MASTER PLAN
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AIRPORT

4 Alternatives Evaluation

4.0 ALTERNATIVES ANALYSIS

This chapter presents a range of airside, landside, and terminal alternatives developed to meet the recommended facility requirements documented in Chapter Three. Each alternative considers the short (5-year), medium (10-year), and long-term (20-year) needs of the Bismarck Airport (BIS). Alternatives were developed using four evaluation criteria including economic, operational, environmental and implementation factors. These criteria are discussed below in Section 4.2. The development of alternatives focuses on several key facilities at BIS including the airfield (runways and taxiways), terminal building, vehicular parking, support facilities (operations and maintenance), fuel farm, and general aviation. This chapter presents each alternative and compares the advantages and disadvantages of each to identify a preferred development option for each facility need. It should be noted that some of the recommended alternatives were selected based on a single, logical development action which met the facility needs identified in Chapter Three and accomplished the long-term goals of the Airport. The alternatives presented in this chapter are conceptual in nature and are subject to further refinement through financial, environmental, and engineering means. This chapter presents each of the alternatives considered for future implementation and is organized by the following sections:

- Evaluation Criteria Methodology
- Runways
- Taxiways and Taxilanes
- Airside Facilities Summary
- SRE Facility
- ARFF Facility
- Fuel Farm Area
- Terminal Area
- Air Traffic Control Tower

- Vehicle Parking
- Landside Alternatives Summary

4.1 EVALUATION CRITERIA METHODOLOGY

To evaluate the alternatives, a set of criteria was developed to compare the advantages and disadvantages of each development option. These criteria focused on quantitative and qualitative factors to be considered when weighing the merits and deficiencies of the alternatives under consideration. The evaluation criteria include:

- **Operational Factors** – Each alternative was evaluated for its ability to accommodate the projected level of demand during the 20-year planning period and included, aircraft operations, passenger enplanements, landside vehicle traffic, based aircraft, air cargo activity, aircraft fuel sales, and the demand for hangar and apron space. Other operational factors such as aircraft delay, airfield circulation, and convenience to Airport users were also considered during the comparison of advantages and disadvantages of each development option.
- **Economic Factors** – Qualitative economic factors such as construction and operational costs were considered in evaluating the cost effectiveness of each alternative. This includes costs for design, construction, day-to-day operation, and maintenance. It is important to note that the focus of this evaluation was not to determine the cost to construct each alternative, but rather the type of costs that should be considered when comparing development options.
- **Environmental Factors** – Environmental conditions that could be directly impacted by the proposed development such as noise, air quality, water quality, scenic oversight, land use, and socioeconomic impacts were the focus of this criterion. It should be noted that significant environmental considerations as they pertain to each alternative were reviewed as a part of this evaluation. A more in-depth overview of the environmental factors that may impact development at Airport is presented in the Environmental Overview chapter.
- **Implementation Feasibility** – This criterion focused on the tangible and intangible factors that should be considered to implement each alternative. Factors such as State Priority System, operational performance, best planning tenants,

environmental and fiscal factors, and probability of unknown contingencies were qualitatively evaluated for each alternative to help support or negate the feasibility of implementing the proposed action.

Each section of this chapter addresses a need that was identified through the review of facility requirements and is organized so that the evaluation of each alternative considers the previously described evaluation criteria. Where multiple alternatives are presented, each section of Chapter identifies a recommended alternative along with justification on why it is the preferred development option for the Airport throughout the 20-year planning period.

4.2 RUNWAYS

Chapter three provided a summary of needs for the runways at BIS including the dimensions, associated NAVAIDS and other design standards. Alternatives will be provided below that address each of these issues. Supporting facilities to the runways, such as instrument approaches and runway protection zones, will be addressed in subsequent sections. In general, the runways are meeting current and anticipated needs although minor changes are needed to comply with current FAA standards.

4.2.1 Runway 13/31

As noted in Chapter Three, Runway 13/31, does not meet current FAA grading standards within the first and last quarter of the runway. The Airport was recently awarded a FAA Airport Improvement Plan (AIP) Grant for the reconstruction of Runway 13/31. This reconstruction project began in July 2017 and will continue during normal construction seasons until completion in October 2019. This project will correct the grading issues noted above as well as increase the PCN value from the current 46 to approximately 89. As identified in Chapter Three, the critical aircraft selected for Runway 13/31 is the MD-83. As a result, the future Runway Design Code (RDC) for Runway 13/31 is D-III.

However, because some aircraft larger than MD-83 are anticipated to use Runway 13/31 over the next 20-years, some changes to the supporting surfaces of Runway 13/31 were considered. For example, current FAA design standards for runways having an RDC greater than D-III recommend that runway shoulders be paved to a width of 25 feet to support the potential for large aircraft to deviate from the runway; however, based upon the Engineering Design Report (EDR) the runway shoulders for Runway 13/31 will not be paved as part of the runway rehabilitation project currently underway. This is due primarily to the typical size of aircraft operating from BIS as well as the cost of implementation. In addition, FAA design standards recommend paved blast pads at the end of each runway. FAA concurred with this recommendation and has included paved blast pads measuring 200 feet wide by 200 feet in length at the end of Runway 13 and 31 as part of the runway reconstruction project. As of October 2017, a paved blast pad has been completed for Runway 31 end. The dimensions of the runway are otherwise found to be adequate to serve the anticipated aircraft over the 20-year planning period. The runway has also been assessed and found that a MALS may be adequate in the future.

4.2.2 Runway 3/21

As stated in Chapter Three, the future RDC for Runway 3/21 is C-II. The crosswind runway currently meets the needs of most existing users. As a result, no major geometric changes are considered necessary over the planning period. Currently, the existing Runway Design Code (RDC) for Runway 3/21 is designated as C-II-4000. The RDC (C-II-4000) is composed of three components. Each component represents specific FAA design standards that apply to Runway 3/21. For example, the first component (C) in C-II-4000 refers to aircraft approach speed. The second component, (II), in C-II-4000 represents the aircraft wingspan or tail height of the largest aircraft expected to operate on the runway, whichever is more restrictive. The third component, (4000), in C-II-4000 is based on the runway's lowest visibility minimums expressed in feet for Runway Visual Range (RVR). Another common way FAA expresses this distance is through the

conversion of feet into statute miles. Using this conversion, 4000 feet is approximately ¾- statue miles. For Runway 3/21, the lowest visibility minimum available is associated with the Localizer Performance with Vertical guidance (LPV) instrument approach to Runway 3. Finally, the use of 4000 feet to represent visibility distance should not be correlated with actual runway length. Runway 3/21 is 6,600 feet in length.

Based on aircraft manufacturer sales projections, commercial airlines are expected to retire and/or reduce use of regional jet aircraft such as the 50-seat regional jets including the CRJ-200 over the next decade and replace them with larger 70- to 90-seat regional jet aircraft. As shown in Table 1, many of the 70- to 90- seat regional aircraft anticipated to replace the existing 50-seat regional jets that serve BIS are classified as RDC category C-III. While many of these C-III aircraft are expected to operate from BIS over the next 20-years, the aviation forecasts developed for the 2018 Bismarck Airport Master Plan indicate that C-III aircraft operations will not reach the FAA threshold for reclassification of 500 annual operations on this runway by the end of the planning period (2035). As a result, it is recommended that the RDC for Runway 3/21 remain C-II-4000 for length and width, but the activity of these larger aircraft does warrant consideration to increase the PCN of the runway to accommodate the operations now, without experiencing premature pavement deterioration.

Runways serving C-III aircraft with a maximum takeoff weight over 150,000 pounds are recommended to have a blast pad measuring 200 feet wide and 200 feet long. As some variants of the Airbus A319 meet this requirement and will occasionally use this runway, it is recommended that blast pads be expanded to meet this standard. The fillets and 60' width of the accompanying taxiways is to remain at a larger TDG to allow these aircraft to safely operate when necessary.

The Bismarck Airport is also in need of additional wetland mitigation on airport property. The Central Watershed Area drains from behind the Air Traffic Control Tower, across the airfield, and eventually into Apple Creek. The previously completed 2010 Drainage Study identified this area as requiring substantial work to facilitate the drainage improvements required to help prolong the pavement life of both Runway 13-31 and Runway 3-21. It is recommended that a pavement rehabilitation and drainage project be scheduled to address these concerns. This will be discussed further in Chapter 5.

4.3 INSTRUMENT APPROACHES

Instrument approaches allow aircraft to land at an airport when weather would otherwise be prohibitive. Providing optimal instrument approaches allows airports to continue operations with minimal interruptions. As stated in Chapter Three, Runway 3 has the highest level of wind coverage for instrument flight rules (IFR) conditions of any single runway end, as shown below in Table 4-1. Currently, Runway 3 offers a single RNAV approach with 200-foot ceiling and 3/4 miles visibility limitations.

Table 4-1: BIS IFR Crosswind Coverage

Crosswind Component	Rwy 13	Rwy 13/31	Rwy 31	Rwy 3	Rwy 3/21	Rwy 21	All Runways
10.5 knots	61.36%	**89.04%**	61.57%	70.53%	**79.50%**	47.67%	**96.57%**
13 knots	64.18%	**93.92%**	64.51%	76.36%	**86.46%**	50.16%	**98.93%**
16 knots	66.83%	**97.91%**	66.91%	82.06%	**93.22%**	52.80%	**99.84%**
20 knots	67.90%	**99.50%**	67.93%	85.87%	**97.47%**	53.96%	**99.97%**

Source: FAA AGIS wind analysis tool

Utilizing this crosswind coverage by decreasing visibility limitations to 1/2 mile would require the installation of one of the approach lighting system (ALS) shown below.

- Medium Intensity ALS with Sequenced Flashers (MALSF)

- Medium Intensity ALS with Runway Alignment (MALSR)
- Simplified Short Approach Light System with Runway Alignment (SSALR)
- ALS with Sequenced Flashing Lights (ALSF)

An ALSF is used for more restrictive CAT-II and CAT-III approaches not present at BIS. Both the MALSRs and SSALRs have identical layouts with sequenced flashing lights, the difference being that SSALRs use high intensity lights. For this reason, MALSFs are a more economical ALS and approved for CAT-I approaches. It is recommended that if another approach is added to the Runway 3 end then a MALSF be used as the ALS for the approach.

4.4 NAVIGATIONAL AIDS

Navigational Aids (NAVAIDs) provide pilots increased situational awareness and aid them in finding and maneuvering the airport environment. The previous chapter conducted a review of Airport NAVAIDs and determined that only minor modifications are recommended beyond the existing plans. Existing projects include separating the MALSR control building further west and to make improvements to the existing grade for a new FAA-owned MALSR lighting system to be installed during the runway rehabilitation project currently underway. This improvement is intended to eliminate signal reflection issues affecting some aircraft types. Assess roads to the airside NAVAIDs will also be relocated to no longer conflict with safety areas.

The remaining NAVAIDs at BIS are currently meeting Airport needs and expected to continue to do so for the duration of the 20-year planning period. These NAVAIDs include the Automated Surface Observing System (ASOS), airport beacon, PAPIs, and segmented circle and wind indicators while minor changes are anticipated for other equipment. This includes updating the runway and taxiway lighting to light emitting diode

(LED) lighting, which is more efficient, and updating signage to achieve compliance with FAA AC 150/5340-18F, Standards for Airport Sign Systems.

4.5 RPZ COMPLIANCE

RPZs at the Airport are sized appropriately for the existing approaches. As discussed in Chapter Three, the Runway 31 RPZ extends over Yegan Road. The alternatives identified in this Master Plan do not trigger the need for an RPZ study to be completed. The area located south of the Runway 3 threshold which includes Airport Expressway, Airway Avenue, and the existing RPZ falls within an uninhabited area. Should the Airport ever implement lower approach visibility minimums for Runway 3, then the existing RPZ would be expanded beyond these two roadways and result in a conflicting land use for RPZs. Airport Expressway is a four-lane highway with businesses located to the south. Relocating the highway out of the RPZ would be very difficult due to its size and surrounding businesses. Although lowered visibility requirements would increase the utility of Runway 3, this is not likely to be a need within the 20-year planning period and would have negative impacts to the surrounding community. Therefore, decreasing the runway visibility minimums is not recommended at this time.

4.6 TAXIWAYS AND TAXILANES

This section will provide a review of the findings from Chapter Three and present the taxiway alternatives considered to meet future needs.

4.6.1 Taxiway Alternative 1: Reconstruction to Standards

Taxiway Alternative 1 includes a complete reconstruction of the taxiway system to comply with current FAA 150/5300-13A design standards. FAA standards for taxiway dimensions and runway separations are often updated as the aircraft fleet evolves over time. The most recent FAA standards are applied to the airside environment as shown in **Exhibit 4-1.** The separation of runways and parallel taxiways are based on the performance and

dimensions of the aircraft intended to use them. Each runway would require a parallel taxiway separation of 400 feet and taxiway fillets would need to be added to most turns. Due to the length of aircraft, the nose gear of the aircraft will often travel a different asymmetrical path than the main gear. Fillets help provide additional pavement to compensate for this turning pattern.

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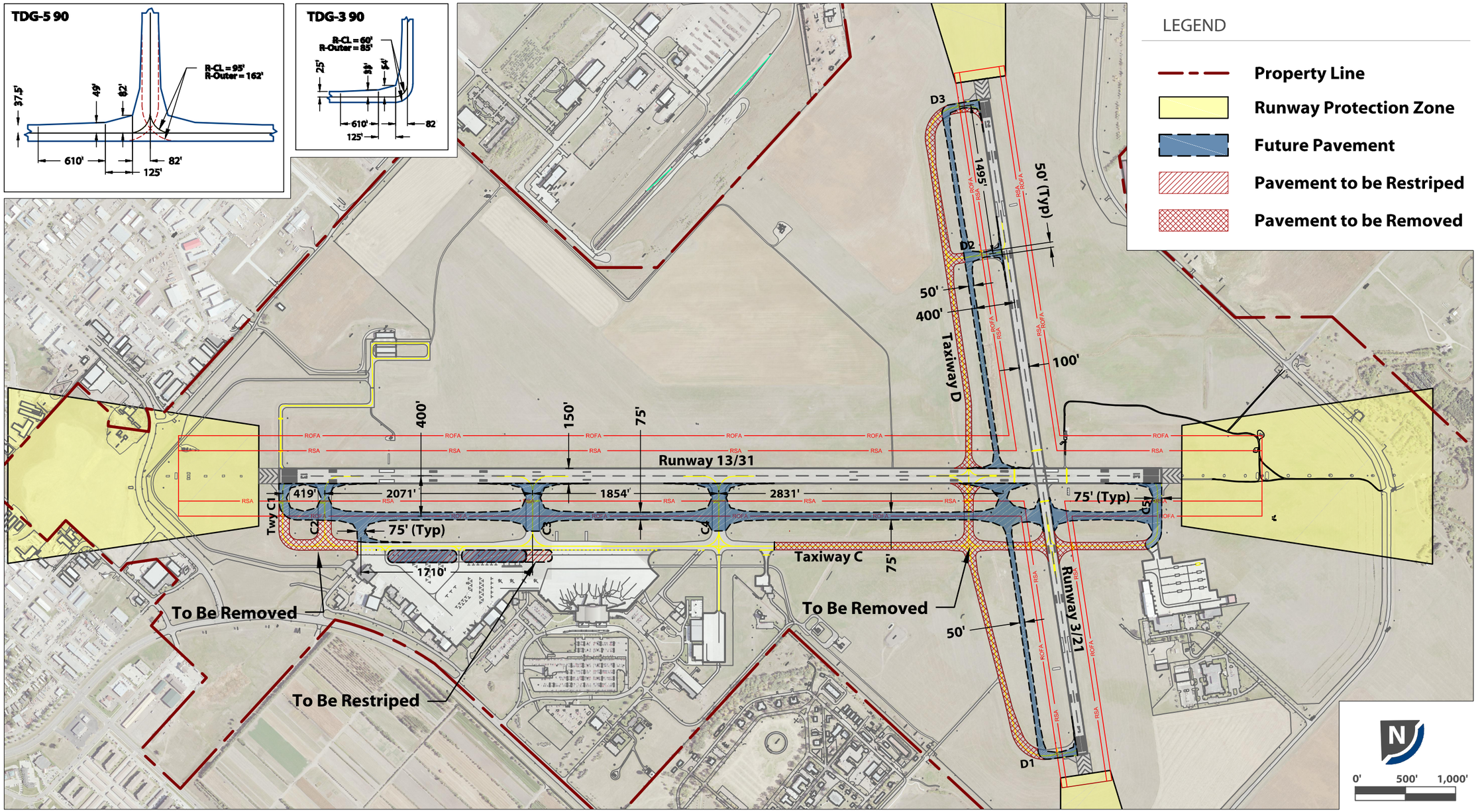

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Exhibit 4-1 **Taxiway Alternative 1: Reconstruction**

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4.6.2 Taxiway Alternative 2: Priority Modification

Taxiway Alternative 2 represents the taxiway modifications needed to meet the Airport's highest priorities for compliance with current FAA taxiway design standards as per AC 5300-13A. It is important to note that these recommended improvements are consistent with those approved by FAA as part of the current runway rehabilitation project underway at the Airport. Taxiway C and connectors C1, C3, C5 and Taxiway D between Runway 13/31 and Taxiway C are intended to serve large aircraft, such as the Boeing 747 and Boeing C-17, and so are approved for TDG V standards. The primary change to the taxiway environment will be the addition of fillets and narrowing connector C4. The new taxiway fillet design will meet current FAA design standards while still providing aircraft with adequate corners to enter and exit Runway 13-31. Taxiway layouts are shown on **Exhibit 4-2**.

In addition to modifying the width and fillets associated with Taxiways C3 and C4, both C3 and C4 provide direct access from an aircraft apron to the Runway 13-31. Direct apron to runway access is discouraged by FAA because taxiways leading directly from an apron to a runway without a turn increase the potential for a runway incursion. Taxiway C3's direct apron to runway connection can been mitigated by restriping the existing non-aircraft movement area island located between the air carrier apron and the entrance to Taxiway C3. These markings would effectively extend the non-aircraft movement island to the southeast along Taxiway C to prevent pilots from taxiing aircraft directly across this segment of the air carrier apron to the runway. Restriping the existing pavement markings would be a less expensive alternative than removing the pavement in this area. Taxiway C4 connects with Taxiway E near the midpoint of parallel Taxiway C and provides direct access to the corporate apron. Despite having a 600-foot separation from the entrance to Taxiway C4 to the corporate apron, FAA considers this to be a direct connection to

Runway 13-31 because pilots are not required to make a right or left-hand turn before reaching the runway environment.

There are additional taxiways that do not meet current FAA ADG III taxiway design standards; however, it is not uncommon for many airports to have taxiway separations which exceed current design standards. FAA recognizes these taxiways exceed the current standard for width and have approved them to remain in place under the current runway rehabilitation project. It is important to note that Taxiways C1, C3, C5, Taxiway C and Taxiway D (between Runway 13-31 and Taxiway C) have been approved by FAA to be built for ADG V standards to accommodate the use of large aircraft (i.e. B747 and C17). In addition, Taxiways C2 and C4 will be constructed to ADG IV standards. During the reconstruction or rehabilitation of taxiways in the future, all hold lines will be updated to reflect current FAA guidance on reference to runway elevation.

FAA's decision to maintain these nonstandard taxiway widths is based on their ability to safely accommodate future aircraft operations throughout the 20-year period. In addition, FAA acknowledges the cost to reconstruct these taxiways, and the accompanying lights, signs, and markings, would require considerable expense without any benefit of improving safety. Based on coordination and approval with FAA, these taxiways, along with D1, D2, and D3, will remain unchanged and have not been included in Taxiway Alternative 2.

In conclusion, Taxiway Alternative 2 is the recommended taxiway alternative and will be carried forward into the preferred alternative incorporated into the airport layout plan. Taxiway Alternative 2's primary purpose is to reflect those taxiway improvements which improve safety in a financial responsible manner as approved by FAA under the current runway rehabilitation project.

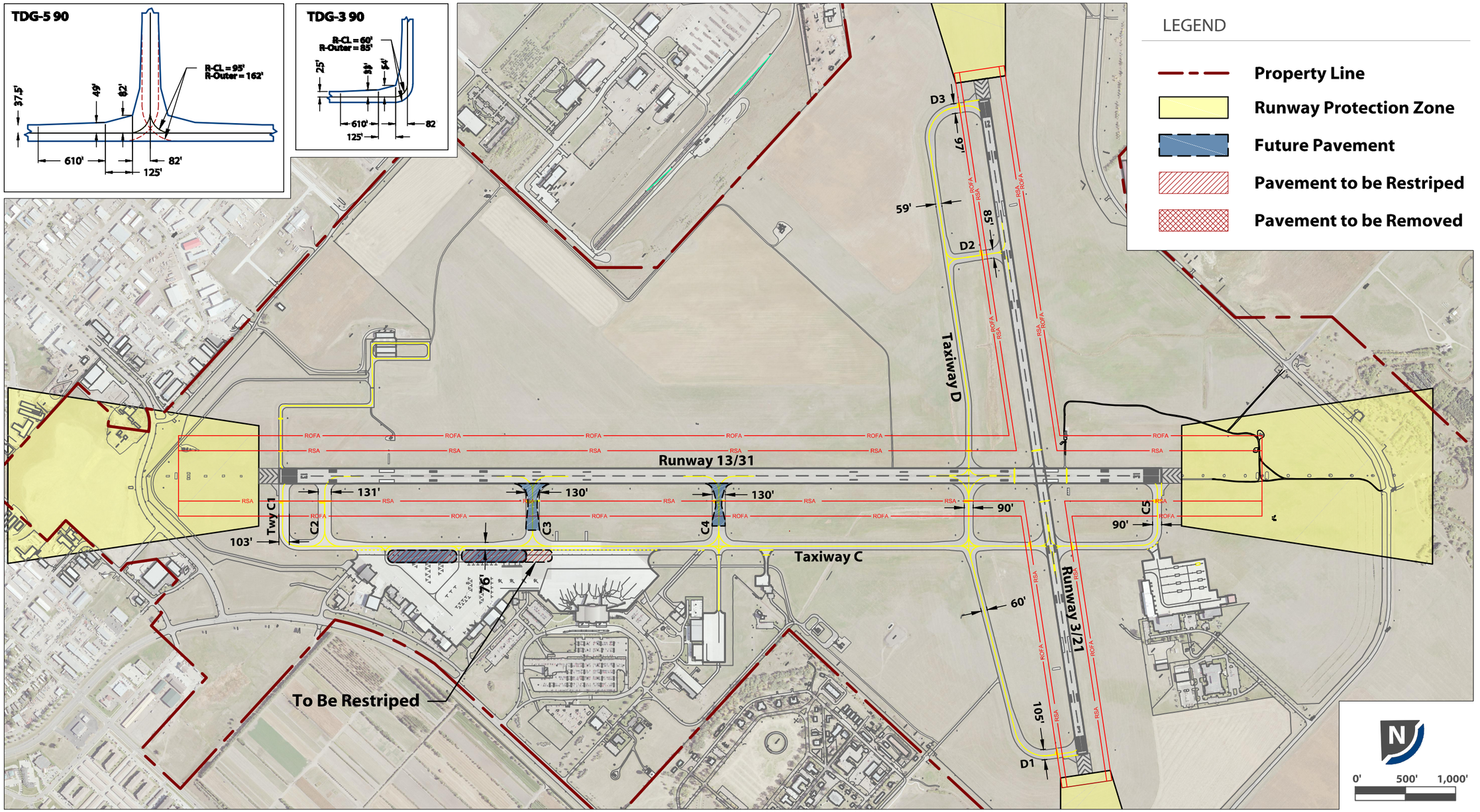

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Exhibit 4-2 **Taxiway Alternative 2: Priority Modification**

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4.7 AIRSIDE FACILITIES SUMMARY

The alternatives discussed in this section, including existing RPZs and NAVAIDS are collectively shown in **Exhibit 4-3** and **Exhibit 4-4** to demonstrate their relationship to each other when constructed.

4.7.1 Snow Removal Equipment (SRE) Facility

The SRE building is undersized to serve the number and type of existing vehicles. The existing conditions of the SRE facility and a list of housed equipment are found in Chapter 1 of this document. SRE vehicles are becoming increasingly larger resulting in the inability of the existing SRE to meet future demands. This section below identifies two SRE alternatives developed to sufficiently store equipment and provide areas for maintenance needed in the short-term (5-10 years). Long-term, a new SRE facility consisting of 28,000 SF of building space and 80,000 SF of supporting pavement is recommended to meet the future needs throughout the 20-year planning period. SRE Alternatives 1 and 2, described below, reflect two options designed to meet short-term facility needs; however, both alternatives also include a long-term option capable of meeting future demand through year 2035.

SRE Alternative 1: South Expansion

SRE Alternative 1 expands the SRE building and apron to the south, as shown in **Exhibit 4-5**. This alternative maintains the existing width of the SRE building while extending its length further south along its current axis. Currently, SRE vehicles must back directly into the facility while avoiding equipment located on each side of the pull in bay. SRE Alternative 1 provides an additional 9,000 SF of vehicle storage space and includes an additional 10,700 SF of pavement to support SRE activities in front of the building. SRE Alternative 1 meets the near-term goal of increasing storage space but does not address the long-term equipment circulation issues anticipated during the last ten years of the

planning period (2025-2035). Long-term needs would be met by construction of a new SRE facility to the northeast.

SRE Alternative 2: West Expansion

As shown in **Exhibit 4-6**, SRE Alternative 2 extends the overall width of the existing SRE facility by adding an additional 12,000 SF of building space to the west and extending the accompanying apron by an additional 64,000 SF further south and west. By reconstructing and extending the west side of the building this would allow a sufficient width to construct pull through bays for vehicles with supporting apron on either side. This would not only increase the storage capacity of the building but improve vehicle circulation. SRE Alternative 2 is the recommend option for meeting the near-term SRE needs because it enables vehicles to pull through both sides of the building and creates additional storage space for equipment. Long-term, a new SRE facility consisting of 28,000 SF of building space and 80,000 SF of supporting pavement will best meet future needs throughout the 20-year planning period. SRE Alternative 2 will be carried forward in the development of the preferred alternative included in the airport layout plan.

4.7.2 Aircraft Rescue and Firefighting (ARFF) Facility

Although many of the ARFF facilities are meeting current demand, such as personnel and storage spaces, the equipment used in ARFF is becoming larger. Lower centers of gravity and wider wheelbases resist vehicle roll-over while cornering and carrying a full load of water and chemical. One of the current ARFF response vehicles is slated to be replaced around the year 2020 and an ARFF facility expansion is recommended to accommodate the current ARFF vehicles and future larger vehicles.

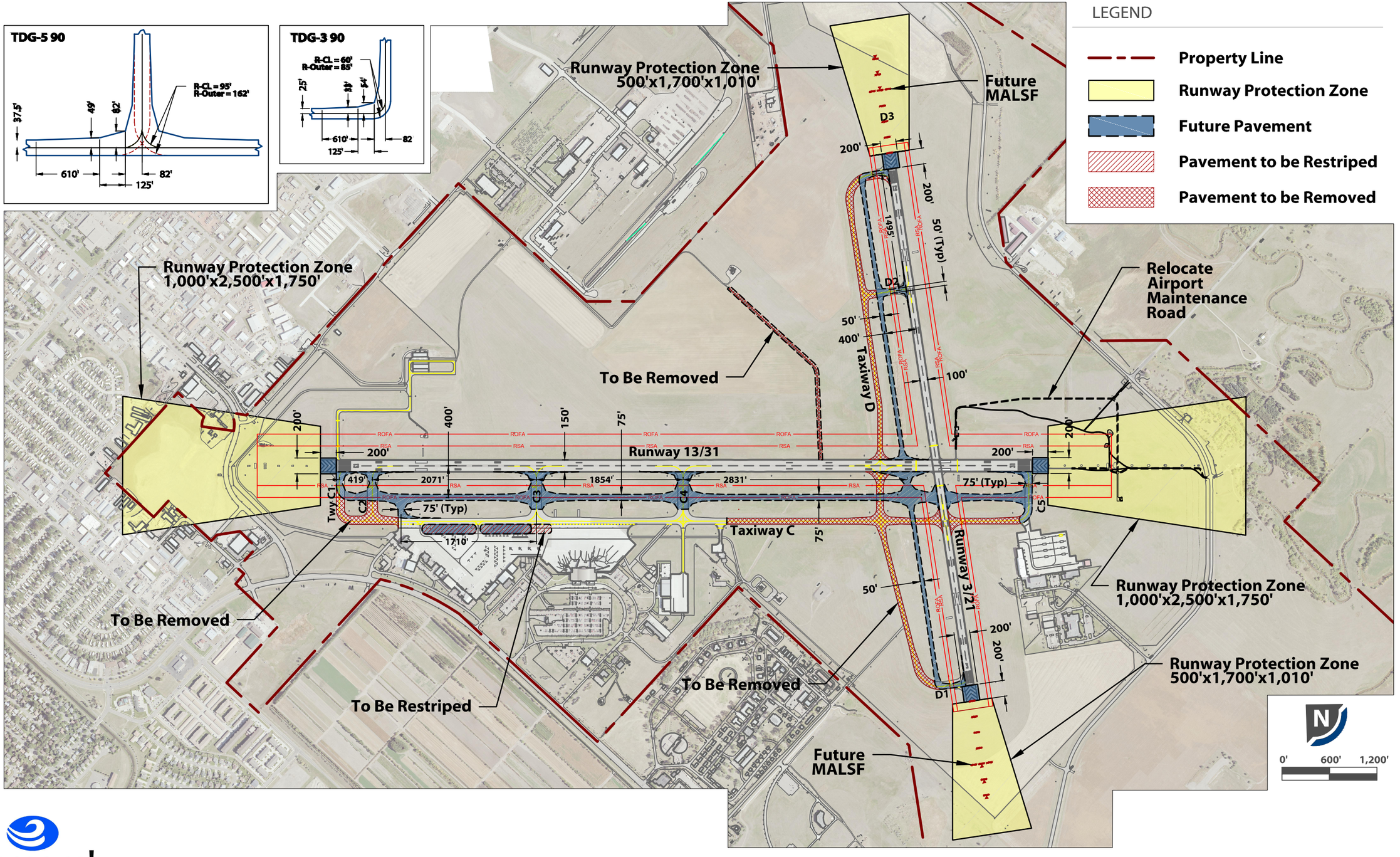

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Exhibit 4-3 **Airside Alternatives Summary 1**

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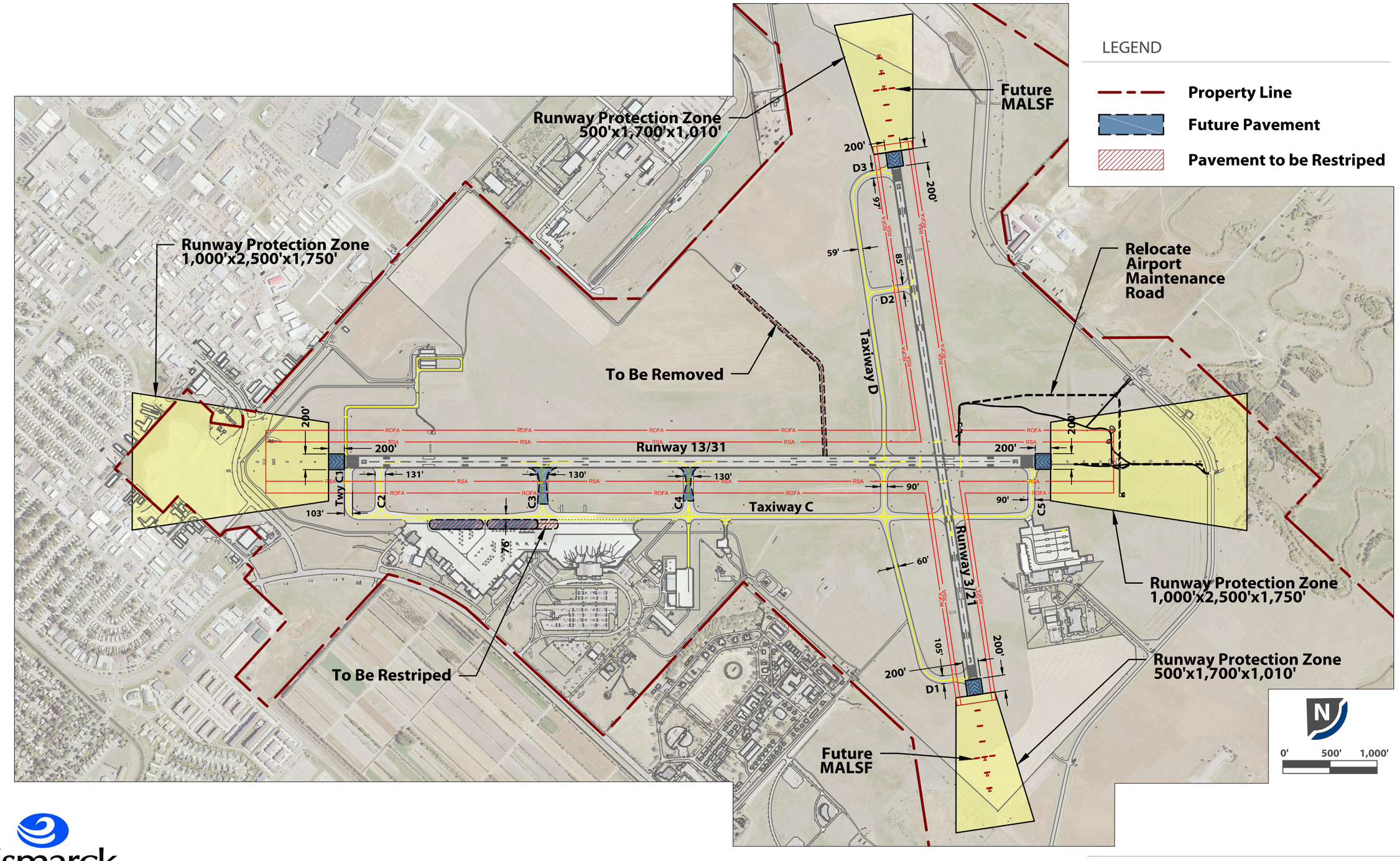

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Exhibit 4-4 **Airside Alternatives Summary 2**

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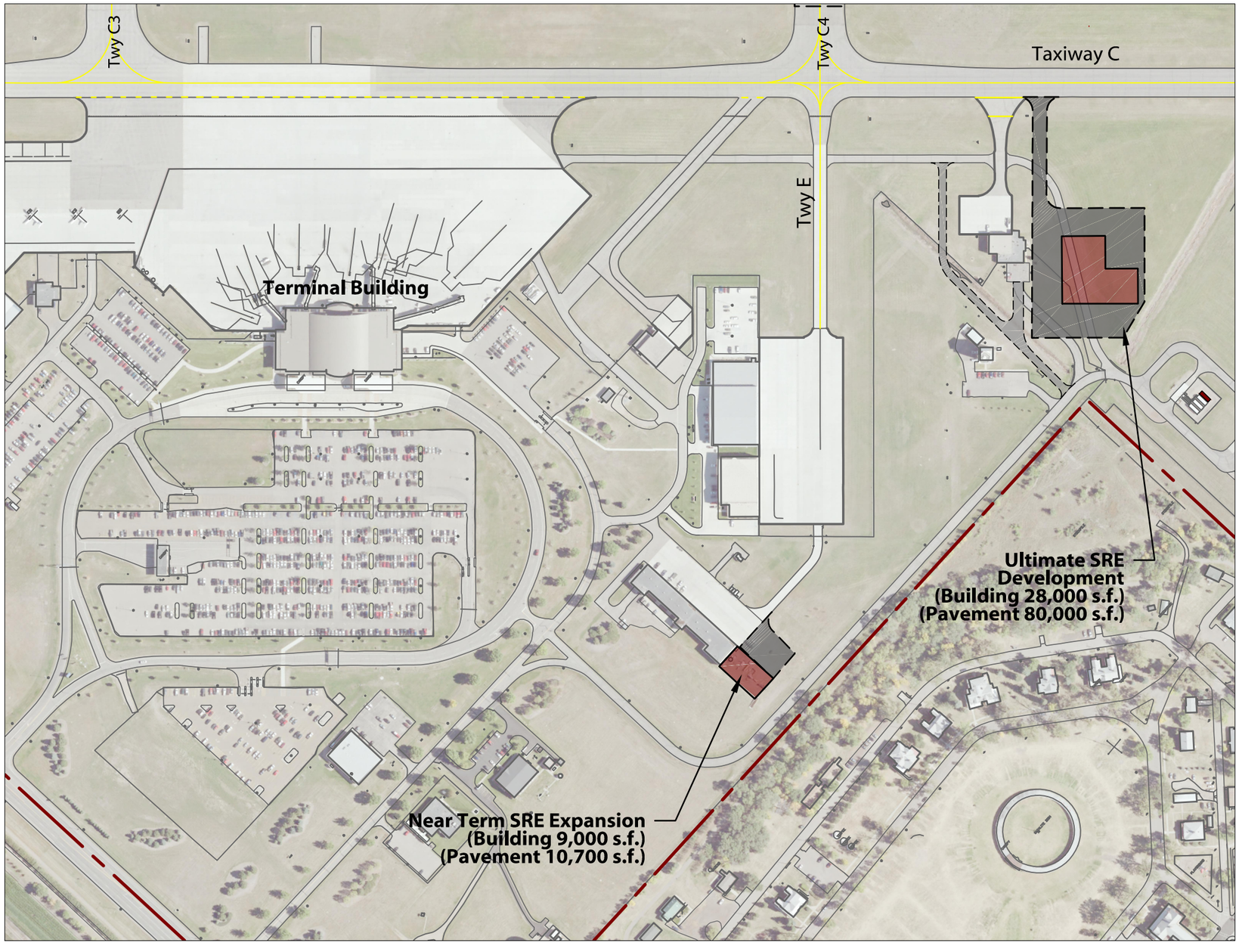

LEGEND

- Property Line
- Future Building
- Future Pavement
- Future Roadway

N

0' 150' 300'

Exhibit 4-5 **SRE Alternative 1: South Expansion**

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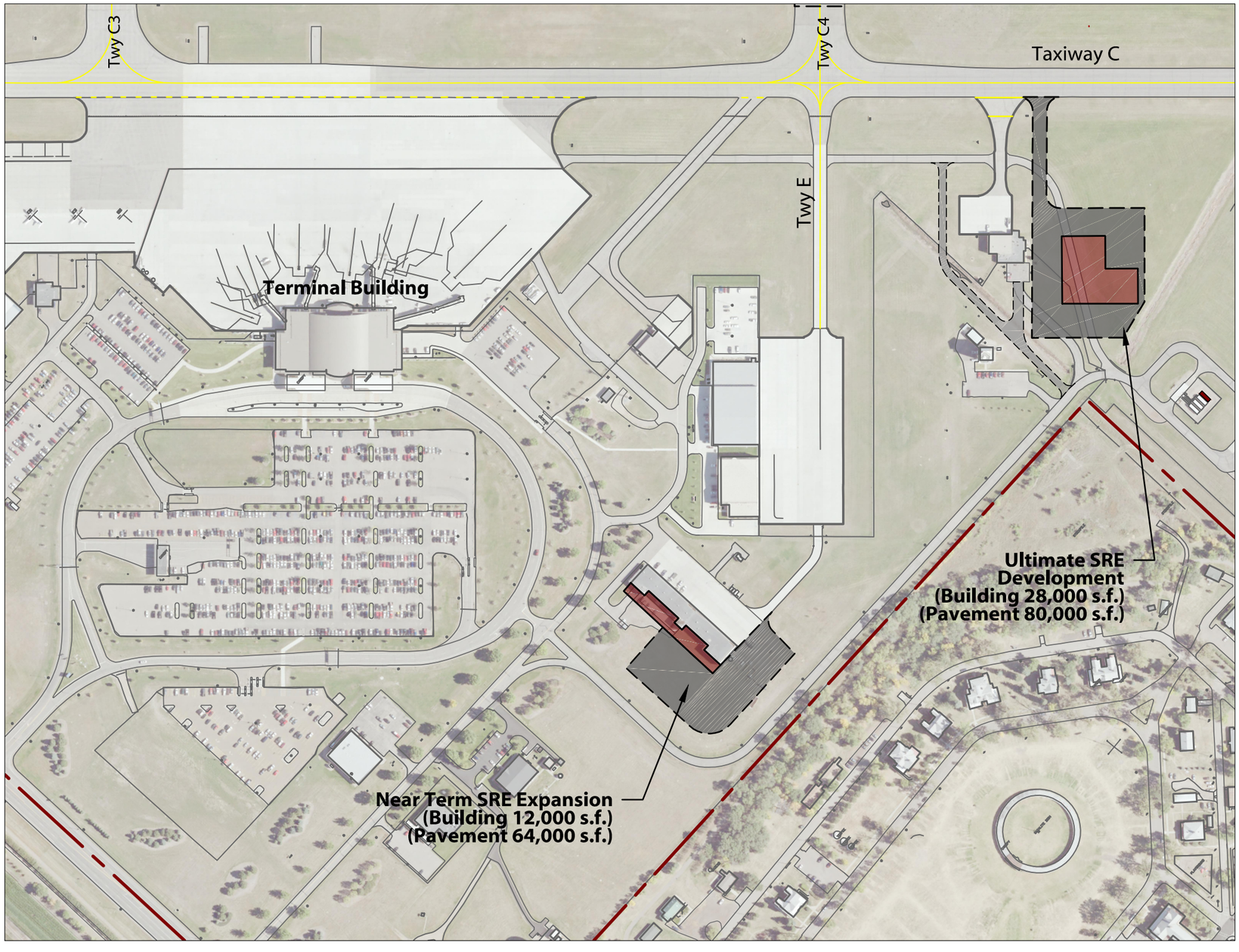

LEGEND

- Property Line
- Future Building
- Future Pavement
- Future Roadway

N

0' 150' 300'

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Exhibit 4-6 **SRE Alternative 2: West Expansion**

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4.7.3 General Aviation Development Areas

General Aviation development at BIS is divided into several sections. This is beneficial as safety and efficiency are often improved by separating operations by aircraft type and providing a safety buffer for turbine and piston aircraft. Each area will be addressed in the following sections to determine local hangar, apron and other supporting facility needs.

Hangars provide a place for aircraft to be sheltered from the elements, such as the harsh North Dakota winters, and allow pilots to perform limited maintenance. Although small aircraft will sometimes utilize tie downs, most pilots prefer hangars. Hangars are necessary for most corporate turbine aircraft based at BIS. Therefore, it is important to have available hangar space for potential tenants. Chapter Three determined that 109,300 square feet of box hangars and 63,000 square feet of T-hangar units will be required by the end of the 20-year planning period. This demand will be satisfied over a series of alternatives for each development area in the following sections. As piston and turbine aircraft are often separated for safety, T-hangars are usually constructed away from corporate areas. Box hangars could be constructed in existing corporate areas and separate areas will be developed for smaller GA aircraft, such as recreational or private pilots. Finally, Chapter Three determined that the Airport has enough apron for the overall needs of the Airport. Therefore, this section will consider apron expansions intended to serve specific functions on the Airport and compliment suggested expansion of hangars and other facilities.

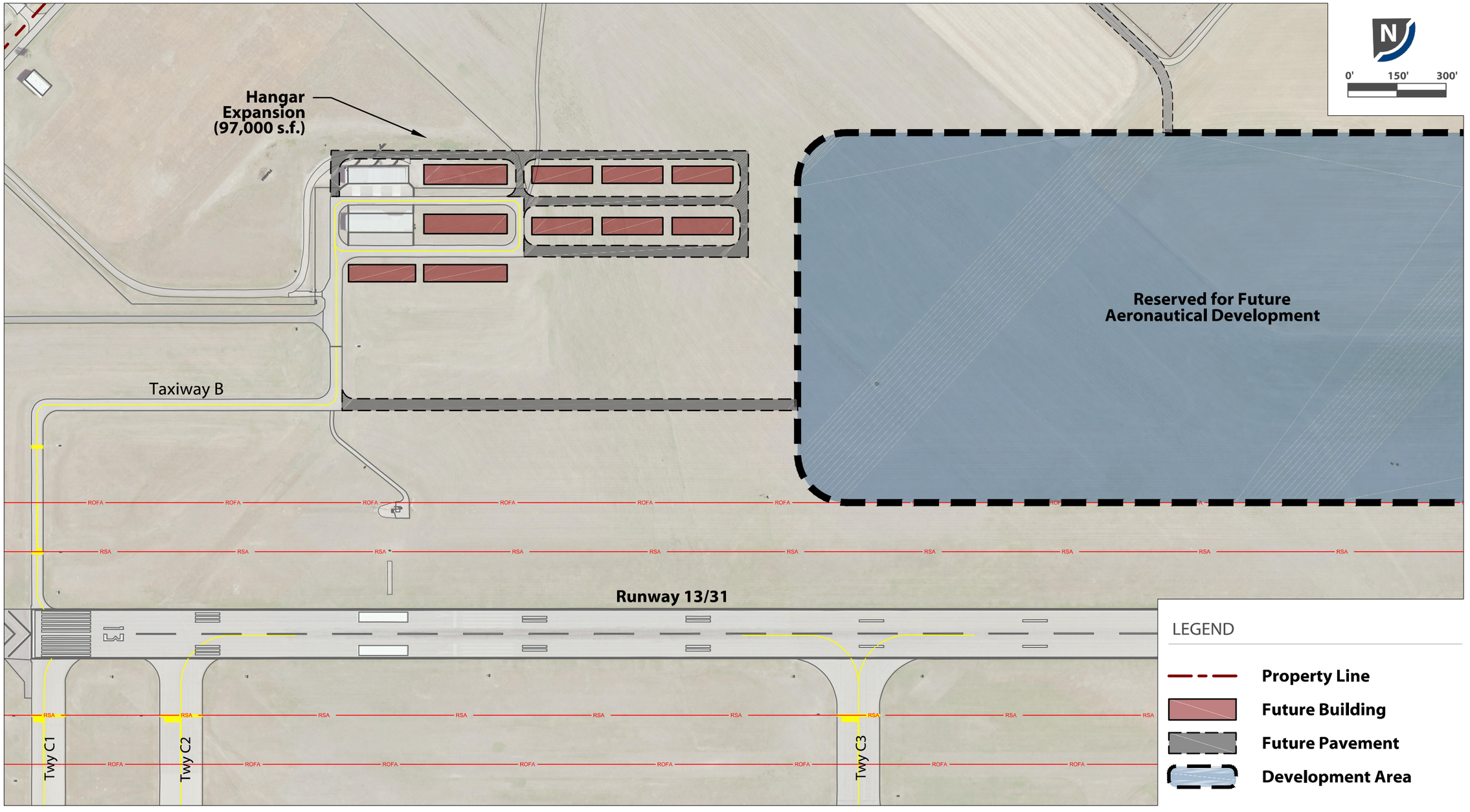
GA Hangar Area

Much of the Airport's piston GA activity is located near Taxiway B. This area is not yet fully developed; therefore, there is potential to construct additional hangars, either T-hangars or joined box hangars, to provide spatially efficient and more economically feasible options for recreational pilots. A proposed buildout of the existing configuration can be seen in **Exhibit 4-7**, with 97,000 square feet of new hangar development. The

large area to the southeast is reserved for future aeronautical development and is anticipated to accommodate increases in demand beyond the 20-year planning period. This area can provide connections to the airfield and nearby roadways. As it is unknown as what specific type of buildings and tenants will eventually be constructed here, it is considered prudent to not plan specific development at this point. As the region grows, additional taxiway connections should be considered based on the type of activity occurring within this area. Currently, Taxiway B provides a single access point to Runway 13/31 and could lead to congestion in this area as traffic increases over time.

North General Aviation Development Area

The GA apron is located to the northwest of the air carrier apron and is constrained due to the number of users concentrated in this area. Although there is a large amount of apron at BIS, reconfiguration or expansion in this area is needed to improve circulation. As mentioned in the previous chapter, there are existing plans to expand the apron 650 feet to the northwest parallel to the primary runway. Hangar 5 is currently located along the GA apron but will be removed to allow for additional expansion of GA ramp. This location would provide convenient access to the Runway 13 threshold for corporate and other aircraft that would utilize the FBO or other GA hangars. This expansion would aid in promoting better circulation and allow additional hangars to be constructed, as seen in **Exhibit 4-8**. Hangars constructed along the GA apron expansion could provide approximately 67,000 square feet of box hangars.


Hangar
Expansion
(97,000 s.f.)
Taxiway B
Reserved for Future
Aeronautical Development
Runway 13/31
Twy C1
Twy C2
Twy C3
ROFA
RSA
N
0'
150'
300'
LEGEND
Property Line
Future Building
Future Pavement
Development Area

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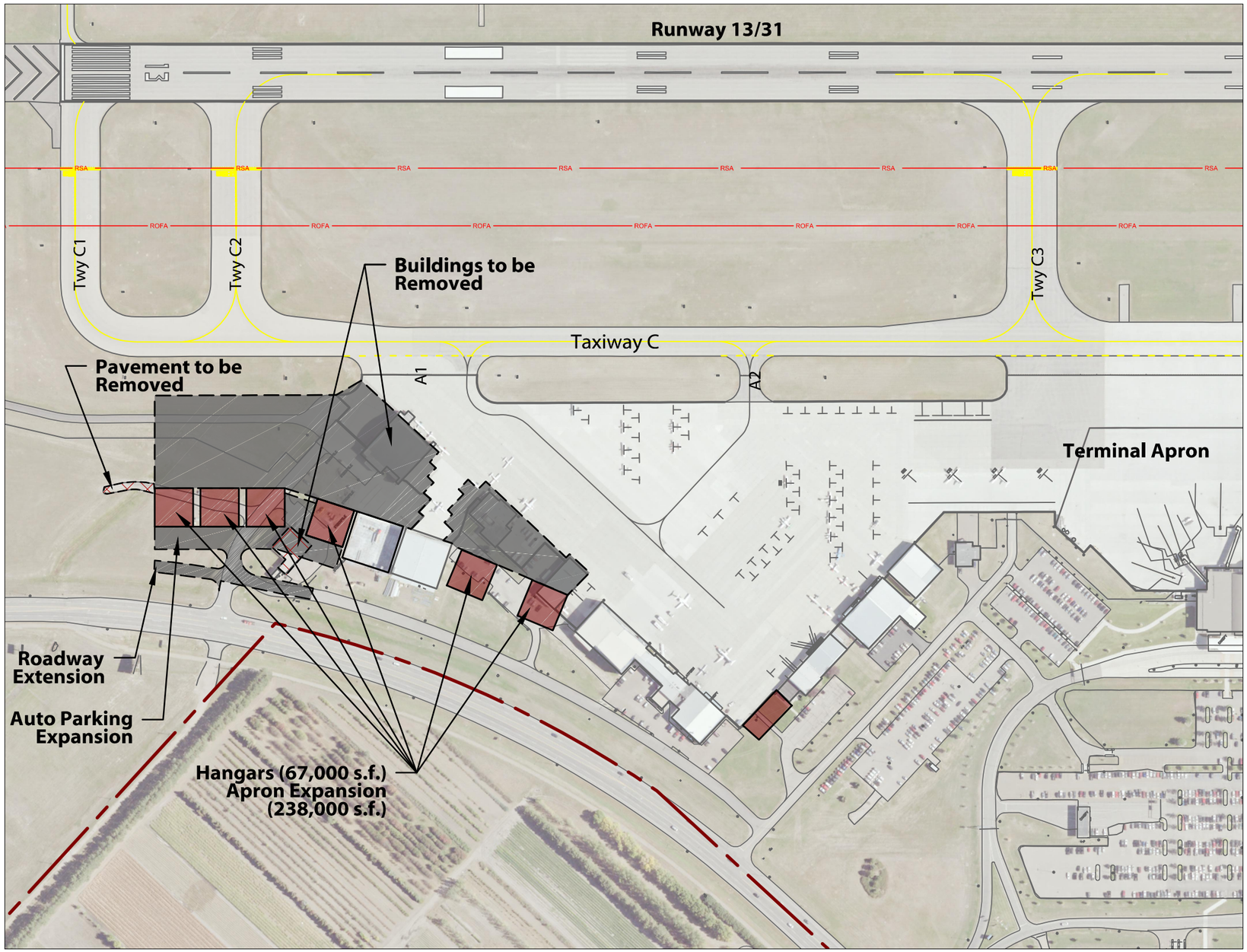

LEGEND

- Property Line
- Future Building
- Future Pavement
- Pavement to be Removed

N

0' 150' 300'

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Exhibit 4-8 **North General Aviation Development**

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South Corporate Development Area

The corporate hangar area located south of the terminal building near the ATCT consists of two hangars with a supporting apron. To meet future corporate aircraft demand, an additional 86,000 SF of box hangars with attached office space and 94,000 SF of new apron are proposed. As shown in **Exhibit 4-9**, the corporate hangar area provides convenient access to the airfield and can accommodate a designated vehicle entrance separate from Terminal Boulevard. The expansion of the corporate hangar area is compatible with existing airport land uses and does not impact nearby facilities.

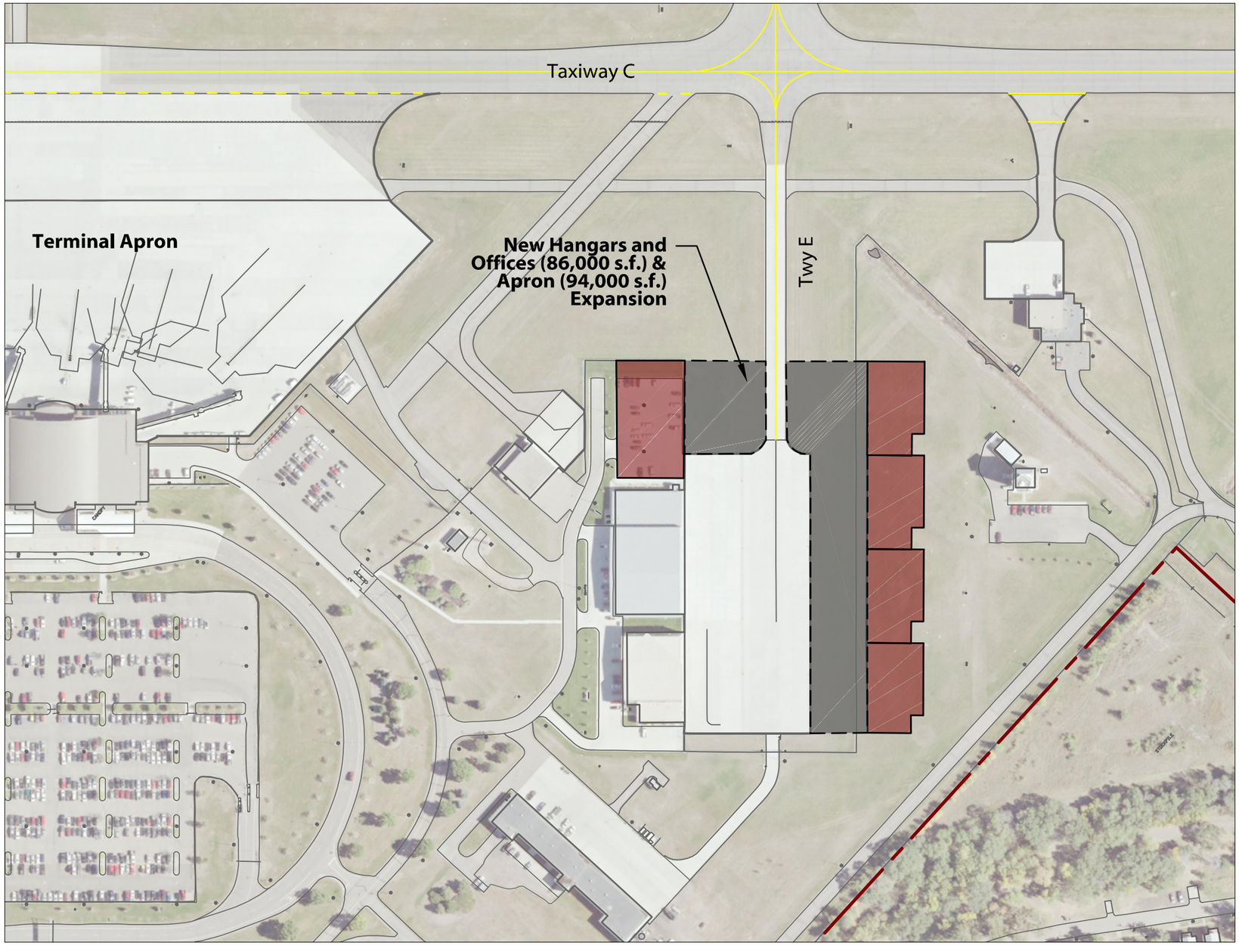
4.7.4 Development Areas Summary

Collectively, these development areas show approximately 97,000 square feet of new T-hangar development and approximately 153,000 square feet of additional box hangar space. While the proposed development areas exceed the 20-year facility requirements identified in Chapter Three, each of these areas are scalable and can be developed as needed. The purpose of these alternatives is to establish a long-term build out plan for those facilities that support aircraft activities while promoting improved circulation and efficiency.

4.8 FUEL FARM AREA

There are two private fuel farms located south of the ATCT. The existing fuel storage capacity at BIS currently meets fuel demand with approximately a seven-day supply of Jet A fuel and an 88-day supply of 100LL fuel. As aircraft activity increases and additional corporate aircraft are based at the Airport the demand for additional fuel storage capacity will increase as well. To meet the anticipated need for additional fuel storage capacity over the 20-year planning period, two additional fuel tanks are recommended. There is adequate space for an additional fuel tank in each fuel farm location. **Exhibit 4-16** depicts the future location for two additional fuel tanks. It should be noted that adequate space

also exists for a third private fuel farm located between the existing two fuel farms or in the area located immediately south.



LEGEND

- Property Line
- Future Building
- Future Pavement

N

0' 100' 200'

Exhibit 4-9 **South Corporate Development**

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4.9 TERMINAL AREA

The present day 78,000 SF terminal at BIS was constructed in 2005 as an entirely new facility. The terminal building has facilitated the Airport's steady growth throughout the last decade. Transitions to larger aircraft, along with added low-cost carriers, have increased enplanements during the same period. As a result, several areas within the terminal are undersized and are resulting in passenger inconveniences. These areas include the TSA Security Check Point, passenger hold rooms, concessions, and restrooms. The Airport has taken steps to increase the size and processing capacity of the TSA Security Check Point; however, the projections of future passenger enplanements necessitate the need for expanding the overall footprint of the terminal building to accommodate demand over the 20-year planning period. As a result, two terminal development alternatives were developed to reflect the additional terminal and concourse space needed. Both terminal alternatives are described below.

4.9.1 Terminal Building Expansion

Terminal Building Expansion Alternative 1: Pier Expansion

As shown in **Exhibit 4-10**, Terminal Expansion Alternative 1 proposes to expand the current terminal building by an additional 10,000 SF to the north and develop a new 50,000 SF pier concourse at the midpoint of the terminal building towards the northeast. Based on the recommend aircraft gate requirements identified in Chapter Three, this alternative increases the number of gates; from the existing four gates to a total of eight gates by 2036. Along with the addition of new gates, retail, security, and hold room areas can also expand to meet future demand and provide improved passenger conveniences.

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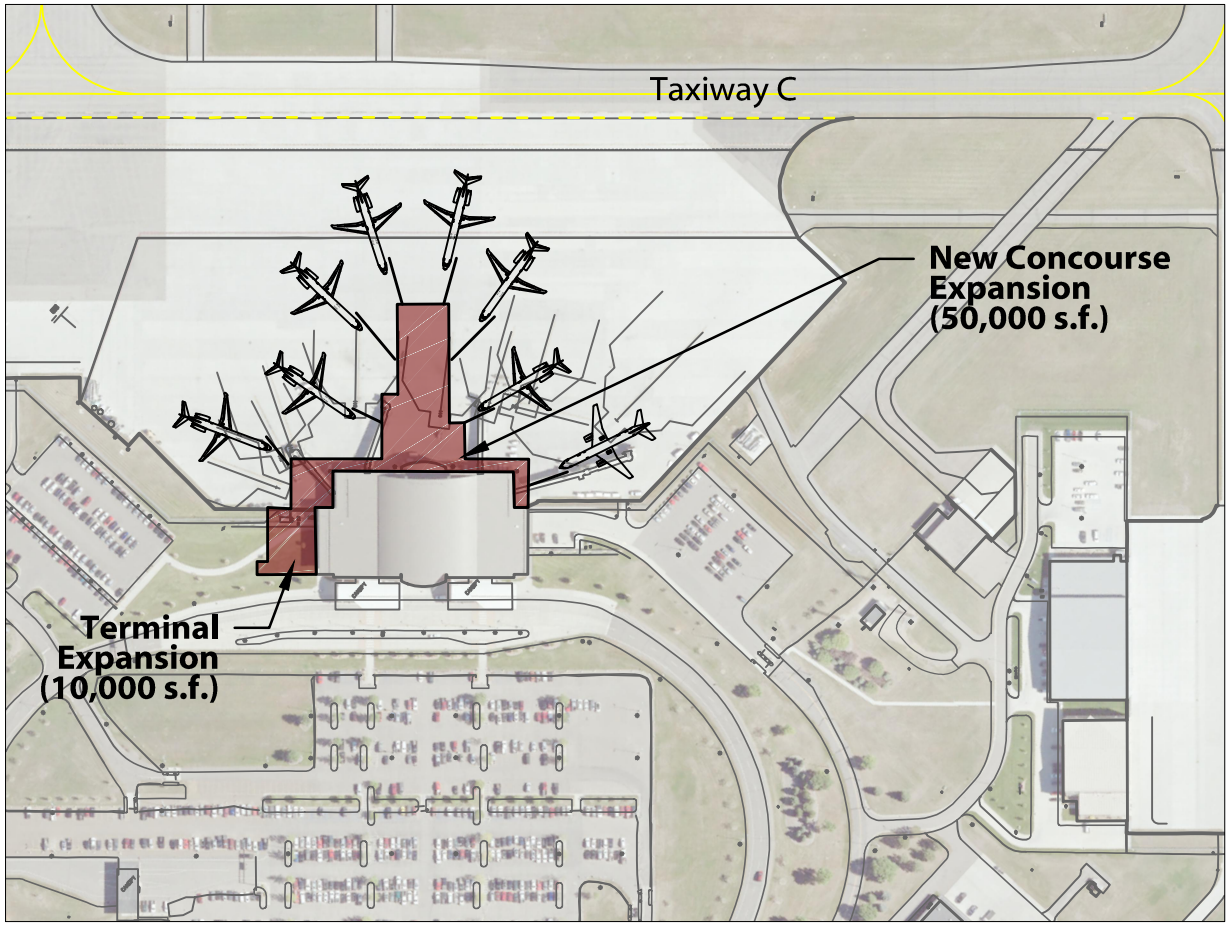

LEGEND

- Property Line
- Future Building
- Future Pavement

0' 150' 300'

N

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Exhibit 4-10 **Airport Terminal Building - Exterior Alternative 1**

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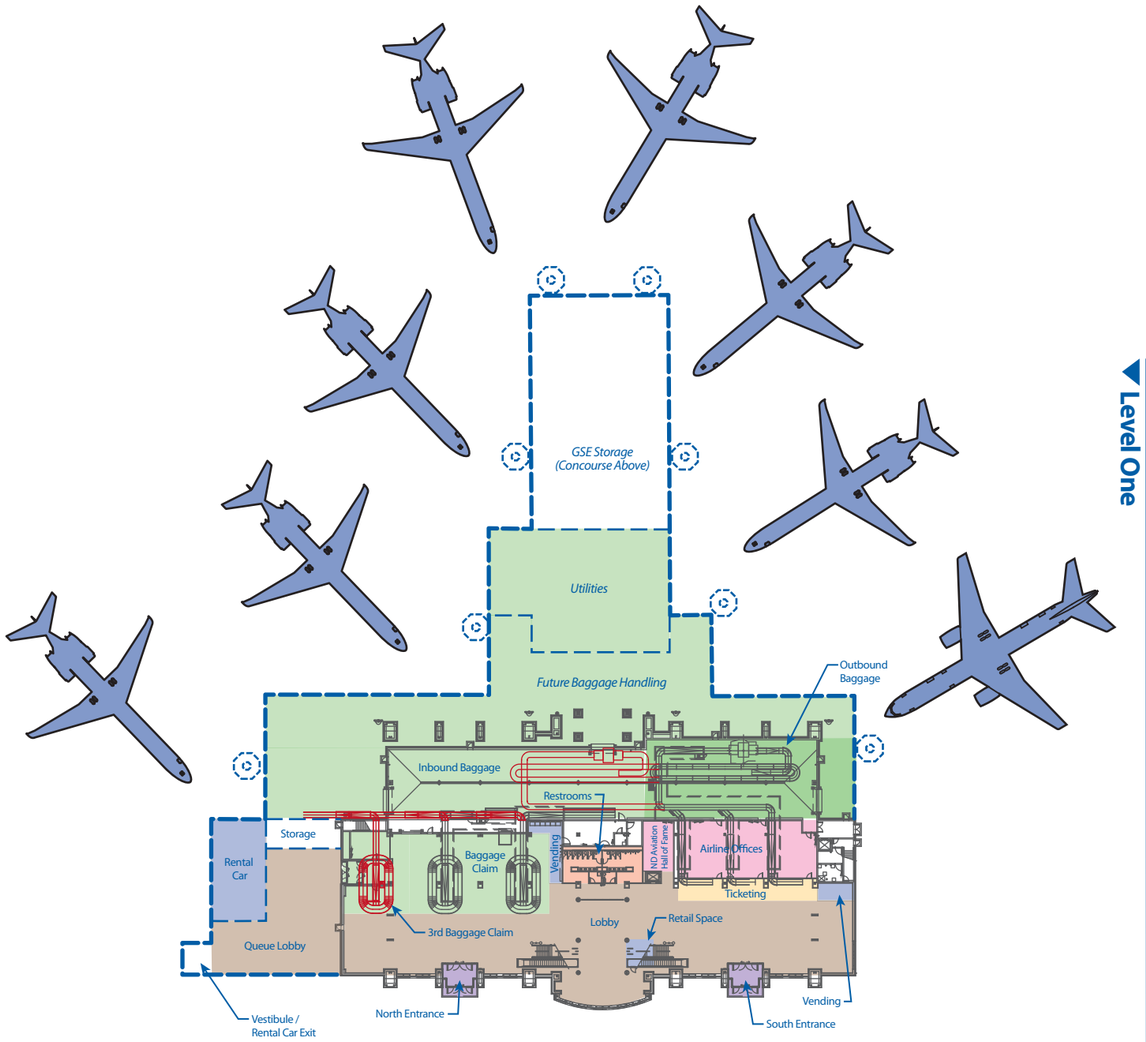
The pier concourse configuration offers the Airport a distinct advantage. As shown in **Exhibit 4-10**, Terminal Alternative 1 a concourse located at the midpoint of the terminal building does not require additional apron area (pavement) to a support future concourse expansion. A mid-pier concourse extension concentrates commercial activity in the same location as present-day operations occur allowing the overall footprint of the terminal area to remain unchanged. In addition, a mid-pier concourse extension can support both large and small air carrier aircraft throughout the 20-year planning period; however, some limitations exist. First, the northward extension of a new concourse would locate aircraft within proximity of the Taxiway Object Free Area (TOFA) located immediately south of Taxiway C. As a result, aircraft located at the end gates would have to contact ATC before taxiing or being moved by a tug into the TOFA, a controlled movement area. For example, aircraft trying to reposition from one side of the terminal to the other would have to first receive clearance from ATC before encroaching into the TOFA. This condition may result in congestion at the end of the concourse during peak activity periods if aircraft need to be repositioned. Second, the development of new pier concourse also creates a significant challenge for snow removal. Much like aircraft having to gain clearance to taxi into the TOFA, snow removal vehicles would also have to get ATC clearance as well. In addition, the development of a pier concourse would alter the way snow is removed from the terminal apron area which could create significant congestion at the end of the concourse during inclement weather. A summary of the advantages and disadvantages for Terminal Alternative 1 are presented in **Table 4-2**.

The pier concourse configuration also provides the opportunity to increase the size of the interior functions within the terminal building and concourse. To meet the anticipated increase in passengers over the 20-year planning period, the size of interior terminal areas including the TSA Security Check Point, hold rooms, concessions, baggage make up and claim, and restrooms must be increased. As shown in **Exhibit 4-11**, Level One and Two within the terminal building include additional space for each of these interior

functions. Level One consists of a third baggage carousel as well as an expanded inbound and outbound baggage make up belt system equipped with an additional TSA baggage screening device needed to meet future demand. The implementation of this additional equipment will help relieve congestion in the queue area and allow bags to be processed more quickly and provide redundancy should one of these systems become inoperable. Level Two of the pier concourse configuration includes new area for a centralized retail space, hold rooms, restrooms, and an enlarged composure area immediately past the TSA Security Check Point. The large expanse of the central portion of the terminal allows for a centralized retail space. This space provides a common area for waiting, eating, and shopping while not interfering with enlarged security checkpoint and composure areas. Airline office and ticketing counter space was not increased due to trends toward self and online check-in and a decrease in checked baggage. A summary of this alternative is provided in **Table 4-2** below.

Table 4-2: Summary of Considerations – Alternative 1

Advantages	Disadvantages
▪ Minimizes passenger walking distances ▪ Improves passenger flow and wayfinding ▪ Consolidated retail and restroom facilities ▪ Enlarged security checkpoint and composure area	▪ Moderate to significant level of impact to existing operations during construction ▪ Majority of expansion needs to be built within 5-year planning period to regain lost gates ▪ Impacts snow removal operations ▪ Proximity of aircraft to TOFA on northeast end of terminal ▪ Pier concourse limited to 8 gates



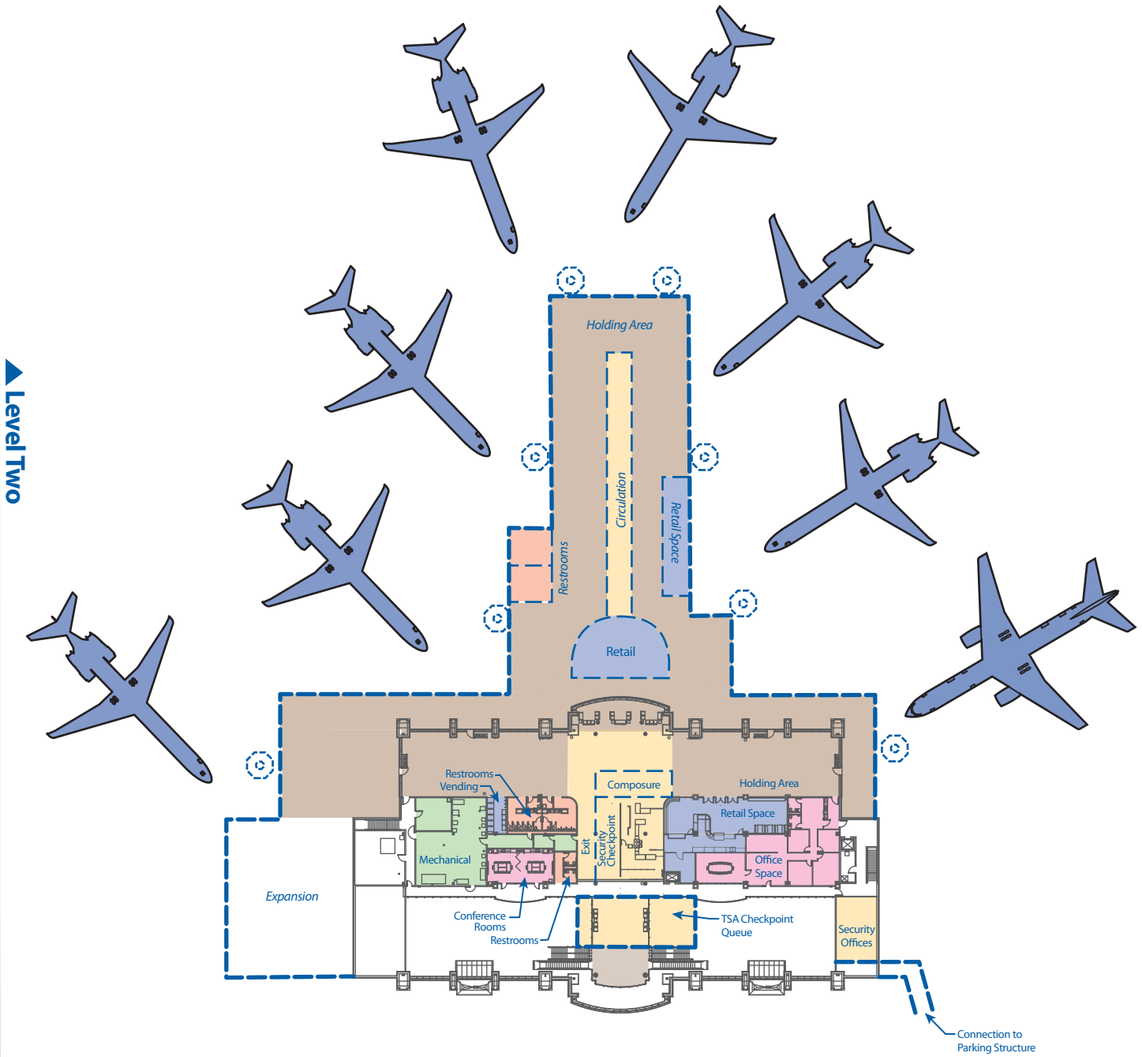


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Exhibit 4-11 **Airport Terminal Building - Interior Alternative 1**

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Terminal Building Expansion Alternative 2: Wing Expansion

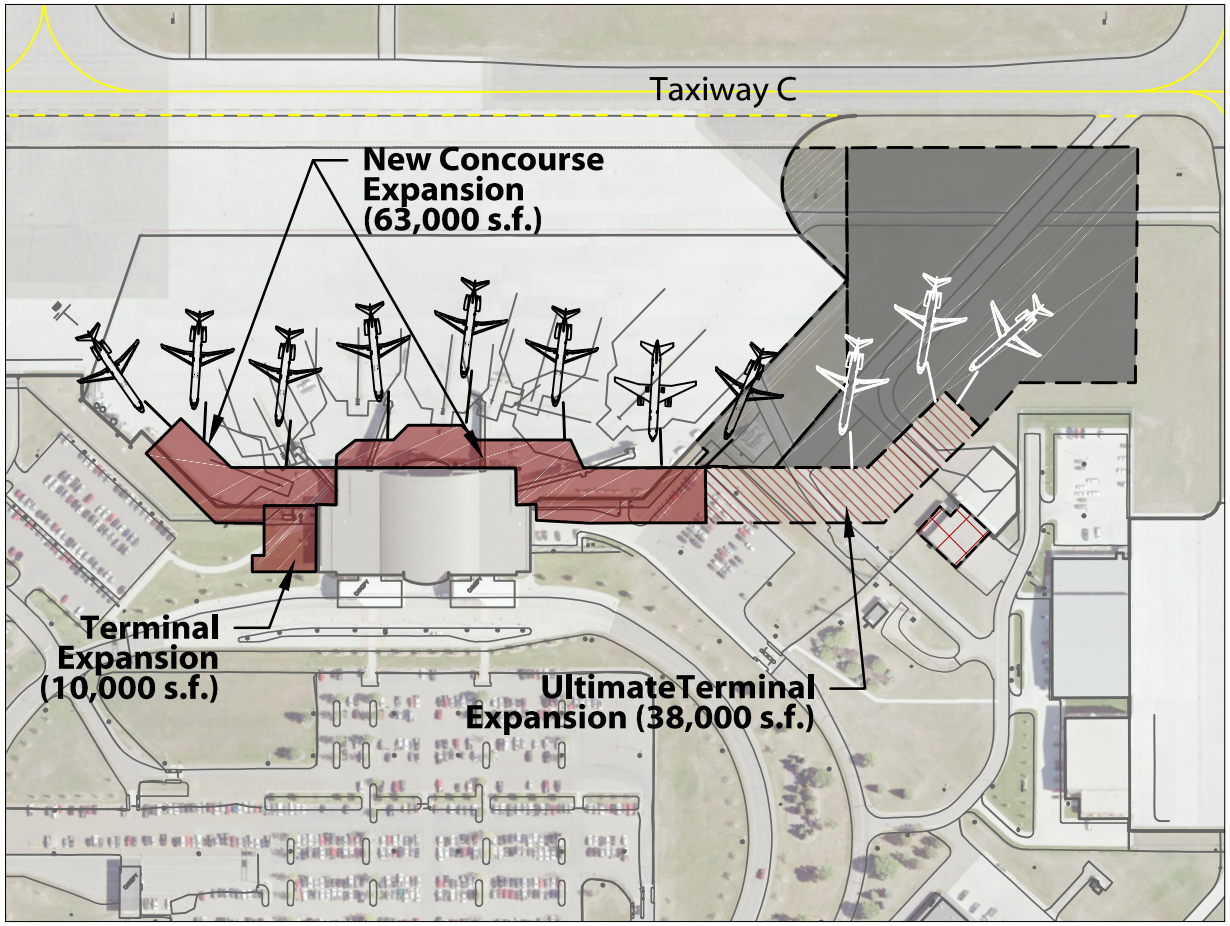
Terminal Expansion Alternative 2 proposes to add an additional 10,000 SF on the northwest side of the existing terminal building and develop a new linear concourse consisting of 63,000 SF oriented in a northwest to southeast configuration. As shown in **Exhibit 4-12**, a linear concourse configuration allows for up to eight gates by 2036. Terminal Expansion Alternative 2 utilizes all the existing terminal apron; however, additional apron is required to provide adequate aircraft parking and circulation at the gate located furthest south. Beyond 2036, the concourse could further be expanded by an additional 38,000 SF to gain three more gates. This would require additional terminal apron immediately south of the existing apron to support these three gates. The primary advantage of Terminal Expansion Alternative 2 is the ability to add additional aircraft gates within and beyond the 20-year planning period without impacting snow removal or creating congestion in an ATC controlled movement area.

The linear concourse configuration also increases the size of the interior functions within the terminal building and concourse. The size of interior terminal areas including the TSA Security Check Point, hold rooms, concessions, baggage make up and claim, and restrooms must be increased to meet future passenger demand. As shown in **Exhibit 4-13**, Level One and Two of the linear configuration include additional space for each of these interior spaces. Level One consists of a third baggage carousel as well as an expanded inbound and outbound baggage make up belt system equipped with an additional TSA baggage screening device. The implementation of this additional equipment will help relieve congestion and allow bags to be processed more quickly and provide redundancy should one of these systems become inoperable. Level Two of the linear concourse configuration includes additional space for a centralized retail, expands the size of hold rooms, new restrooms, and an enlarged composure area immediately past the TSA Security Check Point. The large expanse of the central portion of the terminal allows for a centralized retail space for waiting, eating, and shopping while not

interfering with enlarged security checkpoint and composure areas. Airline office and ticketing counter space was not increased due to trends toward self and online check-in and a decrease in checked baggage. A summary of this alternative is provided in **Table 4-3** below.

Table 4-3: Summary of Considerations – Terminal Expansion Alternative 2

Advantages	Disadvantages
▪ Short aircraft pushbacks ▪ Scalable to meet future demand ▪ Compatible with snow removal process ▪ No impacts to airport geometry ▪ Increases passenger amenities and revenue generating opportunities	▪ Increases passenger walking distance ▪ Increased maintenance and utility costs ▪ Additional pavement (apron) required to support linear configuration



LEGEND

- Property Line
- Future Building
- Ultimate Terminal Expansion (Beyond 20-Year Planning Period)
- Future Pavement
- Building to be Removed

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Exhibit 4-12 **Airport Terminal Building - Exterior Alternative 2**

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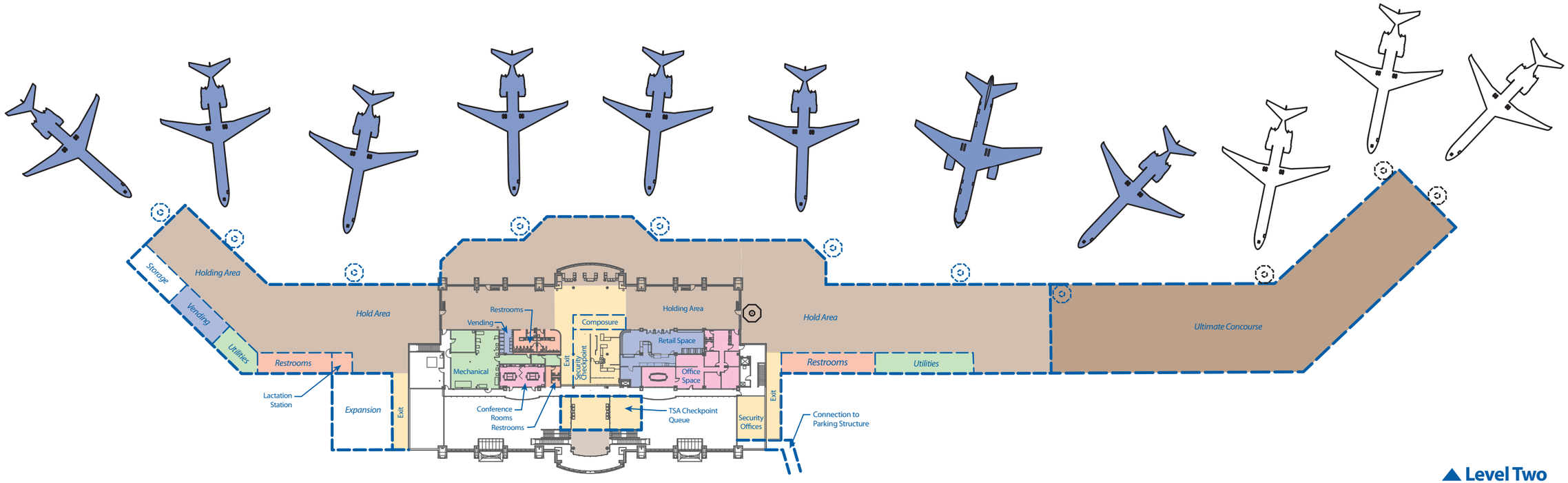

Exhibit 4-13 **Airport Terminal Building - Interior Alternative 2**

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4.10 AIR CARRIER APRON

The air carrier apron supports several functions, such as allowing aircraft and ground support equipment to move to and from the terminal and provides space for aircraft to park overnight. Based on the gate demand conducted in Chapter Three, space for nine aircraft to park and remain overnight will be required by the end of the planning period. The area to the south of the current air carrier apron is largely unoccupied. Expansion in this area would provide additional room for aircraft to park and maneuver as well as support terminal expansion in this direction. The apron would be able to be constructed in phases to grow with Airport needs. The initial phase would provide 46,500 square feet and the second phase would expand the apron to the south towards the existing corporate apron and hangars by an additional 191,000 square feet.

4.11 AIR TRAFFIC CONTROL TOWER/RADAR FACILITY

The ATCT facility is located to the approximately a quarter mile to the southeast of the passenger terminal. This location is free from interference from surrounding buildings or other obstructions. The current location is meeting Airport needs although as expansions occur at the Airport, specifically the passenger terminal building, consideration to ATCT visibility of the Runway 13 threshold will need to be considered during terminal design. The Master Plan recommends continuing to protect the critical design surfaces of the radar facility.

4.12 VEHICLE PARKING

Based on the anticipated passenger and activity growth over the 20-year planning period, 1,085 parking spaces will be needed by the end of the planning period. The expansion of parking areas should be considered so that uses will be complementary with surrounding facilities and provide adequate traffic circulation. Alternatives for increasing Airport parking are discussed below.

4.12.1 Vehicle Parking Alternative 1: Expansion of Existing Parking

This alternative utilizes the green space surrounding the existing parking lots and increases capacity by expanding parking in these areas. The circulation road would be reconfigured to join Jetway Avenue to the south to reduce repetitive roadways and provide additional room for parking in the main lot, as shown in **Exhibit 4-14**. Aside from the roadway reconfiguration the existing layout would remain. This alternative would provide approximately 320 public parking spaces within the bounds of Terminal Boulevard and 625 spaces outside. Rental car storage would be expanded near the wash facility and employee parking would be expanded in its existing location. This alternative can provide more parking spaces than required to meet the 20-year planning period although construction could be staged so that parking spaces are provided as needed.

4.12.2 Vehicle Parking Alternative 2: Parking Garage

This alternative would expand some of the parking spaces in undeveloped areas in addition to constructing a parking garage in the southeast section of the main parking lot, as shown in **Exhibit 4-15**. Terminal Boulevard would be expanded slightly to allow for the garage but would remain independent of Jetway Avenue. The parking garage would provide approximately 450 parking spaces and would be constructed so that it would not obstruct the view of the terminal for people entering from University Drive. In addition to preserving the view of the terminal, this would aid in wayfinding for those unfamiliar with the Airport. Like Alternative 1, this alternative would provide more spaces than needed to fulfill the 20-year parking demand, but the parking lot expansion near University Avenue could be constructed in stages to meet demand as it grows. Although a parking garage is spatially efficient and requires a smaller footprint than ground level parking, the cost for space is significantly more expensive. As there is sufficient space to develop additional ground level parking without interfering with surround facilities, this alternative is not considered to be necessary now.

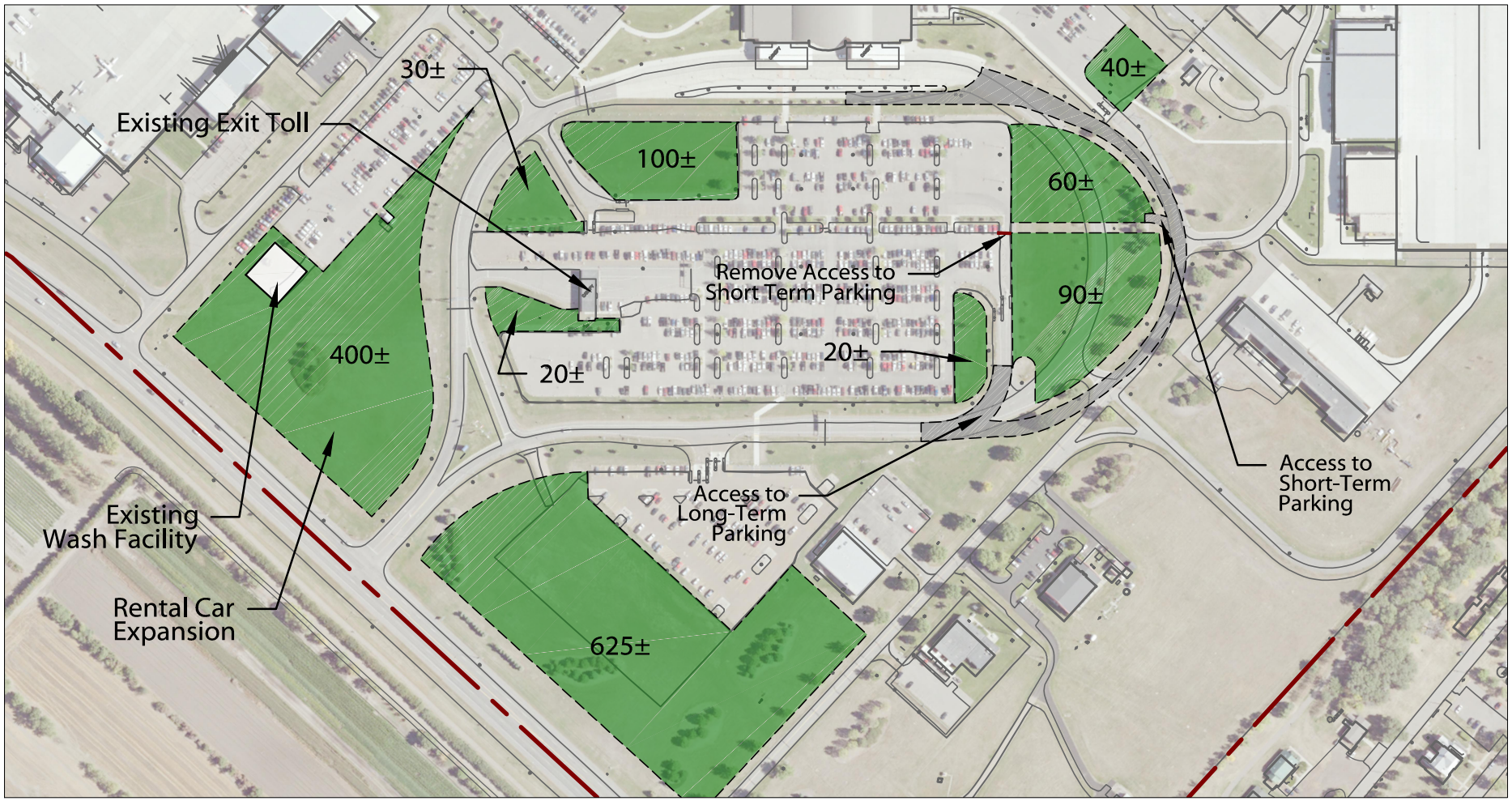

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Exhibit 4-14 **Parking Alternative 1 - Expansion**

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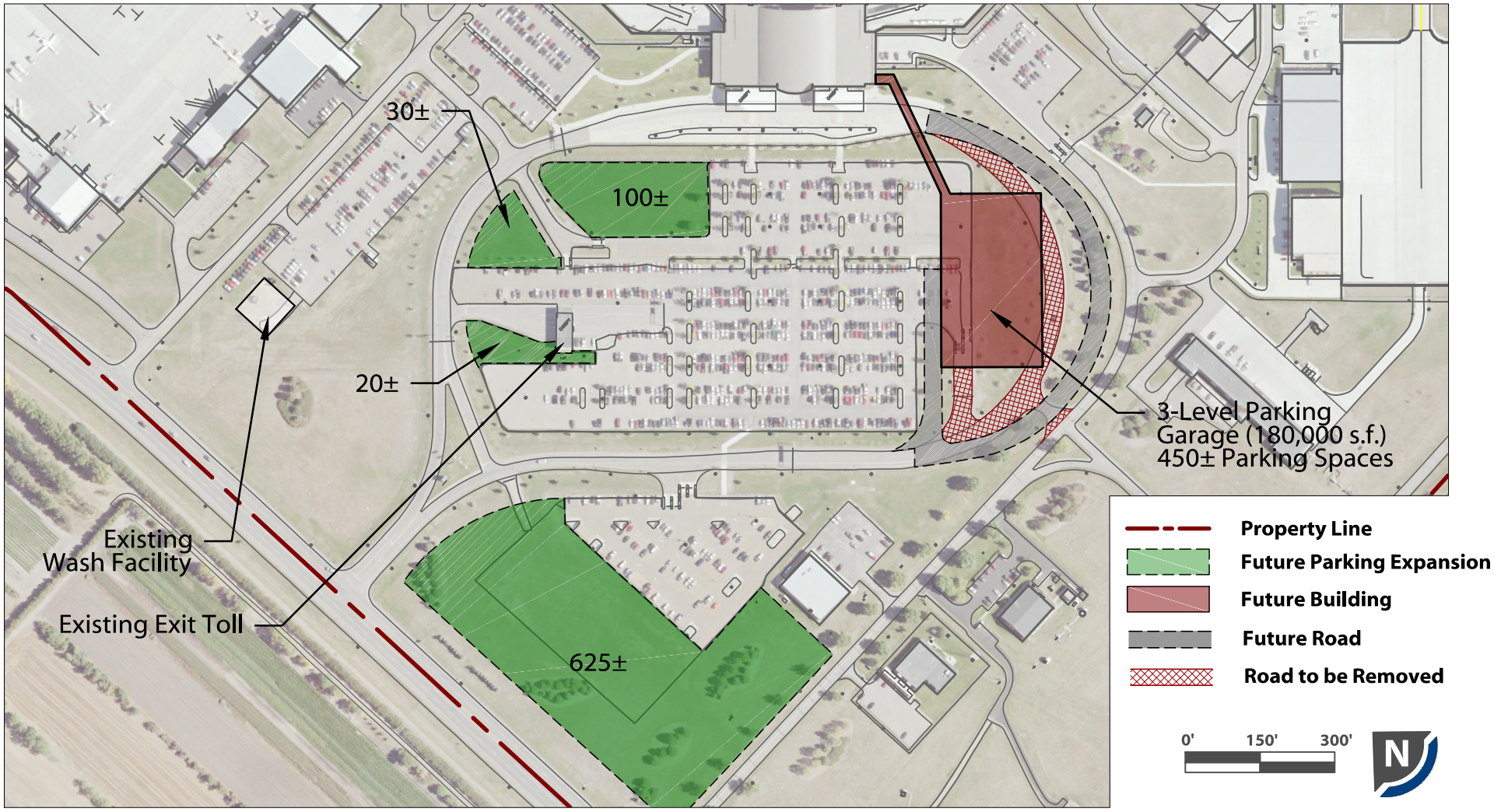

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Exhibit 4-15 **Parking Alternative 2 - Parking Garage**

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4.13 LANDSIDE ALTERNATIVES SUMMARY

Each of the recommended landside alternatives have been incorporated into two alternative concepts shown in **Exhibit 4-16** and **4-17**. The purpose of these landside summary alternatives is to demonstrate the overall build out of the Airport's landside facilities through 2036. The primary difference between these two summary alternatives is the proposed configuration of a new concourse expansion and the layout of a new SRE building with support apron area. Based on the individual landside facility recommendations presented, Landside Alternative Summary 2 has been selected as the preferred landside alternative and will be carried forward in the development of the Airport Layout Plan.

4.14 SUMMARY OF ALTERNATIVES

Overall, the Airport is well positioned to be able to expand and improve its infrastructure so that the demands of its users are met throughout the next 20-years. The following summarizes the recommended alternatives to address these needs. Again, it should be noted that the selection of the recommended alternatives is based on the most logical option to address a facility need, or was the best option in comparison with operational, economic, environmental, sustainable, and implementation factors of other alternatives prepared for a facility need. A graphic summary of the recommended alternatives to address the Airport's facility needs is presented in **Exhibits 4-16** and **4-17**. A narrative description of each facility need is summarized below.

- **Runways** – Few changes required as the width and length for each runway are sufficient for the planning period. Expansion of blast pads to 200 feet wide by 200 feet long for both runways.
- **Taxiways** – As shown previously in **Exhibit 4-2**, only minor taxiway modifications are recommended. These include reducing the width of Taxiways C3 and C4 to meet ADG V and IV design standards, respectively. In addition, the taxiway fillets connecting Runway 13/31 to C3 and C4 will be reduced in width to comply with current design

standards while continuing to serve the forecasted aircraft fleet mix over the next 20-years. Each of these improvements have been approved by FAA under the runway rehabilitation project currently underway at BIS. In addition, it is recommended that paved island near Taxiway C3 be remarked to require pilots to make a turn before accessing the air carrier apron. Remarking this paved area will reduce the potential for aircraft incursions.

- **GA Development Areas** – As shown in **Exhibit 4-7**, it is recommended that additional hangars be developed near Taxiway B to accommodate future demand for piston aircraft. The expansion of hangars near Taxiway B is consistent with the long-term development plans of the Airport. As depicted in **Exhibit 4-8**, the expansion of corporate hangars is in two primary areas, north and south. Expansion to the North supports the continuation of corporate hangars parallel to University Avenue. Expansion to the South is concentrated within the existing corporate hangar located along Taxiway E. The recommended development of these GA development areas maintains the existing separation of smaller piston aircraft from larger turbine and jet aircraft throughout the 20-year planning period.
- **Terminal Building** – Two terminal expansion alternatives were developed to address the need for a total of eight aircraft gates by 2036. As shown in **Exhibit 4-10**, a new concourse extending northward towards Taxiway C enables the development of eight gates; however, the remaining space between the tail of an aircraft parked at the end gates and the TOFA creates significant challenges for repositioning aircraft from one side of the concourse to the other. In addition, snow removal becomes very challenging under a pier concourse expansion. In both instances, the ATCT would have to be contacted before encroaching the TOFA. The preferred terminal expansion alternative, shown in **Exhibit 4-12**, expands the existing terminal building both northwest and southeast and includes a new linear concourse to the south capable of up to 11 gates. Extending the concourse to the southeast can be phased to meet future demand beyond the 20-year planning period. The linear concourse extension does not impact the Taxiway C TOFA and would not require ATCT contact to reposition aircraft or impact snow removal.
- **SRE Facility** – Two SRE alternatives were developed to meet the future needs of BIS. As shown in **Exhibit 4-5**, expanding the existing SRE building and support apron to

the south can accommodate the short-term needs of the Airport. Similarly, **Exhibit 4-6** depicts a second short-term SRE alternative which extends the existing SRE building to the northwest and provides an expanded apron area also located to the northwest. This option provides additional storage space within the existing footprint of the current SRE; however, the expansion of the supporting apron is significantly larger to promote improved circulation. To meet short-term SRE needs, it is recommended that the Airport expand the existing SRE to the northwest (**Exhibit 4-6**). Long-term, it is recommended that the Airport consider the development of a new SRE facility southeast of the ARFF.

- **Fuel Facility** – It is recommended that the Airport increase its fuel storage capacity within the 20-year planning period to meet future demand. Adequate room within the existing fuel farm area is available to accommodate additional fuel storage tanks. Both landside **Exhibits 4-16** and **4-17** depict the recommended location for future fuel tanks.

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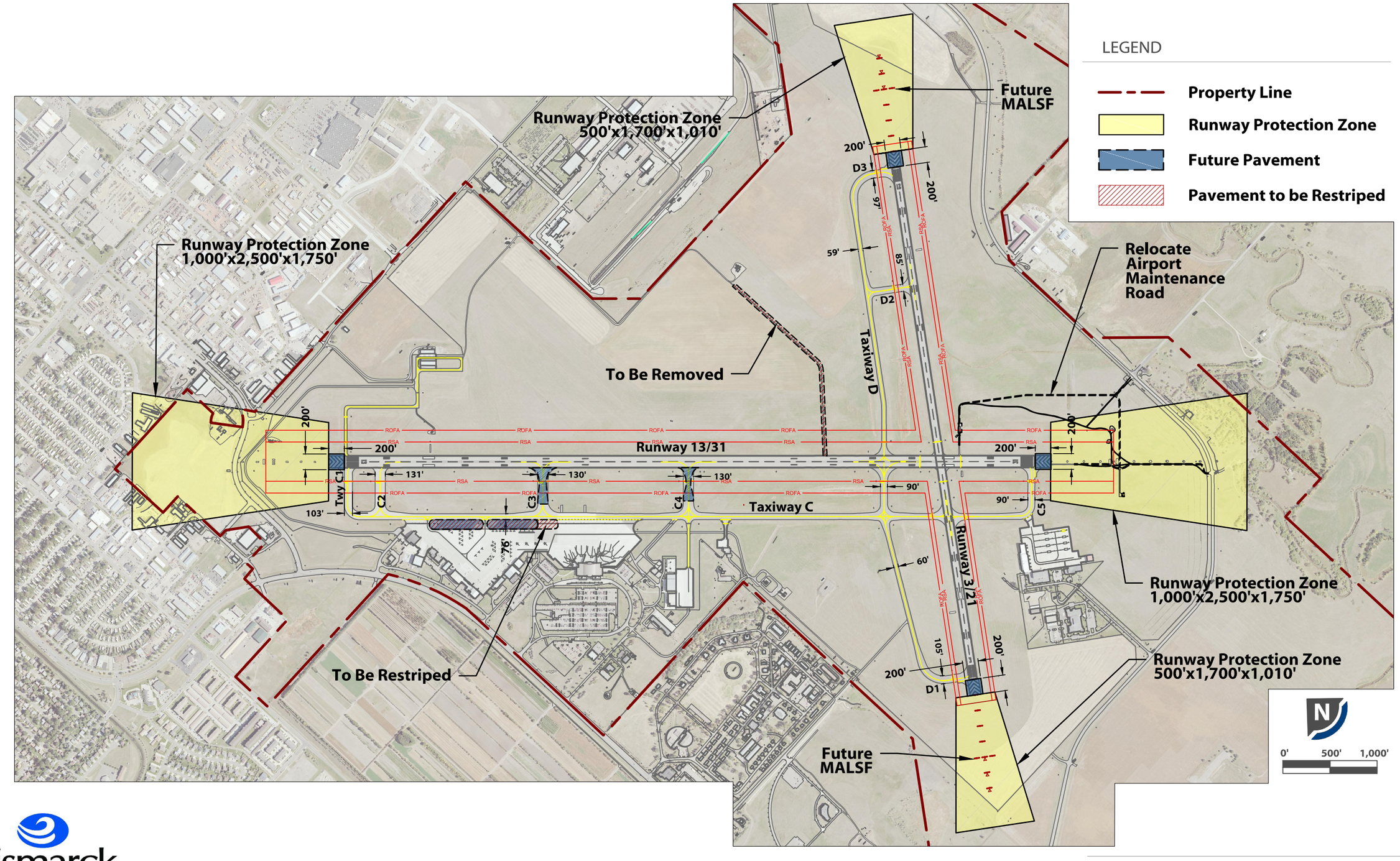

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Exhibit 4-16 **Airside Preferred Alternatives**

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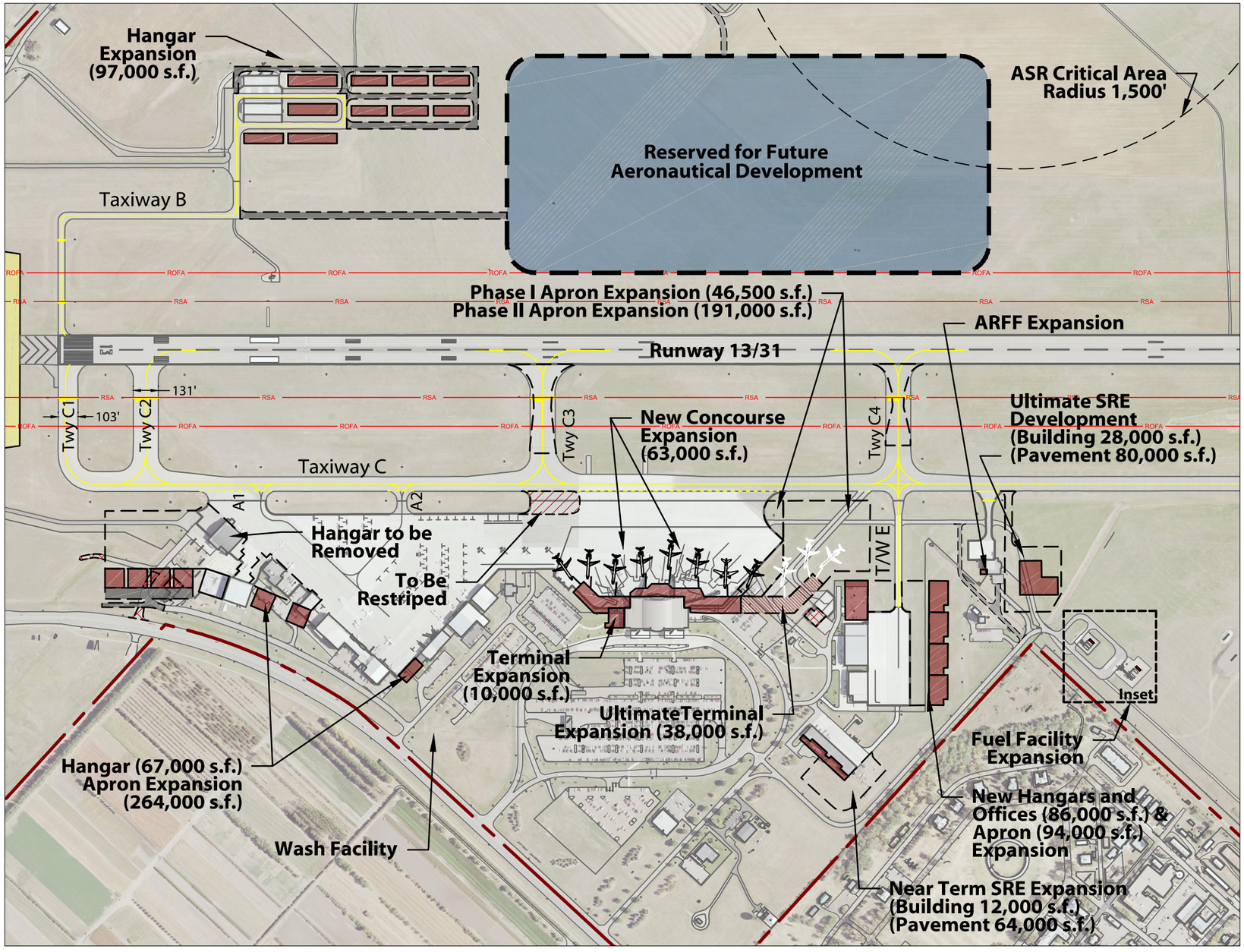

LEGEND

- Property Line
- Future Building
- Ultimate Terminal Expansion (Beyond 20-Year Planning Period)
- Future Pavement
- Development Area
- Pavement to be Restriped
- Pavement to be Removed

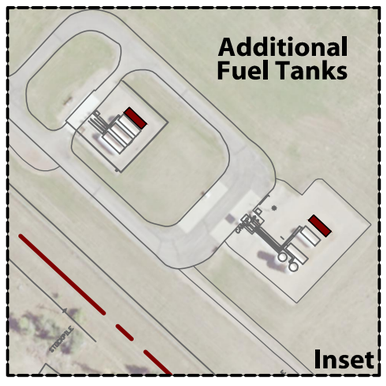

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Exhibit 4-17 **Landside Preferred Alternatives**

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