



2017 AIRPORT MASTER PLAN UPDATE

**Draft Chapters 1 - 4
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CHAPTER 1 - INTRODUCTION

This chapter provides a brief overview of the history of Nashua Municipal Airport- Boire Field (ASH or the Airport), ownership and management, and the master planning process.

1.1 BOIRE FIELD

In 1934, the City of Nashua approved the purchase of a farm owned by Joseph Therrien on Pine Hill Road for the development of an airport. The Airport officially held its grand opening on October 12, 1934. “During World War II, airfields throughout the country were re-named in honor of aviators who had given their lives, and Nashua was no exception. On March 23, 1943, U.S. Navy (Reserve) Ensign Paul A. Boire, stationed aboard an aircraft carrier in the Caribbean, died in a crash at sea. Born in 1921, Boire was a 1939 graduate of Nashua High School, where he was a popular student who had played basketball and volleyball and was a member of the school’s rifle club. He attended St. Anselm College in Manchester after graduation and also enrolled in the Civil Pilot Training Program at Nashua Airport. He completed the program and in July 1941 enlisted in the Navy, receiving further flight instruction at Squantum Naval Air Station (Quincy, Massachusetts), Pensacola, Florida, and Norfolk, Virginia. After receiving his commission on April 3, 1942, he served first as a pilot of scout planes and then carrier-based dive bombers. He was just 22 years old when he died and was the first military pilot Nashua lost in the war. The field was dedicated to his memory in September 1945”¹



Figure 1-1 Ensign Paul A. Boire (1921-1943) WWII; Source: Janice Brown NH History Blog

1.2 GOVERNANCE

ASH is a publicly-owned, public-use general aviation airport owned by the City of Nashua, located in the Merrimack Valley region of New Hampshire. The city leases the airport to the Nashua Airport Authority (NAA). On January 10, 2017, the Mayor and Board of Alderman of the City of Nashua approved a 99-year lease extension through December 31, 2115. The NAA consists of five directors who are appointed by the Mayor and approved by the Board of Aldermen of the City of Nashua. The NAA is tasked with setting the policy and procedures to operate ASH for the City in conjunction with the rules and regulations of the

¹ AHS, Inc., New Hampshire Division of Historical Resources Area Form, 2013

Federal Aviation Administration (FAA) and the New Hampshire Department of Transportation, Bureau of Aeronautics (NHDOT/BA). The Airport Manager is responsible for overseeing the daily operations of ASH, and reports directly to the NAA. ASH is currently served by a staff four, consisting of the following positions:

- Airport Manager
- Office Manager
- Maintenance Supervisor
- Maintenance Technician(s)

1.3 AERONAUTICAL ROLE

ASH provides a significant positive contribution to the state and local economy through flight activities including aviation fuel sales and car rentals, tenant leases, business opportunities/jobs, and visitor expenditures in the area. According to the 2015 New Hampshire Airport State Airport System Plan (NHSASP), “ASH is the busiest general aviation airport in NH and also has the largest based aircraft fleet of all the state’s airports.”

1.3.1 NH AIRPORT STATE SYTEM PLAN

In addition to its role in the National Plan of Integrated Airport Systems (NPIAS), ASH is the only existing airport defined as a National airport in the NHSASP according to the 2015 NHSASP. “Comprised of 3 commercial service and 22 public-use general aviation airports, the NH airport system consists of 25 facilities that serve the air transportation needs of over 1.3 million NH residents, business users, leisure travelers and the military. The system is an important contributor to state and local economies, supporting thousands of jobs and generating millions of dollars in state tax revenue.”² The estimated economic contribution by ASH is highlighted in Table 1-1 below.

Table 1-1: Estimated Economic Contribution of ASH (2015)

	<i>Total Employment</i>	<i>Total Payroll</i>	<i>Total Output</i>	<i>Total Tax Revenue</i>
Total Impact	33	\$14.99 million	\$40.74 million	\$1.32 million

Source: NHDOT/BA 2015 NHSASP

1.3.2 NATIONAL PLAN OF INTEGRATED AIRPORT SYSTESMS

ASH is included in the NPIAS. The Airport is one of nearly 3,400 existing and proposed civilian-use airports in the U.S. that the FAA considers significant to the national air transportation system, and thus eligible to receive Federal grants under the AIP. Within the NPIAS, airports are grouped into two major categories: primary or nonprimary as shown in Figure 1-2. ASH is categorized as a nonprimary airport. ASH is further categorized as a reliever airport, designated by the U.S. Secretary of Transportation to relieve congestion at a commercial service airport and to provide more general aviation access to the overall community. To

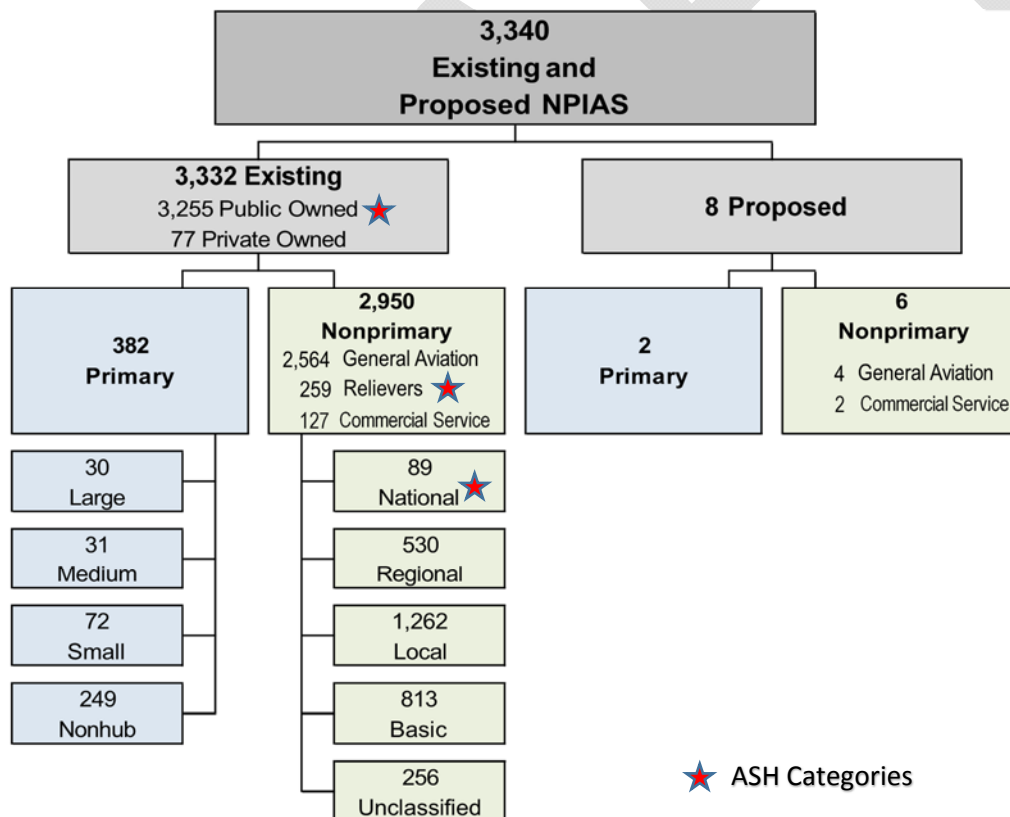
² NHDOT/BA 2015 State Airport System Plan

assist in further defining nonprimary airports to the general public, FAA has identified four subcategories for nonprimary airports based on activity level and role within the aviation system. ASH is further categorized as a *National* airport. To be categorized as *National*, an airport must demonstrate that 1) it supports the national airport system by providing communities across the national and international markets in multiple states and throughout the United States; 2) has very high levels of aviation activity with many jets and multiengine propeller aircraft, and 3) meets one of the following minimum criteria for annual aviation activity:

- 5,000 or more instrument operations, 11 or more based jets, and 20 or more international flights, or 500 or more interstate departures.*
- 10,000 or more commercial passenger enplanements and at least 1 scheduled operation by a large certificated air carrier.
- 500 million pounds or more of landed cargo weight.

*ASH criteria met

Figure 1-2: NPIAS Categories of U.S. Civilian Airports



1.4 HISTORY OF PAST PROJECTS

The State of New Hampshire, through its Department of Transportation Bureau of Aeronautics (NHDOT/BA), was selected by the Federal Aviation Administration's (FAA) New England Region to be a member of FAA's Airport Block Grant Program in FY 2008. The Bureau manages the Airport Improvement Program (AIP) grants for all non-primary National Plan of Integrated Airport System (NPIAS) airports and the statewide program. ASH is a non-primary NPIAS airport eligible to receive AIP program funding administered by the NHDOT/BA. Table 1-2 provides a history of federal funded projects at ASH dating back to 1951.

Table 1-2: History of Federally Funded Capital Projects

Project Year	FAA Grant Number	Description of Work	Total Project Cost
1951	9-27-017-4901	Land acquisition; clearing; construct and pave runway extension; segment circle and windcone; air and runway marking; repair and resealing of the existing runway and taxiway	\$59,718
1955	9-27-017-0506	Runway extension 100' x 300'; runway and taxiway markings; grading and turfing runway shoulders	\$9,622
1960	9-27-017-5903	Land acquisition; taxiway construction; installation of runway and obstruction marking	\$30,188
1960	9-27-017-6004	Construct taxiway 3,850' x 40'; install taxiway signs	\$60,000
1964	9-27-017-6305	Extend runway 455' x 100' NW; lighting; reconstruct runway pavement 2,000' x 100'; construct TW 'B' 850' x 40'; construct TW 'C' 350' x 40'; construct TW 'E' 580' x 40'; clearing in clear zones; relocate airport road SE; drainage; runway and taxiway marking	\$233,934
1967	9-27-017-C506	Drain swamp area; install medium intensity approach lighting system with sequenced flashing condenser discharge lights	\$54,068
1969	9-27-017-C807	Land acquisition for NW clear zone (25 acres); mark and light RW 14-32 1,500' x 100'; relocate MALs, REILs and VASI, obstruction removal, and extend TW 2,140' x 40'; overlay and mark Runway 14-32 (560')	\$291,482
1975	7-33-0012-02-75	Aviation easement under approach and clear zone to Runway 14 (79 acres)	\$240,000
1982	3-33-0012-01	Acquire land for development	\$88,528
1983	3-33-0012-02	Remove and light obstructions; construct taxiways; expand apron; install taxiway sign; acquire land for approaches; improve drainage and install fencing	\$604,900
1984	3-33-0012-03	Expand snow removal equipment storage building; acquire snow removal equipment	\$525,000
1985	3-33-0012-04	Construct apron	\$497,504
1986	3-33-0012-05	Install security fencing; construct runway safety area	\$196,813
1987	3-33-0012-06	Rehabilitate and mark Runway 14-32	\$796,684
1987	3-33-0012-07	Airport Master Plan Update study	\$85,778
1988	3-33-0012-08	Land acquisition- clear zone, Runway 32	\$185,058
1988	3-33-0012-09	Conduct noise compatibility plan study	\$121,649
1990	3-33-0012-10	Extend taxiway (40' x 1,325' and parking apron (460' x 250')); demolish hangar; install security fencing (2,250 FL)	\$584,371
1991	3-33-0012-11	Land acquisition (.5 acres) in the Runway 32 runway protection zone	\$94,280
1991	3-33-0012-12	Reconstruct parallel taxiway, diagonal taxiways and stub taxiways (approx. 39,400 SY); construct bypass taxiway (approx. 1,945 SY)	\$466,044

Project Year	FAA Grant Number	Description of Work	Total Project Cost
1992	3-33-0012-13	Construct access road (2,500 LF); install security fencing (2,400 LF)	\$432,187
1992	3-33-0012-14	EA of Holden property acquisition	\$34,750
1993	3-33-0012-15	Land acquisition (approx. 25 acres) for future development	\$1,018,074
1996	3-33-0012-16	Apron expansion	\$514,000
1997	3-33-0012-17	Environmental assessment of Runway 14L- 32R	\$52,000
1999	3-33-0012-18	Boire Field Airport Plan technical supplement	\$100,616
1999	3-33-0012-19	Acquire land in the runway protection zone to Runway 32 (approx. ½ acre)	\$97,702
2000	3-33-0012-20	Installation of taxiway lighting and signage	\$285,200
2001	3-33-0012-21	SRE building expansion/current building upgrade	\$475,313
2002	3-33-0012-22	Install 8' fence with barb wire	\$230,929
2002	3-33-0012-23	Design only: 15,000 SY aircraft tie-down, etc.	\$99,400
2003	3-33-0012-24	Construction of aircraft apron 17,600 SY, taxilane 25' x 225' and relocation of Perimeter Rd	\$822,031
2004	3-33-0012-25	Environmental assessment and Phase I design of parallel runway and taxiway	\$211,000
2005	3-33-0012-26	Runway relocation feasibility study & obstruction removal of Runway 14 approach area	\$307,000
2006	3-33-0012-27	Purchase SRE	\$270,000
2007	3-33-0012-28	Prepare Environmental Assessment	\$400,000
2008	SBG-12-01-2008	Replace Hazard Beacons and purchase SRE	\$291,000
2009	SBG-12-02-2008	Design only: Runway 14-32 Relocation	\$1,269,800
2009	SBG-12-03-2009	ARRA: Rehabilitate Terminal Aircraft Parking Apron	\$1,596,763
2010	SBG-12-04-2010	Easement Acquisition (13 parcels)	\$804,932
2010	SBG-12-05-2010	FAA Reimbursable Agreement for Runway Construction- Phase Services and Equipment Purchase	\$976,000
2010	SBG-12-06-2010	Obstruction Removal and Airspace Survey	\$712,000
2011	SBG-12-07-2011	Mitigation for Runway Reconstruction	\$2,038,000
2011	SBG-12-08-2011	Runway 14-32 reconstruction- Phase I	\$9,448,316
2011	SBG-12-09-2011	Runway 14-32 Reconstruction- Phase II	\$7,429,684
2013	SBG-12-10-2013	Conduct WHA, SWPPP Update, SHPO Area Form	\$145,000
2013	SBG-12-11-2013	Purchase SRE (blower & tracked dozer)	\$564,000
2014	SBG-12-12-2014	Phase I- Replace Perimeter/Wildlife Fence and Gates (approx. 15,000 LF)	\$312,736
2014	SBG-12-13-2014	Acquire land for RPZ protection (31 Charron Ave)	\$419,800
2014	SBG-12-14-2014	Phase II- Replace Perimeter/Wildlife Fence and Gates (approx. 15,000 LF)	\$477,264
2015	SBG-12-15-2015	Acquire land for RPZ protection (79 Pine Hill Rd)	\$400,000
2016	SBG-12-16-2016	Prepare Airport Master Plan Update	\$445,000
2016	SBG-12-17-2016	Airport Pavement Maintenance and Rehabilitation of Taxiways and Aprons	\$1,645,000

Sum of Capital Project Costs

\$39,551,118.00

1.5 MASTER PLANNING HISTORY AT NASHUA MUNICIPAL AIRPORT

The last comprehensive Master Plan update for ASH was completed in 1989. With the construction of the control tower in 1972, and subsequent staffing in later years, accurate operational data was collected and consequently the Airport commissioned an *Airport Master Plan Technical Supplement* in 2000. The primary purpose of the *Airport Master Plan Technical Supplement* was to “update those areas that are directly affected by the inaccurate traffic estimates³.”

The purpose of this current Airport Master Plan Update (AMPU) is to provide the Airport with its first comprehensive update in nearly 27 years. The objectives of this AMPU are to define the Airport’s aviation and infrastructure needs, and to prudently sustain the Airport and meet the growing needs of its aviation operators in the short (0-5 years), medium (6-10 years) and long terms (11-20 years). To achieve these objectives, this Plan will highlight the Airport’s current land-use characteristics, operations, finances, regulatory requirements, and constraints, among other topics.

Much of the information used to develop this Master Plan Update has been compiled, in part, from multiple documents and plans including:

- *1989 Master Plan Update;*
- *2000 Master Plan Technical Supplement;*
- *2008 Environmental Assessment;*
- *2008 Part 150 Noise Compatibility Study and Noise Exposure Map;*
- *2009 Runway 14-32 Permitting;*
- *2009 Boire Field Runway Redesign;*
- *2015 Wildlife Hazard Assessment;*
- *2015 NH Division of Historical Resources’ Area Inventory Form;*
- *2015 NH State Airport System Plan (NHSASP).*

1.6 AIRPORT MASTER PLAN UPDATE FUNDING

The FAA, NHDOT/BA and the NAA are assisting in the financing of this Master Plan Update. ASH is eligible to receive Federal funding assistance for this project under the FAA’s AIP. AIP funding is provided through a Federal aviation trust fund, funded through “user fees” paid by passengers on commercial flights, aviation fuel tax, cargo fees, and over-flight fees. This project is receiving 90 percent of total project funding through FAA’s AIP program. The NHDOT/BA pays for an additional 5 percent of total project costs from its dedicated aeronautical fund, and the NAA finances the remaining 5 percent of total project costs.

³ Airport Master Plan Technical Supplement, May 2000

1.7 PLANNING PROCESS

Guidance for the airport master planning process comes from the FAA Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, and other relevant FAA ACs, Orders, and Federal Aviation Regulations (FARs), as applicable. This master planning process considers the needs and demands of airport tenants, users, and the general public. The airport master plan process provides opportunities for airport users, political entities, and the public to participate in the development of an airport's aviation plans and goals. These opportunities have been built into this project through public meetings, Client Group meetings, Master Plan Committee meetings, and project updates on the Airport's website.

This airport master plan process will be broken down into phases at logical decisions points:

- Initial data collection and aviation activity forecasts will make up the foundation from which all other decisions in this project are made;
- Aviation facility needs analysis and alternatives development options will be identified for each of the three planning periods (short, intermediate, and long term);
- Environmental, financial, and graphical depictions of the recommended airport development will complete the process.

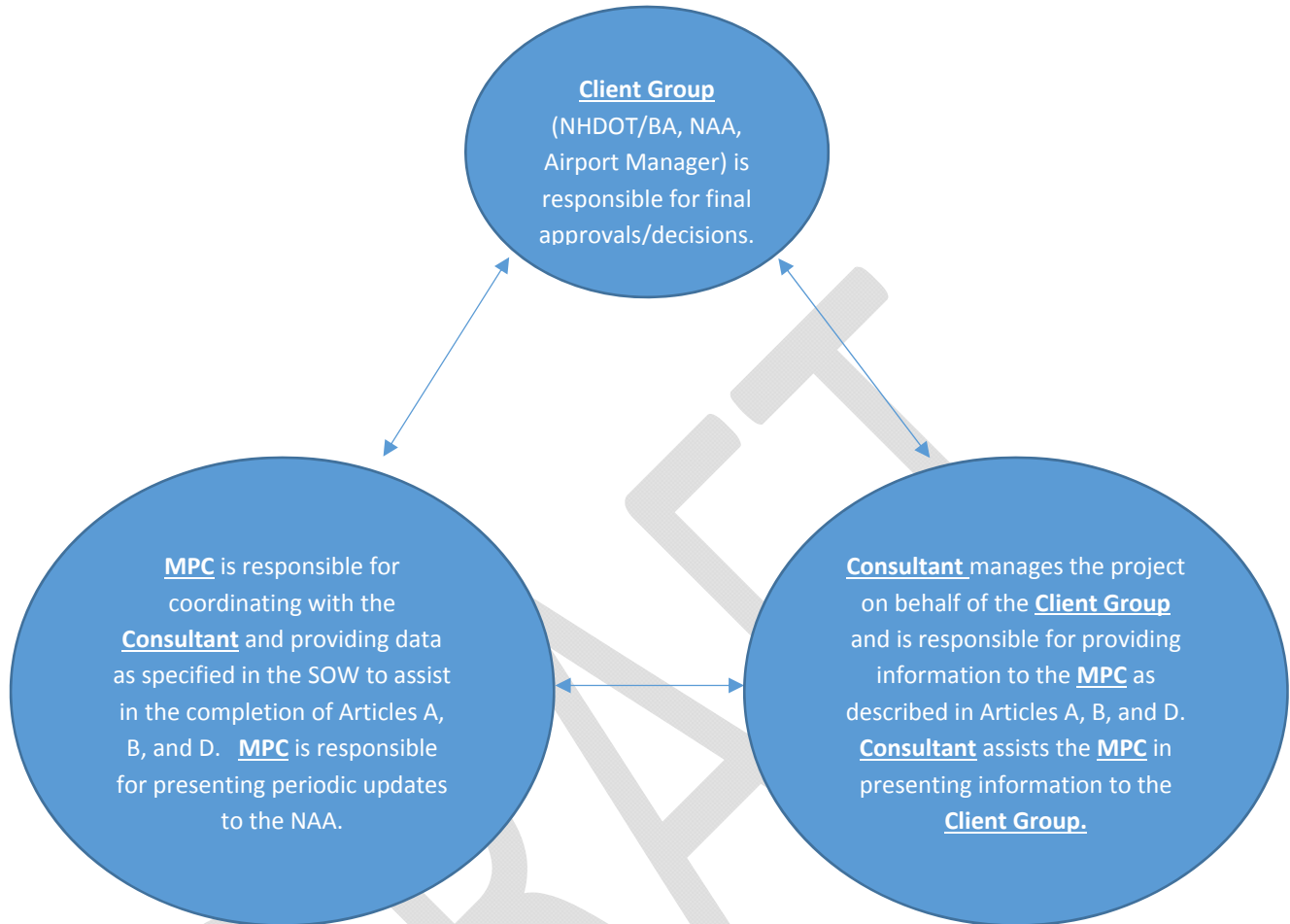
This master planning process will have one component that seeks to help address the understanding of the various FAA grant assurances and certificates that are attached to each FAA grant that ASH accepts. This will be a standalone chapter within the final document that can be used for future training of airport staff and others bound by these requirements.

1.8 ROLES AND RESPONSIBILITIES

The Client Group- consists of representatives from the FAA, NHDOT/BA, NAA, and the Airport Manager. The Client Group is responsible for review of draft documents, interim decisions, and final approvals.

The Master Plan Committee (MPC)- is comprised of 9 members representing the City government, Airport management, NAA, Fixed Base Operators and, airport users. The MPC is responsible for coordinating with the consultant and providing feedback as specified in the scope of work. The MPC is responsible for providing periodic updates to the NAA.

The Consultant- Gale Associates, Inc. is responsible for managing the project on behalf of the Client Group, doing much of the data collection and evaluation, and providing information to the MPC as well as assisting the MPC in presenting information to the Client Group.



CHAPTER 2 INVENTORY OF EXISTING FACILITIES

Documenting and assessing the existing inventory and condition of Airport facilities provides a comprehensive foundation from which facility requirements and improvement recommendations can be made. An on-site inventory of Airport facilities was conducted in [Insert Date] to supplement information previously obtained through a review of Airport drawings, previous reports, and interviews with airport management and the MPC. See Figure 2-1 and sheet XX of the Airport Layout Plan (ALP) for a depiction of existing facilities.

2.1 REGIONAL SETTING AND SURROUNDING LAND USE

ASH is a publicly owned, public-use general aviation airport occupying approximately 400 acres of land at 93 Perimeter Road in the northwest portion of the City of Nashua, Hillsborough County. The second largest city in northern New England, Nashua is located in southern New Hampshire abutting the northern Massachusetts border, approximately 40 miles northwest of Boston, Massachusetts. Nashua is bordered by Hollis, NH to the west, Merrimack, NH to the north, Hudson, NH to the east, and Tyngsboro, MA to the south. The Airport is conveniently located, being accessible from the north or south by the Everett Turnpike (Route 3) and from the east or west by Route 101A, connecting it to major and minor feeder routes in the region.

The Airport is immediately bounded to the east by Charron Avenue, by the Boston and Maine Railroad to the north, by Deerwood Drive to the west, and by Perimeter Road and Pine Hill Road to the south. Perimeter Road provides access to most of the Airport's facilities.

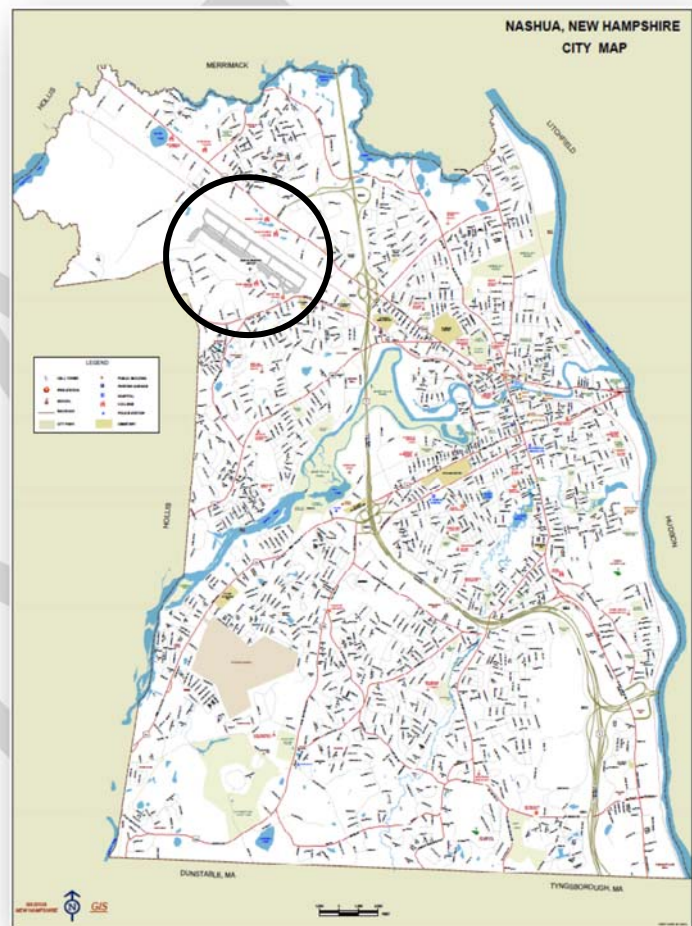


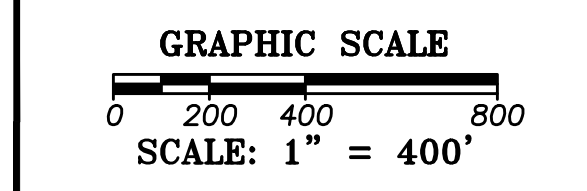
Figure 2-2 Nashua, NH City Map, Source: City of Nashua

PREPARED FOR:



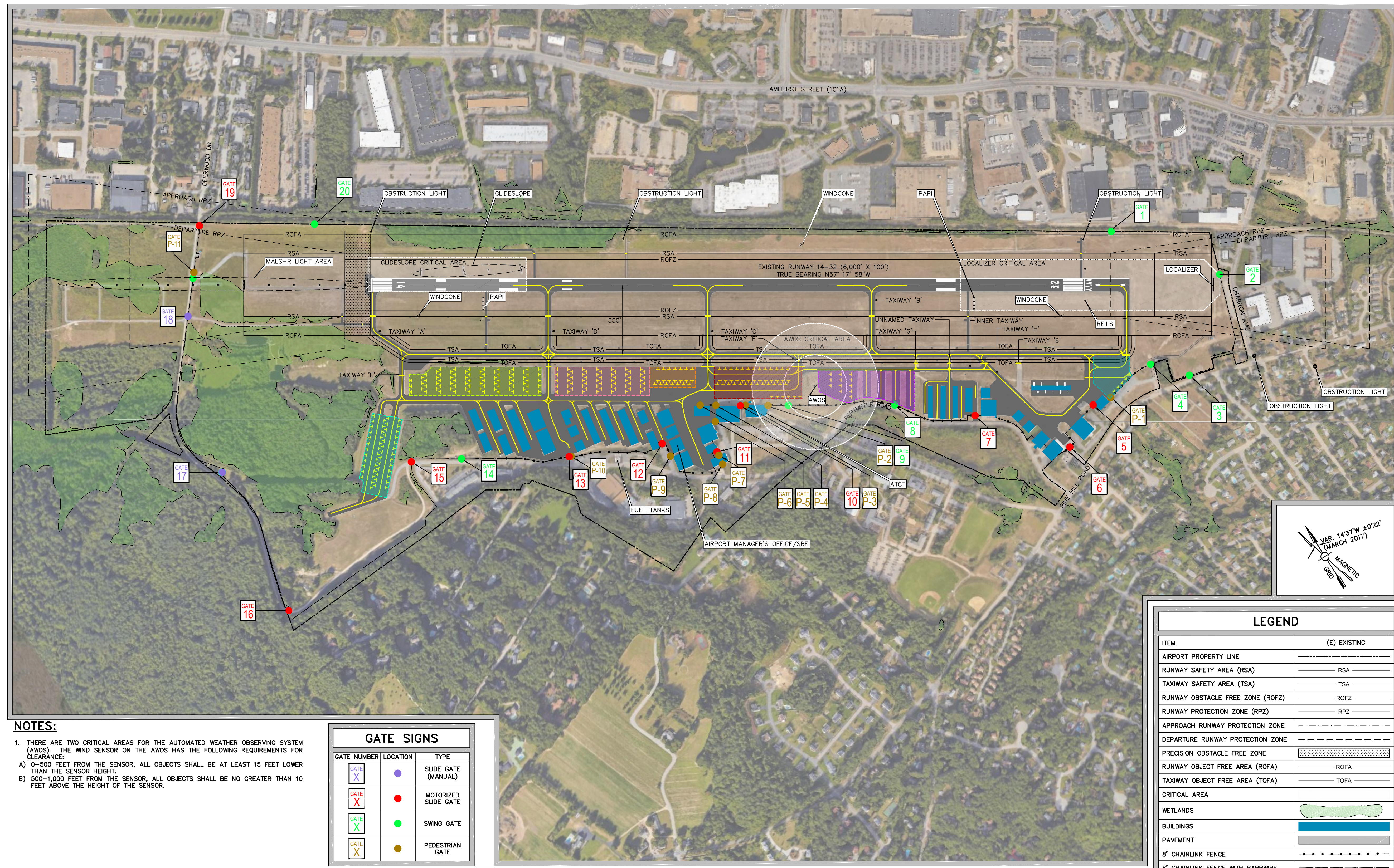
PROJECT
AIRPORT MASTER PLAN UPDATE
NHDOT NO. SBG-12-16-2016
OWNER
CITY OF NASHUA, NEW HAMPSHIRE
AIRPORT AUTHORITY

NO.	DATE	DESCRIPTION	BY
PROJECT NO.	777042		
DESIGNED BY	DCQ		
DRAWN BY	DCQ		
CHECKED BY	NAI		
DATE	DECEMBER, 2016		



SHEET TITLE
EXISTING FACILITIES PLAN
(DRAFT)

DRAWING NO.
FIG.2-1
2 OF X



- NOTES:**
1. THERE ARE TWO CRITICAL AREAS FOR THE AUTOMATED WEATHER OBSERVING SYSTEM (AWOS). THE WIND SENSOR ON THE AWOS HAS THE FOLLOWING REQUIREMENTS FOR CLEARANCE:
A) 0-500 FEET FROM THE SENSOR, ALL OBJECTS SHALL BE AT LEAST 15 FEET LOWER THAN THE SENSOR HEIGHT.
B) 500-1,000 FEET FROM THE SENSOR, ALL OBJECTS SHALL BE NO GREATER THAN 10 FEET ABOVE THE HEIGHT OF THE SENSOR.

GATE SIGNS		
GATE NUMBER	LOCATION	TYPE
GATE X		SLIDE GATE (MANUAL)
GATE X		MOTORIZED SLIDE GATE
GATE X		SWING GATE
GATE X		PEDESTRIAN GATE

EXISTING FACILITIES PLAN
SCALE: 1" = 400'

LEGEND	
ITEM	(E) EXISTING
AIRPORT PROPERTY LINE	-----
RUNWAY SAFETY AREA (RSA)	----- RSA -----
TAXIWAY SAFETY AREA (TSA)	----- TSA -----
RUNWAY OBSTACLE FREE ZONE (ROFZ)	----- ROFZ -----
RUNWAY PROTECTION ZONE (RPZ)	----- RPZ -----
APPROACH RUNWAY PROTECTION ZONE	-----
DEPARTURE RUNWAY PROTECTION ZONE	-----
PRECISION OBSTACLE FREE ZONE	-----
RUNWAY OBJECT FREE AREA (ROFA)	----- ROFA -----
TAXIWAY OBJECT FREE AREA (TOFA)	----- TOFA -----
CRITICAL AREA	-----
WETLANDS	-----
BUILDINGS	-----
PAVEMENT	-----
8' CHAINLINK FENCE	-----
8' CHAINLINK FENCE WITH BARBWIRE	-----
APRON 'A'	-----
APRON 'D'	-----
APRON 'E'	-----
APRON 'F'	-----
APRON 'G'	-----
APRON 'H'	-----
APRON 'I'	-----

As the state's southernmost public-use airport, it is approximately 8 miles from the New Hampshire/Massachusetts border. ASH is located within the City's Airport Industrial zone (see Figure 2-2), with surrounding areas consisting of the following zoning designations:

- R-30: A Suburban Residence
- PI: Park Industrial
- GB: General Business
- LB: Local Business

2.2 GEOMETRY AND DESIGN STANDARDS

FAA AC 150/5300-13A provides design standards and recommendations for the geometric layout and engineering design for runways and runway associated environments such as Runway Safety Areas (RSAs), Obstacle Free Zones (OFZs), Object Free Areas (OFAs), clearways, and stopways, among other elements.

2.2.1 APPROACH AND DEPARTURE REFERENCE CODE

The Airport's Approach and Departure Reference Code (ARC and DRC), formerly referred to as the Airport Reference Code (ARC) at ASH have fluctuated over years as the use of business jets has increased and new aircraft have been introduced to the market. The *Technical Supplement to the 1989 Master Plan Update* documented the current and future ARC for the Airport as B-II based on the Airport's users at the time and on a forecast of likely users in the future. This ARC changed in 2004 when the Air Traffic Control Tower's 2003 data indicated that more than 500 annual operations were performed by Approach Category "C" aircraft in 2003. As a result, the Airport's ARC was changed from B-II to C-II. In 2007, ahead of the 2008 Environmental Assessment, aircraft operation counts by aircraft type were obtained from the Air Traffic Control Tower and reviewed to determine whether the ARC designation of C-II remained valid. The review indicated that enough aircraft operations were conducted in 2007 by the Gulfstream IV (category D aircraft) to warrant a further change in the ARC.

The current Airplane Design Group (ADG) for ASH is D-II. The ADG is a classification of aircraft based on approach speed, wingspan, and tail height.

An aircraft approach category is a grouping differentiating aircraft based on the speed at which the aircraft approaches a runway for a landing. These categories are defined in Tables 2-1 and 2-2, below.

Table 2-1 Airplane Design Group

<i>Aircraft Approach Category</i>	<i>Approach Speed</i>
A	Speed less than 91 knots
B	Speed 91 knots or more but less than 121 knots
C	Speed 121 knots or more but less than 141 knots
D	Speed 141 knots or more but less than 166 knots
E	Speed 166 knots or more

***Bold= ASH's Aircraft Approach Category**

Tale 2-2 Aircraft Approach Category

<i>Airport Design Group</i>	<i>Tail Height [ft. (m)]</i>	<i>Wingspan [ft. (m)]</i>
I	< 20' (<6 m)	<49' (<15m)
II	20' - < 30' (6m- <9m)	49' - <79' (15m- <24m)
III	30' - < 45' (9m- <13.5m)	79' - <118' (24m- <36m)
IV	45' - <60' (13.5m- <18.5m)	118' - 171' (36m- <52m)
V	60' - <66' (18.5m- <20m)	171' - <214' (52m- <65m)
VI	66' - <80' (20m- <24.5m)	214' - <262' (65m- <80m)

***Bold= ASH's Airport Design Group**

2.3 AIRSIDE FACILITIES

Airside facilities are those facilities associated with the movement, takeoff and landing of aircraft. At ASH, this consists of the following:

- Runway
- Taxiways
- Taxilanes
- Hangars
- Aprons
- Tie-downs
- Navigational/Visual/Communication Aids

2.3.1 RUNWAY LENGTH

Runway length requirements are determined based on FAA Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design*. During the 2008 Environmental Assessment, the forecast identified the Gulfstream IV (G-IV) as representative of the most demanding aircraft regularly¹ using the Airport. Thus, the G-IV was identified as the Airport's "Design Airplane". In accordance with the AC, the chart taken from the G-IV operation manual indicated the required runway length to be 6,800 feet. However, due to significant impacts to wetlands that would occur as a result of implementing such a length, the NAA, FAA and the NHDOT/BA agreed that a length of 6,000 feet would lessen the runway's environmental impact and would constitute a sufficient improvement over existing conditions (5,500 feet). Consequently, Runway 14-32 was reconstructed in 2015 to 6,000 feet in length. **Figure 2-1** illustrates the runway characteristics and existing critical data for Runway 14-32.

Following the completion of the Environmental Assessment in 2009, the preferred alternative included extending the Runway 14 end by 150 feet, paving a 350-foot portion of the Runway 32 runway safety area, and using declared distances to achieve 6,000 feet of available take-off distance when departing from Runway 32. Declared distances are the distances the FAA declares available for use in meeting an airplane's takeoff run available (TORA), takeoff distance available (TODA), accelerated-stop distance

¹ FAA defines regular use of an airport as minimum of 500 operations annually by an aircraft of family of similar aircraft.

available (ASDA), and landing distance available (LDA). **Figure 2-3** summarizes the critical data for Runway 14-32.

2.3.2 RUNWAY SAFETY AREAS

A Runway Safety Area (RSA) is a defined surface centered on the runway center line surrounding the runway prepared or suitable under dry conditions for reducing the risk of damage to airplanes or injury to persons in the event of an undershoot, overshoot, or excursion from the runway. In accordance with FAA AC 150/5300-13A, ASH's RSA is 500 feet in width, and 1,000 feet in length beyond each runway end (see **Figure 2-1**).

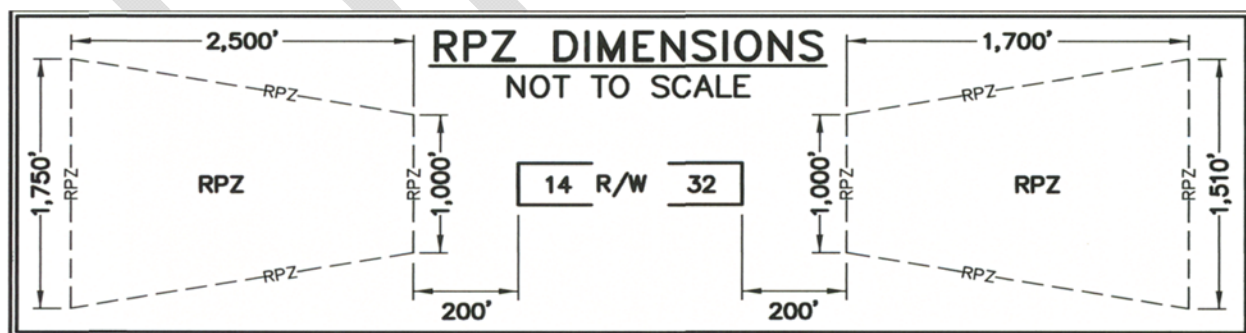
2.3.3 RUNWAY OBJECT FREE AREAS

The Runway Object Free Area (ROFA) is an area centered on the runway centerline. The ROFA clearing standards requires clearing the ROFA of objects protruding above the nearest point of the runway centerline, except where fixed by function. It is acceptable to place objects that are necessary to be located in the ROFA for air navigation or aircraft ground maneuvering purposes and to taxi and hold aircraft in the ROFA. In accordance with AC 150/5300-13A, ASH's ROFA is 800 feet in width and 1,000 feet in length beyond each end of the runway (see **Figure 2-1**).

2.3.4 RUNWAY PROTECTION ZONE

The Runway Protection Zones (RPZ) are a trapezoidal area located at the end of a runway designed to enhance the protection of people and property on the ground in the event an aircraft overshoots the runway end. Where practical, airport owners should own the property under the runway approach and departure areas to at least the limits of the RPZ. While ASH does not own all of the property under the RPZ, where opportunities have presented themselves, land and aviation easements have been obtained. The dimensions of the RPZ at ASH is shown below on **Figure 2-4**.

Figure 2-4 Runway Protection Zone Dimensions



2.3.5 RUNWAY OBSTACLE FREE ZONE

The Runway Obstacle Free Zone (ROFZ) is a defined volume of airspace centered above the runway centerline, above a surface whose elevation at any point is the same as the elevation of the nearest point

on the runway centerline. ASH's ROFZ is 400 feet in width by 200 feet in length beyond the end of the runway (see Figure 2-1).

2.3.6 RUNWAY AND TAXIWAY PAVEMENT MARKINGS

Table 2-3 provides an inventory of the runway and taxiway markings at ASH.

Table 2-3: Inventory of Runway and Taxiway Markings

<i>Runway</i>	<i>Taxiway/taxilanes</i>
Chevron markings	Taxiway "A" Runway holding position marking
Threshold markings	Taxiway "A" Enhanced centerline markings
Runway 14 end designation markings	Taxiway "A" Centerline marking
Runway 14 end touchdown zone markings	Taxiway "A" Edge marking
Runway centerline markings	Taxiway "B" Runway holding position marking
Aiming point markings	Taxiway "B" Enhanced centerline markings
Runway edge markings	Taxiway "B" Centerline marking
Subsequent touchdown zone markings	Taxiway "C" Runway holding position marking
Runway 32 designation markings	Taxiway "C" Enhanced centerline markings
Runway 32 threshold markings	Taxiway "C" Centerline marking
Runway 32 end threshold bar	Taxiway "C" Non-movement area marking
Runway 32 arrowheads and arrows	Taxiway "D" Runway holding position marking
	Taxiway "D" Enhanced centerline markings
	Taxiway "D" Centerline marking
	Taxiway "D" Non-movement area marking
	Taxiway "E" Centerline marking
	Taxiway "E" Non-movement area marking
	Taxiway "F" Centerline marking
	Taxiway "F" Non-movement area marking
	Taxiway "G" Centerline marking
	Taxiway "G" Non-movement area marking

Note: All runway markings are striated. No taxiway markings are striated.

2.3.7 TAXIWAY SYSTEM

ASH has an extensive system of taxiways designated with letters from 'A' through 'H,' plus an "unnamed" taxiway, "Taxiway 6," and "Inner" taxiway, which are further defined below and shown on Figure 2-1. The

taxiway system provides access to the runway system from the terminal area environment and is designed to increase operational safety and efficiency between arriving and departing aircraft.

Taxiway 'A'- is a full-length parallel taxiway serving Runway 14-32. Taxiway 'A' is 40 feet wide and 6,790 feet in length.

Taxiway 'B'- is a stub taxiway located between Runway 14-32 and Taxiway 'A.' It is located approximately 1,685 feet northeast of the Runway 32 threshold bar. Taxiway 'B' is 40 feet wide and approximately 480 feet in length.

Taxiway 'C'- is a stub taxiway located between Runway 14-32 and the main apron, midfield of the runway, and is intersected by Taxiway 'A'. It is approximately 40 feet wide from Runway 14-32 to Taxiway 'A,' and approximately 52 feet wide from Taxiway 'A' to the apron.

Taxiway 'D'- is a stub taxiway located between Runway 14-32 and the "inner taxiway." It is located approximately 1,406 feet southeast from the Runway 14 threshold bar. Taxiway 'D' is 40 feet wide between Runway 14-32 and Taxiway 'A' and reduces to 35 feet in width between Taxiway 'A' and the "inner taxiway."



Figure 2-5 Taxiway 'A'

Taxiway 'E'- connects to Taxiway 'A' at the Runway 14 end and provides access to India Ramp. It is 40 feet in width and approximately 360 feet long.

Taxiway 'F'- connects to Taxiway 'A' at the Runway 14 end and provides access to India Ramp. It is 40 feet in width and approximately 360 feet long.

Taxiway 'F'- is a stub taxiway between Taxiway 'A' and the "inner taxiway." Taxiway 'F' is located between the area where Taxiway 'B' and Taxiway 'C' connect to Taxiway 'A.' Taxiway 'F' is approximately 52 feet wide and approximately 79 feet long.

Taxiway 'G'- is a stub taxiway between Taxiway 'A' and the "inner taxiway." Taxiway 'G' is located southeast of Taxiway 'F,' is approximately 30 feet wide, and is scheduled to be abandoned in spring 2017.

Taxiway 'H'- connects to Taxiway 'A' in two locations: 1) near Runway 32 end; and 2) southeast of Taxiway 'G.' Taxiway 'H' has varying widths and is approximately 1,398 feet long.

Unnamed Taxiway- is a stub taxiway located between Taxiway 'A' and the taxilanes that provide access to hangars, 13, 15, 17, and 19. The unnamed taxiway intersects with the "inner taxiway." The unnamed taxiway is approximately 20 feet wide and approximately 188 feet long from Taxiway 'A' edge of pavement

to the edge of pavement of the taxilanes that provide access to the hangars, and located southwest of Taxiway 'G.'

Taxiway '6'- is a stub taxiway between Taxiway 'A' and Taxiway 'H.' Taxiway '6' is located near the Runway 32 end and is scheduled to be abandoned in the spring of 2017. Taxiway '6' is 40 feet wide and approximately 280 feet long.

Inner Taxiway- the "inner taxiway" essentially connects India Ramp to Taxiway 'H.' The "inner taxiway" provides access to the main apron, hangars, terminal building, etc.

2.3.8 TAXILANES

There are several taxilanes providing access from taxiways (usually an apron taxiway) to airplane parking positions and other terminal areas.

2.3.9 HANGARS

Aircraft hangars are buildings designed to store aircraft, many with office, workshop, and lounge space. At ASH, there are 106 T-hangar units with capacity for 106 aircraft, and 12 corporate hangars with capacity for 26 aircraft. The City of Nashua owns the "Brick Hangar" and the SRE building. The remaining hangars and buildings are privately owned. (see Figure 2-1).



Figure 2-6 "Brick Hangar"

2.3.10 APRONS

The function of aircraft aprons is to provide areas for based and transient aircraft parking, as well as aircraft fueling operations. At ASH, there are seven named aprons: Apron A, D, E, F, G, H, and I, which are shown on Figure 2-1.

2.3.11 PAVED TIE-DOWNS

There are 262 tie-downs at ASH. The tie-downs are located on various aprons and are owned and managed by the Nashua Airport Authority.

2.3.12 NAVIGATIONAL/VISUAL/COMMUNICATION AIDS

FAA AC 150/5340-30H provides guidance and specifications for the design and installation of airport visual aids. The use of this AC is mandatory for all projects relating to the design and installation of airport visual aids funded with federal grant monies through the Airport Improvement Program (AIP). Navigational aids provide assistance to pilots by providing navigational, visual, and communication guidance to locate the Airport in support of safe operations in the airport environment.

2.3.12.1 RUNWAY LIGHTING

Runway 14-32 has a L-862 High Intensity Runway Lighting System (HIRLS) with its cables placed in conduit. The HIRL system is a pilot-activated light system consisting of white, red, amber and green stake-mounted lights. The HIRLS system, installed in 2012, is airport owned and is in excellent condition (see Figure 2-1).

2.3.12.2 RUNWAY END IDENTIFIER LIGHTS

Runway End Identifier Lights (REILs) are located at the Runway 32 end at the displaced threshold bar, and are airport owned. The Runway 14 end is not serviced by REILs (see Figure 2-1).

2.3.12.3 THRESHOLD LIGHTS

Threshold lights are located on the Runway 14 end at the landing threshold of the runway. On the Runway 32 end, thresholds lights are located at the displaced threshold, which is 350 feet from the runway pavement end (see Figure 2-1).

2.3.12.4 TAXIWAY LIGHTS

Taxiway lights are located on the following taxiways: Taxiway 'A'; Taxiway 'B'; Taxiway 'C'; Taxiway 'D'; and Taxiway 'E'. The taxiway lights are owned and maintained by the Airport (see Figure 2-1).

2.3.12.5 PRECISION APPROACH PATH INDICATOR

A precision approach path indicator (PAPI) is a lighting system located near a runway end that consists of light boxes that provide a visual indication of an aircraft's position on the glidepath for the runway. ASH has a 4-light PAPI (3.0-degree approach angle) on Runway 14 which is owned and maintained by the FAA. Runway 32 has a 4-light PAPI (3.0-degree approach angle), which is owned and maintained by the Airport.

2.3.12.6 MEDIUM APPROACH LIGHT SYSTEM WITH RUNWAY ALIGNMENT INDICATOR LIGHTS

The Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MASLR) is a lighting system installed in the Runway 14 approach zone along the extended centerline of the runway. The MASLR consists of a combination of threshold lamps, steady burning light bars and flashers, providing visual information to pilots on runway alignment, height perception, roll guidance, and horizontal references for Category I Precision Approaches. The MASLR servicing Runway 14 is owned and maintained by the FAA (see Figure 2-1).



Figure 2-7 MASLR RW 14 Approach (picture not of ASH)

2.3.12.7 INSTRUMENT LANDING SYSTEM LOCALIZER

An Instrument Landing System Localizer (Localizer) is the component of an instrument landing system that provides horizontal guidance, used to guide aircraft along the axis of the runway. ASH has a CAT I Localizer south of the Runway 32 end, which is owned and maintained by the FAA.



Figure 2-8 Localizer Runway 32 End

2.3.12.8 GLIDE SLOPE

The Runway 14 end is equipped with and END-FIRE Glide Slope, which is owned and maintained by the FAA. The Glide Slope provides vertical guidance for aircraft during approach and landing.



Figure 2-9 End Fire Glideslope Runway 14 End

2.3.12.9 AIRPORT ROTATING BEACON

The Airport owns and maintains a 36-inch rotating beacon on a 60-foot tall tower located near the “Brick Hangar” (Building No. 1) on the southeast side of the airport near Pine Hill Road. The beacon is used to indicate to pilots the location of the Airport at nighttime or during periods of low visibility. The beacon emits two beams of light, one green and the other white (or clear), 180° apart that indicate that ASH is a civilian airport with runway lighting. The beacon is owned and maintained by the Airport.

2.3.12.10 HAZARD BEACONS AND OBSTRUCTION LIGHTS

The Airport owns and maintains two hazard beacons and five obstructions lights. Hazard Beacon #1 is located in an easement on the Labombarde property, south of Indian Rock Road in Nashua. Hazard Beacon #2 is located in the right-of-way of Nartoff Road in Hollis. Three obstruction lights are located on Airport property along the railroad tracks (see Figure 2-1). The two off-airport obstruction lights are

located at the corner of Charron Avenue and Pine Hill Road; and on Robert Drive, approximately 150 feet off Pine Hill Road, southeast of the Airport (See Figure 2-1).

2.3.12.11 WINDCONE

A windcone provides visual information on wind direction and speed. ASH has one lighted windcone, located on the northeast side of the runway at approximately midfield, and a non-lighted, supplemental windcone located adjacent to Taxiway 'B' near the Runway 32 end.

2.3.12.12 AUTOMATED WEATHER OBSERVING SYSTEM (AWOS)

An Automated Weather Observing System, or AWOS, as defined by the FAA, is a suite of weather sensors, which measure, collect and disseminate weather data to help meteorologists, pilots and flight dispatchers prepare and monitor weather forecasts, plan flight routes, and provide necessary information for correct takeoffs and landings. Specifically, ASH is equipped with an AWOS III P/T, which records wind speed, wind gusts, wind direction, variable wind direction, temperature, dew point, altimeter setting, density altitude, present weather, and lightning detection. The AWOS is owned and maintained by the FAA.



Figure 2-10 AWOS

2.3.12.13 GUIDANCE SIGNS

ASH has the following inventory of guidance signs located throughout the airfield:

Table 2-4: Inventory of Guidance Signs

<i>Sign Tag #</i>	<i>Location</i>	<i>Description</i>
1	R/W 14-32	R/W 14 and TW 'A' position sign
2	T/W 'A'	T/W 'A' and 'E' direction sign
3	T/W 'A'	T/W 'A' and 'E' direction sign
4	T/W 'A'	T/W 'A' and 'E' direction sign
5	R/W 14-32	T/W 'A' direction sign
6	R/W 14-32	T/W 'D' direction sign
7	R/W 14- 32	R/W 14 and TW 'D' position sign
8	T/W 'A'	T/W 'A' and 'D' direction sign
9	T/W 'A'	T/W 'D' and 'A' direction sign
10	T/W 'A'	T/W 'A' and 'D' direction sign
11	T/W 'A'	T/W 'D' and 'A' direction sign
12	R/W 14-32	T/W 'D' direction sign

13	R/W 14-32	T/W 'C' direction
14	R/W 14-32	R/W 14 and TW 'C' position sign
15	T/W 'A'	T/W 'A' and 'C' direction sign
16	T/W 'A'	T/W 'C' and 'A' direction sign
17	T/W 'A'	T/W 'A' and 'C' direction sign
18	T/W 'A'	T/W 'C' and 'A' direction sign
19	R/W 14-32	T/W 'C' direction
20	R/W 14- 32	T/W 'B' direction
21	R/W 14-32	R/W 14 and TW 'B' position sign
22	T/W 'A'	T/W B and A direction
23	T/W 'A'	T/W 'A' and 'B' direction sign
24	T/W 'A'	T/W 'B' and 'A' direction
25	R/W 14-32	T/W 'B' direction sign
26	R/W 14-32	T/W 'A' direction sign
27	R/W 14-32	R/W 14 and TW 'A' position sign
28	R/W 14-32	R/W 14 and TW 'A' position sign
29	T/W 'A'	T/W 'F' and 'A' direction sign

2.3.12.14 INSTRUMENT APPROACH PROCEDURES

ASH is served by four standardized instrument approach procedures for Runway 14-32. These procedures utilize both ground-based and satellite-based instrumentation. As part of these procedures, both special alternate minimums and departure procedures apply. **Table 2-5** details the currently published instrument approach procedures available at the Airport.

Table 2-5: Published Instrument Approach Procedures

Runway	Approach Type	Primary NAVAID	Visibility (miles)	Minima (AGL)
Runway 14	S-ILS	ILS	½	400
	LOC	LOC	1-1/8	760
	RNAV	GPS	½	400
Runway 32	RNAV	GPS	1	481
	VOR		2	900

Source: FAA Instrument Approach Procedures Published for use between April 27, 2017 & May 2017

2.4 INVENTORY OF LANDSIDE FACILITIES

The landside facilities of an airport are those facilities not related to the movement of aircraft, and provide for the processing of passengers, freight, and ground transportation vehicles. This section presents an overview of these facilities at ASH, including the following:

- Terminal Building
- Fencing
- Automobile Parking
- Miscellaneous Buildings
- Major Utilities
- Access Road (Perimeter Road)

2.4.1 TERMINAL BUILDING

Currently, ASH does not have a traditional terminal building. Airport operations and staff services are conducted in small offices connected to the snow removal equipment (SRE) building. This building currently operates at capacity and is not sufficient to meet user demands.

2.4.2 FENCING

ASH has perimeter fencing; however, the fence line does not correspond with the Airport's property line. The perimeter fence begins at the intersection of Deerwood Drive and the Boston & Maine Railroad, continues along the Boston & Maine Railroad in an easterly direction, then meets the businesses located on the north side of Charron Avenue, and proceeds behind the businesses in a southerly direction. Near the intersection of Charron Avenue and Pine Hill Road, the fence runs along Pine Hill Road in a westerly direction



Figure 2-11 Perimeter Fencing- Gate 15

until the intersection of Pine Hill Road and Perimeter Road. From the intersection of Pine Hill Road and Perimeter Road, the fence follows Perimeter Road to the end. It then runs near the southern airport property line to Deerwood Drive, where it eventually terminates back at Deerwood Drive and the Boston & Maine Railroad. The perimeter fence along the Boston & Maine Railroad and Perimeter Road were installed in 2014-2015. The section of fence along Pine Hill Road was installed in 2013, 2014, 2015, and 2016. The portion of fence south of the gate at the end of Perimeter Road, which then runs near the southern airport property line to Deerwood Drive, was installed in 2003. Majority of the fence is 8-foot galvanized chain link, with some 8-foot high, PVC coated portions for aesthetic purposes in public areas.

2.4.3 AUTOMOBILE PARKING

ASH has automobile parking in various locations around the airport (both inside and outside the fence) providing access to the Air Traffic Control Tower, hangars, restaurants, administration and SRE buildings, and FBOs. It is estimated that there are approximately 300 designated aviation related parking spaces throughout the Airport ([see Figure 2-1](#)).

2.4.4 MAJOR UTILITIES

2.4.4.1 WATER

The Pennichuck Water Company supplies the Airport (administration building, SRE building, and some tenant buildings) with water.

2.4.4.2 ELECTRIC SERVICE

Electric services are provided to several airport buildings and tenants by Eversource and Agera Energy.

2.4.4.3 GAS SERVICE

Natural Gas is provided to 79 & 93 Perimeter Road through Direct Energy. Liberty Utilities provides natural gas to 97 Pine Hill Road.

2.4.5 ACCESS ROAD (PERIMETER ROAD)

On-airport access is provided at two points: directly off Pine Hill Road, which serves the hangars at the southeast end of the airport; and via Perimeter Road providing access to hangars, businesses and the main portion of the Airport. While Perimeter Road is owned by the Airport, the City of Nashua provides snow plowing services and minor repairs.

2.5 SUPPORT FACILITIES/SERVICES

ASH has a variety of support facilities and services that assist in providing a safe and efficient airport environment. Aircraft Rescue and Fire Fighting (ARFF) are provided by the City of Nashua, with Station 5 (Airport Fire State) located adjacent to the Airport at 101 Pine Hill Road. The principal support facilities at ASH include the following:

- Air Traffic Control Tower
- Snow Removal Equipment
- Airport Maintenance
- Fuel
- Fixed Base Operator

2.5.1 AIR TRAFFIC CONTROL TOWER

While the ATCT at ASH was constructed in 1972, it was not until 1988 that the ATCT was staffed and activated for service. It was one of the first to operate as a Non-Federal Owned Air Traffic Control Tower in the early 1990s. The ATCT is located on the southwest side of the Airport at approximately midfield, and sits atop Building # 79. The ATCT is staffed 7 days a week from 7:00AM- 9:00PM.



Figure 2-12 ATCT

2.5.2 AIRCRAFT RESCUE AND FIRE FIGHTING

ARFF services are provided by the City of Nashua. Station 5- *Airport Fire Station* is located at 101 Pine Hill Road, abutting airport property with direct access to the airfield in case of emergencies. Station 5 is equipped with the following:

- 2010 Pierce Arrow Xt- 1250 Gallons Per Minute (GMP), 750 gallons;
- 2008 Ford 550/C.E.T.- 500 gallons foam; and
- 1996 Pierce Arrow- 1250 GMP, 705.

2.5.3 SNOW REMOVAL

In 2016, ASH developed a *Snow and Ice Control Plan* to “document how Boire Field will work toward mitigating the hazards associated with the regular annual occurrence of snow and ice accumulation²”. Among other things, the *Snow and Ice Control Plan* prioritizes the entire airfield and supporting parking areas into four (4) segments, as described below, and further outlined in *Snow and Ice Control Plan* located in **Appendix A**.

Priority 1- areas are those vital to the takeoff, landing and moving of aircraft to and from the runway.

Priority 2- areas are those areas that support Priority 1 areas as well as areas used by on-airport businesses.

Priority 3- areas are those areas that are not used every day, nor are critical to the takeoff and landing of aircraft or on-airport businesses.

Priority 4- areas are those that can wait until all other areas are cleared and in some circumstances, might be serviced on subsequent days after a storm.

ASH has the following inventory of Snow Removal Equipment (SRE):

- | | |
|--|--|
| • 2007 624J John Deere Loader, 30,000 lbs. (SNOW 50) | • 1985 MP-3D Sno-Go Rotary Plow, Loader Mount, 7,500 lbs. |
| • 1985 FG-85 Fiat Grader, 35,000 lbs. (SNOW 30) | • 1988 75-C Michigan Loader, 32,000 lbs. (SNOW 12) |
| • 1985 FR-15 Fiat Loader, 30,000 lbs. | • 2011 MP-3D Sno-Go Rotary Plow, Loader Mount, 8,400 lbs. |
| • 1996 SL-150 Samsung Loader, 30,000 lbs. (SNOW 11) | • 2014 764HSD John Deere High Speed Dozer, 34,000 lbs. (SNOW 60) |
| • 1979 SMI Rotary Plow, 28,000 lbs. (SNOW 40) | |

² Nashua Airport Authority Snow and Ice Control Plan, 2016

2.5.4 AIRPORT MANAGEMENT

ASH is staffed with a full-time Airport Manager, Maintenance Supervisor, Airfield Technician, and an Office Manager/Bookkeeper. During the winter months (December-April) the Airport typically hires seasonal help to assist with snow removal activities. Similarly, during the summer months (June-September), part-time seasonal help is hired to assist with maintenance activities. While the Airport does not have a written maintenance plan, there is a mowing plan that is utilized to assist in communications with the ATCT (See Figure 2-13).

2.5.5 FUEL

There are two aboveground aviation fuel tanks at the Airport. They are identified on Figure 2-1 and Sheet XX of the ALP, and further described as follows:

- One 20,000-gallon above ground tank for 100LL
- One 20,000-gallon above ground tank for Jet-A

Both the 100 LL and Jet-A fuels are delivered to aircraft by fuel trucks. While the Airport owns the fuel tanks and charges a fuel flowage fee, the equipment and operations are privately owned by the FBOs.



Figure 2-14 Fuel Farm

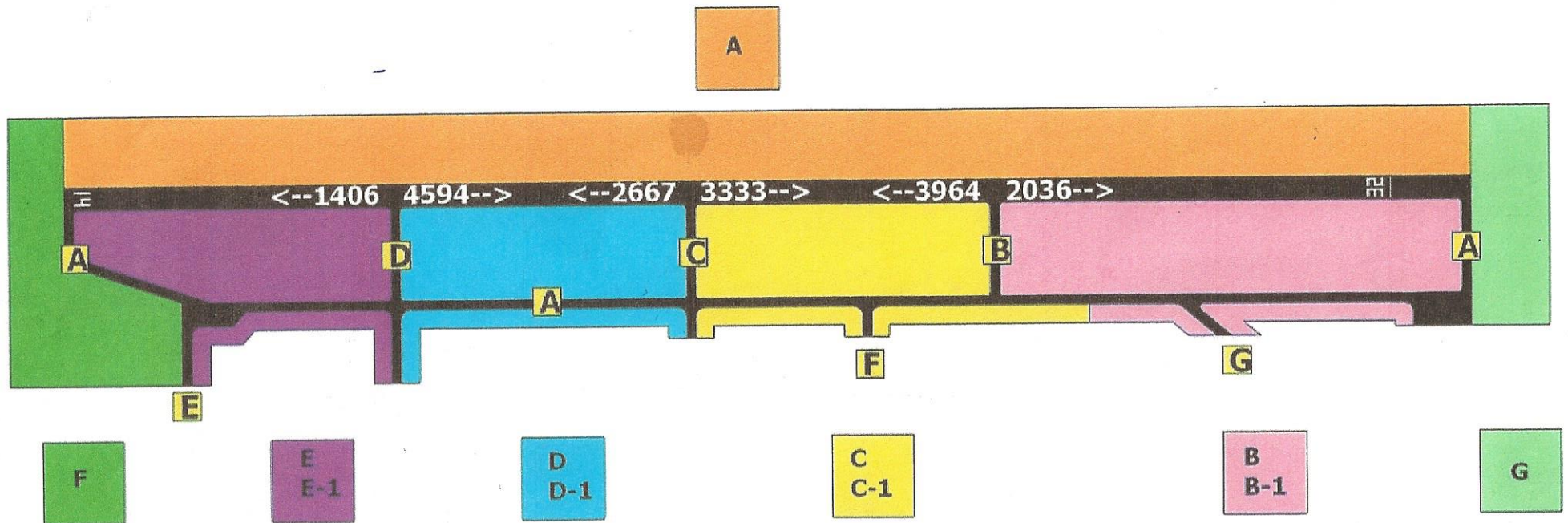
2.5.6 FIXED BASED OPERATOR

A fixed based operator (FBO) is typically a private entity that leases land and/or buildings from the airport to provide various aeronautical services to based and itinerant aircraft. Currently, ASH has one full-service FBO with several “Independent Operators” that collectively provide and support the following services at the Airport:

- Aircraft fuel storage and dispensing
- Aircraft ground handling, tie-down and hangars
- Aircraft charter/flight instruction/sales
- Aircraft maintenance (powerplant/frame)
- Pilot amenities (i.e. flight planning, pilots lounge, courtesy car, and supplies)

Figure 2-13

NASHUA AIRPORT RUNWAY DISTANCE REMAINING, TAXIWAY AND MOWING ZONE DIAGRAM



CHAPTER 3 EXISTING ENVIRONMENTAL CONDITIONS AND SENSITIVE AREAS

This chapter provides an overview of the environmental conditions and sensitive areas that have been identified by previous studies and/or investigations at ASH. This information is an integral component to the master planning process as consideration of environmental factors is critical to the evaluation of airport development alternatives, and understanding subsequent environmental permitting requirements.

FAA Orders 1050.1F *Environmental Impacts: Policies and Procedures* and 5050.4B *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions* provide policy and procedures for compliance with the National Environmental Policy Act (NEPA), and requirements for airport actions pursuant to FAA authority. It is important to note that the environmental analysis included in this Master Plan Update is not a document intended to satisfy the need for formal NEPA analysis. Prior to the implementation of an action, the following list of applicable environmental impact categories outlined in FAA Order 1050.1F must be addressed:

- Air Quality
- Biological resources (including fish, wildlife, and plants)
- Climate
- Coastal resources
- Department of Transportation Act, Section 4(f)
- Farmlands
- Hazardous materials, solid waste, and pollution prevention
- Historical, architectural, archeological, and cultural resources
- Land use
- Natural resources and energy supply
- Noise and compatible land use
- Socioeconomic, environmental justice, and children's environmental health and safety risks
- Visual effects (including light emissions)
- Water resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers)

3.1 EXISTING AND PREVIOUSLY IDENTIFIED ENVIRONMENTAL CONDITIONS

The most recent analysis of environmental impact categories occurred during the 2008 Environmental Assessment for the Runway 14-32 runway reconstruction project (AIP 3-33-0012-028-2007). This section focuses solely on the environmental impact categories that were identified as either occurring on airport property or in the vicinity of ASH during the 2008 Environmental Assessment. Where a particular environmental impact category was not affected by the Runway 14-32 reconstruction project, it is not discussed in this chapter.

3.1.1 BIOLOGICAL RESOURCES (INCLUDING FISH, WILDLIFE, AND PLANTS)

According to correspondence dated January 7, 2008, from the U.S. Department of the Interior, Fish and Wildlife Service, in Concord, NH, there were no Federally listed endangered or threatened species recorded as present in the project area at that time. (Appendix B).

A database review was conducted on November 17, 2007 by the New Hampshire Natural Heritage Bureau's (NHNHB) *Rare Plants, Rare Animals, and Exemplary Natural Communities in New Hampshire Towns 2007* for ASH, via the online DataCheck Tool of rare species or exemplary natural communities (Appendix C). NHNHB data indicated that three state-listed endangered or threatened species were known to be present on or in the vicinity of the Airport in 2007. (see Table 3-1):

- Northern blazing star (*Liatris scariosa* var. *novaeangliae*)- State Endangered
- Wild lupine (*Lupinus perennis*)- State Threatened
- Eastern hognose snake (*Heterodon platirhinos*)- State Threatened

One additional species was identified by GZA GeoEnvironmental (formerly Baystate Environmental Consultants) during their field review of rare species on the Airport prior to the runway reconstruction project in 2012 (Table 3-1).

- Bird's foot violet (*Viola pedata*)- State Threatened

In addition, three other species that are not currently listed but are tracked by NHNHB are located within the vicinity of the Airport, mainly in the area of Stump Pond approximately one mile north of the vegetation management activity areas highlighted in the 2008 Environmental Assessment. These species include (Table 3-1):

- Banded sunfish (*Enneacanthus obesus*)
- Spotted turtle (*Clemmys guttata*)
- Blanding's turtle (*Emydoidea blandingii*)

The NHNHB boundaries around known locations of these species are indicted on Figure 3-1.

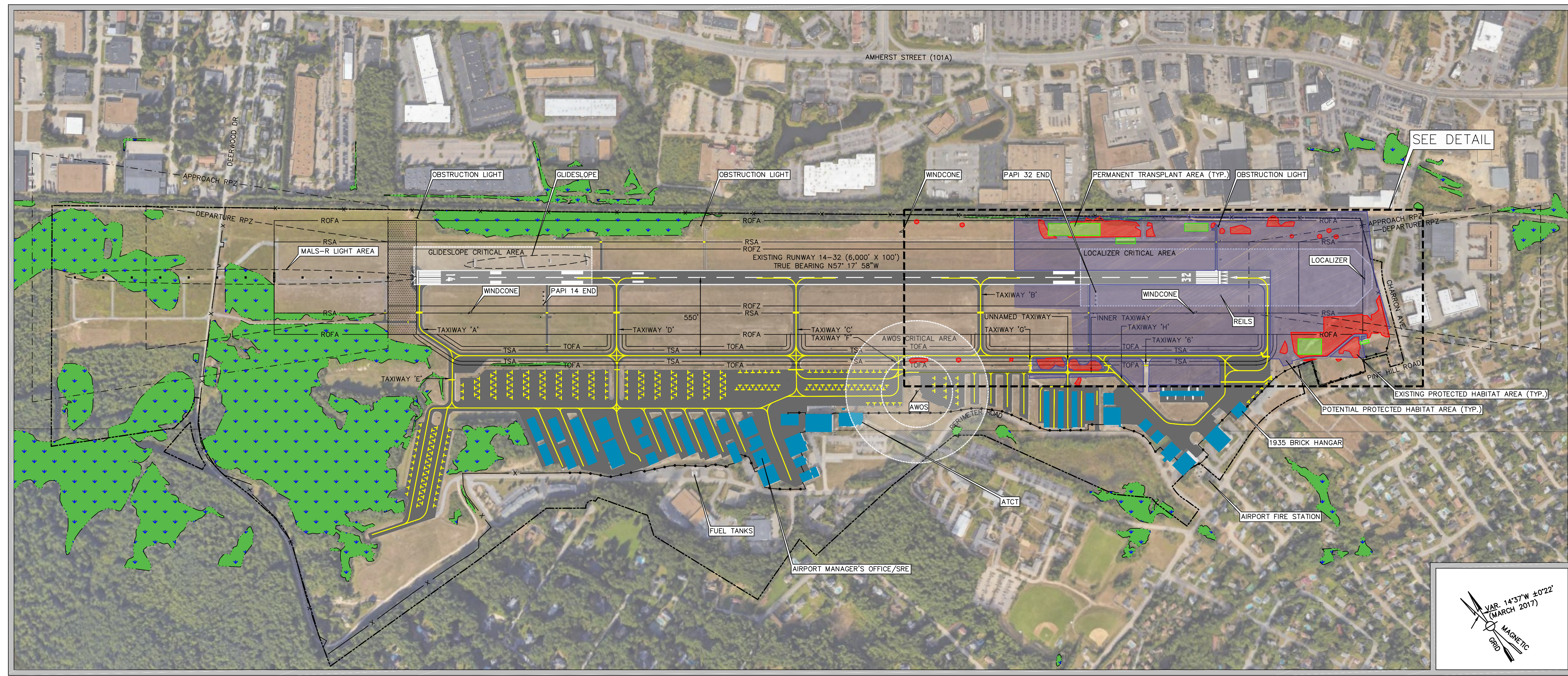
Table 3-1: Endangered, Threatened or Tracked Species identified by NH Natural Heritage Bureau (NHNHB) or Baystate Environmental Consultants, Inc. (BEC) relevant to ASH

Species/Community	Status	Habitat	Distance from known location at ASH	Potential Presence at ASH	Source
Northern Blazing Star	E	Dry, open grassy, early-successional, nutrient poor, sandy soil	Present at ASH	Known to be present	NHNHB
Wild Lupine	T	Dry, sandy soil in open to partially shaded locations	500' from vegetation management	Moderate	NHNHB

PREPARED FOR:

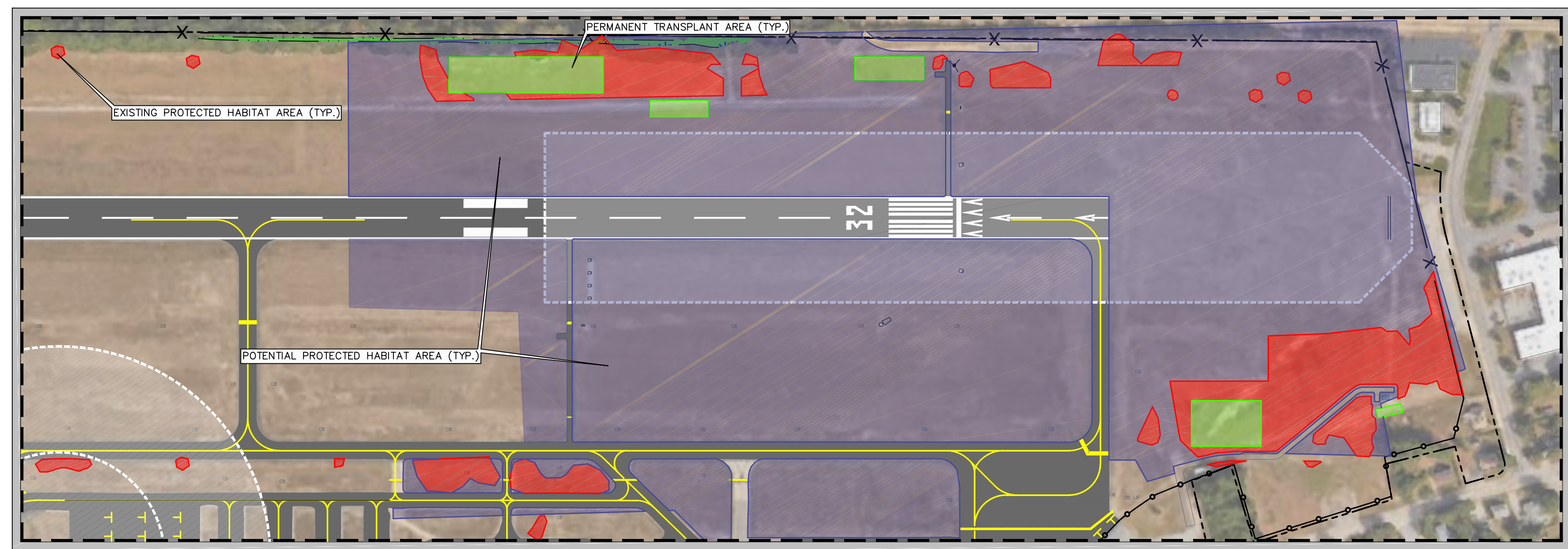


PROJECT
AIRPORT MASTER PLAN UPDATE
NHDOT NO. SBG-12-16-2016
OWNER
CITY OF NASHUA, NEW HAMPSHIRE
AIRPORT AUTHORITY



EXISTING ENVIRONMENTAL CONDITIONS
SCALE: 1" = 400'

- NOTES:**
1. THERE ARE TWO CRITICAL AREAS FOR THE AUTOMATED WEATHER OBSERVING SYSTEM (AWOS). THE WIND SENSOR ON THE AWOS HAS THE FOLLOWING REQUIREMENTS FOR CLEARANCE:
A) 0-500 FEET FROM THE SENSOR, ALL OBJECTS SHALL BE AT LEAST 15 FEET LOWER THAN THE SENSOR HEIGHT.
B) 500-1,000 FEET FROM THE SENSOR, ALL OBJECTS SHALL BE NO GREATER THAN 10 FEET ABOVE THE HEIGHT OF THE SENSOR.



DETAIL
SCALE: 1" = 200'

LEGEND	
ITEM	(E) EXISTING
AIRPORT PROPERTY LINE	-----
RUNWAY SAFETY AREA (RSA)	----- RSA -----
TAXIWAY SAFETY AREA (TSA)	----- TSA -----
RUNWAY OBSTACLE FREE ZONE (ROFZ)	----- ROFZ -----
RUNWAY PROTECTION ZONE (RPZ)	----- RPZ -----
APPROACH RUNWAY PROTECTION ZONE	-----
DEPARTURE RUNWAY PROTECTION ZONE	-----
PRECISION OBSTACLE FREE ZONE	-----
RUNWAY OBJECT FREE AREA (ROFA)	----- ROFA -----
TAXIWAY OBJECT FREE AREA (TOFA)	----- TOFA -----
CRITICAL AREA	-----
WETLANDS	
BUILDINGS	
PAVEMENT	
8' CHAINLINK FENCE	
8' CHAINLINK FENCE WITH BARBWIRE	
PERMANENT TRANSPLANT AREA	
EXISTING PROTECTED HABITAT AREA	
POTENTIAL PROTECTED HABITAT AREA	

NO.	DATE	DESCRIPTION	BY
PROJECT NO.		777042	
DESIGNED BY		DCQ	
DRAWN BY		DCQ	
CHECKED BY		NAI	
DATE		DECEMBER, 2016	

GRAPHIC SCALE
SCALE: AS SHOWN

SHEET TITLE
EXISTING ENVIRONMENTAL CONDITIONS (DRAFT)

DRAWING NO.
FIG.3-1
2 OF X

Table 3-1: Endangered, Threatened or Tracked Species identified by NH Natural Heritage Bureau (NHNHB) or Baystate Environmental Consultants, Inc. (BEC) relevant to ASH (Continued)

<i>Species/Community</i>	<i>Status</i>	<i>Habitat</i>	<i>Distance from known location at ASH</i>	<i>Potential Presence at ASH</i>	<i>Source</i>
Eastern Hognose Snake	T	Dry, sandy soils in open fields, river valleys, pine forest and upland hillsides near wetlands or vernal pools	1.5± mile from vegetation management	Moderate	NHNHB
Bird's Foot Violet*	T	Well drained, sandy soil in open, unshaded locations	Present at ASH	Known to be present	GZA
Blanding's Turtle	R	Lakes, ponds, creeks, wet meadows, vernal pools with soft substrates and abundant vegetation	Present at ASH	Known to be present	NHNHB
Spotted Turtle	R	Shallow wetlands including swamps, bogs, fens, wet pastures, marshes, pond edges, and small woodland streams	1± mile	Moderate	NHNHB
Banded Sunfish	R	Small ponds, backwaters of creeks to small rivers and boggy brooks	1± mile	Low	NHNHB
E= Endangered, T= Threatened, R= Tracked by NHNHB, but not listed					
*Was not identified as being on site by NHNHB, but observed by GZA					

3.1.1.1 POTENTIAL FOR RARE SPECIES TO OCCUR

A field review of relevant habitat characteristics present at the Airport was conducted by GZA GeoEnvironmental's biologists in November 2007 and the following outlines the potential for the rare species to be found on the Airport.

3.1.1.2 STATE LISTED SPECIES

Northern Blazing Star: The 2007 review of the NHHB database revealed a population of northern blazing star on the southern portion of the Airport. Based on the report, 401 stems were counted in 2006. During reconstruction of Runway 14-32, this habitat was fenced off during construction (Figure 3-1) and remains undisturbed today.



Figure 3- 2 Northern Blazing Star

Wild Lupine: The 2007 review of the NHHB database revealed a population of wild lupine along the railroad tracks to the north of the runway. During the reconstruction of Runway 14-32, 573 plants were transplanted (with a 3-inch diameter tree spade) see Figure 3-1.



Figure 3-3 Wild Lupine

Eastern Hognose Snake: The 2007 review of the NHHB database documented hognose snakes to be present in a grassy area bordering woods near Stump Pond (2± miles from the Airport). In general, the sandy soiled forested wetlands and grasslands of the Airport are moderately suitable for eastern hognose snakes; however, the closest known location documented of the species is 1.5± miles from the Airport.



Figure 3-4 Eastern Hognose Snake

Bird's Foot Violet: The November 2007 field review confirmed the presence of Bird's Foot Violet in several patches of grassland along the parallel taxiway at the southern end of the Airport as well as just east of the southern end of the runway. Implementation of the runway reconstruction project was expected to disturb this species. As a result, working with NHHB, mitigation efforts to transplant individuals of this species to other portions of the airfield exhibiting suitable soils and conditions occurred. The location of this mitigation area is shown on **Figure 3-1**.



Figure 3-5 Bird's Foot Violet

3.1.1.3 STATE TRACKED SPECIES

Blanding's Turtle: The presence of Blanding's turtle in and near Stump Pond, approximately 2± miles northwest of the Airport, has been documented. There is also a mapped point for the species on Airport property in the thin strip of wetland along the forest edge north of the Runway 14 end. As part of mitigation during the reconstruction of Runway 14-32, turtle barriers were implemented during construction to keep any of these turtles from entering the construction area.



Figure 3-6 Blanding's Turtle

Spotted Turtle: The 2007 review of the NHHB database found spotted turtles to be present at Stump Pond located to the west of the Runway 14 end, and at a location approximately 2± miles southwest of the Runway 14 end in the Pennichuck Brook wetland system. Given the species presence in the expansive wetland system to the west and south of the Airport, the species may be potentially found in the wet depressions on the Airport. During the reconstruction of Runway 14-32, turtle barriers were implemented.



Figure 3-7 Spotted Turtle

Banded Sunfish: The review of the NHHB database revealed a relatively abundant population of at least 100 individuals in Stump Pond in 1998 (Appendix C). Stump Pond is approximately one mile northwest of the Airport. A specimen was also collected in Pennichuck Brook in 1948. It is extremely unlikely that the wet depressions or the wetlands at the airport could support a population of this species. The wet depressions lack the depth and vegetation required for this species to occur. There is no potential habitat for this species at the Airport.



Figure 3-8 Banded Sunfish

3.1.2 HISTORICAL, ARCHITECTURAL, ARCHEOLOGICAL, AND CULTURAL RESOURCES

Historical, architectural, archaeological, and cultural resources encompass a range of sites, properties, and physical resources relating to human activities, society, and cultural institutions. Such resources include past and present expressions of human culture and history in the physical environment, such as prehistoric and historic archaeological sites, structures, objects, and districts, which are considered important to a culture or community. Historical, architectural, archaeological, and cultural resources also include aspects of the physical environment, namely natural features and biota, that are a part of traditional ways of life and practices and are associated with community values and institutions.

In April 2008, as part of the Airport's Environmental Assessment, UMass Archaeological Services conducted a literature review and walkover survey of ASH as part of a Phase 1A Archaeological Assessment Survey. The survey found low sensitivity for archaeological and historical resources at ASH and concluded that the proposed action (Runway and Taxiway Relocation and Expansion Project) was unlikely to affect significant archaeological resources. The Archaeological Assessment Report found that

no additional survey or testing was recommended prior to the implementation of the runway reconstruction. On December 2, 2008, the New Hampshire Division of Historical Resources (NHDHR) accepted the findings of the report and concurred with its recommendations (see Appendix D).

In 2013, following the reconstruction of Runway 14-32, as part of mitigation for the runway project, and as requested by the NHDHR, Archaeological and Historical Services, Inc. completed a NHDHR Historic District Area Inventory for ASH. The Area Inventory Form documented the historical development of ASH and included aerial photos of the existing runway configuration, and photos depicting the relationship of the existing runway configuration to ASH's historic buildings/structures. The boundary of the Historic District Form included all of the property administered by the NAA between Perimeter Road on the south and the former Boston and Maine railroad line on the north. In addition, a parcel at the corner of Pine Hill Road and Perimeter Road, owned by the City of Nashua was included because of its close association with the airport. The parcel, 101 Pine Hill Road, includes the Airport Fire Station (built in 1961) and Memorial Park at the entrance to the airport (constructed in 2005).

Two of the buildings included in this study are more than 50 years old, the 1935 brick hangar at 97 Pine Hill Road and the 1961 Airport Fire Station at 101 Pine Hill Road (Figure 3-1). However, as a whole, the historian determined that the "airport lacks sufficient integrity to convey its significance as an early artifact of New Hampshire's aviation history, nor does its current physical condition call to mind its identity as a work-relief project of the 1930s."¹ The historian did recommend that the 1935 hangar, together with its associated ca. 1940 beacon, be "considered as an individually eligible historic resource that readily conveys its significance as an early aviation facility and as a product of 1930s work-relief efforts."²

3.1.3 LAND USE

As outlined in the City of Nashua's Land Use Code "Any publicly owned airport or privately-owned airport licensed for commercial operations, existing or which may be developed, shall have an airport approach plan prepared by the New Hampshire Aeronautics Commission in accordance with RSA 424 as last amended. The airport approach plan for Boire Field, adopted by the New Hampshire Aeronautics Commission February 12, 1968, is hereby declared to be part of this section"³ (see Appendix E).

Increased aircraft activity at ASH has resulted in the need for special zoning restrictions for uses subject to the most recently adopted Part 150 Noise Compatibility Plan prepared for ASH. To avoid land use conflicts with uses that may be incompatible with noise levels generated at the Airport, the regulations of the Noise Overlay District provide for the exclusion of certain land uses, and for soundproofing to be required in the construction of other uses which may be compatible if mitigating action is taken to reduce noise interference with the use.

¹ AHS, Inc. New Hampshire Division of Historic Resources Area Form, 2013

² AHS, Inc. New Hampshire Division of Historic Resources Area Form, 2013

³ City of Nashua, Land Use Code (NRO'S- Chapter 190)

The Airport property is surrounded by a mix of commercial, industrial and residential uses. To the south and east of the Runway 32 end is largely a mix of commercial and industrial properties. To the southwest of the Airport are residential neighborhoods, while to the north and west of the Airport lies a large open space watershed area owned by the City of Nashua. North and east of the Airport lies additional commercial and retail land uses long Amherst Street (see Figure 3-9).

3.1.4 WATER RESOURCES (INCLUDING WETLANDS, FLOODPLAINS, SURFACE WATERS, GROUNDWATER, AND WILD AND SCENIC RIVERS)

3.1.4.1 WETLANDS

During the 2008 Environmental Assessment for the runway reconstruction project, wetlands were delineated by wetland scientists and evaluated relative to the functions and values of the resources. As part of the runway reconstruction project, ASH received an approved Dredge and Fill application through the New Hampshire Department of Environmental Services (NHDES) to fill 11.63 acres (506,605 sq. ft.) of predominately palustrine wetlands. The remaining wetlands that exist today are shown on Figure 3-1.

3.1.4.2 FLOODPLAIN

According to the 1994 Environmental Assessment, “An examination of floodplain maps for the City of Nashua has established that neither the Airport, nor the Holden Property are located in, or are immediately adjacent to the designated floodplain.”⁴ The 1998 Environmental Assessment states “The only designated 100-Year flood boundary within the Airport property is in the vicinity of the Spectacle Brook wetlands, south of the existing runway”⁵ and across the airfield from Perimeter Road. Therefore, due to the location, design and construction of a new stormwater management system to accompany the relocated runway and taxiway, there were no impacts to any regulated floodplain as a result of that project.

3.1.4.3 SURFACE WATERS

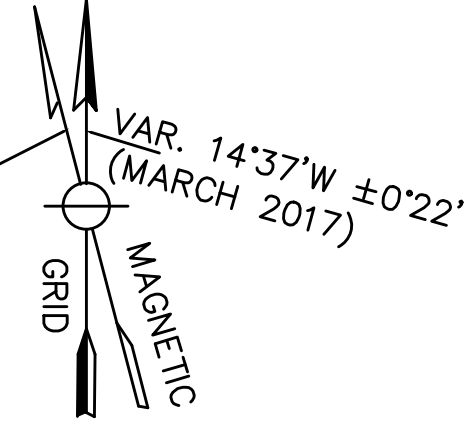
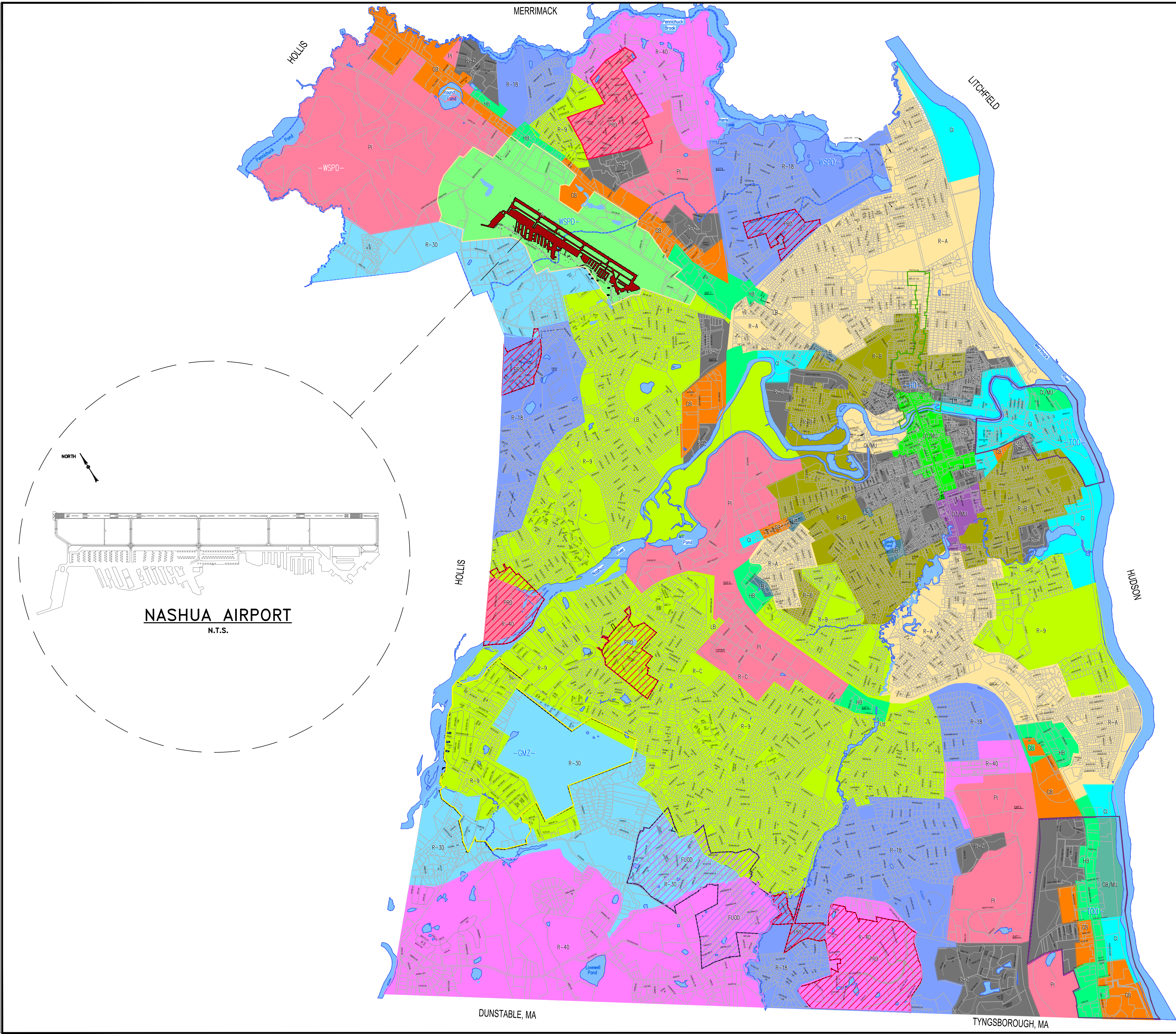
The Airport property contributes to two separate watersheds and brooks:

1. Spectacle Brook, located to the southwest of the airfield; and
2. Pennichuck Brook, located to the north of the airfield.

In general, surface water from the Airport is transported through man-made and natural vegetated swales to either underground culvert pipes or infiltration-type catch basins. The western-most area of the Airport drains indirectly to a wetland area near the Runway 14 end of the Airport’s parallel taxiway. The remaining stormwater flows are directed through vegetated swales and drainage pipes to Spectacle Brook and its associated wetlands.

⁴ Nashua Municipal Airport, Holden Property, Acquisition, Environmental Assessment, prepared for The Nashua Airport Authority, 1994, Prepared by: Dubois & King, Inc., 100 Perimeter Road, Nashua, New Hampshire

⁵ Nashua Municipal Airport, Environmental Assessment for Runway 14-32 Relocation and Reconstruction, 1998, Prepared by: Gale Associates, Inc.



LEGEND

ZONING DISTRICT	
	GENERAL BUS / MIXED USE
	D1/MU DOWNTOWN 1 /MIXED USE
	D3/MU DOWNTOWN 3 / MIXED USE
	GI/MU GENERAL INDUSTRIAL / MIXED USE
	R-40 RURAL RESIDENCE
	R-30 A SUBURBAN RESIDENCE
	R-18 B SUBURBAN RESIDENCE
	R-9 C SUBURBAN RESIDENCE
	R-A A URBAN RESIDENCE
	R-B B URBAN RESIDENCE
	R-C C URBAN RESIDENCE
	LB LOCAL BUSINESS
	GB GENERAL BUSINESS
	D-1 DOWNTOWN 1
	D-3 DOWNTOWN 3
	HB HIGHWAY BUSINESS
	PI PARK INDUSTRIAL
	GI GENERAL INDUSTRIAL
	AI AIRPORT INDUSTRIAL
	HISTORIC DISTRICT
	FUOD FLEXIBLE USE OVERLAY DISTRICT
	FHL- GMZ DISTRICT FOUR HILLS LANDFILL GROUNDWATER MANAGEMENT ZONE
	TRANSIT ORIENTED DISTRICT
	WATER SUPPLY PROTECTION DISTRICT
	PRD PLANNED RESIDENTIAL DEV

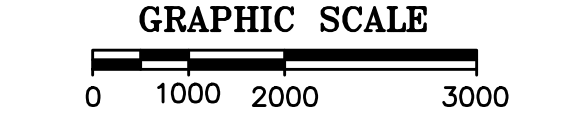
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PREPARED FOR:



PROJECT	OFF AIRPORT LAND USE DRAWING		OWNER	CITY OF NASHUA, NEW HAMPSHIRE AIRPORT AUTHORITY	

NO.	DATE	DESCRIPTION	BY
PROJECT NO.		777042	
DESIGNED BY			
DRAWN BY			
CHECKED BY			
DATE		DECEMBER, 2016	



SHEET TITLE
DRAWING NO.

Almost all developed portions of the airfield, to the south of Deerwood Drive, drain to Spectacle Pond and Spectacle Brook, located southwest of the airfield between Perimeter Road and University Drive. Areas to the north of Deerwood Drive drain to the northwest, leading ultimately to the Pennichuck River via either an intermittent stream flowing to Muddy Brook, upgradient of Pennichuck Pond, or an intermittent stream flowing to the Pennichuck Brook below the outlet of the pond.

3.1.4.4 WILD AND SCENIC RIVERS

There are no wild and scenic rivers in the project area.

DRAFT

CHAPTER 4 FORECAST OF AVIATION DEMAND AND CAPACITY

In order to identify Airport facility needs during the planning period, it is necessary to accurately depict the current aviation use of the Airport, and to project future aviation demand levels. This chapter summarizes current aircraft usage at the Airport, and will document the projected aviation demand for the Airport during the 20-year planning period of this Study.

The forecasts presented in this chapter provide short-term, mid-term, and long-term projections for the years 2022, 2027, and 2037. These represent the 5-, 10-, and 20-year estimate of aviation activity at ASH. It is important, however, to view the projections independently of specific years and to consider the actual growth of activity as the impetus that influences the need for future airport facilities. Similarly, slower than projected growth may warrant deferment of planned improvements. Actual growth activity should be periodically (i.e. annually) compared to projected growth, so scheduled corrections can be identified and implemented.

4.1 OVERVIEW OF AVIATION FORECASTS

The objective of forecasting an airport's activity is to identify the factors that influence aviation demand so that future infrastructure and facility needs can be determined. The FAA's Terminal Area Forecast¹ (TAF) is the standard benchmark of an airport's future activity and serves as the basis for FAA planning. Therefore, this forecast uses the most recent TAF (2016-2045) as a starting point for analysis. In addition to the TAF, FAA Aerospace Forecasts², air traffic control (tower) counts, historic airport reports, and the New Hampshire State Airport System Plan (NHSASP) will be reviewed and analyzed to further compliment the TAF.

Forecasting aviation activity serves two primary purposes in the development of this master plan. Specifically, forecasts provide the basis for:

- Determining the necessary capacity of the airfield and terminal area;
- Identifying the future facilities required to support demand, including determining the size and implementation, thereof.

The demand for aviation facilities is typically expressed in terms of based aircraft and aircraft operations. Preparation of aviation activity forecasts is essential in assessing the needs and requirements for future aviation development. ASH's aviation forecasts serve as an overall planning guide for identifying airport capacity needs and for the basis of preparing airport alternatives. This forecast consists of layers of information that build upon each other to provide a sound foundation to support final conclusions. These layers include:

- Defining the various forecasting methodologies to be employed;
- Historical aviation data upon which forecasting methods rely;
- Analysis of the validity of the forecast;

¹ FAA Terminal Area Forecasts (https://www.faa.gov/data_research/aviation/taf/)

² FAA Aerospace Forecasts (https://www.faa.gov/data_research/aviation/aerospace_forecasts/)

- Identification and analysis of unique local factors that could affect the forecasts;
- Provision of a summary of the forecasts findings.

Once the aviation forecasts are complete, relationship between aviation demand, airfield capacity, and facilities can be established. This will be done in the next chapter, *Chapter 5- Facility Requirements*.

The following terms are often used in airport forecasts, and their meanings are often confused with each other even though they are quite different. For clarification, the meaning of each of these terms is presented below.

Based Aircraft- this term refers to where an airplane makes its home or, in the case of ASH, an aircraft whose “home” is at the Airport.

Transient Aircraft- this term refers to an airplane whose “home” is at an airport other than the airport for which the forecast is being produced. In other words, any aircraft that uses ASH, but whose home base is at another airport is a transient aircraft.

Local Operation- a local operation is one where an aircraft operates within 20 nautical miles of the airport for which the forecast is prepared. A local operation can be performed by either a based or transient aircraft.

Itinerant Operation- an itinerant operation is one where an aircraft operates at a greater distance than 20 nautical miles of the airport for which the forecast is prepared. Again, an itinerant operation can be performed by either a based or transient aircraft.

4.1.1 TERMINAL AREA FORECASTS (TAF)

The TAF represents the FAA’s forecast of aviation activity for U.S. airports and provides a summary of historical and forecast statistics on passenger demand and aviation activity. The TAF is prepared to meet the budget and planning needs of the FAA and provide information for use by state and local authorities, the aviation industry, and the public. Forecasts of itinerant general aviation operations and local civil operations at FAA facilities are based primarily on time series analysis. Because military operations forecasts have national security implications, the Department of Defense provides only limited information on future aviation activity. Hence, the TAF projects military activity at its present level except when FAA has specific knowledge of a change. For non- FAA facilities, historic operations in the TAF are from the Form 5010 (Master Airport Record) data. These operation levels are held constant for the forecast unless otherwise specified by a local or regional FAA official.

4.1.2 FAA AEROSPACE FORECAST

The second set FAA forecasts consulted were the FAA Aerospace Forecasts, FY 2017-2037. The Aerospace Forecast provides an overview of aviation industry trends and expected growth for the commercial passenger carrier, cargo carriers, and general aviation activity sectors. National growth rates in enplanements, operations, fleet growth, and fleet mix for the general aviation fleet are provided over a 20-year forecast horizon.

In its review of 2016, the Aerospace Forecast highlights that the general aviation industry recorded a small decline in deliveries in 2016, with only the business jet segment seeing a year over year increase. General aviation activity at FAA contract tower airports recorded a 0.2 percent decline in 2016 as local activity fell 0.5 percent, more than offsetting a 0.1 percent increase in itinerant operations.

According to the 2017-2037 Aerospace forecast, the long-term outlook for general aviation is stable to optimistic. The active general aviation fleet is forecast to increase 0.1 percent a year between 2016 and 2037, resulting in an increase in the fleet of about 3,400 units. The Forecast expects continued growth of the turbine and rotorcraft fleets, but the largest segment of the fleet, fixed wing piston aircraft, to decrease over the forecast.

4.1.3 NEW HAMPSHIRE STATE AIRPORT SYSTEM PLAN (NHSASP)

In 2015, the NHDOT updated its NHSASP which serves as a guide to maintain and develop the system of airports in New Hampshire. The System Plan provides the state with the resources to monitor the ability of the airports to meet performance measures identified through the aviation system planning process. A major component of the System Plan is the projection of aviation demand at both the local and state levels, which will assist in determining which airports should be earmarked for an upgrade in their roles.

4.2 AIRPORT SERVICE AREA

Defining ASH's service area is an important component in estimating future aviation demand. The service area for airports is heavily influenced by a number of factors, including but not limited to:

- Proximity of an airport to an aircraft owner's home or business
- Level of convenience, services, and capabilities available at the airport
- Level of convenience, services, and capabilities available at competing airports
- Population and economic characteristics from which the airport draws its users, both existing and potential

In an effort to define ASH's service area, this report relies on the home address of each based-aircraft owner. Based on the proximity of the home address of each based-aircraft owner, the service area was divided into two categories (see Figure 4-1): 1) Primary Service Area- those within 15 miles of ASH; and 2) Secondary Service Area- those outside 15 miles but within 25 miles of ASH. Using this methodology, approximately 63 percent of based-aircraft owners are located within 15 miles of ASH; 24 percent are located within 25 miles; and 13 percent are located beyond 25 miles of ASH.

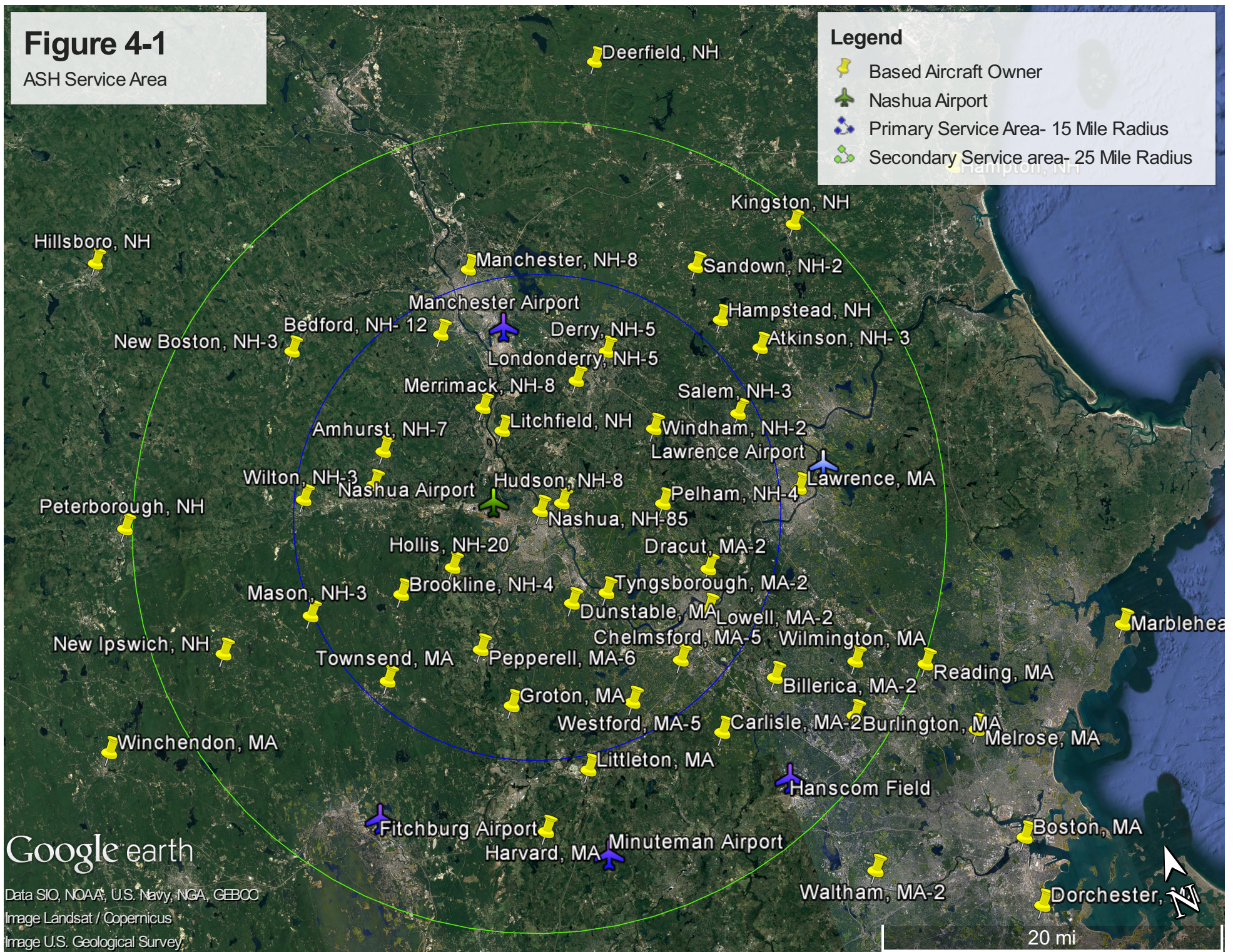
Within the Primary, and Secondary Service Areas, the following public-use airports exist:

Figure 4-1

ASH Service Area

Legend

- Based Aircraft Owner
- Nashua Airport
- Primary Service Area- 15 Mile Radius
- Secondary Service area- 25 Mile Radius



Primary Service Area

- Manchester-Boston Regional Airport (MHT)- has two runways, 17-35 (9,250' x 150') and 06-24 (7,651' x 150'), and offers numerous facilities for general aviation (GA) aircraft and operators, including full FBO services, conventional and T-hangars, apron tie-down space, and automobile parking areas.

Secondary Service Area

- Fitchburg Municipal Airport (KFIT)- has two runways: Runway 14-32 (4,510' x 100'), and Runway 02-20 (3,504' x 75'). KFIT offers numerous facilities for GA aircraft and operators, including full FBO services, conventional and T-hangars, apron tie-down space, and automobile parking. KFIT primarily serves smaller aircraft but can also accommodate some larger aircraft with wing spans of less than 79 feet.
- Hanscom Field (KBED)- is served by two runways: Runway 11-29 (7,011' x 150'), and Runway 05-23 (5,107 x 150'). KBED offers numerous facilities for GA aircraft and operators, including full FBO services, conventional and T-hangars, apron-tie down space, and automobile parking. KBED serves as a corporate reliever for Boston Logan International Airport.
- Lawrence Municipal Airport (KLWM)- is served by two runways: Runway 05-23 (5,001' x 150'), and Runway 14-32 (3,900' x 100'). KLWM offers numerous facilities for GA aircraft and operators, including full FBO services, conventional hangars and T-hangars, apron-tie down space, and automobile parking. KLWM can accommodate a full range of aircraft, including small to medium size jets.

4.3 SOCIOECONOMIC TRENDS

While ASH's service area extends into portions of Worcester, Middlesex, and Essex counties in Massachusetts, the overwhelming majority of based-aircraft owners reside in Hillsborough county, New Hampshire. For purposes of this section, the socioeconomic trends affecting aviation demand at ASH (population, age, income, and employment) will rely on information gathered for Hillsborough county which will then be compared against state and national trends.

4.3.1 HISTORICAL POPULATION

Historical population growth from 2000-2016 was reviewed on a county, state, and national level. As derived from the U.S. decennial census data collected in 2000 and 2010, Hillsborough County experienced an increase in population of 5.3 percent. During the same period, the state of New Hampshire experienced a 6.6 percent increase, with the U.S. experiencing a 10 percent increase. The U.S. Census estimates that during the period of 2010-2016, Hillsborough county experienced relatively slow growth with an average annual growth rate (AAGR) of 0.28 percent, while New Hampshire and the U.S. experienced an AAGR of 0.23 percent, and 0.73 percent, respectively (see Table 4-1).

Table 4-1 Historic Population Growth (2010-2016)

Year	Hillsborough County	AAGR%	New Hampshire	AAGR%	United States	AAGR%
2010	401,039		1,316,872		309,348,193	
2011	401,774	0.18	1,318,473	0.12	311,663,358	0.75
2012	402,651	0.22	1,321,182	0.21	313,998,379	0.75
2013	403,308	0.16	1,322,687	0.11	316,204,908	0.70
2014	405,003	0.42	1,328,743	0.46	318,563,456	0.75
2015	406,015	0.25	1,330,111	0.10	320,896,618	0.73
2016	407,761	0.43	1,334,795	0.35	323,127,513	0.70
AAGR		0.28		0.23		0.73

Source: United States Census Bureau

Population growth during the period from 2020-2035 for Hillsborough County is projected to grow by 4.9 percent. During the same period, New Hampshire and the U.S. are projected to experience a 5.4 percent and 11 percent growth. These data are presented in **Table 4-2** below.

Table 4-2 Projected Population Growth (2020-2035)

Year	Hillsborough County	New Hampshire	United States
2020	409,478	1,349,908	334,503,000
2025	416,445	1,374,702	347,335,000
2030	424,492	1,402,878	359,402,000
2035	429,538	1,422,530	370,338,000

Source: NH Office of Energy and Planning

4.3.1.1 Median Age of Total Population

According to the New Hampshire Center for Public Studies, by 2030, nearly half a million of the state of New Hampshire's residents will be over the age of 65 and will account for nearly one-third of the total population. During the next 20 years, the fastest-growing age group will be those aged 70-74, but there will also be significant growth in the number of people aged 75 and over. By contrast, the number of people aged 20-34 is expected to decrease.

According to the U.S. Census Bureau, New Hampshire has the third highest median age of the total population in the U.S. As shown in **Table 4-3** below, since 2010 median age for Hillsborough County has been increasing at an AAGR 0.8 percent compared to New Hampshire at 0.9 percent and U.S at 0.4 percent. This sector has the potential to affect ASH as pilots are retiring at a rate higher than the rate at which student pilots are beginning to fly and become certified.

Table 4-3 Median Age of the Total Population

Year	Hillsborough County	New Hampshire	U.S.
2010	38.5	40.3	36.9
2011	38.9	40.7	37.0
2012	39.2	41.1	37.2
2013	39.5	41.5	37.3
2014	39.9	41.8	37.4
2015	40.1	42.2	37.6
AAGR	0.8%	0.9%	0.4%

Source: United States Census Bureau

4.3.2 PER CAPITA PERSONAL INCOME AND WAGES

Per Capita Income (PCI) data provides a measure of the income of a particular region. Generally, higher income leads to higher potential for participation in GA activity. Per Capita Personal Income (historic) data on a county, statewide, and national basis was obtained from the Bureau of Economic Analysis.

The historical trend of PCI from 2005-2015 indicated relatively steady growth throughout the 10-year period. For Hillsborough County, the PCPI grew at an AAGR of 3.1 percent during this period. At the same time, New Hampshire and the U.S. experienced an AAGR of 3.2 percent, and 3.0 percent respectively (see Table 4-4).

Table 4-4 Per Capita Personal Income (2005-2015)

Year	Hillsborough County	New Hampshire	United States
2005	42,327	40,922	35,904
2006	44,576	43,763	38,144
2007	46,802	45,199	39,821
2008	47,871	46,365	41,082
2009	47,096	45,742	39,376
2010	47,795	47,154	40,277
2011	50,766	49,562	42,453
2012	53,524	51,826	44,267
2013	53,124	51,609	44,462
2014	54,578	53,629	46,414
2015	57,180	55,905	48,122
AAGR	3.1%	3.2%	3.0%

Source: Bureau of Economic Analysis

4.3.2.1 Median Household Income

From 2000-2010, Hillsborough County experienced a 30 percent increase in median household income from \$53,384 to \$69,321. During the same period, the state of New Hampshire and nation experienced increases of 29 percent and 24 percent, respectively. However, during the period from 2010-2015, Hillsborough County has remained generally flat experiencing an AAGR of 0.6 percent with New Hampshire and the nation experiencing an AAGR of 1.1 percent and 0.8 percent as shown in **Table 4-5** below. This sector has the potential to affect ASH as the cost of obtaining a pilot's license varies widely depending on a number of factors such as location, type of airplane, flight school, etc.

Table 4-5 Median Household Income (dollars) 2010-2015

Year	Hillsborough County	New Hampshire	U.S.
2010	69,321	63,227	51,914
2011	70,591	64,664	52,762
2012	70,472	64,925	53,046
2013	69,829	64,916	53,046
2014	70,906	65,986	53,482
2015	71,244	66,779	53,889
AAGR	0.6%	1.1%	0.8%

Source: United States Census Bureau

4.3.2.2 Unemployment

This section reviews the historic unemployment rates in the region as compared to the State of New Hampshire and the U.S. As illustrated in **Table 4-6**, Hillsborough County has fared much better than the United States, but has a slight higher percentage of unemployment as compared to New Hampshire. However, the higher percent of unemployment in Hillsborough County compared to the State is likely the result of Hillsborough County housing the largest population in the state as of the 2010 U.S. Census. Similar to median house income, this sector has the potential to affect ASH as lower levels of unemployment indicate better economic conditions for businesses. In turn, this can potentially lead to an increase in aviation demand, and/or potential for pilots being able to financially support their flying activities.

Table 4-6 Percent of Population Unemployed (16 years and older)

Year	Hillsborough County	New Hampshire	U.S.
2000	2.5	2.7	3.7
2010	4.4	4.1	5.1
2011	4.8	4.4	5.6
2012	4.9	4.6	6.0

2013	5.3	4.8	6.2
2014	4.8	4.4	5.8
2015	4.2	3.9	5.2
AAGR	4.7%	4.3%	5.6%

Source: U.S. Census Bureau

4.3.3 SOCIOECONOMIC CONDITIONS SUMMARY

General aviation airports are influenced by a number of local factors including, but not limited to population, age, income, and unemployment. The previous sections reviewed these sectors of Hillsborough County and compared them to the State of New Hampshire and the United States.

With respect to population, Hillsborough County is expected to grow relatively slowly over the next 15-years experiencing a 4.9 percent increase in population from 2020-2035. Both the State of New Hampshire and the United States are projected to outpace Hillsborough County with increases of 5.4 percent and 11 percent, respectively. Additionally, it is important to note that New Hampshire is the third oldest state in the country when comparing median age against total population at 42.2 years old³. Hillsborough County much like the State of New Hampshire has generally experienced a similar growth in aging population as previously illustrated in **Table 4-3**, which is outpacing the United States.

Economically, Hillsborough County has experienced growth in per capita income similar to that of New Hampshire and the United States as illustrated in **Table 4-4**. According to the U.S. Bureau of Economic Analysis⁴, in 2015 the State of New Hampshire experienced a 4.2 percent growth in state personal income, which ranked 20th in the United States. At the local level, Hillsborough County experienced a slightly higher increase with 4.8 percent.

After reviewing the socioeconomic conditions, it appears from the analysis that there are no demographic factors or other local unique circumstances that suggest an unusual or greater than average growth in the region.

4.4 HISTORIC AVIATION DATA

This section presents the historical aviation statistics for ASH, including based aircraft and annual operations. This information will be used to help identify and evaluate factors that influence aviation demand, which in turn will be used to determine forecasts of future aviation activity.

4.4.1 ASH BASED AIRCRAFT

Prior to 2009, and the integration of FAA's National Based Aircraft Inventory Program, airport managers were responsible for counting the number of based aircraft and reporting totals to the FAA and state

³ <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF>

⁴ https://www.bea.gov/newsreleases/regional/spi/2016/pdf/spi0316b_fax.pdf

inspectors. These totals would then appear on the airport's master record form, also known as the "5010." At the time, little guidance was provided on how the based aircraft counts should be determined and there was no method of validating the counts. As a result, based aircraft counts were often unreliable, and duplicated.

The FAA defines based aircraft as an aircraft that is operational and airworthy, which is typically based at the facility in question for a majority of the year. Based aircraft categories include single-engine piston, multi-engine piston, jet, and rotorcraft.

According to the New Hampshire Aeronautics Act, Section 422:22 paragraph IV, "Rental of a hangar space, tie down, or other means of storage in this state by a nonresident for more than 90 days cumulatively each registration year shall create a rebuttable presumption that such aircraft must be registered in this state."⁵

Based aircraft are major economic contributors to the airport. They help generate revenues from tie-down fees, hangar leases, fuel sales, and maintenance. Based aircraft forecasts are used to evaluate the size of the ramp, tie-down, and hangar areas.

As previously mentioned, the vast majority of aircraft based at the airport are owned by individuals residing in roughly a 25± -mile radius of the airport. According to the 2016 FAA Terminal Area Forecast for ASH, the number of based aircraft at the Airport in 2016 was 249. **Table 4-7** below presents a comparison of based aircraft over the past 10 years at ASH.

Table 4-7 Based Aircraft History

Year	NHDOT Based Aircraft Count	AAGR%	TAF Based Aircraft Count	AAGR%
2007	314		441	
2008	303	-3.5	364	-17.5
2009	287	-5.3	372	2.2
2010	292	1.7	333	-10.5
2011	290	-0.7	317	-4.8
2012	271	-6.6	294	-7.3
2013	259	-4.4	234	-20.4
2014	237	-8.5	253	8.1
2015	232	-2.1	243	-4.0
2016	218	-6.0	249	2.5
	AAGR	-3.9		-5.7

Source: NHDOT, FAA TAF 2016

⁵ <http://www.gencourt.state.nh.us/rsa/html/XXXIX/422/422-22.htm>

The significant decline in based aircraft at ASH from 2007-2013 is likely attributed to several factors. First, from 2007-2009, the United States experienced a *Great Recession*, which marked the longest recession since World War II. The *Great Recession* had a resounding impact on the GA industry as the United States GA inventory declined from 231,606 aircraft in 2007 to approximately 200,000 aircraft in 2013⁶.

Secondly, and most unique to ASH was the closing of Daniel Webster College. In 2010, the flight program was phased out and the college stopped accepting new flight students, while allowing students currently enrolled in the program to complete their education by 2013.

Lastly, a contributing factor in the decline of based aircraft at ASH, more precisely from 2011-2013 may be attributed to the runway reconstruction project that occurred over two calendar years from November 2011- Fall 2013. During this time, the original runway (Runway 14-32) was replaced by a new 6,000-foot runway 300 feet northeast of the original location.

4.4.2 REGIONAL BASED AIRCRAFT

According to the FAA TAF, the FAA New England Region experienced a slight average annual decrease in based aircraft growth from 2006-2016. The FAA New England Region includes the states of Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island.

According to the NH State Airport System Plan, from 2004 to 2013, the New England Region experienced a 17 percent decline in based aircraft while New Hampshire saw a 15.5 percent decline. The General Aviation survey data used to produce the national FAA Aerospace Forecasts indicates that between 2010 and 2012 the number of active GA registered aircraft went down by 6.4 percent, from 223,370 to 209,034. During that same period, New Hampshire experienced a 4.3 percent decline of registered aircraft from 1,173 to 1,122. From 2012 to 2013 New Hampshire saw a 5.4 percent decline. The FAA Aerospace forecast indicates that between 2012 and 2013 the total national general aviation fleet declined by roughly 3 percent, from 209,034 to 202,865.

Table 4-8 presents a comparison of based aircraft growth over the past 10 years in the FAA New England Region.

Table 4-8 FAA ANE Based Aircraft History

Year	ANE Based Aircraft History	AAGR%
2006	6,959	
2007	6,961	0.0
2008	6,663	-4.3
2009	6,705	0.6
2010	5,952	-11.2
2011	5,782	-2.9

⁶ <http://www.fi-aeroweb.com/General-Aviation.html>

2012	5,803	0.4
2013	5,985	3.1
2014	6,291	5.1
2015	5,729	-8.9
2016	5,788	1.0
	AAGR	-1.7

Source: FAA TAF 2016

4.4.3 NATIONAL BASED AIRCRAFT

At the National level, from 2006-2016 based aircraft also experienced a slight average annual decrease of about 1.6 percent. **Table 4-9** presents a comparison of national based aircraft growth over the past 10 years.

Table 4-9 National Based Aircraft History

Year	National Based Aircraft History	AAGR%
2006	197,301	
2007	199,608	1.2
2008	175,576	-12.0
2009	177,432	1.1
2010	165,472	-6.7
2011	160,374	-3.1
2012	163,333	1.8
2013	166,953	2.2
2014	170,375	2.0
2015	163,994	-3.7
2016	165,480	0.9
	AAGR	-1.6

Source: FAA TAF 2016

4.5 HISTORIC ANNUAL AIRCRAFT OPERATIONS

In airport planning terms “airport operation” is defined as the number of arrivals and departures from an airport. Therefore, an airplane that arrives and then departs from an airport is considered to have made two operations. Operations are further classified as either local or itinerant.

- Local operations are performed by aircraft that: (a) operate in the local traffic pattern or within sight of the airport; (b) are known to be departing for, or arriving from, flight in local practice

areas located within a 20-mile radius of the airport; (c) execute simulated instrument approaches or low passes at the airport.

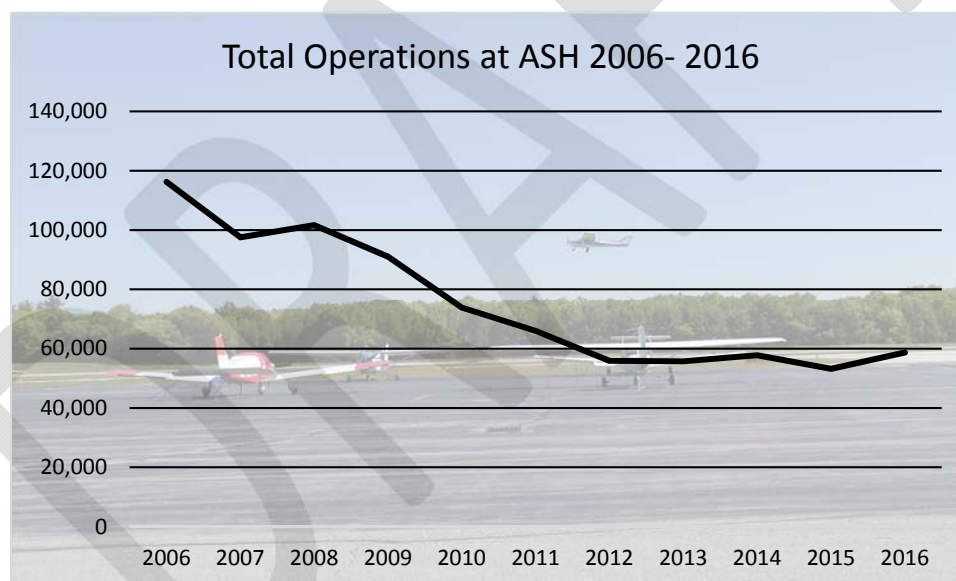
- Itinerant operations are all aircraft operations other than local operations, such as landing or take off of a flight departing from or arriving at another airport greater than 20 miles away.

Aircraft operations are also defined by type, such as air carrier, regional/commuter, air taxi, general aviation, or military. Aircraft operations at the Airport are predominantly general aviation with a small percent of air taxi, and military.

4.5.1 ASH HISTORIC OPERATIONS

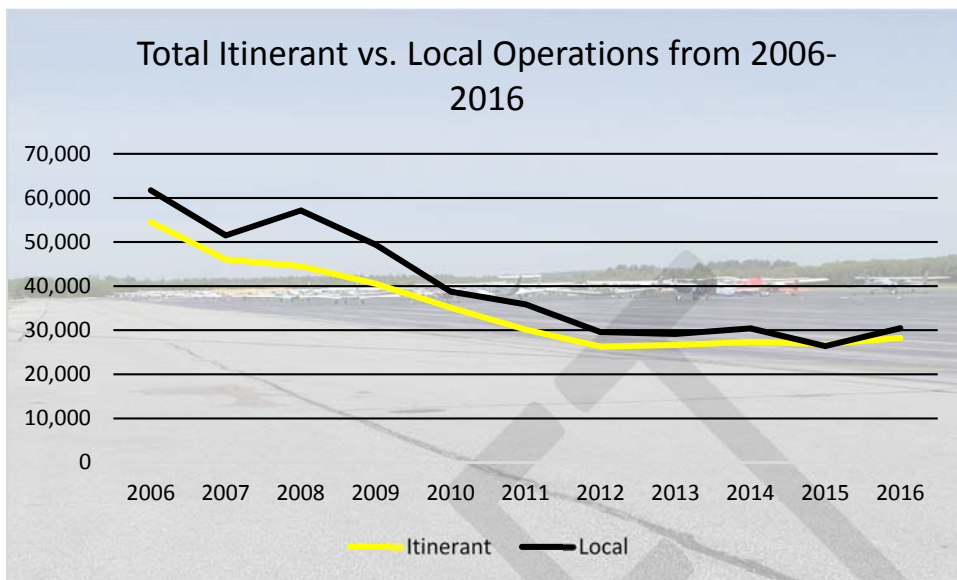
Historic aircraft operations for ASH were obtained from ASH's tower records. According to the data shown in **Table 4-10** below, the Airport had a marked decrease in operations between 2006-2016, losing approximately 50 percent of its operations over this period with an average annual loss of 6.1 percent per year. During this same period, ASH has experienced an approximate 47 percent decrease in itinerant operations, and 52 percent decrease in local operations (see **Table 4-11**).

Table 4-10 Total ASH Operations from 2006- 2016



Source: ASH Tower Records 2006-2016

Table 4-11 ASH Itinerant vs. Local Operations from 2006- 2016

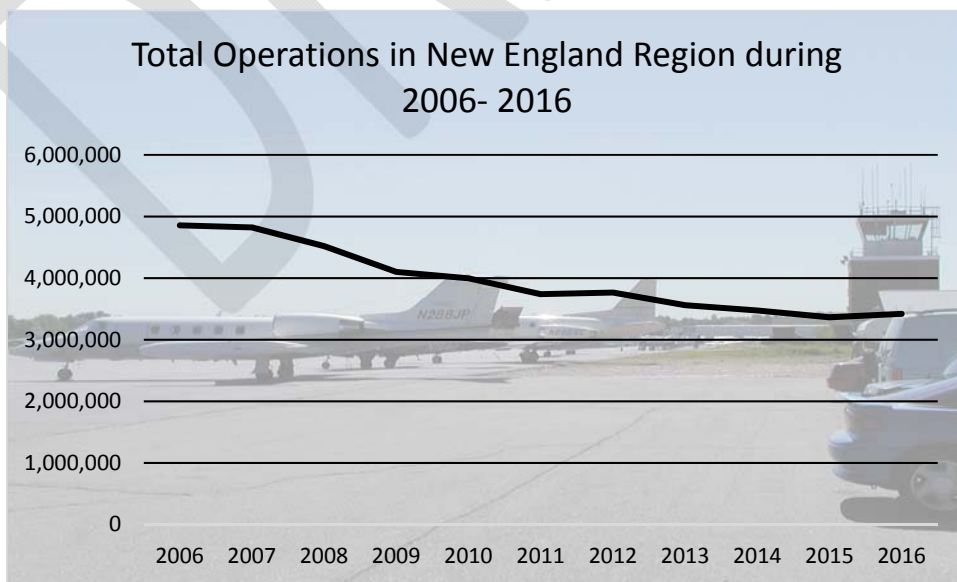


Source: ASH Tower Records 2016-2016, Gale Analysis 2017

4.5.2 NEW ENGLAND REGIONAL TRENDS

Historic aircraft operations for FAA New England Region were obtained from the FAA's TAF. According to the data shown in **Table 4-12** below, the New England Region experienced a decrease in operations between 2006-2016, losing approximately 30 percent of its operations over this period with an average annual loss of 3.4 percent per year.

Table 4-12 Total New England Region Operations from 2006-2016

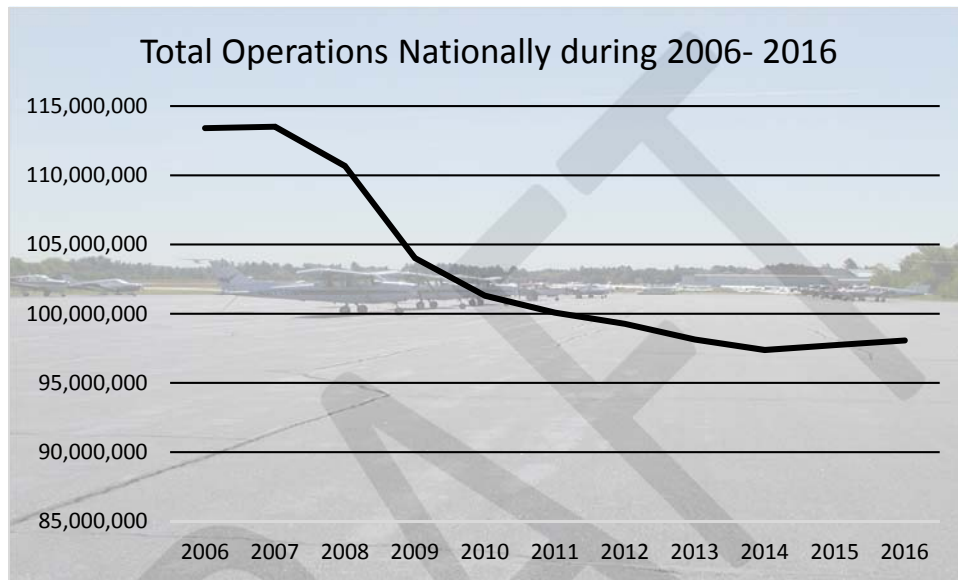


Source: FAA TAF 2006-2016

4.5.3 NATIONAL HISTORIC TRENDS

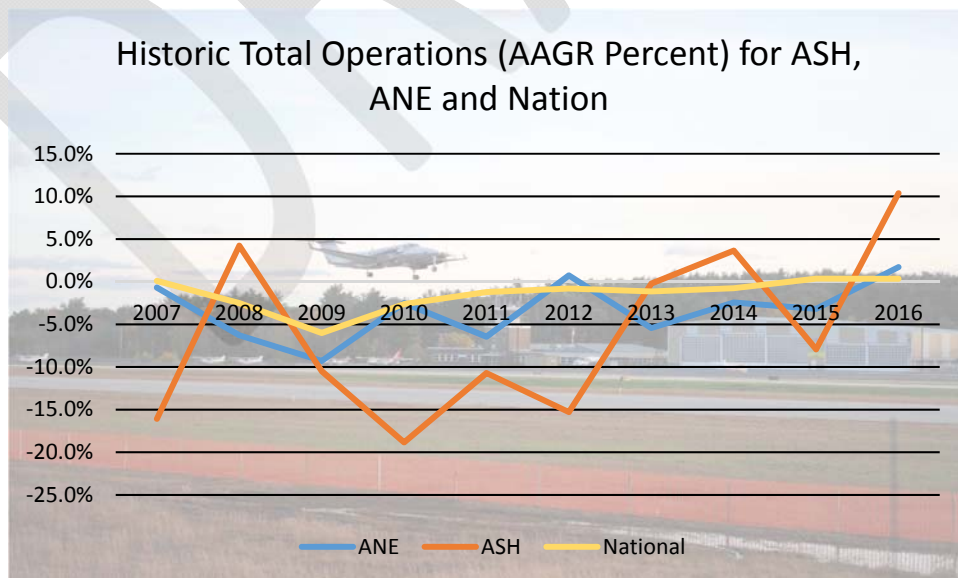
Historic aircraft operations for the Nation were obtained from the FAA's TAF. According to the data shown in **Table 4-13** below, the Nation experienced a decrease in operations between 2006-2016, losing approximately 13.5 percent of its operations over this period with an average annual loss of 1.4 percent per year. A comparison of the historic AAGR for ASH, ANE, and Nation is highlighted in **Table 4-14** below.

Table 4-13 Total Operations Nationally from 2006- 2016



Source: FAA TAF 2006-2016

Table 4-14 Historic Total Operations (AAGR) ASH, ANE, and Nation

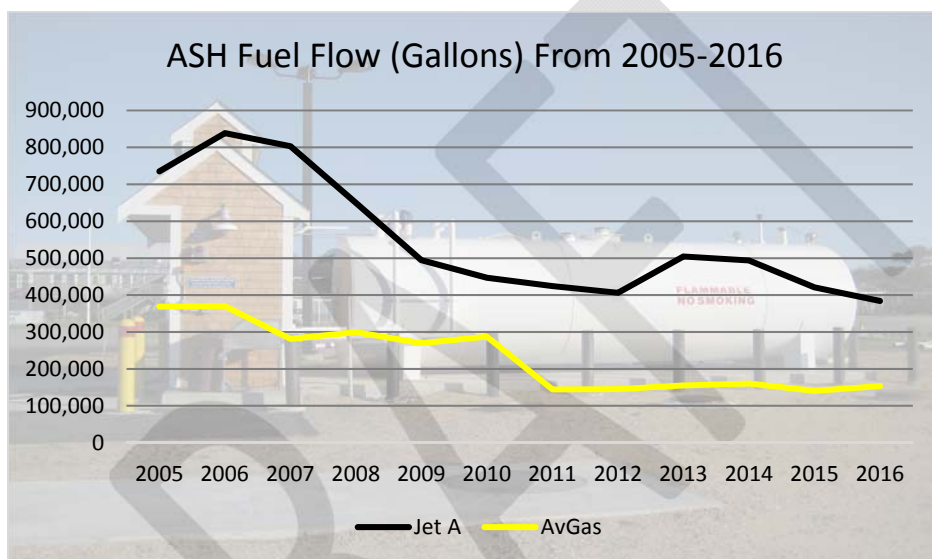


Source: FAA TAF 2006-2016

4.6 ASH JET FUEL AND AVIATION GASOLINE CONSUMPTION

Historic fuel sales data from 2005 to 2016 was obtained from the Airport. Fuel sales can often be considered a good indicator of aviation activity at an airport and help determine future fuel storage needs at an airport. In terms of gallons sold, the data presented in **Table 4-15** indicates a significant decrease in fuel sales (both for Jet-A and AvGas) between 2005 and 2016. During this period, jet fuel sales decreased by approximately 48 percent with an average annual decrease of approximately 5 percent. Similarly, AvGas sales decreased by approximately 51 percent between 2005 and 2016 with average annual decrease of approximately 6 percent.

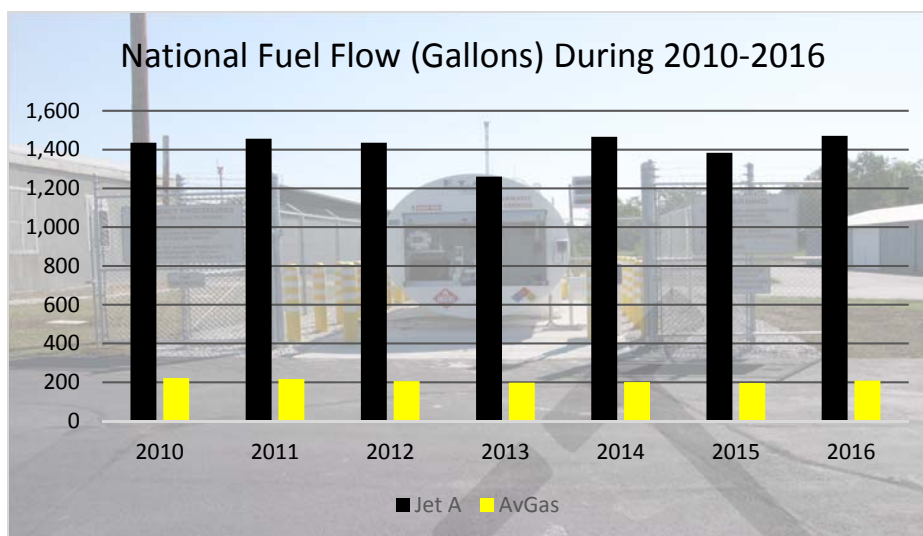
Table 4-15 ASH Fuel Flow 2005-2016



Source: Airport Master Plan Committee, Gale Analysis 2017

As indicated in **Table 4-16** below, the FAA Aerospace Forecast (2017-2037) reported that between 2010 and 2016, Jet-A fuel consumption for GA aircraft increased 2.5 percent with an average annual increase of 0.81 percent. AvGas on the other hand was reported to have decreased by approximately 6.0 percent during this same period with an average annual decrease of approximately 0.9 percent. Through the planning period, the FAA Aerospace Forecast anticipates an average annual growth in Jet-A fuel consumption of 1.9 percent, and an average annual decrease of 0.4 percent per year in AvGas.

Table 4-16 National Fuel Flow 2010-2016



Source: FAA Aerospace Forecast 2017-2037

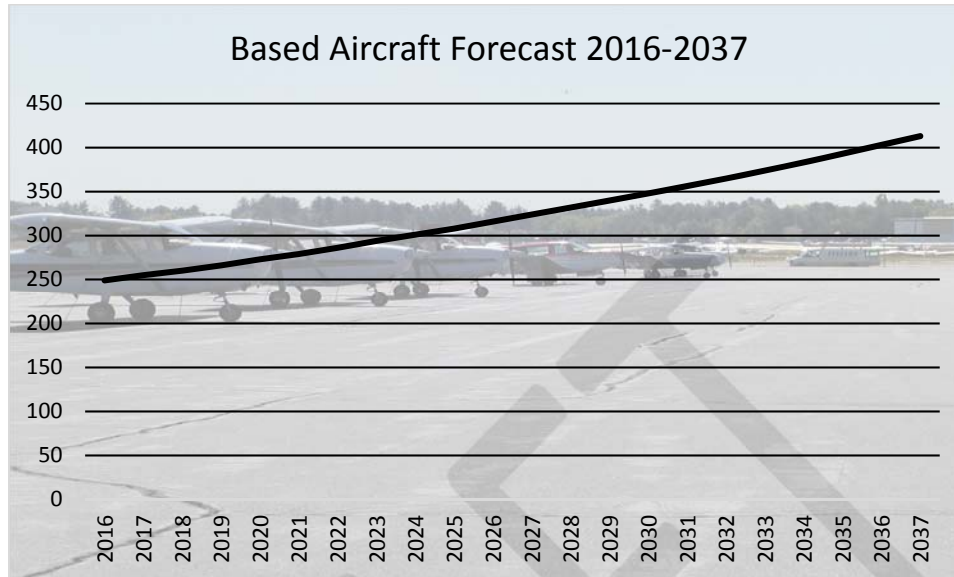
4.7 AVIATION ACTIVITY FORECASTS

This section presents the aviation activity forecasts for ASH for the planning period of 2017-2037. The forecasts provide short-term, mid-term and long-term projections for the years 2022, 2027, and 2037. These represent the 5-, 10-, and 20-year estimates of aviation activity at the Airport. Activity projections include based aircraft, itinerant operations, local operations, and total operations. Forecasts developed by the Airport are reviewed by the FAA and compared to the FAA TAF projections. FAA Order 5090.3C provides guidance on the FAA review process, and states that the FAA will find a locally developed airport planning forecast acceptable if it meets any of the following three conditions for a general aviation and reliever airport:

1. The forecast differs less than 10 percent in the 5-year forecast period, and 15 percent in the 10-year forecast period;
2. The forecast activity levels do not affect the timing or scale of an airport project;
3. The forecast activity levels do not affect the role of the airport as defined in FAA Order 5090.3C.

4.7.1 BASED AIRCRAFT FORECAST BY TYPE

Based on the 2016 TAF growth rates for the Airport, it is projected that based aircraft will grow at an average rate of 2.4 percent per year. On average, this represents approximately 7-8 new based aircraft per year. This growth rate is expected to outpace not only the New England region (0.9 percent per year), but the National growth rate (0.8 percent per year) as well. The forecast uses the TAF 2016 based aircraft data as its baseline, with a total based aircraft of 249. **Table 4-17** details the TAF projected based aircraft growth rate out to 2037.

Table 4-17 Based Aircraft Forecast


Source: FAA TAF 2016-2045

As illustrated in **Table 4-18**, single-engine aircraft are expected to continue to dominate the based aircraft fleet at the Airport, but multi-engine aircraft are projected to increase at a slightly higher rate during the planning period (2.6 percent per year vs. 3.0 percent per year). According to the General Aviation Manufacturers Association⁷ (GAMA), From 2007 to 2016, the average price of a piston-engine aircraft has increased from approximately \$328,000 in 2007 to \$712,000 today. At the same time, the average price of turboprops has declined from \$3.5 million to \$2.9 million. The average price of a business jet is up from \$12.5 million to \$22.4 million, which is a likely contributor to the projected flat growth for based jet aircraft. Helicopters are projected to remain flat during the planning period according to the TAF.

Table 4-18 Based Aircraft Forecast by Type

Year	Single Engine	Multi Engine	Jet	Helicopter	Other	Total
2016	197	25	14	9	4	249
2017	202	26	14	9	4	255
2018	207	26	14	9	4	260
2019	212	27	14	9	4	266
2020	218	28	14	9	4	273
2021	223	29	14	9	4	279
2022	229	30	14	9	4	286
2023	235	32	14	9	4	294
2024	241	33	14	9	4	301
2025	247	34	14	9	4	308
2026	254	35	14	9	4	316
2027	261	36	14	9	4	324
2028	268	37	14	9	4	332

⁷ <http://www.fi-aeroweb.com/General-Aviation.html#Fleet>

2029	275	38	14	9	4	340
2030	282	39	14	9	4	348
2031	289	40	14	9	4	356
2032	297	41	14	9	4	365
2033	305	42	14	9	4	374
2034	313	43	14	9	4	383
2035	322	44	14	9	4	393
2036	331	45	14	9	4	403
2037	340	46	14	9	4	413
AAGR	2.6%	3.0%	0.0%	0.0%	0.0%	2.45

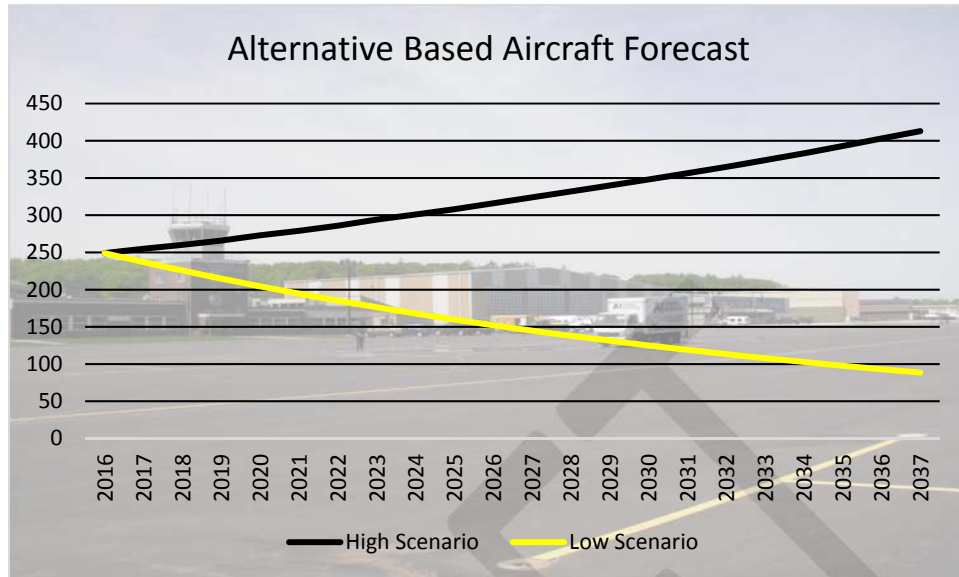
Source: FAA TAF 2016-2045

4.7.1.1 Alternative Based Aircraft Forecast

As discussed in Section 4.4.1, based aircraft are major economic contributors to the airport. They help generate revenues from tie-down fees, hangar leases, fuel sales, and maintenance. Providing adequate facilities to accommodate based aircraft growth is important, and it influences the future development needs of the Airport. The alternative based aircraft forecast for ASH develops both “high” and “low” scenarios based on historical growth rates. As previously discussed, projections should be viewed independently of specific years and to consider the actual growth of activity as the impetus that influences the need for future airport facilities. Similarly, slower than projected growth may warrant deferment of planned improvements. Actual growth activity should be periodically (i.e. annually) compared to projected growth, so scheduled corrections can be identified and implemented.

- **Hight Scenario:** as detailed in Section 4.4.1, the TAF projects growth in the number of based aircraft at an average annual growth rate (AAGR) of 2.4 percent. This rate of growth significantly out paces that expected for both the New England Region (0.9 percent) and Nationally (0.8 percent). Thus, an average annual growth rate of 2.4 percent for ASH represents the optimistic growth of based aircraft, which is applied to the TAF total based aircraft number of 249 for 2016 and projected over the period of 2017-2037.
- **Low Scenario:** As detailed in Section 4.4.1, the Airport has experienced a decline in the number of based aircraft at an average annual rate of -3.9 percent (NHDOT Based Aircraft Count) to -5.7 percent (TAF Based Aircraft Count). Using an average of the NHDOT Based Aircraft Count and the TAF Based Aircraft Count, this negative growth rate (-4.8 percent) is assumed as the basis for the low scenario for 2017-2037. This -4.8 percent annual rate is applied to the TAF total based aircraft number of 249 for 2016, and projected from 2017-2037. This scenario assumes negative growth in activity over the next 20 years that reflects recent trends at ASH.

As illustrated in **Table 4-19**, the high scenario projects the number of based aircraft to increase from 249 to 413 within the planning period. This equates to approximately 7-8 aircraft per year. The low scenario projects a decrease in based aircraft from 249 to 89 during the period, which equates to a loss of approximately 8 based aircraft per year.

Table 4-19 Alternative Based Aircraft Forecast


Source: FAA TAF 2016-2045, NHDOT, Gale Analysis 2017

4.7.1.2 Recommended Based Aircraft Growth Rate

To further assist in developing a recommended based aircraft growth rate, this section compares ASH's projected TAF based aircraft growth rate against the TAF growth rate of three airports within ASH's service area (Lawrence, Fitchburg and Hanscom). As illustrated in **Table 4-20** below, ASH's TAF based aircraft growth rate is expected to outpace the three comparable airports.

Table 4-20 Projected Based Aircraft Comparisons

Year	ASH	LWM	BED	FIT
2016	249	214	350	98
2017	255	218	357	98
2018	260	221	363	98
2019	266	226	371	98
2020	273	229	376	98
2021	279	232	384	98
2022	286	236	388	98
2023	294	241	395	98
2024	301	245	403	98
2025	308	248	410	98
2026	316	252	417	98
2027	324	257	424	98

2028	332	261	431	98
2029	340	266	438	98
2030	348	270	445	98
2031	356	274	452	98
2032	365	279	459	98
2033	374	283	466	98
2034	383	288	473	98
2035	393	292	480	98
2036	403	297	487	98
2037	413	303	494	98
AAGR	2.4%	1.7%	1.7%	0.0%

Source: FAA TAF 2016-2045, Gale Analysis 2017

After comparing the average annual growth rate (AAGR) forecast and historic trendline analysis, an average annual growth rate of 1.9 percent was selected for based aircraft through the planning period. While the average annual growth rate of 1.9 percent deviates from the TAF's 2.4 percent projection, it remains within 10 percent of the TAF projection. Further, a 1.9 percent AAGR maintains an optimistic outlook of aviation growth at the Airport, and is more consistent with what the region is expected to experience, particularly with the airports in ASH's service area. **Table 4-21** below compares the recommend 1.9 percent based aircraft AAGR against the high and low scenarios.

Table 4-21 Recommended Based Aircraft Growth Rate

Year	High Scenario +2.4%	Low Scenario -4.8%	Recommend +1.9%
2016	249	249	249
2017	255	237	254
2018	260	226	259
2019	266	215	263
2020	273	205	268
2021	279	195	274
2022	286	185	279
2023	294	176	284
2024	301	168	289
2025	308	160	295
2026	316	152	301
2027	324	145	306
2028	332	138	312

2029	340	131	318
2030	348	125	324
2031	356	119	330
2032	365	113	337
2033	374	108	343
2034	383	103	349
2035	393	98	356
2036	403	93	363
2037	413	89	370

Source: Gale Analysis 2017

4.7.2 AIRCRAFT OPERATIONS FORECAST

The total aircraft operations forecast for ASH for the planning period 2017-2037 is presented in **Table 4-22** below. Air Taxi & Commuter operations as well as Military operations are projected to remain flat throughout the planning period while Itinerant GA operations are expected to decrease slightly at an average annual rate of -0.04 percent per year. On the contrary, Local Civil operations are expected to increase at an average annual rate of 0.5 percent per year throughout the planning period.

Overall, total operations are expected to increase on average by 0.26 percent per year. While an average annual increase of 0.26 percent is below the regional average of 0.39 percent, and national average of 0.61 percent, it is in line with the competing airports in ASH's service area. LWM is projecting an average annual increase of 0.2 percent, FIT 0.0 percent, BED 0.2 percent, and MHT 0.45 percent. In the short-term (2022), total operations at ASH are expected to grow by 5.0 percent; in the medium-term (2027) by 6.4 percent; and in the long-term (2037) by 9.3 percent from 2016 total operations.

Table 4-22 Total Projected Aircraft Operations Forecast

Year	Itinerant Operations				Local Operations			
	Air Taxi & Commuter	GA	Military	Total	Civil	Military	Total	Total Operations
2016	370	27,557	31	27,958	29,809	16	29,825	57,783
2017	370	26,647	31	27,048	32,831	16	32,847	59,895
2018	370	26,637	31	27,038	32,994	16	33,010	60,048
2019	370	26,627	31	27,028	33,158	16	33,174	60,202
2020	370	26,617	31	27,018	33,325	16	33,341	60,359
2021	370	26,607	31	27,008	33,492	16	33,508	60,516
2022	370	26,597	31	26,998	33,660	16	33,676	60,674
2023	370	26,587	31	26,988	33,829	16	33,845	60,833
2024	370	26,577	31	26,978	33,998	16	34,014	60,992
2025	370	26,567	31	26,968	34,168	16	34,184	61,152
2026	370	26,557	31	26,958	34,339	16	34,355	61,313
2027	370	26,547	31	26,948	34,510	16	34,526	61,474
2028	370	26,537	31	26,938	34,682	16	34,698	61,636
2029	370	26,527	31	26,928	34,855	16	34,871	61,799

2030	370	26,517	31	26,918	35,029	16	35,045	61,963
2031	370	26,507	31	26,908	35,203	16	35,219	62,127
2032	370	26,497	31	26,898	35,378	16	35,394	62,292
2033	370	26,487	31	26,888	35,554	16	35,570	62,458
2034	370	26,477	31	26,878	35,732	16	35,748	62,626
2035	370	26,467	31	26,868	35,910	16	35,926	62,794
2036	370	26,457	31	26,858	36,090	16	36,106	62,964
2037	370	26,447	31	26,848	36,271	16	36,287	63,135
AAGR	0.0%	-0.04%	0.0%	-0.04%	0.5%	0.0%	0.5%	0.26%

Source: FAA TAF 2016-2045

4.7.2.1 Aircraft Operations Forecast (Local vs. Itinerant Split)

The Airport's Tower count records were analyzed to develop the activity split between local and itinerant operations. AS shown in **Table 4-23**, from 2007- 2016 local operations on average have accounted for approximately 53 percent of total operations, while itinerant operations accounted for approximately 47 percent.

Table 4-23 Historic Itinerant vs. Local Operations

Year	Itinerant Operations	Itinerant Percent	Local Operations	Local Percent	Total Operations
2007	46,063	47.2	51,484	52.8	97,547
2008	44,510	43.8	57,162	56.2	101,672
2009	40,539	44.5	49,378	54.3	91,017
2010	35,119	47.5	38,749	52.5	73,868
2011	30,119	45.7	35,846	54.3	65,965
2012	26,295	47.1	29,588	52.9	55,883
2013	26,624	47.7	29,140	52.3	55,764
2014	27,379	47.4	30,420	52.6	57,799
2015	26,808	50.4	26,402	49.6	53,210
2016	28,284	48.9	30,442	51.8	58,726

Source: ASH Tower Records, Gale Analysis 2017

As described in section 4.7.2, the TAF projects that itinerant operations at ASH will experience an AAGR of -0.04 percent through the planning period. At the same time, local civil operations are expected to experience an increase in operations with an AAGR of 0.5 percent. Consequently, the itinerant vs. local split is expected to continue to shift in favor of local operations through the planning period as illustrated in **Table 4-24** below.

Table 4-24 Forecast of Itinerant vs. Local Operations

Year	Itinerant Operations	Itinerant Percent	Local Operations	Local Percent	Total Operations
Base Year 2016	28,284	48.9	30,442	51.8	58,726
Forecast					
2022	26,998	44.5	33,676	55.5	60,674
2027	26,948	43.8	34,526	56.2	61,474
2037	26,848	42.5	36,287	57.5	63,135

Source: FAA TAF 2016-2045, Gale Analysis 2017

4.7.2.2 Baseline Operational Fleet Mix

In 2008, the Airport conducted a Noise Technical Report in relation to the proposed relocation and extension of Runway 14-32. In addition to other characteristics compiled, the Noise Technical Report identified the operational fleet mix, which included single-engine, multi-engine, jet, military, and helicopter operations on an average annual day. This information was used to establish the anticipated percent of operational fleet mix for the planning period. Table 4-25 illustrates the operational fleet mix reported in the Noise Technical Report.

Table 4-25 Baseline Operational Fleet Mix

Aircraft Category	Number of Operations	Percent of Fleet Mix
Single-Engine	233	81
Multi-Engine	39	14
Jet	4	2
Military	0	0
Helicopter	10	3
Total	286	100

Source: Wyle, 2008

4.7.2.3 Projected Operational Fleet Mix

Operational fleet mix is an important factor in determining the needs for airfield improvements. While ASH supports a variety of aircraft, the majority of the current operations are conducted by single-engine aircraft. As discussed in the previous section, the percent of operational fleet mix is based on the percentage of the average annual day operations baseline established in the 2008 Noise Technical Report and through discussions with airport management. Using the established percentage of fleet mix, Table 4-26 projects the operational fleet mix over the planning period.

Table 4-26 Projected Operational Fleet Mix

Aircraft Category	2022	2027	2037
Single-Engine	49,147	49,795	51,139
Multi-Engine	8,494	8,606	8,839
Jet	1,213	1,229	1,263
Military	0	0	0
Helicopter	1,820	1,844	1,894
Total	60,674	61,474	63,135

Source: Gale Analysis 2017

4.7.2.4 Alternative Projected Aircraft Operations Forecast

Projecting the number of annual operations at GA airports plays an important role in understanding potential sources of revenue, facility needs, and adequacy of existing facilities. The more activity generated at an airport, the more likely revenue streams from collection of tie-downs, fuel sales, and other charges increase. This alternative projected aircraft operations forecast employs the AAGR from three alternative sources: 1) Historic Operations at ASH, 2) Regional Comparison; and 3) FAA Aerospace Forecast.

- Alternative 1- ASH Historic Operations:** operations at ASH over the past 10 years (2006-2016) have been declining at an AAGR of -6.1 percent. As previously discussed in this Chapter, contributing factors to the decline in operations can likely be attributed to the *Great Recession*, which had a marked impact on GA airports throughout the country. Additionally, and unique to ASH, the closing of Daniel Webster College and its flight program in 2010 played a significant role in the decline in operations at ASH. These two anomalies aren't expected to be reoccurring. Therefore, for purposes of this alternative, the focus is on operations from 2012-2016. During the period of 2012-2016, operations at ASH have declined at an AAGR of -1.9 percent. Using 2016 operations as a base, an AAGR of -1.9 percent is applied to the operations through the planning period (2017-2037). The results are outlined in [Table 4-27](#).

Table 4-27 Alternative 1- ASH Historic Operations

Year	Itinerant				Local Operations			Total Operations
	Air Taxi & Commuter	GA	Military	Total	Civil	Military	Total	
2016	370	27,557	31	27,958	29,809	16	29,825	57,783
2017	363	27,033	30	27,427	29,243	16	29,258	56,685
2018	356	26,520	30	26,906	28,687	15	28,702	55,608
2019	349	26,016	29	26,394	28,142	15	28,157	54,552
2020	343	25,522	29	25,893	27,607	15	27,622	53,515

2021	336	25,037	28	25,401	27,083	15	27,097	52,498
2022	330	24,561	28	24,918	26,568	14	26,582	51,501
2023	324	24,094	27	24,445	26,063	14	26,077	50,522
2024	317	23,637	27	23,980	25,568	14	25,582	49,562
2025	311	23,187	26	23,525	25,082	13	25,096	48,621
2026	305	22,747	26	23,078	24,606	13	24,619	47,697
2027	300	22,315	25	22,639	24,138	13	24,151	46,791
2028	294	21,891	25	22,209	23,680	13	23,692	45,902
2029	288	21,475	24	21,787	23,230	12	23,242	45,030
2030	283	21,067	24	21,373	22,788	12	22,801	44,174
2031	277	20,667	23	20,967	22,355	12	22,367	43,335
2032	272	20,274	23	20,569	21,931	12	21,942	42,511
2033	267	19,889	22	20,178	21,514	12	21,526	41,704
2034	262	19,511	22	19,795	21,105	11	21,117	40,911
2035	257	19,140	22	19,419	20,704	11	20,715	40,134
2036	252	18,776	21	19,050	20,311	11	20,322	39,371
2037	247	18,420	21	18,688	19,925	11	19,936	38,623
AAGR	-1.9%	-1.9%	-1.9%	-1.9%	-1.9%	-1.9%	-1.9%	-1.9%

Source: TAF, ATCT Counts, Gale Analysis 2017

- **Alternative 2- Regional Comparison:** this alternative reviewed the TAF projections for airports located within ASH's service area (MHT, FIT, LWM, and BED). The TAF projects an AAGR of 0.45 percent for MHT, 0.0 percent for FIT, 0.2 percent for LWM, and 0.2 percent for BED through the planning period (2017-2037). The average combined AAGR for MHT, FIT, LWM, and BED is 0.2 percent. As such, for purposes of this alternative an AAGR of 0.2 percent is applied to the 2016 total operations through the planning period (2017-2037). The results are outlined in **Table 4-28**.

Table 4-28 Alternative 2- Regional Comparison

Year	Itinerant Operations				Local Operations			Total Operations
	Air Taxi & Commuter	GA	Military	Total	Civil	Military	Total	
2016	370	27,557	31	27,958	29,809	16	29,825	57,783
2017	371	27,612	31	28,014	29,869	16	29,885	57,899
2018	371	27,667	31	28,070	29,928	16	29,944	58,014
2019	372	27,723	31	28,126	29,988	16	30,004	58,130
2020	373	27,778	31	28,182	30,048	16	30,064	58,247
2021	374	27,834	31	28,239	30,108	16	30,124	58,363

2022	374	27,889	31	28,295	30,169	16	30,185	58,480
2023	375	27,945	31	28,352	30,229	16	30,245	58,597
2024	376	28,001	31	28,408	30,289	16	30,306	58,714
2025	377	28,057	32	28,465	30,350	16	30,366	58,831
2026	377	28,113	32	28,522	30,411	16	30,427	58,949
2027	378	28,169	32	28,579	30,471	16	30,488	59,067
2028	379	28,226	32	28,636	30,532	16	30,549	59,185
2029	380	28,282	32	28,694	30,593	16	30,610	59,304
2030	380	28,339	32	28,751	30,655	16	30,671	59,422
2031	381	28,395	32	28,809	30,716	16	30,732	59,541
2032	382	28,452	32	28,866	30,777	17	30,794	59,660
2033	383	28,509	32	28,924	30,839	17	30,855	59,779
2034	384	28,566	32	28,982	30,901	17	30,917	59,899
2035	384	28,623	32	29,040	30,962	17	30,979	60,019
2036	385	28,680	32	29,098	31,024	17	31,041	60,139
2037	386	28,738	32	29,156	31,086	17	31,103	60,259
AAGR	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%

Source: FAA TAF 2016-2045, Gale Analysis 2017

- Alternative 3- FAA Aerospace Forecast:** the national forecasts for contract towered airports in the FAA Aerospace Forecasts, Fiscal Years 2016-2037 show aircraft operations growing at an average annual rate of 0.8 percent over the 21-year forecast period. Average annual growth rates for this period by user group are as follows; air carrier, 2.3 percent; air taxi/commuter, -0.9 percent; itinerant general aviation, 0.3 percent; and local civil, 0.4 percent. Table 4-29 illustrates the projected growth by applying the average FAA Aerospace rates to the appropriate user group at ASH. The AAGR for the air carrier user group was excluded from this analysis as ASH does not have air carrier service.

Table 4-29 Alternative 3- FAA Aerospace Forecast

Year	Itinerant Operations				Local Operations			Total Operations
	Air Taxi & Commuter	GA	Military	Total	Civil	Military	Total	
2016	370	27557	31	27,958	29,809	16	29,825	57,783
2017	367	27640	31	28,037	29,928	16	29,944	57,982
2018	363	27723	31	28,117	30,048	16	30,064	58,181
2019	360	27806	31	28,197	30,168	16	30,184	58,381
2020	357	27889	31	28,277	30,289	16	30,305	58,582

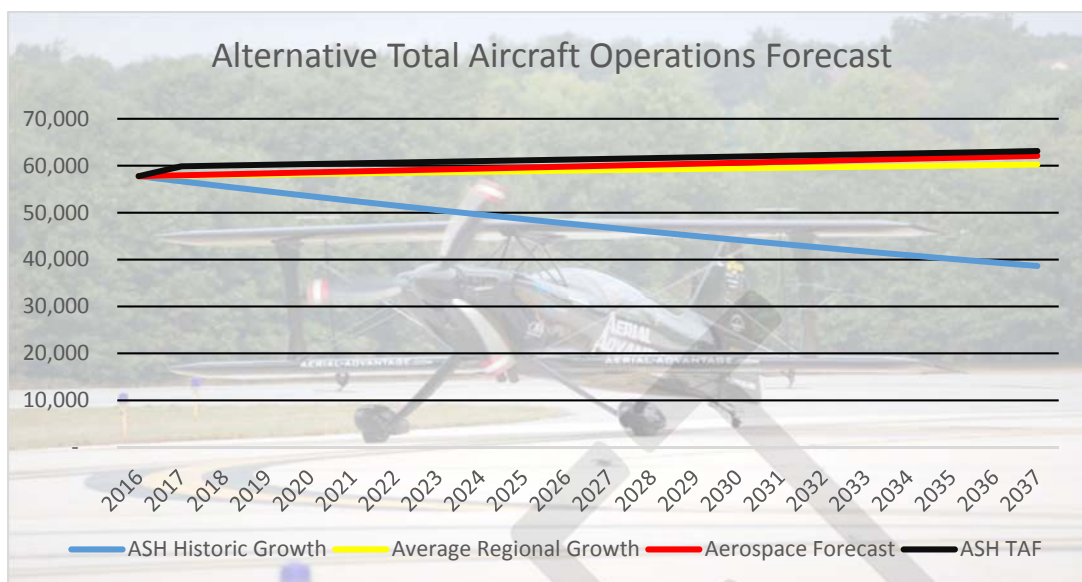
2021	354	27973	31	28,357	30,410	16	30,426	58,783
2022	350	28057	31	28,438	30,532	16	30,548	58,986
2023	347	28141	31	28,519	30,654	16	30,670	59,189
2024	344	28225	31	28,601	30,776	16	30,792	59,393
2025	341	28310	31	28,682	30,899	16	30,915	59,598
2026	338	28395	31	28,764	31,023	16	31,039	59,803
2027	335	28480	31	28,846	31,147	16	31,163	60,009
2028	332	28566	31	28,929	31,272	16	31,288	60,216
2029	329	28651	31	29,011	31,397	16	31,413	60,424
2030	326	28737	31	29,094	31,522	16	31,538	60,633
2031	323	28823	31	29,178	31,648	16	31,664	60,842
2032	320	28910	31	29,261	31,775	16	31,791	61,052
2033	317	28997	31	29,345	31,902	16	31,918	61,263
2034	314	29084	31	29,429	32,030	16	32,046	61,475
2035	312	29171	31	29,513	32,158	16	32,174	61,687
2036	309	29258	31	29,598	32,287	16	32,303	61,901
2037	306	29346	31	29,683	32,416	16	32,432	62,115
AAGR	-0.9%	0.30%	0.0%	0.40%	0.4%	0.0%	0.4%	0.3%

Source: FAA Aerospace Forecast 2017-2037

4.7.2.5 Recommended Aircraft Operations Forecast

As detailed in [Table 4-30](#), the TAF for ASH projects an increase of 5,352 operations from 57,783 in 2016 to 63,135 in 2037. This represents a 9.3 percent increase in operations during the planning period with AAGR of 0.26 percent. Alternative 1- *ASH Historic Operations* projects the total number of aircraft operations at the Airport to decrease by 19,160 operations from 57,783 in 2016 to 38,623 in 2037. This represents a 33 percent decrease in operations during the planning period with an AAGR of -1.9 percent. Alternative 2- *Regional Comparison* projects an increase of 2,476 operations from 57,783 in 2016 to 60,259 in 2037. This represents a 4.0 percent increase in operations during the planning period with an AAGR of 0.2 percent. Alternative 3- *FAA Aerospace Forecast* projects an increase of 4,332 from 57,783 in 2016 to 62,115 in 2037. This represents 7.5 percent increase in operations during the planning period with an AAGR of 0.3 percent.

Table 4-30 Alternative Total Aircraft Operations Forecast



Source: FAA Aerospace Forecast 2017-2037, FAA TAF 2016-2045, Gale Analysis

After comparing total aircraft operations at ASH, and applying the three alternative scenarios, there does not appear to be any unique circumstances or influencing factors that suggest a deviation from the TAF as outlined in section 4.7.2. In fact, the difference in projected operations at ASH through the planning period (2017-2037) are negligible when compared to what is expected at competing airports in ASH's service area, and that of the Aerospace Forecast. Therefore, it is recommended that the TAF projections of future aviation activity be used to assess the capacity of existing facilities and determine improvements required to satisfy future activity levels in the following chapters.

Although future aviation activity will rely on the TAF projections, it is recommended that the Airport monitor actual growth activity annually, so scheduling of capital improvements can be identified and implemented. Among other things, the implementation of the following, or changes in policies could influence operations at ASH:

- NH HB124- which seeks to repeal all aircraft registration fees collected by the Department of Transportation;
- Aircraft Deicing System;
- Implementation of ASH as "landing rights airport" in accordance with United States Customs and Border Protection;
- Technological advances in unmanned aerial vehicles (UAVs);
- Occupancy of Daniel Webster College.

It is important, however, to view the projections independently of specific years and to consider the actual growth of activity as the impetus that influences the need for future airport facilities. Similarly, slower than projected growth may warrant deferment of planned improvements. Actual growth activity should

be periodically (i.e. annually) compared to projected growth, so scheduled corrections can be identified and implemented.

4.8 PEAK ACTIVITY ESTIMATES

Many airport facility needs are related to the levels of activity during peak periods. Peak characteristics are typically defined as peak month, average day, and peak hour activity. When projecting future activity levels at an airport, it is important to identify and project peak period activity levels. These projections help facilitate future planning decisions, and highlight an airport's ability to accommodate future aviation activity demand.

The values for average day peak month and for the peak hour have been calculated by taking the number of operations calculated for the peak month and dividing that figure by the number of days in the peak month. In the case of ASH, August represents the peak month with 31 days. It is estimated that 15 percent of the average day peak month would best represent the number of peak hour operations. The calculation of peak activity is illustrated in [Table 4-31](#).

Table 4-31 Peak Activity Estimates

	Total Annual Operations	Peak Month	Average Day Peak Month	Peak Hour (ADPM)
<i>Base Year</i>				
2016	58,726	6,325	204	31
<i>Forecast</i>				
2022	60,674	6,674	215	32
2027	61,474	6,762	218	33
2037	63,135	6,945	224	34

Source: ASH ATCT, Gale Analysis 2017

4.9 SUMMARY OF FORECASTS

[Table 4-32](#) summarizes the recommended aviation demand forecasts for ASH for the 5-, 10-, and 20- year planning periods discussed in this chapter. These projections of future aviation activity will be used to assess the capacity of existing facilities and determine improvements required to satisfy future activity levels in the subsequent chapters of this Master Plan.

Table 4-32 Airport Recommended Forecast Summary

Fiscal Year	Itinerant				Local			
	Air Carrier	Air Taxi	General Aviation	Military	Civil	Military	Total Operations	Based Aircraft
2022	0	370	26,597	31	33,660	16	60,674	279

2027	0	370	26,948	31	34,510	16	61,474	306
2037	0	370	26,447	31	36,271	16	63,135	370

Source: TAF, Gale 2017

4.9.1 DESIGN AIRCRAFT

The selection of design standards for airfield facilities is predicated upon the characteristics of the aircraft that are expected to use the airport. The design aircraft is defined as the most demanding aircraft type operating at the airport with a minimum of 500 annual operations (take-off and landings are considered as separate operations), as described by the FAA.

As described in Chapter 2, the FAA groups aircraft into five categories (A-E) based upon their approach speeds. Aircraft Categories A-B generally include small propeller aircraft, and smaller business jets with approach speeds of less than 121 knots. Categories C, D, and E generally consist of the remaining business jets and other larger propeller aircraft with approach speeds of 121 knots or more. The FAA establishes six airplane design groups (I-IV), which are predicated on the wingspan and tail height of the aircraft. These categories range from Airplane Design Group (ADG) I through VI (I- aircraft with wingspans of less than 49 feet, to ADG VI for the largest commercial and military aircraft).

The combination of the airplane design group and aircraft approach speed for the design aircraft establishes the approach and departure reference code, which is used to define applicable airfield design standards. Based on discussions with ASH ATCT, the appropriate design aircraft remains the Gulfstream IV, which is included in Aircraft Approach Category D and Airport Design Group II.

Appendix A

Snow and Ice Control Plan



NASHUA AIRPORT AUTHORITY
SNOW AND ICE
CONTROL PLAN

2016

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Scope and Purpose

The safety of the airport employees and users is the highest priority of the Nashua Airport Authority (NAA). This Snow and Ice Control Plan (SICP) has been created to document how Boire Field will work toward mitigating the hazards associated with the regular annual occurrence of snow and ice accumulation. Winter snow conditions reduce traffic volumes and can impair the safety of airport operations. Severe storm conditions can force airport closures. This plan is an effort to minimize these undesirable effects on the airport and ensure as safe an operating environment as possible. The goal of the NAA is to maintain the airport surfaces in a, “no worse than wet” condition. Secondly, this plan attempts to inform the operating public at Boire Field so they might better understand how snow removal functions are carried out. The Nashua Airport Authority recognizes and understands the need and desire of our stakeholders to be part of the processes that affect them, and this Plan is an attempt to promote communication. Questions or comments on this plan or snow removal operations can be directed to the airport management office at (603) 882-0661 or info@nashuaairport.com.

Section 1 – Definitions

- a) Contaminant. Any substance on a runway or taxiway, for the purpose of this Snow and Ice Control Plan (SICP) would be snow, slush, ice or standing water.
- b) Dry Snow. Snow that insufficient free water to cause cohesion between individual particles. If when making a snowball, it falls apart, the snow is considered dry.
- c) Wet Snow. Snow that has grains coated with liquid water, which bonds the mass together, but that has no excess water in the pore spaces. A well-compacted, solid snowball can be made, but water will not squeeze out.
- d) Compacted Snow. Snow that has been compressed into a solid mass that resists further compression and will hold together or break up into lumps if picked up.
- e) Slush. Snow that has water content exceeding its freely drained condition, such that it takes on a fluid property (e.g. flowing and splashing). Water will drain from slush when a handful is picked up.
- f) Patchy Conditions. Contaminate conditions that cover 25% or less of the cleared/treated/usable surface shall be classified as "Patchy." Conditions covering more than 25% should be considered as covering the total surface area for surface condition reporting purposes.
- g) Approved Chemicals. A chemical, either solid or liquid, that meets a generic SAE or MIL specification. (Note, Boire Field does not use any airside approved chemicals at the time of this publication)
- h) Fluid Deicer/Anti-Icers. The approved specification is SAE AMS 1435, Fluid, Generic Deicing/Anti-icing, Runways and Taxiways. (Note, Boire Field does not use any airside fluid deicer/anti-icers at the time of this publication)
- i) Generic Solids. The approved specification is SAE AMS 1431, Compound, Solid Runway and Taxiway Deicing/Anti-Icing. (Note, Boire Field does not use any airside generic solids at the time of this publication)

Section 2 - Administrative

- a) Airport Management Pre-Season Meeting. The meeting should determine if the post season objectives were met, and effective. The maintenance supervisor will typically initiate a meeting in October to discuss equipment and material inventory, repair needs, staffing, budget, training, previous years' issues, and any other topics associated with snow and ice control and this plan. Additionally, the following topics may be discussed in the Pre-Season Meeting:

- Areas Designated as Priority 1 and any new airfield infrastructure
 - Clearing operations and follow-up airfield assessments
 - Potentials for pilot or vehicular runway incursions or incidents
 - Staff requirements and qualifications (training)
 - Response time to keep runways, taxiways and apron areas operational
 - Radio Communications
 - Communication, terminology, frequencies, and procedures
 - Monitoring and updating of runway surface conditions
 - Issuance of NOTAMS and dissemination to ensure timely notification
 - Equipment inventory
 - Snow hauling/disposing, snow dumps
- b) Pre-event Meetings.** Before each snow event, airport management and all available snow removal personnel will conduct a meeting to discuss any issues that have arisen from the last snow event, and any outstanding issues or items that have been resolved. In addition, NAA will ensure that sufficient and qualified staffing, materials, and equipment are available for a snow or ice event.
- c) Post Event Meetings.** After each snow event airport management will host a meeting within three days to discuss any issues that have arisen from the event.
- d) Equipment Preparation.** Airfield snow removal equipment shall be inspected prior to utilization for safety and proper operation. At a minimum, the oil level and other pertinent fluids of equipment to be utilized during that snow event will be checked. Also, equipment will be inspected for obvious deficiencies or safety issues.

Typically, in mid-October or earlier, the maintenance supervisor shall inspect and prepare each piece of snow removal equipment. Required fluids, replacement parts, and snow removal equipment components will be inventoried and stockpiled. Worn items will be replaced as needed.

Section 3 – Snow Removal Operations

- a)** The maintenance supervisor is responsible for making the decision to commence snow removal operations upon contamination of airport surfaces. In some situations, it may be prudent to wait to begin snow removal operations. In some cases, it may be necessary to close the Airport, or portions thereof to aircraft use if they are deemed to be unsafe for aircraft use. If any airport surfaces are closed, the maintenance supervisor will immediately notify the airport manager. The maintenance supervisor should physically inspect the airport to make the determination as to when to begin snow removal operations.
- b) Weather Forecasting.**
- The maintenance supervisor is responsible for monitoring the current and/or forecast weather conditions.

- The maintenance supervisor is the person delegated the authority to call-in personnel/snow-team members.
 - Conditions are monitored before the storm and periodically throughout the weather event by the maintenance supervisor.
 - Sources for weather forecasts and current conditions include TV news, newspapers, online weather resources such as NWS, the air traffic control tower and the on field AWOS (Automated Weather Observation System)
- c) Typical shift coverage will provide for each piece of snow removal equipment to be deployed at the beginning of the snow event. The goal in shift coverage is to ensure the Priority 1 areas are cleared of contaminants in the shortest amount of time, thereby restoring the Airport to safe, usable condition. The maintenance supervisor will make determinations throughout the storm event to release snow crew members as the airfield returns to normal conditions and areas are cleared.
- d) According to the FAA, the recommended clearance time for Priority 1 areas is two hours. The snow removal team will work toward this goal as safely as possible.

Table 1-2. Clearance Times for Non-Commercial Service Airports

<i>Annual Airplane Operations (includes cargo operations)</i>	<i>Clearance Time¹ (hour)</i>
<i>40,000 or more</i>	<i>2</i>
<i>10,000 – but less than 40,000</i>	<i>3</i>
<i>6,000 – but less than 10,000</i>	<i>4</i>
<i>Less than 6,000</i>	<i>6</i>
<i>General: Although not specifically defined, Non-Commercial Service Airports are airports that are not classified as Commercial Service Airports [see Table 1-1, general note].</i>	
<i>Footnote 1: These airports may wish to have sufficient equipment to clear 1 inch (2.54 cm) of falling snow weighing up to 25 lb/ft³ (400 kg/m³) from Priority 1 areas within the recommended clearance times.</i>	

- e) **Airfield Clearing Priorities.** Boire Field is segmented for snow clearing purposes into four areas. These areas are listed as Priority 1 through Priority 4. Priority 1 areas are those vital to the takeoff, landing and moving of aircraft to and from the runway. Priority 2 areas are those areas that support Priority 1 areas as well as areas used by on airport businesses. Priority 3 areas are those areas that are not used every day, nor are critical to the takeoff and landing of aircraft or on airport businesses. Priority 4 areas are those that can wait until all other areas are cleared and in some circumstances might be taken care of on subsequent days after the storm. The NAA makes every effort to keep the entire airfield and supporting parking areas cleared of snow and ready for use, but some factors may delay the clearing of an area. These factors include, but are not limited to staffing, particular weather events such as impending freezing rain or blowing snow, equipment failures, etc. The priority areas are as follows and can be seen on the attached map in Appendix A:

Priority 1

Priority 1 areas are primary areas that must be cleared as soon as practicable. These areas include the most critical portions of the aircraft movement area and supporting facilities. This will normally include the runway and associated turnoffs, access taxiways leading to the FBO(s) and other airport businesses and designated emergency response roads, NAVAIDs and Mutual Aid access/gates/locks. The entire airport would not be a Priority 1 (Figure A-1).

Priority 2

Priority 2 areas are secondary in importance and include the Inner Taxilane and the ramps associated with the on-airport businesses as well as the Airport Maintenance Facility. Typically, Priority 2 areas are cleared simultaneously with the Priority 1 areas. Taxiway B can be considered a Priority 2 area, so long as the remainder of the stub taxiways are cleared (Figure A-1).

Priority 3

Priority 3 areas are tertiary areas that should be cleared after the Priority 1 and Priority 2 areas are cleared and open for use. These areas include the tie-down ramps and in between T-hangars that do not house businesses. Typically, Priority 3 areas are cleared simultaneously or immediately following the clearing of Priority 1 and Priority 2 areas (Figure A-1).

Priority 4

Priority 4 areas include service roads and access roads to airfield equipment. In some cases, Priority 4 areas might be left for the following days after the storm, however the maintenance supervisor should coordinate closely with FAA Tech-Ops to ensure they have adequate access to FAA owned equipment.

- f) Snow Removal Operations Triggers.** Typically, snow removal operations will commence when contaminants hamper operation or decrease braking action. In circumstances where snow will be followed by freezing rain or freezing conditions, it may be prudent to delay the start of snow removal operations to create an insulating layer between the freezing condition and the paved surface, thereby preventing bonding.
- g) Closing of Airport Surfaces.** Airport surfaces will be initially closed as snow removal begins. On the runway, snow removal involves plowing windrows and gradually forcing all of the snow to the edge of a surface where it can be blown or thrown over the edge lights. While the windrow is being pulled to the side, it presents a significant hazard to aircraft operations. Surfaces will also be closed when any of the parameters are met in the following table.

Precipitation	Depth in Inches
Slush	<i>1 inch</i>
Wet Snow	<i>2 inches</i>
Dry Snow	<i>3 inches</i>
Ice or Freezing Rain	<i>100% coverage</i>

Boire Field serves such a diverse array of aircraft types and operator experience that it would be difficult or impossible to try and accommodate everyone's operational limitations. The maintenance supervisor will err on the side of caution if he or she thinks a surface might not be safe for use and should be closed to aircraft use.

As soon as conditions allow. The maintenance supervisor will change the closed condition of a surface to a PPR (Prior Permission Required) with sufficient time to allow for men and equipment to vacate the surface for arriving or departing aircraft. A PPR will only be used in cases where the surface is rendered as safe as possible by the removal of contaminants. A typical PPR will be issued for 15 or 30 minutes on both ground and tower frequencies.

In all circumstances where surfaces are impacted by contamination, snow removal operations or closures, an appropriate NOTAM will be issued notifying the public about the circumstance.

Additionally, the NAA has a Letter of Agreement with the Nashua FAA Contract Tower that states:

Nashua Tower shall cease landing and takeoff operations and immediately notify Nashua Airport Authority upon receipt of a PIREP [Pilot Report] of NIL braking action on the runway. Resume landings and takeoffs operations only after notification by Nashua Airport Authority that the runway is safe for use.

- h) Snow Equipment List.** The maintenance supervisor will work toward having every piece of available snow removal equipment in operation with an operator to clear snow. The current inventory includes (vehicle callsigns are in parenthesis):
- a. 2007 624J John Deere Loader, 30,000 lbs. (SNOW 50)
 - b. 1985 FG-85 Fiat Grader, 35,000 lbs. (SNOW 30)
 - c. 1985 FR-15 Fiat Loader, 30,000 lbs.
 - d. 1996 SL-150 Samsung Loader, 30,000 lbs. (SNOW 11)
 - e. 1979 SMI Rotary Plow, 28,000 lbs. (SNOW 40)
 - f. 1985 MP-3D Sno-Go Rotary Plow, Loader Mount, 7,500 lbs.
 - g. 1988 75-C Michigan Loader, 32,000 lbs. (SNOW 12)
 - h. 2011 MP-3D Sno-Go Rotary Plow, Loader Mount, 8,400 lbs.
 - i. 2014 764HSD John Deere High Speed Dozer, 34,000 lbs. (SNOW 60)

- j. 1988 1954 International Dump Truck, 48,000 lbs. (SNOW 23)
 - k. 2007 MB Pavement Broom, Loader Mount.
 - l. 2009 F350 Ford with Plow and Caster Spreader, 10,600 lbs.
 - m. 2002 K-2500 Chevrolet Pickup with plow, 8,600 lbs.
- i) **Storage of Snow and Ice Control Equipment.** Snow removal equipment is stored and maintained inside the Snow Removal Equipment building at 93 Perimeter Rd. This building includes several heated bays.
 - j) **FAA-Approved Chemicals.** At the time of this publication, the NAA does not utilize any FAA-Approved chemicals for anti-ice or de-ice. The Ford Pickup does have a material spreader which is typically filled with road salt and sand and is reserved for the landside parking lots. This vehicle is rarely taken out onto the airport when filled as these are not FAA approved materials and they are never deployed airside.

Section 4 – Snow Clearing Principles

- a) **Runway and Taxiways.** Runways and taxiways are typically plowed into windrows by the grader and or a loader capable of receiving the articulating hydraulic plow. The direction of the plowing is dependent on the current and forecast winds. Ideally, all the snow is pushed toward the infield where it is blown over the lights with a rotary plow. In some circumstances, the winds will favor pushing snow to the east side of the runway. In either case, the section of the runway between Taxiway D and Taxiway A-North, the snow is ALWAYS plowed toward the infield. This section of the runway is adjacent to the Watts Endfire Glide Slope array which cannot support snow being blown toward it. If snow is pushed to the edge of the runway in this area, we have no way of removing it. In cases where winds are out of the west, it is sometimes prudent to have a smaller loader with an adjustable plow that is much more agile than the grader to care for that loop of the runway/taxiway circuit. This invariably takes a loader away from their task of clearing snow from hangars and ramps but the tradeoff is worth it.

Once all the snow is windrowed, a blower or rotary plow casts the snow over and beyond the lights.

Simultaneously or after the plowing/blowing operation is complete, the MB Pavement Broom is usually deployed to attempt to get the pavement down to, “no worse than wet” conditions. At this point, solar radiation is extremely helpful in remediating any remaining contaminants.

In some circumstances, it is acceptable to clear the runway at less than the 100’ full width to accommodate operations of smaller piston and helicopter operations. In these cases, the pilots and Tower will be made fully aware of the existing conditions.

- b) **Snow Bank Height Profiles – See Figure 4-1**

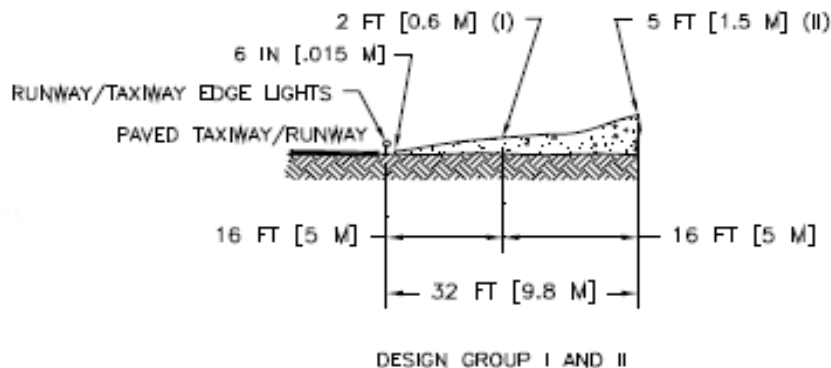


Figure 4-1. Snow Bank Profile Limits Along Edges of Runways and Taxiways with the Airplane Wheels On Full Strength Pavement

- c) Tenants are responsible for snow clearing in their lease area, however the NAA performs snow removal for a nominal fee. Tenants may contract their own snow removal, however contractors must provide proof of insurance naming the City of Nashua and the Nashua Airport Authority as additional insureds and must undergo driver training to operate on the airport.
- d) After all priority areas are cleared, care should be taken to ensure all lights and signs are dug out and are visible to pilots.
- e) Care should always be taken to ensure snow is not stockpiled in taxiway or taxilane safety areas or object free areas unless it meets the criteria in Figure 4-1 above. Snow should never be stockpiled in the Runway Safety Areas or Object Free Areas.
- f) If snow needs to be hauled away, there are at least two areas where it can be dumped. Typically, snow is stored at the old grass tie-downs or out of the way on India Ramp.
- g) NAVAIDs/Weather Observation Equipment:
 - a. Snow should never be stored or dumped in the critical areas of the localizer or glide slope. Also, when blowing snow from the runway, ejected snow should never be directed at PAPI's or any other NAVAIDs.
 - b. No snow may be piled within 50 feet of the AWOS system and there should be no piles of snow over 7 feet high within 200 feet of the AWOS.
- h) Controlling/Mitigating Snow Drifts is accomplished by utilizing snow trenches or snow fences where applicable. Each year, a snow fence is deployed in the field adjacent to the air traffic control tower to mitigate the hazards of snow drifting across Perimeter Rd.

Wind ditches are typically cut along all east-west taxiways such as TWY B, TWY C, TWY D etc. A minimum of two wind ditches has been found to be useful in mitigating snow drifting across the stub taxiways. Deeper the ditches and steep the sidewalls make this technique most effective.

- i) In years of heavy snowfall, it is advantageous to run a snow blower along both sides of the lights on the runway and along the taxiways to make room for additional snowfall. This technique prevents lights from becoming buried in snow.
- j) At the time of the writing of this document, the NAA does not use any FAA approved anti or deice chemicals or applications. There are no approved locations on the airport for the chemical deicing of aircraft.

Section 5 - Runway Incursion/Surface Incident Mitigation Procedures

Each year at the pre-season snow meeting, any incidents in the past will be discussed to ensure they do not occur again. Also, any ideas for preventing accidents or incidents during snow removal are encouraged to be shared.

Vehicles will be marked and lighted in accordance with AC 150/2510-5, *Painting, Marking and Lighting of Vehicles Used on an Airport*.

- a) Radio Communications. NAA vehicle operators identify themselves to the air traffic control tower by the number of the vehicle they are operating. Requests for access to the Airport Movement Area (AMA) should be made on Ground frequency at 121.8 Mhz. Operators should continually monitor this frequency while they are operating on the taxiways.

Requests for access to the runway should be made on Tower frequency at 133.2 MHz and operators should continually monitor the frequency while operating on the runway surface.

- b) In the event of failed radio communication with ATC, operators should exit the Airport Movement Area and contact the air traffic control tower by phone. If an operator finds themselves in a situation where they cannot communicate with the air traffic control tower via radio and they need to access the Airport Movement Area or the runway to get back to the shop (i.e. on the northeast side of the runway) to have radio equipment inspected, they should call the air traffic control tower via phone at (603) 595-2104 in order to get clearance to cross the runway or to access the AMA. If a piece of equipment is unable to communicate with the air traffic control tower via radio, either it should be parked until the radio can be serviced, or a handheld radio should be taken to ensure two way communications is maintained.

- d) In the event of low visibility and/or whiteout conditions the maintenance supervisor may suspend snow removal operations until they can be conducted safely.

Section 6 – Surface Condition Reporting

- a) Condition reporting will be provided whenever the pavement condition is worse than bare and wet and when conditions change. NOTAMS will be issued to inform pilots and the public about surface conditions.

In general, conditions will be reported as:

- Surface conditions by contaminants types and depths.
- Friction reporting if applicable (i.e. braking action good, medium, poor or nil)
- When the cleared runway width is less than full width, and if there are uncleared runway edges with a different condition from cleared width on runway.

Generally, during winter conditions, the airfield will be inspected more regularly to assess any changing conditions. Days with higher winds should trigger more frequent inspections and care should be taken during freeze/thaw cycles as snow typically blows onto paved surfaces, melts and then refreezes causing ice.

NOTAMS should be continually adjusted to reflect the actual conditions on the airport. Conditions to be aware of that may prompt changes to surface conditions might include:

- Active snow event
- Plowing/brooming/deicing
- Rapidly rising or falling temperatures
- Rapidly changing conditions

Typically, conditions are assessed in an operations vehicle, however any vehicle could serve to assess airfield conditions. At the time of the writing of this document, no mechanical devices are being utilized to measure friction conditions on paved surfaces. As of October 1, 2016, vehicle braking action reports will no longer be an acceptable means of conveying runway information to pilots.

It is the maintenance supervisor's responsibility to ensure the NOTAMS issued accurately reflect the current conditions on the airport.

- b) In December, 2005 a Boeing 737 overran a snow-covered runway at BWI, killing a 5-year-old boy in a vehicle the aircraft collided with. The FAA responded by developing the TALPA ARC (Takeoff and Landing Performance Assessment Aviation Rulemaking Committee) which was a consortium of aircraft operators, airports and alphabet groups tasked with addressing requirements for aircraft and airport operators. The committee developed the Runway Condition Assessment Matrix (RCAM) which was designed to convey standardized information to pilots about contamination on runways in an objective format. The RCAM chart is shown

below. The RCAM divides the runway into thirds with a 6 being dry pavement and a 0 being braking action NIL.

Assessment Criteria		Downgrade Assessment Criteria		
Runway Condition Description	Code	Mu (μ) ¹	Vehicle Deceleration or Directional Control Observation	Pilot Reported Braking Action
• Dry	6	40 or Higher	---	---
• Frost • Wet (Includes Damp and 1/8 inch depth or less of water) 1/8 inch (3mm) depth or less of: • Slush • Dry Snow • Wet Snow	5		Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	Good
5° F (-15°C) and Colder outside air temperature: • Compacted Snow	4	39 to 30	Braking deceleration OR directional control is between Good and Medium.	Good to Medium
• Slippery When Wet (wet runway) • Dry Snow or Wet Snow (Any depth) over Compacted Snow Greater than 1/8 inch (3mm) depth of: • Dry Snow • Wet Snow Warmer than 5° F (-15°C) outside air temperature: • Compacted Snow	3	29 to 21	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	Medium
Greater than 1/8 (3mm) inch depth of: • Water • Slush	2	20 or Lower	Braking deceleration OR directional control is between Medium and Poor.	Medium to Poor
• Ice ²	1		Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	Poor
• Wet Ice ² • Slush over Ice • Water over Compacted Snow ² • Dry Snow or Wet Snow over Ice ²	0		Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	Nil

¹ The correlation of the Mu (μ) values with runway conditions and condition codes in the Matrix are only approximate ranges for a generic friction measuring device and are intended to be used only to downgrade a runway condition code; with the exception of circumstances identified in Note 2. Airport operators should use their best judgment when using friction measuring devices for downgrade assessments, including their experience with the specific measuring devices used.

² In some circumstances, these runway surface conditions may not be as slippery as the runway condition code assigned by the Matrix. The airport operator may issue a higher runway condition code (but no higher than code 3) for each third of the runway if the Mu value for that third of the runway is 40 or greater obtained by a properly operated and calibrated friction measuring device, and all other observations, judgment, and vehicle braking action support the higher runway condition code. The decision to issue a higher runway condition code than would be called for by the Matrix cannot be based on Mu values alone; all available means of assessing runway slipperiness must be used and must support the higher runway condition code. This ability to raise the reported runway condition code to a code 1, 2, or 3 can only be applied to those runway conditions listed under codes 0 and 1 in the Matrix.

The airport operator must also continually monitor the runway surface as long as the higher code is in effect to ensure that the runway surface condition does not deteriorate below the assigned code. The extent of monitoring must consider all variables that may affect the runway surface condition, including any precipitation conditions, changing temperatures, effects of wind, frequency of runway use, and type of aircraft using the runway. If sand or other approved runway treatments are used to satisfy the requirements for issuing this higher runway condition code, the continued monitoring program must confirm continued effectiveness of the treatment.

Caution: Temperatures near and above freezing (e.g., at 26.6° F (-3°C) and warmer) may cause contaminants to behave more slippery than indicated by the runway condition code given in the Matrix. At these temperatures, airport operators should exercise a heightened level of runway assessment, and should downgrade the runway condition code if appropriate.

- c) NOTAMS will be issued conveying the Runway Condition Code (RCC) as well as a description of the surface contaminants through the NOTAM system by calling 1-

877-487-6867. The caller will convey the surface contaminants of the runway in thirds and the briefer will calculate the RCC to be placed in the NOTAM.

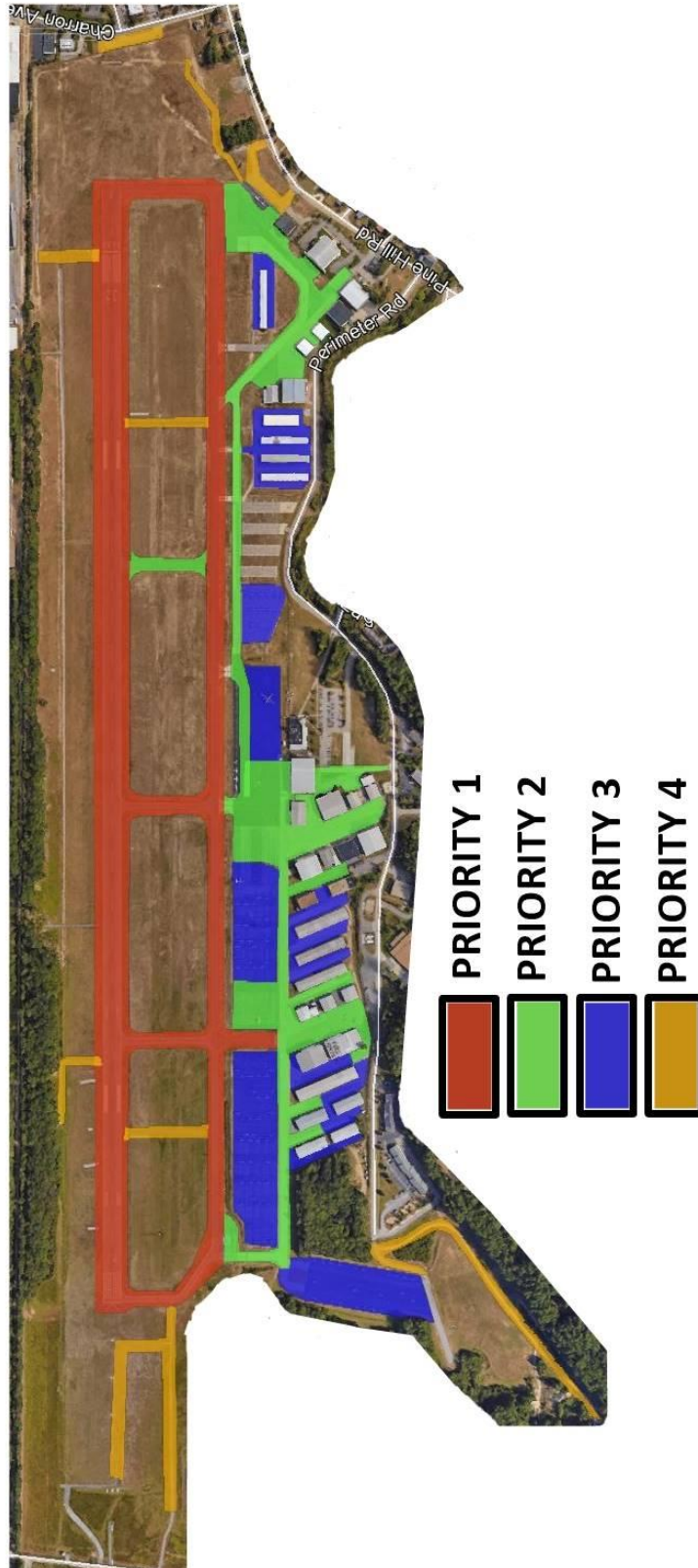
Section 7 – Post Season Activities

- a) Post Season Snow Meeting. After each snow season, a Post Season Snow Meeting will be held, typically in April to review the snow season issues and recommend any changes to this plan for subsequent years. The same topics as the Pre-Season Snow Meeting will be reviewed.
- b) The Airport Maintenance Department will assess all snow removal equipment and initiate any repairs or changes of wear parts, etc.
- c) The Airport Manager will update this SICP if necessary based on the Post Season Snow Meeting recommendations

Section 8 – Appendix A-1 Snow Clearing Priority Areas

Figure A-1 – Snow Clearing Priority Areas

Appendix A-1 Snow Clearing Priority Areas



Appendix B

U.S. Department of the Interior, Fish and Wildlife Service Correspondence



United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087



January 7, 2008

Reference:	<u>Project</u>	<u>Location</u>
	Airport runway extension	Nashua, NH

William DeLuca
Baystate Environmental Consultants, Inc.
296 North Main St.
East Longmeadow, MA 01028

Dear Mr. DeLuca:

This responds to your recent correspondence requesting information on the presence of federally-listed and/or proposed endangered or threatened species in relation to the proposed activity(ies) referenced above.

Based on information currently available to us, no federally-listed or proposed, threatened or endangered species or critical habitat under the jurisdiction of the U.S. Fish and Wildlife Service are known to occur in the project area(s). Preparation of a Biological Assessment or further consultation with us under Section 7 of the Endangered Species Act is not required.

This concludes our review of listed species and critical habitat in the project location(s) and environs referenced above. No further Endangered Species Act coordination of this type is necessary for a period of one year from the date of this letter, unless additional information on listed or proposed species becomes available.

In order to curtail the need to contact this office in the future for updated lists of federally-listed or proposed threatened or endangered species and critical habitats, please visit the Endangered Species Consultation page on the New England Field Office's website:

www.fws.gov/northeast/newenglandfieldoffice/EndangeredSpec-Consultation.htm

In addition, there is a link to procedures that may allow you to conclude if habitat for a listed species is present in the project area. If no habitat exists, then no federally-listed species are present in the project area and there is no need to contact us for further consultation. If the above conclusion cannot be reached, further consultation with this office is advised. Information describing the nature and location of the proposed activity that should be provided to us for further informal consultation can be found at the above-referenced site.

Thank you for your coordination. Please contact us at 603-223-2541 if we can be of further assistance.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Anthony P. Tur". The signature is fluid and cursive, with a distinct loop at the end.

Anthony P. Tur
Endangered Species Specialist
New England Field Office

Memo



NH NATURAL HERITAGE BUREAU

To: William DeLuca, Baystate Environmental Consultants, Inc.
296 North Main St.
East Longmeadow, MA 01028

From: Melissa Coppola, NH Natural Heritage Bureau

Date: 11/19/2007 (valid for one year from this date)

Re: Review by NH Natural Heritage Bureau

NHB File ID: NHB07-1861

Project type: Other: Airport improvements

cc: Kim Tuttle

Town: Nashua, Merrimack

Location: Tax Maps: sheet E and lot 60

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

Comments: NHB has concerns about the impact this project may have on plants and/or natural communities and would like more information about the project details.

Plant species

	State ¹	Federal	Notes
Northern Blazing Star (<i>Liatrix scariosa</i> var. <i>novae-angliae</i>)	E	--	Threats to this highly imperiled species are development activities that eliminate its habitat and invasion of its open, grassy habitat by trees and shrubs.
Wild Lupine (<i>Lupinus perennis</i>)	T	--	This wildflower grows in extremely dry, sandy openings and is easily identified in the field (see any wildflower guide) between early May and August. It is tolerant of surrounding disturbance and depends upon periodic mowing (or, historically, wildfire) to eliminate trees that would otherwise shade it out. It does not transplant well due to a tap root that can be more than three feet long.

Vertebrate species

	State ¹	Federal	Notes
Banded Sunfish (<i>Enneacanthus obesus</i>)	--	--	Contact the NH Fish & Game Dept (see below).
Blanding's Turtle (<i>Emydoidea blandingii</i>)	--	--	Contact the NH Fish & Game Dept (see below).
Eastern Hognose Snake (<i>Heterodon platirhinos</i>)	T	--	Contact the NH Fish & Game Dept (see below).
Spotted Turtle (<i>Clemmys guttata</i>)	--	--	Contact the NH Fish & Game Dept (see below).

¹Codes: "E" = Endangered, "T" = Threatened, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

Contact for all animal reviews: Kim Tuttle, NH F&G, (603) 271-6544.

A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on

Memo



NH NATURAL HERITAGE BUREAU

information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. For some purposes, including legal requirements for state wetland permits, the fact that no species of concern are known to be present is sufficient. However, an on-site survey would provide better information on what species and communities are indeed present.



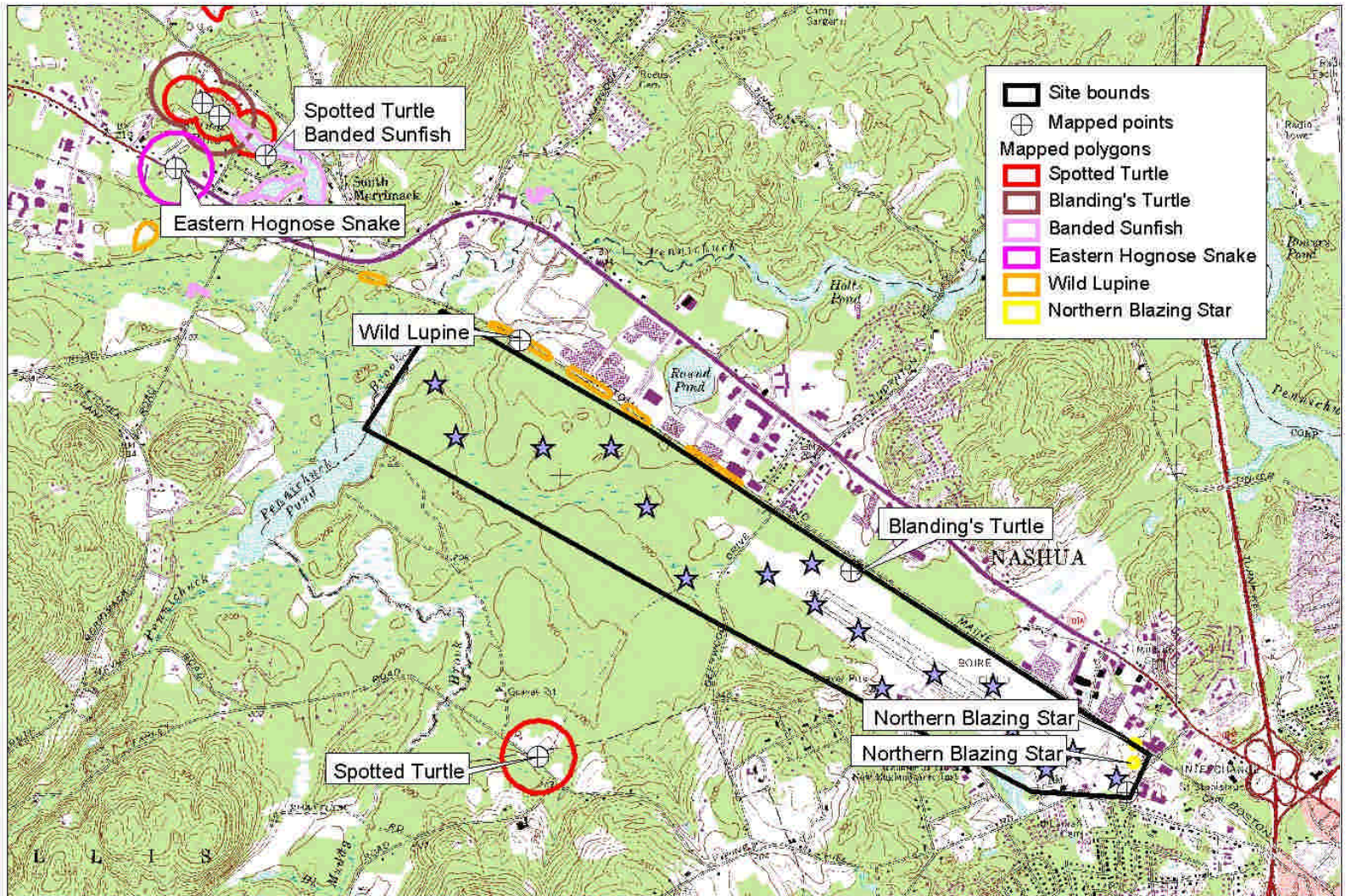
NHB07-1861



NH NATURAL HERITAGE BUREAU

Known locations of rare species and exemplary natural communities

Note: Mapped locations are not always exact. Occurrences that are not in the vicinity of the project are not shown.



0.25 0 0.25 0.5 0.75 1 Miles

1:31000

*Historical record

Valid for one year from this date: 19 Nov 2007

New Hampshire Natural Heritage Bureau - Plant Record

Northern Blazing Star (*Liatris scariosa* var. *novae-angliae*)**Legal Status**

Federal: Not listed
 State: Listed Endangered

Conservation Status

Global: Rare or uncommon
 State: Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Not ranked
 Comments on Rank:

Detailed Description: 2006: 401 stems counted, 35% in flower. 2005: 12 plants, 8 in bud.

General Area: 2006: Dominant species were *Danthonia spicata* (poverty oatgrass), *Schizachyrium scoparium* (little bluestem), and *Festuca rubra* (red fescue). Associated species: *Rumex acetosella* (red sorrel), *Asclepias amplexicaulis* (blunt-leaved milkweed), *Lespedeza capitata* (round headed bush-clover), *Hypericum gentianoides* (orange grass), *Lechea maritima* (seabeach pinweed), *Lechea intermedia* var. *intermedia* (intermediate pinweed), *Carex tonsa* var. *rugosperma* (shaved sedge), *Juncus tenuis* (pointed auricle path rush), *Ionactis linariifolius* (stiff-leaved aster), *Dichanthelium linearifolium* (linear-leaved panic grass), *Oenothera biennis* (biennial evening primrose), *Carex pensylvanica* (Pennsylvanian sedge), *Hieracium* spp. (hawkweed), *Polygonella articulata* (jointweed), *Viola pedata* (bird's-foot violet), *Trifolium arvense* (rabbit-foot clover), and *Trichostema dichotomum* (bluecurls). 2005: Grassy/sandy area within airport property, some near railroad and road. Dominant/characteristic species are *Danthonia spicata* (poverty oatgrass), *Schizachyrium scoparium* (little bluestem), and *Festuca rubra* (red fescue). An additional 19 herbaceous plant species are listed as occurring in the immediate vicinity of the *Liatris* plants.

General Comments: 2006: Much larger population than previously thought, and more plants are likely to occur elsewhere on the airport property or in nearby open areas and railroad corridor. Abundant suitable habitat nearby.

Management Comments: 2006: Mowing had cut off most flowering stems before maturity. Delay mowing in fence margin area until late fall to allow for seed production and dispersal. 2005: Landowner is aware of plant and has been asked to delay mowing until late fall to allow for seed dispersal.

Location

Survey Site Name: Boire Field Airport
 Managed By:

County: Hillsborough
 Town(s): Nashua
 Size: 1.4 acres

USGS quad(s): South Merrimack (4207175)
 Lat, Long: 424633N, 0713010W
 Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Take NH Rte. 101A to Charron Ave. Take Charron Ave. SW about 150 m to gravel parking/pull-off on right next to airport fence. Plants are in grassy/sandy area mostly inside fenced airport property, but a few plants are located at the SW edge of the grass SW of the pull-off, and SW of nearby railroad that crosses Charron Ave.

Dates documented

First reported: 2005-06-23 Last reported: 2006-07-20

Kane, Chris. 2006. Field survey to Boire Field Airport on July 20.

New Hampshire Natural Heritage Bureau - Plant Record

Wild Lupine (*Lupinus perennis*)**Legal Status**

Federal: Not listed
State: Listed Threatened

Conservation Status

Global: Demonstrably widespread, abundant, and secure
State: Imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Fair quality, condition and/or landscape context ('C' on a scale of A-D).
Comments on Rank:

Detailed Description: 2002: Five or more patches of varying size up to 50 x 100 feet in area, were found flowering and with immature seed pods, along ca. 0.5 mile of RR tracks. Several individual plants were scattered in vicinity. 1990: Nashua, ca. 150 plants. Amherst, 2 plants. Merrimack, 5 plants.

General Area: 1990: Alongside railroad tracks.

General Comments: 2002: RR track runs behind industrial/commercial businesses. To the south and west is the City of Nashua's Northwest Conservation Area (former Pennichuck-Westwood property).
1990: See quad sheet for specific locations along railroad tracks.

Management
Comments:

Location

Survey Site Name: Nashua, B&M Railroad, Rte. 101A
Managed By:

County: Hillsborough
Town(s): Nashua
Size: 14.3 acres

USGS quad(s): South Merrimack (4207175)
Lat, Long: 424754N, 0713238W
Elevation: 200 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2002: From Everett Turnpike, Exit 7W (Rte. 101A). Proceed 2 miles west. Turn left (SW) on to Deerwood Dr. Guilford Industries (B& M Railroad) track is at terminus. Gate marks rear entry to Boire Airport. Plants are distributed along RR tracks in northwest direction for ca. 0.5 mile. Patches are relatively large and interspersed within ca. 75 feet of track on northeast side. 1990: B & M Railroad, Rte. 101A. Along sides of railroad tracks. Populations mapped along tracks in Nashua, Amherst, and Merrimack.

Dates documented

First reported: 1990
Last reported: 2002-06-12

Poole, Eann, and D. H. Geiger. 2002. Field visit to Nashua, B& m Railroad, Rte 101a on June 12.

New Hampshire Natural Heritage Bureau - Animal Record

Banded Sunfish (*Enneacanthus obesus*)**Legal Status**

Federal: Not listed
State: Not listed

Conservation Status

Global: Demonstrably widespread, abundant, and secure
State: Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2005: Area 4562M: 1 observed. Area 9018: 7 observed. 1998: Area 4562M: 100 observed, age and sex unknown (Obs_id 1896). 1938: Pennichuck Brook: Specimen.

General Area: 2005: Area 9018: Freshwater pond. 1998, 2005: Area 4562M: Freshwater pond (Obs_id 1896). 1938: Pennichuck Brook: Brook, vegetation abundant. Water lily, Potamogeton, Ceratophyllum. Shore with rush marsh. Deep swamp stream.

General Comments: 1998: Area 4562M: Swampy pond with lots of pickerel weed, white and yellow water lily, watershield, coontail, Closely bordered by houses, lawns, trees where most of them are found. Seem to be somewhat abundant. ID verified by Larry Stolte USFWS National Fish Hatchery, Nashua.

Management
Comments:

Location

Survey Site Name: Stump Pond
Managed By:

County: Hillsborough
Town(s): Amherst
Size: 20.2 acres

USGS quad(s): South Merrimack (4207175)
Lat, Long: 424827N, 0713340W
Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2005: Area 9018: Witches Brook at South Merrimack Rd. 1998: Area 4562: Stump Pond in Amherst/Merrimack, NH. From nearby dock at 15 Willow Lane (Obs_id 1896). 1938: Pennichuck Brook: 0.25 miles above T9, 0.6 miles E of South Merrimack.

Dates documented

First reported: 1938
Last reported: 2005-09-19

Bailey, R. M. 1938. New Hampshire Fish and Game. Field Notes, Coll. Blanks Corr. to STA. M-107, M1 to STA. M11-10, M160. Field data files.

New Hampshire Natural Heritage Bureau - Animal Record

Blanding's Turtle (*Emydoidea blandingii*)**Legal Status**

Federal: Not listed
State: Not listed

Conservation Status

Global: Apparently secure but with cause for concern
State: Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 1996: Area 6451: 1 adult.1992: Area 6604: 4 adults. Area 6606: 2 young. Area 2067: 2 adults.1990: Area 8845: 2 turtles.

General Area: 1996: Area 6451: Sedges/alder at pondside.1992: Area 2067: Basking on logs near Great Blue Heron nests in cattails/ open water.

General Comments: 1996: Area 6451: Observed by Trudy Loy. Also reported 2 fifty-cent sized Blanding's turtles at Tiffany Square, a vernal pool of unknown location in the same area.1990: Area 8845: Observed by Trudy Loy with David Carroll.

Management
Comments:

Location

Survey Site Name: Stump Pond
Managed By:

County: Hillsborough
Town(s): Amherst
Size: 83.3 acres

USGS quad(s): South Merrimack (4207175)
Lat, Long:
Elevation: 195 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 1996: Area 6451: [From South Merrimack, take the Boston Post Rd north ca. 1.0 mile to the inlet stream for Stump Pond. Site is downstream, near junction of inlet with the pond.] 2nd inlet above Stump Pond.1992: Area 2067: Terrault's marsh upstream from Stump Pond, across Boston Post Road [near trailer park]. Area 6604: Just upstream from McPhee's Landing, across from Jasper's Landing. Area 6606: Just below Jasper's Landing.

Dates documented

First reported: 1990-06-07 Last reported: 1996-03-27

Loy, Trudy. 1990. Rare turtle records at Stump Pond on June 7.

New Hampshire Natural Heritage Bureau - Animal Record

Blanding's Turtle (*Emydoidea blandingii*)**Legal Status**

Federal: Not listed
State: Not listed

Conservation Status

Global: Apparently secure but with cause for concern
State: Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2005: Area 9291: 1 adult male turtle.
General Area: 2005: Area 9291: Red maple forest/swamp, low wet depressions and even a bit of peatland according to airport employee.
General Comments:
Management
Comments:

Location

Survey Site Name: Nashua Airport
Managed By:

County: Hillsborough
Town(s): Nashua
Size: 1.9 acres

USGS quad(s): South Merrimack (4207175)
Lat, Long:
Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Area 9291: North side of Boire Field airstrip at Nashua Airport. Turtle was in wet grass between airstrip and forest to north of airport.

Dates documented

First reported: 2005-06-01
Last reported: 2005-06-01

New Hampshire Natural Heritage Bureau - Animal Record

Eastern Hognose Snake (*Heterodon platirhinos*)**Legal Status**

Federal: Not listed
State: Listed Threatened

Conservation Status

Global: Demonstrably widespread, abundant, and secure
State: Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 1998: 2 seen. Adults. (Obs_id 1998.0389).

General Area: 1998: Overgrown grass on sand bordering woods with many wood frogs in it. (Obs_id 1998.0389).

General Comments:
Management
Comments:

Location

Survey Site Name: Pennichuck Pond
Managed By:

County: Hillsborough
Town(s): Amherst
Size: 30.8 acres

USGS quad(s): South Merrimack (4207175)
Lat, Long: 424825N, 0713402W
Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 1998: 124 Route 101A. Face rear of lot. Behind building on right (Obs_id 1998.0389).

Dates documented

First reported: 1998-07-15

Last reported: 1998-07-15

New Hampshire Natural Heritage Bureau - Animal Record

Spotted Turtle (*Clemmys guttata*)

Legal Status

Federal: Not listed
State: Not listed

Conservation Status

Global: Demonstrably widespread, abundant, and secure
State: Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 1998: 1 male seen, notch code L3R9 (Obs_id 1992.1127). 1 female seen, notch code L2R2. Adult. (Obs_id 1998.038). 1996: 2 adult females observed on 5/30 and 5/1. "30" (?) adults reported seen on 3/27. 1992: 4 seen. Adults. (4/21 Obs_id 1992.0082, 5/7 1992.0318). 1 female seen. Adult. (Obs_id 1992.002). 1 adult seen, notch code L2 R3. 1993: 2 females seen, one with notch code L3R2 (Obs_id 1992.1127, 1993.0046). 1990: 12 individuals observed.

General Area: 1996: At or near inlet of pond, with sedge/alder vegetation (Obs_id 1996.0156). Also sighted were 2 Blanding's and 1 painted turtle. 1993: Sedge/alder/red maple, with painted turtles. 1992: Basking on logs near great blue heron nests in cattails/open water (Obs_id 1992.0318). Sedge/alder channels (Obs_id 1992.0082). Sedges, alders and red maples (Obs_id 1992.002).

General Comments: 1996: Observed by Trudy Loy. Basking on sedge (Obs_id 1996.0156) 1990: Observed by Trudy Loy and David Carroll.

Management
Comments:

Location

Survey Site Name: Stump Pond
Managed By:

County: Hillsborough
Town(s): Amherst
Size: 43.0 acres

USGS quad(s): South Merrimack (4207175)
Lat, Long:
Elevation: 195 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 1996: 2nd inlet bend above Stump Pond (Obs_id 1996.0156). 1993: Sedges at head of pond, just above Jasper's Landing (Obs_id 1993.0046, 1992.0082). 1992: 2nd inlet bend above Stump Pond (Obs_id 1996.0156), 2' upstream of "gold mine" at head of pond (Obs_id 1992.002). Stump Pond; first cove up from Jasper's Landing (Obs_id 1992.1127). [From South Merrimack, take the Boston Post Rd north ca. 1.0 mile to the inlet stream for Stump Pond. Site is downstream, near junction of inlet with the pond.] Sightings at "First bend inlet head of pond in sedges", "From 'Gold Mine' at head and McPhee's Landing", and "Within fifteen feet, either side McPhee's landing". Also Terrault's Marsh, upstream from Stump Pond, across Boston Post Rd. (Obs_id 1992_0318).

Dates documented

First reported: 1990-06-07 Last reported: 1996-05-30

Loy, Trudy. 1990. Rare turtle records at Stump Pond on June 7.

New Hampshire Natural Heritage Bureau - Animal Record

Spotted Turtle (*Clemmys guttata*)**Legal Status**

Federal: Not listed
State: Not listed

Conservation Status

Global: Demonstrably widespread, abundant, and secure
State: Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2004: 1 female seen. Adult. (Obs_id 2004.0097).
General Area: 2004: Lower part of the yard is swampy (Obs_id 2004.0097).
General Comments: 2004: Spotted turtle came up from the swamp and laid eggs in the sand (Obs_id 2004.0097).
Management
Comments:

Location

Survey Site Name: Muddy Brook
Managed By:

County: Hillsborough
Town(s): Hollis
Size: 30.8 acres

USGS quad(s): South Merrimack (4207175)
Lat, Long:
Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2004: Residence on Hollis/Nashua line. Muddy brook skirts edge of lawn, then crosses road (Obs_id 2004.0097).

Dates documented

First reported: 2004-06-09
Last reported: 2004-06-09

Appendix C

New Hampshire Natural Heritage Bureau's *Rare Plants, Rare Animals, and Exemplary Natural Communities in New Hampshire Towns 2007*

**FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES
IN NEW HAMPSHIRE**

COUNTY	SPECIES	FEDERAL STATUS	GENERAL LOCATION/HABITAT	TOWNS
Belknap	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Meredith, Alton and Laconia
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Carroll	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Albany, Brookfield, Eaton, Effingham, Madison, Ossipee, Wakefield and Wolfeboro
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Coos	Canada Lynx	Threatened	Regenerating softwood forest, usually with a high density of snowshoe hare.	All Towns
	Dwarf wedgemussel	Endangered	Connecticut River main channel and Johns River	Northumberland, Lancaster and Dalton
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Cheshire	Dwarf wedgemussel	Endangered	S. Branch Ashuelot River and Ashuelot River	Swanzey, Keene and Surry
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Grafton	Dwarf wedgemussel	Endangered	Connecticut River main channel	Haverhill, Piermont, Orford and Lyme
	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Holderness
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Hillsborough	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Manchester, Weare
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Merrimack	Karner Blue Butterfly	Endangered	Pine Barrens with wild blue lupine	Concord and Pembroke
	Small whorled Pogonia	Threatened	Forests	Bow, Danbury, Epsom, Loudon, Warner and Allenstown
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide

**FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES
IN NEW HAMPSHIRE**

COUNTY	SPECIES	FEDERAL STATUS	GENERAL LOCATION/HABITAT	TOWNS
Rockingham	Piping Plover	Threatened	Coastal Beaches	Hampton and Seabrook
	Roseate Tern	Endangered	Atlantic Ocean and nesting at the Isle of Shoals	
	Red knot ¹	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal towns
	Small whorled Pogonia	Threatened	Forests	Deerfield, Northwood, Nottingham, and Epping
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Strafford	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Middleton, New Durham, Milton, Farmington, Strafford, Barrington, and Madbury
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Sullivan	Northeastern bulrush	Endangered	Wetlands	Acworth, Charlestown, Langdon
	Dwarf wedgemussel	Endangered	Connecticut River main channel	Plainfield, Cornish, Claremont and Charlestown
	Jesup's milk-vetch	Endangered	Banks of the Connecticut River	Plainfield and Claremont
	Northern Long-eared Bat	Threatened Final 4(d) Rule	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide

¹Migratory only, scattered along the coast in small numbers

-Eastern cougar, gray wolf and Puritan tiger beetle are considered extirpated in New Hampshire.

-Endangered gray wolves are not known to be present in New Hampshire, but dispersing individuals from source populations in Canada may occur statewide.-There is no federally-designated Critical Habitat in New Hampshire

Appendix D

UMass Archeological Services Literature Review and Walkover Survey



UNIVERSITY OF MASSACHUSETTS
AMHERST

Archaeological Services
Department of Anthropology
Blaisdell House
310 Hicks Way
Amherst, MA 01003-9280

voice: 413.545.1552
fax: 413.577.1458

Mr. Armand Dufresne
Gale Associates, Inc.
15 Constitution Drive
Bedford, NH 03110-6041

July 31, 2008

**Re: Nashua Municipal Airport
Management Memorandum for Phase 1A Archaeological Assessment Survey**

Dear Armand,

Enclosed please find a copy of the management memorandum that provides a summary of the findings of the archaeological Phase 1A assessment at the Nashua Municipal Airport. The airport in general exhibits low sensitivity for unrecorded Native American or historical archaeological sites. No additional survey or testing is recommended for the Runway and Taxiway Relocation and Expansion Project.

With your approval, a copy of this memorandum will be submitted to the NH SHPO. The comprehensive draft survey report is currently in preparation and will be provided for your review shortly. Thank you for your assistance on this project.

Best Regards,

A handwritten signature in black ink, appearing to read "Timothy Binzen", with a stylized flourish at the end.

Timothy Binzen

GALE ASSOCIATES, INC.

AUG 01 2008

RECEIVED

Management Memorandum
Phase 1A Archaeological Assessment Survey of Nashua Municipal Airport (Boire Field)
Nashua, New Hampshire

Submitted to Gale Associates Inc. on July 31, 2008 by Timothy Binzen, Project Archaeologist
UMass Archaeological Services (413) 577-0776. (tbinzen@tei.umass.edu)

Introduction

An archaeological Phase 1A Assessment survey was performed for the property of the Nashua Municipal Airport. The main focus of the survey was the Area of Potential Effects (APE) of the programmed Runway and Taxiway Relocation and Expansion Project at the airport. The survey was conducted in order to evaluate the level of archaeological sensitivity of the APE and the airport in general for unrecorded pre-Contact Native American and historical resources.

Section 4.8 of the 1998 EA indicates that the New Hampshire State Historic Preservation Office (SHPO) was last contacted in 1981 to determine whether there were historically significant areas or structures on the airport or in the vicinity of the project area. Apparently, the SHPO responded in 1981 that there were no such areas or structures known to exist on the airport or in the project vicinity. The current proposed improvements (except for two approach light stations) are located on airport property. However, the extent of previous historical or archaeological surveys at the airport was unclear and it was not known whether the areas slated for disturbance within the APE have been previously "cleared" by the New Hampshire SHPO. Further, standards and other information may have changed over the past 26 years that make it prudent to conduct the necessary literature reviews and field observations to confirm either that this project will not disturb any significant archaeological or historical resources.

Scope. Gale Associates, Inc. ("Gale") retained Archaeological Services at the University of Massachusetts-Amherst to perform an archaeological Phase 1A assessment survey in order to assess archaeological sensitivity at the airport. The Phase 1A archaeological assessment included background research, a field reconnaissance, and consultation with the airport manager, but no subsurface testing. This memorandum summarizes the results of the Phase 1A assessment and provides findings for archaeological sensitivity at the Nashua Municipal Airport.

Authority. Archaeological Services conducts archaeological investigations in accordance with federal and state legislation and regulations concerning the impact to archaeological properties from federally funded or permitted activities. Legislation and regulations include the National Historic Preservation Act of 1966 as amended (PL 89-665); the National Environmental Policy Act of 1969 (PL 91-190, 42 USC 4321); Executive Order 11593 of 1971 (16 USC 470); Procedures for the Protection of Historic and Cultural Properties (36 CFR 800); and the Archaeological and Historical Preservation Act of 1974 (PL 93-291). State legislation dealing with the protection of historical and archaeological resources is summarized in the New Hampshire Division of Historical Resources' *Procedures for Identifying Cultural Resources* (1992).

Survey Area Boundaries and Description

Geographic Setting. The City of Nashua is centrally located in the Merrimack River Valley, bounded to the east by the Merrimack River, situated to the north and south of the Nashua River and located south of the Pennichuck River. The Nashua Municipal Airport is located in the northwest part of Nashua, west of Route 3, south of Route 101A, and approximately 1.5 mile north of the Nashua River. The airport has an elevation of 200 feet, and contains approximately 355 acres.

Airport Layout. The runway at the airport is approximately 5,500 feet long and 100 feet wide, and is oriented from northwest to southeast. The parallel taxiway is on the southern side of the runway. Access to the airport is from Perimeter Road. The airport terminal, hangars, and other structural facilities are located on the southern side of the central section of the runway. The safety areas beyond the runway ends consist of level expanses of grass.

The APE for the proposed Runway and Taxiway Relocation and Expansion Project includes the safety areas extending 1,000 feet from both ends of the runway, relocation of the runway 300 feet to the north, construction of a taxiway where the current runway is located, and construction of light stations at the western end of the airport.

Results of the Phase 1A Assessment Survey

Background Research. Background research for the Nashua Municipal Airport and for the general Nashua area was conducted at the New Hampshire Division of Historical Resources, Department of Cultural Resources. The state archaeological site files were consulted.

Regarding Native American resources, Victoria Bunker Kenyon has written the most extensive reports concerning the pre-Contact period in the Merrimack River Valley, including areas around Nashua. Based on her work at the Mine Falls park sites (27 HB 32, 33, 34) and other sites, she has concluded that the area was widely used by Native American populations of the Valley. Terraces along the Merrimack River and numerous falls, streams and tributaries made the area rich for short-term sites for food collection, which is reflected in the preponderance of tools found that were designed for hunting and fishing (Kenyon, 1984:16).

The Price (1967) map of Major Historic Indian Trails of South Central New Hampshire indicates that the Nasamok Trail ran just north of Nashua and met with four other major trails at the Merrimack River, suggesting that this area was an important point for the region's Native population. More recent work has turned up a variety of Native American sites, supporting the likelihood that areas around Nashua may contain additional unrecorded ancient sites. However, Nashua has gone through significant growth, during which many sites may have been partially destroyed. The area around the airport was not excluded from this activity. Various Phase I surveys and impact evaluations conducted over the past 30 years in Nashua reveal limited finds, such as project C-330158-03 located under a kilometer southeast from the airport. Completed in 1979, the report determined that cultural resources "are no longer present within the project area due to massive landscaping, land-filling, and construction" (Nicholas:1979, 4). The Nashua Park and Ride project, which was located to the northeast of the airport, found no significant archaeological resources.

To date, there are 17 known Native American sites within a 5-kilometer radius of the airport, with approximately 10 sites located along the edge of this radius to the east and northeast. A cluster of 8 sites are positioned north, northwest of the airport. Southeast of the airport are the important Mine Falls Park sites. No Native American sites have ever been recorded on the Nashua Municipal Airport property, or in areas directly adjacent to the airport.

From the 17th century to present day, Nashua has been influenced by Euro-American settlement. The earliest Euro-American settlements tended to be around the areas of Salmon Brook and incorporated what was known as Dunstable Township, which included settlements south of the contemporary city center of Nashua. Expansion of the township grew along the Nashua River to its confluence with the Merrimack. The 19th century saw an explosion of development with first a system of canals and then the railroad being built to increase industrial production specifically for the Nashua Manufacturing Company and smaller firms associated with it. The period from about 1824 to about 1840 was dominated by shipping up the Merrimack with the building of a canal and lock system to connect the Nashua and Merrimack Rivers. The introduction of the railroad cut back the use of the rivers, though they still played an important role in the development of the city. The Nashua and Wilton Railroad (now Boston to Maine line) ran along the road to the town of Merrimack. This was one of three main lines to depot in the city.

Because of the 19th century expansion and continued growth through to modern times, the remains of earlier settlements have been destroyed. Nashua does have a large amount of National Historic Register buildings and homes with the city center. Outside of the city of Nashua were family farms. Based on the 1857 map, the area around the modern-day airport was limited to agricultural holdings both to the west and east. By 1892, Hurd's map indicates a reduction in these family holdings.

Within a 5 km radius of the airport, there are only 3 recorded historical archaeological sites, none of which is located within 2 km from the airport. No historical archaeological sites are known on the airport property itself.

Historically, the area now occupied by the airport was used for farming, and consisted primarily of open grazing land during the historic period. Sandy soils made the vicinity sub-optimal for cultivation. In the early 20th century, a small turf airfield was established where the eastern end of the runway is located. In 1934, the City of Nashua acquired the property. The runway was paved, and federally-funded airport facilities were constructed between 1934 and 1939.

Results of Walkover Survey at Airport. Staff from Archaeological Services consulted with Mr. Royce N. Rankin, Jr., the Airport Manager. Mr. Rankin provided an informative jeep tour of the airport property. Afterwards, a walkover survey was conducted for the north side of the runway, the safety areas and eastern and western ends of the airport, and in outlying areas.

Visual inspection confirmed that while the central part of the airport property was naturally quite flat, all infield areas, safety areas, and the northern side of the main runway were graded when the modern runway was constructed, and large piles of topsoil were pushed to peripheral sections of the airport. A low grassy ridge on the north side of the runway, opposite the terminal area, consists of an artificial mound of topsoil. The north and northwest ends of the

airport property are marshy or contain wetland soils, and are partially wooded with greater distance from the end of the runway.

Expected Cultural Resources at the Airport

Native American Sites. The likelihood for the Nashua Municipal Airport project area to contain pre-Contact Native American archaeological resources is based upon several criteria. These include proximity to previously recorded ancient sites, the types and condition of soils, surficial geology, degree of slope, slope orientation, proximity to freshwater sources and wetlands, and proximity to useful resources or raw materials. The degree of previous disturbance also is considered.

Historical Sites. The likelihood for historical archaeological sites to be present in the airport project area was assessed through historical documents, maps, and town histories that describe the settlement systems and land use seen in Nashua during the historic period.

Assessment of Archaeological Sensitivity. The assessment of sensitivity for unrecorded archaeological resources at the Nashua Municipal Airport addresses the likelihood for pre-Contact Native American sites as well as historic-period resources.

Native American Site Sensitivity. The likelihood for the airport to contain significant, unrecorded Native American archaeological deposits or sites is LOW.

Historical Site Sensitivity. The likelihood for the airport to contain significant, unrecorded historical archaeological resources is LOW.

Recommendations

Due to the findings of low archaeological sensitivity (likelihood) for either Native American or historical sites at the Nashua Municipal Airport, the proposed Runway and Taxiway Relocation and Expansion Project is unlikely to affect significant archaeological resources. No additional survey or testing is recommended for the project.

Appendix E

City of Nashua Land Use Code

Chapter 190. Land Use

Part 2. Zoning Districts and Supplemental Use Regulations

Article IV. Overlay Districts

§ 190-21. Airport Approach Zone.

Purpose and findings: The increasing aircraft activity that is occurring at the Boire Field Municipal Airport has created the need for special zoning restrictions for uses subject to the most recently adopted Part 150 Noise Compatibility Plan prepared by the Boire Field Airport Authority. To avoid land use conflicts with uses which may be incompatible with noise levels generated at the Boire Field Airport, the regulations of the Noise Overlay District provide for the exclusion of certain land uses, and for soundproofing to be required in the construction of other uses which may be compatible if mitigating action is taken to reduce noise interference with the use.

A. Applicability.

- (1) In addition to the limitations and requirements set forth in the other articles of this Part **2** for various zoning districts within the City, any use, structure or object of natural growth situated within the limits of Airport Approach Zones and other restricted areas shall be further governed by the limitations of this section.
- (2) All other articles of this Part **2**, including those relating to permits, nonconforming uses and variances, shall, where applicable, apply to the persons and subject matter governed by this Part **2**.
- (3) Prior to filing an application for development approval within the Airport Approach Zone, the applicant shall submit a Federal Aviation Administration (FAA) Form 7460-1 to the FAA, and shall submit the comments of the FAA as part of the application for approval.

B. Establishment of airport approach plans. Any publicly owned airport or privately owned airport licensed for commercial operations, existing or which may be developed, shall have an airport approach plan prepared by the New Hampshire Aeronautics Commission in accordance with RSA 424 as last amended. The airport approach plan for the Boire Field, adopted by the New Hampshire Aeronautics Commission February 12, 1968, is hereby declared to be part of this section.

C. Boire Field airport approach plan.

- (1)

This airport approach plan, prepared under the authority of RSA 424:3, is based upon the ultimate development of a general aviation type airport with a runway 14/32 5,550 feet and a primary surface 5,900 feet by 1,000 feet.

- (2) Federal Aviation Regulations, Part 77, effective May 1, 1965, establishes the standards used to determine the limit of height of obstructions in the vicinity of the airport.
 - (3) The limit of height of obstructions shall be:
 - (a) In the approach zone to Runway 32 (SE end), which is 500 feet wide at a point 200 feet from the end of the runway and 2,500 feet wide at a point 10,200 feet from the end of the runway, an inclined plane of 40:1 slope.
 - (b) In the approach zone to Runway 14 (NW end), which is 1,000 feet wide at a point 200 feet from the end of the runway and 7,000 feet wide at a point 10,200 feet from the end of the runway, an inclined plane of 50:1 slope, widening thereafter to 16,000 feet at a point 50,200 feet from the end of the runway, an inclined plane of 40:1 slope.
 - (c) On the sides of the primary and approach surfaces, an inclined plane of 7:1 slope from the edges of those surfaces. This subsection does not limit the height of a structure or tree to less than 30 feet above the ground upon which it is located.
 - (d) Within 7,000 feet of the airport reference point 150 feet above the airport, 349 feet above sea level.
 - (e) Between 7,000 feet and 12,000 feet from the airport reference point, a conical surface with a slope of 20:1 measured in a vertical plane passing through the center of the airport.
 - (4) The airport reference point is located on the center line of the runway, 2,750 feet from the southeast end of the runway, and the airport elevation is 199 feet above mean sea level (USGS Datum).
 - (5) Noise compatibility zones for the affected areas in the vicinity of the Boire Field Airport are hereby established based on the Ldn contours for aircraft noise as defined by the most recently approved Federal Aviation Regulation Part 150 Noise Compatibility Program for the Boire Field Airport. A generalized map of the approximate location of these zones is illustrated in the Noise Exposure Map. The boundaries of the Noise Overlay Zones are shown in the Part 150 Boire Field Airport Noise Compatibility Program.
- D. Height limits. No structure or tree shall be erected, altered or allowed to grow within an airport approach zone and adjacent area above a height of 30 feet above the ground on which it is located unless the inclined plane is more than 30 feet above the ground, in which case a structure or tree may be erected, altered or allowed to grow up to the level of the plane or the height limitation of § 190-16, whichever is less.
- E. Permitted uses.
- (1) Notwithstanding any other provisions of this Part 2 no use may be made of land within the airport hazard area in such manner as to:
 - (a) Create electrical or visual interference with any electronic facility or instrumentation, wherever located within the airport hazard area, including

but not limited to, radio transmitters and receivers, radar installations, landing and navigational aids and weather instruments where such facilities are used in connection with the landing, taking off and maneuvering of aircraft;

- (b) Make it difficult for flyers to distinguish between airport lights and others;
 - (c) Result in glare in the eyes of flyers using the airport;
 - (d) Impair visibility in the vicinity of the airport;
 - (e) Cause physical objects of any nature to penetrate, however briefly, the air space above the imaginary surfaces established in this article, such objects including but not limited to kites, balloons, projectiles, rockets, model aircraft, derricks and cranes, unless a special temporary permit be obtained from the authorities in charge of the affected airport;
 - (f) Establish or alter privately owned flying fields, strips or heliports, unless found not to be objectionable after a special aeronautical study by federal aviation authorities;
 - (g) Create bird strike hazards;
 - (h) Otherwise endanger the landing, taking off, or maneuvering of aircraft.
- (2) Uses prohibited in the noise overlay zones shall be as specified in the Table of Land Use Compatibility Standards. Soundproofing shall be required for certain land uses in each of the noise overlay zones as shown in the Table of Land Use Compatibility Standards (Table 21-1 below). Where soundproofing is required, no building permits shall be issued until the applicant has demonstrated that the building design is capable of achieving the noise level reduction required in the Table of Land Use Compatibility Standards.

Table 21-1

Table of Land Use Compatibility Standards

Land Use	Yearly Day/Night Average Sound Level (Ldn) in Decibels					
	Below					
	65	65-70	70-75	75-80	80-85	Over 85
Schools (any category)	Y	N(1)	N(1)	N	N	N
Hospitals (any category)	Y	25	30	N	N	N
Churches; exhibition, convention or conference structures; performance theaters; or theaters	Y	25	30	N	N	N
Governmental offices	Y	Y	25	30	N	N
Transportation, communication, information and utilities (generally)	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)

Table 21-1**Table of Land Use Compatibility Standards**

Land Use	Yearly Day/Night Average Sound Level (Ldn) in Decibels					
	Below 65	65-70	70-75	75-80	80-85	Over 85
Parking lots	Y	Y	Y(2)	Y(3)	Y(4)	N
Office buildings	Y	Y	25	30	N	N
Warehousing and storage uses	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail (general sales or service) uses	Y	Y	25	30	N	N
Utility uses and structures	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication antennas, radio/television stations, telecommunication towers, telephone repeater stations	Y	Y	25	30	N	N
Industrial and manufacturing uses, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Agriculture (except livestock)	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Excavation of sand, gravel and clay	Y	Y	Y	Y	Y	Y
Sports stadiums, arenas, coliseums, or assembly halls	Y	Y(5)	Y(5)	N	N	N
Amphitheaters, outdoor stages, band stands	Y	N	N	N	N	N
Golf courses	Y	Y	25	30	N	N

Source: 14 CFR Part 150, Article X, Division 1

Key to Table 21-1:

Numbers in parentheses refer to notes.

"Y (Yes)" means land use and related structures compatible without restrictions.

"N (No)" means land use and related structures are not compatible and should be prohibited.

"NLR" means noise level reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

"25, 30, or 35" means that the land use and related structures are generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

Notes to Table 21-1:

- (1) Where school uses are permitted by a use variance, measures to achieve outdoor to indoor noise level reduction (NLR) of at least 25 dB and 30 dB should be incorporated into buildings. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year-round. However, the use of NLR criteria will not eliminate outdoor noise problems.
 - (2) Measures to achieve NLR 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
 - (3) Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
 - (4) Measures to achieve NLR 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal level is low.
 - (5) Land use compatible provided special sound reinforcement systems are installed.
 - (6) Residential buildings require an NLR of 25.
 - (7) Residential buildings require an NLR of 30.
 - (8) Residential buildings not permitted.
- F. Signs. Within the fenced perimeter of Boire Field, a sign permit (see § 190-94) for any proposed sign advertising a business or service located thereon may be issued by the airport manager or his designee, subject to review by the Nashua Airport Authority and in compliance with the requirements set forth below:
- (1) No sign may be directed at or oriented to any street that serves the airport with the intent that the sign not be visible to or readable from said street, except as provided in the Boire Field Sign Standards booklet.
 - (2) The Administrative Officer shall assist the airport manager in the preparation and updating of the Boire Field sign standards booklet. In no event shall sign size exceed the maximum permitted in the PI Zoning District. (See Article X of this chapter.)
 - (3) The airport manager shall consult with the Administrative Officer as necessary concerning compliance with these requirements.
 - (4) The Administrative Officer may cause any sign to be removed that does not comply with these requirements, or as otherwise specified in the PI Zoning District. (See Article IX of this chapter.) Appeals concerning the removal of any sign shall be as set forth in § 190-136.
- G. Variances. In granting a variance from this article, the Zoning Board of Adjustment may, if such action is deemed advisable to effectuate the purposes of this article and is reasonable in the circumstances, condition the variance to require the owner of the structure or object of natural growth in question to permit the City, at its own expense, to install, operate and maintain thereon such markers and lights as may be necessary to indicate to flyers the presence of an airport hazard.

