Cape Cod Gateway Airport

Airport Master Plan

Alternatives

McFarland Johnson

6. Alternatives

This Alternatives chapter documents a variety of proposed development scenarios to accomplish the recommended facility improvements identified in Chapter 5, *Facility Requirements.* It evaluates the scenarios against several evaluation factors as well as through different levels of screenings to determine how best to strike a balance between safety, environmental/community impacts, operational needs, and project implementation cost. The evaluation factors and screening levels used to compare development options were selected based on specific considerations associated with the Cape Cod Gateway Airport (HYA or the Airport).

From a Federal Aviation Administration (FAA) standpoint and prioritization, airside alternatives are considered first, followed by an evaluation of terminal alternatives, and then general aviation (GA) areas and support facilities. Each of these areas are evaluated within this chapter starting with the No Build Alternative, followed by other potential alternatives considered. The preferred alternatives are selected based on assessed criteria, their compatibility with one another, ability to correct non-standard FAA geometry or design conditions, screening factors, and the overall airport environment. These individual alternatives are then combined to create an overall Preliminary Recommendation for the Airport Layout Plan (ALP).

A summary of the Airside Facility Requirements is outlined below with background and additional detail outlined in the following sections:

- Airside Alternatives
- Terminal Alternatives
- General Aviation Alternatives
- Support Facilities
- Green Opportunities
- Preliminary Recommendation for the Airport Layout Plan

6.1. AIRSIDE FACILITY REQUIREMENTS SUMMARY

In Chapter 5, *Facility Requirements*, airside improvements were identified that should be addressed to accommodate the non-standard FAA geometry or design conditions and projected growth anticipated over the next 20 years. These improvements are shown in Table 6-1.

Table 6-1: Summary of Airside Recommendations

FAA Standard	Recommendation	More Details
Airfield Capacity	• Extend a runway to accommodate Weight Class C aircraft (existing capacity is 12-27% of Weight Class C aircraft (weighing 12,500-300,000 pounds) in wet[1] runway pavement conditions) • The Airport should maintain C-III standards for both Runway 15-33 and Runway 6-24 to improve flexibility and capacity at the Airport.	Section 5.2.1

FAA Standard	Recommendation	More Details
Runway Length	• Extend one or both runways to 6,000 - 6,400 feet of useable distance for a family of aircraft (both GA and commercial) (existing Runway 6-24 is 5,425 feet long and Runway 15-33 is 5,253 feet long)	Section 5.2.2
Runway Safety Areas, Runway Object Free Areas, Runway Protection Zones	• Review alternatives for incremental improvements and enhanced land use controls by the Airport per Federal Aviation Administration (FAA) standards; establish a policy for incremental safety enhancements in future projects	Sections 5.2.6 – 5.2.8
Taxiways	• Widen Taxiway B to meet taxiway design group 3 standards to optimize existing and future aircraft movement • Review Taxiways A, B, and E object free areas for improvements	Section 5.2.11
Passenger Terminal Ramp	• Plan for a second aircraft parking position based upon a potential increase in passenger service or changes to the type of aircraft using the terminal could trigger reconfiguration	Section 5.2.12
Airfield Geometry	• Resolve the areas of non-standard geometry to meet FAA standards as much as practicable	Section 5.2.13
Airfield Lighting	• Add a precision approach path indicator (PAPI) to Runway 15 to improve the visual approach capabilities • Resolve Runway 15 threshold light separation • Add medium intensity taxiway lights (MITLs) or reflective markers to Taxiway E	Section 5.2.15

[1] Does not account for snow, ice, or other contamination factors.
[2] Useable runway length is based on declared distances, which protects for safety areas prior to the landing threshold and beyond the end of the runway
Source: McFarland Johnson analysis, 2021.

6.2. AIRSIDE ALTERNATIVES

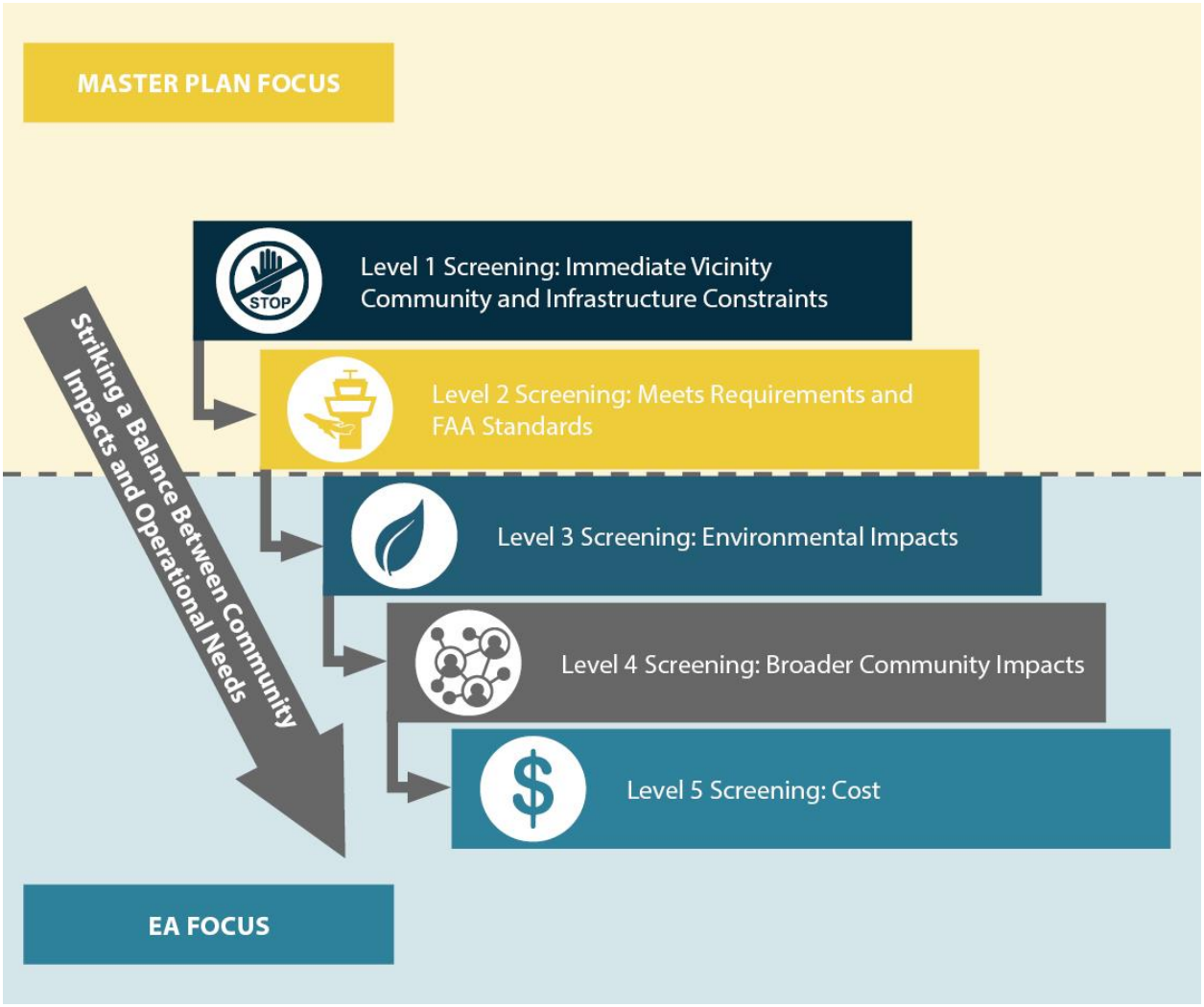
Airside alternatives present potential solutions to non-standard FAA geometry or design conditions as identified in Chapter 5, *Facility Requirements*. The array of alternatives presented were evaluated against five screening level criteria, as shown in **Figure 6-1**. Those alternatives that meet the screening level criteria and are deemed reasonable and feasible are advanced to create a preliminary airside recommendation (the Proposed Action) for the Airport.

The five screening criteria have been developed to provide a tiered assessment of each alternative. Each alternative must pass one level of screening before proceeding to the next, pass or fail criteria. The alternative must also be reasonable, feasible, and practicable that might accomplish the objectives of a project. These five screening criteria consist of the following:

- **Level 1:** Does the Alternative Cause Immediate Vicinity Community and Infrastructure Impacts?
- **Level 2:** Does the Alternative Meet Requirements and FAA Standards?
- **Level 3:** Does the Alternative Impact the Natural Environment?
- **Level 4:** Does the Alternative Impact the Broader Community?
- **Level 5:** How Does the Alternative Rank for Costs?

The goal of the screening criteria is to strike a balance between minimizing immediate vicinity community and infrastructure constraints, meeting facility requirements and FAA standards, minimizing environmental impacts, minimizing broader community impacts, and being cost efficient. Additional community and environmental impacts will be reviewed in further detail in the Cape Cod Commission review, Massachusetts Environmental Policy Act (MEPA) review, and Environmental Assessment (that will be prepared is based upon the National Environmental Policy Act (NEPA)) processes, which all start after the Master Plan is completed.

Figure 6-1: Screening Criteria



Source: McFarland Johnson, 2021.

6.2.1. Level 1 Screening: Immediate Vicinity Community and Infrastructure Constraints

Level 1 Evaluation Criteria

Level 1 screening reviews alternatives that have community and infrastructure constraints in the immediate vicinity. The following were evaluation criteria used to determine if an alternative moved forward to Level 2 screening:

- Creates Disproportionate Burden: Shortening of either one of the two runways to be less than the existing lengths at the Airport (either the physical pavement or useable runway distance, such as declared distances), would result in an increase in larger aircraft operations using one runway (instead of balanced use between both runways in existing conditions). Shortening one runway to be less than its existing length would shift greater than ten percent of existing aircraft operations to the longer runway and put a disproportionate burden on neighborhoods located near the runway that remains intact. Any alternative with a physical or useable runway shortening does not pass Level 1 screening criteria.

- Has Immediate Vicinity Community and Infrastructure Constraints: The Airport is surrounded by public infrastructure. On the northwest side of the Airport (Runway 15) is Independence Drive. On the southwest side of the Airport (Runway 6) are both Iyannough Road and Barnstable Road. The southeast side of the Airport (Runway 33) is bounded by Mary Dunn Way, Iyannough Road, Yarmouth Road, and railroad tracks. The northeast side of the Airport (Runway 24) is next to Yarmouth Road and railroad tracks. The immediate vicinity community would be adversely impacted should any road or railroad need to be relocated. This would also require extensive land acquisition and relocation of houses and businesses. Any alternative that shows relocating major roads or railroads, as well as significant Airport infrastructure, does not pass Level 1 screening criteria.

- Exceeds Runway Safety Area (RSA) Maximum Feasible Cost (applies to RSA alternatives only): The FAA identifies a maximum feasible cost to improve RSAs in Order 5200.9, Financial Feasibility and Equivalency of Runway Safety Area Improvements and Engineered Materials Arresting System. Per FAA Order 5200.9 Figure 4, the maximum feasible RSA improvement cost for Runway 6-24 is approximately $14.5 - $17.5 million based on an estimated engineered materials arresting system (EMAS) length of 330 to 400 feet (the final EMAS length is determined by the manufacturer during the engineering design phase). Cost estimates were not created for all alternatives; only those RSA alternatives that could come close to the RSA maximum feasible costs include a planning-level cost estimate. Any RSA alternative that exceeds $17.5 million for RSA improvements does not pass Level 1 screening criteria.

Level 1 Runway 6-24 RSA Alternatives Executive Summary

An extensive review of the Runway 6-24 safety area was conducted as part of this Master Plan. Appendix K describes the initial alternatives reviewed and provides the full presentation of alternatives after FAA and Massachusetts Department of Transportation (MassDOT) feedback. A

summary of the alternatives considered in Level 1 screening are shown in **Table 6-2**. Based on this review, only the No Build and Runway 24 EMAS pass to Level 2.

Table 6-2: Level 1 Screening Summary

Alternative	Creates Disproportionate Burden	Has Immediate Vicinity Community and Infrastructure Impacts	Exceeds Maximum Feasible Cost Impacts	Passes Level 1
Alternatives to Meet Runway 6-24 FAA RSA Alternatives				
No Build	No	No	No	**Yes**
Provide Full Dimension RSA	No	Yes	Yes	No
Reduce Runway 6-24 to 4,028 feet	Yes	No	No	No
Relocate Runway 6-24	No	Yes	Yes	No
Realign Runway 6-24 Alt. 1	No	Yes	Yes	No
Realign Runway 6-24 Alt. 2	No	Yes	Yes	No
Shifting Runway 6-24	No	Yes	Yes	No
Apply Declared Distances	Yes	No	No	No
Change Operational Characteristics	Yes	No	No	No
Install Runway 24 EMAS	No	No	No	**Yes**
Extend Runway 24	No	Yes	Yes	No
Extend Runway 6	No	Yes	Yes	No
Runway 15-33 RSA Constraints				
Runway 15 RSA Off Airport Property	No	Yes	N/A	No
Runway 33 RSA Off Airport Property	No	Yes	N/A	No

Source: McFarland Johnson analysis, 2021.

Level 1 Runway 15-33 RSA Constraints

The following Runway 15-33 RSA constraints were identified to prevent any immediate vicinity community and infrastructure impacts.

- **Runway 15 RSA Off Airport Property:** Extending the Runway 15 RSA off Airport property would require the relocation of Independence Drive.
  - **Has Immediate Vicinity Community and Infrastructure Impacts:** Runway 15 is constrained by Independence Drive.
  - **Result**: Additional runway length at Runway 15 will be limited to keeping the RSA on Airport property.

- **Runway 33 RSA Off Airport Property:** Extending the Runway 33 RSA off Airport property would require the relocation of Mary Dunn Way.
  - **Has Immediate Vicinity Community and Infrastructure Impacts:** Runway 33 is constrained by Mary Dunn Way.
  - **Result**: Additional runway length at Runway 33 will be limited to keeping the RSA in its current location.

Level 1 Screening Alternatives Moving Forward

Only two alternatives met the evaluation criteria and are being carried forward to Level 2:

- No Build
- Runway 24 EMAS

Additional on-airport alternatives for Runway 15-33, Runway 15-33 taxiways, and Runway 6-24 taxiways are introduced in Level 2 screening.

6.2.2. Level 2 Screening: Meets Requirements and FAA Standards

Level 2 Screening

This screening level looks at individual alternatives created to address one or multiple facility requirements (as identified in Chapter 5) and FAA design and geometry standards (as identified in FAA Advisory Circular (AC) 150/5300-13A). Alternatives in this section were split into three distinct categories:

- **Runway 15-33 Alternatives:** Those alternatives that review if/how the Airport can meet the facility requirements runway length identified. Alternatives were limited by the Runway 15 RSA staying on Airport property and keeping the Runway 33 RSA in its existing location.

- **Runway 15-33 Taxiway Alternatives**: Those alternatives that review how best to address the non-standards geometry of Taxiways E and D with Runway 15-33.

- **Runway 6-24 Taxiway Alternatives:** Those alternatives that review the higher than standard Taxiway B separation from Runway 6-24 and alternatives that review non-standard geometry conditions of taxiways intersecting Runway 6-24.

Level 2 Evaluation Criteria and Executive Summary

After each section, a review was conducted to determine which alternative(s) are carried forward to the Level 3 Screening.

The following evaluation criteria were considered during Level 2 screening and an executive summary table is provided as **Table 6-3**:

- **Meets FAA Standards:** Does the alternative meet the design and geometry standards of FAA AC 150/5300-13A, *Airport Design*, and Code of Federal Regulations (CFR) Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (Part 77) to the maximum extent feasible?
- **Meets Facility Requirements:** Does the alternative meet the existing and future needs of the Airport and is the alternative feasible for implementation?
- **Is Constructable:** Is the alternative feasible to construct?
- **Has Operational Impacts on Airport:** What effect does this alternative have from an operational standpoint? Does this alternative allow the Airport to operate equally or more efficient? This evaluation criteria applies to taxiway alternatives only.

Table 6-3: Level 2 Screening Summary

Alternative	Meets FAA Standards	Meets Facility Requirements	Is Constructable	Has Operational Impacts on Airport	Passes Level 2
Airside Alt. 1 – No Build	Yes	No	N/A	N/A	No
Runway 15-33 Alt. 2 – Meet All Facility Requirements	No	Yes – On Airport; No – Off Airport	Yes	N/A	No
Runway 15-33 Alt. 3 – Reduced Obstructions, Enhanced Land Use Compatibility	Yes	Yes	Yes	N/A	No
Runway 15-33 Alt. 4 – Meets Most Requirements, Enhanced Land Use Compatibility	Yes	Yes	Yes	N/A	**Yes**
Runway 33 Optimized Access Taxiway	No	Yes	Yes	No	No
Runway 33 EMAS	Yes	Yes	Yes	N/A	**Yes**
Runway 15-33 RSA/ROFA	Yes	N/A	N/A	N/A	**Yes**

Alternative	Meets FAA Standards	Meets Facility Requirements	Is Constructable	Has Operational Impacts on Airport	Passes Level 2
Incremental Improvements					
Runway 15-33 RPZ Incremental Improvements	Yes	N/A	N/A	N/A	**Yes**
Runway 24 EMAS	Yes	N/A	Yes	N/A	**Yes**
Runway 6-24 RSA Determination	Yes	N/A	N/A	N/A	**Yes**
Runway 6-24 RPZ Incremental Improvements	Yes	N/A	N/A	N/A	**Yes**
Runway 15-33 Taxiway Alt. 2	Yes	Yes	Yes	No	**Yes**
Runway 15-33 Taxiway Alt. 3	No	Yes	Yes	No	No
Runway 6-24 Taxiway Alt. 2	Yes	Yes	Yes	Yes	**Yes**

Source: McFarland Johnson analysis, 2021.

Airside Alternative 1 - No Build

This alternative shows no changes to the existing runway and taxiway layout. The No Build alternative is shown in **Figure 6-2**.

The No Build Alternative was assessed against the three evaluation factors; the results are below:

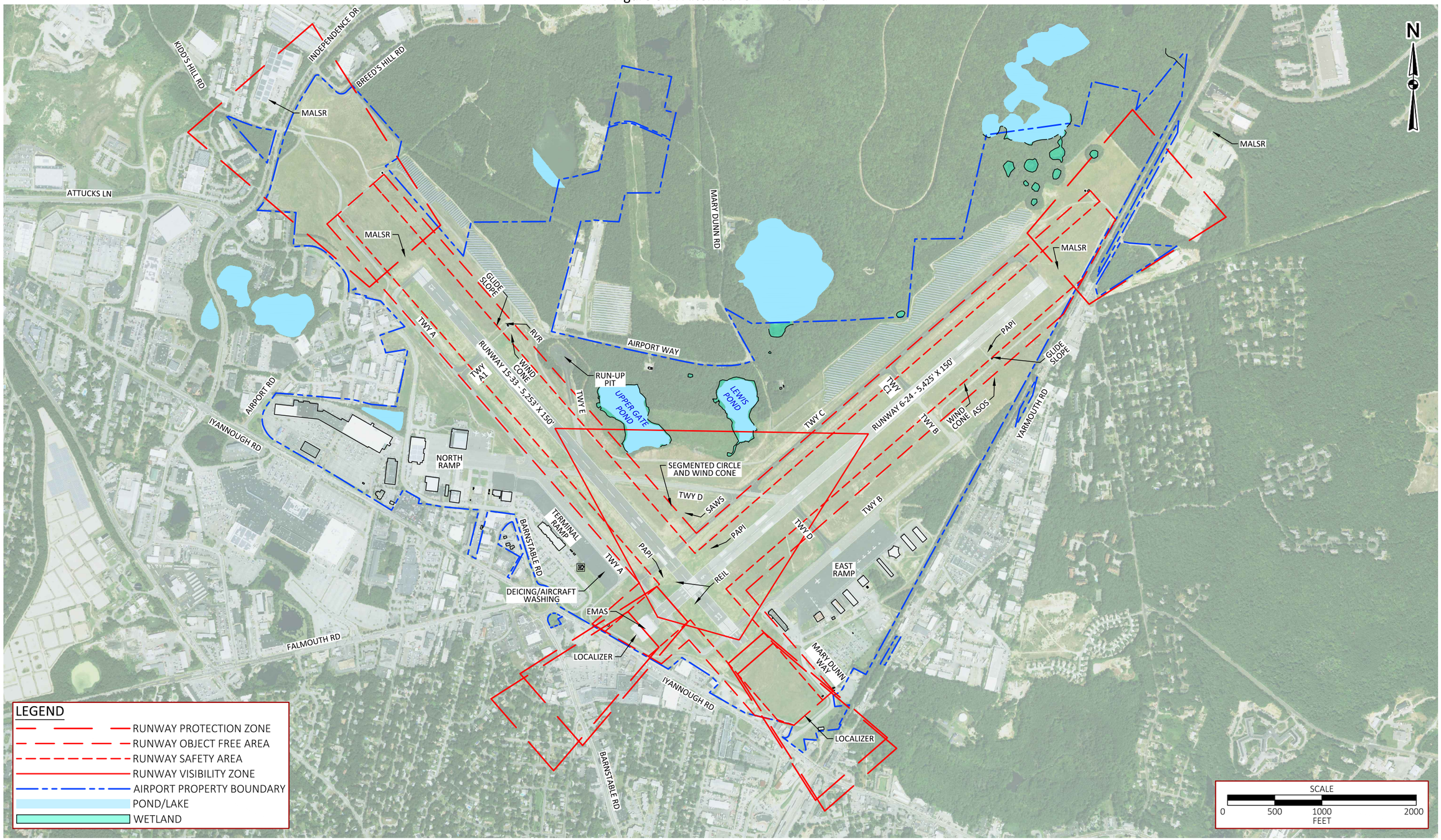
- **Meets FAA Standards:** Since the existing Airport meets FAA standards using RSA determinations and Modifications to Standards (MOS), this alternative meets FAA design standards.

- **Meets Facility Requirements:** The No Build Alternative does not meet the existing and future facility requirements related to runway length.

PLANNING CONSIDERATION
The Airport will not be able to meet the needs of the year-round community that relies on aviation - business and residents – using the No Build alternative.

- **Is Constructable**: Since there is no construction proposed, constructability does not apply.

Figure 6-2: Alternative 1 – No Build



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Runway 15-33 Alternative 2 – Meets All Facility Requirements

This alternative is a maximum build out scenario. It proposes constructing a Runway 15-33 extension that meets the runway length identified in Chapter 5. This alternative includes a 1,295-foot extension to the Runway 15 end and a 400-foot extension to the Runway 33 end. The Runway 33 extension would be a displaced threshold; the Runway 33 landing threshold would remain in its current location. In this alternative, Taxiway A would extend to the new runway ends and connect to the runway at a 90-degree angle. All areas within the taxiway object free areas (TOFAs) and relocated perimeter road located off Airport property would be acquired when the land becomes available on a willing seller basis. Alternative 2 would meet the requirement of 6,000 feet of both accelerated stop distance available (ASDA) and landing distance available (LDA) in both directions of Runway 15 and 33. Relocating the Runway 15 landing threshold would require obstruction removal and creates an incompatible land use by having Victory Chapel (a house of worship) within the runway protection zone (RPZ). This alternative is shown in **Figure 6-3**.

This Alternative was assessed against the three evaluation factors; the results are below:

- **Meets FAA Standards:** The runway extension moves the RPZs further out and over Victory Chapel. A house of worship within an RPZ is an incompatible land use. Therefore, this alternative does not meet FAA standards.

- **Meets Facility Requirements:** The runway length meets the facility requirements identified in Chapter 5. Therefore, this alternative meets facility requirements.

- **Is Constructable**: The obstructions that would need to be removed or lowered for this alternative make constructability challenging and costly. The obstructions include above ground utilities (mounted on poles) that would require re-location along Independence Drive as well as other man-made structures and natural obstructions.

Runway 15-33 Alternative 3 – Reduced Obstructions, Enhanced Land Use Compatibility

This alternative is similar to the alternative presented in the 2008 Master Plan. This alternative proposes a 1,258-foot extension to the Runway 15 end and a 400-foot extension to the Runway 33 end. This alternative includes a 1,058-foot displaced landing threshold on the Runway 15 end and a 550-foot displaced threshold on the Runway 33 end. In this alternative, Taxiway A would extend to the new runway ends and connect to the runway at a 90-degree angle. All areas within the TOFAs and relocated perimeter road located off Airport property would be acquired when the land becomes available on a willing seller basis. Runway 15-33 Alternative 3 would result in reduced obstruction impacts and enhanced land use compatibility compared to Runway 15-33 Alternative 2. While it does not meet the Runway 15 recommended LDA of 6,000 feet, it improves the Runway 15 LDA by 200 feet compared to existing conditions. This alternative is shown in **Figure 6-4**. This Alternative was assessed against the three evaluation factors; the results are below:

- **Meets FAA Standards:** This alternative, like the No Build, meets FAA standards.

- **Meets Facility Requirements:** This alternative meets the Runway 33 runway length need and improves the Runway 15 landing distance by 200 feet.

- Is Constructable: This alternative has minimal man-made obstructions and a reduced number of natural obstructions compared to Runway 15-33 Alternative 2 and is constructible.

Runway 15-33 Alternative 4 – Meets Most Requirements, Enhanced Land Use Compatibility

This alternative proposes an 895-foot extension to the Runway 15 end and a 400-foot extension to the Runway 33 end. This alternative includes a 695-foot displaced threshold on the Runway 15 end and a 550-foot displaced threshold on the Runway 33 end. In this alternative, Taxiway A would be extended to the new runway ends and connect to the Runway 15 and 33 ends at 90-degree angles. All areas within the TOFAs and relocated perimeter road located off Airport property would be acquired when the land becomes available on a willing seller basis. Runway 15-33 Alternative 4 would result in reduced obstruction impacts and enhanced land use compatibility compared to Runway 15-33 Alternative 2. While it does not meet the Runway 15 recommended LDA of 6,000 feet, it improves the Runway 15 LDA by 200 feet compared to existing conditions.

Runway 15-33 Alternative 4 distinguishes itself from Runway 15-33 Alternative 3 by reviewing the balance of Airport expansion and at what point runway length has diminishing returns in terms of operations. The additional runway length that is proposed in Runway 15-33 Alternative 3 only aids for take-off purposes and does not help bring the Airport closer to meeting the facility requirements for landing needs. Runway 15-33 Alternative 4 removes this excess pavement and focuses on the key pavement necessary to meet the facility requirements, where possible. This alternative is shown in Figure 6-5.

This Alternative was assessed against the three evaluation factors; the results are below:

- Meets FAA Standards: This alternative, like the No Build, meets FAA standards.
- Meets Facility Requirements: This alternative meets the Runway 33 runway length need and improves the Runway 15 landing distance by 200 feet.
- Is Constructable: This alternative has minimal man-made obstructions and a reduced number of natural obstructions compared to Runway 15-33 Alternative 2 and is constructible.

Level 2 Screening Runway 15-33 Alternatives Comparison

Table 6-4 compares the declared distances for all four Runway 15-33 alternatives and Table 6-5 compares the four Runway 15-33 alternatives based on the Level 2 screening evaluation criteria. Runway 15-33 Alternative 4 - Meets Most Requirements, Enhanced Land Use Compatibility is the only alternative moving forward to Level 3 Screening. This alternative balances the need to meet FAA design standards and Airport facility requirements, while minimizing obstruction removal and being constructible with few challenges.

Figure 6-3: Runway 15-33 Alternative 2 – Meets All Facility Requirements

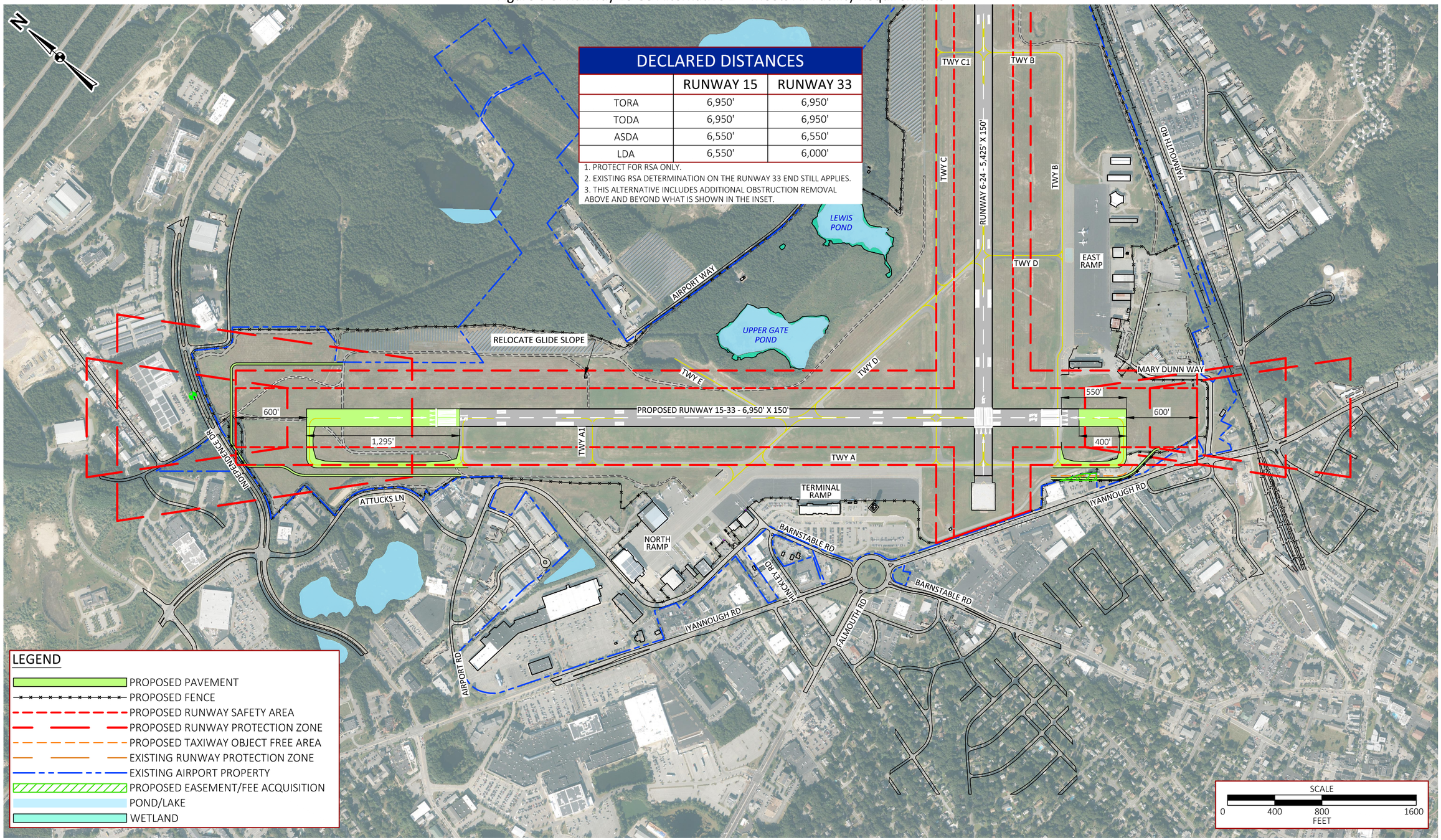

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Figure 6-4: Runway 15-33 Alternative 3 - Reduced Obstructions, Enhanced Land Use Compatibility

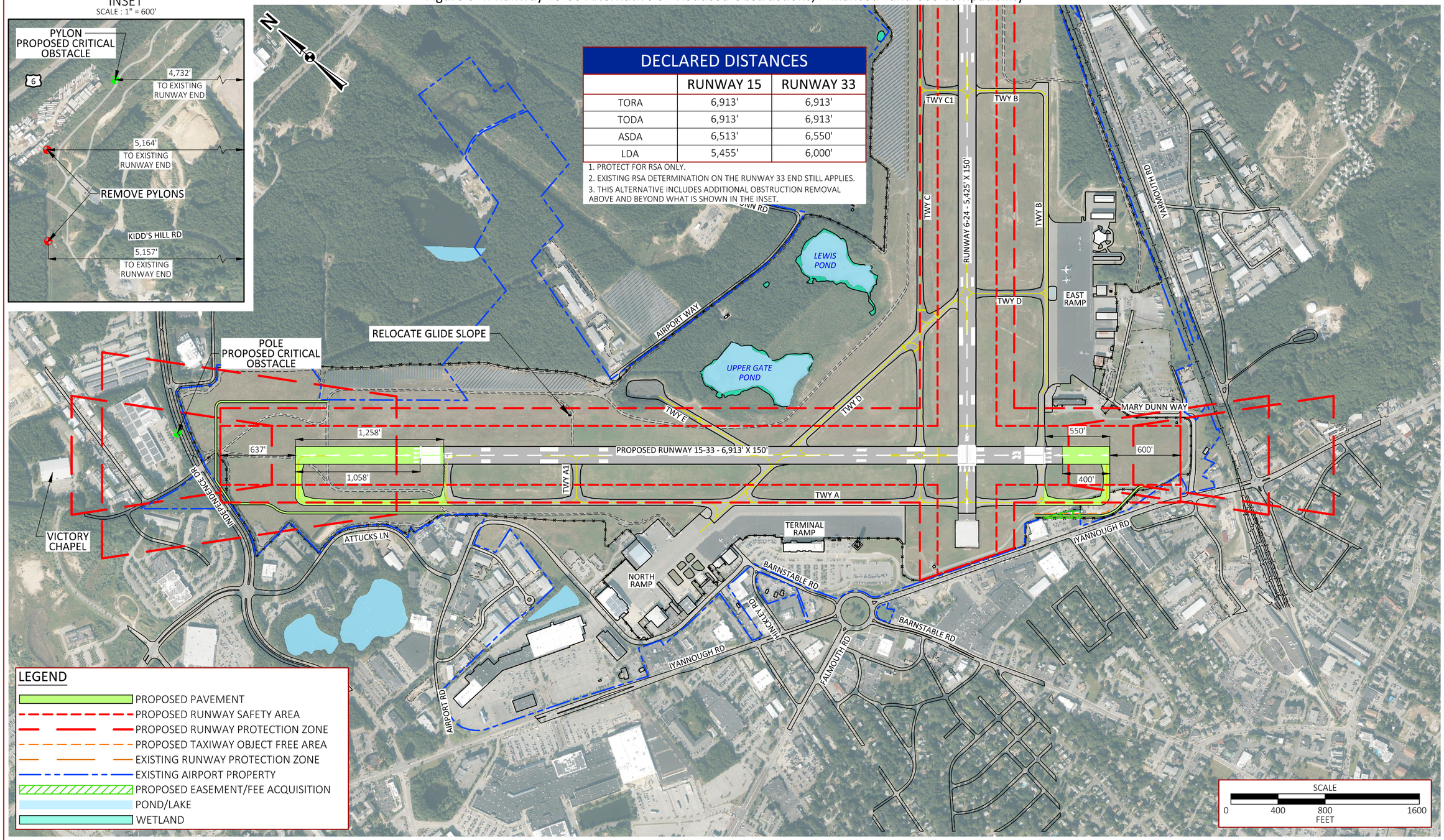

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Figure 6-5: Runway 15-33 Alternative 4 - Meets Most Requirements, Enhanced Land Use Compatibility

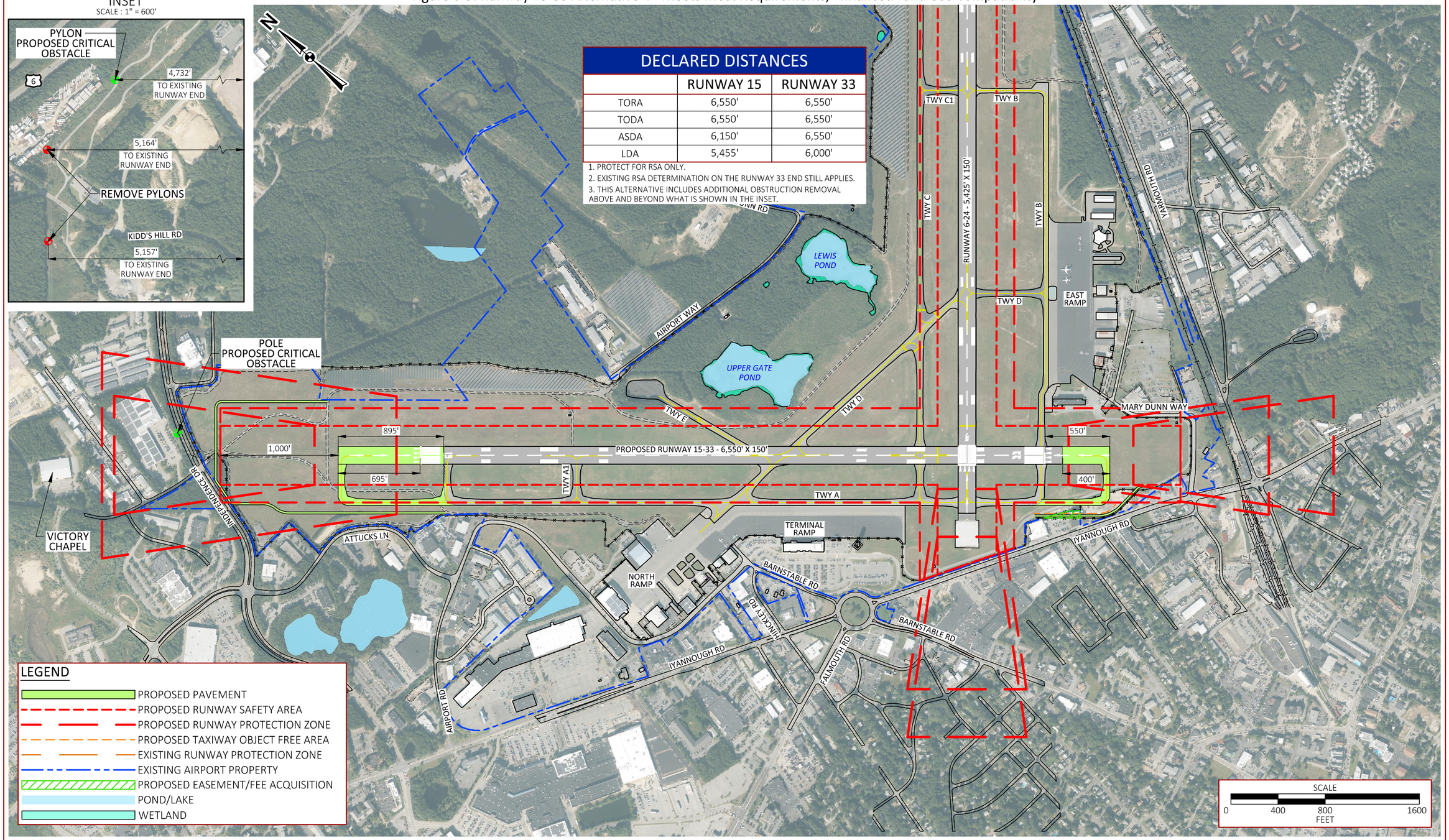

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Table 6-4: Declared Distances Comparison

	Runway 15			
Declared Distances (feet)	No Build	Meets Facility Requirements	Reduced Obstructions, Enhanced Land Use Compatibility	Meets Most Requirements, Enhanced Land Use Compatibility
TORA	5,253	**6,950**	**6,913**	**6,550**
TODA	5,253	**6,950**	**6,913**	**6,550**
ASDA	5,253	**6,550**	**6,513**	**6,150**
LDA	5,253	**6,550**	5,455	5,455
	Runway 33			
Declared Distances (feet)	No Build	Meets Facility Requirements	Reduced Obstructions, Enhanced Land Use Compatibility	Meets Most Requirements, Enhanced Land Use Compatibility
TORA	5,253	**6,950**	**6,913**	**6,550**
TODA	5,253	**6,950**	**6,913**	**6,550**
ASDA	5,253	**6,550**	**6,550**	**6,550**
LDA	5,103	**6,000**	**6,000**	**6,000**

Bold meets facility requirements of at least 6,000 feet landing/takeoff distance or at least 6,400 feet rejected takeoff.

Sources: FAA Airport/Facility Directory, 25 Feb. 2021 – 22 Apr. 2021; McFarland Johnson, 2021.

Table 6-5: Level 2 Screening Runway 15-33 Alternatives Comparison

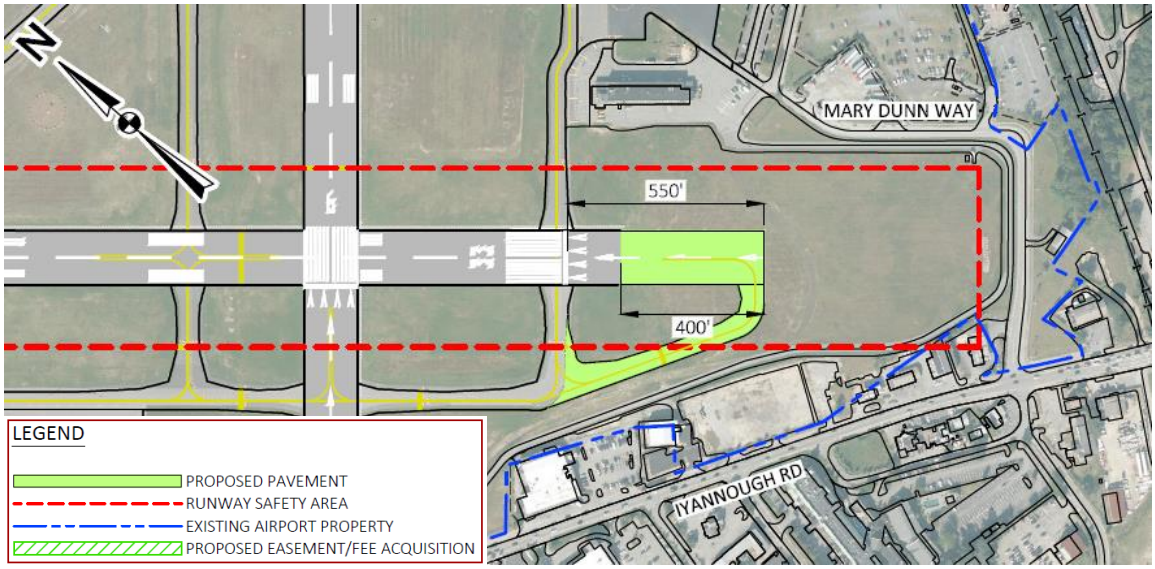
Alternative	Meets FAA Standards	Meets Facility Requirements	Is Constructable	Passes Level 2
No Build	Yes	No	N/A	No: Does not attempt to meet facility requirements
Meets Facility Requirements	On-Airport: Yes Off-Airport: No, incompatible land use	Yes	Yes: Multiple obstructions	No: Does not meet FAA standards; constructability challenges
Reduced Obstructions, Enhanced Land Use Compatibility	Yes	Yes: Runway 33; Improves: Runway 15 LDA by 200 feet	Yes: Minimal obstructions; excess runway length	No: No need for excess runway pavement
Meets Most Requirements, Enhanced Land Use Compatibility	Yes	Yes: Runway 33; Improves: Runway 15 LDA by 200 feet	Yes: Minimal obstructions	**Yes:** Balances standards, needs, and minimizing impacts

Source: McFarland Johnson analysis, 2021.

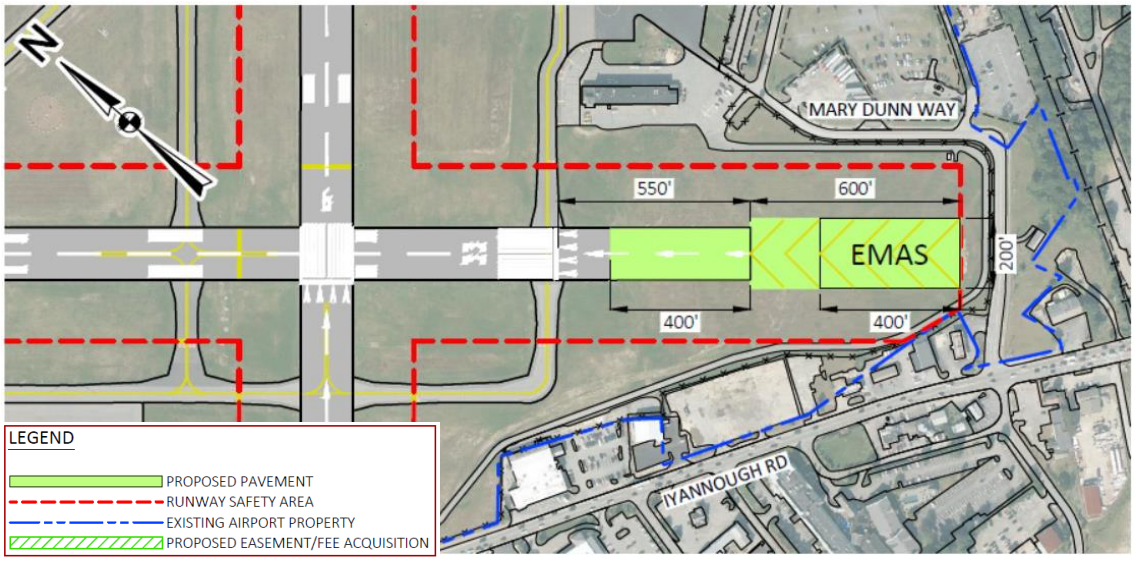
Runway 15-33 Alternatives Enhancements

The following alternative enhancements for Runway 15-33 were considered as part of the Master Plan process as defined below:

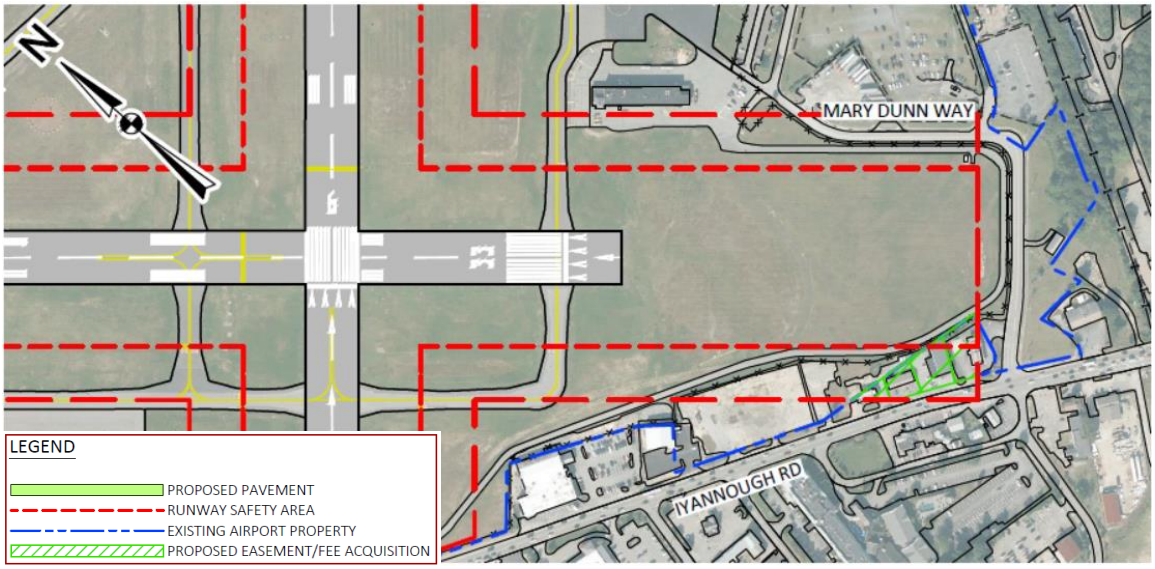
- **Runway 33 Optimized Access Taxiway:** This enhancement proposes an angled access taxiway to the proposed Runway 33 end. This enhancement improves visibility of the approach areas and does not require property acquisition. However, it does not meet full FAA geometry standards. Opportunities such as additional signage, markings, and lighting could be considered to mitigate the non-standard angle. This alternative enhancement could be considered to provide a full-length parallel taxiway and prevent back-taxiing on Runway 33 for Runway 33 departures. Since the standard access taxiway requires land acquisition that has not become available since the 2008 ALP, this may be a feasible solution until the needed properties are acquired by the Airport for the standard access taxiways. In an effort to fully meet FAA geometry standards, this enhancement does not move forward to Level 3 screening, but may be reviewed in the subsequent NEPA process as a lower impact, interim option until the land needed for a standard taxiway becomes available.



- **Runway 33 EMAS:** This enhancement would add an EMAS beyond the proposed Runway 33 extension. This enhancement increases the Runway 15 ASDA and LDA by 400 feet. However, constructing and maintaining an EMAS is costly. To meet facility needs, this enhancement will be carried forward to Level 3 screening.



- **Runway Safety Area /Runway Object Free Area Incremental Improvements:** The current RSA and ROFA conditions are standard based on the existing RSA determination and MOS. To continue to provide incremental improvements at the Airport, this enhancement shows acquiring all properties within RSAs and ROFAs, except for public roads and railroads, on a willing seller basis. Easement/land acquisition required to meet full dimension FAA design standards for Runway 33 would be approximately 0.2 acres for the RSA and approximately 1.3 acres for the ROFA. Based on FAA guidance this enhancement will be carried forward to Level 3 screening.



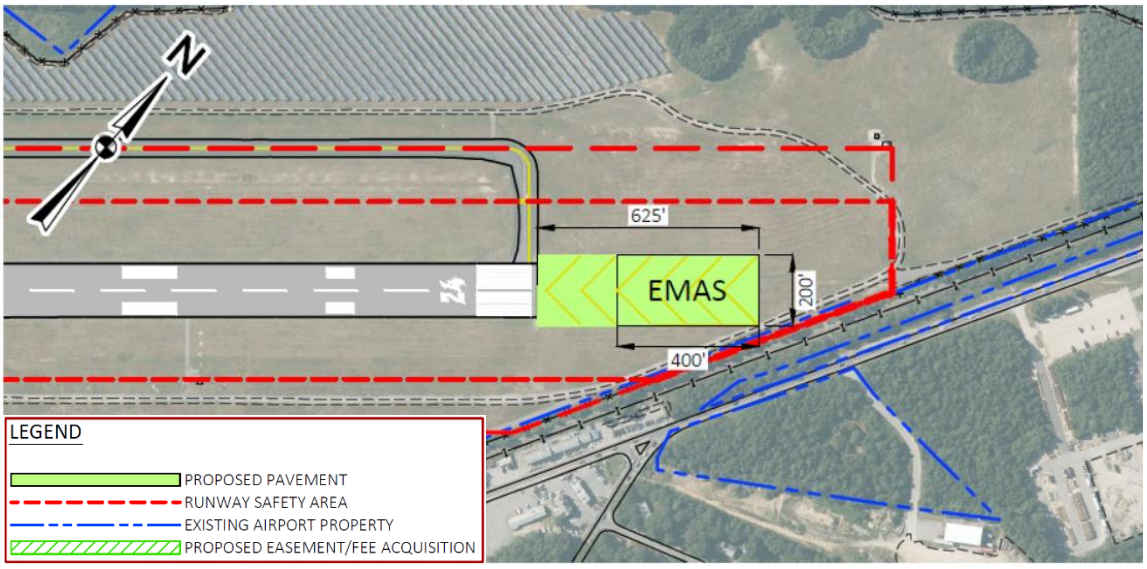
- **Runway Protection Zone Incremental Improvements (not shown):** The current RPZ conditions are grandfathered into the standards; therefore, the current conditions are considered standard. To continue to identify incremental improvements, this enhancement shows increasing Airport control of the land area within the RPZs on a willing seller basis. Approximately 52 acres within the Runway 15 and 33 RPZs are off Airport property. Based on FAA standards this enhancement will be carried forward to Level 3 screening.

Runway 6-24 Alternative Enhancements

The following alternative enhancements for Runway 6-24 were considered as part of the Master Plan process as defined below:

- **Runway 24 EMAS:** This enhancement would add an EMAS beyond the existing Runway 6 departure end (near the Runway 24 threshold). As shown in the Level 1 screening, it is not feasible to provide full dimension RSA for Runway 6-24. An EMAS provides an equivalent level of safety to a full dimension RSA.

PLANNING CONSIDERATION
An EMAS will be shown for Runway 24 as an option to bring the RSAs into full compliance with FAA standards, should the Airport need to meet standards above and beyond the existing RSA determination (such as with enhanced commercial service operations).



PLANNING CONSIDERATION
Any adjustments to declared distances or landing thresholds will be further evaluated in conjunction with the EMAS installation.

- **Runway Safety Area Determination (not shown):** The existing RSA determination (approved by the FAA on September 13, 2000) deemed Runway 6-24 to be safe. The RSA determination remains in effect until such a time that changes to the operations, FAA standards, or local conditions change from those at the time the RSA determination was signed. Runway 6-24 is being used

today in a similar manner as in 2000. Future projects will attempt to eliminate, where possible, the need for the existing RSA determination.

- **Runway Protection Zone Incremental Improvements (not shown):** The current RPZ conditions are grandfathered into the standards; therefore, the current conditions are considered standard. To continue to identify incremental improvements at the Airport, this enhancement shows increasing Airport control of the land area in the RPZs on a willing seller basis. Approximately 43 acres within the Runway 6 and 24 RPZs are off Airport property. Based on FAA standards this enhancement will be carried forward to Level 3 screening.

A summary of alternatives enhancements is shown in **Table 6-6**.

Table 6-6: Alternative Enhancements Summary

Alternatives	Meets FAA Standards	Meets Facility Requirements	Is Constructable	Has Operational Impacts on Airport	Passes Level 2
Runway 33 Optimized Access Taxiway	No	Yes	Yes	No	No
Runway 33 EMAS	Yes	Yes	Yes	N/A	**Yes**
Runway 33 RSA/ROFA Incremental Improvements	Yes	Yes	N/A	N/A	**Yes**
Runway 15-33 RPZ Incremental Improvements	Yes	Yes	N/A	N/A	**Yes**
Runway 24 EMAS	Yes	Yes	Yes	N/A	**Yes**
Runway 24 RSA Determination	Yes: Current condition is deemed safe	Yes	N/A	N/A	**Yes**
Runway 6-24 RPZ Incremental Improvements	Yes	Yes	N/A	N/A	**Yes**

Source: McFarland Johnson analysis, 2021.

Runway 15-33 Taxiway Alternative 2

The existing Taxiway D has multiple non-standards geometry conditions. Two build alternatives were created to resolve these. Runway 15-33 Taxiway Alternative 2 (shown in **Figure 6-6**) proposes the following projects:

- Construct a partial parallel taxiway with a 400-foot standard separation east of Runway 15-33 from Taxiway B to existing Taxiway A1. This construction includes the removal of Taxiway D between Taxiway A and this new parallel taxiway. This prevents any operational concerns of two-way taxiing occurring in front of the terminal building and eliminates direct access from the North Ramp, the y-shaped runway crossing, and the high-energy crossing on Runway 15-33. This project impacts the edge of Upper Gate Pond, which will be reviewed in more detail in the Level 3 screening.
- Construct a run-up area along the north side of the proposed partial parallel taxiway to replace the existing Taxiway E run-up pit that will be removed. The current run-up pit is at a lower elevation and surrounded by trees, which shield the neighboring communities from the run-up sound impact. It is recommended that blast fence/wall will be constructed next to the proposed run-up pit both for blast protection as well as noise protection. This run-up area should accommodate the existing fleet of aircraft using the run-up pit (including the Cessna 402 and Tecnam P2012). The run-up pit and associated object free area will remain clear of the access/maintenance road.
- Remove Taxiway E

This Alternative was assessed against the four evaluation factors; the results are below:

- **Meets FAA Standards:** This alternative meets FAA design standards by providing a standard 400-foot runway-taxiway centerline separation and meets FAA geometry standards by, eliminating the high-energy intersection, non-standard runway-taxiway intersection angles, the y-shaped runway crossing, and direct access.

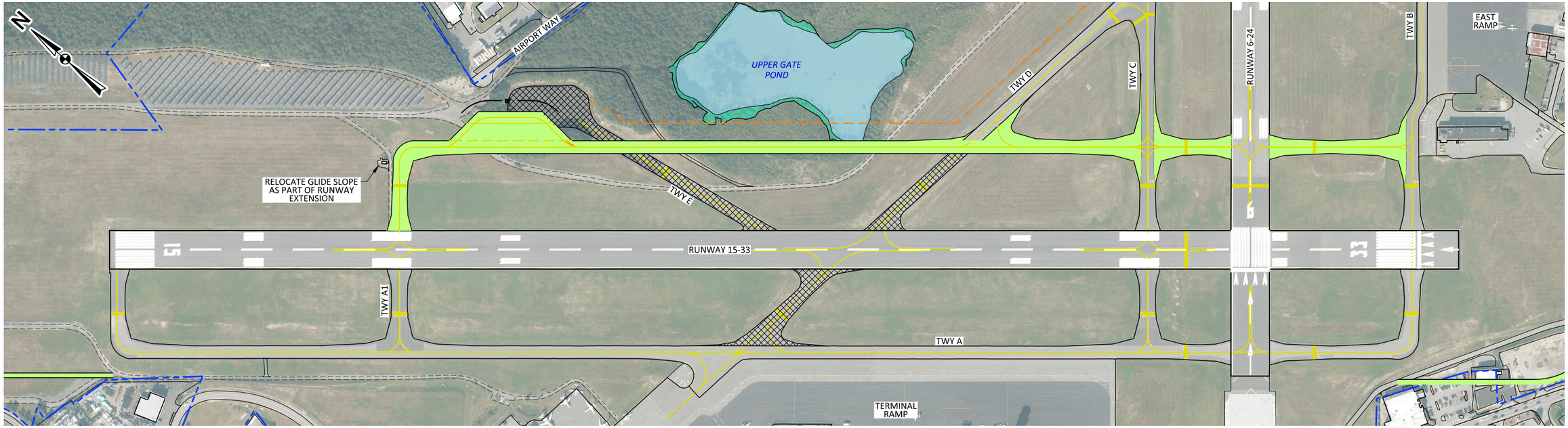
- **Meets Facility Requirements:** This alternative meets facility requirements.

- **Is Constructable**: This alternative is constructable.

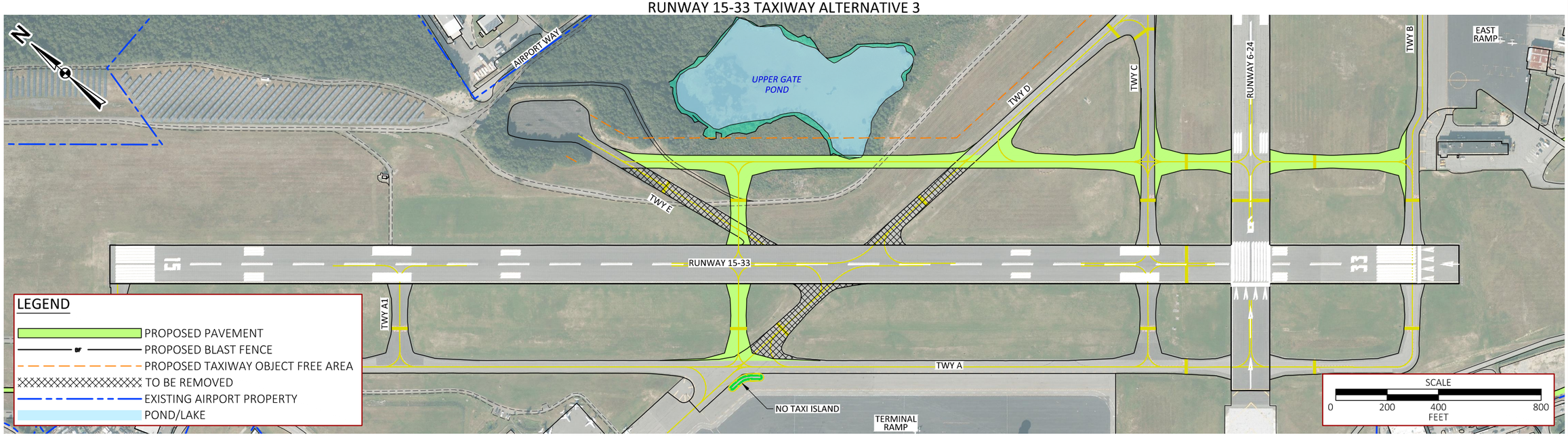
- **Has Operational Impacts on Airport**: This alternative prevents two-way taxi operations in front of the terminal, which therefore prevents head-to-head potential in front of the terminal. Aircraft may have longer taxi times to/from the terminal but may have shorter taxi times should the North Ramp be expanded within the planning period.

Figure 6-6: Runway 15-33 Taxiway Alternatives

RUNWAY 15-33 TAXIWAY ALTERNATIVE 2



RUNWAY 15-33 TAXIWAY ALTERNATIVE 3



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Runway 15-33 Taxiway Alternative 3

The intent of this alternative was to prevent two aircraft coming head-to-head on the taxiway in front of the terminal building. This could occur if the Runway 15-33 crossing was anywhere southeast of the midfield crossing to line up with Taxiway D coming out of the North Ramp. This alternative maintains the run-up pad in its existing location.

This alternative proposes the following projects (shown in Figure 6-6):

- Construct a partial parallel at 400-foot standard separation east of Runway 15-33 from Taxiway B crossing Runway 15-33 midfield (connecting to existing Taxiway D coming out of the North Ramp). This construction includes the removal of Taxiway D between Taxiway A and this new parallel taxiway. This prevents any operational concerns of two-way taxiing occurring in front of the terminal building and eliminates direct access from the North Ramp, and the y-shaped runway crossing but still has a high-energy crossing on Runway 15-33. This project impacts Upper Gate Pond.
- Remove the portion of Taxiway E from the proposed partial parallel taxiway to Runway 15-33

This alternative was assessed against the four evaluation factors; the results are below:

- Meets FAA Standards: This alternative improves conditions to the No Build by providing a standard 400-foot runway-taxiway centerline separation and improves the following non-standard FAA geometry conditions: eliminates non-standard runway-taxiway intersection angles, the y-shaped runway crossing, and direct access. It does not fully meet FAA geometry standards due to the high-energy crossing.

- Meets Facility Requirements: This alternative meets facility requirements.

- Is Constructable: This alternative is constructable.

- Has Operational Impacts on Airport: This layout maintains operational flexibility for two-runway configuration and providing alternate taxi routes to prevent head-to-head conditions.

Level 2 Runway 15-33 Taxiway Alternatives Comparison

Table 6-7 compares the Runway 15-33 Taxiway alternatives based on the Level 2 screening evaluation criteria.

As shown in Table 6-7, Runway 15-33 Taxiway Alternative 2 moves forward to Level 3 Screening since it is the only alternative that meets FAA design and geometry standards.

Table 6-7: Level 2 Screening Runway 15-33 Taxiway Alternatives Comparison

Alternative	Meets FAA Standards	Meets Facility Requirements	Is Constructable	Has Operational Impacts	Passes Level 2
No Build	No	No	N/A	None	No
Runway 15-33 Taxiway Alternative 2	Yes	Yes	Yes	None	**Yes**
Runway 15-33 Taxiway Alternative 3	No: High-energy crossing	Yes	Yes	Yes	No: Does not meet FAA standards and has operational impacts

Source: McFarland Johnson analysis, 2021.

Runway 6-24 Taxiway Alternative 2

The existing Runway 6-24 has multiple non-standards geometry conditions. One build alternative was created to resolve these. This alternative would include the following projects (shown in **Figure 6-7**):

- Move Taxiway B to a standard 400-foot separation from Runway 6-24. This reduces taxi time and opens up additional land for aeronautical development potential.
- Construct a perpendicular crossover taxiway south of the existing glide slope so that the new taxiway's TOFA remains clear of the glide slope. It is located approximately 3,480 feet from the Runway 6 threshold.
- Remove Taxiway C1 and the keep the portion of existing Taxiway B connecting to Runway 6-24.
- Construct a midfield taxiway to Taxiway B.
- Keep Taxiway D exit to Taxiway C as an acute-angled exit only taxiway.
- Construct a standard separation taxiway north of Runway 15-33.

Table 6-8 shows the cumulative percentages of aircraft that can exit at each of the proposed taxiways. It shows that all small and most twin-engine aircraft (weighing 12,500 pounds or less) can exit prior to or at the new taxiway near the glide slope after landing on Runway 6. Heavy/large aircraft would have the full-length available and could use Taxiway C to taxi back to the terminal or North Ramp. All single and twin-engine aircraft landing on Runway 24 would be able to exit prior to the Runway 15-33 intersection. Large/heavy aircraft or commercial aircraft would have some opportunity to exit prior to the Runway 15-33 intersection. This alternative would limit runway crossings, especially those in the high-energy portion of the runway, and maintain or improve existing aircraft flow.

Figure 6-7: Runway 6-24 Taxiway Alternative 2

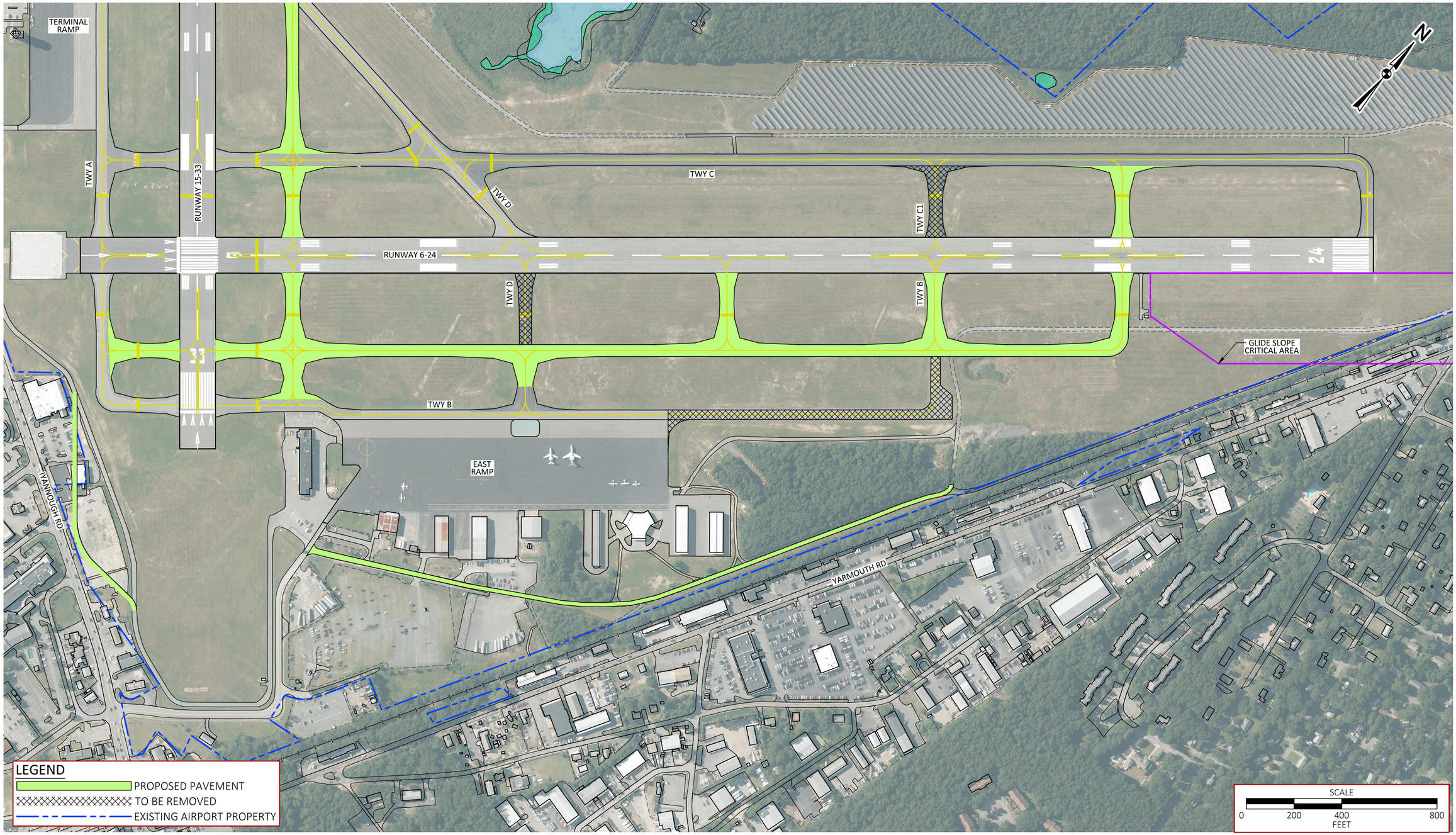

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Table 6-8: Runway 6-24 Taxiway Alternative 2 Exit Taxiway Percentages

	Runway 6 Landing		Runway 24 Landing	
	Dry	Wet*	Dry	Wet*
New Taxiway Near Glide Slope	Single: All Twin: 81%	Single: 99% Twin: 41%	None	None
Taxiway B (East only)	Single: All Twin: 55%	Single: 97% Twin: 22%	Single: 67% Twin: None	Single: 40% Twin: None
Midfield Taxiway (East only)	Single: 93% Twin: 7%	Single: 75% Twin: None	Single: 99% Twin: 24%	Single: 89% Twin: 4%
Taxiway D Acute-Angled	N/A	N/A	Single: All Twin: 74% Heavy: 7%	Single: 98% Twin: 35% Heavy: None
New Parallel North of Runway 15-33	None	None	Single/Twin: All Heavy: 24%	Single/Twin: All Heavy: 4%

* This only includes wet runways and does not include snow, ice, or other runway contamination.
Sources: FAA AC 150/5300-13A and McFarland Johnson analysis, 2021.

This alternative was assessed against the four evaluation factors; the results are below:

- **Meets FAA Standards:** This alternative meets FAA design standards by providing a standard 400-foot runway-taxiway centerline separation, eliminating high energy intersections, and addressing direct access and non-standard runway-taxiway intersection angles.
- **Meets Facility Requirements:** This alternative meets facility requirements by minimizing taxi distance and opening up space available for aviation development currently not available due to the larger than standard Runway 6-24 to Taxiway B separation.
- **Is Constructable**: This alternative is constructible and attempts to use existing pavement whenever possible.
- **Has Operational Impacts on Airport**: Taxiways were reviewed to make sure taxiways allow efficient Runway 6-24 exit opportunities. No operational impacts on the Airport have been identified.

Level 2 Runway 6-24 Taxiway Alternatives Comparison

Table 6-9 compares the Runway 6-24 Taxiway alternatives based on the Level 2 screening evaluation criteria.

As shown in **Table 6-9**, Runway 6-24 Taxiway Alternative 2 moves forward to Level 3 screening since it is the only alternative that meet FAA design and geometry standards.

Table 6-9: Level 2 Screening Runway 6-24 Taxiway Alternatives Comparison

Alternative	Meets FAA Standards	Meets Facility Requirements	Is Constructable	Has Operational Impacts	Passes Level 2
No Build	No	No	N/A	None	No: Does not meet FAA Standards
Runway 6-24 Taxiway Alternative 2	Yes	Yes	Yes	None	**Yes**

Source: McFarland Johnson analysis, 2021.

Level 2 Screening Alternatives Moving Forward

The alternatives identified as being carried forward to Level 3 are:

- Runway 15-33 Meets Most Requirements, Enhanced Land Use Compatibility
- Runway 33 EMAS
- Runway 15-33 RSA/ROFA Incremental Improvements
- Runway 15-33 RPZ Incremental Improvements
- Runway 24 EMAS
- Runway 6-24 RSA Determination
- Runway 6-24 RPZ Incremental Improvements
- Runway 15-33 Taxiway Alternative 2
- Runway 6-24 Taxiway Alternative 2

The above alternatives are combined into two alternatives. Both alternatives include projects that provide incremental improvements to FAA design and geometry standards. Since the Runway 33 EMAS provides operational improvements, it is the only variable factor. The following two combined alternatives have been carried forward to Level 3 screening:

- Most Requirements, Enhanced Land Use Compatibility with Runway 33 EMAS (see **Figure 6-8**)
- Most Requirements, Enhanced Land Use Compatibility without Runway 33 EMAS (see **Figure 6-9**)

Figure 6-8: Most Requirements, Enhanced Land Use Compatibility With Runway 33 EMAS

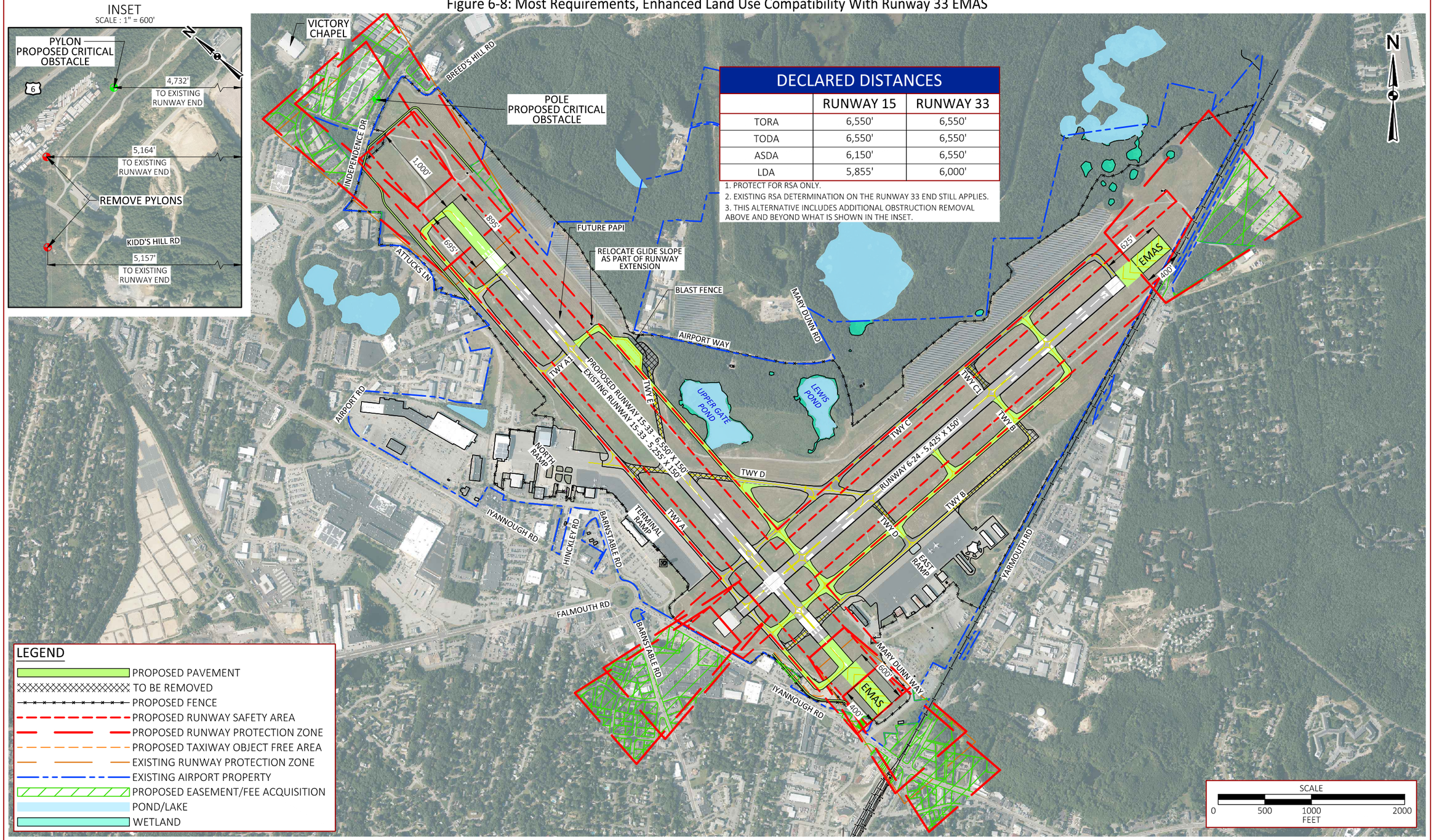

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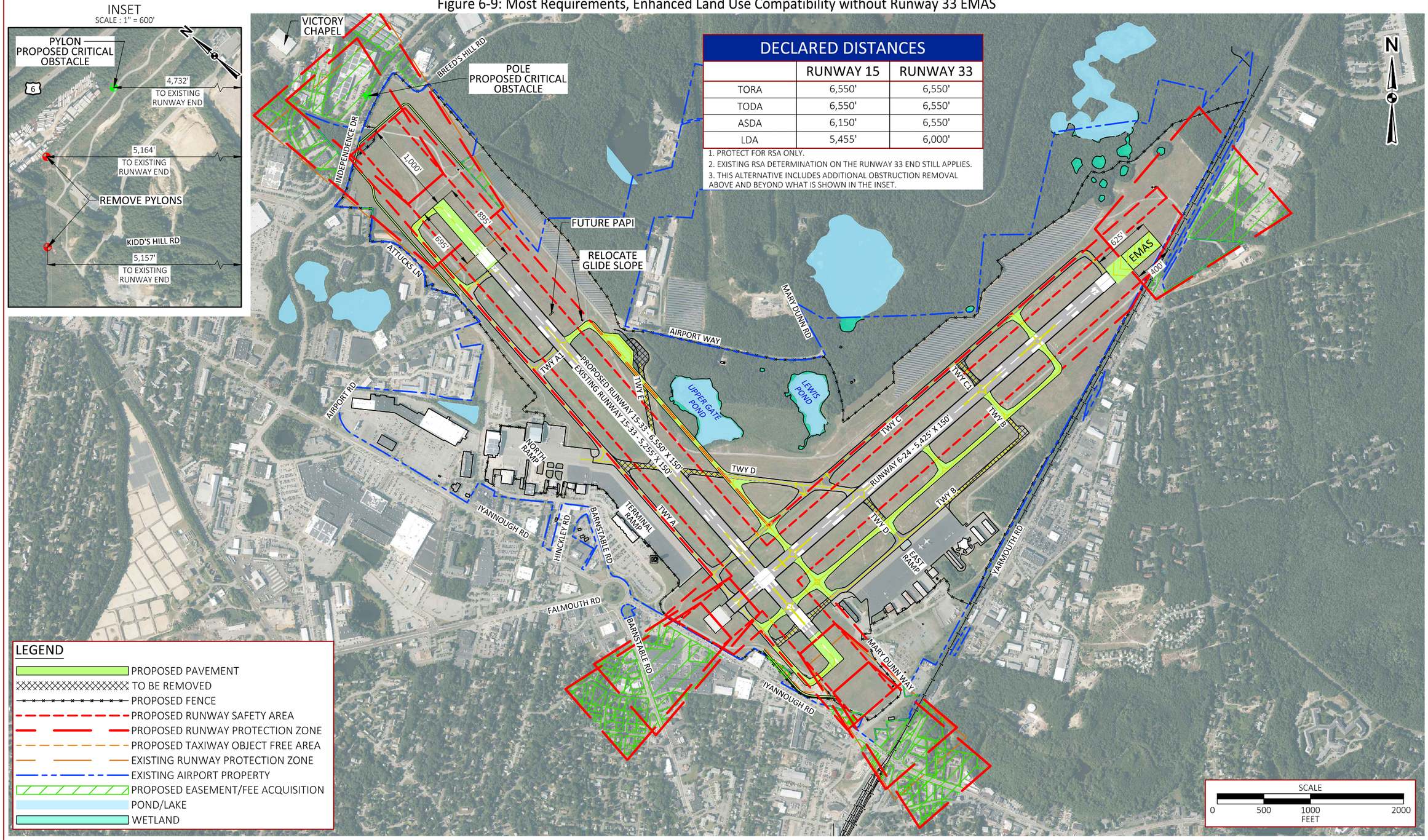
Figure 6-9: Most Requirements, Enhanced Land Use Compatibility without Runway 33 EMAS



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6.2.3. Level 3 Screening: Environmental Impacts

This screening level looks at the remaining alternatives to assess potential impacts to the surrounding environment including wetlands, ponds, vernal pools, priority habitats of rare species, estimated locations of other habitats of rare wildlife, and farmland soils of statewide importance. A summary of the impacts is shown in Table 6-10.

Table 6-10: Level 3 Screening Summary

Alternative	Has Higher Environmental Impacts Over Other Alternatives	Increases New Impervious Surfaces >5 Percent of Airport Property	Passes Level 3
Most Requirements, Enhanced Land Use Compatibility with Runway 33 EMAS	No	No	Yes
Most Requirements, Enhanced Land Use Compatibility without Runway 33 EMAS	No	No	Yes

Source: McFarland Johnson, 2021.

Both remaining alternatives were deemed to have similar environmental impacts including no vernal pool or habitat of rare species/wildlife impacts. The environmental constraints on and around the Airport can be seen in Chapter 3, *Environmental Overview*, Figure 3-17.

Both alternatives have the same environmental impacts, as follows:

- 4.7 acres of farmland soils of statewide importance on Airport property surrounding the Runway 15 end
- 4.3 acres of wetland buffer and pond buffer impact including the 200-foot wetland buffer put in place by the Cape Cod Commission around Upper Gate Pond due to the new northeast parallel taxiway to Runway 15-33
- 0.2 acres of pond impact to Upper Gate Pond due to the new northeast parallel taxiway to Runway 15-33

The difference between the two alternatives is the new impervious pavement:

- The alternative with the Runway 33 EMAS proposes the construction of approximately 27 acres of new impervious pavement. This additional pavement is equivalent to paving an additional approximately 4.2 percent of the Airport property. The Airport is currently approximately 15.4 percent paved.
- The alternative without the Runway 33 EMAS proposes the construction of approximately 25 acres of new impervious pavement. This is equivalent to paving an additional approximately 3.9 percent of the Airport property. The Airport is currently approximately 15.4 percent paved.

Following the Master Plan, projects will be reviewed in detail through the Cape Cod Commission, MEPA, and NEPA processes.

Level 3 Screening Alternatives Moving Forward

The only difference is the amount of new impervious pavement on the airfield. Since the difference between the two alternatives is minor (additional 0.3 percent of Airport property being paved), both alternatives have similar environmental impacts and therefore are carried forward to the Level 4 screening.

6.2.4. Level 4 Screening: Broader Community Impacts

Broader community impacts reviewed as part of this screening level include balanced impacts to the neighborhoods around the Airport (rather than one neighborhood being disproportionately affected) and travel flexibility for Cape Cod residents. An alternative summary is provided in **Table 6-11**.

Table 6-11: Level 4 Screening Summary

Alternative	Balances Operational Impacts	Creates Travel Flexibility and Convenience	Passes Level 4
Most Requirements, Enhanced Land Use Compatibility with Runway 33 EMAS	Yes	Yes	**Yes**
Most Requirements, Enhanced Land Use Compatibility without Runway 33 EMAS	Yes	Yes	**Yes**

Source: McFarland Johnson, 2021.

Both alternatives create increased travel flexibility and convenience for Cape Cod residents. Both alternatives aim to create a balanced approach to operational impacts. Both alternatives differ from the 2008 Master Plan by balancing impacts, while the 2008 Master Plan alternative could result in undue burdens on specific neighborhoods. There is no change to the Runway 33 landing location from existing conditions for either alternative. It is the goal of the Airport to make sure that no neighborhood is disproportionately affected compared to any another by aircraft operations.

Since both alternatives have the same runway ends, both have the same common broader community impacts.

Level 4 Screening Alternatives Moving Forward

Both alternatives have the same broader community impacts and therefore are carried forward to the Level 5 screening.

6.2.5. Level 5 Screening: Cost

Both remaining alternatives were reviewed for construction costs and operational costs. The sole difference between the remaining alternatives is the construction of the Runway 33 EMAS. The cost of constructing an EMAS is high (approximately $7-8 million) and there are operational/maintenance costs associated with EMAS. Operational costs include inspections by both staff and manufacturers (approximately $66,000-$80,000 every three years). Maintenance

costs include the cost of replacing the EMAS components (bricks) every 10 years (approximately $5-6 million). **Table 6-12** compares the cost evaluation criteria of both alternatives.

Table 6-12: Level 5 Screening Summary

Alternative	Relative Construction Cost	Operational Cost	Passes Level 5
Most Requirements, Enhanced Land Use Compatibility with Runway 33 EMAS	High	Medium	No
Most Requirements, Enhanced Land Use Compatibility without Runway 33 EMAS	Medium	Low	**Yes**

Source: McFarland Johnson analysis, 2021.

Level 5 Screening Alternative Moving Forward

The alternative moving forward as the Preliminary Airside Recommendation for the ALP is Most Requirements, Enhanced Land Use Compatibility without Runway 33 EMAS due to the lower construction and operational costs. Since most operations currently operate in the summer peak season, aircraft can operate with limited weight and route penalties without the additional 400 feet of additional accelerate stop distance available and landing distance available that an EMAS on the Runway 33 end would provide for Runway 15 operations. Space is available to construct an EMAS near the Runway 33 threshold should conditions change.

6.2.6. Preliminary Airside Recommendation for the ALP

The result of the five screening levels identifies the alternative, Most Requirements, Enhanced Land Use Compatibility Without Runway 33 EMAS, as the Preliminary Airside Recommendation for the ALP. The preference of this alternative does not preclude an EMAS from being constructed in the future should one be deemed necessary to improve safety standards. The Preliminary Airside Recommendation for the ALP is shown in **Figure 6-10**. This alternative includes the following projects:

- Extend Runway 15-33 by 895 feet (including 695-foot displaced threshold) on the Runway 15 end and 400 feet of displaced threshold on the Runway 33 end. This includes the relocation of navigational and visual aids near the Runway 15 end.
- Extend Taxiway A to the proposed Runway 15-33 ends.
- Acquire the Runway 33 RSA and ROFA properties on a willing seller basis.
- Acquire the proposed Taxiway A TOFA properties on a willing seller basis.
- Enhance Airport control over RPZ properties for all runway ends in easement or fee on a willing seller basis.
- Construct a partial parallel taxiway at a standard 400-foot separation east of Runway 15-33 from Taxiway B to across from Taxiway A1.
- Construct a runup area along the north side of the proposed partial parallel taxiway.
- Remove Taxiway E and the existing runup pit.
- Remove the portion of Taxiway D between the proposed partial parallel taxiway and Taxiway A.
- Construct a 200-foot by 400-foot EMAS near the Runway 24 end/Runway 6 departure end. This project includes reviewing to see if any incremental improvements can be made to

the Runway 24 RSA prior to the landing threshold, such as moving the fence, trimming trees, etc.

- Move Taxiway B to a standard 400-foot separation south of Runway 6-24 and extend it north until it is located south of the existing glide slope and the TOFA remains clear of the glide slope.
- Remove Taxiway C1 between Runway 6-24 and Taxiway C.
- Construct a midfield taxiway from Taxiway B to Runway 6-24.
- Remove Taxiway D between Runway 6-24 and the proposed Taxiway B location.

The Preliminary Airside Recommendation for the ALP meets the most requirements with the least amount of impact. This alternative balances the need to meet FAA design standards and Airport facility requirements, while minimizing obstruction removal, environmental impacts and is considered to be constructible with few challenges.

6.3. TERMINAL ALTERNATIVES

6.3.1. Summary of Terminal Space Deficiencies

As described in detail under Chapter 5, *Facility Requirements,* Section 5.3, the terminal building has an overall deficiency of between 5,000 – 10,000 square feet (SF) to meet the projected 150 peak hour passenger requirements and 20,000 – 25,000 SF to meet the projected 200 peak hour passenger requirements. The primary areas needing additional space for proper function include:

- Secure holdroom
- Security screening checkpoint and queue area
- Outbound baggage screening and make up
- Baggage claim and inbound baggage handling

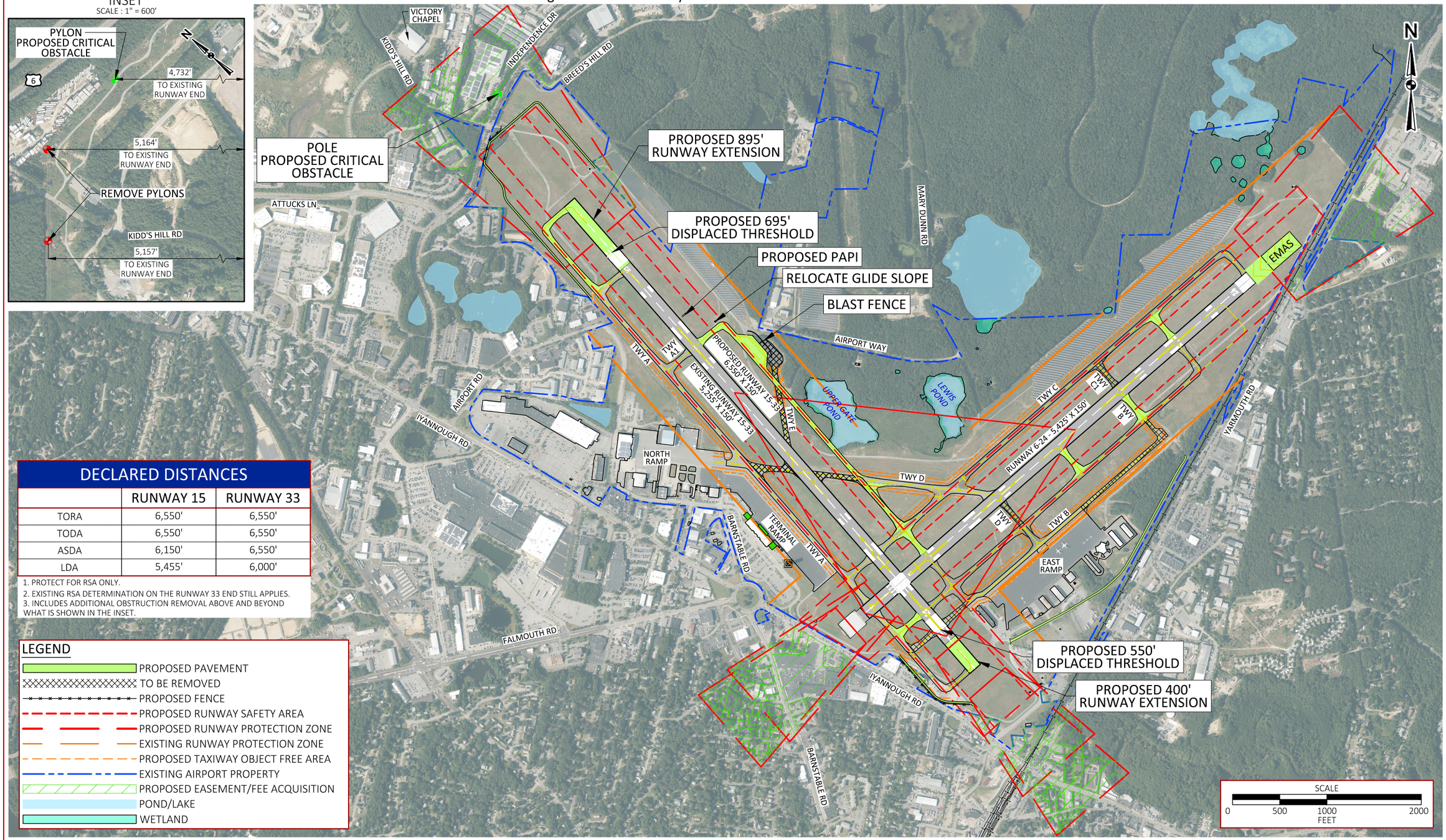
The relative age of the existing terminal building (less than 20 years) and the availability of some land to the north and south of the building (currently parking lots) suggests that a reconfiguration and expansion approach to accommodate additional space needs is preferable to an entirely new facility. **Figure 6-11** shows the existing terminal expansion opportunities.

The terminal functions uniquely in that it handles both secure and non-secure departures. This hybrid departures model is expected to continue forward for the foreseeable future. The secure and non-secure holdrooms are separated by a central outbound bag screening/make up area. This terminal layout results in efficient ramp operations and effective separation of screened and unscreened passengers as shown in **Figure 6-12**. Accordingly, any future reconfiguration and/or expansion is expected to maintain the general organizational layout of the terminal primary departure functions.

Certain functions with deficient space allocation (security checkpoint and baggage claim) are proximate to spaces which could benefit from relocation or repurposing for most efficient use of available space, creating an opportunity to address some of the space deficiencies within the existing

PLANNING CONSIDERATION
An EMAS at the Runway 33 end is an option should destination distances increase and operations expand further outside of the peak season.

Figure 6-10: Preliminary Airside Recommendation for the ALP



DECLARED DISTANCES		
	RUNWAY 15	RUNWAY 33
TORA	6,550'	6,550'
TODA	6,550'	6,550'
ASDA	6,150'	6,550'
LDA	5,455'	6,000'

1. PROTECT FOR RSA ONLY.
2. EXISTING RSA DETERMINATION ON THE RUNWAY 33 END STILL APPLIES.
3. INCLUDES ADDITIONAL OBSTRUCTION REMOVAL ABOVE AND BEYOND WHAT IS SHOWN IN THE INSET.

LEGEND

- PROPOSED PAVEMENT
- TO BE REMOVED
- PROPOSED FENCE
- PROPOSED RUNWAY SAFETY AREA
- PROPOSED RUNWAY PROTECTION ZONE
- EXISTING RUNWAY PROTECTION ZONE
- PROPOSED TAXIWAY OBJECT FREE AREA
- EXISTING AIRPORT PROPERTY
- PROPOSED EASEMENT/FEE ACQUISITION
- POND/LAKE
- WETLAND

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Figure 6-11: Existing Terminal Expansion Opportunities

Source: Fennick McCredie Architecture Ltd.

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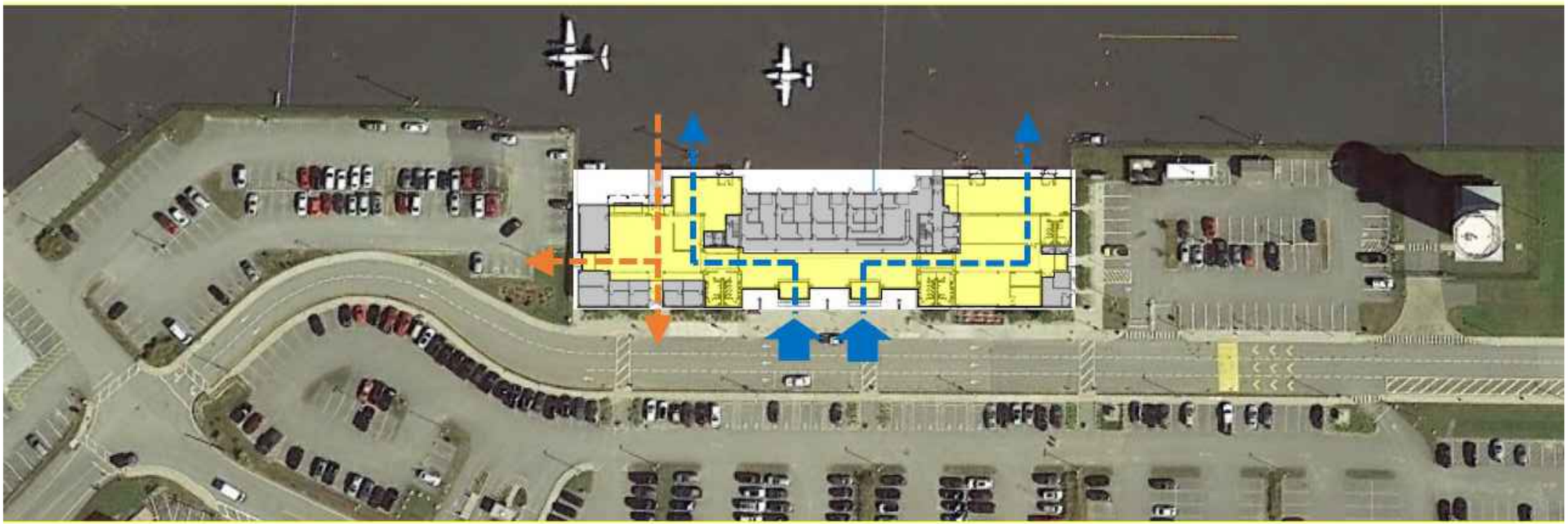
Figure 6-12: Existing Terminal Public Passenger Flow



Source: Fennick McCredie Architecture Ltd.

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building footprint via reconfiguration. Existing space deficiencies are shown in Figure 6-13.

Discussions with the Airport and stakeholders revealed the following core principles should form the basis for the evaluation and designation of a preferred alternative:

- Maximize efficiency and 'highest best use' of existing building space and infrastructure.
- Account for future trends in travel including new technology, aircraft service typologies, and ground transportation options.
- Improvements involving increased terminal space to be incrementally phased in line with available funding and to avoid 'overbuild'.
- Provide flexibility in implementation approach to effectively address evolving market demand, support airport revenue goals, meet traveler and operator needs, and maximize benefits to the Cape Cod Community.

6.3.2. Alternatives Studied to Address Space Deficiencies

The following primary alternatives were studied to establish the preferred approach to addressing the terminal space deficiencies forecasted within the 20-year planning horizon and are shown in Figure 6-14.

Terminal Alternative 1: Current Functional Organization, Existing Envelope

This alternative has the advantage of zero impact to adjacent parking areas and other site infrastructure. However, studies of various 'interior-only' reconfiguration options were unsuccessful in resolving all space deficiencies identified in the 150 peak hour passenger analysis. Therefore, Terminal Alternative 1 is not viewed as a viable long-term solution to accommodate the passengers and operational needs for the forecasted demand.

Terminal Alternative 2: Current Functional Organization, Incremental Improvements

This alternative envisages a combination of reconfiguration of existing interior space for maximum efficiency of use and isolated building additions to accommodate increased passenger and baggage demand in key areas. Interior reconfiguration allows for the additions to be smaller than would otherwise be required. In this alternative, the reconfiguration would maintain the basic terminal organization: a single terminal with secure departures to the south, arrivals/non-secure departures to the north, with airline operations/ticketing in the center.

Terminal Alternative 2 has the added advantage of a feasibly phased implementation. As such, improvements could begin with interior reconfiguration for maximum efficiency and in the future, follow-on with one or multiple isolated space additions, as appropriate, to meet demand and as funding becomes available.

Terminal Alternative 3: New Functional Organization, Incremental Improvements

This alternative changes the core functional organization of the terminal building. Rather than a single terminal with departures and arrivals at each end, the terminal is re-organized to be a secure terminal on the south end (with both departures and arrivals/bag claim functions), and an

attached, but functionally independent, non-secure terminal at the north end with its own departures and arrivals/bag claim functions for non-secure flights.

The advantage of this approach is improved passenger flow, allowing secure arrivals/departures to remain contained at one end of the terminal and eliminating the need for secure arrivals to traverse the ramp or terminal to access baggage claim at the north end. However, the capital and operational cost for duplication of baggage claim is not warranted by the level of air traffic. Also, the future of the non-secure departures is uncertain, as security requirements can and do change over time, as do airline flight schedules and destinations. Accordingly, Terminal Alternative 3 is not viewed as a viable long-term solution to accommodate the passengers and operational needs for the forecasted demand.

6.3.3. Preferred Terminal Alternative

Based upon the above core principles and evaluation of each alternative, Terminal Alternative 2 has been deemed the preferred alternative to address the forecasted demand of the terminal facilities.

As part of this analysis, the feasibility of an incrementally phased interior reconfiguration, coupled with a minor addition and allowing for future additional space expansions to ultimately meet the demand of 150 or 200 peak hour passengers, was completed and deemed viable This phased approach is shown in Figures 6-15 and 6-16. The approximately 19 rental parking spaces displaced with the expansion are anticipated to be accommodated in the main parking lot.

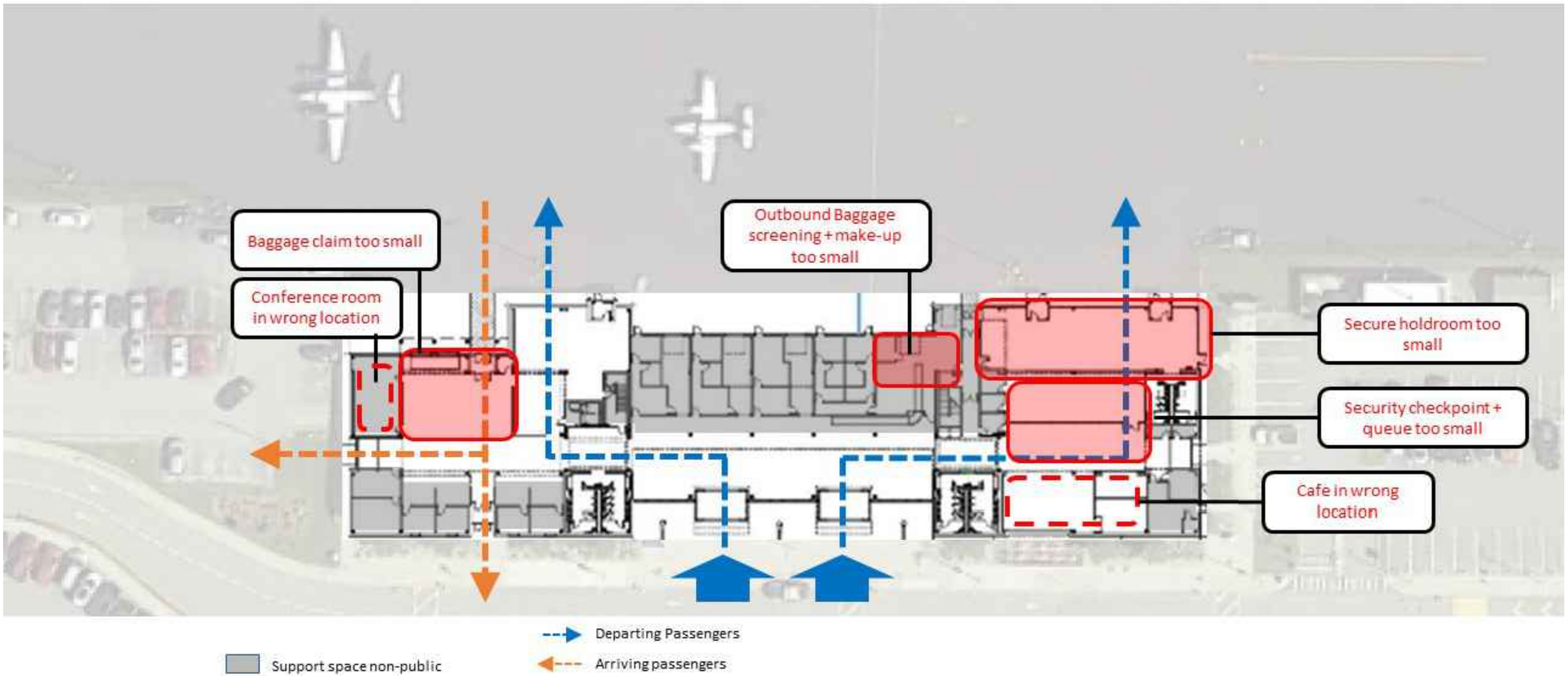
Phased Implementation

Modest alterations and improvements can be implemented over time in smaller individual pieces. This series of smaller projects allows the Airport maximum flexibility in addressing the evolving needs of airlines and the Transportation Security Administration (TSA) without over-investing in the needs of the moment. Prioritizing the re-purposing of existing interior space provides a pathway to significant improvements with minimal investment.

Phase 1 (Figure 6-15) identifies opportunities for re-purposing of existing space to alleviate current space deficiencies in key public areas/functions to meet 150 peak hour passenger demand. These opportunities include:

- Conversion of the existing first floor conference room to connect with and enlarge the existing bag claim area (currently significantly undersized). As part of this conversion the existing baggage slide would be extended – doubling the linear frontage for accessing of bags by passengers. Overall bag claim passenger floor space would be increased by 40 percent without need for any expansion of this building.
- Conversion of the existing restaurant/kitchen space in one of the two following ways:
    - Connect with and enlarge the TSA passenger security checkpoint queue area. Included in this conversion could be a small soft seating lounge for departing passengers who may have arrived early and are awaiting checkpoint opening. Additionally, this area could be used as a holdroom overflow space (holding of departing passengers pre-security when the current secure holdroom is at or near capacity). This latter 'overflow' functionality is particularly beneficial during

Figure 6-13: Existing Terminal Space Deficiencies



Source: Fennick McCredie Architecture Ltd.

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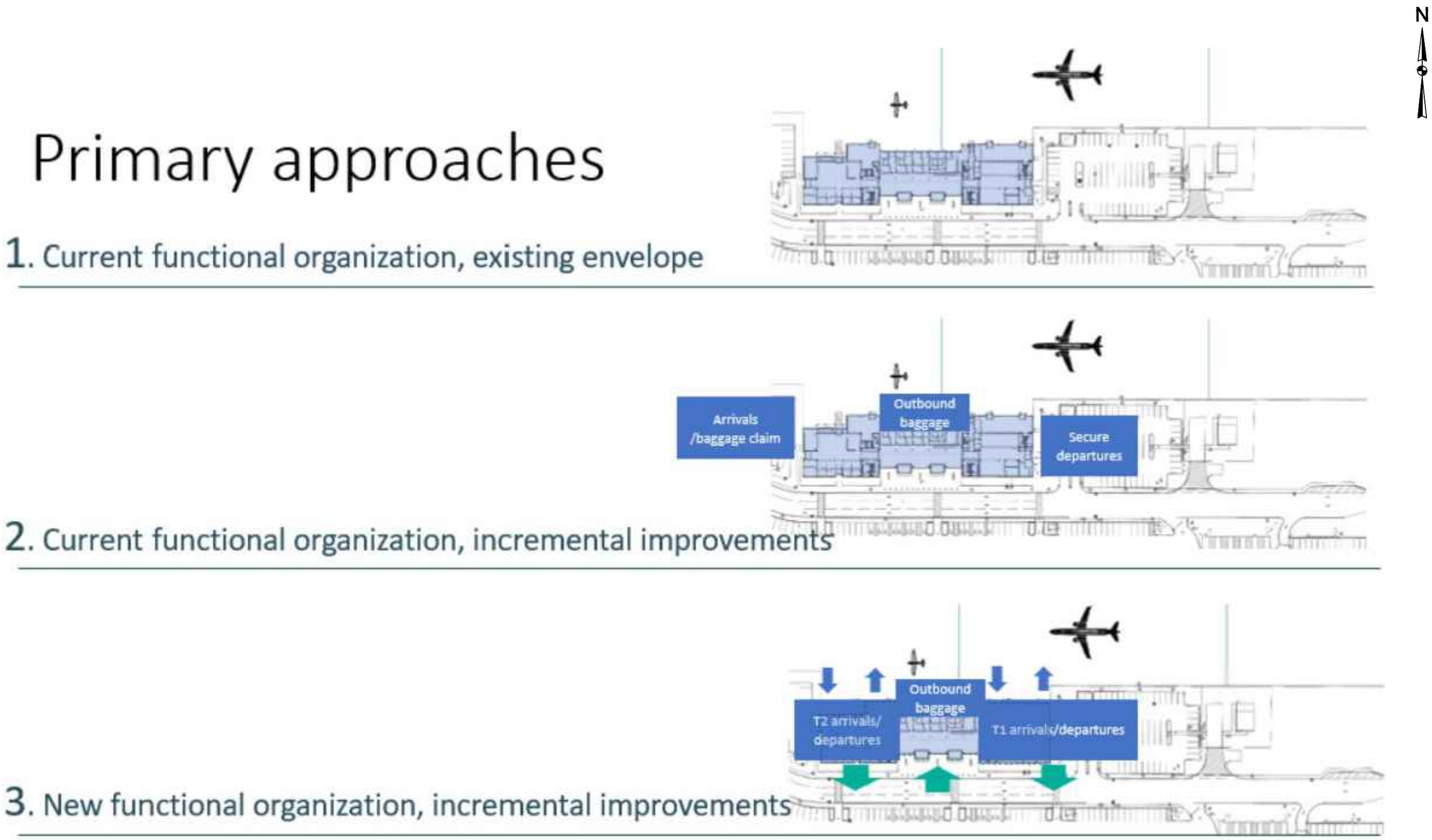
Figure 6-14: Primary Approach Terminal Alternatives



Source: Fennick McCredie Architecture Ltd.

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Figure 6-15: Preferred Terminal Alternative 2: Example Components of Phase 1 Reconfiguration

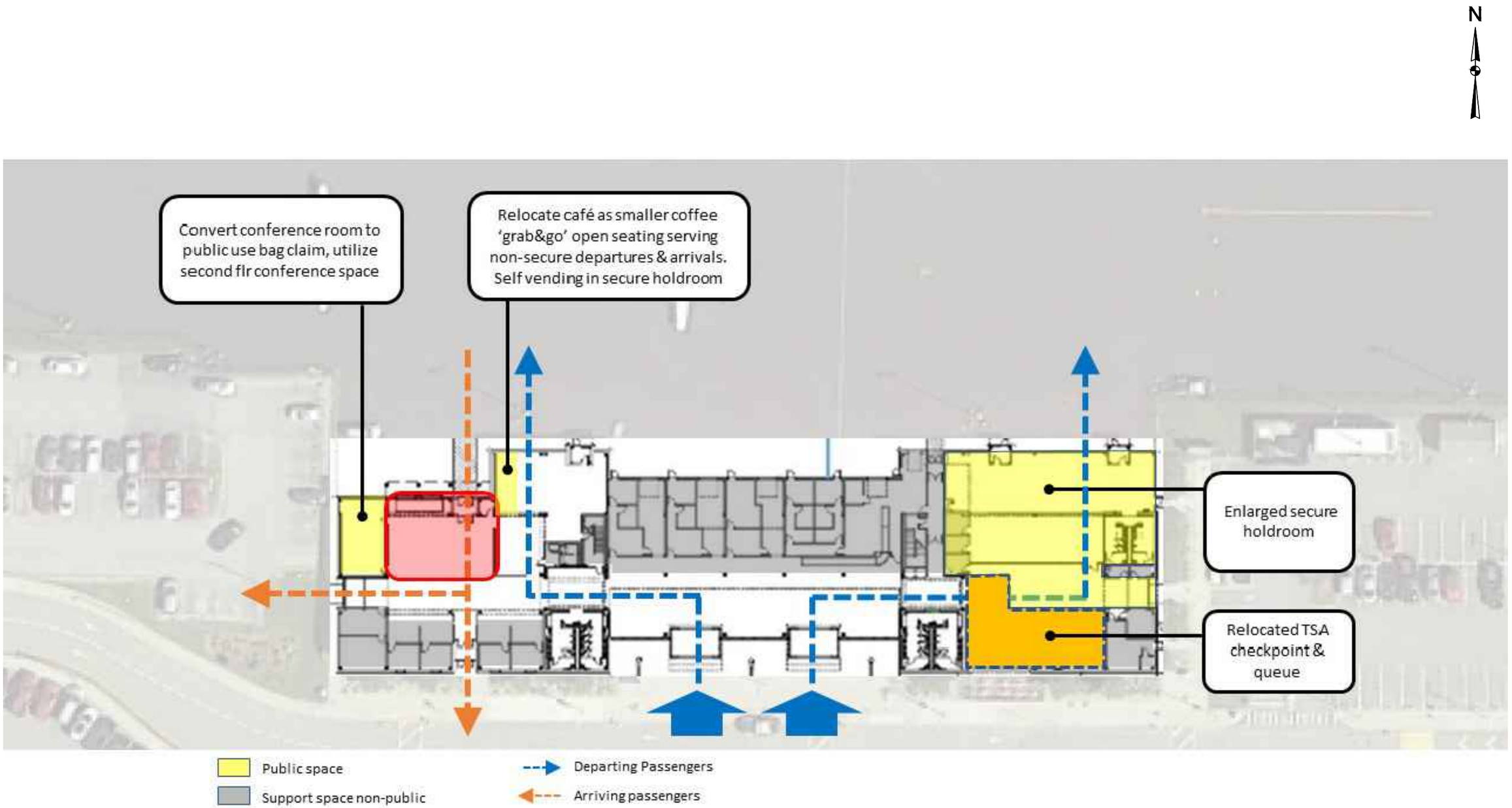

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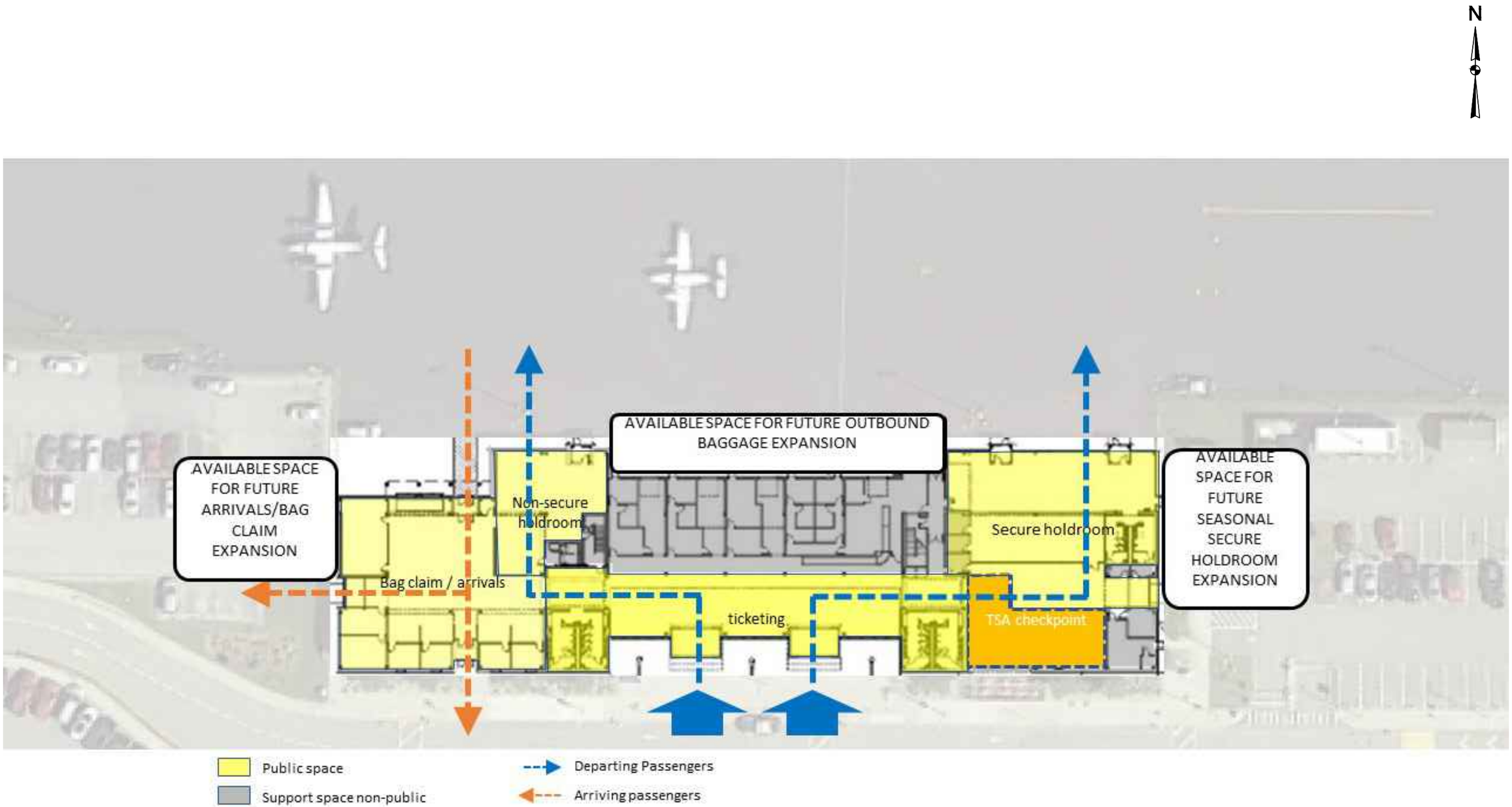
Figure 6-16: Preferred Terminal Alternative 2: Example Components of Phase 2 Reconfiguration



Source: Fennick McCredie Architecture Ltd.

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weather events which delay departing flights, as well as pandemic conditions, where social distancing is required in the secure holdroom. In either case (early arrivals or holdroom overflow), the existing exterior patio combined with interior soft seating and vending could provide a comfortable, and when necessary, socially-distanced environment for waiting departing passengers who cannot yet access the secure holdroom. In effect, this approach allows for an increase in departing passenger capacity of the terminal without requiring new construction.
    - Relocation of existing TSA passenger checkpoint into the existing restaurant space, effectively increasing the size of the secure holdroom.
- Installation of a new food and beverage counter at the existing non-secure departures area. This counter operation would be smaller than the current restaurant space and located adjacent to the bag claim. This new counter would more appropriately service the needs of passengers as well as meeters/greeters in the arrivals area.

Phase 2 (Figure 6-16) identifies strategies for cost-effective, targeted increases in key terminal space functions. Such increases would be implemented subsequent to Phase 1 repurposing and would be triggered by 200 peak hour passengers. Key guidelines for the planning and design of Phase 2 improvements include:

- Location of any new construction should occur at existing impervious areas to the greatest extent possible.
- Design of new construction should address the seasonal nature of passenger demand at the Airport. Potential strategies include semi-permanent fabric structures or permanent structures able to be closed off during low-demand seasons.
- New construction should be flexible in how it can be utilized as the aviation industry evolves over time. For example, modular construction may be used for car rental functions, in recognition of the increase in rideshare usage and the potential decrease in car rental space needs over time.
- Construction should support sustainability goals of the Airport and community, as well as anticipating future trends towards electric zero-emissions aircraft and ground transportation.

Anticipated components of Phase 2 construction include:

- Relocation of car rental counters and offices to a separate exterior building (potentially cost-effective modular construction). Such relocation would allow for significant increase in baggage claim/arrivals hall interior space to meet current space standards without the need for a major building expansion. Utilization of a modular building for this purpose would allow for ease of relocation in long-term if a second baggage claim is needed (likely in excess of 200 peak hour passengers).
- Expansion of the existing TSA baggage screening room (currently undersized) at the rear of the existing terminal.
- Construction of a seasonal holdroom space (potentially a fabric structure or permanent structure capable of being closed off-season) at the existing parking lot to the southeast of the existing secure holdroom.

6.4. GENERAL AVIATION ALTERNATIVES

The Airport currently has two GA areas on the airfield: North Ramp and East Ramp. This section looks at potential areas on the airfield that could be used for future development of aeronautical activities.

6.4.1. Summary of General Aviation Facility Requirements

In Chapter 5, *Facility Requirements*, GA needs were assessed for both existing and future demand. The following needs were identified:

- Up to six additional individual hangars
- Up to eight new conventional hangars of various sizes
- Up to 67,000 SF of additional ramp space

The GA needs of the Airport will be based on demand. However, the Airport should plan for aeronautical development both for the identified needs as well as opportunities that may come up should GA growth occur faster than forecast.

6.4.2. General Aviation Development Areas

Two areas were identified for GA development: one near the North Ramp and one off the East Ramp. On the North Ramp, approximately 8.7 acres of land were identified north of the existing ramp and west of Taxiway A. On the East Ramp, approximately 31.3 acres of land were identified north and east of the existing East Ramp. With the relocation of Taxiway B, space was opened that was previously occupied by the taxiway. Potential uses for the development areas are:

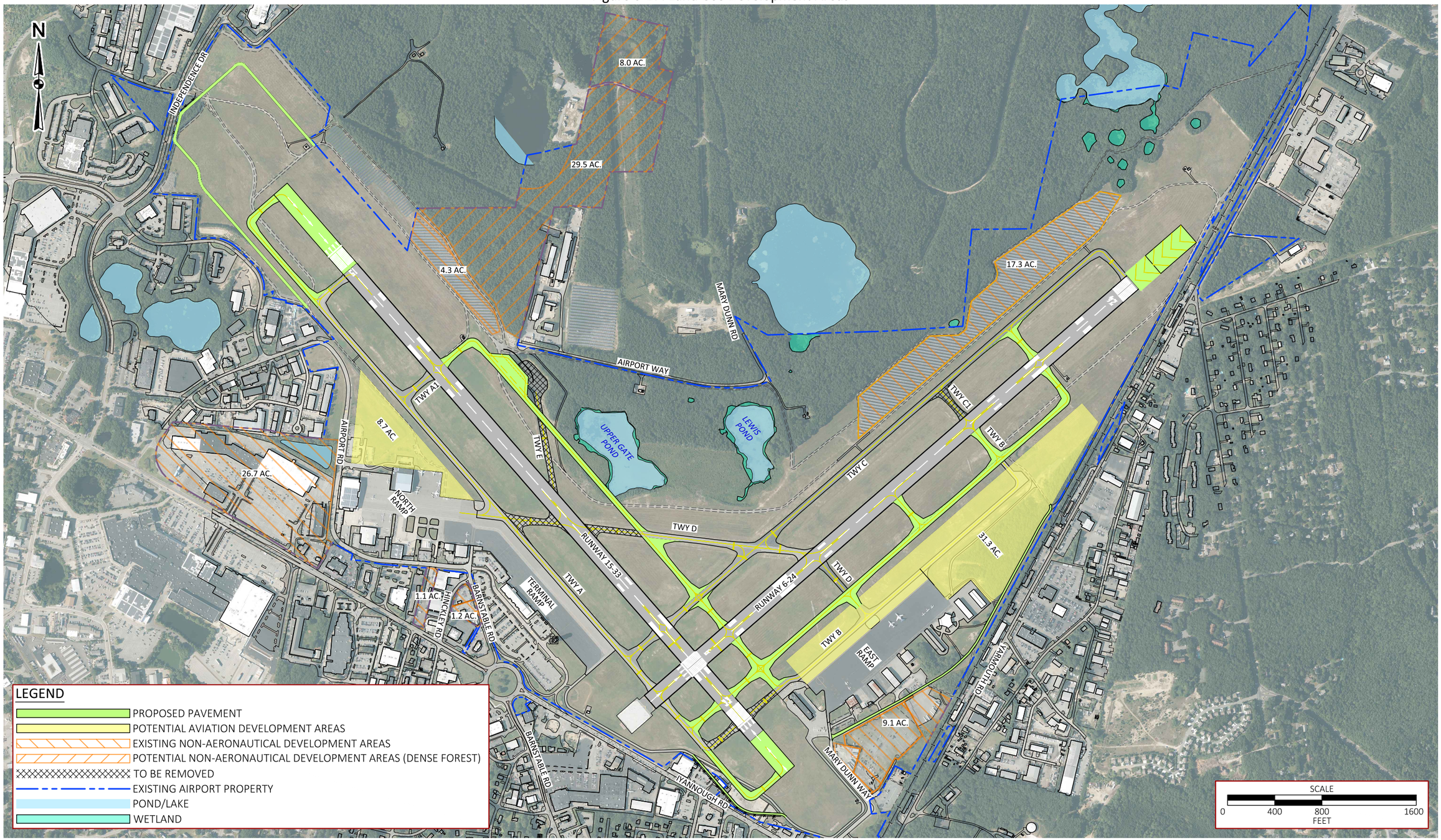
- Aviation education center
- Aviation museum
- New hangars (on demand basis)
- New ramp space (on demand basis)
- Aviation businesses including maintenance, charters, or flight schools

Figure 6-17 shows the planned development areas for the North and East Ramps. The areas identified meet and exceed the facility requirements identified in Section 6.4.1.

6.4.3. Non-Aeronautical Land Use Development Areas

Potential non-aeronautical development areas were identified and are shown in Figure 6-17. There are three non-aeronautical land use development areas located west of the Airport, one located south of the Airport, one located north of Runway 24, and three located east of Runway 15. Currently all identified areas are being leased except for the densely forested area. These areas total approximately 97.2 acres. Highest and best use of these areas will be reviewed in Chapter 7, *Implementation Plan*.

Figure 6-17: Land Use Development Areas



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6.5. SUPPORT FACILITIES

In Chapter 5, *Facility Requirements*, support facility needs were identified as follows:

- Up to six electric aircraft parking for itinerant airplane ADG II aircraft (discussed further in Section 6.7, *Green Opportunities*)
- 20,000-gallon Jet-A fuel tank
- Self-service 100LL fueling option (discussed further in Section 6.5.1, *Aircraft Fueling*)

6.5.1. Aircraft Fueling

The Airport currently offers both Jet-A and 100LL Avgas fuel. All fueling is provided via full-service fuel trucks. The Airport has three 20,000-gallon Jet-A fuel tanks. These tanks are situated on a foundation pad that was constructed with the capacity to hold four fuel tanks. Additionally, there has been a desire at the Airport to add a self-fueling option for 100LL Avgas. The existing fuel farm has space for an additional 20,000-gallon Jet-A fuel tank to be constructed as demand arises. It is recommended that a card reader be installed to provide a 100LL self-fueling option.

6.5.2. Snow Removal Equipment/Maintenance Storage

Currently, there is not enough space in the snow removal equipment (SRE)/maintenance building to store all necessary equipment. A seasonal vehicle storage structure is recommended to be constructed on the northeast side of the Airport. This facility could function as winter vehicle and equipment storage in the summer and as summer vehicles and equipment storage in the winter.

6.5.3. Other Recommendations Beyond the Master Plan

Presently, there is no direct route to access the Airport. The four most common routes by which people are directed to the Airport include: Route 6 via Exit 68, Route 6 via Exit 72, Centerville via Falmouth Road, and Waterfront via Barnstable Road. Signage is also small and sometimes unclear. Speed limits are low and there are many stops for each route.

With the renaming of the Airport, there is an opportunity for rebranding and signage standardization. The FAA cannot fund projects located off Airport property. The Airport does and will continue to coordinate with the MassDOT Highway Division and the Towns of Barnstable and Yarmouth to improve and simplify roadway access and improve wayfinding. **It is recommended that a stand-alone signage study be conducted.**

In addition to the stand-alone signage study, based on the review conducted in Chapter 3, *Environmental Overview*, **it is also recommended that an invasive species plant management plan be created.**

6.6. GREEN OPPORTUNITIES

The Airport strives to be good stewards of the environment and continuously looks for opportunities to reduce its carbon footprint. In recent years, the Airport has put in place best management practices, as well as made changes to infrastructure to help reduce the environmental impact. For more details on best management practices employed by the Airport and changes to infrastructure, refer to Chapter 3, *Environmental Overview*, Section 3.1.3.

The Airport works and will continue working together with the Cape Cod Commission and the Town of Barnstable for any green opportunities that arise above and beyond the initiatives already identified by the Airport.

Green opportunities the Airport is actively considering include:

- Installing electric aircraft charging stations
- Installing electric vehicle charging stations
- Installing solar panels on vehicle awnings and hangars
- Modifying guidelines for construction to now include initiatives for green development

Electric aircraft opportunities continue to evolve. The Airport is reserving space on either side of the terminal to plan for electric aircraft charging for both GA and commercial aircraft as shown in Figure 6-18. As the technology continues to advance, more details will be planned for in terms of electrical access and charging options for aircraft, including if charging will occur via truck or in-ground connectivity.

Best management practices employed by the Airport include the following:

- Implementation of a designated aircraft deicing and washing facility
- Purchase of an Ecologic Cart system to prevent the discharge of firefighting foam onto the ground surface during annual, federally required, testing of the foam
- Perform regular inspections to inventory hazardous materials
- Elimination of the use Airport-wide of pesticides, road salt, and deicing chemicals

Infrastructure changes that have been made to the Airport include the following:

- Closure of multiple hangar floor drains and leaching pits
- Installation of engineered cap over approximately 2.25 acres of land historically used for the deployment of firefighting foam
- Installation and maintenance of five stormwater treatment units
- Installation and maintenance of seven bioretention basins that treat stormwater runoff
- Removal of five underground fuel storage tanks and their placement above ground with double wall containment systems
- Implementation of green technology
    - Installation of a seven megawatt solar array
    - Installation of roof mounted solar arrays on hangars
    - Upgrade street and parking lot lights to LED
    - Implementation of eight electric vehicle charging stations
    - Reduction of paper within airport administration office

The Airport also strives to be a leader for green opportunities within the aviation industry, as shown in the implementation of green technology and by continuing to identify opportunities for green technology in the aviation industry as listed above. The Airport plans to continue ongoing

Figure 6-18: Reserved for Supporting Electric Aircraft

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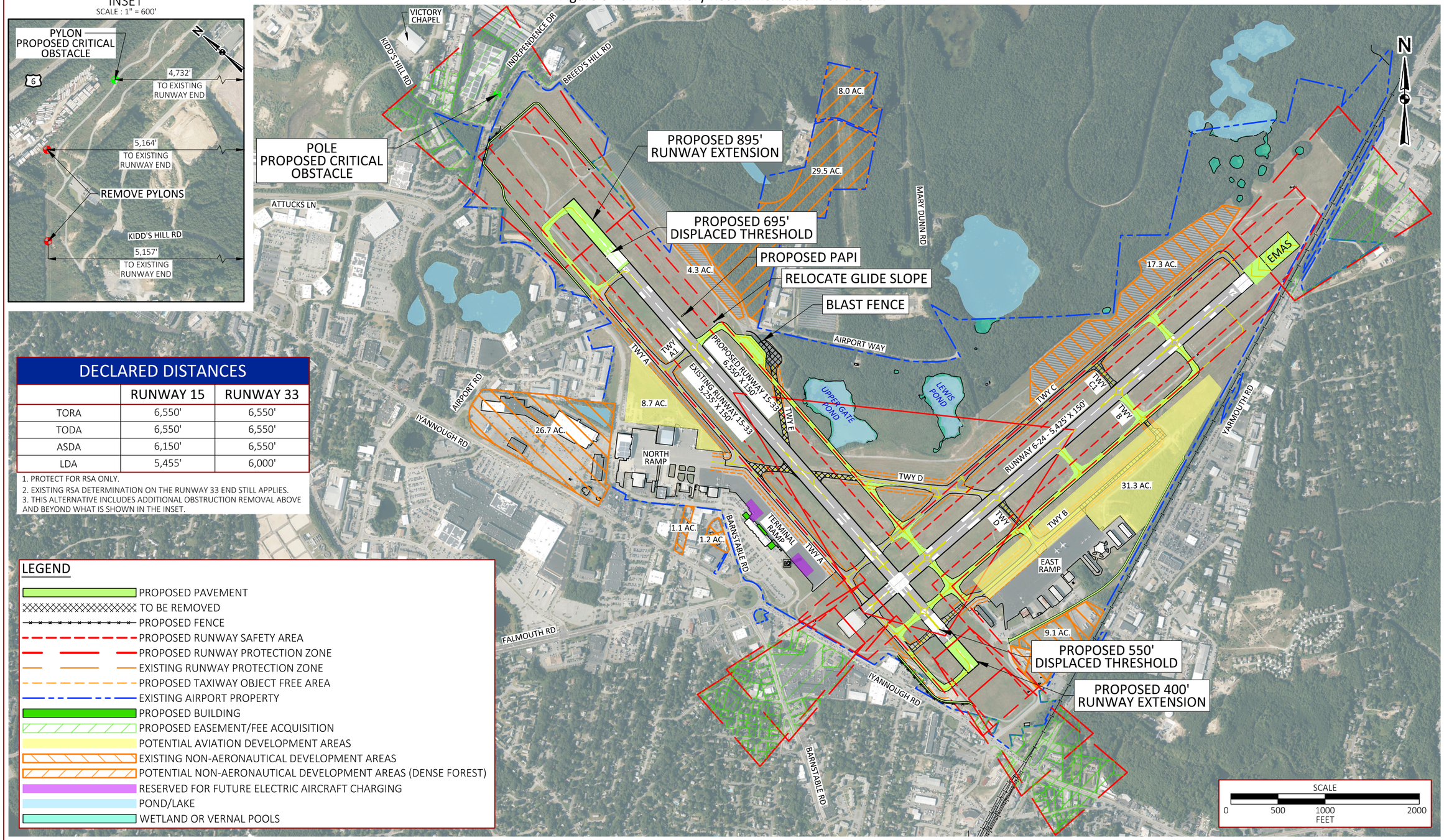
coordination efforts with the Cape Cod Commission, Town of Barnstable, and others to identify additional areas of green opportunities in the future.

6.7. PRELIMINARY RECOMMENDATION FOR THE AIRPORT LAYOUT PLAN

The Preliminary Recommendation for the ALP combines the recommended airside, terminal, and GA alternatives as well as green opportunities. This alternative is shown in **Figure 6-19**.

Figure 6-19: Preliminary Recommendation for the ALP



DECLARED DISTANCES		
	RUNWAY 15	RUNWAY 33
TORA	6,550'	6,550'
TODA	6,550'	6,550'
ASDA	6,150'	6,550'
LDA	5,455'	6,000'

1. PROTECT FOR RSA ONLY.
2. EXISTING RSA DETERMINATION ON THE RUNWAY 33 END STILL APPLIES.
3. THIS ALTERNATIVE INCLUDES ADDITIONAL OBSTRUCTION REMOVAL ABOVE AND BEYOND WHAT IS SHOWN IN THE INSET.

LEGEND

- PROPOSED PAVEMENT
- TO BE REMOVED
- PROPOSED FENCE
- PROPOSED RUNWAY SAFETY AREA
- PROPOSED RUNWAY PROTECTION ZONE
- EXISTING RUNWAY PROTECTION ZONE
- PROPOSED TAXIWAY OBJECT FREE AREA
- EXISTING AIRPORT PROPERTY
- PROPOSED BUILDING
- PROPOSED EASEMENT/FEE ACQUISITION
- POTENTIAL AVIATION DEVELOPMENT AREAS
- EXISTING NON-AERONAUTICAL DEVELOPMENT AREAS
- POTENTIAL NON-AERONAUTICAL DEVELOPMENT AREAS (DENSE FOREST)
- RESERVED FOR FUTURE ELECTRIC AIRCRAFT CHARGING
- POND/LAKE
- WETLAND OR VERNAL POOLS

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