D. Concepts, Alternatives, and Development Plan

Introduction

This chapter presents development alternatives and recommendations for Pueblo Memorial Airport (PUB) in terms of concepts and reasoning and provides a description of the various factors and influences, which will form the basis for PUB's long-term development plan. In concert with the role of PUB, and community input received during the planning process, several basic assumptions have been established that are intended to direct the development of PUB in the future.

Assumption One. PUB will be developed and operated in a manner that is consistent with local ordinances and codes, federal and state statutes, federal grant assurances, and Federal Aviation Administration (FAA) regulations.

Assumption Two. This assumption recognizes the role of PUB, which will continue to serve as a facility that accommodates regional commercial service passenger activity, along with general aviation (private, corporate, and training) activity and a small amount of military aviation activity.

Assumption Three. This assumption focuses on the need to accommodate forecast operations of all aviation types, as expressed by the Annual Service Volume (ASV) capabilities in the previous chapter. Forecasts of operational activity and the analysis of the capacity of PUB's runway layout indicate that additional capacity (both runway and taxiway) is needed to accommodate aircraft landings and takeoffs efficiently, primarily due to the expected increase in flight training activity at PUB.

Assumption Four. This assumption relates to the size and type of aircraft that utilize PUB and the resulting setback and safety criteria used as the basis for the layout of associated airport facilities.

- **Runway 8R/26L (Primary).** This runway is used by both the commercial service aircraft and many of the larger business jet aircraft that operate at PUB. The future Critical Aircraft for this runway is an Airplane Design Group (ADG) III commercial service type aircraft, specifically the Embraer E-175. As such, this runway should continue to be planned and designed using Runway Design Code (RDC) C-III-2400 criteria.
- **Runway 17/35 (Crosswind).** This runway is also used by both the commercial service aircraft and many of the larger business jet type aircraft that operate at PUB. The future Critical Aircraft for this runway is also the E-175. Thus, this runway should continue to be planned and designed using Runway Design Code (RDC) C-III-2400 criteria.
- **Runway 8L/26R (Parallel or Training).** This runway is used primarily by smaller general aviation aircraft. The Critical Aircraft for this runway is the Diamond DA20 Katana. This indicates the runway should continue to be designed using RDC B-II-VIS dimensional criteria.
- **Taxiway Dimensional Criteria.** The majority of taxiways and taxilanes at PUB currently accommodate all sizes of aircraft. However, in accordance with FAA's recently published Taxiway Design Group (TDG) standards, alternatives that correct or improve the deficiencies and non-standard taxiway/taxilane configurations identified in the previous chapter will be evaluated.

Assumption Five. The fifth assumption relates to the need for PUB to accommodate aircraft operations with great reliability and safety. This indicates that PUB's runway system should be developed with instrument approach guidance capabilities that accommodate the forecast operations as safely as possible under most weather conditions.

Assumption Six. The existing length provided by all three runways is adequate to accommodate the needs of the existing and forecast aircraft fleet safely and efficiently.

Assumption Seven. Because the amount of accessible landside development area at any airport is at a premium, this assumption states that the plan for future airport development should strive to make the most efficient use of the available area for aviation-related activities, including general aviation facilities and passenger terminal facilities. Aviation use areas should be developed to be compatible with surrounding land uses.

Assumption Eight. The eighth assumption focuses on the relationship of PUB to off-airport land uses and the compatible and complementary development of each. To the maximum extent possible, future facilities will be designed to enhance the compatibility of the operation of PUB with the environs.

Goals for Development

Accompanying these assumptions are several goals which have been established for purposes of directing the plan and establishing continuity in the future development of PUB. These goals account for several categorical considerations relating to the needs of PUB, both in the short-term and the long-term, including safety, capacity, noise, capital improvements, land use compatibility, financial and economic conditions, public interest and investment, and community recognition and awareness. While all are project oriented, some obviously represent more tangible activities than others; however, all are deemed important and appropriate to the future of PUB.

The following goals are intended to guide the preparation of this Airport Master Plan and direct the future development and expansion of PUB:

- **Plan and develop PUB to be capable of accommodating the future needs of the City of Pueblo, Pueblo County, and the surrounding area.**
- **Program the construction of facilities when demand is realized (construction is demand driven, not forecast driven).**
- **Plan PUB to accommodate the forecast aircraft fleet safely and efficiently with the facilities needed to accommodate demand. The primary potential facilities improvements under consideration include:**
    - **Taxiway improvements, extensions, and reconfigurations to enhance airfield capacity.**
    - **A fourth runway to enhance airfield capacity.**
    - **Improvements to the terminal building to accommodate passenger screening and waiting areas more efficiently.**
    - **Construction and rehabilitation of apron and taxilanes needed to accommodate and facilitate aircraft parking.**
- **Provide effective direction for the future development through the preparation of a rational plan and adherence to the adopted development program.**
- **Plan and develop PUB to be environmentally compatible with the community. Minimize environmental impacts on both airport property and adjacent property.**
- **Integrate the needs of existing tenants with future airport development plans. Recognize and accommodate the needs of general aviation including corporate and flight training activity.**
- **Enhance the self-sustaining capability of PUB and the financial feasibility of proposed airport development.**

Airside Development Concepts, Alternatives, and Recommendations

Because all other functions relate to, and revolve around, the basic runway/taxiway layout and approaches, airside development alternatives must first be examined and evaluated. The primary objective of the airside alternatives analysis is to examine options that will result in the best and safest possible aircraft operating environment. The analysis has been prepared to provide PUB with a comprehensive outline of each alternative's key components and the advantages and disadvantages associated with each. Specific airside considerations include a fourth runway that increases airfield capacity, airfield dimensional standards and design criteria, taxiway geometry, and instrument approach capabilities.

Airfield Capacity

Initial Fourth Runway Alternatives

The planning and programming for airfield capacity enhancement involves, but is not limited to, an examination of a fourth runway. By adding additional runway capacity, overall airfield capacity is increased in expectation of the increased aviation activity demand. The fourth runway should be designed to Runway Reference Code (RDC) A-I standards since its principal function would be to accommodate increased training activity, which is expected to be dominated by the Diamond DA20 Katana aircraft. Only visual approaches are required.

Figure D1 provides an illustration of the five initial fourth runway alternative locations considered. While not illustrated, all runway alternatives would be served by a parallel taxiway, entrance taxiways at each runway end, and one exit taxiway at the mid-point of the runway. After an initial broad examination of the five alternatives using a qualitative analysis categories, two alternatives were carried forward using the RunwaySimulator model to quantify the change in airfield capacity provided. PUB Airport Traffic Control Tower (ATCT) personnel and PUB staff reviewed the runway alternatives and provided input.

East-West Option 1. This east-west oriented alternative is in the far north part of PUB property approximately 955 feet north of the Runway 17 threshold. This location is needed to provide an approximate ½ nautical mile (NM), or 3,000 feet, separation of the training traffic pattern flight track associated with Runway 8L/26R and the centerline of the new runway. By recommendation of ATCT personnel, the west runway end is aligned with the existing Runway ends 8R and 8L.

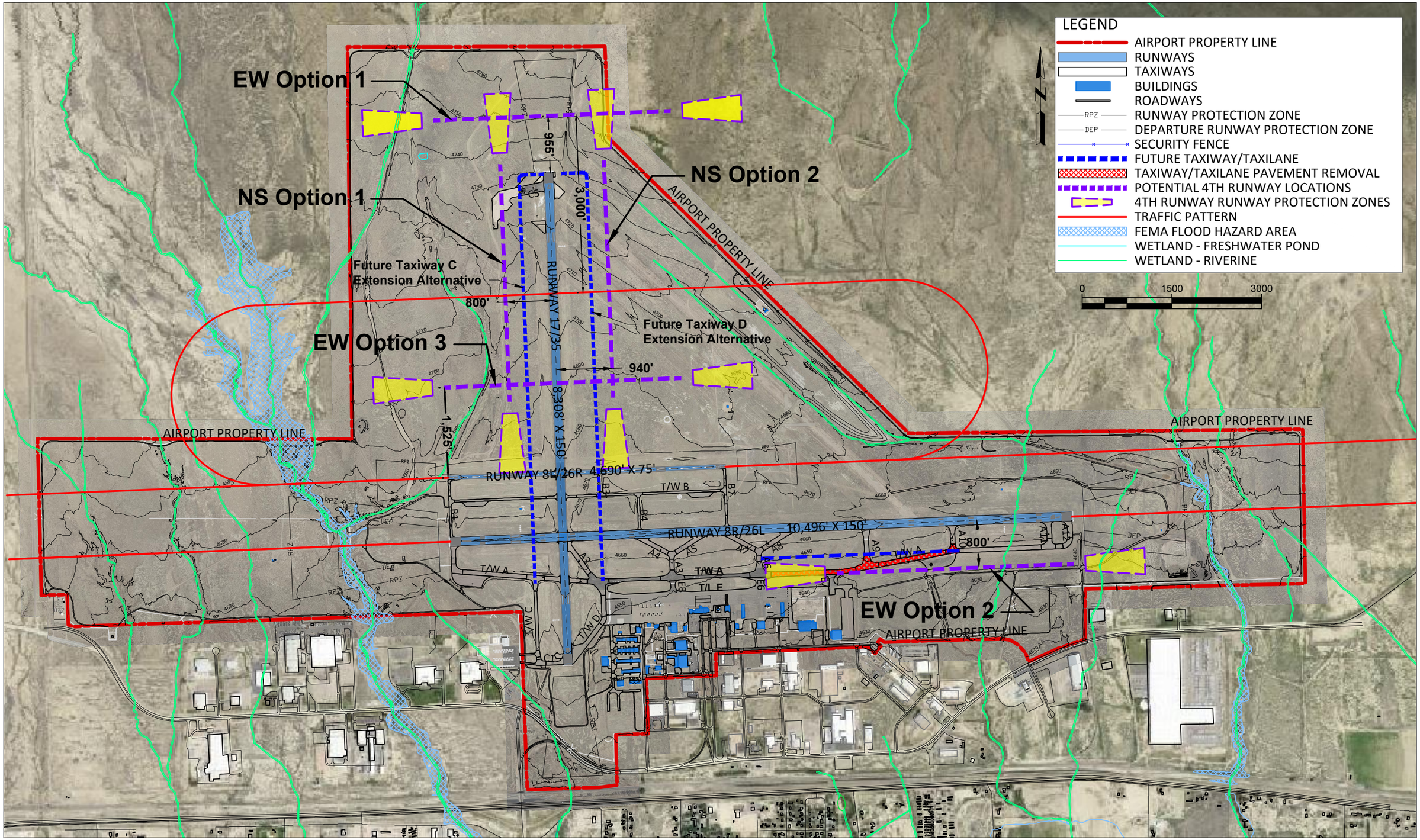


FIGURE D1 **Potential 4th Runway Location Alternatives**

Advantages:

- **No wake turbulence concerns from large or heavy aircraft utilizing Runway 8R/26L simultaneously.**
- **Provides adequate separation to conduct simultaneous training operations to both this runway and Runway 8L/26R.**
- **Has no impact to drainageways.**

Disadvantages:

- **Potential line of sight (LOS) concerns from existing ATCT cab.**
- **Longest taxi times for training aircraft of the five options.**
- **Requires land acquisition and relocation of 10-foot perimeter fence for implementation.**
- **Terrain variations in the area north of Runway 8L/26R require extensive earthwork.**

East-West Option 2. This east-west oriented alternative is located south of Taxiway A at the east end PUB's airfield. It is located 300 feet south of Taxiway A corresponding to RDC C-III dimensional standards for runway to taxiway centerline separation. In this location it would require the realignment of Taxiway A between Taxiways A6 and A10.

Advantages:

- **Least amount of taxi times for training aircraft of the five options.**
- **No LOS concerns from existing ATCT cab.**

Disadvantages:

- **The 800-foot separation from Runway 8R/26L causes wake turbulence concerns from large or heavy aircraft utilizing the primary runway simultaneously.**
- **Concerns with overflying existing taxiways and buildings at low altitudes on approaches from and departures to the west.**
- **Steep terrain at the runway location would require extensive fill to provide necessary Runway Safety Area (RSA) width.**
- **Impacts a north-south drainageway and riverine wetland at the east end of the runway.**

East-West Option 3. This east-west oriented alternative is located approximately 2,600 feet north of Runway 8R/26L (1,525 feet north of Runway 8L/26R). Sited here, uninterrupted training operations can occur simultaneously with large and heavy itinerant aircraft operations on the primary runway.

Advantages:

- **Reduced taxi times for training aircraft compared to East-West Option 1.**
- **Improved ATCT visibility compared to East-West Option 1.**
- **The 2,600-foot separation from Runway 8R/26L causes no wake turbulence concerns from large or heavy aircraft utilizing the primary runway simultaneously.**

Disadvantages:

- **Limits operations on Runway 8L/26R to itinerant operations only (no training operations because there is not sufficient space for a traffic pattern that does not overlap the other parallel runways).**
- **Impacts a north-south drainageway and riverine wetland at the west end of the runway.**

North-South Option 1. This north-south oriented alternative is in the north part of PUB's airfield located west of Runway 17/35. Its south runway end is sited such that the southern RPZ remains clear of Runway 8L/26R, which extends the north runway end approximately 180 feet north of the Runway 17 threshold. It is located 300 feet west of a future extended Taxiway C (in accordance with RDC C-III dimensional standards for runway to taxiway centerline separation).

Advantages:

- **Would provide a slight airfield capacity enhancement compared to existing conditions. However, since it would only be required in extensive crosswind conditions and not preferred by training pilots during calm wind conditions, the enhancement provided would be less than the East-West options.**

Disadvantages:

- **Minimal capacity enhancement provided due to the small percentage of time that winds favor north/south operations at PUB.**
- **The 800-foot separation from Runway 17/35 causes wake turbulence concerns from large or heavy aircraft utilizing the crosswind runway simultaneously.**
- **Potential LOS concerns from existing ATCT cab, especially to the north runway end.**
- **Slight potential impact to north-south drainageway.**
- **Long taxi times for training aircraft, although less so than East-West Option 1.**

North-South Option 2. This north-south oriented alternative is also in the north part of PUB's airfield but is located east of Runway 17/35. Its south runway end is also sited such that the southern RPZ remains clear of Runway 8L/26R, which extends the north runway end approximately 180 feet north of the Runway 17 threshold. It is located 300 feet east of a future extended Taxiway D (in accordance with RDC C-III dimensional standards for runway to taxiway centerline separation).

Advantages:

- **Would provide a slight airfield capacity enhancement compared to existing conditions (similar to North-South Option 1). However, since it would only be required in extensive crosswind conditions and not preferred by training pilots during calm wind conditions, the enhancement provided would be less than the East-West options.**
- **Has no impact to drainageways.**

Disadvantages:

- **Minimal capacity enhancement provided due to the small percentage of time that winds favor north/south operations at PUB.**
- **The 950-foot separation from Runway 17/35 causes wake turbulence concerns from large or heavy aircraft utilizing the crosswind runway simultaneously, although less so compared to North-South Option 1 and East-West Option 2.**
- **Potential LOS concerns from existing ATCT cab, especially to the north runway end.**
- **Terrain variations along the length of the runway requires extensive earthwork to construct.**
- **Long taxi times for training aircraft, although less so than East-West Option 1.**
- **Requires land acquisition for implementation.**

Refined 4th Runway Alternatives

Given that prevailing winds at PUB heavily favor east/west operations, this runway orientation is expected to have a significantly greater capacity enhancement than the north/south alternatives. Consequently, the north/south alternatives were eliminated from further consideration. East-West Option 2 was also eliminated due to the safety concerns related to overflying the existing developed areas on the airfield as well as the wake turbulence concerns that would reduce the capacity enhancement provided by a runway in this location.

East-West Options 1 and 3 were carried forward for further evaluation. Specifically, analysis was conducted utilizing RunwaySimulator to quantify the capacity enhancement provided by both alternatives. It is also expected that both alternatives will reduce or eliminate the wake turbulence concerns from simultaneous large or heavy aircraft operations on a parallel runway.

Background

Prior to evaluating and comparing the anticipated capacity enhancements provided by the two east/west runway alternatives using computer modeling, it is necessary to establish an ASV of the existing airfield configuration using computer modeling (Runway Simulator) so that a direct comparison can be made of the improvements. Determining ASV via the computer modeling follows a similar process used in FAA's Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*.

The model is used to determine the base hourly capacities of the four existing airfield configurations presented in **Chapter C – Capacity Analysis and Facility Requirements**. For reference, these four configurations are:

- **VFR Runways 8R/26L and 8L/26R**
- **VFR Runway 17/35**
- **IFR Runways 8R/26L and 8L/26R**
- **IFR Runway 17/35**

Once the hourly capacity base of each of these configurations is determined through computer modeling, the same methods from AC 150/5060-5 are applied to account for weather conditions, touch and go frequency, taxiway exits, and local demand ratios. The resulting adjusted hour bases for each scenario is shown below:

- **Configuration 1: VFR Runways 8R/26L and 8L/26R**
  - **C* x T x E = 143.5 x 1.2 x 1.0 = 172.2 operations**
- **Configuration 2: VFR Runway 17/35**
  - **C* x T x E = 61 x 1.2 x 0.86 = 63 operations**
- **Configuration 3: IFR Runways 8R/26L and 8L/26R**
  - **C* x T x E = 52.8 x 1.0 x 1.0 = 52.8 operations**
- **Configuration 4: IFR Runway 17/35**
  - **C* x T x E = 45.7 x 1 x 0.86 = 39.3 operations**

These hourly capacities are then used to determine the weighted capacity of 108.29. Finally, this is combined with the local demand factors determined in the previous chapter to calculate the ASV.

$ASV = C_W \times D \times H$
$ASV = 108.29 \times 323.07 \times 9.09$
$ASV = 318{,}162$

By comparison, as presented in the previous chapter using only the methodology from AC 150/5060-5 (i.e., no computer modeling), an ASV of 462,108 operations was determined. While this is a notable difference, the primary reason for this change is the method through which the AC determines the hourly capacity base. Once the appropriate runway configurations and corresponding charts from AC 150/5060-5 are determined, the mix index is the primary influence. The fleet mix, and resulting mix index, at PUB is unique to airports with large training programs. Although commercial service is available at PUB, the strong presence of flight training aircraft means that these more demanding aircraft make up a very small percentage of the total fleet mix. Operations by the CRJ 200 for instance, which is used for air carrier service at PUB, made up only 0.8% of operations in 2019. The resulting fleet mix index of 1.0 results in an VFR hourly capacity base of 200 as opposed to 143.5 presented above in Configuration 1.

Capacity Analysis Results

From an airfield capacity standpoint, both east/west runway alternatives are similar in that they both propose a third parallel runway. The primary difference is that the reduced separation between Runway 8L/26R and the East-West Option 3 would reduce the number of IFR operations slightly due to the increased separation required between aircraft during IFR conditions. The computer derived hourly capacity base (C*), the weighted capacity (C_W), and ASV calculations for each runway alternative are provided below.

East-West Option 1

- **Configuration 1: VFR Runways 8R/26L, 8L/26R and East-West Option 1**
  - *C* x T x E* = 218.7 x 1.2 x 1.0 = 262.4 operations
- **Configuration 2: VFR Runway 17/35**
  - *C* x T x E* = 61 x 1.2 x 0.86 = 63 operations
- **Configuration 3: IFR Runways 8R/26L, 8L/26R and proposed East-West Option 1**
  - *C* x T x E* = 100.9 x 1.0 x 1.0 = 100.9 operations
- **Configuration 4: IFR Runway 17/35**
  - *C* x T x E* = 45.7 x 1 x 0.86 = 39.3 operations

ASV = C_W x D x H
ASV = 147.69 x 323.07 x 9.09
ASV = 433,930

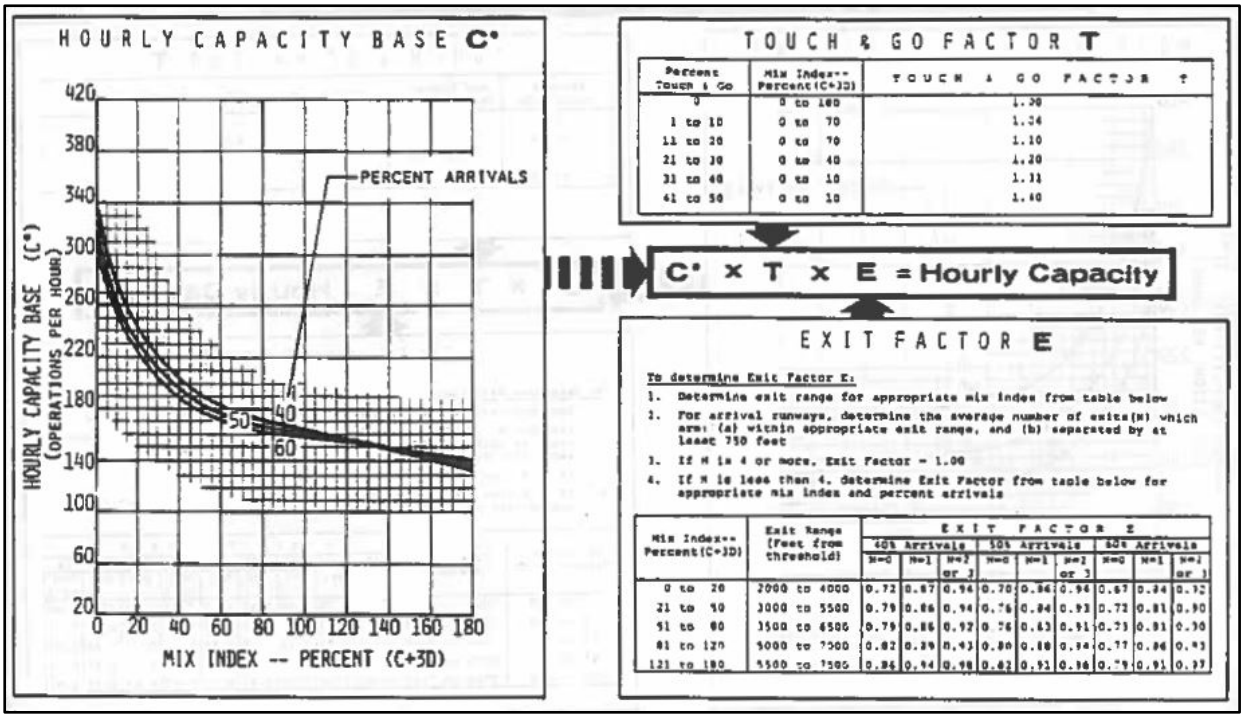
East-West Option 3

- **Configuration 1: VFR Runways 8R/26L, 8L/26R and East-West Option 3**
  - *C* x T x E* = 218.7 x 1.2 x 1.0 = 262.6 operations
- **Configuration 2: VFR Runway 17/35**
  - *C* x T x E* = 61 x 1.2 x 0.86 = 63 operations
- **Configuration 3: IFR Runways 8R/26L, 8L/26R and proposed East-West Option 3**
  - *C* x T x E* = 100.9 x 1.0 x 1.0 = 90.1 operations
- **Configuration 4: IFR Runway 17/35**
  - *C* x T x E* = 45.7 x 1 x 0.86 = 39.3 operations

ASV = C_W x D x H
ASV = 147.12 x 323.07 x 9.09
ASV = 432,259

For comparison, the ASV for each runway alternative was determined using only the methodology from AC 150/5060-5. Using the new runway configurations and applying the VFR and IFR performance curves for East-West Option 1, presented in **Figures D2** and **D3**, respectively, and the VFR and IFR performance curves for East-West Option 3, presented in **Figures D4** and **D5**, respectively, the methodology for calculating ASV is the same as presented previously. The charts contained on the left provide hourly capacity base (C*) for the appropriate mix index, the tables in the upper right hand corner provide the touch and go factor (T), and the tables in the bottom right hand corner provide the exit factor (E) based on number of exit taxiways. Since the north-south flow conditions of Runway 17/35 would remain the same for both east-west runway alternatives, it is not presented but is considered in the ASV calculations.

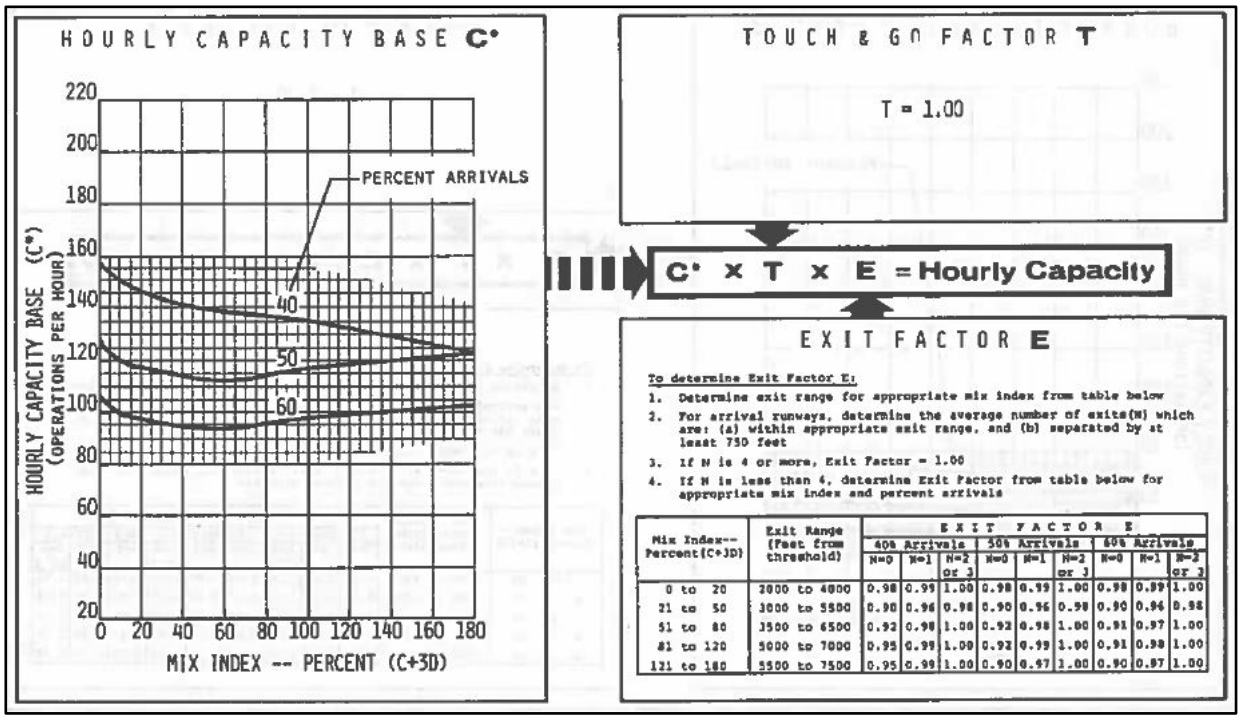
FIGURE D2 **Configuration 1: VFR Runways 8R/26L, 8L/26R, and Proposed East-West Option 1**



SOURCE: FAA AC 150/5060-5, *Airport Capacity and Delay*, Figure 3-19.

- **Configuration 1: VFR Runways 8R/26L, 8L/26R, and Proposed East-West Option 1**
  - *C* x T x E* = 305 x 1.2 x 1.0 = 366.0 operations.

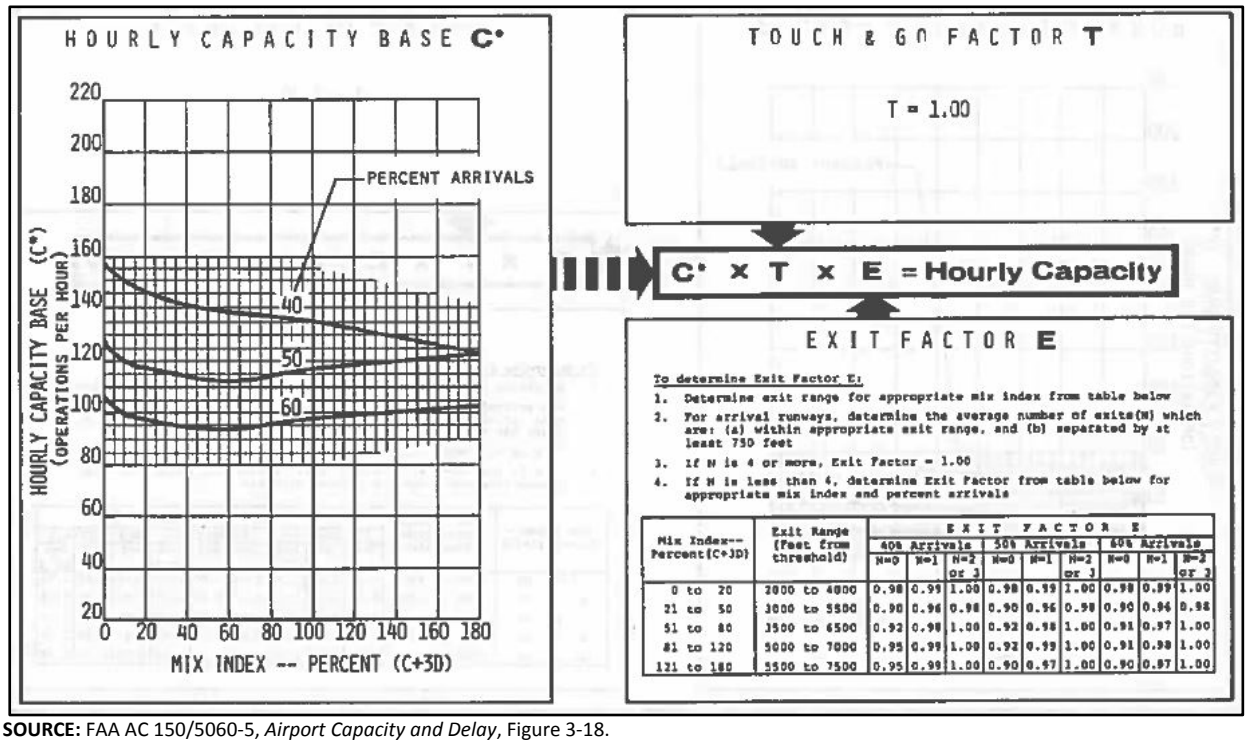
FIGURE D3 **Configuration 3: IFR Runways 8R/26L, 8L/26R, and Proposed East-West Option 1**



SOURCE: FAA AC 150/5060-5, *Airport Capacity and Delay*, Figure 3-55.

- **Configuration 3: IFR Runways 8R/26L, 8L/26R, and Proposed East-West Option 1**
  - *C* x T x E* = 126 x 1.0 x 1.0 = 126.0 operations.

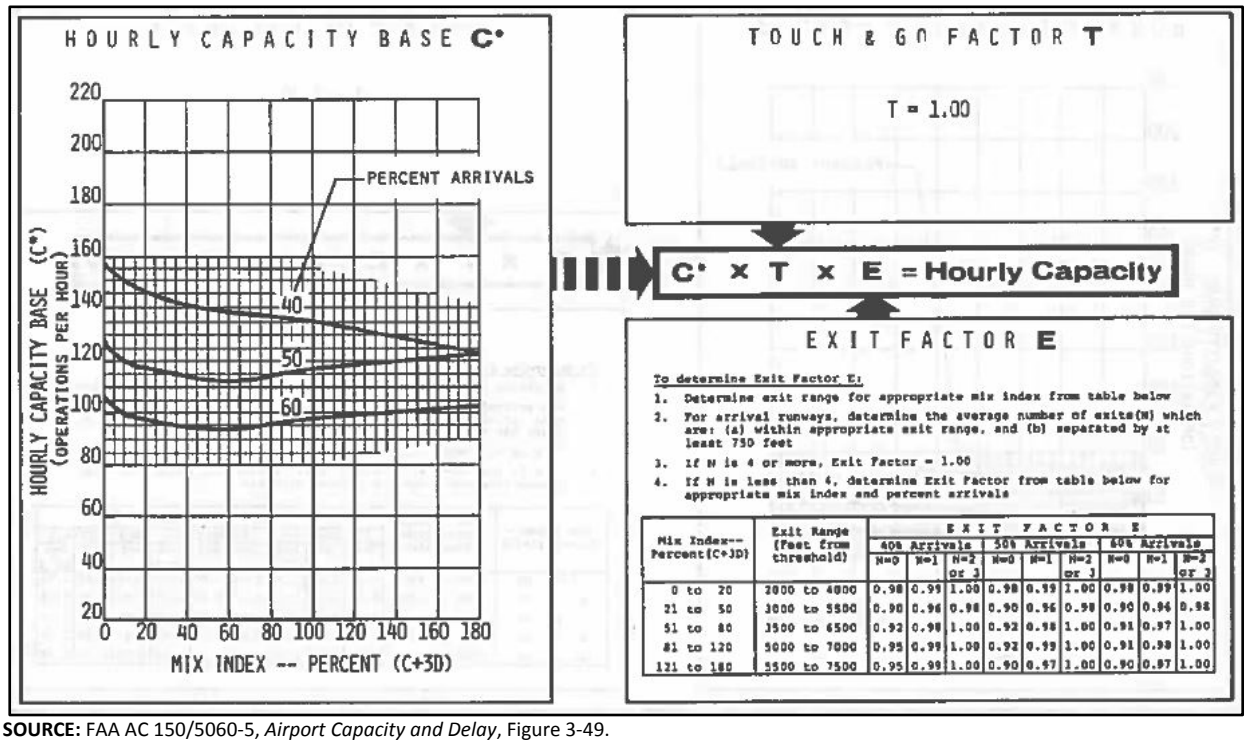
FIGURE D4 Configuration 1: VFR Runways 8R/26L, 8L/26R, and Proposed East-West Option 3



SOURCE: FAA AC 150/5060-5, *Airport Capacity and Delay*, Figure 3-18.

- **Configuration 1: VFR Runways 8R/26L, 8L/26R, and Proposed East-West Option 3**
  - *C* x T x E* = 302 x 1.2 x 1.0 = 362.4 operations.

FIGURE D5 **Configuration 1: IFR Runways 8R/26L, 8L/26R, and Proposed East-West Option 3**



SOURCE: FAA AC 150/5060-5, *Airport Capacity and Delay*, Figure 3-49.

- **Configuration 3: IFR Runways 8R/26L, 8L/26R, and Proposed East-West Option 3**
  - *C* x T x E* = 63 x 1.0 x 1.0 = 63.0 operations.

The different configurations and resulting ASV for each alternative are presented in **Table D1**. As presented, East-West Runway Options 1 and 3 result in very similar ASV enhancements (an approximate 0.4 percent difference in the computer modeled ASV calculations). By comparison, the ASV calculation derived from using AC 150/5060-5 only also resulted in very similar enhancements (an approximate 2.4 percent difference). From an airfield capacity standpoint enhancement only, East-West Runway Option 1 provides a modest advantage over East-West Runway Option 3 due to its greater runway separation from Runway 8L/26R. This is true for both the computer model and AC methodologies.

TABLE D1 Runway Alternatives Airfield Capacity Enhancement

AIRFIELD CONFIGURATION	COMPUTER MODEL DERIVED ASV	PERCENTAGE CHANGE	ADVISORY CIRCULAR DERIVED ASV	PERCENTAGE CHANGE
Existing Configuration	318,162	-	462,108	-
East-West Option 1	433,930	36.4%	629,717	36.3%
East-West Option 3	432,259	35.9%	614,836	33.1%

SOURCE: Mead & Hunt analysis using RunwaySimulator computer model and FAA AC 150/5060-5, *Airport Capacity and Delay*.

Recommendation. East-West Runway Option 3 is the preferred runway alternative as it provides nearly an identical increase in airfield capacity as East-West Runway Option 1, but the taxi times for training aircraft to access the runway would be less. While East-West Option 3 does impact the north-south drainageway and riverine wetland, it does not require additional property to implement. Finally, East-West Runway Option 3 poses fewer visibility and LOS concerns from the existing ATCT cab than East-West Runway Option 1. Although consideration of a taller ATCT or a relocated ATCT prior to construction of this runway is recommended.

Taxiway Improvements

Other capacity enhancing improvements to the existing airfield configuration were considered and are presented below. They consist of taxiway improvements that either reduce runway occupancy times for landing aircraft or enhance the ATCT personnel abilities to maximize utility of the existing runway system configuration. **Figure D6** presents the improvement options.

Taxiway C Extension. Extending Taxiway C to a full parallel taxiway serving Runway 17/35 provides ATCT personnel the ability to use Runway 17/35 for takeoffs to the north of Runway 8L/26R while simultaneously using the parallel runways for departures, landings, or training operations, thus enhancing airfield capacity. It allows aircraft the ability to taxi to and from Runway end 17 without back taxiing on the runway. Additionally, it eliminates the need for aircraft utilizing Runway 26R to cross Runway 8R/26L at the Taxiways A7 and B7 intersection, a "high energy" runway crossing discussed later in this chapter.

Advantages:

- **Eliminates back taxiing on Runway 17/35.**
- **Eliminates the high energy crossing in the middle third of Runway 8R/26L.**

Disadvantages:

- **Potential LOS concerns to north end of taxiway from existing ATCT cab.**
- **Construction costs could outweigh benefits gained.**

LEGEND

- AIRPORT PROPERTY LINE
- RUNWAYS
- TAXIWAYS
- BUILDINGS
- ROADWAYS
- RPZ — RUNWAY PROTECTION ZONE
- DEP — DEPARTURE RUNWAY PROTECTION ZONE
- SECURITY FENCE
- FUTURE TAXIWAY/TAXILANE
- TAXIWAY/TAXILANE PAVEMENT REMOVAL
- FEMA FLOOD HAZARD AREA
- WETLAND - FRESHWATER POND
- WETLAND - RIVERINE

0 1500 3000

AIRPORT PROPERTY LINE

Future Taxiway C Extension Alternative

RUNWAY 17/35 8,308' X 150'

Future Taxiway D Extension Alternative

AIRPORT PROPERTY LINE

AIRPORT PROPERTY LINE

RUNWAY 8L/26R 4,690' X 75'

T/W B

Future High Speed Exit Taxiways Alternative

10,496' X 150'

RUNWAY 8R/26L

T/W A

T/W A

T/L E

Future Taxiway E Extension

AIRPORT PROPERTY LINE

T/W D

FIGURE D6 **Taxiway Capacity Enhancement Alternatives**

Taxiway D Extension. Extending Taxiway D to a full parallel taxiway serving Runway 17/35 also provides ATCT personnel the ability to use Runway 17/35 for takeoffs to the north of Runway 8L/26R while simultaneously using the parallel runways for departures, landings, or training operations, thus enhancing airfield capacity. It also allows aircraft the ability to taxi to and from Runway end 17 without back taxiing on the runway. And finally, it eliminates the need for aircraft utilizing Runway 26R to cross Runway 8R/26L at the Taxiways A7 and B7 intersection, a "high energy" runway crossing, and a crossing that rarely occurs according to PUB staff.

Advantages:

- **Eliminates back taxiing on Runway 17/35.**
- **Eliminates the high energy crossing in the middle third of Runway 8R/26L.**

Disadvantages:

- **Potential LOS concerns to north end of taxiway from existing ATCT cab.**
- **Steep terrain between Taxiway A and Runway 8R/26L (existing grade of approximately 2.0 percent) proves challenging to meet the maximum 1.5 percent longitudinal gradient standard for airports accommodating aircraft with approach categories C, D, and E.**
- **Terrain variations along the length of the taxiway north of Runway 8L/26R requires extensive earthwork to construct.**
- **Construction costs could outweigh benefits gained.**

High Speed Exit Taxiways. Acute-angled, high speed exit taxiways normally increase airfield capacity by reducing runway occupancy times. Replacing the existing Y configured Taxiways A3, A4, A5, A6, A7, and A8 with two high speed exit taxiways has the potential to improve PUB's airfield capacity. As presented in **Figure D6**, by lengthening the segment between the runway and Taxiway A, it appears the maximum 1.5 percent longitudinal gradient standard can be achieved. This provides an additional benefit of rectifying the existing non-standard longitudinal gradients associated with Taxiways A3, A6, A7, and A8.

However, by replacing four mid-runway exit taxiways (Taxiways A4, A5, A7, and A8, which can be used at faster than normal speeds than right angled taxiways) with only two exit taxiways, airfield capacity is in fact not improved. For instance, aircraft landing to Runway 8R not able to reduce speed sufficiently to exit at the future east-flow high speed exit taxiway (located approximately 2,200 feet from the Runway 8R threshold) must continue another approximate 3,500 feet along the runway before encountering the next exit taxiway (the future west-flow high speed exit taxiway, a maneuver requiring an approximate 150-degree turn). Should this exit prove to be problematic, then aircraft must travel an additional 1,300 feet before exiting at Taxiway A9.

Consequently, aircraft landing to Runway 26L not able to reduce speed sufficiently to exit at the future west-flow high speed exit taxiway (located approximately 4,300 feet from the Runway 26L threshold) must continue another approximate 3,600 feet along the runway before encountering the next exit taxiway (the future east-flow high speed exit taxiway, a maneuver requiring an approximate 150-degree turn). Should this exit prove to be problematic, then aircraft must travel an additional 2,500 feet before exiting at Taxiway A1. The increased distance between mid-runway exit taxiways, even if high speed exits, tends to increase runway occupancy times and thus decrease airfield capacity.

Advantages:

- **Corrects the longitudinal gradient standards exceeding the 1.5 percent maximum associated with existing Taxiways A3, A6, A7, and A8.**

Disadvantages:

- **Removes multiple mid-runway exit taxiways potentially useful for smaller aircraft.**
- **Construction costs could outweigh benefits gained.**

Recommendation. Extend Taxiway C to full length parallel taxiway serving Runway 17/35. Provide ample exit taxiways spaced to minimize runway occupancy times of landing aircraft and allow for departures to the north of Runway 8L/26R while simultaneously using the parallel runways for departures, landings, or training operations. It is not recommended to replace Taxiways A3, A4, A5, A6, A7, and A8 with high speed exit taxiways as is unlikely that the benefits derived would outweigh the costs incurred.

Runway Design Standards

Runway 8R/26L ROFA

As presented in the previous chapter, an FAA-owned equipment building is located within the Runway 8R/26L Runway Object Free Area (ROFA) southwest of the Runway 8R threshold, approximately 260 feet south of the runway centerline. Thus, the ROFA width is deficient by 140 feet, providing only a total width of 660 feet.

Recommendation. Relocate the equipment building a minimum 140 feet to the south outside the ROFA.

Taxiway Holding Position Lines and Signs

As presented in the previous chapter, all holding position lines marked on taxiways serving Runway 8R/26L, except for Taxiway A2, are deficient by 22 feet. Similarly, many of the Runway 17/35 connector taxiways do not meet the 297-foot holding position line standard required at PUB's elevation.

Recommendation. Plan and program for the relocation of holding position lines and signs on taxiways serving Runways 8R/26L and 17/35 at the next scheduled pavement rehabilitation projects.

Runway 17/35 Gradient

As presented in the previous chapter, the overall Runway 17/35 longitudinal gradient of 1.0 percent exceeds the allowable 0.8 percent standard within the last 25 percent of runway length.

Recommendation. At the next scheduled Runway 17/35 pavement reconstruction project, evaluate the cost of and benefits to achieving the standard 0.8 percent gradient within the last 25 percent of the runway length. If benefits are found to outweigh the cost incurred, then plan and program for the project to include the correction of this deficiency.

Instrument Approach Procedure Improvements

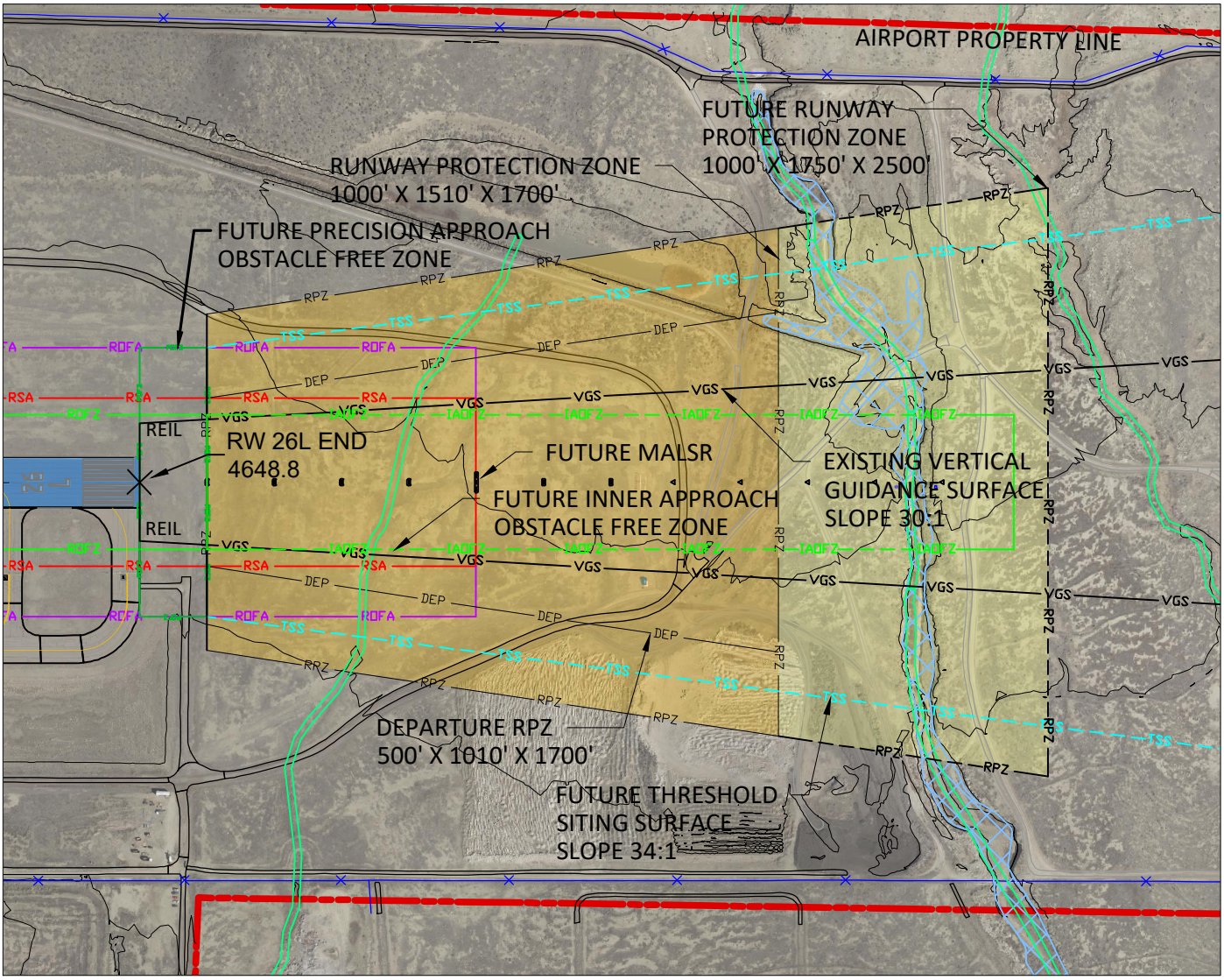
As stated in the previous chapter, an evaluation of implementing improved GPS-based Instrument Approach Procedures (IAP) to Runways 26L, 17, and 35 are warranted to enhance PUB's access during inclement weather conditions.

Runway 26L

Since this runway is already equipped with an Instrument Landing System (ILS) and Area Navigation (RNAV) Global Positioning Satellite (GPS) approaches with visibility minimums as low as ¾-mile, the installation of a Medium Intensity Approach Light System with Runway Alignment Indicator Lights (MALSR) would provide lighting credit enabling a decrease of the visibility minimums to as low as ½-mile. In doing so, the RPZ and threshold siting surface would increase in size accordingly. **Figure D7** illustrates the location of the MALSR, increased RPZ, increased threshold siting surface, and existing vertical guidance approach surface associated with this IAP improvement. The future RPZ would remain entirely on PUB property. The outer one or two light units of the MALSR would be located within or close to a riverine wetland and floodplain. There are no known obstructions to either the threshold siting or vertical guidance approach surfaces.

Runway 17

To achieve an IAP with visibility minimums as low as ¾-mile to Runway 17, as designated on the existing Airport Layout Plan (ALP), an enhancement to the existing RNAV (GPS) approach can be implemented. According to FAA Advisory Circular (AC) 150/5300-13A, an Approach Lighting System (ALS) is recommended but not required for this type of IAP. Non-precision markings are required and are currently provided to Runway 17. In implementing this type of IAP, the RPZ and threshold siting surface would increase in size accordingly. It is anticipated that this IAP would provide vertical guidance so a vertical guidance approach surface would be required that is free of any obstructions. **Figure D8** illustrates the location of the increased RPZ, larger threshold siting surface, and the vertical guidance approach surface associated with this IAP improvement. The future RPZ would remain entirely on PUB property. There are no known obstructions to either the threshold siting or vertical guidance approach surfaces.



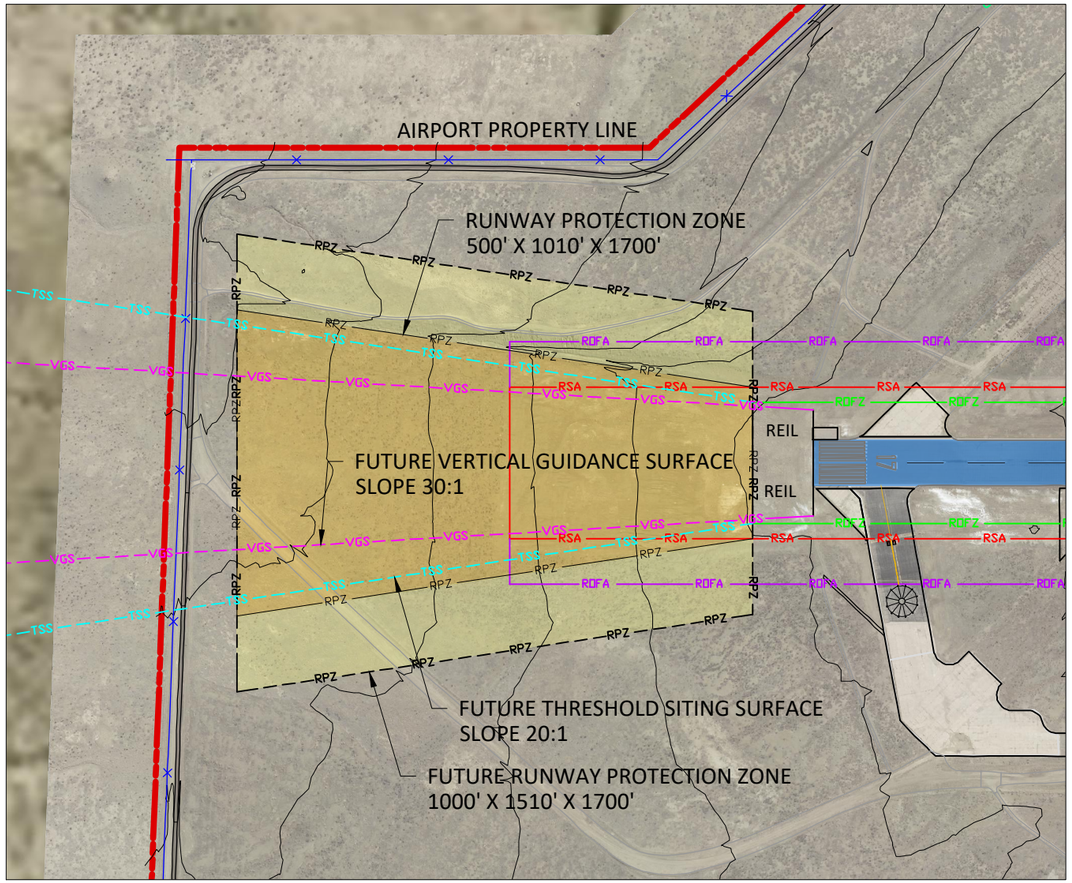
LEGEND

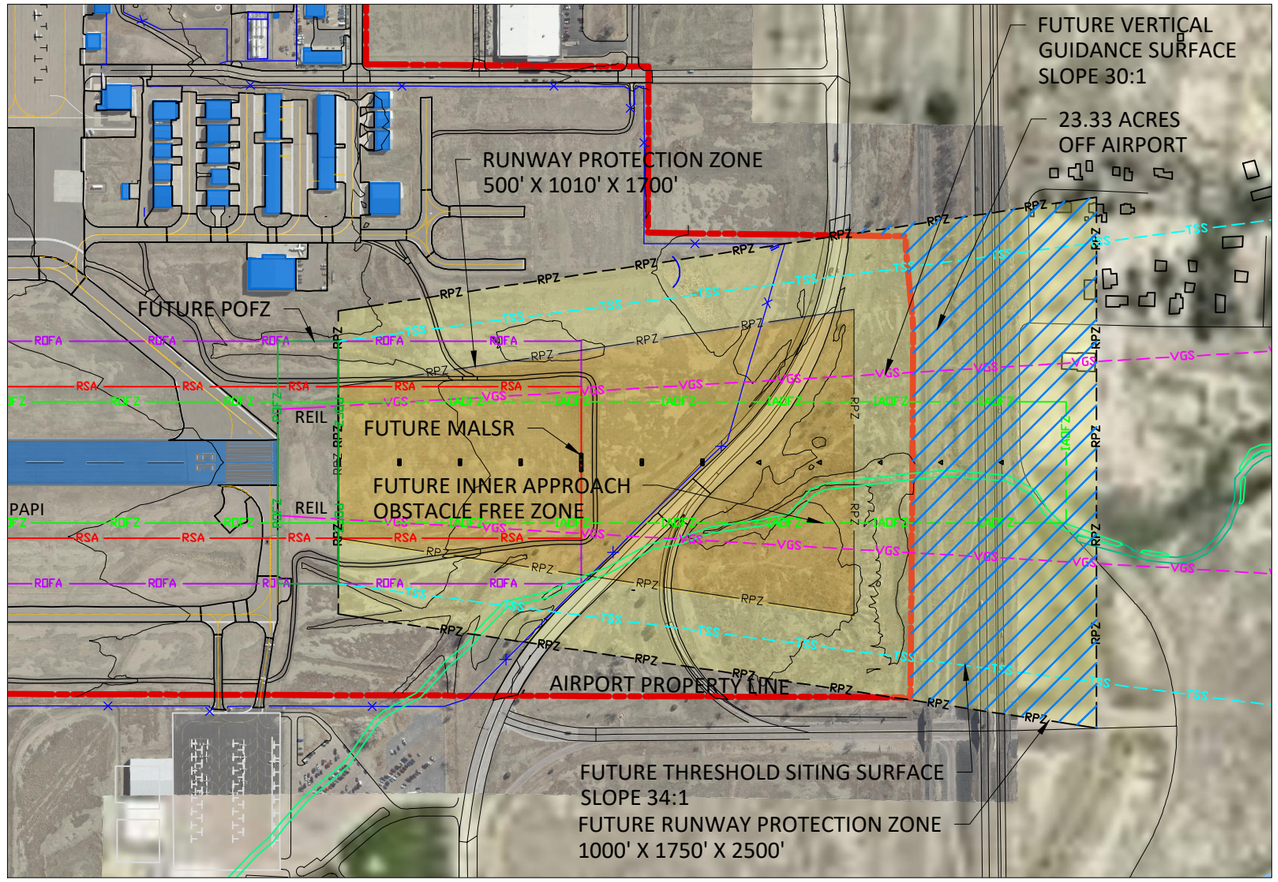
- AIRPORT PROPERTY LINE
- RUNWAYS
- TAXIWAYS
- BUILDINGS
- ROADWAYS
- RSA — RUNWAY SAFETY AREA
- ROFA — RUNWAY OBJECT FREE AREA
- ROFZ — RUNWAY OBSTACLE FREE ZONE
- RVZ — RUNWAY VISIBILITY ZONE
- RPZ — RUNWAY PROTECTION ZONE
- DEP — DEPARTURE RUNWAY PROTECTION ZONE
- POFZ — PRECISION APPROACH OBSTACLE FREE ZONE
- VGS — EXISTING VERTICAL GUIDANCE SURFACE
- SECURITY FENCE
- RPZ — FUTURE RUNWAY PROTECTION ZONE
- IAOFZ — FUTURE INNER APPROACH OBSTACLE FREE ZONE
- TSS — FUTURE THRESHOLD SITING SURFACE
- FEMA FLOOD HAZARD AREA
- WETLAND - RIVERINE

0 500' 1000'

N

FIGURE D7 **Runway 26L IAP Improvement Requirements**





LEGEND

- AIRPORT PROPERTY LINE
- RUNWAYS
- TAXIWAYS
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- ROADWAYS
- RSA — RUNWAY SAFETY AREA
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- IAOFZ — FUTURE INNER APPROACH OBSTACLE FREE ZONE
- TSS — FUTURE THRESHOLD SITING SURFACE
- WETLAND - RIVERINE

FIGURE D8 **Runway 17/35 IAP Improvement Requirements**

Runway 35

As presented in the previous chapter, when considering individual runway ends, Runway 35 provides the best wind coverage for the 13- and 20-knot crosswind components during Instrument Flight Rules (IFR) weather conditions. It is second only to Runway 8R for providing the best wind coverage for the 10.5-knot crosswind component. To achieve an IAP with visibility minimums as low as ½-mile to Runway 35, as designated on the existing ALP, an enhancement of the existing RNAV (GPS) approach to a Localizer Performance with Vertical Guidance (LPV) approach is expected. In doing so, the RPZ and threshold siting surface would increase in size accordingly. The provision of a MALSR and precision markings would be required. Additionally, a vertical guidance approach surface free of any obstacle penetrations would be required for implementation. **Figure D8** also illustrates the location of the MALSR, increased RPZ, larger threshold siting surface, and the vertical guidance approach surface associated with the Runway 35 IAP improvement.

The future RPZ would extend beyond PUB property (approximately 23 acres) and encompass State Highway 96. Because public roadways are considered incompatible land uses within an RPZ, coordination with FAA headquarters is required before approval of this improved IAP can be granted. There are no obstructions to either of the threshold siting or vertical guidance approach surfaces.

Recommendation. Continue to include the improved visibility minimum IAPs as shown on the existing ALP. The cost to mitigate the incompatible land uses within the Runway 35 RPZ might outweigh the benefits gained, but preserving the airspace associated with the improved IAPs assures that future implementation is not impeded by obstructions created beyond PUB's boundary.

Taxiway/Taxilane Design Standards

As presented in the previous chapter, there are multiple occurrences of PUB's taxiway geometry and design standards not meeting current FAA guidelines. Each occurrence is reviewed below and a recommendation provided that corrects the deficiency. **Figure D9** illustrates the taxiway and taxilane deficiencies and potential corrective measures that will rectify the deficiencies.

A general recommendation for the entire PUB taxiway system is that as pavement conditions warrant reconstruction, design guidelines providing for "cockpit over centerline" and adequate Taxiway Edge Safety Margin (TESM) be used for appropriate fillet design at intersections.

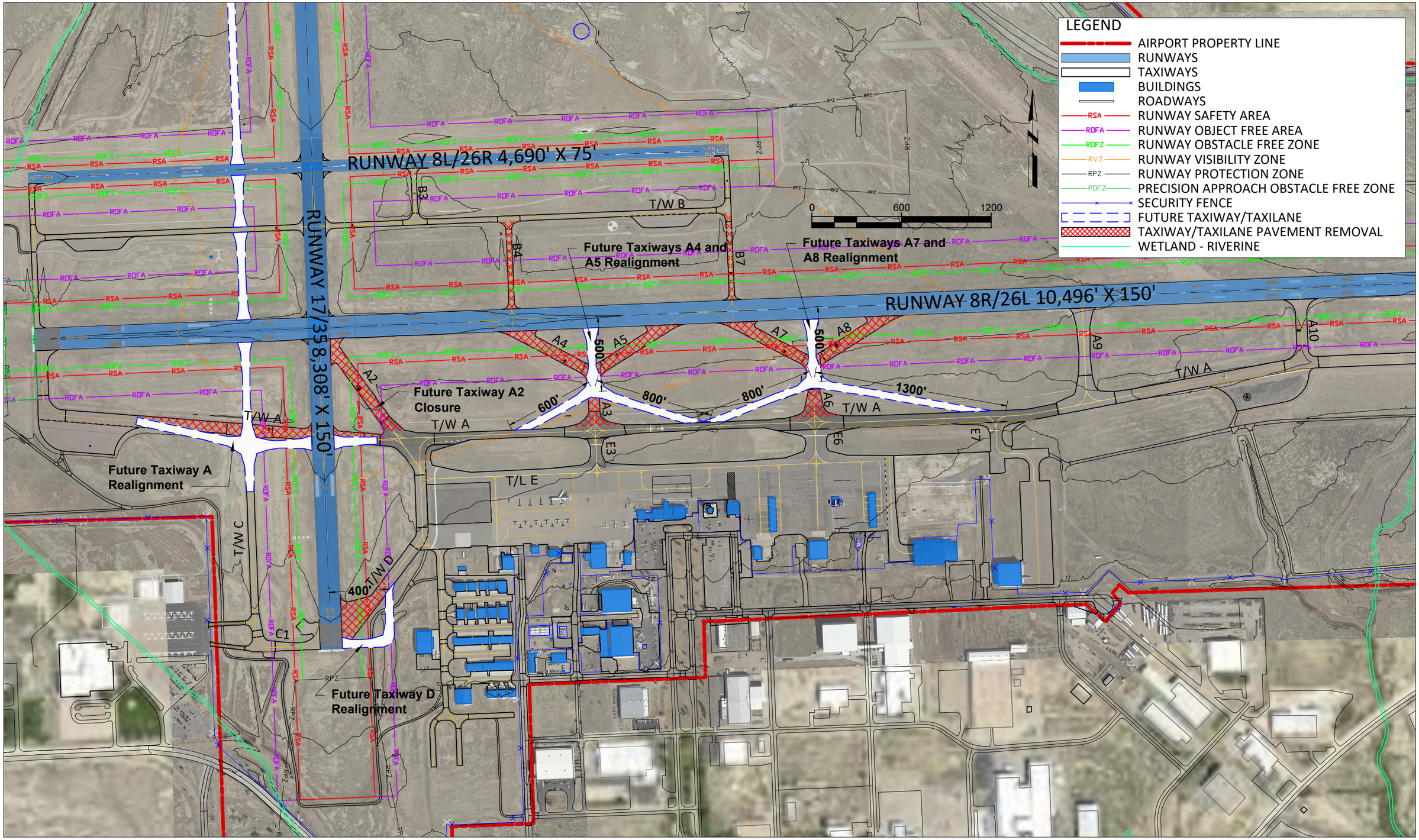

FIGURE D9 **Taxiway Standards Alternative Improvements**

Taxiway A

Taxiway A intersects Runway 17/35 at a non 90-degree angle, which does not optimize pilot visibility in both directions.

Recommendation. When pavement conditions warrant a reconstruction of the Taxiway A sections between Taxiways C and D, it is recommended to reconfigure the intersections with Runway 17/35 at 90 degrees.

Taxiway A2

Taxiway A2 violates multiple taxiway design standards and geometry, including non-90-degree runway intersections, allowing direct access from an apron to a runway environment without requiring a turn, and exceeding the maximum 1.5 percent longitudinal gradient. Because of its proximity to Runway 8R threshold, only small aircraft can decelerate in time to exit the runway environment when landing to the east. It does provide one of only three exit taxiways for aircraft landing to the south on Runway 17.

Recommendation. Because of the non-90-degree intersections, excessive grade, and limited use, it is recommended to remove Taxiway A2.

Taxiways A4, A5, A7, A8

Taxiways A4, A5, A7, and A8 intersect Runway 8R/26L at non 90-degree angles. As presented in the previous chapter, the added lengths of the "Y" shaped segments are needed to optimize the longitudinal gradient standard of 1.5 percent, although Taxiways A3, A6, A7, and A8 currently exceed this standard. As illustrated on **Figure D9**, the inverted "Y" alternative provides sufficient pavement length to intersect Runway 8R/26L at 90 degrees and remain within the maximum 1.5 percent longitudinal gradient between the runway pavement edge and the centerline of existing Taxiway A.

ATCT personnel indicate that Taxiways A4, A5, A7, and A8 are used as "high speed" exit taxiways allowing aircraft to exit Runway 8R/26L at faster-than-normal exiting speeds. This decreases runway occupancy times and improves airfield capacity even though the taxiways' geometric designs do not meet the standard geometry of true high speed exit taxiways as analyzed and presented earlier in this chapter.

Should the decision be made to not rectify the non 90-degree runway intersections, then PUB should request and be granted a Modification of Standards (MOS) from the FAA that allows the continued use of the non 90-degree standard geometric design of the existing taxiway intersections with Runway 8R/26L, as well as the continuation of the existing longitudinal gradients associated with Taxiways A3, A6, A7, and A8 exceeding the maximum 1.5 percent standard. The MOS should be noted on the ALP.

Recommendation. Retain the existing configuration of Taxiways A4, A5, A7 and A8. Request a MOS from the FAA that allows the continued use of the non 90-degree runway intersections and the longitudinal gradients exceeding the maximum 1.5 percent standard.

Taxiways A7 and B7

Because of the lack of optimized taxiway access to Runway 26R, aircraft can cross Runway 8R/26L at the Taxiways A7 and B7 intersection, which is within the "high energy" middle third of Runway 8R/26L. PUB staff report that this rarely occurs, but it does happen, and the existence of the intersection allows for the possibility of it occurring more frequently. If Taxiway C were extended to at least Taxiway B, then aircraft access to the Runway 26R threshold could be accomplished via Taxiways C, B, and B7.

Recommendation. Extend Taxiway C to Taxiway B and eliminate the Taxiway A7 and B7 intersection crossing of Runway 8R/26L.

Taxiways A3/E3 and A6/E6

Taxiways A3/E3 and A6/E6 provide direct taxiway access from the main apron to the Runway 8R/26L environment without making a turn (notwithstanding the 45-degree turns required of the "Y" shaped segments of Taxiways A4, A5, A7, and A8). If the high-speed exit taxiways alternative or the inverted "Y" shaped alternative rectifying the non 90-degree intersections of Taxiways A4, A5, A7, and A8 with Runway 8R/26L presented earlier are selected, then the direct runway access is alleviated. If not, then PUB has two options available:

- **A clarification from the FAA can be provided that the "Y" shaped segments of Taxiways A4, A5, A7, and A8 do constitute a turn and therefore the standard is met. The clarification might require PUB to request and be granted a MOS from the FAA. Either way, the clarification/MOS would be noted on the ALP.**
- **The second option would be to reconfigure the pavement islands separating Taxiway A and Taxilane E that would require a turn onto Taxiway A from the apron prior to accessing Taxiways A3 and A6.**

Recommendation. Request a clarification and MOS that the "Y" shaped segments of Taxiways A4, A5, A7, and A8 do constitute a turn and retain the existing taxiway configuration.

Taxiway A11

As presented in the previous chapter, PUB personnel report that Taxiway A11 is seldom used by aircraft for either aircraft entering or exiting Runway 8R/26L. The closure/removal of Taxiway A11 would slightly reduce overall pavement maintenance costs. However, PUB personnel also indicate this taxiway is used during snow events to pile snow from the surrounding pavements. The airfield capacity analysis indicates that Taxiway A11 provides no benefit as an exit taxiway that increases the ASV calculations, so its existence is of no overall value.

Recommendation. Retain Taxiway A11 for the rare use of aircraft departures and landings, but also as a storage area for snow during snow events and as a potential run-up area if needed.

Taxiway D

Taxiway D intersects the Runway 35 threshold at an approximate 40-degree angle, which does not optimize pilot visibility in both directions.

Recommendation. When pavement condition warrants a reconstruction of this section of Taxiway D, it is recommended to reconfigure the intersection with the Runway 35 threshold at 90 degrees.

Holding Bays

As presented in the previous chapter, PUB's existing holding bays are no longer the FAA's preferred design since the wide amount of pavement makes lighting and signage difficult for pilots to see clearly and easily. Current FAA preferred holding bay design includes clearly marked entrances and exits that allow independent usage of the parking positions separated by islands. This design allows aircraft to bypass one another and assure taxiway wingtip clearances. Since small training aircraft represent most users requiring holding bays, each parking position is designed to accommodate aircraft in Aircraft Reference Code (ARC) A-I, which translates to aircraft having wingspans less than 49 feet and a length 30 feet or less.

Recommendation. When pavement conditions warrant reconstruction, it is recommended that a minimum of three-position holding bays replace the existing holding bays at the west end of Taxiway A and at the west and east ends of Taxiway B. Additionally, a minimum of three-position holding bays are recommended at the west and east ends of the parallel taxiway serving the new training runway.

Landside Development Concepts, Alternatives, and Recommendations

With the framework of PUB's ultimate airside development identified, placement of needed landside facilities can now be analyzed. The overall objectives of the landside plan are the provisions of conceptual development locations for facilities that are conveniently located and accessible to the community, and that accommodate the specific requirements of PUB's users.

Passenger Terminal Facilities

The passenger terminal analysis process began with an observational review and assessment of the functionality and condition of the existing terminal building. The analysis took into consideration the current standard airport terminal building operational characteristics, building and safety codes, and the physical condition of the facility. As discussed in the previous chapter, the terminal at PUB has a dated appearance and is in need of interior and exterior updates.

Observations, Assessments, and Conclusions

The existing passenger terminal building's functionality, capacity, and operational issues were assessed in **Chapter C – Airport Capacity and Facility Requirements**. The following observations and conclusions were made and are summarized below.

- **Ticketing/Baggage Check-In, Checked Baggage Screening, Outbound Baggage Make-Up, Baggage Claim, and Office Space.** All these areas of the passenger terminal building have adequate space and function well. No improvements to these spaces are recommended.
- **Passenger Security Screening.** The security checkpoint is insufficiently sized for security screening operations and its configuration restricts the amount of baggage lay-down and pick-up space available, inhibiting flow-through. The existing checkpoint is approximately 1,255 square feet and should be 1,725 square feet based on industry standards and 2019 passenger enplanement levels. Additional space for Transportation Security Administration (TSA) security screening is necessary. However, any decisions to expand the area will be made in consultation with the TSA.
- **Secure Passenger Departure Lounge.** The existing secure departure lounge provides approximately 1,000 square feet of space. It is undersized to comfortably accommodate passengers for more than a short wait. There are also no restrooms, water, or concessions/vending machines beyond the security checkpoint. Additional space is required for the provision of restrooms and concessions to meet building codes for passenger waiting areas or improve the level of service provided to passengers.
- **Terminal Parking.** Existing passenger terminal parking is sufficient to meet demand, although resurfacing of the terminal parking area is needed.
- **Terminal Appearance.** The interior and exterior areas of the terminal should be updated to achieve a more modern aesthetic.

Passenger Terminal Building Expansion Concepts

The purpose of these concepts is to explore potential passenger terminal building expansion configurations that can be developed in a phased manner while minimizing the need for temporary facilities. The passenger terminal building concepts presented on the following pages delineate potential terminal footprint options for a future phased terminal expansion and renovation at PUB.

Short-Term Terminal Expansion Concept

This concept would increase the size of the existing security checkpoint and secure departure lounge space by expanding immediately west of the existing departure lounge. The concept also reconfigures the security screening checkpoint and eliminates the 90-degree turn that passengers currently make when proceeding through the checkpoint. Finally, this concept adds restrooms and vending machines or food delivery options to the secure area. This concept is illustrated in **Figure D10**.

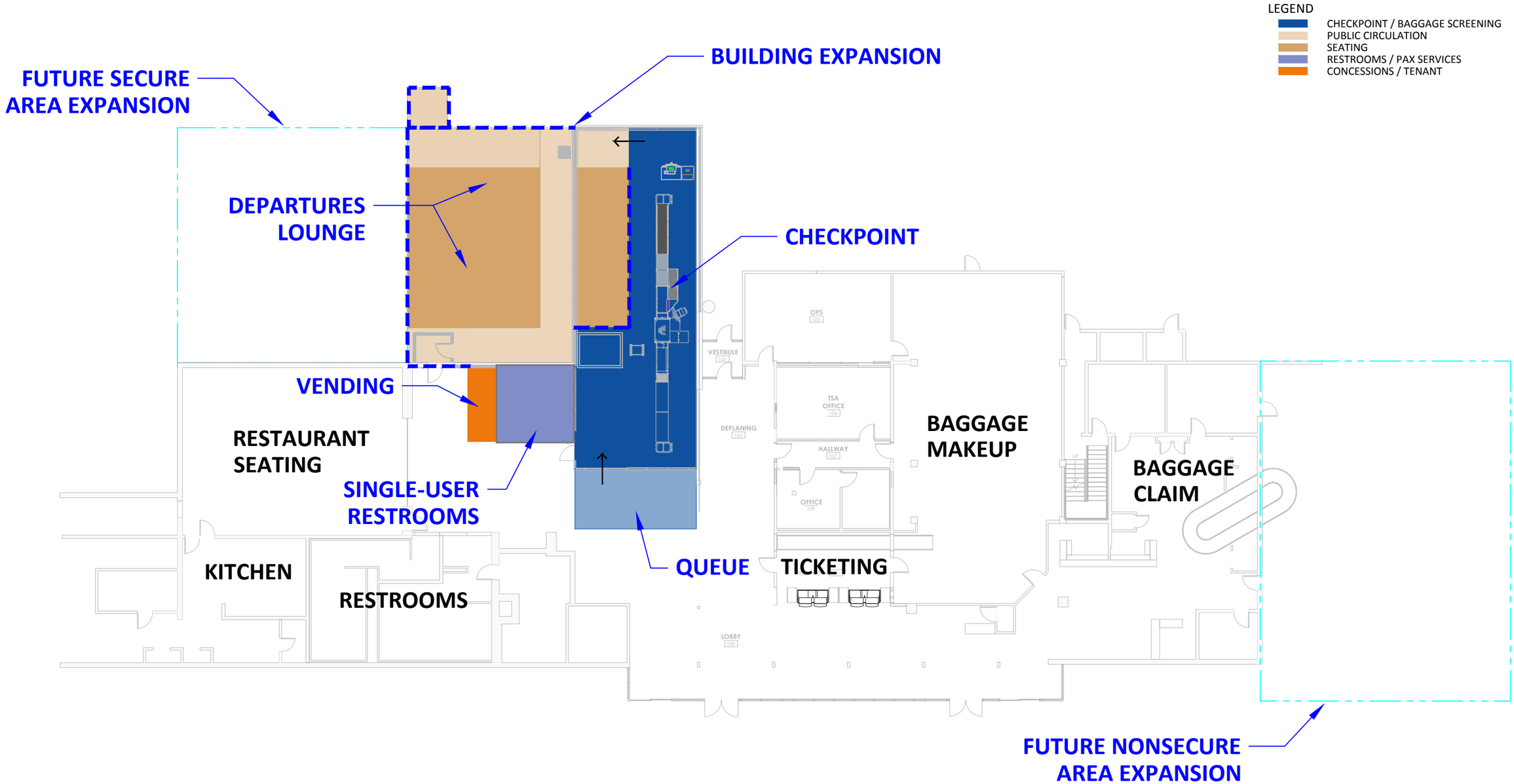

FIGURE D10 **Short-Term Terminal Expansion Concept**

Advantages:

- **Provides adequate space for security screening and the secure departure lounge.**
- **Provides for post security restrooms, meeting code requirements at PUB.**
- **Provides access to food and water beyond the security checkpoint.**
- **Realigns security screening to a linear layout in accordance with TSA checkpoint guidance.**
- **Plans for aesthetic terminal improvements.**
- **Provides adequate departure lounge area required for existing and planned commercial flights.**

Disadvantages:

- **Requires approximately 1,600 square feet of expansion to the passenger terminal building footprint.**
- **Departure lounge area would be slightly undersized to adequately accommodate narrow body aircraft used for typical casino charter flights.**
- **Does not address ADA access issues to the second floor or other physical upgrades needed throughout the original two-story portion of the passenger terminal building.**

Long-Term Terminal Expansion Concept

This concept would likely only be required if an additional airline like Allegiant Air were to reinitiate service at PUB. This concept further modifies the passenger terminal building by providing additional space to the west of the hold room that was expanded in the previous short-term concept. Additional space is also provided for a second security screening checkpoint lane that would be required if an additional airline served PUB and had overlapping flights during the peak hour.

This long-term concept also provides a reconfiguration of the restaurant seating area, the airlines ticketing and car rental counters and office space, and a terminal expansion to the east to provide an expanded baggage claim and baggage makeup areas. These major renovations and expansions of this concept are illustrated in **Figure D11**.

Advantages:

- **Provides adequate passenger terminal building space for an additional airline at PUB.**
- **Provides adequate passenger terminal building space for typical casino charter flights with narrow body aircraft.**
- **Reconfigures spaces in the passenger terminal building such as airline and car rental counters and office space, as well as baggage screening, makeup and baggage claim if determined to be necessary to accommodate future demand.**

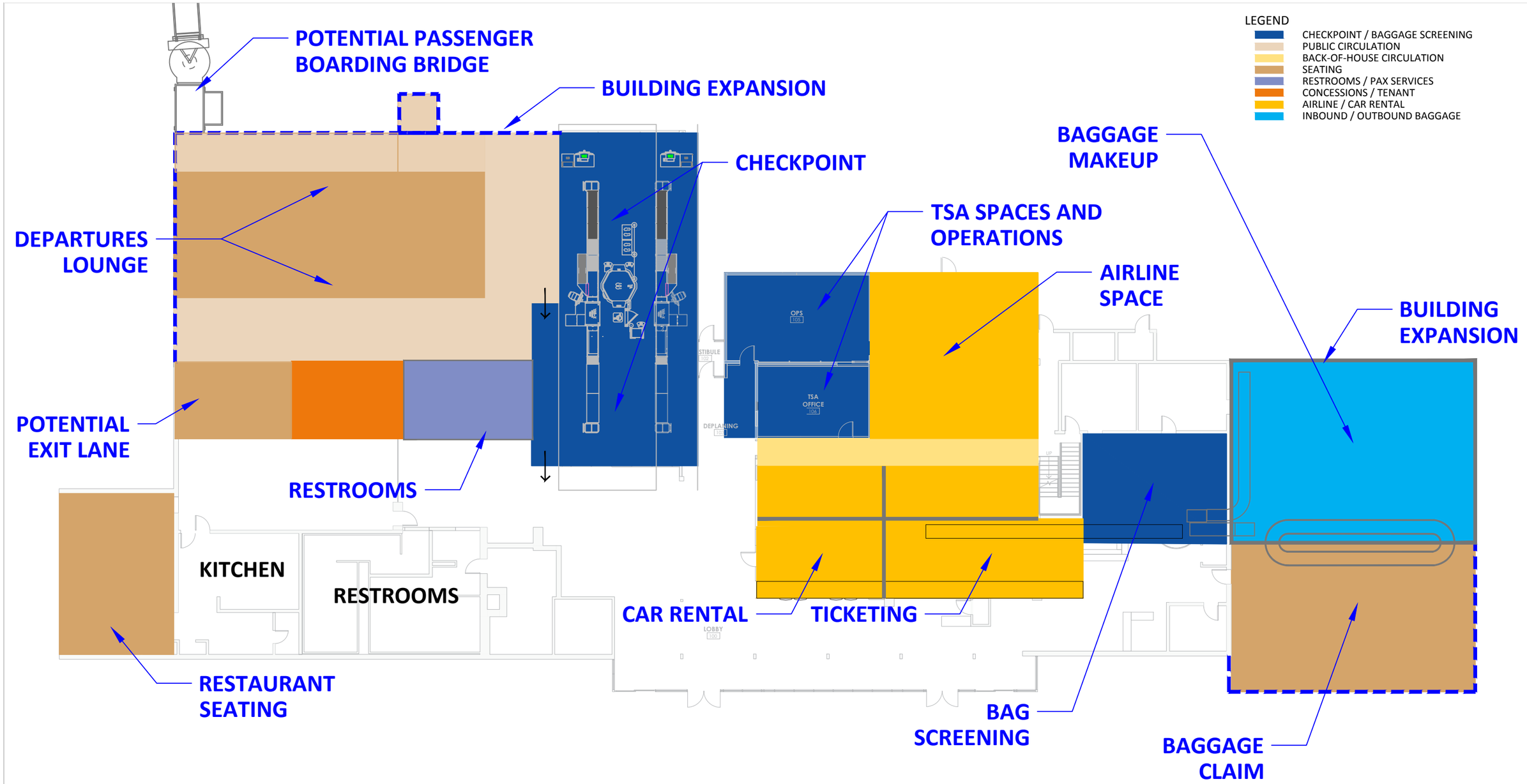

FIGURE D11 **Long-Term Terminal Expansion Concept**

Disadvantages:

- **Requires a significant increase in the square footage of the passenger terminal building footprint: 5,600 square feet in addition to the 1,600 square feet added in the short-term expansion concept.**
- **Construction would significantly impact current airline, TSA, and concession operations and would likely require phasing and/or temporary facilities to process passengers.**
- **Provides more space than necessary for one airline and should only be considered if demand from a second airline materializes.**

Recommendation. The existing passenger terminal building served PUB and the community well for several years. However, short-term improvements are needed to accommodate current demand and should be programmed in the short-term planning period. These improvements include additional hold room space and the provision of concessions and restrooms, additional security screening checkpoint space, and a resurfacing of the existing vehicle parking area.

Reservation of space for construction of the long-term concept should be illustrated on the Conceptual Development Plan and Airport Layout Plan (ALP) if demand from an additional airline or low-cost carrier like Allegiant Air materializes in the future.

General Aviation Facilities

General aviation (GA) is a very diverse category of aviation uses considering various aircraft sizes, aircraft technology and sophistication, mission of the organization operating the aircraft, and both airside and landside access requirements. It is usually defined as all activity that is not related to commercial passenger operations, large transport air cargo operations, or military operations. It includes private aviation related to recreational flying, flight training, business transportation and storage, corporate aviation related to employee transportation and aircraft storage, and Fixed Base Operators (FBOs) or Specialized Aviation Service Operators (SASOs) providing single or multiple aviation services generally consisting of aircraft maintenance, aircraft charter and rental, aircraft storage, fuel sales, and aircraft manufacturing and/or refurbishment.

The diverse aviation use categories mentioned above will impact the appropriateness of a given location for specific GA uses. However, as in most cases, any given site can accommodate a variety of GA uses. The recommendations provided here attempt to identify the best types of facilities for a specific developable site. Ultimately, PUB must evaluate specific development proposals and make land use determinations based on the proposed site use efficiencies, striving to maximize the utilization of the available property in the most efficient and effective manner (i.e., the highest and best use of each property parcel), and best business practices.

Figure D12 graphically illustrates the proposed layout of future GA development at PUB. The overall development scheme focuses on accommodating smaller aircraft types and therefore, smaller storage facilities west of the passenger terminal building area. Smaller aircraft in Airplane Design Groups (ADGs) I and II, with Taxiway Design Groups (TDGs) 1A, 1B, and 2 match this category. Facilities identified in this area consist primarily of nested T-hangars and individual aircraft box/executive hangars. Larger aircraft types and larger storage facilities are accommodated east of the passenger terminal building area. Larger aircraft in ADGs II and III and TDGs 2 and 3 match this category. Facilities identified for this area consist primarily of larger aircraft box/executive hangars, multiple aircraft storage hangars, and SASOs. The lingering effects of the COVID-19 pandemic have had a positive impact on GA activity at PUB. Allocating adequate space for increased based aircraft and transient GA hangars are needed to meet the increased demand.

Airport and Terminal Support Facilities

Airport and terminal support facilities provide those services and functions that are necessary for an airport to operate properly but are not part of the runway/taxiway system and are not related to the passenger terminal building, aircraft storage, or aircraft maintenance. Support facilities in need of consideration at PUB include the Airport Traffic Control Tower (ATCT), the Aircraft Rescue and Fire Fighting (ARFF) facility, and the Snow Removal Equipment (SRE) and airport maintenance facility.

ATCT

ATCT personnel report visibility and detection ability difficulties to the north end of Runway 17/35 from the existing tower cab. A taller tower located in the same general area or a new tower located northeast of the intersection of Runways 8R/26L and 17/35 would more than likely alleviate these issues. Any replacement of the existing tower would need to be conducted using FAA Order 6480.4B, *Airport Traffic Control Tower Siting Process* as well as coordinated through the Airport Facilities Terminal Integration Laboratory (AFTIL). It is beyond the scope of this Master Plan to provide a detailed ATCT siting analysis.

Aircraft Rescue and Fire Fighting Facility

The existing ARFF is sited to maximize emergency response times to airfield locations at PUB. However, its age warrants the planning and programming of a replacement facility, preferably in the same location. As presented in the previous chapter, two of three existing ARFF vehicles should be replaced due to their age and condition.

SRE and Airport Maintenance Facility

The existing SRE and airport maintenance facility is undersized to accommodate the recommended SRE and materials storage needs at PUB. Expansion, remodeling, or replacing the existing facility in the existing location is recommended.

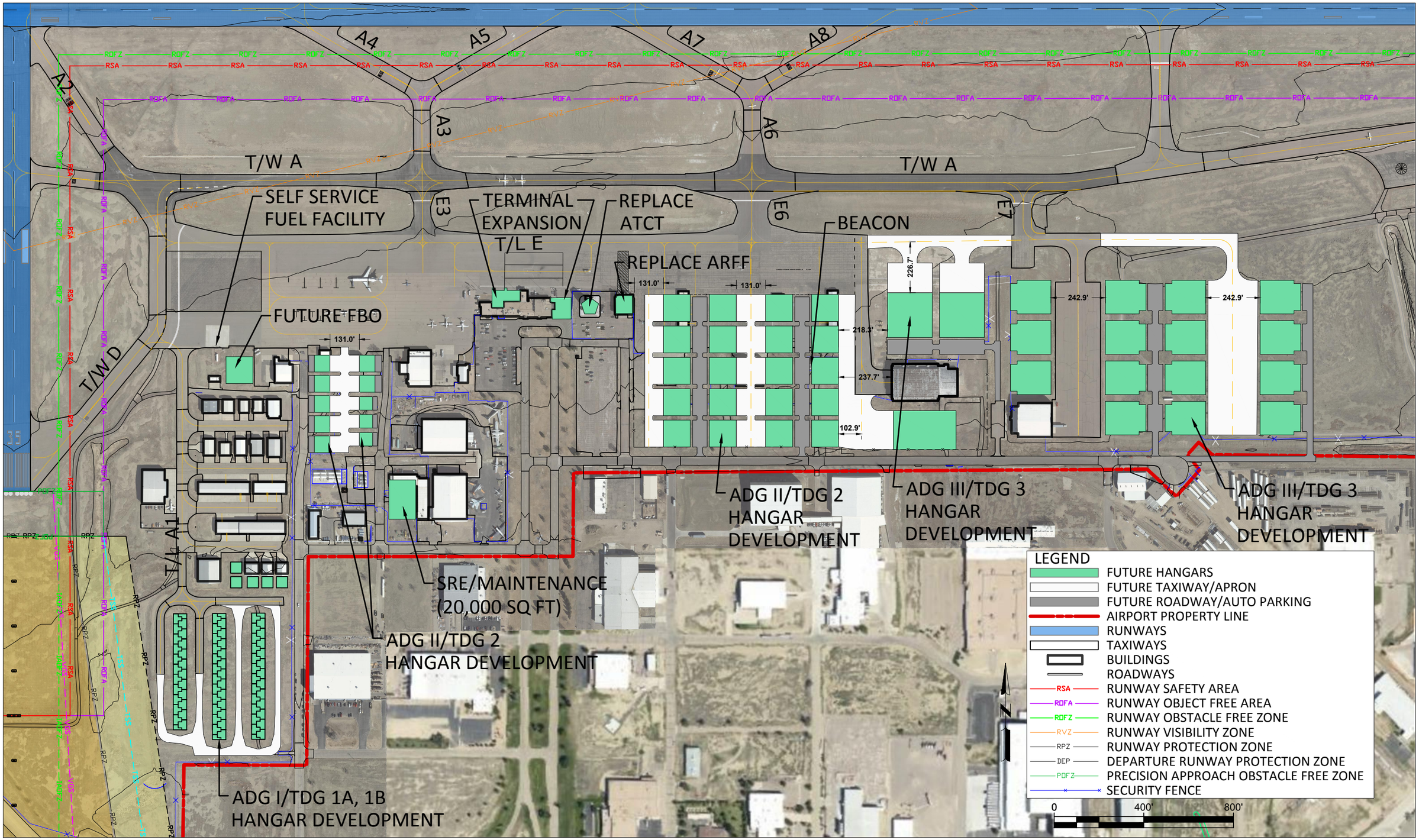

FIGURE D12 **General Aviation Development**

Conceptual Development Plan

Utilizing the recommended components of PUB's airside and landside development areas as presented in this chapter results in the Conceptual Development Plan presented in **Figure D13**. The plan presents PUB with a comprehensive development scheme accommodating a wide range of aviation user groups and operational activities. As with any airport planning decision, the ultimate build-out of the various aviation and aviation-compatible development areas will be demand driven, and the depicted development far exceeds that which is projected during the 20-year planning period. The Conceptual Development Plan will be used for the preparation of the ALP set representing the ultimate long-term airport configuration.

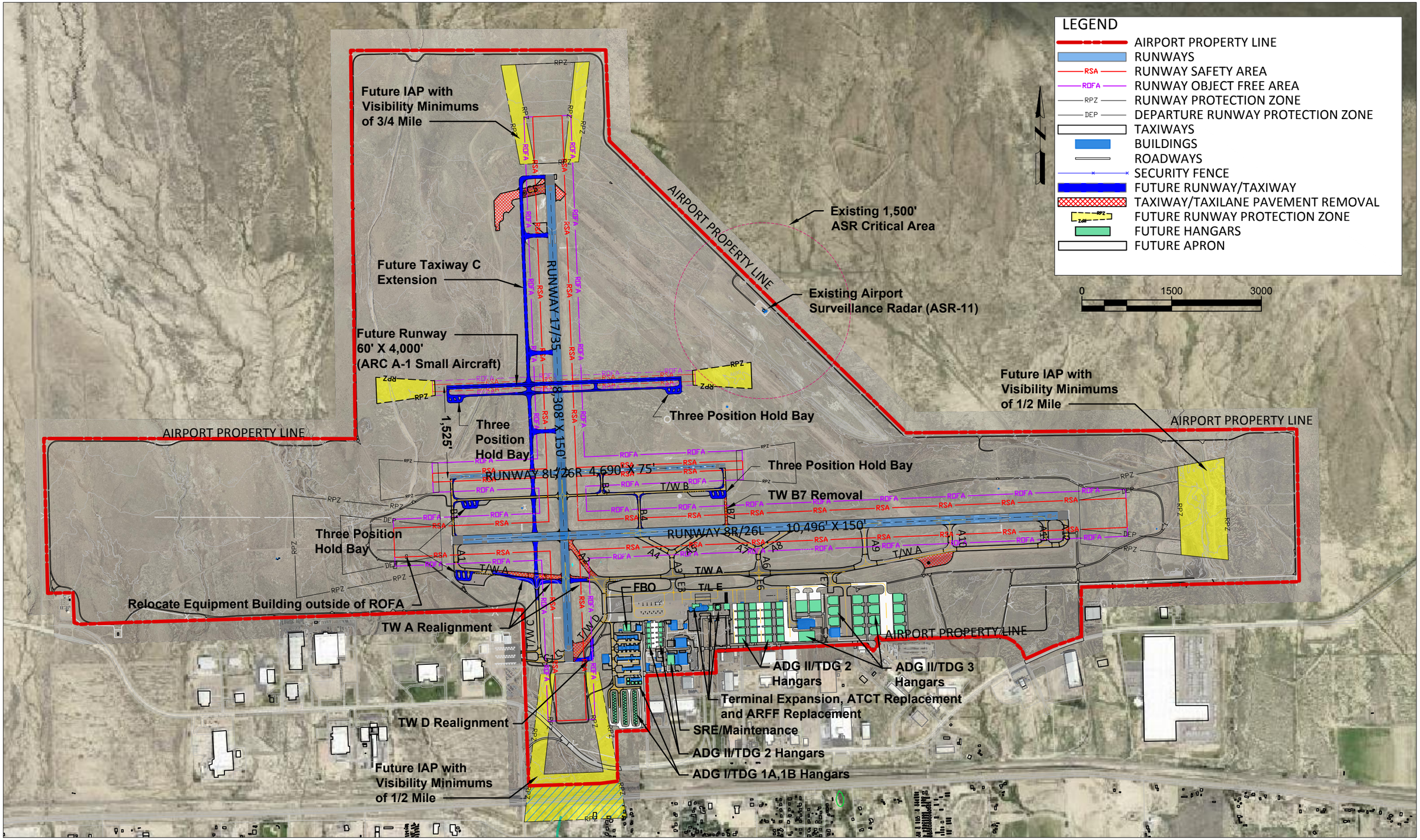

FIGURE D13 **Conceptual Development Plan**