Leigh Fisher

In association with

Architecture Building Culture LLC
CH2M Hill Engineers, Inc.
Corgan Associates, Inc.
Corich Group LLC
C&N Consultants, Inc.
Lea+Elliott
Logplan
PRR
Quantum Spatial
Synergy Consultants, Inc.

FINAL

EXECUTIVE SUMMARY

Seattle-Tacoma International Airport

Prepared for

Port of Seattle
Seattle, Washington

May 2018

Sustainable
Airport Master Plan
Seattle-Tacoma International Airport

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Introduction

The key outcomes of the SAMP are a vision for long-term Airport development and Near-Term Projects consistent with the long-term vision.

1.1 Background

The Port of Seattle (the Port) has prepared a Sustainable Airport Master Plan (SAMP) for Seattle-Tacoma International Airport (Airport). The technical approach, analyses, results, and conclusions from the SAMP are documented in nine technical memorandums, this Executive Summary, and airport layout plans. These documents are available on the Port's website; their purpose and contents are described in Appendix A.

1.2 Purpose

The purpose of the SAMP was to develop a facilities plan that will allow the Airport to satisfy the region's air transportation needs through the next 20 years and identify measures that enable the Port to build, manage, and operate the Airport's facilities in ways that meet the Port's sustainability goals and objectives.

1.3 Scope

The SAMP includes the traditional elements of an airport master plan, as defined by the Federal Aviation Administration (FAA) in its Advisory Circular 150/5070-6B *Airport Master Plans* and is augmented with sustainability concepts.

1.4 Approach

The SAMP was initiated with a series of scoping workshops involving the consultant team and stakeholders both internal and external to the Port of Seattle. Stakeholders involved in these scoping workshops included staff from the Port's Aviation Division, the Federal Aviation Administration (FAA), airlines, and local jurisdictions.

Sustainability goals and objectives were developed with guidance from the Port's Century Agenda goals; those goals and objectives guided the development of alternatives and screening criteria that were applied to identify preferred alternatives.

As described in Chapter 5 of this document, the results of extensive airfield modeling and FAA coordination indicate that, as the airfield is currently operated, average annual aircraft delay will exceed sustainable levels with activity forecast to occur by 2029. Accordingly, having identified a vision for comprehensive long-range Airport development (Long-Term Vision, as described in Chapter 4), projects were then identified that are consistent with the Long-Term Vision and will satisfy

the Airport's facility requirements at a level of activity approaching that forecast for 2029 (i.e., the Near-Term Projects).

This package of Near-Term Projects (described in Chapter 5) include airfield improvements that provide benefit with or without longer-term development and can be constructed by 2027. Additional airfield modeling verified that the airfield, with the improvements included in the Near-Term Projects, can support the level of activity forecast for 2027 at a level of average annual delay considered to be sustainable (16.6 minutes, as discussed in Section 5.4).

In summary, the Airport's facility requirements for a 20-year planning horizon ending in 2034 were determined and then used to develop the vision for comprehensive long-range Airport development. A package of Near-Term Projects were then identified that can be constructed by 2027 and can support the level of activity forecast for that year.

A series of actions are recommended following completion of the SAMP (as described in Section 5.6), that will enable a better understanding of the Airport's capacity in the future, and therefore enable the Port to plan for the Airport's development beyond 2027. In addition to actions directly related to environmental approvals, design, and construction of the Near-Term Projects , the most significant actions following completion of the SAMP relate the configuration and operation of airfield/airspace system. Given the complexity of the issues and potential solutions involving benefit-cost trade offs, additional study is required. The study should include a comprehensive systems and modeling approach and an inclusive stakeholder engagement process.

1.5 Contents of this Executive Summary

The SAMP process resulted in both a vision for comprehensive long-range Airport development and a near-term plan, to be implemented by 2027. This document summarizes the principal results of the SAMP - forecasts of aviation activity; facility requirements; alternatives considered; the Long-Term Vision for comprehensive Airport development; the Near-Term Projects that will be implemented by 2027; key actions required following the completion of the SAMP; the potential environmental effects of the proposed development; and the Port's strategic plan to ensure Airport growth will be accomplished as sustainably as possible.

Forecasts of Aviation Activity

The Airport was the fastest-growing large hub in the United States when the SAMP began in 2014; passengers, aircraft operations, and cargo tonnage are forecast to grow.

2.1 Introduction

This chapter summarizes unconstrained forecasts of aviation activity for the Airport, including the forecast approach, methodology, and assumptions. The forecasts are "unconstrained" and, therefore, do not include physical, regulatory, environmental or other impediments to aviation activity growth. Forecasts of aviation activity are presented for enplaned passengers (passengers boarding aircraft at the Airport), air cargo, and aircraft operations, including passenger, all-cargo, general aviation, and military operations. Using data for calendar year 2014 as the base year data, forecasts of annual activity were prepared for four future planning years - 2019, 2024, 2029, and 2034. The forecasts were approved by the FAA on September 24, 2015. In its approval letter the FAA stated the "forecast was considered to be based on reasonable planning assumptions, current data, appropriate forecasting methods, and is consistent with the FAA 2014 Terminal Area Forecast, accessed January 2015."

2.2 Approach

The SAMP forecasts were prepared using a collaborative process which included: (1) a review of previous forecasts prepared for the Airport, including the Part 150 forecasts prepared in 2010 and the Federal Aviation Administration (FAA) 2013 Terminal Area Forecasts (TAF); (2) a review of historical data, (3) the collection and analysis of data related to the key issues and trends affecting future aviation demand at SEA and in the Seattle Region*; (4) input on future airline schedules and fleet mix obtained through a survey of the airlines serving the Airport, (5) the development of statistical models to identify historical causal factors; and (6) coordination with representatives of the Airport and the FAA.

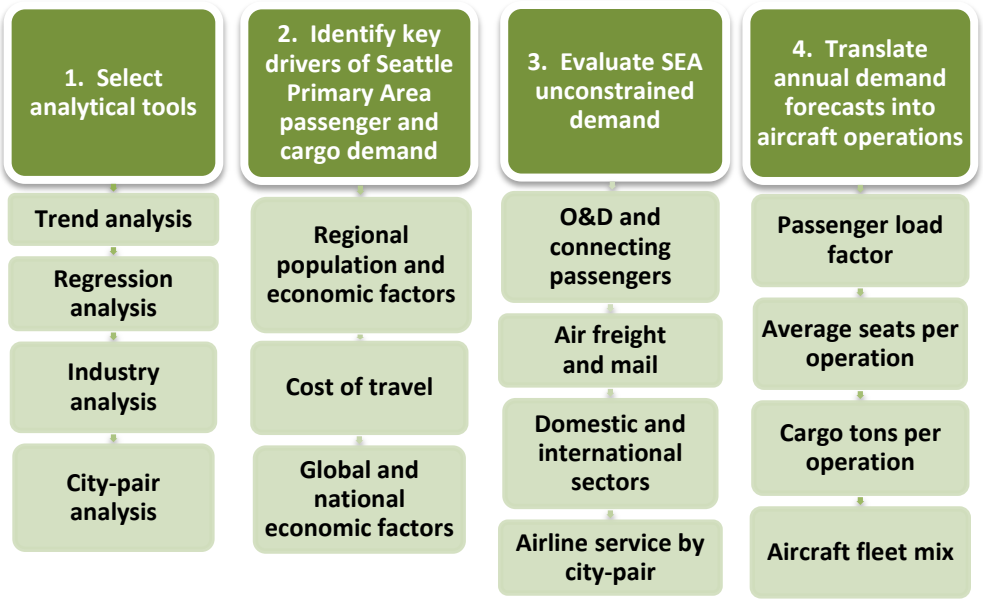
As illustrated in Figure 2-1, the forecast incorporated a multi-tiered approach to evaluate passenger traffic in the Seattle Primary Area. The primary area is defined as the 5-county Puget Sound Regional Council Planning Area (the Seattle Primary Area) which includes the Seattle-Tacoma-Bellevue Metropolitan Statistical Area (MSA), the Olympia-Turnwater MSA, and the Bremerton-Silverdale MSA. The Seattle Primary Area includes the counties of King, Kitsap, Pierce, Snohomish, and Thurston.

*The Seattle Region, also referred to as the Airport service region in this report, includes a primary and secondary area. The primary area consists of 5 counties, including King, Kitsap, Pierce, Snohomish, and Thurston. The secondary area includes the adjacent counties and is defined by the location of and driving distance to other air carrier airports, as well as by the availability, price, and quality of airline service at those other airports.

2.3 Results

The unconstrained forecasts of aviation activity for 2019, 2024, 2029, and 2034 are summarized in Table 2-1.

Figure 2-1
Forecast Approach
Seattle-Tacoma International Airport



Source: LeighFisher, 2014.

Table 2-1

Historical and Forecast Enplaned Passengers, Total Air Cargo, and Aircraft Operations

Seattle-Tacoma International Airport

	Historical	Forecast			
	2014	2019	2024	2029	2034
Enplaned Passengers					
Domestic	16,824,216	20,047,500	23,060,100	26,066,500	28,874,800
International	1,892,399	2,360,100	2,853,600	3,394,300	3,948,800
Airport total	18,716,615	22,407,600	25,913,700	29,460,800	32,823,600
Total Air Cargo					
Domestic	210,810	219,290	230,470	242,230	254,590
International	108,680	132,250	152,540	171,520	187,280
Airport total	319,490	351,540	383,010	413,750	441,870
Aircraft Operations					
Commercial operations	336,238	394,470	444,310	492,520	535,630
General aviation	4,113	4,240	4,350	4,460	4,570
Military	150	200	200	200	200
Airport total	340,478	398,910	448,860	497,180	540,400

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 and U.S. Department of Transportation.
Forecast—LeighFisher, based on available data through September 2014.

Requirements

The SAMP is being driven by a significant requirement for gates and passenger processing facilities and by an airfield system that lacks sufficient capacity.

3.1 Introduction

This chapter summarizes the requirements for facilities and associated land areas to accommodate the forecasts of aviation demand for 2019, 2024, 2029, and 2034, as presented in Chapter 2.

3.2 Approach

Requirements were estimated based on Federal Aviation Administration guidelines (e.g., FAA Advisory Circular 150/5300-13A, *Airport Design*), industry accepted planning guidelines (e.g., those published by the Transportation Research Board), the application of analytical and simulation models (e.g., a gate model, Jeppesen's Total Airspace and Airspace Modeler, and ground transportation models), experience, and judgement.

Recognizing the uncertainties associated with long-range aviation activity forecasting, four planning activity levels (PALs) were identified to represent future levels of activity at which key Airport improvements will be necessary. The use of PALs allows for facilities planning that is realistically tied to milestone activity levels as they occur, rather than arbitrary years. PAL 1, PAL 2, PAL 3, and PAL 4 correspond to the forecasts for 2019, 2024, 2029, and 2034, respectively.

The requirements summarized in this Chapter 3 are the basis for the alternative solutions discussed in Chapter 4.

3.3 Results

The conclusions from the requirements analyses having the greatest impact on long-range planning for the Airport were (1) improvements in airfield facilities (e.g., new taxiways and runway exits)and airfield and airspace operating strategies (e.g., the use of Runway 16L-34R for arrivals) will be needed by 2029 to avoid high aircraft delay, (2) by 2034, 35 additional gates will be required, (3) significant increases in terminal and landside capacity are needed, and (4) significant increases in cargo warehouse capacity are needed. In this document, "gate" refers to an aircraft parking position equipped with a passenger boarding bridge connected to the passenger terminal, also known as a "contact gate."

Estimates of facility requirements are summarized in Table 3-1 for PAL 1(2019), PAL 2, (2024), PAL 3 (2029), and PAL 4 (2024). In Chapter 1, the year 2027 was identified as the year in which the Near-Term Projects will be completed. The significance of the year 2027 and how it relates to the near-term plan is explained in Chapter 5.

Table 3-1
Facility Requirements Summary
Seattle-Tacoma International Airport

Facility	Existing (2014)	PAL 1 (2019)	PAL 2 (2024)	PAL 3 (2029)	PAL 4 (2034)	Sources
AIRFIELD						
Runway length (feet)						LeighFisher, 2015
Runway 16L - 34R	11,901		Existing length is adequate			
Runway 16C - 34C	9,426		Existing length is adequate			
Runway 16R - 34L	8,500		Existing length is adequate			
Compliance-related requirements						
Separation between Runway 16R-34L and Taxiway B	No expansion, beyond that already approved, to impede meeting 500-foot standard.					FAA, 2017
PASSENGER TERMINAL						
Aircraft gates						LeighFisher, 2015
Domestic	70	77	82	82	84	
International	13	18	22	24	29	
Total gates	83	95	104	106	113	
Passenger check-in positions						LeighFisher, 2015
Check-in lobby						
Kiosk no bag check	40	77	80	84	90	
Agent with bag check	214	211	219	235	250	
Garage	15	11	11	11	12	
Curb	15	14	15	16	17	
Passenger security screening lanes	31	34	36	37	41	LeighFisher, 2015
Domestic baggage claim devices	16	18	20	22	24	Logplan, 2016
ACCESS AND PARKING						
Terminal-area circulation roadways (lanes)						InterVISTAS, 2016
Approach to Upper Drive	2	2	2	3	3	
Approach to Lower Drive	2	4	4	5	5	
Curbside roadways (linear feet)						InterVISTAS, 2016
Enplaning curbside (upper drive)	1,200	1,180	1,260	1,320	1,460	
Deplaning curbside (lower drive)	1,530	1,970	2,190	2,290	2,500	
Curbside roadways (number of lanes)						InterVISTAS, 2016
Enplaning curbside (upper drive)	4	4	4	4	5	
Deplaning curbside (lower drive)	5	5	5	6	6	
Public parking (spaces)	32,920	30,750	34,670	38,450	42,240	InterVISTAS, 2016
Employee parking (spaces) – Port Facilities	4,876	4,970	5,570	6,790	7,650	Port of Seattle, 2016
Rental car facilities (thousand sf)	1,700	1,700	1,700	1,700	1,970	InterVISTAS, 2016
AIR CARGO *(based on forecast demand – conservative utilization scenario)*						
Warehouse area (sf)						Logplan, 2015
Air freight	n/a	270,000	303,000	335,000	362,000	
Integrator freight	n/a	74,000	78,000	83,000	87,000	
Air mail	n/a	53,000	54,000	56,000	57,000	
Total	354,660	397,000	435,000	474,000	506,000	
Freighter hardstands	14	15	17	19	19	LeighFisher, 2015
AIRLINE SUPPORT						
Fuel storage						
Based on 10-day reserves						Corich Group, 2016
Quantity (millions of gallons)	17	26	29	32	35	
Land area (acres)	11	16	18	20	21	
AIRPORT SUPPORT						
Aviation maintenance (acres)	5	6	6	6	6	Corich Group, 2016
Airport rescue and firefighting (acres)						
East station	4	2	2	2	2	
West station	n/a	2	2	2	2	

Source: LeighFisher, June 2017.

3.3.1 Airfield

The initial analyses of airfield capacity and delay determined that, if future demand levels materialize and no procedural improvements or capacity enhancements to the existing airfield were made, estimated average annual aircraft delay would be between 20 – 25 minutes by 2029 and in excess of 40 minutes by 2034. The analysis of airfield capacity and delay is technically complex; since the initial SAMP analyses were completed, Port and FAA staff have worked collaboratively to better understand the issues, conduct additional analyses using simulation modeling, and agree on a path forward. The results of the initial analyses and the additional analyses are reported in detail in *Technical Memorandum No. 5 Facility Requirements* and *Technical Memorandum No. 6 Alternatives*, respectively.

The characteristics of the airport and airfield that most limit airfield capacity are (1) the location of the passenger terminal relative to runways, (2) the location of runway exits, (3) a limited taxiway system, (4) the proximity of runways to the terminal area, (5) runway spacing, and (6) the stagger (i.e., offset) between runway thresholds.

Interactions between operations at SEA and Boeing Field also limit airfield capacity as do the "noise corridors" that were established to the north and south of the Airport to minimize noise impacts on the communities. All departing jet aircraft must use these corridors. Structural and operational changes related to the airspace are needed to achieve the goal of increasing capacity while continuing to minimize noise exposure. Such changes were outside the scope of the SAMP and were not included.

Instances of non-compliance with FAA airfield design criteria were identified and categorized into two groups:

- ***Separation Between Runway 16L-34R and Taxiway B.*** *The applicable standard separation between the centerline of Runway 16L and the centerline of Taxiway B, given the way the Airport is operated, is 500 feet. The existing separation is 400 feet.*

- ***General Airfield Geometrics****. This category of non-compliance generally refers to taxiway intersection geometry inconsistent with design criteria and best practices. Examples include non-standard runway blast pads and geometry that could result in pilot confusion or reduced visibility.*

It is not an unusual circumstance when some characteristics of airport airfield facilities do not comply with current FAA design criteria. Design criteria evolve over time as do the aircraft to which the criteria apply. Non-compliance does not indicate unsafe conditions. Port and FAA staff have coordinated closely and developed approved operating procedures, referred to as modifications to standards, which allow continued safe operations until the non-compliance issues are resolved.

3.3.2 Passenger Terminal

Due to the rapid growth of passenger activity and lack of gate development over the past 10 years, the number of gates at the Airport is substantially below the number currently needed. To accommodate the activity forecast for 2029 and 2034, 24 and 35 gates, respectively will be required in addition to the 83 gates existing in 2014. Details of the gate requirements analysis are provided in *Technical Memorandum No. 5 Facility Requirements*, Appendix B, Gate Requirements Summary.

Significant increases in passenger processing facilities are needed. The application of newer technologies would yield significant capacity and productivity gains for certain passenger processing functions (e.g., ticketing). However, the existing passenger terminal cannot accommodate forecast demand without major expansion and modification. Increased activity would exacerbate existing deficiencies in areas required for basic passenger processing functions such as general passenger circulation, security screening, baggage make up, and baggage claim. The results would range from unacceptably low levels of customer service at best to an inability to process the demand, at worst.

In order to deliver passengers connecting from flights arriving at the new international arrivals facility to departing domestic flights with a high level of service, a people mover system(s) capable of providing a minimum connect time of 80 minutes is needed. A people mover is a system used to transport passengers from one airport location to another and can be an automated people mover (APM) or a manual system involving driver-operated buses. The Airport's existing Satellite Transit System is an APM that was designed to serve the North Satellite and South Satellite. The required system also should provide high levels of service for passengers connecting between domestic flights.

3.3.3 Access and Parking

Off-Airport roads important to the Airport include the surrounding state and regional highway network (i.e., I-5, I-405, SR 518, and SR 509) as well as local roadways (i.e., SR 99 / International Boulevard, S. 188th St, S. 170th St, and S. 160th St) that provide access to and from the Airport. Although the Port does not control these off-Airport access roadways, and their future requirements are outside the scope of the SAMP, the roads were evaluated by Port staff. Port staff should closely coordinate the Airport's future needs with local, regional, and federal agencies responsible for off-Airport roadways.

Significant increases in on-Airport terminal-area circulation roadway capacity (lanes) and curbside roadway capacity (both lanes and linear feet) are needed. The existing roadway system cannot accommodate the forecast demand without major expansion and modification. Increased activity will exacerbate existing deficiencies in areas required for basic landside functions such as roadways and curbsides.

The Main Garage and Doug Fox Lot have sufficient capacity to continue to meet parking demand through 2034, assuming a continuation of the Port's existing market share.

By 2034, rental car facilities will need to grow by approximately 15%.

3.3.4 Air Cargo

Existing on airfield cargo warehousing is used primarily for transferring cargo to/from aircraft and trucks, but there are some functions such as truck to truck transfers and office on ground floor levels that could be accommodated elsewhere or more efficiently in reconfigured facilities. Tables 5-5 and 5-6 in *Technical Memorandum 5 Facility Requirements* estimate the total warehouse square footage requirements for the SAMP 20-year forecast and Century Agenda goal respectively. Under the most conservative utilization rate scenarios, 506,000 square feet of air cargo warehouse floorplate used for transferring cargo to/from aircraft and trucks is needed by 2034 to accommodate forecast demand of 441,770 metric tons and a total of 749,000 square feet of air cargo warehouse floorplate is needed to achieve the Century Agenda goal of 750,000 metric tons. A total of 19 freighter hardstands will also be

needed to accommodate forecast cargo demand – an increase of 36% over the existing 14 freighter hardstands.

3.3.5 Airline Support

Airline support facilities include aircraft maintenance hangars, flight kitchens, ground handling service facilities, fuel storage and distribution facilities, and office space.

Neither Alaska Airlines nor Delta Air Lines, the two major carriers with maintenance hangars at the Airport, has asked for additional aircraft maintenance hangars during the planning period.

The airlines and their service providers are responsible for determining the requirements for the flight kitchens. Locating the flight kitchens on Airport property is a convenience but not a necessity.

The requirements for future jet-fuel storage were estimated for a range of capacity equaling 3-, 5-, 7-, and 10-days of usage, based on historical data for actual fuel used on an average day during the peak month (July is the peak month for fuel flowage). Based on the industry standard of 10-days of fuel reserves, by 2034 the Airport's fuel storage capacity should be increased from 17 million gallons to 35 million gallons, an increase of about 106%.

3.3.6 Airport Support

Airport support facilities include those related to aviation maintenance, aircraft rescue and firefighting, aircraft ground run-up, concessions distribution, recycling and composting, and utilities.

Aviation maintenance facilities located south of the airfield and to the north of the North Satellite will need to be relocated and future requirements met. In order to clear a site for construction of hardstand in the near-term and gates in the longer term, the Port's aviation maintenance facility must be relocated. The Port's Bus Maintenance Facilities and Distribution Center to the south of the airfield will also need to be relocated to clear a site for the future South Aviation Support Area (SASA).

In order to clear the site for gate expansion in the near-term, the existing fire station will need to be relocated and a second station constructed to the east of the existing in order to meet near- and long-term requirements. The requirements for two stations were estimated - a west station to serve as the primary station for airfield emergency response with landside response capability and an east station to serve as a secondary location for airfield emergency response in addition to emergency medical response to the terminals and fuel spill clean-up.

A ground run-up enclosure (GRE) is a three-sided structure used to minimize aircraft noise generated when maintenance personnel test aircraft engines. There is no GRE currently at the Airport. The area required to accommodate such a facility was estimated.

The capacity of the Airport's existing electrical, mechanical, sanitary sewer, storm water drainage, and industrial waste, as well as the supporting regional power, water, and sewerage infrastructure are believed to be generally adequate to meet future needs. Nevertheless, there are requirements related to the redistribution of infrastructure capacity to adequately serve the Airport as its facilities and their

locations evolve. These requirements related to distribution were beyond the scope of the SAMP and will be studied in detail during future studies such as the Utilities Master Plan.

3.3.7 General Aviation

The site utilized to accommodate itinerant general aviation aircraft (i.e., the site accommodating both the fixed base operator building and itinerant aircraft apron) should be retained for use by general aviation; no increase in size is recommended.

Alternatives

This SAMP priority is to add gates as quickly as possible to address recent and expected future demand, but the Airport has little land available to improve airside efficiency and reduce delays. Achieving these objectives will require comprehensive redevelopment and relocation of facilities before construction of new gates can begin.

4.1 Introduction

This chapter summarizes the alternatives considered for meeting the requirements for major Airport functions.

4.2 Objective, Approach, and Assumptions

The objective of the alternatives analysis was to identify the vision for long-range Airport development (i.e., the best Long-Term Vision) with the understanding that not all elements may be affordable and knowledge of the best Long-Term Vision will inform implementation decisions. Issues related to affordability and implementation are discussed in Chapter 5.

The approach was to identify, evaluate, and refine alternative concepts, including management and operational initiatives, for satisfying the 2034 requirement in each of seven major functional areas of the Airport - airfield, passenger terminal, access and parking, cargo, airline support, airport support, and general aviation. The alternatives for these functional areas are described in the following sections; for convenience in describing the alternatives, the passenger terminal and access and parking functional areas were combined.

Initial alternatives underwent high-level screening relative to the SAMP objectives. The results of the screening were summarized in decision matrices. The concepts that best achieved the objectives were refined and subsequently rescreened to determine the preferred concepts for the functional areas. Screening criteria were selected to best enable the planning team to differentiate among alternatives. The criteria reflected the SAMP sustainability goals and objectives and were both qualitative and quantitative. The screening matrices and criteria are presented in *Technical Memorandum No. 6 Alternatives*.

The preferred alternatives for individual Airport functions were then combined, resulting in the vision for comprehensive long-range Airport development. This concept was further evaluated to ascertain that it (1) can be constructed in increments as activity increases, (2) is sufficiently flexible, and (3) is the best concept, even if the full 20-year forecast activity does not occur within the planning horizon (i.e., 2034).

4.3 Results

4.3.1 Airfield

Numerous alternatives related to airfield capacity enhancement and delay reduction were considered including (1) relocating runways to permit midfield terminal development, (2) building taxiways that permit arriving aircraft to avoid taxiing across one or more runways to reach the terminal, thereby increasing departure capacity (referred to as end around taxiways), (3) building a new centerfield taxiway between Runways 16C-34C and 16L-34R, (4) revising taxiway geometry, (5) constructing dual parallel taxiways A and B at the south end of the Airport to the south of Taxiway S, and (6) providing a midfield aircraft staging area between Runways 16R-34L and 16C-34C to serve as a holding area for arriving aircraft awaiting a gate.

Alternatives were identified related to compliance with FAA design criteria. The ability to resolve instances of non-compliance ranges from relatively simple/low-cost to difficult/very expensive. The most challenging alternatives in this regard related to the 500' separation requirements between the centerlines of Runway 16L-34R and Taxiway B. Compliance with the 500' requirement would involve reconstructing Taxiway B 500' from Runway 16L-34R for the full length of the runway, which would result in the loss of multiple existing gates. In consultation with the FAA, it was resolved that (1) new facilities will provide for the desired 500' separation between the centerlines of Runway 16L-34R and Taxiway B to the south of Taxiway S and to the north of Taxiway L, and (2) resolution of the 500' issue between Taxiways S and L will occur during the comprehensive study of airfield/airspace operations to commence following completion of the SAMP.

The alternatives analysis: (1) determined how to approach resolving the 500' issue, (2) concluded that many airfield issues related to capacity enhancement and design criteria compliance are interrelated and best resolved in a comprehensive study of airfield/airspace operations to occur following completion of the SAMP, and (3) identified a package of airfield improvements that have independent utility with or without future development and should be implemented as quickly as possible - these are described in Chapter 5.

Airfield simulation analyses conducted in the alternatives phase concluded: (1) off-gate parking positions are essential for effective future airfield operations, (2) the space currently occupied by Alaska Airlines' aircraft maintenance hangars should be reserved for off-gate aircraft parking, and (3) even with the proposed airfield improvements, average annual aircraft delays exceed 20 minutes at activity levels forecast for 2029 assuming current airfield/airspace system operations. As described in Section 3.3.1, structural and operational changes to the airspace were beyond the scope of SAMP and were not included. Therefore, the full benefits of the proposed airfield improvements will be determined during the comprehensive study of airfield/airspace operations when they can be tested in conjunction with changes in airspace operations.

4.3.2 Passenger Terminal and Access and Parking

Sixteen alternatives for satisfying passenger terminal requirements were identified. The alternatives were divided into two concept groups: One-Terminal and Two-Terminal. One-Terminal Concepts seek to maintain all passenger-processing within the existing terminal, modifying it as necessary to

accommodate the forecasted growth in passenger demand. Two-Terminal Concepts seek to minimize modifications to the existing terminal by adding a second passenger terminal.

Passenger terminal alternatives were evaluated in three rounds of screening and a final comparison of the refined finalist alternatives. Round one screening eliminated six alternative concepts based on "threshold" or pass/fail criteria. Round two screening identified the preferred One-Terminal and the preferred Two-Terminal Concepts based on decision criteria that reflected economic and operational, environmental, and social issues. From round three screening the preferred gate layout was determined to be the same for either the One-Terminal or the Two-Terminal Concept. The preferred One-Terminal and Two-Terminal Concepts were refined and compared based on five criteria. The conclusion from this final comparison was that the Two-Terminal Concept is clearly superior to the One-Terminal Concept.

Alternatives were identified and evaluated, and recommendations made related to nine major ground access and parking functions and facilities: off-Airport roadways, on-Airport roadways, terminal-area roadways, commercial vehicles, public transit facilities, public parking, rental car facility, rental car shuttle/pre-security APM, and non-motorized access. The recommended concepts are included, as appropriate, in both the One-Terminal Concept and the Two-Terminal Concept.

4.3.2.1 One-Terminal Concept

Functions Driving the Concept

Planning related to the One-Terminal Concept focused on functions which have the most significant impact on the concept: ticketing and baggage drop, passenger circulation, passenger security screening check points, baggage claim, ground access, curbsides, and parking.

Four concepts were considered for modifying the existing passenger terminal, roads, and garage to accommodate forecast activity through 2034:

- Concept 1 - Extend the Main Terminal to the north
- Concept 2 (*Preferred concept*) - Extend the Main Terminal ticketing level façade to the east along the entire terminal face
- Concept 3 - Extend the middle section of the Main Terminal to the east (cutting across the nose of the garage)
- Concept 4 - Extend the middle section of the Main Terminal to the east and provide a secure/non-secure Automated People Mover (APM) station in the garage

The concepts were evaluated based on experience and professional judgement. The preferred One-Terminal Concept, Concept 2, involves expanding the passenger terminal to the east. Consequently, Concept 2 involves extensive new-terminal construction and existing-terminal renovation as well as extensive demolition and reconstruction related to the drives, garage, and bridges between the garage and terminal.

One-Terminal Concept - Key Ideas

Implementing the One-Terminal Concept would involve resolving substantial issues during advanced planning and design phases. Those issues include the planning and design of the (1) the modified garage and roadway structure to support fire and rescue vehicles, (2) an APM system to support international to domestic connecting passengers, and (3) a new high-speed baggage system between the existing terminal and the new gates.

Planning related to functions in the secure portions of the passenger terminal, referred to as airside functions, focused on outbound baggage makeup, Concourses A through D, and the South and North Satellites. The major conclusions from this planning were (1) during the planning period, airside Concourses A through D and the North and South Satellites will undergo appropriate programs of improvements, and (b) the program of improvements will be the same for either the One-Terminal Concept or the Two-Terminal Concept.

Four APM options were considered for transporting post-security passengers (i.e., passengers having passed through the passenger security screening check points) between passenger terminal concourses and satellites and between the new International Arrivals Facility and gates. Three of the options are below ground and one is elevated. The options were scored against decision criteria and the preferred post-security APM system was identified as a below-ground system with six stations.

4.3.2.2 Two-Terminal Concept

The Two-Terminal Concept consists of two terminals - a second terminal (the North Terminal), located on the Doug Fox lot, and the existing terminal (the Main Terminal). Key ideas are summarized below.

Main Terminal

- The objective of the Two-Terminal Concept is to minimize the overall facilities cost by investing in the Main Terminal only as necessary to satisfy demand until the Second Terminal is opened, or to renew aging infrastructure.
- Prior to the Second Terminal opening in 2027, the Main Terminal may accommodate as many as 54 million annual passengers, albeit at less than desirable levels of service. Modifications to the Main Terminal would be limited to those needed to accommodate 54 million annual passengers.
- Following the opening of the Second Terminal, the Main Terminal would accommodate approximately 70% (46 million annual passengers, or MAP) of the forecast 2034 passenger activity.
- The modifications to Concourses A through D, the South Satellite, and the North Satellite are the same for the Two-Terminal Concept as for the One-Terminal Concept.
- 2029 and 2034 traffic is expected to be approximately 30% less than with the One-Terminal Concept, which would require the Main Terminal to accommodate all Airport traffic.

Second Terminal

- The Second Terminal would be constructed by 2027, operate effectively for either a single airline or a combination of airlines, and ultimately accommodate about 30% (20 MAP) of the total Airport passenger activity forecast for 2034 (66 MAP).
- The Second Terminal would be planned to serve the North Satellite as well as the new north gates.
- Curbsides would be provided on a single level to reduce roadway complexity and cost.
- Both ticketing/bag drop and baggage claim functions will be on the same level as the roadway.
- The adjacent cemetery will not be affected.
- Adequate parking would be provided adjacent to the terminal.
- Passengers would be able to walk between the Second Terminal and north gates through an enclosed pedestrian bridge that spans the North Airport Expressway and light rail right-of-way.

4.3.2.3 Comparison of the Refined One-Terminal and Two-Terminal Concepts

The refined One-Terminal and Two-Terminal Concepts were compared based on five criteria—total cost of ownership (TCO; i.e., total capital, operations, and maintenance and renewal costs through 2050), phasing, risk, customer service, and operational flexibility. The conclusions from this final screening analysis were:

- TCO is less for the Two-Terminal Concept than for the One-Terminal Concept. This is largely attributable to the high cost of terminal, roadway, and garage modifications required for the One-Terminal Concept and relatively lesser cost of new construction on a site less encumbered by existing facilities for the Second Terminal.
- Phasing is easier with the Two-Terminal Concept than with the One-Terminal Concept. The complexity of phasing necessary to maintain passenger operations, and the duration passengers would be subject to the inconveniences of major construction, are significantly greater with the One-Terminal Concept than with the Two-Terminal Concept.
- There are lower risks associated with the Two-Terminal Concept than with the One-Terminal Concept. With the One-Terminal Concept, (a) it is much more difficult to accommodate faster than expected passenger growth than with the Two-Terminal Concept, and (b) the modifications envisioned to the garage are complex and subject to the interpretation of construction codes that cannot occur until the project is designed.
- A higher level of customer service is achieved with the Two-Terminal Concept than with the One-Terminal Concept. Wayfinding and walking distances between security screening and gates in the Second Terminal are considerably improved over the Main Terminal.

- The Two-Terminal Concept has greater operational flexibility than the One-Terminal Concept. The Two-Terminal Concept enables (1) easier airline assignments to new gates, (2) group check-in and surge loading to be distributed between two terminals, and (3) more options for relief to stressed baggage handling systems.

The overarching conclusions from this final comparison were that the Two-Terminal Concept is clearly superior to the One-Terminal Concept and the gate layout is the same for either concept. Stated differently, the best location and configuration for the new gates are the same regardless of the terminal concept selected.

4.3.3 Air Cargo

The key concepts influencing the formulation of air cargo facility alternatives were land use priorities and the impact of future passenger facilities development on existing and future air cargo facilities. Due to the fact that passenger gates, terminal processors and supporting landside access/parking facilities are relatively inflexible in terms of location and configuration, planning for cargo facilities was both impacted by and worked around the plan for passenger facilities.

The best use of developable Airport land bounded to the south by the existing FedEx facility, to the north by State Route (SR) 518, to the west by Taxiway A, and to the east by Air Cargo Road is for air cargo. This area is referred to as the north cargo area.

A total site area of approximately 92.5 acres is needed to accommodate the forecast 2034 cargo facility requirements. The area available in the north cargo area is approximately 68 acres, leaving a gap between the area required and the area available of 24.5 acres. This gap must ultimately be satisfied by (1) expanding the existing north cargo area to the south of the FedEx facilities, (2) supplementing the facilities in the north cargo area with other, non-contiguous areas, or (3) relocating some or all cargo functions to a new location.

Five potential sites for cargo development were identified, assessed, and screened relative to economic/operational, environmental, and social criteria. From the assessment and screening, we concluded that the preferred sites for cargo development are the north cargo area and the South Aviation Support Area (SASA).

Alternative concepts for cargo development at the north cargo area and SASA were developed, assessed, and screened relative to economic/operational, environmental, and social criteria. From the assessment and screening, we concluded that the preferred long-term cargo development concept is to develop the North Cargo Area for air freight and to develop SASA for integrator freight.

4.3.4 Airline Support

Airline support facilities include aircraft maintenance hangars, flight kitchens, and fuel storage and distribution facilities.

4.3.4.1 Aircraft Maintenance Hangars

Airfield simulation analyses, concluded that Alaska Airlines' two aircraft maintenance hangars ultimately must be relocated to provide the space necessary for higher-priority off-gate aircraft parking

(to accommodate arriving aircraft awaiting gates, departing aircraft awaiting their departure sequence, and aircraft with long dwell times that must be towed from contact gates) and the Delta Air Lines aircraft maintenance hangar must be relocated to provide additional International capable gates. From analyses related to on-Airport land development, it was concluded that two areas exist for potentially locating replacement aircraft maintenance hangars—the north cargo area and SASA. Three alternatives for developing aircraft maintenance hangars were considered—all replacement hangars in the vicinity of the north cargo area, some replacement hangars in the north cargo area and some in SASA, and all replacement hangars in SASA.

The preferred concept is to construct all replacement aircraft hangars in SASA. This allows the most effective use of the space available and permits the Port to achieve its objective of reducing noise generated by aircraft engine testing with a single GRE. The most significant assumption related to the alternatives for aircraft maintenance hangars was that they cannot be accommodated at another airport. Both Alaska Airlines and Delta Air Lines representatives stated that the hangars are essential to their passenger operations at the Airport.

4.3.4.2 Flight Kitchens

We concluded that (1) the Gate Gourmet flight kitchen (located adjacent to the Doug Fox lot) should be demolished to make available space for the Second Terminal and associated parking and (2) the Flying Foods and Sky Chef flight kitchens (located to the north of the North Cargo Area) should be permitted to remain as long as the properties are not needed for higher-priority functions (e.g., cargo).

4.3.4.3 Fuel Storage and Distribution Facilities

The key conclusion related to the analysis of fuel storage alternatives was that sufficient land is available adjacent to the existing fuel farm to permit the requirements to be satisfied.

4.3.5 Airport Support

Airport support facilities include aviation maintenance facilities, aircraft rescue and firefighting facilities, and an aircraft ground run-up enclosure.

4.3.5.1 Aviation Maintenance Facilities

Seven sites were assessed to determine their suitability to satisfy the requirements for aviation maintenance facilities. From the assessment, we concluded that the west-side site is the only viable site to accommodate the relocated maintenance functions.

4.3.5.2 Aircraft Rescue and Firefighting Facilities

Seven potential fire station locations were identified and evaluated resulting in the conclusions that (1) the existing station must be replaced with two stations—one on the east side of the Airport and one on the west side of the Airport, (2) the east side station should be integrated with extended Concourse D, and (3) the west side station should be located on the site currently occupied by the Weyerhaeuser hangar.

4.3.5.3 Aircraft Ground Run-up Enclosure

The ground run-up enclosure must be located near the aircraft maintenance hangars. Therefore, the preferred alternative location for the ground run-up enclosure is SASA. There are no other available sites with enough space, the proper airfield access, and the appropriate adjacency to the maintenance facilities.

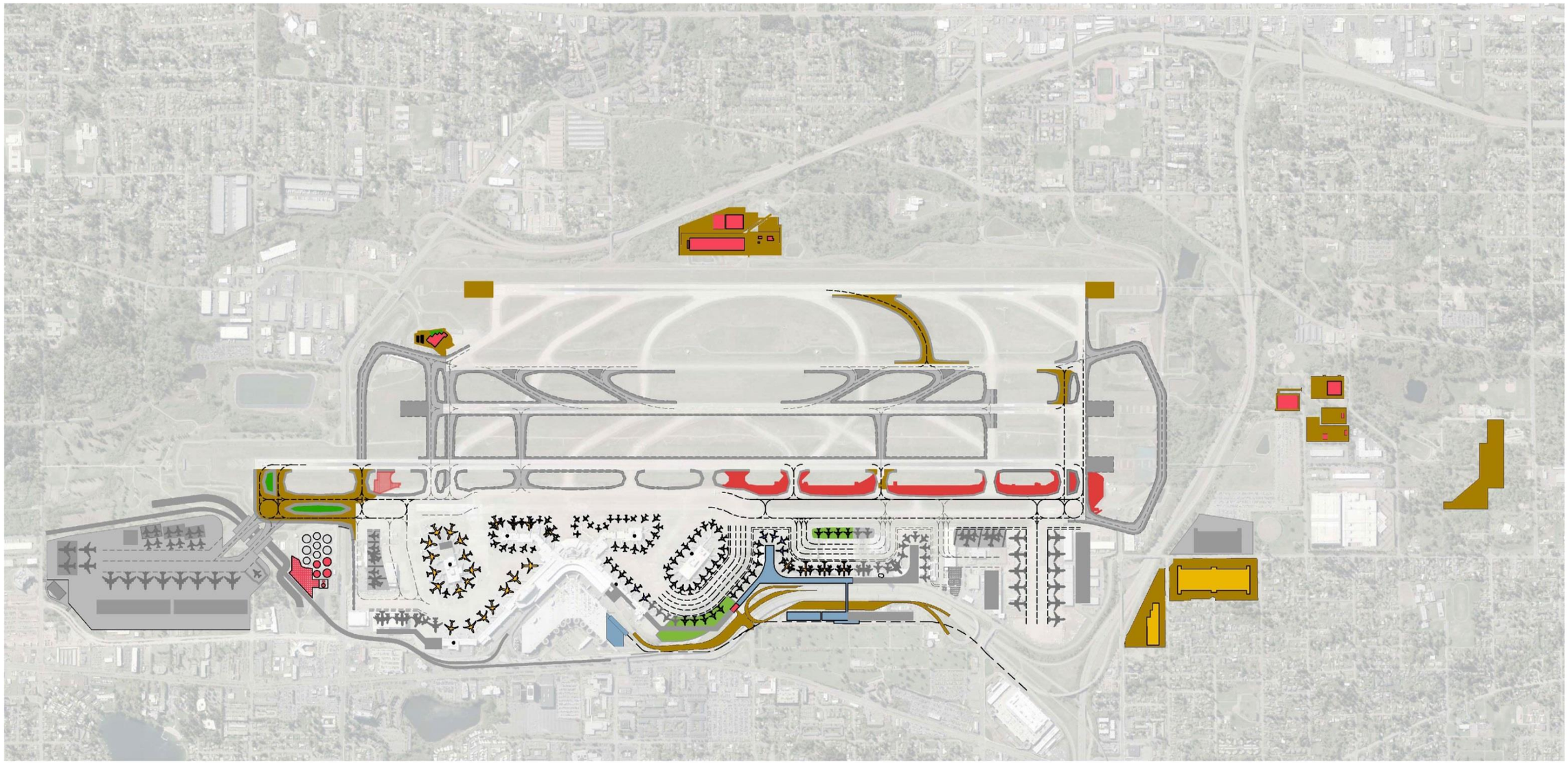
4.3.6 General Aviation

The site utilized to accommodate itinerant GA aircraft (i.e., the site accommodating both the FBO building and itinerant GA aircraft apron) should be retained. The site is adequate to accommodate demand through 2034; no increase in size is recommended.

4.3.7 Comprehensive Airport Development

The preferred alternatives for the individual functional areas of the Airport were combined, resulting in the vision for comprehensive long-range Airport development shown on Figure 4-1.

Figure 4-1
Vision for Comprehensive Long-range Airport Development
Seattle-Tacoma International Airport



Facilities Implementation and Financial Feasibility

The implementation plan consists of Near-Term Projects that are consistent with the Long-Term Vision, compatible with the existing airfield, and affordable.

5.1 Introduction

This chapter summarizes the recommended Near-Term Projects resulting from the SAMP, the approach to identifying the Near-Term Projects, the results of airfield simulation modeling that demonstrated the ability of the airfield to support the Near-Term Projects, and the analyses that demonstrated the Near-Term Projects are financially feasible. Finally, this chapter recommends key follow-on actions, all related to the airfield/airspace system, which should be initiated as soon as practical.

5.2 Approach

The approach to developing the Near-Term Projects, described in Section 5.3, was influenced considerably by limitations of the airfield as it is currently operated, physical constraints unique to the Airport, recent and sustained increases in demand, the vision for comprehensive long-range Airport development (Long-Term Vision), and financial considerations related to affordability.

As described in Section 3.3.1, the results of extensive airfield modeling and FAA coordination indicated that as the airfield is currently operated, average annual aircraft delay will exceed sustainable levels with activity projected to occur by 2029. Accordingly, projects were identified that are consistent with the Long-Term Vision which include airfield improvements that provide benefit with or without longer-term development and can be constructed by 2027. Additional airfield modeling verified that the airfield, with the improvements included in the Near-Term Projects, can support the level of activity forecast for 2027 at a level of average annual delay considered to be sustainable (16.6 minutes, as discussed in Section 5.4).

Among North American large hubs, the Airport experienced the highest growth (21.9%) in aircraft movements and the second highest growth (52.6%) in passenger traffic in the last 10 years. High passenger and cargo demand has strained existing facilities, leaving very few opportunities to relocate functions to underutilized areas and generating a pressing need to provide additional facilities in all key functional areas. The high utilization of the majority of existing facilities, coupled with physical constraints, results in difficult construction sequencing and long sequences of enabling projects, both of which increase program costs and delay the delivery of needed improvements. These factors drove the need to explore alternative project sequencing that could deliver improvements sooner and/or delay expensive enabling projects.

The starting point for implementation planning was the vision for comprehensive long-range Airport The starting point for implementation planning was the vision for comprehensive long-range Airport

development (Long –Term Vision) discussed in Chapter 4 and shown on Figure 4-8. The objective of implementation planning was to identify a subset of the vision for comprehensive long-range Airport development (i.e., the Near-Term Projects) that can be supported by the airfield and is affordable. The implementation planning approach included the following guiding principles:

- Sequence projects to add gate and hardstand (designated aircraft parking) facilities for passenger operations as soon as possible.
- Program construction of a second terminal and landside access to align with construction of gates that can be readily connected to the Second Terminal.
- Sequence projects to add warehouse and hardstand capacity for cargo operations as soon as possible.
- Minimize impacts to existing cargo and aircraft maintenance facilities until additional facilities can be constructed.
- Minimize throwaway costs, by avoiding, where possible, building new facilities that will be impacted by subsequent construction.

As described in Section 5.5, the Near-Term Projects are financially feasible.

5.3 Near-Term Projects

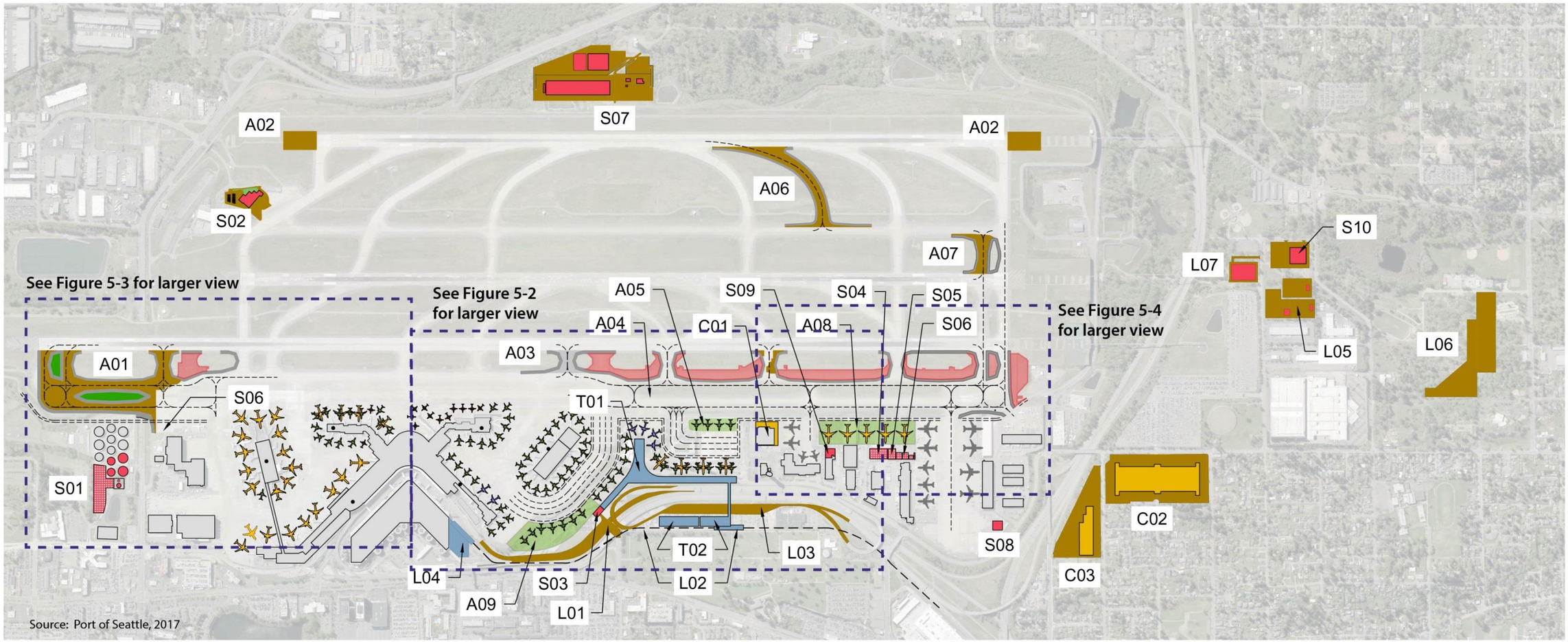
The Near-Term Projects, illustrated on Figure 5-1, include enabling and capacity improvement projects through the year 2027 (approximately 56 million annual passengers), when projects yielding substantial new facilities will become operational. Figures 5-2, 5-3 and 5-4 illustrate in greater detail the Near-Term Projects for areas close to, north of, and south of the existing terminal complex. The Near-Term Projects are described in the following sections, which are organized by project purpose.

5.3.1 Purpose is to Meet Forecast Passenger Demand

Projects

- **T01 – North Gates**. The North Gates project is a multi-level concourse connected to the Second Terminal via a pedestrian bridge and tunnel for baggage conveyance. In addition to gates, it includes an apron area for at gate aircraft parking, taxilanes, and a hold pad (A05 North Hold Pad). The multi-level concourse occupies an approximately 215,000 sf footprint and includes a ramp level for baggage/aircraft support functions; passenger concourse level with holdrooms, concessions, restrooms, etc.; and a mezzanine level with office space and vertical circulation to the north terminal passenger walkway. The apron would accommodate up to 19 Aircraft Design Group (ADG)-III contact gates (sized for narrowbody aircraft such as the Boeing 737, but with the ability to be reconfigured for larger aircraft, and connected to the building) surrounded by dual ADG-III or a single ADG-V taxilane.

Figure 5-1
Near-Term Projects
Seattle-Tacoma International Airport



AIRSIDE
A01 - Taxiway A/B Extension
A02 - Runway 16R-34L Blast Pads
A03 - Taxiway L Relocation (*Pre-SAMP project*)
A04 - Taxiway B 500' Separation & RIM Mitigation
A05 - North Hold Pad
A06 - Runway 34L Highspeed Exit
A07 - Taxiway D Extension
A08 - Hardstand (*north*)
A09 - Hardstand (*central*)
A10 - Taxiway Fillets (*not shown*)
A11 - Taxiway Q HS/RIM (*Pre-SAMP project*) (*not shown*)

CARGO
C01 - Cargo 4 South Redevelopment
C02 - Off-site Cargo PH 1 (*L-Shape*)
C03 - Off-site Cargo PH 2 (*L-Shape*)

LANDSIDE
L01 - NAE Relocation (*southbound lanes*)
L02 - Elevated Busway & Stations
L03 - Second Terminal Roads/Curbside
L04 - Main Terminal North GT Lot
L05 - North GT Holding Lot
L06 - Employee Parking Surface Lot
L07 - Employee Parking Structure

TERMINAL
T01 - North Gates
T02 - Second Terminal & Parking

AIRPORT/AIRLINE SUPPORT
S01 - Fuel Farm Expansion
S02 - Primary ARFF
S03 - Secondary ARFF
S04 - Fuel Rack Relocation
S05 - Triculator
S06 - Consolidated De-icing Tanks
S07 - Westside Maintenance Campus
S08 - Airline Support (*north*)
S09 - Airline Support (*west*)
S10 - Centralized Rec. & Dist. Center

LEGEND
NEW TERMINAL
NEW MAINTENANCE
NEW CARGO
NEW SUPPORT FACILITIES
NEW PAVEMENT
NEW HARDSTAND / HOLD PAD
EXISTING BUILDING
DEMOLITION
RJ/TP
GROUP III
GROUP IV
GROUP V
CARGO / MAINTENANCE
RON

0' N/A N/A
N

Figure 5-2
Near-Term Projects Close to Existing Terminal Complex

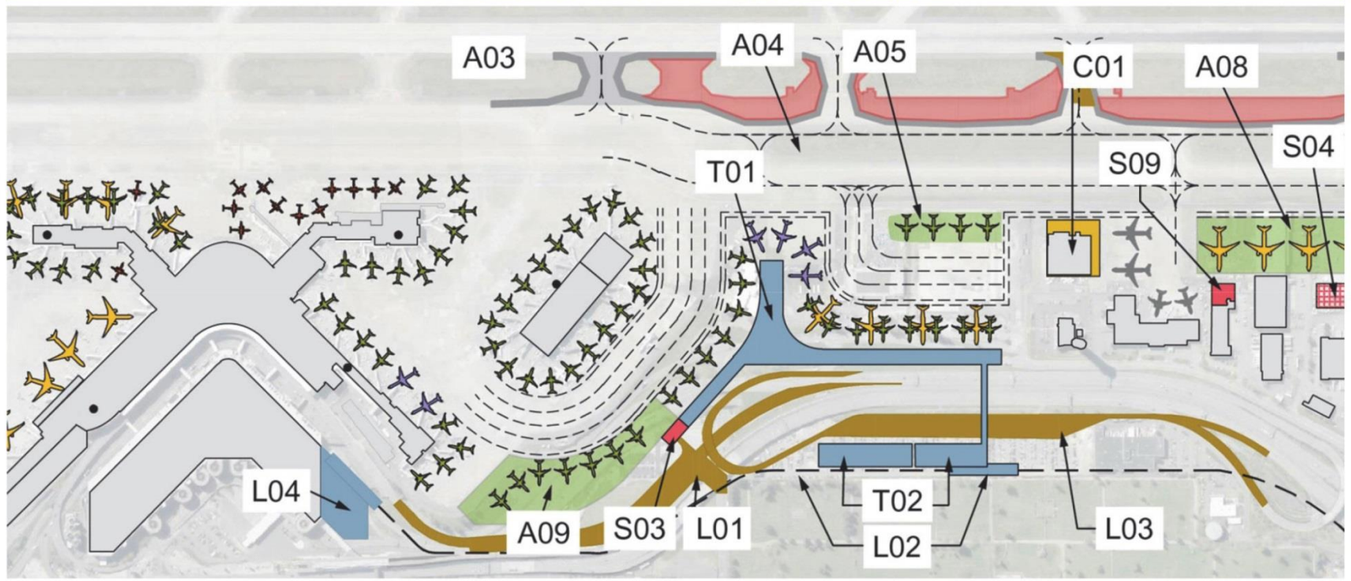
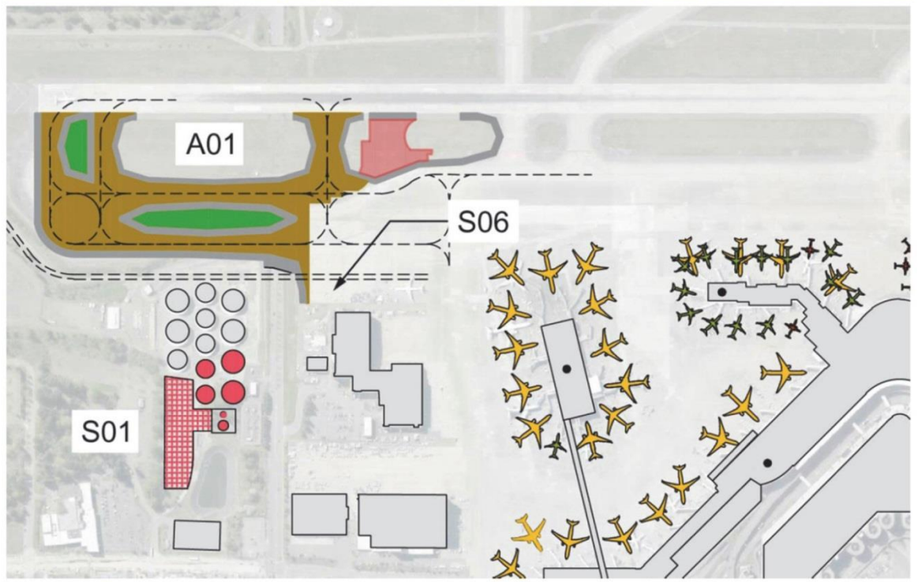


Figure 5-3
Near-Term Projects South of Existing Terminal Complex



AIRSIDE
A01 - Taxiway A/B Extension
A02 - Runway 16R-34L Blast Pads
A03 - Taxiway L Relocation (*Pre-SAMP project*)
A04 - Taxiway B 500' Separation & RIM Mitigation
A05 - North Hold Pad
A06 - Runway 34L Highspeed Exit
A07 - Taxiway D Extension
A08 - Hardstand (*north*)
A09 - Hardstand (*central*)
A10 - Taxiway Fillets (*not shown*)
A11 - Taxiway Q HS/RIM (*Pre-SAMP project*) (*not shown*)

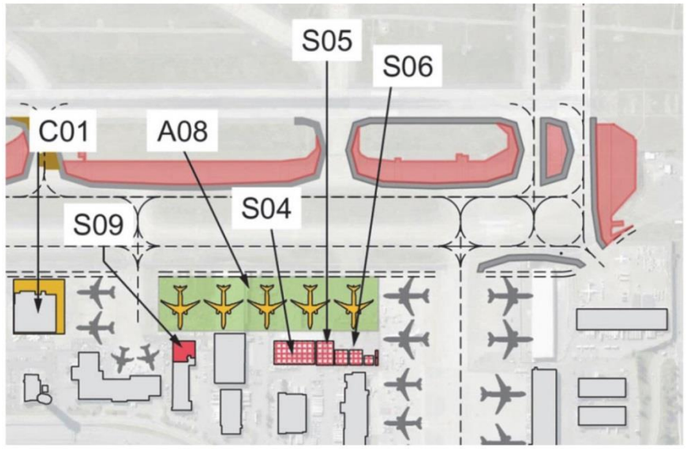
CARGO
C01 - Cargo 4 South Redevelopment
C02 - Off-site Cargo PH 1 (*L-Shape*)
C03 - Off-site Cargo PH 2 (*L-Shape*)

LANDSIDE
L01 - NAE Relocation (*southbound lanes*)
L02 - Elevated Busway & Stations
L03 - Second Terminal Roads/Curbside
L04 - Main Terminal North GT Lot
L05 - North GT Holding Lot
L06 - Employee Parking Surface Lot
L07 - Employee Parking Structure

TERMINAL
T01 - North Gates
T02 - Second Terminal & Parking

AIRPORT/AIRLINE SUPPORT
S01 - Fuel Farm Expansion
S02 - Primary ARFF
S03 - Secondary ARFF
S04 - Fuel Rack Relocation
S05 - Triculator
S06 - Consolidated De-icing Tanks
S07 - Westside Maintenance Campus
S08 - Airline Support (*north*)
S09 - Airline Support (*west*)
S10 - Centralized Rec. & Dist. Center

Figure 5-4
Near-Term Projects North of Existing Terminal Complex



LEGEND
NEW TERMINAL
NEW MAINTENANCE
NEW CARGO
NEW SUPPORT FACILITIES
NEW PAVEMENT
NEW HARDSTAND / HOLD PAD
EXISTING BUILDING
DEMOLITION
RJ/TP
GROUP III
GROUP IV
GROUP V
CARGO / MAINTENANCE
RON

Sources for Figures 5-2, 5-3, and 5-4: Port of Seattle.

Construction of the North Gates and Apron requires the relocation of multiple facilities, including: the primary fire station, fuel rack, the southbound lanes of the North Airport Expressway (NAE), Cargo 5 hardstand, Cargo 6 hardstand, deicing fluid storage, and the Swissport cargo building. The majority of facilities impacted by the North Gates will be relocated (Projects S02, S04, L01, S06, C02, and C03), with the exception of the Cargo 5 & 6 hardstands. Reconstruction/expansion of the Cargo 5 & 6 hardstands will be one of the initial phases for the North Gates project and will accommodate increased demand for hardstand operations and Remain Overnight parking of passenger aircraft (RON, used for aircraft parking at night so that they can be used for early-morning departures) until the North Gates are activated and hardstand operations can be moved to contact gates.

- **T02 – Second Terminal & Parking**. A second terminal to the north is needed to support the planned North Gates. The Second Terminal will include facilities for passenger check-in; passenger and baggage screening; airline offices, baggage conveyance and claim; concessions; and restrooms. The Second Terminal and associated parking will be sized to support the new North Gates.

- **L02 – Elevated Busway & Stations**. An elevated busway and stations are required to provide a landside connection for non-secure passengers accessing the Main Terminal, Second Terminal, and Rental Car Facility (RCF). The Main Terminal busway station will be at level 4 at the north end of the existing Main Parking garage and over the Main Terminal North Ground Transportation (GT) lot. The busway will extend north over the NAE and Light Rail to a Second Terminal station. The busway will extend north from the Second Terminal Station and ramp down to an at grade intersection at the S. 160th GT lot site where the existing RCF bus entrance will provide access to the RCF curb.

- **L03 – Second Terminal Roads & Curbside.** Landside improvements are required to provide ingress/egress to the Second Terminal and to connect the existing roadways system, providing access to/from the existing Main Terminal. Ingress is provided via a loop ramp from the southbound lanes of the NAE. Curbs for private and commercial vehicles are provided on a single level for arriving and departing passengers. Egress is provided via exit lanes/ramps connecting to the existing S. 160th St. Loop, westbound SR 518 on-ramp at S. 160th St., and the northbound lanes of the NAE.

- **A05 – North Hold Pad.** In the northwest corner of the apron constructed as part of the T01 North Gates project is a hold pad capable of accommodating four ADG-III aircraft. The hold pad would be used by aircraft waiting to take off or waiting for a gate, to reduce congestion on the taxiways and at the terminal.

- **A09 – Hardstand (central)**. New hardstand is needed to accommodate increased demand for passenger hardstand operations and RON. Passengers will be bused to/from aircraft on the hardstand, primarily from the Concourse D hardstand

holdroom and other holdrooms with bus access on the north side of the terminal complex. This project will create apron space for hardstand/RON operations north of Concourse D and East of the North Satellite. The apron space should be sufficient to accommodate approximately 7 ADG-III aircraft. The depth and width of the apron varies. This project requires the relocation of the southbound lanes of the North Airport Expressway (Project L01). Following relocation of the roadway, fill will be required to increase the elevation in the area to provide a continuous expansion of the existing apron.

Enabling Actions

- **L01 – North Airport Expressway (NAE) Relocation *(southbound lanes).*** Relocation of the southbound lanes of the NAE is required to clear the site for construction of A08 Hardstand (central) and T01 North Gates. The reconstructed southbound lanes will include the same number of lanes as exist today, and will result in the elimination of the cell phone waiting lot as well as Air Cargo Road and associated on/off ramps currently located south of Gate E125 and air traffic control tower. There are no suitable locations on Port property for relocation of the cell phone waiting lot which requires convenient and intuitive access to the freeway system. In the absence of a cell phone waiting lot, the Port will explore operational alternatives utilizing parking garages at the existing and future terminals.

- **L05 – North Ground Transportation (GT) Lot**. A new GT lot is needed to accommodate increased demand and replace the S 160th St. GT lot displaced by the Elevated Busway. A new 180,000 square foot surface lot will be constructed on Port property north of SR 518.

- **S02 – Primary Air Rescue and Firefighting (ARFF) station & S03 – Secondary ARFF**. Relocation of the Primary ARFF station from its current location in the Cargo 6 area is required to clear the site for construction of T01 North Gates. The Primary ARFF will be relocated to the site of the existing secondary ARFF in the General Aviation Area. From this location, response times to the furthest runway can be achieved. The ARFF facility will be a multi-bay station that conforms to AC 150/5210-15A – Aircraft Rescue and Firefighting Station Building Design.

- **S04 – Fuel Rack Relocation**. Relocation of the fuel rack from its current location in the Cargo 6 area is required to clear the site for construction of T01 North Gates. The project will include extension of the fuel line to the future location in the North Cargo area east of the new A08 Hardstand (north). The project will replace existing, displaced facilities and fuel truck parking.

- **S05 – Triculator**. The Triculator (or Triturator) is a waste grinding facility that requires water and sewer access to process the contents of ground service provider lavatory trucks. The Triculator is currently located east of the existing ARFF station and is an impediment to the A09 Hardstand (central) project. To facilitate the A09 Hardstand (central) project, the triculator will be relocated to the North Cargo area east of the new A08 Hardstand (north).

- **S06 – Consolidated De-icing Fluid Storage Tanks**. In an effort to consolidate storage of aircraft deicing fluid and to clear a site for the construction of T01 North Gates, sets of deicing fluid tanks are proposed on both the north and south ends of the airfield. The consolidated de-icing fluid storage tanks will be the common de-icing fluid racks from which all ground service providers can fill de-icing equipment with de-icing fluid. The southern set of tanks will replace and occupy the same location as the individual airline tanks that are currently located at Cargo 7. The northern set of tanks is to be located in the North Cargo area, east of the new A08 Hardstand (north) and will replace tanks that are displaced from the Cargo 6 area. Each site will have two tanks, one for Type I and the second for Type IV.* Each set of tanks will also have a blending station.

Connected Actions

- **L04 – Main Terminal North Ground Transportation (GT) Lot**. Expansion of the existing lot is required to accommodate increased demand of charter and cruise passenger buses. The expansion will be a new second floor of approximately 100,000 square feet to support 35-40 buses.

- **L05 – North Ground Transportation (GT) Lot**. A new GT lot is needed to accommodate increased demand and replace the S 160th St. GT lot displaced by the Elevated Busway. A new 180,000 square foot surface lot will be constructed on Port property north of SR 518. L05 includes both enabling features (making room for L02 - Elevated Busway) and connected features (additional employees to support overall projected increase in demand).

- **L06 – Employee Parking Surface Lot**. A new surface parking lot is required to accommodate increased demand. A new 1,500 stall employee parking surface lot will be constructed on Port owned property north of SR 518.

- **L07 – Employee Parking Structure**. A new parking structure would provide additional capacity to accommodate increased demand and/or replace stalls displaced by potential cargo development on the existing North Employee Parking Lot (NEPL). A new parking structure of up to 2,000 stalls would be constructed on Port property adjacent to and west of NEPL.

- **S10 – Centralized Receiving & Distribution Center (CRDC)**. A new CRDC is needed to improve security and more efficiently screen and move supplies to concessionaires in the current and future passenger terminals. The new CRDC will be constructed on Port owned property north of SR 518 and will include a roughly 50,000 square foot building with warehouse and office space, truck terminals and parking for visitors and employees.

*Type I and IV deicing fluids are two types of deicing agents that differ in holdover time, active temperature range, and use in a deicing or anti-icing application. Type 1 is generally used for removal of frost or snow with minimal holdover time and a higher active temperature range. Type IV is generally used for de/anti-acing purposes during periods of low temperatures and longer holdover times.

5.3.2 Purpose is to Meet Forecast Cargo Demand

Projects

- **A08 – Hardstand (north)**. New hardstand (designated aircraft parking) is needed to accommodate increased cargo freighter demand. The hardstand will be constructed in the North Cargo area and located east of Taxiway A with all aircraft entering/exiting the hardstand via Taxiway A. The hardstand will be approximately 1,200' long with a depth of approximately 300' on the south and 500' on the north. The hardstand should be sufficient to accommodate approximately 5 ADG-V aircraft. This project requires the relocation of Airfield Maintenance Building (Project S07) and demolition of the United Airlines maintenance building.

- **C01 – Cargo 4 South Redevelopment**. Additional cargo warehouse space is needed to accommodate growth in cargo activity. The Cargo 4 South site will be redeveloped to maximize warehouse capacity. New facilities will include a roughly 80,000 square foot building with warehouse and office space, truck terminals and parking for visitors and employees.

- **C02 – Off-site Cargo Phase 1 (L-Shape)**. Additional cargo warehouse space is needed to accommodate growth in cargo activity. New cargo facilities constructed on the Port owned L-Shape property in this first phase of development will include a roughly 330,000 square foot building with warehouse and office space, truck terminals and parking for visitors and employees. While the L-Shape property is not located on the airfield and has no direct adjacency to freighter hardstands or secure warehouse access for cargo tugs, the close proximity of the L-Shape to the airfield provides the ability to transfer prescreened cargo pallets via trucks to/from the airfield. Cargo warehousing on the L-Shape will be used to build-up and breakdown cargo and will maximize the use of existing and planned freighter hardstand positions.

- **C03 – Off-site Cargo Phase 2 (L-Shape)**. Additional cargo warehouse space is needed to accommodate growth in cargo activity. New cargo facilities constructed on the Port owned L-Shape property in this second phase of development will include a roughly 90,000 square foot building with warehouse and office space, truck terminals and parking for visitors and employees. While the L-Shape property is not located on the airfield and has no direct adjacency to freighter hardstands or secure warehouse access for cargo tugs, the close proximity of the L-Shape to the airfield provides the ability to transfer prescreened cargo pallets via trucks to/from the airfield. Cargo warehousing on the L-Shape will be used to build-up and breakdown cargo and will maximize the use of existing and planned freighter hardstand positions.

<u>Enabling Actions</u>

  - **S07 – West-side Maintenance Campus**. Relocation of the Port's Aviation Maintenance Facility (AMF) from its current location in the North Cargo area is required to clear the site for construction of the A08 Hardstand (north) project. The AMF will be located on the

west side of the airport in the West-side Maintenance Campus and situated on a set of tiered platforms moving down the hill side. The new AMF will accommodate the relocation of current AMF facilities which includes a vehicle fuel rack, airfield deicer storage, and an approximate 135,000 square feet multi-bay building.

- **S08 – Airline Support (north)**. To accommodate displaced Ground Service Equipment (GSE) maintenance and aircraft maintenance functions from the United Airlines maintenance building and Swissport cargo facility, and aircraft maintenance functions from the United Airlines maintenance building, two airline support buildings/expansions are planned. The first is a new building that would be located in the far northeast corner of the North Cargo area. The building will have an approximate 15,000 square feet footprint (S08 Airlines Support (north)).

- **S09 – Airline Support (west)**. The second is an expansion of the existing AMB/AFCO III building to the west. The AMB/AFCO III building is currently being used for GSE maintenance functions. The proposed building expansion footprint is approximate 12,500 square feet (S09 Airlines Support (west)). Both buildings may be one or two stories depending on need/use.

5.3.3 Purpose is to Improve Airfield Operational Efficiency

Projects

- **A01 – Taxiway A/B Extension**. Taxiway B is a full-length Taxiway parallel to Runway 16L/34R and serves as a primary link to the runway and all gates. Taxiway A runs parallel to Taxiway B north of the terminal complex. This project would create a similar configuration south of the Cargo 7 hardstand by relocating Taxiway B south of Taxiway S to 500' runway/taxiway separation and provide a new parallel taxiway, Taxiway A. Taxiway A will be located 267' east of Taxiway B. The existing Taxiway B (Runway 16L-34R entry/exit taxiway) would also be split into two entry/exit taxiways, one at the runway threshold and a second 267' (centerline-to-centerline separation) north. All taxiways should be designed to Aircraft Design Group (ADG)-V / Taxiway Design Group (TDG)-6 standards aligning with the airports critical aircrafts. The taxiways should be equipped with in-pavement centerline lights and elevated taxiway edge lights. For Runway 16L-34R protection, the taxiway shall include hold position markings with in-pavement lights and elevated runway guard lights. Taxiway signage will be provided. To facilitate the taxiway work, the Runway 34R Glide Slope (GS) will need to relocate to the west side of Runway 16L-34R because it will be displaced by the Taxiway B construction. Relocation of the GS will require fill material to create a pad for the GS antenna and reflective plane that is at the runway elevation. Additional work that may also be required to facilitate the taxiway construction is a new Vehicle Service Road (VSR) bridge over S. 188 Street. The VSR will be placed outside of the proposed Taxiway A Object Free Area (OFA).

- **A06 – Runway 34L High-speed Exit**. High-speed exits allow landing aircraft to exit the runway at relatively higher speeds, leading to less time on the runway. A new

high-speed exit will be constructed for Runway 34L arrivals. The high-speed exit should be designed to ADG-V / TDG-6 standards aligning with the airport's critical aircrafts. The high-speed exit should be located between Taxiway J and Taxiway E, approximately 5,000' from the RWY 34L threshold. The high-speed exit should be equipped with in-pavement centerline lights and elevated taxiway edge lights. For Runway 16R-34L protection, the taxiway shall include a hold position marking with in-pavement lights. Taxiway signage will be provided. The Airport is currently updating from a Local-Area Augmentation System (LAAS) to a Ground Based Augmentation System (GBAS). As part of the update, a new location for the GBAS is being considered. If the GBAS utilizes the existing LAAS site, the GBAS will need to be relocated to facilitate construction of the high-speed exit.

- **A07 – Taxiway D Extension**. Taxiway D is currently a short taxiway between Runways 16C-34C and 16L-34R, and is used by aircraft waiting to take off from Runway 16C. This project will extend Taxiway D from Runway 16C-34C west to Taxiway T, which is a full-length taxiway between Runways 16C-34C and 16R-34L. Taxiway D should be designed to ADG-V / TDG-6 standards aligning with the airport's critical aircrafts. Taxiway D should be parallel to and located 267' (centerline-to-centerline separation) from Taxiway C. Taxiway D should be equipped with in-pavement centerline lights and elevated taxiway edge lights. For Runway 16C-34C protection, the taxiway shall include a hold position marking with in-pavement lights and elevated runway guard lights. Taxiway signage will be provided.

5.3.4 Purpose is to Comply with FAA Airfield Standards/Guidance

Projects

- **A02 – Runway 16R-34L Blast Pads**. A runway blast pad is a surface adjacent to a runway intended to provide erosion protection from aircraft jet blast. The existing blast pads on RWY 16R-34L will be expanded to standard 220'x400' blast pads. This project will require additional asphalt pavement and pavement markings.

- **A04 – Taxiway B 500' Separation & RIM Mitigation**. To provide the standard 500' runway/taxiway separation, Taxiway B will be moved 100' to the east between Taxiway C (at the north end of the airfield) and the approximate location of the existing Taxiway L. Shifting Taxiway B will also result in Taxiway A being shifted east so that it is 267' (centerline-to-centerline separation) east of Taxiway B. Taxiway A will become a taxilane with 138' Taxiway Object Free Area (OFA) separation. Taxilanes can be either inside or outside of the movement area and the SAMP is not proposing to change the existing operational use of Taxiway A when it becomes the new Taxilane A. Taxiways C, D, E, H, and K between Taxiway B and Runway 16L-34R will need to be adjusted/extended to account for the shift in Taxiway B. Taxiways C and D will also be extended to Taxilane A and the expanse of pavement north of Taxiway C will be removed in an attempt to mitigate the existing RIM location. A phased approach to mitigating the RIM location by connecting

Taxiways C and D perpendicularly to the existing Taxiway A and eliminating the expanse of pavement will be evaluated as part of ongoing planning and design activities with the intent to incrementally improve safety at this location. A phased approach appears feasible and may provide an opportunity to mitigate the RIM location earlier than shown in Figure 2-7. All taxiways should be designed to ADG-V / TDG-6 standards aligning with the airport's critical aircrafts. The taxiways should be equipped with in-pavement centerline lights and elevated taxiway edge lights. For Runway 16L-34R protection, all taxiway entrances/exits shall include hold position markings with in-pavement lights and elevated runway guard lights. Taxiway signage will be provided.

- **A10 – Taxiway Fillets [NOT SHOWN]**. Fillets are essentially rounded corners created with pavement and markings, and are used as part of taxiways to provide adequate distances between aircraft and the pavement edges. Fillets which currently do not meet TDG-6 standards will be improved when the fillet/area is in need of a reconstruction or impacted by a project. Adjustments to fillets will likely require adjustments to full strength pavement panels, shoulders, edge lighting, and signage.

5.3.5 Purpose is to Provide Additional Fuel Storage Capacity and Meet Port's Sustainable Aviation Fuel initiative

Projects

- **S01 – Fuel Farm Expansion**. Expansion of the fuel farm includes additional settling tank capacity and construction of infrastructure to support the Port's Sustainable Aviation biofuel (SAF) initiative. The addition of four settling tanks adding approximately 10 million gallon storage capacity will require additional piping, expansion of the spill containment dike, and four above ground storage tanks. Infrastructure required to support the Port's SAF initiative includes a 500,000 gallon blending tank, 100,000 gallon neat SAF receipt tank, spill containment dike, fuel transfer pump, piping to transfer the fuel from the blending station to the existing/proposed settling tanks, and a truck fuel rack to support the delivery of SAFs for blending. The infrastructure required for both projects will be located east of the existing fuel farm on the abandoned south end employee parking lot.

5.4 Airfield Operational Feasibility

Simulation modeling was performed using the Total Airspace and Airport Modeler (TAAM) to confirm the ability of the airfield to support the Near-Term Projects. The facilities modeled are illustrated on Figure 5-1 and included Near-Term Project improvements to both the airfield and passenger terminal. For the purposes of the modeling, a design-day flight schedule was developed, consistent with other flight schedules used during the SAMP and representative of the year in which the Near-Term Projects would be completed (2027). From the simulation modeling, it was concluded that airfield operations with the Near-Term Projects at the level of activity forecast for 2027 are feasible with an average annual delay of approximately 16.6 minutes.

5.5 Financial Feasibility

A financial assessment was conducted to demonstrate the Port's ability to finance the NTP and maintain debt service coverage consistent with bond covenants and within practical levels, maintain appropriate cash reserves, maintain reasonable costs, and preserve the capital capacity necessary for renewal and replacement of existing assets and ongoing maintenance. Based on the estimated costs of the Near-Term Projects, and the estimated timing of the expenditures, the assessment indicates that the Port's objectives can be met and that the Near-Term Projects are financially feasible.

The Port recognizes that undertaking this capital program will significantly increase airline costs at Sea-Tac, and significantly increase debt levels for the Port of Seattle. Information from peer airports suggest large hubs undertaking major expansions are increasing projected Cost Per Enplanements (CPE)s to levels that would have been considered "too high" a few years ago. Major expansions are very expensive, but the alternatives to expanding these large hubs are even more expensive to the cities and communities: foregoing airport expansion and suffering the economic consequences, or building or expanding another local airport.

5.6 Key Actions Following Completion of the SAMP

In addition to actions directly related to environmental approvals, design, and construction of the Near-Term Projects the most significant actions following completion of the SAMP relate to the airfield/airspace system configuration and operation. We have concluded:

- The airfield/airspace system, as currently configured and operated, (1) can support the Near-Term Projects at the level of activity forecast for 2027, but (2) would have insufficient capacity to meet the unconstrained 20-year forecast demand at a sustainable level of delay with the improvements in the SAMP Long-Term Vision.

- Numerous airfield issues related to design criteria must be resolved and many of these issues are interrelated.

The issues and potential solutions involving airfield/airspace system effectiveness and design criteria compliance are complex and involve benefit-cost tradeoffs. Therefore, additional study is required and should include a comprehensive systems and modeling approach and an inclusive stakeholder engagement process. The FAA and the Port should engage in this comprehensive study as soon as practical to assess the full range of issues and opportunities associated with reasonably improving airfield/airspace capacity and resolving design criteria compliance issues. The approach should be rigorous, analytical and involve airspace/airfield simulation modeling. The scope of the study should be limited to Sea-Tac airport and the close-in airspace and involve key stakeholders, including but not limited to the Port, FAA, airlines, and the public. The Port and the FAA have committed to scoping the study.

Environmental Overview

To implement the recommendations of the Master Plan, the Port of Seattle will have to comply with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA)

6.1 Background

The purpose of preparing the SAMP Environmental Overview was to identify the potential environmental effects of the proposed Near-Term Projects. These Near-Term Projects are identified and detailed in *Technical Memorandum No. 7 Facilities Implementation and Financial Feasibility* and summarized in Section 5.3 of this document.

The Environmental Overview is not a replacement for the analysis associated with environmental review and compliance (i.e. NEPA and SEPA). Rather, the scope for this Environmental Overview relies on existing published environmental conditions and qualitative estimates of the effects of the SAMP Near-Term Projects. Master plans, per Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5070-6B – Airport Master Plans, contain an environmental overview to document environmental conditions that should be considered in the identification and analysis of airport development alternatives.

6.2 Environmental Overview Methodology

In preparing the Environmental Overview, relevant past studies for the Airport were reviewed in addition to more recent project-specific documentation considered within each resource area. Information from this review served as the basis for determining the presence (or lack of) and condition of environmental features and resources. The resources reviewed are listed in *Technical Memorandum No. 8 Environmental Overview*.

The sources of information, in additional to project-specific documentation, were used to identify the existing conditions. Then, based on the Near-Term Projects, the potential effects were estimated by either professional judgment or comparing the Near-Term Projects location/profile with the location of known environmental resources. These effects were estimated based on the consideration of the location and extent of proposed facilities relative to the identified environmental resources.

6.3 Existing Setting

Existing conditions associated with 12 primary factors derived from FAA Orders 1050.1F, Environmental Impacts: Policies and Procedures, and 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions, were identified and considered during the environmental overview process. The process focused on Airport-owned land except where impacts could extend off-Airport.

Inasmuch as the Near-Term Projects would not involve property acquisition; all development would occur on land owned by the Port. The 12 primary factors considered during the environmental overview process were:

- Air Quality
- Biological Resources
- Climate
- Coastal Resources
- Department of Transportation Act Section 4(f)
- Farmlands
- Hazardous Materials, Pollution Prevention, and Solid Waste
- Historical, Architectural, Archaeological, and Cultural Resources
- Land Use
- Noise and Noise Compatible Land Use
- Socioeconomic Impacts
- Water Resources

The above-listed primary factors are defined and the existing conditions for each factor are described in detail in Chapter 2 of *Technical Memorandum No. 8 Environmental Overview*.

6.4 Potential Effect of the Near-Term SAMP Recommendations

This section summarizes the environmental resources that potentially could be affected by the Near-Term Projects identified in Section 5.3. As an Environmental Overview, the impacts identified are not at the same level of detail as will be developed in the pending SAMP Environmental Review process but rather provide an overview of potential direct impacts of the proposed Near-Term Projects; indirect effects were beyond the scope of the review.

The Environmental Overview is not a replacement for the analysis associated with environmental review and compliance under NEPA and SEPA. Rather, the scope for this Environmental Overview relies on existing published environmental conditions and qualitative estimates of the effects of the SAMP Near-Term Projects.

6.4.1 Resources Not Expected to be Affected

Based on the Near-Term Projects noted in Chapter 1.3 and the conditions noted in Chapter 2, the potential effects of the Near-Term Projects were identified. While not to the depth and degree required

by FAA Order 1050.1F and SEPA WAC 197-11 for an environmental review process, the analysis for this technical memorandum provides an overview of potential direct project effects.

The proposed Near-Term Projects, occurring on existing Airport land, are not expected to change future conditions for the following resources:

- Coastal Resources: There are no identified coastal resources on Airport property.
- Farmlands: No farmland exists on Airport lands.
- Land Use: Acquisition of land is not anticipated and the proposed Near-Term Projects are consistent with zoning.

While the Near-Term Projects are not expected to have an effect on the above resources, the analysis that will be undertaken in compliance within the SAMP Environmental Review process to identify effects, if any.

6.4.2 Resources that Could be Affected

The following sections summarize the potential effects of the proposed Near-Term Projects.

6.4.2.1 Air Quality

The construction and operation of the recommended Near-Term Projects would be expected to produce emissions of criteria pollutants. During construction, emissions would be expected from site preparation, building construction, materials delivery, and construction employee commute.

Because the Airport is in an area designated as attainment for all pollutants but is subject to a maintenance plan for carbon monoxide, before the FAA can approve the recommendations, the projects must be first shown to conform to the carbon monoxide State Implementation Plan (SIP).

6.4.2.2 Biological Resources (Fish, Wildlife, and Plants)

Much of the land that would be impacted by the Near-Term Projects is developed and impervious. However, the site of the proposed Westside Maintenance Campus (S07) and lands designated for development north of State Route 518 (Centralized Receiving and Distribution Center, employee parking garage, North Ground Transportation Lot, and the cargo development on the L-Shaped parcel) are partially or fully undeveloped. While no known endangered species of fish, plants, or wildlife are known to inhabit these areas, during the SAMP Environmental Review process, agency consultation may be needed under Section 7 of the Endangered Species Act relative to the Westside Maintenance Campus and parcels north of SR 518.

6.4.2.3 Climate

It is expected that the construction and operation of the recommended Near-Term Projects will require energy, and, thus produce air and greenhouse gas emissions. Potential Near-Term Projects project-related greenhouse gas emissions will be quantified during the environmental review process.

6.4.2.4 Hazardous Materials, Pollution Prevention, and Solid Waste

Construction of the recommended Near-Term Projects has the potential to generate and expose hazardous materials through demolition of existing Port-owned buildings and excavation of past ground contamination. Operation of new facilities could also lead to release of materials associated with vehicle operations, cleaning, or maintenance. The Port's established policies and procedures intend to prevent impacts on soil or water and will be identified in detail in the SAMP Environmental Review process.

Construction would produce construction debris. In addition, during operation of the Near-Term Projects, an increase in solid waste would be expected. During the SAMP Environmental Review process, the effects of this additional waste and its disposal to landfills will be considered.

6.4.2.5 Historical, Architectural, Archaeological, and Cultural Resources and Department of Transportation Act: Section 4(f)

Based on past evaluations, only one architectural site may be affected directly by the recommended Near-Term Projects: The Main Terminal parking garage. The parking garage has been determined eligible for the NRHP as noted in Chapter 2, and thus effects will be considered relative to Section 106 and DOT 4(f) during the SAMP Environmental Review process.

The Westside Maintenance Campus (S07) would be built on previously disturbed lands and is not expected to affect archaeological and cultural resources. However, as part of the SAMP Environmental Review process, this will be re-analyzed and updated.

No parks, recreational or nature preserves would be directly affected and thus, no other elements that might be considered protected under the DOT Section 4(f) provisions would be expected.

6.4.2.6 Light Emissions and Visual Impacts

The recommended Near-Term Projects may result in additional lighting at the Airport, largely associated with building lighting on the Westside Airport Maintenance Campus, and lighting for the facilities proposed north of SR518.

The recommended Near-Term Projects may produce visual conditions like conditions today and consistent with the presence of an airport when considering natural features, such as topography, effects of manmade structures and visual composition. Development of the Westside Maintenance area west of the airfield would be expected to occur at airfield level and thus not be highly visible on the west side but would be visible from higher areas located east of the Airport.

The L-Shaped parcels proposed for cargo development are immediately adjacent to residential uses. The Comprehensive Development Plan (most recent prior Port master plan) Environmental Assessment contains a discussion of the visual and lighting impacts associated with the development of the L-Shaped parcels.

6.4.2.7 Energy Supply

Construction and operation of the recommended Near-Term Projects are likely to consume natural resources such as water, sand, gravel, and energy. Although the Port has adopted a Century Agenda

goal requiring future increases in energy to be offset by energy conservation or renewables, there are no specific measures in place that would guarantee this goal is met for the Near-Term Projects. Therefore, there may be increases in energy demand due to additional heating, cooling, and lighting of the proposed facilities.

6.4.2.8 Noise and Compatible Land Use

Construction of the Near-Term Projects would generate noise. As activity increases in the future, additional aircraft overflights, and potential aircraft noise impacts could increase. These impacts will be analyzed in detail during the environmental review process.

6.4.2.9 Socioeconomic Impacts, Environmental Justice, Children's Environmental Health Risk

Socioeconomic impacts are those factors that affect surrounding communities, such as shifts in patterns of population movement and growth, public service demands, and changes in business and economic activity to the extent influenced by the airport development. The Near-Term Projects are not anticipated to require land acquisition, nor are they likely to relocate residences. Airport businesses (tenants) are the only business activities that may be directly affected, and most displaced facilities are expected to be relocated within the Airport. During construction, additional construction employment would be generated and thus, expenditures in the local communities would increase from the expenditures of the construction workers. However, these changes would not be expected to result in shifts in population movement or growth.

Impacts of the Near-Term Projects to environmental justice populations and to children's environmental health risk would need to be addressed once an evaluation is conducted for noise, air quality, water, and surface transportation in the SAMP Environmental Review process.

6.4.2.10 Surface Transportation

The Near-Term Projects would alter on-airport surface transportation due to the changes in the on-Airport North Airport Expressway (project L01), second terminal roads/curbside (L03), and development north of SR 518. A detailed surface transportation analysis will be completed during the SAMP Environmental Review process. This analysis will also support and complement the air quality analysis.

6.4.2.11 Water Resources (Floodplains, Wetlands, and Water Quality)

Development within the wellhead protection areas (north of SR 518) and development of a Westside Maintenance Campus west of Runway 16R/34L have the potential to affect water resources.

The Westside Maintenance Campus could also affect wetlands and/or wetland buffers. Further site evaluation would need to assess the ability to avoid wetland impacts and if avoidance is not possible to minimize impacts. In addition, site evaluation would be needed to ensure Campus development complies with adjacent mitigation site restrictive covenant requirements. The West Maintenance Campus will likely result in an increase of impervious surface.

Sustainability Planning and Management Strategy

The Port of Seattle has a strategic plan for sustainable growth at Seattle-Tacoma International Airport.

7.1 Background

In accordance with Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, and FAA Sustainability Guidance,* the Port of Seattle (the Port) has prepared a Sustainable Airport Master Plan (SAMP) for Seattle-Tacoma International Airport. The Port had two main objectives for pursuing a *sustainable* airport master plan. The first was to ensure that the Airport's Master Plan and vision for long-range Airport growth would be accomplished as sustainably as possible and align the planning effort with the Commission's goal for the organization to be the greenest, most efficient Port in North America.

7.2 Strategic Framework

In developing the overall framework for the sustainability aspect of the SAMP, the Port recognized that it would have to consider strategies that are typically outside traditional master planning to meet its ambitious sustainability goals. For example, if the Port is to meet its goal to double the number of international flights and destinations and, at the same time, reduce greenhouse gases by 50%, it will have to consider a broader range of options in addition to traditional capital development strategies in the SAMP. This led to a conceptual SAMP framework that combines the traditional planning efforts of **what we build** and **where we build** with sustainability-related concepts of **how we build,** and **how we manage/operate.**

In a traditional master plan, the effort focuses on serving forecast demand with development that achieves the highest operational performance at the lowest dollar and environmental cost. Sustainability Management Plans (SMPs) address how an airport can manage and/or operate its facilities in a sustainable fashion. The SAMP contains alternative development actions and initiatives, opportunities, and actions that address where, what, and how the Port builds combined with how the Port manages and operates its Airport facilities. Collectively, these initiatives, opportunities, and actions were identified as they will help to achieve the sustainability goals and objectives.

* http://www.faa.gov/airports/environmental/sustainability/

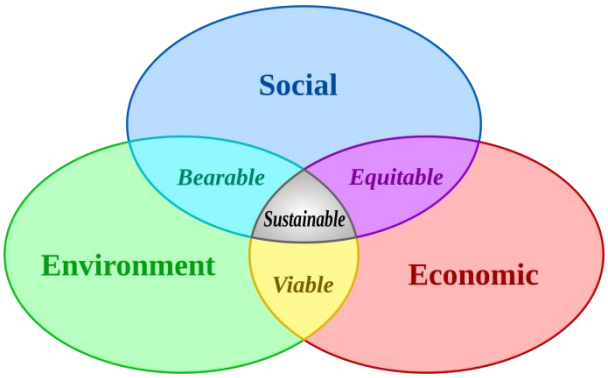
7.3 Defining Sustainability

A key first step to integrating sustainability into the Port's master planning process was to identify how the Port defines sustainability and Port goals and objectives designed to create a more sustainable Port of Seattle.

7.3.1 Brundtland Definition

"Sustainability" has many definitions, but generally has its origin in the 1987 United Nations Commission on Environment and Development (known as the Brundtland Commission). The Brundtland Commission suggested that development was acceptable and necessary, but that it must be done in a sustainable manner. A plan or development is sustainable if it balances three – often competing – elements: economic/financial, environmental, and social. Actions and development that accomplishes this is known as meeting the "Triple Bottom Line," illustrated on Table 7-1.

Table 7-1
The Triple Bottom Line: Economic, Environmental, and Social
Seattle-Tacoma International Airport



Source: "Sustainable development," Johann Dréo, Creative Commons, January, 2007.

7.3.2 FAA Sustainability Goals and Objectives

Because the Airport received a grant from the FAA to develop a SAMP, the FAA's approach and definition of sustainability and SAMP requirements influenced the process and integration of sustainability into the master plan. The FAA defines as sustainable actions that (1) help maintain high, stable levels of economic growth, (2) reduce environmental impacts, and (3) help achieve "social progress," a broad set of actions that ensure organizational goals are achieved in a way that's consistent with the needs and values of the local community*.

The FAA also provides guidance for airports preparing sustainable airport master plans, stating that "Sustainability Master Plans (SAMPs) fully integrate sustainability into an airport's long-range planning [and] use(s) baseline assessments of environmental resources and community outreach to identify

* http://www.faa.gov/airports/environmental/sustainability/

sustainability objectives that will reduce environmental impacts, realize economic benefits, and improve community relations."[*]

7.3.3 Port of Seattle Sustainability Goals and Objectives

The sustainability goals and objectives for the SAMP were developed based on goals and objectives established by the Aviation Division and the Port Commission in the Century Agenda, Long-Range Plan, and Strategy for a Sustainable Sea-Tac. These goals and objectives are presented in *Technical Memorandum No. 9 Sustainability Planning and Management Strategy*.

7.4 Applying FAA Guidance

In 2010, the FAA developed and issued guidance for airports that opt to include sustainability in their master plans.[**] The Port followed this guidance throughout the development of the sustainability component of the SAMP. The FAA's guidance states that sustainability contents and scope of the Sustainable Master Plan or Sustainable Management Plan should include and/or address the following at a minimum (1) a written sustainability policy or mission statement, (2) defined sustainability categories, (3) a baseline inventory or assessment of each defined sustainability category, (4) measurable goals, (5) specific sustainability initiatives, and (6) public participation and community outreach.

The Port's approach to meeting FAA requirements for the Mission Statement, the Sustainability Categories, and the Establishment of Measurable Goals and Objectives is described and summarized below. The Port's approach to developing the Baseline Inventory and the Sustainability Initiatives is described in *Technical Memorandum No. 9 Sustainability Planning and Management Strategy*.

7.4.1 Port Mission Statement and Vision

As recommended by FAA guidance, the Port established a Mission Statement and Vision for overall Port facilities in the Century Agenda.[***] For the Airport, the mission of the Aviation Division is "Connecting our region to the world through flight" and is included in the Port's webpage as well as in a variety of outreach publications and messaging.

7.4.2 Sustainability Categories/Focus Areas

The FAA's guidance to airports recommends that airports identify categories or areas within which the plan should focus. Since the Port had a well-established sustainability culture before the SAMP was initiated, the focus areas were identified based on the categories used in the Port's goals and objectives.

In addition, the Port added five potential focus areas to the Social/Community Outreach element in an effort to align the social sustainability element with the master planning process. The Port opted to add

[*] FAA, Airport Sustainability Master Plan, Memo from Elliot Black dated May 27, 2010 available at: http://www.faa.gov/airports/environmental/sustainability/media/interim_guidance_sustainable_master_plan_pilot.pdf

[**] The guidance in this section is quoted directly from: Federal Aviation Administration. Memorandum to Regional Airports Divisions Managers Re: Notification: Airport Sustainable Master Plan Pilot Program. From: Elliott Black, Acting Director, Office of Airport Planning and Programming. May 24, 2010. https://www.faa.gov/airports/environmental/sustainability/

[***] http://www.portseattle.org/about/commission/pages/century-agenda.aspx.

social/community outreach categories such as land use compatibility and public outreach, as these categories may be applied to the master planning process to consider development options. The general focus areas are combined and shown in Table 7-2.

Table 7-2
Port Sustainability Focus Areas
Seattle-Tacoma International Airport

Financial-Operational	Environmental	Social/Community Outreach
Air travel demand	Air Quality and Climate Protection	Employee welfare and workforce development
Gateway of Choice	Buildings and Infrastructure	Land Use Compatibility
Customer service	Energy	Community benefits
Project affordability/cost center imbalances	Fish & Wildlife	Public outreach
Productivity of existing facilities	Noise	Transparency
Ground vehicle operational efficiency	Transportation	
Aircraft optional efficiency	Water Conservation	
Satisfying cargo demand	Water Quality	
Renew aging landside infrastructure	Waste Management	
Maximize efficient passenger and baggage movement		

Source: Port of Seattle, LeighFisher, Synergy Consultants, March 2018.

7.4.3 Goals and Objectives

As described above, the Port has numerous overall goals and related objectives. These were narrowed to include goals and objectives that would pertain specifically to the SAMP development concepts and analyses. This includes tasks such as screening among the development concepts identified to create a vision for future air travel at the Airport, as well as various operational needs related to the focus areas.

7.5 Integrating Sustainability into Screening Alternatives

As shown in *Technical Memorandum No. 6 Alternatives*, the Port's evaluation of the development alternatives includes sustainability as part of the screening criteria used to select among multiple concepts for long-range Airport development. The intent of this approach was to minimize the environmental and social impacts of "what and where we build."

The Port screened the concepts for long-range Airport development according to key planning priorities such as taxiway operations, passenger convenience, incremental expansion, constructability, flexibility to assign gates, ease of adding international gates, and ability to add gates quickly. To include sustainability among the priorities, the Port added five sustainability criteria: (1) reduce taxi/idle/delay, (2) minimize impact on wetlands/creeks, (3) limit addition of impervious surfaces, (4) proximity to noise and light sensitive land uses, and (5) consistency with zoning.

7.6 Baseline Inventory

During the preparation of the SAMP, data were collected to identify the current performance of the Airport and recent past, if available, relative to the focus areas. Those existing conditions are referred to as the baseline, or in some cases reference year that corresponds to a goal/objective. This inventory enables the identification of gaps relative to achieving the Port's desired goals and objectives. The sole purpose of this gap analysis was to aid in determining the range of initiatives, opportunities, and actions (sustainability strategies) that the Port might consider implementing. Baseline data and conditions are described in detail in *Technical Memorandum No. 9 Sustainability Planning and Management Strategy*.

7.7 Sustainability Initiatives, Opportunities, and Actions

Technical Memorandum No. 9 Sustainability Planning and Management Strategy identifies numerous candidate strategies that would address the sustainability goals and objectives at Sea-Tac Airport. Collectively, these strategies are referred to as Initiatives, Opportunities, and Actions (IOAs).

- **Initiatives**. Initiatives are specific new actions that could be taken to enhance performance in one of the triple bottom line focus areas (i.e., make progress towards achieving sustainability goals/objectives).

- **Opportunities**. Opportunities are potential actions that, when applied to the recommendations of the SAMP, could improve triple bottom line performance. At a concept level, it is not a prudent use of resources to develop highly specific actions, but rather identify opportunities that could be incorporated during the engineering and design process for future projects.

- **Actions**. The Port has an ongoing program of actions that it implements to achieve its various goals and objectives. Items in this category would extend the existing program(s) to include recommendations resulting from the SAMP.

The IOAs were identified for each of the triple bottom line categories: financial-operational efficiency, environmental, and social-community outreach. The Port recognizes that even by implementing all IOAs, the Port may not be able to achieve all of its sustainability goals and objectives in the SAMP.

APPENDIX A

SAMP Documentation

The SAMP is documented in nine Technical Memorandums, an executive summary, and Airport layout plans. These documents and their purpose and content are summarized below.

- *Technical Memorandum No. 1 Background, Process, Goals, and Objectives*—Defines the SAMP's purpose and desired outcome, (2) explains how the Port has made sustainability a strategic priority at the Airport, (3) communicates the results of the most recent sustainability goal-setting process as part of the SAMP, and (4) illustrates the integration of those sustainability goals into the SAMP process.

- *Technical Memorandum No. 2 Inventory of Existing Conditions*—Documents drawings, plans and data that the planning team used for subsequent requirements and alternatives analyses.

- *Technical Memorandum No. 3 Air Cargo Market Assessment*—Documents (1) the composition of air carriers (and allied services) that forms the Airport's air cargo operating environment, (2) improvements in facilities and services at the Airport that could stimulate air cargo growth beyond that reasonably expected through organic growth over the 25-year planning period, (3) competitive pressures from other gateways and other transport modes that could limit air cargo growth, (4) the commodity composition of exports and imports transported principally by air, as well as relevant intermodal combinations, (5) the international origins and destinations of commodities traversing regional gateways, and (6) the external economic factors that affect air cargo demand in the region.

- *Technical Memorandum No. 4 Forecasts of Aviation Activity*—Documents forecasts of enplaned passengers, air cargo, based aircraft, and aircraft operations by type for use in the facility requirements and alternatives analyses.

- *Technical Memorandum No. 5 Facility Requirements*—Documents the facilities and associated land areas required to accommodate future aviation activity for planning activity levels corresponding with activity forecast for the 5-, 10-, 15-, and 20-year planning periods.

- *Technical Memorandum No. 6 Alternatives*—Documents the alternatives considered for satisfying the requirements for major functional areas of the Airport, identifies the recommended alternatives, and presents the recommended vision for long-range development.

- *Technical Memorandum No. 7 Facilities Implementation and Financial Feasibility*—Documents the near-term plan for developing the Airport, describes the analyses conducted to demonstrate that the airfield will adequately support the plan, and summarizes the results of the analyses that led to the conclusion the near term plan is financially feasible.

- *Technical Memorandum No. 8 Environmental Overview*—Identifies existing environmental conditions, any special purpose law that conflicts with the proposed SAMP recommendations, and general project-related potential environmental effects.

- *Technical Memorandum No. 9 Sustainability Plan and Management*—Documents the Port's strategic plan to ensure sustainable growth at the Airport.

- *Executive Summary*—The Executive Summary summarizes the principle results of the SAMP—the forecasts of aviation activity, facility requirements, alternatives considered, the long-term vision for Airport development, and the projects recommended for implementation in the near term.

- *Airport Layout Plan*—The Airport layout plan is a set of drawings, prepared according to FAA criteria, that reflect the near term development plan and must be approved by the FAA.