Manassas Regional Airport
Master Plan Update

Chapter 3
Inventory and Facility Requirements

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INVENTORY AND FACILITY REQUIREMENTS

3.1 INTRODUCTION

Future airport facility requirements, including the type, size, and quantity, are dependent on the future aviation activity levels projected in the aviation activity forecasts discussed in **Chapter 2 *Aviation Activity Forecast***. The need for new or expanded facilities is often driven by capacity shortfalls that leave an airport unable to accommodate the forecasted growth using existing facilities. However, the requirements for new or improved facilities can also be driven by other circumstances, such as, updated standards adopted by the FAA or another regulatory agency, an evolving strategic vision for the airport, the replacement of outdated or inefficient facilities that are prohibitively costly to maintain or modernize, or the desire to introduce new services and facilities. These various circumstances can have a significant impact on future needs, and all have been considered in this analysis which presents an inventory of Manassas Regional Airport (HEF or Airport) facilities and infrastructure as well as their ability to accommodate forecast future demand. In this chapter, a list of specific requirements, recommendations, and best practices are made to inform development of facility alternatives that meet user needs throughout the 20-year planning horizon.

A Master Plan cannot be comprehensive without integrating sustainable thinking, and therefore, this plan incorporates four principles of airport sustainability (EONS):

- Economic viability
- Operational efficiency
- Natural resource conservation
- Social responsibility

Consideration of these airport sustainability principles is critical to the development of the facility alternatives analysis. The EONS principles will be described in more detail in **Section 3.2 Sustainability**.

Facility requirement determinations are quantitative and objectively determined by way of regulatory standards, modern industry guidance, and industry best practices. Most of this chapter is devoted to need assessments in the following functional areas of Manassas Regional Airport:

- Airport Setting and Role
- Sustainability
- Environmental Conditions
- Inventory of Key Financial Data
- Planning Activity Levels
- Meteorological Conditions
- Airfield Design and Capacity
- Airspace Analysis
- Navigational Aids, Lighting, Signage, and Markings
- GA Terminal
- GA Aircraft Parking and Storage
- Aviation Support Facilities
- Landside Facilities
- Deicing and Stormwater Facilities
- Utilities
- Security

HEF's goals and objectives for this project and the Airport include identifying solutions for the following areas and are described in a high-level throughout this chapter.

- Vehicle access
- Multimodal Pedestrian Access and AAM
- Terminal Area
- FBO Expansion
- East Side Expansion
- West Side Expansion
- Runway Extension
- Southwest Development Area

This chapter concludes with a section summarizing the key findings of the facility requirement assessments, which will be used to guide identification and evaluation of future development alternatives.

3.1.1 Strategic Visioning

The Airport updated its Strategic Plan in February 2022 which aligned the Airport's strategic operations plan with the Manassas City Council's 2025 Strategic Plan. Strategic Planning for airports projects a future vision for the Airport organization, determines strategies and objectives for the growth or prosperity of the organization (including the type of products and services it should provide), and defines how the vision and objectives can be accomplished. Manassas Regional Airport Strategic Plan 2022 – 2025 identified five strategic priorities which will be taken into consideration and shape development of the Master Plan. The five strategic priorities are as follows:

- **Operational Expansion & Improvement:** The Airport will create an exceptional, world-class experience for current and future aviation customers.
- **Business Growth & Economic Development:** The Airport will position itself for business growth and development through sound master planning, aggressive marketing efforts and strategic partnerships.
- **Innovation & Emerging Technology:** The Airport will take a leadership role in preparing for and supporting new Advanced Air Mobility (AAM) technology in the region.
- **Community Education & Partnerships:** The Airport will contribute to the community's learning environment by providing innovative and engaging opportunities about the aviation industry, including education and careers.
- **Sustainability & Organizational Excellence:** The Airport will operate in such a manner as to optimize revenue generation for continued growth while managing operating costs to create a strong bottom line and financial stability.

3.1.2 Airport Setting and Role

This section describes the following details about Manassas Regional Airport:

» History
» Classification and role within the National Plan of Integrated Airport Systems (NPIAS)
» Hierarchy of ownership and control
» Property and zoning
» Facilities overview

3.1.2.1 Airport History

The following chronological list of events provides a brief history of the Airport's start and growth to its current state.[1]

» **1930**- Manassas Town Council proposed that a landing strip be constructed along Virginia Route 234 near Manassas.

» **1931**- A group of investors purchased almost 95 acres of land in the area currently known as Manaport Shopping Center along Route 234. The Airport was leased to the City of Manassas.

» **1932**- The Airport officially opened on June 8.

» **1945**- An additional 12.6 acres was purchased and several improvements were made at the airport. The City purchased the airport outright.

» **1963**- 268 acres was purchased with federal, state, and local funds at a new airport location.

» **1964**- The new airport was dedicated as the Manassas Municipal Airport on September 20. The airport had a single 3700' x 100' paved runway (16R-34L), a rotating beacon, maintenance hangar, office, and 30 T-Hangars.

» **1968**- The Airport began an apron extension project.

» **1974**- The Airport embarked on an apron extension, parallel taxiway strengthening, high speed exits, and 214-acre land acquisition.

» **1980**-The West Complex was constructed and included 30 T-hangar units.

» **1981**- A perimeter access road was developed and 20 additional acres of land were acquired.

» **1992**- The City of Manassas undertook the first ever effort to "recycle" an air traffic control tower. The tower was from an airport near Denver, CO, where it was disassembled and shipped to Manassas. The tower was reassembled at the Airport and was dedicated on April 16.

» **1996**- A modern Main Terminal Building was completed and dedicated in September.

» **1997-**A new 5700' parallel runway, 16L-34R, and Taxiway Bravo were constructed.

» **1998-** A new airfield lighting vault, segmented circle, and the 16L PAPIs were installed.

» **2000-** Rehabilitation of Runway 16R-34L and Taxiway Alpha added a great improvement for pilots.

» **2003**- The main runway, 16L-34R, and parallel Taxiway Bravo were rehabilitated and continuing for the next several years. This project included changing the right angle exits of the taxiways to an acute angle exit to enable aircraft to exit the runway at an easier and more efficient pace.

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[1] Manassas Regional Airport (2022) https://www.manassasva.gov/airport/airport_history.php

- **2007**- The Airport completed its East Apron Expansion project, which included adding Taxilane Golf and new T-hangars. It also added 22 new tie downs to the current 88 tie-downs.
- **2011**- An economic impact study was conducted; and it was determined that the Airport contributed more than $234 million to its local economy.
- **2012**- Manassas Regional Airport was identified as one of 84 National GA airports by the FAA. The Manassas Regional Airport completed Phase I of II of the Runway Extension Project, giving Runway 16L-34R a new distance of 6,200'.
- **2014**- Phase II of the project was completed with the relocation of its Instrument Landing System (ILS), the realignment of Taxiway Kilo, and a bridge widening project for Taxiway Bravo and Runway 34R.
- **2017-** Rehabilitated West Apron.
- **2020**- Significant renovations and improvements completed on Runway 16R-34L which included fresh pavement, new PAPI's, added airfield guidance signage, and new LED light fixtures.
- **2021-** Construction of Taxiway Golf and Taxilane Yankee.

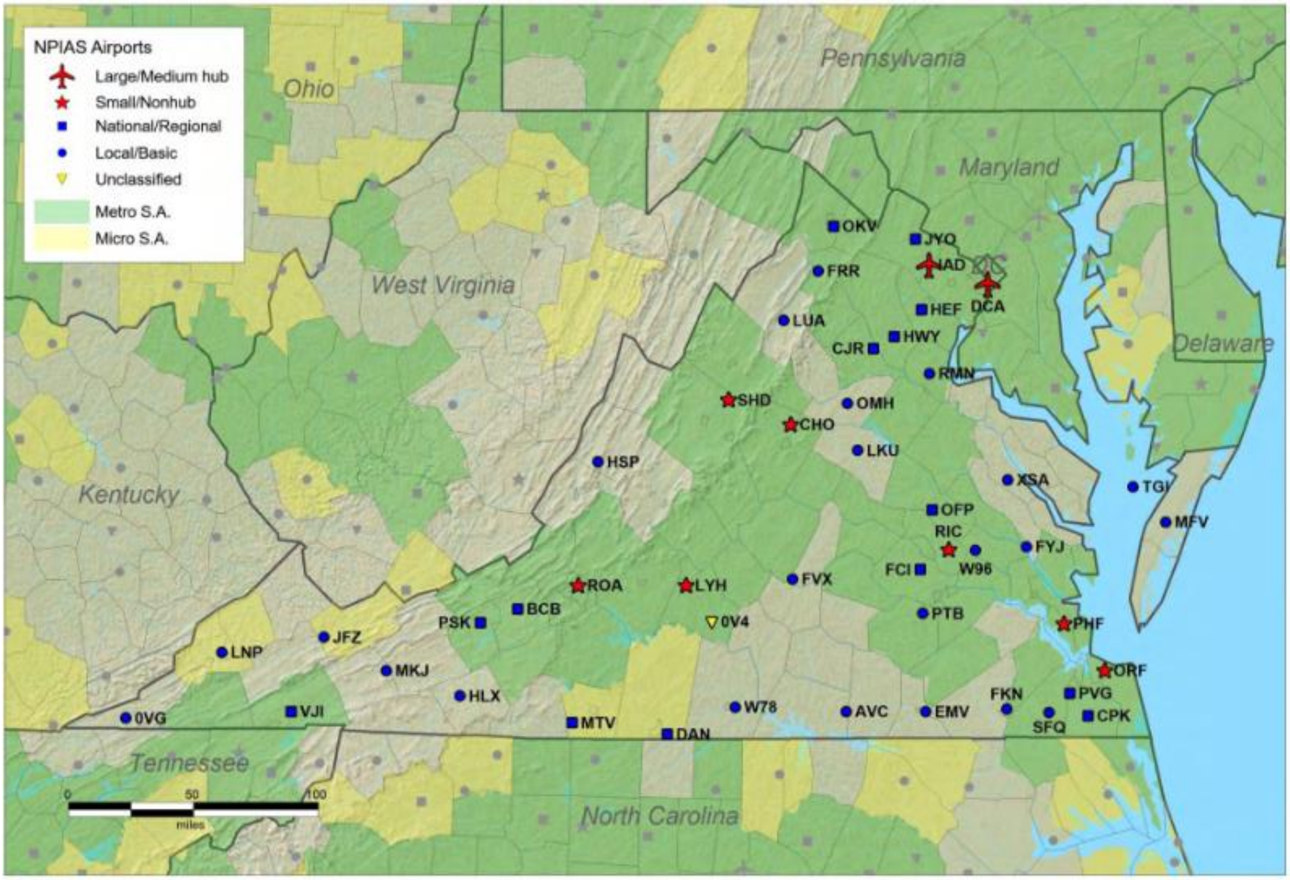
3.1.2.2 Airport Classification and Role

The following sections describe the Airport's Federal Aviation Administration (FAA) classification and its role within the Commonwealth of Virginia.

3.1.2.3 NPIAS Role

The Airport is classified in the FAA's National Plan of Integrated Airport Systems (NPIAS) 2023-2027 Report as a public National Reliever airport. National reliever airports are defined as airports that are designated by the FAA to relieve congestion at Commercial Service airports and to provide improved general aviation (GA) access to the overall community. GA airports are public use airports that do not have scheduled service or has service scheduled with less than 2,500 passenger boardings each year. **Figure 3-1** shows NPIAS airports in the Commonwealth of Virginia.

FIGURE 3-1
NPIAS AIRPORTS IN THE COMMONWEALTH OF VIRGINA



Source: FAA NPIAS FY 2021 – 2025

3.1.2.4 State Role

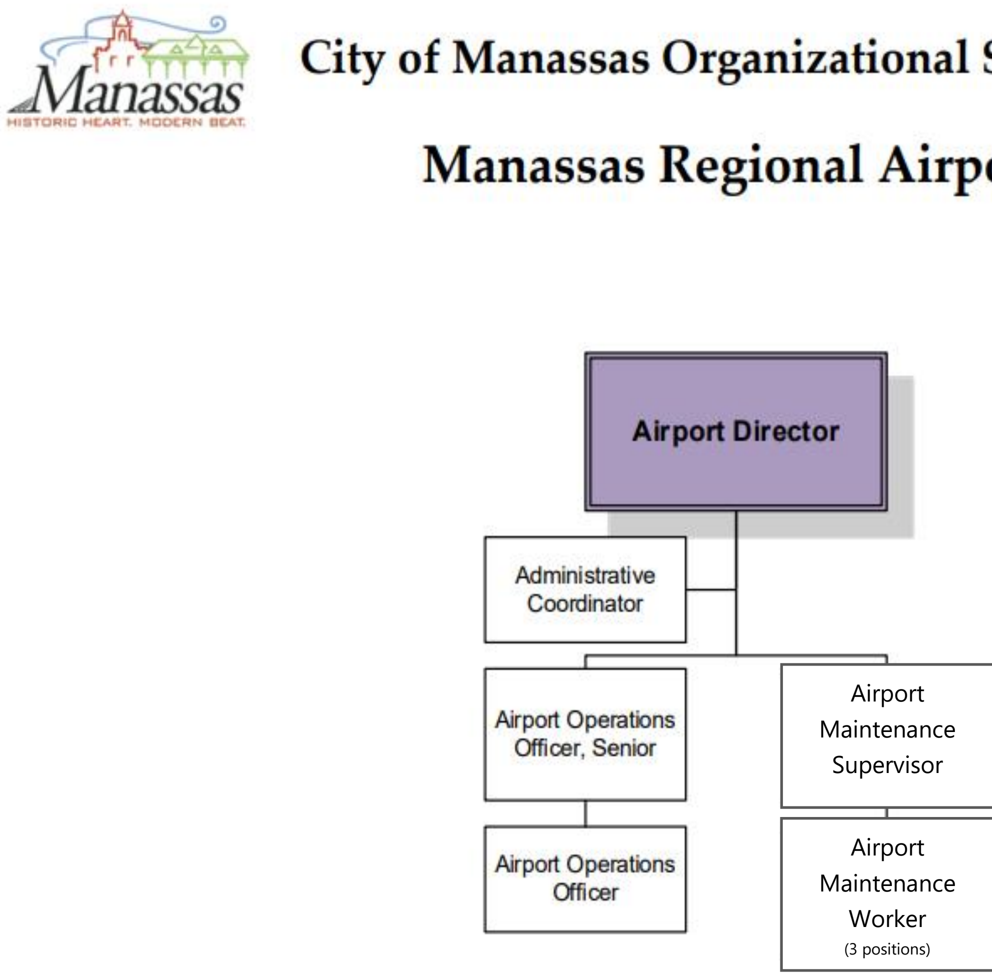
The 2019 Virginia Air Transportation System Plan (VATSP) Update classifies each of its 66 public-use airports based on their size and function. Manassas Regional Airport is classified as a Reliever Airport and identified as the designated reliever for Dulles International Airport (IAD). Reliever airports are general aviation airports located near or in larger metropolitan areas that are intended to reduce congestion at commercial service airports, providing comparable general aviation facilities and services typically found at a commercial service airport. They are recommended to meet a minimum of FAA Approach Category "C" design criteria to accommodate the full range of general aviation aircraft. An Aircraft Approach Category (AAC) C includes aircraft with approach speed of 121 knots or more but less than 141 knots. A precision instrument approach should be provided if feasible from a technical and financial perspective. Reliever airports are eligible for Air Carrier/Reliever discretionary funding from the Commonwealth Airport Fund.

3.1.2.5 Airport Ownership and Control

Manassas Regional Airport is governed by the City of Manassas and is overseen by the Manassas Regional Airport Commission (or "Commission"). The Commission is appointed by the Manassas City Council. The

Manassas Regional Airport Commission made up of ten members of which two are from the County and are appointed to 4-year terms. The Airport Commission oversees activities at the Manassas Regional Airport, recommends approval of the Airport's Capital Improvement Program (CIP) and manages its budget. The Airport is managed and operated by nine staff members led by an Airport Director. The Airport is home to two Fixed Based Operators (FBO), APP Jet Center and Chantilly Air FBO Jet Center, that provide fueling, on-site maintenance, ground handling and de-icing. **Figure 3-2** shows the Manassas Regional Airport organizational chart.

FIGURE 3-2
HEF ORGANIZATIONAL CHART



Source: City of Manassas, 2022

3.2 SUSTAINABILITY

The U.S. Environmental Protection Agency (EPA) describes sustainability as the basis of one guiding principle: "Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. To pursue sustainability is to create and maintain the conditions under which humans and nature can [co]exist in productive harmony to support present and future generations." Unfortunately, sustainability is often misinterpreted and over-simplified as an inflexible protection of the natural environment at any cost. However, sustainable development under real-world conditions requires a comprehensive approach with consideration of many factors. The complex nature of securing a sustainable future is why government agencies across the globe, including the FAA, are supporting airport planning initiatives that incorporate sustainable approaches.

In 2015, the Virginia Department of Aviation (DOAV) developed a statewide Sustainability Management Plan (SMP) for its public-use airports within the Commonwealth of Virginia. According to the Virginia Airports SMP, airports in Virginia face an array of sustainability challenges and opportunities. The Virginia Airports SMP implements short and long-term initiatives that address sustainability across:

- Economic Performance
- Airport Community
- Energy and Emission
- Waste
- Natural Resources

Integrated into an airport master plan, airports can promote greater financial, environmental, and community-oriented initiatives that support these goals and incorporate sustainable planning. The table below includes a list of recommended sustainability goals for HEF within each subcategory.

TABLE 3-1
SUSTAINABILITY CATEGORIES, SUBCATEGORIES, AND ASSOCIATED GOALS

Category	Subcategory	Goals
Economic Performance	Air service and business development	1. Increase user and tenant retention rates. 2. Reduce costs of airport operations and, where feasible, costs of tenant operations. 3. Attract additional aviation-related, on-airport businesses.
	Non-aeronautical development	1. Increase non-aeronautics-related revenue generation. 2. Attract local businesses with potential ties to airport customers.
	Asset management and resilience	1. Incorporate resilience and adaptation design and construction practices into the development of facilities to mitigate risks to business, system, and community continuity. 2. Integrate standardized sustainability and resilience measures into the airport's asset management system and everyday operations. 3. Enhance the health, safety, economy, and security of the airport community by testing and reassessing preparedness and disaster recovery plans.
Airport Community	Public outreach	1. Increase public awareness of initiatives undertaken by the airport by engaging the local community/stakeholders. 2. Enrich opportunities and the experience of citizens communicating feedback to the airport on issues of concern. 3. Educate the community about the airport's value.
	Airport workforce	1. Promote employee satisfaction, retention, and workforce development. 2. Promote Health and Safety of airport workforce. 3. Engage employees in sustainable practices at the airport. 4. Encourage the development of a sustainable airport community by engaging airport tenants and encouraging their use of sustainable practices and products.
Energy and Emissions	Energy efficiency	1. Reduce operating costs by decreasing electricity usage for all airport operating areas. 2. Maximize efficiency of lighting systems. 3. Reduce operating costs by decreasing usage of natural gas and other thermal fuel. 4. Reduce greenhouse gas (GHG) emissions. 5. Reduce light pollution.
	Transportation fuels	1. When feasible, switch to alternatively-powered ground vehicles operated at the airport. 2. Increase customer and staff ridership of high-occupancy transportation to and from the airport, where available. 3. Decrease fuel use by reducing field mowing requirements.

Category	Subcategory	Goals
	Energy generation	1. Increase portion of airport's electricity supplied by onsite renewable energy sources.
Waste	Waste management and recycling	1. Reduce Municipal Solid Waste (MSW) sent to landfills. 2. Increase the airport's diversion rate through recycling and reuse. 3. Increase recycling of construction and demolition waste.
	Chemical and hazardous waste management	1. Find and use substitutes for products with lower environmental, health, and safety risks. 2. Implement a chemical tracking system to improve hazardous materials management. 3. Reduce chemical/oil spills by enhancing spill prevention and control measures. 4. Minimize hazardous waste generation. 5. Use the least number of hazardous waste handlers that meet the criteria for "acceptable" business.
Natural Resources	Stormwater management	1. Reduce water quality and quantity impacts from stormwater runoff. 2. Reduce sediment runoff from construction areas. 3. Reduce water quality risk from de-icing fluid runoff.
	Water efficiency	1. Reduce water use in areas directly under the control of the airport. 2. Encourage tenants, airport users, and employees to use water efficiently.

Source: Virginia Department of Aviation Sustainability Management Plan, Reliever and General Aviation-Regional Supplement, May 2016.

3.2.1 Economic Viability

Manassas Regional Airport is an integral part of the Virginia economy, supporting commerce and industry throughout the Commonwealth. The Airport's financial health is of utmost importance to securing its long-term sustainability within the region. Airports are mandated under FAA Grant Assurances to be "as self-sustaining as possible under circumstances existing at the particular airport." By using federal (Airport Improvement Program) AIP funds for capital projects, the Airport is contractually obligated to meet FAA grant assurances as mandated through federal statute Title 49 US Code §47107. As stated by the 2015 Airport Cooperative Research Program Report Synthesis 66 – Lessons Learned from Airport Sustainability Plans, "Unless an airport can ensure its economic viability, either through its own resources or through its governing body, the airport will cease to exist." Manassas Regional Airport, while providing services and facilities for the public, must maintain a financial structure that optimizes revenue generation, minimizes overall costs, and provides funding suitable to cover necessary operating and capital costs. For these reasons, the Manassas Regional Airport Master Plan Update will focus on generating sustainable development solutions that seek to maximize economic viability without sacrificing EONS principles. This Master Plan Update develops a baseline inventory of the conditions and facilities which influence or impact the economic viability of Manassas Regional Airport. Economic viability is also a key evaluation criterion for development alternatives considered within this Master Plan Update.

3.2.2 Operational Efficiency

Operational efficiency and maximizing the usefulness of all resources and facilities are vital to the success of Manassas Regional Airport. Airfield runways and taxiways are determined based on aircraft performance requirements with design and implementation triggers dictated by FAA design standards and capacity driven implementation decisions. All remaining airport facility location and design decisions are driven by varying degrees of FAA instruction and mandate, Airport leadership planning decisions, local politics, and private sector investments. To create sustainable and operationally efficient airport facilities at HEF, leadership must have a long-term land use vision that is reviewed and updated intermittently to account for changing circumstances. This chapter will establish that land use vision and a preferred 20-year development plan with operational efficiency as one of the key evaluation criteria.

3.2.3 Natural Resources

When not managed and maintained responsibly, natural resources can be exhausted. As owners and operators of a public service facility, the City of Manassas and Manassas Regional Airport understands it has a duty to promote policies which seek to protect and conserve natural resources to every reasonable degree. Acting on this duty occurs through policies and development which limit/reduce greenhouse gas emissions and any contaminating discharge into water systems, provide opportunities for development of energy efficient facilities, promote environmental stewardship practices, protect wildlife by humanely discouraging its presence on the airfield, and support industry transitions to renewable energy sources. This chapter will develop a baseline inventory of the conditions and facilities which influence or impact the natural resource conservation efforts by Manassas Regional Airport. Environmental impacts are also considered as a key evaluation criterion for development alternatives within this Master Plan Update.

3.2.4 Social Responsibility

As a public facility in the Metro Washington D.C. area and within the Commonwealth of Virginia, Manassas Regional Airport recognizes it has a duty to the surrounding communities to act in a socially responsible manner. In action, this translates into the following:

- Abide by all federal, state, and local regulations and meet contractual FAA grant assurances
- Maintain competitive rate and fee structure to support operating and capital expenses
- Act ethically in all business and development decisions
- Remain transparent with community stakeholders about airport related decisions
- Make efforts to provide business and employment opportunities to the region
- Ensure equal treatment of all persons and remain intolerant of discrimination in any form
- Ensure the Airport has a Disadvantaged Business Enterprise (DBE) program plan per FAA Order 5100.38D and updated every three years
- Use the Airport's standing within the community to support and advance positive community goals and values

This chapter will take into consideration these aspects of the Airport's role in being socially responsible during development and evaluation of all facility alternatives.

3.3 ENVIRONMENTAL CONDITIONS

The purpose of considering environmental factors in airport master planning is to help the Airport Sponsor thoroughly evaluate airport development alternatives and to provide information that will help expedite subsequent environmental processing. For a comprehensive description of the existing environmental conditions at the Airport, environmental resource categories outlined in FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures,* were used as a guide that help identify potential environmental effects during the planning process.

FAA Order 1050.1F and FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, require the evaluation of airport development projects as they relate to specific environmental resource categories by outlining impacts and thresholds at which the impacts are considered significant. For some environmental resource categories, this determination can be made through calculations, measurements, or observations. However, other environmental resource categories require that the determination be established through correspondence with appropriate federal, state, and/or local agencies. A complete evaluation of the environmental resource categories identified in FAA Orders 1050.1F and 5050.4B is required during a categorical exclusion, environmental assessment, or environmental impact statement.

Future development plans at the Airport take into consideration environmental resources that are known to exist in the vicinity of the Airport. Early identification of these environmental resources helps avoid impeding development plans in the future.

This section provides an overview of resource categories defined in FAA Order 1050.1F, Chapter 4, as it applies to the environs at, and surrounding, the Airport. **Table 3-2** provides a summary of the environmental resource categories studied for the Master Plan Update. It is important to note that while the environmental analysis is included in this Master Plan Update, it is not in and of itself a NEPA document. Additional information regarding the environmental conditions at HEF is provided in **Appendix A**.

TABLE 3-2
SUMMARY OF ENVIRONMENTAL RESOURCE CATEGORIES STUDIED

Environmental Resource	Description
Air Quality	The Airport is in “maintenance” for Ozone, and in “attainment” for all other National Ambient Air Quality Standards (NAAQS). See **Appendix A** for details.
Biological Resources	There is federal- and state-threatened, –endangered and candidate species, and migratory birds in the Airport area. There is no critical habitat at the Airport. See **Appendix A** for details.
Climate	There are greenhouse gas (GHG) emissions produced at the Airport. See **Appendix A** for details.
Coastal Resources	A portion of the Airport is within Virginia’s Coastal Zone Management Program, however, there are no Coastal Barrier Resource System (CBRS) segments within Airport property. See **Appendix A** for details.

Environmental Resource	Description
Department of Transportation Act, Section 4(f)	There are no Section 4(f) properties on Airport property. See **Appendix A** for details.
Farmlands	The Airport contains prime farmland and farmland of statewide importance. See **Appendix A** for details.
Hazardous Materials, Solid Waste and Pollution Prevention	There are six Resource and Recovery Act (RCRA) Hazardous Waste Generators on Airport property. Solid waste generated at the Airport is disposed of at the Manassas Transfer Station. The Airport has a Virginia Pollutant Discharge Elimination System Permit (VPDES) General Permit (VAR050985). The City of Manassas also maintains an Oil Discharge Contingency Plan, an Integrated Spill Prevention, Control and Countermeasures (SPCC) Plan, and a Stormwater Pollution Prevention Plan (SWPPP) for the Airport. See **Appendix A** for details.
Historical, Architectural, Archaeological and Cultural Resources	One historic resource located at the Airport. See **Appendix A** for details.
Land Use	Current land uses surrounding the Airport include Airport, Technology Community Mixed Use, Flexible Use Employment Center, Agricultural and Forestry, and Federal Property. See **Appendix A** for details.
Natural Resources and Energy Supply	Electricity and water are supplied to the Airport by the City of Manassas. Natural gas is provided by Washington Gas. See **Appendix A** for details.
Noise and Noise-Compatible Land Use	The Airport is zoned as an Airport District and is bordered by areas zoned as industrial to promote compatible development in and around the Airport. Areas bordering the Airport in Prince William County are zoned as Agricultural, Industrial, and Planned Business District. Noise contours are shown in **Appendix A** for details.
Socioeconomics, Environmental Justice, Children's Environmental Health, and Safety Risks	The Airport is located within Manassas City, Census Tract 9104.2, Block Group 5. See **Appendix A** for details.

Environmental Resource	Description
Visual Effects	Light emissions at the Airport currently result from airfield, building, access roadway, parking, and apron area lighting fixtures required for the safe and secure movement of people, vehicles, and aircraft. The visual resources and visual character of the Airport currently includes the air traffic control tower, fixed base operators, hangars, and maintenance buildings. See **Appendix A** for all Visual Effects details.
Water Resources	Airport property contains wetlands, floodplains, and surface waters. The Airport property is in the Rocky Branch-Broad Run watersheds. The Airport property does not contain any wild and scenic rivers. See **Appendix A** for all Water Resources details.

Prepared by: RS&H, 2022

3.3.1 Floodplain Development Coordination

As part of the 2022 Airport Master Plan Update, the Airport asked RS&H to coordinate with required agencies regarding floodplain permitting for future airport development. The Airport requested RS&H to investigate streamlining permitting associated with a Conditional Letter of Map Revision (CLOMR) for development with floodplain impacts. RS&H coordinated with the Federal Emergency Management Agency (FEMA) as the CLOMR issuing agency and the City of Manassas as the local floodplain authority.

The National Flood Insurance Program (NFIP), outlined in Title 44 of the Code of Federal Regulations (44 CFR), requires communities to adopt floodplain ordinances and sets minimum criteria to reduce losses associated with flooding. On April 27, 2022, RS&H held a discussion with the City Engineer to further review the necessity and requirements of a separate floodplain study for the Master Plan. The City Engineer is the local floodplain authority delegated by FEMA to implement the requirements of 44 CFR and other ordinances adopted by the City. The Engineer confirmed a separate study is necessary to reflect updated hydrology and estimate flood stages for comparison to FEMA's effective elevations. Based on document review and agency coordination, the Airport can streamline FEMA floodplain permitting by submitting one CLOMR for phased future development. Additionally, a separate floodplain study is also required by the City for large and multi-phase projects. However, as-built LOMRs are required within six months of completing an individual or phase of a project unless the following phase of a project will begin within six months. The phases can then be combined into one LOMR.

3.4 SUMMARY OF KEY FINANCIAL DATA

This section provides an overview of key financial performance of HEF. Historical financial data is used to help projects anticipate finances during implementation planning for preferred development alternatives, as defined later in the Master Plan Update. The preferred development implementation plan is phased by specific projects which will be summarized in the Airport Capital Improvement Program (CIP) following alternatives evaluation. All data in this financial overview is reported in fiscal years (FY) according to the

HEF fiscal calendar which aligns with the City of Manassas Fiscal Year starting July 1st and ending June 30th.

3.4.1 Airport Revenues

Airport revenues are generated from three distinct revenue sources as follows: the operation of the airport, nonoperating sources (e.g. interest income), and contributions from grants from the Federal and State governments and other sources to be used for development of capital projects. Nonoperating revenues refers to non-airline revenues associated with the Airfield and Terminal Cost Centers, which are not paid by Signatory Airlines (e.g., revenue from aircraft parking other than Terminal Apron Fees, military use fees, all Terminal concessions, and Terminal Rents from non-airline tenants). As is common with most airports, wages and benefits accounts for the highest expense at HEF with services and supplies as the second highest expense. **Table 3-3** shows the Airport revenues and capital contributions at HEF from FY 2017 through FY 2021.

TABLE 3-3
HISTORICAL AIRPORT REVENUES AND CAPITAL CONTRIBUTIONS (FY 2017- FY 2021)

Source	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Operating Revenues					
Franchises and leases	$1,663,878	$1,519,148	$1,853,911	$1,951,260	$2,145,378
Hangar rentals	$617,029	$950,664	$963,623	$985,510	$923,943
Tie Downs & Other	$283,329	$251,014	$308,001	$433,918	$196,570
Fuel sales	$144,057	$270,809	$272,499	$244,676	$241,298
Total operating revenues	$2,707,481	$2,991,636	$3,398,035	$3,615,365	$3,507,188
Nonoperating revenues (expenses)					
Wages and benefits	$778,810	$710,717	$732,441	$737,371	$777,972
Services and supplies	$564,305	$521,968	$677,501	$590,701	$636,366
Utilities	$109,730	$136,447	$144,136	$148,557	$126,636
Security	$85,348	$86,855	$91,131	$85,621	$91,877
FAA tower and misc.	$134,764	$139,681	$169,458	$153,119	$161,712
Total nonoperating revenues (expenses)	$1,673,247	$1,595,668	$1,814,667	$1,715,369	$1,794,562
Total Revenues	**$1,034,234**	**$1,395,968**	**$1,583,368**	**$1,899,996**	**$1,712,626**

Source: HEF Financial Plans FY 2017- FY 2021, RS&H Compiled, 2022

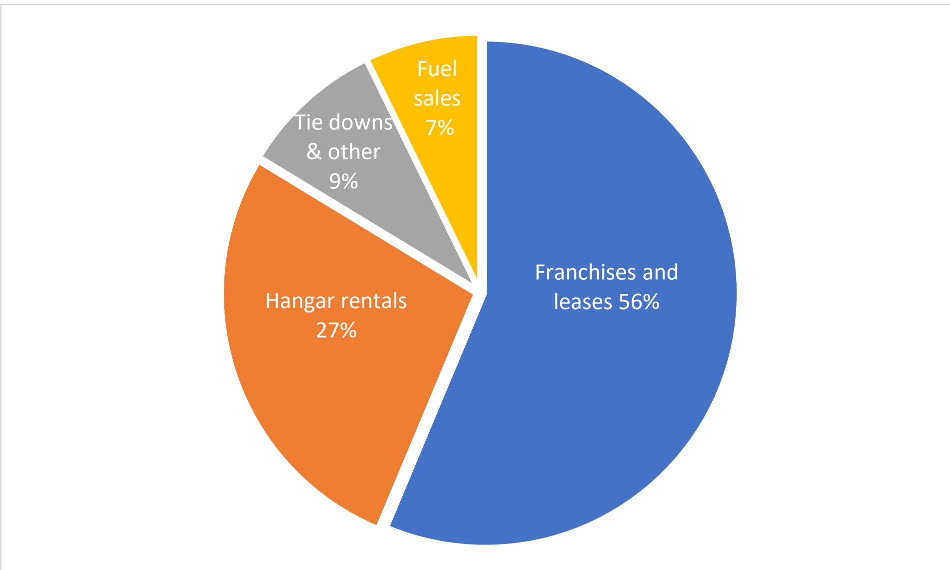
3.4.1.1 Operating Revenues

Operating revenues at HEF, which totaled $3.5 million in FY 2021, are divided into four categories:

- Franchises and leases
- Hangar rentals
- Tie downs & other
- Fuel sales

Figure 3-3 shows each revenue category as an average percentage of operating revenue from FY 2017 through FY 2021. Over that time, franchises and leases were consistently the largest source of operating revenue averaging 56 percent of total operating revenue during the period. HEF rates for hangars and tie-down rentals are competitive and in line with regional peer GA airports in the vicinity.

FIGURE 3-3
AVERAGE OPERATING REVENUE AS A PERCENTAGE OF TOTAL REVENUE (FY 2017- FY 2021)

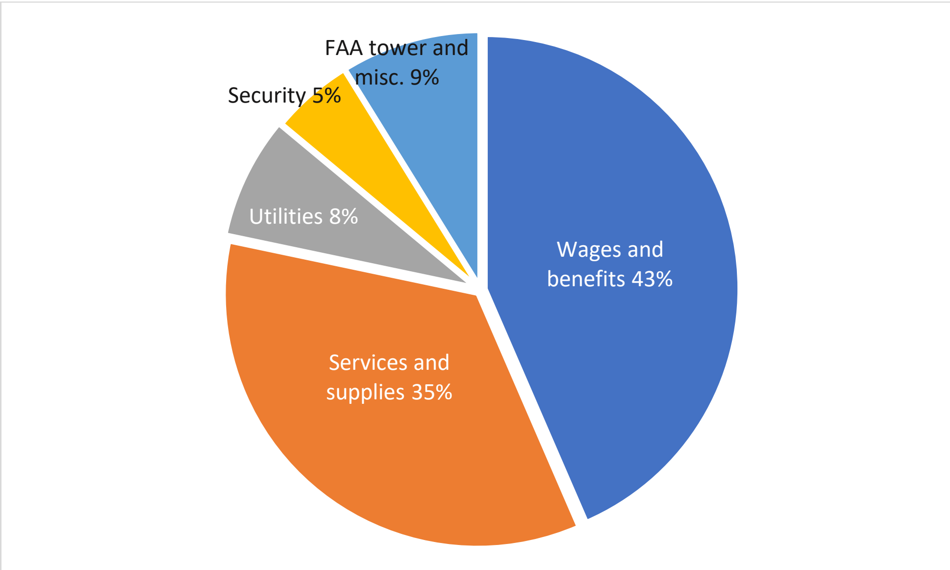


Source: HEF Financial Plans FY 2017- FY 2021, RS&H Compiled, 2022

3.4.1.2 Nonoperating Revenues

Nonoperating revenues are generated outside the operation of the Airport. Operating expenses include salaries and fringe benefit costs, utility costs, and other operating expenses. In FY 2021, operating revenue totaled $2,507,188. Excluding depreciation, wages and benefits make up the largest source of nonoperating revenue from FY 2017 through FY 2021 (see **Figure 3-4**). Services and supplies were consistently the second largest source of nonoperating revenues. **Figure 3-4** shows each expense category as an average percentage of nonoperating revenue during the period.

FIGURE 3-4
AVERAGE NONOPERATING REVENUE AS A PERCENTAGE OF TOTAL NONOPERATING (FY 2017- FY 2021)



Source: HEF Financial Plans FY 2017- FY 2021, RS&H Compiled, 2022

3.4.1.3 Airport Capital Expenditures

Capital expenditures are primarily funded by federal and state capital contributions and on occasion by the issuance of bonds. Additional match requirements are met by the Airport through its operating budget. **Table 3-4** shows historic total Airport capital expenditures between FY 2017 through FY 2021 by fiscal year. Much of this expense was funded through Federal AIP grants for recent large airfield projects.

TABLE 3-4
HISTORIC AIRPORT CAPITAL EXPENDITURES

Source	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Capital Expenditures	$776,994	$776,994	$476,471	$1,211,808	$2,551,000

Source: HEF Financial Plans FY 2017- FY 2021, RS&H Compiled, 2022

3.4.1.4 Federal and State Grants

The Airport receives grants from various sources primarily for the planning, design, and construction of capital projects. The largest source of grants for all capital projects has been the Federal Government through the FAA Airport Improvement Program (AIP). Capital projects deemed eligible are 90 percent funded through FAA grants, with the remaining 10 percent funded either through grants from the Virginia Department of Aviation (DOAV) or by airport funds. On March 27, 2020, the Coronavirus Aid, Relief, and Economic Security (CARES) Act (H.R. 748, Public Law 116-136) was signed into law by the President and includes $10 billion in funds to be awarded as economic relief to eligible airports in response to the COVID-19 pandemic. **Table 3-5** summarizes federal funding received for all major capital projects at HEF since 2010.

TABLE 3-5
FEDERAL GRANT AWARD HISTORY

Fiscal Year	Grant Seq #	Project Description	Federal AIP Entitlement	CARES Act Local Matching Funds	Federal AIP Discretionary	Total Federal AIP Funds
2010	34	Extend Taxiway, Rehabilitate Taxiway	$484,025	$0	$0	$484,025
2010	33	Extend Runway - 16L-34R	$927,062	$0	$0	$927,062
2012	35	Extend Runway - 16L-34R	$3,974,723	$0	$0	$3,974,723
2013	39	Extend Runway - 16L-34R	$600,000	$0	$0	$600,000
2013	36	Rehabilitate Taxiway	$877,390	$0	$0	$877,390
2013	37	Rehabilitate Taxiway	$1,735,645	$0	$0	$1,735,645
2013	38	Extend Runway 16L-34R	$3,099,245	$0	$0	$3,099,245
2014	40	Extend Taxiway	$1,541,804	$0	$0	$1,541,804
2017	43	Rehabilitate Apron	$1,723,834	$0	$0	$1,723,834
2018	44	Construct Taxiway	$263,500	$0	$0	$263,500

Notes: FAA grant records do not differentiate entitlement and discretionary funding prior to 2010.
Source: FAA Grant History Lookup Tool, 2022

In addition to AIP, funds are available through the State of Virginia which uses sales and use tax revenue created in the Department of the Treasury for a special non-reverting fund which is part of the Transportation Trust Fund known as the Commonwealth Airport Fund (CAF). The Commonwealth Transportation Board annually allocates 2.4 percent of the Transportation Trust Fund for the CAF. These funds are allocated by the Commonwealth Transportation Board to the Virginia Aviation Board (VAB). Funds are then allocated by the VAB through the DOAV to any Virginia airport, a governmental subdivision thereof, or a private entity to which the public has access for the purposes enumerated in Code of Virginia §5.1-2.16 or is owned or leased by the Metropolitan Washington Airports Authority.

The Airport Capital Improvement Program utilizes the CAF, through entitlement and discretionary funds, to provide funding for planning and engineering projects that focus on airport facility development. In general, these projects include master plan and airport layout plan studies, environmental studies, land acquisition, airside facility design and construction, and terminal building design and construction. **Table 3-6** shows historic DOAV grants for associated projects through 2021.

TABLE 3-6
HISTORIC ANNUAL DOAV GRANT TOTALS AND PERCENT OF ASSOCIATED PROJECT COST (2019-2021)

Year	Project Number	Project Description	DOAV Grants
2019	CF0030-036	Relocate Localizer	$10,391
2019	CF0030-38	Runway 16L-34R & Taxiway B Widening (Construction)	$12,656
2019	CF0030-41	West Apron Rehabilitation Phase 1	$1,225
2019	CF0030-42	West Corporate Development EA	$829
2019	CF0030-43	West Apron Rehab Phase I (Construction)	$15,323
2019	CS0030-33	Airfield Lighting Regulators	$2,080
2019	CS0030-35	West Apron Rehabilitation (Middle Section) (Construction) non-AIP	$871
2019	CS0030-37	Terminal Loop Road Rehab	$44,396
2019	FE0030-30	Replace Taxiway B Directional Signs	$4,653
2019	FM0030-29	Electrical Vault HVAC Repair	$11,233
2019	MT0030-64	Airport Security Cameras Troubleshoot	$6,761
2019	MT0030-65	Airfield Lighting Supplies	$1,375
2019	MT0030-66	Boiler Pump Replacement	$7,767
2019	PR0030-01	Aviation Promotional	$1,346
2019	VS0030-22	Security Flood Gate Installation	$15,165
2020	CF-0030-43	West Apron Rehabilitation Phase 1	$7,816
2020	CF-0030-045	Taxiway 'G' & Taxilane 'Y' (Construction)	$5,794
2020	CF-0030-044	Taxiway G/Taxilane Y (Design)	$21,715
2020	CF-0030-046	Runway 16R-34L Rehabilitation (Design)	$24,754
2020	PR0030-01	Aviation Promotional	$7,924
2020	CS0030-38	Access Control (Gates) Fiber Optic Backbone	$124,565
2020	VS0030-23	Security Cameras and Upgrades	$40,673
2021	CF-0030-045	Construct Taxiway G/Taxilane Y Construction	$274,466

Year	Project Number	Project Description	DOAV Grants
2021	CF-0030-046	Runway 16R-34L Rehabilitation (Design)	$1,267
2021	CS-0030-039	Stormwater Pollution Prevention Plan and Spill	$3,685
2021	MT0030-067	Main Terminal Building Roof (Specifications)	$7,874
2021	MT0030-069	Terminal Building Roof Replacement (Construction)	$34,750
2021	PR0030-003	Airport Promotion and Marketing	$1,487
2021	CS00300-38	Access Controls (Gates) Fiber Optic Backbone	$8,123

Source: DOAV Annual Self-Reporting of State Aviation funding Received 2019-2021, RS&H Compiled, 2022

3.4.1.5 Debt Coverage

Debt service is the annual payment of principal and interest on the City's bonds held by the Airport Commission on behalf of the Airport. **Table 3-7** shows HEF's debt coverage ratio (DCR) information from FY 2017 to FY 2021. The DCR demonstrates the revenue available to cover debt service payments and it is used as an element of determining creditworthiness by financial lenders. The DCR measures the ratio between available cash and debt service payments and it is used as an element of determining creditworthiness by financial lenders. Throughout the five-year period, HEF's DCR has been above an average of 4.8, indicating a positive cash flow and creditworthiness because it was above the typical minimum lending institution threshold of 1.0. This indicates the Airport had revenues far exceeding any debt obligations.

TABLE 3-7
AIRPORT DEBT COVERAGE (FY 2017- FY 2021)

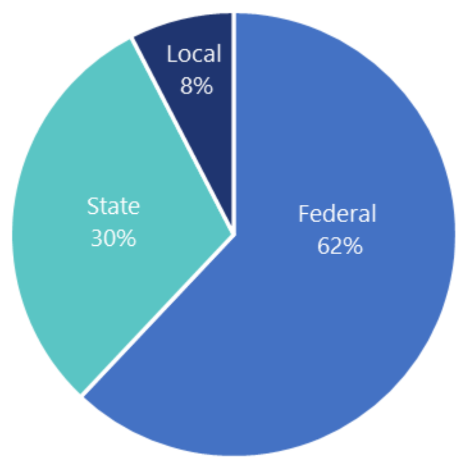
Debt Coverage	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Revenues & Expenses					
Operating revenues	$2,707,481	$2,991,636	$3,398,035	$3,615,365	$3,507,188
Nonoperating revenues (expenses)	$1,673,247	$1,595,668	$1,814,667	$1,715,369	$1,715,626
Total revenues	**$1,034,234**	**$1,395,968**	**$1,583,368**	**$1,899,996**	**$1,791,562**
Annual Debt Service	**$407,689**	**$451,760**	**$453,410**	**$450,010**	**$451,341**
Debt Coverage Ratio	**2.54**	**3.09**	**3.49**	**7.95**	**7.12**

Source: HEF Financial Plans FY 2017- FY 2021, RS&H Compiled, 2022

3.4.2 Existing Capital Improvement Program

HEF develops a CIP every year with the goal of meeting airport capital project needs. Total anticipated capital project funding over the FY 2022 to FY 2028 period is approximately $44 million. **Figure 3-5** shows projected funding sources for the CIP. **Table 3-8** depicts the CIP projects for FY 2022 through FY 2028. The Airport's projected CIP is mostly funded from Federal and State funds.

FIGURE 3-5
AIRPORT PROJECTED CAPITAL FUNDING BY SOURCE (FY 2022- FY 2028)



Source: Airport Records, RS&H Analysis, 2022

TABLE 3-8
EXISTING AIRPORT CIP PROJECTS (FY 2023- FY 2028)

FY	Project Name	Federal Funding	State Funding	Local Funding	Total Funding
2023	City West T-Hangar Rehabilitation (Construction)	$0	$60,000	$15,000	$75,000
2023	East T-hangar Concrete Repair & Replacement (Construction)	$0	$0	$5,570	$5,570
2023	New FAA ATCT Phase 1 (Siting & EA)	$712,500	$22,500	$15,000	$750,000
2023	New Security Fence Installation	$0	$80,000	$20,000	$100,000
2023	Runway 16L-34R Rehabilitation (Design)	$540,000	$48,000	$12,000	$600,000
2023	Taxiway 'B' Rehabilitation & Widening (Construction)	$4,500,000	$400,000	$100,000	$5,000,000
2024	East Apron Rehabilitation (Design)	$360,000	$32,000	$8,000	$400,000
2024	New FAA ATCT Phase 2 (Design)	$665,000	$21,000	$14,000	$700,000
2024	South West T-hangar Alleyways Rehabilitation (Construction)	$0	$60,000	$15,000	$75,000
2024	Taxiways Z & E Concrete Pads Replacement	$0	$12,000	$3,000	$15,000
2025	Landside Paving Program - Terminal Parking Lot Rehabilitation	$0	$73,600	$18,400	$92,000

FY	Project Name	Federal Funding	State Funding	Local Funding	Total Funding
2025	Midfield Ditch Restoration (Design Study)	$0	$120,000	$30,000	$150,000
2025	New FAA ATCT Phase 3 (Construction)	$8,122,500	$256,500	$171,000	$8,550,000
2025	New Security Fence at Fuel Farm Installation	$0	$36,000	$9,000	$45,000
2025	Runway 16L-34R Rehabilitation (Construction)	$4,500,000	$400,000	$100,000	$5,000,000
2025	Tree Clearing/Obstruction Removal	$0	$24,000	$6,000	$30,000
2026	Land Acquisition South West of Airport	$2,700,000	$240,000	$60,000	$3,000,000
2026	Midfield Ditch Restoration (Construction)	$0	$400,000	$100,000	$500,000
2026	New Security Fence for Broad Run	$0	$80,000	$20,000	$100,000
2026	South East Airport Complex Site Development (Design)	$360,000	$32,000	$8,000	$400,000
2026	South West Hangar Redevelopment (Design)	$0	$160,000	$40,000	$200,000
2026	Taxilane X-Ray (Design)	$135,000	$12,000	$3,000	$150,000
2026	Taxiway X-Ray (Construction)	$1,350,000	$120,000	$30,000	$1,500,000
2026	Terminal Parking Lot Expansion (Design)	$0	$80,000	$20,000	$100,000
2027	East Apron Rehabilitation (Construction)	$3,150,000	$280,000	$70,000	$3,500,000
2027	Glen-Gerry Property Reimbursement	$1,764,000	$156,800	$39,200	$1,960,000
2027	North East Apron Expansion (Construction)	$1,080,000	$96,000	$24,000	$1,200,000
2027	North East Apron Expansion (Design)	$90,000	$8,000	$2,000	$100,000
2027	Runway 16L/34R Extension (Design)	$360,000	$32,000	$8,000	$400,000
2027	Terminal Parking Lot Expansion (Construction)	$0	$800,000	$200,000	$1,000,000
2027	Vertiport Development Planning Study	$0	$80,000	$20,000	$100,000
2028	Bypass Taxiway for Runways 16L & 16R (Design)	$90,000	$8,000	$2,000	$100,000
2028	Bypass Taxiway for Runways 16L & 16R (Construction)	$2,700,000	$240,000	$60,000	$3,000,000
2028	Fuel Farm Upgrades	$0	$400,000	$100,000	$500,000
2028	Install Backup Airfield and Terminal Generators	$0	$440,000	$110,000	$550,000
2028	Land Acquisition (34L RPZ)	$270,000	$24,000	$6,000	$300,000

FY	Project Name	Federal Funding	State Funding	Local Funding	Total Funding
2028	Runway 16L-34R Extension (Construction)	$3,150,000	$280,000	$70,000	$3,500,000
2028	South East Airport Complex Site Development (Construction)	$4,500,000	$400,000	$100,000	$5,000,000
2028	South West Hangar Redevelopment (Construction)	$3,600,000	$320,000	$80,000	$4,000,000

Source: Airport Records, RS&H Analysis, 2022

3.4.3 Current and Future Budget

Operating budgets have been prepared for expenses and revenues at HEF for FY 2022 and FY 2023. FY 2022 budgeted revenue is slightly over $3.5 million and approximately $2.6 million in expenses. Despite the impacts of the COVID-19 pandemic, FY 2022 operating revenues are forecast to increase. In addition, FY 2021 reflects that activity at HEF is returning to pre-pandemic levels with an increase in airport operations as presented in the Forecast chapter. Total operating revenues for FY 2023 are projected to be around $3.6 million with operating expenses totaling around $2.8 million. HEF's financial performance has outperformed budget estimates and indicates a continued strong financial profile.

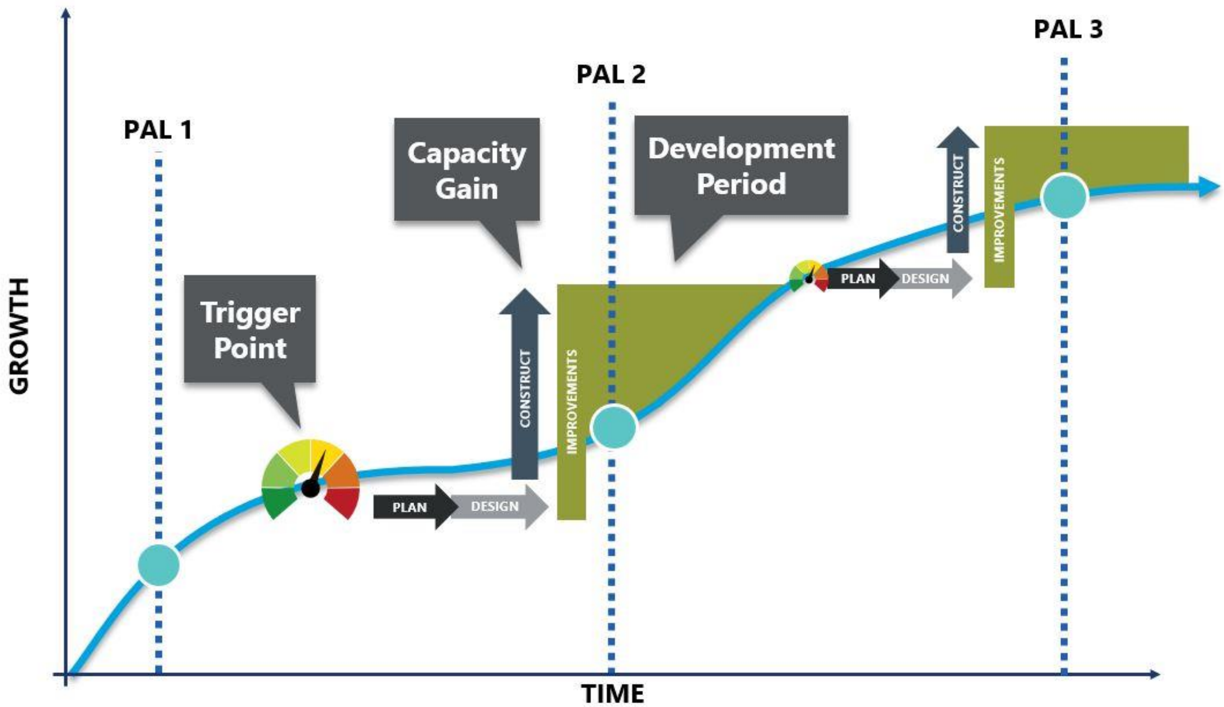
3.5 PLANNING ACTIVITY LEVELS

Airport facility requirements, including the type, size, and quantity, are in large part dependent upon the future aviation activity levels projected in the aviation demand forecasts discussed in **Chapter 2, *Aviation Activity Forecast***. Necessary addition, upgrading, expansion, or sometimes even elimination of facilities can be driven by many factors including capacity constraints, updates to regulatory standards, or adjustments in HEF's strategic vision. Replacement of outdated or inefficient facilities that are cost prohibitive to maintain or modernize also inform facility needs.

The Manassas Regional Airport aviation demand forecast used demographic, economic, and geographic statistical analysis to derive a preferred forecast scenario that ultimately supports scenario-based growth. Although the forecast defines aviation activity milestones for the years 2026, 2031, and 2041, it is important to understand that facility requirements at Manassas Regional Airport are driven by levels of aircraft activity metrics such as enplanements, operations, or based aircraft, which may or may not coincide with those specific years. Therefore, to eliminate associations between demand levels and specific years, the levels of demand triggering facility improvements will be referred to from this point forward as Planning Activity Levels (PALs). PALs correlate with operational levels in each respective forecast year and, subsequently, are divided into three activity levels: PAL 1, PAL 2, and PAL 3.

Figure 3-6 diagrams how and when PALs trigger the need for project planning, design, and implementation at certain demand levels, and the effect on overall facility capacity to meet user needs.

FIGURE 3-6
PLANNING LEVEL TRIGGER POINTS



Source: RS&H, 2022

3.5.1 Aviation Demand Forecasts Review

The Base Case forecast provides the projected metrics that are necessary inputs in developing many of the Airport's facility requirements. A short summary review of some of these metrics shows that Manassas Airport will continue to be an active reliever airport for the city of Manassas and Washington D.C. region. Specifically, a combination of air taxi and general aviation (GA) operations are anticipated to collectively increase each planning activity level (PAL), ultimately increasing the Airport's annual total by more than 30,000 over the forecast horizon. The Airport's based aircraft total is projected to increase by 26 aircraft from 2021-2041.

TABLE 3-9
BASE CASE FORECAST SUMMARY

	Existing	PAL 1	PAL 2	PAL 3
Enplanements	-	-	-	-
Operations	99,649	106,144	113,514	130,088
Air Carrier	1	5	5	5
Air Taxi	12,890	14,250	16,177	20,849
Itinerant GA	37,396	39,676	42,094	47,383
Local GA	46,766	49,617	52,642	59,255
Military	171	171	171	171
Based Aircraft	410	415	423	436

Source: RS&H Analysis, 2022

3.6 METEORLOGICAL CONDITIONS

Weather plays a significant role in influencing airport facility needs and design requirements. Ambient temperature, precipitation, wind, visibility, cloud ceiling, and atmospheric pressure are all climate factors that affect operational parameters and future facility needs.

An analysis of ten years of monthly weather station data from the National Oceanographic and Atmospheric Administration (NOAA) showed that July was the warmest month at Manassas Regional Airport with an average high temperature of 87 degrees Fahrenheit between 2011 and 2021. During that time, the month of July averaged one day of air temperatures exceeding 90 degrees.[2]

Comparatively, the coldest month on average was January, with an average low temperature of 24 degrees Fahrenheit. From 2011-2021, the month of January averaged 23 days with air temperatures at or below freezing (32 degrees).

3.6.1 Runway Orientation and Wind Analysis

Runway wind coverage analysis was conducted using the FAA's Airports GIS Wind Analysis Tool and considers 10 years of meteorological data (January 2011 through December 2020). Data for this tool is supplied by the National Climatic Data Center through the weather reporting station located in the city of Manassas, VA. The wind coverage analysis examines all-weather conditions, visual meteorological conditions (VMC), and instrument meteorological conditions (IMC).

The primary factor in determining runway orientation is the direction of prevailing winds. As stated in FAA AC 150/5300-13B, *Airport Design*, the primary runway should be orientated in the direction of the prevailing winds barring other considerations. FAA runway design standards recommend a runway with a runway design code (RDC) of C-III (Runway 16L-34R) provide a minimum of 95 percent wind coverage at a 16-knot crosswind, and slightly smaller runways (such as Runway 16R-34L), with a RDC of B-II provide a

[2] NOAA, Global Summary of Month Station Details (2022). Global Summary of the Month Station Details: MANASSAS, VA US, GHCND:USC00445204 | Climate Data Online (CDO) | National Climatic Data Center (NCDC) (noaa.gov)

minimum of 95 percent wind coverage at a 13-knot crosswind. With a C-III RDC, Runway 16L-34R meets the 95 percent threshold for VMC, IMC, and all-weather conditions at 16 knots. As a runway system, Runway 16L-34R and Runway 16R-34L meet the 13 knot crosswind requirements for VMC, IMC, and all-weather conditions.

Table 3-10 shows the runway wind coverage percentages in VMC conditions. **Table 3-11** shows the runway wind coverage percentages in IMC conditions. **Table 3-12** shows the runway wind coverage percentages in all-weather conditions at HEF.

TABLE 3-10
RUNWAY WIND COVERAGE - VISUAL METEOROLOGICAL CONDITIONS

VMC WIND DATA				
Runway	Crosswind Component			
	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 16L-34R	98.62%	99.51%	99.92%	99.99%
Runway 16R-34L	98.62%	99.51%	99.92%	99.99%

Source: NOAA National Climatic Data Center
VMC Weather Observations: 126,316
Station: 724036
Data Range: 2011-2020

TABLE 3-11
RUNWAY WIND COVERAGE - INSTRUMENT METEOROLOGICAL CONDITIONS

IMC WIND DATA				
Runway	Crosswind Component			
	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 16L-34R	99.31%	99.69%	99.92%	99.96%
Runway 16R-34L	99.31%	99.69%	99.92%	99.96%

Source: NOAA National Climatic Data Center
IMC Weather Observations: 17,882
Station: 724036
Data Range: 2011-2020

TABLE 3-12
RUNWAY WIND COVERAGE – ALL WEATHER CONDITIONS

ALL-WEATHER CONDITIONS WIND DATA				
Runway	Crosswind Component			
	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 16L-34R	98.69%	99.53%	99.92%	99.98%
Runway 16R-34L	98.69%	99.53%	99.92%	99.98%

Source: NOAA National Climatic Data Center
All-Weather Observations: 147,512
Station: 724036
Data Range: 2011-2020

3.7 AIRFIELD CAPACITY

Capacity, or throughput capacity, is defined as a measure of the maximum number of aircraft operations that can be accommodated on the airport in an hour. To determine airfield capacity and associated aircraft delays at a planning level, the methodology of FAA AC 150/5060-5, *Airport Capacity and Delay* is generally used. HEF is a two-runway system comparable to configuration number 2 depicted in FAA AC 150/5060-5, *Airport Capacity and Delay*. See Figure 2-7.

FAA uses the Annual Service Volume (ASV) as a reasonable estimate of an airport's annual operations capacity. **Table 3-13** shows a comparison of forecast aircraft operations and the estimated ASV ratio of the existing airfield. Calculation of the ASV includes considerations of factors such as runway configuration, weather, the percentage of large and heavy aircraft operations compared to total annual operations as the fleet mix, and the number of touch-and-go operations. The ASV of the existing runway configuration is estimated at 355,000 operations and significantly exceeds forecast operations levels therefore, no additional runway capacity will be necessary within the planning period. With both runways adequately serving the overall airport fleet mix of the future, planning for additional runway capacity should begin when the ASV ratio reaches 60 percent (213,000 operations).

TABLE 3-13
COMPARISON OF FORECAST OPERATIONS AND ANNUAL AIRFIELD CAPACITY

	Existing 2021	Planning Activity Level		
		PAL 1	PAL 2	PAL 3
Forecast Operations	99,649	106,144	113,514	130,088
Existing ASV	355,000	355,000	355,000	355,000
ASV Ratio	28%	30%	32%	37%

Source: RS&H Analysis, 2022

FIGURE 3-7
CAPACITY AND ASV FOR LONG RANGE PLANNING

NO.	Runway-use Configuration	Mix Index %(C+3D)	Hourly Capacity Ops/Hr VFR	Hourly Capacity Ops/Hr IFR	Annual Service Volume Ops/Yr
1.	(single runway)	0 to 20	98	59	230,000
		21 to 50	74	57	195,000
		51 to 80	63	56	205,000
		81 to 120	55	53	210,000
		121 to 130	51	50	240,000
2.	700' to 2499'*	0 to 20	197	59	355,000
		21 to 50	145	57	275,000
		51 to 80	121	56	260,000
		81 to 120	105	59	285,000
		121 to 180	94	60	340,000
3.	2500' * to 3399' or 4299' **	0 to 20	197	62	355,000
		21 to 50	149	63	285,000
		51 to 80	126	65	275,000
		81 to 120	111	70	300,000
		121 to 180	103	75	365,000
4.	3400'+ or 4300'+	0 to 20	197	119	370,000
		21 to 50	149	113	320,000
		51 to 80	126	111	305,000
		81 to 120	111	105	315,000
		121 to 180	103	99	370,000
5.	700' to 2499' / 700' to 2499'	0 to 20	295	62	385,000
		21 to 50	213	63	305,000
		51 to 80	171	65	285,000
		81 to 120	149	70	310,000
		121 to 180	129	75	375,000

* Staggered threshold adjustments may apply, see paragraph 4-6.
** Refer to paragraph 2-2.f.

3.8 AIRFIELD DESIGN

3.8.1 Airfield Configuration

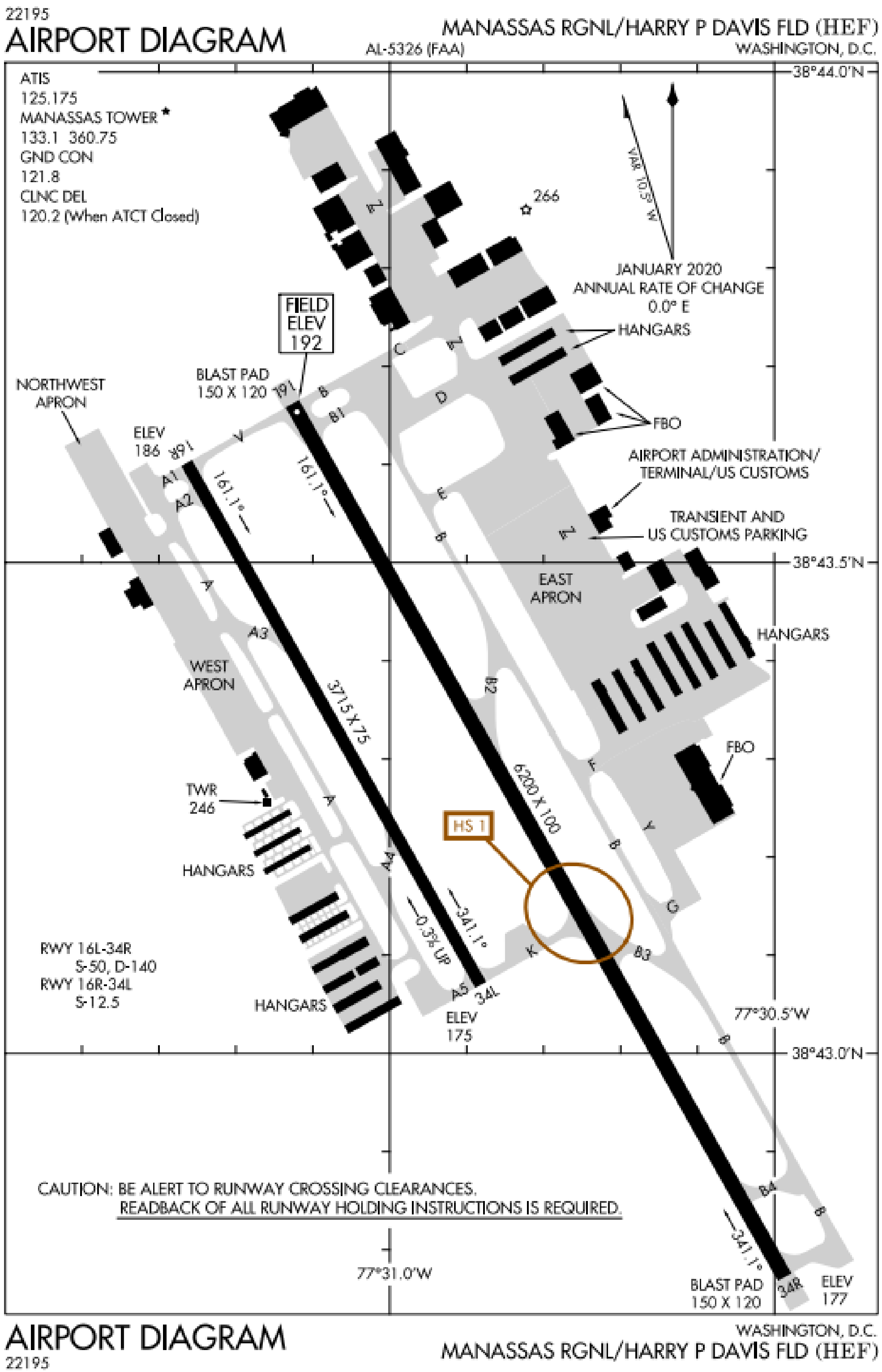
The airfield configuration consists of two runways and 20 taxiways/taxilanes, **Figure 3-8** shows the FAA airport diagram. The Airport's primary runway, Runway 16L – 34R, is 6,200 feet long and 100 feet wide. It is separated from the centerline of parallel Taxiway B by 400 feet. The secondary runway, Runway 16R – 34L, is 3,715 feet long by 75 feet wide and it is separated from the centerline of parallel Taxiway A by 250 feet.

The purpose of a taxiway/taxilane system is to provide safe and efficient movement of aircraft to and from the aprons and runways. The taxiway/taxilane system at HEF consists of the following elements:

- Taxiway A is a full parallel taxiway on the west side of Runway 16R – 34L providing full access to the runway from the Northwest Apron, West Apron and associated hangars. Taxiway A extends in a northwest-southeast orientation. Taxiway A has five connector taxiways, all of which are located to the west of Runway 16R – 34L.
- Taxiway A-1 is a connector taxiway with access to the north end of Taxiway A from Runway 16R
- Taxiway A-2 is a connector taxiway with access to the north end of Taxiway A from Runway 16R
- Taxiway A-3 is a high-speed exit taxiway with access to Taxiway A and West Apron from Runway 16R
- Taxiway A-4 is a high-speed exit taxiway with access to Taxiway A and west hangars from Runway 34L
- Taxiway A-5 is a connector taxiway with access to the south end of Taxiway A from Runway 34L
- Taxiway B is a full parallel taxiway on the east side of Runway 16L – 34R providing full access to the runway from the Passenger Terminal, East Apron, and associated hangar facilities. Taxiway B extends in the northwest-southeast orientation. Taxiway B has four exit taxiways, all of which are located to the east side of Runway 16L – 34R.
- Taxiway B-1 is a connector taxiway with access to the north end of Taxiway B from Runway 16L.
- Taxiway B-2 is a high-speed exit taxiway with access to Taxiway B from Runway 34R.
- Taxiway B-3 is a high-speed exit taxiway with access to Taxiway B from Runway 16L.
- Taxiway B-4 is a connector taxiway with access to the south end of Taxiway B from Runway 34R.
- Taxilane C is a connector taxilane with access from Taxiway B to the Northeast Apron
- Taxilane D is a connector taxilane with access from Taxiway B to the Northeast and East Apron
- Taxilane E is a connector taxilane with access from Taxiway B to the East Apron
- Taxilane F is a connector taxilane with access from Taxiway B to the East Apron and T Hangars
- Taxilane G is a connector taxilane with access from Taxiway B to the Southeast Apron
- Taxilane Y is a connector taxilane with access from Taxiway G to the Southeast Apron and Taxiway F
- Taxilane Z is a connector taxilane providing access along the East Apron
- Taxiway V is a crossover taxiway oriented in an east-west direction providing access to the threshold of Runway 16L and Runway 16R
- Taxiway K is a crossover taxiway oriented in an east-west direction providing access to the threshold of Runway 34L and the midsection of Runway 16L-34R

All Airport taxiways allow for the efficient movement of aircraft. FAA design standards and non-standard conditions for HEF taxiways will be analyzed in **Section 3.8.4**., Taxiway Design, of this chapter.

FIGURE 3-8
FAA AIRPORT DIAGRAM OF MANASSAS REGIONAL AIRPORT



Source: Airport IQ 5010, 2022

3.8.2 Airfield Design Criteria

As is true of all federally obligated airports, FAA airfield design standards are designated by FAA approved critical aircraft[3]. These design standards include geometric standards as well as dimensional requirements, such as the distance between taxiways and runways, and the size of certain areas protecting the safety of aircraft operations and passengers, all designed to accommodate specific critical aircraft.

The FAA recently issued an update to the established guidance for airport design standards in FAA AC 150/5300-13B, Airport Design. This AC outlines design criteria for certain groups of aircraft depending on the Aircraft Approach Category (AAC), Airplane Design Group (ADG), and Taxiway Design Group (TDG). Engineering airfield surfaces to FAA design criteria is critical to maintaining an airfield environment that can safely accommodate the Airport's critical aircraft. Historically, C-III design criteria has guided airfield design at HEF. This has enabled the Airport to meet design standards for the Gulfstream V (existing C-III critical aircraft). However, with the recently issued AC, the parameter for airport design standards will be specified by AAC, ADG and TDG.

Taxiway design guidance is driven by the critical aircraft undercarriage dimensions including overall main gear width and cockpit to main gear distance. The future critical aircraft for HEF's primary runway, Gulfstream V, is a TDG-2B. The airfield configuration at HEF necessitates that Runway 16L-34R and the associated taxiway system will be evaluated based on their ability to accommodate C-III and TDG-2B design standards. Runway 16R-34L is designed to B-II standards as its critical aircraft identified in **Chapter 2, *Aviation Activity Forecast*** is a Citation Sovereign, TDG-1B. Therefore, the associated taxiway network will be evaluated based on its ability to accommodate TDG-1B.

The following sections discuss runway design requirements and taxiway design requirements.

3.8.3 Runway Design

An analysis of HEF runways must evaluate its ability to meet design standards and forecast demand. At a minimum, runways must have adequate length, width, and strength to meet FAA design standards for the critical aircraft. This section analyzes these specific runway criteria and makes recommendations based on forecasted need. Elements to be examined in this section include runway design group, designation, length, width, strength, runway separation requirements and runway protection zones.

3.8.3.1 Runway Design Requirements

The Runway Design Code (RDC) of a runway is used by the FAA to determine the standards that apply to a specific runway and parallel taxiway to allow unrestricted operations by the design aircraft under desired meteorological conditions.[4]

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[3] The most demanding aircraft type, or grouping of aircraft with similar characteristics, that make regular use of the airport. Regular use is a minimum of 500 annual operations, excluding touch-and-go operations. An operation is a takeoff or landing. AC 150/5000-17, *Critical Aircraft and Regular Use Determination* provides FAA guidance on defining critical aircraft at an airport. (FAA, 2017)

[4] FAA AC 150/5300-13B, *Airport Design* (2022)

Runway 16L is the only precision runway at HEF coupled with an instrument landing system (ILS). Runways 16R, 34L, and 34R are non-precision runways. **Table 3-14** shows FAA instrument approach visibility minimums and equivalent runway visual range definitions. Based on existing ½ mile visibility minimums at HEF, the RDC for Runway 16L is C-III-2400. Runway 34R has an RNAV (GPS) approach with 1 mile visibility minimums. The RDC for Runway 34R is C-III-5000. As the secondary runway, Runway 16R-34L primarily accommodates general aviation operations by smaller piston and turboprop aircraft, but it is also capable of accommodating some smaller corporate jets. Runway 16R-34L has an RNAV (GPS) approach on each end with 1 mile visibility minimums, making it an RDC of B-II-5000.

TABLE 3-14
INSTRUMENT APPROACH VISIBILITY MINIMUMS

Runway Visual Range (RVR)	Instrument Flight Visibility Category (Statute Miles)
5000	Not lower than 1 mile
4000	Lower than 1 mile but not lower than 3/4 mile
2400	Lower than 3/4 mile but not lower than 1/2 mile
1600	Lower than 1/2 mile but not lower than 1/4 mile
1200	Lower than 1/4 mile

Note: RVR values are not exact equivalents.
Source: FAA AC 150/5300-13B, *Airport Design* (2022)

3.8.3.2 Runway Designation

Every runway has two associated directional headings. A true heading, or the direction toward which it is physically oriented that will not change unless the runway is realigned, and a magnetic heading, which is determined by the runway's orientation relative to magnetic north. A runway's magnetic heading is important because navigation equipment and instrument approaches are designed with respect to magnetic heading rather than a true heading. Due to the slow drift of the magnetic poles on the Earth's surface, the magnetic bearing of a runway may change over time and a runway redesignation must occur.

Analysis conducted indicates that the rate of magnetic variance at HEF is 10.27° W ± 0.22° W as of February 2022. The current rate of change is 0° 0' W per year. As shown in **Table 3-15,** neither Runway 16L-34R or Runway 16R-34L will require a runway designation revision within the next 100 years. It is industry standard that a runway designation be considered when the runway magnetic heading shifts more than 5° from the existing runway designation. However, HEF will not experience a runway magnetic heading shift.

Table 3-15 shows the Airport's runway designations and anticipated changes throughout the planning period.

TABLE 3-15
RUNWAY DESIGNATION

Existing				Future (2041)		
Runway Designation	**Runway Heading**	**True Bearing**	**Magnetic Bearing**	**Magnetic Heading**	**Runway Heading**	**Runway Designation**
Runway 16L	160°	150° 43' 4.08"	160° 16' 4.08"	160° 16' 4.08"	160°	Runway 16L
Runway 34R	340°	330° 43' 4.08"	340° 16' 4.08"	340° 16' 4.08"	340°	Runway 34R
Runway 16R	160°	150° 38' 14.28"	160° 11' 14.28"	160° 11' 14.28"	160°	Runway 16R
Runway 34L	340°	330° 38' 14.28"	340° 11' 14.28"	340° 11' 14.28"	340°	Runway 34L

Source: NOAA – National Centers for Environmental Information; RS&H Analysis, 2022

3.8.3.3 Runway Length Requirements

Runway length is determined by the greater requirement of the takeoff or landing performance characteristics of the existing and future design aircraft, or the composite family of airplanes as represented by the design aircraft. The takeoff length, including takeoff run, takeoff distance, and accelerate-stop distance, is typically the more demanding of the runway length requirements.

As described below, there are two primary means for determining the Airport's recommended runway lengths:

Guidance A FAA Recommended Runway Length: This analysis provides a general estimated runway length guidance based on FAA Runway Design Matrix Tool and Advisory Circular 150/5325-4B performance graphs for composite aircraft groups, as adjusted for HEF mean maximum temperature, field elevation, difference in runway centerline elevations, and aircraft flight range of greater than 500 nautical miles.

Guidance B Critical Aircraft Planning Manuals (Performance Curves or Performance Tables): This analysis determines runway length required for specific aircraft models and engines based on data from the aircraft manufacturer, operator requirements, aircraft operating (payload) weights, flight range, historical environmental conditions, and field elevation.

General runway length analysis was computed based on FAA computer modeling software and Advisory Circular performance graphs for composite aircraft groups, as adjusted for HEF mean maximum temperature (87.0°F), field elevation (192.3 feet above mean sea level), and difference in runway centerline elevations (15 feet for Runway 16L-34R). **Table 3-16** provides the FAA recommended runway length requirements.

TABLE 3-16
RUNWAY LENGTH REQUIREMENTS

Aircraft Category	FAA Recommended Runway Length
Existing Runway 16L-34R Length	**6,200'**
Existing Runway 16R-34L Length	**3,715'**
Small Airplanes with approach speeds of less than 50 knots	
Small Airplanes (< 12,500 lbs)	
100% of Fleet (< 10 seats)	3,600'
100% of Fleet (> 10 seats)	4,150'
Large Airplanes (12,501 lbs - 60,000 lbs)	
75% of Fleet @ 60% Useful Load	4,800'
75% of Fleet @ 90% Useful Load	6,600'
100% of Fleet @ 60% Useful Load	5,400'
100% of Fleet @ 90% Useful Load	8,150'
Large Airplanes (> 60,000 lbs)	
500 Mile Stage Length	5,340'
1,000 Mile Stage Length (e.g., Dallas, TX)	5,690'
1,500 Mile Stage Length (e.g., Salt Lake City, UT)	6,120'
Long Haul Stage Length	6,700'

Sources: FAA Advisory Circular 150/5325-4, Runway Length Requirements for Airport Design; FAA Airport Design Microcomputer Program 4.2D; RS&H Analysis, 2022

Runway 16R-34L is currently 3,700 feet long and is located on the west side of the airfield parallel to Runway 16L-34R. Runway 16R-34L is primarily intended for piston and turboprop aircraft operations, although its critical aircraft is the Citation Sovereign, a business jet. Guidance A was used to assess aircraft which operate on Runway 16R-34L, small piston and turboprop aircraft below 12,500 pounds and large airplanes between 12,501 pounds and 60,000 pounds. The analysis for piston and turboprop aircraft under 12,500 pounds produced a runway length requirement of approximately 3,600 feet. The subsequent analysis for aircraft between 12,501 pounds and 60,000 pounds found the FAA's runway length curves exceed the takeoff length requirement, 3,650 feet, found in the critical aircraft's Airport Planning Manual. Therefore, the current length of 3,715 feet should be adequate to accommodate regular piston, turboprop, and critical aircraft operations operating off Runway 16R-34L during the planning period.

Guidance B was used to assess large airplanes over 60,000 pounds. The Airplane Planning Manual of the critical aircraft family and larger business jets which operate out of HEF were also referenced. The analysis complimented with the Airport's Runway 16L-34R Aircraft Usage Matrix on file found that nearly all HEF's fleet mix can operate unrestricted using the airport's longest runway of 6,200 feet, however, some of the largest business jets at HEF cannot takeoff at maximum allowable weight (MTOW) during the highest temperatures experienced at HEF. **Table 3-17** identifies the fleet mix which fall into this category, their total operations based on CY 2020 FAA Offload data and required runway length at HEF during the highest temperatures experienced at the airport. Runway length calculations for individual aircraft and pilot surveys for additional support for the runway extension are found in **Appendix B** of this Master Plan.

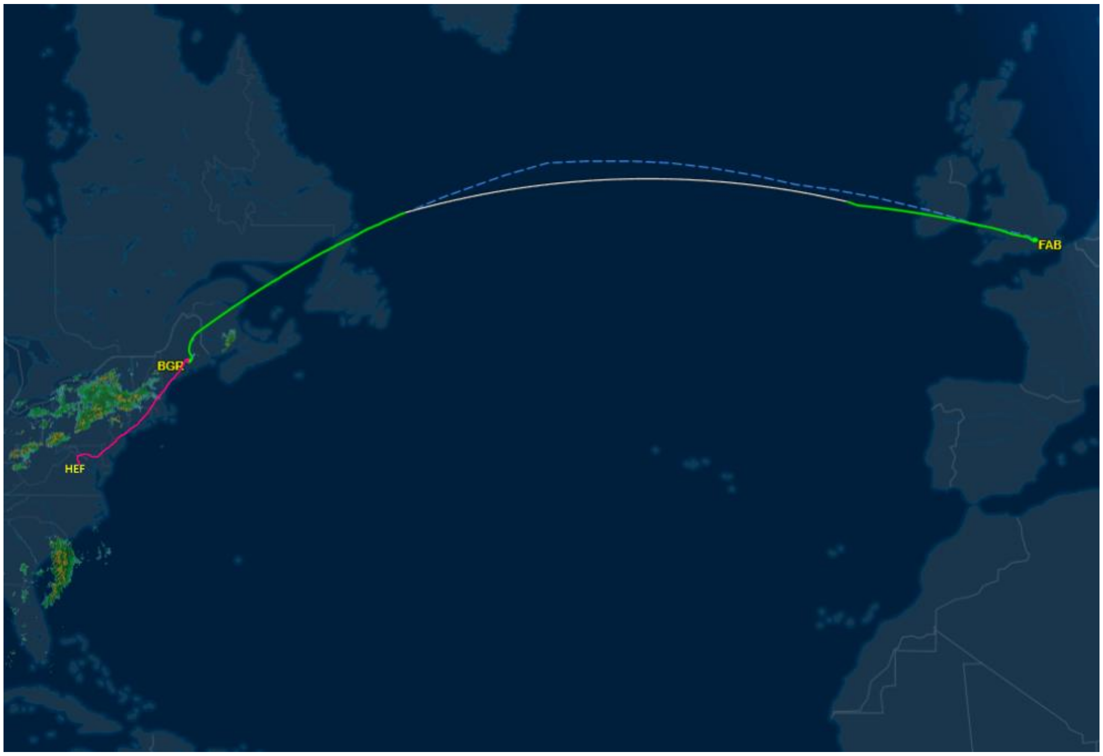
TABLE 3-17
BUSINESS/REGIONAL JET REQUIRED RUNWAY LENGTH AT MTOW

ICAO Code	Model	AAC/ADG	2020 Operations	Runway Length
CL60	Challenger 650	C/II	306	7,550
E145	EMB/ERJ-145	C/II	2	6,476
LJ35/36	Learjet 35/36	D/I	21	6,404
LJ60	Learjet 60, 60XR	C/I	163	6,404
GLEX	Global 6000	B/III	8	6,464
GLF5	Gulfstream V	C/III	35	6,492
TOTAL			535	

Sources: FAA Offload Data; Runway Length Requirements for Airport Design; Airport Planning Manuals; RS&H Analysis, 2022

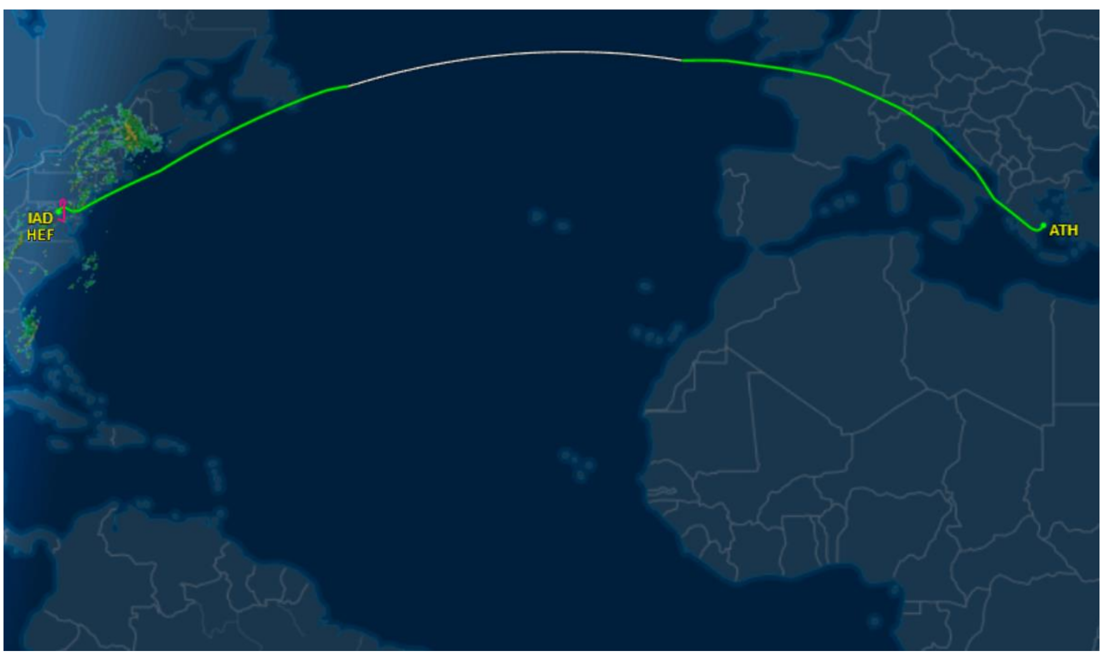
Historical data indicates over 500 operations by aircraft within the fleet mix and this number will continue to increase since business jet share for the Commonwealth and HEF is forecasted to increase over the planning period. There is evidence of larger business jets repositioning to an airport with a longer runway prior to embarking on long-haul trips, indicative of MTOW. **Figure 3-9** depicts a trip by a Challenger 600 repositioning from HEF to Bangor International Airport (BGR) prior to flying over 3,150 nautical miles to Farnborough, England (FAB/EGLF). BGR has one runway with a length of 11,440 feet. Additionally, **Figure 3-10** depicts a trip by a Gulfstream V repositioning from HEF to Washington Dulles (IAD) prior to flying over 4,500 nautical miles to Athens, Greece (ATH/LGAV). IAD has four runways with all runway lengths extending over 9,400 feet. Both flight operations occurred within the month of July and indicate the frequency of similar operations.

FIGURE 3-9
CL60 TRIP: HEF TO BGR TO FAB/ EGLF



Source: Flightaware.com

FIGURE 3-10
GLF5 TRIP: HEF TO IAD TO ATH/LGAV



Source: Flightaware.com

Consequently, the runway lengths at HEF are deemed inadequate to serve the current and forecast fleet mix for airplanes over 60,000 pounds. The runway length analysis resulted in a recommended runway length of approximately 6,700 feet, thus requiring a runway extension of 300 feet to Runway 16L-34R. An extension to Runway 16L-34R would impact the MALSF lighting and would require adjustment. The localizer is placed 1,300 feet from the runway end and therefore would likely remain in place with an extension. The Alternatives chapter will explore and incorporate change to runway lighting resulting from a runway extension.

3.8.3.4 Runway Widths

Runway 16L-34R is 100 feet wide with no paved shoulders. Runway 16R-34L is 75 feet wide with paved shoulders that are 12.5 feet wide. The Airport does currently mow its shoulders and stabilizes turf on the sides of both runways. FAA design standards recommend or require runway shoulders dependent upon the ADG of aircraft using the runway, to provide resistance to blast erosion and accommodate passage of maintenance and emergency equipment as well as the occasional aircraft veering from the runway. Per AC 150/5300-13B, *Airport Design*, paved shoulders on runways are not required for runways with critical aircraft designated as ADG-I, ADG-II, or ADG-III. In their place, guidance suggests using turf or stabilized soil treatments. Paved shoulders are required for runways accommodating ADG IV and higher aircraft and are recommended for runways with ADG-III as the critical aircraft. For this reason, it is recommended that the shoulders of Runway 16L-34R are paved as the critical aircraft, Gulfstream V, is an ADG-III aircraft. **Table 3-18** shows the widths of Runway 16L-34R and 16R-34L both meet current FAA standards. As is true of all facility requirement tables within this chapter, facilities meeting FAA design standards are shown with a checkmark "✓" and unmet design standards are denoted by a bold "**X**".

TABLE 3-18
RUNWAY WIDTH REQUIREMENTS

Runway	Design Group	Width	Shoulder	Meets Requirements (✓)
16L-34R	ADG-III	100′	0′	✓[1]
16R-34L	ADG-II	75′	12.5′	✓

Note: 1) Shoulders are not required for Runway 16L-34R but are recommended as ADG-III aircraft operations reach 500 operations annually.
Source: AC 150/5300-13B, *Airport Design*; RS&H Analysis, 2022

3.8.3.5 Runway Protection Zones

FAA defines Runway Protection Zones (RPZs) off runway ends to enhance the protection of people and property on the ground. The size of these zones varies according to design aircraft characteristics, visual approaches, and the lowest instrument approach visibility minimum defined for each runway. It is most desirable to have these areas clear of incompatible objects and owned by the Airport.

There are two RPZs for each runway end – a departure and an approach RPZ. HEF has instrument approaches for all runway ends and therefore each runway end has an approach RPZ, the larger and more limiting of the two. There are no declared distances at HEF so all RPZs begin at 200 feet from the end of the usable pavement on each runway. **Table 3-19** lists dimensions and acreage of the most demanding RPZ (approach RPZ) for each runway end, and amount of acreage not owned by the Airport.

TABLE 3-19
RUNWAY PROTECTION ZONE REQUIREMENTS

RPZ Measure	Runway			
	16L	34R	16R	34L
Length	2,500'	1,700'	1,000'	1,000'
Inner Width	1,000'	500'	500'	500'
Outer Width	1,750'	1,010'	700'	700'
Total Acreage	78.91	29.47	13.77	13.77
Airport Owned (✓)	**X (21.92 Acres)**	✓	✓	**X (3.71 Acres)**

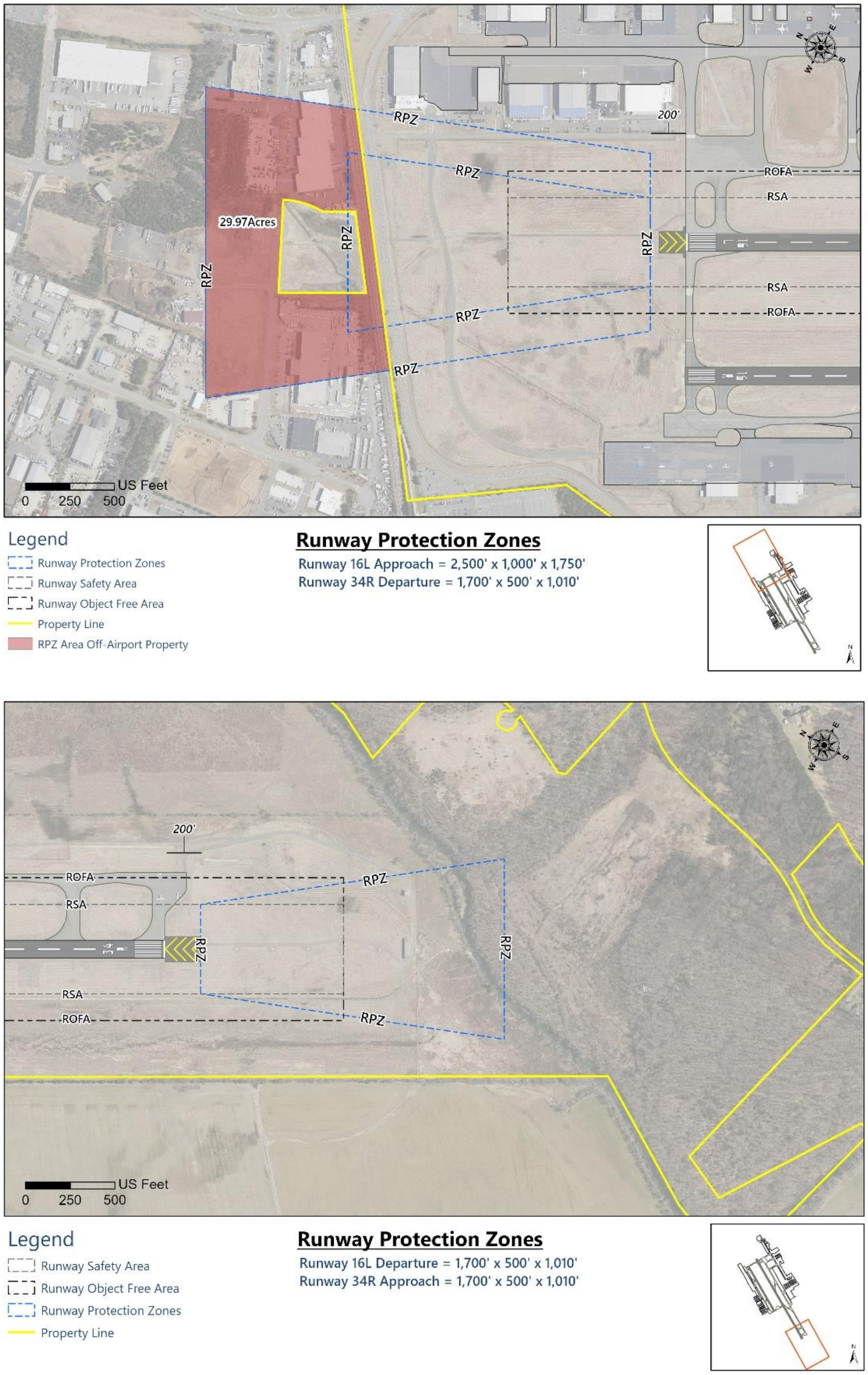
Source: AC 150/5300-13B, *Airport Design*; RS&H Analysis, 2022

As recommended, the existing RPZs are fully owned by the Airport on Runway 34R and Runway 16R. The approach RPZ for Runway 16L contains approximately 21.92 acres of off-Airport property and crosses a rail line. Runway 34L includes approximately 3.71 acres of off-Airport property.

In FAA RPZ guidance, transportation facilities but not limited to including public roads/highways were identified as examples of land uses in an RPZ that are incompatible. The intention of this guidance is to address the introduction of new or modified land uses, meaning that while the uses are defined as incompatible, mitigation is not immediately required for previously existing infrastructure. However, FAA does not support expansion of incompatible uses within the RPZs. The Airport should continue to regularly assess overall risk presented by the rail line and maintain communication with the FAA Regional Office and Airports District Office (ADO).

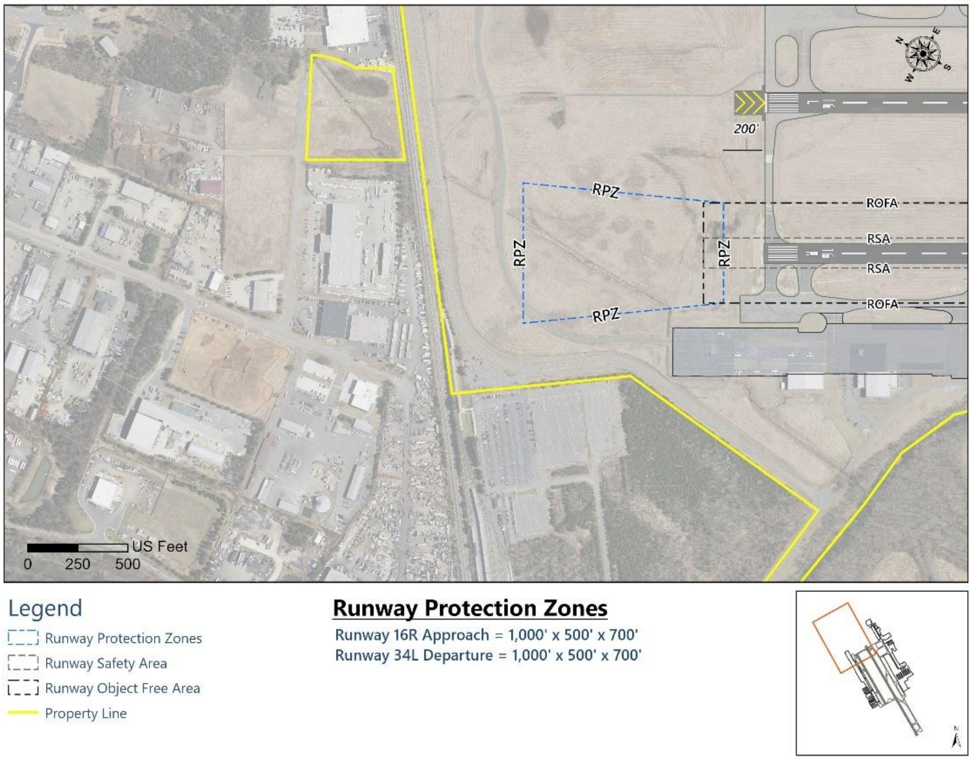
The approach RPZs for each runway end are shown in **Figure 3-11** and **Figure 3-12**. Portions of the RPZs outside the airport property boundary are highlighted in red along with their associated acreage. 21.92 acres on the approach end of Runway 16L and 3.71 acres on the approach end of Runway 34L are outside of the airport property boundary, however, the airspace over these areas are controlled through existing avigation easements. While this is not an immediate concern, the Airport should monitor the properties and attempt to acquire the remaining unowned land within each RPZ when practical.

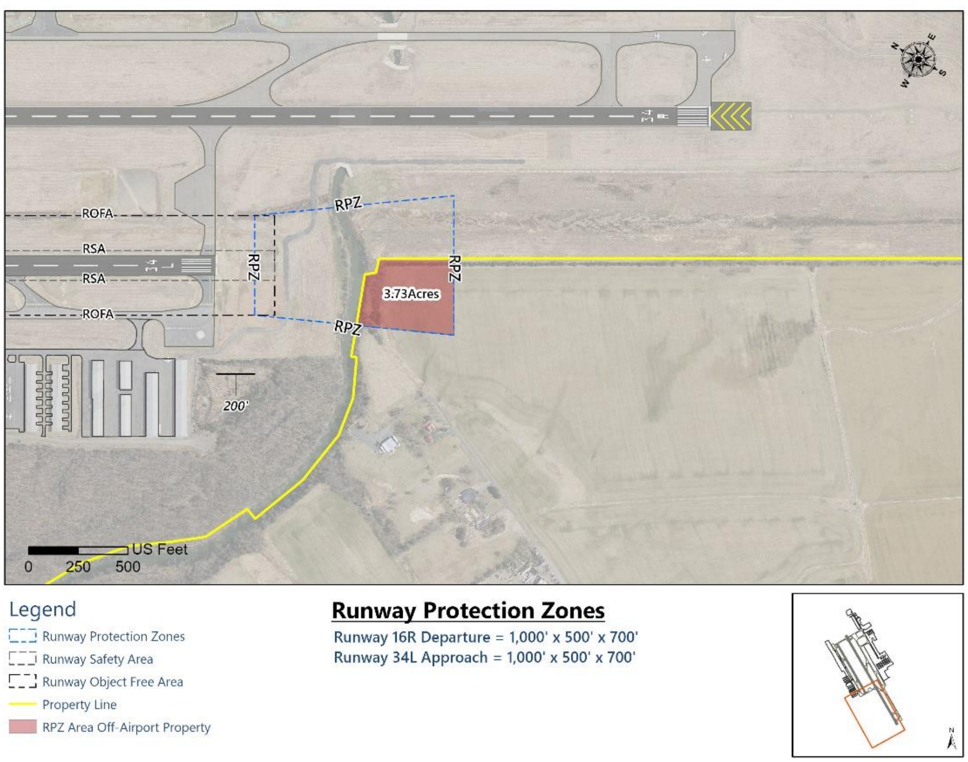
FIGURE 3-11
RUNWAY 16L-34R RPZ EVALUATION



Source: RS&H Analysis, 2022

FIGURE 3-12
RUNWAY 16R-34L RPZ EVALUATION





Source: RS&H Analysis, 2022

3.8.3.6 Runway Geometric and Separation Standards

This section analyzes the existing runway geometric and separation distances against the dimensional standards that arise from the critical aircraft category designated for each runway. Compliance with FAA airport geometric and separation standards is intended to meet a minimum level of airport operational safety and efficiency.

Runway 16L-34R Design Standards

Runway 16L-34R was evaluated for geometric and separation deficiencies using C-III runway design criteria. **Table 3-20** compares the current FAA C-III design standards to existing conditions.

TABLE 3-20
RUNWAY 16L-34R DESIGN STANDARDS

Airfield Components	C-III Requirement	Existing	Meets C-III Requirement
Blast Pad Design			
Runway blast pad width	140′	120′ - 140'	X[1]
Runway blast pad length	200'	150' – 200'	X[1]
Runway Separation			
Runway centerline to:			
Holding position	250'	250'	✓
Parallel taxiway/taxilane centerline	400'	400'	✓
Parallel runway centerline	700′	750′	✓[2]
Aircraft Parking Area	*485.5′	700'	✓
Safety Areas			
Runway Safety Area (RSA)			
Length beyond departure end	1,000'	1,000'	✓
Length prior to threshold	600'	600'	✓
Width	500'	500'	✓
Runway Object Free Area (ROFA)			
Length beyond runway end	1,000'	1,000'	✓
Length prior to threshold	600'	600'	✓
Width	800'	800'	✓
Runway Obstacle Free Zone			
Length beyond runway end	200'	200'	✓
Width	400'	400'	✓
Precision Obstacle Free Zone[3]			
Length	200'	200'	✓
Width	800'	800'	✓

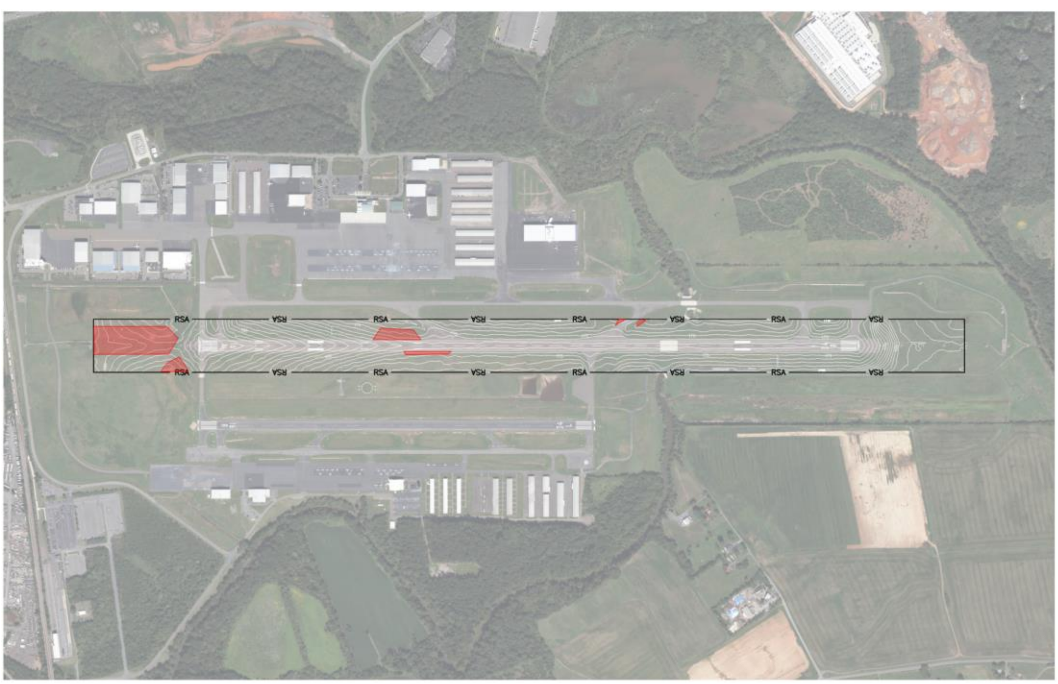
Note: AC 150/5300-13B: Airport Design adjusts separation of aircraft parking area to allow aircraft parking outside of the TOFA
Note: 1) Runway 16L blast pad width and length do not meet C-III requirement
Note 2) Minimum separation standards for runway centerlines is dependent on simultaneous Visual Flight Rule operations. Simultaneous landings and takeoffs using VFR, the minimum separation between centerlines of parallel runways is 700 feet.
Note 3) The Precision Obstacle Free Zone only applies to Runway 16L

The only element that does not meet C-III geometric design standards is the blast pad width and length at the 16L approach end. The critical aircraft for 16L-34R is the Gulfstream V (ADG-III), therefore the design standards will need to be met.

The single hot spot on the airfield, HS-1 (see **Figure 3-8**), is located within the safety area of 16L-34R where Taxiway K and B3 intersect the runway. The FAA defines hot spot as a location on an airport movement area with a history of potential risk of a collision or runway incursion. Heightened attention by pilots, drivers, and controllers is necessary when maneuvering through a hot spot. As a result of the crown of Runway 16R-34L, inhibits a pilot's ability to locate Taxiway B3 while holding short on Taxiway K. The inability to locate Taxiway B3 introduces risk to surface operations. The Airport installed a new airfield guidance direction sign to Taxiway B3 so pilots holding short on Taxiway K can more easily locate Taxiway B3. From interviews with ATC, there have been no incursions at HS-1 in the last year. Alternatives will examine solutions to correct the hot spot intersection (HS-1).

From daily inspections and visual observations, a number of surface variations were found within the RSA. These surface variations can be found at the approach end of Runway 16L, near the Taxiway B2 intersection, and Taxiway B3 intersection. **Figure 3-13** depicts areas within the RSA with observed surface variations and/or drainage discrepancies which may impact the ability to support snow removal equipment, ARFF equipment, and passage of aircraft during dry conditions. These areas will require a topographic survey during the Runway 16L-34R rehabilitation design to determine solutions to mitigate the non-standard RSA conditions. The transverse and longitudinal grading of the RSA were assessed and found to be within grading standards found in FAA Advisory Circular 150/5300-13B, paragraph 3.16.6.

FIGURE 3-13
RWY 16L-34R SURFACE VARIATIONS



Source: RS&H Analysis, 2022

Runway 16L-34R Design Standards

Table 3-21 compares FAA airport design standards to existing conditions for Runway 16R-34L using B-II runway design criteria. The B-II design criteria will be used as the standard as opposed to the B-II Small criteria as the critical aircraft for the runway is the Citation Sovereign.

TABLE 3-21
RUNWAY 16R-34L DESIGN STANDARDS

Airfield Components	B-II Requirement	Existing	Meets B-II Requirement
Blast Pad Design			
Runway blast pad width	95'	n/a	✓
Runway blast pad length	150'	n/a	✓
Runway Separation			
Runway centerline to:			
Holding position	200'	200'	✓
Parallel Taxiway/Taxilane Centerline	240'	250'	✓
Parallel runway centerline		750'	✓[1]
Aircraft Parking Area	302'	350'	✓
Safety Areas			
Runway Safety Area (RSA)			
Length beyond departure end	300'	300'	✓
Length prior to threshold	300'	300'	✓
Width	150'	150'	✓
Runway Object Free Area (ROFA)			
Length beyond runway end	300'	300'	✓
Length prior to threshold	300'	300'	✓
Width	500'	500'	✓
Runway Obstacle Free Zone (ROFZ)			✓
Length beyond runway end	200'	200'	✓
Width	400'	400'	✓
Precision Obstacle Free Zone			
Length	n/a	n/a	n/a
Width	n/a	n/a	n/a

Note: AC 150/5300-13B: Airport Design adjusts separation of aircraft parking area to allow aircraft parking outside of the TOFA ROFZ is 120' wide for operations on runways by small aircraft with approach speeds of less than 50 knots. ROFZ is 250' wide for operations on runways by small aircraft with approach speeds of 50 knots or more. ROFZ is 400' wide for operations by large aircraft.
Note 1) Minimum separation standards for runway centerlines is dependent on simultaneous Visual Flight Rule operations. Simultaneous landings and takeoffs using VFR, the minimum separation between centerlines of parallel runways is 700 feet.

3.8.4 Taxiway Design

This taxiway analysis addresses specific requirements relative to FAA design criteria and the ability of the existing taxiways to accommodate the current and projected demand. At a minimum, taxiways must provide efficient circulation, be constructed to the proper strength, and meet FAA design standards to safely accommodate the design aircraft. Airport runways need to be supported by a system of taxiways that provide access between the runways and the aircraft parking and hangar areas. Taxiways are classified as:

- Parallel Taxiway - Facilitate the movement of aircraft to and from the runway.
- Exit Taxiway – Provide a means of entering and exiting the runway (does not include those taxiways designated as connector, parallel, or apron edge taxiway).
- Crossover or Traverse Taxiway – Provide increased taxiway flexibility between two parallel taxiways.
- Apron Taxiway or Connector- Provide primary aircraft access in an aircraft parking apron.

Classifications for HEF taxiways and taxilanes are shown in **Table 3-22**.

TABLE 3-22
TAXIWAY/TAXILANE CLASSIFICATIONS

Taxiway Designation	Taxiway Classification
TWY A	Full Parallel Taxiway
TWY A1	Exit Taxiway
TWY A2	Exit Taxiway
TWY A3	Exit Taxiway
TWY A4	Exit Taxiway
TWY A5	Exit Taxiway
TWY B	Full Parallel Taxiway/Exit Taxiway
TWY B1	Exit Taxiway
TWY B2	Exit Taxiway
TWY B3	Exit Taxiway
TWY B4	Exit Taxiway
TWY C	Apron Taxiway
TWY D	Apron Taxiway
TWY E	Apron Taxiway
TWY F	Apron Taxiway
TWY G	Apron Taxiway
TWY V	Crossover Taxiway
TWY K	Crossover Taxiway
TXL Y	Apron Taxiway
TXL Z	Apron Taxiway

Source: AC 150/5300-13B, Airport Design; RS&H Analysis 2022

The goal of an effective taxiway system is to maintain traffic flow using taxi routing with a minimum number of points requiring a change in the airplane’s taxing speed. At HEF, there are a total of 20 taxiways, including taxiway connectors. Taxiway A serves as the parallel taxiway for Runway 16R-34L.

Taxiway A has two exit taxiways from Runway 16R-34L and three connector taxiways, all of which are located on the west side of the runway. Aircraft routing to and from the West Apron will use Taxiway A and associated connectors. Taxiway A is supported by two run up areas located near the thresholds for Runway 16R-34L. The run-up areas allow aircraft operators to perform the necessary high RPM flight checks in a designated area while also allowing aircraft to effectively sequence for departure or maintenance operations.

Taxiway B serves as the parallel taxiway for Runway 16L-34R and has six exit taxiways all of which are located on the east side of the runway. There is a run-up area near the end of Runway 16L and Runway 34R. Taxiways C, D, E, F and G provide access to hangars and parking positions on the East apron. Taxiways Y and Z allow aircraft to taxi through the East apron. Taxiway V serves as a crossover taxiway providing access to the approach end of Runway 16L and 16R. Taxiway K serves as a crossover taxiway providing access to the approach end of Runway 34L and mid-section of 34R. Taxiway K has a run-up area to allow aircraft operators to perform flight checks.

The Airport's design aircraft determines taxiway design standards and dimensional criteria. Taxiway pavement width is determined by the TDG of the design aircraft. Separation standards are determined by the ADG of the design aircraft. Depending on demand, portions of an airfield may be designed for one specific aircraft type while other portions are designed for other aircraft types. These divisions of airfield design are dependent upon the role each facility plays at the Airport. The intent behind this FAA guidance is to avoid overdesign and/or under-design of airport facilities. At HEF, Runway 16L-34R and Taxiway B are the primary facilities serving a critical aircraft of a Gulfstream V. The FAA recommended design standards for ADG-III/ TDG-2B taxiways are provided in **Table 3-23**.

TABLE 3-23
TAXIWAY REQUIREMENTS: ADG-III/TDG-2B

Taxiway Components	Taxiway Width	Taxiway Shoulder Width	Taxiway Safety Area Width	Taxiway Object Free Area Width	Centerline to Parallel Taxiway	Centerline to Parallel Taxilane	Centerline to Fixed or Movable Object	Taxiway Fillet Design
Requirement (ADG III, TDG 2)	35'	15'	118'	171'	144'	138'	85.5'	[2]
TWY B	✓	✓[1]	✓	✓	-	✓	✓	✓
TWY C	✓	✓[1]	✓	✓	✓	-	-	✓
TWY D	✓	✓[1]	✓	✓	✓			✓
TWY E	✓	✓[1]	✓	✓	✓	-	✓	✓
TWY F	✓	✓	✓	✓	✓	-	✓	✓
TWY G	✓	✓	✓	✓	✓	-	✓	✓
TWY K	✓	✓[1]	✓	✓	✓	-	✓	✓
TWY V	✓	✓[1]	✓	✓	✓	-	✓	✓

Note: 1) Paved taxiway shoulders are not required taxiway serving ADG-III or smaller aircraft, however, they are recommended by FAA.
Note 2) See section 4.7 in FAA Advisory Circular 150/5300-13B for fillet design dimensions
Source: AC 150/5300-13B, Airport Design; RS&H Analysis, 2022

At HEF, Runway 16R-34L and Taxiway A are the primary facilities serving pistons, turboprops, and the runway's critical aircraft, Citation Sovereign. TDG-2B aircraft regularly operate on Taxiway A to cross the airfield via Taxiways V and K, including a handful of jet aircraft based on the west side of the airfield (i.e., Cessna Citation); therefore, design standards for Taxiway A will reflect ADG-II/TDG-2B. The FAA recommended design standards for ADG-II/ TDG-2B taxiways are provided in **Table 3-24**.

TABLE 3-24
TAXIWAY REQUIREMENTS: ADG-II/TDG-2B

Taxiway Components	Taxiway Width	Taxiway Shoulder Width	Taxiway Safety Area Width	Taxiway Object Free Area Width	Centerline to Parallel Taxiway	Centerline to Fixed or Movable Object	Taxiway Fillet Design
Requirement (ADG II, TDG 2B)	35′	15′	79′	124′	102′	55′	1
TWY A	✓	✓	✓	✓	✓	✓	✓2

Note 1) See section 4.7 in FAA Advisory Circular 150/5300-13B for fillet design dimensions
Note 2) The Taxiway Edge Safety Margin (TESM) for the Citation Sovereign goes to the edge of pavement at TWY A intersection between TWY A4 and TWY A5.
Source: AC 150/5300-13B, Airport Design; RS&H Analysis, 2022

The non-movement area pavement was evaluated as ADG-III/TDG-2B taxilanes. Taxiways C, D, E, F and G are considered Taxilanes once inside the non-movement boundary. Taxilane Y extends from Taxilane F to Taxilane G along the southern end of the East apron. Taxilane Z extends across majority of the East apron and intersects Taxilanes C, D, and E. **Table 3-25** shows the requirements for Taxilanes designed to ADG-III/TDG-2B standards.

TABLE 3-25
TAXILANE REQUIREMENTS: ADG-III/TDG-2B

Taxilane Components	Taxilane Width	Taxilane Shoulder Width	Taxilane Safety Area Width	Taxilane Object Free Area Width	Centerline to Parallel Taxiway	Centerline to Fixed or Movable Object
Requirement (ADG III, TDG 2B)	35′	15′	118′	158′	138′	79″
TXL C	✓	✓	✓	✓	✓	X
TXL D	✓	✓	✓	✓	✓	✓
TXL E	✓	✓	✓	✓	✓	✓
TXL F	✓	✓	✓	✓	✓	✓
TXL G	✓	✓	✓	✓	✓	✓
TXL Y	✓	✓	✓	✓	✓	✓
TXL Z	✓	✓	✓	✓	✓	✓

Source: AC 150/5300-13B, Airport Design; RS&H Analysis, 2022

The existing taxiways and associated connectors were compared to the design standards set forth in AC 150/5300-13B, Airport Design, to identify deficiencies. Currently, all the taxiways have turf shoulders which meet FAA standards. FAA guidance recommends that taxiway shoulders should be paved for all taxiways that serve ADG-III aircraft. Taxiway B rehabilitation project is currently in design and widening of the pavement was recently removed from the project scope. It is recommended that 15-foot paved shoulders be considered for Taxiway B during subsequent rehabilitation projects. 15-foot paved shoulders are also recommended for Taxiways C, D, E, K and V, however, they all meet the design standards.

3.8.4.1 Taxiway Deficiencies Summary

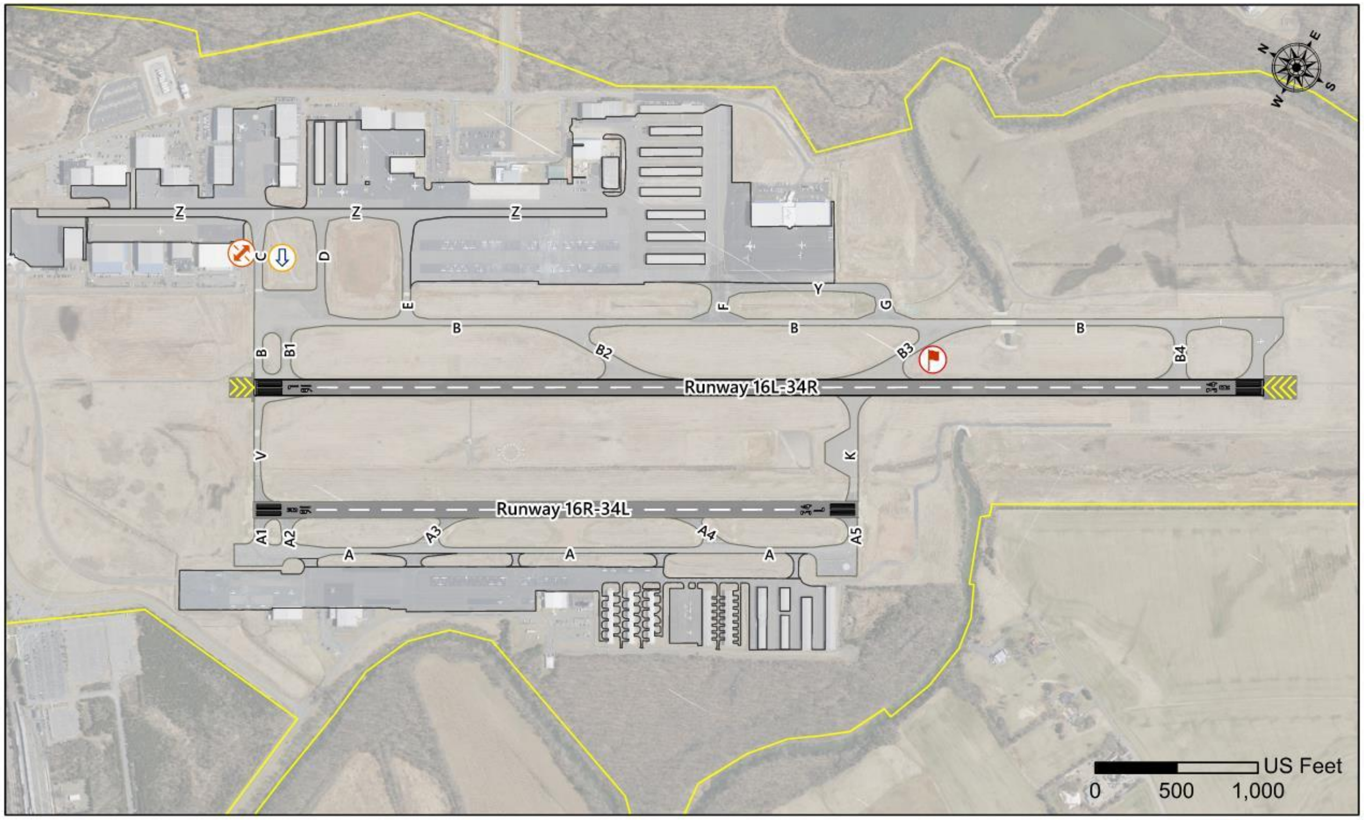
Analysis of the taxiways and taxilanes were conducted to determine if airfield deficiencies existed compared to current FAA design standards. The deficiencies found are described in this section. Some deficiencies are critical to safe operations and should be focused on during the planning period. Other deficiencies are less safety-critical and therefore are better candidates for deferral when they could be addressed in conjunction with major rehabilitation projects as appropriate. It is important to note that deviations from FAA standards stem from updated FAA standards and these differences are known to the FAA. The FAA typically takes the position that these taxiway deficiencies are best corrected as pavement reaches the end of its useful life and reconstruction is necessary.

- **Taxiway B** lacks paved taxiway shoulders. While they are not required, it is recommended that they be constructed for improved safety. FAA guidance recommends paved shoulders for taxiways, taxilanes, and aprons accommodating ADG-III aircraft. A number of ADG-III aircraft have under-wing engines that overhang the shoulder. The critical aircraft at HEF, Gulfstream V, has engines in the tail section that do not overhang the shoulders therefore paved shoulders may not be as critical for the taxiway.
- **Taxiway B** exit taxiways have an unusual naming convention. It is recommended that the taxiways be renamed from B1 to B6 during the next Taxiway B rehabilitation project.
- **Taxiway C** lacks paved taxiway shoulders. While they are not required, it is recommended that they be constructed for improved safety. FAA guidance recommends paved shoulders for taxiways, taxilanes, and aprons accommodating ADG-III aircraft.
- **Taxiway C** provides direct access from the apron to the runway, which is not recommended per Advisory Circular 150/5300-13B Section 4.3.5.1. Either the apron or runway entrance for Taxiway C is recommended to be offset so pilots must make a series of turns before entering the runway from the apron.
- **Taxilane C**, Taxilane Object Free Area (TLOFA) separation standards are not met as the perimeter fence protrudes into the TLOFA. This discrepancy can be alleviated by offsetting the taxilane to the south to provide the required TLOFA without impact to the fence or moving the fence.
- **Taxiway D** lacks paved taxiway shoulders. While they are not required, it is recommended that they be constructed for improved safety. FAA guidance recommends paved shoulders for taxiways, taxilanes, and aprons accommodating ADG-III aircraft.
- **Taxiway E** lacks paved taxiway shoulders. While they are not required, it is recommended that they be constructed for improved safety. FAA guidance recommends paved shoulders for taxiways, taxilanes, and aprons accommodating ADG-III aircraft.
- **Taxiway K** lacks paved taxiway shoulders. While they are not required, it is recommended that they be constructed for improved safety. FAA guidance recommends paved shoulders for taxiways, taxilanes, and aprons accommodating ADG-III aircraft.

- **Taxiway K,** which includes an area with HS-1 in the airport diagram provides aircraft access to a high-speed taxiway, Taxiway B3. An elevated taxiway location sign has been placed in the areas to address concerns; however, this area will be reviewed in the alternative analysis process to ensure reasonable solutions have been worked and reviewed by Airport staff.
- **Taxiway V** lacks paved taxiway shoulders. While they are not required, it is recommended that they be constructed for improved safety. FAA guidance recommends paved shoulders for taxiways, taxilanes, and aprons accommodating ADG-III aircraft.

In summary, a portion of the items identified are not deficiencies requiring immediate action due to any critical safety risk. Rather, many are the result of FAA design guidance updates occurring after the construction of certain areas of the airfield. The following chapter, **Airport Development Alternatives** will address the design recommendations previously mentioned. These airfield items are presented in **Figure 3-14**.

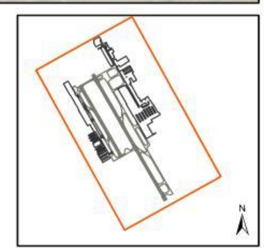
FIGURE 3-14
TAXIWAY DEFICIENCIES



Taxiway Deficiencies

Legend

- Property Line
- TLOFA Penetration
- Line-of-Sight: Complex Runway-Taxiway Intersection
- Direct Taxiing Access to Runways from Ramp Areas



Note: Standards in accordance with FAA AC 150/530-13B J.5.2

3.8.5 Runway Incursion Mitigation

In 2015, the FAA initiated a pilot program to improve runway safety at airports. The Runway Incursion Mitigation (RIM) program identified areas of increased risk of runway incursions at specific airfield intersections at an airport. The FAA has evaluated runway incursion data and has compiled a list of locations that have a higher-than-average frequency of runway incursions. Locations where three or more incursions occurred in a given year, or locations where more than 10 incursions occurred over the evaluation period were identified and published on the RIM Inventory List. HEF has no RIM locations at this time.

The FAA has also defined specific locations at airports as hot spots to help alert airport users of the locations of the airfield that may be confusing to pilots and lead to a higher risk of incursions. Hot spots and RIM locations are similar but not the same. Hot spots are identified based on local stakeholders and the user's perception of a location on the airfield whereas RIM locations are determined based on set standards established by the FAA. HEF has one identified hot spot at the intersection of Taxiway K and Taxiway B3.

Through the RIM program, the FAA has established geometry code keys, also referred to as "Geocodes", to catalog specific geometry conditions that may contribute to an increase in runway incursions. There is a total of 19 Geocodes. Each one describes a specific issue related to non-standard geometry. The analysis examined the Geocodes in relation to the HEF airfield. The following Geocodes are associated with each location as well as a description of how these issues increase the risk of runway incursions.

Taxiway A3

- **Geocode 13-** Taxiway intersects runway at other than a right angle.

Taxiway A4

- **Geocode 13-** Taxiway intersects runway at other than a right angle.

Taxiway B

- **Geocode 8-** Direct taxiing access to runways from apron areas. The design increases the risk of a pilot inadvertently taxiing onto the runway by mistake because no decision-making process, in the form of directional input, is required by the pilot before entering the runway.

Taxiway B2

- **Geocode 13-** Taxiway intersects runway at other than a right angle.

Taxiway B3

- **Geocode 13**- Taxiway intersects runway at other than a right angle.

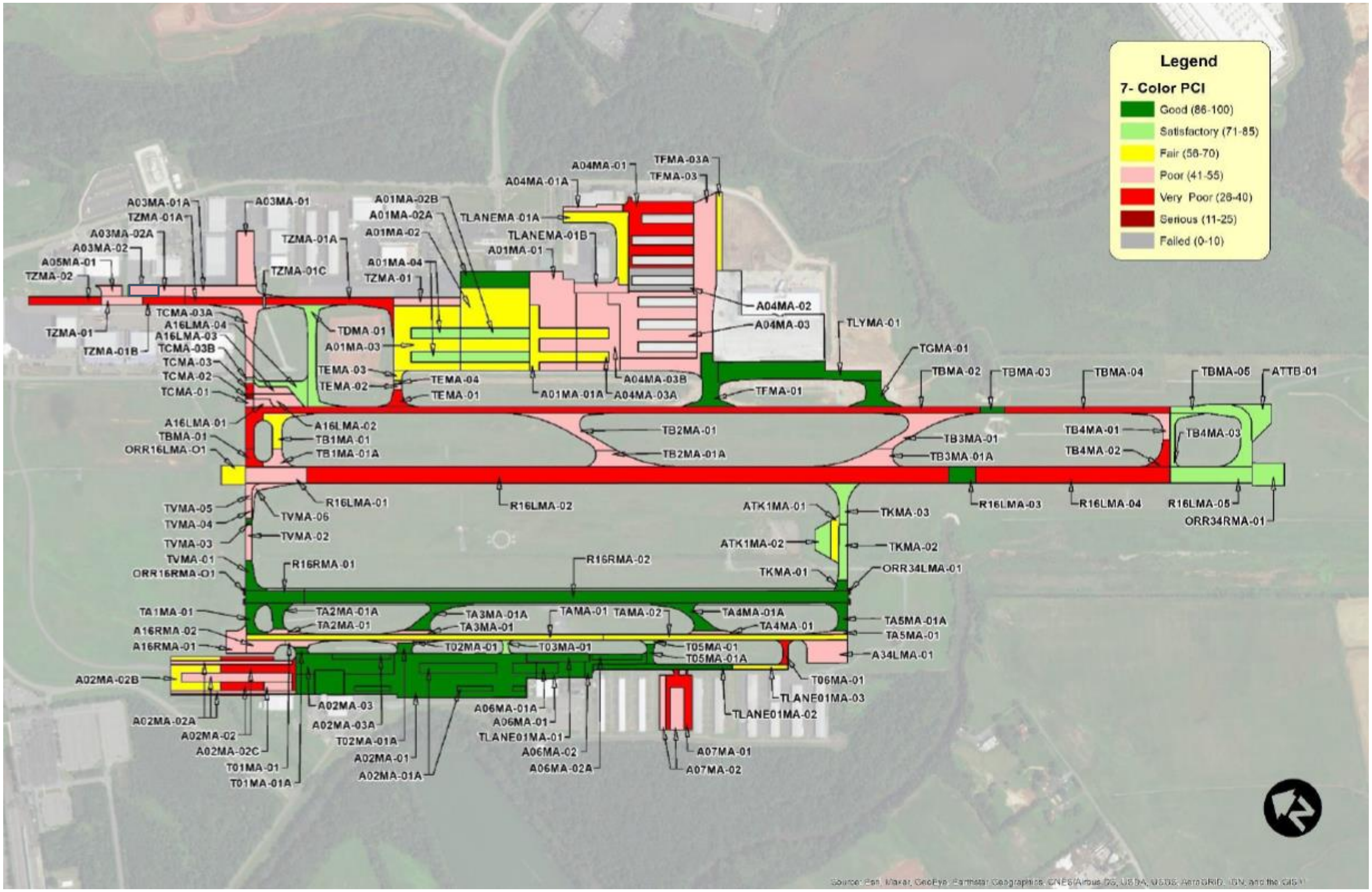
It is unrealistic to expect that all Geocodes at all these locations could be addressed. Associated facilities, such as the runways, taxiways, and apron environment are relatively fixed, and addressing every listed Geocode would entail significant capital investment to the degree it may be impractical. Instead, less costly, and more practical measures, such as education, signage, and marking enhancements may be more viable options to address those concerns. The following chapter will describe potential solutions for addressing the Geocodes at each location.

3.8.6 Pavement Condition

The DOAV conducted pavement inspections in October 2020 using the Pavement Condition Index (PCI) method as specified in ASTM D5340-20 and FAA AC 150/5380-6C. The PCI is a numerical rating scale from 0 to 100 that provides a measure of the pavement's functional surface condition. The overall area-weighted network PCI (AW PCI) for the HEF pavement network is 62, representing a "Fair" condition. The network are-weighted pavement age (AW Age) is 12 years. The DOAV report states pavement within the 56-70 range is considered "fair" and that the near-term maintenance and rehabilitation (M&R) needs may range from routine to major. The report also identifies a PCI of 60 on non-runway pavements as the 'trigger' for major M&R work.

Construction of new Taxiway G occurred in 2019 and rehabilitation of 16R-34L occurred in 2020. All five Taxiway A connector pavements, up to the runway holding position marking, were rehabilitated in 2020. Therefore, these surfaces were rated 'Good', meaning pavement has minor or no distresses and should require only routine maintenance. Majority of Runway 16L-34R, Taxiway B, Taxilane Z, hangar pavement on the East apron received a 'Very Poor' rating which means the pavement has predominantly medium- and high-severity distresses that cause considerable maintenance and operational problems. Near-term maintenance and rehabilitation needs will be major and intensive in nature and should be treated as soon as practical. **Figure 3-15** shows the Airport's PCI ratings from October 2020.

FIGURE 3-15
2020 AIRPORT PAVEMENT CONDITION REPORT



Source: DOAV Pavement Management Update, 2021

3.9 NAVIGATIONAL AIDS, LIGHTING, SIGNAGE, MARKING, AND AIRSPACE

3.9.1 NAVAIDS

Navigational aids and lighting, often referred to as NAVAIDS, consist of equipment to help pilots locate the Airport. NAVAIDS can provide information to pilots about the aircraft's horizontal alignment, height above the ground, location of airport facilities, and the aircraft's position on the airfield. HEF features all three types of navigational aids (visual, electronic, and meteorological). The following narrative describes the three types of NAVAIDS as well as any deficiencies that currently exist at HEF.

Ownership and maintenance of some NAVAIDS are not always provided by the FAA. The Airport or Department of Aviation in some cases owns the NAVAIDS. However, at Manassas Regional Airport, the non-federal NAVAIDS are owned by the Airport. Airport staff and FAA personnel confirmed the NAVAIDS at the Airport are not owned and maintained by one entity. The Runway 34R MALSF, PAPIs and REILs are owned and maintained by the Airport. All other NAVAIDS on the Airport are owned and maintained by the FAA.

3.9.1.1 Visual Aids and Electronic Aids

Visual aids at HEF include those specific to each runway and those that serve the entire airport. Electronic aids include devices and equipment used for aircraft instrument approaches.

The airfield lighting at Manassas Regional Airport is extended to both runways. Runway 16L-34R has high-intensity runway edge lights (HIRL). Runway 16L has Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) equipment. Runway 16L MALSR equipment does not meet the 3-inch frangibility requirement found in FAA Advisory Circular 150/5300-13B and Advisory Circular 150/5220-23A. The airport and FAA are aware of this non-standard condition and intend to resolve this issue during RWY 16L-34R rehabilitation. Each end of Runway 16L-34R has threshold lights. Runway 34R has a Medium Intensity Approach Lighting System with Sequenced Flashers (MALSF) and does not have touchdown zone lighting. Runway 16R-34L has Medium-Intensity Runway Edge Lighting (MIRL). Each end of Runway 16R-34L has Runway End Identifier Lighting (REIL).

The Airport's taxiway system meets the FAA standard with a minimum of medium-intensity taxiway lighting (MITL). Analysis of the other HEF navigational aids found the Airport does have an illuminated wind cone and a segmented circle. The traffic pattern indicators on the segmented circle indicate non-standard right turns for Runway 16R and Runway 34R.

The Airport's electronic aids include an airport beacon and Category I instrument landing system (ILS) equipped with a localizer and glideslope for Runway 16L. The Airport also has two four-light PAPI at Runway 16L-34R and two two-light PAPI at Runway 16R-34L. The Airport does not have distance measuring equipment (DME); however, the airport is pursuing this option with the FAA.

Visual and electronic aids, and their ownership status at HEF, are listed in **Table 3-26.** An "X" denotes a facility that the Airport does not have, and is recommended based on FAA Airport Design criteria, while the dashes indicate the NAVAIDs the Airport does not currently have.

TABLE 3-26
VISUAL AND ELECTRONIC NAVIGATIONAL AIDS

NAVAID	Primary Runway		Parallel Runway		Ownership
	16L	34R	16R	34L	
Visual Aids					
Approach Lighting	MALSR	MALSF	REIL	REIL	FAA / Airport
Lighting System	HIRL	HIRL	MIRL	MIRL	Airport
Runway Markings	Precision	Non-Precision	Non-Precision	Non-Precision	Airport
Runway Wind Cone	Yes	Yes	Yes	Yes	Airport
Visual Slope Indicator	PAPI (P4L)	PAPI (P4L)	PAPI (P2L)	PAPI (P2L)	Airport
Rotating Beacon	Yes	Yes	Yes	Yes	Airport
Segmented Circle	Yes	Yes	Yes	Yes	Airport
Electronic Aids (Approaches)					
Glideslope	Yes	No	No	No	FAA
LOC	Yes	No	No	No	FAA
RNAV (GPS)	Yes	Yes	Yes	Yes	FAA
DME	-	-	-	-	-

Note: 1) A segmented circle is used by all runways. Abbreviations: PAPI=Precision Approach Path Indicator; P4L=PAPI 4 Light; P2L=PAPI 2 Light; MALSR=Medium Approach Light System with Runway Alignment Indicator Lights; MALSF=Medium Approach Light System with Sequenced Flashers; HIRL=High Intensity Runway Lighting; MIRL=Medium Intensity Runway Lighting
Source: FAA Chart Supplements, 2022; FAA 5010 Form, 2022; RS&H Analysis, 2022

3.9.1.2 Meteorological Aids

Meteorological aids consist of equipment that reports weather conditions to users and tenants at an airport. Manassas Airport has a single meteorological aid, an Automated Weather Observation System (AWOS-3). Analysis of the existing equipment and the needs of the airport indicate that there are no deficiencies, and all meteorological aids are adequate through the planning period.

3.9.2 Airspace

This section contains a summary of the airspace surrounding Manassas Regional Airport, the responsibilities of various air traffic control facilities, and limitations imposed on the flight paths of individual aircraft by the geography and surrounding airspace. In addition, it describes the preferred runway uses, aircraft approaches and departures, special air traffic rules, and noise mitigation strategies.

The FAA controls airspace through several layers of air traffic control facilities. The Potomac Consolidated Terminal Radar Approach Control (TRACON) facility handles arriving aircraft during their initial descent towards HEF and departing traffic after they clear the Airport traffic pattern. The Air Traffic Control Tower (ATCT) located on the Airport is responsible for aircraft making their final approach before landing, ground operations, takeoff, and initial climb.

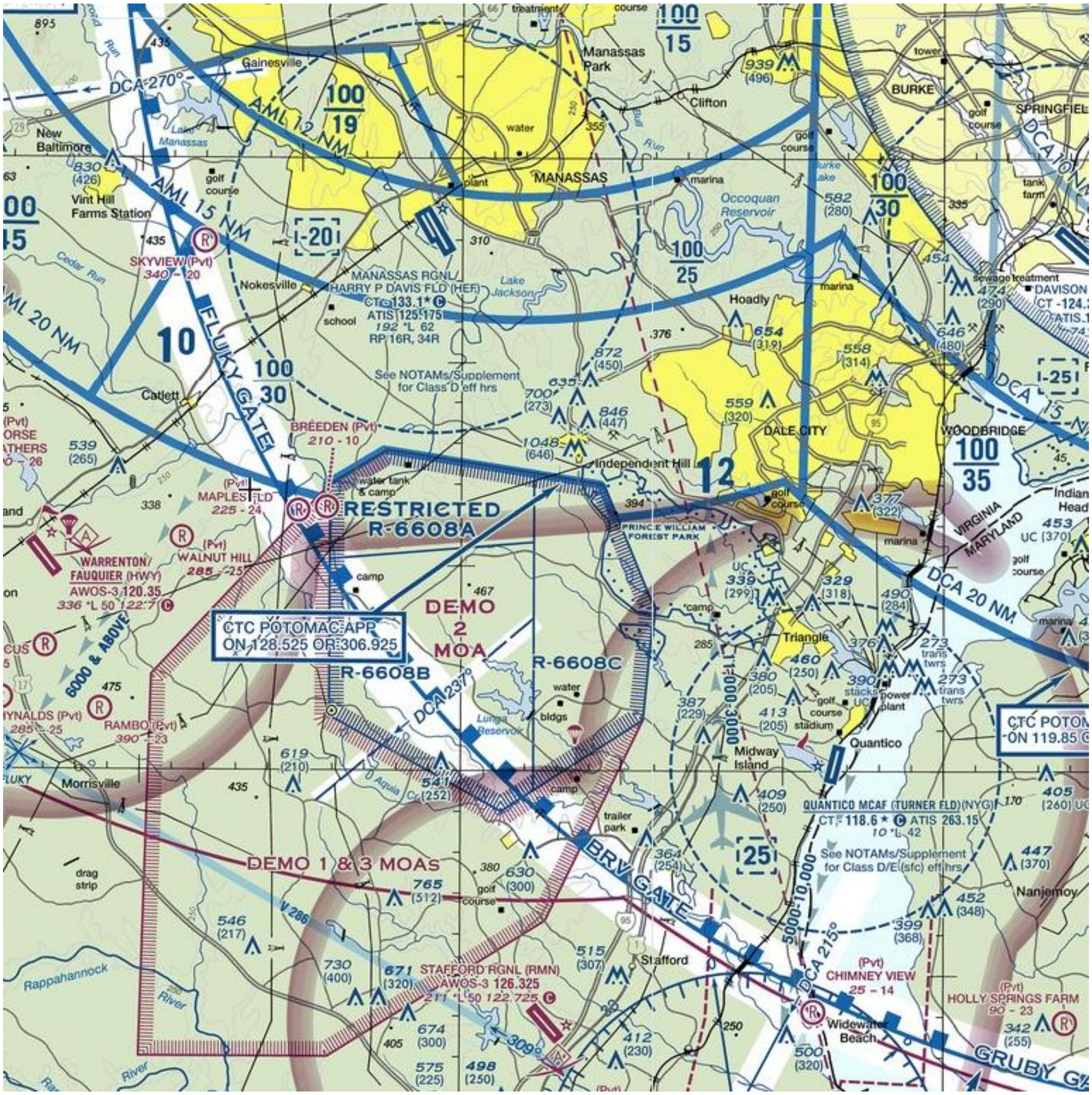
Figure 3-16 depicts the airspace surrounding the Airport. South of the Airport there are two special use airspaces. These two special use airspaces are a DEMO Military Operating Area (MOA) and a Restricted Area (R-6608). A MOA is airspace where military operations are conducted frequently enough that a special designation is justified to ensure non-military pilots are aware of the potential for military aircraft activity. The MOA has been divided into three areas identified as DEMO 1, DEMO 2, and DEMO 3. Demo Areas 1, 2, and 3 are active six to ten times a year with two-to-four-hour blocks. When the DEMO areas are active, they are active from the surface up to 15,000 feet MSL. IFR arrivals and departures require extra coordination with Potomac TRACON. No practice approaches are authorized at this time due to minimized airspace. When the MOA is active during south flow operations IFR departures are given a heading from Potomac TRACON/Shenandoah East/Northwest bound. IFR arrivals during south flow are provided alternate missed approach instructions, weather permitting HEF ATC would keep the aircraft in the pattern, East of the Airport. When the MOA is active during north flow operations there is no change to IFR departures. Most aircraft enter ATC's airspace from the North or East of the airfield during IFR arrivals in North flow. There is not enough airspace to take aircraft East of the DEMO area coming from the South, therefore, all aircraft are vectored West and then brought in North of the Airport.

Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from a controlling agency may be extremely hazardous to an aircraft and its occupants. R-6608 is divided into three areas identified as R-6608A, R-6608B, and R-6608C. These areas have been established as joint-use restricted airspace over MCB Quantico, extending from the earth's surface to 10,000 feet MSL.

The Airport itself lies within Class D airspace when the ATCT is operational (between the hours of 6:30 A.M. to 10:30 P.M. local time). The Class D airspace extends from the surface up to but not including 2,000 feet above the Airport's elevation. The airspace from 2,000 feet to 10,000 feet above the surface is Class B airspace which Washington Dulles International Airport (IAD) falls within. The Airport is also located within the Washington DC Metropolitan Special Flight Rule Area (SFRA). Special regulations apply to all aircraft operations from the surface to but not including flight level 180 in the Washington DC Metropolitan Area. When the ATCT is closed, pilots and vehicle operators that are approved to operate in the movement area will state their intentions on the common traffic advisory frequency (CTAF). IFR[5] clearance is available when the ATCT tower is closed through the Potomac TRACON. IFR clearance allows pilots to fly in instrument meteorological conditions (IMC) and maneuver their aircraft solely on referencing the instrumentation in the cockpit.

[5] Instrument Flight Rules

FIGURE 3-16
AIRSPACE SURROUNDING MANASSAS AIRPORT



Source: Skyvector.com, 2022

3.9.2.1 Instrument and Visual Flight Rules Procedures

Air traffic operations generally fall within one of two categories, those flying under Visual Flight Rules (VFR) and those under Instrument Flight Rules (IFR). Under VFR, aircraft operating in good visibility weather do so using “see and avoid” practices with other aircraft.

Aircraft flying under IFR are required to comply with routes and altitudes given by Air Traffic Controllers during all phases of flight. The controllers are then responsible for ensuring adequate separation between aircraft, which may be flying in clouds, snow, or other conditions of poor visibility. Aircraft fly through the airport environment and to the runway using predetermined routes called Standardized Instrument Approach Procedures. The pilot's ability to land during inclement weather is determined by a number of factors, including approach lighting, navigational aids, aircraft equipment, and pilot qualifications. **Table 3-27** shows the Instrument Approaches available at HEF.

TABLE 3-27
INSTRUMENT APPROACHES

Instrument Approaches	Minimum Visibility	Decision Altitude (AGL)(feet)
Runway 16L-34R		
Runway 16L		
ILS or LOC	1/2 SM	200'
RNAV (GPS)	1/2 SM	250'
Runway 34R		
RNAV (GPS)	1 SM	442'
Runway 16R-34L		
Runway 16R		
RNAV (GPS)	1 SM	308'
Runway 34L		
RNAV (GPS)	1 SM	458'

Source: FAA Facility Directory, FAA.gov, 2022
Notes: All approaches listed are best approach available.
Definitions: AGL – Above Ground Level, DME – Distance Measuring Equipment, GPS – Global Positioning System, ILS – Instrument Landing System, LOC – Localizer, RNAV – Area Navigation, NM – Nautical Mile

3.9.3 Part 77 Objects Affecting Navigable Airspace

The airspace surrounding the Airport should be kept clear of obstructions to the furthest extent possible. Title 14 Code of Federal Regulations (CFR) Part 77, Objects Affecting Navigable Airspace keeps essential airspace free and clear of obstructions that could be hazardous to aircraft on an approach to an airport. For an object to be deemed an obstruction, it must penetrate at least one of the five sections of airspace defined by Part 77 as "imaginary surfaces." The five sections of Part 77 airspace are broken out into the following surfaces: Primary Surface, Approach Surface, Transitional Surface, Horizontal Surface, and Conical Surface. A description of each surface along with their dimensions are listed below:

- **Primary Surface** – This surface is centered on the runway, extending 200 feet beyond the edge of the runway. The width of the surface is dependent upon the type of approach to the runway. Since Runway 16L has an instrument landing approach, the primary surface width of Runway 16L-34R is 1,000 feet. The width of the primary surface for Runway 16R-34L is 500 feet.
- **Approach Surface** – This surface is a sloped plane that begins at the edge of the Primary Surface and extends horizontal in the shape of a trapezoid. The slope horizontal length, and the width of

the surface are dependent upon the approach to the runway. Runway 16L is a precision instrument runway with an approach surface length of 50,000 feet and a width at the end of the surface of 16,000 feet. The first 10,000 feet of the approach surface has a slope of 50:1, while the remaining 40,000 feet has a slope of 40:1. The non-precision instrument approach on Runway 34R has a 34:1 slope and extends for a horizontal distance of 10,000 feet with an outer width of 3,500 feet. The approach surfaces for Runway 16R and 34L at Manassas Regional Airport are non-precision with 34:1 approach slopes. The inner width of the non-precision approach surfaces for Runways 16R and 34L have inner widths of 500 feet and extend for a horizontal distance of 10,000 feet and have outer widths of 3,500 feet.

- **Transitional Surface** – This surface is a plane sloped at 7:1 from the primary surface and approach surfaces. The surface terminates when it intersects with the horizontal surface.
- **Horizontal Surface** – This surface is a horizontal plane 150 feet above the airport elevation. The geometry of the surface is created by arcs centered on the edge of the primary surface with defined radii and then connected by tangents. The radius of the horizontal surface, based on the approaches at Manassas Airport, is 10,000 feet.
- **Conical Surface** – This surface is a plane sloped at 20:1 extending upward from the periphery of the horizontal surface to 4,000 feet.

3.9.3.1 Departure Procedures and Airspace Obstructions

Departure procedures (DP) are preplanned IFR procedures that provide obstacle protection for aircraft departing from the airport. As of June 17, 2022, Manassas Airport has three approved DPs[6] as follows:

- ARSENAL FIVE
- GABBE THREE
- HIICH TWO

FAA published airspace obstructions for Runway 16L-34R and Runway 16R-34L are detailed in **Table 3-28.**

[6] These procedures are always subject to change, especially with consideration of airspace restructuring in the Washington Metroplex.

TABLE 3-28
AIRSPACE OBSTRUCTIONS

Runway	Obstruction	Height Above Ground Level (Feet)	Location
16L	Trees	99′	1,247 ft. from end, 178 ft. left of centerline
	Trees	73′	1,810 ft. from end, 88 ft right of centerline
	Trees	84′	2,618 ft. from end, 4 ft left of centerline
	Trees	75′	3,414 ft from end, 14 ft right of centerline
	Trees	100′	3,703 ft from end, 145 ft left of centerline
	Trees	82′	4,193 ft from end, 1,343 ft left of centerline
	Trees	89′	4,677 ft from end, 313 ft right of centerline
34R	Poles	24′	518 ft from end, 595 ft right of centerline
	Trees	39′	1,759 ft from end, 448 ft left of centerline
	Trees	39′	1,859 ft from end, 828 ft right of centerline
	Trees	54′	2,548 ft from end, 828 ft left of centerline
	Trees	57′	2,653 ft from end, 1,082 ft right of centerline
16R	Trees	32′	119 ft from end, 437 ft from right of centerline
	Trees	29′	749 ft from end
	Trees	33′	745 ft from end, 85 ft right of centerline
	Trees	37′	588 ft from end, 536 ft right of centerline
34L	Poles	54′	877 ft from end, 616 ft left of centerline
	Trees	39′	1,573 ft from end, 249 ft left of centerline
	Trees	39′	1,752 ft from end, 187 ft right of centerline
	Tower/Trees	64′	2,563 ft from end, 182 ft left of centerline

Runway	Obstruction	Height Above Ground Level (Feet)	Location
	Trees	56′	2,563 ft from end, 250 ft right of centerline

Source: FAA Published Departure Procedure, RS&H 2022

3.10 PASSENGER TERMINAL

Passenger terminals are the interface between the public space and commercial aircraft. The passenger terminal connects landside facilities (e.g., public-access airport roads) and the airport sterile airside (e.g., aircraft apron and airfield). Understanding how this space and interface operate is key to evaluating the effectiveness of the existing terminal facility. The terminal provides space for ground transportation functions, ticketing and check-in, passenger and baggage screening, baggage claim, and passenger gate hold rooms. This section describes the existing conditions and facility requirements for the passenger terminal facility.

The terminal building programmatic requirements are estimated based upon airport terminal planning best practices and recommended methodologies, which are derived from various industry resources. Two reputable industry resources, the International Air Transportation Association (IATA) and the Airport Cooperative Research Program (ACRP), have developed rating systems that discuss methodologies and recommendations for determining level of service (LOS) for passenger terminals. The methodologies and best practices used for this analysis can be found within the following resources:

- *Airport Passenger Terminal Planning and Design* – ACRP Report 25, Volumes 1 and 2, 2010
- *Guidebook on General Aviation Facility Planning* – ACRP Report 113, 2014
- *Resource Manual for Airport In-Terminal Concessions*, ACRP Report 54, 2011
- *IATA Airport Development Reference Manual*, 12th Edition, 2022
- FAA, AC 150/5360-13A, *Planning and Design Guidelines for Airport Terminal Facilities*, 2018

General aviation administrative/terminal facilities are required to meet the needs of pilots, passengers and visitors using the airport. However, no official FAA guidance exists on recommended or required sized of general aviation terminal buildings. ACRP Report 113: Guidebook on General Aviation Planning provides practical guidance to help determine the size of a GA terminal building. For planning a factor of 2.5 people (pilots and passengers) per peak-hour operation can be assumed. An area of 100 to 150 square feet of space per person is considered adequate to accommodate the peak hour traffic. Using these figures, the following formula can be used to provide the size for a GA terminal building for an ALP.

(Peak-hour operations) x (2.5) x (100 sf to 150 sf) = Building square footage

Analysis found the peak-hour operations at Planning Activity Level 3, 130,000 Annual Operations, is approximately 10 operations. After applying the prior formula, the Airport will need a 3,750 square foot terminal building by PAL 3. The analysis found that the existing terminal building size is sufficient for operations during the forecast horizon.

3.10.1 Facilities

The HEF passenger terminal building is approximately 17,650 square-feet. The two-level facility was constructed in 1995 with functional areas which include a lobby, tenant offices, administrative offices, a flight school, pilot's lounge, conference rooms, and restrooms. The terminal is primarily used for charter operations and international clearance. Majority of traffic out of the Airport are GA operations. The functional area size allocations and descriptions of the terminal building are outlined in **Table 3-29**. **Figure 3-17** and **Figure 3-18** depict the lower and upper floor plan of the existing passenger terminal.

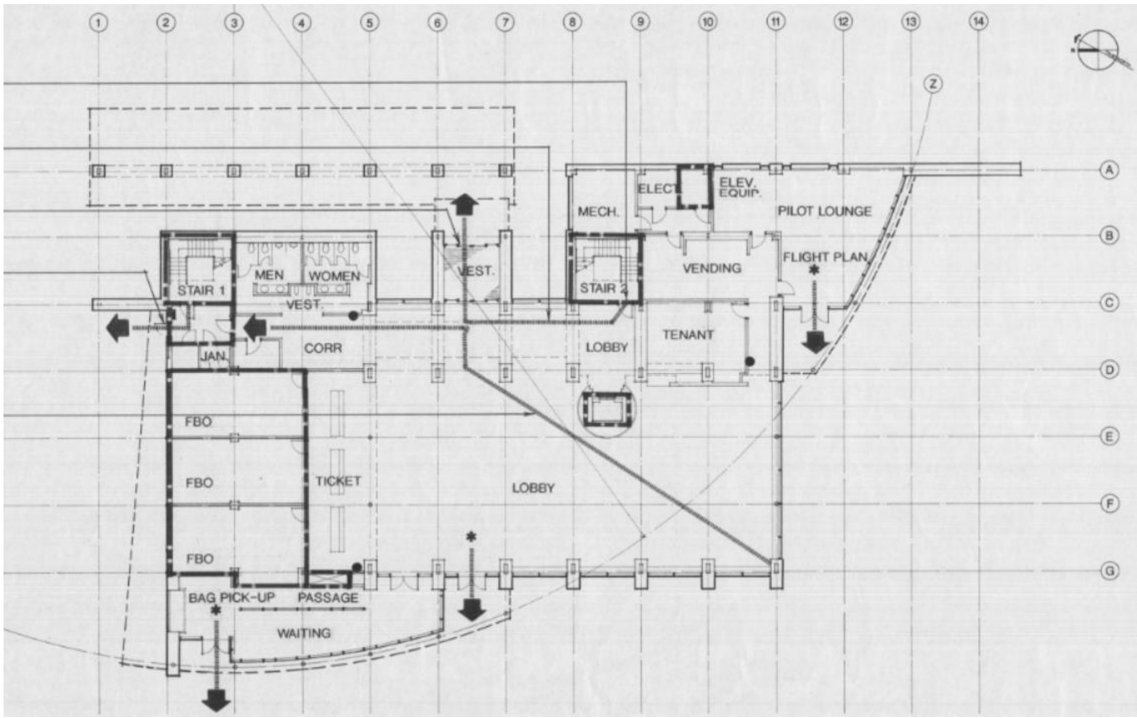
TABLE 3-29
TERMINAL BUILDING FUNCTIONAL AREAS

Terminal Building Functional Areas	Existing Square Feet
Gross Floor Area	17,650
Tenant Area	
Tenant Offices	2,660
Concession	
Vending	1,040
Public	
Lobby	4,390
Vestibules	490
Conference Room	1,060
Restrooms	780
Waiting Area	960
Public Circulation	3,610
Administration, Storage and Miscellaneous	
Conference Rooms	730
Office(s)	950
Employee Lounge/Break Area	140
Storage	330
Building Systems	
Mechanical, Electrical, and Telecom Space	510
Total	**17,650**

Note: Numbers are rounded.

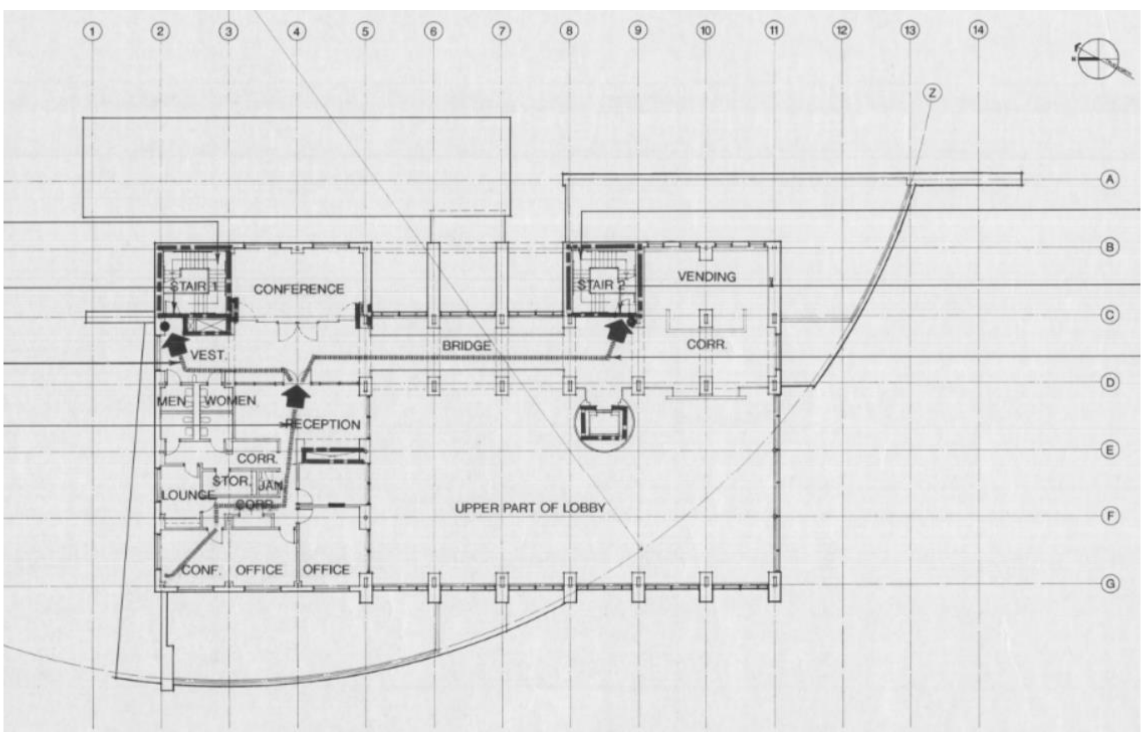
Source: RS&H Analysis, 2022

FIGURE 3-17
PASSENGER TERMINAL LOWER-LEVEL FLOOR PLAN



Source: City of Manassas Record Drawings, 2022

FIGURE 3-18
PASSENGER TERMINAL UPPER-LEVEL FLOOR PLAN



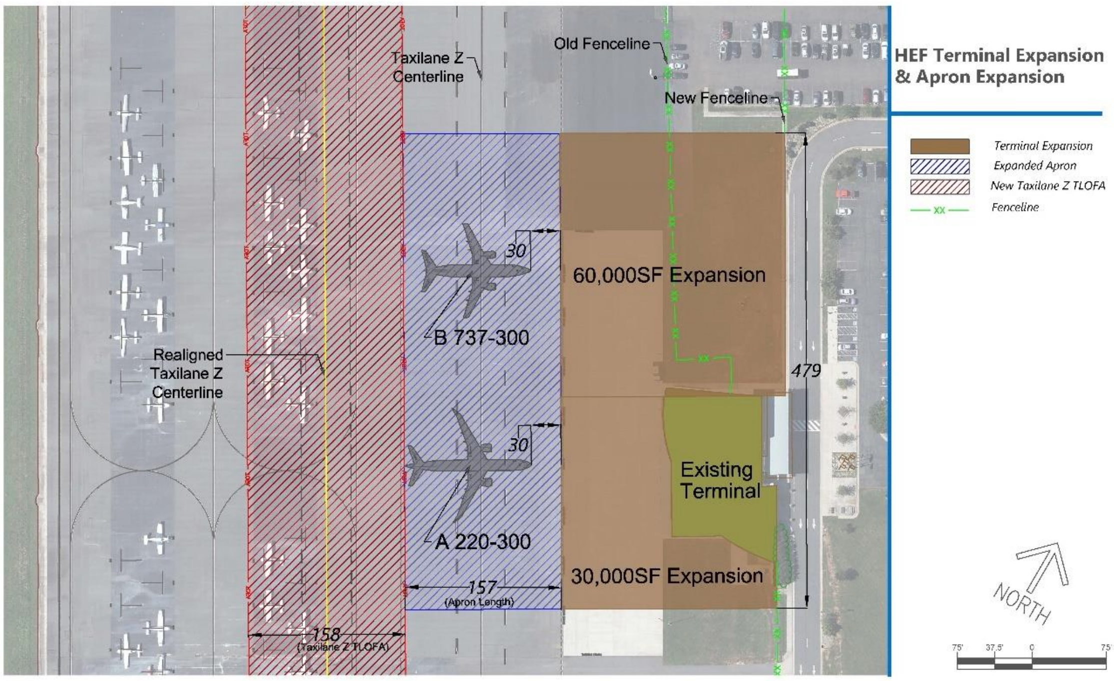
Source: City of Manassas Record Drawings, 2022

For future planning considerations, if the airport should desire to serve air carrier operations specified in Part 139 the terminal will require facility modifications in various areas to allow for passenger processing and baggage screening. In order to develop sound functional requirements for a terminal facility it is critical to obtain forecasts of passenger enplanements and aircraft activity. With this critical information outstanding, terminal modifications were derived from site observations and guidance established for airports serving scheduled air carrier operations. For passenger and baggage processing the primary elements which would require alteration or introduction in HEF's terminal include ticketing/check-in area, passenger screening, hold room, baggage screening system, baggage claim, airline offices and operations areas, and upgrade of building systems (e.g. mechanical, electrical, plumbing).

Introduction of air carrier traffic to HEF could also require terminal modifications towards the airside. Aircraft staging and method of passenger boarding will influence the terminal modifications. One method of passenger boarding with minimal terminal modifications is hardstand[7] boarding. Hardstand operations are typically done at airports that have gate capacity constraints or don't have the capability to accommodate a jet bridge on the terminal facility. While hardstand operations may limit terminal modifications there are several operational impacts which would need to be addressed. These impacts include but are not limited to security measures to provide a sterile corridor for passengers enroute to boarding, impact to tie-downs in front of the terminal, number of hardstands to allow for simultaneous boarding, and operational procedures during irregular operations (IROPS). Use of jet bridges is the boarding method most commonly experienced when boarding a passenger air carrier. This boarding method would require considerable modification to the terminal facility including procurement installation of a jet bridge, installation of access-controlled jet bridge doors, and additional infrastructure to operate the jet bridge. **Figure 3-19** depicts the spatial impacts to the terminal and surrounding areas with the introduction of air carrier operations

[7] Hardstand operations: Areas on the airfield designated by the airport for air carrier parking and passenger loading/unloading.

FIGURE 3-19
TERMINAL EXPANSION CONCEPT



Source: RS&H Analysis, 2022

3.11 GENERAL AVIATION AIRCRAFT PARKING AND STORAGE

This section outlines the requirements during the planning period for the general aviation (GA) facilities used for aircraft parking and storage. The GA facilities evaluated in this section include aircraft hangars, aircraft tie-downs, and apron. The analysis divides aircraft storage needs between transient and based aircraft.

3.11.1 Transient Aircraft Parking

The apron areas are intended to accommodate based and transient aircraft parking. Transient aircraft typically require a greater area for shorter amounts of time (usually less than 24 hours). Based aircraft require a smaller area for longer amounts of time. Since parking configurations and spatial requirements for transient and based aircraft can vary, they have been analyzed separately.

Transient aircraft are those aircraft not based at HEF. The transient aprons, primarily used for transient aircraft, are located behind the terminal building, the two FBOs, and three locations on the West Apron if needed. The total area for transient apron space is approximately 340,000 square feet. For transient aircraft, consideration must be made for the aircraft parking area, taxilanes leading into and out of the parking positions, and circulation areas. In addition to the required parking area for the aircraft, taxilane object free area and aircraft clearances on all sides of the aircraft are included in the area requirements.

Table 3-30 summarizes the weighted average parking apron requirements per itinerant aircraft by type. The analysis results in a weighted average of 13,000 square feet per fixed wing itinerant aircraft.

TABLE 3-30
ITINERANT AIRCRAFT PARKING APRON REQUIREMENTS PER AIRCRAFT

Airplane Design Group	Average Length (ft)	Average Wingspan	Additional Clearances (ft)	TOFA Clearance (ft)	Average Parking Area Required (sf)	Fleet Mix	Weighted Average Parking (sf)
I	30	49	10	89	7,611	60%	4,567
II	60	79	10	110	16,020	30%	4,806
III	102	95	25	158	34,200	10%	3,420
					Weighted Average		12,793
					Weighted Average (rounded)		**13,000**

Source: ACRP Report 113, Guidebook on General Aviation Facility Planning (2014); RS&H Analysis, 2022

The annual itinerant operations ratio is forecasted to remain at the current ratio of 53% of total operations throughout the planning period. To calculate demand for itinerant fixed wing aircraft, the following assumptions were applied to the annual operations forecast developed in Chapter 1.

- Itinerant Operations – 53% of total
- Peak Month Itinerant Operations – 2021 Air Traffic Activity System (ATADS) Data referenced. Growth rate of annual itinerant operations applied for peak month itinerant operations
- Peak Month Average Day (PMAD) Itinerant Operations – peak month itinerant operations divided by 31
- PMAD Itinerant Aircraft – PMAD itinerant operations divided by 2 (1 aircraft performing one take-off and one landing)
- Itinerant Aircraft Parking Stalls – Assumes 50% of itinerant aircraft on the ground at a given time and multiplied by 50% (itinerant percentage for apron storage)

Table 3-31 summarized the itinerant aircraft parking demand based on the assumptions outlined above.

TABLE 3-31
ITINERANT AIRCRAFT PARKING APRON DEMAND

Planning Level	Annual Operations	Annual Itinerant Operations	Peak Month Itinerant Operations	PMAD Itinerant Operations	Average Day Itinerant Aircraft	Itinerant Aircraft Parking Stalls
2021	99,649	52,712	5,271	170	85	21
PAL 1	106,144	56,356	5,636	182	91	23
PAL 2	113,514	60,701	6,070	196	98	24
PAL 3	130,088	70,662	7,066	228	114	28

Source: ACRP Report 113, Guidebook on General Aviation Facility Planning (2014); RS&H Analysis, 2022
Note: Planning Activity Level (PAL)

The spatial requirements of the transient apron are based on ADG I, II, and III aircraft given the operations from the FAA Traffic Flow Management Systems count and site observations from airport staff. This does not prevent any larger aircraft from using the apron, rather it outlines the required space for multiple aircraft up to ADG-III parking simultaneously. Analysis shows transient apron parking is sufficient today; however, during the planning period there will be a deficiency of 30,400 square feet. The following chapter will explore alternatives and evaluate the transient apron requirement for PAL 3.

Table 3-32 shows the transient apron requirements.

TABLE 3-32
TRANSIENT APRON REQUIREMENTS

Transient Apron	Existing	PAL 1	PAL 2	PAL 3
Transient Apron Requirement	340,000	295,400	318,200	370,400
Surplus / (Deficit)		44,600	21,800	(30,400)

Source: ACRP Report 113, Guidebook on General Aviation Facility Planning (2014); RS&H Analysis, 2022

3.11.2 Based Aircraft Storage

The quantity and type of aircraft storage space is driven by many different factors including total number of based aircraft, fleet mix, local weather conditions, airport security, user preference, and other various market forces. This section outlines requirements for tie-downs, T-hangars, conventional box hangars, and corporate hangars. These storage types are general terms used to describe different aircraft storage sizes with different uses. The following outlines broad definitions for how each hangar space is programmed within the context of this Master Plan:

- Tie-Downs – Uncovered defined locations on the apron with anchors to secure aircraft while parked at the Airport. These spaces are leased to based aircraft; primarily single-engine or light twin aircraft classified under ADG-I. If available some tie-down positions are used for itinerant operations. Airport staff conveyed based aircraft tie-down sizing on the airfield are airport specific and sized for a Cessna 172 at 1,050 square feet. Planning period analysis will take this tie-down sizing into consideration.

- T-hangars – This type of hangar is an individual storage unit for a small aircraft, usually a single-engine or light twin aircraft classified under ADG-I. The "T" designation corresponds to the overall shape of the unit as they are often arranged so single engine aircraft are "nested: to each other in alternating directions. The individual hangars are generally grouped into linear buildings containing multiple units in a row. Each T-hangar unit has an assumed size of 1,400 square feet with a door opening width of 42 feet. For a 10-unit nested T-hangar facility (14,000 square feet), approximately 65,000 square feet of airside land is required for development.
- Conventional Hangar – Hangars larger than a T-hangar and potentially housing multiple smaller aircraft. A conventional hangar itself can range from 5,000 – 30,000 square feet. Additional space is required for apron frontage needs, landside/parking, buffers and safety area offsets, and other various site development elements. For this analysis the average size of a conventional hangar is approximately 5,000 square feet.
- Corporate Hangar – Large hangars, containing one or more aircraft, with associated office space for flight crews, corporate passenger staging, and some maintenance. Corporate hangars alone typically range from 30,000 – 60,000 square feet, or more. In addition, incorporated office elements, landside area, and other site development aspects can vary greatly depending on owner preference. The average size of corporate hangars at the Airport is approximately 30,000 square feet.

The aviation activity forecast shows steady growth in based aircraft facilitating the need for additional storage. Of the five aircraft types, an increase in the number of based single engine, multi-engine, jet-engine and helicopters are forecasted. At PAL 3, an additional 26 aircraft above existing 2021 levels are projected to require storage accommodations, as shown in **Table 3-33**.

TABLE 3-33
BASED AIRCRAFT STORAGE

Based Aircraft	2021	PAL 1	PAL 2	PAL 3
Single Engine	312	314	319	324
Multi Engine	51	51	52	55
Jet Engine	27	30	32	35
Helicopter	18	18	18	20
Other	2	2	2	2
Total	**410**	**415**	**423**	**436**

Source: RS&H Aviation Forecast, 2022

Using historical distributions of based aircraft at HEF and industry trends, the projected square footage for each aircraft storage type was determined at each PAL. It is assumed all based aircraft will be stored on a tie-down, T-hangar, conventional hangar, or corporate hangar. In 2022 tie-downs accommodated 141 of the Airport's based aircraft (34%), T-hangars stored 210 of the Airport's based aircraft (51%), 23 based aircraft were stored in conventional hangars (6%), and 36 based aircraft were stored in corporate hangars (9%).

Table 3-34 assumes the same distribution for aircraft storage throughout the planning period. The analysis indicates that if the Airport retains the same distribution of aircraft between storage areas the Airport will need additional T-hangars and conventional hangars by PAL 1. By PAL 3, the Airport will need two additional T-hangar bays and three additional conventional hangars.

TABLE 3-34
BASED AIRCRAFT STORAGE AND PARKING REQUIREMENTS

Storage Facility	Existing	PAL 1	PAL 2	PAL 3
Tie-Downs (Spaces)				
Spaces	193	141	144	148
Square Footage	202,700	157,500	151,200	155,400
Surplus / **(Deficit)**		45,200	51,500	47,300
T-Hangar (Bays)				
Hangar Structures	16	17	17	18
Hangar Bays	210	212	216	223
Square Footage	294,000	296,800	302,400	312,200
Surplus / **(Deficit)**		**(2,800)**	**(8,400)**	**(18,200)**
Conventional Hangars				
Hangars	23	25	25	26
Square Footage	115,000	125,000	125,000	130,000
Surplus / **(Deficit)**		**(10,000)**	**(10,000)**	**(15,000)**
Corporate Hangars				
Hangars	24	24	24	24
Square Footage	720,000	720,000	720,000	720,000
Surplus / **(Deficit)**		0	0	0

Note: Square footage has been rounded to the nearest hundred. Based aircraft tie-downs assumed to be 1,050 square feet. T-hangars are assumed to be 1,400 square feet. Conventional hangars assumed to be 5,000 square feet. Corporate hangars are assumed to be 30,000 square feet.
Source: RS&H Analysis, 2022

An additional analysis for based aircraft storage was completed as a result of the Airport's extensive hangar waitlist which is 120 people long and growing. Airport staff revealed although the waitlist is 120 people long, historically about a third of those on the waitlist will rent a hangar when one becomes available. Approximately 44 out of 120 on the wait list are currently on an airport tie-down. **Table 3-35** assumes the Airport has intentions to accommodate all 44 of 120 (36.67%) on the hangar waitlist currently on tie-downs during the planning period. This closely aligns with the historical statistic of a third (33%) of those on the waitlist who would rent a hangar once available. This shift in storage redistributes based aircraft storage to tie-downs accommodating 24% of the Airport's based aircraft, T-hangars storing 61% of the Airport's based aircraft, 6% of based aircraft stored in conventional hangars, and 9% of based aircraft stored in corporate hangars. With this analysis the Airport will need 56 additional T-hangar bays by PAL 3. The Airport would also need three additional conventional hangars given this storage breakdown.

TABLE 3-35
BASED AIRCRAFT STORAGE AND PARKING REQUIREMENTS (STORAGE REDISTRIBUTION)

Storage Facility	Existing	PAL 1	PAL 2	PAL 3
Tie-Downs (Spaces)				
Spaces	193	104	106	109
Square Footage	300,000	157,500	111,300	114,500
Surplus / **(Deficit)**		142,500	188,700	185,500
T-Hangar (Bays)				
Hangar Structures	18	23	24	24
Hangar Bays	210	254	258	266
Square Footage	289,200	355,600	361,200	372,400
Surplus / **(Deficit)**		**(66,400)**	**(72,000)**	**(83,200)**
Conventional Hangars				
Hangars	23	24	25	26
Square Footage	115,000	120,000	125,000	130,000
Surplus / **(Deficit)**		**(5,000)**	**(10,000)**	**(15,000)**
Corporate Hangars				
Hangars	24	24	24	24
Square Footage	720,000	720,000	720,000	720,000
Surplus / **(Deficit)**		0	0	0

Note: Square footage has been rounded to the nearest hundred. Based aircraft tie-downs assumed to be 1,050 square feet. T-hangars are assumed to be 1,400 square feet. Conventional hangars assumed to be 5,000 square feet. Corporate hangars are assumed to be 30,000 square feet.
Source: RS&H Analysis, 2022

With consideration to aging facilities and the development trends occurring at HEF, it is reasonable to plan for space accommodations for additional T-hangars and conventional hangars on the west side as a result of the deficit within the planning period and the Airport's intent to shift more GA operations to the west side of the Airport. Although there is no facility requirement for additional corporate hangars, there are areas around the Airport which are prime for development of corporate facilities which can thus accommodate future based aircraft. Whether through land redevelopment or development of greenfield sites[8] the Airport will be able to support a number of facility configurations to support the based aircraft demand. Based aircraft storage during the planning period will be assessed in the Alternatives chapter of this Master Plan.

3.12 AVIATION SUPPORT FACILITIES

This section describes the location and condition of various support facilities important to the overall operation of the Airport. These facilities include hangars, FAA facilities, aircraft rescue and firefighting (ARFF), fixed based operators (FBOs), air charter, fuel facilities, deicing operations, and airport owned facilities.

[8] A greenfield site is land that has not been previously developed.

3.12.1 Fixed Based Operator and Aircraft Maintenance

Fixed Based Operators (FBOs) provide a range of aeronautical services that can include fueling, hangar facilities aircraft rental, aircraft maintenance, flight instruction and terminal facilities. FBO's are either full-service or limited-service in nature.

There are two full-service FBOs at the Airport. APP Jet Center is a full-service FBO which has 115,000 square feet of hangar space and offers on-site maintenance, planeside U.S. Customs and Immigration assistance, ground handling, de-icing, lavatory services, and 100LL/Jet-A fuel. The FBO is staffed 24 hours a day. APP Jet Center's operations expand into six facilities located in the center of the East apron. Landside access to APP Jet Center is gained via Wakeman Drive.

Chantilly Air Jet Center is the second of two full-service FBOs at the airport. It's the newest facility at the Airport with construction of the corporate hangar completed in 2021. The facility is comprised of 60,000 square feet of climate cooled hangar space, 11,000 square feet of private FBO, 15,000 square feet of rentable office space, tenant storage and workspace. The FBO offers on-site maintenance, conference rooms, de-icing, planeside U.S. Customs and Immigration assistance, 100LL/Jet-A fuel, ground handling, and on-site rental cars. The FBO is also home to ATP Flight School. Chantilly Air Jet Center is located on the East Apron and south of the city hangars. Landside access to Duncan Aviation and Chantilly Air Jet Center is gained from Skyview Terrace via Wakeman Drive.

For future planning purposes, consideration should be given to allocate land for future aviation services developments such as a third full service FBO or a large corporate hangar that can be used by transient aircraft. This consideration aligns with the airport's Strategic Plan and direction provided by airport management during Master Plan discussions.

3.12.2 General Aviation Hangars and Apron

The Airport has a variety of general aviation hangars on the east and west side of the airfield. There is a group of eight city owned T-Hangars on the south end of the East Apron. These T-hangars provide a total of 97 spaces for small aircraft storage. Additionally, there are nine individual box hangars owned by corporations located on the East Apron. The Airport has ten T-hangars on the West Apron which provide a total of 59 spaces for small aircraft storage. There is one additional box hanger on the West Apron. The conditions of the hangars range from newly built to poor condition. Since the 2002 Master Plan, three box hangars, two executive style hangars and one nested T-hangar has been constructed.

There are two locations that comprise the apron and tie-down spaces at the Airport. The first location is the East Apron which is the larger of the two aprons and typically houses the larger aircraft based at the Airport. The West Apron is the second of the two aprons and typically serves the smaller aircraft based at the Airport. When interviewed as part of the facility inventory and forecast process, some tenants demonstrated interest in additional hangar space as demand increases in the future.

The PCI conditions of the two apron locations range from good to poor as depicted in **Section 3.8.6**. The East apron's pavement condition is generally in fair to poor condition. Majority of the West apron is in good condition except for the northern most section which pavement condition ranges from fair, poor, and very poor.

3.12.3 FAA Facilities

The FAA operates and maintains the Manassas Air Traffic Control Tower. The facility opened in 1992 after being dissembled at an airport near Denver, CO and being reassembled at the HEF. When the tower is in operation, air traffic controllers provide clearance and direction to aircraft and vehicles operating on the airfield. The tower is in operation between the hours of 6:30 A.M. to 10:30 P.M. local time. Personnel interviews noted the tower facility is aged and the staff continuously deal with heating/cooling inconsistencies during business hours. The facility needs rehabilitation/replacement. The following chapter will explore and incorporate the preferred site of the air traffic control tower.

3.12.4 Aircraft Rescue and Fire Fighting (ARFF)

The Airport does not currently have an on-site ARFF facility as it's not required due to the Airport not being a certified 14 CFR Part 139 airport. Although the Airport does not adhere to Part 139 ARFF standards, the Airport strives to follow Part 139 standards in other areas such as daily airfield inspections, emergency planning, wildlife management and security programs. The City of Manassas Fire and Rescue Department currently relies on structural firefighting truck, 2000 E-One, as the primary response vehicle to the Airport. The firefighting apparatus is currently stored in Hangar C-3 on the East apron.

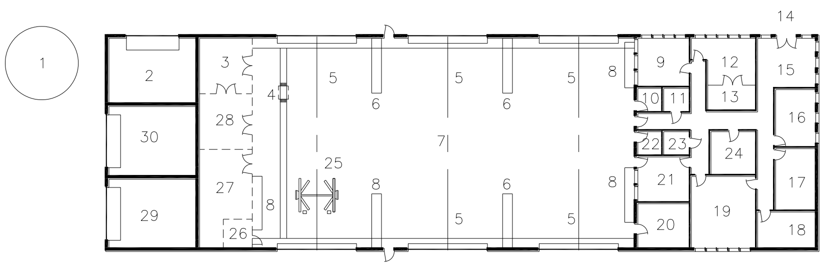
Until mandated to meet requirements referenced in Part 139.315, 139.317, and 139.319, the City of Manassas Fire Department has taken steps to provide aircraft rescue and firefighting resources through an intergovernmental agreement with the Northern Virginia Emergency Response Agreement. This agreement provides additional structural firefighting equipment and responders to the Airport. The Prince William County Fire Department and other mutual aid Fire/Rescue agencies stand ready to supplement the Department. An ARFF apparatus from Dulles International is also available to provide support once requested by an Incident Commander.

An ARFF Feasibility Study, dated September 2017, confirmed the need for an ARFF facility at the Airport. The study determined with existing agreements and apparatus equipment on-site, the Airport's emergency personnel would not be able to respond to an accident within the desired time of 2-3 minutes. With existing resources, it is reasonable to expect a total response time of 7 minutes from the time of notification. Such a response time is unacceptable and inadequate, especially when responding to an emergency that may be a fuel-fed fire or have critical injuries. This risk to safety has posed great concern to the Airport. The Airport has expressed the need for a "safety center", a facility with the capability to support ARFF services and public safety personnel. A facility with this purpose will be evaluated in the following chapter.

3.12.5 Maintenance Equipment Storage

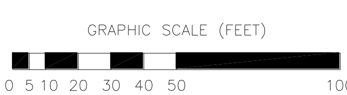
There is one facility used for Airport maintenance equipment storage (MES) and repairs. The Airport's maintenance and equipment storage facility was constructed in 2006 and is approximately 8,000 square feet. The MES facility is located on the East apron just south of the passenger terminal. The MES is a two-level facility with an office, restrooms, and equipment on the lower level while additional storage is located on the upper level. The MES facility only has airside access which is gained either through two overhead garage doors or two entry/exit doors. AC 150/5220-18A, Building for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials, identifies a drive-through facility design as efficient for airports with small to medium equipment fleets, the MES facility itself is not built in a drive through configuration. Landside access is gained through an adjacent sliding gate which leads to Harry J Parrish Blvd. **Figure 3-20** shows an example of a maintenance/snow removal equipment (SRE) storage facility using a drive through design. **Figure 3-21** depicts the site plan for the Airport's MES facility.

FIGURE 3-20
EXAMPLE OF DRIVE-THROUGH MAINTENANCE/SRE STORAGE FACILITY DESIGN



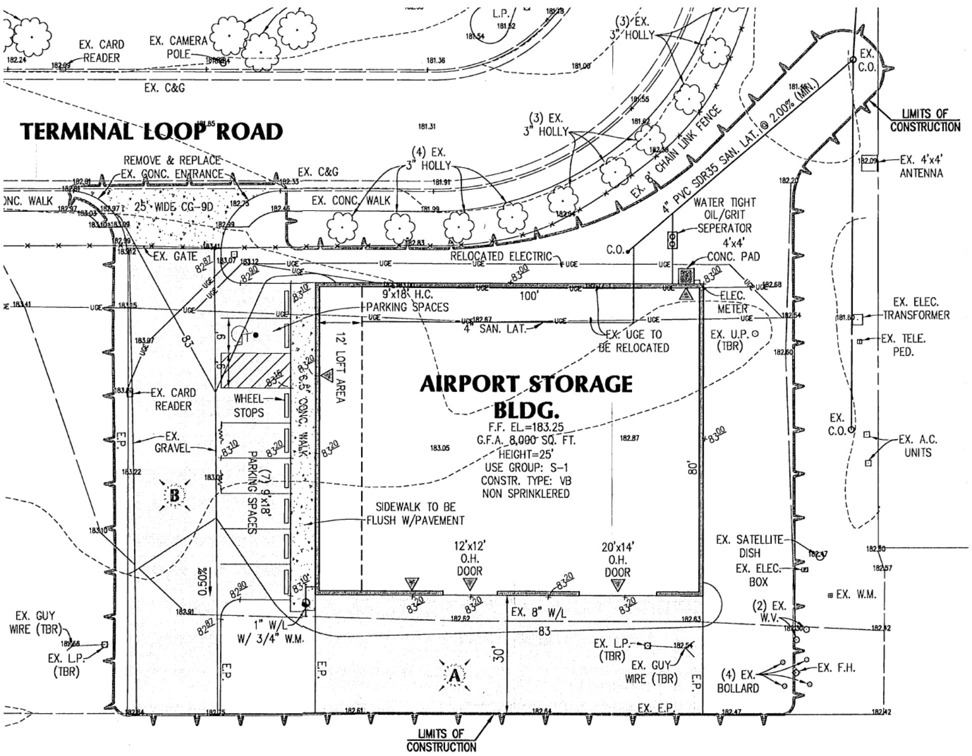
LEGEND

1. LIQUID DEICER TANK
2. HEATED SAND STORAGE
3. PARTS CLEANING/DEGREASER/ BLAST CABINET/PAINT BOOTH
4. BRIDGE CRANE
5. EQUIPMENT PARKING
6. SNOW REMOVAL EQUIPMENT STORAGE
7. VEHICLE WASH/STEAM BAY
8. MECHANIC'S WORK BENCHES
9. SNOW DESK
10. MEN'S REST ROOM
11. MECHANICAL ROOM (HVAC)
12. ELECTRICAL EQUIPMENT REPAIR
13. ELECTRICAL PARTS STORAGE
14. BUILDING ENTRANCE
15. ADMINISTRATION/RECEPTION AREA
16. AIRPORT OPERATIONS MANAGER
17. MEN'S REST ROOM/LOCKERS/SHOWERS
18. WOMEN'S REST ROOM/LOCKERS/SHOWERS
19. CONFERENCE/BREAK ROOM & KITCHEN
20. SPECIAL TOOLS
21. GARAGE SUPERVISOR'S OFFICE
22. WOMEN'S REST ROOM
23. MECHANICAL ROOM (PHONE, ELECTRICAL)
24. REFERENCE LIBRARY
25. MAINTENANCE AREA
26. USED AUTOMOTIVE FLUID STORAGE
27. LARGE/SMALL PARTS STORAGE
28. MACHINE SHOP/WELDING AREA
29. DRY DEICER STORAGE AREA
30. UREA STORAGE AREA



Source: AC 150/5220-18A, Building for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials, Figure 3-1, 2022

FIGURE 3-21
AIRPORT MAINTENANCE EQUIPMENT STORAGE FACILITY SITE PLAN



Source: City of Manassas Record Drawings, 2022

The following list provides an inventory and average age of the Airport's maintenance and snow removal equipment:

Snow Removal Equipment (SRE)

- 2017 Ford F250 (5 years)
- 2019 Freightliner 108SD (3 years)
- 2010 Ford Ranger (12 years)
- 2005 Ford F450 (17 years)
- 2016 Ford F250 (6 years)
- 2019 T650 Bobcast Skid Steer (2 years)
- 2002 New Holland TV140 (20 years)
- 2019 Bobcast UTV (2 years)
- 2014 New Holland T6040 (8 years)
- 1974 Snowblast 2200-A (48 years)

- 1999 Oshkosh Broom (23 years)

Mowers

- 4 x Scag Zero Turn Mowers

As noted, a few of the Airport's SRE is more than 20 years old. Therefore, it is recommended that the Airport plan to phase out older pieces as they become obsolete or unusable due to a lack of parts and program new replacement equipment purchases. A replacement of the Airport's SRE should consider multi-function machines equipped with various combinations of plow, broom, and air blower. Multi-function machines provide added value in their efficiency and time reducing the process of taxiing equipment to and from the storage facilities. Multi-function pieces of equipment are larger and longer than single function pieces of equipment, therefore, the space allocated for them in MES facilities will increase. With new space and turning radius requirements associated with the format and size of these new machines, future Airport maintenance facilities should be configured to accommodate pull through bays using drive-through design building configuration (as shown in **Figure 3-20**) for all critical equipment including multi-function SRE.

3.12.6 Fuel Farm/Fueling

The fuel farm consists of three 15,000-gallon tanks of 100LL avgas and six jet-A fuel tanks with a capacity of 112,000 gallons. The two Fixed Based Operators, App Jet Center and Chantilly Jet Center, provide most of the fueling services at the Airport. Historical records from the Airport were used to assess how much of each fuel type was used in the peak month on an average day (PMAD). The analysis shows that the Airport, under baseline forecast demand, has adequate storage for both 100LL avgas and Jet-A fuels. **Table 3-36** shows the fuel farm requirements for five days in the peak month of operations.

TABLE 3-36
FUEL FARM REQUIREMENTS

	2021	Planning Activity Level		
		PAL 1	PAL 2	PAL 3
Peak Month Average Day (PMAD) Operations	332	354	378	434
100LL				
PMAD Operations	129	138	147	169
5 - Day Fuel Need (Gallons)	4,040	4,310	4,610	5,280
Available Storage (Fuel Facility) (Gallons)	45,000	45,000	45,000	45,000
Total Storage for 5 Day Need: Surplus/ (Deficit)	40,960	40,690	40,390	39,720
Jet A				
PMAD Operations	203	216	231	265
5 - Day Fuel Need (Gallons)	38,840	41,370	44,250	50,710
Available Storage (Gallons)	112,000	112,000	112,000	112,000
Total Storage for 5 Day Need: Surplus/ (Deficit)	73,160	70,630	67,750	61,290

Source: RS&H Analysis, 2022

With the shift of GA operations to the West Apron it is recommended that the Airport consider a secondary fuel farm and a self-serve fuel option on the west side. Enabling single-engine piston users to buy gas at a cheaper rate by fueling their own aircraft might incentivize them to use the Airport over other competing airports.

During discussions airport staff noted the current fuel farm's containment system is in need of repair and have expressed interest in exploring a truck staging area for the fuel farm in an effort to decrease congestion on Wakeman Drive. These items will be evaluated in the Airport Development Alternatives chapter.

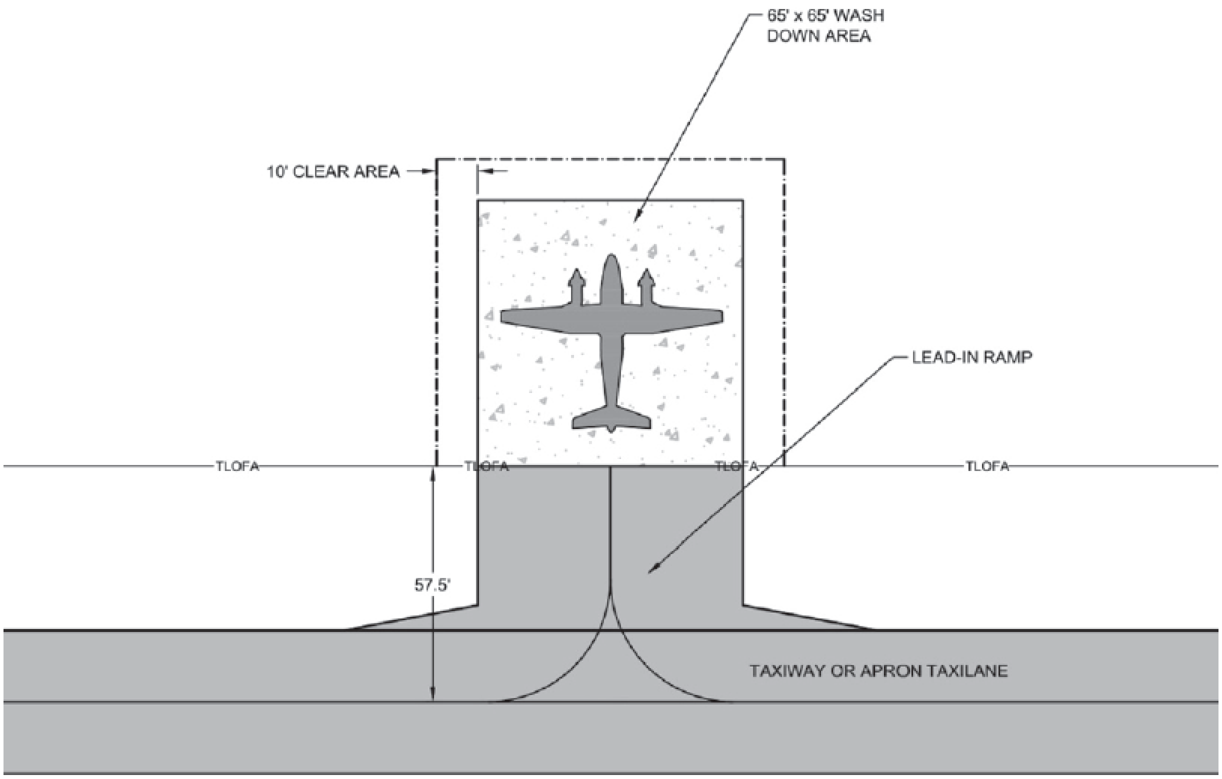
3.12.7 Aircraft Wash Facilities

HEF does not have an aircraft wash rack facility, but this type of facility is generally desirable to small general aviation aircraft owners based at airports. Aircraft wash facilities can be financed/operated by the Airport, private investors, or a combination of both.

There are different styles of aircraft wash facilities possible at HEF. Wash facilities can be an open air, covered, or completely enclosed. When considering local climate, local environmental requirements, and cost, either an open air or covered facility are logical choices for the Airport. Open air has the advantage of size flexibility and cost savings, however, a covered structure benefits from reduced infiltration of precipitation into the drain and less runoff of grease and soaps around the pad. A covered facility also protects people and equipment from the sun and is relatively inexpensive to construct, although more expensive than an open-air concept. The downside of the covered facility is the inflexibility to accommodate aircraft larger than the size of structure.

It is recommended the facility be built to accommodate aircraft up to the size of a single engine or twin aircraft. A covered structure would need to be 70' by 70' across and 18-feet high. At this size, most general aviation aircraft based at the Airport would be able to use the facility. A wash facility is best located in proximity to small aircraft storage locations and near connections to water, sanitary sewer, electricity utilities. To easily collect fees for this service, a communication line would be required to serve a transaction system that accepts credit cards. The facility needs to be equipped with multiple hose bibs, as well as grease, oil, and sand separators to prevent discharge from entering the sanitary sewer drainage system. Additionally, the facility must be located outside of all taxilane object free areas, in a location that will not penetrate Part 77 surfaces, and away from all areas that may experience prop wash or jet blast. **Figure 3-22** shows an example of wash rack design.

FIGURE 3-22
AIRPORT WASHRACK FACILITY EXAMPLE



Source: ACRP Report 113, Guidebook on General Aviation Facility Planning, 2022

3.12.8 Advanced Air Mobility and Electric/Hybrid Aircraft Charging

Advanced Air Mobility (AAM) is expected to revolutionize segments of the aviation industry by enabling new ways of transporting goods and people in an environmentally sustainable and cost-effective way. The first AAM use cases will likely include cargo and medical transport services, with passenger transport following due to issues regarding safety, insurance, and cautious operating models. Regional and general aviation airports are likely to benefit from AAM in the mid-term by preserving or enhancing regional connectivity, making flights to smaller markets a possibility. The biggest challenge for AAM introduction is expected to be infrastructure. Infrastructure for AAM will have requirements both from the customer (passenger experience) and aircraft (operations) perspective. Airspace integration will be a key first step toward AAM operations at airports. Airports and air traffic control services will need to provide controlled airspace access to AAM aircraft, allowing them to operate safely and independently from each other. Once AAM aircraft are on the ground, they will need a place to drop-off and to board passengers while charging and servicing the aircraft. The AAM industry is built around the idea of time savings, therefore, the staging areas should be located such that taxi in and taxi out times for aircraft and walking distances for passengers are minimized, preferably in close proximity to passenger terminals or FBOs servicing business travelers. Landside staging facilities are also a possibility for AAM operations as many eVTOL manufacturers have published conceptual designs of future operations from rooftops of airport parking garages.

Future development and facility planning should consider the infrastructure, utilities, and space necessary for AAM staging and electric aircraft charging. Such facilities may begin to show demand over the planning horizon, especially by based electric training aircraft, transient aircraft, and electric vertical takeoff and landing (eVTOL) aircraft. Different energy vectors and technical solutions are being explored by the electric aircraft industry to deliver power to the electric powertrain. Electric charging of high-capacity batteries can be done by fixed ground chargers (also known as charging stations, recharge by mobile supercharge on batteries (truck or trailer), and recharge by battery swap on the ramp (batteries are recharged separately. Delivery options for Hydrogen or H2 powered aircraft can be done from a hydrant system, from a tanker (truck), or swapping H2 containers. Specific considerations on airport power infrastructure will vary based on current power capabilities and density of the expected electric aircraft traffic. It is recommended that with future development, the location and space necessary for staging and electric aircraft charging should be taken into consideration.

3.13 LANDSIDE FACILITIES

Airport landside facilities provide intermodal connections between the Airport and a variety of ground transportation modes. These facilities include regional access connections, on-airport circulation roadways, public and employee parking facilities, and rental car ready/return. These facilities are described briefly in the following sections.

3.13.1 Airport Regional Access and Multimodal Transportation

Primary regional vehicular access to the Airport is provided via Interstate Highway 66 (I-66) to the north and Interstate Highway 95 (I-95) to the south which connect to Prince William Parkway (Route 234) to the east of the Airport. Route 234 provides access to Clover Hill Road then Harry J Parrish Boulevard leading to the terminal area entry. Secondary access is provided from Nokesville Road (Route 28) via Pennsylvania Avenue to Carolina Drive or Gateway Boulevard and leading onto Wakeman Drive. Access from the west of the Airport is available from Route 28 using Piper Lane and Observation Road.

The internal "on-airport" surface transportation routes consist of Piper Lane, Observation Road, Wakeman Drive, and Harry J Parrish Boulevard. Observation Road provides access to the Northwest District and West District. Wakeman Drive provides access to the Northeast District and East District.
The Virginia Department of Transportation (VDOT) has scheduled construction at the interchange between Route 234 and Clover Hill Road in 2025. Construction duration is expected to run for 12 months and is expected to improve operations and reduce delays for mainline through vehicles as well as the overall intersection. Access from Route 234 to the Airport during construction will be provided via Route 28 interchange.

Construction is currently underway on I-66 to install dynamic toll lanes. The toll lanes are anticipated to enhance mobility in the I-66 corridor and enhance transit services in the region. The toll lanes are scheduled to open in 2022 and will be operational during the weekdays. Inside the beltway, Westbound hours of operation will run from 3:00 P.M. to 7:00 P.M and Eastbound hours of operation will run from 5:30 A.M. to 9:30 A.M. Outside the beltway the toll lanes are in operation 24-hours a day in each direction.

These improvements will create opportunities for improved traffic flow not only on I-66, but also parallel routes leading to the Airport.

Observation Road Relocation is scheduled to commence construction in 2023. The road realignment will also include demolition of hangars and building facilities, draining, and grading improvement of 10 acres in the Northwest District.

During review of primary and secondary access routes to HEF, airport staff noted access corridors were adequate for airport vehicular traffic and conformed to their level of service and wayfinding expectations. In the alternatives analysis it is assumed the existing terminal access routes are sufficient for the planning period and no further improvements warranted.

3.13.1.1 Rail Access

Rail access to the Airport comes by the Virginia Railway Express (VRE) Manassas Line. The Manassas line feeds into Broad Run Station which is located just off airport property to the northwest. The VRE Manassas line complements I-66 and US 50/29 for east-west regional travel by providing an alternative mode to travel by car. An expansion to Broad Run Station is scheduled to begin in 2024. Project details of the Broad Run Expansion project includes station platform modifications, parking expansion, maintenance, and storage facility (MSF) expansion, and an addition of a third main track. The objective of the Broad Run Expansion project is to accommodate growth in passenger boardings, parking demand associated with future service, and equipment storage needs as identified in the VRE System Plan 2040[9]. The third main track will run through the RPZ for Runway 16L like the two existing rail tracks.

3.13.1.2 Multimodal Transportation

The City of Manassas has adopted the Manassas 2040 Comprehensive Plan which provides guidance on the city's shared vision related to land use, development, transportation, and community facilities through the year 2040. The Plan is conceptual but also practical in nature as it identifies the city's overarching goals and ultimately serves as planning policy for the future of Manassas. The Plan aims to advance the city's integrated, multimodal transportation system to offer residents, businesses, and visitors of all ranges a variety of mobility choices to access the city's major centers. The key transportation project which impacts the Airport is the VRE Broad Run Expansion project as depicted in **Figure 3-23**. Future road improvements with a bike network plan aimed at improving access to the airport were adopted by the Plan. **Figure 3-24** depicts the bicycle accommodations on all streets anticipated by the year 2040. The updated network improves upon the current imbalance in bike infrastructure that exists between the northern and southern portions of the city.

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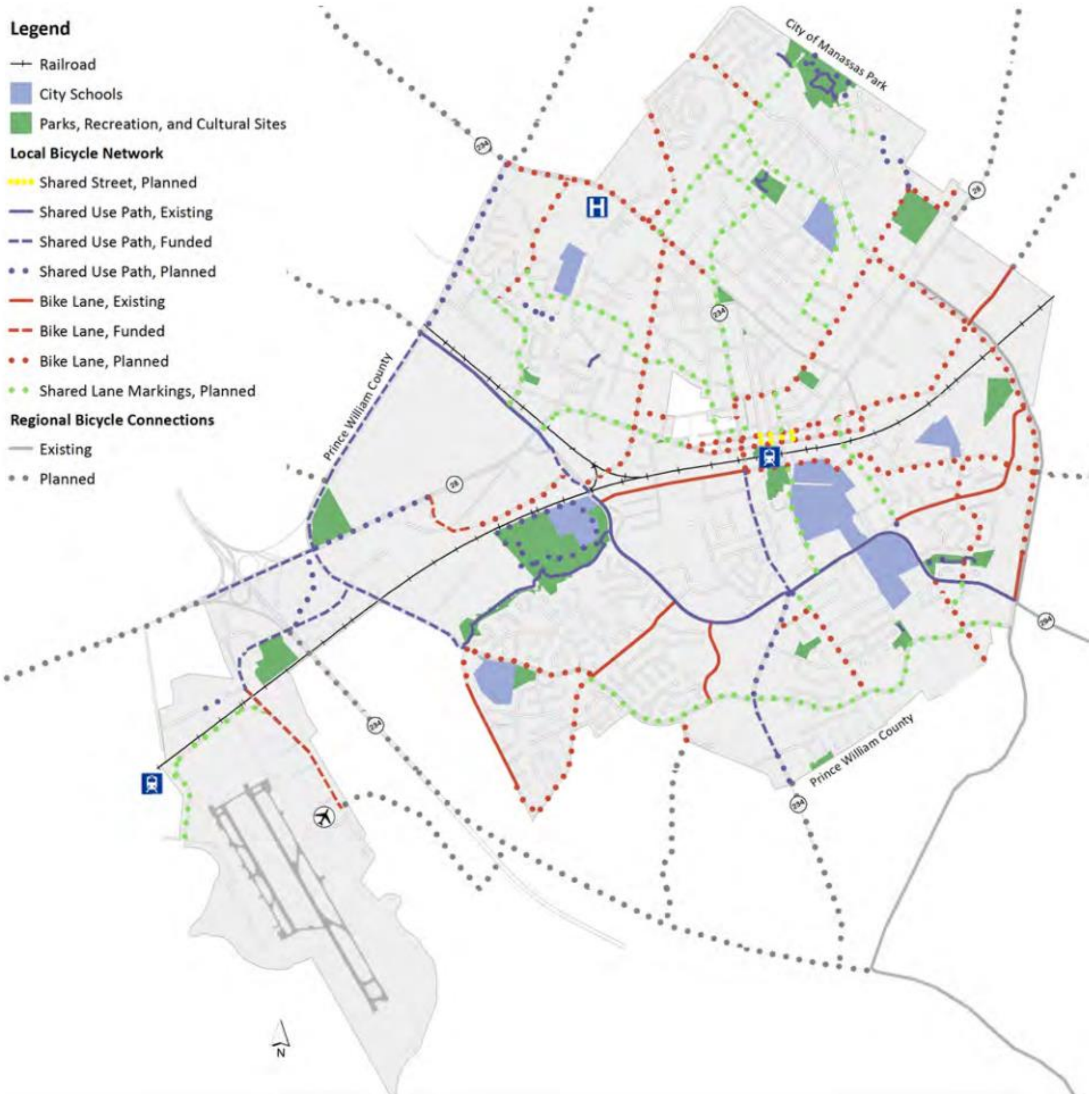
[9] VRE System Plan 2040 provides a framework for VRE system investments and actions VRE should pursue through 2040 to best meet regional travel needs.

FIGURE 3-23
MANASSAS KEY TRANSPORTATION PROJECTS

Source: Manassas 2040 Comprehensive Plan

FIGURE 3-24
MANASSAS LONG-RANGE BIKE NETWORK PLAN

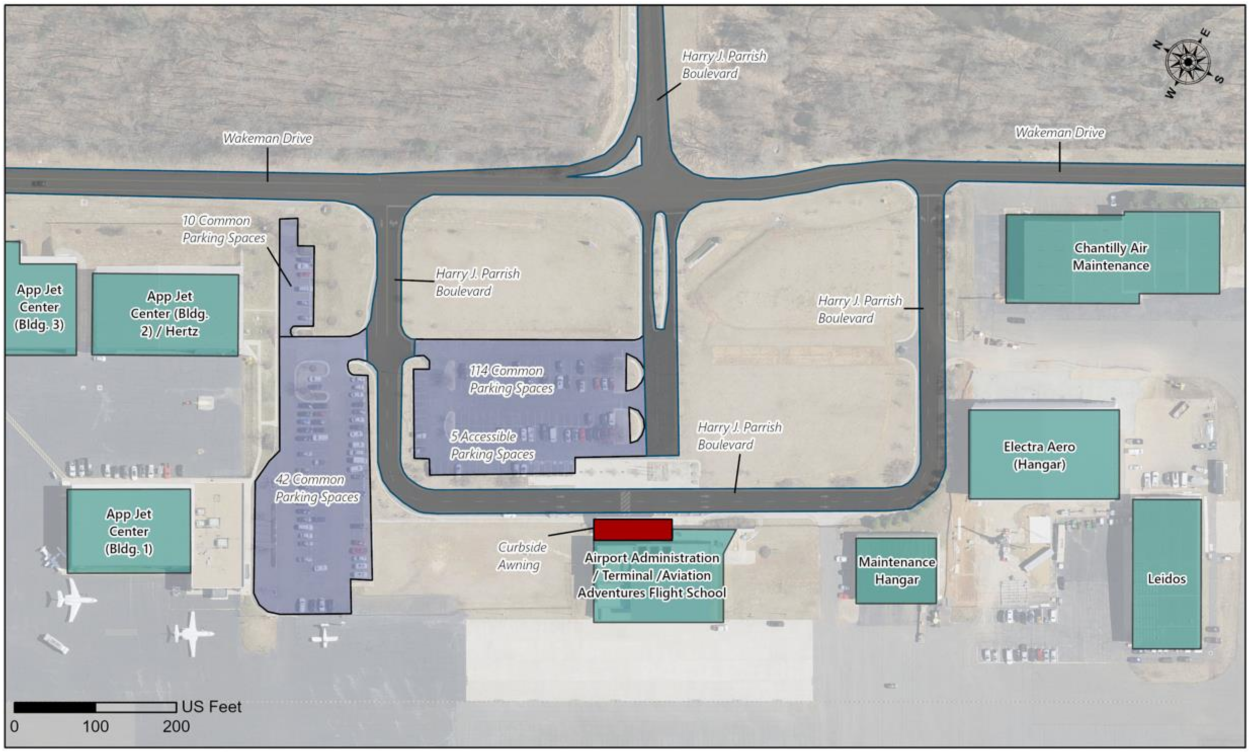


Source: Manassas 2040 Comprehensive Plan

3.13.2 Terminal Area Landside

The terminal area landside at HEF serves a variety of users including airport and tenant employees, general aviation users, and rental car agencies. Observations by Airport staff indicate that nearly all vehicular traffic is privately owned vehicles and taxi service to HEF is limited. The layout for the landside terminal area landside can be seen in **Figure 3-25.**

FIGURE 3-25
AIRPORT TERMINAL LANDSIDE



Source: RS&H Analysis, 2022

The terminal curb road is approximately 600 feet long with lanes, one for loading/unloading vehicles and the other for through vehicles. The terminal area lot has 119 parking spaces which includes 5 accessible parking spaces. The terminal area parking is free of charge for customers exclusively traveling to/from the Airport or have a business purpose at the Airport. There is a 48-hour limit for parking, however the Airport asks to be notified for extended durations. Given the nature of operations out of the terminal, the terminal parking lot has sufficient parking for the forecast period. Should the airport expand air carrier service during the planning period terminal parking will need to be further assessed to determine if expansion of the lot is warranted.

The landside area of the terminal is separated into quadrants with the terminal parking lot sited on the only developed quadrant. The three undeveloped quadrants provide an opportunity for development and will be further assessed in the following chapter.

3.13.2.1 Ground Transportation and Rental Car Services

The Airport offers multiple options for ground transportation including on-site car rentals, local taxi service, and transportation network companies (TNCs). All ground transportation services need to be prearranged with local providers.

Rental car services are currently available through Hertz Rental Car. The Chantilly Jet Center also has Go rentals available. Reservations must be made ahead of arriving to the airport. The Hertz Rental Car service is based at the APP Jet Center and can be accessed via the terminal area roadway, Harry J Parrish Boulevard. Hertz and Tesla entered a partnership in late 2021 that would see 100,000 electrical vehicles overhaul its rental fleet. Consideration should be made to implement infrastructure for new EV charging as Hertz's Tesla fleet expands across the country.

3.14 SECURITY

The Transportation Security Administration (TSA) has not required GA airports to implement security measures except as necessary to provide enhanced security for the Washington, D.C. metropolitan area. These facilities are located within the Washington, D.C. Metropolitan Special Flight Rules Area and gateway airports that are the last point of departure to Ronald Reagan Washington National Airport (DCA). Nevertheless, HEF has implemented security measures similar to those found throughout the nation's commercial service airports. Included in these measures to hinder security breaches are security fencing around most of the Air Operations Area (AOA) coupled with natural features (e.g. trees, creeks, vegetation), access-controlled vehicle gates, daily airfield inspections, landside and airfield signage, and public awareness programs for educating the aviation community on the safe and secure use of the facility. The airport does not have dedicated law enforcement or airport security on-site. For future planning considerations, if the airport should desire to serve air carrier operations specified in Part 139 the airport will need to enhance security measures to meet provisions found in its updated Airport Certification Manual (ACM) and Airport Emergency Plan (AEP).

3.15 EXISTING AND FUTURE LAND USE

Based on analysis from this Chapter, discussions with the Airport, and site observations parcels of land have been recommended to be controlled by the airport and some parcels of land have been identified to be released/dispositioned. Uncontrolled parcels of land within the RPZ should be acquired to have control over the land use of these areas. Runway 34L RPZ sits within a 50-acre parcel of land which the property owner and Airport have shown interest in exchanging. This 50-acre parcel sits in Prince William County and if acquired the land use is recommended to be converted to aeronautical land use.

An opportunity to expand the airport property to the Northwest has been identified just south of the VRE's Broad Run train station. The 8-acre parcel sits in Prince William Country between Piper Lane and Observation Road and can be used for aeronautical or non-aeronautical land uses. Opportunities exist to incorporate the vacant 8-acre parcel currently zoned for General Business into the northwest development area.

In accordance with the airport's Strategic Plan, the Airport would like to continue expansion of corporate hangar development. An area of land within the airport property on the east side and just south of Broad Run Creek provides an opportunity for this corporate expansion. The most effective way to develop these areas will be further assessed in future development alternatives.

The airport has expressed interest in selling an 11-acre parcel and 14-acre parcel of land, approximately one mile south of RWY 34R threshold, as these areas have no intended use for the airport. Any release of airport property must be coordinated with the FAA to determine the extent of Federal obligations associated with a parcel of land. Release of these property will be assessed and reflected accordingly in the Exhibit A property map and the Airport Layout Plan.

3.16 DEICING AND STORMWATER MANAGEMENT

Municipal stormwater runoff is regulated under the framework established by the Federal Clean Water Act. The Airport operates under a Virginia Pollutant Discharge Elimination System Permit (VDEPS) General Permit (VAR050985) for stormwater discharge associated with industrial activity. This permit expires on June 30, 2024. The City also maintains an Oil Discharge Contingency Plan, an Integrated Spill Prevention, Control and Countermeasures (SPCC) Plan, and a Stormwater Pollution Prevention Plan (SWPPP) for the Airport. These plans outline best management practices (BMPs) for controlling potential pollutant releases to the surrounding surface waters. These plans also provide detailed procedures to follow in the unlikely event of a spill to minimize potential effects to the surrounding environment.

There are eight regulated stormwater outfalls that exist throughout the airport property. These locations are monitored through quarterly visual inspection sampling. A minimum of one sample is collected from each stormwater outfall within the first 30 minutes but no more than 3 hours after (or as soon thereafter as practical) of when the runoff begins. Benchmark monitoring of stormwater discharges is done semiannually against the parameters of total suspended solids (TSS)[10] 100mg/L and total petroleum hydrocarbons (TPH)[11] 15 mg/L. Exceedance of a benchmark concentration does not constitute a violation of the general VPDES Permit for Discharges of Stormwater Associated with Industrial Activity and does not indicate that violation; however, it does signal that modifications may be necessary. Future regulations at the local, state, or federal level may set regulations for per- and polyfluoroalkyl substances (PFAS) and require monitoring by the Airport.

Deicing chemicals are used at the Airport in quantities less than 500 gallons during the deicing season (November – March). Airport tenants are responsible for their own deicing operations; therefore, deicing is covered under the tenants' SWPPPs. There may be instances where aircraft are deiced in Airport areas that drain to Airport outfalls. The Airport implements BMPs to minimize storm water exposure to deicing chemicals and subsequent contaminated runoff. The Airport reports deicing type and quantities, provided by tenants, to the Virginia Department of Environmental Quality (DEQ) on a biannual basis. Facility alternatives to manage deicing and stormwater will be identified within the following chapter.

3.17 UTILITIES

This section provides a summary of the existing utility infrastructure of the Airport. The Airport's primary developed area, including the terminal is served by main lines of utilities. This section will look at existing utilities and their general locations. The city is in process of updating its Utility Master Plan. In lieu of the

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[10] Total Suspended Solids (TSS) is the dry-weight of suspended particles, that are not dissolved, in a sample of water that can be trapped by a filter.

[11] Total Petrolem Hydrocarbons (TPH) is the sum of individual gasoline range organics and diesel range organics to be measured by EPA SW 846 Methods

final Utility Plan this section speaks to the existing utility runs. **Figure 3-26** shows approximate locations of water, sewage, gas, electrical and communication lines at the Airport.

3.17.1 Water

Water service at HEF is provided by the City of Manassas. Water lines to the Airport run along Observation Road, Harry J. Parrish Boulevard, James Payne Court, Aviation Lane, Skyview Terrace, and Wakeman Drive. The water lines that run to the terminal area are 8-inch distribution lines along Harry J. Parrish Boulevard. The lines that run along Wakeman Drive are 12-inch distribution lines and 8-inch distribution lines servicing the east side of the Airport. 6-inch and 10-inch distribution lines service the west side of the Airport along Observation Road. Distribution lines on James Payne Court and Aviation Lane vary between 6-inch and 8-inch lines. The city has plans for a future project to connect water lines on the east and west side of the airport to level water pressure seen at the end of the line. The connection tie-in will occur under the airfield.

3.17.2 Sewage

Sewage service at HEF is supplied by the City of Manassas. The sanitary sewer lines are made up of 10-inch pipes that runs along Piper Lane and Observation Road. There are sanitary sewer network lift stations near the ATCT on Observation Road and the southernmost end of Observation Road. A future project is expected to connect the east and west water lines to level pressure and will be located under the airfield.

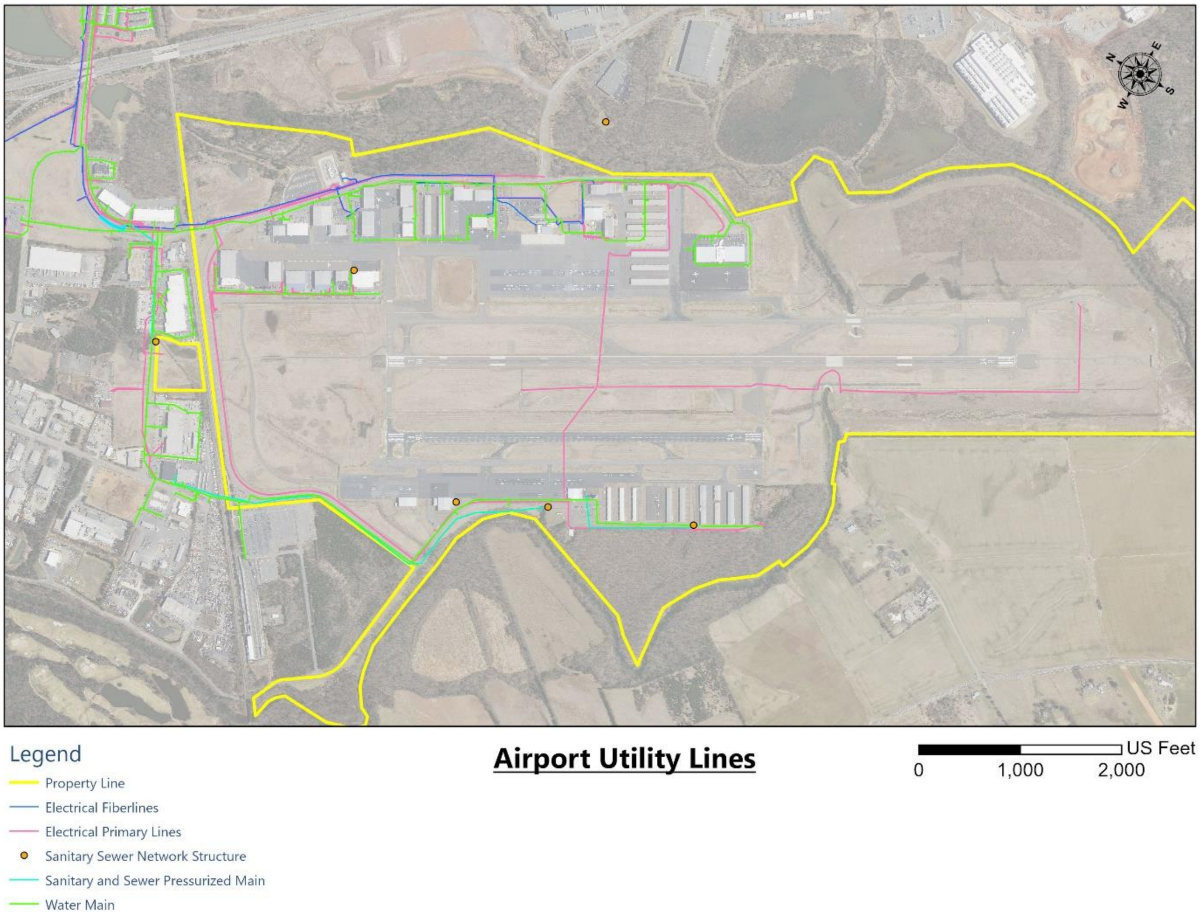
3.17.3 Gas

PLACEHOLDER UNTIL GAS UTILITY INFORMATION IS OBTAINED

3.17.4 Electricity

Electricity at HEF is supplied by the City of Manassas. The main electrical lines run underground along the southern part of Observation Road and along Wakeman Drive. An underground line also extends south of Wakeman Drive into Skyview Terrace. Electrical fiber lines also extend from Wakeman Drive into the terminal area from Harry J. Parrish Boulevard.

FIGURE 3-26
AIRPORT UTILITY LINES



Source: City of Manassas GIS, RS&H Analysis, 2022

3.17.5 Communications

PLACEHOLDER UNTIL TELECOMMUNICATION UTILITY INFORMATION IS OBTAINED

3.18 FACILITY REQUIREMENTS SUMMARY

The following is a summary list of airport facility needs and improvement considerations through Planning Activity Level 3. These needs and considerations will be the basis for creation of development alternatives in the Airport Development Alternatives Chapter, which will be evaluated and refined through public process into a long-range preferred development plan for the planning period. A graphic representation of the facility requirements summary can be seen in **Figure 3-27**.

Runways

- **Runway Protection Zones** – Acquire unowned RPZ land beyond Runways 16L and 34R within designated RPZ areas. This includes 21.92 acres for Runway 16L and 3.71 acres for Runway 34L. Acquiring land beyond current RPZs for all runways as practical is also recommended.
- **Runway Shoulders** – Construction of paved runway shoulders for Runway 16L-34R is recommended as the runway serves over 500 ADG-III operations annually.
- **Runway Blast Pad** – Construct runway blast pad with a width of 140 feet and length of 200 feet for Runway 16L-34R.
- **Runway Pavement** – Address pavement rehabilitation for Runway 16L-34R
- **Runway Length** – Extend Runway 16L-34R and preserve land to accommodate a runway extension
- **Runway Safety Area** – Surface variations and drainage discrepancies are present in the RSA for RWY 16L-34R and should be addressed.

Taxiways

- **Taxiway B** – It is recommended that paved shoulders be constructed for improved safety. Widening of the taxiway will be assessed. Address pavement rehabilitation for Taxiway B full length.
- **Taxiways B2/B3** – It is recommended to fix drainage.
- **Taxiway C** – It is recommended that paved shoulders be constructed for improved safety.
- **Taxiway C** – Consider addressing direct apron to runway access. Correct fence line protrusion into TOFA.
- **Taxiway D** – It is recommended that paved shoulders be constructed for improved safety.
- **Taxiway E** – It is recommended that paved shoulders be constructed for improved safety.
- **Taxiway K** – It is recommended that paved shoulders be constructed for improved safety. Alternatives will examine solutions to fix the hot spot intersection (HS 1)
- **Taxiway V** – It is recommended that paved shoulders be constructed for improved safety.

Aircraft Parking and Storage

- **Based aircraft storage** – By PAL 3 provide
    - Additional T-hangar structures
    - Additional conventional hangars

- **Transient aircraft apron** – By PAL 3 provide an additional apron for transient aircraft parking

Navigational Aids and Lighting

- **Runway 16L-34R** – Enhance markings and lighting
- **Runway 16L Glide Slope** – Relocate Glide Slope out of Runway 16L-34R ROFA
- **Runway 34R MALSF lighting** – An extension of Runway 16L-34R will impact MALSF stations and is recommended to be relocated to meet current FAA standards.
- **Runway 16L MALSR** – Does not meet the 3" frangibility requirements within the RSA. It is recommended to upgrade light bases to meet current FAA standards.

Landside

- **Terminal Area** – Find highest and best use of three vacant quadrants in terminal area.

Support Facilities

- **Air Traffic Control Tower** – The preferred ATCT site will be incorporated into the preferred development alternative.
- **Aircraft Wash Facility** – Construct a 70' by 70' wash structure, preferably covered, that is 18-feet high (Accommodates aircraft up to the size required by a single engine or twin aircraft)
- **Safety Center** – Site a new "safety center" with the intent to expedite emergency response, would provide storage for ARFF apparatus combined with a police office
- **Fixed Based Operators** – Allocate land for a future full service FBO and/or corporate hangar that can be used by transient aircraft.
- **Fuel Farm/Storage** – Examine a satellite fuel farm with allowances for airfield access and self-serve fuel option on the west side as well as bolster existing fuel farm containment.

Utilities

- **Future Expansion** – Expand natural gas, communication lines, water, sewer, and/or electrical lines from main lines to future development areas.
- **Temperature Sensors –** Explore opportunities to install temperature sensors in runways and airfield bridges

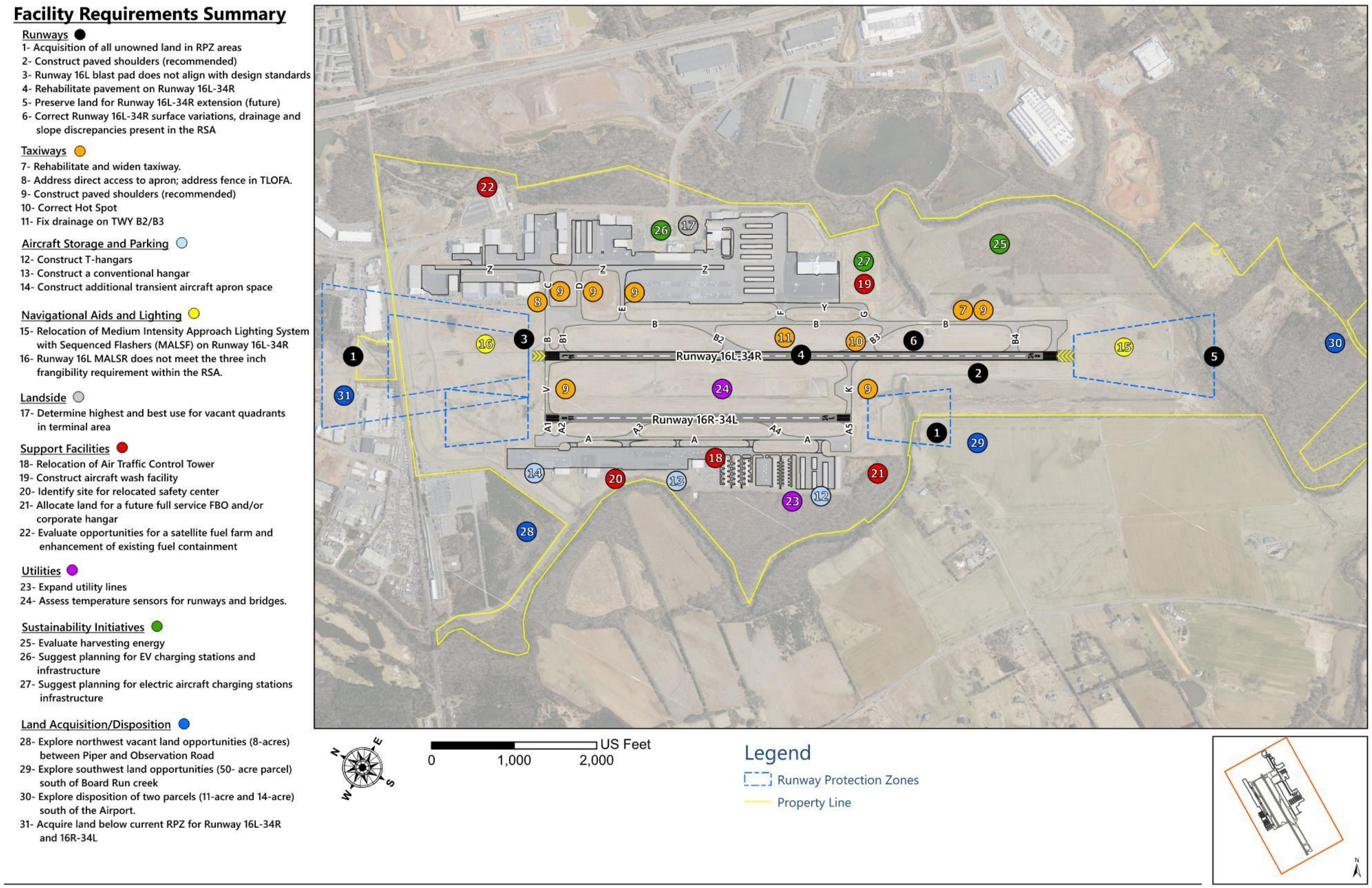
Sustainability Initiatives

- **Vehicle Charging Stations** – Suggest implementing infrastructure for dedicated EV charging stations. Airport policies should be developed on where to locate theses spaces within the total stock of available parking. It is recommended that they are dispersed across the overall stock as a percent allocation of total.
- **Aircraft Charging Stations** – Consider the infrastructure, utilities, and space necessary for electric aircraft charging stations for Advanced Air Mobility technology.
- **Airport energy sustainability** – Determine if sustainability efforts will include harvesting renewable energy.

Land Acquisition/Disposition

- **Northwest Land** – Explore opportunities to expand airport property to vacant land (8-acres) between Piper and Observation Road.
- **Southwest Land** – Explore opportunities to expand airport property into 50-acre parcel south of Board Run creek.
- **South Land Parcels** – Explore disposition of two parcels (11-acre and 14-acre) of airport owned land south of the Airport.
- **RPZ Land** – As stated, acquire unowned land beyond Runways 16L and 34R within designated RPZ area. Acquiring land beyond current RPZ for Runway 16L-34R and 16R-34L is also recommended.

FIGURE 3-27
FACILITY REQUIREMENTS SUMMARY



Source: RS&H Analysis, 2022