5 ALTERNATIVES ANALYSIS/EVALUATION AND ENVIRONMENTAL CONDITIONS

5.1 Methodology for the Development and Screening of Alternatives

This chapter identifies and evaluates the airport development alternatives to determine the ultimate layout for ABIA to meet the 2037 demand as defined in Chapter 4, *Demand/Capacity and Facility Requirements*. The possible combinations of airport development can be endless, so application of intuitive judgement is required to identify those concepts with the greatest potential for achieving the Airport's long-term goals and objectives. As such, the most viable plan will provide the optimum combination of financial viability, ease of construction, and flexibility to adapt to the needs of the aviation industry throughout the 20-year planning period and beyond.

ABIA is in a unique position with respect to the amount of airport-owned land available for aviation development. The key to this ABIA Master Plan study is the ability to provide the necessary facilities in the proper locations to serve today's operations efficiently, while also preserving the space needed to accommodate anticipated aviation and airfield facility growth in the long-term.

All major functional areas at ABIA require consideration during this process, which includes airfield development, terminal area expansion, aeronautical support functions, and a supporting roadway network. Other considerations include the potential for future rail access, commercial development, and the impact of new technologies on future airport facility demand. Many of the key functional areas of the airport are interrelated and affect the development potential of the surrounding land, either within the current 20-year planning horizon or beyond.

5.2 Airfield Alternative Development and Screening

5.2.1 Airfield Alternatives

The two primary components of an airfield are the runways and taxiways, along with their safety areas. Airfield facilities are the focal point of any airport complex. The runway system requires the greatest commitment of land area and often has the greatest impact on development of alternatives and placement of other airport facilities. The physical characteristics of various airfield development options directly influence the nature of other system components, such as terminal and support facilities. These criteria can also have a significant impact on the viability of various alternatives designed to meet airfield needs. It is for these reasons that this study has looked at various runway alternatives, even though ABIA's need for additional runway capacity is not required until beyond the 20-year planning horizon.

Identification of the runway and taxiway system that optimally meet airfield capacity requirements is the primary goal of the airfield alternatives analysis. As a planning standard for this study, all proposed future runways will include as a minimum a single full-length parallel taxiway (dual-parallel where needed), and a Category III approach capability on both the north and south approach ends.

5.2.1.1 Future Runway Length Requirement

In addition to assessing the existing runways at ABIA as presented in Chapter 4, *Demand/Capacity and Facility Requirements,* a potential future runway was analyzed for takeoff length requirements. A sampling of domestic and international passenger aircraft, as well as cargo aircraft were used to determine a recommended runway length. Aircraft analyzed included:

- Boeing 737-700 (Domestic Passenger)
- Boeing 737-800 (Domestic Passenger)
- Boeing 737-900 (Domestic Passenger)
- Boeing 767-300F (Cargo)
- Boeing 777-300ER (International Passenger)
- Boeing 787-900 (International Passenger)
- Boeing 747-400 (Cargo)
- Boeing 747-8F (Cargo)

An initial analysis was conducted to determine initial runway length requirements based on each aircrafts Maximum Takeoff Weight (MTOW). Takeoff length requirements ranged from 5,800 feet (B-737-700) to 11,300 feet (B747-400) as presented in Chapter 4, *Demand/Capacity and Facility Requirements*. Runway 17R-35L serves as a long-haul runway, capable of serving larger cargo and domestic aircraft traveling to international destinations, while Runway 17L-35R serves more of the narrow-body domestic aircraft. A new third runway should be capable of serving the domestic market and as much of the international market as possible, while trying to minimize its overall footprint impact (on- and off-airport).

The top five aircraft requiring the most runway length at ABIA were assessed for range ability using 10,000, 11,000 and 12,000-foot long runways. The resulting ranges using maximum payload are found in **Table 5.2-1**.

Table 5.2-1: Aircraft Range (NM) Analysis at Maximum Payload

AIRCRAFT	RANGE (10,000' LENGTH)	RANGE (11,000' LENGTH)	RANGE (12,000' LENGTH)
Boeing 777-300ER	5,000	5,700	5,700
Boeing 787-9	4,900	5,100	5,250
Boeing 747-400	4,300	4,800	5,200
Boeing 747-8F	3,500	4,200	4,200
Boeing 737-900	2,000	2,000	2,000
Average Range	**3,940**	**4,360**	**4,470**

Sources: Aviation Forecast 2037 fleet mix and Landrum & Brown analysis.

The longest range achievable with maximum payload is the B777-300ER going 5,700 nautical miles (NM) and requiring an 11,000 or 12,000-foot long runway. The average range for the aircraft mentioned above ranged from roughly 3,940NM to 4,470NM. Existing Runway 17R-35L (12,250') is sufficient to accommodate the furthest destinations, while a 10,000-foot long runway can accommodate destinations between 2,000NM and 5,000NM for specific aircraft type.

5.2.1.1.1 Runway Length Analysis at 85 Percent Payload

A payload analysis was conducted in order to determine more realistic destination ranges from ABIA using an average payload factor of 85 percent. Chapter 3, *Aviation Activity Forecast,* indicated that the current average payload on aircraft taking-off from ABIA is roughly 83 percent and is expected to increase to 85 percent through the end of the 20-year planning period. Aircraft at 85 percent payload are capable of traveling farther on a 10,000-foot long runway than aircraft at maximum payload. These aircraft are sacrificing payload in order to add fuel to the aircraft to achieve a farther destination distance. The difference between an 85 percent payload and 100 percent payload range on a 10,000-foot long runway are depicted in **Table 5.2-2**. The travel range for aircraft at 85 percent payload is shown in **Exhibit 5.2-1**.

Aircraft at 85 percent payload can fly 400NM to 1,000NM farther from a 10,000-foot long runway versus taking-off at 100 percent payload. Based on the above analysis, it was determined that the minimum length for a third parallel runway at ABIA should be 10,000 feet.

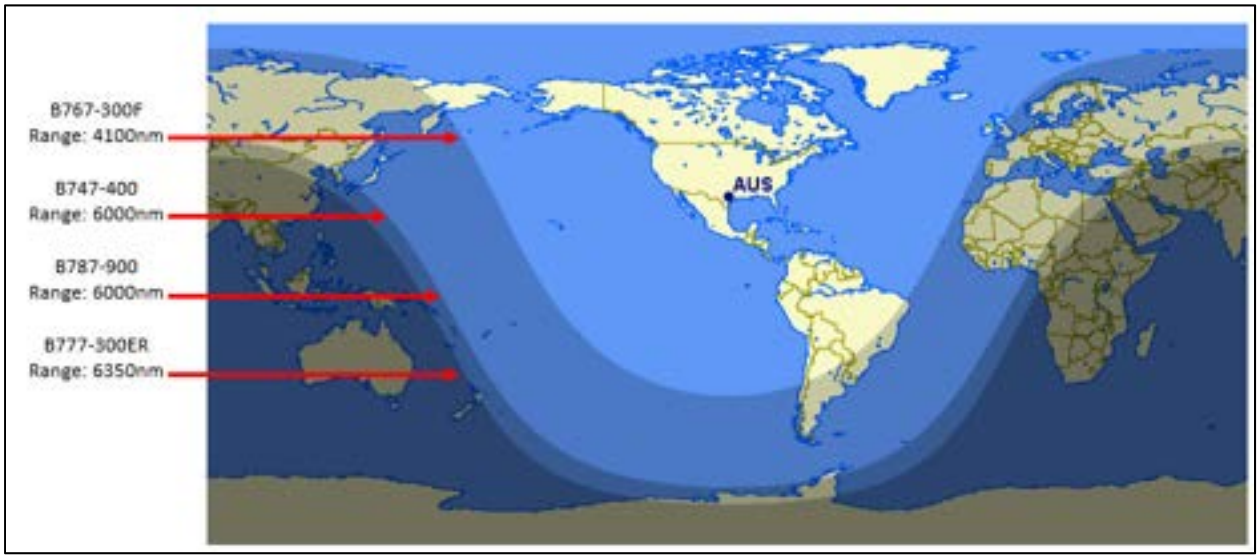
The FAA's Runway Exit Interactive Design Mode (REDIM) l was used to analyze the 2037 forecast fleet mix to determine the appropriate location for rapid exit taxiways (RETs) on the 10,000-foot long runway. The results of this analysis determined that two RETs at approximately 5,575 feet and 6,900 feet from the runway thresholds (north and south) will provide an average runway occupancy time (ROT) of approximately 49.5 seconds.

Table 5.2-2: Range Results From 10,000-Foot Runway with Different Payloads

AIRCRAFT	RUNWAY LENGTH [FT.]	RANGE - NM [100% PAYLOAD]	RANGE - NM [85% PAYLOAD]
Boeing 777-300ER	10,000	5,000	5,600
Boeing 787-9	10,000	4,900	5,700
Boeing 747-400	10,000	4,300	5,300
Boeing 747-8F	10,000	3,500	4,500
Boeing 737-900	10,000	2,000	2,400

Sources: Aviation Forecast 2037 fleet mix and Landrum & Brown analysis.

Exhibit 5.2-1: Aircraft Ranges at 85 Percent Payload (10,000' Runway)



Source: Landrum & Brown analysis

5.2.1.2 Runway Alternatives Analysis

While the need for additional runway capacity at ABIA is beyond the master plan timeframe, it is important to preserve a location for a third runway. This will also be important when looking at future terminal expansion alternatives and other support facility development. In addition, it is recommended that existing Runway 17L-35R be extended in the future (beyond 2037) to be comparable in length to existing Runway 17R-35L. This will help to balance the runway usage by long-haul international aircraft and cargo aircraft operations. The most likely runway extension would be on the 17L end due to the location of the international gates on the east side of the Barbara Jordan Terminal. Any extension of Runway 17L will require the relocation of SH 71 to the north.

There are a number of important criteria to consider when evaluating runway development alternatives. Two levels of evaluation and refinement were utilized in order to narrow down the runway alternatives to a short-list, and to select the preferred alternative based upon the runway capacity requirements and environmental impacts (on- and off-airport).

- **Level 1** consisted of the initial development of 14 runway alternatives, as well as a No-Action alternative. Three runway alternatives were selected to move forward to a more intensive screening and refinement process.
- **Level 2** consisted of the final screening and refinement process of the top three runway alternatives, in addition to the No-Action alternative. Level 2 screened out two of the three alternatives, with a remaining preferred alternative as the end result.

5.2.1.3 Level 1 Runway Alternatives Evaluation

As noted earlier, there is no immediate need for additional runway capacity; however, it was determined that this 2040 Master Plan study should look beyond the 20-year planning period and determine the location and geometry for the next runway(s) that will provide the maximum increase in Instrument Flight Rule (IFR) and Visual Flight Rule (VFR) airfield capacity to meet future demand.

- **Number of Runways**: An initial set of 14 runway alternatives and the No-Action was developed that showed various locations for a third, fourth, or even fifth parallel runway at ABIA. The total number of ultimate runways was dependent on where the next third runway would be located. Closely-spaced (1,200-foot separation) and widely-space (4,300-foot separation) runway layouts were developed and analyzed as shown in **Exhibit 5.2-2**. The 14 runway alternatives and No-Action (existing) are depicted in **Exhibit 5.2-3** through **Exhibit 5.2-7**. Specific characteristics of each runway alternative is listed in **Table 5.2-3**.

Exhibit 5.2-2: Runway Separation Layouts

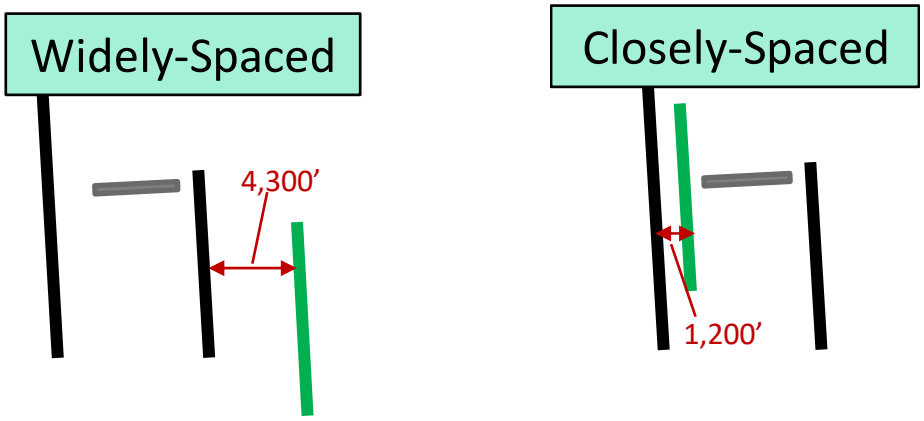
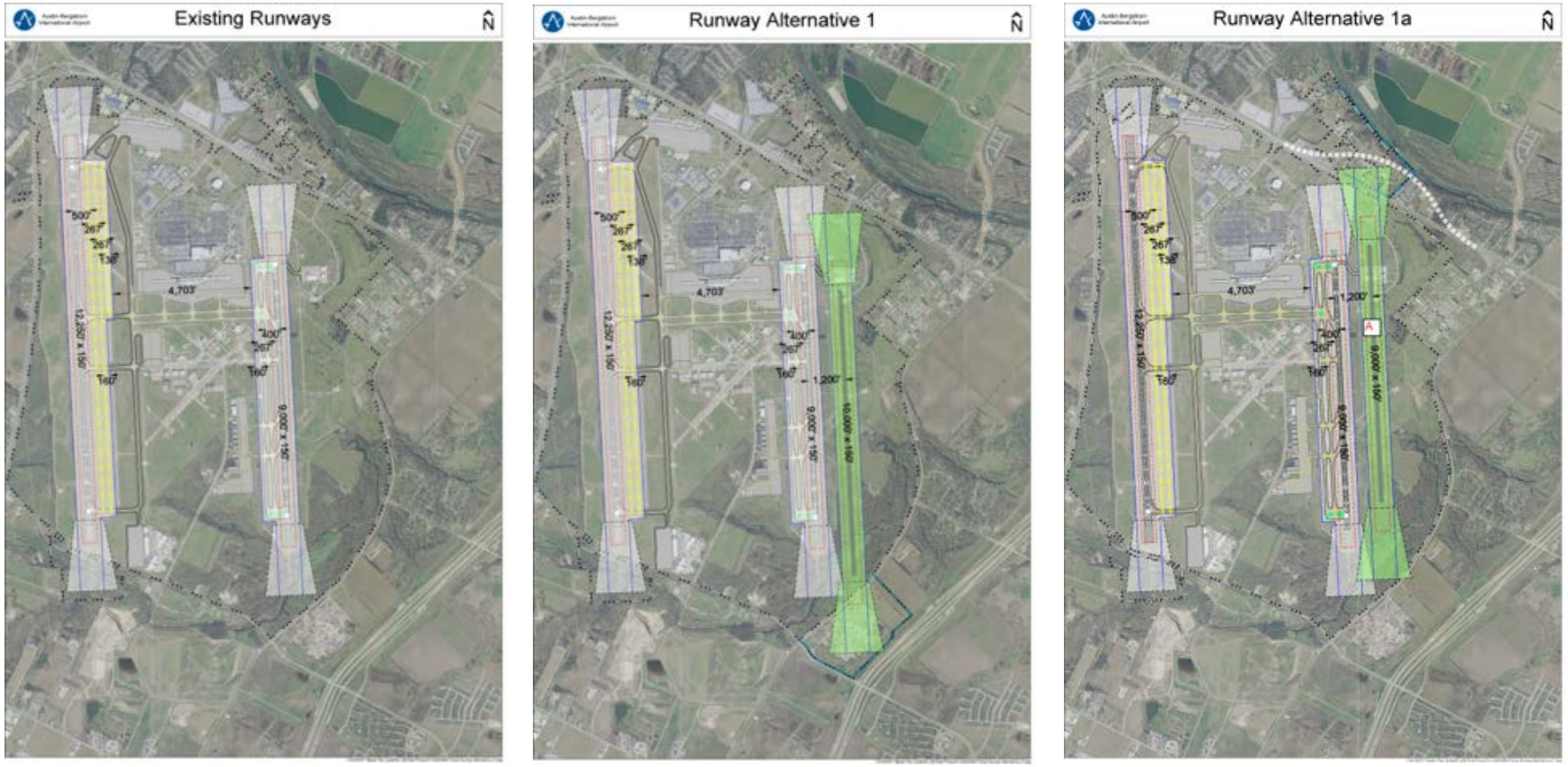
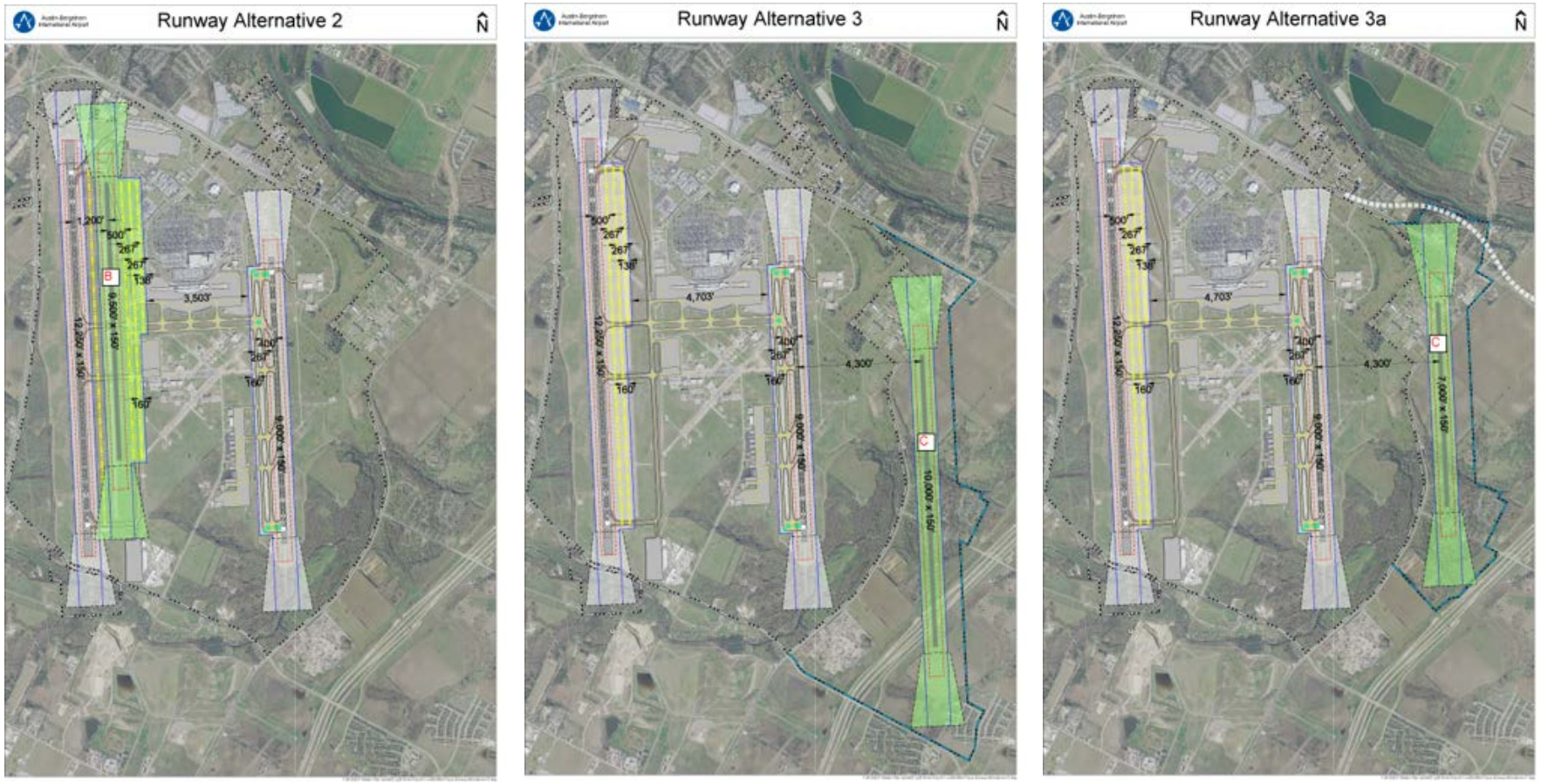


Exhibit 5.2-3: Existing and Runway Alternatives 1 and 1a



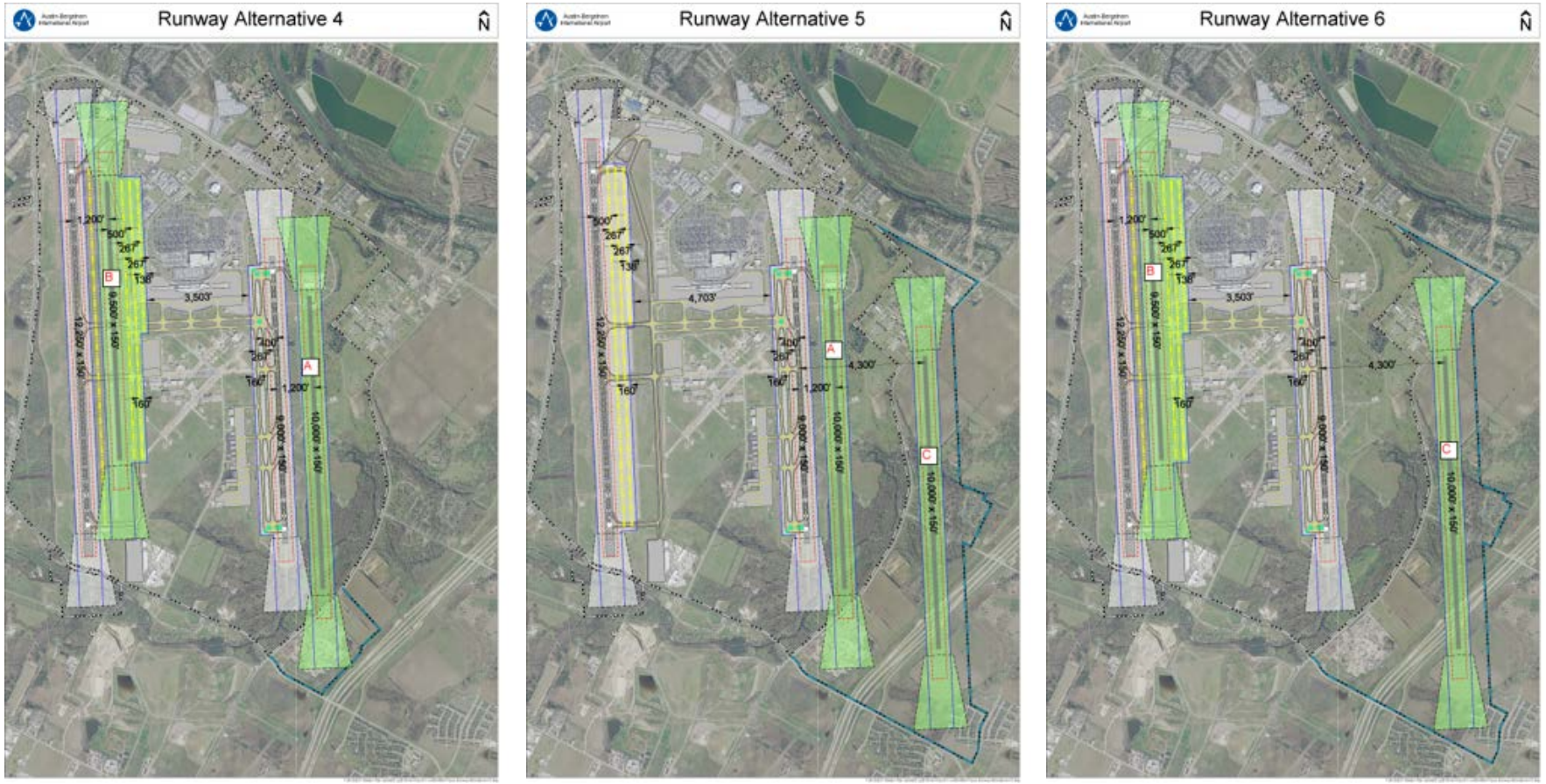
Source: Landrum & Brown analysis

Exhibit 5.2-4: Runway Alternatives 2, 3 and 3a



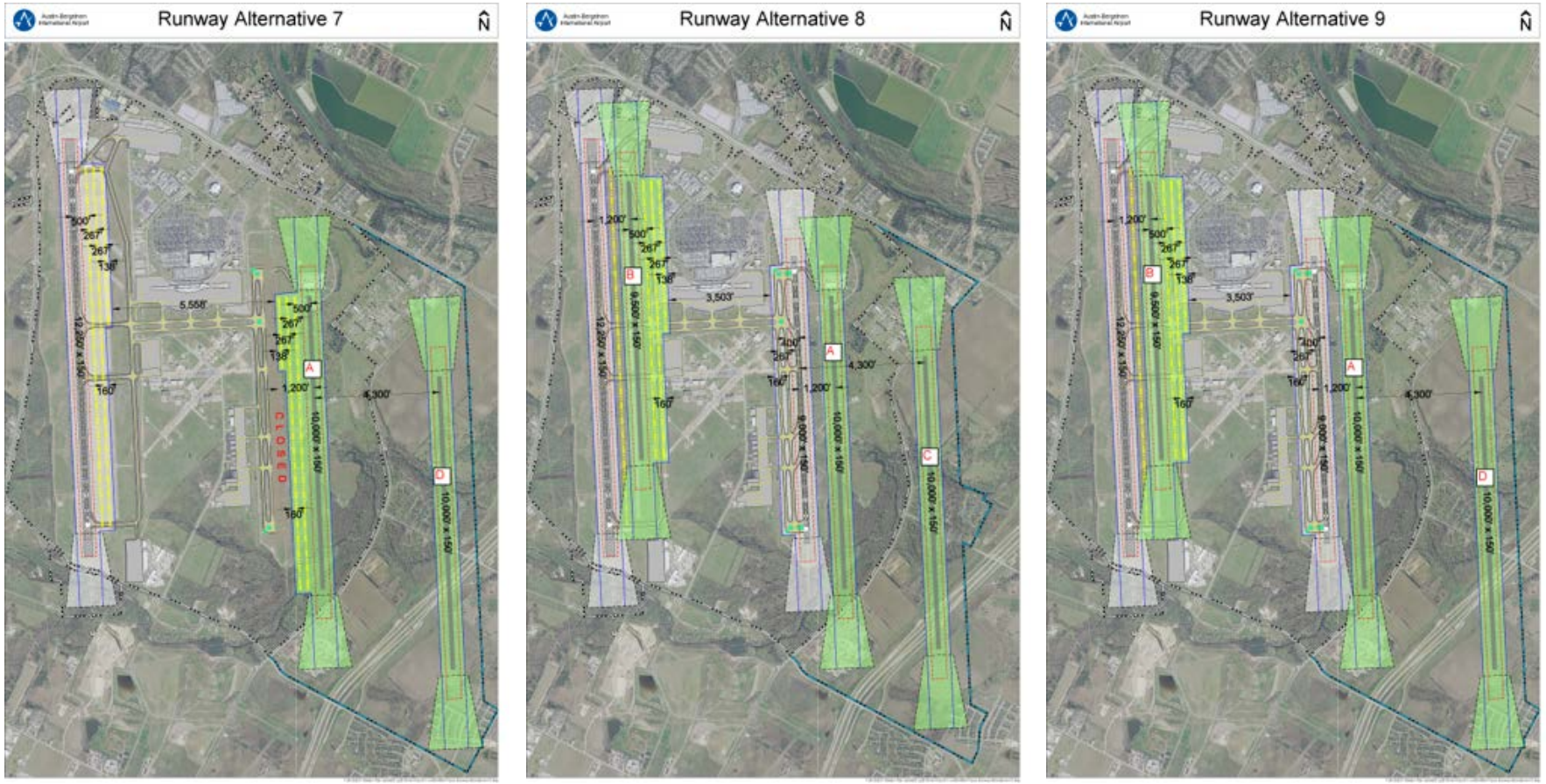
Source: Landrum & Brown analysis

Exhibit 5.2-5: Runway Alternatives 4, 5 and 6



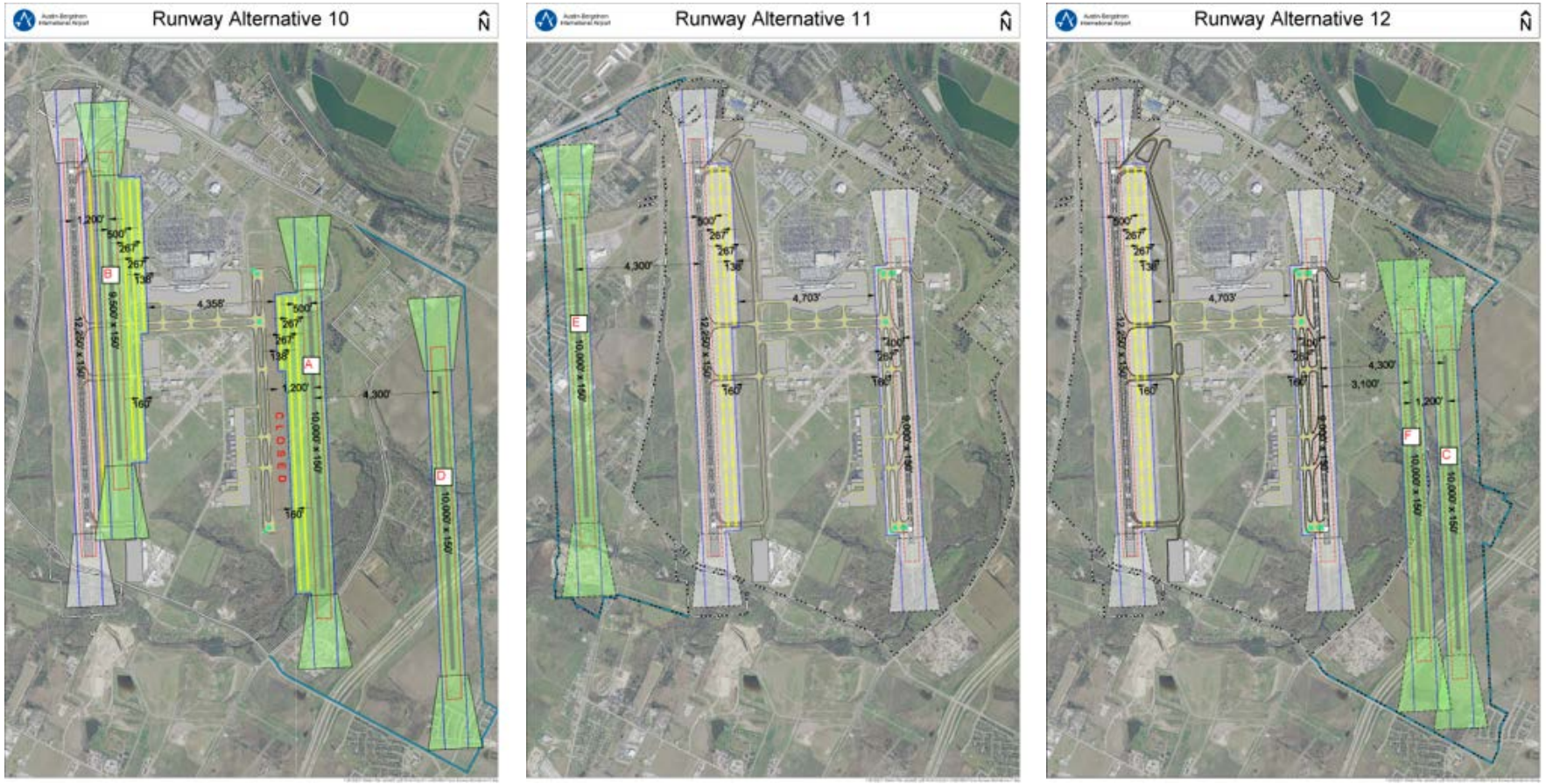
Source: Landrum & Brown analysis

Exhibit 5.2-6: Runway Alternatives 7, 8 and 9



Source: Landrum & Brown analysis

Exhibit 5.2-7: Runway Alternatives 10, 11 and 12



Source: Landrum & Brown analysis

Table 5.2-3: Runway Alternative Characteristics

RUNWAY ALTERNATIVE	#NO. OF NEW RUNWAYS	AIRPORT LOCATION	SEPARATION FROM RWY. 17R-35L [FT.]	SEPARATION FROM RWY. 17L-35R [FT.]	RUNWAY LENGTH [FT.]
1	1	East	-	1,200 (east)	10,000
1a	1	East	-	1,200 (east)	9,000
2	1	West	1,200 (east)	-	10,000
3	1	East	-	4,300 (east)	10,000
3a	1	East	-	4,300 (east)	7,000
4	2	East/West	1,200 (east)	1,200 (east0	10,000
5	2	East	-	1,200 & 4,300 (east)	10,000
6	2	East/West	1,200 (east)	4,300 (east)	10,000
7	2	East	-	1,200 & 5,500 (east) Close Rwy. 17L-35R	10,000
8	3	East/West	1,200 (east)	1,200 & 4,300 (east)	10,000
9	3	East/West	1,200 (east)	1,200 & 5,500 (east)	10,000
10	3	East/West	1,200 (east)	1,200 & 5,500 (east) Close Rwy. 17L-35R	10,000
11	1	West	4,300 (west)	-	10,000
12	2	East	-	3,100 & 4,300 (east)	10,000

Source: Landrum & Brown analysis

- **Runway Separation**: Lateral separation of the parallel runways in the 17-35 heading was considered. Some runways are widely-spaced (4,300') to provide for independent simultaneous Instrument Flight Rule (IFR) landing and takeoff operations, while some runways are closely-spaced (1,200') that will have dependent simultaneous IFR operations. Parallel runways that are widely-spaced can provide more peak hour landing and takeoff capacity than closely-spaced parallel runways.
- **Airfield Annual Capacity**: As noted in Chapter 4, *Demand/Capacity Facility Requirements,* the capacities were calculated for each of the runway operating configurations using the Airfield Capacity Estimation Spreadsheet Model and Airfield Capacity Model[1]. **Table 5.2-4** provides the annual peak hour airfield capacity for the existing runway configuration and proposed runway alternatives. In addition, an approximation of the total number of annual passengers is provided based on an average aircraft seating capacity of 125 passengers, which equates to an average load factor of 85 percent per operation. It has been estimated that the existing dual parallel runway configuration should be able to accommodate approximately 445,000 annual operations and accommodate approximately 40 million annual passengers. Based on the high scenario aviation forecast, the anticipated 2037 (20 year) demand at ABIA will be approximately 427,000 annual operations and 31 million annual passengers.
- **Evaluation Criteria**: The Level 1 evaluation criteria as shown in **Table 5.2-5** was used to screen the initial set of 14 runway alternatives down to a short-list of three alternatives. A simple scoring of Positive (+1), Neutral (0) and Negative (-1) were given to reach runway alternative for each of the evaluation criteria.

[1] ACRP Report 79, Evaluating Airfield Capacity.

Table 5.2-4: Runway Alternatives Peak Hour Capacity

RUNWAY ALTERNATIVES	PEAK HOUR ARRIVALS		PEAK HOUR DEPARTURES		BALANCED		TOTAL AIR TRAFFIC MOVEMENTS	MILLION ANNUAL PASSENGERS
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES		
Existing	66	28	30	70	58	58	445,000	40.0
Alternatives 1 / 1a	73	38	35	78	65	68	511,000	46.0
Alternative 2	74	40	36	80	66	70	522,000	46.9
Alternatives 3 / 3a	106	30	30	110	90	90	691,000	62.1
Alternative 4	81	76	36	110	72	80	584,000	52.5
Alternative 5	112	40	36	120	96	100	805,000	72.3
Alternative 6	112	40	36	120	96	100	805,000	72.3
Alternative 7	106	30	30	110	90	90	740,000	66.5
Alternative 8	110	80	72	120	102	110	870,000	78.2
Alternative 9	110	80	72	120	102	110	870,000	78.2
Alternative 10	112	40	36	120	96	100	805,000	72.3
Alternative 11	106	30	30	110	90	90	740,000	66.5
Alternative 12	112	40	36	120	96	100	753,000	67.7

Notes: Balanced refers to equal use of runway ends for arrival and departure operations
Source: Landrum & Brown analysis

Table 5.2-5: Future Runway Alternatives Evaluation Criteria

EVALUATION CRITERIA	DESCRIPTION
Runway centerline separation	Separation from adjacent parallel runway to provide independent or dependent simultaneous IFR operations (takeoff and landings). Provides added flexibility in runway use to meet future demand.
Runway length	Minimum length of 10,000 feet for maximum aircraft landing and takeoff weights for domestic and international destinations. Also used in the event another runway is closed for maintenance or emergency.
Peak hour balanced operations (takeoff and landing)	Total number takeoff and landing operations during the peak periods.
Annual total movements (ATMs)	Total number of annual total movements with an average of less than 10 minutes of delay per aircraft.
Million annual passengers (MAP)	Total number of annual passengers the airfield can potentially deliver (estimate).
Land acquisition	Minimum land acquisition for the runway, parallel taxiway, safety areas, and runway protection zone area.
Environmental impacts	Impacts that require major environmental mitigation (land fill, Onion Creek, noise, community impacts, etc.).
Off-airport roadway impacts	Impact on the surrounding roadways that might require relocation, depressing or tunneling.
Off-airport land development impacts	Impact on the surrounding existing and proposed land development.
Potential terminal development	Distance between the parallel runway for future terminal, concourses and aircraft gate development.
Constructability/Phasing	Ease of construction phasing with minimal impact on existing and future airport facilities, and the ability to add capacity in a timely manner. Life-cycle impact on existing facilities.
Development costs	Order-of-magnitude costs associated with land acquisition and major environmental mitigation.

Source: Landrum & Brown analysis

5.2.1.3.1 Level 1 Runway Alternatives Evaluation Results

A summary of the on and off-airport impacts is shown in **Table 5.2-6**, and the overall scoring is provided in **Table 5.2-7** for the Level 1 evaluation. A simple scoring of Positive (+1), Neutral (0) and Negative (-1) were given to reach runway alternative for each of the evaluation criteria. Runway Alternatives 1, 2 and 4 scored the highest based on the Level 1 evaluation process. Each of these alternatives can accommodate a 10,000-foot long runway. Details of the three short-list runway alternatives is provided below and will be carried forward into the Level 2 evaluation process.

- **Runway Alternative 1**: This runway alternative as shown in Exhibit 5.2-3, has the second highest score of seven (7) points. It provides a 10,000-foot long runway located 1,200 feet east of existing Runway 17L-35R. While Alternative 1 will provide the same annual runway capacity as Alternative 2, it is located on top of the east landfill area and Onion Creek. Environmental mitigation of these two areas will be very costly and time consuming. There will be minimal land acquisition (155 acres) required to the southeast. This alternative will also require a tunnel or relocation of FM 973 and will require the proposed new Consolidated Airport Maintenance and Police facilities to be relocated elsewhere. Alternative 1 will move forward into the Level 2 evaluation process.
- **Runway Alternative 2**: This runway alternative as shown in Exhibit 5.2-4, scored the highest with nine (9) points. It provides a 10,000-foot long runway located 1,200 feet east of existing Runway 17R-35L. Alternative 2 provides additional future runway capacity with the least amount of on- and off-airport impacts. It will require relocation of various west support facilities (fuel farm, belly freight, GSEM, and rental car storage lots). It will also limit the Barbara Jordan Terminal (BJT) expansion to the west and require any additional contact aircraft gates to the south of BJT. The southern runway threshold will require relocation of various facilities at the Austin Army Aviation Support Facility (AASF) such as ramp area and hangars. The Alternative 2 physical runway will be located completely within the existing airport boundary; however, it will require acquisition of The Parking Spot that will be within the 17C Runway Protection Zone area. In addition, the existing aircraft noise footprint should only slightly increase due to the new runway geometry. The noise contour for the preferred airfield layout is presented in Chapter 10, *Airport Layout Plan Drawings*. Alternative 2 will move forward into the Level 2 evaluation process.
- **Runway Alternative 4**: This runway alternative as shown in Exhibit 5.2-5 had the third highest score of five (5) points. Alternative 4 is a combination of the Alternatives 1 and 2 runways. This represents the maximum capacity that the airport can accomplish within the existing airport boundary.

These three short-listed runway alternatives will move into the Level 2 evaluation process in the next section.

Table 5.2-6: Runway Alternatives Level 1 Impact Areas

ON / OFF-AIRPORT IMPACTS	RUNWAY ALTERNATIVES													
	1	1A	2	3	3A	4	5	6	7	8	9	10	11	12
Land Acquisition	X	X	X			X	X		X	X	X	X	X	X
Relocate/Tunnel FM 973	X	X												
Relocate SH 71					X									
Relocate The Parking Spot			X			X		X		X	X			
Relocate Cargo & Support Facilities			X			X		X		X	X			
Relocate/ Tunnel TX 130 Tollway				X			X	X	X	X	X	X		X
Relocate Travis County Correctional Complex				X	X		X	X	X	X	X	X		X
Taxiway Bridges Over SH 183													X	
Hazardous Waste Site Clean-up	X	X				X	X		X	X	X	X		
Onion Creek/Wetland Impacts	X	X		X	X	X	X	X	X	X	X	X		X
Additional Noise Impacts			X	X	X		X	X	X	X	X	X	X	X

Source: Landrum & Brown analysis

Table 5.2-7: Runway Alternatives Level 1 Evaluation Summary

EVALUATION CRITERIA	RUNWAY ALTERNATIVES													
	1	1A	2	3	3A	4	5	6	7	8	9	10	11	12
Million Annual Passengers	46.0	46.0	46.9	62.1	62.1	52.5	72.3	72.3	66.5	78.2	78.2	72.3	66.5	67.7
ATMs (000's)	511	511	522	691	691	584	805	805	740	870	870	805	740	753
Runway Centerline Separation	●	●	●	✚	✚	●	✚	✚	✚	✚	✚	✚	✚	✚
Runway Length	✚	✚	✚	✚	▬	✚	✚	✚	✚	✚	✚	✚	✚	✚
Peak Hour Balanced Operations	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚
Annual Total Movements	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚
Million Annual Passengers	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚	✚
Land Acquisition	✚	✚	✚	●	●	✚	●	●	▬	●	▬	▬	▬	●
Environmental Impacts	●	●	✚	●	●	●	●	●	●	●	●	●	●	●
Off-Airport roadway Impacts	●	▬	✚	▬	▬	●	▬	▬	▬	▬	▬	▬	●	▬
Off-Airport Land Development Impacts	✚	✚	✚	▬	▬	✚	▬	▬	▬	▬	▬	▬	▬	▬
Potential Terminal Development	✚	✚	▬	✚	✚	▬	✚	▬	▬	▬	▬	▬	✚	✚
Constructability / Phasing	●	●	✚	●	●	●	●	▬	▬	▬	▬	▬	▬	●
Development Costs	●	●	✚	●	●	●	●	▬	▬	▬	▬	▬	▬	●
TOTAL SCORE	**7**	**4**	**9**	**4**	**2**	**5**	**4**	**0**	**1**	**0**	**-1**	**-1**	**2**	**4**

Source: Landrum & Brown analysis

5.2.1.4 Level 2 Runway Alternatives Evaluation

The Level 2 evaluation process looked at the three short-listed runway alternative layouts (1, 2 and 4) from an environmental impact perspective (both on-airport and off-airport).

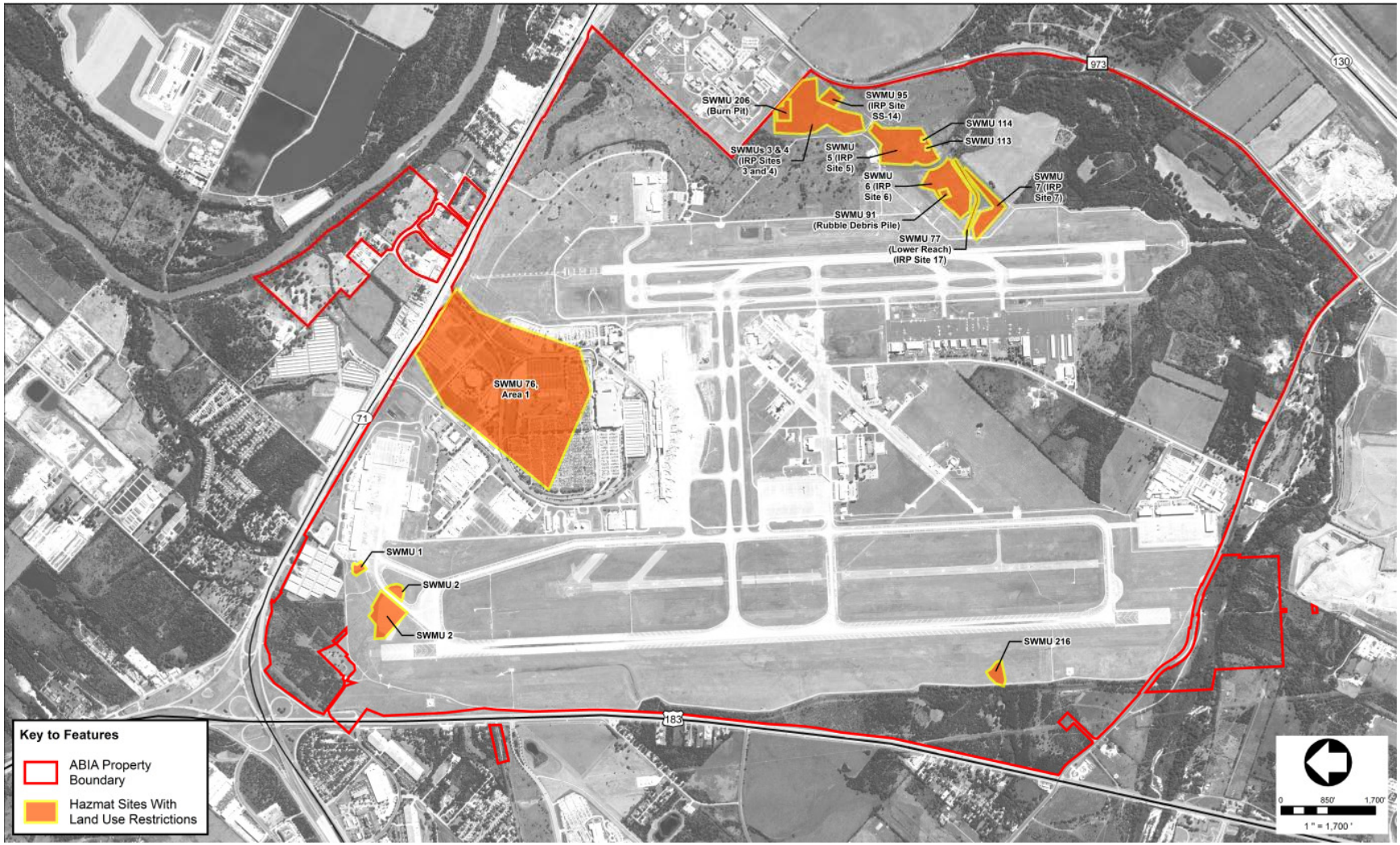
5.2.1.4.1 Environmental Evaluation

This section describes the potential impacts related to hazardous materials associated with the short-list runway alternatives. The potential impacts described herein are approximated based on the best available data at the time this assessment was conducted and are intended to serve as a means of comparison of the runway alternatives at a master planning level. The potential impacts of short-list Runway Alternatives 1, 2, and 4 as they relate to hazardous materials are described based on the potential of the alternatives to conflict with previously documented hazardous materials sites with current land use restrictions. Preliminary estimates of the potential costs associated with the construction of each of these runway alternatives are included for planning-level comparison purposes only.

All of the hazardous materials sites that would potentially be impacted by the short-list runway alternatives fall within the southeastern portion of the ABIA property as shown on **Exhibit 5.2-8**. This area is a combination of previously identified hazardous materials sites, including Solid Waste Management Units (SWMU 3–7), a road oiling area (SWMU 95), the south fork drainage ditch (SWMU 77), rubble debris piles (SWMU 91), and an old ammunition burn pit (SWMU 206). For the purposes of this assessment, these sites are collectively referred to as the combined southeast landfill area. Two additional sites, SWMUs 1 and 2, are located immediately northeast of the existing west Runway 17R-35L and are located within the area of the Alternative 2 runway; however, these sites do not have land use restrictions that would be anticipated to require remediation costs. As shown in **Table 5.2-8**, only runways in Alternatives 1 and 4 occur within areas of previously identified hazardous materials sites with current land use restrictions.

SWMU 5 and the two asphalt storage areas within its cover system boundaries (SWMUs 113 and 114) lie in close proximity to, but outside the footprint of the Alternative 1 and 4 runways. These hazardous materials sites are not included in this assessment; however, if impacts to these areas were to occur, the area requiring landfill removal and remediation would increase by approximately 14.6 acres for Alternatives 1 and 4.

Exhibit 5.2-8: Hazardous Materials with Current Land Use Restrictions



Source: HydroGeoLogic, Inc., 2010; Aerial Photography; NAIP, 2016.

Table 5.2-8: Potentially Affected Hazardous Materials Sites with Land Use Restrictions

SWMU SITE	DESCRIPTION	AREA WITHIN RUNWAY FOOTPRINT [ACRES][2]	ENTIRE SITE FOOTPRINT [ACRES][3]
RUNWAY ALTERNATIVES 1 and 4			
SWMU 6	• Primarily received domestic solid waste and construction debris. • Industrial (hazardous) waste also disposed of at these sites. • Seven drums of dichlorodiphenyltrichloroethane (DDT) were discovered in the early 1970s, one of which had leaked. • Trenches have been reported to be 30 feet deep.* (FPM Remediations, Inc. 2017)	10.71	11.78
SWMU 7	• Primarily received domestic solid waste and construction debris. • Industrial (hazardous) waste also disposed of at these sites. • Depth of site not known.* (FPM Remediations, Inc. 2017)	2.57	6.03
SWMU 77	• South fork drainage ditch. • Waste materials, primarily fuels and oils, flowed in the ditch and soaked into the ground along the ditch and/or evaporated. • The sediment and soil were classified as Class II non-hazardous waste. • Although this site falls within the combined southeast landfill area, no waste material is present following remediation. • Depth of site not known.* (HydroGeoLogic 2011)	N/A	N/A
SWMU 91	• Construction rubble debris piles. • Up to eight individual debris piles of soil mixed with concrete, asphalt, and other materials consistent with building demolition. • No information available regarding the operational history of this site. • Depth of site not known.* (HydroGeoLogic 2011)	0.54	0.54
	Total – Runway Alternative 1	**13.82**	**18.35**

Notes: *Site depth information provided where available based on previous studies; however, inconsistencies in estimated site depths have been report. See below for further information.
SWMUs within the Runway Protection Zones (RPZs) are not included based on the assumption that no construction activities would take place in these areas.
Impacted areas would potentially be larger for each development alternative. Final layouts of the supporting taxiways and navigational aid facilities have not been determined at this stage of analysis.

[2] See Exhibit 5.2-3 and 5.2-5 for locations of runway alternatives.
[3] See Exhibit 5.2-8 for locations of hazardous materials with land use restrictions on ABIA property.

5.2.1.4.2 Current Status of Hazardous Materials Sites

The exact depths and volumes of the hazardous materials sites located in the combined southeast landfill area have not been confirmed to date. Site characterizations carried out in 1995 by OHM Remediation Services Corporation provided lateral dimensions using shallow electromagnetic terrain conductivity as well as details on landfill cover depths using test pits. However, determining the exact depths and volumes of the landfills presented a challenge when using standard ground penetrating radar due to the presence of clay with high electromagnetic conductivity. Standard terrain conductivity equipment was more effective but did not provide exact depth details; instead, this method detected the presence or absence of waste at specific depths (25, 30, and 50 feet). Deeper electromagnetic terrain conductivity tests indicated that the buried waste does not exceed 25 feet in depth at any of the combined southeast landfills.[4] To date, no further site characterization studies have been conducted that provide detailed depths or allow for calculations of the volumes for these hazardous materials sites.

No further remedial actions are required for the combined southeast landfill area. The previously conducted remedial actions for the combined southeast landfill area included the following:

- The construction of landfill cover systems (Resource Conservation and Recovery Act composite cap)
- Improvements to the drainage channels
- Toe drain systems
- Passive gas control
- Erosion control measures
- Fencing off the entire area in order to limit access

The cover systems for SWMUs 3 and 4 were combined and installed as a single cover, in addition to SWMUs 95 and 206, whereas, the cover systems for SWMUs 6 and 7 were constructed separately.[5]

Deed restrictive covenants include prohibiting surface or subsurface soil and well installation activities that may compromise the landfill caps, prohibiting the extraction and use of onsite groundwater, prohibiting residential land use, and ensuring that controlled access is maintained. Post-closure care, including groundwater monitoring, and institutional control measures (deed restrictive covenants) are ongoing.[6]

4 OHM Remediation Services Corporation, 1995.
5 FPM Remediations, Inc., 2017.
6 HydroGeoLogic, 2011.

5.2.1.4.3 Closure Conditions and Assumptions

A number of assumptions have been made regarding the closure condition of the various hazardous material sites in order to understand the potential implications of the various runway alternatives. The key assumptions with regard to remediation requirements and closure conditions are as follows:

- Waste material would not remain under the proposed runways.
- All of the waste material and contaminated soils would be removed from sites and disposed of at a suitable offsite location.
- The full extent of the affected sites would be remediated as it is assumed that partial remediation of the individual capped sites would not be an option.
- All removed material would be handled as hazardous waste. Detailed investigations into the landfill contents and dimensions would enable more accurate costing as well as allow for planning in terms of separation of waste for disposal purposes.
- The topography and landforms would be contoured using material sourced from site in order to provide stable landforms on which the runway could be constructed.

5.2.1.4.4 Estimated Costs Associated with Hazardous Materials-Related Impacts of Runway Alternatives

The provision of remediation costs requires detailed closure planning as well as a high level of confidence with regard to the existing conditions of the sites being remediated. The estimated costs provided in this section are solely intended for comparison of the short-list runway alternatives at the master planning level. Cost estimates are based on landfill acreages instead of volumes due to the lack of detailed site characterization studies that would provide accurate waste depths and volumes for the sites.

In order to estimate the costs associated with landfill removal in the Austin area, the recent removals of two local landfills were evaluated. The two landfills removed were the Loop 360 Landfill and the Rosewood Municipal Solid Waste (MSW) Site, which were carried out in 2012 and 2013, respectively. The waste removed from both of these sites included hazardous waste. The costs associated with the removal of these sites are shown in **Table 5.2-9**.

Although there is substantial variation between the costs of removal per acre, the Rosewood MSW Site cost includes removal and disposal of waste as well as restoration of site topography (i.e., replacement with infill). The Loop 360 Landfill cost only includes the removal and disposal of surface material; waste was not placed in excavations, and no infilling was required. Therefore, only the respective costs of waste removal per acre are relatively similar for the two sites.

For the purposes of this assessment, the per-acre unit cost of the Rosewood MSW has been utilized to compare the short-list runway alternatives. It should be noted that the per-acre unit cost

of removal of hazardous materials from ABIA would be expected to be substantially higher, since the depth and volume of each site would likely be greater than at the Rosewood MSW Site.[7]

Table 5.2-9: Landfill Removal Costs for Loop 360 Landfill and Rosewood MSW Site

DATE	LOOP 360 LANDFILL 2012	ROSEWOOD MSW SITE 2013
Location	Illegal dumping site located on a slope in the Barton Creek greenbelt south of Barton Creek and east of Loop 360 (approximately 12 miles from ABIA).	Municipal landfill located at 731 ½ McClain Street (approximately 6.5 miles from ABIA).
Area	3.6 acres	2.3 acres
Depth	Waste depth between 2 and 6 feet.	Waste depth of approximately 6 feet.
Removal Activities	– Removal of surface waste carried out. – No infill as waste was not placed in excavations.	– Removal of waste from landfill site and disposal at alternate facility. – Infill brought in and restoration of topography carried out. – 8,500 cubic yards of material removed and replaced with infill.
Hazardous Waste	Antimony and lead detected.	Lead, arsenic and DDT detected.
Estimated Cost	$2.1 million	$2.7 million
Cost/Acre	$583,333.00	$ 1,173,913.00
Adjusted (2018) Cost/Acre*	$637,897.34	$1,263,567.37

Note: *Considering Consumer Price Index increases calculated from January 2012 to January 2018 (Loop 360 Landfill) and January 2013 to January 2018 (Rosewood MSW Site). https://www.bls.gov/data/inflation_calculator.htm (accessed 3/21/2018)

Source: Website - http://www.austintexas.gov/edims/document.cfm?id=172745 (accessed 01/27/2018), Baer Engineering and Environmental Consulting, Inc. 2008. *Rosewood Site Characterization.* Prepared for the City of Austin Public Works Department. December 2008.

Table 5.2-10 provides a high-level cost estimate for the full removal of previously documented hazardous materials that would be impacted by the short-list runway alternatives.

Table 5.2-10: Estimated Landfill Removal and Remediation Costs

RUNWAY ALTERNATIVE	TOTAL FOOTPRINT OF IMPACTED SITE [ACRES]	PRELIMINARY COST ESTIMATE*
Alternative 1	18.35	$23,186,461.24
Alternative 2	0	0
Alternative 4	18.35	$23,186,461.24

Note: *Taking into account Consumer Price Index increase calculated from January 2013 and January 2018 for Rosewood MSW Site https://www.bls.gov/data/inflation_calculator.htm (accessed 3/21/2018)
If SWMUs 5, 113, and 114 were included in the landfill removal and remediation calculation, the cost estimate for Alternatives 1 and 4 would be $41,634,544.84 for a total footprint of 32.95 acres.

[7] FPM Remediations, Inc., 2017.

5.2.1.4.5 Environmental Evaluation Conclusion

Runway Alternative 2 would not be expected to result in impacts to previously documented hazardous materials sites with current land use restrictions on the ABIA property. While Runway Alternative 2 is located within the area of two hazardous materials sites (SWMUs 1 and 2) immediately northeast of the existing west runway, these sites do not have land use restrictions that would be anticipated to require remediation actions. Alternatives 1 and 4 would impact a higher number of hazardous materials sites with current land use restrictions and would be similar since the east runway is located in the same site.

5.2.1.5 Level 2 Runway Alternatives Evaluation Results

Based on the Level 2 environmental evaluation, Runway Alternative 2 is the preferred long-term runway location. This is the same approximate location as the preferred runway (see Exhibit 5.2-4) from the previous 2003 Master Plan, and 2009 Updated Master Plan recommendations. The Alternative 2 runway location provides an increase in airport capacity with the least amount of environmental impacts on and off-airport. ABIA has been preserving the Part 77 airspace as it relates to this new runway location and its future construction since the 2003 Master Plan. This proposed Alternative 2 long-term runway location will be carried forward into the terminal alternative development and evaluation process.

5.2.1.6 Runway Requirements

Both existing parallel runways are designed as Airport Design Group V (ADG-V), and Aircraft Approach Category D (AAC-D) and will be adequate to accommodate the critical design aircraft Boeing 787-900 (ADG-V). Both existing parallel runways are 150 feet wide and can accommodate ADG-V aircraft. Existing Runway 17R-35L is the preferred runway to accommodate ADG-VI aircraft, because of its 300-foot overall pavement width (including shoulders). Any future runways should be designed at 200-foot wide and shoulders at 40-foot wide in accordance with FAA Advisory Circular 150/5300-13A, *Airport Design*. However, further study on any new ADG-VI runway design should be coordinated with the FAA. It might be possible to utilize the reduced design standards for ADG-VI aircraft operations as presented in the FAA Engineering Briefs 65A and 74A to avoid any Modification of Standards (MODs).[8]

5.2.1.7 Taxiway Requirements

The following taxiway requirements are recommended to help increase airfield capacity by maximizing the efficient movement of aircraft to and from the runway environment.

- Construct a full length parallel new Taxiway D on the east side of Runway 17R-35L at a separation distance of 550 feet.

[8] FAA Engineering Brief 65A, Use of 150-Foot Wide Runways for Airbus A380 Operations, December 10, 2007. FAA Engineering Brief 74A, Use of 150-Foot Wide Runways and Blast Pads for Boeing 747-8 Operations, August 12, 2011.

- Provide rapid exit taxiways on Runway 17R-35L at distances of approximately 2,250, 6,900 and 9,020 feet from the thresholds. This will provide an average runway occupancy time of 50-seconds or less based on the future aircraft fleet mix. A reduced ROT will help to increase airfield capacity by reducing the in-trail separation between succeeding aircraft based on RECAT and wake turbulence requirements.
- Modification of various Taxiway C fillets to accommodate ADG-VI aircraft.

Construction of a new Taxiway D will provide the following operational benefits:

- The location of new Taxiway D is in accordance with the standard FAA airport design, where existing Taxiway C is a no-standard layout.
- Ability to construct RETs and 90-degree exits to reduce the average runway occupancy time from 58.5 seconds to 50 seconds or less should increase runway capacity. This will allow for 2.5 nautical miles separation between aircraft established on the final approach course within 10 NM of the landing runway. The leading aircraft's weight class must be the same or less than the trailing aircraft.[9]
- Maintain operations on existing Taxiway C during construction of new Taxiway D.
- Allows for future expansion of the Barbara Jordan Terminal to the west for increased terminal, gate and curb capacity.
- Provides additional taxi flexibility during Runway 17R-35L operations.
- Allow for future expansion of the South Maintenance Ramp for additional remain overnight (RON) and South Terminal gate positions.
- Positions the Airport for construction of a new closely-spaced west Runway 17C-35C in the future.

5.2.1.8 Navigational Aid Requirements

The Airport currently has an Instrument Landing System (ILS) on each end of the existing parallel runways. Runway End 17L is equipped for Category IIIB landings with a 600 Runway Visual Range (RVR), while Runway Ends 17R and 35L are equipped for Category I landings. Runway 35R has a CAT II Special Authority procedure with a 1200 RVR.

It is recommended to upgrade Runway Ends 17R and 35L to Category IIIA capability to allow for simultaneous Category III landings. Also, the future third parallel runway should be equipped with Category IIIA equipment in both directions.

[9] FAA Order JO7110.65X, *Air Traffic Control*, September 12, 2017.

5.2.1.9 Other Airfield Design Requirements

In the event the Boeing 777 Folding Wingtip aircraft were to operate at ABIA in the future, it will be necessary to follow the operating procedures contained in FAA Engineering Brief No. 94.[10] The existing and future ABIA airfield layout will be capable of accommodating this aircraft due to its ability to fold the wingtips during taxi operations, resulting in its unique ability to reduce from ADG-VI (runway takeoff and landing) to ADG-V while taxiing. The FAA standard for runway width for ADG-VI is 200 feet. However, the FAA Flight Standards Service determines the runway width required for the takeoff and landing of particular airplanes and allows the operations of other ADG-VI airplanes on runways as narrow as 150 feet based on demonstrated capabilities of those airplanes. It might be possible to utilize the reduced design standards for ADG-VI aircraft operations as presented in the FAA Engineering Briefs 65A and 74A as previously noted.

5.3 Terminal Area Alternative Development and Analysis

The analysis presented in Chapter 4, *Demand/Capacity Facility Requirements,* Section 4.4, *Terminal Demand/Capacity Analysis,* identified the passenger terminal facility requirements to meet the forecast demand through the 20-year planning period. These requirements determined that when the East Terminal Expansion opens in early 2019, most of the terminal components at ABIA will be operating at or above capacity and by PAL 2 (18.0 MAP), substantial capacity expansion will be required. Several terminal development alternative concepts have been developed in order to accommodate the required demand. Each alternative preserves the ability to develop Runway Alternative 2 as described in Section 5.2. Through these alternatives, two different paths for terminal development emerged, development to the west and to the south. The development of both west and south terminal alternatives is necessary to determine ability to address near-term growth. The objectives of the terminal alternatives are to:

- Address near-term expansion requirements
- Maintain or increase the number of available gates during construction of the next phase
- Minimize disruption to passengers or operations during expansion
- Maintain or enhance passenger experience
- Invest in the near-term while maintaining flexibility to adapt in the long-term

The following sections present in detail the various terminal alternatives that were analyzed as part of this Master Plan. All aircraft parking positions are shown according to the PAL 4 (31.0 MAP) aircraft gate requirement as presented in Table 4.4-2 in Chapter 4, *Demand/Capacity Facility Requirements*. The PAL 4 gate requirement is for 59 Aircraft Design Group (ADG) III aircraft and five ADG-V aircraft, with 74 remain overnight positions.

[10] Federal Aviation Administration Memorandum, April 2, 2018, Engineering Brief No. 94, Accommodating the Boeing B-777 Folding Wingtip Airplane on Airports Built to ADG-V or Lower.

5.3.1 Alternative 1 – Maximum Capacity of Barbara Jordan Terminal

Terminal Alternative 1 as presented in **Exhibit 5.3-1** is centered on maximizing the capacity of the Barbara Jordan Terminal. Under this configuration, the BJT processor would be expanded to the northwest, Parking Garage 1 would be converted to a Ground Transportation Center and parking, two pier concourses would be developed to the south, one pier concourse would be developed to the northwest, and a small western concourse extension would also be developed. The two pier concourses developed to the south would extend up to the taxiway Object Free Area (OFA) for Taxiway G, with the necessary space for aircraft parking. The northwest and western concourse extensions would be developed as far west as possible, while preserving space for a parallel western runway with a parallel taxiway. With this alternative, dual parallel taxiways off of the new western runway are not possible.

Fifty-nine ADG-III would be accommodated on the BJT with the additions as mentioned previously, and three ADG-III gates would still be utilized on the South Terminal. Five ADG-V gates would be accommodated on the east side of the BJT.

Seventy-four RON parking positions would be accommodated south of Taxiway H.

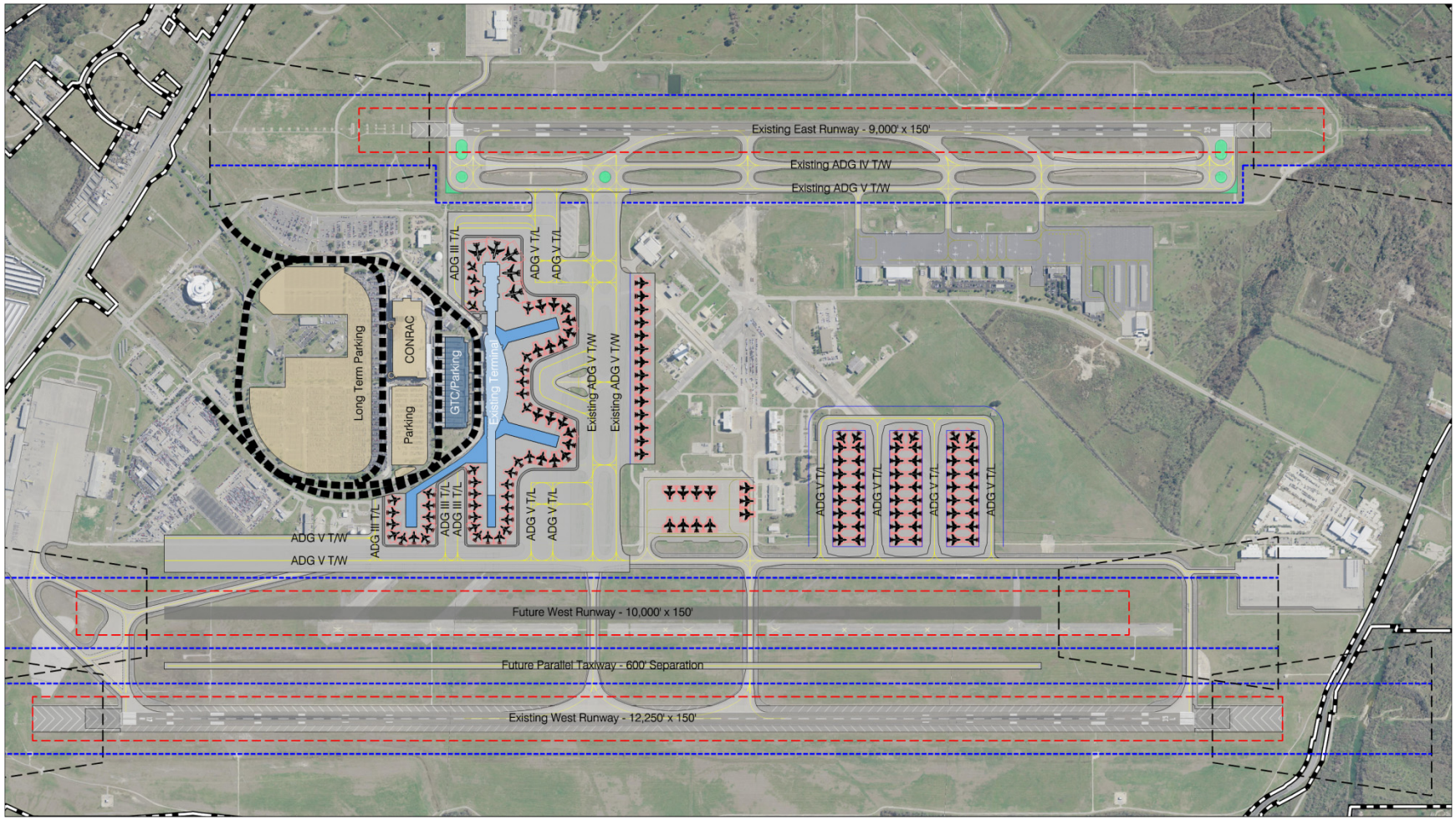
5.3.2 Alternative 2 – Redeveloped Barbara Jordan Terminal

Terminal Alternative 2, presented in **Exhibit 5.3-2**, is also designed to maximize and expand the capacity of the Barbara Jordan Terminal. Under this configuration, the BJT processor would be expanded to the northwest, and a new western concourse extension (oriented north to south) would be developed off of the BJT. Parking Garage 1, located closest to the BJT, would be converted to a Ground Transportation Center (GTC), as well as passenger parking. The apron area would be developed around the existing Air Traffic Control Tower (ATCT) in order to avoid relocating the facility. A hold pad with three aircraft positions would be added to the northern end of the new closely-spaced west runway. Additionally, the western concourse extension would not impede the development of a new west runway with two parallel ADG-V taxiways.

Fifty-nine ADG-III would be accommodated on the BJT, with the additions as mentioned previously, and five ADG-V gates would be accommodated on the east side of the BJT.

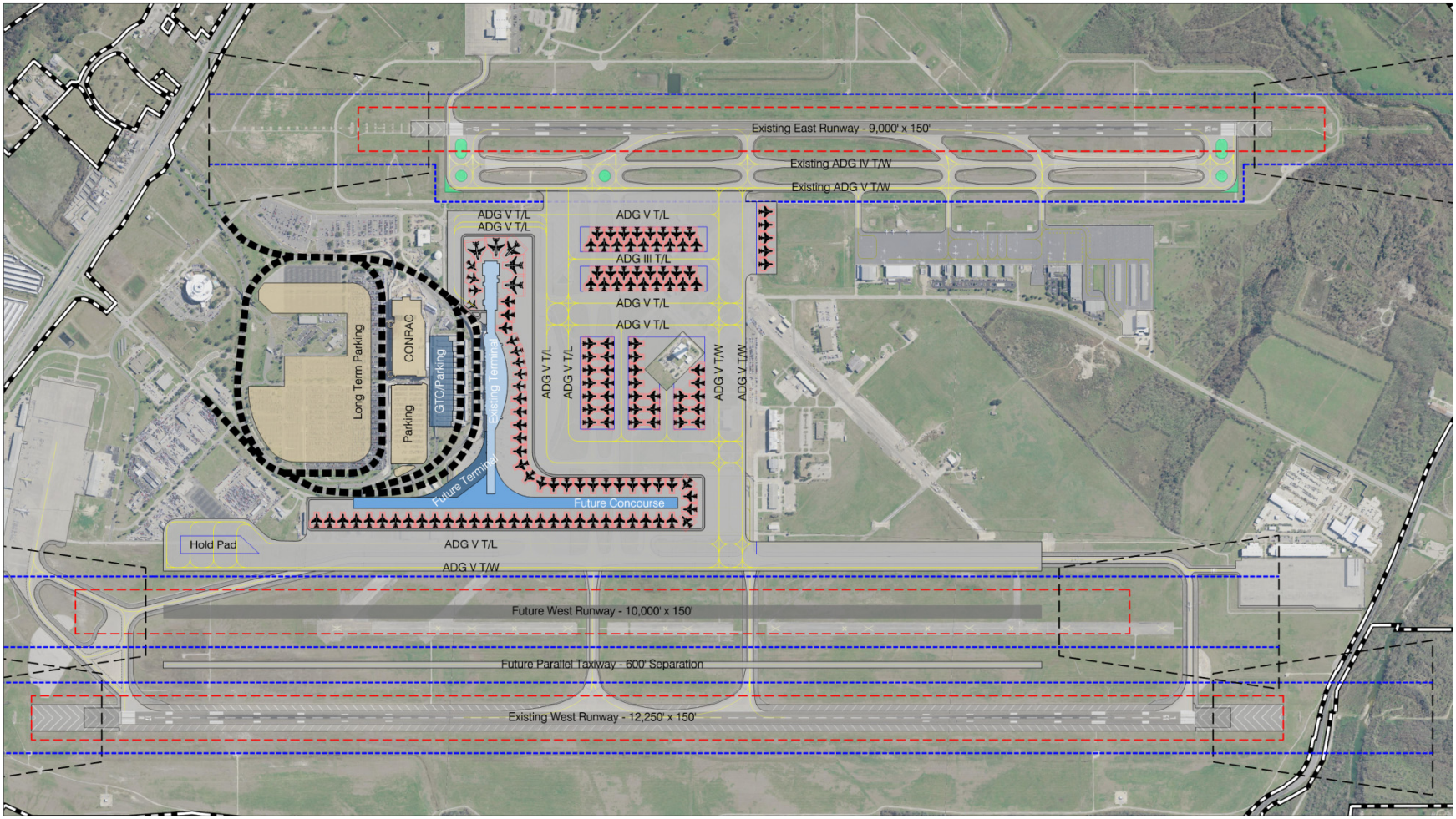
Seventy-one RON parking positions would be accommodated on the eastern apron south of the BJT and south of the BJT near the ATCT. The remaining three RON parking positions would be located on the north end of the new BJT western concourse. Additional RON parking beyond the master plan requirement would be available in the midfield apron area.

Exhibit 5.3-1: Terminal Alternative 1



Source: Landrum & Brown analysis

Exhibit 5.3-2: Terminal Alternative 2



Source: Landrum & Brown analysis

5.3.3 Alternative 3 – New North Terminal with Midfield Concourses

Terminal Alternative 3, presented in **Exhibit 5.3-3**, is designed to create a new north terminal, convert the BJT to a concourse, and develop a new pier concourse running north to south connecting the BJT and a new midfield concourse oriented east and west. Under this configuration, Parking Garage 1, located closest to the BJT, would be replaced by the new north terminal. Additionally, this alternative preserves the space required for a new closely-spaced west runway with two parallel ADG-V taxiways.

Fifty-nine ADG-III would be accommodated on the BJT, with the additions as mentioned previously, and five ADG-V gates would be accommodated on the east side of the BJT.

Seventy-four RON parking positions would be accommodated in the aprons to the east and west of the new midfield concourse with eight positions to the west and 13 positions to the east of the midfield concourse. Additional RON parking beyond the master plan requirement would be immediately available to the south of the midfield concourse.

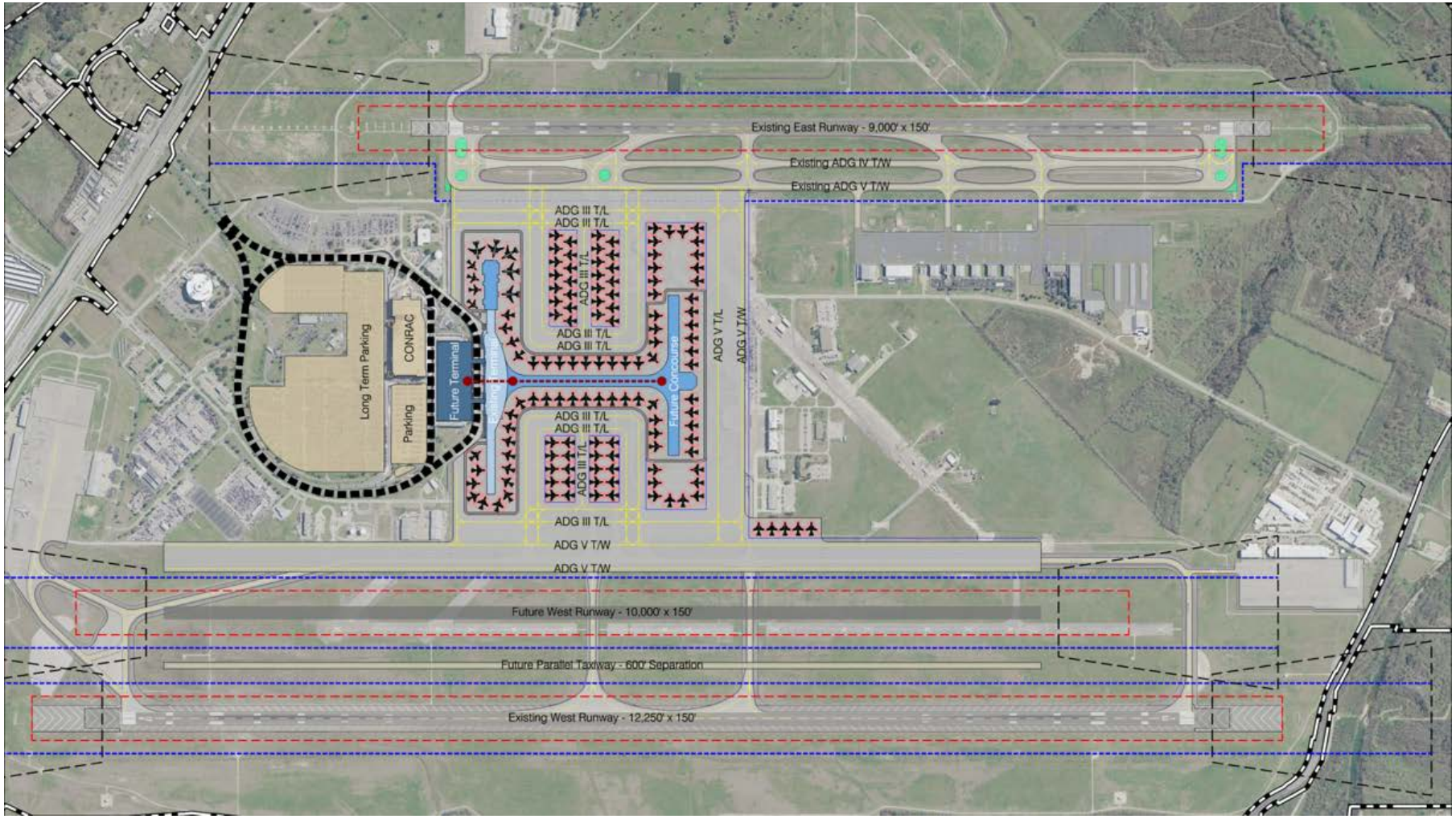
5.3.4 Alternative 4 – New North Terminal with Midfield Satellite Concourse

Terminal Alternative 4, presented in **Exhibit 5.3-4**, is similar to Terminal Alternative 3 and designed to create a new north terminal, convert the BJT to a concourse, and develop a new midfield satellite concourse with automated transit link to the BJT via bridge or tunnel. Under this configuration, Parking Garage 1, located closest to the BJT, would be replaced by the new north terminal. Additionally, this alternative preserves the space required for a new closely-spaced west runway with two parallel ADG-V taxiways.

Thirty-five ADG-III gates would be developed on the new midfield concourse. 24 ADG-III gates would be accommodated on the BJT, and three ADG III gates would still be utilized on the existing South Terminal. Five ADG-V gates would be accommodated on the east side of the BJT.

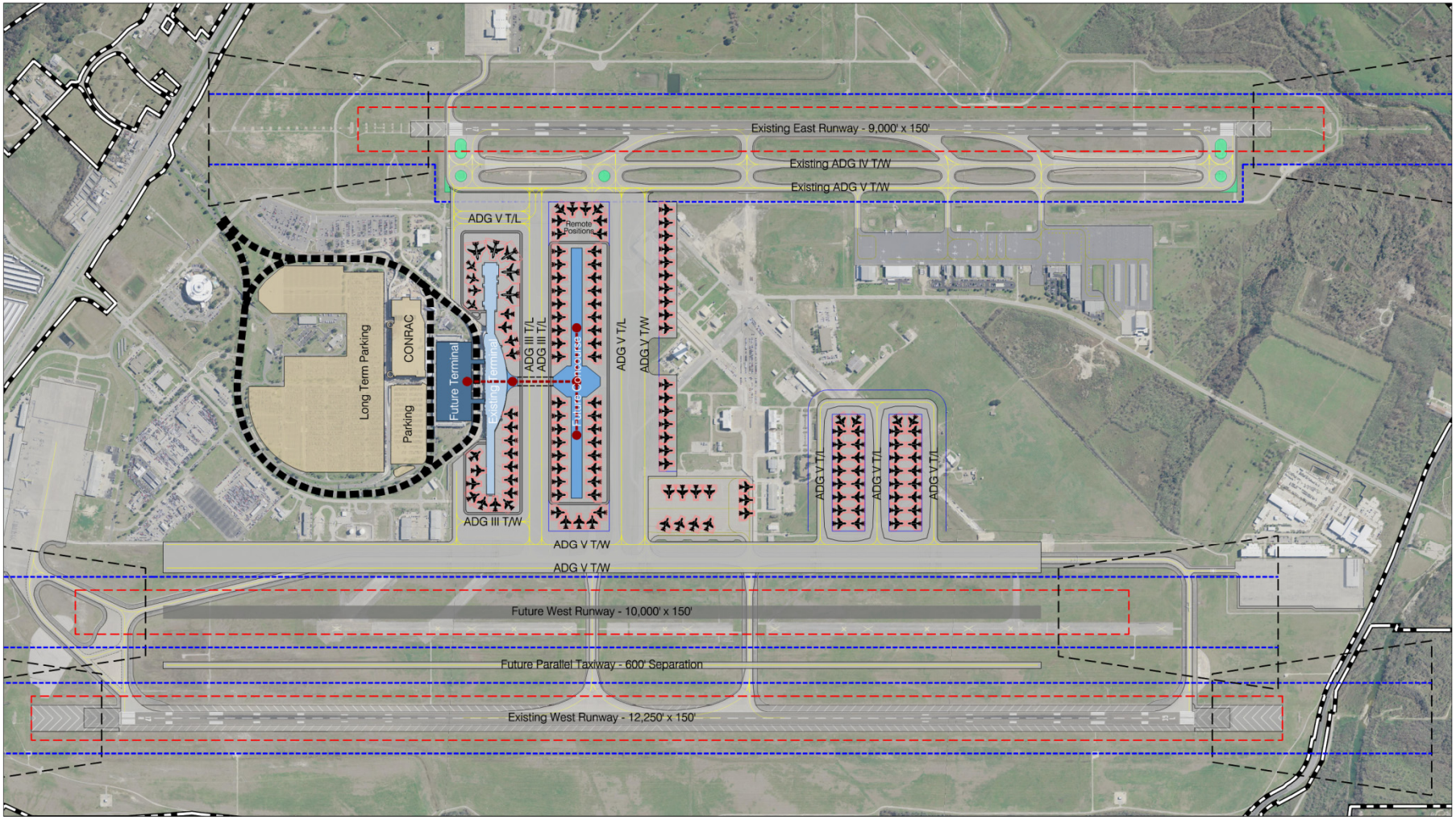
Seventy-four RON parking would be accommodated to the east and west of the new midfield concourse as well as new aprons to the south. Eight RON positions would remain on the existing South Terminal apron.

Exhibit 5.3-3: Terminal Alternative 3



Source: Landrum & Brown analysis

Exhibit 5.3-4: Terminal Alternative 4



Source: Landrum & Brown analysis

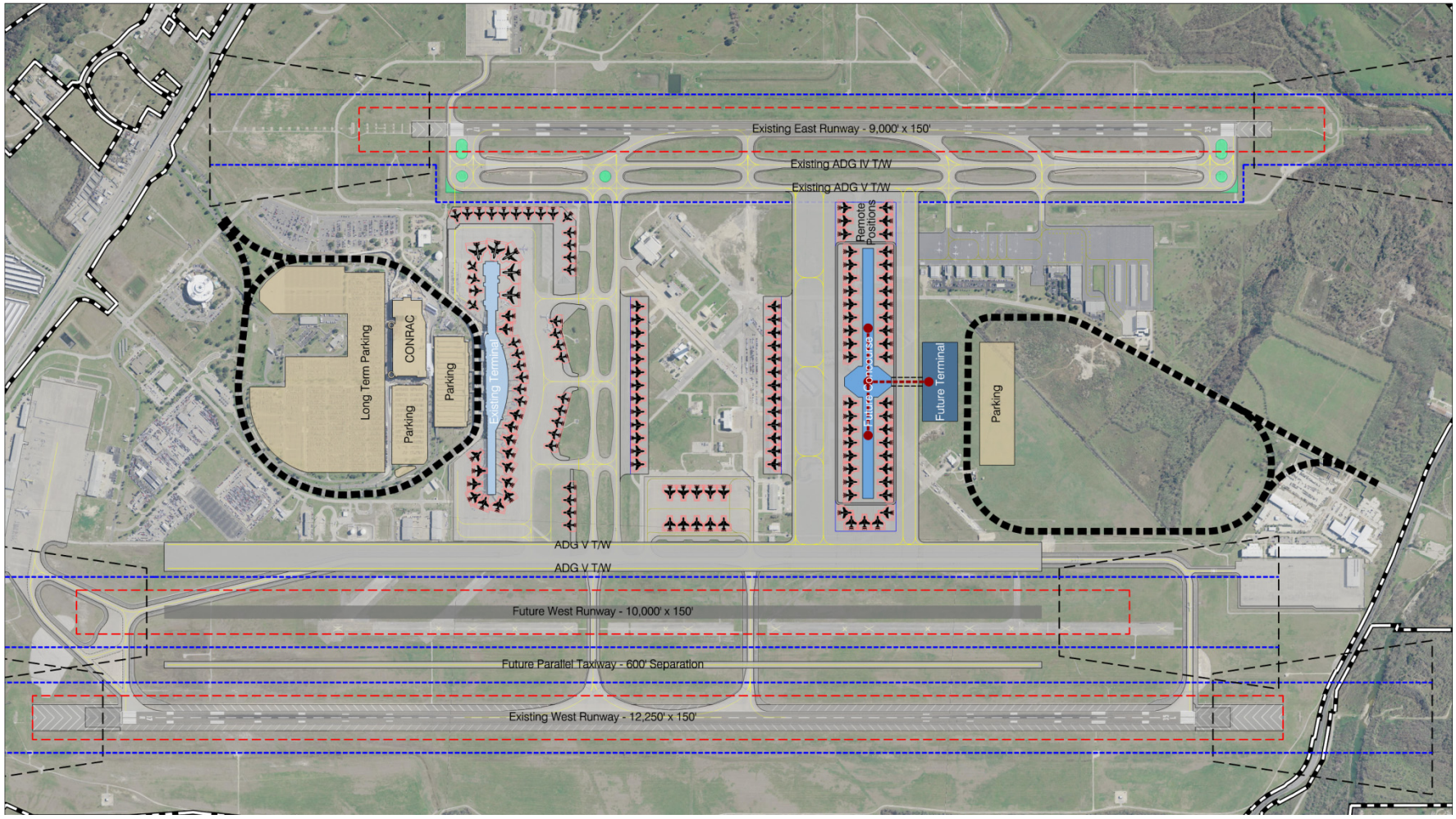
5.3.5 Alternative 5 – New South Terminal with Satellite Concourse

Terminal Alternative 5, presented in **Exhibit 5.3-5**, is strategically different than the previous alternatives and is centered on starting development from the south. A new south terminal and southern midfield concourse would be developed south of the majority of infield support facilities off of Burleson Road. Under this configuration, the BJT and northern terminal/apron area would not be impacted.

Thirty-two ADG III gates would be developed on the new southern midfield concourse. Twenty-seven ADG-III would be accommodated on the BJT, and five ADG-V gates would be accommodated on the east side of the BJT.

RON parking would be accommodated to the east and west of the new south midfield concourse with five positions to the west and eight positions to the east. The remaining eight RON positions would be accommodated on existing and new aprons between the two terminal areas.

Exhibit 5.3-5: Terminal Alternative 5



Source: Landrum & Brown analysis

5.3.6 Alternatives Comparison

The five terminal alternatives previously described were compared against one another using the criteria shown in **Table 5.3-1**. The criteria ranges from the impact to existing infrastructure on the Airport to the passengers' experience.

Table 5.3-1: Terminal Alternatives Criteria

CRITERIA	DESCRIPTION / KEY FACTORS
Maintains ABIA Experience	Curb to gate convenience similar to BJT
Intuitive Wayfinding	Minimal decision points
Flexible Gate Growth	Gates can be added in various increments
Requires Automated Transit	Automated People Mover (APM) or Personal Rapid Transit (PRT) required within the terminal
Operational Flexibility	Can accommodate various airline operational needs
Impacts Current CIP Projects	Current major Capital Improvement Projects (CIP) are compatible with future expansion
ATCT to Remain	Existing location is compatible with future expansion
Central Utility Plant to Remain	Existing location is compatible with future expansion
Impacts General Aviation	Some or all General Aviation will have to be relocated
Fuel Farm to Remain	Existing location is compatible with future expansion

Source: Landrum & Brown analysis

Additionally, in support of the above-mentioned criteria, other important considerations in the comparison of the alternatives are as follows:

- **Passenger Experience**
  - "Austin Airport Experience"
  - Walk distances
  - Wayfinding
  - Concessions
- **Implementation**
  - Minimize disruption to ongoing operations
  - Incremental gate growth
  - Flexibility to accommodate various airline operations
  - RON positions
- **Financial**
  - Enhanced concessions revenue
  - Enhanced parking revenue
  - Operating costs
  - Capital costs

- **Airfield Operations**
  - Taxi distances
  - Closely-spaced west runway
  - ATCT relocation
  - General aviation relocation
  - Support facility relocations (CUP, Fueling, Cargo, Catering, etc.)

Initially, a simple comparison using the criteria mentioned in Table 5.3-1 was applied to the five terminal alternatives. The results of that comparison are summarized in **Table 5.3-2**.

Table 5.3-2: Evaluation of Terminal Alternatives

EVALUATION CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5
Maintains ABIA Experience	Yes	Yes	Yes*	Yes*	Yes*
Intuitive Wayfinding	No	Yes	Yes	Yes	No
Flexible Gate Growth	Yes	Yes	Yes	Yes	Yes
Requires Automated Transit	No	No	Yes	Yes	Yes
Operational Flexibility	Yes	Yes	Yes	Yes	Yes
Impacts Current CIP Projects	No	Yes	No	No	No
ATCT to Remain	Yes	Yes	No	Yes	Yes
Central Utility Plant to Remain	Yes**	Yes**	Yes**	Yes**	Yes**
Impacts General Aviation	No	No	No	No	Yes
Fuel Farm to Remain	No	No	Yes	Yes	Yes

Notes: * ABIA curb-to-gate convenience is maintained through the implementation of an automated transit system
** A second Central Utility Plant is needed for all terminal alternatives for additional capacity

Source: Landrum & Brown analysis

As shown, all five alternatives offer operational and future growth flexibility. Only Alternative 3 requires the displacement of the ATCT. Alternatives 1 and 2 require the relocation of the fuel farm. Alternative 5 impacts the General Aviation area. None of the alternatives impact the existing Central Utility Plant, but it is anticipated that all of the alternatives will require a new CUP to be developed in the southern portion of the airport due to the additional demand for power. The "Austin Airport Experience" would be different in Alternatives 3, 4, and 5 as an automated transit system, such as PRT or APM would be used to maintain the curb-to-gate convenience of the existing BJT.

Due to near-term constructability issues including grading issues with Taxiway C, the displacement of the fuel farm, and the impact on the new administrative building, Alternative 2 was eliminated. Alternative 3 was also eliminated, as it requires relocation of the ATCT in the initial phase of development.

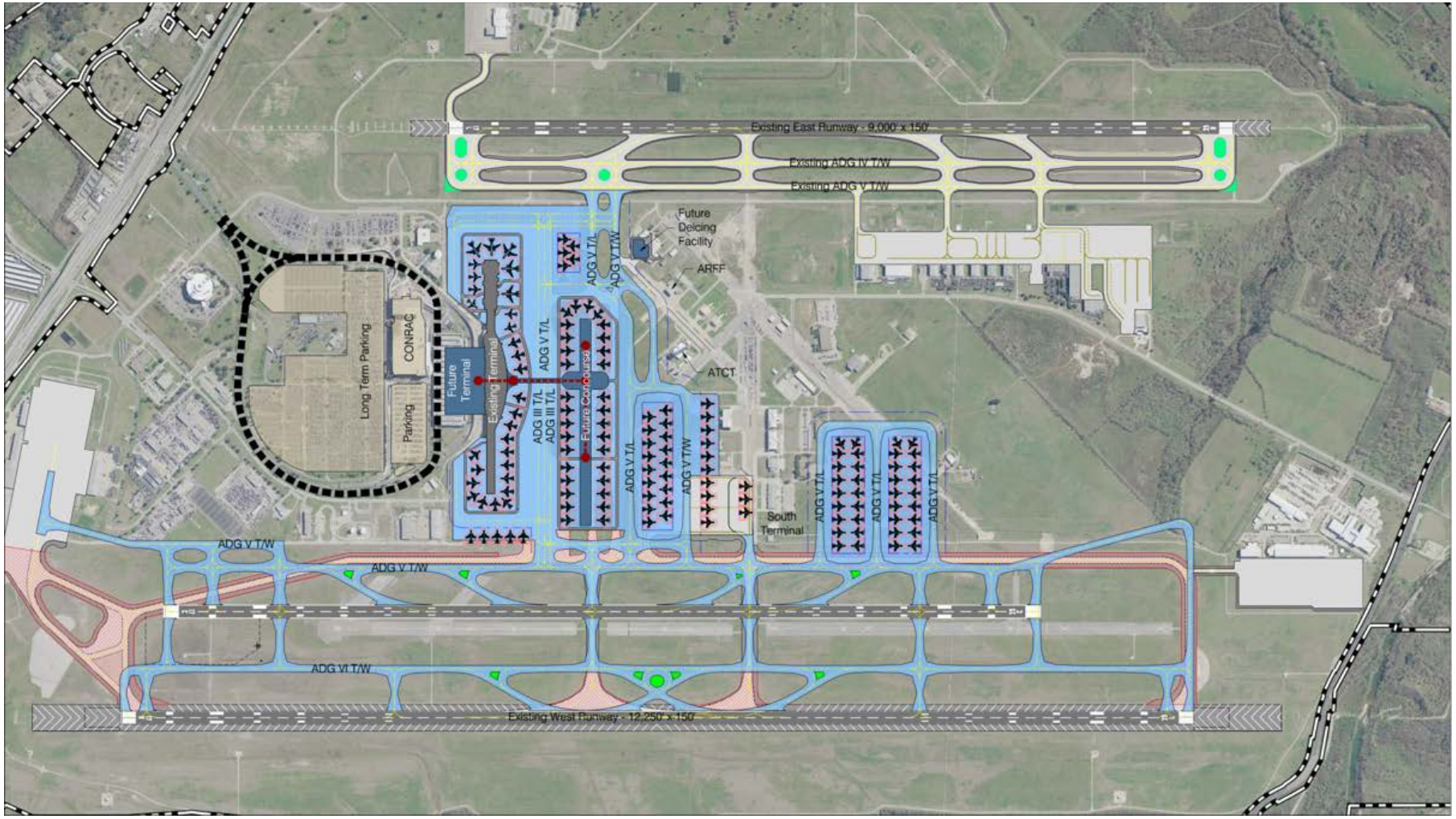
Alternative 3 would have a significant impact to existing operations with much of the construction centered on the BJT and existing apron. Alternative 5 does not impact the BJT and would be developed independently to the south. However, this alternative would require the displacement of several GA facilities. A split operation between the BJT and the new south terminal may create issues with the "Austin Airport Experience" and wayfinding between the two terminals. The other remaining alternative, Alternative 4, offers the flexibility and benefits of Alternatives 3 and 5 without the significant impacts to the existing infrastructure.

For the reasons stated above, Alternative 4 was identified as the Preferred Alternative and modified based on the review of the initial alternatives. The updated Preferred 2037 Terminal Alternative is shown in **Exhibit 5.3-6**. This alternative is designed to create a new North Terminal and later develop a new Midfield Concourse. Under this configuration, Parking Garage 1, located closest to the BJT, would be replaced with the new North Terminal. A key feature of the selected alternative is a connector bridge which is illustrated in Exhibit 5.3-6. This connector bridge serves as the primary connection between the North Terminal, the existing BJT, and the new Midfield Concourse. This connector is envisioned to accommodate pedestrian traffic, an automated transit system, as well as potentially the baggage transport sub-system of the Baggage Handling System (BHS). The existing BJT and Midfield Concourse separation distance allows for a single ADG-V taxilanes, or two ADG-III taxilanes. This alternative also preserves the space required for a new closely-spaced parallel runway on the west side, with two ADG-V parallel taxiways.
Thirty-two ADG-III gates would be developed on the new Midfield Concourse. Twenty-nine ADG-III would be accommodated on the existing BJT, and five ADG-V gates would be accommodated on the east side of the BJT, for a total of 34 gates on the existing BJT. Approximately 87 RON parking positions could be accommodated on the existing BJT aprons and new aprons to the south and east of the Midfield Concourse if necessary. Some of these RON positions can be used for a central deicing operation.

The Preferred Alternative has the following advantages:

- Able to meet the 2037 demand and beyond (terminal area, gates, RONs)
- Maintaining single point of access from SH 71 maximizes near-term non-aero revenue (parking, rental cars)
- Terminal processor expansion and airside concourse can be constructed with minimal impact to existing gates
- Provides flexibility to expand terminal processor and airside concourse in phases based on demand
- Improves ADG-V aircraft operations

Exhibit 5.3-6: Preferred 2037 Terminal Alternative



Source: Landrum & Brown analysis

However, the Preferred Alternative also has its disadvantages, including the following:

- West infill may be required for interim terminal processor capacity expansion
- Temporary remote holdroom facility and bussing operation required to provide interim gate capacity expansion
- APM/PRT will change the “Austin Airport Experience”
- APM/pedestrian bridge will displace existing gate(s)

Overall, this alternative preserves critical infrastructure on the Airport, the ATCT and the new deicing pond. It also preserves for the ability for a closely-spaced parallel runway on the west side. With the ability to meet the demand of the planning period, minimize the impact to other areas of the airfield, and preserve space for future growth, this alternative is preferred.

5.3.7 Preferred Alternative Concept Development

It is clear that significant expansion of nearly all functional spaces are needed to address both current and projected demand for the ABIA terminal based on the Chapter 4 facility requirement data. Significant changes are needed, not just to keep pace with the current high demand, but also to position ABIA toward a growth strategy that allows for planned expansion in the future as demand continues to grow.

Through analyzing facility requirements data, the most significant near-term needs were identified to be with the land-side passenger processing function, such as the curbside, ticketing/check-in, baggage drop, baggage screening, and to a lesser extent, security/passenger screening. To address these land-side, customer-facing needs, a new North Terminal Building (North Terminal) is proposed in the location of existing Garage One, which is proposed to be demolished. This proposed configuration maintains close adjacencies to the new East Terminal Expansion in the existing Barbara Jordan Terminal, and allows the existing roadway and curbside to remain operational while a North Terminal and roadway curbside are constructed.

On the airside of the North Terminal, the current East Terminal Expansion project is helping ABIA to get “caught-up” to current levels of demand. However, given the time needed to construct future gate positions, by the time these new gates become operational, ABIA will need to begin the process of adding additional gates. In addition to the proposed North Terminal, a new Midfield Concourse is recommended to provide the needed growth for gate positions, see **Exhibit 5.3-7**.

Exhibit 5.3-7: North Terminal/Midfield Concourse (Aerial Image)

Source: Page Southerland Page, Inc.

Through the planning processes undertaken in this 2040 Master Plan Study effort, which included significant research, public input, stakeholder engagement, technical advisory reviews, and regulatory oversight and approvals, several key themes rose to the surface that informed the recommendations for the New North Terminal and Midfield Concourse development illustrated in **Exhibit 5.3-8**. These themes include:

- Operational Efficiency and Flexibility
- Passenger Convenience and Intuitive Wayfinding
- Reflecting the Nature and Character of Austin
- "One Airport"

Exhibit 5.3-8: New North Terminal View on Approach

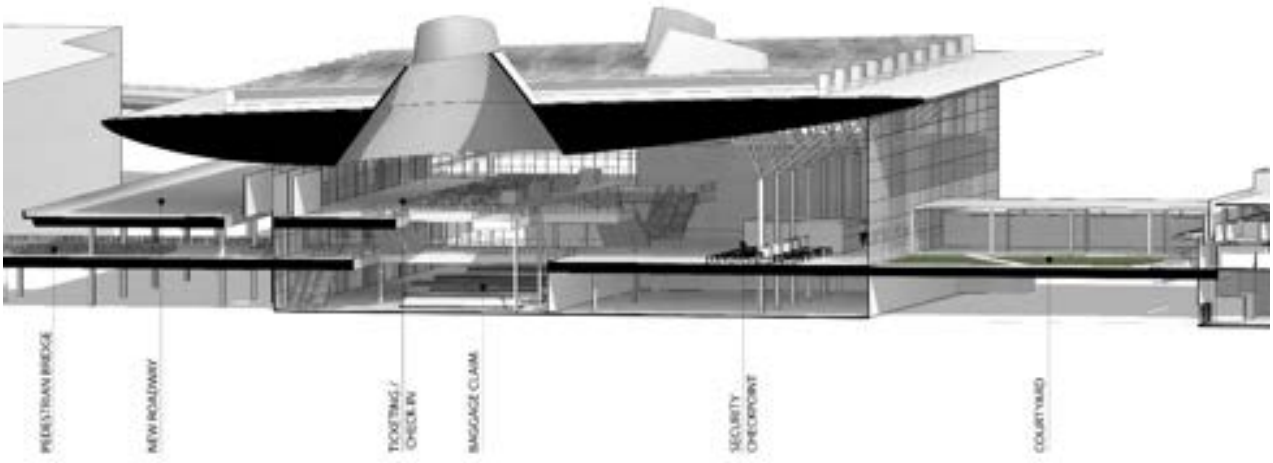
Source: Page Southerland Page, Inc.

5.3.7.1 Operational Efficiency and Flexibility

The New North Terminal will serve as the doorway to Austin for all departing and arriving passengers. The recommended concept for the New North Terminal proposes an East-West oriented building that maximizes presentation and entrance opportunities along a new and longer curbside. The building concept is that of an open pavilion, providing a large and unobstructed space for maximum flexibility of the functional elements such as ticketing kiosks and security checkpoint lanes to grow and change over the life of the building.

Technology will continue to change and improve over time, and the terminal building will need to be flexible to adapt to these new technologies. The open pavilion concept provides a building diagram with maximum flexibility and adaptability for the future, see **Exhibit 5.3-9**.

Exhibit 5.3-9: New North Terminal Section Perspective



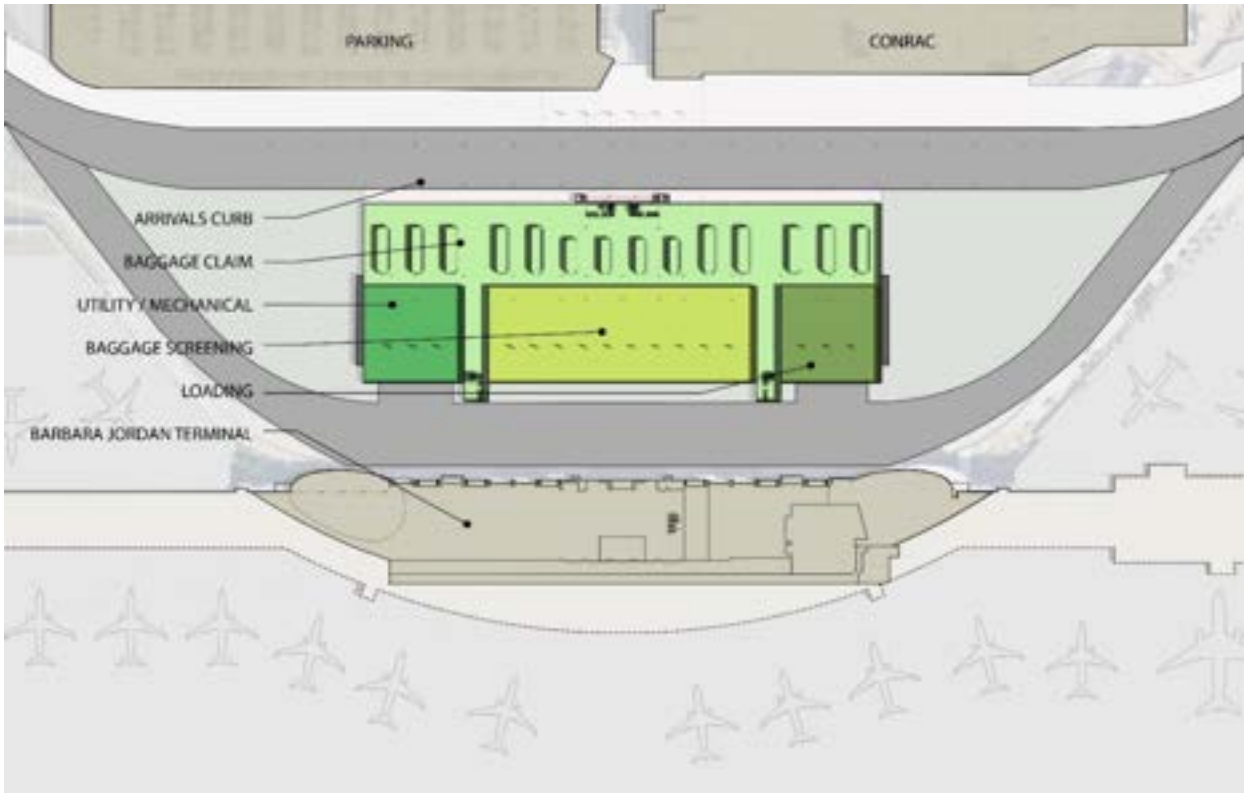
Source: Page Southerland Page, Inc.

5.3.7.1.1 New North Terminal Level One – Baggage Claim and Central Baggage Processing

Level 1 of the New North Terminal will serve as a new baggage claim hall. Customer related spaces are organized against the north wall, directly adjacent to the new departure curb. Support spaces are organized along the south side of the building. The existing lower level roadway will be retained for service access to the BJT and North Terminal.

Also, on this level is a new centralized baggage screening function, as illustrated in **Exhibit 5.3-10**. The area shown for the baggage screening function is oversized, with service spaces located to the sides. This will provide for future expansion of the baggage screening infrastructure beyond 2040.

Exhibit 5.3-10: New North Terminal Level One - Baggage Claim



Source: Page Southerland Page, Inc.

5.3.7.1.2 New North Terminal Level Two – Apron

The existing Barbara Jordan Terminal has space at the apron level that will align with the airfield grade. This preliminary conceptual layout of the New North Terminal has no significant programmed areas at this level in the master plan, as the floor-to-floor heights at this level are very tight. However, there is the opportunity that some mezzanine areas could be investigated above the baggage screening or service areas, to increase "back-of-house" space. The full details of the New North Terminal will be determined during the design stage.

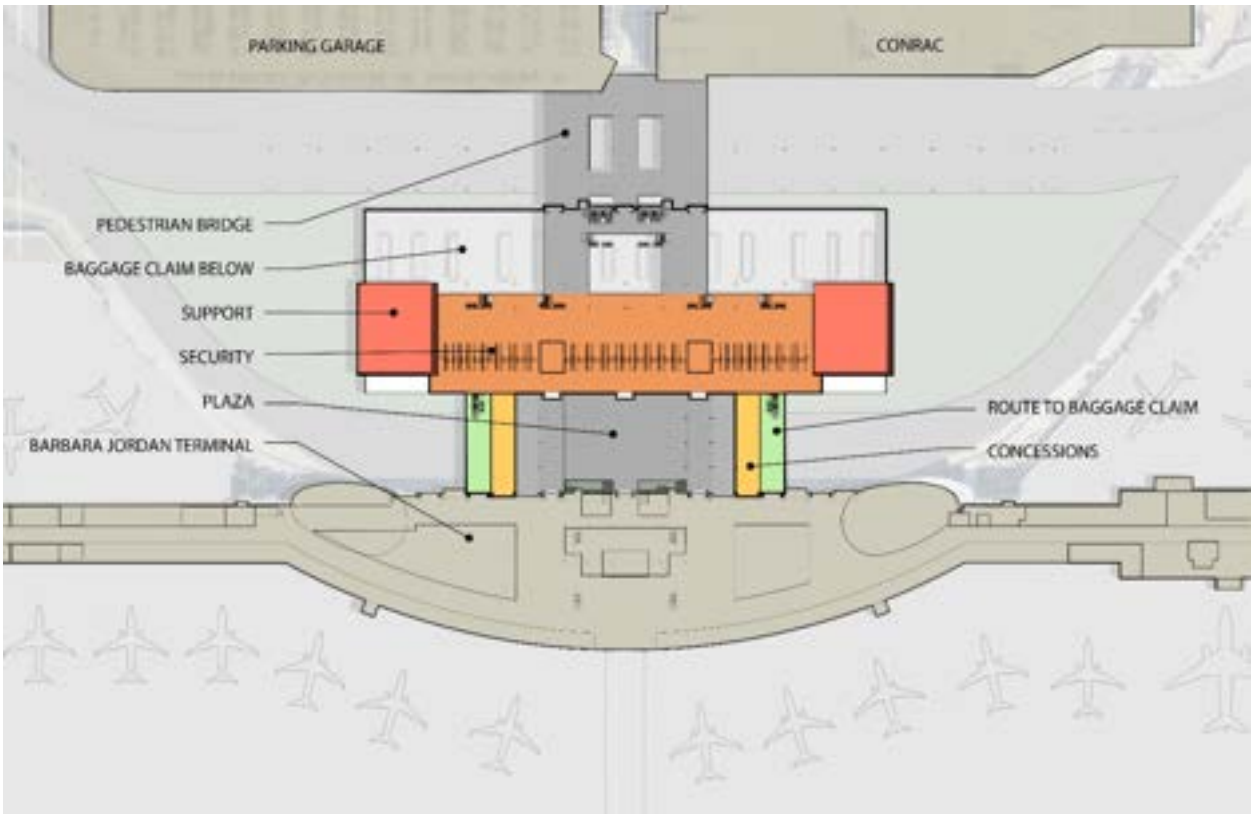
5.3.7.1.3 New North Terminal Level Three – Pedestrian Plaza

Level Three of the New North Terminal is the Pedestrian Plaza Level. This level aligns with the existing Barbara Jordan Terminal concourse level, and the existing service desk level of the CONRAC rental car facility. The Pedestrian Plaza level will provide a direct circulation path for pedestrians from the existing parking garage and CONRAC all the way through security and out to the existing BJT. This offers a simple and clear pathway for many travelers to get from car to gate as quickly and efficiently as possible.

The security checkpoint as shown in orange on **Exhibit 5.3-11**, is proposed as a contiguous open space, with maximum flexibility. TSA should have the ability to adjust the numbers of lanes and staffing as needed based on passenger demand at any given time. Enclosed spaces for private screening and support spaces should be provided within the open volume of space, which can also be reconfigured in the future, as needed.

Once past the new security checkpoint, passengers will have a short walk over to the existing Barbara Jordan Terminal, and will have the opportunity to experience several amenities in an outdoor plaza. Reflecting Austin's many public green spaces, this outdoor space could include amenities such as playscapes for kids and pet walking areas. The outdoor plaza is flanked on both sides with space for outdoor seating and indoor concessions spaces, as shown in yellow and green on Exhibit 5.3-11. This provides passenger circulation into two parallel paths on both sides of the building's atrium, allowing passengers to proceed directly to the existing BJT concourse, with more opportunities for concessions in the recaptured space.

Exhibit 5.3-11: New North Terminal Level Three - Pedestrian Plaza



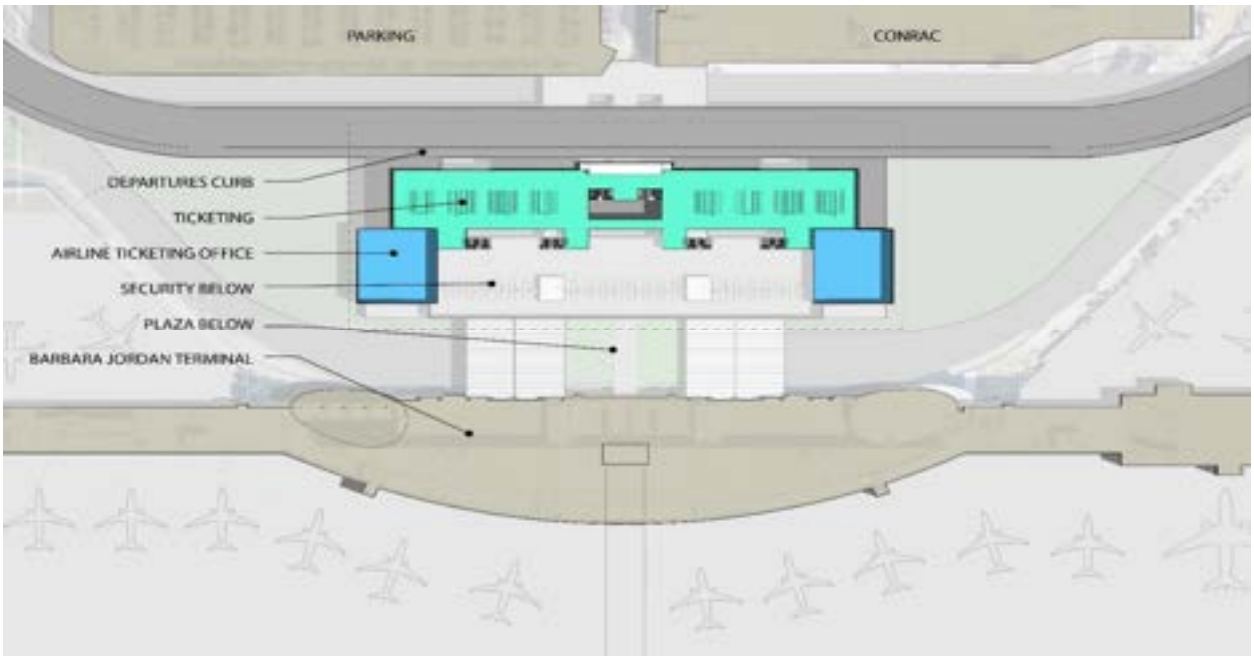
Source: Page Southerland Page, Inc.

5.3.7.1.4 New North Terminal Level Four – Ticketing

Level Four of the New North Terminal serves as a new ticketing hall. This ticketing area is aligned with the new departures curb, for direct access from the public drop-off into the ticketing areas. A significant aspect of the ticketing hall includes space for people to meet and gather with the rest of their party prior to travelling. Often passengers will have cart loads of bags to be checked as well. This can often be the most congested area of the airport and requires a generous amount of space as shown on the proposed concept on **Exhibit 5.3-12**. Open areas to the east and west of the New North Terminal also offer opportunity for future expansion.

The ticketing and check-in process have been ever evolving with new technologies such as shared use, self-serve kiosks and e-tickets on smartphone devices. These have been reducing the need for passengers to wait in a line to talk to an airline ticketing agent. For instance, a business traveler with an e-ticket and only a carry-on bag, can proceed directly to security without needing to come through the ticketing hall. There can also be opportunities for a consolidated bag-drop at the level below, allowing a greater number of passengers a more direct route to their gate. The ticketing level should also position self-serve opportunities prior to ticket counters.

Exhibit 5.3-12: New North Terminal Level Four – Ticketing



Source: Page Southerland Page, Inc.

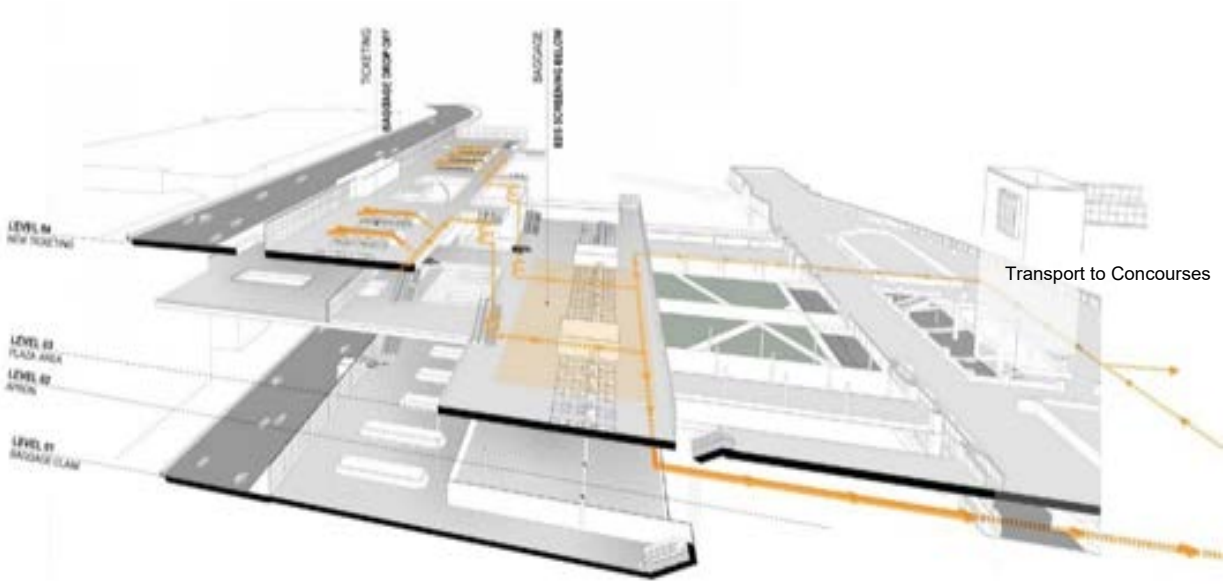
5.3.7.1.5 Baggage Systems

The proposed New North Terminal concept incorporates a simplistic design for baggage systems that leverages a new consolidated bag screening function within the New North Terminal for improved efficiency and redundancy for baggage screening operations. The Baggage Handling System (BHS) will also include a central Baggage Transport Subsystem (BTS) connecting the New North Terminal, BJT, and the future Midfield Concourse's outbound and inbound checked baggage across the airport.

Departing passengers' checked baggage will be received primarily at the ticketing level for departing and international connecting passengers, but potentially also at a consolidated bag drop at the pedestrian plaza level. Bags are collected onto two main lines positioned at either side of the building with both feeding the central baggage screening function located directly below security.
Once screened, the cleared bags are transferred via the BTS to the baggage makeup areas within each concourse. Two alternatives for placement of the BTS should be examined during future terminal design: 1) co-located with the connector bridge above ground, or 2) tunneled below ground between facilities.

Once bags arrive at the concourses, sortation to designated flight makeup areas will occur and airline operators resume their standard baggage handling processes. **Exhibit 5.3-13** shows the proposed departures baggage circulation paths within the New North Terminal and as bags are transported outward to the concourse gates.

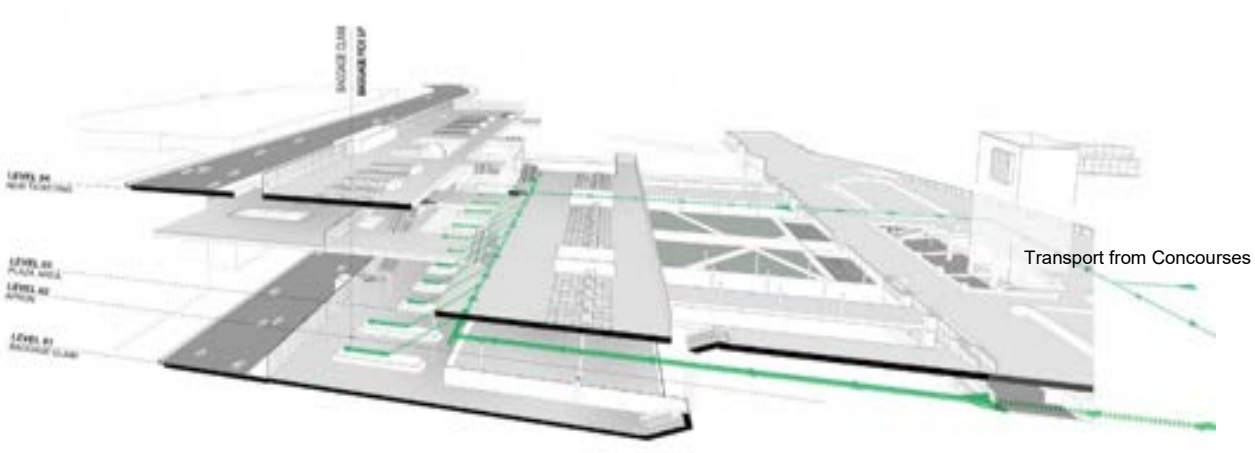
Exhibit 5.3-13: Baggage Handling System Diagram – Departures



Source: Page Southerland Page, Inc.

Checked baggage from arriving flights will also be processed through the BTS. Once bags are placed onto carts from the aircraft, it is envisioned that those bags will be introduced into the inbound BHS at the concourses and transported via the BTS back to the New North Terminal for distribution to the various baggage claim units servicing both domestic and international arriving passengers. **Exhibit 5.3-14** shows the proposed arrivals baggage circulation paths within the New North Terminal once bags are delivered from the concourses.

Exhibit 5.3-14: Baggage Handling System Diagram – Arrivals

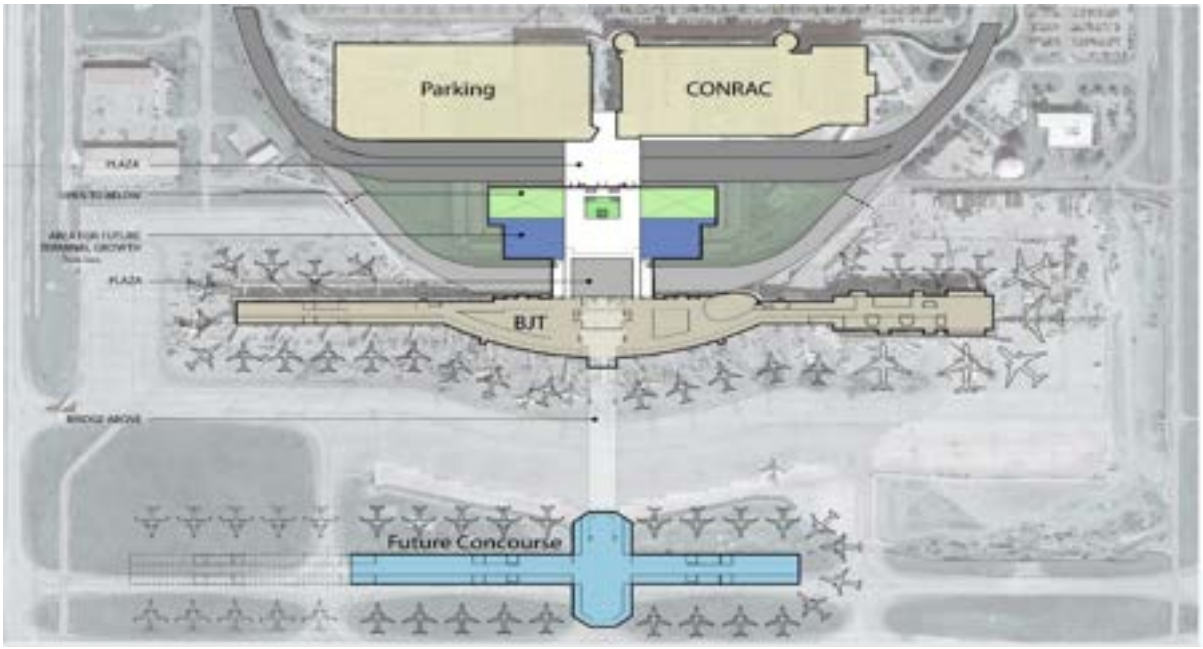


Source: Page Southerland Page, Inc.

5.3.7.1.6 Midfield Concourse

For the airside expansion, a new Midfield Concourse provides much needed additional gate capacity as shown in **Exhibit 5.3-15**. Given the existing parallel runway configuration, a new midfield concourse is an extremely efficient configuration for adding gate capacity while maintaining efficient airfield operations. The airport midfield area also offers ample space for future growth beyond 2040 with the potential for multiple future midfield concourses continuing south of the midfield taxiways.

Exhibit 5.3-15: Midfield Concourse Plan Diagram – Concourse Level



Source: Page Southerland Page, Inc.

Connectivity to the new Midfield Concourse is proposed via an overhead bridge as illustrated in **Exhibit 5.3-16**. The bridge is designed to allow a single ADG-V aircraft to taxi underneath, or two ADG-III aircraft to taxi underneath simultaneously. This aircraft taxi capability is to support growing international travel, as the current Customs International Arrivals hall will remain on the east side of the Barbara Jordan Terminal.

The connector bridge is expected to have both an automated people moving system, such as a PRT system, as well as space for passengers to walk, should they choose that option. The bridge could also contain the baggage transport sub-system; underslung below the pedestrian spaces to connect baggage between the new Midfield Concourse, BJT, and the New North Terminal baggage handling systems.

Exhibit 5.3-16: Aerial View of Bridge to Midfield Concourse

Source: Page Southerland Page, Inc.

An underground tunnel connection for passengers and baggage should also be considered during the design stage for this connection; however, two aspects of a tunnel might make it less desirable:

- First, ABIA has experienced significant ground water issues with the recent construction of the new de-icing pond, which is not far from where the tunnel would need to be constructed. Ground water issues can pose significant costs, not only with the initial construction of a tunnel, but also with long-term maintenance. This also poses significant risks to the reliability of any automated system conveying passengers and baggage between the New North Terminal and Midfield Concourse.

- Secondly, the passenger experience of a bridge, with daylight and views, is seen as more desirable than a tunnel, and helps ABIA maintain positive impressions with the travelling public.

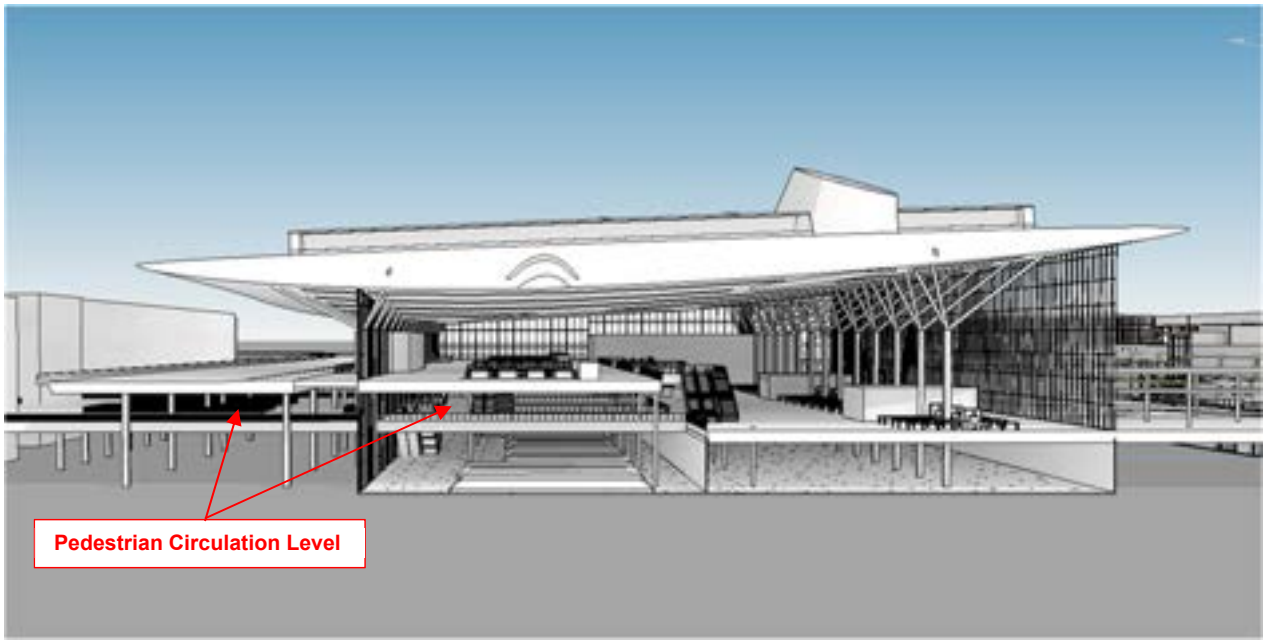
5.3.7.2 Passenger Convenience and Intuitive Wayfinding

The existing BJT has consistently rated very high in passenger experience, including notable honors such as making the list of Aviation Council International (ACI's) World's Best Airports in 2015, and receiving honors from Air Line Pilots Association (ALPA) as the 2017 Airport of the Year. More recently, Airport Experience News recognized ABIA's Executive Director of Aviation, Jim Smith, as the 2018 Director of the Year for "making a positive impact on both passengers and employees at the airport". Per the public outreach and stakeholder engagement performed by the Master Plan team, travelers prefer ABIA for its convenience and ease of wayfinding, which are significant factors to a positive passenger experience.

One of the key circulation changes proposed in the New North Terminal and Midfield Concourse conceptual concept, is creating an intermediate pedestrian circulation level, to remove conflicting circulation paths between pedestrians and vehicular traffic at the roadways as shown in **Exhibit 5.3-17**. The existing curbside at ABIA has five pedestrian crosswalks that impede the flow of

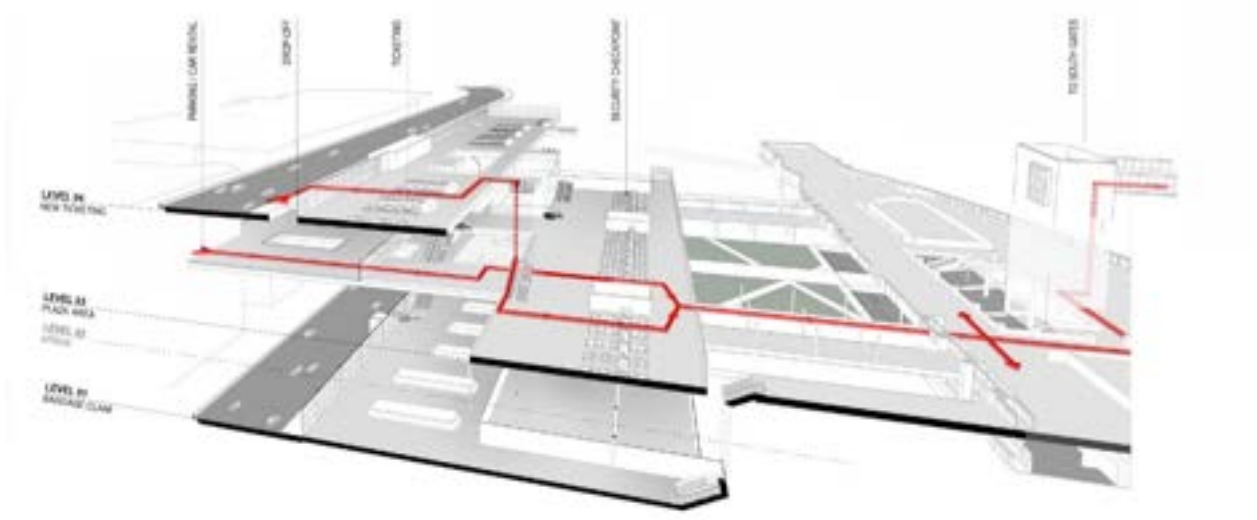
vehicles on the roadway and creates a safety issue for pedestrians. This proposed pedestrian only level allows travelers to proceed directly from the existing parking garages, rental car facility, future ground transportation center and mass transit, directly into the New North Terminal. For travelers who have an e-ticket, they can continue straight on this level to the new security checkpoint and bypass the ticketing area as shown in **Exhibit 5.3-18**. This will also alleviate congestion at the ticketing area for other passengers.

Exhibit 5.3-17: Proposed Intermediate Pedestrian Circulation Level



Source: Page Southerland Page, Inc.

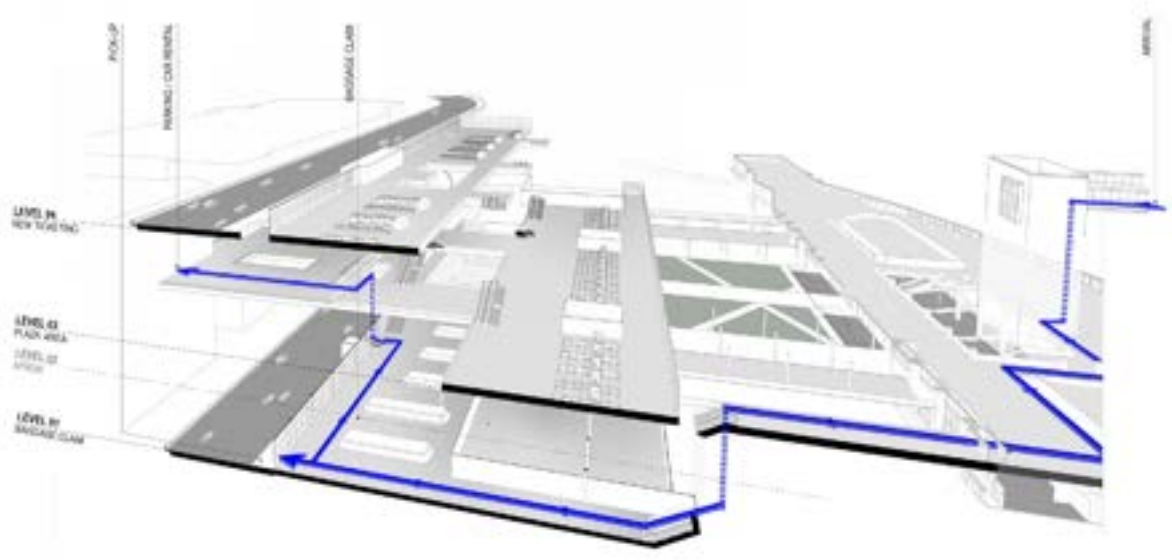
Exhibit 5.3-18: New North Terminal Passenger Circulation Diagram – Departures



Source: Page Southerland Page, Inc.

Similarly, the proposed circulation path for arriving passengers, shown in blue on **Exhibit 5.3-19**, provides a straight path, down one level, from the existing BJT concourse to the new baggage claim area and arrivals curb. For passengers continuing over to the parking garage or rental cars, vertical circulation is provided at the front of the building to move passengers up to the level of the commercial traffic roadway, mass transit providers, CONRAC and parking garage entrances.

Exhibit 5.3-19: New Terminal Passenger Circulation Diagram – Arrivals



Source: Page Southerland Page, Inc.

The New North Terminal open concept of a “pavilion” allows for direct line of sight for passengers as they move through the building as shown on **Exhibit 5.3-20**. The proposed New North Terminal section diagram illustrates a clear and direct path that passengers can take through the building.

Exhibit 5.3-20: New North Terminal Building Section

Source: Page Southerland Page, Inc.

5.3.7.3 Reflecting the Nature and Character of Austin

The fabric of the city includes a multitude of lush outdoor spaces that are at the heart of each residential neighborhood and weave their way through downtown. Outdoor living, whether in your own backyard, a public park, or a downtown cafe, is a staple of the Austin culture. In keeping with this tradition, a new airport courtyard could offer a unique amenity that folds the landscape into the passenger experience. Not only would you be able to step outside and enjoy the fresh air, but you could also have a beautiful view from the new ticketing and security hall. Additionally, the courtyard can be lined with concessions for al fresco dining and impromptu picnics as shown in Exhibit **5.3-21**.

Exhibit 5.3-21: New North Terminal Courtyard

Source: Page Southerland Page, Inc.

The technology industry has become an important part of the identity of Austin. While the city may always be known as the 'music capital of the world', it has rapidly become a high-tech hub. Since technologies evolve so quickly, the best way to showcase the most cutting-edge the industry has to offer is to provide the flexibility for the building to evolve along with the technology. The open nature of the proposed New North Terminal would allow for greater flexibility to easily incorporate new technologies. All of the elements in the ticketing hall and security checkpoints could be replaced or reorganized to accommodate the changing needs of the airport without significant remodeling.

5.3.7.4 "One Airport" Concept

There is a cohesive look and feel to the airport which permeates the existing Barbara Jordan Terminal and should be incorporated into the proposed future North Terminal/Midfield Concourse expansions, as shown on **Exhibit 5.3-22**. This will ensure that the airport maintains its identity within the community and provides a consistent experience for passengers. While the various architectural elements, concessions, and art installations may evolve as the airport grows, it will be important to maintain a consistent thread of these elements throughout and should be considered during the design stage.

Exhibit 5.3-22: New North Terminal/Midfield Concourse (Aerial Image)

Source: Page Southerland Page, Inc.

The existing architectural language is defined by several important features: the gentle arc form along the south façade of the Barbara Jordan Terminal, the ovoid shape of Checkpoint One (East Infill), expressed structural framing, and high-volume spaces filled with natural light. Continuing with this architectural form, the proposed concept for the new midfield concourse mirrors the curved shape of the south façade of BJT with high ceilings in the high-traffic areas and plenty of windows for daylighting. Similarly, the New North Terminal pavilion could make use of high ceilings and an open plan to allow daylight to permeate the space. Additionally, the ovoid shape of Checkpoint One (East Infill) could be repeated in a new West Infill project for BJT, a concessions node in the new midfield concourse and ovoid shaped skylights in the pavilion roof. This is only one conceptual layout of the future North Terminal and Midfield Concourse that could take shape at ABIA, but whatever final design is developed, it is important to assure that it is compatible with the existing airport architecture.

5.3.8 Air Traffic Control Tower Line-of-Sight Analysis

During the Safety Assessment and Management Process review of the preferred airfield layout, the FAA Air Traffic Control identified the potential for line-of-sight issues from the existing tower cab to the airfield "movement areas." These included:

- The new Midfield Concourse blocking view of the existing and relocated Taxiway C.
- The new Midfield Concourse blocking view of the proposed new west Runway 17C-35C.
- Inability to see the new east-west midfield taxiway just north of the ATCT due to its close proximity to the tower.

A preliminary line-of-sight analysis has been conducted to determine the anticipated line-of-sight conflicts associated with the proposed remote concourse preliminary configuration and the proposed taxiway geometry. Recommendations are presented to help minimize or alleviate these conflict areas.

5.3.8.1 Midfield Concourse Line-of-Sight Analysis

A preliminary line-of-sight analysis was conducted from the existing ATCT cab to the existing and proposed airfield movement areas based on the proposed airport development projects. An eye-level elevation of 696.7 MSL (cab floor elevation of 691.2 MSL) and preliminary future building and airfield elevations were used in this analysis. Based on this information, there should be no line-of-sight issues from the existing ATCT to the existing or future airfield movement areas as shown in **Exhibit 5.3-23**.

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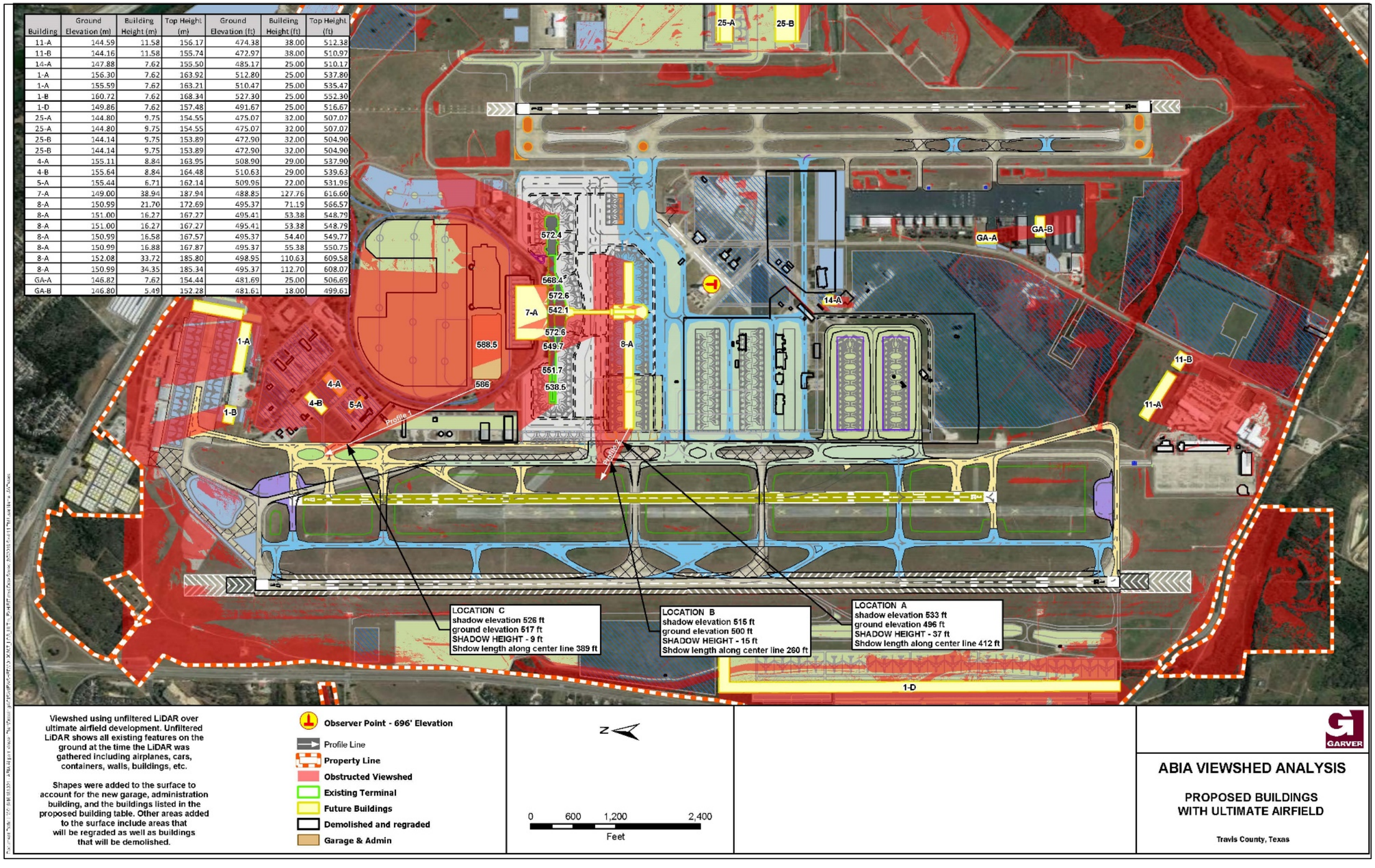
Exhibit 5.3-23: Midfield Concourse Line-of-Sight



Source: Garver

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5.3.8.2 East-West Taxiway Line-of-Sight Analysis

A new midfield east-west taxiway is proposed to be located immediately north of the existing Air Traffic Control Tower. Concerns were raised that portions of this new taxiway might not be visible from the ATCT cab positions due to its close proximity. **Exhibit 5.3-24** illustrates the anticipated view from the ATCT cab to the future midfield east-west taxiway centerline. There should be a good view from each of the three windows in the new midfield east-west taxiway direction. However, there currently is not a single location within the tower cab that has a clear view of the entire taxiway directly adjacent to the ATCT site. The controller will need to move between window areas to track an aircraft as the aircraft taxis past the control tower. The following solutions can be explored further and implemented as necessary:

- Remove the control panel from the north view window to provide a clear view of the entire new east-west taxiway. This will require shifting of equipment within this panel section.
- Install CCTV's in this area with monitors in the ATCT cab.

Exhibit 5.3-24: ATCT View of New East-West Taxiway

Source: Landrum & Brown analysis

It should be noted that the majority of aircraft type operating at ABIA will be visible due to their height along the entire length of this new taxiway. Some small Regional Jet and GA aircraft and ground vehicles might not be fully visible from some cab locations if these actions are not taken.

The new midfield east-west taxiway will require relocation of a portion of the existing auto parking area and security fence. In addition, a few trees will also need to be removed and/or relocated.

5.3.9 Subsequent Detailed Studies

Further refinements to the Preferred Alternative during the advanced planning or preliminary design phase should include the following:

- Detailed engineering and construction phasing analysis to determine whether a tunnel or a bridge connector from the BJT to the Midfield Concourse is the preferred solution for connecting the BJT and the Midfield Concourse. An underground corridor will be required for utilities and potentially baggage transport portions of the baggage handling systems.
- Aircraft movement and taxi time analysis to determine if the taxilanes between the BJT and new Midfield Concourse need to be capable of accommodating ADG-V aircraft as well as ADG-III aircraft. This will significantly impact the clearance height of the bridge if that connector option is selected.
- Location of the primary vertical circulation cores between the BJT and the new Midfield Concourse.
- Detailed evaluation of current and anticipated automated transit technologies and selection of a preferred alternative for connecting the New North Terminal, BJT and Midfield Concourse. Consideration should be given to providing connection between the New North Terminal, parking garages and future ground transportation or intermodal center.
- Future trends for baggage handling include offering the convenience for passengers or their third-party service providers to check baggage away from the curb and lobby ticketing areas. Logical on-airport areas for convenient baggage drop-off may include the parking garage and/or CONRAC. Therefore, potential locations for connecting the baggage handling system with the garages and CONRAC should be considered in conceptual design, thus enabling flexibility for future services by the airport or outside service providers to efficiently get checked bags into the BHS.
- Detailed line-of-sight study from the existing ATCT to the airfield “movement areas” based on the proposed airfield layout and final New North Terminal/Midfield Concourse design. This study will be performed in accordance with FAA Order 6480.4B, *Airport Traffic Control Tower Siting Process* and the Airport Facilities Terminal Integration Laboratory (AFTIL).

5.4 Landside/Transportation Alternative Development and Screening

5.4.1 Terminal Roadway Access

Terminal roadways include Presidential Boulevard and Spirit of Texas Drive that are integral to passengers accessing the parking facilities, rental car area, and terminal curb front. The capacity of these roadways was established by traffic counts at various intersections and along the roadways. The details of the data collection and analysis are found in Chapters 2 and 4.

Level of Service is the key metric used to determine how well, or how poorly, a section of a roadway is performing. Intersection and roadway segment performance was calculated in Chapter 4, *Demand/Capacity Facility Requirements,* for the planning horizon year 2037. The results of that analysis indicated that intersection LOS in the afternoon (PM) period would be E or F for all of the intersections. The morning (AM) period was somewhat better, but since the PM period LOS results were unacceptable, each of the intersections listed in Table 4.7-4 will require changes in signalization and geometry to maintain a LOS C or better.

5.4.2 Terminal Roadway Alternatives

As noted previously, the intersections of SH 71 with Presidential Boulevard and Spirit of Texas Drive will require new designs for moving traffic to and from the Airport by 2037. The ultimate configuration of these two intersections with SH 71 will require modelling to determine the recommended solution. The following paragraphs describe interim and long-term alternatives for these two intersections that will allow a LOS C or better for passengers, staff, and vendors who utilize the terminal roadway system.

Multiple workshops were convened to develop alternatives to reconfiguring the SH 71 intersections with Presidential Boulevard. The various alternatives were narrowed to a few options and presented to the advisory committees and are summarized below.

5.4.2.1 SH 71/Presidential Boulevard Interchange Options

5.4.2.1.1 Braided Left Option (short-term)

This option improves flow by crossing the entering and exiting roadways of Presidential Boulevard. The point of crossing would be configured by a grade separation of the two roadways allowing for free flow in both directions. This option also proposes to elevate the east bound (EB) frontage road (EBFR) over Presidential Boulevard at the same elevation as the SH 71 mainlane crossing. A stop condition would be introduced for the westbound frontage road through movement. This removes the existing conflict points and signals at the east and westbound frontage roads and allows traffic exiting the terminal to proceed without a stop condition to the mainlanes of SH 71.

Vehicles exiting the terminal wanting to go west on SH 71 will proceed through the grade separated crossing underneath the eastbound frontage road and mainlanes, then turn left onto the westbound frontage road and continue to the SH 71 entrance ramp. Vehicles wanting to travel east from the terminal will exit right onto a dedicated lane where they will turn right onto the eastbound frontage road and continue to the SH 71 eastbound entrance ramp.

There is an existing off-ramp on Presidential Boulevard to access Hotel Drive. This off-ramp would be too close to the new entrance for vehicles coming from the east to allow for adequate weaving distance. This traffic movement will be addressed by signage directing westbound traffic wishing

to access Hotel Drive to continue on the westbound frontage road to Spirit of Texas Drive. The proposed Braided Left option is shown on **Exhibit 5.4-1**.

5.4.2.1.2 Diverging Diamond Option (short-term)

This option is similar to the Braided Left option in that it proposes to cross the exiting and entering traffic on Presidential Blvd. and elevating the east bound frontage road to remove the existing conflict points at SH 71. The signature difference in this option is that instead of constructing a grade separated crossing point, the crossing would be at-grade with a signal to control traffic. This option would introduce periodic stop conditions on entering and exiting traffic but would allow the signal phasing to be allocated to prioritize the heaviest volume. The conflict point would be between vehicles exiting to travel west and vehicles entering from the east.

This option also includes the same considerations for Hotel Drive and Cardinal Loop as the Braided Left option. The proposed diverging diamond option is shown on **Exhibit 5.4-2**.

5.4.2.1.3 U-Turn Bridge Option (short-term)

This option proposes to force all vehicles exiting the terminal to turn right onto the east bound frontage road. Vehicles that wish to travel west would continue to a new U-turn overpass over SH 71. This option would remove the stop condition for vehicles exiting the terminal but would add travel distance for westbound vehicles.

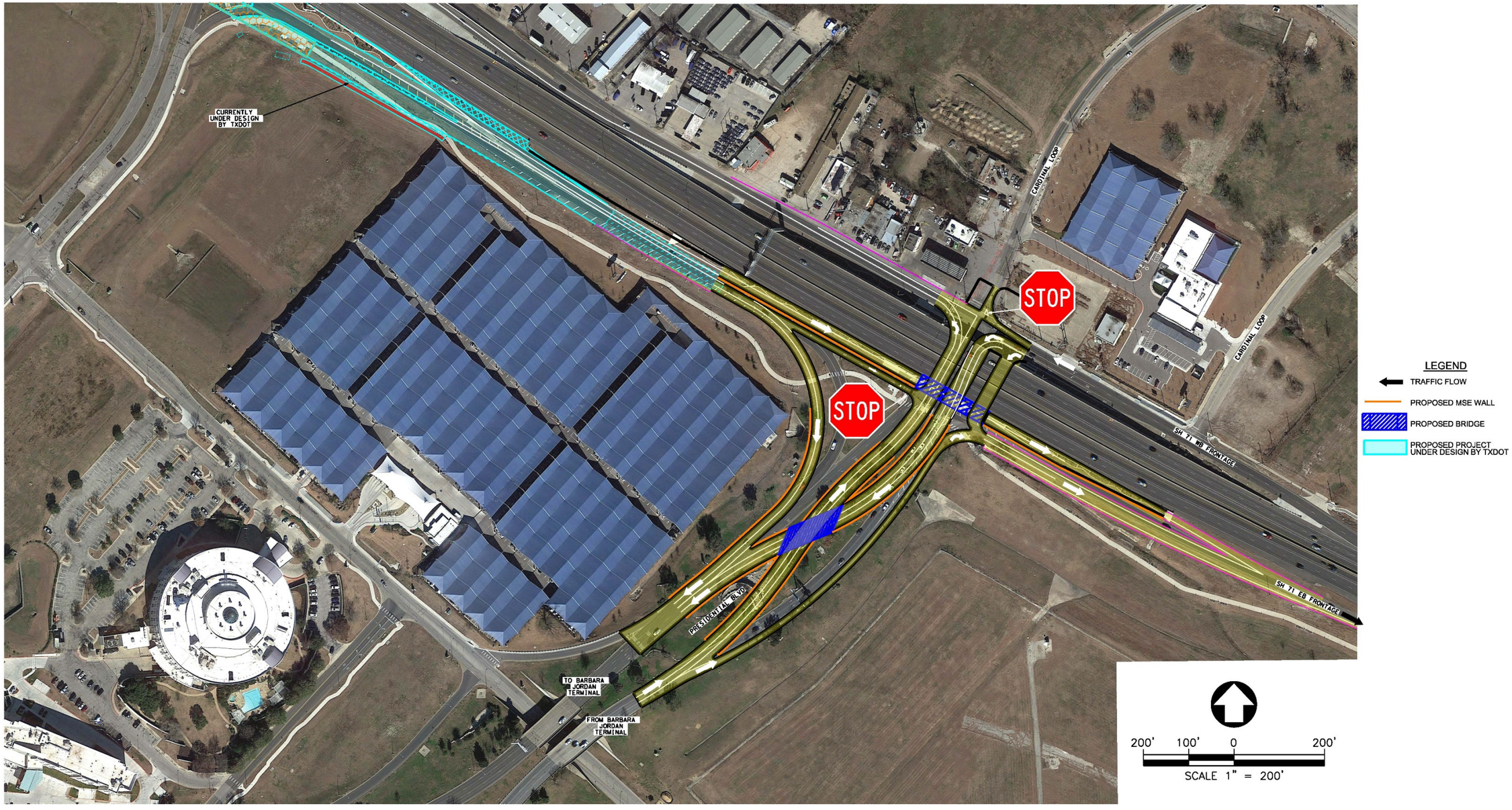
This option would leave all other operations in their existing configuration. The proposed U-turn bridge option is shown on **Exhibit 5.4-3**.

5.4.2.2 Relocated SH 71 (long-term)

This option proposed to relocate SH 71, frontage road, and toll lanes from its existing alignment to the north. This option provides the opportunity to construct direct connectors to and from the relocated SH 71 alignment. This would allow for future entering and exiting vehicles unimpeded flow to and from the terminal. Relocating SH 71 would also provide the opportunity to develop the area between the new SH 71 alignment and the New North Terminal for other airport-related and commercial development uses, like a Ground Transportation Center. Since the entrance road from SH 71 would be longer, it also provides opportunities for a signature entrance to establish a sense of place that they are entering the airport. The proposed relocated SH 71 option is shown on **Exhibit 5.4-4**.

As previously noted in Section 5.2.1.2, it is recommended that existing Runway End 17L be extended in the future to be comparable in length to existing Runway 17R-35L. This will help to balance the runway usage by long-haul international aircraft and cargo aircraft operations. Relocation of SH 71 to the north will allow this runway extension to happen. An additional, study will be required to determine the exact Runway 17L extension length, while providing the necessary safety and clearance areas.

Exhibit 5.4-1: Braided Left Option (Short-term)



Source: K. Friese + Assoc.

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Exhibit 5.4-2: Diverging Diamond Option (Short-term)

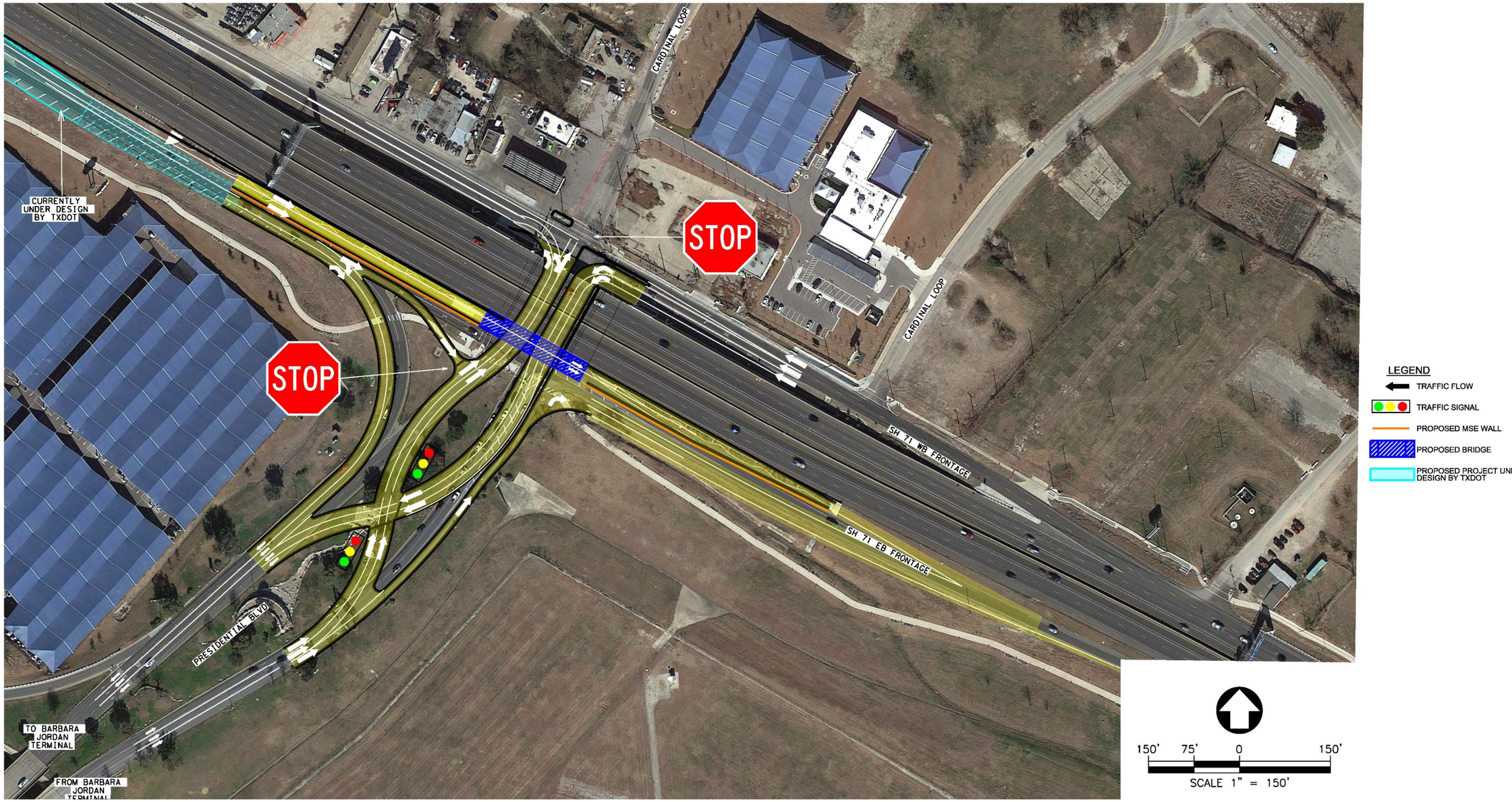

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Exhibit 5.4-3: U-Turn Bridge Option (Short-term)

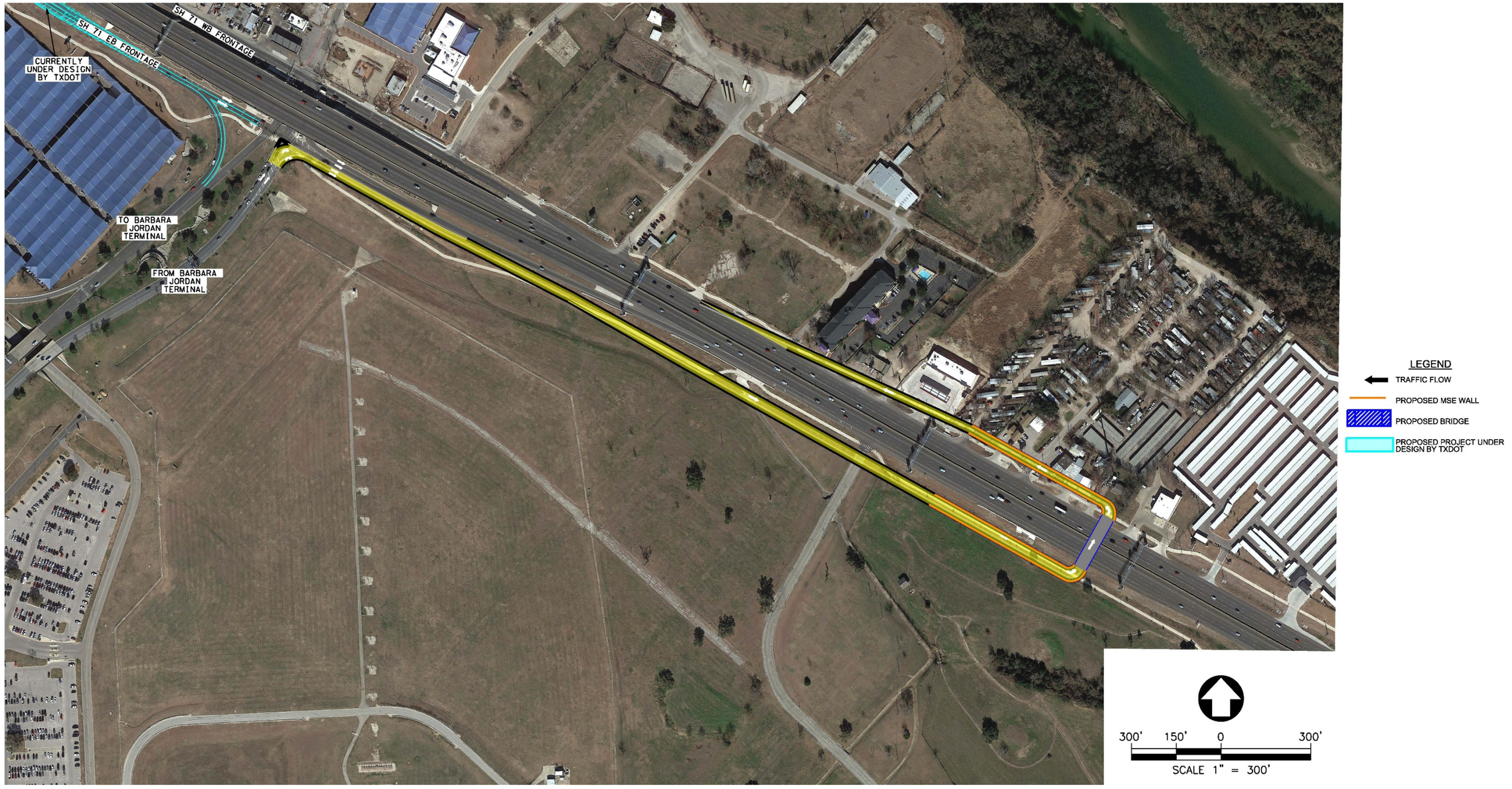

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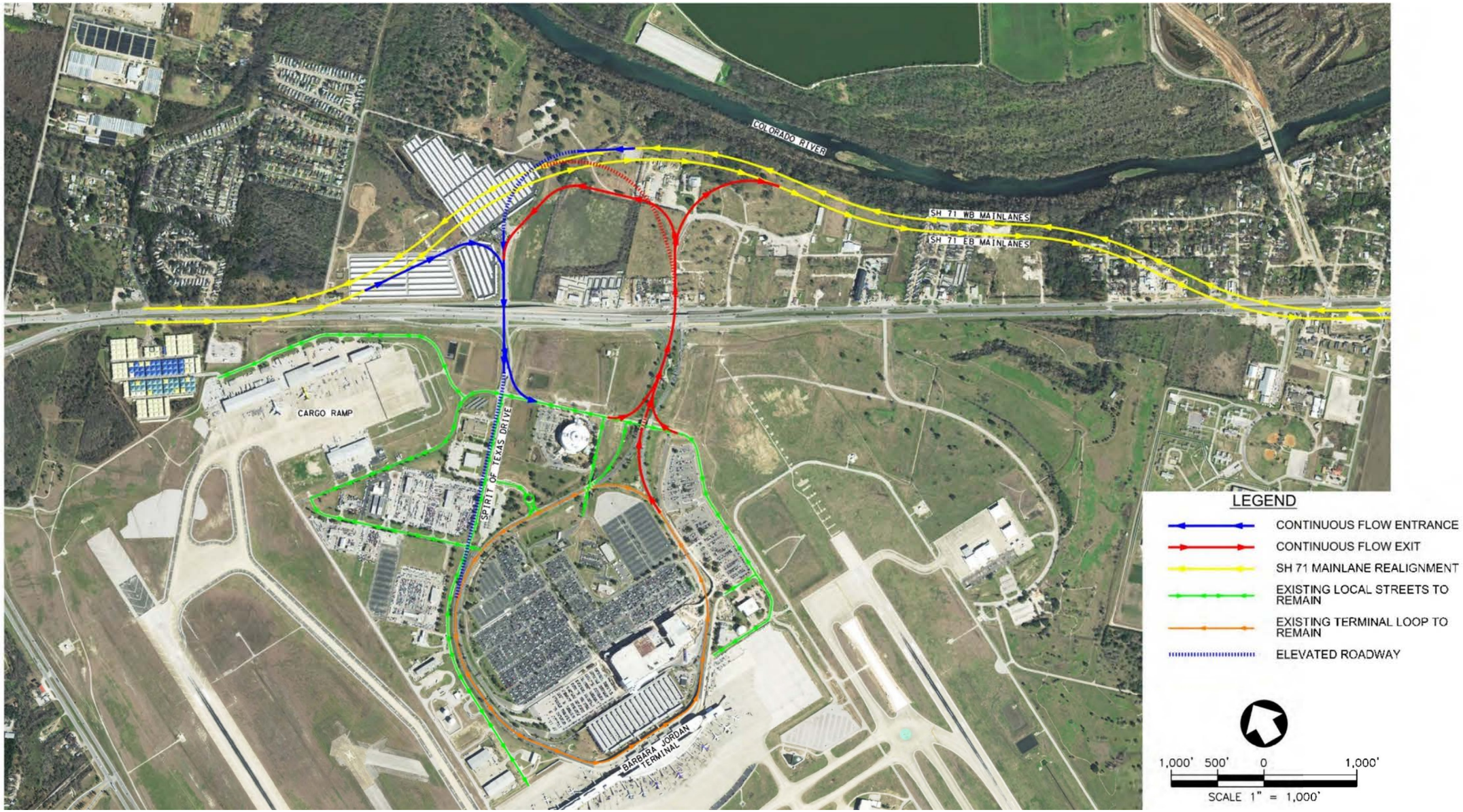
Exhibit 5.4-4: Realign SH 71 (Long-term)



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5.4.2.3 Roadways North of SH 71

Relocation of the employee parking and future non-aeronautical aviation development on the north side of SH 71 will require additional connectivity needs in this area. This will require extension of Spirit of Texas Drive to the North, and Crozier Lane to the west, so that these roads connect and create a loop. This will allow more options for connectivity from the areas north of SH 71 to the terminal area. Including giving more options for access for the existing fire station that exists on Cardinal Loop.

Additionally, the recommended Braided Left option on Presidential Boulevard would impact the circulation of Cardinal Loop as it will no longer be possible for traffic to access Presidential Boulevard directly from Cardinal Loop, as a portion of the road will be made one-way only allowing northbound traffic from the SH 71 intersection. While the rest of Cardinal Loop will remain two-way, vehicles wishing to access Presidential Boulevard would be required to circulate in a clockwise direction and turn right onto the westbound frontage road from the eastern roadway. Once they enter the frontage road, they will be able to turn left onto the Presidential Boulevard entrance. They will also be able to take the U-turn to travel east or continue straight to access westbound SH 71. Or with the completion of the Spirit of Texas Drive and Crozier Lane extensions, access to Spirit of Texas Drive and the terminal area will be possible from Cardinal Loop. The proposed roadways north of SH 71 are shown on **Exhibit 5.4-5**.

This change in traffic flow on Cardinal Loop will require the off-airport Fire Engine Company #42 to travel approximately 800 feet farther to gain access to the terminal building (landside). However, it is anticipated that this extra travel distance will not increase the travel time but will be quicker since there will be a free-flow access into the terminal area with the proposed Braided Left option configuration, as opposed to the existing roadway signalizations. In addition, the proposed extension of Crozier Lane to Spirit of Texas Drive will provide an additional route to the Airport from the fire station.

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Exhibit 5.4-5: Roadways North of SH 71

Source: K. Friese + Assoc.

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5.4.3 Terminal Curb Alternatives

The results of Chapter 4, *Demand/Capacity Facility Requirements,* identified the extent of future demand and capacity issues with the existing terminal curb (arrivals and departures) as passenger enplanement numbers continue to increase in the future. The LOS will continue to decrease on all the existing curbs, with the arrivals curb experiencing the fastest decline in LOS, both for privately owned vehicles and commercial vehicles. Transportation Network Companies, such as Uber and Lyft, will likely increase their activity and continue to contribute to congestion on both curbs, but especially at the arrivals curb. The departures curb will eventually suffer from a decline in LOS later in the planning period. This difference in the amount of congestion between the departure curb and the arrivals curb is a common pattern. The departing passengers tend to access the curb over a longer period of time and arriving passengers are concentrated in a very short span of time because they are all attempting to exit the airport at the same time.

5.4.3.1 Existing Terminal Curb Alternatives

Existing curb issues have been observed and addressed in two previous studies and the suggested solutions are still valid.[11], [12] This Master Plan collected curb observations via digital video, and it was observed that the primary cause of congestion on the arrivals curb was from Privately Owned Vehicles (POVs) queueing along the approach roadway to be in position to access the two loading lanes. The congestion was caused by trolling vehicles maneuvering around parked vehicles in the process of loading and having to stop at one or more of the five crosswalks. Instead of seeking open curb space further down the curb, the tendency is for vehicles to queue at the beginning of the curb, resulting in a backup along the approach roadway, thereby hindering those who may want to move further down the curb. Following are recommendations from this Master Plan and previous terminal curb studies for ABIA to implement in order to help improve the operational efficiency of the POV curb and help alleviate congestion until the New North Terminal curb is operational in approximately 2025.

1. Encourage motorists to not que at the beginning of the curb and use the through and maneuver lanes to move farther down the curb. This can be accomplished in several ways.
    a. Using signage to direct passengers from designated curb areas along the full curb length. This can be done through signage directing them to a lettered column or to a color-coded curb zone that may be easier to see by both passenger and motorist.
    b. Use signage to direct passengers not using the baggage carousels to exits along the curb that are closer to the end of the curb.

[11] Engineering Report for Curbside Improvement Project, February 2013, and Final Curbside Operations Analysis, December 2013, Ricondo & Associates.
[12] Final Curbside Operations Analysis, December 2013, TransSolutions.

2. Reduce the number of pedestrian crosswalks on the arrivals level to reduce the number of conflict points with pedestrians and vehicles. Where this is not feasible, consider signalizing the crosswalks during peak periods to meter the flow of passengers using the crosswalks. Also consider moving the Capital Metro loading area and other lesser used commercial vehicles to the beginning of the commercial curve and concentrate higher utilized commercial vehicles, such as the parking shuttles, as far-east along the curb as possible.
3. Provide staffing at peak arrival times to manage the movement of vehicles and passengers along the entire curb to reduce congestion and assure vehicles are following the policies of the airport concerning loading and unloading.
4. Move all TNC activity to the upper level (departures) curb. This will involve new terminal signage and a public information program. Moving all TNC activity to the upper level curb will alleviate some of the POV traffic accessing the arrivals curb. Since the arrival and departure banks are somewhat cyclic, it should not tax the capacity of the upper level curb since the arrival and departure passenger streams will occur at different times with minimal overlap.
5. Move TNCs into designated stalls on the first floor of the existing short-term parking garage or CONRAC. TNC drivers would text their passenger the number of the stall and the passenger would cross the roadway via the existing crosswalks, preferably towards the east end of the curb, to meet their ride. ABIA is in the process of converting the CONRAC facility for this to occur in late 2017 (after this analysis was conducted).

5.4.3.2 Future Curb Length Allocation and Design

In 2037, the arrival curb demand length for POVs will be 990 feet as shown in **Table 5.4-1**. Since the portion of the arrivals curb used by POVs/TNCs is currently the most congested at ABIA, the length required for this curb was the critical length used to lay out the New North Terminal curb alternatives. The arrivals curb length was set at 1,000 feet which will meet the 2037 demand. Based on a benchmarking study of similar size airports, the curb demand length from Table 5.4-1, and discussions with the ABIA staff, the specific curb lengths were determined for each mode of transportation as shown in **Table 5.4-2.**

The proposed New North Terminal curb roadway will be located between the proposed New North Terminal processor and the existing Parking Garage #3 and CONRAC. There is sufficient space, both in length and width, to accommodate the terminal curb and entrance roadway ramps to serve the arrival and departure curb length requirements**.**

Table 5.4-1: Future Curbside Demand

MODE	DEMAND LENGTH [ft.]	CURBSIDE LOADING/ UNLOADING EFFECTIVE LENGTH [ft.]	CURB UTILIZATION RATIO	LOS BASED ON UTILIZATION FACTOR
PAL 1 (2019)				
Departure (Upper) Curb				
Privately Owned Vehicle	810	820	0.99	B
On-Site Parking Shuttle	114	200	0.57	A
Off-Site Parking Shuttle	228	210	1.09	B
Arrival (Lower) Curb				
Privately Owned Vehicle	810	540	1.5	D
Taxi	750	590	1.27	C
On-Site Parking Shuttle	114	210	0.54	A
Off-Site Parking Shuttle	228	210	1.09	B
Transit	114	180	0.63	A
PAL 2 (2022)				
Departure (Upper) Curb				
Privately Owned Vehicle	810	820	0.99	B
On-Site Parking Shuttle	228	200	1.14	C
Off-Site Parking Shuttle	228	210	1.09	B
Arrival (Lower) Curb				
Privately Owned Vehicle	810	540	1.5	D
Taxi	780	590	1.32	D
On-Site Parking Shuttle	114	210	0.54	A
Off-Site Parking Shuttle	228	210	1.09	B
Transit	114	180	0.63	A
PAL 3 (2027)				
Departure (Upper) Curb				
Privately Owned Vehicle	810	820	0.99	B
On-Site Parking Shuttle	228	200	1.14	C
Off-Site Parking Shuttle	228	210	1.09	B
Arrival (Lower) Curb				
Privately Owned Vehicle	810	540	1.5	D
Taxi	810	590	1.37	D
On-Site Parking Shuttle	114	210	0.54	A
Off-Site Parking Shuttle	342	210	1.63	D
Transit	114	180	0.63	A
(2032)				
Departure (Upper) Curb				
Privately Owned Vehicle	810	820	0.99	B

MODE	DEMAND LENGTH [ft.]	CURBSIDE LOADING/ UNLOADING EFFECTIVE LENGTH [ft.]	CURB UTILIZATION RATIO	LOS BASED ON UTILIZATION FACTOR
On-Site Parking Shuttle	228	200	1.14	C
Off-Site Parking Shuttle	228	210	1.09	B
Arrival (Lower) Curb				
Privately Owned Vehicle	870	540	1.61	D
Taxi	810	590	1.37	D
On-Site Parking Shuttle	114	209	0.55	A
Off-Site Parking Shuttle	342	210	1.63	D
Transit	114	180	0.63	A
PAL 4 (2037)				
Departure (Upper) Curb				
Privately Owned Vehicle	870	820	1.06	B
On-Site Parking Shuttle	228	200	1.14	C
Off-Site Parking Shuttle	228	210	1.09	B
Arrival (Lower) Curb				
Privately Owned Vehicle	990	540	1.83	E
Taxi	810	590	1.37	D
On-Site Parking Shuttle	114	209	0.55	A
Off-Site Parking Shuttle	342	210	1.63	D
Transit	114	180	0.63	A

Source: Atkins

Table 5.4-2: Proposed Curb Allocation

MODE	CURB LENGTH REQUIRED [ft.]	CURB LENGTH PROVIDED [ft.]
Privately Owned Vehicles/TNCs	990	1,000
Parking Shuttles	342	460
Hotel Shuttles	(no forecast)	400
Shared Ride (non-TNC)	(no forecast)	120
Taxis	750	750
Limos	(no forecast)	250
Charter/Transit Bus	114	300

Source: Atkins

5.4.3.2.1 Roadway Width and Lane Considerations

Once the future terminal curb length requirements were determined, the width of the roadway (number of lanes) supporting those curbs was determined. A typical roadway lane width of 12 feet was used in accordance with the Texas Department of Transportation. This width provides easy transit for all vehicle sizes anticipated to use the curbs from sedans to commercial busses. Also, 12 feet provides a safety margin for opening and closing vehicle doors when the lane is designated for loading and unloading.

As noted earlier, the arrivals curb servicing POVs/TNCs is the source of most of the curb congestion at ABIA. With this in mind, the 1,000-foot arrivals curb was a critical driver in the design of the curb alternatives and allocation of the anticipated mode users. The typical POVs/TNCs curb width consisted of four 12-foot lanes. The two right lanes are designated as loading lanes for a total of 2,000 feet of curb space devoted to POV/TNC loading. The left lane is devoted to vehicle through movements, while the center left lane is used for vehicles to maneuver to find a loading space. The typical commercial curb consists of three or four 12-foot lanes. The right lane is for loading passengers, the center lanes are designated for maneuvering and through movement of vehicles, and the far-left lane is reserved for the staging of commercial vehicles and does not have a loading curb.

The departures curb width was based on proven layouts used at other airports that have large numbers of loading and unloading passengers. The departures roadway consists of four 12-foot lanes. The two right lanes are designated as unloading lanes for a total curb length of 2,000 feet devoted to unloading. The left lane is devoted to vehicle through movements, and the center left lane is used for vehicles to maneuver to find an unloading space. The departure curb is not segregated by mode and is available for use by all modes along the curb face.

5.4.3.2.2 Roadway Width versus Curb Length Considerations

Both arrival and departure curbs are 1,000 feet in length and meets the overall curb demand length requirement for 2037. However, with two lanes designated for loading and unloading on both the arrivals and departures curb, the effective curb length is actually 2,000 feet. This is twice the amount of curb length needed to meet the 2037 demand. This added departure curb length will provide ample space to accommodate the POV/TNC and commercial vehicles and reduce the potential for congestion during peak operating periods. The same is true for the arrivals curb. Therefore, it is recommended to develop the full 1,000-foot curb length during construction of the New North Terminal processor. There might be some cost savings in not building the elevated departure portions of the curb during the initial build period; however, the added costs and disruption to existing traffic flows to expand these elevated portions in the future would be very disruptive to passengers and traffic congestion. Therefore, it is recommended to construct the entire 1,000- foot long New North Terminal curb during Phase 1 of the development program.

5.4.3.3 Future New North Terminal Curb Alternatives

Following is a list of assumptions used in developing the New North Terminal curb alternatives:

- Pedestrian crossings were not permitted on any curb level. Passengers transitioning between the terminal and new parking garage or CONRAC will use the proposed dedicated passenger walkway above the departures curb level.
- The departures curb was assumed to serve all vehicle modes with no special curb allocation to alleviate congestion at the commercial arrivals curb and to simplify driver decision making.
- The curb servicing privately owned vehicles utilizes four lanes; two for loading/unloading, one for maneuvering, and one for through passage.
- Where possible, the commercial curb utilizes four lanes for better maneuverability and safety.

Four terminal curb alternatives were developed based on the location and size of the proposed New North Terminal building. The alternatives were developed to accommodate the 2037 forecast terminal curb demand, and the integration of driverless vehicles. It is assumed that as driverless vehicles are integrated into the passenger transportation mix, more demand will occur on the privately-owned vehicle portion of the arrivals curb as parking shuttle and taxi demand decreases on the commercial curb.

All the curb alternatives incorporate the following common design aspects:

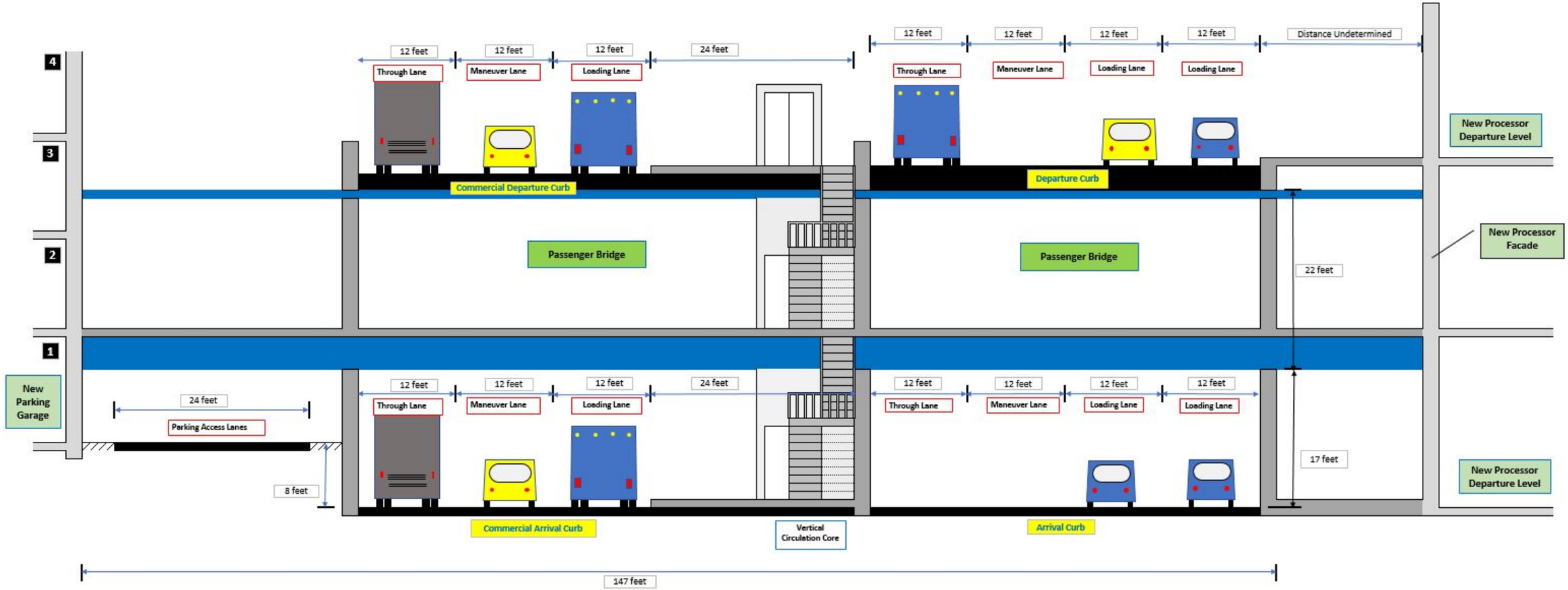
- A dedicated passenger bridge will provide a direct connection between the New North Terminal and the new Parking Garage #3 and existing CONRAC facilities.
- A minimum clearance height of 17 feet is maintained for the commercial curb.
- Each alternative is shown in relation to the new Parking Garage #3 since it is currently under design and the floor elevations are known.
- Spans were kept between 48 and 60 feet to accommodate lane widths and raised curbs, and to keep the depth of the curb deck from becoming too thick, in excess of five feet.

5.4.3.3.1 Alternative A (Full Service – Two Level Curb)

Alternative A is similar to the curb layout at the existing terminal; however, the curb length is significantly longer. The total curb width is 147 feet from the new parking Garage #3 face to the beginning of the raised curb for the New North Terminal processor (see **Exhibit 5.4-6**).

This is a two-level curb with departures using the upper level curb and arrivals the lower level curb. The departure curb is split into two curbs, one for privately owned vehicles and the other for commercial vehicles as shown in Exhibit 5.4-6. The inner departure curb consists of four 12-foot lanes – two loading lanes, one maneuver lane, and one through lane. Only POVs and TNCs will utilize this inner arrival curb. There are no pedestrian crosswalks and there will be 2,000 feet of curb length available (two loading lanes) to accommodate POVs and TNCs.

Exhibit 5.4-6: Alternative A (Section View)



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The upper level commercial departure curb will accommodate all commercial vehicles, such as, taxis, shuttles, commercial busses, limos, transit busses, and commercial vans. Passenger access to the commercial departure curb is via two dedicated passenger bridges connecting the New North Terminal building to the new Parking Garage #3 and the existing CONRAC. There will be a vertical core from the passenger bridges to the outer commercial departure curb that includes elevators, escalators and stairs.

The lower level (arrival) curb has a layout identical to the upper level departure curb with the same distribution of vehicle spaces for POVs/TNCs and commercial vehicles. The vertical circulation core that serves the upper level curb from the passenger bridges will serve the lower level commercial arrival curb. The vertical clearance between the lower level roadway surface and the passenger bridge is a minimum 17 feet to permit access for large commercial busses and emergency vehicles (fire trucks). To obtain the 17-foot clearance, the arrivals curb was depressed eight (8) feet below the level of the access lanes for the new Parking Garage #3 based on the passenger bridge elevation. **Exhibits 5.4-7** and **5.4-8** show details of the lower level arrivals curb allocations. **Exhibits 5.4-9** and **5.4-10** show details of the upper level departures curb allocations.

The positive and negative attributes of Alternative A are as follows:

Positive Attributes:

- Commercial and POV drivers who frequent the Airport will find this alternative similar to the existing terminal curb layout.
- Signage is simple requiring only one decision point for POV drivers and one decision point for all drivers.

Negative Attributes:

- Departing passengers will have to descend to the passenger bridge via the vertical circulation core and then proceed to the departure level of the terminal processor. While this eliminates the crosswalks, it creates a longer, multiple level change path to the ticketing level of the New North Terminal building.

5.4.3.3.2 Alternative B (Two Level Curb with GTC)

Alternative B retains the two-level curb configuration similar to Alternative A but removes the lower level outer commercial arrivals curb. All commercial vehicles, including TNCs, serving arrival passengers will be located in a future Ground Transportation Center on the first level of the existing CONRAC facility. Commercial vehicles will continue to drop off departing passengers on the upper level departures curb. The upper level departure curb and lower level arrival curb will have the same layout as Alternative A with each having four 12-foot lanes. **Exhibit 5.4-11** shows the curb layout in section view. **Exhibits 5.4-12** and **5.4-13**, show details of the lower level arrivals curb allocations. **Exhibits 5.4-14** and **5.4-15** show details of the upper level departures curb allocations.

One option for a GTC facility that can quickly be put into service is using the first floor of the existing CONRAC for taxis, limos, and TNCs. Currently this first floor is being used for passenger parking. The minimum height clearance on the existing first floor entrance is approximately 7 feet -8 inches at the clearance bar, with a 9 foot-4.8-inch clearance inside the CONRAC structure. This clearance height limits the type of vehicle that can be accommodated to automobiles and small vans. Hotel shuttle busses and regional busses will not be able to use this interim GTC facility. With the expanded terminal curb length provided, a curb area can be designated to accommodate the larger commercial busses, which will require a minimum of 114 feet of curb length. By providing 160 feet of curb, three 40-foot busses could easily be accommodated simultaneously without any impact on the POVs using the same curb. **Exhibit 5.4-16** illustrates a potential configuration for the GTC inside the existing CONRAC. Vehicles would enter the first floor through the emergency vehicle access gate on the west side of the facility. Users would then proceed down one of the four aisles reserved for GTC users. Three of the aisles would accommodate taxis and one aisle would accommodate TNCs and limos. This would be a one-way flow from north to south to the common west-east travel way that serves the private vehicle garage parking area. The taxis, limos, and TNCs would exit the garage using the same exist gate as the public vehicles. GTC users could be issued an exit card or tag to allow them to exit the garage through the toll booth. A pricing structure could be established that charges them at exit if an exit card or tag was not used to track usage.

The GTC configuration shown in Exhibit 5.4-16 would provide approximately 730 feet of curb length for taxis, 18 spaces for TNCs, and 23 spaces for limos. The TNC and limo space allocation should be reassessed each year to make necessary adjustments in the curb demand and allocation. The proposed GTC configuration would eliminate 14 designated handicap spaces and 113 premium parking spaces.

The positive and negative attributes of Alternative B are as follows:

Positive Attributes:

- POV drivers who frequent the Airport will find this alternative similar to the existing terminal curb layout.
- Signage is simple requiring only one decision point for POV drivers and one decision point for all drivers.
- TNCs are completely removed from the lower level arrivals curb which will reduce congestion.

Negative Attributes:

- The cost of creating the GTC (barriers, curbs, painting, additional lighting).
- Loss of approximately 113 premium passenger parking spaces and 14 designated handicap spaces.

Exhibit 5.4-7: Alternative A (Lower Level Arrival Curb)

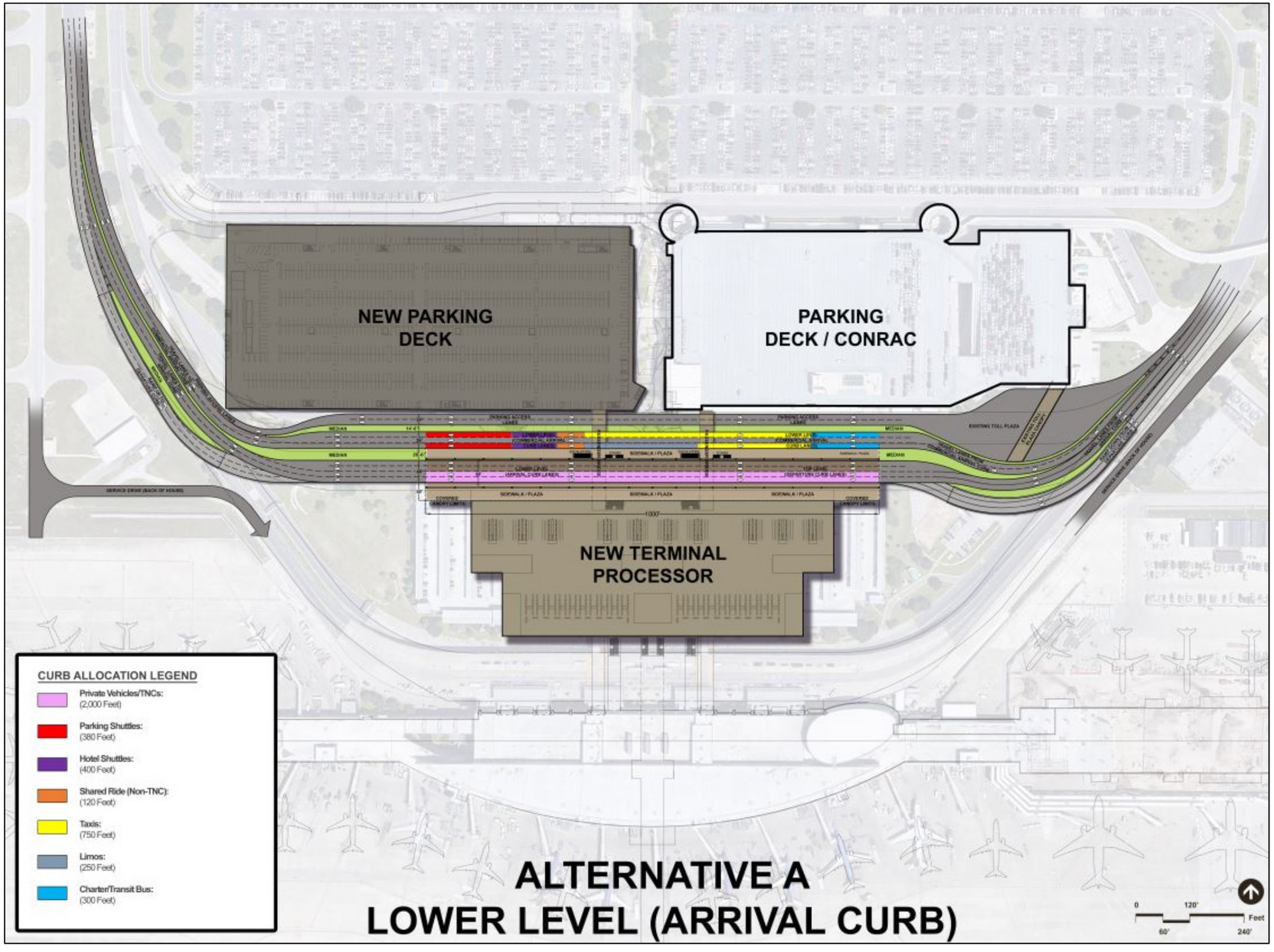

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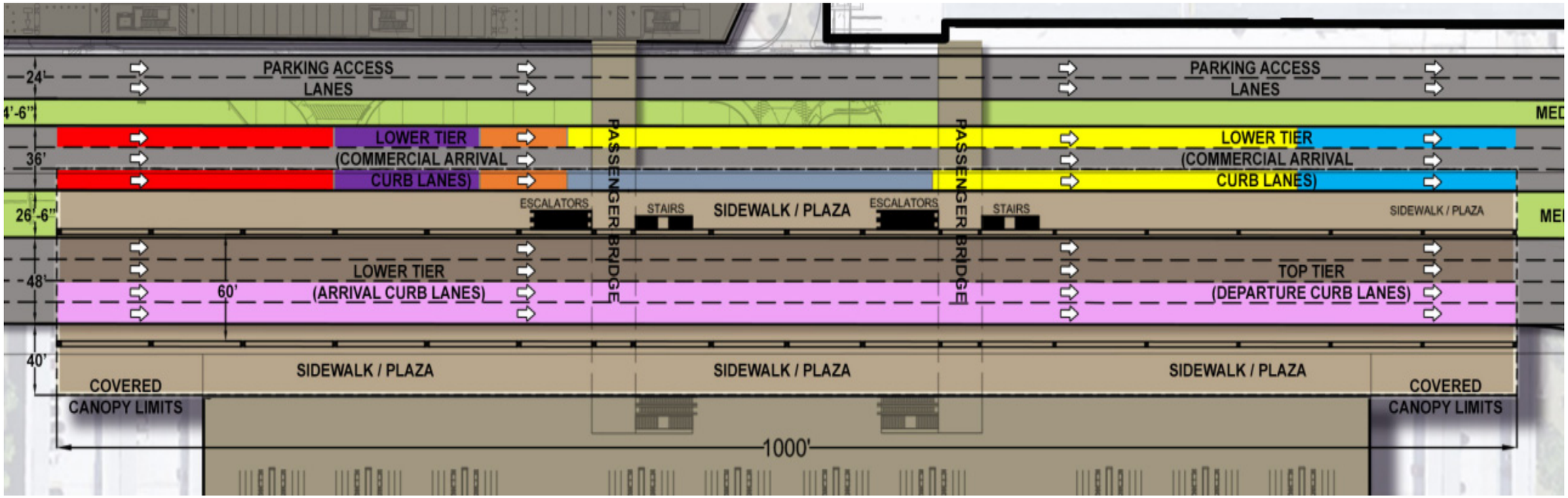
Exhibit 5.4-8: Alternative A (Lower Arrival Curb Detail)



CURB ALLOCATION LEGEND

- Private Vehicles/TNCs (2,000 ft.)
- Taxis (750 ft.)
- Parking Shuttles (460 ft.)
- Limos (250 ft.)
- Hotel Shuttles (400 ft.)
- Charter/Transit Busses (300 ft.)
- Shared Ride (Non-TNCs) (120 ft.)

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Exhibit 5.4-9: Alternative A (Upper Level Departure Curb)

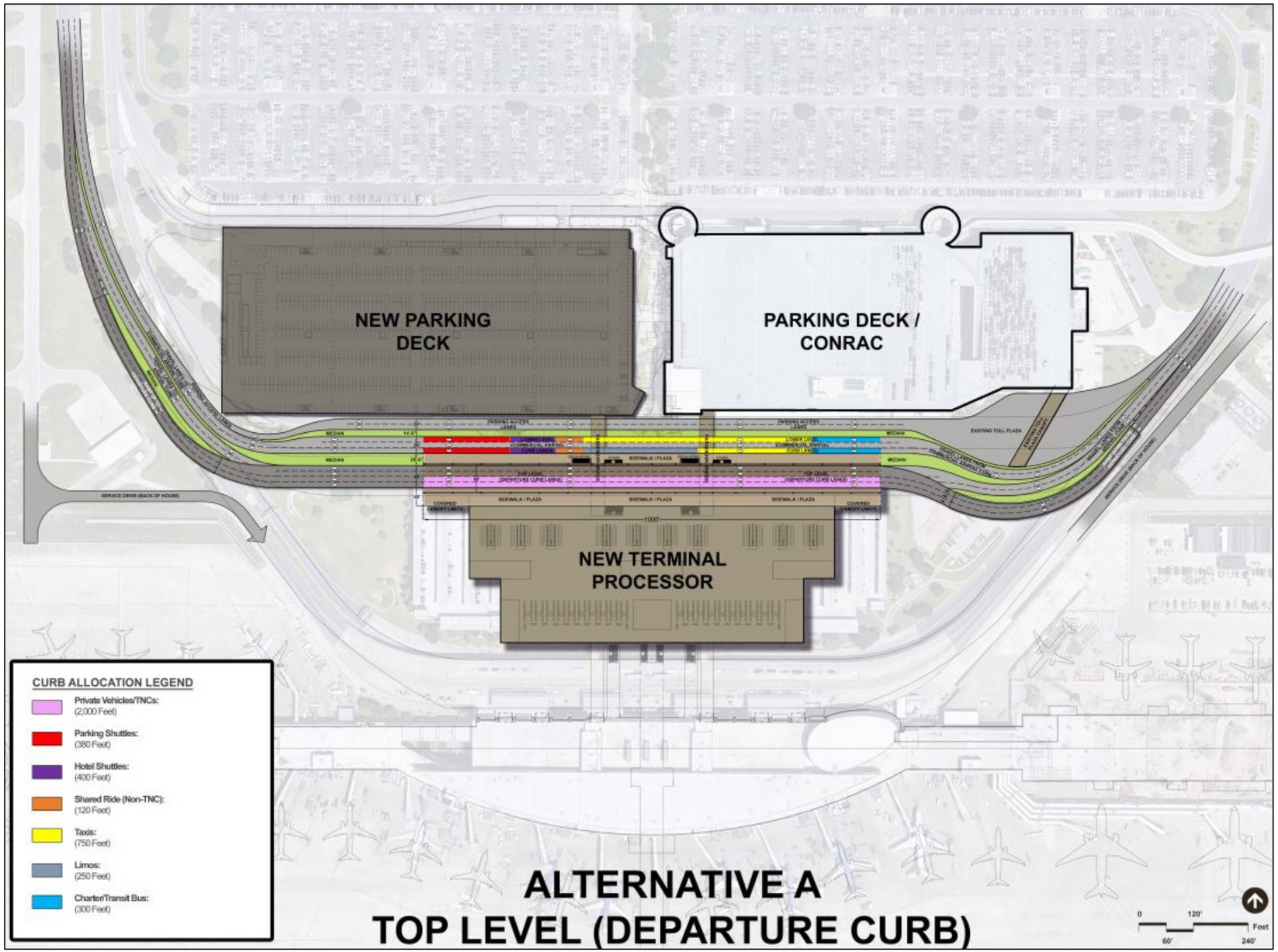

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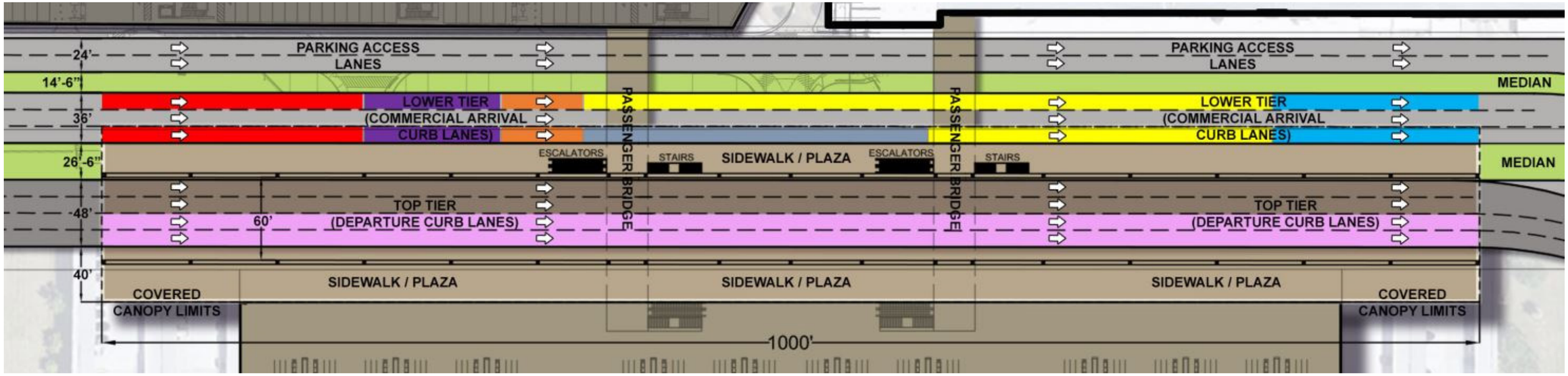
Exhibit 5.4-10: Alternative A (Upper Level Departure Curb Detail)



CURB ALLOCATION LEGEND

- Private Vehicles/TNCs (2,000 ft.)
- Parking Shuttles (460 ft.)
- Hotel Shuttles (400 ft.)
- Shared Ride (Non-TNCs) (120 ft.)
- Taxis (750 ft.)
- Limos (250 ft.)
- Charter/Transit Busses (300 ft.)

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Exhibit 5.4-11: Alternative B (Section View)

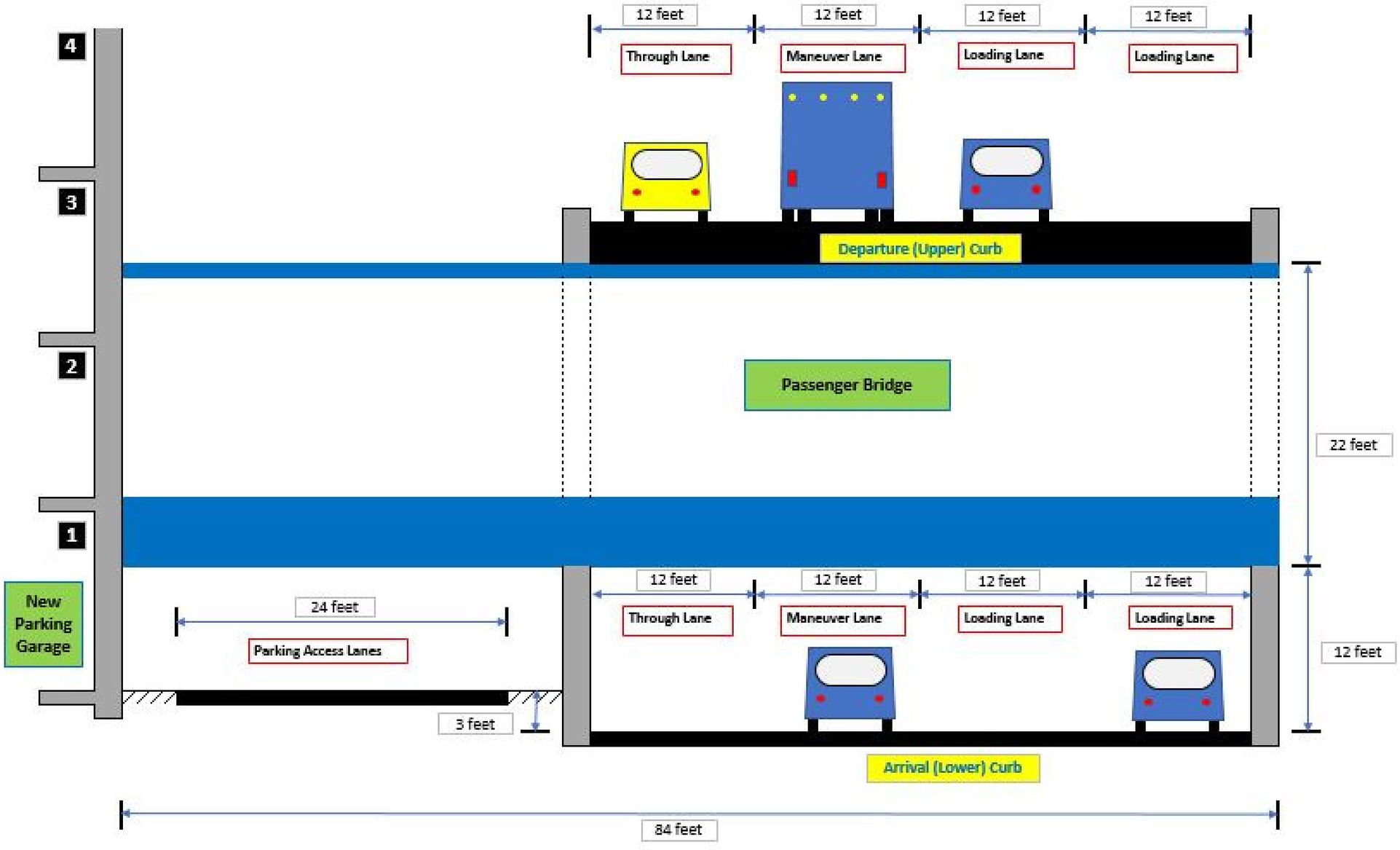

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Exhibit 5.4-12: Alternative B (Lower Level Arrival Curb)

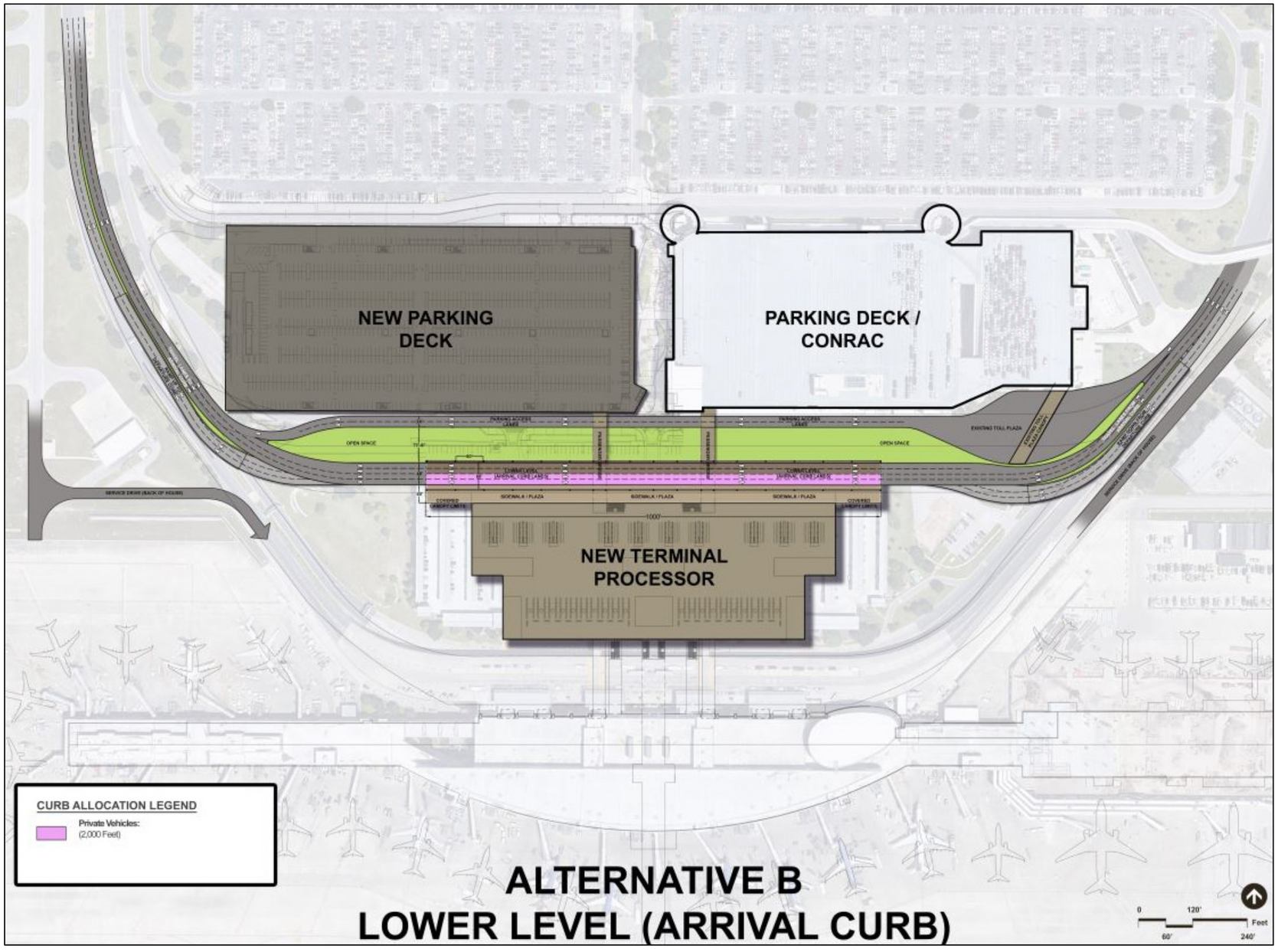

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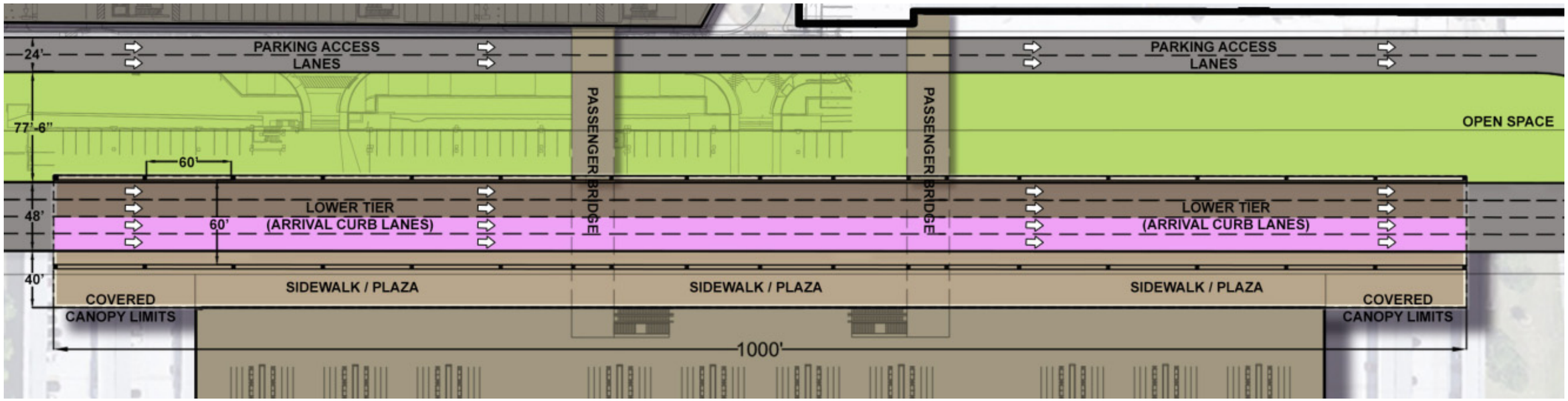
Exhibit 5.4-13: Alternative B (Lower Level Arrival Curb Detail)



CURB ALLOCATION LEGEND

- Private Vehicles/TNCs (2,000 ft.)
- Taxis (750 ft.)
- Parking Shuttles (460 ft.)
- Limos (250 ft.)
- Hotel Shuttles (400 ft.)
- Charter/Transit Busses (300 ft.)
- Shared Ride (Non-TNCs) (120 ft.)

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Exhibit 5.4-14: Alternative B (Upper Level Departure Curb)

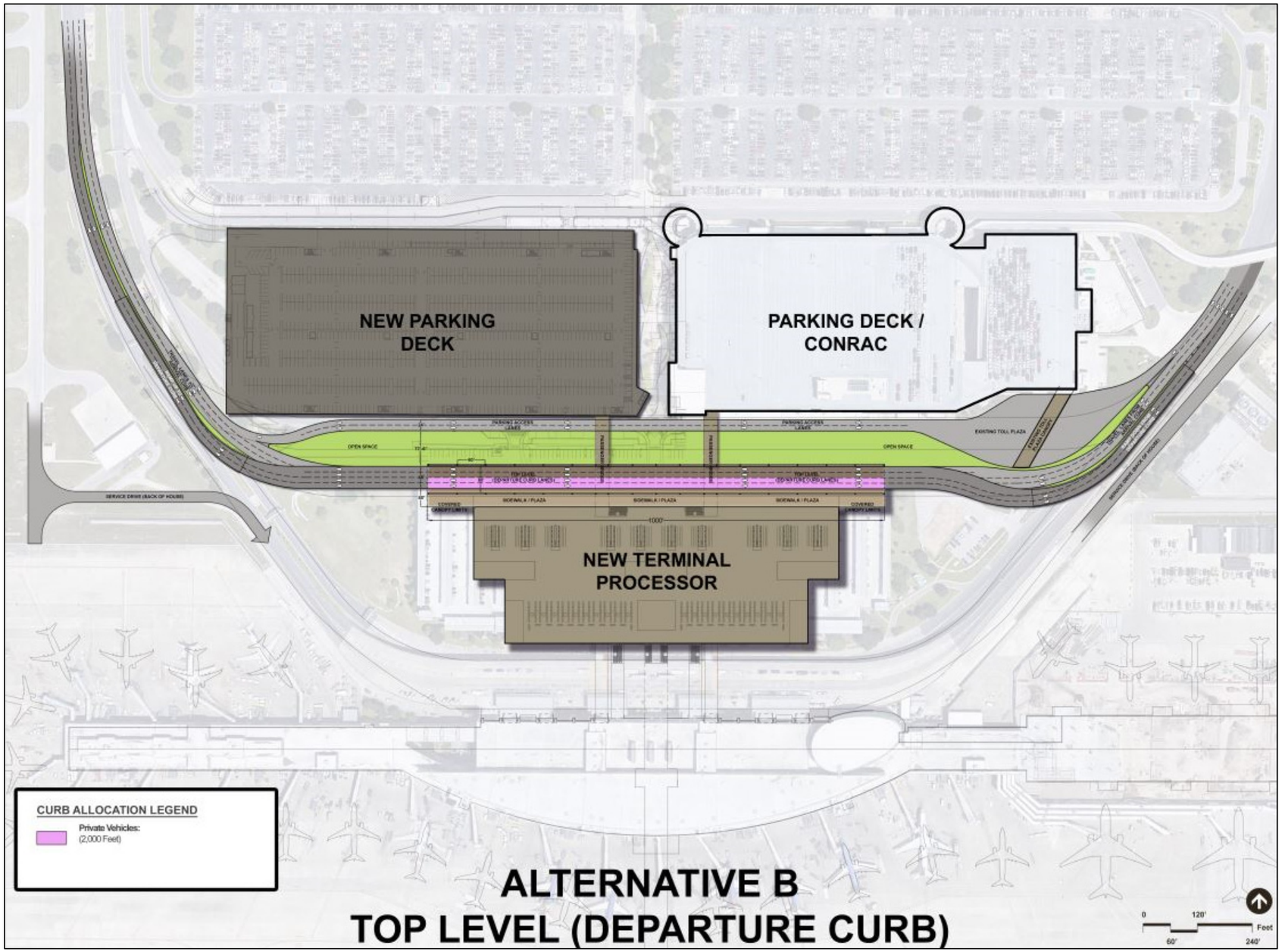

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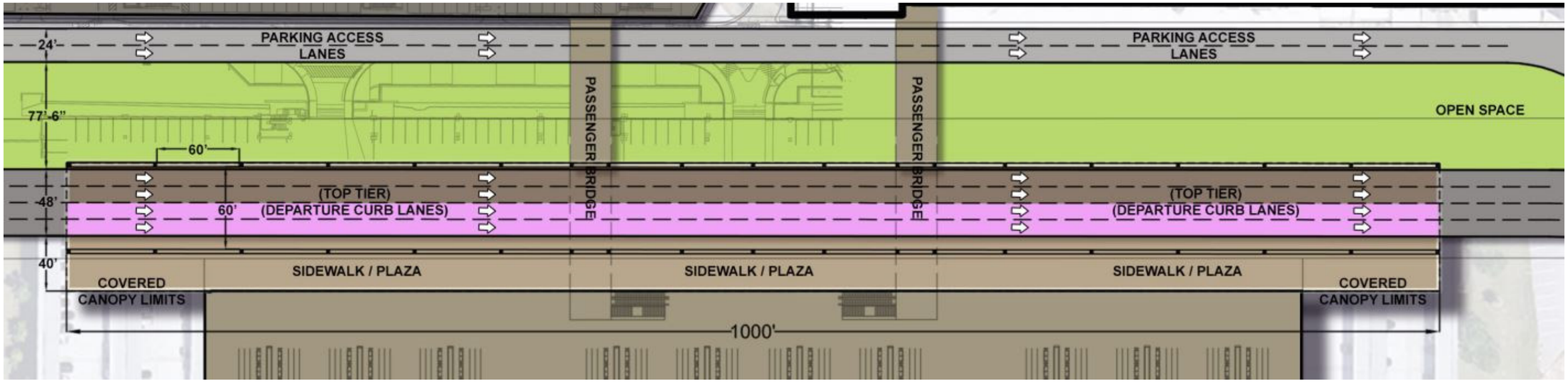
Exhibit 5.4-15: Alternative B (Upper Level Departure Curb Detail)



CURB ALLOCATION LEGEND

- Private Vehicles/TNCs (2,000 ft.)
- Taxis (750 ft.)
- Parking Shuttles (460 ft.)
- Limos (250 ft.)
- Hotel Shuttles (400 ft.)
- Charter/Transit Busses (300 ft.)
- Shared Ride (Non-TNCs) (120 ft.)

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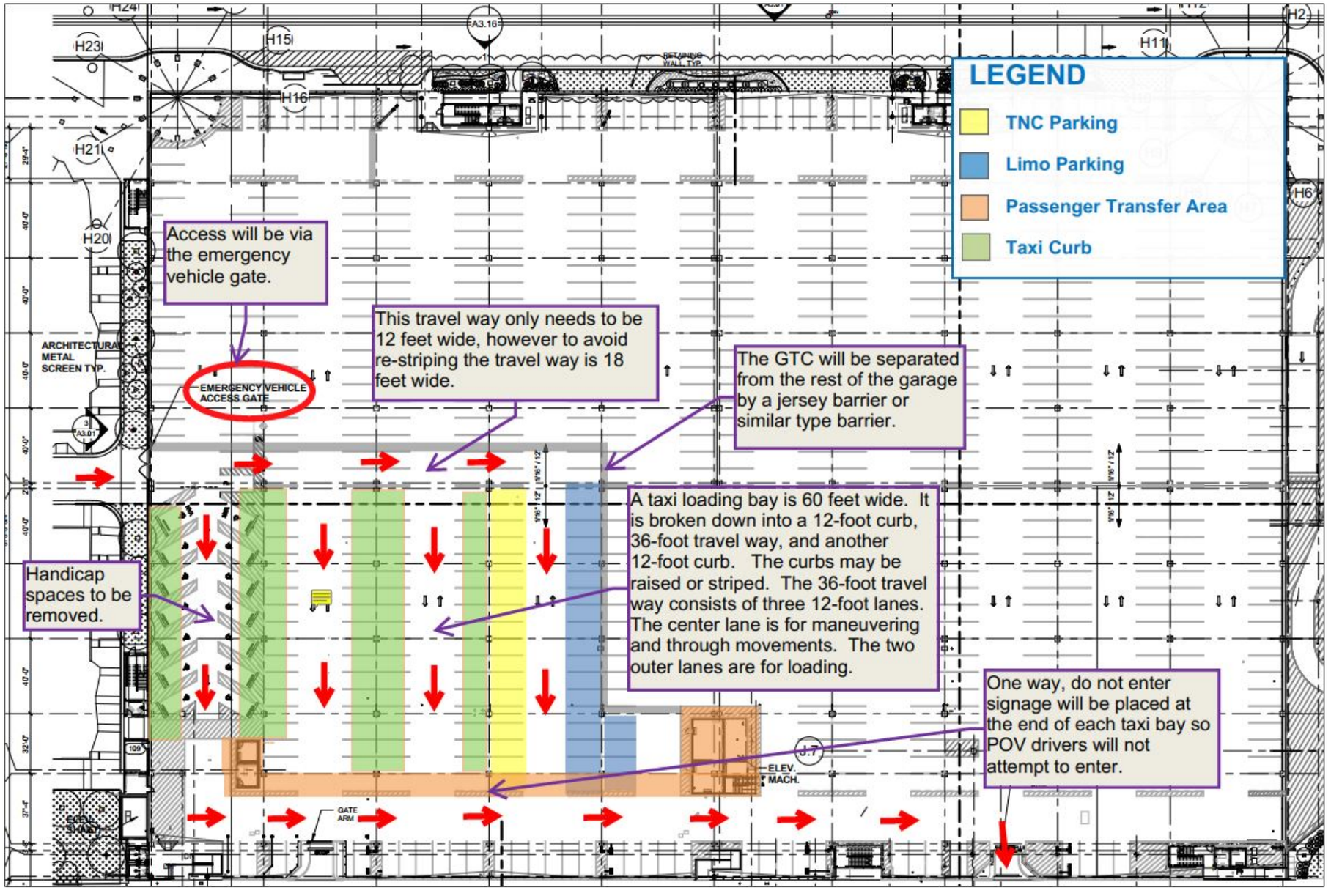
Exhibit 5.4-16: Alternative B – Interim GTC Layout Schematic



Source: ABIA, CONRAC Architectural Drawings

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5.4.3.3.3 Alternative C (Full Service – Three Level Curb)

Alternative C introduces a three-level curb with the departing curb on the top level, the arrivals curb on the middle level, and the commercial arrivals curb on the lower level. All lane dimensions are 12 feet wide, as with the previous alternatives. A profile view of this three-level curb configuration is shown in **Exhibit 5.4-17**, with the departures curb used by all modes, the arrivals curb available to POVs, and the commercial arrivals curb handling all types of commercial vehicles.

Alternative C separates the taxi and limo curb from the shuttle busses, shared ride vans, and commercial/transit busses on the lower level curb as shown in **Exhibits 5.4-18** and **5.4-19**. TNCs will continue to mix with the POV traffic on the upper and middle curbs as shown on **Exhibits 5.4-20**, through **Exhibit 5.4-23**. The taxis and limos will utilize the inner two lanes of the curb, one for maneuvering and one for loading. There is sufficient space for these operations along the 1,000-foot curb length where taxis are forecast to only need 750 linear feet of curb and limos 250 linear feet by 2037. The commercial/transit busses and shuttle busses will occupy three lanes, one for loading, one for maneuvering, and one for staging. There will be 1,000 feet available for bus loading and staging, which is adequate to meet the PAL 4 (2037) demand. Passengers will use the dedicated passenger bridge and vertical circulation core to access the commercial bus/shuttle curbs.

The positive and negative attributes of Alternative C are as follows:

Positive Attributes:

- More width is available for the commercial arrival curb which permits more options for creating curbs and distributing modes.
- TNCs are completely removed from the arrivals curb which will reduce congestion.

Negative Attributes:

- The addition of a third level curb will result in a more complex terminal design and multiple level changes to get departing passengers down to the ticketing level.
- Vertical circulation from the baggage lower level to the middle level arrivals curb for POVs will need to be provided. This could be a counter-intuitive movement for passengers.
- There would be added cost to construct a third level roadway and potential loss of curb length on the top level due to longer access and egress ramps.
- The inner curb on the commercial (lower level) will be like a tunnel requiring additional artificial lighting and ventilation.

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Exhibit 5.4-17: Alternative C (Section View)

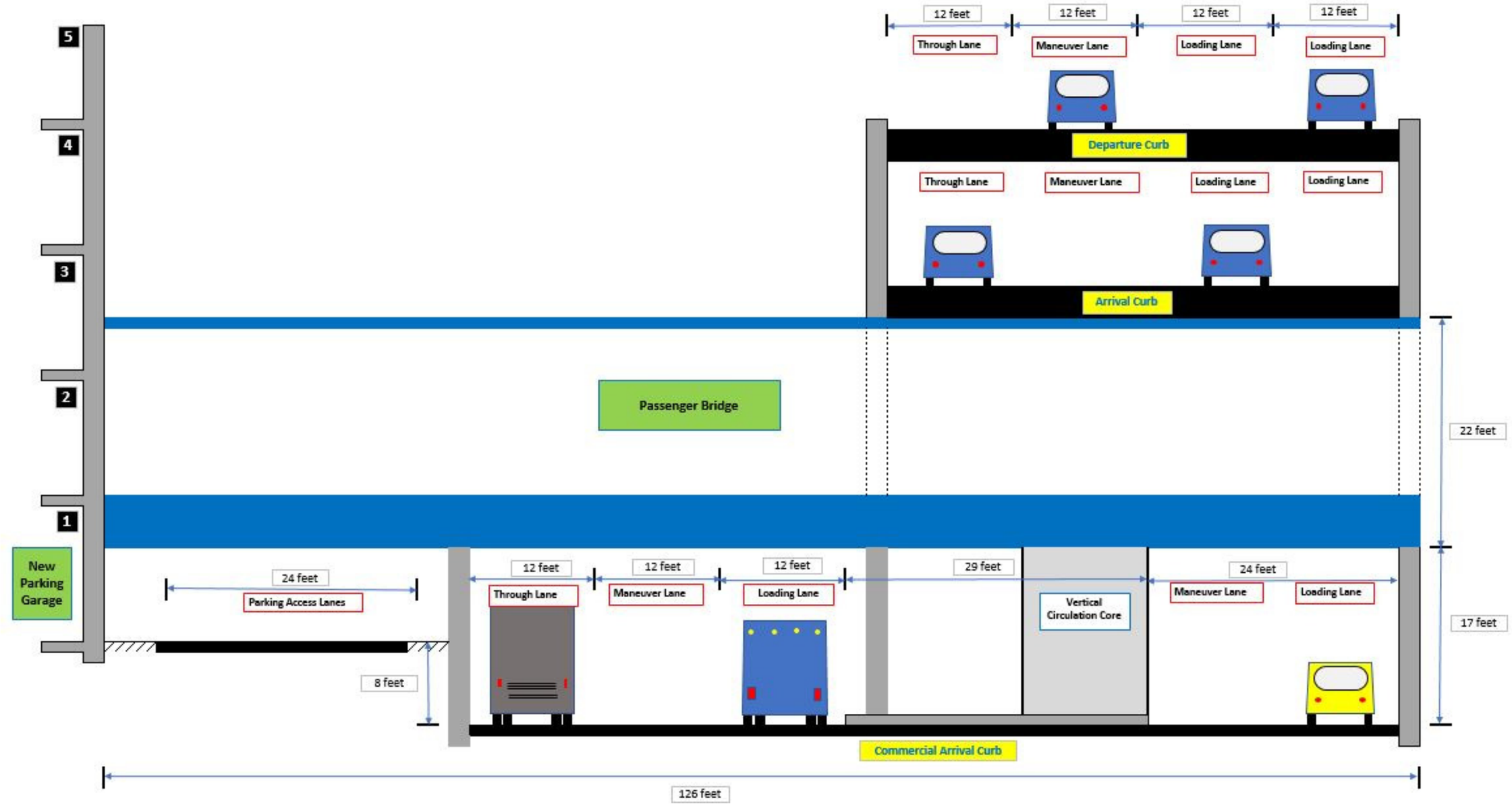

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Exhibit 5.4-18: Alternative C (Lower Level Commercial Arrival Curb)

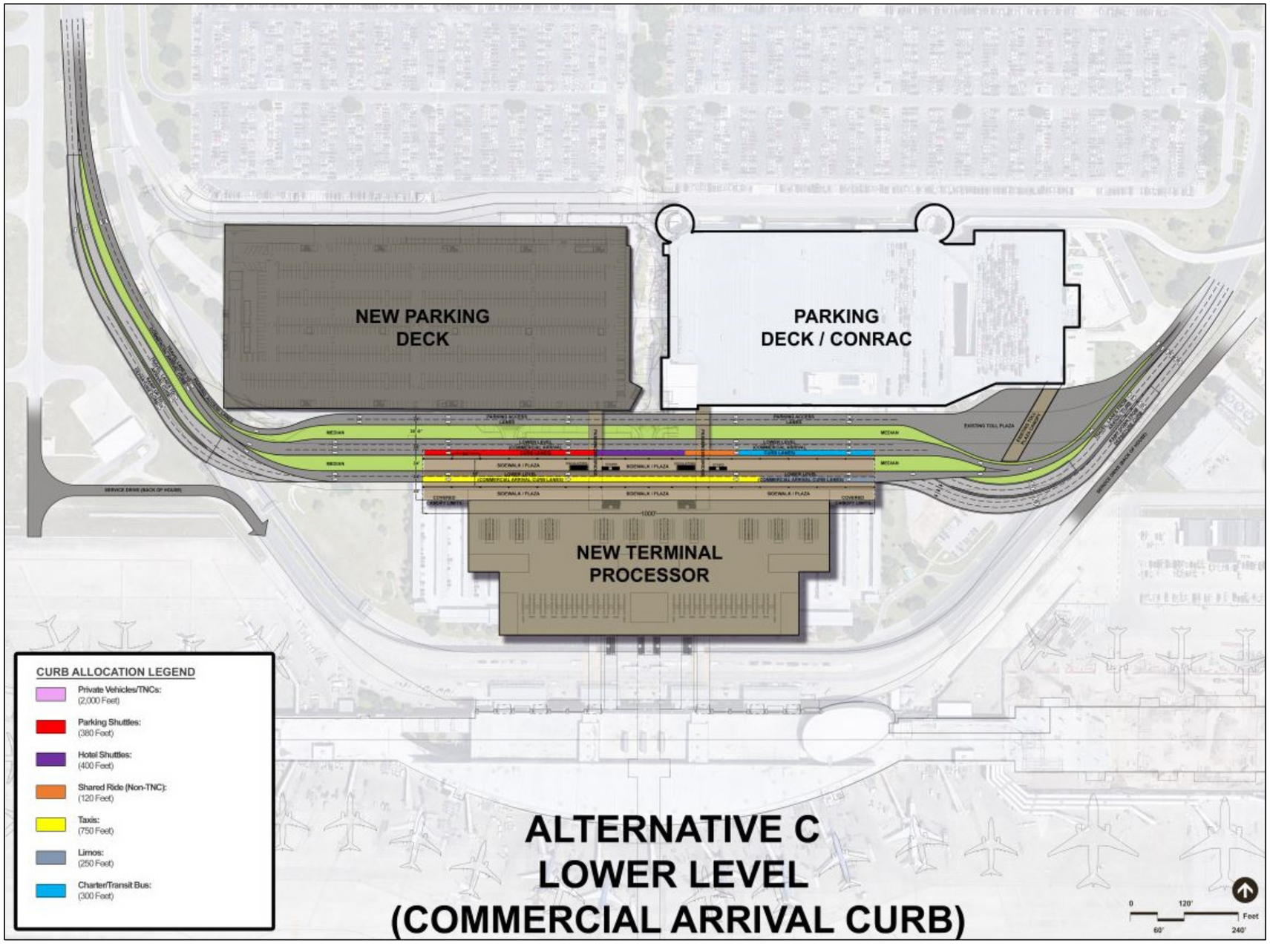

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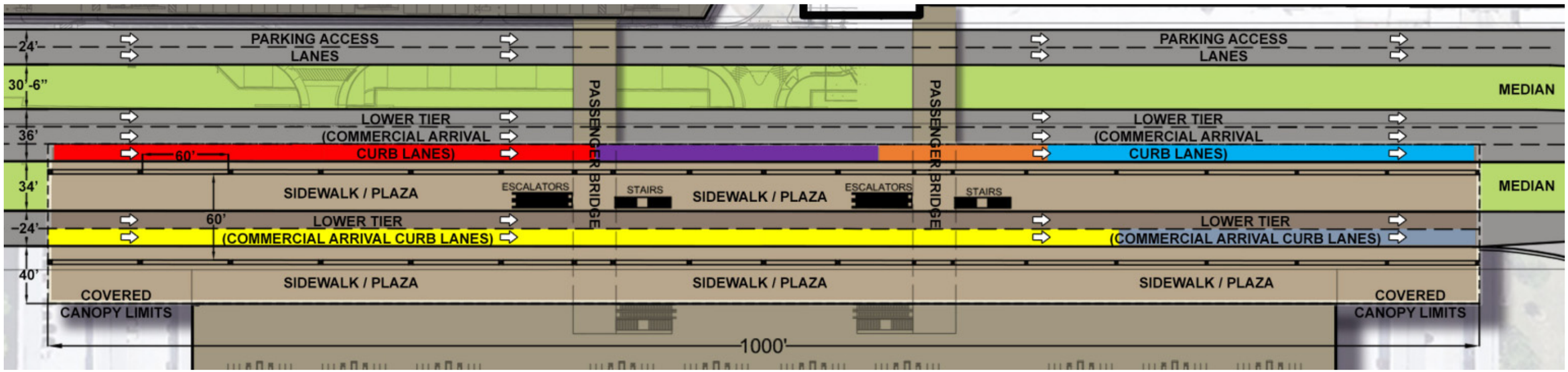
Exhibit 5.4-19: Alternative C (Lower Level Commercial Arrival Curb Detail)



CURB ALLOCATION LEGEND

- Private Vehicles/TNCs (2,000 ft.)
- Parking Shuttles (460 ft.)
- Hotel Shuttles (400 ft.)
- Shared Ride (Non-TNCs) (120 ft.)
- Taxis (750 ft.)
- Limos (250 ft.)
- Charter/Transit Busses (300 ft.)

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Exhibit 5.4-20: Alternative C (Middle Level Arrival Curb)

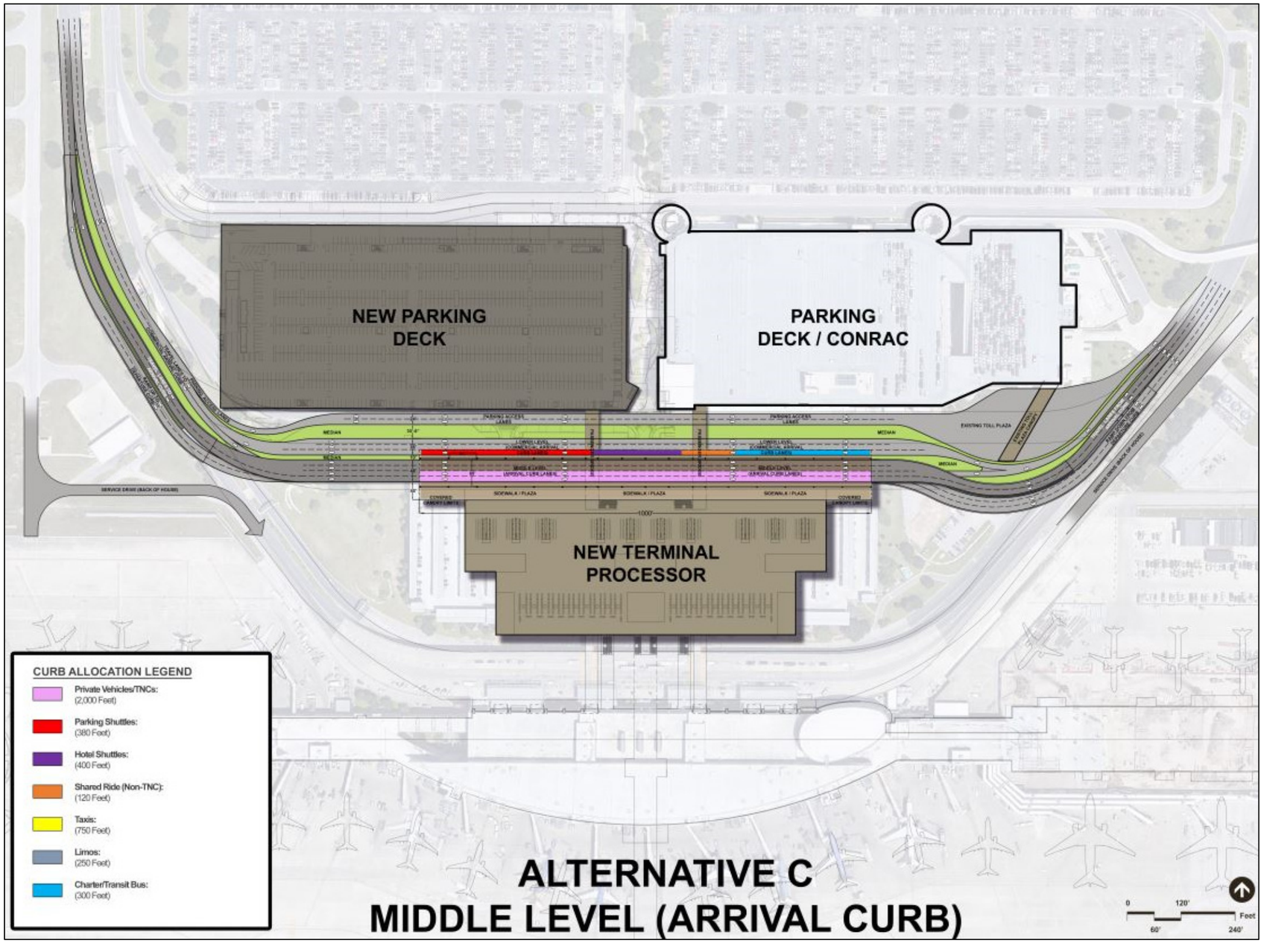

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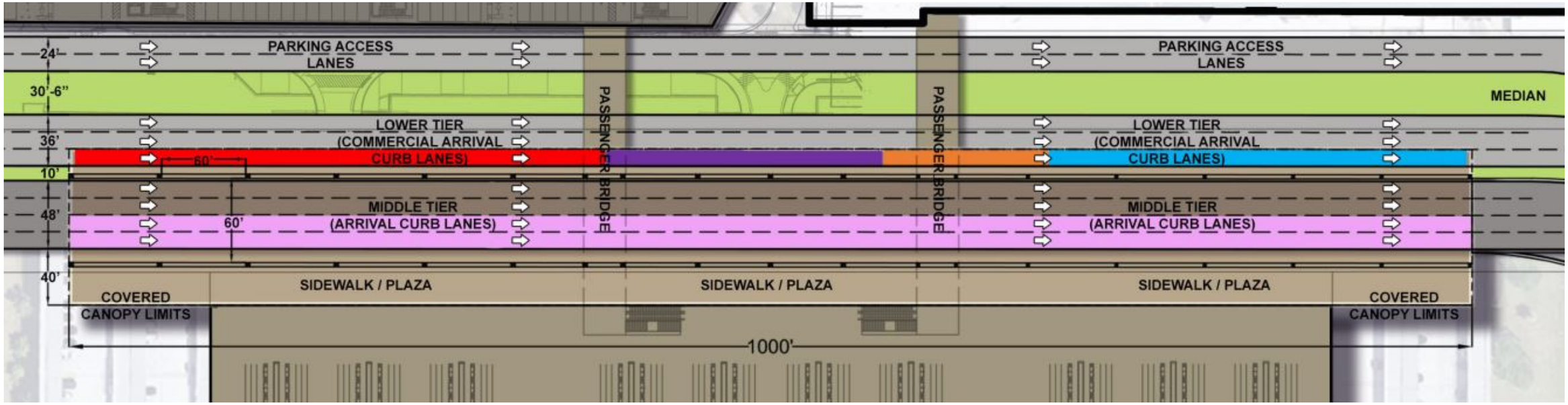
Exhibit 5.4-21: Alternative C (Middle Level Arrival Curb Detail)



CURB ALLOCATION LEGEND

- Private Vehicles/TNCs (2,000 ft.)
- Taxis (750 ft.)
- Parking Shuttles (460 ft.)
- Limos (250 ft.)
- Hotel Shuttles (400 ft.)
- Charter/Transit Busses (300 ft.)
- Shared Ride (Non-TNCs) (120 ft.)

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Exhibit 5.4-22: Alternative C (Upper Level Departure Curb)

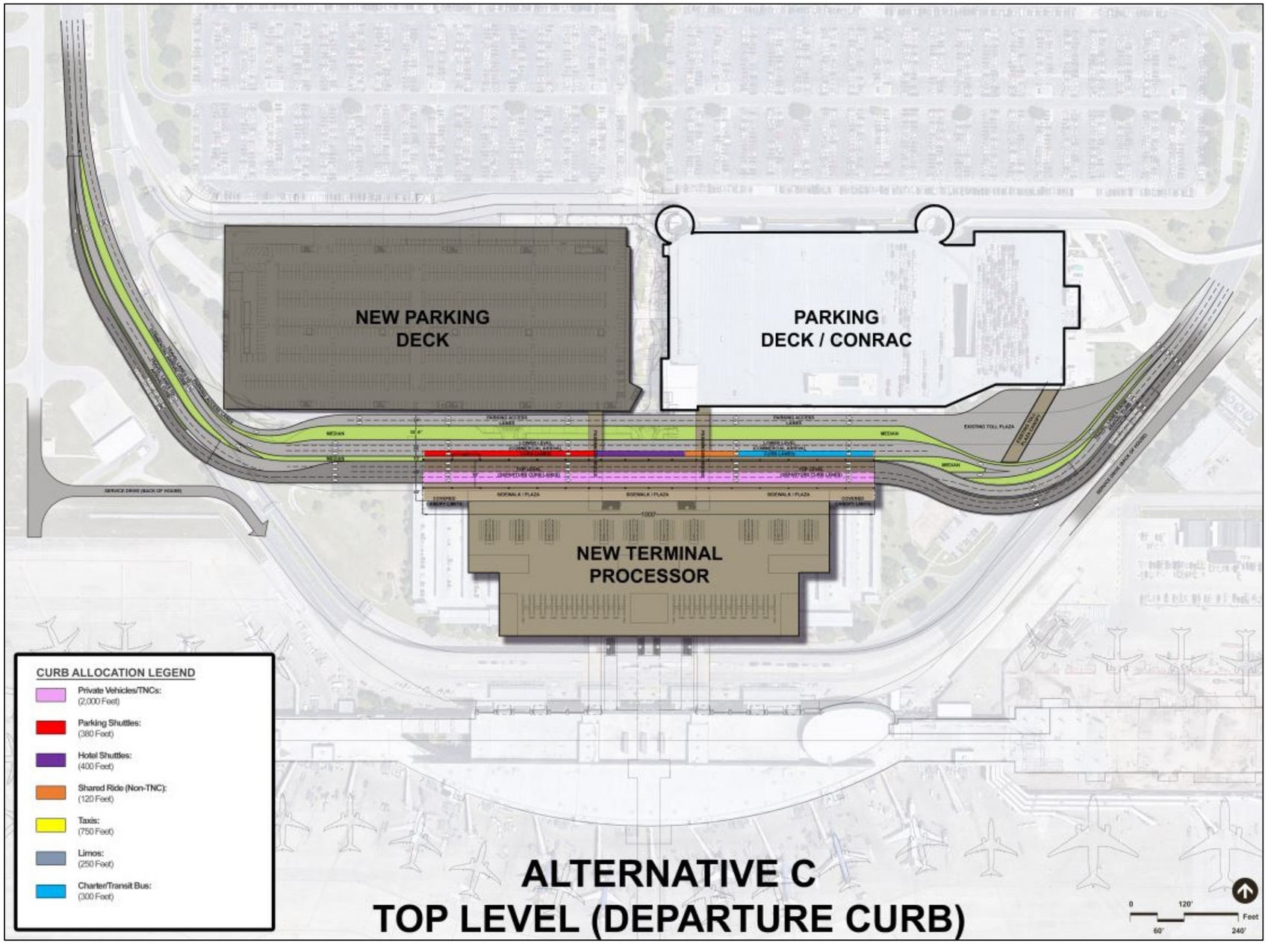

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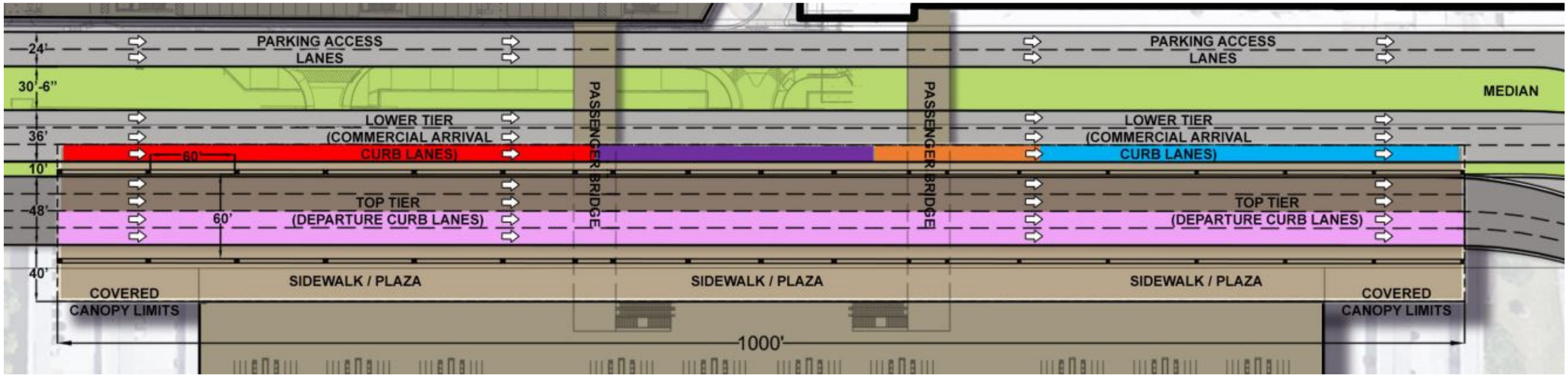
Exhibit 5.4-23: Alternative C (Upper Level Departure Curb Detail)



CURB ALLOCATION LEGEND

- Private Vehicles/TNCs (2,000 ft.)
- Taxis (750 ft.)
- Parking Shuttles (460 ft.)
- Limos (250 ft.)
- Hotel Shuttles (400 ft.)
- Charter/Transit Busses (300 ft.)
- Shared Ride (Non-TNCs) (120 ft.)

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5.4.3.3.4 Alternative D (Commercial Plaza with Two Level Curb)

Alternative D incorporates the two-level curb configuration of Alternative B as shown in the **Exhibit 5.4-24** section view, along with two ground-level commercial vehicle plazas on either side of the New North Terminal building as shown in **Exhibit 5.4-25**. POVs and TNCs will utilize the upper level departure and lower level arrival curbs, and all commercial traffic will use the two ground-level plazas. These two plazas will be accessed via a secure, gate-controlled ground-level access roadway that is the lower level roadway of the existing BJT. Both plazas will have adequate curb lengths to meet the PAL 4 (2037) commercial traffic demand.

The east and west plazas will have a two separate curbs as shown in **Exhibit 5.4-26**. Passengers will access each plaza from the ground (baggage) level of the New North Terminal building via access doors on the east and west sides of the terminal building. Pedestrian crossings of the inner curb will be necessary but should not greatly impede traffic movements. These two plazas will be built at ground level and can be relocated in the future if the New North Terminal needs to be expanded on either side. If necessary, the commercial traffic can be sent to an interim GTC facility on the first level of the existing CONRAC as proposed in Alternative B, or to a permanent GTC located along SH 71.

The positive and negative attributes of Alternative D are as follows:

Positive Attributes:

- The two-level curb is cheaper and quicker to construct.
- The lower level arrivals curb has more access to natural light and ventilation without the adjacent outer commercial arrivals curb.
- Commercial service is separate from the departure and arrivals curb which should simplify terminal signage for passengers.
- The plazas provide an open area with natural lighting and ventilation. The plaza open areas provide room for landscaping, pet relief areas, artwork, and other amenities.
- The plazas could be easily relocated to make room for future terminal expansion.
- Access and egress will utilize the existing lower terminal roadway network.
- If the plazas needed to be removed, the remaining terminal curb could be expanded to create a commercial arrivals curb as described in Alternative A.

Negative Attributes:

- Vehicle security checkpoint and equipment will be required for access to the commercial plazas.
- Vertical circulation will need to be included in the New North Terminal building.

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Exhibit 5.4-24: Alternative D (Section View)

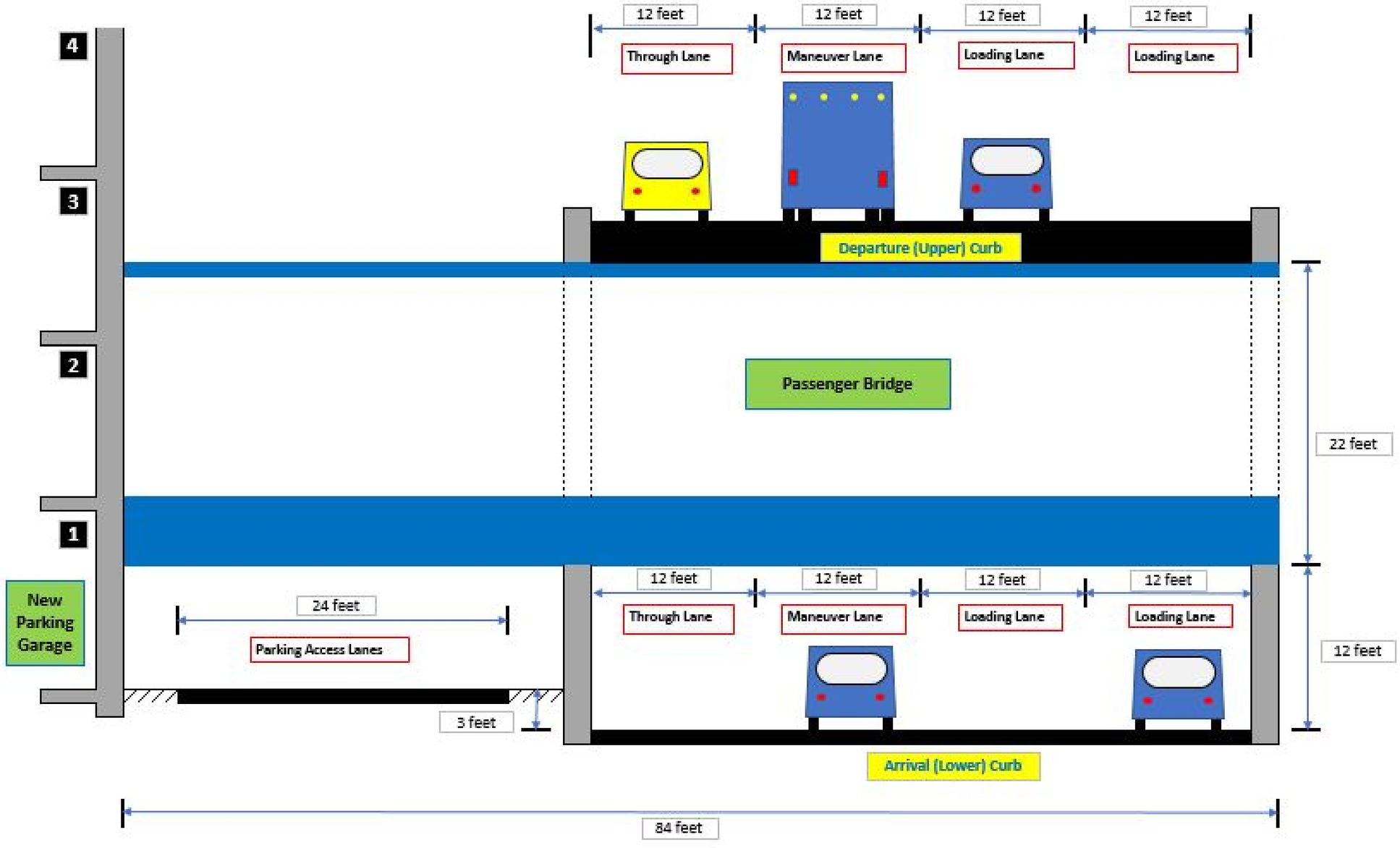

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Exhibit 5.4-25: Alternative D (Lower Level Arrival Curb)

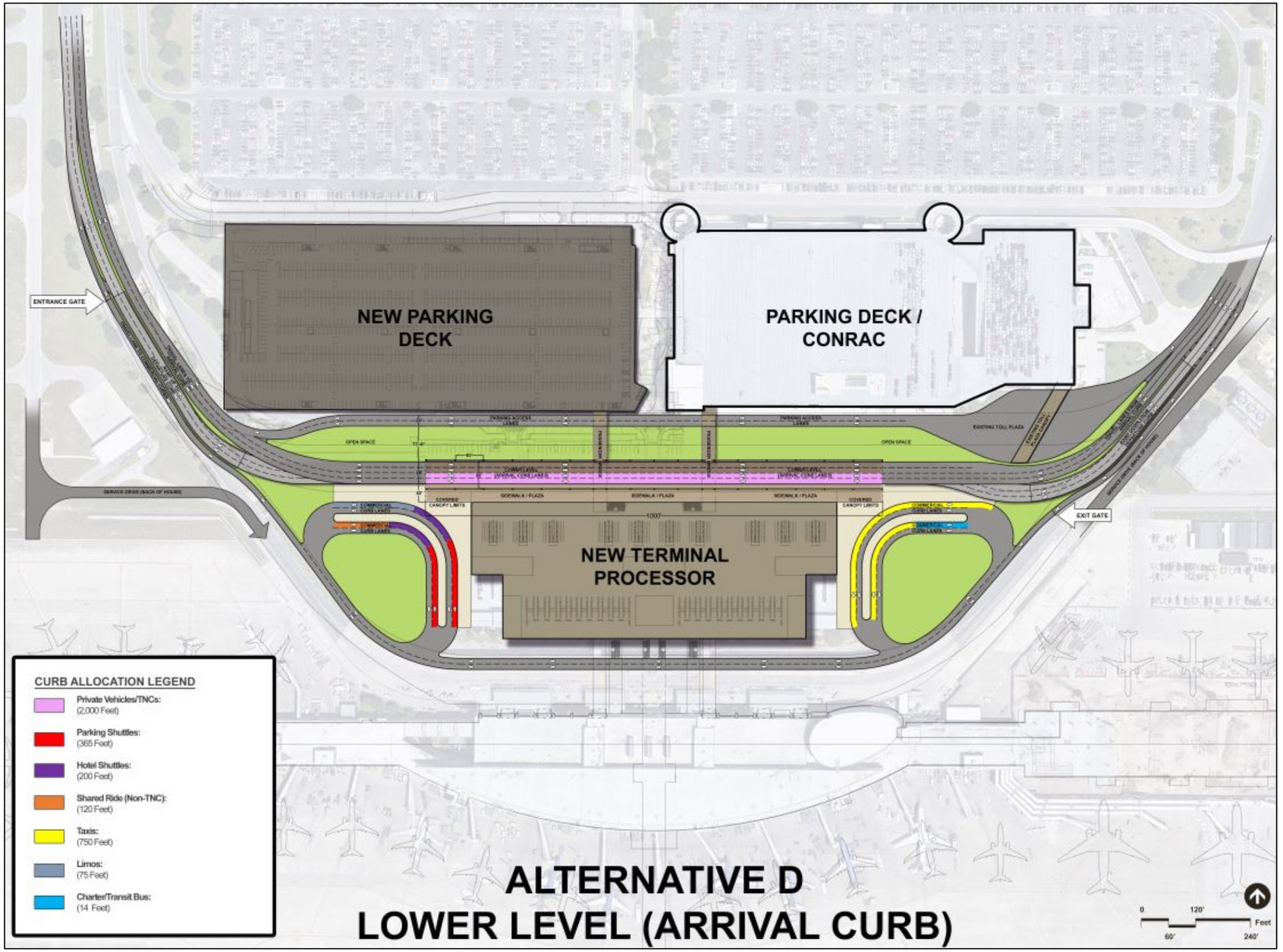

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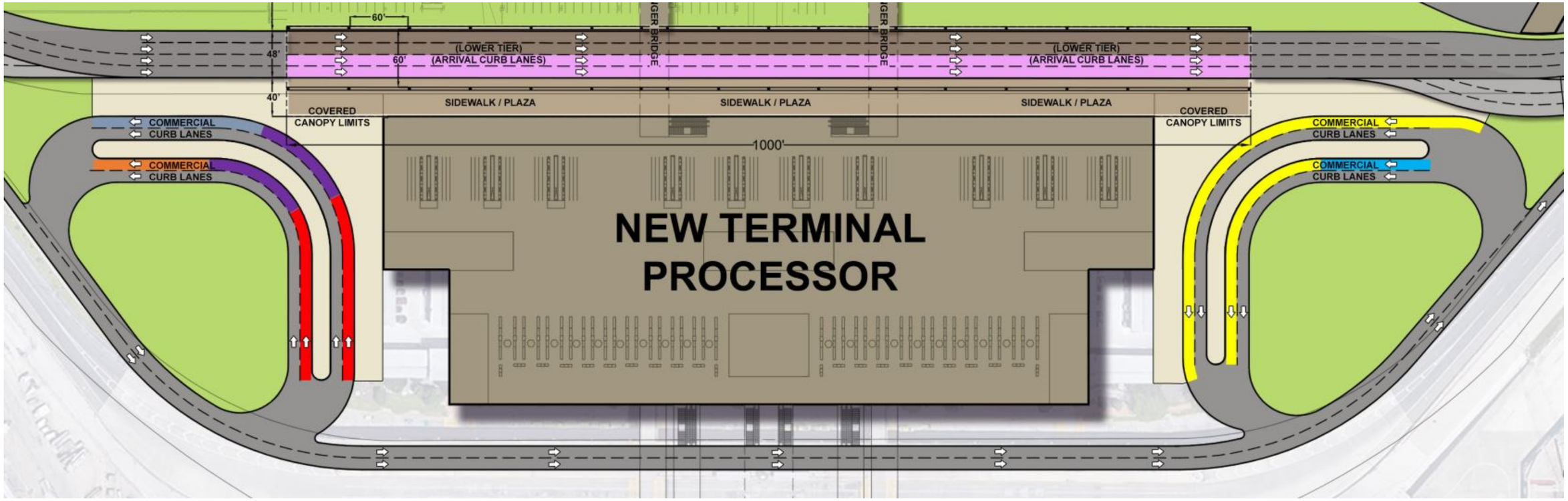
Exhibit 5.4-26: Concept D (Detail)



CURB ALLOCATION LEGEND

- Private Vehicles/TNCs (2,000 ft.)
- Taxis (750 ft.)
- Parking Shuttles (460 ft.)
- Limos (250 ft.)
- Hotel Shuttles (400 ft.)
- Charter/Transit Busses (300 ft.)
- Shared Ride (Non-TNCs) (120 ft.)

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5.4.3.4 Terminal Curb Alternatives Evaluation

The alternative descriptions above indicated positive and negatives attributes of each curb alternative for the New North Terminal. To properly assess the alternatives, a list of evaluation criteria was developed as a basis of comparison. As previously noted, each terminal curb alternative provides for the following basic requirements:

- No pedestrian crosswalks
- Curb allocation requirements to meet the PAL 4 (2037) demand
- Fitting within the 197-foot space between the New North Terminal building and the new parking garage and existing CONRAC
- Dedicated passenger bridge connection on a separate level from the traffic

The following evaluation criteria were used to score each of the terminal curb alternatives:

- ***Flexibility*** **–** The capability to reallocate curb length to meet current and future demand.
- ***Expandability*** **–** The capability to add additional lanes, curb length, or amenities.
- ***Simplicity*** **–** The intuitive ease in which drivers can follow directional signage and roadway flow.
- ***Operability*** **–** The ability to reduce congestion and maintain a high level of service.
- ***Constructability*** **–** The capability to construct the facility using standard construction practices at a reasonable cost, and without impacts to existing operations.
- ***Sensitivity*** **–** The physical impression of the environment experienced by the passengers and drivers using the curb.

Table 5.4-3 provides a summary evaluation of each terminal curb alternative based on the evaluation criteria. **Table 5.4-4** provides a qualitative scoring based on the evaluation criteria that will be used in selecting a terminal curb layout alternative to be included in the preferred airport development program. For each of the evaluation criteria, a rating of either positive (+1), neutral (0), or negative (-1) was assigned. The results shown in Table 5.4-4 are a summary of evaluation scoring by the consultant team and the Airport staff. Based on this evaluation, Alternative A, scored the highest based on the evaluation criteria. Alternative A will be carried forward in this Master Plan and will be modelled to determine its level of service for the anticipated 2037 traffic demand. If for some unexpected reason additional capacity is needed in the future, it is possible to provide additional capacity by implementing the GTC (Alternative B) or Commercial Plaza (Alternative D) components.

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Table 5.4-3: New North Terminal Curb Alternatives Evaluation Descriptions

CRITERIA	ALTERNATIVE A FULL SERVICE – TWO LEVEL	ALTERNATIVE B TWO LEVEL WITH GTC	ALTERNATIVE C FULL SERVICE – THREE LEVEL	ALTERNATIVE D COMMERCIAL PLAZA – TWO LEVEL
Flexibility – The capability to reallocate curb length to meet current and future demand.	The physical length of the curb on both levels is over 1,000 feet with no clear physical barriers to break up curb allocation.	The physical length of the curb on both levels is over 1,000 feet with no clear physical barriers to break up curb allocation.	The physical length of the curb on all three levels is over 1,000 feet with no clear physical barriers to break up curb allocation. There is a possibility that the top level may lose some curb length to accommodate a longer entrance and exit ramp. However, the addition of the middle level does not impact the overall flexibility of allocating available curb space, however it does contribute to shortening the width of the overall footprint.	The physical length of the curb on both levels is over 1,000 feet with no clear physical barriers to break up curb allocation. The levels are dedicated for the use of POVs and will function like the two-level configuration in Alternative B. Commercial vehicles will use two ground-level plazas as passenger pick-up and drop-off areas. These areas can accommodate all commercial traffic such as charter busses (both loading and unloading) and curb allocation can easily be changed or switched between plazas.
Expandability – The capability to add additional lanes, curb length, or amenities.	The lower level and upper level widths are only 115 feet of the available 197 feet between the new terminal and new parking garage. Approximately 30 feet is available for landscaping, additional lanes on both curb levels, or for expanding the curb space for passengers on the lower level without displacing the parking access lanes for the garage.	The lower level width is only 54 feet of the available 197 feet between the new terminal and new parking garage. Approximately 113 feet is available on the lower level for additional lanes, landscaping, expanding curb space for passengers. The upper level could be widened to provide additional lanes or curb space.	The lower level width is only 96 feet of the available 197 feet between the new terminal and new parking garage. Approximately 71 feet is available on the lower level for additional lanes, landscaping, expanding curb space for passengers. The upper and middle levels could be widened to provide additional lanes or curb space, but there would be an impact on the commercial shuttle curb which would have to be moved outward to accommodate the support columns.	The lower level width is only 54 feet of the available 197 feet between the new terminal and new parking garage. Approximately 113 feet is available on the lower level for additional lanes, landscaping, expanding curb space for passengers. The upper level could be widened to provide additional lanes or curb space. The commercial plazas have room for expansion or reconfiguration using the greenspace at the core of each plaza. If necessary, one or both plazas could be closed to provide expansion for the terminal processor. In this case the commercial vehicles could be moved to either a GTC (as in Alternative B) or a new commercial arrivals curb (as in Alternative A).
Simplicity – The intuitive ease in which drivers can follow directional signage and roadway flow.	Drivers have a single decision point, whether to go to the upper or lower curb levels. Dividing the curb into zones with easy to read markers can further simplify the passenger finding the pick-up areas. Curb allocation can be clearly marked for ease of identification.	POV drivers have a single decision point, whether to go to the upper or lower levels. The use of a GTC for commercial vehicles serving arriving passengers also simplifies signage. Dividing the curb into zones with easy to read markers can further simplify the passenger finding the pick-up areas. Curb allocation can be clearly marked for ease of identification.	POV drivers would have a single decision point, whether to go to the upper or middle level. However, this decision point will be further back on the terminal roadway which could conflict with other signage for parking and the commercial arrivals curb. This would be detrimental to simplicity with shorter decision times and more signage which could lead to driver confusion.	POV drivers have a single decision point, whether to go to the upper or lower level. The use of the plazas for commercial vehicles serving arriving passengers also simplifies signage. Dividing the curb into zones with easy to read markers can further simplify passengers finding the pick-up areas. Curb allocation can be clearly marked for ease of identification.

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CRITERIA	ALTERNATIVE A FULL SERVICE – TWO LEVEL	ALTERNATIVE B TWO LEVEL WITH GTC	ALTERNATIVE C FULL SERVICE – THREE LEVEL	ALTERNATIVE D COMMERCIAL PLAZA – TWO LEVEL
Operability – The ability to reduce congestion and maintain a high level of service.	Unless properly directed, POV drivers on the lower level (arrivals curb) will likely choose to congregate near the beginning of the curb as they do today, causing congestion on the access roadway. There is sufficient curb length on both the upper and lower levels to accommodate POVs which will help to operate at a higher level of service. Technological solutions can be employed to encourage drivers to utilize the entire curb length by identifying available empty curb space or segregating passengers by airline along the curb.	Unless properly directed, POV drivers on the lower level (arrivals curb) will likely choose to congregate near the beginning of the curb as they do today, causing congestion on the access roadway. There is sufficient curb length on both the upper and lower levels to accommodate POVs which will help to operate at a higher level of service. Technological solutions can be employed to encourage drivers to utilize the entire curb length by identifying available empty curb space or segregating passengers by airline along the curb.	Unless properly directed, POV drivers on the middle level (arrivals curb) will likely choose to congregate near the beginning of the curb as they do today, causing congestion on the access roadway. There is sufficient curb length on both the upper and middle levels to accommodate POVs which will help to operate at a higher level of service. Technological solutions can be employed to encourage drivers to utilize the entire curb length by identifying available empty curb space or segregating passengers by airline along the curb.	Unless properly directed, POV drivers on the lower level (arrivals curb) will likely choose to congregate near the beginning of the curb as they do today, causing congestion on the access roadway. There is sufficient curb length on both the upper and lower levels to accommodate POVs which will help to operate at a higher level of service. Technological solutions can be employed to encourage drivers to utilize the entire curb length by identifying available empty curb space or segregating passengers by airline along the curb. Commercial vehicles will need to be issued transponders to access the plaza non-public roadway. The west plaza will use a counterclockwise circulation which will require lane weaving when entering and exiting, but with the limited amount of traffic on this roadway, that should not pose a problem.
Constructability – The capability to construct the facility using standard construction practices at a reasonable cost.	The two-level curb configuration is a common layout that is relatively standard to design and construct. Some excavation may be necessary to provide a 17-foot clearance height of the passenger bridge over the lower curb level. The spacing of support columns and the distance of spans can easily be accomplished with modern techniques and materials.	The two-level curb configuration is a common layout that is relatively standard to design and construct. Some excavation may be necessary to provide a 17-foot clearance height of the passenger bridge over the lower curb level.	The three-level curb configuration is not the typical curb layout as the two-level configuration; therefore, design and construction cost will be higher. Some excavation will be necessary to provide a 17-foot clearance height of the passenger bridge over the lower curb level. The spacing of support columns and the distance of spans can be accomplished with modern techniques and materials. Due to the height of the upper level in relation to the new terminal processor, an additional vertical circulation core will be required.	The two-level curb configuration is a common layout that is relatively standard to design and construct. Some excavation may be necessary to provide a 17-foot clearance height of the passenger bridge over the lower curb level. The spacing of support columns and the distance of spans can easily be accomplished with modern techniques and materials. The commercial plazas will be constructed at ground level and require no special construction equipment or techniques.
Sensitivity – The physical impression of the environment experienced by the passengers and drivers using the curb-front.	The upper level will be open to the elements and may require protection from rain and sun but will have plenty of natural light. The lower level POV curb will be enclosed by the outer commercial curb and upper level. This will require additional lighting and ventilation to improve the environment and passenger experience. The outer commercial curb on the lower level will have access to adequate natural light and ventilation.	The upper will be open to the elements and may require protection from rain and sun but will have plenty of natural light. The lower level POV curb will have access to natural light and ventilation on one side.	The upper level will be open to the elements and may require protection from rain and sun but will have plenty of natural light. The middle level POV curb will have access to natural light and ventilation on one side but could use landscaping to help define zones and provide a calming effect. The lower level taxi curb will be enclosed by the middle level above, the terminal processor curb, and the commercial curb which will create a dark, confining space. Additional lighting and ventilation will be required, or design elements included to allow natural light and are to enter the curb. The bus and shuttle curb will have access to natural light and air on one side.	The upper level will be open to the elements and may require protection from rain and sun but will have plenty of natural light. The lower level POV curb will have access to natural light and ventilation on one side. Proper landscaping could be incorporated to provide a more relaxing atmosphere on the lower level and help define curb zones. The commercial plazas will be open to the elements and will require protection from rain and sun but will have plenty of natural light and ventilation. The plaza cores will provide additional space for landscaping and pet relief areas that cannot easily be provided in the other alternatives.

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Table 5.4-4: New North Terminal Curb Alternatives Evaluation Matrix

+1 : POSITIVE 0 : NEUTRAL -1 : NEGATIVE	ALTERNATIVE A FULL SERVICE – TWO LEVEL	ALTERNATIVE B TWO LEVEL WITH GTC	ALTERNATIVE C FULL SERVICE – THREE LEVEL	ALTERNATIVE D COMMERCIAL PLAZA – TWO LEVEL
Flexibility	1	1	1	1
Expandability	1	0	1	0
Simplicity	1	1	-1	1
Operability	1	1	1	1
Constructability	1	1	-1	1
Sensitivity	0	0	0	0
TOTAL SCORE	**5**	**4**	**1**	**4**

5.4.4 Airport Roadway Network Modeling

Sections 5.4.2 and 5.4.3 identified the key changes to the terminal roadway system needed to accommodate the growth of vehicular traffic resulting from forecasted increase in passengers expected to meet the PAL 4 (2037) demand. The future terminal roadway system, with the addition of the braided left turn at Presidential Boulevard and SH 71 was modelled and tested to determine if it would provide an acceptable level of service in the future. PTV Vision's VISSIM Microscopic Traffic Simulation software was used to model the 2037 traffic operations on the terminal roadway system to evaluate how the roadways would perform. VISSIM is a widely used traffic analysis software program that assists transportation planners and engineers to realistically simulate system traffic operations and evaluate/identify system operational improvements and capacity needs. **Exhibit 5.4-27** shows the terminal roadway network that was modelled.

Exhibit 5.4-27: VISSIM Model Roadway Network

Source: Atkins 2018

The software was used to model future AM Peak Hour traffic conditions and PM Peak Hour traffic conditions using 2017 traffic data. A technical memo in **Appendix 5.4** describes the process used to determine the current and future model conditions and the logic used to determine if any traffic improvements would be needed to meet the future demand levels. The AM and PM Peak Hour VISSIM traffic models contain roadway network, traffic control, and all traffic movements that occur on the terminal roadway system. The traffic movements are derived from existing traffic data that was gathered as part of the inventory process and included the flow of traffic between nodes (usually intersections) and the turning movements at those nodes (left turns, right turns, through traffic). The 2017 base year traffic models were validated and calibrated to ensure these models reflected the terminal roadway system's existing condition.

The calibration parameters were subsequently carried over to the 2037 planning horizon year traffic models. The future year models were developed for both No-Build and Build scenarios and based on future passenger traffic forecasts as described in Chapter 4, *Demand/Capacity Facility Requirements*. The future year models were used to evaluate traffic operations of the existing roadway system under future traffic projections and to identify any problem areas. Problem areas were defined as those areas of the network that performed at a Level of Service D or below. Different operational improvements were then introduced into the model to alleviate traffic congestion in these problem areas so that they function at a LOS C or above. These improvements included traffic control changes, segment re-configurations and added capacity throughout roadway system serving the terminal. These improvements were subsequently modeled incrementally to determine if they provided traffic congestion relief. For reference, the level of service categories used to measure the operational conditions were taken from the Airport Cooperative Research Program (ACRP) Report 40, *Airport Curbside and Terminal Area Roadway Operations*. LOS C is the minimum acceptable level of service for the terminal roadways. For reference, the definitions of the different levels of service are provided in **Table 5.4-5**.

Table 5.4-5: Level of Service Descriptions

LOS	LEVEL OF SERVICE DESCRIPTIONS
LOS A	This level represents operations where free-flow speeds prevail. The ability of each driver to maneuver within the traffic stream, change lanes, merge, or weave is almost completely unimpeded by other vehicles because of low traffic densities.
LOS B	This level represents conditions in which free-flow speeds are maintained. The ability of each driver to maneuver within the traffic stream, change lanes, or weave is only slightly restricted by the presence of other vehicles.
LOS C	This level represents traffic flow with speeds at or near the free flow speeds of the roadway. Freedom to maneuver within the traffic stream is noticeably restricted (by the presence of other vehicles) and lane changes may require more care and vigilance on the part of the driver because of high traffic densities., LOS C is generally considered to be the minimum “acceptable” level of service because of the lack of alternative travel paths and the significant negative consequences of travel delays.
LOS D	This level represents the level at which speeds begin to decline slightly with increasing flows, and density (on freeways and other roadways with uninterrupted flows) begins to increase somewhat more quickly.
LOS E	This level represents operations at or near capacity. Operations at this level are volatile because there are virtually no usable gaps in the traffic stream. Vehicles are closely-spaced, leaving little room to maneuver (or allow for lane changes or weaving) within the traffic stream.
LOS F	This level represents breakdowns in vehicular flow. Such conditions generally exist within queues forming behind bottleneck points.

Source: Transportation Research Board ACRP Report 40

The results of the modelling show that the future terminal roadway network will function at a LOS C or above if certain operational improvements are implemented. Operational improvements are typically introduced to a roadway in a logical order with lower cost and lower impact solutions tested first. For the purposes of this analysis, if the lower cost/lower impact solution achieved a LOS C or above, then no other solutions were modelled. The suggested operational improvements listed in **Table 5.4-6** are the least costly to implement that will provide a LOS of C or above for the planning horizon year 2037.

Table 5.4-6: Future Traffic Improvement Projects

PROJECT NUMBER	ROADWAY SEGMENT	SUGGESTED PROJECT	ESTIMATED COST
1	Intersection of Spirit of Texas Drive and State Highway 71	Signalize the intersection	$325,000
2	Intersection of Spirit of Texas Drive and Hotel Drive	Signalize the intersection	$250,000
3	Intersection of Spirit of Texas Drive and Spirit of Austin Lane	Convert from a four-way stop to a two-way stop	$5,000
4	Intersection of Spirit of Texas Drive and Rental Car Lane	Signalize the intersection	$200,000
5	Intersection of Hotel Drive and Employee Avenue	Signalize the intersection	$200,000
6	Intersection of Hotel Drive and Presidential Boulevard off-ramp	Signalize the intersection	$200,000
7	Hotel Drive from Spirit of Texas Drive to Presidential Boulevard	Widen by one lane in each direction	$650,000
8	Presidential Boulevard at State Highway 71	Provide an additional 12-foot turning lane	$350,000
9	Presidential Boulevard from Hotel Drive overpass to the Terminal Curb ramp (inbound)	Widen the roadway by one additional 12-foot lane	$2,150,000
10	Presidential Boulevard from Terminal ramp to Hotel Drive overpass (outbound)	Widen the roadway by one additional 12-foot lane.	$1,100,000
11	Right turn lane from State Highway 71 at Presidential Boulevard	Provide an additional 12-foot turning lane	$35,000

Source: Atkins 2018

The terminal roadway network will function at a LOS C or above through the planning period with the implementation of these proposed projects. Following is a brief description of the suggested traffic improvements. The locations of these improvements are shown in **Exhibit 5.4-28**.

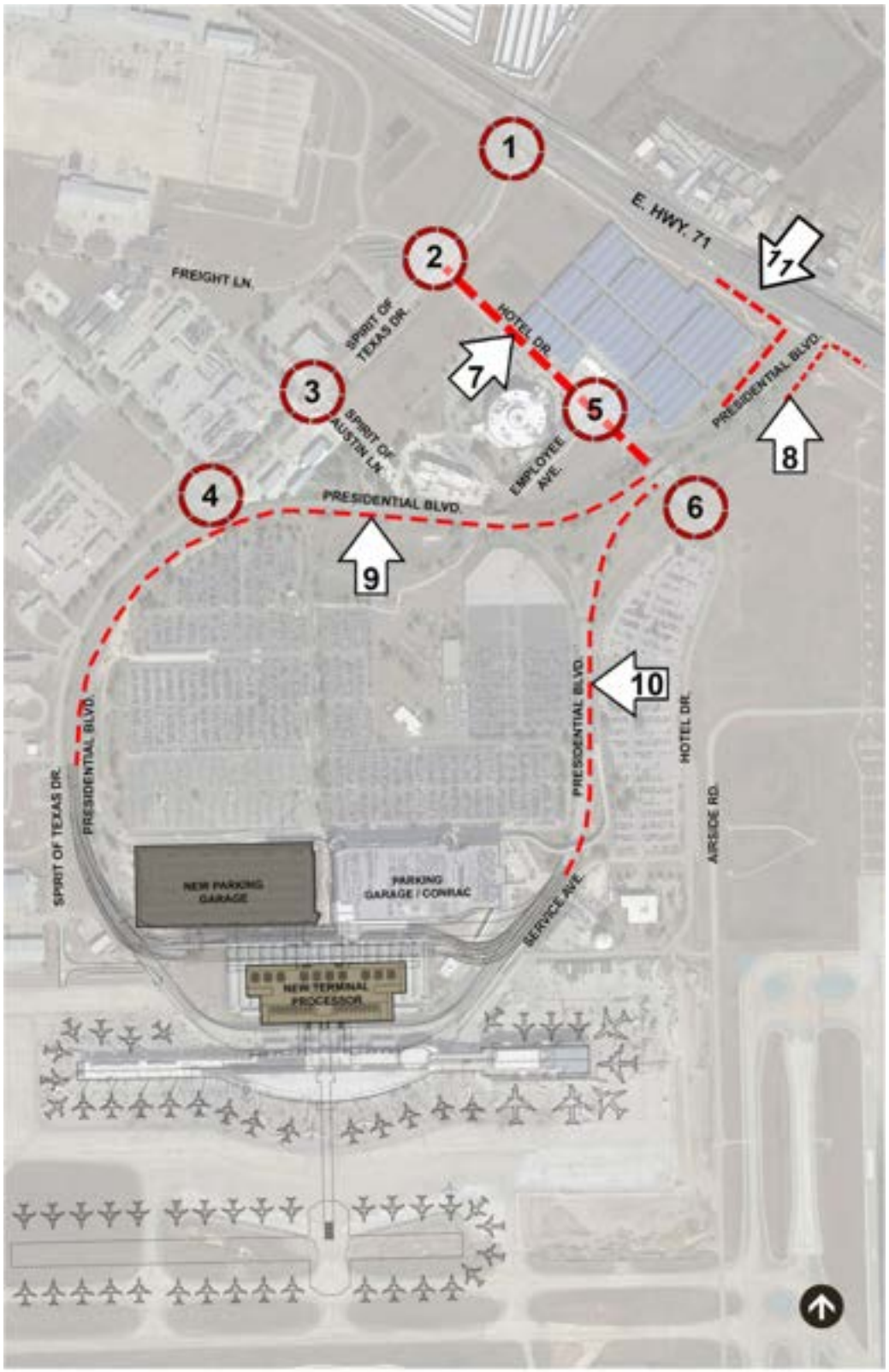
- Project 1 – The intersection at Spirit of Texas Drive and SH 71 will continue to cause traffic congestion and long queues as traffic increases. Eventually the four-way stop traffic control will no longer be effective at managing traffic at the intersection and signalization will be the next logical traffic control option.
- Project 2 – The Spirit of Texas Drive and Hotel Drive intersection has a four-way stop traffic control which is ineffective during certain peak traffic times of the day. The next logical traffic control option is to signalize the intersection. Modern traffic signal devices can adapt to changing traffic conditions such as those encountered during the afternoon peak or a less active period such as experienced during mid-morning.
- Project 3 – Modelling for the intersection of Spirit of Texas Drive and Spirit of Austin Lane indicated that implementing a two-way stop traffic control would increase the performance (traffic flow) of the intersection since most of the traffic moves along Spirit of Texas Drive and congestion would be reduced by taking out the stop signs on this route.
- Project 4 - The complexity of the Rental Car Lane and Spirit of Texas Drive intersection calls for signalization of this intersection. This intersection is the most accessible for vehicles wishing to transfer to Presidential Boulevard and access the terminal. Also,

signalization can make it easier for vehicles to exit from the new convenience store/gas station located on the northeast corner.

- Project 5 – At certain periods during the day, the intersection of Hotel Drive and Employee Avenue can become very congested. Signalizing this intersection can better manage the flow of vehicles during different portions of the day.
- Project 6 - The intersection of Hotel Drive and the section of Presidential Boulevard located east of the Presidential Boulevard overpass has a periodic traffic congestion problem like that found in Project 5. Traffic can queue on the off-ramp and potentially block traffic movement on Presidential Boulevard since traffic movement preference is given to traffic moving along Hotel Drive. By signalizing this intersection, the queues along the off-ramp can be monitored and signal timing adjusted to keep the queue from impacting traffic on Presidential Boulevard.
- Project 7 - As traffic increases on Hotel Drive between Spirit of Texas Drive and Presidential Boulevard more traffic storage will be necessary. This project proposes adding one lane (12-foot) in each direction to accommodate the additional traffic. Hotel Drive already has three lanes between the Presidential Boulevard overpass and the intersection with Spirit of Texas Drive. This project will provide more room for vehicle maneuvering and storage.
- Project 8 - As traffic increases more vehicles will want to make a right turn maneuver from Presidential Boulevard to SH 71's eastbound frontage road. To accommodate this increase in that turning movement, a second 12-foot right turn lane is proposed that will converge into a dual acceleration lane.
- Project 9 - To accommodate additional traffic entering the airport along Presidential Boulevard through 2037, an additional 12-foot lane is recommended that stretches from the Presidential Boulevard overpass at Hotel Drive to the beginning of the ramp at the New North Terminal processor. This will permit more maneuver and storage space for vehicles along this section of roadway.
- Project 10 – This project resembles Project 9, except the additional 12-foot lane is needed between the terminal curb ramp and the Presidential Boulevard overpass over Hotel Drive.
- Project 11 – This project functions similarly to Project 8 except it provides an additional lane for right turn traffic accessing Presidential Boulevard and entering the Airport. The additional lane is necessary to prevent queues from the eastbound left turn lane from blocking traffic using this lane to make a right turn onto Presidential Boulevard.

Exhibit 5.4-28 shows the location of the recommended projects listed above. **Exhibit 5.4-29** shows the proposed Braided Left Option recommended changes per Project 11. This modification is from the roadway modelling results. Implementing the eleven projects indicated from the model results will allow the Airport roadway system to function at an acceptable LOS C or better throughout the 20-year planning period. The relocation of SH 71, as depicted in Exhibit 5.4-4, is the proposed long-term solution for accommodating airport traffic beyond 2037.

Exhibit 5.4-28: Roadway Improvement Project Locations



Source: Atkins 2018

Exhibit 5.4-29: Modified Braided Left Option (Modeling Results)

Source: Atkins 2018

5.4.5 Parking Alternatives

Based on the discussion of Chapter 4, *Demand/Capacity Facility Requirements,* on-site parking at ABIA currently reaches capacity for basically all parking modes during peak usage. Peak day conditions are encountered during several months throughout the year during prime holiday periods including March, July, November, and December. As the airport seeks to expand on-site parking to meet anticipated growth, a premium should be placed on efficient methods that can be adapted to meet an uncertain future with the development of autonomous vehicles and mass transit modes.

This evaluation only reviews the parking opportunities on currently owned ABIA property, expansions and new off property parking lots are not in the control of the airport and have not been evaluated.

Some of the primary assumptions used in developing the parking expansion alternatives include:

- Parking Garage 1 (Short Term) is anticipated to be demolished in the relatively near future to make space for the New North Terminal.
- Parking Garage 2 (CONRAC) is anticipated to lose some existing ground floor parking public parking spaces for use as a Ground Transportation Center.
- Parking Garage 2 (CONRAC) can be considered for conversion to full public parking use if demands dictate it, and assuming that a relocated CONRAC facility can be negotiated.
- Parking Garage 3 is currently under construction and is assumed to be complete in 2018.
- The focus of this study is related to parking for the Barbara Jordan Terminal, parking for the South Terminal is anticipated to be available to meet demands for its anticipated life.
- Current valet parking areas are included in the Short-Term parking space counts.
- The Park & Zoom and Bark & Zoom parking spaces are included in the on-site long-term parking space counts as they are located on airport property.
- A temporary GTC is anticipated to be constructed on the ground floor of Garage 2 (CONRAC) which will eliminate approximate 180 parking spaces in the near future and possibly the entire first floor (750 spaces) over time.
- By approximately PAL 3 demand, use of the Cargo Apron for overflow parking would be discontinued if cargo operations dictate that the full apron is required.

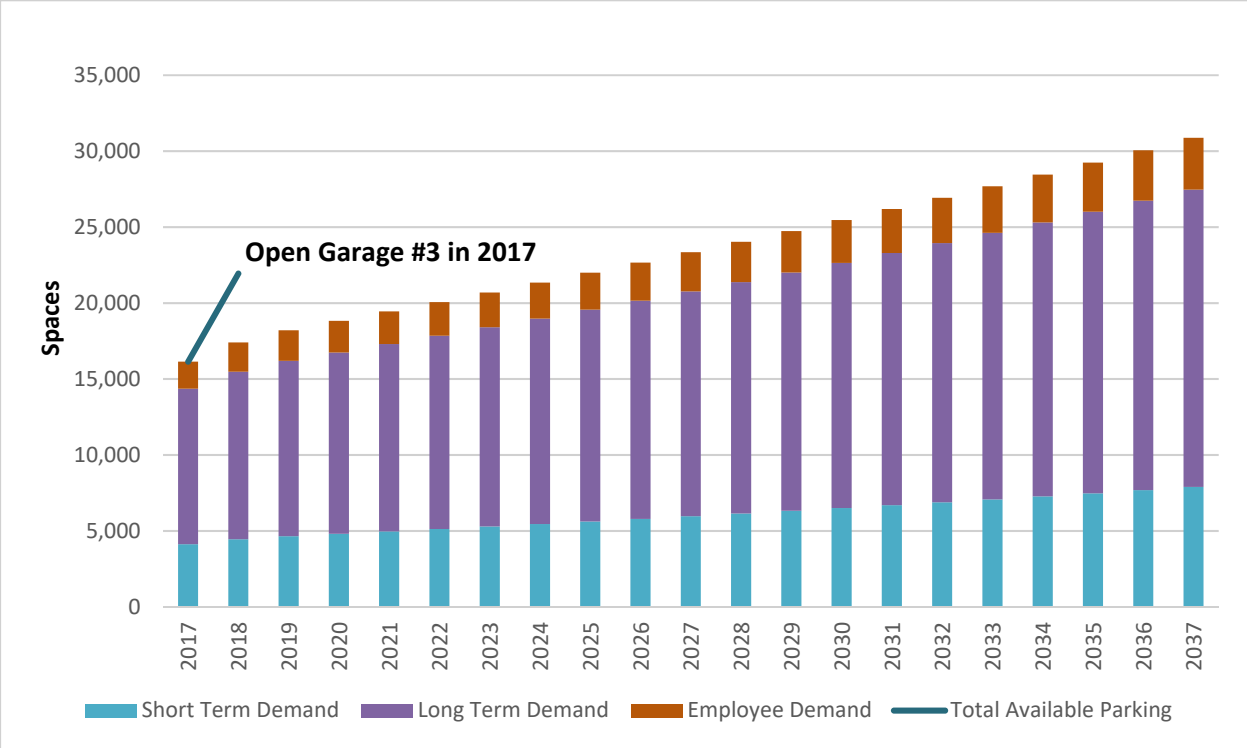
5.4.5.1 Anticipated Parking Demands

The future parking demands anticipated at the airport during the study period will be impacted by the adoption of autonomous vehicles, extension of mass transit to the airport, and other unforeseen technologies and behavioral changes. This evaluation includes both a “Base Case” for parking demands that are unaffected by any future technologies/modes, and a “Medium Impact from Technology” for parking demands that have been reduced to account for these anticipated behavioral changes in car usage. These two scenarios will provide the expected envelop for parking demand growth over the study period.

5.4.5.1.1 Base Case Parking Demands

For the Base Case, parking demands were anticipated to grow linearly with enplaned passenger growth at the airport over the entire study period. **Exhibit 5.4-30** shows the anticipated Base Case parking demands and the available on-site parking including the known projects affecting parking.

Exhibit 5.4-30: Total On-Site Parking Demand & Capacity (Base Case)

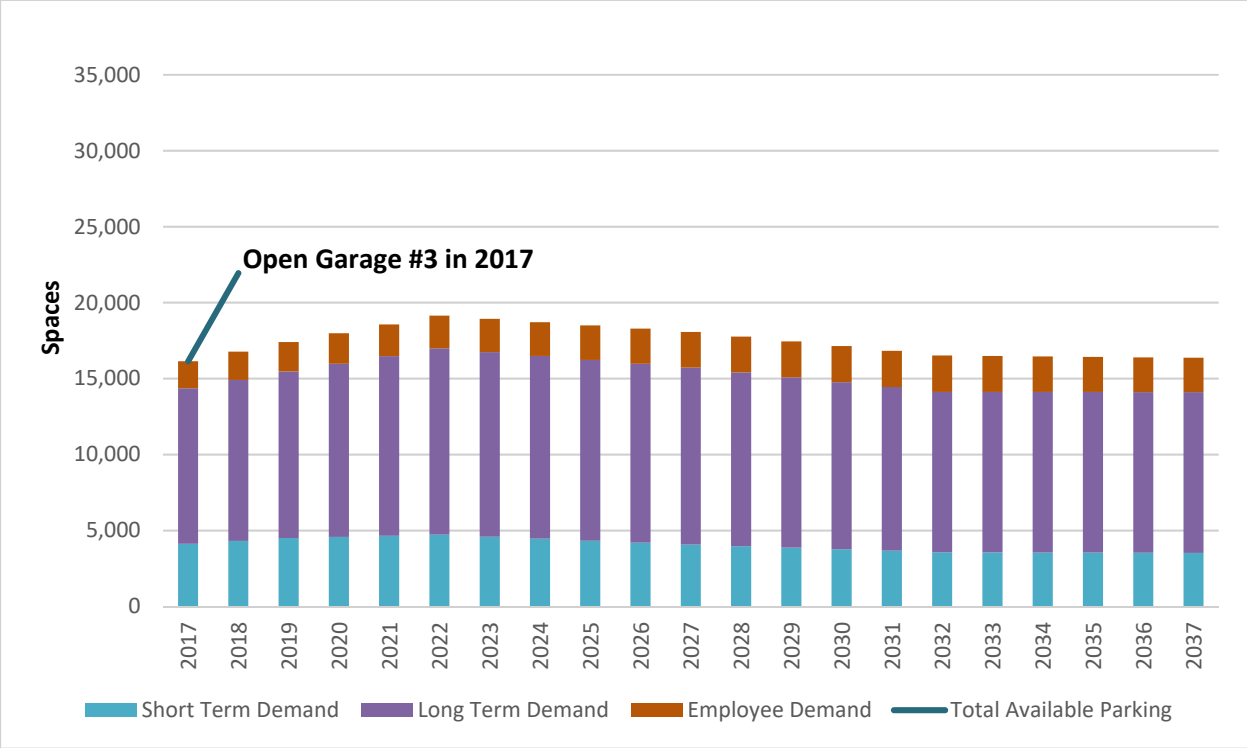


Source: Garver

5.4.5.1.2 Medium Impact from Technology Case Parking Demands

For the Medium Impact from Technology Case, parking demands were anticipated to be significantly affected by emerging technologies such as autonomous vehicles and mass transit. **Exhibit 5.4-31** shows the anticipated Medium Impact from Technology Case parking demands and the available on-site parking including the known projects affecting parking.

Exhibit 5.4-31: Total On-Site Parking Demand & Capacity (Medium Impact from Technology)



Source: Garver

5.4.5.2 Future Parking Project Alternatives

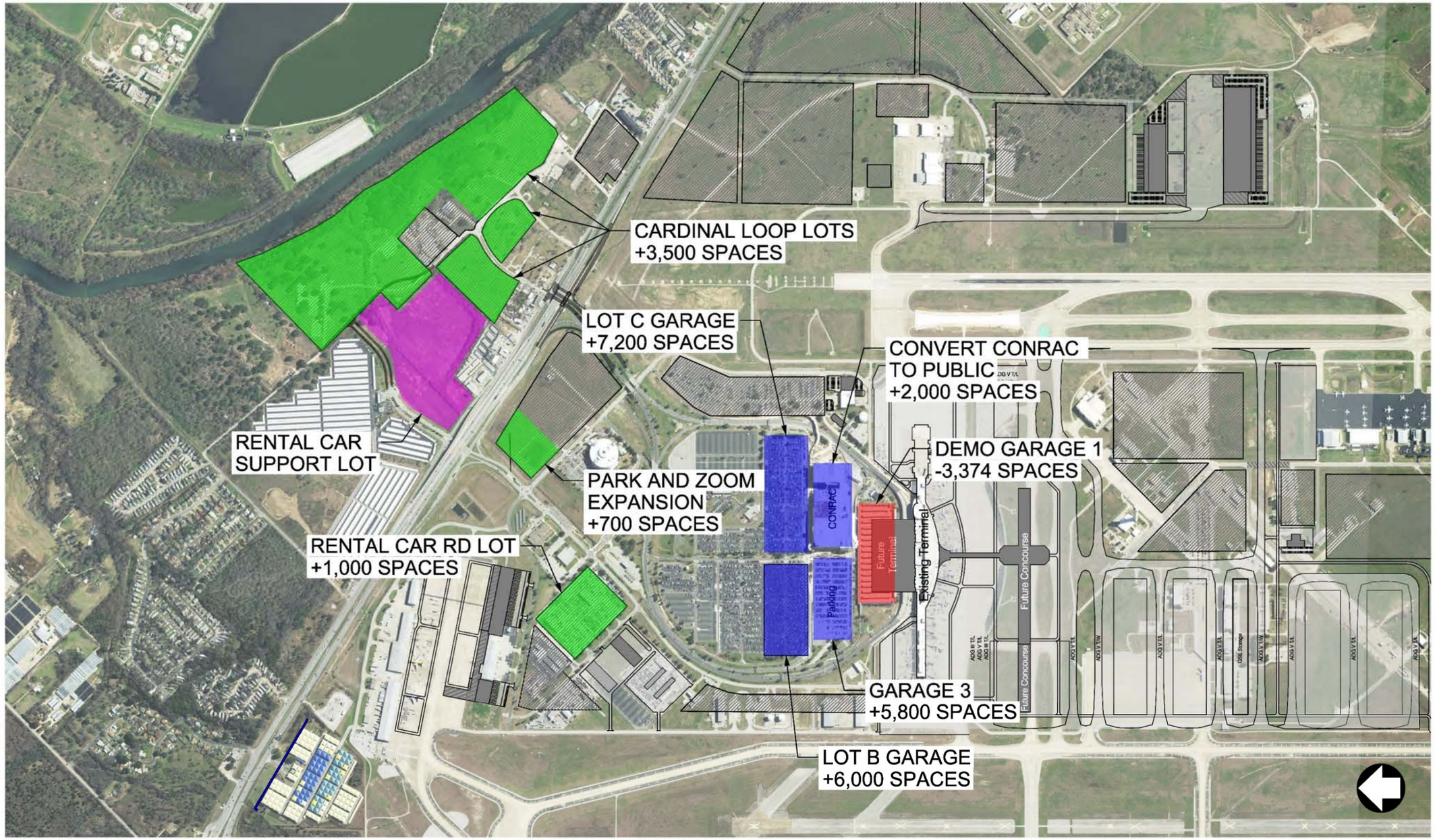
As there is a wide window in the anticipated parking demands depending on the speed and extent that new technologies are adopted, therefore it is difficult to specifically plan expansion of parking on a set schedule. Rather, a menu of alternatives will be discussed that can be picked from as demands dictate, allowing the airport to efficiently meet parking demands without over building as technology innovations are implemented and begin to have significant impacts.

5.4.5.2.1 New Surface Lot Alternatives

The airport has both undeveloped land north of SH 71, and land that is currently being used for Rental Car parking/staging on the northwest side of the "eyeball" that could be developed into new surface parking lots. These possible surface lot developments are shown in **Exhibit 5.4-32**.

- Park and Zoom Expansion (700 Spaces) – It is believed that the tenant for the Park and Zoom lot is pursuing expansion of their facility on airport property. The exact number of spaces that the expansion will include is unknown but has been anticipated to be approximately 700 parking spaces.
- Cardinal Loop Lots (3,200 Spaces) – Located north of SH 71 on both sides of Cardinal Loop on airport owned land. This surface lot could either be developed directly by the Airport or possibly as a Public Private Partnership similar to the Park and Zoom facility. This area is currently largely undeveloped and could be viewed negatively as development of new impervious cover (IC) for surface parking through a City owned project, although pursuit of a Public Private Partnership may mitigate this concern. This area could accommodate approximately 3,200 parking spaces.
- Rental Car Road Surface Lots (up to 2,500 Spaces, assume 1,000 Spaces) – Located on both sides of Rental Car Road, this lot would require the relocation (or removal) of the rental car parking and support services that are currently operated from this area. Rental car companies could be relocated to other airport owned properties or could be told they must vacate airport property and develop their own land for their operation. An advantage of this alternative is that much of this area is currently paved, possibly saving on construction costs, and would likely be more environmentally palatable as it would have limited impacts to impervious cover. The primary disadvantage of this area would be its possible use for other airport/aviation facilities that could make better use of this location: it is likely that only a portion of this area will be available for rental car uses. Therefore, based on the expected available land for parking in this area, 1,000 new surface parking spaces have been assumed.
- Surface Lots on Newly Acquired Land – The airport could pursue acquisition of new land to provide additional parking options. Areas north of SH 71 along Cardinal Loop and Spirit of Texas Drive would be prime candidates for land acquisition that would be favorably located for parking operations and/or relocation of rental car staging operations.

Exhibit 5.4-32: Parking Project Alternatives During Study Period Map



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5.4.5.2.2 Conversion of Garage 2 (CONRAC) to Public Parking Alternative

The existing Garage 2 has approximately 2,000 parking spaces that are currently used as the CONRAC facility: the garage could be fully converted to use for public parking. For this to happen within the current lease agreement time frame, negotiation with the CONRAC partners would be required to terminate this lease. An alternative site for the CONRAC would need to be determined and negotiated, which is further discussed in the following section on the CONRAC. It is anticipated that much of the existing bottom floor of the CONRAC will be converted to a Ground Transportation Center over the study period, resulting in a loss of that floor to public parking uses.

5.4.5.2.3 New Parking Garage Alternatives

Conversion of existing surface lots and other close in areas to new parking garages is also an option for providing more parking as demands increase.

- Lot B Conversion to Garage (increase of up to 7,200 spaces) – Lot B currently includes approximately 1,244 public parking spaces. Conversion of Lot B to a parking garage is anticipated to be up to 6 stories in height to match the massing of adjacent Garage 3. Based on the area available, approximately 1,200 spaces per floor of garage space could be developed into a garage with approximately 7,200 total spaces. Conversion of existing paved parking to garage space would be viewed positively from an environmental aspect avoiding the impervious cover addition of surface lots and would be easy to incorporate operationally. It also preserves airport land for other uses, although the cost of a parking garage are approximately 3 to 4 times that of a surface lot per parking space constructed.
- Lot C Conversion to Garage (up to 8,400 spaces) – Lot C currently includes approximately 1,531 public parking spaces. Conversion of Lot C to a parking garage is anticipated to be up to 6 stories in height to match the massing of adjacent garages. Based on the area available, approximately 1,400 spaces per floor of garage space could be developed with approximately 8,400 total spaces. Conversion of existing paved parking to garage space would be viewed positively from an environmental aspect, avoiding the impervious cover addition of surface lots. It also preserves airport land for other uses, although the cost of a parking garage are approximately 3 to 4 times that of a surface lot per parking space constructed.

5.4.5.3 Summary of Parking Alternatives

A summary of the full menu of parking expansion alternatives is shown in **Table 5.4-7**.

Table 5.4-7: Summary of Parking Expansion Alternatives

ALTERNATIVE	APPROX. MAX. PARKING SPACE INCREASE	NOTES
Cardinal Loop Lots (Currently ABIA Owned Land)	3,200	Located on both sides of Cardinal Loop on airport owned land
Cardinal Loop Lots (Land acquisition required)	Variable	Includes areas north of SH 71 that will require land acquisition
Park and Zoom Expansion	700	Estimated number of new spaces that are available for development under the Park and Zoom lease
Rental Car Road Surface Lot	1,000	Located on both sides of Rental Car Road, requires relocation of rental car facilities, other competing uses for this area are being considered and actual spaces available will depend on selected development
Conversion of CONRAC Garage to Public	2,000	If all of the bottom floor of CONRAC Garage is converted to a GTC the new spaces would decrease to 1,250 spaces, requires relocation or elimination of the CONRAC facility
Parking Garage Over Lot B	7,200	Assume 6 stories at approximately 1,200 spaces per level
Parking Garage Over Lot C	8,400	Assume 6 stories at approximately 1,400 spaces per level

Source: Garver

5.4.5.4 Recommended Parking Alternatives

The recommendations of this section are based on the conservative assumption that parking demand (for all types) will continue to grow at a rate equal to enplaned passenger growth at the Airport (Base Case described in Section 5.4.5.1). Therefore, as new technologies and public transit begin to impact parking demands, the airport will be able to delay the timing of parking expansion to meet the actual demands. For this reason, the high cost projects of building new parking garages are recommended as the final projects to meet the projected demands, giving time for further evaluation of changing parking demands before needing to make any decisions on these large investments.

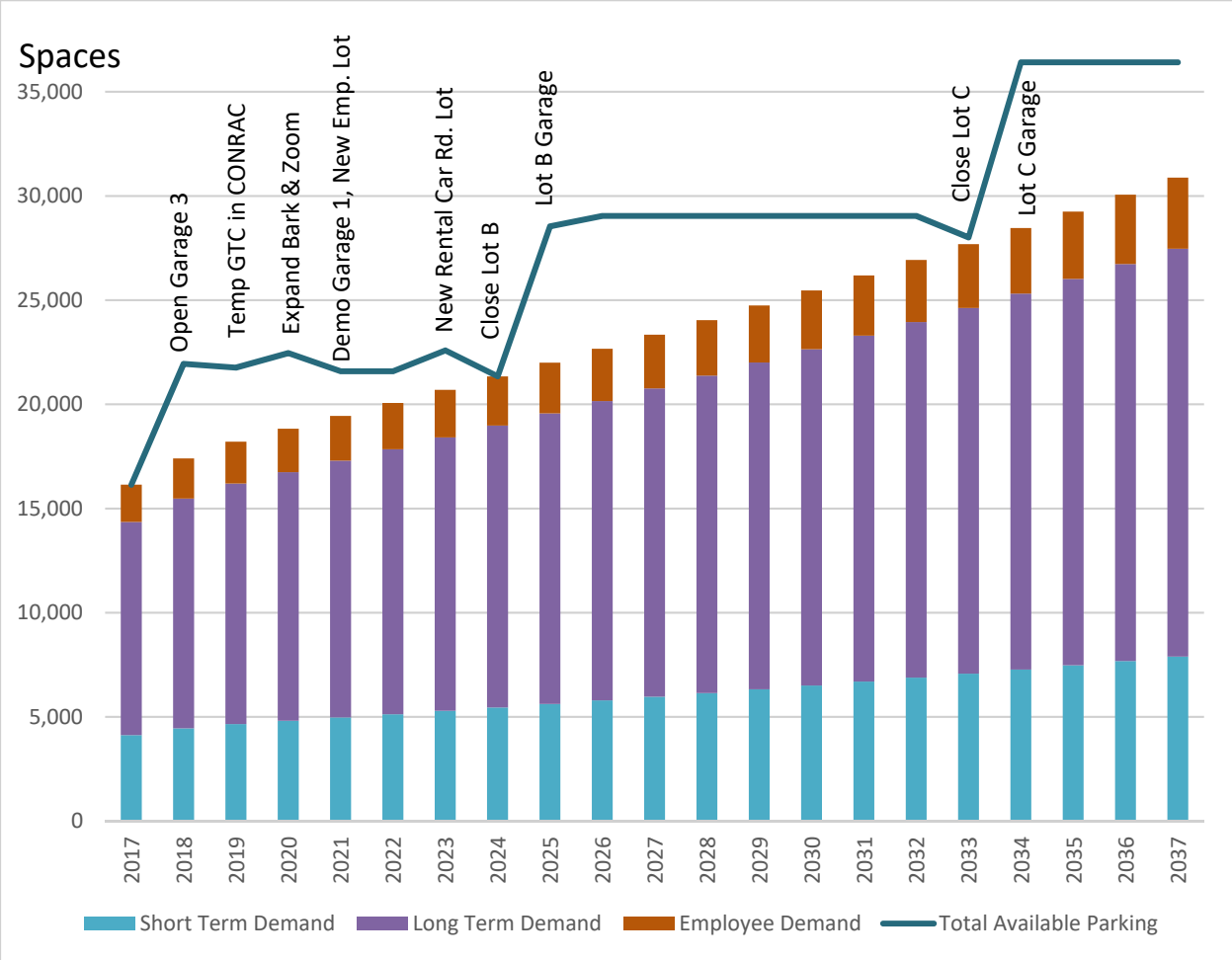
To address parking demands through the 20-year study period, a recommended phased approach to parking expansion would consist of the following:

- Open Garage 3 – Garage 3 is currently under construction and anticipated to be open by the end of 2018. This will result in increase of 5,800 parking spaces. These spaces will be utilized for public and staff parking.
- Interim GTC in CONRAC Garage – Proposed conversion of a portion of the 1st floor CONRAC garage from public parking to an interim Ground Transportation Center. Results in the loss of approximately 200 spaces.
- Expansion of Park and Zoom – It is believed that the tenant for the Park and Zoom lot will be pursuing expansion of their facility on airport property. The exact number of spaces that the expansion will include is unknown but has been estimated to be approximately 700 spaces.
- Relocation of Employee Parking Lot – Construction of a new employee parking lot north of SH 71 along Cardinal Loop will allow for repurposing of the existing employee parking lot (Lot J) to public parking. The new employee parking lot would be proposed to include approximately 3,500 spaces to serve the employee parking demands through 2037, although consideration to phasing its build out is recommended. Conversion of Lot J will increase long-term public parking by 1,785 spaces.
- Demolish Garage 1 – To make way for the proposed New North Terminal, existing Garage 1 will need to be demolished. Demolition of Garage 1 will reduce short-term public parking by 3,374 spaces.
- New Rental Car Road Surface Lot – Conversion of the existing rental car support lots on the north side of Rental Car Road to long-term public parking. This will require demolition of existing buildings and build-out of the lot. This conversion will increase long-term public parking by approximately 1,000 spaces. This conversion of the rental car staging areas to parking and other uses will require relocation of the rental car support lots to an off-airport site (to be determined).
- New Parking Garage Over Lot B – The proposed construction of a new parking garage where Lot B currently exists. Lot B currently consists of 1,244 spaces. It is anticipated that the new garage would be 6 stories tall, providing total parking of 7,200 spaces (a net increase of approximately 6,000 spaces after losing the spaces of existing Lot B).

- New Parking Garage Over Lot C – The proposed construction of a new parking garage where Lot C currently exists. Lot C currently consists of 1,532 spaces. It is anticipated that the new garage would be 6 stories tall, providing total parking of 8,400 spaces (a net increase of approximately 7,000 spaces after losing the spaces of existing Lot C).

Each of these proposed projects are reflected in the future parking demand and capacity on **Exhibit 5.4-33** and in the map on the previous Exhibit 5.4-32. As discussed, the Base Case will likely over-estimate the parking demands into the future once impacts of new technologies and public transit begin to occur. It is recommended that parking demands be continuously updated as these impacts take effect, and that the timing of these projects be evaluated against updated demands. It is also recommended that the Airport evaluate options for repurposing of the new parking facilities to other uses if parking demands actually start to decline. This would include allowing for parking garages to be converted to building uses, and for parking lots to be leased for commercial development, etc.

Exhibit 5.4-33: Total On-Site Parking Demand & Recommended Proposed Capacity (Base Case)



Source: Garver

5.4.6 Drainage & Water Quality Alternatives

5.4.6.1 Potable Water Alternatives

As discussed in Chapter 4, *Demand/Capacity Facility Requirements,* the primary potable water mains feeding the airport site appear to be adequately sized for providing the needed potable and fire flow demands through the 20-year study period. Therefore, the proposed water system improvements are primarily new pipeline extensions to serve new buildings. Some relocation of existing mains will be required to accommodate infrastructure improvements. Some operational improvements are also recommended to provide redundant and looping water supply on the site. It is anticipated that ongoing maintenance of existing water infrastructure will be required, even though no evaluation of the existing conditions have been made.

The proposed water main sizes shown in this study reflect the estimated sizes needed to serve the estimated demands and fire flows. Hydrant testing and system wide modeling has not been performed to verify these sizes, and each new project will need to have its demands and fire flow availability confirmed to finalize the proposed main sizes. In general, the proposed main extensions have been sized as 12-inch diameter minimum to provide estimated fire flows.

Based on the recommended overall alternatives for build-out of the Airport during the 20-year study period, the resulting proposed water projects have been determined. The proposed water system improvements are shown in **Exhibit 5.4-34** and are described below:

- New 12-inch diameter main to create a loop around the proposed terminal expansion area. This main will provide looping, redundancy, and potable/fire service for the expansion.
- The existing 12-inch main runs in the vicinity of the proposed New North Terminal building and will likely require some relocation to accommodate construction of this building. Full replacement of this main should also be considered as it will be located under new apron pavement and will help to minimize future maintenance conflicts.
- Extension of the 12-inch diameter main to serve future improvements on the east side of the airport.
- Currently no appropriately sized water main exists along the east side of US 183 to serve the proposed buildings in the southeast corner of the airport. Therefore, extension of a 12-inch main from the existing main in Burleson Road is proposed.
- Addition of another 16-inch diameter connection to the existing 24-inch main along SH 71. While it is not anticipated that this connection is necessary to provide the anticipated demand on the Airport, this connection would provide for additional capacity, looping, and redundancy during maintenance or any pipe failures.
- The proposed depression of Emma Browning Avenue will require replacement/relocation of a portion of the existing 16-inch main in this area.
- The existing 8-inch water mains that serve the area near the existing South Terminal will be abandoned/removed as the buildings in this area are demolished and new apron and support facilities are constructed.

5.4.6.2 Wastewater Alternatives

As discussed in Chapter 4, *Demand/Capacity Facility Requirements,* the primary wastewater mains serving the airport site appear to be adequately sized to provide wastewater collection through the 20-year study period. Therefore, the proposed wastewater system improvements are primarily new pipeline extensions to serve new buildings and development areas. Some relocation of existing mains may also be required to accommodate the proposed new buildings and infrastructure construction. It is anticipated that ongoing maintenance of existing wastewater infrastructure will be required, even though no evaluation of the existing conditions have been made.

The proposed wastewater main sizes shown in this study reflect the estimated sizes needed to serve the estimated flows expected and are based on assumptions of the proposed pipe slopes. The design of the final pipe sizing will be affected by the City of Austin's criteria for minimum and maximum flow velocities, etc. It is anticipated that certain areas and buildings may require wastewater to be pumped due to insufficient slope to connect to existing gravity mains.

Based on the recommended overall alternatives for buildout of the airport during the 20-year study period, the resulting proposed wastewater projects have been determined. The proposed improvements are shown in **Exhibit 5.4-35** and are described below:

- New 12-inch diameter main extension will be required to serve the New North Terminal. Depending upon the internal layout of the plumbing for the terminal building, this main may not be required as the new structure could be connected to the existing main in Presidential Boulevard in front of the existing Barbara Jordan Terminal.
- New 12-inch diameter main extension will be required to the proposed Midfield Concourse building.
- Extension of the main will be required to serve future improvements on the east side of the airport. The elevation of the existing gravity main on this side of the airport is not at a low enough elevation to be extended, therefore it is assumed that a new gravity main will be required to new facilities in this area. Therefore, a 3-inch diameter low pressure main is proposed for this extension.
- Currently no wastewater main exists along the east side of US 183 to serve the proposed buildings in the southeast corner of the airport. Extension of a 12-inch main from the existing main in Burleson Road is proposed.
- The existing 8-inch and 10-inch mains that serve the area near the existing South Terminal will be abandoned/removed as the buildings in this area are demolished and new apron space and support facilities are constructed.
- The proposed depression of Emma Browning Avenue will require replacement/relocation of a portion of the existing 12-inch and 15-inch mains in this area. To maintain gravity service, it is anticipated that the main would be rerouted around the depressed roadway section. If this proves infeasible a lift station would be required.

Exhibit 5.4-34: Proposed Potable Water System Improvements During Study Period

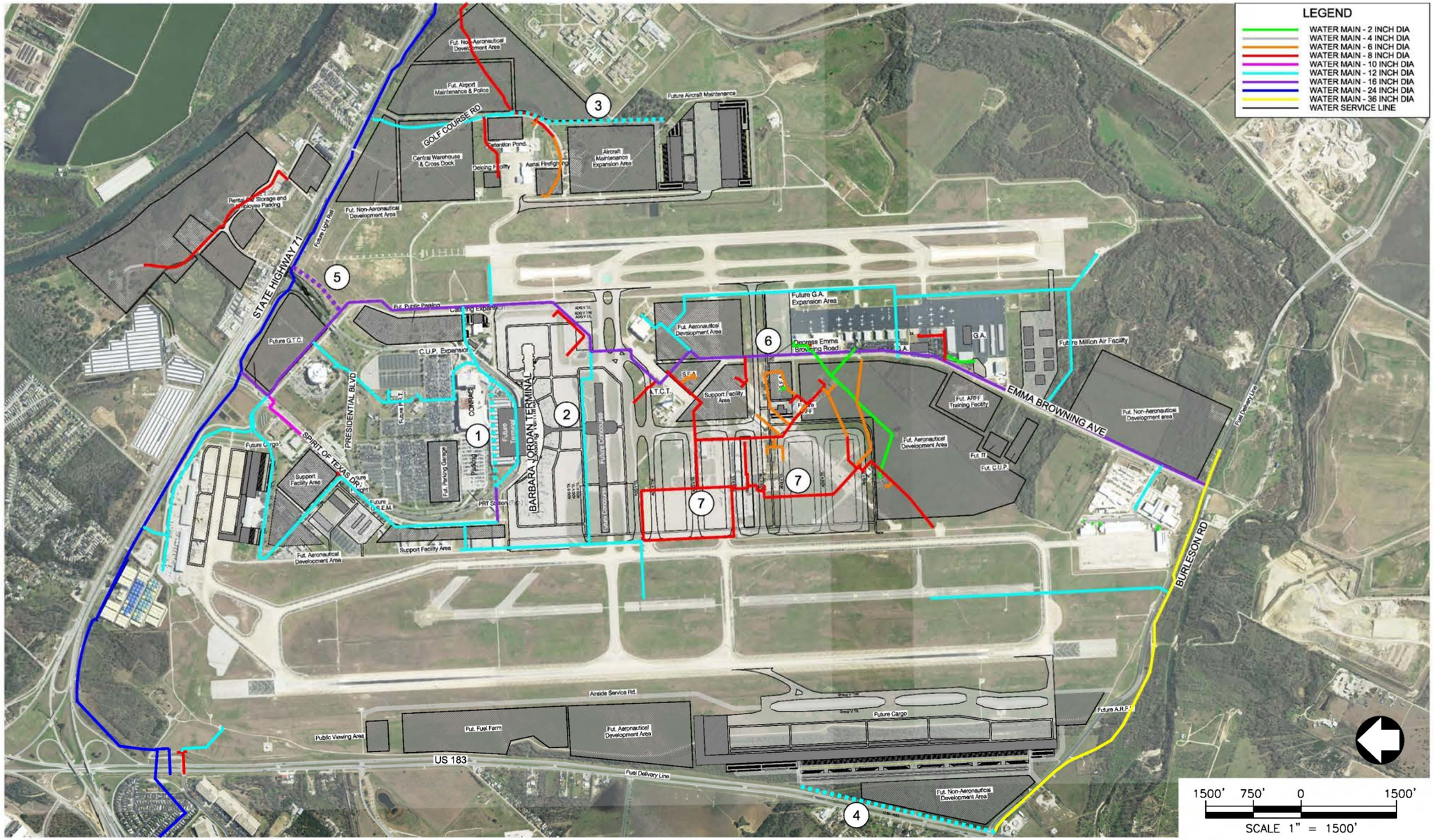


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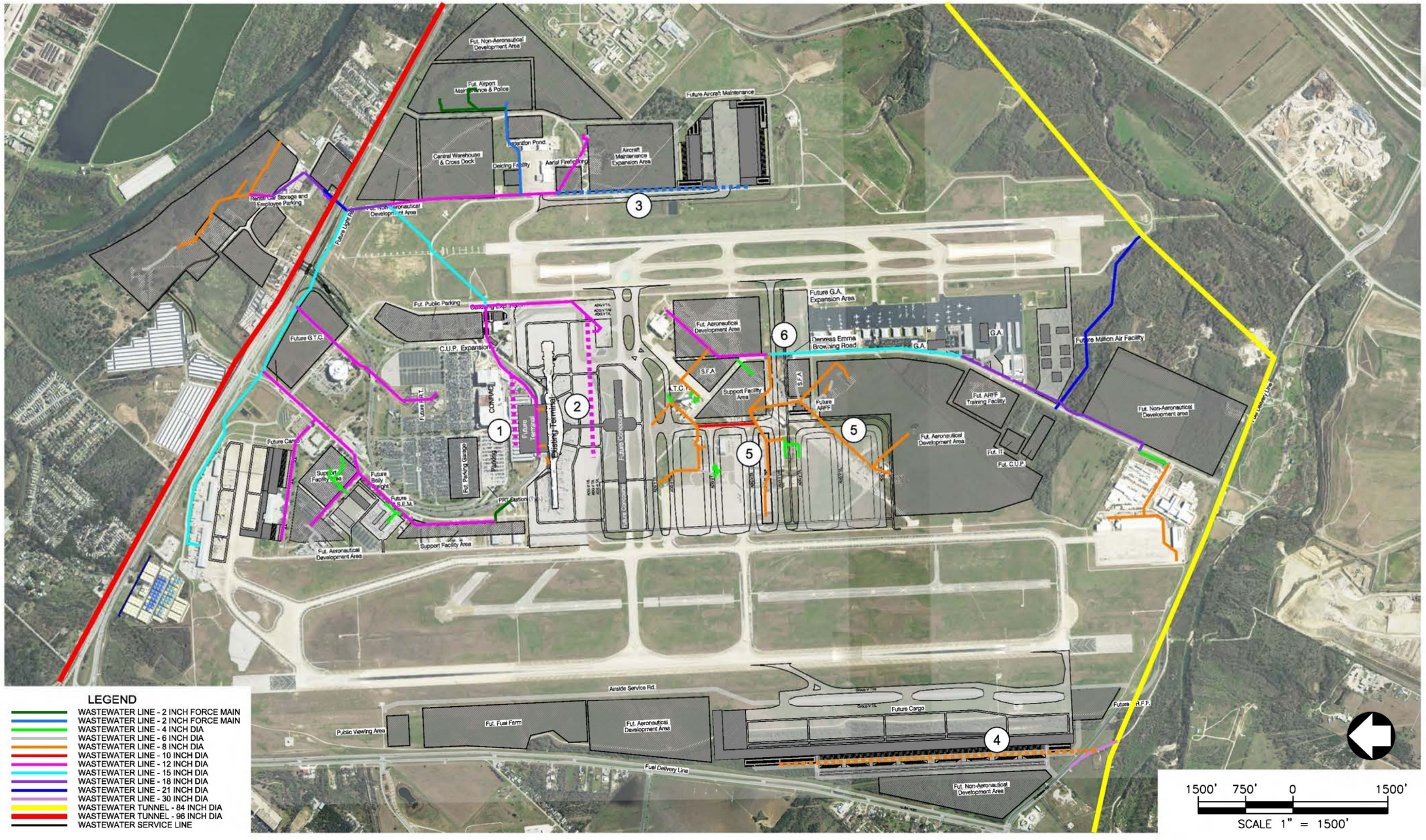
Exhibit 5.4-35: Proposed Wastewater System Improvements During Study Period



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5.4.6.3 Reclaimed Water Alternatives

The existing reclaimed water system currently only serves irrigation areas near the "eyeball" of the Airport and is currently being extended to serve irrigation at the future Consolidated Maintenance Facility along Golf Course Road. Opportunities for extension of reclaimed water service to serve new irrigation areas associated with new building projects exist.

Another possible use for reclaimed water would be in the existing Central Utility Plant that serves the existing Barbara Jordan Terminal. Currently, the CUP uses potable water, but as part of the expansion of this system to serve the New North Terminal and Midfield Concourse buildings, the Airport should consider designing the new system around reclaimed water use. Reclaimed water mains currently exist at the location of the existing CUP and where the expansion is anticipated.

There may also be opportunities for reclaimed water service to be used for domestic uses (bathrooms) in new buildings. The complicating factor for pursuing this use in the terminal area is that currently there is a single reclaimed water meter that serves all of the "eyeball" area. Domestic uses would need to be separately metered from irrigation uses so that the City's wastewater billing can account for reclaimed water that enters the wastewater collection system. This means that either a new main would need to be constructed from SH 71 to the proposed buildings to be served, or that meters would need to be installed on all irrigation connections to the main that would serve domestic uses. A second complicating factor would be ensuring that the reclaimed water system in this area is able to be supplied at a sufficient and consistent pressure to serve the proposed new buildings. At the time of this study, it is not clear if or when the improvements to the overall reclaimed system will be able to provide reliable service for this purpose.

Based on the recommended overall alternatives for build-out of the Airport during the 20-year study period, the resulting primary alternatives for extension of the reclaimed water system have been determined. Extension of the reclaimed system is not likely to be a requirement for each of these projects, but they have been listed out as options that the Airport should evaluate on a project by project basis. The proposed improvements are shown in **Exhibit 5.4-36** and described below:

- Use of reclaimed water in the existing Central Utility Plant would not require any extension of existing mains. Changes to the operation of the existing plant, along with designing the expansion of the system around reclaimed water should be considered as it is likely to result in money savings over potable water use, as well as have positive environmental impacts.
- Extension of reclaimed water to the New North Terminal and Midfield Concourse buildings to serve domestic (bathroom) purposes is complicated by the metering issue described above. The map does not show a proposed main extension as it would depend on whether the Water Utility would approve metering of all irrigation connections on the existing main loop around the "eyeball", or if a new main from SH 71 would be required. Either of those options may not be cost effective combined with the increased building costs associated with separate plumbing for the reclaimed service.
- New 8-inch main extension to serve future irrigation improvements on the east side of the Airport.
- New 8-inch main extension to serve future improvements on the southwest portion of the Airport. An existing 18-inch reclaimed water main exists along Burleson Road.

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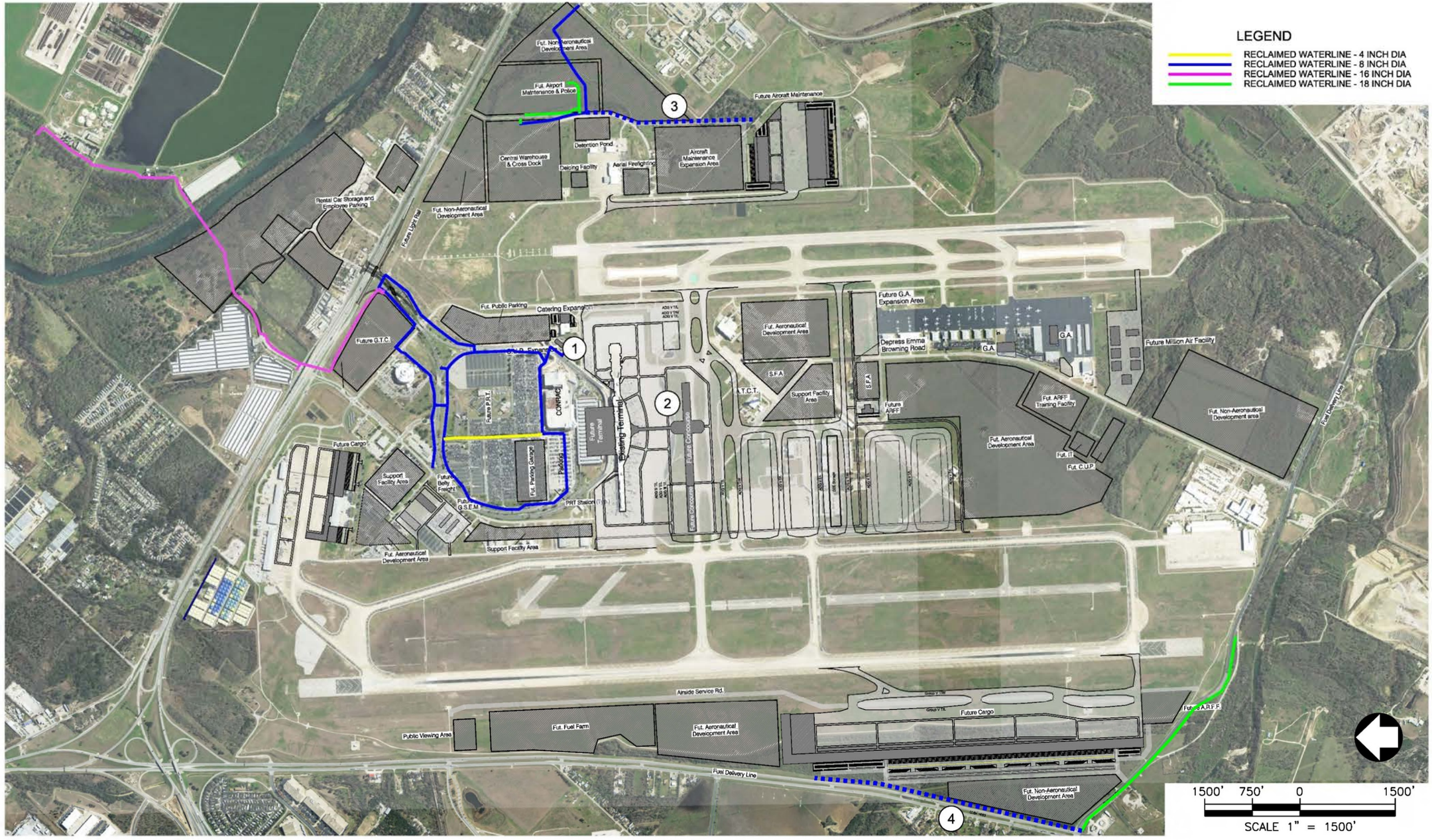
Exhibit 5.4-36: Proposed Reclaimed Water System Improvements During Study Period



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5.5 Support Facility Alternatives and Screening

5.5.1 Catering

LSG Sky Chefs is the current catering company at ABIA and is located in Building #7375 with approximately 65,000 square feet of space. The existing catering facility can be expanded within the existing 2.3-acre lease area to meet the PAL 4 demand requirements. **Exhibit 5.5-1** shows the proposed catering area expansion that will include:

- 43,400 sq. ft. catering building expansion (2-levels)
- 8,400 sq. ft. auto parking expansion
- 15,800 sq. ft. truck dock expansion
- 400 sq. ft. autoclave expansion

Exhibit 5.5-1: Proposed Existing Catering Expansion

5.5.2 Airport Rescue and Firefighting (ARFF)

The recommended increase in ARFF Index from 'D' to 'E' will require an increase in the amount of extinguishing agents from 4,000 to 6,000 gallons of water. All other facility requirements do not change between ARFF Index 'D" and Index 'E'. This increase in water capacity can be accommodated by an increase in vehicle size and/or by including an additional truck. As shown on **Exhibit 5.5-2**, it is recommended to expand the existing ARFF facility with two vehicle bays (4,100 sq. ft.) to provide for additional equipment, and to provide additional area for an already space constrained facility. It is also recommended to expand the personal space area by approximately 2,100 sq. ft.

If it is determined that expansion of the existing ARFF station is not practical due to its age, physical condition, and/or configuration, an alternative ARFF site has been identified as Item #3 as shown on Exhibit 5.5-21 at the end of this section. This new ARFF station should have a minimum of 20,000 sq. ft. of space and be located south of the new ADG-V midfield taxiway. It should have a minimum of four vehicle bays, with supporting amenities to meet Federal Aviation Regulations (FAR) Index E requirements.

Exhibit 5.5-2: Proposed Existing ARFF Expansion

5.5.2.1 ARFF Response Time and Route

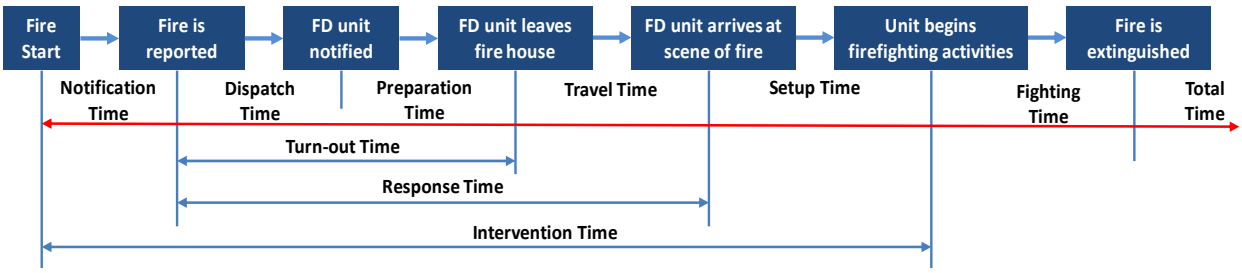
Current Federal Aviation Regulations (FAR) Part 139.319 requires the following[13]:

- (h)(2)(i) Within three (3) minutes from the time of the alarm, at least one required aircraft rescue and firefighting vehicle must reach the midpoint of the farthest runway serving air carrier aircraft from its assigned post or reach any other specified point of comparable distance on the movement area that is available to air carriers, and begin application of extinguishing agent.
- (h)(2)(ii) Within four (4) minutes from the time of alarm, all other required vehicles must reach the point specified in paragraph (h)(2)(i) of this section from their assigned posts and begin application of an extinguishing agent.

The typical sequence of events in a fire fighting response are illustrated in **Exhibit 5.5-3**, and account for the following:

- Dispatch Time – Elapsed time between the initial sighting of the fire and when the station is notified.
- Preparation Time – Time required for fire fighters to assemble for an emergency response after receiving the dispatching alarm up to the time just before leaving the fire station.
- Total Response Time – Time taken for the fire unit to arrive at the scene of the fire after the fire is reported. It is the summation of Turn-Out Time (Dispatch Time + Preparation Time) + Travel Time.

Exhibit 5.5-3: Typical Sequence of Fire Fighting Response Event



For the purposes of calculating the anticipated ARFF response times from the existing and future stations to the runway mid-points, the following assumptions were used to calculate the time and distance requirements of various response sequence events:

- Air Traffic Control is the first to observe and report an incident and issue the alarm.
- Fire vehicle speed during 90-degree turns is 35 miles per hour (minimize where possible)

[13] Electronic Code of Federal Regulation, FAR Part 139, May 17, 2018.

- Route takes the shortest distance across paved surfaces (runways, taxiways, apron and service roads). Add dedicated services roads where appropriate to maintain the highest travel possible and minimize turns.
- Dispatch Time and Preparation Time is assumed to be 15 seconds and 25 seconds, respectively; this results in a Turn-out Time of 40 seconds.
- Travel Time = Response Time (90 seconds) – Turn-out Time (40 seconds) = 140 seconds.
- Average travel speed is assumed to be 50 mph (Striker 8x8).
- Average Acceleration Time to 50 mph is 35 seconds (Striker 8x8 fire response vehicle).
- Acceleration Distance to 50 mph is 680 feet ((35*140/2) * (1000/3600))

ARFF vehicle response routes and times were determined from the existing fire station to the midpoint of the existing and future runways as shown on **Exhibit 5.5-4**. This was a paper exercise in determining the response times to each of the designated areas, and a real-life or detailed model should be undertaken to verify these travel times under actual conditions. All runway midpoints can be reached within the FAR specified 3-minute response time as shown in **Table 5.5-1**.

Exhibit 5.5-4: Existing ARFF Response Routes and Times

Source: Landrum & Brown analysis

Table 5.5-1: ARFF Response Times

LOCATION	DISPATCH TIME [sec]	PREPARATION time [sec]	TRAVEL TIME [sec]	TOTAL TRAVEL DISTANCE [ft.]	AVG. ACCELERATION TIME TO 50 MPH [sec]	RATE OF ACCELERATION [ft./sec]	ACCELERATION DISTANCE TO 50 MPH [ft.]	TRAVEL DISTANCE @ CONSTANT 50 MPH [ft.]	TRAVEL TIME @ 50 MPH [sec]	TOTAL RESPONSE TIME [sec]	TOTAL RESPONSE TIME [min. sec]
Existing ARFF Station											
Exiting Rwy. 17R—35L Midpoint	15	25	140	6,000	35	1.43	875	5,125	70	105	1:45
Exiting Rwy. 17L—35R Midpoint	15	25	140	4,800	35	1.43	875	3,925	54	89	1:29
Exiting Rwy. 17CR—35C Midpoint	15	25	140	4,200	35	1.43	875	3,325	45	80	1:20
Future South ARFF Station											
Exiting Rwy. 17R—35L Midpoint	15	25	140	5,875	35	1.43	875	5,000	68	103	1:43
Exiting Rwy. 17L—35R Midpoint	15	25	140	3,500	35	1.43	875	2,625	36	71	1:11
Exiting Rwy. 17CR—35C Midpoint	15	25	140	5,125	35	1.43	875	4,250	58	*93*	*1:33*

Notes: Average acceleration time to reach 50 mph = 35 seconds (Striker 8X9), Acceleration distance to 50 mph – $S=1/2at^2$, 50 mph = 73.3 fps

Source: Landrum & Brown analysis.

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In addition, ARFF vehicle response routes and times were determined from the proposed new south fire station to the midpoint of the existing and future runways as shown on **Exhibit 5.5-5**. All runway midpoints can be reached within the FAR specified 3-minute response time as shown in Table 5.5-1.

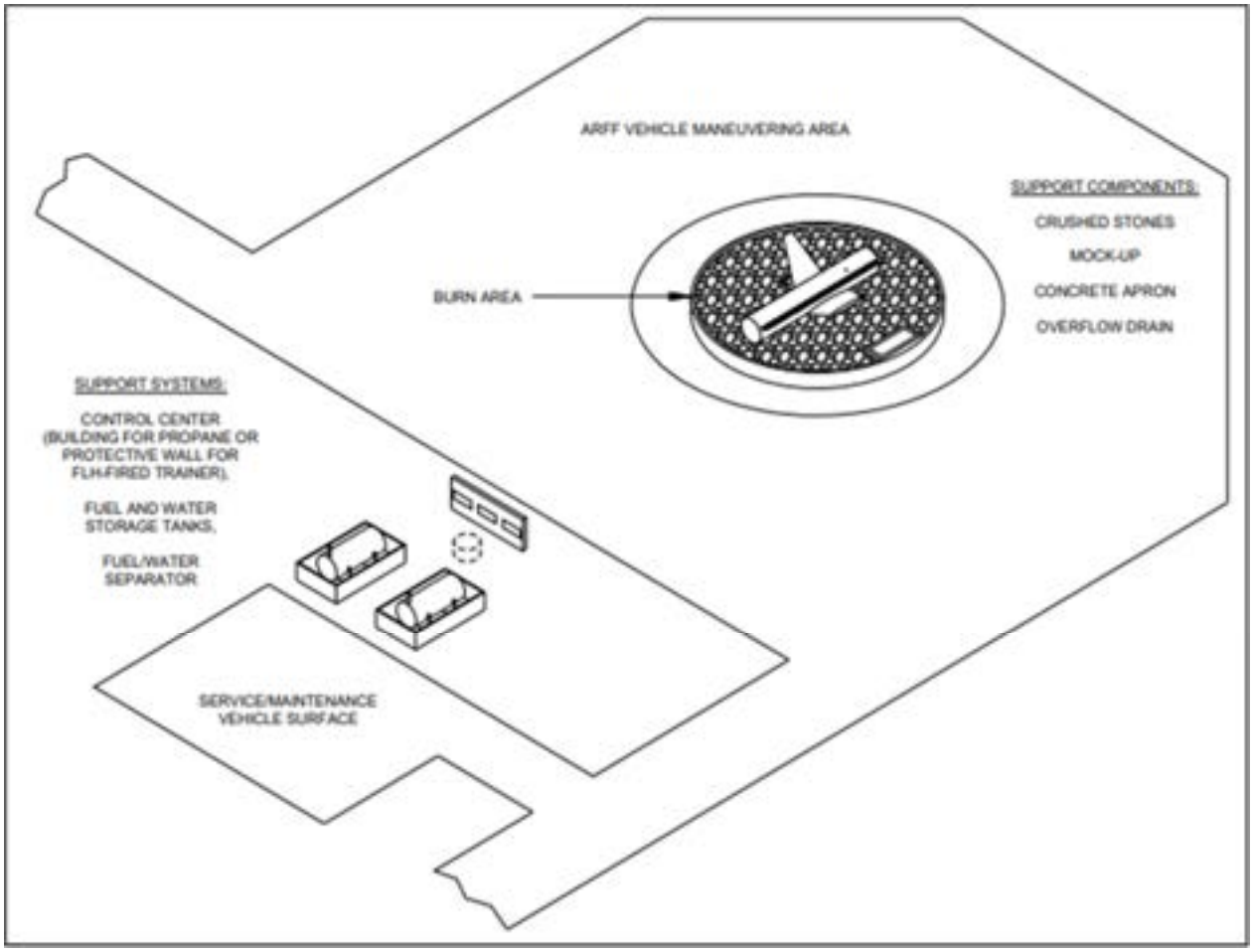
Exhibit 5.5-5: Future South ARFF Response Routes and Times

Source: Landrum & Brown analysis

5.5.2.2 ARFF Training Facility

A typical ARFF training facility layout is shown in **Exhibit 5.5-6**. A long-term fixed ARFF training facility site is proposed on the south side of the airport and is identified as Item #6 on Exhibit 5.5-21 at the end of this section. This site should to accommodate a full aircraft fuselage mock-up, burn area, and systems control station. Coordination with the Fire Department will be necessary to determine the desired location and configuration of this facility. This facility will also be used as a joint use training facility with the Forest Service.

Exhibit 5.5-6: ARFF Training Facility Layout



Source: FAA Advisory Circular 150/5220-17B, *Aircraft Rescue and Fire Fighting (ARFF) Training Facilities*

5.5.3 General Aviation Alternatives

This section provides an overview of the proposed development alternatives for the general aviation facilities to meet the future facility requirements identified in Chapter 4, *Demand/Capacity Facility Requirements*.

5.5.3.1 Primary General Aviation Area – Development Objectives

The following development objectives are noted for the general aviation area expansion to meet the ultimate PAL 4 (2037) facility requirements:

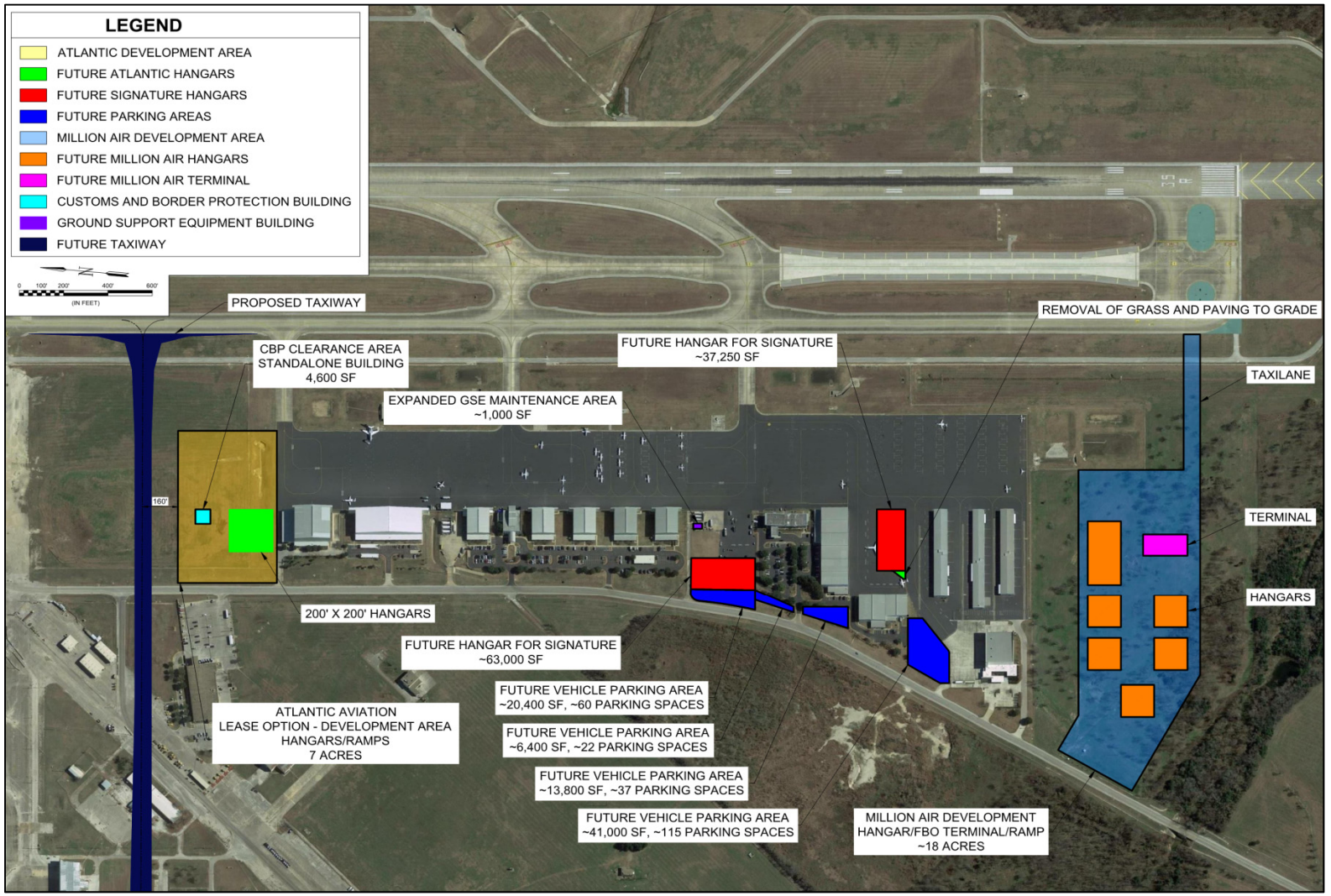
- Increase hangar space for jet and turbo-prop aircraft by approximately 56,000 sq. ft.
- Establish hangar facilities able to accommodate the larger corporate/business jet aircraft (G650, Global 7000, BBJs, etc.) that are expected to operate more frequently at ABIA.
- Increase ramp space by approximately 94,000 sq. ft.
- Increase the number of vehicle parking spots to accommodate the existing and future parking demand at Signature Flight Support.
- Increase the Ground Support Equipment maintenance area size at Signature Flight Support by approximately 1,000 sq. ft.
- Establish a location for a U.S. Customs and Border Protection General Aviation Facility at approximately 4,600 sq. ft.
- Remove the grass strip south of Hangar #9040 and pave the area for the movement of aircraft through the area.

These development objectives were used to guide the creation of the development alternatives discussed in the following sections.

5.5.3.2 General Aviation Area – Development Alternatives

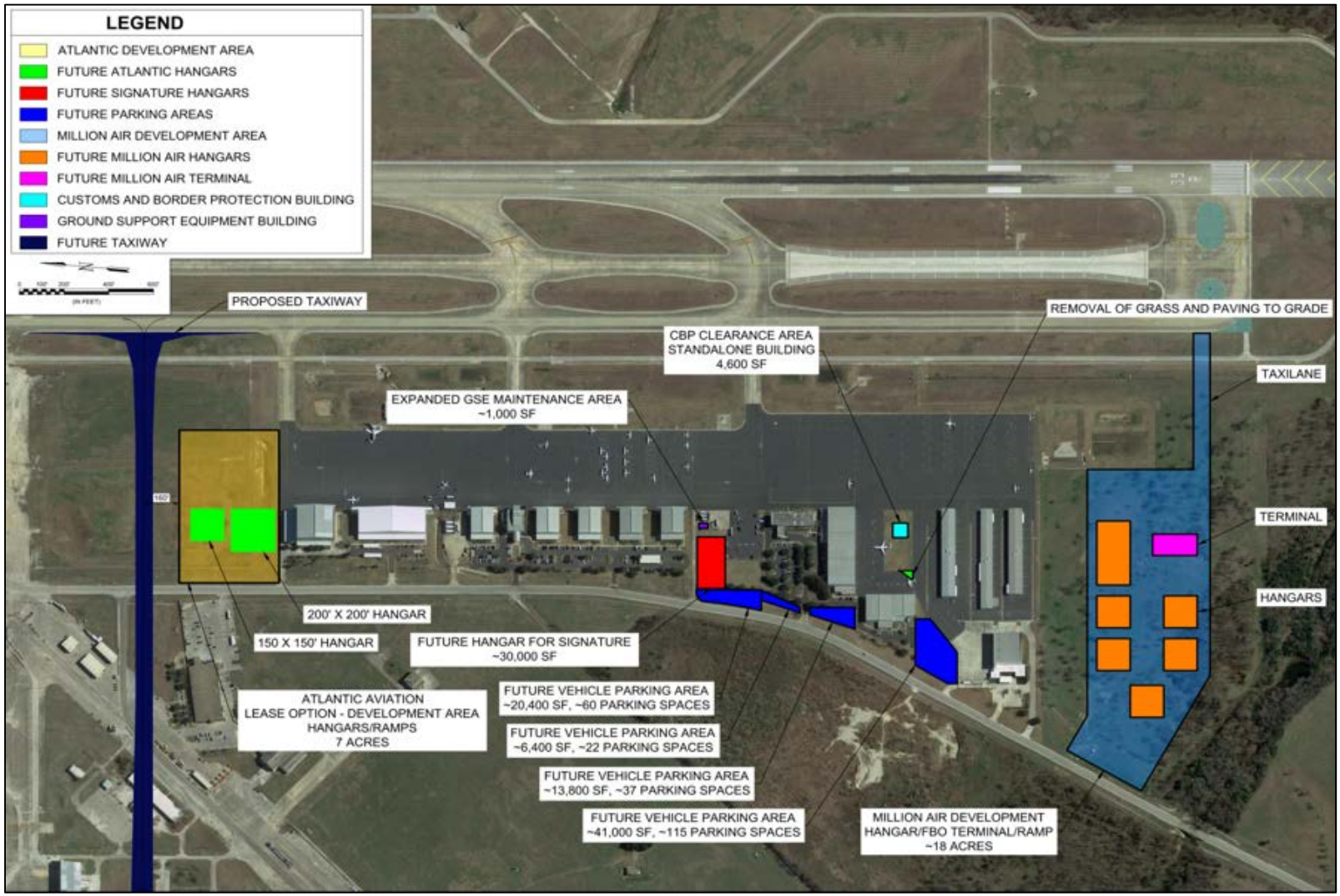
Two development alternatives were created for the general aviation area. All the proposed development objectives can be accommodated within the footprint of the existing lease areas and the two expansion site areas – the Million Air development to the south and the 20-acre Atlantic Aviation lease development option area. However, to accommodate the proposed southern cross-field taxiway, only 7 of the 20 acres currently under lease option by Atlantic Aviation will be available for additional GA development. The Alternative 1 layout is shown on **Exhibit 5.5-7** and Alternative 2 layout on **Exhibit 5.5-8**.

Exhibit 5.5-7: General Aviation Development Alternative 1



Source: Garver

Exhibit 5.5-8: General Aviation Development Alternative 2



Source: Garver

Several of the proposed development objectives are accommodated in a similar manner for both development alternatives. Specifically, the following elements are the same in each of the two proposed development alternatives:

- Million Air Development Area Layout – A conceptual layout of the Million Air development is shown on their website was used for both of the development alternatives.
- Removal of the Grass Strip South of Hangar #9040 – The small grass strip located south of Hangar #9040 is removed and paved in each alternative.
- GSE Maintenance Facility Expansion at Signature Aviation – The same GSE maintenance facility location for Signature Flight Support was used in both alternatives. This location is located away from any active aircraft taxi route and is located adjacent to the Signature Flight Support fuel farm, which will minimize impact on aircraft operations.
- Parking Expansion Options for the Southern Portion of the GA Area – The same four potential vehicle parking development locations for the southern portion of the GA area are shown on both alternatives. These options allow for a scaled expansion of the vehicle parking in the area.

While the elements discussed above are the same in each alternative, there are a number of elements that are different in each of the development alternatives.

Alternative 1 Unique Elements:

- Signature Hangar Development – Two new hangar development areas (approximately 100,250 sq. ft.) are shown for Signature Flight Support to provide additional demand without needing to expand beyond their existing lease area. This alternative will allow Signature to support a significant amount of aeronautical based aircraft growth and provides them the ability to accommodate larger jet aircraft in the northern hangar development area.
- Atlantic Aviation Development – One 200’ x 200’ hangar is shown in the Atlantic Aviation Development Area on the north end of the existing GA development. The development of additional hangars in this area is limited by the proposed crossfield taxiway and the establishment of the proposed U.S. CBP General Aviation Facility in the area.
- U.S. CBP General Aviation Facility – The proposed U.S. CBP General Aviation Facility is located on the northern end of the Atlantic Aviation development area. This location will allow for good access to the facility without disrupting aircraft taxi routes, the linear hangar development along the existing ramp area, or the aircraft parking configurations of the Fixed Base Operators (FBOs) and other tenants.

Alternative 2 Unique Elements:

- Signature Hangar Development – A single new hangar development site (approximately 30,000 sq. ft.) is proposed for Signature Flight Support. This will provide additional demand without expanding beyond their existing lease area. This alternative will allow Signature to support a smaller amount of based aircraft growth and limits their ability to accommodate larger jet aircraft hangar space in the future.

- Atlantic Aviation Development – One 200' x 200' hangar and one 150'x150' hangar is shown in the Atlantic Aviation Development Area on the north end of the existing GA development. The development of additional hangars in this area is limited by the proposed crossfield taxiway.
- U.S. CBP General Aviation Facility – The U.S. CBP General Aviation Facility is located north of the T-hangar facility in the grass area. This alternative utilizes the existing ramp space but will likely cause congestion issues with other taxing aircraft while also limiting the potential for future hangar development in this area.

5.5.3.3 General Aviation Area – Alternatives Screening

The two GA development alternatives were evaluated based on the screening criteria described below. These criteria were used to determine which alternative or combination of alternatives would best serve the future ABIA General Aviation operation. The screening criteria is as follows:

- Criteria 1: Ability to Meet the Established Development Demand and Objectives – Does the alternative effectively meet the future PAL 4 demand and development objectives?
- Criteria 2: Flexibility for Future Development – Does the alternative provide flexibility by allowing for the scaled expansion of future facilities based on future demand?
- Criteria 3: Efficient Movement of Aircraft – Will the proposed layout impact the efficient movement of aircraft?

Each alternative was assigned a rating of "good", "fair", or "poor" for its ability to satisfy each of the screening criteria. **Table 5.5-2** depicts the ratings for the two proposed alternatives.

Table 5.5-2: General Aviation Development Alternatives Screening

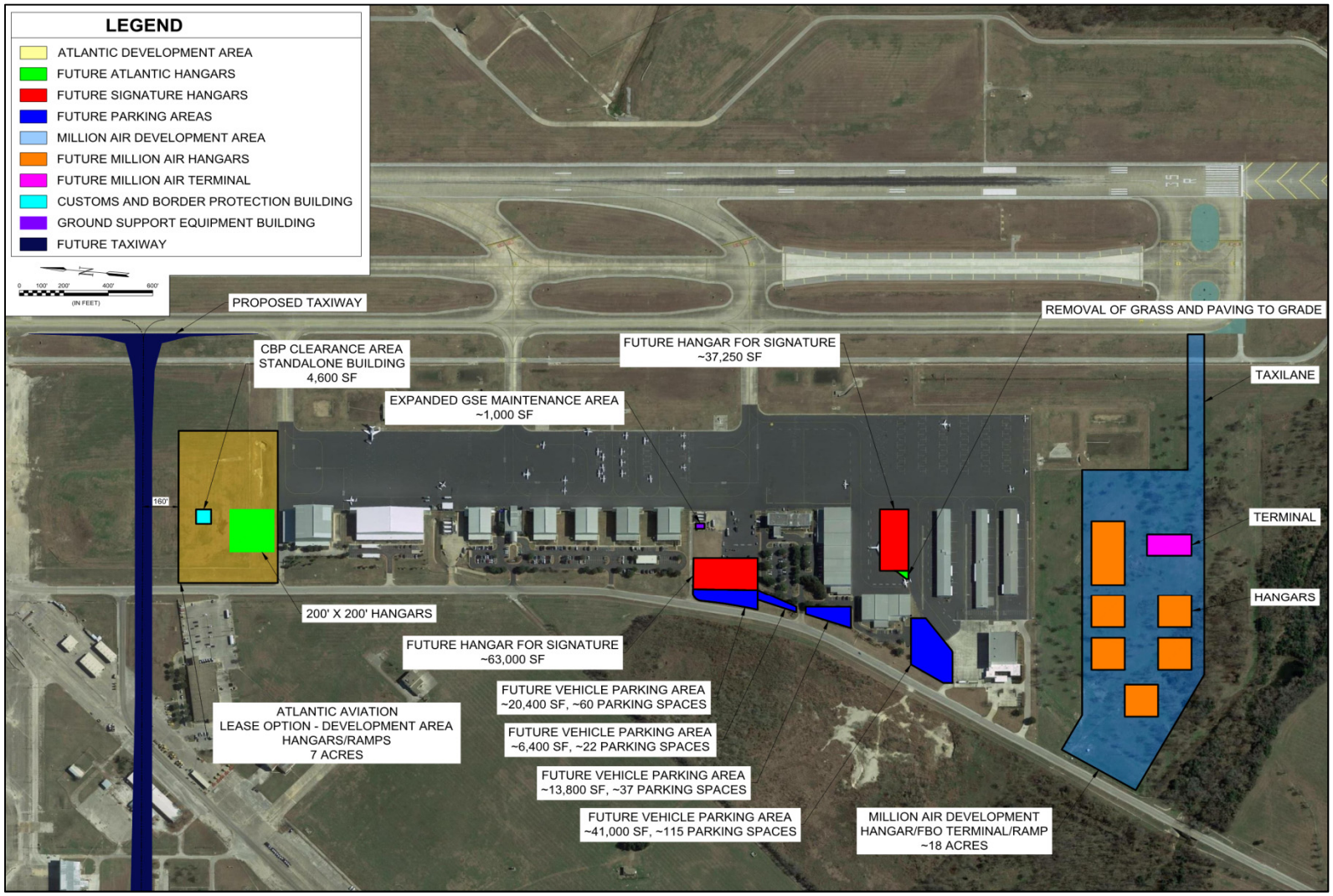
ALTERNATIVE	CRITERIA 1: MEET ESTABLISHED DEMAND & DEVELOPMENT OBJECTIVES	CRITERIA 2: FLEXIBILITY FOR FUTURE DEVELOPMENT	CRITERIA 3: EFFICIENT MOVEMENT OF AIRCRAFT
Alternative 1	Good	Good	Good
Alternative 2	Good	Good	Fair

Both alternatives received a rating of "good" for their ability to meet the established long-term PAL 4 (2037) demand and development objectives. They both also allow for a scalable expansion of the ramp and hangars to meeting the anticipated growth in general aviation activity.

Alternative 1 was rated as "good" regarding the efficient movement of aircraft. This is primarily due to the location of the proposed U.S. CBP General Aviation Facility on the northern end of the ramp. In Alternative 2, the U.S. CBP General Aviation Facility is located in the grass area north of the existing T-hangar development. The ramp in front of this proposed location is already very congested; therefore, the parking of aircraft in this area for U.S. Customs clearance purposes will only add to the already congested area.

Based on the above screening analysis, Alternative 1 is the recommended development alternative for the general aviation area at ABIA. The recommended development layout is shown in **Exhibit 5.5-9**.

Exhibit 5.5-9: Preferred General Aviation Development Alternative



Source: Garver

5.5.4 TxDOT Aviation Services Department

As previously noted in Chapter 4, *Demand/Capacity and Facility Requirements,* there is no anticipated expansion of the TxDOT facilities located east of the Runway 17L threshold along Golf Course Road.

5.5.5 Aerial Firefighting

As the north cargo complex is expanded to meet future demand, it is envisioned to relocate the Texas A&M Forestry Service Aerial Firefighting facility to the east side of the airport adjacent to the TxDOT Aviation complex. As shown as Item #3 on Exhibit 5.5-20 (at the end of this section), this area will include the following facilities, along with access to the airfield:

- B-747-400 aircraft ramp area
- Water storage tank
- Office space
- Auto parking

Aircraft will have access to the airfield via a new parallel taxiway east of Runway 17L-35R.

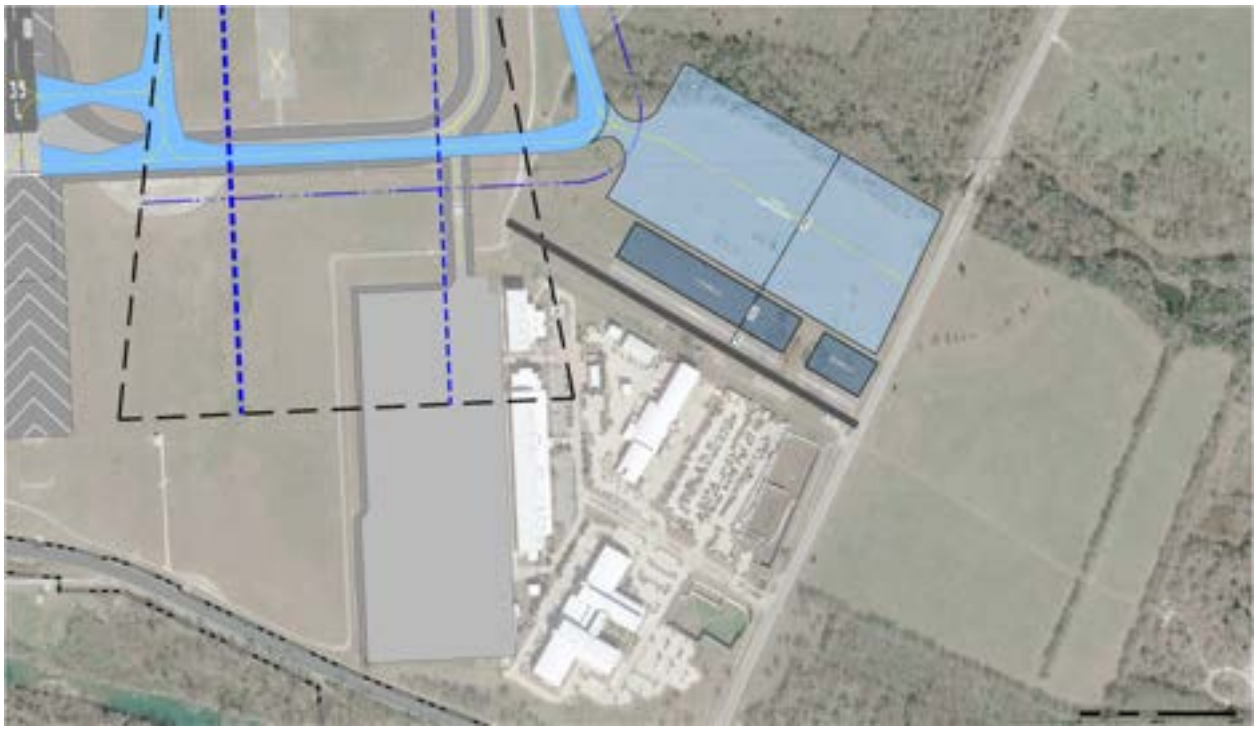
5.5.6 Military Facility

The U.S. Army Reserve Center is located at the southern end of existing Runway 35L. This facility is not expected to be expanded in the future; however, various facilities will need to be relocated upon construction of the proposed 10,000-foot long Runway 17C-35C (beyond the 20-year horizon). The following facilities will be within the 35C Runway Protection Zone and will need to be relocated:

- Aircraft/Helicopter Ramp Area
- Building No's.
    - #9530 – Aviation Support Facility (AASF) Fixed Wing Support
    - #9532 – AASF Fixed Wing Hangar
    - #9535 – AASF Operations Specialist
    - #9540 – AASF Rotary Wing Support
    - #9541 – AASF Rotary Wing Hangar

As shown on **Exhibit 5.5-10**, it is proposed to relocate these facilities to the northeast of the military site and provide a taxiway connection to the future end-around taxiway. Additional analysis will need to be conducted to determine if any additional facilities will be an obstruction to the FAR Part 77 Imaginary Surfaces associated with the new Runway 17C-35C once the runway has been fully designed.

Exhibit 5.5-10: Relocated U.S. Army Reserve Center Facilities



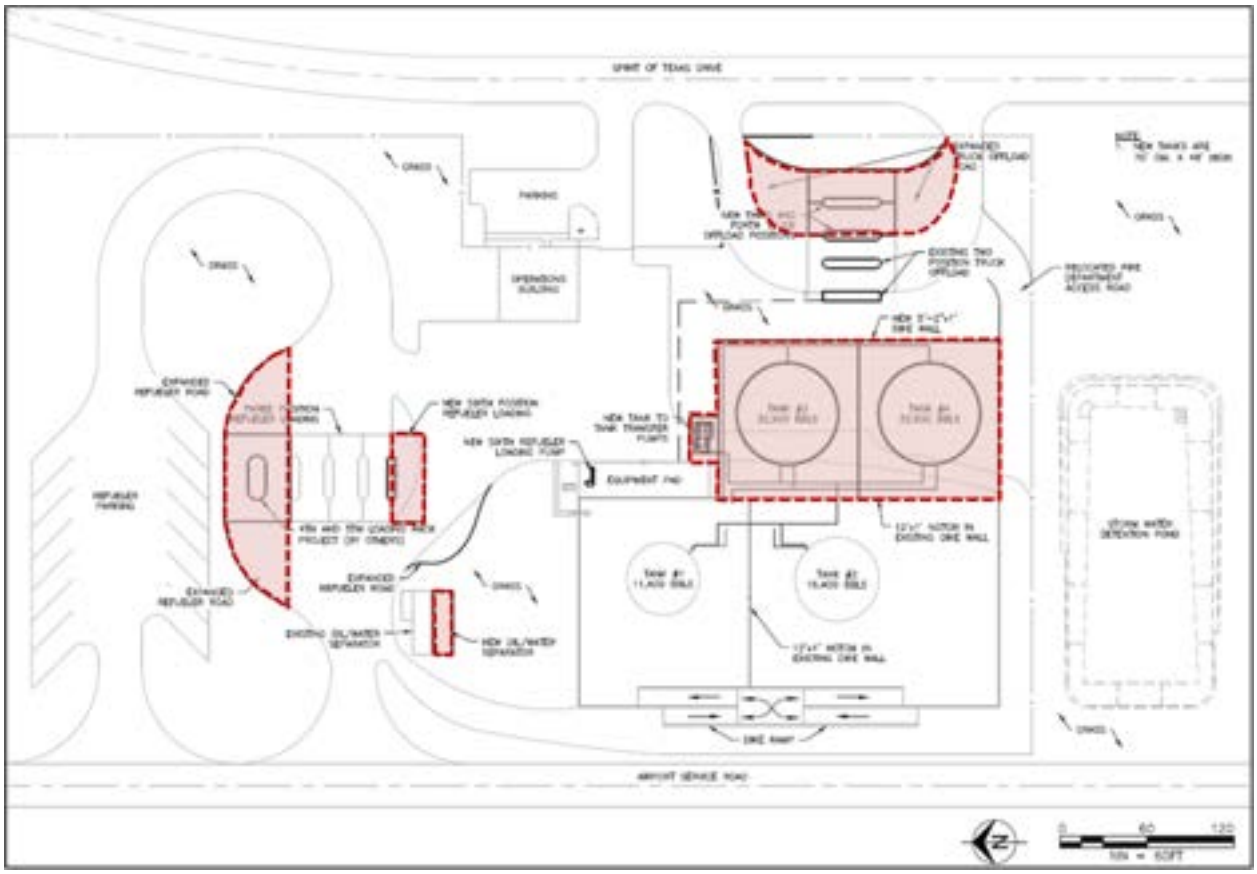
Source: Landrum & Brown analysis

5.5.7 Aircraft Fueling

The current Airline Consortium has proposed an expansion of the existing fuel farm area that will provide capacity for the next 20-years and meet the PAL 4 (2037) fueling demand requirements. **Exhibit 5.5-11** shows the proposed fuel farm expansion plan. Beyond the 20-year time horizon it is recommended to relocate the fuel farm facility to the west side of the airport and have a direct fuel line connection from the Flint Hills Bastrop Terminal. It is proposed that all new commercial and cargo aircraft parking positions will be equipped with hydrant fueling. In addition, it is proposed to install a hydrant fueling system for the existing BJT gates when feasible (physically and monetarily).

A potential long-term fuel farm site is shown as Item #2 on Exhibit 5.5-22 (at the end of this section) and will be sized to meet the PAL 4 (2037) demand of 2.3 million gallons of jet fuel capacity, with additional land for expansion in the future. The Airline Consortium will need to determine if it is better to relocate the existing fuel farm earlier in the development program based on the construction timing of the proposed 3rd parallel Runway 17C-35C.

Exhibit 5.5-11: Aircraft Fuel Farm Expansion



Source: Argus Consulting, Inc., Jan. 29, 2018.

5.5.8 Airport Administration Offices

The new Airport Administration Office site is located just west of the new Parking Garage #3 and will include the following departments:

- Airport Administration
- Operations & Security (partial)
- Information Systems
- Finance
- Support Services & Property management
- Business Development & Customer Relations
- Enterprise Business Services (partial)

The new Airport Administration Office building will have five levels, with a total area of 81,800 sq. ft. It is anticipated that this building will be adequate to meet the PAL 4 (2037) demand. Employee parking will be accommodated within Garage #3.

5.5.9 Airport Maintenance and Police Department

The new Consolidated Maintenance Facility will be located on the east side of Golf Course Road and the facility layout is shown in **Exhibit 5.5-12** and is identified as Item #6 on Exhibit 5.5-20 at the end of this section. This facility will be 13.42 acres in size and house the following facilities:

- Airport Maintenance Operations
- Motor Pool
- Warehouse Storage
- Truck Wash
- Recycling
- Spoil Bins
- Airport Police Department

Also, the 0.84-acre deicing material storage facility will be located immediately north of the existing TxDOT Aviation facility west of Golf Course Road and is identified as Item #5 on Exhibit 5.5-20 at the end of this section.

Exhibit 5.5-12: Airport Maintenance and Police Department Complex

Source: City of Austin Department of Aviation

5.5.10 Aircraft Maintenance

Currently there are no aircraft maintenance facilities located at ABIA. However, in the event an airline wishes to perform maintenance on their aircraft fleet, it is proposed to locate a maintenance facility on the east side of Runway 17L-35R and is identified as Item #1 on Exhibit 5.5-20 at the end of this section. The site will have a dedicated taxiway for access to the maintenance ramp and hangar space, and will include the following facilities:

- 142,967 sq. ft. narrow-body aircraft hangar building space
- 330,766 sq. ft. wide-body aircraft hangar building space
- 261,400 sq. ft. shop/storage building space
- 80,153 sq. ft. GSE storage space
- 220,736 sq. ft. auto parking space
- 190,000 sq. ft. truck dock space

An additional expansion area has been provided to the north and is shown as Item #2 on Exhibit 5.5-20 at the end of this section.

5.5.11 Ground Service Equipment Maintenance

The existing Ground Service Equipment Maintenance facility is located in Building #7005 along the west side of Spirit of Texas Drive. The current facility is operating at 100% capacity and is proposed to be relocated and expanded to accommodate the future demand and to allow for a second parallel taxiway to the future Runway 17C-35C. This facility also needs to be relocated because it cannot be expanded in its current location due to various site constraints.

A new GSEM facility is proposed in the current rental car storage area as shown in **Exhibit 5.5-13**, and will include the following:

- 6.0-acre site area
- 27,500 sq. ft. building
- 107,000 sq. ft. auto parking and truck dock area

The relocated and expanded GSEM facility is also shown as Item #9 on Exhibit 5.5-19 at the end of this section.

Exhibit 5.5-13: Ground Service Equipment Maintenance

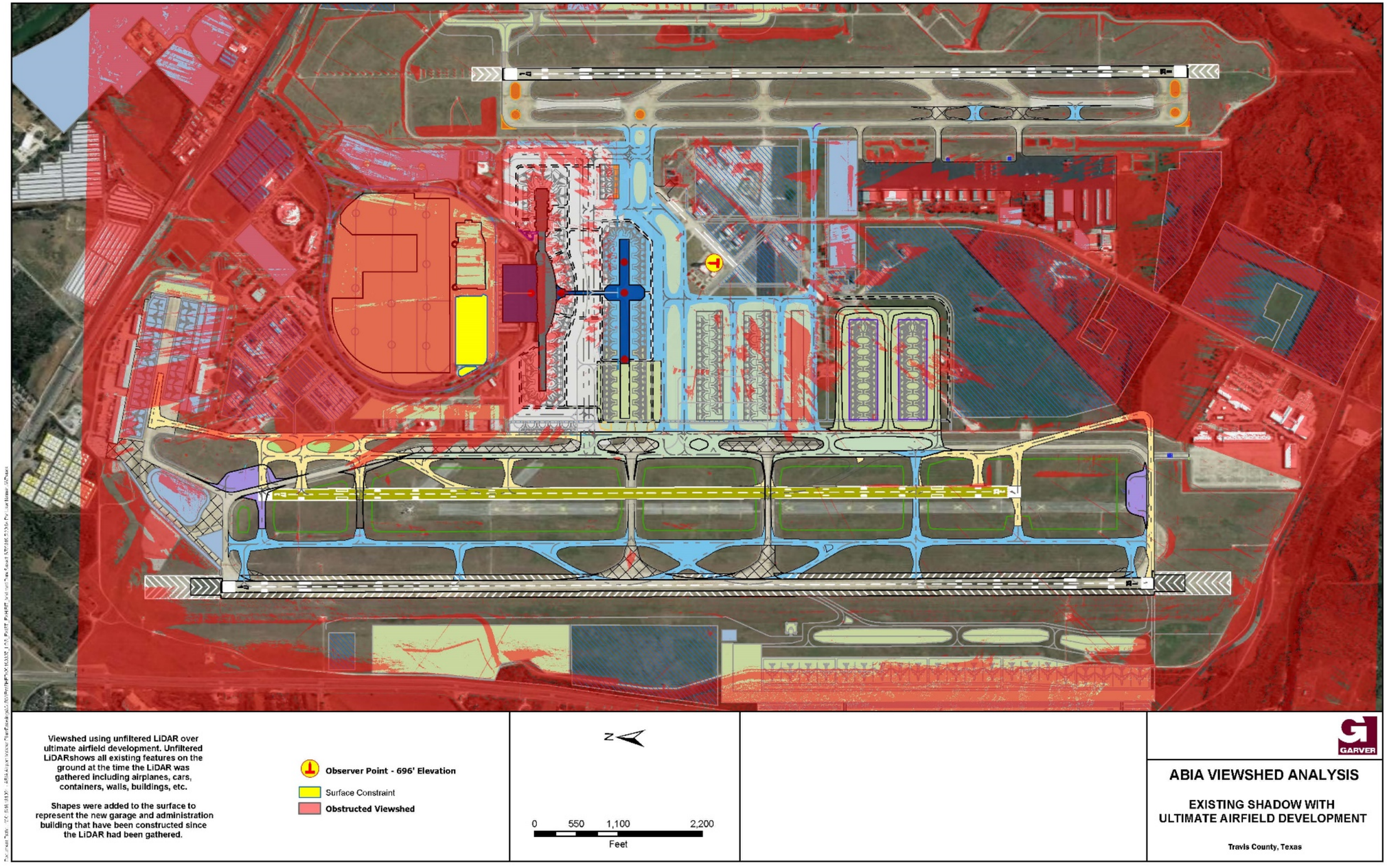
Source: Landrum & Brown analysis

5.5.12 Federal Aviation Administration

This Master Plan does not require relocation of the existing Air Traffic Control Tower and TRACON facilities. However, due to the location and height of the proposed remote concourse building, there will be some non-movement areas of the airport that will not be visible from the existing ATCT cab. For those non-movement areas within the terminal/concourse area, it is recommended that a physical ramp tower or virtual tower be constructed to provide visual (eye or camera) access of these areas. For those movement areas, it is recommended to install CCTV's to provide visual access to these areas for the ATCT.

A line-of-sight analysis was conducted from the existing ATCT to the existing and future airfield pavement areas as shown in **Exhibit 5.5-14**. An eye-level elevation of 696.0 MSL was used for this analysis, along with preliminary future building and pavement elevations. Based on this preliminary analysis, there should be no line-of-sight issues from the existing ATCT to the airfield movement and non-movement pavement areas. A final analysis will need to be conducted once the final building and pavement surface elevations are known per the engineering design drawings.

Exhibit 5.5-14: Existing ATCT Line-of-Sight Analysis



Source: Garver

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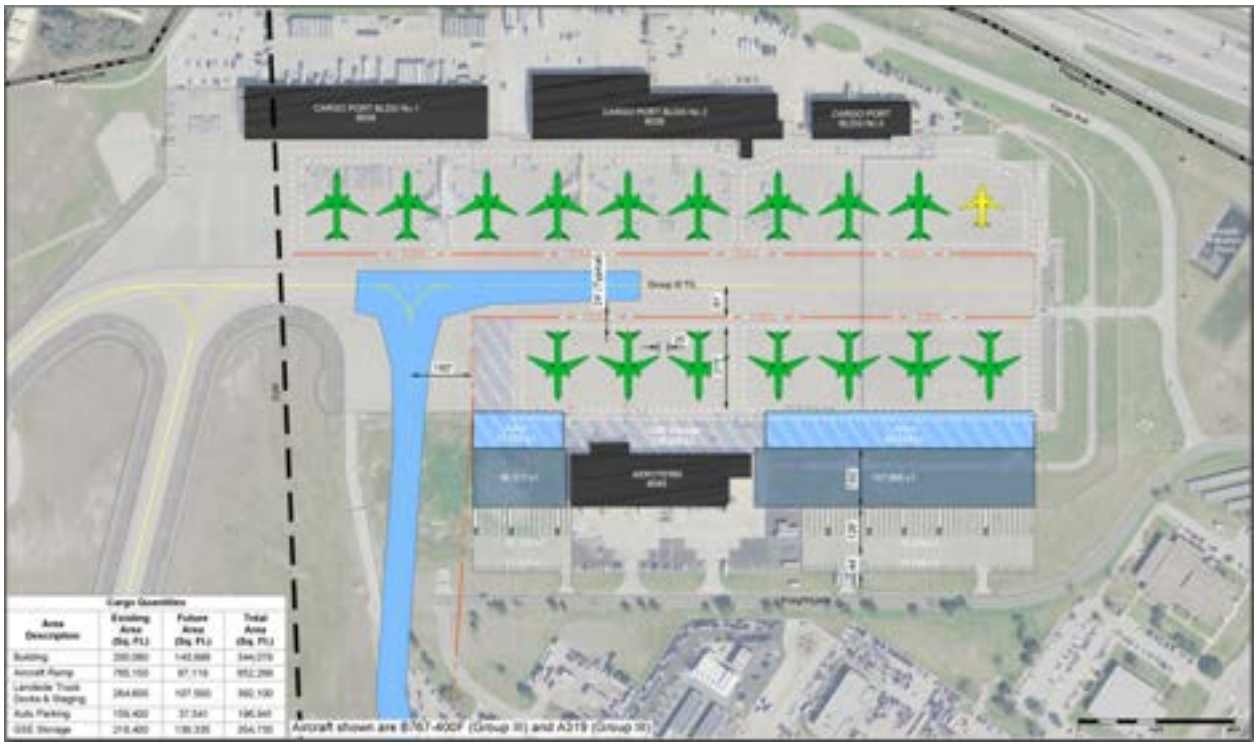
5.5.13 Air Cargo Facilities

The future air cargo requirements were determined based on two air cargo tonnage forecasts (base case and high case scenarios). The base case cargo forecast assumes a continuation of the current cargo market at ABIA with an average annual growth rate of 3.4 percent. The high case cargo forecast assumes that an e-commerce distribution center will be developed at ABIA. This e-commerce distribution hub will begin service in approximately 2027, with more than 25,500 annual aircraft operations and an average annual growth rate of 15.2 percent.

Exhibit 5.5-15 shows the proposed north cargo area expansion that will accommodate the anticipated PAL 4 (2037) base case demand and is also shown as Item #12 in Exhibit 5.5-19 at the end of this section. This additional capacity can be accommodated by converting the existing cargo buildings that are not being used for cargo activity (Building #3 and Aeroterm). These two buildings have a total area of 46,080 sq. ft. In addition, the Aeroterm building can be expanded to the west by approximately 212,000 sq. ft. The eastern portion of the cargo aircraft ramp can also be reclaimed (currently used for overflow auto parking), as demand increases. The north cargo area will encompass approximately 54 acres of land.

Exhibit 5.5-15: North Air Cargo Complex



Source: Landrum & Brown analysis

With the introduction of e-commerce at ABIA, there will be a need for additional cargo space beyond that which can be provided in the north cargo area. A large cargo distribution center will drive the need for an extensive expansion of the all-cargo facilities at ABIA around the PAL 3

(2027) timeframe, or about 540,000 tons of cargo. This cargo distribution center will require approximately 167 acres of land that includes buildings, aircraft ramp, truck docks, auto parking, and GSE staging/storage area. **Exhibit 5.5-16** illustrates a proposed cargo layout in the southwest corner of the airport and is also shown as Item #5 on Exhibit 5.5-21 at the end of this section. A partial ADG-V parallel taxiway will be provided for access to the airfield. Ground access to this facility will be via Burleson Road.

Exhibit 5.5-16: Southwest Air Cargo Complex

Source: Landrum & Brown analysis

5.5.14 Belly Cargo

The existing belly cargo complex encompasses approximately 4 acres of land between the airside service road and Spirit of Texas Drive. The high case future belly cargo requirements indicate that additional belly cargo facilities will be needed around the PAL 3 (2027) timeframe, or about 25,500 tons of belly cargo. This facility will double in size to approximately 8 acres in size. This additional space requirement will require a relocation of the belly cargo complex. **Exhibit 5.5-17** shows the proposed relocated site for belly cargo to the north in the current rental car storage area. Landside access to this site will remain off the Spirit of Texas Drive. A new roadway connector will be required to connect to the existing airside service road prior to construction of the new Runway 17C-35C. Once the new runway is under construction, a new airside service roadway will be necessary to remain clear of the future east parallel taxiway system. The relocated and expanded Belly Cargo facility is also shown as Item #10 on Exhibit 5.5-19 at the end of this section.

Exhibit 5.5-17: Relocated Belly Cargo

Source: Landrum & Brown analysis

5.5.15 Central Warehouse & Cross Dock

A Central Warehouse and Cross Dock facility site Feasibility Study[14] was conducted by RS&H to determine the optimum location and requirements for this facility at ABIA. The following requirements and considerations were used to evaluate possible sites:

5.5.15.1 Requirements

1. Receive materials on the landside (non-secure) area of the airport and deliver material on the airside (secure) area of the airport.
    a. Locate the facility for receiving that avoids existing/future traffic throughout the airport.
    b. Locate the facility for delivering that has minimal conflicts with aircraft.
2. Accommodate a 50,000 s.f. facility with the potential to expand to 75,000 s.f. with adequate space for truck off-loading and employee parking.
3. Locate in an undeveloped area or where existing infrastructure can be demolished.
4. Locate the facility a minimum of 300 feet from the terminal for security purposes.

[14] Central Warehouse and Cross Dock Facility Site Feasibility Study (Assignment 6.1), Draft Version No. 0.1, July 2017, RS&H.

5.5.15.2 Evaluation

1. The distance to the facility from the terminal where the Transportation Security Administration will come from to provide security screening.
2. Available utilities and existing infrastructure that may affect construction.
3. Permitting needs.
4. Development as it relates to the existing master drainage plan.
5. Environmental that may be necessary.
6. Cost of the sites relative to each other.

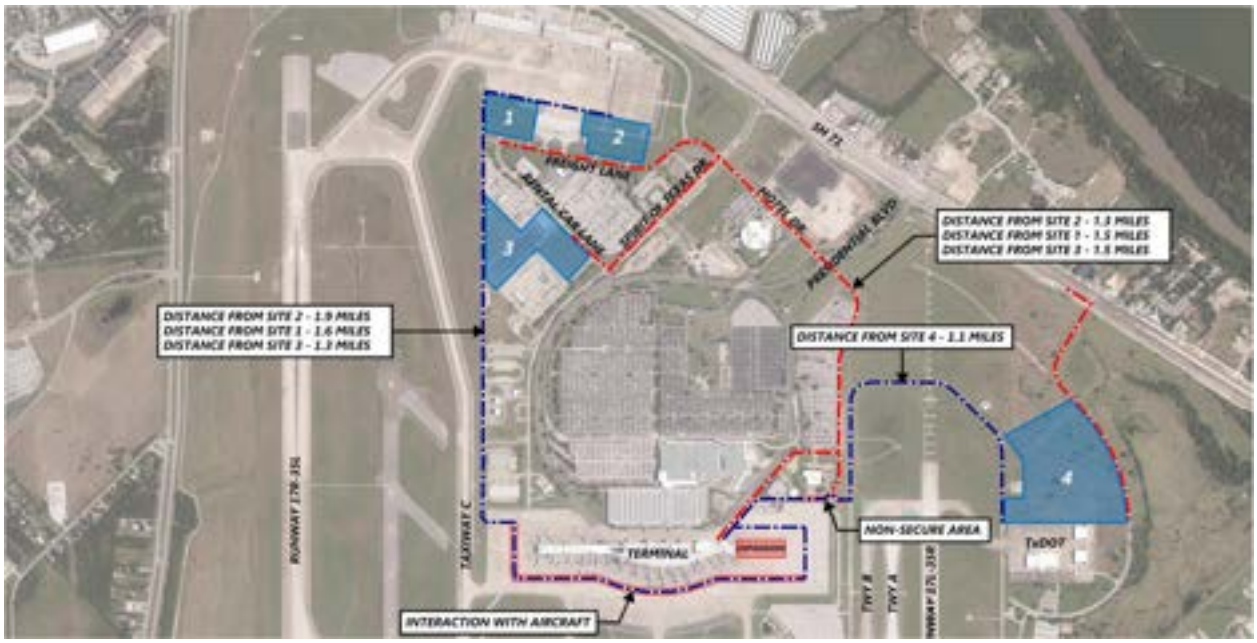
The following facility requirements were noted by ABIA for this facility:

1. Each existing concessionaire will need approximately 17,000 s.f. for their operations. This includes storage space and kitchens.
2. Approximately 4,000 s.f. is needed for the cross-dock operation.
3. Approximately 5,000 s.f. is needed for other space (restrooms and break room).
4. Approximately 7,000 s.f. is needed for a third concessionaire for operational expansion for an existing concessionaire.

To accommodate these requirements, the facility needs to be 50,000 s.f. To accommodate future growth at ABIA, an additional 25,000 s.f. of a total building size of 75,000 s.f. will be required.

Four initial sites were evaluated in detail based on these requirements as shown in **Exhibit 5.5-18**. After evaluating these sites, it was determined that Site 4 provides shorter, less complicated routes to the existing Barbara Jordan Terminal, and the development cost of the site preparation is the lowest. Therefore, Site 4 is the preferred location for the Central Warehouse and Cross Dock facility. This site is also shown as Item #7 on **Exhibit 5.5-20**.

Exhibit 5.5-18: Future Central Warehouse and Cross Dock Alternative Sites

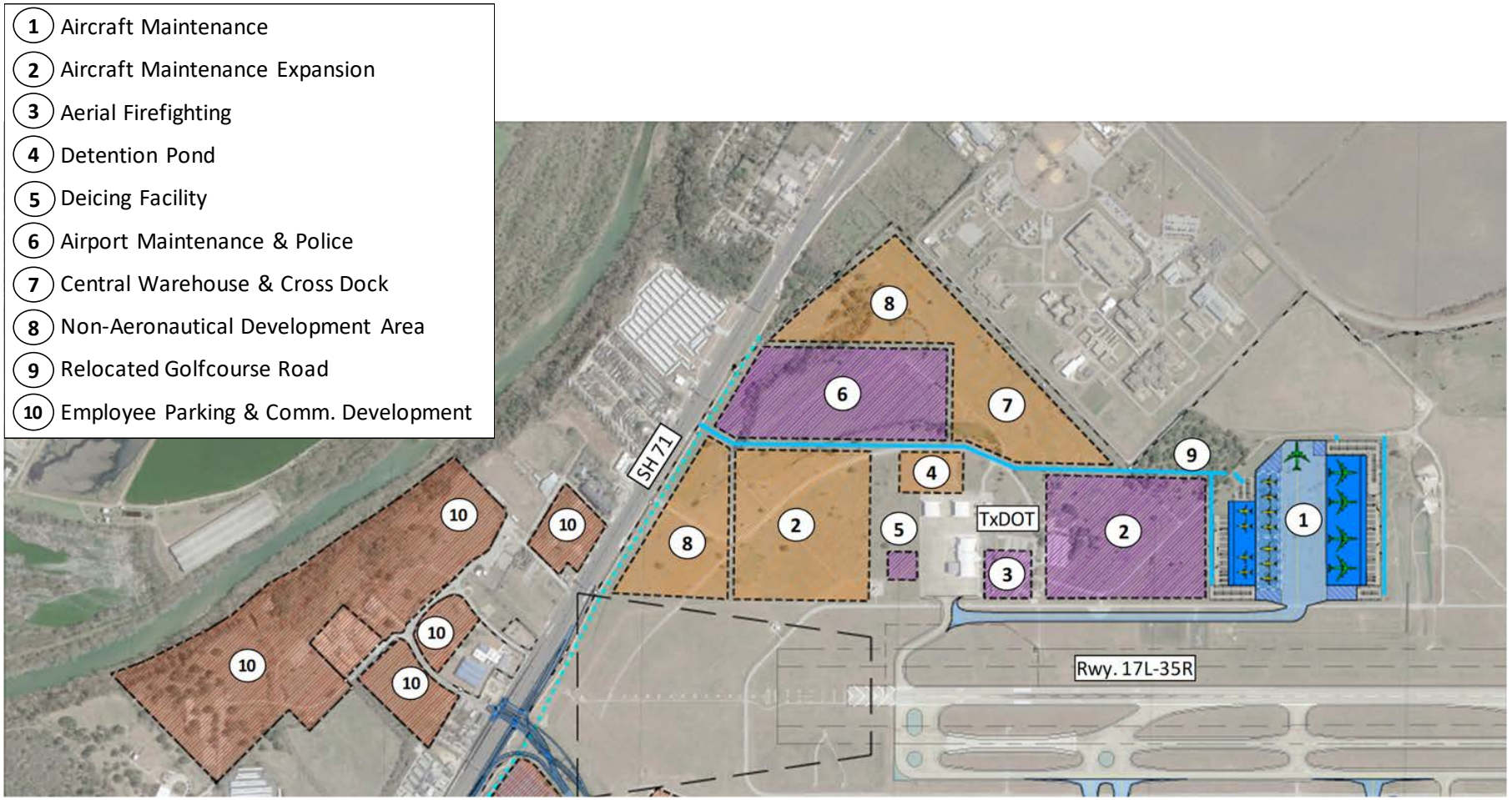


Source: Central Warehouse and Cross Dock Facility Site Feasibility Study, RS&H, July 2017.

Exhibit 5.5-19: Proposed ABIA Terminal Development Area

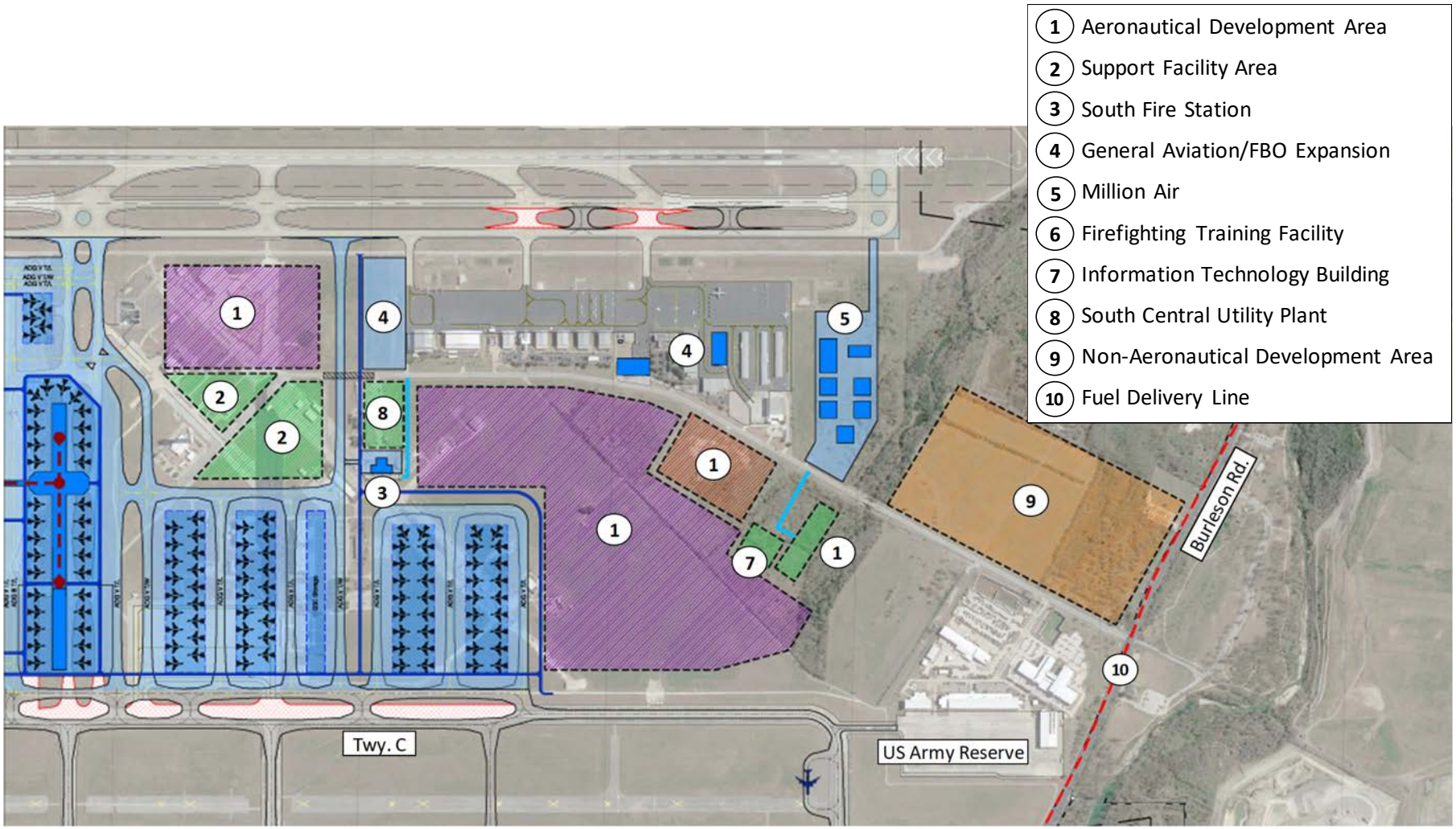
Source: Landrum & Brown analysis

Exhibit 5.5-20: Proposed ABIA North & East Development Area



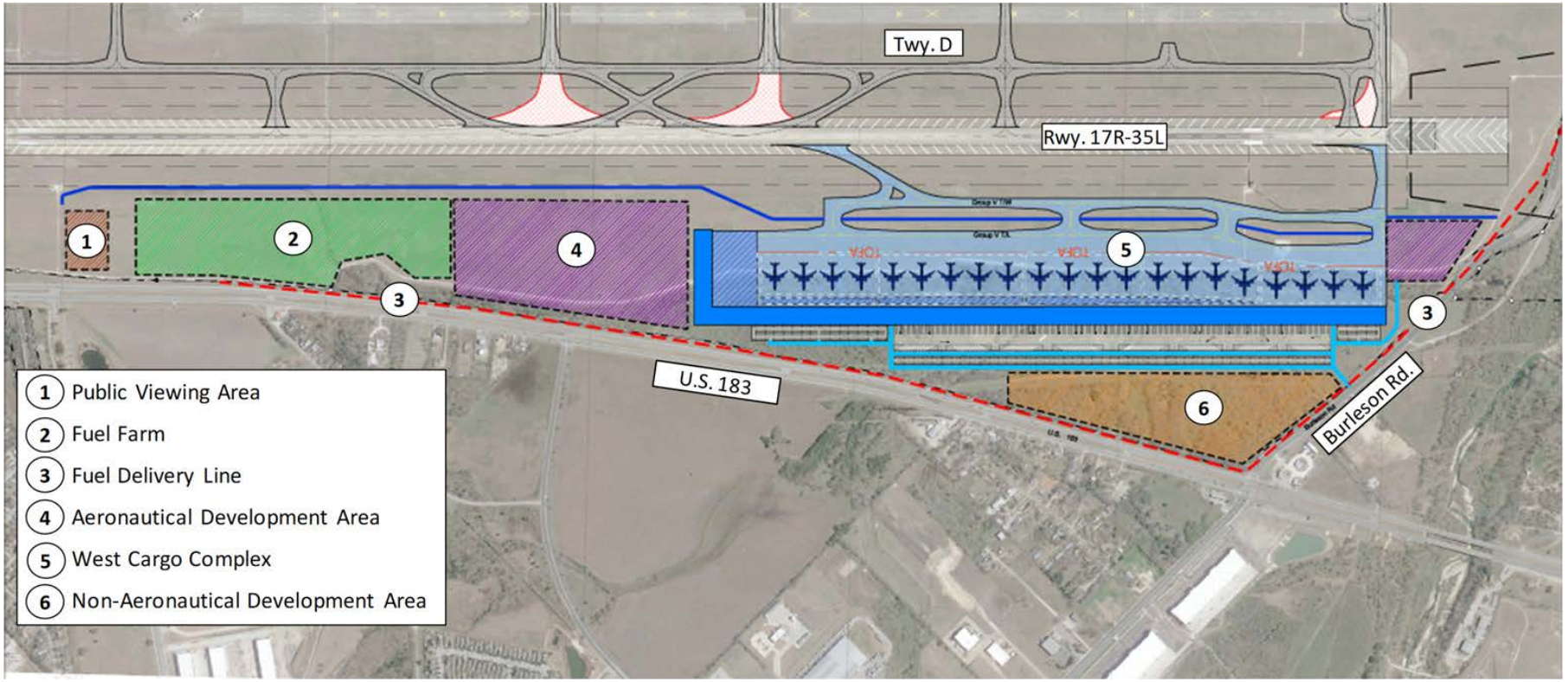
Source: Landrum & Brown analysis

Exhibit 5.5-21: ABIA Proposed South Development Area



Source: Landrum & Brown analysis

Exhibit 5.5-22: ABIA Proposed West Development Area



Source: Landrum & Brown analysis

5.6 Aircraft Deicing Pad Requirements

The purpose of this analysis is to determine the required number of positions needed for a consolidated deicing pad to serve commercial passenger aircraft. The deicing of aircraft is critical to ensure safe operations during winter weather, including rain, snow, and ice. According to the FAA's "clean aircraft" concept[15] and associated guidance, the FAA requires that all critical surfaces of an aircraft be free of contamination at takeoff. In order to achieve this clean aircraft concept during winter weather, deicing of aircraft is required, which involves removing frost, snow, and ice. The deicing process is accomplished with a combination of physical removal techniques and the application of specialized deicing and anti-icing products. The deicing applications may occur when freezing precipitation is imminent or occurring.

5.6.1 Assumptions

The required number of deicing positions at the airport is directly related to the number and size of aircraft that need to be deiced and the average amount of time required to deice each aircraft.

5.6.2 Departure Forecast

According to recommendations in FAA AC 150/5300-14C, *Design of Aircraft Deicing Facilities*, airport deicing facilities should have a deicing/anti-icing capacity that approximates the peak hour runway departure rate that the ATCT can manage during deicing conditions. The peak hour departure rate at ABIA was not used in this analysis because all of the operations that use the runway system are not being analyzed (cargo and general aviation aircraft are not included in this analysis since they are being deiced within their designated apron areas). Instead, the peak hour departure forecast for commercial passenger operations was used to determine the required deicing pad capacity for the commercial passenger airlines (see **Table 5.6-1**).

[15] An aircraft cannot depart when frost, ice, or snow is adhering to the wings, control surfaces, or propellers of an aircraft (Federal Aviation Regulation Sections 121.629 and 135.227). The presence of even minute amounts of frost, ice, or snow on particular aircraft surfaces can cause potentially dangerous degradation of aircraft performance and unexpected changes in aircraft flight characteristics.

Table 5.6-1: Commercial Passenger Peak Hour Departures

AIRCRAFT TYPE	PEAK HOUR DEPARTURES	
	2027	2037
Widebody	1	1
Narrowbody	27	36
Regional Jet	5	7
Total	33	44

Source: Design Day Flight Schedules; High Passenger Forecast

5.6.3 Deicing Time per Aircraft

Aircraft deicing is a time-consuming process. The time it takes to deice an aircraft is calculated from when the wheels enter the pad to when the wheels exit the pad. This includes the time for the aircraft to enter the pad, turn the engines off (when applicable), dispense the deicing application, notify the pilot that deicing is complete, restart the engines (when applicable), and exit the pad. The amount of time spent deicing each aircraft depends on various factors, including:

- Amount of snow/ice accumulated on the aircraft
- Rate at which additional precipitation is falling
- Time needed to position the aircraft and deicing equipment
- Number of deicing trucks dedicated to each aircraft
- Type of deicing fluid being dispensed
- Type of deicing trucks operated
- Size of the aircraft

Aircraft at ABIA are currently deiced at the gates. Southwest Airlines indicated it currently takes 20 minutes to deice their narrowbody fleet at the gate. This time does not include the time it takes to enter and exit a centralized pad. The Southwest deice time was adjusted upwards to account for this time using two minutes to enter the pad and three minutes to exit the pad.[16] This results in a total deicing time of 25 minutes for narrowbody aircraft as shown in **Table 5.6-2**. This deicing time equates to the ability to deice 2.4 aircraft per hour (60 minutes divided by 25 minutes).

[16] Based on consultant's industry knowledge of deicing operations at other U.S. airports.

Table 5.6-2: Total Deicing Time Per Aircraft

AIRCRAFT TYPE	DEICING TIME (MINUTES)			
	ENTER PAD	DEICE	EXIT PAD	TOTAL
Widebody	3.0	28.0	4.0	35.0
Narrowbody	2.0	20.0	3.0	25.0
Regional Jet	2.0	18.5	3.0	23.5

Source: Southwest Airlines and Landrum & Brown industry knowledge

Deicing time data for the other carriers and other aircraft types was not available. As a result, widebody and regional jet aircraft deicing times were estimated at 35 minutes and 23.5 minutes respectively, based on the consultant's knowledge of deicing operations at other U.S. airports. These times equate to the ability to deice 1.7 aircraft per hour for widebodies and 2.6 aircraft per hour for regional jets.

5.6.4 Aircraft Deicing Requirements

The number of commercial passenger aircraft deicing lanes required at ABIA was calculated by dividing the number of peak hour departures in each year by the number of aircraft that can be processed by a lane in one hour. These results are presented in **Table 5.6-3** for the PAL 3 (2027) and in **Table 5.6-4** for the PAL 4 (2037) demand. This methodology results in a need for 15 positions in 2027 and 19 positions in 2037. It is recommended that a centralized aircraft deicing pad be located in the south Remain Overnight (RON) parking area that includes an adequate drainage collection system for deicing fluids.

Table 5.6-3: 2027 Commercial Passenger Aircraft Deicing Position Requirements

AIRCRAFT TYPE	PEAK HOUR DEPARTURES	NUMBER OF AIRCRAFT PROCESSED PER LANE PER HOUR	DEICING LANES REQUIRED
Widebody	1	1.7	1
Narrowbody	27	2.4	12
Regional Jet	5	2.6	2
Total	33		15

Source: Landrum & Brown analysis

Table 5.6-4: 2037 Commercial Passenger Aircraft Deicing Position Requirements

AIRCRAFT TYPE	PEAK HOUR DEPARTURES	NUMBER OF AIRCRAFT PROCESSED PER LANE PER HOUR	DEICING LANES REQUIRED
Widebody	1	1.7	1
Narrowbody	36	2.4	15
Regional Jet	7	2.6	3
Total Positions	**18**		**19**

Source: Landrum & Brown analysis

5.7 Drainage and Water Quality Requirements for Preferred Alternative

Impervious cover area totals required for PAL 1, PAL 3, and the PAL 4 condition of the Preferred Runway and Terminal option outlined in previous sections of this report are shown for each of the three watersheds and the ABIA campus overall in the **Table 5.7-1** through **Table 5.7-3**. It is anticipated that each proposed project will be permitted and developed separately by independent consultants under the review of the City of Austin and DOA.

Table 5.7-1: PAL 1 (2019) Impervious Cover Totals

WATERSHED	2019 EXISTING IMPERVIOUS COVER [AC]	PROPOSED NEW IMPERVIOUS COVER [AC]	EXISTING IMPERVIOUS COVER TO BE REMOVED [AC]	TOTAL IMPERVIOUS COVER AT END OF PHASE 1 [AC]	NET CHANGE TO IMPERVIOUS COVER [AC]
Carson Creek	79.8	10.3	-13.6	76.5	-3.3
Colorado River	150.2	34.9	-2.1	183.0	32.8
Onion Creek	868.4	161.1	-43.5	986.0	117.6
ABIA Campus Total	**1,098.4**	**206.3**	**-59.2**	**1,245.5**	**147.1**

Notes: AC=Acre. Impervious cover totals shown are for the Preferred Terminal and Runway Option for PAL 1 (2019).
Source: ABIA Master Plan Update.

Table 5.7-2: PAL 3 (2027) Impervious Cover Totals

WATERSHED	2027 EXISTING IMPERVIOUS COVER [AC]	PROPOSED NEW IMPERVIOUS COVER [AC]	EXISTING IMPERVIOUS COVER TO BE REMOVED [AC]	TOTAL IMPERVIOUS COVER AT END OF PHASE 2 [AC]	NET CHANGE TO IMPERVIOUS COVER [AC]
Carson Creek	76.5	0.0	0.0	76.5	0.0
Colorado River	183.0	15.5	0.0	198.5	15.5
Onion Creek	986.0	245.2	-3.8	1,227.4	241.4
ABIA Campus Total	**1,245.5**	**260.7**	**-3.8**	**1,502.4**	**256.9**

Notes: AC=Acre. Impervious cover totals shown are for the Preferred Terminal and Runway Option for PAL 3 (2027).
Source: ABIA Master Plan Update.

Table 5.7-3: PAL 4 (2037) Impervious Cover Totals

WATERSHED	2037 EXISTING IMPERVIOUS COVER [AC]	PROPOSED NEW IMPERVIOUS COVER [AC]	EXISTING IMPERVIOUS COVER TO BE REMOVED [AC]	TOTAL IMPERVIOUS COVER AT ULTIMATE CONDITION [AC]	NET CHANGE TO IMPERVIOUS COVER [AC]
Carson Creek	76.5	0.4	-2.4	74.5	-2.0
Colorado River	198.5	55.1	-9.1	244.4	46.0
Onion Creek	1,227.4	69.9	-80.9	1,216.3	-11.1
ABIA Campus Total	**1,502.4**	**125.3**	**-92.4**	**1,535.3**	**32.9**

Notes: AC=Acre. Impervious cover totals shown are for the Preferred Terminal and Runway Option for PAL 4 (2037).
Source: ABIA Master Plan Update.

5.7.1 Drainage and Detention Requirements

5.7.1.1 Onion Creek Watershed

As described in Section *2.10.4 Regional Stormwater Management Program (RSMP)*, ABIA has been approved for 300 acres of net impervious cover within the Onion Creek Watershed to be constructed without local on-site detention requirements as a part of the in the RSMP program. As of June 2018, ABIA currently has utilized 70.28 Acres (AC) of existing Impervious Cover used within the Onion Creek RSMP, which leaves 229.72 AC of remaining allowable impervious cover within the Onion Creek Watershed to be used in the RSMP. The current ABIA RSMP Impervious Cover Tracking Table has been updated to reflect the Preferred Runway and Terminal Option for PAL 1, PAL 3 and the PAL 4 Condition, see **Appendix 5.3**.

At the completion of PAL 1, with the addition of 117.6 AC of impervious cover within the Onion Creek watershed, ABIA will have approximately 112.1 acres (AC) of remaining allowable impervious cover within the Onion Creek Watershed. Additional detention facilities will not be required within the Onion Creek Watershed for PAL 1.

At the completion of PAL 3, with the addition of 241.4 AC of impervious cover within the Onion Creek watershed, ABIA will have exceeded the 300 AC of allowable impervious cover included in the RSMP by 129.3 AC. There are several options to consider for mitigating this additional impervious cover.

There is potentially additional capacity within the Onion Creek RSMP that could be purchased by ABIA, this option should be evaluated by ABIA and discussed with the City of Austin Watershed Protection Department. It is recommended to purchase enough acreage within the Onion Creek RSMP to account for additional future development projects at ABIA that were not evaluated with this Master Plan Update. If an additional 130.0 AC is available to be purchased within Onion Creek, no additional detention facilities will be required within the Onion Creek Watershed to construct the proposed impervious cover required for the Preferred Terminal and Runway Option PAL 4 conditions.

5.7.1.2 Carson Creek Watershed

The Preferred Terminal and Runway Option results in a net decrease in impervious cover within the Carson Creek Watershed for PAL 1, no change for PAL 3, and a net decrease in the PAL 4 conditions. Additional detention is not anticipated to be required to mitigate the Preferred Terminal and Runway Option within the Carson Creek watershed. Any future projects are anticipated to be designed and permitted on a case-by-case basis and shall ensure that proposed conditions do not exceed existing condition discharge flows at each of the ABIA outfalls.

5.7.1.3 Colorado River Watershed

The Preferred Terminal and Runway Option results in a net increase in impervious cover of 32.8 AC in PAL 1, 15.5 AC in PAL 3, and 46.0 AC in the PAL 4 conditions within the Colorado River Watershed. This net increase of 94.3 AC of impervious cover from existing conditions to ultimate conditions will require site specific detention facilities to mitigate adverse impacts to downstream conditions. Any future projects are anticipated to be designed and permitted on a case-by-case basis and shall ensure that proposed conditions do not exceed existing condition discharge flows at each of the ABIA outfalls.

5.7.1.4 Potential On-Site Detention Options

Stormwater detention facilities at ABIA shall be designed in accordance with the City of Austin (COA) detention requirements outlined in the COA Erosion Criteria Manual (ECM) and COA Drainage Criteria Manual (DCM). Stormwater detention facilities shall also be designed in accordance with FAA Advisory Circular 150/5200-3B *Hazardous Wildlife Attractants on or Near Airports* and 150/5320-5D *Airport Drainage Design*. Potential detention solutions will be dependent on adjacent existing and proposed site-specific topography and should be considered at each existing ABIA outfall where an increase in impervious cover is proposed and RSMP mitigation is not available.

Future on-site detention facilities will be evaluated and sized on a case-by-case basis for each proposed project to be permitted by the COA. To determine the required detention volume for an individual project, it is recommended to develop a model for the project site area in HEC-HMS using the basin delineations provided by the Department of Aviation from the current ABIA Drainage Master Plan model. The basins directly adjacent to the project site should be modified to reflect assumed proposed site conditions. The SCS Unit hydrograph methodology is recommended to determine existing and proposed runoff values. Curve numbers shall be developed independent of the impervious cover to model the impact to the peak flow due to the increase in impervious cover. Time of concentration values shall be updated to reflect the proposed site conditions. The detention storage volume required will be determined by routing onsite basins to a detention pond and iterating the outlet conditions and storage volume until the proposed peak flows at the project outfall are equal or less than the existing peak flows.
Stormwater detention mitigation options include:

- Graded surface ponds
- Modifications to existing ponds
- Regrading existing channels to create inline detention
- Stacking the detention volume above the water quality volume in a proposed bio filtration pond
- Using underground detention storage in oversized box culvert systems

Future detention facilities at ABIA shall meet the following standards:

- Maximum 4H:1V side slopes
- Minimum 0.5-ft of freeboard from the detained water surface elevation to top of pond
- Maximum 6-ft height of embankment

5.7.2 ABIA Development Ordinance Update

The current ABIA Development Ordinance 20120628-014 grants specific variances to City code related to development within the Critical Water Quality Zone and Water Quality Transition Zones. In October 2013, City Council approved a new Watershed Protection Ordinance with the intention of improving creek and floodplain protection and simplifying development regulations by minimizing the impact on the ability to develop land within the City of Austin. As the current ABIA Development Ordinance took effect July 9, 2012 it is not subject to the 2013 Watershed Protection Ordinance. The ABIA Development ordinance requires administrative review and approval at least every ten years. It is recommended that prior to significant construction of projects identified within the PAL 1 timeframe ABIA modifies the current development ordinance to consider the latest Watershed Protection Ordinance and other relevant provisions in City Code.

5.7.3 Water Quality Requirements

5.7.3.1 City of Austin Water Quality Requirements for ABIA

Development projects at ABIA are required to follow City of Austin criteria for water quality as outlined in the Environmental Criteria Manual Section 1.6, along with the current ABIA Development Ordinance. Water quality controls shall also be designed in accordance with FAA Advisory Circular 150/5200-3B *Hazardous Wildlife Attractants on or Near Airports* and 150/5320-5D *Airport Drainage Design*.

All future taxiways, runways, access roads, and other areas of impervious cover in which the length of flow to edge of pavement in the direction of flow is less than 150-ft shall be treated with Vegetative filter strips where site conditions allow. Vegetative filters strips shall be designed in accordance with the COA ECM Section 1.6.7.

Required water quality volume will be determined using the half-inch plus rule defined in the COA ECM Section 1.6.2.A. For the purposes of this study, existing, proposed and removed impervious cover totals, and preliminary required water quality volumes have been determined for existing major outfalls at ABIA for the PAL 1, PAL 3 and PAL 4 conditions described in this report. A summary of the estimated required water quality volumes by outfall is located in Appendix 5.3.

Exhibits 5.7-1, **5.7-2** and **5.7-3** show proposed projects and contributing areas to the major outfalls described in Appendix 5.3.

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Exhibit 5.7-1: PAL 1 Drainage Area Map

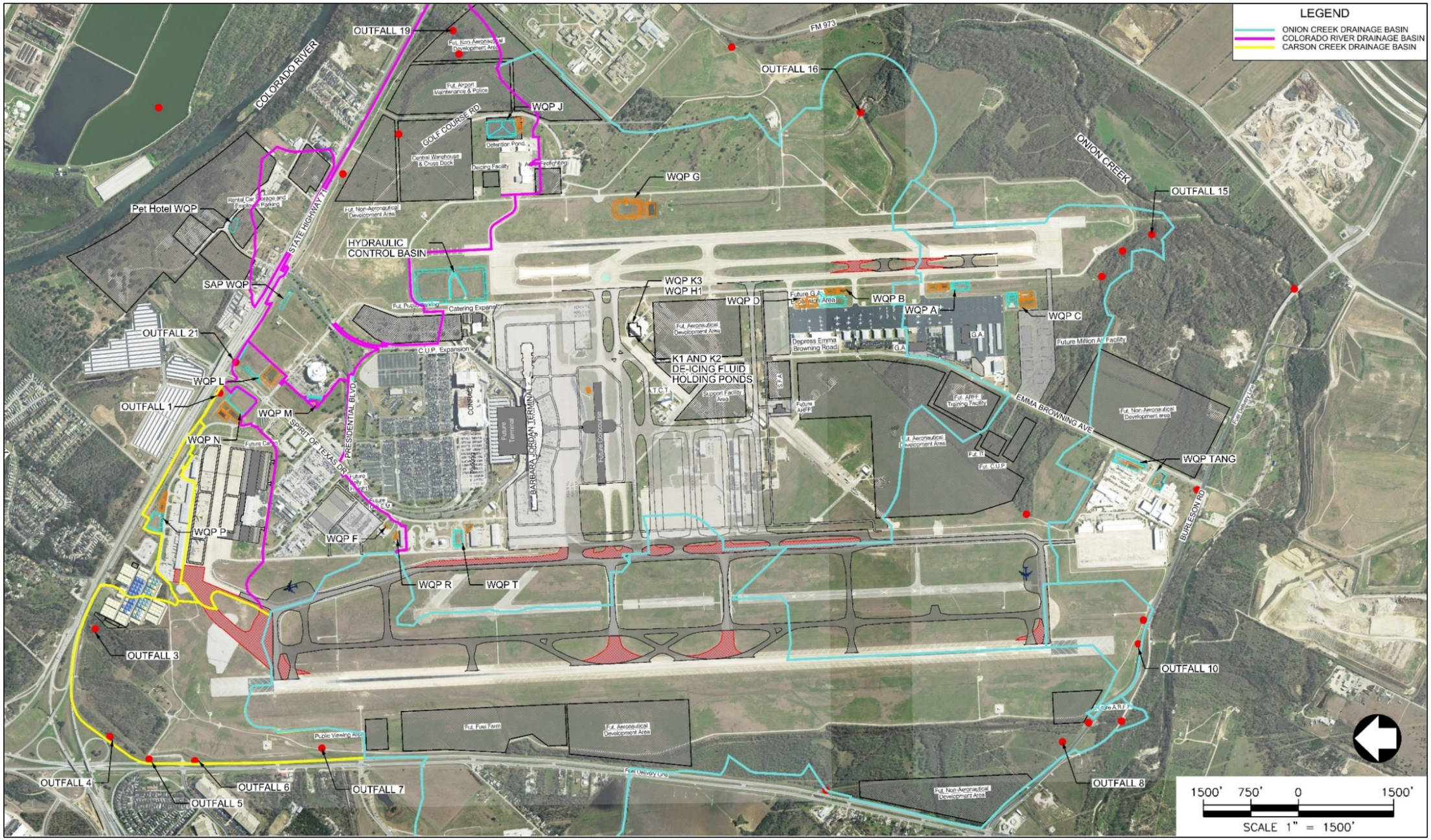

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Exhibit 5.7-2: PAL 2 Drainage Area Map

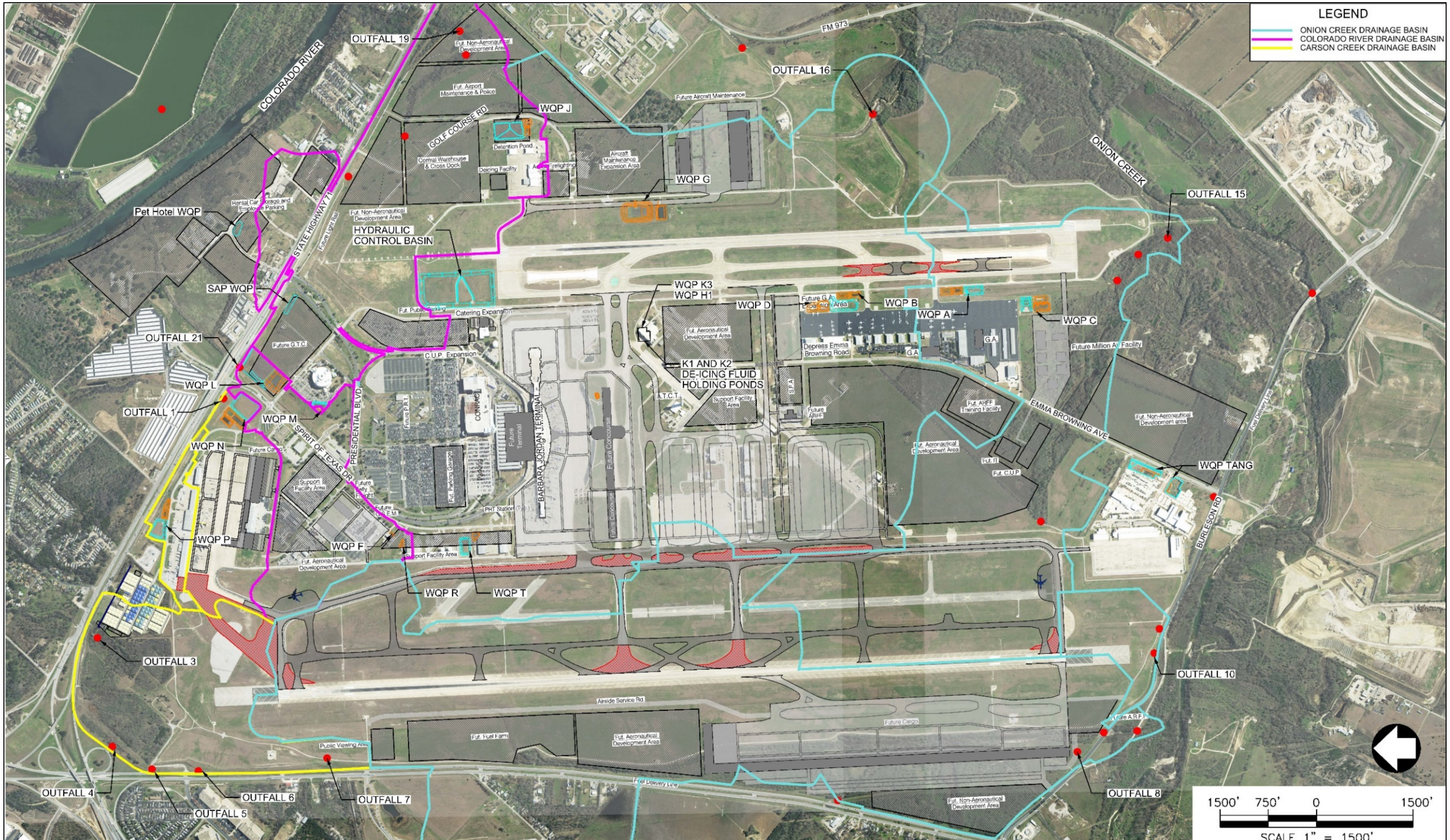

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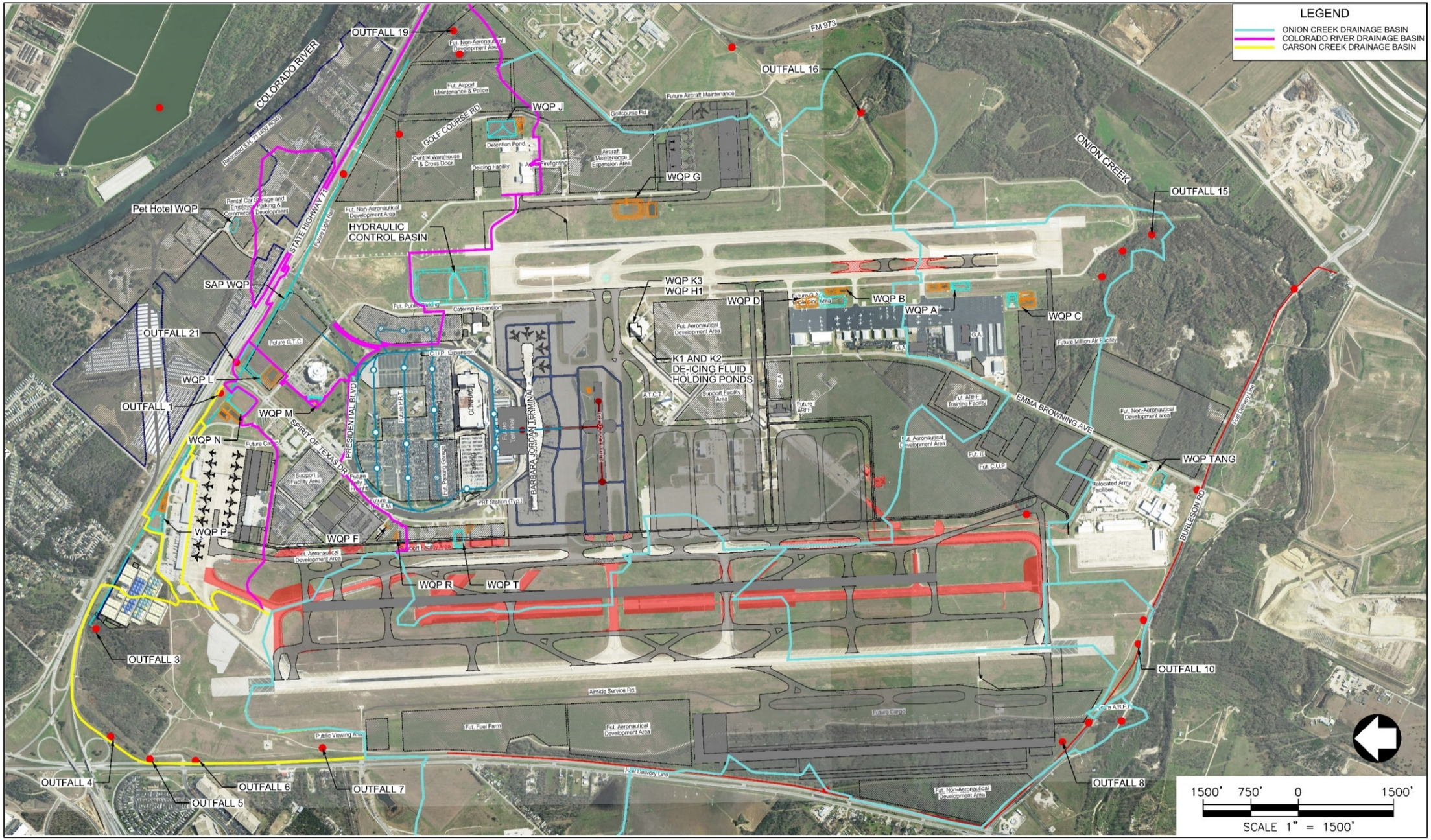
Exhibit 5.7-3: PAL 4 Drainage Area Map



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5.7.3.2 Carson Creek Watershed

5.7.3.2.1 Outfall 1

Modifications to the Cargo Apron in PAL 1, and future taxiway and apron modifications in the PAL 4 conditions will require additional water quality ponds upstream of Outfall 1. A combined total of 149,979 cubic feet (CF) of additional water quality volume will be required for the proposed PAL 4 conditions for Outfall 1.

5.7.3.2.2 Outfall 2

The proposed improved exit ramps from SH 71 to Spirit of Texas Dr. and Presidential Blvd. in PAL 1 will require additional water quality ponds or an expansion to the existing WQP P. A total of 34,682 CF of additional water quality volume will be required for the proposed PAL 4 conditions for Outfall 2.

5.7.3.2.3 Outfalls 3, 4, 5, 6, 7

Contributing areas to Outfalls 3, 4, 5, 6 and 7 were combined for the purposes of this analysis, as the future routing of storm sewer and drainage channels is unknown at this time. Although there is no anticipated proposed new impervious cover located within this contributing area, there are no existing water quality facilities treating the existing impervious cover. Based on the requirements of the COA ECM, all existing impervious cover shall be considered for the purposes of determining the water quality treatment required for a project area. A total of 330,929 CF of new water quality volume will be required for the proposed PAL 4 conditions for Outfalls 3, 4, 5, 6 and 7.

5.7.3.3 Onion Creek Watershed

5.7.3.3.1 Outfall 8

The proposed taxiways in PAL 1, Cargo Facilities in PAL 3, and PAL 4 runway configuration will require new water quality facilities upstream of Outfall 8. A combined total of 2,077,946 CF of water quality volume will be required for the proposed PAL 4 conditions for Outfall 8. A majority of this treatment will be in the form of vegetative filter strips along future taxiways, runways, and service roads. Structural water quality ponds are anticipated to treat the additional impervious cover required for the future Cargo Facilities.

5.7.3.3.2 Outfall 10

Although there is no anticipated proposed new impervious cover located within this contributing area, there are no existing water quality facilities treating the existing impervious cover. Based on the requirements of the COA ECM, all existing impervious cover shall be considered for the purposes of determining the water quality treatment required for a project area. A total of 81,621 CF of new water quality volume will be required for the proposed PAL 4 conditions for Outfall 10.

5.7.3.3.3 Outfall 15

Proposed midfield taxiway modifications and Million Air facility in PAL 1, and the PAL 4 runway and taxiway configuration will require new water quality facilities upstream of Outfall 15. A combined total of 1,128,509 CF of water quality volume will be required for the proposed PAL 4 conditions for Outfall 15. A majority of this treatment will be in the form of vegetative filter strips along future taxiways, runways and service roads.

5.7.3.3.4 Outfall 16

Proposed Terminal and Apron expansions in PAL 1, Future Aircraft Maintenance Facility in PAL 3 and the PAL 4 airfield conditions will require new water quality facilities upstream of Outfall 16. It is anticipated that ¼ of the existing water quality volume (WQV) of WQP G will be eliminated with the proposed Future Aircraft Maintenance facility in PAL 3, and ½ of the existing WQV of WQP T will be eliminated with the proposed PAL 4 conditions service road. A combined total of 3,481,685 CF of new water quality volume will be required for the proposed PAL 4 for Outfall 16.

5.7.3.4 Colorado River Watershed

5.7.3.4.1 Outfall 19

Modifications to the exit and entrance ramps at Presidential Blvd, proposed parking north of SH 71 and the proposed Golf Course Road projects in PAL 1 1, the Future G.T.C. in and parking north of SH 71 in PAL 3, and Relocated SH 71 and associated parking projects in the PAL 4 conditions will require new water quality facilities upstream of Outfall 19. A combined total of 609,954 CF of new water quality volume will be required for the proposed PAL 4 conditions for Outfall 19.

5.7.3.4.2 Outfall 21

Proposed Future Belly Freight, G.S.E.M., and Taxiway apron modifications in PAL 1, G.T.C. in PAL 3, and the PAL 4 conditions Taxiway modifications will require new water quality facilities upstream of Outfall 21. It is anticipated that existing WQP F, L and R have adequate capacity to mitigate the proposed additional impervious cover in PAL 1. However, the proposed G.T.C. in PAL 3 will eliminate all of the existing treatment provided by WQP L. This will result in 355,026 CF of new water quality volume that will be required in PAL 3 for Outfall 21.

5.8 Electrical Requirements

The anticipated electrical loads for future expansions to the airport facility will require new high-voltage circuits provided by Austin Energy, the local electrical utility company. To provide two levels of redundancy, the facility will need to be served by two high-voltage circuits from different substations, through automatic throw-over switches. This applies to the existing Barbara Jordan Terminal area as well as the South Terminal airport facility. The construction of the high-voltage circuits will need to be closely coordinated with Austin Energy so that the utility company can plan for infrastructure upgrades that may be required to their affected substations (Bergstrom and Carson Creek), as well as the primary underground feeds along SH 71.

5.8.1 Existing Loads

The information in **Table 5.8-1** is based on 2017 Peak Loads for the existing 12.47 kV feeders to ABIA.

Table 5.8-1: Existing Capacity

EXISTING A/E FEEDER	CABLE RATING [AMPS]	PHASE A [AMPS]	PHASE B [AMPS]	PHASE C [AMPS]	AVERAGE [AMPS]	MAX LOADING [%]
Bergstrom 01 (BE01)	640	153.00	147.00	147.00	151.00	24%
Bergstrom 04 (BE04)	640	236.00	231.00	231.00	236.00	38%
Carson Creek 01 (CC01)	640	-	-	-	-	-
TOTAL					**387.00**	
				kW at 12,470V	**4,825.89**	

Notes: BE01 – Bergstrom Circuit #01 included the Control Tower, Fire Station, and Airfield Lighting (preferred circuit)
BE04 – Bergstrom Circuit #04 (standby circuit)
CC01 – Carson Creek Circuit #01 information was not provided
Source: Encotech analysis

A breakdown of existing electrical loads by meter or address was also provided by Austin energy, see **Table 5.8-2**.

Table 5.8-2: Existing Electrical Loads

EXISTING FACILITY	ADDRESS	LOAD [kW]
Central Utility Plant	9815 SERVICE AVE Unit A	1,701.60
Terminal	3600 PRESIDENTIAL BLVD Unit EAST-B	1,060.00
Terminal	3600 PRESIDENTIAL BLVD Unit WEST-A	1,010.00
Terminal	3600 PRESIDENTIAL BLVD Unit WEST-C	1,000.00
Terminal	3600 PRESIDENTIAL BLVD Unit EAST-C	720.00
Terminal	3600 PRESIDENTIAL BLVD Unit WEST-B	650.00
Parking Garage	3601 PRESIDENTIAL BLVD	261.00
Airfield Electrical Vault	10104 AIRCRAFT LN	233.00
DOC and Parking Bldg.	3011 EMPLOYEE AVE	140.20
P&E (office)	2716 SPIRIT OF TEXAS DR	120.00
DOA IT Bldg.	2901 EMPLOYEE AVE	86.00
Parking Lots	3325 PRESIDENTIAL BLVD	83.43
Unknown	3601 1/2 MAINTENANCE BND	50.00
TOTAL		**7,115.23**

Source: ABIA Planning and Engineering

The anticipated electrical loads from the East Terminal/Apron Expansion, Parking Garage, and Administration Building projects currently under construction are shown in **Table 5.8-3**.

Table 5.8-3: Anticipated Electrical Loads

EXISTING FACILITY	LOAD [kW]
Garage	2,000.00
Site	170.00
Emergency Generator	800.00
Terminal/Apron Expansion	1,072.82
Administration Building	2,000.00
TOTAL	**6,42.82**

Source: Encotech analysis

5.8.2 Expansions

Upon completion of the East Terminal Expansion in early 2019, the passenger terminal facilities at ABIA will provide 34 gates and 984,300 square feet of floor area. In the next 5 years, the demand will require 1.2 million square feet. By PAL 3 (2027) there will need to be 50 gates and more than 1.5 million square feet. The gates will increase to 64 with approximately 2 million square feet of terminal area required by PAL 4 (2037). There are various terminal options proposed to meet these expansion demands, all of which require upgrades to the electrical infrastructure. These options do not include possible expansions to supporting facilities, such as hangars, catering, and Airport Rescue and Firefighting.

5.8.3 Proposed Options

5.8.3.1 Future PAL 4 (2037)

This includes a New North Terminal in the area immediately to the north of the existing BJT and the addition of one new Midfield Concourse located south of the existing BJT. The total number of additional gates would be approximately 32 on the new Midfield Concourse, or approximately double the existing load. In addition, a new Cargo complex would be located on the airport's west side off US 183.

Thus, the electrical loads may not require a new high-voltage circuit from Austin Energy since the existing circuit is at less than 50% capacity. Further information on the anticipated loads of the facilities currently under construction and the planned support facilities, are needed to definitively determine if new circuits are needed to meet the PAL 4 demand (2037).

As previously discussed, a second circuit from the south would provide redundancy that is currently missing.

5.8.3.2 Post-Planning Beyond PAL 4 Demand (2037)

This analysis includes two Future Terminals (North and South), as well as, the addition of three new Midfield Concourses between the terminals. A new Cargo facility would also be added to the west off US 183. Overall, the total number of added gates and building square footage would be about four times the size of the existing BJT.

Based on these future facilities, the anticipated electrical loads will require a new high-voltage circuit from Austin Energy. The entire facility will need to be served by high-voltage circuits from different substations routed through automatic throw-over switches to provide two levels of redundancy.

The estimated additional electrical loads for these future facilities are shown in **Table 5.8-4**.

Table 5.8-4: Future Capacity

FUTURE FACILITY	SQUARE FOOTAGE	LOCATION **	LOAD [sq.ft.]	NORTH LOAD [kW]	SOUTH LOAD [kW]
New North Terminal Processor	1,150,000	North	10	11500	-
New Midfield Concourse	1,028,000	South	10	-	10280
New CUP (8588 tons)	-	South	-	-	4300
New IT Office	15,000	South	10.5	-	157.5
Catering*	103,000	North	9.5	978.5	-
New Cargo Hangars	950,000	West	3	2850	-
Cargo Hangars (Note 1)	214,000	North	3	642	-
New Aircraft Maintenance Hangars	540,000	East	5	2700	-
General Aviation Hangars (Note 1)	360,000	South	3	-	1080
New Airport Rescue & Firefighting	30,000	South	5	-	150
New Airport Maintenance & Police	71,000	North & East	5	355	-
New Ground Service Equip. Maintenance	23,000	North	3	69	-
New Belly Cargo	96,000	North	3	288	-
TOTAL				**19,382.50**	**15,967.50**

Notes: * - includes existing + future building requirements*
** - North denotes facilities north of the existing BJT. South denotes facilities south of the existing BJT, West denotes facilities west of Rwy. 17R-35L. East denotes facilities east of Rwy. 17L-35R.
Source: Encotech analysis

5.8.4 Recommendations

- PAL 4 Demand (2037): Add one new circuit from Carson Creek to the south for redundancy for a total number of four circuits.
- Post-Planning Beyond 2037: Add three new circuits, one from Bergstrom and one from Carson Creek to serve the anticipated loads and another circuit from Carson Creek to provide redundancy to the south for a total number of six circuits.

5.9 Central Plant Requirements

The anticipated chilled water and heating hot water loads for future expansions to ABIA facilities will require an increase to the existing Central Utility Plant chilled water, and possibly the heating hot water capacity. The amount of increase in capacity will be determined by three proposed expansion scenarios to be implemented in CY2022, CY2027 and CY2037. The existing CUP (Building #7360) and the Cooling Tower Facility (Building #7365) will remain in place and will be inter-connected with an expansion to the existing CUP. This will provide additional base loading of the existing airport facilities, in addition to the proposed future North Terminal. New cooling tower(s) would be included in this expansion. The expansion to the existing CUP will be located across the entrance driveway to the CUP.

A new Central Utility Plant is proposed to be located on the south side of the airport, just south of the proposed midfield taxiway. The continued expansion of the airport beyond 2037 will be in a southerly direction. The anticipated CUP loads for future expansions to the airport facilities will require a new Central Plant to provide additional capacity to the airport based on the anticipated post 2037 planning projections. The new CUP facility will provide for the heating and cooling needs beyond the 2037 timeframe and could also provide backup to the existing infrastructure in the case of emergency.

5.9.1 Chiller Requirements

The information provided in **Table 5.9-1** is based on 2015 CUP capacity which serves the ABIA facilities.

Table 5.9-1: Existing Chiller Capacity (2015)

MARK NO.	TYPE*	LOCATION	CAPACITY (TONS)
CH-1	1	1.7	1
CH-2	36	2.4	15
CH-3	7	2.6	3
CH-4	18		19
CH-5			
		Total	**3,730**

Note: Water cooled
Source: ABIA Engineering

The current loading with diversity is 3,115 tons based on the Thermal Storage Study performed by Burn-McDonnell in 2015. Based on information from ABIA Engineering, the existing CUP is at capacity and will not be able to support additional expansion beyond that which is currently scheduled to be completed in early 2019 (East Terminal Expansion).

5.9.1.1 Proposed Terminal/Concourse Expansion Layouts

The following narrative encompasses the utility infrastructure upgrades required to support the proposed terminal/concourse expansion to meet the PAL 4 (2037) demand and beyond. This does not include proposed expansions to supporting facilities, such as Hangars, Catering, and Airport Rescue and Firefighting. The current trend and recommendation are for supporting facilities to have standalone cooling/heating plants at each location.

5.9.1.1.1 PAL 2 (2022) Layout

This includes a New North Terminal processor in the area immediately to the north of the existing BJT, along with the addition of a new 20 gate Midfield Concourse. In this layout, the anticipated additional cooling loads shown in **Table 5.9-2** are required due to the additional conditioned spaces. This additional demand will require expansion of the existing CUP. The existing CUP has recently added chillers and associated pumping to fill out the maximum buildout capacity of the facility to accommodate the new 9 gate East Terminal expansion. Therefore, the CUP is at capacity with no room to expand within the existing facility.

Table 5.9-2: Chilled Water Requirements

ADDED TERMINAL SQUARE FOOTAGE [MM]*	ADDITIONAL TONNAGE @ 212 SF/TON	ADDITIONAL TONNAGE @ 300 SF/TON	ADDITIONAL TONNAGE @ 315 SF/TON	BASE CAPACITY [TONS]	TOTAL TONNAGE @ 212 [sq.ft./TON]	TOTAL TONNAGE @ 300 [sq.ft./TON]	TOTAL TONNAGE @ 315 sq.ft./TON
PAL 2 (2022)							
0.23	1,085	767	730	3,730	4,815	4,497	4,460
PAL 4 (2037)							
0.53	2,500	1,767	1,683	3,730	6,230	5,497	5,413
Post Master Plan (Beyond 2037)							
1.03	4,858	3,433	3,270	3,730	8,588	7,163	7,000

Note: MM = Million Square Feet
Source: Encotech analysis

The PAL 2 (2022) layout calls for the expansion of the existing CUP by adding a separate building located across the driveway. This layout also calls for a Future CUP to be located just south of the proposed crossfield taxiway. As shown in Table 5.9-2 for PAL 2 (2022), the estimated capacity would require an additional 1,085 tons to meet the demand for the New North Terminal and Midfield Concourse facilities.

5.9.1.1.2 PAL 4 (2037) Layout

This PAL 4 demand airport layout includes the new North Terminal and 32 gate Midfield Concourse. As shown in Table 5.9-2, the estimated cooling capacity requirement would be an additional 2,500 tons to meet the demand from these facilities. This will require an expansion of the existing CUP and development of a new CUP on the south side.

5.9.1.1.3 Post-Master Plan (Beyond 2037)

This layout provides for two future terminals, one located on the north side of the existing BJT with the second terminal located to the south with access from Burleson Road. There will be three future concourses located between the two terminals. The total number of aircraft gates would be approximately 132, or about 4.5 times the size of the existing BJT gate capacity.

This Post Master Plan (beyond 2037) layout would require an expansion of the existing CUP and development of a Future CUP on the south side of the airport. As shown in Table 5.9-2, there will be a demand for an additional 4,858 tons of chilled water to support these future terminal/concourse facilities.

5.9.2 Natural Gas Requirements

The natural gas infrastructure, as currently configured, should have ample capacity to serve the PAL 4 (2037) airport demand requirements. However, modifications to the gas supply piping will be required when the future South CUP is constructed. Currently, all the gas service for the Airport is provided from the gas main located along SH 71 on the north side of the Airport. To extend a gas main to serve the future South will require modification to the distribution lines. These modifications will include an extension of the gas lines and may require installation across existing ramps and taxiways, which could be accomplished with boring. Texas Gas provides natural gas to the Airport. They should be approached to determine if there is existing infrastructure available on the south side of the airport which could be utilized to provide service to the future South CUP and other facilities requiring gas service. If an alternate source is unavailable, specific routing will be required to mitigate crossing under the existing ramps and taxiways if boring is not an option.

Redundancy could be incorporated in the system if an alternate distribution source main can be found. An alternative would be to modify the existing system such that portions of the distribution system are re-designed to upsize the system to provide the additional capacity, and also provide a “looping” of the service distribution lines to allow back feeding the system in the event a break or rupture in any of the service lines occur.

5.9.3 Recommendations

- PAL 4 (2037) - Begin design and construct the expansion of the existing CUP facility to provide the additional capacity required to cover the requirements up through PAL 3 (2027). Provide space for the South CUP to accommodate the necessary heating and cooling equipment to provide for the PAL 4 (2037) demand.
- Contact Texas Gas and investigate the possibility of increasing gas service to the south side of the Airport.

5.10 Conformity with FAA Design Standards and Requirement

The proposed airfield geometry was presented to the Safety Risk Management (SRM) Panel on June 21, 2018 for review and comment. Various adjustments were recommended to provide a safer operation and eliminate any non-standard FAA design recommendations as per Advisory Circular 150/5300-13A, *Airport Design*. The recommendations from the SRM Panel have been incorporated into the Future Airport Layout Plan drawing as depicted in this Master Plan report.

Two areas that were previously identified in Chapter 2, *Existing Conditions and Issues,* as not meeting current FAA design standards were discussed at the SRM Panel meeting and are summarized below:

- Existing Taxiways G and H below Runway 17L-35R create a “Y” shaped taxiway crossing a runway and is not in compliance with current FAA design standards. The SRM Panel determined that the existing controls that are in place are sufficient to manage this hazard.
- Hot Spot #1 where the East Service Road crosses Taxiways G and H. Drivers heading northbound on the East Service Road might be unaware of aircraft taxiing northbound on Taxiways ‘A’ or ‘B’ and turning onto Taxiways G or H. ABIA is managing this current Hot Spot with controls, such as implementation of an aircraft hold bar and driver training. There have been no incidents at this Hot Spot since implementation of these operating procedures.
- The current 400-foot separation of Taxiway A to Runway 17L-35R will not be changed as part of this Master Plan Study. The SRM Panel determined that the current operational restrictions imposed on the use of Runway 17L-35R and Taxiway A when ADG-V aircraft are using either of these surface areas was a safe operation with the current operations procedures in place. It was determined that this cost to relocate Runway 17L-35R to have the required 500-foot separation from Taxiway A for ADG-V aircraft was too costly and would result in major environmental impacts.

See Chapter 6, *Safety Assessment and Management Process,* for further details on these and other airfield layout issues.

5.11 Environmental Evaluation

This section evaluates the potential environmental impacts associated with the proposed short-list Runway Alternatives 1, 2 and 4. This evaluation considers the existing environmental conditions inventoried in Chapter 2, *Existing Conditions and Issues,* Section 2.11, *Environmental Overview,* and identifies the key environmental impacts that would potentially occur with development of the short-list runway alternatives. This section also identifies potential permitting scenarios associated with each runway alternative within the regulatory environments outlined in Chapter 2, *Existing Conditions and Issues,* Section 2.11.1, *Regulatory Overview*. FAA Advisory Circular 150/5070-6B, *Airport Master Plans,* served as the primary guidance for development of this environmental evaluation, along with FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures.* To the extent appropriate, FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions* was also referenced; however, this environmental evaluation is intended to support the master planning process and does not assess potential environmental impacts at the NEPA level.

In accordance with FAA Advisory Circular 150/5070-6B, the alternatives analysis should consider the environmental categories that are specific to the sites being evaluated. Only those resources considered key to identifying potential environmental impacts that facilitate comparison of the short-list runway alternatives were considered. Environmental categories such as air quality and climate, visual effects, and children's environmental health and safety risks will be assessed in greater detail during future NEPA processes required prior to initiation of airport development actions.

5.11.1 Land Use and Noise Compatibility

Potential impacts to existing land uses were assessed using the anticipated construction footprint (i.e., pavement, safety areas, etc.) of each short-list runway alternative. Existing development (including structures and roadways) located within the anticipated construction footprint are listed in **Table 5.11-1**. In addition, **Table 5.11-2** shows the land uses that occur within the construction footprint of each of the runway alternatives based on the COA 2014 Land Use Inventory17 and current aerial photography. These inventories are preliminary and are intended to represent the developments and existing land uses that would likely be directly impacted by construction of the short-list runway alternatives.

[17] COA. 2014. City of Austin Land Use Inventory. Available at: https://data.austintexas.gov/Locations-and-Maps/Land-Use-Inventory/aqug-n98v. Accessed March 10, 2018.

Table 5.11-1: Existing Development within Construction Footprints of Runway Alternatives

RUNWAY ALTERNATIVE	EXISTING DEVELOPMENT WITHIN CONSTRUCTION FOOTPRINT	LOCATION
Alternative 1	TxDOT Aviation Building	Located on current ABIA property
	ABIA Central Warehouse & Cross Dock Complex	Located on current ABIA property
	Family Viewing Area	Located on current ABIA property
	Recon Services, Inc.	Located immediately south of current ABIA property
	FM 973	Crossed south of current ABIA property
Alternative 2	Existing taxiways	Runway alternative located entirely within current ABIA property
	Existing United States Army Reserve Center	Located on current ABIA property
	Rental Car Storage Area	Located on current ABIA property
	The Parking Spot West	Located on current ABIA property
Alternative 4	TxDOT Aviation Building	Located on current ABIA property
	ABIA Central Warehouse & Cross Dock Complex	Located on current ABIA property
	Family Viewing Area	Located on current ABIA property
	Recon Services, Inc.	Located immediately south of current ABIA property
	FM 973	Crossed south of current ABIA property
	Existing taxiways	Runway alternative located entirely within current ABIA property
	Existing United States Army Reserve Center	Located on current ABIA property
	Rental Car Storage Area	Located on current ABIA property
	The Parking Spot West	Located on current ABIA property

Source: Google Earth aerial photography (2017); Travis Central Appraisal District (CAD) (2018).

Table 5.11-2: Potentially Impacted Land Uses by Runway Alternative

RUNWAY ALTERNATIVE	LAND USE ACREAGE WITHIN CONSTRUCTION FOOTPRINT [ACRES]	
Alternative 1	Aviation	101.4
	Parks/greenbelts	31.8
	Commercial	2.0
	Roadway	1.7
	Agricultural	0.9
	Total	**137.8**
Alternative 2	Aviation	137.7
	Total	**137.7**
Alternative 4	Aviation	239.1
	Parks/greenbelts	31.8
	Commercial	2.0
	Roadway	1.7
	Agricultural	0.9
	Total	**275.5**

Source: COA Land Use Inventory (2014).

Runway Alternative 1 is located primarily on the current ABIA property; therefore, the majority of land within the construction footprint for this runway alternative is considered to be aviation use. The second-most prevalent land use within the construction footprint of Runway Alternative 1 is parks/greenbelts, the majority of which consists of the green space along Onion Creek (and is not designated as parkland by the COA or Travis County).

Runway Alternative 2 is located entirely on existing ABIA property and, therefore, would not impact existing off-airport development. However, it will require relocation of various on-airport development facilities.

Runway Alternative 4 is a combination of Alternatives 1 and 2 and would have similar impacts as noted above.

As discussed in Chapter 2, *Existing Conditions and Issues,* Section 2.11.3, *Land Use and Noise Compatibility,* compatibility of airport development activities with existing and planned land uses is often assessed within the context of noise impacts. The evaluation of the potential impacts of the short-list runway alternatives with regard to land use and noise compatibility considers current COA zoning, existing and future land uses, and, in particular, noise sensitive land uses[18] as discussed in Chapter 2, *Existing Conditions and Issues,* Section 2.11.3, *Land Use and Noise Compatibility,* and further discussed in the *Socioeconomic and Community Resources*.

[18] FAA. 2006. U.S. Department of Transportation. FAA Order 5050.4B. Subject: National Environmental Policy Act Implementing Instructions for Airport Actions. Effective April 28, 2006. Available at: https://www.faa.gov/airports/resources/publications/orders/environmental_5050_4/media/5050-4B_complete.pdf. Access March 15, 2018.

5.11.2 Socioeconomic and Community Resources

In the absence of future noise contours for the short-list runway alternatives, this evaluation uses the boundaries of the existing 65 DNL noise contour for the existing east Runway 17L-35R, which includes a greater area than the existing 65 Day-Night Levels (DNL) for the existing west Runway 17R-35L. The existing 65 DNL boundary for existing Runway 17L-35R was superimposed onto each of the proposed runway alternatives to determine the areas that would potentially be subject to future noise impacts. These projected 65 DNL boundaries for the runway alternatives provide conservative areas within which potential land use conflicts were assessed. Some of the land uses within these areas are considered noise sensitive land uses per FAA guidelines and per COA zoning for the Airport Overlay Zones identified for the Aviation Zoning District (see Chapter 2, *Existing Conditions and Issues,* Section 2.11.3.1, *COA Zoning,* for additional information).

Table 5.11-3 shows the sensitive land uses wholly or partially within the construction footprint and projected 65 DNL boundaries of the short-list Runway Alternatives 1, 2 and 4. While not all of the noise land uses would be strictly prohibited within these areas, these noise sensitive land uses are considered subject to future analysis to determine what level of mitigation might be required. As noted below, some of these land uses—such as Austin Pecan Park Mobile Homes in the Glenbrook area north of the ABIA property, Greenwood/Martin Cemetery and Waters Cemetery on the ABIA property, and Richard Moya Park south of the ABIA property—are already located within the 65 DNL boundaries of the existing ABIA runways and would not be considered as newly impacted areas from the short-list runway alternatives.

All of the parks and recreational areas would potentially be afforded protection under Section 4(f) of the Department of Transportation Act of 1966. While none of the runway alternatives would be expected to result in direct construction-related impacts to parkland, the projected 65 DNL boundaries for each of the runway alternatives encompass properties potentially protected under Section 4(f). A determination of significance would be required in order for a property to be considered protected under Section 4(f), and future NEPA-level studies would be required to determine the level of potential impact of development on Section 4(f) properties.

The Richard Moya Park was developed with funds through the Land and Water Conservation Fund administered through the National Park Service. This site is considered a Section 6(f) resource under the LWCF Act and must remain in public outdoor recreation use in perpetuity unless the NPS approves substitution of property of reasonably equivalent usefulness and location and of at least equal fair market value (see Chapter 2, *Existing Conditions and Issues,* Section 2.11.3.5, *Section 4(f) and Section 6(f) Properties,* for additional details). None of the runway alternatives would result in direct conversion of this park to transportation use; however, it should be noted that this park is located immediately south of the ABIA property and is partially within the 65 DNL boundary of the existing east Runway 17L-35R. This park is also located within the projected 65 DNL boundary of the Runway Alternatives 2 and 4.

Table 5.11-3: Potentially Affected Noise Sensitive Land Uses by Runway Alternative

RUNWAY ALTERNATIVE	POTENTIALLY AFFECTED NOISE SENSITIVE LAND USES**
Alternative 1	**PARKS/RECREATIONAL AREAS (2)** Stoney Ridge Neighborhood Park Hornsby Bend Bird Observatory **RESIDENTIAL SUBDIVISIONS (3)** Stoney Ridge Austin Pecan Park Mobile Homes* Timbercreek **OTHER NOISE SENSITIVE LAND USES (2)** Waters Cemetery* Travis County Correctional Complex
Alternative 2	**PARKS/RECREATIONAL AREAS (1)** Richard Moya Park* **RESIDENTIAL SUBDIVISIONS (3)** Carson Creek Richland Estates* Tejas Mobile Plaza **OTHER NOISE SENSITIVE LAND USES (1)** Greenwood/Martin Cemetery*
Alternative 4	**PARKS/RECREATIONAL AREAS (3)** Stoney Ridge Neighborhood Park Hornsby Bend Bird Observatory Richard Moya Park* **RESIDENTIAL SUBDIVISIONS (6)** Stoney Ridge Austin Pecan Park Mobile Homes* Timbercreek Carson Creek Richland Estates* Tejas Mobile Plaza **OTHER NOISE SENSITIVE LAND USES (3)** Waters Cemetery* Travis County Correctional Complex Greenwood/Martin Cemetery*

Notes: *Land uses that are currently within 65 DNL boundaries of existing ABIA runways.
**The table above represents sensitive land uses that would potentially be affected by noise related to the runway alternatives. These numbers above do not represent displacements and are intended for comparative purposes. For the purposes of this assessment, other noise sensitive land uses beyond parks/recreational areas and residential subdivisions include churches, schools, cemeteries, and health services. Per FAA Order 5050.4B, noise sensitive land uses typically include residential uses, schools, health services, churches, and parks. The COA has zoned ABIA as an Aviation Services (AV) District Use in which certain land uses are permitted, restricted, or prohibited. See Table 2.11-2 in Chapter 2 for additional detail regarding COA Airport Overlay Zones.

Source: COA Land Use Inventory (2014); Google Earth aerial photography (2017)

The residential subdivisions listed in Table 5.11-1 are wholly or partially located within the projected 65 DNL boundaries of the runway alternatives and would potentially be subject to future noise impacts. With the exception of Austin Pecan Park Mobile Homes and Tejas Mobile Plaza, both located north of the existing ABIA property, all of the subdivisions are single-family residential neighborhoods in relatively close proximity to the northern, eastern, and southern property boundaries of ABIA. Some scattered single-family residential uses located outside of these subdivisions (referred to as large-lot residential uses) also occur within the 65 DNL boundaries of Runway Alternatives 1 and 4.

In addition to parks and residential uses, a handful of community facilities would potentially be impacted by the construction of, or noise associated with, one or more of the runway alternatives. These include two cemeteries (Waters and Greenwood/Martin) located on the existing ABIA property and the Travis County Correctional Complex.

All land acquisition for airport development or noise compatibility purposes must by conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally-Assisted Programs,[19] which implements the requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. Additionally, the FAA is required to take affirmative action to ensure nondiscrimination in all operations in compliance with Title VI of the Civil Rights Act of 1964, as amended. Airport development activities are also required to comply with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, and Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency.[20] Potential impacts resulting from these land acquisitions would be further evaluated during the NEPA process.

As discussed in Chapter 2, *Existing Conditions and Issues,* Section 2.11.4.2, *Minority and Low-income Populations,* all Census Block Groups adjacent to the ABIA property are predominantly comprised of Environmental Justice populations (minority and/or low-income populations). Future studies would be required to determine the potential impacts of airport development activities to EJ populations per Executive Order 12898, which requires all federal agencies to consider whether their programs, policies, and activities would have disproportionately high and adverse human health or environmental effects on minority and low-income populations.[21]

5.11.2.1 Archeological Resources

Potential impacts of the short-list Runway Alternatives 1, 2 and 4 on archeological resources were evaluated based on background research of previously conducted archeological surveys and previously documented archeological sites. Chapter 2, *Existing Conditions and Issues,* Section 2.11.8, *Cultural Resources,* discusses the previously conducted survey and documentation efforts conducted at ABIA for cultural resources, including for archeological resources and non-

[19] 49 CFR Part 24
[20] FAA. 2018. Acquiring Land for Airport and Relocation Assistance—Airport. Available at: https://www.faa.gov/airports/environmental/relocation_assistance/. Accessed March 20, 2018.
[21] 59 FR 7629

archeological standing structures. Details regarding these sites are provided in Chapter 2, *Existing Conditions and Issues,* Appendix 2.3. **Table 5.11-4** includes the previously recorded archeological sites that would potentially be impacted by the short-list runway alternatives. Also included is the eligibility status of each site as determined by the State Historic Preservation Officer for listing on the National Register of Historic Places under Section 106 of the NRHP[22] and for listing as a State Antiquities Landmark per the Antiquities Code of Texas (ACT).[23]

Table 5.11-4: Recorded Archeological Sites Potentially Impacted by Runway Alternatives

RUNWAY ALTERNATIVE	SITE TRINOMIAL	DESCRIPTION	ELIGIBILITY DETERMINATION	ELIGIBILITY ASSESSMENT REFERENCE
Alternative 1	41TV433	Remnants of historic period house	No determination by SHPO. Recommended ineligible by Hicks & Company in 1993.	Texas Historical Commission (THC) 2018,[24] Masson et al. 1994[25]
	41TV1629	Multi-component site with prehistoric and historic deposits	No determination by SHPO. Recommended ineligible by Hicks & Company in 1993.	Texas Historical Commission (THC) 2018, Masson et al. 1994
	41TV1630	Mid-twentieth-century dairy farm	Determined ineligible for SAL/NRHP listing by SHPO in 2003.	THC 2018
	41TV1631	Multi-component site with prehistoric and historic deposits	Determined eligible for SAL/NRHP listing by SHPO in 1998.	THC 2018, Lohse and Ireguas 1998[26]
	41TV1632	Mid-twentieth-century dairy farm	Determined ineligible for SAL/NRHP listing by SHPO 2003.	THC 2018
	41TV1645	Remnants of historic period structures	No determination by SHPO. Recommended ineligible by Hicks & Company in 1993.	THC 2018, Masson et al. 1994
	41TV1646	Remnants of historic period structures	No determination by SHPO. Recommended ineligible by Hicks & Company in 1993.	THC 2018, Masson et al. 1994
Alternative 2	None			

22 16 USC 470 et seq.
23 Texas Natural Resource Code, Title 9, Chapter 191
24 Texas Historical Commission Online Sites Atlas. Available at: https://atlas.thc.state.tx.us/. Accessed February 25, 2018.
25 Masson, Marilyn A., James T. Jones, Michael Myers, and David O. Brown. 1994. *Cultural Resources Survey for the New Austin Airport, Travis County, Texas.* Hicks & Company Archeology Series 28. Austin, Texas. Report for Greiner, Inc.
26 Lohse, Jon C., and Sergio Ireguas (editors). 1998. *Archeological Testing for the New Austin-Bergstrom International Airport in the Lower Onion Creek Drainage of Travis County, Texas*. Hicks & Company Archeology Series 50. Austin, Texas.

RUNWAY ALTERNATIVE	SITE TRINOMIAL	DESCRIPTION	ELIGIBILITY DETERMINATION	ELIGIBILITY ASSESSMENT REFERENCE
Alternative 4	41TV433	Remnants of historic period house	No determination by SHPO. Recommended ineligible by Hicks & Company in 1993.	Texas Historical Commission (THC) 2018,[27] Masson et al. 1994[28]
	41TV1629	Multi-component site with prehistoric and historic deposits	No determination by SHPO. Recommended ineligible by Hicks & Company in 1993.	Texas Historical Commission (THC) 2018, Masson et al. 1994
	41TV1630	Mid-twentieth-century dairy farm	Determined ineligible for SAL/NRHP listing by SHPO in 2003.	THC 2018
	41TV1631	Multi-component site with prehistoric and historic deposits	Determined eligible for SAL/NRHP listing by SHPO in 1998.	THC 2018, Lohse and Ireguas 1998[29]
	41TV1632	Mid-twentieth-century dairy farm	Determined ineligible for SAL/NRHP listing by SHPO 2003.	THC 2018
	41TV1645	Remnants of historic period structures	No determination by SHPO. Recommended ineligible by Hicks & Company in 1993.	THC 2018, Masson et al. 1994
	41TV1646	Remnants of historic period structures	No determination by SHPO. Recommended ineligible by Hicks & Company in 1993.	THC 2018, Masson et al. 1994

Source: Texas Historical Commission (2018). See also eligibility assessment references in table.

Sites that are eligible or potentially eligible for listing on the NRHP or as SALs have been determined to possess significant research value and are afforded legal protection under Section 106 of the NHPA and the ACT, respectively. Listing on the NRHP or as a SAL does not necessarily prohibit impacts to these sites; however, extensive coordination with the SHPO would be required and additional investigations would likely be necessary prior to impacting these sites. These efforts could include further archeological testing, data recovery, and potential mitigation efforts, among others. Additionally, any future airport development actions that occurred on lands that have not been previously surveyed for archeological resources would likely require an archeological survey to determine the potential for impacts to intact archeological resources.

Runway Alternatives 1 and 4 would potentially impact seven previously recorded archeological sites, one of which, Site 41TV1631, has been recommended as eligible for listing on the NRHP

[27] Texas Historical Commission Online Sites Atlas. Available at: https://atlas.thc.state.tx.us/. Accessed February 25, 2018.

[28] Masson, Marilyn A., James T. Jones, Michael Myers, and David O. Brown. 1994. *Cultural Resources Survey for the New Austin Airport, Travis County, Texas.* Hicks & Company Archeology Series 28. Austin, Texas. Report for Greiner, Inc.

[29] Lohse, Jon C., and Sergio Ireguas (editors). 1998. Archeological Testing for the New Austin-Bergstrom International Airport in the Lower Onion Creek Drainage of Travis County, Texas. Hicks & Company Archeology Series 50. Austin, Texas.

and as a SAL by the SHPO. Runway Alternative 2, located entirely within the existing ABIA property, would not impact any previously recorded archeological sites.

5.11.2.2 Historic Resources

Potential impacts of the proposed runway alternatives to historic resources were determined based on review of previous studies conducted at or near ABIA and using the THC's Online Sites Atlas and TxDOT's online GIS layer for historic resources.[30] As discussed in Chapter 2, *Existing Conditions and Issues,* Section 2.11.8, *Cultural Resources,* over 20 cultural resources surveys have been conducted in the ABIA area, including surveys conducted by the Travis County Historical Commission. The resources listed in **Table 5.11-5** are located within the projected 65 DNL contour for each runway alternative in order to account for effects beyond direct construction-related impacts (including noise impacts, visual impacts, etc.).

Table 5.11-5: Documented Historic Resources Potentially Impacted by Runway Alternatives

RUNWAY ALTERNATIVE	RESOURCE NAME	LOCATION	DESIGNATION	NOTES
Alternative 1	Wallace-Burleson-Moore Homestead	West side of FM 973 north of Burleson Road intersection (on ABIA property)	Determined NRHP eligible by SHPO	Within 65 DNL immediately adjacent to runway construction footprint on ABIA property
	Waters Cemetery (41TV413)	Off FM 973 adjacent to Pearce Lane intersection (on ABIA property)	No designation	Within 65 DNL outside of runway construction footprint
	Moore's Crossing Historic District	Roughly bounded by FM 973, Moore's Bridge Road (Old Burleson Road), and Onion Creek	NRHP-listed historic district	Adjacent to 65 DNL outside of runway construction footprint
	Moore's Crossing Bridge (41TV430)	Bridge over Onion Creek (Richard Moya Park)	Registered Texas Historic Landmark (RTHL), Official Texas Historical Marker (OTHM)	Adjacent to 65 DNL outside of runway construction footprint
Alternative 2	Greenwood/Martin Cemetery (41TV1688)	E. Riverside Drive (on ABIA property immediately north of existing west runway	No designation	Adjacent to 65 DNL outside of runway construction footprint on ABIA property
Alternative 4	Wallace-Burleson-Moore Homestead	West side of FM 973 north of Burleson Road intersection (on ABIA property)	Determined NRHP eligible by SHPO	Within 65 DNL immediately adjacent to runway construction footprint on ABIA property

[30] Texas Department of Transportation (TxDOT) Texas Historic Overlay. Texas National Resources Information System, TxDOT, and PBS&J. Available at: https://tnris.org/data-catalog/entry/txdot-texas-historic-overlay/. Accessed February 25, 2018.

RUNWAY ALTERNATIVE	RESOURCE NAME	LOCATION	DESIGNATION	NOTES
	Waters Cemetery (41TV413)	Off FM 973 adjacent to Pearce Lane intersection (on ABIA property)	No designation	Within 65 DNL outside of runway construction footprint
	Moore's Crossing Historic District	Roughly bounded by FM 973, Moore's Bridge Road (Old Burleson Road), and Onion Creek	NRHP-listed historic district	Adjacent to 65 DNL outside of runway construction footprint
	Moore's Crossing Bridge (41TV430)	Bridge over Onion Creek (Richard Moya Park)	Registered Texas Historic Landmark (RTHL), Official Texas Historical Marker (OTHM)	Adjacent to 65 DNL outside of runway construction footprint
	Greenwood/Martin Cemetery (41TV1688)	E. Riverside Drive (on ABIA property immediately north of existing west runway	No designation	Adjacent to 65 DNL outside of runway construction footprint on ABIA property

Source: Texas Historical Commission (2018); TxDOT Texas Historic Overlay (2018).

As discussed above, sites listed on the NRHP are afforded legal protection under Section 106 of the NHPA. Federal agencies (including the FAA) are required to determine whether historic properties would be affected by a proposed undertaking and to consult with the SHPO regarding effects to properties that are included on the NRHP, or that meet the criteria for listing on the NRHP. The SHPO makes a determination regarding whether effects to a historic property would be adverse, and, if so, further consultation is conducted to seek ways to avoid, minimize, or mitigate adverse effects.[31] In addition to consultation requirements under Section 106, eligible or potentially eligible historic sites are also protected under Section 4(f) of the DOT Act, which prohibits use of land of a historic site of national, state, or local significance unless there is no feasible and prudent alternative to the use of that land and the project incorporates all possible planning to minimize harm resulting from use. FAA Order 1050.1F[32] outlines the types of use that could occur, including a *de minimis* impact, constructive use, and physical use. Potential impacts to Section 4(f) properties would be determined during more detailed NEPA-level studies.

[31] Advisory Council on Historic Preservation. Section 106 Regulations Summary. Available at: http://www.achp.gov/106summary.html. Accessed March 16, 2018.

[32] FAA. 2015b. FAA Order 1050.1F Desk Reference. Subject: Environmental Impacts: Policies and Procedures. July 16, 2015.

None of the short-list runway alternatives are anticipated to directly impact eligible or listed historic resources as a result of their construction. However, all of the runway alternatives would be expected to require further consideration of potential impacts to historic resources during NEPA-level studies. Four historic resources are located within the projected 65 DNL boundary of the Runway Alternative 1, including the NRHP-listed Moore's Crossing Historic District and NRHP-eligible Wallace-Burleson-Moore Homestead (located in close proximity to the Alternative 1 runway construction footprint). Also located within or adjacent to the projected 65 DNL boundary for Runway Alternative 1 are Waters Cemetery, located on ABIA property, and Moore's Crossing Bridge over Onion Creek (RTHL and OTHM). The Greenwood/Martin Cemetery, located on ABIA property immediately north of the west Runway 17R-35L, is located adjacent to the projected 65 DNL boundary of Runway Alternative 2. Runway Alternative 4 would impact all of the above referenced historic resources noted for Runway Alternatives 1 and 2.

5.11.2.3 Ecological Resources

This section evaluates the potential impacts of the short-list runway alternatives to ecological resources, including vegetation and wildlife, prime farmland, threatened and endangered species, and water resources. Impacts are evaluated based on the anticipated construction footprint of the short-list Runway Alternatives 1, 2 and 4.

5.11.2.3.1 Vegetation and Wildlife

A total of four major vegetation communities occur within the ABIA vicinity. These communities represent varying levels of wildlife habitat value are summarized in **Table 5.11-6** according to the potential construction-related impacts of the short-list runway alternatives.

Runway Alternative 1 extends across the Onion Creek floodplain and would impact 23.2 acres of riparian woodland and forest, which represents potentially high habitat value for wildlife. A total of 24.8 acres of vegetation with moderate habitat value (parkland and upland woodland and forest) would also be impacted, along with 78.2 acres of vegetation with low habitat value. Alternative 1 runway would also hinder the movement of wildlife species (particularly birds and mammals) from travelling upstream or downstream along the Onion Creek corridor to feed, breed, nest, or escape from predators. Attempts to proceed up and down the riparian corridor intersected by the runway would likely result in attempts by birds and mammals to cross the runway, thus raising the risk for wildlife hazards to aviation operations.

Runway Alternative 2 is located on the existing ABIA property and therefore would predominantly impact grasslands that are maintained and frequently mowed (94 acres). Wildlife habitat value is low, supporting fewer wildlife species than the other vegetation communities. The Alternative 2 runway would present the lowest level of potential impacts to wildlife species among the four short-list runway alternatives.

Runway Alternative 4 would impact all of the vegetation community impacts previously noted under Runway Alternatives 1 and 2.

Table 5.11-6: Vegetation Communities Potentially Impacted by Runway Alternatives

RUNWAY ALTERNATIVE	VEGETATION COMMUNITY	ACREAGE	NOTES
Alternative 1	Grasslands	78.2 acres	Mowed and maintained grasslands; low habitat value for wildlife
	Riparian Woodland and Forest	23.2 acres	Associated with Onion Creek; potentially high habitat value due to high ecological site productivity, high plant species diversity, and a relatively unfragmented riparian corridor
	Parkland	15.0 acres	Moderate habitat value for wildlife
	Upland Woodland and Forest	9.8 acres	Moderate habitat value for wildlife
Alternative 2	Grasslands	94.0 acres	Mowed and maintained grasslands; low habitat value for wildlife
Alternative 4	Grasslands	172.2 acres	Mowed and maintained grasslands; low habitat value for wildlife
	Riparian Woodland and Forest	23.2 acres	Associated with Onion Creek; potentially high habitat value due to high ecological site productivity, high plant species diversity, and a relatively unfragmented riparian corridor
	Parkland	15.0 acres	Moderate habitat value for wildlife
	Upland Woodland and Forest	9.8 acres	Moderate habitat value for wildlife

Note: Not included in the above acreage calculations above are open water and paved areas. Therefore, while each runway alternative would impact approximately the same amount of acreage, the total acres for each runway alternative above represent the amount of vegetation impacted, not the total amount of land impacted.

Source: Hicks & Company (2018)

5.11.2.3.2 Prime Farmland

The Farmland Protection Policy Act (FPPA), as detailed in Subtitle I of Title XV of the Agricultural and Food Act of 1981,[33] provides protection to prime and unique farmlands, as well as farmlands of statewide or local importance. Prime farmland soils, as defined by the United States Department of Agriculture, are soils that are best suited for producing food, feed, forage, and oilseed crops. Such soils have properties that are favorable for the production of sustained high yields. Prime farmland can include cropland, pastureland, rangeland, or forestland, but does not include land converted to urban, industrial, transportation, or water uses. The majority of the ABIA property is within an Urbanized Area (UA) as depicted on the 2010 U.S. Census Bureau maps and is therefore exempt from the provisions of the FPPA. However, a portion of the property south

[33] 7 U.S.C. 73

of Onion Creek is not within a UA; therefore, impacts to prime farmland within this area are subject to the provisions of the FPPA.

Runway Alternative 2 is located within the current ABIA property and would not result in impacts to prime farmland. Runway Alternatives 1 and 4 would impact 14.4 acres of prime farmland.

5.11.2.3.3 Threatened and Endangered Species

The Texas Parks and Wildlife Department's Texas Natural Diversity Database (TXNDD)[34] maintains a record of observations of tracked rare, threatened, or endangered species and assemblages throughout the state. These observances are called Element of Occurrence Records (EORs) and are defined as areas of land and/or water where a species or ecological community is or was present that has practical conservation value.[35] Considered collectively, the TXNDD results along with TPWD and U.S. Fish and Wildlife county lists identify several species that have historically occurred in Travis County. It should be noted that information from the TXNDD cannot be used for presence/absence determinations; in order to verify the current (not historical) distribution of a particular species, presence/absence surveys would be required. The TXNDD was searched for EORs by TPWD on January 29, 2018, and indicated potential habitat for one mussel species, the Texas Fatmucket (*Lampsilis bracteata*), state-listed as threatened and also a candidate for federal listing, occurs within the ABIA property boundary within Onion Creek. This species has been documented within Onion Creek both upstream (0.26 miles) and downstream (1.04 miles) of the ABIA property boundary. In the most recent Review of Native Species that are Candidates for Listing as Endangered or Threatened,[36] USFWS maintained a Listing Priority Number (LPN) of 2 for the Texas Fatmucket, indicating a high priority for listing based on imminent, high magnitude threats to this species. These threats include habitat destruction and modification from impoundments, as well as sedimentation, dewatering, sand and gravel mining, and chemical contaminants.

Runway Alternatives 1 and 4 have the potential to impact freshwater mussels including the Texas Fatmucket, which is currently state-listed threatened and could be federally listed in the future. At a minimum, for any work conducted within the water of Onion Creek, a survey for mussels would need to be conducted prior to construction of any one of these runways by a TPWD permitted biologist. If the Texas Fatmucket were to become federally listed as threatened or endangered prior to the construction of one of these alternatives, consultation with USFWS would be required under Section 7 of the Endangered Species Act.[37]

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34 Texas Parks and Wildlife Department Natural Diversity Database. Available at: https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/txndd/. Accessed March 11, 2018.

35 NatureServe. 2002. EO Definition. http://downloads.natureserve.org/conservation_tools/element_occurence_data_standard.pdf.

36 81 FR 87246

37 16 U.S.C. §§1531–1544

5.11.2.3.4 Water Resources, Including Wetlands

The current ABIA property boundary lies within three watershed boundaries: the Colorado River watershed, the Carson Creek watershed, and the Onion Creek watershed. The majority of ABIA is within the Onion Creek watershed where water flows south and east towards Onion Creek, which runs through the southeast portion of the airport property. This stretch of Onion Creek has been identified by TPWD as having unique ecological value with high water quality and diverse aquatic life.[38]

Potential impacts to Waters of the U.S. including wetlands subject to permitting by the U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act were investigated for each of the short-list runway alternatives. As shown in **Table 5.11-7**, the Runway Alternatives 1 and 4 would potentially impact WOTUS represented by Onion Creek.

Table 5.11-7: Potential Impacts to Onion Creek by Runway Alternative

RUNWAY ALTERNATIVE	AVG. OHWM (FEET)	LINEAR FEET OF POTENTIAL IMPACTS	ACREAGE OF POTENTIAL IMPACTS
Alternative 1	68 feet	974.6 feet	1.52 acres
Alternative 2	0 feet	0 feet	0 acres
Alternative 4	68 feet	974.6 feet	1.52 acres

Sources: ABIA Airport Layout Plan; COA 2015 Creek Lines.

Runway Alternative 2 runway would avoid direct impacts to Onion Creek, while Runway Alternatives 1 and 4 would potentially have 974.6 linear feet (1.52 acres) of impacts to the creek. See the *Memorandum on the Potential Impacts of ABIA 2040 Master Plan Short-List Runway Alternatives to Onion Creek* in **Appendix 5.2** for additional information.

Wetlands are defined by the COA Environmental Criteria Manual Section 1.10.3(E) as lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. An area shall be classified as a wetland if it meets the USACE three-parameter technical criteria associated with soils, hydrology, and vegetation as outlined in the *Corps of Engineers Wetlands Delineation Manual* (Section D, Routine Determinations).[39] Under this definition, the wetland may be considered jurisdictional and subject to permitting by the USACE under Section 404 of the Clean Water Act.

The construction footprint of the three short-list runway alternatives was superimposed over the locations of currently documented wetlands that have been determined to be potentially

[38] Texas Parks and Wildlife Department. 2018. Ecologically significant stream segments. Planning Data by Region. Available at: https://tpwd.texas.gov/landwater/water/conservation/water_resources/ water quantity/sigsegs/regionk.phtml. Accessed February 7, 2018.

[39] U.S. Army Corps of Engineers. 1987. Corps of Engineers Wetlands Delineation Manual by Environmental Laboratory. Available at: http://www.lrh.usace.army.mil/Portals/38/docs/USACE%2087%20Wetland%20Delineation%20Manual.pdf. Accessed February 7, 2018).

jurisdictional (see Chapter 2, *Existing Conditions and Issues,* Section 2.11.6.3, *Water Resources, including Wetlands*) to evaluate the potential impacts of the runway alternatives. Two wetlands that are considered to be potentially jurisdictional would be impacted by Runway Alternatives 1 and 4. No currently documented jurisdictional wetlands would be impacted by Runway Alternative 2.

5.11.2.4 Hazardous Materials

Impacts of the short-list runway alternatives were evaluated based on known hazardous materials sites on ABIA property with current land use restrictions. The potential impacts described herein are approximated based on the best available data at the time this assessment was conducted and are intended to serve as a means of comparison of the runway alternatives.

All of the hazardous materials sites that would potentially be impacted by the short-list runway alternatives fall within the southeastern portion of the ABIA property. This area is a combination of previously identified hazardous materials sites, including Solid Waste Management Units 3–7, a road oiling area (SWMU 95), the south fork drainage ditch (SWMU 77), rubble debris piles (SWMU 91), and an old ammunition burn pit (SWMU 206). For the purposes of this assessment, these sites are collectively referred to as the combined southeast landfill area. As shown in **Table 5.11-8**, only Runway Alternatives 1 and 4 are located within areas of previously identified hazardous materials sites with current land use restrictions.

SWMU 5 and two asphalt storage areas within its cover system boundaries (SWMUs 113 and 114) lie in close proximity to, but outside the footprint of, Runway Alternatives 1 and 4. These hazardous material sites are not included in this assessment; however, if impacts to these areas were to occur, the area requiring landfill removal and remediation would increase by approximately 14.6 acres for Runway Alternatives 1 and 4.

Table 5.11-8: Potentially Affected Hazardous materials Sites with Land Use Restrictions Sites by Runway Alternative

RUNWAY ALTERNATIVE	SWMU SITE	DESCRIPTION	AREA WITHIN RUNWAY FOOTPRINT [ACRES]	ENTIRE SITE FOOTPRINT [ACRES]
Alternative 1 Alternative 4	SWMU 6	– Primarily received domestic solid waste and construction debris. – Industrial (hazardous) waste also disposed of at these sites. – Seven drums of dichlorodiphenyltrichloroethane (DDT) were discovered in the early 1970s, one of which had leaked. – Trenches have been reported to be 30 feet deep.[40]*	10.71	11.78
	SWMU 7	– Primarily received domestic solid waste and construction debris. – Industrial (hazardous) waste also disposed of at these sites. – Depth of site not known.[40]*	2.57	6.03
	SWMU 77	– South fork drainage ditch. – Waste materials, primarily fuels and oils, flowed in the ditch and soaked into the ground along the ditch and/or evaporated. – The sediment and soil were classified as Class II non-hazardous waste. – Although this site falls within the combined southeast landfill area, no waste material is present following remediation. – Depth of site not known.[41]*		
	SWMU 91	– Construction rubble debris piles. – Up to eight individual debris piles of soil mixed with concrete, asphalt, and other materials consistent with building demolition. – No information available regarding the operational history of this site. – Depth of site not known.[41]	0.54	0.54
		Total – Runway Alternatives 1 & 4 (each)	**13.82**	**18.35**

Notes: *Site depth information provided where available based on previous studies; however, Inconsistencies in estimated site depths have been report. See below for further information. SWMUs within the Runway Protection Zones (RPZs) are not included based on the assumption that no construction activities would take place in these areas. See Section 2.11.9, Chapter 2 for locations of hazardous materials with land use restrictions on ABIA property.

[40] FPM Remediations, Inc. 2017. Final 2016 Annual Monitoring Report for the Combined Southeast Landfills 3-7 and Solid Waste Management Unit 76, Area 1 Former Bergstrom Air Force Base, Texas. June 2011.

[41] HydroGeoLogic, Inc. 2011. Final second five-year review for former Bergstrom Air Force Base Austin, Texas. June 2011.

5.11.2.4.1 Current Status of Hazardous Materials Sites

The exact depths and volumes of the hazardous materials sites located in the combined southeast landfill area have not been confirmed to date. Site characterizations carried out in 1995 by OHM Remediation Services Corporation provided lateral dimensions using shallow electromagnetic terrain conductivity as well as details on landfill cover depths using test pits. However, determining the exact depths and volumes of the landfills presented a challenge when using standard ground penetrating radar due to the presence of clay with high electromagnetic conductivity. Standard terrain conductivity equipment was more effective but did not provide exact depth details; instead, this method detected the presence or absence of waste at specific depths (25, 30, and 50 feet). Deeper electromagnetic terrain conductivity tests indicated that the buried waste does not exceed 25 feet in depth at any of the combined southeast landfills.[42] To date, no further site characterization studies have been conducted that provide detailed depths or allow for calculations of the volumes for these hazardous materials sites.

No further remedial actions are required for the combined southeast landfill area. The previously conducted remedial actions for the combined southeast landfill area included: the construction of landfill cover systems (RCRA composite cap); improvements to the drainage channels; toe drain systems; passive gas control; erosion control measures; and fencing off the entire area in order to limit access. The cover systems for SWMUs 3 and 4 were combined and installed as a single cover (in addition to SWMUs 95 and 206), whereas the cover systems for SWMUs 6 and 7 were constructed separately.[43]

Deed restrictive covenants include prohibiting surface or subsurface soil and well installation activities that may compromise the landfill caps; prohibiting the extraction and use of onsite groundwater; prohibiting residential land use; and ensuring that controlled access is maintained. Post-closure care, including groundwater monitoring, and institutional control measures (deed restrictive covenants) are ongoing.[44]

See the *Memorandum on the Potential Impacts of ABIA 2040 Master Plan Short-List Runway Alternatives Related to Hazardous Materials* in **Appendix 5.1** for additional information.

[42] OHM Remediation Services Corporation. 1995. *Report for the Delineation of Boundaries at the Combined Southeast Landfill Area Sites LF-3, LF-4, LF-5, LF-6, and LF-7.* August 1995. Available at: http://www.austintexas.gov/edims/document.cfm?id=172745. Accessed January 27, 2018.

[43] FPM Remediations, Inc. 2017. Final 2016 Annual Monitoring Report for the Combined Southeast Landfills 3-7 and Solid Waste Management Unit 76, Area 1 Former Bergstrom Air Force Base, Austin, Texas. June 2011.

[44] HydroGeoLogic, Inc. 2011. Final second five-year review for former Bergstrom Air Force Base, Austin, Texas. June 2011.

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