5 Facility Requirements

5.1 Introduction

This chapter focuses on the market based customer needs and the ability of existing airport facilities at the Bellingham International Airport (BLI) to meet forecast demand levels. When demand exceeds capacity, additional facilities are needed to accommodate the unmet demand. In addition, the requirements for new or expanded facilities consider the following:

- Customer Service requirements
- Enhanced security requirements
- Updated FAA Design Standards
- Actions necessary to achieve the Port's strategic vision.

Facility requirement discussions will center on the following areas,

Airfield – including the runway and taxiway system, navigation aids, and instrumentation

Terminal Area – including the passenger terminal building, commercial aircraft parking apron for both terminal gate positions and remain overnight (RON) positions, surface access and automobile parking, and terminal support services.

General Aviation – including based aircraft storage, Fixed Base Operations (FBO), auto parking and access.

Other – including fuel storage and distribution, security, and support services.

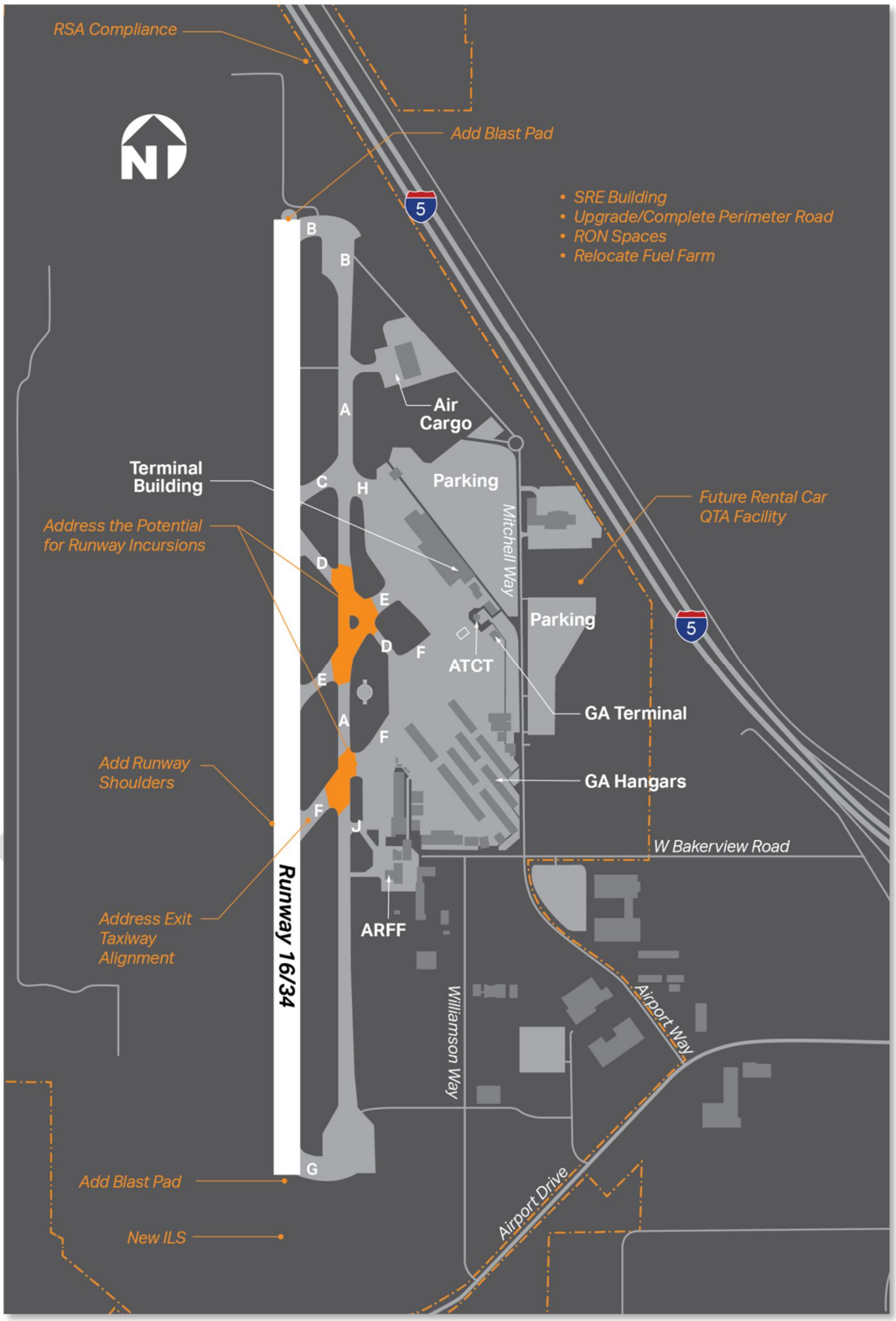
Table 5–1 and Figure 5–1 summarizes the conclusions of this chapter and shows the location of some of the recommendations.

Table 5–1: Existing Facilities Assessment

Facilities	Conclusions
Airfield System	· Runway 16/34, at 6,701 feet, provides marginally sufficient take-off length for all aircraft forecast to use the airport and the markets currently being served. · At the present time there are no shoulders or blast pads on the runway. These need to be added. · The Runway Safety Area (RSA) for Runway 16 does not meet FAA criteria and needs to be brought into compliance. · The taxiway system, particularly Taxiways E and H, need to be upgraded to eliminate the potential of runway incursions by realigning or truncating Taxiways F, E, D, and C. · The airport's Interior Service Road around the perimeter of the airfield should be completed along with updating fencing where applicable. · In the interest of both sustainability and cost control, new LED lighting systems should be installed on both the runway and taxiway systems.

Facilities	Conclusions
Passenger Terminal	· The passenger terminal building was expanded in 2014 to accommodate 750,000 to 800,000 annual enplaned passengers. Based on the forecasts, this should serve the airport through the planning period. Any expansion of the terminal will be driven by the introduction of new based service by an existing or new carrier that is unforeseen at this time. · Remain Overnight (RON) parking spaces need to be developed to accommodate the airlines' needs. Two of these positions are required immediately.
Terminal Area Support	· The fuel truck storage/ready area, Ground Service Equipment (GSE) storage, charging and maintenance areas, de-icing storage and application, waste disposal facilities, commissary and stores buildings, and delivery facilities are all part of the terminal complex. These areas are sufficient to meet forecast demand levels but additional area will need to be considered should the terminal area be expanded.
Automobile Parking	· The current public parking lots provide space for 2,063 vehicles. This includes 1,237 public spaces, 17 Americans with Disabilities Act (ADA) compliant spaces, 3 recreational vehicle (RV) stalls, 16 drop-off/pick-up (30 minutes free) spaces, and a free 14-space cell phone lot. Forecasts show additional expansion may be needed as passenger levels grow although off-site parking could reduce demand for on-airport facilities. The employee parking area consisting of 250 spaces is comingled with the Terminal Main and Economy A parking lots enabled by an upgraded RFID parking management system. The 131 spaces in the northern portion of the main parking lot reserved for Rent-a-Car ready and return has been expanded to 253 spaces and relocated to the southern portion of the lot adjacent to baggage claim and the arrivals exit. These areas are sufficient for activity levels forecast through the planning, period. A "Quick Turn Around" (QTA) facility is needed to clean, fuel, service and wash rental vehicles and return them back to service.
Air Cargo	· The passenger terminal contains facilities for processing all cargo shipped on the commercial airlines. This area will suffice through the period covered in the master plan. All-cargo activity is forecast to continue to consist of feeder service using small regional aircraft but additional space will need to be provided to handle the increased usage. This will be done either by re-marking existing pavement or by constructing new air cargo apron areas.
Based Aircraft Storage Hangars	· With the forecasted growth in based aircraft, as well as the existing unmet demand for hangar space, additional area for hangar development is needed.
FBO and Support	· Adequate Fixed Base Operator (FBO) facilities are provided and available to meet GA needs within the forecast period.
Fueling	· The current fuel storage facility provides less than two days of fueling capacity. The fuel storage capacity needs to match the aviation activity forecast and provide a minimum 7 day storage capacity to cover supply interruption emergencies. Fuel facilities should be relocated within the secure area of the airport.
Other	· The possibility of adding a new Instrument Landing System (ILS) on Runway 34 to provide for better all-weather operations as well as to increase operational flexibility should be considered. FAA will review the need for the facility as demand increases. · An Airport Surveillance Radar (ASR) would greatly enhance capacity and flow and should be considered by FAA's ANI for installation at BLI.

Figure 5–1: Summary of Facility Requirements



5.2 Airfield Requirements

BLI operates with a single runway (16/34) that is 6,701 feet long and 150 feet wide. It has a full parallel taxiway, Taxiway A, which is 75 feet wide. Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5300-13A, Airport Design, requires that the future classification of the airport be used as the basis for airfield design. In Chapter 4, Forecast of Aviation Demand, the critical aircraft at BLI was determined to be the Boeing 737-900.

The Runway Design Code (RDC) is used by FAA to relate airport design criteria to the operational and physical characteristics of the most demanding type of aircraft expected to operate at the airport on a regular basis. The RDC is based on a combination of the Aircraft Approach Category (AAC) and the Airplane Design Group (ADG) for the most demanding aircraft operating on the runway and the approach visibility minimums for the runway.

The AAC is denoted by a letter based on the aircraft's approach speed as shown in Table 5–2. Generally, aircraft approach speed affects runway length, exit taxiway locations, and runway-related facilities.

The second component of the RDC is the ADG which is depicted by a roman numeral. This relates numeral to the physical characteristics of the design aircraft (wingspan and tail height). The group categories are shown in Table 5–3. Finally, the visibility minimums for the runway are considered. These are expressed in terms of the Runway Visibility Range (RVR) using the categories listed in Table 5–4.

The current BLI Airport Layout Plan shows an Airport Reference Code (ARC) of C-IV based on forecast use by the Boeing 757-200W aircraft that Allegiant Airlines was using at the time the master plan was prepared in 2015. The current design aircraft, as determined in the forecasts is the Boeing 737 -900. The 737-900 has a wingspan of 117 feet 10 inches and a tail height of 40 feet 9 inches. The 737-900 is classified as a D-III aircraft.

Table 5–2: Aircraft Approach Category (AAC)

Category	Approach Speed
A	Less than 91 knots
B	91 knots or more, but less than 121 knots
C	121 knots or more, but less than 141 knots
D	141 knots or more, but less than 166 knots
E	166 knots or more

Table 5–3: Airplane Design Group (ADG)

ADG	Tail Height	Wingspan
I	Less than 20 ft.	Less than 49 ft.
II	20 to less than 30 ft.	49 to less than 79 ft.
III	30 to less than 45 ft.	79 to less than 118 ft.
IV	45 to less than 60 ft.	118 to less 171 ft.
V	60 to less than 66 ft.	171 to less than 214 ft.
VI	66 to less than 80 ft.	214 to less than 262 ft.

Table 5–4: Instrument Flight Visibility

RVR (feet)	Instrument Flight Visibility Category (statute mile)
5000	Not lower than 1 mile
4000	Lower than 1 mile but not lower than ¾ mile
2400	Lower than ¾ mile but not lower than ½ mile
1600	Lower than ½ mile but not lower than ¼ mile
1200	Lower than ¼ mile

The approach to BLI is a Category I Instrument Approach to Runway 16. The minimums for this approach are less than ½ mile but more than ¼ mile for an RVR of 1,600 feet. Dimensional design criteria for a D-III 1,600 category runway are shown in Table 5–6. The table also provides a comparison of the FAA standards with existing conditions on Runway 16/34.

Table 5–5: Instrument Approach Categories

Approach Category	Decision Height	Runway Visual Range (RVR)
I	200 feet or more	1,800 feet
II	less than 200 feet and more than 100 feet	1,000 feet
IIIa	less than 100 feet and more than 50 feet	600 feet
IIIb	less than 50 feet or none	150 feet

Table 5–6: Existing Conditions vs. D-III Design Criteria

Design Feature	Existing (feet)	Standard (feet)	Difference
Runway			
Width	150	150	Meets Standard
Runway Shoulder Width	0	25	-25 feet
Runway Blast Pad Width	0	200	-200 feet
Runway Blast Pad Length	0	200	-200 feet
Runway Safety Area (RSA) Width	500	500	Meets Standard
RSA Length Prior To Threshold	600	600	Meets standard
RSA Length (beyond RWY 16 end)	866	1,000	-134 feet
RSA Length (beyond RWY 34 end)	1,000	1,000	Meets standard
Object Free Area (OFA) Width	800	800	Meets Standard
OFA Length Prior To Threshold	600	600	Meets standard
OFA Length (beyond RWY end)	1,000	1,000	Meets Standard
Obstacle Free Zone (OFZ) Width	400	400	Meets Standard
Obstacle Free Zone Length (beyond RWY end)	200	200	Meets Standard
Taxiway	Taxiway Design Group (TGD) III		
Pavement Width	75	50	+25 feet
Shoulder Width	0 to 12	20	-8 to -20 feet
Safety Area Width	171	118	+53 feet
Object Free Area Width	259	186	+73 feet
Taxilane Object Free Area Width	225	162	+63 feet
Runway Centerline to:			
Taxiway Centerline	410	400	+10 feet
Aircraft Parking Area	600	500	Meets Standard
Taxiway Centerline to Fixed or Movable Object	129.5	93	+36.5 feet
Taxilane Centerline to Fixed or Movable Object	112.5	81	+31.5 feet

Source: FAA Advisory Circular 150/5300-13A, Airport Design, Change 1

As seen in the table, the airfield facilities at BLI meet or exceed FAA design standards in all but three instances;

- Runway shoulders do not meet standards.
- There are no blast pads on either runway end and because the runway length is marginal, jets are running their engines to gain power prior to initiating the takeoff roll and the jet blast is eroding the ground.
- The Runway Safety Area (RSA) on Runway 16 does not meet standards.

5.2.1 Runway Length

At 6,701 feet, Runway 16/34 is marginally sufficient to serve the airline operations that are occurring now. However, available length of the runway likely limits service and destinations being offered at BLI.

To determine the runway length needs at BLI the guidance from Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5325-4B "Runway Length Requirements for Airport Design" is referenced. This AC sets forth the procedure used to determine recommended runway lengths. The applicable steps and their rationale are as follows:

- Identify the critical design aircraft that will make regular use of the proposed runway for an established planning period. These have been presented in the forecast of aviation demand with the critical air carrier aircraft listed in Table 5–7.
- Identify the aircraft that require the longest runway lengths at maximum certificated takeoff weight (MTOW). The MTOW of the most critical airplanes at BLI is over 60,000 pounds (27,200 kg) and the recommended runway length has been determined according to the technical manuals prepared by the aircraft manufacturers (The Boeing Company, Airbus). Table 5–7 shows the calculated length for the commercial aircraft. These are compared graphically with the existing 6,701 feet length on Figure 5–2.

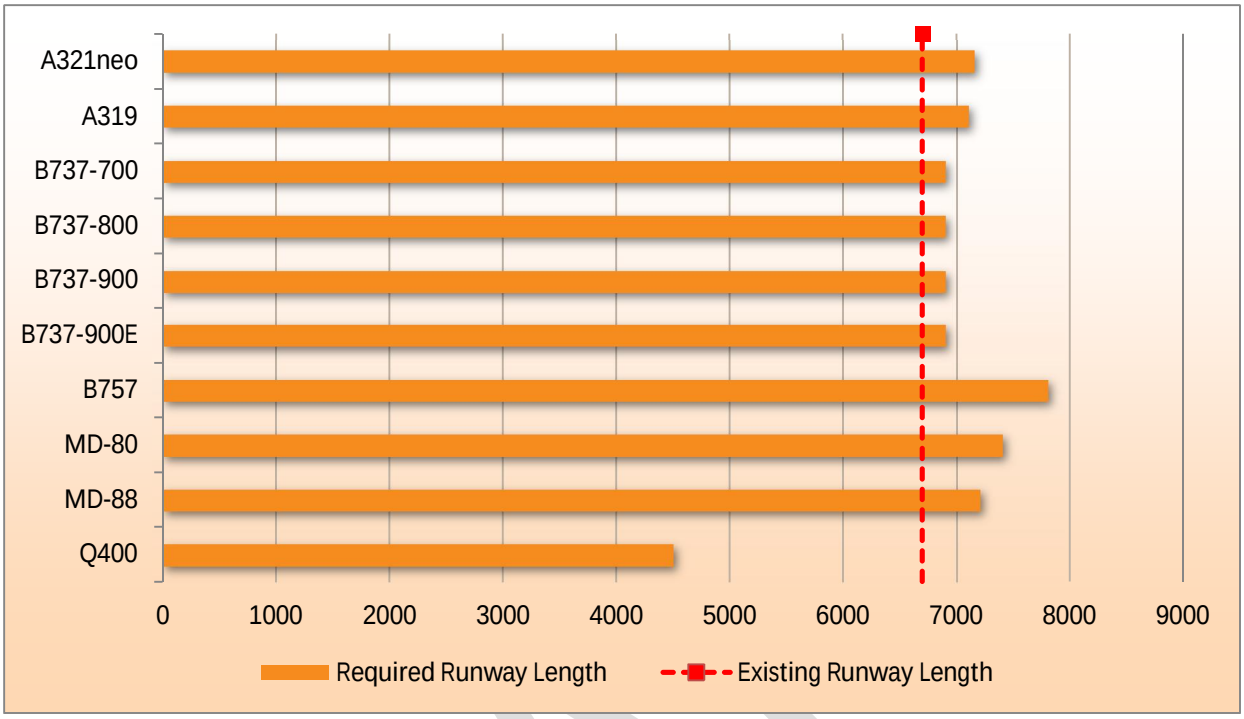
Table 5–7: Design Aircraft at BLI

Type	ADG	Runway Length at MTOW	Annual Operations				
			2016	2022	2027	2032	2037
A319	C-III	7,100	5,073	4,657	4,485	4,285	4,017
B737-700	C-III	6,900	590	155	157	159	161
B737-800	C-III	6,900	0	621	629	635	643
B737-900	D-III	6,900	0	272	708	873	964
B737-900E	D-III	6,900	0	78	315	397	643
MD-80	C-III	7,400	236	39	0	0	0
Q400	C-III	4,500	2,123	1,941	1,574	1,587	1,607
Total			8,022	7,762	7,868	7,936	8,034

Notes:

- *The runway lengths shown were calculated at Maximum Take-Off Weight (MTOW) using the airport elevation (171 feet MSL) and a mean maximum temperature of 71 degrees Fahrenheit.*
- *Runway calculations are for wet runway conditions*

Figure 5–2: Aircraft Runway Length Requirements



Note: The A321neo is not forecast to operate at BLI but is the size and capacity that is forecast to serve the airport in the future and is included for that reason.

As shown, the 6,701 foot runway at BLI is marginal for several of the aircraft that currently operate at BLI and may be a factor limiting future flight expansion. This is especially true for the critical aircraft – the Boeing 737-900 which requires a length of 6,900 feet at MTOW. Runway length requirements for the Boeing 737 Max, which is likely to serve BLI in the future have not been calculated by the Boeing Company to date but are assumed to be comparable to the 737-900.

5.2.2 Runway Capacity

Runway capacity measures the theoretical maximum number of aircraft operations that can operate on a runway system over a specified time. An operation is counted each time an aircraft lands or takes off. There are a variety of techniques available for determining airfield capacity. The most widely accepted method is described in FAA AC 150/5060-5, Airport Capacity and Delay. The analysis shown on the following pages uses the methods detailed in this publication.

Airfield capacity at BLI is evaluated in two ways:

Annual Service Volume (ASV): This is an estimate of the airport's annual capacity. The ASV accounts for differences in runway use, aircraft fleet mix, weather conditions, and other factors that occur at the airport over a year's time.

Hourly Capacity: This is an estimate of the number of operations that can take place on the runway system during a one-hour period. Hourly VFR and IFR capacities are based on the runway configuration, percent arrivals, percent touch-and-go, taxiway locations, airspace limitations, and runway instrumentation.

Table 5–8 shows the results of the capacity analysis for BLI compared with the forecast operations levels from the preceding chapter.

The analysis of capacity shows that demand levels forecast for BLI will not exceed the annual capacity of the runway within the 20-year planning period. By 2037, hourly demand levels during VFR conditions could equal 62 percent of the capacity of the runway. Under IFR conditions the demand levels will be approximately 40 percent of the hourly capacity.

Table 5–8: Demand/Capacity Comparison

				Annual Capacity	
	2016	2022	2027	2032	2037
Annual Service Volume (ASV)	230,000	230,000	230,000	230,000	230,000
Annual Demand	80,822	85,348	88,676	92,151	95,886
Percent Capacity	35.1%	37.1%	38.6%	40.1%	41.7%
					Hourly Capacity
VFR Conditions					
Peak Hour Capacity	98	98	98	98	98
Peak Hour Demand	52	55	57	59	61
Percent Capacity	53.1%	56.1%	58.2%	60.2%	62.2%
IFR Conditions					
Peak Hour Capacity	59	59	59	59	59
Peak Hour Demand	21	21	22	23	24
Percent Capacity	35.6%	35.6%	37.3%	39.0%	40.7%

Source: AECOM:

Capacity for ASV and peak hour conditions derived from Sketch 9 - AC 150/5060-5

VFR – Visual Flight Rules

IFR – Instrument Flight Rules

5.2.3 Lighting and Markings

FAA Advisory Circulars 150/5300-13 B "Airport Design", AC150/5340 and AC150/5345 set forth the standards for runway and taxiway lighting and marking runways. These standards are all currently met at BLI although the 2016 Part 139 Certification Inspection identified a need to adjust some RWY hold position and enhanced pavement marking to meet standards. The Airport currently plans to correct these in 2017 to meet standards. However, the existing lighting fixtures use conventional technology. In the interest of both sustainability and cost control, new LED lighting systems should be installed on both the runway and taxiway systems.

5.2.4 Signage

FAA AC 150/5340-18F provides guidance on airport signage at airports. All airfield signage at BLI meets these FAA standards. The addition of three information signs have been recommended by RSAT to lessen confusion at hotspot intersections.

5.2.5 Navigational Aids

Runway 16 at BLI is currently equipped with an Instrument Landing System that provides Category I instrument approach procedures. Current approaches to Runway 34 are non-precision. To enhance

the airport's all weather capacity and to preserve flexibility in operations the airport should reserve the ability to accommodate the installation of a new ILS on Runway 34 should FAA determine that this is needed.

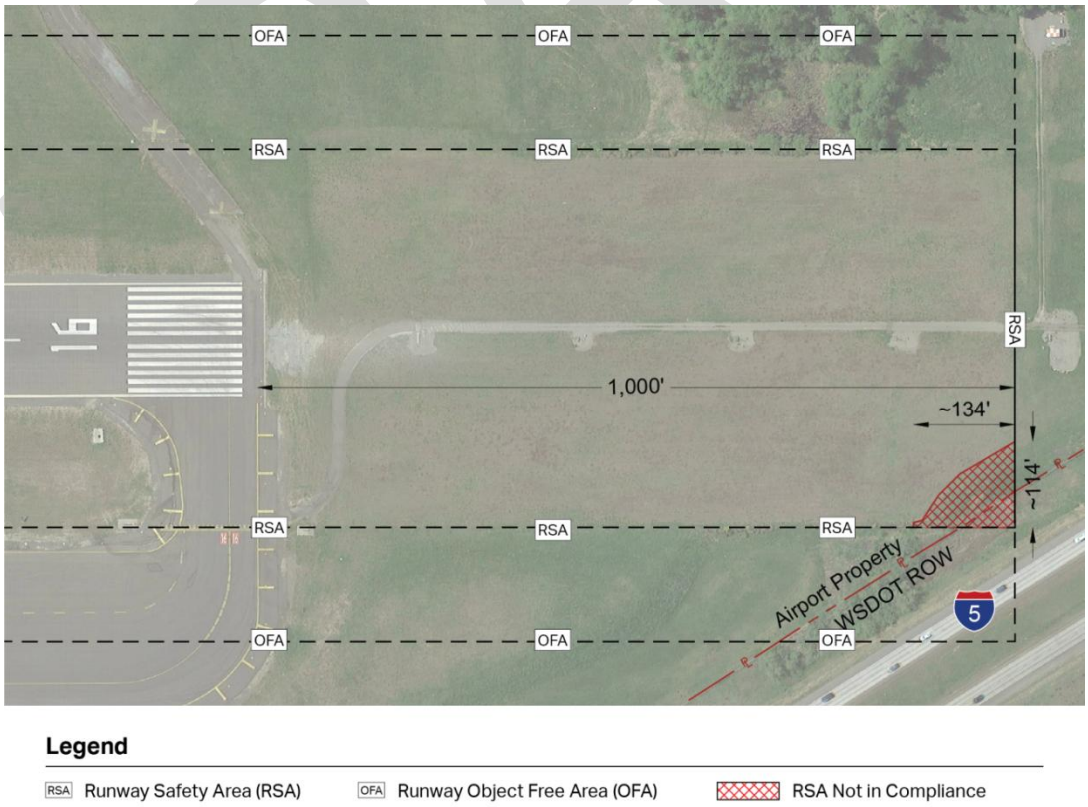
5.2.6 Runway Safety Area (RSA)

The RSA is a critical, two-dimensional area surrounding the active runway that must be:

- Cleared, graded, and free of potential hazardous surface variations,
- Properly drained,
- Capable of supporting Aircraft Rescue and Fire Fighting (ARFF) equipment, maintenance equipment, and aircraft under normal weather conditions, and
- Free of objects, except for those mounted using low-impact supports and whose location is fixed by function.

Based on FAA criteria from AC 150/5300-13 A for a D-III runway, the RSA needs to be 500 feet wide and extend 1,000 feet beyond each runway end. At BLI, the RSA for Runway 34 is in compliance with these standards. However, on the Runway16 end, an area measuring approximately 1,701 SF is not owned by the Port and therefore the RSA is not in compliance with the standard. Additionally, the maximum slope in this area does not meet standards. These two areas combined account for approximately 7,236 SF of not-to-standard RSA. Figure 5–3 shows the area that does not meet the standard. In the interest of compliance the RSA should be brought to standard.

Figure 5–3: Runway 16 RSA Noncompliance Area



5.2.7 Runway Object Free Areas (OFA)

The OFA is a two-dimensional ground area surrounding each runway. The OFA clearing standard precludes parked aircraft or other objects except Navigational Aids (NAVAIDs) and facilities whose locations are fixed by function. The current OFA dimensions call for an area 800 feet wide and extending 1,000 feet beyond the end of the runway. The OFA dimensions fall entirely on airport property and meet FAA criteria on the Runway 34 end. However, approximately 30,600 SF is not owned by the airport on the Runway 16 end. There are scattered groupings of trees within the OFA on the west side of the runway that will need mitigation.

5.2.8 Runway Protection Zones (RPZs)

The RPZ is trapezoidal in shape and centered on the extended runway centerline for each runway end. The function of the RPZ is to enhance the protection of people and property on the ground. It begins 200 feet beyond the permanent runway threshold (at the end of the primary surface). The RPZ dimensions are based on the type of aircraft using the runway, the type of operations (visual or instrument) being conducted, and the visibility minimums associated with the most demanding approach available. Table 5–9 shows the RPZ dimensions for Runways 16 and 34 Figure 5–4 depicts the RPZ ownership.

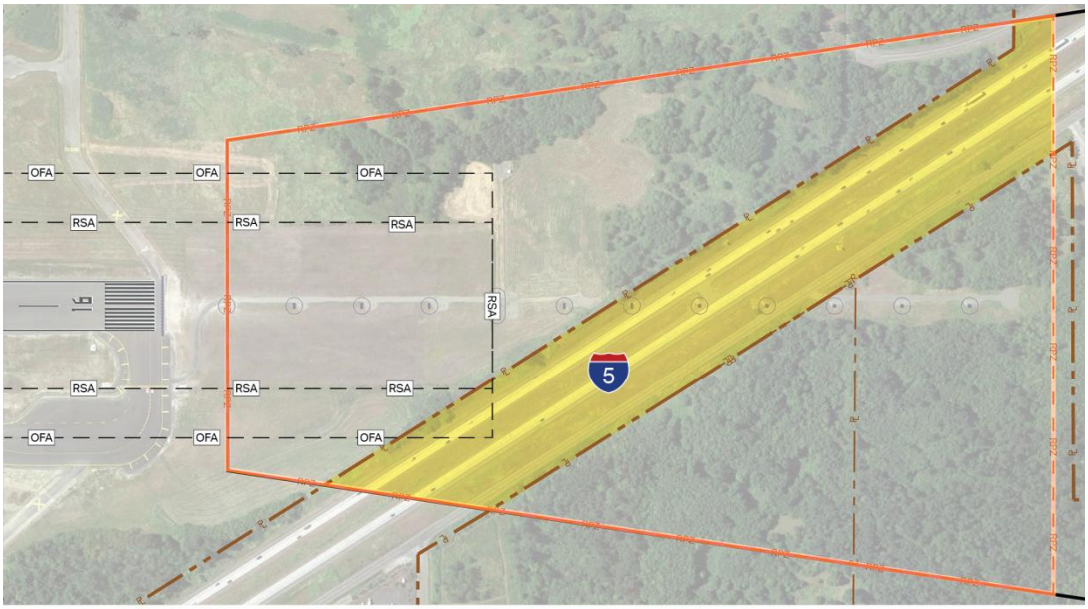
Table 5–9: Runway Protection Zone Dimensions (RPZ)

Runway	Aircraft Served	Approved Approach	Zone Length (feet)	Inner Width (feet)	Outer Width (feet)	Acres
16	Large	Precision	2,500	1,000	1,750	78.9
34	Large	Non-Precision	1,700	1,000	1,510	48.9

As shown on the 16 end, the RPZ contains portions of Interstate 5 and two local roads. While these are not desirable, they have in the past been viewed as acceptable. On the Runway 34 end, the Port does not own the portions of Alderwood Avenue, Marine Drive, and railroad right-of-way that crosses through the RPZ as well as a small piece (0.78 acres) of property to the south. This parcel is currently undeveloped.

Figure 5–4: BLI RPZ Ownership

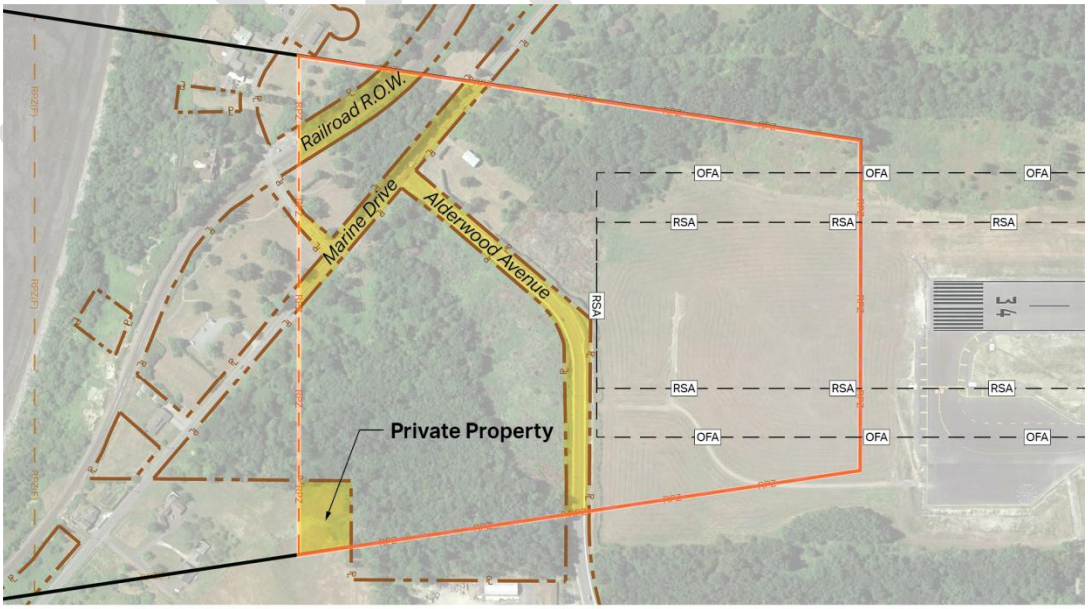
Runway 16



Legend

- Airport Property Line
- Runway Protection Zone
- RSA Runway Safety Area (RSA)
- OFA Runway Object Free Area (OFA)
- Area Not Owned by Airport

Runway 34



Legend

- Airport Property Line
- Runway Protection Zone
- RSA Runway Safety Area (RSA)
- OFA Runway Object Free Area (OFA)
- Area Not Owned by Airport

5.2.9 Taxiways

The taxiway system at BLI consists of a full parallel taxiway (TWY Alpha), four angled exits (TWYs Charlie, Delta, Echo, and Foxtrot), two entrance taxiways (TWYs Bravo and Golf) and two additional taxiways (TWY Juliet and Hotel). The FAA, in AC 150/5300-13A establishes the concept of Taxiway Design Groups (TDG) to guide the evaluation and design of taxiways. The TDG adds consideration of the dimensions of the aircraft undercarriage (main wheel gear and cockpit to main gear) to the ADG. Table 5–10 shows the dimensional requirements for the TDG groups compared with the actual conditions at BLI.

Table 5–10: Taxiway/Taxilane Data Table

ITEM	Taxiway A	Taxiway B	Taxiway C
Airplane Design Group (ADG)	III	III	III
Taxiway Design Group (TDG)	3	3	3
Taxiway / Taxilane	Actual [Standard]	Actual [Standard]	Actual [Standard]
Width	75' [50']	102.5' [50']	70' [50']
Safety Area (TSA) Width	171' [118']	118' [118']	118' [118']
Object Free Area (TOFA)	259' [186'/162']	186' [186'/162']	186' [186'/162']
Separation	148' [160'] – ICE TLN 340' [160'] – TWY F 181' [160'] – TWY H	NA [160']	NA [160']
Lighting	MITL [MITL]	MITL [MITL]	MITL [MITL]

ITEM	Taxiway D		Taxiway E	Taxiway F	
Airplane Design Group (ADG)	II	III	III	II	III
Taxiway Design Group (TDG)	2	3	3	2	3
Taxiway / Taxilane	Actual [Standard]		Actual [Standard]	Actual [Standard]	
Width	40' [35']	60' [50']	70' [50']	40', 48' [35']	50', 80' [50']
Safety Area (TSA) Width	79' [79']	118' [118']	118' [118']	79' [79']	118' [118']
Object Free Area (TOFA)	131' [131'/115']	186' [186'/162']	186' [186'/162']	131' [131'/115']	186' [186'/162']
Separation	328.5' [70'] – TWY H	NA [160']	NA [160']	NA [70']	340' [160'] – TWY A
Lighting	MITL [MITL]	MITL {MITL]	MITL [MITL]	MITL [MITL]	MITL {MITL]

ITEM	Taxiway G	Taxilane H	Taxiway J
Airplane Design Group (ADG)	III	III	II
Taxiway Design Group (TDG)	3	3	2
Taxiway / Taxilane	Actual [Standard]	Actual [Standard]	Actual [Standard]
Width	75' [50']	60' [50']	40' [35']
Safety Area Width	118' [118']	118' [118']	79' [79']
Object Free Area (TOFA)	186' [186'/162']	225' [186'/162']	131' [131'/115']
Separation	NA [160']	NA [160']	NA [70']
Lighting	MITL [MITL]	MITL [MITL]	MITL [MITL]

As shown, the taxiways at BLI meet or exceed the FAA dimensional criteria for the design aircraft.

5.2.10 Taxiway Layout

In a local Runway Safety Action Plan (RSAP) for BLI conducted in 2015, the FAA conducted a review of conditions at BLI and identified issues or concerns that could affect runway safety. The review found that there were two surface incidents and no runway incursions recorded at BLI in the previous 5 year period. With consideration of the low incident numbers, the design of the exit taxiways was no longer valid for the traffic using the airport. It was recommended that the existing angled exits be replaced with new 90 degree exits. These are shown on Figure 5–5.

In addition to the above taxiway system, there are a series of taxilanes that serve the general aviation and terminal areas that were designed to varying standards based on the aircraft expected to use them.

5.3 Terminal Requirements

Within the passenger terminal building, services are required for processing passengers arriving and departing on commercial flights. Enplaning services include ticketing, baggage check-in, airline offices and baggage screening. Processing services include passenger screening facilities operated by the Transportation Security Administration (TSA). Deplaning services include baggage claim, rental car facilities, and parking prepay facilities. Other services necessary in a terminal building include concessions (restaurants and gift shops), restrooms, advertising and display areas, mechanical and utility rooms, and janitorial service and storage areas.

The future of the passenger terminal needs to be planned to ensure that additional airlines and larger aircraft are not precluded from serving Bellingham in the future should demand arise, as well as ensuring that the current and projected peak passenger and aircraft parking loads are accommodated. The following discussion provides details on the facility requirements for the passenger terminal. Included are the base line (2016) conditions and future requirements summarized in 5-year increments.

5.3.1 Passenger Enplaning Facilities

The terminal expansion, completed in 2014, provided ticket counter space and check-in kiosks for five to six airlines. AECOM calculated the requirements at the ticket counter assuming that each airline would require area for four to six agents with space to process enplaning passengers, separated by a bag well between the agent positions to accommodate checked baggage.

Each airline also requires office space for administrative staff, employee break/locker areas, and air cargo offices. Additionally each airline needs baggage make-up space. This space includes the area to move bags from the counters to the make-up area where they are loaded onto carts to be transported to the aircraft. Prior to, but adjacent to the bag make-up spaces, bag screening needs to occur. The bag screening facility, operated by TSA, needs to be sufficient to accommodate the equipment and personnel necessary to screen peak-hour baggage.

Figure 5–5: Taxiway Design Issues

Passenger Screening Checkpoint Facilities

Once passengers are ticketed, they proceed to a passenger-screening checkpoint. There are currently two processing lanes at BLI with a theoretical capacity of accommodating 100 to 120 passengers per hour per lane. Based on forecast growth and a processing rate of 100 to 120 passengers per hour, the terminal building should allow for six screening lanes, with Advanced Imaging Technology (AIT) machines and/or magnetometers and one carry-on screening machine per lane. TSA design standards require an average of 1,050 square feet of space per screening lane, including a seating-composure area, response corridor, law enforcement officer, and a private search room. For passengers waiting to access security screening, a queuing area is calculated assuming that no more than 75 percent of the peak-hour enplaning passengers will be in line at any given time and each will require roughly 16 square feet of space.

TSA also needs ancillary operations support space for employee break room and/or training room functions. These are not necessarily required to be adjacent to the checkpoint and at BLI they are located on the second floor of the terminal.

Gate Area

Once ticketed and through security, passengers proceed to the hold room/gate area to await aircraft boarding. This area requires sufficient seating for 90 percent of the peak-hour passengers. An estimated 20 square feet is required for each seat and includes associated circulation space. In addition to seating, a departure podium, queuing area, and exit corridor add approximately 300 square feet total per airline gate.

Space must also be provided for restrooms and concessions, since this area is located behind the security checkpoint and passengers can no longer access non-secure facilities.

5.3.2 Deplaning Services

When passengers deplane, they proceed from the aircraft through the hold room to the baggage claim area. The future baggage claim area should include space for three automated baggage claim devices. Assuming a 25-foot-long device with a 12-foot-wide retrieval zone in front, the area for each baggage claim device will need to be approximately 300 square feet. Additionally, the area needs to accommodate people who are meeting incoming passengers.

This area also needs to provide for rental car agencies with customer service areas, queuing space, and parking prepay kiosks.

5.3.3 Other Services

In addition to facilities used for processing passengers, the terminal must also provide public services such as restaurant/concessions (minimum of 1,000 square feet), restrooms in the non-secure zones, a display area for advertising, and building systems and janitorial rooms.

5.3.4 Airport Management Space

Space requirements include an office for Airport Administration. This space should include a security badging workstation, conference/meeting area, kitchen/support area, circulation space, and restroom.

Table 5–11 shows the calculated areas required for terminal operations at BLI.

Table 5–11: Passenger Terminal Requirements

	Unit	2016	2022	2027	2032	2037
Annual Enplaned Passengers		417,930	392,209	424,606	459,679	497,649
Enplaning						
Ticket counter length	l.f.	32	32	40	48	56
Agent work area	s.f.	320	320	400	480	560
Passenger queueing	s.f.	640	640	800	720	840
Circulation space	s.f.	320	320	400	480	560
Self-service kiosks	s.f.	160	160	200	240	280
Airline offices	s.f.	480	480	600	720	840
Airline baggage make-up	s.f.	4,000	4,000	4,000	5,000	6,000
TSA baggage screening	s.f.	4,000	4,000	5,000	5,000	6,000
Total enplaning requirement	s.f.	9,920	9,920	11,400	12,640	15,080
Security/Screening						
Passenger security lanes	no.	2	2	3	4	5
Screening area	s.f.	2,100	2,100	3,150	4,200	5,250
Passenger queueing area	s.f.	4,824	4,527	4,905	5,310	5,751
TSA administration	s.f.	1,000	1,000	1,000	1,000	1,000
Total security requirement	s.f.	11,924	11,627	14,055	15,510	18,001
Gate Areas						
Number of gates	no.	5	5	5	6	7
Gate area	s.f.	13,000	13,000	13,000	15,600	18,200
Restrooms	s.f.	900	1,800	1,800	1,800	1,800
Concessions	s.f.	1,600	1,600	1,600	1,600	3,200
Circulation	s.f.	4,290	4,290	4,290	5,148	6,006
Total gate area requirement	s.f.	19,790	20,690	20,690	24,148	29,206
Deplaning						
Bag claim devices	unit	2	2	3	3	3
Baggage claim active area	s.f.	600	600	900	900	900
Waiting area	s.f.	8,576	8,048	8,720	9,440	10,224
Circulation area	s.f.	918	865	962	1,034	1,112
Inbound baggage area	s.f.	1,500	1,500	2,200	2,500	3,000
Rental Car						
Counter length	l.f.	32	32	32	32	32
Area	s.f.	320	320	320	320	320
Customer queueing	s.f.	320	320	320	320	320
Offices	s.f.	320	320	320	320	320
Parking pre-pay	s.f.	50	50	50	50	50
Total deplaning requirement	s.f.	11,104	10,523	11,592	12,384	13,246
Offices						
Airport management	s.f.	5,000	5,000	5,000	5,000	5,000
Other	s.f.	1,500	1,500	1,500	1,500	1,500
Total office requirement	s.f.	6,500	6,500	6,500	6,500	6,500

	Unit	2016	2022	2027	2032	2037
Other Needs						
Concessions	s.f.	2,500	2,500	2,943	3,186	3,451
Display area	s.f.	200	500	750	1,000	1,500
Restrooms	s.f.	450	900	900	900	900
Mechanical/Electrical	s.f.	1,777	1,778	1,927	2,135	2,461
Janitorial	s.f.	1,185	1,185	1,285	1,424	1,641
Total other requirement	s.f.	6,112	6,863	7,805	8,645	9,952
Total Requirement	s.f.	65,349	66,123	72,042	79,827	91,986

The Passenger Terminal Building was expanded in 2014 to approximately 105,000 square feet. This will be adequate for the passenger volumes as forecast. No terminal expansion will be required but longer term provisions for the possibility of a new airline serving BLI should be included in the planning for the terminal area. Should such a situation arise, a determination would need to be made as to whether that airline could be accommodated within the existing terminal footprint or an expanded footprint would be needed.

5.3.5 Terminal Apron

Aircraft parking is arranged along the terminal concourse and currently consists of eight terminal frontage gate positions, all of which are power-in/push-out positions. All of the gate positions can be used as RON spaces based on schedule needs of the airlines.

The exact size of any future terminal apron will depend on the final footprint and layout of the terminal building. Forecasts show that the eight existing gate positions will be adequate for the future. However, two dedicated RON locations should be provided in the short term. The RON spaces should be in the terminal area in a location where they do not interfere with aircraft circulation or safety and where they can park without affecting the ATCT line-of-sight.

5.3.6 Automobile Parking and Surface Access

The current public parking lots provide space for 2,063 vehicles. This includes 1,237 public spaces, 17 Americans with Disabilities Act (ADA) compliant spaces, 3 recreational vehicle (RV) stalls, 16 drop-off/pick-up (30 minutes free) spaces, and a free 14-space cell phone lot. Forecasts show that additional expansion may be needed as passenger levels grow although off-site parking could reduce the demand for on-airport facilities. The employee parking area consisting of 250 spaces is being comingled with the Terminal Main and Economy A parking lots enabled by an upgraded RFID parking management system.

The 134 spaces in the northern portion of the main parking lot reserved for Rent-a-Car ready and return has been expanded to 253 spaces and relocated the southern portion of the lot adjacent to and in proximity of baggage claim and the arrivals exit. These areas are sufficient for activity levels forecast through the planning, period. A “Quick Turn Around” (QTA) facility is needed to clean, fuel, service and wash rental vehicles and return them back to service.

Projecting demand for public parking is based on an airport’s annual enplaned passengers. According to FAA Advisory Circular 150/5360-13, Planning and Design Guidelines for Airport Terminal Facilities, there is a range from 1,000 to 3,500 public parking spaces required for each million annual

enplanements, depending on the type of use at the specific airport. In addition, it is typical to provide for 15 percent more space than the calculated need to minimize the amount of time required to find an available space.

Currently at BLI, there are approximately 4,936 spaces per million annual passengers. This reflects the fact that a high percentage of the passengers using BLI are traveling for recreational purposes. These passengers typically park for a longer time period than do business flyers. The projections shown in Table 5–12 support growth in passengers with similar use patterns.

Rental car parking projections were made using the assumption that the ready and return lots would continue to be located in the main lot near the terminal building. Currently there are 253 rental car spaces located in the terminal area with long-term storage being supplied at off-site locations. The ratio of rental car spaces to passengers equals roughly one space per 3,120 arriving passengers. This represents low usage when compared to national averages that show that one space per every 750 arriving passengers should be provided. This lower use pattern is consistent with the nature of the passengers and airlines using BLI.

Table 5–12: Automobile Parking Requirements

Year	Annual Enplaned Passengers	Public Parking	R-A-C Ready/Return Area	Employee
2016	417,930	2,063	131	250
2022	392,209	1,936	253	250
2027	424,606	2,096	253	250
2032	459,679	2,269	253	300
2037	497,649	2,457	253	350

Note: RAC ready/return area was expanded to 253 spaces in 2017.

5.4 Air Cargo

There are two distinct types of cargo operation at BLI. There is the cargo being processed and shipped by the commercial air carriers using the same planes that they use to transport passengers (commonly referred to as belly-cargo) and the cargo carried by the all-cargo carriers such as Federal Express and United Parcel Service (UPS). These two types of cargo require different facilities for processing, as explained in the following.

5.4.1 Airline Cargo (Belly Cargo)

The volume of belly cargo being shipped into and out of BLI is minimal as the market does not support large volumes and the airlines that operate do not emphasize this market. All belly cargo is currently processed in space provided on the north end of the passenger terminal. The space provided is expected to be adequate for future needs.

5.4.2 All-Cargo Carriers

Forecasts of the volume of all-cargo carriers in Bellingham have been based on two assumptions regarding the marketplace;

1. Carriers such as FedEx and UPS that move small packages on a time-critical basis will continue to operate feeder service out of BLI connecting with their hub operations located in the Puget Sound Region.
2. The movement of goods to and from the San Juan Islands will continue by air. Most of the growth in this activity will be tied to population and economic conditions in the Islands, specifically the population and demographics for Whatcom and San Juan Counties.

At present, all of this cargo is accommodated in privately owned and operated facilities or processed off-site and loaded onto the aircraft on the apron. Given that the rate of growth for air cargo is not projected to be steep, the need for additional facilities at BLI is expected to be limited. It is assumed that the FedEx facility will be sufficient for their operations through the planning horizon. Other carriers will continue to operate either on the apron area or at private hangar facilities. The need for these will consist of additional apron area on which to load and unload the cargo.

Should any of the major all-cargo carriers decide to expand their facilities at BLI as a result of changes in their logistical planning, long-range plans will need to identify potential locations for such an expansion.

5.5 General Aviation Requirements

In 2016 there were 189 general aviation aircraft based at BLI. The long-term forecast for based aircraft at BLI anticipated that 256 aircraft would need to be accommodated by 2036. This is an increase of 67 aircraft. The majority of these aircraft will require hangars or some form of indoor storage. The number and type of aircraft storage facilities needed over the course of the 20-year planning period is detailed in the sections below.

Table 5–13: Based Aircraft Forecast

Year	Single Engine Piston		Multi Engine Piston		Turbine		Rotor		Total	
	No	%	No	%	No	%	No	%	No	%
2016	169	89.3%	8	4%	5	3%	7	4%	189	100%
2022	184	89.0%	8	4%	6	3%	8	4%	207	100%
2027	193	87.0%	9	4%	9	4%	11	5%	222	100%
2032	202	85.0%	12	5%	12	5%	12	5%	238	100%
2037	212	83.0%	13	5%	15	6%	15	6%	256	100%

5.5.1 Hangar Storage Requirements

Aircraft hangar storage is in demand at BLI at present but land available for hangar development is limited. Although current storage rates show that 59 percent of all based aircraft are stored in hangars and 41 percent in tie-downs, this distribution is heavily influenced by the fact that the supply of hangars does not currently meet demand. Table 5–14 lists the assumed storage preferences for based aircraft if adequate facilities were available. These percentages have been based on an assessment of the hangar waiting list that exists for BLI as well as at other facilities in Western Washington. The

percentages recognize the value of aircraft and the desire of pilots to protect their investments from the weather.

Table 5–14: Assumed Storage for Based Aircraft

Aircraft Type	T-hangars	Corporate Hangars	Tiedown	Total
Single Engine Piston	80%	15%	5%	100%
Multi-Engine Piston	50%	50%	0%	100%
Turbine	0%	100%	0%	100%
Rotor	0%	100%	0%	100%

Combining these with the based aircraft forecast produced the requirements for hangar space as shown in Table 5–15. As shown, demand for open-air tiedowns is relatively low and the largest growth in demand is expected to be in corporate hangars.

Table 5–15: Based Aircraft Storage Requirements

Year	T-Hangars	Corporate Hangars	Tiedowns	Totals
2016	139	42	8	189
2022	152	46	9	207
2027	159	53	10	222
2032	168	60	10	238
2037	176	69	11	256

It should be remembered that the demand for aircraft hangars is based on forecasts that can change. Consequently, it is recommended that these larger hangar facilities be reflected in the airport's long-term plans, it is also recommend that hangars only be constructed as specific demand arises.

5.5.2 Transient Aircraft Tiedown Requirements

Tiedown space is also needed for transient aircraft parking. It is best to provide this space at or adjacent to FBO hangars where the aircraft owners can have access to fueling and other services. AECOM employed the following method to calculate the number of aircraft that will require transient aircraft parking spaces as shown in Table 5–16.

- Determine the number of itinerant aircraft operations that occur on the average day.
- Convert the average day itinerant operations to the number of daily transient arrival aircraft by dividing by two.
- Divide the number of aircraft performing itinerant operations by two to account for the fact that based aircraft perform some itinerant operations.

Table 5–16: Itinerant Aircraft Tiedown Requirements

Year	Itinerant Operations				Transient Tiedowns Required
	Annual	Average Day	Daily Arrivals	Transient Arrivals	
2016	31,195	109	55	27	14
2022	35,438	124	62	31	16
2027	36,668	128	64	32	16
2032	38,637	135	68	34	17
2037	40,450	142	71	35	18

- Assume that no more than 50 percent of the resulting daily transient aircraft will require storage at any one period.

5.5.3 Summary of Aircraft Storage Requirements

The preceding analyses show that the focus for future aircraft storage should be on hangars (either corporate or T-hangars) instead of tiedowns. Table 5–17 shows the amount of space needed for aircraft storage throughout the forecast period.

Table 5–17: Aircraft Storage Requirements

Facility		2016	2022	2027	2032	2037
T-Hangars	no.	139	152	159	168	176
	s.f	834,511	909,144	953,712	1,006,740	1,058,304
Corporate Hangars	no.	42	46	53	60	69
	s.f	312,488	346,984	400,433	450,713	517,440
Based Aircraft Tiedowns	no.	8	9	10	10	11
	s.f	4,913	5,581	5,775	6,085	6,371
Transient Tiedowns	no.	14	16	16	17	18
	s.f	9,553	10,853	11,230	11,833	12,388
Total Requirements	s.f	1,161,465	1,272,562	1,371,149	1,475,370	1,594,503
	acres	27	29	31	34	37

5.5.4 Fixed Base Operator Facilities

As the number of based aircraft increases and the level of operations continue to rise, the airport needs to ensure that adequate land is set aside for FBO facilities. In this report, the space needed is calculated at 15 percent of the total area designated for based aircraft storage and transient tiedowns. Table 5–18 shows the space that should be dedicated to FBO facilities. The area set aside for the FBO expansion should include the transient aircraft parking spaces discussed previously.

Table 5–18: FBO Facilities Area Requirements

	2016	2022	2027	2032	2037
GA Needs					
Square feet	1,161,465	1,272,562	1,371,149	1,475,370	1,594,503
Acres	27	29	31	34	37
FBO Needs					
Square feet	174,220	190,884	205,672	221,306	239,175
Acres	4	4	5	5	5

5.6 Utilities and Drainage

The only identified issue is the lack of utilities on the airport's west side. This creates a situation that makes development of any airport facilities on this side more expensive and time consuming. As new facilities are developed in new areas, utilities will need to be extended or expanded to provide the necessary services. For terminal and general aviation areas, utility services typically include electricity, water, data cables, and the collection of storm water treatment.

5.7 Aircraft Fueling

Aircraft fueling facilities currently include both Jet-A and Avgas. Four 25,000-gallon aboveground storage tanks provide fuel for the air carrier and general aviation jets at BLI. These tanks provide for less than a 2-day supply. Avgas is available from two 12,000-gallon aboveground tanks located mid-field.

In calculating the need for additional storage capacity, a 7-day supply of Jet-A fuel is preferred in order to assure an uninterrupted supply to the scheduled carriers. Therefore, our calculation includes a factor to bring the current capacity up to standards and then grow it based on the increase in the number of jet operations anticipated.

Table 5–19: Fuel Storage Requirements

Year	Annual Operations	Capacity (gallons)	Days' Supply	Tanks
2011	23,230	50,000	2	2
2016	24,563	52,868	7	2
2022	25,559	55,013	7	2
2027	26,585	57,220	7	2
2032	27,642	59,497	7	2

Avgas demand is lower than that for Jet-A and new capacity is expected to be added by the Fixed Base Operators as they relocate their facilities. Table 5–19 shows the need for fuel storage over the 20-year planning period.

In addition to capacity, the current fuel storage area is only accessible from the non-secure side of the airport. As such, fuel trucks must travel on public roads in order to access the fuel. This is not ideal and can lead to issues of Foreign Object Debris (FOD) in the Airport Operations Area (AOA) as well as security concerns and staffing needs in order to conduct inspections. A future location should be identified on the secure side of the airport.