SECTION 5: ALTERNATIVES ANALYSIS

PURPOSE

This section assesses alternatives, or development options in meeting the 20-year demand for Airport facilities identified in Section 4. As outlined below, the alternatives analysis involves three major sections:

Section 5.1 Impacts Per Primary Runway Length Options:
- 4,300' Runway (existing) - Constrained
- 5,000' Runway –Constrained (Preferred Option "J")
- 5,500' Runway - Unconstrained

Crosswind Runway Length Options:
- 3,700' Runway - Unconstrained

Section 5.2 Layout Alternatives for Future Airport Development Concepts:
- Runway Length/Siting Options
- Terminal Area Expansion Options (Preferred Option "B")

Section 5.3 Replacement Airport Site Analysis

The alternatives process systematically evaluates options to provide the technical basis necessary for arriving at a single, preferred development concept to carry-forward as part of the Airport Development Program and Airport Layout Plan (ALP) drawings.

Runway Length Options Under Consideration

The alternatives center around the planned, or ultimate, runway dimensions recommended for the Dare County Regional Airport:

5,500' 'Unconstrained ARC C-II': runway length to meet current Dare County business jet demand, and a length recommended by FAA and NCDOT, Division of Aviation (red group airport) to satisfy pure-jet runway length planning standards.

5,000' 'Constrained ARC B-II': An interim runway length to accommodate 50% to 70% of the general aviation business jet fleet (Category B, C & D jets), and the 'minimum' length recommended by NCDOT, Division of Aviation (red group airport).

4,300' 'Constrained ARC B-II': The longest existing runway length currently available (Runway 5-23), that is inadequate to meet business current jet demands, but establishes a baseline for assessing the operational and economic comparisons with 5,000' and 5,500'.

5.1 IMPACTS ASSOCIATED WITH RUNWAY LENGTH OPTIONS

MQI BUSINESS JET DEMAND / RUNWAY OPTIONS

The following identifies the demand for business jet operations at MQI throughout the 20-year planning period, and jet takeoff capabilities based on the 5,500', 5,000' and 4,300' runway length options. The purpose of this section is to explain the incremental benefits generated between each of the runway length options.

General Aviation Business Jet Comparisons (ARC B, C & D Jets)

The FAA's business jet database contains performance data for 61 jets models (ie, Citations, Falcon, Challenger, Learjet, Gulfstream, etc.), with the entire database fleet totaling 12,200 jets (2004 data). The 61 jets have profound differences in size, weight, speed and flight performances. From a runway length standpoint, the distinction between jets has important take-off, landing and accelerate-stop distance implications. Specifically, the range of differences corresponding to runway length requirements include: maximum jet takeoff weights ranging from 20,000 to 95,000 pounds, fuel payload capacities ranging form 1,200 to 4,000 gallons, seating from 4 to 15 passengers, and takeoff distances generally ranging from 4,000' to 6,500'.

Below is a list of representative Category B, C and D business jets, in which Category B are considered 'small-cabin' jets, and Category C & D are 'large-cabin' jets.

Representative Category B, C & D Business Jet Characteristics		
Small-Cabin Business Jets	Large-Cabin Business Jets	
CATEGORY B	CATEGORY C	CATEGORY D
45' to 50' Wingspan MTOW 15,000 to 25,000 lbs. 4 to 6 Passenger Seats 1,200 to 1,500 lbs. Pax. Load 1,200 NM Flight Range	45' to 60' Wingspan MTOW 25,000 to 45,000 lbs. 6-10 Passenger Seats 1,600 to 2,000 lbs. Pax. Load 2,000 NM Flight Range	60' to 100' Wingspan MTOW 45,000 to 90,000 lbs. 10+ Passenger Seats Stand-Up Cabin 2,200 to 2,800 lbs. Pax. Load 6,000 NM Flight Range

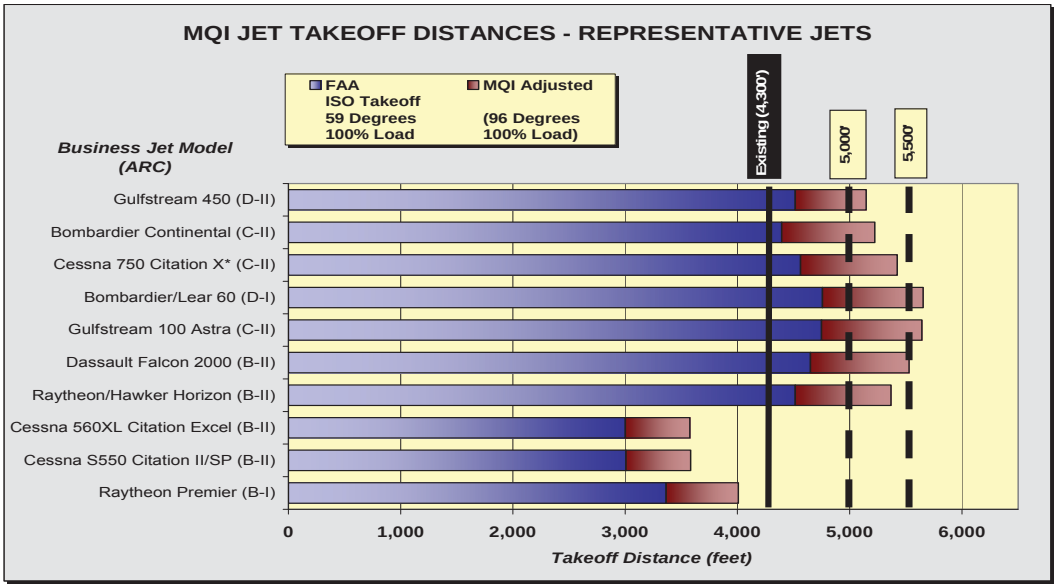
Category B Jets: 91 to 120 knot approach speed
Category C Jets: 121 to 140 knot approach speed
Category D Jets: 141 to 165 knot approach speed

Note: 1 Knot = 1.152 MPH

MQI Jet Takeoff Performance Capabilities – MQI Representative Jet Fleet

The graph below shows the adjusted takeoff distances of 10 representative jet models known to operate at the Dare County Regional Airport. Each jet shows two segments, the first is the FAA takeoff distance under standard atmospheric conditions, the second segment is the MQI adjusted takeoff distance compensated for mean high temperatures and 60% to 100% useful load. Of these, all 7 large-cabin jets exceed the

4,300' length, requiring between 5,000' and 5,500'. Only the small-cabin jets are capable of operating on 4,300', however, even these jets are marginal with 4,300' on days hotter than 88° F and more than 60% useful load. It should be noted that the Accelerate-Stop Distance Available (ASDA) is often an important factor in runway usability, however the FAA does not publish or calculate this data for business jets.



The FAA jet take-off distances have been adjusted for the Dare County Regional Airport using local temperatures experienced during the hottest months (June to August). During hotter ambient temperatures aircraft performance diminishes, which either increases takeoff/landing distances and/or limits available payload (fuel and/or passengers). MQI Jet-A fuel sale records (N-numbers) shows a surprising level of jet use for a 4,300' runway, as this length is designed to accommodate up to turboprop aircraft.

MQI Jet Demand (2005 to 2025)

The following lists the MQI 'unconstrained' business jet demand during the 20-year planning period. The existing MQI business jet demand is estimated to be about 2,400 annual operations, or 3.4 times the 700 jet operations actually conducted in 2004.

Unconstrained MQI Business Jet Demand (2005 to 2025)					
Annual Operations	2005 MQI Jet Demand	2010 MQI Jet Demand	2015 MQI Jet Demand	2020 MQI Jet Demand	2025 MQI Jet Demand
MQI 20-Year Jet Demand	2,400	2,850	3,800	4,700	5,850

Note: Unconstrained jet demand assumes 5,500'+ runway length.
Note: Annual activity rounded to 100th of operations.

MQI Jet Demand - Unconstrained Vs. Constrained Runway Length Options

The number of jet operations experienced is dependent on the available runway length. Table 5.1 shows the demand in business jet operations from 2010 to 2025 relative to the take-off capabilities provided by a 5,500', 5,000' and 4,300' runway. The following are assumptions used in quantifying the difference in jet activity between the 5,500', 5,000' and 4,300' runway options:

- 5,500' is 'unconstrained' jet runway length for takeoff & landing demand[1]
- Extension to 5,000' or 5,500' would occur by the year 2010
- 5,000' and 5,500' accommodates based jet demand – 4,300' does not
- Itinerant jet traffic includes fractional, charter and privately-operated planes
- Precision-type instrument approach procedure would be established by 2010

Table 5.1: MQI Business Jet Operations (4,300' – 5,000' – 5,500')

Jet Fleet Able to Operate at MQI (Measured by Operations)	2010 Jet Demand	2015 Jet Demand	2020 Jet Demand	2025 Jet Demand
5,500' Unconstrained Runway Length				
CAT B: Small-Cabin Jet - Itinerant	1,200	1,400	1,650	2,000
CAT B: Small-Cabin Jet - MQI Based	300	750	1,150	1,550
CAT C/D: Medium-Cabin Jet - Itinerant	1,350	1,650	1,900	2,300
5,500' TOTAL JET OPERATIONS	2,850	3,800	4,700	5,850
5,000' Constrained Runway Length				
CAT B: Small-Cabin Jet – Itinerant	1,200	1,400	1,650	1,950
CAT B: Small-Cabin Jet - MQI Based	300	750	1,150	1,550
CAT C/D: Medium-Cabin Jet – Itinerant	600	800	850	1,050
5,000' TOTAL JET OPERATIONS	2,100	2,950	3,650	4,550
4,300' Existing Constrained Runway Length				
CAT B: Small-Cabin Jet	920	1,040	1,200	1,350
CAT B: Small-Cabin Jet - MQI Based	0	0	0	0
CAT C/D: Medium-Cabin Jet	230	260	300	350
4,300' TOTAL JET OPERATIONS	1,150	1,300	1,500	1,700

FAA Jet Fleet Database Composition (61 Jets):
24 Category B Jets (45% to 50% of jet fleet)
31 Category C (30% to 35% of jet fleet)
6 Category D (10% to 20% of jet fleet)

[1] About 4 to 6 large to ultra-large cabin jets, which are typically used on trans-continental/trans-oceanic flights, require more than 5,500' takeoff distance under flights with high payloads, long-range and high ambient temperatures.

Percent Jet Operations Growth			
Jet Operations Per 4,300' – 5,000' – 5,500'	2010 Jet Demand	2025 Jet Demand	% Annual Change (2010 – 2025)
5,500' JET OPERATIONS	2,850	5,850	5.1%
5,000' JET OPERATIONS	2,100	4,550	3.9%
4,300' JET OPERATIONS	1,150	1,700	2.7%

MQI Jets Unable to Operate Per 5,500' - 5,000' - 4,300' Runway Length Options

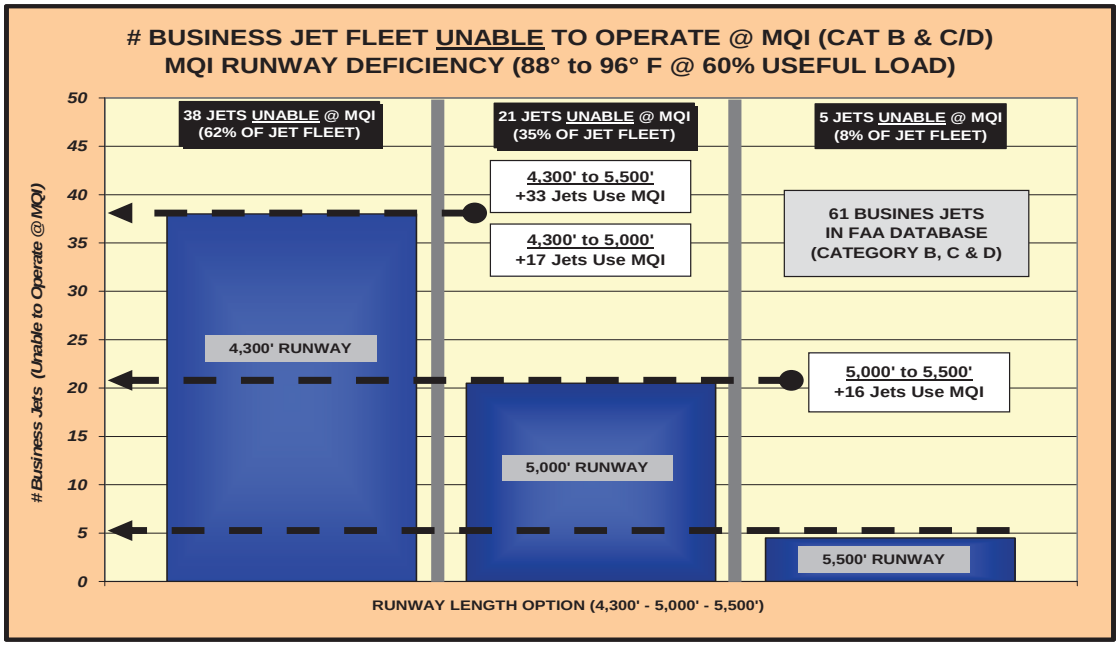
For MQI, the runway takeoff length requirements for each of the 61 FAA jet models has been adjusted using FAA formulas to reflect takeoff distances compensated for local-area mean maximum temperatures (88° to 96° F), field elevation, and standard useful loads of 60% to 100% as prescribed by FAA policy (fuel, passengers & luggage). Below are the adjusted takeoff distances indicating the number and percent of the 61 jet models unable to operate on 5,500', 5,000' and 4,300' at MQI.

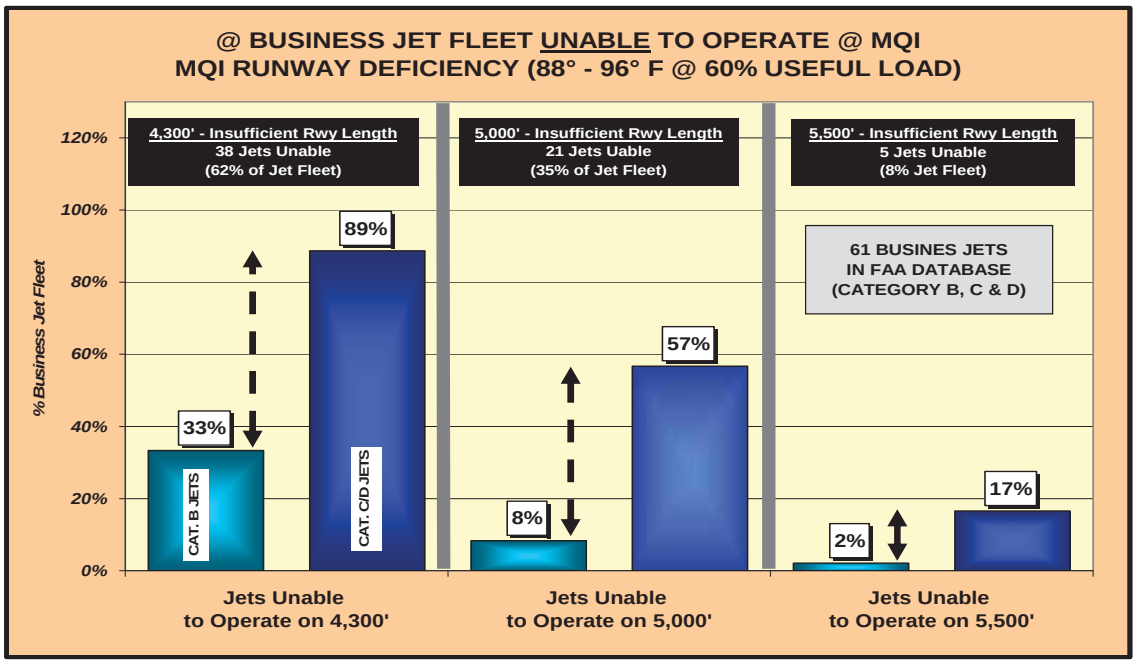
Table 5.2: Jet Unable to Operate @ MQI (4,300' – 5,000' – 5,500')

Percent of General Aviation Business Jet Fleet Models Unable to Operate at MQI			
Ambient Air Temperature (88° to 96° F) Jet Load Factor (60% Useful Load)	4,300' (% of Fleet/ # of Jets)	5,000' (% of Fleet/ # of Jets)	5,500' (% of Fleet/ # of Jets)
CAT. B Jet Fleet Models Unable to Operate @ MQI	33% 8 Jets	8% 2 Jets	2% 1 Jet
CAT. C/D Jet Fleet Models Unable to Operate @ MQI	90% 33 Jets	58% 21 Jets	7% 6 Jets
JET MODELS UNABLE TO OPERATE @ MQI (61 Jets in FAA Database)	62% 38 Jets	35% 21 Jets	8 % 5 Jets

FAA Jet Fleet Database Composition:
- 24 Category B Jet Models (45% to 50% of jet fleet)
- 31 Category C Jet Models (30% to 35% of jet fleet)
- 6 Category D Jet Models (10% to 20% of jet fleet)

The graphs below shows the number of jets, per Category B, C & D, unable to operate on 4,300',5,000' and 5,500'. The incremental number of jets models, or percent of the jet fleet accommodated between 4,300' and 5,000' (700'), and between 5,000' and 5,500' (500') is 17 jets, which is 28% of the jet fleet. Therefore, the greatest proportional gains in accommodating the jet fleet is between 4,300' and 5,000'.





From the demand shown in Table 5.2 above, the following identifies disparities in the number of annual jet operations expected by the year 2025 assuming the 4,300' and 5,000' length, compared with the 5,800 jet operations projected with the unconstrained 5,500' length. This comparison identifies a 'deficiency factor', which is a ratio that indexes jet demand to runway length. As can be seen, the greatest total gain is from 5,500' vs. 4,300', by a factor of nearly 3:1. However, the greatest marginal gain in additional jet operations-per-feet of runway extension is between 4,300' and

5,000', by a factor of nearly 2:1 over 5,500' versus 5,000'.

Net Comparison of Jet Operation for 5,500', 5,000' & 4,300' MQI Runway Length

Runway Length Differences	2025 Jet Demand (Annul Jet Operation)	2025 Jet Difference (Ops.)	Runway 'Ops.' Factor	Runway 'Length' Factor
Unconstrained 5,500'	5,800 Jet Ops.	Meets Demand	1.0	1.0
5,500' vs. 5,000'	5,800 vs. 4,700 Ops.	(-1,100 Jet Ops.)	1.2	2.4
5,500' vs. 4,300'	5,800 vs. 1,750 Ops.	(-4,050 Jet Ops.)	3.3	2.6
5,000' vs. 4,300'	4,700 vs. 1,750 Ops.	(-2,950 Jet Ops.)	2.6	3.7

Deficiency Factor: A ratio to express the variance of jet-only operations as measured, or attained between runway lengths (example: 5,000' / 1.2 equals a difference of 710 jet operations). The factor in parenthesis is the percent of each additional jet operations accommodate per extended runway length (example: 1.15 Factor / 500' Rwy Extension Length = 0.23%)

Source: Talbert & Bright, Inc. – Business Jet Projections September, 2005
(incorporates supplemental MQI Jet-A fuel sale records from May to August, 2005).

MQI Economic Impacts – Operating Revenue & Profit

Table 5.3 shows estimates of jet-only 'revenues' and 'profits' for the years 2010, 2015, 2020 and 2025, varied between the unconstrained and constrained runway length options. It is conceivable that jet 'profits' could reach $1.5 million annually, compared with the $200,000 currently generated by jet activity.

MQI Business Jet Revenues & Profits (2005 to 2025):

- Jet-A Fuel Sales to 'Itinerant' Business Jets
- Jet-A Fuel Sales to 'Based' Business Jets *
- Hangar Ground Lease for Business Jet Storage *
- Overnight/Extended Parking Fees for Itinerant Business Jet Traffic
- Miscellaneous On-Airport Spending for Supplies and Services

* 4,300' option excludes based jet revenues (fuel & hangar rents)

Jet-A Fuel Impacts (Business Jets): Jet-A fuel sales would increase with a 5,000' to 5,500' runway extension, for both itinerant (transient) jet traffic and MQI based jets. The typical business jet has a fuel capacity of 1,600 gallons, and burn about 225 to 250 gallons per hour, with the average business jet flight of 1.2 to 1.8 hours. The average jet takes-on 300 to 450 gallons per fuel event.

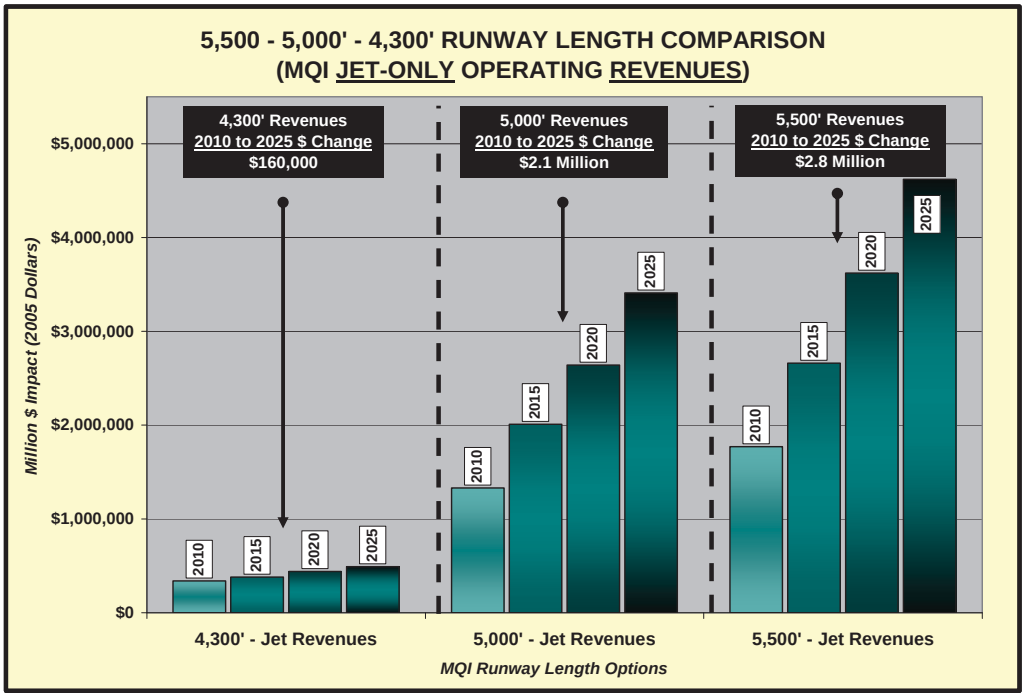
Based on these industry averages, it is evident that jets departing MQI are unable to take-on the load necessary for a typical flight distance, plus instrument fuel reserves. At MQI, the fuel sales drop-off significantly beyond 400 gallons. This is supported by 2004 MQI Jet-A fuel records, in which 65% of all jet fueling events were less than 1 hour of flight-time, which also includes taxiing and clearance hold times (125 ÷ 190 = 65%). It is common for jets to take-on a token amount, to offset other fees/charges normally assessed to aircraft that don't purchase fuel.

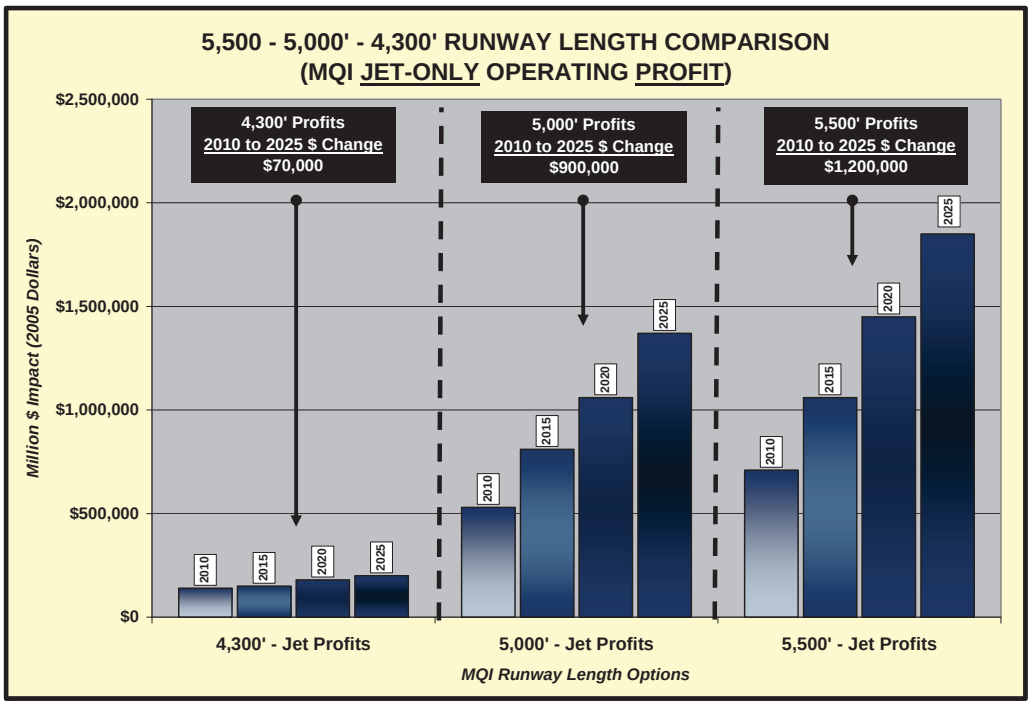
Hangar Revenues & Profits (Business Jets): With an extension to 5,000' and/or 5,500', it is reasonable to expect one or more business jets to be based at MQI, either permanently or seasonally. Almost all business jets are hangared, usually in common-type clearspan hangars. Therefore, a based jet operator/owner would be expected to build a sizable hangar, which would generate ground lease rent to the Airport. It should be noted that revenues grow proportionally higher than profits because hangar rents (ground lease) or tie-down fees were not assigned a 'profit margin'.

Table 5-3: MQI Jet Revenue & Profits (4,300' – 5,000' – 5,500')

MQI Revenues & Profit	Year 2010	Year 2015	Year 2020	Year 2025
Annual Airport Revenues From Business Jets (4,300' – 5,000' – 5,500')				
5,500' – Jet Revenues	$1,770,000	$2,660,000	$3,620,000	$4,620,000
5,000' – Jet Revenues	$1,330,000	$2,010,000	$2,640,000	$3,410,000
4,300' – Jet Revenues	$340,000	$380,000	$440,000	$490,000
Revenue Difference (Factor) - 5,500' vs. 5,000' -------				1.4
Revenue Difference (Factor) - 5,500' vs. 4,300' -------				9.5
Revenue Difference (Factor) - 5,000' vs. 4,300' -------				7.0
Annual Airport Profits From Business Jets (4,300' – 5,000' – 5,500')				
5,500' – Jet Profits	$710,000	$1,060,000	$1,450,000	$1,850,000
5,000' – Jet Profits	$530,000	$810,000	$1,060,000	$1,370,000
4,300' – Jet Profits	$140,000	$150,000	$180,000	$200,000
Profit Difference (Factor) - 5,500' vs. 5,000' -------				1.3
Profit Difference (Factor) - 5,500' vs. 4,300' -------				9.4
Profit Difference (Factor) - 5,000' vs. 4,300' -------				7.0
Note: Factor is ratio of runway length revenue & profit options.				

The following graph depicts the jet-related revenues and profits for 2010, 2015, 2020 and 2025. As shown, the greatest margin of gain for Airport revenues and profits is between 4,300' and 5,000'. Again, revenue grows proportionally higher than profits because hangar rents (ground lease) or tie-down fees don't involve profit margins.





MQI BUSINESS JET DEMAND- ECONOMIC IMPACT COMPARISON

The inability to accommodate jet demand at the Dare County Regional Airport has measured effects, as a condition of forgone jet-related operating revenues & profits, and the lost direct and value-added economic impacts associated with missed visitor/passenger spending. As discussed below, these impacts accumulate to potentially millions in foregone Airport revenues, each year.

For this reason, the impact analysis quantifies the operational and financial implications -- comparing the 5,500' 'unconstrained' length against the 'constrained' 5,000' length and existing 4,300' length. The economic assessment quantifies both the 'operating revenue & profit' and 'direct economic impacts' associated with each runway length, or deficiencies thereof. The economic impact findings matched against the estimated development costs for the 5,500', 5,000' and 4,300' lengths provide a relative comparison of opportunities afforded by each runway length option, as measured in dollars.

2004 MQI Economic Impacts @ 4,300' (2005 Dollars Values)

Table 5.4 shows the occurrence of airport economic impacts resulting from business jet activity, per the 'unconstrained' and 'constrained' runway lengths.

Table 5.4: Airport Economic Impact Characteristics (CY 2004)

Impact Category	Impact Dollars (2005 $)
Economic Impacts (Direct, Indirect & Induced Impacts - 2004 $)	
Total Annual MQI Airport Impacts (2004)	$ 16.2 Million
MQI Impacts Attributed to 'Itinerant' Traffic	$ 10.5 Million (65%)
MQI Impacts Attributed to 'Local Area' Traffic (Tours, etc.)	$ 5.7 Million (35%)
MQI Economic Impacts (Direct, Indirect & Induced Impacts - 2004 $)	
Impact ($) Per Jet Flight (700 Annual MQI Jet Operations)	$ 2,500 to $4,200
Impact ($) Per Business/Tourist Itinerant Jet Visitor – Per Day	$ 375 to $650
Dare County Tourism Spending (Outer Banks Tourism Data – Average Tourist Visitor)	
Average Party Size (6 adults + 2 Children) Average Party Expenditure (2002 Conversion Research, pg. 35) Average Party Duration - Summer Season (Days) Average Expenditure Per Party Member	8 $ 2,295 6.5 $ 287
Note: 90% to 100% of jet flights considered as business or tourist-related.	

Source: Talbert & Bright, Inc. – IMPLAN Analysis
Source: 2002 Conversion Research, pg. 14, 21 and 35
Source: Outer Banks Tourism Visitor Bureau
Source: Talbert & Bright, Inc – MQI Airport Economic Impact Analysis (IMPLAN)

The jet visitor/passenger, on average, spends 2 to 4 times the average tourist visitor. The majority of Airport visitor/passenger spending impact is by 'itinerant' users, operating business-class turbine aircraft, including jets. The estimated impact of the Dare County Regional Airport is $16.2 million, including direct, indirect and induced spending. As identified by FAA/AOPA studies, the MQI impact is already comparable with the average impact for a general aviation facility with a jet-capable runway and precision (ILS) approach.

MQI Economic Impacts – Airport Visitor & County Tourism Impacts

The direct impact of the Dare County Regional Airport is $10.5 million, which accounts for over 6% of the Dare County tourism/visitor impact of $162 million (2004 dollars). Similarly, the Airport contributes about 1.5% to the $ 600 million in tourism impacts to Dare County annually.

MQI Economic Jet Impacts

The following depicts the annual jet-only impacts, compared for 2010, 2015, 2020 and 2025 for the 4,300', 5,000' and 5,500' runway length options. At present, the total direct, indirect and induced economic impacts contributed by jet-only traffic with the 4,300' runway is about $2.3 million per year, or about 15% of the Airport's total impact. As seen, the economic benefits for the 4,300' length remains fairly stagnant for the 20-year period. The spending connected to the 5,000' to 5,500' length would increase much more than allowed by the present 4,300' runway.

Net Comparison of Jet Impacts for 5,500', 5,000' & 4,300' MQI Runway Length

Runway Length Differences	Year 2010 (Millions)	Year 2015 (Millions)	Year 2020 (Millions)	Year 2025 (Millions)
JET ECONOMIC IMPACT (DIRECT, INDIRECT & INDUCED)				
5,500' – Jet Impacts	$10.4	$13.8	$17.2	$21.3
5,000' – Jet Impacts	$6.1	$8.6	$10.6	$13.2
4,300' –Jet Impacts	$2.9	$3.3	$3.8	$4.3
TOTAL AIRPORT ECONOMIC IMPACT (DIRECT, INDIRECT & INDUCED)				
5,500' – Total Airport	$26.6	$30.0	$33.3	$37.5
5,000' – Total Airport	$22.3	$24.7	$26.8	$29.4
4,300' – Total Airport	$19.1	$19.5	$20.0	$20.5
% JET ECONOMIC IMPACT to TOTAL AIRPORT IMPACT (DIRECT, INDIRECT & INDUCED)				
5,500' – % Jet Impacts	39%	46%	51%	57%
5,000' – % Jet Impacts	27%	35%	40%	45%
4,300' –% Jet Impacts	15%	17%	19%	21%

Total Annual Economic Impacts = Based on 2005 $ (Not Adjusted for Inflation)

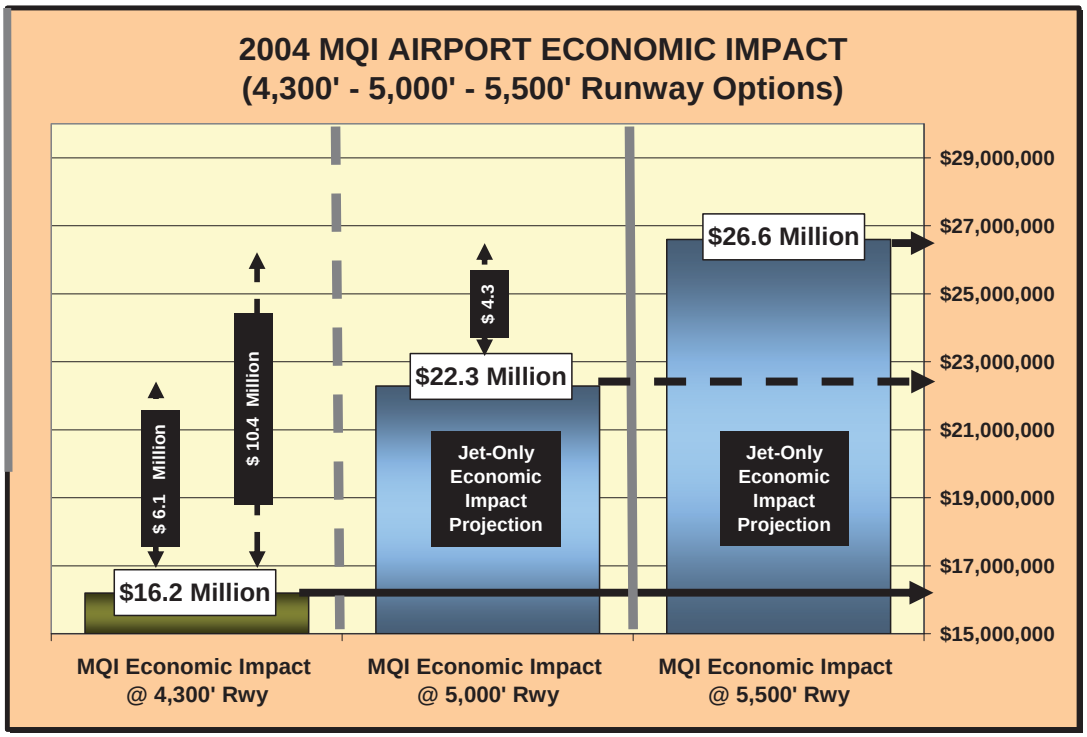
Source: Talbert & Bright, Inc. – Business Jet Projections September, 2005

MQI Economic Impacts – 5,500' – 5,000' – 4,300' Runway Length Options for 2005

A 5,000' to 5,000' runway length will accommodate about 70% to 90% of the business jet fleet, rather than about 30% to 40% with the present 4,300' runway.

The impact difference between runway length options would largely be accounted for by Jet-A fuel sales, in which the 5,500' length not only accommodates most of the jet fleet for take-off and landing, but allows larger quantities of fuel payload. As shown below, spending impacts would increase commensurate with a longer runway. By virtue of the runway extension and ability to accommodate more and larger jets, the Airport's economic impact immediately increases nearly $2 million annually, and grows proportionally higher for 5,000' and 5,500' thereafter.

The following depicts the cumulative 20-year difference between total jet-related airport revenues and profits; for the 5,500', 5,000 and 4,300' length options. Potentially with a 5,000' to 5,500' runway length, jet impacts could contribute nearly 40% to 50% of the total airport impact – up from 15% to 20%.



5.2 AIRPORT LAYOUT ALTERNATIVES

This section of the alternatives analysis assesses airfield and terminal area expansion options to meet the 20-year aviation facility demands identified in Section 4. The following is an outline of the options under consideration in this section.

Runway Length Options:

- 4,300' Constrained Length
- 5,000' Constrained Length
- 5,500' Unconstrained Length

Terminal Area Expansion Options:

- Option A Avoid Encroachment of VOR Station / Minimize Development into Proposed Coastal Studies Institute (CSI) Area
- Option B Relocate VOR Station / Minimize Development into Proposed Coastal Studies Institute (CSI) Area
- Option C Develop Future Hangars South of Runway 5-23

RUNWAY LENGTH/SITING OPTIONS (4,300' – 5,000' – 5,500')

The runway alternatives identified in this section show a reasonable range of options to resolve facility deficiencies. The physical and social constraints in expanding Airport facilities beyond the existing property boundary is complicated by various implications to land use, complex airspace/navigational issues, social factors, environmental impacts and project costs/funding.

There are two principle runway development scenarios for meeting existing MQI business jet demands: 1) 5,500' unconstrained runway length; and, 2) 5,000' and the existing 4,300' constrained lengths. Therefore, the emphasis of this section is to determine the incremental development impacts associated with the 4,300', 5,000' and 5,500' runway options. This allows for a comparison of costs with the corresponding economic benefits provided by each of the runway lengths options.

Runway Option Matrix

A matrix evaluates and ranks the runway alternatives under consideration. This comparison of quantifiable physical factors allows for the elimination and refinement of options in order to arrive at a preferred development plan. The selected option is depicted on the MQI Airport Layout Plan (ALP) drawings, the official airport planning document. This objective means compares the major physical implications associated with each runway length option. The matrix emphasis is on 1) Land Acquisition and 2) Relocation Costs, which are typically most pervasive.

The following are factors considered in the development of the plausible runway alignment/orientation options:

- Compliance with FAA/NCDOA airport standards and airspace criteria – preferably without modification of airport planning design standards;
- Future precision instrument approach capabilities;
- Maintain compatibility with existing and proposed on and off-airport land uses;
- Consider short and long-term development costs;
- Integration of future, or incremental expansion to reach ultimate development;
- Construction impacts, including facility upgrades to meet design standards;
- Minimize the consequences of environmental impacts and potential mitigation.

The following site development factors have been considered in the evaluation of candidate runway options:

- Ability to serve 'unconstrained' forecast demand
- Airport geometric standards
- Airspace & navigational capabilities
- Surrounding land use implications
- Environmental implications
- Project funding

Overall, it should be noted that the Airport Master Plan is the formulation of a development policy rather than the presentation of a design recommendation. While the assessment of alternatives is based on technical judgment, the most favorable airport improvement option should be compatible with local planning policies and consistent with social, economic, political and environmental goals.

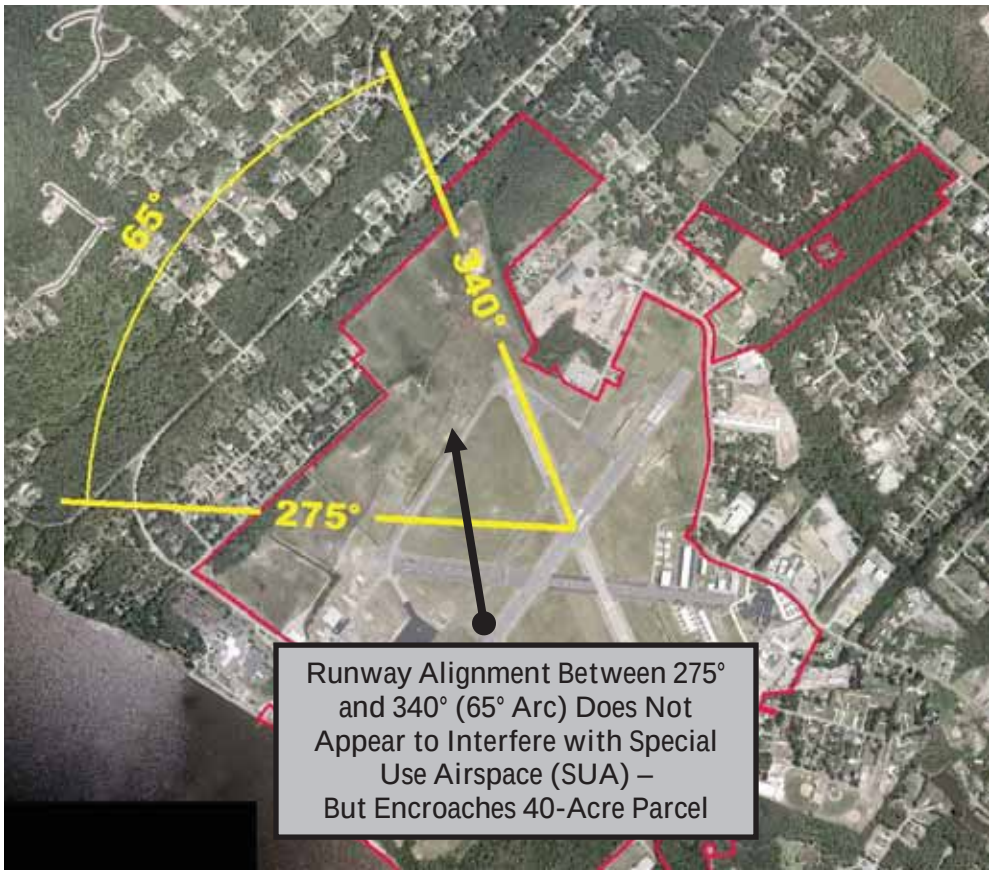
Precision Instrument Approach Capabilities

A major factor in developing Airport facilities for business jet aircraft is to provide for 'precision' instrument approach capabilities. Design and operational logistics associated with implementing a precision approach procedure at MQI (ILS or future WAAS) are described in the Inventory and Facility Requirement Sections of this study.

Exhibit 5.1 shows the range in runway centerline alignments capable of conforming with developing an ILS (precision) instrument procedure using general US Terminal Instrument Procedure airspace criteria.

As seen, a runway alignment between 275° and 340° true (65° arc) would likely allow for a precision instrument procedure without conflict to surrounding Special Use Airspace (SUA) used for military purposes. The findings indicate that the only existing runway end which could qualify for a precision instrument procedure is an approach to Runway 17 (from the north). Otherwise, until such time that the FAA develops criteria for 'curved' precision instrument procedures, a new runway alignment would need to be constructed.

EXHIBIT 5.1
RANGE OF POSSIBLE RUNWAY ALIGNMENTS FOR
'PRECISION' INSTRUMENT APPROACH

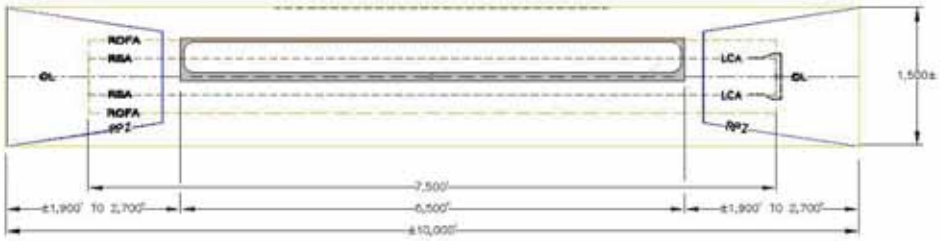


The following is a depiction of the MQI runway templates for each runway length option, including a distinction in the approximate number of acres involved:

- 5,000' vs. 5,500'
- Precision vs. Non-Precision Instrument Approach
- ARC B-II vs. ARC C-II Airport Design Standards

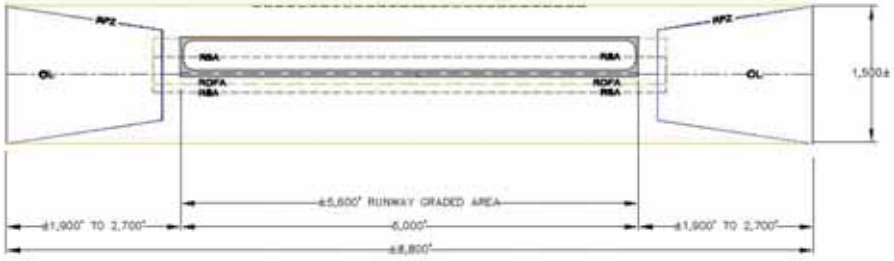
5,500' ARC C-II (PRECISION)

± 350 Acres



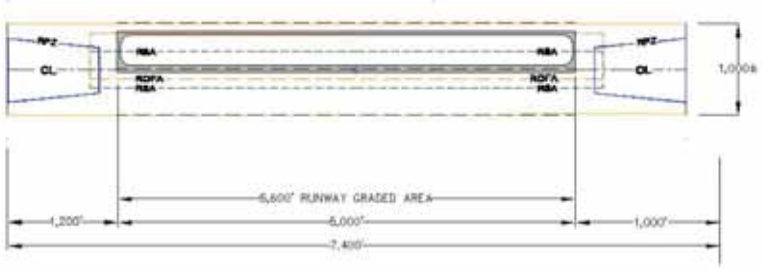
5,000' ARC B-II (PRECISION)

± 300 Acres

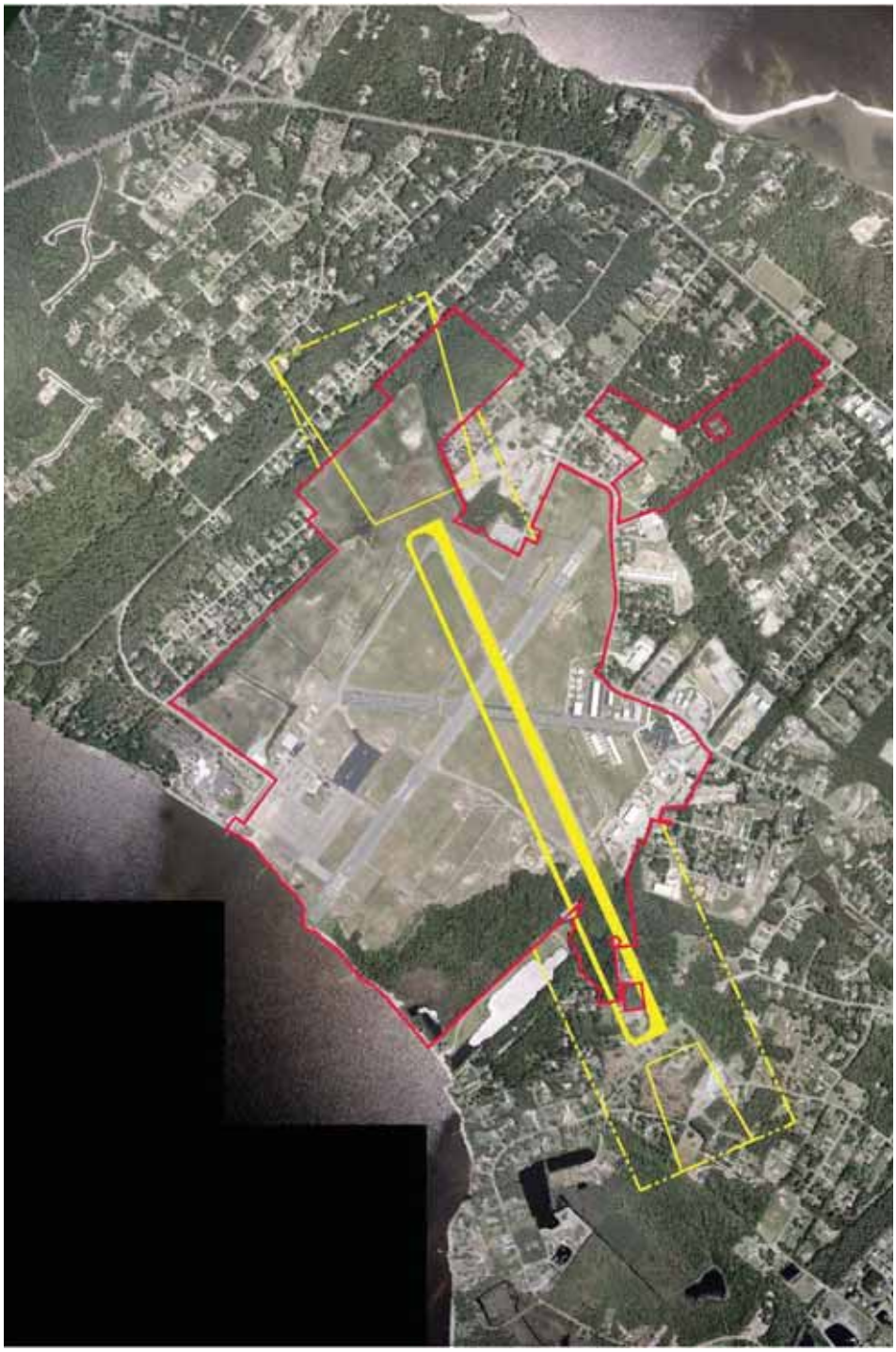


5,000' ARC B-II (NON-PRECISION)

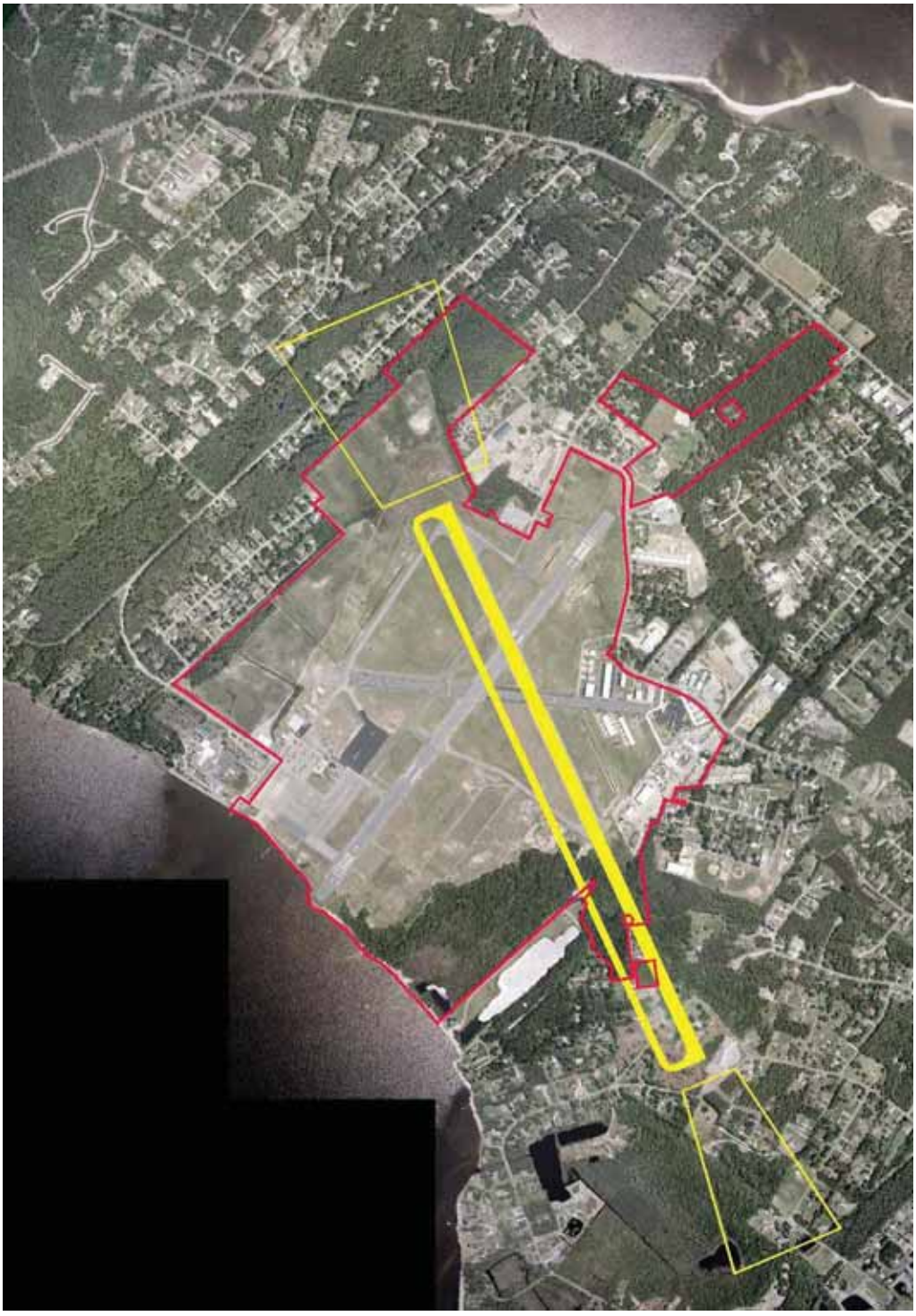
± 270 Acres



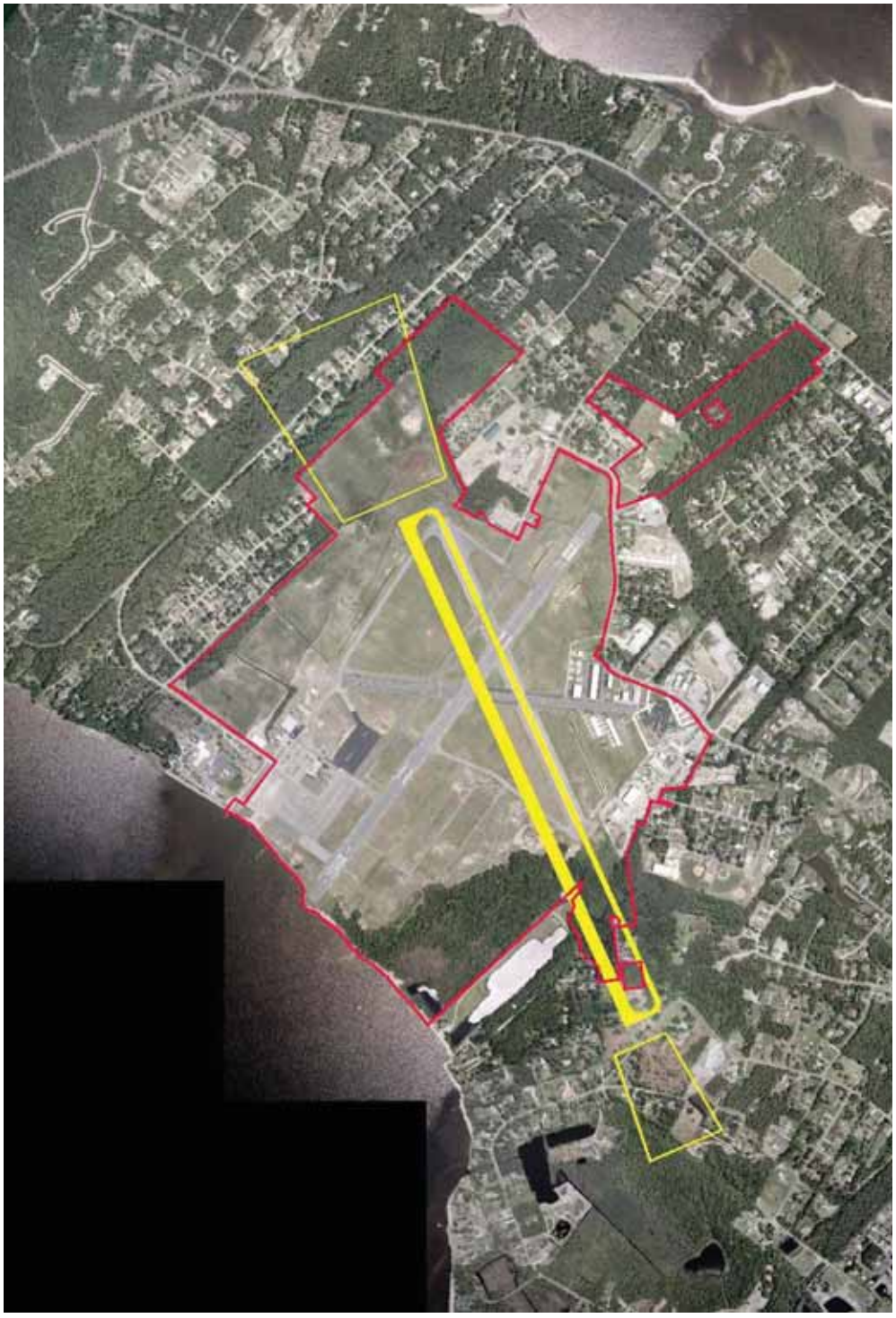
AIRSIDE ALTERNATIVE "A" @ 5,000'



AIRSIDE ALTERNATIVE "B" @ 5,500'



AIRSIDE ALTERNATIVE "C" @ 5,000'

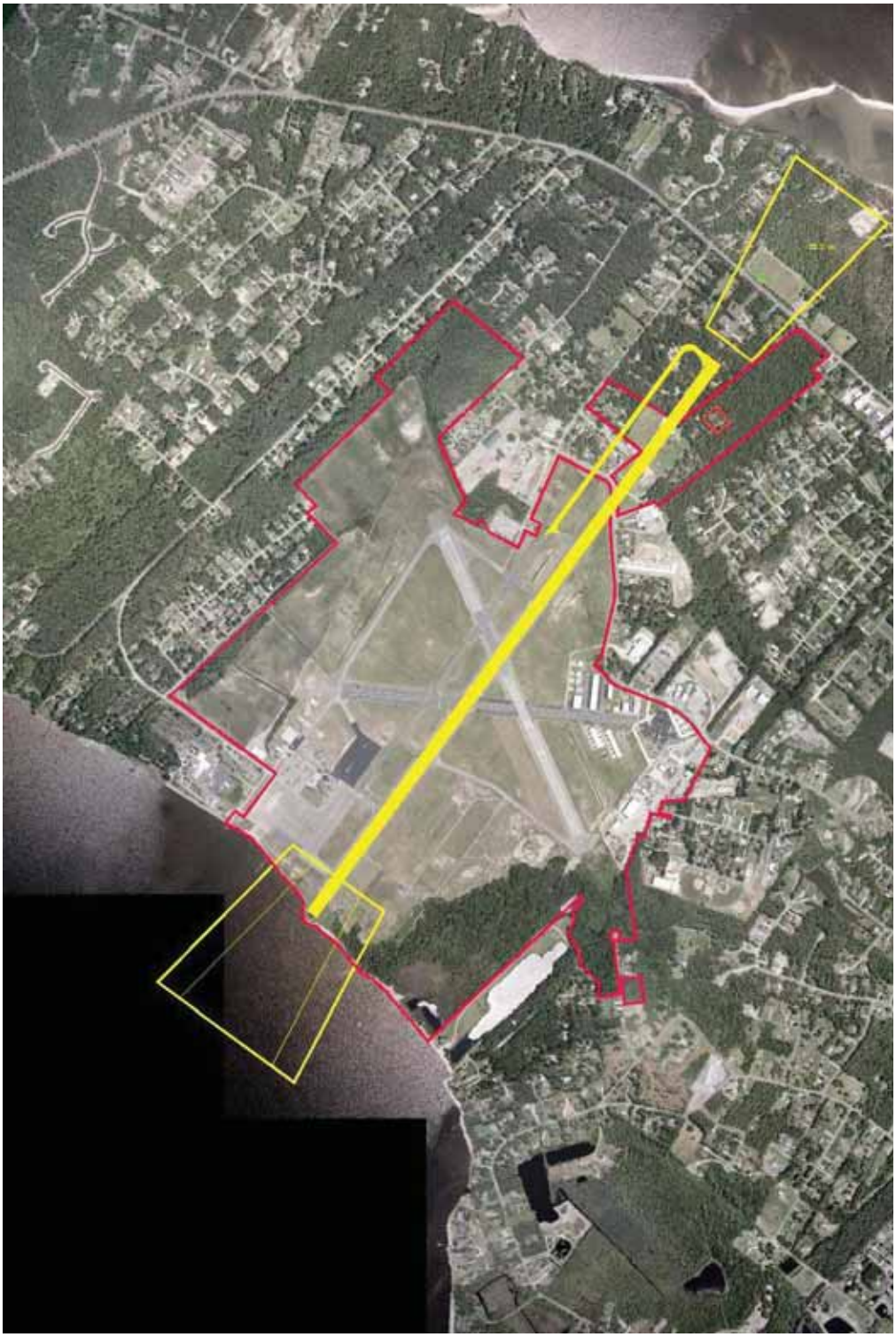


AIRSIDE ALTERNATIVE "D" @ 5,500'

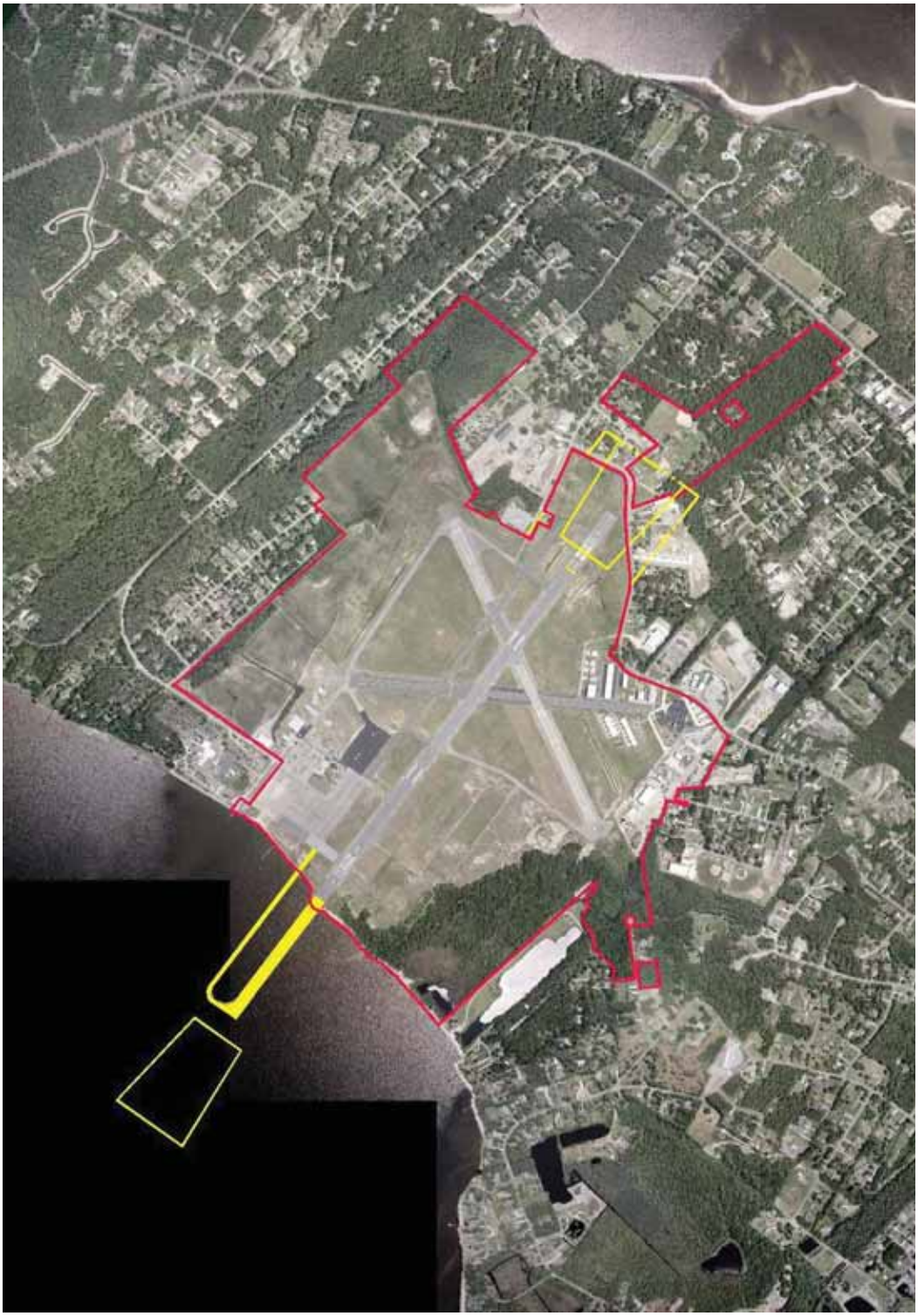
AIRSIDE ALTERNATIVE "E" @ 4,300'

AIRSIDE ALTERNATIVE "F" @ 5,000'

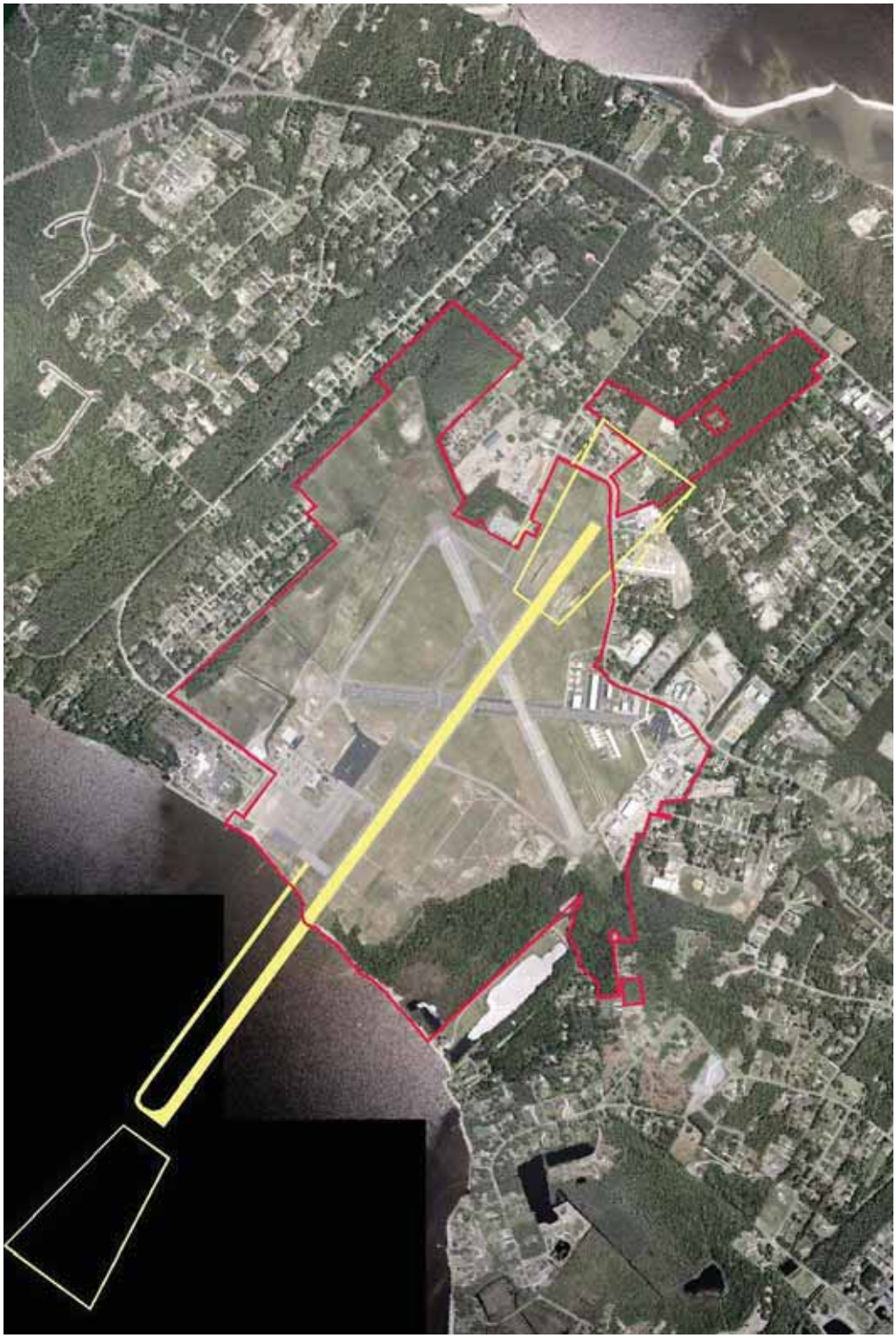
AIRSIDE ALTERNATIVE "G" @ 5,500'



AIRSIDE ALTERNATIVE "H" @ 5,000'

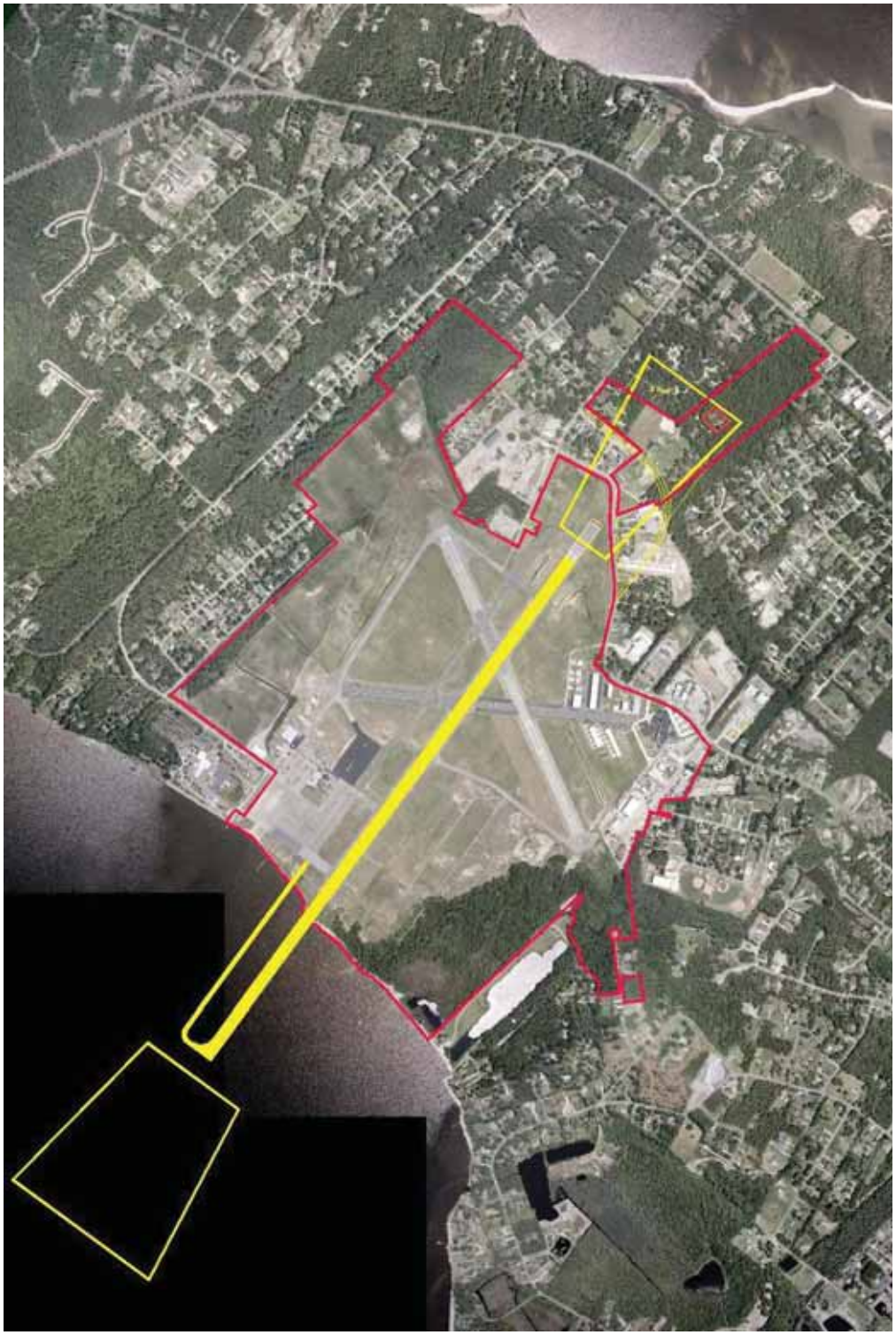


AIRSIDE ALTERNATIVE "I" @ 5,500'



AIRSIDE ALTERNATIVE "J" @ 5,000'

AIRSIDE ALTERNATIVE "K" @ 5,500'

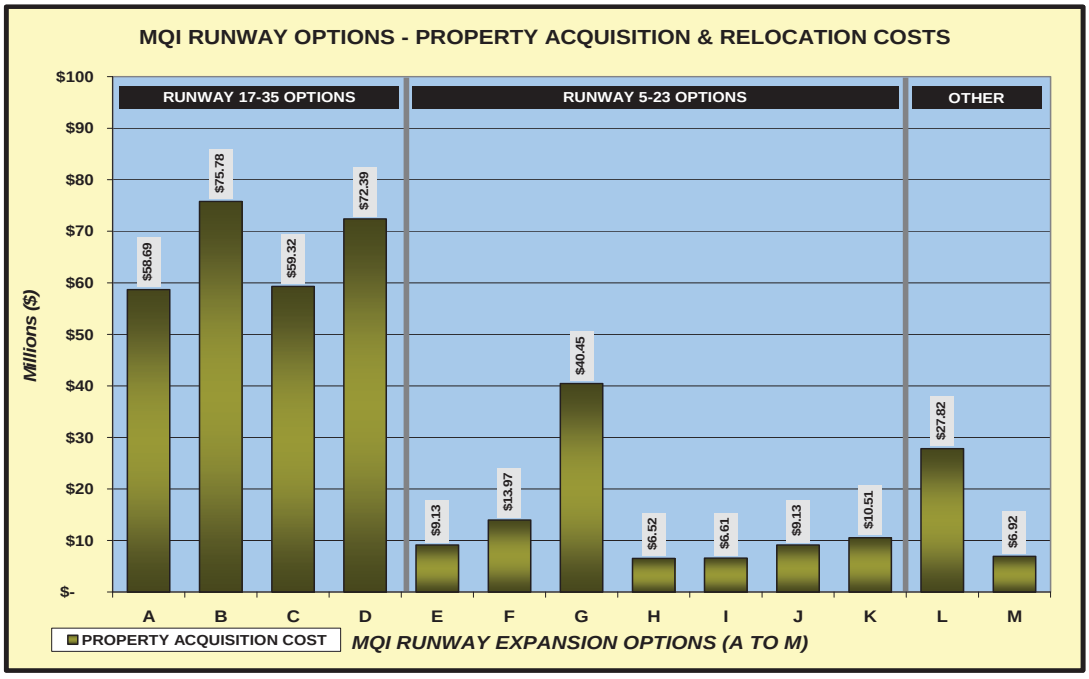


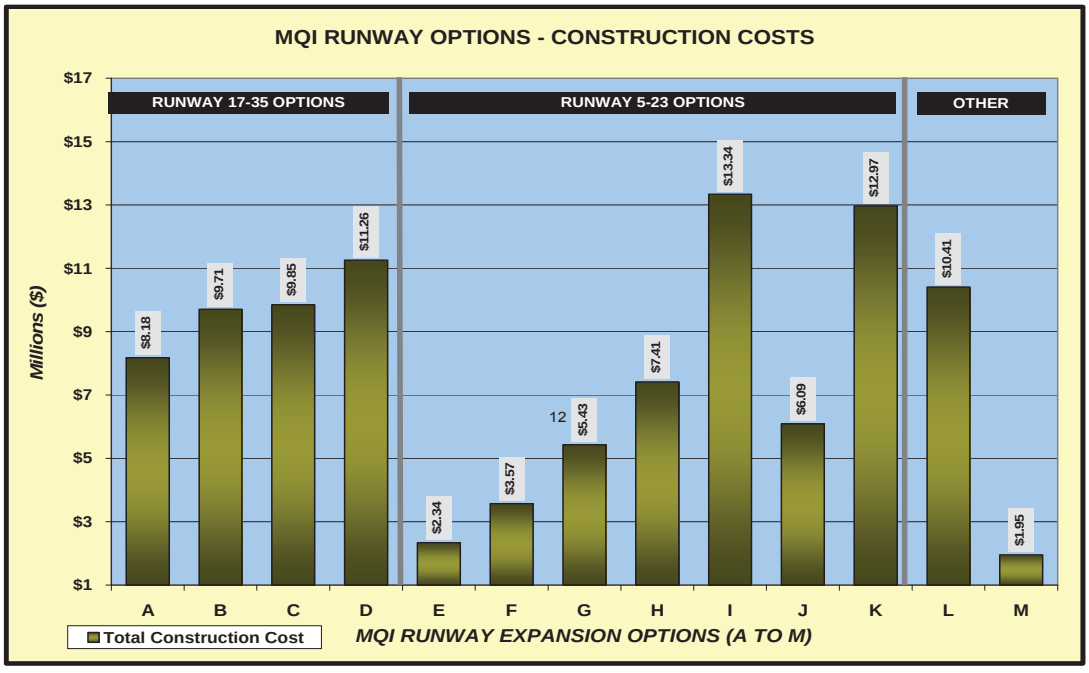
AIRSIDE ALTERNATIVE "L" @ 5,000'

AIRSIDE ALTERNATIVE "M" @ 4,300'

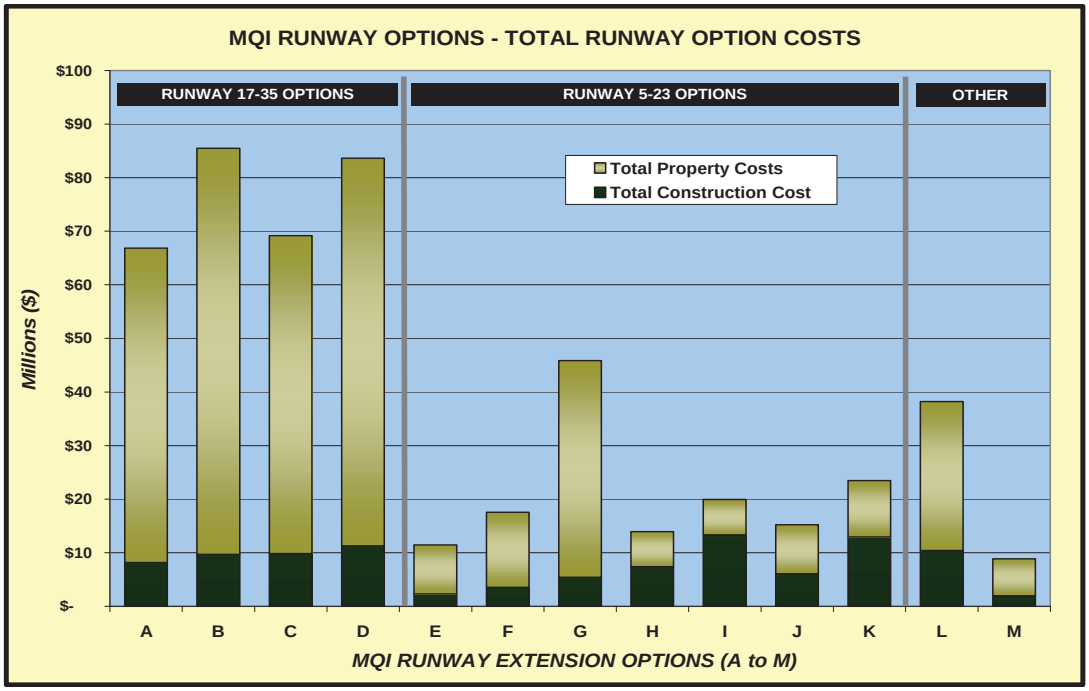
Primary Runway Option – Estimated Development Costs

The following illustrates cost estimates for 'land acquisition/relocation' and 'construction' for each runway option. This cost comparison is intended to provide a relative comparison between options, and is for planning purposes only.





The following illustrates the total cost for each runway option (Option A through M). As shown, the majority of the cost involves land acquisition and relocation expenses. Construction costs generally average about $10 million between options. As seen, land acquisition and relocation cost for the extension of Runway 17-35 is higher than the Runway 5-23 options, or a new primary runway alignment.



The following table is a matrix showing the detailed analysis, or quantifiable evaluation of each runway option (Option A through M). The comparison of options

Insert Runway Alternative Matrix Table – Here

CROSSWIND RUNWAY LENGTH/SITING OPTIONS (3,700')

Section 4 recommended an ultimate crosswind runway length of 3,700', a design goal to accommodate 100% of the piston-aircraft fleet. The existing length is 3,303'. For planning purposes, a 3,700' length corresponds to ARC B-II design standards.

The Runway 17-35 alignment is capable of being extended to 3,700'. Various combinations of runway extension increments were studied, with land acquisition/relocation costs, obstruction clearing and construction costs being the primary factors in determining the most plausible extension options.

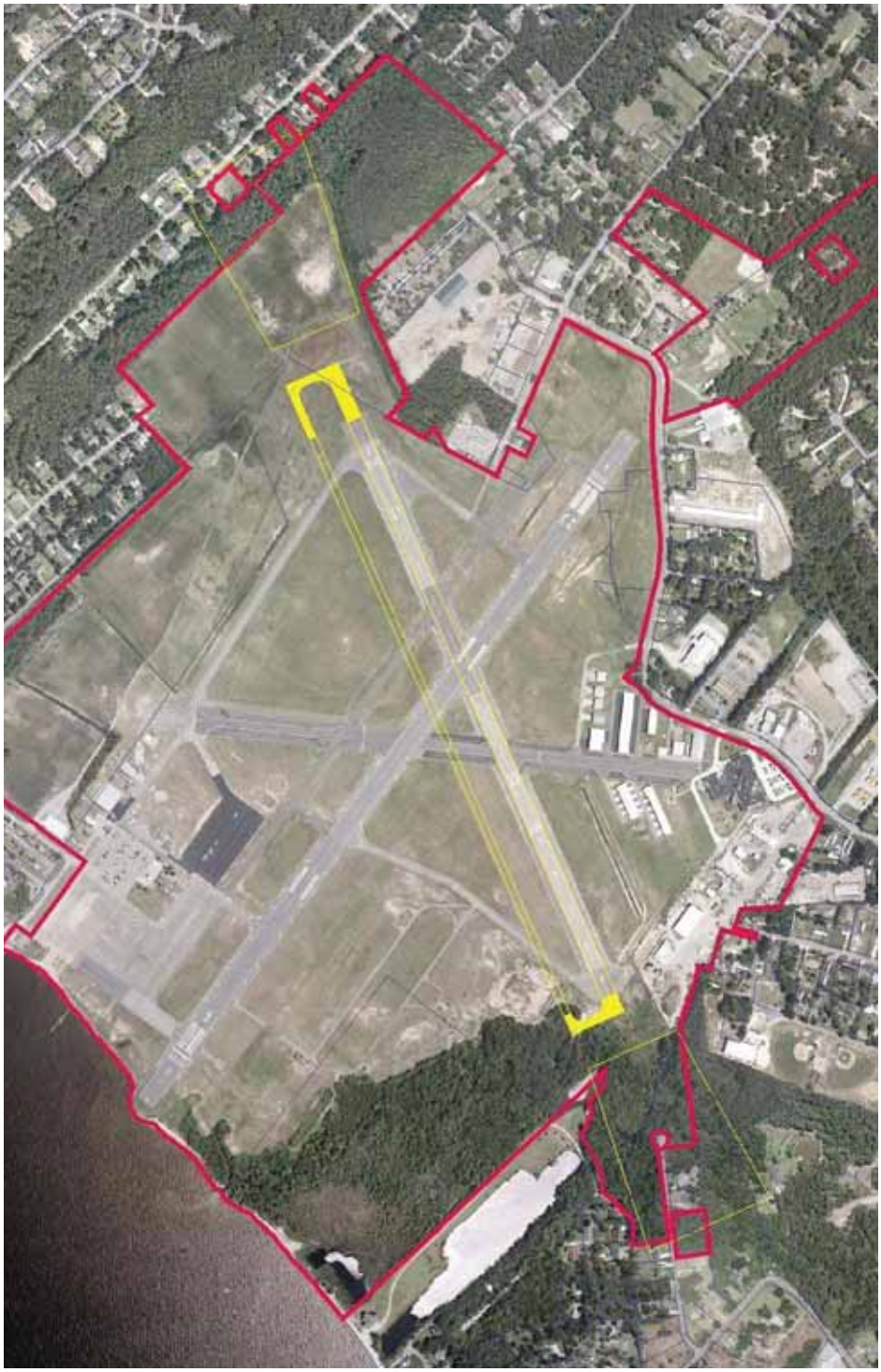
The property acquisition and relocation costs estimated for an unrestricted crosswind takeoff and landing distance of 3,700' exceeds $3.6 million. Also a consideration for expansion is the lower funding priority typically assigned to crosswind runways, with maintenance and rehabilitation often a priority over capacity projects. For this reason, declared distances were invoked in order to obtain at least a 3,700' takeoff distance – for both runway directions. This dismissed the need for additional land acquisition beyond that already obtained in restoring the thresholds to the 3,303' length.

From this, it was determined that a pavement extension of 400' to the Runway 17 end and a 300' pavement extension to the Runway 35 end would best utilize existing airport property.

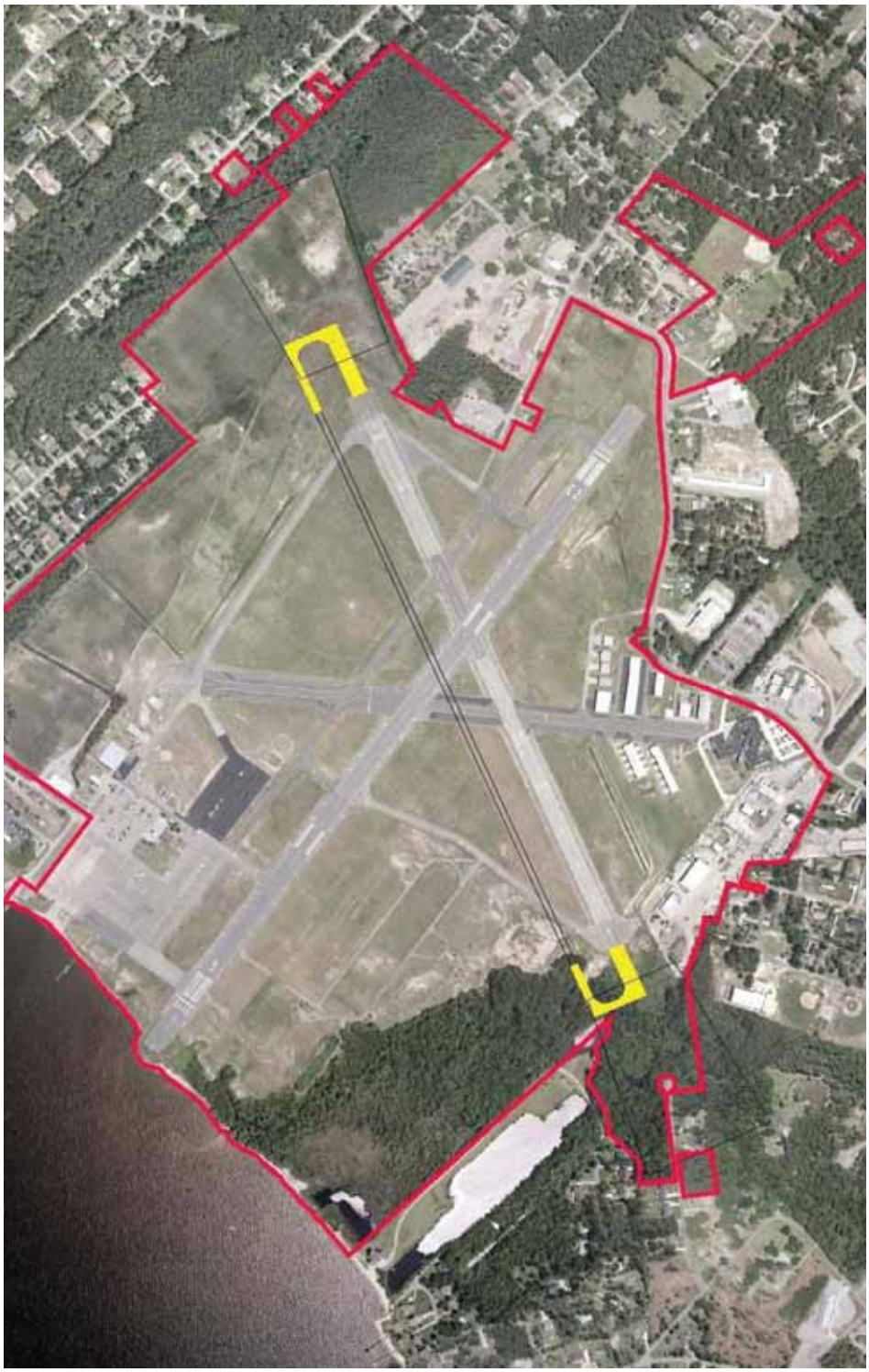
The paved areas would provide a 4,000' takeoff distance and accelerate-stop distance – for both the Runway 17 and 35 ends. These declared distances are most important to decision speeds required of twin-engine business class aircraft. The additional pavement would be marked with a displaced threshold (not available for landing). The landing thresholds would remain. The parallel taxiway system to Runway 17-35 would be extended to provide an entrance taxiway to the Runway 17 and 35 departure ends, as Runway 17-35 has a level of activity to warrant a full-length parallel taxiway system.

The following are exhibits showing the Crosswind Runway options.

CROSSWIND OPTION 'A': RUNWAY 17-35 @ 3,700'



CROSSWIND OPTION 'B': RUNWAY 17-35 @ 3,700'



PREFERRED RUNWAY EXTENSION ALTERNATIVE(S):

Preferred Option - Primary Runway Extension Option:

In October 2005, the Airport Authority selected Option 'J' as the preferred runway development plan. This option was favored due to a comparison of costs to business jet benefits, and the reduction in direct impacts to surrounding residents and businesses – as compared with impacts associated with other runway options for the primary runway.

OPTION 'J'
PRIMARY RUNWAY EXPANSION
(100' extension of Runway 5 and 600' extension to Runway 23)

Unrestricted Runway Length:	5,000'
FAA ARC:	B-II
Approach:	Non-Precision – Runway 5 & 23 Ends

Option 'J' was carried forward for depiction on the updated MQI Airport Layout Plan drawings.

Preferred Option - Crosswind Runway Extension Option:

OPTION 'B'
CROSSWIND RUNWAY EXPANSION
(400' extension of Runway 17 and 300' extension to Runway 35)

Unrestricted Runway Length:	3,700'
FAA ARC:	B-II
Instrument Approach:	Non-Precision – Runway 17 & 35 Ends

Option 'B' was carried forward for depiction on the updated MQI Airport Layout Plan drawings.

TERMINAL AREA DEVELOPMENT OPTIONS

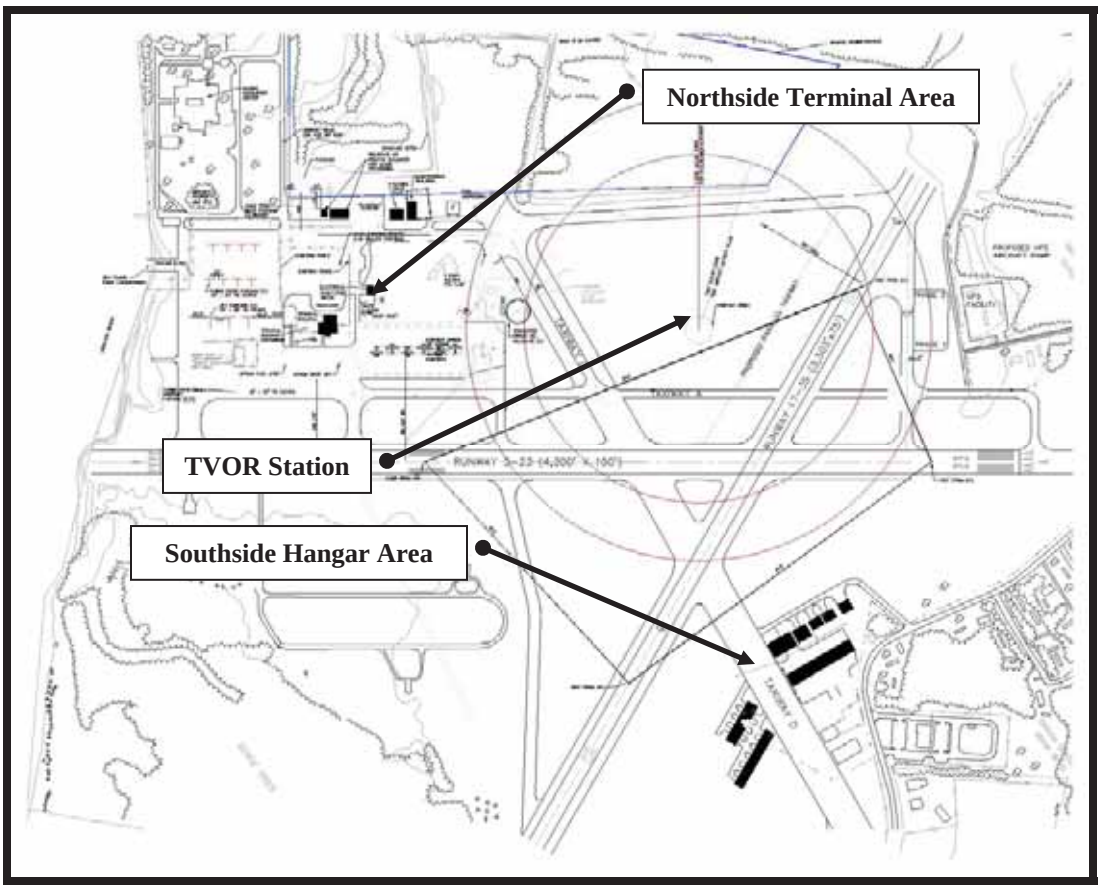
This section identifies planning for terminal area expansion options in meeting the 20-year aviation demand for based and itinerant Airport users.

The terminal area components include:

- Hangars (T-Hangars & Common Hangars)
- Terminal Building
- Main Apron - configuration & tie-downs for small and large aircraft
- Airport equipment storage and maintenance building area
- Aviation fuel storage and dispensing facilities; including fuel trucks
- Aeronautical tenants (location, area, potential development)
- Auto parking, circulation, access
- Property acquisition - as applicable

Below depicts the exiting Northside and Southside terminal/hangar facilities:

EXISTING MQI TERMINAL AREA(S) – BASE DRAWING



TERMINAL PLANNING & DESIGN FACTORS

Terminal area planning involves space allocation for new development, or re-development. Although there is moderate flexibility in terminal layouts, geometric standards must be met as determined by the aircraft's wingspan category, per the FAA Airport Reference Code (ARC).

There are two primary sources of guidance on terminal area design:

1) FAA standards involve various safety area dimensions, separation setbacks, and airspace clearance requirements for the terminal area (See Table 5-5). These standards are largely derived from the following FAA documents:

   - FAA Advisory Circular 150/5070-6A, *Airport Master Plans*
   - FAA Advisory Circular 150-5300-13, *Airport Design*
   - 14 CFR Part 77, *Objects Affecting Navigable Airspace*.

2) NCDOA has recently developed 'minimum' and 'recommended' design standards, including terminal area criteria. The Dare County Regional Airport is a 'red group', the highest ranking of general aviation facilities (See Table 4-6).

   Note: A 5,000' runway is an FAA ARC B-II design standard. However, this length is expected to generate frequent Category C / D business jet activity. The larger jets typically operate within the core terminal area surrounding the terminal building. Areas for smaller aircraft demand less stringent standards.

FAA ARC design standards applied to the Terminal Area options:

- Core Terminal Area (Piston, Turboprop & Jets): ARC C/D-II
- Main Apron Areas (Piston, Turboprop & Jets): ARC B-II to C/D-II
- Maintenance-Hangar(s) (Piston, Turboprop & Jets): ARC B-II to C/D-II
- Common Box-Hangar(s) (Piston & Turboprop): ARC B-II
- T-Hangar(s) (Piston Aircraft) (Piston): ARC A-I to B-I

MQI Terminal Area Considerations:

The following describes factors considered as part of the Terminal Area options:

Coastal Studies Institute (CSI): A 40-acre tract north-northeast of the terminal building has been proposed for development as a research campus. At the time of the development of terminal area options, it was reported to the Airport Authority that the CSI was in the programming phase of their development, and that no planning options/concepts were available for review by the Airport Authority or consultant.

Table 5-5: FAA Airport Design ALP Standards – Terminal Area

Airport – Terminal Area Geometric Component (Parenthesis is half the distance)	Future ARC B-II (Minimums Not Lower than ¾-Mile)	Future ARC C/D-II (Minimums Not Lower than ¾-Mile)
Runway to Building Restriction Line (BRL) *	500' - Non-Precision 750' – Precision	500' - Non-Precision 750' – Precision
Runway to Taxiway Holdline	200' – Non-Precision 250' – Precision	200' – Non-Precision 250' – Precision
Runway to Taxiway/Taxilane Centerline	240'	300'
Runway to Aircraft Parking Area	200'	400'
Runway to Helicopter Touchdown Pad	Reference A/C 150/5390-2	
Obstacle Free Zone (OFZ) Width	400' (200')	400' (200')
Object Free Area (OFA) Width	500' (250')	500' (250')
TAXIWAY / TAXILANE SYSTEM		
Taxiway Width	35'	35'
Taxiway Object Free Area (OFA) Width	131' (65.5')	131' (65.5')
Taxilane Object Free Area (OFA) Width	115' (57.5')	115' (57.5')
Taxiway Turn Radius	75'	75'

* Note: Building Restriction Line (BRL): The BRL identifies suitable airport building area locations. The BRL runway centerline separation is determined by object clearing criteria, and is implicit of; 1) runway protection zone (RPZ), 2) runway object free area (ROFA), 3) runway visibility zone (RVZ), 4) navigational aids (NAVAIDS), 5) terminal instrument procedures (TERPS) criteria, and 6) line-of-sight standards.

Source: FAA Advisory Circular 150/5300-13, Change #8, *Airport Design*.

MQI TVOR Navigational Aid: The existing Terminal VOR station (TVOR) occupies approximately 22 acres of terminal expansion area. The TVOR, with upgrade/replacement in 2003, requires a 1,000' radius buffer totaling ±72 acres in which nearly no structures are permitted, particularly metal objects which could distort signal integrity. The existing TVOR buffer extends westward almost to Apron 'B', and northward into about 10 acres of the undeveloped 40-acre parcel. To provide adequate terminal area expansion, it is recommended the TVOR be relocated approximately 1,900' to the southwest. The relocated site permits the TVOR to remain on existing Airport/County property, requiring about 17 acres of tree/vegetation removal. Impacts to airspace and other detailed siting factors, per FAA analysis, requires further study for TVOR site determination.

MQI AWOS-3: The automated weather observation (AWOS) requires a 500' radius buffer. To provide adequate terminal area expansion, it is recommended the AWOS be relocated to the southwest of the airfield – the same general site area as TVOR.

MQI RCO Aid: The RCO antenna is off-Airport. Discussions with the FAA, Southern Region indicated that relocating the TVOR and AWOS-3 does not impact the existing RCO.

Environmental Factors: Stormwater possibilities are incorporated into the terminal area concept, as reasonable, based on non-surveyed topographical drainage patterns and conditions to be expected under the high-density stormwater regulations.

Fire Code / Building Code Factors (Hangars): To the extent possible, general National Fire Protection Association (NFPA) standards were taken into account in determining the layout and proximity of hangars and fuel facilities.

TERMINAL AREA EXPANSION OPTIONS (A, B & C)

Table 5-6 shows the attainment of facility requirements for each of the terminal area options; identified as Option A, Option B and Option C. The attainment is a performance measure, expressed as a percent, which shows the ability of each option to meet the recommended space allocation requirements identified in Section 4. Specifically, attainments are listed for the apron, T-hangars and common hangars.

Table 5-6: FAA Airport Design ALP Standards – Terminal Area

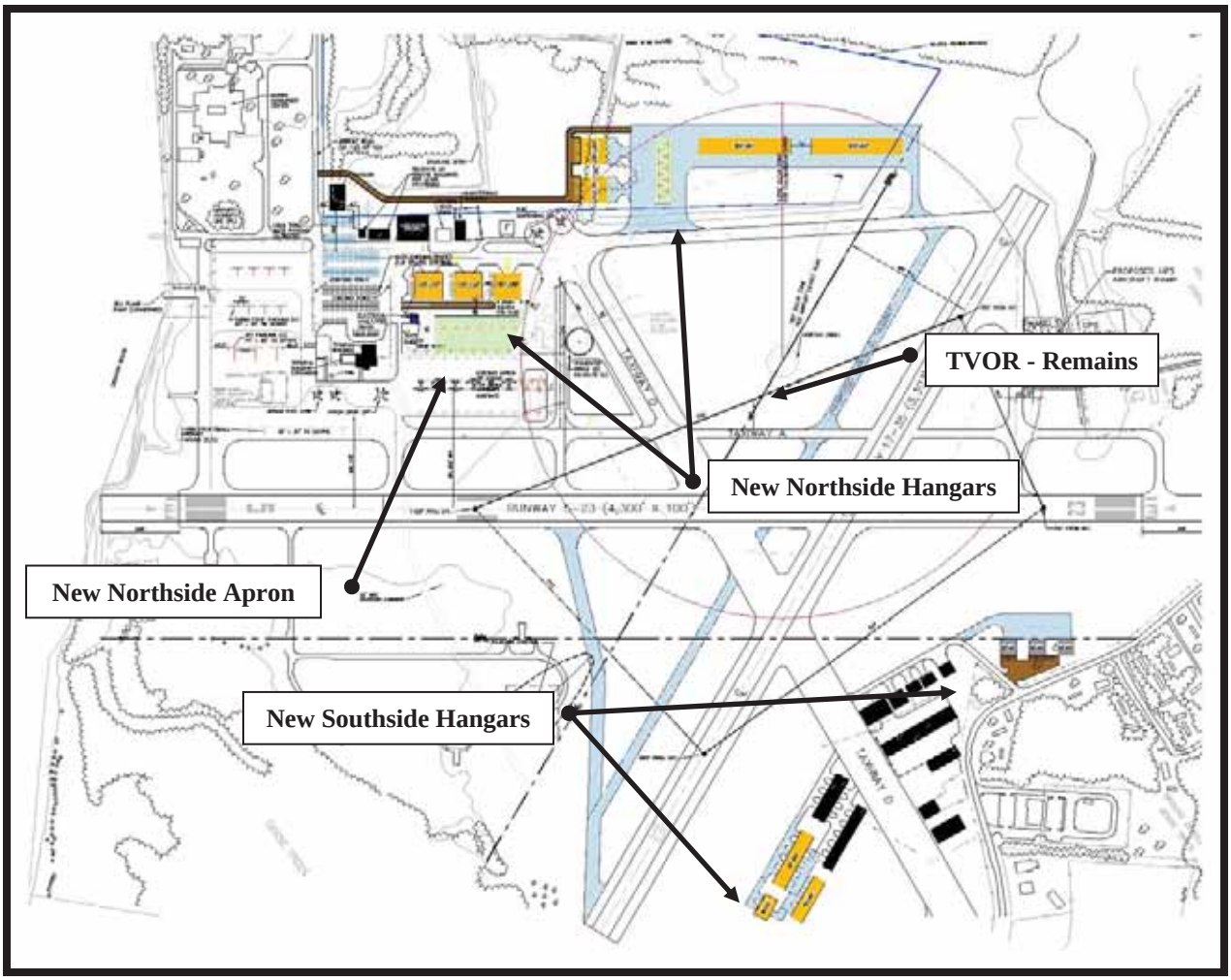
Terminal Component	Apron Attained (SF)	% Attained	T-Hangars Attained (SF)	% Attained	Common Hangars Attained (SF)	% Attained
2025 Terminal Area Requirements	+165,000		+60,000		+50,000	
Option A	+46,000	28%	+41,000	68%	+24,000	48%
Option B (Preferred)	+165,000	100%	+60,000	100%	+50,000	100%
Option C	+165,000	100%	+60,000	100%	+50,000	100%

Base Options:

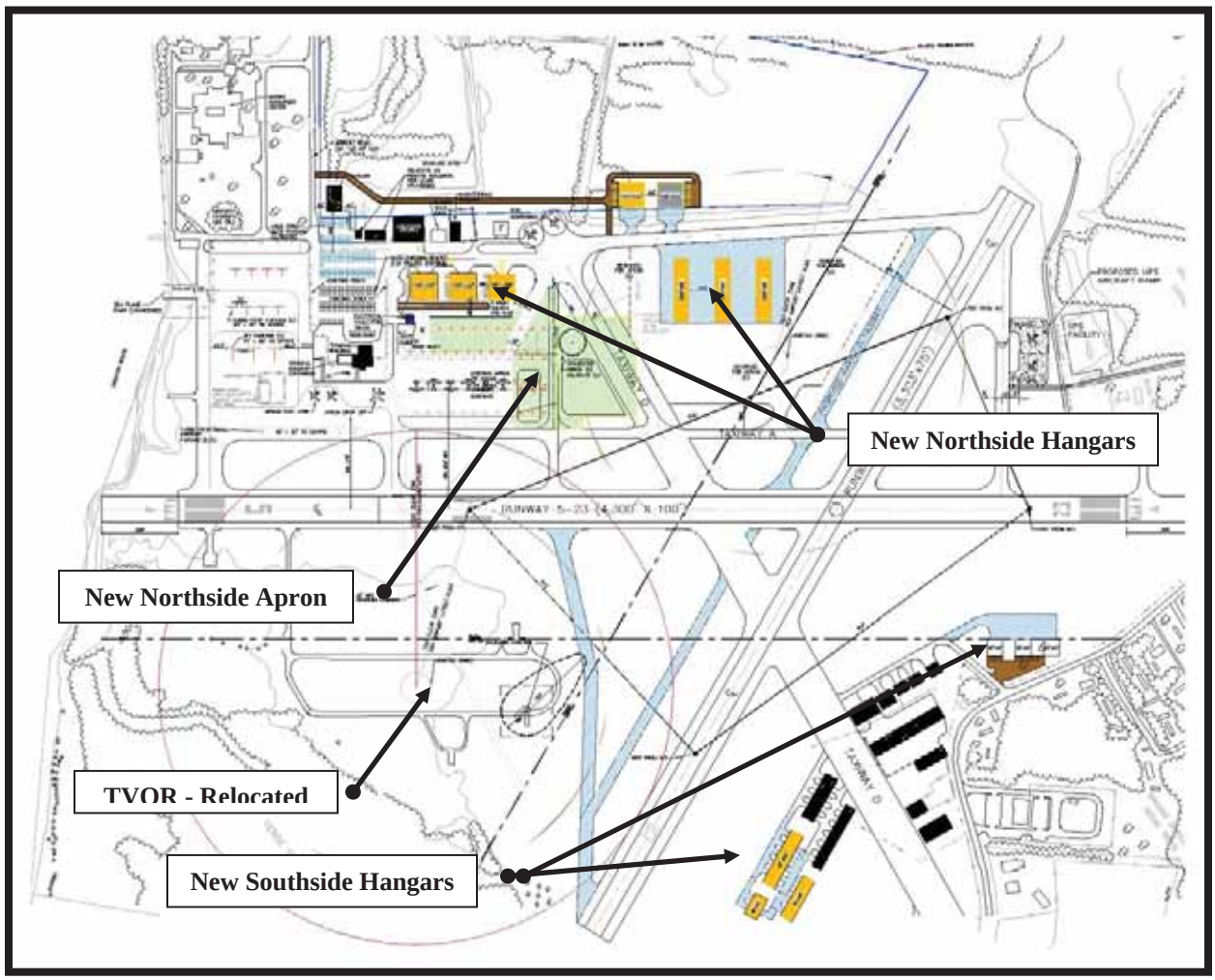
Each of the three (3) Terminal Area Options shares a common baseline of improvements, in which the baseline facilities includes:

- Expansion of T-hangars in the Southside Hangar Area
- Expansion of up to 3 common hangars in the Southside Hangar Area
- Expansion of 2 to 3 common hangars in Northside Terminal Area
- Expansion of apron north of Apron 'B'

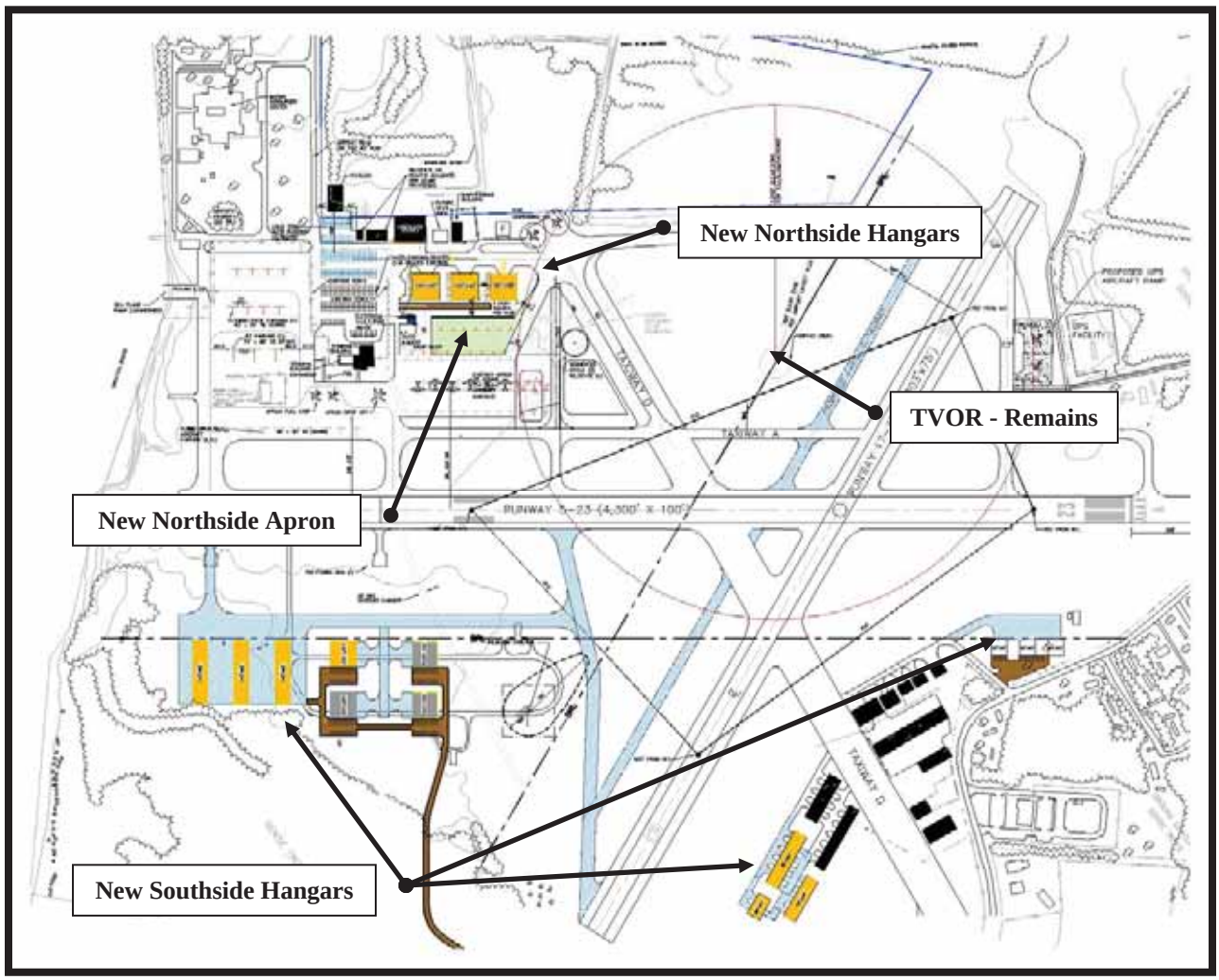
TERMINAL AREA OPTION 'A'



TERMINAL AREA OPTION 'B'



TERMINAL AREA OPTION 'C'



PREFERRED TERMINAL OPTION:

In October 2005, the Airport Authority selected Option 'B' as the preferred terminal area concept. Option A was eliminated because it did not meet the 10 to 20 year demand for hangars and apron. Options B and C allow sufficient expansion to accommodate 100% of the projected apron and hangar growth.

Option 'B' was favored because it met based user demands, with the possibility for expansion to accommodate unforeseen and/or long-term demand. Option 'B' involves the eventual relocation of the TVOR, RCO and AWOS station to the southwest portion of the airfield, which allows for contiguous apron and hangar expansion adjacent to the existing 'core' terminal area, and maintaining continuity of access and visibility.

In addition, this Option 'B' centralizes most of the future development within the 'core' terminal area, connecting to existing paved areas, utilities. The larger common hangars, with the possibility of commercial-related activity and those with frequent auto traffic are recommended northeast of the terminal building.

While this option does not require additional land acquisition, it does require a portion of the 40-acres being considered for CSI development.

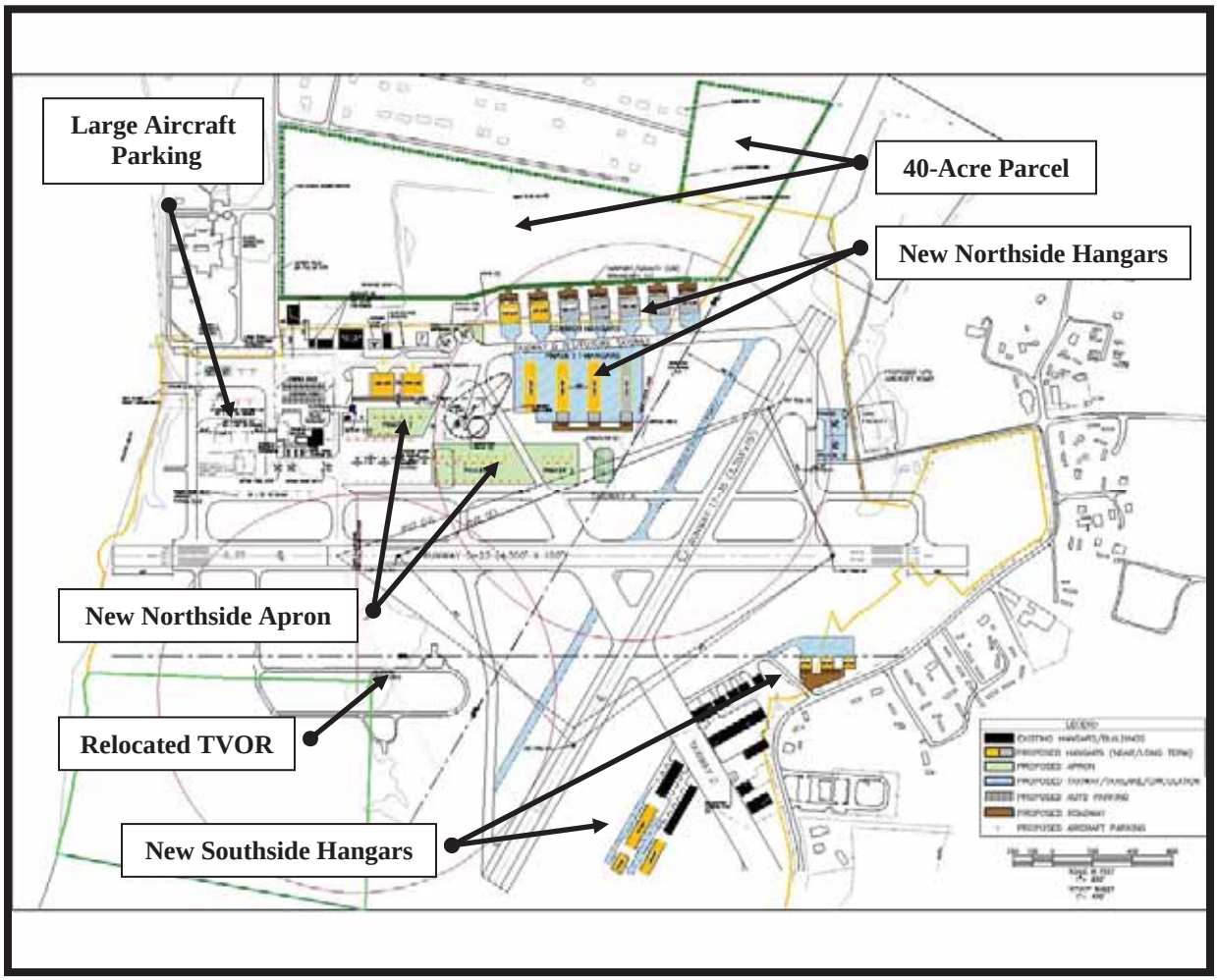
Option 'B' was modified following the Airport's decision, in order to accommodate potential CSI development as part of a particular 40-acre tract north of the terminal area and TVOR. The modification also contended with property ownership, control and encumbrances associated with various Airport Authority and County parcels.

The modifications to Option 'B' included:

- Common public-use access roadway to serve the 40-acre site and future hangars
- Additional common hangars along Taxiway 'B' (taxilane in the future)
- Potential areas for stormwater basins.
- Additional paved area for 100LL fueling.
- Rearrangement of auto parking for future T-hangars.

From this, the revised Option 'B' was accepted and carried forward for depiction on the updated MQI Airport Layout Plan (ALP) drawings.

PREFERRED - TERMINAL AREA
MODIFIED OPTION 'B'



5.3 REPLACEMENT AIRPORT SITE ANALYSIS

This section of the alternatives analysis assessed the potential for a suitable replacement airport site within Dare County. An airport site analysis was performed as part of the Airport Master Plan Update process to evaluate potential replacement airports, in order to compare with the development costs to expand the existing Airport site.

Airport Site Selection Process:

The site selection process combines analysis of GIS data and mapping to systematically assess physical, social, and environmental constraints within the airport study area. The electronic mapping results in an overlay process to graphically evaluate locations that offer suitable locations for airport development. This allows for a uniform screening of site attributes within the entire search areas, and objectively eliminates undesirable areas from further consideration.

The identification of potential sites includes:

- Accommodation of Ultimate Airport Geometric Design
- Wind Coverage
- Airspace and Instrument Approaches
- Airport Location and Visibility
- Ground Travel Time
- Construction Costs
- Surrounding Land Use
- Property Ownership/Tract Size/Site Acquisition
- Flood Potential (FEMA 100-year flood event)
- Wetland Impact Potential (County GIS delineation)
- Relocation of Commercial, Residential, and Public Structures
- Relocation and/or Closure of Public Roadways
- Major Utilities and Public Services

Airport Geometric Footprint

The recommended runway length planned for the Dare County Regional Airport is 5,500'. The following summarizes the major Airport facility requirements used in application of the replacement airport site assessment.

- 5,500' x 100' runway (FAA ARC C/D-II Design Standards)
- Full-length parallel taxiway system
- Fee-simple control of Airport safety areas
- Precision instrument approach capabilities with ¾-mile visibility minimums
- Approximate 50-acre terminal area (terminal building, hangars, apron, fuel facilities, auto parking and circulation).

Findings – Potential Sites:

The following are the results of the replacement airport site analysis, in which four (4) potential sites were revealed (3 new sites). The sites are shown on the following pages.

SITE A: MANTEO/ EXISTING AIRPORT SITE: Site A is located in the northwestern part of Manteo Island, at the existing MQI Airport site.

SITE B: KITTY HAWK SITE: Located north of Kitty Hawk on the Outer Banks of Dare County.

SITE C: MANNS HARBOR SITE: Located on the mainland of Dare County approximately 2 miles west of Mann's Harbor.

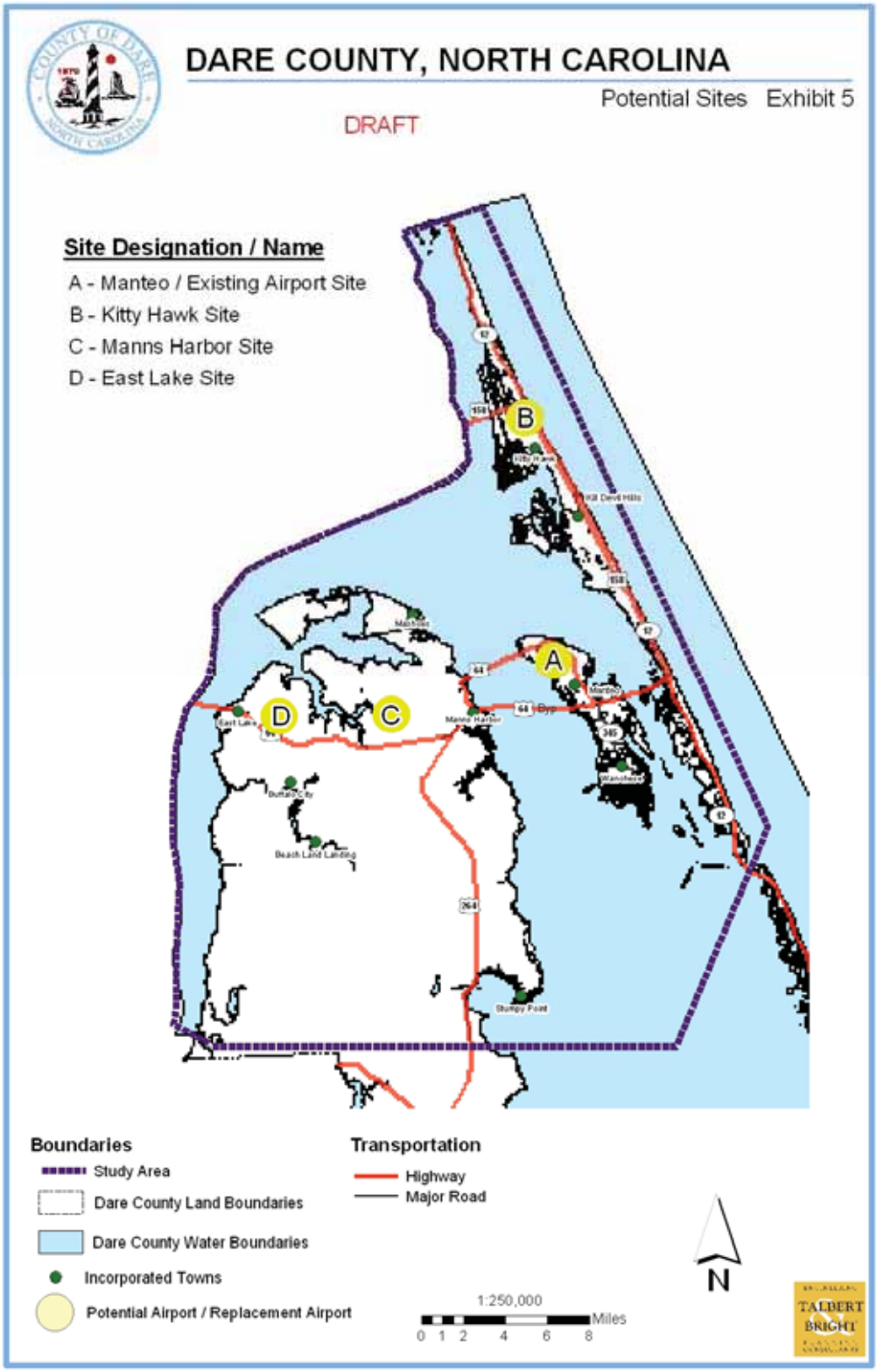
SITE D: EAST LAKE SITE: Located on the mainland approximately 1 mile east of East Lake and north of Highway 64.

Site A is an existing, funded site which offers a current level-of-service not readily or immediately capable with any of the replacement sites. Site A does involve limitations and some restrictions to development, but not at a level with comparatively significant disadvantage to the replacement sites. From a site selection standpoint, Site A offers capabilities meeting, and often exceeding the physical and social attributes which would be involved as impacts with the other replacement sites.

Site B is perhaps physically viable, but at a disadvantage predominately because of surrounding land use, airspace issues (towers), expansion limitation, and unspecified land acquisition/relocation and construction costs. Site B is not viable for a crosswind runway, and has access and expansion issues associated with the terminal area.

Sites C and D, while favored because of the absence of surrounding developed areas, has perhaps insurmountable development restrictions due to it's land ownership as a wildlife refuge, remote location to the major population center and ground access corridors, floodplain & wetland issues, penetration of military airspace, and unspecified land acquisition and construction costs.

Overall, the composite site analysis demonstrates that Site A, the existing airport location, clearly has the most favorable site selection attributes because it's conveniently located, durable and comparatively cost-effective when considered based on providing an existing level-of-service, and for future expansion to meet demand.


DARE COUNTY, NORTH CAROLINA
Potential Sites Exhibit 5
DRAFT
Site Designation / Name
A - Manteo / Existing Airport Site
B - Kitty Hawk Site
C - Manns Harbor Site
D - East Lake Site
A
B
C
D
Boundaries
Study Area
Dare County Land Boundaries
Dare County Water Boundaries
Incorporated Towns
Potential Airport / Replacement Airport
Transportation
Highway
Major Road
1:250,000
0 1 2 4 6 8 Miles
N
TALBERT BRIGHT


DARE COUNTY, NORTH CAROLINA
Potential Sites Exhibit 6
DRAFT
Camden Point
Harbinger
Kitty Hawk
Powells Point
FIRST FLIGHT (FFA)
Colington
Wright Monument
DARE CO REGIONAL (MQI)
AWOS-3 128.275
WRIGHT BROTHERS VOR/DME
MANTEO 370 MQI
Manteo
East Lake
Harbor
ROANOKE ISLAND
Wanchese
Nags Head
buildings
PEA ISLAND NATIONAL WILDLIFE REFUGE
PHELPS C MOA
Stumpy Point
STUMPY POINT MOA
R-5313C
R-5313A
Rodanthe
CAPE HATTERAS NATIONAL SEASHORE
PAMLICO A MOA
HYDE CO (7W6)
Site Designation / Name
A - Manteo / Existing Airport Site
B - Kitty Hawk Site
C - Manns Harbor Site
D - East Lake Site
Study Area
Potential Airport / Replacement Airport
N
TALBERT BRIGHT