

5. Development Concepts

Previous sections presented an inventory of existing conditions, assessed future demand for aviation activity, and identified current and future facility requirements for the Airport. The primary focus of this section is to identify and evaluate Airport development concepts that address existing facility deficiencies, satisfy future aviation-related demand, and are responsive to the needs of the communities served by the Airport. This section discusses the identification and evaluation of development concepts, organized as follows:

- Airfield development concepts
- Passenger terminal development concepts
- Tenant facility development concepts
- Ground access and support facility development concepts

Concepts were based on the information presented in Sections 2, 3, and 4, as well as previously identified planning studies summarized in Section 1. This information was supplemented by the judgment and recommendations of Airport staff, as well as Airport user input from the TRC and the general public.

5.1 Airfield Development Concepts

This subsection describes the development and evaluation of concepts that address the airfield requirements presented in Section 4. In summary, these requirements include realigning the existing crosswind runway to improve crosswind coverage for general aviation aircraft, as well as various taxiway/taxilane improvements to increase airfield efficiency and provide access for potential Airport development.

5.1.1 CROSSWIND RUNWAY REALIGNMENT CONCEPTS

As described in Section 4, the existing runway system (primary Runway 7-25 and crosswind Runway 12-30) does not provide adequate all weather wind coverage. In accordance with FAA design standards, the runway system should be configured to provide at least 95 percent wind coverage in all weather (VMC and IMC) wind conditions. The existing runway system at TWF provides only about 91 percent all weather wind coverage, assuming a maximum crosswind component of 10.5 knots. This deficiency primarily affects the availability of the Airport for small general aviation aircraft that make up a significant portion of aircraft operations at TWF. Specifically, the analysis described in Section 4 notes that IMC wind coverage at the Airport is adequate and concludes that Runway 12-30 should be realigned to increase VMC wind coverage such that the combined runway system provides at least 95 percent wind coverage in all wind conditions.

5.1.1.1 Development and Evaluation of Initial Crosswind Runway Realignment Concepts

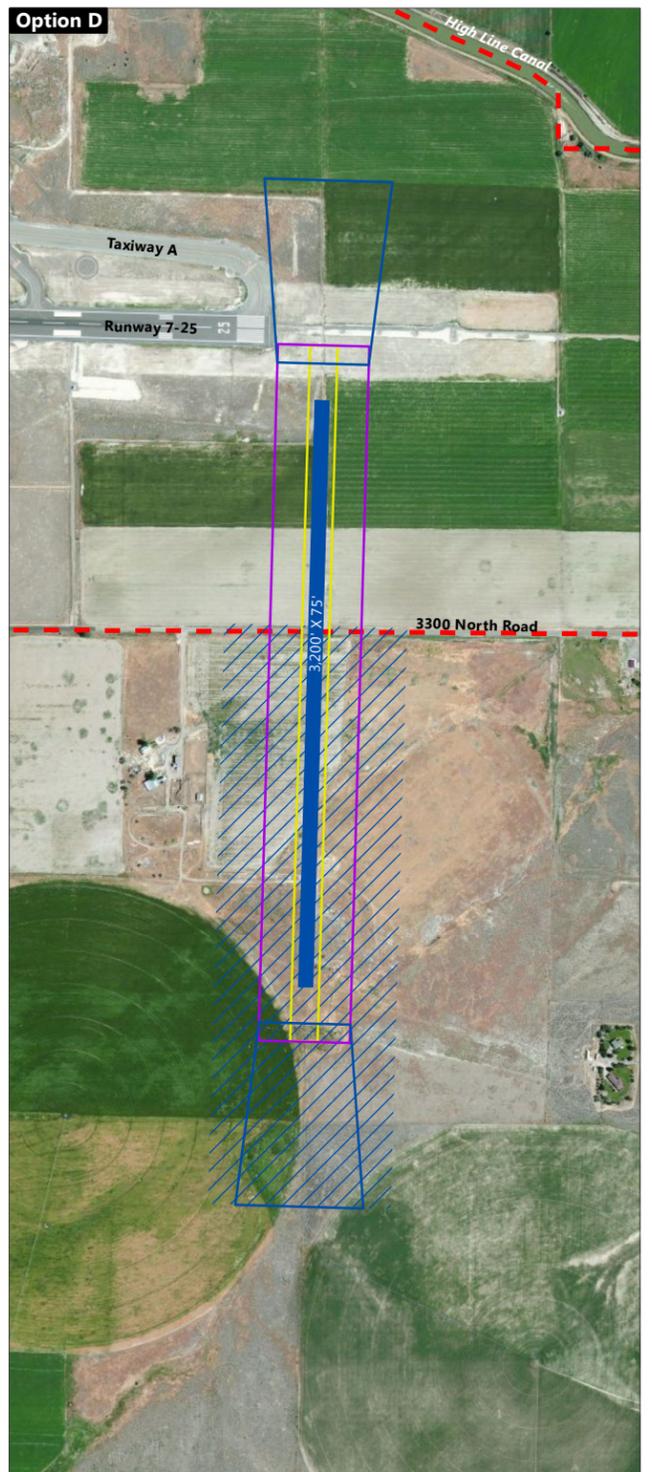
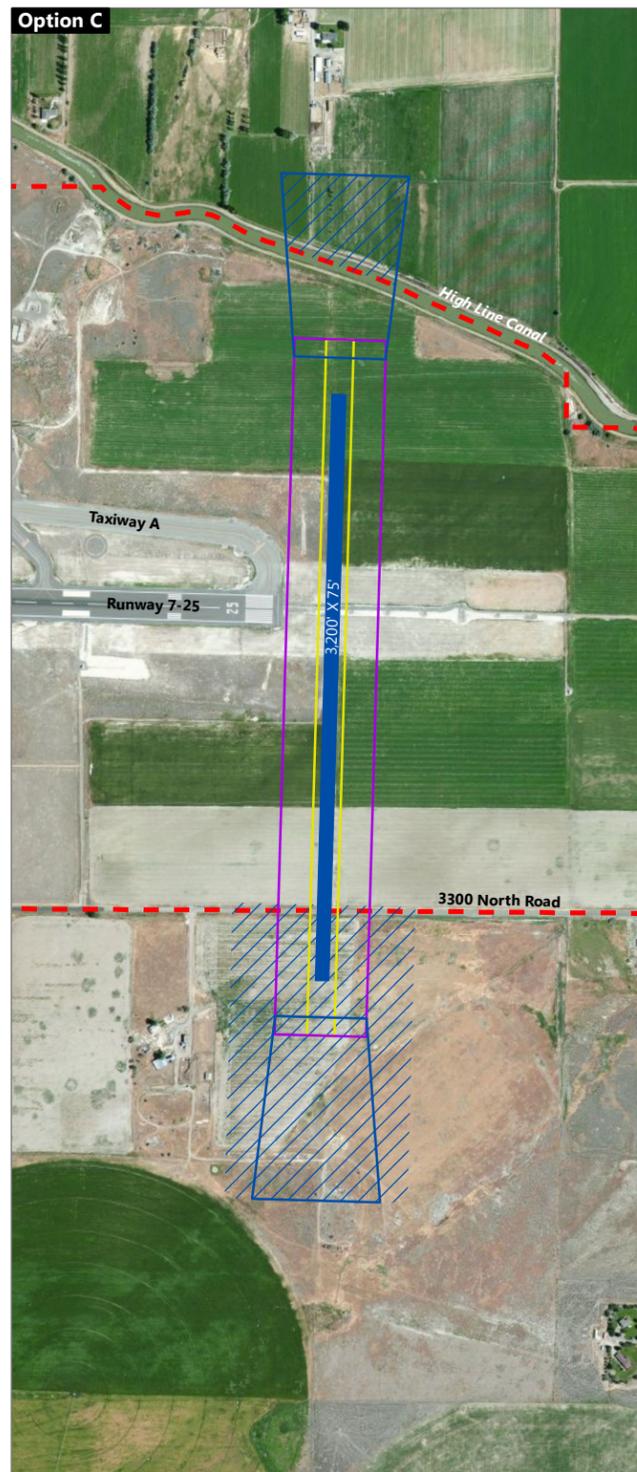
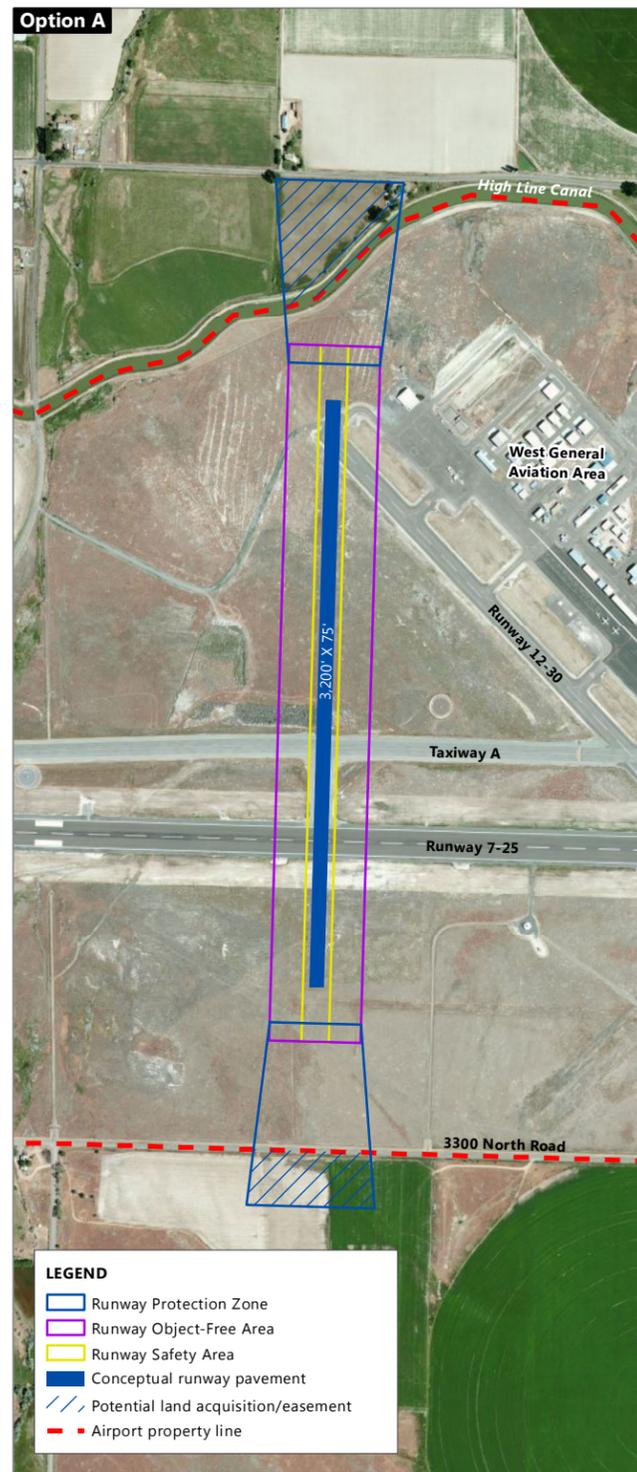
Initial crosswind runway realignment concepts were developed in consideration of the general location, layout, and terrain of the Airport and surrounding land uses, along with the operational requirements of the crosswind runway, and were based on the following assumptions and requirements:

- Upon construction of a new crosswind runway, the existing crosswind runway will be decommissioned (i.e., a second crosswind runway is not proposed to supplement existing Runway 12-30).
- Based on the wind data presented in Section 2 and assuming a maximum crosswind component of 10.5 knots, the range of crosswind runway orientations that would result in a combined runway all weather wind coverage of at least 95 percent is approximately 153° true to 240° true. The new crosswind runway should be oriented within this range.
- The new crosswind runway should be an in-kind replacement of Runway 12-30, which would be decommissioned and converted to a taxiway. This means that the relocated runway should meet FAA design standards for ARC B-II, with a length of 3,200 feet, which would maintain the utility of both the crosswind runway and the combined runway system at the Airport.
- The new runway should be positioned such that a reasonable taxiway system can be developed to connect the new runway to the existing airfield.

Four initial crosswind runway realignment concepts were developed. For purposes of this Master Plan Update, these concepts are identified as Option A, Option B, Option C, and Option D, and are depicted on **Exhibit 5-1**.

Options A and B involve development of a realigned crosswind runway on the west side of the Airport in the same general location as existing Runway 12-30 and remain within Airport property. Option A rotates the southeast end of Runway 12-30 45 degrees to an orientation of 181.3° true, such that the realigned runway is oriented perpendicular to Runway 7-25. In this concept, the runway would cross Taxiway A and Runway 7-25 along existing exit Taxiway A4. Option B rotates the southeast end of Runway 12-30 90 degrees to an orientation of 226.3° true. In this concept, the southwest end of the runway would intersect with Taxiway A in the vicinity of exit Taxiway A5.

Options C and D involve the relocation of the crosswind runway east of and perpendicular to Runway 7-25, with the same orientation as Option A. Both of these concepts involve a portion of runway development extending south of the existing Airport property line. In Option C, the realigned crosswind runway would be located off the end of the Runway 25 threshold at a centerline distance of approximately 300 feet, with the southern end of the runway extending approximately 400 feet south of 3300 North Road. Option D is located along the same alignment as Option C, but involves shifting the Option C crosswind runway south approximately 1,550 feet. In this concept, the southern end of the runway would extend approximately 1,950 feet south of 3300 North Road.



LEGEND

- Runway Protection Zone
- Runway Object-Free Area
- Runway Safety Area
- Conceptual runway pavement
- Potential land acquisition/easement
- Airport property line

SOURCES: ESRI, May 2010 (Bing Maps aerial photograph); Riedesel Engineering, Inc., January 2011 (Airport property line and crosswind runway realignment concepts).
 PREPARED BY: Ricondo & Associates, Inc., March 2012.

EXHIBIT 5-1



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Exhibit 5-2 presents the evaluation of the initial crosswind runway realignment concepts. Each concept involves construction of a 3,200-foot runway with an ARC of B-II. As shown, the recommended combined runway all weather wind coverage under all four concepts is greater than 95 percent. Wind coverage for Options A, C, and D are slightly higher than wind coverage for Option B. However, since all concepts result in combined all weather wind coverage of at least 95 percent, wind coverage was not considered in the evaluation of each concept. Rather, each concept was evaluated against specific categories organized by on-Airport impacts, off-Airport impacts, operational impacts, and construction costs.

A two-step methodology was used to evaluate each concept. First, for each evaluation category, a numerical ranking was assigned to each concept, assessing the ability of a concept to meet the criteria/objective associated with the category, relative to the other concepts. In cases where concepts may be ranked equally for a specific category, the ranking was split evenly such that the total ranking "points" awarded for each category adds up to 10. In this way, concepts that are not part of the "tie" are treated more fairly in relation to the other concepts. The second step of the evaluation methodology was to assess the ability of a concept to meet the criteria/objective associated with a specific category, irrespective of the other concepts. For each category, each concept was ranked as "more favorable," "less favorable," or "unfavorable," corresponding to a weighting factor of 2, 1, and 0, respectively. A "more favorable" ranking was assigned to concepts that meet the criteria/objective associated with the category in a more desirable or ideal manner. A "less favorable" ranking was assigned to concepts that do not meet the criteria/objective associated with the category, or meet the criteria/objective in a less desirable manner. An "unfavorable" ranking assigned to a concept for a specific category indicates a significant concern that affects the overall viability of the concept. It was assumed that concepts determined to be unfavorable for any evaluation category could not be ultimately recommended unless the unfavorable conditions can be mitigated.

Where applicable, the rankings were based on quantitative analysis. In other cases, rankings were based on professional judgment of the project team, in consultation with Airport staff, the TRC, and other sources, as applicable. The following subsections describe how the concepts were ranked within and relative to each evaluation category.

On-Airport Impacts

- **Constructability** – This category considers the relative ease of constructing the conceptual runway given geographic/engineering considerations such as terrain, accessibility, and required grading. Options C and D were determined to be the easiest to construct due to relatively level terrain and were therefore determined to be more favorable in terms of constructability. Options A and B would require more significant earthwork, as well as tie-ins with existing airfield pavement, making them less favorable in terms of constructability.
- **Phasing/implementation** – This category considers the ability of construction of a given concept to be phased or implemented in such a way that is least disruptive to Airport operations. Option D is located furthest away from any existing airfield pavement area and would have the least impact on Airport operations during construction, making this concept more favorable. The other three concepts would directly impact Airport operations, and were determined to be less favorable in this regard.

Replacement Crosswind Runway Options ---->		Option A	Option B	Option C	Option D
Black line represents existing Runway 7-25; blue line represents new crosswind runway option. Note that under all options, existing crosswind Runway 12-30 would be decommissioned.					
Design Specifications	Description				
Runway length	Suitable length to accommodate takeoffs and landings of aircraft that currently use the existing crosswind runway	3,200 feet	3,200 feet	3,200 feet	3,200 feet
Airport Reference Code (ARC)	Conforms to the same design criteria currently associated with the existing crosswind runway	B-II	B-II	B-II	B-II
Combined all-weather wind coverage assuming a 10.5-knot crosswind component	Percentage of time that an aircraft can use the airport based on a crosswind not exceeding a specified level;	98.82%	97.21%	98.82%	98.82%
Combined all-weather wind coverage assuming a 13-knot crosswind component	FAA recommends 95% or greater	99.75%	98.73%	99.75%	99.75%
Evaluation Category	Criteria/Objective	Rank (1 = worst; 4 = best)			
On-Airport Impacts					
Constructability	Ease of construction given geographic/engineering considerations such as terrain, accessibility, required grading, etc.	1	2	3	4
Phasing/implementation	Ability to phase/implement construction in a way that is least disruptive to airport operations	1	3	2	4
On-Airport planned land use	Compatibility of the option with long-range airport development plans	3.5	3.5	1	2
Safety considerations	Ability to design, implement, and operate the runway without creating unnecessary safety risks	1	3.5	2	3.5
Environmental considerations	Potential to limit impacts to areas of potential environmental concern	2	1	3.5	3.5
Off-Airport Impacts					
Land acquisition/avigation easements	Limits/eliminates the need to acquire land outside of existing airport property for runway development or associated safety zones and limits/eliminates the need to acquire avigation easements for the runway protection zones	3	4	2	1
Roadway impacts	Eliminates the need to relocate roadway sections due to runway development or associated safety zones	3	4	1	2
Aircraft noise/overflights	sensitive areas when operating in the airport traffic pattern	3.5	1	2	3.5
Operational Impacts					
Taxi time to/from primary small GA aircraft area	Minimizes the time required to taxi between the runway and the primary small GA aircraft area located in the northwest quadrant of the airport	4	3	2	1
Segregation of small and large aircraft	Enhances airfield safety and efficiency by minimizing the operation of small GA aircraft in areas more suited for/dominated by larger aircraft	3.5	3.5	2	1
ATCT line of sight considerations	Ability of air traffic controllers to easily locate, identify, and positively control aircraft operating on the runway	4	3	2	1
Construction Costs					
Comparative rank	Considers costs associated only with construction of the runway	1	2	3	4
Ranking	Weighting Factor	Overall Ranking (individual option rank x weighting factor)			
More favorable	2	10	19	13.5	28.5
Less favorable	1	16	17	3	9
Unfavorable	0	23	19	2	0
Summary:	Construction Costs	1	2	6	8
Options A and B are carried forward to final evaluation	Total	50	57	24.5	45.5

SOURCES: Ricondo & Associates, Inc. and Riedesel Engineering, Inc., June 2011.
 PREPARED BY: Ricondo & Associates, Inc., March 2012.

EXHIBIT 5-2

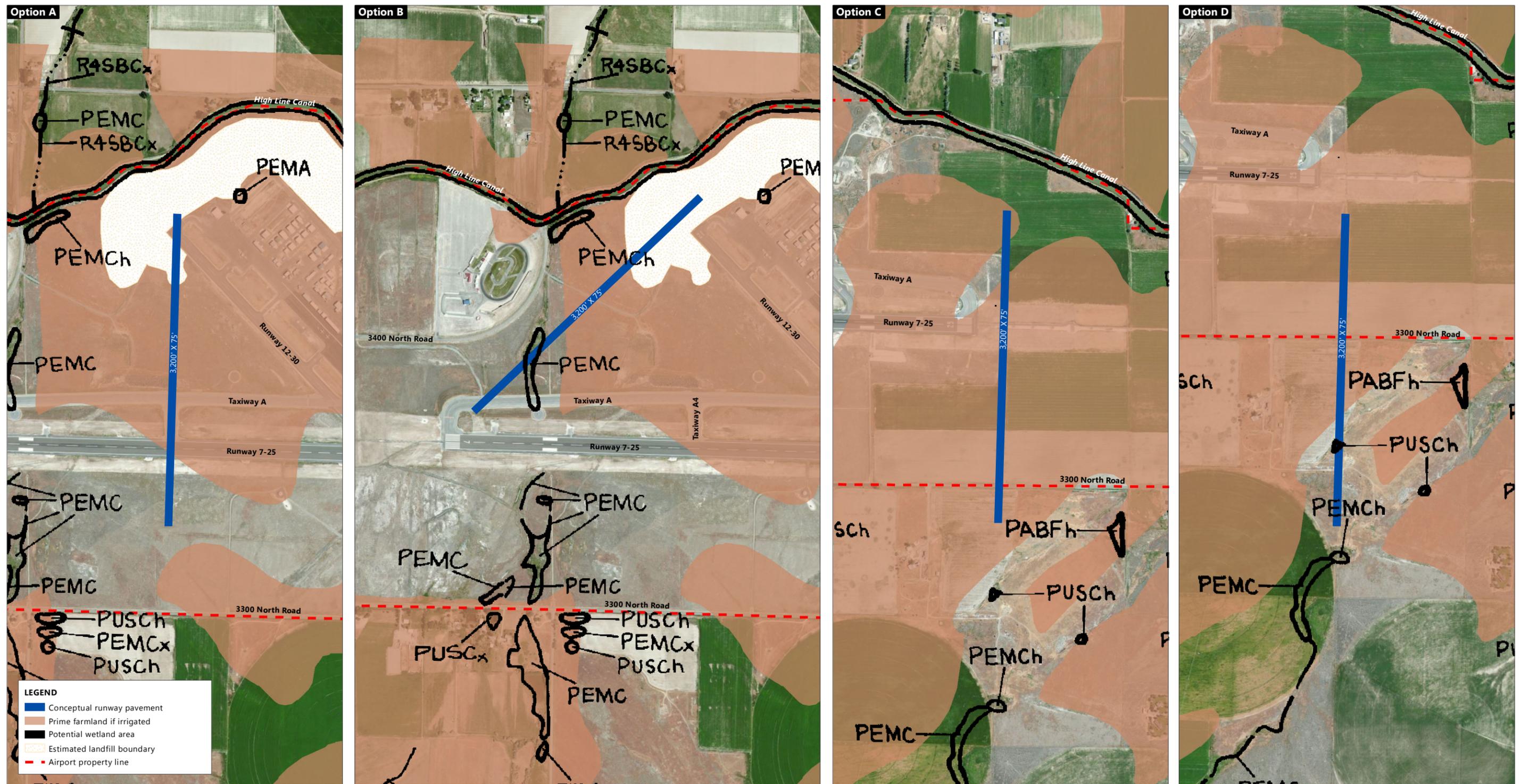


Evaluation of Initial Crosswind Runway Realignment Concepts

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Taxiway A would be inactive in the vicinity of the Runway 7 end during construction of the southwest end of Option B. However, other taxiway routes could be utilized during construction and construction could be phased to limit the disruption to this portion of the airfield. Option A would necessitate temporary closure of a portion of Taxiway A and Runway 7-25, although construction could be scheduled to take place during low activity periods and phased to limit the overall downtime of Taxiway A and Runway 7-25. Option C would not directly interact with existing airfield pavement, although the staging and operation of construction equipment off the approach end of Runway 25 would likely necessitate temporary closure of or limitations placed on Runway 7-25. As with Option B, construction in proximity to Runway 25 could be scheduled during low activity periods and phased to limit any necessary downtime of Runway 7-25.

- **On-Airport planned land use** – This category considers the compatibility of each concept relative to long-range Airport development/land use plans. Section 6 describes the development of the recommended on-Airport land use plan. Options A and B are both located in a more favorable area designated for future airfield development. Option D is also located in an area designated for future airfield development. However, the northern RPZ associated with this concept would overlay an area designated for future aeronautical development, resulting in potential limitations on the development of future hangars, taxiways, and related aeronautical infrastructure. Option C was determined to be in an unfavorable location with regard on-Airport planned land use. Approximately 420 feet of runway pavement would cross into an area designated for future aeronautical development, significantly affecting the land available for future hangar, taxiway, and related aeronautical development in this area. Additionally, a portion of the northern OFA and RPZ associated with this concept would overlay an area determined to be prime area for non-aeronautical development, thereby affecting potential future revenue-generating development for the Airport.
- **Safety considerations** – This category considers the ability of each concept to be designed, implemented, and operated without creating unnecessary safety risks. Options B and D are most favorable in this regard, although aircraft operating on Option D would have to taxi across the arrival/departure path of aircraft operating on Runway 7-25 and Option B directly ties-in with Taxiway A. Option C is less favorable in that the conceptual crosswind runway would be located directly under the flight path of aircraft operating on Runway 7-25. ATCT operating procedures would have to restrict operations on the crosswind runway when operations are taking place on Runway 7-25 and vice versa. Option A is also less favorable from a safety standpoint, given its physical intersection with Taxiway A and Runway 7-25. ATCT already has operating procedures in place to reduce safety risks related to the intersection of Runway 7-25 with existing crosswind Runway 12-30. Option A would require the implementation of similar procedures.
- **Environmental considerations** – This category considers the potential of each concept to limit impact to areas of potential environmental concern. Based on the environmental overview described in Section 2, the primary environmental features/conditions that should be considered when identifying and analyzing future Airport development projects at TFW include air quality, water quality, the former County landfill site, wetlands, and farmlands. Each concept would be expected to have minimal, but similar impacts on air and water quality due to construction activities and increased pavement area. The proximity of each concept to the landfill, wetlands, and farmlands, is depicted on **Exhibit 5-3**.



SOURCES: ESRI, May 2010 (Bing Maps aerial photograph); Riedesel Engineering, Inc., January 2011 (Airport property line and crosswind runway realignment concepts); U.S. Department of Agriculture, Natural Resources Conservation Service, Web Soil Survey, accessed March 2011 (farmland designations); Riedesel Engineering, Inc., June 2011 (estimated landfill boundary); U.S. Fish and Wildlife Service, National Wetlands Inventory Wetlands Mapper, accessed April 2011 (potential wetland areas).
 PREPARED BY: Ricondo & Associates, Inc., March 2012.

EXHIBIT 5-3



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As shown on Exhibit 5-3, a portion of Options A and B are located within the estimated boundary of a former County landfill, as described in Section 2. As part of the process of evaluating the initial crosswind runway realignment concepts, the Idaho Department of Environmental Quality (DEQ) was consulted to help determine the potential impacts of developing or disturbing the site. According to the DEQ, the site may contain hazardous waste, the site may be classified as a feature of cultural/historical significance, and methane may be an issue. However, the DEQ also stated that there do not appear to be any current Idaho regulations preventing development on the landfill. Based on available information regarding the site, an initial investigation of the site, the concerns raised by the DEQ, previous construction experience in the vicinity of the site, and conversations with Airport staff, it was determined, for purposes of this Master Plan Update, that runway development on any portion of the site should be avoided.¹ Therefore, Options A and B were classified as unfavorable with regard to this evaluation category.

As described in Section 2, an initial investigation of potential wetland areas on Airport property found a willow pocket near the High Line Canal, which supports wetland indicators (identified as PEMCh on Exhibit 5-3).² Option B is located in relatively close proximity to this area, although the ultimate extent of construction activity and the nature/quality of the wetland area would need to be assessed to accurately determine the significance of any potential impact. As shown on Exhibit 5-3, Option B crosses another potential wetland area (PEMCh) characterized as a depression. A field survey found no hydrology, soils, or vegetation to indicate the presence of a wetland in this area. Option C is not located near any known potential wetland areas. Option D crosses through a potential wetland area identified as PUSCh, approximately 1,000 feet south of 3300 North Road. Selection of this option would require an investigation of this area and adjacent potential wetland areas to determine if they meet the applicable wetland criteria, as defined in Section 2.

Exhibit 5-3 depicts areas classified as "prime farmland if irrigated." No such areas on Airport property are irrigated. Areas on Airport property classified as "prime farmland if irrigated" that would be impacted by Options A and B are not irrigated and were therefore considered to be more desirable in this regard. Option C and Option D (to a greater extent) extend south of Airport property into an area classified as "prime farmland if irrigated." Additional investigation of these lands would be necessary to determine if a dependable irrigation source of adequate quality is available in these areas. The northern end of Option D would extend into an area on Airport property that appears to be irrigated.

In summary, as discussed previously, Options A and B were determined to be unfavorable with regard to environmental considerations due to their location on the former County landfill site. In addition, Option B is in relatively close proximity to a potential wetland area with confirmed wetland indicators.

¹ A thorough investigation of the landfill site would be conducted as part of a future environmental assessment for realignment of the crosswind runway. Such an investigation, which was beyond the scope of this Master Plan Update, may determine that development on the landfill site would not result in significant environmental impacts and/or substantial mitigation or construction costs. For master planning purposes, a conservative approach was undertaken to discourage runway development on the landfill site.

² A description of the potential wetland areas located on Airport property can be found in Section 2.5.1.4.

Options C and D both extend into areas designated as “prime farmland if irrigated,” which would need to be further investigated. Option D also crosses through an uninvestigated potential wetland area.

Off-Airport Impacts

- **Land acquisition/avigation easements** – This category considers the extent to which each concept limits/eliminates the need to acquire land or avigation easements outside of existing Airport property, either for runway development or associated safety zones. Exhibit 5-3 depicts the areas of each concept where the acquisition of land and/or avigation easements may be required. The physical runway, as well as the RSA, should be located on Airport-owned land.

For Options A and B, the entire physical runway and RSA would be located on existing Airport property. For these concepts, a portion of the RPZs would extend beyond Airport property, but land acquisition is not necessarily required for proper protection/control of the RPZs. Rather the Airport could acquire avigation easements³ over the applicable underlying property to prevent the construction of buildings and towers, planting of trees, installation of lighting, or any other development that might interfere with the takeoff and landing of aircraft. Option A would require acquisition of avigation easements over a portion of the RPZs on each end of the conceptual runway, totaling approximately 12 acres. Option B would require acquisition of an avigation easement over a portion of the northernmost RPZ, totaling less than 1 acre.

For Options C and D, the physical runway extends south of Airport property, requiring land acquisition or a combination of land acquisition and avigation easements. At a minimum, land acquisition would be required to accommodate the length of the physical runway and RSA, and to a width including the BRL. The total estimated additional land to be controlled by the Airport (either through land acquisition or a combination of land acquisition and avigation easements) for Options C and D would be approximately 37 acres and 73 acres, respectively. Based on discussions with the TRC and Airport/City staff, along with concerns expressed by the general public, any outright acquisition of land outside the existing Airport property line (i.e., south of 3300 North Road) was determined to be unfavorable for purposes of runway development. Therefore, Options C and D were considered to be unfavorable for this category.

- **Roadway impacts** – This category considers the extent to which each concept eliminates the need to close or relocate portions of 3300 North Road due to runway development or associated safety zones. 3300 North Road is a lightly used County road. Therefore, it is unlikely that the closure or relocation of a small portion of 3300 North Road would have a significant impact on vehicle traffic/access in the area. However, there would likely be some impact and the cost of relocating a roadway section could be significant. Therefore, those concepts whereby a portion of the physical runway and/or associated safety areas would extend southward past 3300 North Road were determined to be less favorable for this category.

³ An avigation easement is the right a public or private agency acquires to use the airspace above a specific height for the flight of aircraft.

No portion of the runway or associated safety areas for Option B would be anticipated to impact 3300 North Road. For Option A, the southernmost RPZ of the conceptual runway would extend approximately 300 feet south of 3300 North Road. In accordance with AC 150/5300-13, an active roadway may not necessarily be impacted by an overlying RPZ. Therefore, for evaluation purposes, it was assumed that no modification to 3300 North Road would be required for Option A and as such, Options A and B were determined to be equally ranked and more favorable for this category.

Both Options C and D involve the physical runway and associated safety areas extending southward past 3300 North Road, requiring closure of 3300 North Road where it impacts the conceptual runway. The southernmost extent of the RPZ associated with Option C is located approximately 1,600 feet south of 3300 North Road. The roadway network in this area is based on grid of 1-mile spaces between roadways. It is assumed that for Option C, a new roadway segment would be constructed ½ mile south of 3300 North Road to divert traffic around the runway. The southernmost extent of the RPZ associated with Option D is located approximately 3,200 feet south of 3300 North Road. For Option D, it is assumed traffic would be diverted south along 2900 East Road to 3200 North Road, which is 1 mile south of 3300 North Road. Without the potential need to construct a new roadway, Option D was ranked higher than Option C for this category.

- **Aircraft noise/overflights** – This category considers the extent to which each concept reduces the potential for aircraft overflights of noise-sensitive areas when operating in the Airport traffic pattern. This evaluation was conducted by overlaying potential aircraft traffic patterns on aerial photographs, existing and planned land use maps, and zoning maps, to make a qualitative assessment of residential areas that could experience overflights by aircraft operating in the traffic pattern. The evaluation assumed that aircraft could operate in either left hand (standard) or right hand traffic patterns on the realigned crosswind runway. The potential traffic patterns for Options A and D were determined to be least likely to result in aircraft overflights of residential areas, resulting in a more favorable classification for this category. The potential traffic pattern for Option B encompasses areas zoned for residential single household and medium density development, and may potentially route aircraft over existing houses located along 3300 North Road near the southwest corner of the Airport. The potential traffic pattern for Option C encompasses areas zoned for residential single household development. Options B and C were therefore determined to be less favorable for this category.

Operational Impacts

- **Taxi time to/from primary small general aviation aircraft area** – This category considers the extent to which aircraft taxi time is minimized for small general aviation aircraft taxiing between the conceptual runway and the west general aviation hangar area. This area serves as the primary parking/storage area for small general aviation aircraft; the type of aircraft that do and would predominantly use the crosswind runway. A conceptual taxiway system was not developed for each runway concept. However, the rankings shown on Exhibit 5-2 reflect a qualitative assessment of comparative taxi distances among each concept. Options A and B are more favorable in this regard, given their location on the west side of the airfield. Conversely, Options C and D are located on the opposite end of the airfield. Option C would result in a less favorable taxi distance/time, while Option D was determined to be unfavorable for this category.

- **Segregation of small and large aircraft** – To enhance the safety and efficiency of the Airport, it is generally desirable to separate the general operating areas of aircraft on the airfield based on aircraft size, type, and type of operation. Larger aircraft operating at the Airport generally consist of passenger airline aircraft, BLM aerial fire-fighting aircraft, cargo aircraft, and large charter aircraft. For the most part, the operation of these aircraft take place on or around the terminal apron and the east side of the Airport. Therefore, a more favorable location for a runway that primarily supports smaller aircraft would be on the west side of the Airport where such aircraft are primarily stored. Options A and B exemplify this concept. Small aircraft operating on a runway located pursuant to Options C and D would be required to taxi around or through areas on the airfield where operations of larger aircraft are more frequent, making these concepts unfavorable, particularly due to safety implications.
- **ATCT line of sight considerations** – This category considers the ability of ATCT personnel to easily locate, identify, and positively control aircraft operating on each conceptual runway. Based on conversations with ATCT personnel and observations from the ATCT, aircraft operating on Options C and D would be difficult to identify and control given the existing height and location of the ATCT. The southernmost portions of the runways for these concepts are located at such a distance from the ATCT that the line of site is almost level, resulting in degraded depth perception. For this reason, Options C and D were determined to be unfavorable for this category. Options A and B are located in close proximity to existing runways over which ATCT personnel experience adequate line of site and are therefore more favorable in this regard.

Construction Costs

Order of magnitude construction costs were developed in order to compare the relative costs of each concept, based only on construction of the physical runway. Options A and B were determined to have a relatively higher cost to construct compared to Options C and D due to the amount of earthwork required, including tie-ins with existing airfield pavement.

Initial Evaluation Summary

A score for each concept was calculated by multiplying the numerical rank by the associated weighting factor for each category. For example, a concept that ranks “3” with a “more favorable” (green color) weighting (valued at 2), would receive a score of “6” (3 multiplied by 2) for that specific evaluation category. The individual category scores calculated for each concept were summed to determine the total score for each concept. The As shown on Exhibit 5-2, Option B received the highest overall score, followed by Option A. These two concepts were carried forward for further evaluation.

Option C received the lowest overall score and was eliminated from further consideration. Option D ranked closely behind Option A, but, had “unfavorable” rankings for several evaluation categories that could not be feasibly mitigated, and was therefore determined not to be a viable concept.

5.1.1.2 Development and Evaluation of Refined Crosswind Runway Realignment Concepts

As previously described, Options A and B were determined to be unfavorable for the environmental considerations evaluation category due to their location on the former County landfill site. To mitigate this unfavorable condition, Options A and B were refined such that the entire physical runway would remain clear

of the estimated landfill boundary. Option A was shifted approximately 750 feet south along its initial alignment and renamed as Option A1. Option B was shifted approximately 1,100 feet southwest along its initial alignment and renamed as Option B1. Other than the position of the runway itself, no other changes were made to the initial Options A and B.⁴ The refined concepts are depicted on **Exhibit 5-4**. As shown, the most significant change resulting from the concept refinement process is that Option B1 now crosses both Taxiway A, as well as the edge of the Runway 7 threshold.

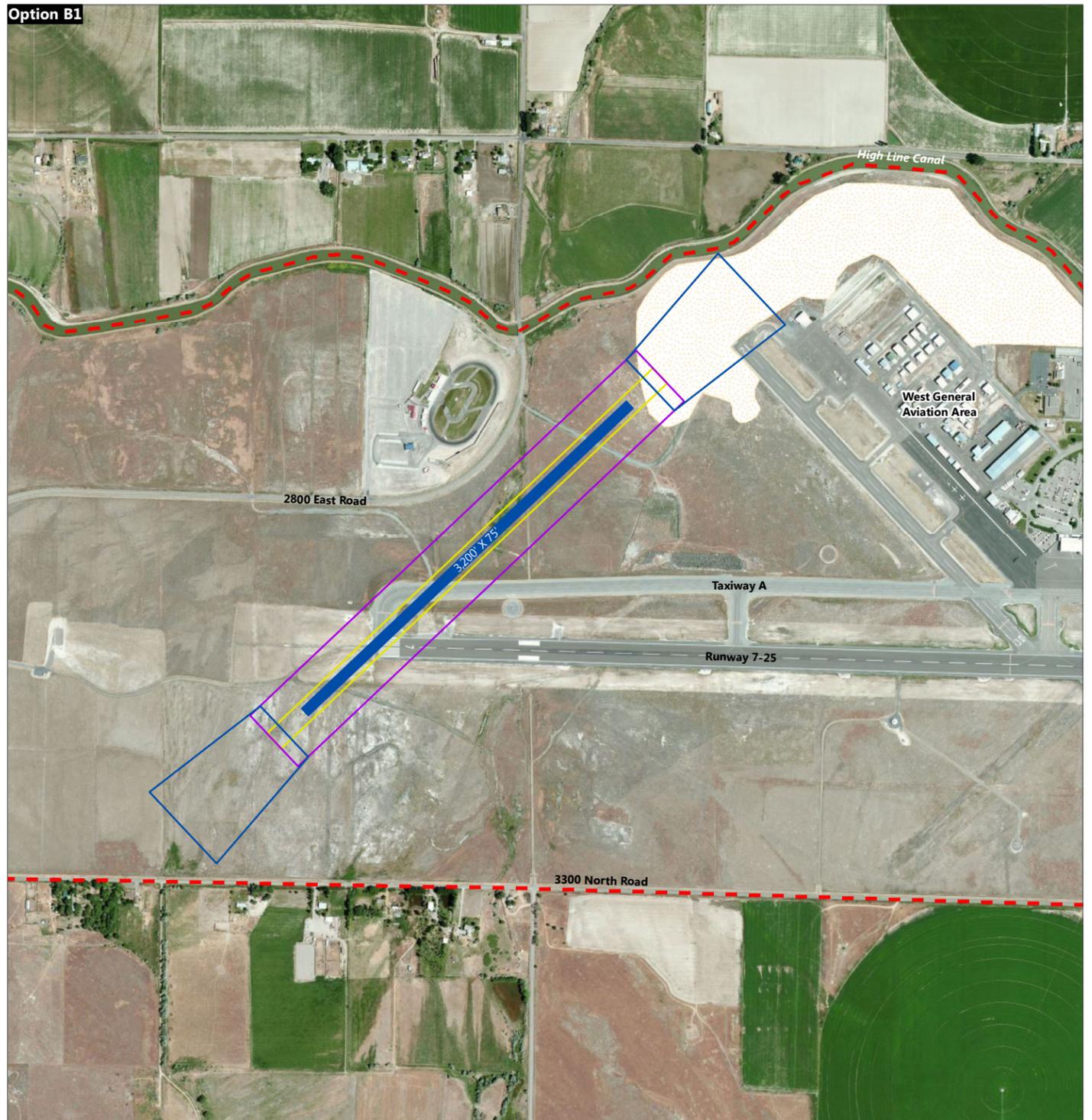
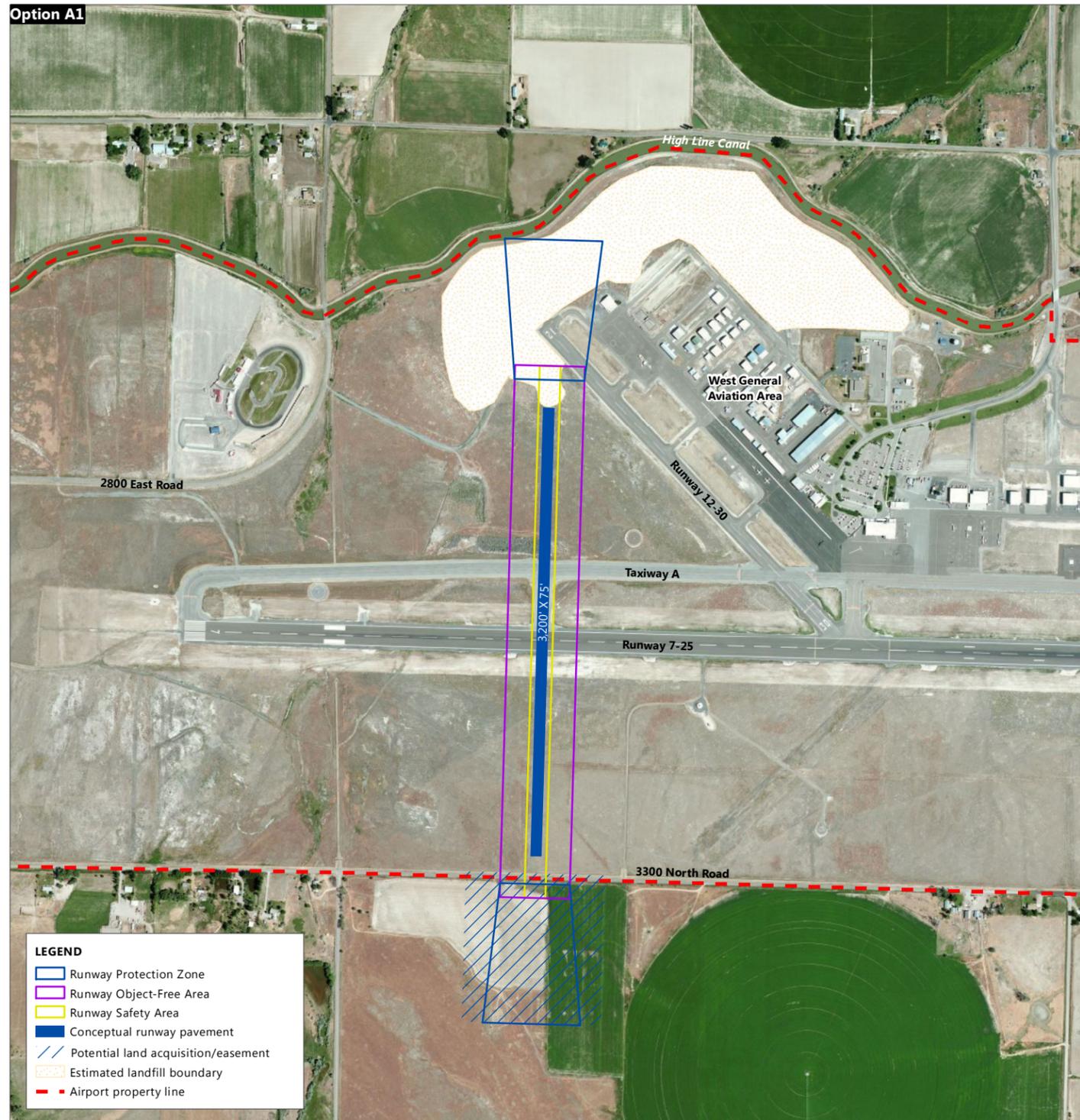
Options A1 and B1 were evaluated using the same methodology used to evaluate the initial concepts. This “final” evaluation involved only those categories from the initial evaluation where the two concepts differ in ranking and included some additional categories to further assess the potential impacts of the concepts. The evaluation of the refined concepts is presented on **Exhibit 5-5** and described in the following subsections.

On-Airport Impacts

- **Constructability** – From a constructability standpoint, Option A1 is not materially different from initial Option A. However, the shifting of Option B to the southwest (now Option B1) presents additional complications with regard to constructability compared to initial Option B. Option B1 would require tie-ins not only with Taxiway A, but also the Runway 7 threshold, which could be particularly complicated given terrain/grade considerations in the area. It should also be noted that the extent of grade differences between the location of the conceptual runway and 2800 East Road make shifting the runway northwest to avoid direct interaction with the Runway 7 threshold problematic. Therefore, Option A1 was determined to be more favorable with regard to constructability.
- **Phasing/implementation** – Similar to Option A, Option A1 would necessitate temporary closure of a portion of Taxiway A and Runway 7-25, although it is anticipated that construction would be scheduled to take place during low activity periods and phased to limit the overall downtime of Taxiway A and Runway 7-25. Option B1 also impacts Runway 7-25 and Taxiway A. However, it is anticipated that almost the entire length of Runway 7-25 could remain open during construction of the crosswind runway, since only the westernmost portion of Runway 7-25 and Taxiway A would be affected. Arrivals on Runway 25 are more frequent than on Runway 7 and nearly all aircraft that operate at the Airport are able to and do exit Runway 25 at or before Taxiway A4. Therefore, the operational impact of constructing Option B1 would be expected to be limited. Option B1 was determined to be more favorable with regard to this evaluation category.
- **Adherence to FAA Engineering Brief No. 75 recommendations** – Since both Options A1 and B1 directly interact with Taxiway A and Runway 7-25, this category focuses on evaluating the potential layout of each option in consideration of the recommendations contained in FAA Engineering Brief 75 (EB 75).⁵

⁴ The design specifications of the refined crosswind runway realignment concepts are identical to the corresponding initial concepts, with the same respective orientations, runway length (3,200 feet), and design standards (ARC B-II).

⁵ Federal Aviation Administration, *Engineering Brief No. 75: Incorporation of Runway Incursion Prevention into Taxiway and Apron Design*, November 19, 2007.



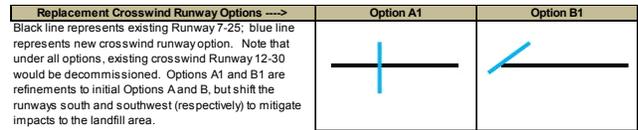
SOURCES: ESRI, May 2010 (Bing Maps aerial photograph); Riedesel Engineering, Inc., January 2011 (Airport property line); Riedesel Engineering, Inc., June 2011 (estimated landfill boundary and crosswind runway realignment concepts).
 PREPARED BY: Ricondo & Associates, Inc., March 2012.

EXHIBIT 5-4



Refined Crosswind Runway Realignment Concepts

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Design Specifications	Description	Option A1	Option B1
Runway length	Suitable length to accommodate takeoffs and landings of aircraft that currently use the existing crosswind runway	3,200 feet	3,200 feet
Airport Reference Code (ARC)	Conforms to the same design criteria currently associated with the existing crosswind runway	B-II	B-II
Combined all-weather wind coverage assuming a 10.5-knot crosswind component	Percentage of time that an aircraft can use the airport based on a crosswind not exceeding a specified level; FAA recommends 95% or greater	98.82%	97.21%
Combined all-weather wind coverage assuming a 13-knot crosswind component		99.75%	98.73%

Evaluation Category	Criteria/Objective	Rank (2 = best)	
On-Airport Impacts			
Constructability	Ease of construction given geographic/engineering considerations such as terrain, accessibility, required grading, etc.	2	1
Phasing/implementation	Ability to phase/implement construction in a way that is least disruptive to airport operations	1	2
Adherence to FAA Engineering Brief 75 recommendations	The extent to which the runway and associated taxiways can be designed and marked to help prevent runway incursions, pursuant to the recommendations in FAA Engineering Brief 75	2	1
NAVAID/lighting relocation	Minimizes the need to relocate navigational aids and/or existing runway/taxiway lighting equipment	2	1
Environmental considerations	Potential to limit impacts to areas of potential environmental concern	2	1
Off-Airport Impacts			
Land acquisition/aviation easements	Limits/eliminates the need to acquire land outside of existing airport property for runway development or associated safety zones and limits/eliminates the need to acquire aviation easements for the runway protection zones	1	2
Roadway impacts	Eliminates the need to relocate roadway sections due to runway development or associated safety zones	1	2
Aircraft noise/overflights	Reduces potential for aircraft overflights over noise-sensitive areas when operating in the airport traffic pattern	2	1
Operational Impacts			
Taxi time to/from primary General Aviation area	Minimizes the time required to taxi between the runway and the primary small GA aircraft area located in the northwest quadrant of the airport	2	1
ATCT line of sight (based on ATCT controller interviews)	Ability of air traffic controllers to easily locate, identify, and positively control aircraft operating on the runway	2	1
Construction Costs			
Comparative rank	Considers costs associated only with construction of the runway	1	2
Ranking	Weighting Factor	Evaluation Category	
More favorable	2	On-Airport Impacts	17
Less favorable	1	Off-Airport Impacts	5
Unfavorable	0	Operational Impacts	8
Summary:		Construction Costs	1
Option A1 is the recommended development option		Total	31
			23

SOURCES: Ricondo & Associates, Inc. and Riedesel Engineering, Inc., June 2011.
 PREPARED BY: Ricondo & Associates, Inc., March 2012.

EXHIBIT 5-5



Evaluation of Refined Crosswind Runway Realignment Concepts

E:\Ricondo GIS\WPMaster Plan Update\Exhibits\Chapter 5 - Concepts\Exhibit 5-5_Refined Runway Concepts_Evaluation.mxd

EB 75 provides guidance on design strategies of taxiways and aprons to help prevent runway incursions.⁶ With regard to the interaction between taxiways and runways, design strategies recommended in EB 75 include the following:

- Limit the number of aircraft crossing an active runway.
- Optimize pilots' recognition of entry to the runway (increase situational awareness) through design of the taxiway layout, including the use of a right angle for taxiway-runway intersections, limiting the number of taxiways intersecting in one spot, and avoiding wide expanses of pavement at runway entry.
- Ensure the taxiway layouts take operational requirements and realities into account to safely and efficiently manage departure queues, avoid using runways as taxiways, use taxi strategies to reduce the number of active runway crossings, and correct runway incursion "hot spots."

Option A1 crosses Taxiway A and Runway 7-25 at a right angle, which complies with EB 75 guidance, and would present pilots taxiing on Taxiway A with a more straightforward or "conventional" runway intersection. In comparison, the intersection of Option B1 with Taxiway A and Runway 7-25 would create a more visually complicated intersection that would require careful marking and signage to ensure that pilots remain on the intended taxiway/runway. It is also possible that special ATC taxiing procedures would need to be developed and followed to reduce the potential for pilot confusion in this area of the airfield. Overall, it was determined that Option A1 can be designed and implemented in a way that best adheres to the strategies and recommendations presented in EB 75 to help prevent runway incursions.

- **Navigational aid/lighting relocation** – This category considers the extent to which each concept minimizes the need to relocate navigational aids and/or existing runway or taxiway lighting equipment. Option A1 may necessitate removing or relocating lighting units where it intersects with Taxiway A and Runway 7-25. Option B1 would also potentially necessitate removing or relocating lighting equipment installed on Taxiway A. More critically, however, Option B would impact the REIL and threshold lighting installed on the Runway 7 threshold. Given the potentially significant cost and complexity involved with relocating the REIL and threshold lights on Runway 7, Option A1 is more favorable for this category.
- **Environmental considerations** – This category considers the impact of each refined concept on the same set of environmental features/conditions as described previously for the initial concepts. The most potentially significant environmental impact (development on the landfill site) has been mitigated for the refined concepts by shifting the runway out of the estimated landfill boundary. Option B1 would still be located in relatively close proximity to the willow pocket that supports wetland indicators observed near the High Line Canal, as depicted previously on Exhibit 5-3, thereby making Option B1 less favorable for this category.

⁶ A runway incursion is defined in EB 75 as "Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and takeoff of aircraft."

Off-Airport Impacts

- **Land acquisition/aviation easements** – By shifting Option A approximately 750 feet south, the southernmost portion of the Option A1 RSA and the entire RPZ would extend beyond Airport property, requiring land acquisition or a combination of land acquisition and aviation easements. At a minimum, land acquisition would be required to accommodate the portion of the RSA extending beyond Airport property, out to a width including the BRL, with aviation easements acquired for the RPZ. The total estimated additional land to be controlled by the Airport (either through land acquisition or a combination of land acquisition and aviation easements) for Option A1 would be approximately 25 acres. Since this option would require outright acquisition of land outside the existing Airport property line, this concept was determined to be unfavorable for this category. Option B1 would not require the acquisition of any land or aviation easements.
- **Roadway impacts** – Because the southernmost portion of the RSA associated with Option A1 would extend over 3300 North Road, the portion of the roadway traversing this area would need to be closed and rerouted either via existing roads or through construction of a new roadway segment. This potential roadway impact makes Option A1 less favorable for this category. Option B1 would not be anticipated to impact any existing roadway.
- **Aircraft noise/overflights** – As described in the evaluation of the initial concepts, the potential traffic patterns for Option A was (along with Option D) determined to be least likely to result in aircraft overflights of residential areas. Shifting the runway further south away from City limits (Option A1) would be expected to further decrease the potential for aircraft overflights of residential areas, making this concept more favorable for this category. Shifting Option B to the southwest would be expected to have a similar effect of reducing the potential for aircraft overflights of residential areas. However, a portion of the potential traffic pattern for Option B1 would still encompass areas zoned for residential single household development.

Operational Impacts

- **Taxi time to/from primary small general aviation aircraft area** – As previously described, Options A and B were both determined to be more favorable with regard to aircraft taxi time between the respective runway and the west general aviation hangar area. Options A1 and B1 would be expected to result in a slightly increased taxi time for both configurations. However, Option B1 is shifted further from the west general aviation area compared to Option A1. In addition, Option B1 would require aircraft to taxi around the estimated landfill boundary, while Option A1 would result in a more direct (and shorter) taxi route between the runway and the parking area. Therefore, Option A1 was determined to be more favorable for this category.
- **ATCT line of sight considerations** – The shifting of Options A and B to the south and southwest, respectively, would increase the line of sight distance from the ATCT to the runway. The refined concepts (Options A1 and B1) were discussed with ATCT personnel and it was determined that the southwest threshold of Option B1 would be less favorable with respect to the ability of controllers to easily locate, identify, and positively control aircraft operating on the runway. This determination is based not only on the line of sight distance, but also the interaction of the southwest end of the runway with the Runway 7 threshold.

Construction Costs

Order of magnitude construction costs developed for Options A and B were revised to account for any additional costs associated with the refined concepts Options A1 and B1. Option B1 would be expected to incur additional construction costs due to the required tie-in with the Runway 7 threshold. However, Option A1 was still determined to cost more to construct than Option B1 based on the assumed amount of re-grading and other earthwork that would be necessary to tie the new runway to Taxiway A and Runway 7-25.

Final Evaluation Summary

Based on the evaluation results of the refined crosswind runway realignment concepts presented in Exhibit 5-5, Option A1 emerged as the most favorable concept. Therefore, Option A1 was carried forward for final refinement and integration into the recommended development plan.

5.1.1.3 Final Refined and Recommended Crosswind Runway Realignment Concept

The following subsections describe the final refinements made to Option A1 in order to develop a fully integrated recommended crosswind runway realignment concept.

Refinement #1 – Runway Length

Although Option A1 received the highest overall score in the final evaluation, pursuant to the adopted evaluation methodology, Option A1 could not be considered as the recommended concept for development (as is) based on the unfavorable conditions associated with the need to acquire land for the RSA. To mitigate this unfavorable condition, the concept was refined to shorten the runway by 200 feet on the southernmost end to a total length of 3,000 feet. This refinement brings the RSA completely within existing Airport property, eliminating the need to acquire additional land. Acquisition of an aviation easement would still be recommended for the portion of the RPZ that extends beyond Airport property.

In shortening the conceptual runway to 3,000 feet, the takeoff and landing runway length requirements of those aircraft most likely to use the new crosswind runway were considered. Based on the runway length analysis detailed in Appendix E (see Table E-4), a usable length of 3,000 feet would be able to accommodate takeoff and landing operations over a 50-foot obstacle conducted by a representative group of aircraft (under the conditions and limitations noted in Table E-4). Therefore, a total usable length of 3,000 feet was determined to be reasonable for the new crosswind runway.

Refinement #2 – Taxiway System/Runway Shift

A second refinement was made to develop a conceptual taxiway system to provide access to/from the new crosswind runway. To correspond with the new runway, the taxiway system should, at a minimum, adhere to ARC B-II design standards, with a width of 35 feet. The FAA recommends a full-length parallel taxiway to allow for the most efficient and safe movement of aircraft from the runway to the parking area. To eliminate unnecessary runway crossings and to provide a more direct taxi route to the west general aviation area, a full-length parallel taxiway system developed on the east side of the new crosswind runway was assumed.

As described and depicted, Option A1 involves development of the new crosswind runway along existing exit Taxiway A4. Exit Taxiway A4 is a full-strength exit taxiway designed to ADG IV standards, and serves as a critical exit taxiway for aircraft landing on Runway 7-25. Taxiway A4 is frequently used by large aircraft upon landing on Runway 25, as well as by smaller aircraft upon landing on Runway 7.

Development of the new crosswind runway along Taxiway A4 would necessitate constructing a replacement ADG IV exit taxiway, which would likely result in a significant capital cost and may not be as operationally efficient as the existing exit taxiway with regard to location. Alternatively, it was determined that the existing Taxiway A4 could be left in place and integrated into the parallel taxiway system developed for the new crosswind runway. This would necessitate shifting the new crosswind runway east, at a specified distance from the parallel taxiway. ARC B-II design standards specify a runway/taxiway centerline separation of 240 feet. However, with a separation of 240 feet, operations on the new crosswind runway would be restricted when an ADG III aircraft is utilizing Taxiway A4. Increasing the runway/taxiway centerline separation to 300 feet (ADG III standards) would remove such a restriction. Additionally, initial development of the runway/taxiway at ADG III separation would allow flexibility for future modification of the entire length of the parallel taxiway to ADG III standards, if necessary.

Refinement #3 – Runway 12-30 Taxiway Conversion

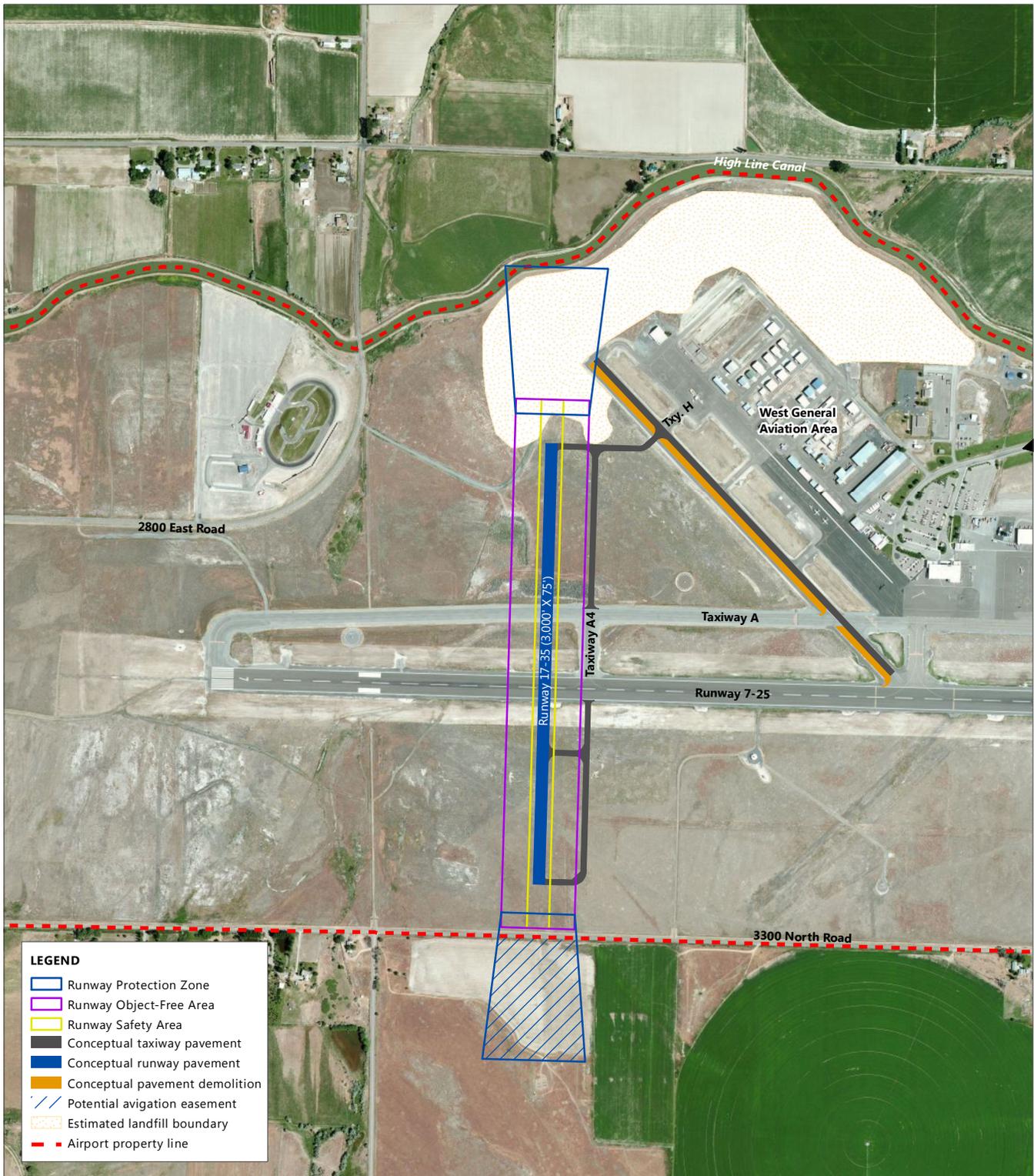
As described previously in Section 5.1.1.1, the new crosswind runway is intended to be a replacement of the existing crosswind Runway 12-30. As part of the recommended concept, Runway 12-30 would be decommissioned as an active runway and converted to a taxiway. The taxiway would be designated and striped/marked in accordance with ARC B-II design standards, with a minimum width of 35 feet. Runway 12-30 is currently 75 feet wide. It is assumed that any excess pavement not required/designated as taxiway pavement would ultimately be demolished.

Recommended Crosswind Runway Realignment Concept

The final refined and recommended crosswind runway realignment concept is depicted on **Exhibit 5-6**, with various specifications of the recommended concept presented in **Table 5-1**. Based on magnetic orientation, the realigned runway would be designated as Runway 17-35, at a length of 3,000 feet and a width of 75 feet.

Exhibit 5-6 shows Runway 17-35 with the parallel taxiway located east of the runway at a separation of 300 feet. The parallel taxiway crosses through existing exit Taxiway A4. Taxiway A4 has a width of 75 feet, while the parallel taxiway segments located north and south of Taxiway A4 have a width of 35 feet. Based on an initial review of the recommended concept, the FAA suggested the addition of an exit taxiway south of Runway 7-25. The purpose of this taxiway is to reduce the risk of a runway incursion by aircraft landing on Runway 35, such that the first opportunity to exit the runway upon landing is not Runway 7-25.

Also shown on Exhibit 5-6 is a conceptual taxiway connection of the of the Runway 17 threshold and parallel taxiway system to the new taxiway created by the decommissioning of Runway 12-30. The connection would be an extension of existing Taxiway H, providing access between the new crosswind runway and the west general aviation area.



SOURCES: ESRI, May 2010 (Bing Maps aerial photograph); Ricondo & Associates, Inc. and Riedesel Engineering, Inc., November 2011 (recommended crosswind runway realignment concept); Riedesel Engineering, Inc., January 2011 (Airport property line); Riedesel Engineering, Inc., June 2011 (estimated landfill boundary); PREPARED BY: Ricondo & Associates, Inc., March 2012.

EXHIBIT 5-6



NORTH



Recommended Crosswind Runway Realignment Concept

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Table 5-1 Recommended Crosswind Runway Realignment Concept Specifications

RUNWAY DESIGN ELEMENT	SPECIFICATION/DESCRIPTION
New Crosswind Runway	
Runway designation	Runway 17-35 (bearing N 181° 18' 00" W)
Airport reference Code (ARC)	Airport Approach Category (AAC) B Airplane Deign Group (ADG) II ARC B-II
Runway length	3,000 feet
Runway width	75 feet
Shoulder	10 feet
Effective runway gradient	1.61% based on available terrain data (maximum allowable grade change is 2.0%)
Runway end elevation	17 – 4,119.3 feet 35 – 4,167.5 feet
Pavement material	Asphalt
Pavement strength	19,000 pounds (single wheel landing gear)
Instrument approach procedures	Visual approach only (20:1 approach surface on both runway ends)
Runway lighting	No lighting assumed, although lighting would add utility to the runway
Runway marking	Basic markings (runway designation and centerline markings)
Runway Safety Area	Length: 3,600 feet Width: 150 feet
Object-Free Area (beyond runway end)	Length: 3,600 feet Width: 500 feet
Runway Protection Zone	Offset from runway end: 200 feet Length: 1,000 feet Width: 500 feet to 700 feet
Taxiway System	
Taxiway type	Full-length parallel taxiway
Taxiway design standards	ARC B-II
Taxiway/runway centerline spacing	300 feet, per ADG III standards
Taxiway width	35 feet, per ADG II standards, except for existing Taxiway A4 segment (ADG IV: 75 feet)
Connector taxiway	Connected to existing Runway 12-30 (future taxiway) via extension of Taxiway H
Pavement material	Asphalt
Taxiway lighting	None
Existing Runway 12-30	
Conversion to taxiway	Existing runway to be decommissioned and converted to an ARC B-II taxiway
Taxiway design standards	ARC B-II
Taxiway width	35 feet, per ADG II standards
Taxiway lighting	None
Pavement removal	Demolition of excess pavement not needed as taxiway pavement

SOURCE: Ricondo & Associates, Inc., June 2011.

PREPARED BY: Ricondo & Associates, Inc., March 2012.

5.1.2 TAXIWAY DEVELOPMENT CONCEPTS

Through analysis of facility requirements described in Section 4, various taxiway improvements are recommended for the Airport, including an extension of Taxiway L, aircraft run-up pads on Runway 7-25, and construction/expansion of taxilanes on the east side of the Airport. **Exhibit 5-7** depicts recommended taxiway development concepts to address the needed improvements.

5.1.2.1 Taxiway L Extension

Exhibit 5-7 shows an extension of Taxiway L approximately 2,000 feet to the east, before turning south to join with Taxiway A/A1. This configuration would provide direct access to Runway 25, thereby enhancing the safety and efficiency of aircraft operations on this area of the airfield by eliminating the need for aircraft to taxi through the east apron area and BLM helipad and fire retardant loading areas. The extension would also provide access for a proposed BLM apron expansion (see Section 5.3.2) and facilitate access for future aeronautical development that may occur in this area. It is recommended that a width of 35 feet be maintained for the Taxiway L extension, consistent with ARC B-II design standards.

5.1.2.2 Runway 7-25 Run-Up Pads

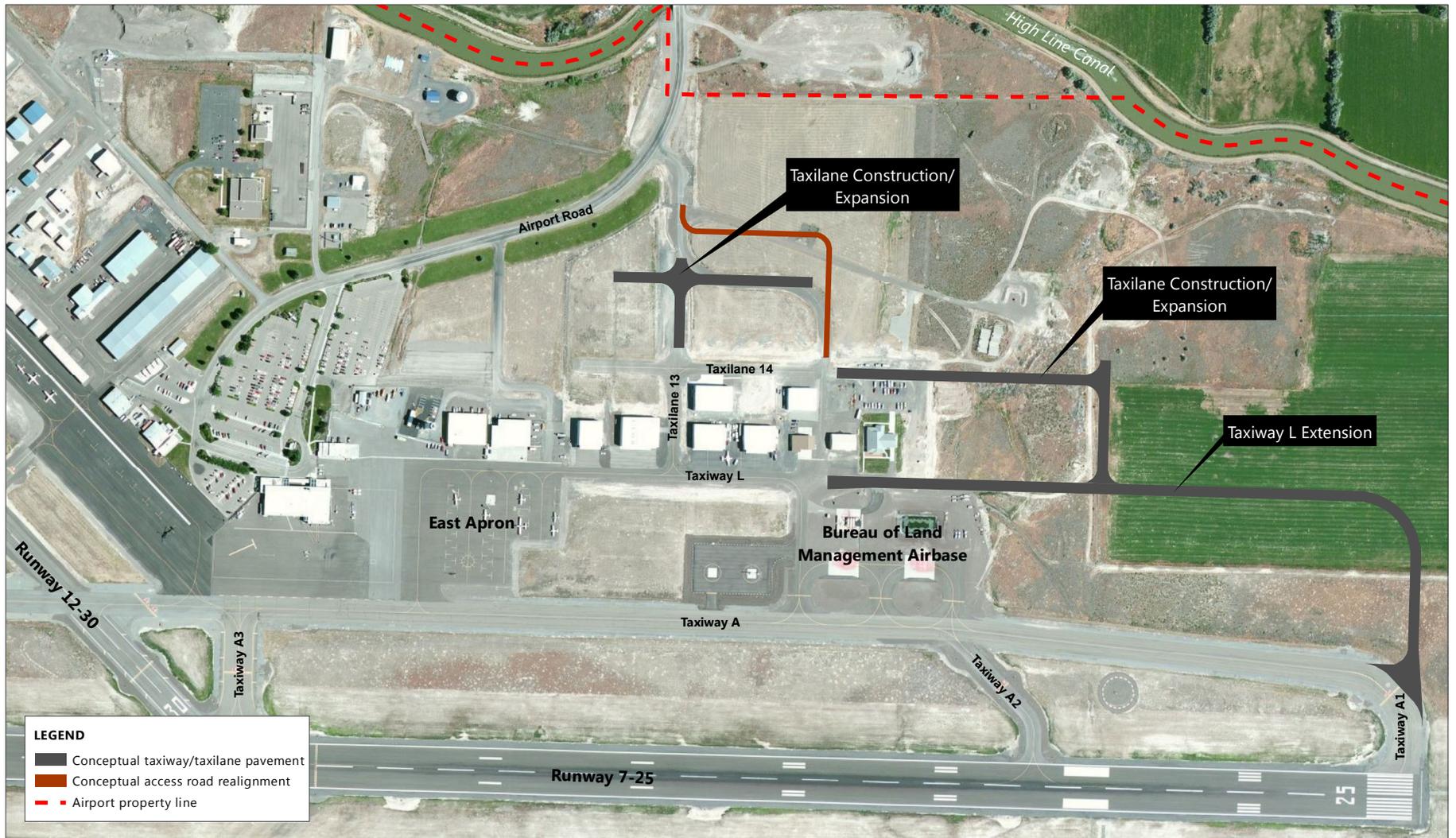
Another recommended taxiway-related improvement is the development of aircraft run-up pads on each end of Runway 7-25. Run-up pads would allow pilots of primarily small general aviation aircraft to pull off of Taxiway A to perform engine and systems checks prior to takeoff. The run-up area proposed on the Runway 7 end adjacent to Taxiway A/A-5 (not shown on Exhibit 5-7 – see ALP Sheet 2 in Section 9) is approximately one-half acre, which would be sufficient to accommodate one or more single- or multi-engine piston aircraft. The precise dimensions of the run-up area would be determined during the design phase. If Taxiway L is extended as described above, a separate run-up pad would not need to be constructed to serve Runway 25. It is anticipated that the fillet required to join the Taxiway L extension with Taxiway A/A-1 would adequately accommodate aircraft run-up operations on this end.

5.1.2.3 East Airfield Taxilane Construction/Expansion

As described in Section 4, the construction of new taxilanes and expansion of existing taxilanes on the east side of the airfield would provide access for future general aviation development and/or other aeronautical development. The recommended concept for such development is depicted on Exhibit 5-7.

One area of potential taxilane development is shown north of the east building area, with a northward extension of Taxilane 13, along with associated east/west expansions. This taxilane development is consistent with development identified in the 2003 Master Plan Update and would open up an area for future hangar or other aeronautical development. It is anticipated that all taxilanes would be constructed at a width of 35 feet. It should be noted that a portion of this potential taxilane development would cross an existing roadway that provides access to the ARFF, BLM, and conventional hangar facilities in this area. Exhibit 5-7 depicts a conceptual realignment of the access road around the potential taxilane development.

The second area of potential taxilane development depicted on Exhibit 5-7 shows an eastward extension of Taxilane 14 north of the BLM facility, with a connection to the proposed Taxiway L extension. This taxilane would provide access for future aeronautical development.



SOURCES: ESRI, May 2010 (Bing Maps aerial photograph); Riedesel Engineering, Inc., January 2011 (airport property line); Riedesel Engineering, Inc., March 2011 (taxiway development concepts).
PREPARED BY: Ricondo & Associates, Inc., April 2012.



Recommended Taxiway Development Concepts

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5.2 Passenger Terminal Development Concepts

Passenger terminal facilities at the Airport include the passenger terminal building, the terminal curb, and the terminal apron. As described in Section 4, the existing terminal curb is expected to be adequate through the planning period, and a concrete overlay is recommended for the terminal apron. This subsection focuses on the development and evaluation of terminal modification concepts that address deficiencies with the existing passenger terminal building.

As a result of the terminal building facility requirements analysis, it was determined that modification of the existing terminal building is necessary to meet functional space and operational deficiencies. Development and ultimate selection of recommended terminal modification concepts was based the following goals:

- **Holdroom** – Provide additional sterile holdroom area to accommodate potential peak-hour enplaned passengers.
- **Baggage screening** – Designate/provide area(s) for “behind-the-wall” EDS and/or ETD baggage screening (either in a stand-alone configuration or as part of a mini-inline system), as well as associated baggage make-up/sortation areas.
- **Passenger flow** – Maintain/improve the efficient flow of passengers throughout the terminal, particularly in the ticketing area.
- **Passenger amenities** – Accommodate restroom facilities and possibly food/beverage concessions in the sterile (holdroom) area.

5.2.1 TERMINAL MODIFICATION CONCEPTS

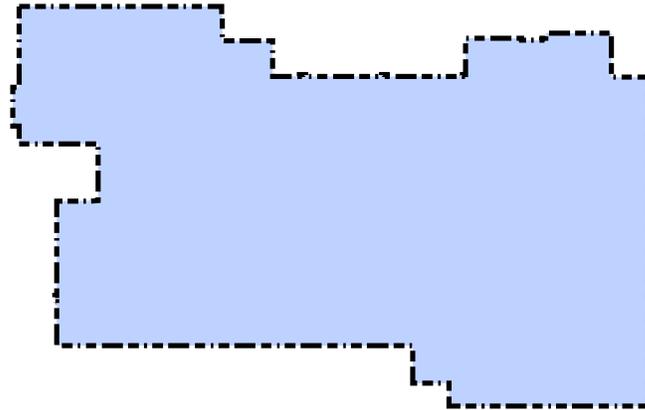
Two general terminal modification concepts were developed and evaluated. These concepts are depicted on **Exhibit 5-8** and described below.

5.2.1.1 Terminal Modification Concept 1

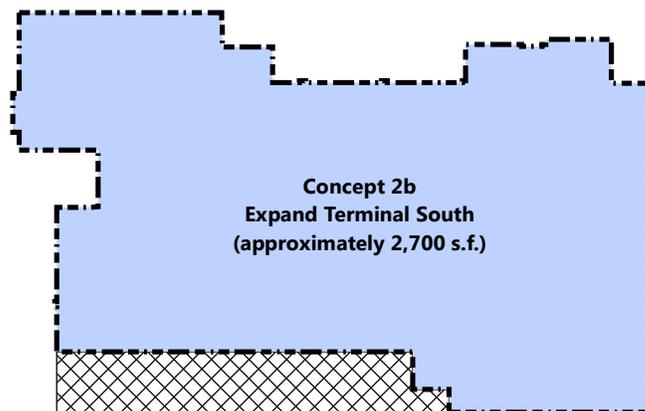
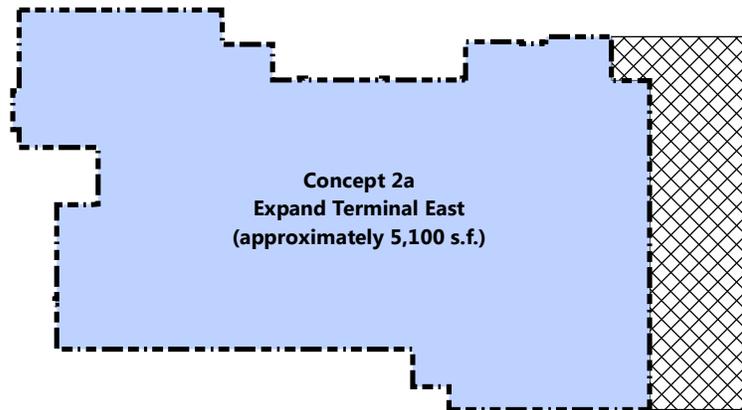
The facility requirements described in Section 4 reveal that the requirements could theoretically be accommodated within the existing footprint of the terminal building. Therefore, Concept 1 focuses on maintaining the overall footprint of the existing building, while modifying the interior layout of the building to meet the identified facility requirements.

To evaluate the feasibility of this concept, several conceptual terminal layouts were developed and reviewed with TRC members and Airport staff. These layouts are not presented in this report because they were developed for discussion/evaluation purposes only and do not necessarily represent specific development options. Under this concept, attaining the required holdroom and baggage screening space can only be accomplished by reducing space currently allocated to other functional areas. For example, the holdroom could be enlarged by relocating the passenger screening checkpoint into the waiting lobby. However, this modification would significantly affect passenger circulation around the core of the terminal and diminish the spaciousness of the waiting lobby, which is one of the most attractive features of the terminal building.

Concept 1
Maintain Existing
Terminal Footprint



Concept 2
Expand Terminal
Footprint



LEGEND

-  Existing terminal footprint
-  Conceptual terminal expansion

SOURCE: Ricondo & Associates, Inc., March 2011.
PREPARED BY: Ricondo & Associates, Inc., April 2012.

EXHIBIT 5-8



NORTH



Terminal Modification Concepts

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In addition, this concept would likely only be able to accommodate the currently utilized stand-alone baggage screening operation using ETD equipment, where checked bags are moved/conveyed from the ticketing area to the screening area and are subsequently moved manually through each level of screening and ultimately delivered to the bag make-up/sortation area for loading onto baggage carts. Implementation of larger EDS equipment would require further sacrifices of space within the ticket lobby, airline areas, or other functional areas.

Overall, Concept 1 could potentially be made to work with regard to minimum space requirements. However, this concept would restrict passenger flow, limit the availability of space for additional airline tenants, and could necessitate significant interior modifications in order to re-size various functional areas.

5.2.1.2 Terminal Modification Concept 2

The second terminal modification concept involves construction of additional terminal space. Exhibit 5-8 depicts two variants of this concept (Concepts 2a and 2b). As shown, Concept 2a involves an eastward expansion of approximately 5,100 square feet, while Concept 2b involves a an expansion on the south side of the terminal totaling approximately 2,700 square feet. These derivative concepts do not necessarily represent specific development options, either in terms of expansion space or location. The concepts were developed in conjunction with corresponding interior layouts to assess the potential advantages gained with various amounts of additional space. As with Concept 1, the interior layouts developed for Concept 2 were developed for discussion/evaluation purposes and are not presented in this report as specific development options.

Both Concept 2 variants were found to be able to accommodate an expanded holdroom, along with adequate space for one or more EDS machines arranged as a mini-inline system where bags are conveyed from the ticketing area to the screening area and conveyed through each level of screening and ultimately delivered to the bag make-up/sortation area by means of an automated system. Compared to Concept 2a, the location and size of the expansion depicted for Concept 2b was found to require more trade-offs in terms of existing functional area space, such as the waiting lobby and restroom facilities. However, provision for restroom facilities within the holdroom area were considered for both variants. Concept 2 more adequately meets the established terminal modification goals. In general, expansion of the existing terminal building footprint (in any increment or location) would allow more opportunities to accommodate a more appropriately sized holdroom area and increased area for larger baggage screening equipment to be located away from public circulation areas, while maintaining or improving overall passenger flow throughout the building.

5.2.2 RECOMMENDATIONS

Based on the evaluation of each of the terminal modification concepts, expansion of the passenger terminal building is recommended (Concept 2). However, for purposes of this Master Plan Update, a specific expansion concept has not been identified. The master plan process produced terminal facility requirements and identifies a recommended course of action to address specific deficiencies. However, the master plan process did not assess other issues that may influence how and where the existing terminal building can or should be expanded. As such, it is recommended that a separate terminal modification study be conducted in the future to assess in more detail a specific plan/blueprint for expanding the terminal building. The terminal modification study should include the following elements:

- **Facility requirements** – Terminal facility requirements reflected in the Master Plan Update are based on conservative peak-hour demand scenarios. However, TWF has experienced changes in airline operations (frequencies and aircraft types) throughout the master planning process, with additional changes possible in the short-term. At the time the terminal modification study is undertaken, the facility requirements included in the Master Plan Update should be validated and expanded upon, as necessary, to develop a detailed set of requirements that include both space and equipment needs.
- **Coordination** – Close coordination with tenants (i.e., airlines, TSA, rental car companies, etc.) will help to determine specific space and equipment requirements, as well as optimized operational requirements, such as facility location and passenger flow. Coordination with TSA officials will be especially important to determine the specific types and numbers of equipment that are expected to be implemented at the Airport, for both passenger and baggage screening. Screening technologies, along with associated space and operational requirements, are continuing to evolve and future terminal modifications should be made to allow sufficient space for optimum flexibility.
- **Engineering/architectural considerations** – The terminal modification study should incorporate engineering and architectural elements to determine the most feasible expansion areas and tie-ins with the existing structure. Considerations may include the location and capacity of utilities, structural implications of removing/relocating walls, terrain/elevation (i.e., requirements for ramps/steps), as well as aesthetic elements to maintain a desired look and feel of the existing facility and any new space.
- **Changes to existing facility** – The current terminal structure was renovated in 1996. While planning for the potential addition of space, the terminal modification study would be an ideal process through which to identify any needed or desired modifications or renovations that should be considered to the existing terminal structure. A potential course of action may be to leave the existing terminal structure/layout unchanged, to the extent possible, with any identified space deficiencies resolved through additional space. However, it is possible that the optimal solution may be a combination of additional space and modification to existing space.
- **Recommended layout plan** – Based on information obtained from the previously described elements, the terminal modification study should present and evaluate one or more alternative exterior/interior layout plans, and identify a recommended plan for development.
- **Cost estimates** – Due to uncertainties regarding the overall scope of potential terminal modifications that may be required, the Master Plan Update considers only a general estimate of construction costs, for financial planning purposes. The terminal modification study should include a detailed cost estimate for the recommended plan that can be used for identifying potential funding sources, as well as in support of assembling bid packages.
- **Funding** – The detailed cost estimates would be used, along with coordination with FAA and TSA, to identify funding opportunities/eligibility, and to develop a feasible funding plan in consideration of available Airport financial resources.

The terminal modification study may be conducted as a stand-alone study, or as a preliminary design element integrated into the actual engineering design process. The latter option may allow for economies of scope to be achieved, thereby potentially reducing the overall combined cost of the study and design.

5.3 Tenant Facility Development Concepts

Based on the facility requirements analysis in Section 4, future development should be considered for several tenant-related facilities, including general aviation, BLM, and air cargo. Development concepts addressing the needs of these tenants are described in this subsection.

5.3.1 GENERAL AVIATION DEVELOPMENT CONCEPTS

Areas suitable and recommended for general aviation development within the planning period are depicted on **Exhibit 5-9**.

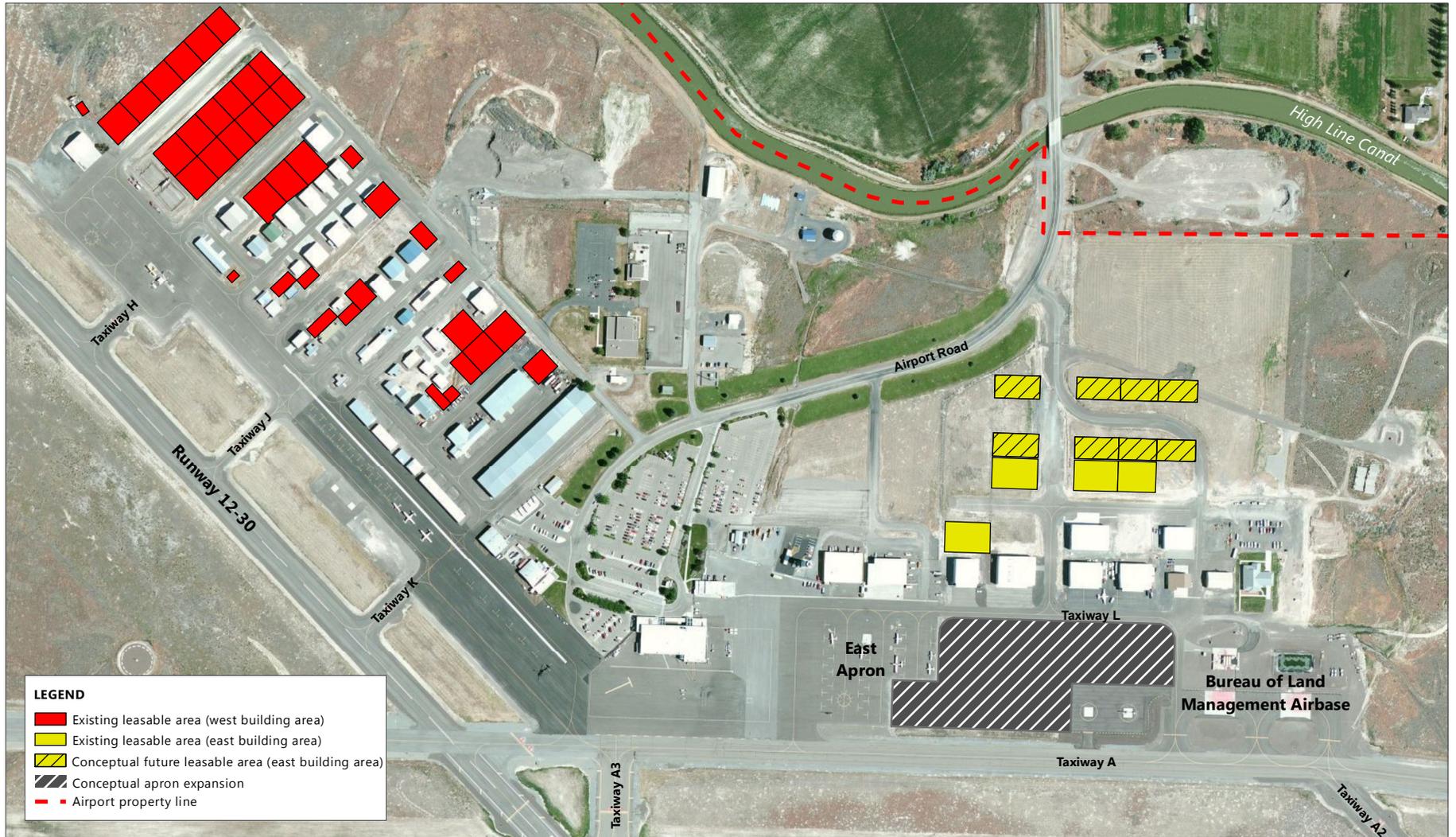
5.3.1.1 Hangar Development

Facility requirements for general aviation facilities indicate the need to identify appropriate areas for additional hangar development. By 2029, approximately 95,000 square feet of additional area is projected to be needed for conventional hangar development, including approximately 54,000 square feet for single-engine aircraft, approximately 26,000 square feet for multi-engine aircraft, approximately 10,000 square feet for business jets, and approximately 5,000 square feet for helicopters.⁷

The largest concentration of hangar facilities at the Airport is located within the west building area, along Runway 12-30. Conventional hangars and T-hangars located in this area currently accommodate most of the based single-engine aircraft at TWF, as well as some helicopters and small multi-engine aircraft. According to Airport lease records, nearly 300,000 square feet of available lease space is currently vacant in this area, which is sufficient for accommodating projected demand for single-engine and small multi-engine aircraft storage through the planning period.

The west building area is ideally suited to accommodate additional hangar development for small general aviation aircraft. Utility services have been installed and are adequate for meeting additional demand in this area. Convenient roadway access is available off of Airport Road. In addition, several taxilanes provide access between the hangar facilities and the west apron area, which in turn allows access to the entire airfield. Also, the operation of additional small general aviation aircraft in this area is compatible with the types of aircraft currently operating in this area. Such compatibility is encouraged in order to maximize aircraft operational safety and efficiency. Finally, this area is close to the existing crosswind runway, as well as the recommended site for future reorientation of the crosswind runway. As previously discussed, the types of aircraft stored in this area are the same types of aircraft that primarily utilize the crosswind runway. For these reasons, continued hangar development is recommended in this area, which represents the preferred development concept for accommodating projected single-engine, and small multi-engine aircraft storage requirements.

⁷ As noted in Section 4, this area represents a total development area, which includes the hangar building itself, as well as an allowance for automobile parking, landscaping, building setbacks, and open area surrounding the building.



SOURCES: ESRI, May 2010 (Bing Maps aerial photograph); Riedesel Engineering, Inc., January 2011 (Airport property line, existing leasable areas, conceptual future leasable areas, and conceptual apron expansion).
PREPARED BY: Ricondo & Associates, Inc., April 2012.

EXHIBIT 5-9



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The other area of the Airport used for storage of based aircraft is located within the east building area, which is located east of the passenger terminal building and adjacent to Runway 7-25. Existing hangar facilities in this area primarily accommodate larger multi-engine aircraft, as well as helicopters. The BLM and other aircraft operators that support aerial fire-fighting activities are also located in this area, making this area operationally compatible with larger general aviation aircraft. Similar to the west building area, hangar development within the east building area benefits from the availability of utilities, convenient roadway access, and established taxilanes for access to the airfield. According to Airport lease records, approximately 113,000 square feet of leasable plots is available in this area. In addition, expansion of taxilanes in this area, as proposed under airfield development concepts, would allow for additional lease areas for hangar development. Therefore, continued hangar development in this area is recommended and represents the preferred development concept for accommodating storage requirements for larger multi-engine aircraft, as well as business jets and helicopters.

5.3.1.2 Apron Expansion

In addition to additional hangar storage, the facility requirements analysis indicates that an expansion of existing apron areas at the Airport should be considered during the planning period to accommodate peak period operations of diverted aircraft, along with the overall forecast growth of itinerant aircraft operations. The recommended concept for such apron development is the expansion of the east apron area, which is depicted on Exhibit 5-9. This area comprises approximately 5.7 acres of undeveloped land stretching from the east apron tie-down area to the BLM helipads. Paving this area for aircraft parking was identified as a future development concept in the 2003 Master Plan Update. To accommodate an increasing number of helicopter operations at the Airport, a portion of this area could be developed or marked as a helipad.

5.3.2 BUREAU OF LAND MANAGEMENT DEVELOPMENT CONCEPT

BLM facilities currently occupy facilities located on the east side of the Airport. As described in Section 4, BLM officials have expressed the need to expand the BLM Airbase to accommodate future needs of the BLM's fire-fighting operations, including expansion of the existing administration/operations building, additional aircraft apron development, and expansion of the vehicle parking lot. The recommended BLM facility development concept is presented on **Exhibit 5-10** and described as follows:

- **Administration/operations building expansion** – The recommended concept depicts an expansion of the administration/operations building that mirrors the existing building, essentially doubling the space of the facility.
- **Aircraft apron expansion** – An apron area of approximately 68,000 square feet would be developed to provide additional parking for BLM-operated aircraft. A majority of the apron area would be paved with asphalt. However, a portion of the apron, totaling approximately 18,000 square feet, is proposed to be paved with concrete to support heavier fire-fighting aircraft, such as the Lockheed P-3 Orion and C-130 Hercules (both are large 4-engine turboprop aircraft).
- **Vehicle parking lot expansion** – To better accommodate existing and future parking demand, expansion/improvement of the existing parking lot has been planned. As depicted on Exhibit 5-10, the parking area could accommodate up to approximately 65 parking spaces.



SOURCES: ESRI, May 2010 (Bing Maps aerial photograph); Riedesel Engineering, Inc., August 2011 (Bureau of Land Management development concept).
 PREPARED BY: Ricondo & Associates, Inc., April 2012.

EXHIBIT 5-10



NORTH



Bureau of Land Management Development Concept

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5.3.3 AIR CARGO DEVELOPMENT CONCEPTS

TWF does not currently have any designated facility for air cargo. Currently, delivery vans/trucks drive onto the east apron where cargo is sorted and loaded directly onto cargo aircraft. The existing operation is anticipated to be adequate given forecast demand, although, as described in Section 4, future air cargo screening/security requirements or a significant increase in air cargo demand, could result in a requirement or preference for a dedicated air cargo facility to be developed at the Airport. A dedicated air cargo facility concept is not proposed as part of this Master Plan Update. However, based on the facility requirements analysis, it is recommended that an area of approximately 1-2 acres for such development be identified for long-term planning purposes, which could accommodate one or more buildings and a loading apron.

Potential air cargo facility development areas were identified and evaluated in the 2003 Master Plan Update. The preferred location was a group of lease plots located within the east building area adjacent to Taxiway 13 and Taxiway L. Advantages to this site include convenient vehicle access, the availability of utilities, and minimal site preparation requirements. In addition, air cargo aircraft would be operationally compatible with other larger aircraft located in this area. Since 2003, several tenants have developed hangar facilities in the area recommended for future air cargo development. However, any appropriately sized available area within the east building area could adequately support air cargo operations at the Airport with the same realized benefits, provided the location is adjacent to a taxiway/taxiway and an access road. **Exhibit 5-11** depicts several conceptual locations within the east building area for potential future development of an air cargo facility.

5.4 Ground Access and Support Facility Development Concepts

Development concepts described in this subsection include those that satisfy the identified requirements for ground access and support facilities, as described in Section 4.

5.4.1 GROUND ACCESS DEVELOPMENT CONCEPTS

5.4.1.1 Secondary Airport Access Road

As described in the facility requirements analysis, development of a new/secondary access road to the terminal area is recommended within the planning period. Currently, the only public vehicle access point to the Airport is via Airport Road, which crosses the High Line Canal. In addition, the existing access road does not allow for direct access of the Airport via Blue Lakes Boulevard, which is the primary commercial roadway running north/south through the City.

Feasible options for developing a secondary access road to the Airport are limited. Additional entrance points from the north would require another crossing of the High Line Canal. From the west, an access road would have to be constructed through the landfill site and could interfere with the recommended option for realignment of the crosswind runway. Access from the south via 3300 North Road is not practical due to the location of the terminal area on the north side of the Airport. As depicted on **Exhibit 5-12**, the recommended concept is development of a new access road from the east via Blue Lakes Boulevard.

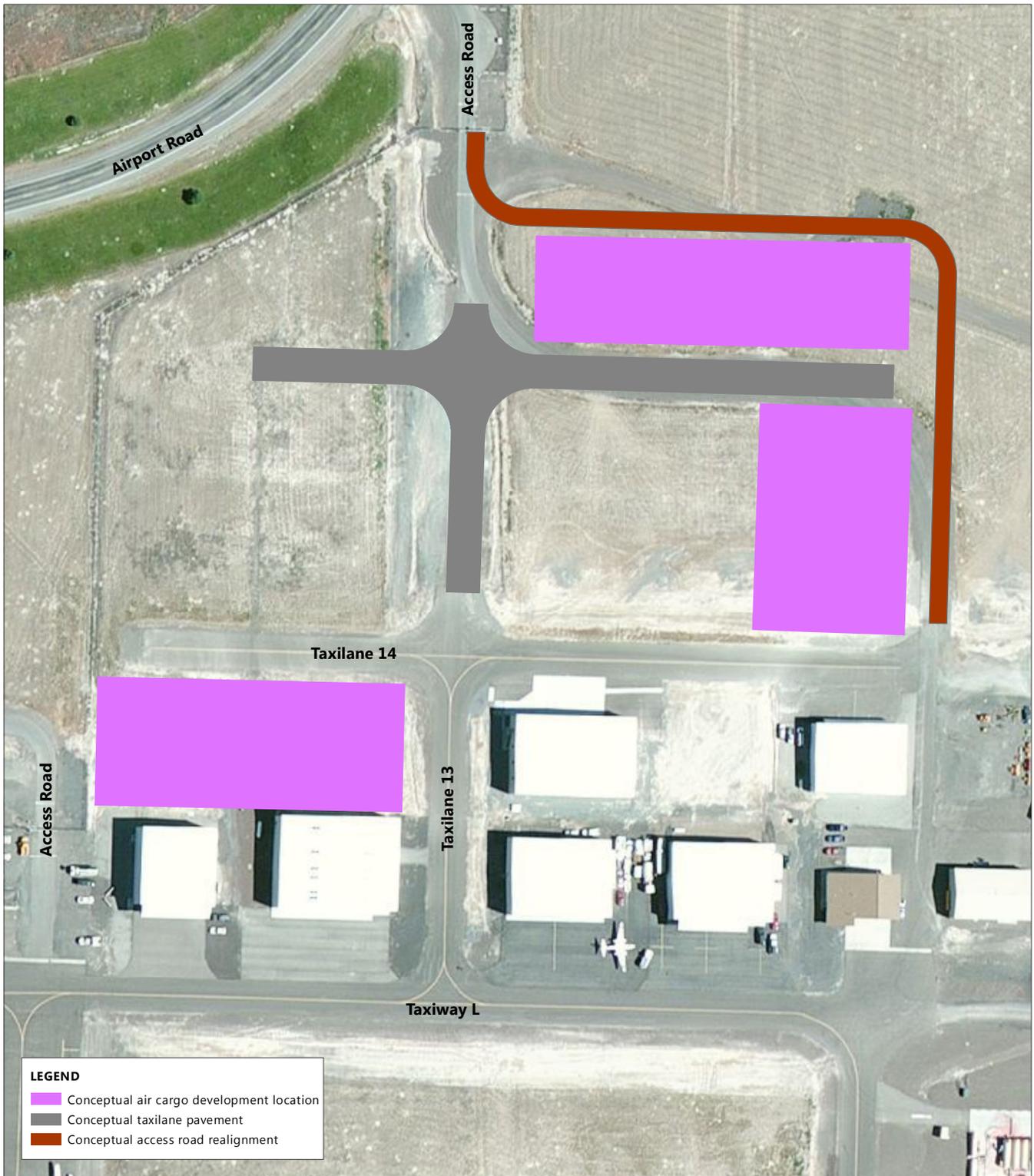


EXHIBIT 5-11

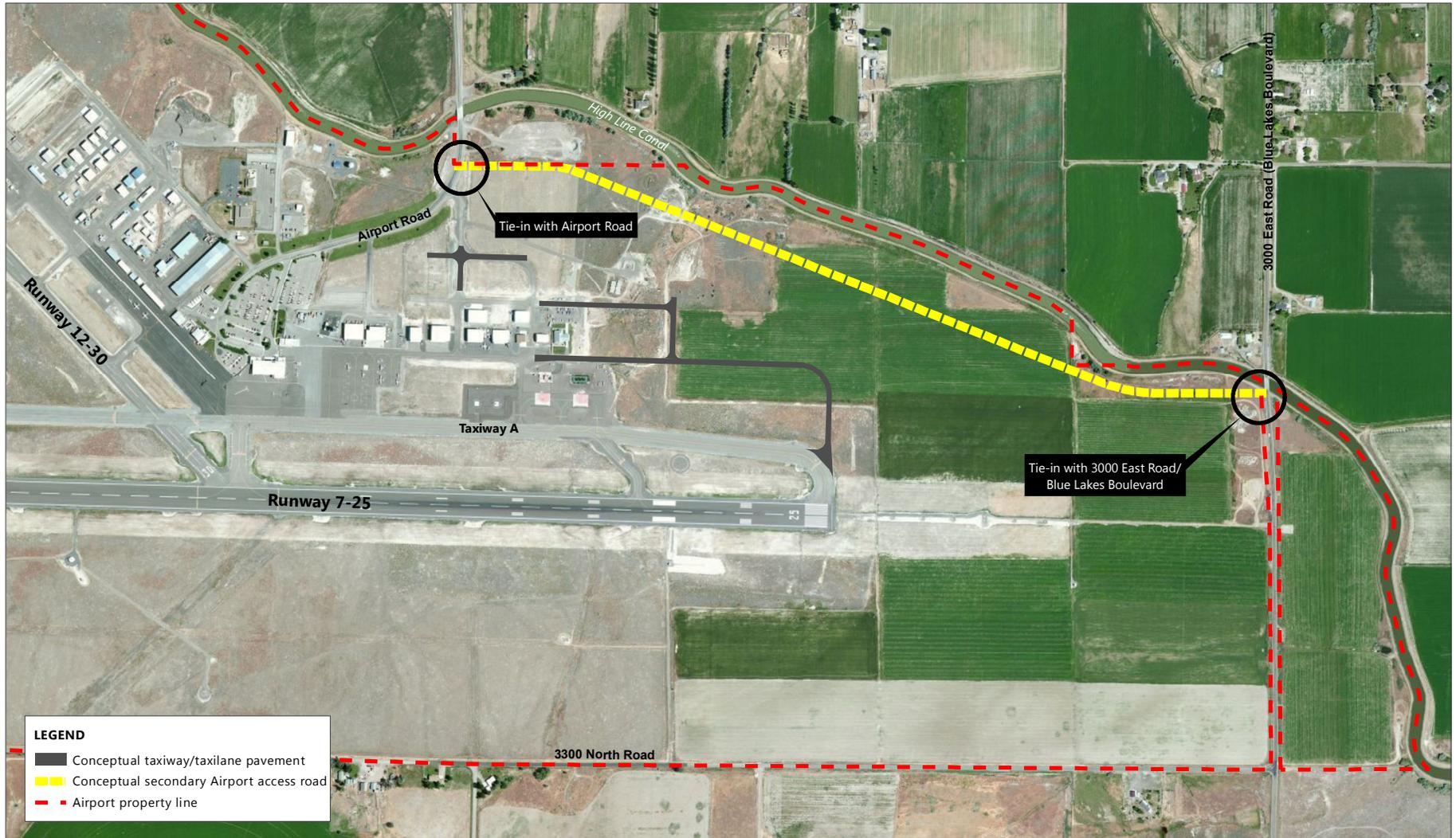


NORTH

0 150 feet

Conceptual Air Cargo Development Locations

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SOURCES: ESRI, May 2010 (Bing Maps aerial photograph); Riedesel Engineering, Inc., January 2011 (Airport property line); Riedesel Engineering, Inc., March 2011 (secondary access road concept).
 PREPARED BY: Ricondo & Associates, Inc., April 2012.

EXHIBIT 5-12



Recommended Secondary Airport Access Road Concept

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Development of a secondary access road in this location is consistent with the 2003 Master Plan Update and has two primary advantages. First, it provides direct access to/from Blue Lakes Boulevard, which would allow for a more direct and potentially faster route between the Airport and the CDB. The second advantage of this alignment is that the new roadway would facilitate access for potential development of new aeronautical and nonaeronautical areas on the east side of the Airport, as described in Section 6.

As depicted, the conceptual alignment of the roadway would proceed west from Blue Lakes Boulevard for approximately 1,000 feet before turning northwest and running approximately parallel to the High Line Canal, before turning west and joining with Airport Road just south of the High Line Canal bridge. The concept includes relocation of the Airport fence line currently located along the High Line Canal to a position along the southern edge of the roadway.

5.4.1.2 Public Parking Improvements

Currently available parking facilities are anticipated to be adequate through the planning period, as described in Section 4. The southern portion of the overflow area adjacent to the main terminal parking lot has recently been paved and marked to accommodate periods of excess demand. Depicted on **Exhibit 5-13**, the total area comprises approximately 3 acres, of which approximately 1 acre has been paved/marked. For long-term planning purposes, it is recommended that the remaining unpaved/unmarked overflow area be reserved for ultimate vehicle parking facilities. Future improvements to the area may include paving/marketing of the remaining area, as required to meet parking demand.

Other parking improvements to both the overflow lot and the main lot could include designated areas for premium parking. One of the strategies identified through the Strategic Planning Initiative conducted at the outset of the master plan process is to identify nonaeronautical revenue opportunities to help offset the current City/County tax burden associated with the Airport (see Section 1). Since the Airport does not currently charge a fee for general public parking, the establishment of premium parking areas could provide an opportunity to collect parking revenues. Covered parking areas could be an example of potential premium parking opportunities. Conceptual locations for such premium parking areas are depicted on Exhibit 5-13.

5.4.2 SUPPORT FACILITY DEVELOPMENT CONCEPTS

5.4.2.1 Snow Removal Equipment Storage Facility

As discussed in Section 4, snow removal and related equipment at the Airport are currently stored in a sand storage building that is not ideally sized for or equipped to store this equipment. A new storage facility has been designed, with construction anticipated to occur in 2013. The conceptual layout of the facility is depicted on **Exhibit 5-14**. Located adjacent to the overflow parking area, the overall facility will include a storage building and apron area, and will have airfield access via Taxiway 14.

5.4.2.2 Supplemental General Aviation Fuel Storage

As noted in Section 4, Airport Management has indicated the need provide a location near the west building area to store bulk aviation fuels for tenant use. Such a facility has been designated adjacent to the existing fuel farm and is depicted on Sheet 2 of the ALP, presented in Section 9.



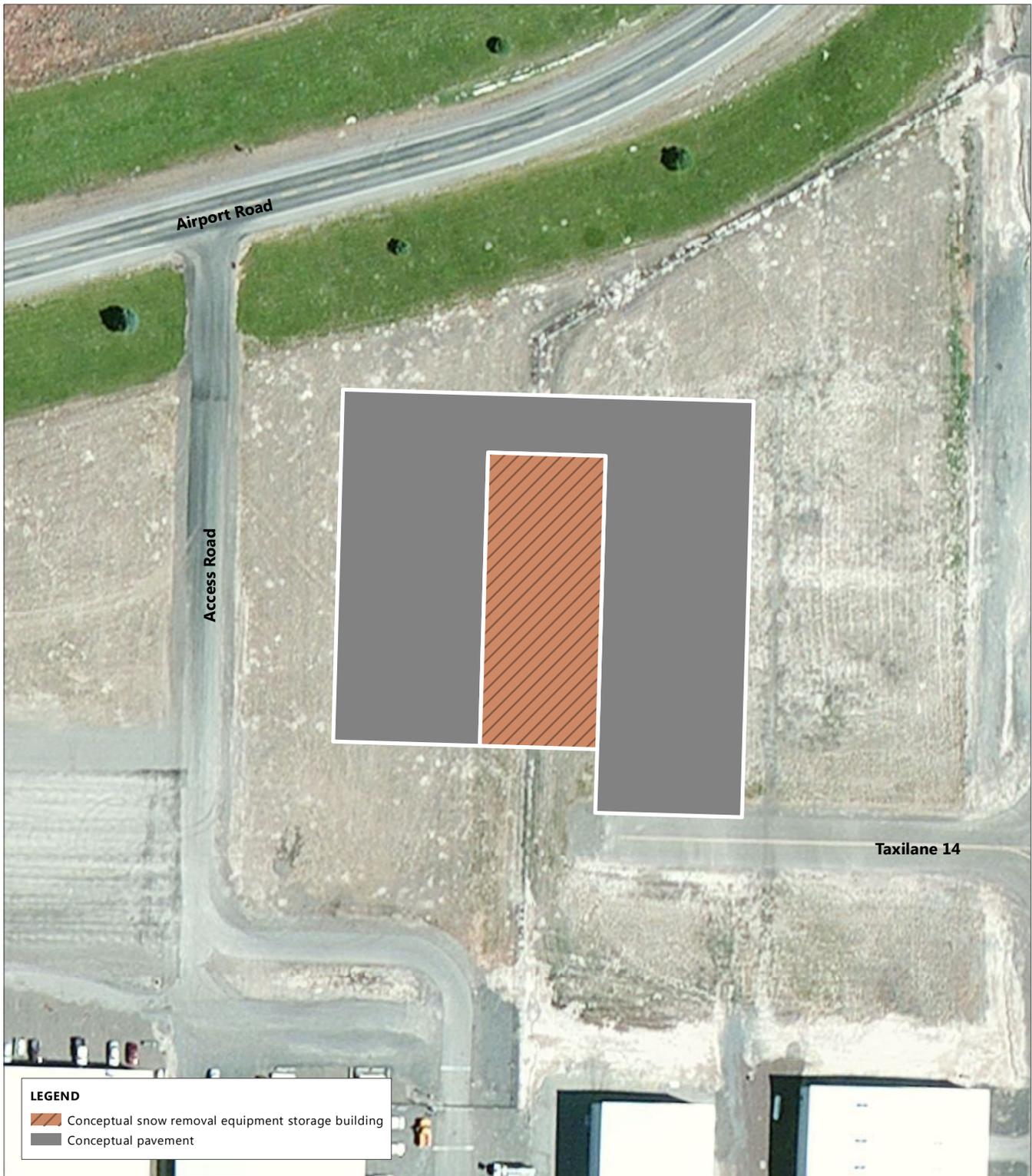
SOURCES: ESRI, May 2010 (Bing Maps aerial photograph); Ricondo & Associates, Inc., Inc., March 2011 (conceptual parking improvements).
PREPARED BY: Ricondo & Associates, Inc., April 2012.

EXHIBIT 5-13



Conceptual Public Parking Improvements

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SOURCES: ESRI, May 2010 (Bing Maps aerial photograph); Riedesel Engineering, Inc., November 2011 (conceptual snow removal equipment storage facility).
PREPARED BY: Ricondo & Associates, Inc., April 2012.

EXHIBIT 5-14



Proposed Snow Removal Equipment Storage Facility

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