KEN JERNSTEDT AIRFIELD - HOOD RIVER | AIRPORT MASTER PLAN

FINAL REPORT - MARCH 2018

CENTURY WEST ENGINEERING

PORT OF HOOD RIVER

KEN JERNSTEDT AIRFIELD | AIRPORT MASTER PLAN REPORT

FINAL REPORT, MARCH 2018
PREPARED FOR

PREPARED BY

CENTURY WEST ENGINEERING

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Chapter 1 – Introduction and Project Overview

Introduction

The Port of Hood River is preparing an updated Airport Master Plan for Ken Jernstedt Airfield, Hood River (4S2) in cooperation with the Federal Aviation Administration (FAA) to address the airport's needs for the next twenty years. The Airport Master Plan provides specific guidance in making the improvements necessary to maintain a safe and efficient airport that is economically, environmentally, and socially sustainable.

Study Purpose

The purpose of the Airport Master Plan is to define the current, short-term, and long-term needs of the airport through a comprehensive evaluation of facilities, conditions, and FAA airport planning and design standards. The study also addresses elements of local planning (land use, transportation, environmental, economic development, etc.) that have the potential of affecting the planning, development and operation of the airport. FAA Advisory Circular 150/5070-6B Airport Master Plans defines the specific requirements and evaluation methods established by FAA for the study.

Project Need

The FAA requires airports to periodically update their airport master plans as conditions change in order to maintain current planning. This project updates the 2002[1] Airport Layout Plan report, which has

[1] ALP report was updated in 2009 and adopted by Hood River County.

provided the primary airport planning guidance for the airport over the last ten years. During this period, several of the airport layout plan recommendations have been implemented, changes have occurred in the local community, and FAA airport design standards have been updated. In addition, changes have occurred within the aviation industry and are reflected in the updated planning.

Based on these factors, it is appropriate to update the long-term planning for the airport to reflect changing local conditions, current trends, and current FAA standards. The updated Airport Master Plan and Airport Layout Plan (ALP) replaces the previous plan and meets the FAA's requirement to maintain current planning.

Project Funding

Funding for the Airport Master Plan Update was provided through an FAA Airport Improvement Program (AIP) grant (90%) with a local match (10%) provided by the Port of Hood River. The AIP is a dedicated fund administered by the FAA with the specific purpose of maintaining and improving the nation's public use airports. The AIP is funded exclusively through fees paid by users of general aviation and commercial aviation and these funds can only be used for eligible aviation related projects.

Airport History

As noted in the 2002 ALP report, Hood River County constructed an airfield in 1928 on the west side of Hood River for airplanes flying through the Columbia Gorge. By 1931, increased air traffic led to noise, dust, and complaints from the residential area surrounding the airfield. This caused the County Court to limit the use of the airfield to refueling and emergencies only, which ultimately closed the airstrip.

In 1945, the current airport location was established on 80 acres of pasture that was leased by two local pilots. Members of the Civil Air Patrol helped prepare the field in exchange for use of the airstrip. In 1946, Hood River County assumed ownership and operation of the airfield in order to establish a municipal (public) airport facility. Numerous improvements were completed by the County over the next thirty years, until airport ownership was transferred to the Port of Hood River in 1976. The Port continued to improve the airport by purchasing an additional 35 acres of land and began working towards bringing the airport into compliance with FAA standards. On June 19, 2001, the Port Commission changed the airport name to Ken Jernstedt Airfield to honor a long-time resident, American Volunteer Group Flying Tiger ace Ken Jernstedt.

Several major airfield improvements have been completed since the last master plan, including the recent easterly shift of Runway 7/25, which addressed incompatible land uses and public roadways located beyond the runway ends. Another recent improvement was the addition of a grass-surfaced area between the runway and the north parallel taxiway available for aircraft use. The Western Antique Aeroplane and

Automobile Museum (WAAAM), located adjacent to the airport's north side, opened in 2008 and has quickly become one of the Northwest's most popular aircraft museums.

Study Organization

Work in progress on the Airport Master Plan Update was documented in a series of technical memoranda (originally presented as draft chapters). The chapters were prepared to document progress in the study, facilitate the review of preliminary results, and to obtain input early and throughout the master planning process. Updated information was added to the chapters as needed and incorporated into the Airport Master Plan report.

The evaluation of airfield development alternatives involved multiple iterations and refinement of the landside concepts. This process ultimately led to the facility configurations presented in the preliminary preferred alternative in the draft master plan report and depicted on the draft Airport Layout Plan (ALP). Subsequent coordination between the Port of Hood River and the FAA Seattle Airports District Office (ADO) led to specific refinements to the development concepts and proposed property acquisition. The implementation of high priority apron and taxiway improvements led to additional evaluation and change in design standards recommended for Runway 7/25.

The draft chapters and supporting documents were prepared over a period of approximately 12 months. Each draft chapter was reviewed by the Port, the planning advisory committee (PAC), the Federal Aviation Administration (FAA), and the Oregon Department of Aviation (ODA). The master plan elements were available for public review and comment throughout the project.

The 2014-2034 Ken Jernstedt Airfield Master Plan includes the following chapters:

- *Chapter 1 - Introduction & Project Overview*
- *Chapter 2 - Airport Inventory*
- *Chapter 3 - Aviation Activity Forecasts*
- *Chapter 4 - Airport Facility Requirements*
- *Chapter 5 - Alternatives Analysis*
- *Chapter 6 - Capital Improvement Program and Financial Plan*
- *Chapter 7 - Airport Layout Plan*
- *Chapter 8 - Environmental Review*
- *Chapter 9 - Airport Land Use Compatibility*
- *Chapter 10 - FAA Compliance Review and Recycling and Solid Waste Management Plan*

Local Citizen Participation

The Port of Hood River is committed to an inclusive, transparent planning process and has made project work products available for public review. The public involvement element of the Airport Master Plan Update provided several ways for all interested individuals, organizations, or groups to participate in the project.

Draft work products developed during the project were available for public review and comment. Links to the documents were posted on the Port of Hood River's webpage to allow for convenient access, review, and comment. Copies of the draft work products were available for public review and comment throughout the project. Comment forms were available for both electronic and printed versions of the draft work products.

A series of public meetings were held during the project to facilitate public participation. The project team presented information, provided updates on study progress, and identified upcoming decision points in a workshop format to facilitate discussion. The project team utilized a variety of tools to encourage citizen participation, including surveys and project updates posted on the Port of Hood River's webpage.

A local Planning Advisory Committee (PAC) was formed by the Port to assist the project team in reviewing draft technical working papers and to provide input into the planning process. The composition of the PAC was intended to provide an effective blend of airport users, neighbors, local business, local government representation, and other interests. Representatives from the FAA Seattle Airports District Office and the Oregon Department of Aviation served as ex officio members of the PAC. The PAC met throughout the project, reviewed and commented on draft work products, discussed key project issues, and provided local knowledge and expertise to the planning process.

The PAC meetings were open to public to ensure that all interested stakeholders were provided an opportunity to participate in the project.

Summary

The FAA-defined airport master planning process requires a sequential, systematic approach, which leads to selection of a preferred development option for the airport that is integrated into the Airport Layout Plan (ALP) and Airport Capital Improvement Program (ACIP). To meet this goal, the Airport Master Plan Update will:

- *Provide an updated assessment of existing facilities and activity;*
- *Forecast airport activity measures (design aircraft, based aircraft, aircraft operations, etc.) for the current twenty-year planning period;*
- *Examine previous planning recommendations (Airport Layout Plan) as appropriate, to meet the current and projected airport facility needs, consistent with FAA airport design standards;*
- *Determine current and future facility requirements for both demand-driven development and conformance with FAA design standards;*
- *Provide consistency between airport planning and land use planning to promote maximum compatibility between the airport and surrounding areas;*
- *Prepare an updated Airport Layout Plan (ALP) drawing set to accurately reflect current conditions and master plan facility recommendations; and*
- *Develop an Airport Capital Improvement Program (ACIP) that prioritizes improvements and estimates project development costs and funding eligibility for the twenty-year planning period.*
- *Evaluate airport sponsor compliance with FAA Airport Improvement Program (AIP) grant assurances.*

The preparation of this document may have been supported, in part, through the Airport Improvement Program financial assistance from the Federal Aviation Administration as provided under Title 49, United States Code section 47104. The contents do not necessarily reflect the official views or policy of the FAA. Acceptance of this report by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein nor does it indicate that the proposed development is environmentally acceptable with appropriate public laws.

Chapter 2 – Inventory of Existing Conditions

Chapter 2 – Inventory of Existing Conditions

The purpose of this chapter is to document the existing facilities and conditions at Ken Jernstedt Airfield (Airport Identifier 4S2). The airport is owned and operated by the Port of Hood River, Oregon.

This project replaces the 2004 Airport Layout Plan Report and the 2009 update, which serve as primary sources for inventory data.[1] Where available, more current or comprehensive data have been included in the chapter to illustrate current conditions. Existing airfield facilities were examined during on-site inspections to update facility inventory data. The consultants also worked closely with Port staff to review current facility and operational data maintained by the Port. Data from a variety of sources are used in this evaluation (a summary of data sources is provided at the end of the chapter). New aerial photography was flown in August 2014 specifically for this project.

Locale and Geography

Hood River is located in northern Hood River County, approximately 60 miles east of Portland, adjacent U.S. Interstate 84 (I-84)/U.S. Route 30, the main east-west travel route across northern Oregon. Hood River County has a land area of approximately 533 square miles, extending from the Columbia River to south of Mt. Hood, and east and west of Hood River. More than half of Hood River County's land area is in federal ownership, primarily the Mt. Hood National Forest and the Columbia Gorge National Scenic Area. Adjacent counties include Wasco to the east and south; Clackamas and Multnomah to the west; and Klickitat and Skamania (Washington) to the north.

[1] 2004 Airport Layout Plan (Century West Engineering, Aron Faegre & Associates)

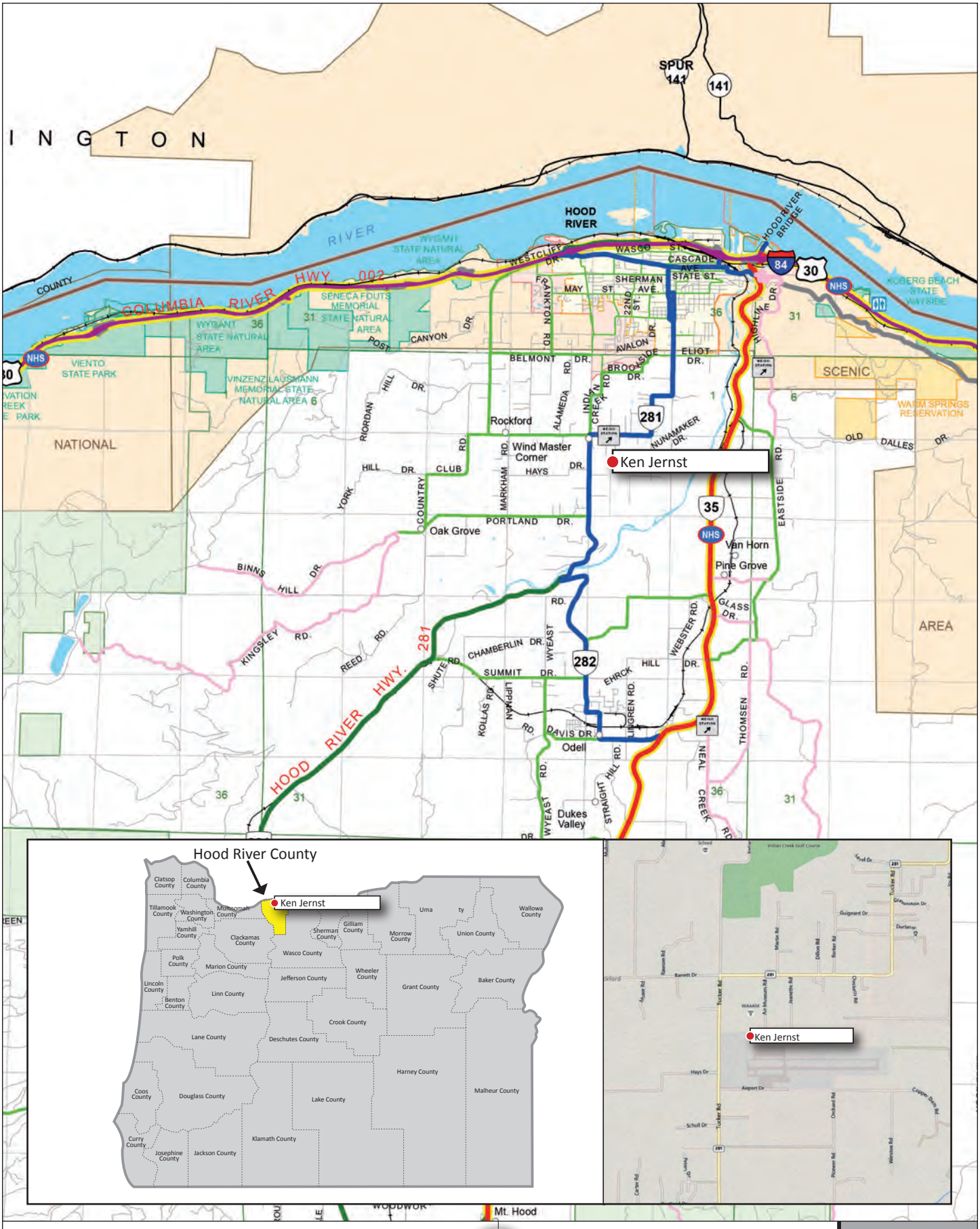
The community of Hood River is situated at the north end of the Hood River drainage basin, or watershed, at the confluence of the Columbia River and Hood River. The basin extends from the Columbia River to Mount Hood with a wide variation in physical conditions (climate, terrain composition and elevation, native vegetation, etc.) The basin is comprised of farmland, orchards and forest lands with rivers, lakes, and creeks surrounded by moderate to high mountainous terrain.

Hood River is the largest of two incorporated cities in Hood River County and is the county seat. The 2013 annual population estimate (July 1, 2013) prepared by Portland State University for Hood River County was 23,295; the City of Hood River population (incorporated area only) was 7,460. Population within both the city and county has increased by approximately 4 percent since the 2010 census. Major sectors in the local economy, which extends beyond Hood River through the Columbia Gorge and outlying areas, include agriculture and natural resources, tourism, technology, retail and wholesale sales, manufacturing, education, health services, and government.

Ken Jernstedt Airfield is located approximately 3 miles southwest of Hood River, beyond the City of Hood River city limits and urban growth boundary (UGB), in unincorporated Hood River County. Hood River County has local land use authority for the airport and its surrounding areas. Surface access to the airport is provided via Tucker Road (State Highway 281) with connections to Airport Drive (south side of airport); and Air Museum Road (north side of airport). A location and vicinity map for Ken Jernstedt Airfield is provided in **Figure 2-1**.

Highway 281 extends south from Hood River to Trout Creek and Parkdale, before connecting with State Highway 35. Highway 282 connects to Highway 281 approximately 2 miles south of the airport, and extends east and south to connect with Odell and Highway 35. Highway 35 extends south from Hood River to Mount Hood and U.S. Highway 26, and north to Washington (State Highway 14) via the Hood River Bridge over the Columbia River.

Elevations within the county range from 51 feet above mean sea level (MSL) along the Columbia River to 10,239 feet MSL at Mt. Hood, located approximately 22 miles to the southwest of the airport. A review of the Seattle Sectional aeronautical chart identifies Maximum Elevation Figures (MEF), representing the highest terrain in the vicinity of the airport. The MEFS in the four quadrants surrounding the airport are 5,600 feet (NW); 4,600 feet (NE); 11,600 feet (SW); and 6,300 feet (SE). The elevation of Ken Jernstedt Airfield is 638 feet (MSL).



KEN JERNSTEDT AIRFIELD- HOOD RIVER | AIRPORT MASTER PLAN

LOCATION MAP | **FIG. 2-1**

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Geology

Hood River County is made up of layers of basalt known as the Columbia River Basalt Group. This area of basalt is an important water-bearing unit in the Hood River basin. The basalt is highly permeable and provides an abundance of water.[2] The area covers nearly 250,000 square miles varying in thickness from 300 to 4,000 feet, formed by a series of eruptions between Mount Hood and Mount Adams. Ken Jernstedt Airfield is situated in the Hood River Valley, which extends about 16 miles south of Hood River's city center. The soil is very fertile and supports a variety of agricultural crops, woodland, wildlife habitat and water supply. The land immediately surrounding the airport consists primarily of fruit orchards with sparsely developed areas of urbanization.

The terrain at the airport is generally level with some gentle sloping. The soil survey[3] for the area indicates that the dominant soil on airport is classified as "***Rockford stony loam*** *(typically located on uplands), moderately deep and well drained with 0 to 8 percent slope. Rockford soils were formed in very stony, medium and fine textured glacial outwash from basalt and andesite. These soils have a depth to bedrock of 40 to 60 inches."* At the east end of the airport, the soils become a mix of "***sandy loams and fine sandy loams (Van Horn and Wind River series),*** *which were formed in alluvial deposits."* These alluvial deposits are likely associated with the proximity of the east end of the airport to Hood River, which is a major tributary of the Columbia River.

Climate

The climate for Hood River County varies greatly and is heavily influenced by terrain. Ken Jernstedt Airfield is located in northern Hood River County, which has less precipitation, less snowfall, and significantly warmer temperatures in the summer than the southern areas of the county. The climate of southern Hood River County is characterized by heavy precipitation, considerable winter snowfall and cool summer temperatures over higher elevations.

The Western Regional Climate Center maintains historic climate summaries for Hood River from 1893 to 2013.[4] Hood River's maximum average temperature is 81.1° Fahrenheit (F) in July; the average minimum temperature is 27.7° F in January. The average total precipitation is 30.6 inches and the average total snowfall is 36.0 inches annually.

[2] U.S. Geological Survey, Water-Resources Investigation Report 81-1108 for Wasco and Hood River Counties (1983)

[3] U.S. Department of Agriculture, Soil Conservation Service (1981)

[4] Hood River Experimental Station, Oregon (Station Number 354003)

Historical Aviation Activity

Ken Jernstedt Airfield accommodates a wide variety of aeronautical activity, including small single- and multi-engine piston aircraft, small business class turbine aircraft (business jets and turboprops) capable of operating on the existing 3,040-foot long runway, and helicopters. The airport's fixed base operator (FBO) provides maintenance, aircraft fueling, flight training, and other services, which generate local flight activity and attract itinerant users.

The Western Antique Aeroplane and Automobile Museum (WAAAM), located adjacent to the north side of the airport, was established after the last major airport planning project was adopted in 2004 and has become a major attraction that contributes to airport activity through its collection (based aircraft, aircraft operations) and its events and visitors. WAAAM representatives estimate that a total of 118 aircraft are currently active and have current FAA registrations. By FAA definition, these aircraft are included in the airport's based aircraft count.

The airport accommodates seasonal wildfire response support and staging activity with a variety or large and small helicopters, operated by, or contracted through the United States Forest Service (USFS) or the Bureau of Land Management (BLM). The frequency and duration of this activity varies by year and is determined by the tactical response requirements for each fire in the area. Airport management has responded to this facility need by utilizing existing taxiways or other areas of the airport to accommodate staging and emergency operations.

The airport accommodates regular aerial applicator activity with facilities located near the southwest corner of the airport. The airport has developed significant glider activity in recent years and the airport and vicinity is identified as a Glider Operations Area on the Seattle Sectional Aeronautical Chart.

AIRPORT ACTIVITY

The 2004 Airport Layout Plan report estimated that Ken Jernstedt Airfield had approximately 14,190 aircraft operations and 86 based aircraft in 2003 (a ratio of 165 operations per based aircraft). The 2007 Oregon Aviation Plan (OAP) forecast update estimated 14,324 annual aircraft operations and 86 based aircraft at Ken Jernstedt Airfield for 2005 (a ratio of 166 operations per based aircraft), based on FAA Terminal Area Forecast (TAF) system data. It appears that the FAA TAF data were updated to reflect the ALP report forecasts approved by FAA in 2004 and these numbers were used in the 2007 OAP without revision. A recent revision in the TAF reduced the based aircraft totals from 88 in 2011 to 37 in 2012, which clearly appears to be in error.

The FAA recommends use of activity ratios for non-towered general aviation airports to estimate annual operations, when actual operations data (counts) are not available. This technique was used in previous master plans and state aviation system planning to estimate activity at Ken Jernstedt Airfield. The current

FAA 5010-1 Airport Record Form lists 40 based aircraft and 14,210 annual operations for the 12 months ending 8/7/13.

An updated count of 208 based aircraft was prepared in October 2014 for the master plan update (see **Table 2-1**) by reviewing the FAA registered aircraft (by County) database, Port and tenant records. The significant increase (+122) in based aircraft is attributed primarily to the addition of active, FAA-registered aircraft included in the WAAAM collection noted above. It is recognized that these aircraft are active, but they do not generate activity levels comparable to general aviation aircraft in regular use. As a result, the active museum aircraft, while being included in the airport's based aircraft count, should not be assumed to generate a volume of activity comparable to the ratios previously defined.

A review of recent development indicates that no new aircraft storage hangars have been constructed on the airport since the previous ALP Report was completed in 2004. The number of aircraft observed parked on the north and south aircraft tiedown aprons is comparable to levels identified in the previous ALP Report. As a result, the *net* increase in non-WAAAM aircraft based at Ken Jernstedt Airfield over the last ten years was 4 aircraft.

A detailed analysis of aviation activity data will be presented in the updated Aviation Activity Forecasts (Chapter 3). Current airport activity is summarized in **Table 2-1**.

TABLE 2-1: KEN JERNSTEDT AIRFIELD (4S2) BASED AIRCRAFT AND OPERATIONS

ACTIVITY TYPE	ACTIVITY LEVEL
Based Aircraft *(Fall 2014 Airport Count)*	
Single-Engine Piston	190
Multi-Engine Piston	2
Turboprop	0
Turbojet	0
Rotorcraft	2
Glider	14
Total Based Aircraft	**208**
Annual Aircraft Operations	
➢ 2005 Estimate (2007 OAP)	14,324
➢ 2013 Estimate (FAA 5010 Airport Record Form, dated 8/7/13)	14,210

Airfield Facilities

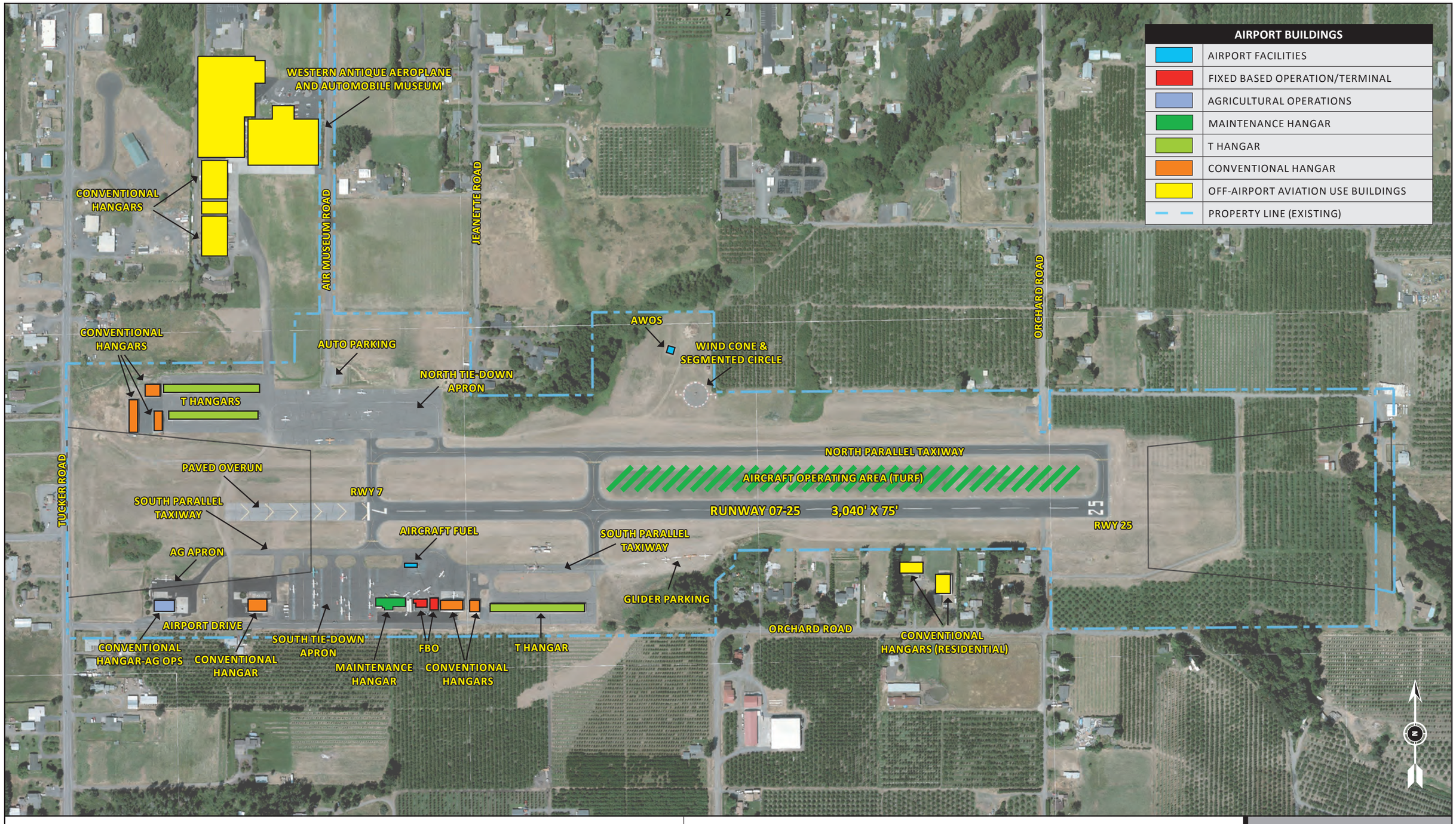
Airfield facilities are broken into two categories: airside and landside. Airside facilities include the runways, taxiways, airfield lighting, and navigational aids that provide for the safe and efficient movement of aircraft. Landside facilities include aircraft storage (hangars, apron) and fixed base operator (FBO) services (aircraft maintenance, fueling, passenger services, etc.) and support facilities. **Table 2-2** summarizes current airport data and **Figure 2-2** depicts existing airfield facilities.

Ken Jernstedt Airfield has one runway (7/25) that is oriented in an east/west direction. Runway 7/25 is lighted and accommodates day and night operations in visual flight rules (VFR) conditions. The runway is configured with parallel taxiways on both sides serving adjacent landside areas.

The published airfield elevation is 638 feet above mean sea level (MSL). The airport traffic pattern altitude is 869 feet above ground level (1,507 feet MSL). The airport utilizes a standard left traffic pattern, except for gliders and ultralights who use a right traffic pattern. Ken Jernstedt Airfield is a non-towered airport and pilots use the airport Unicom/Common Traffic Advisory Frequency (CTAF) for communications on the ground and in the vicinity of the airport.

TABLE 2-2: AIRPORT DATA

AIRPORT NAME/DESIGNATION	KEN JERNSTEDT AIRFIELD (4S2)
Airport Owner	Port of Hood River, Oregon
Date Established	1946
Airport Category	**National Plan of Integrated Airport Systems (NPIAS):** General Aviation **FAA Airport Reference Code:** B-II (as depicted on current FAA-approved Airport Layout Plan) **Oregon Aviation System Plan Category:** Category IV – Local General Aviation Airport
Airport Acreage	Approximately 120 Acres as indicated on current FAA Airport Master Record Form 5010-1
Airport Reference Point (ARP) Coordinates	N 45° 40.36' W 121° 32.19'
Airport Elevation	638 feet MSL
Airport Traffic Pattern Configuration/Altitude	Left Traffic (RWY 7/25) for conventional aircraft Right Traffic (RWY 7/25) for gliders and ultralights Pattern Altitudes: 869 feet AGL / 1,507 feet MSL



KEN JERNSTEDT AIRFIELD- HOOD RIVER | AIRPORT MASTER PLAN

EXISTING CONDITIONS | **FIG. 2-2**

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Site Configuration

Ken Jernstedt Airfield consists of approximately 120 acres configured in an east-west rectangular shape that follows the runway-taxiway system. The airport has landside development areas (aircraft hangars and parking aprons) located on the north and south sides of the runway, although all services (FBO, aircraft fueling, maintenance, etc.) are currently located in the south landside area. The airport has limited undeveloped areas capable of accommodating additional landside facilities, although the current FAA-approved Airport Layout Plan (ALP) depicts future property acquisition on the north side of the airport (northwest section) that is intended to accommodate future hangar development. Adjacent off-airport development with "through-the-fence" access to the airport include two residential hangars located near the southeast corner of the airport and the WAAAM development located near the northwest corner of the airport.

A 2013 project shifted Runway 7/25 approximately 580 feet to the east, while maintaining its existing length and width dimensions. The project added 580 feet of runway at the east end and eliminated 580 feet of useable runway at the west end. The project also included a new (relocated) north parallel taxiway and several new/reconfigured exit taxiways. All of the runway-taxiway elements in the project were designed to meet Airplane Design Group II (ADG II) standards. The runway shift required vacating a section of Orchard Road that was located beyond the previous east end of the runway. The primary objective of the runway shift was to bring the runway protection zone (RPZ) for Runway 7 entirely within airport property (east of Tucker Road) and to mitigate an existing Runway 25 approach surface penetration (vehicles on Orchard Road).

Another recent improvement at the airport is the addition of a turf landing area, located adjacent to the runway on its north side—between the runway and the north parallel taxiway.

Runways

RUNWAY 7/25

Runway 7/25 is 3,040 feet long and 75 feet wide. The runway is paved (asphalt) and lighted with basic (visual) runway markings. The runway is in excellent condition, having been constructed new (east section) or rehabilitated (original runway section) in 2013 during the runway shift project. The runway has an effective gradient of 1.13 percent, with the high point (631.1 feet MSL) located at the west end (Runway 7 threshold). The west end of the runway has a 580-foot paved overrun (75 feet wide - marked with yellow chevrons) that is not part of the useable runway. This pavement was not rehabilitated when the runway was shifted.

Runway 7/25 has painted (white) visual markings including runway designation numbers and centerline stripe. Taxiway lead-in lines (yellow) are painted on the runway (both directions) for exits A2 and B2. All runway markings are consistent with FAA standards for configuration, color, and approach type. The markings were observed to be in excellent condition during a recent site visit.

The runway is equipped with threshold and edge lighting and runway end identifier lights (REIL) on Runway 7 and 25. The runway is not equipped with visual guidance indicators (VGI) such as precision approach path indicators (PAPI) or visual approach slope indicators (VASI).

The runway is served by a full-length parallel taxiway (Taxiway A) on its north side with three exit taxiways (A1, A2, A3) and a partial-length parallel taxiway (Taxiway B) on its south side with two exit taxiways (B1, B2).

ALTERNATE GRASS LANDING AREA

The airfield has a designated alternate grass landing area located between the runway and the north parallel taxiway (Taxiway A). The area is available for aircraft operations but is not to be used simultaneously with the paved runway. The irrigated grass area is approximately 2,000 feet long and 100 feet wide, located between the east and middle exit taxiways (A2 and A3). The FAA Airport/Facility Directory (A/FD) includes the following description in the Airport Remarks section of the listing for Ken Jernstedt Airfield:

"Rwy 7-25 alternate grass landing area available in median. Not to be used simultaneously with paved runway."

Table 2-3 summarizes existing runway facilities at Ken Jernstedt Airfield.

TABLE 2-3: RUNWAY DATA

RUNWAY 7/25	
Dimensions	3,040 x 75 feet (580' paved overrun beyond Rwy 7 end)
Bearing	N 89.47°E (True)
Effective Gradient	1.113%
Surface/Condition	Asphalt/Excellent (overlay and new construction in 2013)
Markings	Visual/Basic: Runway Designation Numbers and Centerline Stripe (White) Taxiway Lead-in Lines (Yellow) at Exit Taxiways A2 and B2 Chevrons (Yellow) on Paved Overrun
Lighting	Medium Intensity Runway Lights (MIRL), Threshold Lights Blue Edge Lights at runway exit taxiways Runway End Identifier Lights (REIL) – Rwy 7 & 25
Signage	Runway /Taxiway Hold Position (internally illuminated) at all exit taxiways
ALTERNATE GRASS LANDING AREA ***(PARALLEL TO RWY 7/25)***	
Dimensions	2,000 x 100 feet (approximate)
Surface/Condition	Grass-Turf/Good (irrigated during summer months)
Lighting/Marking	None

Airfield Pavement Strength

The runway, taxiways, taxilanes and apron pavements are designed to accommodate a variety of general aviation aircraft. Tiedown aprons and hangar taxilanes have pavement strengths consistent with use by small aircraft. The published weight bearing capacity (WBC) for Runway 7/25 is 23,000 pounds for aircraft equipped with single wheel landing gear.[5] However, based on the section design for the recent runway project, it appears that the runway WBC is approximately 12,500 pounds. Published data should be updated.

Runway Wind Coverage

It is generally preferable for aircraft to land and takeoff directly into the wind, although varying wind conditions often require crosswind operations at airports. When wind conditions exceed the capabilities of a specific aircraft, use of a crosswind runway (when available) may occur. At airports with one runway alignment, occasional periods of strong crosswinds may limit operations until conditions improve.

[5] FAA Chart Supplement – Airport Facility Directory (EFD Feb 1, 2018-Mar 29, 2018)

The FAA-recommended planning standard is that primary runways should be capable of accommodating at least 95 percent of wind conditions within the prescribed crosswind component. This component is based on a direct crosswind (90 degrees to the direction of flight) of 10.5 knots (12 miles per hour) for small aircraft and 13 knots (15 miles per hour) for larger general aviation aircraft. Larger aircraft are typically designed to accommodate higher crosswind components. Aircraft are able to tolerate increasingly higher wind speeds as the crosswind angle is reduced and moves closer to the direction of flight.

A review of wind data collected on site (118,746 observations from 2006-2013) by Automated Weather Observation System (AWOS) indicates that more than 99 percent of local wind conditions are accommodated at both the 10.5 knot (99.9%) and 13 knot (99.98%) crosswind component on Runway 7/25. This level of wind coverage meets FAA requirements for small and large general aviation runways. Local pilots indicate that the prevailing winds generally follow an easterly-westerly direction, with seasonal shifts.

Taxiways

Ken Jernstedt Airfield has an extensive taxiway system that provides access to the entire runway, the alternate grass landing area, and adjacent landside facilities. As noted earlier, several significant changes to taxiways were included in the 2013 runway shift project including shifting the north parallel taxiway outward to meet ADG II standards, relocating or replacing all existing exit taxiways and adding a new south exit taxiway east of the south landside area. A system of taxilanes provides access to aircraft parking and hangar development areas on both sides of the runway (see Apron section). **Table 2-4** summarizes existing taxiway facilities.

TAXIWAY A

Taxiway A is the north parallel taxiway for Runway 7/25. Taxiway A is 35 feet wide, has a runway separation of 240 feet centerline to centerline, and has three exit taxiway connections (A1, A2, A3) to the runway. Taxiway A and the three north-side exit taxiways are in excellent condition. The number and location of the north exit taxiways provides efficient aircraft movement and accommodates the alternate grass landing area located along the eastern two-thirds of the runway. Taxiway A is equipped with stake mounted blue edge reflectors, except for the inboard section located between Taxiways A2 and A3 to facilitate aircraft movement between the parallel taxiway and the grass landing area. Taxiway A is marked with a yellow centerline stripe along the main section of the taxiway with connections to each exit taxiway and adjacent apron taxilanes.

TAXIWAY B

Taxiway B is a partial-length south parallel taxiway for Runway 7/25. Taxiway B has two sections:

- The western section (925 x 25') extends from the west end of the paved overrun (former runway) to near the eastern end of the main apron. Taxiway B1, located at the relocated Runway 7 threshold, connects to Taxiway B. This section of Taxiway B has a runway-to-taxiway separation of 165 feet and was designed to meet ADG I standards. A project to relocate the taxiway to meet the ADG II runway separation standard (240 feet) is identified on the current FAA-approved airport layout plan (ALP). The taxiway relocation will require changes to the south apron configuration and the location of the aircraft fuel storage tank.
- The eastern section (564 x 35') extends from the northeast corner of the main apron and terminates at Taxiway B2. This section of taxiway is used to access the runway and the south T-hangar. This section of Taxiway B has a runway-to-taxiway separation of 240 feet.

Portions of Taxiway B are marked with a yellow centerline stripe (worn) with connections to both exit taxiways (B1 and B2) and adjacent apron taxilanes. The pavement condition on Taxiway B ranges from "serious" to "satisfactory" and will be replaced (new construction) or rehabilitated in a future project.

TAXIWAYS A1-A3, B1- B2 (RUNWAY 7/25 EXITS)

Runway 7/25 has five 90-degree exit taxiways (A1-A3, B1 and B2) that connect the runway to the north and south parallel taxiways (Taxiways A and B) that are in excellent condition. The exit taxiways are 35 feet wide. The exit taxiways are marked with yellow centerline stripes and runway hold position markings at each runway-taxiway intersection.

The aircraft hold position markings on Taxiways A1-A3 and B2 are located 200 feet from runway centerline. The aircraft hold position markings on Taxiway B1 are located 125 feet from runway centerline.

TABLE 2-4: TAXIWAY DATA

TAXIWAY	DIMENSIONS/CONFIGURATION
North Parallel Taxiway (Alpha)	
Dimensions	3,040 x 35 feet with three 90-degree exit taxiways (A1, A2, A3)
Surface/Condition	Asphalt/Excellent (new construction in 2013)
Marking	Centerline stripe (good condition); Hold lines 200 feet from RWY centerline on Taxiways A1-A3 (good condition)
Lighting/Reflectors	Reflectors (except inboard section between A2 and A3)
Runway-Parallel Taxiway Separation	240 feet
South Parallel Taxiway (Bravo) ***West Section***	
Dimensions	925 x 25 feet with one 90-degree exit taxiway (B1)
Surface/Condition	Asphalt/Serious, Fair (extensive cracking)
Marking	Centerline stripe (poor condition); Hold line 125 feet from RWY centerline on Taxiway B1 (good condition)
Lighting/Reflectors	None
Runway-Parallel Taxiway Separation	165 feet
South Parallel Taxiway (Bravo) ***East Section***	
Dimensions	560 x 35 feet extending from the NE corner of the main apron to Taxiway B2 and the south T-hangar taxilanes. One 90-degree exit taxiway (B2).
Surface	Asphalt/Satisfactory, Fair Taxiway B2 was new construction in 2013 (Excellent condition)
Marking	Centerline stripe (poor condition); Hold line 200 feet from RWY centerline on Taxiway B2 (good condition)
Lighting/Reflectors	None
Runway-Parallel Taxiway Separation	240 feet
North Hangar Taxiway (off airport)	
Dimensions	Approximately 470 x 25 feet (width varies), extending from NW corner of north apron to WAAAM
Surface/Condition	Asphalt/ Fair condition (not rated in PCI report)
Marking/Lighting/Reflectors	None
Southwest AG Area Taxiway	
Dimensions	185 x 20 feet
Surface	Asphalt/Fair (Rated Very Poor in 2011; Sealcoated in 2012)
Marking/Lighting/Reflectors	None

TAXILANES

The north and south aircraft aprons are configured with taxilanes to access tiedowns, aircraft fueling, the fixed base operator (FBO) building, and conventional hangars. The south T-hangar is served by two taxilanes that connect to the east section of Taxiway B. The north hangar area has three taxilanes that provide access to two T-hangars and three conventional hangars. The aerial applicator operations area located near the southwest corner of the airport is accessed by a single taxilane that connects to the west end of Taxiway B. It is noted that several existing taxilanes have limited wingtip clearances (from centerline) to adjacent objects (parked aircraft, hangars, etc.).

Aircraft Apron

Ken Jernstedt Airfield has several apron areas that support a variety of uses including aircraft parking, fueling, FBO operations, aerial applicator operations and frontage for aircraft hangars. These include a terminal apron, two aircraft tiedown aprons and several smaller aprons associated with individual hangars. **Table 2-5** summarizes the existing apron facilities at the airport.

Aircraft tiedown aprons are located on the north and south sides of Runway 7/25 with a total of 74 tiedown positions with permanent anchors. Additional aircraft parking is provided on individual aprons located on the south side of the runway and in unimproved areas between aprons and east of the terminal area (gliders, tow aircraft).

The apron located near the southwest corner of the airport was developed to accommodate aerial applicator operations. The apron and adjacent hangar currently support aerial applicator operations and are used for glider and tow aircraft storage.

TABLE 2-5: AIRCRAFT APRON AREAS

North Tiedown Apron	Approximately 700 x 220‘ except for 315 x 20 foot (≈ 700 SY) section at SE corner removed for Taxiway A and two apron connecting taxilanes (16,211 square yards) 41 Light aircraft tiedowns Asphalt Concrete (AC)
South Tiedown Apron	Approximately 365 x 210’ (8,517 square yards) 28 Light aircraft tiedowns Asphalt Concrete (AC)
FBO/Terminal Apron	Approximately 370 x 120‘; fueling area 55’ x 135’ (5,760 square yards) 5 Light aircraft tiedowns Temporary aircraft parking, aircraft fueling Asphalt Concrete (AC)
Hangar Apron (SW Section of Airport)	Approximately 200 x 80’ (1,778 square yards) Hangar Frontage Asphalt Concrete w/ Portland Concrete Cement (PCC) sections
Hangar Apron (NW section of airport)	Approximately 135 x 60’ (900 square yards) Hangar Frontage Asphalt Concrete (AC)
Hangar Apron (SE section of airport)	Approximately 90 x 40’ (400 square yards) Hangar Frontage Asphalt Concrete (AC) w/ Portland Concrete Cement (PCC) Section 12 x12’
AG Aircraft Apron	Approximately 200 x 80’ (1,778 square yards) Asphalt Concrete 2 Hard Surfaced Loading Pads (approximately 30 x 50’) Portland Cement Concrete (PCC)

SOUTH TIEDOWN APRON

The south apron has 28 small airplane tiedowns configured in four north-south rows (with east/west facing positions) served by three stub taxilanes that connect to the south parallel taxiway (Bravo). The middle two tiedown rows are double-sided and the outer rows are single-sided facing inward toward the apron. One additional east-facing tiedown is located in the eastern row, adjacent to the maintenance hangar.

FBO/TERMINAL APRON

The apron located in front of the FBO building has 5 tiedown positions configured in a semi-circle facing northwest. The east end of the apron provides access to the FBO building and maintenance hangar and accommodates aircraft loading/unloading and fueling. The aboveground aircraft fuel storage tank and dispensing facilities are located near the outer edge of the apron, adjacent to Taxiway B.

NORTH TIEDOWN APRON

The north apron has 41 small airplane tiedowns configured in three rows of north/south facing aircraft parking positions accessed by two east-west taxilanes that extend through the entire apron. The outer two rows of tiedowns are configured with single tail-in positions and the inner double row has tail-to-tail parking positions. The apron has two taxilane connections to the north parallel taxiway (Alpha). An outer section of apron located at the east end containing six tiedowns was eliminated in the 2013 to accommodate the shifted north parallel taxiway and two relocated access taxilanes.

The west end of the apron abuts the north hangar area, which accommodates two 12-unit T-hangars, two medium size conventional hangars, and one 3-unit hangar. Aircraft access the north hangar area is provided by the north apron taxilane connections to the runway-taxiway system. A taxiway serving several off-airport hangars, including the Western Antique Aeroplane and Automobile Museum (WAAAM) extends from the northeast corner of the north hangar apron.

Airport Lighting and Signage

The airfield lighting at Ken Jernstedt Airfield accommodates day and night operations in visual meteorological conditions. Airfield lighting includes runway lights, illuminated wind cones, runway guidance signs and the airport beacon. The runway is not currently equipped with visual guidance indicators (VGI), although precision approach path indicators (PAPI) were recommended for both runway ends in the previous master plan. The lighting systems at Ken Jernstedt Airfield are Port-owned and maintained.

AIRPORT LIGHTING

The airport has a rotating beacon mounted on the roof of the large Quonset hangar adjacent to the south apron. Rotating beacons are used to indicate the location of an airport to pilots at night or during reduced visibility. The beacon provides sequenced white and green flashing lights (representing a lighted land airport) that rotate 360 degrees to allow pilots to identify the airport from all directions from several miles.

Two lighted wind cones are located on the airfield; one wind cone north of the runway and parallel taxiway, located within the segmented circle. The second wind cone is located at the southeast corner of the airfield. The southeast wind cone was installed during the 2013 runway shift project and is in excellent condition. The north wind cone is in good condition.

The rotating beacon and lighted wind cones operate on photocell switches, which sense low light intensity to activate the equipment during periods of darkness and/or low visibility.

RUNWAY LIGHTING

Runway 7/25 is equipped with medium intensity runway edge lighting (MIRL) and runway end identifier lights (REIL). The MIRL and REIL systems were installed new during the 2013 runway shift project and are in excellent condition.

- MIRL: The MIRL system includes white edge lights and runway thresholds lights. Blue light fixtures mark the location of each exit taxiway on the runway within the MIRL system. The threshold lights consist of two sets of three fixtures near each corner of the runway ends. The fixtures have split lenses (green/red) indicating the beginning and end of the runway. The MIRL system operates on a photocell, with pilot controlled capabilities using common traffic advisory frequency (CTAF) which can increase or decrease the lighting intensity.
- REIL: Runway 7 and 25 are equipped with REILs, which consist of two high-intensity sequenced strobe lights that mark the approach end of the runway to assist pilots in establishing visual contact with the runway environment during periods of darkness or reduced visibility. The REILs are pilot-controlled through the common traffic advisory frequency (CTAF) when the runway edge lights are set to medium intensity.

TAXIWAY LIGHTING

The taxiways on the airport are not equipped with edge lighting. The taxiway exits located on the runway are marked with blue light fixtures (within the MIRL system). Taxiway A (north parallel taxiway) is equipped with blue, stake-mounted edge reflectors, except for the inboard section located between Taxiway A2 and A3, directly adjacent to the grass landing area.

AIRFIELD SIGNAGE

Aircraft hold position signs are located at each of the five exit taxiways serving Runway 7/25. The internally illuminated signs have white numbers and letters on a red background and provide runway information.

OTHER LIGHTING

Overhead lighting is available at the fuel island and on many of the hangars around the airport.

Agricultural Aircraft Facilities

Ken Jernstedt Airfield has one designated agricultural (AG) aircraft loading area located at the southwest corner of the airport. The AG area includes an asphalt apron with one concrete loading pad and a conventional hangar with equipment storage. Aircraft access to the apron and hangar is provided by a paved access taxiway that extends from the west end of Taxiway B to the apron. There are no locally-based aerial applicators currently based on the airport.

Airfield Pavement Condition

The Oregon Department of Aviation (ODA) manages a program of pavement evaluations and maintenance for Oregon's general aviation airports. This evaluation provides standardized pavement condition index (PCI) ratings, pavement features and current conditions. Pavement Management Reports are periodically updated to assist airports in planning ongoing maintenance of airfield pavements. The MicroPAVER software is designed to assess the relative condition of the airport pavement sections and to identify pavement system needs, make programming decisions for funding, provide information for legislative decision-making, and assist local jurisdictions with planning decisions.

The PCI inspection quantifies the types, severities, and amounts of distress observed in the pavements through a visual inspection. The PCI ratings reflect the type and age of pavement and observed surface conditions (weathering, cracking, other distress). The evaluation is measured using a scale from 0 (failed) to 100 (excellent) with ratings applied to individual pavement sections to provide an overall condition report for the airport. The condition is an indication of the needs for maintenance and/or repair that will be required over a seven-year period.

The condition of the airfield pavements observed during site visits performed for the master plan update are generally consistent with the most recent pavement evaluations by ODA. **Table 2-6** summarizes PCI ratings at Ken Jernstedt Airfield based on inspections conducted in 2014 and 2011.

TABLE 2-6: SUMMARY OF AIRFIELD PAVEMENT CONDITION

PAVEMENT	SECTION DESIGN/AGE	2014 PCI RATING[1]	2011 PCI RATING[1]
Runway 7/25	2" AC replacing original 2"AC (ground and removed) in 2013; east 580 feet new construction; west 580 feet closed and converted to paved overrun. Original Section: 2" AC (1986); 13" Crushed Aggregate (6" at west and east ends; 9" near east end) (1986) New Section (eastern 580 feet): 2.5" AC; 6" Crushed Aggregate Base; 7" Aggregate Subbase (2013)	100	57-59 Not Rated
Taxiway A (North Parallel)	New Construction (2013) 2.5" AC; 6" Crushed Aggregate Base; 7" Aggregate Subbase Original Section removed in 2013 2" AC; 6" Crushed Aggregate (1986)	100 57	Not Rated 57
Taxiway B (South Parallel, West Section)	Western 200' Unknown AC & Base (circa 1970) Eastern 725 ' 2" AC; 9" Crushed Aggregate (1986)	10 61	61
Taxiway B (South Parallel, East Section)	2" AC; 7" Crushed Aggregate (1986)	70	76
North Tiedown Apron	Main Section: 2" AC; 6" Crushed Aggregate (1986) Center Section: Unknown AC and Base	69 65	70 72
South Tiedown/FBO Apron	2" AC; 6" Crushed Aggregate (1986)	60/23	46
AG Apron (SW Airport)	Section data not available (AC) Section data not available (PCC)	87	27 100
Hangar Apron (Southwest) *(between tiedown apron and AG apron)*	Unknown AC and Base (circa 1970)	86	37
North Hangar Apron	Section data not available	39/44	70
North Hangar Taxilanes	2" AC; 6" Crushed Aggregate (circa 1980)	44	72
South T-Hangar Taxilane	2" AC; 7" Crushed Aggregate (1995)	62	61
Terminal Apron (East Section)	AC; Unknown Base (circa 1983). Concrete Sections: PCC, Unknown Subbase (circa 1983)	4	14-15
Hangar Apron (Southeast) *(between Quonset and South T-hangar)*	Section data not available (AC circa 1999) Section data not available (PCC circa 1999)	41	57 73

1. The Pavement Condition Index (PCI) scale ranges from 0 to 100, with seven general condition categories ranging from "failed" to "excellent." For additional details, see 2014 Oregon Pavement Evaluation/Maintenance Management Program.

Landside Facilities

HANGARS AND AIRPORT BUILDINGS

Ken Jernstedt Airfield accommodates a variety of aviation-related buildings including aircraft storage hangars (conventional and T-hangars), commercial hangars, mixed-use hangars, fixed base operator (FBO) office and a doublewide mobile home leased by the FBO. All commercial activities and a portion of aircraft storage (apron and hangars) are located in the south landside area of the airport. The north landside area currently accommodates non-commercial aircraft storage. Several aviation-use hangars are located off airport property and access the airfield "through-the-fence." **Table 2-7** summarizes existing aviation use buildings located on and adjacent to the airport.

No new aircraft hangars have been constructed on the airport since the last master plan was completed in 2004, although several off-airport hangars have been constructed during this period.

TABLE 2-7: AVIATION USE BUILDINGS AT KEN JERNSTEDT AIRFIELD (DEPICTED ON FIG. 2-2)

	BUILDING	ON/OFF AIRPORT PROPERTY	USE
1.	Conventional Hangar, AG Hangar (south)	On	AG Operations and Aircraft Storage
2.	Conventional Hangar, Hangar 1 (south)	On	Aircraft Storage
3.	Aircraft Maintenance Hangar (south)	On	Commercial Aircraft Maintenance
4.	Large Quonset Hangar, Hangar 2 (south)	On	Aircraft Storage
5.	Conventional Hangar, Heli-Hangar (south)	On	Commercial Operation
6.	Modular Building (south)	On	FBO/Caretaker Residence
7.	Building-Fixed Based Operator (south)	On	Office, Restrooms, Pilot and Passenger Waiting Area
8.	T-Hangar A, 12-unit (north)	On	Aircraft Storage
9.	T-Hangar B, 12-unit (north)	On	Aircraft Storage
10.	T-Hangar C, 12-unit (south)	On	Aircraft Storage
11.	Large Conventional Hangar 3-unit (north)	On	Aircraft Storage
12.	Medium Conventional Hangar (north)	On	Aircraft Storage
13.	Medium Conventional Hangar (north)	On	Aircraft Storage
14.	Large Conventional Hangar (north)	Off	Aircraft & Automobile Museum
15.	Large Conventional Hangar (north)	Off	Aircraft & Automobile Museum
16.	Large Conventional Hangar (north)	Off	Aircraft & Automobile Museum
17.	Large Conventional Hangar (north)	Off	Aircraft & Automobile Museum
18.	Large Conventional Hangar (north)	Off	Aircraft & Automobile Museum
19.	Small Conventional Hangar (Residence) south	Off	Aircraft Storage
20.	Small Conventional Hangar (Residence) south	Off	Aircraft Storage

OFF-AIRPORT FACILITIES & THROUGH-THE-FENCE AGREEMENTS (TTF)

There are several off-airport users with hangars located adjacent to Ken Jernstedt Airfield that access the airport "through-the-fence" on a regular basis.

- Two residential hangars are located adjacent to the southeast section of the airport. The Port established updated written Through-The-Fence Agreements (TTF) with these off-airport users in 2015.
- The Western Antique Aeroplane & Automobile Museum (WAAAM) multi-hangar complex is located adjacent to the north side of the airport. The current access agreement between the Port and WAAAM originated with a land sale/trade in 1996, in which the Port sold 3.48 acres of land located at the northwest corner of the airport and acquired 1.78 acres of right-of-way from Tucker Road to allow vehicle access to the north landside area of the airport.[6] The agreement included specific access rights to the airport for Mr. Brandt, who is the founder of WAAAM.

A review of current through-the-fence activity and current FAA policy is provided in more detail in the FAA conformance chapter (Chapter 10).

Airspace, Navigational Aids, and Instrument Procedures

Ken Jernstedt Airfield is a non-towered airport that operates under visual flight rules (VFR) conditions. There are no instrument procedures available for the airport and no ground-based navigational aids are located on or near the airport.

AIRSPACE CLASSIFICATIONS

The FAA classifies the airspace within the United States as being "controlled" or "uncontrolled" with altitudes extending from the surface upward to 60,000 feet above mean sea level (MSL). Controlled airspace classifications include Class A, B, C, D, and E. Class G airspace is uncontrolled.

Aircraft operating within controlled airspace are subject to varying levels of positive air traffic control that are unique to each airspace classification. Requirements to operate within controlled airspace vary, with the most stringent requirements associated with large commercial airports in high traffic areas. Uncontrolled airspace is typically found in remote areas or is limited to a 700 or 1,200-foot AGL layer above the surface and below controlled airspace. **Figure 2-3** illustrates and describes the characteristics of the airspace classifications defined by the FAA.

[6] Property ownership information depicted on Airport Exhibit "A" Property Plan.

LOCAL AREA AIRSPACE STRUCTURE

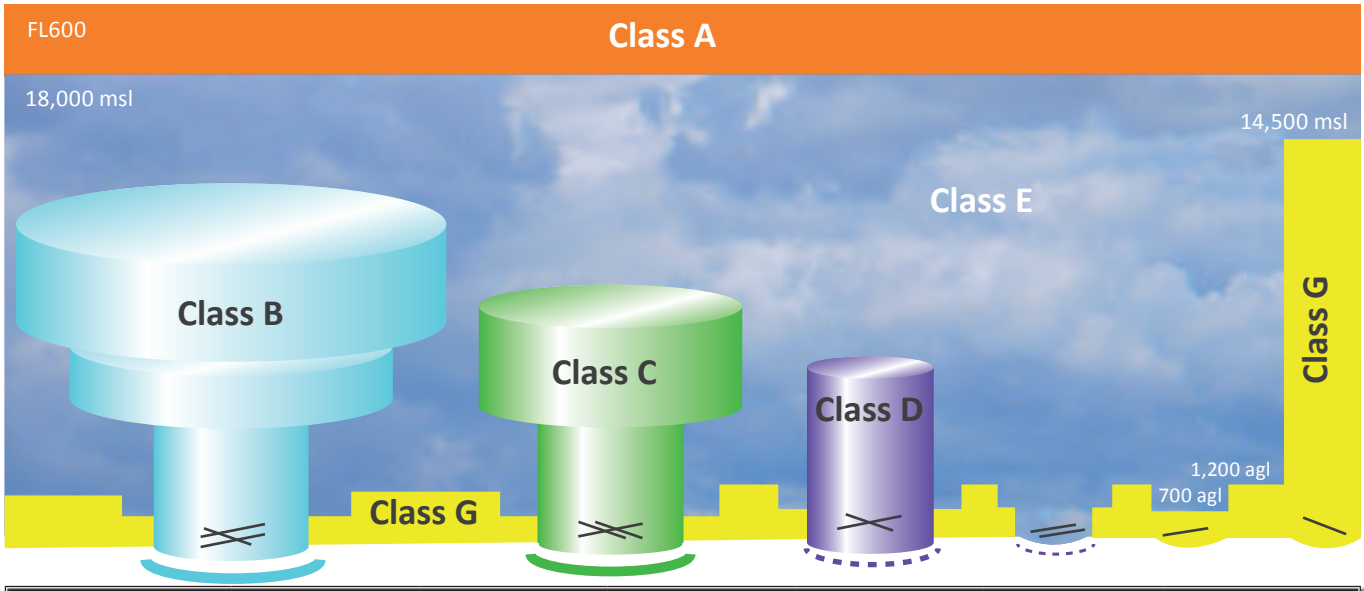
Figure 2-4 depicts nearby airports, notable obstructions, special airspace designations and instrument flight rules (IFR) routes in the vicinity of Ken Jernstedt Airfield, as identified on the Seattle Sectional Chart and IFR Enroute Low Altitude Chart (L-1/L-2, L-11/L-13).

Ken Jernstedt Airfield is located in Class G Airspace, which is uncontrolled, meaning there are no air traffic control (ATC) services provided. Class G Airspace has basic visibility and cloud clearance minimums for operations in visual flight rules (VFR).

The nearest area of Class E Airspace is associated with Columbia Gorge Regional Airport/The Dalles (DLS), located 16 miles east-southwest. The Class E Airspace begins 700 feet above ground level and extends in a 15 nautical mile radius around DLS, with the western edge located approximately 3 miles east of Ken Jernstedt Airfield. Class E Airspace does not require any special equipment such as two-way radio during visual flight rules (VFR) conditions. Pilots are encouraged to use the common traffic advisory frequency (CTAF) when operating at the airport.

Numerous towers, radio towers and electrical transmission lines located near Ken Jernstedt Airfield are depicted on the Seattle Sectional Aeronautical Chart. The towers range between 210 to 345 feet above ground level (AGL) east and west of Hood River. Major electrical transmission lines are located within one mile (north) of the airport with typical heights ranging up to 200 feet AGL.

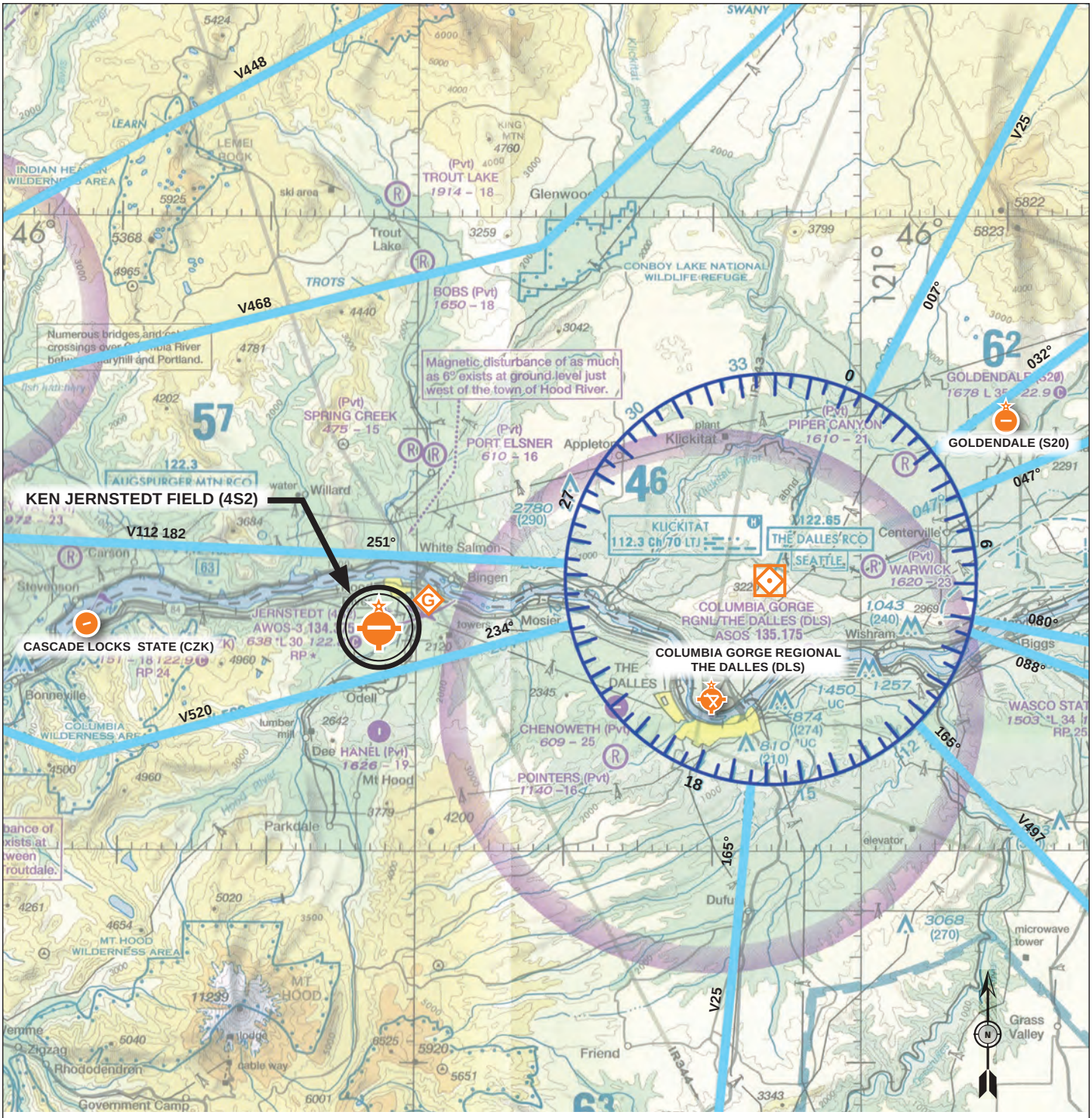
The local fixed-wing traffic pattern altitude at Ken Jernstedt Airfield is 869 feet AGL (1,507' MSL) with left traffic on Runway 7 and 25. Gliders and ultralights have a right traffic pattern to both Runway 7 and 25 with the same pattern altitude. Aircraft operating on the grass landing area utilize the appropriate traffic pattern for their aircraft type and are required to maintain separation from aircraft operating on the paved runway. **Figure 2-5** depicts current airport traffic patterns for Ken Jernstedt Airfield.



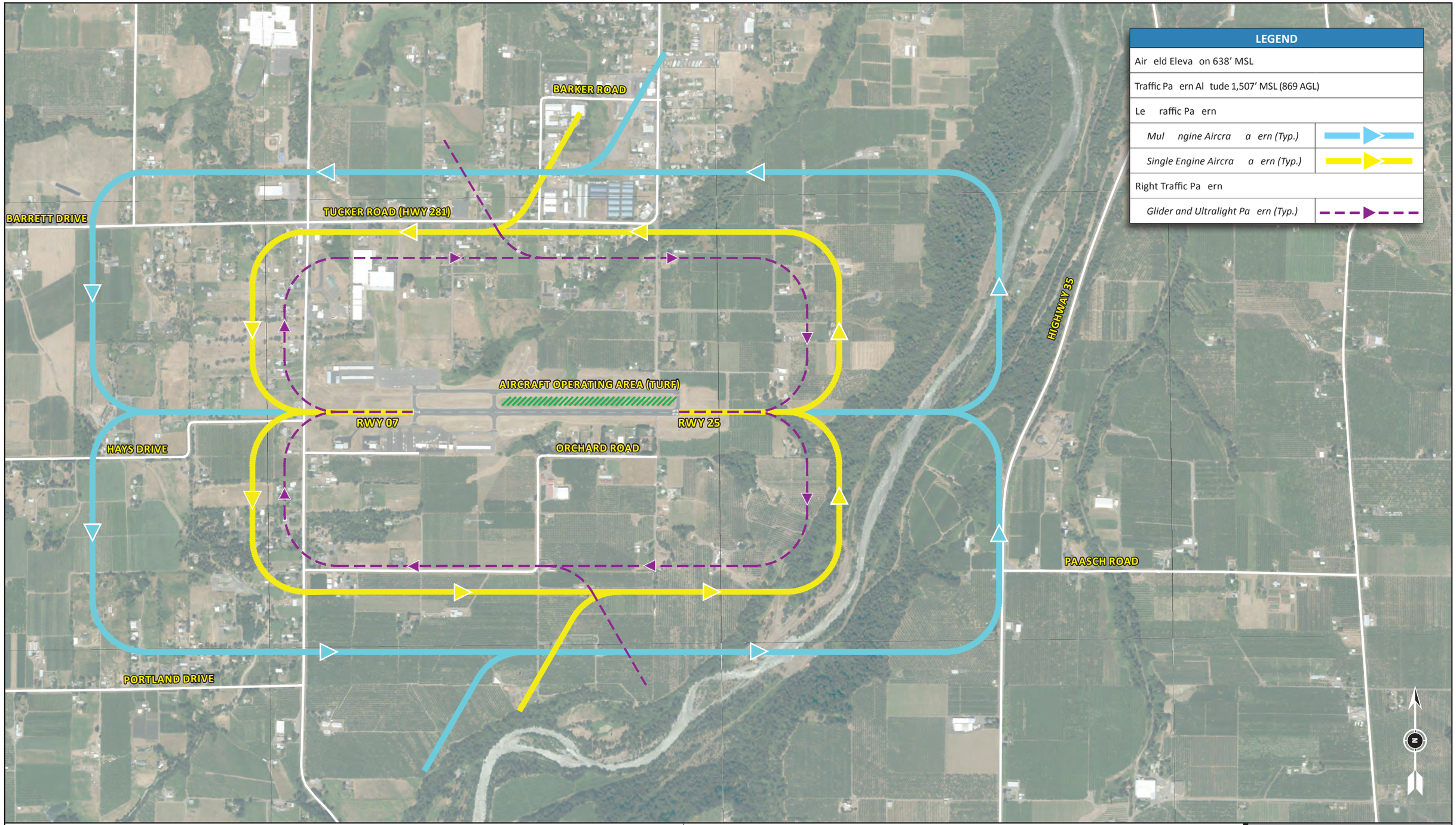
COMMUNICATION REQUIREMENTS AND WEATHER MINIMUMS

	Class A	Class B	Class C	Class D	Class E	Class G
Airspace Class De i	Generally airspace above 18,000 feet MSL up to and including FL 600.	Generally mul - layered airspace from the surface up to 10,000 feet MSL surrounding the na on's busiest airports	Generally airspace from the surface to 4,000 feet AGL surrounding towered airports with service by radar approach control	Generally airspace from the surface to 2,500 feet AGL surrounding towered airports	Generally controlled airspace that is not Class A, Class B, Class C, or Class D	Generally uncontrolled airspace that is not Class A, Class B, Class C, Class D, or Class E
Minimum Pilot Quali a ons	Instrument Ra ng	Student*	Student*	Student*	Student*	Student*
Entry Requirements	IFR: ATC Clearance VFR: Opera ons Prohibited	ATC Clearance	IFR: ATC Clearance VFR: Two-Way Communica on w/ ATC	IFR: ATC Clearance VFR: Two-Way Communica on w/ ATC	IFR: ATC Clearance VFR: None	None
VFR Visibility Below 10,000 msl**	N/A	3 Statute Miles	3 Statute Miles	3 Statute Miles	3 Statute Miles	Day: 1 Statute Mile Night: 3 Statute Miles
VFR Cloud Clearance Below 10,000 msl***	N/A	Clear of Clouds	500 Below 1,000 Above 2,000 Horizontal	500 Below 1,000 Above 2,000 Horizontal	500 Below 1,000 Above 2,000 Horizontal	500 Below 1,000 Above 2,000 Horizontal***
VFR Visibility 10,000 msl and Above**	N/A	3 Statute Miles	3 Statute Miles	3 Statute Miles	5 Statute Miles	5 Statute Miles
VFR Cloud Clearance 10,000 msl and Above	N/A	Clear of Clouds	500 Below 1,000 Above 2,000 Horizontal	500 Below 1,000 Above 2,000 Horizontal	1,000 Below 1,000 Above 1 Statute Mile Horizontal	1,000 Below 1,000 Above 1 Statute Mile Horizontal

*Prior to opera ng within Class B, C or D airspace (or Class E airspace with an opera ng control tower), student, sport, and recrea onal pilots must meet the applicable FAR Part 61 training and endorsement requirements. Solo student, sport, and recrea onal pilot opera ons are prohibited at those airports listed in FAR Part 91, appendix D, sec on 4.
**Student pilot opera ons require at least 3 statute miles visibility during the day and 5 statute miles visibility at night.
***Class G VFR cloud clearance at 1,200 agl and below (day); clear of clouds.



LEGEND			
	Airport with other than hard-surfaced runways		Public Use Airports with hard-surfaced runway
	Glider Opera		Victor Airways
	VOR-DME		Class E Air ve surface
	Compass Rose		Private Airports with Hard Surfaced Runway



KEN JERNSTEDT AIRFIELD- HOOD RIVER | AIRPORT MASTER PLAN

AIRPORT TRAFFIC PATTERN | **FIG. 2-5**

CENTURY WEST ENGINEERING

NAVIGATIONAL AIDS/WEATHER DATA

The Klickitat (LTJ) VOR-DME[7] is the nearest conventional ground based navigational aid, located approximately 18.5 nautical miles east-northeast of Ken Jernstedt Airfield. Nine enroute low altitude instrument airways (Victor Airways) extend outward from the Klickitat VOR-DME. The nearest airways are located north (V112-182) and south (V520) of Ken Jernstedt Airfield within three miles, but do not impact local airport operations. The minimum enroute altitude (MEA) for these airways is 7,000 feet MSL; V112-82 has a 6,400 foot MSL minimum obstruction clearance altitude (MOCA).

The advent of satellite based air navigation systems including the FAA's current "NextGen" technology, will eventually replace ground-based navigational aids as the primary air navigation system and is expected to allow more flexibility for enroute and terminal operations (within the limits of terrain).

Ken Jernstedt Airfield has an automated weather observation system (AWOS) that provides 24-hour weather information. The system is an AWOS-3, which provides altimeter setting, wind data, temperature, dew point, density altitude, visibility, precipitation and cloud/ceiling data. The AWOS-3 is located on the north side of the runway-taxiway system and is Port owned and maintained.

Table 2-8 summarizes existing navigational aids and related items.

TABLE 2-8: NAVIGATIONAL AIDS AND RELATED ITEMS

TYPE	FACILITIES
Electronic Navigational Aids	None on Field Nearest: Klickitat (LTJ) VOR-DME 18.5 nm ENE (112.3 MHz)
Weather Observation	AWOS-3 on Field (134.375 MHz) (541-386-2386) <u>Other Nearby Weather</u> ASOS - Columbia Gorge Regional/The Dalles (135.175 MHz) 16 nm SSE ASOS – Portland Troutdale (135.625 MHz) 35 nm WSW
Communication	Unicom/Common Traffic Advisory Frequency (CTAF 122.8 MHz)
Other	Portland (PDX) Approach (124.35 MHz) *Portland Area Class E Airspace begins approximately 24 nautical miles west of 4S2*

[7] Very high frequency Omnidirectional Range (VOR) with Distance Measuring Equipment (DME)

Airport Support Facilities/Services

AIRCRAFT FUEL

100-octane low lead (100LL) aviation gasoline (AVGAS) is available at the airport. The Port owns and maintains one 12,000-gallon double wall aboveground fuel storage tank with a credit card reader that allows 24-hour self-fueling. The fuel system is leased to the fixed base operator (FBO). The fueling facilities are located on the south apron, adjacent to Taxiway B and the FBO building. Jet fuel is not available at the airport.

FIXED BASE OPERATORS (FBO)

Ken Jernstedt Airfield has one fixed base operator (FBO), Classic Wings Aero Services established in 2009. Classic Wings Aero Services provides scenic air tours, flight training, aircraft rental, tiedown rentals and a range of services for general aviation customers, in addition to providing the Port with limited on-site airport management. The FBO is currently leasing the main building, a maintenance hangar, and the AVGAS fuel storage tank from the Port. The FBO maintains a trailer adjacent to the main apron that serves as a caretaker residence. The main office building is equipped with a pilot lounge, office, restrooms, telephone, snacks and pilot supplies for purchase. All FBO services are currently located on the south apron.

PUBLIC RESTROOMS

Public restrooms are located in the FBO building. Several portable chemical toilets are located adjacent to hangars on the airport.

FENCING

The airport has wire fencing along portions of its boundary, although the majority of the airport is not fenced. There are two automated vehicle gates adjacent to the north apron/hangar area and at the east end of the south landside area. Locked vehicle gates are located north and south of the runway where Orchard Road has been vacated.

Public Safety

Local fire services are provided by the Westside Fire Department with two stations located within 2 miles of the airport. The station at 1185 Tucker Road is staffed by full time firefighters Monday-Friday, 0800-1700 and is on call after hours and weekends. The other nearby fire station (4250 Barrett Drive) is staffed with approximately 70 volunteer Firefighters.

The Hood River County Sheriff's Department provides police service for the airport, which is located in unincorporated Hood River County.

Vehicle Access and Parking

Surface access to the airport is provided via Tucker Road (State Highway 281) with connections to Airport Drive (south side of airport), and Air Museum Road (north side of airport). Air Museum Road provides access to the north apron and north hangar area through an automated vehicle gate. A gravel surfaced vehicle parking area is located outside the gate.

Airport Drive provides access to the south landside area, which includes the south aprons, FBO facilities, and several hangars. An automated vehicle gate is located at the east end of Airport Drive, west of the south T-hangar and one conventional hangar. The majority of the south landside area is not fenced and vehicles access the airfield via several points along Airport Drive. A paved vehicle parking area is located adjacent to the FBO building and maintenance hangar. Additional vehicle parking is available adjacent to several conventional hangars in the south landside area.

It has been observed that vehicles routinely travel across the airfield (north-south) on an unimproved dirt track that extends around the paved overrun located beyond the west end of the runway. Although the track is located outside of the runway safety area, it is within the runway protection zone (RPZ). Vehicles typically cross the west end of the south parallel taxiway and apron and taxilanes when travelling north or south.

Utilities

The developed areas of Ken Jernstedt Airfield have water, natural gas, electrical, and telephone/internet service. **Figure 2-6** depicts the locations of the major utilities serving Ken Jernstedt Airfield.

WATER

The Ice Fountain Water District provides water service for the airport.

- South of runway: 4 hydrants along Airport Road and continuing along to Orchard Road to the east.
- North of runway: 1 hydrant on the northwest corner of the runway that connects to Airport Road; 2 hydrants along Air Museum Road; 2 hydrants along Jeanette Road; and 2 hydrants along Brandt Drive Way.
- The water service lines range from 6” to 12” diameter along Airport Drive, Air Museum Road, Brandt Drive Way, and Jeanette Road.

SANITARY SEWER

The City of Hood River provides sanitary sewer service for the airport. The airport and surrounding areas are located within a **Health Hazard Overlay (HHO)** zone, which provides the basis for extending sanitary service outside the Hood River urban growth boundary. Sewer lines currently extend along Tucker Road, Airport Road and Jeanette Road.

STORMWATER

The airfield utilizes a system of catch basins that capture and divert stormwater to swales and collection areas on the north side of the airfield.

POWER

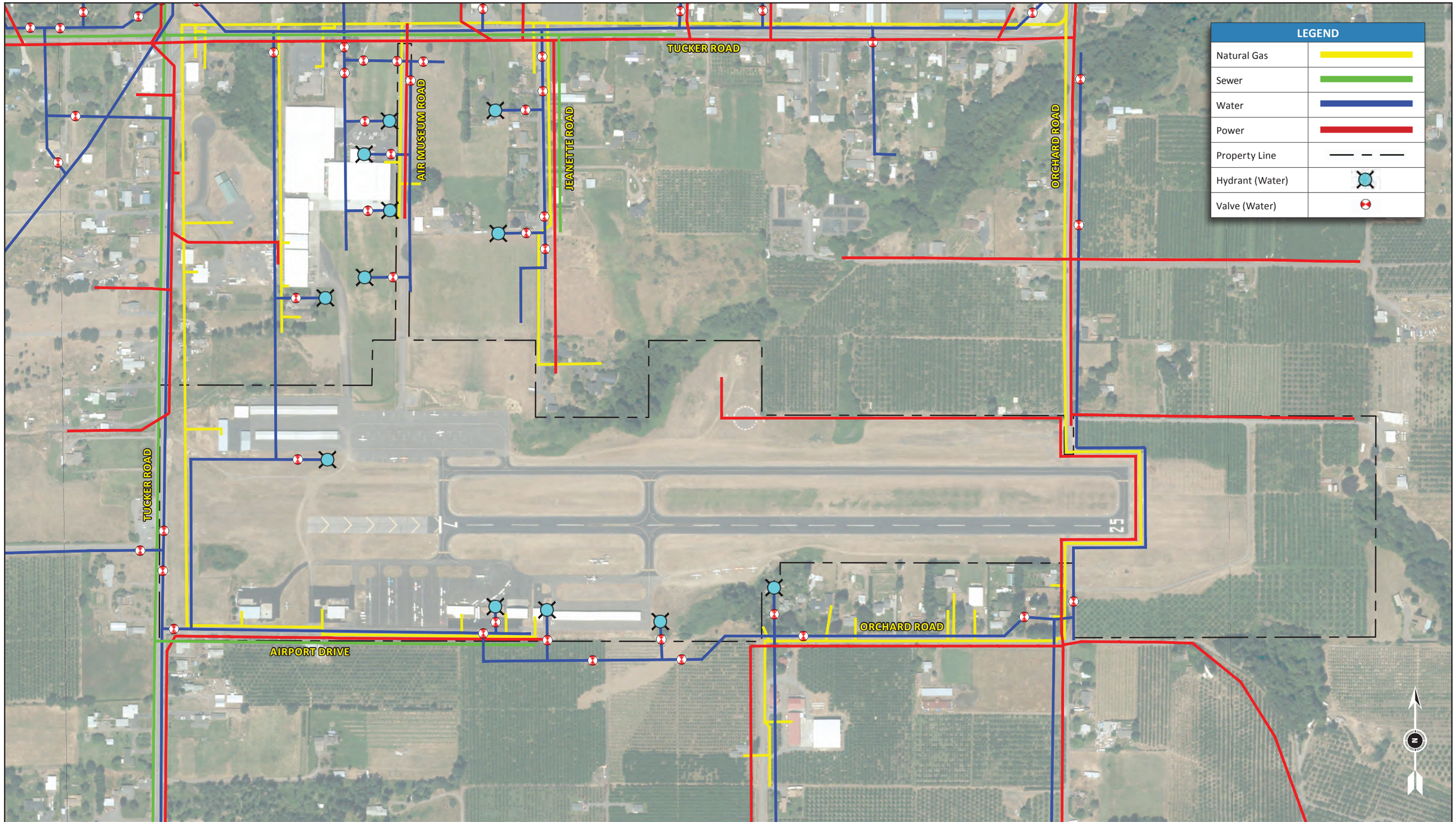
Pacific Power provides electrical service for the airport. Overhead electrical lines extend along Tucker Road, Airport Road, Jeanette Road and Orchard Road. Electrical service lines located west of the runway along Tucker Road are underground; other service lines are above-ground.

GAS

Northwest Natural Gas provides natural gas service for the airport. Current service lines are located along Airport Road, Tucker Road, Air Museum Drive, Orchard Road and Jeanette Road. Several existing airport tenants are connected to natural gas service.

TELEPHONE/INTERNET

CenturyLink provides telephone and internet service for the airport. Other companies including Gorge Networks also provide these services for the airport. A courtesy telephone is located at the FBO on the south apron.



KEN JERNSTEDT AIRFIELD- HOOD RIVER | AIRPORT MASTER PLAN

AIRPORT UTILITIES | **FIG. 2-6**

CENTURY WEST ENGINEERING

Zoning

The majority of Ken Jernstedt Airfield is zoned **Airport Development (AD)** by Hood River County. The eastern end of the airport (approximately 30 acres) is zoned **Exclusive Farm Use (EFU)**. Hood River County approved a revision to their zoning ordinance in 2009, which allowed airport-related uses on the EFU-zoned land as part of the Orchard Road vacation and runway shift.

Uses allowed outright within the AD zone include those specific to functioning airports. **Light Industrial (M-2)** and **Industrial (M-1)** zone uses are permitted within the AD zone with an approved Conditional Use Permit. Examples of uses permitted in M-1 and M-2 zones consist of manufacturing, repairing, compounding, processing, packing or storage, and wholesale distributing facilities. See Chapter Nine for additional detail related to airport land use.

SURROUNDING DESIGNATIONS

County zoning designations north and south of the airport consist primarily of E**xclusive Farm Use (EFU)** and **Rural Residential (RR-1)**. Zones east of the airport consist of EFU, with EFU, RR-2 ½, and RR-1 to the west. RR and EFU uses in the vicinity of the airport consist of commercial (Twin Peaks Restaurant), agriculture, resource related dwellings, and public rights of way for Oregon State Highway 281 and county roads serving the airport.

OVERLAY DISTRICTS

Hood River County has airport overlay zoning (**Airport Hazard Zone -AH**) which incorporates the five FAR Part 77 surfaces defined for runways (approach, primary, transitional, horizontal, and conical) and the runway protection zone (RPZ) defined by FAA airport design standards. The overlay zoning is intended to protect the FAR Part 77 airspace surfaces for Runway 7/25 from built item penetrations. Portions of the airspace for Runway 7/25 extend over the City of Hood River, although the current City zoning ordinance does not appear to include airport overlay zoning.

As noted earlier, the airport and surrounding areas are located within a **Health Hazard Overlay (HHO)** zone. HHO zones are a basis for extending sanitary service outside municipal urban growth boundaries, which normally define service limits for municipal utilities. The HHO is extends approximately ¾ of a mile northwest, northeast, and southwest of the airport.

Data Sources:

- **Ken Jernstedt Airfield –Airport Layout Plan (2013 as-built revision)** (Century West Engineering)
- **Ken Jernstedt Airfield – Airport Design Project Drawings** (Century West Engineering)
- **Ken Jernstedt Airfield – Airport Layout Plan Report 2004 and 2009 Update** (Century West Engineering)
- **Oregon Department of Aviation - 2014 Pavement Evaluation/Maintenance Management Program** (Ken Jernstedt Airfield)
- **FAA Airport Master Record Form (5010-1)**
- **Airport/Facility Directory (AFD) –Northwest U.S.** (U.S. DOT, Federal Aviation Administration, National Aeronautical Charting Office)
- **Seattle Sectional Aeronautical Chart; IFR Enroute Low Altitude (L-13, L-11, L-1, L-2) Chart** (U.S. DOT, Federal Aviation Administration, National Aeronautical Charting Office)
- **Hood River County Comprehensive Plan, Zoning and Land Use Plan Ordinances and Mapping**
- **Port of Hood River Website-Airport History**
- **Portland State University-Annual Oregon Population Report**
- **Local land use planning documents, zoning ordinances and mapping**
- **Western Regional Climate Center-Climate Summary**
- **Local and regional socioeconomic data**
- **NW Natural Gas; Ice Water Fountain District; Pacific Power; City of Hood River (Utility Maps)**
- **A glossary of aviation terminology and a list of acronyms have also been provided to describe technical items and aviation jargon commonly in use.**

Chapter 3 – Aviation Activity Forecasts

Chapter 3 – Aviation Activity Forecasts

The overall goal of aviation activity forecasting is to prepare forecasts that accurately reflect current conditions, relevant historic trends, and provide reasonable projections of future activity, which can be translated into specific airport facility needs anticipated during the next twenty years and beyond.

Introduction

This chapter provides updated forecasts of aviation activity for Ken Jernstedt Airfield (4S2) for the twenty year master plan horizon (2014-2034). The forecasts presented in this chapter are consistent with Ken Jernstedt Airfield's current and historic role as a community general aviation airport.

The intent is to provide updated aviation demand projections for Ken Jernstedt Airfield that will support airport management efforts to maintain a viable, efficient, and cost-effective facility that meets the area's air transportation needs.

Unless specifically noted, the forecasts of activity are unconstrained and assume that the facility improvements necessary to accommodate anticipated demand can be provided—either on airport or off airport, or a combination of both. Through the evaluation of airport development alternatives later in the master plan, the Port will consider if any unconstrained demand will not or cannot be reasonably met.

The FAA-defined airport master plan forecasting process for general aviation airports is designed to address elements critical to airport planning by focusing on two key activity segments: based aircraft and aircraft operations (takeoffs & landings). Detailed breakdowns of these are also provided including aircraft fleet mix, activity peaking, distribution of local and itinerant operations, and the determination of the critical aircraft, also referred to as the design aircraft. Existing forecasts are examined and compared against current and historic activity to gauge their accuracy and potential use in the master plan.

The design aircraft represents the most demanding aircraft type or family of aircraft that uses an airport on a regular basis (a minimum of 500 annual takeoffs & landings). The existing and future design aircraft are used to define the airport reference codes (ARC) to be used in airfield planning. The activity forecasts also provide consistency in evaluating future demand-based facility requirements such as runway and taxiway capacity, aircraft parking and hangar capacity, and other planning evaluations such as airport noise.

Forecast Process

The Federal Aviation Administration (FAA) provides guidance on forecasting aviation activity in airport master planning projects. FAA Advisory Circular (AC) 150/5070-6B, Airport Master Plans, outlines seven standard steps involved in the forecast process:

1) **Identify Aviation Activity Measures**: The level and type of aviation activities likely to impact facility needs. For general aviation, this typically includes based aircraft and operations.
2) **Review Previous Airport Forecasts**: May include the FAA Terminal Area Forecast (TAF), state or regional system plans, and previous master plans.
3) **Gather Data**: Determine what data are required to prepare the forecasts, identify data sources, and collect historical and forecast data.
4) **Select Forecast Methods**: There are several appropriate methodologies and techniques available, including regression analysis, trend analysis, market share or ratio analysis, exponential smoothing, econometric modeling, comparison with other airports, survey techniques, cohort analysis, choice and distribution models, range projections, and professional judgment.
5) **Apply Forecast Methods and Evaluate Results**: Prepare the actual forecasts and evaluate for reasonableness.
6) **Summarize and Document Results**: Provide supporting text and tables as necessary.
7) **Compare Forecast Results with FAA's TAF**: Follow guidance in FAA Order 5090.3C, Field Formulation of the National Plan of Integrated Airport Systems. In part, the Order indicates that forecasts should not vary significantly (more than 10 percent) from the TAF. When there is a greater than 10 percent variance, supporting documentation should be supplied to the FAA. The aviation demand forecasts are then submitted to the FAA for their approval.

National General Aviation Activity Trends

The first decade of the 21st Century was tumultuous for General Aviation (GA) and the first half of the second decade has improved only slightly. The industry was battered by poor economic conditions and steadily rising fuel prices that slowed growth and negatively impacted elements such as aircraft manufacturing, on-demand air travel, aircraft ownership, and aircraft utilization levels. Ongoing concerns over the potential replacement and future availability of 100LL aviation gasoline (AVGAS) have also created uncertainty within general aviation. On a national level, most measures of GA activity declined sharply through "The Great Recession" and have only recently started to show modest signs of improvement.

Data maintained by the FAA show significant system-wide declines of several key general aviation activity indicators between 2000 and 2013 (-39%; piston aircraft hours flown -38%; active piston aircraft -18%; active GA pilots -7%). AVGAS consumption levels dropped every year between 2000 and 2013, ending 39 percent below 2000 levels.

The FAA's long term forecasts predict that the U.S. active GA aircraft fleet will grow modestly at an average annual rate of 0.5 percent between 2013 and 2034.[1] As depicted in **Figure 3-1**, the active GA fleet is expected to increase from 202,865 aircraft in 2013 to 225,700 in 2034 (+22,835) which is an overall increase of approximately 11 percent.

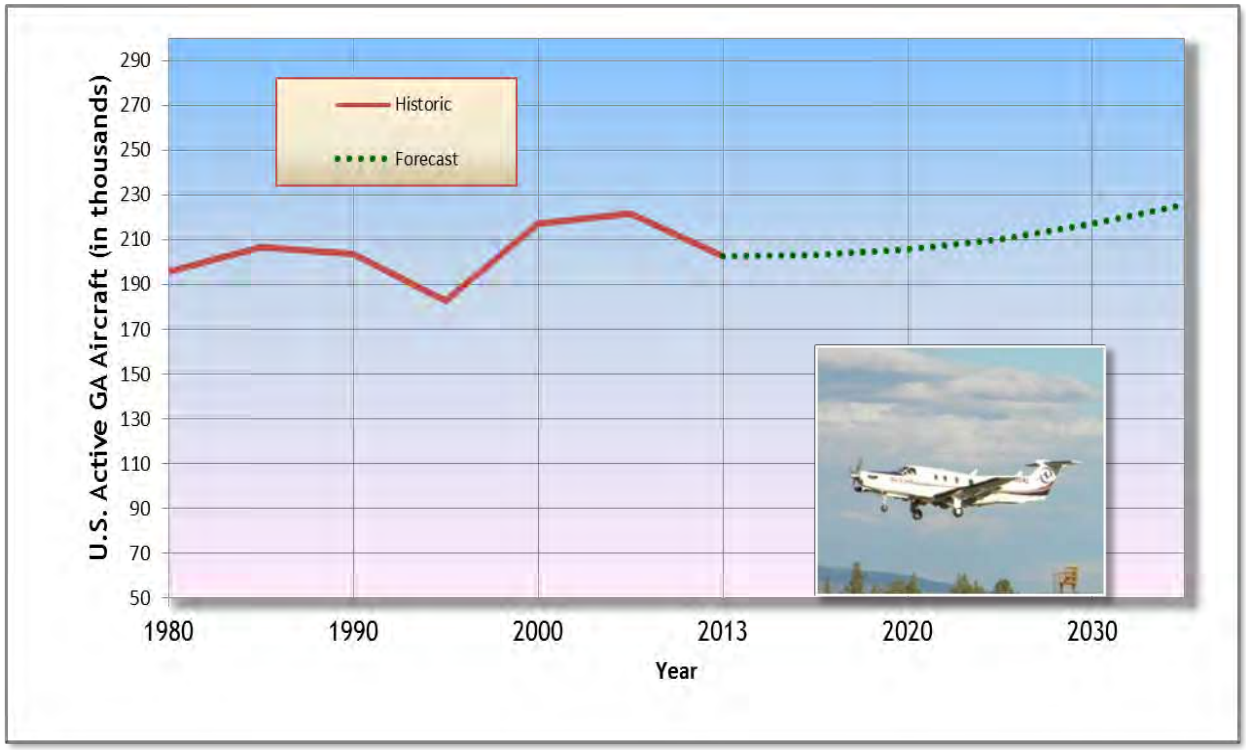
It is noted that within the overall forecast growth, several segments are projected to decline in actual numbers including single engine piston aircraft (-7.9%) and multi-engine piston aircraft (-9.5%). These declines reflect attrition of an aging fleet which is not being offset by new aircraft production. Encouraging areas (net growth) within the GA fleet are found in turboprops (particularly single engine) (+41%), experimental aircraft (+36%), sport aircraft (+131%), and business jets (+85%).

Aircraft manufacturing has shown positive gains in recent years after an extended period of weak sales. Worldwide GA aircraft deliveries in 2013 totaled 3,373 units, an increase of 4.3 percent over the previous year, but about 15 percent below recent peak of shipments in 2008.[2] The adaption of both turbine and diesel engines for small general aviation aircraft by several established manufacturers is positive indication that evolving engine technology may be a significant factor in the long term future of general aviation. In addition, the resurgence of unleaded automobile gasoline powered small aircraft engines may provide a reliable power source for a growing Light Sport Aircraft (LSA) and experimental aircraft fleet.

[1] FAA Aerospace Forecast Fiscal Years 2014-2034

[2] General Aviation Manufacturers Association (GAMA), 2013 Delivery Report

FIGURE 3-1: US ACTIVE GENERAL AVIATION AIRCRAFT FORECAST



Although the FAA maintains a moderately favorable long-term outlook, many of the activity segments associated with piston engine aircraft and AVGAS consumption are not projected to return to "pre-recession" levels until the 2025 to 2034 timeframe. Although some segments of general aviation are expected to grow at moderately high rates, most measures of the general aviation industry suggest modest, sustained growth in the range of 1 to 2 percent annually is expected over the next 20 years. The FAA's annual growth assumptions for individual general aviation activity segments are summarized in **Table 3-1.**

TABLE 3-1: FAA LONG RANGE FORECAST ASSUMPTIONS (U.S. GENERAL AVIATION)

ACTIVITY COMPONENT	FORECAST ANNUAL AVERAGE GROWTH RATE (2013-2034)
Components with Annual Growth Forecast < 0%	
Single Engine Piston Aircraft in U.S. Fleet	-0.4%
Multi-Engine Piston Aircraft in U.S. Fleet	-0.5%
Hours Flown - GA Fleet (Piston AC)	-0.6%
Student Pilots (Indicator of flight training activity)	-0.2%
AVGAS (Gallons consumed - GA only)	-0.2%
Components with Annual Growth Forecast < 1%	
Private Pilots	0.1%
Commercial Pilots / Airline Transport Pilots	0.6% / 0.5%
Instrument Rated Pilots	0.3%
Active Pilots (All Ratings, excluding Airline Transport)	0.4%
GA Operations at Towered Airports (all AC types)	0.5%
Active GA Fleet (# of Aircraft)	0.5%
Components with Annual Growth Forecast 1%-2%	
Experimental Aircraft in U.S. Fleet	1.5%
Turboprop Aircraft in U.S. Fleet	1.6%
Piston Helicopters in U.S. Fleet	1.7%
Components with Annual Growth Forecast >2%	
Sport Pilots	5.6%
Turbine Helicopters in U.S. Fleet	3.0%
Light Sport Aircraft in U.S. Fleet	4.1%
Turbojet Aircraft in U.S. Fleet	3.0%
Hours Flown - GA Fleet (Turbine AC)	3.3%
Hours Flown – Experimental AC	2.6%
Hours Flown – Light Sport AC	5.1%
Jet Fuel (Gallons consumed – GA only)	3.0%
Source: FAA Long Range Aerospace Forecasts (FY 2014-2034)	

Airport Service Area

The airport service area refers to the geographic area surrounding an airport that generates most "local" activity. A 30- or 60-minute surface travel time is used to approximate the boundaries of a service area for a typical general aviation airport. The population, economic characteristics, and capabilities of competing airports within an airport's service area are important factors in defining locally generated demand for aviation facilities and services, and influence the airport's ability to attract transient aircraft activity.

Ken Jernstedt Airfield is the only FAA funded (National Plan of Integrated Airport Systems – NPIAS) airport in Hood River County, which creates a large geographic service area. **Figure 3-2** illustrates the approximate boundary of an approximate 30- and 60-minute drive from the local area. Competing airports located beyond the service area typically have less impact on local airport activity due to the redundancy provided by closer facilities. In contrast, the service area for a commercial airport often extends beyond two hours due the relatively small number of airports with scheduled airline service. With numerous airports nearby, service areas often overlap, creating competition between airports for items such as hangar space, fuel and aviation services. These items are sensitive to cost, convenience and quality of facilities or services for both locally-based and transient users.

Table 3-2 lists the publicly-owned, public use airports within a 50 nautical mile (air miles) radius of Ken Jernstedt Airfield. It is noted that some of the public use airports listed provide competitive facilities and services with master plans that provide for future facility expansion.

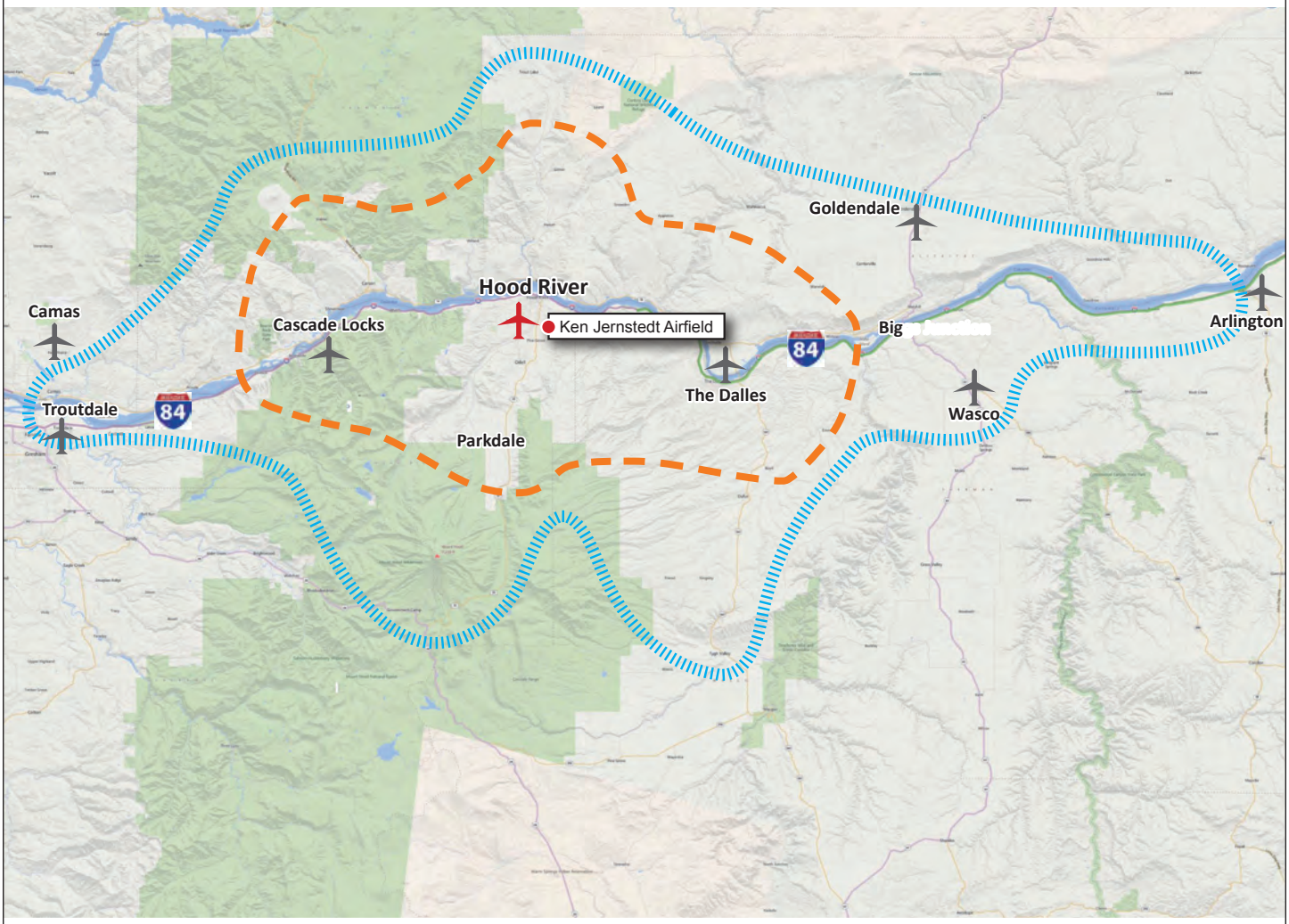
Columbia Gorge Regional/The Dalles Municipal Airport (DLS) is the closest airport in the service area that provides many of the same facilities and services as Ken Jernstedt Airfield. DLS has two paved runways, the longest being 5,097 feet. The airport also has instrument approach capabilities and jet fuel. Airport management indicates that their rental hangars are full and they currently have a waiting list of 15 aircraft (mostly located at other nearby airports). Plans are underway to construct additional T-hangar space in 2015 and beyond.

Portland-Troutdale Airport (TTD) is the largest airport located within the service area for Ken Jernstedt Airfield, accommodating general aviation activity with a full range of facilities and services. The previous master plan[3] projected modest growth in general aviation activity (based aircraft and operations) through 2024. The long-term future for TTD is unknown and is dependent on the Port of Portland's overall development strategy for the airfield and adjacent industrial land base.

[3] 2004 Airport Master Plan (Aron Faegre & Associates, Century West Engineering)

TABLE 3-2: PUBLIC USE AIRPORTS IN VICINITY OF KEN JERNSTEDT AIRFIELD *(WITHIN 50 NAUT. MILES)*

AIRPORT	LOCATION	RUNWAY LENGTH (FEET)	SURFACE	LIGHTED RUNWAY?	FUEL AVAILABLE?
Columbia Gorge Regional / The Dalles Municipal Airport	16 NM Southeast	5,097	Asphalt	Yes	Yes
Cascade Locks State Airport	14 NM West	1,800	Asphalt	No	No
Goldendale Airport	31 NM Northeast	3,491	Asphalt	Yes	No
Wasco State Airport	36 NM East	3,450	Asphalt	Yes	No
Troutdale Airport	37 NM West	5,399	Asphalt	Yes	Yes



	Approximate 60 minute travel time to/from Ken Jernstedt Airfield
	Approximate 30 minute travel time to/from Ken Jernstedt Airfield
	Other public use airports in vicinity

Socioeconomic Trends and Forecasts

AREA ECONOMY

Historically, downturns in general aviation activity often occur during periods of weak economic conditions and growth typically coincides with favorable economic conditions. It is evident that the recent economic recession and the slow recovery that followed, has constrained general aviation activity locally, statewide and throughout the national airport system. However, as indicated in the FAA's national long term aviation forecasts, the overall strength of the U.S. economy is expected to sustain economic growth over the long-term, which is expected to translate into modest to moderate growth in aviation activity.

The local and regional economy for Hood River has historically been led by natural resources, agriculture, and tourism segments, which are characterized by seasonal employment fluctuations and modest wages. These core industries will continue to be leading employers in the region and provide opportunities for local businesses to expand into a variety of value-added products. The region has also experienced considerable diversification in recent years that has resulted in a broader base of new or expanded employment segments such a technology clusters, wineries and craft breweries. Beginning in the mid-1990s, the Columbia River Gorge has seen the emergence of a technology cluster for unmanned aircraft systems (UAS) research and development. Insitu Inc., located in Bingen Washington, four miles northeast of Hood River, is a leader in UAS technology and is largest employer in Klickitat County.[4] Insitu was acquired by Boeing in 2008 and is well established within the region "providing large dollar value jobs and long-term contracts." [5]

Food manufacturing, health care, energy and technology are currently among the most active industry segments in the local area.[6] According to the Hood River Economic Opportunities Analysis (EOA),[7] the fastest areas of employment growth over the next ten years are expected to occur in health care and social services, government, leisure and hospitality, professional and business services, retail, natural resources, trade and durable goods manufacturing.

The Oregon Employment Department provides data showing the leading employment sectors in Hood River County, which include:

1) Healthcare and Social Assistance (14%)
2) Farming (11%)
3) Retail Trade (9.7%)
4) Accommodations and Food Service (8.7%)
5) Manufacturing (8%)
6) Professional and Technical Services (7.2%)
7) State and Local Government (6.7%)

[4] Yakima Herald (April 28, 2013)

[5] Oregon Office of Economic Analysis: Columbia River Gorge (April 3, 2012)

[6] Gorge Technology Alliance (http://crgta.org/)

[7] Oregon Office of Economic Analysis: Columbia River Gorge (April 3, 2012)

The per capita income for Hood River County in 2013 was $36,359, which is below Oregon's per capita income level of $39,286. In 2012, Hood River's unemployment rate was at 7%, which was less than the State of Oregon's unemployment rate of 8.7%. Hood River County's median housing costs were about 30% higher than Oregon's statewide average in 2013.[8] Providing an adequate supply of affordable housing to an expanding workforce has been identified by local leaders as a key factor in the area's ability to sustain economic growth. A summary of historic and forecast economic data is provided in **Table 3-3**.

TABLE 3-3: PERSONAL PER CAPITA INCOME & EMPLOYMENT DATA

	HISTORIC		FORECAST			
	2000	**2013**	**2019**	**2024**	**2029**	**2034**
Per Capita Income						
U.S.	$27,000	$43,597	$54,251	$68,829	$88,534	$114,566
State of Oregon	$25,560	$39,286	$48,694	$61,617	$79,065	$102,073
Hood River County	$23,227	$36,359	$44,570	$56,134	$71,815	$92,520
Hood River County % of Oregon	90.8	92.5	91.5	91.1	90.8	90.6
Employment (Hood River County)						
# Jobs	13,274	16,411	17,893	19,220	20,627	22,132

Source: Woods & Poole (2014)

The City of Hood River conducted an Economic Opportunities Analysis (EOA)[9] in 2011 to assist the city in creating policies and identifying actions needed to ensure the long-term viability of the community. Within the study employment trends and buildable land needs were assessed for various levels of forecast growth. A key assumption in the study was continued growth of the Portland region will create "spillover" into Hood River County. According to the study, the city's proximity to the Portland metropolitan area, agricultural commodities, transportation and green energy sources makes the area ideal for the food manufacturing industry, technology, and recreation industries.

[8] Woods & Poole Economic Data (2014)

[9] Source: City of Hood River Economic Opportunities Analysis (June 2011)

POPULATION

In broad terms, the population within an airport's service area affects the type and scale of aviation facilities and services that can be supported. Although a large number of airport-specific factors can affect activities at an airport, changes in population often reflect other broader economic conditions that may also affect airport activity. The airport service area for Ken Jernstedt Airfield extends beyond the City of Hood River and includes portions of Klickitat, Wasco, Clackamas and Multnomah County in addition to the unincorporated areas of Hood River County. However, for the purposes of forecasting aviation activity, an evaluation of local and county population trends will provide a reasonable indication of activity.

Physical geography is a significant factor in Hood River County's population distribution. Based on current population estimates, the two incorporated cities (Hood River and Cascade Locks) account for approximately 41 percent of county population, with unincorporated areas of the county accounting for 59 percent.

Historic Population

Certified estimates of population for Oregon counties and incorporated cities are developed annually by the Portland State University (PSU) Population Research Center. The annual PSU estimates, coupled with the U.S. Census, conducted every ten years, provide an indication of local area population trends over an extended period.[10] The 2013 PSU certified population estimate for Hood River (incorporated area only) was 7,460 and Hood River County was 23,295. The City of Hood River and Hood River County's population are up about 4 percent over the 2010 Census, which translates into annual growth of approximately 1.4 percent.

Since 1990, Hood River County's population has increased by 47 percent, with an average annual growth rate of 1.7 percent. During the same period, the City of Hood River's population increased by 61 percent, or 2.1 percent annually.[11] Recent historic population data and average growth rates for the City of Hood River, Hood River County, and Oregon are summarized in **Table 3-4**.

[10] Portland State University Population Research Center, July 1, 2013 estimate; 1990, 2000, 2010 U.S. Census.

[11] Net increase in population may be attributed to both natural growth/in-migration and expansion of city-incorporated area through annexation.

TABLE 3-4: HISTORIC POPULATION

YEAR	HOOD RIVER COUNTY	CITY OF HOOD RIVER (INCORPORATED AREA ONLY)	HOOD RIVER SHARE (%) OF HOOD RIVER COUNTY POPULATION	OREGON
1990	15,835	4,632	29.2	2,842,337
2000	20,411	5,831	28.6	3,421,399
2010	22,346	7,167	32.0	3,831,074
2013	**23,295**	**7,460**	**32.0**	**3,919,020**
Average Annual Rates (AAR) of Growth				
	Hood River County	City of Hood River		Oregon
1990-2000	2.4%	2.2%		1.87%
2000-2010	0.9%	2.0%		1.14%
2000-2013	1.0%	1.9%		1.05%
2010-2013	1.3%	1.3%		0.76%
Source: U.S. Census data; Portland State University certified annual estimates.				

POPULATION FORECASTS

Two recent forecasts of local population were reviewed to evaluate future growth expectations. Both forecasts indicate that local population will grow at a faster rate than Oregon's population during next twenty years. Future population growth within the airport service area is expected to be a positive factor affecting future activity at Ken Jernstedt Airfield. **Table 3-5** summarizes the population forecasts for the current planning period.

Oregon Office of Economic Analysis (OEA)

Long-term population forecasts prepared by the Oregon Office of Economic Analysis (OEA) are periodically generated to support local and statewide planning. The OEA long-term forecasts released in March 2013 project modest sustained growth for Hood River County through 2050. Hood River County population is projected to increase from 22,875 in 2012 to 36,066 in 2050, which reflects an overall increase of 58 percent and a 1.2 percent average annual rate of growth.[12]

Hood River County Coordinated Population Forecast

A coordinated population forecast was prepared for Hood River County and the City of Hood River in 2008 to support local planning.[13] The forecast projected annual population growth to average 1.29 percent in the county and 2.0 percent in the city through 2035. The higher growth rate used for the City of Hood

[12] Office of Economic Analysis-Forecasts of Oregon's County Population and Components (March 28, 2013)

[13] Coordinated Population Forecast (Eco Northwest) for Hood River County (October 2008)

River population forecast reflects several local factors including recent historic population growth; historic residential development growth, including annexation; current commercial development; and the ability to attract a population segments projected to grow statewide through 2035 (younger residents, retirees, and Hispanic people).

TABLE 3-5: HOOD RIVER, HOOD RIVER COUNTY & OREGON POPULATION FORECASTS

	2010	2010 US CENSUS	2013 JULY 1 PSU ESTIMATE	2015	2020	2025	2030	2035
City of Hood River UGB								
Coordinated Population Forecast[1] *(2.0% AAR 2007-2035)*	7,121	*7,167*[3]	*7,460*[4]	7,862	8,680	9,584	10,581	11,682
Hood River County								
OEA Forecast[2] *(1.3% AAR 2010-2035)*	22,875	*22,346*	*23,295*	23,675	25,628	27,827	29,979	31,909
Oregon								
OEA Forecast[2] *(1.07% AAR, 2010-2035)*	3,837,300	*3,831,074*	*3,919,020*	4,001,600	4,252,100	4,516,200	4,768,000	4,995,200
City of Hood River % of County Population	31.1%	*32.1%*	*32.0%*	33.2%	33.9%	34.4%	35.3%	36.6%
Hood River County % of Oregon Population	0.60%	*0.58%*	*0.59%*	0.59%	0.60%	0.62%	0.63%	0.64%

1. *Coordinated Population Forecast prepared by Eco Northwest for Hood River County (October 2008)*
2. *Prepared by Office of Economic Analysis, Department of Administrative Services, State of Oregon (March 28, 2013)*
3. *U.S. Census for Incorporated City of Hood River (does not include UGB population)*
4. *PSU estimate for Incorporated City of Hood River (does not include UGB population) (July 1, 2014)*

Overview of Recent Local Events

Between 2003 and 2014, the number of based aircraft at Ken Jernstedt Airfield increased from 86 to 208 aircraft (+122). However, the net increase is largely attributed to the opening of the Western Antique Aeroplane and Automobile Museum (WAAAM), which currently accounts for 118 additional "active" aircraft. Non-WAAAM aircraft at the airport currently total 90, which reflects a small increase (+4.7%) above 2003 levels.

A review of the 2004 Airport Layout Plan indicates no on-airport hangar construction has occurred since 2004; the majority of off-airport hangar construction associated with WAAAM has occurred within the last ten years.

Fuel records provided by the airport's fixed base operator (FBO) - Classic Wings Aero Services, indicate that 100LL AVGAS volumes have averaged 36,000 gallons per year over the last five years, fluctuating within a range of 31,000 to 40,000 gallons annually. The year-to-year fuel consumption levels are relatively consistent with the airport's (non-museum) based aircraft trends in recent years. Considering the national declines in AVGAS consumption, the ability to maintain relatively stable fueling levels represents a positive indication of activity at the airport. The importance of having an established FBO providing reliable services cannot be overstated in terms of an airport's ability to attract/generate locally-based and transient activity.

Historic & Current Aviation Activity

For Ken Jernstedt Airfield, aircraft operational data (takeoffs and landings, touch and go landings, etc.) are limited to estimates. As a non-towered airport, there are no actual counts of airport activity conducted. However, a review of estimates contained in state aviation system plans, previous airport layout plans, and FAA Terminal Area Forecast (TAF) data, and onsite activity counts provide a general indication of activity at the airport over time. Based aircraft counts are updated periodically either as part of a master plan update or by airport management for other purposes.

HISTORIC DATA - FAA TERMINAL AREA FORECAST (TAF)

The Federal Aviation Administration (FAA) maintains the Terminal Area Forecast (TAF) for airports that are included in the federal airport system—the National Plan of Integrated Airport System (NPIAS). When reviewing FAA TAF data, it is important to note that when there is no change from year to year it often indicates a lack of data, rather than no change in activity. Similarly, a large change in data in a single year may follow updated reporting that captures changes that occurred over several years. Small changes in year-to-year activity that extend through the forecast typically reflect assumed growth rates that are not frequently updated. For these reasons, the TAF should be used as general guide for comparison with other forecasts and periodic activity estimates.

A review of historic TAF data for Ken Jernstedt Airfield (1990 through 2012) reflects several significant adjustments (up and down) in annual aircraft operations totals and based aircraft totals. The most recent change in based aircraft totals occurred between 2011 and 2012, dropping from 88 to 37 (-51 aircraft; -58%). The reduced number was then used as the base for future year TAF based aircraft projections. Annual aircraft operations estimates have been relatively steady since 1997, ranging from 13,700 to 14,839. The estimate of aircraft operations for 2012 (14,210) was unchanged from 2011 despite the sharp reduction in based aircraft noted above.

In addition to the 2012 adjustment, the based aircraft total prior to the adjustment count does not reflect the addition of active aircraft housed the Western Antique Aeroplane and Automobile Museum (WAAAM). The 2014 based aircraft count (208) conducted in the airport master plan is well above the TAF based aircraft estimate for 2014 (38), which invalidates the current TAF estimate and all subsequent TAF based aircraft projections.

Table 3-6 summarizes recent historic TAF based aircraft and aircraft operations estimates for the Ken Jernstedt Airfield as currently published by FAA.

TABLE 3-6: FAA TAF DATA – KEN JERNSTEDT AIRFIELD

YEAR	AIRCRAFT OPERATIONS[1]	BASED AIRCRAFT[1]	RATIO: GA OPERATIONS PER BASED AIRCRAFT
1990	15,060	62	243
2002	14,190	86	165
2003	14,234	87	163
2004	14,278	86	166
2005	14,324	86	166
2006	14,368	86	167
2007	14,583	86	169
2008	14,627	42	348
2009	14,839	91	163
2010	14,210	88	162
2011	14,210	88	162
2012	14,210	37	384

1. FAA Terminal Area Historical Activity Estimates

CURRENT ESTIMATE OF ACTIVITY

Based Aircraft

A review of current based aircraft was performed in order to provide the most accurate data for estimating current activity and developing updated activity forecasts. A review of Port tenant records, FAA registered aircraft records, and data collected from users including the local FBO and WAAAM was conducted to determine the current based aircraft total for Ken Jernstedt Airfield. In October 2014 there were 208 total verified based aircraft at Ken Jernstedt Airfield.[14] The based aircraft fleet mix is primarily single engine piston airplanes with a small number of multi-engine piston airplanes, gliders and helicopters. The current based aircraft count is summarized in **Table 3-7**.

TABLE 3-7: KEN JERNSTEDT AIRFIELD (4S2) BASED AIRCRAFT

AIRCRAFT TYPE	ON AIRPORT	OFF AIRPORT[1]	TOTAL
Based Aircraft (Fall 2014 Airport Count)			
Single-Engine Piston	69	121	190
Multi-Engine Piston	0	2	2
Rotorcraft	2	0	2
Glider	14	0	14
Total Based Aircraft	**85**	**123**	**208**
Western Antique Aeroplane and Automobile Museum Active Aircraft Count (11/14): 118 Aircraft (116 single engine; 2 multi-engine)			

The current count includes 85 aircraft located on airport property and 123 aircraft located off airport property. The off-airport based aircraft include 118 in WAAAM hangars[15] and 5 in private residential hangars. It is noted that only active, FAA-registered aircraft are included in the based aircraft totals attributed to WAAAM; the museum has several additional non-active aircraft that are not included in the airport's current based aircraft total.

Aircraft Operations

The FAA provides planning guidance for estimating activity at general aviation airports without control towers, including the use of activity ratios to project aircraft operations from the number of based aircraft at the airport. The ratios provide a method to approximate operations generated by both locally-based

[14] July 2014 Airport Management/Aero Club/FBO Count/WAAAM Count

[15] WAAAM based aircraft count provided by current WAAAM Director.

and transient aircraft. In the absence of actual aircraft operations counts, the ratios of activity are generally adequate for airport planning purposes.

Prior to the recent economic recession, the FAA developed "typical" operations ratios for general aviation airports based on observations at airports throughout the United States.[16] The recommended ratios ranged from 250 to 450 operations per based aircraft depending on the size of the community, airport type, and the nature of the air traffic. These ratios were also consistent with a range of activity models derived from a detailed analysis of independent variables.[17] As noted earlier, most measures of general aviation activity tracked by FAA declined sharply during the recent economic recession and have not yet returned to pre-recession levels. The system wide impact has been a reduction in aircraft utilization, which translates into lower activity ratios.

The 2004 Airport Layout Plan Report forecast base year (2003) activity was 14,190 operations with 86 based aircraft, producing an operations-to-based aircraft ratio of 165. The activity ratio was consistent with automated aircraft traffic counts conducted at the airport during the period (see below). The forecast increased the ratio gradually to 180 operations per based aircraft through the 20-year forecast period. Considering both the negative impacts of the recent national recession and positive local events, it appears reasonable to maintain the base year ratio from the 2004 forecasts (165 operations per based aircraft) to estimate current activity and provide a reasonable basis for developing forecasts of future activity.

The precise impact of the WAAAM-attributed based aircraft on annual aircraft operations at Ken Jernstedt Airfield is not clear. It is known that the majority of the active museum aircraft fly a minimal number of times each year, far below typical levels of privately-owned aircraft in general service. It is recognized that the museum also contributes to airport activity through its events and fly-in visitors. However, applying the airport's historic comparable activity ratio to the current based aircraft fleet at Ken Jernstedt Airfield would likely overestimate activity. For this reason, it is recommended that the activity ratios be applied to non-museum aircraft and adjusted upward slightly to capture the air traffic associated with WAAAM (display aircraft activity, transient activity generated by museum visitors, fly-ins etc.).

As a relatively self-contained entity, the growth in museum aircraft is driven by unique factors such as the ability to refresh its collection through donated or loaned aircraft. As such, changes in the size of its collection are not expected to drive corresponding changes in air traffic volume at the airport. However, it is reasonable to assume that future growth in museum visitor volume will contribute to growth in future airport activity.

[16] Field Formulation of National Plan of Integrated Airport Systems (FAA)

[17] Model for Estimating General Aviation Operations at Non-Towered Airports Using Towered and Non-Towered Airport Data (GRA, 2001)

Applying a ratio of 165 operations to 90 non-museum based aircraft results in a total of **14,850 annual operations for 2014**. A detailed distribution of current traffic is provided in the forecast of aircraft operations later in the chapter.

AIRPORT TRAFFIC COUNTS (HISTORIC)

Beginning in the 1980s, aircraft operations (takeoffs and landings) counts at non-towered airports were conducted on a semi-regular basis by the Oregon Department of Aviation (ODA) through its "RENS" automated activity counting program. The RENS program methodology relied on four sample periods over a 12-month period to account for seasonal variation in activity. Recorders were placed next to runways to capture distinct engine sounds for takeoffs that could be identified by aircraft type. The acoustical events were tallied and the sample data was statistically extrapolated to provide 12-month estimates of activity. The program was phased out in 2003, but provided six annual operations estimates for Ken Jernstedt Airfield between 1981 and 1999. The most recent estimate from 1998-1999 was 13,555 operations with 79 based aircraft (13,555 ÷ 79 = 172 operations per based aircraft).

Aviation Activity Forecasts (Existing Forecasts)

Three existing aviation forecasts for Ken Jernstedt Airfield are available to compare with current activity, recent historic trends, and the updated forecasts prepared for the master plan:

- 2004-2024 Airport Layout Plan Report
- 2007 Oregon Aviation Plan
- FAA Terminal Area Forecasts (TAF) (2013 update)

The existing forecasts have been reviewed but not modified to reflect recent events. Minor adjustments (interpolation, extrapolation) have been made to present each projection with common forecast year intervals. Although some projections may be obsolete relative to current activity (in actual numbers), the existing forecasts provide a useful gauge of future growth rates that are generally consistent with national and statewide expectations for defining general aviation activity.

It is important to note that none of the existing aviation activity forecasts for Ken Jernstedt Airfield reflect the recent addition of WAAAM aircraft to the airport. As a result, both the current and forecast based aircraft numbers developed in the master plan will differ significantly from all existing forecasts, including the FAA Terminal Area Forecast (TAF), which extends to 2040. Master plan forecasts are compared to the TAF and significant deviations from the TAF must be approved by FAA.

Existing based aircraft and operations forecasts are summarized below and in **Tables 3-8** and **3-9.** Updated forecasts have been developed and are presented later in the chapter.

BASED AIRCRAFT FORECASTS

2004 Airport Layout Plan

The 2004 Airport Layout Plan Report[18] forecasts project an increase from 86 to 125 (+39) based aircraft between 2003 and 2022, which reflects an average annual growth rate of **1.99 percent**. The forecasts have reached the mid-point of their projected timeline and provide an opportunity to assess the accuracy of the growth assumptions. The based aircraft forecast for 2012 was 103, which is 13 aircraft above the current non-museum total of 90 based aircraft. The current total of 208 based aircraft, including 118 active museum aircraft, exceeds the 2022 forecast by a wide margin. The actual growth experienced at the airport renders the forecast obsolete as an overall measure. However, when museum aircraft are separated, the current remaining based aircraft total is approximately 17 percent below the ALP forecast for 2012.

FAA Terminal Area Forecast (TAF)

The FAA TAF (February 2014 update) projects based aircraft at Ken Jernstedt Airfield to increase from 37 to 40 (+3) between 2012 and 2040, which represents average annual growth of **0.28 percent**. As noted earlier, the TAF based aircraft total was reduced from 88 to 37 between 2011 and 2012, without explanation. The 2014 based aircraft count confirms that both the adjusted and previous TAF based aircraft counts are not accurate and render the subsequent TAF based aircraft forecasts obsolete.

On a regional level, the 2013-2040 Terminal Area Forecast project the number of based aircraft (general aviation) in the Northwest-Mountain Region to increase at an annual average rate of 0.96 percent through 2040.

2007 Oregon Aviation Plan (OAP)

For Ken Jernstedt Airfield, the OAP forecasts projects based aircraft at Ken Jernstedt Airfield to increase from 86 to 111 (+25) between 2005 and 2025, which represents average annual growth of **1.28 percent**. As with the TAF described above, the recent addition of WAAAM aircraft to the based aircraft fleet is not reflected in the OAP forecast. The current non-museum based aircraft total of 90 aircraft is approximately 10 percent below the 2015 OAP forecast (99 based aircraft).

[18] Century West Engineering, Aron Faegre & Associates, Gazeley & Associates (2004)

TABLE 3-8: SUMMARY OF EXISTING BASED AIRCRAFT FORECASTS FOR KEN JERNSTEDT AIRFIELD

EXISTING FORECASTS	2010	2015	2020	2025	2030	2035
2004 Airport Layout Plan Report (1.99% AAR 2003-2022)	99[1]	109[1]	121[1]	132[2]	-	-
2007 Oregon Aviation Plan (1.28% AAR 2005-2025)	94	99	105[1]	111	-	-
FAA Terminal Area Forecast (Feb. 2014) (0.28% AAR 2012-2040)	-	38	39	40	40	40
Interpolated. 2. Extrapolated.						

AIRCRAFT OPERATIONS FORECASTS

2004 Airport Layout Plan

The 2004 Airport Layout Plan Report projects annual aircraft operations at Ken Jernstedt Airfield to increase from 14,190 to 22,500 between 2003 and 2022, which reflects an average annual growth rate of **2.46 percent**.

The current estimate of 14,850 annual operations is well below the ALP forecast for both 2007 and 2012, which appears to correlate to the based aircraft trends noted earlier. However, the ALP forecasts provide an upper range projection that is useful for comparison within the range of activity ratios recommended by FAA.

FAA Terminal Area Forecast (TAF)

The FAA TAF (February 2014 update) projects aircraft operations at Ken Jernstedt Airfield to increase from 14,210 to 19,833 between 2012 and 2040, which represents average annual growth of **1.20 percent**. Despite the significant discrepancy in the TAF based aircraft data, the aircraft operations forecasts appear to be reasonable and provide valid comparison with other forecasts. The TAF operations forecast for 2014 (14,589) is comparable to the current estimate of 14,850 aircraft operations, however the corresponding ratio of 384 operations per based aircraft is significantly higher than reflected in other existing forecasts. The TAF's 2012 reduction in based aircraft totals appears to be invalid and inadvertently skewed the activity ratios upward (348 to 496) through 2040.

On a regional level, the 2013-2040 Terminal Area Forecast projects itinerant operations (commercial, GA, military) in the Northwest-Mountain Region to increase at an annual average rate of **1.1 percent** through 2040.

2007 Oregon Aviation Plan (OAP)

For Ken Jernstedt Airfield, the OAP forecasts projects annual aircraft operations to increase from 14,324 to 18,443 between 2005 and 2025, which represents average annual growth of **1.28 percent**. The 2015 OAP forecast (16,562) is about 12 percent higher than the current aircraft operations estimate (14,850) which provides a valid projection for comparison.

TABLE 3-9: EXISTING AIRCRAFT OPERATIONS FORECASTS (KEN JERNSTEDT AIRFIELD)

EXISTING FORECASTS	2010	2015	2020	2025	2030	2035
2004 Airport Layout Plan Report (2.46% AAR 2003-2023)	16,610[1]	18,936[1]	21,443[1]	24,184[2]	--	--
2007 Oregon Aviation Plan (1.28% AAR 2005-2025)	15,622	16,562	17,641[1]	18,443	--	--
FAA Terminal Area Forecast (Issued Feb. 2014) (1.20% AAR 2012-2040)	14,210	14,779	15,726	16,673	17,662	18,715
1. Interpolated. 2. Extrapolated.						

Updated Forecasts

BASED AIRCRAFT

Updated projections of based aircraft at Ken Jernstedt Airfield have been prepared based on a review of recent socioeconomic data, existing aviation activity forecasts and current conditions. Two projections were developed based on common market share techniques: Ken Jernstedt Airfield's share of FAA-registered aircraft in Hood River County and its share of U.S. Active General Aviation Aircraft. A third population-based projection was developed utilizing the number of based aircraft per 1,000 Hood River County residents.

The significant increase in based aircraft attributed to WAAAM that has occurred over a relatively short period of time makes trend analysis difficult. However, for the purposes of developing updated aviation activity forecasts, it is assumed that WAAAM's collection of active aircraft will continue to grow during the planning period, accounting for approximately 40 percent of additional based aircraft in each of the forecasts. This assumption may be altered if WAAAM's expectations differ.

Hood River County FAA-Registered Aircraft Market Share

There are currently 245 active aircraft registered by the Federal Aviation Administration (FAA) in Hood River County.[19] By FAA definition, an active aircraft is one that has a current registration and is flown at least one flight hour per calendar year. Although the address of owner registration does not always

[19] FAA Registered Aircraft Database (http://registry.faa.gov/aircraftinquiry.com)

indicate the physical location of an aircraft during the year, the measure provides a reasonable basis to project activity at Ken Jernstedt Airfield's based on a share of the local market. The basis for market share projections is gauging the underlying ability of an airport to compete with other nearby airports within its service area.

The 208 based aircraft at Ken Jernstedt Airfield represents 85 percent of the current FAA-registered aircraft in Hood River County. The 118 active aircraft attributed to the Western Antique Airplane and Automobile Museum (WAAAM) alone represents 48 percent of FAA-registered aircraft for the county. For this forecast, it is assumed that 40 percent of future growth in based aircraft at Ken Jernstedt Airfield will be active museum aircraft and 60 percent will be other aircraft. This assumption may change if additional information is provided by WAAAM regarding their future collection.

The projections assume that the future Hood River County FAA-registered aircraft will increase at the same annual rate (1.28 percent) used to forecast Oregon's statewide general aviation fleet through 2025.[20] Based on this assumption, FAA-registered aircraft in Hood River County increase from 245 to 316 between 2014 and 2034. Projections of based aircraft at Ken Jernstedt Airfield were developed based on *increasing, constant, and decreasing* market share through the planning period. The forecasts are presented in **Table 3-10**.

The *decreasing* market share forecast gradually reduces Ken Jernstedt Airfield's market share from 85 to 77 percent during the twenty-year planning period. The projection results in an increase from 208 to 243 based aircraft at Ken Jernstedt Airfield by 2034, which represents an average annual growth rate of **0.78 percent**. This projection assumes that Ken Jernstedt Airfield's future market share will decline slightly as competition from other airports in the service area increases and the development of new hangar space at the airport is limited.

The *constant* market share forecast maintains Ken Jernstedt Airfield's market share at 85 percent during the twenty-year planning period. The projection results in an increase from 208 to 269 based aircraft at Ken Jernstedt Airfield by 2034, which represents an average annual growth rate of **1.29 percent**. This projection assumes that Ken Jernstedt Airfield will be able to maintain current market share in a competitive environment through modest facility improvement (additional hangar capacity, etc.).

The *increasing* market share forecast gradually increases Ken Jernstedt Airfield's market share from 85 to 89 percent during the twenty-year planning period. The projection results in an increase from 208 to 281 based aircraft at Ken Jernstedt Airfield by 2034, which represents an average annual growth rate of **1.52 percent**. This projection assumes that Ken Jernstedt Airfield's future market share will grow through proactive facility improvement (property acquisition, on or off-airport hangar development, etc.) and providing services in demand by aviation users.

[20] 2007 Oregon Aviation Plan Forecasts (2005-2025)

TABLE 3-10: BASED AIRCRAFT FORECAST (MARKET SHARE OF FAA REGISTERED AIRCRAFT IN HOOD RIVER COUNTY)

YEAR	BASED AIRCRAFT KEN JERNSTEDT AIRFIELD	FAA REGISTERED AIRCRAFT HOOD RIVER COUNTY[1]	% OF FAA REGISTERED AIRCRAFT AT KEN JERNSTEDT AIRFIELD
Historic			
2014	**208**	**245**	**85%**
Forecast – Decreasing Share (0.78% AAR) [2]			
2019	217	261	83%
2024	225	278	81%
2029	235	297	79%
2034	243	316	77%
Forecast – Constant Share (1.29% AAR) [2]			
2019	222	261	85%
2024	236	278	85%
2029	252	297	85%
2034	269	316	85%
Forecast – Increasing Share (1.52% AAR) [2]			
2019	225	261	86%
2024	242	278	87%
2029	261	297	88%
2034	281	316	89%

Source: Based aircraft - airport records, 2004 ALP Report; Registered Aircraft – FAA
1. Hood River County FAA-registered aircraft projections based on statewide forecast growth (1.28%) the of general aviation fleet (2007 OAP)
2. AAR: average annual rate of growth (2014-2034)

U.S. Active General Aviation Fleet Market Share

In 2014, Ken Jernstedt Airfield accounted for approximately 0.102 percent of the U.S. active general aviation fleet, up from 0.041 percent in 2003. The increase reflects the addition of 118 WAAAM aircraft to the airport's based aircraft fleet, which has more than doubled since 2003. Projections were developed based on *increasing, constant, and decreasing* market share. The forecasts are presented in **Table 3-11**.

The FAA Aerospace Forecast 2014-2034 projects the active general aviation fleet to grow at an average annual rate of 0.5 percent between 2013 and 2034. The U.S. fleet is projected to increase from 202,865 in 2013 to 225,700 in 2034. The modest net increase of 22,835 aircraft over 21 years is tempered by fleet attrition.

The *decreasing* market share forecast gradually reduces Ken Jernstedt Airfield's market share from 0.102 to 0.097 percent. The projection results in a small increase from 209 to 219 based aircraft at Ken Jernstedt Airfield by 2034, which represents an average annual decline of **0.26 percent**. This projection assumes that Ken Jernstedt Airfield's growth in based aircraft will increase at approximately half the forecast rate as the U.S. fleet (0.26% vs 0.50%). The lower growth projection reflects a combination of factors, including

competition from other airports within the local airport service area and ability to accommodate demand for facilities and services.

The *constant* market share forecast maintains Ken Jernstedt Airfield's current market share at 0.102 percent. The projection results in an increase from 208 to 231 based aircraft by 2034, which represents an average annual growth rate of **0.53 percent**. This projection assumes that Ken Jernstedt Airfield's growth in based aircraft will mirror the national average over the next twenty years, which suggests an ability to respond to demand for facilities and services.

The *increasing* market share forecast gradually increases Ken Jernstedt Airfield's share of the active U.S. fleet from 0.102 to 0.107 percent. The projection results in an increase from 208 to 242 based aircraft at Ken Jernstedt Airfield by 2034, which represents an average annual growth rate of **0.76 percent**. This projection assumes that Ken Jernstedt Airfield's growth in based aircraft will exceed the forecast average annual growth rate for the overall fleet by approximately 50 percent (0.76% vs 0.50%). As with the other increased market share projection, the underlying strength of the local area and the Airport's ability to attract and accommodate new aircraft are key factors in outperforming broader markets.

TABLE 3-11: BASED AIRCRAFT FORECAST (MARKET SHARE OF US ACTIVE GA AIRCRAFT)

YEAR	BASED AIRCRAFT KEN JERNSTEDT AIRFIELD	U.S. ACTIVE GENERAL AVIATION AIRCRAFT[1]	% OF U.S. ACTIVE GA AIRCRAFT BASED AT KEN JERNSTEDT AIRFIELD
Historic			
2003	86	209,606	0.0041029
2014	208	203,020	0.0102453
Forecast – Decreasing Share (0.26% AAR) [2]			
2019	209	205,140	0.0101882
2024	211	209,040	0.0100938
2029	214	215,840	0.0100099
2034	219	225,700	0.0097032
Forecast – Constant Share (0.53% AAR) [2]			
2019	210	205,140	0.0102453
2024	214	209,040	0.0102453
2029	221	215,840	0.0102453
2034	231	225,700	0.0102453
Forecast – Increasing Share (0.76% AAR) [2]			
2019	216	205,140	0.0105294
2024	224	209,040	0.0107157
2029	233	215,840	0.0107950
2034	242	225,700	0.0107222

Source: Based aircraft- airport records, 2004 ALP Report; Registered Aircraft – FAA
1. FAA Aerospace Forecasts 2014-2034
2. AAR: annual average rate of growth (2014-2034)

Ken Jernstedt Airfield: Hood River County Population

Available data indicate that the non-WAAAM based aircraft fleet at Ken Jernstedt Airfield has grown at a rate comparable to Hood River County population over the last 20 years. Since 2000, the ratio of non-WAAAM aircraft based at Ken Jernstedt Airfield to Hood River County population has fluctuated between 3.86 and 4.02 aircraft per 1,000 residents. The addition of 118 active WAAAM aircraft to the Ken Jernstedt Airfield based aircraft fleet over the last ten years significantly skews the ratio of based aircraft to population upward (currently 8.93 aircraft per 1,000). Although this measure of activity accurately reflects current conditions relative to population, the order of magnitude change experienced (≈130 percent) is highly unique and the net increase within the period should not be assumed as a predictor of future growth.

The Oregon Office of Economic Analysis (OEA) 2010-2050 population forecast for Hood River County (see Table 3-5) was used to support this projection. Projections were developed based on *increasing, constant, and decreasing* based aircraft to population ratios. The forecasts are presented in **Table 3-12**.

The *decreasing* population ratio forecast gradually decreases Ken Jernstedt Airfield's based aircraft to population ratio from 8.9 to 7.0 per 1,000 Hood River County residents over the next twenty years. The projection results in an increase from 208 to 222 based aircraft at Ken Jernstedt Airfield by 2034, which represents an average annual increase of **0.33 percent**. This projection assumes that Ken Jernstedt Airfield's based aircraft fleet will grow at a slower rate as Hood River County population over the next twenty years.

The *constant* population ratio forecast maintains Ken Jernstedt Airfield's based aircraft to population ratio of 8.9 aircraft per 1,000 Hood River County residents through the twenty year planning period. The projection results in an increase from 208 to 281 based aircraft at Ken Jernstedt Airfield by 2034, which represents an average annual growth rate of **1.51 percent**. This projection assumes that Ken Jernstedt Airfield's based aircraft fleet will grow at the same rate as Hood River County population over the next twenty years.

The *increasing* population ratio forecast gradually increases Ken Jernstedt Airfield's based aircraft to population ratio from 8.9 to 9.6 per 1,000 Hood River County residents over the next twenty years. The projection results in an increase from 208 to 303 based aircraft at Ken Jernstedt Airfield by 2034, which represents an average annual growth rate of **1.90 percent.** This projection assumes that Ken Jernstedt Airfield's based aircraft fleet will continue to grow at a slightly faster rate than Hood River County population over the next twenty years.

TABLE 3-12: BASED AIRCRAFT FORECAST (BASED AIRCRAFT PER 1,000 HOOD RIVER COUNTY RESIDENTS)

YEAR	BASED AIRCRAFT KEN JERNSTEDT AIRFIELD	HOOD RIVER COUNTY POPULATION[1]	BASED AIRCRAFT PER 1,000 RESIDENTS
Historic			
2003	86	21,487	4.0
2014	208	23,295	8.9
Forecast – Decreasing Share (0.33% AAR) [2]			
2019	214	25,225	8.5
2024	219	27,373	8.0
2029	221	29,536	7.5
2034	222	31,513	7.0
Forecast – Constant Share (1.51% AAR) [2]			
2019	225	25,225	8.9
2024	244	27,373	8.9
2029	263	29,536	8.9
2034	281	31,513	8.9
Forecast – Increasing Share (1.90% AAR) [2]			
2019	227	25,225	9.0
2024	252	27,373	9.2
2029	278	29,536	9.4
2034	303	31,513	9.6

Source: Based aircraft - airport records, 2004 ALP Report; Registered Aircraft – FAA
1. Oregon Office of Economic Analysis 2010-2050 forecasts
2. AAR: annual average rate of growth (2014-2034)

Recommended Forecast - Based Aircraft

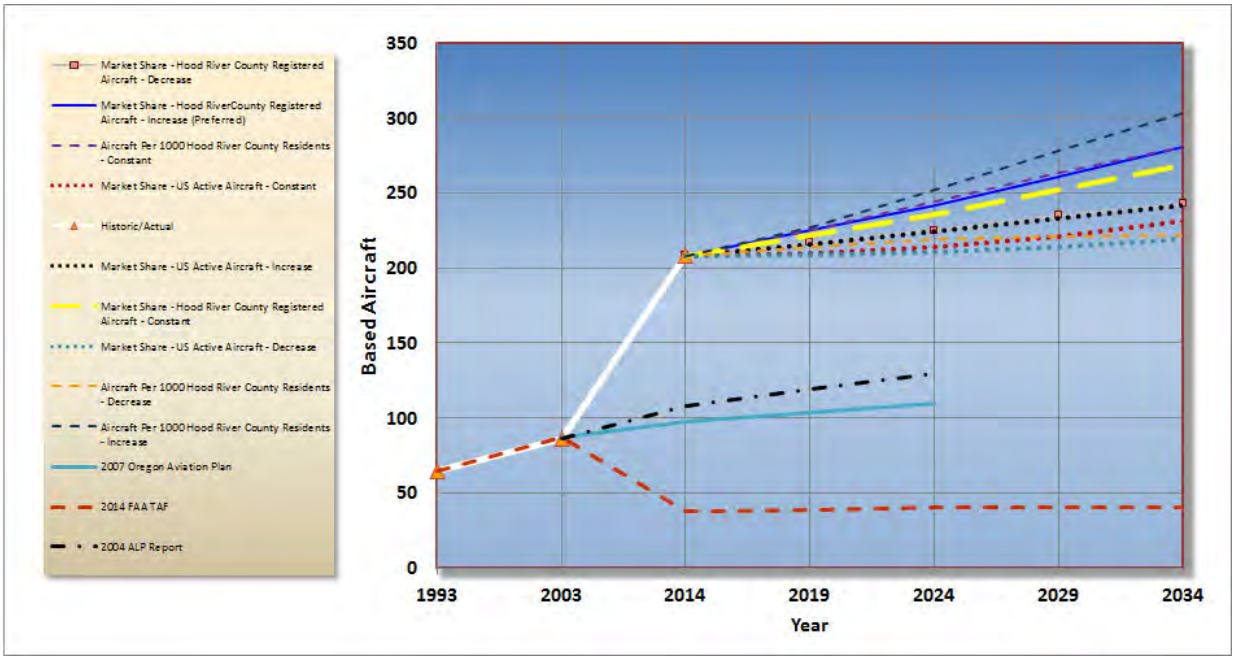
The *Increasing Market Share* projection is recommended as the preferred based aircraft forecast for use in the master plan. The forecast has an average annual growth rate of **1.52 percent** between 2014 and 2034. This projection relies on two key assumptions: 1.) FAA-registered aircraft in Hood River County will grow during the planning period at the same average annual rate (1.28%) as forecast for the State of Oregon in the current Oregon Aviation Plan. 2.) Ken Jernstedt Airfield's share of FAA-registered aircraft in Hood River County will increase. The ability to increase market share at Ken Jernstedt Airfield requires proactive facility improvement (hangar space, etc.) and the ability to accommodate demand for services (FBO services, fuel, etc.). Another significant factor in this projection is the continued expansion of active display aircraft at WAAAM.

Table 3-13 summarizes the based aircraft forecasts. **Figure 3-3** depicts the based aircraft forecasts.

TABLE 3-13: SUMMARY OF BASED AIRCRAFT FORECASTS (KEN JERNSTEDT AIRFIELD)

	2014 (ACTUAL)	2019	2024	2029	2034
Market Share of Registered Aircraft (Hood River County)					
Decreasing Market Share	208	217	225	235	243
Constant Market Share	208	222	236	252	269
Increasing Market Share (Preferred Forecast)	**208**	**225**	**242**	**261**	**281**
Market Share of U.S. Active GA Aircraft					
Decreasing Market Share	208	209	211	214	219
Constant Market Share	208	210	214	221	231
Increasing Market Share	208	216	224	233	242
Aircraft Per 1,000 Residents (Hood River County)					
Decreasing Market Share	208	214	219	221	222
Constant Market Share	208	225	244	263	281
Increasing Market Share	208	227	252	278	303

FIGURE 3-3: KEN JERNSTEDT AIRFIELD - BASED AIRCRAFT FORECASTS



BASED AIRCRAFT FLEET MIX

The airport's current mix of based aircraft includes single engine and multi-engine piston aircraft, gliders and helicopters. **Figures 3-4A and 3-4B** depict the current (2014) and long term (2034) distribution of based aircraft by type. **Table 3-14** summarizes the projected based aircraft fleet mix for the planning period. The table separates airport and residential "through-the-fence" aircraft from WAAAM active aircraft. The based aircraft fleet mix during the planning period is expected to continue being predominantly single-engine piston aircraft and gliders, with a growing number of multi-engine piston aircraft, turboprops and helicopters.

TABLE 3-14: GENERAL AVIATION FORECAST BASED AIRCRAFT FLEET MIX

ACTIVITY	2014	2019	2024	2029	2034
Airport and Off-Airport (Residential TTF) Aircraft					
Single Engine Piston	74	81	87	94	100
Multi-Engine Piston	0	1	1	2	2
Turboprop	0	0	1	2	3
Business Jet/VLJ	0	0	0	0	1
Glider	14	14	14	15	16
Helicopter	2	2	3	3	4
Total Based Aircraft	90	98	106	116	126
WAAAM Aircraft					
Single Engine Piston	116	123	131	140	149
Multi-Engine Piston	2	4	5	5	6
Total WAAAM (Active) Aircraft	118	127	136	145	155
Total Based Aircraft (all)	208	225	242	261	281

FIGURE 3-4A: KEN JERNSTEDT AIRFIELD - BASED AIRCRAFT FLEET MIX (NOVEMBER 2014)

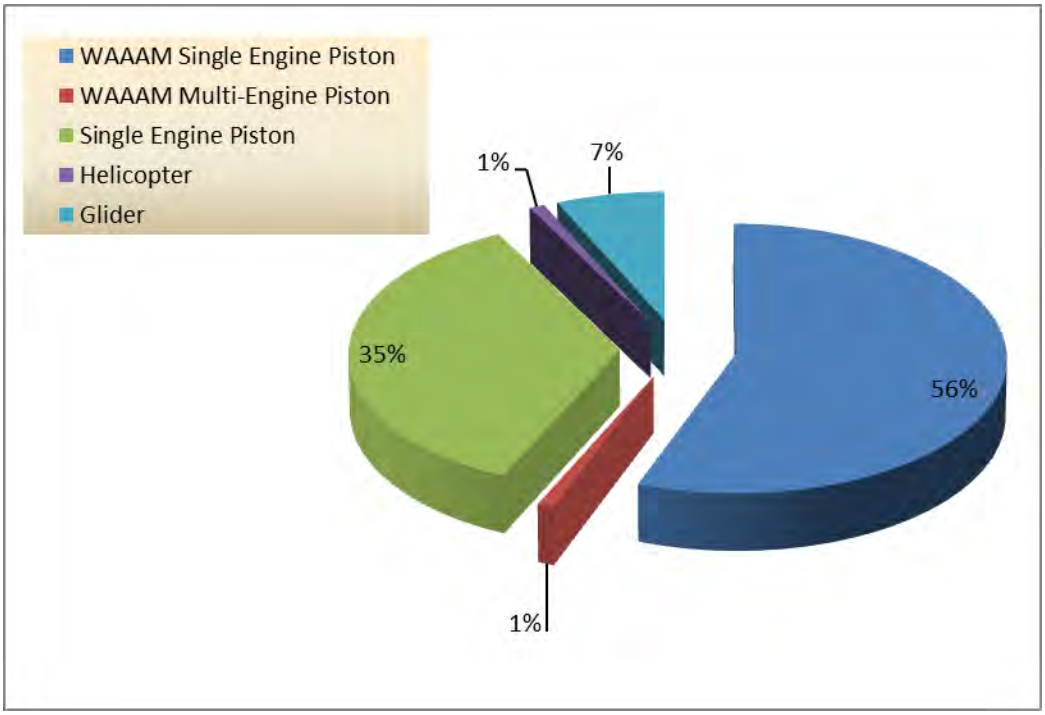
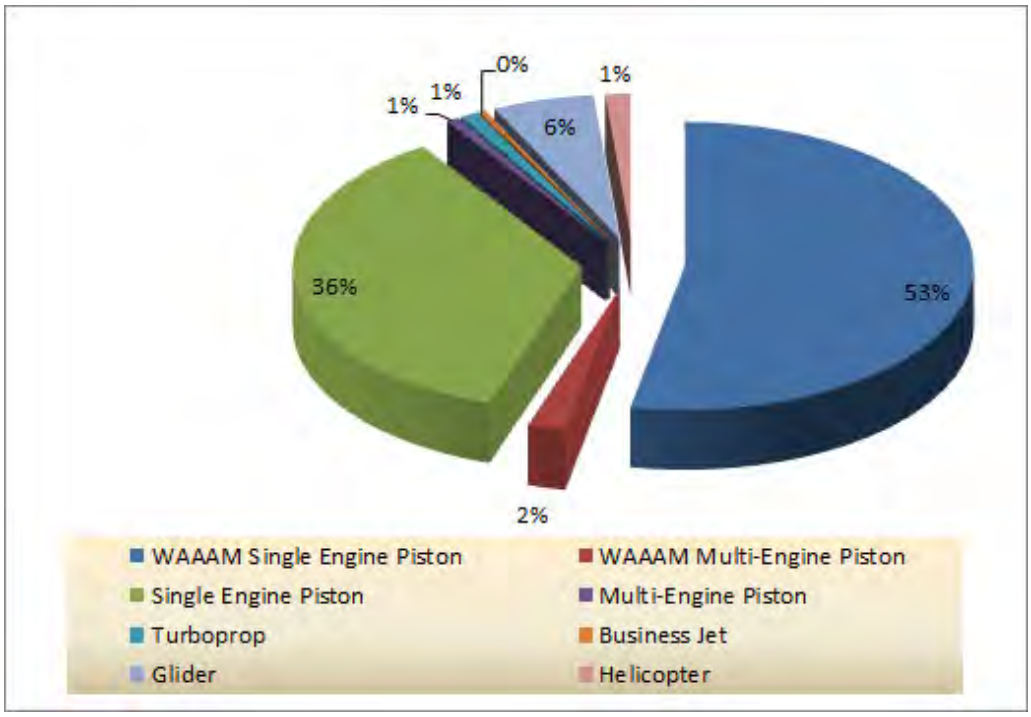


FIGURE 3-4B: KEN JERNSTEDT AIRFIELD – FORECAST BASED AIRCRAFT FLEET MIX (2034)



AIRCRAFT OPERATIONS

Updated aircraft operations projections have been developed for comparison with existing forecasts in order to identify a selected forecast for the master plan. The updated operations forecasts utilize the 2014 estimate (14,850) as the base for new projections. The current estimate reflects a ratio of 165 operations per non-WAAAM based aircraft (90 x 165 = 14,850) based on historic activity trends.

Consistent with the methodology used in the 2004 ALP Report forecasts, the updated aircraft operations forecasts utilize ratios of operations to based aircraft to reflect activity generated by locally-based and transient aircraft. The preferred forecast in the 2004 Airport Layout Plan Report yielded an increasing ratio of 165 to 180 general aviation operations per based aircraft and an average annual growth rate of 2.46 percent.

The updated operations forecasts generally reflect lower growth rates than the 2004 ALP Report forecasts, due in large part to the impact of economic conditions and the current long-term growth expectations nationally, which have been tempered significantly compared to "pre-recession" forecasts.

Constant & Increasing Operations Ratios

Based on the conditions for the local airport service described earlier in the chapter, two scenarios have been developed for aircraft operations. The updated aircraft operations forecasts are summarized in **Table 3-15** and depicted in **Figure 3-5**. The current FAA TAF aircraft operations forecast is also presented in **Table 3-15** for comparison.

The first forecast (**constant ratio projection)** maintains the 165 operations per (non-WAAAM) based aircraft ratio through the twenty-year planning period that was used to estimate current activity. The projection assumes that aircraft utilization will remain at current levels as the airport maintains its competitive position in the service area. Future growth in aircraft operations is driven primarily by a net increase in based aircraft and the ability to retain the current user base. The forecast is compatible with current airfield capabilities and the aircraft operational fleet mix would not change significantly.

The second forecast (**Increasing ratio projection)** assumes a gradual increase from 165 to 180 operations per (non-WAAAM) based aircraft through the planning period. The projection assumes that aircraft utilization will gradually increase above current levels as the airport captures a larger share of transient aviation activity within the service area. The increase in aircraft utilization also reflects the underlying strength of the local economy and the ability to attract increased transient aircraft.

The constant ratio projection results in general aviation aircraft operations increasing from 14,850 to 20,790 by 2034, which represents an average annual growth rate of **1.70 percent.** The increasing ratio projection results in general aviation aircraft operations increasing from 14,850 to 22,680 by 2034, which represents an average annual growth rate of **2.14 percent.**

TABLE 3-15: AIRCRAFT OPERATIONS FORECASTS

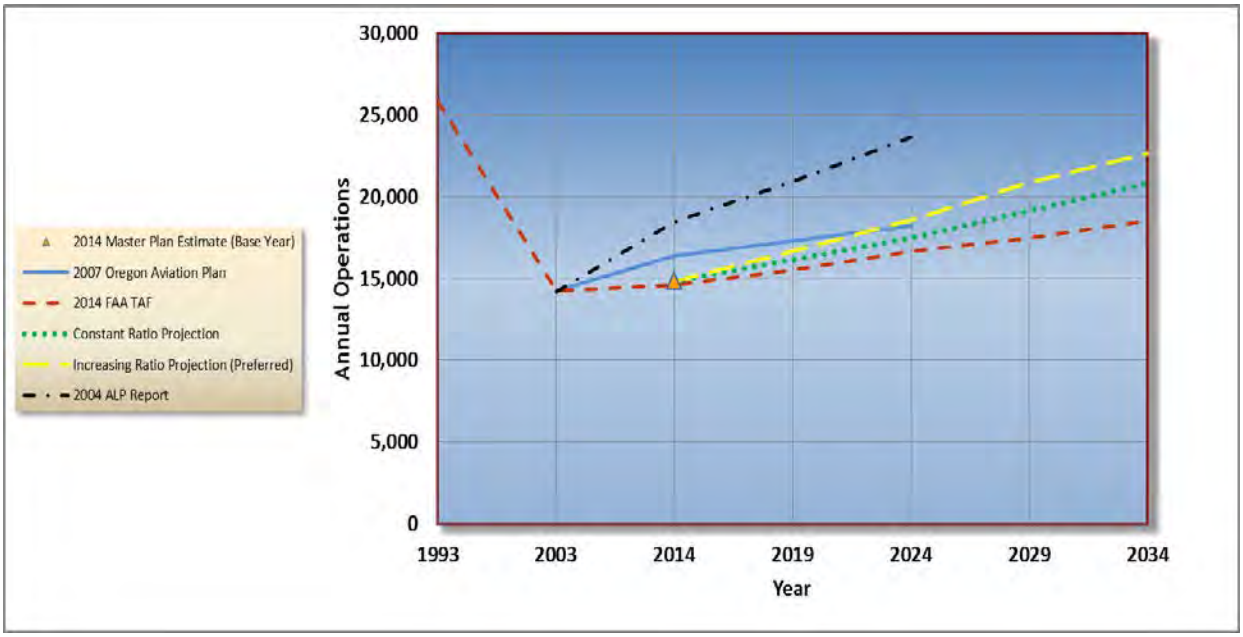
YEAR	BASED AIRCRAFT[1]	LOCAL OPERATIONS	ITINERANT OPERATIONS	TOTAL OPERATIONS	OPERATIONS PER BASED AIRCRAFT
FAA TAF					
2014	37	4,313	10,276	14,589	384
2019	39	4,597	10,939	15,536	398
2024	40	4,881	11,602	16,483	412
2029	40	5,174	12,285	17,459	436
2034	40	5,487	13,012	18,499	462
Constant Ratio Projection (1.70% AAR)					
2014	90	4,455	10,395	14,850	165
2019	98	4,851	11,319	16,170	165
2024	106	5,247	12,243	17,490	165
2029	116	5,742	13,398	19,140	165
2034	126	6,237	14,553	20,790	165
Increasing Ratio Projection (2.14% AAR) (Preferred Forecast)					
2014	90	4,455	10,395	14,850	165
2019	98	4,938	11,662	16,660	170
2024	106	5,565	12,985	18,550	175
2029	116	6,264	14,616	20,880	180
2034	126	6,804	15,876	22,680	180

1. Non-WAAAM based aircraft; see Table 3-14

Summary (Aircraft Operations)

The *Increasing Ratio Operations Forecast* is recommended for use in the airport master plan. This forecast assumes that the airport will be successful in building on current market share and maintaining an active locally-based aircraft community. It is evident that the economic base that exists in the Hood River area, including the continued development and visitor attraction of WAAAM, provides a solid airport user base that is capable of sustaining aviation activity through the current planning period and beyond.

FIGURE 3-5: KEN JERNSTEDT AIRFIELD GENERAL AVIATION OPERATIONS FORECAST



Local and Itinerant Operations

General aviation operations consist of aircraft takeoffs and landings conducted by general aviation aircraft and are classified as local or itinerant. Local operations are conducted in the vicinity of an airport and include flights that begin and end the airport. These include local area flight training, touch and go landings, flightseeing, glider operations and other flights that do not involve a landing at another airport. Itinerant operations include flights between airports, including cross country flights. Itinerant operations reflect specific travel between multiple points, often associated with business and personal travel.

The FAA TAF and the 2004 ALP Report forecasts reflect a 30 percent local and 70 percent itinerant traffic distribution for forecast operations. The 30/70 percent split is maintained in the updated operations forecast. Local and itinerant data for each forecast year are summarized in **Table 3-19**.

Aircraft Operations Fleet Mix

The aircraft operations fleet mix is expected to be similar to the airport's based aircraft fleet mix, which anticipates slightly more diverse air traffic including turbine fixed wing aircraft including single-engine turboprops, multi-engine turboprops, and small jets that are capable of operating on the current runway.

Currently, single and multi-engine piston aircraft account for approximately 94 percent of airport operations followed by helicopter, turboprop, and glider operations. Although single engine piston aircraft will continue to generate the majority of aircraft operations at Ken Jernstedt Airfield through the planning

period, their portion of overall traffic is expected to gradually decline as other aircraft types become more common. The general aviation forecast aircraft operations fleet mix is summarized in **Table 3-16**.

TABLE 3-16: GENERAL AVIATION FORECAST AIRCRAFT OPERATIONS FLEET MIX

AIRCRAFT TYPE	2014	%	2019	%	2024	%	2029	%	2034	%
Single Engine Piston	13,670	92	15,300	92	16,900	91	19,040	91	20,600	90
Multi Engine Piston	300	2	320	2	370	2	400	2	440	2
Turboprop	200	1	230	1	380	2	420	2	460	2
Jet	0	0	10	<1	10	<1	20	<1	60	<1
Glider	280	2	300	2	350	2	400	2	420	2
Helicopter	400	3	500	3	540	3	600	3	700	3
Total Operations (100%)	**14,850**	**100**	**16,660**	**100**	**18,550**	**100**	**20,880**	**100**	**22,680**	**100**
Note: Percentages may not sum due to independent rounding										

Critical Aircraft

As noted earlier, the selection of design standards for airfield facilities is based upon the characteristics of the aircraft that are expected to use the airport. This aircraft or aircraft type is designated as the "critical aircraft." The FAA provides the following definitions:

"The critical aircraft is the most demanding aircraft type, or grouping of aircraft with similar characteristics, that make regular use of the airport. Regular use is 500 annual operations, including both itinerant and local operations, but excluding touch-and-go operations. An operation is either a takeoff or landing." [21]

The FAA groups aircraft into five categories (A-E) based upon their approach speeds. Aircraft Approach Categories A and B include small propeller aircraft, many small or medium business jet aircraft, and some larger aircraft with approach speeds of less than 121 knots (nautical miles per hour). Categories C, D, and E consist of the remaining business jets as well as larger jet and propeller aircraft generally associated with commercial and military use with approach speeds of 121 knots or more. The FAA also establishes six airplane design groups (I-VI), based on the wingspan and tail height of the aircraft. The categories range from Airplane Design Group (ADG) I, for aircraft with wingspans of less than 49 feet, to ADG VI for the largest commercial and military aircraft.

[21] FAA Advisory Circular (AC) 150/5000-17 Critical Aircraft and Regular Use Determination

The combination of airplane design group and aircraft approach speed for the design aircraft creates the Runway Design Code (RDC) and Airport Reference Code (ARC), which is used to define applicable airfield design standards. Aircraft with a maximum gross takeoff weight greater than 12,500 pounds are classified as "large aircraft" by the FAA; aircraft 12,500 pounds and less are classified as "small aircraft."

A list of typical general aviation and business aviation aircraft and their respective design categories is presented in **Table 3-17. Figure 3-6** illustrates representative aircraft in various design groups.

TABLE 3-17: GENERAL AVIATION AIRCRAFT & DESIGN CATEGORIES

AIRCRAFT	AIRCRAFT APPROACH CATEGORY	AIRPLANE DESIGN GROUP	MAXIMUM GROSS TAKEOFF WEIGHT (LBS)
Cessna 182 (Skylane)	A	I	3,100
Cirrus Design SR22	A	I	3,400
Cessna 206 (Stationair)	A	I	3,614
Beechcraft Bonanza A36	A	I	3,650
Socata/Aerospatiale TBM 700	A	I	6,579
Beechcraft Baron 58	B	I	5,500
Cessna 340	B	I	5,990
Cessna Citation Mustang	B	I	8,645
Embraer Phenom 100	B	I	10,472
Cessna Citation CJ1+	B	I	10,700
Beech King Air C90	B	I	11,800
Beechcraft 400A/Premier I	B	I	16,100
Piper Malibu (PA-46)	A	II	4,340
Cessna Caravan 675	A	II	8,000
Pilatus PC-12	A	II	10,450
Cessna Citation CJ2+	B	II	12,500
Cessna Citation II	B	II	13,300
Beech King Air 350	B	II	15,000
Cessna Citation Bravo	B	II	15,000
Cessna Citation CJ4	B	II	16,950
Source: AC 150/5300-13, as amended; aircraft manufacturer data.			

				
A-I *12,500 lbs. or less (small)*	**B-I** *12,500 lbs. or less (small)*	**A-II, B-II** *12,500 lbs. or less (small)*	**B-II** *Greater than 12,500 lbs.*	**A-III, B-III** *Greater than 12,500 lbs.*
Beech Baron 55 Beech Bonanza **Cessna 182** Piper Archer Piper Seneca	**Beech Baron 58** Beech King Air 100 Cessna 402 Cessna 421 Piper Navajo Piper Cheyenne Cessna Citation I	Super King Air 200 **Pilatus PC-12** DHC Twin Otter Cessna Caravan King Air C90	Super King Air 300, 350 Beech 1900 **Cessna Citation Excel** Falcon 20, 50 Falcon 200, 900 Citation II, Bravo XLS+ Citation CJ3	DHC Dash 7, Dash 8 **Q-200, Q-300** DC-3 Convair 580 Fairchild F-27 ATR 72 ATP
				
C-I, D-I **Lear 25, 35, 55, 60** Israeli Westwind HS 125-700	**C-II, D-II** Gulfstream II, III, IV **Canadair 600** Canadair Regional Jet Lockheed JetStar Citation X Citation Sovereign Hawker 800 XP	**C-III, D-III** Boeing Business Jet **Gulfstream 650** B 737-300 Series MD-80, DC-9 Q-400 A319, A320 Gulfstream V Global Express	**C-IV, D-IV** **B-757** B-767 DC - 8-70 DC - 10 MD - 11 L 1011	**D-V** **B - 747 Series** B - 777

Current and Future Critical Aircraft

Based on current and forecast air traffic, ADG II appears to be the appropriate current and future design group for the current planning period. This activity includes aerial applicator aircraft, gliders, small single and multi-engine piston and turbine, and small jets. The airport has experienced an increase in glider activity in recent years. A review of 2017 aerial photography identified six gliders parked on the airport (south side of runway), including several ADG II aircraft. In addition to existing aerial applicator and glider activity, an increase in ADG II single-engine turboprops, including the Cessna Caravan (C208) and the Pilatus PC-12 is anticipated based on both the current capabilities of the airport and the ongoing trends in aircraft manufacturing. The airport is also expected to see an increase in other turbine aircraft operations, including small or very small business jets (ADG I) that are capable of operating on relatively short runways. Current models include the Cessna Mustang and Citation M2, Pilatus PC-24, Eclipse 550, Embraer Phenom 100, and HondaJet.

It appears that the majority of existing ADG II aircraft using the airport are operate on the current 3,040-foot runway with minimal constraints (reduced fuel or payload). The most demanding aircraft for determining current runway length requirements appears to be a typical multi-engine piston aircraft, such as a Beechcraft Baron 58, which is included in ADG I.

Existing Airport Reference Code (ARC): A-II Small (single-engine turboprop). These glider aircraft are classified as a "small" aircraft based on their maximum operating weights (less than 12,500 pounds).

Future Airport Reference Code (ARC): B-II Small (multi-engine turboprop or business jet). This aircraft is classified as a "large" aircraft based on their maximum operating weights (more than 12,500 pounds).

Air Taxi and Military Operations

Air taxi activity includes operations regulated by the FAA under FAR Part 135, including on-demand passenger service (charter and fractional), small parcel transport (cargo), and air ambulance activity. Air taxi activity at Ken Jernstedt Airfield currently includes occasional charter and air ambulance flights. Some aerial firefighting activity is conducted by contractors operating under FAR Part 135. The FAA TAF projects 200 annual air taxi operations for Ken Jernstedt Airfield through 2040, which accounts for about 1 percent of total operations. Maintaining this level of air taxi activity appears to be reasonable for planning purposes.

Military operations at Ken Jernstedt Airfield are relatively limited, consisting primarily of Oregon National Guard helicopters and smaller fixed wing aircraft. This activity is typically in support of emergency response operations. The FAA TAF projects 60 annual military operations for Ken Jernstedt Airfield through 2040, which accounts for less than 1 percent of total operations. Maintaining this level of military activity appears to be reasonable.

Air taxi and military operations forecasts are summarized in **Table 3-19**.

Operational Peaks

It is estimated that peak month activity at Ken Jernstedt Airfield occurs during the summer (typically July or August) and accounts for approximately 12 percent of annual aircraft operations. This level of peaking is consistent with the mix of airport traffic and is expected to remain relatively unchanged during the planning period. Peak day operations are defined by the average day in the peak month (design day) and the busy day in the typical week during peak month (busy day); the peak hour within the design day represents the design hour. The design day is calculated by dividing peak month operations by 30. The busy day is estimated to be 25 percent higher than the average day in the peak month (design day x 1.25). The design hour operations are estimated to equal 15 percent of design day operations. Operational peaks for each of the forecast scenarios are summarized in **Table 3-18**.

TABLE 3-18: PEAK GENERAL AVIATION OPERATIONS FORECAST

ACTIVITY	2014	2019	2024	2029	2034
Annual Operations	14,850	16,660	18,550	20,880	22,680
Peak Month Operations (12%)	1,782	1,999	2,226	2,506	2,722
Design Day (average day in peak month)	59	67	74	84	91
Busy Day	74	83	93	104	113
Design Hour Operations (assumed 15% of design day)	9	10	11	13	14

Instrument Flight Activity

Ken Jernstedt Airfield is not currently equipped to accommodate instrument flight activity. Previous FAA evaluations on the feasibility of establishing an instrument approach to the airport indicated the need for high approach minimums due to the proximity to mountainous terrain. The consensus FAA opinion is that while developing an approach may be technically feasible, the effectiveness of the approach in actual instrument weather conditions would be very limited.

Forecast Summary

The summary of based aircraft and annual aircraft operations forecasts is provided in **Table 3-19.** As with any long term facility demand forecast, it is recommended that long term development reserves be protected to accommodate demand that may exceed current projections. For planning purposes, a reserve capable of accommodating a doubling of the 20-year preferred forecast demand for based aircraft should be adequate to accommodate unforeseen facility needs during the current planning period. However, should demand significantly deviate from the airport's recent historical trend, updated forecasts should be prepared to ensure that adequate facility planning is maintained.

TABLE 3-19: FORECAST SUMMARY

ACTIVITY	2014	2019	2024	2029	2034
ANNUAL OPERATIONS					
Itinerant					
General Aviation	10,135	11,402	12,725	14,356	15,616
Air Taxi	200	200	200	200	200
Military	60	60	60	60	60
Total Itinerant	10,395	11,662	12,985	14,616	15,876
Local (all General Aviation)	4,455	4,998	5,565	6,264	6,804
Total Operations	14,850	16,660	18,550	20,880	22,680
BASED AIRCRAFT					
Single Engine Piston	190	204	218	234	249
Multi-Engine Piston	2	5	6	7	8
Turboprop	0	0	1	2	3
Business Jet/VLJ	0	0	0	0	1
Glider	14	14	14	15	16
Helicopter	2	2	3	3	4
Total Based Aircraft (including WAAAM)	**208**	**225**	**242**	**261**	**281**
Subtotal WAAAM Aircraft	*118*	*127*	*136*	*145*	*155*

Fifty-Year Forecast

Per the airport master plan project scope of work, fifty-year demand forecasts were prepared by extrapolating the average annual growth rates (AAGR) for the recommended 20-year based aircraft and aircraft operations forecasts. The purpose of the 50-year projection is to provide an estimate of demand that can be used to approximate long-term aviation use land requirements for the airport. **Table 3-20** summarizes the 50-year, and intermediate 30- and 40-year based aircraft and aircraft operations

TABLE 3-20: 50-YEAR FORECAST

ACTIVITY	2014	2034	2044	2054	2064
Annual Operations	14,850	22,680	28,029	34,639	42,807
Based Aircraft	208	269	306	348	396

Chapter 4 – Airport Facility Requirements

Chapter 4 – Airport Facility Requirements

The evaluation of airport facility requirements uses the results of the inventory and forecasts contained in Chapters Two and Three, as well as established planning criteria, to determine the future facility needs for Ken Jernstedt Airfield through the current twenty-year planning period.

Note: The initial evaluation of airfield facility requirements for Ken Jernstedt Airfield was based on Airplane Design Group II (ADG II) standards defined for large airplanes (above 12,500 pounds). However, based on subsequent evaluations and extended coordination between the Port of Hood River and the FAA Seattle Airports District Office (ADO), it was determined that ADG II standards defined for small airplanes (12,500 pounds and less) were appropriate for Runway 7/25. This change in design criteria reduces the dimensions of several protected areas/development setbacks related to the runway. These include two airport design elements (runway obstacle free zone (OFZ) and runway protection zones (RPZ)) and three airspace surfaces defined in FAR Part 77 (primary surface, transitional surface, and the runway approach surfaces). These changes are reflected in this chapter and in the recommended preferred alternative depicted on the final Airport Layout Plan (ALP) drawing.

Introduction

Airside facilities include runways, taxiways, navigational aids and lighting systems. **Landside** facilities include hangars, fixed base operator (FBO) facilities, aircraft parking apron, aircraft fueling, surface access and automobile parking, utilities, and other related items. All airfield items are evaluated based on established standards from the Federal Aviation Administration (FAA).

The facility requirements evaluation is used to identify the adequacy or inadequacy of existing airport facilities and identify what new facilities may be needed during the planning period based on forecast demand. Potential options and preliminary costs for providing these facilities will be evaluated in the - Airport Development Alternatives (Chapter Five), to determine the most cost effective and efficient means for meeting projected facility needs.

Organization of Materials

This chapter evaluates facility requirements from two perspectives: (1) conformance of existing facilities with FAA airport design and airspace planning standards; and (2) new demand-based facility needs, consistent with the updated aviation activity forecasts presented in Chapter Three.

The evaluation of current and future conformance with FAA airport design standards and airspace planning criteria will be reflected on the updated FAA approved Airport Layout Plan. The evaluation of demand-driven items will reflect in gross numbers, new facility needs such as runway length requirements, hangar spaces and aircraft parking positions based on forecast demand and the needs of the design aircraft. Items such as lighting and navigational aids are evaluated based on the type of airport activity, airport classification and capabilities.

The updated inventory of existing facilities presented in Chapter Two, is used to evaluate conformance with FAA standards. **Figures 4-1, 4-2** and **4-3** illustrate the location of the non-conforming items identified in this chapter.

Previous Airport Layout Plan Overview

The 2004 Airport Layout Plan Report for Ken Jernstedt Airfield provided recommendations for airport facility improvements for a twenty-year planning period that extended to 2024. **Table 4-1** provides a summary of the previously recommended projects and their current status.

TABLE 4-1: SUMMARY OF THE PREVIOUS AIRPORT LAYOUT PLAN RECOMMENDED PROJECTS AND CURRENT STATUS

COMPLETED? YES/NO	PROJECTS
No	Property Acquisition NW corner of airport; site development for hangars
No	Reconstruct FBO Apron and Fueling Area
No	Construct Internal Access Road (in Rwy 7 RPZ)
No	Relocate Restaurant located in Rwy 7 RPZ (previous runway configuration)
No	Limited Reconstruct of South Parallel Taxiway (west end)
No	Airport Fencing (west/south sections) w/ 2 vehicle gates
No	Construct NW T-Hangar Taxilane
No	Construct T-Hangar #1 (8/10 units)
No	Airport Fencing (north section) w/ 2 vehicle gates
Yes	Relocate north parallel taxiway meet B-II runway separation standard (240 feet)
No	Airport Fencing (east section)
Yes	Shift Runway 7/25 east; maintain existing length; replace lighting; overlay existing runway
No	Demo original west end runway/taxiway pavement
Yes	Vacate Orchard Road near the Runway 25 end
Yes	REIL - Rwy 7 & 25
No	PAPI –Rwy 7 & 25
No	Construct NW T-Hangar Taxilane
No	Construct T-Hangar #2 (8/10 units)
No	North side landside improvements including: apron expansion, hangar sites, FBO building, fuel relocation
No	Reconstruct/Relocate south parallel taxiway based on B-II runway separation
No	Property Acquisition (N Section of airport); site development for hangars
No	Property Acquisition (NE Section of airport); site development for hangars
No	Property Acquisition (SE Section of airport) OFA, OFZ and Primary Surface Clearing
No	Overlay North Tiedown Apron
No	Overlay South Tiedown Apron

Design Aircraft

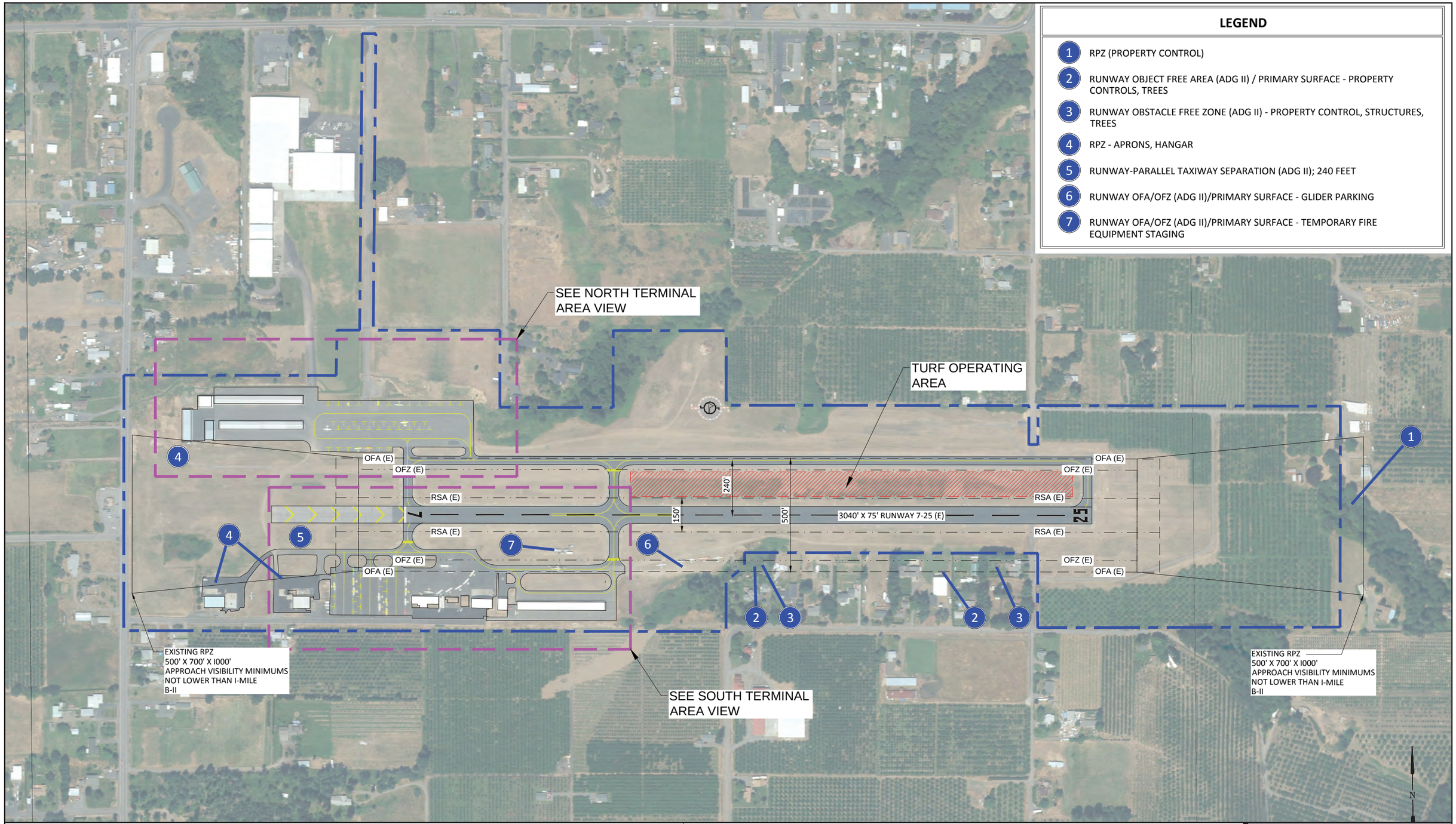
As indicated in Chapter Three (Aviation Activity Forecast), the current design aircraft identified for Ken Jernstedt Airfield is a single-engine turboprop, included in **Aircraft Approach Category A** and **Airplane Design Group II (Airport Reference Code - ARC: A-II Small).** The future design aircraft is identified a multi-engine turboprop, included in **Aircraft Approach Category B** and **Airplane Design Group II (Airport Reference Code - ARC: B-II Small).**

In addition to the powered ADG II aircraft noted above, Ken Jernstedt Airfield also accommodates several hundred ADG II (ARC A-II) glider operations annually. When combined with the powered ARC A/B-II aircraft, the composite of all ADG II activity meets the FAA's substantial use threshold of 500 annual operations. The Schleicher ASW20CL (54.4-foot wingspan) is representative of the larger (ADG II) gliders operating at the airport.

The following section describes the methods used by the Federal Aviation Administration (FAA) to define appropriate airport design standards.

Airport Design Standards

FAA **Advisory Circular 150/5300-13A**, Airport Design serves as the primary reference in planning airfield facilities. The FAA design standards are based on Airport Reference Code (ARC) (defined by airplane design group and aircraft approach speed) and taxiway design group. The physical dimensions and required setbacks for facilities typically increase as airfields are designed to accommodate larger aircraft or more demanding approach capabilities. A description of ARC criteria is provided in Chapter Three.



KEN JERNSTEDT AIRFIELD- HOOD RIVER | AIRPORT MASTER PLAN

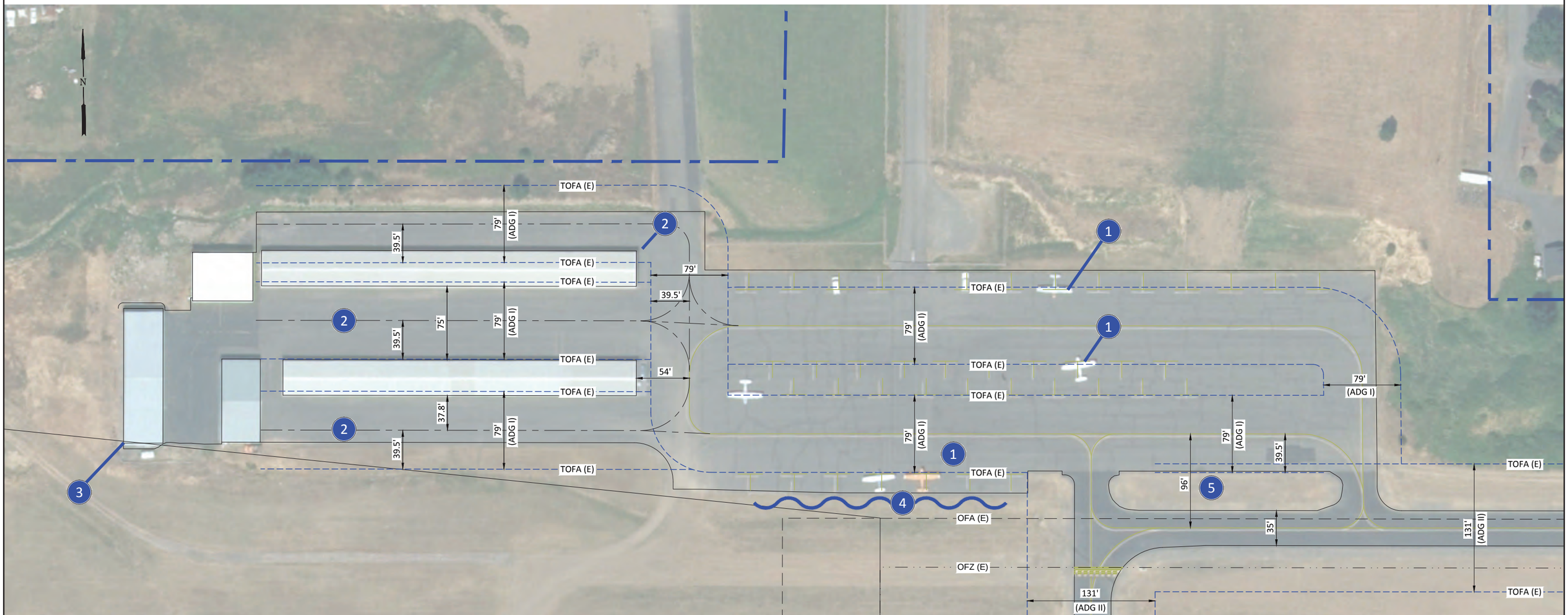
AIRSIDE CONFORMANCE | **FIG. 4-1**

CENTURY WEST ENGINEERING

LEGEND

1. TAXILANE OFA (ADG I) - AIRCRAFT PARKING TIEDOWN
2. TAXILANE OFA (ADG I) - HANGAR
3. RWY 7 RPZ - HANGAR
4. TRANSITIONAL SURFACE (PART 77) OBSTRUCTIONS - PARKED AIRCRAFT
5. TAXIWAY CL TO PARALLEL TAXILANE SEPERATION STANDARD (ADG II) - 105 FEET

NOTE : (TOFA) TAXIWAY OR TAXILANE OBJECT FREE AREA



KEN JERNSTEDT AIRFIELD- HOOD RIVER | AIRPORT MASTER PLAN

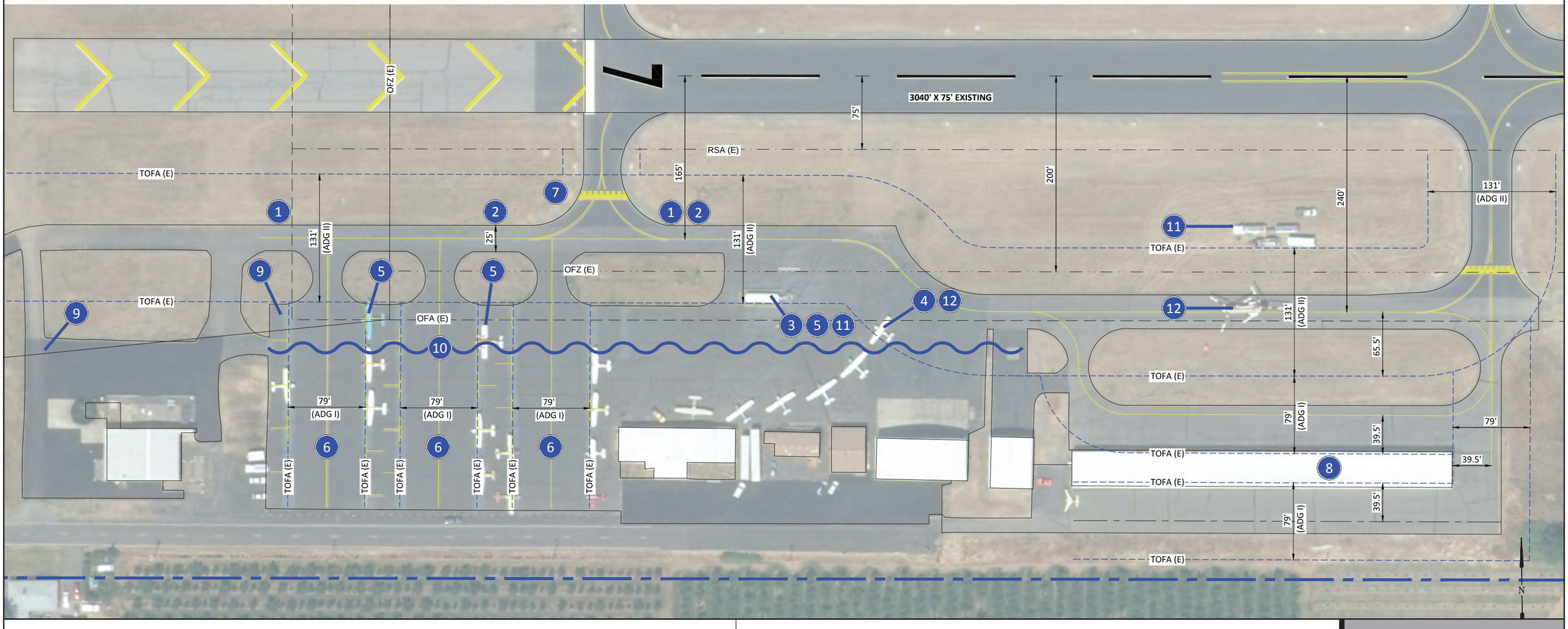
NORTH LANDSIDE AREA CONFORMANCE | **FIG. 4-2**

CENTURY WEST ENGINEERING

LEGEND

1. RUNWAY - PARALLEL TAXIWAY SEPARATION; 240 FEET (ADG II)
2. TAXIWAY WIDTH STANDARD; 35 FEET (ADG II)
3. TAXIWAY OFA (ADG II) - FUEL TANK
4. TAXIWAY OFA (ADG II) - PARKED AIRCRAFT
5. RUNWAY OFA (ADG II) - PARKED AIRCRAFT, FUEL TANK
6. TAXILANE OFA (ADG I) - PARKED AIRCRAFT
7. RUNWAY OFZ / AIRCRAFT HOLDLINE (ADG II)
8. TAXILANE OFA (ADG I) - HANGAR
9. RPZ - APRON
10. TRANSITIONAL SURFACE (PART 77) OBSTRUCTIONS - PARKED AIRCRAFT
11. RUNWAY OFA/OFZ/PRIMARY SURFACE (PART 77) OBSTRUCTION -TEMPORARY FIRE EQUIPMENT STAGING
12. PRIMARY SURFACE (PART 77) TEMPORARY PARKED AIRCRAFT

NOTE : (TOFA) TAXIWAY OR TAXILANE OBJECT FREE AREA



KEN JERNSTEDT AIRFIELD- HOOD RIVER | AIRPORT MASTER PLAN

SOUTH LANDSIDE AREA CONFORMANCE | **FIG. 4-3**

CENTURY WEST ENGINEERING

The current and future design standards for Ken Jernstedt Airfield are based on Airplane Design Group II and Approach Category A or B, which corresponds to ARC A-II Small or B-II Small. It should be noted that the FAA utilizes common design standards for Approach Category A and B aircraft in Airplane Design Group II Small.

Federal Air Regulations (FAR) Part 77.25, Objects Affecting Navigable Airspace, defines airport imaginary surfaces for runways which are used by aircraft during flight operations in the airport environment. The airspace surfaces begin at runway elevation and extend upward and outward along the approaches and from the sides of the runway. The defined airspace should be free of obstructions (e.g., structures and other built items, parked aircraft, terrain, trees, etc.) to the greatest extent possible to provide a safe operating environment for aircraft. Part 77 surface dimensions and slopes are determined by the category of runway (utility or larger than utility) and approach capabilities (visual, non-precision instrument, precision instrument).

The 2009 update of Airport Airspace Plan depicts ultimate Part 77 airspace surfaces consistent with "larger than utility" runways with visual approaches. These standards apply to runways that accommodate aircraft weighing more than 12,500 pounds. The airspace configuration is compatible with both standard visual approaches and instrument approaches with a "circling" procedure, where the pilot must establish and maintain visual contact with the runway environment prior to reaching the missed approach point while preparing to land. Based on previous instrument approach feasibility assessments and forecast activity, the recommended airspace planning criteria for Runway 7/25 is modified from the 2009 ALP to reflect small aircraft (utility). A comparison of existing conditions for Runway 7/25 and the current/future standards is summarized in **Table 4-2**. A summary of Ken Jernstedt Airfield's current conformance with the applicable standards is presented in **Table 4-3**.

TABLE 4-2: AIRPORT DESIGN STANDARDS SUMMARY (DIMENSIONS IN FEET)

FAA STANDARD	RUNWAY 7/25 *EXISTING CONDITIONS*[1]	AIRPORT REFERENCE CODE A/B-II SMALL[2] *APPROACH VISIBILITY ≥ 1 MILE*	CONFORMS TO FAA STANDARD (YES/NO)
Runway Length	3,040	3,760[8]	No*
Runway Width	75	75	Yes
Runway Shoulder Width	10	10	Yes
Runway Safety Area Width Beyond RWY End Prior to Landing Threshold	 150 300 300	 150 300 300	Yes
Obstacle Free Zone Width Beyond RWY End Prior to Landing Threshold	 400 200 200	 250 200 200	Yes
Object Free Area Width Beyond RWY End Prior to Landing Threshold	 500 300 300	 500 300 300	 No Yes Yes
Primary Surface Width	500	250	No
Primary Surface Length (Beyond RWY End)	200	200	Yes
Runway Protection Zone Length	1,000	1,000	Yes
Runway Protection Zone Inner Width	500	250	Yes
Runway Protection Zone Outer Width	700	450	Yes
Runway Centerline to: Parallel Taxiway/Taxilane Centerline Building Restriction Line (BRL)	 240/165[3] 376-402[4]	 240 251/306[9]	 Yes (North Par.) Yes
Taxiway Width	≤35[6]	35	Yes (North Par.) No (South Par.)
Taxiway Shoulder Width	10	10	Yes
Taxiway Safety Area Width	79	79	Yes (North Par.) No (South Par.)
Taxiway Object Free Area Width	131	131	Yes (North Par.) No (South Par.)
Taxiway Centerline to Fixed/Movable Object	65.5/<65.5[6]	65.5	Yes (North Par.) No (South Par.)
Taxilane OFA Width (ADG II)	115	115	No

Taxilane CL to Fixed/Movable Object (ADG II)	<57.5[7]	57.5	No (South Fueling Apron)
Small Airplane Tiedown Apron Taxilane CL to Fixed/Moveable Object (ADG I)	<39.5[7]	39.5	No (North & South Tiedown Aprons)

Table 4-2 Notes:

1. Runway length dimensions as depicted on current Airport Layout Plan (ALP); updated to depict runway shift and north parallel taxiway relocation.
2. Based on Utility Visual Approach Runway (Per FAR Part 77). Runway Protection Zone dimensions based on approach visibility minimums 1-mile (Per AC 150/5300-13A).
3. North parallel taxiway 240 feet; south parallel taxiway (western section) 165 feet.
4. 2009 ALP identifies a north BRL 376 feet from runway centerline (10' clear) and south BRL 360 to 402.5 feet (varies) from runway centerline.
5. North parallel taxiway 35 feet; portions of south parallel taxiway 25 feet wide.
6. Aircraft fuel tank, fueling area located within ADG II taxiway for existing south parallel taxiway.
7. Taxilane centerlines to parked aircraft on north and south aprons and some hangars on the airfield.
8. Per FAA Runway Length Model: Runway lengths required to accommodate 100 percent of small airplanes (12,500 pounds or less) at Ken Jernstedt Airfield. 81 degrees F, 38-foot change in runway centerline elevation/length required to accommodate 75 percent of large airplane fleet at 60% useful load (corresponds to B-II multi-engine turboprop).

***** For planning purposes only; FAA does not require runway extension based on planning criteria.

9. Distance required to accommodate an 18-foot structure (typical small/medium conventional hangar roof heights) without penetrating the 7:1 Transitional Surface extending from a 500 foot wide Primary Surface when ground elevation is the same for the runway and building and additional distance required to clear parallel taxiway OFA, when applicable. Setbacks for larger hangars or for hangars constructed in areas with terrain elevated above runway elevation would depend on roof elevation and actual clearance of Transitional Surface slope.
10. Trees and bushes located in southeast section.

Airport Planning & Design Standards Note:

The following FAA standards are recommended for use in evaluating Runway 7/25 and its taxiway system:

Runway 7/25 (Existing and Future) – Airport Reference Code (ARC) A/B-II Small. Runway design standards for aircraft approach category A & B runways with not lower than 1 statute mile approach visibility minimums. The existing and future Runway Protection Zones (RPZ) for Runway 7/25 based on not lower than 1-mile approach visibility minimums.

FAR Part 77 airspace planning criteria based on "utility runways" with visual approach of not less than 1-mile visibility.

All references to the "standards" are based on these assumptions, unless otherwise noted (Per FAA Advisory Circular 150/5300-13A and FAR Part 77.25)

RUNWAY SAFETY AREA

The FAA defines runway safety area (RSA) as "A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway." Runway safety areas are most commonly used by aircraft that inadvertently leave the runway environment during landing or takeoff.

By FAA design standard, the runway safety area "shall be:

1. *cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations;*
2. *drained by grading or storm sewers to prevent water accumulation;*
3. *capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft; and*
4. *free of objects, except for objects that need to be located in the runway safety area because of their function. Objects higher than 3 inches above grade should be constructed on low impact resistant supports (frangible mounted structures) of the lowest practical height with the frangible point no higher than 3 inches. Other objects such as manholes should be constructed at grade. In no case should their height exceed 3 inches.*

Grading and/or soil compaction within runway safety areas should be completed as needed, and grass, brush or other debris should be regularly cleared to maintain FAA standards. Runway pavement edges should be periodically inspected to ensure that grass, dirt or gravel build ups do not exceed 3 inches.

RSA - Existing/Future Standard
ARC A/B-II Small 1-Mile Approach Visibility Minimum
150 feet wide and extends 300 feet beyond each runway end.
The RSA appears to be free of built items except those with locations fixed by function on break-away mounts. The RSA surface appears to meet gradient and compaction standards. Periodic maintenance and clearing is required.

RUNWAY OBJECT FREE AREA

Runway object free areas (ROFA) are two dimensional surfaces intended to be clear of ground objects that protrude above the runway safety area edge elevation. Obstructions within the object free area may interfere with aircraft flight in the immediate vicinity of the runway. The FAA defines the object free area clearing standard:

"The object free area clearing standard requires clearing the object free area of above ground objects protruding above the runway safety area edge elevation. Except where precluded by other clearing standards, it is acceptable to place objects that need to be located in the object free area for air navigation or aircraft ground maneuvering purposes and to taxi and hold aircraft in the object free area. Objects non-essential for air navigation or aircraft ground maneuvering purposes are not to be placed in the object free area. This includes parked airplanes and agricultural operations."

A portion of the existing OFA extends off airport property along the southeast section of the airport. Areas of brush or trees on and off airport property located within the OFA should be cleared to meet FAA standards. Development on the south apron, including portions of parked aircraft and the aircraft fuel tank are located within the OFA. An unimproved glider parking area located on the south side of the runway (east of the terminal area) is partially within the OFA. These items will be addressed during the alternatives evaluation.

OFA - Existing/Future
ARC A/B-II Small 1-Mile Approach Visibility Minimum
500 feet wide and extends 300 feet beyond each end of runway.
Several nonstandard item are identified in the OFA: 1) The location of the aircraft holding area on Taxiway B1 (within the OFA). 2) The aircraft fuel tank located on the south apron. 3) Trees and brush in the southeast section. The remaining areas of the OFZ appear to meet FAA standards, including obstruction clearing and frangibility of built items. Periodic maintenance and clearing is required. 5) Seasonal (temporary) firefighting equipment staging located between runway and Taxiway B. 6) Seasonal (temporary) helicopter parking on south parallel taxiway section (taxiway is temporarily closed during fire operations, although the aircraft parking occurs within the runway OFA).

OBSTACLE FREE ZONE

The obstacle free zone (OFZ) is a plane of clear airspace extending upward above runway elevation that are intended to protect close-in obstructions that may create hazards for aircraft. The FAA defines the following clearing standard for the OFZ:

"The obstacle free zone clearing standard precludes taxiing and parked airplanes and object penetrations, except for frangible visual NAVAIDs [navigational aids] that need to located in the obstacle free zone because of their function."

The FAA defines the Runway Obstacle Free Zone (ROFZ) as:

"The ROFZ is a defined volume of airspace centered above the runway centerline. The ROFZ is the airspace above a surface whose elevation at any point is the same as the elevation of the nearest point on the runway centerline. The runway OFZ extends 200 feet beyond each end of the runway."

Runway OFZ- Existing/Future
ARC A/B-II Small 1-Mile Approach Visibility Minimum
250 feet wide and extends 200 feet beyond each end of runway.
The OFZ appears to meet FAA standards, including obstruction clearing and frangibility of built items. Periodic maintenance and clearing is required.

TAXIWAY SAFETY AREA

Taxiway safety areas (TSA) serve a similar function as runway safety areas and use the same design criteria for surface condition (see description of runway safety area provided earlier in this chapter), with varying dimensions based on airplane design group.

It is noted that safety area standards do not apply to *taxilanes* typically located within hangar developments or aircraft parking aprons. Taxilanes provide aircraft access within a parking or hangar area; taxiways provide aircraft access between points on the airfield and serve runways (e.g. parallel taxiways and exit taxiways).

The north parallel taxiway and three north exit taxiways are designed to meet ADG II standards. The two south exit taxiways are also designed to meet ADG II standards, although Taxiway B1 will require extension as part of the south parallel taxiway relocation. The western section of the south parallel taxiway does not meet ADG II standards and will require reconfiguration/relocation to meet a variety of ADG II standards.

As with runway safety areas, the ground surface located immediately adjacent to the taxiways periodically requires maintenance or improvement to adequately support the weight of an aircraft or an airport vehicle. Grading and/or soil compaction within taxiway safety areas should be completed as needed, and grass, brush or other debris should be regularly cleared to maintain FAA standards. Taxiway pavement edges should be periodically inspected to ensure that grass, dirt or gravel build ups do not exceed 3 inches.

TSA - Existing/Future
ADG-II
79 feet wide, 39.5 feet from taxiway centerline
The TSA for Taxiway A and the east section of Taxiway B appears to be free of built items except those with locations fixed by function on break-away mounts. The TSA surface appears to meet gradient and compaction standards. Periodic maintenance and clearing is required. The replacement (west) section of Taxiway B will be designed to ADG II standards.

TAXIWAY/TAXILANE OBJECT FREE AREA

Taxiway and taxilane object free areas (TOFA) are intended to provide unobstructed taxi routes (adequate wingtip clearance) for aircraft. The outer edge of the OFA defines the recommended standard distance from taxiway or taxilane centerline to a fixed or moveable object. The FAA clearing standard prohibits service vehicle roads, parked aircraft, and above ground objects (hangars, other built items, etc.), except for objects with locations that are fixed by function (navigational aids, airfield signs, etc.). The applicable design standard is determined by the largest size of aircraft that may be accommodated in aircraft parking areas or hangars served by that taxiway/taxilane.

Taxiways

The airport's main taxiways, with the exception of the west section of Taxiway B meet the ADG II OFA standards. The section of Taxiway B that extends along the south apron does not meet ADG II OFA clearing standard (65.5 feet from taxiway centerline) due to parked aircraft and the aircraft fuel tank. As noted earlier, the western section of Taxiway B will be relocated to meet ADG II runway separation standards and will meet the ADG II OFA standard.

Taxilanes

The taxilanes intended for use by small aircraft (north and south tiedown aprons) do not meet ADG I OFA clearing standard (39.5 feet from taxiway centerline) based on the separation provided between tiedown rows. Options for addressing taxilane OFA clearance should be included in the alternatives analysis.

The appropriate method for determining taxilane clearance standards for hangar developments is to consider the largest aircraft that can be physically accommodated in the hangar (door width). ADG II standards are applied to taxilanes serving larger hangars (door openings 50 feet and larger) and ADG I standards are applied to taxilanes serving small individual hangars or T-hangars (doors less than 50 feet wide). The taxilanes located adjacent to the north and south T-hangars do not meet the ADG I OFA clearance standard.

The FAA allows a modification to standards for Taxilane OFA clearance based the following formula: 1.2 x airplane wingspan plus 20 feet. Using this formula, a taxilane with a 60-foot wide clearance could accommodate airplanes with wingspans up to 33 feet (33.3' x 1.2 + 20' = 60'). For comparison, a Cessna 172 and 182 both have wingspans of 36 feet; a Cessna 150 has a wingspan of 33.3 feet.

While relocation of most hangars is not considered highly feasible, any new hangars (and the associated taxilanes) planned should meet the applicable ADG I or ADG II taxilane OFA clearance standard. A modification to FAA standards should be noted for these hangars, with the recommended disposition (reconfiguration) to be addressed when the hangars reach the end of their useful lives.

Existing/Future	Existing/Future
ADG I	**ADG II**
Taxiway Object Free Area 89 feet wide (44.5 feet from centerline) **Taxilane Object Free Area** 79 feet wide (39.5 feet from centerline)	**Taxiway Object Free Area** 131 feet wide (65.5 feet from centerline) **Taxilane Object Free Area** 115 feet wide (57.5 feet from centerline)
Some existing tiedown apron and hangar taxilanes and aircraft parking areas do not meet the current OFA standard.	West section of Taxiway B does not meet OFA clearing standards. Main access taxiways intended to accommodate ADG II aircraft have less than standard wingtip clearances from centerline to fixed/moveable object (parked aircraft, aviation fueling area).

BUILDING RESTRICTION LINE

A building restriction line (BRL) identifies the minimum setback required to accommodate a typical building height; such as a T-hangar or large conventional hangar. The desired siting is based on the ability to remain clear of all runway and taxiway clearances on the ground, and the protected airspace surrounding a runway, particularly the 7:1 runway transitional surface slope that extends outward from the sides of the runway.

The 2009 Airport Layout Plan identifies the south BRL 402.5 feet from runway centerline and the north BRL 376 feet from runway centerline. For structures constructed to the sides of Runway 7/25, a 376-foot BRL will accommodate a structure 18 feet (top roof elevation) above runway elevation. The south 402.5-foot BRL will accommodate a structure up to 21.7 feet above runway elevation. These clearances assume the same ground elevation as the runway. Variations in ground elevation will impact building roof elevations and clearances for adjacent airspace surfaces. Taller buildings may require additional runway separation to avoid penetrating the runway transitional surface.

The new BRL setback based on a 250-foot wide primary surface is 306 feet from runway centerline to the north and south, which also protects the parallel taxiway OFA. To the south, the BRL is 251 feet in the area that does not have a parallel taxiway, in order to accommodate an 18-foot structure.

RUNWAY PROTECTION ZONES (RPZ)

The FAA provides the following definition for runway protection zones:

"The RPZ's [runway protection zone] function is to enhance the protection of people and property on the ground. This is best achieved through airport owner control over RPZs. Control is preferably exercised through the acquisition of sufficient property interest in the RPZ and includes clearing RPZ areas (and maintaining them clear) of incompatible objects and activities. The RPZ is trapezoidal in shape and centered about the extended runway centerline. The RPZ's begins 200 feet beyond the end of the area useable for takeoff or landing." The central portion and controlled activity area are the two components of the RPZ. The central portion of the RPZ extends from the beginning to the end of the RPZ, centered on the [extended] runway centerline and is equal to the width of the runway OFA.

Runway protection zones (RPZ) with buildings, roadways, or other items do not fully comply with FAA standards. It is recognized that realigning major surface roads located within the RPZs may not always be feasible. As noted earlier, the FAA recommends that airport sponsors control the RPZs through ownership whenever possible, although avigation easements[1] are commonly used when outright purchase is not feasible.

The 2013 shift of Runway 7/25 to the east, allowed the Runway 7 RPZ to be contained entirely on airport property and clear of the adjacent public road (Tucker Road). The public road (Orchard Road) previously located within the Runway 25 RPZ was vacated to accommodate the runway shift. A small section of the Runway 25 RPZ extends beyond airport property, although no public roadways are located in the RPZ. The existing RPZs are consistent with approach visibility minimums not lower than 1 mile for both visual and "circling" non-precision instrument approaches.

RPZ- Existing/Future
ARC A/B-II Small 1-Mile Approach Visibility Minimums
Length- 1,000 feet Inner Width- 250 feet Outer Width- 450 feet
Current RPZ dimensions meet standards.

[1] An avigation easement (*avigation = aviation + navigation*) involves the purchase of airspace rights over a particular defined ground area. The easement normally limits the maximum height of any natural or built items (to coincide with the runway approach surface slope) and may include provisions restricting the type of activities permitted. Compensation is negotiated between the airport owner and property owner.

RUNWAY - PARALLEL TAXIWAY SEPARATION

The north parallel taxiway (Taxiway A) for Runway 7/25 meets the ADG II runway separation standard of 240 feet. The eastern section of the south parallel taxiway (Taxiway B) also meets the ADG II standard (runway separation of 240 feet). However, the western section of Taxiway B has a runway separation of 165 feet, which does not meet the ADG II standard. The 2009 ALP identifies a future relocation of Taxiway B combined with a reconfiguration of the adjacent south apron to meet the 240-foot ADG II runway parallel taxiway separation standard.

Runway-Parallel Taxiway Separation Existing/Future
ARC A/B-II Small 1-Mile Approach Visibility Minimums
Runway-Parallel Taxiway Separation: 240 feet
North parallel taxiway meets ADG II standards; the west section of the south parallel taxiway does not meet the ADG II standard.

FAR Part 77 Surfaces

Federal Aviation Regulation (FAR) Part 77.25, Objects Affecting Navigable Airspace, defines airport imaginary surfaces which are established to protect the airspace immediately surrounding a runway. The airspace and ground areas surrounding a runway should be free of obstructions (i.e., structures, parked aircraft, trees, etc.) to the greatest extent possible to provide a safe operating environment for aircraft.

As noted in the January 2009 update of the Ken Jernstedt Airfield Airport Layout Plan Report, the FAR Part 77 airspace criteria for Runway 7/25 was changed from the previous planning recommendation. *"Due to the 'marginal effectiveness' of an instrument approach as cited in the December 2008 Airport Layout Plan Airspace Classification Review, the Port has abandoned plans for an instrument approach and now relies on visual standards. The 500-foot wide primary surface continues to be appropriate for Runway 7/25 based on the utility/visual approach capabilities of the runway."* The analysis supported both the "utility" ADG I aircraft and "other-than-utility" aircraft, which corresponds to the ADG II design aircraft. The changes involved reducing the approach slopes from 34:1 to 20:1, and reducing the approach surface length and horizontal surface radii from 10,000 feet to 5,000 feet. A 2013 update of the Airspace Plan for Runway 7/25 was completed following the eastern runway shift, an obstruction survey and the reconfiguration of the Part 77 airspace surfaces noted above. The updated plan identifies five obstructions (trees) in the runway primary, transitional, and (Runway 25) approach surface. The previous (2009) airspace plan identified thirteen obstructions, most of which were eliminated through the change in airspace planning criteria or mitigated during the runway shift.

An updated review of the Part 77 obstructions included ten items listed on the airspace plan; however, four items are not obstructions and are for reference only. Five of the six obstructions are trees with a disposition to top or remove, and the sixth obstruction is a dirt road that should be relocated.

All new construction on or in the immediate vicinity of the Airport should routinely involve FAA review for airspace compatibility. FAA Form 7460-1, Notice of Proposed Construction or Alternation, should be prepared and submitted to FAA at least 60 to 90 days prior to planned construction. The 7460 form should be submitted by ODA for any projects located on the Airport and submitted by the applicant for any projects located off airport property. The FAA reviews all proposed development to determine if the proposed action would create any obstructions to FAR Part 77 airspace surfaces. In general, the FAA will object to proposals that result in a "significant" penetration to any FAR Part 77 airspace surfaces on the basis of safety.

Table 4-3 summarizes the airspace surface dimensions for Ken Jernstedt Airfield based on current and future approach capabilities ("utility" runway with visual approaches). **Figures 4-5 and 4-6** on the following pages illustrate plan and isometric views of generic FAR Part 77 surfaces.

TABLE 4-3: FAR PART 77 AIRSPACE SURFACES (RUNWAY 7/25)

ITEM	EXISTING VISUAL/UTILITY
Primary Surface	Width: 250 feet / Length: 200 feet beyond ends of runway
Transitional Surface	7:1 Slope to 150 feet above runway
Horizontal Surface Elevation/Radius	150 feet above airport elevation/5,000 feet
Conical Surface	20:1 for 4,000 / Top: 350 feet above airport elevation
Approach Surface Length	5,000 feet
Approach Surface Slope	20:1 (top/end elevation: 250 feet above runway end)
Approach Surface Width at Inner End	250 feet
Approach Surface Width at Outer End	1,250 feet

APPROACH SURFACE

The Approach Surface extends outward and upward from each end of the primary surface, along the extended runway centerline. The dimensions and slope of the approach surfaces are determined by the type of aircraft intended to use the runway and the most demanding approach planned for the runway. The 2013 update of the airport airspace plan identified a tree with antenna beyond the Runway 25 end as an existing penetration of 9 feet and future penetration of 55 feet with a disposition to relocate.

PRIMARY SURFACE

The primary surface is a surface longitudinally centered on the runway (250 feet wide) and extends 200 feet beyond the runway end. The primary surface connects to the inner portion of the runway approach surfaces at each end, and the runway transitional surfaces along the sides. The tree and brush obstructions previously identified within the runway object free area (OFA) also penetrates the primary surface (same width dimension). The primary surface should be free of any penetrations, except items with locations fixed by function (i.e., PAPI, runway or taxiway edge lights, etc.). As noted earlier, the 2013 update of the airport airspace plan identifies 2 tree obstructions to the primary surface with a recommendation to "top or remove." These obstructions will be re-evaluated based on the updated FAR Part 77 criterial summarized in Table 4-3.

TRANSITIONAL SURFACE

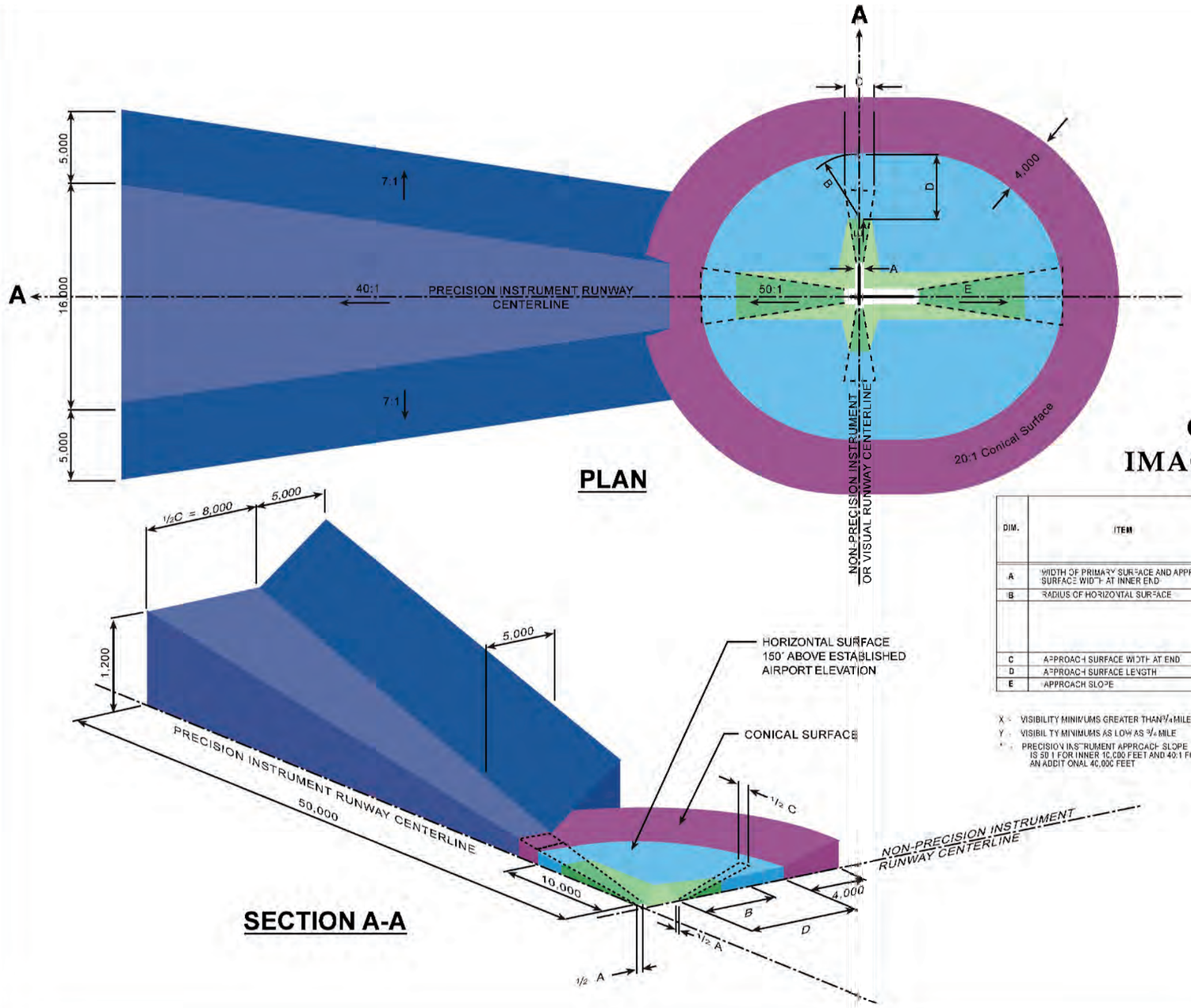
The transitional surface is located at the outer edge of the primary surface, represented by a plane of airspace that rises perpendicularly to 150 feet above runway elevation at a slope of 7 to 1, beginning 125 feet from either side of runway centerline. As noted earlier, the 2013 update of the airport airspace plan identifies 2 tree obstructions to the transitional surface with a recommendation to "top or remove."

HORIZONTAL SURFACE

The horizontal surface is a flat plane of airspace located 150 feet above runway elevation with a radius of 5,000 feet extending from each runway end (end of the primary surface). The outer points of the radii for each runway are connected to form an oval, which is defined as the horizontal surface. A small area of terrain penetration is identified near the southwest edge of the horizontal surface (no disposition recommended) on the 2013 airspace plan update.

CONICAL SURFACE

The conical surface is an outer band of airspace, which abuts the horizontal surface. The conical surface begins at the elevation of the horizontal surface and extends outward 4,000 feet at a slope of 20:1. An area of terrain penetration is identified in the southwest section of the conical surface (no disposition recommended) on the 2013 airspace plan update.



PLAN

SECTION A-A

SURFACE SLOPE KEY

- HORIZONTAL SURFACE
- 20:1
- 7:1
- 7:1
- VARIES (SEE "E" VALUE IN TABLE BELOW)
- 40:1 (PRECISION INSTRUMENT RUNWAY ONLY)

CIVIL AIRPORT IMAGINARY SURFACES

DIM.	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		UTILITY	LARGER THAN UTILITY	UTILITY	LARGER THAN UTILITY		
					X	Y	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL APPROACH		NON-PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		UTILITY	LARGER THAN UTILITY	UTILITY	LARGER THAN UTILITY		
					X	Y	
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:1	34:1	34:1	*

X - VISIBILITY MINIMUMS GREATER THAN ¾ MILE
Y - VISIBILITY MINIMUMS AS LOW AS ¾ MILE
* - PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET

HEIGHT HAZARD AIRSPACE SURFACES

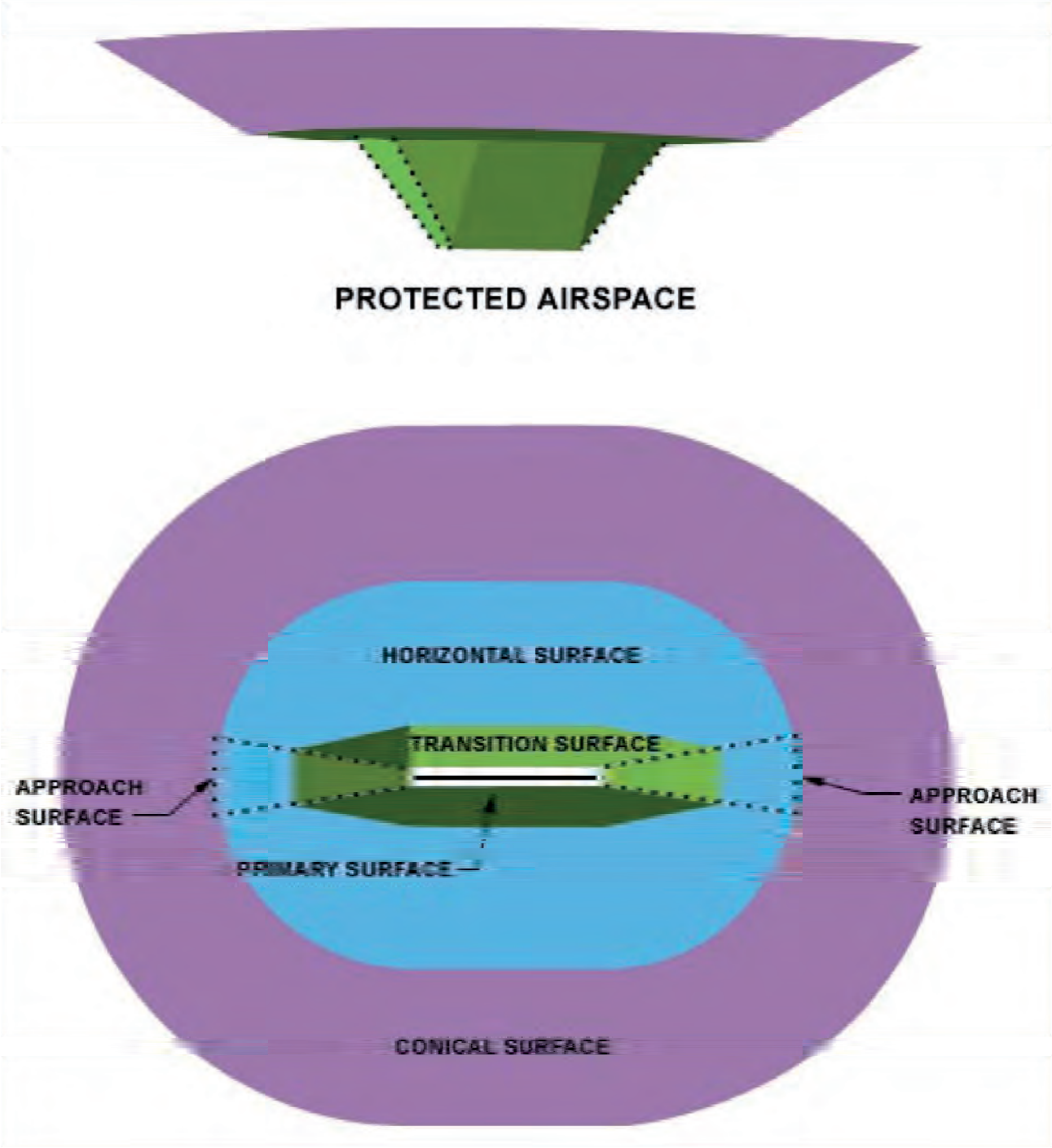


IMAGE SOURCE: WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (AVIATION DIVISION).

Airside Requirements

Airside facilities are those directly related to the arrival, departure and ground movement of aircraft on the airfield:

- Runways
- Taxiways
- Airfield Instrumentation and Lighting

Runways

The adequacy of the existing runway system at Ken Jernstedt Airfield was analyzed from a number of perspectives including runway orientation, airfield capacity, runway length, and pavement strength.

RUNWAY ORIENTATION & WIND COVERAGE

As noted in the Inventory Chapter, a runway's wind coverage is measured by an aircraft's ability to operate with a "direct" crosswind, which is defined as 90 degrees to the direction of travel. For runways used by exclusively by small aircraft, the maximum direct crosswind for is 12 miles per hour (10.5 knots); for runways used by larger general aviation aircraft, a 15-mile per hour (13 knot) direct crosswind is used. Based on analysis of wind data collected through the onsite AWOS, Runway 7/25 accommodates 99.85 percent of wind conditions for the 13 knot crosswind component, which exceeds the FAA threshold of 95 percent coverage for a single runway.

RUNWAY LENGTH

Runway length requirements are based primarily upon airport elevation, mean maximum daily temperature of the hottest month, runway gradient, and the critical aircraft type expected to use the runway.

The 2009 Airport Layout Plan update indicated that the current runway length of 3,040 feet would be maintained in the runway shift project, stating *"There are absolutely no plans to extend the runway beyond its present length."* This decision was made by the Port of Hood River in recognition of existing site limitations and surrounding terrain. A primary objective of the recent runway shift project was to clear the Runway 7 RPZ of all incompatible land uses and to bring the entire RPZ into airport ownership. FAA has indicated that converting the overrun to usable runway would not be supported if it required any shifting of the Runway 7 RPZ off airport property or over a public roadway. The outer edge of the existing Runway 7 RPZ is immediately east of Tucker Road on airport property.

The current and historic composition of ADG II traffic at Ken Jernstedt Airfield is unique and includes aerial applicator single-engine turboprops, gliders, locally-based and transient business aircraft capable of operating on the existing 3,040-foot runway. The updated aviation activity forecasts anticipate an increase in business class aircraft activity during the current planning period within Airplane Design Group II (ADG II) and it is assumed that this activity will reflect the practical operational limits of the existing runway.

The 580-foot paved overrun (former runway) located at the west end of Runway 7/25 currently provides an "informal" emergency use area for aircraft operating on the runway. Designating the overrun as a stopway should be evaluated in the alternatives analysis as a potential safety-related improvement. Stopways are used by pilots when calculating accelerate-stop distances for takeoff in multi-engine aircraft. The accelerate-stop distance is the runway length required for a multi-engine aircraft to reach rotate (takeoff) speed, simultaneously lose power in one engine, allow the pilot to recognize and react to the engine failure, abort the takeoff by cutting the power to the remaining engine(s), and stop the aircraft on the remaining runway by applying maximum braking action within the normal design limits of the aircraft.

Officially designating a stopway beyond the end of Runway 7 increases the Runway 25 accelerate-stop distance available (ASDA) by 19 percent over the current 3,040-foot runway length. This length corresponds closely the ASDA requirements of many typical ADG I and II multi-engine piston and turbine aircraft and represents a significant improvement in operating safety on the runway. It is important to note that the additional stopway pavement does not increase the published length of the runway or provide additional (normal) takeoff or landing distances for either runway end. Stopways are not intended for use in normal takeoffs and landings and pilots are responsible for recognizing the pavement as a non-movement area (marked with yellow chevrons) except in an emergency.

The dimension of the stopway would be published in the Airport/Facility Directory with corresponding declared distances for multi-engine aircraft. No physical changes to the overrun pavement would be required, although the existing Runway 7 above-grade threshold lights would need to be modified or replaced with flush mounted fixtures to avoid potential damage from the occasional aircraft passage from the runway. The stopway markings and pavement surface would need to be maintained to FAA standards.

For planning purposes, the current runway length of 3,040 feet is capable of accommodating approximately 94 percent of the small airplane fleet (airplanes weighing 12,500 pounds and less) and a segment of large airplanes (between 12,500 and 60,000 pounds). The current runway length accommodates a composite of small and large aircraft, but is not driven by the requirements of one specific aircraft or aircraft type. As noted in the FAA runway length analysis, the planning standard required to accommodate all small aircraft and the lower segment of large business class aircraft fleet ranges between 3,760 and 5,060 feet. The capabilities of the existing runway are balanced with the physical limits of the site.

Although the composition of the airport's current and forecast ADG II traffic would not be expected to justify an increase in runway length, maintaining the existing runway length is important in the airport's ability to accommodate the range of ADG I and II aircraft operations anticipated during the planning period.

A summary of FAA recommended runway lengths for planning based on the requirements of small aircraft and large general aviation aircraft in a variety of load configurations is presented in **Table 4-4**.

TABLE 4-4: FAA RECOMMENDED RUNWAY LENGTHS FOR PLANNING (FROM FAA COMPUTER MODEL)

Runway Length Parameters for Ken Jernstedt Airfield • Airport Elevation: 631 feet MSL • Mean Max Temperature in Hottest Month: 81° F • Maximum Difference in Runway Centerline Elevation: 33.9 feet • Existing Runway Length: 3,040 feet	
Small Airplanes with less than 10 seats	
75 percent of these airplanes	2,620 feet
95 percent of these airplanes	3,150 feet
100 percent of these airplanes	3,760 feet
Small airplanes with 10 or more seats	4,230 feet
Large Airplanes of 60,000 pounds or less	
75 percent of these airplanes at 60 percent useful load	5,060 feet
75 percent of these airplanes at 90 percent useful load	6,540 feet
100 percent of these airplanes at 60 percent useful load	5,640 feet
100 percent of these airplanes at 90 percent useful load	8,190 feet
Airplanes of more than 60,000 pounds	5,230 feet

The runway length requirements for a variety of business aircraft are summarized in **Table 4-5** for comparison to the output from the FAA model. It shows that there are a several business aircraft that can operate on runways with lengths of 3,000 feet. However, with higher temperatures and a slightly higher airfield elevation, passenger and/or fuel load limitations may occur for aircraft in this category and for some multi-engine turboprop aircraft.

TABLE 4-5: TYPICAL BUSINESS AIRCRAFT RUNWAY REQUIREMENTS

AIRCRAFT	PASSENGERS (TYPICAL CONFIGURATION)	MAXIMUM TAKEOFF WEIGHT	RUNWAY LENGTH REQUIRED FOR NORMAL TAKEOFF[1]	RUNWAY LENGTH REQUIRED FOR LANDING[2]
Beech Baron 55	6	5,71	2,154	2,148
B100 King Air	13	11,800	1,898	1,290
Beechcraft 99	15	11,300	2,480	1,810
Citation 510-Mustang	6	8,645	3,110	2,390
Cessna Citation CJ1+	4-6	10,700	3,530	2,660
Cessna Citation CJ2+	6-7	12,500	3,590	3,060
Cessna Citation CJ3	6-7	13,870	3,610	3,140
Cessna Citation CJ4	6-7	16,950	3,440	2,740

1. 14 CFR Part 25 or 23 Balanced Field Length (Distance to 35 Feet Above the Runway); Sea Level, 77 degrees F; Zero Wind, Dry Level Runway, 15 degrees flaps, except otherwise noted.
2. Distance from 50 Feet above the Runway; Flaps Land, Zero Wind.

TURF LANDING AREA

The alternate turf landing area located between the runway and north parallel taxiway is available for non-simultaneous use with Runway 7/25. The turf area is not formally designated as a separate runway and has no defined FAR Part 77 airspace surfaces. The irrigated turf area is bound on its sides and ends by runway or taxiway pavement.

Runway Width

Runway 7/25 is 75 feet wide, which meets the ARC A/B-II Small standard for runways with approach visibility minimums of not lower than 1-mile.

Airfield Pavement

An updated Pavement Evaluation/Maintenance Management Program inspection, performed by Oregon Department of Aviation, was conducted in 2014. The runway, five exit taxiways, north parallel taxiway, and two north apron connecting taxiways were reconstructed or constructed new in 2013 and are in excellent condition. It is noted that the highest numeric ratings (85 to 100) in Micro PAVER now correspond to a rating of "good" rather than "excellent," which was used in previous software versions. Similar changes were made to other rating categories, which appear to be intended to simplify or de-emphasize the qualitative assessments in favor of the numeric scale.

The published runway pavement strength rating is 23,000 pounds for aircraft equipped with single-wheel landing gear, which is sufficient to accommodate most A/B-II Small aircraft. Ideally, taxiway and apron pavements designed to accommodate all aircraft operating at an airport should have the same weight

bearing strength as the runway. Pavements used by small aircraft (T-hangar taxilanes, tiedown aprons) are normally designed to accommodate aircraft weighing 12,500 pounds or less with single-wheel landing gear configurations.

Ongoing maintenance, including vegetation removal, crack filling, and sealcoats should be conducted on a regular basis to maximize the longevity of asphalt airfield pavements through the planning period. For planning purposes, rehabilitation of asphalt pavements is typically assumed on a 15- to 25-year cycle, depending on use and pavement design. A prioritized list of pavement rehabilitation or reconstruction projects will be provided in the updated capital improvement program. **Table 4-6** summarizes the current and predicted pavement conditions assuming no pavement maintenance is performed. Several apron and taxilane pavements on the airfield will require rehabilitation or reconstruction during the current planning period.

TABLE 4-6: FORECAST PAVEMENT CONDITION INDICES

PAVEMENT SECTION	2014 PCI [1&2]	2019 PCI [1]	2024 PCI [1]	CURRENT CONDITION
Runway 7/25	**100**	*87*	*76*	Reconstructed/New Construction in 2013. "Good" Condition
Taxiway A (North Parallel) and Exit Taxiways	**100**	*90*	*78*	New Construction in 2013. "Good" Condition
Taxiway B (South Parallel – West Section)	**61/10**	53/10	43/9	Fair/Failed* (*failed section is located west of tiedown apron)
Taxiway B (East Section)	**70**	61	44	Fair
North Tiedown Apron	**67**	62	57	Fair
South Tiedown Apron	**60**	55	50	Fair
Terminal/FBO Apron	**23/4**	16/3	9/2	Serious/Failed
South (West) Hangar Apron - (Glider Area)	**87**	77	70	Good
South Hangar Apron (west of tiedown apron)	**86**	77	69	Good
North Hangar Taxilanes	**44**	37	30	Poor
South T-Hangar Taxilane	**62**	57	52	Fair
South (East) Hangar Apron	**41**	34	27	Poor

1. The Pavement Condition Index (PCI) scale ranges from 0 to 100, with seven general condition categories ranging from "failed" to "good." For additional details, see *Oregon Aviation System Plan Pavement Evaluation/Maintenance Management Program* (2014) for Ken Jernstedt Airfield
2. PCI number listed for a pavement with multiple sections is the largest pavement section PCI or a weighted value. For additional details, see 2014 Oregon Pavement Evaluation/Maintenance Management Program.

Taxiways

Taxiways are constructed primarily to facilitate aircraft movement to and from the runway system. Some taxiways are necessary simply to provide access between apron and runways, while other taxiways become necessary as activity increases and safer and more efficient use of the airfield is needed. The existing taxiway system at Ken Jernstedt Airfield provides aircraft access to the full runway and all landside facilities.

PARALLEL TAXIWAY

Taxiways are constructed primarily to facilitate aircraft movement to and from the runway system. Some taxiways are necessary to simply provide access between aprons and runways, while other taxiways become necessary as activity increases and safer or more efficient use of the airfield is needed. The existing taxiway system at Ken Jernstedt Airfield provides access to all developed landside areas on the airfield and to adjacent off-airport aviation development.

As noted earlier, a current taxiway facility need is related to the western section of Taxiway B (south parallel taxiway), which requires upgrading to meet ADG II standards:

- Relocate taxiway approximately 75 feet south, increasing runway separation to 240 feet;
- Widen taxiway to 35 feet;
- Provide taxiway safety area and object free area;
- Relocate existing items on apron required to accommodate new taxiway and required clear areas; and
- Extend Taxiway B1 and relocate aircraft hold line and runway signage

Adding aircraft hold areas at both ends of Taxiway A (north parallel taxiway) may be considered as traffic levels increase.

No eastern extension of Taxiway B is anticipated at this time based on several site constraints including a surface drainage and adjacent privately owned residential parcels that are partially located in the runway OFA.

TAXILANES

The configuration of aircraft tiedowns and adjacent taxilanes on the north and south tiedown aprons was identified earlier as being non-standard for ADG I taxilane OFA clearance. Although the small airplane tiedown anchors are typically installed along the edges of 79-foot taxilane OFAs, portions of parked aircraft extend into the adjacent OFA. The FAA clearing standard for taxilane OFAs is measured as the distance from the taxilane centerline to a fixed or movable object (parked aircraft). Access taxilanes on aprons used by larger (ADG II) aircraft should be designed to the meet the ADG II taxilane OFA standard (115 feet). The configuration of the existing parking aprons will be examined in the alternatives analysis in

conjunction with evaluating future parking capacity requirements. Taxilanes required to access new landside development areas will be designed based on the size of aircraft anticipated.

Airfield Instrumentation, Lighting and Marking

NAVIGATIONAL AIDS

There are no navigational aids (NAVAID) at Ken Jernstedt Airfield. The nearest NAVAID is the Very High Frequency Omnidirectional Range (VOR) with Distance Measuring Equipment (DME), located near Columbia Gorge Regional Airport approximately 18 nautical miles east-northeast. As noted earlier, the additional of instrument approach capabilities is not planned at this time.

AIRFIELD LIGHTING AND SIGNAGE

The lighting systems for Runway 7/25 include Medium Intensity Runway Lighting (MIRL) and Runway End Identifier Lights (REIL). The lighting systems were installed in 2013 as part of the runway shift/reconstruction project and are reported to operate normally. Stake-mounted reflective markers are recommended for all major taxiways and exits. The addition of taxiway edge lighting may be considered in the future depending on the level of night operations, although reflectors are generally adequate and economical.

The other airfield lighting systems (airport beacon, wind cones) are in good condition and reportedly function normally. Replacement of existing lighting systems should be assumed during the current twenty-year planning period.

Internally illuminated runway hold position signs are located at each taxiway entrance to the runway (new in 2013). The sign located at Taxiway B1 will be relocated as part of a future Taxiway B shift to meet ADG II standards.

RUNWAY MARKINGS

Runway 7/25 has visual runway markings which include; designation numbers, centerline stripe and threshold bars at both ends indicating the end of usable runway. Yellow chevrons markings are painted on Runway 7 overrun. All markings were installed during the 2013 runway shift.

On Field Weather Data

The airport has on-site weather observation capabilities with an automated weather observation system (AWOS). The AWOS meets all current weather reporting needs for the airport. Additional tree clearing near the unit sensors may be considered to reduce potential interference with wind readings.

Landside Facilities

For general aviation airports, landside facilities are generally defined as those that serve aircraft, passenger needs and their related functions. At Ken Jernstedt Airfield, landside facilities include aircraft aprons, hangars, fixed base operator (FBO), and aircraft fueling facilities.

AIRCRAFT PARKING AND TIEDOWN APRON

Aircraft aprons provide parking for both locally based aircraft that are not stored in hangars and for transient aircraft visiting the airport. Ken Jernstedt Airfield currently has a two aircraft tiedown aprons (approximately 24,728 square yards) configured with 69 aircraft parking positons, in addition to the FBO apron and several small hangar aprons.

As noted earlier, the current configuration of the north and south apron taxilanes and adjacent aircraft parking areas does not fully conform to FAA taxilane object free area standards. The aircraft tiedowns located along the front (south side) of the north tiedown apron appear to penetrate the runway transitional surface. Options for addressing the apron configuration and FAA standards will be evaluated in the alternatives analysis, in addition to planning for future demand and fleet mix. The planned relocation of the south parallel taxiway to meet ADG II runway separation standards will reduce existing parking capacity on the south tiedown apron and reduce usable apron for fueling and FBO operations.

For planning purposes, it is assumed that 20 percent of current and forecast (non-WAAAM) based aircraft will utilize apron parking and 80 percent will utilize hangar storage. While the percentage of hangared based aircraft may increase above 80 percent as the availability of new hangar space improves, this planning metric reflects the potential to attract and accommodate based aircraft when hangar space is unavailable. As noted in the forecast chapter, it is assumed that new based aircraft at the airport will be equally between WAAAM and non-WAAAM aircraft. It is assumed that all WAAAM aircraft storage needs will be met in WAAAM facilities. The non-WAAAM aircraft will require on- or off-airport storage.

As indicated in the aviation activity forecasts, the number of based aircraft at Ken Jernstedt Airfield is projected to increase from 208 to 281 during the twenty-year planning period. This projection increases non-WAAAM aircraft by 36.

Assuming 20 percent of based aircraft will require apron parking **demand for locally based aircraft tiedowns will range from 17 to 24 during the twenty year planning period**. The FAA planning criterion of 300 square yards per based aircraft was used to determine future itinerant ramp requirements for small airplane parking.

FAA AC 150/5300-13 suggests a methodology by which itinerant parking requirements can be determined from knowledge of busy day operations (takeoffs and landings).[2] For planning purposes,

[2] Busy Day Operations is defined as the average number of daily operations during the peak month (peak month operations divided by 30 days).

future demand for itinerant parking spaces was estimated based on 30 percent of design day itinerant operations (30% of design day itinerant operations divided by two, to identify peak parking demand). **Itinerant aircraft parking requirements are estimated to range from 9 to 14 during the twenty year planning period** and will include a variety of aircraft types. The FAA planning criterion of 360 square yards per itinerant (small) aircraft was used to determine future itinerant ramp requirements. Larger space allocations are used to determine parking requirements for multi-engine or business class aircraft and helicopters. Projected aircraft parking requirements are summarized in **Table 4-9**.

It is recognized that forecast growth in based and transient aircraft activity could be exceeded if conditions are favorable. Individual aircraft owner needs vary and demand can be influenced by a wide range of factors beyond the control of an airport. Based on the potential for higher demand, it is recommended that a development reserve equal to 100 percent of forecast demand be used in future apron planning.

Other design considerations include the need to provide a dedicated aircraft fueling area that is clear of adjacent taxilane OFAs and aircraft parking positions, and helicopter parking that provides adequate separation from fixed-wing aircraft parking to minimize rotor wash damage.

AIRCRAFT HANGARS

Ken Jernstedt Airfield accommodates a variety of hangars including commercial hangars and hangars used primarily for aircraft storage (conventional hangars and T-hangars). For planning purposes, it is assumed that 80 percent of the airport's non-WAAAM based aircraft will be stored in hangars. It is also assumed that existing hangar space is committed and all additional (forecast) demand would need to be met through new construction.

As indicated in the aviation activity forecasts, the number of non-WAAAM based aircraft at Ken Jernstedt Airfield is projected to increase by 37 aircraft during the twenty-year planning period. Based on a projected 80 percent hangar utilization level, additional demand for new hangar space is estimated to be 29 spaces (approximately 43,500 square feet). A planning standard of 1,500 square feet per based aircraft stored in hangars is used to project gross space requirements. The projected hangar requirements for aircraft storage at Ken Jernstedt Airfield are presented in **Table 4-9.**

Individual aircraft owners needs vary and demand can be influenced by a wide range of factors beyond the control of an airport. In addition, the moderate forecast growth in based aircraft may be exceeded if conditions are favorable. For this reason, it is recommended that hangar development reserves be identified to address the uncertainty of hangar market conditions and demand factors. Conservative development reserves should be established to accommodate a combination of conventional hangars and T-hangars, roughly equal to 50 to 100 percent of the twenty year forecast (net) demand. The location and configuration of the development reserves will be addressed in the alternatives analysis.

In addition to aircraft storage, additional demand for business related and commercial hangar needs may be required. Specialized aviation service businesses such as fixed base operators (FBO), engine & airframe repair, etc. generally prefer locations that provide convenient aircraft access and public access. While there is no specific formula to predict demand for general aviation service businesses at a particular airport, reserving space for larger commercial hangars is recommended.

TABLE 4-9: APRON AND HANGAR FACILITY REQUIREMENTS SUMMARY

ITEM	BASE YEAR 2014	2019	2024	2029	2034
Based Aircraft Forecast (non-WAAAM Aircraft)	**90**	**98**	**106**	**116**	**126**
Aircraft Parking Apron ***(Note: capacities reflect current configuration of existing public use apron areas, actual capacity when reconfigured may be different.)***					
Small Aircraft Tiedowns (SE/ME)	74				
Large Aircraft Tiedowns (ME/TP)	0*				
Small Helicopter Parking Spaces	0*				
Total Designated Parking Spaces Available	74				
Total Apron Area *(N&S tiedown aprons including taxilanes)*	24,728 SY (Apprx.)				
Projected Needs (*Gross Demand)* [1]					
Transient Small Airplane Tiedowns (@ 360 SY each)		8 2,880 SY	11 3,960 SY	12 4,320 SY	12 4,320 SY
Locally-Based Tiedowns (@ 300 SY each)		17 5,100 SY	18 5,400 SY	20 6,000 SY	24 7,200 SY
Transient Business Aircraft Parking Positions (@ 625 SY each)		1 625 SY	2 1,250 SY	2 1,250 SY	2 1,250 SY
Transient Small Helicopter Parking Positions (@ 380 SY each)		1 380 SY	1 380 SY	1 380 SY	2 760 SY
Total Apron Needs (Aircraft Parking)		**27 8,985 SY**	**32 10,990 SY**	**35 11,950 SY**	**40 13,530 SY**
Aircraft Hangars					
(New) Hangar Demand[2] (@ 1,500 sf per space) *(Cumulative twenty year projected demand 18 spaces / 27,000 sf)*		4 spaces/ 6,000 sf	4 spaces/ 6,000 sf	5 spaces/ 7,500 sf	5 spaces/ 7,500 sf

* These aircraft are accommodated on the main apron (open areas)

1. Aircraft parking demand levels identified for each forecast year represent total gross demand
2. Hangar demand levels current hangar capacity (assume 1,500 sf per space)

AIRCRAFT WASH DOWN FACILITIES

Wash down facilities are recommended to accommodate general aviation aircraft with a catch basin and hard piping to divert wash residue into a sanitary sewer system. Wash facilities are typically sized to accommodate one aircraft on a pad approximately 50 feet by 50 feet. The wash pad may be located adjacent to existing parking apron or hangars; close access to utility systems is a key siting factor.

GENERAL AVIATION TERMINAL/FIXED BASE OPERATOR BUILDING

The existing FBO facilities are located in the south landside area, adjacent to the south apron. The building includes public restrooms, telephone, office space, waiting areas and operations space used for flight training. The 2004 Airport Layout Plan maintained the recommendation of the two previous master plans to relocate FBO facilities to the north landside area. The primary benefits of the north landside area location are the availability of developable space and the additional setback provided to the runway-taxiway system for aircraft parking, fueling operations and related activities.

SURFACE ACCESS AND VEHICLE PARKING

Surface access to the landside areas of Ken Jernstedt Airfield appears adequate for current and future facility needs. Additional vehicle parking should be provided adjacent to hangar and apron development areas. Previous master plan recommendations to relocate the fixed base operator (FBO) facilities to the north side of the runway will require upgraded parking and roadway circulation

AGRICULTURAL AIRCRAFT FACILITIES

There is one aerial applicator based at Ken Jernstedt Airfield that uses an existing hangar and apron on the southwest corner of the airfield. These facilities appear to be adequate for current and future needs,

Support Facilities

AVIATION FUEL STORAGE

Ken Jernstedt Airfield has one 12.000-gallon above ground fuel tank used for 100-octane low lead (100LL) aviation gasoline (AVGAS). The fuel storage and dispensing facilities are Port owned and leased to the fixed base operator (FBO). The fuel storage tank and dispensing area are located on the south apron, near the FBO building. The relocation of the fuel storage and dispensing facilities has been recommended in the last three master plans as part of the overall development of terminal area facilities on the north landside area. An updated evaluation of terminal area facility needs will be included in the alternatives analysis. The option of adding a second fuel storage tank for another fuel grade should be considered in terminal planning layouts. The ability to provide multiple fuel grades depends on market demand; however, reserving space to accommodate additional storage will provide the airport with flexibility to respond to demand as needed.

UTILITIES

The existing utility service to the north and south landside areas of the airport appears to be adequate to support future facility needs. New service line extensions may be required for new development areas.

Security

The airport currently has wire fencing located along portions of its property line. Although fencing is not required at general aviation airports such as Ken Jernstedt Airfield, adding perimeter fencing with controlled access gates is recommended as a best practice. Currently, there is no barrier to unauthorized public access on the airfield along the airport's western and southern perimeter. The direct access provided by Airport Road also allows vehicles to cross the runway-taxiway system when moving between the north and south landside areas, which is not recommended by FAA.

Flood lighting is recommended in aircraft fueling locations, aircraft parking and hangar areas. The use of full or partial cutoff light fixtures is recommended for all exterior lighting on airports to limit upward glare.

Airfield Capacity

Annual service volume (ASV) is a measure of estimated airport capacity and delay used for long-term planning. ASV, as defined in FAA Advisory Circular (AC) 150/5060-5, Airport Capacity and Delay, provides a reasonable estimate of an airport's operational capacity. The ratio between demand and capacity helps to define a timeline to address potential runway capacity constraints before they reach a critical point. If average delay becomes excessive (greater than 3 minutes per aircraft), significant congestion can occur on a regular basis, which significantly reduces the efficient movement of air traffic. ASV is calculated based on the runway and taxiway configuration, percent of VFR/IFR traffic, aircraft mix, lighting, instrumentation, the availability of terminal radar coverage and the level of air traffic control at an airport.

The 2004 ALP Report did not analyze annual airfield capacity. However, for long-term planning purposes, the FAA estimates annual capacity (ASV) for a single runway with no air carrier traffic is approximately 230,000 operations; hourly capacity is estimated to be 98 operations during visual flight rules (VFR) conditions and 59 operations during instrument flight rules (IFR) conditions. Although these estimates assume optimal conditions (air traffic control, etc.), they provide a reasonable basis for approximating existing and future capacity:

Existing Capacity: 14,850 Annual Operations / 230,000 ASV = 6.5% (demand/capacity ratio)

Future Capacity: 22,680 Annual Operations / 230,000 ASV = 9.9% (demand/capacity ratio)

Based on these ratios, the average delay per aircraft would be expected to remain below one minute through the planning period. The FAA recommends that airports proceed with planning to provide additional capacity when 60 percent of ASV is reached. As indicated in the updated aviation activity forecasts, peak activity is projected to remain well below the 60 percent threshold during the planning period.

Although the theoretical capacity estimates are useful, non-towered single runway airports are generally capable of accommodating activity in the range of 80,000 to 100,000 annual operations before congestion become significant enough to consider capacity related upgrades or air traffic control. The twenty-year forecast for Ken Jernstedt Airfield is well below these levels.