NORFOLK INTERNATIONAL AIRPORT

IELS AVIAU

AIRPORT MASTER PLAN

WORKING PAPER #4 AIRPORT DEVELOPMENT ALTERNATIVES AND ENVIRONMENTAL REVIEW

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5 AIRPORT DEVELOPMENT CONCEPTS

To satisfy the facility requirements identified in **Chapter 4**, numerous concepts, site configurations, and development options were created and reviewed for the various components of the Airport. In many circumstances, multiple alternatives were identified, but eliminated early in the planning process from further consideration. The concepts deemed most reasonable to support the long-term operational sustainability of the Airport are identified and carried forward in the evaluation.

This chapter includes separate concepts and configurations for runways, taxiways, passenger terminal facilities, air cargo, general aviation, and support facilities. The number of potential recommendations is substantial; however, it is emphasized that although projects may be desired, they may not necessarily be financially or environmentally feasible. As such, recommendations presented within this chapter may be further modified or narrowed during the financial planning components of the Master Plan Study. The overall effort will refine the final strategy into actionable recommended projects for implementation in phases.

5.1 CONCEPT EVALUATION

Regardless of timeframe or activity level, the overarching principles guiding facility recommendations are to provide an elevated level of customer service and promote regional economic wellbeing while accommodating the evolving business model of the airlines and airport tenants. For some functional areas, such as the airfield, the logical recommendations were distinctly apparent as they are driven largely by Federal Aviation Administration (FAA) design standards as well as by existing infrastructure and available property. In contrast, improvements related to the passenger terminal buildings and vehicle parking have variability in their configuration. This is due to potential financing and implementation challenges, and their influence on surrounding Airport facilities.

During the identification of facility requirements, it became evident that the Master Plan would not consist of all-encompassing or competing alternatives for development of the Airport. Rather, the concepts and alternatives presented consist of a series of separate improvements that are assembled into the overall strategy. As such, individual components are reviewed and recommended separately to develop the preferred improvements program.

5.2 CURRENT AIRFIELD COMPLIANCES AND DEFICIENCIES

Norfolk International Airport (ORF) currently operates two runways (Runway 5/23 and Runway 14/32), each having unique capabilities and constraints. Each runway was evaluated based on its operational requirements, with the identified improvements provided below. To identify the best methods for improving airfield operations with regard to the runway infrastructure, it was important to evaluate the strengths and weaknesses of closing Runway 14/32 and/or the addition of a secondary runway (i.e., parallel Runway 5R/23L).

To satisfy operational efficiency, access to and from the runways, improvements and expansions to the associated taxiway systems, and FAA design standards were also identified. Concepts

relating to runway standards and deficiencies are presented in **Sections 5.2.1** and **5.2.2**, while taxiway standards and deficiencies are discussed in **Section 5.2.3**.

5.2.1 Runway 5/23

Design Standards Satisfied

Based on the demands outlined in **Chapter 4**, the current length, width, Runway Object Free Zone (ROFZ), and Runway Protection Zones (RPZs) of the primary runway (Runway 5/23) are adequate and are anticipated to remain adequate throughout the forecast period; therefore, it is recommended that these fundamentals of Runway 5/23 be maintained throughout the planning period. No development alternatives are needed for these elements.

Design Standards Needing Improvements

Although many attributes of Runway 5/23 meet FAA design criteria, some features do not, including: the runway shoulders, safety areas, object free areas, and the blast pads.

- Runway Shoulders When evaluating runway designs standards in Chapter 4, it was determined that Runway 5/23 does not meet the 25-foot shoulder requirement, with the current shoulders measuring zero to 15 feet. It is recommended that pavement be added to both sides of the runway to meet the 25-foot requirement.
- Runway Safety Area (RSA) –the Runway 5/23 RSA width contains a drainage structure located near the intersection with Taxiway 'A'. Furthermore, portions of the RSA do not meet the transverse grading requirements. Per FAA design criteria, transverse grades should be -1.5 percent to -3.0 percent away from the runway shoulder edge and beyond the runway ends; however, the existing grades are 0.7% to 2.0 percent. It is recommended these areas be graded to meet FAA design criteria and that the RSA is widened where necessary.
- Runway Object Free Area (ROFA) The ROFA design standard for Runway Design Code (RDC) III and IV is 800 feet wide, centered about the runway centerline, and extends 1,000 feet beyond each runway end. Currently, the Runway 5/23 ROFA contains portions of the glideslope shelter and antenna. To address this condition, these facilities could be relocated, or the Airport could seek an FAA Modification of Standards (MOS).
- <u>Runway Blast Pads</u> Conformance to FAA design criteria requires that 200-foot wide by 200-foot length blast pads be placed symmetrically at the end of each RDC IV runway. At present, the blast pads on each runway end have a deficient width of only 150 feet. The blast pads could be widened, or the Airport could seek an FAA MOS.

Chapter 4 provides additional details regarding FAA design standards.

5.2.2 Runway 14/32

Design Standards Satisfied

Based on the requirements outlined within **Chapter 4**, the current runway width, RSA, ROFZ, and RPZ of the crosswind runway (Runway 14/32) are adequate and are anticipated to remain adequate throughout the forecast period; therefore, it is recommended that these fundamentals of Runway 14/32 be maintained as long as the Runway remains in operation. No development alternatives are needed for these elements.

Design Standards Needing Improvements

Although many attributes of Runway 14/32 meet FAA design criteria, the runway shoulders and ROFA are deficient.

- Runway Shoulders Runway 14/32 currently lacks the required 25-foot paved shoulders. It is recommended that 25-foot shoulders be added to the runway.
- ✤ <u>ROFA</u> The ROFA design standard for RDC III and IV is 800 feet wide, centered about the runway centerline, and extends 1,000 feet beyond each runway end. Currently, the ROFA contains part of Robin Hood Road and the airport access road. An FAA MOS is recommended for this condition while the runway remains in use.

5.2.3 Taxiways

Design Standards Satisfied

The taxiway system at ORF was evaluated and compared to FAA standards for taxiway designs based on the Airport's Taxiway Design Group (TDG 5). Based on FAA standards, the following items are satisfactory:

- ✤ Width: All taxiways
- ✤ Shoulders (30 feet): Taxiway 'V'
- Distance of taxiway centerlines from objects: Taxiways 'A', 'J', and 'F'
- ✤ Taxiway Safety Area (TSA): All taxiways
- Taxiway Object Free Area (TOFA): Taxiways 'A', 'J', and 'V'
- → Taxiway Fillets: All taxiways, except for Taxiway 'C'

Design Standards Needing Improvements

Although many attributes of ORF's taxiway system meet FAA design criteria, some features do not, including the following:

- Shoulders: Neither Taxiway 'A' or 'F' have shoulders, while the shoulders for Taxiways 'C' and 'J' are less than the required width and unpaved.
- Distance of taxiway centerlines from objects: Taxiways 'C' and 'F'
 - Result of access roads impeding the TOFA (near the Runway 23 end)
- TOFA: Taxiways 'C' and 'F'
 - An MOS is required if objects are not be relocated outside the TOFA.
- ✤ Taxiway Fillets: Taxiway 'C'
 - Revised pavement geometry is necessary to meet standards.

5.3 AIRFIELD DEVELOPMENT CONCEPTS

This section identifies and evaluates potential runway and taxiway improvements that will enhance the overall safety, efficiency, reliability, and capacity of the airfield at ORF. Aircraft flows between the runway system and various functional areas (e.g., terminal area, air cargo, and general aviation) have been considered. Runway and taxiway concepts were developed through qualitative review of the following considerations:

- ✤ Construction and operating costs
- ✤ Operational changes and considerations
- ✤ Construction impacts, including ease of phasing and construction
- ✤ Airfield delays and other operational factors
- ✤ Capacity, safety, and reliability considerations
- ✤ Airspace considerations
- + Environmental considerations
- ✤ Community acceptance

As discussed within previous section of the Master Plan, the goal is to plan for a safe and operationally efficient airfield. This can be accomplished by meeting the following objectives:

- + Adhere to FAA design standards, reducing/eliminating Modifications of Standards
- ✤ Accommodate all existing and projected users
- + Provide sufficient airfield capacity to meet demand, while minimizing airfield delays
- + Reduce runway crossings (particularly in the middle third of runway) to improve safety
- ✤ Reduce risk of pilot confusion
 - o Reducing the number of taxiways intersecting at a single location
 - o Eliminating acute angle intersections
 - Increasing the pilot's situational awareness (proper signage and marking)
 - o Avoiding wide expanses of pavement
 - o Increasing visibility
- ✤ Determine the ultimate Airport Layout

5.3.1 Initial Runway Alternatives

ORF currently operates a two-runway system, each with unique capabilities and constraints. Both runways were evaluated based on previously outlined criteria. In total, 16 runway alternatives were initially evaluated, as listed in **Table 5-1**. Runway alternatives considered various issues, including displaced threshold locations on the primary runway (Runway 5/23), improvements to or closure of the crosswind runway (Runway 14/32), and various options for a new secondary parallel runway; which would be designated Runway 5R/23L. Previous studies have also considered this need at ORF. The following runway alternatives include refinements of past concepts and additional layouts based on present and forecasted needs. It is noted that the justification for a secondary parallel runway has not been accepted by FAA at this time but remains a strong ultimate goal of the Airport.

					Vicibility	TCC #	Parallel Rwy	Parallel T	ху
Alternative	Description	Length	Width	ARC	Minimums	(FAA EB 99)	CL Separation	CL Separation	TDG
			F	Runway	5/23				
1	Relocate 5 Threshold	9,001'	150'	D-IV	< 3/4 Mile	5 - 34:1	-	-	-
			R	unway :	14/32				
2	Reconfigure 14-32	4,876'	100'	B-II	<u>></u> 1 Mile	4 - 20:1	-	240'	3
3	Close 14-32	-	-	-	-	-	-	-	-
		N	ew Parallel I	Runway	(Runway 5R/2	23L)			
4	9,001' - 400' Offset	9,001'	150'	D-IV	< 3/4 Mile	5 - 34:1	400'	-	-
5	9,001' - 876' Offset	9,001'	150'	D-IV	< 3/4 Mile	5 - 34:1	876'	400'	5
6	7,900'	7,900'	150'	C-III	< 3/4 Mile	5 - 34:1	876'	400'	3
7	7,200'	7,200'	150'	C-III	< 3/4 Mile	5 - 34:1	876'	400'	3
8	6,000', 34:1	6,000'	150'	C-III	< 3/4 Mile	5 - 34:1	876'	400'	3
9	6,000', 20:1	6,000'	150'	C-II	<u>></u> 3/4 Mile	4 - 20:1	876'	300'	3
10	5,500', 34:1	5,500'	150'	C-II	< 3/4 Mile	5 - 34:1	876'	400'	3
11	4,876', 20:1	4,876	100'	B-II	<u>></u> 1 Mile	4 - 20:1	876'	240'	3
Additional Runway Alternatives									
12A	5,500' with EMAS	5,500'	100′	C-II	<u>></u> 3/4 Mile	4 - 20:1	876'	300'	3
12B	5,500' with EMAS	5,500'	100′	C-II	<u>></u> 1 Mile	4 - 20:1	876'	300'	3
13A	Runway Realignment	7,500′	100'						
13B	Runway Shift West	7,900'	100′						
14	Rotated Runway	5,500'	100'						

Table 5-1 – Initial Runway Alternatives

Note: The new runway (5R/23L) would be parallel to the current runway (Runway 5/23), which would become Runway 5L/23R. Source: CHA, 2019.

5.3.2 Eliminated Runway Alternatives

Upon further evaluation, it was determined that the following 11 alternatives listed within Table 5-1 are not preferable and do not require further consideration:

- ✤ Alternative 1: Relocate Runway 5 Threshold
- + Alternative 4: 9,001', Offset: 400' (Commercial Operations)
- + Alternative 5: 9,001', Offset: 876' (Commercial Operations)
- → Alternative 6: 7,900' (Commercial Operations)

- → Alternative 7: 7,200' (Commercial Operations)
- → Alternative 9: 6,000', ARC C-II (20:1)
- → Alternative 10: 5,500', ARC C-II (34:1)
- + Alternative 12A: 5,500', ARC C-II, with EMAS, 3/4-mile visibility minimum
- ✤ Alternative 13A: Runway Realignment
- ✤ Alternative 13B: Runway Shift
- → Alternative 14: Rotated Runway

Appendix A contains further detail and illustrations regarding the alternatives not chosen for further consideration.

5.3.3 Runway Alternatives for Further Consideration

Of the initial 16 alternatives, five have been recommended for further consideration, with each briefly discussed and illustrated throughout the subsequent sections.

Runway 14/32 Alternatives

Alternative 2: Reconfigure Runway 14/32

This alternative (**Figure 5-1**) would retain Runway 14/32 throughout the planning period. The runway was reviewed for standards for commercial operations and large jet aircraft (Airport Reference Code [ARC] C-III) and for lighter general aviation activity (ARC B-II). To provide the RSA and ROFA required for ARC C-III, the Accelerate to Stop Distance Available (ASDA) and Landing Distance Available (LDA) would remain below 4,000 feet for Runway 32 due to the limited property available, making this option impractical. However, if the Runway was designed for lighter (i.e., non-commercial) aircraft with ARC B-II and improved with a full-length parallel taxiway, all declared distances would be over 4,500 feet. This length would satisfy runway requirements for piston and turboprop aircraft, as well as for some light jets. Thus, this alternative is advanced for consideration as a general aviation crosswind runway. **Table 5-2** lists the opportunities and constraints for Runway Alternative 2.

Opportunities	Constraints
 Retains crosswind coverage for light General Aviation aircraft 	 Design standards hinders usage by GA jets and commercial aircraft
 Provides improved parallel taxiway 	 Requires parallel taxiway relocation and extension Occupies critical airport property that could be used for other facilities Airspace limitations (north/south traffic) and conflicts with surrounding facilities

Table 5-2 – Alternative 2: Reconfigure Runway 14/32

Source: CHA, 2019.





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DECLARED DISTANCES						
	RUNWAY 14					
	EXISTING C-III PROPOSED B-I					
TORA	4,876'	4,876'				
TODA	4,876'	4,876'				
ASDA	4,876'	4,876'				
LDA	4,301'	4,576'				

DECLARED DISTANCES					
	RUNWAY 32				
EXISTING C-III PROPOSED B-I					
TORA	4,876'	4,876'			
TODA	4,876'	4,876'			
ASDA	3,876'	4,576'			
LDA	3,876'	4,576'			

Figure 5-1 Reconfigure Runway 14-32

20:1 TSS , B-II Runway Alternative 2

Alternative 3: Close Runway 14/32

This alternative (Figure 5-2) would permanently close Runway 14/32 and enable redevelopment of the property for expanded airport facilities. Runway 14/32 can only effectively serve piston aircraft and is used infrequently. (More detail regarding usage of Runway 14/32 is provided in **Chapter 3, Table 4-7: Runway Usage**). Furthermore, even with a runway extension the surrounding regional airspace would render commercial activity on this orientation difficult. As such, with very limited benefit, there is a strong case for this alternative; therefore, it is also advanced for additional consideration. **Table 5-3** lists the opportunities and constraints for Runway Alternative 3.

	Opportunities		Constraints
≁	Recaptures airport property to expand	¥	Reduces crosswind coverage for light General Aviation
	critical aviation facilities		aircraft
≁	Avoids airspace conflicts with surrounding		
	facilities		
≁	Eliminates some operational conflicts and		
	safety concerns		
-			

Table 5-3 – Alternative 3: Close Runway 14/32

Source: CHA, 2019.

Proposed Parallel Runway 5R/23L Alternatives

Alternative 8: Runway 5R/23L – 6,000 Feet, ARC C-III

This alternative (**Figure 5-3**) includes building a new parallel runway 876 feet east of the existing Runway 5/23. The new runway would be 6,000 feet in length and 150 feet in width, providing the greatest length without physically impacting adjacent Lake Whitehurst. This runway concept would be capable of serving up to C-III aircraft. Constraints to this alternative include penetration to the Runway 5L glideslope critical area, potentially requiring its relocation¹.

Accompanying the parallel runway would be a full-length parallel taxiway capable of accommodating aircraft up to TDG 3. This taxiway would be 50 feet wide and provide 400 feet of separation from the runway. As shown in **Figure 5-3**, Lake Whitehurst would impede the TOFA, TSA, and RSA. To minimize airspace and obstruction considerations, both runway ends would include displaced thresholds, reducing landing distance to 5,000 or 5,500 feet. The US Navy has indicated their concern for impacts to Naval training activity for this and any parallel runway alternative.

This concept warrants further consideration and was used as the foundation for the remaining derivative alternatives of various lengths and approach capabilities. **Table 5-4** lists the opportunities and constraints for Runway Alternative 8.

¹ It should be noted that this constraint would be present for the other parallel runway alternatives -with the same runway to runway offset.





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Figure 5-2 Close Runway 14-32 Alternative 3







DECLARED DISTANCES				
PROPOSED RUNWAY 5R-23L				
	RUNWAY 5R	RUNWAY 23L		
TORA	6,000'	6,000'		
TODA	6,000'	6,000'		
ASDA	6,000'	6,000'		
LDA	5,000'	5,500'		

NOTE: COMMERCIAL TAKEOFFS ARE RESTRICTED ON 5R DUE TO LOCATION OF EXISTING 5L GLIDESLOPE CRITICAL AREA.

EXHIBIT 5-3 PROPOSED 5R-23L - 6,000' 34:1 TSS , C-III Runway 180' SHIP HEIGHTS Alternative 8

	Opportunities		Constraints
*	Provides secondary runway for GA airport users	≁	Length limits usage by most commercial
÷	876' separation enables simultaneous VFR	≁	Impacts to on-airport facilities (airport maintenance facilities, AREE training facility,
≁	No direct physical impacts to Lake Whitehurst (however some wetland impacts will occur)	≁	MRO hangar, and GA parking apron) RPZ impacts to commercial buildings Potential
≁	Greater height over Little Creek Naval Base		Impact to Naval training activity

Table 5-4 – Alternative 8: Runway 5R/23L (6,000', ARC C-III)

Source: CHA, 2019.

Alternative 11: Runway 5R/23L – 4,876 Foot, ARC B-II

This alternative (Figure 5-4) illustrates the shortest parallel runway concept, providing the existing length of Runway 14/32 at 4,876 feet. The purpose of this concept is to replace the crosswind runway with a parallel runway. At this length, an ARC of B-II is appropriate with a taxiway offset of only 240 feet. A one-mile visibility minimum results in a steeper 20:1 threshold surface. This minimalist concept would reduce costs and impacts but would not accommodate the full general aviation corporate jet fleet. Larger aircraft would often taxi across the new runway to use the longer length of the primary runway. Nevertheless, with the lowest costs and impacts, this concept is advanced for further consideration. Table 5-5 lists the opportunities and constraints for Runway Alternative 11.

Table 5-5 – Alternative 11: Runway 5R/23L (Length: 4,876', ARC B-II)

	Opportunities		Constraints
≁	Lower cost GA runway for non-jet aircraft	¥	Runway use limited to propeller and light jet
≁	No impacts to airport support facilities		aircraft
≁	No impacts to Lake Whitehurst	≁	Potential Impact to Naval training activity
≁	No VOR impacts		
≁	Allows for 876-foot simultaneous runway operations		
Carrie	1001 CUA 2010		

Source: CHA, 2019.

Alternative 12B: Runway 5R/23L – 5,500 Foot, ARC C-II

Alternative 12B (**Figure 5-5**) is also intended to be a modest approach to providing a capable parallel runway, and thus, includes a 5,500-foot length and 100-foot width. To keep costs and potential impacts at a minimum, this concept adds an aircraft arresting system, known as an Engineered Materials Arresting System (EMAS), at both ends of the runway. The EMAS beds eliminate the requirement for an RSA beyond the "stop-end" of the runway, with only a 600-foot long RSA on the approach end. As such, the RSA impacts to Lake Whitehurst are avoided, requiring little filling or grading overall. The ARC C-II design includes a 300-foot runway-taxiway offset. A 600-foot runway displacement is included on Runway 5R to avoid building and object obstructions.

Alternative 12B depicts one-mile visibility minimum, which results in a reduced width of the RPZ that is clear of all buildings. It also has a steeper 20:1 threshold surface. Due to its minimum impacts, 12B is advanced for potential implementation. **Table 5-6** lists the opportunities and constraints for Runway Alternative 12B, and **Appendix A** lists the differences between Alternatives 12A and 12B.







DECLARED DISTANCES				
PROPOSED RUNWAY 5R-23L				
	RUNWAY 5R	RUNWAY 23L		
TORA	4,876'	4,876'		
TODA	4,876'	4,876'		
ASDA	4,876'	4,876'		
LDA	3,876'	4,876'		

Figure 5-4 Proposed 5R-23L - 4,876'

20:1 TSS , B-II Runway 180' SHIP HEIGHTS Alternative 11







DECLARED DISTANCES				
PROPOSED RUNWAY 5R-23L				
	RUNWAY 5R	RUNWAY 23L		
TORA	5,500	5,500'		
TODA	5,500	5,500		
ASDA	5,500	5,500'		
LDA	4,900	5,500'		

Figure 5-5 Proposed 5R-23L 5,500' With EMAS At Both Ends

20:1 TSS , C-II Runway Not Lower than 1 Mile Visibility Alternative 12B

Opportunities	Constraints
Provides secondary runway for GA airport	✤ Length restricts usage by
users	commercial operations
	Potential Impact to Naval training
	activity
Avoids impacts to VORTAC	
✤ 876' separation enables simultaneous VFR	
operations	
✤ No impacts to Lake Whitehurst	
✤ No wetland impacts	

Table 5-0 – Alternative 12D. Runway $5R/25L$ (Length, 5,500, ARC C-II)
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Source: CHA, 2019.

5.3.4 Taxiway Alternatives

Aircraft ground movement at ORF is supported by a system of taxiways providing access to all portions of the airfield. Nevertheless, portions of the taxiway system are considered non-standard with regard to current FAA design standards or are such that an improved configuration could reduce the risk of pilot confusion and thus a runway incursion. The following taxiway alternatives were developed with the aforementioned considerations and adherence to all FAA design standards.

It is important to note that with each concept, focus is given to the portions of the taxiway system west of the existing Runway 5/23; therefore, the conceptualized taxiway system supporting the potential parallel Runway 5R/23L remains the same throughout each alternative with a TDG 3 full-length parallel taxiway. **Table 5-6** lists the opportunities and constraints for all taxiway alternatives.

Taxiway Alternative 1

Taxiway Alternative 1 (**Figure 5-6**) addresses the variable separation distance between Taxiway 'C' and Runway 5/23. Taxiway 'C' is currently designated as TDG 5, requiring a minimum taxiway to runway centerline distance of 400 feet. However, the current separation of Taxiway 'C' ranges from 400 feet at the Runway 5 end to over 600 feet at the Runway 23 end. While this distance provides an added separation margin, it also reduces the available non-movement space near the southeasternmost gates of Terminal Concourse B, requiring aircraft push-back into the Taxiway 'C' environment. Therefore, Taxiway Alternative 1 illustrates a parallel Taxiway 'C' offset of 400 feet from the Runway 5 end to Taxiway 'H'.

Additionally, Taxiway Alternative 1 illustrates the conversion of the Runway 14/32 pavement (from Runway 5/23 northeastward) into a new TDG 3 taxiway. This conversion of pavement allows for continued ingress/egress to the cargo area and for potential aeronautical development along the taxiway.

Lastly, Taxiway Alternative 1 shows the removal and update of taxiways that would be either no longer required or are non-standard. Specifically, this concept shows a realignment of Taxiway 'F' to meet current FAA taxiway design geometry. As a result of this realignment, this concept also shows a relocation of Taxiway 'E' to provide improved access. Although this concept shows the removal of Taxiway 'G', a pavement corridor is reserved for an ARFF access road between the existing firefighting station and the southern portion of the airfield.



LEGEND

Future Airfield Pavement

Future Parallel Runway

Taxiway Alternative 1

Taxiway Alternative 2

Taxiway Alternative 2 (**Figure 5-7**) shows similar concepts to address non-standard taxiway conditions and improved design geometry. While Taxiway Alternative 1 shows a Taxiway 'C' offset of 400 feet from the Runway 5 end to Taxiway 'H', this concept shows the offset distance throughout the full length of the taxiway. This full-length offset of 400 feet does not require a turn north of Taxiway 'H' and is compliant with current FAA taxiway geometry; however, this configuration impacts the existing Runway 23 glide slope antennae and PAPI, requiring relocation of both NAVAID systems. As a result of these relocations, a portion of Lake Whitehurst east of the Runway 23 end would require filling and grading in order to provide sufficient ground to accommodate reinstallation and operation of both systems, as well as to provide access roads. Significant environmental permitting and coordination would be required prior to moving the NAVAIDs.

Taxiway Alternative 3

Similar to Taxiway Alternative 1, Taxiway Alternative 3 (**Figure 5-8**) shows a partially realigned offset of Taxiway 'C' from the Runway 5 end to Taxiway 'H', along with the conversion of the Runway 14/32 pavement (from Runway 5/23 northward) into a new TDG 3 taxiway; however, this concept adds a new TDG 5 partial-length parallel taxiway east of Runway 5/23 from the end of Runway 5 to the realigned portion (as discussed in Taxiway Alternative 2) of Taxiway 'E', terminating prior to Lake Whitehurst to avoid filling a portion of the lake.

To accommodate the parallel taxiway, relocation of both the VORTAC and Runway 5 glide slope antenna would be required.

Alternative	Opportunities	Constraints			
Alternative 1: Partial Realignment of Taxiway C	 Realignment of Taxiway C to 400' offset improves the separation from Concourse B Partial taxiway realignment avoids impact to Runway 23 Glideslope Conversion of Runway 14/32 to Taxiway expands area for air cargo apron Removes non-standard conditions (direct apron to runway access) 	 Taxiway C retains existing curves near Runway 23 end Does not provide full-length standard parallel taxiway 			
Alternative 2: Full Realignment of Taxiway C	 → Full Realignment removes all curves in Taxiway C centerline → Realignment improves separation from Concourse B → Conversion of Runway 14/32 to Taxiway expands area for air cargo apron 	 Taxiway C realignment near Runway 23 requires relocation of Glideslope and PAPI Substantial environmental impacts to Lake Whitehurst 			
Alternative 3: Extension of Taxiway J	 ➤ Improves operational flexibility ➤ Provides additional runway exits 	 Requires relocation of VORTAC Taxiway J cannot be extended to full parallel without impacts to Lake Whitehurst 			

Table 5-7 – Taxiway Alternatives

Source: CHA, 2019.

LEGEND

Future Airfield Pavement

Future Parallel Runway

LEGEND

Future Airfield Pavement

Future Parallel Runway

5.4 PASSENGER TERMINAL FACILITY ALTERNATIVES

The preliminary passenger terminal facility concepts for ORF were developed to satisfy the identified facility requirements throughout the twenty-year planning period. Each concept incorporates the new or replacement facilities within the footprint of the existing terminal complex. In each alternative, the existing and proposed parking garages are retained, as is the 2002 arrivals building. However, several concepts consider the possibility of developing a two-level terminal facility with upper- and lower-level roadways along with a two-level departures/arrivals building ("headhouse"). This two-level concept would have baggage claim functions on the lower level and would call for repurposing the arrivals building as a ground transportation center (GTC) on the lower-level and airport administrative offices on the upper mezzanine level, with the potential for future infrastructure improvements to the second level with renovation as needed for administrative repurposing. Other than the Status Quo Alternative, all of the terminal concepts include substantial changes to the concourses, gates, security screening, ticketing, concessions, access roadways and other facilities, as described below.

Based on discussions with the Norfolk Airport Authority (NAA) management staff and Board Members, the preliminary terminal alternatives will be refined, with the selection of a recommended concept. The ultimate plan will be organized to include several phases, based on Planning Activity Levels (PALs) following a long-term implementation program.

5.4.1 Status Quo Alternative

The main departure terminal and Concourses A and B were originally constructed in 1974. Over the past 45 years, the NAA has continuously maintained these facilities, including several renovations in the past five years to upgrade the main lobby (i.e., atrium), concourses, airline gate areas, restrooms, concessions, and security checkpoints, and additional renovations are in the design phase. Thus, the Status Quo Alternative includes continuous improvements and renovations of existing facilities, but without any major new or replacement facilities.

It is noted that without expansion of concourses, gates, post-security concessions, out-bound baggage processors, and other facilities, current problem areas will persist, and the level of passenger service will continually decline as activity grows. At a minimum, with the addition of some airline gates (potentially through an extension of Concourse A), the existing passenger terminal could continue to operate through the planning period, although all of the current shortcomings will become heightened to the detriment of the passenger experience and operational efficiency.

5.4.2 2009 Master Plan Alternative

The previous Airport Master Plan developed an incremental terminal recommendation that retained the existing building layout and internal configuration, and included expansion of gates, and associated facilities through the addition of a third concourse (Concourse C). This layout utilizes the area of the long-term surface parking lot for the location of the additional concourse. This alternative is a simple and low-cost expansion option that maximizes use of existing facilities. However, several shortcomings are apparent, including the need for a third security checkpoint and taxilane/push-back conflicts between the concourses. The following exhibit (**Figure 5-9**) from

the 2009 Master Plan provides a graphic depiction of this concept, and **Table 5-8** summarizes the 2009 passenger terminal alternative.

Figure 5-9 – 2009 Passenger Terminal Alternative

Source: CHA, 2019.

Ge	neral Layout	
Retain the existing terminal layout including the departure and arrivals building, curbside and circulation,		
but expand the number of gates, hold rooms, and	post-security concessions by adding a third concourse.	
Advantages	Disadvantages	
 Low capital costs Ease of construction phasing; virtually no impact to passenger activity Provides adequate number of gates and added space for related services. 	 Requires addition of a third security checkpoint. Issues with TSA staffing and duplication of facilities Results in separation and some duplication of all post-security facilities, services, and concessions Reduced flexibility for airline gate utilization and operations No improvements or expansion of other needed facilities (e.g., out-bound baggage) Existing deficiencies remain in passenger circulation Retains split facilities for the ticking hall and curb side drop-off, with associated passenger confusion Retains the overly complex roadway layout, see Figure 5-10. 	

Table 5-8 – 2009 Passenger Terminal Facility Summary

Source: CHA, 2019.

Due to the disadvantages of the 2009 Terminal Alternative, four new concepts were developed as part of this Master Plan and are subsequently discussed and illustrated below.

5.4.3 Passenger Terminal Facility Alternative 1

Passenger Terminal Facility Alternative 1 (Figure 5-11) addresses pre-security configuration issues of the current terminal complex. In particular, the split ticketing halls are combined and relocated to the west side of the departure building, facing the arrival building. This enables reconfiguration and shortening of the departure roadways with an efficient parallel alignment with the arrivals building's curbside. The new departure curbside will provide greater overall length, with adjacent short-term parking serving both arrivals and departures.

Relocation of the ticketing halls enable redevelopment of the lower level of the departure building for expansion of the outbound baggage make-up facilities to serve all three concourses. TSA security would be consolidated into a single check point that is located on the eastern half of the atrium area. As is the case with the Status Quo Alternative, the previous Airport Master Plan developed an incremental terminal recommendation that retained the existing building layout and internal configuration, and included gates, and associated facilities through the addition of a third concourse (Concourse C). This layout utilizes the area of the long-term surface parking lot for the location of the additional concourse. This alternative is a simple and low-cost expansion option that maximizes use of existing facilities; however, several shortcomings are apparent, including long walking distances and taxilane/push-back conflicts between the concourses. **Figure 5-11** provides a graphic depiction of this concept, while **Table 5-9** summarizes Passenger Terminal Alternative 1.

Figure 5-10 – Existing Terminal Curbside Layout

Table 5-9 – Passenger Terminal Facility Alternative 1 Summary

General Layout

Builds upon the 2009 terminal layout with three concourses, and retention of the arrival building. The departure building is modified to relocate and consolidation of the ticketing halls, security screening check point, and departure curbside, expansion of outbound baggage make-up facilities, and improve vehicular circulation.

	Advantages		Disadvantages
+ + +	Modest capital costs through retention of several existing facilities Ease of construction phasing with minor impacts to passenger activity	* *	Results in separation and potential duplication of all post-security facilities, services, and concessions Reduced flexibility for airline gate utilization and
* ** **	Provides adequate additional facilities for all terminal requirements, including outbound baggage Removes deficiencies in passenger circulation Combines split facilities for the ticking hall and curbside drop-off (reduces passenger confusion) Eliminates overly complex roadway layout	*	operations Retains existing long walking distances to baggage claim and parking garages
*	Eliminates the need for a third security checkpoint.		

Source: CHA, 2019.

LEGEND

Existing Facility

Circulation/Holdroom

Concessions

Airline

Security/Regulatory

New Apron/Airfield Pavement

New Landside Pavement

Removal/Demolition

5.4.4 Passenger Terminal Facility Alternative 2A

The goal of Passenger Terminal Facility Alternative 2A (**Figure 5-12**) is to retain the benefits of Alternative 1, while removing its disadvantages. To achieve this goal, Passenger Terminal Facility Alternative 2A includes the same improvements to the departure building's vehicular circulation, and parking as Alternative 1; however, this alternative would completely replace existing Concourses A and B with a new consolidated north-south concourse to house all gates and a centralized security checkpoint and concession core. Alternative 2A assumes that the departures and arrivals function will continue to be separated. As such, the arrivals building is proposed to remain as the baggage claim facility on the lower level. However, in order to provide increased consolidated space for airport administrative functions, the mezzanine level would be used. **Table 5-10** summarizes the Passenger Terminal Facility Alternative 2A.

Table 5-10 – Passenger Terminal Facility Alternative 2A Summary

General Layout

Includes the development of a new departures building, curbside, and circulation. All existing gates are replaced with a large new contact gate concourse and centralized security checkpoint and concessions core. Arrivals building will continue to function as is with the addition of airport administrative offices on the second level.

 Provides adequate additional facilities for all terminal requirements Consolidates the security checkpoint, improves TSA staffing and eliminates duplicate facilities Enables a new central FIS facility below an expanded security checkpoint Provides passenger access to all post-security facilities, services, and concessions Maximizes flexibility for airline gate utilization and operations Removes deficiencies in passenger circulation Combined sentities for the ticketing halls 	Advantages	Disadvantages
and curbside drop-off (reduces passenger confusion)	 Provides adequate additional facilities for all terminal requirements Consolidates the security checkpoint, improves TSA staffing and eliminates duplicate facilities Enables a new central FIS facility below an expanded security checkpoint Provides passenger access to all post-security facilities, services, and concessions Maximizes flexibility for airline gate utilization and operations Removes deficiencies in passenger circulation Combines split facilities for the ticketing halls and curbside drop-off (reduces passenger confusion) 	 → High capital costs, with substantial new facilities → Moderately difficult construction phasing with impact to passenger activity → Retains long walking distances to baggage claim and parking garages

Source: CHA, 2019.

LEGEND

Removal/Demolition

5.4.5 Passenger Terminal Facility Alternative 2B

The goal of Passenger Terminal Facility Alternative 2B (**Figure 5-13**) is to retain the benefits of Alternative 2A, while consolidating passenger and baggage processing functions and roadway/curbside activities into a single consolidated facility. To achieve this goal, Passenger Terminal Facility Alternative 2B includes the same improvements to the concourse and gate area; however, it would completely replace the departures and arrivals buildings and vehicular circulation roadway system. In order to do this, a two-level roadway system would be constructed to serve a new two-level terminal building. The upper level of this building would house the departures and out-bound baggage make-up functions and the lower level will accommodate the in-bound baggage and baggage claim facilities. Alternative 2B calls for repurposing the arrivals building as a new Ground Transportation Center (GTC) on the lower level, with the second level use to house an expanded airport administrative office area. As in Alternative 2A, this alternative would completely replace existing Concourses A and B with a new consolidated north-south concourse to house all gates, with a centralized security checkpoint and concessions core. **Table 5-11** summarizes the Passenger Terminal Facility Alternative 2B.

Table 5-11 – Passenger Terminal Facility Alternative 2B Summary

General Layout

Includes the development of a new consolidated passenger and baggage processing facility with a two-level building and support roadway/curbside system. All existing gates are replaced with a large new contact gate concourse and centralized security checkpoint and concessions core. Arrivals building will be repurposed as a ground transportation center and will also provide area for airport administrative offices on the second level.

	Advantages		Disadvantages
≁	Provides adequate additional facilities for all	¥	Higher capital costs, with substantial new facilities
÷	Consolidates the security checknoint	×.	Highly difficult construction phasing with impact
4	improves TSA staffing and eliminates	1	to passonger and topant activity
	duplicate facilities	*	Rotains long walking distance to parking garages
*	Enables a new control EIS facility below an	1	Retains long warking distance to parking garages
	expanded security checkpoint		
≁	Provides passenger access to all post-security		
	facilities, services, and concessions		
≁	Maximizes flexibility for airline gate utilization and operations		
≁	Removes deficiencies in passenger circulation		
≁	Combines split facilities for the ticketing and		
	arrivals halls (reduces passenger confusion)		
≁	Eliminates the overly complex roadway layout		
≁	Provides a new GTC to house all ground		
	transportation functions		

Source: CHA, 2019.

LEGEND

Circulation/Holdroom

Concessions

Airline - Ticketing

Airline - Baggage Claim

Ground Transportation

Security/Regulatory

New Apron/Airfield Pavement

New Landside Pavement

Removal/Demolition

Figure 5-13 Terminal Facility Alternative 2B

5.4.6 Passenger Terminal Facility Alternative 3A

Passenger Terminal Facility Alternative 3A (Figure 5-14) is a derivative of Alternative 2A that provides for additional gate expansion (beyond what is needed during the planning period) in a configuration that may reduce passenger walking distances. The concept includes the centralized security checkpoint and up to four concourses surrounded by a central concessions core. The layout would incorporate development of two double-loaded concourses, with ultimate expansion of two additional single-loaded piers. Alternatively, the concept could include partial development of all four concourses, with expansion as needed. As shown in the figure, up to 42 gates could be accommodated. Table 5-12 summarizes the Passenger Terminal Facility Alternative 3A.

Table 5-12 – Passenger Terminal Facility Alternative 3A Summary

Includes the development of a new departures building, curbside, and circulation. All existing gates are					
replaced with a large new contact gate concourse, but with greater expansion capability on four					
concourses. Includes a centralized security checkpoint and concessions core. Arrivals building will continue					
to function as is with the addition of airport administrative offices on the second level.					
	Advantages		Disadvantages		
→ P	rovides adequate additional facilities for	≁	High capital costs, with substantial new facilities		
а	Il terminal requirements	≁	Moderately difficult construction phasing with		
. → C	onsolidates security checkpoint, improves		impact to passenger activity		
т	SA staffing and eliminates duplicate	≁	Four concourses will result in duplication of		
fa	acilities		concessions and operational functions		
•) ⊢ E	nable central FIS facility below an	≁	Multiple concourses may result in complex signage		
е	xpanded security checkpoint		and passenger confusion.		
→ P	rovides passenger access to all post-	≁	Retains long walking distances between the		
si si	ecurity facilities services and concessions		concourse gates/holdrooms/security screening		
→ N	Aaximizes flexibility and expandability for		checknoint and the narking garage/haggage claim		
/ IV	irline gate utilization and operations		areas		
a → − D	atoptial to reduce passanger walking		areas.		
7 F	istences between the security series				
a	istances between the security screening				
C	heckpoint and concourse gates/holdroom				
, a	reas				
א+ R	emoves deficiencies in passenger				
C	irculation				
→ c	ombines split facilities for the ticketing				
h	alls and curbside drop-off (reduces				
р	assenger confusion)				
) → E	liminates the overly complex roadway				
la	avout				
Source: CHA_2019					

Conoral Lavout

Source: CHA, 2019.

LEGEND

Existing Facility

Circulation/Holdroom

Concessions

Airline

Security/Regulatory

New Apron/Airfield Pavement

New Landside Pavement

Future Building Expansion

Removal/Demolition

Figure 5-14 Terminal Facility Alternative 3A

5.4.7 Passenger Terminal Facility Alternative 3B

The goal of Passenger Terminal Facility Alternative (Figure 5-15) is to retain the benefits of Alternative 3A, while consolidating passenger and baggage processing functions and roadway/curbside activities into a single consolidated facility. To achieve this goal, Passenger Terminal Facility Alternative 3B includes the same improvements to the concourse and gate area as Alternative 3A; however, it would completely replace the departures and arrivals buildings and vehicular circulation roadway system. In order to do this, a two-level roadway system would be constructed to serve a new two-level terminal building. The upper level of this building would house the departures and out-bound baggage make-up functions and the lower level will accommodate the in-bound baggage and baggage claim facilities. Alternative 3B calls for repurposing the arrivals building as a new GTC on the lower level, with the second level used to house an expanded airport administrative office area. As in Alternative 3A, this alternative would completely replace existing Concourses A and B, with a new consolidated north-south concourse to house all gates and provide additional gates beyond what is needed in the 20-year planning horizon. This concept also incorporates a centralized security checkpoint and concessions core. Table 5-13 summarizes the Passenger Terminal Facility Alternative 3B.

General Layout				
Includes the development of a new consolidated passenger and baggage processing facility with a two-level building and support roadway/curbside system. All existing gates are replaced with a large new contact gate concourse and centralized security checkpoint and concessions core. Arrivals building will be repurposed as a ground transportation center and will also provide area for airport administrative offices on the second level.				
Advantages	Disadvantages			
 Provides adequate additional facilities for all terminal requirements Consolidates the security checkpoint, improves TSA staffing and eliminates duplicate facilities Enables a new central FIS facility below an expanded security checkpoint Provides passenger access to all post-security facilities, services, and concessions Maximizes flexibility and future expandability for airline gate utilization and operations Removes deficiencies in passenger circulation Combines split facilities for the ticketing and arrivals halls (reduces passenger confusion) Eliminates the overly complex roadway layout Provides a new GTC to house all ground transportation functions 	 Higher capital costs, with substantial new facilities and a reconfigured GTC/administrative building Highly difficult construction phasing with impact to passenger and tenant activity Four concourses will result in duplication of concessions and operational functions Multiple concourses may result in complex signage and passenger confusion. Retains long walking distance to parking garages 			

Table 5-13 – Passenger Terminal Facility Alternative 3B Summary		
General Layout		

Source: CHA, 2019.






LEGEND



Existing Facility

Circulation/Holdroom

Concessions

Airline - Ticketing

Airline - Baggage Claim

Ground Transportation

Security/Regulatory

New Apron/Airfield Pavement

New Landside Pavement



Removal/Demolition

Figure 5-15 Terminal Facility Alternative 3B

5.4.8 Passenger Terminal Facility Alternative 4A

Passenger Terminal Facility Alternative 4A (**Figure 5-16**) is a derivative of Alternatives 1, 2A, and 3A that provides for additional gate expansion (beyond what is needed during the planning period). However, due to the split concourse configuration, Alternative 4A increases walking distances between gates and to the headhouse but reduces distances from the headhouse to arrivals and parking This concept includes the centralized security checkpoint and two double-loaded concourses (one to the north and one to the south). It also provides five contact gates at its central core. This central portion of the terminal also serves as a central concessions core area and supports a consolidated security screening check point. The layout would incorporate development of up to 10 remote aircraft parking positions that can support overnight parking and/or four deicing lanes. Alternatively, the concept could include partial development of a third central concourse, with expansion as needed. **Table 5-14** summarizes the Passenger Terminal Facility Alternative 4A.

Table 5-14 – Passenger Terminal Facility Alternative 4A Summary

General Layout					
Includes a new and improved departure building, curbside, and centralized security checkpoint, but with greater expansion capability on two concourses. The new departures building that will house all ticketing and out-bound baggage functions and is moved closer to the arrivals building, and an overhead canopy is provided.					
Advantages	Disadvantages				
 Provides adequate additional facilities for all terminal requirements Consolidates security checkpoint and improves TSA staffing Enable central FIS facility below an expanded security checkpoint Provides passenger access to all post- security facilities, services, and concessions Maximizes flexibility and expandability for airline gate utilization and operations Combines split facilities for the ticketing halls and curbside drop-off (reduces passenger confusion) Eliminates the overly complex roadway layout 	 High capital costs, with substantial new facilities Moderately difficult construction phasing with impact to passenger activity Two concourses will result in duplication of concessions and operational functions Increases walking distances between gates and to arrivals building and parking given the extension lengths of the concourses 				









LEGEND



Existing Facility

Circulation/Holdroom

Airline - Ticketing

Security/Regulatory

New Apron/Airfield Pavement

New Landside Pavement



5.4.9 Passenger Terminal Facility Alternative 4B

The goal of Passenger Terminal Facility Alternative (Figure 5-17) is to retain the benefits of Alternative 4A, while consolidating passenger and baggage processing functions and roadway/curbside activities into a single consolidated facility. To achieve this goal, Passenger Terminal Facility Alternative 4B includes the same improvements to the concourse and gate area as Alternative 4A, However, it would completely replace the departures and arrivals buildings and vehicular circulation roadway system. In order to do this, a two-level roadway system would be constructed to serve a new two-level terminal building. The upper level of this building would house the departures and out-bound baggage make-up functions and the lower level will accommodate the in-bound baggage and baggage claim facilities. Alternative 4B calls for repurposing the arrivals building as a new GTC on the lower level with the second level to house airport administrative office area. This alternative would completely replace existing Concourses A and B, with two new consolidated double-loaded concourses, one to the north and one to the south of the head house, along with a centralized security checkpoint and concessions core. In addition, 5 contact gates are located in the central portion of the terminal facility. Alternative 4B meets the 20-year gate requirements and provides expansion capabilities for a third central concourse beyond what is needed in the 20-year planning horizon. Table 5-15 summarizes the Passenger Terminal Facility Alternative 4B.

Table 5-15 – Passenger Terminal Facility Alternative 4B Summary

General Layout

Includes the development of a new consolidated passenger and baggage processing facility with a two-level building and support roadway/curbside system. All existing gates are replaced with two new contact gate concourses and centralized security checkpoint and concessions core. Arrivals building will be repurposed as a ground transportation center and will also provide area for airport administrative offices on the second level.

	Advantages		Disadvantages
≁	Provides adequate additional facilities for all	≁	Higher capital costs, with substantial new facilities
	terminal requirements		and a reconfigured GTC/administrative building
≁	Consolidates the security checkpoint and	≁	Highly difficult construction phasing with impact
	improves TSA staffing		to passenger and tenant activity
≁	Enables a new central FIS facility below an	≁	Two concourses will result in duplication of
	expanded security checkpoint		concessions and operational functions
≁	Provides passenger access to all post-security	≁	Increases walking distances between gates and
	facilities, services, and concessions		parking garages
≁	Maximizes flexibility and future expandability		
	for airline gate utilization and operations		
≁	Combines split facilities for the ticketing and		
	arrivals halls (reduces passenger confusion)		
≁	Eliminates the overly complex roadway layout		
≁	Provides an expanded area for airport		
	administrative offices		
≁	Provides a new GTC to house all ground		
	transportation functions		







LEGEND



Existing Facility

- Circulation/Holdroom
- Airline Ticketing
- Airline Baggage Claim



New Apron/Airfield Pavement

New Landside Pavement



5.5 LANDSIDE COMMERCIAL DEVELOPMENT OPTIONS

The previous Master Plan identified the northwestern corner of the new Robin Hood Road/Norview Road intersection for additional long-term parking along with the eastern corner as new employee parking should the Airport's parking capacity become constrained. As detailed within **Chapter 3**, even with the loss of the existing long-term parking lot, passenger parking is adequate throughout the forecast period with the development and construction of Garage D. As previously described, with the new Passenger Facility Terminal options presented, additional parking locations become available in proximity to the Terminal front, resulting in additional parking for temporary or emergency purposes in the event construction phasing impacts existing parking capacity. However, should the Airport require additional parking, these two areas are potential locations for a future surface parking lot and are illustrated within **Figure 5-18** and **Table 5-16** summarizes all Landside Commercial Development Options

Landside Commercial Development

With the potential closure of Runway 14/32 and realignment of Robin Hood Road, considerable land for redevelopment would become available. Several opportunities are presented throughout these alternatives for various options on the land use of these available properties. This alternative presents potential non-aeronautical opportunities within this area.

Commercial Retail/Cell Phone Lot/Gas Station

One option is to develop a commercial retail station along the eastern corner of the new Robin Hood Road and Norview Road intersection. This commercial center has the potential to house a consolidated gas station, thus providing a partnership opportunity with terminal concessionaires for an external food court option along with a potential location for a more robust cell phone/passenger wait lot. This concept is a growing trend amongst heavily trafficked airports and provides a potential opportunity for increased revenue generation.

General Lavout				
Includes commercial retail/concessions, cell phone lot, and gas station				
Opportunities	Constraints			
 Revenue generation Passenger convenience Consolidation of new gas station, cell phone lot, "courtyard" Provides opportunities for new partnership with concessionaires Potential overflow or emergency parking 	 → Utilizes area with potential for airside connectivity → Potential parking for employees and/or temporary staging lots are pushed further from the Terminal → Requires realignment of Robin Hood Road and Norview Avenue/Airport Road 			

Table 5-16 – Landside Commercial Development Options







LEGEND



Future Building

Future Landside Pavement



5.6 SUPPORT FACILITIES DEVELOPMENT CONCEPTS

5.6.1 Rental Car Concessions Alternatives

The Facility Requirements analysis in **Chapter 4** identified sufficient short- and long-term vehicle parking spaces for ORF throughout the planning horizon. However, the analysis further identified a growing deficit of rental car spaces during peak periods, including a need for approximately 450 additional spaces by PAL 4. This additional capacity can be accommodated in a various number of ways. Physical capacity increases, consolidation of rental car operations, and relocating offsite rental car activities nearer to the Airport's terminal itself.

As discussed in **Chapter 2** and **Chapter 4**, rental car companies currently have off-site Quick Turnaround (QTA) facilities along Military Highway, resulting in unnecessary rental car throughput (i.e., rental car companies moving overflow and vehicles requiring maintenance) along the terminal curbsides, Norview Ave., and Airport/Robin Hood Road, and unnecessary expenditures for rental car companies maintaining off-site facilities. As such, there has been a need identified to decrease rental car traffic or separate rental car activity from passenger/pedestrian activity along the Airport's roads and consolidate rental car functions in proximity to the Airport terminal; therefore, concepts have been developed that provide additional rental car space to accommodate growing demand through consolidated QTA facilities or through the development of a Consolidated Rental Car Facility (CONRAC).

It is important to note, that although these alternatives show potential structures to accommodate rental car activity, for planning purposes the overarching goal is the preservation of land to accommodate these activities. As demand changes, the physical structures necessary to accommodate the activity will change; therefore, three potential layouts were developed for a QTA and two potential layouts for a CONRAC facility. All QTA Alternatives are depicted in **Figure 5-19** and all CONRAC alternatives are presented in **Figure 5-20**. **Table 5-17** summarizes both the QTA and CONRAC alternatives.

QTA Alternatives

Alternative 1 - New QTA Facility

QTA Alternative 1 shows a new rental car QTA facility along the western portion of the airfield nearby the existing Runway 14 end. The construction of a consolidated QTA area/facility provides easy access to all rental car operations for both passengers and rental car employees and reduces the need for vehicle transport to/from airport property. In this concept, Robin Hood Road is realigned (but is not necessary), providing increased connectivity to Military Highway. While this location preserves the area adjacent to the existing long-term and (Transportation Network Company) TNC parking lots (e.g., *Uber, Lyft*, etc.), the location of the QTA facility is dependent upon closure of Runway 14/32.

Alternative 2 - Consolidated QTA

Similar to Alternative 1, QTA Alternative 2 shows a new QTA facility at the existing Runway 14 end. The location shown in Alternative 2 allows for development of a new QTA facility without the need for immediate realignment Robin Hood Road. This concept does require some degree of reconstruction of the existing Airport Road and access to/from Robin Hood Road. This location, however, limits full aeronautical or non-aeronautical (i.e., parking, retail commercial, etc.)

development potential of the area as this location east of the Robin Hood Road realignment has access to the airfield.

Alternative 3 - Dedicated QTA

QTA Alternative 3 shows the repurposing of the existing employee parking lot into a dedicated QTA facility. For the purposes of the physical make-up of this location, a consolidated single-structure QTA is not feasible; however, this concept allows for a more cost-effective solution by providing a dedicated area for rental car operations without the need for construction of a parking garage. This concept requires a longer shuttle of rental cars to/from the airport along Robin Hood Road but limits the potential throughput of rental vehicles along the arrivals or departures curbsides and eliminates the use of Norview Avenue as a potential rental car route.

CONRAC Alternatives

With the identified need for consolidation of rental car facilities, and the first potential step being the consolidation of QTA facilities from Military Highway, it was identified that if a permanent structure was to be constructed, is the possibility of a ConRAC feasible on the Airport. Typically, ConRACs provide a full service on-stop location for all rental car activities, including ready return, QTA, overflow storage, and rental pick-up (including rental car counters). Such a facility is most commonly attached to the terminal in some fashion, providing access for arriving passengers.

ConRAC facility sizing varies from airport to airport based on demand for rental car services, if a ground transportation center is included, etc. However, several design considerations exist and should be sized accordingly to accommodate the existing and future needs of the rental car companies. When developing a ConRAC facility, it is important to account for safety of the employees and the general public, convenience to the rental car agencies and customers, efficient operational capabilities, operational sustainability, and cost efficiency. For the purposes of this study, two locations for a ConRAC were identified, and the facility sizing of each location were independent of each other.

Alternative 1 – Consolidated ConRAC and QTA

This alternative proposes the construction of a CONRAC and QTA facility west of Airport Road, nearby the taxi queue area. This facility would consolidate all rental car functions and operations, with a pedestrian access bridge that would be constructed across Airport Road to connect the ConRAC facility with the existing Arrivals building. Access into and out of the ConRAC facility would be via Robin Hood Rd and Airport Road. As such, preventing interference and congestion of the Terminal Loop. Based on industry standard facility sizing, it is expected that this ConRAC would accommodate all rental car vehicles and operations across five levels, sufficiently accommodating all current and future demand at the Airport. However, it is important to note that facility sizing may change prior to any future planning for this facility, and the purpose of this alternative is for the preservation of space sufficient to accommodate such a facility.

This site for the ConRAC has the potential to accommodate the ConRAC itself, additional parking along Robin Hood Rd, and plenty of space for a potential commercial/retail development at the corner of Robin Hood Rd and Norview Ave., potentially housing a gas station/convenience store and food options with a cell phone lot for passengers, visitors and the general public.

Alternative 2 – ConRAC Only

This alternative suggests a replacement of Garages B and C to support a ConRAC facility. For the purposes of the sizing of this facility, the current spacing of Garages B and C provide more than adequate width required for a potential ConRAC, thus decreasing the requirement to accommodate additional floors for rental purposes. As such, an opportunity within this alternative suggests the potential for additional floors within this ConRAC facility could be used for passenger parking, which continues the adequate capacity for public parking on the Airport. The lower floors would be dedicated to QTA, rental car ready and return parking, preventing interference with existing public parking within the garages. Customers would be able to access the facility via ingress and egress points currently in place. Although this option would provide the necessary space for ConRAC activity, QTA operations within the lower level of this space would be difficult. In addition, rental car vehicular access would impede the Airport's Terminal Loop, potentially resulting in congestion during peak periods.

The positioning of the facility would also allow space for future commercial development, such as those shown in **Figure 5-18**.

Alternative	Opportunities	Constraints		
QTA Development	 Runway 14/32 end provides sufficient space for either consolidated or dedicated QTA facility Existing employee lot provides immediate space for consolidation or dedicated QTA facility 	 → QTA development near existing Runway 14 end dependent upon runway closure and realignment of Robin Hood Road → Building within existing long-term lot limits development of future terminal facilities within the existing area 		
Consolidated ConRAC and QTA	 → Prevent interference and congestion of the Terminal Loop → Ingress/Egress points in place (Airport Road) 	 → Require relocation of the existing taxi queuing area → Maintenance cost for pedestrian access bridge 		
ConRAC (Not QTA)	 → Does not require building an entirely new facility → Avoids interference with existing public parking → Ingress/Egress points in place (to the terminal facilities and by roadway) 	 No space for QTA activity, thus requiring a QTA elsewhere Rental car traffic will still impede the Airport's Terminal Loop 		

Table 5-17 – Rental Car Alternatives (QTA and/or CONRAC)





LEGEND



Future Landside Pavement



Future Building









LEGEND



Future Building

Future Landside Pavement

Figure 5-20 CONRAC Alternatives

5.6.2 Air Cargo Facilities Alternatives

As described in **Chapter 4**, air cargo facilities at ORF are currently undersized to adequately accommodate the existing level of cargo activity, both by physical footprint and functionality, as leaseholds and processors are separated for each cargo operator. Based on the facility requirements calculations, cargo operations currently exceed maximum capacity by approximately 10 percent during peak periods. The dedicated air cargo apron is currently sufficient in size and capable of supporting up to four widebody aircraft and one single-engine turboprop aircraft with angled parking; however, by PAL 1, it is forecasted that there will be a need for one additional cargo aircraft parking position, with a deficit of approximately 3,450 square yards (SY). This deficit may grow to over 19,000 SY by PAL 4. Furthermore, the existing 88,000 square feet (SF) of cargo processing building space does not meet the current need of approximately 97,000 SF, with demand forecasted to grow to over 143,800 SF by PAL 4.

During the development of the alternatives, future transition of cargo fleet mixes was incorporated as air cargo operators transition to new and converted B767-300 aircraft with decreased operations of A300 and B757 airframes. Based on these observations and the projected growth of cargo operations over the forecast period, three conceptual air cargo facility alternatives were identified for evaluation.

North Cargo/MRO Area Alternative 1

The North Cargo/MRO Area Alternative 1 (**Figure 5-21**) shows an approximate 56,000 SF cargo facility northeast of the current facilities, improving the physical footprint of cargo infrastructure and allowing consolidation of processors. This alternative further depicts area dedicated to loading and unloading activity on the landside of the newly proposed facility, as well as parking for ground-cargo vehicles and cargo operator employee parking.

This concept would shift Taxiway V approximately 114 feet west, providing additional space for aircraft parking and improved functionality. By shifting the taxiway, cargo operators would have the ability to park widebody aircraft perpendicular to the present facilities rather than the current angled configuration. In addition to parking reorientation, the apron would sufficiently accommodate up to five B767-300 aircraft and two Cessna 208 Caravans.

Additional apron space will be required to accommodate the shifted taxiway, as well as for aircraft parking at the additional processing facility. Apron parking at the depicted cargo facility would accommodate two to three B767-300 aircraft. In addition to cargo activity, MRO activity can also be supported within the development area, with space for two MRO facilities (approximately 85,000 SF each). In total, approximately 74,030 SY of airfield pavement is recommended to support the shifted taxiway, as well as to support parking for aircraft at the newly proposed cargo and Maintenance, Repair, and Overhaul (MRO) facilities. The additional pavement and infrastructure repurposes the pavement currently serving as Runway 14/32, lowering developmental costs. This alternative is cost-effective due to the reuse of existing pavement and retaining existing cargo buildings and apron, rather than razing and replacing current facilities. **Table 5-18** summarizes the North Cargo/MRO Area Alternative 1.







LEGEND





Future Airfield Pavement

Future Landside Pavement

Future Building



Pavement Removal

Figure 5-21 North Cargo / MRO Area Alternative 1

General Layout						
Incremental Expansion of existing Air Cargo facilities.						
Opportunities	Constraints					
Accommodates relocation of Robin Hood	✤ Requires closure of Runway 14/32					
Road.	Layout is limited to a single taxilane, resulting in					
Provide locations for additional	potential for some apron congestion/delay					
infrastructure needed throughout the						
Planning Period						
Maintains existing air cargo facilities						
✤ Repurposes Runway 14/32 for						
apron/taxiway						
Includes locations for MRO facilities						
Does not infringe upon long-term surface						
parking lot						
Lowest cost of the air cargo concepts						

Table 5-18 – North Cargo/MRO Area Alternative 1 Summary

Source: CHA,2019.

North Cargo/MRO Area Alternative 2

North Cargo/MRO Area Alternative 2 (**Figure 5-22**) shows razing of the existing cargo buildings for improved functionality and best-use of the developable area. As such, two new cargo facilities are incorporated, providing a minimum of approximately 56,000 SF of total space. The largest of the two facilities (located northeast of the current building) would serve as a dedicated cargo sort facility, with vehicular parking to the north (landside) and an aircraft parking apron to the south (airside). The aircraft parking apron would utilize the pavement and infrastructure currently used for cargo related vehicular parking, aiding in cost efficiency. The new apron would measure approximately 100,000 SY and could support up to 10 cargo aircraft, allowing cargo operators more options and flexibility when processing freight. The smaller facility shown would also have dedicated apron space capable of supporting up to two B767-300s. To allow for the development of the new cargo buildings and apron space, it is necessary to shift Taxiway V approximately 400 feet to the west, converting the pavement currently used for a runway (Runway 14/32) to use as a taxiway, thus lowering costs.

Similar to the first development concept, this alternative also provides the option for the development of two MROs to the east of the shifted taxiway, enabling increased utilization of the available developable area. **Table 5-19** summarizes the North Cargo/MRO Area Alternative 2.

	General Layout			
Redevelopment of existing Air Cargo facilities				
	Opportunities		Constraints	
ትት ትትት	Accommodates relocation of Robin Hood Road. Provide locations for additional infrastructure beyond that needed during the Planning Period Repurposes Runway 14/32 for future Taxiway Includes locations for MRO facilities Includes separate taxiway access to each	ት ት ት ት	Requires closure of Runway 14/32 Requires replacement of existing air cargo buildings Highest cost of the alternative concepts	
	component to improve efficiency			

Table 5-19 – North Cargo/MRO Area Alternative 2 Summary







LEGEND





Future Airfield Pavement

Future Landside Pavement

Future Building

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Pavement Removal

Figure 5-22 North Cargo / MRO Area Alternative 2

North Cargo/MRO Area Alternative 3

Similar to Alternative 2, North Cargo/MRO Area Alternative 3 (**Figure 5-23**) depicts razing the current cargo facilities and constructing two new facilities to satisfy long-term requirements, with one facility being dedicated to cargo sort activities. A new aircraft parking apron for the sort facility would be necessary, measuring approximately 100,000 SY and capable of supporting up to 10 B767-300 aircraft. The apron would repurpose existing pavement to decrease developmental costs. The smaller cargo facility's apron would also reutilize pavement from Runway 14/32 and would provide parking for up to three B767-300 freighters. Landside parking and areas for loading and unloading activities would be provided to the west of each newly constructed cargo facility, again repurposing some existing pavement. Roadway access from the proposed Robin Hood Road realignment would serve these new facilities.

In addition, Alternative 3 provides the option of building two new MRO facilities on the southwest side of the developable area, along with a single apron for joint-use operations with the MRO facility operators. An access road is shown to allow for entry from the proposed cargo drive to the Robin Hood Road realignment. The locations of the recommended roadways will maintain the separation of cargo and MRO activities from FAA equipment and non-airport related businesses (i.e., the existing catering company) adjacent to the developable area. The location of the roadways also allows for the repurposing of existing infrastructure (i.e., cargo-related vehicle parking and loading/loading space) used by cargo operators. **Table 20** summarizes the North Cargo/MRO Area Alternative 3.

	0,		4		
	General Layout				
Ma	jor Buildout Air Cargo facilities				
	Advantages		Disadvantages		
≁	Accommodates relocation of Robin	≁	Requires closure of Runway 14/32		
	Hood Road.	≁	Requires replacement of existing air cargo		
≁	Provide locations for additional		buildings		
	infrastructure needed throughout the	≁	Occupies space of the existing long-term		
	Planning Period		lot the potential future terminal facilities		
≁	Repurposes Runway 14/32 for future				
	Taxiway				
≁	Includes locations for MRO facilities				
≁	Does not infringe upon long-term				
	surface parking lot				
C	CUA 2010				

Table 5-20 – North Cargo/MRC	Area Alternative 3 Summary
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LEGEND





Future Airfield Pavement

Future Landside Pavement

Future Building



Pavement Removal



5.6.3 General Aviation Facilities Alternatives

General Aviation (GA) activity at ORF represents approximately 31 percent of total annual airport operations and includes various types of private, corporate, and business aircraft flights. GA services and facilities are accommodated by Signature Flight Support, which is located along the southern portion of the airport and currently the Airport's only Fixed Based Operator (FBO).

The following discusses the existing GA infrastructure as well as potential concepts to accommodate forecasted demand and future buildout. Note that each concept was developed with the presumed closure of Runway 14/32.

General Aviation Alternative 1

General Aviation Area Alternative 1 (**Figure 5-24**) depicts an option to accommodate forecasted apron and hangar demand within PAL 1 while requiring minimal construction of additional infrastructure to support future development. This concept depicts a northeasterly expansion of the current GA apron by approximately 29,000 SY. The southern portion of the expansion would support a TDG 2 taxilane to provide access as well as ingress/egress for additional expansion. Although more space than currently forecasted is depicted, the expansion accommodates apron parking for 12 ADG II aircraft and allows for phased development.

Southeast of the GA apron expansion, General Aviation Area Alternative 1 depicts two bulk hangars (150' x 200'), each providing 30,000 SF of aircraft storage. Similar to the GA apron expansion, this concept allows for phased development northeast of the FBO building (Building 20) and along the existing TDG 2 taxilane. Since the development would occur outside of the airside secure limits, vehicle parking/access and associated security measures would likely be required.

This concept depicts several portions of existing taxiway to be either removed or repurposed. As such, a new taxiway providing TDG 3 access to the Ground Runup Enclosure (GRE) is shown. This taxiway would also provide access to potential corporate hangar development located northwest of the FAA Aircraft Traffic Control facility. Lastly, this concept depicts several areas capable of accommodating future aeronautical and/or non-aeronautical development. As stated, this concept requires closure of Runway 14/32, but other existing facilities (i.e., the GRE, ATCT, fuel farm, ASR, etc.) are all retained. **Table 21** summarizes the General Aviation Alternative 1.

	General Layout				
Nor	Northeasterly expansion of the current GA facilities serviced by existing FBO				
	Opportunities		Constraints		
* * * *	Minimal additional infrastructure required to accommodate development Sufficient apron parking and aircraft storage space for short-term demand Accommodates phased development to accommodate all long-term requirements Retains existing airport support facilities and access road	**	Requires closure of Runway 14/32 Northeasterly apron expansion may be limited by construction of TDG 3 taxiway to GRE		

Table 5-21 – General Aviation Alternative 1 Summary







LEGEND





Future Airfield Pavement

Future Landside Pavement

Future Building



Pavement Removal



General Aviation Alternative 2

Similar to Alternative 1, General Aviation Alternative 2 (**Figure 5-25**) depicts an option to accommodate forecasted apron and hangar space within PAL 1 with the option for future expansion. Alternative 2, however, assumes the addition of a second FBO servicing additional apron space and aircraft storage located along the proposed Runway 5R/23L eastern corridor.

The GA apron expansion depicted (approximately 36,400 SY) accommodates parking for 16 ADG II aircraft, and a TDG 2 taxilane is shown along the eastern portion of the apron expansion for increased connectivity. Additionally, two bulk hangars (200 x 100) are shown providing a total of 40,000 SF of aircraft storage.

Differing from the first alternative, Alternative 2 depicts a potential second FBO nearby the existing fuel farm, which would be relocated in this concept. As part of this concept, an itinerant apron expansion is shown southeast of the the proposed Runway 5R/23L. Although Alterative 2 depicts various bulk hangar sizes, this area provides sufficient space for a variety of hangar sizes and types depending upon demand. This concept also shows preservation of the GRE along with taxiway/runway access. Additionally, the proposed corporate hangar development northeast of the FAA Air Traffic Control facility would likely require access to the apron expansion. Similar to Alternative 1, several areas capable of accommodating future aeronautical and/or non-aeronautical development are shown. Lastly, this concept assumes the redevelopment of Taxiway F. **Table 5-22** summarizes the General Aviation Alternative 2.

	General Layout				
Ado sto	Addition of a second Fixed Base Operator (FBO) servicing additional apron space and aircraft storage located along the proposed Runway 5R/23L eastern corridor				
	Opportunities		Constraints		
+ +	Sufficient apron parking and aircraft storage space for short-term demand Accommodates phased development to accommodate all long-term requirement	** *	Requires closure of Runway 14/32 Additional infrastructure required (replaced Taxiway F) Ultimate buildout dependent upon establishment of second EBO		
≁	Provides frontage and separation between FBOs	≁	Additional vehicle access to eastern corridor required		
≁ ≁	Maintains uninterrupted GA layout across proposed Runway 5R/23L eastern corridor Retains existing airport support facilities and access road				
c					

Table 5-22 – General Aviation Alternative 2 Summary







LEGEND





Future Airfield Pavement

Future Landside Pavement

Future Building



Pavement Removal



5.6.4 Aviation Fueling Facilities Alternatives

The existing Jet-A fuel farm is located north of the Air Traffic Control Tower and includes four aboveground Jet-A fuel tanks with storage capacities of 210,000-gallons per tank. From the fuel farm, fuel is pumped via underground pipeline to a dispensing location north of the ARFF facility, where it is transferred to fuel trucks for dispensing to aircraft.

The Airport maintains the Jet-A fuel farm, dispensing facility, and underground fuel piping system. Do to the age and condition of the fueling system it is near the end of its useful life and the Airport is experiencing increasing operations and maintenance costs for upkeep of the system. Therefore, in an effort to consolidate the fueling system, **Figure 5-26** depicts two potential locations a new consolidated Jet-A fuel farm.

Both alternatives assume that the Jet-A fuel storage and upload will be located within a consolidated area, thus eliminating the need for an underground pipeline. With each location, environmental



Source: Google Earth.

permitting would be required, as well as the decommissioning and demolition of the existing system.

Alterative 1 depicts a location within the existing rental car overflow parking lot. This location allows for quick access of fuel deliveries along with airside connectivity to commercial and cargo aircraft. However, relocation of the rental car overflow parking lot may be required.

Alternative 2 shows expansion of the existing fuel dispensing facility to also include Jet A storage. This location reuses a portion of the fueling system currently in place and minimizes impacts to existing infrastructure. Access for fuel tanker trucks may be difficult and is shared with the terminal access road. The overall size of this site is limited.

With the potential relocation of Robin Hood road, additional locations are possible that provide both landside and airside access.

5.6.5 Aircraft Deicing Facilities Alternatives

Commercial Aircraft deicing operations at ORF are confined to the main terminal apron, and the cargo apron on the west side of the airfield. The Airport's main deicing facility/pad is located on the northeast side of the main terminal apron and consists of four deicing positions, which are utilized on a first-come-firstserve basis.



Source: Google Earth.







Exhibit 5-26 Fuel / Glycol Storage Facility Alternatives To ensure that deicing operations are accounted for during future terminal development, **Figure 5-27** depicts two deicing alternative locations.

The remote terminal deicing apron location shows an area for four ADG IV deicing positions along the northwestern edge of Taxiway C and on a portion of the current Runway 14/32, which is presumed closed for this alternative. As this location is not a part of the Passenger Terminal apron, a deicing fluid (i.e., glycol) drainage system would be required, however, deicing would be served by mobile trucks and deicing equipment, as impacts to terminal area operations may hinder the likelihood any permanent deicing equipment may remain in place. This location is respective of Cargo Alternative 1 (**Figure 5-21**), which currently depicts MRO development within the area, and would provide a consolidated commercial/cargo deicing location. Based on ingress and egress requirements for the taxilanes associated with the terminal gates, the overall length or the deicing bays are more than adequate for single use and may be simultaneously occupied with two aircraft at a time. The over space is a dual use with RON capability at night with positions for up to eight RON aircraft.

The Terminal Alterative 4 deicing apron location shows an area southwest of the existing deicing area. This alternative depicts four ADG IV deicing positions and is respective of Passenger Terminal Alternative 4 (**Figures 5-16**) and **5-17**). This location allows for utilization of existing apron space and aircraft ingress/egress nearby the terminal gates. Similar to the remote deicing facility, lane length is more than adequate for single aircraft use, and may be utilized by up to two aircraft at a time per lane for simultaneous use, therefor increasing the overall deicing capacity at the Airport. Additionally, during non-deicing periods the area can accommodate up to ten RON aircraft. Single taxilane access as a result of this location may be considered an operational disadvantage.

5.6.6 Airfield Maintenance Facilities Alternatives

The NAA airfield maintenance facilities are currently located on the southeast end of the airfield and consist of a 40,000 SF facility that houses the snow removal equipment and a 6,000 SF facility for sand storage and airport maintenance and utility vehicles. According to the NAA, these buildings are at capacity and do not account for the most recent FAA guidance within FAA AC 150/5220/18A, *Buildings for Storage and maintenance of Airport Snow and Ice Control Equipment and Materials*. Therefore, **Figure 5-28** depicts several alternate locations for additional airfield maintenance facilities. Note that with each location, the potential exists for either complete facility relocation or establishment of a secondary airfield maintenance site, depending on need or location.

Airfield Maintenance Alterative 1

Alternative 1 shows an expanded maintenance facility directly northwest of the existing. This location provides consolidation of all airport maintenance resources within a dedicated area. A disadvantage to this concept is the impact to the existing ARFF training area, which is shown relocated southward.

Airfield Maintenance Alterative 2

Alternative 2 shows an expanded area southeast of the GA apron. This location provides quick access to both the airfield and Miller Store Road with the ability for expansion. However, this area is dependent upon closure of Runway 14/32 and is ideal space for future aeronautical and/or

aeronautical-related development. Proximity to the FBO terminal building could be considered to an aesthetic disadvantage.

Airfield Maintenance Alterative 3

Alternative 3 is also dependent upon closure of Runway 14/32. Although less of an impact to future aeronautical and/or aeronautical-related development, this location may also be dependent upon potential relocation of the GRE facility.

Airfield Maintenance Alterative 4

Alternative 4 takes advantage of the undeveloped wooded area to the north of the existing fuel farm. This area provides connectivity to the airfield and Miller Store Road but would require land acquisition and site clearing prior to development. Table 5-23 summarizes the Airfield Maintenance Alternatives.

	Table 5 25 Anneld Maintenance Alternatives				
	Opportunities		Constraints		
≁	Existing facility can be retained, allowing for smaller addition(s) to supplement space needs Sufficient locations throughout airfield allow for total relocation or for a secondary	≁ ≁	Partial or total relocation within existing Runway 32 approach area limits potential aeronautical and/or aeronautical-related development Proximity to the FBO terminal building could be considered an aesthetic disadvantage		
	airfield maintenance site				
Sour					

Table 5-23 – Airfield Maintenance Alternatives







Figure 5-27 Deicing Apron Alternatives New Maintenance Building (With Any Alternative)

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Airfield Maintenance (Alternative 1)

Airfield Maintenance _ (Alternative 2)

Airfield Maintenance (Alternative 3) Airfield Maintenance (Alternative 4)







LEGEND



Future Airfield Pavement



Future Building

Figure 5-28 Airfield Maintenance Alternatives

6 ENVIRONMENTAL OVERVIEW

This section provides a preliminary assessment of the environmental factors existing on and around the Norfolk International Airport (ORF). This review was conducted in accordance with the FAA Orders 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions* and 1050.1F, *Environmental Impacts: Policies and Procedures*. This review does not provide a complete investigation sufficient for obtaining environmental permits or compliance with environmental documentation as required by the National Environmental Policy Act (NEPA). A review of existing GIS data, coordination with relevant environmental regulatory agencies and a field walk-over were conducted to develop this overview of the environmental resources.

The purpose of this review is to identify the environmental resources that may affect future development at the Airport and to identify those environmental issues that may require additional environmental analysis prior to implementation of future projects. The environmental impact categories discussed in this overview are:

- ✤ Air Quality
- → Water Quality
- + Historic, Architectural, Archaeological, and Cultural Resources
- ✤ Biotic Communities
- ✤ Threatened and Endangered Species
- ✤ Wetlands
- + Floodplains
- ✤ Coastal Zone Management Program
- Prime and Unique Farmlands
- Wild and Scenic Rivers
- ✤ Solid Waste
- ✤ Hazardous Waste

Categories discussed elsewhere in this Master Plan are:

- ✤ Compatible Land Use
- ✤ Social and Economic Environment

6.1 AIR QUALITY

The Clean Air Act Amendments (CAAA) of 1990 requires the EPA to set National Ambient Air Quality Standards (NAAQS) for six "criteria" pollutants considered harmful to public health and the environment. The NAAQS identify two types of air quality standards: primary and secondary. Primary standards provide public health protection, including protecting the health of "sensitive" populations, such as asthmatics, children, and the elderly. Secondary standards were established

to provide public welfare protection, including protection against impaired visibility and damage to animals, soils, crops, vegetation, and buildings. The six "criteria air pollutants" that have been established by EPA to protect public health and welfare include:

- ✤ Ozone (O3)
- ✤ Carbon monoxide (CO)
- ✤ Particulates (PM10 and PM2.5)
- ✤ Sulfur dioxide (SO2)
- ✤ Nitrogen dioxide (NO2)
- ✤ Lead (Pb)

The Commonwealth of Virginia has established the Air Pollution Control Board to establish general administrative and air quality program provisions that support the Regulations for the Control and Abatement of Air Pollution and the provisions of the federal Clean Air Act. This program is administered through six regions throughout the Commonwealth of Virginia. Norfolk International Airport lies within the Tidewater Region. As of 2017, the Tidewater Region was in attainment with all six EPA criteria air pollutants, which includes the City of Norfolk. Previously, this area had been in non-attainment with the 1-hour and 8-hour ozone levels. This designation was revoked in 2007, and the City of Norfolk has been redesignated as a maintenance area for these two criteria.

No air quality modeling was conducted as part of this study. If proposed developments require air quality modeling, it would be conducted during preparation of additional environmental documentation (and before construction). The results of the air quality modeling should be evaluated to determine whether the proposed activity may contribute to significant 1-hour or 8-hour ozone levels.

6.2 WATER QUALITY

Water quality standards applicable to the Airport are established under the federal Clean Water Act (CWA) and the Virginia State Water Control Law and the Groundwater Management Act of 1992. Together, these regulations include requirements for controlling discharges into surface water and groundwater, develop waste treatment management plans and practices, and establish federal permitting requirements for discharges (CWA Section 402) and dredged and fill materials (CWA Section 404). Existing surface water and groundwater quality at the Airport are described below.

6.2.1 Surface Water

Surface water features on and in the immediate vicinity of the Airport include a network of drainage features, wetlands and open water that comprise the Lake Whitehurst Reservoir. Existing wetlands are described in subsequent sections. Surface waters on the airport flow, either through stormwater drainage systems or concentrated drainage channels, into Lake Whitehurst.

Lake Whitehurst is classified as an Impaired (Category 5A) Water by the Virginia DEQ. This designation represents the poor ability of the lake to support aquatic life (due to high levels of chlorophyll-a and phosphorus, and low levels of dissolved oxygen) and a restriction on the

consumption of fish removed from the lake (due to the presence of PCB's and mercury in fish tissue). Lake Whitehurst was first listed as an Impaired Water in 2006, with additional listings added in 2008 and 2010.

Any future projects that would potentially add additional impervious surface would increase the potential for runoff from the Airport into nearby surface water. Prior to implementation of these improvements, more detailed documentation would be required to more specifically quantify the additional impervious surface area and assess resulting impacts to surface water. Drainage improvements would be required to minimize stormwater runoff and associated potential for adverse impacts to surface waters. These improvements should be included in the project design and fully evaluated in the project-specific environmental documentation to be conducted closer to the time of construction. If such elements are incorporated, it is not anticipated that the proposed projects would result in adverse impacts to surface water quality.



6.2.2 Groundwater

The Virginia Department of Environmental Quality administers the Groundwater Characterization Program, which assesses groundwater availability and ambient groundwater quality to inform management decisions in legislatively designated Groundwater Management Areas. ORF lies within the Eastern Virginia Groundwater Management Area.

At the level of effort for this overview, no specific information on groundwater quality in the immediate vicinity of ORF was available. Any proposed projects would be evaluated closer to implementation, when more details are available, in a project-specific environmental document to determine potential impacts.

6.2.3 Stormwater

ORF holds an existing Virginia Pollution Discharge Elimination System (VPDES) permit (permit #VA0089737), which is the state-administered program regulating the discharge of stormwater from an industrial facility. As an airport, ORF is classified as a minor industrial facility and must comply with the Virginia Pollution Discharge Elimination System Permit Regulation (9VAC25-31-190). This includes compliance with all effluent standards mandated by the Clean Water Act through the proper operation and maintenance of all facilities and systems of treatment and control which are installed or used by the permittee to achieve compliance with the conditions of the permit. ORF is also required to monitor the existing stormwater discharges from the Airport for the effluents of concern and report those to the Virginia Department of Environmental Quality (DEQ).

Any modifications to the drainage system or modifications to physical facilities at the Airport which would result in a change to either the quantity or potential quality of stormwater discharge from the airport should be communicated to the Virginia DEQ to determine if the existing permit would require modification or reissue.

In general, new airfield or major terminal projects would trigger the need to address water quality and associated permitting. General maintenance and minor projects typically do not affect water quality.

6.3 DEPARTMENT OF TRANSPORTATION ACT, SECTION 303

Pursuant to Section 303 of the U.S. Department of Transportation (formerly Section 4(f)), programs or projects requiring the use of any publicly-owned land, including public parks, recreation areas, wildlife or waterfowl refuge areas, and historic sites (including traditional cultural properties) of national, state, or local significance shall not be approved by the Secretary of Transportation unless there is no feasible and prudent alternative to the use of such land, and such program includes all possible planning to minimize harm.

Based on a review of the surrounding area, two such facilities exist. Lake Whitehurst, which provides recreational opportunities, surrounds the Airport on three sides. Additionally, the Norfolk Botanical Gardens (also known as Azalea Gardens) lies directly adjacent to the airport property just to the north of the terminal area.

Future projects at ORF should be evaluated for potential impacts to these resources as part of the required environmental documentation under NEPA. Impacts to Lake Whitehurst would require a detailed review under Section 303.

6.4 HISTORIC, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Under the National Historic Preservation Act of 1966 and the Archaeological and Historic Preservation Act of 1974, federal undertakings, such as the actions included in the Master Plan Update, are subject to Section 106 review to ensure that properties or data having historic, scientific, prehistoric, archaeological or paleontological significance are surveyed, recovered or preserved.

The Virginia Cultural Information System (V-CRIS) of the Virginia Department of Historic Resources was queried in order to identify federally and state-listed resources in the project area. The GIS review identified three potentially historic sites near the project area.

- ✤ Robin Hood Road Bridge, DHR ID 122-5005, located along Robin Hood Road along the southwest perimeter of the airport. This bridge was constructed in 1944.
- Norfolk Azalea Garden/Norfolk Botanical Garden, DHR ID 122-1007, located immediately to the north of the existing airport terminal. First established in 1938, this facility lies at 6700 Azalea Garden Road.
- Little Creek Amphibious Naval Base Historic District, DHR ID 134-0999 approximately
 0.35 miles to the northeast of the airport.



Figure 6-1 – Historical Resources

Of these three resources, only the Norfolk Botanical Garden is listed on both the Virginia Landmarks Register (VLR #06-01-2005) and the National Historic Register of Places (NHRP #08-17-2005).

Prior to implementation of specific airfield recommendations, a more detailed environmental review, including DHR consultation, would be conducted to confirm existing resources and assess any potential effects. The identified resources above are not likely to be impacted by Master Plan recommendations.

6.5 **BIOTIC COMMUNITIES**

Information regarding biotic communities at the Airport was obtained through a review of the Natural Heritage Data Explorer (NHDE) of the Virginia Department of Conservation and Recreation, screening through the U.S. Fish & Wildlife Service's (USFWS) Information Planning and Conservation (IPaC) System, and a general field walkover.

A large portion of the Airport consists of impervious surfaces such as asphalt, concrete, or buildings. Significant acreage with the Air Operations Area (AOA) is comprised of managed turf adjacent to runways, taxiways and apron areas. These areas provide minimal ecological diversity, and show extensive habitat fragmentation.

Intact biotic communities that remain within the Airport include both emergent and forested wetlands (see Section 6.10), urban woodlands and open water areas. While no specific critical habitat designations are applicable for the Airport Property (see below), such habitats can support a range of wildlife, including reptiles, amphibians, mammals, song birds and wading birds. For both security purposes and to prevent large mammals, such as deer and coyote, from traversing the runways, the Airport maintains fencing around the airfield.

For implementation of the airfield recommendations, a more detailed environmental analysis would be conducted to assess potential impacts to biotic communities, including quantifying acreages of potential sand barren habitat to be disturbed and identifying mitigation measures to address that loss.

6.6 THREATENED AND ENDANGERED SPECIES

The Endangered Species Act of 1973 (ESA) provides for listing, conservation, and recovery of endangered and threatened species of plants and wildlife. Section 7(a)(2) of the ESA states that federal agencies shall ensure the actions it authorizes, funds, or carries out are not likely to jeopardize the continued existence of a listed species or result in a destruction or adverse modification of designated critical habitat. Section 9 of the ESA prohibits the take of listed species. Take is defined in the ESA as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect." The definition of harm also includes adverse habitat modifications. Federal actions that could result in a take must be coordinated under Section 7.

Similar to the biotic communities previously discussed, threatened and endangered species that may or are known to occur within the project area were identified through queries of the Virginia Department of Game and Inland Fisheries Fish and Wildlife Information Service (VaFWIS),

screening through the USFWS IPaC system, and a review of the Natural Heritage Data Explorer (NHDE) of the Virginia Department of Conservation and Recreation.

6.6.1 Federally Listed Species

The IPaC report prepared as part of this overview identified only one federally listed species as potentially occurring at the Airport: the Northern Long-eared Bat (*Myotis septentrionalis*). However, the IPaC report indicated that no critical habitat for this species is found at the Airport.

With respect to the Northern Long-eared Bat, the Final 4(d) rule, issued on January 14, 2016, prohibits an incidental take that may occur from tree removal activities within 150 feet of known occupied maternity roost tree(s) during the "pup season" (generally June 1 to July 31). The 4(d) rule also prohibits an incidental take that may occur from tree removal activities within ¼ mile of a hibernation site, year-round. The nearest known maternity roost tree is located 12.8 miles to the southeast of the airport. The nearest known hibernacula is located over 180 miles to the northwest of the airport.

The USFWS IPaC report also identified the following 16 migratory birds as having distributional ranges that overlap the project area:

- ✤ American Oystercatcher (Haematopus palliatus)
- ✤ Bald Eagle (Haliaeetus leucocephalus)
- Black Skimmer (Rynchops niger)
- + Clapper Rail (*Rallus crepitans*)
- ✤ Dunlin (Calidris alpine articola)
- → Gull-billed Tern (*Gelochelidon nilotica*)
- → Least Tern (*Sterna antillarum*)
- Prairie Warbler (Dendroica discolor)
- Prothonotary Warbler (Protonotaria citrea)
- ✤ Purple Sandpiper (Calidris maritima)
- + Red-headed Woodpecker (*Melenerpes erythrocephalus*)
- ✤ Red-throated Loon (Gavia stellata)
- Ruddy Turnstone (Arenaria interpres morinella)
- ✤ Rusty Blackbird (*Euphagus carolinus*)
- Semipalmated Sandpiper (Calidris pusilla)
- → Willet (*Tringa semipalmata*)

Closer to implementation of specific airfield recommendations, more detailed environmental analysis would be conducted, including consultation with USFWS, confirmation of existing species within the project area, an evaluation of potential impacts to those species and habitat areas, and, if appropriate, mitigation measures to address adverse impacts.

6.6.2 State-Listed Species

A review of VaFWIS data revealed that fifteen vertebrates, four invertebrates, and four vascular plant species listed as endangered, threatened, and special concern species occur, or formerly within three miles of the Airport. A species specific evaluation of the available occurrence data indicated that only four state listed avian species and two reptile species of concern occur within the City of Norfolk, and consequently may potentially be found on Airport property. These species are the Eastern Black Rail (*Laterallus jamaicensis jamaicensis*), the Gull-billed Tern (*Gelochelidon nilotica*), the Peregrine Falcon (*Falco peregrinus*), the Loggerhead Shrike (*Lanius ludovicianus*), the Northern Diamond-backed Terrapin (*Malaclemys terrapin terrapin*), and the Spotted Turtle (*Clemmys guttata*).

Of the four state-listed bird species, only the Eastern Black Rail would have specific habitat requirements met within the Airport property. The existing emergent and scrub-shrub wetland habitats could potentially provide this species with both foraging and nesting opportunities. The remaining state listed birds species may potentially be found on or near the Airport, but are unlikely to rely upon Airport property for nesting habitat.

The two state species of concern, the Northern Diamond-backed Terrapin and the Spotted Turtle, are both aquatic turtle species. As Lake Whitehurst is classified as an Impaired Water for aquatic species, the usage of that water body by such species, while possible, is unlikely.

The review of the NHDE indicated no state listed plant species likely to naturally occur within the Airport or adjacent areas. This does not include specimen plants that may exist within the adjacent Norfolk Botanical Garden.

A more detailed environmental analysis would be conducted prior to implementation of the airfield recommendations, including formal consultation with the Virginia Department of Game and Inland Fisheries and Virginia Department of Conservation and Recreation, potential field surveys to determine the presence/absence of any listed species, and an evaluation of potential impacts to those species and habitat areas. If appropriate, mitigation measures to address adverse impacts would be pursued.

6.7 WETLANDS

Wetlands at the Airport are regulated and protected under both federal and state regulatory programs. U.S. Department of Transportation Order 5660.1A, *Preservation of the Nation's Wetlands*, implements Executive Order 11990, *Protection of Wetlands*. The U.S. Army Corps of Engineers (USACE) administers Section 404 of the Clean Water Act (CWA) (33 CFR 320-332) which regulates discharges of fill into wetlands and waters of the United States. Wetlands as defined in 33 CFR Part 328 are "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." The Virginia Water Protection Permit Program (VWP) of the Virginia Department of Environmental Quality serves as Virginia's Section 401 certification program of federal Section 404 permits issued by the USACE. The VWP regulates activities in both tidal and non-tidal wetlands, including non-tidal wetlands that may not fall under federal jurisdiction but are still considered waters of the state.
In order to identify wetlands occurring within the Airport Property, data available online through the National Wetlands Inventory (NWI) mapper was reviewed. A field walkover of the Airport was also conducted to confirm the potential presence of the wetlands indicated on the NWI. Wetland boundaries were not formally delineated as part of this study. It is anticipated that prior to initiating specific projects, a current wetland delineation would be required to determine federal and state regulated wetland boundaries.





A number of wetlands occur on the Airport. Based upon available information, and observations during the field walkover, all of the wetland areas are non-tidal wetlands. Based on information obtained (other than Lake Whitehurst), on-airport wetlands are primarily forested and dominated by red maples and northern spice bush. The largest contiguous wetlands occur at the end of Runway 23 associated with Lake Whitehurst, and are comprised of a mosaic of wetland types. Emergent, scrub/shrub and forested wetland areas were observed, adjacent to and surrounding the open water area of Lake Whitehurst. Additional wetland areas are also present at the end of Runway 5, including emergent and forested wetlands.



Figure 6-3 – Runway 23 Wetland Detail



Figure 6-4 – Runway 5 Wetland Detail

6.8 FLOODPLAINS

Executive Order 11988, *Floodplain Management*, defines floodplains as "the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands", including the area that would be inundated by a 100-year flood. 100-year floodplain is an area that has a 1% chance of being flooded in any given year (Zone AE). A 500-year floodplain is an area that has a 0.2% chance of being flooded in any given year.



Figure 6-5 – Floodplain Map

Both 100 and 500-year floodplains are present on the Airport in connection with Lake Whitehurst and the nearby Chesapeake Bay Estuary.

Based on the foregoing, the projects recommended in the master plan are not anticipated to impact floodplains. However, prior to implementation, project-specific environmental documentation would be prepared to document existing floodplains in the area and evaluate potential for impacts. If it is determined that a proposed action would occur within the 100-year floodplain, compliance with applicable state and federal flood and stormwater management standards must be demonstrated.

6.9 COASTAL ZONE MANAGEMENT PROGRAM

The National Oceanic and Atmospheric Administration (NOAA) regulations (15 CFR Part 930) require an analysis of any action affecting the coastal areas along the Atlantic and Gulf Coasts. The Virginia DEQ administers the Virginia Coast Zone Management Program, established in 1986, which administers enforceable laws, regulations and policies that protect the coastal resources of Virginia, foster sustainable use of coastal resources and coordinate the management of coastal lands to ensure sustainable development while minimizing resource use conflicts by promoting informed, science-based decision making. The Airport does lie within the Hampton Roads Planning District of the Virginia Coastal Zone.

This will require that any federal action (including decision making and project funding) that has a reasonably foreseeable effect on any land or water use or natural resource of the coastal zone must be consistent with the enforceable policies of the Virginia Coastal Zone Management Program. This includes both direct and indirect effects. Any proposed project at the Airport will require coordination with the Virginia DEQ to ensure compliance with the enforceable policies (which include Fisheries Management, Subaqueous Lands Management, Wetlands Management, Dunes Management, Non-point Source Pollution Control, Point Source Pollution Control, Shoreline Sanitation, Air Pollution Control, and Coastal Lands Management). Given the location of the Airport and the non-tidal nature of the surrounding aquatic resources (lake and wetlands), some of these policies are not likely to apply.

6.10 PRIME AND UNIQUE FARMLAND

The Farmland Protection Policy Act (FPPA) limits the conversion of significant agricultural lands to non-agricultural uses as a result of federal actions (7 USC § 4201, et seq.). The determination of whether farmlands are subject to FPPA requirements is based on soil type; the land does not have to be actively used for agriculture. Farmland subject to FPPA requirements can be pastureland, forested, or other land types, but not open water or developed urban or transportation areas. The FPPA regulates four types of farmland soils:

- Prime Farmland;
- ✤ Unique Farmland;
- ✤ Farmland of Statewide Importance; and
- ✤ Farmland of Local Importance.

The evaluation is based upon soils identified by the Natural Resources Conservation Services (NRCS). Prime farmland is defined by the NRCS as "land that has the best combination of physical and chemical characteristics" for agriculture. This includes land with these characteristics used for livestock or timber production but not land that is already urbanized or used for water storage. Unique farmland is defined as "land other than prime farmland that is used for production of specific high-value food and fiber crops," with such crops defined by the Secretary of Agriculture. Farmland of statewide or local importance is farmland other than prime or unique farmland that "is used for the production of food, feed, fiber, forage or oilseed crops."

No portion of the Airport is designated prime farmland Or the other regulated categories.

6.11 WILD AND SCENIC RIVERS

Through the National Wild and Scenic Rivers Act of 1968 (16 U.S.C 1271), rivers can be federally designated as wild and scenic if they contain remarkable scenic, recreational, or fish and wildlife related values. Such rivers are granted protection under the Act and must be evaluated as part of the NEPA process. Based upon a review of the National Wild and Scenic Rivers System, Virginia has no designated Wild and Scenic Rivers.

6.12 HAZARDOUS WASTE

The available GIS resources from the EPA were reviewed, indicating a total of eight locations with existing or historic permits under the Resource Conservation and Recovery Act (RCRA). RCRA creates the framework for the proper management of hazardous and non-hazardous solid waste.



Of these eight locations (Figure-5-6), five were located on or adjacent to airport property. The first corresponds to Norfolk International Airport itself, classified as a Conditionally Exempt Small Quantity Generator, including both Norfolk Airport Authority (NAA) and the Transportation Security Administration (TSA) activities. Covered activities include the bulb crusher used by the Airport Authority to recycle spent fluorescent bulbs and the generation of potentially ignitable, corrosive, or reactive waste at the TSA checkpoint.

Two of the directly adjacent locations correspond to air cargo operators at ORF (FedEx and UPS), which are classified as Conditionally Exempt Small Quantity Generators. This designation covers the use of solvents and ignitable waste as part of the service and delivery operations. A third location corresponds to Piedmont Airlines, classified as a Small Quantity Generator of similar materials to the shipping companies. The fifth location represents an FAA facility classified as a Conditionally Exempt Small Quantity Generator of ignitable waste.

The remaining three locations correspond to Arai Americans, Inc (a Small Quantity Generator of ignitable waste and solvents associated with automobile parts manufacturing), TCS Materials Ferry Road Plant (a ready-mix concrete manufacturer) and AEPCO Marine Inc. (A Small Quantity Generator of solvents associated with paint manufacturing).

A search of all available EPA compliance databases was conducted, which demonstrated that as of 2018, all identified facilities were in compliance with the applicable environmental regulations.

Typical of airport facilities, ORF does have potential sources of hazardous material that are generated at the Airport. These include:

- ✤ Above-ground storage tanks (ASTs)
- Underground storage tanks (USTs)
- ➔ Transformers
- Glycol and deicing
- ✤ Buckeye jet fuel pipeline
- ✤ Sewage pump areas
- ✤ Indoor and outdoor floor/ground drains
- ✤ Elevators
- Spills on taxiways, roadways, and parking lots
- ✤ Waste storage

Modifications to the existing airport facilities should be evaluated for the potential to generate additional hazardous materials. However, it is not expected that any commended projects would produce wastes that could not be properly mitigated and addressed.

6.13 SUMMARY

Projects recommended in the master plan are anticipated to have some impacts on the environment, with concerns generally focused on water quality, biotic communities, threatened and endangered species, and wetlands. As noted under each of the resource-specific sections, before implementation of some of the proposed development projects, further environmental documentation would be required to identify existing conditions at that time, determine impacts on each resource, and if appropriate, identity mitigation measures to address adverse impacts. Once project details are available, if appropriate under NEPA, Categorical Exclusion(s) or Environmental Assessment(s) will be prepared in accordance with FAA guidance. Based on past studies and the types of projects recommended in the master plan, it is anticipated that impacts can be successfully mitigated allowing implementation of the recommended plan.

APPENDIX A – ELIMINATED RUNWAY ALTERNATIVES

	Table A-1 – Eliminated Runway Alternativ	ves Summary
Alternative	Opportunities	Constraints
Alternative 1: Relocate Runway 5 Threshold	 Captures full length of runway for landing on Runway 5 (current Landing Distance Available is adequate for all aircraft operations) 	 Cost and impact of relocating approach lighting system and navigational aids (glideslope, PAPIs, runway markings) Off-airport tree removal required
Alternative 4: 9,000' Offset: 400'	 → Provides secondary runway for operational flexibility → Proposed length accommodates all commercial activity → Avoids impacts to existing landside facilities 	 400' separation does not permit simultaneous operations Overlapping Runway Object Free Areas (ROFAs) Requires relocation or decommissioning of VORTAC Environmental impacts to Lake Whitehurst Significant construction costs Approach/departure overfly Little Creek Naval Base
Alternative 5: 9,000' Offset: 876'	 Provides secondary runway for operational flexibility Proposed length accommodates all commercial activity Avoids impacts to VORTAC 876' separation enables simultaneous VFR operations 	 Impacts to Lake Whitehurst Impacts to on-airport facilities (airport maintenance facilities, ARFF training facility, MRO hangar, and GA parking apron) Significant construction costs Approach/departure overfly Little Creek Naval Base
Alternative 6: 7,900' and 7,200' Offset: 876'	 Provides secondary runway for operational flexibility Proposed length accommodates all or most commercial activity Avoids impacts to VORTAC 876' separation enables simultaneous VFR operations Reduces costs and impacts due to shorter runway lengths (7,900' or 7,200') 	 Impacts to Lake Whitehurst Impacts to on-airport facilities (airport maintenance facilities, ARFF training facility, MRO hangar, and GA parking apron) Approach/departure overfly Little Creek Naval Base

Table A.1 Eliminated Bunway Alternativ

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Alternative	Opportunities	Constraints
Alternative 7: 6,000', ARC-C-II (20:1)	 → Provides secondary runway for GA airport users → Avoids impacts to VORTAC → 876' separation enables simultaneous VFR operations → No direct impacts to Lake Whitehurst 	 → Length limits usage by most commercial operations → Impacts to on-airport facilities (airport maintenance facilities, ARFF training facility, MRO hangar, and GA parking apron) → Higher IFR visibility minimums
	 → No direct impacts to take writeholst (however some wetland impacts will occur) → No RPZ impacts → Greater height over Little Creek Naval Base 	-
Alternative 10: 5,500', ARC C-II (34:1)	 → Provides secondary runway for GA airport users → Avoids impacts to VORTAC → 876' separation enables simultaneous VFR operations → No direct impacts to Lake Whitehurst (however some wetland impacts will occur) → Greater height over Little Creek Naval Base 	 → Length restricts usage by all commercial operations → Impacts to on-airport facilities (airport maintenance facilities, ARFF training facility, MRO hangar, and GA parking apron) → RPZ impacts to commercial buildings
Alternative 12A: 5,500', ARC C-II EMAS 3/4-Mile Visibility Minimum	 → Provides secondary runway for GA airport users → Avoids impacts to VORTAC → 876' separation enables simultaneous VFR operations → No impacts to Lake Whitehurst → No wetland impacts → Provides separation of fleet mix (commercial and GA) → Provides secondary runway for operational flexibility → Provides more developable land on the east side of the airfield 	 → Length restricts usage by commercial operations → Impacts to on-airport facilities (airport maintenance and ARFF training facilities) → RPZ impacts to commercial buildings → Relocation of existing airfield maintenance buildings → Impacts on several GA hangars, the MRO facility, the itinerant parking apron, and the ARFF training area → Difficult construction phasing

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Alternative	Opportunities	Constraints
	Avoids flyovers of Little Creek Naval Base Boduced impact to Little Creek Naval Base	✤ Reduced primary runway length (7,500') to accommodate safety areas
	operations box	T complete reconstruction of airfield
	 Standard full length parallel taxiway option for primary and potential parallel runway 	✤ Reduced terminal apron space
Altornativo 12A:	Provides the opportunity to reuse the existing primary runway as a full-length mid-field parallel taxiway	✤ Substantial costs
Runway Realignment to 3-21 Orientation		Impacts to on-airport facilities (airport maintenance facilities, ARFF training facility, MRO hangar, GA hangar facilities and GA parking apron)
		Requires filling a portion of Lake Whitehurst
		✤ Relocation of runway NAVAIDs
		Realignment over residential area
	 Limits flyovers of Little Creek Naval Base Provides more developable land on the east airfield for potential cargo relocation and 	 Runway length shortened to 7,900' Complete reconstruction of airfield
	expansion and GA facility expansion	↔ Substantial costs
		Closure of secondary airport access
		route Robin Hood Road
Alternative 13B		Requires removal of 6 gates on Concourse B and RON parking
Runway Shift 400' West		→ Removal of air cargo building and
		employee lot
		Requires filling a portion of Lake Whitehurst
		+ Relocation of runway NAVAIDs,
		VORTAC
		station, ARFF storage building, and
		airport triturator
	Limits operations over Little Creek Naval Base	➔ Substantial cost
	Provides separation of fleet mix	✤ Relocation of existing airfield
Alternative 14:	(commercial and GA)	maintenance buildings
Secondary Runway	flexibility	MRO facility, the itinerant parking apron, and the ARFF training area
	Provides more developable land on the east side of the airfield	Difficult construction phasing

Source: CHA, 2019.

Runway 5/23 Threshold Relocation Alternatives

Relocate Runway 5 Threshold (EXHIBIT 1)

Currently the Runway 5 threshold is displaced by 1,000 feet and provides approach clearance over trees and object penetrations to the approach surface southwest of the runway. This alternative (shown in **Figure A-1**) would relocate the Runway 5 threshold to the end of pavement, recapturing 1,000 feet of landing length. Exhibit 1 shows the resulting Threshold Siting Surface (TSS) approach profile (34:1 slope). The only resulting TSS obstructions are trees, which could potentially be removed in the future without significant environmental impacts. All structures, poles, and roadways are at least 10 feet below the surface.

If the Airport were to relocate the Runway 5 threshold, the threshold lights, Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR), and glideslope would also need to be relocated. In addition to relocating the various lighting systems, runway markings would also need to be updated to eliminate the displaced threshold.

Runway 5 currently provides over 7,800 feet of landing length, which remains adequate throughout the planning period for the fleet mix serving the Airport. As such, this option would only be pursued if needs changed and/or the Airport requires additional pavement on the Runway 5 end to meet airline Landing Distance Available (LDA) requirements or the potential for runway projects impacting a significant amount of the runway. As there are future plans for runway rehabilitation and reconstruction, the threshold could be relocated to the end of pavement during construction on the Runway 23 end as part of the construction safety and phasing.

Proposed Parallel Runway 5R/23L Alternatives

Runway 5R/23L for Commercial Operations (EXHIBITS 4-7)

Ideally, the new parallel runway would be able to accommodate all airport users; however, with airport property limited by Lake Whitehurst and the local airspace influenced by the Little Creek Naval base, it is challenging to provide a commercial-capable parallel runway. As such, four alternatives were developed for this Master Plan (Figure A-2 through Figure A-5) and include commercial runway concepts with lengths of 7,200 to 9,001 feet. While these concepts may be considered at a later time, the Master Plan is not advancing them for additional consideration based upon the considerable environmental impacts, financial feasibility, and operations justification.

The remaining parallel runway alternatives would serve all general aviation aircraft, with occasional use by some airline and air cargo aircraft. Although limited to a subcomponent of airport users, which is a key disadvantage, it is recommended that one or more of the following runway alternatives be advanced for consideration and inclusion in the recommended plan. The benefits of these runway concepts include the following:

- + Accommodates most aircraft operations (in terms of total ORF operations)
- Segregates general aviation from commercial activity (i.e., larger commercial/cargo jets from smaller single engine piston aircraft)

- ✤ Consistent air traffic flows and beneficial airspace considerations
- ✤ Maximizes use of available airport property
- ✤ Releases critical airport property for needed landside development
- ✤ Minimizes environmental impacts

Runway 5R/23L – 6,000 Foot, ARC C-II (EXHIBIT 9)

This alternative (**Figure A-6**) is a refinement or "scale-back" of the alternative depicted in **Figure 5-9**, providing instrument visibility minimums of greater than 3/4-mile. The higher minimums enable a steeper 20:1 threshold surface and corresponding greater clearance over the Little Creek Naval Base. In addition, the parallel taxiway offset may be reduced to 300 feet for ARC C-II. The other runway dimensions and configuration presented in **Figure 5-10** are the same as those presented in **Figure 5-9**.

Runway 5R/23L – 5,500 Foot, ARC C-II (EXHIBIT 10)

This derivative alternative (**Figure A-7**) refines or scales-back the previous concepts, providing a shorter 5,500-foot runway length while providing the lower minimums of 3/4-mile serving ARC B-II aircraft. The reduced length further reduces costs and impacts to providing a standard RSA. With the lower minimums, the threshold surface is the flatter 34:1 slope.

Runway 5R/23L – 5,500 Foot, ARC C-II (EXHIBIT 12A)

This alternative (**Figure A-8**) is the same as Alternative 12B with the exception of planned approach visibility minimums. Alternative 12A provides 3/4-mile visibility minimum, which has a wider Runway Protection Zone (RPZ) that would include both on- and off-airport existing buildings.

Runway 5R/23L – Realignment and Shift (EXHIBIT 13A & 13B)

Two final derivative runway alternatives [13A (**Figure A-9**) and 13B (**Figure A-10**)] were developed to avoid direct overflight of the Little Creek Naval Base: a runway realignment (Option A) and a runway shift (Option B). It should be noted that these concepts were examined exclusively for ground-based requirements; therefore, they have not been fully vetted for airspace impacts.

Option A examines the realignment of Runway 5/23, as well as the proposed parallel runway, by approximately 20-degrees counterclockwise, designating the runways at Runway 3L/21R and Runway 3R/21L, respectively. As a result of the realignment, the primary runway (i.e., Runway 3R/21L) length is reduced to 7,500 feet to accommodate the RSA and ROFA length beyond the end of the runway and avoid significant environmental permitting to fill and grade a portion of Lake Whitehurst; however, a smaller area of the lake located northwest of the ARFF station would still require fill to accommodate portions of the parallel taxiway (i.e., Taxiway C) and associated safety areas. Furthermore, the existing ARFF station, ARFF storage building, and airport triturator would require removal and relocation if this alternative is adopted.

Additionally, the existing Runway 5/23 RPZ, given the current configuration of the runway, is located over Little Creek Bay, as well as over land being used for industrial purposes. If the runway is realigned as detailed in Option A, it will encroach upon a residential-use area (i.e., the East

Beach community) east of the bay. Finally, the depicted realignment and resulting runway length reduction would require relocation of all runway instrumentation.

This concept also depicts a shift of the proposed parallel runway (i.e., Runway 3R/21L) and taxiway systems into portions of the existing General Aviation (GA) area. As a result, it is likely that the existing airfield maintenance, ARFF training facility, and MRO building would require removal and relocation. Portions of the GA apron would also require reconfiguration to accommodate ground movement and to ensure sufficient aircraft parking. Significant grading would also be required along the proposed Runway 21L end due to elevation changes in the terrain north of the fuel farm.

Option B depicts a 400-foot shift of Runway 5/23 to the northeast rather than a realignment. Similar to the concept shown in Option A, Option B illustrates a Runway reduction (7,900 feet) to accommodate the RSA and ROFA length beyond the end of the runway for Runway 5/23. Also. similar to Option A, this concept requires fill within portions of Lake Whitehurst directly northwest of the ARFF station to accommodate the parallel taxiway (i.e., Taxiway C) and associated taxiway safety areas. This concept also requires removal and relocation of the existing ARFF station, ARFF storage building, and airport triturator. Additionally, due to the associated shift to Taxiway C, a large portion of the passenger terminal apron would be reduced. Portions of facilities such as the southeasternmost portions of Passenger Terminal Concourse B, the air cargo building, and the air cargo employee parking lot would also be negatively impacted by the associated shift to the taxiway. Furthermore, a reconfiguration of Airport Road would be required to provide access between Robin Hood Road and Military Highway. The drainage ditch located east of the Runway 5 end would also require culverting or realignment.

Alternative 14: Rotated Runway

Based on conversations with Airport and Board representatives, an alternative (**Figure A-11**) presenting a secondary runway was established, supporting limited operations over Little Creek Naval Base. The secondary runway would also provide more operational flexibility and separation of fleet mix, with GA operators primarily arriving and departing the new runway while commercial operators continue to operate via existing Runway 5/23.

Despite limited impacts to military operations and increased operational flexibility, this alternative is not feasible from a financial or airfield safety perspective. Constructing the runway would require the demolition and/or relocation of several support facilities including GA hangars, the MRO, the GA itinerant apron, and the ARFF practice area. Construction phasing would require the closure of the primary runway due to impacts to the safety areas associated with Runway 5/23. To reduce impacts on airfield infrastructure, installation of an EMAS would be required. Furthermore, given the layout, simultaneous operations could not occur, as the safety areas associated with the new runway would be within the approach path of Runway 5/23.



Y. PROACTS/WATVA13370/CAOD/POJRES/MEPTLD ALTERNATINE
 Y.14/2019 1:50:59 PM PROISE: 7/14/2019 1:50:59 PM Context







Figure A-2 Proposed 5R-23L - 9,001' 34:1 TSS , D-IV Runway 180' SHIP HEIGHTS Alternative 4







Figure A-3 Proposed 5R-23L - 9,001'

34:1 TSS , D-IV Runway 180' SHIP HEIGHTS Alternative 5







Figure A-4 Proposed 5R-23L - 7,900'

34:1 TSS , C-III Runway 180' SHIP HEIGHTS Alternative 6







Figure A-5 Proposed 5R-23L - 7,200' 34:1 TSS , C-III Runway 180' SHIP HEIGHTS Alternative 7







Figure A-6 Proposed 5R-23L - 6,000' 20:1 TSS , C-II Runway 180' SHIP HEIGHTS Alternative 9







DECLARED DISTANCES		
PROPOSED RUNWAY 5R-23L		
	RUNWAY 5R	RUNWAY 23L
TORA	5,500'	5,500'
TODA	5,500'	5,500'
ASDA	5,500'	5,500'
LDA	4,500'	5,500'

Figure A-7 **Proposed 5R-23L - 5,500'** 34:1 TSS , C-II Runway 180' SHIP HEIGHTS

Alternative 10







DECLARED DISTANCES			
PROPOSED RUNWAY 5R-23L			
	RUNWAY 5R	RUNWAY 23L	
TORA	5,500	5,500	
TODA	5,500	5,500	
ASDA	5,500	5,500'	
LDA	4,900	5,500'	

Figure A-8 Proposed 5R-23L 5,500' With EMAS At Both Ends 20:1 TSS , C-II Runway Not Lower than³ Mile Visibility Alternative 12A









LEGEND



Future Airfield Pavement



Future Runway

Figure A-9 Runway Realignment Proposed Runway 3R/21L - 7,500' Proposed Runway 3L/21R Alternative 13A







LEGEND







Future Runway

Figure A-10 Runway Shift 400' Proposed Runway 5R/23L - 7,900' Alternative 13B







Figure A-11 ROTATED 5'500' RUNWAY Alternative 14