do not yet exist, the modeling team made high-level assumptions regarding airline gate use. TAAM assigned aircraft to available gates subject to rules based on airline and/or aircraft type. These rules were informed by present-day airline allocations and size restrictions and, where appropriate, the intended users of future facilities. Tables 6 and 7 summarize the gate assignments for the No Action and the Proposed Action alternatives.

Several additional aircraft parking positions were available as remain overnight (RON) positions. In TAAM, these were used as either long-term parking positions or as stand-offs (i.e., a staging position for an arrival while it awaits a gate) at which passengers were not assumed to enplane or deplane. Table 8 lists these parking areas, how many parking positions were available at each in the No Action and Proposed Action, and which carriers were permitted to use each.

Table 6
No Action Gate Use
Seattle-Tacoma International Airport

Airline	Aircraft Class	Primary Location(s)	Secondary Location(s)	Permitted to use Non-Contact Gates
Air Canada	Narrow-body jet, turboprop	South Satellite	Gates B01—B07 (odd)	Yes
Alaska	Regional jet, turboprop	Concourse C	North Satellite; Gates D01—D05	Yes
Alaska	Narrow-body jet	North Satellite; Concourse C; Gates D01—D05	N/A	Yes
American	Narrow-body jet, regional jet	Gates D07-D11	Concourse D; Concourse C	Yes
Delta	Regional jet	Gates B09, B11, B15, B14	South Satellite; Concourse A	Yes
Delta	Narrow-body jet	Gates A01, A02, B09, B11, B15, B14; South Satellite	Concourse A	Yes
Delta	Wide-body jet	South Satellite	Concourse A	No*
Frontier	Narrow-body jet	N/A	N/A	Yes
Hawaiian	Wide-body jet	Concourse A; South Satellite	N/A	No
jetBlue	Narrow-body jet	N/A	N/A	Yes
Southwest	Narrow-body jet	Gates B04—B12 (even)	Concourse B	Yes
Spirit	Narrow-body jet	N/A	N/A	Yes
Sun Country	Narrow-body jet	N/A	N/A	Yes
United	Narrow-body jet, wide-body jet, regional jet	Gates B01—B07 (odd)	Concourse B	Yes
Foreign Flags	Narrow-body jet, wide-body jet	Concourse A (except Gates A01, A02)	South Satellite	No
Cargo Carriers	Wide-body jet, turboprop	Cargo Ramp	N/A	Yes
General Aviation	Regional jet, turboprop	FBO	N/A	No

*Note: One Delta wide-body jet was permitted to use the remote hardstands in the North IMC 2032 No Action model.

Source: LeighFisher.

Table 7
Proposed Action Gate Use
Seattle-Tacoma International Airport

Airline	Aircraft Class	Primary Location(s)	Secondary Location(s)	Permitted to use Non-Contact Gates
Air Canada	Narrow-body jet, turboprop	New Terminal	N/A	Yes
Alaska	Regional jet, turboprop	Concourse C	North Satellite; Gates D01—D05	Yes
Alaska	Narrow-body jet	North Satellite; Concourse C; Gates D01—D05	New Terminal	Yes
American	Narrow-body jet, regional jet	Gates D07-D11	Concourse D; Concourse C; New Terminal	Yes
Delta	Regional jet	Concourse B	N/A	Yes
Delta	Narrow-body jet	Concourse B; Gates A01, A02	South Satellite; Concourse A	Yes
Delta	Wide-body jet	South Satellite	Concourse A	No
Frontier	Narrow-body jet	New Terminal	N/A	Yes
Hawaiian	Wide-body jet	Concourse A; South Satellite	N/A	No
jetBlue	Narrow-body jet	New Terminal	N/A	Yes
Southwest	Narrow-body jet	New Terminal	N/A	Yes
Spirit	Narrow-body jet	New Terminal	N/A	Yes
Sun Country	Narrow-body jet	New Terminal	N/A	Yes
United	Narrow-body jet, wide-body jet, regional jet	New Terminal	N/A	Yes
Foreign Flags	Narrow-body jet, wide-body jet	Concourse A (except Gates A01, A02)	South Satellite	No
Cargo Carriers	Wide-body jet, turboprop	Cargo Ramp	N/A	Yes
General Aviation	Regional jet, turboprop	FBO	N/A	No

Source: LeighFisher.

Table 8
Remain Overnight Positions
Seattle-Tacoma International Airport

Area	Number of Positions (No Action)	Number of Positions (Proposed Action)	Permitted Air Carrier(s)
Alaska Maintenance Hangar	5 narrow-body	5 narrow-body	Alaska mainline
Delta Maintenance Hangar	4 narrow-body	4 narrow-body	Delta mainline
Cargo 7 Ramp	5 narrow-body and 1 wide-body	5 narrow-body and 1 wide-body	Any
Cargo 6 Ramp	3 narrow-body	N/A	Any
Cargo 4 Ramp	5 narrow-body	4 narrow-body	Any
Maintenance Ramp	1 wide-body	5 wide-body	Any (except foreign flags)

Source: LeighFisher.

3.9 Wake Turbulence Standards and Aircraft Separations

Controllers must maintain minimum distance-based and/or time-based radar separations between consecutive aircraft on arrival or departure paths to protect for wake turbulence. Consistent with previous modeling efforts, the minimum wake turbulence separations assumed in the models were based on FAA Order JO 7110.65W, which classified aircraft as “Heavy” (aircraft with MTOW capabilities of at least 300,000 pounds and the B757), “Large” (aircraft with MTOW capabilities between 41,000 pounds and 300,000 pounds), and “Small” (aircraft with MTOW capabilities less than 41,000 pounds). Tables 9 and 10 provide the minimum distance-based and time-based aircraft separations assumed, respectively.

Table 9
Assumed Minimum Distance-Based Aircraft Separations
Seattle-Tacoma International Airport

		Trailing Aircraft		
		Heavy	Large	Small
Leading Aircraft	Heavy	4.0 nmi	5.0 nmi	6.0 nmi
	Large	2.5 nmi	2.5 nmi	4.0 nmi
	Small	2.5 nmi	2.5 nmi	2.5 nmi

Source: Adapted from FAA Order JO 7110.65W.

Table 10
Assumed Minimum Time-Based Aircraft Separations
Seattle-Tacoma International Airport

		Trailing Aircraft		
		Heavy	Large	Small
Leading Aircraft	Heavy	90 sec	120 sec	120 sec
	Large	60 sec	60 sec	90 sec
	Small	60 sec	60 sec	60 sec

Source: Adapted from FAA Order JO 7110.65W.

Under visual conditions, controllers may grant pilots a visual approach clearance. When a pilot accepts responsibility to maintain separation under this clearance, separations tend to compress below the minimum standards. Therefore, the minimum distance-based separations in Table 11 were assumed between arrivals in the South VMC and North VMC models.

Table 11
Assumed Minimum Distance-Based Aircraft Separations (VMC)
Seattle-Tacoma International Airport

		Trailing Aircraft		
		Heavy	Large	Small
Leading Aircraft	Heavy	2.7 nmi	3.6 nmi	4.5 nmi
	Large	1.9 nmi	1.9 nmi	2.7 nmi
	Small	1.9 nmi	1.9 nmi	1.9 nmi

Source: LeighFisher analysis.

Typically, controllers add a buffer on top of the minimum radar separations to reduce the risk of an operational error. The sizes of these buffers depend on the level of air traffic control equipment, technologies, procedures, and staff experience. Buffers may also be adjusted as a means of regulating runway throughput. For this modeling effort, the ~5% operational efficiency gains were primarily simulated by reducing the buffers on top of minimum aircraft separations. Table 12 lists the buffers assumed for both distance-based and time-based separations.

Table 12
Simulated Aircraft Separation Buffers
Seattle-Tacoma International Airport

	No Action			Proposed Action		
	Operating Scenario	Distance	Time	Operating Scenario	Distance	Time
2027	South VMC	+0.7 nmi	+0.0 min*	South VMC	+0.7 nmi	+0.0 min*
	South MMC	+0.5 nmi	+0.0 min*	South MMC	+0.5 nmi	+0.0 min*
	South IMC	+0.5 nmi	+0.1 min	South IMC	+0.5 nmi	+0.1 min
	North VMC	+0.6 nmi	+0.0 min*	North VMC	+0.5 nmi	+0.0 min*
	North IMC	+1.4 nmi	+0.0 min	North IMC	+1.25 nmi	+0.0 min
	Operating Scenario	Distance	Time	Operating Scenario	Distance	Time
2032	South VMC	+0.8 nmi	+0.0 min*	South VMC	+0.7 nmi	+0.0 min*
	South MMC	+0.5 nmi	+0.0 min*	South MMC	+0.5 nmi	+0.0 min*
	South IMC	+0.6 nmi	+0.1 min	South IMC	+0.6 nmi	+0.1 min
	North VMC	+0.7 nmi	+0.0 min*	North VMC	+0.5 nmi	+0.0 min*
	North IMC	+1.4 nmi	+0.0 min	North IMC	+1.25 nmi	+0.0 min

*Note: Buffer for time-based separation behind "Light" and "Medium Light" aircraft was -0.2 min in VMC models and -0.1 min in South MMC.
Source: LeighFisher.

FAA Order JO 7110.65W was the governing document for wake turbulence separation standards at SEA at the time of previous modeling efforts. At the time of the Environmental Review Airside Modeling, the governing document for such standards at SEA was Order JO 7110.126A. These updated standards classify aircraft according to nine types ("A" through "I") instead of three. However, for the purposes of the Environmental Review Airside Modeling, the minimum wake turbulence separations were not updated for two reasons:

1. The previous model calibration was assumed to be valid
2. Changes in wake turbulence separation standards were assumed to be included in the ~5% operational efficiency gains

Indeed, based on a comparison between the minimum distance-based separation standards for the aircraft types in the design day flight schedules under JO 7110.65W and JO 7110.126A, most of the differences between the two sets of standards result in lower minimum separation standards under JO 7110.126A. Table 13 on the following page provides a summary of this comparison.

Table 13

Comparison of Minimum Aircraft Separation Standards Between JO 7110.65W and JO 7110.126A

Seattle-Tacoma International Airport

Leader			Follower						
			A330/A340/A350/ B747/B777/B787	A306/B767/ DC10/MD11	B757	A220/A320/ B737/DH8D	CRJ/E175	CL30/FA50	BE99/Cessna/ PA31
			Heavy B	Heavy C	Heavy E	Large F	Large G	Small H	Small I
Leader	A330/A340/A350/ B747/B777/B787	Heavy B	4 / 3	4 / 4	4 / 5	5 / 5	5 / 5	6 / 5	6 / 6
Leader	A306/B767/ DC10/MD11	Heavy C	4 / 2.5	4 / 2.5	4 / 3.5	5 / 3.5	5 / 3.5	6 / 5	6 / 6
Leader	B757	Heavy E	4 / 2.5	4 / 2.5	4 / 2.5	5 / 2.5	5 / 2.5	6 / 2.5	6 / 4
Leader	A220/A320/ B737/DH8D	Large F	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	4 / 2.5	4 / 4
Leader	CRJ/E175	Large G	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	4 / 2.5	4 / 2.5
Leader	CL30/FA50	Small H	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5
Leader	BE99/Cessna/ PA31	Small I	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5	2.5 / 2.5

Note 1: Each 2x2 sub-matrix includes the minimum required separation for a given leader-follower pair of aircraft types. The upper left entry corresponds to the minimum aircraft wake turbulence separation required under JO 7110.65W; and the bottom right entry corresponds to the separation required under JO 7110.126A. The corresponding row and column headers indicate the aircraft wake turbulence classification under the respective Orders.

Note 2: Blue-highlighted 2x2 sub-matrices correspond to aircraft types in the DDFS for which the minimum required aircraft separation is greater in JO 7110.65W than in JO 7110.126A. That is, the modeled aircraft separation is more conservative than the current standard. Red-highlighted 2x2 sub-matrices correspond to aircraft types in the DDFS for which the minimum required aircraft separation is greater in JO 7110.126A than in JO 7110.65W.

Source: LeighFisher; adapted from FAA Order JO 7110.65W and FAA Order JO 7110.126A.

4 RESULTS

The following simulation metrics were produced for the purposes of the environmental analysis:

- Annualized average taxi-in times
    - Airport-wide, separated into unimpeded and ground delay components
    - Passenger arrivals
    - Passenger arrivals using the new north terminal
    - Passenger arrivals not using the new north terminal
    - Cargo arrivals
    - General aviation arrivals
- Annualized average taxi-out times
    - Airport-wide, separated into unimpeded, taxi-out delay, and queueing delay components
    - Passenger departures
    - Passenger departures using the new north terminal
    - Passenger departures not using the new north terminal
    - Cargo departures
    - General aviation departures
- Annualized average departure gate delay
- Annualized average taxi delay for each runway end and operation type (arrival/departure)
- Flights scheduled to occur in daytime hours (7:00 AM—9:59 PM) but were simulated to occur in nighttime hours (10:00 PM—6:59 AM)
- Flights scheduled to occur in nighttime hours but were simulated to occur in daytime hours
- Flights terminated
- Simulated runway use per operation type (arrival/departure)

A "terminated" flight is a flight in the schedule which TAAM cannot successfully simulate to completion. It is not equivalent to an airline cancelation of a flight. Flight cancelations were not simulated.

4.1 2027 No Action

The subsequent eight tables summarize the results of the 2027 No Action models. Table 14 presents the average taxi-in times, taxi-out times, and departure gate delay. Table 15 presents the average taxi delay per runway end. Table 16 presents the number of flights pushed from daytime to nighttime hours, pushed from nighttime to daytime hours, and terminated. Each of these tables contains the metrics for each of the five 2027 No Action models as well as the annualized metrics. Annualization was conducted using the weights shown in Table 3 of Section 2.3. Tables 17 through 21 present the input and output runway use for each 2027 No Action model.

Table 14
2027 No Action: Average Taxi-In Times, Taxi-Out Times, and Departure Gate Delay
Seattle-Tacoma International Airport

	South VMC	South MMC	South IMC	North VMC	North IMC	Annualized
Average Taxi-In						
Overall						
Unimpeded	5.48	5.37	5.41	6.54	6.59	5.76
Ground Delay	1.70	2.32	4.40	3.52	1.63	2.80
Total	7.18	7.69	9.81	10.06	8.23	8.56
Passenger						
Overall	7.14	7.71	9.68	10.19	8.27	8.55
New Terminal	N/A	N/A	N/A	N/A	N/A	N/A
Other	7.14	7.71	9.68	10.19	8.27	8.55
Cargo	8.84	8.06	14.63	7.56	7.66	9.53
General Aviation	3.85	3.90	3.50	5.57	4.99	4.27
Average Taxi-Out						
Overall						
Unimpeded	9.18	8.85	8.94	8.05	8.13	8.76
Taxi-Out Delay	3.83	4.14	11.25	7.12	12.07	6.47
Queueing Delay	1.21	1.09	1.69	1.39	2.67	1.38
Total	14.22	14.08	21.87	16.56	22.88	16.61
Passenger						
Overall	14.50	14.29	22.29	16.45	22.82	16.80
New Terminal	N/A	N/A	N/A	N/A	N/A	N/A
Other	14.50	14.29	22.29	16.45	22.82	16.80
Cargo	7.64	8.48	12.24	19.27	24.36	12.34
General Aviation	9.04	8.82	13.73	18.14	24.49	12.80
Average Departure Gate Delay	2.22	4.49	7.85	10.18	51.14	7.27

Note: All times are given in minutes.
Source: LeighFisher, April 2020.

Table 15
2027 No Action: Average Taxi Delay Per Runway End
Seattle-Tacoma International Airport

	16L	16C	16R	34R	34C	34L
South VMC						
Arrival	1.98		1.69			
Departure	5.63	4.63				
South MMC						
Arrival	1.88		2.35			
Departure	6.07	2.59				
South IMC						
Arrival	4.82		4.38			
Departure	12.94					
North VMC						
Arrival				2.32		3.60
Departure				8.51		
North IMC						
Arrival				3.36		1.60
Departure				14.75		
Annualized						
Arrival	1.96		1.82	0.71		0.99
Departure	5.51	2.09		2.67		

Note: All times are given in minutes.
Source: LeighFisher, April 2020.

Table 16
2027 No Action: Schedule Changes
Seattle-Tacoma International Airport

	Daytime pushed to Nighttime	Nighttime pushed to Daytime	Terminations
South VMC			
Arrival	8	0	0
Departure	4	1	
South MMC			
Arrival	11	1	0
Departure	8	2	
South IMC			
Arrival	10	1	0
Departure	12	3	
North VMC			
Arrival	6	0	0
Departure	6	3	
North IMC			
Arrival	57	1	0
Departure	73	3	
Annualized			
Arrival	9.8	0.4	0.0
Departure	8.7	2.1	

Note: "Daytime" is defined as 07:00 to 21:59; "Nighttime" is defined as after 22:00 or before 06:59.
Source: LeighFisher, April 2020.

Table 17
2027 South VMC No Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
16L	75%			70%			5%
16C							
16R	25%	100%	100%	30%	100%	100%	95%
Departures							
16L	100%	40%	40%	100%	37%	33%	41%
16C		60%	60%		63%	67%	59%
16R							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 18
2027 South MMC No Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
16L	75%			70%			5%
16C							
16R	25%	100%	100%	30%	100%	100%	95%
Departures							
16L	100%	75%	75%	100%	75%	33%	76%
16C		25%	25%		25%	67%	24%
16R							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 19
2027 South IMC No Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
16L	75%			70%			5%
16C							
16R	25%	100%	100%	30%	100%	100%	95%
Departures							
16L	100%	100%	100%	100%	100%	100%	100%
16C							
16R							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 20
2027 North VMC No Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
34R	75%			80%			6%
34C							
34L	25%	100%	100%	20%	100%	100%	94%
Departures							
34R	100%	100%	100%	100%	100%	100%	100%
34C							
34L							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 21
2027 North IMC No Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
34R	25%			32%			2%
34C							
34L	75%	100%	100%	68%	100%	100%	98%
Departures							
34R	100%	100%	100%	100%	100%	100%	100%
34C							
34L							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

4.2 2027 Proposed Action

The subsequent eight tables summarize the results of the 2027 Proposed Action models. Table 22 presents the average taxi-in times, taxi-out times, and departure gate delay. Table 23 presents the average taxi delay per runway end. Table 24 presents the number of flights pushed from daytime to nighttime hours, pushed from nighttime to daytime hours, and terminated. Each of these tables contains the metrics for each of the five 2027 Proposed Action models as well as the annualized metrics. Annualization was conducted using the weights shown in Table 3 of Section 2.3. Tables 25 through 29 present the input and output runway use for each 2027 Proposed Action model.

Table 22
2027 Proposed Action: Average Taxi-In Times, Taxi-Out Times, and Departure Gate Delay
Seattle-Tacoma International Airport

	South VMC	South MMC	South IMC	North VMC	North IMC	Annualized
Average Taxi-In						
Overall						
Unimpeded	5.63	5.54	5.54	6.41	6.47	5.83
Ground Delay	1.37	2.25	3.75	3.48	1.64	2.58
Total	7.00	7.79	9.29	9.89	8.11	8.41
Passenger						
Overall	6.97	7.79	9.24	10.00	8.15	8.42
New Terminal	7.49	8.16	9.33	9.00	7.91	8.40
Other	6.86	7.71	9.22	10.20	8.21	8.42
Cargo	8.26	8.64	11.63	7.74	7.46	8.89
General Aviation	3.41	3.28	3.28	5.95	4.69	4.09
Average Taxi-Out						
Overall						
Unimpeded	8.74	8.45	8.59	8.17	8.14	8.51
Taxi-Out Delay	3.40	4.63	9.71	8.62	16.39	6.58
Queueing Delay	1.19	1.10	1.61	1.49	2.98	1.40
Total	13.34	14.18	19.90	18.28	27.51	16.49
Passenger						
Overall	13.59	14.34	20.32	18.28	27.24	16.67
New Terminal	11.49	12.39	18.99	18.54	26.79	15.42
Other	14.02	14.70	20.57	18.22	27.34	16.92
Cargo	7.41	10.91	10.42	18.23	33.51	12.08
General Aviation	9.77	9.56	11.91	18.96	34.33	13.32
Average Departure Gate Delay	2.17	6.22	5.87	4.79	48.85	5.53

Note: All times are given in minutes.
Source: LeighFisher, April 2020.

Table 23
2027 Proposed Action: Average Taxi Delay Per Runway End
Seattle-Tacoma International Airport

	16L	16C	16R	34R	34C	34L
South VMC						
Arrival	1.95		1.34			
Departure	5.09	4.34				
South MMC						
Arrival	1.89		2.27			
Departure	6.29	3.98				
South IMC						
Arrival	3.04		3.79			
Departure	11.32					
North VMC						
Arrival				2.53		3.53
Departure				10.11		
North IMC						
Arrival				3.40		1.62
Departure				19.37		
Annualized						
Arrival	1.59		1.56	0.76		0.97
Departure	5.01	2.12		3.23		

Note: All times are given in minutes.
Source: LeighFisher, April 2020.

Table 24
2027 Proposed Action: Schedule Changes
Seattle-Tacoma International Airport

	Daytime pushed to Nighttime	Nighttime pushed to Daytime	Terminations
South VMC			
Arrival	8	0	0
Departure	4	3	
South MMC			
Arrival	11	0	0
Departure	6	2	
South IMC			
Arrival	9	0	0
Departure	7	3	
North VMC			
Arrival	6	1	0
Departure	7	4	
North IMC			
Arrival	54	1	0
Departure	86	6	
Annualized			
Arrival	9.5	0.3	0.0
Departure	8.1	3.2	

Note: "Daytime" is defined as 07:00 to 21:59; "Nighttime" is defined as after 22:00 or before 06:59.
Source: LeighFisher, April 2020.

Table 25
2027 South VMC Proposed Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
16L	75%			65%			5%
16C							
16R	25%	100%	100%	35%	100%	100%	95%
Departures							
16L	100%	40%	40%	100%	37%	33%	41%
16C		60%	60%		63%	67%	59%
16R							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 26
2027 South MMC Proposed Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
16L	75%			71%			5%
16C							
16R	25%	100%	100%	29%	100%	100%	95%
Departures							
16L	100%	75%	75%	100%	75%	33%	76%
16C		25%	25%		25%	67%	24%
16R							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 27
2027 South IMC Proposed Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
16L	75%			71%			5%
16C							
16R	25%	100%	100%	29%	100%	100%	95%
Departures							
16L	100%	100%	100%	100%	100%	100%	100%
16C							
16R							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 28
2027 North VMC Proposed Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
34R	75%			73%			5%
34C							
34L	25%	100%	100%	27%	100%	100%	95%
Departures							
34R	100%	100%	100%	100%	100%	100%	100%
34C							
34L							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 29
2027 North IMC Proposed Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
34R	25%			23%			2%
34C							
34L	75%	100%	100%	77%	100%	100%	98%
Departures							
34R	100%	100%	100%	100%	100%	100%	100%
34C							
34L							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

4.3 2032 No Action

The subsequent eight tables summarize the results of the 2032 No Action models. Table 30 presents the average taxi-in times, taxi-out times, and departure gate delay. Table 31 presents the average taxi delay per runway end. Table 32 presents the number of flights pushed from daytime to nighttime hours, pushed from nighttime to daytime hours, and terminated. Each of these tables contains the metrics for each of the five

2032 No Action models as well as the annualized metrics. Annualization was conducted using the weights shown in Table 3 of Section 2.3. Tables 33 through 37 present the input and output runway use for each 2032 No Action model.

Table 30
2032 No Action: Average Taxi-In Times, Taxi-Out Times, and Departure Gate Delay
Seattle-Tacoma International Airport

	South VMC	South MMC	South IMC	North VMC	North IMC	Annualized
Average Taxi-In						
Overall						
Unimpeded	5.55	5.44	5.45	6.59	6.53	5.82
Ground Delay	1.87	2.41	4.59	3.82	1.27	2.97
Total	7.42	7.86	10.04	10.40	7.81	8.79
Passenger						
Overall	7.38	7.87	9.92	10.52	7.84	8.79
New Terminal	N/A	N/A	N/A	N/A	N/A	N/A
Other	7.38	7.87	9.92	10.52	7.84	8.79
Cargo	9.16	8.29	14.59	7.87	7.50	9.75
General Aviation	3.33	3.31	3.31	4.96	4.71	3.79
Average Taxi-Out						
Overall						
Unimpeded	9.16	8.86	8.94	8.09	8.12	8.77
Taxi-Out Delay	4.14	3.79	12.18	6.94	11.64	6.67
Queueing Delay	1.20	1.04	1.62	1.36	2.86	1.35
Total	14.50	13.69	22.74	16.39	22.63	16.79
Passenger						
Overall	14.77	13.89	23.20	16.32	22.58	16.96
New Terminal	N/A	N/A	N/A	N/A	N/A	N/A
Other	14.77	13.89	23.20	16.32	22.58	16.99
Cargo	7.53	8.33	10.97	18.63	23.77	11.71
General Aviation	9.70	10.40	13.61	14.78	23.95	12.33
Average Departure Gate Delay	2.68	4.59	11.81	10.16	46.73	8.05

Note: All times are given in minutes.
Source: LeighFisher, April 2020.

Table 31
2032 No Action: Average Taxi Delay Per Runway End
Seattle-Tacoma International Airport

	16L	16C	16R	34R	34C	34L
South VMC						
Arrival	2.27		1.85			
Departure	6.08	4.80				
South MMC						
Arrival	1.78		2.45			
Departure	5.61	2.38				
South IMC						
Arrival	4.12		4.61			
Departure	13.80					
North VMC						
Arrival				2.09		3.92
Departure				8.30		
North IMC						
Arrival				4.11		1.21
Departure				14.50		
Annualized						
Arrival	1.91		1.94	0.67		1.06
Departure	5.79	2.31		2.61		

Note: All times are given in minutes.
Source: LeighFisher, April 2020.

Table 32

2032 No Action: Schedule Changes

Seattle-Tacoma International Airport

	Daytime pushed to Nighttime	Nighttime pushed to Daytime	Terminations
South VMC			
Arrival	7	0	0
Departure	4	2	
South MMC			
Arrival	12	0	0
Departure	6	1	
South IMC			
Arrival	13	0	0
Departure	11	3	
North VMC			
Arrival	6	1	0
Departure	7	3	
North IMC			
Arrival	70	1	0
Departure	78	3	
Annualized			
Arrival	10.5	0.3	0.0
Departure	8.7	2.4	

Note: "Daytime" is defined as 07:00 to 21:59; "Nighttime" is defined as after 22:00 or before 06:59.
Source: LeighFisher, April 2020.

Table 33

2032 South VMC No Action: Input and Output Runway Use

Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
16L	75%			69%			5%
16C							
16R	25%	100%	100%	31%	100%	100%	95%
Departures							
16L	100%	40%	40%	100%	37%	50%	42%
16C		60%	60%		63%	50%	58%
16R							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 34
2032 South MMC No Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
16L	75%			73%			5%
16C							
16R	25%	100%	100%	27%	100%	100%	95%
Departures							
16L	100%	75%	75%	100%	75%	33%	76%
16C		25%	25%		25%	67%	24%
16R							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 35
2032 South IMC No Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
16L	75%			69%			5%
16C							
16R	25%	100%	100%	31%	100%	100%	95%
Departures							
16L	100%	100%	100%	100%	100%	100%	100%
16C							
16R							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 36
2032 North VMC No Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
34R	75%			80%			6%
34C							
34L	25%	100%	100%	20%	100%	100%	94%
Departures							
34R	100%	100%	100%	100%	100%	100%	100%
34C							
34L							

Note: “Heavy” aircraft have MTOW capabilities of at least 300,000 pounds. “Medium” aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. “Small” aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 37
2032 North IMC No Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
34R	25%			33%			2%
34C							
34L	75%	100%	100%	67%	100%	100%	98%
Departures							
34R	100%	100%	100%	100%	100%	100%	100%
34C							
34L							

Note: “Heavy” aircraft have MTOW capabilities of at least 300,000 pounds. “Medium” aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. “Small” aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

4.4 2032 Proposed Action

The subsequent eight tables summarize the results of the 2032 Proposed Action models. Table 38 presents the average taxi-in times, taxi-out times, and departure gate delay. Table 39 presents the average taxi delay per runway end. Table 40 presents the number of flights pushed from daytime to nighttime hours, pushed from nighttime to daytime hours, and terminated. Each of these tables contains the metrics for each of the five 2032 Proposed Action models as well as the annualized metrics. Annualization was conducted using the weights shown in Table 3 of Section 2.3. Tables 41 through 45 present the input and output runway use for each 2032 Proposed Action model.

Table 38
2032 Proposed Action: Average Taxi-In Times, Taxi-Out Times, and Departure Gate Delay
Seattle-Tacoma International Airport

	South VMC	South MMC	South IMC	North VMC	North IMC	Annualized
Average Taxi-In						
Overall						
Unimpeded	5.69	5.56	5.81	6.42	6.52	5.91
Ground Delay	1.78	2.20	4.50	3.90	1.61	2.93
Total	7.48	7.76	10.31	10.32	8.13	8.84
Passenger						
Overall	7.44	7.76	9.88	10.39	8.17	8.76
New Terminal	7.61	8.27	9.86	9.56	7.51	8.65
Other	7.40	7.65	9.88	10.57	8.31	8.79
Cargo	9.16	8.45	24.01	9.15	7.70	12.00
General Aviation	3.79	3.28	3.28	5.88	4.69	4.19
Average Taxi-Out						
Overall						
Unimpeded	8.74	8.46	8.53	8.15	8.22	8.50
Taxi-Out Delay	3.68	4.34	13.56	11.80	15.89	8.24
Queueing Delay	1.16	1.16	1.83	1.65	2.90	1.48
Total	13.59	13.96	23.92	16.32	27.01	18.21
Passenger						
Overall	13.81	14.18	24.24	21.43	26.78	18.33
New Terminal	11.97	11.99	22.51	21.68	28.18	17.49
Other	14.18	14.62	24.59	23.10	26.47	18.50
Cargo	8.36	8.49	16.37	21.06	32.38	15.62
General Aviation	9.13	9.51	16.24	27.13	32.28	14.04
Average Departure Gate Delay	2.58	5.66	18.73	19.56	50.99	11.28

Note: All times are given in minutes.
Source: LeighFisher, April 2020.

Table 39
2032 Proposed Action: Average Taxi Delay Per Runway End
Seattle-Tacoma International Airport

	16L	16C	16R	34R	34C	34L
South VMC						
Arrival	2.07		1.77			
Departure	5.51	4.34				
South MMC						
Arrival	2.02		2.22			
Departure	6.40	2.75				
South IMC						
Arrival	5.00		4.48			
Departure	15.38					
North VMC						
Arrival				3.34		3.94
Departure				13.45		
North IMC						
Arrival				2.22		1.60
Departure				18.79		
Annualized						
Arrival	2.05		1.85	0.94		1.08
Departure	6.00	2.00		4.08		

Note: All times are given in minutes.
Source: LeighFisher, April 2020.

Table 40
2032 Proposed Action: Schedule Changes
Seattle-Tacoma International Airport

	Daytime pushed to Nighttime	Nighttime pushed to Daytime	Terminations
South VMC			
Arrival	7	0	0
Departure	5	4	
South MMC			
Arrival	16	0	1
Departure	10	4	
South IMC			
Arrival	16	0	1
Departure	17	4	
North VMC			
Arrival	6	0	0
Departure	11	5	
North IMC			
Arrival	72	1	0
Departure	95	6	
Annualized			
Arrival	11.7	0.0	0.3
Departure	12.4	4.3	

Note: "Daytime" is defined as 07:00 to 21:59; "Nighttime" is defined as after 22:00 or before 06:59.
Source: LeighFisher, April 2020.

Table 41
2032 South VMC Proposed Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
16L	75%			72%			5%
16C							
16R	25%	100%	100%	28%	100%	100%	95%
Departures							
16L	100%	40%	40%	100%	39%	33%	43%
16C		60%	60%		61%	67%	57%
16R							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 42
2032 South MMC Proposed Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
16L	75%			75%			6%
16C							
16R	25%	100%	100%	25%	100%	100%	94%
Departures							
16L	100%	75%	75%	100%	74%	22%	75%
16C		25%	25%		26%	78%	25%
16R							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 43
2032 South IMC Proposed Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
16L	75%			72%			5%
16C							
16R	25%	100%	100%	28%	100%	100%	95%
Departures							
16L	100%	100%	100%	100%	100%	100%	100%
16C							
16R							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 44
2032 North VMC Proposed Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
34R	75%			79%			6%
34C							
34L	25%	100%	100%	21%	100%	100%	94%
Departures							
34R	100%	100%	100%	100%	100%	100%	100%
34C							
34L							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

Table 45
2032 North IMC Proposed Action: Input and Output Runway Use
Seattle-Tacoma International Airport

	Input			Output			
	Heavy	Medium	Small	Heavy	Medium	Small	Total
Arrival							
34R	25%			22%			2%
34C							
34L	75%	100%	100%	78%	100%	100%	98%
Departures							
34R	100%	100%	100%	100%	100%	100%	100%
34C							
34L							

Note: "Heavy" aircraft have MTOW capabilities of at least 300,000 pounds. "Medium" aircraft have MTOW capabilities of at least 41,000 pounds and less than 300,000 pounds. "Small" aircraft have MTOW capabilities of less than 41,000 pounds.
Source: LeighFisher, April 2020.

5 COMPARISON OF NO ACTION AND PROPOSED ACTION

The key simulation metrics for the EA—taxi-in and taxi-out times—differ for the four scenarios simulated. Multiple factors may influence simulated taxi times, including the point-to-point taxi paths taken, the volume of aircraft taxiing, interactions between taxiing aircraft, and departure queue length limitations, among other factors. Combinations of these factors may also be dependent on each other, interacting to jointly influence taxi times.

Taxi paths taken. The Proposed Action scenario contains additional infrastructure that changes aircraft taxi flow patterns, including the new north terminal, a new high-speed exit, an additional runway crossing point, and the Taxiway A/B extension. By changing taxi flow patterns, this infrastructure affects taxi times. The effects of the new north terminal are perhaps the most influential on taxi times, as suggested by the simulated unimpeded taxi times. In all South flow models, average unimpeded taxi-in times were higher and average unimpeded taxi-out times were lower in the Proposed Action scenario. Similarly, in all North flow models, average unimpeded taxi-in times were lower and average unimpeded taxi-out times were higher in the Proposed Action scenario. These relationships are expected given the new north terminal's location relative to arrival runway exits and departure runway entrances.

Volume of aircraft taxiing. The 2027 Proposed Action models accommodated an AAD flight schedule with 25 more operations than the 2027 No Action models (approximately 1.8% more activity). The 2032 Proposed Action models accommodated an AAD flight schedule with 51 more operations than the 2032 No Action models (approximately 3.6% more activity). These increased volumes of airport demand affected the number of aircraft simultaneously taxiing on the airfield, resulting in increased interactions between taxiing aircraft.

Interactions between taxiing aircraft. If more aircraft are simultaneously taxiing on similar areas of the airfield, the likelihood of higher taxi times increases due to more frequent yielding or stopping-and-starting. Similarly, with fewer aircraft simultaneously taxiing, the likelihood of higher taxi times decreases.

Departure queue length limitations. In all models, the maximum number of aircraft permitted to simultaneously taxi for departure was limited. This was done to ensure that the physical length of the departure queue would not block aircraft gates or movement areas. A higher maximum could result in longer taxi-out times, as aircraft joining the departure queue would have more aircraft ahead of them in the queue. However, a higher maximum could also cause other effects that are not captured by taxi time statistics, such as lower gate hold times and consequently higher gate availability. The possible effects of the limits on departure queue length are evident in the North flow models, where the maximum departure queue length was higher in the Proposed Action scenario due to the Taxiway A/B extension.

Qualitatively, the Proposed Action scenario overall improves the operational flexibility of the airfield. It enables more space for aircraft in the departure queue, greater diversity in use of arrival runway exits, and lesser use of stand-off positions while an aircraft waits for a gate upon arrival. These improvements allow for the Airport to accept more hourly arrivals, possibly resulting in more aircraft taxiing on the ground simultaneously. While this is likely to increase taxi times, other effects of this increased upstream arrival capacity may not be captured by taxi time statistics, such as lower airspace delay.

6 HYBRID TERMINAL ALTERNATIVE

The EA also considered a "Hybrid Terminal" alternative in approximately the same location on the Airport as the new North Terminal in the Proposed Action. The Hybrid Terminal alternative included a different layout of the new 19 contact gates and the hardstand positions as compared to the Proposed Action. This option was not subjected to the same analysis as the Proposed Action alternative, including airfield simulation. While taxi times would likely have differed between the Proposed Action and the Hybrid Terminal alternatives, the Hybrid Terminal alternative was not simulated because the environmental and planning teams agreed it was unlikely to result in meaningful differences in the air quality and noise analyses.

B-2 Operational Data

Sustainable Airport Master Plan – Near-Term Projects

Noise Technical Report

March 2024

PREPARED FOR
Port of Seattle

PREPARED BY
Landrum & Brown, Incorporated

Contents

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1. Introduction

Landrum & Brown prepared this Noise Technical Report to document the potential operational noise impacts resulting from the Sustainable Airport Master Plan (SAMP) Near-Term Projects (NTPs) at the Seattle-Tacoma International Airport (SEA or Airport). This report also provides information related to noise-compatible land use.

1.1 Description of the Proposed Action

The Port of Seattle (Port) identified a set of NTPs to address the near-term activity levels projected to occur at the Airport. The NTPs include 30 projects that would improve efficiency, safety, access to the Airport, and support facilities for airlines and the Airport. The NTPs (as a whole) are the Proposed Action and are shown on **Exhibit 1-1.**

In addition to the Proposed Action, the Environmental Assessment (EA) also evaluated a Hybrid Terminal Option. For the purposes of modeling aircraft noise, the Hybrid Terminal Option resulted in no differences from the Proposed Action. Therefore, the methodology, input data, and results presented in this technical report for the Proposed Action are also representative of the Hybrid Terminal Option.

1.2 Regulatory Setting

The Federal Aviation Administration (FAA) has laws and regulations that provide a basis for local development of airport plans, analysis of potential impacts from airport development, and compatibility policies. The *Airport and Airway Improvement Act of 1982* authorized funding for noise mitigation and noise compatibility planning and projects, and established certain requirements related to noise-compatible land uses for federally funded airport development projects. The 1979 *Aviation Safety and Noise Abatement Act* directs the FAA to establish, by regulation, a single system for measuring noise and determining the exposure of people to noise and to identify land uses normally compatible with various noise exposures.

This noise analysis was conducted in accordance with FAA Order 1050.1F and its associated desk reference, which specifies a number of requirements for the noise analyses. These include:

- Acceptable noise models to be used and the circumstances under which their use is required;
- The metrics to be used for characterizing the noise environment and quantifying impacts;
- Thresholds of significance for determining whether the effects of an action would constitute a significant impact under National Environmental Policy Act.
-

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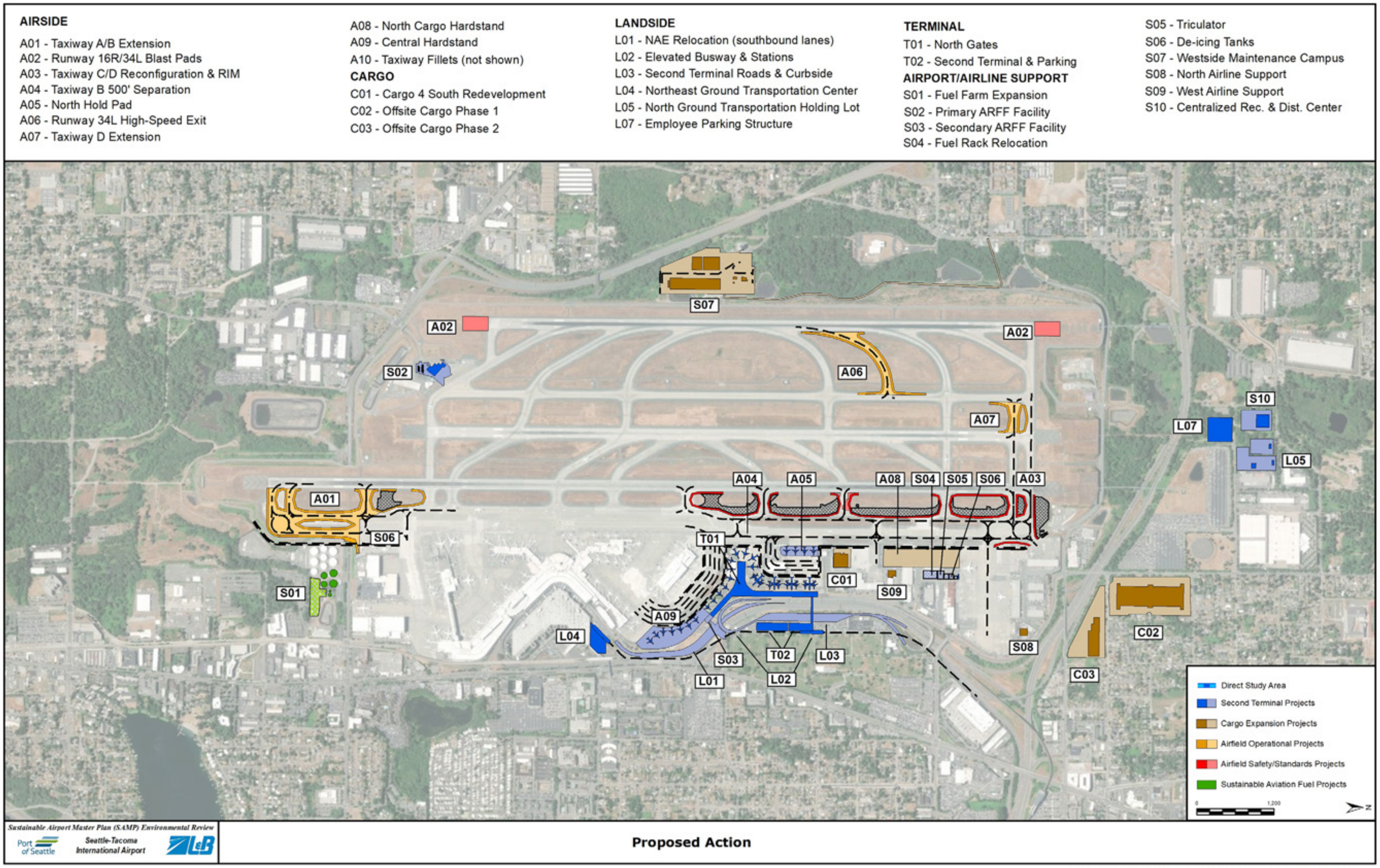
EXHIBIT 1:1: PROPOSED ACTION



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2. Background on Characteristics of Noise

Sound is created by a vibrating source that induces vibrations in the air. The vibration produces alternating bands of relatively dense and sparse particles of air, spreading outward from the source like ripples on a pond. Sound waves dissipate with increasing distance from the source. Sound waves can also be reflected, diffracted, refracted, or scattered. When the source stops vibrating, the sound waves disappear almost instantly and the sound ceases.

Sound conveys information to listeners. It can be instructional, alarming, pleasant and relaxing, or annoying. Identical sounds can be characterized by different people or even by the same person at different times, as desirable or unwanted. Unwanted sound is commonly referred to as “noise.”

Sound can be defined in terms of three components:

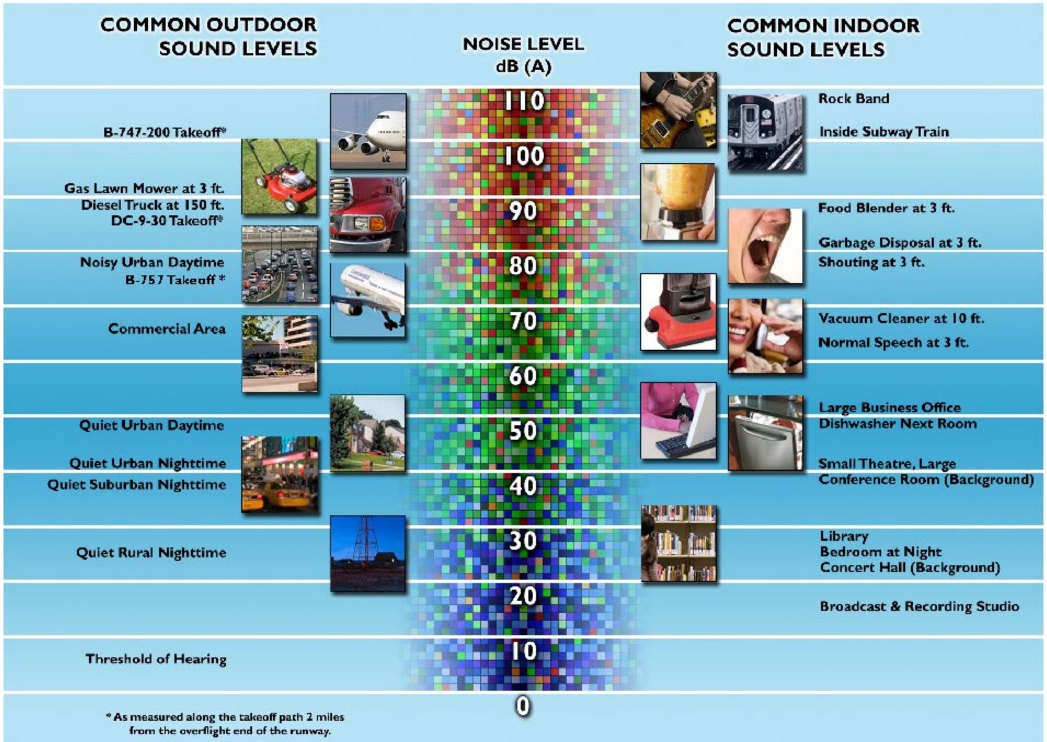
- Level (amplitude)
- Pitch (frequency)
- Duration (time pattern)

2.1 Sound Level

The level of sound is measured by the difference between atmospheric pressure (without the sound) and the total pressure (with the sound). Amplitude of sound is like the relative height of the ripples caused by the stone thrown into the water. Although physicists typically measure pressure using the linear Pascal scale, sound is measured using the logarithmic decibel (dB) scale. This is because the range of sound pressures detectable by the human ear can vary from 1 to 100 trillion units. A logarithmic scale allows us to discuss and analyze noise using numbers that are more manageable. The range of audible sound ranges from approximately 1 to 140 dB, although everyday sounds rarely rise above about 120 dB. The human ear is extremely sensitive to sound pressure fluctuations. A sound of 140 dB, which is sharply painful to humans, contains 100 trillion (10^{14}) times more sound pressure than the least audible sound. **Exhibit 2-1** shows a comparison of common sources of indoor and outdoor sounds measured on the dB scale.

By definition, a 10 dB increase in sound is equal to a tenfold (10^{1}) increase in the mean square sound pressure of the reference sound. A 20 dB increase is a 100-fold (10^{2}) increase in the mean square sound pressure of the reference sound. A 30 dB increase is a 1,000-fold (10^{3}) increase in mean square sound pressure.

EXHIBIT 2-1: COMPARISON OF SOUND



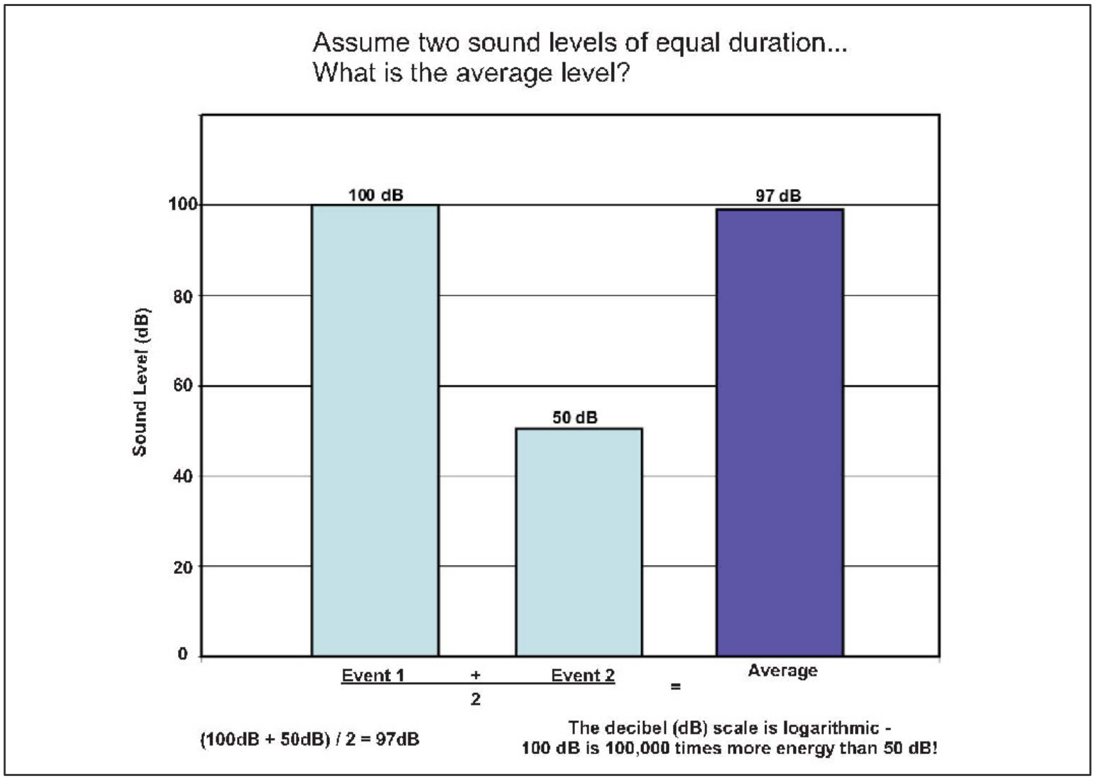
Source: Landrum & Brown

A logarithmic scale requires different mathematics than used with linear scales. The sound pressures of two separate sounds, expressed in dB, are not arithmetically additive. For example, if a sound of 80 dB is added to another sound of 74 dB, the total is a 1 dB increase in the louder sound (81 dB), not the arithmetic sum of 154 dB. If two equally loud noise events occur simultaneously, the sound pressure level from the combined events is 3 dB higher than the level produced by either event alone.

Logarithmic averaging also yields results that are quite different from simple arithmetic averaging. The example shown in **Exhibit 2-2** averages two sound levels of equal duration. One has a maximum sound level (Lmax) of 100 dB, the other 50 dB. Using conventional arithmetic, the average would be 75 dB. Using logarithmic math, the average is 97 dB. This is because 100 dB has far more energy than 50 dB (100,000 times as much) and is overwhelmingly dominant in computing the average of the two sounds.

Human perceptions of changes in sound pressure are less sensitive than a sound level meter. People typically perceive a tenfold increase in sound pressure, a 10 dB increase, as a doubling of loudness. Conversely, a 10 dB decrease in sound pressure is normally perceived as half as loud. In community settings, most people perceive a 3 dB increase in sound pressure (a doubling of the sound pressure or energy) as just noticeable. (In laboratory settings, people with good hearing are able to detect changes in sounds of as little as 1 dB.)

EXHIBIT 2-2: EXAMPLE OF SOUND LEVEL AVERAGING



Source: Landrum & Brown, 2019.

2.2 Sound Frequency

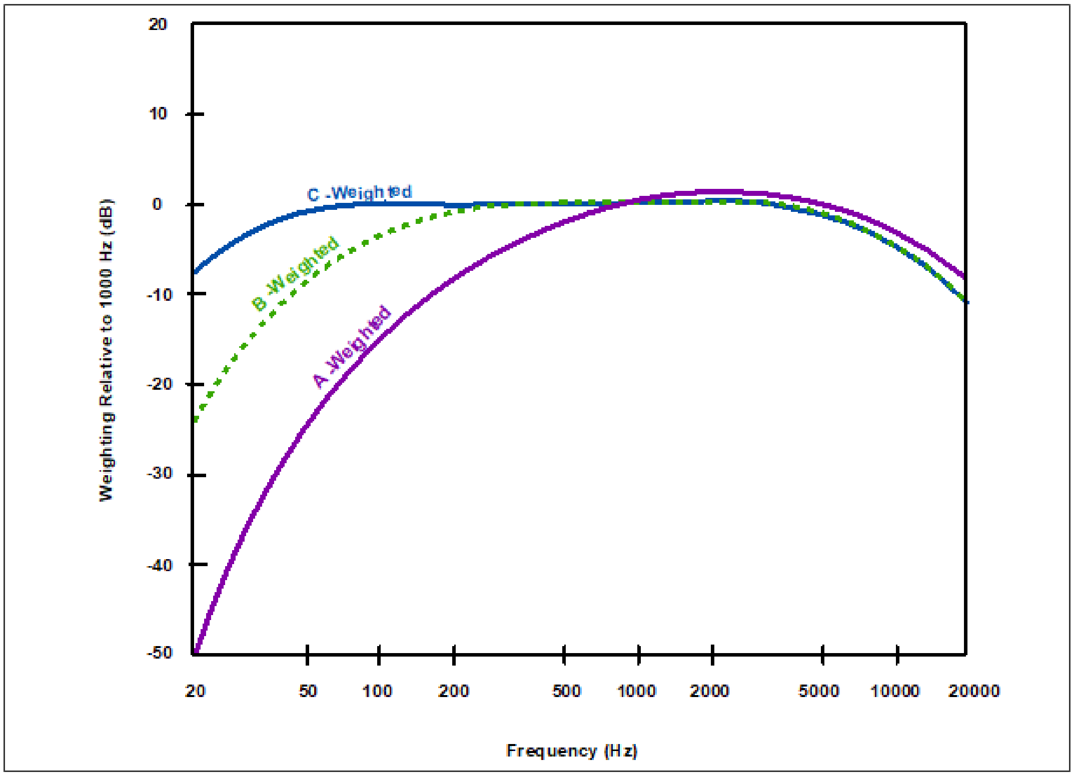
The pitch (or frequency) of sound can vary greatly from a low-pitched rumble to a shrill whistle. If we consider the analogy of ripples in a pond, high frequency sounds are vibrations with tightly spaced ripples, while low rumbles are vibrations with widely spaced ripples. The rate at which a source vibrates determines the frequency. The rate of vibration is measured in units called "Hertz" -- the number of cycles, or waves, per second. One's ability to hear a sound depends greatly on the frequency composition. Humans hear sounds best at frequencies between 1,000 and 6,000 Hertz. Sound at frequencies above 10,000 Hertz (high-pitched hissing) and below 100 Hertz (low rumble) are much more difficult to hear.

When attempting to measure sound in a way that approximates what our ears hear, we must give more weight to sounds at the frequencies we hear well and less weight to sounds at frequencies we do not hear well. Acousticians have developed several weighting scales for measuring sound. The A-weighted scale correlates with the judgments people make about the loudness of sounds. The A-weighted decibel scale (dBA) is used in studies where audible sound is the focus of inquiry. **Exhibit 2-3** shows the A, B, and C sound weighting scale. The U.S. Environmental Protection Agency (USEPA) has recommended the use of the A-weighted decibel scale in studies of environmental noise.[1] Its use is

[1] Information on Levels of Environmental Noise Requisite to Protect Health and Welfare with an Adequate Margin of Safety. U.S. Environmental Protection Agency, Office of Noise Abatement and Control. 1974, P. A-10.

required by the FAA in airport noise studies.[2] For the purposes of this analysis, dBA was used as the noise metric and dB and dBA are used interchangeably.

EXHIBIT 2-3: SOUND FREQUENCY WEIGHTING CURVES



Source: Landrum & Brown, 2019.

2.3 Duration of Sounds

The duration of sounds – their patterns of loudness and pitch over time – can vary greatly. Sounds can be continuous like a waterfall, impulsive like a firecracker, or intermittent like aircraft overflights. Intermittent sounds are produced for relatively short periods, with the instantaneous sound level during the event roughly appearing as a bell-shaped curve. An aircraft event is characterized by the period during which it rises above the background sound level, reaches its peak, and then recedes below the background level.

2 "Airport Noise Compatibility Planning." 14 CFR Part 150, Sec. A150.3, September 24, 2004.

2.4 Perceived Noise Level

Perceived noisiness is another method of rating sound developed for the assessment of aircraft noise. Perceived noisiness is the subjective measure of the degree to which noise is unwanted or causes annoyance to an individual. To determine perceived noise level, individuals are asked to judge in a laboratory setting when two sounds are equally noisy or disturbing if heard regularly in their own environment. These surveys are inherently subjective and thus subject to greater variability. For example, two separate events of equal noise energy may be perceived differently if one sound is more annoying to the listener than the other.

2.5 Propagation of Noise

Outdoor sound levels decrease as a function of distance from the source, and as a result of wave divergence, atmospheric absorption, and ground attenuation. Sound radiated from a source in a homogeneous and undisturbed manner travels as spherical waves. As the sound wave travels away from the source, the sound energy is distributed over a greater area, dispersing the sound energy of the wave. Spherical spreading of the sound wave reduces the noise level at a rate of 6 dB per doubling of the distance.

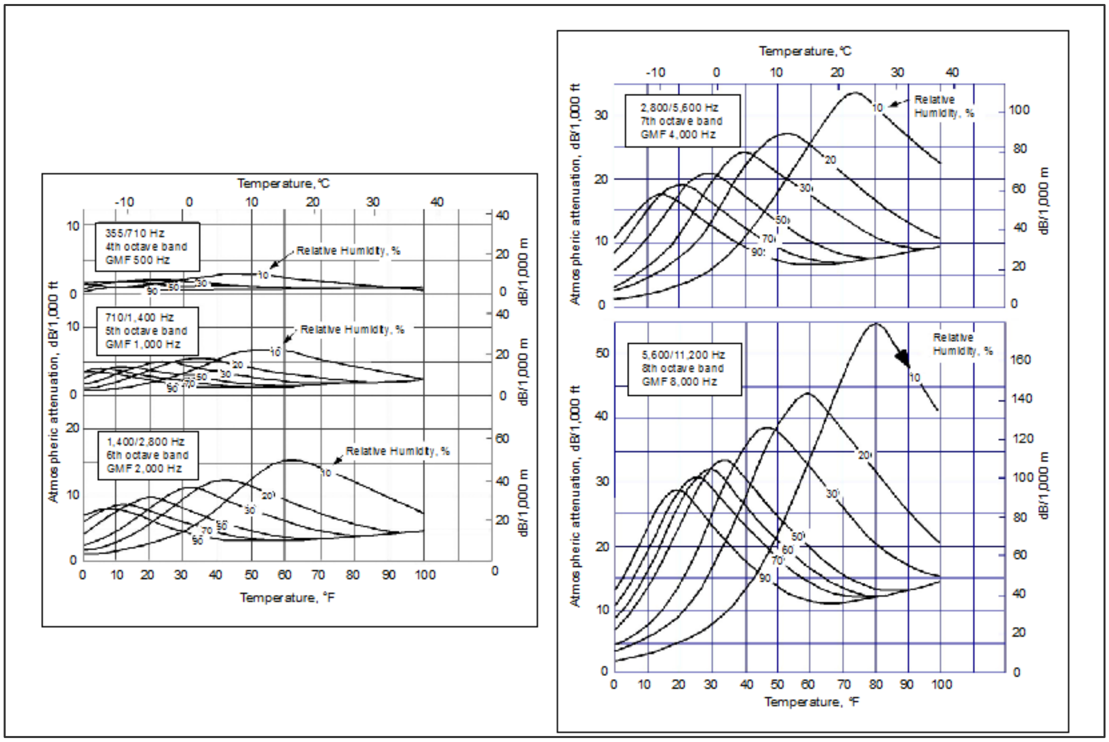
Atmospheric absorption also influences sound levels received by an observer. The greater the distance traveled, the greater the influence of the atmosphere and the resultant fluctuations. Atmospheric absorption becomes important at distances of greater than 1,000 feet. The degree of absorption is a function of the frequency of the sound as well as the humidity and temperature of the air. For example, atmospheric absorption is lowest at high humidity and higher temperatures. **Exhibit 2-4** provides sample atmospheric attenuation graphs. The graphs show noise absorption rates based on temperature, relative humidity, and distance at five different frequency ranges. For example, sounds at a frequency of 2,000 Hz, with a relative humidity of 10 percent and a temperature of 90° Fahrenheit (32° Celsius), will dissipate by 10 dB per for every 1,000 feet (305 meters) from the source.

The rate of atmospheric absorption also varies with sound frequency, and turbulence and gradients of wind. The higher frequencies are more readily absorbed than the lower frequencies. Over large distances, the lower frequencies become the dominant sound as the higher frequencies are attenuated. Certain conditions, such as inversions, can result in higher noise levels than would result from spherical spreading as a result of channeling or focusing the sound waves.

The effect of ground attenuation on noise propagation is a function of the height of the source and/or receiver and the characteristics of the terrain. The closer the source of noise is to the ground, the greater the ground absorption. Terrain consisting of soft surfaces such as vegetation provide for more ground absorption than hard surfaces. Ground attenuation is important for the study of noise from airfield operations (such as thrust reversals) and in the design of noise berms or engine run-up facilities.

These factors are an important consideration for assessing in-flight and ground noise in the Puget Sound area. Atmospheric conditions will play a significant role in affecting the sound levels on a daily basis and how these sounds are perceived by the population.

EXHIBIT 2-4: SOUND ATTENUATION GRAPHS



Source: Beranek, 1981

3. Health Effects of Noise

A considerable amount of research has been conducted over the last 30 years to identify, measure, and quantify the potential effects of aviation noise on health. The various methods by which noise can be measured (e.g., single dose, long-term average, number of events above a certain level, etc.), and difficulties in separating other lifestyle factors from the analysis, increase the complexity of determining the health effects of noise, and have caused considerable variability in the results of past studies. The health effects of noise are often divided into the following topics: hearing loss, sleep disturbance, and speech/communication interference.

3.1 Hearing Loss

The potential for noise-induced hearing loss is commonly associated with occupational noise exposure from working in a noisy work environment or recreational noise such as listening to loud music. Recent studies have concluded that “because environmental noise does not approximate occupational noise levels or recreational noise exposures…it does not have an effect on hearing threshold levels.” Furthermore, “aviation noise does not pose a risk factor for child or adolescent hearing loss, but perhaps other noise sources (personal music devices, concerts, motorcycles, or night clubs) are a main risk factor.”[3] Because aviation noise levels near airports do not approach levels of occupational or

[3] Airport Cooperative Research Program, Transportation Research Board, Effects of Aircraft Noise: Research Update on Selected Topics, 2008.

recreational noise exposures associated with hearing loss, hearing impairment is likely not caused by aircraft noise for populations living near an airport.

3.2 Sleep Disturbance

Sleep disturbance is a common complaint from people who live in the vicinity of an airport. A large amount of research has been published on the topic of sleep disturbance caused by environmental noise. This research has produced variable results due to differing definitions of sleep disturbance, different ways for measuring sleep disturbance (behavioral awakenings or sleep interruption), and different settings in which to measure it (laboratory setting or field setting).

In 1992, the Federal Interagency Committee on Noise (FICON) recommended an interim dose-response curve to predict the percent of the exposed population expected to be awakened percent awakening) as a function of the exposure to single event noise levels expressed in terms of the Sound Exposure Level (SEL). This interim curve was based on statistical adjustment of previous analysis and included data from both laboratory and field studies. In 1997, the Federal Interagency Committee on Aviation Noise (FICAN) recommended a revised sleep disturbance relationship based on data and analysis from three field studies.

Exhibit 3-1 shows the results of the 1992 and 1997 analyses. The top graph shows a comparison of the 1992 FICON and 1997 FICAN curves. The 1997 FICAN curve represents the upper limit of the observed field data and should be interpreted as predicting the "maximum percent of the exposed population expected to be behaviorally awakened" or the "maximum percent awakened" for a given residential population.

In 2008, FICAN recommended the use of a revised method to predict sleep disturbance in terms of percent awakenings based on data published by the American National Standards Institute (ANSI).[4] In contrast to the earlier FICAN recommendation, the 2008 ANSI standard indicates that the probability of awakening is lower for a single noise event in cases where the population is exposed to the given noise source for a long period of time (more than one year) compared to the probability of awakening for sound that is new to an area. In Exhibit 3-1, the lower graph shows these two relationships, with Equation 1 (blue dotted line) representing percent awakenings from long-term noise and Equation B1 (pink dashed line) representing percent awakenings from a new noise source based on the 1997 FICAN results. As shown in this exhibit, at an indoor SEL of 100 dB, the probability of awakenings would be expected to exceed 15 percent for a new noise source; yet for long-term noise sources, the probability of awakening is expected to be less than 10 percent.

The numerous studies and reports that have been developed on the subject of sleep disturbance related to environmental noise over the past several decades have produced varied results. A review of past studies conducted by the Airport Cooperative Research Program suggests that in-home sleep disturbance studies clearly demonstrate that it requires more noise to cause awakenings than was previously theorized based on laboratory sleep disturbance studies.[5]

Due to the variability of study methodologies, particularly studies outside of a laboratory, and other influencing factors, it is difficult to determine the noise level at which a high percentage of the

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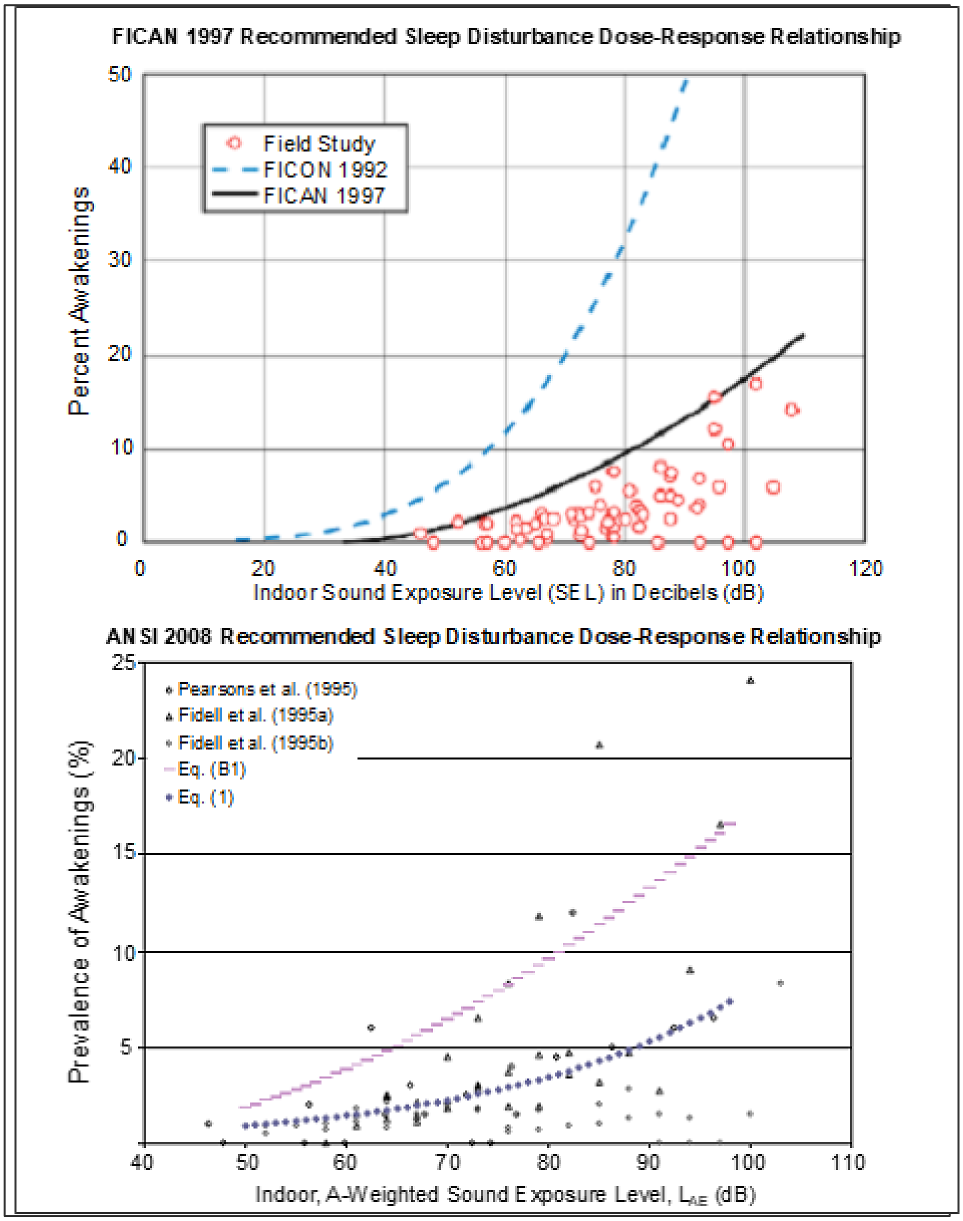
4 ANSI S12.9-2008, Quantities and Procedures for Description and Measurement of Environmental Sound — Part 6: Methods for Estimation of Awakenings Associated with Outdoor Noise Events Heard in Homes, 2008

5 Airport Cooperative Research Program, Transportation Research Board, Effects of Aircraft Noise: Research Update on Selected Topics, 2008.

population would be expected to be awakened by aircraft noise. No definitive conclusions have been drawn on the percent of a population that is estimated to be awakened by a certain level of aircraft noise and recent studies have cautioned about the over-interpretation of the data.[6]

EXHIBIT 3-1: SLEEP DISTURBANCE DOSE-RESPONSE CURVES



Source: Federal Interagency Committee on Aviation (FICAN), 1997. ANSI, 2008.

3.3 Communication Interference

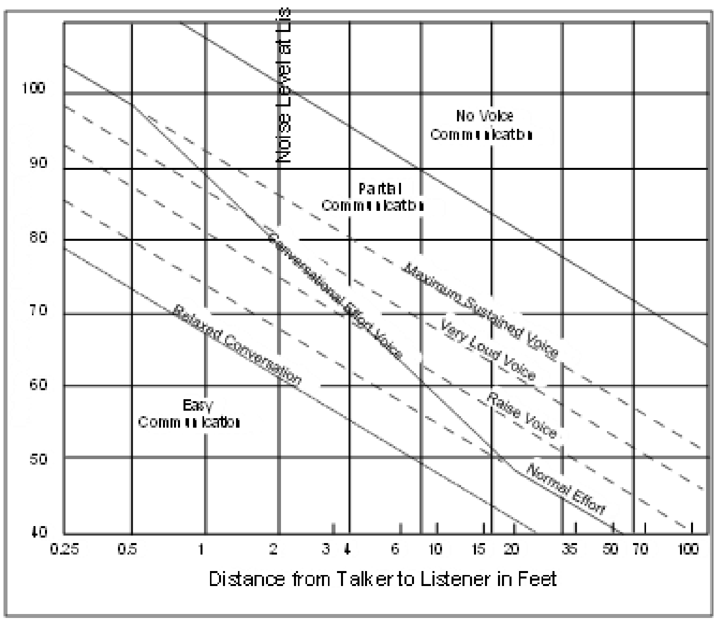
Communication interference can impact activities such as personal conversations, classroom learning, and listening to radio and television. Most studies have focused on communication interference due to

6 Airport Cooperative Research Program, Transportation Research Board, Effects of Aircraft Noise: Research Update on Selected Topics, 2008.

continual noise sources. In 1974, the USEPA published Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, which is one of the few studies to focus on intermittent noise. The study concluded that for voice communication, an indoor Leq of 45 dB allows normal conversation at distances up to 2 meters with 95 percent sentence intelligibility. **Exhibit 3-2** shows the required distance between talker and listener based on the type of speech communication (normal voice, loud voice, etc.) and the environmental noise level from the 1974 USEPA report.

Noise can also impact communication between student and teacher necessary for learning in a classroom setting. It is usually accepted that noise levels above a certain Leq may affect a child's learning experiences. Research has shown a "decline in reading when outdoor noise levels equal or exceed Leq of 65 dBA."[7] Furthermore, a study conducted by FICAN in 2007 found: "(1) a substantial association between noise reduction and decreased failure (worst-score) rates for high-school students, and (2) significant association between noise reduction and increased average test scores for student/test subgroups. In general, the study found little dependence upon student group and upon test type."[8] A study of noise exposure and the effects on school test scores between 2000/01 and 2008/09 found "…statistically significant associations between airport noise and student mathematics and reading test scores, after taking demographic and school factors into account."[9] This study also found that schools that had been provided sound insulation had better test scores than schools that were not sound insulated. This Study made no recommendation regarding the noise level at which impacts upon learning may occur.

EXHIBIT 3-2: NOISE EFFECTS ON DISTANCE NECESSARY FOR SPEECH COMMUNICATION



Source: FICON, 1992; from USEPA, 1974.

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7 Airport Cooperative Research Program, Transportation Research Board, Effects of Aircraft Noise: Research Update on Selected Topics, 2008.

8 Federal Interagency Committee on Aviation Noise (FICAN), Findings of the FICAN Pilot Study on the Relationship between Aircraft Noise Reduction and Changes in Standardized Test Scores, July 2007.

9 National Academies of Sciences, Engineering, and Medicine; Assessing Aircraft Noise Conditions Affecting Student Learning, Volume 1: Final Report; 2014.

4. Standard Noise Descriptors

Given the multiple dimensions of sound, a variety of descriptors, or metrics, have been developed for describing sound and noise. The Day-Night Average Sound Level (DNL) is widely accepted as the best available metric to describe aircraft noise exposure and is the noise descriptor required by the FAA for use in aircraft noise analyses and noise compatibility planning. Because the DNL metric correlates well with the degree of community annoyance from aircraft noise, DNL has been formally adopted by most federal agencies dealing with noise exposure. In addition to the FAA, these agencies include the Environmental Protection Agency (EPA), Department of Defense, Department of Housing and Urban Development (HUD) and the Veterans Administration. Also, federal interagency committees, such as the Federal Interagency Committee on Urban Noise and the FICON, have not identified new cumulative sound descriptors or metrics of sufficient scientific standing to substitute for DNL. Other cumulative metrics can be used to supplement, but not replace, DNL. FAA Orders 1050.1F and 5050.4B require that environmental studies use the DNL metric to describe cumulative noise exposure and identify aircraft noise/land use compatibility issues.

DNL is a cumulative sound level that provides a measure of the total sound energy during a specified time-period and is typically expressed as an annual average. DNL does not represent the sound level heard at any particular time, but rather represents the total sound exposure. DNL logarithmically averages the sound levels at a location over a 24-hour period, with a 10-decibel (dB) weighted penalty added to all noise events occurring during nighttime hours between 10:00 p.m. and 6:59 a.m. The 10 dB penalty represents the added intrusiveness of noise that occurs during sleeping hours, when ambient sound levels are typically lower than during daytime hours. This weighted penalty treats one nighttime noise event as equivalent to 10 daytime events of the same magnitude.

It is important to note that due to the logarithmic nature of noise, the *loudest* noise levels control the 24-hour average. For example, 30 seconds of sound of 100 dB, followed by 23 hours, 59 minutes, and 30 seconds of silence, would compute to a DNL value of 65 dB. If the 30 seconds of sound occurred at night, it would yield a DNL of 75 dB.

5. Noise Compatibility

5.1 FAA 14 CFR Part 150

The FAA uses the 14 C.F.R. Part 150, Airport Noise Compatibility Planning, land use compatibility guidelines to determine compatibility with most land uses. The FAA has created guidelines regarding the compatibility of land uses with various aircraft noise levels measured using the DNL metric. These guidelines are defined in Appendix A to 14 C.F.R. Part 150. These guidelines are consistent with land use compatibility guidelines developed by other federal agencies such as EPA and HUD.

Based on FAA guidelines, DNL 65 dB is the noise level where noise sensitive land uses (residences, churches, schools, libraries, and nursing homes) are not compatible with aircraft noise. Below 65 DNL, all land uses are determined to be compatible with airport noise. The land use compatibility table found in 14 C.F.R. Part 150 is presented in **Table 5-1.**

TABLE 5-1: YEARLY DAY-NIGHT AVERAGE SOUND LEVEL (DNL) IN DECIBELS (DB) BY LAND USE FROM THE LAND USE COMPATIBILITY GUIDELINES – 14 C.F.R. PART 150

LAND USE	BELOW DNL 65 dB	DNL 65-70 dB	DNL 70-75 dB	DNL 75-80 dB	DNL 80-85 dB	OVER DNL 85 dB
Residential						
Residential, other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail—building materials, hardware and farm equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade—general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables and water recreation	Y	Y	25	30	N	N

(1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.
(2) Measures to achieve NLR 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
(3) Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
(4) Measures to achieve NLR 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal level is low.
(5) Land use compatible provided special sound reinforcement systems are installed.

(6) Residential buildings require an NLR of 25.
(7) Residential buildings require an NLR of 30.
(8) Residential buildings not permitted.
Notes:
1. The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable under federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise-compatible land uses.
2. SLUCM=Standard Land Use Coding Manual.
3. Y (Yes)=Land Use and related structures compatible without restrictions.
4. N (No)=Land Use and related structures are not compatible and should be prohibited.
5. NLR=Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
6. 25, 30, or 35=Land use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

Source: 14 C.F.R. § 150 Airport Noise Compatibility Planning, Appendix A, Table 1.

5.2 Thresholds of Significance

FAA Order 1050.1F identifies the threshold of "significant impact" based on the yearly DNL and an incorporation of compatible land use standards found at 14 CFR Part 150, Airport Noise Compatibility Planning, specifically in Appendix A of that regulation. Implementation of a proposed action would have a significant impact with respect to aircraft noise if it would cause an increase in noise of 1.5 dB or more to a noise sensitive land use at the 65 DNL or greater contour.

FAA Order 1050.1F also provides direction for disclosing changes in aircraft noise exposure that while not meeting the threshold of significance, are nonetheless of interest to stakeholders. These are referred to as "reportable" changes. This implements a 1992 FICON recommendation that in addition to significant impacts, less-than-significant noise level changes be identified for noise sensitive locations exposed to Project-related increases. FICON recommended reporting any increases in DNL of 3 dB or more between 60 and 65 dB DNL, and increases of DNL 5 dB or more between 45 and 60 dB DNL. These recommendations ordinarily only apply to cases where the significance threshold (increase of 1.5 dB or more within the 65 dB DNL contour) is met or exceeded.

6. Noise Model

For this noise analysis, noise contours were developed using the FAA's Aviation Environmental Design Tool (AEDT). AEDT is the FAA-approved, industry-accepted tool for determining the total effect of aircraft noise exposure near an airport. AEDT has been the FAA's required model for estimating aircraft noise exposure near airports for NEPA studies since May of 2015 when it replaced the Integrated Noise Model.

AEDT uses runway and flight track information, aircraft operation levels distributed by time of day, aircraft fleet mix, and aircraft performance characteristics as inputs. The program includes a built-in Geographic Information System (GIS) platform, tools for comparing contours, and utilities that facilitate easy export to other GIS software suites. AEDT can also calculate predicted noise at specific sites such as hospitals, schools, or other noise sensitive locations. This analysis was prepared using AEDT Version 3f, which was the latest version of the model when modeling began.

Detailed inputs to AEDT fall into two general categories:

- Physical Characteristics – airfield layout, flight track geometry, terrain, climatological data, and aircraft noise and performance data.
- Operational Characteristics – aircraft operations, runway use, and flight track use.

6.1 Aircraft Activity Levels and Fleet Mix

In order to calculate DNL noise exposure levels for SEA, the average number of operations, types of aircraft, and the time of day at which the aircraft operate by specific AEDT airframe model and engine code were prepared for input into AEDT. AEDT airframe models are based on the manufactured aircraft types included in the fleet mix while the engine code refers to the version of engines that is associated with the defined airframe model.

6.2 Airfield Layout

The airfield layout is a physical description of the airfield configuration, including location, length and orientation of all runways and taxiways, and airport elevation. SEA's airfield system consists of three Runways (16L/34R, 16C/34C, 16R/34L), oriented in a north-south direction. **Table 6-1** provides the length and width of the runways at SEA.

TABLE 6-1: SEA RUNWAYS

Runway	Length (feet)	Width (feet)
16R/34L	8,500	150
16C/34C	9,425	150
16L/34R	11,899	150

Source: AEDT Version 3f

Table 6-2 provides the coordinates, elevation, crossing height and glide slope of the current runway ends at SEA used in AEDT:

TABLE 6-2: RUNWAY DEFINITION

Runway	Latitude	Longitude	Elevation (feet)	Crossing Height[1] (feet)	Glide Slope[2] (degrees)
16L	47.4637952222	-122.307750222	432.3	76	3
34R	47.4311722778	-122.30803825	346.7	81	2.75[3]
16C	47.4638098611	-122.31098375	429.4	71	3
34C	47.4379712778	-122.311209833	362.9	73	3
16R	47.4638363611	-122.317856833	414.8	69	3
34L	47.4405338056	-122.318058056	356.2	75	3

1 Crossing height is the height above the runway threshold at which the aircraft would be if maintaining the proper glide slope.
2 Glide slope represents the proper path (or angle) of descent for arriving aircraft.
3 AEDT utilizes a standard 3.0-degree glide on arrival profiles. Runway 34R glide slope of 2.75 is modeled as a 3.0-degree glide slope until threshold crossing.
Source: Port of Seattle, SEA Airport Layout Plan; AEDT Version 3f

6.3 Runway End Utilization

Runway end utilization refers to the frequency with which aircraft utilize each runway during the course of a year, as dictated or permitted by wind, weather, aircraft weight, air traffic control conditions, and noise considerations. Aircraft generally take-off and land facing into the wind, making it the primary factor in selecting a runway for take-off or landing. The efficient and safe use of the runways, taxiways, and airspace generally encourages the use of a single direction of "flow." "Head-to-head" operations, where aircraft depart in one direction and arrive in the opposite direction on the same runway are generally only possible when aircraft operations are well separated in both time and space.

6.4 Engine Run-Ups

Engine run-ups are routine engine maintenance or diagnostic tests where the engine is run at various settings to test performance. Depending on the frequency, engine run-ups may influence the size and location of noise contours.

6.5 Flight Tracks

A flight track is the path over the ground as aircraft fly to or from an airport. In order to model the arrival and departure flight corridors for SEA, consolidated flight tracks were developed from 2022 radar data and given a track ID. The radar data provide the location, density, and width of existing flight corridors. The AEDT models aircraft flight corridors with a system of primary flight tracks (or "backbone" tracks) and additional "dispersed" tracks. The backbone track lies at the center of the corridor, flanked by one or more dispersed tracks on each side. The AEDT distributes the operations assigned to a track among the backbone and dispersed tracks using a normal distribution or a user-defined distribution based on the observed flight track density. This dispersion more accurately models each flight corridor by accounting for variability attributed to weather, aircraft type, traffic, pilot technique and other factors.

Departure corridors are defined by a series of individual flight tracks located across the width of the corridor. Generally, aircraft on approach to a runway end are located within a smaller corridor due to the use of navigational instruments.

6.6 Aircraft Trip Length and Operational Profiles

Aircraft weight during departure is a factor in the dispersion of noise because it impacts the rate at which an aircraft is able to climb. Generally, the heavier an aircraft is, the slower the rate of climb and the wider the dispersion of noise along its route of flight. Where specific aircraft weights are unknown, AEDT uses the distance flown to the first stop as a surrogate for the weight, by assuming that the weight has a direct relationship with the fuel load necessary to reach the first destination. AEDT groups trip lengths into nine categories as shown in **Table 6-3.**

TABLE 6-3: AEDT STAGE LENGTH CATEGORIES

Stage Length	Distance
1	0-500 nautical miles
2	500-1000 nautical miles
3	1000-1500 nautical miles
4	1500-2500 nautical miles
5	2500-3500 nautical miles
6	3500-4500 nautical miles
7	4500-5500 nautical miles
8	5500-6500 nautical miles
9	6500-11000 nautical miles
M	Maximum range at maximum take-off weight

Source: Landrum & Brown analysis, 2024

AEDT includes standard flight procedure data for each aircraft that represents each phase of flight to or from an airport. Information related to aircraft speed, altitude, thrust settings, flap settings, and distance is available and used by AEDT to calculate noise levels on the ground. Additionally, terrain data was used to account for ground elevation variations under the flight paths.

6.7 Atmospheric Conditions

Weather is an important factor in the performance of aircraft and the amount of noise generated on landing and take-off. AEDT default weather parameters are based on Integrated Surface Data[10] average weather data (2012 -2021) from the National Oceanic and Atmospheric Administration. **Table 6-4** shows the default AEDT atmospheric settings for SEA.

TABLE 6-4: ATMOSPHERIC ELEMENTS

Atmospheric Element	Default AEDT Value
Temperature	52.67° Fahrenheit
Sea Level Pressure	1,018.13 millibars
Static Pressure	1,001.43 millibars
Dew Point	43.82° Fahrenheit
Relative Humidity	71.79%
Wind Speed	6.74 knots

Source: AEDT Version 3f, Landrum & Brown analysis, 2024.

7. Aircraft Noise

The following sections present the methodology and modeling input assumptions for the Existing (2022) condition, Future (2032) condition, and Future (2037) condition.

7.1 Existing Conditions

The following describes the input data and methodologies used in preparing the Existing (2022) Condition noise contour.

Aircraft Activity Levels and Fleet Mix

Information on aircraft operations was collected from FAA Air Traffic Activity System (ATADS) and the Port's EnvironmentalVue Flight Track Monitoring System. During the baseline condition year (2022), 401,351 total annual operations occurred at SEA. Additionally, specific AEDT airframe and engine combinations were developed from the EnvironmentalVue Flight Track Monitoring System data and a widely used airline fleet database.[11] **Table 7-1** presents the average daily operations by AEDT airframe and AEDT engine code that were used to calculate the Existing (2022) Contour.

The average daily number of aircraft arrivals and departures for the Existing (2022) Condition was calculated by determining the total annual operations and dividing by 365 (days in a year). The baseline conditions annual average day included 1,100 total operations, 15.9 percent of which occurred during the nighttime hours of 10:00 p.m. to 6:59 a.m.

10 https://www.ncdc.noaa.gov/isd, provided in AEDT Version 3f.
11 Diio Mi: Market Intelligence for the Aviation Industry, Accessed on February 3, 2022, https://mi.diio.net.

TABLE 7-1: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – EXISTING (2022) CONDITION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Commercial Jets						
Airbus A319-100 Series	01P10IA020	0.01	0.00	0.01	0.00	0.03
Airbus A319-100 Series	3CM028	0.10	0.02	0.10	0.02	0.24
Airbus A319-100 Series	3IA006	2.26	0.45	2.36	0.35	5.42
Airbus A319-100 Series	3IA007	1.21	0.24	1.26	0.19	2.90
Airbus A319-100 Series	4CM035	0.09	0.02	0.09	0.01	0.22
Airbus A319-100 Series	8IA09	0.04	0.01	0.04	0.01	0.10
Airbus A320-200 Series	01P08CM105	16.35	2.34	15.89	2.79	37.36
Airbus A320-200 Series	01P10IA021	1.47	0.21	1.43	0.25	3.35
Airbus A320-200 Series	01P10IA022	0.32	0.05	0.31	0.05	0.72
Airbus A320-200 Series	1CM008	0.40	0.06	0.39	0.07	0.91
Airbus A320-200 Series	1CM009	1.62	0.23	1.57	0.28	3.70
Airbus A320-200 Series	1IA003	3.09	0.44	3.00	0.53	7.06
Airbus A320-200 Series	3CM026	1.76	0.25	1.71	0.30	4.02
Airbus A320-200 Series	8IA010	0.00	0.00	0.00	0.00	0.01
Airbus A320-NEO	01P20CM128	0.87	0.06	0.72	0.22	1.86
Airbus A320-NEO	01P22PW163	1.39	0.09	1.13	0.34	2.95
Airbus A321-200 Series	01P08CM104	1.11	0.25	0.75	0.61	2.72
Airbus A321-200 Series	01P10IA025	6.73	1.54	4.54	3.72	16.52
Airbus A321-200 Series	3CM025	1.14	0.26	0.77	0.63	2.81
Airbus A321-NEO	01P18PW157	1.71	0.50	1.51	0.69	4.42
Airbus A321-NEO	01P20CM132	5.06	1.50	4.49	2.06	13.11
Airbus A330-200 Series	2RR023	1.15	1.37	2.49	0.02	5.03
Airbus A330-200 Series	9PW094	0.02	0.02	0.04	0.00	0.07
Airbus A330-300 Series	2RR023	0.64	0.02	0.64	0.02	1.33
Airbus A330-300 Series	4GE080	0.65	0.02	0.65	0.02	1.35
Airbus A330-300 Series	7PW082	0.09	0.00	0.09	0.00	0.18
Airbus A330-300 Series	9PW094	1.84	0.07	1.84	0.07	3.82
Airbus A330-300 Series	9PW095	0.43	0.02	0.43	0.02	0.90
Airbus A330-900N Series (Neo)	02P23RR141	3.13	0.51	3.35	0.29	7.29
Airbus A340-300 Series	2CM015	0.07	--	0.07	--	0.15
Airbus A350-1000 Series	18RR080	0.00	0.00	0.01		0.01
Airbus A350-900 series	01P18RR124	1.02	0.02	1.04	0.01	2.09
Boeing 717-200 Series	4BR002	0.00	--	0.00	--	0.00
Boeing 737-300 Series	1CM004	0.01	--	0.01	--	0.02
Boeing 737-300 Series	1CM005	0.01	--	0.01	--	0.02
Boeing 737-700 Series	3CM030	0.43	0.15	0.44	0.14	1.16
Boeing 737-700 Series	3CM031	14.65	5.01	15.01	4.65	39.32
Boeing 737-700 Series	3CM032	2.67	0.91	2.73	0.85	7.16
Boeing 737-700 Series	8CM051	0.01	0.00	0.01	0.00	0.03
Boeing 737-700 Series	8CM062	0.11	0.04	0.11	0.03	0.28
Boeing 737-700 Series	8CM063	2.48	0.85	2.55	0.79	6.67
Boeing 737-8	01P20CM135	0.04	0.02	0.04	0.02	0.11

TABLE 7-1: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – EXISTING (2022) CONDITION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Boeing 737-8	01P20CM136	1.17	0.67	1.17	0.67	3.67
Boeing 737-8	01P20CM140	1.08	0.62	1.08	0.62	3.39
Boeing 737-800 Series	01P11CM114	0.48	0.07	0.47	0.07	1.09
Boeing 737-800 Series	01P11CM116	6.51	0.94	6.45	1.00	14.90
Boeing 737-800 Series	01P11CM122	3.55	0.51	3.52	0.55	8.13
Boeing 737-800 Series	01P11CM125	0.79	0.11	0.78	0.12	1.81
Boeing 737-800 Series	01P11CM126	0.07	0.01	0.07	0.01	0.17
Boeing 737-800 Series	3CM032	19.93	2.88	19.74	3.08	45.62
Boeing 737-800 Series	3CM034	1.92	0.28	1.91	0.30	4.40
Boeing 737-800 Series	8CM051	27.28	3.95	27.02	4.21	62.45
Boeing 737-800 Series	8CM064	0.20	0.03	0.20	0.03	0.45
Boeing 737-800 Series	8CM065	2.55	0.37	2.52	0.39	5.83
Boeing 737-800 Series	8CM066	11.96	1.73	11.85	1.85	27.39
Boeing 737-800BCF	3CM034	0.18	0.01	0.15	0.03	0.38
Boeing 737-9	01P20CM136	0.60	0.11	0.58	0.13	1.42
Boeing 737-9	01P20CM140	23.54	4.42	22.93	5.03	55.92
Boeing 737-900 Series	01P11CM114	0.98	0.13	0.98	0.13	2.21
Boeing 737-900 Series	8CM051	11.05	1.43	11.07	1.41	24.97
Boeing 737-900-ER	01P11CM116	22.62	3.69	20.95	5.35	52.62
Boeing 737-900-ER	01P11CM121	64.23	10.46	59.49	15.20	149.39
Boeing 737-900-ER	01P11CM125	0.20	0.03	0.18	0.05	0.46
Boeing 737-900-ER	3CM034	0.91	0.15	0.84	0.22	2.12
Boeing 737-900-ER	8CM065	1.02	0.17	0.94	0.24	2.36
Boeing 737-900-ER_MA*	01P11CM121_MA	2.74	0.09	1.37	0.05	4.26
Boeing 757-200 Series	4PW072	6.00	1.84	6.21	1.63	15.68
Boeing 757-200 Series	4PW073	0.21	0.06	0.21	0.06	0.54
Boeing 757-200 Series	5RR038	0.59	0.18	0.62	0.16	1.55
Boeing 757-200 Series	5RR039	0.04	0.01	0.04	0.01	0.10
Boeing 757-300 Series	3RR028	0.00	0.00	0.00	0.00	0.01
Boeing 757-300 Series	5RR039	0.01	0.00	0.01	0.00	0.03
Boeing 757-300 Series	XPW204	1.58	0.81	1.99	0.39	4.77
Boeing 767-300 ER	12PW102	0.01	0.00	0.01	0.00	0.03
Boeing 767-300 ER	1GE029	0.08	0.03	0.09	0.02	0.21
Boeing 767-300 ER	1GE030	0.78	0.26	0.86	0.17	2.06
Boeing 767-300 ER	1PW043	0.56	0.18	0.62	0.12	1.49
Boeing 767-300 ER	1RR011	0.00	0.00	0.00	0.00	0.00
Boeing 767-300 ER	2GE055	0.31	0.10	0.35	0.07	0.83
Boeing 767-400 ER	8GE101	0.33	0.03	0.35	0.01	0.72
Boeing 777-200-ER	10PW099	0.11	0.00	0.11	0.00	0.22
Boeing 777-200-ER	2RR027	0.39	0.01	0.39	0.01	0.79
Boeing 777-200-ER	3GE060	0.17	0.00	0.17	0.00	0.35
Boeing 777-200-ER	3GE064	0.00	0.00	0.00	0.00	0.01
Boeing 777-200-ER	8GE100	0.18	0.00	0.18	0.00	0.36

TABLE 7-1: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – EXISTING (2022) CONDITION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Boeing 777-200-LR	01P21GE216	0.07	0.00	0.07	0.00	0.14
Boeing 777-200-LR	01P21GE217	0.26	0.00	0.25	0.00	0.52
Boeing 777-300 ER	01P21GE217	1.89	0.01	1.82	0.08	3.81
Boeing 787-10 Dreamliner	01P17GE211	0.18	0.00	0.04	0.14	0.36
Boeing 787-10 Dreamliner	02P23RR134	0.20	0.00	0.04	0.15	0.40
Boeing 787-10 Dreamliner	01P17GE213	0.39	0.00	0.09	0.31	0.78
Boeing 787-8 Dreamliner	01P17GE206	0.16	0.00	0.16	0.00	0.33
Boeing 787-8 Dreamliner	01P17GE210	0.01	0.00	0.01	0.00	0.01
Boeing 787-8 Dreamliner	11GE137	0.26	0.00	0.26	0.00	0.52
Boeing 787-8 Dreamliner	11GE138	0.64	0.00	0.64	0.00	1.28
Boeing 787-9 Dreamliner	01P17GE211	1.22	--	1.06	0.16	2.44
Boeing 787-9 Dreamliner	01P17GE214	0.01	--	0.01	0.00	0.02
Boeing 787-9 Dreamliner	02P23RR131	0.28	--	0.24	0.04	0.55
Boeing 787-9 Dreamliner	12RR067	1.26	--	1.09	0.17	2.52
Boeing 787-9 Dreamliner	12RR068	0.53	--	0.46	0.07	1.06
Bombardier CRJ-900-ER	01P08GE190	0.03	--	0.03	--	0.06
Bombardier CS100	04P20PW196	11.85	1.53	12.06	1.33	26.77
Bombardier CS300	04P20PW196	0.09	0.04	0.12	0.01	0.27
Bombardier CS300	04P20PW197	2.11	0.88	2.66	0.33	5.97
Bombardier Global Express	01P04BR013	0.01	--	0.01	--	0.01
Embraer ERJ175-LR	01P08GE197	81.63	11.10	80.82	11.91	185.46
Embraer ERJ175-LR_MA*	01P08GE197_MA	1.36	0.17	0.68	0.09	2.30
Subtotal		*397.49*	*67.69*	*384.75*	*78.24*	*928.17*
Cargo Jets						
Airbus A300F4-600 Series	1GE020	0.00	0.00	0.00	0.00	0.01
Airbus A300F4-600 Series	1PW048	0.12	0.00	0.01	0.11	0.24
Airbus A300F4-600 Series	3GE056	0.21	0.00	0.01	0.20	0.43
Boeing 747-400 ERF	12PW102	0.07	0.06	0.08	0.04	0.24
Boeing 747-400 Series	1GE024	0.67	0.41	0.63	0.45	2.17
Boeing 747-400 Series Freighter	01P03GE187	0.08	0.03	0.04	0.07	0.21
Boeing 747-400 Series Freighter	1GE024	0.01	0.00	0.00	0.01	0.02
Boeing 747-400 Series Freighter	1PW041	0.01	0.00	0.00	0.01	0.02
Boeing 747-400 Series Freighter	4RR037	0.08	0.03	0.04	0.06	0.20
Boeing 747-400BCF	1GE024	0.27	0.07	0.25	0.09	0.68
Boeing 747-400BCF	1PW041	0.01	0.00	0.01	0.00	0.03
Boeing 747-8F	01P17GE215	0.19	0.19	0.18	0.20	0.77
Boeing 747-8F	13GE156	0.05	0.05	0.05	0.05	0.20

TABLE 7-1: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – EXISTING (2022) CONDITION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Boeing 747-8F	8GENX1	0.16	0.17	0.16	0.17	0.66
Boeing 757-200 Series Freighter	3RR028	0.13	0.01	0.02	0.12	0.28
Boeing 757-200 Series Freighter	4PW072	0.06	0.00	0.01	0.06	0.13
Boeing 757-200 Series Freighter	4PW073	0.07	0.00	0.01	0.06	0.14
Boeing 757-200 Series Freighter	5RR039	0.00	0.00	0.00	0.00	0.01
Boeing 767-200 Series Freighter	1GE010	0.30	0.05	0.27	0.08	0.71
Boeing 767-200 Series Freighter	1GE012	0.15	0.03	0.14	0.04	0.35
Boeing 767-200 Series Freighter	1PW026	0.03	0.00	0.02	0.01	0.06
Boeing 767-300 ER Freighter	1GE030	4.35	3.43	4.75	3.03	15.56
Boeing 767-300 ER Freighter	2GE055	0.43	0.34	0.47	0.30	1.53
Boeing 767-300BCF	2GE055	0.03	0.05	0.07	0.01	0.16
Boeing 777 Freighter	01P21GE216	0.94	0.46	0.97	0.42	2.78
Boeing 777 Freighter	01P21GE217	0.02	0.01	0.02	0.01	0.07
Boeing 777-200-LR_C	01P21GE216_C	0.05	0.00	0.03	0.02	0.11
Boeing MD-10-30	3GE074	0.06	0.03	0.06	0.03	0.18
Boeing MD-11 Freighter	12PW102	0.22	0.19	0.29	0.12	0.81
Boeing MD-11 Freighter	1GE031	1.10	0.94	1.46	0.58	4.08
Boeing MD-11 Freighter	1PW052	0.36	0.30	0.47	0.19	1.33
Subtotal		*10.22*	*6.86*	*10.53*	*6.56*	*34.17*
Regional Jets						
Bombardier CRJ-200-LR	01P05GE189	0.01	0.00	0.01	--	0.02
Bombardier CRJ-700	01P08GE192	0.01	--	0.01	0.00	0.02
Bombardier CRJ-700-ER	01P08GE190	0.02	0.00	0.01	0.01	0.03
Bombardier CRJ-700-ER	01P08GE192	0.12	0.01	0.09	0.04	0.26
Bombardier CRJ-700-ER	5GE083	0.06	0.00	0.04	0.02	0.13
Subtotal		*0.22*	*0.01*	*0.16*	*0.07*	*0.46*
Turboprops						
Bombardier de Havilland Dash 8 Q400	PW150A	54.40	6.68	53.40	7.68	122.16
Raytheon Beech 99	PT6A27	0.01	--	0.01	0.00	0.03
Raytheon Beech 99	PT6A36	0.82	--	0.81	0.00	1.63
Raytheon C-12 Huron	PT660A	0.03	--	0.03	--	0.05
Raytheon Super King Air 200	PT6A42	0.00	--	0.00	--	0.01
Subtotal		*55.26*	*6.68*	*54.25*	*7.69*	*123.88*
Cargo Props						
Cessna 208 Caravan	P6114A	1.59	--	1.55	0.04	3.18
Cessna 208 Caravan	PT6A14	1.57	--	1.53	0.04	3.14

TABLE 7-1: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – EXISTING (2022) CONDITION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Raytheon Super King Air 300	PT660A	0.10	--	0.10	--	0.20
Subtotal		*3.26*	*0.00*	*3.18*	*0.08*	*6.52*
General Aviation Jets						
Bombardier Challenger 300	01P14HN011	0.05	0.00	0.05	--	0.10
Bombardier Challenger 300	11HN003	0.05	0.00	0.05	--	0.10
Bombardier Challenger 350	01P14HN011	0.18	0.01	0.19	0.00	0.39
Bombardier Challenger 600	01P05GE189	0.05	0.01	0.05	0.00	0.10
Bombardier Challenger 600	1GE034	0.03	0.00	0.03	0.00	0.07
Bombardier Global 5000	01P04BR013	0.04	--	0.04	0.00	0.08
Bombardier Global 5500	01P20BR015	0.00	--	0.00	--	0.01
Bombardier Learjet 35A/36A (C-21A)	1AS001	--	0.00	0.00	--	0.01
Bombardier Learjet 40	TFE731	0.01	--	0.01	--	0.01
Bombardier Learjet 45	1AS001	0.02	0.00	0.02	0.00	0.04
Bombardier Learjet 45	TFE731	0.04	0.01	0.04	0.01	0.10
Bombardier Learjet 60	7PW077	0.03		0.03	--	0.06
Bombardier Learjet 70	1AS002	0.00		0.00	--	0.01
Cessna 560 Citation Encore	PW530	0.01		0.01	--	0.03
Cessna 560 Citation Excel	PW530	0.05		0.05	--	0.10
Cessna 560 Citation Ultra	1PW038	0.01	0.00	0.01	0.00	0.02
Cessna 560 Citation XLS	PW530	0.08	--	0.08	0.00	0.16
Cessna 680 Citation Sovereign	03P14PW194	0.02	--	0.02	--	0.04
Cessna 680 Citation Sovereign	7PW078	0.04	--	0.04	--	0.09
Cessna 680-A Citation Latitude	7PW078	0.11	--	0.11	--	0.23
Cessna 700 Citation Longitude	01P18HN013	0.02	--	0.02	--	0.04
Cessna 750 Citation X	6AL024	0.11	0.00	0.11	0.00	0.23
Cessna CitationJet CJ2 (Cessna 525A)	1PW036	0.04	--	0.03	0.01	0.09
Cessna CitationJet CJ3 (Cessna 525B)	1PW038	0.09	0.00	0.09	0.00	0.18
Dassault Falcon 2000	CF700D	0.08	0.00	0.08	--	0.16
Dassault Falcon 50	1AS002	0.26	0.01	0.24	0.03	0.54
Embraer Legacy 450 (EMB-545)	01P14HN014	0.07		0.06	0.00	0.14
Embraer Phenom 300 (EMB-505)	PW530	0.11	0.01	0.11	0.00	0.22
Gulfstream G200	7PW077	0.03	--	0.03	0.00	0.07
Gulfstream G450	11RR048	0.04	0.00	0.03	0.01	0.08

TABLE 7-1: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – EXISTING (2022) CONDITION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Gulfstream G650	01P11BR016	0.03	0.00	0.03	0.00	0.06
Gulfstream G650ER	01P11BR016	0.01	0.01	0.02	--	0.04
Gulfstream IV-SP	11RR048	0.01	--	0.01	--	0.02
Gulfstream V-SP	01P06BR014	0.03	0.01	0.03	0.01	0.08
Honda HA-420 Hondajet	PW610F	0.02	0.00	0.03	--	0.05
Raytheon Beechjet 400	1PW037	0.03	0.00	0.03	--	0.06
Raytheon Hawker 800	1AS002	0.05	0.00	0.05	0.00	0.10
Subtotal		*1.87*	*0.09*	*1.86*	*0.09*	*3.92*
General Aviation Props						
Beechcraft Bonanza 35 (FAS)	TIO540	0.03	--	0.03	--	0.06
Cessna 150 Series	O200	0.02	--	0.02	0.00	0.05
Cessna 152 (FAS)	O200	0.10	--	0.09	0.01	0.19
Cessna 172 Skyhawk	IO320	0.47	0.16	0.59	0.04	1.27
Cessna 182	IO360	0.13	--	0.13	0.00	0.27
Cessna 206	TIO540	0.02	--	0.02	--	0.04
Cirrus SR22 Turbo (FAS)	TIO540	0.09	0.01	0.09	0.00	0.19
Mooney M20-K	TSIO36	0.02	--	0.02	--	0.05
Pilatus PC-12	PT6A67	0.07	0.01	0.07	0.01	0.15
Piper PA-28 Cherokee Series	IO320	0.08	--	0.08	0.00	0.16
Raytheon Beech Bonanza 36	TIO540	0.02	0.00	0.03	--	0.05
Subtotal		*1.06*	*0.18*	*1.18*	*0.06*	*2.48*
Grand Total:		**469.38**	**81.51**	**455.91**	**92.79**	**1099.59**

Notes: Day = 7:00 a.m. to 9:59 p.m., Night = 10:00 p.m. to 6:59 a.m.
Sources: SEA EnvironmentalVue Monitoring System data, January 2022-December 2022; Landrum & Brown analysis, 2024.

Runway End Utilization

Average annual day runway end utilization was derived from EnvironmentalVue Monitoring System data from January 2022 through December 2022. **Table 7-2** summarizes the percentage of use by each aircraft category on each of the runways at the Airport during the daytime (7:00 a.m.–9:59 p.m.) and nighttime (10:00 p.m.–6:59 a.m.) periods for the Existing (2022) Condition.

SEA primarily operates in a south flow configuration due to the prevailing winds. When SEA operates in this configuration, aircraft arrive from the north, landing on Runways 16R, 16L, and 16C; and depart to the south, taking off from Runways 16C, 16L, and to a lesser extent Runway 16R. A review of EnvironmentalVue Monitoring System data from January 2022 through December 2022 shows that SEA operated in the south flow configuration 70.6 percent of the time.

When in a north flow configuration, aircraft arrive from the south, landing on Runways 34L, 34R, and 34C, and depart to the north, taking off on Runways 34R, 34C, and, to a lesser extent, 34L. A review of EnvironmentalVue Monitoring System data from January 2022 through December 2022, shows that SEA operated in north flow configuration approximately 29.4 percent of the time. Runway use percentages modeled for the Existing (2022) Condition noise contour reflect this average annual runway use pattern.

TABLE 7-2: RUNWAY END UTILIZATION SUMMARY – EXISTING (2022) CONDITION

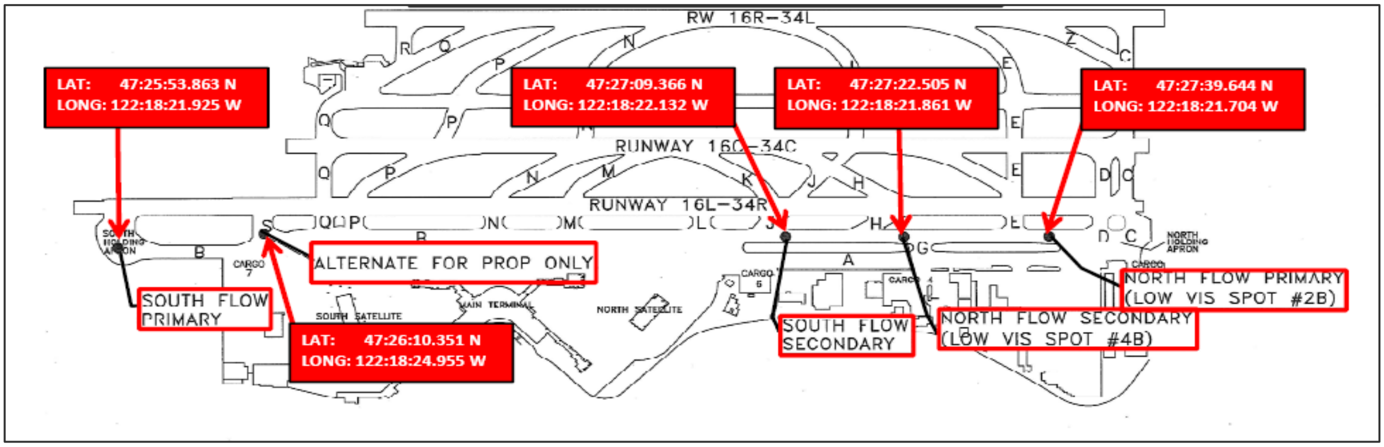
Aircraft Category	Runway End 16L	Runway End 16C	Runway End 16R	Runway End 34L	Runway End 34C	Runway End 34R
Daytime Arrivals						
Commercial Jets	4.57%	0.20%	65.32%	27.59%	0.14%	2.17%
Cargo Jets	45.97%	0.19%	25.35%	10.82%	0.03%	17.65%
Regional Jets	3.84%	0.00%	67.84%	28.32%	0.00%	0.00%
Turboprops	1.89%	0.19%	69.79%	27.30%	0.09%	0.74%
Cargo Props	9.40%	0.46%	59.75%	29.58%	0.46%	0.36%
GA Jets	1.45%	0.16%	64.70%	32.89%	0.00%	0.80%
GA Props	5.11%	4.04%	50.31%	20.28%	4.04%	16.21%
Missed Approaches*	--	--	77.33%	22.67%	--	--
Daytime Departures						
Commercial Jets	66.36%	4.43%	0.00%	0.00%	0.49%	28.71%
Cargo Jets	71.31%	0.73%	0.00%	0.00%	0.24%	27.72%
Regional Jets	63.05%	3.49%	0.00%	0.00%	0.00%	33.45%
Turboprops	62.53%	9.39%	0.00%	0.00%	1.95%	26.13%
Cargo Props	47.46%	31.06%	0.09%	0.00%	2.80%	18.59%
GA Jets	4.83%	64.47%	0.00%	0.11%	30.02%	0.58%
GA Props	9.06%	43.77%	8.48%	4.21%	34.48%	0.00%
Missed Approaches*	--	--	77.33%	22.67%	--	--
Nighttime Arrivals						
Commercial Jets	8.78%	5.55%	54.87%	24.67%	3.13%	2.99%
Cargo Jets	47.00%	9.06%	15.40%	5.28%	6.16%	17.10%
Regional Jet	26.10%	0.00%	73.90%	0.00%	0.00%	0.00%
Turboprops	1.78%	1.91%	71.24%	21.96%	2.20%	0.91%
Cargo Props	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
GA Jets	7.01%	10.09%	40.64%	31.94%	6.97%	3.34%
GA Props	17.97%	17.97%	46.08%	17.97%	0.00%	0.00%
Missed Approaches*	--	--	80.98%	19.02%	--	--
Nighttime Departures						
Commercial Jets	67.10%	3.09%	0.00%	0.00%	2.18%	27.62%
Cargo Jets	68.73%	5.32%	0.00%	0.00%	3.62%	22.32%
Regional Jets	88.46%	0.00%	0.00%	0.00%	0.00%	11.54%
Turboprops	66.21%	5.97%	0.00%	0.00%	0.79%	27.03%
Cargo Props	57.69%	3.85%	0.00%	0.00%	0.00%	38.46%
GA Jets	13.38%	56.77%	0.00%	0.00%	26.87%	2.98%
GA Props	56.56%	22.81%	0.84%	12.64%	7.16%	0.00%
Missed Approaches*	--	--	80.98%	19.02%	--	--

Notes: Day = 7:00 a.m. to 9:59 p.m., Night = 10:00 p.m. to 6:59 a.m.
* Missed approaches count as two arrivals and one departure for modeling purposes.
Sources: SEA EnvironmentalVue Monitoring System, January 2022-December 2022; Landrum & Brown analysis, 2024.

Engine Run-Ups

Exhibit 7-1: *Existing Aircraft Run-up Locations*, shows the north flow and south flow primary and secondary aircraft run-up locations at SEA. Aircraft utilizing the north flow primary and secondary locations are oriented at 340 degrees (i.e., nose pointing toward the north-northwest), while aircraft utilizing the south flow primary location are oriented at 160 degrees (i.e., nose pointing toward the south-southeast). Aircraft may use the secondary run-up location only when the primary run-up location is being utilized or is unavailable due to construction or weather. Airport staff log run-up activity that occurs at SEA. These run-up activity logs were utilized to determine the number of run-up operations, location of the run-up, average duration, thrust settings (high power, medium power) and the associated airframe and engine. During 2022 run-ups were only conducted at the North Primary, South Primary and Tango X locations. A total of 477 run-up operations were reported in the run-up activity logs for SEA in 2022. Table 7-3 presents the number of run-up operations, average duration and thrust settings per airframe and engine type that occurred at each run-up location in 2022. The AEDT aircraft are representative of all run-up operations occurring at SEA. The annual run-up totals for the 23 aircraft types, were proportionately distributed across each aircraft.

EXHIBIT 7-1: EXISTING AIRCRAFT RUN-UP LOCATIONS



Source: Port of Seattle

TABLE 7-3: ANNUAL AIRCRAFT RUN-UP ACTIVITY – EXISTING (2022) CONDITION

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
North Flow Primary Location						
Airbus A319-100 Series	3IA006	1.0	3.0	--	--	22000
Airbus A320-200 Series	01P08CM105	17.0	15.8	1.0	2.0	25000
Airbus A320-200 Series	1CM009	2.0	69.5	--	--	25000
Airbus A320-200 Series	3CM026	2.0	15.5	--	--	25000
Airbus A321-200 Series	3CM025	3.0	36.7	--	--	30000
Airbus A321-NEO	01P20CM132	--	--	1.0	2.0	30000
Airbus A330-200 Series	9PW094	6.0	27.7	--	--	71100
Airbus A330-300 Series	4GE080	1.0	37.0	--	--	67500
Airbus A330-900N Series (Neo)	02P23RR141	1.0	26.0	--	--	71100
Boeing 737-700 Freighter	3CM031	5.0	16.8	--	--	24000
Boeing 737-700 Series	3CM031	4.0	26.8	--	--	24000
Boeing 737-700 Series	3CM032	5.0	56.4	--	--	24000
Boeing 737-800 Series	01P11CM122	1.0	10.0	--	--	26300
Boeing 737-800 Series	3CM032	14.0	27.6	--	--	26300
Boeing 737-800 Series	3CM034	1.0	9.0	--	--	26300
Boeing 737-800 Series	8CM051	2.0	40.5	--	--	26300

TABLE 7-3: ANNUAL AIRCRAFT RUN-UP ACTIVITY – EXISTING (2022) CONDITION (CONTINUED)

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Boeing 737-800 Series	8CM066	3	33.0	--	--	26300
Boeing 737-9	01P20CM140	9.0	14.6	--	--	26400
Boeing 737-900 Series	8CM051	10.0	8.0	--	--	26300
Boeing 737-900-ER	01P11CM116	10.0	20.2	--	--	26300
Boeing 737-900-ER	01P11CM121	16.0	25.1	--	--	26300
Boeing 737-900-ER	01P11CM121	1.0	4.0	--	--	13150
Boeing MD-11 Freighter	1GE031	--	--	1.0	2.0	61500
Bombardier de Havilland Dash 8 Q400	PW150A	7.0	15.9	--	--	4918
Cessna 560 Citation Encore	PW530	1.0	15.0	--	--	3313
Embraer ERJ175-LR	01P08GE197	4.0	28.0	--	--	13800
Embraer ERJ175-LR	01P08GE197	1.0	6.0	--	--	6900
South Flow Primary Location						
Airbus A319-100 Series	3IA006	1.0	15.0	--	--	22000
Airbus A319-100 Series	3IA007	1.0	26.0	1.0	11.0	22000
Airbus A320-200 Series	01P08CM105	28.0	12.9	--	--	25000
Airbus A320-200 Series	01P08CM105	2.0	6.0	--	--	12500
Airbus A320-200 Series	1CM009	5.0	31.6	--	--	25000
Airbus A321-NEO	01P20CM132	2.0	12.5	--	--	30000
Airbus A330-200 Series	2RR023	1.0	6.0	--	--	71100
Airbus A330-200 Series	9PW094	8.0	14.9	--	--	71100
Airbus A330-200 Series	9PW094	1.0	26.0	--	--	35550
Airbus A330-300 Series	4GE080	3.0	10.7	--	--	67500
Airbus A330-900N Series (Neo)	02P23RR141	3.0	26.7	--	--	71100
Boeing 737-700 Freighter	3CM031	11.0	27.8	--	--	24000
Boeing 737-700 Freighter	3CM031	1.0	5.0	--	--	12000
Boeing 737-700 Series	3CM031	16.0	17.6	--	--	24000
Boeing 737-700 Series	3CM031	1.0	20.0	1.0	2.0	12000
Boeing 737-700 Series	3CM032	4.0	31.5	--	--	24000
Boeing 737-800 Series	3CM032	42.0	18.3	--	--	26300
Boeing 737-800 Series	3CM032	3.0	18.3	--	--	13150
Boeing 737-800 Series	8CM051	11.0	21.0	--	--	26300
Boeing 737-800 Series	8CM065	1.0	6.0	--	--	26300
Boeing 737-800 Series	8CM066	24.0	10.7	--	--	26300
Boeing 737-800 Series	8CM066	1.0	3.0	1.0	2.0	13150
Boeing 737-800BCF	3CM034	1.0	11.0	--	--	26300
Boeing 737-9	01P20CM140	21.0	10.4	--	--	26400
Boeing 737-9	01P20CM140	1.0	9.0	--	--	13200
Boeing 737-900 Series	01P11CM114	1.0	4.0	--	--	26300
Boeing 737-900 Series	8CM051	22.0	8.7	--	--	26300
Boeing 737-900 Series	8CM051	1.0	26.0	2.0	2.0	13150

TABLE 7-3: ANNUAL AIRCRAFT RUN-UP ACTIVITY – EXISTING (2022) CONDITION (CONTINUED)

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Boeing 737-900-ER	01P11CM116	21.0	15.7	2.0	2.0	26300
Boeing 737-900-ER	01P11CM116	1.0	3.0	--	--	13150
Boeing 737-900-ER	01P11CM121	54.0	25.5	--	--	26300
Boeing 737-900-ER	01P11CM121	1.0	8.0	--	--	13150
Boeing 757-200 Series	4PW072	2.0	36.5	--	--	38300
Boeing 757-300 Series	XPW204	4.0	27.0	--	--	43100
Boeing 767-200 Series Freighter	1GE012	1.0	6.0	--	--	48000
Boeing 767-300 ER Freighter	1GE030	3.0	21.0	--	--	60000
Boeing MD-11 Freighter	1GE031	2.0	44.5	--	--	61500
Bombardier de Havilland Dash 8 Q400	PW150A	23.0	15.2	--	--	4918
Bombardier de Havilland Dash 8 Q400	PW150A	1.0	10.0	--	--	2459
Bombardier Learjet 60	7PW077	1.0	9.0	--	--	3500
Cessna 560 Citation Encore	PW530	1.0	4.0	--	--	3313
Embraer ERJ175-LR	01P08GE197	7.0	11.1	--	--	13800
Tango X Location						
Airbus A330-200 Series	9PW094	1.0	38.0	--	--	71100
Total		467.0		10.0		

Notes: Totals may not sum due to rounding.
Daytime = 7:00am – 9:59pm, Nighttime = 10:00pm – 6:59am.
Source: SEA Engine Run-up Log, 2022; Landrum & Brown analysis, 2024.

Flight Tracks

Arrival and departure flight tracks modeled for the Existing (2022) Condition are depicted on **Exhibit 7-2** through **Exhibit 7-7**. The first two exhibits show jet aircraft flight tracks and the last two show propeller aircraft flight tracks. These flight tracks are separated because the flight patterns of jet aircraft versus propeller aircraft can be notably different.

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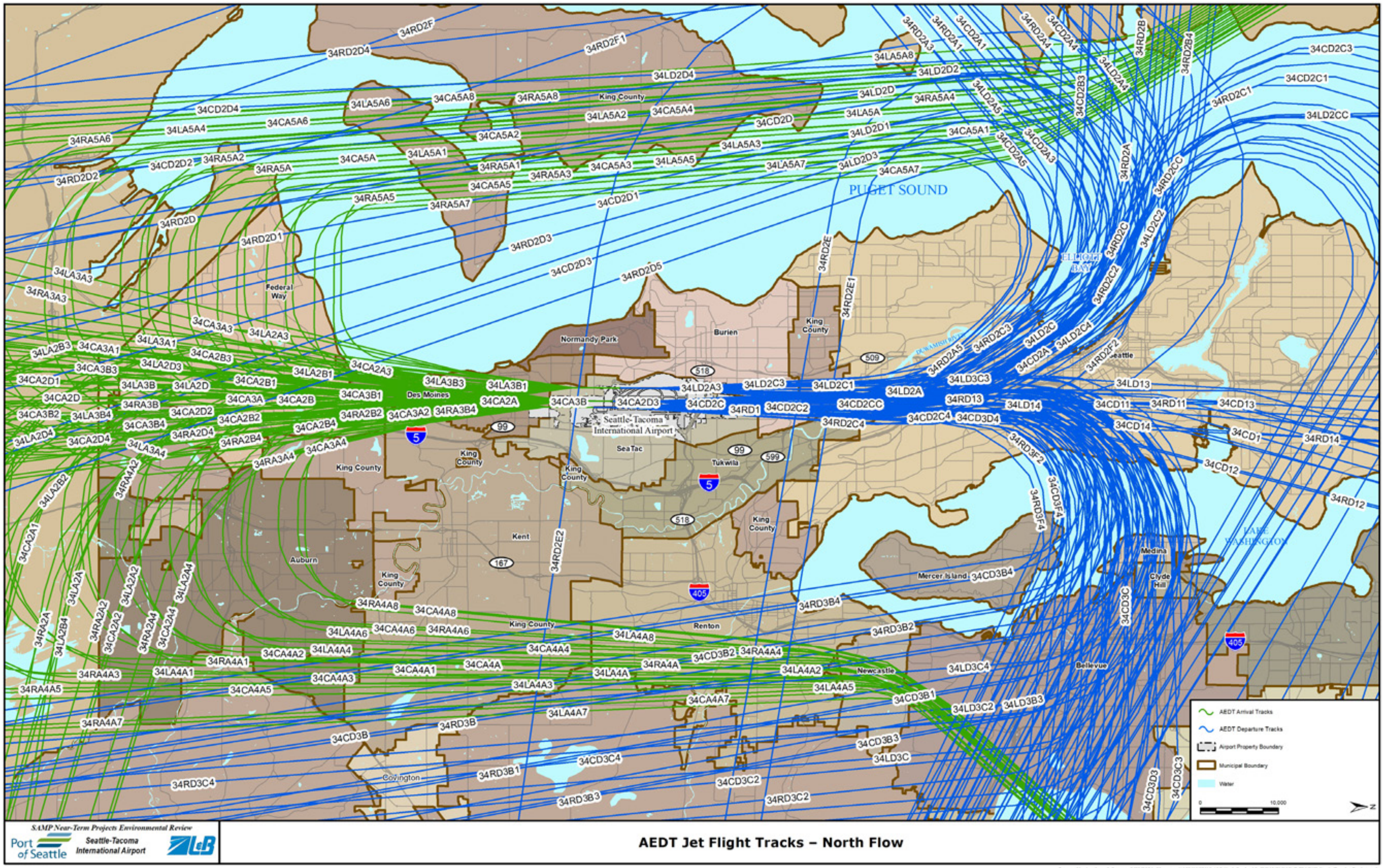
EXHIBIT 7-2: AEDT JET FLIGHT TRACKS – NORTH FLOW



Sources: SEA EnvironmentalVue Monitoring System data, January 2022-December 2022; Landrum & Brown analysis, 2024.

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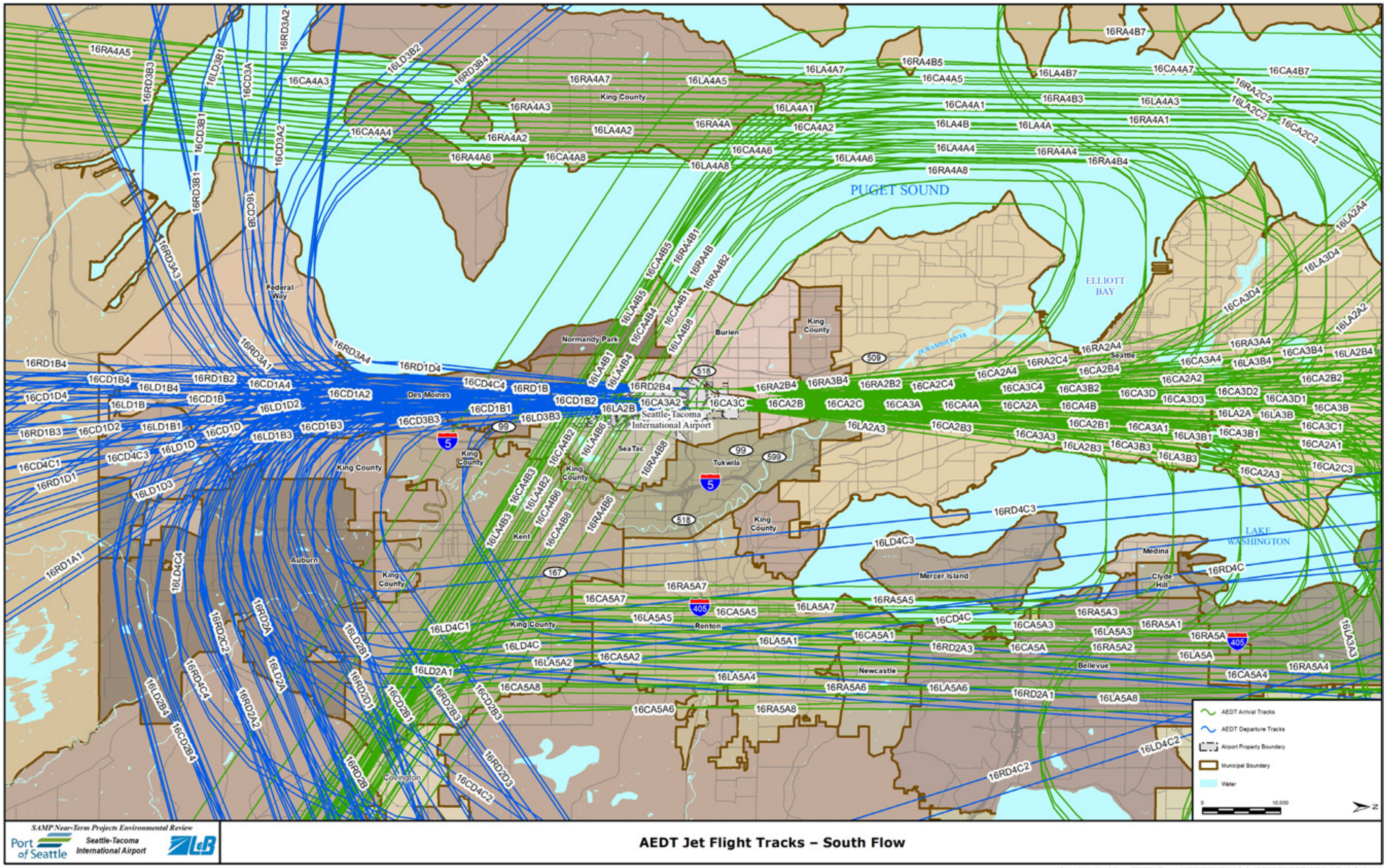
EXHIBIT 7-3: AEDT JET FLIGHT TRACKS – SOUTH FLOW



Sources: SEA EnvironmentalVue Monitoring System data, January 2022-December 2022; Landrum & Brown analysis, 2024.

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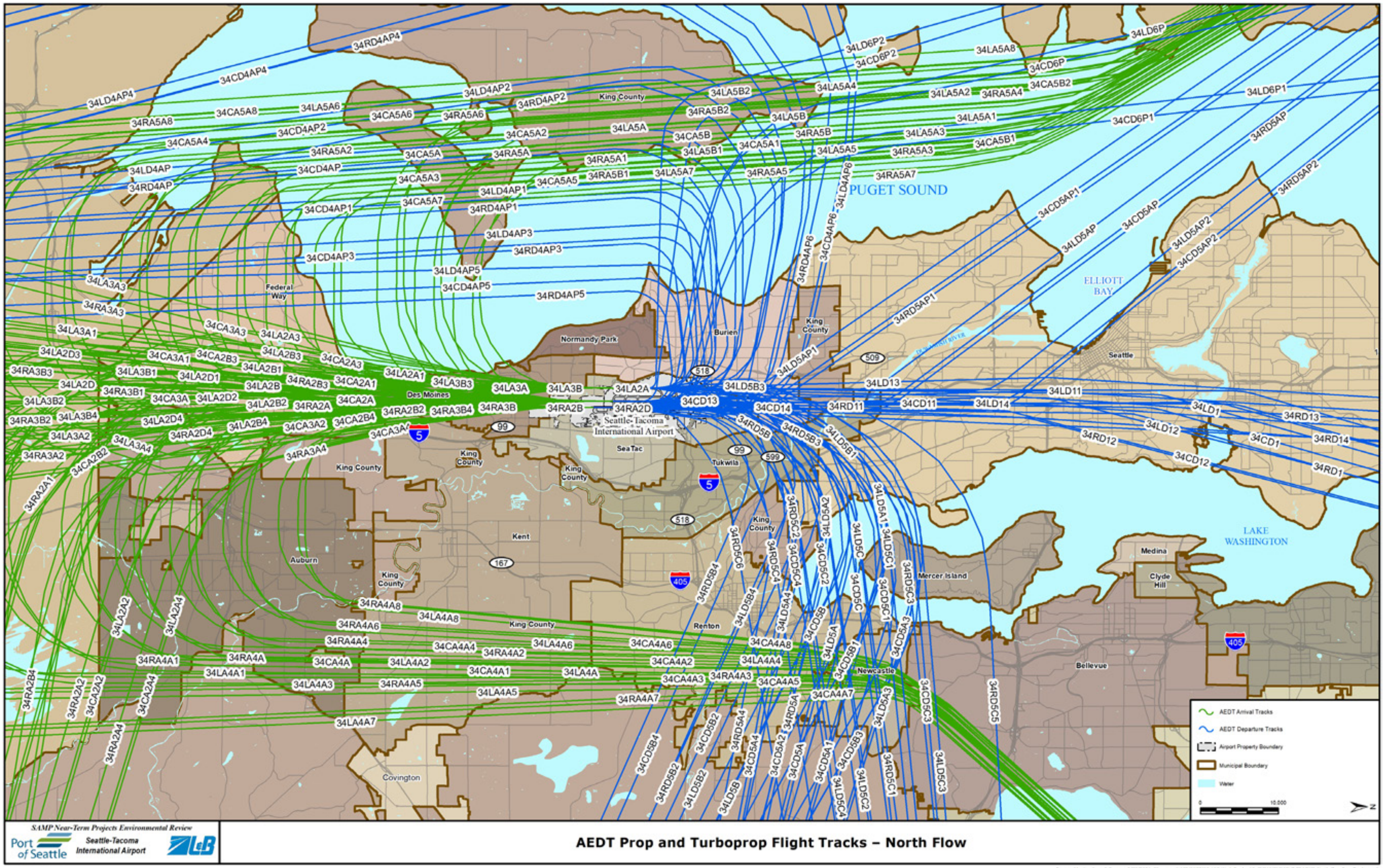
EXHIBIT 7-4: AEDT TURBOPROP AND PROP FLIGHT TRACKS – NORTH FLOW



Sources: SEA EnvironmentalVue Monitoring System data, January 2022-December 2022; Landrum & Brown analysis, 2024.

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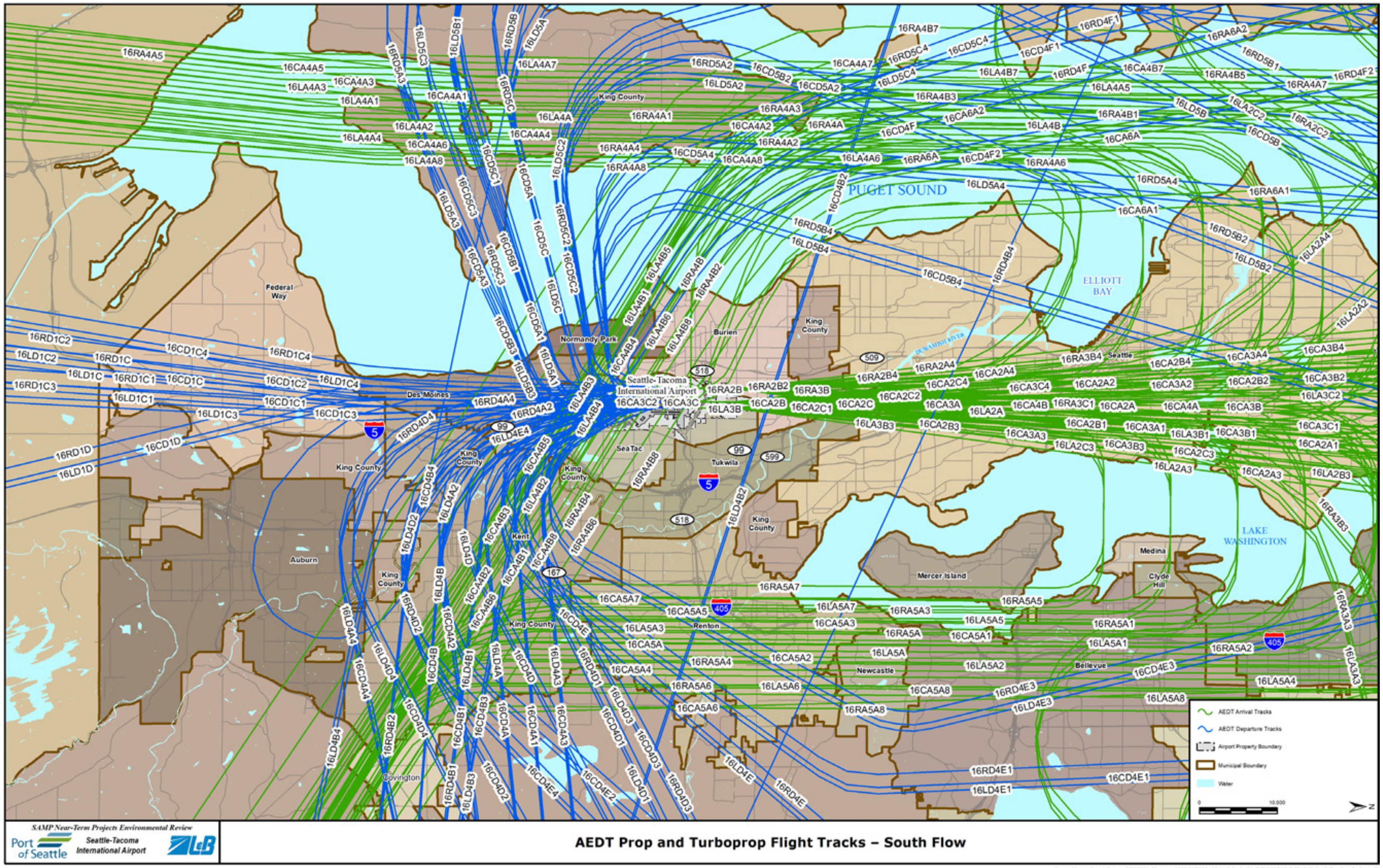
EXHIBIT 7-5: AEDT TURBOPROP AND PROP FLIGHT TRACKS – SOUTH FLOW



Sources: SEA EnvironmentalVue Monitoring System data, January 2022-December 2022; Landrum & Brown analysis, 2024

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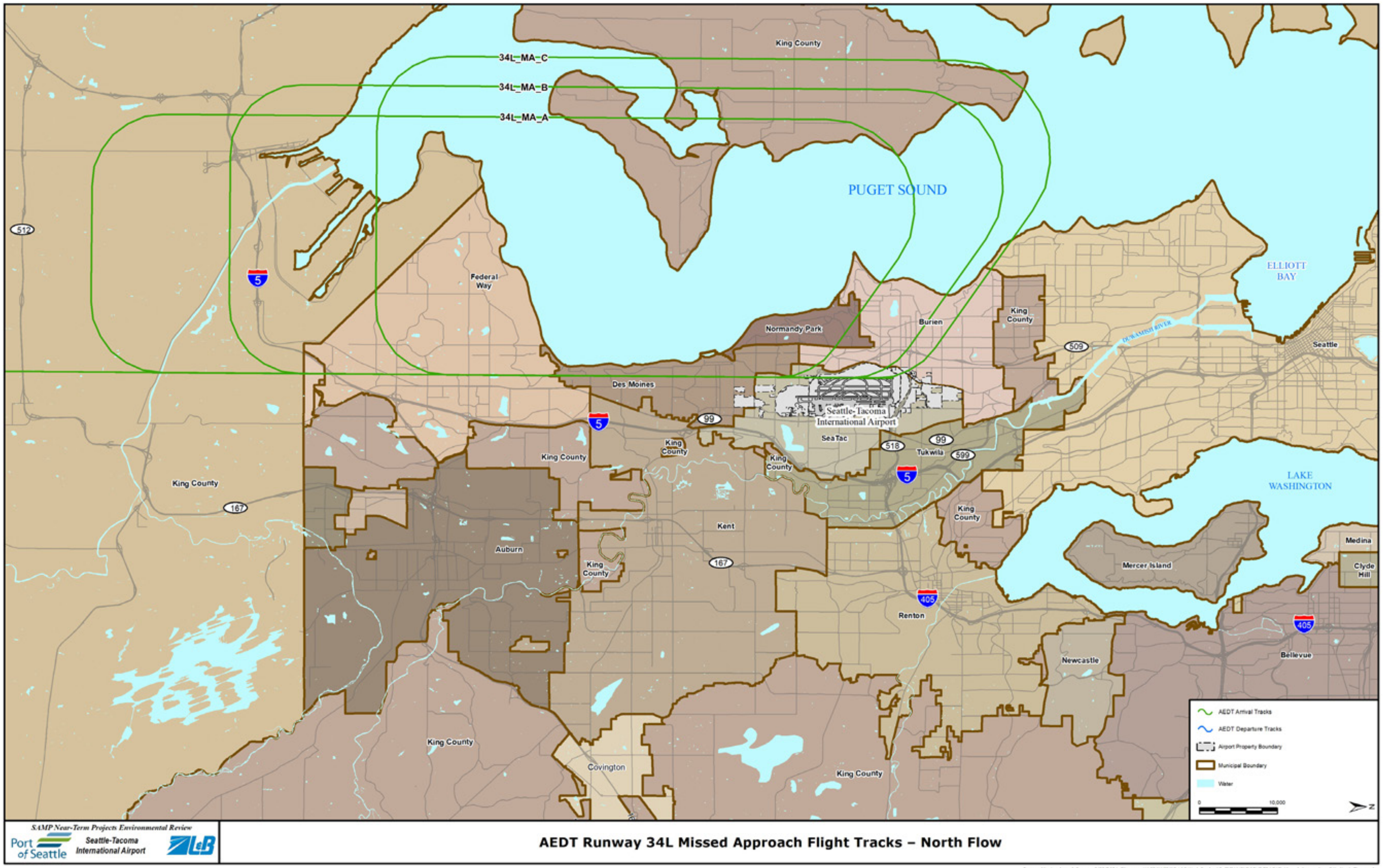
EXHIBIT 7-6: AEDT RUNWAY 34L MISSED APPROACH FLIGHT TRACKS – NORTH FLOW



Sources: SEA EnvironmentalVue Monitoring System data, January 2022-December 2022; Landrum & Brown analysis, 2024.

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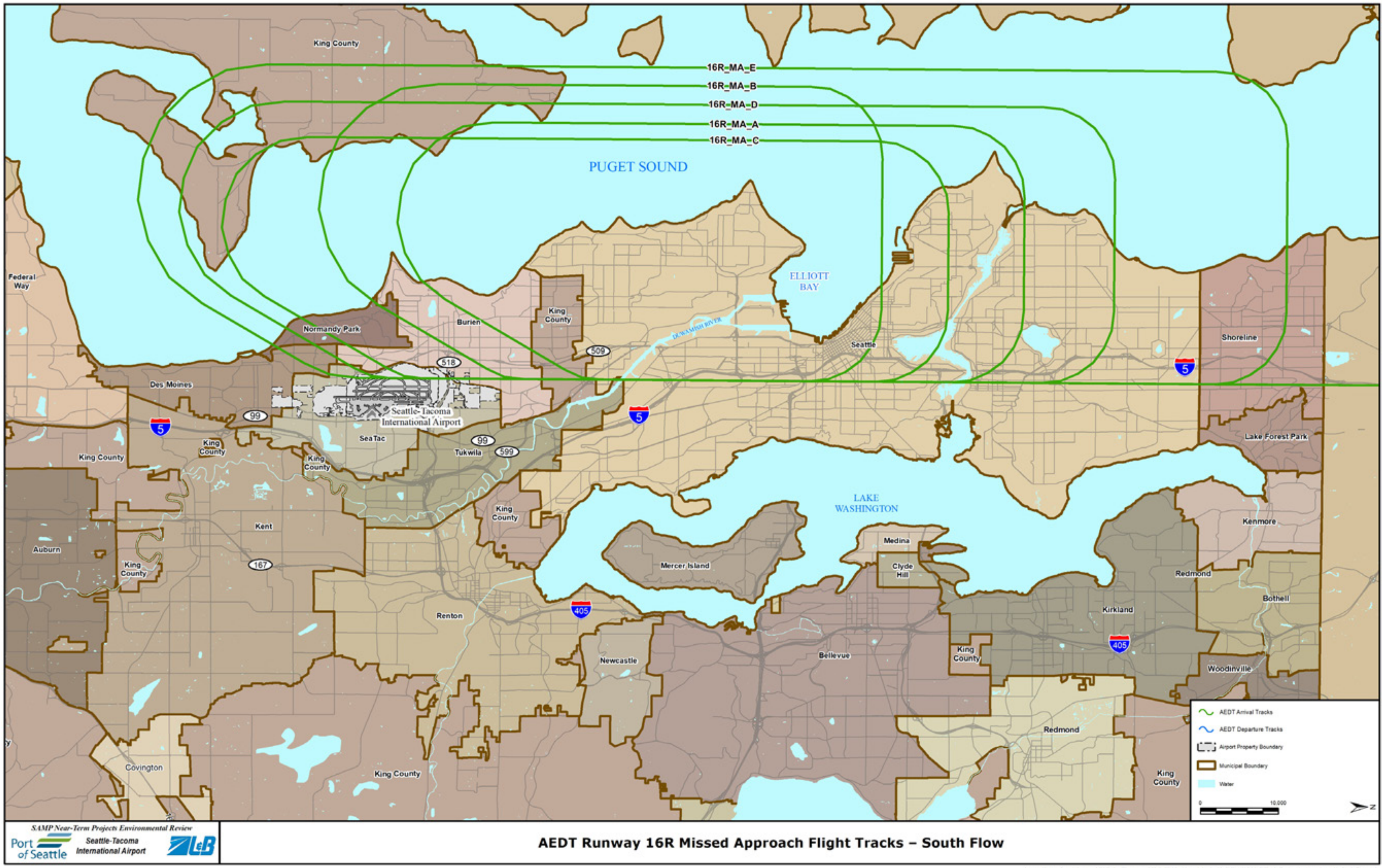
EXHIBIT 7-7: AEDT RUNWAY 16R MISSED APPROACH FLIGHT TRACKS – SORTH FLOW



Sources: SEA EnvironmentalVue Monitoring System data, January 2022-December 2022; Landrum & Brown analysis, 2024

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Aircraft Trip Length and Operational Profiles
Table 7-4 indicates the proportion of the 2022 departures that fell within each of the nine trip length categories for the Existing (2022) Condition.

TABLE 7-4: DEPARTURE STAGE LENGTH DISTRIBUTION – EXISTING (2022) CONDITION

Stage Length	Commercial Jets	Cargo Jets	Regional Jets	Turbo-Props	Cargo Props	GA Jets	GA Props	Total
1	17.0%	5.3%	3.9%	100%	100%	85.5%	100%	27.0%
2	40.0%	25.4%	96.1%	--	--	5.5%	--	34.6%
3	15.3%	12.6%	--	--	--	3.7%	--	13.3%
4	24.0%	41.6%	--	--	--	5.1%	--	21.6%
5	0.3%	0.0%	--	--	--	--	--	0.2%
6	2.3%	2.9%	--	--	--	0.3%	--	2.0%
7	0.7%	12.1%	--	--	--	0.5%	--	1.0%
8	0.1%	--	--	--	--	--	--	0.0%
9	0.2%	0.0%	--	--	--	--	--	0.2%
M	--	--	--	--	--	--	--	--

Sources: SEA EnvironmentalVue Monitoring System Data, January 2022-December 2022; Landrum & Brown analysis, 2024.

Typical destinations for Stage Length Category 1 (0-500 nautical miles) include Boise, Idaho; Portland, Oregon; and Vancouver, British Columbia. Typical destinations for Stage Length Category 2 distances (501-1,000 nautical miles) include Denver, Colorado; Las Vegas, Nevada; and Los Angeles, California. Typical destinations for Stage Length Category 3 distances (1,001-1,500 nautical miles) include Chicago, Illinois; Dallas, Texas; and Minneapolis-St. Paul, Minnesota. Typical destinations for Stage Length Category 4 distances (1,501-2,500 nautical miles) include Atlanta, Georgia; New York City, New York; and Toronto, Ontario. Typical destinations in the Stage Length Category 5 or greater (2,501 or more nautical miles) include destinations in Asia and Europe. The departure segment of the missed approaches are modeled as Stage Length Category 1.

7.1.1 Existing (2022) Condition Noise Contour

Exhibit 7-8: *Existing (2022) Condition Noise Contour*, graphically depicts the average annual noise contour for the Existing (2022) Condition. The 65 DNL noise contour of the Existing (2022) Condition encompasses 8.8 total square miles within the cities of Burien, Des Moines, and SeaTac, and unincorporated King County. The area in square miles of each DNL contour band is summarized in **Table 7-5**.

The 65 DNL contour extends approximately 3.4 miles to the north and 2.8 miles south of SEA. The area within the contour to the north and south is made up of a mix of single-family residential, multi-family residential, commercial, and industrial land uses.

TABLE 7-5: AREA (SQUARE MILES) OF 65, 70, AND 75 DNL NOISE CONTOURS – EXISTING (2022)

Alternative	DNL 65 - 70 dB	DNL 70 - 75 dB	DNL 75+ dB	DNL 65+ dB
Existing (2022)	5.41	2.14	1.24	8.79

Source: Landrum & Brown analysis, 2024.

7.1.2 Non-Compatible Land Use

Summaries of the residential population and housing units exposed to noise levels exceeding 65 DNL for the Existing (2022) Condition noise contour are provided in **Table 7-6**. A total of 6,216 housing units are located within the 65+ DNL noise contour.

TABLE 7-6: NON-COMPATIBLE LAND USE HOUSING AND POPULATION – EXISTING (2022) CONDITION

Mitigation Status/Land Use	DNL 65 - 70 dB	DNL 70 - 75 dB	DNL 65+ dB
Sound Insulation Completed			
Single-Family	3,100	93	3,193
Multi-Family	349	0	349
Mobile Home	0	0	0
Subtotal	3,449	93	3,542
Not Sound Insulated			
Single-Family	649	13	662
Multi-Family	1,887	0	1,887
Mobile Home	119	6	125
Subtotal	2,655	19	2,674
Total Housing Units	**6,104**	**112**	**6,216**
Estimated Population			
Total Estimated Population	**13,754**	**307**	**14,061**

Notes: Multi-family includes total units in a complex and were verified using King County assessor data. Population numbers are estimates based on the 2020 United States Census average household size per number of housing units.
Source: Landrum & Brown analysis, 2024.

A list of noise sensitive facilities within the 65+ DNL Noise Contour for the Existing (2022) Condition are listed in **Table 7-7**. There are nine schools (two have been sound insulated), 19 places of worship, three nursing homes, and two libraries within the 65+ DNL noise contour.

TABLE 7-7: NOISE SENSITIVE FACILITIES IN THE EXISTING (2022) CONDITION 65+ DNL NOISE CONTOUR

Map ID	Name
Schools	
S-1	Puget Sound Skills Center
S-3	Midway Elementary School
S-4	Mount Rainier High School
S-5	Southern Heights Elementary School
S-6	Pacific Middle School
S-7	Beverly Park Elementary School
S-8	Our Lady of Lourdes School
S-9	St. Philomena Catholic School
S-10	Glacier Middle School
Places of Worship	
C-1	Saint Philomena Catholic Church
C-2	Prince of Peace Lutheran Church
C-3	Samoan Christian Fellowship
C-4	Normandy Christian Church
C-6	Hope Church
C-7	Gospel Russian Baptist Church
C-8	The Mountain Church
C-9	Riverton Heights Baptist Church
C-10	Boulevard Park Presbyterian
C-11	Midway Community Covenant Church
C-12	Apostolic Bible Church of Jesus Christ
C-13	Highline 7th Day Adventist Church
C-14	Glen Acres Church of Christ
C-15	Kingdom Hall of Jehovah's Witnesses
C-17	Our Lady of Lourdes Church
C-18	Pacific Northwest United Methodist
C-19	Wat Buddharam Buddhist Temple
C-20	Hanuman Nagri Temple
C-21	Way of Salvation Church
Libraries	
L-1	Des Moines Library
L-2	Boulevard Park Library
Nursing Homes	
N-2	Wesley Homes Terrace
N-3	Wesley Homes Health Center
N-4	Wesley Homes Gardens and Bungalows

Source: Landrum & Brown analysis, 2024.

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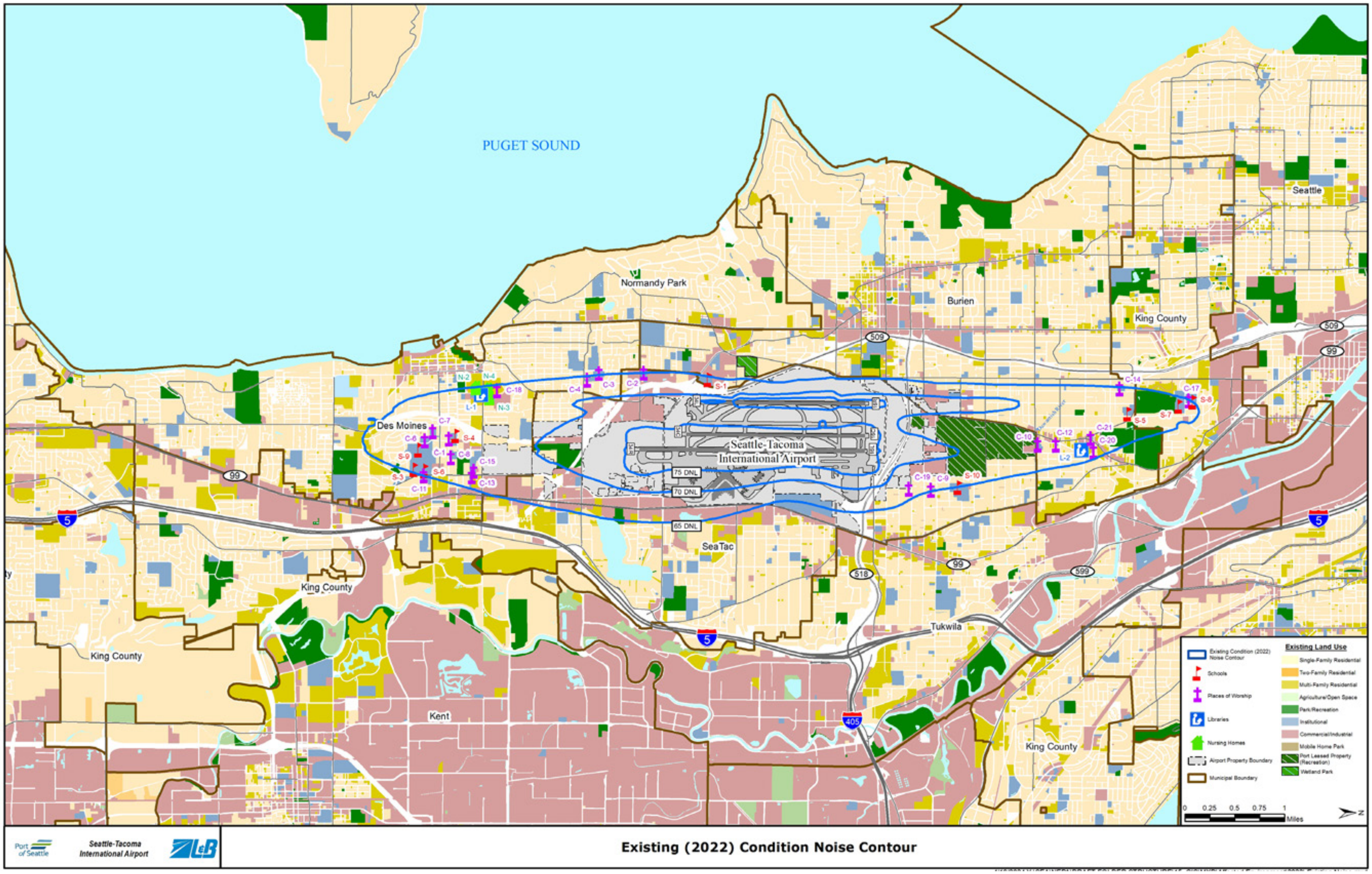
EXHIBIT 7-8: EXISTING (2022) CONDITION NOISE CONTOUR



Sources: AEDT Version 3f; Landrum & Brown analysis, 2024.

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7.2 Future Conditions

7.2.1 Future (2032) No Action

The following describes the input data and methodologies used in preparing the Future (2032) No Action noise contour, followed by the resulting noise exposure contours.

Aircraft Activity Levels and Fleet Mix

Table 7-8 shows the number of operations by detailed aircraft type and by time of day (daytime or nighttime). The Future (2032) No Action annual average day included 1,279 average annual day operations, 16 percent of which occurred during the nighttime hours of 10:00 p.m. to 6:59 a.m.

TABLE 7-8: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2032) NO ACTION

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Commercial Jets						
Airbus A220-100	16PW111	23.80	2.38	26.18	--	52.37
Airbus A220-300	16PW111	6.29	1.26	7.55	--	15.09
Airbus A220-300	16PW112	3.10	0.62	3.72	--	7.43
Airbus A319-100 Series	01P10IA020	--	0.01	0.00	0.00	0.01
Airbus A319-100 Series	3CM028	--	0.05	0.02	0.02	0.09
Airbus A319-100 Series	3IA006	--	1.04	0.52	0.52	2.08
Airbus A319-100 Series	3IA007	--	0.56	0.28	0.28	1.11
Airbus A319-100 Series	4CM035	--	0.04	0.02	0.02	0.08
Airbus A319-100 Series	8IA09	--	0.02	0.01	0.01	0.04
Airbus A320-200 Series	01P08CM105	6.14	1.84	4.91	3.07	15.96
Airbus A320-200 Series	01P10IA021	0.55	0.17	0.44	0.28	1.43
Airbus A320-200 Series	01P10IA022	0.12	0.04	0.10	0.06	0.31
Airbus A320-200 Series	1CM008	0.15	0.04	0.12	0.07	0.39
Airbus A320-200 Series	1CM009	0.61	0.18	0.49	0.30	1.58
Airbus A320-200 Series	1IA003	1.16	0.35	0.93	0.58	3.01
Airbus A320-200 Series	3CM026	0.66	0.20	0.53	0.33	1.72
Airbus A320-200 Series	8IA010	0.00	0.00	0.00	0.00	0.00
Airbus A320-NEO	01P20CM128	3.21	1.43	2.50	2.14	9.29
Airbus A320-NEO	01P22PW163	5.10	2.27	3.97	3.40	14.74
Airbus A321-200 Series	01P08CM104	1.03	0.39	0.86	0.55	2.84
Airbus A321-200 Series	01P10IA025	6.26	2.35	5.24	3.37	17.20
Airbus A321-200 Series	3CM025	1.06	0.40	0.89	0.57	2.93
Airbus A321-NEO	01P18PW157	4.57	2.54	6.09	1.01	14.21
Airbus A321-NEO	01P20CM132	13.54	7.52	18.06	3.01	42.14
Boeing 737-7	01P20CM136	1.19	0.30	1.19	0.30	2.99
Boeing 737-700 Series	3CM030	0.08	0.05	0.10	0.03	0.26
Boeing 737-700 Series	3CM031	2.81	1.56	3.37	1.01	8.75
Boeing 737-700 Series	3CM032	0.51	0.28	0.61	0.18	1.59
Boeing 737-700 Series	8CM051	0.00	0.00	0.00	0.00	0.01
Boeing 737-700 Series	8CM062	0.02	0.01	0.02	0.01	0.06
Boeing 737-700 Series	8CM063	0.48	0.27	0.57	0.17	1.48
Boeing 737-8	01P20CM135	0.31	0.08	0.31	0.08	0.77
Boeing 737-8	01P20CM136	10.02	2.51	10.02	2.51	25.05
Boeing 737-8	01P20CM140	9.24	2.31	9.24	2.31	23.11
Boeing 737-800 Series	01P11CM114	0.48	0.10	0.50	0.09	1.16

TABLE 7-8: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2032) NO ACTION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Boeing 737-800 Series	01P11CM116	6.50	1.43	6.74	1.18	15.85
Boeing 737-800 Series	01P11CM122	3.55	0.78	3.68	0.64	8.65
Boeing 737-800 Series	01P11CM125	0.79	0.17	0.82	0.14	1.92
Boeing 737-800 Series	01P11CM126	0.07	0.02	0.08	0.01	0.18
Boeing 737-800 Series	3CM032	19.89	4.37	20.65	3.62	48.53
Boeing 737-800 Series	3CM034	1.92	0.42	1.99	0.35	4.69
Boeing 737-800 Series	8CM051	27.23	5.98	28.26	4.95	66.43
Boeing 737-800 Series	8CM064	0.20	0.04	0.21	0.04	0.48
Boeing 737-800 Series	8CM065	2.54	0.56	2.64	0.46	6.20
Boeing 737-800 Series	8CM066	11.94	2.62	12.39	2.17	29.13
Boeing 737-9	01P20CM136	0.52	0.09	0.40	0.20	1.21
Boeing 737-9	01P20CM140	20.41	3.40	15.87	7.94	47.62
Boeing 737-900-ER	01P11CM116	33.03	7.49	33.44	7.09	81.04
Boeing 737-900-ER	01P11CM121	94.44	21.41	95.59	20.26	231.70
Boeing 737-900-ER	01P11CM125	0.29	0.07	0.29	0.06	0.71
Boeing 737-900-ER	3CM034	1.33	0.30	1.35	0.29	3.26
Boeing 737-900-ER	8CM065	1.48	0.34	1.50	0.32	3.64
Boeing 737-900-ER_MA	01P11CM121_MA	3.19	0.11	1.60	0.06	4.95
Airbus A330-200 Series	2RR023	3.02	0.38	3.39	--	6.79
Airbus A330-200 Series	9PW094	0.04	0.01	0.05	--	0.10
Airbus A330-300 Series	2RR023	0.74	--	0.74	--	1.47
Airbus A330-300 Series	4GE080	0.75	--	0.75	--	1.49
Airbus A330-300 Series	7PW082	0.10	--	0.10	--	0.20
Airbus A330-300 Series	9PW094	2.11	--	2.11	--	4.21
Airbus A330-300 Series	9PW095	0.49	--	0.49	--	0.99
Airbus A330-900N Series (Neo)	02P23RR141	6.86	--	6.86	--	13.72
Airbus A350-900 series	01P18RR124	2.57	--	1.71	0.86	5.13
Boeing 767-400 ER	8GE101	0.49	--		0.49	0.98
Boeing 777-200-ER	10PW099	0.16	--	0.16	--	0.33
Boeing 777-200-ER	2RR027	0.58	--	0.58	--	1.16
Boeing 777-200-ER	3GE060	0.26	--	0.26	--	0.51
Boeing 777-200-ER	3GE064	0.00	--	0.00	--	0.01
Boeing 777-200-ER	8GE100	0.27	--	0.27	--	0.53
Boeing 777-300 ER	01P21GE217	1.73	--	1.15	0.58	3.45
Boeing 787-10 Dreamliner	01P17GE211	0.46	--	0.46	--	0.92
Boeing 787-10 Dreamliner	01P17GE213	0.99	--	0.99	--	1.98
Boeing 787-10 Dreamliner	02P23RR134	0.50	--	0.50	--	1.00
Boeing 787-8 Dreamliner	01P17GE206	1.45	--	1.45	--	2.89
Boeing 787-8 Dreamliner	01P17GE210	0.05	--	0.05	--	0.10
Boeing 787-8 Dreamliner	11GE137	2.28	--	2.28	--	4.57

TABLE 7-8: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2032) NO ACTION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Boeing 787-8 Dreamliner	11GE138	5.61	--	5.61	--	11.22
Boeing 787-9 Dreamliner	01P17GE211	2.85	--	2.85	--	5.70
Boeing 787-9 Dreamliner	01P17GE214	0.02	--	0.02	--	0.04
Boeing 787-9 Dreamliner	02P23RR131	0.64	--	0.64	--	1.29
Boeing 787-9 Dreamliner	12RR067	2.94	--	2.94	--	5.89
Boeing 787-9 Dreamliner	12RR068	1.24	--	1.24	--	2.48
	Subtotal	371.03	83.12	374.51	77.99	906.65
Cargo Jets						
Airbus A300F4-600 Series	1GE020	0.01	--	0.01	--	0.01
Airbus A300F4-600 Series	1PW048	0.18	--	0.18	--	0.36
Airbus A300F4-600 Series	3GE056	0.33	--	0.33	--	0.66
Boeing 747-400 ERF	12PW102	0.27	0.54	0.54	0.27	1.62
Boeing 747-400BCF	01P03GE187	0.27	0.54	0.54	0.27	1.62
Boeing 747-8F	01P17GE215	0.40	--	0.40	--	0.79
Boeing 747-8F	13GE156	0.11	--	0.11	--	0.21
Boeing 747-8F	8GENX1	0.34	--	0.34	--	0.68
Boeing 767-200 Series Freighter	1GE010	1.31	2.62	2.62	1.31	7.85
Boeing 767-200 Series Freighter	1GE012	0.65	1.30	1.30	0.65	3.91
Boeing 767-200 Series Freighter	1PW026	0.12	0.23	0.23	0.12	0.70
Boeing 767-300 ER Freighter	1GE030	4.73	0.95	4.73	0.95	11.35
Boeing 767-300 ER Freighter	2GE055	0.47	0.09	0.47	0.09	1.12
Boeing 777 Freighter	01P21GE216	3.31	--	3.31	--	6.62
Boeing 777 Freighter	01P21GE217	0.08	--	0.08	--	0.16
Boeing MD-11 Freighter	12PW102	0.09	0.26	0.26	0.09	0.68
Boeing MD-11 Freighter	1GE031	0.43	1.29	1.29	0.43	3.43
Boeing MD-11 Freighter	1PW052	0.14	0.42	0.42	0.14	1.12
	Subtotal	13.21	8.23	17.14	4.31	42.89
Regional Jets						
Embraer ERJ175-LR	01P08GE197	138.94	17.08	142.35	13.67	312.04
Embraer ERJ175-LR_MA_Y2	01P08GE197_MA_Y2	1.59	0.20	0.79	0.10	2.68
	Subtotal	140.52	17.28	143.15	13.77	314.72
Cargo Props						
ATR 72-600 Freighter	PW127F	0.28	--	0.28	--	0.56
Cessna 208 Caravan	P6114A	1.59	--	1.59	--	3.19

TABLE 7-8: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2032) NO ACTION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Cessna 208 Caravan	PT6A14	1.57	--	1.57	--	3.14
Cessna 408 SkyCourier	PT6A6B	0.28	--	0.28	--	0.56
Raytheon Beech 99	PT6A27	0.00	--	0.00	--	0.01
Raytheon Beech 99	PT6A36	0.25	--	0.25	--	0.50
	Subtotal	3.98	--	3.98	--	7.95
General Aviation						
Bombardier Challenger 350	01P14HN011	0.76	--	0.76	--	1.52
Cessna 172 Skyhawk	IO320	0.09	0.09	0.18	--	0.36
Dassault Falcon 50	1AS002	0.76	--	0.76	--	1.52
Embraer Phenom 300 (EMB-505)	PW530	0.17	--	0.17	--	0.35
Piper PA-31 Navajo	TIO540	0.02	--	0.02	--	0.05
Raytheon C-12 Huron	PT660A	0.08	--	0.08	--	0.17
	Subtotal	1.89	0.09	1.98	--	3.96
Other						
Boeing 737-900-ER_O1	01P11CM121_O1	0.49	0.11	0.49	0.10	1.20
Boeing 737-900-ER_O2	01P11CM125_O2	0.00	0.00	0.00	0.00	0.00
Boeing 737-900-ER_O3	3CM034_O3	0.01	0.00	0.01	0.00	0.02
Boeing 737-900-ER_O4	8CM065_O4	0.01	0.00	0.01	0.00	0.02
Boeing 737-900-ER_O7	01P11CM116_O7	0.17	0.04	0.17	0.04	0.41
Cessna 208 Caravan_O5	P6114A_O5	0.28	--	0.28	--	0.55
Cessna 208 Caravan_O6	PT6A14_O6	0.27	--	0.27	--	0.54
	Subtotal	1.22	0.15	1.23	0.14	2.74
Military						
Cessna 172 Skyhawk_M2	IO320_M2	0.00	--	0.00	--	0.01
Embraer Phenom 300 (EMB-505)_M1	PW530_M1	0.10	--	0.10	--	0.20
Raytheon C-12 Huron_M	PT660A_M	0.04	--	0.04	--	0.07
	Subtotal	0.14	--	0.14	--	0.27
	Grand Total	**531.98**	**108.88**	**542.11**	**96.21**	**1279.18**

Note: Totals may not sum due to rounding.
Day = 7:00 a.m. to 9:59 p.m., Night = 10:00 p.m. to 6:59 a.m.

Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Landrum & Brown analysis, 2024.

Runway Definition

Under the Future (2032) No Action, none of the proposed airfield changes would occur and it is assumed that no changes to the runway locations would occur. Therefore, the runway definition discussed for the Existing (2022) Condition (see Section 7.1) would remain the same for the Future (2032) No Action.

Runway End Utilization

Under the Future (2032) No Action, the runway end utilization was estimated using operational output from the Total Airspace and Airport Modeler (TAAM) airfield simulation modeling.[12] The runway end utilization under the No Action condition would be influenced by airfield congestion and the total number of operations occurring at the Airport. **Table 7-9** presents the runway end utilization used for the modeling of the Future (2032) No Action.

TABLE 7-9: GENERALIZED RUNWAY END UTILIZATION SUMMARY – FUTURE (2032) NO ACTION

Aircraft Category	Runway End 16L	Runway End 16C	Runway End 16R	Runway End 34L	Runway End 34C	Runway End 34R
Daytime Arrivals						
Commercial Jets	10.33%	1.00%	59.67%	24.37%	0.50%	4.13%
Cargo Jets	55.00%	1.00%	15.00%	6.50%	0.50%	22.00%
Regional Jets	5.00%	1.00%	65.00%	26.50%	0.50%	2.00%
Cargo Props	23.05%	1.43%	46.52%	26.50%	0.93%	1.57%
General Aviation	26.00%	1.50%	43.50%	26.50%	1.00%	1.50%
Other	14.45%	1.22%	55.33%	26.50%	0.72%	1.78%
Military	26.00%	1.50%	43.50%	26.50%	1.00%	1.50%
Missed Approaches*	--	--	77.33%	22.67	--	--
Daytime Departures						
Commercial Jets	45.41%	25.59%	--	--	0.95%	28.05%
Cargo Jets	58.00%	13.00%	--	--	0.50%	28.50%
Regional Jets	44.00%	27.00%	--	--	1.00%	28.00%
Cargo Props	36.27%	32.16%	2.58%	1.72%	12.60%	14.68%
General Aviation	35.00%	33.00%	3.00%	2.00%	14.50%	12.50%
Other	39.98%	29.68%	1.34%	0.89%	7.03%	21.07%
Military	35.00%	33.00%	3.00%	2.00%	14.50%	12.50%
Missed Approaches*	--	--	77.33%	22.67	--	--
Nighttime Arrivals						
Commercial Jets	5.23%	1.00%	64.77%	26.41%	0.50%	2.09%
Cargo Jets	55.00%	1.00%	15.00%	6.50%	0.50%	22.00%
Regional Jets	5.00%	1.00%	65.00%	26.50%	0.50%	2.00%
Cargo Props	--	--	--	--	--	--
General Aviation	26.00%	1.50%	43.50%	26.50%	1.00%	1.50%
Other	5.00%	1.00%	65.00%	26.50%	0.50%	2.00%
Military	--	--	--	--	--	--
Missed Approaches*	--	--	80.98%	19.02%	--	--

12 Environmental Review Airside Modeling, Seattle-Tacoma International Airport (LeighFisher, 2020)

TABLE 7-9: GENERALIZED RUNWAY END UTILIZATION SUMMARY – FUTURE (2032) NO ACTION (CONTINUED)

Aircraft Category	Runway End 16L	Runway End 16C	Runway End 16R	Runway End 34L	Runway End 34C	Runway End 34R
Nighttime Departures						
Commercial Jets	44.35%	26.65%	--	--	0.99%	28.01%
Cargo Jets	58.00%	13.00%	--	--	0.50%	28.50%
Regional Jets	44.00%	27.00%	--	--	1.00%	28.00%
Cargo Props	--	--	--	--	--	--
General Aviation	--	--	--	--	--	--
Other	44.00%	27.00%	--	--	1.00%	28.00%
Military	--	--	--	--	--	--
Missed Approaches*	--	--	80.98%	19.02%	--	--

Note: Day = 7:00 a.m. to 9:59 p.m., Night = 10:00 p.m. to 6:59 a.m.
* Missed approaches count as two arrivals and one departure for modeling purposes.
Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Environmental Review Airside Modeling, Seattle-Tacoma International Airport, LeighFisher, 2020, Landrum & Brown analysis, 2024.

Engine Run-Ups

Under the Future (2032) No Action, no changes to run-up locations would occur. Therefore, the run-up locations discussed for the Existing (2022) Condition in Section 7.1 would remain the same for the Future (2032) No Action. The number of engine run-up operations are estimated for Future (2032) No Action conditions based on scaling the engine run-ups from 2022 for the number of total operations, assuming the same distribution across aircraft type. The resulting number of engine run-ups are presented below in **Table 7-10**.

TABLE 7-10: ANNUAL AIRCRAFT RUN-UP ACTIVITY – FUTURE (2032) NO ACTION

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
North Flow Primary Location						
Airbus A319-100 Series	3IA006	1.4	3.0	--	--	22,000 lbs.
Airbus A320-200 Series	01P08CM105	24.6	15.8	1.5	2	25,000 lbs.
Airbus A320-200 Series	1CM009	2.9	69.5	--	--	25,000 lbs.
Airbus A320-200 Series	3CM026	2.9	15.5	--	--	25,000 lbs.
Airbus A321-200 Series	3CM025	4.3	36.7	--	--	30,000 lbs.
Airbus A321-NEO	01P20CM132	--	--	1.5	2	30,000 lbs.
Airbus A330-200 Series	9PW094	8.7	27.7	--	--	71,100 lbs.
Airbus A330-300 Series	4GE080	1.4	37.0	--	--	67,500 lbs.
Airbus A330-900N Series (Neo)	02P23RR141	1.4	26.0	--	--	71,100 lbs.
Boeing 737-700 Series	3CM031	5.8	26.8	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	7.2	56.4	--	--	24,000 lbs.
Boeing 737-800 Series	01P11CM122	1.4	10.0	--	--	26,300 lbs.
Boeing 737-800 Series	3CM032	20.3	27.6	--	--	26,300 lbs.

TABLE 7-10: ANNUAL AIRCRAFT RUN-UP ACTIVITY – FUTURE (2032) NO ACTION (CONTINUED)

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Boeing 737-800 Series	3CM034	1.4	9.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM051	2.9	40.5	--	--	26,300 lbs.
Boeing 737-800 Series	8CM066	4.3	33.0	--	--	26,300 lbs.
Boeing 737-9	01P20CM140	13.0	14.6	--	--	26,400 lbs.
Boeing 737-900-ER	01P11CM116	14.5	20.2	--	--	26,300 lbs.
Boeing 737-900-ER	01P11CM121	1.4	4.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM121	23.2	25.1	--	--	26,300 lbs.
Boeing MD-11 Freighter	1GE031	--	--	1.5	2	61,500 lbs.
Embraer ERJ175-LR	01P08GE197	1.4	6.0	--	--	6,900 lbs.
Embraer ERJ175-LR	01P08GE197	5.8	28.0	--	--	13,800 lbs.
South Flow Primary Location						
Airbus A319-100 Series	3IA006	1.4	15.0	--	--	22,000 lbs.
Airbus A319-100 Series	3IA007	1.4	26.0	1.5	11	22,000 lbs.
Airbus A320-200 Series	01P08CM105	2.9	6.0	--	--	12,500 lbs.
Airbus A320-200 Series	01P08CM105	40.6	12.9	--	--	25,000 lbs.
Airbus A320-200 Series	1CM009	7.2	31.6	--	--	25,000 lbs.
Airbus A321-NEO	01P20CM132	2.9	12.5	--	--	30,000 lbs.
Airbus A330-200 Series	2RR023	1.4	6.0	--	--	71,100 lbs.
Airbus A330-200 Series	9PW094	1.4	26.0	--	--	35,550 lbs.
Airbus A330-200 Series	9PW094	11.6	14.9	--	--	71,100 lbs.
Airbus A330-300 Series	4GE080	4.3	10.7	--	--	67,500 lbs.
Airbus A330-900N Series (Neo)	02P23RR141	4.3	26.7	--	--	71,100 lbs.
Boeing 737-700 Series	3CM031	1.4	20.0	1.5	2	12,000 lbs.
Boeing 737-700 Series	3CM031	23.2	17.6	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	5.8	31.5	--	--	24,000 lbs.
Boeing 737-800 Series	3CM032	4.3	18.3	--	--	13,150 lbs.
Boeing 737-800 Series	3CM032	60.8	18.3	--	--	26,300 lbs.
Boeing 737-800 Series	8CM051	15.9	21.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM065	1.4	6.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM066	1.4	3.0	1.5	2	13,150 lbs.
Boeing 737-800 Series	8CM066	34.8	10.7	--	--	26,300 lbs.
Boeing 737-9	01P20CM140	1.4	9.0	--	--	13,200 lbs.
Boeing 737-9	01P20CM140	30.4	10.4	--	--	26,400 lbs.
Boeing 737-900-ER	01P11CM116	1.4	3.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM116	30.4	15.7	2.9	2	26,300 lbs.
Boeing 737-900-ER	01P11CM121	1.4	8.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM121	78.2	25.5	--	--	26,300 lbs.
Boeing 767-200 Series Freighter	1GE012	1.4	6.0	--	--	48,000 lbs.
Boeing 767-300 ER Freighter	1GE030	4.3	21.0	--	--	60,000 lbs.
Boeing MD-11 Freighter	1GE031	2.9	44.5	--	--	61,500 lbs.

TABLE 7-10: ANNUAL AIRCRAFT RUN-UP ACTIVITY – FUTURE (2032) NO ACTION (CONTINUED)

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Embraer ERJ175-LR	01P08GE197	10.1	11.2	--	--	13,800 lbs.
Tango X Location						
Airbus A330-200 Series	9PW094	1.4	38.0	--	--	71,100 lbs.
Total		543.3	--	11.6	--	--

Notes: Totals may not sum due to rounding.
Daytime = 7:00am – 9:59pm, Nighttime = 10:00pm – 6:59am.
Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Landrum & Brown analysis, 2024.

Flight Tracks

Flight track locations for the Future (2032) No Action would not change. As such, the flight tracks for the Future (2032) No Action are expected to be the same as the Existing (2022) Condition. The flight track information discussed for the Existing (2022) Condition in Section 7.1 would remain the same for the Future (2032) No Action.

Aircraft Trip Length and Operational Profiles

Table 7-11 presents the departure stage length distribution for the Future (2032) No Action. The departure segment of the missed approaches is modeled as Stage Length Category 1.

TABLE 7-11: DEPARTURE STAGE LENGTH DISTRIBUTION – FUTURE (2032) NO ACTION

Stage Length	Commercial Jets	Cargo Jets	Regional Jets	Cargo Props	General Aviation	Other	Military	Total
1	3.61%	0.00%	73.72%	100.0%	100.0%	41.97%	100.0%	21.70%
2	45.95%	18.20%	22.63%	--	--	30.16%	--	38.81%
3	17.09%	26.73%	3.65%	--	--	14.75%	--	13.95%
4	25.38%	30.31%	--	--	--	13.11%	--	19.05%
5	--	--	--	--	--	--	--	--
6	3.20%	15.80%	--	--	--	--	--	2.80%
7	4.77%	8.95%	--	--	--	--	--	3.68%
8	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--

Note: Totals may not sum due to rounding.
Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Landrum & Brown analysis, 2024.

7.2.1.2 Future 2032 No Action Noise Contours

Exhibit 7-9: *Future (2032) No Action Noise Contour* depicts the 65, 70, and 75 DNL noise contours for the Future (2032) No Action. The area in square miles of each DNL contour band is summarized in **Table 7-12**.

The 65 DNL contour extends approximately 3.7 miles to the north and 3.3 miles south of SEA. The area within the contour to the north and south is made up of a mix of single-family residential, multi-family residential, commercial, and industrial land uses.

TABLE 7-12: AREA (SQUARE MILES) OF 65, 70, AND 75 DNL NOISE CONTOURS – FUTURE (2032) NO ACTION

Alternative	DNL 65 - 70 dB	DNL 70 - 75 dB	DNL 75+ dB	DNL 65+ dB
Existing (2022)	5.41	2.14	1.24	8.79
Future (2032) No Action	6.23	2.42	1.45	10.10
Change	0.82	0.28	0.21	1.31

Source: Landrum & Brown analysis, 2024.

7.2.1.3 Non-Compatible Land Use

Summaries of the residential population and housing units exposed to noise levels exceeding 65+ DNL for the Future (2032) No Action noise contour are provided in **Table 7-13**. A total of 9,518 housing units would be located within the 65+ DNL noise contour (an increase of 3,402 from the 2022 Existing Condition). The increase in housing units and population from the Existing Condition is due to the increase in aircraft operations and the increase in size of the 65+ DNL contour. For the "sound insulation completed" category, the additional areas within the 65+ DNL contour includes homes treated prior phases of the Port's Part 150 Noise Remedy Program, which extends back to 1985 (when the noise contours were much larger). Therefore, the increases in the numbers are solely due to the changes in the noise contour.

TABLE 7-13 NON-COMPATIBLE LAND USE HOUSING AND POPULATION – FUTURE (2032) NO ACTION

Mitigation Status/Land Use	DNL 65 - 70 dB	DNL 70 - 75 dB	DNL 65+ dB
Sound Insulation Completed			
Single-Family	3,720	426	4,146
Multi-Family	384	4	388
Mobile Home	0	0	0
Subtotal	4,104	430	4,534
Not Sound Insulated			
Single-Family	959	87	1,046
Multi-Family	3,772	10	3,782
Mobile Home	139	17	156
Subtotal	4,870	114	4,984
Total Housing Units	**8,974**	**544**	**9,518**
Estimated Population			
Total Estimated Population	**20,571**	**1,404**	**21,975**

Notes: Multi-family includes total units in a complex and were verified using King County assessor data. Population numbers are estimates based on the 2020 United States Census average household size per number of housing units.
Source: Landrum & Brown analysis, 2024.

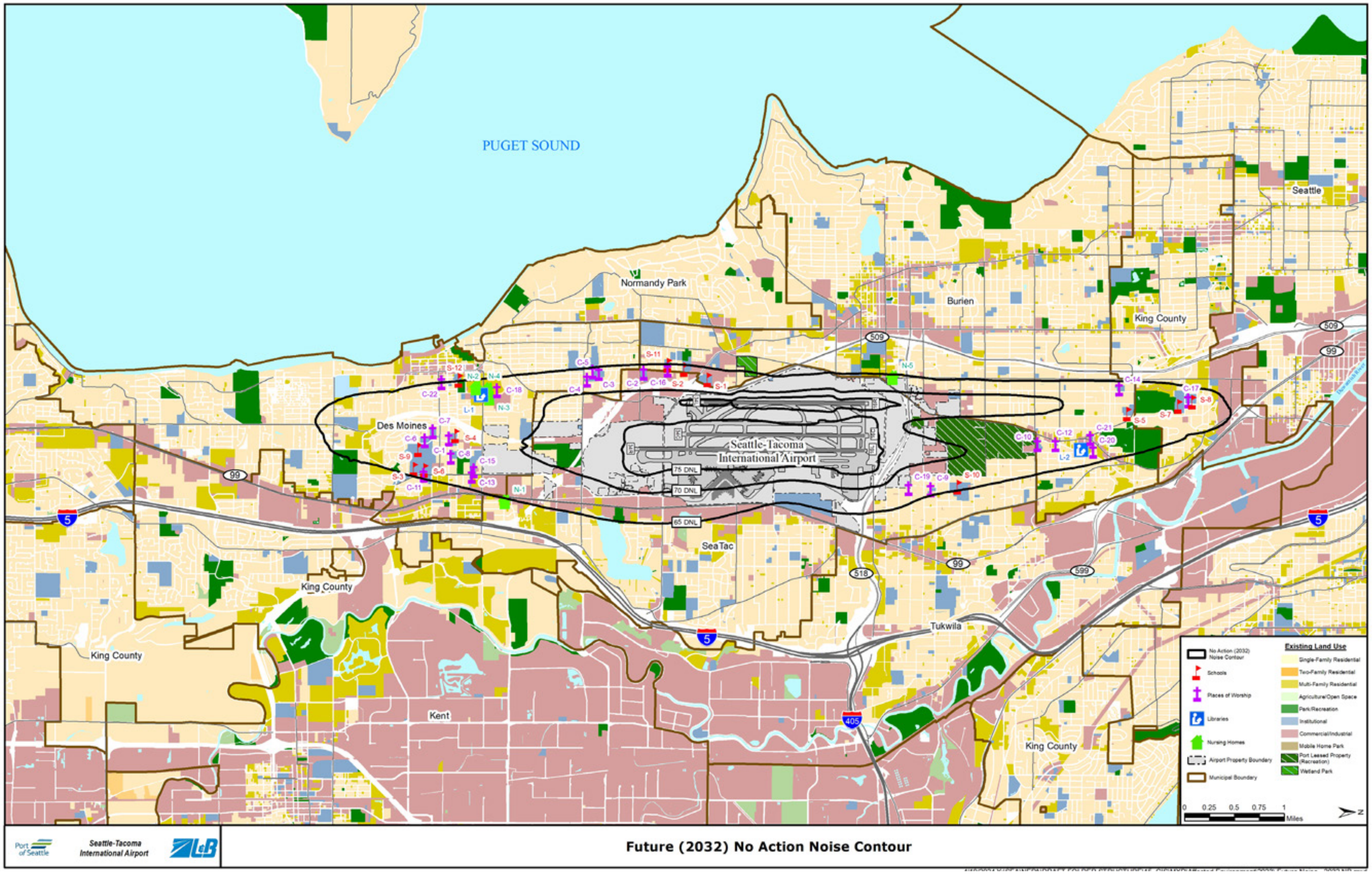
A list of noise sensitive within the 65+ DNL Noise Contour for the Future (2032) No Action are listed in **Table 7-14**. There would be 12 schools, 22 places of worship, five nursing homes, and two libraries within the 65 DNL noise contour. There are no noise sensitive facilities within the 70 or 75 DNL noise contours for the Future (2032) No Action.

TABLE 7-14: NOISE SENSITIVE FACILITIES IN THE FUTURE (2032) NO ACTION 65+ DNL NOISE CONTOUR

Map ID	Name
Schools	
S-1	Puget Sound Skills Center
S-2	Choice Academy – Homeschool Center
S-3	Midway Elementary School
S-4	Mount Rainier High School
S-5	Southern Heights Elementary School
S-6	Pacific Middle School
S-7	Beverly Park Elementary School
S-8	Our Lady of Lourdes School
S-9	St. Philomena Catholic School
S-10	Glacier Middle School
S-11	Community Chapel Christian School
S-12	Des Moines Elementary School
Places of Worship	
C-1	Saint Philomena Catholic Church
C-2	Prince of Peace Lutheran Church
C-3	Samoan Christian Fellowship
C-4	Normandy Christian Church
C-5	Southminster Presbyterian Church
C-6	Hope Church
C-7	Gospel Russian Baptist Church
C-8	The Mountain Church
C-9	Riverton Heights Baptist Church
C-10	Boulevard Park Presbyterian
C-11	Midway Community Covenant Church
C-12	Apostolic Bible Church of Jesus Christ
C-13	Highline 7th Day Adventist Church
C-14	Glen Acres Church of Christ
C-15	Kingdom Hall of Jehovah's Witnesses
C-16	New Testament Christian Church
C-17	Our Lady of Lourdes Church
C-18	Pacific Northwest United Methodist
C-19	Wat Buddharam Buddhist Temple
C-20	Hanuman Nagri Temple
C-21	Way of Salvation Church
C-22	Des Moines United Methodist Church
Libraries	
L-1	Des Moines Library
L-2	Boulevard Park Library
Nursing Homes	
N-1	Falcon Ridge Assisted Living
N-2	Wesley Homes Terrace
N-3	Wesley Homes Health Center
N-4	Wesley Homes Gardens and Bungalows
N-5	High West Residence

Source: Landrum & Brown analysis, 2024.

EXHIBIT 7-9: FUTURE (2032) NO ACTION NOISE CONTOUR



Sources: AEDT Version 3f; Landrum & Brown analysis, 2024.

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7.2.2 Future (2032) Proposed Action

The following describes the input data and methodologies used in preparing the Future (2032) Proposed Action noise contour, followed by the resulting noise exposure contours.

Aircraft Activity Levels and Fleet Mix

Table 7-15 shows the total number of operations by detailed aircraft type and by time of day (daytime or nighttime). The Future (2032) Proposed Action annual average day included 1,303 average-annual day operations, 16 percent of which occurred during the nighttime hours of 10:00 p.m. to 6:59 a.m. This is an increase of 24 average-annual day operations over the Future (2032) No Action condition.

TABLE 7-15: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2032) PROPOSED ACTION

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Commercial Jets						
Airbus A220-100	16PW111	24.27	2.43	26.70	--	53.40
Airbus A220-300	16PW111	6.41	1.28	7.69	--	15.39
Airbus A220-300	16PW112	3.16	0.63	3.79	--	7.58
Airbus A319-100 Series	01P10IA020	0.00	0.00	0.00	0.00	0.01
Airbus A319-100 Series	3CM028	0.02	0.03	0.02	0.02	0.09
Airbus A319-100 Series	3IA006	0.35	0.71	0.53	0.53	2.12
Airbus A319-100 Series	3IA007	0.19	0.38	0.28	0.28	1.14
Airbus A319-100 Series	4CM035	0.01	0.03	0.02	0.02	0.08
Airbus A319-100 Series	8IA09	0.01	0.01	0.01	0.01	0.04
Airbus A320-200 Series	01P08CM105	6.26	1.88	5.32	2.82	16.28
Airbus A320-200 Series	01P10IA021	0.56	0.17	0.48	0.25	1.46
Airbus A320-200 Series	01P10IA022	0.12	0.04	0.10	0.05	0.32
Airbus A320-200 Series	1CM008	0.15	0.05	0.13	0.07	0.40
Airbus A320-200 Series	1CM009	0.62	0.19	0.53	0.28	1.61
Airbus A320-200 Series	1IA003	1.18	0.35	1.00	0.53	3.07
Airbus A320-200 Series	3CM026	0.67	0.20	0.57	0.30	1.75
Airbus A320-200 Series	8IA010	0.00	0.00	0.00	0.00	0.00
Airbus A320-NEO	01P20CM128	2.91	1.82	2.55	2.19	9.47
Airbus A320-NEO	01P22PW163	4.62	2.89	4.05	3.47	15.03
Airbus A321-200 Series	01P08CM104	1.05	0.39	0.88	0.57	2.89
Airbus A321-200 Series	01P10IA025	6.38	2.39	5.34	3.43	17.54
Airbus A321-200 Series	3CM025	1.09	0.41	0.91	0.58	2.99
Airbus A321-NEO	01P18PW157	4.66	2.59	6.21	1.03	14.48
Airbus A321-NEO	01P20CM132	13.81	7.67	18.41	3.07	42.96
Airbus A330-200 Series	2RR023	3.15	0.31	3.46	--	6.92
Airbus A330-200 Series	9PW094	0.05	0.00	0.05	--	0.10
Airbus A330-300 Series	2RR023	0.75	--	0.75	--	1.50
Airbus A330-300 Series	4GE080	0.76	--	0.76	--	1.52
Airbus A330-300 Series	7PW082	0.10	--	0.10	--	0.21
Airbus A330-300 Series	9PW094	2.15	--	2.15	--	4.30
Airbus A330-300 Series	9PW095	0.50	--	0.50	--	1.01
Airbus A330-900N Series (Neo)	02P23RR141	6.99	--	6.99	--	13.99

TABLE 7-15: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2032) PROPOSED ACTION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Airbus A350-900 series	01P18RR124	2.62	--	1.75	0.87	5.24
Boeing 737-7	01P20CM136	1.27	0.25	1.27	0.25	3.04
Boeing 737-700 Series	3CM030	0.07	0.07	0.10	0.03	0.26
Boeing 737-700 Series	3CM031	2.23	2.23	3.47	0.99	8.93
Boeing 737-700 Series	3CM032	0.41	0.41	0.63	0.18	1.62
Boeing 737-700 Series	8CM051	0.00	0.00	0.00	0.00	0.01
Boeing 737-700 Series	8CM062	0.02	0.02	0.03	0.01	0.06
Boeing 737-700 Series	8CM063	0.38	0.38	0.59	0.17	1.51
Boeing 737-8	01P20CM135	0.33	0.07	0.33	0.07	0.79
Boeing 737-8	01P20CM136	10.64	2.13	10.64	2.13	25.54
Boeing 737-8	01P20CM140	9.82	1.96	9.82	1.96	23.56
Boeing 737-800 Series	01P11CM114	0.49	0.10	0.50	0.10	1.19
Boeing 737-800 Series	01P11CM116	6.68	1.40	6.78	1.30	16.16
Boeing 737-800 Series	01P11CM122	3.64	0.77	3.70	0.71	8.82
Boeing 737-800 Series	01P11CM125	0.81	0.17	0.82	0.16	1.96
Boeing 737-800 Series	01P11CM126	0.08	0.02	0.08	0.01	0.19
Boeing 737-800 Series	3CM032	20.45	4.29	20.75	3.99	49.48
Boeing 737-800 Series	3CM034	1.97	0.41	2.00	0.39	4.78
Boeing 737-800 Series	8CM051	27.99	5.88	28.40	5.46	67.73
Boeing 737-800 Series	8CM064	0.20	0.04	0.21	0.04	0.49
Boeing 737-800 Series	8CM065	2.61	0.55	2.65	0.51	6.32
Boeing 737-800 Series	8CM066	12.27	2.58	12.46	2.40	29.70
Boeing 737-9	01P20CM136	0.53	0.08	0.39	0.22	1.23
Boeing 737-9	01P20CM140	20.97	3.31	15.45	8.83	48.56
Boeing 737-900-ER	01P11CM116	33.94	7.38	34.54	6.78	82.63
Boeing 737-900-ER	01P11CM121	97.03	21.09	98.74	19.39	236.26
Boeing 737-900-ER	01P11CM125	0.30	0.06	0.30	0.06	0.72
Boeing 737-900-ER	3CM034	1.37	0.30	1.39	0.27	3.33
Boeing 737-900-ER	8CM065	1.52	0.33	1.55	0.30	3.71
Boeing 737-900-ER_MA	01P11CM121_MA	3.25	0.11	1.63	0.06	5.05
Boeing 767-400 ER	8GE101	0.50	--	--	0.50	1.00
Boeing 777-200-ER	10PW099	0.17	--	0.17	--	0.34
Boeing 777-200-ER	2RR027	0.59	--	0.59	--	1.18
Boeing 777-200-ER	3GE060	0.26	--	0.26	--	0.52
Boeing 777-200-ER	3GE064	0.00	--	0.00	--	0.01
Boeing 777-200-ER	8GE100	0.27	--	0.27	--	0.54
Boeing 777-300 ER	01P21GE217	1.76	--	1.17	0.59	3.52
Boeing 787-10 Dreamliner	01P17GE211	0.47	--	0.47	--	0.93
Boeing 787-10 Dreamliner	01P17GE213	1.01	--	1.01	--	2.02
Boeing 787-10 Dreamliner	02P23RR134	0.51	--	0.51	--	1.02

TABLE 7-15: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2032) PROPOSED ACTION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Boeing 787-8 Dreamliner	01P17GE206	1.47	--	1.47	--	2.95
Boeing 787-8 Dreamliner	01P17GE210	0.05	--	0.05	--	0.10
Boeing 787-8 Dreamliner	11GE137	2.33	--	2.33	--	4.66
Boeing 787-8 Dreamliner	11GE138	5.72	--	5.72	--	11.44
Boeing 787-9 Dreamliner	01P17GE211	2.91	--	2.91	--	5.81
Boeing 787-9 Dreamliner	01P17GE214	0.02	--	0.02	--	0.04
Boeing 787-9 Dreamliner	02P23RR131	0.66	--	0.66	--	1.31
Boeing 787-9 Dreamliner	12RR067	3.00	--	3.00	--	6.01
Boeing 787-9 Dreamliner	12RR068	1.27	--	1.27	--	2.53
Subtotal		*379.82*	*83.25*	*383.14*	*78.24*	*924.45*
Cargo Jets						
Airbus A300F4-600 Series	1GE020	0.01	--	0.01	--	0.01
Airbus A300F4-600 Series	1PW048	0.18	--	0.18	--	0.36
Airbus A300F4-600 Series	3GE056	0.33	--	0.33	--	0.66
Boeing 747-400 ERF	12PW102	0.27	0.54	0.54	0.27	1.62
Boeing 747-400BCF	01P03GE187	0.27	0.54	0.54	0.27	1.62
Boeing 747-8F	01P17GE215	0.40	--	0.40	--	0.79
Boeing 747-8F	13GE156	0.11	--	0.11	--	0.21
Boeing 747-8F	8GENX1	0.34	--	0.34	--	0.68
Boeing 767-200 Series Freighter	1GE010	1.31	2.62	2.62	1.31	7.85
Boeing 767-200 Series Freighter	1GE012	0.65	1.30	1.30	0.65	3.91
Boeing 767-200 Series Freighter	1PW026	0.12	0.23	0.23	0.12	0.70
Boeing 767-300 ER Freighter	1GE030	4.73	0.95	4.73	0.95	11.35
Boeing 767-300 ER Freighter	2GE055	0.47	0.09	0.47	0.09	1.12
Boeing 777 Freighter	01P21GE216	3.31	--	3.31	--	6.62
Boeing 777 Freighter	01P21GE217	0.08	--	0.08	--	0.16
Boeing MD-11 Freighter	12PW102	0.09	0.26	0.26	0.09	0.68
Boeing MD-11 Freighter	1GE031	0.43	1.29	1.29	0.43	3.43

TABLE 7-15: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2032) PROPOSED ACTION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Boeing MD-11 Freighter	1PW052	0.14	0.42	0.42	0.14	1.12
Subtotal		*13.21*	*8.23*	*17.14*	*4.31*	*42.89*
Regional Jets						
Embraer ERJ175-LR	01P08GE197	142.69	16.39	141.62	17.46	318.17
Embraer ERJ175-LR_MA_Y2	01P08GE197_MA_Y2	1.62	0.20	0.81	0.10	2.73
Subtotal		*144.31*	*16.59*	*142.43*	*17.56*	*320.90*
Cargo Props						
ATR 72-600 Freighter	PW127F	0.28	--	0.28	--	0.56
Cessna 208 Caravan	P6114A	1.59	--	1.59	--	3.19
Cessna 208 Caravan	PT6A14	1.57	--	1.57	--	3.14
Cessna 408 SkyCourier	PT6A6B	0.28	--	0.28	--	0.56
Raytheon Beech 99	PT6A27	0.00	--	0.00	--	0.01
Raytheon Beech 99	PT6A36	0.25	--	0.25	--	0.50
Subtotal		*3.98*	--	*3.98*	--	*7.95*
General Aviation						
Bombardier Challenger 350	01P14HN011	0.76	--	0.76	--	1.52
Cessna 172 Skyhawk	IO320	0.09	0.09	0.18	--	0.36
Dassault Falcon 50	1AS002	0.76	--	0.76	--	1.52
Embraer Phenom 300 (EMB-505)	PW530	0.17	--	0.17	--	0.35
Piper PA-31 Navajo	TIO540	0.02	--	0.02	--	0.05
Raytheon C-12 Huron	PT660A	0.08	--	0.08	--	0.17
Subtotal		*1.89*	*0.09*	*1.98*	--	*3.96*
Other						
Boeing 737-900-ER_O1	01P11CM121_O1	0.49	0.11	0.50	0.10	1.20
Boeing 737-900-ER_O2	01P11CM125_O2	0.00	0.00	0.00	0.00	0.00
Boeing 737-900-ER_O3	3CM034_O3	0.01	0.00	0.01	0.00	0.02
Boeing 737-900-ER_O4	8CM065_O4	0.01	0.00	0.01	0.00	0.02
Boeing 737-900-ER_O7	01P11CM116_O7	0.17	0.04	0.17	0.03	0.41
Cessna 208 Caravan_O5	P6114A_O5	0.28	--	0.28	--	0.55
Cessna 208 Caravan_O6	PT6A14_O6	0.27	--	0.27	--	0.54
Subtotal		*1.22*	*0.15*	*1.23*	*0.13*	*2.74*
Military						
Cessna 172 Skyhawk_M2	IO320_M2	0.00	--	0.00	--	0.01
Embraer Phenom 300 (EMB-505)_M1	PW530_M1	0.10	--	0.10	--	0.20

TABLE 7-15: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2032) PROPOSED ACTION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Raytheon C-12 Huron_M	PT660A_M	0.04	--	0.04	--	0.07
Subtotal		*0.14*	*--*	*0.14*	*--*	*0.27*
Total		**544.56**	**108.31**	**550.04**	**100.25**	**1303.16**

Note: Totals may not sum due to rounding.
Day = 7:00 a.m. to 9:59 p.m., Night = 10:00 p.m. to 6:59 a.m.
Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Landrum & Brown analysis, 2024.

Runway Definition

Under the Future (2032) Proposed Action, no changes to the runway location or definition would occur. Therefore, the runway definition discussed for the Existing (2022) Condition in Section 7.1 would remain the same for the Future (2032) Proposed Action.

Runway End Utilization

Under the Future (2032) Proposed Action, the runway end utilization would be influenced by airfield congestion and the total number of operations occurring at the Airport, as well as the addition of several proposed taxiway improvements designed to enhance efficiency of the airfield. **Table 7-16** presents the runway end utilization for the Future (2032) Proposed Action.

TABLE 7-16: GENERALIZED RUNWAY END UTILIZATION SUMMARY – FUTURE (2032) PROPOSED ACTION

Aircraft Category	Runway End 16L	Runway End 16C	Runway End 16R	Runway End 34L	Runway End 34C	Runway End 34R
Daytime Arrivals						
Commercial Jets	10.18%	0.99%	58.92%	23.78%	0.99%	3.86%
Cargo Jets	55.00%	1.00%	15.00%	8.00%	1.00%	20.00%
Regional Jets	4.92%	0.98%	63.91%	25.57%	0.98%	1.97%
Cargo Props	23.05%	1.43%	46.52%	26.43%	1.00%	1.57%
General Aviation	26.00%	1.50%	43.50%	26.50%	1.00%	1.50%
Other	14.41%	1.22%	55.37%	26.22%	1.00%	1.78%
Military	26.00%	1.50%	43.50%	26.50%	1.00%	1.50%
Missed Approaches*	--	--	77.33%	22.67%	--	--
Daytime Departures						
Commercial Jets	45.41%	25.59%	--	--	0.95%	28.05%
Cargo Jets	58.00%	13.00%	--	--	0.50%	28.50%
Regional Jets	44.00%	27.00%	--	--	1.00%	28.00%
Cargo Props	35.84%	32.59%	2.58%	1.72%	12.60%	14.68%
General Aviation	34.50%	33.50%	3.00%	2.00%	14.50%	12.50%
Other	39.78%	29.88%	1.33%	0.89%	6.99%	21.12%
Military	34.50%	33.50%	3.00%	2.00%	14.50%	12.50%
Missed Approaches*	--	--	77.33%	22.67%	--	--

TABLE 7-16: GENERALIZED RUNWAY END UTILIZATION SUMMARY – FUTURE (2032) PROPOSED ACTION (CONTINUED)

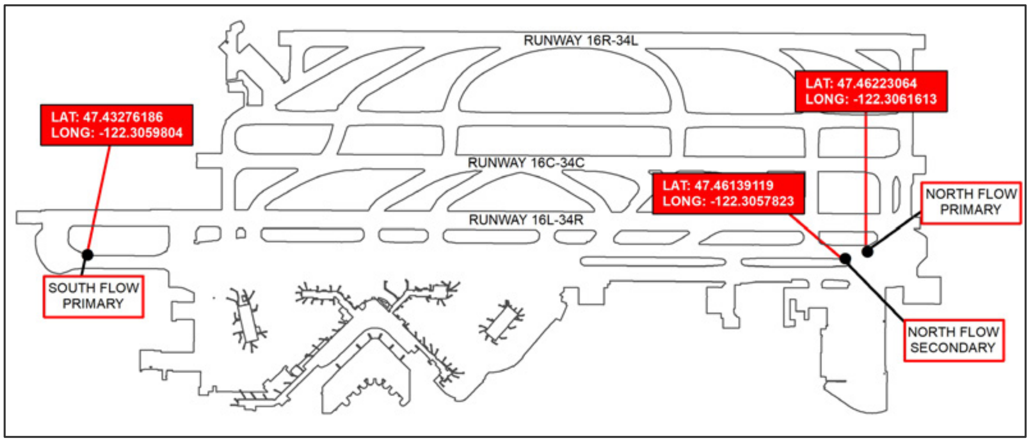
Aircraft Category	Runway End 16L	Runway End 16C	Runway End 16R	Runway End 34L	Runway End 34C	Runway End 34R
Nighttime Arrivals						
Commercial Jets	5.18%	1.00%	64.68%	25.88%	1.00%	2.06%
Cargo Jets	55.00%	1.00%	15.00%	8.00%	1.00%	20.00%
Regional Jets	4.91%	0.98%	63.82%	25.53%	0.98%	1.96%
Cargo Props	--	--	--	--	--	--
General Aviation	26.00%	1.50%	43.50%	26.50%	1.00%	1.50%
Other	5.00%	1.00%	65.00%	26.00%	1.00%	2.00%
Military	--	--	--	--	--	--
Missed Approaches*	--	--	80.98%	19.02%	--	--
Nighttime Departures						
Commercial Jets	44.35%	26.65%	--	--	0.99%	28.01%
Cargo Jets	58.00%	13.00%	--	--	0.50%	28.50%
Regional Jets	44.00%	27.00%	--	--	1.00%	28.00%
Cargo Props	--	--	--	--	--	--
General Aviation	--	--	--	--	--	--
Other	44.00%	27.00%	--	--	1.00%	28.00%
Military	--	--	--	--	--	--
Missed Approaches*	--	--	80.98%	19.02%	--	--

Note: Day = 7:00 a.m. to 9:59 p.m., Night = 10:00 p.m. to 6:59 a.m.
* Missed approaches count as two arrivals and one departure for modeling purposes.
Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Environmental Review Airside Modeling, Seattle-Tacoma International Airport, LeighFisher, 2020, Landrum & Brown analysis, 2024.

Engine Run-Ups

Under the Future (2032) Proposed Action, changes to run-up locations would occur due to changes in the taxiways and new passenger terminal facilities. As a result, there would be fewer run-up locations and the locations would be on the north and south ends of the airfield. **Exhibit 7-10: *Proposed Action Run-up Locations*** shows the future location of the run-ups. The number and type of engine run-up operations for the Future (2032) Proposed Action are presented below in **Table 7-17**. The number of engine run-up operations were scaled up from 2022 levels assuming the same distribution across aircraft types.

EXHIBIT 7-10: PROPOSED ACTION RUN-UP LOCATIONS



Source: Port of Seattle

TABLE 7-17: ANNUAL AIRCRAFT RUN-UP ACTIVITY – FUTURE (2032) PROPOSED ACTION

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
North Flow Primary Location						
Airbus A319-100 Series	3IA006	1.5	3.0	--	--	22,000 lbs.
Airbus A320-200 Series	01P08CM105	25.1	15.8	1.5	2.0	25,000 lbs.
Airbus A320-200 Series	1CM009	3.0	69.5	--	--	25,000 lbs.
Airbus A320-200 Series	3CM026	3.0	15.5	--	--	25,000 lbs.
Airbus A321-200 Series	3CM025	4.4	36.7	--	--	30,000 lbs.
Airbus A321-NEO	01P20CM132			1.5	2.0	30,000 lbs.
Airbus A330-200 Series	9PW094	8.9	27.7	--	--	71,100 lbs.
Airbus A330-300 Series	4GE080	1.5	37.0	--	--	67,500 lbs.
Airbus A330-900N Series (Neo)	02P23RR141	1.5	26.0	--	--	71,100 lbs.
Boeing 737-700 Series	3CM031	5.9	26.8	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	7.4	56.4	--	--	24,000 lbs.
Boeing 737-800 Series	01P11CM122	1.5	10.0	--	--	26,300 lbs.
Boeing 737-800 Series	3CM032	20.7	27.6	--	--	26,300 lbs.
Boeing 737-800 Series	3CM034	1.5	9.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM051	3.0	40.5	--	--	26,300 lbs.
Boeing 737-800 Series	8CM066	4.4	33.0	--	--	26,300 lbs.
Boeing 737-9	01P20CM140	13.3	14.6	--	--	26,400 lbs.
Boeing 737-900-ER	01P11CM116	14.8	20.2	--	--	26,300 lbs.
Boeing 737-900-ER	01P11CM121	1.5	4.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM121	23.6	25.1	--	--	26,300 lbs.
Boeing MD-11 Freighter	1GE031	--	--	1.5	2.0	61,500 lbs.
Embraer ERJ175-LR	01P08GE197	1.5	6.0	--	--	6,900 lbs.
Embraer ERJ175-LR	01P08GE197	5.9	28.0	--	--	13,800 lbs.
South Flow Primary Location						
Airbus A319-100 Series	3IA006	1.5	15.0	--	--	22,000 lbs.

TABLE 7-17: ANNUAL AIRCRAFT RUN-UP ACTIVITY – FUTURE (2032) PROPOSED ACTION (CONTINUED)

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Airbus A319-100 Series	3IA007	1.5	26.0	1.5	11.0	22,000 lbs.
Airbus A320-200 Series	01P08CM105	3.0	6.0	--	--	12,500 lbs.
Airbus A320-200 Series	01P08CM105	41.3	12.9	--	--	25,000 lbs.
Airbus A320-200 Series	1CM009	7.4	31.6	--	--	25,000 lbs.
Airbus A321-NEO	01P20CM132	3.0	12.5	--	--	30,000 lbs.
Airbus A330-200 Series	2RR023	1.5	6.0	--	--	71,100 lbs.
Airbus A330-200 Series	9PW094	1.5	26.0	--	--	35,550 lbs.
Airbus A330-200 Series	9PW094	11.8	14.9	--	--	71,100 lbs.
Airbus A330-300 Series	4GE080	4.4	10.7	--	--	67,500 lbs.
Airbus A330-900N Series (Neo)	02P23RR141	4.4	26.7	--	--	71,100 lbs.
Boeing 737-700 Series	3CM031	1.5	20.0	1.5	2.0	12,000 lbs.
Boeing 737-700 Series	3CM031	23.6	17.6	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	5.9	31.5	--	--	24,000 lbs.
Boeing 737-800 Series	3CM032	4.4	18.3	--	--	13,150 lbs.
Boeing 737-800 Series	3CM032	62.0	18.3	--	--	26,300 lbs.
Boeing 737-800 Series	8CM051	16.2	21.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM065	1.5	6.0			26,300 lbs.
Boeing 737-800 Series	8CM066	1.5	3.0	1.5	2.0	13,150 lbs.
Boeing 737-800 Series	8CM066	35.4	10.7	--	--	26,300 lbs.
Boeing 737-9	01P20CM140	1.5	9.0	--	--	13,200 lbs.
Boeing 737-9	01P20CM140	31.0	10.4	--	--	26,400 lbs.
Boeing 737-900-ER	01P11CM116	1.5	3.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM116	31.0	15.7	3.0	2.0	26,300 lbs.
Boeing 737-900-ER	01P11CM121	1.5	8.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM121	79.7	25.5	--	--	26,300 lbs.
Boeing 767-200 Series Freighter	1GE012	1.5	6.0	--	--	48,000 lbs.
Boeing 767-300 ER Freighter	1GE030	4.4	21.0	--	--	60,000 lbs.
Boeing MD-11 Freighter	1GE031	3.0	44.5	--	--	61,500 lbs.
Embraer ERJ175-LR	01P08GE197	10.3	11.2	--	--	13,800 lbs.
North Flow Secondary Location						
Airbus A330-200 Series	9PW094	1.5	38.0	--	--	71,100 lbs.
Total		**553.46**	**--**	**11.85**	**--**	**--**

Notes: Totals may not sum due to rounding.
Daytime = 7:00am – 9:59pm, Nighttime = 10:00pm – 6:59am.

Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Landrum & Brown analysis, 2024.

Flight Tracks

Flight track locations for the Future (2032) Proposed Action are expected to be the same as the Existing (2022) Condition, because there are no changes to the runway locations and flight track proposed.[13] Therefore, the flight track location information discussed for the Existing (2022) Condition in Section 7.1 would remain the same for the Future (2032) Proposed Action.

Aircraft Departure Stage Length and Operational Profiles

Table 7-18 presents the departure stage length distribution for the Future (2032) Proposed Action. The departure segment of the missed approaches is modeled as Stage Length Category 1.

TABLE 7-18: DEPARTURE STAGE LENGTH DISTRIBUTION – FUTURE (2032) PROPOSED ACTION

Stage Length	Commercial Jets	Cargo Jets	Regional Jets	Cargo Props	General Aviation	Other	Military	Total
1	3.57%	--	74.09%	100.00%	100.00%	41.92%	100.00%	21.76%
2	44.89%	18.20%	22.43%	--	--	28.98%	--	38.03%
3	17.51%	26.73%	3.48%	--	--	15.37%	--	14.20%
4	25.96%	30.31%	--	--	--	13.74%	--	19.45%
5	--	--	--	--	--	--	--	--
6	3.38%	15.80%	--	--	--	--	--	2.92%
7	4.69%	8.95%	--	--	--	--	--	3.63%
8	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--

Note: Totals may not sum due to rounding.
Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Landrum & Brown analysis, 2024.

7.2.2.2 Future (2032) Proposed Action Noise Contours

Exhibit 7-11: *Future (2032) Proposed Action Noise Contour* depicts the 65, 70, and 75 DNL noise contour for the Future (2032) Proposed Action. The area in square miles of each DNL contour band is summarized in **Table 7-19**.

The 65+ DNL contour extends approximately 3.7 miles to the north and 3.3 miles south of SEA. The area within the contour to the north and south is made up of a mix of single-family residential, multi-family residential, commercial, and industrial land uses.

TABLE 7-19: AREA (SQUARE MILES) OF 65, 70, AND 75 DNL NOISE CONTOURS – FUTURE (2032) PROPOSED ACTION

Alternative	DNL 65 - 70 dB	DNL 70 - 75 dB	DNL 75+ dB	DNL 65+ dB
Future (2032) No Action	6.23	2.42	1.45	10.10
Future (2032) Proposed Action	6.33	2.45	1.47	10.25
Change	0.10	0.03	0.02	0.15

Source: Landrum & Brown analysis, 2024.

[13] It is expected that the Runway 34R arrival profile will be slightly higher due to the relocation of the glide slope. This higher Runway 34R arrival profile was not specifically included in this analysis because AEDT does not provide a function to reflect this minor change. Furthermore, by not including the change in Runway 34R arrival profile this analysis represents a conservative evaluation of noise impacts.

7.2.2.3 Non-Compatible Land Use

Summaries of the residential population and housing units exposed to noise levels exceeding 65 DNL for the Future (2032) Proposed Action noise contour are provided in **Table 7-20**. A total of 9,855 housing units (an increase of 337 from the Future (2032) No Action) would be located within the Future (2032) Proposed Action 65+ DNL noise contour. The increase in housing units and population from the Future (2032) No Action is due to the increase in aircraft operations and the increase in size of the 65+ DNL contour. For the "sound insulation completed" category, the additional areas within the 65+ DNL contour includes homes treated during prior phases of the Port's Part 150 Noise Remedy Program, which extends back to 1985 (when the noise contours were much larger). Therefore, the increases in the numbers are solely due to the changes in the noise contour.

TABLE 7-20: NON-COMPATIBLE LAND USE HOUSING AND POPULATION – FUTURE (2032) PROPOSED ACTION

Mitigation Status/Land Use	DNL 65 - 70 dB	DNL 70 - 75 dB	DNL 65+ dB
Sound Insulation Completed			
Single-Family	3,819	439	4,258
Multi-Family	432	4	436
Mobile Home	0	0	0
Subtotal	4,251	443	4,694
Not Sound Insulated			
Single-Family	1,000	89	1,089
Multi-Family	3,885	10	3,895
Mobile Home	160	17	177
Subtotal	5,045	116	5,161
Total Housing Units	**9,296**	**559**	**9,855**
Estimated Population			
Total Estimated Population	**21,354**	**1,445**	**22,799**

Notes: Multi-family includes total units in a complex and were verified using King County assessor data. Population numbers are estimates based on the 2020 United States Census average household size per number of housing units.
Source: Landrum & Brown analysis, 2024.

A list of noise sensitive facilities within the 65+ DNL Noise Contour for the Future (2032) Proposed Action are listed in **Table 7-21**. The number of noise sensitive facilities within the 65+ DNL would be the same as the Future (2032) No Action, for a total of 12 schools, 22 places of worship, five nursing homes, and two libraries within the 65 DNL noise contour. There are no noise sensitive facilities within the 70 or 75 DNL noise contours for the Future (2032) Proposed Action.

TABLE 7-21: NOISE SENSITIVE FACILITIES IN THE FUTURE (2032) PROPOSED ACTION 65+ DNL NOISE CONTOUR

Map ID	Name
Schools	
S-1	Puget Sound Skills Center
S-2	Choice Academy – Homeschool Center
S-3	Midway Elementary School
S-4	Mount Rainier High School
S-5	Southern Heights Elementary School
S-6	Pacific Middle School
S-7	Beverly Park Elementary School
S-8	Our Lady of Lourdes School
S-9	St. Philomena Catholic School
S-10	Glacier Middle School
S-11	Community Chapel Christian School
S-12	Des Moines Elementary School
Places of Worship	
C-1	Saint Philomena Catholic Church
C-2	Prince of Peace Lutheran Church
C-3	Samoan Christian Fellowship
C-4	Normandy Christian Church
C-5	Southminster Presbyterian Church
C-6	Hope Church
C-7	Gospel Russian Baptist Church
C-8	The Mountain Church
C-9	Riverton Heights Baptist Church
C-10	Boulevard Park Presbyterian
C-11	Midway Community Covenant Church
C-12	Apostolic Bible Church of Jesus Christ
C-13	Highline 7th Day Adventist Church
C-14	Glen Acres Church of Christ
C-15	Kingdom Hall of Jehovah's Witnesses
C-16	New Testament Christian Church
C-17	Our Lady of Lourdes Church
C-18	Pacific Northwest United Methodist
C-19	Wat Buddharam Buddhist Temple
C-20	Hanuman Nagri Temple
C-21	Way of Salvation Church
C-22	Des Moines United Methodist Church
Libraries	
L-1	Des Moines Library
L-2	Boulevard Park Library
Nursing Homes	
N-1	Falcon Ridge Assisted Living
N-2	Wesley Homes Terrace
N-3	Wesley Homes Health Center
N-4	Wesley Homes Gardens and Bungalows
N-5	High West Residence

Source: Landrum & Brown analysis, 2024.

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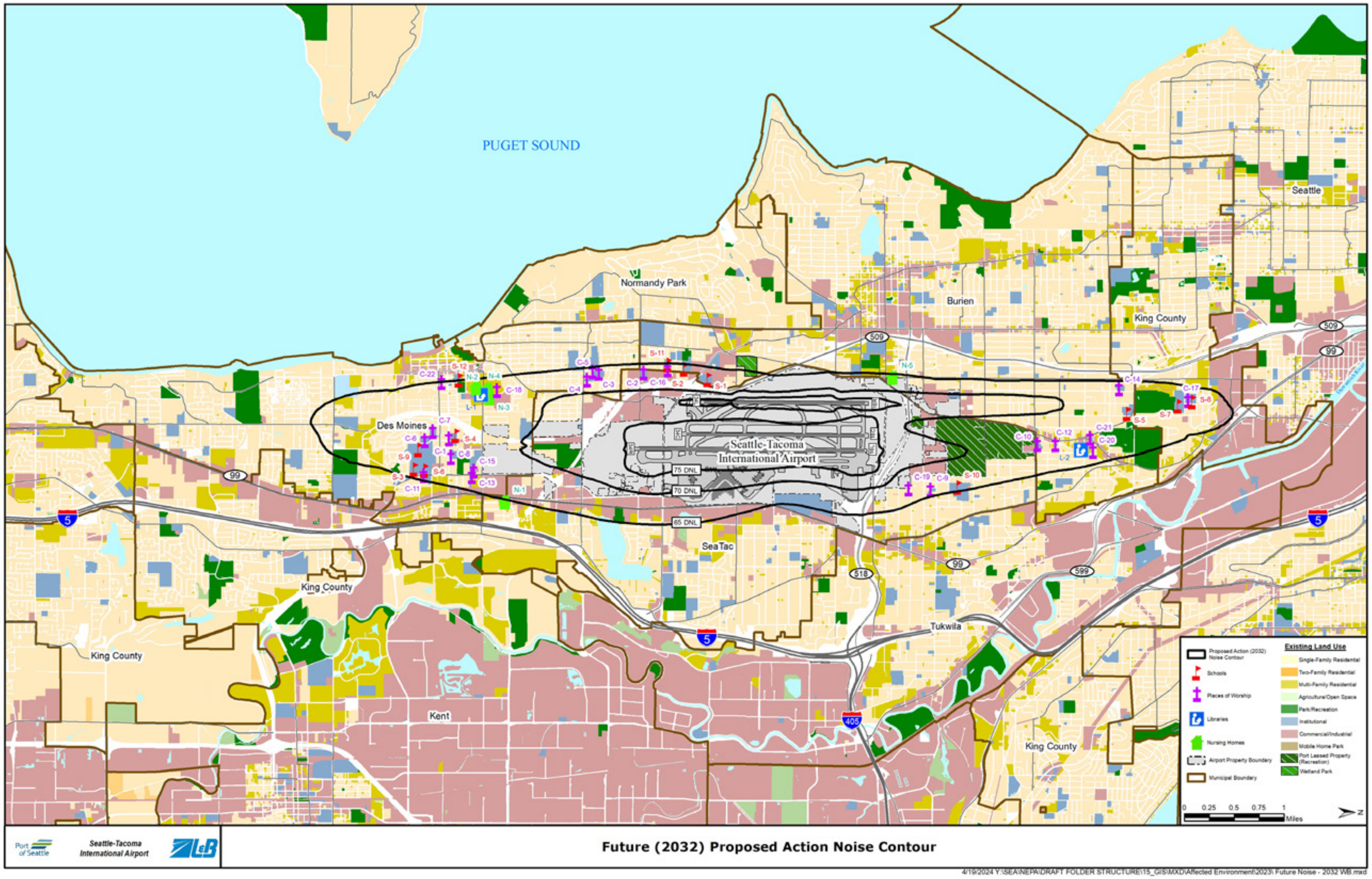
EXHIBIT 7-11: FUTURE (2032) PROPOSED ACTION NOISE CONTOUR



Sources: AEDT Version 3f; Landrum & Brown analysis, 2024.

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7.2.3 Future (2037) No Action

The following describes the input data and methodologies used in preparing the Future (2037) No Action noise contour, followed by the resulting noise exposure contours.

Aircraft Activity Levels and Fleet Mix

Table 7-22 shows the total number of operations by detailed aircraft type and by time of day (daytime or nighttime). The Future (2037) No Action annual average day included 1,301 average annual day operations, 15.4 percent of which occurred during the nighttime hours of 10:00 p.m. to 6:59 a.m.

TABLE 7-22: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2037) NO ACTION

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Commercial Jets						
Airbus A220-100	16PW111	31.48	3.15	34.63	--	69.26
Airbus A220-300	16PW111	11.98	--	11.98	--	23.95
Airbus A220-300	16PW112	5.90	--	5.90	--	11.80
Airbus A320-200 Series	01P08CM105	2.12	0.63	1.69	1.06	5.50
Airbus A320-200 Series	01P10IA021	0.19	0.06	0.15	0.10	0.49
Airbus A320-200 Series	01P10IA022	0.04	0.01	0.03	0.02	0.11
Airbus A320-200 Series	1CM008	0.05	0.02	0.04	0.03	0.13
Airbus A320-200 Series	1CM009	0.21	0.06	0.17	0.10	0.55
Airbus A320-200 Series	1IA003	0.40	0.12	0.32	0.20	1.04
Airbus A320-200 Series	3CM026	0.23	0.07	0.18	0.11	0.59
Airbus A320-200 Series	8IA010	0.00	0.00	0.00	0.00	0.00
Airbus A320-NEO	01P20CM128	5.45	2.42	4.24	3.63	15.74
Airbus A320-NEO	01P22PW163	8.65	3.84	6.72	5.76	24.97
Airbus A321-200 Series	01P08CM104	0.32	0.12	0.27	0.17	0.89
Airbus A321-200 Series	01P10IA025	1.96	0.74	1.64	1.05	5.39
Airbus A321-200 Series	3CM025	0.33	0.13	0.28	0.18	0.92
Airbus A321-NEO	01P18PW157	6.24	3.46	8.32	1.39	19.40
Airbus A321-NEO	01P20CM132	18.50	10.28	24.67	4.11	57.55
Airbus A330-200 Series	2RR023	3.06	0.38	3.44	--	6.89
Airbus A330-200 Series	9PW094	0.04	0.01	0.05	--	0.10
Airbus A330-300 Series	2RR023	0.75	--	0.75	--	1.49
Airbus A330-300 Series	4GE080	0.76	--	0.76	--	1.51
Airbus A330-300 Series	7PW082	0.10	--	0.10	--	0.20
Airbus A330-300 Series	9PW094	2.14	--	2.14	--	4.27
Airbus A330-300 Series	9PW095	0.50	--	0.50	--	1.00
Airbus A330-900N Series (Neo)	02P23RR141	7.54	--	7.54	--	15.08
Airbus A350-900 series	01P18RR124	4.45		2.97	1.48	8.90
Boeing 737-7	01P20CM136	1.85	0.46	1.85	0.46	4.63
Boeing 737-700 Series	3CM030	0.01	0.01	0.02	0.01	0.05
Boeing 737-700 Series	3CM031	0.45	0.45	0.59	0.30	1.78
Boeing 737-700 Series	3CM032	0.08	0.08	0.11	0.05	0.32
Boeing 737-700 Series	8CM051	0.00	0.00	0.00	0.00	0.00
Boeing 737-700 Series	8CM062	0.00	0.00	0.00	0.00	0.01
Boeing 737-700 Series	8CM063	0.08	0.08	0.10	0.05	0.30
Boeing 737-8	01P20CM135	0.70	0.18	0.70	0.18	1.76
Boeing 737-8	01P20CM136	22.83	5.71	22.83	5.71	57.08
Boeing 737-8	01P20CM140	21.06	5.27	21.06	5.27	52.65

TABLE 7-22: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2037) NO ACTION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Boeing 737-800 Series	01P11CM114	0.33	0.06	0.33	0.06	0.78
Boeing 737-800 Series	01P11CM116	4.45	0.84	4.52	0.77	10.58
Boeing 737-800 Series	01P11CM122	2.43	0.46	2.46	0.42	5.77
Boeing 737-800 Series	01P11CM125	0.54	0.10	0.55	0.09	1.28
Boeing 737-800 Series	01P11CM126	0.05	0.01	0.05	0.01	0.12
Boeing 737-800 Series	3CM032	13.63	2.56	13.82	2.37	32.38
Boeing 737-800 Series	3CM034	1.32	0.25	1.33	0.23	3.13
Boeing 737-800 Series	8CM051	18.66	3.51	18.92	3.24	44.33
Boeing 737-800 Series	8CM064	0.14	0.03	0.14	0.02	0.32
Boeing 737-800 Series	8CM065	1.74	0.33	1.77	0.30	4.14
Boeing 737-800 Series	8CM066	8.18	1.54	8.30	1.42	19.44
Boeing 737-9	01P20CM136	1.13	0.19	0.88	0.44	2.63
Boeing 737-9	01P20CM140	44.38	7.40	34.52	17.26	103.55
Boeing 737-900-ER	01P11CM116	28.64	5.80	28.79	5.65	68.88
Boeing 737-900-ER	01P11CM121	81.53	16.52	81.98	16.07	196.11
Boeing 737-900-ER	01P11CM125	0.25	0.05	0.25	0.05	0.60
Boeing 737-900-ER	3CM034	1.15	0.23	1.16	0.23	2.77
Boeing 737-900-ER	8CM065	1.29	0.26	1.29	0.25	3.09
Boeing 737-900-ER_MA	01P11CM121_MA	3.25	0.11	1.62	0.06	5.04
Boeing 787-10 Dreamliner	01P17GE211	0.61	--	0.61	--	1.22
Boeing 787-10 Dreamliner	01P17GE213	1.32	--	1.32	--	2.64
Boeing 787-10 Dreamliner	02P23RR134	0.67	--	0.67	--	1.33
Boeing 787-8 Dreamliner	01P17GE206	1.94	--	1.94	--	3.89
Boeing 787-8 Dreamliner	01P17GE210	0.07	--	0.07	--	0.13
Boeing 787-8 Dreamliner	11GE137	3.07	--	3.07	--	6.14
Boeing 787-8 Dreamliner	11GE138	7.54	--	7.54	--	15.08
Boeing 787-9 Dreamliner	01P17GE211	4.73	--	4.73	--	9.45
Boeing 787-9 Dreamliner	01P17GE214	0.03	--	0.03	--	0.06
Boeing 787-9 Dreamliner	02P23RR131	1.07	--	1.07	--	2.13
Boeing 787-9 Dreamliner	12RR067	4.88	--	4.88	--	9.76
Boeing 787-9 Dreamliner	12RR068	2.06	--	2.06	--	4.11
Subtotal		*401.49*	*77.97*	*397.40*	*80.38*	*957.23*
Cargo Jets						
Boeing 747-400 ERF	12PW102	0.26	0.53	0.53	0.26	1.58
Boeing 747-400BCF	01P03GE187	0.26	0.53	0.53	0.26	1.58
Boeing 747-8F	01P17GE215	0.43	--	0.43	--	0.86
Boeing 747-8F	13GE156	0.11	--	0.11	--	0.23
Boeing 747-8F	8GENX1	0.37	--	0.37	--	0.75
Boeing 767-200 Series Freighter	1GE010	1.70	3.40	3.40	1.70	10.19
Boeing 767-200 Series Freighter	1GE012	0.85	1.69	1.69	0.85	5.07
Boeing 767-200 Series Freighter	1PW026	0.15	0.30	0.30	0.15	0.91
Boeing 767-300 ER Freighter	1GE030	5.72	1.43	5.72	1.43	14.31
Boeing 767-300 ER Freighter	2GE055	0.56	0.14	0.56	0.14	1.41
Boeing 777 Freighter	01P21GE216	5.05	--	5.05	--	10.11

TABLE 7-22: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2037) NO ACTION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Boeing 777 Freighter	01P21GE217	0.12	--	0.12	--	0.24
Subtotal		*15.60*	*8.02*	*18.83*	*4.79*	*47.24*
Regional Jets						
Embraer ERJ175-LR	01P08GE197	125.85	13.20	124.09	14.96	278.10
Embraer ERJ175-LR_MA_Y2	01P08GE197_MA_Y2	1.61	0.20	0.81	0.10	2.72
Subtotal		127.46	13.40	124.89	15.06	280.82
Cargo Props						
ATR 72-600 Freighter	PW127F	0.44	--	0.44	--	0.88
Cessna 208 Caravan	P6114A	1.57	--	1.57	--	3.14
Cessna 208 Caravan	PT6A14	1.55	--	1.55	--	3.10
Cessna 408 SkyCourier	PT6A6B	0.44	--	0.44	--	0.88
Raytheon Beech 99	PT6A27	0.01	--	0.01	--	0.01
Raytheon Beech 99	PT6A36	0.32	--	0.32	--	0.64
Subtotal		*4.33*	--	*4.33*	--	*8.67*
General Aviation						
Bombardier Challenger 350	01P14HN011	0.78	--	0.78	--	1.57
Cessna 172 Skyhawk	IO320	0.08	0.08	0.16	--	0.33
Dassault Falcon 50	1AS002	0.78	--	0.78	--	1.57
Embraer Phenom 300 (EMB-505)	PW530	0.19	--	0.19	--	0.37
Piper PA-31 Navajo	TIO540	0.02	--	0.02	--	0.04
Raytheon C-12 Huron	PT660A	0.09	--	0.09	--	0.18
Subtotal		*1.95*	*0.08*	*2.03*	--	*4.06*
Other						
Boeing 737-900-ER_O1	01P11CM121_O1	0.50	0.10	0.50	0.10	1.20
Boeing 737-900-ER_O2	01P11CM125_O2	0.00	0.00	0.00	0.00	0.00
Boeing 737-900-ER_O3	3CM034_O3	0.01	0.00	0.01	0.00	0.02
Boeing 737-900-ER_O4	8CM065_O4	0.01	0.00	0.01	0.00	0.02
Boeing 737-900-ER_O7	01P11CM116_O7	0.17	0.03	0.17	0.03	0.41
Cessna 208 Caravan_O5	P6114A_O5	0.28	--	0.28	--	0.55
Cessna 208 Caravan_O6	PT6A14_O6	0.27	--	0.27	--	0.54
Subtotal	*Subtotal*	*1.23*	*0.14*	*1.24*	*0.13*	*2.74*
Military						
Cessna 172 Skyhawk_M2	IO320_M2	0.00	--	0.00	--	0.01
Embraer Phenom 300 (EMB-505)_M1	PW530_M1	0.10	--	0.10	--	0.20
Raytheon C-12 Huron_M	PT660A_M	0.04	--	0.04	--	0.07
Subtotal		*0.14*	--	*0.14*	--	*0.27*
Total		**552.22**	**99.62**	**548.85**	**100.34**	**1300.96**

Note: Totals may not sum due to rounding.
Day = 7:00 a.m. to 9:59 p.m., Night = 10:00 p.m. to 6:59 a.m.

Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Landrum & Brown analysis, 2024.

Runway Definition

Under the Future (2037) No Action, none of the proposed airfield changes would occur and it is assumed that no changes to the runway locations would occur. Therefore, the runway definition discussed for the Existing (2022) Condition in Section 7.1 would remain the same for the Future (2037) No Action.

Runway End Utilization

Table 7-23 presents the runway end utilization used for the modeling of the Future (2037) No Action.

TABLE 7-23: GENERALIZED RUNWAY END UTILIZATION SUMMARY – FUTURE (2037) NO ACTION

Aircraft Category	Runway End 16L	Runway End 16C	Runway End 16R	Runway End 34L	Runway End 34C	Runway End 34R
Daytime Arrivals						
Commercial Jets	10.94%	1.00%	59.06%	24.12%	0.50%	4.38%
Cargo Jets	55.00%	1.00%	15.00%	6.50%	0.50%	22.00%
Regional Jets	5.00%	1.00%	65.00%	26.50%	0.50%	2.00%
Cargo Props	21.71%	1.40%	47.89%	26.50%	0.90%	1.60%
General Aviation	26.00%	1.50%	43.50%	26.50%	1.00%	1.50%
Other	14.34%	1.22%	55.43%	26.50%	0.72%	1.78%
Military	26.00%	1.50%	43.50%	26.50%	1.00%	1.50%
Missed Approaches*	--	--	77.33%	22.67%	--	--
Daytime Departures						
Commercial Jets	45.63%	25.37%	--	--	0.94%	28.06%
Cargo Jets	58.00%	13.00%	--	--	0.50%	28.50%
Regional Jets	44.00%	27.00%	--	--	1.00%	28.00%
Cargo Props	44.00%	24.61%	2.39%	1.59%	11.74%	15.67%
General Aviation	44.00%	24.00%	3.00%	2.00%	14.50%	12.50%
Other	44.00%	25.67%	1.33%	0.89%	6.99%	21.12%
Military	44.00%	24.00%	3.00%	2.00%	14.50%	12.50%
Missed Approaches*	--	--	77.33%	22.67%	--	--
Nighttime Arrivals						
Commercial Jets	5.25%	1.00%	64.75%	26.40%	0.50%	2.10%
Cargo Jets	55.00%	1.00%	15.00%	6.50%	0.50%	22.00%
Regional Jets	5.00%	1.00%	65.00%	26.50%	0.50%	2.00%
Cargo Props	--	--	--	--	--	--
General Aviation	26.00%	1.50%	43.50%	26.50%	1.00%	1.50%
Other	5.00%	1.00%	65.00%	26.50%	0.50%	2.00%
Military	--	--	--	--	--	--
Missed Approaches*	--	--	80.98%%	19.02%	--	--
Nighttime Departures						
Commercial Jets	44.26%	26.74%	--	--	0.99%	28.01%
Cargo Jets	58.00%	13.00%	--	--	0.50%	28.50%
Regional Jets	44.00%	27.00%	--	--	1.00%	28.00%
Cargo Props	--	--	--	--	--	--
General Aviation	--	--	--	--	--	--
Other	44.00%	27.00%	--	--	1.00%	28.00%
Military	--	--	--	--	--	--
Missed Approaches*	--	--	80.98%%	19.02%	--	--

Note: Day = 7:00 a.m. to 9:59 p.m., Night = 10:00 p.m. to 6:59 a.m.
* Missed approaches count as two arrivals and one departure for modeling purposes.
Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Environmental Review Airside Modeling, Seattle-Tacoma International Airport, LeighFisher, 2020, Landrum & Brown analysis, 2024.

Engine Run-Ups

Under the Future (2037) No Action, no changes to run-up locations would occur. Therefore, the run-up locations discussed for the Existing (2022) Condition in Section 7.1 would remain the same for the Future (2037) No Action. The numbers of engine run-up operations are estimated for Future (2037) No Action conditions based on scaling the engine run-ups from 2022 for the number of total operations, assuming the same distribution across aircraft type. The resulting numbers of engine run-ups are presented below in **Table 7-24**.

TABLE 7-24: ANNUAL AIRCRAFT RUN-UP ACTIVITY – FUTURE (2037) NO ACTION

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
North Flow Primary Location						
Airbus A320-200 Series	01P08CM105	25.4	15.8	2.0	2.0	25,000 lbs.
Airbus A320-200 Series	1CM009	3.0	69.5	--	--	25,000 lbs.
Airbus A320-200 Series	3CM026	3.0	15.5	--	--	25,000 lbs.
Airbus A321-200 Series	3CM025	4.5	36.7	--	--	30,000 lbs.
Airbus A321-NEO	01P20CM132	--	--	2.0	2.0	30,000 lbs.
Airbus A330-200 Series	9PW094	9.0	27.7	--	--	71,100 lbs.
Airbus A330-300 Series	4GE080	1.5	37.0	--	--	67,500 lbs.
Airbus A330-900N Series (Neo)	02P23RR141	1.5	26.0	--	--	71,100 lbs.
Boeing 737-700 Series	3CM031	6.0	26.8	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	7.5	56.4	--	--	24,000 lbs.
Boeing 737-800 Series	01P11CM122	1.5	10.0	--	--	26,300 lbs.
Boeing 737-800 Series	3CM032	20.9	27.6	--	--	26,300 lbs.
Boeing 737-800 Series	3CM034	1.5	9.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM051	3.0	40.5	--	--	26,300 lbs.
Boeing 737-800 Series	8CM066	4.5	33.0	--	--	26,300 lbs.
Boeing 737-9	01P20CM140	13.4	14.6	--	--	26,400 lbs.
Boeing 737-900-ER	01P11CM116	14.9	20.2	--	--	26,300 lbs.
Boeing 737-900-ER	01P11CM121	23.9	25.1	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM121	1.5	4.0	--	--	26,300 lbs.
Embraer ERJ175-LR	01P08GE197	1.5	6.0	--	--	6,900 lbs.
Embraer ERJ175-LR	01P08GE197	6.0	28.0	--	--	13,800 lbs.
South Flow Primary Location						
Airbus A320-200 Series	01P08CM105	3.0	6.0	--	--	12,500 lbs.
Airbus A320-200 Series	01P08CM105	41.8	12.9	--	--	25,000 lbs.
Airbus A320-200 Series	1CM009	7.5	31.6	--	--	25,000 lbs.
Airbus A321-NEO	01P20CM132	3.0	12.5	--	--	30,000 lbs.

TABLE 7-24: ANNUAL AIRCRAFT RUN-UP ACTIVITY – FUTURE (2037) NO ACTION (CONTINUED)

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Airbus A330-200 Series	2RR023	1.5	6.0	--	--	71,100 lbs.
Airbus A330-200 Series	9PW094	1.5	26.0	--	--	35,550 lbs.
Airbus A330-200 Series	9PW094	11.9	14.9	--	--	71,100 lbs.
Airbus A330-300 Series	4GE080	4.5	10.7	--	--	67,500 lbs.
Airbus A330-900N Series (Neo)	02P23RR141	4.5	26.7	--	--	71,100 lbs.
Boeing 737-700 Series	3CM031	1.5	20.0	2.0	2.0	12,000 lbs.
Boeing 737-700 Series	3CM031	23.9	17.6	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	6.0	31.5	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	62.7	18.3	--	--	26,300 lbs.
Boeing 737-800 Series	3CM032	4.5	18.3	--	--	13,150 lbs.
Boeing 737-800 Series	8CM051	16.4	21.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM065	1.5	6.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM066	1.5	3.0	2.0	2.0	13,150 lbs.
Boeing 737-800 Series	8CM066	35.8	10.7	--	--	26,300 lbs.
Boeing 737-9	01P20CM140	1.5	9.0	--	--	13,200 lbs.
Boeing 737-9	01P20CM140	31.4	10.4	--	--	26,400 lbs.
Boeing 737-900-ER	01P11CM116	1.5	3.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM116	31.4	15.7	3.9	2.0	26,300 lbs.
Boeing 737-900-ER	01P11CM121	1.5	8.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM121	80.6	25.5	--	--	26,300 lbs.
Boeing 767-200 Series Freighter	1GE012	1.5	6.0	--	--	48,000 lbs.
Boeing 767-300 ER Freighter	1GE030	4.5	21.0	--	--	60,000 lbs.
Embraer ERJ175-LR	01P08GE197	10.5	11.1	--	--	13,800 lbs.
Tango X Location						
Airbus A330-200 Series	9PW094	1.5	38.0	--	--	71,100 lbs.
	Total	552.6	--	11.8	--	

Notes: Totals may not sum due to rounding.
Daytime = 7:00am – 9:59pm, Nighttime = 10:00pm – 6:59am.

Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Landrum & Brown analysis, 2024.

Flight Tracks

Flight track locations for the Future (2037) No Action would not change. As such, the flight tracks for the Future (2037) No Action are expected to be the same as the Existing (2022) Condition. The flight track information discussed for the Existing (2022) Condition in Section 7.1 would remain the same for the Future (2037) No Action.

Aircraft Trip Length and Operational Profiles

Table 7-25 presents the departure stage length distribution for the Future (2037) No Action. The departure segment of the missed approaches is modeled as Stage Length Category 1.

TABLE 7-25: DEPARTURE STAGE LENGTH DISTRIBUTION – FUTURE (2037) NO ACTION

Stage Length	Commercial Jets	Cargo Jets	Regional Jets	Cargo Props	General Aviation	Other	Military	Total
1	3.33%	--	75.95%	100.00%	100.00%	41.97%	100.00%	19.88%
2	44.28%	13.31%	20.25%	--	--	29.18%	--	37.51%
3	14.56%	26.95%	3.80%	--	--	14.75%	--	12.55%
4	28.77%	29.48%	--	--	--	14.10%	--	22.29%
5	--	--	--	--	--	--	--	--
6	3.66%	21.91%	--	--	--	--	--	3.49%
7	5.39%	8.35%	--	--	--	--	--	4.28%
8	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--

Note: Totals may not sum due to rounding.
Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Landrum & Brown analysis, 2024.

7.2.3.2 Future 2037 No Action Noise Contours

Exhibit 7-12: *Future (2037) No Action Noise Contour* depicts the 65, 70, and 75 DNL noise contour for the Future (2037) No Action. The area in square miles of each DNL contour band is summarized in **Table 7-26**. The 65+ DNL of the Future (2037) No Action is smaller than the 65+ DNL of the Future (2032) No Action Alternative due to the increase in the number of Boeing 737-7/8/9 MAX aircraft in the fleet. The MAX aircraft have a substantially smaller noise footprint than the aircraft they are replacing (Boeing 737-700/800/900 aircraft).

The 65+ DNL contour extends approximately 3.6 miles to the north and 3.0 miles south of SEA. The area within the contour to the north and south is made up of a mix of single-family residential, multi-family residential, commercial, and industrial land uses.

TABLE 7-26: AREA (SQUARE MILES) OF 65, 70, AND 75 DNL NOISE CONTOURS – FUTURE (2037) NO ACTION

Alternative	DNL 65 – 70 dB	DNL 70 – 75 dB	DNL 75+ dB	DNL 65+ dB
Future (2032) No Action	6.23	2.42	1.45	10.10
Future (2037) No Action	5.67	2.17	1.32	9.16
Change	-0.56	-0.25	-0.13	-0.94

Source: Landrum & Brown, 2024.

7.2.3.3 Non-Compatible Land Use

Summaries of the residential population and housing units exposed to noise levels exceeding 65+ DNL for the Future (2037) No Action noise contour are provided in **Table 7-27**. A total of 7,166 housing units would be located within the 65+ DNL noise contour. The decrease in housing units and population from the Future (2032) No Action is due to the previously mentioned increase of Boeing 737 MAX aircraft in 2037, resulting in a decrease in size of the 65+ DNL contour. For the "sound insulation completed," the additional areas within the 65 DNL contour include homes treated during prior phases of the Port's Part 150 Noise Remedy Program, which extends back to 1985 (when the noise contours were much larger). Therefore, the increases in the numbers are solely due to the changes in the noise contour.

TABLE 7-27: NON-COMPATIBLE LAND USE HOUSING AND POPULATION – FUTURE (2037) NO ACTION

Mitigation Status/Land Use	DNL 65 - 70 dB	DNL 70 - 75 dB	DNL 65+ dB
Sound Insulation Completed			
Single-Family	3,247	299	3,546
Multi-Family	321	4	325
Mobile Home	0	0	0
Subtotal	3,568	303	3,871
Not Sound Insulated			
Single-Family	783	54	837
Multi-Family	2,356	0	2,356
Mobile Home	91	11	102
Subtotal	3,230	65	3,295
Total Housing Units	**6,798**	**368**	**7,166**
Estimated Population			
Total Estimated Population	**15,331**	**966**	**16,297**

Notes: Multi-family includes total units in a complex and were verified using King County assessor data. Population numbers are estimates based on the 2020 United States Census average household size per number of housing units.
Source: Landrum & Brown analysis, 2024.

A list of noise sensitive facilities within the 65+ DNL noise contour for the Future (2037) No Action are listed in **Table 7-28**. There would be 10 schools, 21 places of worship, four nursing homes, and two libraries within the 65+ DNL noise contour. There are no noise sensitive facilities within the 70 or 75 DNL noise contours for the Future (2037) No Action.

TABLE 7-28: NOISE SENSITIVE FACILITIES IN THE FUTURE (2037) NO ACTION 65+ DNL NOISE CONTOUR

Map ID	Name
Schools	
S-1	Puget Sound Skills Center
S-2	Choice Academy – Homeschool Center
S-3	Midway Elementary School
S-4	Mount Rainier High School
S-5	Southern Heights Elementary School
S-6	Pacific Middle School
S-7	Beverly Park Elementary School
S-8	Our Lady of Lourdes School
S-9	St. Philomena Catholic School
S-10	Glacier Middle School
Places of Worship	
C-1	Saint Philomena Catholic Church
C-2	Prince of Peace Lutheran Church
C-3	Samoan Christian Fellowship
C-4	Normandy Christian Church
C-5	Southminster Presbyterian Church
C-6	Hope Church
C-7	Gospel Russian Baptist Church
C-8	The Mountain Church
C-9	Riverton Heights Baptist Church
C-10	Boulevard Park Presbyterian
C-11	Midway Community Covenant Church
C-12	Apostolic Bible Church of Jesus Christ
C-13	Highline 7th Day Adventist Church
C-14	Glen Acres Church of Christ
C-15	Kingdom Hall of Jehovah's Witnesses
C-16	New Testament Christian Church
C-17	Our Lady of Lourdes Church
C-18	Pacific Northwest United Methodist
C-19	Wat Buddharam Buddhist Temple
C-20	Hanuman Nagri Temple
C-21	Way of Salvation Church
Libraries	
L-1	Des Moines Library
L-2	Boulevard Park Library
Nursing Homes	
N-2	Wesley Homes Terrace
N-3	Wesley Homes Health Center
N-4	Wesley Homes Gardens and Bungalows
N-5	High West Residence

Source: Landrum & Brown analysis, 2024.

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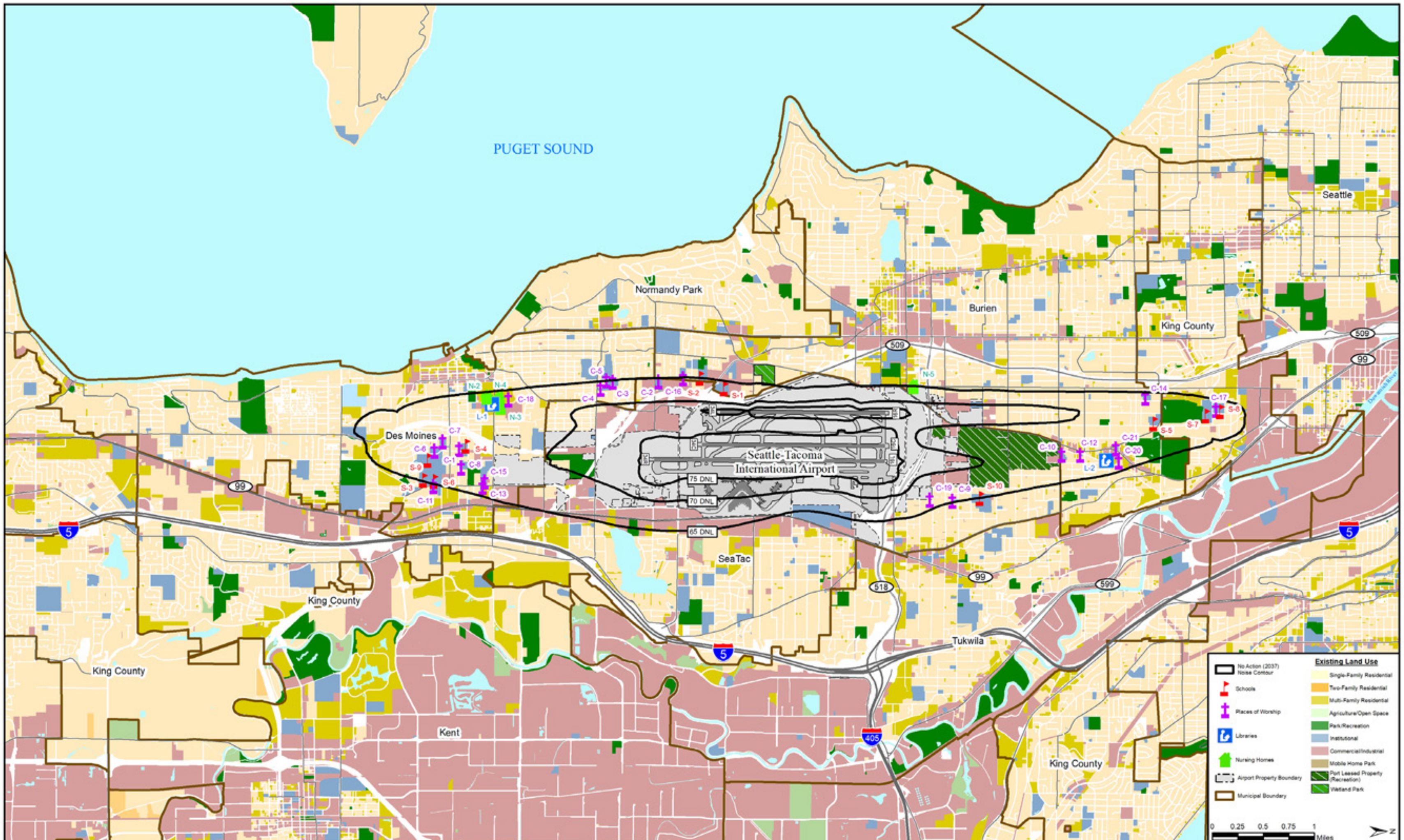
EXHIBIT 7-12: FUTURE (2037) NO ACTION NOISE CONTOUR



Port of Seattle | Seattle-Tacoma International Airport | Future (2037) No Action Noise Contour

Sources: AEDT Version 3f; Landrum & Brown analysis, 2024.

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7.2.4 Future (2037) Proposed Action

The following describes the input data and methodologies used in preparing the Future (2037) Proposed Action noise contour, followed by the resulting noise exposure contours.

Aircraft Activity Levels and Fleet Mix

Table 7-29 shows the total number of operations by detailed aircraft type and by time of day (daytime or nighttime). The Future (2037) Proposed Action annual average day included 1,397 average annual day operations, 15.8 percent of which occurred during the nighttime hours of 10:00 p.m. to 6:59 a.m. This is an increase of 96 average annual day operations over the Future (2037) No Action condition.

TABLE 7-29: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2037) PROPOSED ACTION

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Commercial Jets						
Airbus A220-100	16PW111	33.92	3.39	37.31		74.62
Airbus A220-300	16PW111	10.75	2.15	12.91		25.81
Airbus A220-300	16PW112	5.30	1.06	6.36		12.71
Airbus A320-200 Series	01P08CM105	2.28	0.68	1.94	1.03	5.93
Airbus A320-200 Series	01P10IA021	0.20	0.06	0.17	0.09	0.53
Airbus A320-200 Series	01P10IA022	0.04	0.01	0.04	0.02	0.11
Airbus A320-200 Series	1CM008	0.06	0.02	0.05	0.03	0.14
Airbus A320-200 Series	1CM009	0.23	0.07	0.19	0.10	0.59
Airbus A320-200 Series	1IA003	0.43	0.13	0.37	0.19	1.12
Airbus A320-200 Series	3CM026	0.25	0.07	0.21	0.11	0.64
Airbus A320-200 Series	8IA010	0.00	0.00	0.00	0.00	0.00
Airbus A320-NEO	01P20CM128	5.22	3.26	4.57	3.91	16.96
Airbus A320-NEO	01P22PW163	8.28	5.17	7.24	6.21	26.91
Airbus A321-200 Series	01P08CM104	0.35	0.13	0.29	0.19	0.96
Airbus A321-200 Series	01P10IA025	2.11	0.79	1.77	1.14	5.81
Airbus A321-200 Series	3CM025	0.36	0.13	0.30	0.19	0.99
Airbus A321-NEO	01P18PW157	6.72	3.73	8.96	1.49	20.91
Airbus A321-NEO	01P20CM132	19.93	11.07	26.58	4.43	62.01
Airbus A330-200 Series	2RR023	3.37	0.34	3.71		7.42
Airbus A330-200 Series	9PW094	0.05	0.00	0.05		0.11
Airbus A330-300 Series	2RR023	0.80		0.80		1.61
Airbus A330-300 Series	4GE080	0.82		0.82		1.63
Airbus A330-300 Series	7PW082	0.11		0.11		0.22
Airbus A330-300 Series	9PW094	2.30		2.30		4.61
Airbus A330-300 Series	9PW095	0.54		0.54		1.08
Airbus A330-900N Series (Neo)	02P23RR141	8.12		8.12		16.25
Airbus A350-900 series	01P18RR124	4.79		3.20	1.60	9.59
Boeing 737-7	01P20CM136	2.08	0.42	2.08	0.42	4.99
Boeing 737-700 Series	3CM030	0.01	0.01	0.02	0.01	0.06
Boeing 737-700 Series	3CM031	0.48	0.48	0.75	0.21	1.92
Boeing 737-700 Series	3CM032	0.09	0.09	0.14	0.04	0.35
Boeing 737-700 Series	8CM051	0.00	0.00	0.00	0.00	0.00

TABLE 7-29: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2037) PROPOSED ACTION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Boeing 737-700 Series	8CM062	0.00	0.00	0.01	0.00	0.01
Boeing 737-700 Series	8CM063	0.08	0.08	0.13	0.04	0.33
Boeing 737-8	01P20CM135	0.79	0.16	0.79	0.16	1.90
Boeing 737-8	01P20CM136	25.63	5.13	25.63	5.13	61.50
Boeing 737-8	01P20CM140	23.64	4.73	23.64	4.73	56.73
Boeing 737-800 Series	01P11CM114	0.35	0.07	0.35	0.07	0.84
Boeing 737-800 Series	01P11CM116	4.71	0.99	4.78	0.92	11.40
Boeing 737-800 Series	01P11CM122	2.57	0.54	2.61	0.50	6.22
Boeing 737-800 Series	01P11CM125	0.57	0.12	0.58	0.11	1.38
Boeing 737-800 Series	01P11CM126	0.05	0.01	0.05	0.01	0.13
Boeing 737-800 Series	3CM032	14.42	3.03	14.63	2.81	34.89
Boeing 737-800 Series	3CM034	1.39	0.29	1.41	0.27	3.37
Boeing 737-800 Series	8CM051	19.74	4.14	20.03	3.85	47.76
Boeing 737-800 Series	8CM064	0.14	0.03	0.15	0.03	0.35
Boeing 737-800 Series	8CM065	1.84	0.39	1.87	0.36	4.46
Boeing 737-800 Series	8CM066	8.66	1.82	8.78	1.69	20.95
Boeing 737-9	01P20CM136	1.22	0.19	0.90	0.51	2.83
Boeing 737-9	01P20CM140	48.18	7.61	35.50	20.29	111.57
Boeing 737-900-ER	01P11CM116	30.48	6.63	31.02	6.09	74.22
Boeing 737-900-ER	01P11CM121	86.79	18.87	88.32	17.34	211.32
Boeing 737-900-ER	01P11CM125	0.27	0.06	0.27	0.05	0.65
Boeing 737-900-ER	3CM034	1.23	0.27	1.25	0.25	2.99
Boeing 737-900-ER	8CM065	1.37	0.30	1.39	0.27	3.33
Boeing 737-900-ER_MA	01P11CM121_MA	3.49	0.12	1.74	0.06	5.41
Boeing 787-10 Dreamliner	01P17GE211	0.66		0.66		1.31
Boeing 787-10 Dreamliner	01P17GE213	1.42		1.42		2.84
Boeing 787-10 Dreamliner	02P23RR134	0.72		0.72		1.43
Boeing 787-8 Dreamliner	01P17GE206	2.09		2.09		4.19
Boeing 787-8 Dreamliner	01P17GE210	0.07		0.07		0.14
Boeing 787-8 Dreamliner	11GE137	3.31		3.31		6.61
Boeing 787-8 Dreamliner	11GE138	8.13		8.13		16.25
Boeing 787-9 Dreamliner	01P17GE211	5.09		5.09		10.18
Boeing 787-9 Dreamliner	01P17GE214	0.03		0.03		0.07
Boeing 787-9 Dreamliner	02P23RR131	1.15		1.15		2.30
Boeing 787-9 Dreamliner	12RR067	5.26		5.26		10.52
Boeing 787-9 Dreamliner	12RR068	2.22		2.22		4.43
Subtotal		*427.75*	*88.86*	*427.86*	*86.94*	*1031.41*
Cargo Jets						
Boeing 747-400 ERF	12PW102	0.26	0.53	0.53	0.26	1.58
Boeing 747-400BCF	01P03GE187	0.26	0.53	0.53	0.26	1.58

TABLE 7-29: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2037) PROPOSED ACTION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Boeing 747-8F	01P17GE215	0.43		0.43		0.86
Boeing 747-8F	13GE156	0.11		0.11		0.23
Boeing 747-8F	8GENX1	0.37		0.37		0.75
Boeing 767-200 Series Freighter	1GE010	1.70	3.40	3.40	1.70	10.19
Boeing 767-200 Series Freighter	1GE012	0.85	1.69	1.69	0.85	5.07
Boeing 767-200 Series Freighter	1PW026	0.15	0.30	0.30	0.15	0.91
Boeing 767-300 ER Freighter	1GE030	5.96	1.19	5.96	1.19	14.31
Boeing 767-300 ER Freighter	2GE055	0.59	0.12	0.59	0.12	1.41
Boeing 777 Freighter	01P21GE216	5.05		5.05		10.11
Boeing 777 Freighter	01P21GE217	0.12		0.12		0.24
	Subtotal	15.86	7.75	19.09	4.53	47.24
Regional Jets						
Embraer ERJ175-LR	01P08GE197	134.39	15.44	133.38	16.44	299.66
Embraer ERJ175-LR_MA_Y2	01P08GE197_MA_Y2	1.73	0.22	0.87	0.11	2.92
Subtotal		*136.12*	*15.65*	*134.25*	*16.55*	*302.58*
Cargo Props						
ATR 72-600 Freighter	PW127F	0.44		0.44		0.88
Cessna 208 Caravan	P6114A	1.57		1.57		3.14
Cessna 208 Caravan	PT6A14	1.55		1.55		3.10
Cessna 408 SkyCourier	PT6A6B	0.44		0.44		0.88
Raytheon Beech 99	PT6A27	0.01		0.01		0.01
Raytheon Beech 99	PT6A36	0.32		0.32		0.64
Subtotal		*4.33*	--	*4.33*	--	*8.67*
General Aviation						
Bombardier Challenger 350	01P14HN011	0.78	--	0.78	--	1.57
Cessna 172 Skyhawk	IO320	0.08	0.08	0.16	--	0.33
Dassault Falcon 50	1AS002	0.78	--	0.78	--	1.57
Embraer Phenom 300 (EMB-505)	PW530	0.19	--	0.19	--	0.37
Piper PA-31 Navajo	TIO540	0.02	--	0.02	--	0.04
Raytheon C-12 Huron	PT660A	0.09	--	0.09	--	0.18
Subtotal		*1.95*	*0.08*	*2.03*	--	*4.06*
Other						
Boeing 737-900-ER_O1	01P11CM121_O1	0.49	0.11	0.50	0.10	1.20
Boeing 737-900-ER_O2	01P11CM125_O2	0.00	0.00	0.00	0.00	0.00

TABLE 7-29: AVERAGE DAILY OPERATIONS BY AEDT AIRFRAME AND ENGINE CODE – FUTURE (2037) PROPOSED ACTION (CONTINUED)

Airframe	Engine Code	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Operations
Boeing 737-900-ER_O3	3CM034_O3	0.01	0.00	0.01	0.00	0.02
Boeing 737-900-ER_O4	8CM065_O4	0.01	0.00	0.01	0.00	0.02
Boeing 737-900-ER_O7	01P11CM116_O7	0.17	0.04	0.17	0.03	0.41
Cessna 208 Caravan_O5	P6114A_O5	0.28	--	0.28	--	0.55
Cessna 208 Caravan_O6	PT6A14_O6	0.27	--	0.27	--	0.54
Subtotal		*1.22*	*0.15*	*1.23*	*0.13*	*2.74*
Military						
Cessna 172 Skyhawk_M2	IO320_M2	0.00	--	0.00	--	0.01
Embraer Phenom 300 (EMB-505)_M1	PW530_M1	0.10	--	0.10	--	0.20
Raytheon C-12 Huron_M	PT660A_M	0.04	--	0.04	--	0.07
Subtotal		*0.14*	--	*0.14*	--	*0.27*
Total		**587.38**	**112.49**	**588.93**	**108.16**	**1396.96**

Note: Totals may not sum due to rounding.
Day = 7:00 a.m. to 9:59 p.m., Night = 10:00 p.m. to 6:59 a.m.

Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Landrum & Brown analysis, 2024.

Runway Definition

Under the Future (2037) Proposed Action, no changes to the runway location or definition would occur. Therefore, the runway definition discussed for the Existing (2022) Condition in Section 7.1 would remain the same for the Future (2037) Proposed Action.

Runway End Utilization

Table 7-30 presents the runway end utilization for the Future (2037) Proposed Action.

TABLE 7-30: GENERALIZED RUNWAY END UTILIZATION SUMMARY – FUTURE (2037) PROPOSED ACTION

Aircraft Category	Runway End 16L	Runway End 16C	Runway End 16R	Runway End 34L	Runway End 34C	Runway End 34R
Daytime Arrivals						
Regional Jets	5.00%	1.00%	65.00%	26.00%	1.00%	2.00%
Cargo Props	23.86%	1.45%	45.70%	26.45%	1.00%	1.55%
General Aviation	26.00%	1.50%	43.50%	26.50%	1.00%	1.50%
Other	14.41%	1.22%	55.37%	26.22%	1.00%	1.78%
Military	26.00%	1.50%	43.50%	26.50%	1.00%	1.50%
Missed Approaches*	--	--	77.33%	22.67%	--	--
Daytime Departures						
Commercial Jets	45.64%	25.36%	--	--	0.94%	28.06%
Cargo Jets	58.00%	13.00%	--	--	0.50%	28.50%
Regional Jets	44.00%	27.00%	--	--	1.00%	28.00%
Cargo Props	35.47%	32.84%	2.69%	1.80%	13.12%	14.08%
General Aviation	34.50%	33.50%	3.00%	2.00%	14.50%	12.50%
Other	39.78%	29.88%	1.33%	0.89%	6.99%	21.12%
Military	34.50%	33.50%	3.00%	2.00%	14.50%	12.50%
Missed Approaches*	--	--	77.33%	22.67%	--	--
Nighttime Arrivals						
Commercial Jets	5.19%	1.00%	64.81%	25.93%	1.00%	2.07%
Cargo Jets	55.00%	1.00%	15.00%	7.00%	1.00%	21.00%
Regional Jets	5.00%	1.00%	65.00%	26.00%	1.00%	2.00%
Cargo Props	--	--	--	--	--	--
General Aviation	26.00%	1.50%	43.50%	26.50%	1.00%	1.50%
Other	5.00%	1.00%	65.00%	26.00%	1.00%	2.00%
Military	--	--	--	--	--	--
Missed Approaches*	--	--	80.98%	19.02%	--	--
Nighttime Departures						
Commercial Jets	44.26%	26.74%	--	--	0.99%	28.01%
Cargo Jets	58.00%	13.00%	--	--	0.50%	28.50%
Regional Jets	44.00%	27.00%	--	--	1.00%	28.00%
Cargo Props	--	--	--	--	--	--
General Aviation	--	--	--	--	--	--
Other	44.00%	27.00%	--	--	1.00%	28.00%
Military	--	--	--	--	--	--
Missed Approaches*	--	--	80.98%	19.02%	--	--

Note: Day = 7:00 a.m. to 9:59 p.m., Night = 10:00 p.m. to 6:59 a.m.
* Missed approaches count as two arrivals and one departure for modeling purposes.
Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Environmental Review Airside Modeling, Seattle-Tacoma International Airport, LeighFisher, 2020, Landrum & Brown analysis, 2024.

Engine Run-Ups

Under the Future (2037) Proposed Action, changes to run-up locations would occur due to changes in the taxiways and new passenger terminal facilities. The result is that there would be fewer total run-up locations and the locations would be on the north and south ends of the airfield, in the same location as the Future (2032) Proposed Action. Exhibit 7-10 shows the location of the run-ups for this condition. The number and type of engine run-up operations for the Future (2037) Proposed Action are presented below in **Table 7-31**. The number of engine run-up operations were scaled up from 2022 levels assuming the same distribution across aircraft types.

TABLE 7-31: ANNUAL AIRCRAFT RUN-UP ACTIVITY – FUTURE (2037) PROPOSED ACTION

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
North Flow Primary Location						
Airbus A320-200 Series	01P08CM105	27.3	15.8	2.1	2.0	25,000 lbs.
Airbus A320-200 Series	1CM009	3.2	69.5	--	--	25,000 lbs.
Airbus A320-200 Series	3CM026	3.2	15.5	--	--	25,000 lbs.
Airbus A321-200 Series	3CM025	4.8	36.7	--	--	30,000 lbs.
Airbus A321-NEO	01P20CM132			2.1	2.0	30,000 lbs.
Airbus A330-200 Series	9PW094	9.6	27.7	--	--	71,100 lbs.
Airbus A330-300 Series	4GE080	1.6	37.0	--	--	67,500 lbs.
Airbus A330-900N Series (Neo)	02P23RR141	1.6	26.0	--	--	71,100 lbs.
Boeing 737-700 Series	3CM031	6.4	26.8	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	8.0	56.4	--	--	24,000 lbs.
Boeing 737-800 Series	01P11CM122	1.6	10.0	--	--	26,300 lbs.
Boeing 737-800 Series	3CM032	22.4	27.6	--	--	26,300 lbs.
Boeing 737-800 Series	3CM034	1.6	9.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM051	3.2	40.5	--	--	26,300 lbs.
Boeing 737-800 Series	8CM066	4.8	33.0	--	--	26,300 lbs.
Boeing 737-9	01P20CM140	14.4	14.6	--	--	26,400 lbs.
Boeing 737-900-ER	01P11CM116	16.0	20.2	--	--	26,300 lbs.
Boeing 737-900-ER	01P11CM121	1.6	4.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM121	25.7	25.1	--	--	26,300 lbs.
Embraer ERJ175-LR	01P08GE197	1.6	6.0	--	--	6,900 lbs.
Embraer ERJ175-LR	01P08GE197	6.4	28.0	--	--	13,800 lbs.
South Flow Primary Location						
Airbus A320-200 Series	01P08CM105	3.2	6.0	--	--	12,500 lbs.
Airbus A320-200 Series	01P08CM105	44.9	12.9	--	--	25,000 lbs.
Airbus A320-200 Series	1CM009	8.0	31.6	--	--	25,000 lbs.
Airbus A321-NEO	01P20CM132	3.2	12.5	--	--	30,000 lbs.
Airbus A330-200 Series	2RR023	1.6	6.0	--	--	71,100 lbs.
Airbus A330-200 Series	9PW094	1.6	26.0	--	--	35,550 lbs.
Airbus A330-200 Series	9PW094	12.8	14.9	--	--	71,100 lbs.
Airbus A330-300 Series	4GE080	4.8	10.7	--	--	67,500 lbs.
Airbus A330-900N Series (Neo)	02P23RR141	4.8	26.7	--	--	71,100 lbs.
Boeing 737-700 Series	3CM031	1.6	20.0	2.1	2.0	12,000 lbs.
Boeing 737-700 Series	3CM031	25.7	17.6	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	6.4	31.5	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	67.3	18.3	--	--	26,300 lbs.
Boeing 737-800 Series	3CM032	4.8	18.3	--	--	13,150 lbs.
Boeing 737-800 Series	8CM051	17.6	21.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM065	1.6	6.0	--	--	26,300 lbs.

TABLE 7-31: ANNUAL AIRCRAFT RUN-UP ACTIVITY – FUTURE (2037) PROPOSED ACTION (CONTINUED)

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Boeing 737-800 Series	8CM066	1.6	3.0	2.1	2.0	13,150 lbs.
Boeing 737-800 Series	8CM066	38.5	10.7	--	--	26,300 lbs.
Boeing 737-9	01P20CM140	1.6	9.0	--	--	13,200 lbs.
Boeing 737-9	01P20CM140	33.7	10.4	--	--	26,400 lbs.
Boeing 737-900-ER	01P11CM116	1.6	3.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM116	33.7	15.7	4.2	2.0	26,300 lbs.
Boeing 737-900-ER	01P11CM121	1.6	8.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM121	86.6	25.5	--	--	26,300 lbs.
Boeing 767-200 Series Freighter	1GE012	1.6	6.0	--	--	48,000 lbs.
Boeing 767-300 ER Freighter	1GE030	4.8	21.0	--	--	60,000 lbs.
Embraer ERJ175-LR	01P08GE197	11.2	11.2	--	--	13,800 lbs.
North Flow Secondary Location						
Airbus A330-200 Series	9PW094	1.6	38.0	--	--	71,100 lbs.
Total		593.3	--	12.7	--	--

Notes: Totals may not sum due to rounding.
Daytime = 7:00am – 9:59pm, Nighttime = 10:00pm – 6:59am.

Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Landrum & Brown analysis, 2024.

Flight Tracks

Flight track locations for the Future (2037) Proposed Action are expected to be the same as the Existing (2022) conditions because there are no changes to the runway locations and no flight track changes are being proposed.[14] Therefore, the flight track location information discussed for the Existing (2022) Condition in Section 7.1 would remain the same for the Future (2037) Proposed Action.

Aircraft Departure Stage Length and Operational Profiles

Table 7-32 presents the departure stage length distribution for the Future (2037) Proposed Action. The departure segment of the missed approaches is modeled as Stage Length Category 1.

14 It is expected that the Runway 34R arrival profile will be slightly higher due to the relocation of the glide slope. This higher Runway 34R arrival profile was not specifically included in this analysis because AEDT does not provide a function to reflect this minor change. Furthermore, by not including the change in Runway 34R arrival profile this analysis represents a conservative evaluation of noise impacts.

TABLE 7-32: DEPARTURE STAGE LENGTH DISTRIBUTION – FUTURE (2037) PROPOSED ACTION

Stage Length	Commercial Jets	Cargo Jets	Regional Jets	Cargo Props	General Aviation	Other	Military	Total
1	3.41%	--	76.22%	100.00%	100.00%	42.15%	100.00%	19.99%
2	44.77%	11.09%	20.12%	--	--	28.92%	--	37.85%
3	14.81%	30.28%	3.66%	--	--	15.08%	--	12.79%
4	27.84%	28.37%	--	--	--	13.85%	--	21.56%
5	--	--	--	--	--	--	--	--
6	4.00%	21.91%	--	--	--	--	--	3.70%
7	5.17%	8.35%	--	--	--	--	--	4.11%
8	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--

Note: Totals may not sum due to rounding.
Sources: Aviation Forecast Update, prepared by Port of Seattle/LeighFisher, 2023, Sustainable Airport Master Plan Near-Term Projects, Constrained Operating Growth Scenarios, Seattle-Tacoma International Airport, Landrum & Brown, September 2023, Landrum & Brown analysis, 2024.

7.2.4.2 Future 2037 Proposed Action Noise Contours

Exhibit 7-13 *Future (2037) Proposed Action Noise Contour* depicts the 65, 70, and 75 DNL noise contour for the Future (2037) Proposed Action. The area in square miles of each DNL contour band is summarized in **Table 7-33**.

The 65+ DNL contour extends approximately 3.7 miles to the north and 3.2 miles south of SEA. The area within the contour to the north and south is made up of a mix of single-family residential, multi-family residential, commercial, and industrial land uses.

TABLE 7-33: AREA (SQUARE MILES) OF 65, 70, AND 75 DNL NOISE CONTOURS – FUTURE (2037) PROPOSED ACTION

Alternative	DNL 65 - 70 dB	DNL 70 - 75 dB	DNL 75+ dB	DNL 65+ dB
Future (2037) No Action	5.67	2.17	1.32	9.16
Future (2037) Proposed Action	6.08	2.34	1.39	9.82
Change	0.41	0.17	0.07	0.66

Source: Landrum & Brown, 2024.

7.2.4.3 Non-Compatible Land Use

Summaries of the residential population and housing units exposed to noise levels exceeding 65+ DNL for the Future (2037) Proposed Action noise contour are provided in **Table 7-34**. A total of 9,017 housing units (an increase of 1,851 from the Future (2037) No Action) would be located within the Future (2037) Proposed Action 65+ DNL noise contour. The increase in housing units and population from the No Action is due to the increased aircraft operations forecast for the Future (2037) Proposed Action and the increase in size of the 65+ DNL noise contour. For the “sound insulation completed,” the additional areas within the 65+ DNL contour include homes treated during prior phases of the Port’s Part 150 Noise Remedy Program, which extends back to 1985 (when the noise contours were much larger). Therefore, the increases in the numbers are solely due to the changes in the noise contour.

TABLE 7-34: NON-COMPATIBLE LAND USE HOUSING AND POPULATION – FUTURE (2037) PROPOSED ACTION

Mitigation Status/Land Use	DNL 65 - 70 dB	DNL 70 - 75 dB	DNL 65+ dB
Sound Insulation Completed			
Single-Family	3,570	389	3,959
Multi-Family	362	4	366
Mobile Home	0	0	0
Subtotal	3,932	393	4,325
Not Sound Insulated			
Single-Family	917	72	989
Multi-Family	3,572	0	3,572
Mobile Home	114	17	131
Subtotal	4,603	89	4,692
Total Housing Units	**8,535**	**482**	**9,017**
Estimated Population			
Total Estimated Population	**19,468**	**1,268**	**20,736**

Notes: Multi-family includes total units in a complex and were verified using King County assessor data. Population numbers are estimates based on the 2020 United States Census average household size per number of housing units.
Source: Landrum & Brown analysis, 2024.

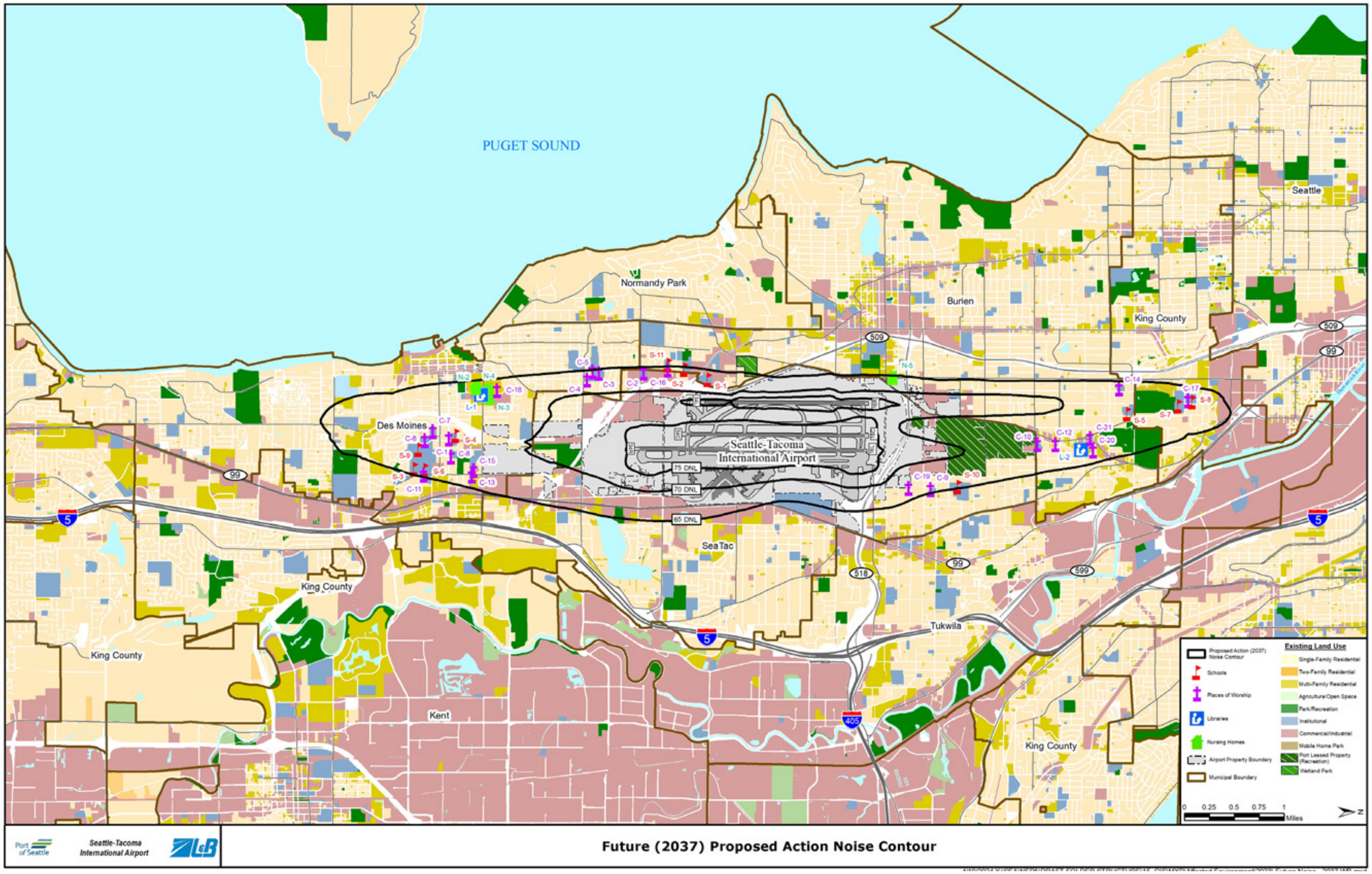
A list of noise sensitive facilities within the 65+ DNL noise contour for the Future (2037) Proposed Action are listed in **Table 7-35**. There would be 11 schools, 21 places of worship, four nursing homes, and two libraries within the 65 DNL noise contour. There are no noise sensitive facilities within the 70 or 75 DNL noise contours for the Future (2037) Proposed Action.

TABLE 7-35: NOISE SENSITIVE FACILITIES IN THE FUTURE (2037) PROPOSED ACTION 65+ DNL NOISE CONTOUR

Map ID	Name
Schools	
S-1	Puget Sound Skills Center
S-2	Choice Academy – Homeschool Center
S-3	Midway Elementary School
S-4	Mount Rainier High School
S-5	Southern Heights Elementary School
S-6	Pacific Middle School
S-7	Beverly Park Elementary School
S-8	Our Lady of Lourdes School
S-9	St. Philomena Catholic School
S-10	Glacier Middle School
S-11	Community Chapel Christian School
Places of Worship	
C-1	Saint Philomena Catholic Church
C-2	Prince of Peace Lutheran Church
C-3	Samoan Christian Fellowship
C-4	Normandy Christian Church
C-5	Southminster Presbyterian Church
C-6	Hope Church
C-7	Gospel Russian Baptist Church
C-8	The Mountain Church
C-9	Riverton Heights Baptist Church
C-10	Boulevard Park Presbyterian
C-11	Midway Community Covenant Church
C-12	Apostolic Bible Church of Jesus Christ
C-13	Highline 7th Day Adventist Church
C-14	Glen Acres Church of Christ
C-15	Kingdom Hall of Jehovah's Witnesses
C-16	New Testament Christian Church
C-17	Our Lady of Lourdes Church
C-18	Pacific Northwest United Methodist
C-19	Wat Buddharam Buddhist Temple
C-20	Hanuman Nagri Temple
C-21	Way of Salvation Church
Libraries	
L-1	Des Moines Library
L-2	Boulevard Park Library
Nursing Homes	
N-2	Wesley Homes Terrace
N-3	Wesley Homes Health Center
N-4	Wesley Homes Gardens and Bungalows
N-5	High West Residence

Source: Landrum & Brown analysis, 2024.

EXHIBIT 7-13: FUTURE (2037) PROPOSED ACTION NOISE CONTOUR



Sources: AEDT Version 3f; Landrum & Brown analysis, 2024.

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8. Significant Impact Conclusion

The Future (2032) Proposed Action noise contour would be larger than the Future (2032) No Action by 0.15 square miles due primarily to the 24 additional average annual day operations (see **Exhibit 9-1, *Comparison of Future (2032) Proposed Action/Hybrid Terminal Option and Future (2032) No Action Noise Contours***). Within the area of increased noise exposure associated with the Future (2032) Proposed Alternative there would be 337 additional housing units and 824 additional people within the 65+ DNL. The Future (2032) Proposed Action would not increase noise by 1.5 DNL or more for a noise sensitive area at or above the 65 DNL (the range of increase was between 0.0 DNL and 0.6 DNL) or that would be exposed at or above the 65 DNL level due to a 1.5 dB or greater increase, when compared to the Future (2032) No Action, as shown in **Exhibit 9-2, *Area of 1.5 dB Increase Within the 65+ DNL of the 2032 Proposed Action Noise Contour***. Therefore, no significant noise impact would occur as a result of implementing the Future (2032) Proposed Action. The results would be the same for the Hybrid Terminal Option.

The Future (2037) Proposed Action noise contour would be larger than the Future (2037) No Action by 0.66 square miles due primarily to the 96 additional average annual day operations (see **Exhibit 9-3, *Comparison of Future (2037) Proposed Action/Hybrid Terminal Option and Future (2037) No Action Noise Contours)***. Within the area of increased noise exposure associated with the Future (2037) Proposed Alternative there would be 1,851 additional housing units and 4,439 additional population within the 65+ DNL. The Future (2037) Proposed Action would not increase noise by 1.5 DNL or more for a noise sensitive area at or above the 65 DNL (the range of increase was between 0.0 DNL and 0.6 DNL) or that would be exposed at or above the 65 DNL level due to a 1.5 dB or greater increase, when compared to the Future (2037) No Action, as shown in **Exhibit 9-4, *Area of 1.5 dB Increase Within the 65+ DNL of the 2037 Proposed Action Noise Contour***. Therefore, no significant noise impact would occur as a result of implementing the Future (2037) Proposed Action. The results would be the same for the Hybrid Terminal Option.

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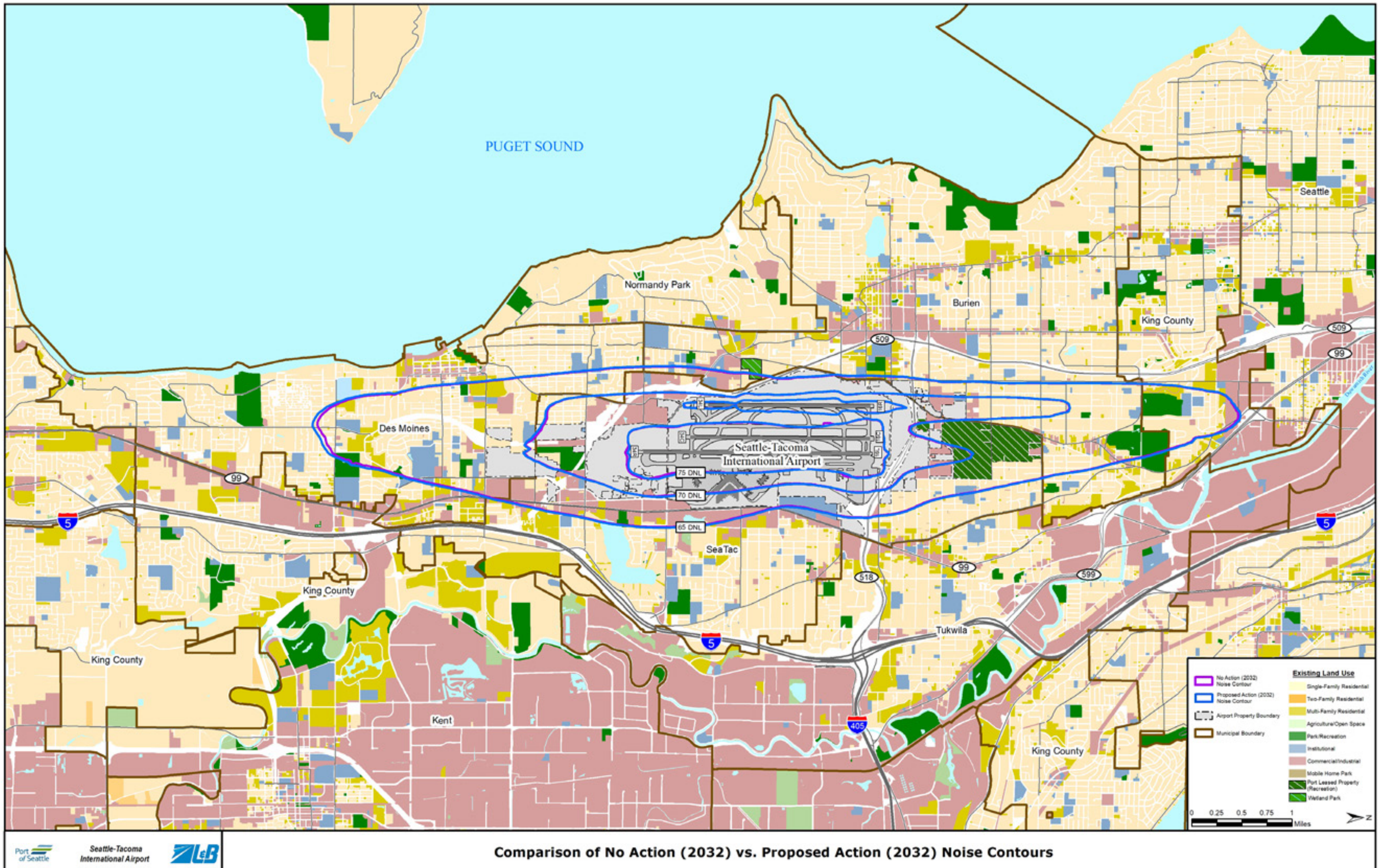
EXHIBIT 9-1: COMPARISON OF FUTURE (2032) PROPOSED ACTION/HYBRID TERMINAL OPTION AND FUTURE (2032) NO ACTION NOISE CONTOURS



Sources: AEDT Version 3f; Landrum & Brown analysis, 2024.

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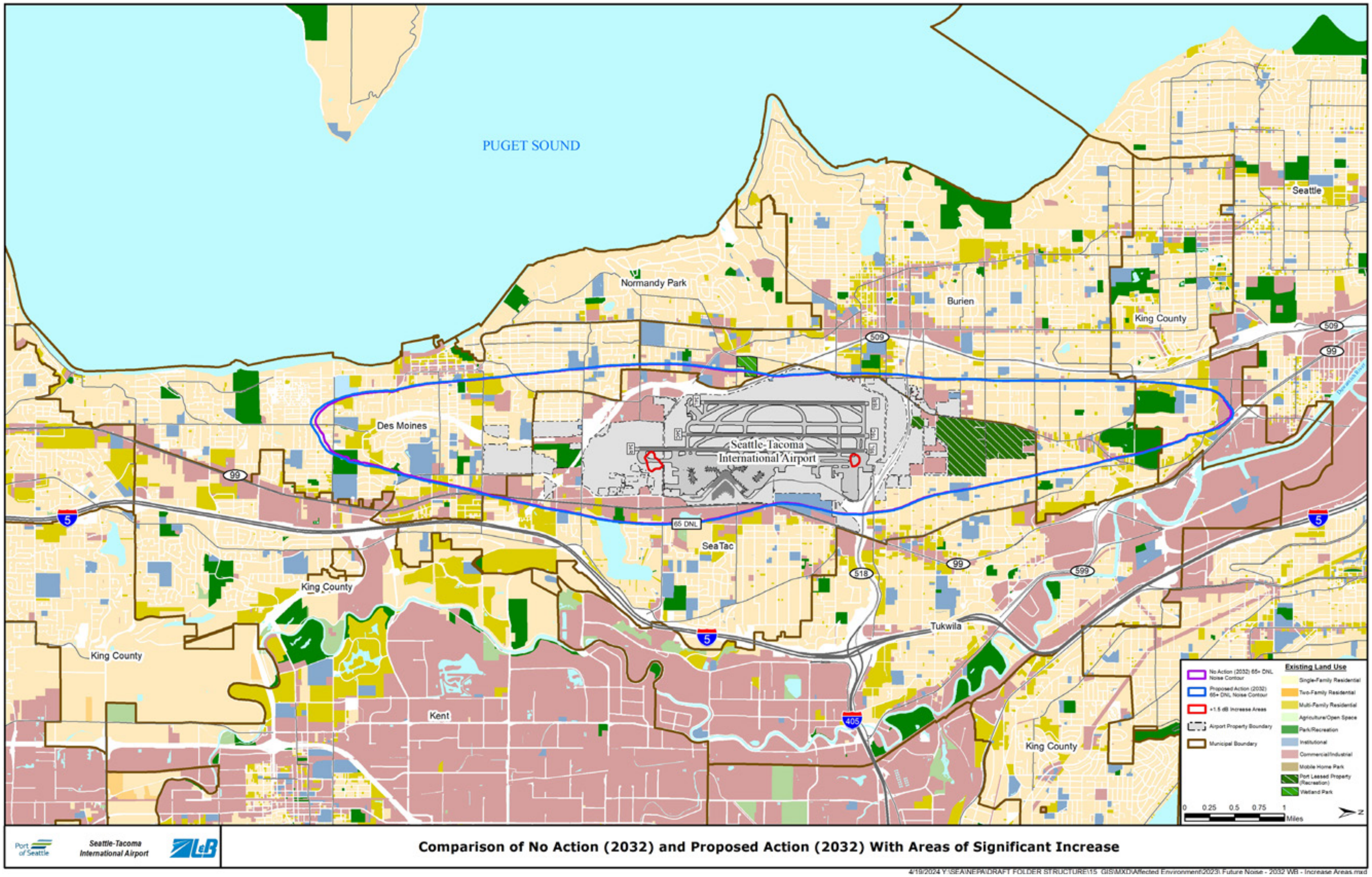
EXHIBIT 9-2: AREA OF 1.5 DB INCREASE WITHIN THE 65+ DNL OF THE 2032 PROPOSED ACTION NOISE CONTOUR



Sources: AEDT Version 3f; Landrum & Brown analysis, 2024.

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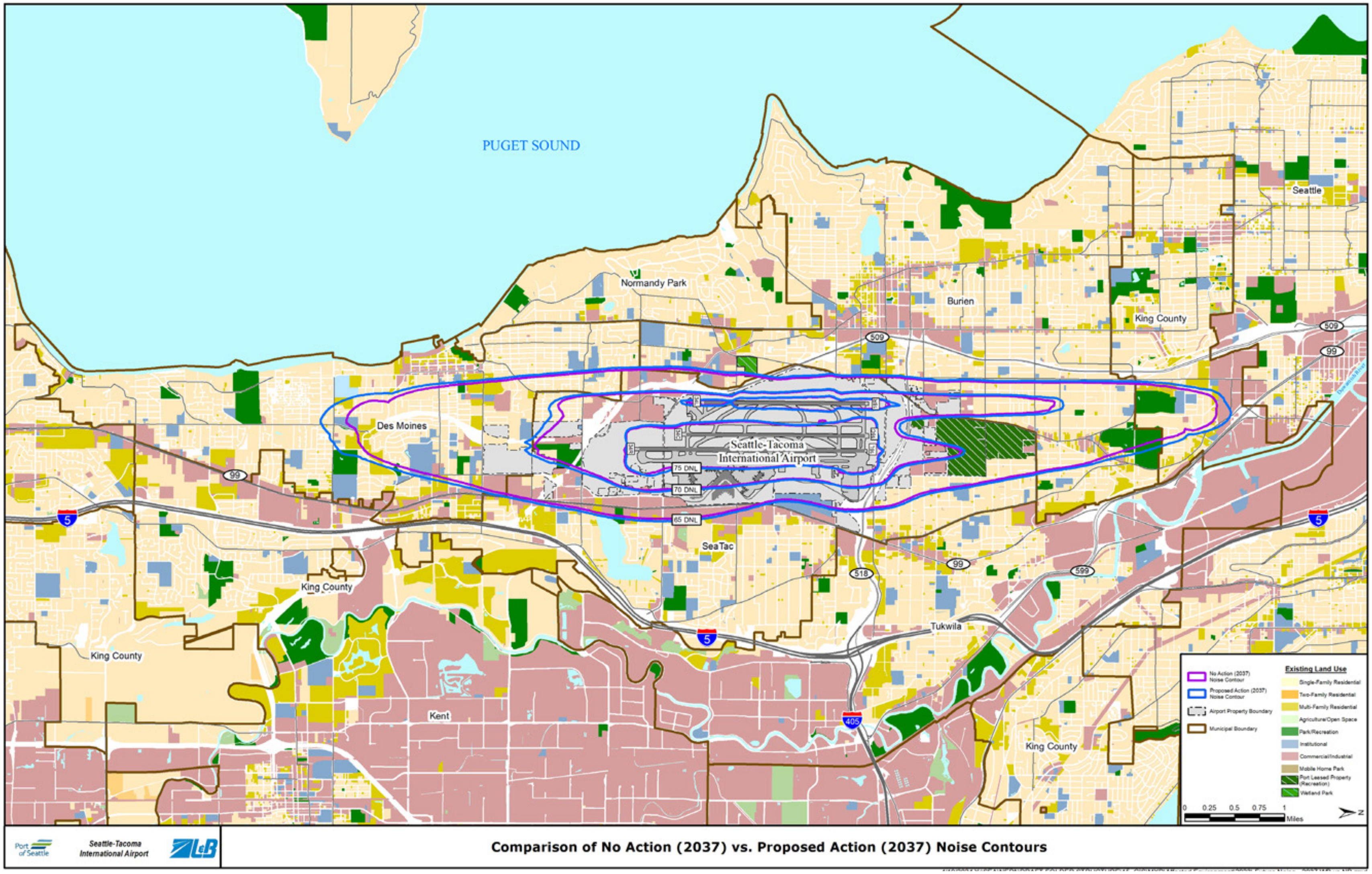
EXHIBIT 9-3: COMPARISON OF FUTURE (2037) PROPOSED ACTION/HYBRID TERMINAL OPTION AND FUTURE (2037) NO ACTION NOISE CONTOURS



Sources: AEDT Version 3f; Landrum & Brown analysis, 2024.

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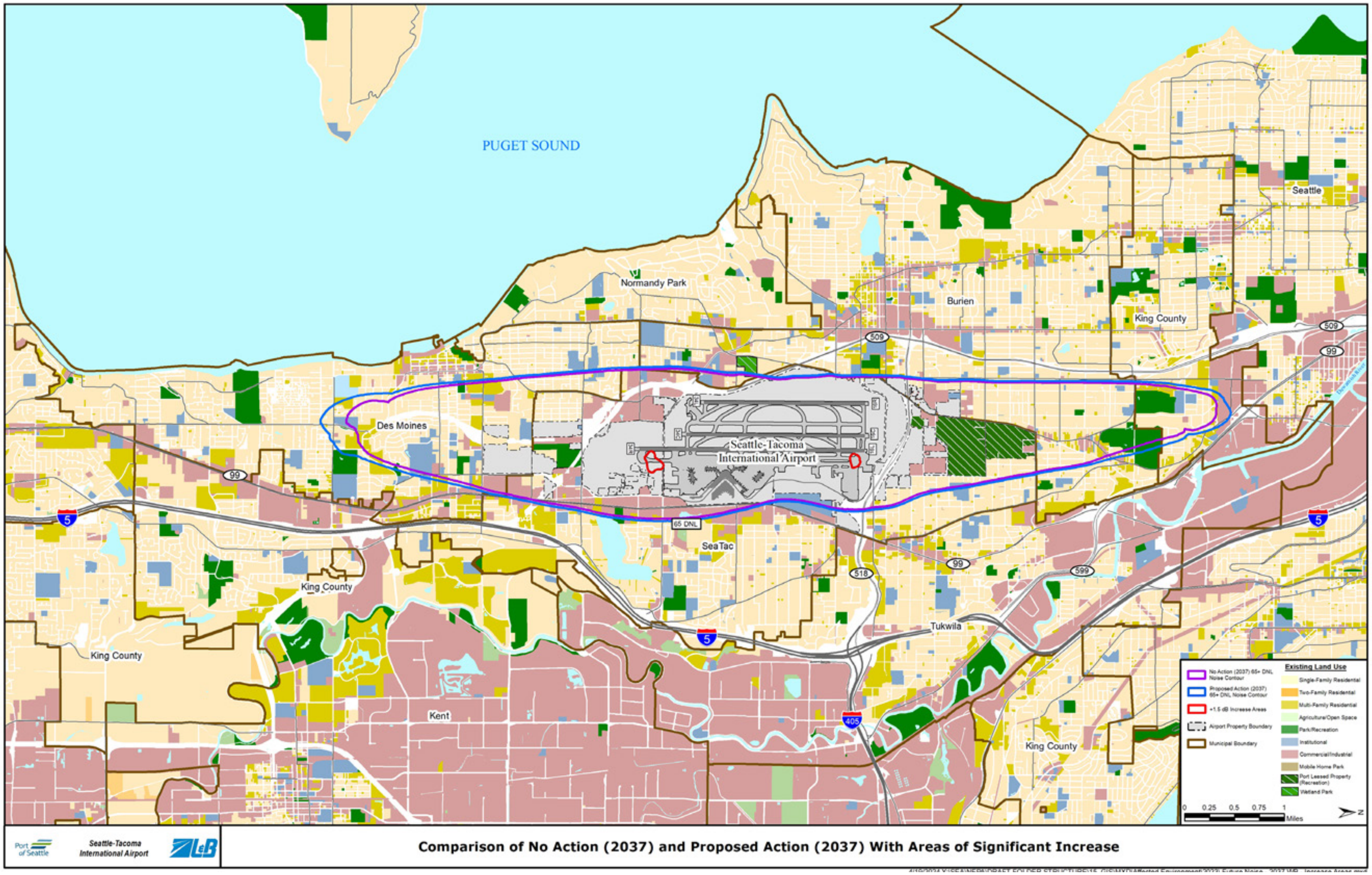
EXHIBIT 9-4: AREA OF 1.5 DB INCREASE WITHIN THE 65+ DNL OF THE 2037 PROPOSED ACTION NOISE CONTOUR



Sources: AEDT Version 3f; Landrum & Brown analysis, 2024.

APPENDIX J

Noise and Noise-Compatible Land Use

Noise Modeling Protocol

memorandum

Landrum & Brown, Incorporated
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Project: SEA SAMP Environmental Review

Subject: SAMP Environmental Review Noise Protocol

From: Landrum & Brown, Inc.

Date: February 8, 2024

The approved noise and modeling protocol for the SEA SAMP Environmental Review had the modeling using AEDT Version 3e. The protocol was based on airframes and engines that were available in AEDT Version 3e. As part of the protocol, aircraft substitutions were required to capture forecasted aircraft, Boeing 737-7 and the Cessna 408 Sky Courier. In AEDT Version 3e, the Boeing 737-7 was substituted with the Boeing 737-8 and the Cessna 408 Sky Courier was substituted with the Shorts 330-200 Series.

On December 13, 2023, AEDT Version 3f was released and included the Boeing 737-7 and the Cessna 408 SkyCourier. As a result, the decision was made to update the noise modeling using AEDT Version 3f. The following is a summary of the differences between the Airframes, Engines and Aircraft Noise and Performance (ANP) data included in the AEDT Version 3e and AEDT Version 3f studies for the SEA SAMP Environmental Review. AEDT Version 3f studies did not require substitutions for the Boeing 737-7 and the Cessna 408 Sky Courier.

Aircraft Noise & Performance Modifications

Airframe	Engine Code	AEDT 3e Anp	AEDT 3f ANP	Existing/ Future
Airbus A320-NEO	01P20CM128	A320-271N	A320-270N	Existing \ Future
Airbus A320-NEO	01P20CM132	A320-271N	A320-270N	Existing \ Future
Gulfstream G200	7PW077	CNA750	CL600	Existing
Cessna 208 Caravan	P6114A	PA42	CNA208	Existing \ Future
Cessna 208 Caravan	PT6A36	PA42	CNA208	Existing \ Future

Airframe Modifications

AEDT 3e Airframe	AEDT 3e Engine Code	AEDT 3f Airframe	AEDT 3f Engine Code	Existing \ Future
Raytheon Super King Air 200	PT660A	Raytheon C-12 Huron	PT660A	Existing \ Future
Shorts 330-200 Series	PT6A6B	Cessna 408 SkyCourier	PT6A6B	Future
Boeing 737-8_7MAX	01P20CM136	Boeing 737-7	01P20CM136	Future

Engine Modifications

AEDT 3e Airframe	AEDT 3e Engine Code	AEDT 3f Airframe	AEDT 3f Engine Code	Existing \ Future
Boeing 787-10 Dreamliner	17GE179	Boeing 787-10 Dreamliner	01P17GE213	Existing \ Future
Bombardier CS100	01P220PW183	Bombardier CS100	04P20PW196	Existing
Bombardier CS300	01P220PW183	Bombardier CS300	04P20PW196	Existing
Bombardier CS300	01P220PW184	Bombardier CS300	04P20PW197	Existing

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Table 17 was updated to include the accurate number of 737-9 operations. See bold in table.

Table 17 Alternative 2: 2037 Proposed Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations

Airframe	Anp Id	Engine Code	Annual Operations
Commercial Jets			
Boeing 737-9	7378MAX	01P20CM136	1033.0
Boeing 737-9	7378MAX	01P20CM140	40723.9

Source: L&B Analysis, 2023.

Tables 22 and 23 were updated to reflect the correct day night percentages for the Narrowbody Jet.

Table 22 Alternative 1: 2037 No Action Arrival Day/Night Split per Operator Category

Operator Category	Day	Night
Passenger		
Narrowbody Jet	81.9%	18.1%
Grand Total	**84.7%**	**15.3%**

Source: L&B Analysis, 2023.

Table 23 Alternative 1: 2037 No Action Departure Day/Night Split per Operator Category

Operator Category	Day	Night
Passenger		
Narrow Body Jet	81.6%	18.4%
Grand Total	**84.5%**	**15.5%**

Source: L&B Analysis, 2023.

In addition, Tables 26 through 29 have been updated to include the Boeing 767-300 Freighter run up operations.

Table 26 Alternative 1: 2032 No Action Aircraft Run-up Activity

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
North Flow Primary Location						
Airbus A319-100 Series	3IA006	1.4	3.0	--	--	22,000 lbs
Airbus A320-200 Series	01P08CM105	24.6	15.8	1.5	2	25,000 lbs
Airbus A320-200 Series	1CM009	2.9	69.5	--	--	25,000 lbs
Airbus A320-200 Series	3CM026	2.9	15.5	--	--	25,000 lbs
Airbus A321-200 Series	3CM025	4.3	36.7	--	--	30,000 lbs
Airbus A321-NEO	01P20CM132	--	--	1.5	2	30,000 lbs
Airbus A330-200 Series	9PW094	8.7	27.7	--	--	71,100 lbs
Airbus A330-300 Series	4GE080	1.4	37.0	--	--	67,500 lbs
Airbus A330-900N Series (Neo)	02P23RR141	1.4	26.0	--	--	71,100 lbs
Boeing 737-700 Series	3CM031	5.8	26.8	--	--	24,000 lbs
Boeing 737-700 Series	3CM032	7.2	56.4	--	--	24,000 lbs
Boeing 737-800 Series	01P11CM122	1.4	10.0	--	--	26,300 lbs
Boeing 737-800 Series	3CM032	20.3	27.6	--	--	26,300 lbs
Boeing 737-800 Series	3CM034	1.4	9.0	--	--	26,300 lbs
Boeing 737-800 Series	8CM051	2.9	40.5	--	--	26,300 lbs
Boeing 737-800 Series	8CM066	4.3	33.0	--	--	26,300 lbs
Boeing 737-9	01P20CM140	13.0	14.6	--	--	26,400 lbs

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Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Boeing 737-900-ER	01P11CM116	14.5	20.2	--	--	26,300 lbs
Boeing 737-900-ER	01P11CM121	1.4	4.0	--	--	13,150 lbs
Boeing 737-900-ER	01P11CM121	23.2	25.1	--	--	26,300 lbs
Boeing MD-11 Freighter	1GE031	--	--	1.5	2	61,500 lbs
Embraer ERJ175-LR	01P08GE197	1.4	6.0	--	--	6,900 lbs
Embraer ERJ175-LR	01P08GE197	5.8	28.0	--	--	13,800 lbs
Tango X Location						
Airbus A330-200 Series	9PW094	1.4	38.0	--	--	71,100 lbs
South Flow Primary Location						
Airbus A319-100 Series	3IA006	1.4	15.0	--	--	22,000 lbs
Airbus A319-100 Series	3IA007	1.4	26.0	1.5	11	22,000 lbs
Airbus A320-200 Series	01P08CM105	2.9	6.0	--	--	12,500 lbs
Airbus A320-200 Series	01P08CM105	40.6	12.9	--	--	25,000 lbs
Airbus A320-200 Series	1CM009	7.2	31.6	--	--	25,000 lbs
Airbus A321-NEO	01P20CM132	2.9	12.5	--	--	30,000 lbs
Airbus A330-200 Series	2RR023	1.4	6.0	--	--	71,100 lbs
Airbus A330-200 Series	9PW094	1.4	26.0	--	--	35,550 lbs
Airbus A330-200 Series	9PW094	11.6	14.9	--	--	71,100 lbs
Airbus A330-300 Series	4GE080	4.3	10.7	--	--	67,500 lbs
Airbus A330-900N Series (Neo)	02P23RR141	4.3	26.7	--	--	71,100 lbs
Boeing 737-700 Series	3CM031	1.4	20.0	1.5	2	12,000 lbs
Boeing 737-700 Series	3CM031	23.2	17.6	--	--	24,000 lbs
Boeing 737-700 Series	3CM032	5.8	31.5	--	--	24,000 lbs
Boeing 737-800 Series	3CM032	4.3	18.3	--	--	13,150 lbs
Boeing 737-800 Series	3CM032	60.8	18.3	--	--	26,300 lbs
Boeing 737-800 Series	8CM051	15.9	21.0	--	--	26,300 lbs
Boeing 737-800 Series	8CM065	1.4	6.0	--	--	26,300 lbs
Boeing 737-800 Series	8CM066	1.4	3.0	1.5	2	13,150 lbs
Boeing 737-800 Series	8CM066	34.8	10.7	--	--	26,300 lbs
Boeing 737-9	01P20CM140	1.4	9.0	--	--	13,200 lbs
Boeing 737-9	01P20CM140	30.4	10.4	--	--	26,400 lbs
Boeing 737-900-ER	01P11CM116	1.4	3.0	--	--	13,150 lbs
Boeing 737-900-ER	01P11CM116	30.4	15.7	2.9	2	26,300 lbs
Boeing 737-900-ER	01P11CM121	1.4	8.0	--	--	13,150 lbs
Boeing 737-900-ER	01P11CM121	78.2	25.5	--	--	26,300 lbs
Boeing 767-200 Series Freighter	1GE012	1.4	6.0	--	--	48,000 lbs
Boeing 767-300 ER Freighter	1GE030	4.3	21.0	--	--	60,000 lbs
Boeing MD-11 Freighter	1GE031	2.9	44.5	--	--	61,500 lbs
Embraer ERJ175-LR	01P08GE197	10.1	11.2	--	--	13,800 lbs
	Total	**543.3**	**--**	**11.6**	**--**	

Notes: Totals may not equal sum total due to rounding.
Daytime = 7:00am – 9:59pm, Nighttime = 10:00pm – 6:59am.

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TABLE 27 ALTERNATIVE 2: 2032 PROPOSED ACTION AIRCRAFT RUN-UP ACTIVITY

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
North Flow Primary Location						
Airbus A319-100 Series	3IA006	1.5	3.0	--	--	22,000 lbs
Airbus A320-200 Series	01P08CM105	25.1	15.8	1.5	2.0	25,000 lbs
Airbus A320-200 Series	1CM009	3.0	69.5	--	--	25,000 lbs
Airbus A320-200 Series	3CM026	3.0	15.5	--	--	25,000 lbs
Airbus A321-200 Series	3CM025	4.4	36.7	--	--	30,000 lbs
Airbus A321-NEO	01P20CM132			1.5	2.0	30,000 lbs
Airbus A330-200 Series	9PW094	8.9	27.7	--	--	71,100 lbs
Airbus A330-300 Series	4GE080	1.5	37.0	--	--	67,500 lbs
Airbus A330-900N Series (Neo)	02P23RR141	1.5	26.0	--	--	71,100 lbs
Boeing 737-700 Series	3CM031	5.9	26.8	--	--	24,000 lbs
Boeing 737-700 Series	3CM032	7.4	56.4	--	--	24,000 lbs
Boeing 737-800 Series	01P11CM122	1.5	10.0	--	--	26,300 lbs
Boeing 737-800 Series	3CM032	20.7	27.6	--	--	26,300 lbs
Boeing 737-800 Series	3CM034	1.5	9.0	--	--	26,300 lbs
Boeing 737-800 Series	8CM051	3.0	40.5	--	--	26,300 lbs
Boeing 737-800 Series	8CM066	4.4	33.0	--	--	26,300 lbs
Boeing 737-9	01P20CM140	13.3	14.6	--	--	26,400 lbs
Boeing 737-900-ER	01P11CM116	14.8	20.2	--	--	26,300 lbs
Boeing 737-900-ER	01P11CM121	1.5	4.0	--	--	13,150 lbs
Boeing 737-900-ER	01P11CM121	23.6	25.1	--	--	26,300 lbs
Boeing MD-11 Freighter	1GE031	--	--	1.5	2.0	61,500 lbs
Embraer ERJ175-LR	01P08GE197	1.5	6.0	--	--	6,900 lbs
Embraer ERJ175-LR	01P08GE197	5.9	28.0	--	--	13,800 lbs
North Flow Secondary Location						
Airbus A330-200 Series	9PW094	1.5	38.0	--	--	71,100 lbs
South Flow Primary Location						
Airbus A319-100 Series	3IA006	1.5	15.0	--	--	22,000 lbs
Airbus A319-100 Series	3IA007	1.5	26.0	1.5	11.0	22,000 lbs
Airbus A320-200 Series	01P08CM105	3.0	6.0	--	--	12,500 lbs
Airbus A320-200 Series	01P08CM105	41.3	12.9	--	--	25,000 lbs
Airbus A320-200 Series	1CM009	7.4	31.6	--	--	25,000 lbs
Airbus A321-NEO	01P20CM132	3.0	12.5	--	--	30,000 lbs
Airbus A330-200 Series	2RR023	1.5	6.0	--	--	71,100 lbs
Airbus A330-200 Series	9PW094	1.5	26.0	--	--	35,550 lbs
Airbus A330-200 Series	9PW094	11.8	14.9	--	--	71,100 lbs
Airbus A330-300 Series	4GE080	4.4	10.7	--	--	67,500 lbs
Airbus A330-900N Series (Neo)	02P23RR141	4.4	26.7	--	--	71,100 lbs
Boeing 737-700 Series	3CM031	1.5	20.0	1.5	2.0	12,000 lbs
Boeing 737-700 Series	3CM031	23.6	17.6	--	--	24,000 lbs
Boeing 737-700 Series	3CM032	5.9	31.5	--	--	24,000 lbs
Boeing 737-800 Series	3CM032	4.4	18.3	--	--	13,150 lbs
Boeing 737-800 Series	3CM032	62.0	18.3	--	--	26,300 lbs

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Boeing 737-800 Series	8CM051	16.2	21.0	--	--	26,300 lbs
Boeing 737-800 Series	8CM065	1.5	6.0			26,300 lbs
Boeing 737-800 Series	8CM066	1.5	3.0	1.5	2.0	13,150 lbs
Boeing 737-800 Series	8CM066	35.4	10.7	--	--	26,300 lbs
Boeing 737-9	01P20CM140	1.5	9.0	--	--	13,200 lbs
Boeing 737-9	01P20CM140	31.0	10.4	--	--	26,400 lbs
Boeing 737-900-ER	01P11CM116	1.5	3.0	--	--	13,150 lbs
Boeing 737-900-ER	01P11CM116	31.0	15.7	3.0	2.0	26,300 lbs
Boeing 737-900-ER	01P11CM121	1.5	8.0	--	--	13,150 lbs
Boeing 737-900-ER	01P11CM121	79.7	25.5	--	--	26,300 lbs
Boeing 767-200 Series Freighter	1GE012	1.5	6.0	--	--	48,000 lbs
Boeing 767-300 ER Freighter	1GE030	4.4	21.0	--	--	60,000 lbs
Boeing MD-11 Freighter	1GE031	3.0	44.5	--	--	61,500 lbs
Embraer ERJ175-LR	01P08GE197	10.3	11.2	--	--	13,800 lbs
	Total	**553.46**	**--**	**11.85**	**--**	**-**

Notes: Totals may not equal sum total due to rounding.
Daytime = 7:00am – 9:59pm, Nighttime = 10:00pm – 6:59am.

Table 28 Alternative 1: 2037 No Action Aircraft Run-up Activity

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
North Flow Primary Location						
Airbus A320-200 Series	01P08CM105	25.4	15.8	2.0	2.0	25,000 lbs.
Airbus A320-200 Series	1CM009	3.0	69.5	--	--	25,000 lbs.
Airbus A320-200 Series	3CM026	3.0	15.5	--	--	25,000 lbs.
Airbus A321-200 Series	3CM025	4.5	36.7	--	--	30,000 lbs.
Airbus A321-NEO	01P20CM132	--	--	2.0	2.0	30,000 lbs.
Airbus A330-200 Series	9PW094	9.0	27.7	--	--	71,100 lbs.
Airbus A330-300 Series	4GE080	1.5	37.0	--	--	67,500 lbs.
Airbus A330-900N Series (Neo)	02P23RR141	1.5	26.0	--	--	71,100 lbs.
Boeing 737-700 Series	3CM031	6.0	26.8	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	7.5	56.4	--	--	24,000 lbs.
Boeing 737-800 Series	01P11CM122	1.5	10.0	--	--	26,300 lbs.
Boeing 737-800 Series	3CM032	20.9	27.6	--	--	26,300 lbs.
Boeing 737-800 Series	3CM034	1.5	9.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM051	3.0	40.5	--	--	26,300 lbs.
Boeing 737-800 Series	8CM066	4.5	33.0	--	--	26,300 lbs.
Boeing 737-9	01P20CM140	13.4	14.6	--	--	26,400 lbs.
Boeing 737-900-ER	01P11CM116	14.9	20.2	--	--	26,300 lbs.
Boeing 737-900-ER	01P11CM121	23.9	25.1	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM121	1.5	4.0	--	--	26,300 lbs.
Embraer ERJ175-LR	01P08GE197	1.5	6.0	--	--	6,900 lbs.
Embraer ERJ175-LR	01P08GE197	6.0	28.0	--	--	13,800 lbs.

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Tango X Location						
Airbus A330-200 Series	9PW094	1.5	38.0	--	--	71,100 lbs.
South Flow Primary Location						
Airbus A320-200 Series	01P08CM105	3.0	6.0	--	--	12,500 lbs.
Airbus A320-200 Series	01P08CM105	41.8	12.9	--	--	25,000 lbs.
Airbus A320-200 Series	1CM009	7.5	31.6	--	--	25,000 lbs.
Airbus A321-NEO	01P20CM132	3.0	12.5	--	--	30,000 lbs.
Airbus A330-200 Series	2RR023	1.5	6.0	--	--	71,100 lbs.
Airbus A330-200 Series	9PW094	1.5	26.0	--	--	35,550 lbs.
Airbus A330-200 Series	9PW094	11.9	14.9	--	--	71,100 lbs.
Airbus A330-300 Series	4GE080	4.5	10.7	--	--	67,500 lbs.
Airbus A330-900N Series (Neo)	02P23RR141	4.5	26.7	--	--	71,100 lbs.
Boeing 737-700 Series	3CM031	1.5	20.0	2.0	2.0	12,000 lbs.
Boeing 737-700 Series	3CM031	23.9	17.6	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	6.0	31.5	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	62.7	18.3	--	--	26,300 lbs.
Boeing 737-800 Series	3CM032	4.5	18.3	--	--	13,150 lbs.
Boeing 737-800 Series	8CM051	16.4	21.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM065	1.5	6.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM066	1.5	3.0	2.0	2.0	13,150 lbs.
Boeing 737-800 Series	8CM066	35.8	10.7	--	--	26,300 lbs.
Boeing 737-9	01P20CM140	1.5	9.0	--	--	13,200 lbs.
Boeing 737-9	01P20CM140	31.4	10.4	--	--	26,400 lbs.
Boeing 737-900-ER	01P11CM116	1.5	3.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM116	31.4	15.7	3.9	2.0	26,300 lbs.
Boeing 737-900-ER	01P11CM121	1.5	8.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM121	80.6	25.5	--	--	26,300 lbs.
Boeing 767-200 Series Freighter	1GE012	1.5	6.0	--	--	48,000 lbs.
Boeing 767-300 ER Freighter	1GE030	4.5	21.0	--	--	60,000 lbs.
Embraer ERJ175-LR	01P08GE197	10.5	11.1	--	--	13,800 lbs.
	Total	**552.6**	**--**	**11.8**	**--**	**--**

Notes: Totals may not equal sum total due to rounding.
Daytime = 7:00am – 9:59pm, Nighttime = 10:00pm – 6:59am.

Table 29 Alternative 2: 2037 Proposed Action Aircraft Run-up Activity

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
North Flow Primary Location						
Airbus A320-200 Series	01P08CM105	27.3	15.8	2.1	2.0	25,000 lbs.
Airbus A320-200 Series	1CM009	3.2	69.5	--	--	25,000 lbs.
Airbus A320-200 Series	3CM026	3.2	15.5	--	--	25,000 lbs.
Airbus A321-200 Series	3CM025	4.8	36.7	--	--	30,000 lbs.
Airbus A321-NEO	01P20CM132			2.1	2.0	30,000 lbs.

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Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Airbus A330-200 Series	9PW094	9.6	27.7	--	--	71,100 lbs.
Airbus A330-300 Series	4GE080	1.6	37.0	--	--	67,500 lbs.
Airbus A330-900N Series (Neo)	02P23RR141	1.6	26.0	--	--	71,100 lbs.
Boeing 737-700 Series	3CM031	6.4	26.8	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	8.0	56.4	--	--	24,000 lbs.
Boeing 737-800 Series	01P11CM122	1.6	10.0	--	--	26,300 lbs.
Boeing 737-800 Series	3CM032	22.4	27.6	--	--	26,300 lbs.
Boeing 737-800 Series	3CM034	1.6	9.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM051	3.2	40.5	--	--	26,300 lbs.
Boeing 737-800 Series	8CM066	4.8	33.0	--	--	26,300 lbs.
Boeing 737-9	01P20CM140	14.4	14.6	--	--	26,400 lbs.
Boeing 737-900-ER	01P11CM116	16.0	20.2	--	--	26,300 lbs.
Boeing 737-900-ER	01P11CM121	1.6	4.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM121	25.7	25.1	--	--	26,300 lbs.
Embraer ERJ175-LR	01P08GE197	1.6	6.0	--	--	6,900 lbs.
Embraer ERJ175-LR	01P08GE197	6.4	28.0	--	--	13,800 lbs.
North Flow Secondary Location						
Airbus A330-200 Series	9PW094	1.6	38.0	--	--	71,100 lbs.
South Flow Primary Location						
Airbus A320-200 Series	01P08CM105	3.2	6.0	--	--	12,500 lbs.
Airbus A320-200 Series	01P08CM105	44.9	12.9	--	--	25,000 lbs.
Airbus A320-200 Series	1CM009	8.0	31.6	--	--	25,000 lbs.
Airbus A321-NEO	01P20CM132	3.2	12.5	--	--	30,000 lbs.
Airbus A330-200 Series	2RR023	1.6	6.0	--	--	71,100 lbs.
Airbus A330-200 Series	9PW094	1.6	26.0	--	--	35,550 lbs.
Airbus A330-200 Series	9PW094	12.8	14.9	--	--	71,100 lbs.
Airbus A330-300 Series	4GE080	4.8	10.7	--	--	67,500 lbs.
Airbus A330-900N Series (Neo)	02P23RR141	4.8	26.7	--	--	71,100 lbs.
Boeing 737-700 Series	3CM031	1.6	20.0	2.1	2.0	12,000 lbs.
Boeing 737-700 Series	3CM031	25.7	17.6	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	6.4	31.5	--	--	24,000 lbs.
Boeing 737-700 Series	3CM032	67.3	18.3	--	--	26,300 lbs.
Boeing 737-800 Series	3CM032	4.8	18.3	--	--	13,150 lbs.
Boeing 737-800 Series	8CM051	17.6	21.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM065	1.6	6.0	--	--	26,300 lbs.
Boeing 737-800 Series	8CM066	1.6	3.0	2.1	2.0	13,150 lbs.
Boeing 737-800 Series	8CM066	38.5	10.7	--	--	26,300 lbs.
Boeing 737-9	01P20CM140	1.6	9.0	--	--	13,200 lbs.
Boeing 737-9	01P20CM140	33.7	10.4	--	--	26,400 lbs.
Boeing 737-900-ER	01P11CM116	1.6	3.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM116	33.7	15.7	4.2	2.0	26,300 lbs.
Boeing 737-900-ER	01P11CM121	1.6	8.0	--	--	13,150 lbs.
Boeing 737-900-ER	01P11CM121	86.6	25.5	--	--	26,300 lbs.
Boeing 767-200 Series Freighter	1GE012	1.6	6.0	--	--	48,000 lbs.
Boeing 767-300 ER Freighter	1GE030	4.8	21.0	--	--	60,000 lbs.

memorandum

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Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Embraer ERJ175-LR	01P08GE197	11.2	11.2	--	--	13,800 lbs.
	Total	**593.3**	**--**	**12.7**	**--**	**--**

Notes: Totals may not equal sum total due to rounding.
Daytime = 7:00am – 9:59pm, Nighttime = 10:00pm – 6:59am.

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Noise Modeling Protocol
Existing and Future Conditions

FINAL – September 2023

PREPARED FOR
Port of Seattle

PREPARED BY
Landrum & Brown, Incorporated

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1 Existing Condition Noise Modeling Methodology

For aviation noise analyses, the Federal Aviation Administration (FAA) has determined that the cumulative noise energy exposure of individuals to noise resulting from aviation activities must be established in terms of annual Day-Night Sound Equivalent (DNL), the FAA's primary noise metric. To evaluate aircraft noise, the FAA has an approved computer model, the Aviation Environmental Design Tool (AEDT) that simulates aircraft activity at an airport. AEDT replaced the Integrated Noise Model (INM), as the tool for environmental modeling of FAA actions to determine if significant noise impacts would result. The analysis of the noise exposure for the existing conditions and the future alternatives around Seattle-Tacoma International Airport (SEA or Airport) will be prepared using the FAA's AEDT Version 3e.

The noise pattern calculated by the AEDT for an airport is a function of several factors, including: the number of aircraft operations during the period evaluated, the types of aircraft flown, the time of day when they are flown, the way they are flown, how frequently each runway is used for landing and takeoff, and the routes of flight used to and from the runways. Substantial variations in any one of these factors may, when extended over a long period of time, cause marked changes to the noise pattern.

The following sections present the methodology and modeling input assumptions for the Existing (2022) condition. The methodology and modeling input assumptions for the future conditions are presented later in this document.

1.1 Aircraft Activity Levels and Fleet Mix

According to the FAA's Air Traffic Activity System (ATADS), there were 401,351 total annual operations at SEA from January 2022 through December 2022. Specific aircraft types and times of operation were obtained from the Port of Seattle's 2022 EnvironmentalVue Flight Track Monitoring System data. Additionally, specific airframe and engine combinations were developed from the EnvironmentalVue Flight Track Monitoring System data at SEA and an airline fleet database downloaded from Diio Mi[1]. **Table 1** presents the Existing (2022) condition fleet operations at SEA by airframe and engine code for each aircraft category. Missed approach operational totals are included in Table 1. For more information on missed approaches including time of day, runway use, flight track location and allocation input parameters, see **Appendix B**.

Table 1 Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Commercial Jets			
Airbus A319-100 Series	A319-131	01P10IA020	10.1
Airbus A319-100 Series	A319-131	3CM028	87.8
Airbus A319-100 Series	A319-131	3IA006	1,977.1
Airbus A319-100 Series	A319-131	3IA007	1,058.7
Airbus A319-100 Series	A319-131	4CM035	78.7
Airbus A319-100 Series	A319-131	8IA09	36.3
Airbus A320-200 Series	A320-211	01P08CM105	13,637.0
Airbus A320-200 Series	A320-232	01P10IA021	1,224.2
Airbus A320-200 Series	A320-232	01P10IA022	264.4
Airbus A320-200 Series	A320-211	1CM008	333.1
Airbus A320-200 Series	A320-211	1CM009	1,351.4
Airbus A320-200 Series	A320-232	1IA003	2,575.6
Airbus A320-200 Series	A320-211	3CM026	1,466.4
Airbus A320-200 Series	A320-232	8IA010	2.0
Airbus A320-NEO	A320-271N	01P20CM128	679.2
Airbus A320-NEO	A320-271N	01P22PW163	1,077.9
Airbus A321-200 Series	A321-232	01P08CM104	994.1
Airbus A321-200 Series	A321-232	01P10IA025	6,031.3

[1] Diio Mi: Market Intelligence for the Aviation Industry, Accessed on February 3, 2022, https://mi.diio.net. Diio Mi is a standard airline industry source of information.

Table 1 Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Airbus A321-200 Series	A321-232	3CM025	1,026.4
Airbus A321-NEO	A321-232	01P18PW157	1,612.8
Airbus A321-NEO	A321-232	01P20CM132	4,783.8
Airbus A330-200 Series	A330-343	2RR023	1,834.8
Airbus A330-200 Series	A330-343	9PW094	26.2
Airbus A330-300 Series	A330-343	2RR023	486.5
Airbus A330-300 Series	A330-301	4GE080	493.5
Airbus A330-300 Series	A330-343	7PW082	66.6
Airbus A330-300 Series	A330-301	9PW094	1,393.8
Airbus A330-300 Series	A330-301	9PW095	327.0
Airbus A330-900N Series (Neo)	A330-343	02P23RR141	2,659.4
Airbus A340-300 Series	A340-211	2CM015	53.5
Airbus A350-1000 Series	A350-941	18RR080	4.0
Airbus A350-900 series	A350-941	01P18RR124	764.0
Boeing 717-200 Series	717200	4BR002	1.0
Boeing 737-300 Series	737300	1CM004	6.1
Boeing 737-300 Series	737300	1CM005	8.1
Boeing 737-700 Series	737700	3CM030	424.9
Boeing 737-700 Series	737700	3CM031	14,350.5
Boeing 737-700 Series	737700	3CM032	2,611.9
Boeing 737-700 Series	737700	8CM051	10.1
Boeing 737-700 Series	737700	8CM062	104.0
Boeing 737-700 Series	737700	8CM063	2,434.3
Boeing 737-8	7378MAX	01P20CM135	41.4
Boeing 737-8	7378MAX	01P20CM136	1,340.3
Boeing 737-8	7378MAX	01P20CM140	1,236.3
Boeing 737-800 Series	737800	01P11CM114	399.7
Boeing 737-800 Series	737800	01P11CM116	5,439.9
Boeing 737-800 Series	737800	01P11CM122	2,968.2
Boeing 737-800 Series	737800	01P11CM125	660.0
Boeing 737-800 Series	737800	01P11CM126	62.6
Boeing 737-800 Series	737800	3CM032	16,652.6
Boeing 737-800 Series	737800	3CM034	1,607.7
Boeing 737-800 Series	737800	8CM051	22795.9
Boeing 737-800 Series	737800	8CM064	165.5
Boeing 737-800 Series	737800	8CM065	2,128.5
Boeing 737-800 Series	737800	8CM066	9,996.6
Boeing 737-800BCF	737800	3CM034	137.3
Boeing 737-9	7378MAX	01P20CM136	517.7
Boeing 737-9	7378MAX	01P20CM140	20,410.0
Boeing 737-900 Series	737800	01P11CM114	806.4
Boeing 737-900 Series	737800	8CM051	9,114.5
Boeing 737-900-ER	737800	01P11CM116	19,205.0
Boeing 737-900-ER	737800	01P11CM121	54527.4
Boeing 737-900-ER_MA	737800_MA	01P11CM121_MA	1554.5
Boeing 737-900-ER	737800	01P11CM125	167.5
Boeing 737-900-ER	737800	3CM034	773.1
Boeing 737-900-ER	737800	8CM065	861.9
Boeing 757-200 Series	757PW	4PW072	5,722.4
Boeing 757-200 Series	757PW	4PW073	197.8
Boeing 757-200 Series	757RR	5RR038	567.2
Boeing 757-200 Series	757RR	5RR039	37.3
Boeing 757-300 Series	757300	3RR028	2.0
Boeing 757-300 Series	757300	5RR039	10.1
Boeing 757-300 Series	757300	XPW204	1,741.0

Table 1 Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Boeing 767-300 ER	7673ER	12PW102	12.1
Boeing 767-300 ER	7673ER	1GE029	75.7
Boeing 767-300 ER	7673ER	1GE030	752.9
Boeing 767-300 ER	7673ER	1PW043	543.0
Boeing 767-300 ER	7673ER	1RR011	1.0
Boeing 767-300 ER	7673ER	2GE055	303.8
Boeing 767-400 ER	767400	8GE101	263.4
Boeing 777-200-ER	777200	10PW099	81.7
Boeing 777-200-ER	777200	2RR027	287.6
Boeing 777-200-ER	777200	3GE060	127.2
Boeing 777-200-ER	777200	3GE064	2.0
Boeing 777-200-ER	777200	8GE100	132.2
Boeing 777-200-LR	777300	01P21GE216	50.5
Boeing 777-200-LR	777300	01P21GE217	188.7
Boeing 777-300 ER	7773ER	01P21GE217	1,389.7
Boeing 787-10 Dreamliner	7879	01P17GE211	132.2
Boeing 787-10 Dreamliner	7879	02P23RR134	144.3
Boeing 787-10 Dreamliner	7879	17GE179	285.6
Boeing 787-8 Dreamliner	7878R	01P17GE206	120.1
Boeing 787-8 Dreamliner	7878R	01P17GE210	4.0
Boeing 787-8 Dreamliner	7878R	11GE137	189.7
Boeing 787-8 Dreamliner	7878R	11GE138	466.3
Boeing 787-9 Dreamliner	7879	01P17GE211	890.2
Boeing 787-9 Dreamliner	7879	01P17GE214	6.1
Boeing 787-9 Dreamliner	7879	02P23RR131	200.8
Boeing 787-9 Dreamliner	7879	12RR067	919.4
Boeing 787-9 Dreamliner	7879	12RR068	387.6
Bombardier CRJ-900-ER	CRJ9-ER	01P08GE190	22.2
Bombardier CS100	737700	01P20PW183	9,770.5
Bombardier CS300	737700	01P20PW183	97.9
Bombardier CS300	737700	01P20PW184	2,180.0
Bombardier Global Express	BD-700-1A10	01P04BR013	4.3
Embraer ERJ175-LR	EMB175	01P08GE197	67693.6
Embraer ERJ175-LR_MA	EMB175_MA	01P08GE197_MA	839.5
		Subtotal	***338,782.9***
Cargo Jets			
Airbus A300F4-600 Series	A300-622R	1GE020	3.0
Airbus A300F4-600 Series	A300-622R	1PW048	85.8
Airbus A300F4-600 Series	A300-622R	3GE056	155.4
Boeing 747-400 ERF	747400RN	12PW102	88.8
Boeing 747-400 Series	747400	1GE024	790.2
Boeing 747-400 Series Freighter	747400	01P03GE187	76.7
Boeing 747-400 Series Freighter	747400	1GE024	6.1
Boeing 747-400 Series Freighter	747400	1PW041	7.1
Boeing 747-400 Series Freighter	747400	4RR037	74.7
Boeing 747-400BCF	747400	1GE024	249.3
Boeing 747-400BCF	747400	1PW041	10.1
Boeing 747-8F	7478	01P17GE215	280.6
Boeing 747-8F	7478	13GE156	74.7
Boeing 747-8F	7478	8GENX1	242.2
Boeing 757-200 Series Freighter	757RR	3RR028	101.9
Boeing 757-200 Series Freighter	757PW	4PW072	48.4
Boeing 757-200 Series Freighter	757PW	4PW073	49.5
Boeing 757-200 Series Freighter	757RR	5RR039	2.0
Boeing 767-200 Series Freighter	767CF6	1GE010	259.4

Table 1 Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Boeing 767-200 Series Freighter	767CF6	1GE012	129.2
Boeing 767-200 Series Freighter	767JT9	1PW026	23.2
Boeing 767-300 ER Freighter	7673ER	1GE030	5,679.0
Boeing 767-300 ER Freighter	7673ER	2GE055	559.1
Boeing 767-300BCF	767300	2GE055	57.5
Boeing 777 Freighter	777200	01P21GE216	1,016.3
Boeing 777 Freighter	777300	01P21GE217	24.2
Boeing 777-200-LR_C	777300_C	01P21GE216_C	40.4
Boeing MD-10-30	DC1030	3GE074	64.6
Boeing MD-11 Freighter	MD11PW	12PW102	296.7
Boeing MD-11 Freighter	MD11GE	1GE031	1,489.7
Boeing MD-11 Freighter	MD11PW	1PW052	484.4
		Subtotal	***12,470.3***
Regional Jets			
Bombardier CRJ-200-LR	CL600	01P05GE189	6.5
Bombardier CRJ-700	CRJ9-ER	01P08GE192	6.1
Bombardier CRJ-700-ER	CRJ9-ER	01P08GE190	12.1
Bombardier CRJ-700-ER	CRJ9-ER	01P08GE192	94.9
Bombardier CRJ-700-ER	CRJ9-ER	5GE083	47.4
		Subtotal	***166.9***
Turboprop			
Bombardier de Havilland Dash 8 Q400	DHC830	PW150A	44,587.6
Raytheon Beech 99	DHC6	PT6A27	10.8
Raytheon Beech 99	DHC6	PT6A36	596.2
Raytheon Super King Air 200	C12	PT660A	4.3
Raytheon Super King Air 200	DHC6	PT6A42	2.2
		Subtotal	***45,201.0***
Cargo Prop			
Cessna 208 Caravan	PA42	P6114A	1,162.3
Cessna 208 Caravan	CNA208	PT6A14	1,146.2
Raytheon Super King Air 300	DHC6	PT660A	72.1
		Subtotal	***2,380.6***
GA Jets			
Bombardier Challenger 300	CL600	01P14HN011	36.6
Bombardier Challenger 300	CL600	11HN003	37.7
Bombardier Challenger 350	CL600	01P14HN011	142.1
Bombardier Challenger 600	CL600	01P05GE189	37.7
Bombardier Challenger 600	CL601	1GE034	25.8
Bombardier Global 5000	BD-700-1A11	01P04BR013	28.0
Bombardier Global 5500	BD-700-1A11	01P20BR015	2.2
Bombardier Learjet 35A/36A (C-21A)	C21A	1AS001	3.2
Bombardier Learjet 40	LEAR35	TFE731	5.4
Bombardier Learjet 45	LEAR35	1AS001	14.0
Bombardier Learjet 45	LEAR35	TFE731	36.6
Bombardier Learjet 60	LEAR35	7PW077	22.6
Bombardier Learjet 70	LEAR35	1AS002	2.2
Cessna 560 Citation Encore	CNA560E	PW530	10.8
Cessna 560 Citation Excel	CNA560XL	PW530	36.6
Cessna 560 Citation Ultra	CNA560U	1PW038	8.6
Cessna 560 Citation XLS	CNA560XL	PW530	59.7
Cessna 680 Citation Sovereign	CNA680	03P14PW194	15.8
Cessna 680 Citation Sovereign	CNA680	7PW078	31.7
Cessna 680-A Citation Latitude	CNA680	7PW078	83.9
Cessna 700 Citation Longitude	CNA680	01P18HN013	15.1
Cessna 750 Citation X	CNA750	6AL024	82.8

Table 1 Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Cessna CitationJet CJ2 (Cessna 525A)	CNA525C	1PW036	31.2
Cessna CitationJet CJ3 (Cessna 525B)	CNA525C	1PW038	66.7
Dassault Falcon 2000	CNA750	CF700D	58.1
Dassault Falcon 50	FAL900EX	1AS002	196.5
Embraer Legacy 450 (EMB-545)	CNA510	01P14HN014	49.5
Embraer Phenom 300 (EMB-505)	CNA55B	PW530	42.1
Gulfstream G200	CNA750	7PW077	24.8
Gulfstream G450	GIV	11RR048	29.1
Gulfstream G650	G650ER	01P11BR016	23.7
Gulfstream G650ER	G650ER	01P11BR016	15.1
Gulfstream IV-SP	GIV	11RR048	7.5
Gulfstream V-SP	GV	01P06BR014	29.1
Honda HA-420 Hondajet	CNA680	PW610F	18.7
Raytheon Beechjet 400	MU3001	1PW037	23.7
Raytheon Hawker 800	LEAR35	1AS002	36.0
		Subtotal	***1,390.5***
GA Prop			
Beechcraft Bonanza 35 (FAS)	GASEPV	TIO540	22.3
Cessna 150 Series	GASEPF	O200	18.0
Cessna 152 (FAS)	GASEPF	O200	70.5
Cessna 172 Skyhawk	CNA172	IO320	461.8
Cessna 182	CNA182	IO360	97.2
Cessna 206	CNA20T	TIO540	15.1
Cirrus SR22 Turbo (FAS)	COMSEP	TIO540	69.1
Mooney M20-K	GASEPV	TSIO36	16.6
Pilatus PC-12	CNA208	PT6A67	54.7
Piper PA-28 Cherokee Series	GASEPF	IO320	59.7
Raytheon Beech Bonanza 36	GASEPV	TIO540	18.7
		Subtotal	***903.7***
Military			
Embraer Phenom 300 (EMB-505)_M	CNA55B_M	PW530_M	40.0
Raytheon Super King Air 200_M	C12_M	PT660A_M	14.0
Cessna 172 Skyhawk_M	CNA172_M	IO320_M	1.0
		Subtotal	***55.0***
		Grand Total	**401,351.0**

Note: Totals may not sum due to rounding.
Source: SEA EnvironmentalVue 2022, L&B Analysis, 2023.

1.2 Day/Night Operating Characteristics

Through analysis of the EnvironmentalVue Flight Track Monitoring System data, 10 operator categories were developed for aircraft operating at SEA. **Table 2** and **Table 3** presents the assumed day and night operating characteristics assumptions for the Existing (2022) condition per operator category.

Table 2 Arrival Day/Night Split per Operator Category

Operator Category	Day	Night
Passenger		
Heavy Jet	87.7%	12.3%
Narrow Body Jet	85.2%	14.8%
Regional Jet	95.1%	4.9%
Turboprop	89.1%	10.9%
Cargo		
Heavy Jet	59.3%	40.7%
Narrow Body Jet	96.0%	4.0%
Prop	100.0%	0.0%
General Aviation		
Jet	95.6%	4.4%
Turboprop	100.0%	0.0%
Prop	85.3%	14.7%
Grand Total	**85.1%**	**14.9%**

Source: SEA EnvironmentalVue 2022, L&B Analysis, 2023.

Table 3 Departure Day/Night Split per Operator Category

Operator Category	Day	Night
Passenger		
Heavy Jet	91.0%	9.0%
Narrow Body Jet	82.7%	17.3%
Regional Jet	68.8%	31.2%
Turboprop	87.4%	12.6%
Cargo		
Heavy Jet	62.5%	37.5%
Narrow Body Jet	11.0%	89.0%
Prop	97.6%	2.4%
General Aviation		
Jet	95.2%	4.8%
Turboprop	99.7%	0.3%
Prop	94.8%	5.2%
Grand Total	**83.0%**	**17.0%**

Source: SEA EnvironmentalVue 2022, L&B Analysis, 2023.

1.3 Aircraft Runup Activity Levels

Depending on the frequency, engine run-ups may influence the size and location of noise exposure contours. **Exhibit 1** shows the North and South primary and secondary aircraft run-up locations at SEA. Aircraft utilizing the North Flow Primary location are oriented at 340 degrees, while aircraft utilizing the South Flow Primary location are oriented at 160 degrees. Aircraft run-up activity logs were utilized to determine the amount of run-up operations, the location of the run-up, average duration and the associated airframe and engine. A total of 477 run-up operations were reported in the run-up activity logs at SEA in 2022. **Table 4** presents the amount of run-up operations, average duration and thrust settings per airframe and engine type that occurred at each SEA run-up location in 2022. The AEDT run-up fleet mix below is representative of all run-ups occurring at SEA. There are a total of 23 different AEDT airframes that were identified, AEDT engine codes were assigned based on airline.

Exhibit 1: Aircraft Run-up Locations

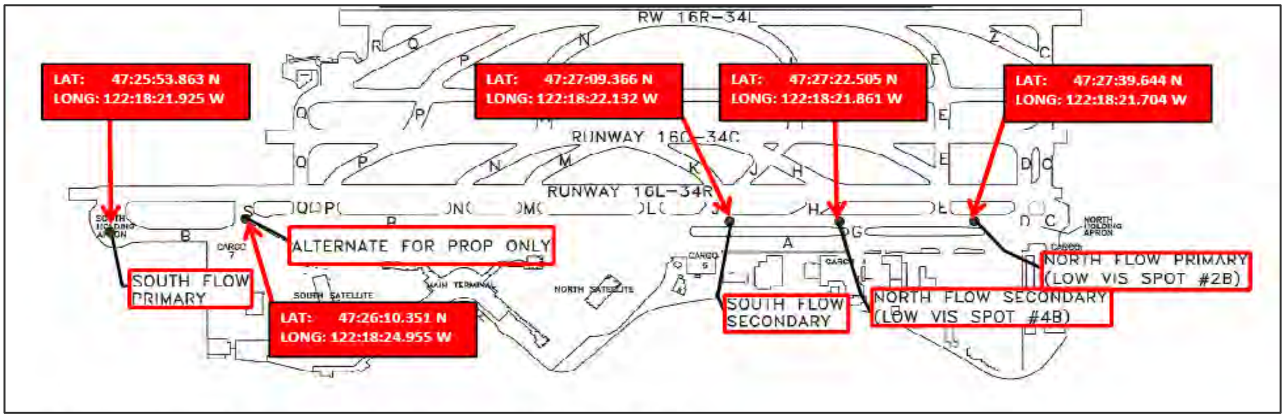


Table 4 Aircraft Run-up Activity

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings (lbs.)
North Flow Primary Location						
Airbus A319-100 Series	3IA006	1.0	3.0	--	--	22000
Airbus A320-200 Series	01P08CM105	17.0	15.8	1.0	2.0	25000
Airbus A320-200 Series	1CM009	2.0	69.5	--	--	25000
Airbus A320-200 Series	3CM026	2.0	15.5	--	--	25000
Airbus A321-200 Series	3CM025	3.0	36.7	--	--	30000
Airbus A321-NEO	01P20CM132	--	--	1.0	2.0	30000
Airbus A330-200 Series	9PW094	6.0	27.7	--	--	71100
Airbus A330-300 Series	4GE080	1.0	37.0	--	--	67500
Airbus A330-900N Series (Neo)	02P23RR141	1.0	26.0	--	--	71100
Boeing 737-700 Freighter	3CM031	5.0	16.8	--	--	24000
Boeing 737-700 Series	3CM031	4.0	26.8	--	--	24000
Boeing 737-700 Series	3CM032	5.0	56.4	--	--	24000
Boeing 737-800 Series	01P11CM122	1.0	10.0	--	--	26300
Boeing 737-800 Series	3CM032	14.0	27.6	--	--	26300
Boeing 737-800 Series	3CM034	1.0	9.0	--	--	26300
Boeing 737-800 Series	8CM051	2.0	40.5	--	--	26300
Boeing 737-800 Series	8CM066	3	33.0	--	--	26300
Boeing 737-9	01P20CM140	9.0	14.6	--	--	26400
Boeing 737-900 Series	8CM051	10.0	8.0	--	--	26300
Boeing 737-900-ER	01P11CM116	10.0	20.2	--	--	26300
Boeing 737-900-ER	01P11CM121	16.0	25.1	--	--	26300
Boeing 737-900-ER	01P11CM121	1.0	4.0	--	--	13150
Boeing MD-11 Freighter	1GE031	--	--	1.0	2.0	61500
Bombardier de Havilland Dash 8 Q400	PW150A	7.0	15.9	--	--	4918
Cessna 560 Citation Encore	PW530	1.0	15.0	--	--	3313
Embraer ERJ175-LR	01P08GE197	4.0	28.0	--	--	13800
Embraer ERJ175-LR	01P08GE197	1.0	6.0	--	--	6900
South Primary Location						
Airbus A319-100 Series	3IA006	1.0	15.0	--	--	22000
Airbus A319-100 Series	3IA007	1.0	26.0	1.0	11.0	22000
Airbus A320-200 Series	01P08CM105	28.0	12.9	--	--	25000
Airbus A320-200 Series	01P08CM105	2.0	6.0	--	--	12500
Airbus A320-200 Series	1CM009	5.0	31.6	--	--	25000
Airbus A321-NEO	01P20CM132	2.0	12.5	--	--	30000
Airbus A330-200 Series	2RR023	1.0	6.0	--	--	71100
Airbus A330-200 Series	9PW094	8.0	14.9	--	--	71100
Airbus A330-200 Series	9PW094	1.0	26.0	--	--	35550
Airbus A330-300 Series	4GE080	3.0	10.7	--	--	67500
Airbus A330-900N Series (Neo)	02P23RR141	3.0	26.7	--	--	71100

Table 4 Aircraft Run-up Activity (Continued)

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings (lbs.)
Boeing 737-700 Freighter	3CM031	11.0	27.8	--	--	24000
Boeing 737-700 Freighter	3CM031	1.0	5.0	--	--	12000
Boeing 737-700 Series	3CM031	16.0	17.6	--	--	24000
Boeing 737-700 Series	3CM031	1.0	20.0	1.0	2.0	12000
Boeing 737-700 Series	3CM032	4.0	31.5	--	--	24000
Boeing 737-800 Series	3CM032	42.0	18.3	--	--	26300
Boeing 737-800 Series	3CM032	3.0	18.3	--	--	13150
Boeing 737-800 Series	8CM051	11.0	21.0	--	--	26300
Boeing 737-800 Series	8CM065	1.0	6.0	--	--	26300
Boeing 737-800 Series	8CM066	24.0	10.7	--	--	26300
Boeing 737-800 Series	8CM066	1.0	3.0	1.0	2.0	13150
Boeing 737-800BCF	3CM034	1.0	11.0	--	--	26300
Boeing 737-9	01P20CM140	21.0	10.4	--	--	26400
Boeing 737-9	01P20CM140	1.0	9.0	--	--	13200
Boeing 737-900 Series	01P11CM114	1.0	4.0	--	--	26300
Boeing 737-900 Series	8CM051	22.0	8.7	--	--	26300
Boeing 737-900 Series	8CM051	1.0	26.0	2.0	2.0	13150
Boeing 737-900-ER	01P11CM116	21.0	15.7	2.0	2.0	26300
Boeing 737-900-ER	01P11CM116	1.0	3.0	--	--	13150
Boeing 737-900-ER	01P11CM121	54.0	25.5	--	--	26300
Boeing 737-900-ER	01P11CM121	1.0	8.0	--	--	13150
Boeing 757-200 Series	4PW072	2.0	36.5	--	--	38300
Boeing 757-300 Series	XPW204	4.0	27.0	--	--	43100
Boeing 767-200 Series Freighter	1GE012	1.0	6.0	--	--	48000
Boeing 767-300 ER Freighter	1GE030	3.0	21.0	--	--	60000
Boeing MD-11 Freighter	1GE031	2.0	44.5	--	--	61500
Bombardier de Havilland Dash 8 Q400	PW150A	23.0	15.2	--	--	4918
Bombardier de Havilland Dash 8 Q400	PW150A	1.0	10.0	--	--	2459
Bombardier Learjet 60	7PW077	1.0	9.0	--	--	3500
Cessna 560 Citation Encore	PW530	1.0	4.0	--	--	3313
Embraer ERJ175-LR	01P08GE197	7.0	11.1	--	--	13800
Tango X Location						
Airbus A330-200 Series	9PW094	1.0	38.0	--	--	71100
Total		**467.0**		**10.0**		

Source: SEA Runup log 2022, L&B Analysis, 2023.

1.4 Runway Definition

SEA is a commercial service airport that currently encompasses 2,500 acres (approximately 3.9 square miles) in King County. The airfield system consists of 3 runways, (16L/34R, 16C/34C, 16R/34L) oriented in a north-south direction. **Table 5** provides the length and width of the current runways at SEA used in AEDT.

Table 5 Runways

Runway	Length (feet)	Width (feet)
16R/34L	8,500	150
16C/34C	9,425	150
16L/34R	11,899	150

Source: AEDT Version 3e.

Table 6 provides the coordinates, elevation, crossing height and glide slope of the current runway ends at SEA used in AEDT:

Table 6 Runway End Definition

Runway End	Latitude	Longitude	Elevation (feet)	Crossing Height (feet)	Glide Slope (degrees)
16L	47.4637952222	-122.307750222	432.3	76	3
34R	47.4311722778	-122.30803825	346.7	81	2.75*
16C	47.4638098611	-122.31098375	429.4	71	3
34C	47.4379712778	-122.311209833	362.9	73	3
16R	47.4638363611	-122.317856833	414.8	69	3
34L	47.4405338056	-122.318058056	356.2	75	3

*AEDT utilizes a standard 3.0-degree glide on arrival profiles. Runway 34R glide slope of 2.75 is modeled as a 3.0-degree glide slope until threshold crossing.
Source: AEDT Version 3e.

1.5 Runway End Utilization

Average-annual day runway end utilization was derived from EnvironmentalVue Flight Track Monitoring System data from January 2022 through December 2022. The Airport primarily operates in a south flow configuration due to the prevailing winds. A review of EnvironmentalVue Flight Track Monitoring System 2022 data shows that SEA operated in south flow configuration approximately 70 percent of the time, and in north flow configuration approximately 30 percent of the time.

Table 7 and **Table 8** present the assumed arrival and departure runway utilization for the existing (2022) condition that was developed from the EnvironmentalVue Flight Track Monitoring System data. The runway utilization was developed for each of the 10 operator categories occurring at SEA.

Table 7 Arrival Runway Utilization per Operator Category

Operator Category	16C	16L	16R	34C	34L	34R	Total
Passenger							
Heavy Jet	0.4%	54.6%	16.0%	0.3%	7.1%	21.6%	100.0%
Narrow Body Jet	1.0%	2.7%	66.2%	0.6%	28.2%	1.3%	100.0%
Regional Jet	0.0%	4.9%	68.1%	0.0%	26.9%	0.0%	100.0%
Turboprop	0.4%	1.5%	70.4%	0.3%	26.8%	0.6%	100.0%
Cargo							
Heavy Jet	3.8%	47.0%	20.7%	2.5%	8.3%	17.7%	100.0%
Narrow Body Jet	1.0%	9.0%	62.0%	0.0%	26.0%	2.0%	100.0%
Prop	0.5%	9.4%	59.7%	0.5%	29.6%	0.4%	100.0%
General Aviation							
Jet	0.6%	1.7%	63.6%	0.3%	32.9%	0.9%	100.0%
Turboprop	0.3%	29.7%	39.6%	0.3%	19.7%	10.4%	100.0%
Prop	6.1%	7.0%	49.7%	3.5%	19.9%	13.8%	100.0%
Overall Arrival Total	**1.0%**	**6.1%**	**63.1%**	**0.6%**	**26.6%**	**2.6%**	**100.0%**

Note: Totals may not sum due to rounding.
Source: SEA Environmental Vue 2022, L&B Analysis, 2023.

Table 8 Departure Runway Utilization per Operator Category

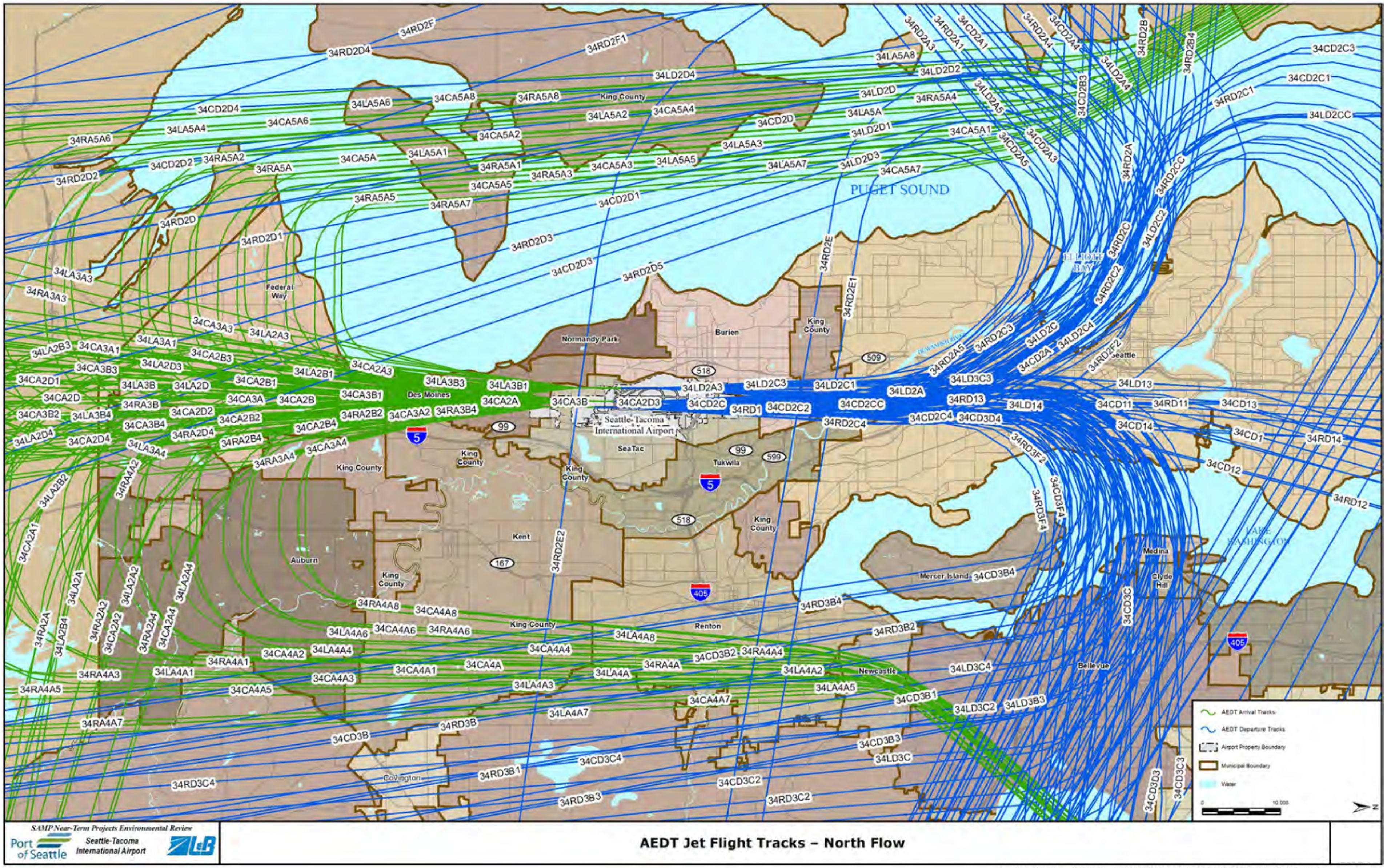
Operator Category	16C	16L	16R	34C	34L	34R	Total
Passenger							
Heavy Jet	0.6%	68.6%	0.0%	0.3%	0.0%	30.5%	100.0%
Narrow Body Jet	4.4%	66.4%	0.0%	0.8%	0.0%	28.4%	100.0%
Regional Jet	2.4%	71.0%	0.0%	0.0%	0.0%	26.6%	100.0%
Turboprop	8.9%	63.0%	0.0%	1.8%	0.0%	26.3%	100.0%
Cargo							
Heavy Jet	2.5%	70.4%	0.0%	1.6%	0.0%	25.5%	100.0%
Narrow Body Jet	0.0%	63.0%	0.0%	0.0%	0.0%	37.0%	100.0%
Prop	30.4%	47.7%	0.1%	2.7%	0.0%	19.1%	100.0%
General Aviation							
Jet	63.9%	5.2%	0.0%	30.1%	0.1%	0.7%	100.0%
Turboprop	12.1%	63.4%	0.0%	1.4%	0.0%	23.2%	100.0%
Prop	42.7%	11.5%	8.1%	33.1%	4.6%	0.0%	100.0%
Overall Departure Total	**5.1%**	**65.8%**	**0.0%**	**1.1%**	**0.0%**	**28.0%**	**100.0%**

Note: Totals may not sum due to rounding.
Source: SEA EnvironmentalVue 2022, L&B Analysis, 2023.

1.6 Flight Tracks

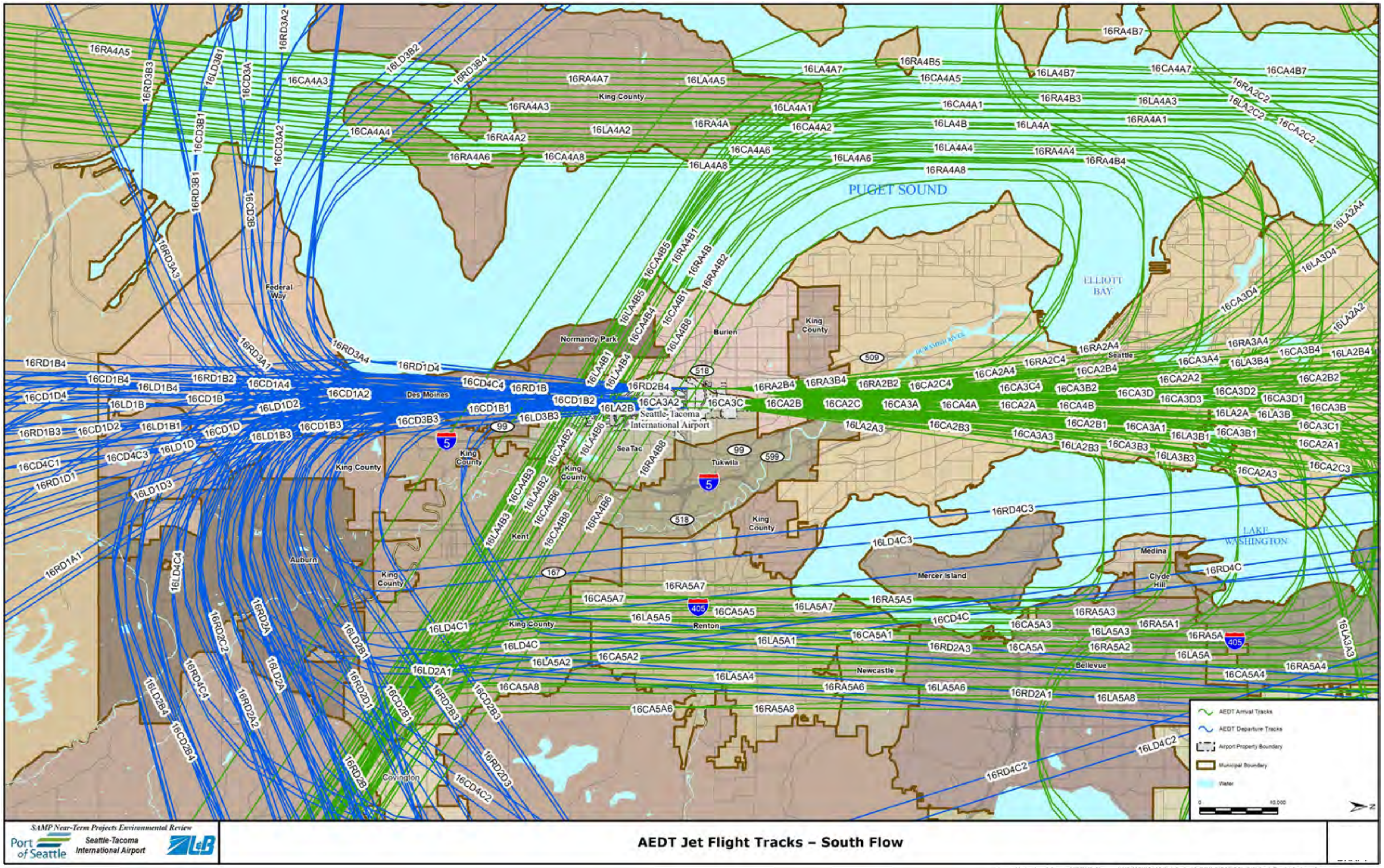
There are two components to flight tracks used for noise modeling, flight track definition/location and percentage of use. Flight track definition and percent utilization was based on EnvironmentalVue Flight Track Monitoring System data from the months of January, February, March, April, May, July, September and October of 2022 and previous studies. The North Flow and South Flow Jet flight tracks are presented in Exhibit 2 and Exhibit 3. The North Flow and South Flow Turboprop and Prop flight tracks are presented in **Exhibit 2** and **Exhibit 3**. Flight tracks for missed approaches are provided in **Exhibit 4** and **Exhibit 5**. Flight track utilization percentages are presented in **Appendix A**.

Exhibit 2: North Flow Jet Flight Tracks



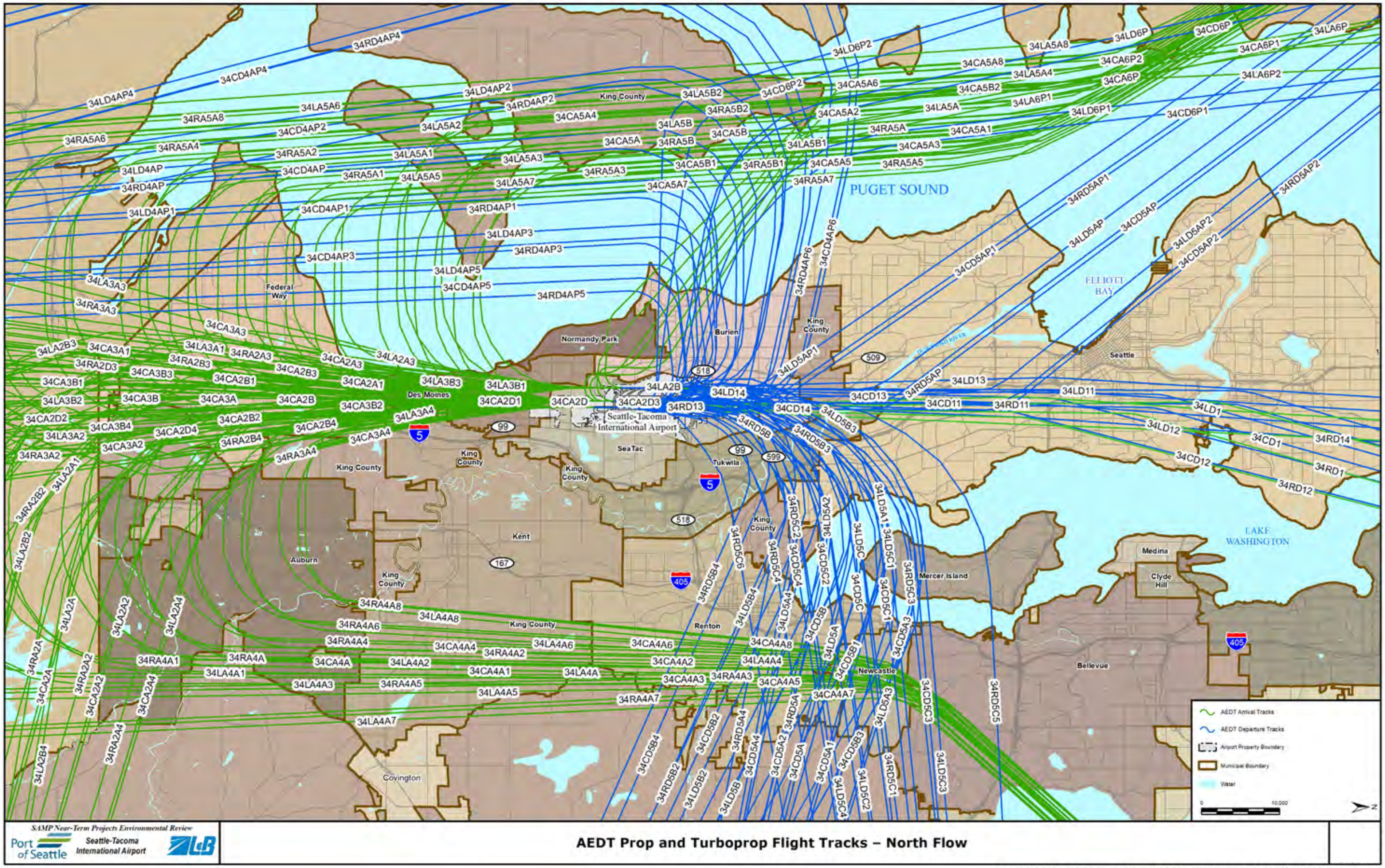
Source: Source: SEA EnvironmentalVue 2022, L&B Analysis, 2023.

Exhibit 3: South Flow Jet Flight Tracks



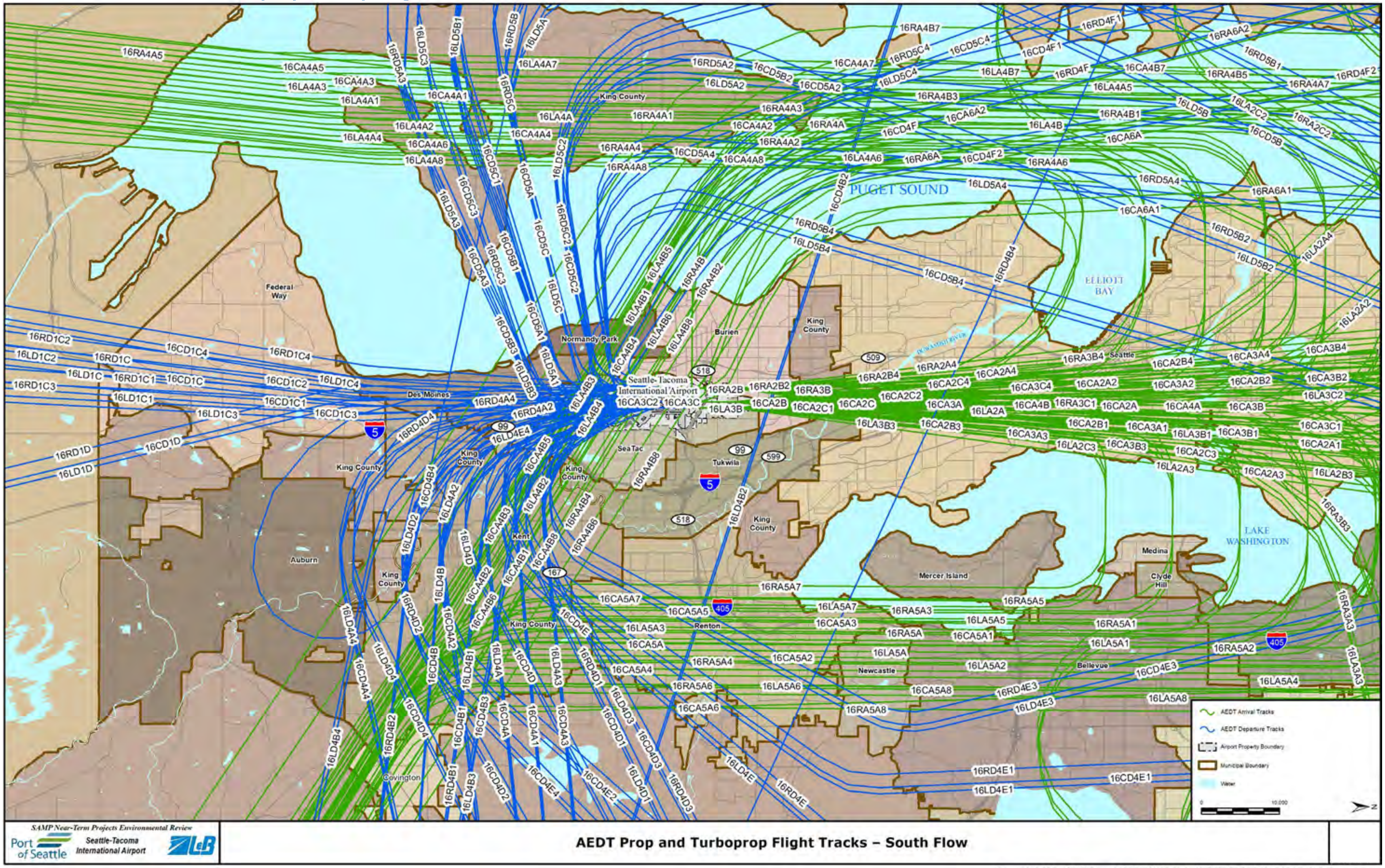
Source: SEA EnvironmentalVue 2022, L&B Analysis, 2023.

Exhibit 4: North Flow Turboprop & Prop Flight Tracks



Source: SEA EnvironmentalVue 2022, L&B Analysis, 2023.

Exhibit 5: South Flow Turboprop & Prop Flight Tracks



Source: SEA EnvironmentalVue 2022, L&B Analysis, 2023.

1.7 Aircraft Weight, Trip Length

Aircraft weight during departure is a factor in the dispersion of noise because it impacts the rate at which an aircraft is able to climb. Generally, the heavier an aircraft is, the slower the rate of climb and the wider the dispersion of noise along its route of flight. Where specific aircraft weights are unknown, the AEDT uses the distance flown to the first stop as a surrogate for the weight, by assuming that the weight has a direct relationship with the fuel load necessary to reach the first destination. The AEDT groups trip lengths into nine categories; these categories are provided in **Table 9**.

Table 9 Daytime Stage Length Distribution

Category	Stage Length
1	0-500 nautical miles
2	500-1000 nautical miles
3	1000-1500 nautical miles
4	1500-2500 nautical miles
5	2500-3500 nautical miles
6	3500-4500 nautical miles
7	4500-5500 nautical miles
8	5500-6500 nautical miles
9	6500-11000 nautical miles
M	Maximum range at maximum take-off weight

Source: L&B Analysis, 2023

The trip lengths modeled for the Existing (2022) condition are based upon the distance to destinations from SEA that were reported in the EnvironmentalVue Flight Track Monitoring System data from January 2022 through December of 2022. **Table 10** and **Table 11** present the assumed daytime and nighttime stage length distributions for each of the 10 operator categories.

Table 10 Daytime Stage Length Distribution

Operator Category	1	2	3	4	5	6	7	8	9	Total
Passenger										
Heavy Jet	1.8%	0.5%	1.8%	25.2%	1.4%	52.9%	10.2%	1.3%	4.9%	100.0%
Narrow Body Jet	17.2%	44.7%	15.1%	22.7%	0.3%	0.0%	0.0%	0.0%	0.0%	100.0%
Regional Jet	5.6%	94.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Turboprop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Cargo										
Heavy Jet	7.2%	38.9%	8.8%	31.8%	0.0%	1.7%	11.6%	0.0%	0.0%	100.0%
Narrow Body Jet	18.2%	54.5%	0.0%	27.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Prop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
General Aviation										
Jet	85.2%	5.3%	3.7%	5.0%	0.0%	0.3%	0.5%	0.0%	0.0%	100.0%
Turboprop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Prop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%

Note: Totals may not sum due to rounding.
Source: SEA EnvironmentalVue 2022, L&B Analysis, 2023.

Table 11 Nighttime Stage Length Distribution

Operator Category	1	2	3	4	5	6	7	8	9	Total
Passenger										
Heavy Jet	1.0%	0.8%	5.3%	18.6%	0.0%	5.4%	68.8%	0.1%	0.0%	100.0%
Narrow Body Jet	20.3%	28.9%	20.4%	30.4%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Regional Jet	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Turboprop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Cargo										
Heavy Jet	2.3%	3.8%	19.4%	55.8%	0.0%	5.1%	13.4%	0.0%	0.0%	100.0%
Narrow Body Jet	0.0%	0.0%	1.1%	98.9%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Prop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
General Aviation										
Jet	74.4%	16.4%	2.0%	7.2%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Turboprop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Prop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%

Note: Totals may not sum due to rounding.
Source: SEA EnvironmentalVue 2022, L&B Analysis, 2023.

1.8 Atmospheric Conditions

Weather is an important factor in the performance of aircraft and the amount of noise generated on landing and takeoff. AEDT default weather parameters are based on Integrated Surface Data (ISD)[2] average weather data (2012 -2021) from the National Oceanic and Atmospheric Administration. **Table 12** shows the default AEDT atmospheric settings for SEA:

Table 12 Atmospheric Conditions

Atmospheric Element	AEDT SEA Value - Default
Temperature	52.67° Fahrenheit
Sea Level Pressure	1,018.13 millibars
Static Pressure	1,001.43 millibars
Dew Point	43.82° Fahrenheit
Relative Humidity	71.79%
Wind Speed	6.74 knots

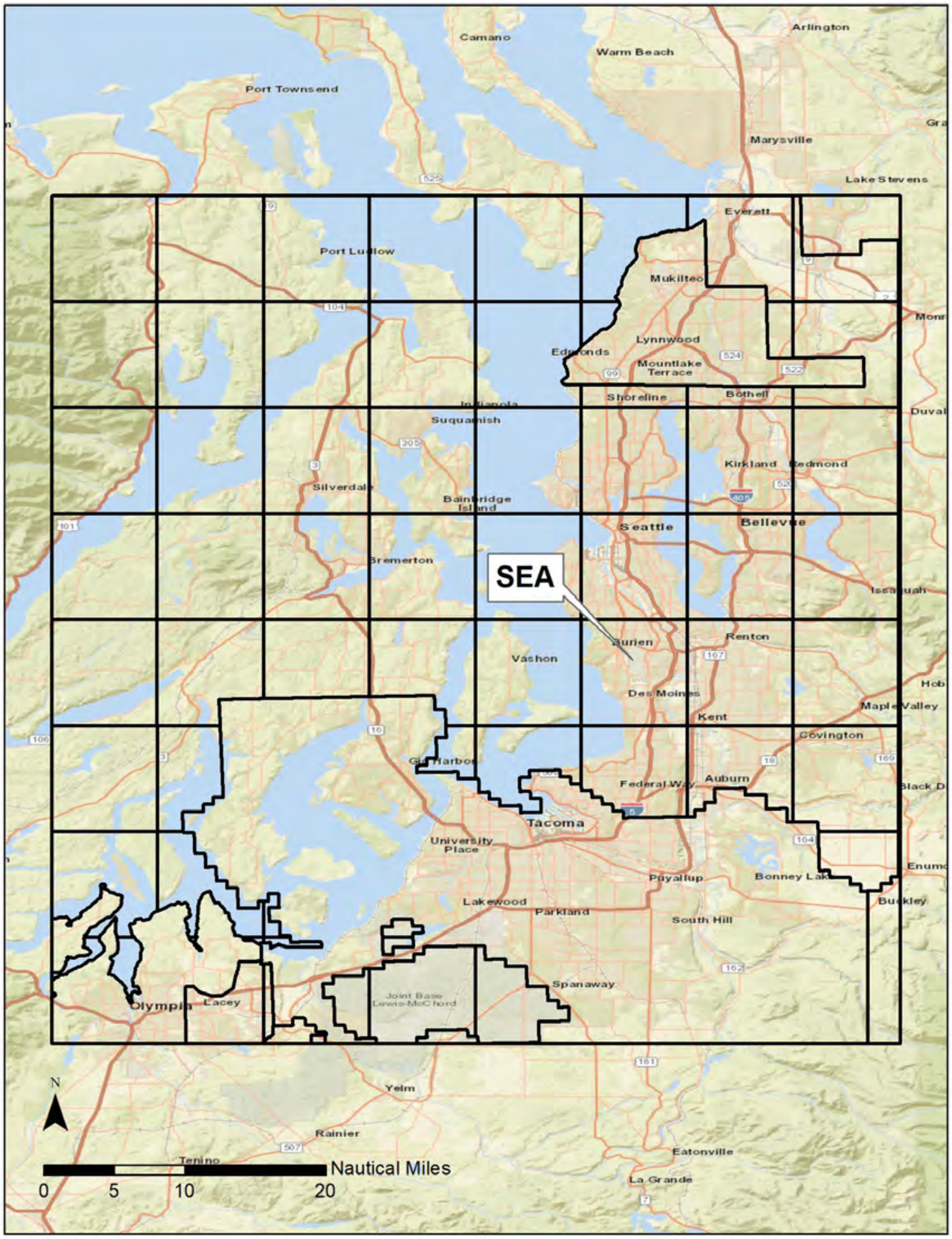
Source: AEDT Version 3e.

1.9 Topographic Data

High resolution topographic data will be utilized from the United States Geological Survey (USGS) National Elevation Dataset[3] repository for the areas surrounding SEA. The topographic data is in GeoTIFF format with a resolution of 1/3 Arc Second (approximately 32.8 feet or 10 meters). The topographic data was published on June 8, 2023. **Exhibit 6** shows the extent of the topographic data that will be utilized in the modeling.

[2] https://www.ncdc.noaa.gov/isd, provided in AEDT Version 3e.
[3] https://www.usgs.gov/core-science-systems/ngp/tnm-delivery

Exhibit 6: Topographic Data Extent



2 Future Conditions Noise Modeling Methodology

This report presents the inputs used to model the three alternatives analyzed in the Sustainable Airport Master Plan (SAMP) Near-Term Projects (NTPs) Environmental Assessment (EA) at Seattle-Tacoma International Airport (SEA) for the years 2032 and 2037. The alternatives included in the EA are Alternative 1: 2032 and 2037 No Action, Alternative 2: 2032 and 2037 Proposed Action, Alternative 3: 2032 and 2037 Hybrid Terminal Option. The Proposed Action and the Hybrid Terminal Option for 2032 and 2037 have the same inputs for noise modeling. As a result, only the Proposed Action inputs are presented in this protocol.

Table 13 presents the annual-average day operations for each alternative in 2032 and 2037.

Table 13 Future Annual Operations

Alternative	Total Operations
2032	
Alternative 1: No Action	466,900
Alternative 2: Proposed Action	475,655
2037	
Alternative 1: No Action	474,874
Alternative 2: Proposed Action	509,892

Source: Aviation Activity Forecast Update, prepared by Leigh Fisher, September 2023, Constrained Operations Growth Scenario; prepared by Landrum & Brown, July 2023.

2.1 Aircraft Activity Levels and Fleet Mix

Fleet mix percentages for the future activity levels were derived from the Aviation Activity Forecast Update, Table 5. Engine codes were assigned based on the engine codes from the Existing (2022) condition. The fleet mix for each alternative in 2032 and 2037 is presented in **Tables 14, 15, 16,** and **17,** respectively.

Table 14 Alternative 1: 2032 No Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Commercial Jets			
Airbus A220-100	737700	16PW111	19113.9
Airbus A220-300	737700	16PW111	5507.9
Airbus A220-300	737700	16PW112	2712.8
Airbus A319-100 Series	A319-131	01P10IA020	3.9
Airbus A319-100 Series	A319-131	3CM028	33.7
Airbus A319-100 Series	A319-131	3IA006	759.9
Airbus A319-100 Series	A319-131	3IA007	406.9
Airbus A319-100 Series	A319-131	4CM035	30.3
Airbus A319-100 Series	A319-131	8IA09	14.0
Airbus A320-200 Series	A320-211	01P08CM105	5826.4
Airbus A320-200 Series	A320-232	01P10IA021	523.0
Airbus A320-200 Series	A320-232	01P10IA022	113.0
Airbus A320-200 Series	A320-211	1CM008	142.3
Airbus A320-200 Series	A320-211	1CM009	577.4
Airbus A320-200 Series	A320-232	1IA003	1100.4
Airbus A320-200 Series	A320-211	3CM026	626.5
Airbus A320-200 Series	A320-232	8IA010	0.9
Airbus A320-NEO	A320-271N	01P20CM128	3389.8
Airbus A320-NEO	A320-271N	01P22PW163	5379.4
Airbus A321-200 Series	A321-232	01P08CM104	1034.9
Airbus A321-200 Series	A321-232	01P10IA025	6278.9
Airbus A321-200 Series	A321-232	3CM025	1068.5

Table 14 Alternative 1: 2032 No Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Airbus A321-NEO	A321-232	01P18PW157	5185.0
Airbus A321-NEO	A321-232	01P20CM132	15379.9
Boeing 737-700 Series	737700	3CM030	94.6
Boeing 737-700 Series	737700	3CM031	3195.1
Boeing 737-700 Series	737700	3CM032	581.5
Boeing 737-700 Series	737700	8CM051	2.2
Boeing 737-700 Series	737700	8CM062	23.1
Boeing 737-700 Series	737700	8CM063	542.0
Boeing 737-8	7378MAX	01P20CM135	282.3
Boeing 737-8	7378MAX	01P20CM136	9143.8
Boeing 737-8	7378MAX	01P20CM140	8434.6
Boeing 737-8_MAX7	7378MAX_MAX7	01P20CM136_MAX7	1089.7
Boeing 737-800 Series	737800	01P11CM114	425.1
Boeing 737-800 Series	737800	01P11CM116	5786.0
Boeing 737-800 Series	737800	01P11CM122	3157.1
Boeing 737-800 Series	737800	01P11CM125	702.0
Boeing 737-800 Series	737800	01P11CM126	66.6
Boeing 737-800 Series	737800	3CM032	17712.2
Boeing 737-800 Series	737800	3CM034	1710.0
Boeing 737-800 Series	737800	8CM051	24246.4
Boeing 737-800 Series	737800	8CM064	176.0
Boeing 737-800 Series	737800	8CM065	2263.9
Boeing 737-800 Series	737800	8CM066	10632.7
Boeing 737-9	7378MAX	01P20CM136	440.9
Boeing 737-9	7378MAX	01P20CM140	17382.6
Boeing 737-900-ER	737800	01P11CM116	29580.5
Boeing 737-900-ER	737800	01P11CM121	84571.7
Boeing 737-900-ER_MA	737800	01P11CM121_MA	1808.4
Boeing 737-900-ER	737800	01P11CM125	258.0
Boeing 737-900-ER	737800	3CM034	1190.7
Boeing 737-900-ER	737800	8CM065	1327.5
Airbus A330-200 Series	A330-343	2RR023	2478.1
Airbus A330-200 Series	A330-343	9PW094	35.4
Airbus A330-300 Series	A330-343	2RR023	536.8
Airbus A330-300 Series	A330-301	4GE080	544.6
Airbus A330-300 Series	A330-343	7PW082	73.5
Airbus A330-300 Series	A330-301	9PW094	1538.1
Airbus A330-300 Series	A330-301	9PW095	360.8
Airbus A330-900N Series (Neo)	A330-343	02P23RR141	5007.1
Airbus A350-900 series	A350-941	01P18RR124	1874.2
Boeing 767-400 ER	767400	8GE101	357.8
Boeing 777-200-ER	777200	10PW099	120.3
Boeing 777-200-ER	777200	2RR027	423.2
Boeing 777-200-ER	777200	3GE060	187.1
Boeing 777-200-ER	777200	3GE064	3.0
Boeing 777-200-ER	777200	8GE100	194.5
Boeing 777-300 ER	7773ER	01P21GE217	1259.5
Boeing 787-10 Dreamliner	7879	01P17GE211	334.0
Boeing 787-10 Dreamliner	7879	02P23RR134	364.6
Boeing 787-10 Dreamliner	7879	17GE179	721.6
Boeing 787-8 Dreamliner	7878R	01P17GE206	1055.2
Boeing 787-8 Dreamliner	7878R	01P17GE210	35.5

Table 14 Alternative 1: 2032 No Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Boeing 787-8 Dreamliner	7878R	11GE137	1667.0
Boeing 787-8 Dreamliner	7878R	11GE138	4096.5
Boeing 787-9 Dreamliner	7879	01P17GE211	2081.3
Boeing 787-9 Dreamliner	7879	01P17GE214	14.2
Boeing 787-9 Dreamliner	7879	02P23RR131	469.6
Boeing 787-9 Dreamliner	7879	12RR067	2149.7
Boeing 787-9 Dreamliner	7879	12RR068	906.1
		Subtotal	***330,926.5***
Cargo Jets			
Airbus A300F4-600 Series	A300-622R	1GE020	4.7
Airbus A300F4-600 Series	A300-622R	1PW048	133.1
Airbus A300F4-600 Series	A300-622R	3GE056	241.2
Boeing 747-400 ERF	747400RN	12PW102	590.0
Boeing 747-400BCF	747400	01P03GE187	590.0
Boeing 747-8F	7478	01P17GE215	288.8
Boeing 747-8F	7478	13GE156	76.9
Boeing 747-8F	7478	8GENX1	249.3
Boeing 767-200 Series Freighter	767CF6	1GE010	2866.1
Boeing 767-200 Series Freighter	767CF6	1GE012	1427.5
Boeing 767-200 Series Freighter	767JT9	1PW026	256.5
Boeing 767-300 ER Freighter	7673ER	1GE030	4142.2
Boeing 767-300 ER Freighter	7673ER	2GE055	407.8
Boeing 777 Freighter	777200	01P21GE216	2415.4
Boeing 777 Freighter	777300	01P21GE217	57.6
Boeing MD-11 Freighter	MD11PW	12PW102	249.3
Boeing MD-11 Freighter	MD11GE	1GE031	1251.6
Boeing MD-11 Freighter	MD11PW	1PW052	407.0
		Subtotal	***15,655.0***
Regional Jets			
Embraer ERJ175-LR	EMB175	01P08GE197	113894.7
Embraer ERJ175-LR_MA	EMB175_MA	01P08GE197_MA	976.6
		Subtotal	***114,871.3***
Cargo Prop			
ATR 72-600 Freighter	DHC830	PW127F	204.0
Cessna 208 Caravan	PA42	P6114A	1162.6
Cessna 208 Caravan	CNA208	PT6A14	1146.4
Raytheon Beech 99	DHC6	PT6A27	3.3
Raytheon Beech 99	DHC6	PT6A36	181.7
Shorts 330-200 Series	SD330	PT6A6B	204.0
		Subtotal	***2,902.0***
Other			
Cessna 208 Caravan_O	PA42_O	P6114A_O	201.4
Cessna 208 Caravan_O	PA42_O	PT6A14_O	198.6
Boeing 737-900-ER_O	737800_O	01P11CM116_O	149.5
Boeing 737-900-ER_O	737800_O	01P11CM121_O	436.5
Boeing 737-900-ER_O	737800_O	01P11CM125_O	1.3
Boeing 737-900-ER_O	737800_O	3CM034_O	6.0
Boeing 737-900-ER_O	737800_O	8CM065_O	6.7
		Subtotal	***1,000.0***
GA Jet			
Bombardier Challenger 350	CL600	01P14HN011	554.5
Dassault Falcon 50	FAL900EX	1AS002	554.5

Table 14 Alternative 1: 2032 No Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Embraer Phenom 300 (EMB-505)	CNA55B	PW530	126.0
		Subtotal	***1,235.0***
GA Prop			
Raytheon Super King Air 200	C12	PT660A	61.0
Cessna 172 Skyhawk	CNA172	IO320	132.0
Piper PA-31 Navajo	BEC58P	TIO540	17.0
		Subtotal	***210.0***
Military			
Embraer Phenom 300 (EMB-505)_M	CNA55B_M	PW530_M	72.0
Raytheon Super King Air 200_M	C12_M	PT660A_M	26.0
Cessna 172 Skyhawk_M	CNA172_M	IO320_M	2.0
		Subtotal	***100.0***
		Grand Total	***466,899.8***

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 15 Alternative 2: 2032 Proposed Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Commercial Jets			
Airbus A220-100	737700	16PW111	19489.2
Airbus A220-300	737700	16PW111	5616.0
Airbus A220-300	737700	16PW112	2766.1
Airbus A319-100 Series	A319-131	01P10IA020	4.0
Airbus A319-100 Series	A319-131	3CM028	34.4
Airbus A319-100 Series	A319-131	3IA006	774.8
Airbus A319-100 Series	A319-131	3IA007	414.9
Airbus A319-100 Series	A319-131	4CM035	30.8
Airbus A319-100 Series	A319-131	8IA09	14.2
Airbus A320-200 Series	A320-211	01P08CM105	5940.8
Airbus A320-200 Series	A320-232	01P10IA021	533.3
Airbus A320-200 Series	A320-232	01P10IA022	115.2
Airbus A320-200 Series	A320-211	1CM008	145.1
Airbus A320-200 Series	A320-211	1CM009	588.7
Airbus A320-200 Series	A320-232	1IA003	1122.0
Airbus A320-200 Series	A320-211	3CM026	638.8
Airbus A320-200 Series	A320-232	8IA010	0.9
Airbus A320-NEO	A320-271N	01P20CM128	3456.4
Airbus A320-NEO	A320-271N	01P22PW163	5485.0
Airbus A321-200 Series	A321-232	01P08CM104	1055.2
Airbus A321-200 Series	A321-232	01P10IA025	6402.2
Airbus A321-200 Series	A321-232	3CM025	1089.5
Airbus A321-NEO	A321-232	01P18PW157	5286.9
Airbus A321-NEO	A321-232	01P20CM132	15681.9
Boeing 737-700 Series	737700	3CM030	96.5
Boeing 737-700 Series	737700	3CM031	3257.8
Boeing 737-700 Series	737700	3CM032	593.0
Boeing 737-700 Series	737700	8CM051	2.3
Boeing 737-700 Series	737700	8CM062	23.6
Boeing 737-700 Series	737700	8CM063	552.6
Boeing 737-8	7378MAX	01P20CM135	287.8

Table 15 Alternative 2: 2032 Proposed Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Boeing 737-8	7378MAX	01P20CM136	9323.4
Boeing 737-8	7378MAX	01P20CM140	8600.2
Boeing 737-8_MAX7	7378MAX_MAX7	01P20CM136_MAX7	1111.1
Boeing 737-800 Series	737800	01P11CM114	433.4
Boeing 737-800 Series	737800	01P11CM116	5899.6
Boeing 737-800 Series	737800	01P11CM122	3219.1
Boeing 737-800 Series	737800	01P11CM125	715.8
Boeing 737-800 Series	737800	01P11CM126	67.9
Boeing 737-800 Series	737800	3CM032	18060.0
Boeing 737-800 Series	737800	3CM034	1743.6
Boeing 737-800 Series	737800	8CM051	24722.5
Boeing 737-800 Series	737800	8CM064	179.5
Boeing 737-800 Series	737800	8CM065	2308.4
Boeing 737-800 Series	737800	8CM066	10841.5
Boeing 737-9	7378MAX	01P20CM136	449.6
Boeing 737-9	7378MAX	01P20CM140	17723.9
Boeing 737-900-ER	737800	01P11CM116	30161.3
Boeing 737-900-ER	737800	01P11CM121	86233.9
Boeing 737-900-ER_MA	737800_MA	01P11CM121_MA	1842.3
Boeing 737-900-ER	737800	01P11CM125	263.1
Boeing 737-900-ER	737800	3CM034	1214.1
Boeing 737-900-ER	737800	8CM065	1353.6
Airbus A330-200 Series	A330-343	2RR023	2526.7
Airbus A330-200 Series	A330-343	9PW094	36.1
Airbus A330-300 Series	A330-343	2RR023	547.4
Airbus A330-300 Series	A330-301	4GE080	555.3
Airbus A330-300 Series	A330-343	7PW082	74.9
Airbus A330-300 Series	A330-301	9PW094	1568.3
Airbus A330-300 Series	A330-301	9PW095	367.9
Airbus A330-900N Series (Neo)	A330-343	02P23RR141	5106.3
Airbus A350-900 series	A350-941	01P18RR124	1911.1
Boeing 767-400 ER	767400	8GE101	364.8
Boeing 777-200-ER	777200	10PW099	122.6
Boeing 777-200-ER	777200	2RR027	431.5
Boeing 777-200-ER	777200	3GE060	190.8
Boeing 777-200-ER	777200	3GE064	3.0
Boeing 777-200-ER	777200	8GE100	198.3
Boeing 777-300 ER	7773ER	01P21GE217	1284.2
Boeing 787-10 Dreamliner	7879	01P17GE211	340.6
Boeing 787-10 Dreamliner	7879	02P23RR134	371.8
Boeing 787-10 Dreamliner	7879	17GE179	735.8
Boeing 787-8 Dreamliner	7878R	01P17GE206	1075.9
Boeing 787-8 Dreamliner	7878R	01P17GE210	36.2
Boeing 787-8 Dreamliner	7878R	11GE137	1699.7
Boeing 787-8 Dreamliner	7878R	11GE138	4176.9
Boeing 787-9 Dreamliner	7879	01P17GE211	2122.2
Boeing 787-9 Dreamliner	7879	01P17GE214	14.4
Boeing 787-9 Dreamliner	7879	02P23RR131	478.8
Boeing 787-9 Dreamliner	7879	12RR067	2191.9
Boeing 787-9 Dreamliner	7879	12RR068	923.9
		Subtotal	***337,425.5***

Table 15 Alternative 2: 2032 Proposed Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Cargo Jets			
Airbus A300F4-600 Series	A300-622R	1GE020	4.7
Airbus A300F4-600 Series	A300-622R	1PW048	133.1
Airbus A300F4-600 Series	A300-622R	3GE056	241.2
Boeing 747-400 ERF	747400RN	12PW102	590.0
Boeing 747-400BCF	747400	01P03GE187	590.0
Boeing 747-8F	7478	01P17GE215	288.8
Boeing 747-8F	7478	13GE156	76.9
Boeing 747-8F	7478	8GENX1	249.3
Boeing 767-200 Series Freighter	767CF6	1GE010	2866.1
Boeing 767-200 Series Freighter	767CF6	1GE012	1427.5
Boeing 767-200 Series Freighter	767JT9	1PW026	256.5
Boeing 767-300 ER Freighter	7673ER	1GE030	4142.2
Boeing 767-300 ER Freighter	7673ER	2GE055	407.8
Boeing 777 Freighter	777200	01P21GE216	2415.4
Boeing 777 Freighter	777300	01P21GE217	57.6
Boeing MD-11 Freighter	MD11PW	12PW102	249.3
Boeing MD-11 Freighter	MD11GE	1GE031	1251.6
Boeing MD-11 Freighter	MD11PW	1PW052	407.0
		Subtotal	***15,655.0***
Regional Jets			
Embraer ERJ175-LR	EMB175	01P08GE197	116132.0
Embraer ERJ175-LR_MA	EMB175_MA	01P08GE197_MA	994.9
		Subtotal	***117,126.9***
Cargo Prop			
ATR 72-600 Freighter	DHC830	PW127F	204.0
Cessna 208 Caravan	PA42	P6114A	1162.6
Cessna 208 Caravan	CNA208	PT6A14	1146.4
Raytheon Beech 99	DHC6	PT6A27	3.3
Raytheon Beech 99	DHC6	PT6A36	181.7
Shorts 330-200 Series	SD330	PT6A6B	204.0
		Subtotal	***2,902.0***
Other			
Cessna 208 Caravan_O	PA42_O	P6114A_O	201.4
Cessna 208 Caravan_O	PA42_O	PT6A14_O	198.6
Boeing 737-900-ER_O	737800_O	01P11CM116_O	149.5
Boeing 737-900-ER_O	737800_O	01P11CM121_O	436.5
Boeing 737-900-ER_O	737800_O	01P11CM125_O	1.3
Boeing 737-900-ER_O	737800_O	3CM034_O	6.0
Boeing 737-900-ER_O	737800_O	8CM065_O	6.7
		Subtotal	***1,000.0***
GA Jets			
Bombardier Challenger 350	CL600	01P14HN011	554.5
Dassault Falcon 50	FAL900EX	1AS002	554.5
Embraer Phenom 300 (EMB-505)	CNA55B	PW530	126.0
		Subtotal	***1,235.0***
GA Prop			
Raytheon Super King Air 200	C12	PT660A	61.0
Cessna 172 Skyhawk	CNA172	IO320	132.0
Piper PA-31 Navajo	BEC58P	TIO540	17.0
		Subtotal	***210.0***

Table 15 Alternative 2: 2032 Proposed Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Military			
Embraer Phenom 300 (EMB-505)_M	CNA55B_M	PW530_M	72.0
Raytheon Super King Air 200_M	C12_M	PT660A_M	26.0
Cessna 172 Skyhawk_M	CNA172_M	IO320_M	2.0
		Subtotal	***100.00***
		Grand Total	**475,654.4**

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 16 Alternative 1: 2037 No Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Commercial Jets			
Airbus A220-100	737700	16PW111	25278.7
Airbus A220-300	737700	16PW111	8743.4
Airbus A220-300	737700	16PW112	4306.4
Airbus A320-200 Series	A320-211	01P08CM105	2008.6
Airbus A320-200 Series	A320-232	01P10IA021	180.3
Airbus A320-200 Series	A320-232	01P10IA022	38.9
Airbus A320-200 Series	A320-211	1CM008	49.1
Airbus A320-200 Series	A320-211	1CM009	199.0
Airbus A320-200 Series	A320-232	1IA003	379.4
Airbus A320-200 Series	A320-211	3CM026	216.0
Airbus A320-200 Series	A320-232	8IA010	0.3
Airbus A320-NEO	A320-271N	01P20CM128	5744.3
Airbus A320-NEO	A320-271N	01P22PW163	9115.7
Airbus A321-200 Series	A321-232	01P08CM104	324.3
Airbus A321-200 Series	A321-232	01P10IA025	1967.7
Airbus A321-200 Series	A321-232	3CM025	334.9
Airbus A321-NEO	A321-232	01P18PW157	7082.1
Airbus A321-NEO	A321-232	01P20CM132	21006.9
Boeing 737-700 Series	737700	3CM030	19.3
Boeing 737-700 Series	737700	3CM031	650.6
Boeing 737-700 Series	737700	3CM032	118.4
Boeing 737-700 Series	737700	8CM051	0.5
Boeing 737-700 Series	737700	8CM062	4.7
Boeing 737-700 Series	737700	8CM063	110.4
Boeing 737-8	7378MAX	01P20CM135	643.2
Boeing 737-8	7378MAX	01P20CM136	20834.7
Boeing 737-8	7378MAX	01P20CM140	19218.7
Boeing 737-8_MAX7	7378MAX_MAX7	01P20CM136_MAX7	1690.9
Boeing 737-800 Series	737800	01P11CM114	283.7
Boeing 737-800 Series	737800	01P11CM116	3861.1
Boeing 737-800 Series	737800	01P11CM122	2106.8
Boeing 737-800 Series	737800	01P11CM125	468.5
Boeing 737-800 Series	737800	01P11CM126	44.4
Boeing 737-800 Series	737800	3CM032	11819.7
Boeing 737-800 Series	737800	3CM034	1141.1
Boeing 737-800 Series	737800	8CM051	16180.1
Boeing 737-800 Series	737800	8CM064	117.5
Boeing 737-800 Series	737800	8CM065	1510.8
Boeing 737-800 Series	737800	8CM066	7095.4
Boeing 737-9	7378MAX	01P20CM136	958.8
Boeing 737-9	7378MAX	01P20CM140	37795.0

Table 16 Alternative 1: 2037 No Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Boeing 737-900-ER	737800	01P11CM116	25141.9
Boeing 737-900-ER	737800	01P11CM121	71579.3
Boeing 737-900-ER_MA	737800_MA	01P11CM121_MA	1839.3
Boeing 737-900-ER	737800	01P11CM125	219.3
Boeing 737-900-ER	737800	3CM034	1012.1
Boeing 737-900-ER	737800	8CM065	1128.3
Airbus A330-200 Series	A330-343	2RR023	2514.0
Airbus A330-200 Series	A330-343	9PW094	36.0
Airbus A330-300 Series	A330-343	2RR023	544.5
Airbus A330-300 Series	A330-301	4GE080	552.5
Airbus A330-300 Series	A330-343	7PW082	74.6
Airbus A330-300 Series	A330-301	9PW094	1560.2
Airbus A330-300 Series	A330-301	9PW095	366.0
Airbus A330-900N Series (Neo)	A330-343	02P23RR141	5503.2
Airbus A350-900 series	A350-941	01P18RR124	3247.4
Boeing 787-10 Dreamliner	7879	01P17GE211	445.2
Boeing 787-10 Dreamliner	7879	02P23RR134	486.0
Boeing 787-10 Dreamliner	7879	17GE179	961.8
Boeing 787-8 Dreamliner	7878R	01P17GE206	1418.2
Boeing 787-8 Dreamliner	7878R	01P17GE210	47.7
Boeing 787-8 Dreamliner	7878R	11GE137	2240.5
Boeing 787-8 Dreamliner	7878R	11GE138	5505.9
Boeing 787-9 Dreamliner	7879	01P17GE211	3449.3
Boeing 787-9 Dreamliner	7879	01P17GE214	23.5
Boeing 787-9 Dreamliner	7879	02P23RR131	778.2
Boeing 787-9 Dreamliner	7879	12RR067	3562.7
Boeing 787-9 Dreamliner	7879	12RR068	1501.7
		Subtotal	***349,389.2***
Cargo Jets			
Boeing 747-400 ERF	747400RN	12PW102	577.0
Boeing 747-400BCF	747400	01P03GE187	577.0
Boeing 747-8F	7478	01P17GE215	315.1
Boeing 747-8F	7478	13GE156	83.9
Boeing 747-8F	7478	8GENX1	272.0
Boeing 767-200 Series Freighter	767CF6	1GE010	3718.6
Boeing 767-200 Series Freighter	767CF6	1GE012	1852.1
Boeing 767-200 Series Freighter	767JT9	1PW026	332.8
Boeing 767-300 ER Freighter	7673ER	1GE030	5221.4
Boeing 767-300 ER Freighter	7673ER	2GE055	514.1
Boeing 777 Freighter	777200	01P21GE216	3690.1
Boeing 777 Freighter	777300	01P21GE217	87.9
		Subtotal	***17,242.0***
Regional Jets			
Embraer ERJ175-LR	EMB175	01P08GE197	101505.5
Embraer ERJ175-LR_MA	EMB175_MA	01P08GE197_MA	993.2
		Subtotal	***102,498.7***

Table 16 Alternative 1: 2037 No Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Cargo Prop			
ATR 72-600 Freighter	DHC830	PW127F	323.0
Cessna 208 Caravan	PA42	P6114A	1147.0
Cessna 208 Caravan	CNA208	PT6A14	1131.0
Raytheon Beech 99	DHC6	PT6A27	4.2
Raytheon Beech 99	DHC6	PT6A36	234.8
Shorts 330-200 Series	SD330	PT6A6B	323.0
		Subtotal	***3,163.0***
Other			
Cessna 208 Caravan_O	PA42_O	P6114A_O	201.4
Cessna 208 Caravan_O	PA42_O	PT6A14_O	198.6
Boeing 737-900-ER_O	737800_O	01P11CM116_O	149.5
Boeing 737-900-ER_O	737800_O	01P11CM121_O	436.5
Boeing 737-900-ER_O	737800_O	01P11CM125_O	1.3
Boeing 737-900-ER_O	737800_O	3CM034_O	6.0
Boeing 737-900-ER_O	737800_O	8CM065_O	6.7
		Subtotal	***1,000.0***
GA Jets			
Bombardier Challenger 350	CL600	01P14HN011	572.0
Dassault Falcon 50	FAL900EX	1AS002	572.0
Embraer Phenom 300 (EMB-505)	CNA55B	PW530	136.0
		Subtotal	***1,280.0***
GA Prop			
Raytheon Super King Air 200	C12	PT660A	67.0
Cessna 172 Skyhawk	CNA172	IO320	120.0
Piper PA-31 Navajo	BEC58P	TIO540	14.0
		Subtotal	***201.0***
Military			
Embraer Phenom 300 (EMB-505)_M	CNA55B_M	PW530_M	72.0
Raytheon Super King Air 200_M	C12_M	PT660A_M	26.0
Cessna 172 Skyhawk_M	CNA172_M	IO320_M	2.0
		Subtotal	***100.0***
		Grand Total	**474,874.0**

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 17 Alternative 2: 2037 Proposed Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Commercial Jets			
Airbus A220-100	737700	16PW111	27237.6
Airbus A220-300	737700	16PW111	9420.9
Airbus A220-300	737700	16PW112	4640.2
Airbus A320-200 Series	A320-211	01P08CM105	2164.2
Airbus A320-200 Series	A320-232	01P10IA021	194.3
Airbus A320-200 Series	A320-232	01P10IA022	42.0
Airbus A320-200 Series	A320-211	1CM008	52.9
Airbus A320-200 Series	A320-211	1CM009	214.5
Airbus A320-200 Series	A320-232	1IA003	408.8
Airbus A320-200 Series	A320-211	3CM026	232.7
Airbus A320-200 Series	A320-232	8IA010	0.3
Airbus A320-NEO	A320-271N	01P20CM128	6189.4
Airbus A320-NEO	A320-271N	01P22PW163	9822.1
Airbus A321-200 Series	A321-232	01P08CM104	349.5

Table 17 Alternative 2: 2037 Proposed Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Airbus A321-200 Series	A321-232	01P10IA025	2120.2
Airbus A321-200 Series	A321-232	3CM025	360.8
Airbus A321-NEO	A321-232	01P18PW157	7630.9
Airbus A321-NEO	A321-232	01P20CM132	22634.8
Boeing 737-700 Series	737700	3CM030	20.8
Boeing 737-700 Series	737700	3CM031	701.0
Boeing 737-700 Series	737700	3CM032	127.6
Boeing 737-700 Series	737700	8CM051	0.5
Boeing 737-700 Series	737700	8CM062	5.1
Boeing 737-700 Series	737700	8CM063	118.9
Boeing 737-8	7378MAX	01P20CM135	693.1
Boeing 737-8	7378MAX	01P20CM136	22449.2
Boeing 737-8	7378MAX	01P20CM140	20708.1
Boeing 737-8_MAX7	7378MAX_MAX7	01P20CM136_MAX7	1822.0
Boeing 737-800 Series	737800	01P11CM114	305.7
Boeing 737-800 Series	737800	01P11CM116	4160.3
Boeing 737-800 Series	737800	01P11CM122	2270.0
Boeing 737-800 Series	737800	01P11CM125	504.8
Boeing 737-800 Series	737800	01P11CM126	47.9
Boeing 737-800 Series	737800	3CM032	12735.6
Boeing 737-800 Series	737800	3CM034	1229.6
Boeing 737-800 Series	737800	8CM051	17433.9
Boeing 737-800 Series	737800	8CM064	126.6
Boeing 737-800 Series	737800	8CM065	1627.8
Boeing 737-800 Series	737800	8CM066	7645.2
Boeing 737-9	7378MAX	01P20CM136	45.2
Boeing 737-9	7378MAX	01P20CM140	1780.5
Boeing 737-900-ER	737800	01P11CM116	27090.2
Boeing 737-900-ER	737800	01P11CM121	77133.1
Boeing 737-900-ER_MA	737800_MA	01P11CM121_MA	1975.0
Boeing 737-900-ER	737800	01P11CM125	236.3
Boeing 737-900-ER	737800	3CM034	1090.5
Boeing 737-900-ER	737800	8CM065	1215.8
Airbus A330-200 Series	A330-343	2RR023	2708.8
Airbus A330-200 Series	A330-343	9PW094	38.7
Airbus A330-300 Series	A330-343	2RR023	586.7
Airbus A330-300 Series	A330-301	4GE080	595.3
Airbus A330-300 Series	A330-343	7PW082	80.3
Airbus A330-300 Series	A330-301	9PW094	1681.1
Airbus A330-300 Series	A330-301	9PW095	394.4
Airbus A330-900N Series (Neo)	A330-343	02P23RR141	5929.6
Airbus A350-900 series	A350-941	01P18RR124	3499.1
Boeing 787-10 Dreamliner	7879	01P17GE211	479.7
Boeing 787-10 Dreamliner	7879	02P23RR134	523.7
Boeing 787-10 Dreamliner	7879	17GE179	1036.3
Boeing 787-8 Dreamliner	7878R	01P17GE206	1528.1
Boeing 787-8 Dreamliner	7878R	01P17GE210	51.4
Boeing 787-8 Dreamliner	7878R	11GE137	2414.1
Boeing 787-8 Dreamliner	7878R	11GE138	5932.6
Boeing 787-9 Dreamliner	7879	01P17GE211	3716.6
Boeing 787-9 Dreamliner	7879	01P17GE214	25.3
Boeing 787-9 Dreamliner	7879	02P23RR131	838.5
Boeing 787-9 Dreamliner	7879	12RR067	3838.8

Table 17 Alternative 2: 2037 Proposed Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Boeing 787-9 Dreamliner	7879	12RR068	1618.1
		Subtotal	***376,464.5***
Cargo Jets			
Boeing 747-400 ERF	747400RN	12PW102	577.0
Boeing 747-400BCF	747400	01P03GE187	577.0
Boeing 747-8F	7478	01P17GE215	315.1
Boeing 747-8F	7478	13GE156	83.9
Boeing 747-8F	7478	8GENX1	272.0
Boeing 767-200 Series Freighter	767CF6	1GE010	3718.6
Boeing 767-200 Series Freighter	767CF6	1GE012	1852.1
Boeing 767-200 Series Freighter	767JT9	1PW026	332.8
Boeing 767-300 ER Freighter	7673ER	1GE030	5221.4
Boeing 767-300 ER Freighter	7673ER	2GE055	514.1
Boeing 777 Freighter	777200	01P21GE216	3690.1
Boeing 777 Freighter	777300	01P21GE217	87.9
		Subtotal	***17,242.0***
Regional Jets			
Embraer ERJ175-LR	EMB175	01P08GE197	109375.2
Embraer ERJ175-LR_MA	EMB175_MA	01P08GE197_MA	1066.5
		Subtotal	***110,441.7***
Cargo Prop			
ATR 72-600 Freighter	DHC830	PW127F	323.0
Cessna 208 Caravan	PA42	P6114A	1147.0
Cessna 208 Caravan	CNA208	PT6A14	1131.0
Raytheon Beech 99	DHC6	PT6A27	4.2
Raytheon Beech 99	DHC6	PT6A36	234.8
Shorts 330-200 Series	SD330	PT6A6B	323.0
		Subtotal	***3,163.0***
Other			
Cessna 208 Caravan_O	PA42_O	P6114A_O	201.4
Cessna 208 Caravan_O	PA42_O	PT6A14_O	198.6
Boeing 737-900-ER_O	737800_O	01P11CM116_O	149.5
Boeing 737-900-ER_O	737800_O	01P11CM121_O	436.5
Boeing 737-900-ER_O	737800_O	01P11CM125_O	1.3
Boeing 737-900-ER_O	737800_O	3CM034_O	6.0
Boeing 737-900-ER_O	737800_O	8CM065_O	6.7
		Subtotal	***1,000.0***
GA Jets			
Bombardier Challenger 350	CL600	01P14HN011	572.0
Dassault Falcon 50	FAL900EX	1AS002	572.0
Embraer Phenom 300 (EMB-505)	CNA55B	PW530	136.0
		Subtotal	***1,280.0***
GA Prop			
Raytheon Super King Air 200	C12	PT660A	67.0
Cessna 172 Skyhawk	CNA172	IO320	120.0
Piper PA-31 Navajo	BEC58P	TIO540	14.0
		Subtotal	***201.0***

Table 17 Alternative 2: 2037 Proposed Action Fleet Mix (Airframe, ANP ID, and AEDT Engine Code) and Operations (Continued)

AIRFRAME	ANP ID	ENGINE CODE	ANNUAL OPERATIONS
Military			
Raytheon Super King Air 200_M	CNA55B_M	PT660A_M	26.0
Embraer Phenom 300 (EMB-505)_M	C12_M	PW530_M	72.0
Cessna 172 Skyhawk_M	CNA172_M	IO320_M	2.0
		Subtotal	***100.0***
		Grand Total	**509,892.2**

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

2.2 Day/Night Operating Characteristics

Table 18 through Table 25 present the day and night percentages per operator category for each alternative in 2032 and 2037. The day and night percentages were calculated using operational output from the Total Airspace and Airport Modeler (TAAM) airfield simulation modeling.[4]

Table 18 Alternative 1: 2032 No Action Arrival Day/Night Split per Operator Category

Operator Category	Day	Night
Passenger		
Heavy Jet	99.0%	1.0%
Narrow Body Jet	79.9%	20.1%
Regional Jet	89.1%	10.9%
Cargo		
Heavy Jet	61.6%	38.4%
Prop	100.0%	0.0%
General Aviation		
Jet	100.0%	0.0%
Turboprop	100.0%	0.0%
Prop	55.7%	44.3%
Grand Total	**82.9%**	**17.1%**

Source: L&B Analysis, 2023.

Table 19 Alternative 1: 2032 No Action Departure Day/Night Split per Operator Category

Operator Category	Day	Night
Passenger		
Heavy Jet	95.1%	4.9%
Narrow Body Jet	81.5%	18.5%
Regional Jet	91.2%	8.8%
Cargo		
Heavy Jet	79.9%	20.1%
Prop	100.0%	0.0%
General Aviation		
Jet	100.0%	0.0%
Turboprop	100.0%	0.0%
Prop	100.0%	0.0%
Grand Total	**84.9%**	**15.1%**

Source: L&B Analysis, 2023.

[4] See Appendix A, Forecast and Operational Assumptions for more information regarding the TAAM modeling results.

Table 20 Alternative 2: 2032 Proposed Action Arrival Day/Night Split per Operator Category

Operator Category	Day	Night
Passenger		
Heavy Jet	99.2%	0.8%
Narrow Body Jet	80.3%	19.7%
Regional Jet	89.7%	10.3%
Cargo		
Heavy Jet	61.6%	38.4%
Prop	100.0%	0.0%
General Aviation		
Jet	100.0%	0.0%
Turboprop	100.0%	0.0%
Prop	55.7%	44.3%
Grand Total	**83.3%**	**16.7%**

Source: L&B Analysis, 2023.

Table 21 Alternative 2: 2032 Proposed Action Departure Day/Night Split per Operator Category

Operator Category	Day	Night
Passenger		
Heavy Jet	95.1%	4.9%
Narrow Body Jet	81.8%	18.2%
Regional Jet	89.0%	11.0%
Cargo		
Heavy Jet	79.9%	20.1%
Prop	100.0%	0.0%
General Aviation		
Jet	100.0%	0.0%
Turboprop	100.0%	0.0%
Prop	100.0%	0.0%
Grand Total	**84.5%**	**15.5%**

Source: L&B Analysis, 2023.

Table 22 Alternative 1: 2037 No Action Arrival Day/Night Split per Operator Category

Operator Category	Day	Night
Passenger		
Heavy Jet	99.2%	0.8%
Narrow Body Jet	82.5%	17.5%
Regional Jet	90.5%	9.5%
Cargo		
Heavy Jet	66.1%	33.9%
Prop	100.0%	0.0%
General Aviation		
Jet	100.0%	0.0%
Turboprop	100.0%	0.0%
Prop	55.2%	44.8%
Grand Total	**85.1%**	**14.9%**

Source: L&B Analysis, 2023.

Table 23 Alternative 1: 2037 No Action Departure Day/Night Split per Operator Category

Operator Category	Day	Night
Passenger		
Heavy Jet	96.9%	3.1%
Narrow Body Jet	81.8%	18.2%
Regional Jet	89.2%	10.8%
Cargo		
Heavy Jet	79.7%	20.3%
Prop	100.0%	0.0%
General Aviation		
Jet	100.0%	0.0%
Turboprop	100.0%	0.0%
Prop	100.0%	0.0%
Grand Total	**84.6%**	**15.4%**

Source: L&B Analysis, 2023.

Table 24 Alternative 2: 2037 Proposed Action Arrival Day/Night Split per Operator Category

Operator Category	Day	Night
Passenger		
Heavy Jet	99.3%	0.7%
Narrow Body Jet	80.9%	19.1%
Regional Jet	89.7%	10.3%
Cargo		
Heavy Jet	67.2%	32.8%
Prop	100.0%	0.0%
General Aviation		
Jet	100.0%	0.0%
Turboprop	100.0%	0.0%
Prop	55.2%	44.8%
Grand Total	**83.8%**	**16.2%**

Source: L&B Analysis, 2023.

Table 25 Alternative 2: 2037 Proposed Action Departure Day/Night Split per Operator Category

Operator Category	Day	Night
Passenger		
Heavy Jet	96.9%	3.1%
Narrow Body Jet	81.5%	18.5%
Regional Jet	89.0%	11.0%
Cargo		
Heavy Jet	80.8%	19.2%
Prop	100.0%	0.0%
General Aviation		
Jet	100.0%	0.0%
Turboprop	100.0%	0.0%
Prop	100.0%	0.0%
Grand Total	**84.4%**	**15.6%**

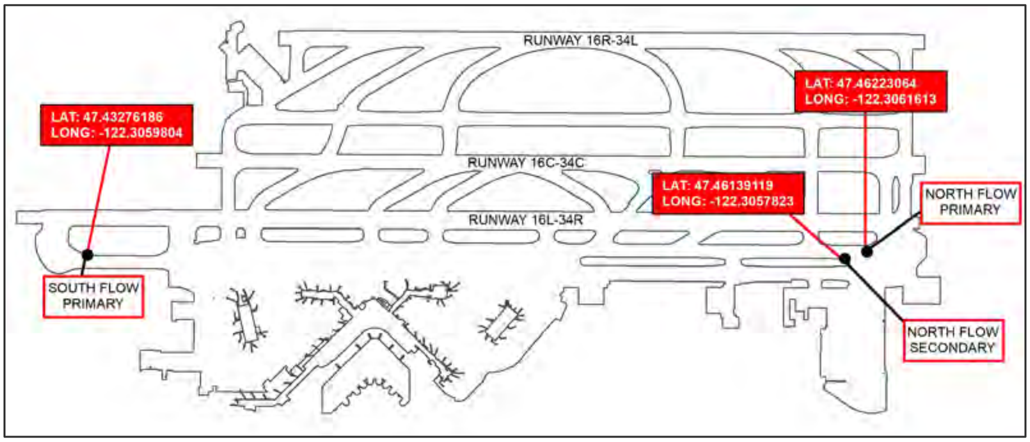
Source: L&B Analysis, 2023.

2.3 Aircraft Run Up Activity Levels

No changes to run-up locations would occur in Alternative 1: 2032 and 2037 No Action conditions. Therefore, the run-up locations discussed for the Existing (2022) condition would remain the same for Alternative 1. The number of engine run-up operations were determined for Alternative 1: 2032 and 2037 No Action conditions by scaling the engine run-ups from 2022 for the number of total operations, assuming the same distribution across aircraft type.

In Alternative 2: 2032 and 2037 Proposed Action conditions, changes to run-up locations would occur due to changes in the taxiways and new passenger terminal facilities. As a result, the locations would be located towards the north and south ends of the airfield. **Exhibit 7: *Proposed Action Run-up Locations*** shows the future location of the run-ups. In Alternative 2, the number of engine run-up operations were scaled up from 2022 levels assuming the same distribution across aircraft types.

Exhibit 7: Proposed Action Run-up Locations



Tables 26 through 29 present the amount of run-up operations, average duration and thrust settings per airframe and engine type that occurred at each SEA run-up location for each alternative in the future conditions.

Table 26 Alternative 1: 2032 No Action Aircraft Run-up Activity

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings (lbs)
North Flow Primary Location						
Airbus A319-100 Series	3IA006	1.5	3.0	--	--	22000
Airbus A320-200 Series	01P08CM105	24.8	15.8	1.5	2.0	25000
Airbus A320-200 Series	1CM009	2.9	69.5	--	--	25000
Airbus A320-200 Series	3CM026	2.9	15.5	--	--	25000
Airbus A321-200 Series	3CM025	4.4	36.7	--	--	30000
Airbus A321-NEO	01P20CM132	--	--	1.5	2.0	30000
Airbus A330-200 Series	9PW094	8.8	27.7	--	--	71100
Airbus A330-300 Series	4GE080	1.5	37.0	--	--	67500
Airbus A330-900N Series (Neo)	02P23RR141	1.5	26.0	--	--	71100
Boeing 737-700 Series	3CM031	5.8	26.8	--	--	24000
Boeing 737-700 Series	3CM032	7.3	56.4	--	--	24000
Boeing 737-800 Series	01P11CM122	1.5	10.0	--	--	26300
Boeing 737-800 Series	3CM032	20.4	27.6	--	--	26300
Boeing 737-800 Series	3CM034	1.5	9.0	--	--	26300
Boeing 737-800 Series	8CM051	2.9	40.5	--	--	26300
Boeing 737-800 Series	8CM066	4.4	33.0	--	--	26300
Boeing 737-9	01P20CM140	13.1	14.6	--	--	26400
Boeing 737-900-ER	01P11CM116	14.6	20.2	--	--	26300
Boeing 737-900-ER	01P11CM121	23.4	25.1	--	--	26300
Boeing 737-900-ER	01P11CM121	1.5	4.0	--	--	13150
Boeing MD-11 Freighter	1GE031	--	--	1.5	2.0	61500
Embraer ERJ175-LR	01P08GE197	5.8	28.0	--	--	13800
Embraer ERJ175-LR	01P08GE197	1.5	6.0	--	--	6900

Table 26 Alternative 1: 2032 No Action Aircraft Run-up Activity

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings (lbs)
South Flow Primary Location						
Airbus A319-100 Series	3IA006	1.5	15.0	--	--	22000
Airbus A319-100 Series	3IA007	1.5	26.0	1.5	11.0	22000
Airbus A320-200 Series	01P08CM105	40.9	12.9	--	--	25000
Airbus A320-200 Series	01P08CM105	2.9	6.0	--	--	12500
Airbus A320-200 Series	1CM009	7.3	31.6	--	--	25000
Airbus A321-NEO	01P20CM132	2.9	12.5	--	--	30000
Airbus A330-200 Series	2RR023	1.5	6.0	--	--	71100
Airbus A330-200 Series	9PW094	11.7	14.9	--	--	71100
Airbus A330-200 Series	9PW094	1.5	26.0	--	--	35550
Airbus A330-300 Series	4GE080	4.4	10.7	--	--	67500
Airbus A330-900N Series (Neo)	02P23RR141	4.4	26.7	--	--	71100
Boeing 737-700 Series	3CM031	23.4	17.6	--	--	24000
Boeing 737-700 Series	3CM031	1.5	20.0	1.5	2.0	12000
Boeing 737-700 Series	3CM032	5.8	31.5	--	--	24000
Boeing 737-800 Series	3CM032	61.3	18.3	--	--	26300
Boeing 737-800 Series	3CM032	4.4	18.3	--	--	13150
Boeing 737-800 Series	8CM051	16.1	21.0	--	--	26300
Boeing 737-800 Series	8CM065	1.5	6.0	--	--	26300
Boeing 737-800 Series	8CM066	35.0	10.7	--	--	26300
Boeing 737-800 Series	8CM066	1.5	3.0	1.5	2.0	13150
Boeing 737-9	01P20CM140	30.7	10.4	--	--	26400
Boeing 737-9	01P20CM140	1.5	9.0	--	--	13200
Boeing 737-900-ER	01P11CM116	30.7	15.7	2.9	2.0	26300
Boeing 737-900-ER	01P11CM116	1.5	3.0	--	--	13150
Boeing 737-900-ER	01P11CM121	78.9	25.5	--	--	26300
Boeing 737-900-ER	01P11CM121	1.5	8.0	--	--	13150
Boeing 767-200 Series Freighter	1GE012	1.5	6.0	--	--	48000
Boeing MD-11 Freighter	1GE031	2.9	44.5	--	--	61500
Embraer ERJ175-LR	01P08GE197	10.2	11.1	--	--	13800
North Flow Secondary Location						
Airbus A330-200 Series	9PW094	1.4	38.0	--	--	71100
	Total	**543.3**	**--**	**11.6**	**--**	**--**

Notes: Totals may not sum total due to rounding.
Daytime = 7:00am – 9:59pm, Nighttime = 10:00pm – 6:59am.

Table 27 Alternative 2: 2032 Proposed Action Aircraft Run-up Activity

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
North Flow Primary Location						
Airbus A319-100 Series	3IA006	1.5	3.0	--	--	22000
Airbus A320-200 Series	01P08CM105	25.3	15.8	1.5	2.0	25000
Airbus A320-200 Series	1CM009	3.0	69.5	--	--	25000
Airbus A320-200 Series	3CM026	3.0	15.5	--	--	25000
Airbus A321-200 Series	3CM025	4.5	36.7	--	--	30000
Airbus A321-NEO	01P20CM132	--	--	1.5	2.0	30000
Airbus A330-200 Series	9PW094	8.9	27.7	--	--	71100
Airbus A330-300 Series	4GE080	1.5	37.0	--	--	67500
Airbus A330-900N Series (Neo)	02P23RR141	1.5	26.0	--	--	71100
Boeing 737-700 Series	3CM031	6.0	26.8	--	--	24000

Table 27 Alternative 2: 2032 Proposed Action Aircraft Run-up Activity (Continued)

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Boeing 737-700 Series	3CM032	7.4	56.4	--	--	24000
Boeing 737-800 Series	01P11CM122	1.5	10.0	--	--	26300
Boeing 737-800 Series	3CM032	20.8	27.6	--	--	26300
Boeing 737-800 Series	3CM034	1.5	9.0	--	--	26300
Boeing 737-800 Series	8CM051	3.0	40.5	--	--	26300
Boeing 737-800 Series	8CM066	4.5	33.0	--	--	26300
Boeing 737-9	01P20CM140	13.4	14.6	--	--	26400
Boeing 737-900-ER	01P11CM116	14.9	20.2	--	--	26300
Boeing 737-900-ER	01P11CM121	23.8	25.1	--	--	26300
Boeing 737-900-ER	01P11CM121	1.5	4.0	--	--	13150
Boeing MD-11 Freighter	1GE031	--	--	1.5	2.0	61500
Embraer ERJ175-LR	01P08GE197	6.0	28.0	--	--	13800
Embraer ERJ175-LR	01P08GE197	1.5	6.0	--	--	6900
South Flow Primary Location						
Airbus A319-100 Series	3IA006	1.5	15.0	--	--	22000
Airbus A319-100 Series	3IA007	1.5	26.0	1.5	11.0	22000
Airbus A320-200 Series	01P08CM105	41.7	12.9	--	--	25000
Airbus A320-200 Series	01P08CM105	3.0	6.0	--	--	12500
Airbus A320-200 Series	1CM009	7.4	31.6	--	--	25000
Airbus A321-NEO	01P20CM132	3.0	12.5	--	--	30000
Airbus A330-200 Series	2RR023	1.5	6.0	--	--	71100
Airbus A330-200 Series	9PW094	11.9	14.9	--	--	71100
Airbus A330-200 Series	9PW094	1.5	26.0	--	--	35550
Airbus A330-300 Series	4GE080	4.5	10.7	--	--	67500
Airbus A330-900N Series (Neo)	02P23RR141	4.5	26.7	--	--	71100
Boeing 737-700 Series	3CM031	23.8	17.6	--	--	24000
Boeing 737-700 Series	3CM031	1.5	20.0	1.5	2.0	12000
Boeing 737-700 Series	3CM032	6.0	31.5	--	--	24000
Boeing 737-800 Series	3CM032	62.5	18.3	--	--	26300
Boeing 737-800 Series	3CM032	4.5	18.3	--	--	13150
Boeing 737-800 Series	8CM051	16.4	21.0	--	--	26300
Boeing 737-800 Series	8CM065	1.5	6.0	--	--	26300
Boeing 737-800 Series	8CM066	35.7	10.7	--	--	26300
Boeing 737-800 Series	8CM066	1.5	3.0	1.5	2.0	13150
Boeing 737-9	01P20CM140	31.2	10.4	--	--	26400
Boeing 737-9	01P20CM140	1.5	9.0	--	--	13200
Boeing 737-900-ER	01P11CM116	31.2	15.7	3.0	2.0	26300
Boeing 737-900-ER	01P11CM116	1.5	3.0	--	--	13150
Boeing 737-900-ER	01P11CM121	80.3	25.5	--	--	26300
Boeing 737-900-ER	01P11CM121	1.5	8.0	--	--	13150
Boeing 767-200 Series Freighter	1GE012	1.5	6.0	--	--	48000
Boeing MD-11 Freighter	1GE031	3.0	44.5	--	--	61500
Embraer ERJ175-LR	01P08GE197	10.4	11.1	--	--	13800
North Flow Secondary Location						
Airbus A330-200 Series	9PW094	1.5	38.0		--	71100
Total		**553.5**	**--**	**11.9**	**--**	**--**

Notes: Totals may not sum total due to rounding.
Daytime = 7:00am – 9:59pm, Nighttime = 10:00pm – 6:59am.

Table 28 Alternative 1: 2037 No Action Aircraft Run-up Activity

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
North Flow Primary Location						
Airbus A320-200 Series	01P08CM105	25.6	15.8	2.0	2.0	25000
Airbus A320-200 Series	1CM009	3.0	69.5	--	--	25000
Airbus A320-200 Series	3CM026	3.0	15.5	--	--	25000
Airbus A321-200 Series	3CM025	4.5	36.7	--	--	30000
Airbus A321-NEO	01P20CM132	--	--	2.0	2.0	30000
Airbus A330-200 Series	9PW094	9.0	27.7	--	--	71100
Airbus A330-300 Series	4GE080	1.5	37.0	--	--	67500
Airbus A330-900N Series (Neo)	02P23RR141	1.5	26.0	--	--	71100
Boeing 737-700 Series	3CM031	6.0	26.8	--	--	24000
Boeing 737-700 Series	3CM032	7.5	56.4	--	--	24000
Boeing 737-800 Series	01P11CM122	1.5	10.0	--	--	26300
Boeing 737-800 Series	3CM032	21.1	27.6	--	--	26300
Boeing 737-800 Series	3CM034	1.5	9.0	--	--	26300
Boeing 737-800 Series	8CM051	3.0	40.5	--	--	26300
Boeing 737-800 Series	8CM066	4.5	33.0	--	--	26300
Boeing 737-9	01P20CM140	13.6	14.6	--	--	26400
Boeing 737-900-ER	01P11CM116	15.1	20.2	--	--	26300
Boeing 737-900-ER	01P11CM121	24.1	25.1	--	--	26300
Boeing 737-900-ER	01P11CM121	1.5	4.0	--	--	13150
Embraer ERJ175-LR	01P08GE197	6.0	28.0	--	--	13800
Embraer ERJ175-LR	01P08GE197	1.5	6.0	--	--	6900
South Flow Primary Location						
Airbus A320-200 Series	01P08CM105	42.2	12.9	--	--	25000
Airbus A320-200 Series	01P08CM105	3.0	6.0	--	--	12500
Airbus A320-200 Series	1CM009	7.5	31.6	--	--	25000
Airbus A321-NEO	01P20CM132	3.0	12.5	--	--	30000
Airbus A330-200 Series	2RR023	1.5	6.0	--	--	71100
Airbus A330-200 Series	9PW094	12.0	14.9	--	--	71100
Airbus A330-200 Series	9PW094	1.5	26.0	--	--	35550
Airbus A330-300 Series	4GE080	4.5	10.7	--	--	67500
Airbus A330-900N Series (Neo)	02P23RR141	4.5	26.7	--	--	71100
Boeing 737-700 Series	3CM031	24.1	17.6	--	--	24000
Boeing 737-700 Series	3CM031	1.5	20.0	2.0	2.0	12000
Boeing 737-700 Series	3CM032	6.0	31.5	--	--	24000
Boeing 737-800 Series	3CM032	63.2	18.3	--	--	26300
Boeing 737-800 Series	3CM032	4.5	18.3	--	--	13150
Boeing 737-800 Series	8CM051	16.6	21.0	--	--	26300
Boeing 737-800 Series	8CM065	1.5	6.0	--	--	26300
Boeing 737-800 Series	8CM066	36.1	10.7	--	--	26300
Boeing 737-800 Series	8CM066	1.5	3.0	2.0	2.0	13150
Boeing 737-9	01P20CM140	31.6	10.4	--	--	26400
Boeing 737-9	01P20CM140	1.5	9.0	--	--	13200
Boeing 737-900-ER	01P11CM116	31.6	15.7	3.9	2.0	26300
Boeing 737-900-ER	01P11CM116	1.5	3.0	--	--	13150
Boeing 737-900-ER	01P11CM121	81.3	25.5	--	--	26300
Boeing 737-900-ER	01P11CM121	1.5	8.0	--	--	13150
Boeing 767-200 Series Freighter	1GE012	1.5	6.0	--	--	48000

Table 28 Alternative 1: 2037 No Action Aircraft Run-up Activity (Continued)

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Embraer ERJ175-LR	01P08GE197	10.5	11.1	--	--	13800
North Flow Secondary Location						
Airbus A330-200 Series	9PW094	1.5	38.0	--	--	71100
	Total	**552.5**	**--**	**11.8**	**--**	**--**

Notes: Totals may not sum total due to rounding.
Daytime = 7:00am – 9:59pm, Nighttime = 10:00pm – 6:59am.

Table 29 Alternative 2: 2037 Proposed Action Aircraft Run-up Activity

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
North Flow Primary Location						
Airbus A320-200 Series	01P08CM105	27.5	15.8	2.1	2.0	25000
Airbus A320-200 Series	1CM009	3.2	69.5	--	--	25000
Airbus A320-200 Series	3CM026	3.2	15.5	--	--	25000
Airbus A321-200 Series	3CM025	4.8	36.7	--	--	30000
Airbus A321-NEO	01P20CM132	--	--	2.1	2.0	30000
Airbus A330-200 Series	9PW094	9.7	27.7	--	--	71100
Airbus A330-300 Series	4GE080	1.6	37.0	--	--	67500
Airbus A330-900N Series (Neo)	02P23RR141	1.6	26.0	--	--	71100
Boeing 737-700 Series	3CM031	6.5	26.8	--	--	24000
Boeing 737-700 Series	3CM032	8.1	56.4	--	--	24000
Boeing 737-800 Series	01P11CM122	1.6	10.0	--	--	26300
Boeing 737-800 Series	3CM032	22.6	27.6	--	--	26300
Boeing 737-800 Series	3CM034	1.6	9.0	--	--	26300
Boeing 737-800 Series	8CM051	3.2	40.5	--	--	26300
Boeing 737-800 Series	8CM066	4.8	33.0	--	--	26300
Boeing 737-9	01P20CM140	14.5	14.6	--	--	26400
Boeing 737-900-ER	01P11CM116	16.2	20.2	--	--	26300
Boeing 737-900-ER	01P11CM121	25.9	25.1	--	--	26300
Boeing 737-900-ER	01P11CM121	1.6	4.0	--	--	13150
Embraer ERJ175-LR	01P08GE197	6.5	28.0	--	--	13800
Embraer ERJ175-LR	01P08GE197	1.6	6.0	--	--	6900
South Flow Primary Location						
Airbus A320-200 Series	01P08CM105	45.3	12.9	--	--	25000
Airbus A320-200 Series	01P08CM105	3.2	6.0	--	--	12500
Airbus A320-200 Series	1CM009	8.1	31.6	--	--	25000
Airbus A321-NEO	01P20CM132	3.2	12.5	--	--	30000
Airbus A330-200 Series	2RR023	1.6	6.0	--	--	71100
Airbus A330-200 Series	9PW094	12.9	14.9	--	--	71100
Airbus A330-200 Series	9PW094	1.6	26.0	--	--	35550
Airbus A330-300 Series	4GE080	4.8	10.7	--	--	67500
Airbus A330-900N Series (Neo)	02P23RR141	4.8	26.7	--	--	71100
Boeing 737-700 Series	3CM031	25.9	17.6	--	--	24000
Boeing 737-700 Series	3CM031	1.6	20.0	2.1	2.0	12000
Boeing 737-700 Series	3CM032	6.5	31.5	--	--	24000
Boeing 737-800 Series	3CM032	67.9	18.3	--	--	26300
Boeing 737-800 Series	3CM032	4.8	18.3	--	--	13150

Table 29 Alternative 2: 2037 Proposed Action Aircraft Run-up Activity (Continued)

Airframe	Engine Code	Annual Daytime Operations	Average Duration Daytime (minutes)	Annual Nighttime Operations	Average Duration Nighttime (minutes)	Thrust Settings
Boeing 737-800 Series	8CM051	17.8	21.0	--	--	26300
Boeing 737-800 Series	8CM065	1.6	6.0	--	--	26300
Boeing 737-800 Series	8CM066	38.8	10.7	--	--	26300
Boeing 737-800 Series	8CM066	1.6	3.0	2.1	2.0	13150
Boeing 737-9	01P20CM140	33.9	10.4	--	--	26400
Boeing 737-9	01P20CM140	1.6	9.0	--	--	13200
Boeing 737-900-ER	01P11CM116	33.9	15.7	4.2	2.0	26300
Boeing 737-900-ER	01P11CM116	1.6	3.0	--	--	13150
Boeing 737-900-ER	01P11CM121	87.3	25.5	--	--	26300
Boeing 737-900-ER	01P11CM121	1.6	8.0	--	--	13150
Boeing 767-200 Series Freighter	1GE012	1.6	6.0	--	--	48000
Embraer ERJ175-LR	01P08GE197	11.3	11.1	--	--	13800
North Flow Secondary Location						
Airbus A330-200 Series	9PW094	1.5	38.0	--	--	71100
Total		**593.3**	**--**	**12.7**	**--**	**--**

Notes: Totals may not sum total due to rounding.
Daytime = 7:00am – 9:59pm, Nighttime = 10:00pm – 6:59am.

2.4 Runway Definition

No changes to the runway location or definition would occur in any of the alternatives. Therefore, the runway definition discussed for the Existing (2022) condition would remain the same for the alternatives in 2032 and 2037.

2.5 Runway End Utilization

The runway end utilization for the alternatives was estimated using operational output from the TAAM airfield simulation modeling. The runway end utilization under the alternatives in 2032 and 2037 would be influenced by airfield congestion and the total number of operations occurring at the Airport. Several taxiway improvements designed to enhance efficiency of the airfield influence Alternative 2. **Table 30 through Table 37** present the assumed arrival and departure runway utilization by operator category for the alternatives in 2032 and 2037.

Table 30 Alternative 1: 2032 No Action Arrival Runway Utilization per Operator Category

Operator Category	16C	16L	16R	34C	34L	34R	Total
Passenger							
Heavy Jet	1.0%	55.0%	15.0%	0.5%	6.5%	22.0%	100.0%
Narrow Body Jet	1.0%	5.0%	65.0%	0.5%	26.5%	2.0%	100.0%
Regional Jet	1.0%	5.0%	65.0%	0.5%	26.5%	2.0%	100.0%
Cargo							
Heavy Jet	1.0%	55.0%	15.0%	0.5%	6.5%	22.0%	100.0%
Prop	1.4%	23.4%	46.1%	0.9%	26.5%	1.6%	100.0%
General Aviation							
Jet	1.5%	26.0%	43.5%	1.0%	26.5%	1.5%	100.0%
Turboprop	1.5%	26.0%	43.5%	1.0%	26.5%	1.5%	100.0%
Prop	1.5%	26.0%	43.5%	1.0%	26.5%	1.5%	100.0%
Overall Arrival Total	**1.0%**	**10.0%**	**60.0%**	**0.5%**	**24.6%**	**3.9%**	**100.0%**

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 31 Alternative 1: 2032 No Action Departure Runway Utilization per Operator Category

Operator Category	16C	16L	16R	34C	34L	34R	Total
Passenger							
Heavy Jet	13.0%	58.0%	0.0%	0.5%	0.0%	28.5%	100.0%
Narrow Body Jet	27.0%	44.0%	0.0%	1.0%	0.0%	28.0%	100.0%
Regional Jet	27.0%	44.0%	0.0%	1.0%	0.0%	28.0%	100.0%
Cargo							
Heavy Jet	13.0%	58.0%	0.0%	0.5%	0.0%	28.5%	100.0%
Prop	32.3%	36.1%	2.6%	12.8%	1.8%	14.4%	100.0%
General Aviation							
Jet	33.0%	35.0%	3.0%	14.5%	2.0%	12.5%	100.0%
Turboprop	33.0%	35.0%	3.0%	14.5%	2.0%	12.5%	100.0%
Prop	33.0%	35.0%	3.0%	14.5%	2.0%	12.5%	100.0%
Overall Departure Total	**25.7%**	**45.3%**	**0.0%**	**1.1%**	**0.0%**	**27.9%**	**100.0%**

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 32 Alternative 2: 2032 Proposed Action Arrival Runway Utilization per Operator Category

Operator Category	16C	16L	16R	34C	34L	34R	Total
Passenger							
Heavy Jet	1.0%	55.0%	15.0%	1.0%	8.0%	20.0%	100.0%
Narrow Body Jet	1.0%	5.0%	65.0%	1.0%	26.0%	2.0%	100.0%
Regional Jet	1.0%	5.0%	65.0%	1.0%	26.0%	2.0%	100.0%
Cargo							
Heavy Jet	1.0%	55.0%	15.0%	1.0%	8.0%	20.0%	100.0%
Prop	1.4%	23.4%	46.1%	1.0%	26.4%	1.6%	100.0%
General Aviation							
Jet	1.5%	26.0%	43.5%	1.0%	26.5%	1.5%	100.0%
Turboprop	1.5%	26.0%	43.5%	1.0%	26.5%	1.5%	100.0%
Prop	1.5%	26.0%	43.5%	1.0%	26.5%	1.5%	100.0%
Overall Arrival Total	**1.0%**	**10.0%**	**60.0%**	**1.0%**	**24.3%**	**3.7%**	**100.0%**

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 33 Alternative 2: 2032 Proposed Action Departure Runway Utilization per Operator Category

Operator Category	16C	16L	16R	34C	34L	34R	Total
Passenger							
Heavy Jet	13.0%	58.0%	0.0%	0.5%	0.0%	28.5%	100.0%
Narrow Body Jet	27.0%	44.0%	0.0%	1.0%	0.0%	28.0%	100.0%
Regional Jet	27.0%	44.0%	0.0%	1.0%	0.0%	28.0%	100.0%
Cargo							
Heavy Jet	13.0%	58.0%	0.0%	0.5%	0.0%	28.5%	100.0%
Prop	32.7%	35.7%	2.6%	12.8%	1.8%	14.4%	100.0%
General Aviation							
Jet	33.5%	34.5%	3.0%	14.5%	2.0%	12.5%	100.0%
Turboprop	33.5%	34.5%	3.0%	14.5%	2.0%	12.5%	100.0%
Prop	33.5%	34.5%	3.0%	14.5%	2.0%	12.5%	100.0%
Overall Departure Total	**25.7%**	**45.2%**	**0.0%**	**1.1%**	**0.0%**	**27.9%**	**100.0%**

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 34 Alternative 1: 2037 No Action Arrival Runway Utilization per Operator Category

Operator Category	16C	16L	16R	34C	34L	34R	Total
Passenger							
Heavy Jet	1.0%	55.0%	15.0%	0.5%	6.5%	22.0%	100.0%
Narrow Body Jet	1.0%	5.0%	65.0%	0.5%	26.5%	2.0%	100.0%
Regional Jet	1.0%	5.0%	65.0%	0.5%	26.5%	2.0%	100.0%
Cargo							
Heavy Jet	1.0%	55.0%	15.0%	0.5%	6.5%	22.0%	100.0%
Prop	1.4%	22.2%	47.4%	0.9%	26.5%	1.6%	100.0%
General Aviation							
Jet	1.5%	26.0%	43.5%	1.0%	26.5%	1.5%	100.0%
Turboprop	1.5%	26.0%	43.5%	1.0%	26.5%	1.5%	100.0%
Prop	1.5%	26.0%	43.5%	1.0%	26.5%	1.5%	100.0%
Overall Arrival Total	**1.0%**	**10.7%**	**59.3%**	**0.5%**	**24.3%**	**4.2%**	**100.0%**

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 35 Alternative 1: 2037 No Action Departure Runway Utilization per Operator Category

Operator Category	16C	16L	16R	34C	34L	34R	Total
Passenger							
Heavy Jet	13.0%	58.0%	0.0%	0.5%	0.0%	28.5%	100.0%
Narrow Body Jet	27.0%	44.0%	0.0%	1.0%	0.0%	28.0%	100.0%
Regional Jet	27.0%	44.0%	0.0%	1.0%	0.0%	28.0%	100.0%
Cargo							
Heavy Jet	13.0%	58.0%	0.0%	0.5%	0.0%	28.5%	100.0%
Prop	24.5%	44.0%	2.5%	12.1%	1.6%	15.3%	100.0%
General Aviation							
Jet	24.0%	44.0%	3.0%	14.5%	2.0%	12.5%	100.0%
Turboprop	24.0%	44.0%	3.0%	14.5%	2.0%	12.5%	100.0%
Prop	24.0%	44.0%	3.0%	14.5%	2.0%	12.5%	100.0%
Overall Departure Total	**25.4%**	**45.5%**	**0.0%**	**1.1%**	**0.0%**	**27.9%**	**100.0%**

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 36 Alternative 2: 2037 Proposed Action Arrival Runway Utilization per Operator Category

Operator Category	16C	16L	16R	34C	34L	34R	Total
Passenger							
Heavy Jet	1.0%	55.0%	15.0%	1.0%	7.0%	21.0%	100.0%
Narrow Body Jet	1.0%	5.0%	65.0%	1.0%	26.0%	2.0%	100.0%
Regional Jet	1.0%	5.0%	65.0%	1.0%	26.0%	2.0%	100.0%
Cargo							
Heavy Jet	1.0%	55.0%	15.0%	1.0%	7.0%	21.0%	100.0%
Prop	1.5%	24.1%	45.4%	1.0%	26.5%	1.5%	100.0%
General Aviation							
Jet	1.5%	26.0%	43.5%	1.0%	26.5%	1.5%	100.0%
Turboprop	1.5%	26.0%	43.5%	1.0%	26.5%	1.5%	100.0%
Prop	1.5%	26.0%	43.5%	1.0%	26.5%	1.5%	100.0%
Overall Arrival Total	**1.0%**	**10.6%**	**59.4%**	**1.0%**	**24.0%**	**4.0%**	**100.0%**

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 37 Alternative 2: 2037 Proposed Action Departure Runway Utilization per Operator Category

Operator Category	16C	16L	16R	34C	34L	34R	Total
Passenger							
Heavy Jet	13.0%	58.0%	0.0%	0.5%	0.0%	28.5%	100.0%
Narrow Body Jet	27.0%	44.0%	0.0%	1.0%	0.0%	28.0%	100.0%
Regional Jet	27.0%	44.0%	0.0%	1.0%	0.0%	28.0%	100.0%
Cargo							
Heavy Jet	13.0%	58.0%	0.0%	0.5%	0.0%	28.5%	100.0%
Prop	32.9%	35.4%	2.7%	13.3%	1.8%	13.9%	100.0%
General Aviation							
Jet	33.5%	34.5%	3.0%	14.5%	2.0%	12.5%	100.0%
Turboprop	33.5%	34.5%	3.0%	14.5%	2.0%	12.5%	100.0%
Prop	33.5%	34.5%	3.0%	14.5%	2.0%	12.5%	100.0%
Overall Departure Total	**25.5%**	**45.4%**	**0.0%**	**1.1%**	**0.0%**	**27.9%**	**100.0%**

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

2.6 Flight Tracks

Flight track locations for the alternatives in 2032 and 2037 would not change. As such, the flight tracks for Alternative 1 and Alternative 2 in 2032 and 2037 are expected to be the same as the Existing (2022) condition.[5]

2.7 Aircraft Weight, Trip Length

Table 38 through Table 45 presents the departure stage length distributions for each of the alternatives. The stage length was estimated for each alternative in 2032 and 2037 by using operational output from the TAAM airfield simulation modeling.

Table 38 Alternative 1: 2032 No Action Daytime Stage Length Distribution

Operator Category	1	2	3	4	5	6	7	8	9	Total
Passenger										
Heavy Jet	0.0%	6.4%	0.0%	2.0%	0.0%	38.3%	53.3%	0.0%	0.0%	100.0%
Narrow Body Jet	3.9%	53.5%	17.4%	25.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Regional Jet	72.8%	23.2%	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Cargo										
Heavy Jet	0.0%	22.8%	27.4%	22.0%	0.0%	19.8%	8.1%	0.0%	0.0%	100.0%
Prop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
General Aviation										
Jet	57.6%	0.0%	0.0%	42.4%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Turboprop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Prop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

[5] In Alternative 2, it is expected that the Runway 34R arrival profile will be slightly higher due to the relocation of the glide slope. This higher Runway 34R arrival profile was not specifically included in this analysis because AEDT does not provide a function to reflect this minor change. Furthermore, by not including the change in Runway 34R arrival profile this analysis represents a conservative evaluation of noise impacts.

Table 39 Alternative 1: 2032 No Action Nighttime Stage Length Distribution

Operator Category	1	2	3	4	5	6	7	8	9	Total
Passenger										
Heavy Jet	0.0%	0.0%	25.5%	0.0%	0.0%	0.0%	74.5%	0.0%	0.0%	100.0%
Narrow Body Jet	4.4%	33.4%	24.2%	38.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Regional Jet	83.3%	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Cargo										
Heavy Jet	0.0%	0.0%	24.1%	63.4%	0.0%	0.0%	12.5%	0.0%	0.0%	100.0%
Prop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
General Aviation										
Jet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Turboprop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Prop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 40 Alternative 2: 2032 Proposed Action Daytime Stage Length Distribution

Operator Category	1	2	3	4	5	6	7	8	9	Total
Passenger										
Heavy Jet	0.0%	5.1%	0.0%	2.0%	0.0%	40.4%	52.4%	0.0%	0.0%	100.0%
Narrow Body Jet	3.8%	52.0%	17.9%	26.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Regional Jet	72.7%	23.4%	3.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Cargo										
Heavy Jet	0.0%	22.8%	27.4%	22.0%	0.0%	19.8%	8.1%	0.0%	0.0%	100.0%
Prop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
General Aviation										
Jet	57.6%	0.0%	0.0%	42.4%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Turboprop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Prop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 41 Alternative 2: 2032 Proposed Action Nighttime Stage Length Distribution

Operator Category	1	2	3	4	5	6	7	8	9	Total
Passenger										
Heavy Jet	0.0%	0.0%	25.5%	0.0%	0.0%	0.0%	74.5%	0.0%	0.0%	100.0%
Narrow Body Jet	4.5%	33.9%	24.5%	37.1%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Regional Jet	85.7%	14.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Cargo										
Heavy Jet	0.0%	0.0%	24.1%	63.4%	0.0%	0.0%	12.5%	0.0%	0.0%	100.0%
Prop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
General Aviation										
Jet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Turboprop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Prop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 42 Alternative 1: 2037 No Action Daytime Stage Length Distribution

Operator Category	1	2	3	4	5	6	7	8	9	Total
Passenger										
Heavy Jet	0.0%	8.3%	0.0%	1.7%	0.0%	37.7%	52.3%	0.0%	0.0%	100.0%
Narrow Body Jet	4.0%	51.0%	14.8%	30.1%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Regional Jet	74.5%	21.3%	4.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Cargo										
Heavy Jet	0.0%	16.7%	25.5%	22.7%	0.0%	27.5%	7.7%	0.0%	0.0%	100.0%
Prop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
General Aviation										
Jet	57.7%	0.0%	0.0%	42.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Turboprop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Prop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 43 Alternative 1: 2037 No Action Nighttime Stage Length Distribution

Operator Category	1	2	3	4	5	6	7	8	9	Total
Passenger										
Heavy Jet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
Narrow Body Jet	2.2%	36.2%	22.4%	39.1%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Regional Jet	88.2%	11.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Cargo										
Heavy Jet	0.0%	0.0%	32.8%	56.2%	0.0%	0.0%	11.0%	0.0%	0.0%	100.0%
Prop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
General Aviation										
Jet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Turboprop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Prop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 44 Alternative 2: 2037 Proposed Action Daytime Stage Length Distribution

Operator Category	1	2	3	4	5	6	7	8	9	Total
Passenger										
Heavy Jet	0.0%	6.6%	0.0%	2.1%	0.0%	41.2%	50.1%	0.0%	0.0%	100.0%
Narrow Body Jet	3.8%	52.7%	15.4%	28.1%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Regional Jet	74.7%	21.2%	4.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Cargo										
Heavy Jet	0.0%	13.7%	30.6%	21.0%	0.0%	27.1%	7.6%	0.0%	0.0%	100.0%
Prop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
General Aviation										
Jet	57.7%	0.0%	0.0%	42.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Turboprop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Prop	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Table 45 Alternative 2: 2037 Proposed Action Nighttime Stage Length Distribution

Operator Category	1	2	3	4	5	6	7	8	9	Total
Passenger										
Heavy Jet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
Narrow Body Jet	3.6%	33.0%	21.4%	42.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Regional Jet	88.9%	11.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Cargo										
Heavy Jet	0.0%	0.0%	28.9%	59.5%	0.0%	0.0%	11.6%	0.0%	0.0%	100.0%
Prop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
General Aviation										
Jet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Turboprop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Prop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Note: Totals may not sum due to rounding.
Source: L&B Analysis, 2023.

Appendix A

Table A-1 Arrival and Departure Flight Track Utilization

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
A	16C	16CA2A	1.57%	1.78%	--	Jet, Turbo
A	16C	16CA2A1	0.52%	2.07%	--	Jet, Turbo
A	16C	16CA2A2	0.71%	0.36%	--	Jet, Turbo
A	16C	16CA2A3	0.43%	0.06%	--	Jet, Turbo
A	16C	16CA2A4	0.34%	0.59%	--	Jet, Turbo
A	16C	16CA2B	4.67%	3.55%	--	Jet, Turbo
A	16C	16CA2B1	1.09%	2.61%	--	Jet, Turbo
A	16C	16CA2B2	1.09%	2.61%	--	Jet, Turbo
A	16C	16CA2B3	0.41%	2.43%	--	Jet, Turbo
A	16C	16CA2B4	0.52%	2.37%	--	Jet, Turbo
A	16C	16CA2C	0.40%	0.18%	--	Jet, Turbo
A	16C	16CA2C1	0.29%	0.53%	--	Jet, Turbo
A	16C	16CA2C2	0.09%	0.30%	--	Jet, Turbo
A	16C	16CA2C3	0.11%	0.41%	--	Jet, Turbo
A	16C	16CA2C4	0.02%	0.30%	--	Jet, Turbo
A	16C	16CA3A	2.09%	1.54%	--	Jet, Turbo
A	16C	16CA3A1	0.71%	1.78%	--	Jet, Turbo
A	16C	16CA3A2	1.65%	1.78%	--	Jet, Turbo
A	16C	16CA3A3	0.24%	1.48%	--	Jet, Turbo
A	16C	16CA3A4	0.71%	0.59%	--	Jet, Turbo
A	16C	16CA3B	4.72%	5.33%	--	Jet, Turbo
A	16C	16CA3B1	2.78%	5.92%	--	Jet, Turbo
A	16C	16CA3B2	2.78%	2.96%	--	Jet, Turbo
A	16C	16CA3B3	0.90%	2.96%	--	Jet, Turbo
A	16C	16CA3B4	0.52%	1.48%	--	Jet, Turbo
A	16C	16CA3C	2.37%	2.13%	--	Jet, Turbo
A	16C	16CA3C1	0.71%	0.59%	--	Jet, Turbo
A	16C	16CA3C2	1.47%	1.78%	--	Jet, Turbo
A	16C	16CA3C3	0.15%	0.59%	--	Jet, Turbo
A	16C	16CA3C4	0.24%	0.87%	--	Jet, Turbo
A	16C	16CA3D	0.75%	--	--	Jet Only
A	16C	16CA3D1	0.38%	--	--	Jet Only
A	16C	16CA3D2	0.38%	--	--	Jet Only
A	16C	16CA3D3	0.38%	--	--	Jet Only
A	16C	16CA3D4	0.38%	--	--	Jet Only
A	16C	16CA4A	6.57%	5.91%	--	Jet, Turbo
A	16C	16CA4A1	5.61%	3.55%	--	Jet, Turbo
A	16C	16CA4A2	5.61%	3.55%	--	Jet, Turbo
A	16C	16CA4A3	5.04%	2.37%	--	Jet, Turbo
A	16C	16CA4A4	5.04%	4.74%	--	Jet, Turbo
A	16C	16CA4A5	4.67%	2.37%	--	Jet, Turbo
A	16C	16CA4A6	4.67%	4.74%	--	Jet, Turbo
A	16C	16CA4A7	1.65%	2.37%	--	Jet, Turbo
A	16C	16CA4A8	1.65%	1.18%	--	Jet, Turbo
A	16C	16CA4B	0.54%	0.31%	--	Jet, Turbo
A	16C	16CA4B1	0.09%	0.14%	--	Jet, Turbo
A	16C	16CA4B2	0.09%	0.14%	--	Jet, Turbo
A	16C	16CA4B3	0.04%	0.09%	--	Jet, Turbo
A	16C	16CA4B4	0.04%	0.09%	--	Jet, Turbo
A	16C	16CA4B5	0.02%	0.05%	--	Jet, Turbo

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
A	16C	16CA4B6	0.02%	0.05%	--	Jet, Turbo
A	16C	16CA4B7	0.04%	0.02%	--	Jet, Turbo
A	16C	16CA4B8	0.04%	0.02%	--	Jet, Turbo
A	16C	16CA5A	7.49%	4.73%	--	Jet, Turbo
A	16C	16CA5A1	1.28%	2.37%	--	Jet, Turbo
A	16C	16CA5A2	5.61%	3.55%	--	Jet, Turbo
A	16C	16CA5A3	0.52%	1.78%	--	Jet, Turbo
A	16C	16CA5A4	5.61%	1.78%	--	Jet, Turbo
A	16C	16CA5A5	0.09%	0.89%	--	Jet, Turbo
A	16C	16CA5A6	0.90%	0.89%	--	Jet, Turbo
A	16C	16CA5A7	0.05%	0.18%	--	Jet, Turbo
A	16C	16CA5A8	0.43%	0.18%	--	Jet, Turbo
A	16C	16CA5B	--	--	--	Not In Use
A	16C	16CA5B1	--	--	--	Not In Use
A	16C	16CA5B2	--	--	--	Not In Use
A	16C	16CA5B3	--	--	--	Not In Use
A	16C	16CA5B4	--	--	--	Not In Use
A	16C	16CA5B5	--	--	--	Not In Use
A	16C	16CA5B6	--	--	--	Not In Use
A	16C	16CA5B7	--	--	--	Not In Use
A	16C	16CA5B8	--	--	--	Not In Use
A	16C	16CA6A	--	--	67.74%	Prop Only
A	16C	16CA6A1	--	--	16.13%	Prop Only
A	16C	16CA6A2	--	--	16.13%	Prop Only
A	16L	16LA2A	1.57%	1.78%	--	Jet, Turbo
A	16L	16LA2A1	0.52%	2.07%	--	Jet, Turbo
A	16L	16LA2A2	0.71%	0.36%	--	Jet, Turbo
A	16L	16LA2A3	0.43%	0.06%	--	Jet, Turbo
A	16L	16LA2A4	0.34%	0.59%	--	Jet, Turbo
A	16L	16LA2B	4.67%	3.55%	--	Jet, Turbo
A	16L	16LA2B1	1.09%	2.61%	--	Jet, Turbo
A	16L	16LA2B2	1.09%	2.61%	--	Jet, Turbo
A	16L	16LA2B3	0.41%	2.43%	--	Jet, Turbo
A	16L	16LA2B4	0.52%	2.37%	--	Jet, Turbo
A	16L	16LA2C	0.40%	0.18%	--	Jet, Turbo
A	16L	16LA2C1	0.29%	0.53%	--	Jet, Turbo
A	16L	16LA2C2	0.09%	0.30%	--	Jet, Turbo
A	16L	16LA2C3	0.11%	0.41%	--	Jet, Turbo
A	16L	16LA2C4	0.02%	0.30%	--	Jet, Turbo
A	16L	16LA3A	2.09%	1.54%	50.00%	Jet, Turbo, Prop
A	16L	16LA3A1	0.71%	1.78%	20.00%	Jet, Turbo, Prop
A	16L	16LA3A2	1.65%	1.78%	20.00%	Jet, Turbo, Prop
A	16L	16LA3A3	0.24%	1.48%	10.00%	Jet, Turbo, Prop
A	16L	16LA3A4	0.71%	0.59%	10.00%	Jet, Turbo, Prop
A	16L	16LA3B	4.72%	5.33%	--	Jet, Turbo
A	16L	16LA3B1	2.78%	5.92%	--	Jet, Turbo
A	16L	16LA3B2	2.78%	2.96%	--	Jet, Turbo
A	16L	16LA3B3	0.90%	2.96%	--	Jet, Turbo
A	16L	16LA3B4	0.52%	1.48%	--	Jet, Turbo
A	16L	16LA3C	2.37%	2.13%	--	Jet, Turbo
A	16L	16LA3C1	0.71%	0.59%	--	Jet, Turbo
A	16L	16LA3C2	1.47%	1.78%	--	Jet, Turbo
A	16L	16LA3C3	0.15%	0.59%	--	Jet, Turbo
A	16L	16LA3C4	0.24%	0.87%	--	Jet, Turbo

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
A	16L	16LA3D	0.75%		--	Jet Only
A	16L	16LA3D1	0.38%		--	Jet Only
A	16L	16LA3D2	0.38%		--	Jet Only
A	16L	16LA3D3	0.38%		--	Jet Only
A	16L	16LA3D4	0.38%		--	Jet Only
A	16L	16LA4A	6.57%	5.91%	--	Jet, Turbo
A	16L	16LA4A1	5.61%	3.55%	--	Jet, Turbo
A	16L	16LA4A2	5.61%	3.55%	--	Jet, Turbo
A	16L	16LA4A3	5.04%	2.37%	--	Jet, Turbo
A	16L	16LA4A4	5.04%	4.74%	--	Jet, Turbo
A	16L	16LA4A5	4.67%	2.37%	--	Jet, Turbo
A	16L	16LA4A6	4.67%	4.74%	--	Jet, Turbo
A	16L	16LA4A7	1.65%	2.37%	--	Jet, Turbo
A	16L	16LA4A8	1.65%	1.18%	--	Jet, Turbo
A	16L	16LA4B	0.54%	0.31%	--	Jet, Turbo
A	16L	16LA4B1	0.09%	0.14%	--	Jet, Turbo
A	16L	16LA4B2	0.09%	0.14%	--	Jet, Turbo
A	16L	16LA4B3	0.04%	0.09%	--	Jet, Turbo
A	16L	16LA4B4	0.04%	0.09%	--	Jet, Turbo
A	16L	16LA4B5	0.02%	0.05%	--	Jet, Turbo
A	16L	16LA4B6	0.02%	0.05%	--	Jet, Turbo
A	16L	16LA4B7	0.04%	0.02%	--	Jet, Turbo
A	16L	16LA4B8	0.04%	0.02%	--	Jet, Turbo
A	16L	16LA5A	7.49%	4.73%	--	Jet, Turbo
A	16L	16LA5A1	1.28%	2.37%	--	Jet, Turbo
A	16L	16LA5A2	5.61%	3.55%	--	Jet, Turbo
A	16L	16LA5A3	0.52%	1.78%	--	Jet, Turbo
A	16L	16LA5A4	5.61%	1.78%	--	Jet, Turbo
A	16L	16LA5A5	0.09%	0.89%	--	Jet, Turbo
A	16L	16LA5A6	0.90%	0.89%	--	Jet, Turbo
A	16L	16LA5A7	0.05%	0.18%	--	Jet, Turbo
A	16L	16LA5A8	0.43%	0.18%	--	Jet, Turbo
A	16L	16LA5B	--	--	--	Not In Use
A	16L	16LA5B1	--	--	--	Not In Use
A	16L	16LA5B2	--	--	--	Not In Use
A	16L	16LA5B3	--	--	--	Not In Use
A	16L	16LA5B4	--	--	--	Not In Use
A	16L	16LA5B5	--	--	--	Not In Use
A	16L	16LA5B6	--	--	--	Not In Use
A	16L	16LA5B7	--	--	--	Not In Use
A	16L	16LA5B8	--	--	--	Not In Use
A	16R	16RA2A	1.62%	1.78%	12.10%	Jet, Turbo, Prop
A	16R	16RA2A1	0.56%	2.07%	5.10%	Jet, Turbo, Prop
A	16R	16RA2A2	0.75%	0.36%	5.10%	Jet, Turbo, Prop
A	16R	16RA2A3	0.47%	0.06%	3.18%	Jet, Turbo, Prop
A	16R	16RA2A4	0.38%	0.59%	3.18%	Jet, Turbo, Prop
A	16R	16RA2B	4.71%	3.55%	--	Jet, Turbo
A	16R	16RA2B1	1.13%	2.61%	--	Jet, Turbo
A	16R	16RA2B2	1.13%	2.61%	--	Jet, Turbo
A	16R	16RA2B3	0.45%	2.43%	--	Jet, Turbo
A	16R	16RA2B4	0.56%	2.37%	--	Jet, Turbo
A	16R	16RA2C	0.44%	0.18%	--	Jet, Turbo
A	16R	16RA2C1	0.33%	0.53%	--	Jet, Turbo
A	16R	16RA2C2	0.13%	0.30%	--	Jet, Turbo

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
A	16R	16RA2C3	0.15%	0.41%	--	Jet, Turbo
A	16R	16RA2C4	0.06%	0.30%	--	Jet, Turbo
A	16R	16RA3A	2.14%	1.54%	6.37%	Jet, Turbo, Prop
A	16R	16RA3A1	0.75%	1.78%	5.10%	Jet, Turbo, Prop
A	16R	16RA3A2	1.69%	1.78%	5.10%	Jet, Turbo, Prop
A	16R	16RA3A3	0.28%	1.48%	1.91%	Jet, Turbo, Prop
A	16R	16RA3A4	0.75%	0.59%	1.91%	Jet, Turbo, Prop
A	16R	16RA3B	4.76%	5.33%	--	Jet, Turbo
A	16R	16RA3B1	2.82%	5.92%	--	Jet, Turbo
A	16R	16RA3B2	2.82%	2.96%	--	Jet, Turbo
A	16R	16RA3B3	0.94%	2.96%	--	Jet, Turbo
A	16R	16RA3B4	0.56%	1.48%	--	Jet, Turbo
A	16R	16RA3C	2.41%	2.13%	--	Jet, Turbo
A	16R	16RA3C1	0.75%	0.59%	--	Jet, Turbo
A	16R	16RA3C2	1.51%	1.78%	--	Jet, Turbo
A	16R	16RA3C3	0.19%	0.59%	--	Jet, Turbo
A	16R	16RA3C4	0.28%	0.87%	--	Jet, Turbo
A	16R	16RA4A	6.61%	5.91%	5.73%	Jet, Turbo, Prop
A	16R	16RA4A1	5.65%	3.55%	1.27%	Jet, Turbo, Prop
A	16R	16RA4A2	5.65%	3.55%	1.27%	Jet, Turbo, Prop
A	16R	16RA4A3	5.08%	2.37%	--	Jet, Turbo
A	16R	16RA4A4	5.08%	4.74%	--	Jet, Turbo
A	16R	16RA4A5	4.71%	2.37%	--	Jet, Turbo
A	16R	16RA4A6	4.71%	4.74%	--	Jet, Turbo
A	16R	16RA4A7	1.69%	2.37%	--	Jet, Turbo
A	16R	16RA4A8	1.69%	1.18%	--	Jet, Turbo
A	16R	16RA4B	0.58%	0.31%	--	Jet, Turbo
A	16R	16RA4B1	0.13%	0.14%	--	Jet, Turbo
A	16R	16RA4B2	0.13%	0.14%	--	Jet, Turbo
A	16R	16RA4B3	0.08%	0.09%	--	Jet, Turbo
A	16R	16RA4B4	0.08%	0.09%	--	Jet, Turbo
A	16R	16RA4B5	0.07%	0.05%	--	Jet, Turbo
A	16R	16RA4B6	0.07%	0.05%	--	Jet, Turbo
A	16R	16RA4B7	0.04%	0.02%	--	Jet, Turbo
A	16R	16RA4B8	0.04%	0.02%	--	Jet, Turbo
A	16R	16RA5A	7.53%	4.73%	--	Jet, Turbo
A	16R	16RA5A1	1.32%	2.37%	--	Jet, Turbo
A	16R	16RA5A2	5.65%	3.55%	--	Jet, Turbo
A	16R	16RA5A3	0.56%	1.78%	--	Jet, Turbo
A	16R	16RA5A4	5.65%	1.78%	--	Jet, Turbo
A	16R	16RA5A5	0.13%	0.89%	--	Jet, Turbo
A	16R	16RA5A6	0.94%	0.89%	--	Jet, Turbo
A	16R	16RA5A7	0.09%	0.18%	--	Jet, Turbo
A	16R	16RA5A8	0.47%	0.18%	--	Jet, Turbo
A	16R	16RA5B	--	--	--	Not In Use
A	16R	16RA5B1	--	--	--	Not In Use
A	16R	16RA5B2	--	--	--	Not In Use
A	16R	16RA5B3	--	--	--	Not In Use
A	16R	16RA5B4	--	--	--	Not In Use
A	16R	16RA5B5	--	--	--	Not In Use
A	16R	16RA5B6	--	--	--	Not In Use
A	16R	16RA5B7	--	--	--	Not In Use
A	16R	16RA5B8	--	--	--	Not In Use
A	16R	16RA6A	--	--	28.66%	Prop Only

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
A	16R	16RA6A1	--	--	7.01%	Prop Only
A	16R	16RA6A2	--	--	7.01%	Prop Only
A	34C	34CA2A	1.60%	0.97%	2.82%	Jet, Turbo, Prop
A	34C	34CA2A1	1.89%	1.36%	1.79%	Jet, Turbo, Prop
A	34C	34CA2A2	0.81%	0.58%	1.79%	Jet, Turbo, Prop
A	34C	34CA2A3	1.89%	1.36%	0.46%	Jet, Turbo, Prop
A	34C	34CA2A4	0.81%	0.58%	0.46%	Jet, Turbo, Prop
A	34C	34CA2B	4.29%	2.73%	--	Jet, Turbo
A	34C	34CA2B1	2.71%	1.95%	--	Jet, Turbo
A	34C	34CA2B2	2.71%	1.95%	--	Jet, Turbo
A	34C	34CA2B3	2.17%	1.56%	--	Jet, Turbo
A	34C	34CA2B4	2.17%	1.56%	--	Jet, Turbo
A	34C	34CA2C	--	--	--	Not In Use
A	34C	34CA2C1	--	--	--	Not In Use
A	34C	34CA2C2	--	--	--	Not In Use
A	34C	34CA2C3	--	--	--	Not In Use
A	34C	34CA2C4	--	--	--	Not In Use
A	34C	34CA2D	1.60%	0.97%	--	Jet, Turbo
A	34C	34CA2D1	0.81%	0.58%	--	Jet, Turbo
A	34C	34CA2D2	1.89%	1.36%	--	Jet, Turbo
A	34C	34CA2D3	0.81%	0.58%	--	Jet, Turbo
A	34C	34CA2D4	1.89%	1.36%	--	Jet, Turbo
A	34C	34CA3A	14.17%	11.61%	2.82%	Jet, Turbo, Prop
A	34C	34CA3A1	8.86%	7.23%	1.79%	Jet, Turbo, Prop
A	34C	34CA3A2	8.86%	7.23%	1.79%	Jet, Turbo, Prop
A	34C	34CA3A3	2.29%	1.87%	0.46%	Jet, Turbo, Prop
A	34C	34CA3A4	2.29%	1.87%	0.46%	Jet, Turbo, Prop
A	34C	34CA3B	0.94%	0.89%	--	Jet, Turbo
A	34C	34CA3B1	0.94%	0.89%	--	Jet, Turbo
A	34C	34CA3B2	0.94%	0.89%	--	Jet, Turbo
A	34C	34CA3B3	0.94%	0.89%	--	Jet, Turbo
A	34C	34CA3B4	0.94%	0.89%	--	Jet, Turbo
A	34C	34CA3C	--	--	--	Not In Use
A	34C	34CA3C1	--	--	--	Not In Use
A	34C	34CA3C2	--	--	--	Not In Use
A	34C	34CA3C3	--	--	--	Not In Use
A	34C	34CA3C4	--	--	--	Not In Use
A	34C	34CA4A	4.21%	5.50%	7.58%	Jet, Turbo, Prop
A	34C	34CA4A1	4.21%	5.50%	6.52%	Jet, Turbo, Prop
A	34C	34CA4A2	3.19%	4.34%	6.52%	Jet, Turbo, Prop
A	34C	34CA4A3	3.19%	4.34%	4.13%	Jet, Turbo, Prop
A	34C	34CA4A4	1.85%	2.89%	4.13%	Jet, Turbo, Prop
A	34C	34CA4A5	1.85%	2.89%	1.95%	Jet, Turbo, Prop
A	34C	34CA4A6	0.82%	1.45%	1.95%	Jet, Turbo, Prop
A	34C	34CA4A7	0.82%	1.45%	0.68%	Jet, Turbo, Prop
A	34C	34CA4A8	0.41%	0.58%	0.68%	Jet, Turbo, Prop
A	34C	34CA5A	1.95%	3.82%	--	Jet, Turbo
A	34C	34CA5A1	1.23%	3.30%	--	Jet, Turbo
A	34C	34CA5A2	2.25%	3.30%	--	Jet, Turbo
A	34C	34CA5A3	0.61%	2.08%	--	Jet, Turbo
A	34C	34CA5A4	1.95%	2.08%	--	Jet, Turbo
A	34C	34CA5A5	0.20%	0.87%	--	Jet, Turbo
A	34C	34CA5A6	1.23%	0.87%	--	Jet, Turbo
A	34C	34CA5A7	0.20%	0.35%	--	Jet, Turbo

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
A	34C	34CA5A8	0.61%	0.17%	--	Jet, Turbo
A	34C	34CA5B	--	0.17%	--	Turbo Only
A	34C	34CA5B1	--	0.17%	--	Turbo Only
A	34C	34CA5B2	--	0.17%	--	Turbo Only
A	34C	34CA5C	--	--	--	Not In Use
A	34C	34CA5C1	--	--	--	Not In Use
A	34C	34CA5C2	--	--	--	Not In Use
A	34C	34CA5C3	--	--	--	Not In Use
A	34C	34CA5C4	--	--	--	Not In Use
A	34C	34CA5C5	--	--	--	Not In Use
A	34C	34CA5C6	--	--	--	Not In Use
A	34C	34CA5C7	--	--	--	Not In Use
A	34C	34CA5C8	--	--	--	Not In Use
A	34C	34CA6P	--	--	34.70%	Prop Only
A	34C	34CA6P1	--	--	8.26%	Prop Only
A	34C	34CA6P2	--	--	8.26%	Prop Only
A	34L	34LA2A	1.60%	0.97%	2.82%	Jet, Turbo, Prop
A	34L	34LA2A1	1.89%	1.36%	1.79%	Jet, Turbo, Prop
A	34L	34LA2A2	0.81%	0.58%	1.79%	Jet, Turbo, Prop
A	34L	34LA2A3	1.89%	1.36%	0.46%	Jet, Turbo, Prop
A	34L	34LA2A4	0.81%	0.58%	0.46%	Jet, Turbo, Prop
A	34L	34LA2B	4.29%	2.73%	--	Jet, Turbo
A	34L	34LA2B1	2.71%	1.95%	--	Jet, Turbo
A	34L	34LA2B2	2.71%	1.95%	--	Jet, Turbo
A	34L	34LA2B3	2.17%	1.56%	--	Jet, Turbo
A	34L	34LA2B4	2.17%	1.56%	--	Jet, Turbo
A	34L	34LA2C	--	--	--	Not In Use
A	34L	34LA2C1	--	--	--	Not In Use
A	34L	34LA2C2	--	--	--	Not In Use
A	34L	34LA2C3	--	--	--	Not In Use
A	34L	34LA2C4	--	--	--	Not In Use
A	34L	34LA2D	1.60%	0.97%	--	Jet, Turbo
A	34L	34LA2D1	0.81%	0.58%	--	Jet, Turbo
A	34L	34LA2D2	1.89%	1.36%	--	Jet, Turbo
A	34L	34LA2D3	0.81%	0.58%	--	Jet, Turbo
A	34L	34LA2D4	1.89%	1.36%	--	Jet, Turbo
A	34L	34LA3A	14.17%	11.61%	2.82%	Jet, Turbo, Prop
A	34L	34LA3A1	8.86%	7.23%	1.79%	Jet, Turbo, Prop
A	34L	34LA3A2	8.86%	7.23%	1.79%	Jet, Turbo, Prop
A	34L	34LA3A3	2.29%	1.87%	0.46%	Jet, Turbo, Prop
A	34L	34LA3A4	2.29%	1.87%	0.46%	Jet, Turbo, Prop
A	34L	34LA3B	0.94%	0.89%	--	Jet, Turbo
A	34L	34LA3B1	0.94%	0.89%	--	Jet, Turbo
A	34L	34LA3B2	0.94%	0.89%	--	Jet, Turbo
A	34L	34LA3B3	0.94%	0.89%	--	Jet, Turbo
A	34L	34LA3B4	0.94%	0.89%	--	Jet, Turbo
A	34L	34LA3C	--	--	--	Not In Use
A	34L	34LA3C1	--	--	--	Not In Use
A	34L	34LA3C2	--	--	--	Not In Use
A	34L	34LA3C3	--	--	--	Not In Use
A	34L	34LA3C4	--	--	--	Not In Use
A	34L	34LA4A	4.21%	5.50%	7.58%	Jet, Turbo, Prop
A	34L	34LA4A1	4.21%	5.50%	6.52%	Jet, Turbo, Prop
A	34L	34LA4A2	3.19%	4.34%	6.52%	Jet, Turbo, Prop

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
A	34L	34LA4A3	3.19%	4.34%	4.13%	Jet, Turbo, Prop
A	34L	34LA4A4	1.85%	2.89%	4.13%	Jet, Turbo, Prop
A	34L	34LA4A5	1.85%	2.89%	1.95%	Jet, Turbo, Prop
A	34L	34LA4A6	0.82%	1.45%	1.95%	Jet, Turbo, Prop
A	34L	34LA4A7	0.82%	1.45%	0.68%	Jet, Turbo, Prop
A	34L	34LA4A8	0.41%	0.58%	0.68%	Jet, Turbo, Prop
A	34L	34LA5A	1.95%	3.82%	--	Jet, Turbo
A	34L	34LA5A1	1.23%	3.30%	--	Jet, Turbo
A	34L	34LA5A2	2.25%	3.30%	--	Jet, Turbo
A	34L	34LA5A3	0.61%	2.08%	--	Jet, Turbo
A	34L	34LA5A4	1.95%	2.08%	--	Jet, Turbo
A	34L	34LA5A5	0.20%	0.87%	--	Jet, Turbo
A	34L	34LA5A6	1.23%	0.87%	--	Jet, Turbo
A	34L	34LA5A7	0.20%	0.35%	--	Jet, Turbo
A	34L	34LA5A8	0.61%	0.17%	--	Jet, Turbo
A	34L	34LA5B	--	0.17%	--	Turbo Only
A	34L	34LA5B1	--	0.17%	--	Turbo Only
A	34L	34LA5B2	--	0.17%	--	Turbo Only
A	34L	34LA5C	--	--	--	Not In Use
A	34L	34LA5C1	--	--	--	Not In Use
A	34L	34LA5C2	--	--	--	Not In Use
A	34L	34LA5C3	--	--	--	Not In Use
A	34L	34LA5C4	--	--	--	Not In Use
A	34L	34LA5C5	--	--	--	Not In Use
A	34L	34LA5C6	--	--	--	Not In Use
A	34L	34LA5C7	--	--	--	Not In Use
A	34L	34LA5C8	--	--	--	Not In Use
A	34L	34LA6P	--	--	34.70%	Prop Only
A	34L	34LA6P1	--	--	8.26%	Prop Only
A	34L	34LA6P2	--	--	8.26%	Prop Only
A	34R	34RA2A	1.60%	0.97%	3.51%	Jet, Turbo, Prop
A	34R	34RA2A1	1.89%	1.36%	2.22%	Jet, Turbo, Prop
A	34R	34RA2A2	0.81%	0.58%	2.22%	Jet, Turbo, Prop
A	34R	34RA2A3	1.89%	1.36%	0.57%	Jet, Turbo, Prop
A	34R	34RA2A4	0.81%	0.58%	0.57%	Jet, Turbo, Prop
A	34R	34RA2B	4.29%	2.73%	--	Jet, Turbo
A	34R	34RA2B1	2.71%	1.95%	--	Jet, Turbo
A	34R	34RA2B2	2.71%	1.95%	--	Jet, Turbo
A	34R	34RA2B3	2.17%	1.56%	--	Jet, Turbo
A	34R	34RA2B4	2.17%	1.56%	--	Jet, Turbo
A	34R	34RA2C	--	--	--	Not In Use
A	34R	34RA2C1	--	--	--	Not In Use
A	34R	34RA2C2	--	--	--	Not In Use
A	34R	34RA2C3	--	--	--	Not In Use
A	34R	34RA2C4	--	--	--	Not In Use
A	34R	34RA2D	1.60%	0.97%	--	Jet, Turbo
A	34R	34RA2D1	0.81%	0.58%	--	Jet, Turbo
A	34R	34RA2D2	1.89%	1.36%	--	Jet, Turbo
A	34R	34RA2D3	0.81%	0.58%	--	Jet, Turbo
A	34R	34RA2D4	1.89%	1.36%	--	Jet, Turbo
A	34R	34RA3A	14.17%	11.61%	3.51%	Jet, Turbo, Prop
A	34R	34RA3A1	8.86%	7.23%	2.22%	Jet, Turbo, Prop
A	34R	34RA3A2	8.86%	7.23%	2.22%	Jet, Turbo, Prop
A	34R	34RA3A3	2.29%	1.87%	0.57%	Jet, Turbo, Prop

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
A	34R	34RA3A4	2.29%	1.87%	0.57%	Jet, Turbo, Prop
A	34R	34RA3B	0.94%	0.89%	--	Jet, Turbo
A	34R	34RA3B1	0.94%	0.89%	--	Jet, Turbo
A	34R	34RA3B2	0.94%	0.89%	--	Jet, Turbo
A	34R	34RA3B3	0.94%	0.89%	--	Jet, Turbo
A	34R	34RA3B4	0.94%	0.89%	--	Jet, Turbo
A	34R	34RA3C	--	--	--	Not In Use
A	34R	34RA3C1	--	--	--	Not In Use
A	34R	34RA3C2	--	--	--	Not In Use
A	34R	34RA3C3	--	--	--	Not In Use
A	34R	34RA3C4	--	--	--	Not In Use
A	34R	34RA4A	4.21%	5.50%	18.16%	Jet, Turbo, Prop
A	34R	34RA4A1	4.21%	5.50%	15.63%	Jet, Turbo, Prop
A	34R	34RA4A2	3.19%	4.34%	15.63%	Jet, Turbo, Prop
A	34R	34RA4A3	3.19%	4.34%	9.90%	Jet, Turbo, Prop
A	34R	34RA4A4	1.85%	2.89%	9.90%	Jet, Turbo, Prop
A	34R	34RA4A5	1.85%	2.89%	4.66%	Jet, Turbo, Prop
A	34R	34RA4A6	0.82%	1.45%	4.66%	Jet, Turbo, Prop
A	34R	34RA4A7	0.82%	1.45%	1.64%	Jet, Turbo, Prop
A	34R	34RA4A8	0.41%	0.58%	1.64%	Jet, Turbo, Prop
A	34R	34RA5A	1.95%	3.82%	--	Jet, Turbo
A	34R	34RA5A1	1.23%	3.30%	--	Jet, Turbo
A	34R	34RA5A2	2.25%	3.30%	--	Jet, Turbo
A	34R	34RA5A3	0.61%	2.08%	--	Jet, Turbo
A	34R	34RA5A4	1.95%	2.08%	--	Jet, Turbo
A	34R	34RA5A5	0.20%	0.87%	--	Jet, Turbo
A	34R	34RA5A6	1.23%	0.87%	--	Jet, Turbo
A	34R	34RA5A7	0.20%	0.35%	--	Jet, Turbo
A	34R	34RA5A8	0.61%	0.17%	--	Jet, Turbo
A	34R	34RA5B	--	0.17%	--	Turbo Only
A	34R	34RA5B1	--	0.17%	--	Turbo Only
A	34R	34RA5B2	--	0.17%	--	Turbo Only
A	34R	34RA5C	--	--	--	Not In Use
A	34R	34RA5C1	--	--	--	Not In Use
A	34R	34RA5C2	--	--	--	Not In Use
A	34R	34RA5C3	--	--	--	Not In Use
A	34R	34RA5C4	--	--	--	Not In Use
A	34R	34RA5C5	--	--	--	Not In Use
A	34R	34RA5C6	--	--	--	Not In Use
A	34R	34RA5C7	--	--	--	Not In Use
A	34R	34RA5C8	--	--	--	Not In Use
D	16C	16CD1A	6.52%	--	--	Jet Only
D	16C	16CD1A1	0.84%	--	--	Jet Only
D	16C	16CD1A2	0.84%	--	--	Jet Only
D	16C	16CD1A3	0.21%	--	--	Jet Only
D	16C	16CD1A4	0.21%	--	--	Jet Only
D	16C	16CD1B	2.99%	--	--	Jet Only
D	16C	16CD1B1	0.42%	--	--	Jet Only
D	16C	16CD1B2	0.42%	--	--	Jet Only
D	16C	16CD1B3	0.21%	--	--	Jet Only
D	16C	16CD1B4	0.21%	--	--	Jet Only
D	16C	16CD1C	0.00%	10.75%	--	Jet, Turbo
D	16C	16CD1C1	0.00%	2.37%	--	Jet, Turbo
D	16C	16CD1C2	0.00%	3.95%	--	Jet, Turbo

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
D	16C	16CD1C3	0.00%	7.91%	--	Jet, Turbo
D	16C	16CD1C4	0.00%	2.37%	--	Jet, Turbo
D	16C	16CD1D	10.53%	1.98%	--	Jet, Turbo
D	16C	16CD1D1	4.21%	--	--	Jet Only
D	16C	16CD1D2	4.21%	--	--	Jet Only
D	16C	16CD1D3	2.10%	--	--	Jet Only
D	16C	16CD1D4	2.10%	--	--	Jet Only
D	16C	16CD2A	1.09%	--	--	Jet Only
D	16C	16CD2A1	0.84%	--	--	Jet Only
D	16C	16CD2A2	0.84%	--	--	Jet Only
D	16C	16CD2A3	0.21%	--	--	Jet Only
D	16C	16CD2A4	0.21%	--	--	Jet Only
D	16C	16CD2B	1.25%	--	--	Jet Only
D	16C	16CD2B1	0.53%	--	--	Jet Only
D	16C	16CD2B2	0.53%	--	--	Jet Only
D	16C	16CD2B3	0.32%	--	--	Jet Only
D	16C	16CD2B4	0.32%	--	--	Jet Only
D	16C	16CD2C	0.42%	--	--	Jet Only
D	16C	16CD2C1	0.32%	--	--	Jet Only
D	16C	16CD2C2	0.11%	--	--	Jet Only
D	16C	16CD2C3	0.32%	--	--	Jet Only
D	16C	16CD2C4	0.11%	--	--	Jet Only
D	16C	16CD2D	13.05%	--	--	Jet Only
D	16C	16CD2D1	6.40%	--	--	Jet Only
D	16C	16CD2D2	2.10%	--	--	Jet Only
D	16C	16CD2D3	6.40%	--	--	Jet Only
D	16C	16CD2D4	2.10%	--	--	Jet Only
D	16C	16CD3A	11.11%	--	--	Jet Only
D	16C	16CD3A1	0.63%	--	--	Jet Only
D	16C	16CD3A2	0.63%	--	--	Jet Only
D	16C	16CD3A3	0.21%	--	--	Jet Only
D	16C	16CD3A4	0.21%	--	--	Jet Only
D	16C	16CD3B	8.42%	--	--	Jet Only
D	16C	16CD3B1	0.21%	--	--	Jet Only
D	16C	16CD3B2	2.53%	--	--	Jet Only
D	16C	16CD3B3	0.21%	--	--	Jet Only
D	16C	16CD3B4	0.84%	--	--	Jet Only
D	16C	16CD4A	--	7.92%	--	Turbo Only
D	16C	16CD4A1	--	2.57%	--	Turbo Only
D	16C	16CD4A2	--	2.57%	--	Turbo Only
D	16C	16CD4A3	--	1.98%	--	Turbo Only
D	16C	16CD4A4	--	1.98%	--	Turbo Only
D	16C	16CD4B	--	14.68%	--	Turbo Only
D	16C	16CD4B1	--	0.79%	--	Turbo Only
D	16C	16CD4B2	--	2.57%	--	Turbo Only
D	16C	16CD4B3	--	0.40%	--	Turbo Only
D	16C	16CD4B4	--	0.79%	--	Turbo Only
D	16C	16CD4C	0.54%	--	--	Jet Only
D	16C	16CD4C1	0.21%	--	--	Jet Only
D	16C	16CD4C2	0.42%	--	--	Jet Only
D	16C	16CD4C3	0.08%	--	--	Jet Only
D	16C	16CD4C4	0.27%	--	--	Jet Only
D	16C	16CD4D	--	6.42%	8.75%	Turbo, Prop
D	16C	16CD4D1	--	2.47%	2.50%	Turbo, Prop

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
D	16C	16CD4D2	--	1.48%	2.50%	Turbo, Prop
D	16C	16CD4D3	--	2.47%	10.00%	Turbo, Prop
D	16C	16CD4D4	--	1.48%	10.00%	Turbo, Prop
D	16C	16CD4E	--	2.43%	--	Turbo Only
D	16C	16CD4E1	--	1.48%	--	Turbo Only
D	16C	16CD4E2	--	1.48%	--	Turbo Only
D	16C	16CD4E3	--	0.99%	--	Turbo Only
D	16C	16CD4E4	--	0.99%	--	Turbo Only
D	16C	16CD4F			35.00%	Prop Only
D	16C	16CD4F1			18.75%	Prop Only
D	16C	16CD4F2			12.50%	Prop Only
D	16C	16CD5A	--	0.47%	--	Turbo Only
D	16C	16CD5A1	--	0.16%	--	Turbo Only
D	16C	16CD5A2	--	0.16%	--	Turbo Only
D	16C	16CD5A3	--	0.10%	--	Turbo Only
D	16C	16CD5A4	--	0.10%	--	Turbo Only
D	16C	16CD5B	--	2.65%	--	Turbo Only
D	16C	16CD5B1	--	1.48%	--	Turbo Only
D	16C	16CD5B2	--	1.48%	--	Turbo Only
D	16C	16CD5B3	--	0.99%	--	Turbo Only
D	16C	16CD5B4	--	0.99%	--	Turbo Only
D	16C	16CD5C	--	1.58%	--	Turbo Only
D	16C	16CD5C1	--	0.79%	--	Turbo Only
D	16C	16CD5C2	--	0.79%	--	Turbo Only
D	16C	16CD5C3	--	0.49%	--	Turbo Only
D	16C	16CD5C4	--	0.49%	--	Turbo Only
D	16L	16LD1A	6.52%	--	--	Jet Only
D	16L	16LD1A1	0.84%	--	--	Jet Only
D	16L	16LD1A2	0.84%	--	--	Jet Only
D	16L	16LD1A3	0.21%	--	--	Jet Only
D	16L	16LD1A4	0.21%	--	--	Jet Only
D	16L	16LD1B	2.99%	--	--	Jet Only
D	16L	16LD1B1	0.42%	--	--	Jet Only
D	16L	16LD1B2	0.42%	--	--	Jet Only
D	16L	16LD1B3	0.21%	--	--	Jet Only
D	16L	16LD1B4	0.21%	--	--	Jet Only
D	16L	16LD1C	--	10.75%	--	Turbo Only
D	16L	16LD1C1	--	2.37%	--	Turbo Only
D	16L	16LD1C2	--	3.95%	--	Turbo Only
D	16L	16LD1C3	--	7.91%	--	Turbo Only
D	16L	16LD1C4	--	2.37%	--	Turbo Only
D	16L	16LD1D	10.53%	1.98%	--	Jet, Turbo
D	16L	16LD1D1	4.21%	--	--	Jet Only
D	16L	16LD1D2	4.21%	--	--	Jet Only
D	16L	16LD1D3	2.10%	--	--	Jet Only
D	16L	16LD1D4	2.10%	--	--	Jet Only
D	16L	16LD2A	1.09%	--	--	Jet Only
D	16L	16LD2A1	0.84%	--	--	Jet Only
D	16L	16LD2A2	0.84%	--	--	Jet Only
D	16L	16LD2A3	0.21%	--	--	Jet Only
D	16L	16LD2A4	0.21%	--	--	Jet Only
D	16L	16LD2B	1.25%	--	--	Jet Only
D	16L	16LD2B1	0.53%	--	--	Jet Only
D	16L	16LD2B2	0.53%	--	--	Jet Only

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
D	16L	16LD2B3	0.32%	--	--	Jet Only
D	16L	16LD2B4	0.32%	--	--	Jet Only
D	16L	16LD2C	0.42%	--	--	Jet Only
D	16L	16LD2C1	0.32%	--	--	Jet Only
D	16L	16LD2C2	0.11%	--	--	Jet Only
D	16L	16LD2C3	0.32%	--	--	Jet Only
D	16L	16LD2C4	0.11%	--	--	Jet Only
D	16L	16LD2D	13.05%	--	--	Jet Only
D	16L	16LD2D1	6.40%	--	--	Jet Only
D	16L	16LD2D2	2.10%	--	--	Jet Only
D	16L	16LD2D3	6.40%	--	--	Jet Only
D	16L	16LD2D4	2.10%	--	--	Jet Only
D	16L	16LD3A	11.11%	--	--	Jet Only
D	16L	16LD3A1	0.63%	--	--	Jet Only
D	16L	16LD3A2	0.63%	--	--	Jet Only
D	16L	16LD3A3	0.21%	--	--	Jet Only
D	16L	16LD3A4	0.21%	--	--	Jet Only
D	16L	16LD3B	8.42%	--	--	Jet Only
D	16L	16LD3B1	0.21%	--	--	Jet Only
D	16L	16LD3B2	2.53%	--	--	Jet Only
D	16L	16LD3B3	0.21%	--	--	Jet Only
D	16L	16LD3B4	0.84%	--	--	Jet Only
D	16L	16LD4A	--	7.92%	--	Turbo Only
D	16L	16LD4A1	--	2.57%	--	Turbo Only
D	16L	16LD4A2	--	2.57%	--	Turbo Only
D	16L	16LD4A3	--	1.98%	--	Turbo Only
D	16L	16LD4A4	--	1.98%	--	Turbo Only
D	16L	16LD4B	--	14.68%	--	Turbo Only
D	16L	16LD4B1	--	0.79%	--	Turbo Only
D	16L	16LD4B2	--	2.57%	--	Turbo Only
D	16L	16LD4B3	--	0.40%	--	Turbo Only
D	16L	16LD4B4	--	0.79%	--	Turbo Only
D	16L	16LD4C	0.54%	--	--	Jet Only
D	16L	16LD4C1	0.21%	--	--	Jet Only
D	16L	16LD4C2	0.42%	--	--	Jet Only
D	16L	16LD4C3	0.08%	--	--	Jet Only
D	16L	16LD4C4	0.27%	--	--	Jet Only
D	16L	16LD4D	--	6.42%	61.45%	Turbo, Prop
D	16L	16LD4D1	--	2.47%	13.25%	Turbo, Prop
D	16L	16LD4D2	--	1.48%	6.02%	Turbo, Prop
D	16L	16LD4D3	--	2.47%	13.25%	Turbo, Prop
D	16L	16LD4D4	--	1.48%	6.02%	Turbo, Prop
D	16L	16LD4E	--	2.43%	--	Turbo Only
D	16L	16LD4E1	--	1.48%	--	Turbo Only
D	16L	16LD4E2	--	1.48%	--	Turbo Only
D	16L	16LD4E3	--	0.99%	--	Turbo Only
D	16L	16LD4E4	--	0.99%	--	Turbo Only
D	16L	16LD5A	--	0.47%	--	Turbo Only
D	16L	16LD5A1	--	0.16%	--	Turbo Only
D	16L	16LD5A2	--	0.16%	--	Turbo Only
D	16L	16LD5A3	--	0.10%	--	Turbo Only
D	16L	16LD5A4	--	0.10%	--	Turbo Only
D	16L	16LD5B	--	2.65%	--	Turbo Only
D	16L	16LD5B1	--	1.48%	--	Turbo Only

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
D	16L	16LD5B2	--	1.48%	--	Turbo Only
D	16L	16LD5B3	--	0.99%	--	Turbo Only
D	16L	16LD5B4	--	0.99%	--	Turbo Only
D	16L	16LD5C	--	1.58%	--	Turbo Only
D	16L	16LD5C1	--	0.79%	--	Turbo Only
D	16L	16LD5C2	--	0.79%	--	Turbo Only
D	16L	16LD5C3	--	0.49%	--	Turbo Only
D	16L	16LD5C4	--	0.49%	--	Turbo Only
D	16R	16RD1A	6.52%	--	--	Jet Only
D	16R	16RD1A1	0.84%	--	--	Jet Only
D	16R	16RD1A2	0.84%	--	--	Jet Only
D	16R	16RD1A3	0.21%	--	--	Jet Only
D	16R	16RD1A4	0.21%	--	--	Jet Only
D	16R	16RD1B	2.99%	--	--	Jet Only
D	16R	16RD1B1	0.42%	--	--	Jet Only
D	16R	16RD1B2	0.42%	--	--	Jet Only
D	16R	16RD1B3	0.21%	--	--	Jet Only
D	16R	16RD1B4	0.21%	--	--	Jet Only
D	16R	16RD1C	--	10.75%	--	Turbo Only
D	16R	16RD1C1	--	2.37%	--	Turbo Only
D	16R	16RD1C2	--	3.95%	--	Turbo Only
D	16R	16RD1C3	--	7.91%	--	Turbo Only
D	16R	16RD1C4	--	2.37%	--	Turbo Only
D	16R	16RD1D	10.53%	1.98%	--	Jet, Turbo
D	16R	16RD1D1	4.21%	--	--	Jet Only
D	16R	16RD1D2	4.21%	--	--	Jet Only
D	16R	16RD1D3	2.10%	--	--	Jet Only
D	16R	16RD1D4	2.10%	--	--	Jet Only
D	16R	16RD2A	1.09%	--	--	Jet Only
D	16R	16RD2A1	0.84%	--	--	Jet Only
D	16R	16RD2A2	0.84%	--	--	Jet Only
D	16R	16RD2A3	0.21%	--	--	Jet Only
D	16R	16RD2A4	0.21%	--	--	Jet Only
D	16R	16RD2B	1.25%	--	--	Jet Only
D	16R	16RD2B1	0.53%	--	--	Jet Only
D	16R	16RD2B2	0.53%	--	--	Jet Only
D	16R	16RD2B3	0.32%	--	--	Jet Only
D	16R	16RD2B4	0.32%	--	--	Jet Only
D	16R	16RD2C	0.42%	--	--	Jet Only
D	16R	16RD2C1	0.32%	--	--	Jet Only
D	16R	16RD2C2	0.11%	--	--	Jet Only
D	16R	16RD2C3	0.32%	--	--	Jet Only
D	16R	16RD2C4	0.11%	--	--	Jet Only
D	16R	16RD2D	13.05%	--	--	Jet Only
D	16R	16RD2D1	6.40%	--	--	Jet Only
D	16R	16RD2D2	2.10%	--	--	Jet Only
D	16R	16RD2D3	6.40%	--	--	Jet Only
D	16R	16RD2D4	2.10%	--	--	Jet Only
D	16R	16RD3A	11.11%	--	--	Jet Only
D	16R	16RD3A1	0.63%	--	--	Jet Only
D	16R	16RD3A2	0.63%	--	--	Jet Only
D	16R	16RD3A3	0.21%	--	--	Jet Only
D	16R	16RD3A4	0.21%	--	--	Jet Only
D	16R	16RD3B	8.42%	--	--	Jet Only

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
D	16R	16RD3B1	0.21%	--	--	Jet Only
D	16R	16RD3B2	2.53%	--	--	Jet Only
D	16R	16RD3B3	0.21%	--	--	Jet Only
D	16R	16RD3B4	0.84%	--	--	Jet Only
D	16R	16RD4A	--	7.92%	--	Turbo Only
D	16R	16RD4A1	--	2.57%	--	Turbo Only
D	16R	16RD4A2	--	2.57%	--	Turbo Only
D	16R	16RD4A3	--	1.98%	--	Turbo Only
D	16R	16RD4A4	--	1.98%	--	Turbo Only
D	16R	16RD4B	--	14.68%	--	Turbo Only
D	16R	16RD4B1	--	0.79%	--	Turbo Only
D	16R	16RD4B2	--	2.57%	--	Turbo Only
D	16R	16RD4B3	--	0.40%	--	Turbo Only
D	16R	16RD4B4	--	0.79%	--	Turbo Only
D	16R	16RD4C	0.54%	--	--	Jet Only
D	16R	16RD4C1	0.21%	--	--	Jet Only
D	16R	16RD4C2	0.42%	--	--	Jet Only
D	16R	16RD4C3	0.08%	--	--	Jet Only
D	16R	16RD4C4	0.27%	--	--	Jet Only
D	16R	16RD4D	--	6.42%	--	Turbo Only
D	16R	16RD4D1	--	2.47%	--	Turbo Only
D	16R	16RD4D2	--	1.48%	--	Turbo Only
D	16R	16RD4D3	--	2.47%	--	Turbo Only
D	16R	16RD4D4	--	1.48%	--	Turbo Only
D	16R	16RD4E	--	2.43%	--	Turbo Only
D	16R	16RD4E1	--	1.48%	--	Turbo Only
D	16R	16RD4E2	--	1.48%	--	Turbo Only
D	16R	16RD4E3	--	0.99%	--	Turbo Only
D	16R	16RD4E4	--	0.99%	--	Turbo Only
D	16R	16RD4F	--	--	42.86%	Prop Only
D	16R	16RD4F1	--	--	28.57%	Prop Only
D	16R	16RD4F2	--	--	28.57%	Prop Only
D	16R	16RD5A	--	0.47%	--	Turbo Only
D	16R	16RD5A1	--	0.16%	--	Turbo Only
D	16R	16RD5A2	--	0.16%	--	Turbo Only
D	16R	16RD5A3	--	0.10%	--	Turbo Only
D	16R	16RD5A4	--	0.10%	--	Turbo Only
D	16R	16RD5B	--	2.65%	--	Turbo Only
D	16R	16RD5B1	--	1.48%	--	Turbo Only
D	16R	16RD5B2	--	1.48%	--	Turbo Only
D	16R	16RD5B3	--	0.99%	--	Turbo Only
D	16R	16RD5B4	--	0.99%	--	Turbo Only
D	16R	16RD5C	--	1.58%	--	Turbo Only
D	16R	16RD5C1	--	0.79%	--	Turbo Only
D	16R	16RD5C2	--	0.79%	--	Turbo Only
D	16R	16RD5C3	--	0.49%	--	Turbo Only
D	16R	16RD5C4	--	0.49%	--	Turbo Only
D	34C	34CD1	1.42%	0.80%	--	Jet, Turbo
D	34C	34CD11	0.71%	0.60%	--	Jet, Turbo
D	34C	34CD12	0.71%	0.60%	--	Jet, Turbo
D	34C	34CD13	0.37%	7.10%	--	Jet, Turbo
D	34C	34CD14	0.39%	7.10%	--	Jet, Turbo
D	34C	34CD2A	12.21%	--	--	Jet Only
D	34C	34CD2A1	0.50%	--	--	Jet Only

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
D	34C	34CD2A2	0.50%	--	--	Jet Only
D	34C	34CD2A3	0.50%	--	--	Jet Only
D	34C	34CD2A4	0.50%	--	--	Jet Only
D	34C	34CD2A5	0.50%	--	--	Jet Only
D	34C	34CD2B	15.00%	--	--	Jet Only
D	34C	34CD2B1	0.37%	--	--	Jet Only
D	34C	34CD2B2	0.37%	--	--	Jet Only
D	34C	34CD2B3	0.35%	--	--	Jet Only
D	34C	34CD2B4	0.35%	--	--	Jet Only
D	34C	34CD2C	1.55%	--	--	Jet Only
D	34C	34CD2C1	0.39%	--	--	Jet Only
D	34C	34CD2C2	0.39%	--	--	Jet Only
D	34C	34CD2C3	0.37%	--	--	Jet Only
D	34C	34CD2C4	0.37%	--	--	Jet Only
D	34C	34CD2CC	2.98%	--	--	Jet Only
D	34C	34CD2D	3.52%	--	--	Jet Only
D	34C	34CD2D1	1.08%	--	--	Jet Only
D	34C	34CD2D2	1.08%	--	--	Jet Only
D	34C	34CD2D3	0.73%	--	--	Jet Only
D	34C	34CD2D4	0.71%	--	--	Jet Only
D	34C	34CD3A	2.55%	--	--	Jet Only
D	34C	34CD3A1	1.40%	--	--	Jet Only
D	34C	34CD3A2	2.55%	--	--	Jet Only
D	34C	34CD3A3	1.40%	--	--	Jet Only
D	34C	34CD3A4	0.90%	--	--	Jet Only
D	34C	34CD3B	7.51%	--	--	Jet Only
D	34C	34CD3B1	2.16%	--	--	Jet Only
D	34C	34CD3B2	2.16%	--	--	Jet Only
D	34C	34CD3B3	1.21%	--	--	Jet Only
D	34C	34CD3B4	1.21%	--	--	Jet Only
D	34C	34CD3C	1.42%	--	--	Jet Only
D	34C	34CD3C1	1.08%	--	--	Jet Only
D	34C	34CD3C2	1.08%	--	--	Jet Only
D	34C	34CD3C3	1.08%	--	--	Jet Only
D	34C	34CD3C4	1.42%	--	--	Jet Only
D	34C	34CD3D	1.75%	--	--	Jet Only
D	34C	34CD3D1	1.75%	--	--	Jet Only
D	34C	34CD3D2	1.75%	--	--	Jet Only
D	34C	34CD3D3	1.75%	--	--	Jet Only
D	34C	34CD3D4	1.75%	--	--	Jet Only
D	34C	34CD3E	1.08%	--	--	Jet Only
D	34C	34CD3E1	1.08%	--	--	Jet Only
D	34C	34CD3E2	1.08%	--	--	Jet Only
D	34C	34CD3E3	1.08%	--	--	Jet Only
D	34C	34CD3E4	1.08%	--	--	Jet Only
D	34C	34CD3F	2.55%	--	--	Jet Only
D	34C	34CD3F1	1.40%	--	--	Jet Only
D	34C	34CD3F2	2.55%	--	--	Jet Only
D	34C	34CD3F3	1.40%	--	--	Jet Only
D	34C	34CD3F4	0.90%	--	--	Jet Only
D	34C	34CD4A	--	--	--	Not In Use
D	34C	34CD4A1	--	--	--	Not In Use
D	34C	34CD4A2	--	--	--	Not In Use
D	34C	34CD4A3	--	--	--	Not In Use

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
D	34C	34CD4A4	--	--	--	Not In Use
D	34C	34CD4AP	--	6.90%	--	Turbo Only
D	34C	34CD4AP1	--	4.50%	--	Turbo Only
D	34C	34CD4AP2	--	6.80%	--	Turbo Only
D	34C	34CD4AP3	--	4.50%	--	Turbo Only
D	34C	34CD4AP4	--	3.30%	--	Turbo Only
D	34C	34CD4AP5	--	3.30%	--	Turbo Only
D	34C	34CD4AP6	--	1.50%	--	Turbo Only
D	34C	34CD4B	--	--	--	Not In Use
D	34C	34CD4B1	--	--	--	Not In Use
D	34C	34CD4B2	--	--	--	Not In Use
D	34C	34CD4B3	--	--	--	Not In Use
D	34C	34CD4B4	--	--	--	Not In Use
D	34C	34CD4BP	--	--	--	Not In Use
D	34C	34CD4BP1	--	--	--	Not In Use
D	34C	34CD4BP2	--	--	--	Not In Use
D	34C	34CD4BP3	--	--	--	Not In Use
D	34C	34CD4BP4	--	--	--	Not In Use
D	34C	34CD4C	--	--	--	Not In Use
D	34C	34CD4C1	--	--	--	Not In Use
D	34C	34CD4C2	--	--	--	Not In Use
D	34C	34CD4C3	--	--	--	Not In Use
D	34C	34CD4C4	--	--	--	Not In Use
D	34C	34CD4CP	--	--	--	Not In Use
D	34C	34CD4CP1	--	--	--	Not In Use
D	34C	34CD4CP2	--	--	--	Not In Use
D	34C	34CD4CP3	--	--	--	Not In Use
D	34C	34CD4CP4	--	--	--	Not In Use
D	34C	34CD5A	--	7.00%	--	Turbo Only
D	34C	34CD5A1	--	5.00%	--	Turbo Only
D	34C	34CD5A2	--	5.00%	--	Turbo Only
D	34C	34CD5A3	--	1.00%	--	Turbo Only
D	34C	34CD5A4	--	1.00%	--	Turbo Only
D	34C	34CD5AP	--	2.20%	--	Turbo Only
D	34C	34CD5AP1	--	1.70%	--	Turbo Only
D	34C	34CD5AP2	--	1.70%	--	Turbo Only
D	34C	34CD5B	--	7.50%	--	Turbo Only
D	34C	34CD5B1	--	4.70%	--	Turbo Only
D	34C	34CD5B2	--	4.70%	--	Turbo Only
D	34C	34CD5B3	--	1.75%	--	Turbo Only
D	34C	34CD5B4	--	1.75%	--	Turbo Only
D	34C	34CD5C	--	3.00%	--	Turbo Only
D	34C	34CD5C1	--	2.00%	--	Turbo Only
D	34C	34CD5C2	--	2.00%	--	Turbo Only
D	34C	34CD5C3	--	0.50%	--	Turbo Only
D	34C	34CD5C4	--	0.50%	--	Turbo Only
D	34C	34CD6P	--	--	34.00%	Prop Only
D	34C	34CD6P1	--	--	33.00%	Prop Only
D	34C	34CD6P2	--	--	33.00%	Prop Only
D	34L	34LD1	1.42%	0.80%	--	Jet, Turbo
D	34L	34LD11	0.71%	0.60%	--	Jet, Turbo
D	34L	34LD12	0.71%	0.60%	--	Jet, Turbo
D	34L	34LD13	0.37%	7.10%	--	Jet, Turbo
D	34L	34LD14	0.39%	7.10%	--	Jet, Turbo

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
D	34L	34LD2A	12.21%	--	--	Jet Only
D	34L	34LD2A1	0.50%	--	--	Jet Only
D	34L	34LD2A2	0.50%	--	--	Jet Only
D	34L	34LD2A3	0.50%	--	--	Jet Only
D	34L	34LD2A4	0.50%	--	--	Jet Only
D	34L	34LD2A5	0.50%	--	--	Jet Only
D	34L	34LD2B	15.00%	--	--	Jet Only
D	34L	34LD2B1	0.37%	--	--	Jet Only
D	34L	34LD2B2	0.37%	--	--	Jet Only
D	34L	34LD2B3	0.35%	--	--	Jet Only
D	34L	34LD2B4	0.35%	--	--	Jet Only
D	34L	34LD2C	1.55%	--	--	Jet Only
D	34L	34LD2C1	0.39%	--	--	Jet Only
D	34L	34LD2C2	0.39%	--	--	Jet Only
D	34L	34LD2C3	0.37%	--	--	Jet Only
D	34L	34LD2C4	0.37%	--	--	Jet Only
D	34L	34LD2CC	2.98%	--	--	Jet Only
D	34L	34LD2D	3.52%	--	--	Jet Only
D	34L	34LD2D1	1.08%	--	--	Jet Only
D	34L	34LD2D2	1.08%	--	--	Jet Only
D	34L	34LD2D3	0.73%	--	--	Jet Only
D	34L	34LD2D4	0.71%	--	--	Jet Only
D	34L	34LD3A	2.55%	--	--	Jet Only
D	34L	34LD3A1	1.40%	--	--	Jet Only
D	34L	34LD3A2	2.55%	--	--	Jet Only
D	34L	34LD3A3	1.40%	--	--	Jet Only
D	34L	34LD3A4	0.90%	--	--	Jet Only
D	34L	34LD3B	7.51%	--	--	Jet Only
D	34L	34LD3B1	2.16%	--	--	Jet Only
D	34L	34LD3B2	2.16%	--	--	Jet Only
D	34L	34LD3B3	1.21%	--	--	Jet Only
D	34L	34LD3B4	1.21%	--	--	Jet Only
D	34L	34LD3C	1.42%	--	--	Jet Only
D	34L	34LD3C1	1.08%	--	--	Jet Only
D	34L	34LD3C2	1.08%	--	--	Jet Only
D	34L	34LD3C3	1.08%	--	--	Jet Only
D	34L	34LD3C4	1.42%	--	--	Jet Only
D	34L	34LD3D	1.75%	--	--	Jet Only
D	34L	34LD3D1	1.75%	--	--	Jet Only
D	34L	34LD3D2	1.75%	--	--	Jet Only
D	34L	34LD3D3	1.75%	--	--	Jet Only
D	34L	34LD3D4	1.75%	--	--	Jet Only
D	34L	34LD3E	1.08%	--	--	Jet Only
D	34L	34LD3E1	1.08%	--	--	Jet Only
D	34L	34LD3E2	1.08%	--	--	Jet Only
D	34L	34LD3E3	1.08%	--	--	Jet Only
D	34L	34LD3E4	1.08%	--	--	Jet Only
D	34L	34LD3F	2.55%	--	--	Jet Only
D	34L	34LD3F1	1.40%	--	--	Jet Only
D	34L	34LD3F2	2.55%	--	--	Jet Only
D	34L	34LD3F3	1.40%	--	--	Jet Only
D	34L	34LD3F4	0.90%	--	--	Jet Only
D	34L	34LD4A	--	--	--	Not In Use
D	34L	34LD4A1	--	--	--	Not In Use

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
D	34L	34LD4A2	--	--	--	Not In Use
D	34L	34LD4A3	--	--	--	Not In Use
D	34L	34LD4A4	--	--	--	Not In Use
D	34L	34LD4AP	--	6.90%	--	Turbo Only
D	34L	34LD4AP1	--	4.50%	--	Turbo Only
D	34L	34LD4AP2	--	6.80%	--	Turbo Only
D	34L	34LD4AP3	--	4.50%	--	Turbo Only
D	34L	34LD4AP4	--	3.30%	--	Turbo Only
D	34L	34LD4AP5	--	3.30%	--	Turbo Only
D	34L	34LD4AP6	--	1.50%	--	Turbo Only
D	34L	34LD4B	--	--	--	Not In Use
D	34L	34LD4B1	--	--	--	Not In Use
D	34L	34LD4B2	--	--	--	Not In Use
D	34L	34LD4B3	--	--	--	Not In Use
D	34L	34LD4B4	--	--	--	Not In Use
D	34L	34LD4BP	--	--	--	Not In Use
D	34L	34LD4BP1	--	--	--	Not In Use
D	34L	34LD4BP2	--	--	--	Not In Use
D	34L	34LD4BP3	--	--	--	Not In Use
D	34L	34LD4BP4	--	--	--	Not In Use
D	34L	34LD4C	--	--	--	Not In Use
D	34L	34LD4C1	--	--	--	Not In Use
D	34L	34LD4C2	--	--	--	Not In Use
D	34L	34LD4C3	--	--	--	Not In Use
D	34L	34LD4C4	--	--	--	Not In Use
D	34L	34LD4CP	--	--	--	Not In Use
D	34L	34LD4CP1	--	--	--	Not In Use
D	34L	34LD4CP2	--	--	--	Not In Use
D	34L	34LD4CP3	--	--	--	Not In Use
D	34L	34LD4CP4	--	--	--	Not In Use
D	34L	34LD5A	--	7.00%	--	Turbo Only
D	34L	34LD5A1	--	5.00%	--	Turbo Only
D	34L	34LD5A2	--	5.00%	--	Turbo Only
D	34L	34LD5A3	--	1.00%	--	Turbo Only
D	34L	34LD5A4	--	1.00%	--	Turbo Only
D	34L	34LD5AP	--	2.20%	--	Turbo Only
D	34L	34LD5AP1	--	1.70%	--	Turbo Only
D	34L	34LD5AP2	--	1.70%	--	Turbo Only
D	34L	34LD5B	--	7.50%	--	Turbo Only
D	34L	34LD5B1	--	4.70%	--	Turbo Only
D	34L	34LD5B2	--	4.70%	--	Turbo Only
D	34L	34LD5B3	--	1.75%	--	Turbo Only
D	34L	34LD5B4	--	1.75%	--	Turbo Only
D	34L	34LD5C	--	3.00%	--	Turbo Only
D	34L	34LD5C1	--	2.00%	--	Turbo Only
D	34L	34LD5C2	--	2.00%	--	Turbo Only
D	34L	34LD5C3	--	0.50%	--	Turbo Only
D	34L	34LD5C4	--	0.50%	--	Turbo Only
D	34L	34LD6P	--	--	34.00%	Prop Only
D	34L	34LD6P1	--	--	33.00%	Prop Only
D	34L	34LD6P2	--	--	33.00%	Prop Only
D	34R	34RD1	1.42%	0.80%	--	Jet, Turbo
D	34R	34RD11	0.71%	0.60%	--	Jet, Turbo
D	34R	34RD12	0.71%	0.60%	--	Jet, Turbo

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
D	34R	34RD13	0.37%	7.10%	--	Jet, Turbo
D	34R	34RD14	0.39%	7.10%	--	Jet, Turbo
D	34R	34RD2A	6.00%	--	--	Jet Only
D	34R	34RD2A1	2.00%	--	--	Jet Only
D	34R	34RD2A2	3.00%	--	--	Jet Only
D	34R	34RD2A3	2.00%	--	--	Jet Only
D	34R	34RD2A4	0.86%	--	--	Jet Only
D	34R	34RD2A5	0.85%	--	--	Jet Only
D	34R	34RD2B	15.00%	--	--	Jet Only
D	34R	34RD2B1	0.37%	--	--	Jet Only
D	34R	34RD2B2	0.37%	--	--	Jet Only
D	34R	34RD2B3	0.35%	--	--	Jet Only
D	34R	34RD2B4	0.35%	--	--	Jet Only
D	34R	34RD2C	1.55%	--	--	Jet Only
D	34R	34RD2C1	0.39%	--	--	Jet Only
D	34R	34RD2C2	0.39%	--	--	Jet Only
D	34R	34RD2C3	0.37%	--	--	Jet Only
D	34R	34RD2C4	0.37%	--	--	Jet Only
D	34R	34RD2CC	2.98%	--	--	Jet Only
D	34R	34RD2D	2.82%	--	--	Jet Only
D	34R	34RD2D1	0.86%	--	--	Jet Only
D	34R	34RD2D2	0.86%	--	--	Jet Only
D	34R	34RD2D3	0.54%	--	--	Jet Only
D	34R	34RD2D4	0.54%	--	--	Jet Only
D	34R	34RD2D5	0.08%	--	--	Jet Only
D	34R	34RD2E	0.28%	--	--	Jet Only
D	34R	34RD2E1	0.04%	--	--	Jet Only
D	34R	34RD2E2	0.04%	--	--	Jet Only
D	34R	34RD2F	0.53%	--	--	Jet Only
D	34R	34RD2F1	0.27%	--	--	Jet Only
D	34R	34RD2F2	0.27%	--	--	Jet Only
D	34R	34RD3A	2.55%	--	--	Jet Only
D	34R	34RD3A1	1.40%	--	--	Jet Only
D	34R	34RD3A2	2.55%	--	--	Jet Only
D	34R	34RD3A3	1.40%	--	--	Jet Only
D	34R	34RD3A4	0.90%	--	--	Jet Only
D	34R	34RD3B	7.51%	--	--	Jet Only
D	34R	34RD3B1	2.16%	--	--	Jet Only
D	34R	34RD3B2	2.16%	--	--	Jet Only
D	34R	34RD3B3	1.21%	--	--	Jet Only
D	34R	34RD3B4	1.21%	--	--	Jet Only
D	34R	34RD3C	1.42%	--	--	Jet Only
D	34R	34RD3C1	1.08%	--	--	Jet Only
D	34R	34RD3C2	1.08%	--	--	Jet Only
D	34R	34RD3C3	1.08%	--	--	Jet Only
D	34R	34RD3C4	1.42%	--	--	Jet Only
D	34R	34RD3D	1.75%	--	--	Jet Only
D	34R	34RD3D1	1.75%	--	--	Jet Only
D	34R	34RD3D2	1.75%	--	--	Jet Only
D	34R	34RD3D3	1.75%	--	--	Jet Only
D	34R	34RD3D4	1.75%	--	--	Jet Only
D	34R	34RD3E	1.08%	--	--	Jet Only
D	34R	34RD3E1	1.08%	--	--	Jet Only
D	34R	34RD3E2	1.08%	--	--	Jet Only

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
D	34R	34RD3E3	1.08%	--	--	Jet Only
D	34R	34RD3E4	1.08%	--	--	Jet Only
D	34R	34RD3F	2.55%	--	--	Jet Only
D	34R	34RD3F1	1.40%	--	--	Jet Only
D	34R	34RD3F2	2.55%	--	--	Jet Only
D	34R	34RD3F3	1.40%	--	--	Jet Only
D	34R	34RD3F4	0.90%	--	--	Jet Only
D	34R	34RD4A	--	--	--	Not In Use
D	34R	34RD4A1	--	--	--	Not In Use
D	34R	34RD4A2	--	--	--	Not In Use
D	34R	34RD4A3	--	--	--	Not In Use
D	34R	34RD4A4	--	--	--	Not In Use
D	34R	34RD4AP	--	6.90%	--	Turbo Only
D	34R	34RD4AP1	--	4.50%	--	Turbo Only
D	34R	34RD4AP2	--	6.80%	--	Turbo Only
D	34R	34RD4AP3	--	4.50%	--	Turbo Only
D	34R	34RD4AP4	--	3.30%	--	Turbo Only
D	34R	34RD4AP5	--	3.30%	--	Turbo Only
D	34R	34RD4AP6	--	1.50%	--	Turbo Only
D	34R	34RD4B	--	--	--	Not In Use
D	34R	34RD4B1	--	--	--	Not In Use
D	34R	34RD4B2	--	--	--	Not In Use
D	34R	34RD4B3	--	--	--	Not In Use
D	34R	34RD4B4	--	--	--	Not In Use
D	34R	34RD4BP	--	--	--	Not In Use
D	34R	34RD4BP1	--	--	--	Not In Use
D	34R	34RD4BP2	--	--	--	Not In Use
D	34R	34RD4BP3	--	--	--	Not In Use
D	34R	34RD4BP4	--	--	--	Not In Use
D	34R	34RD4C	--	--	--	Not In Use
D	34R	34RD4C1	--	--	--	Not In Use
D	34R	34RD4C2	--	--	--	Not In Use
D	34R	34RD4C3	--	--	--	Not In Use
D	34R	34RD4C4	--	--	--	Not In Use
D	34R	34RD4CP	--	--	--	Not In Use
D	34R	34RD4CP1	--	--	--	Not In Use
D	34R	34RD4CP2	--	--	--	Not In Use
D	34R	34RD4CP3	--	--	--	Not In Use
D	34R	34RD4CP4	--	--	--	Not In Use
D	34R	34RD5A	--	7.00%	--	Turbo Only
D	34R	34RD5A1	--	5.00%	--	Turbo Only
D	34R	34RD5A2	--	5.00%	--	Turbo Only
D	34R	34RD5A3	--	1.00%	--	Turbo Only
D	34R	34RD5A4	--	1.00%	--	Turbo Only
D	34R	34RD5AP	--	2.20%	--	Turbo Only
D	34R	34RD5AP1	--	1.70%	--	Turbo Only
D	34R	34RD5AP2	--	1.70%	--	Turbo Only
D	34R	34RD5B	--	7.50%	--	Turbo Only
D	34R	34RD5B1	--	4.70%	--	Turbo Only
D	34R	34RD5B2	--	4.70%	--	Turbo Only
D	34R	34RD5B3	--	1.75%	--	Turbo Only
D	34R	34RD5B4	--	1.75%	--	Turbo Only
D	34R	34RD5C	--	3.00%	38.00%	Turbo, Prop
D	34R	34RD5C1	--	2.00%	24.00%	Turbo, Prop

Operation Type	Runway	Track Name	Jet Track %	Turboprop Track %	Prop Track %	Notes
D	34R	34RD5C2	--	2.00%	24.00%	Turbo, Prop
D	34R	34RD5C3	--	0.50%	5.50%	Turbo, Prop
D	34R	34RD5C4	--	0.50%	5.50%	Turbo, Prop
D	34R	34RD5C5	--	--	1.50%	Prop Only

Source: SEA EnvironmentalVue 2022, L&B Analysis, 2023.

Appendix B

This appendix provides information on the methodology for modeling missed approach operations in the existing and future conditions. The development of the user-defined profiles and missed approach flight tracks was coordinated with the FAA/AEE. The methodology approved by the FAA/AEE is shown in **Exhibit B-1**. FAA/AEE approval of the user-defined profiles and flight tracks was received on August 2, 2023 as shown in **Exhibit B-2**.

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Project: Sustainable Airport Master Plan (SAMP) Near Term Projects (NTP) Environmental Assessment (EA)

To: Kandice Krull, FAA; Steve Rybolt, Port of Seattle

From: Landrum & Brown

Date: August 15, 2023

Subject: Missed Approach Operations

SECTION 1 – INTRODUCTION

Landrum & Brown (L&B) is currently assisting the Port of Seattle (Port) with preparing an Environmental Assessment (EA) for the Airport Sustainable Master Plan (SAMP) Near Term Projects (NTP) at Seattle-Tacoma International Airport (SEA or Airport). The EA is using 2022 as the existing condition year. The Day-Night Average Sound Level (DNL) noise contours will be generated using the latest version of AEDT Version 3e. This memo provides information on the aircraft types, Aircraft Noise and Performance (ANP) IDs, flight paths, operation, time of day and runway distribution, proposed user-defined profiles and AEDT flight tracks for the missed approach operations. Landrum & Brown is seeking FAA concurrence based on the recommendations in this memorandum for modeling missed approaches in the SAMP NTP EA.

SECTION 2 – STATEMENT OF BENEFIT

Currently, AEDT Version 3e does not have missed approach profiles that accurately represent the missed approach traffic at SEA. Due to the unique nature of the ground track geometry and vertical profiles for aircraft performing missed approach procedures at SEA, user-defined profiles are proposed to accurately model the noise exposure from these operations.

SECTION 3 – SUPPORTING DOCUMENTATION

Table 1 provides the 2022 missed approach operations for the selected AEDT representative Airframe, ANP ID and Engine Code from AEDT. A total of 58 airframe and engine combinations were identified in the missed approach log file. Of these 58 combinations, 29 different aircraft types with ANP data in AEDT Version 3e were identified. The ANP data is provided by aircraft manufacturers to calculate aircraft trajectories and noise by utilizing aircraft performance and noise-power-distance (NPD). In total 798 (2.2 average annual day) missed approaches occurred at SEA in 2022 based on the log file.

TABLE 1, 2022 TOTAL MISSED APPROACHES BY AIRFRAME AND ENGINE

AEDT Airframe	AEDT Engine	ANP ID	Total Missed Approaches
Airbus A300F4-600 Series	1GE020	A300-622R	1
Airbus A319-100 Series	3IA007	A319-131	5
Airbus A319-100 Series	3CM028	A319-131	1
Airbus A320-200 Series	01P08CM105	A320-211	22
Airbus A320-200 Series	1IA003	A320-232	3
Airbus A320-200 Series	01P10IA021	A320-232	2
Airbus A320-200 Series	1CM009	A320-211	2
Airbus A320-200 Series	01P10IA022	A320-232	1
Airbus A320-NEO	01P22PW163	A320-271N	3
Airbus A321-200 Series	01P10IA025	A321-232	14
Airbus A321-200 Series	01P08CM104	A321-232	6
Airbus A321-NEO	01P18PW157	A321-232	8
Airbus A321-NEO	01P20CM132	A321-232	5
Airbus A330-200 Series	2RR023	A330-343	2
Airbus A330-300 Series	2RR023	A330-343	2
Airbus A330-300 Series	4GE080	A330-301	1
Airbus A330-300 Series	9PW094	A330-301	1
Airbus A330-300 Series	9PW095	A330-301	1
Airbus A330-900N Series (Neo)	02P23RR141	A330-343	1
Airbus A350-900 series	01P18RR124	A350-941	3

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AEDT Airframe	AEDT Engine	ANP ID	Total Missed Approaches
Boeing 737-300 Series	1CM005	737300	1
Boeing 737-700 Series	8CM063	737700	20
Boeing 737-700 Series	3CM031	737700	10
Boeing 737-700 Series	3CM032	737700	2
Boeing 737-8	01P20CM136	7378MAX	3
Boeing 737-8	01P20CM140	7378MAX	2
Boeing 737-800 Series	**3CM034**	**737800**	**62**
Boeing 737-800 Series	**8CM051**	**737800**	**61**
Boeing 737-800 Series	**01P11CM116**	**737800**	**7**
Boeing 737-9	01P20CM140	7378MAX	36
Boeing 737-9	01P20CM136	7378MAX	2
Boeing 737-900-ER	**01P11CM121**	**737800**	**164**
Boeing 737-900-ER	**01P11CM125**	**737800**	**6**
Boeing 747-400 Series	1GE024	747400	5
Boeing 747-400BCF	1GE024	747400	2
Boeing 747-8F	8GENX1	7478	1
Boeing 757-200 Series	4PW072	757PW	8
Boeing 757-300 Series	XPW204	757300	5
Boeing 767-300 ER	1PW043	7673ER	1
Boeing 767-300 ER	2GE055	7673ER	1
Boeing 767-300 ER Freighter	1GE030	7673ER	10
Boeing 777 Freighter	01P21GE216	777200	2
Boeing 777-300 ER	01P21GE217	7773ER	3
Boeing 787-10 Dreamliner	17GE179	7879	2
Boeing 787-10 Dreamliner	02P23RR134	7879	1
Boeing 787-8 Dreamliner	11GE138	7878R	4
Boeing 787-9 Dreamliner	12RR067	7879	1
Boeing 787-9 Dreamliner	02P23RR131	7879	1
Boeing 787-9 Dreamliner	12RR068	7879	1
Boeing MD-11 Freighter	1GE031	MD11GE	4
Bombardier Challenger 350	01P14HN011	CL600	1
Bombardier CS100	01P20PW183	737700	26
Bombardier CS300	01P20PW184	737700	7
Bombardier de Havilland Dash 8 Q400	PW150A	DHC830	84
Cessna 208 Caravan	PT6A14	CNA208	3
Embraer ERJ175-LR	**01P08GE197**	**EMB175**	**162**
Honda HA-420 Hondajet	PW610F	CNA680	2
Raytheon Beech 99	PT6A36	DHC6	1
Grand Total			**798**

Source: SEA and L&B (2023)

As shown in **Table 2**, the ANP ID 737800 accounted for 300 annual missed approach operations (0.8 average annual day operations) and the EMB175 accounted for 162 annual missed approach operations (0.4 average annual day operations). L&B is proposing the creation of user-defined profiles for the 737800 and EMB175, given they represent the majority of missed approaches compared to other aircraft types and because these ANP IDs represent the most noise-dominant group of operations compared to the remaining missed approaches performed by other aircraft types.

TABLE 2, 2022 MISSED APPROACHES BY ANP ID

ANP ID	Annual Missed Approaches	Average Annual Day Operations
737800	**300**	**0.8**
EMB175	**162**	**0.4**
DHC830	84	0.2
737700	65	0.2
7378MAX	43	0.1
A321-232	33	0.1
A320-211	24	0.1
7673ER	12	0.0

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ANP ID	Annual Missed Approaches	Average Annual Day Operations
757PW	8	0.0
747400	7	0.0
7879	6	0.0
A320-232	6	0.0
A319-131	6	0.0
757300	5	0.0
A330-343	5	0.0
7878R	4	0.0
MD11GE	4	0.0
A320-271N	3	0.0
7773ER	3	0.0
CNA208	3	0.0
A330-301	3	0.0
A350-941	3	0.0
777200	2	0.0
CNA680	2	0.0
A300-622R	1	0.0
7478	1	0.0
737300	1	0.0
CL600	1	0.0
DHC6	1	0.0
Grand Total	**798**	**2.2**

Source: SEA and L&B (2023)

The annual missed approach operations on each runway during the daytime and nighttime hours are provided in **Table 3**. As shown, a majority of the operations occurred on Runways 16R and 34L, therefore L&B is recommending modeling the 2.2 average annual day missed approach operations on these two runways.

TABLE 3, 2022 DAY/NIGHT SPLIT BY RUNWAY

Runway	Daytime	Nighttime	Total
16C	9	4	13
16L	27	6	33
16R	**549**	**40**	**589**
34C	2	1	3
34L	**145**	**4**	**149**
34R	8	3	11
Grand Total	**740**	**58**	**798**

Source: SEA and L&B (2023)

Exhibit 1 shows missed approach radar data from the Port of Seattle EnvironmentalVue Noise Monitoring System and proposed representative AEDT flight tracks on Runway 16R. **Exhibit 2** shows missed approach radar data and proposed representative AEDT flight tracks on Runway 34L. This radar data is a sample set of data for daytime and nighttime operations at SEA in 2022 and was utilized to propose representative AEDT flight tracks and user-defined profiles. **Table 4** lists the percentage utilization per missed approach track.

TABLE 4, AEDT TRACK PERCENTAGE UTILIZATIOIN

Track Name	% Utilization
16R_MA_A	18.9%
16R_MA_B	25.0%
16R_MA_C	19.3%
16R_MA_D	17.5%
16R_MA_E	19.3%
34L_MA_A	32.0%
34L_MA_B	60.0%
34L_MA_C	8.0%

Source: SEA and L&B (2023)

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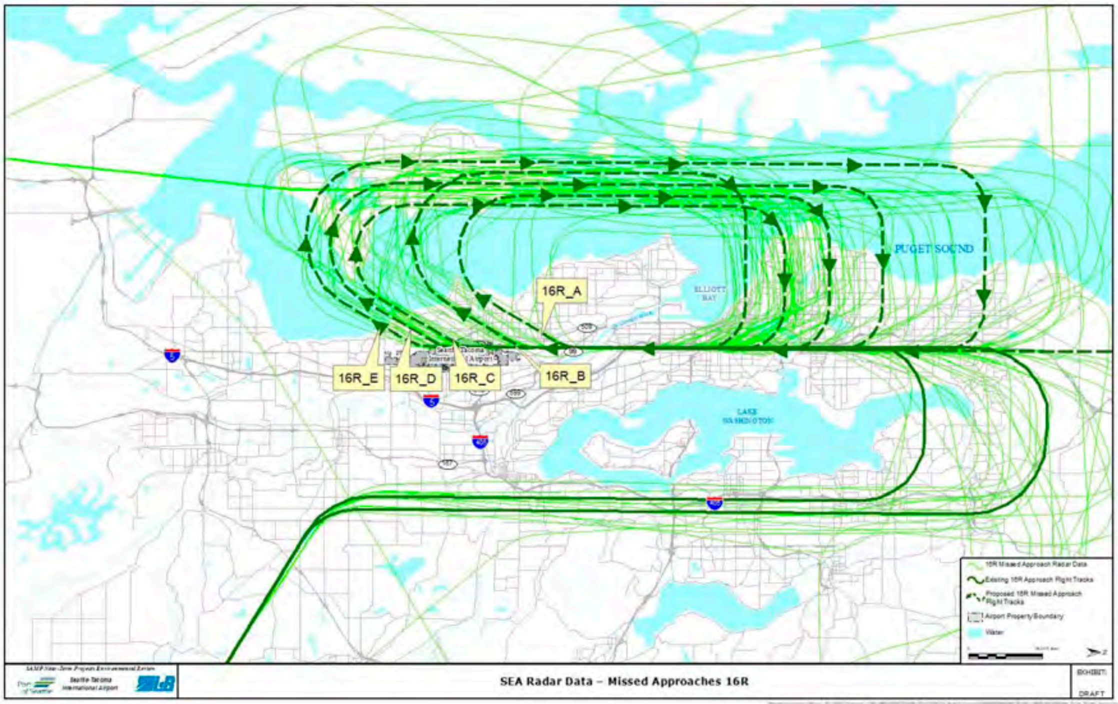
Exhibit 1: SEA 16R Missed Approaches



Source: SEA and L&B (2023)

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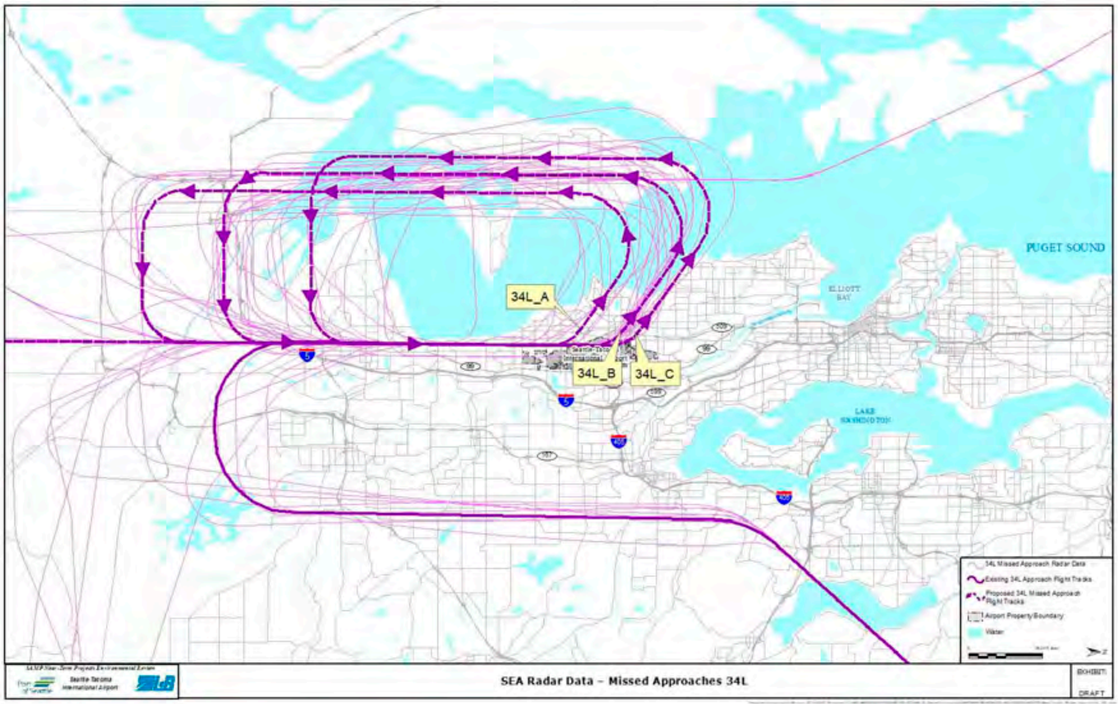
Exhibit 2: SEA 34L Missed Approaches



Source: SEA and L&B (2023)

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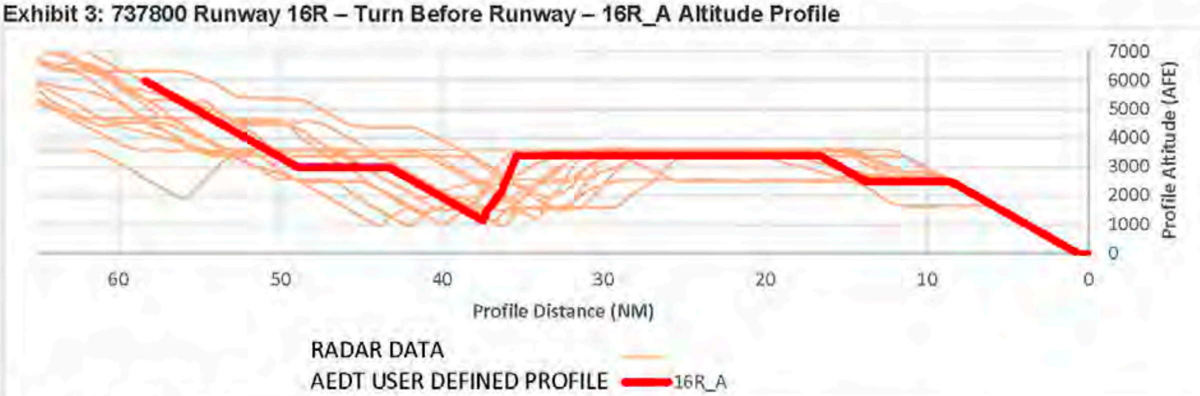
SECTION 3.1 – AIRCRAFT PROFILES

The following information provides L&B's proposed user-defined profiles assigned to the corresponding proposed AEDT flight tracks, shown in Exhibit 1 and Exhibit 2, for each ANP ID (737800 and EMB175). The proposed missed approach profiles are generally based on the STANDARD arrival procedure for the initial arrival portion and the STANDARD Circuit and Touch and Go profiles for the climb and level segments for the 737800 and the EMB175. User-defined profiles are based on altitude, speed and thrust data. Altitudes were obtained using actual missed approach altitudes collected by the Port of Seattle EnvironmentalVue Noise Monitoring System. Speed data and thrust data was obtained from AEDT flight performance calculations because the Port of Seattle EnvironmentalVue Noise Monitoring System does not provide reliable speed and thrust data. Note that the length of the radar tracks downwind segments varied. Therefore, the focus each of the user-defined profiles was to represent the missed approach (decision point) altitude, downwind level segment altitude, and step-down altitude prior to final descent of the radar tracks in the vicinity of the AEDT tracks at the initial turn to the west. The length of the downwind level segment was estimated to cover the wide range of downwind segment lengths and base leg turn locations. Similarly, the focus of the AEDT missed approach backbone track geometry was to cover the location of the initial turns to the west and to cover the wide range of the remaining radar track geometry. Additionally, in order to best represent the wide dispersion of the missed approach radar tracks, multiple backbone AEDT missed approach tracks were developed. Given the radar coverage of the AEDT representative backbone tracks, subtracks were not developed.

__737800 16R Graphs – Turn Before Runway__

This section of graphs shows the vertical profiles of radar missed approaches on Runway 16R starting the missed approach turn before the runway. The following graphs show the 737800 proposed user-defined profile for AEDT flight track 16R_A. **Exhibit 3** compares the radar flight track altitudes and the proposed 16R_A user-defined profile. **Exhibit 4** shows the ground speeds and **Exhibit 5** shows the thrust values calculated by AEDT for the 16R_A user-defined profile based on the parameters in **Table 5**.

Exhibit 3: 737800 Runway 16R – Turn Before Runway – 16R_A Altitude Profile



Source: SEA and L&B (2023)

Exhibit 4: 737800 Runway 16R – Turn Before Runway – 16R_A Ground Speed Profile

Source: AEDT Version 3e and L&B (2023)

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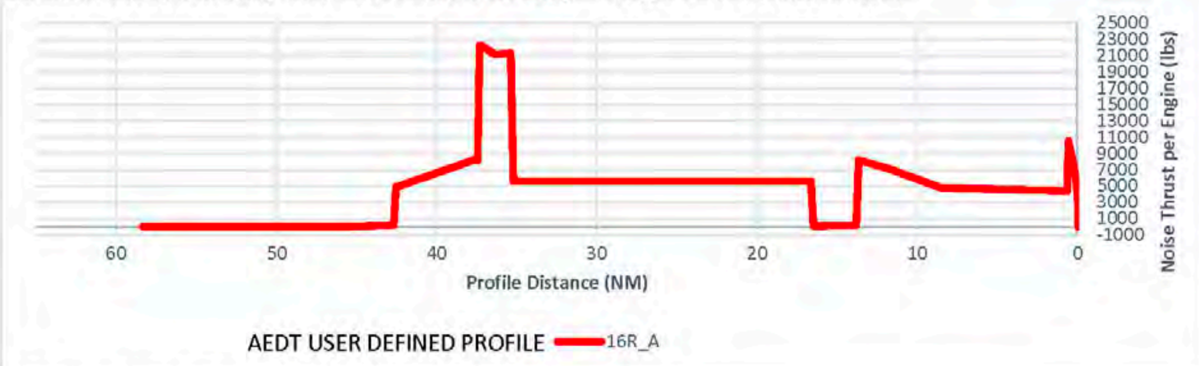
Exhibit 5: 737800 Runway 16R – Turn Before Runway – 16R_A Thrust Values Profile



Source: AEDT Version 3e and L&B (2023)

The following graphs show the 737800 proposed user-defined profile for AEDT flight track 16R_B. **Exhibit 6** compares the radar flight track altitudes and the proposed 16R_B user-defined profile. **Exhibit 7** shows the ground speeds and **Exhibit 8** shows the thrust values calculated by AEDT for the 16R_B user-defined profile based on the parameters in **Table 5**.

Exhibit 6: 737800 Runway 16R – Turn Before Runway – 16R_B Altitude Profile

Source: SEA and L&B (2023)

Exhibit 7: 737800 Runway 16R – Turn Before Runway – 16R_B Ground Speed Profile

Source: AEDT Version 3e and L&B (2023)

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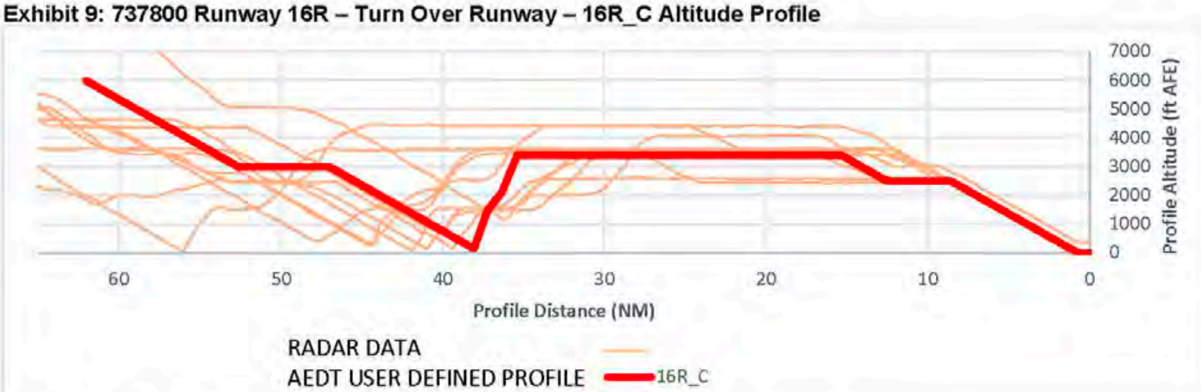
Exhibit 8: 737800 Runway 16R – Turn Before Runway – 16R_B Thrust Values Profile

Source: AEDT Version 3e and L&B (2023)

737800 16R Graphs – Turn Over Runway

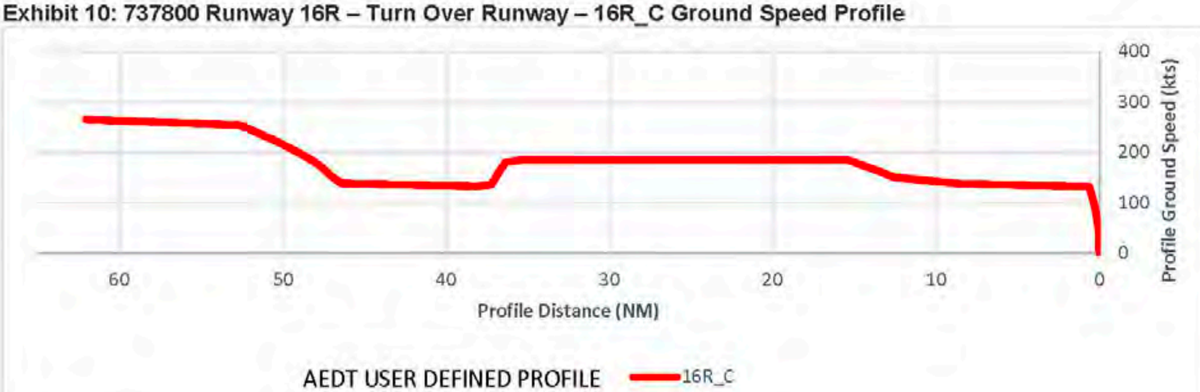
This section of graphs shows the vertical profiles of radar missed approaches on Runway 16R starting the missed approach turn over the runway. The following graphs show the 737800 proposed user-defined profile for AEDT flight track 16R_C. **Exhibit 9** compares the radar flight track altitudes and the proposed 16R_C user-defined profile. **Exhibit 10** shows the ground speeds and **Exhibit 11** shows the thrust values calculated by AEDT for the 16R_C user-defined profile based on the parameters in **Table 5**.

Exhibit 9: 737800 Runway 16R – Turn Over Runway – 16R_C Altitude Profile



Source: SEA and L&B (2023)

Exhibit 10: 737800 Runway 16R – Turn Over Runway – 16R_C Ground Speed Profile



Source: AEDT Version 3e and L&B (2023)

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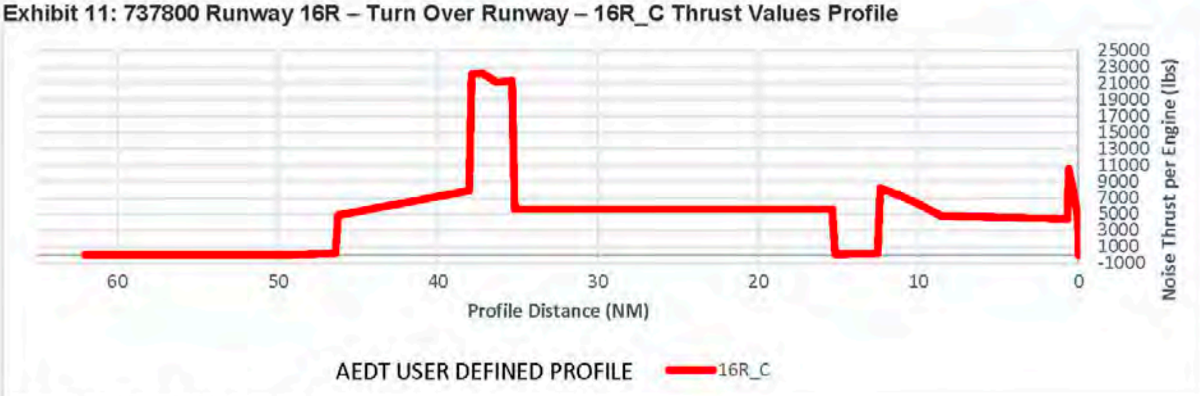
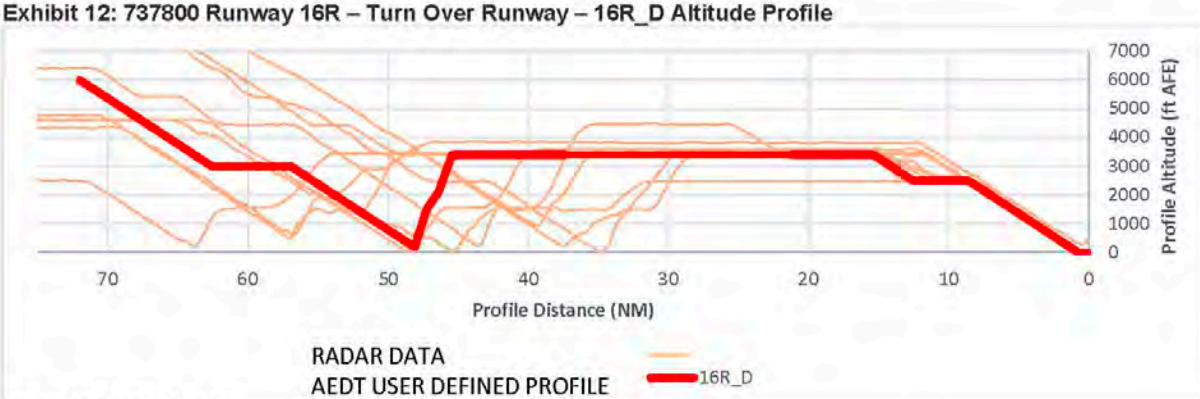
Exhibit 11: 737800 Runway 16R – Turn Over Runway – 16R_C Thrust Values Profile



Source: AEDT Version 3e and L&B (2023)

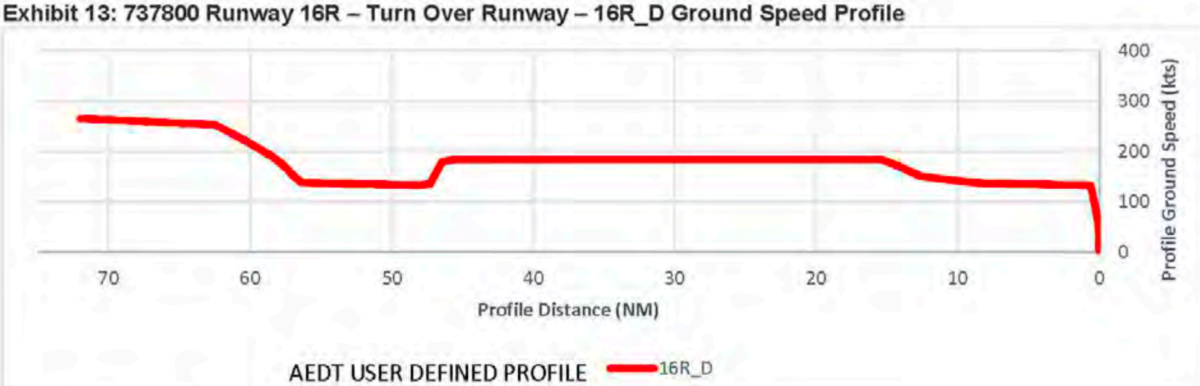
The following graphs show the 737800 proposed user-defined profile for AEDT flight track 16R_D. **Exhibit 12** compares the radar flight track altitudes and the proposed 16R_D user-defined profile. **Exhibit 13** shows the ground speeds and **Exhibit 14** shows the thrust values calculated by AEDT for the 16R_D user-defined profile based on the parameters in **Table 5**.

Exhibit 12: 737800 Runway 16R – Turn Over Runway – 16R_D Altitude Profile



Source: SEA and L&B (2023)

Exhibit 13: 737800 Runway 16R – Turn Over Runway – 16R_D Ground Speed Profile



Source: AEDT Version 3e and L&B (2023)

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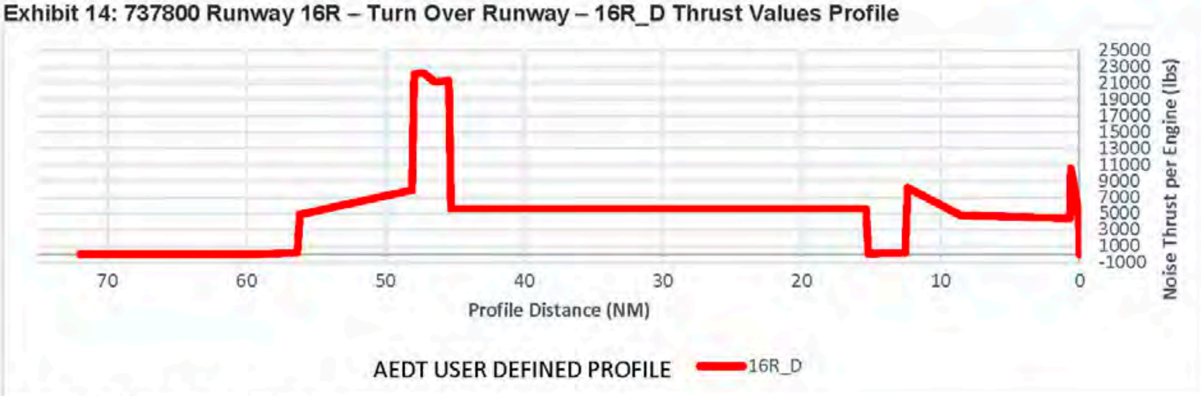
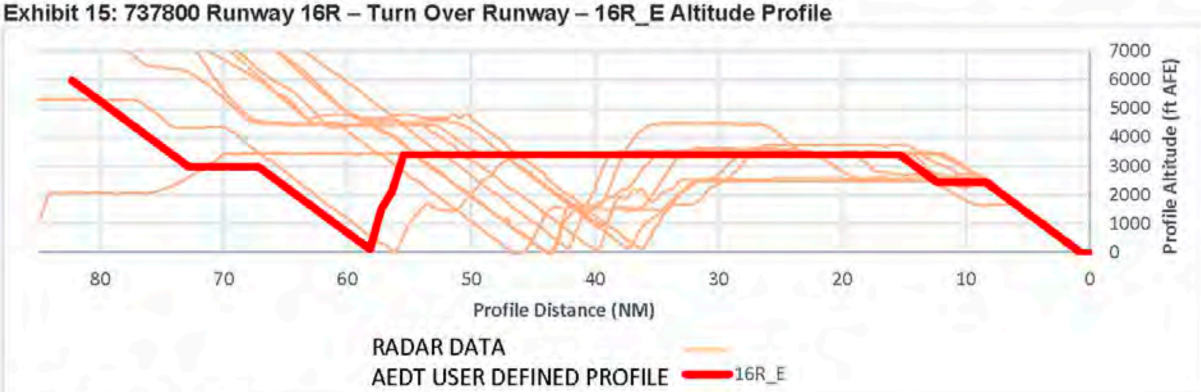
Exhibit 14: 737800 Runway 16R – Turn Over Runway – 16R_D Thrust Values Profile



Source: AEDT Version 3e and L&B (2023)

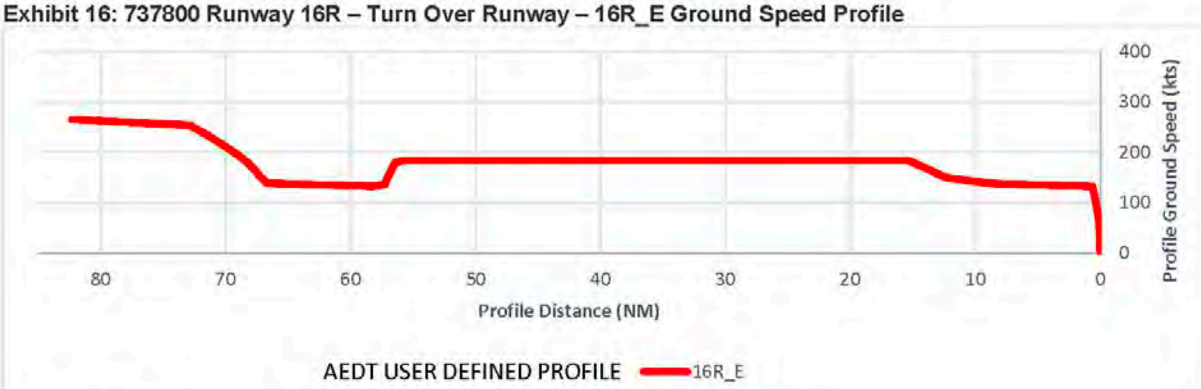
The following graphs show the 737800 proposed user-defined profile for AEDT flight track 16R_E. **Exhibit 15** compares the radar flight track altitudes and the proposed 16R_E user-defined profile. **Exhibit 16** shows the ground speeds and **Exhibit 17** shows the thrust values calculated by AEDT for the 16R_E user-defined profile based on the parameters in **Table 5**.

Exhibit 15: 737800 Runway 16R – Turn Over Runway – 16R_E Altitude Profile



Source: SEA and L&B (2023)

Exhibit 16: 737800 Runway 16R – Turn Over Runway – 16R_E Ground Speed Profile



Source: AEDT Version 3e and L&B (2023)

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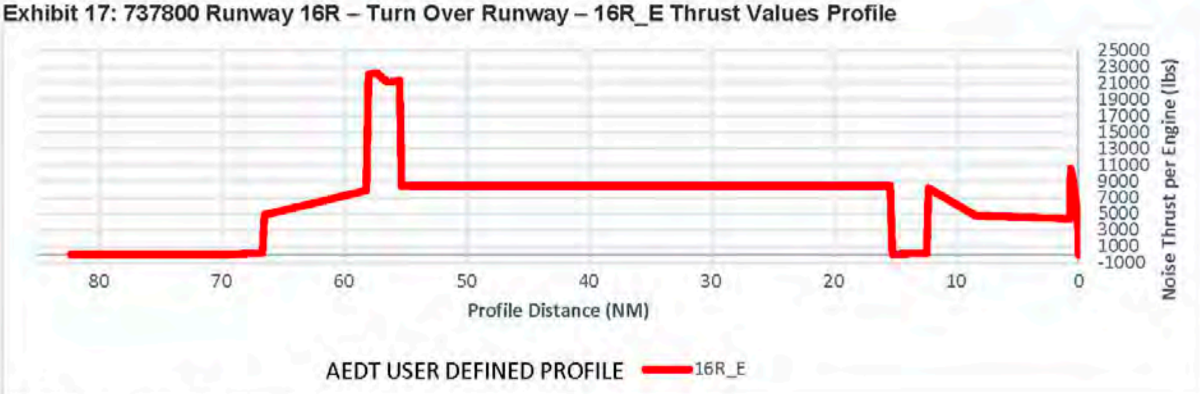
Exhibit 17: 737800 Runway 16R – Turn Over Runway – 16R_E Thrust Values Profile

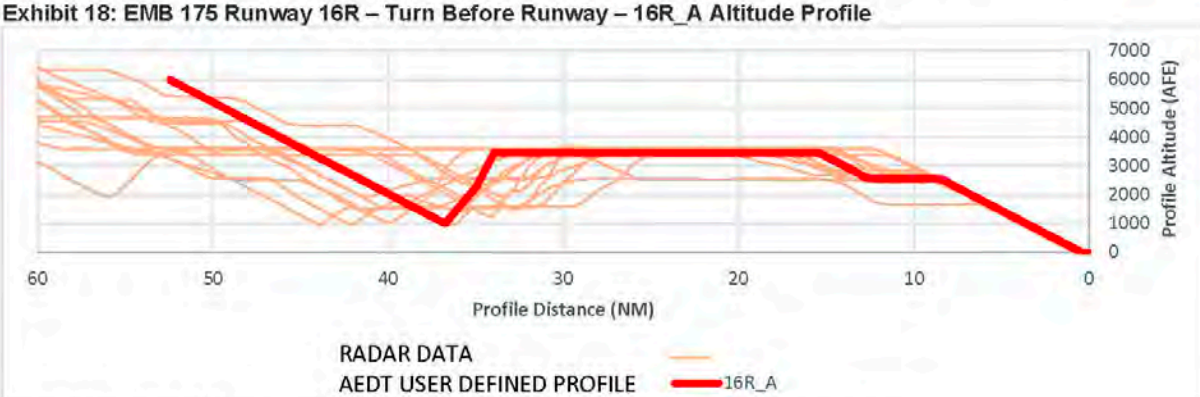


Source: AEDT Version 3e and L&B (2023)

EMB175 16R Graphs Before Runway

This section of graphs shows the vertical profiles of radar missed approaches on Runway 16R starting the missed approach turn before the runway. The following graphs show the EMB175 proposed user-defined profile for AEDT flight track 16R_A. **Exhibit 18** compares the radar flight track altitudes and the proposed 16R_A user-defined profile. **Exhibit 19** shows the ground speeds and **Exhibit 20** shows the thrust values calculated by AEDT for the 16R_A user-defined profile based on the parameters in **Table 5**.

Exhibit 18: EMB 175 Runway 16R – Turn Before Runway – 16R_A Altitude Profile



Source: SEA and L&B (2023)

Exhibit 19: EMB 175 Runway 16R – Turn Before Runway – 16R_A Ground Speed Profile

Source: AEDT Version 3e and L&B (2023)

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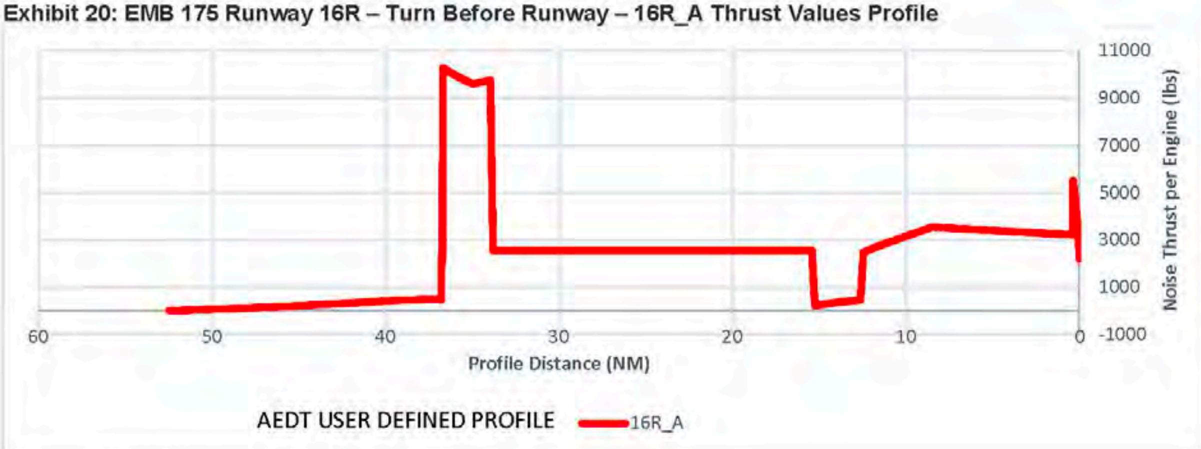
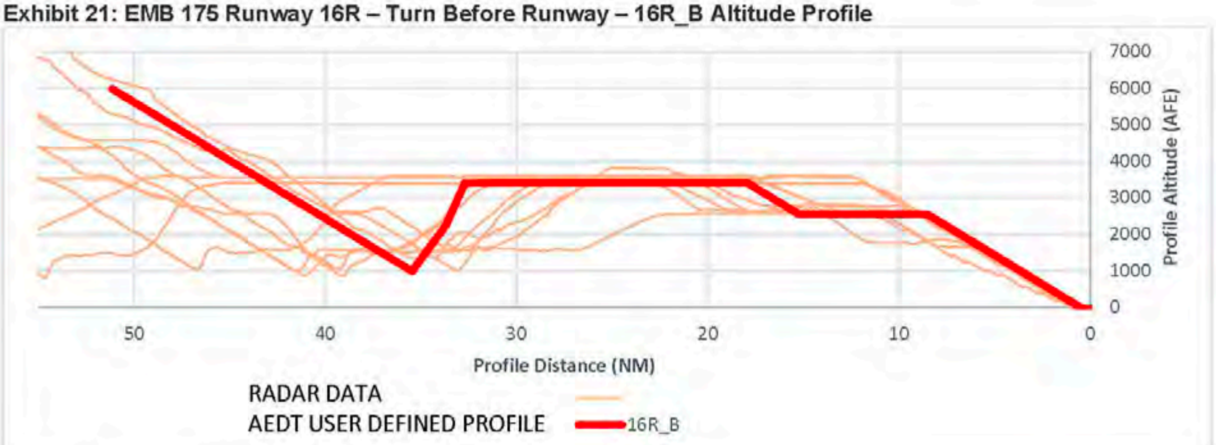
Exhibit 20: EMB 175 Runway 16R – Turn Before Runway – 16R_A Thrust Values Profile



Source: AEDT Version 3e and L&B (2023)

The following graphs show the EMB175 proposed user-defined profile for AEDT flight track 16R_B. **Exhibit 21** compares the radar flight track altitudes and the proposed 16R_B user-defined profile. **Exhibit 22** shows the ground speeds and **Exhibit 23** shows the thrust values calculated by AEDT for the 16R_B user-defined profile based on the parameters in **Table 5**.

Exhibit 21: EMB 175 Runway 16R – Turn Before Runway – 16R_B Altitude Profile



Source: SEA and L&B (2023)

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Exhibit 22: EMB 175 Runway 16R – Turn Before Runway – 16R_B Ground Speed Profile

Source: AEDT Version 3e and L&B (2023)

Exhibit 23: EMB 175 Runway 16R – Turn Before Runway – 16R_B Thrust Values Profile

Source: AEDT Version 3e and L&B (2023)

<u>EMB175 16R Graphs – Turn Over Runway</u>

This section of graphs shows the vertical profiles of radar missed approaches on Runway 16R starting the missed approach turn over the runway. The following graphs show the EMB175 proposed user-defined profile for AEDT flight track 16R_C. **Exhibit 24** compares the radar flight track altitudes and the proposed 16R_C user-defined profile. **Exhibit 25** shows the ground speeds and **Exhibit 26** shows the thrust values calculated by AEDT for the 16R_C user-defined profile based on the parameters in **Table 5**.

Exhibit 24: EMB 175 Runway 16R – Turn Over Runway – 16R_C Altitude Profile

Source: SEA and L&B (2023)

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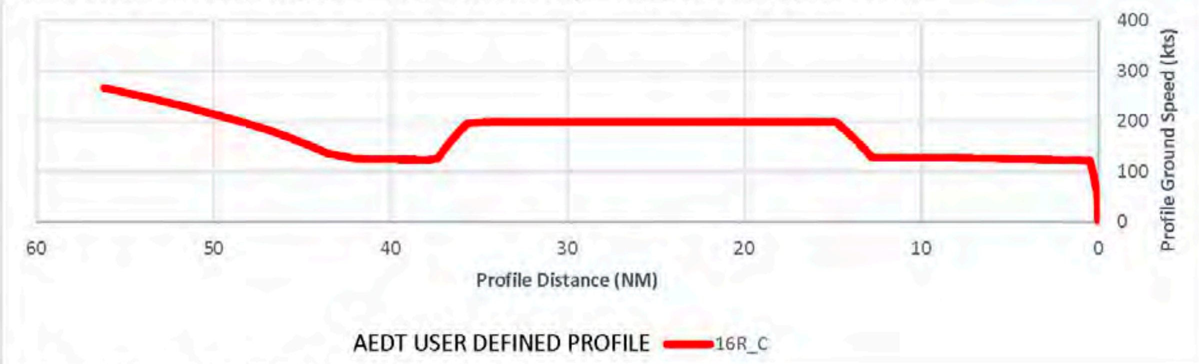
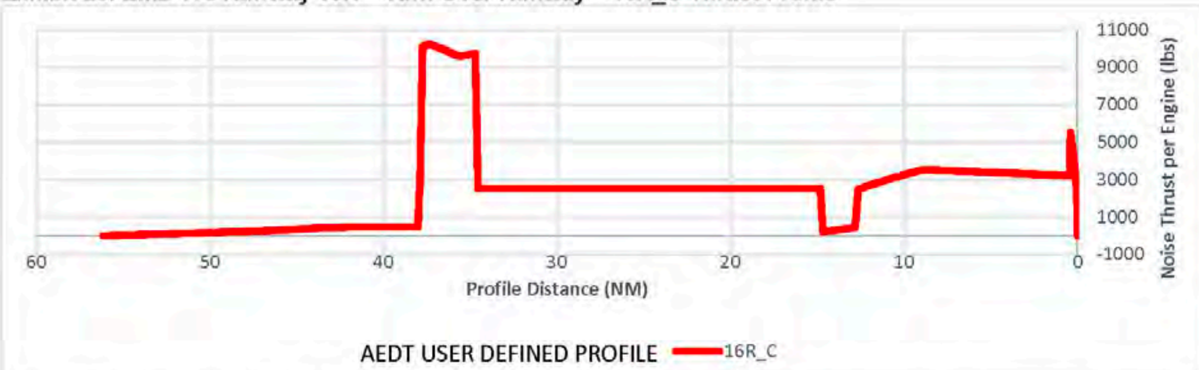
Exhibit 25: EMB 175 Runway 16R – Turn Over Runway – 16R_C Ground Speed Profile



Source: AEDT Version 3e and L&B (2023)

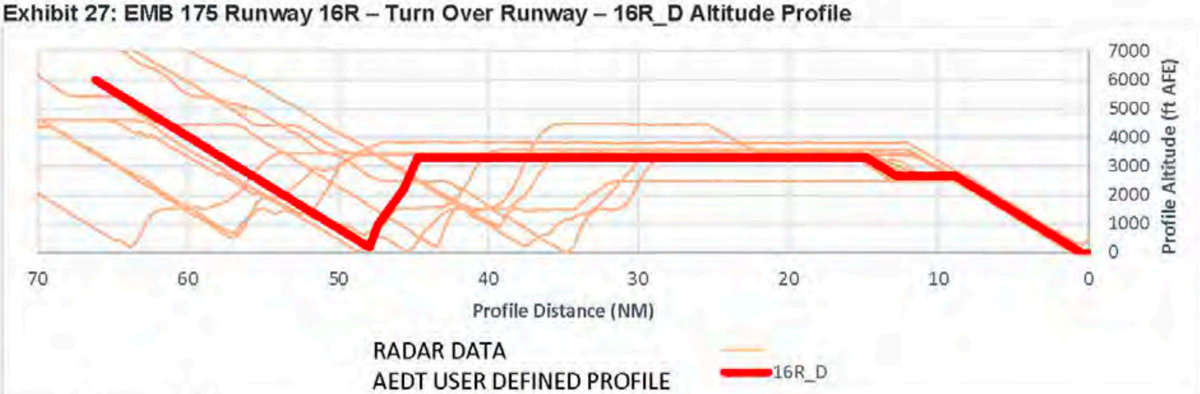
Exhibit 26: EMB 175 Runway 16R – Turn Over Runway – 16R_C Thrust Profile



Source: AEDT Version 3e and L&B (2023)

The following graphs show the EMB175 proposed user-defined profile for AEDT flight track 16R_D. **Exhibit 27** compares the radar flight track altitudes and the proposed 16R_D user-defined profile. **Exhibit 28** shows the ground speeds and **Exhibit 29** shows the thrust values calculated by AEDT for the 16R_D user-defined profile based on the parameters in **Table 5**.

Exhibit 27: EMB 175 Runway 16R – Turn Over Runway – 16R_D Altitude Profile



Source: SEA and L&B (2023)

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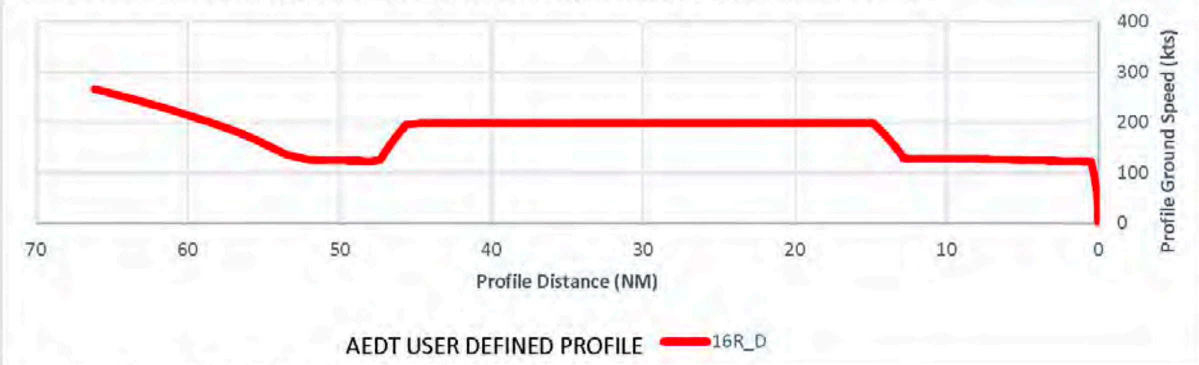
Exhibit 28: EMB 175 Runway 16R – Turn Over Runway – 16R_D Ground Speed Profile



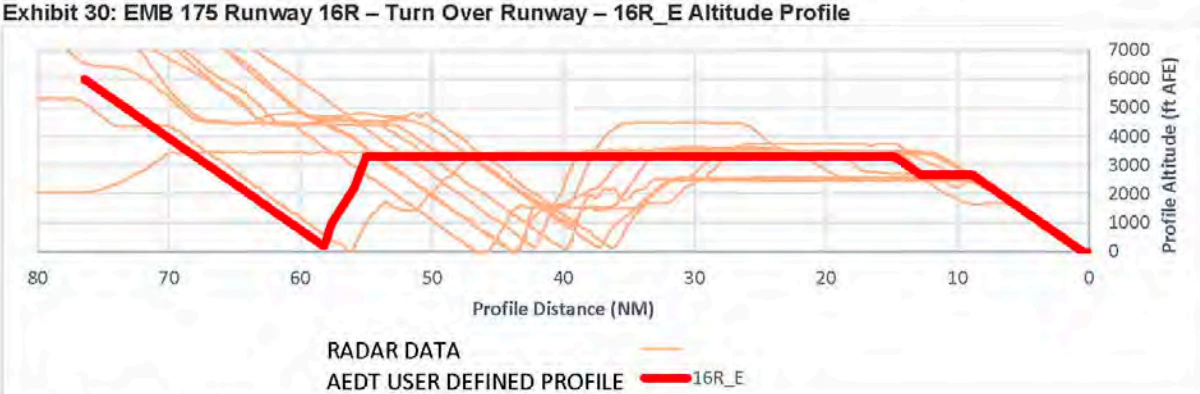
Source: AEDT Version 3e and L&B (2023)

Exhibit 29: EMB 175 Runway 16R – Turn Over Runway – 16R_D Thrust Values Profile

Source: AEDT Version 3e and L&B (2023)

The following graphs show the EMB175 proposed user-defined profile for AEDT flight track 16R_E. **Exhibit 30** compares the radar flight track altitudes and the proposed 16R_E user-defined profile. **Exhibit 31** shows the ground speeds and **Exhibit 32** shows the thrust values calculated by AEDT for the 16R_E user-defined profile based on the parameters in **Table 5**.

Exhibit 30: EMB 175 Runway 16R – Turn Over Runway – 16R_E Altitude Profile



Source: SEA and L&B (2023)

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Exhibit 31: EMB 175 Runway 16R – Turn Over Runway – 16R_E Ground Speed Profile

Source: AEDT Version 3e and L&B (2023)

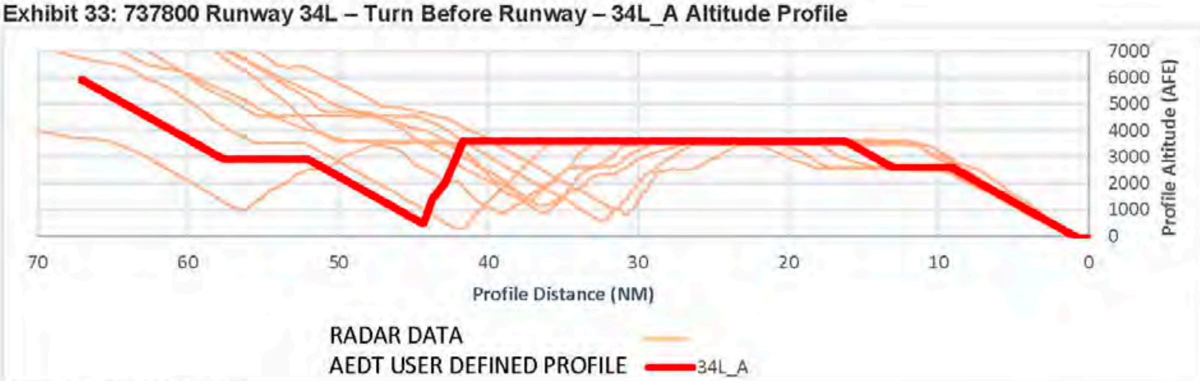
Exhibit 32: EMB 175 Runway 16R – Turn Over Runway – 16R_E Thrust Values Profile

Source: AEDT Version 3e and L&B (2023)

__**737800 34L Graphs - Turn Before Runway**__

This section of graphs shows the vertical profiles of radar missed approaches on Runway 34L starting the missed approach turn before the runway The following graphs show the 737800 proposed user-defined profile for AEDT flight track 34L_A. **Exhibit 33** compares the radar flight track altitudes and the proposed 34L_A user-defined profile. **Exhibit 34** shows the ground speeds and **Exhibit 35** shows the thrust values calculated by AEDT for the 34L_A user-defined profile based on the parameters in **Table 5**.

Exhibit 33: 737800 Runway 34L – Turn Before Runway – 34L_A Altitude Profile



Source: SEA and L&B (2023)

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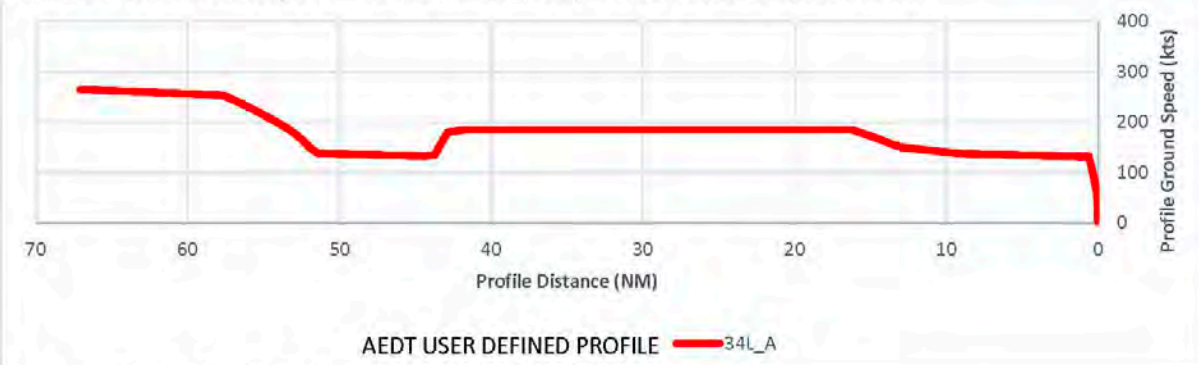
Exhibit 34: 737800 Runway 34L – Turn Before Runway – 34L_A Ground Speed Profile



Source: AEDT Version 3e and L&B (2023)

Exhibit 35: 737800 Runway 34L – Turn Before Runway – 34L_A Thrust Values Profile

Source: AEDT Version 3e and L&B (2023)

737800 34L Graphs – Turn Over Runway

This section of graphs shows the vertical profiles of radar missed approaches on Runway 34L starting the missed approach turn over the runway. The following graphs show the 737800 proposed user-defined profile for AEDT flight track 34L_B. **Exhibit 36** compares the radar flight track altitudes and the proposed 34L_B user-defined profile. **Exhibit 37** shows the ground speeds and **Exhibit 38** shows the thrust values calculated by AEDT for the 34L_B user-defined profile based on the parameters in **Table 5**.

Exhibit 36: 737800 Runway 34L – Turn Over Runway – 34L_B Altitude Profile

Source: SEA and L&B (2023)

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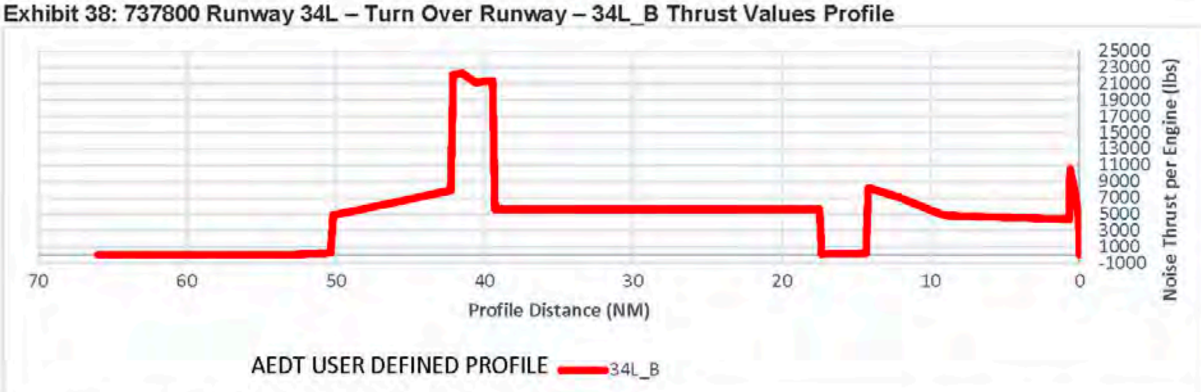
Exhibit 37: 737800 Runway 34L – Turn Over Runway – 34L_B Ground Speed Profile

Source: AEDT Version 3e and L&B (2023)

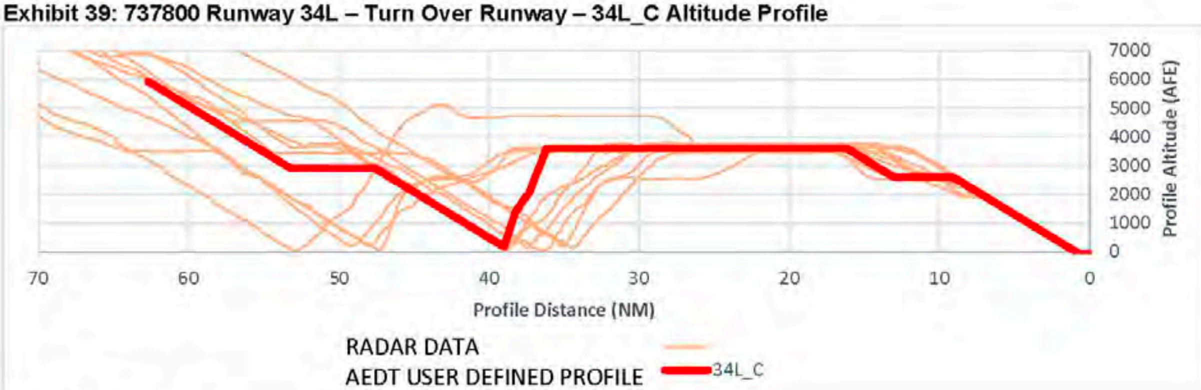
Exhibit 38: 737800 Runway 34L – Turn Over Runway – 34L_B Thrust Values Profile



Source: AEDT Version 3e and L&B (2023)

The following graphs show the 737800 proposed user-defined profile for AEDT flight track 34L_C. **Exhibit 39** compares the radar flight track altitudes and the proposed 34L_C user-defined profile. **Exhibit 40** shows the ground speeds and **Exhibit 41** shows the thrust values calculated by AEDT for the 34L_C user-defined profile based on the parameters in **Table 5**.

Exhibit 39: 737800 Runway 34L – Turn Over Runway – 34L_C Altitude Profile



Source: SEA and L&B (2023)

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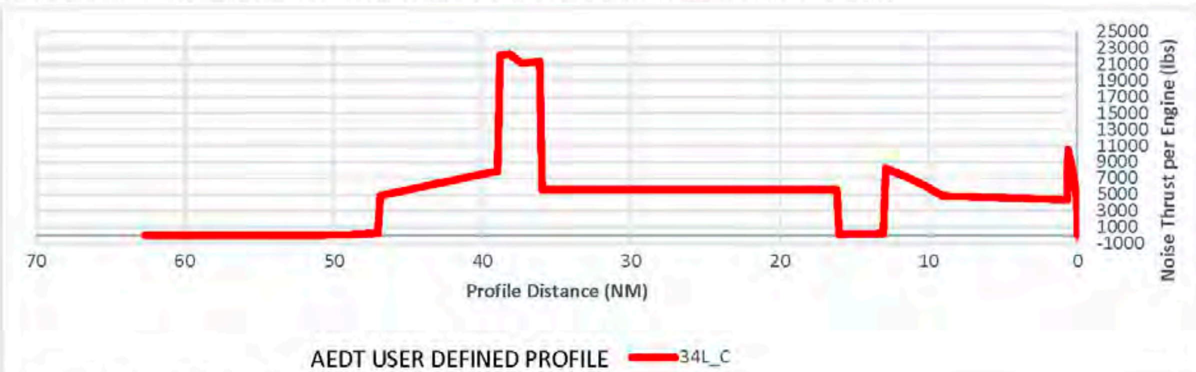
Exhibit 40: 737800 Runway 34L – Turn Over Runway – 34L_C Ground Speed Profile

Source: AEDT Version 3e and L&B (2023)

Exhibit 41: 737800 Runway 34L – Turn Over Runway – 34L_C Thrust Values Profile

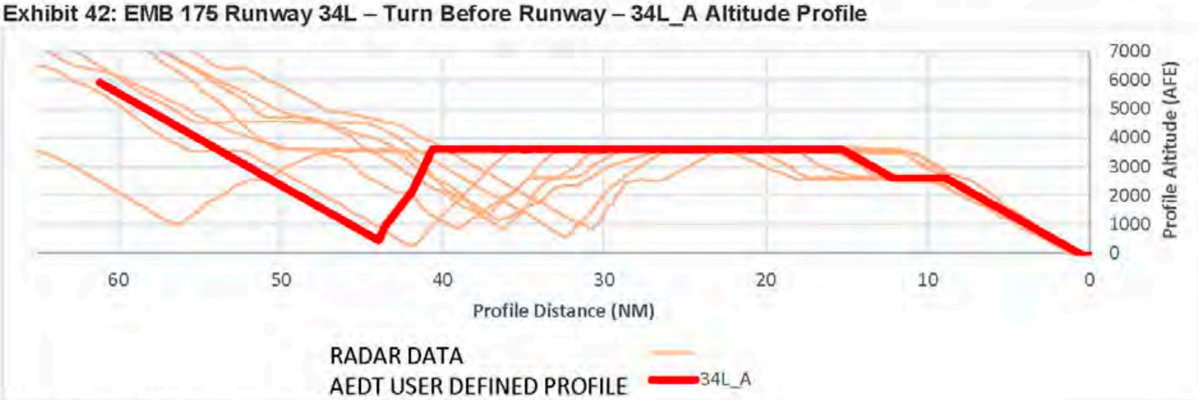


Source: AEDT Version 3e and L&B (2023)

EMB175 34L Graphs – Turn Before Runway

This section of graphs shows the vertical profiles of radar missed approaches on Runway 34L starting the missed approach turn before the runway. The following graphs show the EMB175 proposed user-defined profile for AEDT flight track 34L_A. **Exhibit 42** compares the radar flight track altitudes and the proposed 34L_A user-defined profile. **Exhibit 43** shows the ground speeds and **Exhibit 44** shows the thrust values calculated by AEDT for the 34L_A user-defined profile based on the parameters in **Table 5**.

Exhibit 42: EMB 175 Runway 34L – Turn Before Runway – 34L_A Altitude Profile



Source: SEA and L&B (2023)

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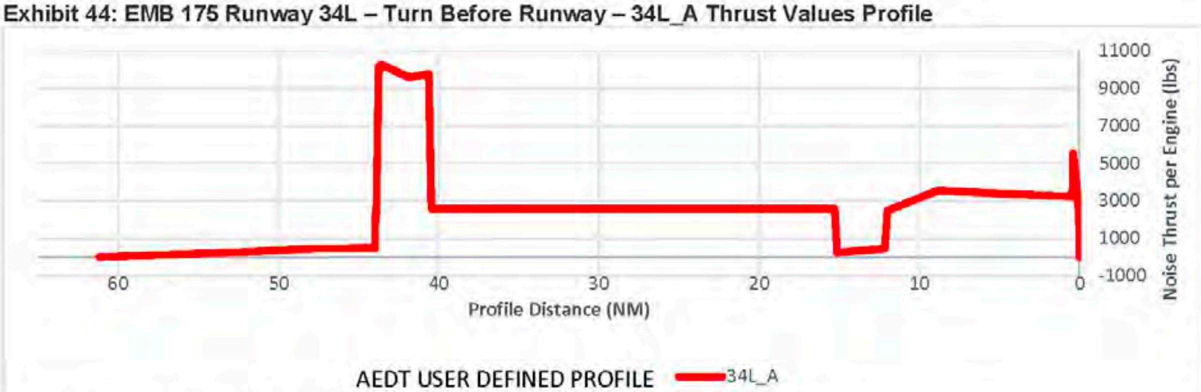
Exhibit 43: EMB 175 Runway 34L – Turn Before Runway – 34L_A Ground Speed Profile

Source: AEDT Version 3e and L&B (2023)

Exhibit 44: EMB 175 Runway 34L – Turn Before Runway – 34L_A Thrust Values Profile

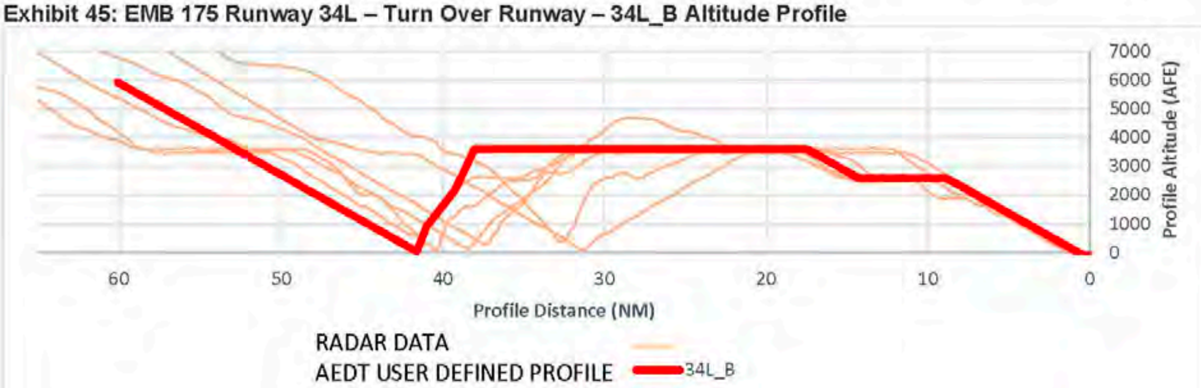


Source: AEDT Version 3e and L&B (2023)

EMB175 34L Graphs – Turn Over Runway

This section of graphs shows the vertical profiles of radar missed approaches on Runway 34L starting the missed approach turn over the runway. The following graphs show the EMB175 proposed user-defined profile for AEDT flight track 34L_B. **Exhibit 45** compares the radar flight track altitudes and the proposed 34L_B user-defined profile. **Exhibit 46** shows the ground speeds and **Exhibit 47** shows the thrust values calculated by AEDT for the 34L_B user-defined profile based on the parameters in **Table 5**.

Exhibit 45: EMB 175 Runway 34L – Turn Over Runway – 34L_B Altitude Profile



Source: SEA and L&B (2023)

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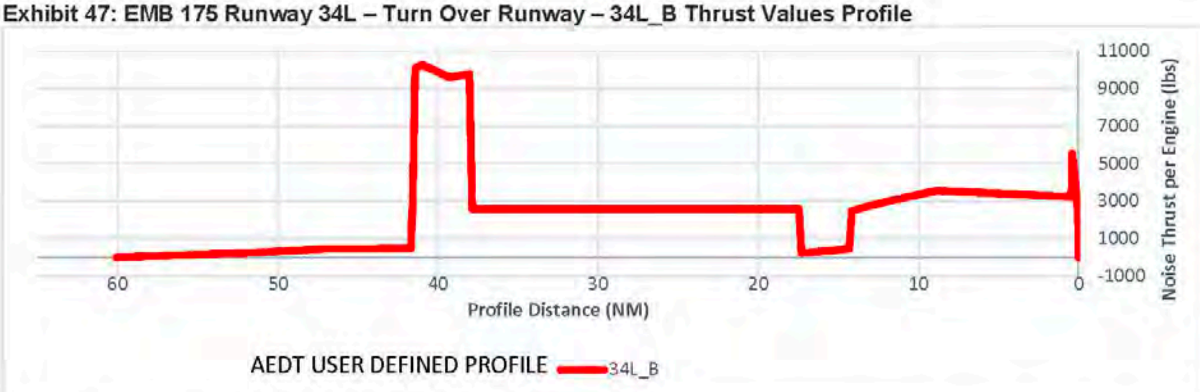
Exhibit 46: EMB 175 Runway 34L – Turn Over Runway – 34L_B Ground Speed Profile

Source: AEDT Version 3e and L&B (2023)

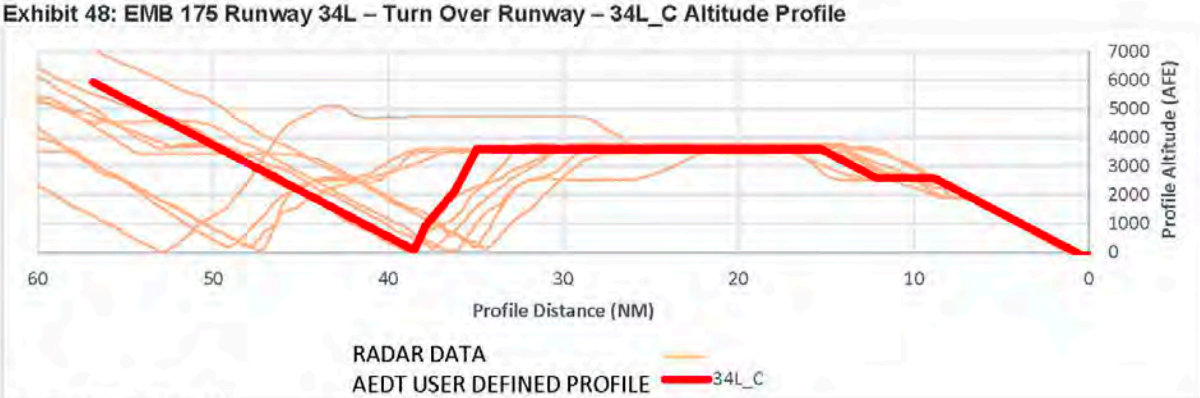
Exhibit 47: EMB 175 Runway 34L – Turn Over Runway – 34L_B Thrust Values Profile



Source: AEDT Version 3e and L&B (2023)

The following graphs show the EMB175 proposed user-defined profile for AEDT flight track 34L_C. **Exhibit 48** compares the radar flight track altitudes and the proposed 34L_C user-defined profile. **Exhibit 49** shows the ground speeds and **Exhibit 50** shows the thrust values calculated by AEDT for the 34L_C user-defined profile based on the parameters in **Table 5**.

Exhibit 48: EMB 175 Runway 34L – Turn Over Runway – 34L_C Altitude Profile



Source: SEA and L&B (2023)

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Exhibit 49: EMB 175 Runway 34L – Turn Over Runway – 34L_C Ground Speed Profile

Source: AEDT Version 3e and L&B (2023)

Exhibit 50: EMB 175 Runway 34L – Turn Over Runway – 34L_C Thrust Profile

Source: AEDT Version 3e and L&B (2023)

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AEDT Missed Approach Procedure Profile Segments

Table 5 lists the procedure profile steps used to create the proposed user-defined profiles for the 737800 and the EMB175.

TABLE 5, MISSED APPROACH PROCEDURE SEGMENTS

ACFT_ID	OP_TYPE	PROF_ID1	PROF_ID2	STEP_NUM	FLAP_ID	STEP_TYPE	THR_TYPE	PARAM1	PARAM2	PARAM3
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	1	A_00	F		6000	248.93	3
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	2	A_00	W	I	3000	249.5	25437
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	3	A_01	W	I	3000	187.18	3671
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	4	A_05	W	I	3000	174.66	5209
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	5	A_15	F		3000	151.41	3
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	6	A_30	D		2817	139.11	3
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	7	A_30	V		1168	139.11	500
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	8	T_05	C	T	1500	0	0
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	9	T_05	A	T	1885.7	181.7	0
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	10	T_05	C	T	3418	0	0
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	11	T_05	V	NULL	3418	181.7	113840
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	12	A_15	F		3418	181.7	3
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	13	A_15	V	NULL	2518	151.41	32000
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	14	A_30	D		2518	139.11	3
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	15	A_30	L	I	393.8	0	0
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	16	NULL	B	V	3837.5	139	40
737800MA_A_X2	A	STANDARDMA_16R_A_X2	1	17	NULL	B	L	0	30	10
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	1	A_00	F		6000	248.93	3
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	2	A_00	W	I	3000	249.5	25437
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	3	A_01	W	I	3000	187.18	3671
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	4	A_05	W	I	3000	174.66	5209
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	5	A_15	F		3000	151.41	3
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	6	A_30	D		2817	139.11	3
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	7	A_30	V		1168	139.11	500
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	8	T_05	C	T	1500	0	0
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	9	T_05	A	T	1885.7	181.7	0
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	10	T_05	C	T	3418	0	0
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	11	T_05	V	NULL	3418	181.7	105200
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	12	A_15	F		3418	181.7	3
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	13	A_15	V	NULL	2618	151.41	32000
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	14	A_30	D		2618	139.11	3
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	15	A_30	L	I	393.8	0	0
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	16	NULL	B	V	3837.5	139	40
737800MA_A_X2	A	STANDARDMA_16R_B_X2	1	17	NULL	B	L	0	30	10
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	1	A_00	F		6000	248.93	3
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	2	A_00	W	I	3000	249.5	25437
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	3	A_01	W	I	3000	187.18	3671
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	4	A_05	W	I	3000	174.66	5209
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	5	A_15	F		3000	151.41	3
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	6	A_30	D		2817	139.11	3
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	7	A_30	V		188	139.11	500
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	8	T_05	C	T	1500	0	0
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	9	T_05	A	T	1885.7	181.7	0
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	10	T_05	C	T	3418	0	0
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	11	T_05	V	NULL	3418	181.7	121550
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	12	A_15	F		3418	181.7	3
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	13	A_15	V		2518	151.41	24000
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	14	A_30	D		2518	139.11	3
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	15	A_30	L	I	393.8	0	0
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	16	NULL	B	V	3837.5	139	40
737800MA_A_X2	A	STANDARDMA_16R_C_X2	1	17	NULL	B	L	0	30	10
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	1	A_00	F		6000	248.93	3
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	2	A_00	W	I	3000	249.5	25437
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	3	A_01	W	I	3000	187.18	3671
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	4	A_05	W	I	3000	174.66	5209
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	5	A_15	F		3000	151.41	3
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	6	A_30	D	NULL	2817	139.11	3
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	7	A_30	V	NULL	218	139.11	500
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	8	T_05	C	T	1500	0	0
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	9	T_05	A	T	1885.7	181.7	0
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	10	T_05	C	T	3418	0	0

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ACFT_ID	OP_TYPE	PROF_ID1	PROF_ID2	STEP_NUM	FLAP_ID	STEP_TYPE	THR_TYPE	PARAM1	PARAM2	PARAM3
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	11	T_05	V	NULL	3418	181.7	182600
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	12	A_15	F		3418	181.7	3
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	13	A_15	V		2518	151.41	24000
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	14	A_30	D		2518	139.11	3
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	15	A_30	L	I	393.8	0	0
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	16	NULL	B	V	3837.5	139	40
737800MA_A_X2	A	STANDARDMA_16R_D_X2	1	17	NULL	B	L	0	30	10
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	1	A_00	F		6000	248.93	3
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	2	A_00	W	I	3000	249.5	25437
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	3	A_01	W	I	3000	187.18	3671
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	4	A_05	W	I	3000	174.66	5209
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	5	A_15	F		3000	151.41	3
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	6	A_30	D	NULL	2817	139.11	3
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	7	A_30	V	NULL	141	139.11	500
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	8	T_05	C	T	1500	0	0
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	9	T_05	A	T	1885.7	181.7	0
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	10	T_05	C	T	3418	0	0
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	11	A_15	V	NULL	3418	181.7	243500
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	12	A_15	F		3418	181.7	3
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	13	A_15	V		2473	151.41	24000
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	14	A_30	D		2473	139.11	3
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	15	A_30	L	I	393.8	0	0
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	16	NULL	B	V	3837.5	139	40
737800MA_A_X2	A	STANDARDMA_16R_E_X2	1	17	NULL	B	L	0	30	10
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	1	A_00	F		6000	248.93	3
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	2	A_00	W	I	3000	249.5	25437
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	3	A_01	W	I	3000	187.18	3671
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	4	A_05	W	I	3000	174.66	5209
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	5	A_15	F		3000	151.41	3
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	6	A_30	D		2817	139.11	3
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	7	A_30	V		577	139.11	500
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	8	T_05	C	T	1500	0	0
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	9	T_05	A	T	1885.7	181.7	0
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	10	T_05	C	T	3677	0	0
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	11	T_05	V	NULL	3677	181.7	154850
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	12	A_15	F		3677	181.7	3
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	13	A_15	V		2677	151.41	24000
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	14	A_30	D		2677	139.11	3
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	15	A_30	L	I	393.8	0	0
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	16	NULL	B	V	3837.5	139	40
737800MA_A_X2	A	STANDARDMA_34L_A_X2	1	17	NULL	B	L	0	30	10
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	1	A_00	F		6000	248.93	3
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	2	A_00	W	I	3000	249.5	25437
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	3	A_01	W	I	3000	187.18	3671
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	4	A_05	W	I	3000	174.66	5209
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	5	A_15	F		3000	151.41	3
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	6	A_30	D		2817	139.11	3
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	7	A_30	V		277	139.11	500
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	8	T_05	C	T	1500	0	0
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	9	T_05	A	T	1885.7	181.7	0
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	10	T_05	C	T	3677	0	0
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	11	T_05	V	NULL	3677	181.7	133450
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	12	A_15	F		3677	181.7	3
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	13	A_15	V		2677	151.41	31900
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	14	A_30	D		2677	139.11	3
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	15	A_30	L	I	393.8	0	0
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	16	NULL	B	V	3837.5	139	40
737800MA_A_X2	A	STANDARDMA_34L_B_X2	1	17	NULL	B	L	0	30	10
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	1	A_00	F		6000	248.93	3
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	2	A_00	W	I	3000	249.5	25437
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	3	A_01	W	I	3000	187.18	3671
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	4	A_05	W	I	3000	174.66	5209
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	5	A_15	F		3000	151.41	3
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	6	A_30	D		2817	139.11	3
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	7	A_30	V		277	139.11	500
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	8	T_05	C	T	1500	0	0

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ACFT_ID	OP_TYPE	PROF_ID1	PROF_ID2	STEP_NUM	FLAP_ID	STEP_TYPE	THR_TYPE	PARAM1	PARAM2	PARAM3
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	9	T_05	A	T	1885.7	181.7	0
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	10	T_05	C	T	3677	0	0
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	11	T_05	V	NULL	3677	181.7	121350
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	12	A_15	F		3677	181.7	3
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	13	A_15	V		2677	151.41	24000
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	14	A_30	D		2677	139.11	3
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	15	A_30	L	I	393.8	0	0
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	16	NULL	B	V	3837.5	139	40
737800MA_A_X2	A	STANDARDMA_34L_C_X2	1	17	NULL	B	L	0	30	10
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	1	1	F		6000	250	3
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	2	NULL	F	I	3000	180	3
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	3	NULL	F	I	2000	140	3
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	4	NULL	F	I	1500	130	3
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	5	ZERO	V		1019	130	500
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	6	ZERO	C	C	1000	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	7	ZERO	A	C	1900	196	0
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	8	ZERO	C	C	3469	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	9	ZERO	V	NULL	3469	196	112600
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	10	NULL	F	I	3469	196	3
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	11	ZERO	V		2577	130	25000
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	12	FULL	D	I	2577	130	3
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	13	FULL	L		276.3	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	14	FULL	B	L	2487	120	40
EMB175_MA_Y2	A	STANDARD_MA_16R_A_Y2	1	15	NULL	B	L	0	30	10
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	1	1	F		6000	250	3
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	2	NULL	F	I	3000	180	3
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	3	NULL	F	I	2000	140	3
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	4	NULL	F	I	1500	130	3
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	5	ZERO	V		1019	130	500
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	6	ZERO	C	C	1000	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	7	ZERO	A	C	1900	196	0
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	8	ZERO	C	C	3419	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	9	ZERO	V	NULL	3419	196	89900
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	10	NULL	F	I	3419	196	3
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	11	ZERO	V		2577	130	40800
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	12	FULL	D	I	2577	130	3
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	13	FULL	L		276.3	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	14	FULL	B	L	2487	120	40
EMB175_MA_Y2	A	STANDARD_MA_16R_B_Y2	1	15	NULL	B	L	0	30	10
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	1	1	F		6000	250	3
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	2	NULL	F	I	3000	180	3
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	3	NULL	F	I	2000	140	3
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	4	NULL	F	I	1500	130	3
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	5	ZERO	V		219	130	500
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	6	ZERO	C	C	1000	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	7	ZERO	A	C	1900	196	0
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	8	ZERO	C	C	3319	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	9	ZERO	V	NULL	3319	196	120800
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	10	NULL	F	I	3319	196	3
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	11	ZERO	V		2677	130	24000
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	12	FULL	D	I	2677	130	3
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	13	FULL	L		276.3	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	14	FULL	B	L	2487	120	40
EMB175_MA_Y2	A	STANDARD_MA_16R_C_Y2	1	15	NULL	B	L	0	30	10
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	1	1	F		6000	250	3
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	2	NULL	F	I	3000	180	3
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	3	NULL	F	I	2000	140	3
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	4	NULL	F	I	1500	130	3
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	5	ZERO	V		219	130	500

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ACFT_ID	OP_TYPE	PROF_ID1	PROF_ID2	STEP_NUM	FLAP_ID	STEP_TYPE	THR_TYPE	PARAM1	PARAM2	PARAM3
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	6	ZERO	C	C	1000	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	7	ZERO	A	C	1900	196	0
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	8	ZERO	C	C	3319	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	9	ZERO	V	NULL	3319	196	181500
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	10	NULL	F	I	3319	196	3
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	11	ZERO	V		2677	130	24000
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	12	FULL	D	I	2677	130	3
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	13	FULL	L		276.3	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	14	FULL	B	L	2487	120	40
EMB175_MA_Y2	A	STANDARD_MA_16R_D_Y2	1	15	NULL	B	L	0	30	10
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	1	1	F		6000	250	3
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	2	NULL	F	I	3000	180	3
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	3	NULL	F	I	2000	140	3
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	4	NULL	F	I	1500	130	3
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	5	ZERO	V		219	130	500
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	6	ZERO	C	C	1000	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	7	ZERO	A	C	1900	196	0
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	8	ZERO	C	C	3319	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	9	ZERO	V	NULL	3319	196	244000
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	10	NULL	F	I	3319	196	3
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	11	ZERO	V		2677	130	24000
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	12	FULL	D	I	2677	130	3
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	13	FULL	L		276.3	0	0
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	14	FULL	B	L	2487	120	40
EMB175_MA_Y2	A	STANDARD_MA_16R_E_Y2	1	15	NULL	B	L	0	30	10
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	1	1	F		6000	250	3
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	2	NULL	F	I	3000	180	3
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	3	NULL	F	I	2000	140	3
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	4	NULL	F	I	1500	130	3
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	5	ZERO	V		527	130	500
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	6	ZERO	C	C	1000	0	0
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	7	ZERO	A	C	1900	196	0
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	8	ZERO	C	C	3677	0	0
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	9	ZERO	V	NULL	3677	196	153900
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	10	NULL	F	I	3677	196	3
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	11	ZERO	V		2677	130	20000
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	12	FULL	D	I	2677	130	3
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	13	FULL	L		276.3	0	0
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	14	FULL	B	L	2487	120	40
EMB175_MA_Y2	A	STANDARD_MA_34L_A_Y2	1	15	NULL	B	L	0	30	10
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	1	1	F		6000	250	3
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	2	NULL	F	I	3000	180	3
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	3	NULL	F	I	2000	140	3
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	4	NULL	F	I	1500	130	3
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	5	ZERO	V		137	130	500
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	6	ZERO	C	C	1000	0	0
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	7	ZERO	A	C	1900	196	0
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	8	ZERO	C	C	3677	0	0
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	9	ZERO	V	NULL	3677	196	125000
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	10	NULL	F	I	3677	196	3
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	11	ZERO	V		2677	130	33200
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	12	FULL	D	I	2677	130	3
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	13	FULL	L		276.3	0	0
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	14	FULL	B	L	2487	120	40
EMB175_MA_Y2	A	STANDARD_MA_34L_B_Y2	1	15	NULL	B	L	0	30	10
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	1	1	F		6000	250	3
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	2	NULL	F	I	3000	180	3
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	3	NULL	F	I	2000	140	3

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ACFT_ID	OP_TYPE	PROF_ID1	PROF_ID2	STEP_NUM	FLAP_ID	STEP_TYPE	THR_TYPE	PARAM1	PARAM2	PARAM3
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	4	NULL	F	I	1500	130	3
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	5	ZERO	V		177	130	500
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	6	ZERO	C	C	1000	0	0
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	7	ZERO	A	C	1900	196	0
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	8	ZERO	C	C	3677	0	0
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	9	ZERO	V	NULL	3677	196	119400
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	10	NULL	F	I	3677	196	3
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	11	ZERO	V		2677	130	20000
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	12	FULL	D	I	2677	130	3
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	13	FULL	L		276.3	0	0
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	14	FULL	B	L	2487	120	40
EMB175_MA_Y2	A	STANDARD_MA_34L_C_Y2	1	15	NULL	B	L	0	30	10

Source: L&B (2023)

AEDT Missed Approach Flight Track Segments

Table 6 lists the AEDT flight track segments for the flight tracks associated with the proposed user-defined profiles.

TABLE 6, MISSED APPROACH FLIGHT TRACK SEGMENTS

TRACK_NAME	SEGMENT_NUM	SEGMENT_TYPE	PARAM_1	PARAM_2
16R_MA_A	1	S	607611.5	NULL
16R_MA_A	2	R	9114.173	30
16R_MA_A	3	S	17827.32	NULL
16R_MA_A	4	R	12152.23	150
16R_MA_A	5	S	58938.32	NULL
16R_MA_A	6	R	9114.173	90
16R_MA_A	7	S	14582.68	NULL
16R_MA_A	8	R	9114.173	90
16R_MA_A	9	S	66837.27	NULL
16R_MA_B	1	S	607611.5	NULL
16R_MA_B	2	R	9114.173	30
16R_MA_B	3	S	16211.08	NULL
16R_MA_B	4	R	15190.29	150
16R_MA_B	5	S	47697.51	NULL
16R_MA_B	6	R	9114.173	90
16R_MA_B	7	S	19443.57	NULL
16R_MA_B	8	R	9114.173	90
16R_MA_B	9	S	48608.92	NULL
16R_MA_C	1	S	607611.5	NULL
16R_MA_C	2	R	9114.173	30
16R_MA_C	3	S	18228.35	NULL
16R_MA_C	4	R	10937.01	150
16R_MA_C	5	S	72913.39	NULL
16R_MA_C	6	R	9114.173	90
16R_MA_C	7	S	12510.72	NULL
16R_MA_C	8	R	9114.173	90
16R_MA_C	9	S	57115.49	NULL
16R_MA_D	1	S	607611.5	NULL
16R_MA_D	2	R	9114.173	30
16R_MA_D	3	S	18228.35	NULL
16R_MA_D	4	R	13367.45	150
16R_MA_D	5	S	97217.85	NULL
16R_MA_D	6	R	9114.173	90
16R_MA_D	7	S	17050.92	NULL
16R_MA_D	8	R	9114.173	90
16R_MA_D	9	S	78394.04	NULL
16R_MA_E	1	S	607611.5	NULL

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TRACK_NAME	SEGMENT_NUM	SEGMENT_TYPE	PARAM_1	PARAM_2
16R_MA_E	2	R	13367.45	30
16R_MA_E	3	S	15190.29	NULL
16R_MA_E	4	R	16405.51	150
16R_MA_E	5	S	121522.3	NULL
16R_MA_E	6	R	9114.173	90
16R_MA_E	7	S	21770.72	NULL
16R_MA_E	8	R	9114.173	90
16R_MA_E	9	S	100468.6	NULL
34L_MA_A	1	S	607611.5	NULL
34L_MA_A	2	L	9114.173	55
34L_MA_A	3	S	13975.07	NULL
34L_MA_A	4	L	11240.81	125
34L_MA_A	5	S	85065.62	NULL
34L_MA_A	6	L	9114.173	90
34L_MA_A	7	S	14794.13	NULL
34L_MA_A	8	L	9114.173	90
34L_MA_A	9	S	85065.62	NULL
34L_MA_B	1	S	607611.5	NULL
34L_MA_B	2	L	9114.173	55
34L_MA_B	3	S	17013.12	NULL
34L_MA_B	4	L	12152.23	125
34L_MA_B	5	S	77774.28	NULL
34L_MA_B	6	L	9114.173	90
34L_MA_B	7	S	18716.95	NULL
34L_MA_B	8	L	9114.173	90
34L_MA_B	9	S	67384.12	NULL
34L_MA_C	1	S	607611.5	NULL
34L_MA_C	2	L	9114.173	55
34L_MA_C	3	S	21609.1	NULL
34L_MA_C	4	L	12152.23	125
34L_MA_C	5	S	65014.44	NULL
34L_MA_C	6	L	9114.173	90
34L_MA_C	7	S	22481.63	NULL
34L_MA_C	8	L	9114.173	90
34L_MA_C	9	S	48608.92	NULL

Source: L&B (2023)

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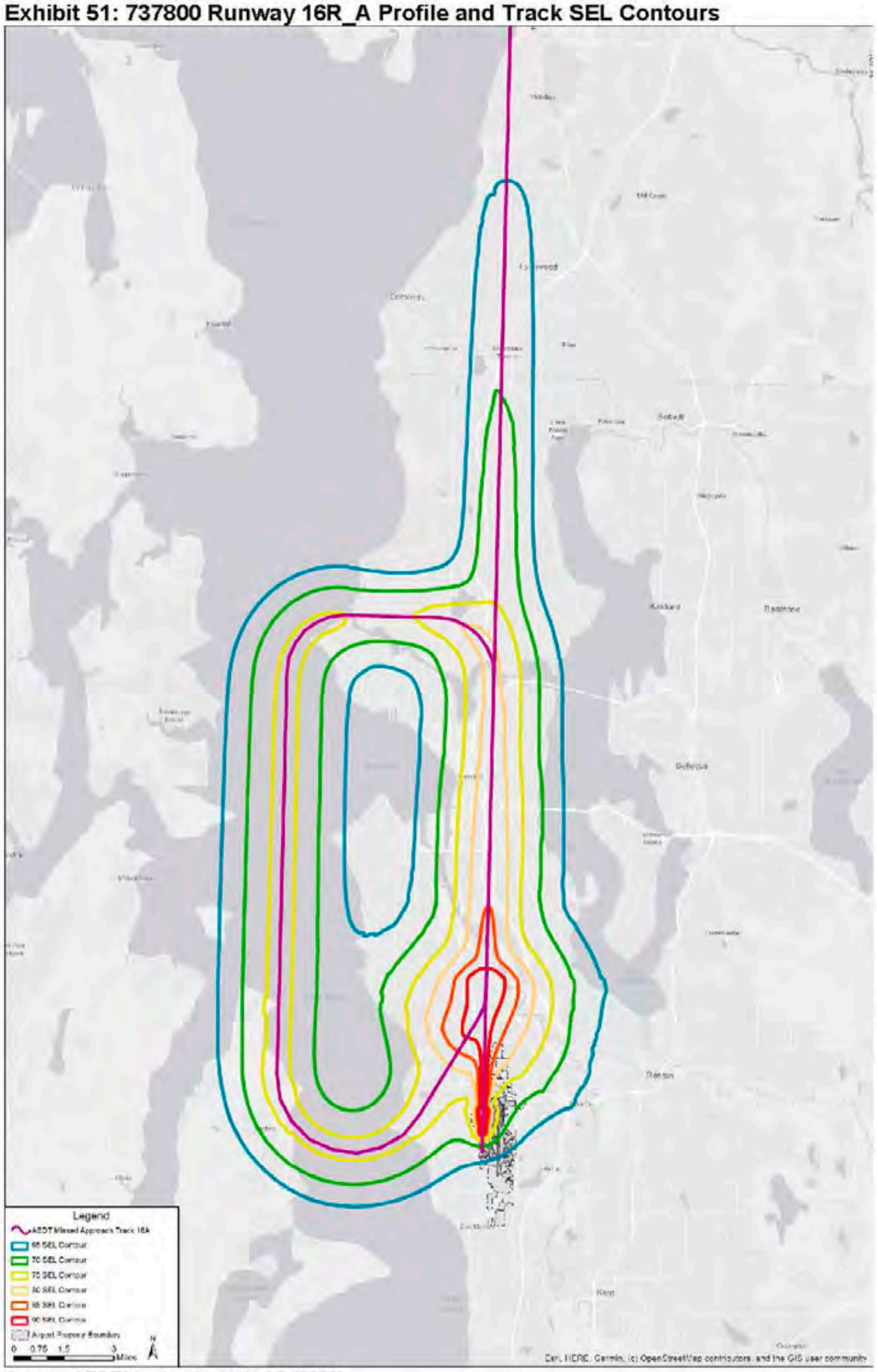
SECTION 3.2 – Sound Exposure Level (SEL) Contours

This section provides maps showing the SEL contours produced by each aircraft, profile, and track described in Section 3.1

Exhibit 51: 737800 Runway 16R_A Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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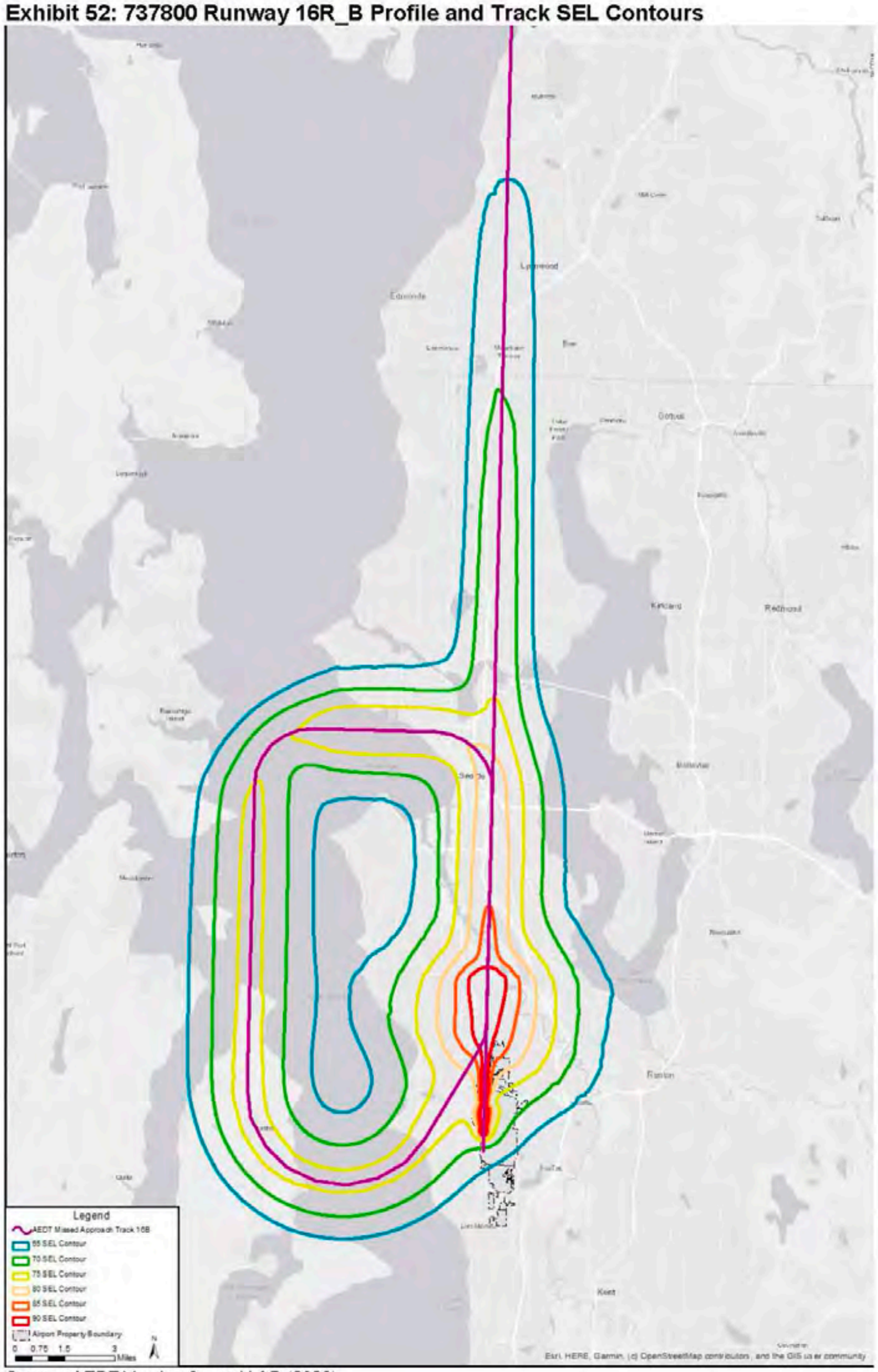
Exhibit 52: 737800 Runway 16R_B Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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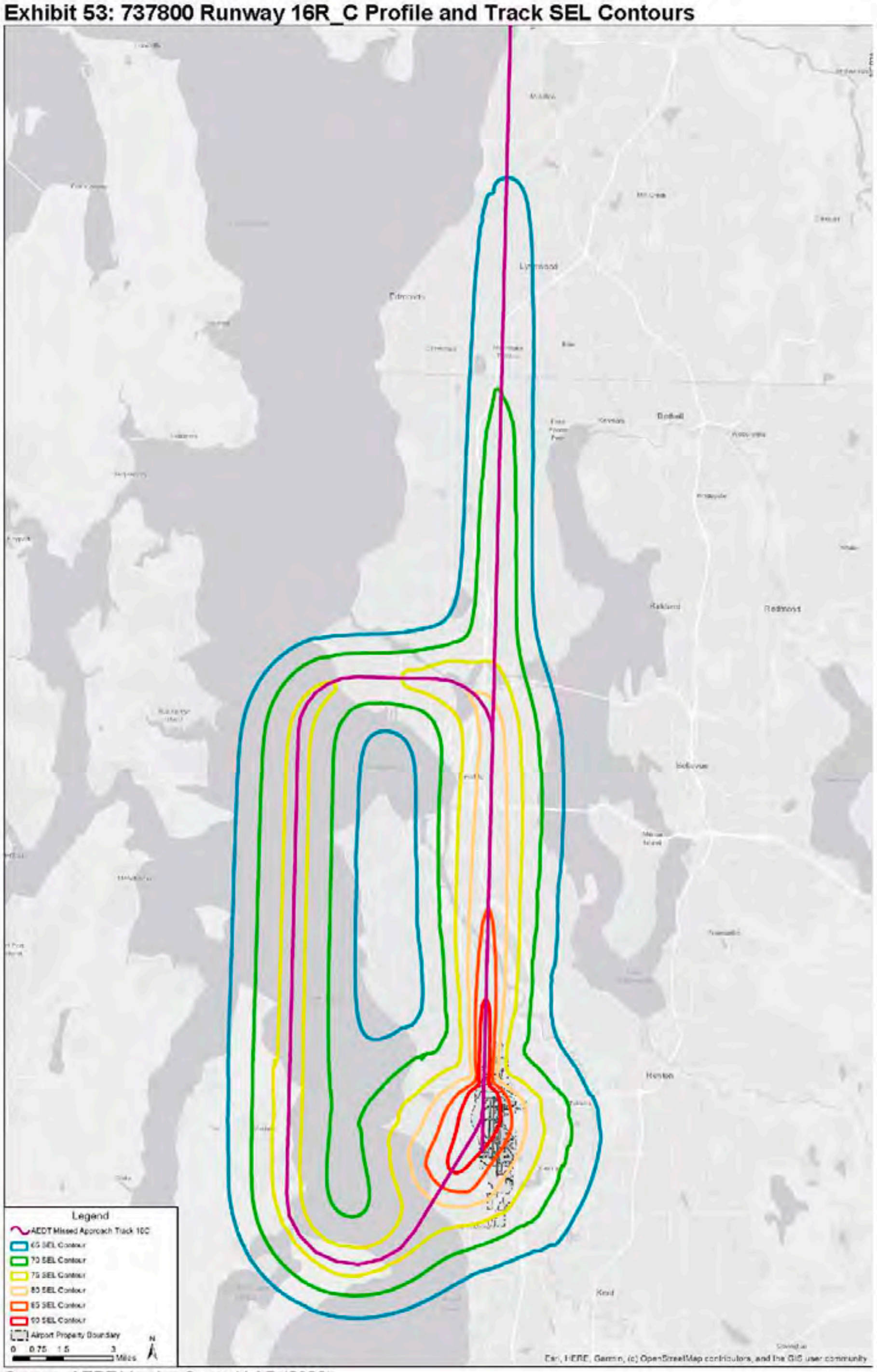
Exhibit 53: 737800 Runway 16R_C Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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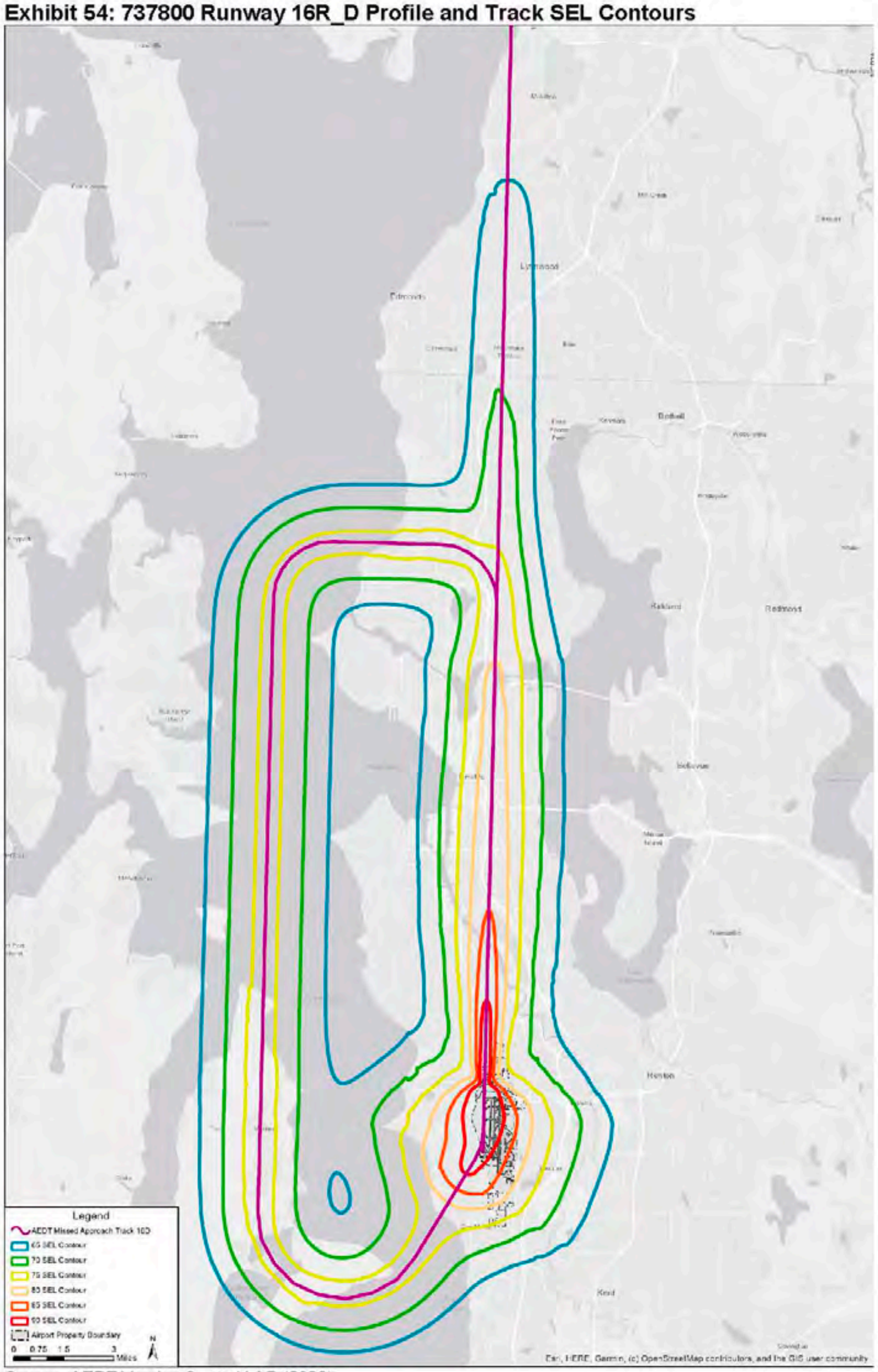
Exhibit 54: 737800 Runway 16R_D Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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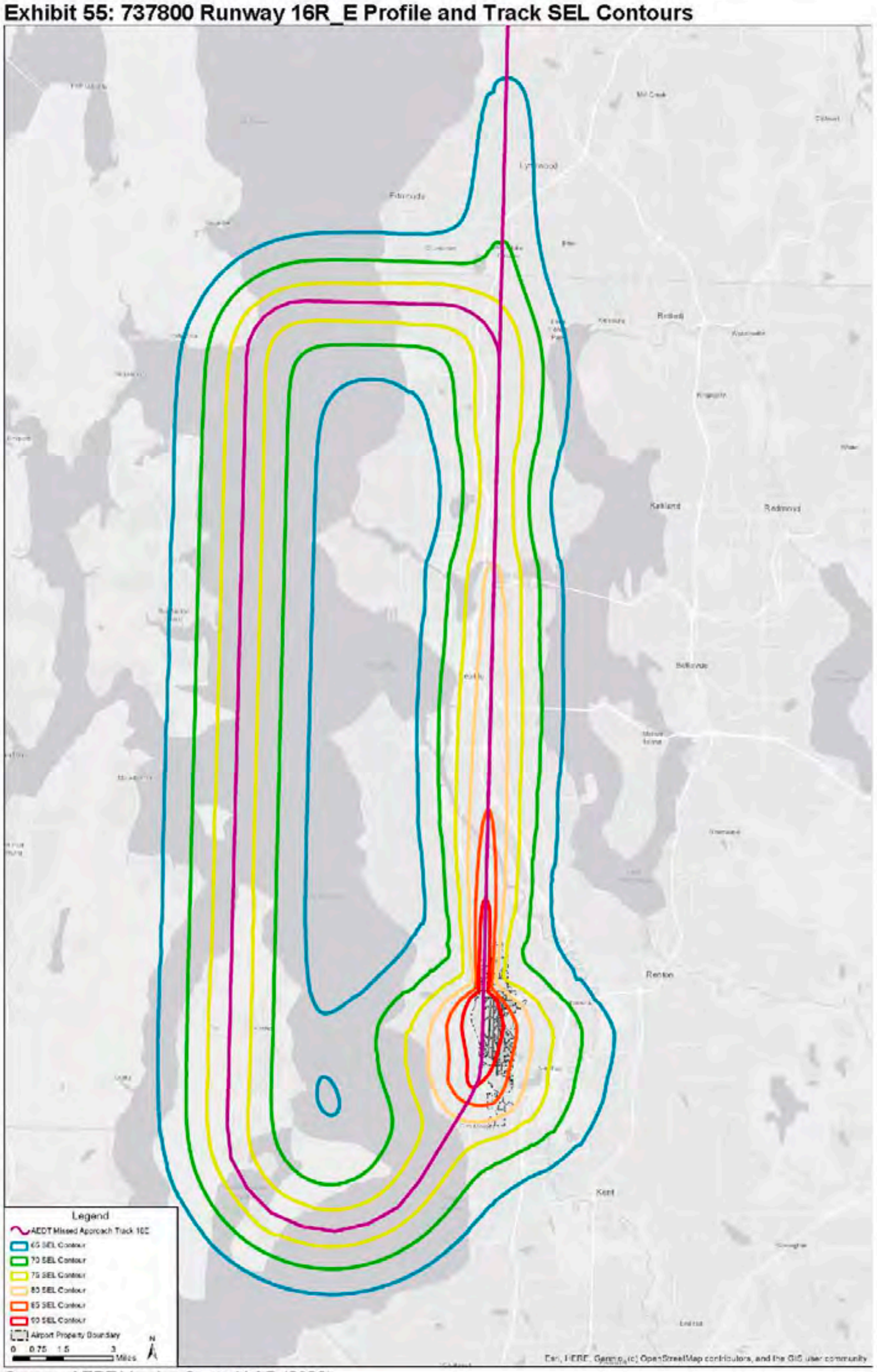
Exhibit 55: 737800 Runway 16R_E Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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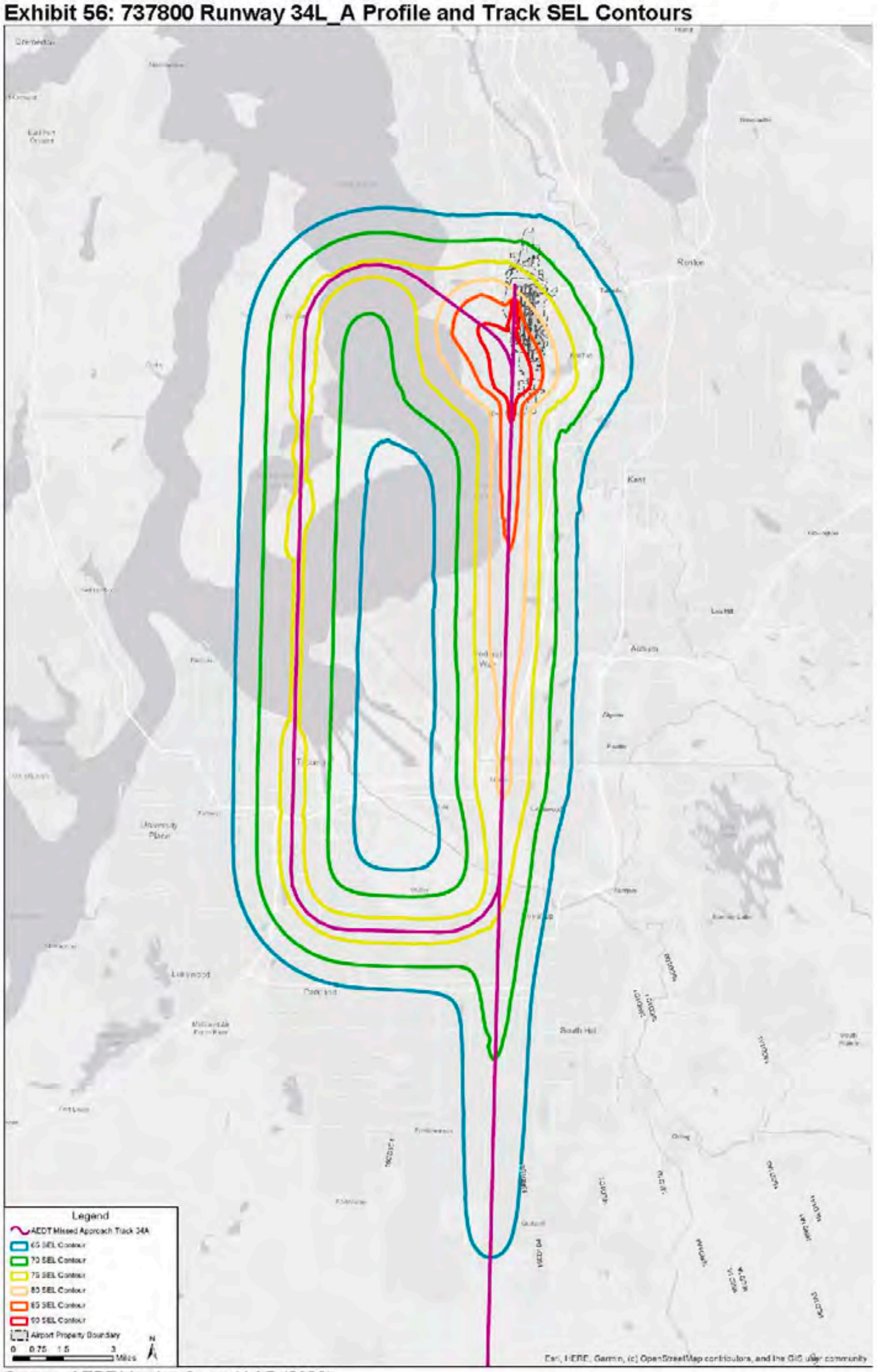
Exhibit 56: 737800 Runway 34L_A Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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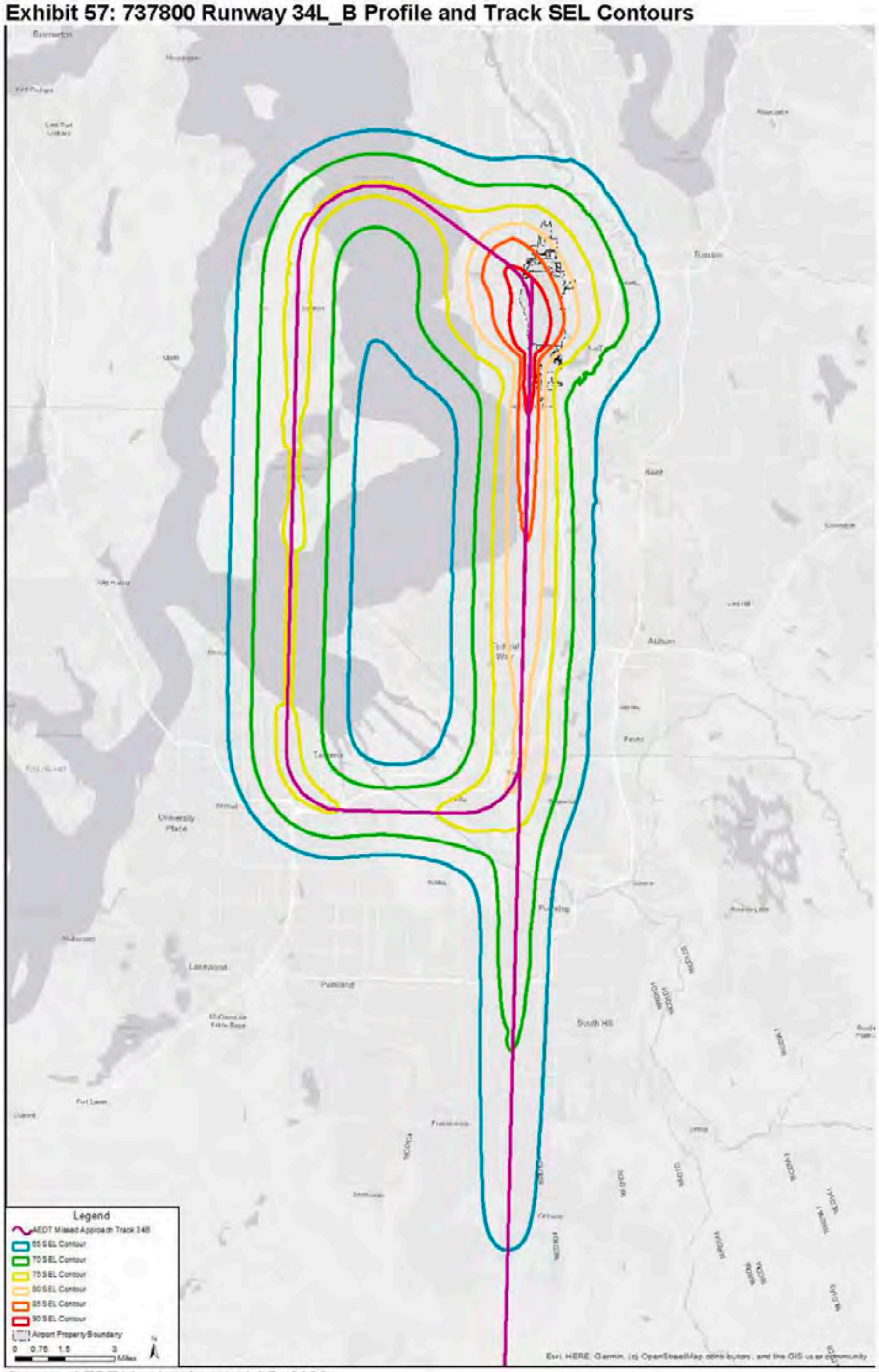
Exhibit 57: 737800 Runway 34L_B Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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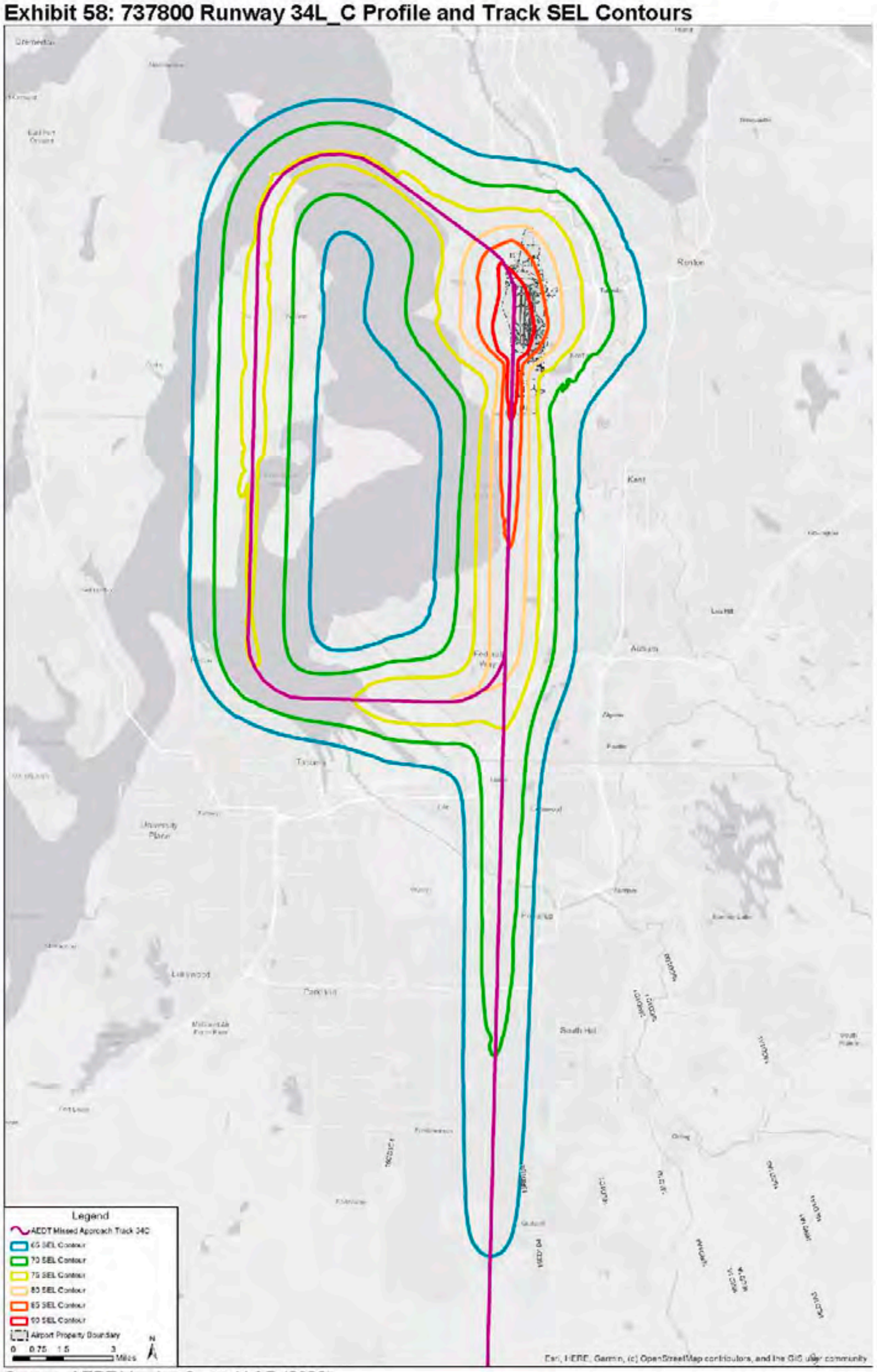
Exhibit 58: 737800 Runway 34L_C Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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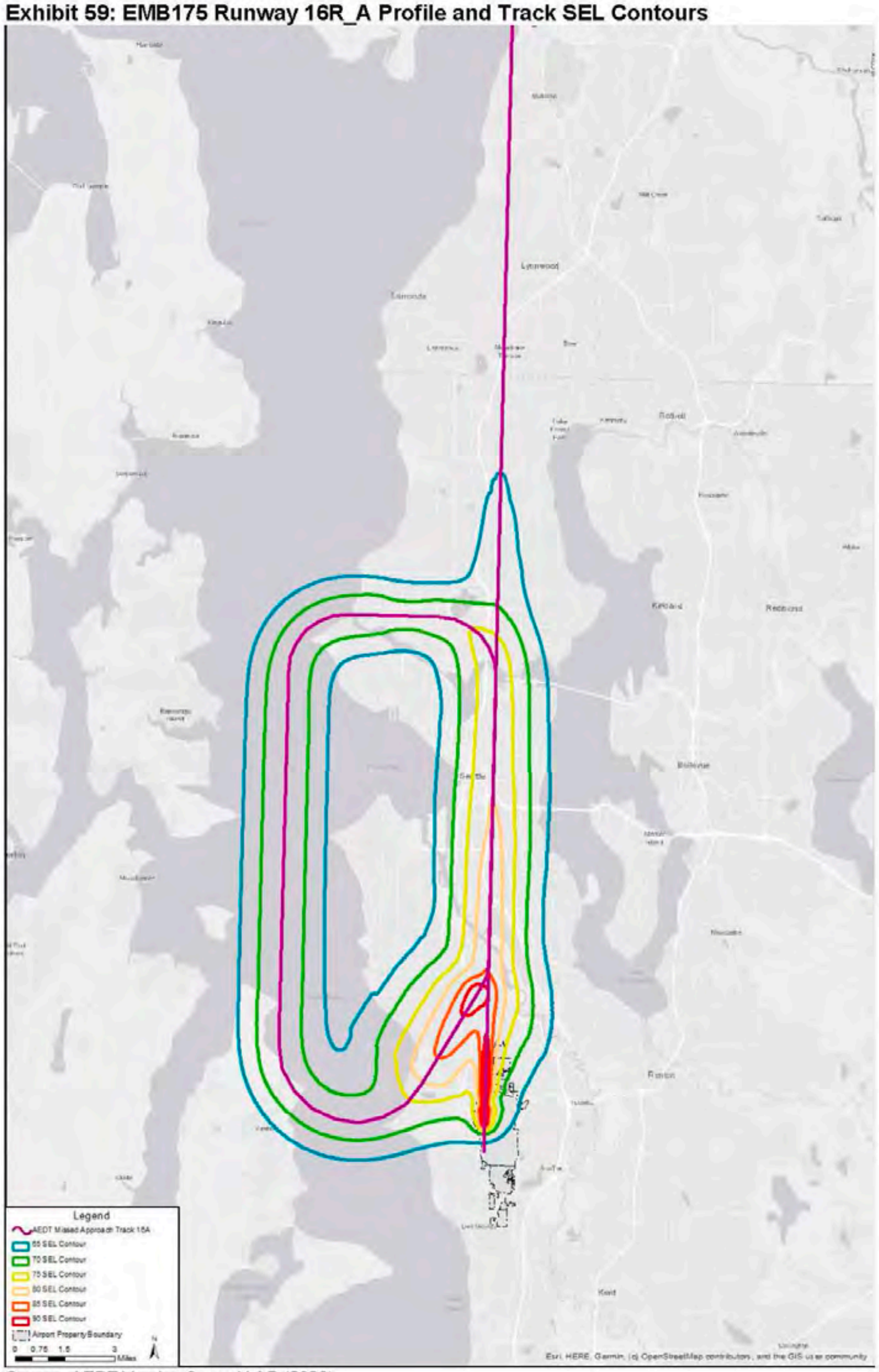
Exhibit 59: EMB175 Runway 16R_A Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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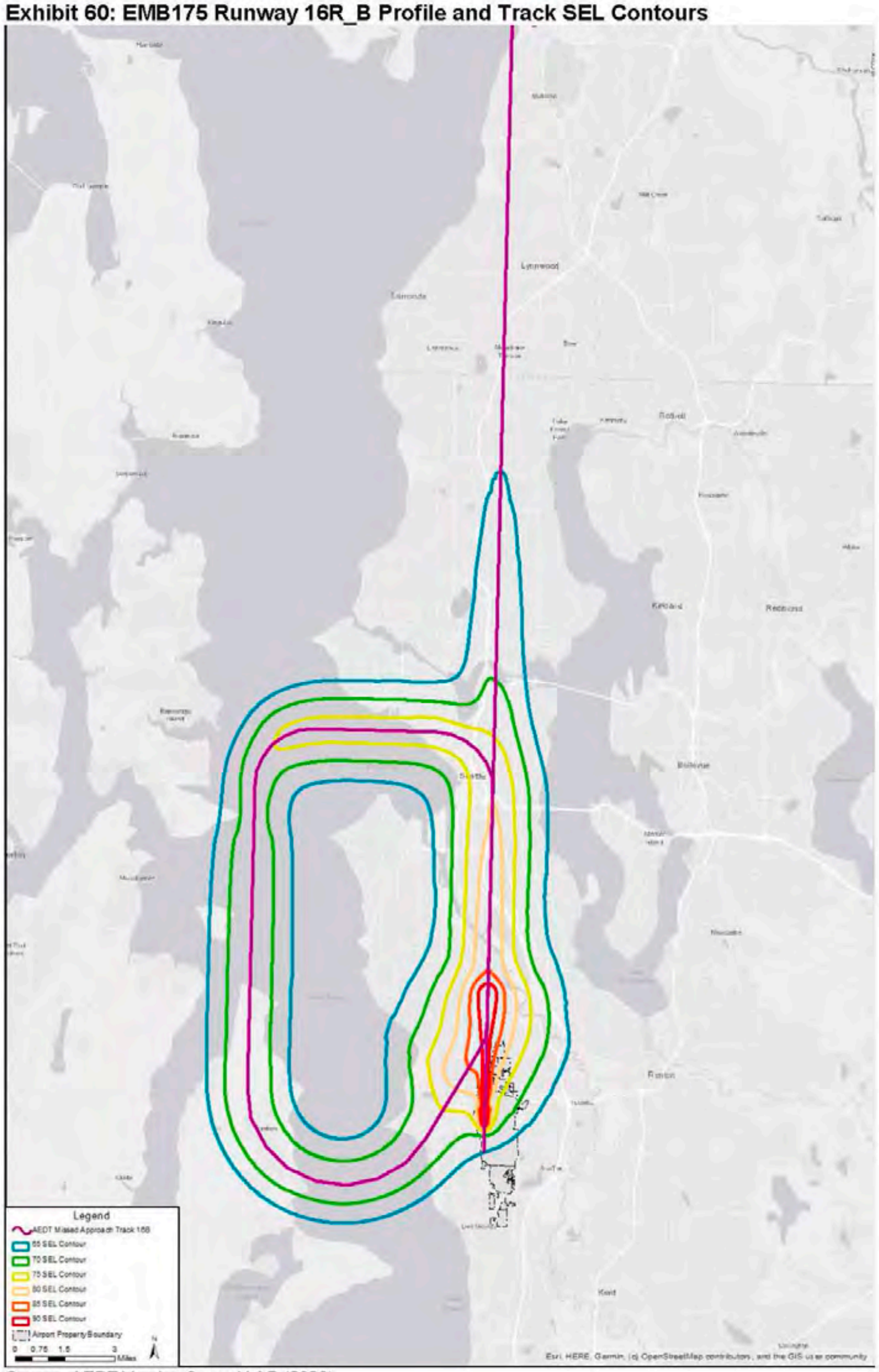
Exhibit 60: EMB175 Runway 16R_B Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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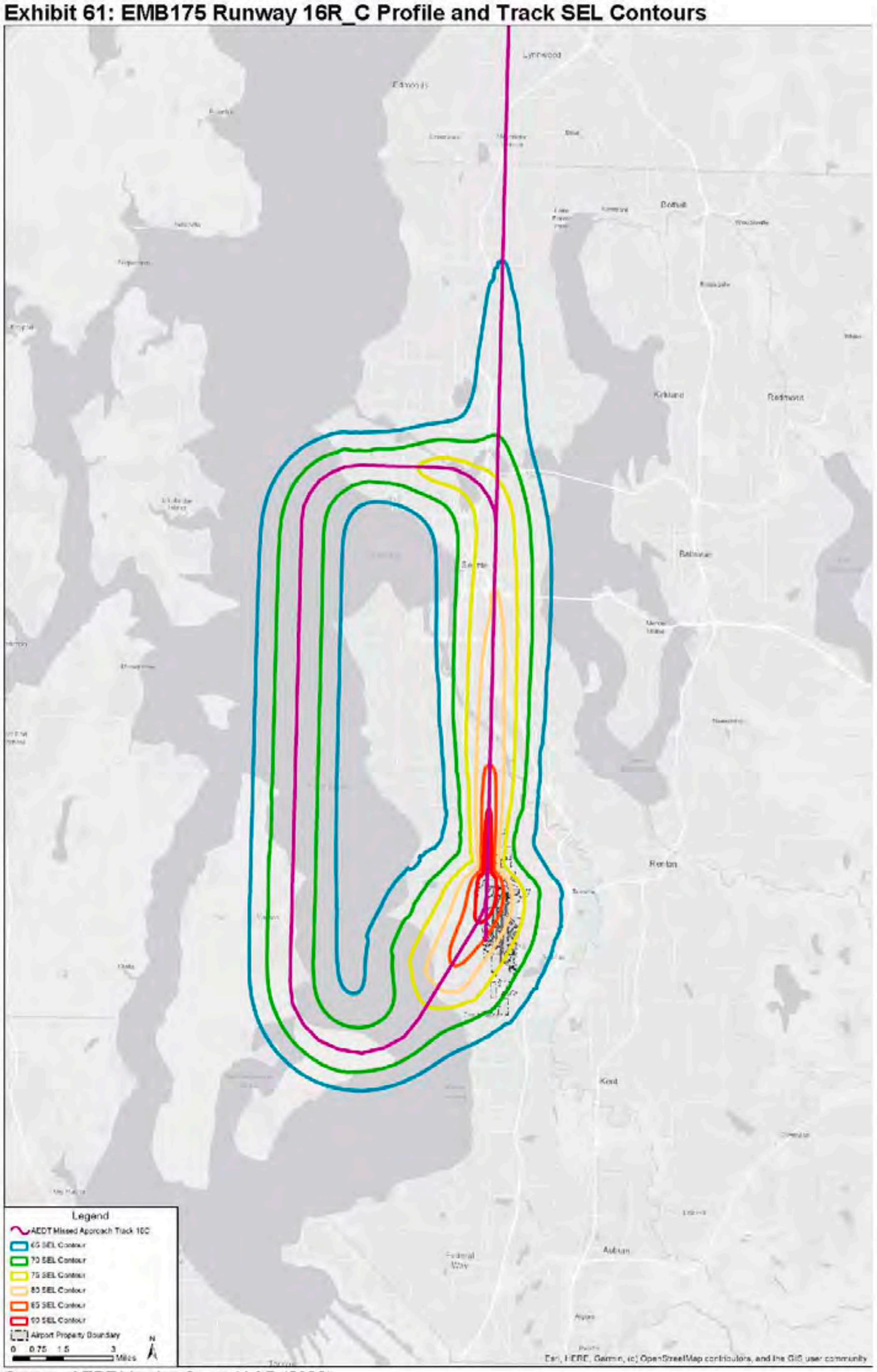
Exhibit 61: EMB175 Runway 16R_C Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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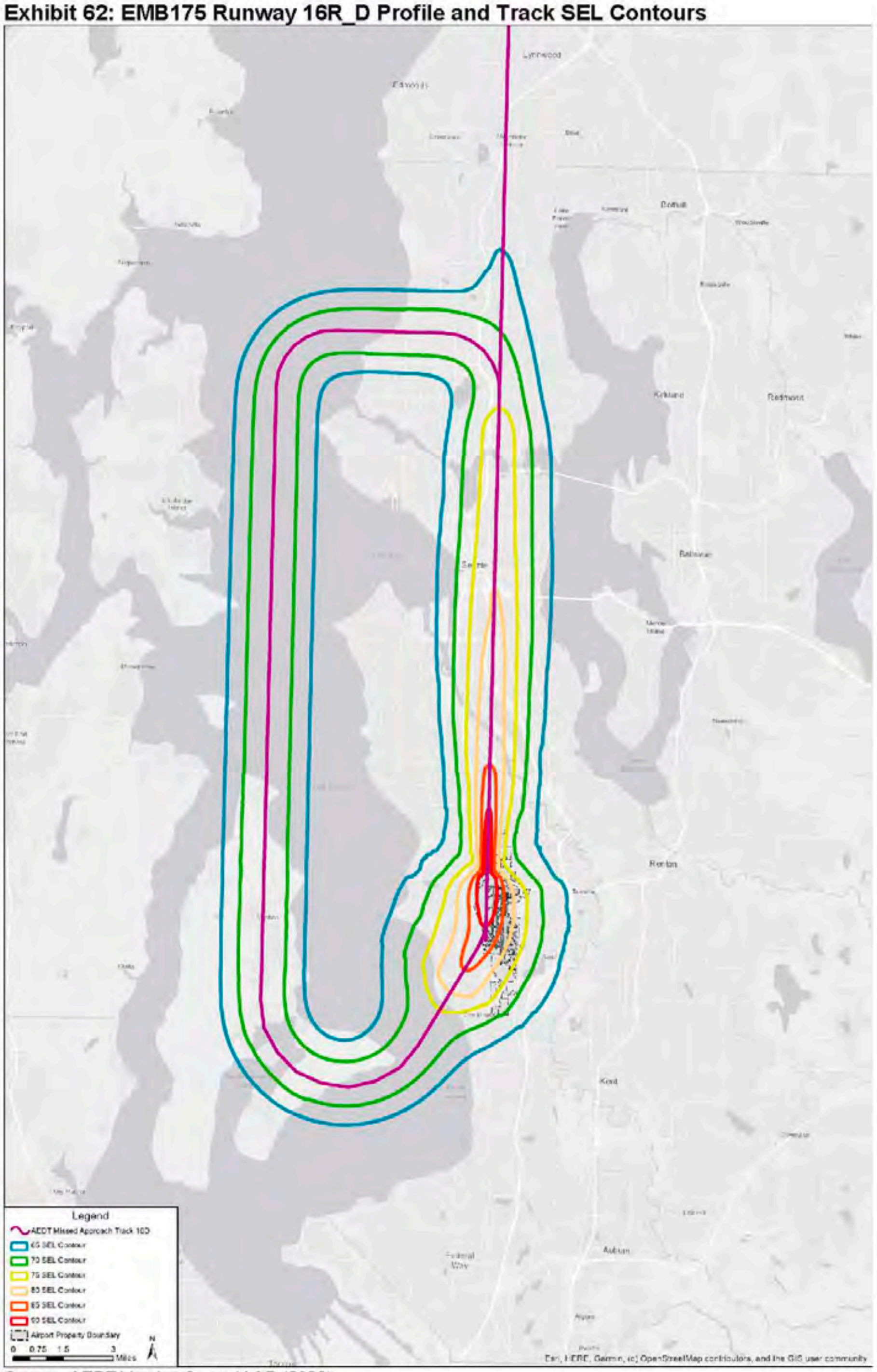
Exhibit 62: EMB175 Runway 16R_D Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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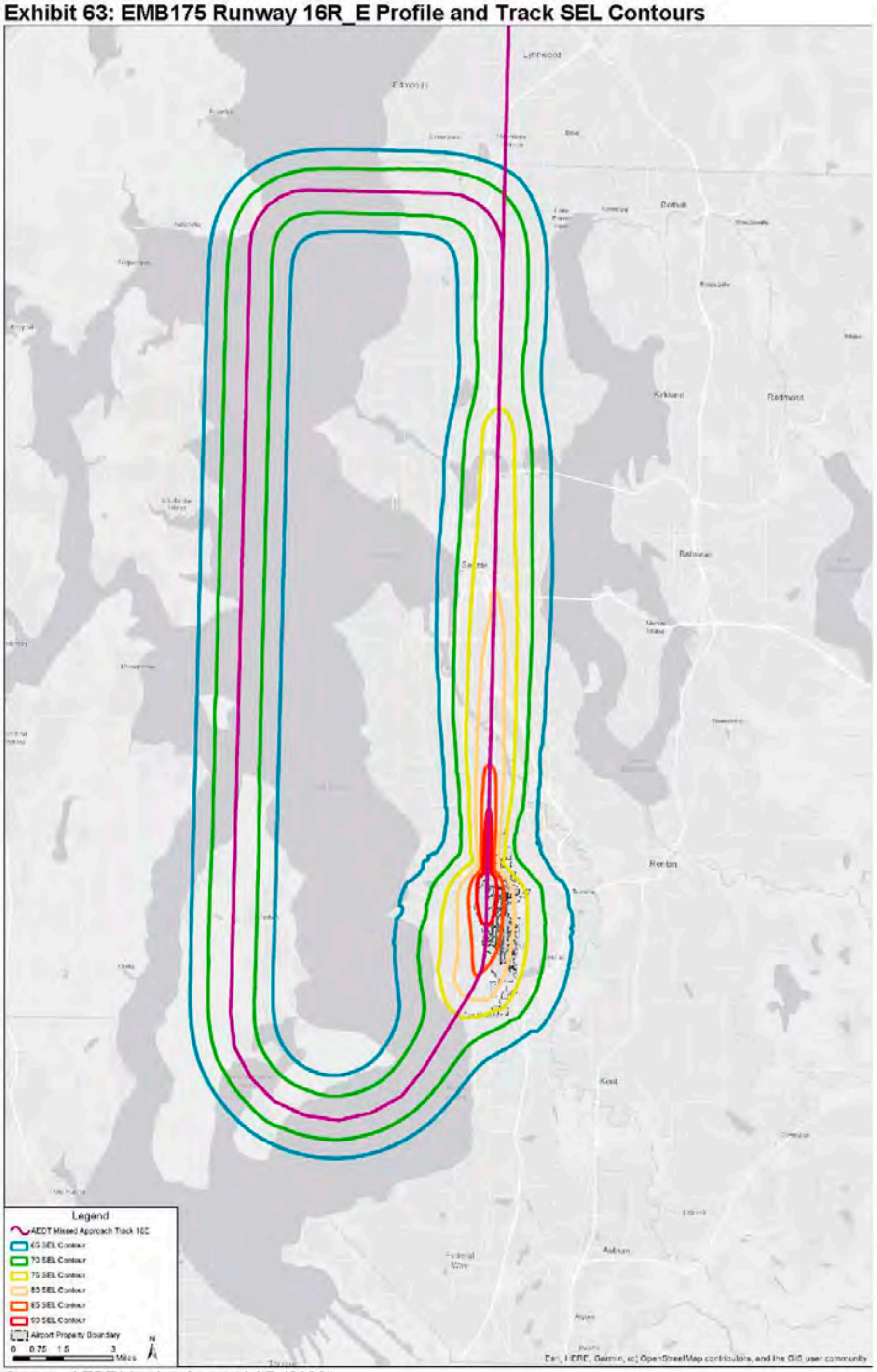
Exhibit 63: EMB175 Runway 16R_E Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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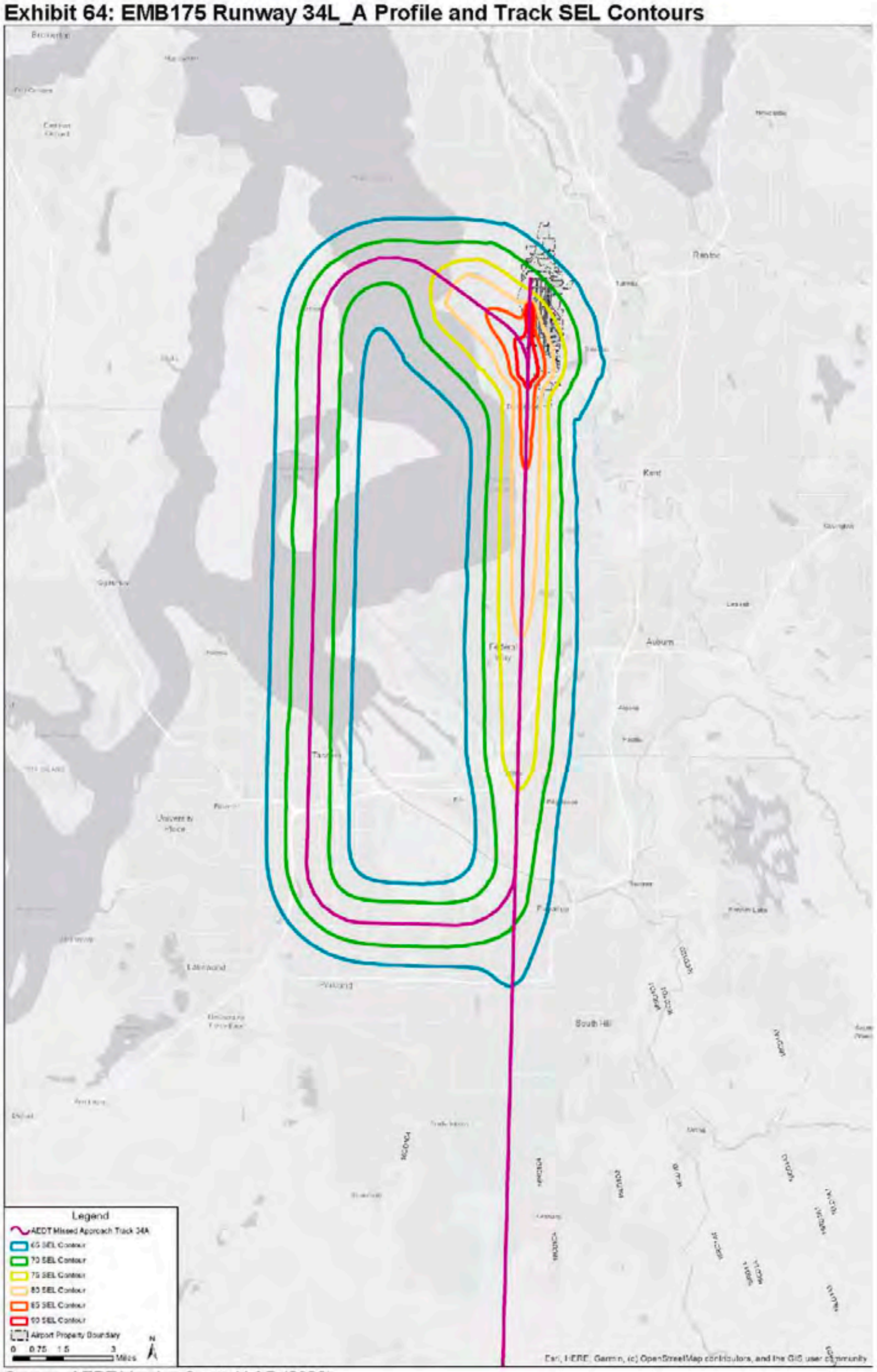
Exhibit 64: EMB175 Runway 34L_A Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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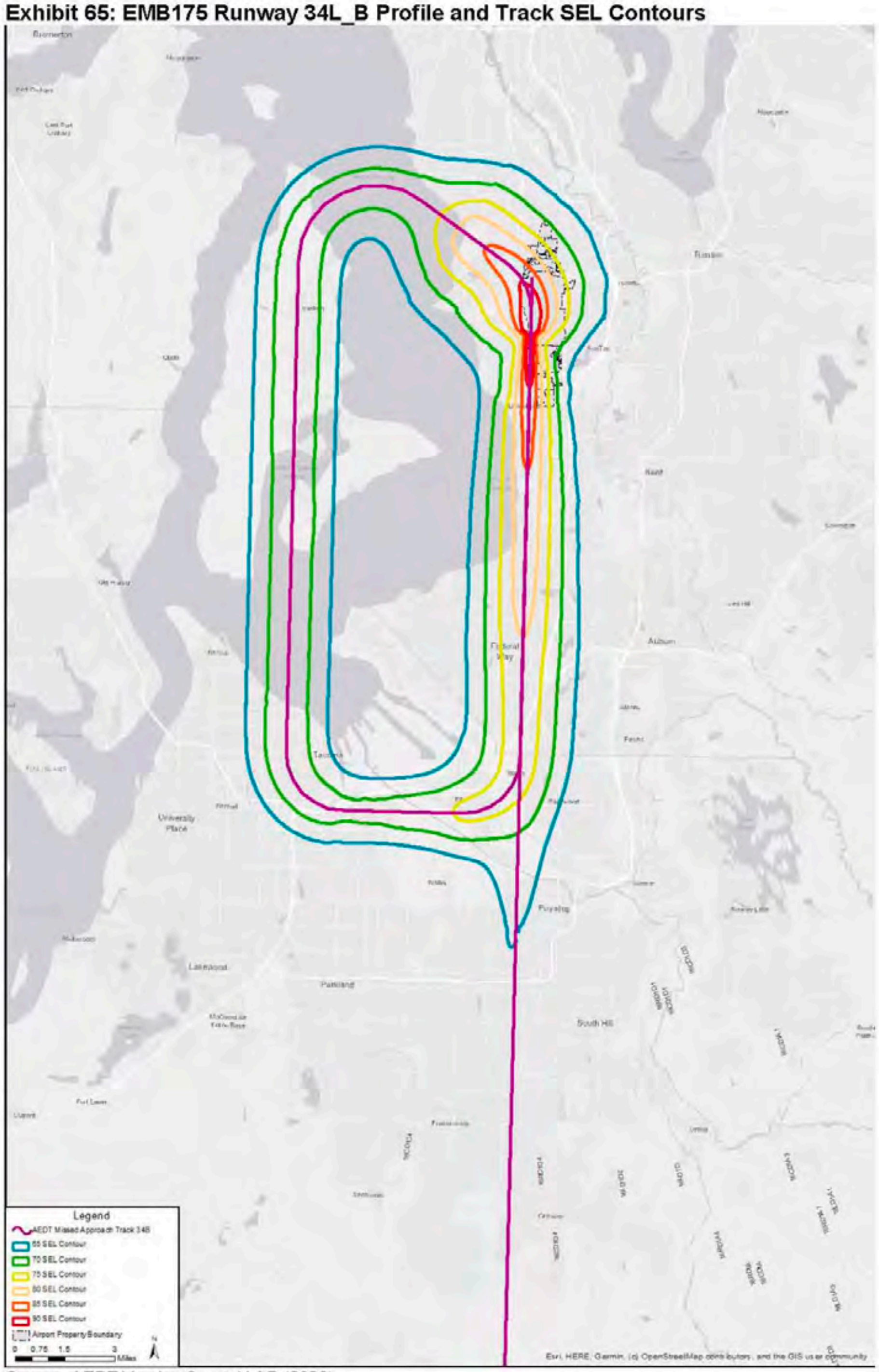
Exhibit 65: EMB175 Runway 34L_B Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

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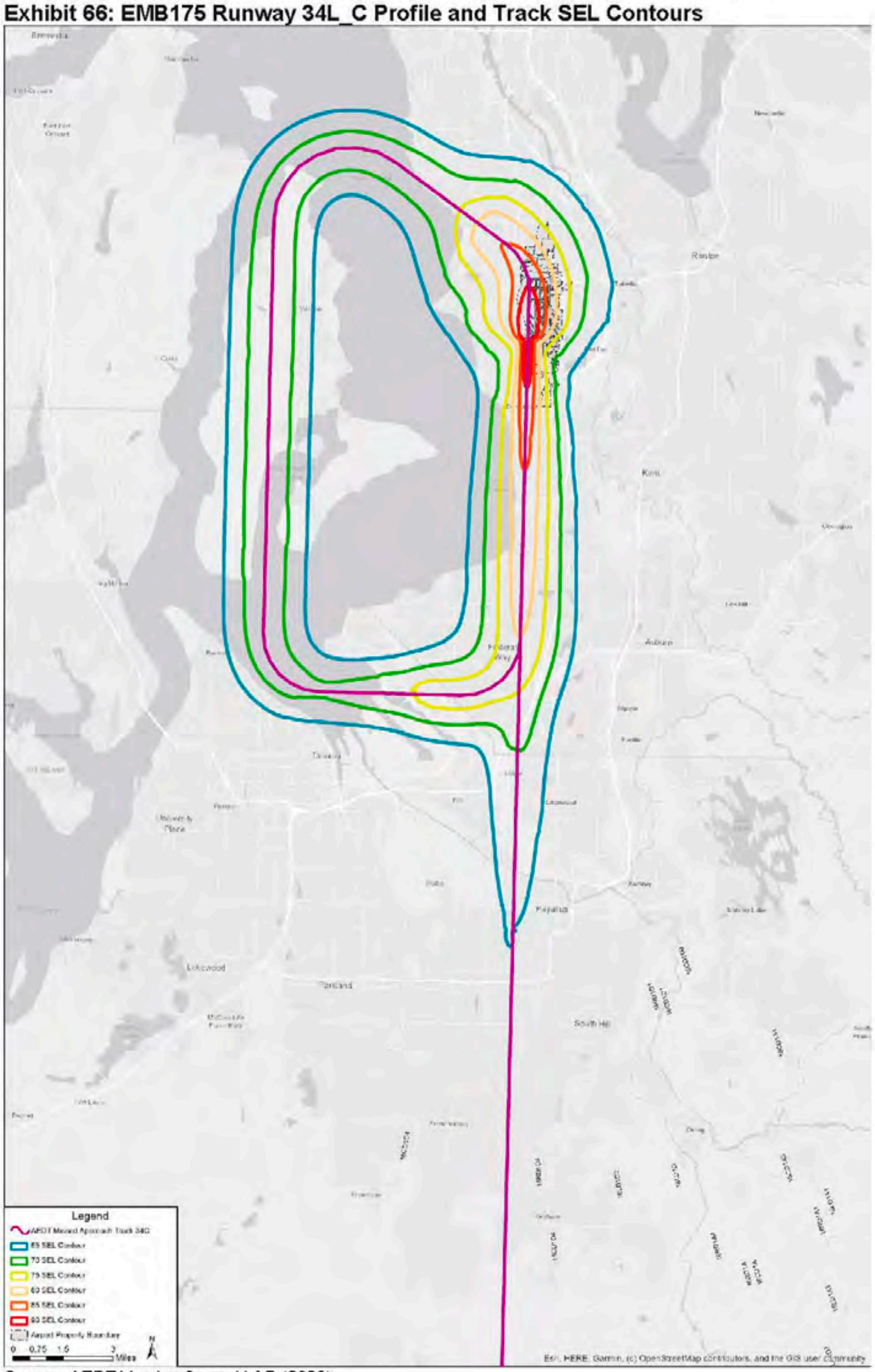
Exhibit 66: EMB175 Runway 34L_C Profile and Track SEL Contours



Source: AEDT Version 3e and L&B (2023)

Exhibit B-2 FAA/AEE Approval Letter

U.S. Department of Transportation
Federal Aviation Administration

Office of Environment and Energy

800 Independence Ave., S.W.
Washington, D.C. 20591

8/22/2023

Kandice Krull
Environmental Protection Specialist
Northwest Mountain Region
Federal Aviation Administration
26805 E 68th Ave, Suite 224
Denver, CO 80249

Dear Kandice Krull,

The Office of Environment and Energy (AEE) has received the memo from Landrum & Brown dated August 15th, 2023, referencing the Environmental Assessment (EA) for the Airport Sustainable Master Plan (SAMP) Near Term Projects (NTP) at Seattle-Tacoma International Airport (SEA). The memo presents a methodology for modeling missed approach operations at SEA in AEDT 3e and requests approval for the use of multiple user-defined profiles for the Boeing 737800 and Embraer EMB175 ANP types to represent missed approached operations.

AEE approves the proposed methodology for modeling missed approaches at SEA and use of the user-defined non-standard AEDT profiles for the Boeing 737800 and Embraer EMB175 ANP types to represent the missed approaches.

Please understand that this approval is limited to this particular Environmental Assessment for the Airport Sustainable Master Plan Near Term Projects at Seattle-Tacoma International Airport and for use with AEDT 3e only. Further non-standard AEDT inputs for additional projects at this or any other site will require separate approval.

Sincerely,

Digitally signed by David Senzig
Date: 2023.08.22 13:19:56 -04'00'

David Senzig
Acting Manager
AEE-100/Noise Division

cc: ARP Contacts (Susan Staehle, APP-400 and Ilon Logan, ANM-610)