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Chapter One

INTRODUCTION

In 1998, the Beverly Airport Commission (BAC) contracted with Dufresne-Henry, Inc., consulting engineers and planners, to prepare an Airport Master Plan Update (AMPU) for the Beverly Municipal Airport in Beverly, Massachusetts. The purposes of this AMPU are to (1) define the airport's role within the community, and (2) provide guidance for management of capital-improvement projects at the airport. This study helps prepare the BAC for the future by identifying an organized approach for meeting projected aviation-demand levels and Federal Aviation Administration (FAA) safety and design standards at the Beverly Municipal Airport. The BAC has developed a mission statement for the facility, as follows:

> The primary mission of Beverly Municipal Airport (John Mountain Field) is to provide aerial access to Beverly and the North Shore region for private, business, and corporate aircraft.
>
> A secondary mission is to enhance the desirability of Beverly and the North Shore as a location for businesses, outlets, offices, and manufacturing facilities by providing direct corporate access for executive visits, raw materials/components, and finished products. The continued presence of the airport is regarded as an asset that has, in the past, facilitated the development of the Cherry Hill Business Park and other North Shore businesses. Based on an estimate made by the Massachusetts Aeronautics Commission, the airport currently "fuels the region's economy with an annual economic impact of 14 million dollars."
>
> Another important mission is the continued support of recreational flying. More than 120 private aircraft are based at Beverly. The airport is now participating in and facilitating the development of Beverly's new Garden City Airport Industrial Park, which will offer additional nonaviation space for industrial development. It is expected that corporate decisions relative to branch and subsidiary locations will continue to be influenced by the availability of aviation access.
>
> The aviation career-training mission is another major concern. With four flight schools and the North Shore Community College Aviation Science Program, there can be more than 300 student pilots enrolled in various levels of pilot

training at any one time. A local chapter of the youth-oriented Civil Air Patrol is also housed here.

To ensure the provision of service to the based aircraft, flight schools, and corporate visitors, the airport is committed to cooperation with and encouragement of its fixed based operators and other support businesses located at the airport. The airport is more than 70 years old and many facilities require significant updating consistent with environmental requirements. The challenge the airport faces is to modernize the airport within strict budget limitations by the City of Beverly.

This AMPU project is financed jointly by the FAA, the Massachusetts Aeronautics Commission (MAC), and the BAC through a planning grant under the Airport Improvement Program (AIP) of the FAA Reauthorization Act of 1994 (AIP Project #3-25-0006-1498).

1.1 PLANNING PROCESS

An AMPU is prepared because the community and/or airport users need to define guidelines for future airport improvements and to identify existing safety and capacity deficiencies at the airport. An AMPU identifies a logical, organized approach for meeting both existing and future airport demands. This approach considers financial, environmental, and social constraints, which can be as important to an airport's viability as its development. Each development recommendation is tied to a projected aviation-demand level or to recommendations to increase airport safety.

An AMPU document consists of several chapters. Each chapter provides systematic analyses that lead the reader along a natural progression, from the inventory of existing conditions to the recommendation of improvement programs. Guidance for preparing an AMPU comes from the FAA, specifically Advisory Circular (AC) 150/5070-6A, *Airport Master Plans*. Various other documents are referenced throughout this report to support the credibility and success of the development recommendations.

According to AC 150/5070-6A, the objectives of an AMPU are as follows:

a. To provide an effective graphic presentation of the future development of the airport and anticipated land uses in the airport vicinity.

b. To establish a realistic schedule for implementation of the development proposed in the plan, particularly for the short-term capital-improvement program.

c. To propose an achievable financial plan to support the implementation schedule.

d. To justify the plan technically and procedurally through a thorough investigation of concepts and alternatives on technical, economic, and environmental grounds.

e. To present for public consideration, in a convincing and candid manner, a plan that adequately addresses the issues and satisfies local, state, and federal regulations.

f. To document policies and future aeronautical demands for reference in municipal deliberations on spending and debt incurrence and land-use controls (e.g., subdivision regulations and the erection of potential obstructions to air navigation).

g. To set the stage and establish the framework for a continuing planning process. Such a process should monitor key conditions and adjust plan recommendations if required by changed circumstances.

In addition to the AMPU report, a set of drawings called the Airport Layout Plan (ALP) provides a graphic description of the airport and the improvement recommendations.

Public participation is an important function in developing the AMPU report. Information provided by the public has the benefit of tailoring the planning process specifically to the needs of the airport and local community. A Planning Advisory Committee (PAC) was organized by the BAC. Volunteers with various perspectives regarding Beverly Municipal Airport or airports in general served on this committee and provided valuable input to the planning process for this AMPU. Figure 1-1 illustrates the process for developing an AMPU.

1.2 OVERVIEW OF AIRPORT ISSUES

The original *Airport Master Plan* for the Beverly Municipal Airport was completed in 1972 and updated in 1980 and again in 1990. The 1990 update predicted modest growth of aviation activity

insert Figure 1-1
Master Planning Process

at the airport; however, due to a downturn in the economy, aviation activity decreased throughout the early 1990s. Therefore, it is necessary to reevaluate the improvement needs.

Another need for this AMPU resulted from a recent study of a proposed industrial park adjacent to the airport, which identified several focus issues to be addressed in this AMPU, including but not limited to the following:

- regaining runway safety areas (RSAs)
- regaining runway object-free areas (ROFAs)
- reducing/eliminating runway displacements
- maintaining a runway with a 5,000-foot length
- determining runway classifications
- identifying likely environmental mitigation efforts
- providing site planning for general-aviation terminal areas
- obtaining conformance with airport design standards
- identifying a likely capital-improvement plan for the next 20 years

All of these issues are discussed in the following chapters. Because this document represents an update, efforts are made to reference information in the 1972 *Airport Master Plan* and the 1990 *Airport Master Plan Update* rather than duplicating it in this text.

Chapter Two

INVENTORY OF EXISTING FACILITIES

The first step in the planning process is to prepare an inventory of existing facilities at the airport. This inventory was conducted using the following sources of information:

- previous AMPUs
- on-site visits
- interviews with airport management, tenants, and users
- coordination with local planning representatives
- federal, state, and local publications
- PAC input
- project record drawings

This chapter describes the physical facilities of Beverly Municipal Airport (BVY) and the surrounding community. Aviation-specific information about the airspace, other airports in the area, aviation activity at BVY, and role of the airport also is described. As previously discussed, this document is an update to the master plan. Information that has not changed significantly and is not necessary for this update (e.g., the history of the airport) is not repeated herein.

Airport development is a constant process and changes to the physical facilities at an airport can occur during preparation of the master plan. As a result, information included in the inventory may be changed during development of the master plan. Where possible, these changes are discussed in later chapters of this report.

2.1 AIRPORT LOCATION AND ROLE

Beverly Municipal Airport, designated by the FAA with the identifier “BVY,” is located in eastern Massachusetts approximately 15 nautical miles (NM) north of Boston’s Logan International Airport. This 412-acre site is located in the northwestern portion of the City of Beverly, with portions of the property also falling within the towns of Wenham and Danvers.

The Airport Reference Point, a geographic coordinate used to locate the airport, is 42° 35' 3" N latitude, 70° 54' 59" W longitude, and the field elevation is 108 feet above mean sea level (MSL). Figure 2-1 shows the location of the airport relative to Essex County. Figure 2-2 shows the general location of the airport relative to other airports in proximity to Beverly Municipal Airport. Ground access to the airport is provided by several state and interstate roads. State Route 128 provides east-west access through Beverly just south of the airport; State Route 97 provides north-south access adjacent to the airport. Interstate 95 also provides north-south access west of BVY, and the airport is just a 10-minute drive from the interstate.

The airport, which is owned by the City of Beverly and operated by the BAC, serves the general-aviation community of primarily private and corporate pilots and aircraft users. The FAA's National Plan of Integrated Airport Systems (NPIAS) designated BVY as a reliever airport to Logan, meaning that BVY provides facilities for smaller aircraft, allowing them to remain clear of the congestion of larger aircraft around Logan. Typical flight activities at BVY include private recreational and business flying, flight instruction, air-taxi service, and corporate aviation. BVY can be used for emergency medical flights as necessary.

Since the previous AMPU was completed in 1990, there have been numerous airport projects at BVY funded by the FAA and MAC. Tables 2-1a and 2-1b summarize all FAA and MAC funded projects since the completion of the 1990 AMPU.

Insert Figure 2-1
Location Map

Insert Figure 2-2
Vicinity Map

TABLE 2-1a
FAA-FUNDED AIRPORT PROJECTS: 1990 - 2000

FAA AIP Number	Project Description	FAA Amount
07-91	Air Traffic Control Tower Line-of-sight Clearing and Revegetation	$163,866
08-88	Land Acquisition	$154,407
09-94	Holding-apron Construction; Runway-threshold Reconstruction; Taxiway Marking; Runway-approach Grubbing, Grading, and Seeding; Fence Design; Taxiway Design and Reconstruction	$471,687
10-95	Install Fencing	$483,949
11-96	Acquire Property Interests in the Runway Protection Zone	$468,000
12-96	Install Medium-Intensity Runway Lights; Taxiway Guidance Signs; Runway Marking	$313,320
13-97	Purchase Snow-Removal Equipment	$126,148
14-98	Airport Master Plan Update	$94,500
15-99	Construct Taxiway; Install Airfield Guidance Signs	$385,000
Site Total		**$2,660,877**

Source: Federal Aviation Administration

TABLE 2-1b
MAC FUNDED AIRPORT PROJECTS: 1990 - 2000

MAC Grant Date	Project Description	MAC Amount
2/19/91	Electrical Vault Construction Change Order	$34,051
4/11/91	Remove Fuel Tank, Replace Windsock & Segmented Circle	$14,000
5/9/91	Tree Clearing & Runway Marking	$8,719
6/12/91	Tank Removal Change Order	$15,960
2/26/92	Tank Removal Change Order	$1,635
3/25/92	Replace Septic System	$72,500
6/24/92	Crack Repairs	$5,250
10/26/92	Septic System Change Order	$4,849
4/29/93	Remove Fuel Tanks	$6,650
7/26/94	Design Taxiway A Reconstruction & Security Fencing	$5,306
7/19/95	Airfield Security Fencing	$27,541
8/23/95	Reconstruct Taxiway A	$18,550
3/27/96	Permitting & Engineering for Implementation of VMP	$133,807
6/26/96	RW 16-34 Edge Lights, Groove 16-34, Remove Shoulders	$24,500
6/25/97	West Side Sewer and Water Line	$80,000
6/25/97	Purchase Snow Removal Equipment	$9,870

MAC Grant Date	Project Description	MAC Amount
1/21/98	Tree Clearing on Airport Property	$120,935
5/14/98	Airport Master Plan Update	$7,350
5/14/98	Land Use Study; Sam Fonzo Drive	$15,372
5/20/99	Land Acquisition; Runway 16 RPZ	$44,058
9/15/99	Extend Taxiway D, Upgrade Guidance Signs, MALS Maintenance	$56,925
Site Total		**$707,828**

Source: Massachusetts Aeronautics Commission

2.2 AIRPORT FACILITIES

The following subsections describe existing facilities at BVY. The airfield is inventoried first, followed by the approaches and existing navigational aids (NAVAIDs), general-aviation support facilities, landside components such as access and parking, nonaviation facilities, and utilities.

2.2.1 Runways and Taxiways

Beverly Municipal Airport has two asphalt runways: Runway 16-34, which is 4,637 feet long, and Runway 9-27, which is 5,001 feet long and designated as the primary runway. The landing threshold of the Runway 16 end has been displaced 239 feet, meaning that pilots can begin their takeoff run at the end of the runway but should not land before the threshold. It has medium-intensity runway lights (MIRLs) along the edges and is marked for the nonprecision approach to the Runway 16 end. The landing threshold on the Runway 27 end has been displaced 190 feet. This runway also is lit with MIRLs and is marked for visual approaches. (Approach types are discussed later in this chapter.) Figure 2-3 shows the runway layout at the airport. A third runway, Runway 2-20, which was depicted in the previous AMPU, was closed in 1994 and converted to a taxiway to reduce pavement maintenance costs. In 1994, this pavement was converted to Taxiway F, a 50-foot-wide taxiway with 100 feet of abandoned pavement on one side. Table 2-2 provides pertinent data regarding the runways.

TABLE 2-2
RUNWAYS

Runway	Length (feet)	Width (feet)	Surface	Gradient (percent)	End Elevation (feet above MSL)
16	4,637	100	Asphalt	0.4	107.5
34	4,637	100	Asphalt	0.4	87.8
9	5,001	150	Asphalt	0.4	69.9
27	5,001	150	Asphalt	0.4	91.5

Source: 1991 *Airport Layout Plan*

Insert Figure 2-3
Runway and Taxiway Layout

The runways are served by a network of taxiways, which also are shown in Figure 2-3. Taxiways A and C have medium-intensity taxiway lights (MITLs). Table 2-3 summarizes the size and function of each taxiway.

TABLE 2-3
TAXIWAYS

Taxiway	Length (approx.)	Width	Function
A	3,350 feet	50 feet	Provides access to Runway 27 from eastern and western ramp areas. Also includes holding bay.
B	4,200 feet	40 feet	Provides access to Runways 9 and 16 from western ramp areas. Also includes holding bay.
C	400 feet	50 feet	Provides connection from Taxiway B to intersection with Runway 16-34.
D	1,700 feet	50 feet	Provides access to Runway 9 from Taxiway B. Also includes holding bay.
E	400 feet	50 feet	Abandoned.
F	2,200 feet	50 feet	Re-use of Runway 2-20 between Runways 9-27 and 16-34. Provides exit from runways.

Source: 1991 *Airport Layout Plan*

2.2.2 Approach and Navigational Aids

Several NAVAIDs assist pilots in finding and flying to and from the airport. An air traffic control tower (ATCT) is located on the eastern side of the airport. The ATCT, which is operated by a private corporation under contract to the FAA, operates from 8 a.m. to 9 p.m. during the summer season (May 15 to October 31) and from 8 a.m. to 8 p.m. during the remainder of the year. Tower personnel provide clearance for aircraft ground movement, landings and takeoffs, and flight-plan clearance for aircraft operating under instrument flight rules (IFR). An automated terminal information service recording provides airport weather information over the radio. When the ATCT is not operational, pilots can activate the lights and advise other pilots of their intentions using the same radio frequency that the tower uses during operation.

Beverly Municipal Airport is located within the Boston Class B airspace (this is discussed in more detail later in this chapter). Aircraft operating in the vicinity of BVY above 3,000 feet MSL must receive clearance from Boston Approach Control, which provides separation from aircraft operating within the entire Boston region, extending for a radius of 20 NM from Logan.

The airport also has several nonprecision instrument approach aids that provide pilots horizontal guidance when attempting to land. These aids, which primarily provide guidance to Runway 16 but can be used for a circling approach to any runway, include the following:

- a localizer located at the far end of Runway 16, which provides precise horizontal guidance to the runway

- a very high frequency omni-range station (VOR), located northwest of Lawrence Municipal Airport, which provides guidance for landings at the airport even though it is not on airport property

- a non-directional radio beacon (NDB) located 2.2 miles northwest of Runway 16 that provides only course guidance to the Runway 16 end; this equipment is not part of the airport. The NDB is scheduled for removal in the near future, but should be replaced with a Global Positioning System (GPS) approach.

- a GPS route to the airport, which does not use ground-based stations; signals are received from satellites to provide position information

Figures 2-4 through 2-7 depict the published instrument approaches to Beverly Municipal Airport.

A sub-standard medium-intensity approach lighting system (MALS) provides additional guidance to Runway 16. The MALS allows pilots to better find the approach for landing at the runway and aligning the aircraft with the runway during reduced-visibility conditions. The current system was installed in 1994, replacing an older system that had been decommissioned. It contains five bars of lights placed at approximately 200-foot intervals, ending just off the runway pavement. The MAC funded and maintains the current MALS, which does not meet the FAA standards for MALS

Insert Figure 2-4
Localizer Approach to Runway 16

Insert Figure 2-5
VOR Approach to Runway 16

Insert Figure 2-6
NDB Approach To Runway 16

Insert Figure 2-7
GPS Approach to Runway 16

installations because it contains only the innermost five of the standard seven light-bar system. Runway-end identifier lights (REILs) are also part of the MALS.

Other NAVAIDs at the airport include the following:

- a precision approach-path indicator (PAPI), which provides visual guidance to Runway 16
- a lighted wind sock and segmented circle located near the middle of the airfield: the wind sock allows pilots to determine wind direction at the airport; the segmented circle indicates traffic pattern
- a rotating airport beacon, which allows pilots to visually locate the airport at night
- REILs for Runway 34; these high-intensity strobe lights make identification of the runway easier during low-visibility conditions
- an Automated Surface Observation System (ASOS), which provides meteorological information such as wind direction and speed, temperature and dewpoint, cloud-cover type, and elevation and altimeter settings to pilots and controllers via radio and telephone

2.2.3 Fixed-Base Operators

Four fixed-base operators (FBOs) offer aviation-related services to the public from their locations at BVY. Figure 2-8 shows the locations of these facilities, which are described as follows:

- General Aviation Services, Inc. (GAS) is located on the eastern and western side of the airport. This FBO provides flight instruction, aircraft rentals and charters, fuel sales, and maintenance.

- New England Flyers, Inc., is also located on the eastern side of the airport. This company provides flight instruction, charters, and aerial photogrammetry.

Insert Figure 2-8
Airport Facilities

- North Atlantic Air, Inc., is located on the western side of the airport and provides maintenance and service for all types of aircraft. This FBO also offers charter services for corporate aviation and fuel sales.

- Beverly Flight Center, Inc., is located on the western side of the airport in space leased from North Atlantic Air, and provides flight training and aircraft rentals.

2.2.4 Hangars

There are four hangar buildings on each side of the airport. The locations of these hangars are shown in Figure 2-8. On the eastern side, the northernmost hangar (two adjoining buildings) is currently being leased by North Atlantic Air, Inc., and Yannai Sightseeing, Ltd. This 36,000-square-foot facility has aircraft storage space and a maintenance area, and is in excellent condition. Until recently, it was used for maintenance, storage, and fueling of some of the GTE corporate aircraft.

The three other hangars on the eastern side, constructed by the Navy in 1941, are leased by GAS. Hangar 1 has approximately 6,400 square feet of floor space and is located adjacent to the GAS office. This hangar is used for aircraft maintenance and is in fair to good condition due to the age of the building. Hangars 2 and 3 are located behind the New England Flyers office and at the southern end of the eastern terminal area, respectively. Both hangars have approximately 4,800 square feet of floor space, are used primarily for aircraft storage, and are in relatively poor condition. On-site fire suppression is unavailable for most of the facilities, forcing tenants to rely on handheld extinguishers and response from the local fire department.

On the western side of the airport, two hangars are attached to the offices of and leased by North Atlantic Air. The 8,000-square-foot hangar west of the offices, used primarily for aircraft storage, also was constructed by the Navy and is currently in poor condition. The hangar east of the offices was constructed in 1981 and is in good condition; this 6,400-square-foot hangar is used primarily for maintenance.

North Atlantic Air also operates a 10-unit T-hangar building located south of its other facilities. This hangar was constructed in 1978 and is in good condition. Each unit can accommodate an aircraft that has less than 46 feet of wingspan and is less than 36 feet long. The two end units are slightly larger and can accommodate multiple aircraft.

GAS Hangar 4 has approximately 5,000 square feet of space, which is used for aircraft maintenance.

2.2.5 Aprons and Tiedowns

The airport has approximately 451,350 square feet of aircraft parking apron (also known as ramp) that contains approximately 181 tiedown spaces. The apron areas are shown in Figure 2-8 and are described as follows:

- Main Ramp: This aircraft apron encompasses approximately 72,000 square feet and is located in front of the ATCT. This apron contains 18 based-aircraft tiedowns leased by the BAC and an area for transient parking that can accommodate approximately 13 small aircraft.

- GAS Ramp: Approximately 18,000 square feet of ramp is located in front of the GAS maintenance hangar. This ramp has 17 tiedowns operated by GAS.

- BAC Ramp: This apron is 50,400 square feet in area and has potential for 36 paved tiedowns, of which three are seasonal. Of the existing tiedowns, 19 are operated by the BAC and the remainder by an FBO. This ramp is located west of the maintenance building and is used primarily by the BAC for based-aircraft parking.

- North Atlantic Air Ramps: A significant amount of apron is available around the North Atlantic Air buildings. A 67,500-square-foot ramp surrounds the buildings to the north and west, accommodating 25 aircraft tiedowns. South and east of the buildings is approximately 54,000 square feet of apron, which can accommodate 20 aircraft tiedowns. However, approximately 1 acre of this area has been designated for larger transient aircraft, which can accommodate approximately six corporate aircraft. South of this area, another 56,250 square feet of parking apron can accommodate 30 aircraft tiedowns.

- T-hangar Ramp: Adjacent to the 10-unit T-hangar, an 88,200-square-foot parking apron contains 20 tiedowns.

- GAS West Ramp: The GAS Hangar 4 aircraft ramp is located east of the FBO. This ramp encompasses approximately 45,000 square feet and accommodates 10 to 12 tiedowns.

The North Atlantic Air / Yannai Sightseeing, Ltd., lease also includes a ramp located adjacent to the hangar. This 19,800-square-foot concrete area can accommodate four corporate aircraft.

2.2.6 Fuel Facilities

Currently, two of the FBOs provide aircraft fueling at the airport. GAS has storage tanks for 5,000 gallons of jet fuel (recently reduced from 10,000 gallons) and 8,000 gallons of 100LL fuel for piston aircraft. GAS also maintains four fueling trucks, each with a 1,200-gallon capacity.

North Atlantic Air also provides fuel. This FBO has two 10,000-gallon aboveground fuel tanks: one for jet fuel and one for 100LL. North Atlantic Air also carries fuel in two trucks: a 2,000-gallon truck for jet fuel and a 1,200-gallon truck for 100LL.

2.2.7 Airport Maintenance, Management, and Snow Removal

A 5,000-square-foot structure located south of L.P. Henderson Road serves as the airport management offices, vehicle maintenance, and storage building. Approximately 2,500 square feet of this building serves as storage for airport maintenance (i.e., grass- and brush-cutting equipment) and snow-removal vehicles. There also is a 1,250-square-foot vehicle-maintenance bay. Administrative offices, a shower, a restroom, and a lunchroom occupy approximately 1,000 square feet of the northern end of the maintenance building. A 2,500-square-foot paved area south of the building is used for additional airport maintenance vehicle storage. Figure 2-8 shows the location of this facility.

Currently, the airport operates the following equipment:

- two 35,000 GVW/trucks/Viking plow system (main plow with wing-plow capability, 17-foot width)

- one VOHL snowblower: 28 tons/hour

- one Caterpillar bucket loader: 3- and 5-cubic-yard buckets

- one 3/4-ton pickup with plow

- three rotary mowers: 4-cylinder
  - 1 Ford
  - 1 International Harvester
  - 1 Minnesota Moline

- one Army surplus 5-ton dumptruck

2.2.8 On-Airport Ground Access and Automobile Parking

Access to the airport from the surrounding network of roads is provided to each side of the field. L.P. Henderson Road is a two-lane road leading to the facilities on the eastern side of the airport from Cabot Street, which runs north to Wenham and south to Beverly. On the western side, McCulloch Road provides access to airport facilities from Old Burley Street.

At the end of L.P. Henderson Road is a centrally located automobile parking lot with 96 parking spaces. This lot serves all of the facilities on the eastern side. Five additional spaces are located adjacent to the airport administration building.

On the western side, approximately 80 marked spaces are provided in the area of the North Atlantic Air complex. Approximately 10 vehicle spaces are also available in the area of GAS Hangar 4; however, these spaces are unpaved and not well defined. Figure 2-8 shows the parking areas.

2.2.9 Nonaviation Facilities

On the eastern side of the airport, there are several buildings that are not used specifically for airport-related activity. South of the GAS maintenance hangar is a building that houses a restaurant and office space. East of the aviation facilities are several vacant buildings that were used formerly for manufacturing sites.

2.2.10 Utilities

- Water: As discussed in the 1990 *Airport Master Plan Update*, water to the eastern side of the airport is supplied by the Salem-Beverly Water Supply Board through water mains owned by the City of Beverly. Water to west-side facilities is provided by two separate water systems. GAS Hangar 4 is connected to the Town of Danvers water-supply system, with a utility easement across adjoining private property to connect with the main water lines on Old Burley Street. North Atlantic Air was recently connected to the water main on Old Burley Street with an 8-inch water line running west of the FBO.

- Sewage: Sewage disposal on the eastern side of the airport is provided by an 8-inch sewer line that connects to the airport along Sam Fonzo Drive. On the western side, GAS Hangar 4 and North Atlantic Air both have connections to the municipal sewer system. The connection at North Atlantic Air was constructed in 1997; the GAS Hangar 4 connection runs through an easement.

- Electric: Electric service to the eastern side of the airport is supplied by Massachusetts Electric Co. New electrical lines were installed in 1985 to service the eastern side of the airport. Electricity to the western side is provided by Danvers Electric.

  The airport installed a new backup electrical system in 1990, including relocation and construction of a new electrical vault and installation of an 80-kW generator. This system is used for the airfield lighting circuit in the event of a power failure of the public utility system. The FAA also has a vault for the localizer at the Runway 34 end.

- Gas: Propane holding tanks are located at the airport maintenance building, on the eastern side of the FBOs, and on the western side of the airport at North Atlantic Air.

2.3 AIRSPACE

The FAA controls the National Airspace System and classifies airspace in four general categories: controlled, uncontrolled, special use, and other. Beverly Municipal Airport falls within controlled airspace during ATCT operations and within uncontrolled airspace at all other times. Only the classifications that relate to BVY and the immediate vicinity are discussed in the following paragraphs.

- Class B Airspace: This area of controlled airspace, formerly known as the Terminal Control Area, extends outward and upward from the busiest airports in the country; in the case of eastern Massachusetts, the Class B airspace extends from Logan International Airport in Boston. This airspace is tailored to meet specific needs of the area and, therefore, has several different “layers” depending on the distance from Logan. Within 8 NM of Logan, the Class B airspace extends from the surface up to 7,000 feet MSL. From 8 to 10.5 NM from Logan, the Class B airspace extends from 2,000 to 7,000 feet MSL. From 10.5 to 20 NM from Logan (which covers BVY), the Class B airspace extends from 3,000 to 7,000 feet MSL, except for a section in the northwestern portion of the Class B airspace that extends from 4,000 to 7,000 feet MSL from 15 to 20 NM. Figure 2-9 shows the airspace surrounding BVY.

  In general, aircraft operating within Class B airspace must meet the following criteria:

  - ATCT clearance to operate within the airspace
  - an operable radio for communicating with the ATCT
  - a pilot-in-command with at least a private pilot license

Insert Figure 2-9
Airspace

- a transponder with altitude-reporting capability (aircraft operating within 30 NM of the primary airport [i.e., Logan] must have this capability)

· Class D Airspace: This area of controlled airspace surrounds airports with an ATCT. For BVY, this airspace extends outward for approximately 5 NM and upward from the surface to 2,600 feet MSL. Pilots operating in this airspace must have communications with the ATCT; however, the Class D designation only occurs when the tower is operational. When the tower is closed, the airspace around BVY becomes Class G.

· Class E Airspace: This designation applies to airspace that is controlled but is not classified as A, B, C, or D. This airspace is still considered controlled because separation and communications services can be provided in that airspace; however, these services are not necessary. Class E airspace generally encompasses areas that are used for instrument approaches; at BVY, the Class E airspace extends northwest of the airport to accommodate approaches to Runway 16.

Low-altitude VOR airways (known as Victor airways) are also classified as Class E airspace. These airways provide travel routes used for cross-country navigation from one VOR facility to the next. The Class E airspace extends from 1,200 to 18,000 feet MSL. In the vicinity of BVY, Victor airway V3 passes directly over the airport.

· Class G Airspace: This airspace is uncontrolled and has no communications or equipment requirements. The area around BVY operates as Class G airspace when the ATCT is not in operation.

In the area within a 5-NM radius of BVY, the airspace between 2,600 and 3,000 feet MSL is classified as Class G, even when the tower is operational. However, a note on the aeronautical charts published by the National Oceanic and Atmospheric Administration (NOAA) indicates that pilots transitioning that area should contact Boston Approach Control.

2.4 FAR PART 77 OBSTRUCTION ANALYSIS

FAR Part 77, *Objects Affecting Navigable Airspace*, defines a set of imaginary planar surfaces that surround the immediate airport vicinity. These surfaces vary depending on the type of aircraft using the facility, number and layout of runways, and type of approaches to the airport. There are five surfaces associated with Part 77, which are defined in the following paragraphs and shown in the Part 77 Airspace Plan as part of the ALP set in Chapter Seven.

Aerial photogrammetry of the airport and surrounding areas was completed in 1994. The data collected as part of that effort was used to identify obstructions to existing airspace, with the primary focus being each runway approach and transitional surface.

The airport has been aggressively undertaking an obstruction-removal program for all identified obstructions contained on-airport. The most recent project completed in 1999 removed all on-airport obstructions. Figure 2-10 shows FAR Part 77 Obstructions to Runways 16 and 34; Figure 2-11 shows FAR Part 77 Obstructions to Runways 9 and 27. Following is a summary of the remaining off-airport obstructions to each of the protected surfaces.

2.4.1 Primary Surface

Runway 16-34 Primary Surface. This is a surface longitudinally centered on the runway centerline and extending 200 feet beyond the ends of the runway, with the same elevation as the nearest point on the runway centerline. The width of the primary surface is 500 feet for Runway 16-34, as defined for a runway with a straight-in nonprecision approach with visibility minima greater than three-fourths of a statute mile (SM). Currently, no vegetative obstructions to the Runway 16-34 primary surface exist at the facility, based on the 1994 photogrammetry.

Runway 9-27 Primary Surface. This is a surface longitudinally centered on the runway centerline and extending 200 feet beyond the ends of the runway, with the same elevation as the nearest point

Insert Figure 2-10
FAR Part 77 Obstructions to Runway 16 and Runway 34

Insert Figure 2-11
Part 77 Obstruction Analysis R/W 9-27

on the runway centerline. The primary surface for Runway 9-27 is also 500 feet wide. This is based on the Part 77 definition of other than utility runways with visual approaches. Currently, no vegetative obstructions to the Runway 9-27 primary surface exist at the facility, based on the 1994 photogrammetry.

2.4.2 Approach Surface

This is a surface centered on the runway centerline and extending outward and upward from each end of the primary surface. The approach surface begins at the end of the primary surface and widens with distance from the primary surface end. The dimensions of these surfaces are summarized in Table 2-4.

TABLE 2-4
FAR PART 77 IMAGINARY APPROACH SURFACES

Runway End	Inner Width (feet)	Outer Width (feet)	Length (feet)	Slope
Runway 16 (n-p 3/4+)	500	3,500	10,000	34:1
Runway 34 (visual)	500	1,500	5,000	20:1
Runway 9 (visual)	500	1,500	5,000	20:1
Runway 27 (visual)	500	1,500	5,000	20:1

Source: FAR Part 77

Based on these approach-surface dimensions (see Figures 2-10 and 2-11), the extent of off-airport vegetative obstructions was calculated based on the area involved and the number of off-airport parcels that contain the obstructions. Areal estimates are based on the number of 100x100-foot blocks that are shown to contain at least one obstruction; therefore, the areal estimates are likely to be greater than the actual acreage. Lot calculations are based on the most current assessors' maps for the individual municipalities.

The Runway 16 approach contains approximately 14 acres of off-airport obstructions contained within 18 residential lots. The Runway 34 approach contains 1 acre of obstructions, contained on two light-industrial lots. The Runway 9 approach contains approximately 3 acres of obstructions on nine lots. The Runway 27 approach contains 10 acres of obstructions on a mix of light-industrial and residential lots.

2.4.3 Transitional Surfaces

The transitional surfaces are inclined planes, parallel to the runway centerline, beginning at the edges of the primary surface. They extend upward and outward from the sides of the primary surface to the horizontal surface (i.e., 150 feet above airport elevation, 259 MSL), and from the side of the approach surface to the horizontal surface at a 7:1 slope (i.e., 1 foot of rise per 7 feet of run).

The extent of obstructions to the transitional surfaces was analyzed in the same manner as the approach surface. The Runway 16-34 transitional surface contains approximately 14 acres of obstructions on 12 residential and light-industrial lots. The Runway 9-27 transitional surface contains 6 acres of obstructions on 15 residential and light-industrial lots.

2.4.4 Horizontal Surface

This is a rounded or oval-shaped horizontal plane 150 feet above the airport elevation (i.e., 259 feet MSL). It is established by drawing semicircles of a given radius at the ends of the primary surface, and then joining these semicircles with tangent lines. For Runways 16-34 and 9-27, the larger radii of 10,000 feet are used for each runway end.

2.4.5 Conical Surface

This is a surface extending upward and outward from the edge of the horizontal surface (except where it is intercepted by the approach surface) at a slope of 20:1 for 4,000 feet (i.e., 4,259 feet MSL).

2.5 PAVEMENT ANALYSIS

Table 2-5 summarizes the history and existing pavement conditions at BVY. From a planning perspective, airfield pavements are assumed to require either a major overlay or full rehabilitation every 20 years. As shown, a significant number of paved surfaces are in poor condition and will have to be addressed in the short term to provide safe use of the airfield by operating aircraft. This subject is discussed in greater detail in Chapter Eight. Figure 2-12 also shows the pavement history.

TABLE 2-5
PAVEMENT HISTORY

Area #	Description	FAA Project Number	Year of Improvement	Condition	Strength x 1,000 lbs. (sw/dw/dtw)
1	Taxiway F	Not Applicable	1943	Poor	15 sw
2	Runway 9-27 Shoulders (outer 25 feet)	Not Applicable	1943	Poor	30/114/180
3	East Apron #1	9-19-026-D804	1968	Poor	n/a
4	West Apron	9-19-026-D804	1968	Poor	n/a
5	East Apron #2	ADAP 8-25-	1974	Poor	n/a
6	North Atlantic Air T-Hangar Apron	Not Applicable	1976	Poor	n/a
7	Runway 9-27	ADAP 5-25-	1977	Poor	30/114/180
8	Taxiway A (east of Runway 16-34)	ADAP 5-25-0006-07	1979	Good	60 dw
9	Taxiway D	ADAP 5-25-	1979	Good	60 dw
10	Taxiway B, including Holding Bay	ADAP 5-25-0006-08	1980	Good	60 dw
11	Runway 16-34	AIP 3-25-0006-	1985	Good	30/55/103

Area #	Description	FAA Project Number	Year of Improvement	Condition	Strength x 1,000 lbs. (sw/dw/dtw)
12	Taxiway C	AIP 3-25-0006-	1985	Good	60 dw
13	Taxiway A Holding Bay	AIP 3-25-0006-	1988	Good	60 dw
14	Runway 27 Threshold	AIP 3-25-0006-	1988	Good	60 dw
15	Runway 9 Threshold, Taxiway D Holding Bay	AIP 3-25-0006-09	1994	Excellent	60 dw
16	Taxiway A (west of Runway 16-34)	AIP 3-25-0006-11	1995	Excellent	60 dw

Source: Beverly Municipal Airport records

Insert Figure 2-12
Pavement History

2.6 METEOROLOGICAL INFORMATION

One of the factors affecting aircraft performance and airport design is the climate at the airport and in the surrounding region. Specifically, prevailing winds and temperature affect the performance of aircraft; these conditions are discussed in the following subsections. Precipitation, especially snow, also affects operations at the airport; therefore, meteorological conditions were analyzed.

2.6.1 Wind

In general, aircraft take off and land into the wind because they fly based on the speed through the air. Therefore, it is important to provide runway orientation at an airport that maximizes operations into the wind and minimizes crosswind conditions that could create unsafe conditions by blowing an aircraft sideways off course. Wind speed and directional information is gathered and stored by the National Climatic Data Center (NCDC), a division of NOAA. This information is used to generate a wind rose, which graphically depicts wind velocities and allows for the computation of crosswind conditions. FAA design standards present allowable crosswinds for different types of aircraft and recommend that 95 percent of wind conditions fall within the recommended crosswind allowances for an airport.

In general, wind conditions are analyzed for a 10-year period. Because the NCDC does not keep wind data for every airport, data from a nearby airport is acceptable as long as terrain and land conditions are similar. For this study, the wind data for Boston was used. Although BVY is not directly on the coast as Logan is, the proximity of the two airports provides enough correlation to use the same climatological data for both airports.

For this study, the wind data from 1988 to 1997 was used for the analysis. This information was entered into the FAA's airport design software, which also allows the user to specify runway directions and crosswind speed. The crosswind component can vary based on the size of aircraft using the airport; larger aircraft can handle higher crosswind speeds. Based on the criteria from AC 150/5300-13 (Change 5), *Airport Design*, the wind analysis was performed at 10.5-, 13-, and 16-knot crosswind components. Table 2-6 and Figure 2-13 present results for all-weather conditions at Beverly Municipal Airport.

Insert Figure 2-13
All Weather Wind Rose

TABLE 2-6
ALL-WEATHER WIND ANALYSIS

	Runway		
Crosswind	16-34	9-27	Both
10.5	77.26%	81.05%	94.87%
13	86.73%	89.98%	98.23%
16	95.33%	96.69%	99.44%

Source: Wind Tabulation for Boston, MA, 1988-1997;
National Climatic Data Center

As Table 2-6 indicates, the current configuration meets the recommended wind coverage for almost all aircraft using the airport. (The 10.5-knot coverage is so close that it would not be cost-effective to develop another runway just to add 0.13 percent coverage.) Each runway also was analyzed separately, and the table demonstrates that a single runway provides sufficient coverage only for the largest aircraft using the airport.

A wind analysis was performed for IFR conditions at the airport, based on when the ceiling (i.e., distance between the ground and the cloud cover) is between 300 and 1,100 feet MSL and visibility is between 1 and 3 SM. Table 2-7 and Figure 2-14 present results of this analysis.

TABLE 2-7
IFR WIND ANALYSIS

	Runway		
Crosswind	16-34	9-27	Both
10.5	77.44%	80.62%	91.65%
13	83.15%	89.28%	96.95%
16	91.62%	96.65%	99.01%

Source: Wind Tabulation for Boston, MA, 1988-1997;
National Climatic Data Center

Insert Figure 2-14
IFR Wind Rose

2.6.2 Temperature and Precipitation

Temperature is also a factor for airport design because aircraft typically need more runway for takeoffs and landings on hotter days. Therefore, the mean maximum temperature for the hottest month is used for airport design. Based on data gathered for Boston for the 10-year period from 1987 to 1996 (1997 data was not available at the NCDC as of this writing), the mean maximum temperature during the hottest month (usually July) for the Beverly area is 81.9°F. Precipitation data also was gathered for the same period. On average, annual precipitation in the Beverly area (with snow amounts converted to equivalent liquid amounts) is 43.4 inches. The actual average amount of snowfall per year (not converted to liquid equivalent) is 48.1 inches. On average, the area receives precipitation 76 days per year.

2.6.3 Visual Flight Rules and IFR Conditions

The percentage of a year that an airport operates under visual flight rules (VFR) and IFR conditions is also important for the development of facilities. This information is derived from wind tabulations provided by the NCDC. The following general assumptions were made regarding the cloud ceiling and visibility conditions:

- VFR ceiling ≥1,100 feet MSL and visibility ≥ 3 SM

- IFR ceiling <1,100 feet MSL but ≥ 300 feet MSL and/or visibility < 3 SM but ≥ 1 SM

- unusable ceiling < 300 feet MSL and/or visibility < 1 SM

Table 2-8 presents the percentage of the year that each condition occurs at Beverly Municipal Airport.

TABLE 2-8
WEATHER CONDITIONS

Condition	Percentage of Year	Days Per Year

Condition	Percentage of Year	Days Per Year
VFR	89.4	326
IFR	9.0	33
Unusable	1.6	6

Sources: Wind Tabulation for Boston, MA, 1988-1997; National Climatic Data Center
Dufresne-Henry, Inc., analysis

2.7 AIRPORTS AND AVIATION IN THE REGION

Airports are part of a system, and it is important to know what services and facilities other airports in the region provide in order to assess the role and development potential of an individual airport. Within a 20-NM radius of BVY, four airports and a seaplane base are available to the public, as follows:

- Logan International Airport, approximately 15 NM south of BVY in Boston, has five runways, four of which are 7,000 feet or longer. Designated by the NPIAS as a large-hub airport, Logan primarily serves commercial service traffic and is the largest airport, in terms of passengers, in New England. Logan also serves air-cargo and some corporate aviation, but has few facilities dedicated to general aviation.

- Hanscom Field in Bedford is located approximately 17 NM southwest of BVY. Hanscom Field is also a reliever airport for Logan; however, the 1993-1997 NPIAS lists it as a commercial-service airport, and it has recently added scheduled service. Hanscom Field has two runways: Runway 11-29 is 7,001 feet long and Runway 5-23 is 5,106 feet long. An instrument landing system (ILS) provides precision-approach capability to Runway 11. This airport has a role similar to BVY, typically serving general and corporate aviation.

- Lawrence Municipal Airport is located approximately 12 NM northwest of BVY and also serves as a reliever to Logan. This airport has a two-runway configuration (i.e., 5,000 feet for Runway 5-23 and 3,901 feet for Runway 14-32) with precision-approach capability to Runway 5. This airport also serves a mix of corporate and general aviation similar to BVY.

- Plum Island Airport in Newburyport is located approximately 12 NM north of BVY. This airport has a single runway that is 2,520 feet long and primarily serves small aircraft.

- Merrimack Valley Seaplane Base is located on the Merrimack River approximately 15 NM northwest of BVY. This base provides a water-landing area for seaplanes with an associated FBO.

2.8 HISTORICAL AVIATION ACTIVITY

Historical aviation activity is an important element of the inventory because it forms the basis for the development of forecasts. Typically, the planning process reviews aviation activity for the preceding 10 years. During the forecasting portion of the AMPU, this historical information is analyzed for trends and correlations, and then can be extrapolated to develop projections of activity.

For general-aviation airports, there are two primary indicators of activity: based aircraft and aircraft operations. A based aircraft is one that uses BVY as its “home” airport. These aircraft require either tiedown or hangar space at the airport; therefore, the projection of based aircraft directly affects facility requirements. An aircraft operation is either a landing or a takeoff. Touch-and-go operations, which occur when an aircraft lands on the runway, continues rolling, and then takes off again, are counted as two operations. Operations numbers are used to determine the capacity of airside facilities.

Information on based aircraft was derived from airport management records of tiedown and hangar leases, as well as from the previous AMPU. In cases where the information was incomplete, Dufresne-Henry, Inc., interpolated to provide estimates of the number of based aircraft for the year. Table 2-9 and Figure 2-15 present the total number of based aircraft per year for the past 10 years.

TABLE 2-9
HISTORICAL BASED AIRCRAFT

Year	Based Aircraft
1988	230
1989	200
1990	184
1991	191
1992	202
1993	174
1994	170
1995	167
1996	149
1997	131

Sources: Airport management records
Dufresne-Henry, Inc., analysis

Airport management records also provided information on the types of aircraft based at BVY. These records indicated that the mix of aircraft based at the airport has been fairly consistent for the past 10 years. Table 2-10 and Figure 2-16 present this fleet mix.

TABLE 2-10
BASED-AIRCRAFT FLEET MIX

Aircraft Type	Percentage of
Single-engine	81
Multi-engine	14
Turboprop	1
Jet	2
Helicopter	2

Source: Airport management records
Dufresne-Henry, Inc., analysis

Insert Figure 2-15

Based Aircraft

Insert Figure 2-16
Based Aircraft Fleet Mix

Aircraft operations numbers were provided by the ATCT, whose personnel count the operations when the tower is in service. Because the tower is not in service at night, these counts do not reflect any night operations after 8:00 p.m. on weekdays and 9:00 p.m. on weekends. Based on observations of actual activity, airport management and ATCT staff estimate that an additional 10 percent of recorded operations occurs during the hours that the tower is not operational. Table 2-11 and Figure 2-17 present the total operations counts for BVY.

TABLE 2-11
HISTORICAL TOTAL OPERATIONS

Year	Operations (ATCT Counts)	Night Operations (Estimated)	Total Operations
1988	144,895	14,490	159,385
1989	133,214	13,321	146,535
1990	129,037	12,904	141,941
1991	142,549	14,255	156,804
1992	121,608	12,161	133,769
1993	104,087	10,409	114,496
1994	83,776	8,378	92,154
1995	85,954	8,595	94,549
1996	76,407	7,641	84,048
1997	73,475	7,348	80,823

Sources: Beverly ATCT airport traffic records
Dufresne-Henry, Inc., analysis

Insert Figure 2-17
Annual Operations

As the table and figure demonstrate, operations at BVY have been generally declining throughout the early to mid-1990s. Recent counts showed a slight increase for 1998 and 1999. This trend is discussed in further detail in Chapter Three.

ATCT counts do not differentiate by type of aircraft; therefore, the operational fleet mix was developed based on estimates by ATCT, airport management, and FBO personnel. The based-aircraft fleet mix was used as a guideline; however, that mix was subjectively adjusted based on the fact that the airport has four FBOs that offer flight training, primarily in single-engine piston aircraft. Therefore, the number of operations by this type of aircraft should be a higher percentage of total operations than that of based aircraft. Personnel at the airport indicated that the increase of the single-engine piston-aircraft operations percentage was offset by a decrease in the multi-engine piston-aircraft operations percentage. Table 2-12 presents the estimated operational fleet mix.

TABLE 2-12
HISTORICAL OPERATIONAL FLEET MIX

Aircraft Type	Percentage of Fleet
Single-engine Piston	91
Multi-engine Piston	6
Turboprop	1
Jet	1
Helicopter	1

Sources: Conversations with on-airport tenants and management
Dufresne-Henry, Inc., analysis

Other operational characteristics also were derived from the ATCT counts. Information regarding the split between local and itinerant operations also was recorded. Local operations are "arrivals and departures of aircraft that operate in the local traffic pattern or within sight of the tower and are known to be departing for or arriving from flights in the local practice areas within a 20-mile radius of the airport and/or control tower; plus simulated instrument approaches or low passes at the airport executed by any aircraft."[1] Itinerant operations are defined as "all aircraft arrivals and departures other than the local operations described previously."[2] This is an important differentiation because local operations are not necessarily operations by based aircraft. The split between these types of operations is used to determine facility needs for hangars and tiedowns. Instrument operations, which are operations conducted under IFR, also are recorded. These operations counts are used to determine capacity of the airfield and demand for instrument facilities.

The data for local versus itinerant operations and instrument operations was derived from the ATCT counts for the 1997 data because it was available on a monthly basis and is the most current data available for a complete year. These numbers and percentages are based on actual counts only and do not contain an estimate for night operations. Table 2-13 presents this information.

TABLE 2-13
OPERATIONS BREAKDOWN - 1997

Type	Number	Percentage of Year
Local	40,659	55.3
Itinerant	32,826	44.7
Instrument	4,631	6.3

Sources: Beverly ATCT airport traffic records
Dufresne-Henry, Inc., analysis

[1]FAA AC 150/5070-6A, *Airport Master Plans*, June 1985, page 22.

[2]Ibid.

2.9 AIRPORT REFERENCE CODE AND EXISTING NONCONFORMING CONDITIONS

Under the current recommended design standards, airports are classified using the Airport Reference Code (ARC), which is specified in AC 150/5300-13, *Airport Design*. The ARC is typically set based on the approach speed and wingspan of the most demanding aircraft to regularly use an airport. Regular use is typically defined by the FAA as 500 annual itinerant operations per year. Most design criteria for an airport are set based on the ARC for the facility. The ARC standards are defined in Table 2-14.

TABLE 2-14
ARC COMPONENT DEFINITIONS

Approach Category	Approach Speed Criteria	Design Group	Wingspan Criteria
A	Speed < 91 knots	I	Wingspan < 49 feet
B	Speed ≥ 91 but < 121 knots	II	Wingspan ≥ 49 but < 79 feet
C	Speed ≥ 121 but < 141 knots	III	Wingspan ≥ 79 but < 118 feet
D	Speed ≥ 141 but < 166 knots	IV	Wingspan ≥ 118 but < 171 feet
E	Speed > 166 knots	V	Wingspan ≥ 171 but < 214 feet
		VI	Wingspan ≥ 214 but < 262 feet

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

The current ALP for BVY indicates that the ARC is B-III for both existing and proposed conditions, which is reasonable for the role of the airport but may not be supported by present-use statistics. Design standards from the ALP were based on this ARC; however, several conditions at the airport do not conform to the recommended design standards set forth in AC 150/5300-13 (Change 5), *Airport Design*, as follows:

- Runway Safety Area. The RSA is a defined ground area centered on the runway centerline and extending 150 feet to either side of it, and 600 feet beyond the runway ends for a B-III airport (with approach visibility minima greater than 3/4-mile). The RSA should be kept graded, capable of supporting the occasional passage of aircraft and emergency equipment under dry conditions, and free of all objects, except those whose function requires them to be in the RSA. At BVY, the RSA does not conform to the standard at either the Runway 9 or Runway 27 end; there are buildings, a road, and a severe grade within 600 feet of the runway end. The Runway 16 and Runway 34 ends have available space to create a standard RSA; however, the current grades do not conform to the B-III standard.

- Runway Object-Free Area. The ROFA is similar in shape to the RSA but slightly larger with slightly less restrictive standards. At a B-III airport, the ROFA extends 400 feet to either side of the runway centerline and 600 feet beyond the runway ends. The ROFA should be free of aboveground objects that protrude above the elevation of the RSA, except for those whose location is fixed by function or for taxiing aircraft. Parked aircraft are not permitted in the ROFA. The ROFA does not conform to the standard on either the Runway 9 or Runway 27 end due to tree penetrations. Because the ROFA is much wider than the RSA, the main ramp on the eastern side of the airport also falls within the ROFA.

As explained in later chapters, it is proposed in this AMPU to modify the ARC for BVY to a B-II designation because the type and number of current airport operations do not support a B-III designation. Typically, the AMPU must contain justification for the present ARC through reports of specific aircraft usage. Reports received from airport sources do not show more than 500 operations of B-III aircraft, thus modification of the ARC to reflect current facility usage is completed in this AMPU. Modification to a B-II designation improves the potential for meeting the design criteria at BVY.

Chapter Three

FORECASTS OF AVIATION ACTIVITY

The next step in the AMPU process is the projection of aviation activity at an airport. These forecasts are developed from the airport activity data presented in the inventory (see Chapter Two). The projections are used in the next step to determine which facilities, if any, are necessary to satisfy the anticipated demand at an airport.

The forecasts presented in this chapter represent unconstrained projections. This is the estimated aviation demand at the facility based on such factors as national, state, and local trends; anticipated economic development; and community development. These projections do not require the airport to meet all demands, nor do they signify necessary growth or decline at the facility. Factors such as environmental and financial considerations, airport-management desires, and community expectations may constrain or enhance aviation activity at an airport. These factors are analyzed in subsequent chapters of this AMPU.

For this update, the following activity statistics are forecasted:

- number and type of based aircraft at Beverly Municipal Airport
- number of annual operations, categorized by aircraft type
- number of operations during peak periods
- number of annual instrument approaches
- number of passengers and pilots using the airport annually

The primary objective of forecasting is to define the magnitude of change that can be expected over time. Because of the cyclical nature of the economy, it is virtually impossible to predict with certainty year-to-year fluctuations in activity when looking 20 years into the future. However, a trend can be established that delineates long-term growth potential. While forecasts are often graphically depicted as a linearly increasing trend, it is important to remember that actual growth may fluctuate above and below this line. Therefore, forecasts should serve only as guidelines, and planning must remain flexible to respond to unforeseen facility needs.

The reasonable levels of activity derived from this forecasting effort are related to planning horizon levels rather than predetermined dates. These planning horizons are established at certain levels of activity that require consideration of implementation of the next step in the AMPU. Dates are presented in this chapter to define specific periods: the short term (zero to 5 years), the intermediate term (6 to 10 years), and the long term (11 to 20 years). However, these dates are flexible and it is the level of activity, not the date, that is the catalyst for development.

Aviation-activity forecasts are typically developed for a 20-year period. However, because airport master plans are typically updated every 5 to 10 years, the forecasts should emphasize the short term. The aviation industry can change drastically within a five-year period, so the intermediate- and long-term forecasts are merely estimates based on current conditions.

The development of forecasts for BVY is accomplished through two approaches: a top-down approach and a bottom-up approach. The top-down approach reviews the trends and forecasts for general aviation on national and state levels to determine the types of change applicable. The bottom-up approach reviews the historical trends and forecasts at the airport to determine actual demand.

3.1 NATIONAL AVIATION TRENDS

General-aviation activity has traditionally followed national economic trends, and the past 10 years have reflected this model. In the late 1980s, the numbers of aircraft and hours flown were increasing; however, in the early and mid-1990s, these numbers dropped. The downturn in general-aviation activity coincided with a recession in the national economy, along with increasing costs of flying associated with product liability. In the mid-1990s, the national economy strengthened and several regulations (e.g., the General Aviation Revitalization Act, which created an 18-year statute of repose on product liability in aircraft accidents) were passed that helped to check the rising costs of flying.

The FAA collects and provides statistical information regarding national trends in aviation in a publication entitled *FAA Aviation Forecasts*. The current period for these forecasts, which are updated annually, is from 1998 to 2009. The forecasts provide information on three indicators of general-aviation activity: number of registered aircraft, hours flown, and number of pilots. The outlook for the industry is moderate growth. The forecast for total number of aircraft indicates that the active general-aviation aircraft fleet will increase 1 percent annually from 1997 through 2009.[3] Higher growth is expected in the early part of this period, with an increase of 1.2 percent annually through 1999, and then 0.9 percent annually for the remainder of the period. Different growth rates are forecasted for different types of aircraft. Single- and multi-engine piston-powered airplanes will grow at 1.0 and 0.4 percent, respectively; general-aviation turboprop and turbojet aircraft will grow at 1.6 and 2.9 percent, respectively. Rotorcraft are forecasted to grow at 0.4 percent. Experimental aircraft numbers also have experienced growth; a 1.1 percent annual growth rate is projected for these aircraft. Figure 3-1 illustrates the combined effects of the FAA's forecasted growth in the national general-aviation fleet through 2009.

The outlook for number of hours flown is also that of moderate growth, although not to the levels before the recession of the 1990s. The total number of hours flown each year by general-aviation aircraft is expected to increase by 1.4 percent annually from 1997 through 2009. Specifically, single-engine piston-aircraft hours flown are expected to increase by 1.4 percent, multi-engine piston-aircraft hours by 0.6 percent, and turbine-powered aircraft hours by 2.4 percent throughout the FAA's 12-year planning period. Rotorcraft hours are expected to increase by 0.9 percent, and hours for experimental aircraft are forecasted to increase 1.3 percent annually.[4] Figure 3-2 presents these forecasts.

The number of active pilots, in general, is anticipated to increase over the FAA's 12-year planning period at a rate of 2.1 percent annually. Specifically, the number of student pilots nationwide is expected to increase by 3.8 percent annually throughout the planning period. Private-pilot certificates are expected to increase by 2.5 percent annually across the nation, while commercial- and instrument-pilot certificates are projected to increase at 0.6 and 1.3 percent, respectively.[5] Figure 3-3 illustrates the FAA forecasts of registered pilots.

[3] *FAA Aviation Forecasts*, FY 1998-2009, page V-14.

[4] *FAA Aviation Forecasts*, FY 1998-2009, pages V-17 and V-20.

[5] *FAA Aviation Forecasts*, FY 1998-2009, page V-20.

Insert Figure 3-1
FAA's Forecasted General Aviation Fleet

Insert Figure 3-2
FAA's Forecasted General Aviation Flight Hours

Insert Figure 3-3
FAA's Forecasted General Aviation Pilot Certificates

The FAA also prepares forecasts for each airport in reports entitled *Terminal Area Forecasts* (TAF). These forecasts provide specific information on enplanements, operations, and based aircraft at all airports in the NPIAS. These forecasts previously were published annually in a bound document; however, that practice has been discontinued. The FAA placed the entire TAF database on the Internet and currently is updating the information as AMPUs are completed. As a result, the current TAF for most general-aviation airports, including BVY, indicates no change in operations or based aircraft counts from 1996 to 2010. Because the numbers vary from the actual numbers at BVY by 10 to 20 percent, these forecasts are not used in this study.

Forecasts of aviation statistics for Massachusetts also were prepared by the MAC; however, these forecasts were last updated in 1988 and, therefore, do not include the effects of the recession. As a result, the MAC forecasts are not used in this study.

3.2 AIRPORT OBJECTIVES AND SERVICE AREA

An important factor in the projection of demand at an airport is the objectives of the airport owners, tenants, and surrounding community. These objectives can influence the demand for the airport and the design standards used in subsequent chapters to determine improvement potential at the facility. Although a public-use airport cannot control the number and type of aircraft that use the facility, the role and objectives of the airport may induce certain types or amounts of demand at the facility.

As a reliever airport, the role of BVY is to provide an alternate facility for general-aviation traffic bound for the metropolitan Boston area and reduce the congestion at Logan International Airport. In general, this traffic includes small single- and multi-engine piston-powered aircraft, small and mid-sized corporate and air-taxi turboprop and jet aircraft, and small and mid-sized helicopters. Business aircraft of various types comprise the majority of transient visits to BVY. Almost all of the major corporations with a presence in the “north of Boston” region have had aircraft land at BVY in recent years. One of the airport’s major objectives is to enhance the regional economic viability by providing ready corporate access to businesses located in the region. The airport also supports future economic development of the area because many businesses look for a nearby airport when deciding to locate in a region. In the future, it is expected that the airport will continue in its current operational mode. Significant expansion to accommodate larger aircraft is *not* an objective of the airport, nor is the institution of scheduled commercial passenger service. The mission statement provided by the BAC (see Chapter One) further defines the airport's objectives.

The 1992 AMPU defined the airport service area for based-aircraft owners primarily as 12 communities within a 20-mile radius of the airport: Beverly, Salem, Peabody, Danvers, Wenham, Hamilton, Middleton, Marblehead, Swampscott, Manchester, Gloucester, and Topsfield. Because the characteristics of other airports in the area have not changed significantly since the last update, it is anticipated that this service area will remain for this update as well. However, aviation demand does not necessarily conform to geographic boundaries; demand for airport services may come from areas outside the service area. In addition, as a reliever airport, BVY provides aviation services for transient pilots whose destination is the metropolitan Boston area.

3.3 ECONOMIC INDICATORS

Once the service area was defined, economic indicators in the area were analyzed to determine general economic trends that may affect demand at the airport. Specifically, employment trends were reviewed because the numbers generally reflect economic development of the area. Because one of the BAC's objectives is to support economic development, this trend is important.

Statistics on employment were gathered from the Internet website of the Commonwealth of Massachusetts Division of Employment and Training. Specific information was obtained for the 12 communities in the defined service area for BVY. These numbers then were aggregated to produce general employment numbers for the whole service area. Information was gathered for employment by place of residence (i.e., how many people living in the service area are employed), area employment (i.e., how many people work in the service area), and number of business establishments in the service area. Figures 3-4 through 3-6 present results of the analysis.

Insert Figure 3-4
Area Employment by Residence

Insert Figure 3-5
Area Employment by Place of Employment

Insert Figure 3-6
Area Businesses Establishments

As the figures demonstrate, employment in the area declined during the recession of the early 1990s, but seems to have rebounded since then. While the number of employed people living in the area has not yet reached the pre-1990 levels, both the number of people working and the number of business establishments in the area had reached a nine-year high in 1996. Data gathered from the U.S. Bureau of Economic Analysis (USBEA) for the Commonwealth of Massachusetts also indicates growth in employment during the 20 years at an average annual rate of approximately 0.8 percent.[6] In general, there appears to be moderate economic growth in the area surrounding BVY.

The economic analysis is supported by subjective evaluations of the area. The City of Beverly began to prepare a city master plan in 1998. Citizen input at the beginning of this process indicated that, in addition to preservation of open space, economic development to increase the tax base was important to the community. In October 1998, the city broke ground on Sam Fonzo Drive, a road adjacent to the airport that will serve an industrial park. The industrial park represents some of the economic development in both the area and the airport.

3.4 AVIATION FORECASTS

Based on the information described in the previous sections, as well as data and opinions from airport management and tenants, specific forecasts were developed for BVY. These forecasts, along with the rationale for their development, are presented in the following subsections.

3.4.1 Establishment of Base Year

The first step in developing forecasts is the establishment of a base year, which provides a starting point for all of the forecasts. Because the forecasts for this AMPU were developed in late 1998, the base year for the update is 1998. Although complete information for airport activity was not available at the time, estimates based on tower counts and conversations with tenants provide a fairly accurate indicator of activity at the airport. The tower provided monthly

[6]USBEA Internet website, data for Massachusetts, interpolated by Dufresne-Henry, Inc.

operations counts for January through August, and a conversation with the airport tenants provided a count of based aircraft. Table 3-1 presents the base-year projections for BVY.

TABLE 3-1
BASE-YEAR FORECASTS

Activity	1998 Projection
Based Aircraft	138
Total Operations	88,000

Sources: ATCT records
Dufresne-Henry, Inc., analysis

3.4.2 Based-Aircraft Projections

During the past 10 years, the number of based aircraft at BVY has fluctuated but has been generally declining. Although this decline does not directly correlate to the economic downturn, airport tenants and management believe that economic conditions created the largest impact on general aviation. In 1998, for the first time in six years, the number of based aircraft at BVY actually increased from the previous year by approximately 5 percent. Although this growth is not expected to continue, it is indicative of positive trends in the local economy and national aviation.

Based on the expectation that modest growth in the number of based aircraft will occur, three different projections were developed based on different average annual growth rates: 0.8 percent based on the forecast of employment in Massachusetts, 1.0 percent based on the forecast of general aviation throughout the nation, and 1.5 percent based on the average rate used in the previous master plan. Table 3-2 and Figure 3-7 show these projections.

TABLE 3-2
BASED-AIRCRAFT FORECASTS

Rate	1998	2003	2008	2018
0.8 %	138	144	149	162

Rate	1998	2003	2008	2018
1.0 %	138	145	152	168
1.5 %	138	149	160	186

Source: Dufresne-Henry, Inc., analysis

Insert Figure 3-7
Based-Aircraft Projections

None of these projections indicate that the total number of based aircraft will reach or exceed the number of aircraft at the airport in 1992, so these modest projections appear reasonable. Based on the expectations of airport tenants and management, the 1.0 percent projection was selected for this AMPU because it was derived from another aviation-related projection. Table 3-3 and Figure 3-8 present the selected based-aircraft forecast for BVY.

TABLE 3-3
SELECTED BASED-AIRCRAFT FORECASTS

Year	Based Aircraft
1998	138
2003	145
2008	152
2018	168

Source: Dufresne-Henry, Inc., analysis

Along with total based aircraft, a projection was developed for the different types of aircraft that would be based at BVY. Table 3-4 presents the breakdown that has been fairly consistent for the past 10 years, along with an estimate of the number of each type of aircraft for the base-year total of 138.

TABLE 3-4
BASED-AIRCRAFT FLEET MIX

Aircraft Type	Percent of Fleet	1998 Estimate
Single-engine Piston	81	112
Multi-engine Piston	14	19
Turboprop	1	1
Jet	2	3
Helicopter	2	3
Totals	100	138

Note: Experimental aircraft are included in the single-engine piston group.
Sources: Airport management records; Dufresne-Henry, Inc., analysis

Insert Figure 3-8
Selected Based-Aircraft Projection

As discussed in Chapter Two, the different types of aircraft are expected to grow at slightly different rates. In general, the turbine fleet is expected to grow slightly faster than the piston fleet. At BVY, the mix is dominated by single-engine piston aircraft; therefore, a direct application of growth rates did not yield a representative projection. A subjective analysis was performed to determine the fleet mix; Table 3-5 presents the results.

TABLE 3-5
BASED-AIRCRAFT FLEET MIX FORECASTS

	1998		2003		2008		2018	
	Percent	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**	**Number**
Single-engine Piston	81	112	81	117	79	120	78	132
Multi-engine Piston	14	19	13	19	13	20	13	21
Turboprop	1	1	1	2	2	3	3	5
Jet	2	3	3	4	3	5	4	6
Helicopter	2	3	2	3	3	4	2	4
Totals	100	138	100	145	100	152	100	168

Source: Dufresne-Henry, Inc., analysis

3.4.3 Aircraft Operations Projections

Operations projections are also an important part of the forecasts. Typically, operations projections for general-aviation airports are prepared by developing an estimate of the number of operations per based aircraft (OPBA) and then multiplying this ratio by the based-aircraft projections. The OPBA ratio accounts for operations by both based and transient aircraft. However, at BVY, historical activity information indicates there is little consistency in the OPBA ratios for the past 10 years. This lack of direct correlation may be attributed to the fact that there is a general shift from operations by based aircraft to operations by transient aircraft.

As such, a more representative forecast of total aircraft operations can be developed by again analyzing trends in the aviation industry and the local economy.

Total operations at BVY also have been generally declining during the past 10 years, although 1998 once again showed growth of 10 percent for the year. Again, the local economy and national aviation trends indicate growth in activity, although not to the levels before 1990. As previously discussed, the number of hours flown is expected to increase by approximately 1.4 percent annually and the number of active pilots is expected to increase by approximately 2.1 percent annually. As these indicators increase, it is expected that the number of operations will increase modestly as well. Because the area economy is also expecting growth, the number of operations at BVY is also expected to grow slightly.

As was done for based aircraft, three projections were analyzed. Growth rates from the economy, projections of hours flown, and projections of pilots were applied to the base-year operations number of 88,000. Table 3-6 and Figure 3-9 present results of this analysis.

TABLE 3-6
ANNUAL AIRCRAFT
OPERATIONS FORECASTS

Rate	1998	2003	2008	2018
0.8 %	88,000	91,600	95,300	103,200
1.4 %	88,000	94,300	101,100	116,200
2.1 %	88,000	97,300	108,300	133,300

Note: Rounded to the nearest 100.
Source: Dufresne-Henry, Inc., analysis

Again, none of the projections bring operations back to the 1992 levels, and only the most optimistic projection has a long-term forecast that exceeds the base year in the previous AMPU. The three operations projections were subjectively analyzed to select one for this update.

Because there was significant growth in 1995, it appears that the lowest projection would underestimate operations at the airport. The mid- and high-range projections both exceed the growth rate for based aircraft at BVY; however, this is a logical difference. Although the number of based aircraft will grow modestly at the airport, the number of operations is expected to increase by a slightly larger amount due to an increase in transient traffic as well. Because traffic at BVY has been declining, the lower growth rate is more realistic for the airport. In addition, the previous master plan forecasts indicated

Insert Figure 3-9
Aircraft Operations Projections

an annual average growth rate of 1.6 percent; therefore, a rate of 1.4 percent was chosen for this AMPU. Table 3-7 and Figure 3-10 present the total operations forecasts for BVY.

TABLE 3-7
SELECTED AIRCRAFT
OPERATIONS FORECASTS

Year	Operations
1998	88,000
2003	94,300
2008	101,100
2018	116,200

Source: Dufresne-Henry, Inc., analysis

Another component to the operations forecasts is the breakdown between local and itinerant operations. As discussed in Chapter Two, the current breakdown is 55.3 percent local operations and 44.7 percent itinerant operations. Because almost all local operations are generated by the four flight schools at the airport, it is expected that a fairly constant percentage of local operations will continue, even as the number of itinerant aircraft operations increases. Table 3-8 presents this forecast.

TABLE 3-8
LOCAL VERSUS ITINERANT
OPERATIONS FORECASTS

Year	Operations	
	Local (55 percent)	Itinerant (45 percent)
1998	48,400	39,600
2003	51,865	42,435
2008	55,605	45,495

	Operations	
2018	63,910	52,290

Source: Dufresne-Henry, Inc., analysis

Insert Figure 3-10

Selected Aircraft Operations Projection

The operations forecasts also are categorized by fleet-mix projection. Chapter Two presents the current operational fleet-mix percentages that were developed based on information provided by airport tenants and management. This mix was subjectively analyzed based on information from the FAA forecasts, which indicate that the hours for turbine-powered aircraft will grow at a slightly higher rate than that of piston-powered aircraft. However, due to the high concentration of flight schools at BVY, the overall operational mix is not expected to change drastically. The flight schools typically produce multiple operations for a single pilot, while a transient jet or turboprop produces two operations over the course of a week. Table 3-9 presents the operational fleet-mix projections.

TABLE 3-9
OPERATIONAL FLEET-MIX FORECASTS

	1998		2003		2008		2018	
	Percent	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**	**Number**
Single-engine Piston	91	80,010	91	85,738	91	91,920	91	105,649
Multi-engine Piston	6	5,280	6	5,658	6	6,066	6	6,972
Turboprop	1	880	1	943	1	1,011	1	1,162
Jet*	1	950	1	1,018	1	1,092	1	1,255
Helicopter	1	880	1	943	1	1,011	1	1,162
Totals	100	88,000	100	94,300	100	101,100	100	116,200

*Number is based on actual observations rather than an applied percent calculation (see Table 3-17).
Source: Dufresne-Henry, Inc., analysis

3.4.4 Instrument Operations Projections

Projections of instrument operations are used to determine the airfield capacity. These projections are different because the FAA has different separation requirements for aircraft operating under IFR conditions than for those operating under VFR conditions.

As presented in Chapter Two, the current estimate of instrument operations as a percent of total operations is 6.3 percent. This percentage is lower that the actual percentage of the year that the airport experiences IFR conditions (i.e., 9 percent); however, this difference is expected because many student and private pilots do not operate in IFR conditions. In the future, it is expected that the current split will remain fairly constant. Table 3-10 presents the instrument operations forecast.

TABLE 3-10
INSTRUMENT OPERATIONS
FORECASTS

Year	Operations
1998	5,544
2003	5,941
2008	6,369
2018	7,321

Source: Dufresne-Henry, Inc., analysis

3.4.5 Pilot and Passenger Projections

Typically, AMPUs develop passenger projections by multiplying the number of takeoffs (or landings) by 1.5 to 2.5 passengers per aircraft. For this AMPU, itinerant and local operations are considered separately because the local operations are almost all touch-and-go operations, and one aircraft may have 6 to 10 operations with the same pilot and passenger(s). To calculate passengers for itinerant aircraft, the total number of itinerant operations was divided by 2 to estimate takeoffs, and this figure was multiplied by 2.5 passengers per aircraft. The higher figure was used for BVY because the itinerant operations include air-taxi and corporate operations, which typically serve several passengers. One pilot per aircraft also was added to the equation, although some corporate aircraft (especially jets) have two pilots (this difference also was factored into the 2.5 passengers per aircraft).

For local operations, one pilot and one passenger (usually a flight instructor) per aircraft were used as an estimate. The number of local operations was divided by 8 to approximate the number of aircraft. Table 3-11 presents the annual pilot and passenger forecasts.

TABLE 3-11
ANNUAL PILOT AND PASSENGER FORECASTS

Year	Local	Itinerant	Totals
1998	12,100	69,300	81,400
2003	12,966	74,261	87,227
2008	13,901	79,616	93,517
2018	15,978	91,507	107,485

Source: Dufresne-Henry, Inc., analysis

3.4.6 Peak-Period Activity Projections

Annual projections generally provide a good overview of the activity at an airport but may not be representative of operational characteristics at that facility. Peak forecasts are developed based on the fact that the annual demand at an airport is typically not equally distributed throughout the entire year and that certain periods are busier than others. In many cases, facility requirements are not driven by annual demand, but rather by the capacity shortfalls and delays experienced during peak times. Peak forecasts are developed for the peak month, the average day in the peak month (ADPM), and the peak hour.

Data to analyze peak activity periods was gathered from the ATCT counts of aircraft operations. This information indicates that there is a peak period during the summer at BVY. Typically, operations in the peak month have accounted for approximately 11 percent of total operations for the year. During the past 10 years, the peak month occurred between the months of May and September, usually in July or August. It is expected that this peaking characteristic will continue throughout the planning period. Table 3-12 presents the peak-month activity projections. Passenger peaks are presented based on the expectation that the peak period of activity also will yield the peak passenger counts.

TABLE 3-12
PEAK-MONTH ACTIVITY FORECASTS

Year	Operations	Pilots/Passengers
1998	9,680	8,954
2003	10,373	9,595
2008	11,121	10,287
2018	12,782	11,823

Source: Dufresne-Henry, Inc., analysis

The ADPM (formerly known as design day) forecasts are developed by dividing the peak-month numbers by 30. The resulting numbers do not necessarily present the maximum day operations for BVY; tower counts indicate that actual peak-day operations occasionally exceed the ADPM by as much as 50 percent, even in non-peak months. However, the ADPM number is a better representation of activity on a typical busy day; if the facility were designed for the absolute peak activity, it would be underutilized most of the time. Table 3-13 presents the ADPM projections.

TABLE 3-13
AVERAGE-DAY/PEAK-MONTH
ACTIVITY FORECASTS

Year	Operations	Pilots/Passengers
1998	323	298
2003	346	320
2008	371	343

Year	Operations	Pilots/Passengers
2018	426	394

Source: Dufresne-Henry, Inc., analysis

ADPM forecasts also were prepared for the operational fleet mix to estimate the daily level of aircraft traffic at the airport. Table 3-14 presents this projection.

TABLE 3-14
ADPM OPERATIONAL FLEET-MIX FORECASTS

	1998	2003	2008	2018
Single-engine Piston	295	316	337	388
Multi-engine Piston	19	21	22	26
Turboprop	3	3	4	4
Jet	3	3	4	4
Helicopter	3	3	4	4
Totals	323	346	371	426

Source: Dufresne-Henry, Inc., analysis

Peak-hour forecasts are developed as a percentage of the ADPM forecasts. Because the activity data from the ATCT does not provide information to the hour, generally accepted planning principles were used. At general-aviation airports, 15 percent of the ADPM provides a good representation of the peak hour. Table 3-15 presents the peak-hour activity projections.

TABLE 3-15
PEAK-HOUR ACTIVITY FORECASTS

Year	Operations	Pilots/Passengers

Year	Operations	Pilots/Passengers
1998	48	45
2003	52	48
2008	56	51
2018	64	59

Source: Dufresne-Henry, Inc., analysis

Peak-hour forecasts also were prepared for instrument operations; these projections are presented in Table 3-16.

TABLE 3-16
PEAK-HOUR IFR
ACTIVITY FORECASTS

Year	IFR Operations
1998	3
2003	3
2008	4
2018	4

Source: Dufresne-Henry, Inc., analysis

3.5 AIRPORT REFERENCE CODE

As part of the forecasts, the ARC for future development also is projected based on the type of aircraft using the airport. This forecast is based on aircraft that are expected to perform 500 or more annual itinerant operations per year. As a rule-of-thumb, 500 operations is equal to one flight per day (in and out) for every business day of the year.

Although the previous AMPU defined the ARC as B-III, it is unlikely that Design Group III standards are necessary for BVY. Few aircraft used regularly in general aviation have wingspans of 79 feet or more. At BVY, it is estimated that there are fewer than 25 operations per year by aircraft in Design Group III or larger; therefore, Group II standards are used in this AMPU.

The issue with the ARC is the differentiation between B-II and C-II. This determination impacts the FAA design criteria at the airport that will affect layout of the facilities. As previously discussed, the ATCT information does not categorize aircraft operations into type of aircraft, and the forecasts presented previously do not specify the aircraft model necessary to determine the ARC. Estimates of aviation activity by tenants, management, and ATCT personnel were used to develop the ARC forecast. The operational fleet-mix forecasts also were referenced. Almost all the piston-powered aircraft fall into the ARC B-II designation or below. Most of the turboprop fleet is represented by the King Air 200, which is the largest turboprop operating regularly at the airport. This aircraft is also a B-II aircraft; therefore, the ARC will most likely be determined by the jets and larger turboprops operating at the airport.
At BVY, almost all transient jets use one FBO at the airport, which also hangars a B-II turboprop and a B-II jet. Information on the number of operations for the past year was gathered from this FBO and is presented in Table 3-17.

TABLE 3-17
AIRPORT REFERENCE CODE FORECASTS

ARC	Representative Aircraft	Operations			
		1998	**2003**	**2008**	**2018**
B-I and B-II	Citation 1 through 5; Falcon 10, 20, 50, 200; Mitsubishi MU2, MU300; Beech Jet; Sabre 40, 60; Corvette	642	688	738	848
C-I and C-II	King Air 300; Lear 24, 31, 35,	292	313	336	386

ARC	Representative Aircraft	Operations			
		1998	**2003**	**2008**	**2018**
	55, 60; Gulfstream III; Hawker; Westwind; Citation VII, X; Jet Commander; Challenger				
D-I and D-II	Gulfstream II, IV	16	17	18	21

Source: Dufresne-Henry, Inc.: The Falcon 20 is used as the jet design aircraft

Because the number of aircraft operations with a higher approach category (i.e., either C or D) does not exceed 500, even in the long term, the ARC for this AMPU is B-II. However, it is possible that more C or D aircraft could use the facility without changing the operating fleet mix or number of operations; for example, if a based B-II aircraft is sold and a C-II aircraft is purchased, the ARC could change. Therefore, where practical, C-II standards will be protected at the airport as long as those standards do not create unnecessary expansion. This concept is further discussed in Chapters Four and Five.

3.6 SUMMARY OF FORECASTS

Table 3-18 summarizes the forecasts for Beverly Municipal Airport.

TABLE 3-18
SUMMARY OF FORECASTS

	1998	2003	2008	2018
Based Aircraft	138	145	152	168
Local Operations	48,400	51,865	55,605	63,910
Itinerant Operations	39,600	42,435	45,495	52,290
Total Operations	88,000	94,300	101,100	116,200
Instrument Operations	5,544	5,941	6,369	7,321
Peak-month Operations	9,680	10,373	11,121	12,782
ADPM Operations	323	346	371	426
Peak-hour Operations	48	52	56	64
Pilots/Passengers	81,400	87,227	93,517	107,485
Airport Reference Code	B-II	B-II	B-II	B-II

Source: Dufresne-Henry, Inc.

Chapter Four

FACILITY REQUIREMENTS

This chapter uses information from the two previous chapters (i.e., inventory and forecasts) to determine the existing capacity of the airport's physical components and to compare those capacities to the forecasts of aviation demand. The objective of this analysis is to determine the adequacy of existing facilities, which will lead to a preliminary determination of what is required to satisfy demand (i.e., upgrading, improving, extending, or abandoning the existing facilities, or even constructing new facilities). The results of these preliminary findings are subjected to an analysis of development alternatives before being finalized.

Facility requirements also are developed based on issues not related to capacity and demand. Items such as FAA design standards, safety, and services for airport users also are considered in the AMPU. In addition, development that meets objectives of the BAC are identified in this chapter.

4.1 DEMAND/CAPACITY ANALYSIS

The demand/capacity analysis determines facility requirements by comparing the capacity of existing facilities to the forecasted demand for those facilities in 5-, 10-, and 20-year planning periods. In cases where demand exceeds capacity, additional facilities are recommended.

4.1.1 Airfield

On an airfield, typically the most limiting factor to operating capacity is the airfield configuration. To determine the capacity of an airfield or a specific runway, the annual service volume (ASV) and the hourly capacity is calculated based on methods outlined in AC 150/5060-5, *Airport Capacity and Delay*. These figures provide the theoretical annual and the hourly capacity for operations at an airport.

Hourly runway capacity, ASV, and aircraft delay are all inherently related and dependent on a variety of capacity factors, including the following:

- Meteorological Conditions: weather conditions that affect runway utilization and visibility

- Aircraft Mix: the percentage of utilization of the airfield by each aircraft type

- Runway Use: the percentage of time that each runway is in use

- Percent Arrivals: the percentage of total arrivals relative to departures during peak hours

- Percent Touch-and-Go Operations: the percentage of total aircraft operations that are touch-and-go training operations

- Taxiway Exit Locations: the location of existing taxiway exits for landing aircraft

The goal of this analysis is to determine whether there is undue delay at the airport that may be alleviated by changing one of these factors, such as the number of taxiways.

For this analysis, the FAA methodology for long-range planning was used to analyze capacity. The numbers developed were compared to long-range forecasts for the airport to determine whether any shortfalls exist. These calculations were developed based on the most conservative assumption that only one runway would be used at a time (i.e., no situations with arrivals on one runway and departures on the intersecting runway). The simultaneous use of intersecting runways (which can be safely performed at airports with a control tower or in light traffic conditions) will increase the capacity of the facility. Table 4-1 presents results of the long-range capacity analysis.

TABLE 4-1
AIRFIELD OPERATIONAL-CAPACITY ANALYSIS

	Capacity (Operations)	Long-range Demand	Percent Capacity

	Capacity (Operations)	Long-range Demand	Percent Capacity
ASV	230,000	116,200	51
Hourly VFR Capacity	98	64	65
Hourly IFR Capacity	59	4	7

Sources: FAA AC 150/5360-5, *Airport Capacity and Delay*
Dufresne-Henry, Inc., analysis

Based on the conservative analysis, demand will not exceed capacity of the airfield, even in the long term. While there still may be some delay to aircraft operating at BVY due to the factors listed previously, significant delay that can be alleviated with airport configuration is not anticipated within the forecasts of this AMPU.

4.1.2 Runways

Several considerations applied to the runway layout at the airport are also a function of demand at the facility but are not capacity shortfalls. The runway system at the airport must provide adequate wind coverage and must be long enough to serve the aircraft using it. These factors also were analyzed to determine facility requirements.

Wind Coverage. The FAA provides standards for the maximum allowable crosswind component in a runway system. These standards, along with the analysis of wind conditions, are presented in Chapter Two and indicate that the airport falls just short of the required coverage for smaller aircraft at the facility. However, because this coverage is so close to the standard, it does not appear economically feasible to add another runway for such a minimal gain. Instead, consideration should be given to maintaining a 100-foot width for the runway to allow more leeway for smaller aircraft landing in crosswind conditions.

Runway Length. The determination of runway length for an airport is dependent on several variables, as follows:

- Type of Aircraft: Each aircraft has specific takeoff and landing length requirements.

- Operating Weight: The number of passengers and amount of cargo and fuel loaded on the aircraft affects takeoff and landing performance. Generally, as an aircraft becomes heavier, it needs more runway for takeoff and landing.

- Operating Range: The distance that the aircraft will fly determines the amount of fuel that must be carried, which affects the weight.

- Temperature and Precipitation: As the outside temperature rises, aircraft need more runway length for takeoff and landing. Wet, slippery runways also degrade the performance of aircraft.

- Wind Direction and Strength: As the headwind component increases, runway-length requirements decrease.

- Elevation of the Airport: Aircraft at higher elevations require more runway than those at lower elevations.

- Runway Grade: The slope of a runway can either increase or decrease aircraft performance, depending on whether it is traveling up or down the slope.

- Operator Requirements: The owner/operator of an aircraft may require specific runway lengths for operation. Insurance companies also may require that the aircraft only be operated on runways of a certain minimum length.

For planning purposes, runway length is determined to be the length that accommodates the needs of most aircraft at an airport. While it is possible to account for the aircraft, temperature, and elevation in the planning calculations, the factors of weight, range, and operator requirements cannot easily be predicted because they will vary significantly.

Historically, a runway length of at least 5,000 feet is needed at general-aviation airports serving corporate aircraft, and FAA guidelines suggest the secondary runway to have 80 percent of the length of the primary runway. For this update, specific runway-length needs were analyzed based on FAA guidelines and manufacturers' specifications.

The FAA developed a computer program that estimates runway lengths for aircraft smaller than 60,000 pounds maximum gross takeoff weight (MTOW) based on the factors of temperature, runway grade, and airport elevation. (Haul length is considered in this software only for aircraft more than 60,000 pounds MTOW.) Table 4-2 presents results of this analysis.

TABLE 4-2
RUNWAY-LENGTH ANALYSIS

AIRPORT AND RUNWAY DATA	
Airport elevation	108 feet
Mean daily maximum temperature of the hottest month	82°F
Maximum difference in runway-centerline elevation	22 feet
RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN	
Small airplanes with approach speeds of less than 30 knots	300 feet
Small airplanes with approach speeds of less than 50 knots	810 feet
Small airplanes with fewer than 10 passenger seats	
75 percent of these small airplanes	2,450 feet
95 percent of these small airplanes	3,010 feet
100 percent of these small airplanes	3,570 feet
Small airplanes with 10 or more passenger seats	4,140 feet
Larger airplanes of 60,000 pounds or less	
75 percent of these larger airplanes at 60 percent useful load	5,300 feet
75 percent of these larger airplanes at 90 percent useful load	

AIRPORT AND RUNWAY DATA

100 percent of these larger airplanes at 60 percent useful load 7,000 feet
100 percent of these larger airplanes at 90 percent useful load 5,500 feet
7,860 feet

Source: FAA Airport Design Software, Version 4.2

This analysis was performed with wet and slippery runway conditions because there is precipitation during 20 percent of the year at BVY.
Based on the ARC forecasts, the type of aircraft operating most often at BVY falls within the 75 percent of larger aircraft. For this update, it is assumed that the 60 percent of useful load is a representative approximation of the range and payload for the aircraft using the airport. Therefore, the suggested runway length based on this analysis is 5,300 feet, which exceeds the 5,000 feet that the BAC wants to maintain at the airport.

To verify this calculation, manufacturers' specifications also were consulted for some of the aircraft that fall within the B-II category. These specifications make certain assumptions regarding weight, elevation, and temperature, but do not consider operator requirements or slippery runways. As a result, these numbers also may not completely represent runway-length requirements. Table 4-3 presents results of this analysis.

TABLE 4-3
MANUFACTURERS'
RUNWAY-LENGTH ANALYSIS

Aircraft	Runway Length
Cessna Citation (I-V)	3,500 feet
Falcon 10	4,500 feet
Falcon 20	4,950 feet

Aircraft	Runway Length
Falcon 50	4,700 feet
Falcon 200	5,250 feet
Mitsubishi MU300	4,100 feet
Beechjet	3,800 feet
Sabre 60	5,100 feet

Sources: Manufacturers' publications
Dufresne-Henry, Inc., analysis

Based on this analysis, as well as the FAA design recommendations, the existing length of Runway 9-27 satisfies the requirements for almost all aircraft regularly using the airport (within the limitations of the analysis defined previously). Some of the aircraft regularly using BVY, as well as most of the larger aircraft occasionally flying into the facility, have runway-length requirements greater than 5,000 feet; however, as previously discussed, the BAC expressed a desire to maintain 5,000 feet for at least one runway at the airport. This length allows BVY to adequately serve most aircraft at the facility. As a rule-of-thumb, the FAA endeavors to have the secondary runway be at least 80 percent as long as the primary runway. Therefore, the secondary runway at BVY should be at least 4,000 feet long.

The runway-length determination also will be affected by the FAA standards for obstruction clearance and RSA. Runway length is discussed further relative to these standards in Chapter Five.

4.1.3 Taxiways

As previously discussed, there is little benefit to the airport to add new taxiways for the sole purpose of increasing the facility capacity. However, construction of taxiways may be necessary to allow for improvement of the apron or other facilities. For safety reasons, it is also desirable to provide taxiway routes from the apron areas to the end of each runway to minimize the time that taxiing aircraft spend on an active runway. Therefore, the alternatives discussed in Chapter Five review any potential taxiway modifications necessary.

4.1.4 Aircraft Parking Hangars

The need for hangars is based on the demand expressed by pilots at the airport. While this demand can be estimated, actual circumstances (e.g., the cost and lease rate of the hangars) will ultimately dictate the demand for sheltered aircraft parking at the airport. A mathematical model is presented in this analysis; however, these figures should be reassessed annually.

Currently, 35 aircraft are based in hangars at the airport, and the FBOs have estimated that approximately eight more aircraft currently on tiedowns desire hangar space. These numbers equate to a demand for hangars of approximately 31 percent of the total based aircraft at the airport. This percentage was applied to the based-aircraft forecasts to yield the hangar-space demand presented in Table 4-4.

TABLE 4-4
HANGAR DEMAND

Year	Based Aircraft	Hangar Demand
1998	138	43
2003	145	45
2008	152	47
2018	168	52

Source: Dufresne-Henry, Inc., analysis

It is difficult to determine the actual existing capacity and the shortfall because there are several types of hangars at the airport. Typically, T-hangars hold one small aircraft (i.e., single-engine or light-twin engine); larger turboprop and jet aircraft are housed in larger, general-purpose hangars. However, at BVY, many of the small aircraft are parked in larger hangars, with several aircraft in each hangar. The capacity of the larger hangars varies significantly based on the size of the aircraft. In many cases, the owners of larger aircraft build one general-purpose hangar to house one jet aircraft. As a result, it is difficult to determine exactly how many hangars are necessary to meet this demand. Table 4-4 indicates that the long-term growth of the airport will increase the demand for hangars by nine aircraft over existing conditions and by 17 aircraft over the number currently in hangars.

Chapter Five discusses potential areas for hangar development. Again, it is important to realize that the timing and layout for hangar development will ultimately be determined by aircraft owners. Need for additional maintenance hangars will be determined by the FBOs; however, it is prudent to assume that most FBOs operating at the airport will have a maintenance hangar.

4.1.5 Aircraft Tiedowns/Aprons

Aircraft parking tiedowns and aprons are necessary for both based and transient aircraft. All based aircraft not parked in hangars will need either apron or tiedown space. Transient aircraft also require parking space, typically on aprons located near the FBO and fueling facilities. FAA AC 150/5300-13, *Airport Design*, provides guidance for determining the apron size necessary to meet projected demand.

FAA guidelines suggest that approximately 2,700 square feet of apron be developed for each based aircraft. Table 4-5 presents the number of based aircraft requiring apron space (i.e., total based aircraft less aircraft in hangars) and the area required.

TABLE 4-5
BASED-AIRCRAFT APRON REQUIREMENTS

Year	Based Aircraft on Apron	Apron Area Required (ft^2)
1998	103*	278,100
2003	100	270,000
2008	105	283,500
2018	116	313,200

*Based on number of aircraft actually in hangars (35) rather than demand for hangars (43)
Source: Dufresne-Henry, Inc., analysis

The decrease in apron area required between the existing and short-term periods is based on the assumption that owners who currently park their aircraft on the apron and desire hangar space will have the space by the end of the short term.

The calculation for itinerant aircraft parking is slightly more complicated. The *Airport Design* AC suggests an area of approximately 3,240 square feet for each itinerant aircraft parked on the apron. (This is larger than based aircraft because itinerant aircraft are typically parked farther apart due to the possibility of mixing aircraft types and the fact that based-aircraft owners are generally more familiar with the airport and surroundings.) The estimate of the number of itinerant aircraft parked on the apron at the same time is based on FAA guidelines and is presented in Table 4-6. Because parking will be most critical during peak conditions, the analysis is based on ADPM conditions.

TABLE 4-6
ITINERANT AIRCRAFT APRON REQUIREMENTS

	1998	2003	2008	2018
ADPM (itinerant only)	145	156	167	192
110% of ADPM (reflects peak-day operational demand)	160	172	184	211
50% of peak-day operational demand (actual aircraft instead of operations)	80	86	92	106
75% of peak-day itinerant aircraft (estimate of simultaneous parking demand)	60	65	69	80
Itinerant aircraft parking apron area (3,240 square feet per aircraft)	194,400	210,600	223,560	259,200

Source: Dufresne-Henry, Inc., analysis

The apron-area calculations are designed primarily for small aircraft, and a larger area is necessary for turboprops and jets. In many cases at BVY, larger aircraft use several of the smaller tiedowns; therefore, the total number of tiedowns presented in Chapter Two does not accurately represent the airport capacity. The apron areas calculated also do not account for movement areas such as taxilanes between tiedowns; therefore, additional apron area will be necessary. Table 4-7 summarizes the total apron requirements at the airport.

TABLE 4-7
AIRCRAFT APRON REQUIREMENTS

Year	Aircraft Tiedowns	Total Apron Area Required (ft^2)
1998	163	472,500
2003	165	480,600
2008	174	507,060
2018	196	572,200

Source: Dufresne-Henry, Inc., analysis

As previously discussed, it is difficult to determine the exact shortfall of apron space because the larger corporate aircraft generally use several spaces identified for smaller aircraft. The existing configuration of apron area results in approximately 2,425 square feet of apron per aircraft tiedown, which is less than the 2,700 square feet required for based aircraft. Therefore, although the number of tiedowns does not exceed the number of spaces available until the long term, the apron area required exceeds the present area available. The existence of this shortfall is supported by the FBOs, who have stated that there is a lack of transient apron space during the summer months. Therefore, additional apron development is recommended as part of this AMPU. The layout of the apron is discussed in further detail in Chapter Five.

4.1.6 Automobile Parking

Automobile-parking demand was estimated using the Institute of Transportation Engineers *Trip Generation* publication. This document provides graphs that estimate the number of one-way vehicle trips based on the independent variable. For this analysis, average flights per day were selected as the independent variable. Parking requirements then are determined by dividing the number of trips by two (i.e., one parked vehicle makes two trips to the airport). It is estimated that 75 percent of these vehicles require simultaneous parking. ADPM flights were used to estimate parking requirements for peak conditions (i.e., one flight equals two operations).

Employee parking also is factored into the demand. It is estimated that approximately 20 employees require parking on the eastern side of the airport and 30 employees require parking on the western side. It is estimated that the employee-parking requirements will grow at the same rate as the based aircraft.

Currently, the eastern-side automobile parking accommodates 96 spaces. The western-side public automobile parking accommodates 80 spaces. These spaces include those reserved for ATCT personnel. Table 4-8 presents the automobile-parking demand.

TABLE 4-8
AUTOMOBILE-PARKING REQUIREMENTS

Year	Employee Spaces	Public Spaces	Total Spaces	Existing Capacity	Shortfall (Surplus)
1998	50	120	170	176	(6)
2003	53	131	184	176	8
2008	55	139	194	176	18
2018	61	150	211	176	35

Sources: Institute of Transportation Engineers, *Trip Generation*, Fifth Edition
Dufresne-Henry, Inc., analysis

This analysis was supplemented through anecdotal information. Airport staff indicated that the parking lots are full during peak days. Therefore, additional automobile parking may be necessary as demand increases. Area for automobile parking is discussed further in Chapter Five.

It is also important to ensure that automobile-parking facilities are not subjected to exhaust and propwash from taxiing aircraft. Therefore, parking areas near aprons should be protected with appropriate barriers. Lights that do not penetrate Part 77 surfaces also should be installed in automobile-parking areas.

4.1.7 Other Capacity-Related Facilities

The storage of aviation fuel also is related to activity at an airport. At BVY, fuel sales are the responsibility of the FBOs; therefore, specific calculations for fuel-storage requirements are not part of this AMPU. All layout and environmental planning should provide adequate area for fueling facilities and tanks for the FBOs, and account for all applicable regulations.

It is not expected that the growth in automobile traffic due to the airport users will create excess demand for the airport access roads and surrounding streets. In the long term, the number of vehicle trips generated in the ADPM is 400, which does not include trips generated by industrial uses along Sam Fonzo Drive. If one conservatively assumes that these trips will occur within an eight-hour day, the average is 50 vehicle trips per hour, or less than one per minute. As a result, the existing airport access should provide ample capacity for the demand. As necessary, these roads should be maintained. Adequate informational signs on the surrounding roads also should be provided.

Currently, the "terminal" functions at the airport (i.e., waiting for charters or flight lessons) are accommodated by the FBO buildings. This is an efficient arrangement because the aircraft based at or using the airport are spread out between the two terminal areas. It is anticipated that this relationship will continue in the future; therefore, a terminal building operated by the airport is not necessary at this time. If the BAC decides to pursue a terminal building, additional study will be required to determine the best location, size, and other details.

4.2 NONCAPACITY FACILITIES

The noncapacity facility requirements are those facilities not directly related to demand at the airport. These improvements are generally related to FAA standards, safety and security of the airfield, and other potential uses of the land.

4.2.1 FAA Standards

FAA standards for BVY are based primarily on the ARC projected for the facility. As discussed in Chapter Three, the existing and projected ARC for the airport is B-II, but C-II standards will be projected where feasible because there is existing use of the facility by C-II aircraft. Both B-II and C-II standards are presented in Tables 4-9 through 4-11 for comparison.

TABLE 4-9
SEPARATION STANDARDS

	B-II Standard	C-II Standard
Runway Centerline to Hold Line	125 feet	250 feet
Runway Centerline to Parallel Taxiway/Taxilane	240 feet	400 feet
Runway Centerline to Aircraft Parking Area	250 feet	500 feet
Taxiway Centerline to Fixed or Movable Object	65.5 feet	65.5 feet
Taxilane Centerline to Parallel Taxilane Centerline	97 feet	97 feet
Taxilane Centerline to Fixed or Movable Object	57.5 feet	57.5 feet

Source: FAA AC 150/5300-13: *Airport Design*

TABLE 4-10
GEOMETRIC STANDARDS

	B-II Standard	C-II Standard
Runway Width	75 feet	100 feet
Runway Safety Area Width	150 feet	400 feet
Runway Safety Area Length Beyond Runway	300 feet	1,000 feet

	B-II Standard	C-II Standard
End		
Runway Obstacle-Free Zone Width	400 feet	400 feet
Runway Obstacle-Free Zone Length Beyond Runway End	200 feet	200 feet
Runway Object-Free Area Width	500 feet	800 feet
Runway Object-Free Area Length Beyond Runway End	300 feet	1,000 feet
Threshold Siting Surface Slope (visibility 1 mile or greater)	20:1	20:1
Taxiway Width	35 feet	35 feet
Radius of Taxiway Turn	75 feet	75 feet
Taxiway Safety Area Width	79 feet	76 feet
Taxiway Object-Free Area Width	131 feet	131 feet
Taxilane Object-Free Area Width	115 feet	115 feet

Source: FAA AC 150/5300-13: *Airport Design*

TABLE 4-11
RUNWAY PROTECTION ZONE STANDARDS

	B-II Standard	C-II Standard
Inner Width	500 feet	500 feet
Outer Width	700 feet	1,010 feet
Length	1,000 feet	1,700 feet

Source: FAA AC 150/5300-13: *Airport Design*

Based on existing conditions at the airport, it appears feasible to project the C-II standard for runway width because both runways are at least 100 feet wide already. Runway 9-27 is currently 150 feet wide; it will be possible to reduce this width to100 feet to save pavement maintenance and snow-removal costs. The existing distance from the Runway 9-27 centerline to parallel

Taxiway D and from the Runway 16-34 centerline to the parallel portion of Taxiway B also exceeds the C-II standard. For most other standards, the B-II criteria are most suited for the facility.

As previously discussed, the B-II RSA and ROFA standards are not currently met for Runway 9-27. In addition, the ROFA for Runway 16-34 extends over the western edge of the main ramp on the east side of the airport. The alternatives analysis presents ways for the airport to meet these standards.

As discussed in Chapter Two, there are still several penetrations to the Part 77 imaginary surfaces. Almost all of the existing penetrations are trees located off airport property. Although it is desirable to trim or remove as many trees as possible, it may not be practical to completely clear the Part 77 surfaces around BVY. This issue is addressed further in Chapter Five.

AC 150/5300-13, *Airport Design*, also provides standards that should be kept clear of vegetation or manmade penetrations. Appendix 2 of the AC presents criteria for the location of the runway thresholds based on the aircraft expected to use the facility and the type of approach (e.g., visual or nonprecision instrument). Based on these criteria and on existing obstructions in the area, some additional displacement of the thresholds may be required, as follows:

- The Runway 9 threshold may have to be displaced 400 feet.
- The Runway 27 threshold may have to be displaced an additional 80 feet, for a total displacement of 270 feet.
- The Runway 16 threshold may have to be displaced an additional 140 feet, for a total displacement of 379 feet.

These standards, as well as the ramifications of these actions, are discussed in Chapter Five.

The function of the runway protection zones (RPZs) is to provide an area of land-use compatibility around runway ends; however, the FAA recognizes that it is not always practical for an airport to own or control the RPZs. This is true at BVY on Runway 9-27, where the RPZs extend off airport property over several residential properties. It does not appear practical or desirable for the BAC to own the property in these RPZs; therefore, compatibility should be ensured through local land-use practices (e.g., zoning). Examples of the use of local land-use regulations and municipal boards to ensure RPZ compatibility include the following:

- development of an airport overlay district where land subdivision and new construction adjacent to the airport is subject to height restrictions, deed notations regarding FAR Part 77 surfaces and existing noise levels, and deed references that indicate the presence and use of the airport (primarily useful for new residential development); the shape and size of the overlay district should, at a minimum, include all off-airport land within the 65-DNL contour

- zoning changes for land adjacent to the airport, and particularly within the runway approaches, that remove residential and/or institutional uses and replace them with industrial, office, and/or open-space uses

- placement of an airport representative on municipal boards to provide input for decisions regarding development and/or use plans adjacent to airport property

Off the ends of Runway 16-34, the RPZs extend primarily over airport property. Acquisition of two parcels in the RPZ on the Runway 16 end was ongoing at the time of this update. The acquisition of these parcels will allow the airport to ensure compatible land uses and remove any obstructions to the Part 77 surfaces on these parcels. Additionally, a substandard MALS system presently exists at the Runway 16 end, consisting of five light bars. The acquisition of the two aforementioned properties may allow for the installation of the final two bars, creating a full MALS system and possibly a MALSF system. The final tower will occur very close to the property boundary, and it may be necessary to shift the runway centerline to the southeast to fit the final bar. If the full system can be installed, a decrease of the operating minima for the runway may be possible. Light emission impacts may be a concern with the installation of the additional approach lights near existing residences.

On the Runway 34 end, the airport controls most of the RPZ.

FAA standards also require a clear line-of-sight from the ATCT to any movement area (i.e., runway or taxiway) on the airport. Currently, this condition is met; however, the areas south of Taxiway A and the wind sock north of Runway 9-27 have some tree and shrub growth that may eventually obscure the view from the tower to Runway 9-27. This growth should be removed.

Line-of-sight standards are also applicable to the runways. Along a single runway, FAA standards state that any two points located 5 feet above the runway centerline must be mutually visible along the entire runway length (or half the length, if a full-parallel taxiway exists). This condition is met along both runways at BVY. The design standards also define the area between intersecting runways that should provide a clear line-of-sight. The Ultimate ALP (see Chapter Seven) presents the runway visibility zone (RVZ) based on the existing runway configuration at the airport. Currently, a portion of the main ramps falls within the RVZ. If possible, this area should be kept clear of buildings and parked aircraft.

4.2.2 Pavement Rehabilitation

As noted in Subsection 2.5, there are several paved areas on-airport that will have to be addressed in the short term for either a full reconstruction or rehabilitation. The most pressing need is Runway 9-27, which has been identified as in poor condition. The runway is scheduled to be narrowed to 100 feet which will allow for a shift in the centerline and improvements to the RSA at the Runway 27 end. In addition, there are several aprons that are in poor condition, including East Aprons 1 and 2 and the West Apron.

4.2.3 NAVAIDs

Currently, the only published instrument approaches to a specific runway are for Runway 16, which has the localizer and VOR approaches. Wind data and conversations with ATCT personnel and the FBOs indicate that Runway 9-27 is more commonly used; however, it is not likely that a localizer could be installed on that runway due to space constraints. Nonprecision GPS approaches could be published with no additional equipment necessary at the airport. Runway 9 appears to provide the most opportunities for operations into the wind; therefore, the FAA should consider publishing a GPS approach for this runway. Due to the relatively low number of instrument operations at the airport, it is not expected that this approach would significantly increase the number of operations on Runway 9.

Currently, aircraft executing an approach to the airport can circle from the approach to Runway 16 to land on Runway 9, which creates additional traffic in the immediate airport vicinity. A straight-in procedure to Runway 9 should reduce the number of times aircraft need to circle that runway. If this procedure has visibility minima of 1 mile or greater, design standards for the runway will not change. The Part 77 surfaces will be more restrictive because the slope on the approach surface will change from 20:1 to 34:1, likely resulting in additional off-airport obstructions in residential areas.

In conjunction with the GPS approach, a PAPI should be installed on Runway 9 (currently proposed by the FAA). This system of low-intensity lights would be installed completely on airport property (a typical installation would be between Runway 9 and Taxiway D) and would provide the pilots with visual vertical guidance for the approach. ATCT personnel also have requested the PAPI because it may allow tower personnel to implement "land and hold short" operations. Pilots have indicated that a PAPI system would be useful for all runway ends to provide visual guidance for landing.

The previous AMPU discussed the installation of an ILS system for precision instrument operations at the airport. It is expected that GPS approaches may be able to provide the same capabilities for precision approaches (i.e., vertical guidance by instruments) in the near future; however, under current design standards and regulations, a precision approach is not feasible at BVY. The expanded primary surface (i.e., 500 feet either side of the runway centerline) would eliminate most of the terminal area on the eastern side of the airport. Therefore, a precision approach is not considered in this AMPU. If standards change in the future, this issue should be reevaluated.

4.2.4 Airport Security and Fencing

Currently, the airport has a fencing and gate system that is effective in preventing unintentional automobile incursions onto airport movement areas. At a general-aviation airport, full security fencing is not required; however, enclosing the airport operating area with a fence is highly recommended for animal-control purposes. Fencing in open areas also can be installed in conjunction with landscaping to improve the surrounding aesthetics of the facility.

4.2.5 Airport Lighting, Signage, and Pavement Marking

Ultimately, all taxiways should have MITLs installed to provide guidance for low-light taxi operations. These MITLs should be installed so that they can be controlled by the tower when it is operating and controlled by the pilots' radios when the tower is not operating.

Adequate guidance signs according to AC 150/5340-18 should be installed and upgraded as necessary. These signs are not mandatory at general-aviation airports, but they are beneficial by providing guidance to taxiing aircraft and can be extremely helpful for pilots unfamiliar with the facility. Pavement markings for runways and taxiways also need to be maintained. If a nonprecision approach is published for Runway 9, then markings on that runway should be updated.

4.2.6 Airport Rescue and Firefighting

On-airport rescue and firefighting equipment is not mandatory for general-aviation airports; however, the presence of such equipment enhances the safety of the facility. A detailed analysis of response times and capability of local rescue and firefighting services was not included in the scope of this update. One FBO expressed an interest in providing a "first-response" vehicle at BVY; the ultimate layout of the facility should allow for this possibility.

4.2.7 Airport Snow-Removal and Maintenance Equipment

Based on guidance presented in AC 150/5220-20, *Airport Snow and Ice Control Equipment*, and AC 150/5200-30A, *Airport Winter Safety and Operations*, it appears that the existing snow-removal equipment at BVY is adequate for operational needs of the facility. As this equipment reaches the end of its useful life, adequate funds should be allocated to replace it. Specifically, the two trucks used for snowplowing are aging and need to be replaced.

Airport staff have indicated that much of the maintenance equipment at the airport is aging and in need of replacement. Specifically, the tractors and mower decks need to be replaced. Other needs include a pavement vacuum sweeper, brush hog, and paint-striping equipment.

Currently, all snow-removal and other airport equipment is stored and maintained in the same building as the manager's office. The garage area of this building has reached capacity, and members of the BAC have expressed a need for a new building for this equipment.

To supplement equipment needs, the BAC should coordinate with the City of Beverly Public Works Department to see if any of the city equipment can be used occasionally to meet the needs of the airport. Such coordination is typical at many general-aviation airports and can be mutually beneficial through increased utilization of city personnel.

4.2.8 Nonaeronautical Uses

One potential element for the development of the airport is a revenue-producing use of property that is not necessary for the aviation demand and safety of the facility. This property can be leased for compatible uses, which will provide funds for the operation of or other improvements at the airport. Examples of compatible land uses around airports include light-industrial development, commercial development, and warehousing and storage.

The development along Sam Fonzo Drive was identified as an important economic development for the area, and it appears that some adjacent airport land may be able to supplement the industrial use. A land-use study prepared for the BAC by Dufresne-Henry, Inc., identified steps that the BAC and the City of Beverly should take to ensure compatibility. Five airport parcels were identified as surplus to aviation needs and available for nonaeronautical use, as follows:

- 6.2± acres located on the north side of L.P. Henderson Road, east of the entrance road to the former Nike Missile Site, opposite the intersection with Sam Fonzo Drive. This parcel is located 400 feet down L.P. Henderson Road from the entrance to the hangar areas and the existing manager's office/maintenance building. It is not located within a runway protection zone or building restriction line. The distance, combined with the need to maintain automobile usage of the road would restrict the use of this parcel for aircraft apron or hangar development. Furthermore, the potential cross-country route to this parcel from the existing apron/hangar areas contains wetlands areas, landside facilities (restaurant, automobile parking), and an existing access road to the former Nike Missile Site (currently used by the Federal Emergency Management Agency [FEMA] for equipment storage). This access road needs to remain open for use by FEMA.

· 3.0± acres located on the north side of L.P. Henderson Road, west of the entrance road to the former Nike Missile Site. This parcel is located closer to the existing airport facilities than the aforementioned parcel, and is within 100 feet of the managers office/maintenance building and existing airport parking. It is not located within a runway protection zone or building restriction line. There exists wetlands and existing landside facilities between this parcel and existing apron/hangars which, in combination with the distance, restricts the feasibility of its use for airside facilities. The parcel is not required for landside facilities as sufficient additional landside capacity has been included in this AMPU to address airport needs well into the future.

· 3.0± acres located on the south side of L.P. Henderson Road, west of Sam Fonzo Drive. It is located in excess of 200 feet from existing airport facilities, and is beyond the runway protection zone for Runway 27. This parcel is separated from existing hangar/apron areas by the airport managers office/maintenance building, a large wetland area, and proposed airport auto parking. The area is not required for additional landside facilities as the AMPU has identified areas which will provide for future airport needs. It is not feasible to site airside facilities on the parcel due to the distance and lack of suitable access to the airport.. It borders directly on Sam Fonzo Drive

· 4.5± acres located on the south side of L.P. Henderson Road, east of Sam Fonzo Drive. Constraints similar to the preceding parcel exist to the use of this site for airport facilities. It is located a greater distance from the existing airport facilities (600 feet), and occurs on the opposite (east) side of Sam Fonzo Drive from these facilities. It is not located within the runway protection zone of Runway 27.

Access to this site from the existing land and airside facilities could only be gained from L.P. Henderson Road, as any cross-country route would need to cross Sam Fonzo Drive. The distance and the accessibility issue re key to identifying this site for nonaeronautical use.

- 10.31± acres located within the Runway 34 approach along Sam Fonzo Drive. This site is located just beyond the runway protection zone of Runway 34, along the north side of Sam Fonzo Drive. The parcel is sufficiently lower in elevation than the runway end to allow for some compatible development to occur, although height restrictions would need to be investigated. It is well removed from existing airport facilities, and is not accessible to either the west or east side hangar/apron facilities. No land-side uses would be practical for the parcel since access to the airport would require travel down Sam Fonzo Drive to L.P. Henderson Road; a distance of almost 4,000 feet.

The locations of these parcels are shown in Figure 5-2.

4.3 SUMMARY OF FACILITY REQUIREMENTS

Table 4-12 summarizes facility requirements at the airport.

TABLE 4-12
SUMMARY OF FACILITY-IMPROVEMENT RECOMMENDATIONS

	Short Term (2003)	Intermediate Term (2008)	Long Term (2018)
Airport Reference Code	B-II	B-II	B-II
Runway Dimensions	Maintain 5,000 X 100 feet for one runway; maintain at least 4,000 X 100 feet for other runway		
Taxiways	Parallel taxiway access to all runway ends, if possible		
Hangar Demand	45 aircraft	47 aircraft	52 aircraft
Apron Requirements*	29,250 square feet	55,710 square feet	120,850 square feet
Automobile-parking Requirements	8 spaces Light parking areas	18 spaces	35 spaces
FAA Standards RSA and ROFA RPZ Part 77 Surfaces Threshold Siting Surfaces Line-of-Sight	Meet RSA and ROFA standards to extent possible Maintain control over RPZs to extent practical Clear off-airport Part 77 surfaces to extent practical Clear threshold siting surface/displaced threshold to extent practical Clear line-of-sight for tower		
Pavement Rehabilitation	Runway 9-27 (short term), Runway 16-34 (intermediate term), existing aprons (intermediate term), Taxiway F (intermediate term), other taxiways (long term)		
NAVAIDs	GPS approach to Runway 9; PAPIs for Runways 9, 27, and 34 Investigate upgrade of MALS at Runway 16 end		
Airport Security and Fencing	Completely enclose airport operating area		
Airport Lighting, Pavement Markings, and Signage	Light all taxiways Upgrade marking and signage as necessary Mark Runway 9 as nonprecision		
Snow-removal and Maintenance Equipment	Upgrade as necessary (two snowplow trucks) Purchase/replace other equipment (tractors, brush hogs, mowers,		

	Short Term (2003)	Intermediate Term (2008)	Long Term (2018)
	pavement sweeper, paint-stripers) Coordinate with City of Beverly		
Nonaeronautical Uses	Provide land for nonaeronautical uses		

*These requirements represent deficiencies from existing conditions.
Source: Dufresne-Henry, Inc., analysis

Chapter Five

ALTERNATIVE DEVELOPMENT ANALYSIS

The next step in the master-planning process is an analysis of development alternatives. This analysis reviews both demand- and safety-related facility requirements presented in Chapter Four, and prepares several alternative development plans that meet those needs to the extent practicable. Constraints to development also are considered in this analysis, including the following:

- environmental considerations
- ability to construct and maintain improvements
- community impacts
- financial impacts

The purpose of this analysis is to determine the layout of the airport that best meets the needs of the facility and the FAA design standards within the identified constraints. In this chapter, several different alternatives are presented. Ultimately, one of these alternatives (or a combination of them) will be selected and presented as the improvement plan for the airport. The mission of the airport, defined by the BAC, is to provide some subjective guidance for the alternatives development.

Selection of a layout for the facility does not imply any commitment to construct all proposed improvements. The layout is simply a guide for these improvements based on the recommendations identified in Chapter Four. Several factors, such as actual demand, availability of funds, and desires of the operator in conjunction with the desires and concerns of the surrounding community, also must be considered when assessing these projects.

5.1 DESCRIPTION OF RUNWAY ALTERNATIVES

One of the purposes of the AMPU is to analyze the existing RSAs and ROFAs that did not conform to the B-III standards identified in the previous update. As presented in Chapters Three and Four, the ARC for this AMPU is B-II, which reduces the RSA and ROFA dimensions. The

ARC modification was completed based on the current-use characteristics of the facility where the extent of existing activity by B-III aircraft is insufficient to support an ARC of B-III. However, even with the reduced ARC, additional steps still may need to be taken because the facility will not meet B-II design standards. The following subsections describe alternatives that may address this issue. These alternatives are focused on meeting the present design criteria and aircraft usage, not accommodating more demanding aircraft.

Each of the proposed alternatives is described first, followed by an analysis. This format allows for a comparison of the alternatives during the analysis. The various runway and taxiway alternatives are depicted in Figures 5-1a through 5-1c.

5.1.1 Runway Alternative 1: Constructing the Necessary RSAs and ROFAs Involving Off-Airport Property Use

The first consideration is an investigation of the possibility of meeting the RSA and ROFA criteria under the existing runway configuration (i.e., maintaining Runway 9-27 at 5,000 feet long). To accomplish this goal, additional fill would be needed off the Runway 9 end, and ledge removal would be required on the Runway 27 end. A turf RSA of 150 feet wide by 300 feet beyond each runway end would need to be constructed. These areas would need to meet the grading standards specified in the FAA design AC: the first 200 feet of the RSA can have a 3 percent slope down from the runway end, and the last 100 feet can slope down at a maximum of 5 percent.

To meet the RSA criteria at the Runway 27 end without relocating the recently constructed Sam Fonzo Drive, the entire runway would have to be shifted 75 feet towards the Runway 9 end (i.e., remove 75 feet from the Runway 27 end and add it to the Runway 9 end). Because there is a significant elevation drop at the Runway 9 end, increased slopes or retaining walls would need to be constructed to construct the RSA. Under this alternative, the severe slope would be necessary regardless of whether the runway is shifted. With the shift, the fill necessary to maintain the 5,000 feet of runway and attain the standard Runway 9 end RSA would extend off airport property. Three residential properties would be impacted and acquisition would be required. The fill involved with this alternative would impact approximately 24,000 square feet of vegetated wetland, and 300 linear feet of intermittent streambank subject to federal, state, and local wetlands regulations.

Insert Figure 5-1a
Airside Alternatives 1 and 2

Insert Figure 5-1b
Airside Alternatives 4 and 5

Insert Figure 5-1c
Airside Alternatives 2 and 4

At the Runways 16 and 34 ends, all the necessary grading to meet the criteria could be performed on airport property. The grading would include a slight relocation of the localizer, which should be moved approximately 10 feet from its current location (away from the runway to clear the RSA). Wetlands impacts would occur at both ends due to the grading. At the Runway 16 end, approximately 6,000± square feet of local and federal (i.e., nonstate jurisdiction) wetlands would be impacted. At the Runway 34 end, 5,000± square feet of vegetated wetlands subject to local, state, and federal jurisdiction would be impacted.

The ROFAs also should be addressed. The ROFAs have no grading standard because they are not a ground-based surface. Instead, the ROFA standard recommends that objects not necessary for taxiing aircraft or aerial navigation that protrude above the RSA elevation should be removed. For the Runways 9, 16, and 34 ends, this standard can be met under existing conditions; for the Runway 27 end, a fence that was recently constructed along the eastern side of Sam Fonzo Drive would have to be addressed in the final RSA/ROFA configuration.

5.1.2 Runway Alternative 2: Converting Runway 16-34 to the Primary (5,000-foot) Runway and Reducing Runway 9-27 to Meet the RSA Standard

A second consideration to achieve the 5,000-foot runway and eliminate the RSA issues would be to designate Runway 16-34 as the primary runway. Under this alternative, Runway 9-27 would be reduced to a 4,480-foot length by relocating the thresholds to meet all RSA, ROFA, and threshold siting criteria; Runway 16-34 would become the 5,000-foot runway by adding 363 feet of runway pavement to the Runway 34 end. This alternative would represent existing conditions at the airport with the roles of the runways essentially reversed. Any necessary grading to meet the RSA standards could be accomplished on both the Runway 16 and Runway 34 ends without the need to purchase additional property. However, the extension of the thresholds at the Runway 34 end would result in additional obstructions to Part 77 surfaces, requiring additional off-airport easements for vegetation management (mainly confined to the industrial park parcels within the Runway 34 approach transition). Conversely, off-airport obstructions at the Runways 9 and 27 ends likely would be reduced. Impacts to protected wetlands resources also would increase beyond the estimates provided for in Runway Alternative 1.

Reconfiguration of Taxiways A and D would be required at their intersections with Runway 9-27. The taxiway ends would need to be realigned with the new runway end locations, resulting in the reconstruction of approximately 600 linear feet of taxiway (i.e., 500 feet of Taxiway D and 100 feet of Taxiway A).

5.1.3 Runway Alternative 3: Declared Distances

Appendix 14 of FAA AC 150/5300-13, *Airport Design*, provides guidance on the concept of declared distances, which allows the airport to publish information regarding the runway length and the distances based on displaced thresholds on which aircraft operators can make decisions regarding operating weights and capabilities for aircraft using that runway. Essentially, this concept treats the distances required for aircraft performance (e.g., takeoff run, landing distance, distance for an aborted takeoff) independently and compares them to the standards for the specific runway and threshold. This concept also allows the airport to displace the threshold of the runway to meet the RSA and ROFA standards. As noted in Appendix 14 of the AC, application of this concept is limited to "existing constrained airports where it is impractical to provide the RSA, ROFA....," which is the case at BVY. Historically, the FAA has approved the application of declared distances only for runways served by jet aircraft. This also is the case at BVY, and it is expected that the declared distances will be crucial only to the jet aircraft (which account for approximately 1 percent of BVY traffic) because there is more than enough runway length for the single-engine and light twin-engine aircraft.

The AC defines the following four declared distances:

- Takeoff Run: the distance to accelerate from brake release to liftoff, plus safety factors

- Takeoff Distance: the distance to accelerate from brake release past liftoff to start of takeoff climb, plus safety factors

- Accelerate-Stop Distance: the distance to accelerate from brake release to [takeoff decision speed] and then to decelerate to a stop, plus safety factors

· Landing Distance: the distance from the threshold to complete the approach, touchdown, and decelerate to a stop, plus safety factors

Under this alternative, the threshold displacement was assumed to be the greatest of the distances necessary to meet the RSA, ROFA, or threshold siting surface. Table 5-1 presents the required displacements.

TABLE 5-1
THRESHOLD DISPLACEMENT

Runway End	Threshold Displacement for			Total Threshold Displacement (feet)
	RSA (feet)	**ROFA (feet)**	**Threshold Siting Surface (feet)**	
9	200	0	400	400
27	40	120	270	270
16	0	0	379	379
34	350*	0	0	350

*The Runway 34 RSA only requires a 100-foot displacement or a regrading and relocation of the localizer to meet criteria; however, if any displacement is considered, the threshold should be moved beyond the runway intersection.
Source: Dufresne-Henry, Inc., analysis

Based on these displacements, the declared distances were calculated and are presented in Table 5-2.

TABLE 5-2
DECLARED DISTANCES

	Runway 9 (feet)	Runway 27 (feet)	Runway 16 (feet)	Runway 34 (feet)
Takeoff Run Available	5,001	5,001	4,637	4,637

	Runway 9 (feet)	Runway 27 (feet)	Runway 16 (feet)	Runway 34 (feet)
(TORA)				
Takeoff Distance Available (TODA)	5,001	5,001	4,637	4,637
Accelerate-Stop Distance Available (ASDA)	4,881	4,801	4,487	4,637
Landing Distance Available (LDA)	4,481	4,531	4,108	4,287

Source: Dufresne-Henry, Inc., analysis

5.1.4 Runway Alternative 4: Runway 9-27 Centerline Shift

Because the recommended runway width for Runway 9-27 under the present ARC is 100 feet, the runway currently is 50 feet wider than necessary. Typically, during rehabilitation of the pavement, this runway would be reduced in width by moving the edges toward the centerline by 25 feet on each side. However, it is also possible to shift the runway centerline 25 feet to the south and shift the northern edge 50 feet to the south, thereby removing all excess pavement from one side of the runway. The centerline shift also would shift the RSA 25 feet to the south, moving it away from Sam Fonzo Drive. This would allow for a 280-foot RSA at the Runway 27 end; however, the slope along the northeast corner of the RSA would require a grade in excess of 3:1 to avoid the roadway. The Runway 9 end would not be improved by this alternative, which would require extensive grading and property acquisition to attain the RSA standard.

5.1.5 Runway Alternative 5: Modification of Standards

Another possible solution to the nonstandard RSA and ROFA lengths is to request a Modification of Standards from the FAA for those specific design standards that are not feasible. The modification is indicated on the ALP, and a formal request for approval of the modification is made to the FAA in writing. A request for a Modification of Standards must be accompanied by a justification that explains why it is not feasible to meet the standard. Because a modification is usually given only in circumstances in which there is no other feasible alternative, this option is presented as a last resort.

For this alternative, no changes to the runway threshold configurations are proposed except for the Runway 9-27 centerline shift resulting from the pavement rehabilitation and runway- width decrease. This project is proposed for the short-term improvement program and allows for substantial RSA compliance at the Runway 27 end (i.e., 280 feet). It is assumed for the purposes of discussing this alternative that the centerline shift discussed in Alternative 4 will occur. Runway 9-27 would still provide 5,000 feet except for landings on Runway 27, which would only have 4,810 feet due to the existing displaced threshold, and Runway 16-34 would provide 4,637 feet (4,398 feet for landings on Runway 16).

The alternative includes completion of minor grading at the Runway 27 end to provide 280 feet of RSA and relocation of the Sam Fonzo Drive fence to a lower elevation adjacent to the road to avoid the ROFA. At the Runway 9 end, fill would be used to extend the existing RSA outward to the property line, using a maximum side slope of 3:1, a maximum RSA slope of 3 percent for the first 200 feet, and 5 percent beyond that. This configuration, without the use of any retaining structure along the property line, would result in a total RSA length of 235 feet at the Runway 9 end. Easements on residential properties would need to be acquired at the Runway 9 end to clear the ROFA. It is proposed to obtain these easements during the planning period. The full RSA width of 150 feet would be achieved at both the Runway 9 and Runway 27 ends.

The following Modification of Standards would be requested (based on existing conditions at the airport):

- The Runway 9 end RSA would be accepted at 150 feet by 235 feet beyond the end of the runway and the RSA side slopes would exceed 3:1 to reduce impacts.

- The Runway 27 end RSA would be accepted at 150 feet by 280 feet beyond the runway end, and the side slopes of the RSA would exceed 3:1 to avoid Sam Fonzo Drive.

- A portion of the main ramp would be allowed to remain within the ROFA as long as the space is used only when no other space is available. The same condition should be applied to parking spaces on the southern end of this ramp that fall within the RVZ.

This analysis assumes that any necessary grading in the RSA for the Runway 16 and Runway 34 ends will be accomplished. At the Runway 34 end, grading will require a slight relocation and raising of the localizer.

Off-airport penetrations to the Part 77 surfaces would be addressed during the planning period on a case-by-case basis. These surfaces are defined by an FAA regulation rather than a standard, so the impact of these penetrations will need to be determined by the FAA. At a minimum, obstructions within the approach surfaces and the ROFA will be addressed to avoid further threshold displacements; however, the off-airport penetrations to the transition surfaces may not be removed due to easement costs. These penetrations are primarily trees located off airport property.

5.2 TAXIWAY AND APRON/HANGAR (LANDSIDE) AREA ALTERNATIVES

Alternatives for taxiway development are dependent on the ultimate runway configuration. Input from ATCT personnel regarding taxi patterns and holding positions also was considered in the analysis of taxiway needs. The taxiway alternatives are shown in Figures 5-1a and 5-1b.

5.2.1 Taxiway Alternative 1: East-Side Partial-Parallel Taxiway to Runway 16

Currently, aircraft parked on the eastern side of the airport must cross Runway 16-34 to taxi up to the Runway 16 end. To eliminate this need, a partial-parallel taxiway could be constructed from the east-side apron/hangar area to Runway 16. This taxiway would be 35 feet wide and have a centerline-to-centerline separation of at least 240 feet from Runway 16-34, based on the B-II standard.

5.2.2 Taxiway Alternative 2: East-Side Partial-Parallel Taxiway to Runway 34

If Runway 34 were extended to maintain current runway length as described in Runway Alternative 2, then a partial-parallel taxiway from Taxiway A to the Runway 34 end also should be constructed to eliminate the need to hold aircraft on Runway 9-27 and back-taxi on Runway 34. This taxiway also would be 35 feet wide and located 240 feet from the centerline of Runway 16-34 (see Figure 5-1a). Even if Runway 34 remains at its current length, a partial-parallel taxiway ending at Runway 9-27 would still allow aircraft to hold for Runway 34 without occupying an active runway.

5.2.3 Taxiway Alternative 3: West-Side Partial-Parallel Taxiway to Runway 34

This alternative provides the same concept as the previous one except that the partial-parallel taxiway is on the western side of Runway 16-34 rather than the eastern side (see Figure 5-1). The benefits and drawbacks of this alternative are discussed in Subsection 5.4.

5.2.4 Taxiway Alternative 4: West-Side Full-Parallel Taxiway to Runway 16-34

This alternative is closely related to Taxiway Alternative 3. Under this alternative, a full-parallel taxiway would be constructed on the western side of Runway 16-34. This would include a realignment of Taxiway B at the Runway 16 end so that the entire taxiway is located at the same separation distance from the runway. Subsection 5.4 presents the advantages and disadvantages of this alternative.

5.2.5 Taxiway Alternative 5: Extension of Taxiway D

The improvement proposed under this alternative includes an extension of Taxiway D from the intersection of Taxiway F and Taxiway D to Runway 16-34 (or to the west-side parallel taxiway if it is constructed). A stub taxiway also would be constructed from this extension to Runway 9-27, near the midpoint of that runway.

5.2.6 Landside Alternative 1: New Apron South of the BAC Ramp

South of the BAC ramp is an area of approximately 46,000 square feet that could be paved and used for small aircraft tiedowns or hangar development. Due to the shape of the area and the setback standards between Taxiway A and aircraft parking areas, it is estimated that seven or eight small aircraft could be parked on this apron. Hangar development would face the same configuration obstacles. However, a corporate/FBO hangar could be sited on the northeastern corner of this site and not violate setback distances from the taxiway. Figure 5-2 shows this area.

5.2.7 Landside Alternative 2: Replace East-Side Automobile Parking with Apron

The automobile parking on the eastern side is located adjacent to the main ramp and the tiedown area for GAS. This pavement could be converted to aircraft parking without requiring significant reconfiguration of the east-side apron markings and tiedown locations. The existing fence around the parking area would need to be removed and the area in which the fence is located would need to be paved. Converting the automobile parking to apron would provide an additional 75,000 square feet of apron. Not all of the existing automobile parking should be converted. A two-lane road and automobile-parking spaces should be provided to the tower and the New England Flyers building in order to minimize pedestrian traffic across the apron.

Replacement parking also could be constructed on the eastern side and expanded to meet the proposed demand. Two areas are candidates for automobile parking: the area east of the GAS maintenance hangar and the restaurant, and the area east of the airport maintenance building. The area behind GAS is limited in size due to the presence of buildings formerly used by Gurnard Manufacturing and wetlands. Additional parking could be constructed behind the maintenance building; however, the ground in this area is approximately 10 feet higher than the ground in the apron area. As a result, parking construction in this area would either contend with a sloped surface or incur increased costs for reduction of the ground-surface elevation to match surrounding grades.

Insert Figure 5-2
Landside Alternatives

5.2.8 Landside Alternative 3: New Apron/Hangar Area Between Taxiways B, D, and F

On the western side of the airport east of the North Atlantic Air apron and hangars is approximately 540,000 square feet of turf between Taxiways B, D, and F that could be developed as aprons or hangars (see Figure 5-2 for the location of this area). While this area exceeds the forecasted demand for apron, the area shown provides a layout to address apron needs beyond the planning period.

5.2.9 Landside Alternative 4: New Hangar Area West of Taxiway B

Another area that could be used for hangar development is the currently undeveloped area north of the west-side apron/hangar area and east of existing Taxiway B. If Taxiway B is realigned as described in Taxiway Alternative 4, then the area could be shifted toward Taxiway B and away from the edges of the airport and existing wetlands. Approximately 286,000 square feet of upland area is available for development if the taxiway is realigned. Figure 5-2 shows the location of this area.

5.2.10 Nonaeronautical Use

Nonaeronautical use of the airport is an important tool in providing revenue without creating significant additional costs. The airport would typically lease a parcel of land to a tenant, who would be responsible for developing and maintaining the property. As the landlord, the BAC would be able to ensure that all land uses and development are compatible with the airport and do not infringe upon the design criteria.

At BVY, the property most suited for nonaeronautical use is adjacent to Sam Fonzo Drive and L.P. Henderson Road. The properties include the Nike manufacturing site and the Gurnard Manufacturing property, both of which were former nonaeronautical uses and are currently vacant land. Other property occurs along the new Sam Fonzo Drive at the Runway 27 end and the Runway 34 end. The land is far removed from aircraft movement areas and could not easily be used as hangar or apron space. The parcels recommended for nonaeronautical use are described in Subsection 4.2.8. It is recommended that these areas be leased in lieu of a feesimple transfer. If the BAC opts to sell the parcels, the FAA will require a formal release of these lands. It is important to note that there is surplus capacity for all future aeronautical landside development needs with development of the nonaeronautical property.

5.3 IMPROVEMENTS COMMON TO ALL ALTERNATIVES

Many of the improvements recommended in Chapter Four do not vary with the alternatives. The airport property fence should be completed under any alternative to prevent incursions. All of the recommendations for pavement rehabilitation and equipment acquisition should be undertaken regardless of runway alternatives. The installation of PAPIs, upgrades of lighting (including the MALS at the Runway 16 end) and signage, and establishment of a new GPS approach also should be accomplished regardless of which alternative is endorsed.

As previously discussed, a Modification of Standards should be requested for the location of the main ramp on the eastern side of the airport. The westernmost portion of this apron falls within the ROFA; however, closing this area to parked aircraft would create an even greater shortfall. As discussed in Subsection 5.2, there are significant constraints to development of the apron area due to the presence of wetlands and the airport boundaries. As a result, creation of additional apron to replace the portion in the ROFA could be relatively expensive due to the environmental mitigation requirements associated with new apron construction. In addition, if this apron were relocated on the western side of the airport, it might provide a competitive advantage to the FBOs located on that side because it would move transient parking spaces nearer to these FBOs, making the pilots more likely to use the services at those facilities. As new apron is developed on the eastern side, the tiedown spaces located within the ROFA should be used only when there is no other space available on the eastern side. The same condition should apply to aircraft parked within the RVZ.

Acquisition of the residential property on Burley Street is proposed mainly based on compatibility issues. This 1± acre property is surrounded on three sides by the airport and is immediately adjacent to the Runway 16 end runup area. Future use of this site could include a vehicle access point if the west-side hangar development alternative is completed. Use of this parcel for access would eliminate the need for vehicle traffic traversing through the North Atlantic Air facility, as well as provide additional automobile parking space. Penetrations to Part

77 surfaces exist on this parcel, and acquisition would improve the navigable airspace conditions for Runway 16.

With all improvements that modify the amount of impervious surface at the airport, drainage of the site must be considered, including mitigation of increased flow rates off the property, and the quality of the stormwater runoff. These considerations include the necessary facilities to treat stormwater flow. Stormwater impacts are discussed further in Chapter Six.

5.4 ANALYSIS OF ALTERNATIVES

The analysis reviews the benefits and costs of each alternative and compares them with the other alternatives. In some cases, these benefits and costs can be quantified; in other cases, a subjective analysis is performed. Input for the review of alternatives was provided by the consultant, BAC, PAC, FAA, and MAC, who were all presented with the alternatives in draft format and asked to comment. Consequently, the analysis is the result of a consensus-based discussion of the improvement needs of the airport.

In some cases, monetary costs associated with the development were estimated for the analysis. These costs are presented only for the purposes of comparing alternatives and are not meant as estimates of total development costs (which include items such as design, permitting, and mitigation). These costs only consider the aspects of each alternative that differ from the others. Once an alternative is selected, cost estimates will be developed for the proposed improvements that may differ from the costs presented herein.

5.4.1 Runway Alternative 1: Constructing the Necessary RSAs and ROFAs Involving Off-Airport Property Use

The improvements proposed in this alternative will provide a greater margin of safety by allowing for the full development of RSAs and ROFAs on all four runway ends. Runway 9-27 has the greater wind coverage (i.e., 89.98 percent for Runway 9-27 versus 86.73 percent for Runway 16-34 in all-weather conditions); therefore, this alternative allows the airport to maintain the better wind coverage on the longer runway.

The analysis of this alternative considered the construction impact on the surrounding area. An impact of this RSA configuration includes an extension of the fill slope beyond the airport property line onto three residential properties within the Town of Danvers at the Runway 9 end. The RSA slope also would encroach into state and federal wetlands areas, resulting in impacts of approximately 24,000 square feet to vegetated wetlands and 300 linear feet to streambank. As a result, acquisition of these properties would be required to construct the necessary RSAs; however, it likely will face significant opposition from the community. Environmental permitting constraints also may affect the feasibility of this alternative. Of particular concern is the lack of area available for wetlands mitigation. A variance from the state wetlands regulations would be required to complete this work because it would exceed permissible impact thresholds.

At the Runway 16 and Runway 34 ends, impacts from the RSA projects are minimal. Land beyond the Runway 16 end is nearly at the required RSA grade, and less than 1,000 cubic yards of fill would be required to establish the proper grade. At the Runway 34 end, the RSA construction involves a cut of the existing grade, and then the use of the material generated to fill the far end of the RSA. It is expected that an excess of material would be generated by the Runway 34 end RSA work, which could be used for the Runway 9 end RSA, assuming the projects are completed in the same time frame. Wetlands impacts would occur at both ends due to the grading. At the Runway 16 end, approximately 6,000± square feet of local and federal (i.e., nonstate jurisdiction) wetlands would be impacted. At the Runway 34 end, 5,000± feet of vegetated wetlands subject to local, state, and federal jurisdiction would be impacted.

If the Runway 27 threshold remains displaced due to penetrations off airport property, then this alternative may create a confusing set of markings on that end. While the actual runway would be shifted slightly to the west, it does not make sense to remove the excess pavement because Taxiway A delivers aircraft to this paved area.

An estimate of probable costs associated with this alternative was developed. These costs included land acquisition and relocation, and engineering and construction costs associated with the runway shift and RSAs. Environmental permitting and mitigation costs were not included in this estimate due to the uncertainty of estimates for these elements. To compare the cost of this alternative with other alternatives, the estimate came to $1.65 million, the majority of which is for the RSA construction at the Runway 9 end.

This alternative is the least favored of the BAC due to limitations of funding and significant community impacts.

5.4.2 Runway Alternative 2: Converting Runway 16-34 to the Primary Runway

This alternative also increases the margin of safety at the airport by providing full-length RSAs and ROFAs at all four runway ends through a change in the roles of the runways. The length of Runway 9-27 would be reduced to accommodate the design standards for RSAs, ROFAs, and threshold-siting surfaces.[7] This change would result in an increase in the length of Runway 16-34 by approximately 8 percent to maintain 5,000 feet of runway at BVY. Runway 16-34 would become the primary runway at the airport, and it is expected that there will be a slight increase in traffic using that runway and a slight decrease in the number of aircraft using Runway 9-27. This expectation is supported by reports from ATCT personnel who have stated that some of the jets using the airport request Runway 9-27 due to its length, even if the winds support the use of Runway 16-34 at that time. Because jet traffic at the airport represents only 1 percent of total operations, it is not expected that there will be a significant shift in the number of operations to Runway 16-34 due to the change in status.

The improvements to Runway 16-34 will affect wetlands at the Runway 34 end (wetlands at the Runway 16 end will be affected under any of the alternatives proposed), but the area affected will be less than that calculated in Runway Alternative 1 because the wetlands area is more extensive at the Runway 9 end compared to the Runway 34 end. Wetlands impact estimates for this alternative include 14,000± square feet of local, state, and federal vegetated wetlands at the Runway 34 end, and 6,000± square feet of local and federal vegetated wetlands at the Runway 16 end. Also, the proposed shift from one runway to the other means that the proposed improvement can be constructed on existing airport property; therefore, land acquisition to accommodate the RSAs would not be necessary, thereby reducing community impacts.

[7] If penetrations to the threshold siting surfaces are removed, the amount of the displacement may be reduced. Overall, only 220 feet of runway pavement must be removed to accommodate the standards RSAs for Runway 9-27.

One additional consideration with the extension of Runway 34 is the impact of the Part 77 approach surface. If the runway is extended to 5,000 feet, then the 20:1 approach surface will be lower over the existing industrial park at the Runway 34 end. However, if the approach slope to Runway 34 remains 20:1, the existing buildings are below the proposed approach slope and, therefore, should not affect the location of the runway threshold. Trees off the end of Runway 34 would become penetrations and likely would have to be removed. Most of these trees are located within the boundaries of airport property.

The change in the primary runway designation affects wind coverage available at the airport. As previously mentioned, the prevailing winds at the airport (based on Boston data) slightly favor Runway 9-27. Wind velocity data from the airport's ASOS also was analyzed to support this analysis; however, this data was available only from December 1998 through May 1999 and, therefore, is not representative of annual wind conditions. The ASOS data did indicate that Runway 9-27 and Runway 16-34 provide approximately the same wind coverage, and tower personnel indicated that Runway 34 and Runway 27 are the most frequently used runways. During IFR conditions, the prevailing winds favor Runway 9 as demonstrated in Table 5-3.

TABLE 5-3
IFR WIND ANALYSIS
(13-Knot Crosswind)

Runway	Coverage
9	61.79%
27	28.58%
16	40.24%
34	43.99%

Source: Wind Tabulation for Boston, MA, 1988-1997
National Climatic Data Center

ATCT personnel and several pilots mentioned that they use Runway 9 during adverse weather by flying the published approach to the airport, then circling Runway 9 to land. It is during IFR conditions that the runways are likely to be wet and/or slippery; therefore, it is important to have the most runway length available during that time. Discussions with senior FBO staff and pilots indicate that the availability of 5,000 feet of grooved pavement on Runway 16-34 would be an advantage during IFR conditions.

For this alternative to be constructed, the localizer that is approximately 300 feet from the Runway 34 end would have to be relocated. Typically, the FAA Facilities and Equipment Division handles the costs associated with installation and maintenance of localizers, and it is assumed that funding for relocation will come from it. Therefore, these costs are not considered in the estimate.

A cost estimate was prepared for this alternative, including work at all four runway ends. These costs include construction of the new portion of the runway, the RSA at the Runway 34 end, construction of RSAs at the Runways 9 and 27 ends by reducing runway length, and construction of the standard RSA at the Runway 16 end. Permitting and other environmental mitigation costs are not included in this estimate. Design and construction costs are estimated to be $1,150,000.

5.4.3 Runway Alternative 3: Declared Distances

This alternative allows the airport to meet FAA design standards without the financial, environmental, and community constraints associated with the first two runway alternatives. According to the *Airport Design* AC, the declared-distance criteria are not meant to be applied to all airports, but should be reserved for "existing constrained airports where it is impractical to provide the RSA, the ROFA, or the RPZ in accordance with the design standards...." Therefore, other alternatives must be considered impractical before declared distances can be considered.

Under this alternative, the only improvements associated with Runway 9-27 would be restriping of the runway to reflect the displaced thresholds and the relocation/addition of threshold lights. If possible, existing penetrations to Part 77 and threshold siting surfaces should be removed, which may reduce the amount of displacement necessary. The striping and electrical work would not impact any environmentally sensitive areas, such as wetlands, and would not create the need for land acquisition. The costs associated with the design and construction for painting and electrical work were estimated to be $100,000.

The use of declared distances would be applicable only to jet aircraft and the larger turboprops using BVY. The single-engine and light twin-engine aircraft typically can operate on less than 4,000 feet of runway and, therefore, would not be greatly affected. As a result, the application of declared distances would apply only to approximately 2 percent of the aircraft using the airport.

One drawback to this alternative is that the use of declared distances reduces the amount of runway available for landing. As shown in Table 5-2, landing distances on Runway 9-27 would be approximately 10 percent shorter than the total runway length. While most aircraft use less runway for landing than for takeoff, it is prudent to have extra length available for landing, especially in poor weather conditions. A reduction in this landing length could cause pilots to divert to other airports when the runway is wet, thereby reducing the operational capability of the airport.

5.4.4 Runway Alternative 4: Runway 9-27 Centerline Shift

This alternative would not require new pavement on either end of the runway; however, it would require a redesign of the runway surface. Typically, runway pavements are designed so that the centerline is the highest point on the runway, and the pavement slopes down toward the edges to promote proper drainage. Therefore, shifting the centerline by 25 feet would require that the rehabilitation also include a redesign of the runway surface and, potentially some of the base under the runway. It also would preclude any design that just overlays the surface with additional pavement. As a result, it is expected that this option would increase the cost of rehabilitating Runway 9-27 by approximately 15 percent to $1,563,000. Other costs associated with this alternative include costs for relocating the runway edge lights on the northern side of the runway.

This alternative would enhance only the RSA available on the Runway 27 end, because the RSA on the Runway 9 end would still be impacted by topography. On the Runway 27 end, the length that the RSA would meet the standard beyond the runway end would increase from approximately 260 to 280 feet. Due to the location of Sam Fonzo Drive, this alternative still would not completely provide the standard RSA; however, if additional costs of the reconstruction are acceptable, then this alternative could be considered to help bring the airport into substantial compliance. Combining the benefits of this alternative with Alternative 5 could provide the most RSA possible while still maintaining 5,000 feet along Runway 9-27 and avoiding property acquisition. Wetlands impacts are not associated with this alternative; rather, the reduction in paved width will allow for a "banking" of impervious area at the facility, which will reduce the necessary stormwater controls associated with the apron and taxiway projects.

5.4.5 Runway Alternative 5: Modification of Standards

As previously discussed, a Modification of Standards can be considered as an alternative of last resort if other alternatives are not feasible. In this case, the modification would be recommended if land acquisition to maintain RSA is not desired; the costs of other alternatives are prohibitive based on federal, state, and local funding sources; or if the BAC does not wish to compromise the operational capability of the airport. This alternative would be the preferred alternative to attain as much RSA as possible at the Runway 9-27 ends without impacting residential properties, while still maintaining 5,000 feet along the runway with the best wind coverage.

The Modification of Standards in combination with the Runway 9-27 centerline shift has a lower cost than the full RSA construction alternative or the change in primary runway alternative. A modification would not require land acquisition, but would have significant wetlands impacts at the Runway 9 end. Full-width RSAs of 235 and 280 feet for Runways 9 and 27, respectively, would be attained, and the construction would be limited to airport property. The RSAs for the Runways 16 and 34 ends would result in the wetlands impacts listed for Alternative 1.

One of the considerations under this alternative is the preservation of runway length. Pilots and FBOs have all expressed a strong desire to maintain a 5,000-foot runway. In the industry, there is a rule-of-thumb, based on issues of liability, that most corporate operators want at least one 5,000-foot runway at an airport for regular use. If the airport were forced to reduce the length of Runway 9-27 without any adjustment to the other runway, the role of the airport would probably change and no longer be able to support the economic development of the area or the mission developed by the BAC. A Modification of Standards will allow the airport to maintain the current runway lengths and roles that provide the best wind coverage.

Another consideration for a modification of standards is maintaining an equivalent level of safety at the airport under current conditions. This concept means that the justification for a modification must show that the existing conditions do not jeopardize the safety of the airport or the intent of the design standards. At BVY, the equivalent level-of-safety analysis focused on fleet mix and existing RSAs.

As discussed in Chapter Three, the fleet mix of aircraft using the airport is dominated by small aircraft. Approximately 98 percent of the existing and forecasted operating fleet mix is single-engine or light twin-engine airplanes or helicopters. Based on FAA criteria for runway length, these aircraft can be served by approximately 3,600 feet of runway length. The remaining 2 percent of the operating fleet mix is corporate and charter turboprop and jet aircraft. Because these aircraft comprise an important component of the economic health of the airport, FBOs, and region, it is essential to provide the runway length for these aircraft. However, two factors may mitigate the need to meet all design standards if meeting them is impractical, as follows:

- Even in the long-term projections, total operations by the larger aircraft at the airport average only approximately six per day (i.e., three landings and three takeoffs). During ATCT operations, controllers provide clearance for this small percentage of operations so the pilots of the larger aircraft have adequate opportunity to line up with the appropriate runway and make a smooth landing, rather than having to make sharp turns and land at high speeds. Even during periods when the tower is closed, the fact that the airport is relatively uncongested means that these aircraft are still able to make a low-speed approach to minimize the chances of an undershoot or overrun.

- Pilots of corporate aircraft typically have much more flying time and experience than pilots of smaller general-aviation aircraft. As a result, the corporate pilots are generally more proficient at operating in constrained situations. Most corporate pilots flying into BVY are frequent users of the airport and, therefore, are familiar with the constraints in the area. These factors also reduce the risk of undershoots and overruns.

Currently, the RSA at the Runway 27 end nearly meets the standard and, with the centerline shift, a total length of 280 feet can be attained. On the northern edge of the RSA, Sam Fonzo Drive and the grading associated with it reduce the area that meets the grading standard for the

RSA; however, from the runway centerline south, the road does not impact the Runway 27 RSA. Portions of the RSA also are at a higher elevation than the runway end, but these will be graded to conform to the required elevations as part of this alternative. As such, the RSA at the Runway 27 end will nearly meet the standard and provides an equivalent level of safety.

At the Runway 9 end, there is only 100 feet of RSA available due to the steep terrain. Additional fill and grading within the property boundary will allow for the creation of an additional 135 feet, for a total RSA length of 235 feet. The RSA at the Runway 27 end is actually a cut project that would generate less than half of the fill required for the Runway 9 RSA. It is assumed in the cost that half of the fill required for the Runway 9 RSA would be generated by the excess material generated at the Runway 27 end. The cost of the RSA construction for all runway ends as described in Alternative 5 is approximately $614,000, not including permitting and mitigation. This cost would be in addition to the cost of the Runway 9-27 centerline shift (which is a cost common to all alternatives). The fill associated with the Runway 9 RSA is the most expensive portion of this project.

TABLE 5-4
SUMMARY OF RUNWAY ALTERNATIVES

Alt. #	Description	Estimated Cost	Wetlands Impact	Advantages	Disadvantages
1	Shift Runway 9-27 75 feet to the west to construct standard RSAs at both runway ends	$1,650,000	24,000 square feet at the Runway 9 end	Meets FAA criteria while maintaining existing runway length for Runway 9-27. Avoids displacement of Sam Fonzo Drive.	Most costly alternative, with significant community impact due to property acquisition. Has large wetlands impact. Variance required from state wetlands regulations.
2	Add 363 feet to the Runway 34 end and reduce Runway 9-27 to meet FAA RSA design standards. Construct standard RSAs at Runway 16 and Runway 34 ends	$1,150,000	6,000 square feet at the Runway 16 end and 14,000 square feet at the Runway 34 end	Meets FAA design criteria. Reduces costs and wetlands impacts compared to Alternative 1.	Reduces length on runway with best wind coverage and requires relocation of localizer. State wetlands impact exceeds allowable amount. Variance required from state wetlands regulations. Permit pursuant to local wetlands bylaw required.

Alt. #	Description	Estimated Cost	Wetlands Impact	Advantages	Disadvantages
3	Displace thresholds on runways to meet FAA design standards	$100,000	0 square feet	Less expensive than Alternatives 1 and 2 with no wetlands impacts or property acquisition.	Reduces landing length available on runways. No runway provides 5,000 feet of usable surface for landings.
4	Shift Runway 9-27 centerline 25 feet south as part of runway pavement rehabilitation	$1,563,000	0 square feet	Improves RSA length to near FAA requirements. No wetlands impact.	Increases costs of rehabilitation for Runway 9-27. No improvement to Runway 9 end.
5	Obtain Modification of Standards for RSAs and ROFAs. Construct RSAs at all four runway ends.	$614,000	24,000 square feet at the Runway 9 end	Maintains Runway 9-27 as primary runway with 5,000 feet of length.	Full RSA compliance not realized for Runways 9 and 27. Wetlands impact requires a variance from state wetlands regulations.

Source: Dufresne-Henry, Inc., analysis

5.4.6 Taxiway Alternative 1: East-Side Partial-Parallel Taxiway to Runway 16

A partial-parallel taxiway from the east-side apron/hangar area to the Runway 16 end would provide a taxi route for aircraft that would not require a runway crossing to reach the runway end. Aircraft on the western side of the airport can access Runway 16 via Taxiway B without crossing Runway 16-34. In addition, aircraft landing on Runway 34 must taxi using Taxiways F or B and cross the runway to get to the eastern side if they cannot exit on Taxiway A. This partial-parallel taxiway would enhance the safety of the airport by reducing the number of times an aircraft must cross an active runway.

Development of this taxiway and the associated RSA (i.e., 39.5 feet either side of the taxiway centerline) could impact a small area of wetlands north of the GTE hangar (i.e., less than 500 square feet) that is within the watershed of a Class A water body (i.e., Wenham Lake). Permitting and mitigation would be necessary as part of the construction including an Individual 401 permit under the Federal Clean Water Act because all impacts to Class A waters require a higher level of review.

A preliminary cost estimate for the design and construction of this taxiway is $500,000. It consists of approximately 3,200 linear feet of taxiway with lighting, 35 feet in width.

5.4.7 Taxiway Alternative 2: East-Side Partial-Parallel Taxiway to Runway 34

ATCT personnel indicated that aircraft holding for takeoff on Runway 34 currently occupy Runway 9-27. In some instances, jet aircraft operating at the airport request Runway 9-27 even when Runway 34 is being used by smaller aircraft, so the holding aircraft must leave the runway. Construction of a partial-parallel taxiway to the end of Runway 34 (or at least to Runway 9-27 if Runway 34 is not extended) would alleviate the necessity to hold aircraft on a runway.

Taxiway Alternatives 2 and 3 are being proposed as exclusive alternatives. Because significant congestion is not expected, it is unlikely that partial-parallel taxiways on both sides of Runway 34 would be approved. The benefits and constraints of these two alternatives were compared. With the taxiway on the eastern side of Runway 34, there would be no additional wetlands impacts other than those associated with the potential addition of 363 feet to Runway 34. The estimated cost for design and construction of this 700 linear feet of taxiway is $109,000. If Runway 34 is extended to 5,000 feet, then the east-side alternative is most feasible because a taxiway and RSA on the eastern side could be contained on existing airport property at an additional cost of approximately $80,000 (i.e., 500 linear feet of taxiway and a runup area). However, this alternative provides little benefit to reduce runway occupancy time, which is discussed in Subsection 5.4.8.

5.4.8 Taxiway Alternative 3: West-Side Partial-Parallel Taxiway to Runway 34

If Runway Alternative 2 is not implemented, a partial-parallel taxiway to Runway 34 would still eliminate the need to hold aircraft on Runway 9-27. A west-side partial-parallel taxiway would serve this purpose and provide an additional advantage: it would reduce runway occupancy time. Currently, aircraft landing on Runway 9 or 27 have three choices to exit the runway before the end: turn off on Taxiway B or F or exit on Runway 34. For jets landing on Runway 9, it is unlikely that they will be able to exit on Taxiway B or F; therefore, the first opportunity is Runway 34. If the partial-parallel taxiway were constructed west of Runway 34, then a larger aircraft would have an opportunity to exit on the new taxiway and taxi to the ramp (if it is headed to the western side of the airport, it would never occupy an active runway once it exits Runway

9). Small aircraft landing on Runway 27 also may not be able to exit on Runway 34; under the current configuration, these aircraft do not have another chance to exit until Taxiway F. The partial-parallel taxiway on the western side of Runway 34 may allow some of the smaller aircraft to exit earlier.

It is possible that a west-side taxiway may impact some of the wetlands located in the middle of the airport, but impacts should be minimal based on sketch-level accuracy. Refinement of grading of the taxiway side slopes may be able to eliminate direct wetlands impacts with this alternative.

The estimated cost for a taxiway on the western side of Runway 34 is $290,000 (not including the extension to an extended Runway 34 end). It consists of approximately 1,850 linear feet of taxiway with lighting, 35 feet in width. If Runway 34 were to be extended, the easement and permitting costs necessary for the extension of a west-side taxiway to the new runway end would be excessive, compared to Taxiway Alternative 2.

5.4.9 Taxiway Alternative 4: West-Side Full-Parallel Taxiway to Runway 16-34

The construction of a full-parallel taxiway on the western side of Runway 16-34 would allow the northern portion of Taxiway B to be eliminated. As a result, the hangar development presented in Apron/Hangar Alternative 4 could be shifted to the east, away from the residential development, and the wetlands impacted could be reduced to near zero. The cost associated with construction of a taxiway on the western side beyond that described in Taxiway Alternative 3 is approximately $350,000. It consists of approximately 2,250 linear feet of taxiway with lighting, 35 feet in width.

It is not likely that the FAA would fund parallel taxiways on both sides of Runway 16-34, because the demand projected for the airport does not exceed the capacity of the existing system. However, both the west- and east-side taxiways are proposed in this plan because the relocation of Taxiway B is preferred as a way of creating more apron/hangar area. The airport has limited landside area remaining, and this project will create significant space to address long-term demand.

5.4.10 Taxiway Alternative 5: Extension of Taxiway D

The primary benefit of the extension of Taxiway D is that it would allow aircraft to exit Runway 9-27 sooner than is currently possible. ATCT personnel report that aircraft landing on Runway 9 are not always able to stop before Taxiway F and, therefore, must taxi to Runway 34. Aircraft landing on Runway 27 rarely are able to stop before the runway intersection and therefore must continue to Taxiway F. The stub taxiway from the extension of Taxiway D would allow these aircraft to exit sooner, thereby, clearing the active runway. In addition, this new taxiway would provide a place for aircraft to hold while waiting to use Runway 34. Aircraft currently hold on Runway 9-27 while waiting for Runway 34, creating several instances where ATCT personnel had to clear them to make way for a landing. With the extension of Taxiway D and the stub taxiway, aircraft from the western-apron area could taxi and hold without ever crossing an active runway. This alternative also will create an area in which aircraft runups could be performed and, because the runup would be in the middle of the airport, this alternative could reduce noise impacts on surrounding residential developments.

The primary drawback to this alternative is wetlands impacts. This taxiway would pass through a large wetlands area and it is estimated that construction could impact approximately 60,000 to 70,000 square feet of local, state, and federal wetlands, requiring a variance from state wetlands regulations. Special design features may be able to reduce the extent of the impact, however reduction to below the state threshold of 5,000 square feet is doubtful. Additionally, there would be no on-airport locations for the replacement of the impacted wetlands, thus off-airport parcels would be required. Costs associated with the construction of this taxiway and stub, exclusive of permitting and mitigation, are estimated to be $280,000.

TABLE 5-5
SUMMARY OF TAXIWAY ALTERNATIVES

Alt. #	Description	Estimated Cost	Wetlands Impacts (square feet)	Advantages	Disadvantages
1	Construct a partial-	$500,000	500	Provides access to the Runway 16	Minor wetlands impacts

Alt. #	Description	Estimated Cost	Wetlands Impacts (square feet)	Advantages	Disadvantages
	parallel taxiway from the eastern apron/ hangar area to the Runway 16 end with stub			end without the need to cross the runway.	within a Class A watershed;.requires stormwater mitigation.
2	Construct a partial-parallel taxiway from the eastern apron/ hangar to Runway 34 end on the eastern side of the runway	$109,000	0	Provides access to the Runway 34 without the need for crossings. Could be extended to a new runway end if 363 feet is added to Runway 34.	Provides little exit benefit.
3	Construct a partial-parallel taxiway from Taxiway A to Runway 9-27 on the western side of Runway 34	$290,000	0	Provides an additional runway exit, which may reduce the need for aircraft to cross an active runway.	Could not be extended to meet the ultimate end of Runway 34 without property acquisition and wetlands impacts.
4	Construct a full-parallel taxiway on the western side of Runway 16-34 and eliminate the northern section of Taxiway B.	$350,000	18,000	Moves hangar development toward the center of the airport and minimizes wetlands impacts.	Does not eliminate aircraft crossing the runway from the eastern apron. Wetlands impacts to local and federal wetlands; requires stormwater mitigation.
5	Extend Taxiway D to Runway 16-34 and provide connection to Runway 9-27	$280,000	45,000	Provides additional exit for landing aircraft in either direction on Runway 9-27; provides a hold area for aircraft coming from the western side to Runway 34; moves runups to the middle of the airport to reduce noise.	Significant wetlands impacts to local, state, and federal wetlands. Requires stormwater mitigation. Variance required from state wetlands regulations.

Source: Dufresne-Henry, Inc., analysis

5.4.11 Landside Alternative 1: New Apron South of BAC Ramp

This alternative was recommended in the previous AMPU, although dimensions of the apron have changed slightly in this AMPU due to the change in ARC from B-III to B-II. Development of this area does not appear to impact environmental resources such as wetlands, but may occur within 100 feet of a wetlands boundary and, therefore, may be subject to state stormwater policy. The area adjacent to the potential apron is already used for aircraft parking; therefore, this development would be compatible with existing facilities. This improvement could be implemented in the short term to help alleviate peak shortfalls; however, additional apron still will be necessary. The estimated cost of this apron is $173,000. It consists of 46,000 square feet of paved apron surface, which could provide a maximum of 15 tiedowns for a mix of based and itinerant aircraft. However, if some or all of this space is utilized for T-hangar development, the number of tiedowns would be reduced. This space potentially addresses the short-term apron deficiencies noted in Chapter Four.

5.4.12 Landside Alternative 2: Replace East-Side Automobile Parking with Apron

Due to the presence of wetlands north of the GTE hangar, there is little aviation-related development potential on the eastern side of the airport. Revision of the apron configuration and automobile parking should provide additional area for aircraft parking. However, this apron would create additional shortfalls in automobile parking; therefore, new parking areas would have to be developed. This parking could be created either east of the restaurant and GAS buildings or east of the airport maintenance building. The area east of the GAS buildings is level, which should reduce construction costs, but automobile parking would reduce the potential for nonaviation use in that area. The area east of the maintenance building is as much as 10 feet higher than the apron area, and would require either ramps or significant blasting to construct the parking area.

Conversion of the parking lot to apron results in approximately 75,000 square feet of apron, and would cost an estimated $281,000. The number of spaces generated by this conversion depends greatly upon the aircraft mix, however accommodations for up to 23 aircraft could be made available. The design and construction of the automobile-parking area behind the restaurant would cost approximately $125,000. Design and construction of the automobile parking area behind the airport maintenance building was estimated at $188,000. This estimate will vary depending on the design of ramps for lot access, or blasting the ledge to reduce the elevation of the lot to approximate the elevation of L.P. Henderson Road.

5.4.13 Landside Alternative 3: New Apron/Hangar Area Between Taxiways B, D, and F

The western side of the airport provides the most area for apron development. This area can accommodate all of the demand projected for the planning period; however, if apron were developed only in this area, a competitive advantage might be provided for the west-side FBOs. Apron development in the southern portion of this area will be required to avoid wetlands areas, and vehicle access to the area should be provided. Costs for apron in this area are approximately $3 per square foot of apron, excluding mitigation and permitting costs. Potential apron space available beyond the wetlands limits (and allowing some space for stormwater control features) is 530,000 square feet, for an approximate total cost of $2,000,000 (including access roadway). This apron area could provide space for up to 175 based and itinerant aircraft. However, the creation of movement lanes and the addition of larger aircraft to the apron likely would reduce the number of spaces available.

5.4.14 Apron/Hangar Alternative 4: New Hangar Area West of Taxiway B

Due to the environmental and layout constraints of the airport, there is little area available for the construction of hangars. The area shown in Figure 5-2 provides adequate space for hangar development, while also allowing easy ground access and automobile parking. This area was recently cleared of trees that were obstructions to the Part 77 surfaces; however, the clearing removed some of the visual barrier between the road and the airport. Properly placed hangars could restore this barrier; however, they would impact wetlands and require permitting. If the northern portion of Taxiway B is eliminated in favor of a new parallel taxiway, then the wetlands impacts could be reduced or eliminated. Approximately 280,000 square feet of area would be available for apron/hangar/taxiway development if the taxiway were realigned.

Two types of hangars could be developed in this area: T-hangars and conventional hangars. Because hangar development is a function of the demand for the facilities and the funding available (i.e., hangars are typically not eligible for federal funding), the specific layout of the hangars will not be developed in this AMPU.

TABLE 5-6
SUMMARY OF APRON/HANGAR ALTERNATIVES

Alt. #	Description	Estimated Cost	Wetlands Impacts	Advantages	Disadvantages
1	Construct apron between Taxiway A and east-side apron/hangar area (46,000 square feet)	$173,000	0 square feet	Can easily be accomplished to address apron deficiencies in the short term; provides some space for T-hangar development	Limited space available so additional apron would still have to be constructed.
2	Turn existing east-side automobile parking into apron (75,000 square feet), and construct new automobile parking	$594,000	0 square feet	Provides additional apron space on eastern side, which is currently constrained for space	Automobile parking construction costs variable due to potential location on hill with ledge outcrops
3	Construct apron between Taxiways B and F (530,000 square feet)	$2,000,000	500 square feet	Ample area exists to construct apron to meet projected demand.	Could provide economic advantage to west-side FBOs; stormwater management would be required
4	Construct hangars north of west-side apron/hangar area	N/A	500 square feet	Provides enough area to construct both T-hangars and conventional hangars. Provides visual barrier for Burley Street residents.	Wetlands impacts can be reduced if Taxiway B is realigned; extensive stormwater management would be required
5	Nonaeronautical use	N/A	N/A	Provides revenue to airport; parcels are located too far from aircraft movement areas to be used for apron/hangar space	Limits improvement potential on eastern side, which is already constrained by space shortfalls

Source: Dufresne-Henry, Inc., analysis

5.4.15 Nonaeronautical Use

One of the key elements to airport improvements is nonaeronautical use of the airport facilities that provide revenue. BVY has an excellent opportunity to supplement the commercial/industrial development along the newly constructed Sam Fonzo Drive with some additional development opportunities on the parcels identified in Subsection 4.2.8. These opportunities may create additional vehicle traffic along L.P. Henderson Road and will limit any expansion potential of the eastern side of the airport; however environmental issues, the distance of the subject parcels to existing airport facilities, and the topography of the land already limit this expansion. Because the development will be on airport land, all leases should allow the BAC to protect Part 77 surfaces and ensure that all nonaeronautical uses will be compatible with airport operations. The locations of the five parcels are shown in Figure 5-2.

The alternative to the use of these parcels for nonaeronautical use is to reserve them for future landside facilities, which may include automobile parking, snow-removal equipment storage, or future terminal use. Their use for airside facilities is constrained by numerous factors as explained in Chapter Four. While landside opportunities are available, their overall feasibility is low due to the need to reconfigure the existing facilities on the eastern side to utilize these spaces.

5.5 SELECTION OF PREFERRED ALTERNATIVE

The proposed airside, landside, and nonaeronautical use alternatives were presented to the BAC, the PAC, the FAA, and the MAC. During those meetings, the FAA and MAC representatives requested additional information regarding the potential impacts of the RSA development based on the alternatives. The policy of the FAA is to recommend full compliance with the RSA criteria, and a detailed analysis of the potential impacts of each alternative was beyond the scope of this study. However, based on the available environmental data, two alternatives that would address the RSA standard deficiencies received additional investigation. Both alternatives would provide the necessary 5,000 feet of runway length, thereby protecting the current role of the airport.

The first included the shift in the centerline of Runway 9-27 as part of the runway rehabilitation project (i.e., Runway Alternative 4) in combination with the limited RSA construction and suggested Modification of Standards proposed in Runway Alternative 5. Combining these two alternatives results in substantial RSA compliance at both the Runway 9 and 27 ends, while maintaining a 5,000-foot length on the runway with the optimal wind coverage. This could be accomplished without the need to acquire residential properties at the Runway 9 end; however, easements on private residential properties would be needed to address tree penetrations to the ROFA at the Runway 9 end. Combining the alternatives does provide some economy of scale because the pavement on this runway exceeds 20 years and is proposed for rehabilitation and decrease in width even without the RSA projects. Taking advantage of the RSA benefits at the Runway 27 end with the centerline shift is practical given the 15 percent cost difference between the shift/non-shift options. Total cost for this runway alternative is estimated to be $614,00 for design and construction of the RSAs at all four runway ends, and an additional $1,563,000 for the centerline shift and rehabilitation of Runway 9-27. This alternative does not result in full RSA compliance, and community impacts are somewhat exacerbated by the fill project at the Runway 9 end. Wetlands impacts of approximately 24,000 square feet would occur.

The second included implementation of Runway Alternative 2 which involves the conversion of Runway 16-34 to the primary runway, and Runway Alternative 4 involving the reduction in width of Runway 9-27 and the shift of the runway centerline to the south to increase the available RSA at the Runway 27 end. The Runway 9-27 pavement length would be reduced 220 linear feet to 4,781 feet in order to provide the full RSA compliance including a 20-foot reduction at the Runway 27 end, and a 200-foot reduction at the Runway 9 end. Runway 16-34 would be extended 363 feet at the Runway 34 end to provide 5,000 feet of runway.

This alternative eliminates wetlands and community impacts at the Runway 9 end by minimizing the extensive fill slope. It somewhat improves conditions within the RPZ at the Runways 9 and 27 ends by moving the ends further onto the airport property. Similarly, noise impacts would be reduced at these ends, by threshold relocation, where residences occur in close proximity to the runway traffic. Wetlands impacts would occur with the extension and RSA construction at the Runway 34 end, where up to 14,000 square feet of impact could occur. Impacts at the Runway 16 end due to RSA construction are limited to local and federal wetlands areas, and total 6,000± square feet. This magnitude of impact would require a variance from state wetlands regulations.

Wind coverage does not favor the change in primary runway designation, however the coverage is within acceptable limits, and the decrease in length of Runway 9-27 is minimal allowing for most existing aircraft at the facility to continue to utilize Runway 9-27 in most weather conditions. This option is also less expensive than the first option, because it eliminates property easements and the extent of fill involved with the first option. Furthermore, this option has some operational advantages. By converting Runway 16-34 to the primary runway, the longest operational runway would now have the non-precision approach. While both options require a variance from the state wetlands regulations, the second option reduces the overall impact, which should have positive effects on the permitting process by reducing environmental and community impacts.

In reviewing the advantages and disadvantages of these two alternative scenarios, the second runway option was selected where Runway 16-34 is improved to function as the primary runway, and Runway 9-27 is decreased in length to provide the necessary RSAs at each end. The final usable runway length of Runway 9-27 is dependant on the ability to remove penetrations to the airspace off of the airport property, allowing for removal of the displaced thresholds. Selection of this alternative reduces both wetlands and community impacts, and results in lower project costs by avoiding off-airport land acquisition. Because Runway 16-34 would be the primary runway, an upgrade of the MALS at the Runway 16 end to include the additional light bars is recommended for the intermediate term. Some further investigation of feasibility of this project is needed, because the final light bar would be close to the new airport property boundary (established through the recent purchase of two residential properties).

Other alternatives also were discussed with the BAC, PAC, FAA, and MAC. Based on input from those meetings, the following taxiway and apron/hangar alternatives were selected:

- Taxiway Alternatives 1 and 2, which together create a full-parallel taxiway for Runway 16-34 on the eastern side, have been identified as improvements that enhance the safety of the airport by reducing necessary crossings of an active runway. Additionally, the extension of this taxiway to the extended Runway 34 end is proposed because the selected runway alternative includes the runway extension.

- Taxiway Alternative 4 was modified to create a partial-parallel taxiway from the end of Runway 16 to Taxiway F. This new taxiway will allow the hangar development identified in Apron/Hangar Alternative 4 to be implemented closer to the middle of the airport and with reduced wetlands impacts. The remainder of the parallel taxiway on the western side was not selected as the preferred alternative, because that portion did not significantly improve the operational capabilities of the facility.

- Taxiway Alternative 5 also was selected because of the safety enhancement and improved operational capacity that the new exit taxiway would provide for Runway 9-27. Potential impacts to wetlands associated with this alternative may require modifications to the design, including increased side slopes.

- All apron/hangar alternatives and nonaviation alternatives also were selected for inclusion in the 20-year plan. Construction of the east-side apron (i.e., Landside Alternative 1) is proposed for the short term to alleviate existing apron and T-hangar shortfalls. This project would be followed by the conversion of the east-side automobile parking area to apron (i.e., Landside Alternative 2) in the intermediate term, which maximizes the development capacity of the eastern side. Long-term apron and hangar construction on the western side involves the incremental construction of Landside Alternative 3 (based on capacity requirements) followed by the development of additional apron and hangar space proposed in Landside Alternative 4. The west-side alternatives involve extensive apron area, which will be developed as capacity requires. Landside Alternative 4 could not be constructed until the shift in Taxiway B occurs as part of the long-term phase of airport development.

- The release of the identified parcels for nonaeronautical use also was selected with a recommendation of a lease arrangement. These parcels are shown in Figure 5-2.

- Upgrade of the MALS at the Runway 16 end to include the additional light bars should be investigated relative to the property limits, and implemented if feasible.

Selection of these preferred alternatives does not imply any commitment to construct all of these facilities, but rather is simply a plan based on the forecasts developed and the standards set forth by the FAA and MAC. Demand-based facilities, such as hangars and apron, should only be constructed as demand warrants, and all improvements should be reviewed for feasibility at the time of design. The review should include environmental and community considerations.

Chapter Six

ENVIRONMENTAL INVENTORY AND ANALYSIS

This section provides an inventory and preliminary evaluation of important natural resources that exist in the vicinity of the Beverly Municipal Airport. These resources include those that are protected by local, state, and/or federal regulations; therefore, their existence on or adjacent to the airport property could impact the feasibility of completing airport-improvement projects. Those resources investigated as part of this AMPU include the following:

- wetlands
- floodplain
- water quality
- public water supply
- wild and scenic river segments
- rare species
- agricultural soils
- historical/archeological
- conservation land (4(f) properties)
- general land use

After an investigation of these resources, likely impacts associated with the preferred improvement projects are analyzed. Because the analysis in Subsection 6.2 includes even the long-term projects, it is likely that, within the planning period, changes to environmental regulations will require a modification of this environmental analysis, particularly with respect to the listing of required permits.

6.1 INTRODUCTION TO ENVIRONMENTAL INVENTORY

The identification and assessment of the natural environment in the vicinity of the Beverly Municipal Airport are important first steps in the efficient planning of airport-improvement projects. Many natural resources are protected by laws and regulations at the local, state, and federal levels and therefore, may impact project location and overall feasibility. Permits are often required before completing any land-altering activities that may impact protected environmental resources. Once issued, many of these permits contain conditions mandating the completion of construction according to specific sequences and methods, which can affect project costs and timing. Additionally, the natural environment of a site often dictates the location and layout of improvement projects because both the cost of construction and permitting can be prohibitive when the proposed development plan involves direct impacts to protected natural resources and/or involves the use of land with physical constraints (e.g., steep slopes, bedrock, and poor soils.) Through the identification of these resources early in the planning process, project alternatives can be selected that avoid these resources or, in cases where avoidance is not possible, minimize the impacts and plan for acceptable mitigation measures. By conducting project planning in this manner, significant time and cost savings can be realized. Additionally, project cost estimates are more accurate when permitting requirements are considered.

Natural-resource information is available through various publications, municipal agencies, and field inspection. The following resources were utilized in the preparation of this chapter:

- Massachusetts Division of Fisheries and Wildlife; Natural Heritage Program
- Massachusetts Historic Commission (MHC)
- Massachusetts Department of Food and Agriculture
- Massachusetts Department of Environmental Protection (MADEP)
- City of Beverly
- Town of Danvers
- Town of Wenham
- U.S. National Park Service (Internet database)
- U.S. Fish and Wildlife Service (USFWS)
- U.S. Natural Resources Conservation Service (soil survey)
- FEMA Flood Map
- Previous airport environmental documents

In addition to the agency review, Dufresne-Henry, Inc., staff utilized existing site construction plans to determine the extent of wetlands on most of the airport property (completed in 1996 as part of a vegetation management plan project). The remaining on-airport wetlands areas were identified for this AMPU using sketch-level accuracy. These remaining wetlands were located mainly within the infield areas of the airport.

TABLE 6-1
ENVIRONMENTAL CONSTRAINTS SUMMARY TABLE

Environmental Constraint	Present or Absent at BVY	Comments
State/Federal Wetlands	Present	More than 55 acres of wetlands exist on remaining open land at BVY. Wetlands are located within the areas of many selected improvement projects.
FEMA Floodplain	Absent	The limits of the 100-year flood do not encroach onto airport property, as determined by the most recent FEMA maps for the three municipalities.
Class A Water Quality	Present	Some wetlands at BVY that drain to Wenham Lake are Class A waters and therefore, subject to more stringent environmental regulation.
Public Water Supplies	Present	The northeastern portion of the airport is within the watershed of Wenham Lake, a public water supply.
Wild and Scenic Rivers	Absent	The Danvers and Bass rivers are not on the most current listing of wild and scenic rivers or study rivers.
Endangered Species	Present	The Natural Heritage Program commented on the presence of one species; however, the site does not appear in the most recent habitat atlas.
Prime Agricultural Soils	Present	Prime soil types exist; however, it is expected that they will receive a low scoring on closer

		evaluation.
Historic/Archeological	Absent	A recent survey of the airport suggests low sensitivity.
Public Properties	Absent	None identified
Incompatible Land Use	Present	Dense residential development exists at two runway ends. Additional development is possible within the Runway 16 approach along Burley Street.

Source: Dufresne-Henry, Inc., analysis

6.1.1 Environmental Setting

BVY is located within three municipalities: the city of Beverly and the towns of Danvers and Wenham. The majority of the facility is located within Beverly and Danvers, with only a small portion of the Runway 16 end located within Wenham (Figure 6-1). The property is situated in an area of elevated terrain, which forms a surface-water divide. Drainage from the western side of the airport property flows westward into Frost Fish Brook, a perennial tributary of the Porter River that is within the North Shore Drainage. The brook and associated on-airport wetlands are listed as Class SB waters in the Massachusetts Surface Water Quality Standards (1995). The eastern side of the airport drains in two directions. Runoff generated north of L.P. Henderson Road flows toward Airport Brook and discharges to Wenham Lake; a Class A water body. Both Airport Brook and Wenham Lake are within the Ipswich River Basin, with a general flow to the northeast. Flow generated south of L.P. Henderson Road (including the entire area of Sam Fonzo Drive) forms the headwaters of Bass River, a perennial tributary of the Danvers River and a Class SB water of the North Shore Drainage. General flow for the Danvers and Porter rivers is to the south.

The airport is located within an area of mixed industrial and residential properties. Cherry Hill Industrial Park forms most of the southern border of the airport, and an expansion of this industrial park is currently occurring along the recently constructed Sam Fonzo Drive to the south and southeast within the approaches and approach transitions of Runways 34 and 27.

Moderately dense residential development exists along much of the eastern and western property boundaries, particularly within the Runway 9 and 27 approaches. Lower density residential development exists to the north, northeast, and northwest of the facility at the Runway 16 end. Some limited open space occurs along the eastern transition of Runway 16.

The airport property contains a mix of paved surfaces, buildings, turf areas, and limited forested and shrub wetlands. The airport environs were modified as a result of the 1999 clearing project that addressed the on-airport Part 77 surfaces. Tree-removal occurred over the entire airport property, replacing most of the forested areas with a shrub-dominated cover type. Those areas that were cut as part of the project are currently subject to a long-term maintenance plan, which includes herbicide use to control the regrowth of trees. Maintenance of the cut areas as shrub-dominated areas was a

Insert Figure 6-1
USGS Site Locus

goal of the vegetation-management plan. Details of the plan are in the document entitled *Findings Report for the Implementation of the Beverly Municipal Airport Vegetation Management Plan* (dated October 1996 by Baystate Environmental Consultants, Inc.). Off-airport obstructions were not removed.

The airport has two principal access points; the eastern and western sides. Access from the east is gained from Route 97 via L.P. Henderson Road, a paved two-lane road. Access to the western side of the facility is provided off Burley Street.

6.1.2 State/Federal Wetlands

The limits of jurisdictional wetlands areas on the airport property were obtained from two sources. The majority of the wetlands boundaries were obtained from actual delineation completed as part of the 1996 vegetation-management plan. These boundaries mainly included the property periphery along the outside edge of the runways and taxiways. Wetlands within the infield areas were delineated using sketch-level accuracy for this AMPU. All wetlands areas are shown in Figure 6-2. More than 55 acres of wetlands subject to federal, state, and/or local jurisdiction occurs on airport property. All of these wetlands boundaries were completed more than three years ago and, therefore, are no longer valid for use under the Massachusetts Wetlands Protection Act(MWPA), unless approval is obtained from the local conservation commissions.

Wetlands areas are located along most of the airport property boundary and include areas within all three drainage basins (i.e., Ipswich River, Danvers River, and Porter River). Scrub-shrub wetlands are the dominant cover type as a result of the vegetation-management plan; however, some limited palustrine open water and palustrine forested areas exist. Wetlands constrain most of the remaining open space on the airport property, limiting the alternatives for airport development.

6.1.3 FEMA Floodplain

The limits of the 100-year floodplain are protected as a state wetlands resource area pursuant to the MWPA Regulations (310 CMR 10.57). This resource area, termed “bordering land subject to

Insert Figure 6-2
Wetland Base Plan

flooding," is described as serving an array of functions, the most important of which includes the retention of floodwaters, thereby minimizing damage resulting from severe storm events. Impacts to this resource area are allowable, provided that suitable mitigation in the form of compensatory flood storage areas is provided. In general, compensatory flood storage refers to the creation of new floodplain areas through the excavation of non-floodplain land. The requirements for compensatory storage areas are detailed in the MWPA Regulations (310 CMR 10.57).

The flood maps for all three municipalities prepared by the FEMA were inspected for this AMPU. The limit of the 100-year floodplain (depicted as Zone A on the FEMA maps) does not include any airport property (Figures 6-3a and 6-3b).

6.1.4 Water Quality

According to the *Massachusetts Surface Water Quality Standards 1995* (314 CMR 4.00), BVY is located within two different drainage basins: the North Shore Coastal Drainage and the Ipswich River Basin. Airport drainage flows in two directions, to the south and northeast. The drainage divide includes L.P. Henderson Road and Runway 16. In general, areas east of Runway 16 and north of L.P. Henderson Road are within the Ipswich River Basin, and drain to Wenham Lake. West of Runway 16 and south of L.P. Henderson Road, drainage is within the North Shore Coastal Drainage Area, and drain to either Porter River or Danvers River. This divide is shown in Figure 6-1.

The water-quality classification assigned to the subject wetlands and water bodies in the vicinity of BVY by 314 CMR 4.00 establishes the level of protection they will receive by certain permitting authorities. Airport-improvement projects are required to provide mitigation for any degradation of these waters to below the established standards. Wenham Lake is designated as a Class A water; therefore, the on-airport wetlands that drain to this surface water receive the highest level of protection. Class A wetlands are designated as Outstanding Resource Waters pursuant to state regulations promulgated under Section 401 of the Federal Clean Water Act. Wetlands designated as such receive additional regulatory protection, including a "no alteration of wetlands or waters" limitation on many projects. The remaining on-airport wetlands drain to

Class SB waters and do not receive this additional level of protection associated with Outstanding Resource Waters.

Insert Figure 6-3a
F.E.M.A. Flood Map Town of Danvers

Insert Figure 6-3b
F.E.M.A. Flood Map Town of Beverly

6.1.5 Public Water Supply

Wenham Lake is a primary drinking-water supply source for Beverly and Salem and a secondary source for Wenham. It is used as a holding reservoir for water pumped from the Ipswich River. The Salem-Beverly Water Supply Board has jurisdiction over activities in the watersheds of Wenham Lake, Putnamville Reservoir, and the Salem-Beverly Waterway Canal (see Figure 6-1). This includes most of the airport property located east of Runway 16 and north of L.P. Henderson Road.

Additionally, all airport property within the City of Beverly is located within the Beverly Watershed Protection Overlay District, a section of the Beverly zoning ordinance. Portions of the airport property in Wenham are within the Town of Wenham Aquifer Protection District. Proposed airport improvements may need to address the requirements of these ordinances prior to construction.

6.1.6 Wild and Scenic Rivers

The Wild and Scenic Rivers Act was passed on October 2, 1968, which granted authority to Congress or the Secretary of the Interior to designate important rivers or river segments for additional federal protection. The designated rivers and segments comprise the National Wild and Scenic Rivers System, which currently consists of 156 rivers or river segments within the United States. Additionally, 136 rivers or river segments are currently designated for study under this Act, all of which have the potential to be added to the system. Once added, these rivers and river segments designated for study will receive the high level of protection afforded those waters already on the list. Projects that include the alteration of area within the designated river corridors must coordinate with the U.S. Department of the Interior to ensure sufficient protection for the resource. Wetlands alterations within these corridors are reviewed in detail by the U.S. Army Corps of Engineers(USACE) pursuant to Section 404 of the Federal Clean Water Act.

The U.S. National Park Service maintains a database listing all rivers and river segments that are currently listed as wild and scenic or have been afforded the status of a "study river" and, therefore, may be eligible in the future for inclusion on the list. This list, updated in January

1999, does not include the Danvers or Porter river or any of the smaller tributaries that receive drainage from BVY.

6.1.7 Rare and Endangered Species

Both state and federal rare wildlife species receive additional regulatory protection under a host of statutes, including the Federal Endangered Species Act, the Federal Clean Water Act, the Massachusetts Endangered Species Act(MESA), and the MWPA. In general, the regulations prohibit the "taking" of the rare species either through direct removal of individuals or the disturbance of their prime habitat. When a rare species is located, the protected area usually includes the site where specimens were identified and all adjacent contiguous habitat that could support the species.

Information regarding the extent of rare species habitat is maintained primarily at the federal level by the USFWS and at the state level by the Massachusetts Natural Heritage and Endangered Species Program (MNHESP). Both agencies were recently contacted as part of other projects to identify the limits of rare species on or adjacent to BVY. While the USFWS did not indicate the presence of any federally protected species, the MNHESP commented in 1990 that the Golden-winged Warbler (*Vermivora chrysoptera*), a state endangered species, was identified on the airport property in the 1980s. The MNHESP did not indicate the presence of this species in a response obtained for the airport in 1996. Figure 6-4 shows the most current boundaries of rare wetlands wildlife and certified vernal pools in the vicinity of BVY, and Figure 6-5 provides the locations of "priority habitats" relative to the MESA. Neither map shows BVY to contain protectable habitat pursuant to the MWPA or MESA. However, because the presence of a rare species was documented at the facility, some coordination with the Massachusetts Natural Heritage Program may be required under MESA.

6.1.8 Agricultural Soils

The Farmland Protection Policy Act (FPPA) regulates federal actions that propose the conversion of farmland (i.e., either active farmland or areas of notable agricultural soils) to nonagricultural uses.

The identification of both active farmland and areas of prime, unique, and/or locally important agricultural soil types adjacent to the airport property allows for an assessment of impacts to farmland.

Insert Figure 6- 4
Estimated Habitat Map

Insert Figure 6-5
MESA Rare Species

No active agricultural fields occur on the airport property or within any areas that may be altered by the construction of the selected improvement projects. However, prime agricultural soils exist on the airport property. Figure 6-6 is the soils map for the property and adjacent areas provided by the Natural Resources Conservation Service (NRCS). Table 6-2 provides a key to the figure for those soil series designated as prime agricultural soils.

TABLE 6-2
KEY TO SOIL SERIES

Soil Symbol	Series Designation
Mm	Merrimack fine sandy loam
Ms	Montauk fine sandy loam
Pa	Paxton fine sandy loam
Wr	Woodbridge fine sandy loam

Proposed improvement projects within the limits of the identified areas will need to address the FPPA, including the scoring of the impact areas using the Farmland Conversion Impact Rating. The results of this scoring will determine the significance of the impacts and the need for further actions, including mitigation.

6.1.9 Historical/Archeological Resources

The National Historic Preservation Act requires that an evaluation be completed for the presence of important historical, archaeological, and/or cultural resources on land that could be impacted by federal actions. This evaluation should include a review of existing data, as well as on-site studies, if it is deemed that such resources may be present. On-site investigations may involve a review of historical literature and references or may involve the completion of a subsurface investigation for artifacts. The extent of the on-site work is determined by the historical sensitivity of the area, as determined by the State Historic Preservation Officer(SHPO) and/or the National Park Service. The preparation of a federal environmental assessment(EA) is required for those airport-improvement activities that may impact such resources.

Insert Figure 6-6
Soils Map

As part of the vegetation-management plan completed for the facility in 1996, the SHPO was contacted to obtain information of known historic/archeological resources within the airport vicinity. The response indicated that no known resources existed on the airport property. However, Native American archeological sites were identified in the area; therefore, there was potential for sites to exist on the airport. In response to this, an archeological survey was conducted on the airport property and it was concluded that overall sensitivity of the site relative to artifacts was low. Based on this 1996 investigation, it was concluded that the proposed improvement program will not result in impacts to sensitive historic and/or archeological resources.

6.1.10 Public Park, Recreation, and Conservation Lands

The ability of a public-use airport to obtain control over additional land area is affected by the ownership and existing use of the land. Where such ownership includes a public entity and the land is utilized for park, recreation, and/or conservation purposes, the U.S. Department of Transportation(USDOT) is mandated pursuant to Section 4(f) of the USDOT Act to follow a strict set of procedures to determine the significance of the land and to develop mitigation strategies. Some airport-improvement projects require the obtainment of easements and/or additional property to comply with current airport design criteria and to efficiently and safely plan for the airport layout in the long term. Of particular importance is the control of land within the runway approaches, where many of the safety-related design criteria stipulate the optimal physical characteristics of the land including slope, elevation, cover type, and use. Prudent airport planning includes pursuing control over runway approach areas, with particular emphasis on RPZs.

Inspection of the current ownership of abutting property owners at BVY suggests that the proposed improvement projects will not result in any land acquisition of 4(f) properties. The current assessors' maps of all three municipalities were investigated to identify any publicly owned parcels adjacent to the airport or within the runway approaches where obstructions may occur. Two public parcels, the first owned by the City of Beverly Conservation Commission (Map 90 Parcel 6) in Beverly and the second owned by the Town of Wenham (Map 23 Parcel 12), were identified. These parcels do not currently contain obstructions and, therefore, will not be involved in any of the selected airport-improvement projects.

6.1.11 General Land Use

Existing land use surrounding the airport consists of a mix of light-industrial, high-density residential, and moderate-density residential uses. Both ends of Runway 9-27 contain high-density, single-family residential developments within the approaches, with some residences occurring within the RPZ. Additional single-family residences line Taxiway D near the approach end of Runway 9. The Runway 16 approach occurs over lower density residential development; however, additional homes were constructed along Burley Street in the past two years. The Runway 34 approach occurs within both existing and proposed industrial development. Proposed industrial lots are associated with the Sam Fonzo Drive project, and mainly occur within the approach of Runway 34. The access road for this development was constructed within the approach of Runway 27. Controls are in place for this development that will restrict structure heights to below the Part 77 surfaces.

The extent of the residential development within proximity to airport movement areas is an existing incompatible land-use situation. Projects proposed in this AMPU will not result in a shift of the movement areas closer to these residences and will not impact current noise contours. However, impacts associated with the RSA alternatives may include impacts to adjacent residences.

Current zoning adjacent to the airport within the three municipalities is identified in Figure 6-7. The zoning includes mainly residential and light-industrial districts.

6.2 INTRODUCTION TO ENVIRONMENTAL ANALYSIS

The intent of this subsection is to evaluate potential environmental impacts associated with airport-improvement projects recommended for BVY during the planning period. This analysis does not replace the possible need for review pursuant to the National Environmental Policy Act (NEPA) and/or the Massachusetts Environmental Policy Act (MEPA). Rather, it provides a preliminary discussion of impact issues that will likely be part of the submissions completed for the NEPA/MEPA regulations and others. The information contained in this subsection will assist the airport in determining likely environmental impacts and associated permit requirements for each of the selected projects.

Insert Figure 6-7
Zoning Map

Documentation of the facility requirements is included in Chapter Four and the preferred development alternative for the entire planning period is described in Chapter Five. The first subsection of Chapter Six provides the environmental setting for the airport, defining important environmental features that could be impacted by the projects; this subsection provides the actual analysis. Figure 6-1 identifies the location of the airport relative to geographic features in the project area.

Analysis of the selected projects suggests that a federal EA will be required. The extent that each environmental issue is addressed in this AMPU is not intended to provide a complete analysis required for a full EA completed pursuant to the NEPA. Rather, the following analysis briefly discusses whether impacts are expected within each major category due to the selected projects and whether each category will need additional evaluation during an EA process. Therefore, this AMPU will be used as a guideline to develop the scope of an EA once project design has progressed.

The environment, which includes soils, wetlands, flora, fauna, historic structures, topographic features, hydrology, and a host of social factors, can dictate the location and layout of development projects at an airport. The presence or absence of specific environmental features, especially those subject to strict state and federal regulations, often guides the use of an area on airport property. The following analysis provides information on these resources and how they may be affected by the proposed short-term improvements. This environmental analysis also provides guidance and information regarding the extent of environmental permitting required for the selected improvement projects at BVY and potential mitigation measures to minimize environmental impacts.

This impact analysis is conducted pursuant to guidelines presented in FAA Order 5050.4A, *Airport Environmental Handbook*, and FAA Order 1050.1D, *Policies and Procedures for Considering Environmental Impacts*. These FAA documents are based on the general requirements for compliance with the NEPA, specifically Sections 1505.1 and 1507.3. Additionally, this subsection provides documentation that the proposed federal actions achieve environmental justice as required by Executive Order 12898. The projects that may be completed during the planning period are anticipated to include the following:

- Taxiway Alternatives 1 and 2 that together create a full-parallel taxiway on the eastern side of the facility along Runway 16-34. The pavement would be 35 feet in width and would have an associated RSA that extends out from the pavement centerline 39.5 feet to both sides. Impacts to land associated with the taxiways assume a total fill/clearing width of 80 feet (i.e., 35 feet of paved surface, 45 feet of turf surface). The total length of taxiway proposed under Alternatives 1 and 2 is approximately 4,400 linear feet.

- Taxiway Alternative 4 creates a partial-parallel taxiway from the end of Runway 16 to Taxiway F, a total length of approximately 2,250 linear feet.

- Taxiway Alternative 5, which includes the small stub to the runway, provides a new exit off Runway 9-27. The total length of paved taxiway associated with this alternative is approximately 1,800 linear feet.

- Runway Alternatives 2 and 4 where Runway 16-34 becomes the primary runway and Runway 9-27 is decreased in length, and the centerline is shifted, to provide standard RSAs at all four runway ends.

- All apron/hangar alternatives and nonaviation alternatives also were selected, which include the new automobile-parking areas. The landside alternatives involve additional impervious surfaces and clearing.

The following subsections evaluate each of the 20 impact categories identified in the NEPA and in Executive Order 12898 as they relate to the recommended airport-improvement projects.

6.2.1 Noise

Aircraft noise has been identified as a significant issue in the community surrounding the airport. Many of the PAC members, as well as members of the surrounding public, described the jet noise as being obtrusive. For this update, a computer model of the noise was developed to identify potential impacts of aircraft noise on the surrounding neighborhoods in order to assist the BAC with compatibility planning.

The noise analysis was performed using the Integrated Noise Model (INM), version 5.2 on the alternative that allowed Runway 9-27 to remain as the primary runway. The potential positive and negative impacts associated with the preferred runway alternative are not included herein. This software was developed by the FAA and is approved for use to estimate noise exposure around airports. Input for the model includes the following:

- layout of the airport
- type of aircraft using the facility
- number of operations within the specified period
- flight corridors used by the aircraft for takeoffs, landings, touch-and-gos, and overflights

Output includes noise "contours," which define areas of similar noise exposure much the same way that ground contours define areas of equal altitude. These contours can be overlaid on a map or photograph of the area around the airport to depict the areas most impacted by aircraft noise (Figures 6-8 and 6-9).

There are several different measurements to define noise exposure. The FAA has approved the use of the day-night average sound level (L_{dn}) for noise compatibility modeling around airports. The L_{dn} represents the average sound level in A-weighted decibels (i.e., sound exposure adjusted for the response of human hearing) for a 24-hour period. The L_{dn} metric also approximates the response of humans to nighttime noises by adding 10 decibels to all noise events (i.e., aircraft operations) between 10 p.m. and 7 a.m.

The FAA also provides guidance for recommended land uses within L_{dn} contours. Below 65 L_{dn}, all land uses are considered compatible. Above 65 L_{dn}, the compatibility of land uses depends on a variety of factors, including the following:

- L_{dn} at a specific location
- type of land use
- construction standards, such as sound insulation and manmade or natural noise barriers

- land-use controls, such as zoning or easements
- ambient noise level

Insert Figure 6-8

Existing Noise Contours

Insert Figure 6-9
Proposed Noise Contours

While local municipalities generally do not have the authority to regulate the type or time of aircraft operations at the airport without complex studies and analysis, the FAA guidelines provide tools for local municipalities to develop compatible land uses surrounding airports.

For this AMPU, aircraft noise models were developed for both the existing conditions and the short-term forecast of operations. Flight corridors were modeled based on input from aircraft operators and the ATCT. The number and type of aircraft operations were determined from the activity forecasts presented in Chapter Three. Because the L_{dn} is a 24-hour metric, the number of operations must be broken down from annual to daily. The generally accepted count is derived by dividing the annual figure by 365 and then applying the operational-mix percentages. However, to model the worst-case scenario, the daily count was obtained using the ADPM operations. While this generally results in a larger noise contour, it does address peak-period noise, which typically generates the majority of noise complaints. The number of residences within the contours would be reduced if the ADPM were not used. This method was used to develop a base contour at BVY, along with the following assumptions:

- Approximately 10 percent of approach and departure operations occur at night.

- Operations noted as "Other" (primarily helicopter) in the fleet-mix forecast are not included in this calculation because there is no way to model them in the INM.

- Touch-and-go operations are performed by single-engine aircraft.

- Jet operations were evenly split between a Cessna Citation II and a Gulfstream GIII.

- Single-engine operations are evenly split between fixed and variable-pitch prop aircraft. All multiple-engine operations were modeled as a BEC58P (Beech Baron), which is the INM default for twin-engine aircraft. Turboprop operations were modeled as a King Air 200.

- The runway-use percentages based on wind were as follows: Runway 16, 20 percent; Runway 34, 30 percent; Runway 9, 18 percent; and Runway 27, 32 percent. These percentages correlate with verbal reports by tower personnel regarding runway use. It was assumed that jet aircraft would use Runway 9-27 more frequently; therefore, 75 percent of jet operations are on Runway 9-27. This may change with the preferred runway alternative.

- All traffic patterns are left traffic.

The noise exposure in the area is based on the projected increase in operations at the airport, and is not directly tied to a specific project recommended in this AMPU because a runway extension or modification to flight patterns are not selected as preferred projects. However, any future runway extensions should be reanalyzed for noise because a change in the contours likely will result.

In general, the analysis of compatibility based on FAA guidelines was developed by noting the non-compatible uses within the contours. In the BVY vicinity, these uses are residential, so the analysis was performed by estimating the number of residences in each contour based on the 1994 aerial photography and supplemented with U.S. Geological Survey(USGS) topographical maps where the exposure contours extend beyond the available photography (see Figures 6-8 and 6-9). Table 6-3 is a summary of the total land area and the number of residential lots contained within the existing and future noise contours.

TABLE 6-3
NOISE CONTOURS VERSUS LAND USE

Contour	Existing Area within Contour	Future Area within Contour	Existing Residential Lots within Contour	Future Residential Lots within Contour
65 L_{dn}	400.3 Acres	408.0 Acres	124	124
70 L_{dn}	193.3 Acres	196.7 Acres	19	19

Contour	Existing Area within Contour	Future Area within Contour	Existing Residential Lots within Contour	Future Residential Lots within Contour
75 L_{dn}	58.0 Acres	58.9 Acres	4	4

Source: Dufresne-Henry, Inc., analysis

The following conclusions were based on this analysis of the existing and future noise contours:

- There exists significant area of residential development within the test contours (using ADPM), including four properties within the 75-L_{dn} contour at the Runway 9 end. The Runway 9 and 27 ends receive the highest impacts, both of which contain properties in the 70-L_{dn} contour. The residential use is considered incompatible with the modeled noise levels.

- No significant change in the areal extent of the test contours is anticipated due to the short-term projects and, more importantly, the short-term projects will not cause an increase in noise levels for those residential properties currently within the 65-L_{dn} contour. While increases in acreage are predicted, they are primarily restricted to airport property. No increase in the number of affected residential lots is anticipated in the future condition.

- Future projects that may increase the levels of off-airport noise by greater than 1 L_{dn} for those properties within the 65-L_{dn} contour may need to provide a further analysis of the noise issue as part of an EA.

6.2.2 Compatible Land Uses

According to FAA Order 5050.4A, the compatibility of existing and planned land uses in an airport vicinity is usually associated with the extent of potential aircraft-noise impacts from the airport, as well as safety concerns with the land under airport imaginary surfaces (i.e., FAR Part

77 surfaces). The aircraft-noise analysis in Subsection 6.2.1 (using ADPM) determined that the noise threshold will extend off airport property. In general, the controls over future development, in the form of town land-use regulations, are not yet in place to restrict the development of additional incompatible uses. However, there is little available space remaining for new development in proximity to the airport boundary. Additional noise-sensitive land uses (e.g., schools, daycare facilities, libraries, and nursing homes) should be restricted from the airport vicinity unless the facility has been modified to reduce or eliminate potential noise disturbances. Residential and industrial development currently dominate the land adjacent to the airport. Open space along Burley Street within the approach of Runway 16 is zoned for residential development, and additional construction could occur on the remaining open land in that area.

FAA Order 5050.4A also states, "the land-use section of an EA shall include documentation to support the required sponsor's assurance under Section 511(a)(5) of the 1982 Airport Improvement Act that appropriate action, including the adoption of zoning laws, has been or will be taken, to the extent reasonable to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations, including landing and takeoff of aircraft." Recently, the airport obtained properties within the Runway 16 approach and will continue to investigate properties within sensitive areas as they become available.

6.2.3 Social Impacts

Social impacts typically are associated with large projects that cause community disruption. In accordance with FAA Order 5050.4A, community disruptions include projects that relocate any residence or business; alter surface-transportation patterns; divide or disrupt established communities; disrupt orderly, planned development; or create an appreciable change in employment.

Most of the selected improvement projects are restricted to the airport property and all involve serving the existing needs of the facility, as opposed to expanding the airport operation or changing the airport classification. For this reason, social impacts relative to job creation or significant noise increases are not anticipated. However, penetrations to the Part 77 surfaces remain off the airport property and, at a minimum, the airport will need to obtain easements on the pertinent properties in order to remove the obstructions. An evaluation of the obstruction analysis indicates that easements will be required on approximately 60 to 65 properties to address all of the remaining obstructions within the approach and transitional surfaces.

The act of obtaining the necessary easements for obstruction removal is not defined as a significant social impact in FAA Order 5050.4A. The work is typically completed quickly and does not involve the relocation of residents or traffic disruption. Often, mitigation in the form of landscaping is provided as part of the obstruction removal, resulting in only minimal impacts to the landowner. Because community impacts as defined in FAA Order 5050.4A are not proposed with the selected improvement projects, significant social impacts are not anticipated.

6.2.4 Induced Socioeconomic Impacts

Induced socioeconomic impacts are usually associated with large airport-improvement projects. They are considered actions that would have secondary impacts on the surrounding community by causing shifts in population patterns and changes in public-service demand and businesses. Induced socioeconomic impacts normally will not be significant except where there also are significant impacts in other categories, especially noise, land-use, or direct social impacts. A typical project that would have an induced socioeconomic impact is the creation of a large manufacturing facility in a rural area.

The projects recommended for the Beverly Municipal Airport are not expected to have any significant adverse induced socioeconomic impacts. Long-term development associated with the airport and the projected increased use of airport services could positively impact employment opportunities and improve transportation in the town and surrounding area. However, any employment impact would not be of sufficient magnitude to affect development in the area. Noise impacts exist at the facility based on the location of the 65-L_{dn} contour; the short-term anticipated increase in aviation activity will not significantly modify this contour. Because the improvements are restricted to demand-based growth and they will not significantly impact the 65-L_{dn} contour, no significant positive or negative socioeconomic impacts are anticipated.

6.2.5 Air Quality

Section 176 of the Clean Air Act Amendments of 1977 states, in part, that no federal agency shall engage in; support in any way; provide financial assistance for; or license, permit, or approve any activity that does not conform to a state implementation plan for meeting air-quality standards after it has been approved or promulgated under Section 110 of that Act. It is the FAA's responsibility to ensure that federally funded airport actions conform to state plans for controlling area-wide air-pollution impacts.

FAA Order 5050.4A also states that general-aviation airports projecting less than 180,000 aircraft operations annually do not require an air-quality analysis as part of an EA. The projected number of aircraft operations for BVY at the end of this planning period is approximately 116,200 (see Table 3-18), well below the 180,000-operation threshold established by the FAA. Therefore, significant impacts to air quality are not anticipated in this planning period.

Essex County is currently in a nonattainment area for ground-level ozone levels (this standard has recently been revoked, but is expected to be reinstated in the near future). The county is in attainment for the remaining U.S. Environmental Protection Agency (USEPA)-criteria air pollutants, including carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead. Air- quality monitoring stations closest to BVY that record the levels of these pollutants are located in Boston and Lynn, Massachusetts (Personal Communication; USEPA Air Quality Section).

6.2.6 Water Quality

The projects proposed during this planning period will result in additional impervious surfaces at the airport and the direct alteration of state and federal wetlands. The wetlands areas that will be altered include some that drain to a Class A water body (i.e., Wenham Lake) and, therefore, are considered to be Class A waters pursuant to Section 401 of the Federal Clean Water Act. The creation of impervious surfaces and the alteration of wetlands areas are two activities that could result in the degradation of water-quality standards if suitable mitigation measures are not proposed with the project design.

Water-quality standards are established in Massachusetts in 314 CMR 4.00, Surface Water Quality Standards (1995). Protection of these standards relative to the projects proposed at BVY is achieved through local, state, and federal statutes, including the following:

- Section 401 of the Federal Clean Water Act
- Section 402 of the Federal Clean Water Act
- Section 404 of the Federal Clean Water Act
- The MWPA (through the 1995 Stormwater Policy)
- City of Beverly Zoning Ordinance
- Town of Wenham Zoning Ordinance
- Town of Danvers Zoning Ordinance

The proposed projects will be required to address some or all of these regulations depending on the location of each improvement and the extent of wetlands impacts. Because most of the projects involve work within wetlands or the buffer zone of wetlands, and include the creation of impervious surfaces, two statutes in particular will mandate the creation of stormwater-control features to control increases in peak flow rates and suspended solids. The MWPA and Section 401 of the Federal Clean Water Act require the preparation of detailed stormwater-management plans for both the construction and post-construction phases of projects that impact wetlands. Analysis is required to show that the projects will not increase stormwater peak flow rates off the project site, and that total suspended solids will be controlled prior to discharge to a wetlands area. During construction, erosion-control plans that protect unstable soil are required. Permits pursuant to these statutes will not be granted until stormwater issues have been addressed.

Where work will occur within the watershed of a Class A water body (i.e., Taxiway Alternative 1), the Section 401 regulations may require a “no wetlands alteration” alternative be prepared. Wetlands alterations within Class A waters must be avoided where possible because the regulations assume that any alteration will degrade water quality below acceptable limits. For the purposes of this analysis, it has been assumed that some minor impacts will occur; however, it may be possible in the design of the taxiway project to avoid the wetlands boundary by proposing steeper slopes adjacent to a portion of the taxiway and/or reducing the RSA.

Section 402 of the Federal Clean Water Act, known as the National Pollution Discharge Elimination System (NPDES), requires that large facilities file a stormwater pollution prevention plan (SWPPP) that addresses the protection of water quality. An SWPPP identifies potential threats to water quality at a facility and the measures in place to mitigate impacts. BVY currently has an SWPPP on file with the USEPA; however, an updated version will be required in 2001. The SWPPP will need to be continuously edited as improvement projects are constructed.

Impacts to water quality could occur due to the projects, and the extent of wetlands alterations involved with some of the construction may require a variance from both the Massachusetts Wetlands Protection Act and Section 401 of the Federal Clean Water Act. At a minimum, all increases in stormwater flows will need to be completely controlled on-site, and controls that remove suspended solids from stormwater flows must be included in the designs. Basins constructed at the airport to address these requirements also must be designed to avoid attracting hazardous wildlife species, as directed by AC 150/5200-33. This combination of the extent of additional impervious surfaces, the requirement for flow rate and sediment control, and the restrictions on the basin designs likely will result in the use of significant open space at BVY for stormwater-control features. The inclusion of these features in all project designs and compliance with the NPDES program should provide for the protection of water quality throughout this planning period.

The proposed landside and airside improvements shown on the ALP set do not depict locations of stormwater-management features. The design and placement of these features requires detailed analysis, which is beyond the scope of this AMPU. It is likely that these features will restrict the sizing of many of the landside projects described herein because land will be needed for detention structures (i.e., up to 1 acre will be needed for stormwater-management features for each new apron project; additional features will be required for each taxiway project).

6.2.7 U.S. Department of Transportation Act, Section 4(f)

Section 4(f) of the USDOT Act requires that the Secretary of Transportation investigate all alternatives before impacting any publicly owned lands designated as public parks; recreation areas; wildlife or waterfowl refuges of national, state, or local significance; or land having national, state, or local historical significance. The only project proposed in the short term that will occur off airport property is the removal of obstructions to navigable airspace. At this time, it is not believed that any of the parcels for which easements may be necessary to remove the obstructions can be defined as a USDOT Section 4(f) property. Inspection of the current assessor's maps for each of the municipalities identified only two parcels near the airport that qualify under Section 4f, and both parcels will be avoided by the proposed improvement projects. For this reason, impacts to Section 4(f) properties are not anticipated.

Mitigation for wetlands altered by the taxiway and runway projects potentially could involve the restoration of wetlands resources on public property. During the preparation of the EA, various mitigation alternatives will be assessed, including wetlands restoration opportunities. Off-site restoration frequently occurs on public properties (e.g., public parks and riverfront areas), and such a project may need to address Section 4(f) as part of the EA.

6.2.8 Historic, Architectural, Archeological, and Cultural Resources

The MHC was contacted as part of the 1996 vegetation-removal project to determine the extent of historic and/or archeological resources on and adjacent to the airport property. The MHC determined that Native American sites had been identified in the area; thus, there was potential for archeological resources to exist on airport property. Its recommendation was to complete a study of the site. The study concluded that due to historic disturbance of most of the on-site soils by construction of the airport, there is an overall low archeological sensitivity on the site. No historic structures were identified on or adjacent to the facility. For these reasons, impacts to historic and/or archeological resources due to the proposed improvement projects are not anticipated.

6.2.9 Biotic Communities

The proposed improvement projects will result in the alteration of state and federal wetlands both on and off airport property. Additionally, both the proposed landside and airside projects may alter brush and grassland habitat that could be habitat for the Golden-winged Warbler, a state endangered species. The extent of the wetlands alterations during the entire planning period will be considered significant at both the state and federal levels because the disturbance will exceed 2 acres. Wetlands alterations of this magnitude likely will involve a variance pursuant to the

MWPA, and an Individual Permit pursuant to both Sections 401 and 404 of the Federal Clean Water Act. Subsection 6.2.11 provides an approximation of the total wetlands impact through the planning period.

The question of the rare species habitat can be addressed only on an individual-project basis, where coordination with the MNHESP will determine whether the species continues to exist in the area. It is possible that the recent vegetation-management project completed at the airport has created additional habitat for this species, and this can possibly be used as mitigation for habitat impacts associated with the proposed airport improvements. If it is determined that the species or its habitat remains within the footprint of the improvement projects, coordination pursuant to the MESA will be required.

Overall, it is likely that impacts to biotic communities could be significant; therefore, the Fish and Wildlife Coordination Act may apply, requiring the airport to address several issues as part of the federal EA process.

6.2.10 Endangered and Threatened Species

The MNHESP commented in 1990 that the Golden-winged Warbler (*Vermivora chrysoptera*), a state endangered species, had been identified on airport property in the 1980s. The MNHESP did not indicate the presence of this species in a response obtained for the airport in 1996. Recent sightings of this species on the property have not been obtained; however, it is likely that the airport is considered to provide habitat because woodland edges and early successional fields provide prime habitat for this species, and both of these cover types are common on the airport property.

Some of the suggested airport-improvement projects will occur within grassland and woodland edge habitat; therefore, if it is determined that this species is still present at the site, then impacts to endangered species could occur. The significance of these impacts will be determined based on the extent of the habitat alteration, possibly offset by the creation of this habitat type by the vegetation management plan. Because the Golden-winged Warbler is only a state-listed endangered species, the procedures to be followed in FAA Order 5050.4a do not apply.

However, alteration of the habitat will require permitting efforts pursuant to the MESA and the MEPA.

6.2.11 Wetlands

Wetlands are regulated and defined by many different levels of government. Federal regulations, implemented by the USACE, are based on Section 404 of the Federal Clean Water Act. The federal definition of a wetlands is found in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands (1987),* in which wetlands are characterized by a three-parameter approach including vegetation, hydrology, and soils. The State of Massachusetts regulates wetlands through the MWPA; the basic state definition of a vegetated wetlands is similar to the federal definition, and can be found in the manual *Delineating Bordering Vegetated Wetlands under the Massachusetts Wetlands Protection Act* (1995). However, the state contains additional wetlands categories, some of which are not necessarily regulated under Section 404, including the limits of the 100-year floodplain and riverfront area. The USACE regulates some isolated wetlands areas that do not meet the state definition. Additionally, the Town of Wenham has a local wetlands bylaw that contains a different definition of wetlands based solely on the presence of wetlands vegetation.

These differing wetlands definitions and methods of protection can create a confusing set of wetlands on the property. This is especially true at the Runway 16 end in the town of Wenham, where different wetlands boundaries exist at the local, state, and federal levels. The remainder of the property outside the town of Wenham contains a single wetlands boundary that represents both the state and federal limits of vegetated wetlands (see Figure 6-2). Some of the wetlands shown for the infield areas do not appear to have outlets to other contiguous wetlands areas, and also do not appear to pond a significant amount of surface water on a yearly basis. After further analysis, it may be determined that most of the infield wetlands areas are subject to federal and local jurisdiction only.

The airport vicinity was investigated to identify wetlands subject to federal, state, and/or local jurisdiction. Actual delineations of most of the airport wetlands were completed as part of the Runway 16 end clearing project in 1994 and vegetation-management plan in 1995. Those areas that were not delineated were investigated as part of a sketch-level wetlands delineation in 1998, which included these infield wetlands areas.

Based on the identified wetlands boundaries, the proposed improvement projects for the airport will require work within vegetated wetlands areas. Table 6-4 summarizes the approximate wetlands impacts associated with various improvement projects, assuming wetlands avoidance is not practiced. Because wetlands impacts are anticipated with the taxiway, runway, and apron projects, an EA pursuant to the NEPA must be prepared before implementation. An EA is required in accordance with the NEPA when federal actions have the potential to impact the environment. As part of this EA, wetlands-mitigation strategies will need to be developed that address the mitigation requirements of the various federal and state wetlands regulations. In addition to the EA, permits pursuant to Sections 401 and 404 of the Federal Clean Water Act, the MWPA, and local wetlands bylaws will be required. Some of the anticipated impacts are of the magnitude such that a variance from state wetlands regulations may be required. If a variance is required, a filing pursuant to the MEPA will be needed.

Off-airport obstruction removal also may result in alterations to wetlands areas, the extent of which has not been determined because off-airport wetlands boundaries have not been determined for this AMPU. However, depending on the method of tree removal, the alteration may not be considered an impact at the federal level. If the project involves removal of trees but not grubbing of the root systems, a permit is not required pursuant to Sections 401 and 404 of the Federal Clean Water Act. Removal of these off-property trees within wetlands areas will be subject to the MWPA; however, there are provisions within the Act that allow for vegetation removal at public-use airports providing certain procedures are followed.

A variety of methods exists for the mitigation of direct wetlands impacts. Where the direct filling of wetlands is proposed, the following strategies can be used to sufficiently mitigate the impacts:

- creation of new wetlands (through grading and planting) in an uplands area (known as wetlands replication) that may or may not violate FAA AC 150/5200-33 regarding the siting of land uses adjacent to airports that may attract hazardous wildlife

- the purchase of existing high-quality wetlands, which are then protected from further impacts through the use of land-restriction easements
- the enhancement of an existing wetlands area (through plantings, improved hydrology, or debris removal)

When only temporary wetlands impacts are involved where the topography and hydrology are not modified (often the case with vegetative-obstruction removal), other forms of mitigation are used, including the following:

- use construction techniques that reduce soil disturbance (i.e., low ground-pressure vehicles)
- replace disturbed vegetation with low-growing native species based on a plant inventory of adjacent wetlands
- use erosion-control practices that limit the disturbance to a well-defined area
- complete all in-wetlands work during the winter or late summer months when the ground is less susceptible to damage due to frost or low soil moisture

Before completion of any proposed projects anticipated to impact wetlands, a wetlands delineation of pertinent areas must be prepared to accurately assess the extent of the impacts. The extent of the impacts will define both the permits that will be required and the level of those permits that must be addressed. This is especially pertinent for off-airport obstruction removal, where recent delineations have not been completed.

TABLE 6-4
ANTICIPATED WETLANDS ALTERATIONS
FOR RECOMMENDED IMPROVEMENT PROJECTS

Improvement Project	Description	Approximate Wetlands

		Impacts
Runway Alternative 2/4	Extend Runway 16-34 and provide full safety areas at both ends. Shift the centerline of Runway 9-27 and reduce the overall length to provide full safety areas on airport property.	20,000 square feet
Taxiway Alternative 1	West-side taxiway extension from existing apron area to the Runway 16 end. Occurs within drainage area of Wenham Lake; thus, all associated wetlands are Class A	500 square feet for RSA side slopes
Taxiway Alternative 2	West-side taxiway extension from Taxiway A to Runway 34	0 square feet
Taxiway Alternative 4	East-side taxiway extension from Taxiway F to the Runway 16 end to replace existing Taxiway B	16,000 - 20,000 square feet
Taxiway Alternative 5	Taxiway extension along Runway 9-27, which will impact existing infield wet meadow area	40,000 - 50,000 square feet
Landside Alternative 1	Expansion of existing east-side apron	0 square feet
Landside Alternative 2	Construction of two new automobile parking areas on the eastern side, which will allow for the conversion of existing automobile parking to apron. Partially occurs within the drainage area of Wenham Lake; thus, the associated wetlands are Class A	0 square feet
Landside Alternative 3	New west-side apron areas located along Taxiway F, which will be constructed adjacent to a shrub wetlands in the infield area	500 square feet for stormwater-basin construction

Landside Alternative 4	New west side apron and hangar area located within the footprint of existing Taxiway B	500 square feet for stormwater-basin construction
Extension of Apron Access Roadway	New west-side access roadway to the proposed apron area (Landside Alternative 3)	500 square feet for road side slopes

Source: Dufresne-Henry, Inc., analysis

6.2.12 Floodplain

No floodplain was identified on airport property; therefore, no impacts to this resource are anticipated due to the improvement projects.

6.2.13 Coastal Zone Management

The City of Beverly contains some land subject to the jurisdiction of the Massachusetts Coastal Zone Management(CZM) program; however, the limits of the airport are located beyond the coastal zone as defined in the regulations. However, the airport does drain to the north shore coastal areas, and the CZM program has expressed concerns about stormwater-pollutant impacts to coastal resources generated by the watershed. Because all projects proposed in this AMPU will have to conform to the state stormwater policy, no impacts to coastal resources are anticipated.

6.2.14 Coastal Barriers

No coastal barriers exist on or adjacent to the airport property; therefore, no impacts to these resources due to the proposed improvement projects will occur.

6.2.15 Wild and Scenic Rivers

There are no water resources within the airport vicinity designated as "wild or scenic" rivers by the U.S. Department of the Interior's National Park Service. Therefore, no impacts are anticipated from the proposed projects. Drainage from the site enters the Danvers and Porter rivers, which are not currently on the national list.

6.2.16 Farmland

Several of the improvement projects will occur on soil types listed as prime agricultural soils; thus, further investigation is required as part of a federal EA to determine the significance of the loss of these soils. The procedures for determining significance relative to the FPPA are included in FAA Order 5050.4a. It is anticipated that, due to the locations of these prime soils adjacent to aircraft movement areas and the history of soil disturbance on the site, the value of these soils will be relatively low and significant mitigation will not be required.

6.2.17 Energy and Natural Resources

The proposed projects will result in minor additional demands for electricity in the form of new taxiway lighting and additional hangar supplies. Fuel consumption will increase at the rate of operational increases, which is projected in this AMPU to be 1.4 percent per annum. This slow growth rate combined with the minor increases in electrical demand will not jeopardize the availability of these resources in the future. The anticipated projects are not of the type where sharp increases in consumption will result. Additionally, only common construction machinery and methods are needed to construct the improvements. For these reasons, no impacts to the available energy supply are anticipated.

6.2.18 Light Emissions

Modification to the airport lighting system proposed during the planning period includes the installation of taxiway-edge lighting along the proposed taxiway extensions to comply with FAA standards. Additionally, an upgrade of the MALS system at the Runway 16 end is proposed in the intermediate term. Potential adverse impacts from light emissions refer to the potential for creating an annoyance to residents in the vicinity of the lighting installation or modification. FAA Order 5050.4A states that "Only in unusual circumstances, as for example when high-intensity strobe lights would shine directly into people's homes, will the impact of light emissions be considered sufficient to warrant special study and a more detailed examination of alternatives in an environmental impact statement." The installation of the taxiway-edge-lighting system and the light bars is not likely to cause an adverse impact. The additional lights for the taxiway extension are in an area far from the airport property line, and are relatively low-energy lamps, approximately 18 inches above the ground elevation. The MALS upgrade may include the installation of two additional light bars near the property line at the Runway 16 end. There is some potential for impacts at this location, however, mitigation included in the design could reduce or eliminate the impact (e.g., shielding, pole height, pilot activated lights only).

6.2.19 Solid Waste

The airport currently produces only a minimal amount of solid waste, which is transported by a private commercial hauler to one of two landfills: the RESCO facility in Saugus, Massachusetts, and the Refuse Tech facility in Melrose, Massachusetts. Both landfills are permitted by the state; however, their current life expectancy is not known.

Construction of the proposed improvements will result in debris that will have to be disposed of by the contractor. The taxiway extensions will not generate solid waste; rather, they likely will require that fill be transported to the facility. Any pavement excavated for the various taxiway projects will be reclaimed and used in the new asphalt paving. The anticipated reduction in width of Runway 9-27 may generate some asphalt waste; however, there are options that may incorporate that waste into the runway-reconstruction project. Hangar development will produce some waste and will be properly disposed of by the contractor. Construction bid documents will require that the demolition debris becomes the property of the contractor and is disposed of according to all applicable federal, state, and local regulations.

The obstruction-removal project may generate significant wood waste, depending on the usability of the timber and the treatment of the root systems. Where clearing without removal of the root systems is proposed (as for all of the wetlands areas), only minimal waste will be generated. Where stump-removal is proposed, disposal of the stumps will be the responsibility of the contractor. Typically, stumps are delivered to an approved woodwaste dump or a grinder is used to reduce the stumps to manageable size for on-site storage. In either case, long-term increases in solid-waste generation will not result from the proposed projects; any short-term generation will be addressed according to current local, state, and federal disposal regulations.

6.2.20 Construction Impacts

FAA Order 5050.4A suggests that, in general, impacts during construction are of lesser magnitude than long-term impacts of any proposed action. Many of the specific types of impacts that could occur are discussed in descriptions of other impact categories (e.g., the generation of solid waste during construction is addressed in Subsection 6.2.19). Only in unusual circumstances (e.g., construction in an ecologically sensitive area or involving substantial urban impacts) would this category be considered to create significant consequences that may not be adequately mitigated. It is recommended that the proposed project specifications include provisions of FAA AC 150/5370, *Standards for Specifying Construction of Airports,* which specifies the use of responsible design practices, appropriate project scheduling (i.e., hours of operation), and erosion and sedimentation control plans.

The proposed projects have relatively large setbacks from most residential properties and include a sufficient vegetative buffer to control potential dust and aesthetic impacts. By adhering to reasonable hours of operation and including adequate dust and sediment controls in the specifications, construction impacts on these adjacent residential parcels can be minimized to acceptable levels.

The off-airport obstruction-removal project will have relatively large construction impacts on adjacent residences and minimal long-term impacts. The removal of vegetation, especially from wetlands areas, can result in soil disturbance and modified drainage patterns due to tire ruts. These impacts are completely avoidable if the removal is designated for dry or frozen ground conditions and the contract documents include specifications for erosion control and ground repair. Some yards may require landscaping plans to replace removed trees; however, the extent of landscaping cannot be determined until the actual project design stage. This will be addressed on a case-by-case basis during the planning process for off-site obstruction removal.

6.2.21 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations*, was issued on February 11, 1994. It established procedures for the USDOT (of which the FAA is a part) to “achieve environmental justice as part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects, including interrelated social and economic effects, of its programs, policies, and activities on minority populations and low-income populations in the United States.”

In preventing disproportionately high and adverse effects on minority and low-income populations, it is USDOT policy to “actively administer and monitor its operations and decision-making to assure that nondiscrimination is an integral part of its programs, policies, and activities.” The USDOT currently administers policies, programs, and activities that are subject to the requirements of the NEPA, Title VI of the Civil Rights Act, Uniform Relocation Assistance and Real Property Acquisition Policies Act, Intermodal Surface Transportation Efficiency Act, and other USDOT statutes that involve human health or environmental matters, or interrelated social and economic impacts. These requirements will be administered to identify, early in the development of the program, policy, or activity, the risk of discrimination so that positive corrective action can be taken. In implementing these requirements, the following information should be obtained where relevant, appropriate, and practical:

- population served and/or affected by race, color, or national origin, and income level

- proposed steps to guard against disproportionately high and adverse effects on persons on the basis of race, color, or national origin

- present and proposed membership by race, color, or national origin in any planning or advisory body that is part of the program

The projects proposed in this AMPU do not involve the creation of any significant noise impacts, the disruption of any town services, traffic impacts, social impacts, induced socioeconomic impacts, or the separation of minority or low-income individuals in the town. In discussing likely impacts in this subsection, it has been documented that no significant impacts, based on

FAA Order 5050.4A, will occur to any population, including low-income and/or minority populations. Future easement acquisition for off-airport obstruction removal will involve primarily middle-income, single-family residential properties, and will not involve a disproportionate number of low-income or minority populations.

This combination of the low severity of the social impacts associated with improvement projects, the Disadvantaged Business Enterprise requirements for the contractors associated with the projects, and the continuous nondiscrimination policy of the Beverly Municipal Airport ensures compliance with the USDOT environmental justice strategy.

6.3 ENVIRONMENTAL PERMITTING REQUIREMENTS

This subsection identifies the likely environmental permits anticipated to be required for the development of planned airport improvements. Some of the selected projects are subject to federal, state, and local environmental regulations. The environmental statutes address a wide range of issues, including wetlands alterations, rare species impacts, air and water quality, and even land acquisitions. To complicate matters, the need for a permit is not always determined by the magnitude of an environmental impact, but rather by the funding source for the project. The use of federal funding sources is considered a federal "action" and, therefore, is subject to the NEPA. The same project completed with private funds would not necessarily require the same permitting effort. Also, the sequence in which the projects are permitted will have an effect on the permitting effort. If projects are permitted separately, it will compound the effort and greatly increase the associated costs. Permitting the improvements in two or three packages, based on the short-, intermediate-, and long-term listing of the projects, will be more efficient in terms of time and costs, and also will be preferable to the reviewing agencies. Some of the agencies require that all likely projects be included in a submission, others allow for an incremental approach. Chapter Eight includes a cost analysis for environmental permitting based on a three-phase approach to the permits, where the projects are permitted in three groups.

Most environmental regulations are threshold-based, in which the magnitude of the impact determines both the need for a particular permit and the level of effort required to obtain the permit. A good example of this is the permitting program established for Section 404 of the Federal Clean Water Act (administered by the USACE), where wetlands alterations below a specific threshold often require no contact with the agency if certain conditions are met. Alterations above the threshold require an "individual 404 permit," where a thorough investigation of all associated issues is completed by the USACE.

Because detailed studies of the impacts associated with the airport-improvement projects have not been completed, the exact permitting effort required to complete the projects is not fully known. While the following discussion presents the likely required permits, the permitting effort and the timelines involved are difficult to assess because it is not known which permit thresholds will be exceeded. These unknowns result in the extreme ranges presented in Table 6-5 for both the timelines and the permitting costs. It is likely that many of the selected projects will be designed to avoid wetlands or minimize wetlands impacts above and beyond the amount assumed in this AMPU. Many of the projects that avoid wetlands impacts will include activities within 100 feet of a wetlands that is a jurisdictional area under the state and local wetlands regulations. These "buffer-zone" projects will require local and state permits.

6.3.1 Federal-Level Environmental Permits

The improvement projects will be completed using federal funding sources and will involve direct impacts to federal wetlands and probable land and/or easement acquisitions. The use of federal funds on such projects requires the preparation of an EA pursuant to the NEPA. The result of the EA process likely will be a finding of no significant impact because a review of the various impact categories did not identify any impacts that could not be mitigated to acceptable levels. Additionally, wetlands alterations involved with the runway, taxiway, and apron projects are subject to Sections 401 and 404 of the Federal Clean Water Act and will require a permit from the USACE. The magnitude of the wetlands impacts likely will require an individual permit pursuant to Section 404. The Section 401 process, which is administered by the MADEP may involve the need for a variance because Taxiway Alternative 1 may involve impacts to Class A waters (i.e., the watershed of Wenham Lake).

The Federal Water Pollution Control Act of 1972, as amended by the Federal Clean Water Act of 1977, provides the authority to establish water-quality standards and control discharges into surface and subsurface water bodies. Section 402 of the Federal Clean Water Act (33 USC 1344) gave the USEPA authority to regulate certain high-priority stormwater discharges. On

September 29, 1995, the USEPA published the *Final National Pollutant Discharge Elimination System Multi-sector General Permit for Industrial Activities* (*Federal Register*; Vol. 60, No. 189). Under this regulation, all airports are required to file an Notice of Intent with the USEPA and prepare an SWPPP for the airport. BVY currently has a valid SWPPP (see Appendix 3). Additionally, a separate SWPPP is required for construction projects that result in the disturbance of 5 acres or more of land. The airport will need to update a facility SWPPP in 2001, and it is anticipated that construction activities may collectively result in 5 acres or more of disturbance; therefore, a construction SWPPP also may be required. This 5 acre minimum criteria of the NPDES program may be subject to change in the near future.

TABLE 6-5
ANTICIPATED ENVIRONMENTAL PERMIT REQUIREMENTS

Permit Name	Review Period	Estimated Cost	Comments
Town of Wenham Wetlands Bylaw	See MWPA	N/A; filed concurrently with the MWPA	The Runway 16 RSA construction will impact local wetlands; bylaw requires delineation of a separate wetlands boundary.
Town of Wenham Zoning Ordinance	Up to 3 months	\$3,000 - \$5,000	Projects located within the Aquifer Protection Overlay District
Town of Danvers Wetlands Bylaw	See MWPA	N/A; filed concurrently with the MWPA	Required for the Runway 34 end extension and RSA, as well as Taxiway Alternative 5.
City of Beverly Zoning Ordinance	Up to 3 months	\$3,000 - \$5,000	Projects located within the Watershed Protection Overlay District
MWPA	1 year to complete initial filing and	\$25,000 - \$35,000	Variance from the regulations likely is required because impacts to vegetated wetlands

Permit Name	Review Period	Estimated Cost	Comments
	variance procedure		will be in excess of 5,000 square feet
MESA	N/A	N/A	The presence of endangered species on the property is questionable, but coordination with the MNHESP is suggested
MEPA	Up to 1 year	$30,000 - $50,000	An Environmental Impact Report likely will be required due to the proposed wetlands impacts
NEPA EA	Up to 9 months	$60,000 - $80,000	A federal EA will be required because wetlands impacts are anticipated for some of the improvement projects
Federal Clean Water Act Section 404 Dredge/Fill Permit (Individual)	Up to 6 months	$15,000 - $25,000	Costs for wetlands replication may be excessive if off-site areas are required
Federal Clean Water Act Section 401 Water Quality Certification Permit (Individual)	Up to 6 months	$15,000 - $25,000	Projects that involve work within Class A waters may require a variance from the regulations
Federal Clean Water Act Section 402 Construction	Up to 3 months	$5,000 - $10,000	An SWPPP is currently prepared for the facility; however, an updated SWPPP will be required

Permit Name	Review Period	Estimated Cost	Comments
SWPPP Facilities SWPPP Modification			in 2001. A construction SWPPP is required for the larger taxiway projects.

6.3.2 State-Level Environmental Permits

Potential impacts to wetlands and rare species will require the airport to obtain a variety of state-level permits. The filing of an Environmental Notification Form pursuant to the MEPA will be required because it is likely that several impact thresholds will be exceeded. The magnitude of the wetlands impacts associated with the improvement projects may result in the requirement to prepare an Environmental Impact Report (EIR) pursuant to the MEPA. This document will include a comprehensive review of all major impact categories and will be prepared prior to other permit applications.

The MWPA requires that a permit be obtained for those projects within wetlands resource areas or associated buffer zones. Current impact thresholds for the various resource areas likely will be exceeded by the projects, and a variance from the regulations may be required. As part of the filing under the MWPA, a comprehensive stormwater-management system will be required that addresses stormwater quantity and quality. The area required for these stormwater-management features may be extensive.

The MESA may need to be addressed prior to completing the selected improvements if it is determined that the site continues to provide habitat for the Golden-winged Warbler. Historic data suggests that the species was observed on the site; however, the most current Natural Heritage Atlas does not show the airport or adjacent area as a priority site for rare species.

6.3.3 Local-Level Environmental Permits

Local-level permits and review will be obtained in conjunction with all proposed improvements. Both the town of Wenham and the town of Danvers have local wetlands ordinances that need to be addressed as part of the filing under the MWPA. Additionally, Wenham and the City of Beverly contain watershed protection overlay districts as part of their local zoning ordinances. Portions of the airport are located within these districts; therefore, coordination with the local zoning authorities will be required. The short-term project list includes wetlands impacts within both municipalities.

Chapter Seven

AIRPORT LAYOUT PLAN SET

7.1 INTRODUCTION

A product of this AMPU is the graphical presentation of the recommended airport improvement projects for the Beverly Municipal Airport. The ALP set presents these data. The following subsections briefly describe the contents of each sheet in the ALP set, which has been reduced in size and is included in this chapter. All recommended airport improvements shown on these sheets are representational in nature, and may be modified as necessary to meet the needs of the City and airport users or the future design requirements of the FAA or MAC.

7.2 TITLE SHEET (Sheet 1 of 9)

This sheet identifies the airport location and provides a table of contents for the ALP set.

7.3 EXISTING AIRPORT FACILITIES PLAN (Sheet 2 of 9)

This sheet identifies details of existing airport facilities and surrounding land features, as well as FAA imaginary surfaces and design criteria. Tables provide additional data about the usage and dimensions of the airport and its facilities.

7.4 ULTIMATE AIRPORT LAYOUT PLAN (Sheet 3 of 9)

This sheet identifies details of the recommended airport facility improvements and their likely impact on surrounding land uses based on the recommendations set forth in Chapter Five. Tables provide additional data about the likely ultimate usage and dimensions of the airport and its facilities. Of particular importance on this sheet is the proposed RSAs at all four runway ends.

FAA design criteria also are depicted on the ALP.

7.5 EAST-SIDE TERMINAL AREA PLAN (Sheet 4 of 9)

This sheet provides a close-up view of the recommended airport facility improvements in the vicinity of the east-side terminal area.

7.6 WEST-SIDE TERMINAL AREA PLAN (Sheet 5 of 9)

This sheet provides a close-up view of the recommended airport facility improvements in the vicinity of the west-side terminal area.

7.7 FAR PART 77 IMAGINARY SURFACES PLAN (Sheet 6 of 9)

This sheet identifies all FAR Part 77 imaginary surfaces for the airport, representing ultimate conditions.

7.8 PART 77 PROFILE FOR RUNWAY 9-27 (Sheet 7 of 9)

This sheet provides a profile view of the Runway 9-27 approach surfaces, complete with likely penetrations to the airspace.

7.9 PART 77 PROFILE FOR RUNWAY 16-34 (Sheet 8 of 9)

This sheet provides a profile view of the Runway 16-34 approach surfaces, complete with likely penetrations to the airspace.

7.10 LAND-USE PLAN (Sheet 9 of 9)

This sheet provides the existing land-use zoning in the vicinity of the airport and the noise contours generated, as discussed in Chapter Six.

Insert Sheets 1-9
ALP Set

INSERT ALP SET HERE

Chapter Eight

FINANCIAL ANALYSIS

8.1 INTRODUCTION

Schedules of proposed development and estimates of development costs at Beverly Municipal Airport resulting from the selected improvement projects are discussed in this chapter. Development items are listed by three time periods: short term (zero to five years), intermediate term (6 to 10 years), and long term (11 to 20 years). Although each period has a designated length of time, projects identified for one period may overlap with another as demand and funding warrant. Tables 8-2 through 8-4 at the end of this chapter list planning-level cost estimates for recommended airport improvements for each term. The tables identify the anticipated financial responsibility for each airport improvement as being from the FAA, MAC, airport sponsor (i.e., City of Beverly/Airport Commission), and/or private sources. Included in the lists are some standard operation and maintenance items (i.e., equipment), most of which are not eligible for FAA funding. They are included in the tables to provide a comprehensive view of the significant expenditures that likely will be incurred by BVY during the planning period.

Project cost estimates developed for Tables 8-2 through 8-4 are based on the selected airport-development projects recommended in Chapter Four and further refined in Chapter Five. In addition to actual construction costs, financial consideration was given to engineering, design, and environmental-permitting efforts, as well as construction items and contingencies not specifically enumerated. For planning purposes, 15 to 25 percent of the base construction costs was added to most projects to reflect approximate engineering and construction contingency costs; environmental permitting costs are additional.

After total project cost estimates were calculated, the respective amounts funded by federal, state, and local or private enterprises were determined based on federal funding-eligibility criteria. Under current legislation, the FAA pays 90 percent of the eligible costs through its AIP. The remaining 10 percent is divided between the MAC (7 percent) and the airport sponsor (3 percent). AIP-eligible items generally include airfield components (i.e., runway and taxiway reconstruction and new aircraft-parking aprons), land acquisition, and equipment acquisition.

Items not eligible for AIP funding typically include hangars, automobile parking, and FBO facilities because they are revenue-generators or do not benefit the general public. Ineligible items can be either 100-percent locally or privately funded, or some combination of the two. Maintenance items (e.g., annual pavement striping, pavement cracksealing, and mowing) also are considered ineligible for federal participation at this time. Some airport maintenance items, such as runway overlays, airfield pavement cracksealing, obstruction removal, and acquisition of maintenance equipment such as tractors and mowing decks, are eligible for state funding even though the FAA will not participate. Some navigational equipment is eligible for 100 percent FAA funding under the Facilities and Equipment Division; the proposed four-box PAPI system for Runway 9 and the upgrade of the Runway 16 MALS fall into this category in this AMPU.

Construction cost estimates listed in Tables 8-2 through 8-4 are based on current (2000) dollar values. These costs undoubtedly will rise in the future, possibly by 1 to 3 percent or more per year as a result of inflation. To compute up-to-date cost estimates or revisions at any time in the future, refer to the Construction Cost Index (CCI) of *Engineering News Record*, a weekly nationwide civil engineering and construction magazine published by the McGraw-Hill Company (also accessible on the Worldwide Web at *http://www.enr.com*). The CCI is revised every week to reflect changes in typical labor rates and material costs. Based on an index of 100 for the year 1913, past CCI annual averages are listed in Table 8-1.

TABLE 8-1
CONSTRUCTION COST INDEX

YEAR	CCI
1990	4,732
1991	4,835
1992	4,985
1993	5,210
1994	5,408
1995	5,471

1996	5,701
1997	5,825
1998	5,920
1999	6,060
February 2000	**6,160**

Source: *Engineering News Record;* McGraw-Hill Company; February 21, 2000.

The average construction cost rate rose by 13 percent between 1990 and 1994. In the most recent five-year period, the rate increased by 10 percent. By applying future CCI numbers as they are determined, cost estimates in this chapter can be updated to more accurately reflect ongoing inflationary factors. An example of computing future project costs using this information is as follows:

$$\frac{\text{(2000 project costs) x (future CCI)}}{\text{(2000 CCI = 6,160)}} = \text{future project costs}$$

8.2 PROJECT SCHEDULING

This subsection discusses factors relative to each component of the scheduling and capital cost tables. Included are comments and exceptions to the percentage of funding participation by the FAA, MAC, and city, including any ineligible airport-development needs.

As discussed previously, construction scheduling of facility improvements at BVY is divided into three development terms. The short term and early intermediate term identify those projects needed at the airport to satisfy existing demand and to correct any safety deficiencies. The intermediate and long terms identify projects needed to satisfy forecasted future demand levels, and act as a “catchall” for those projects that could not be funded in the short term or whose demand was not realized. It is not recommended that facilities in the intermediate and long terms be designed or constructed until the anticipated demand level develops. In all probability, intermediate- and long-term demands will not occur exactly as the schedule indicates, which may affect the development timetable. In addition, any significant interruptions in the review and approval process of proposed projects may delay the proposed schedule accordingly.

Although intermediate- and long-term improvements are tied directly to projected demand, there is no guarantee that the improvements will be required. Therefore, the city, through the airport commission, should closely monitor aviation demand as it develops and be prepared to initiate steps to bring intermediate-term recommendations on-line as needed. The city should begin implementing short-term recommendations now, because those improvements are a direct result of existing safety or capacity deficiencies at the airport.

8.2.1 Short-Term Improvements

This subsection outlines the projects anticipated for the short term. Because a number of proposed projects for the short term are likely to trigger the need for an EA, its preparation should be carried out as the first project. The EA preparation will build on the environmental evaluations conducted herein to better define impacts resulting from the selected improvements. In this way, the project designs can be refined to eliminate, reduce, or mitigate the impacts while still achieving the project objectives. The EA is expected to evaluate only those projects that are likely to occur (i.e., short-term and some intermediate-term projects). As the airport enters the intermediate- or long-term phase, another EA may be necessary. Therefore, this AMPU assumes that, due to the sequencing of the proposed projects, the preparation of an EA will be necessary in both the short and long terms.

The Runway 16-34 extension and RSA project is the most significant expenditure in the short term and will take up to two years to permit. The Runway 16 approach obstruction removal is also a large project, with potential for community impacts. It is suggested that the EA and EIR included on the short-term project list be completed first, and include as many of the suggested improvement projects as possible to reduce the permitting time and effort of some of the future projects. The Runway 9-27 rehabilitation and RSA construction is also proposed in the short term, but impacts due to this project are anticipated to be minor.

Obstruction removal is proposed for the Runway 16 end because it has a nonprecision approach, contains the most off-airport obstructions, and is to be designated as the primary runway. The anticipated expense of the off-airport obstruction-removal projects requires that they be spread out over the planning period. The costs for the off-airport obstruction removal include an estimated cost per easement and a fixed cost for removal of the vegetation per lot. If lighting of the obstructions is selected as an alternative to removal, the cost of this item will be significantly reduced, especially where existing road rights-of-way can be used for the lightpoles (thereby avoiding residential property easements). The installation of a PAPI system on Runway 9 also is proposed, but is listed as an FAA Facilities and Equipment Division project, and is eligible for complete FAA funding. Apron and T-hangar construction is proposed to address existing capacity deficiencies. The apron designated for construction is located on the eastern side, and will address the existing apron shortfalls identified in Chapter Four. The location for hangar construction will be determined on a case-by-case basis as private interests submit proposals.

Equipment needs are identified in Chapter Four. The two existing plow trucks will need to be replaced in the short term, and the costs provided in Table 8-2 assume an in-kind replacement. Also, a brush mower is needed to maintain the Runway 16 end and other areas that were part of the 1996 vegetation-management plan.

Environmental permitting tasks that likely will be required to complete the short-term projects include the following:

- A federal EA to address the probable wetlands impacts associated with the extension and RSA projects and the easement acquisition for the obstruction removal. The EA also will address intermediate-term projects, such as the Runway 9-27 obstruction removal and west-side apron development.

- A state-level EIR to address impact thresholds that likely will be exceeded by the extension and RSA projects. Once a threshold is tripped, all of the projects will be analyzed by the reviewing agency. It is assumed that an EIR will be required, even though the projects are not categorically included to prepare an EIR.

- State and local wetlands permitting pursuant to the MWPA (and Wenham/Danvers wetlands ordinances) for the Runway 16-34 extension, RSA, obstruction-removal, and pavement-rehabilitation work. The RSA at the Runway 16 and 34 ends will exceed 5,000 square feet of impact; therefore, a variance from these regulations may be required.

- Federal-level wetlands permits pursuant to Sections 401 and 404 of the Federal Clean Water Act. An individual Section 401 permit will be required; however, the status of the Section 404 permit will not be certain until final design plans are completed. In the costs, it is assumed that an individual Section 404 permit will be required.

Some maintenance equipment at BVY is in need of replacement and some new equipment is needed to maintain areas that were cleared as part of the 1996 obstruction-removal project. These items are included on the short-term list even though they are not eligible for AIP funding.

8.2.2 Intermediate-Term Improvements

Any projects not implemented during the short term due to lack of funding or demand should be reconsidered in the intermediate term. The most significant projects proposed for this term are the rehabilitation of the Runway 16-34 pavement (excluding the new pavement of the extension). The remaining off-airport obstruction removal also is proposed at the Runways 9 and 27 ends. The estimated cost of this item in Table 8-3 assumes that easements will be required for each of the properties that contains obstructions. Lighting of the obstructions is a possible alternative that could reduce the number of easements (by placing the lights within existing road rights-of-way) and overall project cost. Upgrade of the MALS at the Runway 16 end is also identified as an intermediate term project, but it is assumed that this will be an F & E project. The feasibility and potential impacts of the additional two light bars will need to be addressed as part of the short term EA.

Apron and taxiway projects are proposed in the intermediate term to address demand and overall airport efficiency. The east-side-apron project involves converting the existing 75,000-square-foot parking area to apron, and then constructing a replacement 75,000-square-foot parking area behind the administrative offices (the parking in this area can be expanded well beyond the 75,000 square feet in the future). It is believed that this parking area can be configured to provide the capacity identified in Chapter Four. A secondary parking area is identified on the north side of L.P. Henderson Road; however, this should only be used if the initial site is not adequate in size to provide the required spaces. While the first parking area is shown to be AIP eligible in the table, the secondary area would likely not be eligible. The west-side-apron project proposed in the intermediate term is located in the Landside Alternative 3 area, which is of significant size. While a total cost for this entire apron is presented in Table 8-3, it is likely that it will be constructed in phases as demand occurs. Pavement rehabilitation for existing aprons and Taxiway F is recommended, as these surfaces exceed 30 years in age.

Environmental permitting will be required for many of the intermediate-term projects; however, the federal EA should not be required if the initial EA completed in the short term included some or all of this work. The costs for wetlands mitigation and stormwater detention, which may be required for the taxiway and west-side-apron projects, is not included in Table 8-3. Project designs may be developed that avoid the wetlands areas and reduce mitigation costs. However, if wetlands-replication sites are needed for the projects, additional costs will be incurred because off-site replication may be needed, requiring additional easements or property acquisition.

8.2.3 Long-Term Improvements

If projects from the intermediate term were not implemented, they should be carried over into the long-term planning phase. The project list for this term includes the construction of the remaining recommended taxiway projects, which will minimize runway incursions throughout the facility. The remainder of the currently existing pavement is to be rehabilitated in the long term, including reducing the taxiways in width in accordance with the B-II standards. Demand-based projects including apron and hangar development are scheduled in the long term, if the forecasted demand is realized. The remaining gaps in the perimeter security fence also are scheduled to be closed as a long-term project.

The preparation of the second EA is proposed for this term because additional impacts to wetlands are likely due to the additional apron construction. Local and state wetlands permitting also will be required; however, the impacts anticipated for the long-term projects will be slight, allowing for a reduced permitting effort.