Front Royal-Warren County Airport
Airport Layout Plan Update
Narrative Report

June 2009

Warren County/Warren County Airport Commission
220 North Commerce Street, Suite 100
Front Royal, Virginia 22630

FINAL

Talbert and Bright, Inc.
10105 Krause Road, Suite 100
Chesterfield, Virginia 23832

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1.0 EXISTING CONDITIONS

Warren County Airport (FRR) is owned by Warren County, Virginia with general oversight responsibilities provided by the Warren County Airport Commission. The Airport Commission is appointed by the County Board of Supervisors. Daily operations are managed by the Airport Manager. Warren County Airport has two resident Fixed Base Operators (FBO's). Cass Aviation is responsible for general aviation services such as flight training, fuel sales, line service, etc. Front Royal Aero Services Inc (FRASI) is responsible for aircraft maintenance and repair. The airport includes approximately 90 acres of land which is located within the boundaries of Warren County, approximately 3 miles southwest of Front Royal, Virginia. Warren County is considered to be in the north-western portion of the Commonwealth. Warren County is part of the Washington D.C. Primary Metropolitan Statistical Area (U.S. Census Bureau, last revised 01/28/2002). The airport is ±15 miles south of Winchester, VA; ±30 miles northeast of Luray, VA; and approximately 20 miles from the West Virginia state line. The airport lies ±2 mile west of Route 340 and ±5 miles south of Interstate 66. The airport is located off of Route 615 / Stokes Airport Road, which provides direct public access to/from Route 619 / Rivermont Road. (refer to **Exhibit 1-1**).

Warren County Airport is part of a regional general aviation system serving the entire Eastern Middle Atlantic United States, less than one hour flight time to major population centers including Baltimore-Washington, Charlotte, Philadelphia, and New York. It is estimated that one-half of the U.S. population is within 800 miles of Warren County. The airport is designated as a General Aviation airport in the National Plan of Integrated Airport Systems (NPIAS) and as a General Aviation Community airport in the Virginia Aviation Transportation System Plan (VATSP).

1.1 PURPOSE OF ALP UPDATE AND MAJOR PLANNING ISSUES

The purpose of this Airport Layout Plan Update study is to facilitate and guide the airport in order to achieve the mission set forth by the Warren County Airport Commission to

"Develop the Premier General Aviation Community Airport in Virginia and to be a Revenue Producer for Warren County." One of their market strategies to achieve this is to position the airport as the preferred and most accommodating base of operations for the personal/recreational aircraft owner. This study also aims to re-examine and update the existing, approved and adopted as-built Airport Layout Plan (ALP) drawing, which was prepared by Campbell and Paris Engineers in 1998 as part of the Runway Rehabilitation/taxiway extension/apron expansion and obstruction removal project. This ALP drawing was subsequently revised (i.e. Pen & Ink) in June 24, 2004. Specifically, this effort will include an evaluation of current federal and state airport safety and design standards and the preparation of aviation activity forecasts which will in turn be used to identify what types and sizes of facilities will likely be required to meet those standards and demands over the next twenty years.(2006-2026) An updated ALP drawing set will then be prepared that reflects the "as-built" facilities at the airport and the general layout of where any future facilities could be developed. This plan will support the continued safe and efficient operation of the airport while providing the County and Commission flexibility in meeting the anticipated demand.

The 1998/2004 ALP identified a variety of recommended landside and airside facility improvements that have either been completed or are currently being pursued. Those that have been accomplished to date include the construction of a parallel taxiway, expansion of the main apron adjacent to the terminal building, expansion of the midfield apron, construction of new t-hangar buildings, and the relocation of Stokes Airport Road (Route 615). Identified improvements that have not yet been accomplished include development of a west-side corporate area, midfield corporate hangars, runway extension, additional terminal area automobile parking, and additional land acquisition.

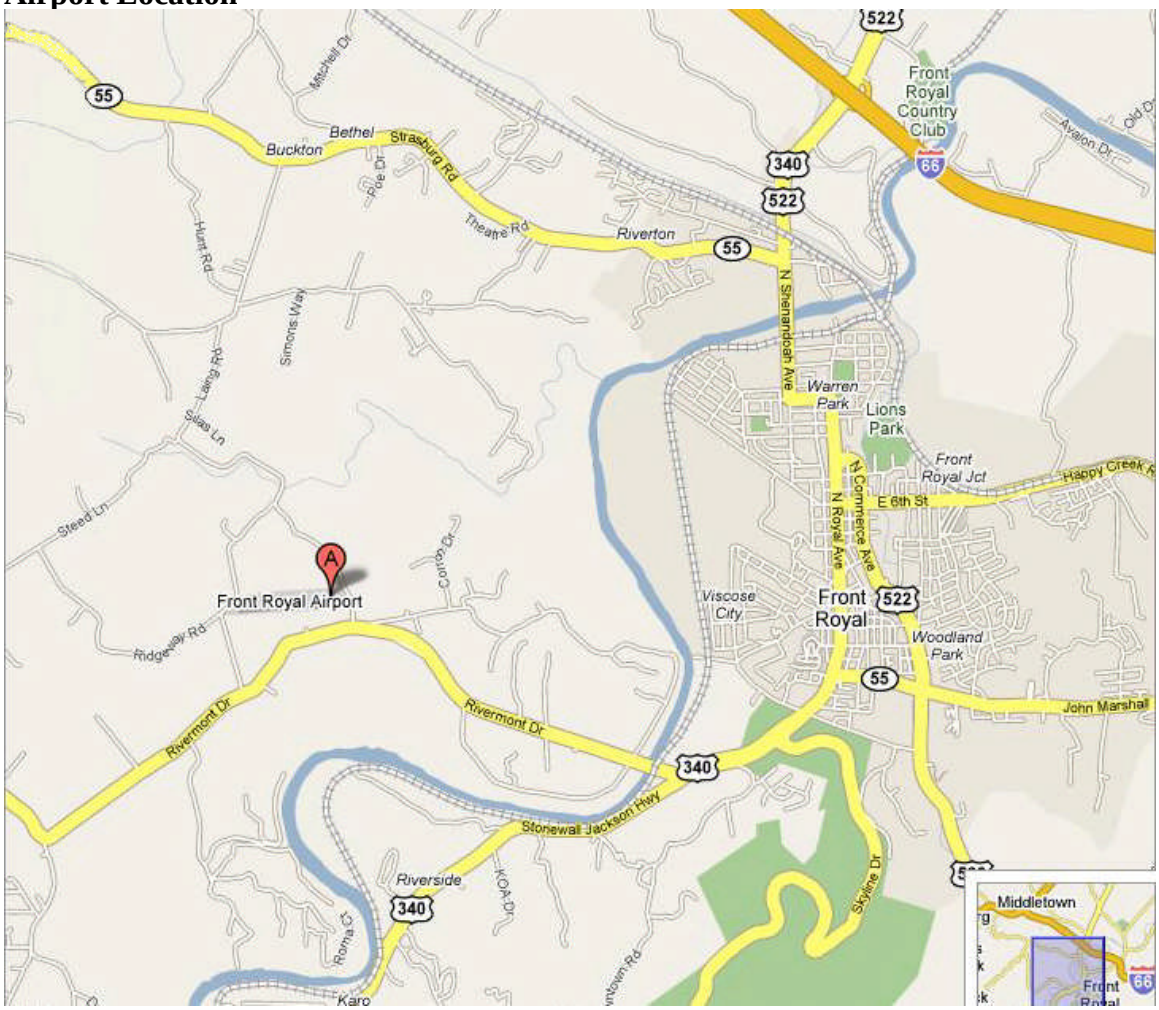
While many of the same issues identified in the previous planning studies will be reviewed again, this ALP Update report is not to be considered a complete Master Plan Update. Consistent with the previous ALP, the airports long-term development goal is to accommodate B-II, business type aircraft (i.e. <121 knot approach speed and <79'

wingspan) and the airport's service role in the NPIAS and VATSP are not anticipated to change. This updated study will purposely focus on how to arrange the development of traditional general aviation personal and business aircraft facilities (i.e., hangars, t-hangars, aprons, taxiways, etc.) while accommodating the national and regional growth in operational demand by corporate turbojet aircraft (i.e. Lears, Citations, Falcons, etc.) and the new very light jet aircraft scheduled to enter the market. This includes evaluating land acquisition requirements, the potential relocation of Ridgeway Road (Rt. 617), runway length requirements, surrounding land-uses, the layout of the terminal area and a preliminary evaluation of improving the instrument approach capability. One of the most important goals of this planning process is to develop a plan with enough flexibility to respond to change, thus enabling the County and Commission to take advantage of unanticipated and favorable economic development opportunities. Information regarding utility services surrounding the airport is limited and although the County does have a Comprehensive Plan that was created in 2004 and a Facilities Plan that was recently drafted in early 2007, there is little information directly related to the airport or the immediate surrounding rural area. The only road improvements currently on file are a western bypass that will go around the town of Front Royal and the airport and connect with Route 340 South. This bypass will provide access to the AVTEX fiber plant, which is now the COE/EPA Super Fund Cleanup Site as well as improved access to the airport from Interstate 66. A figure of this proposed bypass is unavailable at this time but the general location can be seen in Exhibit 1-1. The recommendations presented in this study effort will be valuable in guiding the airport development over the next ten to twenty years.

To gather additional stakeholder input and discuss the future of the airport as it relates to the ALP update, a kickoff meeting was held on February 9, 2006 at the Warren County Airport in the main terminal building. County officials, members of the airport commission, airport staff, and representatives from FAA were among those attending the kickoff meeting facilitated by Campbell & Paris Engineers. The purpose of the ALP

project was discussed as well as short-term and long-term goals for the airport. These goals will be reflected in both the narrative and Airport Layout Plan drawings.

Exhibit 1-1
Airport Location



Source: *Google Maps 2006*

Major planning issues to be examined in this report include:

- **Activity Planning Forecasts:** Twenty year forecasts of based aircraft and operations at Warren County Airport will be prepared taking into account the most recent Terminal Area Forecast prepared by the FAA and the forecasts prepared by the Virginia Department of Aviation (DOAV) for the Virginia Air Transportation System Plan (VATSP) Update 2003.

- **Runway Length Analysis:** A review of the demand for additional runway length and proposed runway extension will be conducted in order to meet the performance criteria of the general aviation aircraft fleet anticipated to use the airport throughout the year. This analysis will also take into consideration the County's economic development objectives and the needs of the tenants, users, and businesses that the airport facilities are intended to serve.

- **Obstruction Analysis:** Using aerial photogrammetry obtained in October 2005, United States Geological Survey (USGS) quadrangle maps, and FAA Obstruction data, a re-evaluation of existing and future Federal Aviation Regulations (FAR) Part 77 surfaces surrounding the airport will be prepared to identify any existing or potential obstructions to air navigation and identify recommended mitigation measures.

- **Land Acquisition:** According to the Warren County Airport Commission, as of October 2005 there were a number of properties that were of interest to the airport for acquisition to accommodate expansion of the aircraft storage facilities. With ongoing land development in the area, the need for compatible land use planning and protection from encroachment is increasing. Any potential or recommended property/easement acquisitions will be identified on the updated ALP and Airport Property Map (formerly "Exhibit A")

- **Taxiway Extension:** As of 2006 the taxiway extension proposed in the 1998 ALP has been completed and will be reflected in this ALP update.

- **Hangar Requirements:** In addition to providing additional transient and based aircraft tie-downs, the need for and potential location for additional hangar space through a mixture of clearspan hangars and t-hangars will be examined.

- **Terminal Area Layout/Location:** This study will evaluate the location of the existing terminal area and make recommendations of potential improvements or relocation. Any recommended re-configurations will be coordinated with planned apron, taxiway and hangar building layouts.

- **Weather/Wind Monitoring System:** This study will identify the airports interest in installing an AWOS/ASOS, the siting requirements and funding eligibility options for such systems.

- **Fuel Storage:** The current location of the above ground fuel storage tank obstructs a clear view from the terminal building to the end of Runway 9. The location of the fuel farm, as well as the possible co-location of a wash rack, will be evaluated.

1.2 HISTORY OF WARREN COUNTY AIRPORT

Warren County Airport (FRR) was originally called Stokes Field and served as a private landing strip for Mr. Aubrey A. Stokes and his three brothers. The original landing strip was actually two separate turf runways that were constructed in 1943. The main east-west landing strip (RW 9-27) was originally constructed at 2,500 feet and later extended to approximately 3,000 feet in length. The secondary, north-south cross wind runway was constructed at approximately 1,300 feet in length and later abandoned due to inactivity.

In 1967, the Aviation Committee of the Chamber of Commerce recommended that the Town of Front Royal and Warren County purchase and operate FRR and appoint a Commission "for the sole purpose of managing the affairs of the Warren County Airport." Upon purchase of the original two parcels consisting of approximately 61 acres of land, the Commission recommended several improvements be made at the facility. In

1968 the east-west Runway was paved to a dimension of 3,000' x 50', with an overlay following in 1975. Additionally, in 1976 the construction of six (6) t-hangars and installation of a low intensity lighting system for the runway was undertaken.

A FAR Part 77 surfaces analysis was performed and a phasing plan was recommended for the efficient removal of identified obstructions in 1988. Additionally, measures were taken to acquire adjacent parcels of land that would enable FRR to control, in fee simple, all land contained within the 250 foot Primary Surface and Runway Protection Zones (RPZ) associated with the runway at that time.

Development of the airport facilities proceeded along the following timeline:

- 1943 - 2,500' E-W (later extended to 3,000') & 1,300' N-S landing strips constructed.
- 1967 -Two original parcels of land (approx. 61 acres) are purchased
- 1968 - Runway 9-27 paved 3,000' x 50' and Runway Safety Area graded to 3,400' x 150'
- 1975 - Runway 9-27 overlay
- 1976 - Six(6) t-hangar buildings constructed and low intensity runway lights installed.
- 1988 - Part 77 analysis and land acquisition plan to contain 250' Primary Surface & RPZ
    - Acquired aircraft Rescue & Firefighting Safety Equipment
    - Land acquisition for approaches
- 1989 - Land acquisition and obstruction removal
    - Noise mitigation measures taken for public buildings
    - Airport Master Plan Study conducted
- 1990 - Land acquisition, obstruction removal, and apron construction
- 1994 - Runway 9-27 rehabilitation
- 1995 - Runway 9-27 rehabilitation, obstruction removal, and taxiway extension

- 1998 - As-built ALP drawing created
- 2002 - Apron & taxiway construction
- 2003 - Taxiway construction
- 2005 - Airport Master Plan Study updated
  - Taxiway construction
- 2005/2006 - Parallel taxiway extension
- 2006 - ALP Update Study
- 2008 – Apron/taxilane extension

1.3 AIRPORT FACILITIES INVENTORY

1.3.1 Runway and Taxiway Facilities

As of 2006, the runway and taxiway system at Warren County Airport consists of a paved 3,007' x 75' Runway 9/27 with a full length, 35' wide parallel taxiway. A parallel taxiway extension project was designed in 2005 to extend the full length of the runway. Construction began in mid 2006 and was completed in Fall 2006. Upon completion of the most recent overlay, the equivalent load bearing capacity of Runway 9-27for single-gear aircraft is 12,500lbs. The runway-to-taxiway separation distance is approximately 240' from the runway centerline in order to meet FAA 150/5300-13 design standards. The runway and parallel taxiway are connected by four 35' wide, perpendicular (900) exit taxiways; one is located at the Runway 27 end, the second is located at midfield, and the other two are located at the Runway 9 end.

1.3.2 Apron Facilities

As of 2006, the main public use apron area is approximately ±11,700 sy in size and located directly adjacent to the terminal building. This apron is used and marked for

circulation, aircraft parking and aircraft self-service fueling. There are 28 paved Group-I tie-down positions located on the main apron.

The apron pavement was constructed with 2 inches of bituminous surface course, 6" of cement treated base course, and 7" of base course aggregate in 2002 and is generally designed to accommodate aircraft with single wheel gear up to 12,500 lbs on a regular basis. Operations by larger aircraft will not typically cause significant damage to the pavement but can reduce the usable lifespan of the facility.

1.3.3 Navigational and Approach Aids

As of 2006, Warren County Airport currently has a RNAV (GPS) A instrument approach under development by the FAA with a scheduled publication date of 07/05/2007. The runway has medium intensity runway lighting (MIRL) that was installed in 2002. There are no ground-based electronic navigational aids (i.e. localizer, NDB), but there are visual reference approach aids including Visual Approach Slope Indicators (VASI's) to both Runway 9 and Runway 27. The airport also has a rotating beacon located north of the midfield apron and a lighted windcone located just south of the fuel farm.

1.3.4 Hangar Facilities

As of 2006, hangar facilities at the airport include three (3) t-hangar buildings, providing approximately 38,000sf of storage space. There is a corporate/storage hangar that is 120' x 35' and provides 4,400sf of storage space. There is also one maintenance hangar that is 3,200sf in size and accommodates Front Royal Aero Services, Inc., a certified FAA repair station that performs maintenance on small, single and twin piston engine aircraft. There are approximately 32 individual t-hangar units which are able to house many of the small, single-engine and twin-engine aircraft. The west-side t-hangar building (t-hangar #3) was constructed in 2002 and the others have been maintained in decent condition.

According to the airport manager, all the t-hangar units are occupied with a current waiting list for t-hangar space.

1.3.5 General Aviation Terminal

The existing public terminal building is 3,070sf and is in good condition. It is located at the main entrance to the airport adjacent to Stokes Airport Road (Route 615). The terminal building houses Airport Management as well as the Fixed Base Operator (FBO) and several public areas. The terminal provides electricity, water, sewer, and phone communications from surrounding utilities. Police, fire, and rescue services are provided by Warren County for the airport. The parking lot adjacent to the terminal building, which is also used by the FBO, is paved and can accommodate approximately 36 automobiles. .

1.3.6 Fuel Storage Facilities

The fuel farm consists of one 12,000 gallon above ground storage tank for AVGAS (100LL) fuel located near the southwest corner of the main apron. A self-serve fuel pump is located with this storage tank. The location of the existing fuel farm will be evaluated and possibly relocated in order to provide an unobstructed line of sight from the existing terminal building to the end of Runway 9.

Table 1.1
Summary of Existing Airport Facilities - 2006

FACILITY / CONDITION	DIMENSIONS	FEATURES
Runway 9-27 (asphalt) / Good	3,007-feet long 75-feet wide ARC B-I (12,500 lbs. Single)	non-precision markings, MIRLs
Parallel Taxiway (asphalt) / Good	Full length, 35-feet wide	Construction complete as of Fall 2006
Apron Area / Good	±11,700 sq. yds.	Main apron accommodates both based and transient aircraft.
T-Hangars / 2 buildings New, others fair	32 units	40' door width

Corporate Hangar / Fair	4,400 sf	40' door width
Maintenance Hangar / Fair	3,200 sq. ft.	Front Royal Aero Services, includes office space
Tie Downs	31 Group-I	Adjacent to terminal building/maintenance hangar
Terminal Building / Good	3,070 sf	Cass Aviation - FBO office space
Fuel Farm	1 Tank	12,000 gallon AVGAS (100LL) Above Ground
Other	Lighted Windcone, Rotating Beacon, VASI	
Auto Parking / Fair	36 spaces Paved, marked	

Source: *Warren County Airport, 2006*

1.4 AIRSPACE & APPROACH CAPABILITY

1.4.1 Airspace

FRR is an uncontrolled airport surrounded primarily by Class G airspace. It is, however situated between Class E airspace associated with Winchester Regional and Luray Caverns Airports. (Refer to **Exhibit 1-2**) Airspace procedures are relatively uncomplicated due to the lack of any major commercial service in the immediate vicinity and Warren County Airport's location outside of the Air Defense Identification Zone (ADIZ).

Warren County Airport can be accessed via several low level Victor Airways. Victor Route 144 connects the Kessel and Linden VOR's and passes approximately 4NM SW of the airport. Victor Route 143 runs SW to NE, outside of the airspace associated with the 3 major DC metropolitan airports and roughly parallel to Interstate 81, providing a course to West Virginia and then further to Lancaster, PA.

Exhibit 1-2
Washington Sectional Aeronautical Chart

1.4.2 Approach Capability

As of 2006, Warren County Airport provides visual approaches to both runway ends. There are no published instrument approach procedures to the airport. Airport management is in the process of coordinating with the FAA and DOAV in order to establish a GPS circling approach to Runway 9-27.

1.5 WEATHER & WIND COVERAGE

Wind conditions affect all airplanes in varying degrees. Generally, the smaller the aircraft, the greater the effect of wind velocity and the corresponding crosswind component (the resulting vector that acts at a 90-degree angle to the path of flight). With this in mind, the FAA has established demonstrated crosswind components based on aircraft type. Ideally, the primary runway at an airport should provide at least 95-percent crosswind coverage in all weather conditions. If a single runway were to provide less

than 95-percent coverage, consideration should be given to the development of a secondary, crosswind runway or providing additional runway width to mitigate for the discrepancy. The meteorological data used for this analysis was obtained from the National Climatic Data Center of the National Oceanic and Atmospheric Administration and included ten years of wind observations (1/1/95-12/31/04) from a reporting station in the City of Winchester, Virginia.

1.5.1 Local Climate

The location of Warren County Airport facilitates a weather pattern that is characterized by four relatively distinct seasons. The mean daily maximum temperature of the hottest month (July) is reported to be 74.60 Fahrenheit while the mean daily minimum temperature of the coldest month (January) is reported to be 30.40 Fahrenheit. Precipitation occurs rather evenly throughout the year ranging from an average 2-4 inches per month with the wettest month occurring in June (average of 4.1"). Snowfall in the area tends to occur from January through April and then again in late November through December. Average annual snowfall is reported to be 20.5" with the greatest volumes falling in January and February (7.9" and 6.7" respectively).

Winds are predominately from the west and northwest throughout the year, with a shift towards the northeast during IFR conditions (mostly during the winter months). This, and the resultant wind rose analysis described below, provides justification for any future instrument approach procedures being established to Runway 9.

1.5.2 Wind Rose Analysis

Wind coverage is calculated by the highest crosswind component that is acceptable for the type of aircraft expected to use the runway system. (Refer to Figure 4 for Wind Rose Information) Larger turbine aircraft have a higher tolerance for crosswind, due to their size, weight and operational speed. Smaller business and recreational aircraft have a

lower tolerance for crosswind for the same reasons. For calculation purposes FAA guidance (AC 150/5300-13) identifies that Airport Reference Code(ARC) A-I and B-I aircraft have a 10.5 knot demonstrated crosswind component, A-II and B-II aircraft have a 13.0 knot crosswind component, and C-I through D-III aircraft have a 16.0 knot demonstrated crosswind component. According to FAA design standards, the goal is to have at least 95-percent crosswind coverage provided by the runway system. (Refer to **Table 1.2** for a description of ARC classifications)

Table 1.2
Airport Reference Codes

Aircraft Approach Category. A grouping of aircraft based on 1.3 times their stall speed in landing configuration at their maximum certified landing weight. The categories are as follows:

Category A: Speed less than 91 knots.	Beech Bonanza (A-I)
Category B: Speed 91 knots or more but less than 121 knots.	Beech King Air (B-I)
Category C: Speed 121 knots or more but less than 141 knots.	Gulfstream III (C-II)
Category D: Speed 141 knots or more but less than 166 knots.	Boeing 777 (D-IV)
Category E: Speed 166 knots or more.	Lockheed SR-71 (E-II)

Airplane Design Group (ADG). A grouping of airplanes based on wingspan. The groups are as follows:

Group I: Up to but not including 49 feet.	Beech Baron (B-I)
Group II: 49 feet (15 m) up to but not including 79 feet.	Cessna Citation (B-II)
Group III: 79 feet (24 m) up to but not including 118 feet.	Boeing 737-500 (C-III)
Group IV: 118 feet (36 m) up to but not including 171 feet.	Boeing 757 (C-IV)
Group V: 171 feet (52 m) up to but not including 214 feet.	Boeing 747-400 (D-V)
Group VI: 214 feet (65 m) up to but not including 262 feet.	Lockheed C-5B (D-VI)

Definitions:
1. "Small" aircraft is defined as having a MTOW of less than 12,500lbs.
2. "Large" aircraft is defined as having a MTOW greater than 12,500 pounds.
3. MTOW = Maximum Takeoff Weight

Source: *FAA AC150/5300-13 "Airport Design" (Change 8)*

The wind observation data was analyzed using the Federal Aviation Administration Airport Design Software v.4.2d to determine the crosswind coverage provided by Runway 9-27 at Warren County Airport. In other words, this evaluation indicates the amount of time that the runway is typically available for use under the various ceiling/visibility conditions for the various aircraft groups. This analysis also looked at individual runway end coverages (i.e. unidirectional runway operations) as an indicator of the preferred approach direction. Runway 9-27 exceeds the desired 95% minimum

coverage. The runway appears very well oriented as it provides crosswind coverage in excess of 95% for all categories of aircraft under all weather conditions. When evaluating the wind coverage for each specific direction of operation, Runway 27 is favorable during VFR weather, however during IFR weather conditions it appears Runway 9 is the more favorable.

1.6 AIRPORT SERVICE AREA AND NEARBY AIRPORTS

1.6.1 Service Area

FAA macro-level guidance suggests that the airport service area (ASA) for a general aviation airport is generally defined by a 30-minute drive time around the facility which roughly equates to a 20 statute mile radius. However, this limit fails to appropriately consider major metropolitan areas, such as the Washington DC region. In such areas population density, property values, and taxes along with restricted airspace are driving cost effective aviation away from the core of the region towards the fringes. For FRR, a drive time of 60-90 minutes is more logical and reasonable when considering the ASA boundaries. Furthermore, according to a study conducted by the Airport Commission, 10 of the 32 based aircraft tenants at FRR live beyond the suggested 20 statute mile limit. It is well accepted that the Northern Shenandoah Valley is becoming part of the Washington D.C. metropolitan area.

While a more detailed, airport specific, analysis can be performed to better define the ASA areas for neighboring airfields (and market competition) when necessary for business and market planning uses, it is reasonable to conclude that at least some portions of the service area for Warren County Airport overlaps with the service areas for other airports in the region (i.e., Winchester Regional, Luray Caverns Airport, Eastern WV Regional, etc), which is consistent with the VATSP 2003 Update.

From a practical marketing perspective one can assume that within the northern Virginia general aviation market, aircraft owners will tend to drive further distances to find affordable aircraft storage facilities and to avoid the airspace constraints associated with the Air Defense Identification Zone (ADIZ). This is supported by the abundance of hangar tenant waiting lists being experienced at most general aviation airports within Virginia. For this reason, and the Airport Commission's previously stated mission, the predominant service area, or market area, for Warren County Airport includes the town of Front Royal, Warren County and portions of the adjacent counties including Arlington, Clarke, Fairfax, Frederick, Fauquier, Greene, Loudon, Orange, Shenandoah, Culpeper, Prince William, Madison, Rockingham, Stafford, Page, and Rappahannock. Hardy, Hampshire, Berkely, and Jefferson Counties in West Virginia are also included in the service area.

The U.S. Census Bureau and FAA data, based on 2005 data, provides the following information for Virginia and the ASA:

Table 1.3
Airport Service Area Demographics

	Estimated Population	Registered Aircraft	Total Airmen
Total Virginia	7,459,827	5,159	15,017
ASA	2,624,266	2,181	7,179
Percentage	35.2%	53.9%	47.8%

Source: *U.S. Census Bureau, FAA Airmen Database*

The high percentage of aircraft and airmen located within the ASA is reflective of the success and economic diversity of the Washington D.C. region. As the number of aircraft and airmen increase, as forecasted by VATSP, this ASA will likely see an increase in numbers as well.

1.6.2 Area Airports

There are a variety of general aviation and commercial service facilities within a ±60 mile radius of Warren County Airport that will have some influence on the operations and user demand in the area. Air carrier airports within ±50 nm of FRR that have general aviation facilities include Dulles International (IAD) in Dulles, VA; Ronald Reagan National Airport (DCA) in Arlington, VA. Charlottesville-Albermarle Airport (CHO) in Charlottesville, VA; Shenandoah Valley Regional Airport (SHD) in Augusta, VA; Eastern WV Regional Airport/Shepherd Field (KMRB) in Martinsburg, WV. General Aviation airports in the vicinity include Winchester Regional Airport (OKV) in Winchester, VA ; Luray Caverns Airport (W45) in Luray, VA; New Market Airport (8W2) in New Market, VA; Leesburg Executive Airport (JYO) in Leesburg, VA; Manassas Regional Airport (HEF) in Manassas, VA; Frederick Municipal Airport (FDK) in Frederick, MD; Gordonsville Municipal Airport (GVE) in Gordonsville, VA; Stafford Regional Airport (RMN) in Stafford, VA; Shannon (EZF) in Fredricksburg, VA; Orange County Airport (OMH) in Orange, VA; Bridgewater Air Park (VBW) in Rockingham, VA; Warrenton-Fauquier Airport (W66) in Warrenton, VA; and Culpeper Regional Airport (CJR) in Culpeper, VA. A brief inventory and comparison of these airports is presented in Table-3. There are also 14 private airfields within this area.

For many businesses and corporate aircraft operators, the decision on where to locate a business or base an aircraft will be dependant upon the approach capability and available runway length of the nearest airport. Additionally, many other considerations such as labor market, tax benefits, local incentives, available infrastructure, etc. also factor into the decision process. However, the increased reliance on door-to-door general aviation access to smaller communities within the marketplace should be considered a valuable resource in the economic development programs of Warren County. Since the municipalities must effectively compete for new, expanding and relocating business tenants, **Table 1.4** and **Exhibit 1-3** should provide a basic understanding of the area's competition. As of 2006 the general aviation airport, within the vicinity of Front Royal

that provides instrument approach capability with the lowest minimums is Stafford Regional Airport. If these airports, in Virginia, West Virginia, and Maryland are considered to be within the airport's service or market area, Warren County Airport maintains ±2.7% of the based aircraft market. When comparing just the Virginia airports, Warren County maintains approximately ±3.5% of the based general aviation market share.

Table 1.4
Area Airports within +/- 60 miles of FRR

AIRPORT	NPIAS	VATSP	DRIVING DISTANCE FROM FRR (miles)	RUNWAYS (Note 2)	INSTR. MINS3 Ceiling MSL / VIS (HAA,HAT - AGL)	NAVAIDS/ LIGHTING (Note 2)	FUEL (Note 2)	2006 BAC (Note 4)	ESTIMATED G.A. OPERATIONS (Note 5)
Warren County (FRR)	GA	GC	0	3007 x 75	visual	MIRL	100LL	32	10,550
Winchester Regional (OKV)	GA	GR	22	5500 x 100	974' / ½ mi (259' HAT)	MALSR, MIRL, REIL	100LL Jet A	103	33,500
Luray Caverns (W45)	GA	GC	26	3125 x 75	2260' / 1 ½ mi (1358' HAT)	MIRL	100LL	17	11,000
Warrenton-Fauquier (W66)	RL	RL	48	5000 x 100	780' / 1 mi (452' HAT)	HIRL, REIL, PAPI	100LL Jet A	124	40,000
Leesburg Executive (JYO)	RL	RL	58	5500 x 100	640' / 1 mi (258' HAT)	MIRL, REIL, ODALS,	100LL Jet A	225	93,350
Culpeper Regional (CJR)	GA	GR	53	5000 x 100	820' / 1 mi (507' HAT)	MIRL, REIL, PAPI	100LL Jet A	120	44,000
Manassas Regional (HEF)	RL	RL	48	5700 x 100 3702 x 100	442' / 3/4 mi (250' HAT)	HIRL/MIRL, PAPI, REIL, MALSR	100LL Jet A	371	147,000
Eastern WV Regional (MRB)	RL	N/A	53	7000 x 150	747' / ½ mi (200' HAT)	HIRL, MALSR	100LL Jet A	75	27,500
New Market (8W2)	N/A	LO	44	2920 x 60	visual	LIRL	100LL	35	13,600
Gordonsville Municipal (GVE)	N/A	LO	77	2300 x 40	visual	MIRL	100LL	10	4,000
Stafford Regional (RMN)	RL	RL	79	5000 x 100	396' / 3/4 mi (200' HAT)	HIRL, REIL, MALS	100LL Jet A	10	7,167
Orange County (OMH)	GA	GC	66	3200 x 75	1120' / 1 mi (674' HAT)	MIRL, REIL, PAPI	100LL	22	19,600
Charlottesville-Albermarle (CHO)	PR	CM	69	6001 x 150	856' / ½ mi (217' HAT)	HIRL, REIL, MALSR	100LL Jet A	85	42,681
Shenandoah Valley Regional (SHD)6	CM	CS	71	6002 x 150	1384' / ½ mi (200' HAT)	HIRL, REIL, MALSR	100LL Jet A	81	32,197
Bridgewater Air Park (VBW)	N/A	LO	70	2745 x 60	2300' / 1 1/4 mi (1135' HAT)	MIRL	100LL Jet A	29	11,000

Frederick Municipal (FDK)	RL	N/A	66	5220 x 100 3600 x 75	684' / 1 ½ mi (388' HAT)	HIRL, REIL, ODALS, PAPI	100LL Jet A	241	150,309

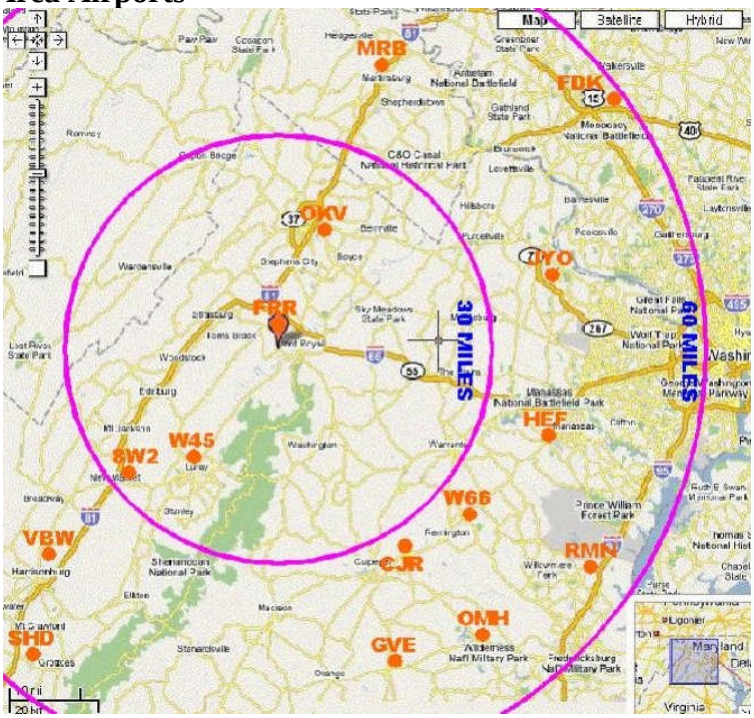
Airport Classifications:

NPIAS:
GA - General Aviation
PR - Primary Commercial Service
CM - Commercial Service
RL - Reliever
N/A - Not included in NPIAS

VATSP:
GC - General Aviation Community
GR - General Aviation Regional
N/A - Not included in VATSP
CS - Commercial Service
LO - Local Service

Sources:
2 FAA-Airport Facilities Directory, Airnav.com, GCR Associates, 5010 Forms, DOAV Airport Directory
3 US Terminal Procedures (5/06)
4 FAA Form 5010 Airport Master Records 4/06(excluding experimental, other)
5 VATSP 2003 Update(MRB & FDK Ops. taken from FAA 5010 Form)
6 5 Year NPIAS projection to "Primary Commercial Service." FAA NPIAS 2005-2009

Exhibit 1-3
Area Airports



Source: *Google Maps 2006*

2.0 FORECAST OF AVIATION DEMAND

Consistent with the scope of work for this ALP Update, the recommended aviation forecasts for the Warren County Airport (FRR) over the 20-year planning horizon (2006-2026) were generally updated using the methodologies described in the VATSP 2003 Update. The recommended forecasts of general aviation activity will provide the basis for determining the facility requirements necessary to accommodate the forecasted demand. The various forecasts presented in this section should be considered a planning guideline and ultimate development of aviation facilities will be driven by experienced demand for those facilities. The 1998 as-built ALP drawing shows the existing critical aircraft is a Conquest I. The ultimate critical aircraft for B-II airports is typically a King Air or small Citation aircraft. The ultimate critical aircraft will be determined after a Runway Length Analysis has been completed during the Demand/Capacity and Facility Requirements stage.

To further support the validity or reasonableness of the recommended forecasts, several market indicators were evaluated including various demographic and socioeconomic trends and local/regional development initiatives. Sources of information include the 1990 and 2000 U.S. Census, the Virginia Employment Commission, and West Virginia University's Regional Research Institute. While these market indicators were not directly linked to the formulation of the forecasts (i.e., in a regression type analysis) they are offered to justify the likely and anticipated increase in both based aircraft and operations at FRR.

For this forecasting effort, the immediate service area for FRR (in regards to competition for based aircraft) is generally defined by a one hour drive time to the airport. This correlates to the ±60 miles circumference identified in Section One and the counties associated. (refer to Figure 3) Within this area, there are 15 public use, general aviation airports in addition to FRR as well as 14 other private landing fields. According to the 2005-2009 NPIAS, 98% of the U.S. public is within 20 miles of an NPIAS airport. New

Market, Gordonsville and Bridgewater are not figured into this equation as they are not, at this time, NPIAS eligible airports.

2.1 DEMOGRAPHIC AND SOCIOECONOMIC TRENDS

It is apparent in the following tables, that the demographics of the market area are likely to support a high concentration of pilots and aircraft owners. The historic rate of population growth within the market area has surpassed the national and state averages, with a significant acceleration in the growth rate from 2000 to 2004 (i.e., 3.4% average annual growth rate as compared to Virginia's 1.2%). Population projections prepared by the U.S. Census Bureau, the Virginia Employment Commission and West Virginia University anticipate that these growth rates will slow through 2030, and while West Virginia's overall population is projected to decline, the population within the market is projected to increase at a rate greater than that of the nation and Virginia from 2010 onward.

While the total population has historically increased for each of the four demographic areas evaluated, the general "flying/working age" population (i.e., 15-64) has actually decreased on the national and state levels. Only in the market area has the flying age population increased. Out of the four demographic areas, the market area for FRR has historically had the lowest unemployment rate. The market area has also historically had the highest growth rate of total households, the highest median household income and the highest concentration of upper-income households (i.e., > $40,000 per year).

Table 2.1
Population Trends and Projections: 1990-2030

Year	United States	Virginia	West Virginia	Market Area
1990	248,709,873 [1]	6,187,358 [1]	1,793,477 [1]	628,217 [2]
2000[1]	281,421,906 [1]	7,078,515 [1]	1,808,344 [1]	770,106 [2]
"90-"00 Avg. Annual Growth (persons)	*3,271,203*	*89,116*	*1,487*	*14,189*
Avg. Annual Growth (%)	*1.2%*	*1.4%*	*0.1%*	*2.1%*

2004 (estimated)	293,655,404 [1]	7,459,827 [1]	1,815,354 [1]	878,934 [2]
'00-'04 Avg. Annual Growth (persons)	*3,058,375*	*95,328*	*1,753*	*27,207*
Avg. Annual Growth (%)	*1.1%*	*1.3%*	*0.1%*	*3.4%*
2010 (projected)	308,935,581 [1]	8,010,245 [1]	1,829,141 [1]	922,381 [2]
'04-'10 Avg. Annual Growth (persons)	*254,669*	*91,736*	*2,298*	*7,241*
Avg. Annual Growth (%)	*0.8 %*	*1.2 %*	*0.1 %*	*0.8 %*
2020 (projected)	335,804,546 [1]	8,917,395 [1]	1,801,112 [1]	1,048,470 [2]
'10-'20 Avg. Annual Growth (persons)	*268,690*	*90,715*	*(2,803)*	*12,609*
Avg. Annual Growth (%)	*0.8 %*	*1.1%*	*-0.2 %*	*1.3 %*
2030 (projected)	363,584,435 [1]	9,825,019 [1]	1,719,959 [1]	1,171,092 [2]
'20-'30 Avg. Annual Growth (persons)	*277,799*	*90,762*	*(8,115)*	*12,262*
Avg. Annual Growth (%)	*0.8 %*	*1.0 %*	*-0.5 %*	*1.1 %*

Sources: *[1] US Census Bureau, [2] Virginia Employment Commission (www.vec.virginia.gov) and West Virginia University Regional Research Institute (http://www.rri.wvu.edu/wvpop4.htm)*

Table 2.2
Age Demographic Trends: 1990-2000 (% of total population)

Year	United States [1]	Virginia [1]	West Virginia [1]	Market Area [2]
Age	15-64	15-64	15-64	15-64
1990	69.0%	72.5%	67.8%	67.9%
2000	66.2%	68.3%	66.5%	69.9%
Change	*-2.8%*	*-4.2%*	*-1.3%*	*2.0%*

Sources: *[1] US Census Bureau, [2] Virginia Employment Commission (www.vec.virginia.gov) and West Virginia University Regional Research Institute (http://www.rri.wvu.edu/wvpop4.htm)*

Table 2.3
Unemployment Rate Trends: 1990-2006 (%)

Year	United States	Virginia	West Virginia [1]	Market Area [2]
1990	5.6	4.4	8.6	4.0
1995	5.6	4.5	7.9	3.8
2000	4.0	2.3	5.5	1.8
2001	4.7	3.2	4.8	2.5

2002	5.8	4.2	6.1	3.4
2003	6.0	4.1	6.1	3.5
2004	5.5	3.7	5.3	2.9
2005	5.1	3.5	5.0	2.7
2006 (April)	4.5	3.1	4.1	2.5
Change ('90-'00)	-1.6	-2.1	-3.1	-2.2
Average ('90-'00)	5.1	3.7	7.3	3.2
Change ('01-'06)	-0.2	-0.1	-0.7	0.0
Average ('01-'06)	5.3	3.6	5.2	2.9

Sources: *Virginia Employment Commission, Virginia's Electronic Labor Market Access (VELMA) unless otherwise noted [1] Workforce West Virginia (www.wvbep.org), [2] WV county data not available for 1990 and 1995. Figures represent VA counties only.*

Table 2.4
Income Trends: 1989-1999

Year	United States	Virginia	West Virginia	Market Area
Median Household Income				
1989	$30,056	$33,328	$20,795	$35,057
1999	$41,994	$46,677	$29,696	$47,828
Avg. Annual Growth ($)	$1,194	$1,335	$890	$1,277
Avg. Annual Growth (%)	3.4%	3.4%	3.6%	3.2%
Total Households				
1989	91,947,410	2,291,830	688,557	220,189
1999	105,539,122	2,700,335	737,360	281,378
Avg. Annual Growth (#)	1,359,171	40,851	4,880	6,119
Avg. Annual Growth (%)	1.4%	1.7%	0.7%	2.5%
Upper Income Households (% of Total) - $40,000 per Year and Greater				
1989	35.6%	40.8%	21.2%	43.9%
1999	52.6%	57.5%	36.4%	61.2%
10 Yr Change	17.0%	16.7%	15.2%	17.3%

Avg. Annual Growth (%)	5.4%	5.2%	6.3%	6.0%

Source: *U.S. Census Bureau*

2.2 LOCAL ECONOMIC DEVELOPMENT

There are six existing industrial/business park areas in or near the town of Front Royal. These areas are mostly centered upon Interstate 66, U.S. Rt. 522, U.S. Rt. 340, Norfolk & Southern Rail Road and Rt. 55. They include the Stephens Industrial Park, Kelly Industrial Park, Warren Industrial Park, Happy Creek Technology Park, HIPP Business Park and the AVTEX Redevelopment Project. Additionally, these areas are enhanced and served by the Virginia Inland Port which maintains full U.S. Customs Service. In all, they represent more than 400 acres of developed business sites.

There are currently two major retail shopping centers being developed for opening during 2007. Anchor stores for these centers include Lowes, Target and Wal-Mart. Other smaller retail centers are also in the planning stages. Additionally, a new 18-hole championship golf course with an adjacent housing and major hotel complex is under construction and scheduled for a 2007 opening. Several large residential housing developments are in the advanced planning stage or under construction.

The current investment in industrial and housing development in Warren County has averaged $95,763,855 over the past three years. This investment is expected to increase over the next few years as the County experiences larger investment in commercial and residential development.

- 1996 Toray Plastics America, automotive components manufacturing, $61 million invested, 120 jobs created
- 1997 Family Dollar Services, retail distribution, $50 million invested, 525 jobs created

- 1998 Ferguson Enterprises, plumbing supplies distribution, $26 million invested, 190 jobs created
- 2002 SYSCO Corporation, food service distribution, $53 million invested, 388 jobs created
- 2005 Interbake Foods LLC, cookie and cracker manufacturing, $40.2 million invested, 381 jobs created

One of the largest economic development initiatives currently underway, is redevelopment of the 500-acre Avtex Fibers Superfund site in Front Royal. In the past, this site manufactured rayon, polyester, and polypropylene fibers for commercial, defense and space industries. Now Warren County, the Economic Development Authority (EDA), and the Town of Front Royal, are pursuing the redevelopment of the site into a mixed-use commercial, light industrial eco-park, office, hotel, and open space project. This project is anticipated to create more than 2,500 long term employment positions and several hundred-construction jobs. Moreover, development of the site is projected to bring $100 million in investment dollars to the community.

Due to the economic activity in northern Virginia, particularly from information technology and telecom companies, Warren County is beginning to receive additional business inquiries from technology companies and service providers seeking mixed-use office space. The existing developed industrial parks north of Front Royal are designed for more traditional industrial companies and therefore do not provide facilities that are ideally suited for these technology-based companies. The Avtex site, when developed, will offer the ideal location and resources needed to fulfill this increasing demand.

The contribution that the Warren County Airport makes to the local and regional economy should also be noted. In 2004, the DOAV published a study entitled "Virginia Airport System Economic Impact Study." This study concluded that the public use airports in Virginia (excluding Dulles and National International Airports) contributed a

total economic impact of $4.67 billion to the Commonwealth's economy. Additionally, the study identified that:

- Virginia public use airports supported 62,305 jobs and expended approx. $1.7 billion in wages. (Table ES-1)
- Virginia public use airport employees and tenants earned an average annual salary of $33,600 per year. (Section 3.2)
- Visitor "on-airport" industry employees earned an average annual salary of $15,500 per year. (Section 3.3)
- Virginia public use airports generated $3,124 of economic impact per 2001 enplanement. (Table 3.10)
- Virginia public use airports generated $2,765 of economic impact per 2001 operation at Air Carrier airports. (Table 3.11)
- Virginia public use airports generated $300 of economic impact per 2001 operation at General Aviation airports. (Table 3.11)
- Virginia public use airports generated $119,000 of economic impact per based aircraft at General Aviation airports (based on 2000 based aircraft data). (Table 3.13)

These figures should help emphasize the importance of investing in, and improving, the facilities at general aviation airports within the system. This study calculated that the total direct economic impact of FRR was over $2.88 million dollars annually including 43 jobs and $1.2 million in wages. The induced, or spin-off, economic impacts were calculated at $2.45 million dollars annually including 34 jobs and $824 million in wages. In all this represents over $5 million in economic activity and over 70 jobs. With the area's current and ongoing initiatives to promote business growth, the anticipated growth in business aviation, and the growing median household income, it is reasonable to assume that the level of economic impact provided by the airport will increase throughout the foreseeable future.

2.3 NATIONAL AVIATION TRENDS

According to the General Aviation Manufacturers Association (GAMA), since the late 1980s, the shipment of new business/general aviation aircraft into the national fleet has been approximately 1,000 aircraft a year. While business and general aviation (GA) aircraft shipments decreased as a result of the national recession in the early 1990s, the passage of the General Aviation Revitalization Act of 1994 and the national economic rebound later in the decade helped to boost the manufacturing of new aircraft, aircraft utilization, and pilot population. In the 12 years since the Revitalization Act, new technologies and new companies have entered the general aviation industry with piston aircraft manufacturing increasing by 310% over that period. GAMA indicates that from 2000 to 2004, the total number of general aviation aircraft registered in Virginia has increased from 3,354 to 4,455 which also represents an increase from 1.5% of the national fleet to 2.0% (GAMA General Aviation Statistical Databook 2005).

According to the 2006-2017 FAA forecasts, the outlook for general aviation appears promising with the industry's continued development and introduction of new, and more affordable, business type aircraft such as the Embraer Legacy, Raytheon Premier, Piper Malibu Meridian, Cessna Turbo Skylane, Hawker Horizon, Cirrus SR22, Cessna X, and the Eclipse 500. After the experienced slow-down in general aviation activity following the terrorist attacks in 2001, the start of the Iraq war and the subsequent increase in fuel costs, the FAA anticipates that the aggregate GA fleet will grow at an annual rate of 1.4%. This is a significant increase from the FAA's 2002 forecast which was 0.3%. Active turbine powered aircraft are anticipated to increase at an annual rate of 4.0% whereas the single engine and multi engine piston aircraft (excluding rotorcraft) are anticipated to grow at 0.3% and 0.1% respectively. This would indicate that business/corporate type aircraft operations are becoming more prevalent and therefore a significant factor to be accounted for in planning airport facilities.

The FAA, the Transportation Research Board, and other industry experts believe that the upcoming introduction of micro jets into the general aviation fleet has the potential to redefine the business jet segment and provide true on-demand air-taxi service from point to point. Such operations would rely on airports like FRR and those conveniently located near business centers. Micro jets could enter the fleet at a rate of 400 to 500 aircraft per year reaching over 4900 by 2017.

Making general aviation more obtainable and affordable to the general public, is the introduction of the new "light sport" aircraft. The FAA anticipates up to 10,000 registrations of this type of aircraft from 2005 to 2011. The number of general aviation operations is projected to increase at an annual rate of 3.2% with the majority of that increase by business and corporate type operators. Piston aircraft hours are projected to grow at an annual rate of 1.8%. Again, this is a greater rate than forecast in 2002. The total number of general aviation pilots is projected to increase at 1.1% annually, with student pilots increasing at a rate of 1.7%. The new light sport aircraft combined with the FAA's new "sport pilot" license is anticipated to reduce the number of private pilot certificates issued. The private pilot population is projected to decline at a rate of 0.2% annually.

Satellite communication and navigation (i.e., GPS) is fast becoming the system of the future for air traffic control. As these systems improve, traffic will no longer be tied to ground-based navigational systems that have remained essentially unchanged since the 1940s and will be able to use routes that are based on efficiency. As air traffic service begins to take advantage of the benefits satellite systems can provide, as well as a comprehensive redesign of the airspace by the FAA, efficiencies in terms of safety, time and money will be realized by the general aviation operators.

Taking all of this into consideration, two things become apparent; 1) the use of business/corporate type aircraft and point to point air-taxi connectivity is increasing, and

2) more affordable, easier to operate aircraft combined with new pilot ratings will make flying available to more people.

2.4 HISTORICAL & EXISTING AIRPORT ACTIVITY

Along with knowledge of the area's demographic trends and the national aviation trends, an integral part in determining any future airport needs is an understanding of historical aviation trends at the airport. Traditional measures of airport activity are based aircraft and levels of aircraft operations. Due to the nature of non-towered GA airports (such as FRR), and their based aircraft reporting requirements, the most historically accurate account of based aircraft for the Warren County Airport is considered to be the annual DOAV Based Aircraft Survey. This survey is submitted by the airport sponsor, being the most familiar with the tenant base, which is then made available to the Commonwealth's Department of Taxation. These figures may vary from other sources such as the FAA Terminal Area Forecasts, 5010 Airport Master Record, or other on-site surveys performed for various planning studies. By cross-referencing the many available data sources, the analyses and subsequent forecasts presented herein appear reasonable and should be considered a fair representation of the aviation trends in this geographic area.

Regardless of these forecasts, which will be used to identify a general timeline of anticipated development at the airport, actual development will occur with evidence of demand in such a manner that the needed facilities will be available for use "just in time". This way, the intended users will not be displaced or severely inconvenienced and the Commission and County will not miss economically important opportunities.

2.4.1 Based Aircraft

According to the DOAV Annual Based Aircraft Survey there were 32 powered aircraft permanently based at the airport as of January 2006. This includes 31 single engine and 1 multi engine piston aircraft. There were also 9 other aircraft termed as "other" that

include ultralights and gliders. When compared to the recorded based aircraft count of 21 in 1990, the net increase represents an annualized growth rate of 3.6% over the last 15 years (see Table-8).

The airports in the general vicinity of Warren County Airport have all increased their number of based aircraft from 1990 to 2005 with the exception of Luray Caverns Airport whose growth rate decreased by 2.1% over the 15 year time frame. The average annual growth among these airports ranges from approximately 2% to 6% with the exception of Culpeper Regional Airport which had an increased growth rate of 16.5%. This analysis also indicates that Warren County Airport has maintained a market share of 2.7% to 3.5% of the total based aircraft population within this group of surrounding airports.

Table 2.5
Historical Based Aircraft at Warren County and Area Airports

AIRPORT	NPIAS	VATSP	1990	1995	2000	2005	Avg. Annual Growth ('95-'05)	Avg. AC/Yr. ('95-'05)
Warren County (FRR)	GA	GC	21	17	24	32	6.5%	1.5
Winchester Regional (OKV)	GA	GR	62	69	79	115	5.2%	4.6
Luray Caverns (W45)	GA	GC	18	14	9	14	0.0%	0.0
Warrenton-Fauquier (W66)	RL	RL	90	92	98	126	3.2%	3.4
Leesburg Executive (JYO)	RL	RL	182	183	211	231	2.4%	4.8
Culpeper Regional (CJR)	GA	GR	20	90	111	125	3.3%	3.5
Manassas Regional (HEF)	RL	RL	281	246	315	401	5.0%	15.5
New Market (8W2)	N/A	LO	14	38	33	27	-3.4%	-1.1
Gordonsville Municipal (GVE)	N/A	LO	6	11	15	11	0.0%	0.0

Stafford Regional (RMN)	RL	RL	NA	NA	NA	21	NA	2.1
Orange County (OMH)	GA	GC	26	21	22	45	7.9%	2.4
Charlottesville-Albemarle (CHO)	PR	CM	60	55	93	89	4.9%	3.4
Shenandoah Valley Regional (SHD)	CM	CS	46	80	87	89	1.1%	0.9
Bridgewater Air Park (VBW)	N/A	LO	14	23	17	21	-0.9%	-0.2
Eastern WV Regional (WRB)	RL	N/A	NA	NA	NA	NA	NA	0.0
Frederick Municipal (FDK)	RL	N/A	NA	NA	NA	246	NA	24.6

Airport Classifications:

NPIAS:	VATSP:
GA - General Aviation	GC - General Aviation Community
PR - Primary Commercial Service	GR - General Aviation Regional
CM - Commercial Service	N/A - Not included in VATSP
RL - Reliever	CS - Commercial Service
N/A - Not included in NPIAS	LO - Local Service

Sources: *FAA Form 5010 Airport Master Records 4/06(excluding experimental, other), VATSP 2003 Update(MRB & FDK Ops. taken from FAA 5010 Form)*

Table 2.6
Historical Market Share of Based Aircraft 1990 - 2005

Peer Group	**% Based at Warren County Airport**			
	1990	**1995**	**2000**	**2005**
Area Airports (Info. available for 9 total)	2.8%	1.9%	2.4%	2.6%
Comparison to OKV, 8W2, W45 (all w/in 25NM)	18.3%	12.4%	16.5%	17.1%

Sources: *Table 2.5*

The based aircraft population at Warren County Airport has historically been comprised of single engine, piston-driven, general aviation aircraft. Warren County Airport is also the only airport within this area, along with Frederick Municipal, that reported gliders.

When comparing the mix of aircraft at the peer group airports (Table 2.7), the tenant base and users of Warren County Airport are similar to those of Orange County Airport and New Market Airport.

Table 2.7
Based Aircraft by Type at Warren County and Area Airports - 2006

AIRPORT	NPIAS	VATSP	Single Engine Piston	Multi Engine Piston	Turbo - Prop	Jet	UL	Glider	Other	Helo.	Total Aircraft
Warren County (FRR)	GA	GC	31	1			2	9			43
Winchester Regional (OKV)	GA	GR	92	15	2	3	1			2	115
Luray Caverns (W45)	GA	GC	11	3							14
Warrenton-Fauquier (W66)	RL	RL	98	20			6			1	125
Leesburg Executive (JYO)	RL	RL	198	17	8	4				4	231
Culpeper Regional (CJR)	GA	GR	118	4			1			2	125
Manassas Regional (HEF)	RL	RL	288	38	34	26				15	401
Eastern WV Regional (MRB)	RL	N/A	60	14		1					75
New Market (8W2)	N/A	LO	23	2			1		1		27
Gordonsville Municipal (GVE)	N/A	LO	11	1							12
Stafford Regional (RMN)	RL	RL	13	4		1	1			2	21
Orange County (OMH)	GA	GC	41		1		1		2		45
Charlottesville-Albemarle (CHO)	PR	CM	57	8	6	10			5	3	89
Shenandoah Valley Regional (SHD)	CM	CS	57	18	2	3	1		3	5	89
Bridgewater Air Park (VBW)	N/A	LO	2	2	17						21
Frederic Municipal (FDK)	RL	N/A	198	27		16	6	42		10	299

Sources: DOAV 2006 Based Aircraft Survey (6/1/2006), FAA 5010 Form Airport Master Record (12/22/05) - For Frederick Municipal and Eastern WV Regional Airports

2.4.2 Aircraft Operations

An aircraft operation is defined as either an aircraft takeoff or landing. A "touch and go" is reported as two operations. As Warren County Airport does not have an Air Traffic Control Tower, determining the actual volume of aircraft activity at the airport is rather difficult as no scientific mechanism exists to continuously count aircraft operations. In this situation, planning documents typically have to extrapolate one or two weeks traffic count which may have been observed at various times during the census year and may not account for cyclical variations in activity levels. As a result, historical aircraft operations reported for an airport can show a rather large variation in operation levels. The historical operations count at Warren County Airport is presented in Table 2.8.

Table 2.8
Historical Annual Operations at Warren County Airport

YEAR	REPORTED ANNUAL OPERATIONS	REPORTED BASED AIRCRAFT (w/o "other")	AVG. OPBA
1990	12,006 2	28 2	429
2000	9,519 1	24	396
2005	11,669 3	32	365

Sources: *1 VATSP Update 2003, 2 1990 Airport Master Plan Update (by Campbell & Paris), 3 Campbell & Paris using VATSP methodology*

2.5 RECCOMENDED FORECAST OF BASED AIRCRAFT

The VATSP methodology is generally considered a "top-down" approach that distributes the overall anticipated growth of Virginia's based aircraft population to the various public use airports based on each airport's historic populations. Forecasting of based aircraft at specific general aviation airports is highly subjective as most airports exhibit some type of constraint in their ability to accommodate all the prospective tenants who would like to base their aircraft there. Many airports have been hindered by the lack of expansion space, the high cost of developing new hangars or sometimes the bureaucratic processes associated with defining and achieving their development needs. This is exacerbated by

the rich competition for hangar space within FRR's market area and it's abundance of general aviation airports. These airports all have waiting lists for hangar availability, and they will likely experience shifts in tenant populations to those airports that can develop acceptable hangar facilities at the best rental rate.

As acknowledged in the VATSP, Virginia has traditionally experienced a based aircraft count (BAC) growth rate higher than that of the nation. With the historic and projected demographics of the market area, it is reasonable to assume that this trend will continue and that FRR, due to its location relative to Northern Virginia, will receive a substantial share of that growing demand. That is, of course, dependent on the airport sponsor's ability to manage, protect, promote and develop the airport in a successful manner consistent with the other local development initiatives.

In this market area, an individual airport has the ability to greatly influence their BAC, tenant base and local aviation demands. The marketing, financing, development and management strategies employed by a particular sponsor, if effective, can result in affordable, user-friendly facilities that have the ability to attract users/tenants from other airports. While the government agencies (i.e. FAA, DOAV) cannot necessarily acknowledge this within the context of their demand-based forecasts, certain sponsors rely on this type of market driven demand in order to enhance their financial self-sufficiency and garner the maximum ancillary benefits from their users.

2.5.1 Based Aircraft

For the reasons mentioned above, most forecasting efforts attempt to identify relevant historic trends and then project those trends into the planning horizon. With that in mind, three different forecast scenarios of based aircraft were prepared for this ALP Update using various trend based methodologies. The various growth trends were applied to the January 2006 BAC of 32 (not including "other") and projected through the 20 year

planning horizon (2006-2026). The scenarios are described below and summarized in Table 2.10.

A. VATSP forecasted growth rate of 0.9 aircraft per year (from 2000 to 2020).

The 2003 VATSP identified a based aircraft growth rate for FRR of 0.9 aircraft per year from 2000-2020. This was the result of averaging the historic 5 year (1995-2000) and 10 year (1990-2000) growth rates. The result was an increase of 17 aircraft (i.e. 24 to 41) from 2000 to 2020 which represents a 2.3% average annual growth rate. This would have calculated to a 2006 BAC of 28. As of January 2006, FRR had 32 based aircraft (excluding ultralights and gliders) far surpassing the VATSP forecast for this time period. Application of this rate to the 2006 BAC of 32 projects out to a total of 50 based aircraft by 2026.

B. Updated growth rate of 1.55 aircraft per year as generated by 2003 VATSP methodology.

By applying the same VATSP methodology for the determination of a forecast growth rate, to the 2006 based aircraft count, the projected growth rate would be 1.55 aircraft per year resulting in 63 based aircraft by 2026.

Table 2.9
VATSP Methodology of Calculating Based Aircraft Growth applied to 2006 BAC

Historic Based Aircraft Counts (w/o "other"):	**1995 = 17, 2000 = 24, 2006 = 32**
5 year average:	(32-24) / 5 = 1.6
10 year average:	(32-17) / 10 = 1.5
Resultant Average Projected Growth Rate:	(1.5+1.6) / 2 = 1.55 aircraft per year

Sources: *VATSP and Campbell & Paris PC*

C. 2006 FAA forecasted growth rate for general aviation piston aircraft of 1.0% annually.

The FAA's 2006-2017 forecasts anticipate that the national general aviation fleet of piston aircraft will increase at a rate of 1.0% annually. According to the FAA and the General Aviation Manufacturing Association (GAMA) in the "2005 General Aviation Statistical Data Book", this rate is the same as the historic growth rate of the national general aviation fleet from 1998-2004. Application of this rate to FRR results in 39 based aircraft by 2026.

Table 2.10
Summary of Based Aircraft (w/o "other") Forecast Scenarios (2006-2026)

	METHODOLOGY		
	A	**B (recommended)**	**C**
	2003 VATSP for FRR	Updated VATSP for FRR	2006 FAA TAF Growth of G.A. Piston Aircraft
2006	32	32	32
2011	37	40	34
2016	41	48	35
2026	50	63	39
Avg. Annual Growth	2.3%	3.4%	1.0%
Avg. Aircraft/Year	0.9	1.6	0.4

Sources: *Campbell & Paris, PC*

Methodology "B" should be considered the forecast scenario that is recommended as the basis for this forecasting effort. This projected growth rate of 1.6 based aircraft per year is the most consistent with the historic growth at FRR as described above and is very similar to the historic aggregate growth of general aviation aircraft in Virginia. To validate the selection of scenario "B" as the recommended forecast, we looked at the ten year (1995-2005) historic growth in based aircraft at the airports within FRR's market area (refer to Table 10). While FRR had one of the highest percentage growth rates, their average aircraft per year increase was one of the lowest. This would indicate that for

whatever reasons, FRR was constrained in their ability to offer the appropriate aircraft storage facilities and the other nearby airports received the bulk of the based aircraft growth.

With this in mind, and considering the FAA's forecasted increase in general aviation aircraft and usage, continuation of the historic trend for FRR appears highly reasonable. Future planning and design efforts should not only consider the recommended forecasts, but the full range of forecasts presented above. This will enable the sponsor to better respond to changing market conditions and yet unforeseen facility demands or opportunities that may arise over the planning horizon. It will also aid in planning the most flexible facility configuration to depict on the ALP drawings.

2.5.2 Based Aircraft by Type (Aircraft Mix)

The VATSP utilized three sets of growth rates, per aircraft type, for three planning horizons (2000-2005, 2005-2015, and 2015-2020). This was an effort to capture the faster historic growth rates at Commonwealth airports when compared to the nation. Considering that FRR's based aircraft mix is predominately single and multi engine piston, the simple mathematical application of these VATSP growth rates to the 2006 mix would only generate a total of 37 aircraft by 2026 (plus another 4 in the "other" category). As stated previously, the Airport Commission's goal is to become the premier base airport for the personal/recreational aircraft owner. In achieving this goal and serving this market segment, their focus will be on providing the aircraft storage and services utilized by those aircraft. Based on the FAA and VATSP projections about the aggregate growth in certain aircraft, some assumptions (or manual adjustments) had to be made to calculate the future aircraft mix at FRR. This was done in order to avoid underestimating the potential demand by basing solely on the existing aircraft mix. These assumptions include the addition of helicopters and turbo-prop aircraft into the mix, as well as additional single and multi-engine aircraft. Consistent with the national trend of the aircraft fleet including more complex aircraft and an increase in

business/corporate aviation, the facility demands generated by the multi-engine and turbo-prop demands could also accommodate business aircraft tenants.

The application of these assumptions and the VATSP growth rates, were then normalized to match the projected twenty year BAC of 63 determined previously (excluding those termed as "others" such as ultralights and gliders). The resultant based aircraft fleet mix recommended for FRR is presented in Table 2.11.

Table 2.11
Forecast of Based Aircraft Fleet Mix for FRR (2006-2026)

YEAR	SE Piston	ME Piston	TurboProp	Jet	Helo *	Other	Total	Total w/o "other"
2006	31	1	0	0	0	11	43	32
2011	37	2	0	0	1	13	53	40
2016	43	3	0	0	2	14	62	48
2026	53	5	2	0	3	16	79	63
Avg. Annual Growth	2.7%	8.4%	--	0.0%	7.6%	1.9%	3.1%	3.4%
Avg. Aircraft/Year	1.1	0.2	0.1	0.0	0.2	0.3	1.8	1.6
* calculated from 2011-2026								

Sources: *Campbell & Paris PC*

2.6 RECCOMENDED FORECAST OF OPERATIONS

The 2003 VATSP Update utilized an operations per based aircraft (OPBA) methodology for forecasting total aircraft operations, by type. This is a similar methodology to that used in the 1990 VATSP but with updated activity ratios based in part on 1998 Civil Air Patrol traffic counts and recent tower counts for airports within Virginia. This is a commonly accepted method for forecasting operations at non-towered airports, and OPBA ratios utilized in the VATSP were determined to be consistent with FAA planning guidelines. These ratios were assumed to increase at a rate of 0.6% annually based upon national rates identified in the FAA Aerospace Forecasts (2000-2011). The projected OPBA ratios used in this ALP Update are presented in the following table.

Table 2.12
Operations per Based Aircraft (OPBA)

YEAR	SINGLE ENGINE	MULTI-ENGINE	TURBO-PROP/JET	HELO/OTHER
2006	381	376	0	0
2011	393	388	0	639
2016	405	399	0	658
2026	430	424	867	699
Avg. Annual Growth	0.6%	0.6%	0.0%	0.2%

Sources: *Campbell & Paris, derived from VATSP 2003 methodology*

2.6.1 Operations by Aircraft Type

As per the VATSP methodology, these OPBA rates were applied by aircraft type to the recommended based aircraft forecast for FRR. The resultant forecast operations were further refined to acknowledge the difference in transient aircraft mix experienced at the various airports, based on available runway length. According to the VATSP, transient aircraft are estimated to account for approximately 30% of an airport's total operations.

Airports with runways over 4000' are considered to be jet capable and therefore would be likely to experience a certain percentage of turbo-prop and jet operations (even if there are no based aircraft of that type at the airport). Previous planning and the 1998 ALP for FRR have identified a future runway extension to 4,006' from its existing 3,007'. This extension had been anticipated to occur sometime within the 2010 time frame, but as of 2006, it is unlikely that will occur. For general forecasting purposes, it will be assumed that a ±4,000' runway could be available at FRR sometime after 2026, and therefore two separate distributions of transient operations will apply as identified in the following table.

Table 2.13
Transient Aircraft Distribution by Aircraft Type (%)

RUNWAY LENGTH	SINGLE ENGINE	MULTI-ENGINE	TURBO-PROP	TURBO-JET	HELO	OTHER	TOTAL
< 4,000'	81	7	0	0	10	2	100%
> 4,000'	71	10	7	3	7	2	100%

Source: *VATSP 2003 Methodology, Campbell & Paris, PC*

To reflect this in the recommended forecasts, the initial operations forecasts were reduced by 30% for all types of aircraft, and that 30% was replaced with the appropriate distribution of transient operations (assuming a 4,000' runway being available after 2026). For FRR this resulted in a total forecast average annual growth rate of 3.8% (2006-2026). This is slightly higher than the growth rate identified in the VATSP for general aviation airports within the Commonwealth (2.1%) but should be considered reasonable, as it reflects the potential for a slight change in aircraft mix consistent with the national and regional trends. This methodology is consistent with the VATSP which forecasted a total of 11,700 operations and 28 based aircraft for FRR by 2005. The calculated "total" forecasts presented in Table-21 would also support the Commission's renewed mission of providing efficient and affordable aircraft storage facilities.

To test these forecasts for reasonableness, they were compared to the annual operations counts maintained by airport manager from 2002 to 2004. While their level of accuracy may be subjective and non-scientific in nature, these counts would indicate a range of 9,000 to 12,000 annual operations. If these were assumed to be reasonably accurate, for the current facilities and tenant base at FRR, they would indicate a slightly lower OPBA ratio than utilized in the VATSP. If FRR did experience ±12,000 operations in 2005, that would be approximately 65% of the 2006 forecast. This could partially be a result of there being no instrument approach available, thereby reducing some of the level of flight training, transient activity, and the current cost of fuel. For a typical public use, general aviation airport like FRR, the difference of 7,000 annual operations would, in all practicality, have no adverse affect on capacity or the airport's ability to accommodate or

manage that level of traffic. Theoretically, those 7,000 operations could equate to 6 aircraft doing 3 touch-and-goes each day.

The following table presents two levels of total operations; 1) the total calculated operations based on the VATSP OBPA ratios and 2) 65% of these operations to reflect the potential observed level of traffic. For purposes of this ALP Update and consistency with the VATSP planning efforts, the recommended total operations forecast by type (based + transient) will be assumed to be the total calculated operations. This acknowledges that levels currently being experienced may remain slightly lower until such time as an instrument approach procedure is established, the cost of fuel stabilizes and aircraft owners return to their flight regimens as anticipated by the FAA forecasts.

Table 2.14
Forecast of Total Annual Operations by Aircraft Type

FORECAST PERIOD	SINGLE ENGINE	MULTI-ENGINE	TURBO-PROP*	TURBO-JET*	HELO	OTHER	TOTAL w/o OTHER	TOTAL	65% of TOTAL
2006	12,899	663	0	0	0	4,887	14,133	18,449	11,992
2011	16,030	1,048	0	0	1,182	5,816	18,260	24,076	15,649
2016	18,352	1,707	608	260	1,568	6,438	22,495	28,933	18,806
2026	24,364	2,681	2,141	359	2,455	7,882	32,000	39,882	25,923
Avg. Annual Growth	3.2%	7.2%	13.4%	3.3%	2.3%	2.4%	4.4%	3.9%	3.9%
* Calculated from 2016-2026									

Source: *Campbell and Paris, P.C.*

2.6.2 Daily and Peak Hour Operations

Peak period operations typically occur during good, temperate weather and generally light winds, when the local traffic is most active. This would generally be considered visual meteorological conditions (VMC) or "VFR weather". The weather analysis described in Section 1.5 indicates that VFR conditions in the area of Warren County occur approximately 91.5% of the year, and are generally associated with the early

summer and fall months. Based on the fuel sales records provided by Cass Aviation (FBO) from 2002 to 2004, the peak months would appear to be May, June and July.

The capacity-based assumptions used in FAA Advisory Circular 150/5060-5 "Airport Capacity" suggest that the average daily demand for the peak month can typically be estimated by dividing the total annual activity by a factor of 290. This method results in an estimated average daily activity for the peak month of 65 operations for 2006 (based on the estimated annual activity of 19,020 operations). Using the estimated average daily rate of 65 operations, the average hourly operations (using a ten hour period) would be ±6. Using a 10% factor for average peak hour activities would then yield a rate of ±7 operations per hour. This rate is consistent with the procedures identified in the "Airport Capacity" circular, which suggests an average peak hour of the peak month can typically be calculated by dividing average daily operations (during the peak month) by a factor of 9, which also yields 6-7 operations per hour.

Peak daily and hourly activities at general aviation airports such as FRR will easily vary, due in part to the sporadic nature of flight training and "touch-and-go" activity. As the facilities and services offered at the airport improve, and as the local economic development initiatives materialize, peak periods may also fluctuate in relation to local events. Therefore these average daily and peak hour rates should be viewed as reasonable, yet conservative, factors for planning the long term facilities needed to accommodate peak period activities and for evaluating overall airfield capacities. The aircraft mix comprising the peak hour operations (i.e., aircraft types) will also vary, but on average should follow the relative percentages described previously and as contained in the VATSP.

Table 2.15
Peak Period Forecasts

FORECAST PERIOD	TOTAL OPERATIONS	AVG. DAILY OPERATIONS (PEAK MONTH)	AVG. PEAK HOUR (PEAK MONTH)
2006	18,449	64	7
2011	24,076	83	9
2016	28,933	100	11
2026	39,882	138	15

Source: *Campbell and Paris, P.C.*

2.6.3 Instrument Approach Forecasts

As of 2009, FRR has an RNAV (GPS) day circling approach procedure with minimums of 1,820' ceiling and 1¼ mile visibility. This approach procedure is considered a "visual approach" however, it does allow for pilots to file IFR flight plans to FRR.

It should be noted, however, that for non-towered airports, the number of recorded instrument approaches is typically far less than the true figure of non-precision instrument approaches that are initially filed and used for en-route navigational aids. One reason for this discrepancy is the amount of flight training which can typically occur at lower traffic airports like FRR. Training for pilots seeking an instrument rating does not usually occur during IFR weather conditions when the instrument approaches are truly necessary.

A 1990 study accomplished at Manassas Regional Airport (prior to the activation of the Control Tower) indicated that FAA recorded instrument approaches were estimated to account for only 10% of the total number of instrument approaches (as counted in both VFR and IFR weather conditions). Experience at Manassas Regional Airport is considered to be greater in terms of flight training due to the existing ILS and proximity to the DC Metro area, than the instrument activity that might be expected at Warren County Airport.

The 2006-2017 FAA workload forecasts indicate that general aviation instrument operations will have an average annual growth rate of 3.3% from 2007 through 2017 (which is 1.9% higher than that previously forecasted from 2003 to 2014). Due to the lack of data regarding the usage of the RNAV approach, no forecasts were instrument approach forecasts were developed for FRR. No additional instrument approach capabilities are anticipated due to the current airport geometry and surrounding terrain. Also, the FAA Flight Procedures office in Atlanta has indicated that additional instrument approaches at FRR are unlikely due to the previously discussed limitations.

2.6.4 Touch and Go Activity

The forecast model used for this ALP Update assumes that the average number of operations per based aircraft by type is generated in part by "touch-and-go" activities. Specifically, it is assumed that 45% of single-engine operations, 20% of multi-engine operations, 4% of the jet/turboprop operations, and 20% of helicopter operations are associated with "touch-and-go" activity. As the aircraft mix at FRR changes to include the more complex and rotor type aircraft, it is logical that the associated percentage of "touch-and-go" activity will decline as well. As presented in the following table, the forecast number of "touch-and-go" operations continues to increase over the twenty-year planning period while the relative percentage of "touch-and-goes" to the total operations decreases.

Table 2.16
Touch & Go Activity Forecast

FORECAST PERIOD	TOTAL ANNUAL OPERATIONS	TOUCH & GOs	PERCENTAGE
2006	19,020	7,029	37.0%
2011	24,076	8,823	36.6%
2016	28,933	10,236	35.4%
2026	39,881	13,667	34.3%

Source: *Campbell and Paris, P.C.*

2.6.5 Itinerant and Local Operations

The FAA has defined local operations to consist of "arrivals and departures of aircraft which operate in the local traffic pattern, or within site of the tower, and are known to be departing to or arriving from flights in local practice areas within a twenty-mile radius of the airport, plus simulated instrument approaches or low passes executed by any aircraft." Most of these operations are typically attributed to smaller single and twin engine aircraft based at the airport and flight training activities. Conversely, the definition of itinerant operations consists of "all aircraft departures and arrivals other than the local operations described above." Many, if not most, of the itinerant operations at FRR result from transient aircraft (i.e. based at other airports) operating into the Warren County area. Therefore for purposes of this study, the estimated percentage of local and itinerant activity associated with based and transient aircraft is presented in the following table.

Table 2.17
Estimated Distribution of Local -vs- Itinerant Operations

	SINGLE ENGINE	MULTI-ENGINE	TURBO-PROP	TURBO-JET	HELO	OTHER
BASED AIRCRAFT						
Local Operations	70%	50%	25%	5%	40%	90%
Itinerant Operations	30%	50%	75%	95%	60%	10%
TRANSIENT AIRCRAFT						
Local Operations	35%	30%	20%	5%	30%	20%
Itinerant Operations	65%	70%	80%	95%	70%	80%

Source: *Campbell and Paris, P.C.*

With an anticipated increase in the number of business type aircraft operations, itinerant operations are expected to increase in both number, and as a relative percentage of total operations over the planning period as presented in the following table.

Table 2.18
Forecast of Local -vs- Itinerant Operations

FORECAST PERIOD	TOTAL ANNUAL OPERATIONS	LOCAL OPERATIONS (based + transient)		ITINERANT OPERATIONS (based + transient)	
		#	%	#	%
2006	19,020	9,778	51.4%	9,242	48.6%
2011	24,076	12,309	51.1%	11,767	48.9%
2016	28,933	14,628	50.6%	14,305	49.4%
2026	39,881	19,721	49.5%	20,160	50.5%
Avg. Annual Growth	3.8%	3.6%		4.0%	

Source: *Campbell and Paris, P.C.*

2.6.6 Automobile Traffic Activity

The Institute of Transportation Engineers (ITE) Trip Generation Manual provides methods of estimating automobile traffic activity based on airport employees, based aircraft, or flights. Using those methodologies, the following calculations are for average weekday (Monday - Friday) Vehicle Trips per Day (VPD).

1. In 2006 the total number of persons employed at the airport was estimated between 4 and 8. Using the ITE fitted curve equation T = 16.2 x Employees + 555.0, results in an estimated count of 620 to 685 VPD.
2. Based aircraft in 2006 totaled 32, and when substituted in the ITE fitted curve equation Ln(T) = 1.37 x Ln(Based Aircraft) - 0.35, yields a calculated rate of 81 VPD.
3. Based on 2006 estimated annual operations of 19,020, the average operations per day (using 365 days per year) would be approximately 52. The ITE fitted curve equation T = 2.28 x Average Flights Per Day + 516.0 results in an estimated 635 VPD.

Based on observations from airport staff, the most realistic accounting of automobile traffic would be in the range of the fitted curve equation (i.e. 81 VPD +). Weekend

vehicular traffic at airports like FRR would tend to be greater than during the weekdays due to the high level of recreational users and the types of aircraft currently based at the airport. Events such as aviation seminars and glider festivals will also create additional automobile (and glider trailer) automobile access and parking demands. Airport related automobile trips will increase in the future as a result of more based aircraft, more employees, more transient activities, and more general business activities in the Front Royal, Warren County area. The projected growth of total airport operations (3.8%) provides a reasonable planning growth rate for related automobile traffic, recognizing that the number of employees and general business activities at the airport will be a function of the fundamental airport activities. Accordingly, the recommended airport related automobile traffic forecasts were developed using an estimated 3.3% growth, expecting that automobile traffic will grow slightly slower than the other related activities. Peak hour vehicles were estimated by assuming that the peak hour is 15% of the average daily traffic. The resultant automobile traffic forecast is presented in the following table.

Table 2.19
Forecast of Automobile Activity

FORECAST PERIOD	AVG. DAILY VEHICLE TRAFFIC (VPD)	PEAK HOUR VEHICLE TRAFFIC (VPD)
2006	81	12
2011	95	14
2016	112	17
2026	155	23
Avg. Annual Growth	3.3%	3.3%

Source: *Campbell and Paris, P.C.*

2.6.7 Summary of Forecasts

A summary of the recommended activity forecasts for the various operational components at the Warren County Airport, over the twenty year planning horizon (2006-2026) is presented in the following table.

Table 2.20
Aviation Forecast Summary

Aircraft Type	2006	2011	2016	2026
BASED AIRCRAFT				
Single-Engine Piston	31	37	43	53
Multi-Engine Piston	1	2	3	5
Turboprop	0	0	0	2
Jets	0	0	0	0
Helicopters	0	1	2	3
Other	11	13	14	16
TOTAL BASED AIRCRAFT	**43**	**53**	**62**	**79**
AIRCRAFT OPERATIONS				
Single Engine	12,899	16,030	18,352	24,364
Multi-Engine	663	1,048	1,707	2,681
Turboprop	0	0	608	2,141
Jet	0	0	260	359
Helicopter	0	1,182	1,568	2,455
Other	4,887	5,816	6,438	7,882
TOTAL OPERATIONS	**18,449**	**24,076**	**28,933**	**39,882**

Source: *Campbell and Paris, P.C.*

3.0 DEMAND/CAPACITY

The purpose of the Demand/Capacity Analysis is to determine the airport's capacity and its ability to support the forecast aviation demand. Facility requirements identify development, replacement, or modification of airport facilities to accommodate the existing and 20-year forecast demand.

The methodology used to determine facility requirements begins with an examination of the airport's major components: Airfield, Airspace, Buildings and Landside/Surface Access. It is important to note that each of these system components should be balanced, in order to achieve system optimization. Any deficiencies in the airport facilities that encompass these four elements will be identified based upon standards presented in Federal Aviation Administration (FAA) Advisory Circular 150/5300-13 *Airport Design*, and FAA Advisory Circular 150/5060-5 *Airport Capacity and Delay.* Recommended improvements to facilities will be noted.

3.0.1 Airfield Capacity and Delay

Airport capacity and delay computations are used to design and evaluate airport development and improvements. As demand approaches capacity, individual aircraft delay is increased. Successive hourly demands exceeding the hourly capacity result in unacceptable delays. Even when hourly demand is less than the hourly capacity, aircraft delays can still occur if the demand within a portion of the time interval exceeds the capacity during that interval.

Airport capacity is governed by runway use configuration, percent arrivals, percent touch and go's, taxiway configuration, airspace limitations and runway instrumentation. Annual service volume (ASV) is a reasonable estimate of an airport's annual capacity. It accounts for differences in runway use, aircraft mix, and weather conditions that would be encountered over a year's time.

The airfield operational capacity for the Front Royal Airport, as calculated from FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, is approximately 230,000 annual operations per year. The current Airport configuration provides an 'hourly' runway capacity of 98 Visual Flight Rules (VFR) operations and 59 Instrument Flight Rules (IFR) operations. A comparison of future demand to current airfield operational capacities do not indicate the need for capacity-enhancement projects. Based on the forecasts for the Airport, the demand as a percent of ASV is presented in **Table 3.1**.

Table 3.1
Forecast Demand as Percent of ASV

Year	Forecast Annual Operations	Percent of ASV
2006	19,020	8.3%
2011	24,076	10.5%
2016	28,933	12.6%
2026	39,881	17.3%

Source: *Talbert & Bright, Inc. Analysis*

Table 3.1 indicates that the forecast total annual operations are expected to grow from 8.3% to 17.3% of the annual service volume by the end of the planning period. Industry and FAA guidelines recommend that capacity improvements be pursued when annual operations reach 60% of the theoretical Annual Service Volume. Therefore, when actual annual operations reach 138,000 operations, more detailed analysis should be performed to better determine the runway's capacity. Since the demand at the Airport is not forecasted to reach the 60% threshold level within the 20-year planning period, no new runways are required to increase the Airport's capacity. The recent completion of the parallel taxiway has increased airfield capacity significantly at the Airport.

Hourly airfield capacity is a measure of the maximum number of aircraft operations which can be accommodated on the airport or airport component in an hour. Hourly capacity is an important consideration, since this measure determines whether an airport can accommodate the projected peak hour operations during the planning period.

FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, is used to estimate the hourly capacity of the Front Royal Airport. The forecast demand as a percent of hourly capacity is presented in **Table 3.2**.

Table 3.2
Forecast Demand as Percent of Hourly Capacity

Year	Forecast Peak Hour Operations (ops/hr)	VFR Hourly Capacity (ops/hr)	Percent of Hourly Capacity (%)
2006	7	98	7.1%
2011	9	98	9.2%
2016	11	98	11.2%
2026	15	98	15.3%

Source: *Talbert & Bright, Inc. Analysis*

Similar to the runway capacity analysis, the actual/projected hourly demand is only expected to reach 15.3% of hourly capacity by the end of the 20-year planning period. Therefore, no improvements are recommended to increase capacity.

3.0.2 Airport Service Level

The current National Plan of Integrated Airport Systems (NPIAS) lists the Front Royal Airport as General Aviation (GA) facility while the 2003 VATSP classifies the Airport as General Aviation Community (GC) facility. These classifications accurately reflect the current and future role of the Airport and do not need to be altered at this time.

3.0.3 Airport Reference Code

The Airport Reference Code (ARC) is a measure of the approach speed and wingspan of the most critical aircraft that operates at an airport. The critical aircraft is thus used to determine the required airport approach and layout dimensions. The aircraft approach categories are listed in **Table 3.3** while the aircraft design groups are listed in **Table 3.4**.

Table 3.3
Aircraft Approach Category

Aircraft Approach Category	Aircraft Approach Speed
Category A	Less than 91 knots
Category B	91 knots or more but less than 121 knots
Category C	121 knots or more but less than 141 knots
Category D	141 knots or more but less than 166 knots
Category E	More than 166 knots

Source*: FAA Advisory Circular 150/5300-13 Airport Design*

Table 3.4
Aircraft Design Group

Aircraft Design Group	Aircraft Wingspan
Group I	Up to but not including 49’
Group II	49’ up to but not including 79’
Group III	79’ up to but not including 118’
Group IV	118’ up to but not including 171’
Group V	171’ up to but not including 214’
Group VI	214’ up to but not including 262’

Source*: FAA Advisory Circular 150/5300-13 Airport Design*

The current ARC for the Front Royal Airport is B-I Small (small aircraft exclusively) as listed on the approved 1998 Airport Layout Plan (ALP). The most critical aircraft based at the Airport is a Cessna 411 multi-engine piston aircraft which is classified as B-I. The proposed ARC for the airport as listed on the ALP is B-II with a future critical aircraft as a Beech King Air 200. The ARC should be changed to B-II once a B-II aircraft becomes based at the Airport or begins flying 500 or more annual operations at the Airport. This event is anticipated to occur at approximately the same time as the runway is extended which is part of the ultimate phase of development. All facilities constructed should be built to B-II FAA design standards to accommodate this future transition to B-II aircraft.

The B-II designation will accommodate all of the existing and projected aircraft over the planning period.

3.1 AIRPORT GEOMETRY

This section presents the airport geometric design standards and recommendations to ensure the safety, economy, efficiency and longevity of an airport. It is important for airport owners to look at both, the present, and the future of the Airport.

3.1.1 Runway Length Requirements

The following section describes the recommended runway length requirements for the Front Royal Airport. The planned, or future, runway length is determined by: **1)** performance requirements to satisfy Category B-II turbine aircraft takeoff, landing and accelerate-stop distances; **2)** conformance with FAA recommended runway length standards per *FAA Advisory Circular 150/5325-4B, Runway Length Standards*, Computer Program Version 4.2D; **3)** conformance with the 2003 VATSP 'general aviation community' classification role; and; **4)** Airport and local interest commensurate with community competitiveness for retaining and attracting business and investment to the region.

The current runway length at the Front Royal Airport is 3,007 feet. By design, this length accommodates 75% of the small aircraft weight 12,500 pounds or less. **Table 3.5** lists these FAA calculations.

Table 3.5
Runway Length Requirements

AIRPORT RUNWAY DATA	
Airport elevation	703' MSL
Mean daily maximum temperature of the hottest month	86°F
Maximum difference in runway centerline elevation	9'
RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN	

Airplanes (12,500 pounds or less) with approach speed of less than 30 knots	320'
Airplanes (12,500 pounds or less) with approach speed of less than 50 knots	860'
AIRPLANES (12,500 POUNDS OR LESS) WITH LESS THAN 10 PASSENGER SEATS	
75 percent of these airplanes (12,500 pounds or less)	2,700'
95 percent of these airplanes (12,500 pounds or less)	3,230'
100 percent of these airplanes (12,500 pounds or less)	3,850'
Airplanes(12,500 pounds or less) with 10 or more passenger seats	4,330'
AIRPLANES OF 60,000 POUNDS OR LESS	
75 percent of these airplanes at 60 percent useful load	4,820'
75 percent of these airplanes at 90 percent useful load	6,570'
100 percent of these airplanes at 60 percent useful load	5,530'
100 percent of these airplanes at 90 percent useful load	8,330'

Source: *FAA Airport Design software (version 4.2D)*

The 2003 VATSP Plan has identified an ultimate runway length of 3,200 feet. The current ALP shows a 1,001 foot runway extension giving the Airport an ultimate runway length of 4,008 feet. A runway length of 3,850 feet will accommodate 100% of the small airplanes weighing 12,500 pounds or less and having less than 10 passenger seats. As discussed in the forecast chapter of this report, the future critical aircraft will be a Beech King Air or Cessna Citation. It is recommended that the Beech King Air 200 be selected as the future critical aircraft as the increase in small/medium corporate aircraft is evident industry-wide. This aircraft is considered has a reference code of B-II and requires a runway length of roughly 3,600 feet. Based on the forecast of aviation activity and the FAA design requirements, it is recommended that the ultimate runway length should be 4,000 feet. As mentioned earlier, the runway should be planned for extension in the ultimate phase of development once there is sufficient demand for the 4,000 foot length. This length will safely accommodate all of the current and future aircraft anticipated to use the Airport over the 20-year planning period.

Runway numbers are determined by the nearest tenth of a degree in magnetic heading. The constant shifting of magnetic north due to declination has can cause runway designation numbers to change occasionally. The true runway heading (86.94°) at the Front Royal Airport, plus the magnetic declination (9.94°) equals the magnetic runway heading of 96.88° or 100° when rounded. The existing runway numbers of 9-27 should be changed to 10-28 to reflect this change in declination and the more accurate magnetic runway heading of 100°. This change should occur in Phase I of the development cycle. It should be noted that the change will require one year for the FAA to modify all references to the runway numbers. Therefore, this change should be accomplished as soon as possible by the airport and possibly be tied in with a runway marking project to achieve an economy of scale for both projects.

3.1.2 Runway Width

FAA Advisory Circular 150/5300-13 provides guidance for runway width standards based on ARC and wind coverage. For Category B-I Small Runways, a 60 foot width is required and for Category B-II runways, a 75 foot width is required. Runway 9-27 at the Front Royal Airport is currently 75' wide. No runway widening is proposed.

3.1.3 Pavement Strength and Condition

Airport pavements are constructed to provide adequate support for the loads imposed by aircraft using the airport and to produce a firm, stable, smooth, all year, all weather surface free from dust or other particles that may be blown or picked up by propeller wash or jet blast. For a pavement to meet the requirements noted it must have the strength and stability to withstand abrasive action, adverse weather and other deteriorating influences. Braking performance on pavement surfaces becomes critical with increases in forecasted turbo jet operations. Under certain conditions, hydroplaning or unacceptable loss of friction can occur resulting in poor braking performance and possible loss of directional control.

The existing runway and taxiway pavements were found to be in good condition. The parallel taxiway was recently extended from the apron area to the Runway 9 jug handle. This pavement is in excellent condition. There is some cracking on the runway and apron. These cracks should be sealed to ensure the maximum pavement design life. A runway overlay project should be considered in Phase II of the development plan. This assumes a 20-year existing pavement life with the appropriate regular maintenance such as crack seal. The aprons and taxiways/taxilanes should be considered for an overlay at this time as well as their condition will deteriorate at a similar rate as the runway.

The current runway, taxiway, and apron strength is rated at 12,500 pounds for a single wheel aircraft. This strength will accommodate all of the existing B-I aircraft and proposed B-II aircraft over the 20-year planning period.

3.1.4 Runway Protection Zones

The Runway Protection Zone's (RPZ) function is to enhance the protection of people and property on the ground. This is achieved through airport owner control over RPZ's. Such control includes clearing RPZ areas (and maintaining them clear) of incompatible objects and activities. Control is preferably exercised through acquisition of sufficient property interest in the RPZ. The geometrics of the RPZ vary depending upon the visibility minimums for the runway approach and the aircraft utilizing the airport.

The Front Royal Airport currently has RPZs measuring 250' inner width by 450' outer width by 1,000' long. This corresponds to airports with visual approaches and approaches not lower than 1 mile, serving small aircraft exclusively. A small aircraft is one that has a 12,500 pound or less maximum certified takeoff weight. The current and future critical aircraft both weigh less than 12,500 pounds and therefore, no change to the RPZ size is required during the 20-year planning period.

3.1.5 Runway Safety Area

A runway safety area (RSA) is defined as a surface surrounding the runway which is suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. The dimensional standards are noted in **Table 3.6**. In addition to the dimensional standards, the RSA should conform to the following design standards:

- Graded and cleared of hazardous items or surface variations
- Drained by grading or other conveyance to prevent water accumulation
- Capable of supporting airport and usage vehicles and the occasional passage of aircraft under dry conditions
- Free from objects except those fixed by function. Objects greater than 3 inches in height above grade shall be frangible

Table 3.6
Runway 9-27 Safety Area Dimensions and Design Standards

	ARC	RSA Width	RSA Length Beyond Runway End	Meets Design Standards
Existing	B-I Small	120’	240’	Yes
Future	B-II	150’	300’	Yes

Source: *Advisory Circular 150/5300-13, Airport Design; Talbert & Bright, Inc. analysis*

3.1.6 Runway Object Free Area

The Runway Object Free Area (ROFA) is an area on the ground centered on the runway centerline provided to enhance the safety of aircraft operations by having the area free of objects except objects that need to be located in the ROFA for air navigation or aircraft maneuvering purposes. The dimensional standards are noted in **Table 3.7**. Additional clearing and grading, primarily on the south side of the runway, will be required for the Airport to meet B-II standards.

Table 3.7
Runway 9-27 Object Free Area Dimensions and Design Standards

	ARC	Width	Length Beyond Runway End	Meets ROFA Clearing Requirements
Existing	B-I Small	250'	240'	Yes
Future	B-II	500’	300’	No

Source: *Advisory Circular 150/5300-13, Airport Design; Talbert & Bright, Inc. analysis*

3.1.7 Runway Line of Sight

An acceptable runway profile permits any two points five feet above the runway centerline to be mutually visible for the entire runway length. However, if the runway has a full length parallel taxiway, the runway profile may be such that an unobstructed line of sight will exist from any point five feet above the runway centerline for one-half the runway length. There are no obstructions or limitations to the line of sight within the visibility zone at the Front Royal Airport. No changes are required to meet runway visibility standards.

3.1.8 Runway Edge Lighting

Edge lights are used to outline usable operational areas of airports during periods of darkness and low visibility weather conditions. The Front Royal Airport is currently equipped with Medium Intensity Runway Lights (MIRL) which can be controlled remotely via a Pilot Controlled Lighting (PCL) system. There is no need to alter these lights over the planning period due to the current and proposed approaches.

There is a transformer located adjacent to the house immediately south of the terminal building which provides power to the airfield via the electrical panel in the terminal building. There is currently sufficient power for the Airport and no need to alter the panel at this time.

3.1.9 Taxiway Requirements

The minimum pavement widths, curve radii, and separations associated with airplane movement areas and airplane physical characteristics establish the taxiway system. Since the taxiway system is the transitional facility, which supports airport operational capacity, the capability to maintain an average taxiing speed of at least 20 mph is recommended, which is currently met by the existing taxiways at the Airport. Taxiway dimensional standards are categorized by separations, widths, curves and fillets. **Table 3.8** summarizes the taxiway dimensional standards.

In addition, the taxiway safety area shall be:

- cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations;
- drained by grading or storm sewers to prevent water accumulation;
- capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage for the aircraft; and
- free of objects except those that need to be located in the taxiway safety area because of their function. Objects higher than 3 inches above grade should be constructed on low impact resistant supports (frangible mounted structures) of the lowest practical height with the frangible point no higher than 3 inches above grade. Other objects, such as manholes, should be constructed at grade. In no case should their height exceed 3 inches above grade.

3.1.10 Taxiway and Taxilane Object Free Areas

The taxiway and taxilane OFAs are centered on the taxiway and taxilane centerlines. The taxiway and taxilane OFA clearing standards prohibit service vehicle roads, parked airplanes, and above ground objects except for objects that need to be located in the OFA

for air navigation or aircraft ground maneuvering purposes. Vehicles may operate within the OFA provided they give right of way to oncoming aircraft by either maintaining a safe distance ahead or behind the aircraft or by exiting the OFA to let the aircraft pass. All of the taxiway and taxilane OFAs meet FAA standards with the exception of one taxilane located between T-Hangar #1 and T-Hangar #2. This Taxilane object free area is only 72' wide instead of the required 79'. This taxilane is limited to Group I aircraft only should be considered non-standard.

Table 3.8
Taxiway Dimensional Standards

Item	Existing	B-I Small	B-II
Taxiway Width	35'	25'	35'
Taxiway Shoulder Width	10'	10'	10'
Taxiway Safety Area Width	79'	49'	79'
Taxiway Object Free Area Width	131'	89'	131'
Taxilane Object Free Area Width	115'	79'	115'

Source: *Advisory Circular 150/5300-13, Airport Design; Talbert & Bright, Inc. analysis*

3.1.11 Parallel Taxiways

A basic airport consists of a runway with a full-length parallel taxiway, an apron, and connecting transverse taxiways between the runway, parallel taxiway, and the apron. The Airport currently has a full parallel taxiway system connecting each end of the runway. This taxiway is connected to the runway via four stub taxiways. The existing taxiways meet B-II design standards and will not need to be altered to accommodate future aircraft movements. However, the taxilanes on the apron adjacent to the terminal building currently meet B-I standards. It is recommended that the future apron expansion be marked to conform with Group II taxilane standards.

3.1.12 Taxiway Edge Lighting and Signage

The taxiway edge lighting system is a configuration of lights that define the lateral and longitudinal limits of usable taxiway. Taxiway signage provides the airport users with guidance information for taxiing destinations and to assist in taxi route decision making upon exiting the apron area. The Front Royal Airport is not equipped with taxiway lighting. It may not be financially justifiable to install taxiway lighting at the Airport however; there is a solution that would increase pilot awareness during night and inclement weather taxiing. It is recommended that retro-reflective markers be installed along the parallel taxiway. These cylindrical markers reflect light from aircraft and easily identify taxiway edges without the need for electrical wire installation. This addition is recommended for Phase I of the planning period.

3.1.13 Runway to Taxiway Separation

Runway to taxiway separation standards are predicated on the Airport Reference Code (ARC), on the airport facility, and the existing/future visibility minimums expected. The higher the ARC and the lower the visibility minimums, the greater the runway to taxiway separation distances. Table 3.12 lists the existing and the required separation distances for B-I small and B-II airports. The Front Royal Airport currently meets the B-II requirements and therefore, no action is required. **Table 3.9** lists the existing and required runway / taxiway separation distances.

Table 3.9
Runway/Taxiway Separation Standards

Runway Centerline to:	Existing	B-I Small	B-II
Taxiway/Taxilane Centerline	240'	150’	240'
Aircraft Parking Area	305'	125'	250'

Source: *Advisory Circular 150/5300-13, Airport Design; Talbert & Bright, Inc. analysis*

The following bullets along with **Table 3.10** summarize the planned runway dimensions and strength:

- **Existing Runway 9-27 Length = 3,007′ x 75′ (12,500 lbs. SWG)**
- **Proposed Runway 10-28 Length = 4,000′ x 75′ (12,500 lbs. SWG)**

Table 3.10
Runway Design Parameters

Runway Design Factors	Existing (ARC B-I Small)	ARC B-II	Does Existing Meet B-II Standards?
Runway Width	75’	75’	Yes
Runway Safety Area (RSA): **RSA width** **RSA length beyond runway end**	 120’ 240’	 150’ 300’	 No No
Object Free Area (OFA): **OFA width** **OFA length beyond runway end (Precision OFA)**	 250’ 240’	 500’ 300’	 No No
Runway Protection Zone (RPZ): **Inner width** **Length** **Outer width** **RPZ Size (Acres)**	Rwy 9 / Rwy 27 250’ / 250’ 1,000’ /1,000’ 450’ / 450’ 8.04 acres / 8.04 acres	Rwy 10 / Rwy 28 250’ / 250’ 1,000’ /1,000’ 450’ / 450’ 8.04 acres / 8.04 acres	Rwy 10 / Rwy 28 Yes Yes Yes Yes
Taxiway width	35’	35’	Yes
Taxiway Object Free Area (TOFA) width	89’	131’	Yes
Runway to Taxiway Distance **Runway to Parking Distance**	240' 305’	240' 250’	Yes Yes

Source: FAA Advisory Circular 150/5300-13, *Airport Design*

3.2 AIRSIDE FACILITY REQUIREMENTS

This Section identifies airfield facilities needed to satisfy the 20-year forecast of aviation demand at the Front Royal Airport. The identification of needed facilities does not constitute a requirement in terms of absolute design standards or goals, but rather an option for facility improvements to resolve various types of facility or operational

inadequacies, or to make improvements as demand warrants. The facilities recommended as part of this Airport Layout Plan Update have been identified from inventory and forecast findings, and planned in accordance with FAA/DOAV airport design standards and airspace criteria.

The following analysis addresses seven major airport areas. The runway length has been addressed as part of the Demand/Capacity study and is thus not included in the following analysis. The DOAV accepted facility requirement parameters were used in developing this analysis. The Facility Requirements section has been broken down into Airside and Landside Facility Requirements.

3.2.1 Aircraft Storage

General aviation aircraft parking and storage requirements can vary widely from airport to airport depending on the number of transient aircraft using the airport and the number of based aircraft owners who chose to tie down their aircraft on the ramp versus those who choose to use available hangar space. **Table 3.11** lists the existing storage percentages at the Front Royal Airport by aircraft type.

Table 3.11
Current Based Aircraft Storage Ratios

Aircraft Types	Apron Tiedowns	T-hangars	Conventional Hangars
Single Engine Piston	10%	85%	5%
Multi Engine Piston	0%	0%	100%

Source: *Talbert & Bright, Inc. analysis*

3.2.2 T-Hangar Storage

General aviation airports most often utilize t-hangars as covered storage for small general aviation aircraft. Roughly 85 percent of single-engine based aircraft are currently stored in t-hangars. It is anticipated that 50 percent of the multi-engine piston aircraft will be stored in T-hangars as these aircraft become based at the Airport. Local general aviation aircraft owners have expressed interest in obtaining T-hangars for their aircraft. There

are currently approximately 50 aircraft owners on a T-Hangar waiting list at the Airport. This demonstrates an ongoing demand for these facilities. However, it should be noted that a number of these owners are on multiple airport lists. The number of owners that would relocate to FRR tomorrow if hangar space was available is most likely a fraction of the 50.

3.2.3 Conventional Hangar Storage

Conventional hangars represent the other most common method of covered aircraft storage. The following represents the DOAV accepted calculations for conventional hangar storage:

- Single-Engine – 850 square feet
- Multi-Engine – 1,200 square feet
- Turboprop – 1,700 square feet
- Jet – 2,900 square feet
- Helicopter – 1,500 square feet

The existing conventional hangar storage area at the Airport totals 4,400 square feet which does not include the aircraft maintenance hangar since this facility does not permanently store aircraft. Roughly 5 percent of the single-engine aircraft are stored in conventional hangars while it is anticipated that 50 percent of multi-engine aircraft will be stored in these same hangars in the future. All of the turboprop, jet, and helicopters are considered stored in conventional hangars due to the value of these aircraft.

3.2.4 Apron Area

Apron areas are used for outside aircraft storage. The remaining 10 percent of single-engine aircraft are stored on these apron areas. The following represents the DOAV accepted calculations for apron area storage:

Single-Engine – 870 square yards
Multi-Engine – 960 square yards
Turboprop – 1,730 square yards
Jet – 2,540 square yards

These calculations account for the ingress and egress of aircraft to and from the apron parking spaces. The existing apron areas at the Front Royal Airport total roughly 11,700 square yards. These existing aprons all meet Group I separation standards while the proposed apron areas will be configured to meet Group II standards.

3.2.5 Transient Aircraft Storage

Transient aircraft parking requirements typically make up the largest demand for apron space requirements. Transient aircraft are defined as those aircraft not based at the facility. **Table 3.12** lists the transient aircraft storage ratios. These percentages were used to calculate the total aircraft storage areas required to meet the forecast demand.

Table 3.12
Transient Aircraft Storage Ratios

Aircraft Types	Apron Tiedowns	T-hangars	Conventional Hangars
Single Engine Piston	90%	10%	0%
Multi Engine Piston	80%	0%	20%
Multi Engine Turbine	80%	0%	20%
Business Jet	80%	0%	20%
Rotorcraft	90%	0%	10%

Source: *Talbert & Bright, Inc. analysis*

Table 3.13 lists the aircraft storage requirements for the 20-year planning period.

Table 3.13
Aircraft Storage Requirements

Facility	Existing	Phase 1 Short-Term (2007-2011)	Phase 2 Mid-Term (2012-2016)	Phase 3 Long-Term (2017-2026)
T-Hangar Units	32	34	40	50
Conventional Hangar (sf)	4,400 sf	5,950 sf	8,435 sf	15,875 sf
Total Apron Area (sy)	11,700 sy	19,836 sy	25,742 sy	35,256 sy

Source: Talbert & Bright, Inc. analysis

3.2.6 Fueling Facilities

The Airport currently has one 12,000 gallon self-serve Avgas tank. As turboprop, jet, and turbine helicopter activity increases at the Airport, it is recommended that a 12,000 gallon Jet A tank be added to the field. It is anticipated that this will occur around 2016 with the forecast addition of turbine aircraft. **Table 3.14** lists the existing fueling capacities at the Airport. It is recommended that the existing Avgas tank be relocated north so that it is adjacent to the Airport access road. This will allow for the expansion of the apron in a more linear form and will eliminate the obstruction that the tank creates with the view of Runway 9 from the terminal building. Also, FRR is eligible to receive up to $76,418.92 from DOAV to relocate the existing tank and/or install the proposed Jet A tank. The relocated Avgas tank and future Jet A tank will be accessed and serviced via the airport access road. A hookup can be installed at the fence for the fuel trucks to offload without driving onto the apron or any of the aircraft movement areas.

Table 3.14
Airport Fuel Farm

Fuel Tank	Size (gallons)	Location	Orientation	Status
Avgas (100 LL) Tank	12,000	above ground	horizontal	existing
Jet A Tank	12,000	above ground	horizontal	proposed

Source: *Airport Layout Plan, Talbert & Bright, Inc.*

The fuel farm meets all EPA requirements and is in good condition. As the number of based aircraft increases, the demand on Avgas will also increase. Due to the forecast change in fleet mix, additional Avgas fuel storage tanks will not be required during the planning period. However, additional supply can be generated with more frequent tank refills until an additional tank can be justified.

The Airport has a current Stormwater Pollution Prevention Plan (SWPPP) and Spill Prevention, Control, & Countermeasures Plan (SPCC). These documents should be updated as facilities change or are added to the Airport. An update is planned for Phase II of the planning period.

3.2.7 Field Maintenance Equipment and Storage Facilities

The airport currently has an airfield maintenance storage facility located adjacent to the airport access road at midfield. This 43' x 31' facility is used to store the airfield maintenance equipment. No additional maintenance storage buildings are required during the 20-year planning period. A storage shed is located adjacent to the terminal building which will be moved to the south side of the terminal when that facility is expanded during Phase II of the planning period.

3.2.8 Perimeter Fencing / Airport Security

Perimeter fencing is crucial to the prevention of animal and human incursion on aircraft operating areas. A portion of the airport is bounded by woods and undeveloped areas and subject to animal incursions. The Airport has installed 4 foot perimeter fencing along the airport property line. This fencing is currently in good condition. Sections of the fence may need to be changed during the planning period if they are damaged or become ineffective at keeping wildlife off of the Airport.

Airport access control consists of a motion sensor gat alarm at the access road entry point adjacent to the terminal building. A security assessment report was completed for the Airport in 2007. Other security features include CCTVs in the terminal area and sodium lighting of the ramp. Recommendations from the assessment include:

- Draft and institute a General Aviation Security Plan.
- Institute procedures to test the plan.
- Draft an airport Mission Statement.
- Upgrade airport maps to include;
    - Utilities
    - Fire hydrants
    - Water, electric and fuel shut-off switch locations.
    - Hangar numbers

Designated ingress and egress points

- Provide copies of upgraded maps to all local law enforcement agencies.
- Install locking devices on all hangar doors on hangar "D"
- Upgrade lighting around the terminal building, fuel farm and all hangars. (Equipped with motion sensors is an option.)
- Re-aim lamps on hangar "B"
- Install security fencing around the fuel farm. Minimum 8ft. with additional three strand barbed wire.
- Install a security gate at the main driveway entrance to limit vehicular traffic.

It is the recommendation of this Airport Layout Plan Study for the Airport to implement the security assessment recommendations in Phase I of the planning period. A security gate with a card reader system is recommended for the airport movement area point of entry.

3.3 AIRSPACE AND NAVAID REQUIREMENTS

It is important to research the airspace surrounding the Front Royal Airport and how it would impact aircraft approaching or departing from the Airport. It is also important to identify existing and potential obstructions to the airspace surfaces in the immediate vicinity of the airport. This section will discuss the airspace around the airport from both perspectives.

3.3.1 Airspace Capacity

As discussed in Section 1.4.1 of the Inventory Chapter of this document, the Front Royal Airport lies within uncontrolled airspace, surrounded by Class G airspace. It is, however situated between Class E airspace associated with Winchester Regional and Luray Caverns Airports. The surrounding airspace can adequately accommodate the existing and proposed operations at the Airport.

3.3.2 Approach Procedures

The Front Royal Airport is equipped with an RNAV (GPS) day circling approach procedure with minimums of 1,820' ceiling and 1¼ mile visibility. Due to the current airport layout as well as the proximity of various structures, it would be very difficult for the Airport to meet the 500' wide primary surface and enlarged runway protection zone required for a non-precision approach. The current approach requires a 250' primary surface. Although not ideal, the current approach meets the needs of the Airport and will accommodate the forecast requirements through the 20-year planning period.

3.3.3 Visual Guidance Lighting System

The Front Royal Airport is currently equipped with visual guidance panels to both ends of Runway 9-27. These panels help pilots remain on the 3 degree approach angle while making their final approach. These approach aids are sufficient for the current and forecast operations. Two-box Precision Approach Path Indicator Lights (PAPI) are recommended to replace the panels and enhance pilot awareness during night or inclement weather approaches. These lights should be installed as a Phase II project. The PAPI should be upgraded to four-box systems once the runway is extended in the ultimate phase.

Runway End Identifier Lights (REIL) are recommended for each runway end at the Airport to aid pilots in locating the ends of the runway during night operations. This project can be tied in with the PAPI installation during Phase II. These lights should be installed so that they can be controlled by pilots over the Common Traffic Advisory Frequency (CTAF). This will keep the lights from being on when they are not needed and reduce the light emission impact on the surrounding community.

The existing rotating beacon at the Airport was recently rehabilitated in 2007. A future rehabilitation project for this light should be planned for Phase III of the planning period.

3.3.4 Automated Weather Observing System

The Front Royal Airport does not currently have a weather monitoring equipment on the field. However, pilots can obtain automated weather information from the Automate Weather Observing System AWOS-III system located at the Winchester Regional airport located 14 miles north of the Front Royal Airport. It is recommended that an AWOS-III be installed at the Front Royal Airport to increase weather information accuracy. This system would accommodate the forecast weather information demand for the 20-year planning period.

In order to accommodate the AWOS, the Airport will be required to purchase an easement over any area not owned by the airport which falls within the 500' AWOS Critical Area. This future easement totals roughly 7 acres and will allow the airport to clear any above-ground obstructions that may interfere with the AWOS sensors.

In addition to the AWOS, A Ground Communications Outlet (GCO) is recommended for installation at the Airport. This communications link will enable pilots to more efficiently obtain and cancel IFR clearances with Potomac Approach Control. This addition should be planned for the installation during Phase I of the planning period.

3.4 LANDSIDE FACILITY REQUIREMENTS

This Section identifies landside facilities needed to satisfy the 20-year forecast of aviation demand at the Front Royal Airport. The identification of needed facilities does not constitute a requirement in terms of absolute design standards or goals, but rather an option for facility improvements to resolve various types of facility or operational inadequacies, or to make improvements as demand warrants. The facilities recommended as part of this Airport Layout Plan Update have been identified from inventory and forecast findings, and planned in accordance with FAA/DOAV airport design standards.

3.4.1 Terminal Building

The airport terminal facility serves as the focal point of an airport and represents the front-door to the community for arriving passengers. The existing terminal building at the Front Royal Airport measures 3,070 square feet. The Virginia Department of Aviation uses a model to determine the eligible terminal size based on forecast operations. These sizes represent the areas eligible for DOAV funding and do not restrict the size of non-public terminal areas. **Table 3.15** lists the eligible terminal sizes based on the approved forecasts from Chapter 2 for each of planning years.

Table 3.15
Eligible Terminal Building Space

Year	Square Footage
Existing	3,070
2006	2,377
2011	3,009
2016	3,616
2026	4,984

Source: *DOAV Analysis/Talbert & Bright Interpolation*

The existing square footage number includes office space which is not eligible for DOAV funding. The square footage numbers from 2006 to 2026 do not include office space. The Front Royal Airport currently has sufficient terminal space through 2011. Beyond this point, a terminal expansion is recommended. The future terminal size should be 5,000 square feet with additional area for offices. This will enable the terminal to accommodate the forecast operation through the planning period.

3.4.2 Auto Parking

An adequate number of auto parking spaces should be provided for airport employees, tenants, and the general public that use the airport facilities. There are currently 36 auto parking spaces at the Airport. Based on the VATSP calculations, the Airport will need 1 parking space per employee and 1.5 parking spaces per based aircraft departure on the average day of the peak month. With this ratio applied to the preferred based aircraft forecast, a total of roughly 60 spaces will be needed by 2026, as shown in **Table 3.16**.

Table 3.16
Auto Parking Space Requirements

Facility	Existing	Phase 1 Short-Term (2007-2011)	Phase 2 Mid-Term (2012-2016)	Phase 3 Long-Term (2017-2026)
Auto Parking Spaces	36	36	44	60

Source: Talbert & Bright, Inc. analysis

It is recommended that additional auto parking spaces be provided for airport users as the Airport activity grows.

3.4.3 Landside Access

Access to the Airport is provided from Stokes Airport Road. A two-lane access road connects this roadway to the auto parking lot adjacent to the terminal building and to the hangar area at midfield. The average daily vehicle traffic at the Airport is 81 vehicles (2006). This number is expected to increase to 155 average daily vehicles by 2026 as noted in the forecast chapter of this report. The existing roadway structure is in good condition and sufficient to accommodate this volume through the 20-year planning period. However, routine maintenance and a resurfacing will be required to ensure that this access road remains in useable condition over the next 20 years. The resurfacing of this airport owned road is expected to occur during Phase III of the planning period.

3.5 LAND / EASEMENT ACQUISITION

The Airport is currently in the preliminary stages of a land acquisition project of which the Environmental Assessment is currently being conducted. This "Form C" EA is required for all federally funded land acquisition projects. The land that is being acquired in fee simple is necessary to grade the Object Free Area and tie this ground into the adjacent terrain. Approximately 2.3 acres will be purchased in fee simple for this grading. It is recommended that the Airport acquire an additional 0.09 acres in fee simple for a sliver of land inside the Runway 27 RPZ. This land was never acquired as part of the runway widening project. The acquisition of this piece would ensure that the Airport has ownership and control of the existing RPZs.

A number of avigation easements are recommended so that the Airport can clear mitigate and maintain obstructions in the transitional surfaces. The recommended easements cover nine property owners along the south side of the existing airport property. The aforementioned Form C EA covers the easement acquisition of this property. All proposed fee simple and avigation easement acquisitions are shown on the Airport Property Map as part of the ALP Set. These properties should be acquired in Phase I of the planning period. The two parcels to be purchased in fee simple for the runway/taxiway extension should be acquired in the Ultimate Phase. Land acquisition will also be required for the future AWOS Critical Area.

3.6 FACILITY REQUIREMENTS SUMMARY

Table 3.17 summarizes the Facility Requirements for the Front Royal Airport and lists the phases which various facilities will be needed as driven by demand.

Table 3.17
Facility Requirements Summary

Facility	Existing	Phase 1 Short-Term (2007-2011)	Phase 2 Mid-Term (2012-2016)	Phase 3 Long-Term (2017-2026)	Ultimate Phase (Beyond 2026)
Runway	3,007' x 75'	3,007' x 75'	3,007' x 75'	3,007' x 75'	4,000' x 75' *
Taxiway	Full-Parallel	Full-Parallel	Full-Parallel	Full-Parallel	Full-Parallel
T-Hangar Units	32	34	40	50	TBD
Conventional Hangar (sf)	4,400 sf	5,950 sf	8,435 sf	15,875 sf	TBD
Total Apron Area (sy)	11,700 sy	19,836 sy	25,742 sy	35,256 sy	TBD
Auto Parking Spaces	36	36	44	60	TBD
GA Terminal (sf)	3,070 sf	3,009 sf	3,616 sf	4,984 sf	TBD

*** Note:** Any runway extension must be warranted by existing demand**.**
Source: *Talbert & Bright Analysis*

3.7 DEVELOPMENT ALTERNATIVVES

The next step in the study is to create development options that will address the needed facilities outlined in the previous section. Four development alternatives were generated for consideration. These alternatives are discussed in the following sections.

The runway extension which is included on the currently approved ALP, has been carried over to the new ALP. The development timeline for this airport addition is anticipated for the ultimate phase of the planning period. Sufficient demand should be identified before this development moves forward. During the public workshop, a number of questions and concerns were raised about the extension. Many local residents feel that it is unjustified and would cause too severe an impact on the surrounding landowners. This impact will be fully evaluated as part of an Environmental Assessment which will be conducted prior to the design and construction of the extension. As mentioned above, an alternative was developed which has the runway extension removed.

The remaining facilities depicted on the development alternatives consist of hangars, apron space, terminal, and auto parking expansions. The size of these facilities is based on the forecast demand and facility requirements section of this report.

3.7.1 Development Alternative 1

Development Alternative 1 is depicted on **Exhibit 3-1**. The facilities included in this alternative are listed below by phase.

PHASE I

- A 6,500 square yard apron expansion
- 8 Box Hangars
- A 4-Unit T-Hangar Expansion
- A 7-Unit T-Hangar Expansion
- A connector taxilane adjacent to T-Hangar #3

PHASE II

- Auto parking expansion
- A 6,000 square yard apron expansion
- A 6-Unit T-Hangar building

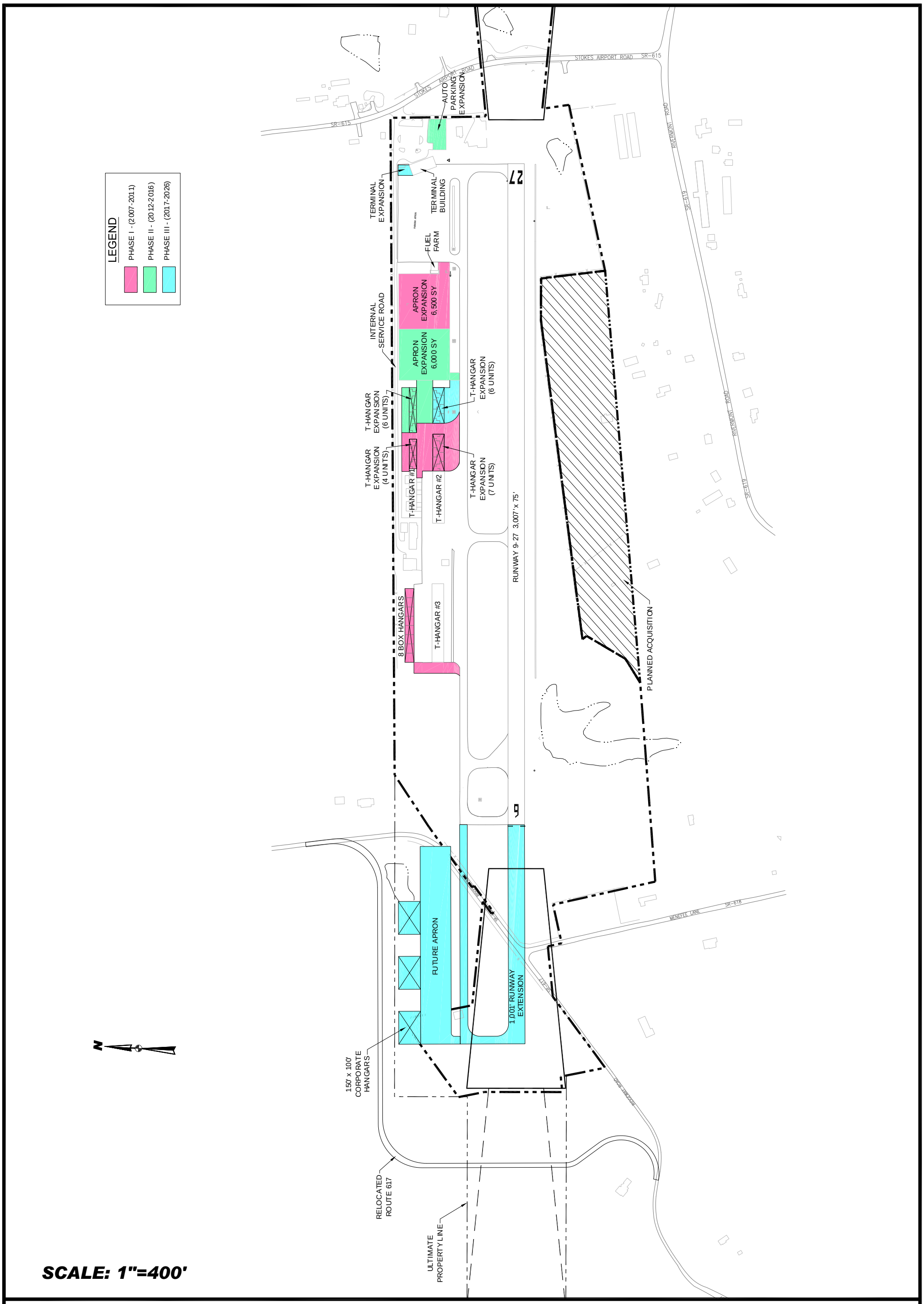


Exhibit 3-1
Front Royal-Warren County Airport

Development Alternative 1

TALBERT & BRIGHT
ENGINEERING & PLANNING CONSULTANTS
10105 KRAUSE ROAD, SUITE 100
CHESTERFIELD, VIRGINIA 23832
PHONE: 804-768-6878 FAX: 804-768-6871

PHASE III

- A terminal expansion
- A 6-Unit T-Hangar building

ULTIMATE PHASE

- A 993’ runway and parallel taxiway extension
- A 13,900 square yard apron
- Three 100’ x 150’ corporate hangars

3.7.2 Development Alternative 2

Development Alternative 2 is depicted on **Exhibit 3-2**. The facilities included in this alternative are listed below by phase.

PHASE I

- A 6,500 square yard apron expansion
- 8 Box Hangars
- A 4-Unit T-Hangar Expansion
- A 7-Unit T-Hangar Expansion
- A connector taxilane adjacent to T-Hangar #3

PHASE II

- Auto parking expansion
- A 6,000 square yard apron expansion
- An 8-Unit T-Hangar building

PHASE III

- A 2,000 square foot terminal expansion
- Two 8-Unit T-Hangar buildings

ULTIMATE PHASE

- A 993’ runway and parallel taxiway extension
- A 13,900 square yard apron

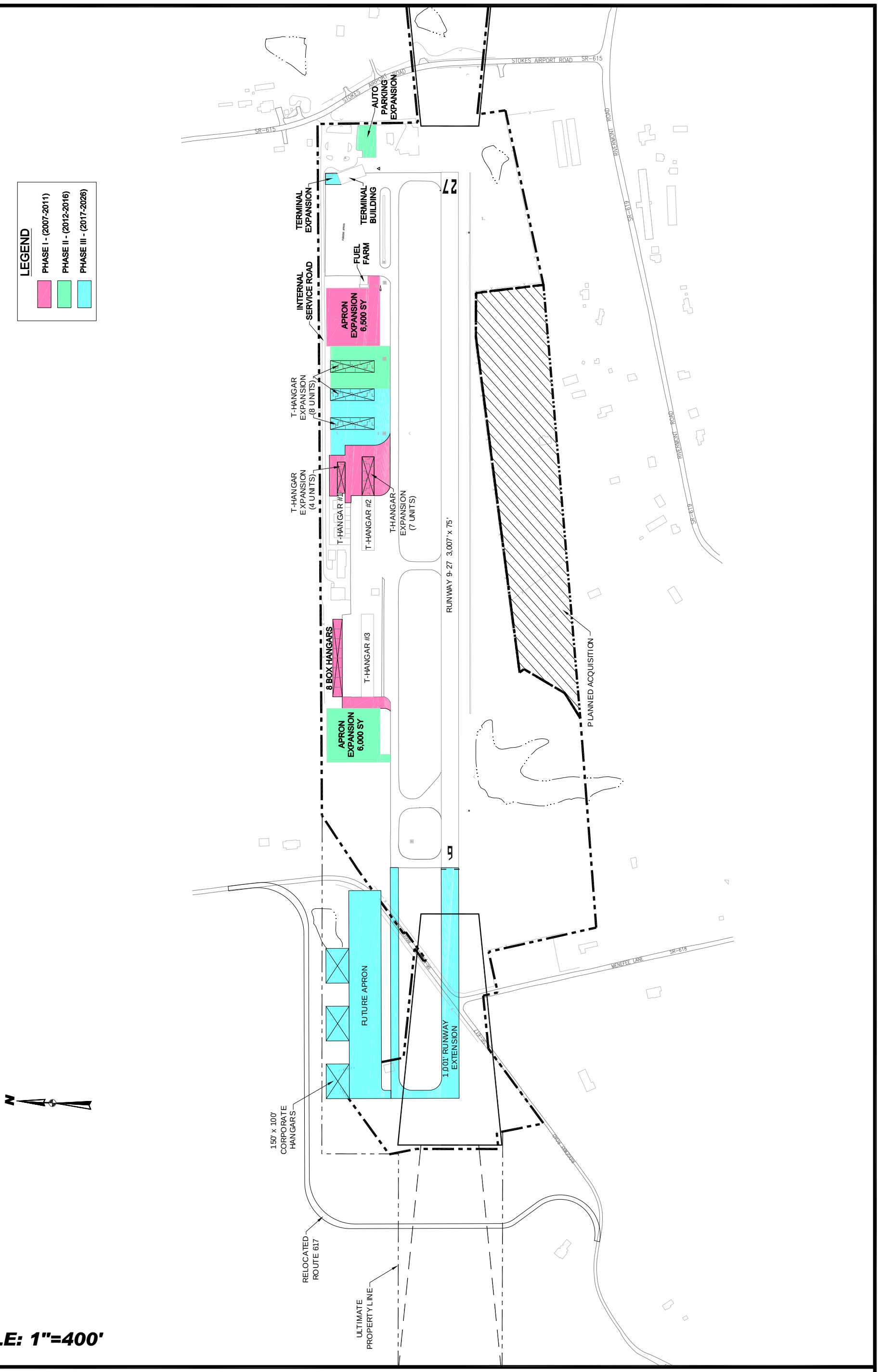


Exhibit 3-2
Front Royal-Warren County Airport

Development Alternative 2

TALBERT & BRIGHT
ENGINEERING & PLANNING CONSULTANTS
10105 KRAUSE ROAD, SUITE 100
CHESTERFIELD, VIRGINIA 23832
PHONE: 804-768-6878 FAX: 804-768-6871

- Three 100’ x 150’ corporate hangars

3.7.3 Development Alternative 3

Development Alternative 3 is depicted on **Exhibit 3-3**. The facilities included in this alternative are listed below by phase.

PHASE I

- A 6,500 square yard apron expansion
- 8 Box Hangars
- A 4-Unit T-Hangar Expansion
- A 7-Unit T-Hangar Expansion
- A connector taxilane adjacent to T-Hangar #3

PHASE II

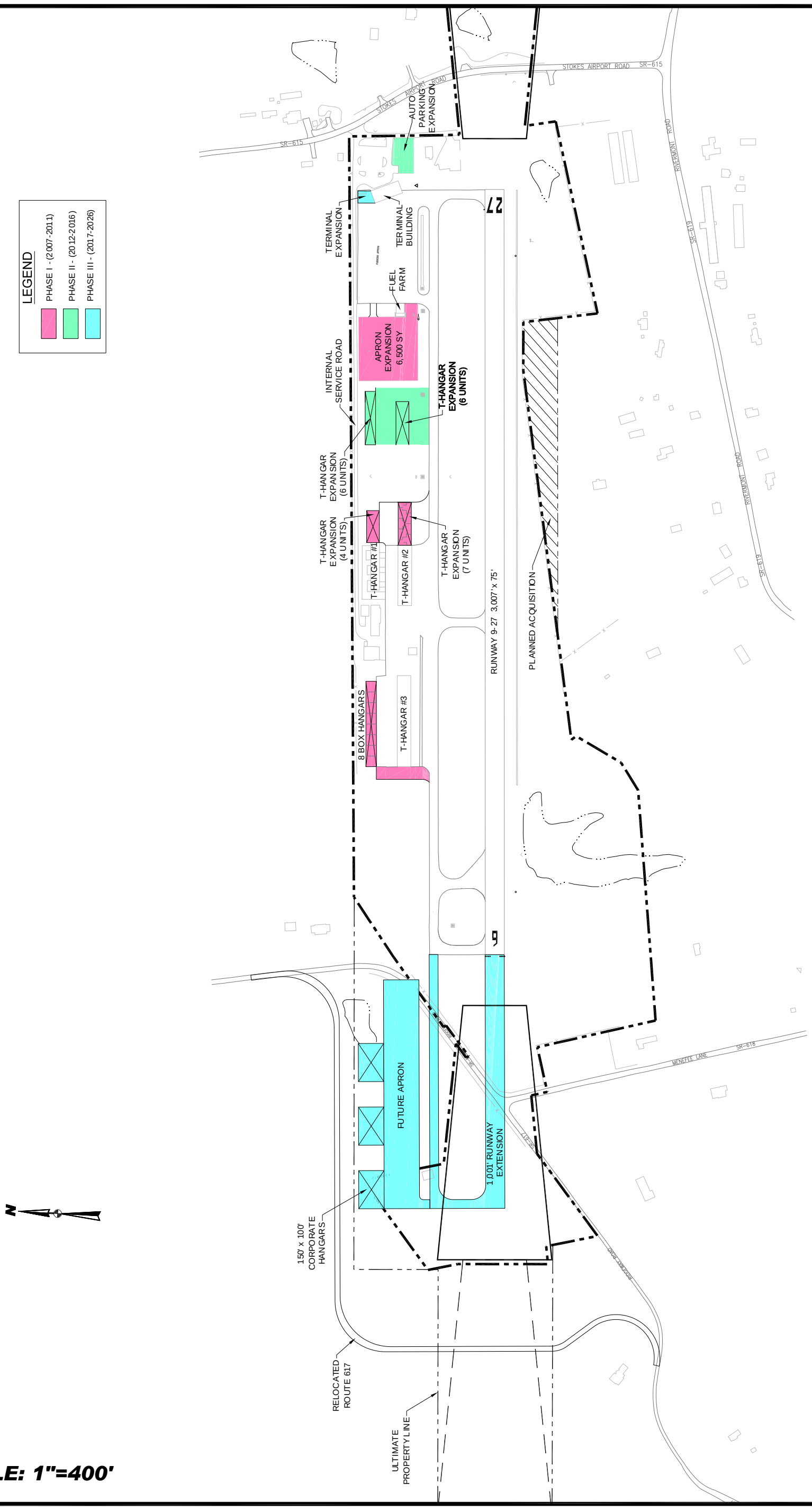
- Auto parking expansion
- Two 6-Unit T-Hangar buildings

PHASE III

- A 2,000 square foot terminal expansion

ULTIMATE PHASE

- A 993’ runway and parallel taxiway extension
- A 13,900 square yard apron
- Three 100’ x 150’ corporate hangars



SCALE: 1"=400'

Exhibit 3-3
Front Royal-Warren County Airport

Development Alternative 3

TALBERT & BRIGHT
ENGINEERING & PLANNING CONSULTANTS
10105 KRAUSE ROAD, SUITE 100
CHESTERFIELD, VIRGINIA 23832
PHONE: 804-768-6878 FAX: 804-768-6871

3.7.4 Development Alternative 4

Development Alternative 4 is depicted on **Exhibit 3-4**. The facilities included in this alternative are listed below by phase. This alternative is identical to Alternative 3 but does not include the runway extension and associated facilities.

PHASE I

- A 6,500 square yard apron expansion
- 8 Box Hangars
- A 4-Unit T-Hangar Expansion
- A 7-Unit T-Hangar Expansion
- A connector taxilane adjacent to T-Hangar #3

PHASE II

- Auto parking expansion
- Two 6-Unit T-Hangar buildings

PHASE III

- A 2,000 square foot terminal expansion

3.7.5 Recommended Development Alternative

The development alternative which is recommended for the future of the Front Royal-Warren County Airport is Alternative 3. The primary difference between Alternatives 1 and 2 is the layout of the proposed T-Hangars. Alternative 3 keeps these proposed hangars in-line with the existing buildings while allowing for apron expansion and necessary drainage improvements at midfield. The facilities outlines in Alternative 3 will meet the current and forecast 20-year aviation demand at the Airport.

As mentioned previously, Alternative 3 and 4 differ in the presence or absence of the proposed runway extension and associated facilities. In February, 2009, the Warren County Board of Supervisors voted to incorporate Alternative 3 on the Airport Layout

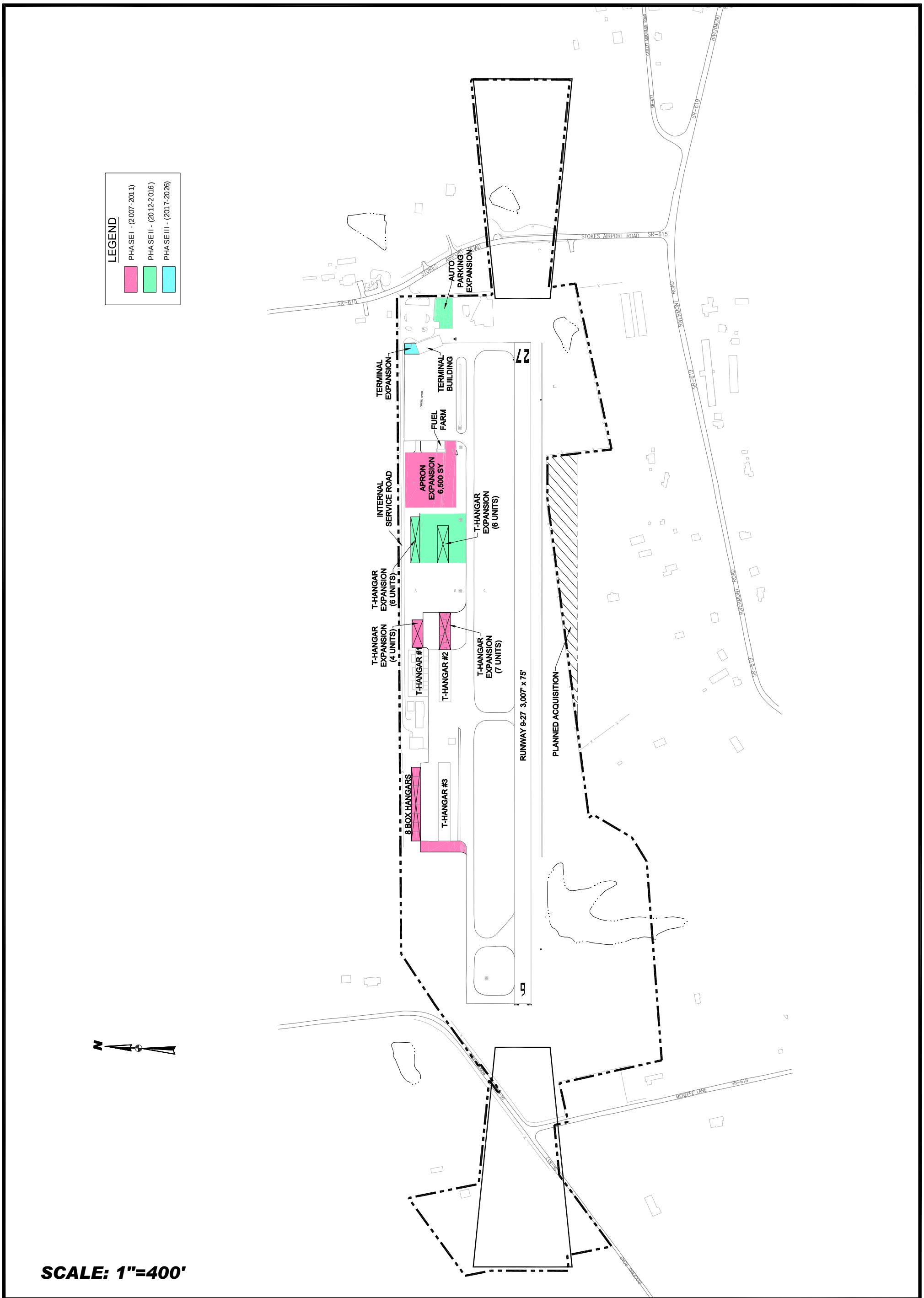


Exhibit 3-4
Front Royal-Warren County Airport

Development Alternative 4

TALBERT & BRIGHT
ENGINEERING & PLANNING CONSULTANTS
10105 KRAUSE ROAD, SUITE 100
CHESTERFIELD, VIRGINIA 23832
PHONE: 804-768-6878 FAX: 804-768-6871

Plan over Alternative 4 and keep the 993' runway extension as part of the County's long-term plan. This future runway extension was moved to the ultimate phase. Alternative 3 originally depicted this extension in Phase III. All of the other proposed facilities shown in Alternative 3 have been added to the Airport Layout Plan. The ALP Set includes:

- Cover Sheet
- Airport Layout Plan Sheet
- Terminal Area Plan
- Airport Airspace / Land Use Drawing (CFR Part 77)
- Inner Approach Surface Drawing
- Inner Approach Obstructions Table
- Airport Property Map

3.8 DEVELOPMENT PHASING AND COST ESTIMATES

The final step in updating the Airport Layout Plan is to determine the appropriate project phasing and order of magnitude cost estimates for the proposed airport facilities. The project phasing was determined by the facilities needed each year from the facility requirements section. A total order of magnitude cost estimate was then determined for each of the proposed facilities. **Table 3.18** depicts the proposed development facilities, phasing, and project costs. These costs include all engineering, administrative, and environmental/permitting fees. The T-Hangar projects will be developed with local funds and include the total cost for the development of these facilities, which have been noted as turnkey facilities.

The total cost estimates were broken down into current funding source levels between the FAA, Virginia Department of Aviation, and Local share. The Airport Leases column represents costs which will require 100% local share. It is anticipated that these costs could be offset by the current and future airport leases for these facilities. The Airport would recoup these development costs with the leasing of these facilities.

Table 3.18
Airport Development Cost Estimates and Funding Sources

Facility	Phase	Total Cost	Funding Source			
			FAA (95%)	State (3%)	Local (2%)	Airport Leases
Land Acquisition Services (Obstructions)	I	$40,000	$38,000	$1,200	$800	-
Acquire Land (Obstructions)	I	$360,000	$342,000	$10,800	$7,200	-
Obstruction Removal Design	I	$30,000	$28,500	$900	$600	-
Obstruction Removal Construction	I	$135,500	$128,725	$4,065	$2,710	-
Runway Number Remarking Design/Bidding	I	$3,000	-	$2,400	$600	-
Runway Number / Striping Remarking	I	$10,000	-	$8,000	$2,000	-
Access Control / Fencing / Security Improvements Design	I	$30,000	-	$24,000	$6,000	-
Access Control / Fencing / Security Improvements Construction	I	$60,000	-	$48,000	$12,000	-
Taxiway Reflectors Design	I	$5,000	$4,750.00	$150	$100	-
Taxiway Reflectors Construction / Bidding	I	$7,000	$6,650.00	$210	$140	-
Apron Expansion Construction	I	$300,000	$285,000	$9,000	$6,000	-
One 4-Unit T-Hangar Construction (Turnkey)	I	$150,000	-	-	-	$150,000
One 7-Unit T-Hangar Construction (Turnkey)	I	$250,000	-	-	-	$250,000
One 8-Unit Box Hangar Construction (Turnkey)	I	$275,000	-	-	-	$275,000
Runway Overlay	II	$300,000	$285,000	$9,000	$6,000	-
REIL / PAPI Lights Design	II	$20,000	$19,000	$600	$400	-
REIL / PAPI Lights Construction / Bidding	II	$50,000	$47,500	$1,500	$1,000	-
AWOS / GCO Design	II	$15,000	$14,250	$450	$300	-
AWOS / GCO Construction / Bidding	II	$50,000	$47,500	$1,500	$1,000	-
Apron / Fuel Farm Expansion Design / Bidding	II	$30,000	$28,500	$900	$600	-
Apron Expansion / Fuel Farm Construction / Relocation	II	$170,000	$161,500	$5,100	$3,400	-
Terminal / Auto Parking Expansion Design	II	$50,000	-	$40,000	$10,000	-
Terminal Expansion Construction / Bidding	II	$250,000	-	$200,000	$50,000	-
Auto Parking Expansion Construction / Bidding	II	$70,000	-	-	$70,000	-

Airport Master Plan	II	$70,000	$66,500	$2,100	$1,400	-
Two 6-Unit T-Hangars (Turnkey)	II	$450,000	-	-	-	$450,000
SWPPP / SPCC Update	II	$20,000	$19,000.00	$600.00	$400.00	-
Airport Access Road Resurfacing	III	$40,000	-	$32,000.0	$8,000.0	-
Runway/Taxiway EA/Permitting	Ult.	$150,000	$142,500	$4,500	$3,000	-
Land Acquisition / Obstruction Removal Services (Runway Extension)	Ult.	$50,000	$47,500	$1,500	$1,000	-
Acquire Land / Remove Obstructions (Runway Extension)	Ult.	$1,000,000	$950,000	$30,000	$20,000	-
Runway/Taxiway Extension Design / Bidding	Ult.	$70,000	$66,500	$2,100	$1,400	-
Runway/Taxiway Extension Construction (includes lighting)	Ult.	$10,730,000	$10,193,500	$321,900	$214,600	-
Three Corporate Hangars/Apron Design (Turnkey)	Ult.	$70,000	-	-	-	$70,000
Three Corporate Hangars/Apron Construction (Turnkey)	Ult.	$1,130,000	-	-	-	$1,130,000
Total		**$16,440,500**	**$12,922,375**	**$762,475**	**$430,650**	**$2,325,000**

Source: *Talbert & Bright Analysis*

The total airport development costs over the 20-year planning period are projected to be roughly $16.1 million. This represents a planning-level approximation of the development costs and could increase or decrease depending upon the exact size, location, and development year of the facilities.

4.0 INTRODUCTION

As part of the Front Royal-Warren County (FRR) Airport Layout Plan Update, a desktop environmental overview was performed on the proposed airport development The purpose of this environmental overview is to screen the proposed development for any potential adverse environmental impacts. The desktop environmental overview does not include field work or site surveys and relies on existing environmental information to determine impacts. A full environmental assessment will be conducted including site surveys before any of the proposed facilities are constructed. The overview includes the same environmental categories that will be addressed in the environmental assessment. Potential environmental impacts are listed for each category below. Every effort has been made to ensure the accuracy of this overview given the limitations of available information.

4.1 NOISE

To achieve airport-environs compatibility, minimizing aircraft noise impacts on areas surrounding the airport is important. Noise is simply unwanted sound. Aircraft noise is perceived differently by different individuals. However, concerns about aircraft noise are often reflections of the degree to which aircraft noise intrudes on existing background noise. In general, where ambient noise is low, aircraft noise is perceived as a problem. For example, in an urban area, noise generated by aircraft is muffled by noise generated by traffic and industry. Each community must decide whether noise related land use controls around their airport should be limited to substantially noise-impacted areas, or if they see a need to control land use in areas impacted by more moderate noise levels.

Historically, airports were constructed on the outskirts of communities. Aircraft noise was not a problem since the airport was located at a significant distance from developed areas. Through the years, development has often expanded toward the airport. As communities have expanded toward an airport, land uses that are sensitive to noise have

developed closer to the airport. In many areas, residential development and other high density development is now occurring near airports. Coupled with increases in air traffic volumes, the potential for noise problems related to land use in the airport environs has intensified in recent years. Inappropriate development approved near airports increases the perceived impact of aircraft noise.

Noise impacts around an airport are greatly influenced by various factors. Factors affecting an airport's noise impact include the number of aircraft operations and the type of aircraft using the airport. In addition, each airport is different in geographical location, size, role, airfield layout, and its patterns of surrounding land use. Thus, each airport may have its own particular noise problem that requires solutions tailored to that specific airport site.

Noise impact areas for an airport are identified by noise contours. The basic methodology employed to define aircraft noise levels involves the use of a mathematical model: the Federal Aviation Administration's (FAA) Integrated Noise Model (INM). The INM contains a database that relates slant range distance and engine thrust to noise levels related to each specific type of aircraft. The goal of the model is to compute the location and size of contours and display them graphically and textually. On an irregular grid around the airport, the Model computes the associated noise exposure level for the specific aircraft and engine thrust used at that point along the aircraft route of flight. The individual noise exposure levels are summed for each on a map of the airport and its environs. Although lines on a map tend to be viewed as definitive, it should be emphasized that the Model is only a planning tool. By developing a set of noise contours for an airport, a planner identifies areas that are most likely to be impacted by aircraft noise, and plan accordingly.

A noise analysis was conducted using the 2026 forecast annual operations and aircraft mix. The results of this analysis are shown in **Exhibit 4-1**. The 65 db DNL noise contour is contained to the Airport property which is in accordance with FAA

recommendations. The following assumptions were used for developing the noise contours:

- 40% of operations are conducted on Runway 9
- 60% of operations are conducted on Runway 27
- 5% of the operations occur at night
- 34.3% of the operations are Touch and Go operations
- A left traffic pattern was used for both runway ends
- The aircraft used included: Single Engine Piston – fixed & variable pitch prop, Multi-Engine Piston – Beech 58, Turboprop – dehavilland Twin Otter, Jet – Cessna Citation, Helicopter – Bell 206.
- The approach and departure track consist of straight in and out operations.

Exhibit 4-2 illustrates various noise producing elements in decibels (dB). Note that airport noise falls between ordinary conversation and garbage disposal noise level. **Table 4.1** shows common general aviation aircraft sounds levels.

Exhibit 4-1
Ultimate Noise Contours

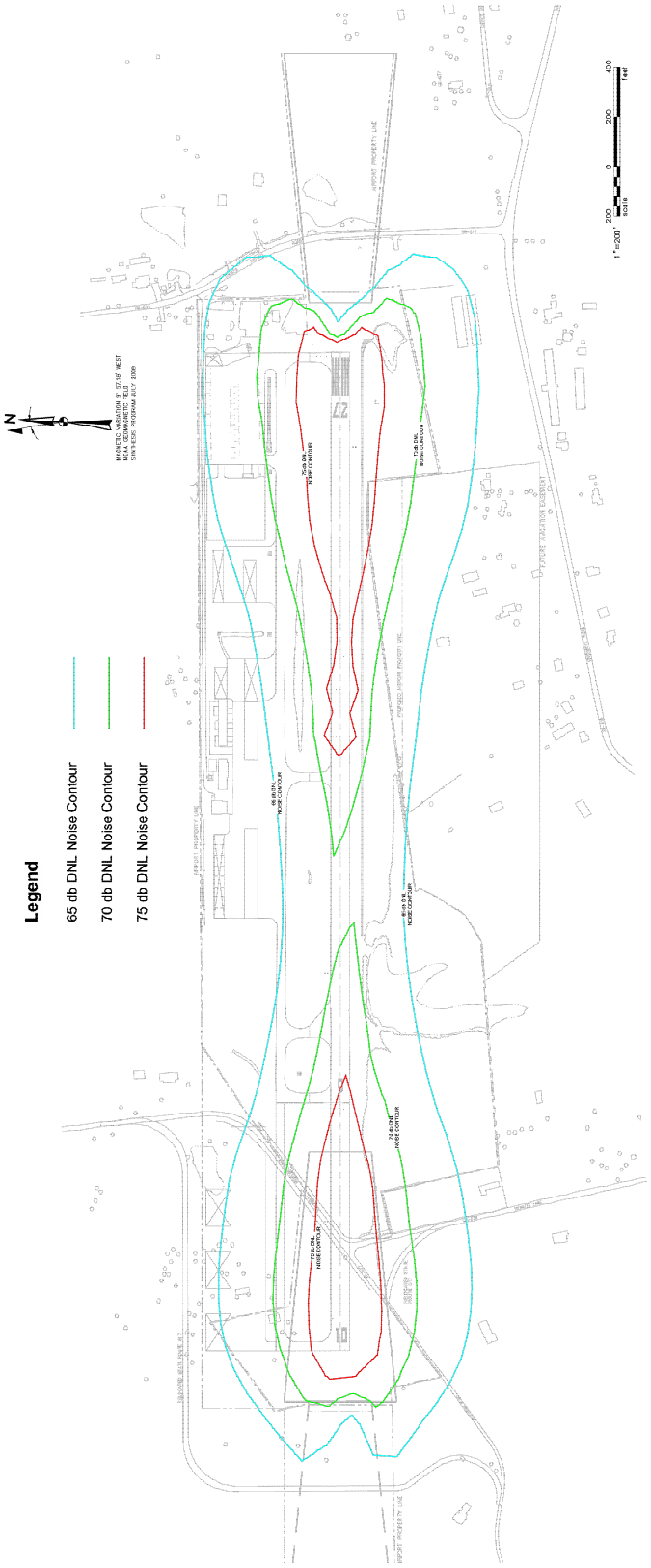


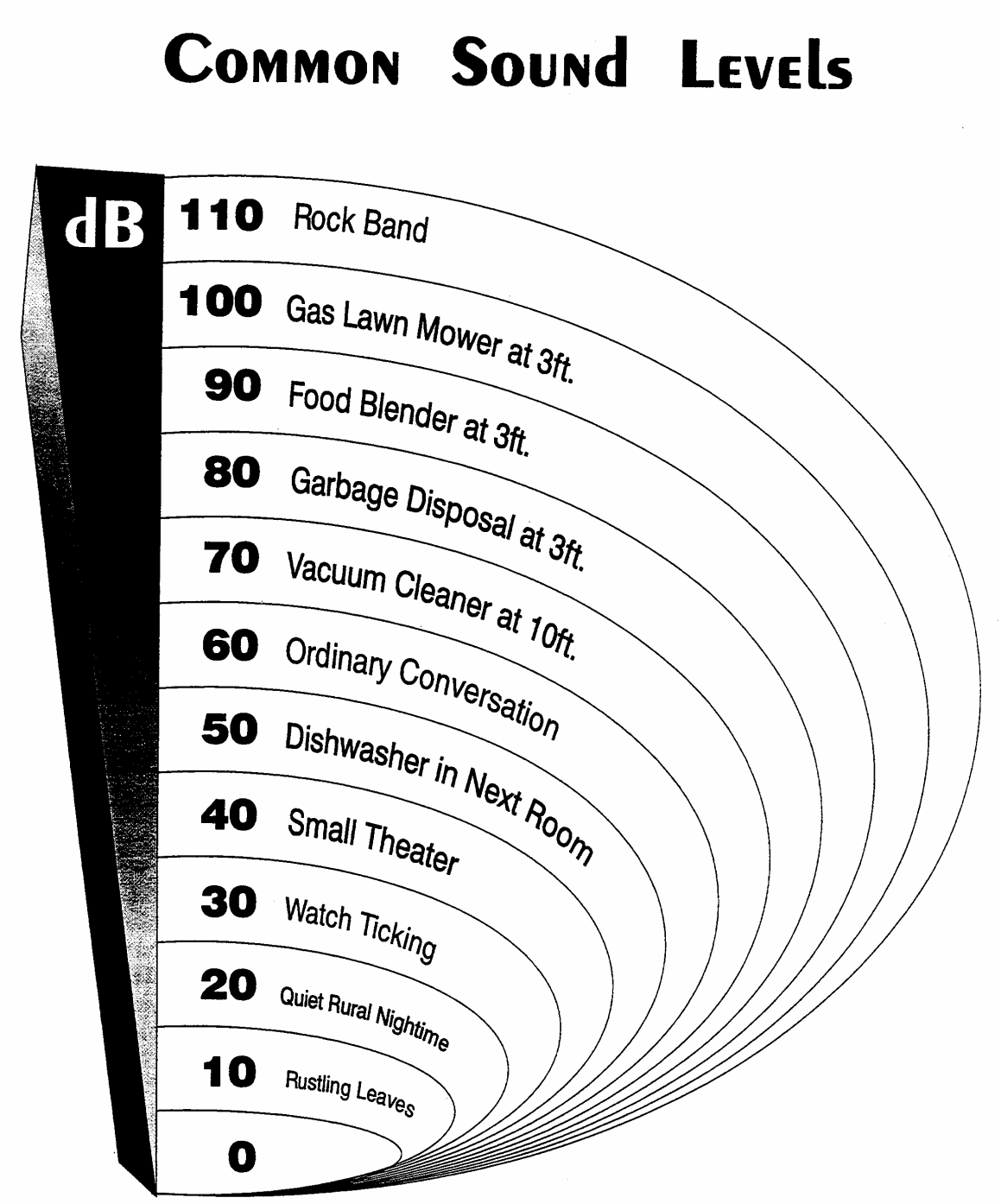
Table 4.1
Common G.A. Aircraft- Estimated Departure Sound Levels

Manufacturer	Airplane	Estimated Db
Gulfstream	G-II	84
Beech	B36TC Bonanza	71
Cessna	Citation III	70
Beech	Super King Air 200	68
Piper	PA-44-180	62
Piper	PA-30 Twin Comanche	56

Source: FAA AC 36-3F; Noise level estimates are provided in FAR Part 36

The FAA has established guidelines for land use compatibility in and around airports in Code of Federal Regulations (CFR) Part 150, Airport "Noise Compatibility Planning." The FAA's Integrated Noise Model (INM) is the recognized program for calculating the day-night average sound level (DNL) of aircraft noise. The DNL is the 24-hour average sound level in decibels. In general, the FAA has said that residential land uses are not

Exhibit 4-2


COMMON SOUND LEVELS
dB
110 Rock Band
100 Gas Lawn Mower at 3ft.
90 Food Blender at 3ft.
80 Garbage Disposal at 3ft.
70 Vacuum Cleaner at 10ft.
60 Ordinary Conversation
50 Dishwasher in Next Room
40 Small Theater
30 Watch Ticking
20 Quiet Rural Nightime
10 Rustling Leaves
0

compatible with DNL values above 65. As a reference, the following table presents the FAA guidelines for airport noise and compatible land use. **Table 4.2** shows the FAA guidelines for sound levels and compatible land uses.

Table 4.2
FAA Guidelines for Airport Sound Levels and Compatible Land Uses

Land Uses Sound Level	**Yearly Day-Night Average (DNL) In Decibels**		
	55-65	65-70	70-75
RESIDENTIAL			
Residential, other than mobile homes, transient lodgings	Y	N	N
Mobile home parks / Mobile homes	Y	N	N
Transient lodgings (motels, hotels)	Y	N	N
PUBLIC USE			
Schools	Y	N	N
Churches, auditoriums, concert halls, hospitals, nursing homes	Y	25	30
Governmental services	Y	Y	25
Transportation / Parking	Y	Y	Y
COMMERCIAL			
Offices-business and professional	Y	Y	25
Wholesale/retail-materials, hardware and farm equipment	Y	Y	Y
Retail trade-general	Y	Y	25
Utilities	Y	Y	Y
Communications	Y	Y	25
MANUFACTURING			
Manufacturing-general	Y	Y	Y
Photographic and optical	Y	Y	25
Agriculture (except livestock) and forestry	Y	Y	Y
Livestock farming and breeding	Y	Y	Y
Mining and fishing, resource production and extraction	Y	Y	Y
RECREATIONAL			
Outdoor sports arenas/spectator sports	Y	Y	Y
Outdoor music shells, amphitheaters	Y	N	N
Nature exhibits and zoos	Y	N	N
Amusement parks, resorts, camps	Y	Y	Y
Golf courses, riding stables, water recreation	Y	Y	25

Note: 25, 30, 35- Land Uses and related structures are generally compatible with these noise levels, but measures to achieve a DNL of 25, 30, 35 must be incorporated into the design and construction of the structure.
Source: *14 CFR Part 150, Appendix A, Table 1.*

Noise contours were developed based on the 2026 future forecast operations level at the Airport. This represents the anticipate noise impact at the end of the planning period.

Table 4.3 depicts the forecast operations by type of aircraft. The 2026 operations were used for modeling the noise contours.

The 65 DNL contour is located within the airport boundary and thus, noise is not expected to become an environmental concern for the Airport over the next 20 years. It is recommended however that noise abatement procedures be used whenever practical to reduce the impact on the surrounding residences.

Table 4.3
Operations Forecast by Aircraft Type

	2006	2011	2016	2026
Single Engine Piston (SEP)	12,899	16,030	18,352	24,364
Multi-Engine Piston (MEP)	663	1,048	1,707	2,681
Turboprop (TP)	0	0	608	2,141
Turbojet (TJ)	0	0	260	359
Helicopter	0	1,182	1,568	2,455
Other	4,887	5,816	6,438	7,882
Total	**18,449**	**24,076**	**28,933**	**39,882**

Source: *Campbell and Paris, P.C.*

4.2 LAND USE

Compatible land use is an important factor when determining the impact of airport development. The land currently located around the Front Royal-Warren County Airport is designated as agricultural while the airport property is designated industrial. Low density residential areas are located approximately 1,000 feet south of the Airport. There are a number of homes located within the surrounding agricultural area. These homes are not clustered and fall within the definition of agricultural land use. Medium to high density residential communities are generally considered not compatible with airport operations. This is due mainly to the noise produced at the airport.

The proposed ultimate phase runway extension will include the addition of airport property which should also be designated as industrial. Warren County should endeavor

to maintain the area surrounding the Airport as agricultural and limit the development of this area with non-airport compatible uses.

4.3 SOCIAL IMPACTS

The assessment of social impacts involves looking at changes in population, or the business and economic environment that can be indirectly attributed to the airport. No major population shifts or changes are anticipated due to the development of the Front Royal-Warren County Airport. The additional development of the Airport should serve as a catalyst for the attraction of industry and the creation of more employment opportunities for the Front Royal area.

An important consideration is that the proposed runway extension may involve the relocation of two residences. These homes are located along the extended runway centerline and would be relocated so that the runway extension and RPF could be constructed to meet FAA design requirements. While not a specific social impact, these relocations may adversely impact the homeowners. Any relocations would be conducted under the Uniform Relocation Assistance and Real Property Acquisition Policies Act. The impact of any relocation will be determined as part of the environmental assessment.

4.4 INDUCED SOCIOECONOMIC IMPACTS

The assessment of socioeconomic impacts involves observing changes in population, or the business and economic environment that can be indirectly attributed to the development and operation of FRR. No major population shifts or changes are anticipated.

Airport development should serve as a catalyst for the attraction of industry and the creation of employment opportunities in the Front Royal area. Limited and gradual population changes may occur in the future due to these added employment opportunities.

4.5 AIR QUALITY

Air quality has become an environmental area of concern relating to airport operations and activity. The primary pollutants associated with airport operations include: ozone (O_3), carbon monoxide (CO), particulates (PM-10), sulfur dioxide (SO_2), nitrogen oxides (NO_X), and lead (Pb).

The U.S. Environmental Protection Agency regulates and monitors air quality standards throughout the U.S. Warren County is currently considered in "attainment" as air quality standards are being maintained. The proposed airport development is not expected to adversely impact air quality in the region and prohibit Warren County from continuing to meet air quality attainment status. A more detailed air quality review will be conducted as part of the environmental assessment to determine air quality levels regarding state and federal guidelines.

4.6 WATER QUALITY

The Clean Water Act provides the authority to establish water quality standards, control discharges into surface and subsurface waters, and develop waste treatment management plans. Water quality should not be adversely impacted provided that standard erosion and sediment controls are used during construction and that appropriate water quality and quantity controls are installed. All storm water controls will be put into place during construction and will be maintained. This will help maintain water quality levels necessary before being discharged into local streams and tributaries.

All construction on the airport will include provisions for sediment and erosion control. Control measures to be considered include detention basins, sediment traps, silt fence, etc. Additional provisions should be made for the control of fuel spills and waste water from aircraft and automobile washing. An erosion and sediment control plan should be an integral part of every major development project. This will include a Storm Water Pollution Prevention Plan (SWPPP) and a Spill Prevention Control and Countermeasures (SPCC) plan. Disturbed areas should be re-seeded as soon as practical to minimize

potential erosion. All required erosion and water quality permits must be obtained from the appropriate federal, state, and local agencies.

4.7 DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(f)

Department of Transportation Section 4(f) states that: "It is hereby declared to be the national policy that special effort should be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites." There are no parks, recreation lands or waterfowl refuges that will be impacted by the proposed development of the Airport. Wildlife and historic sites are addressed in other sections of this report.

The proposed runway/taxiway extension and ultimate Hangars/Apron involves the purchase of private land and relocation of approximately two residences. These homes are located along the extended runway centerline, approximately 2.000 feet from the existing Runway 27 end. These relocations will be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Act. Fair Market Value will be paid to all landowners whose property is required for the airport.

4.8 HISTORIC, ARCHITECTURAL, ARCHEOLOGICAL, AND CULTURAL RESOURCES

The National Historic Preservation Act of 1966, as amended, and the Archaeological and Historic Preservation Act of 1974 are the two laws that establish the requirements for determining historic, architectural, archaeological, and cultural resource significance within the airport environs. Two basic provisions apply:

An initial review should be made to determine if any properties in, or eligible for, inclusion in the National Register of Historic Places are within the area of the proposed development.

The second provision provides for the survey, recovery, and preservation of significant scientific, prehistorical, historical, archeological, or paleontological data when such data may be destroyed or irreparably lost due to a federally licensed or funded project.

The database of the National Register of Historic Resources was reviewed with respect to Warren County. Currently there are ten (10) historical sites in Warren County that are listed on the National Register of Historic Places. None of these sites are located near the Airport and would not be impacted by the proposed airport development.

4.9 BIOTIC COMMUNITIES

Biotic Communities are those which contain species dependent upon one another in a given area. The biotic communities of Warren County consist primarily of forests and pastures. The U.S. Fish & Wildlife Service provides biotic community data. The biotic communities most likely to be impacted by the proposed airport development include a mix of upland forest and pasture grasses.

Any disturbances to biotic communities will be mitigated through on or off airport site measures prior to facility construction.

4.10 ENDANGERED AND THREATENED SPECIES OF FLORA AND FAUNA

Endangered and threatened species of flora and fauna are protected by the U.S. Fish & Wildlife Service and the National Resources Conservation Service (NRCS). A detailed site investigation will be conducted as part of the environmental assessment process.

A number of federal endangered species of flora and fauna are located in Virginia. The environmental assessment site evaluation will determine the location and existence of any potential federal or state endangered or threatened species of flora which may be impacted by any of the proposed airport development.

4.11 WETLANDS

Wetlands are defined by the Clean Water Act as "those areas that are inundated or saturated by surface or ground water 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, marches, bogs, and similar areas."

A desktop review of existing wetlands in Warren County was conducted for this Study. A detailed wetland field survey will be conducted as part of the Environmental Assessment of the ultimate runway extension.

The areas to be impacted by the proposed airport development are located in upland areas and do not appear to contain wetlands. A dry Stormwater retention pond located on the north side of the Airport at midfield, will not be impacted by the proposed hangar development. This Stormwater management facility meets the FAA requirements set forth in AC 150/5200-33B "Hazardous Wildlife Attractants on or near Airports".

4.12 FLOODPLAINS

Floodplains are defined in Executive Order 11988, Floodplain Management as, "…the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year;" i.e., the area that would be inundated by a 100-year flood.

The Flood Insurance Rate Maps (FIRM) were examined for the Front Royal area. The 100 and 500 year floodplain maps were researched as part of the floodplain determination. The Airport is not located near either the 100 or 500 year floodplains in Warren County. Thus, the proposed airport development will not impact nor be impacted by these floodplains. The majority of the floodplains are located along larger rivers and lakes within the county.

4.13 COASTAL ZONE MANAGEMENT PROGRAM AND COASTAL BARRIERS

The Virginia Coastal Resources Management Area encompasses 29 counties and creates Virginia's Tidewater Area. Warren County is not located in this area and thus, no coastal zone management concerns exist regarding the proposed development at the Airport.

4.14 WILD AND SCENIC RIVERS

The National Wild and Scenic Rivers System designates rivers for preservation throughout the U.S. There are currently no designated wild and scenic rivers in Virginia and therefore not applicable to the proposed development of the Front Royal-Warren County Airport.

4.15 FARMLAND

The Farmland Protection Policy Act (FPPA) Pubic Law 97-98 authorized the Department of Agriculture to develop criteria pertaining to the conversion of farmlands to non-agricultural use. A Farmland Impact Conversion Rating is determined by the National Resources Conservation Service (NRCS) through site evaluation to determine project compatibility with existing agricultural use.

The proposed runway extension will impact an area of cleared and wooded land. The cleared area is not currently being farmed. A detailed assessment of the prime farmland areas will be conducted as part of a full Environmental Assessment for the proposed runway extension.

The Virginia Department of Agriculture and Consumer Services has developed a program to recognize the farms which have been operated and owned by one family for 100 consecutive years or more. This program, known as the Virginia Century Farm Program, was developed to honor these farms for their achievement and contribution to the community. There are three Century Farms located in Warren County with the

closest one located approximately 3 miles south east of the Airport. None of these farms will be impacted by the proposed development at the Airport.

4.16 ENERGY SUPPLY AND NATURAL RESOURCES

Energy supply is an important consideration when considering additional airport development. Additional electric capacity must exist or be planned for. The energy required to accommodate the proposed airport development is not expected to have an adverse impact on energy supply or natural resources within Warren County.

4.17 LIGHT EMISSIONS

Due to the relative size and operational level of the Airport, light emissions from the proposed development are not expected to adversely impact the surrounding area. There are currently no approach lighting systems at the Airport, nor are any envisioned for the planning period. These systems involve brighter lights than normal medium intensity runway lights and can be a nuisance for surrounding neighbors.

It is recommended that any apron or flood lighting that would be added to the proposed hangars be installed on a timed circuit so that the lights are only lit when needed by airport users. Light emission impacts can be mitigated if needed by light shielding. A tree buffer exists to the north and south side of the runway which limits the impact of lights on the surrounding neighbors. All proposed lighting will meet local light emission requirements.

4.18 SOLID WASTE IMPACTS

The generation of solid waste due to the additional development of the Airport is not anticipated to create adverse problems for Front Royal or Warren County. All solid waste generated at the Airport will be transported to the Warren County Sanitary Landfill which is located approximately 5 miles south of the Airport. Hazardous waste generated by the Airport will be disposed of properly and in accordance with all local, state, and federal regulations.

4.19 CONSTRUCTION IMPACTS

All construction impacts associated with the new Airport will be temporary and minimized through the use of appropriate controls. These impacts may include noise, dust generation, traffic disruptions, and air and water quality impacts. All airport construction will be accomplished in accordance with FAA AC 150/5370-10A, Standards for Specifying Construction of Airports, and Item P-165, Temporary Air and Water Pollution, Soil Erosion and Siltation Control.

All local, state, and federal guidelines regarding airport construction will be followed. Therefore adverse impacts due to airport construction are not anticipated.

4.20 ALP UPDATE SUMMARY

The Front Royal-Warren County Airport Layout Plan Update documents the exiting and proposed airport facilities and serves as a road map for the airport sponsor to develop the airport in accordance with federal, state, and local requirements. The proposed facilities were determined via the forecast of aviation demand over the next 20 years. As the Airport grown and continues to develop, it will be necessary to revisit the ALP and revise not only the aviation demand levels, but also the future facility recommendations. This ALP then serves as a "living document" which changes along with industry trends and the goals and objectives of the sponsor.

Appendix A
Glossary/Acronyms

GLOSSARY/ACRONYMS

TERMS:

Advisory Circular (AC): A series of external FAA publications consisting of all non-regulatory material of a policy, guidance, and informational nature.

Air Cargo: All commercial air express and air freight with the exception of air-mail and air parcel post.

Air Carrier: A commercial operator providing for the transport of passengers or property by aircraft for compensation or hire utilizing aircraft with greater than 30 seats and certificated in accordance with Federal Aviation Regulations (FAR) Parts 121 or 127.

Aircraft Mix: The numerical or percentage breakdown of aircraft into categories based on aircraft engine and weight.

Aircraft Operation: Any aircraft arrival or departure including touch-and-go operations.

Aircraft Type: A distinctive model of aircraft, as designated by the manufacturer.

Airline: A scheduled air carrier certificated by the Federal Aviation Administration under Part 121 of the Federal Aviation Regulations.

Airline Operations: Takeoffs and landings performed by aircraft operated by Part 121 or 127 airlines on scheduled and non-scheduled flights.

Airport: A landing area regularly used by aircraft for receiving or discharging passengers or cargo.

Airport Service Area: The geographic area that generates demand for aviation services at an airport.

Airport Surveillance Radar (ASR): A navigation instrument used to control air traffic within the immediate airport traffic areas.

Airspace: The area above the ground in which aircraft travel. It is divided into corridors, routes, and restricted zones for the control and safety of traffic.

Air Taxi: The transport of people or property for compensation or hire by a commercial operator (not an air carrier) in an aircraft having a maximum seating capacity of 30 or less and certified under Federal Aviation Regulations Part 135.

Ambient: The sum total of existing environmental conditions for any given impact category.

Ambient Air Quality: The existing quality of the air.

Aquatic: Growing or living in or upon water.

Approach Surface: An imaginary inclined surface longitudinally centered on the extended centerline of a runway, extending outward and upward from the runway. It has a shallower gradient than the corresponding glide slope.

Apron: An area on an airport designated for the parking, loading, fueling, or servicing of aircraft.

Aviation Easement: A form of limited property right purchase that establishes legal land-use control prohibiting incompatible development of areas required for airports or aviation-related purposes.

Based Aircraft: Aircraft permanently stationed or having a long-term agreement to reside at the Airport.

Beacon: See rotating beacon.

Biotic Community: Recognizable assemblages of vegetation and wildlife organisms generally functioning as a unit.

Building Restriction Line (BRL): An imaginary line that identifies suitable building area locations on airports. The BRL is also dependent upon the Runway Visibility Zone (RVZ) and ATCT line-of-sight capabilities.

Capacity: The airport operating level, expressed as the number of aircraft movements that can occur at an airport over a specified time period.

Circling Approach: A descent used in an approved procedure to an airport for a circle to land maneuver.

Commercial Aviation: Aircraft activity licensed by state or federal authority to transport passengers and/or cargo on a scheduled or non-scheduled basis.

Community: A city, group of cities, or a Metropolitan Statistical Area receiving scheduled air service by a certificated route air carrier at an airport.

Commuter Airline: Commercial operators that operate aircraft with a maximum of 60 seats, and that provides scheduled service, or that carriers mail; commuters may be either air taxis or certified air carriers.

Condemnation: Proceedings under which a property interest may be forcibly acquired; government may condemn land through the power of eminent domain; an individual may apply inverse condemnation to obtain just compensation for a property interest taken by government without prior agreement.

Conical Surface: A surface extending outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet and extending to a height of 350 feet above the airport elevation.

Critical Aircraft: The most demanding category or family of aircraft that performs 500 annual itinerant operations at an airport (Also referred to as the design aircraft).

Critical Habitat: An entire habitat or portion thereof, having any constituent element that is necessary to the normal needs or survival of an endangered or threatened species.

Decibel (dB): A unit of measurement used to describe sound pressure level. It is a dimensionless unit, which is commonly expressed as one-tenth of the logarithm of the ratio between two power levels, one of which is nominally a reference level. The human auditory response to a given increase in sound pressure is approximately proportional to the increase in sound pressure in comparison to the pressure already present.

Displaced Threshold: Actual touchdown point on specific runways designated due to obstructions that make it impossible to use the actual physical runway end.

Distance Measuring Equipment (DME): An airborne instrument that indicates the distance the aircraft is from a fixed point, usually a VOR station.

Draft Environmental Impact Statement: FAA's initial evaluation of the environmental impact of a proposed action when coordinated pursuant to Section 102(20Cc)) of NEPA is initiated.

Ecology: The science or study of the relationship between an organism and its environment.

Ecosystem: An ecological community together with its physical environment, considered as a unit.

Effective Runway Gradient: The maximum difference between runway centerline elevations divided by the runway length, expressed as a percentage.

Eminent Domain: Right of the government to take property from the owner, upon compensation, for public facilities or other purposes in the public interest.

Endangered Species: Those species in danger of extinction throughout all or a significant portion of their range.

Enplanement: A term applying to passengers and cargo which board a departing aircraft.

Enroute Airways: The route a flight follows from departure point to destination.

Express: Property transported under published air express tariffs.

Fauna: A collective term for the animal species present in an ecosystem.

Fixed Base Operator (FBO): A private enterprise engaged in services related to general aviation, such as fuel sales, aircraft maintenance, aircraft storage, aircraft rental and sales, flight instruction, and crop dusting.

Flora: A collective term for the plant species present in an ecosystem.

Floodplain: An area that would be inundated by storm-water runoff that occurs under a given recurrent frequency flood condition.

Fleet Mix: See Aircraft Mix.

Flight Service Station (FSS): FAA facility used for pilot briefings on weather, airports, altitudes, routes, and other flight planning data.

General Aviation (GA): All aviation activities except those performed by commercial air carrier or military.

General Aviation Aircraft: All civil aircraft except those owned by and classified as air carriers.

General Obligation Bond: A form of public indebtedness backed by the full faith and credit of the municipality or other appropriate public body.

Glide Slope (GS): Electronic vertical guidance provided the pilot while on the final approach to landing; usually an angle between two degrees and three degrees and intersecting the runway at the touch down area.

Global Positioning System (GPS): Satellite-based navigational system providing lateral and vertical positional accuracy using reference between multiple satellite constellations. GPS is currently FAA certified for en-route and non-precision instrument navigation (GPS stand-alone and overlay approaches). The extent of GPS/RNAV/LNAV/VNAV/WAAS approach capability depends upon the sophistication of on-board receiver equipment. Category I precision approaches in the near future, as enhanced by WAAS and LAAS technology currently under development.

Horizontal Surface: A horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii from the center of each end of the primary surface of each runway and connecting the adjacent arcs by tangent lines.

IFR Conditions: Weather conditions below the minimum prescribed for flight under VFR.

Indirect Source: A facility, building, structure, or installation which attracts mobile air pollution source activity that results in emissions of a pollutant for which there is a national standard.

Instrument Landing System (ILS): A landing approach system that establishes a course and a descent path to align an aircraft with a runway for final approach.

Instrument Flight Rules (IFR): Rules that govern flight procedures when ceiling and visibility are below 1,000 feet and three miles respectively.

Instrument Approach: A landing approach using electronic aids and made without visual reference to the ground.

Itinerant Operations: Arrivals and departures of aircraft to or from an area greater than 20 miles from the airport. Itinerant operations may involve an aircraft based at the airport or an aircraft from another airport.

Local Area Augmentation System (LAAS): Intended to compliment Wide Area Augmentation System (WAAS) by meeting Category II/ III instrument approach requirements, as well as provide users with all weather surface navigation, surface navigation, and surface surveillance/ traffic management system capabilities.

Localizer (LOC): An electronic instrument that is part of an ILS and emits radio signals which provide the pilot with course guidance to the runway centerline.

Local Operations: Operations performed by aircraft that (1) operate in the local traffic pattern or within sight of the tower; (2) are known to be departing for or arriving from +/- light in local practice areas located within a 20 mile radius of the control tower; and (3) execute simulated instrument approaches or low passes at the airport.

Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR): A facility by which the pilot is provided visual reference t the instrument runway during transition from instrument to visual flight.

Microwave Landing System: An instrument landing system using VHF radio signals to guide the aircraft's approach instead of the VHF system still widely used. The microwave system provides for fewer ground reflections, takes up less space, and uses small aerials.

Minimum Descent Altitude (MDA): The lowest altitude, expressed in feet above MSL, to which descent is authorized on final approach or during circling-to-land maneuvering in execution of a standard instrument approach procedure where no electronic glide slope is provided.

Middle Marker (MM): An electronic beacon that indicates a position approximately 3,500 feet from the landing threshold.

Military Operations: An operation by military aircraft.

Missed Approach: A prescribed procedure to be followed by aircraft that cannot complete an attempted landing at an airport.

Nautical Mile: A measure of lineal distance equal to one minute of a great circle at the equator and is the length of one minute of latitude (6,076.1155 feet). To convert to statute miles, multiply by 1.150779.

NAVAID: Any navigational aids, such as PAPI, MALS, REIL, etc.

Noise Contour: A line connecting points of equal noise exposure.

Non-precision Approach Procedure: A standard instrument approach procedure in which no electronic glide slope is provided.

Non-scheduled Service: Revenue flights that are not operated in regular scheduled service such as charter flights and all non-revenue flights incident to such flights.

Object Free Area (OFA): An area on the ground centered on the runway, taxiway, or taxilane centerline provided to enhance the safety of aircraft operations by having the area free of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes. The 'precision' OFA is associated with runway ends with precision capabilities.

Obstacle Free Zone (OFZ): The OFZ is the airspace below 150 feet (45m) above the established airport elevation and along the runway and extended runway centerline that is required to be clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance protection for aircraft landing or departing from the runway, and for missed approaches.

Operation: Any airborne arrival or departure of an aircraft at or from an airport. "Touch-and-go" practice landings are considered as two operations.

Origination: The initial enplanement of any passengers and cargo; total originations include all enplanements except transfers and stop-overs.

Outer Marker (OM): An electronic beacon that indicates a position at which aircraft will intercept the ILS glide path.

Parts 25 and 121 Criteria: Those applicable portions of the Federal Aviation Regulations within which criteria for operational takeoff flight paths are defined.

Part 77: The applicable portions of Federal Aviation Regulations which define obstructions to air navigation.

Peak Hour: Represents that highest number of operations or passengers during the busiest hour of an average day of a peak month.

Precision Approach Path Indicator (PAPI): A lighting system providing for visual flight path, within the airport approach zone, so that an approaching pilot can establish a positive controlled descent (also VASI).

Precision Instrument: The term used to describe an approach using both horizontal and vertical guidance. This term also describes the runway with this type of approach and the markings on the runway.

Primary Runway: That runway which provides the best wind coverage, etc.; this runway receives the most usage at an airport.

Primary Surface: A surface longitudinally centered on a runway. When the runway has a hard surface, the primary surface extends 200 feet beyond each runway end; but when there is no hard surface, or planned hard surface, the primary surface ends at the end of the runway. The width of the primary surface of a runway will be that width prescribed in FAA Part 77 for the most precise existing or planned approach to that runway end.

Revenue Bonds: A form of public indebtedness backed by the revenue generated by the facility for which the debt was incurred.

Rotating Beacon: A visual NAVAID displaying flashes of white and/or colored light used to indicate the location of an airport.

Runway (RW): A defined area on an airport prepared for landing and takeoff of aircraft.

Runway Protection Zone (RPZ): An area off the runway end to enhance the protection of people and property on the ground.

Runway Safety Area: A defined surface surrounding the runway prepared or suitable for reducing the risk of damage o aircraft in the event of an overshoot, undershoot, or excursion from the runway.

Runway Visibility Zone (RVZ): An acceptable runway profile permits any two points five feet (1.5m) above the runway centerline to be mutually visible for the entire runway length. Hence, a clear line-of-sight between the ends of the of intersecting runways is recommended. Finally, the RVZ is an area formed by the imaginary lines connecting the two runways' visibility points.

Scheduled Service: Transport service performed by a commercial operator on a regular basis.

Segmented Circle: An airport aid identifying the traffic pattern direction.

Socioeconomic: Data pertaining to the population and economic characteristics of a region.

Special Use Airspace: Airspace of defined dimensions, within which flight of aircraft, while not wholly prohibited, is subject to restrictions or to hazards that may exist to non-participating aircraft.

Straight-In Approach: A descent in an approach procedure in which the final approach course alignment and descent gradient permits authorization of straight-in landing minimums.

Student Activity: Any aviation activity by student pilots.

Taxiway (TWY): A defined area on an airport prepared for the surface movement of aircraft to and from the runway.

Terminal Airspace: The controlled airspace normally associated with aircraft departure and arrival patterns to or from airports within a terminal control system.

Terminal Building: That building on an airport which is used in making the transition between surface and air transportation.

T-Hangar: A T-shaped aircraft storage building that provides economical shelter for a single aircraft.

Threshold: The beginning of that portion of the runway available for landing. In some instances the landing threshold may be displaced.

Tie Downs: An area on an airport specifically designed for the outdoor storage of aircraft.

Total Operations: The total of all operations (domestic and international) performed at an airport.

Touch-and-Go Operations: An aircraft operation for practice or testing purposes characterized by a landing touch down and then continuing takeoff without stopping.

Traffic Pattern: The flow of traffic that is prescribed for aircraft landing at, taxiing on, or taking off from an airport.

Transition Surface: An imaginary surface extending to the sides of the approach surface and inclined at a specified gradient 90 degrees to the extended centerline of the runway. Any object penetrating this surface would be an obstruction to air navigation.

Turnaround: A pavement area designed for turning around or holding aircraft at the end of a runway when a full parallel taxiway is not provided.

UNICOM: A ground radio communications station that provides pilots with pertinent airport information at specific airports.

Visual Approach Slope Indicator (VASI): A lighting system providing a visual flight path, within the airport approach zone, so that an approaching pilot can establish a more positive controlled descent (also PAPI).

Vector: A heading issued to an aircraft to provide navigational guidance by radar.

Visual Flight Rules (VFR): Rules under which aircraft are operated by visual reference to the ground, and fly on a “see and be seen” principle.

Very High Frequency Omni-Directional Range (VOR): Air navigation aid that provides bearing information to aircraft.

Wide Area Augmentation System (WAAS): Planned as a GPS augmentation by providing users with the use of GPS for all phases of flight from the en route environment to Category 1 precision instrument approaches. Thereby, providing more direct routing of aircraft, saving time, fuel, and money. The LNAV Approach will provide GPS non-precision lateral navigation capabilities. The LNAV/VNAV Approach will provide GPS precision lateral and vertical navigation capabilities.

Wind Cone (Sock): Conical wind direction indicator.

Wind Coverage: Refers to orientation of runway in relationship to direction of prevailing winds (concerns usability of runway for takeoffs and landings).

Wind Rose: A diagram indicating the prevalence of winds from various directions, at a specific place.

Wind Tee: A visual device used to advise pilots about wind direction.

ACRONYM

AC:	Advisory Circular
ADF:	Automatic Direction Finder
AGL:	Above Ground Level
AIP:	Airport Improvement Program
ASR:	Airport Surveillance Radar
ALP:	Airport Layout Plan
ALS:	Approach Lighting System
ARFF:	Aircraft Rescue and Fire Fighting
ARTCC:	Air Route Traffic Control Center
ASDA:	Accelerate – Stop Distance Available
ASV:	Annual Service Volume
ATC:	Air Traffic Control
ATCT:	Air Traffic Control Tower
AWOS:	Automated Weather Observing System
BRL:	Building Restriction Line
BWR:	Bucher, Willis & Ratliff Corporation
CAT:	Category
CWY:	Clearway
dB:	Decibel
DME:	Distance Measuring Equipment
DNL:	Day/Night Average Sound Level
DOT:	Department of Transportation
FAA:	Federal Aviation Administration
FAR:	Federal Aviation Regulation
FIS:	Federal Inspection Service
FBO:	Fixed Base Operator
FSS:	Flight Service Station
FTZ:	Foreign Trade Zone
GA:	General Aviation
GPS:	Global Positioning System
GVGI:	Generic Visual Slope Indicator
GS:	Glide Slope
HIRL:	High Intensity Runway Lights
HUD:	U.S. Department of Housing and Urban Development
IFR:	Instrument Flight Rules
ILS:	Instrument Landing System
IMC:	Instrument Meteorological Conditions
INM:	Integrated Noise Model
KHz:	Kilohertz
LAAS:	Local Area Augmentation System
LDA:	Landing Distance Available
LNAV:	GPS Lateral Navigation Instrument Approach
LIRL:	Low Intensity Runway Lights
LOC:	Localizer
MALSF:	Medium Intensity Approach Lighting System
MALSR:	Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
MDA:	Minimum Descent Altitude
MHz:	Megahertz
MIRL:	Medium Intensity Runway Lights
MITL:	Medium Intensity Taxiway Lights
MM:	Middle Marker
MOA:	Military Operations Area
MSA:	Metropolitan Statistical Area
MSL:	Mean Sea Level
NAVAID:	Navigational Aid
NDB:	Non-directional Beacon
NOS:	National Ocean Survey
NPI:	Non-precision Instrument
NPIAS:	National Plan of Integrated Airport System
NWS:	National Weather Service
OAG:	Official Airline Guide
OC:	Obstruction Chart
OFA:	Object Free Area
OFZ:	Obstacle Free Zone
OM:	Outer Marker
OPBA:	Operations Per Based Aircraft
PAPI:	Precision Approach Path Indicators
PIR:	Precision Instrument
PLASI:	Pulsating Light Approach Slope Indicator
RAIL:	Runway Alignment Indicator Lights
REIL:	Runway End Identifier Lights
RNAV:	Area Navigation
RPZ:	Runway Protection Zone
RVR:	Runway Visibility Range
RVZ:	Runway Visibility Zone
RW:	Runway
SSALF:	Simplified Short Approach Light System with sequenced Flasher Lights
SSALR:	Simplified Short Approach Light System with RAIL
TACAN:	Tactical Air Navigation
TAP:	Terminal Area Plan
TCA:	Terminal Control Area
TERPS:	Terminal Instrument Procedures
TVOR:	Terminal Very High Frequency Omni Range
TW:	Taxiway
UHF:	Ultra-High Frequency
USGS:	United States Geological Survey
VASI:	Visual Approach Slope Indicator
VFR:	Very High Frequency
VMC:	Visual Meteorological Conditions
VNAV:	GPS Vertical Navigation Instrument Approach
VOR:	VHF Omni-Directional Range
WAAS:	Wide Area Augmentation System

Appendix B
VDOT Correspondence

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF HIGHWAYS

Telephone 703-743-6585
P. O. Box 308
Luray, Virginia 22835

March 24, 1981

Mr. Vernon R. Gingell
Dewberry & Davis
8411 Arlington Blvd.
Fairfax, Virginia 22031

Dear Mr. Gingell:

This is in reference to your letter dated March 20, 1981, concerning some proposed changes in the Warren County Secondary Road System as a result of extending the runway at the Front Royal-Warren County Airport.

I have reviewed your proposal as it would affect Routes 617 and 618 in the area and it appears to be satisfactory so far as the Highway Department is concerned. We would expect all the changes to be made at no cost to the Commonwealth of Virginia. This would include all rights of way acquisitions and roadway construction, based on our current standards for a road carrying 50-250 VPD.

In order for a secondary road to be abandoned, a posting for a Public Hearing must be made for a duration of two weeks prior to the hearing date. If no one person objects to the proposed abandonment, action can be taken by the County Board of Supervisors to have the road abandoned from the Secondary System and the right of way reverts to the adjoining property owners. If there is any objection to the abandonment, no action can be taken.

If you should have any questions concerning this matter, please do not hesitate to contact this office.

Sincerely,

M. L. Dickerson
Resident Engineer

MLD:ecl

File

COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION

Luray Residency-P.O. Box 308- Luray, Virginia 22835

GREGORY A. WHIRLEY
ACTING COMMISSIONER

July 25, 2006

Mr. Douglas P. Stanley, County Administrator
Warren County Government Center
220 North Commerce Avenue, Suite 100
Front Royal Virginia 22630

Re: Front Royal-Warren County Airport

Dear Mr. Stanley,

This is in response to our recent conversations concerning impacts to Secondary Routes 617 and 618 as a result of expansion of the Front Royal-Warren County Airport.

As I understand it, a future project will extend the current runway in a direction which will necessitate the relocation/adjustment of portions of both Route 617 and 618. I've enclosed a copy of a conceptual development plan of the airport, which you provided, which details the impacts to the roadways. It appears a large segment of Ridgeway Road (Route 617 & 618) will need to be relocated to the north and west around the runway extension. However, the portion of Route 618 (Menefee Lane) south of the Airport isn't addressed. Is it to be relocated to tie in to Route 617 (Ridgeway Road) or ended in a cul-de-sac? To maintain area access we would strongly encourage a connection to Route 617 (Ridgeway Road).

Regardless, we do not foresee any major problems if the County and Airport wish to pursue these changes to the secondary road system. In fact, we commented on a similar proposal in March 1981 (copy of letter enclosed) when a Master Development Plan for the airport was developed. Any roadway changes would of course need to be constructed in accordance with our design standards, all necessary rights-of-way/easements provided, and funded by sources other than those administered by the Department. Also, any changes made to the secondary system would need to follow the requirements of the pertinent State Code Section which may require a Public Hearing.

Once more detailed plans are developed we will be happy to review them and provide additional comments. Please let me know if you have any questions.

Sincerely,

Robert B. Childress

Robert B. Childress
Assistant Residency Administrator

Enclosure

Appendix C
Warren County ALP Approval Letter

May 13, 2009

Jeff Breeden
FAA/WADO
23723 Air Freight Lane, Suite 210
Dulles, VA 20166-7617

Re: Airport Layout Plan Approval
Front Royal - Warren County Airport

Dear Jeff:

This letter is to inform you that the Airport Layout Plan and associated Narrative Report has been reviewed and accepted by the Front Royal-Warren County Airport Commission. We appreciate your assistance and continued support of the Airport.

Please do not hesitate to contact us if you have any questions or require any additional information.

Sincerely,

Dick Magnifico
Deputy County Administrator

cc: Scott Denny, DOAV