AIRPORT ALTERNATIVES ANALYSIS

EVALUATION ANALYSIS

This chapter describes various airfield and terminal area alternatives for implementation of the facility design recommended in the previous chapter. The focus of this section is to evaluate the merits and deficiencies of alternatives, and provide the technical basis necessary for determining a preferred airport development plan, as depicted in the Airport Layout Plan (ALP).

Overall, the airport plan is the formulation of a development concept, rather than the presentation of a design recommendation. While the assessment of alternatives are based on technical judgement, the most favorable airport improvement option should be compatible with local planning policies, as consistent with social, economic, political and environmental goals. In order to determine the best possible course of action, the following factors should be strongly considered in the development and evaluation of potential design options:

- Compliance with FAA airport standards and airspace criteria - without modification to airport planning design standards;
- Maintain compatibility with existing and proposed on and off-airport land uses;
- Consider short and long-term development costs;
- Minimize the consequences of environmental impacts and potential mitigation.

AIRFIELD ALTERNATIVES

The major airfield design options include the following alternatives:

- ALTERNATIVE A – Improve Instrument Approach Minimums to Less than 1-Mile
- ALTERNATIVE B – Reconstruct Runway 7-25 to ARC B-I Design (3,700’)
- ALTERNATIVE C – Extend Runway 11-29 & Taxiway to ARC B-II+10 Design (4,600’)

The advent of improved GPS navigational aid technology allowing lower non-precision with vertical guidance and precision instrument minimums presents the option to plan for improvements to the airport’s straight-in instrument approach capabilities. Current FAA programs for the augmentation of GPS-only instrument approach technology, possibly using differential equipment, will eventually allow horizontal and vertical guidance with visibility minimums lower than 1-mile for all aircraft categories. Planning for improved non-precision, and eventually GPS precision capabilities is a short to medium-range planning option for ultimate runway design and equipment considerations. The County is interested to know which factors are the controlling limitation for establishing better minimums.

Table 5.1 shows the reliability gained by successive improvements to the instrument approach procedures (ceiling and visibility minimums) as achieved through lower approach minimums. As reported from the Yakima Weather Station (closest first-order weather station to Bowers Field), the region experiences instrument flight conditions (IFR) approximately 12 percent of the time, which is equivalent to nearly 42 days per year that 6,270 operations are affected by weather conditions alone. A precision instrument approach would improve the airports reliability to over 98 percent.

<table>
<thead>
<tr>
<th>Meteorological Condition</th>
<th>Visibility Versus Ceiling Condition</th>
<th>Percent Affected Observation</th>
<th>Affected Days Per Year</th>
<th>Equivalent Annual Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Marginal VFR</td>
<td>Greater than 3-miles visibility higher than 3,000’ ceiling</td>
<td>88.6%</td>
<td>323 days/year</td>
<td>48,730</td>
</tr>
<tr>
<td>Percent IFR</td>
<td>Lower than 3-miles visibility Lower than 3,000’ ceiling</td>
<td>11.4%</td>
<td>42 days/year</td>
<td>6,270</td>
</tr>
</tbody>
</table>

Advantages For Lower Instrument Approach Minimums

<table>
<thead>
<tr>
<th>Meteorological Condition</th>
<th>Visibility Versus Ceiling Condition</th>
<th>Percent IMC Affected Observation</th>
<th>Affected Days Per Year</th>
<th>Affected Itinerant Approaches (24,650)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFR (Existing)</td>
<td>1¼-mile / 1,340’ ceiling</td>
<td>6.8%</td>
<td>25 days/year</td>
<td>840</td>
</tr>
<tr>
<td>IFR (Existing)</td>
<td>1-mile / 700’ ceiling</td>
<td>4.4% (+2.4%)</td>
<td>17 days/year</td>
<td>542</td>
</tr>
<tr>
<td>IFR (NPI)</td>
<td>1-mile / 400’ ceiling</td>
<td>2.2% (+2.2%)</td>
<td>8 days/year</td>
<td>270</td>
</tr>
<tr>
<td>IFR (NPI-Vertical)</td>
<td>¾-mile / 300’ ceiling</td>
<td>1.7% (+0.5%)</td>
<td>6 days/year</td>
<td>210</td>
</tr>
<tr>
<td>IFR (Precision)</td>
<td>½-mile / 200’ ceiling</td>
<td>1.1% (+0.6%)</td>
<td>4 days/year</td>
<td>135</td>
</tr>
</tbody>
</table>

Note: Assumes IFR days are not affected by non-flyable weather conditions (icing, storms, winds, etc.)

Design Considerations:

- The existing circling instrument approach procedures (VOR or GPS-A and VOR or GPS-B) provide relatively high minimums, providing for only for Category A and B aircraft. As the only available straight-in approach procedure, it will be determined whether there are any possible improvements to the existing GPS Runway 25 approach minimums and procedure for all category of aircraft (Category A, B, C and D). A re-evaluation of the instrument procedures will identify any modifications to avoid military restricted areas (coordinate with FAA and Army), addition of step-down fixes, changes to the missed approach procedure, restrictions for night use (light runway), and adjustment to the minimum descent altitude (MDA) based on installation of the ELN ASOS-3.

- At current, Ellensburg VORTAC (ELN VORTAC) only allows for a straight-in instrument approach capability to Runway 25. At present, Runway 25 is only straight-in approach, in which the holding pattern encroaches a military restricted area. Straight-in minimums are not authorized at night, and the procedure is not authorized when military restricted areas (R-6714A, G and H) are in operation. This is a rather severe penalty to any straight-in approach. Current ELN VORTAC restrictions don’t allow VORTAC usage (VOR or DME) between 90 and 158 degrees. This appears to disallow the VORTAC from providing straight-in instrument approaches since its location is beyond 30 degrees from the Runway 11-29 centerline (132.9 degrees). An Airport Airspace Analysis study was requested by the FAA to determine the possibility of establishing improved straight-in capabilities to other runways, primarily Runway 29 and 25. The analysis will determine what modifications, if any, would be necessary to the current Runway 29 and 25 threshold. Under both of these cases, it would be important to identify limitations to the approach procedure, and what categories of aircraft might be excluded from the procedure.

- An approved Approach Lighting System (ALS) is required to accommodate published approach procedures with visibility as low as ¾-mile or ½-mile (ODALS/SSALS/SSALR/MALS/MALSF). Approach lighting systems are classified as high and medium intensity, with medium intensity systems normally installed at general aviation airports. As part of the Airport Alternatives Analysis, it will be determined which approach lighting system provides the most benefit for the least amount of impact, including an analysis of the potential violation of Look Road crossing the proposed inner approach obstacle free zone (OFZ), 34:1 clearance over Look Road, future land acquisition of OFZ beyond current airport property, upgrade to a larger runway protection zone (RPZ) which would possibly transect Look Road, impacts to existing airport hangars, and the proposed extension of Bowers Road to Look Road. Consider options to appropriately control areas within the future runway protection zone.

- The proposed approach to Runway 11-29, primarily the Runway 29 end, would include a published 34:1 non-precision instrument (NPI) approach straight-in procedure with
visibilities down to, but not lower than ¾-mile. Presumably, the straight-in NPI approach to Runway 29 will originate southeast of the airport approximately two (2) nautical miles from the runway threshold. The NPI approach and reduced visibility to Runway 29 will be aided by the installation of a Medium Intensity Approach Lighting System with sequenced flashing lights (MALSF) at the Runway 29 threshold.

A published 34:1 NPI approach to Runway 29 would presumably also include a straight-in 20:1 NPI approach to the Runway 11 end as well. The NPI approach to Runway 11 would accommodate visibilities not lower than 1-mile. A visual approach aid such as a Precision Approach Path Indicator (PAPI) and threshold lights will aid arriving aircraft while navigating to the Runway 11 threshold.

The following identify Approach Lighting Systems (ALS) installed at General Aviation Airports. Also provided is the length of the actual lighting system and allowable instrument visibility minimums (SM).

**High Intensity Approach Lighting Systems:**
- SSALS/SALS – Simplified Short Approach Lighting System (1,400 LF) - ¾-mile
- SSALR – Simplified Short Approach Lighting System with RAIL (2,400 LF) - ½-mile

**Medium Intensity Approach Lighting Systems:**
- MALS – Medium Intensity Approach Lighting System (1,400 LF) - ¾-mile
- MALSF – Medium Intensity Approach Lighting System with Sequenced Flashers (1,400 LF) - ¾-mile
- MALSR – Medium Intensity Approach Lighting System with RAIL (2,400 LF) – ½-mile
- ODALS – Omni-Directional Approach Lighting System (1,500 LF) - ¾-mile

- Installation of an ALS requires a 200-foot runway centerline holding position on taxiways serving a non-precision instrument runway. A potential safety issue exists with taxiway Echo regarding space to accommodate holding aircraft to meet object free area (OFA) and obstacle free zone (OFZ) criteria. Taxiway Echo will likely be recommended to be closed and abandoned.

- Determine land use requirements, based on proposed Airport Zoning Ordinance for airport safety areas and the height control of existing and future structures within the approach surface. A lateral 750-foot building restriction line would be required along both sides of the runway centerline (BRL 495’ existing). After further study, it was determined that the ultimate BRL for Runway 11-29 does not impact the existing clear-span hangars located to the east of the airport flight line/terminal complex.

- Consider environmental impacts to proposed development east of Bowers Field.
ALTERNATIVE B – Reconstruct Runway 7-25 to ARC B-I Design (3,700’)

The local wind characteristics indicate, based on wind analysis alone, that Runway 11-29 provides sufficient crosswind coverage for all aircraft. Runway 7-25, as the crosswind, currently accommodates nearly 30 to 40 percent of the 55,000 annual airport operations, and provides the only straight-in instrument approach procedure and is used predominately for flight training activity. Due to its usage, design options are being studied to reconstruct it to ARC B-I standards, which accommodates most twin-piston aircraft.

Design Considerations:

- Maintain Runway 7-25 at a minimum of 4,200 feet if no other straight-in instrument approach procedures are allowed to any other runway end (Runway 29). Install medium runway edge lighting (MIRL) system. Relocate hold position points based on minimums allowed for instrument approach procedure. Should another Runway end, such as Runway 29, accommodate a straight-in NPI approach, Runway 7-25 is recommended to be shortened to ARC B-I design criteria (3,700’ x 60’).

- Rehabilitate runway to optimize relocated threshold locations.

- Relocate Runway 29 threshold to accommodate entire runway protection zone (RPZ).

- Consider a reduction of runway width to ARC B-I design standards (60’ wide). Current width is 150 feet. Conduct cost/benefit analysis based on specific project items.

- Consider options for maintaining full parallel-taxiway system (Taxiway A, B, C and E) based on current configuration and width (ARC B-I taxiway design width is 25’ wide).

- Relocate Runway 7 and 25 lighting.

- Determine non-aeronautical land uses which would permit future development of airport property for commercial purposes, including roadway clearance.

- Alternative C proposes that the Runway 29 threshold be relocated to the existing Runway 7-25 centerline. Should Runway 7-25 remain at 5,590 feet in the interim planning stages and the Runway 29 end be relocated, the entire length of Runway 7-25 would be usable for landing and takeoff operations without regard for declared distance criteria or other airfield design criteria restrictions.

- Should the County elect to maintain Runway 7-25 at its current length of 5,590 feet, the County would be responsible for maintaining the full length of the runway with local and state dollars rather than Federal AIP funding grants. Runway 7-25 is ineligible for federal
funding due to the wind coverage provided by the Primary Runway 11-29 (99.45 percent at 10.5 knots of wind velocity).

- **ALTERNATIVE C – Extend Runway 11-29 to ARC B-II+10 Design (4,600’).**

The runway length required to accommodate the future critical aircraft is 4,600 feet, which allows unrestricted access of ARC B-II aircraft with more than 10 passenger seats. This runway length accommodates small to medium-sized business jets.

**Design Considerations:**

- Extend Runway 11-29 approximately 300 feet to the northwest (along currently abandoned pavement) to achieve a recommended length of 4,600 feet under wet and slippery weather/ runway conditions. Consider impacts to Runway 29 threshold and future runway design width (75’) based on instrument approach capabilities and benefit/cost analysis.

- Provide appropriate airspace clearance over Hungry Junction Road.

- Extend and relocate Runway 11-29 lighting systems (MIRL, REIL, VASI, ODALS).

- Determine future runway visibility zone (RVZ) to exclude non-aeronautical structures.

- Construct future full-length parallel taxiway to serve Runway 11-29 with an appropriate runway-taxiway centerline separation and hold short distance to accommodate possible future precision instrument approach capabilities. Install MITL for the newly constructed taxiway.

- Should the County decide to maintain Runway 11-29 at or near its current runway end locations, property located to the southeast of Look Road will require acquisition to accommodate the RPZ, Inner Approach OFZ and the Approach Lighting System based upon facility requirements needed to accommodate projected aviation demand levels. Additionally, this course of action would minimize the elimination of paved runway surfaces that are in good condition and serve to preserve the County’s and FAA’s investment in the recently rehabilitated runway surface.

- Should Runway 11-29 be expanded to 4,600 feet and both runway ends be relocated to the northwest to accommodate future aviation demand, the full 5,590 foot length of Runway 7-25 will be usable for landing and takeoff operations regardless of the placement of the Runway 29 threshold.
SUMMARY OF AIRFIELD ALTERNATIVES

Various airfield design options have been prepared for Kittitas County to satisfy the objectives of Alternatives A, B and C. These design concepts represent the range of possibilities to reasonably resolve design and operational deficiencies without modification to FAA airport design standards. Following a review of these design options based on the merits of meeting the performance standards of future airport development, as individual or a combination of strategies, a preferred airfield concept will be selected which will be carried through as an update to the Kittitas County Airport Layout Plan (ALP).

Exhibit 5.1: Base Airfield Map (Current Runway & Taxiway Characteristics)

ALTERNATIVE A - APPROACH LIGHTING SYSTEM (ALS) OPTIONS

Exhibit 5.2: A-I – ½-Mile Approach Lighting System to Runway 29 End
Exhibit 5.3: A-II – ½-Mile Approach Lighting System to Runway 25 End
Exhibit 5.4: A-III – ¾-Mile Approach Lighting System to Runway 29 and 25 End

ALTERNATIVE B – RUNWAY 7-25 DESIGN

Exhibit 5.5: B-I – Runway 7-25 (3,700’ x 60’) and Parallel Taxiway Design
Exhibit 5.6: B-II – Runway 7-25 (3,700’ x 60’) and Parallel Taxiway Design

ALTERNATIVE C – RUNWAY 11-29 ARC B-II+10 DESIGN STANDARDS

Exhibit 5.7: C-I – Runway 11-29 (4,600’) and Parallel Taxiway Design
Exhibit 5.8: C-II – Runway 11-29 (4,600’) / Parallel Taxiway and Approach Lighting System

PREFERRED AIRFIELD ALTERNATIVE

Exhibit 5.9: Runway 11-29 (4,600’)/ Parallel Taxiway and Approach Lighting System-MALSF (¾-Mile Visibility)
Runway 7-25 (3,700’)/ NPI Approach Capability (1-Mile Visibility)
Kittitas County, Washington

BOWERS FIELD
AIRPORT MASTER PLAN UPDATE

AIRPORT ALTERNATIVES ANALYSIS
AIRFIELD ALTERNATIVE "A-B"

RUNWAY 11-29 4,300' (NPI-ARC B-II)
RUNWAY 7-25 4,000' x 75' (PV/MALSR-ARC B-I)
OR
RUNWAY 7-25 4,300' x 75' (PV/MALSR-ARC B-II)

EXHIBIT 5.3
Kittitas County, Washington

BOWERS FIELD
AIRPORT MASTER PLAN UPDATE

AIRPORT ALTERNATIVES ANALYSIS
AIRFIELD ALTERNATIVE B-II

RUNWAY 11-29 4,300' (NPA-ARC B-II)
RUNWAY 7-25 3,700' x 60' (NPA-ARC B-I)
OR
RUNWAY 7-25 4,300' x 75' (NPA-ARC B-II)

EXHIBIT 5.6
Kittitas County, Washington

BOWERS FIELD
AIRPORT MASTER PLAN UPDATE

AIRPORT ALTERNATIVES ANALYSIS
AIRFIELD ALTERNATIVE C-H

PREFERRED AIRFIELD ALTERNATIVE

RUNWAY 11-29 4,600' (PL-ARC B-H+10)
INCLUDES INSTALLATION OF A MALSR & FULL-LENGTH PARALLEL TAXIWAY

EXHIBIT 5.8