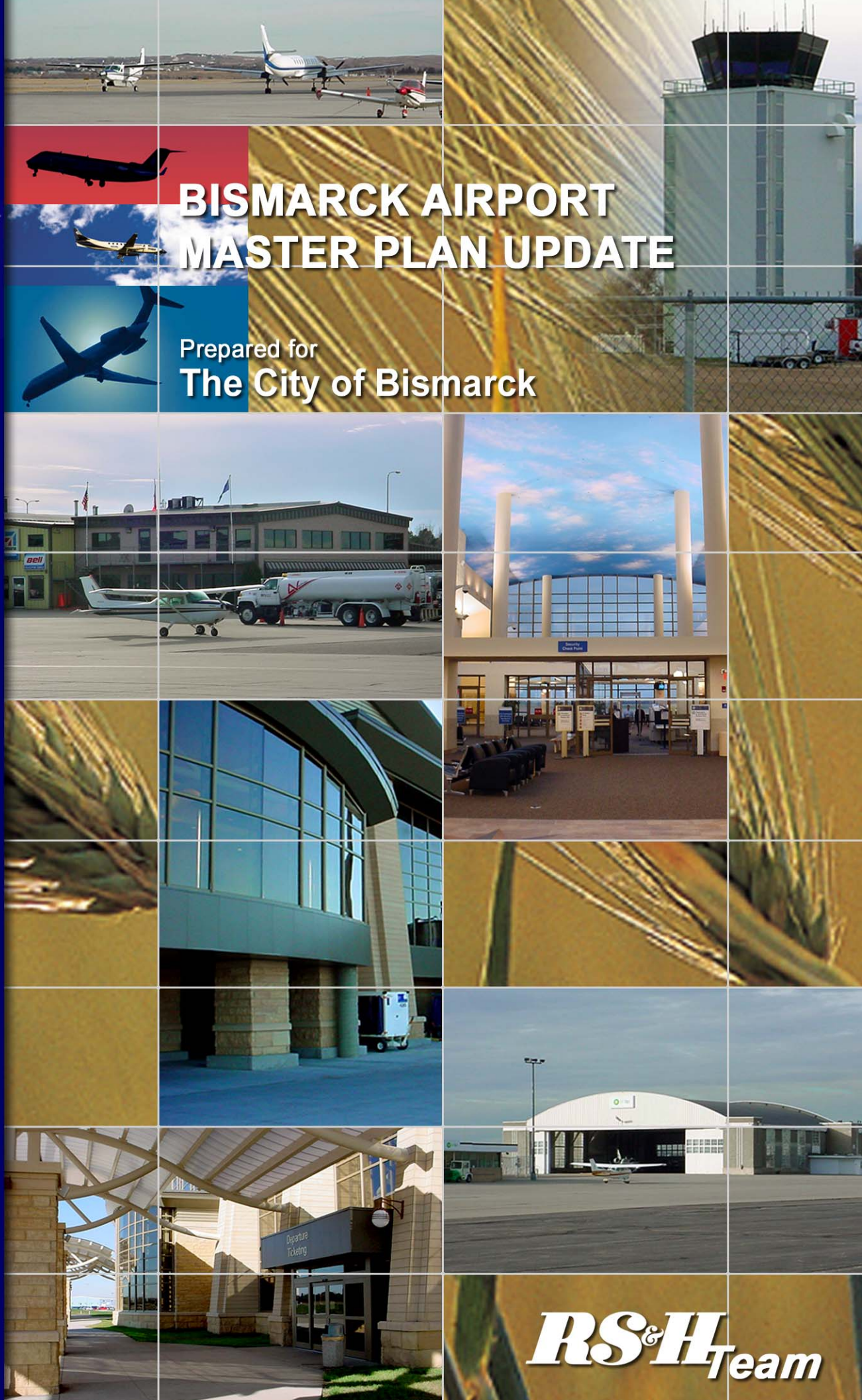
Bismarck

BISMARCK AIRPORT MASTER PLAN UPDATE

Prepared for
The City of Bismarck



RS&H Team

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May 2008

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CHAPTER 1
ISSUES AND EXISTING CONDITIONS

The Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, outlines the development of an airport master plan. An initial step, inventory of issues and existing conditions, is the collection of data pertinent to the airport and the area it serves. The objective of the identification of issues and existing conditions task for Bismarck Airport is to provide information necessary for master plan analyses.

Information was obtained through on-site investigations of the Airport, interviews with airport management, state and federal agencies, fixed base operators, air traffic control and other users and stakeholders, as well as the collection and analyses of previous reports and studies. A glossary of terms is provided in Appendix A.

1.1 BACKGROUND

Background information regarding Bismarck Airport is provided in the following sections. The history section provides a brief overview, from the original dedication of the Airport through the present day conditions by highlighting key events in the historical record. The Airport setting section provides geographic and meteorological data for the Airport and the surrounding area. Finally, the role discussion provides an overview of the Airport's placement in the national system of airports and a generalized description of the size and level of air service provided.

1.1.1 History

In the 1920s, the original airport site was a cow pasture located on the flats between the City of Bismarck and the City of Mandan, approximately across the road from what was once Jerry's Supper Club. The first official city-owned airport was developed through the leasing of 80 acres of land from F. B. Straus and Cora S. McLean. For a time it was known as Straus Field. The terminal buildings and hangars were located on the original tract of ground (80 acres) which were purchased by the City in 1940. At that same time, the City purchased an additional 60 acres from the Wachter family. In 1947, under the Federal Airports Act of 1946, the City acquired 160 acres from the War Assets Administration, and has since purchased other tracts of land accumulating a total of 2,400 acres today.

The first airline operation at Bismarck Airport commenced in June of 1931 with Northwest Airlines making its inaugural flight using equipment built by Stinson Aircraft, designated as the "Stinson Detroiter". Through the years, other aircraft types providing passenger service to Bismarck included: Hamilton, Lockheed 10 A, Lockheed 14 H, Douglas DC-3, Martin 202, Douglas DC-4 and DC-6, the Lockheed Electra, the Boeing 727, and now DC-9s.

Hanford Airlines was the first carrier operating on a north-south route to Bismarck. In 1939, Mid-Continent Airlines merged with Hanford and originated a north-south route from Tulsa to Bismarck. This service was discontinued during World War II, though it resumed again in 1946.

In 1952, Braniff Airlines purchased Mid-Continent Airlines and served Bismarck Airport. The Civil Aeronautics Board awarded North Central Airlines this portion of Braniff's routes in 1959 with two round trips daily.

The first terminal building was constructed in 1936 as part of a Works Progress Administration (WPA) project, and the large municipal hangar was completed as a WPA project in 1940. The first paved runways were constructed in 1940 as a part of a WPA program of airport development. The 7th Ferry Command of the U.S. Army Air Corps used the Airport from 1943 to 1946.

The first control tower was an addition to the original terminal building. The off-site drainage improvements completed in 1950 and 1951 were some of the Airport's first construction project after the end of World War II. Part of the main runway, Runway 13/31, was reconstructed in 1952 and the second phase of this runway construction was completed in 1957. In 1962, Runway 13/31 was lengthened to a length of 6,925 feet to accommodate jet aircraft.

Along with construction of a replacement terminal in the mid-1960s, the City extended a new water main and sanitary sewer to provide adequate service to the facility. Other projects included the construction of the crosswind runway, Runway 3/21, Taxiway D, and a ramp to the new terminal. In addition, field lighting was installed, a surface drainage project completed, and a parking lot and access road to the terminal was built. The terminal building, which had been long needed for growing air service, was a fitting climax to this construction phase. In 1978, Runway 13/31 was extended to a length of 8,794 feet, its current length today.

In the mid-1980s, the south end of the terminal building was expanded to include a two-story ticketing and departure area. The four airline counters and a large waiting area were located on the first floor of the terminal.

Following airline deregulation in 1978, commercial airline operators evolved into what is today commonly referred to as legacy airlines, such as Delta, Continental, American, etc. In 1986, Republic Airlines merged with Northwest Airlines and strengthened Bismarck's access to domestic and international destinations through the Minneapolis / St. Paul hub. In 1992, Continental Airlines discontinued direct service from Bismarck to Denver. Shortly thereafter in 1994, Frontier Airlines resurfaced with new owners and reinstated service between Bismarck and Denver. However, the flights lacked sufficient load factors and service was later discontinued. Great Lakes Aviation, a regional carrier flying as United Express, began operation in the mid-1990s with service to Denver. However, due to scheduling conflicts and lack of passenger acceptance of 19 seat turbo-prop aircraft this service was not successful either. Finally, United Airlines replaced Great Lakes service to Denver with Dornier 328 aircraft, which later evolved into 50 - 66 seat regional jets. Northwest Airlines, through its affiliate airlines, continues to offer daily non-stop service to Minneapolis / St. Paul on a mix of narrow body jets and regional jet aircraft and Allegiant Airlines started scheduled charter service from Bismarck to Las Vegas in 2004. The Allegiant service has been quite successful and represents the only low cost airline service available at the Bismarck Airport.

In May 2005 construction of a new $15 million terminal was completed. The terminal design incorporated a clean, contemporary look with high ceilings and glass walls. In addition to the installation of a new baggage handling system and geo-thermal system, a third boarding bridge was added to the building, and an additional aircraft ramp was constructed. An aerial of the Airport is provided in Exhibit 1-1.

Exhibit 1-1
AERIAL OF AIRPORT

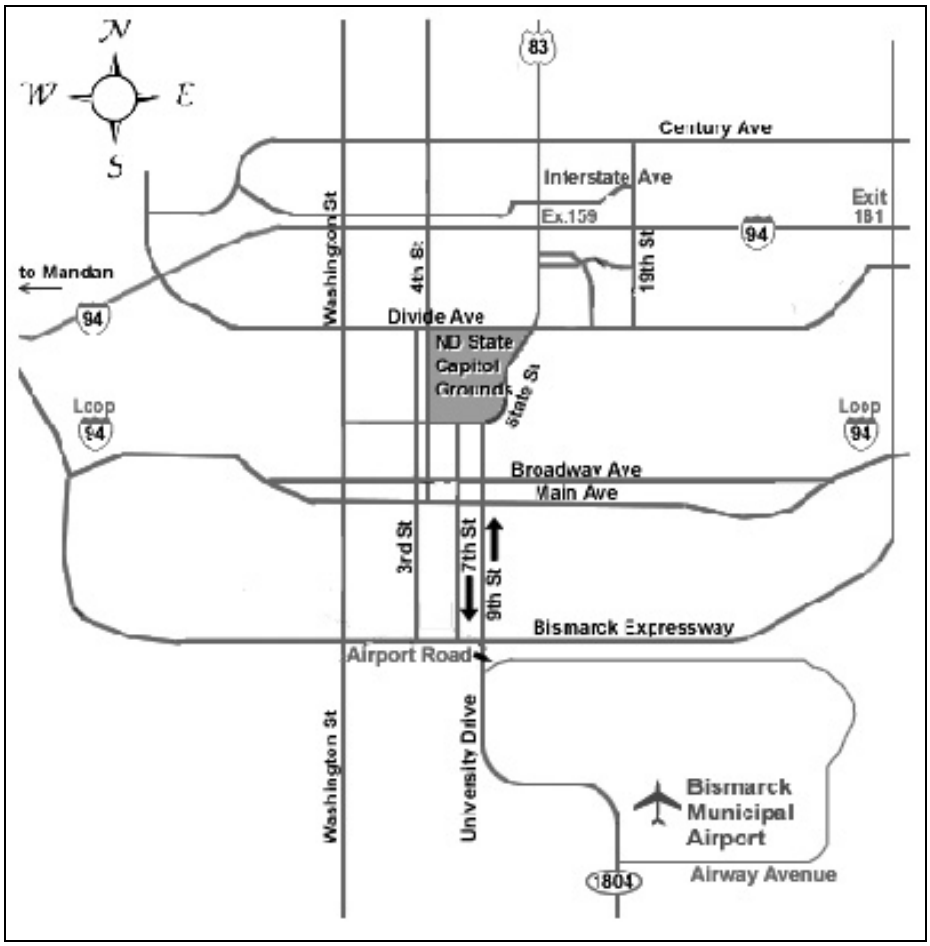
1.1.2 Setting

The Bismarck metropolitan area is located on the eastern shores of the Missouri River in Burleigh County. Transportation and industry originally emerged in the late 1800s in the area because of its strategic location near water and rail connections.

1.1.2.1 Location

Bismarck is located in central North Dakota, near the geographic center of North America. It is on the east bank of the Missouri River, in a shallow basin seven miles wide and 11 miles long. Bismarck Airport is located two miles southeast of the City's central business district and is three miles south of U.S. Interstate 94 (I-94), as depicted in Exhibit 1-2.

Exhibit 1-2
VICINITY MAP



Burleigh County was founded in 1873. It was named for Dr. Walter Burleigh. Dr. Burleigh was an ardent Republican and strong supporter of Abe Lincoln's campaign for President in 1861. Through his support of Lincoln and his strong political ties, Dr. Burleigh was named an Indian Agent of Dakota Territory. With his election as a delegate to Congress, Dr. Burleigh controlled all Federal patronage to the territory.

As such, Dr. Burleigh was awarded the contract to grade the Northern Pacific Railroad from 50 miles east of Bismarck to the River. Originally, the Northern Pacific Railroad decided to locate its terminus at a small village, now called Burleighton, which is two miles south of present day Bismarck. However, in order to avoid the lowland flats and the spring flooding in the area, the rail line was eventually realigned towards the bluffs of Bismarck.

Though the City of Bismarck was originally christened Edwinton in 1872 in honor of Edward F. Johnson, the first building engineer to urge the building of a transcontinental railroad, the City was renamed to Bismarck in 1873. The name of Bismarck was selected to honor Germany's "Iron Chancellor", Prince Baron Otto Eduard Leopold Von Bismarck-Schoenhausen. Prince Bismarck was a famous German statesman from Prussia, credited with the creation of the German Empire and serving as the country's first chancellor.

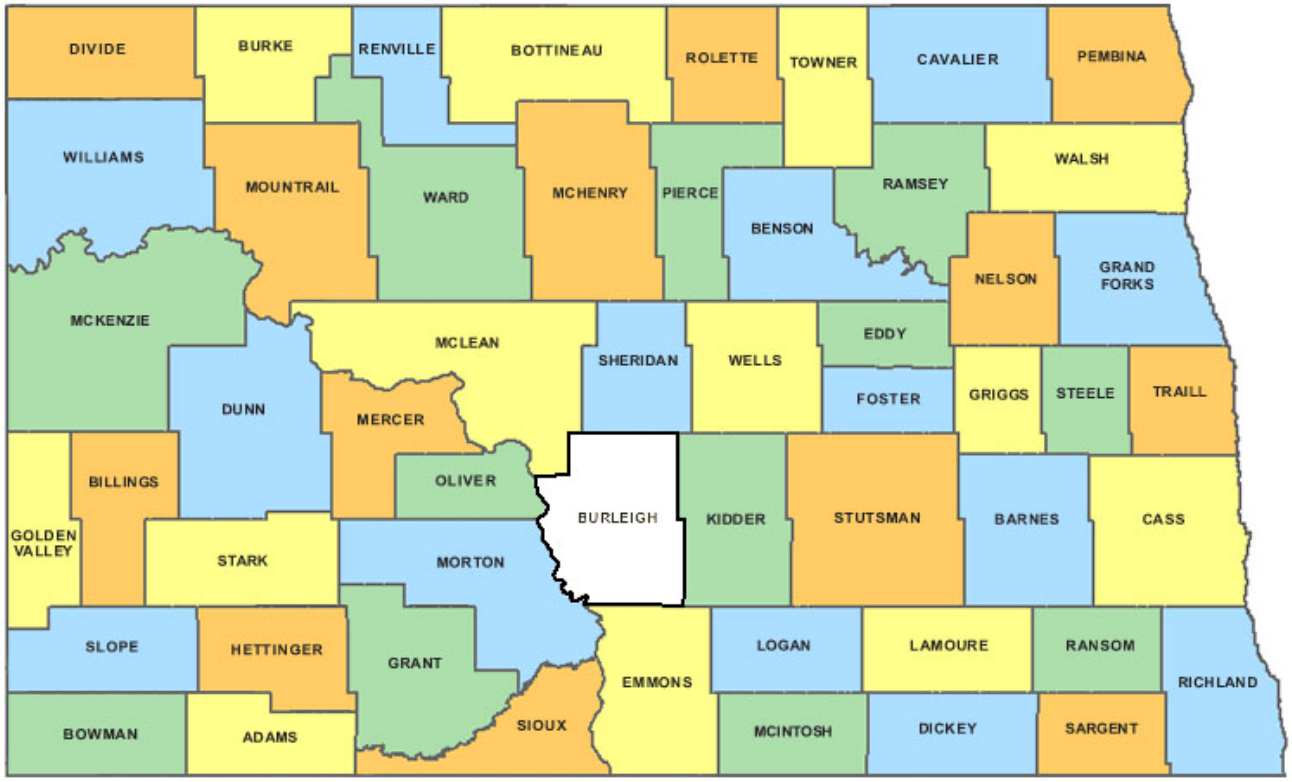
Since the railroad at this time was in need of money, the city's name was modified to encourage German capital in the railroad's transcontinental construction program. The map of the City of Bismarck was shown throughout Europe in hopes that the statesman would invest in the city. Though Prince Bismarck acknowledged his appreciation, he did not provide any financial support. The City of Bismarck was officially incorporated on January 14, 1875. In 1876, the Battle of the Little Big Horn put Bismarck on the world map.

Following the arrival of the railroad, Bismarck quickly became a center of trade and transportation. Steamboat businesses developed and flourished for a time on the Missouri River. During this period, Bismarck became a port as well as a railroad terminus, until the railroad bridged the Missouri River in 1883. Gold discoveries in the Black Hills made Bismarck a freight-shipping center, and long wagon trains pulled by oxen traversed the 300 mile "Custer Route" to the Black Hills.

In 1883, Bismarck became the capital of the Dakota Territory. Six years later, when the Territory divided into two states, Bismarck became the capital of North Dakota. Since then, Bismarck has developed into a major business, financial, and cultural center with its retail trade area reaching over 100 miles and serving upwards of 200,000 people in 2005.

The City of Bismarck's form of government is a five-member city commission, of which the president is also the Mayor of the City. In addition to serving as the State Capital, it is also the County Seat of Burleigh County.

Exhibit 1-3
LOCATION MAP



1.1.2.2 Community Economic Overview

Agriculture is considered a predominate industry in the region because of the high quality farming soils. Much of the land located south of the Airport is currently undeveloped or used for agricultural and preservation purposes. Energy is the second largest industry in the area and includes large operations such as Mandan Refinery and Washburn and Buelah coal electric generating plants. The land to the north, west, and east includes business and residential development.

1.1.2.3 Ownership and Management

The City of Bismarck has owned and operated Bismarck Airport since 1940 as a department of the City The City of Bismarck's form of government is a five-member city commission - elected at-large, of which the president is also the Mayor of the City. The City Commission meets the second and fourth Tuesday of each month.

1.1.2.4 Meteorological Conditions

A review of the prevailing meteorological conditions is necessary to assist in the evaluation of aircraft performance characteristics and select facility requirements. Temperature, precipitation, winds, visibility, and cloud ceiling heights are elements used to summarize an area's climate for airport planning purposes.

The area is semi-arid and experiences a continental type of climate that is characterized by westerly winds and larger temperature fluctuations than in areas at the same latitude near oceans or seas. The Airport is virtually surrounded by low-lying hills that are 200 to 300 feet high. On average, the prevailing winds in Bismarck are southwesterly, averaging 10.2 miles per hour. Sunshine is abundant and is present 59 percent of the year, averaging 2,700 hours out of a possible 4,470 hours.

The summers are warm, but there are not many hot days. The average freeze-free period is between early June and late September. Most summer precipitation occurs during thunderstorms in the late afternoon and evening. Precipitation is well distributed throughout the year with the crop season, April through September, receiving an average of 12.61 inches, or 75 percent of the average annual total. The wettest month is June with an average of 2.59 inches of rainfall.

The winter season usually begins in late November and continues until late March. Average seasonal snowfall for the Bismarck area is 49.3 inches. Snow has been reported in all months except July and August. The last annual freeze typically occurs in May and the first annual freeze occurs in September. January has the lowest average temperature at 0.6^{o} Fahrenheit below zero. The lowest temperature on record is 45.0^{o} Fahrenheit below zero, set in January of 1916 and February of 1936.

The average annual temperature in the City of Bismarck is 42.3^{o} Fahrenheit. The month of July has the highest average temperature of 84.5^{o} Fahrenheit, and a maximum average temperature of 70.4^{o} Fahrenheit. The highest single-day temperature on record was 114.0^{o} Fahrenheit; it was experienced in July of 1936.

1.1.3 Role

Determination of an airport's role and classification is a function of the FAA and is used in the process of assembling the National Plan of Integrated Airport Systems (NPIAS) and determining airport project funding levels. The primary role of Bismarck Airport is commercial service, but the Airport also supports general aviation, cargo, and military operations.

1.1.3.1 National Plan of Integrated Airport Systems Classification

An airport must be included in the NPIAS to be eligible for federal funding under the Airport Improvement Program (AIP). The NPIAS is prepared by the FAA every two years and identifies public-use airports considered necessary to provide a safe, efficient, and integrated system of airports to meet the needs of civil aviation, national defense, and the United States Postal Service. It also takes into consideration the relationship of each airport to the rest of the transportation system in a particular area, the forecast of technological developments in aeronautics, and the development forecast in other modes of transportation. A detailed description of the NPIAS can be found in Appendix B.

Bismarck Airport is presently listed in the NPIAS as a commercial service primary airport. A primary airport has more than 10,000 passenger enplanements each year in the United States on aircraft service in air commerce.

The Airport is also home to the North Dakota Army National Guard and the North Dakota Civil Air Patrol (CAP). The North Dakota Army National Guard at Bismarck includes operations with the National Guard UH-60 Blackhawk, OH-58 Kiowa Warrior, UH-1 Huey helicopters and the C-12 fixed

wing aircraft. The CAP is the official auxiliary to the United States Air Force, and it is tasked with three main missions: Aerospace Education, Cadet Programs, and Emergency Services.

General aviation facilities, located along the west side of Runway 13/31 and east of the Runway 13 end, include two fixed base operators, conventional and t-hangar storage, charter services, flight training, and light and heavy aircraft maintenance. The general aviation aircraft operating at the Airport range from single-engine planes to jets.

1.1.3.2 Adjacent Airports and Services

An important part of conducting an inventory at an airport is the examination of neighboring airports and the services they offer. This includes both public and private use airports that may have an impact on the airspace surrounding an airport and the demand for use of the airport.

The primary and commercial service airports located in North Dakota are identified in Table 1-1. These airports play an important role in identifying the service area for Bismarck Airport and competition offered by other airports with similar services. General aviation airports that are open to the public and are located within 30 statute miles of Bismarck Airport are identified in Table 1-2. A map of all the commercial service and general aviation airports within North Dakota are depicted in Exhibit 1-4.

Table 1-1
NORTH DAKOTA PRIMARY AND COMMERCIAL SERVICE AIRPORTS AND ASSOCIATED SERVICES

Airport	City	Runways	Runway Length	Runway Width	Pavement Type	Instrument Approach	Based A/C	Annual Operations
Bismarck Municipal	Bismarck	13/31	8,794	150	Asphalt	ILS, GPS,	117	52,606
		3/21	6,600	100	Asphalt	LNAV, VOR		
Devils Lake Municipal - Knoke Field	Devils	13/31	5,509	150	Concrete	ILS, GPS,	59	22,965
	Lake	3/21	4,313	75	Concrete	VOR		
Theodore Roosevelt Regional Airport	Dickinson	14/32	6,400	100	Concrete	ILS	22	11,362
		7/25	4,700	75	Concrete			
Hector International	Fargo	18/36	9,000	150	Concrete	ILS, GPS,	188	79,206
		9/27	6,300	100	Concrete	VOR		
		13/31	3,800	150	Asp/Con			
Grand Forks International	Grand	17R/35L	7,349	150	Asphalt	ILS, GPS,	104	254,214
	Forks	8/26	4,206	100	Concrete	VOR		
		17L/35R	3,900	75	Concrete			
Minot International	Minot	13/31	7,700	150	Concrete	ILS, GPS,	78	39,932
		8/26	6,350	100	Asphalt	VOR		
Sloulin Field International	Williston	11/29	6,650	100	Asphalt	ILS, VOR	35	18,390
		2/20	3,453	60	Asphalt			

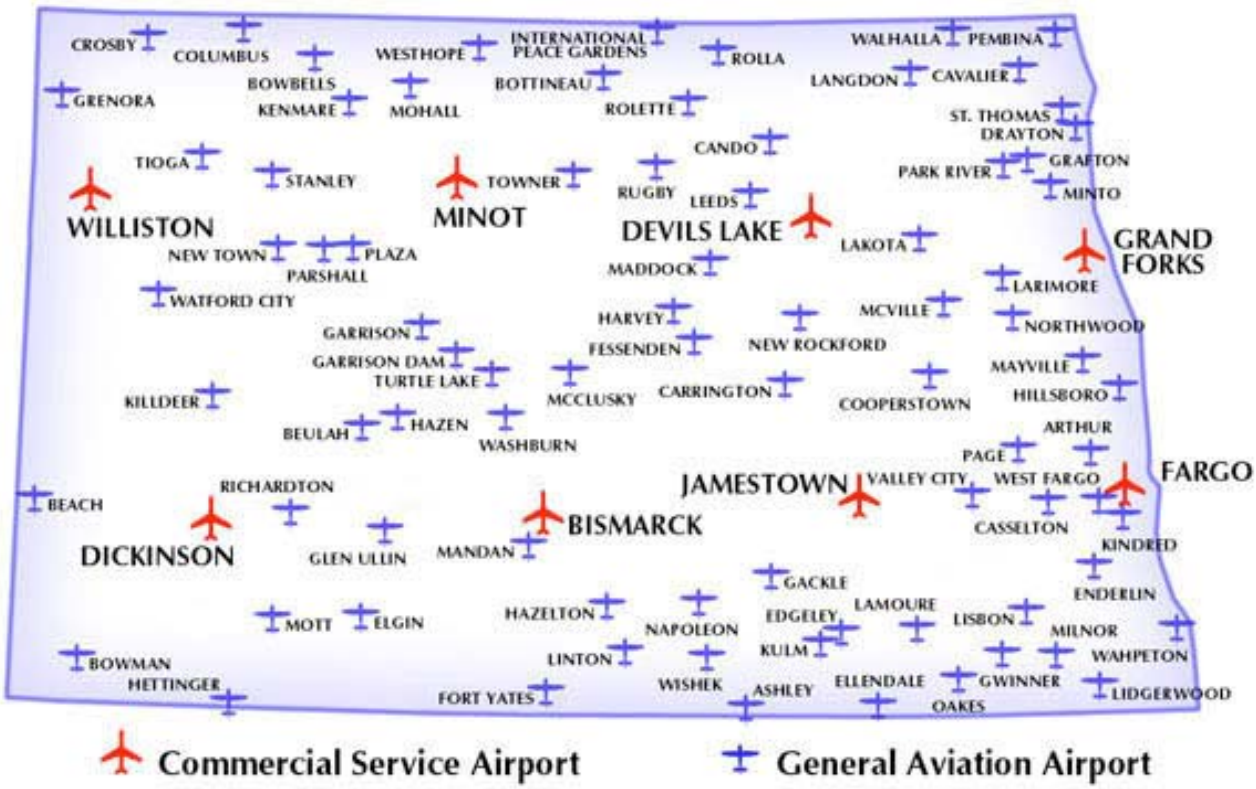
Source: FAA Airports/Facility Directory, Twin Cities Aeronautical Sectional Chart, and FAA Terminal Area Forecast

Table 1-2
SURROUNDING GENERAL AVIATION AIRPORTS AND ASSOCIATED SERVICES

Airport	City	Runways	Runway Length	Runway Width	Pavement Type	Instrument Approach	Based A/C	Annual Operations
Mandan Municipal Airport	Mandan	13/31	4,400	75	Asphalt	VOR	52	8,100
		4/22	2,900	150	Turf			
Linton Municipal Airport	Linton	9/27	3,700	60	Asphalt	GPS	16	1,700
Hazelton Municipal Airport	Hazelton	17/35	3,800	100	Turf	None	0	200

Source: FAA Airports/Facility Directory, Twin Cities Aeronautical Sectional Chart, and FAA Terminal Area Forecast

Exhibit 1-4
AIRPORTS LOCATED WITHIN NORTH DAKOTA



Source: North Dakota Aeronautics Commission

1.1.3.3 Aviation Activity Overview

The Airport is served by three commercial service airlines, including Allegiant Air, Northwest/Northwest Airlink, and United Express. Non-stop passenger air carrier service is offered to Minneapolis-St. Paul, Denver, and Las Vegas. The commercial service destinations are shown in Exhibit 1-5. Some of the top destinations served through the airlines hub locations include Las Vegas, Phoenix, Chicago, Washington D.C., Los Angeles, and Seattle.

Exhibit 1-5
COMMERCIAL SERVICE DESTINATIONS

1.1.4 Prior and Ongoing Studies

The following list provides a summary of prior and ongoing studies conducted for Bismarck Airport. These studies are used to provide essential background information regarding the Airport, including previously identified areas of concern, existing conditions, and development plans.

- **Airport Master Plan** – In December 1996, the Airport completed an update of the master plan. The purpose of the study was to develop a plan that accommodated the aviation needs of the City of Bismarck and the surrounding area. Within the Master Plan, there was also an Airport

Layout Plan and a FAR Part 77 Obstruction Plan. This study serves as an update to the previous master plan.

- **FAR Part 150 Noise Compatibility Plan** – In 1991, the plan was undertaken to assess the community impact produced by aircraft activity. The resulting plan presented noise abatement and mitigation actions.
- **Terminal Area Study**– In April 2001 the Airport completed a terminal area study. The purpose of this report was to investigate existing terminal area conditions and conceptually plan improvements to address deficiencies.
- **Final Airport Surveillance Radar (ASR-11) Site Survey Report** – In June 2005 an analysis of the airport environment was completed for selection of a site for the Bismarck ASR-8. The site selected is located approximately 150 feet north of 48th Avenue, on the southern edge of airport property.
- **Pavement Evaluation Study** – The most recent report by the Aeronautics Commission was completed in February 2006.

1.2 AIRFIELD

The airfield facilities at the Airport include the runways, taxiways, navigational aids, visual aids, and aeronautical environment. The airfield facilities are identified in Exhibit 1-6.

Exhibit 1-6
AIRFIELD AND SUPPORT FACILITIES

1.2.1 Runways

The runway configuration consists of the number of runways, dimensions, characteristics, and orientation. The runways provided at an airport depends largely on the volume of traffic. Dimensions and characteristics are dependent on the aircraft that use the airport and the design standards associated with a runway needed to accommodate the aircraft. The orientation of the runways depends on the direction of the prevailing wind patterns, the size and shape of the area available for development, and land-use or airspace restrictions in the vicinity of the airport.

The airfield configuration at Bismarck Airport is comprised of two intersecting runways. Runway

13/31 is the primary runway and is 8,794 feet long and constructed of asphalt. Runway 3/21, also referred to as the secondary or crosswind runway, is 6,600 feet long and also constructed of asphalt. A summary of the runway facilities is provided in Table 1-3.

Table 1-3
RUNWAY DATA

	Runway			
Item	**3**	**21**	**13**	**31**
Runway Length (ft)	6,600		8,794	
Threshold Displacement	None		None	
Runway Width (ft)	100		150	
Runway Gradient	0.1%		0.1%	
Pavement Type	Asphalt		Asphalt	
Pavement Strength				
Single Wheel Gear	130,000 lbs		130,000 lbs	
Dual Wheel Gear	180,000 lbs		180,000 lbs	
Dual Tandem Wheel Gear	340,000 lbs		340,000 lbs	
Runway Lighting	HIRL		HIRL	
Runway Marking	Precision		Precision	
Visual Aids	PAPI-4L, REIL, HIRL	PAPI-4L, REIL, HIRL	VASI-4L, MALS, HIRL	PAPI-4L, MALSR, HIRL
Airport Reference Code	C-III		D-IV	
Approach Ratio	50:1/40:1	50:1/40:1	50:1/40:1	50:1/40:1
Runway Protection Zone (ft)	500 x 1,010 x 1,700	500 x 1,010 x 1,700	1,000 x 1,750 x 2,500	1,000 x 1,750 x 2,500

Source: FAA Airport Database, FAA 5010 Form

1.2.2 Taxiways

The primary function of a taxiway system is to provide access between runways and the apron areas. The taxiways should be located so that aircraft exiting the runway will have minimal interference with aircraft entering the runway or remaining in the traffic pattern, thus taxiways increase operational safety and efficiency. Taxiway details are summarized in Table 1-4.

Table 1-4
TAXIWAY DATA

Item	Taxiway B	Taxiway C	Taxiway D
Centerline Separation			
Runway To Taxiway (ft)	N.A.*	700	600
Taxiway Width (ft)	40	75	60
Taxiway Shoulder Width (ft)	0	0	0
Taxiway Safety Area Width (ft)	79	214	214
Taxiway Object Free Area Width (ft)	131	320	320
Taxiway Edge Lighting	Medium Intensity	Medium Intensity	Medium Intensity
Taxiway Marking	Centerline, Hold Position	Centerline, Hold Position, Signage	Centerline, Hold Position, Signage
Areas Served	Rwy 13, Bravo Hangars	Rwy 13/31, Txy D, NDANG, Commerical Apron, GA Apron	Rwy 3/21
Crossover Taxiways	none	C1, C2, C3, C4, C5	D1, D2, D3

Source: FAA Advisory Circular 150/5300-13

* Taxiway is not a parallel taxiway, it provides direct access to runway.

1.2.3 Navigational Aids

Navigational aids (NAVAIDs) assist the pilot with enroute navigation and approaches into and out of airports. These aids consist of both ground-based electronic systems and a space-based radio system. Additional information pertaining to NAVAIDs can be found in Appendix C.

The following NAVAIDS serve the Bismarck Airport:

- Non-Directional Beacon (NDB)
- Glide Slope and Localizer components of Instrument Landing Systems (ILS)
- Very High Frequency Omnidirectional Range Facility (VOR)
- Global Position System (GPS)

1.2.4 Visual Aids

Visual aids are a necessary component to facilitate an airport's flight operations and enhance safety, particularly during periods of inclement weather and darkness, by providing visual guidance to pilots in the air and on the ground. Additional information regarding visual aids can be found in Appendix C. Visual aids at Bismarck Airport include an airport beacon, visual approach slope indicators (VASI), precision approach path indicators (PAPI), runway end identifier lights (REIL), approach lighting systems (ALS), and runway edge lights, and runway markings.

1.2.4.1 Airport Beacon

The airport beacon at the Airport consists of an alternating white and green light that identifies the Airport as a civilian land airport. Airport beacons are used to guide pilots to lighted airports and are normally operated from dusk until dawn. However, if the beacon is on during other hours, it typically indicates that the airport is operating under instrument flight rules (IFR).

1.2.4.2 Visual Approach Slope Indicators and Precision Approach Path Indicators

A VASI is installed on Runway 13. VASIs provide pilots with visual guidance information during landing. The VASI systems at the Airport consist of four bars that appear to project red or white light depending on the vertical position of the aircraft in reference to the defined glidepath angle.

PAPIs are installed on Runways 3, 21, and 31. PAPIs are similar to VASIs in that they provide pilots with visual guidance information during landing. However, a PAPI provides additional guidance information and utilizes only one bar. The bar consists of four lights that can be located on either side of the approach runway. The lighting indications still consist of a series of white and/or red lights to indicate the pilot's vertical position.

1.2.4.3 Runway End Identifier Lights

REILs consist of high intensity white strobe lights placed on each side of the runway to enable rapid and positive identification of the runway threshold. REILs are typically installed on runways where an approach lighting system is not available, which holds true for Bismarck Airport as REILs are installed on the ends of Runway 3 and 21.

1.2.4.4 Approach Lighting Systems

A medium-intensity approach lighting system with runway alignment indicator lights (MALSR) is installed on Runway 31. This approach lighting system consists of steady signal lights starting at the landing threshold and extending into the approach area.

A medium-intensity approach lighting system (MALS) is installed on Runway 13. This approach lighting system consists of steady signal lights starting at the landing threshold and extending into the approach area. The system also has runway alignment indicator lights that include a series of sequenced flashing lights installed on the extended centerline of the runway.

1.2.4.5 Runway Edge Lights

Runway edge lights consist of a single row of lights that borders each side of the runway; they can be classified according to three intensity levels. High intensity runway lights (HIRL) are the brightest runway lights available. Medium intensity runway lights (MIRL) and low intensity runway lights (LIRL) are, as their names indicate, lower in intensity. As previously identified, Runway 3/21 and Runway 13/31 have HIRLs installed.

1.2.4.6 Runway Markings

Runway marking requirements are dependent on the available approach procedure to a runway. Runway 13/31 has precision instrument markings. Runway 3/21 also has precision instrument markings, although the runway does not currently have a precision instrument approach. This is an acceptable practice supported by the FAA.

1.2.5 Aeronautical Environment

Bismarck Airport operates within the aeronautical environment associated with the local, regional, and national system of airports. The aeronautical environment includes the surrounding airspace and the type of aeronautical activity that takes place within the airspace, including arrival and departure procedures.

1.2.5.1 National Airspace Environment

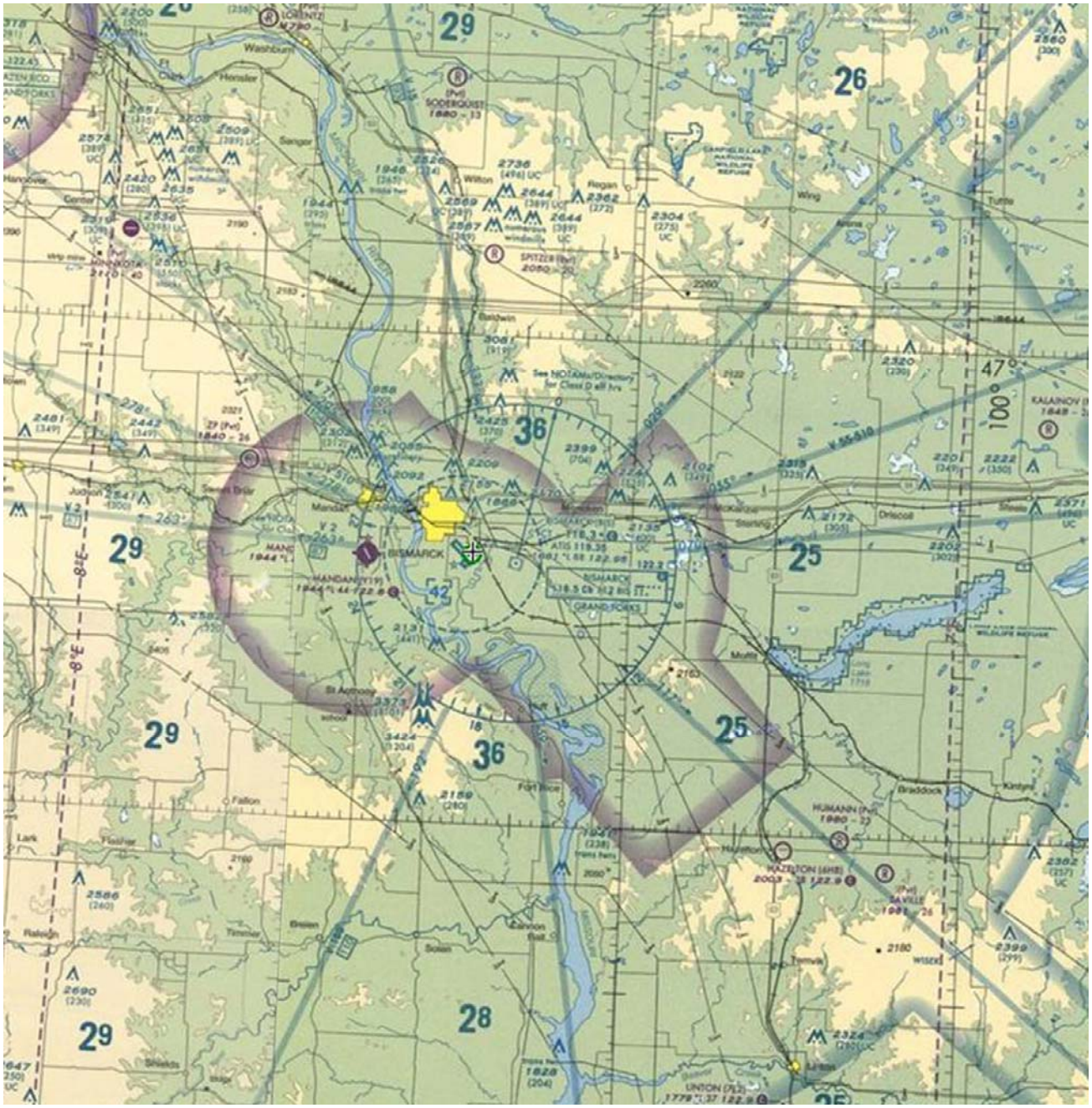
The national airspace system consists of various classifications of airspace that are regulated by the FAA. Airspace classification is necessary to ensure the safety of all aircraft utilizing the facilities. The primary function of airspace classification is to separate air traffic.

Pilots flying in controlled airspace are subject to air traffic control (ATC) requirements, and must follow either IFR or visual flight rules (VFR) regulations. These regulations, which include combinations of operating rules, aircraft equipment, and pilot certification, vary depending on the class of airspace and are described in Federal Aviation Regulation (FAR) Part 71, *Designations of Class A, Class B, Class C, Class D, and Class E Airspace Areas, Air Traffic Service Routes, and Reporting Points*, and FAR Part 91, *General Operating and Flight Rules*. Each of the classes of airspace can be classified as controlled, uncontrolled, special use, or other airspace. A detailed description is provided in Appendix D.

1.2.5.2 Airport Airspace Environment

Airspace associated with Bismarck Airport is depicted on the Twin Cities Sectional Aeronautical Chart, which is used for the purposes of VFR navigation. The portion of the Twin Cities Sectional that includes Bismarck Airport is shown in Exhibit 1-7.

Exhibit 1-7
TWIN CITIES SECTIONAL


29
26
36
25
28
BISMARCK
MANDAN
Washburn
Sanger
Wilton
Regan
Baldwin
Driscoll
Braddock
Fallon
Lark
Raleigh
Solen
Fort Rice
Mobridge
Wing
Tuttle
Hazelton
Haynes
Lehr
Tappen
Timmer
Shields
Mapes
Fisher
Mandan
Sterling
Moffit
Kintyre
Wisek
Tremva
Lindenborg
Zeeland
Ashley
Gettysburg
Hoskins
Hannover
Gardner
Judson
Swede Briar
Menoken
Hensler
Dunn
Sibley
Lorentz
Sodergquist
Spitzer
Humann
Kazeton
Union
Kalanov
Campbell Lake National Wildlife Refuge
Lake Oahe
Missouri River
Cannonball River
Heart River
Square Butte Creek
Apple Creek
Sweet Briar Creek
Big Muddy Creek
Knife River
Beaver Creek
Cedar Creek
Spring Creek
Big Coal Creek
Big Coal Creek
Big Knife Creek
Big Knife Creek
Big Knife

While direct communications are not required to operate within Class E airspace under VFR, aircraft desiring to operate under IFR must contact the area air traffic control facility for clearance information. Class D airspace is depicted on a Sectional Aeronautical Chart with a blue dashed line, while Class E airspace beginning at 700 feet above MSL has a magenta band.

Victor airways are primary routes of aircraft navigation. The aeronautical environment in the immediate vicinity of the Airport includes 10 victor airways. Victor airways are low-level Class E airspace that are eight nautical miles wide, beginning at 1,200 feet AGL.

1.2.5.3 Instrument Approaches

IFR procedures into terminal areas typically consist of one or a combination of instrument procedures. Instrument procedures associated with an airport can include standard terminal arrivals (STAR), standard instrument departures (SID), or instrument approach procedures.

The instrument approach procedures are classified as visual, non-precision, or precision approaches. Visual approaches require that sight contact be maintained at all times with the runway facilities and other aircraft near the airport. Often times these approaches are unmonitored and demand pilot proficiency in “see-and-avoid” procedures. Non-precision and precision instrument approaches are controlled approaches and are monitored by the local air traffic jurisdiction. Non-precision approaches differ from precision approaches in that they only provide horizontal guidance information, while precision instrument approaches provide both horizontal and vertical guidance information. With the addition of vertical guidance information, precision approaches enable aircraft operations in lower visibility and cloud heights.

The Airport is served by published instrument approaches, departure, and arrival procedures. These instrument procedures are identified in Table 1-5.

Table 1-5
PUBLISHED INSTRUMENT PROCEDURES

Runway	Procedure Type
3	GPS, LPV, LNAV/VNAV, VOR-A
21	GPS, LNAV/VNAV, VOR-A
13	ILS, VOR-A
31	ILS, GPS, LPV, LNAV/VNAV, VOR-A

Source: US Terminal Procedures

1.2.5.4 National Air Traffic Control System

The FAA is responsible for providing a safe, secure, and efficient national aviation system. To fulfill this responsibility, the Air Traffic Services Division of the FAA oversees the control and supervision of activity within the National Airspace System. The Air Traffic Services responsibilities include assurance of aircraft separation, air traffic management, dissemination of aviation information, management and maintenance of airways and NAVAID facilities, approach to landing procedures, and aircraft search and rescue.

Control within the National Airspace System is maintained by incorporating a network of air traffic control facilities, which include flight service stations (FSS), air traffic control towers (ATCT), terminal radar approach control (TRACON), and air route traffic control centers. An ATCT and

TRACON are primarily involved with the coordination of air traffic operations within a terminal environment. TRACON facilities coordinate air traffic in the approach and departure segments of flight. Air route traffic control centers (ARTCC) coordinate air traffic operations within the enroute segment. Additional information about the National Air Traffic Control System is located in Appendix E.

1.2.5.5 Air Traffic Control

Bismarck has an ATCT and a terminal radar-approach control (TRACON). These two facilities, when located together in the same cab, are commonly referred to as TRACAB. Airport traffic in the vicinity of the Airport is controlled in a joint effort between Bismarck TRACON and Grand Forks ARTCC.

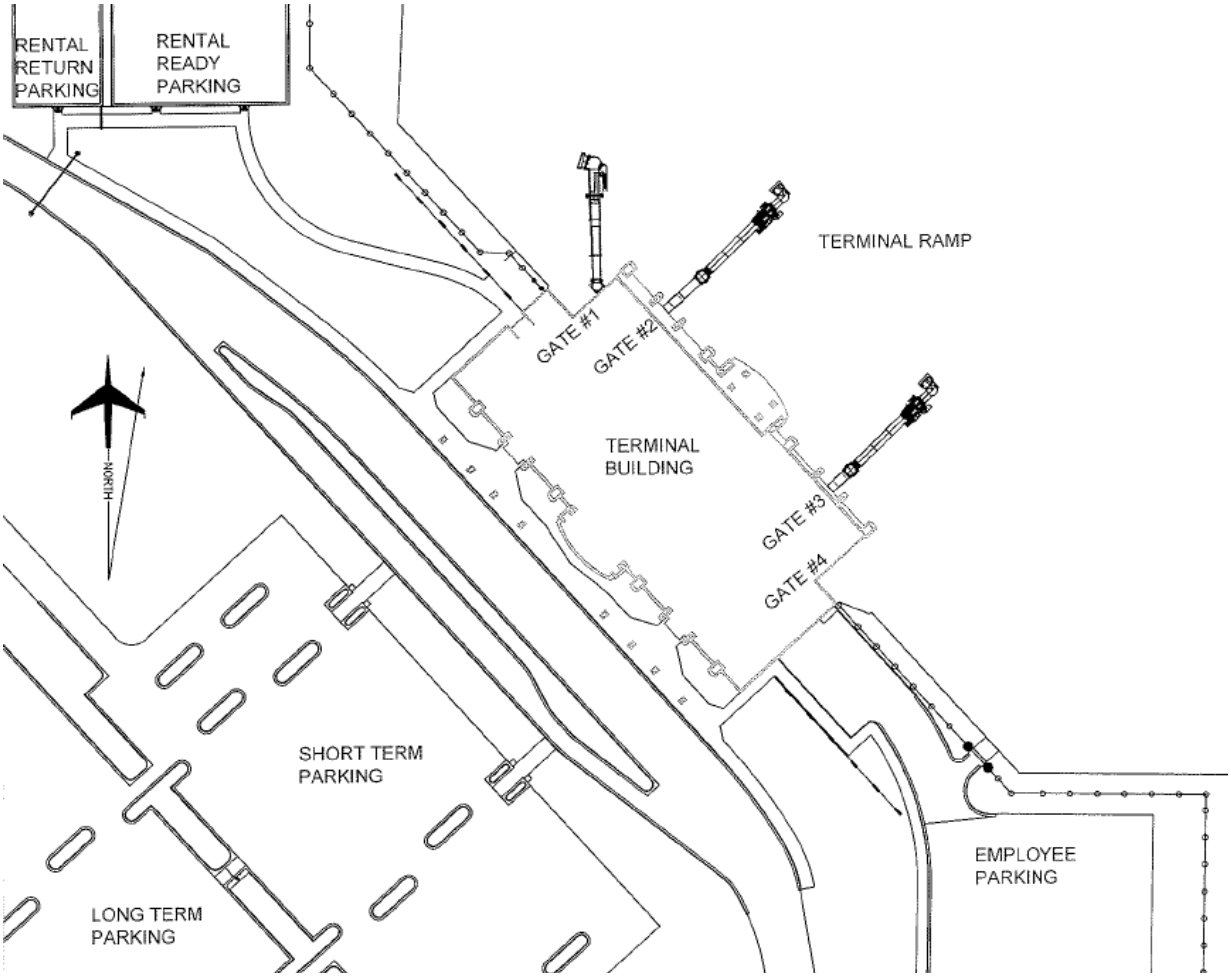
The Airport's ATCT and TRACON are in operation 18 hours a day, from 6 AM to 12 AM, seven days a week. During that time, the ATCT maintains all air to ground communications and visual signaling within five nautical miles of the Airport. Additionally, ATCT staff is responsible for directing ground movement of all aircraft and vehicles on the runway and taxiway system.

Control of enroute traffic in the airspace surrounding the Airport and above 8,000 feet is the responsibility of Grand Forks ARTCC. The primary responsibility of an ARTCC is to provide air traffic service to aircraft operating under IFR on flight plans within controlled airspace, including airways and jet routes, and principally during the enroute phase of flight.

1.3 PASSENGER FACILITIES

The passenger facilities consist of the passenger terminal building, terminal gates, and terminal curbfront. These areas are specifically designed to serve passengers utilizing the commercial airline services at Bismarck Airport. Though the vehicle parking facilities provided at the Airport are also designed to serve commercial passengers, they are discussed in Section 1.7, Surface Access. The passenger facilities are identified in Exhibit 1-8.

Exhibit 1-8
PASSENGER FACILITIES



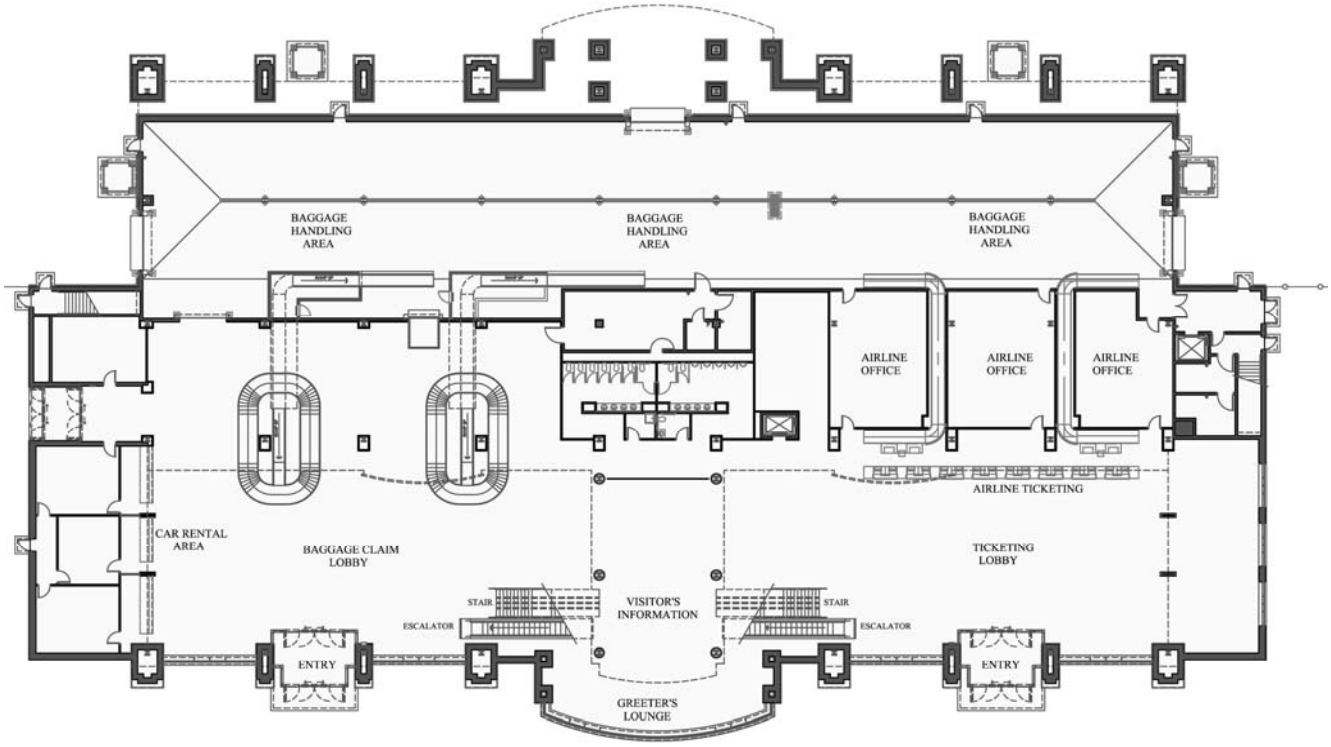
1.3.1 Passenger Terminal Building

The passenger terminal building, opened in May 2005, is located in the northwestern part of the airfield. It is north of United Tribes Technical College, on the east side of University Drive, southwest of the primary runway and parallel taxiway.

1.3.1.1 First Floor

The first floor of the terminal building consists of airline ticketing counters, the North Dakota Aviation Hall of Fame, passenger baggage claim, baggage handling, and rental car counters. These facilities are shown in Exhibit 1-9.

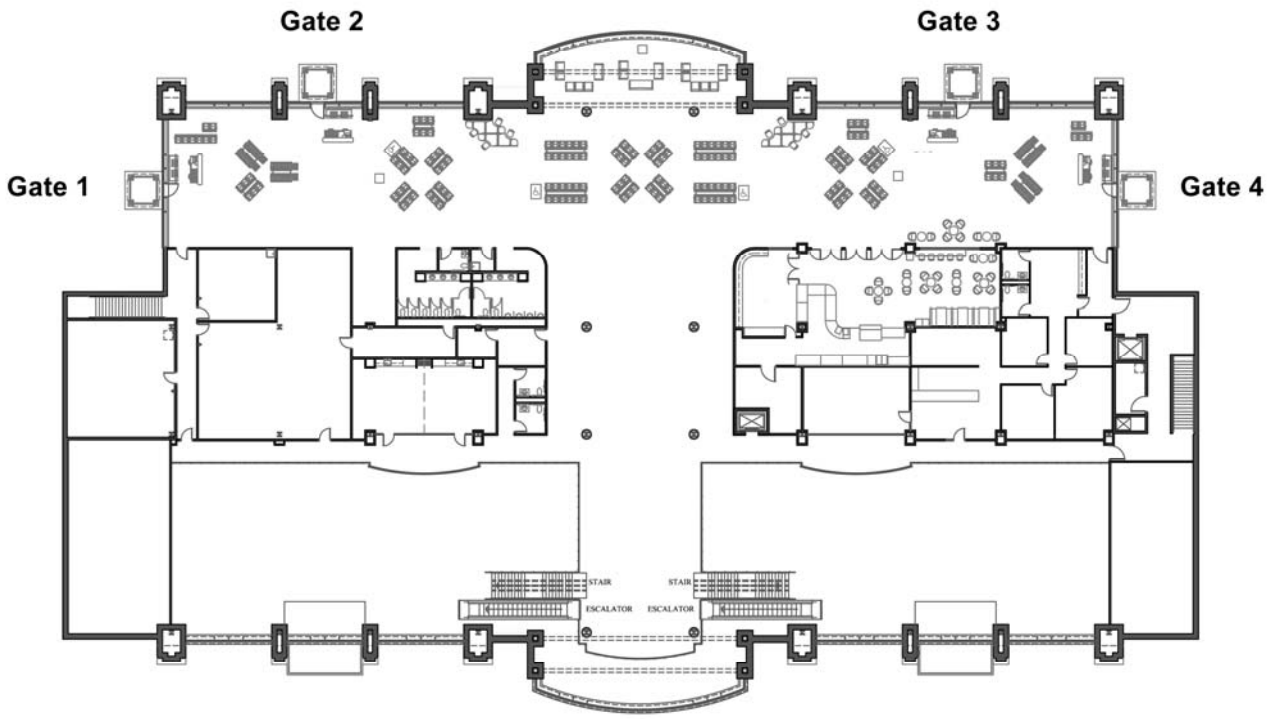
Exhibit 1-9
PASSENGER TERMINAL BUILDING, FIRST FLOOR



1.3.1.2 Second Floor

The second floor of the terminal building primarily consists of two areas, a public area and the sterile area. The public area includes the airport administration offices, conference rooms and the waiting/reception area. The sterile area includes the gate/passenger loading area and concessions. Separating the two areas is the security checkpoint. Each of these facilities is indicated in Exhibit 1-10.

Exhibit 1-10
PASSENGER TERMINAL BUILDING, SECOND FLOOR



1.3.2 Passenger Terminal Gates

There are four passenger loading gates at the Bismarck Airport as depicted in Exhibit 1-11. Three of these gates are currently in use. Gate 1 is used for occasional wide-bodied aircraft. United Express and Allegiant Air use Gate 2. Northwest Airlines uses Gate 3. Gate 4 is presently not used.

1.3.3 Terminal Curbfront

The terminal curbfront roadway at Bismarck Airport is predominately used by automobiles and is configured as a multi-lane, single level roadway providing one-way travel. It incorporates both an inner and outer roadway loop.

The inner roadway loop is located immediately west of the terminal, and contains four one-way 16 foot-wide lanes. Within the inner roadway loop, the two eastern lanes on the terminal side is dedicated as a parking lane to accommodate passenger loading and unloading. The two westernmost lanes are used as through lanes. The inner terminal curbfront is approximately 320 feet in length, with an effective curb length of 278 feet. The length of the inner terminal curbfront associated with enplaning and deplaning activities is estimated below:

- Enplaning 139 feet
- Deplaning 139 feet
- Crosswalk 42 feet
- Total Length 320 feet

The outer roadway loop has two 12 foot-wide lanes. The east lane is predominately used by buses, shuttles, and taxis, as well as itinerant vehicles making deliveries to the Airport. The west lane is primarily used as a through lane. The outer terminal curbfront has a total length of 260 feet, with an effective curb length of 300 feet.

1.4 GENERAL AVIATION FACILITIES

Bismarck Airport is a full service airport providing facilities for the general aviation sector as well as the commercial passenger sector. Bismarck Airport's general aviation area is located on the northwest and north sides of the airfield. The general aviation area encompasses approximately 26 acres west of Runway 13 and 8.5 acres east of Runway 13. Airside operations include two fixed base operators (FBOs). In addition, the following services are provided: corporate flight operators, charter service, aircraft maintenance, air ambulance, flight instruction, hangar storage, tie-downs, aircraft preheat, GPU start, deicing, oxygen, weather computer, conference room, crew car, and catering.

The Airport's general aviation areas consist of airside and landside facilities that include hangars, apron parking, fueling, and ancillary facilities. General Aviation related buildings shown in Exhibit 1-11.

Exhibit 1-11
GENERAL AVIATION FACILITIES

1.4.1 Fixed Base Operators

A FBO is usually a private enterprise that leases land from an airport sponsor on which to provide services to based and itinerant aircraft. The extent of the services provided varies by airport and individual FBOs and frequently include aircraft fueling, major and minor maintenance and repair, aircraft rental and/or charter services, flight instruction, pilot lounge, flight planning facilities, aircraft tie-down, and/or hangar storage.

1.4.2 Hangars

There are 10 t-hangars and 10 conventional hangars at the Airport. Approximately 90 percent of the t-hangar and conventional hangar space are leased. The hangar locations are depicted in Exhibit 1-12.

Exhibit 1-12
HANGAR FACILITIES

1.4.3 Aircraft Aprons

General aviation aprons provide area for based aircraft storage, itinerant aircraft storage, and FBO operations. Aprons dedicated to general aviation operations are located in the northwest part of the airport. The two aprons are depicted in Exhibit 1-13; together they comprise 319,250 square yards.

Exhibit 1-13
APRON FACILITIES

1.5 NORTH DAKOTA ARMY NATIONAL GUARD, ARMY AVIATION SUPPORT FACILITY

The 112th Aviation Security and Support Battalion of the North Dakota Army National Guard's Aviation Support Facility (AASF) are stationed at the south end of Bismarck Airport. The AASF performs air movement, aerial sustainment, search and rescue, command and control, reconnaissance/observation in support of Homeland Security/Defense, counter-drug, and other operations as approved by the Secretary of Defense and the Governor of North Dakota. The AASF

is comprised of Detachment 2, 285th Aviation Company, and Detachment 2, 832d Aviation Medical Company (air ambulance).

The AASF apron is located approximately 750 feet southwest of the end of Runway 31. The AASF complex contains seven buildings, containing approximately 11,700 square yards. The AASF apron is approximately 24,440 square yards. Their fuel farm is located adjacent to the southwestern end of the apron, and is approximately 330 square yards.

1.6 AVIATION SUPPORT FACILITIES

The support facilities at an airport encompass a broad set of functions that exist to ensure the safe and efficient operation of the airport. Support facilities at Bismarck Airport include:

- Rental cars
- Aircraft rescue and fire fighting (ARFF)
- Airport maintenance
- Cargo
- Airport fuels
- ATCT
- Utilities
- Fencing

Exhibit 1-14 provides the locations of all the above listed support facilities, except for the utilities and the fencing.

Exhibit 1-14
SUPPORT FACILITIES

1.6.1 Rental Cars

There are three rental car agencies, all of which are located on airport. Their counters are located at the northwestern end of the commercial terminal, near baggage claim. Rental car ready and return lots for their vehicles are located northwest of the terminal building, as indicated in Exhibit 1-14.

1.6.2 Aircraft Rescue and Fire Fighting

Airports that serve scheduled and unscheduled air carrier flights are required to provide aircraft rescue and fire firefighting (ARFF) facilities and equipment. The ARFF crew conducts fire fighting operations and fire prevention services. More specifically, the ARFF provides emergency assistance; inspection of fuel farms, fuel trucks, and commercial sites; guidance regarding compliance of FAA standards on safety, equipment, and training; and is the medical first responder for an aircraft accident or incident, as well as all medical emergencies at the Airport.

The ARFF facility at Bismarck Airport is located near midfield, approximately 600 feet southwest of Taxiway Exit C4. The 6,400 square foot building contains living quarters, offices, and ARFF vehicle service bays. The living quarters include sleeping quarters, dining area, bathroom facilities, and recreation area. The garage has enough space for parking three pumper trucks and personnel vehicles.

The air carrier airport ARFF facilities are assigned an index group based on the length of the air carrier aircraft that use the airport regularly. The FAR Part 139 index determination for an airport is calculated based on the largest air carrier aircraft in passenger service that conducts an average of five or more daily operations. A listing of the index determinations is provided in Table 1-6.

Table 1-6
FAR PART 139 INDEX DETERMINATIONS

Airport Index	Number of Vehicles	Aircraft Length	Scheduled Departures	Agent and Water Foam Requirements
A	1	< 90 ft	1 or more	500 lbs DC/HALON 1211 or 450 lbs
B	1	≥ 90 ft and < 126 ft	5 or more	Index A and 1,500 gal water
C	2	≥ 126 ft and < 159 ft	5 or more	Index A and 3,000 gal water
D	3	≥ 159 ft and < 200 ft	5 or more	Index A and 4,000 gal water
E	3	≥ 200 ft	5 or more	Index A and 6,000 gal water

Source: FAR Part 139.35 - Aircraft Rescue and Firefighting: Index Determination

The Bismarck Airport ARFF facility is currently required to maintain vehicles, chemicals, and response items in accordance with Index Group B. Response vehicles operated by the Airport include two Oshkosh pumper trucks. One is a 1982 vintage, 1,500-gallon pumper. The other is a 1991, 3,000 gallon truck.

1.6.3 Airport Maintenance

Bismarck Airport owns and operates a variety of maintenance equipment used for snow removal, ground maintenance, pavement and facilities maintenance, and general repairs. There is one airport maintenance facility on the Airport. It is located on the west side of the Airport, south of the passenger terminal. The maintenance buildings provide approximately 17,850 square feet of storage and vehicle maintenance space. This building includes only one vehicle service bay, offices, and storage bays.

Equipment stored in the maintenance building is used for snow removal and airfield maintenance. Snow removal equipment includes six runway snowplows, two runway brooms, one runway sander, one flatbed with deicer tank, two snow blowers, one one-ton dodge truck with sander, and one payloader. For cutting grass, the airport has two tractors with 15-foot rotary mowers, and three front deck mowers. Other maintenance equipment includes one aircraft deicer truck, one 66-foot telescoping manlift, two forklifts, one skidsteer loader with six attachments, and six work vehicles.

1.6.4 Cargo

Since the Airport does not have a building dedicated for cargo operations, cargo is moved to and from off-airport cargo facilities via truck directly to aircraft on the general aviation apron. Similarly, cargo carried by commercial passenger carriers is transferred to and from off-airport facilities.

1.6.5 Airport Fuels

Aircraft at the Airport may purchase either 100 low lead (100LL) or jet fuel (Jet A). General aviation users typically require 100LL for piston aircraft and Jet A for turbine aircraft. Scheduled commercial service aircraft typically require Jet A fuel. A summary of total fuel (100LL and Jet A) provided to users by year is detailed in Table 1-7.

Table 1-7
FUEL FLOW

Year	Total
2000	2,875,287
2001	2,316,003
2002	2,331,427
2003	2,316,231
2004	2,902,029
2005	2,725,467

*Units are in gallons.

1.6.5.1 Aircraft Fueling

All of the general aviation and commercial aircraft fueling at Bismarck Airport is provided by the FBOs through truck service. The Airport does not currently provide any self-fueling alternatives.

1.6.5.2 Fuel Storage

Fuel at the Airport is stored in above ground storage tanks. The two fuel storage areas, also called fuel farms, are located west of Taxiway C and south of the ARFF facility. One fuel farm is owned by the City of Bismarck and the other by Executive Air Taxi. The tank locations, storage container style, capacities, types, and conditions are described for each storage owner in Table 1-8.

Table 1-8
FUEL STORAGE INVENTORY

City of Bismarck Fuel Farm				
Tank	**1**	**2**	**3**	**4**
Geographic Location	North	South	East	West
Tank Style	Vertical	Vertical	Horizontal	Horizontal
Capacity (gal)	17,000	17,000	17,000	17,000
Contents	100LL	Jet A	Jet A	Jet A
Condition	Good	Good	Good	Good

Executive Air Taxi Fuel Farm			
Tank	**1**	**2**	**3**
Geographic Location	West	Middle	East
Tank Style	Horizontal	Horizontal	Horizontal
Capacity (gal)	20,000	20,000	20,000
Contents	Jet A	Jet A	100LL
Condition	Good	Good	Good

1.6.6 Air Traffic Control Tower

The ATCT is located west of Runway 13/31, approximately 300 feet southwest of the ARFF facilities. This facility was built in the early 1970's. It is 78 feet high, and serves as a combination terminal radar approach control (TRACON) and ATCT, commonly referred to as a TRACAB. This facility is operated by the FAA and staffed by Federal employees. The ATCT is operational from 6AM to 12PM every day. Ground access to the ATCT is via the west maintenance road.

1.6.7 Utilities

The availability of water, sanitary sewer, gas, electric and storm water drainage to an airport must be considered while evaluating the existing utility conditions. The public water distribution and sanitary sewage system are significant governmental responsibilities and capital investments in a new or expanding area. Natural gas and electricity services are normally provided by the private sector. The following sections identify the providers of the various utility services, utility capacities, and locations.

1.6.7.1 Water and Sanitary Sewer

Potable water is provided by the City of Bismarck by a 12-inch main along the west side of the Airport. Sanitary sewer service is provided by an 8-inch main along the west side of the Airport.

1.6.7.2 Gas

Natural gas is provided by Montana Dakota Utilities via a gas main along the west side of the Airport.

1.6.7.3 Electric

Electric power is provided by Montana Dakota Utilities via a buried cable along the west side of the Airport.

1.6.7.4 Storm Water Drainage

Storm water drainage is conveyed off the Airport via pipe and open ditch. Most of the Airport drains to the southeast, to Apple Creek. However, the west portion of the Airport drains west to Bismarck's 12th Street drainage facilities.

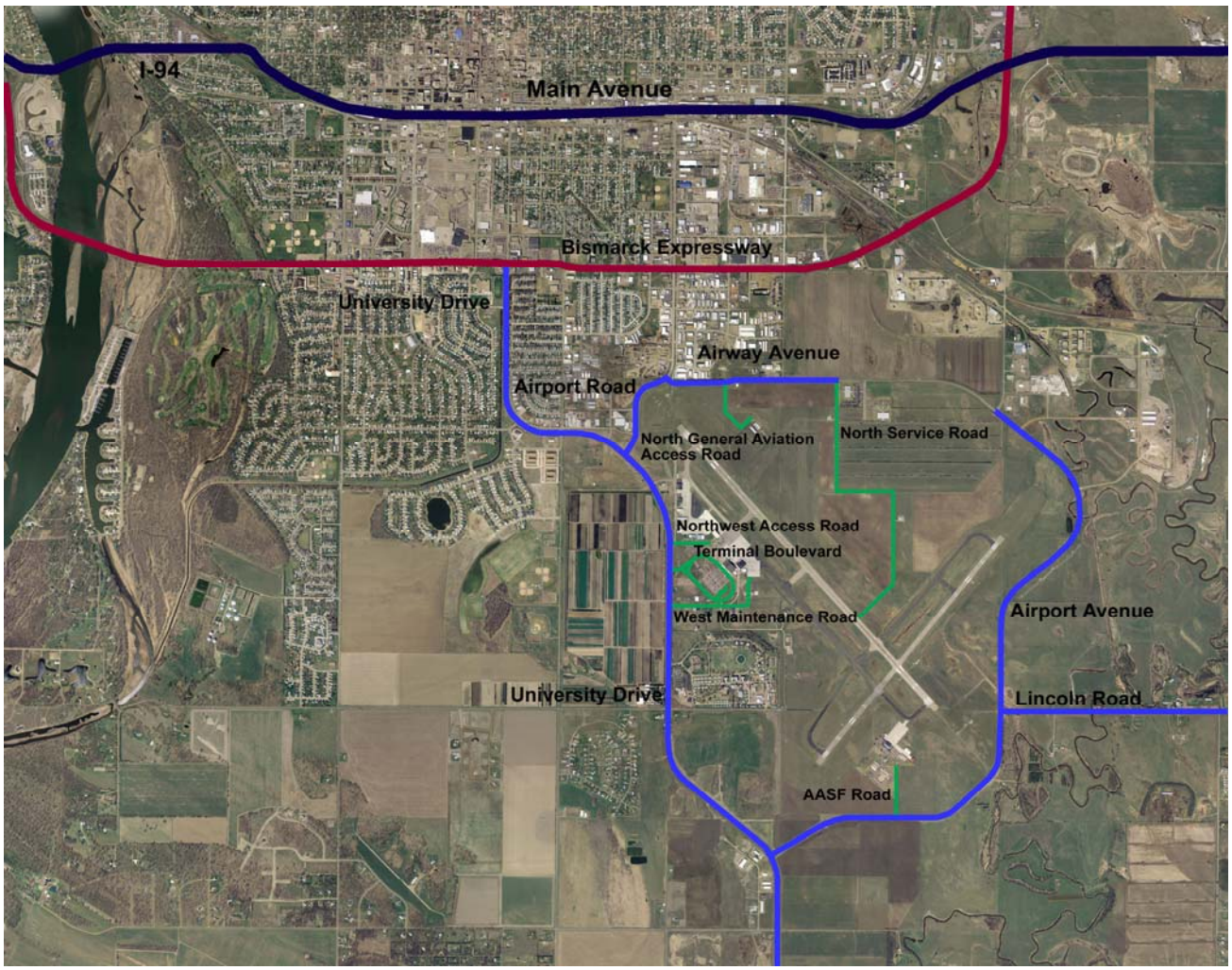
1.6.8 Fencing

The majority of fencing is eight-foot high chain link fence, which is installed along the perimeter of Airport property. Near the terminal however, the chain link fence is 10 feet high. Perimeter fencing provides a necessary security and wildlife control measure for the Airport.

1.7 AIRPORT ACCESS

Convenient, simple, and efficient access to the commercial passenger terminal and other airport facilities is an integral part of the airport system. Airport access is comprised of three stages: off-airport access roads, on-airport circulation, and vehicle parking. An aerial map of the surface access roadways in the immediate vicinity of Bismarck Airport is provided in Exhibit 1-15.

Exhibit 1-15
SURFACE ACCESS ROADWAYS



1.7.1 Off-Airport Access Roads

Bismarck Airport primarily provides service to residents of western and central North Dakota. The primary means of travel into the Airport is by personal automobiles, although there is use by a limited number of taxicabs, rental cars, and hotel buses. The majority of vehicles accessing the Airport travel along U.S. Interstate 94 (I-94), Bismarck Expressway (Highway 810), University Drive, and/or Airway Avenue.

1.7.1.1 U.S. Interstate 94

I-94 is a multi-lane roadway. It is the only major east-west corridor through the northern states. An interchange at I-94 and State Street provides indirect access to the Airport, via University Drive.

1.7.1.2 Bismarck Expressway

Bismarck Expressway is a four-lane major collector that loops around the easterly and southerly sides of Bismarck. It is accessible via an I-94 interchange that is located on the eastern side of Bismarck. Bismarck Expressway provides indirect access to the Airport via Airport Road.

1.7.1.3 Lincoln Road

Lincoln Road is a two-lane arterial that travels in an east-west direction and approaches the southern side of Airport property, near the end of Runway 31. Lincoln Road provides indirect access to the Airport via Airway Avenue.

1.7.1.4 Airway Avenue

Airway Avenue is a two-lane arterial that traverses the Airport property on the east, south, and a portion of the north sides, the roadway provides indirect access to the Airport via University Drive and Lincoln Road.

1.7.1.5 University Drive

University Drive is a four-lane arterial located due west of the terminal, and provides direct access to the Airport via Terminal Boulevard.

1.7.1.6 Airport Road

Airport Road is a two-lane arterial that travels in a north-south direction along the northwestern most portion of Airport property. It provides indirect access to the Airport via University Drive.

1.7.2 On-Airport Access Roads

On-airport access roads are further sub-divided into two categories: public and restricted access roads. Public roads are, as the name indicates, available for public use and provide access to general aviation, cargo, military and commercial service facilities. Restricted access roads are located within airport property and generally provide access to on-airport facilities, such as navigational aids, perimeter fencing, and aprons that cannot be accessed by the general public.

1.7.2.1 Public Roads

Public roads used for access to on-airport facilities include Terminal Boulevard, AASF Road, the general aviation road to the Bravo hangars on the north side of the Airport, and the maintenance road on the west side of the Airport. Note that the on-airport public roads are not officially named and the City has started the process to determine officially roadway names.

TERMINAL BOULEVARD
Access to the passenger terminal, parking lots, and general aviation facilities is provided via Terminal Boulevard. It is located on the east side of University Drive; it is approximately one-half mile south of the intersection of Airport Road and University Drive. At the intersection of University

Drive and Terminal Boulevard, Terminal Boulevard is two lanes wide, allowing east and west bound traffic to enter and exit airport property.

Terminal Boulevard becomes a divided road approximately 100 feet east of the University Drive and Terminal Boulevard intersection. South of that intersection, Terminal Boulevard permits one-way eastbound traffic on a two-lane road. The southern lane is used to access the general airport facilities and then further east, the terminal. The northern lane is used to access the long-term parking lot, and then further east, the short-term parking lot. Both lanes continue southeast to connect to the terminal curbfront, where four additional lanes are provided.

The terminal curbfront at Bismarck Airport consists of six one-way traffic lanes, accommodating south to north travel. The roadway is divided into an inner roadway and outer roadway. The three eastern lanes that comprise the inner roadway are 16 feet wide and accommodate passenger loading and unloading. Of these three lanes, the eastern lane is used for passenger drop-off and pick-up and the western lanes are used for through traffic.

Within the outer roadway, there are two 12 foot-wide lanes. The easternmost lane is predominately used by buses, shuttles, and taxis, as well as itinerant vehicles making deliveries to the Airport. The westernmost lane is used as a through lane.

North of the intersection of University Drive and Terminal Boulevard, Terminal Boulevard accommodates only one-way westbound traffic. This two-lane road is used by vehicles traveling away from the terminal and parking lots. Terminal Boulevard becomes a divided road 400 feet east of its intersection with University Drive. This divided road permits traffic to either travel south to access the one-way lanes traveling east towards the terminal or continue traveling west to exit airport property.

AASF ROAD
AASF Road is a two-lane road that is approximately 1,200 feet long. It is located south of the Army National Guard's facilities and can be accessed via Airway Avenue.

NORTH GENERAL AVIATION ROAD
There is an unnamed two-lane road located approximately one-half mile east of the intersection of Airport Road and University Drive. This road provides access to the general aviation hangars, called the Bravo Hangars, which are located east of the end of Runway 13.

NORTHWEST ACCESS ROAD
There is an unnamed general aviation access road off University Drive on the northwest side of the Airport property that is approximately 600 feet north of Terminal Boulevard. It provides access to Basin Cooperative Services, Simmers Hangar, Executive Air Taxi, North Dakota Aeronautical Commission State Office, and a number of other general aviation facilities.

WEST MAINTENANCE ROAD
There is an unnamed two-lane road off University Drive that is located 800 feet south of the intersection of Terminal Boulevard and University Drive. The main road segment is approximately one-half mile in length and provides access to the FAA facilities, maintenance buildings, ATCT, and the National Weather Service building. At the eastern end of the road, a new roadway segment continues north 800 feet and connects to the south side of the commercial terminal apron.

1.7.2.2 Restricted Access Roads

PERIMETER ACCESS ROAD
Perimeter access roads provide secure access to on-airport facilities for security and maintenance. These roads allow access while avoiding vehicle movement on the aircraft movement area, such as runways and taxiways. Bismarck does not have a complete perimeter road, but does have two road segments.

NORTH SERVICE ROAD
There is a north-south service road on the north side of the Airport property, off Airway Avenue that provides access to the airport surveillance radar (ASR) and the radio transmit receiver (RTR). It is located roughly one mile east of the intersection of Airport Road and University Drive.

WEST SERVICE ROAD
There is an east-west service road along the western airport boundary. It connects University Drive and the fuel farm.

1.7.3 Vehicle Parking

Vehicle parking at the Airport is provided for commercial passengers, rental cars, employees, and users of the general aviation facilities. The vehicle parking available at the passenger terminal is summarized in Table 1-9. The configuration of the vehicle parking facilities is illustrated in Exhibit 1-16.

Table 1-9
VEHICLE PARKING CAPACITIES

Lot Description	Parking Spaces
Public Parking	
Short-Term	193
Long-Term	325
Employee Parking	78
Private Parking	
Rental Car	266
Total Parking Positions	862

Exhibit 1-16
VEHICLE PARKING

1.7.3.1 *Public Parking*

Both short-term and long-term parking is available at Bismarck Airport.

SHORT-TERM PARKING
The short-term parking lot is located directly south of the terminal building, accessed via Terminal Boulevard and has a capacity of 193 spaces. Access to the short-term parking lot is provided in two locations from the roadway circulation loop. The northwest entrance to the short-term parking lot is located on the north side of the roadway circulation loop; it is the first exit past the Commercial Terminal Curbfront.

The southeast entrance to the short-term parking lot is located on the south side of the roadway circulation loop; it is the first exit east of University Drive. Exits from the short-term parking lot are provided via exit lanes through the long-term parking lot. There is a parking lot pay booth located approximately 200 feet east of the roadway circulation loop. Once vehicles exit the pay booth queuing areas, traffic is directed onto the roadway circulation loop.

LONG-TERM PARKING
The long-term parking lot is located immediately southwest of the short-term parking lot. It provides 325 parking spaces. Access to the long-term parking is provided at the same general locations as the short-term parking. The exit from the long-term parking is centrally located within the lot. Once vehicles exit the pay booth queuing areas, traffic is directed onto the roadway circulation loop.

1.7.3.2 *Employee Parking*

The Airport provides 78 designated employee parking spaces in a lot located adjacent to the south side of the terminal building.

1.7.3.3 Rental Car Parking

A ready/return lot shared by the on-airport rental car companies is located immediately adjacent to the west side of the passenger terminal and provides 266 spaces. An entrance to the lot is provided along Terminal Boulevard, approximately 150 feet north of the terminal curbfront.

1.8 REGIONAL SETTING AND LAND USE

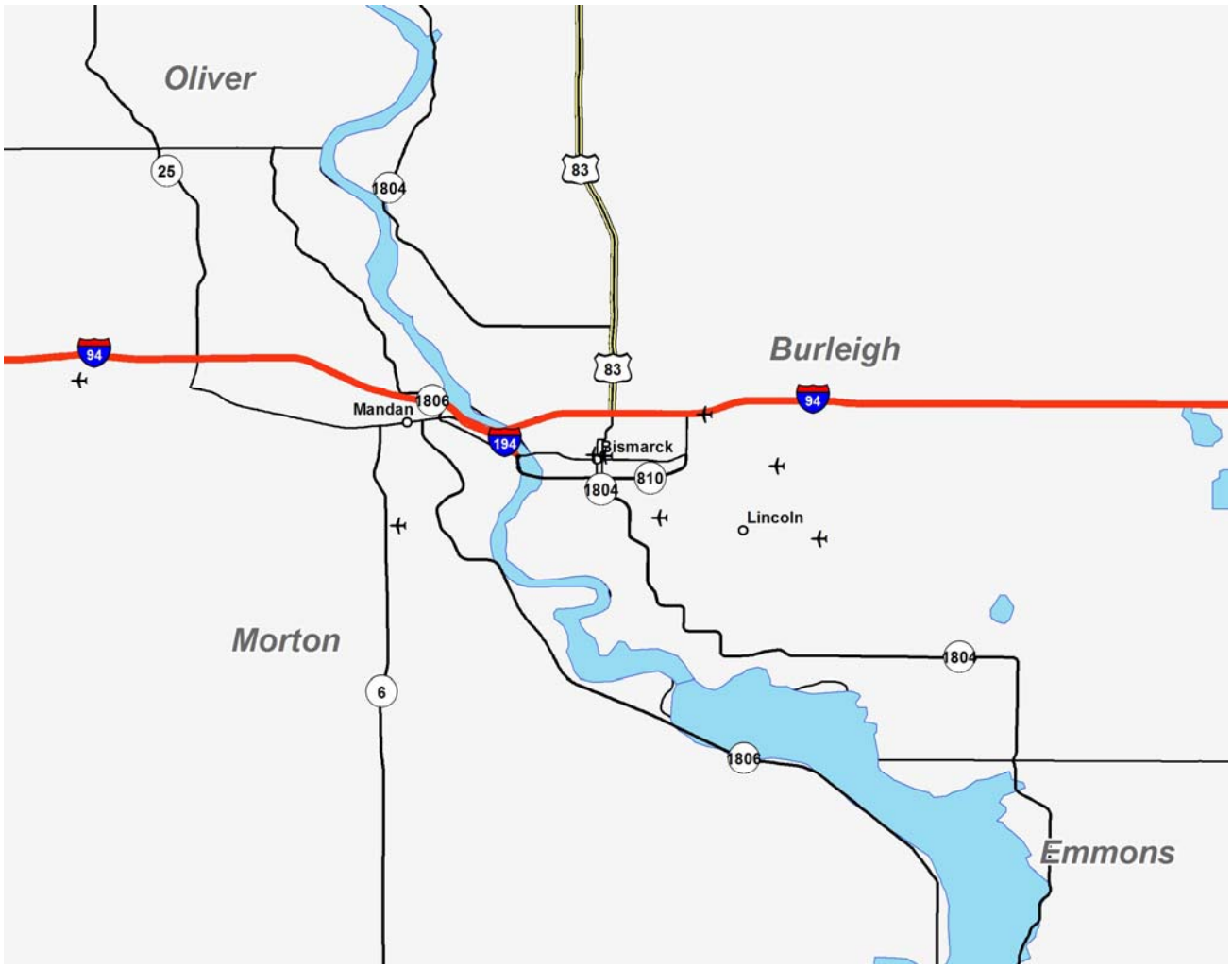
The regional setting and land use discussion includes information about the various communities and land use patterns in the vicinity of the Airport. This includes discussion about how the surrounding communities and their services are impacted by Airport operations, particularly the land use patterns, zoning districts, and transportation facilities. This discussion is affected by the size of the communities, as well as their proximity to one another.

1.8.1 Political Boundaries

Often a region is comprised of a central planning organization that is not affiliated with a single governing agency but perform functions for a region that contains many governmental jurisdictions. Regional planning organizations are usually independent commissions or councils of governments, with only limited authority, and are primarily advisory in nature.

The Bismarck-Mandan Metropolitan Planning Organization (MPO) consists of the cities of Bismarck, Mandan, Lincoln, and portions of Burleigh and Morton Counties. See Exhibit 1-17. The purpose of a MPO is to provide a forum for public officials, citizens, and other interested groups to establish policies and plans for effectively addressing various metropolitan transportation issues. The Bismarck-Mandan MPO has a planning process that supports metropolitan community development and social goals. These plans and programs will lead the development of an integrated, intermodal metropolitan transportation system that facilitates the efficient, economic movement of people and goods. All federally and state-funded transportation projects must be approved by the Bismarck-Mandan MPO to validate the approved planning process and to receive approved federal funds.

Exhibit 1-17
POLITICAL BOUNDARIES



1.8.2 Land Use / Zoning

Land use and zoning near the vicinity of an airport controls the location, type, and intensity of land uses and prevents incompatible land use from locating near the airport.

The City of Bismarck has zoning regulation powers over airport property. Per the City's municipal code, an airport noise overlay district exists for the area around the Airport. The overlay district establishes specific standards to mitigate problems caused by airport noise, encourages the establishment and continuation of particular land uses, and prohibits the development of new noise-sensitive land uses.

Burleigh County has zoning regulation powers for the county, outside of the City of Bismarck's Four-Mile Extraterritorial Boundary.

1.8.3 Transportation

Capital Area Transit (CAT) operates nine bus routes in and around the Bismarck metropolitan area. Though CAT does not service Bismarck Airport, the specialized transit services section called Bis-Man Transit offers door-to-door service throughout Bismarck for the elderly and individuals with disabilities.

1.9 ENVIRONMENTAL SETTING

FAA Order 5050.4B, *Airport Environmental Handbook*, requires the evaluation of airport development projects as they relate to specific environmental impact categories by outlining types of impacts and the thresholds at which the impacts are considered to be significant. For some impact categories, this determination can be made through calculations, measurements, or observations. While other impact categories require the determination be established through correspondence with appropriate federal, state, and/or local agencies. A complete evaluation of the impact categories identified in FAA Order 5050.4B is required during environmental processing in accordance with National Environmental Protection Act.

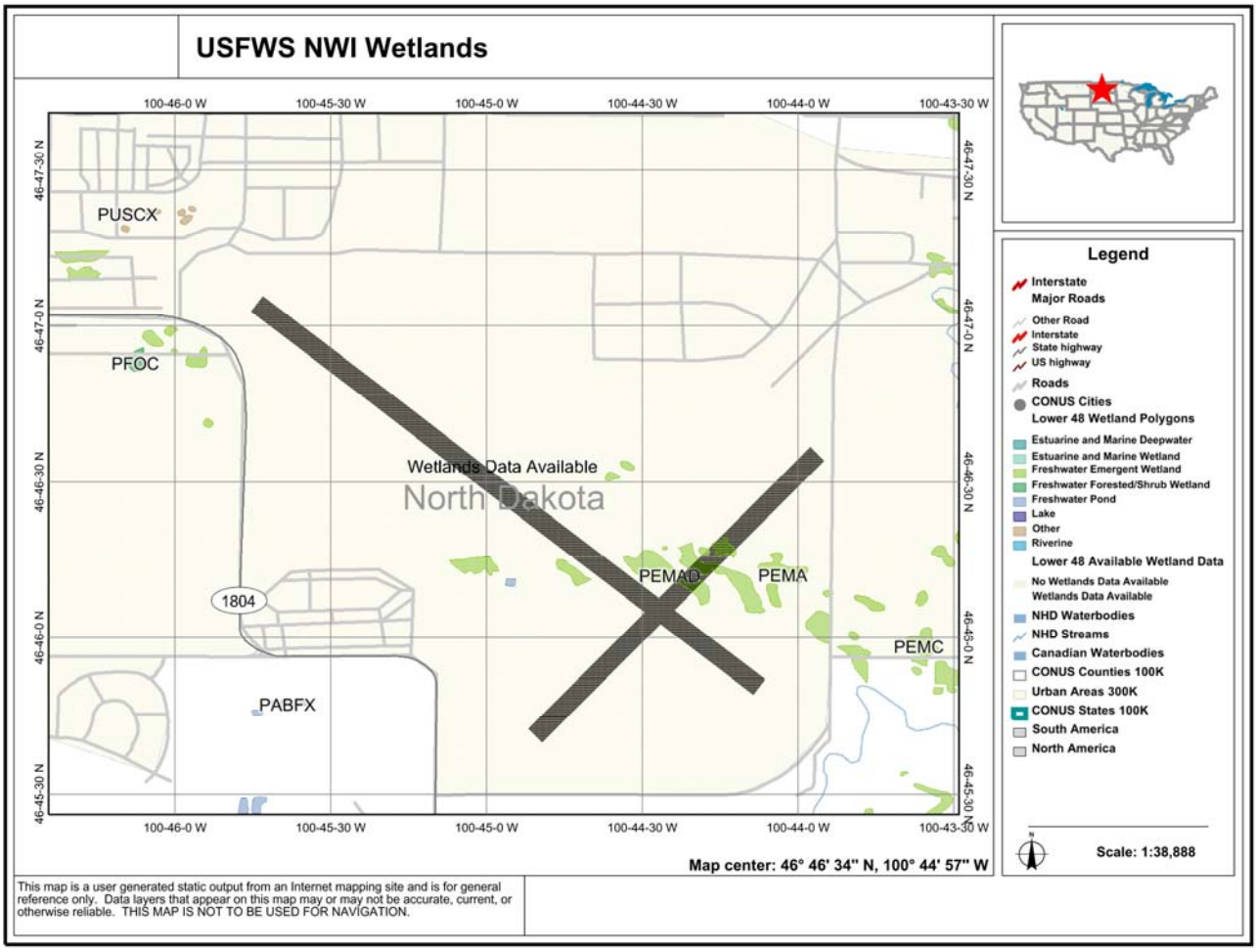
Future development plans at Bismarck Airport should take into careful consideration those environmental issues that are known to exist in the vicinity of the Airport. Early identification of these environmental factors may help to avoid impeding development plans in the future. The following sections present four impact categories that may likely have development implications at Bismarck.

1.9.1 Wetlands

An important environmental factor that should not be overlooked during the development of alternatives is the presence of wetlands in the vicinity of the Airport. The U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) has mapped several wetlands located on Airport property. This NWI map is provided in Exhibit 1-18.

These areas of concern include areas located immediately west and east of the end of Runway 3; immediately east of the end of Runway 31; and east of the end of Runway 21. Future alternatives should factor in the location of these wetlands.

Exhibit 1-18
NATIONAL WETLAND INVENTORY MAP



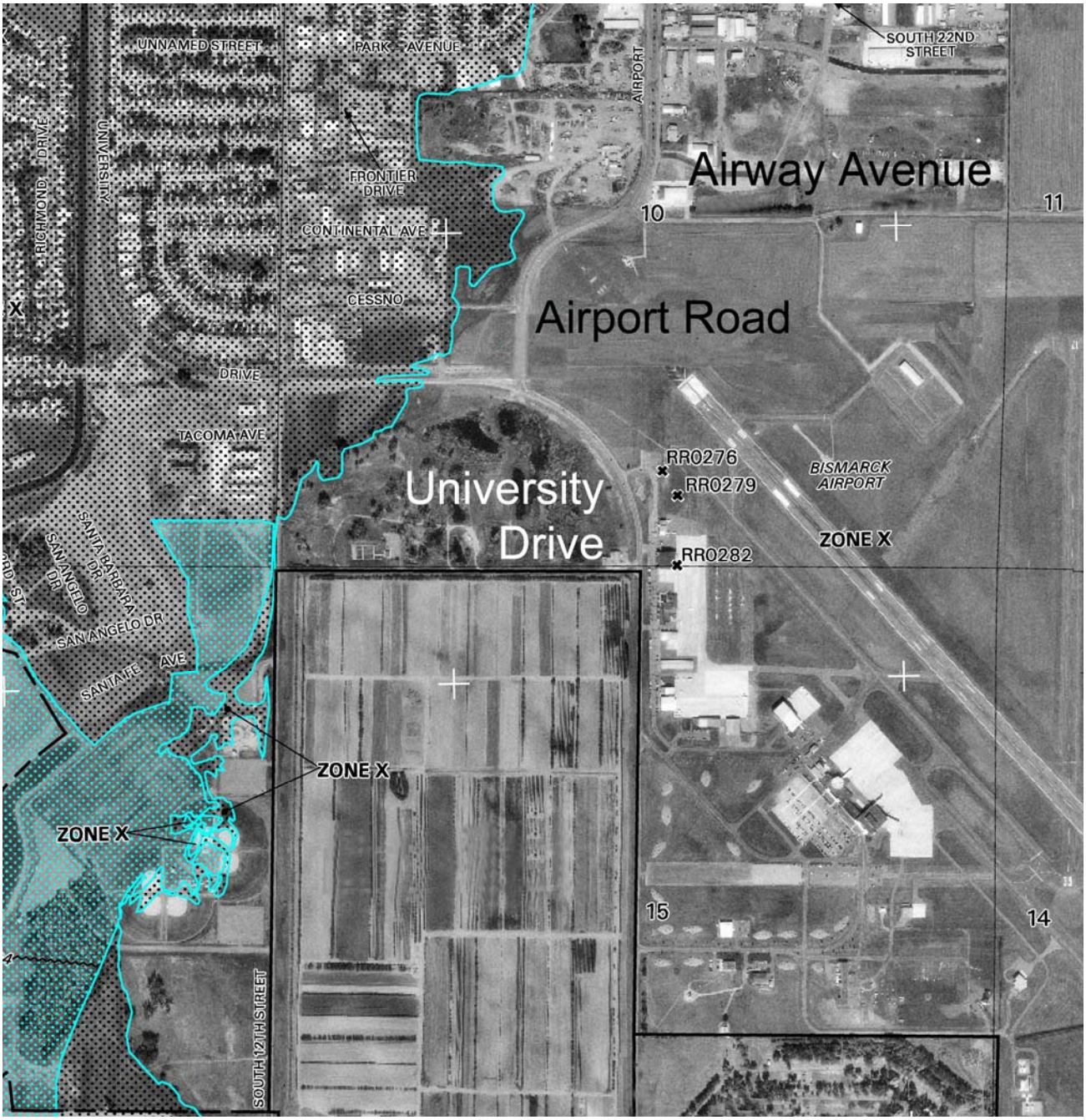
Source: U.S. Fish and Wildlife Service, National Wetlands Inventory

1.9.2 Floodplains

The Federal Emergency Management Agency (FEMA) has mapped the floodplains located near the Airport. The area west of the Airport is depicted on Floodplain Map 38015C0795C and the area east is on Floodplain Map 38015C0815C, they are depicted in Exhibit 1-19 and Exhibit 1-20 , respectively.

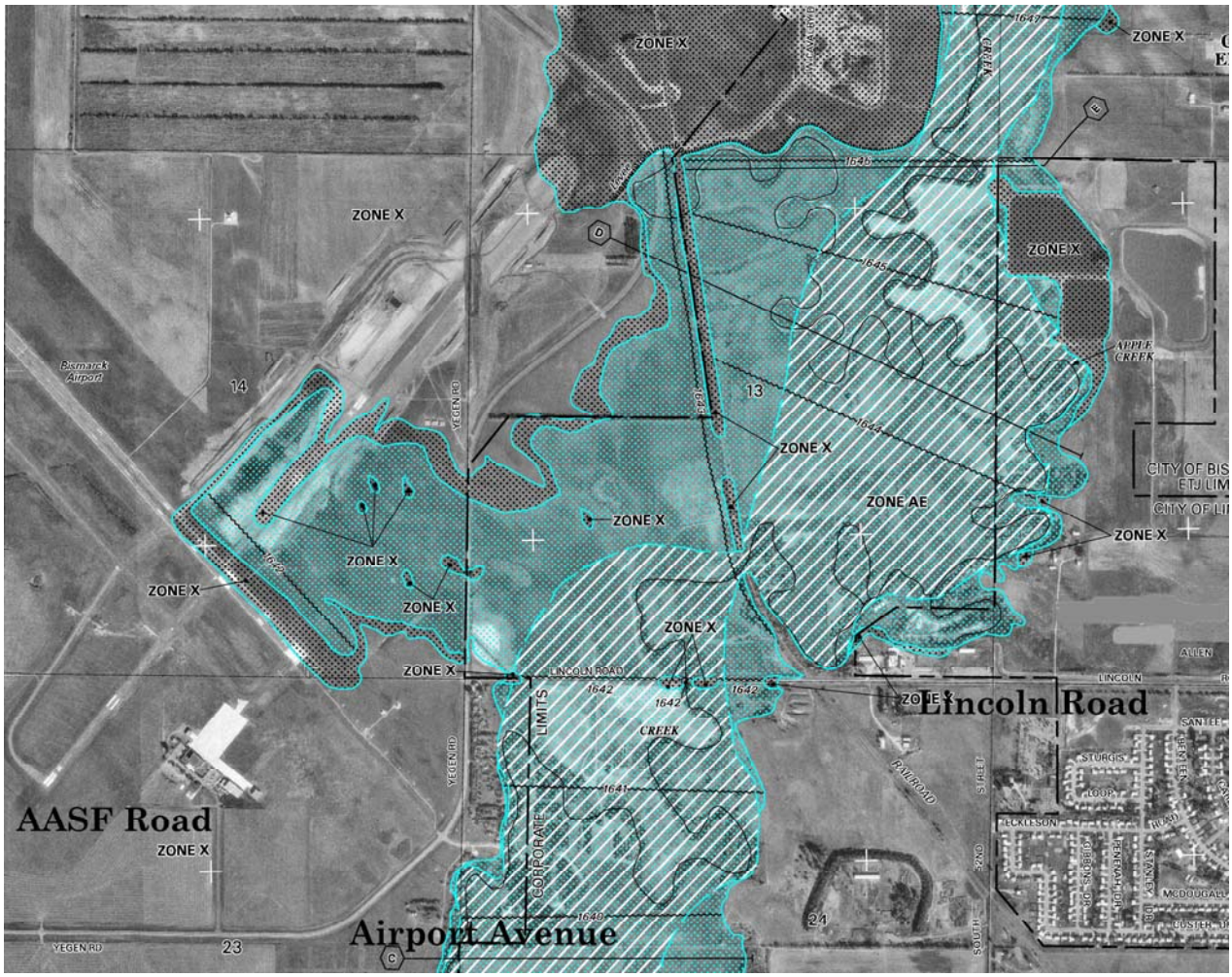
The floodplains contained on Map 38015C0795C and Map 38015C0815C depict the areas surrounding the Airport property. The floodplain areas categorized as Zone X are shaded in light gray. Zone X areas contain: 500-year floodplains; areas of 100-year floodplains that have average depths of less than one foot or with drainage areas less than one square mile; and areas protected by levees from a 100-year flood. Areas contained within Zone X that do not have shading, fall outside the boundaries of the 500-year floodplain. The areas with the blue dots are the boundary areas dividing special flood hazard areas of different base flood elevations, flood depths, and/or velocities.

Exhibit 1-19
FLOODPLAIN MAP 38015C0795C



Source: FEMA Floodplain Map 38015C0795C

Exhibit 1-20
FLOODPLAIN MAP 38015C0815C



Source: FEMA Floodplain Map 38015C0815C

Careful consideration should be given to the location of the floodplains in the vicinity of the Airport when determining future development; in addition to, establishing grades of pavements.

1.9.3 Farmlands

There are farmlands located to the west of University Drive, across from the United Tribes Technical College; south of the Airport, due south of AASF Road; and east of Airway Avenue, on either side of Lincoln Road. Further coordination with the North Dakota Department of Agriculture is recommended to determine if the farmlands are considered prime and unique.

1.9.4 Fish, Wildlife, and Plants

The U.S. Fish and Wildlife Service's list of threatened, endangered, proposed, and candidate species has identified six endangered species and three threatened species within North Dakota. These species, their status, and their habitats are listed in Table 1-10.

Table 1-10
NORTH DAKOTA THREATENED AND ENDANGERED SPECIES

Species	Status	Habitat
Mammals		
Whooping Crane	Endangered	Wetlands areas
Eskimo Curlew	Endangered	Prairie grassland areas
Bald Eagle	Threatened	Tops of large trees near rivers, lakes, marshes, or other aquatic areas.
Piping Plover	Threatened	River channels and sandbars
Least Tern	Endangered	Wide unobstructed and unvegetated river channels along lake shorelines.
Gray Wolf	Endangered	Mountainous forested areas with high populations of hoofed animals and low agricultural use and few people
Fish		
Pallid Sturgeon	Endangered	Along the bottom of swift waters of large free-flowing rivers
Insect		
American Burying Beetle	Endangered	Shrub thickets, coastal grasslands, and pastureland
Plants		
Fringed Orchid	Threatened	Moderately moist habitats, wet prairies and meadows

Source: U.S. Fish and Wildlife Service

Since any future activities at Bismarck Airport may impact any one or all of the threatened, endangered, proposed, and candidate species discussed above, careful consideration should be given during the preparation of development alternatives.

1.10 BUSINESS ASPECTS

Responsive airport master planning must examine the fiscal environment under which airport improvements may be undertaken. Key aspects of the fiscal environment are the airport's basic business model, operation revenues and expenses, and sources and uses of capital funds.

1.10.1 Business Operating Model Overview

Since the City of Bismarck owns the Airport and is responsible for management of the Airport, the business model in place at Bismarck relies on operating revenues from airport tenants and users in the form of rentals and fees to cover the operating costs at the Airport. Capital project funding sources are federal and state grants in-aid from the FAA's AIP, passenger facility charges (PFCs), local tax levy revenue, and revenue bonds.

As part of the annual budget process, Airport management determines the amount of expected revenues from the airlines, revenues from other Airport tenants and other miscellaneous sources. These revenues are applied to the projected operating and maintenance (O&M) expenses, debt service for the outstanding bonds and other expenses anticipated for the year. Each year's budget must have sufficient revenues to cover all O&M expenses and debt service for the budget year. If the revenues do not create a surplus, Airport management must revise the budget to make the Airport financially self-sufficient by raising rates fees and charges within the context of the leases with the tenants, reducing O&M expenses or delaying capital projects.

CHAPTER 2
AVIATION DEMAND FORECAST

Aviation demand forecasts at Bismarck Airport are presented in this chapter for the 20-year planning period (2005-2025). Forecasts of aviation demand provide a basis for determining the type, size, and timing of aviation facility development. Consequently, the forecasts influence virtually all phases of the planning process.

Forecasting future activity involves both analytical techniques and subjective considerations. Regardless of the methodology used, assumptions must be made about how internal and external forces might change in the future. Factors that can influence aviation activity levels include regulatory policy on the local and national level, price of aviation fuel, technological innovations, aviation industry trends, and local fluctuations in population and employment. The objective of forecasting is to develop a realistic measure of the potential for these changes so their effect can be estimated in a rational manner and preparations can be made to smoothly and cost-effectively accommodate their impact on airport facilities. The development of forecasts of aviation demand for Bismarck Airport are presented in the following sections of this chapter.

- Historical Activity Review
- Factors Affecting Future Aviation Demand
- Forecast of Annual Enplaned Passengers
- Forecasts of Annual Aircraft Operations
- Forecast of Air Cargo
- Based Aircraft Forecast
- Instrument Approaches
- Design Day/Design Hour Activity Forecasts
- Comparison with Other Forecast Efforts
- Summary of Forecasts

The forecasts provide three planning activity levels (PAL1, PAL2, and PAL3) for five, 10, and 20-year estimates of future aviation activity levels at the Airport. The association of planning activity levels with specific time frames is necessary in order to develop a schedule of improvement needs and assess the ability of the Airport to finance the recommended development plan. It is important, however, to view the projections independent of specific years, and consider the projections to be planning activity levels, which identify trigger points for future airport facilities. If actual growth occurs faster than anticipated, development should be reassessed and accelerated as necessary. Similarly, slower than projected growth may warrant deferment of planned improvements to a later date. Actual activity growth should be frequently compared to projected growth so schedule corrections can be identified and implemented.

2.1 HISTORICAL ACTIVITY REVIEW

This section presents a general overview of commercial service airports followed by a brief review of long-term historical trends in various elements of aviation activity at Bismarck Airport. Elements reviewed included airlines serving the Airport, market services, market share, annual enplaned passengers, and annual aircraft operations.

2.1.1 Regional Commercial Service Airports

Bismarck Airport is classified as a non-hub airport by the Federal Aviation Administration (FAA). The FAA's definition of a hub is not to be confused with the designation of a city/airport used by an airline where flights are concentrated in a hub-and-spoke operating concept. The FAA definitions are important because federal Airport Improvement Program (AIP) funding is dependent, in part, upon hub classification.

The FAA hub classifications are based on the percentage of enplanements at an airport compared to the total number of enplanements in the United States. These percentages are as follows:

- **Large Hub** – Enplanes more than 1.0 percent of the nation's enplaned passengers
- **Medium Hub** – less than 1.0 percent but greater than 0.5 percent
- **Small Hub** – less than 0.5 percent but greater than 0.25 percent
- **Non-Hub** – less than 0.25 percent

In 2004, Bismarck Airport was ranked the 187th busiest airport in the nation, 47th largest of the 259 non-hub airports. It is the second busiest commercial service airport in North Dakota.

Table 2-1
NORTH DAKOTA AIRPORT RANKINGS

	National	Airport				CY 2004 ACAIS Data		
Class	National	Airport	Airport Name	City	State	Annual		Percent of
N	158	FAR	Hector International	Fargo	ND	261,872		0.04%
N	187	BIS	Bismarck Airport	Bismarck	ND	163,420	*	0.02%
N	215	GFK	Grand Forks International	Grand Forks	ND	91,746		0.01%
N	225	MOT	Minot International	Minot	ND	74,594		0.01%
			Total All US Airports			706,424,048		100.00%

Source: FAA's CY04 Air Carrier Activity Information System (ACAIS) Database
*Airport Records vary slightly from FAA Records

2.1.2 Airlines Serving the Airport

Air carrier and commuter passenger airlines that have operated at Bismarck Airport since calendar year 2000 are identified in Table 2-2.

Table 2-2
AIR CARRIERS SERVING THE AIRPORT

	2000	2001	2002	2003	2004	2005
AIR CARRIER						
Allegiant					•	•
Northwest	•	•	•	•	•	•
Northwest Airlink (Big Sky)	•	•	•	•	•	
Northwest Airlink (Mesaba)	•	•	•	•	•	•
Northwest Airlink (Pinnacle)			•	•	•	•
United Express (Air Wisconsin)	•	•	•	•	•	•
United Express (Skywest)			•	•	•	•
TOTAL AIR CARRIERS	4	4	6	6	7	6

Source: Bismarck Airport Records

2.1.3 Market Services

Since airline economic deregulation in 1978, most of the major airlines adopted a hub-and-spoke operating concept. A hub is a collecting point for traffic where passengers arrive on flights from multiple origination points, connect to other flights timed to provide multiple destination options, and depart again to their final destination. Bismarck Airport operates chiefly as a spoke airport with mainline and/or their commuter airlines feeding traffic to the airlines' respective hub airports. The hub-and-spoke system is a means for a single flight from a spoke airport to have multiple one-stop markets through the hub airport. Principal hub information by the major airlines is as follows:

Table 2-3
PRIMARY DOMESTIC HUB AIRPORTS

Airline	Hub City
AirTran	Atlanta
Alaska	Seattle, Anchorage
Allegiant	Las Vegas
American	Dallas-Ft.Worth, Chicago (O'Hare), St. Louis, Miami
Continental	Houston, Newark, Cleveland
Delta	Atlanta, Cincinnati, Salt Lake City, Orlando
Frontier	Denver
JetBlue	New York (JFK)
Northwest	Detroit, Minneapolis-St. Paul, Memphis
Southwest	Dallas (Love Field), Chicago (Midway), Las Vegas, Phoenix, Houston (Hobby), Baltimore
US Airways	Philadelphia, Charlotte, Phoenix, Las Vegas
United	Chicago (O'Hare), Denver, San Francisco, Washington (Dulles)

As a spoke airport, the air service at Bismarck Airport is focused on the hub airports of the major and regional airlines. Because the Airport is a dynamic market, flights to an airline hub provide multiple service destinations that could not be supported by the amount of locally generated traffic. Most spoke airports typically have service limited to hub airports, except for some key recreational and/or seasonal services to cities such as Las Vegas or Orlando. The current direct markets served at the Airport fit these patterns of service:

- Allegiant Air serves Las Vegas
- Northwest Airlines and Northwest Airlink (Mesaba Aviation and Pinnacle Airlines) serve Minneapolis
- United Express (Sky West) provides service to Denver

Over the past 20 years, Bismarck has had 19 seat passenger service to Williston. This services was discontinued in the early 2000's, due to the decline in demand for this service along with an assortment of other reasons. The recent growth in the oil industry in westerner North Dakota may once again justify restoring service to Williston linking it back to Minneapolis Hub. This pattern of service reflects the industry trends in hub and spoke services and offers insight into potential future services. Specifically, airlines compete by offering hub services that are equal to or greater than those of other airline hubs, the objective being to maximize the size of the hub by serving as many spoke markets as feasible. This suggests that hub airlines not currently serving Bismarck are candidates for future services to assure the competitiveness of their hub.

In addition, airlines currently serving the Airport have a reasonable expectation of having service to multiple hubs so long as they can be served with an aircraft that suits the market in terms of size and range. Over the intermediate and long term, this means that Bismarck Airport is a potential candidate particularly for non-stop regional airline service with regional jets. The introduction of regional jets into the airline fleets provides the opportunity for more distant hub services to communities such as Bismarck.

The key positive aspect of the hub-and-spoke concept for airports like Bismarck Airport is numerous one-stop service destinations, available through the hub airports that would not typically be available on a non-stop basis. The negative impact is that passengers must make flight connections at the hub airport.

2.1.4 Market Share

The passenger market share for the airlines serving Bismarck Airport in 2004 and 2005 is presented in Table 2-4. As shown, Northwest Airlines carried the largest percentage of the enplanements in both years.

Table 2-4
AIRLINE MARKET SHARE

Airline	CY 2005 Enplanements	Percent of Total	CY 2004 Enplanements	Percent of Total
Allegiant	15,795	9.1%	9,548	6.1%
Northwest/Northwest Airlink	118,277	67.8%	113,640	72.1%
United Express	40,419	23.2%	34,449	21.9%
Total	174,491	100.0%	157,637	100.0%

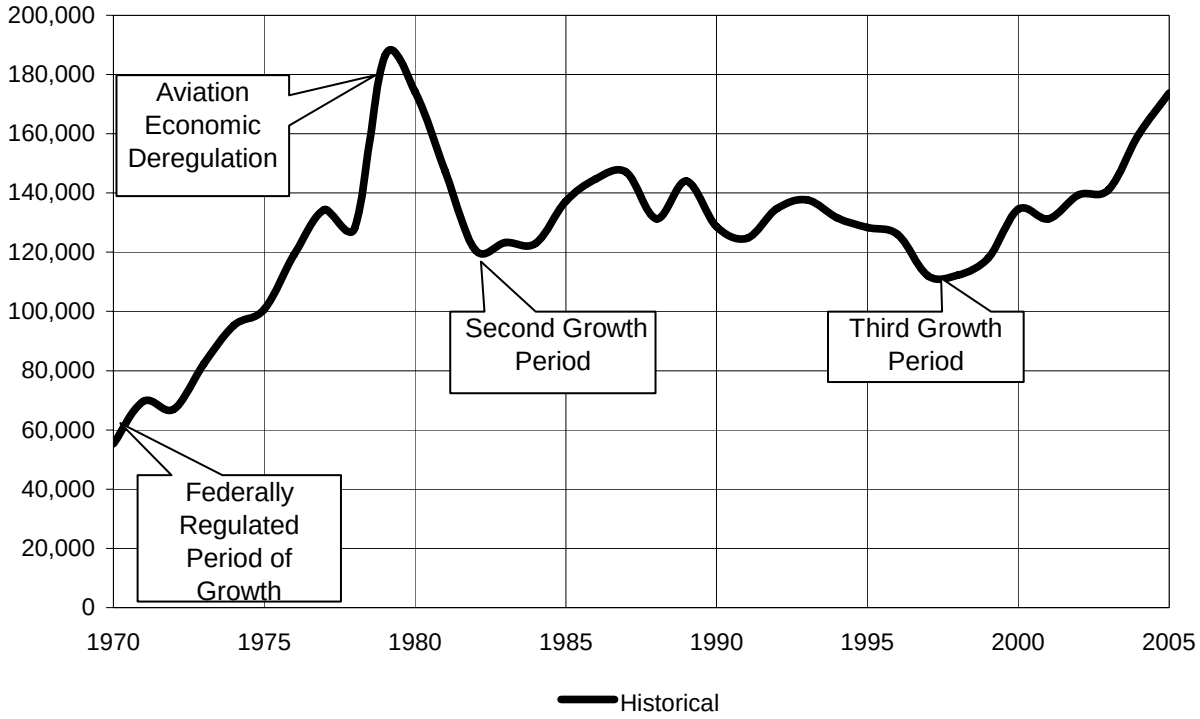
Source: Bismarck Airport Records

2.1.5 Annual Enplaned Passengers

An extended history of passengers boarding commercial service aircraft, or enplanements, at the Airport is presented in Table 2-5. Enplanements at Bismarck Airport have grown at an average annual rate of 3.3 percent over the last 35 years. This growth rate has varied with several multi-year peak and drop fluctuations in enplanements due to national and local economic conditions. Over the last eight years, enplanements at Bismarck Airport have grown at an average annual rate of about 6.5 percent.

The Airport experienced a period of relatively strong growth from 1970 to 1979. After approximately three years of decline (as the US airline industry adjusted fares and service in response to deregulation and the national economic recession in the early 1980s), enplanements at the Airport entered a second short period of growth. This second period of growth consisted of an underlying cycle of small expansions and contractions. Enplanement activity at the Airport has been expanding since 1997.

Table 2-5
HISTORICAL ENPLANEMENTS



Year	Total Enplanements	Annual Increase / Decrease
1970	55,271	
1975	100,755	
1980	174,199	
1985	137,245	
1990	128,691	
1995	128,369	
1996	125,999	- 1.8%
1997	112,073	-11.1%
1998	112,267	0.2%
1999	117,943	5.1%
2000	134,483	14.0%
2001	131,246	- 2.4%
2002	139,343	6.2%
2003	141,090	1.3%
2004	159,963	13.4%
2005	173,738	8.6%

Source: Bismarck Airport Records

2.1.6 Annual Aircraft Operations

An aircraft operation is defined as either a takeoff or a landing. Table 2-6 presents a long-term history of the annual aircraft operations recorded at the Airport in four categories: air carrier, commuter/air taxi (commuter), general aviation, and military. An air carrier operation represents either a takeoff or a landing of a commercial aircraft with seating capacity of more than 60 seats. Commuter operations represent scheduled commercial flights for aircraft with 60 or fewer seats and include air taxi operations, which are nonscheduled flights or for-hire flights of aircraft with 60 or fewer seats. General aviation operations represent all civil aviation aircraft takeoffs and landings not classified as commercial (air carrier or commuter) or military.

Air carrier operations were at their highest annual historical level at more than 17,700 operations in 1980. Air carrier operations declined each year through 1994 and have remained relatively steady between 2,600 and 3,000 operations in recent years.

Commuter operations have grown considerably since 1980, increasing from approximately 1,300 to a peak of more than 16,500 operations in 1994. After declines in the mid 1990s, commuter operations have remained relatively steady between 9,000 and 11,000 annual operations in recent years.

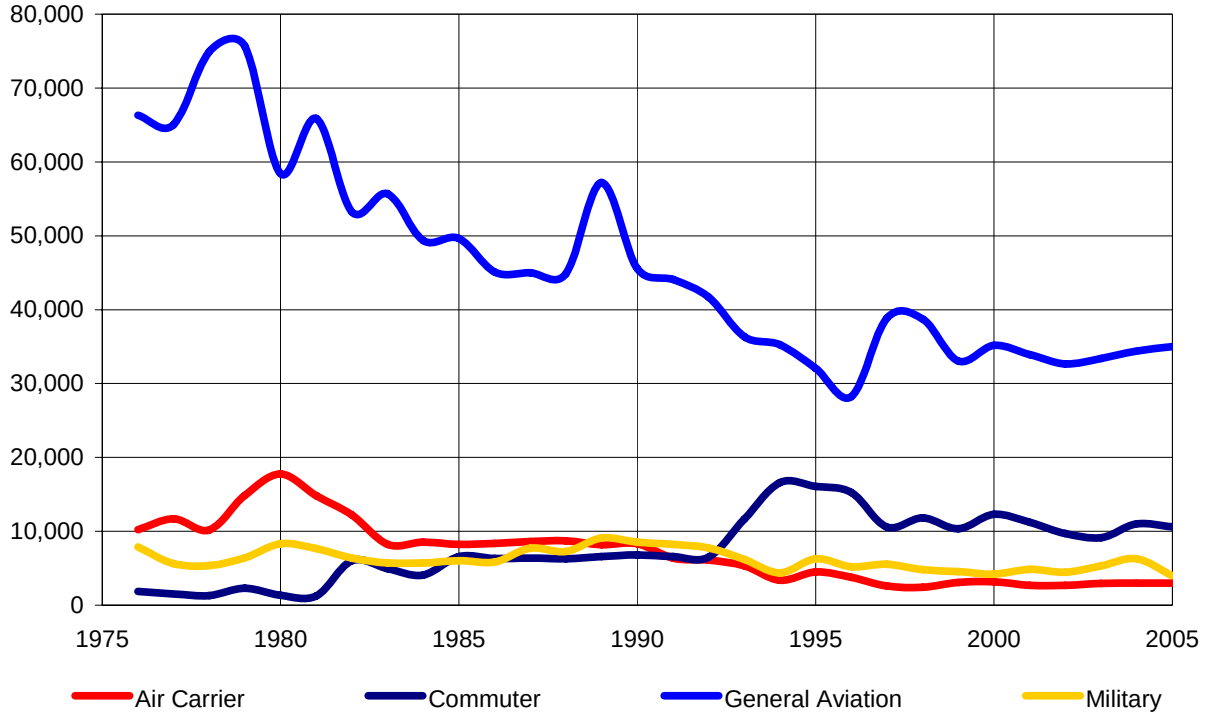
Until the early 1990s, air carrier operations significantly exceeded commuter operations. However, consistent with airline industry trends throughout the US, Bismarck air service became much more reliant on commuter category aircraft in the 1990s as evidenced by the increase in the number of annual commuter operations relative to air carrier operations. This trend has grown even more pronounced throughout the US and at Bismarck in recent years. At Bismarck Airport, commuter operations now outnumber air carrier operations by roughly a three to one margin.

The changes in air carrier versus commuter operations are not necessarily a negative factor in the air service trend. Today, many commuter airlines operate regional jet aircraft that offer 50 or more seats. The use of regional jet aircraft has allowed a much higher level of perceived quality of service to many communities, as passenger preferences for jet aircraft relative to propeller, has been demonstrated. The changes made in fleet aircraft size have contributed to this transition as airlines assign the most economical aircraft to the market. Since 1978, most of the major airlines have accomplished this by transitioning the services to their affiliated or code share partners that operate smaller aircraft than those of the mainline carrier. Early on, these commuter aircraft were 19 seat propeller aircraft. These aircraft transitioned to 30 seat turboprop aircraft. The 30 seat turboprop aircraft are in transition to the 50 seat and larger regional jet aircraft now appearing in the commuter fleet.

General aviation operations represent all civil aviation aircraft takeoffs and landings not classified as commercial (air carrier or commuter) or military. As shown in Table 2-6, general aviation operations were at their highest annual level at more than 75,000 operations throughout the late 1970s. General aviation operations had a generally declining trend with the exception of a few spikes through 1996 where there was a slight increase to about 40,000 operations followed by a stabilizing trend to approximately 35,000 annual operations thereafter through 2005.

Military aircraft operations have fluctuated within a range of approximately 4,000 to 8,500 annual operations over the past 15 years. There were slightly less than 4,000 annual military operations at Bismarck Airport in 2005.

Table 2-6
HISTORICAL OPERATIONS



	Commercial Service			General		
Year	**Air Carrier**	**Commuter**	**Total**	**Aviation**	**Military**	**Total**
1976	10,218	1,848	12,066	66,308	7,892	86,266
1980	17,761	1,324	19,085	58,450	8,321	85,856
1985	8,230	6,571	14,801	49,625	6,007	70,433
1990	8,302	6,785	15,087	45,566	8,514	69,167
1991	6,380	6,575	12,955	44,095	8,215	65,265
1992	6,093	6,505	12,598	41,729	7,773	62,100
1993	5,320	11,633	16,953	36,338	6,188	59,479
1994	3,361	16,608	19,969	35,245	4,374	59,588
1995	4,487	16,061	20,548	32,073	6,287	58,908
1996	3,754	15,253	19,007	28,255	5,189	52,451
1997	2,590	10,572	13,162	38,852	5,550	57,564
1998	2,413	11,832	14,245	38,732	4,792	57,769
1999	3,059	10,354	13,413	33,053	4,566	51,032
2000	3,163	12,292	15,455	35,184	4,206	54,845
2001	2,673	11,219	13,892	33,918	4,859	52,669
2002	2,688	9,702	12,390	32,647	4,446	49,483
2003	2,928	9,130	12,058	33,406	5,348	50,812
2004	3,009	11,008	14,017	34,374	6,301	54,692
2005	2,982	10,621	13,603	35,018	3,985	52,606

Source: FAA Terminal Area Forecast (FY76 - FY05)
Bismarck Airport Records

Total operations at the Airport have decreased at an average annual rate of approximately 1.7 percent over the last 29 years, with most of the change attributable to the decline in general aviation activity.

2.2 FACTORS AFFECTING FUTURE AVIATION DEMAND

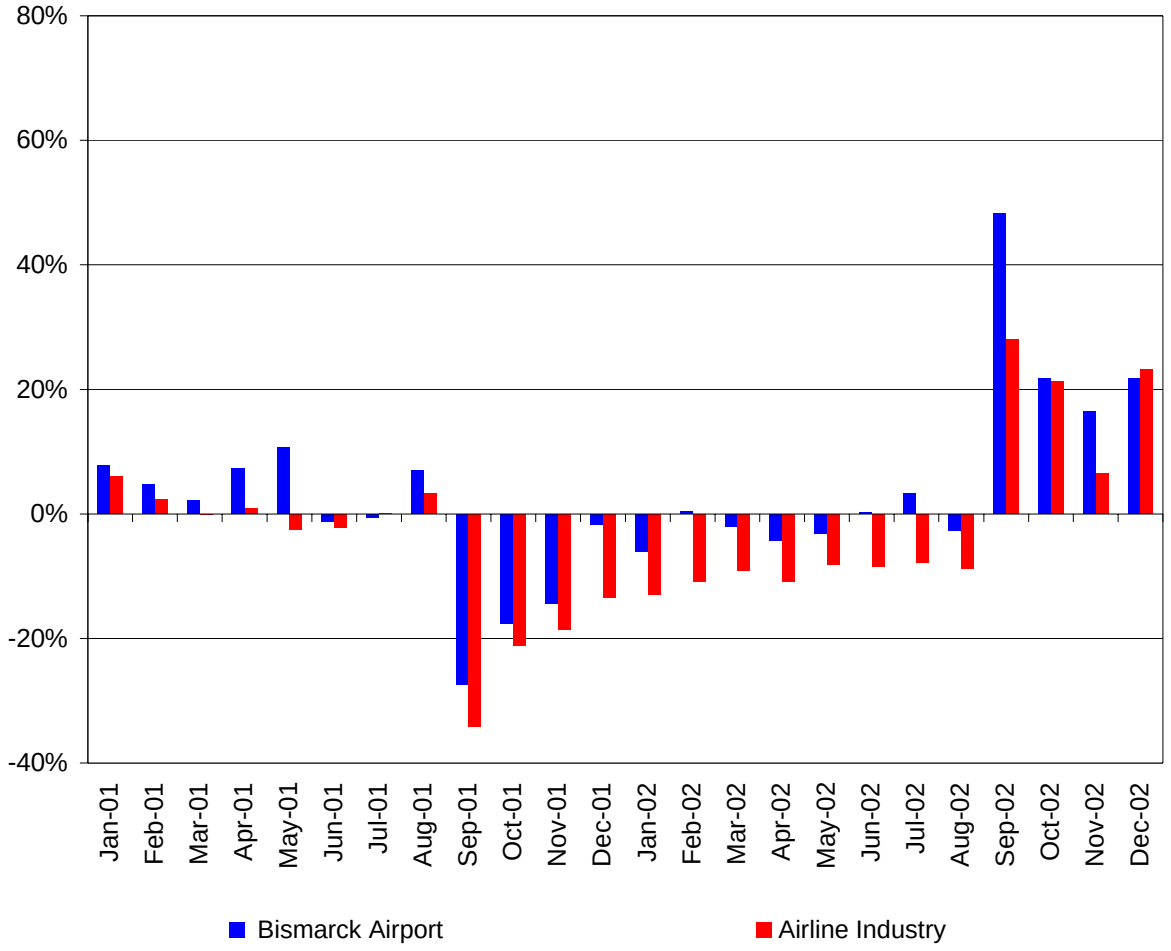
The terrorist acts of September 11, 2001, resulted in a pronounced negative impact on the aviation industry. A brief review of what has happened at the Airport since September 11, 2001, is followed by a discussion of other factors that will have an affect on the aviation industry. The national economy, local socioeconomic conditions, airfare levels, airline competition, and the quality of airline service are reviewed to determine what effect these variables may have on the demand for future aviation activity at Bismarck Airport.

2.2.1 Impact of September 11, 2001

The events of September 11th had a profound impact on passenger interest to travel in the ensuing months. All airports were negatively affected, some more than others. Bismarck Airport and many other airports were impacted by the airline economic troubles that followed September 11th. Service cutbacks were widespread and many smaller communities were deeply impacted.

Table 2-7 tracks monthly enplanements at Bismarck Airport compared to the airline industry during 2001 and 2002. The Airport outperformed the industry throughout the period. In general, month to month percentage increases in enplanements at Bismarck Airport were greater than the industry overall and percentage declines were less. Moreover, Bismarck's recovery from the September 11th events appeared to have been quicker and more pronounced.

Table 2-7
MONTHLY ENPLANEMENTS – BISMARCK AND THE AIRLINE INDUSTRY



	Bismarck Municipal Airport				Airline Industry (in thousands)			
Month	**2001**	**Change Prior Year**	**2002**	**Change Prior Year**	**2001**	**Change Prior Year**	**2002**	**Change Prior Year**
January	10,536	7.7%	9,899	- 6.0%	43,832	6.0%	38,126	- 13.0%
February	9,987	4.7%	10,026	0.4%	47,560	2.3%	42,429	- 10.8%
March	10,878	2.1%	10,659	- 2.0%	52,825	- 0.1%	48,047	- 9.0%
April	9,982	7.2%	9,561	- 4.2%	52,097	0.8%	46,477	- 10.8%
May	12,372	10.6%	11,988	- 3.1%	50,720	- 2.4%	46,581	- 8.2%
June	11,941	- 1.2%	11,977	0.3%	54,889	- 2.2%	50,293	- 8.4%
July	14,072	- 0.6%	14,532	3.3%	55,497	0.2%	51,156	- 7.8%
August	12,152	7.0%	11,820	- 2.7%	56,143	3.2%	51,226	- 8.8%
September	7,648	- 27.4%	11,332	48.2%	31,409	- 34.2%	40,224	28.1%
October	11,080	- 17.6%	13,498	21.8%	39,817	- 21.2%	48,273	21.2%
November	9,881	- 14.5%	11,499	16.4%	41,503	- 18.5%	44,226	6.6%
December	10,717	- 1.7%	13,057	21.8%	40,450	- 13.4%	49,865	23.3%
Total	131,246	- 2.4%	139,848	6.6%	566,743	- 6.5%	556,923	- 1.7%
Jan - Aug		4.4%		- 1.6%		0.8%		- 9.5%

Source: Bismarck Airport Records

2.2.2 National Economic Conditions

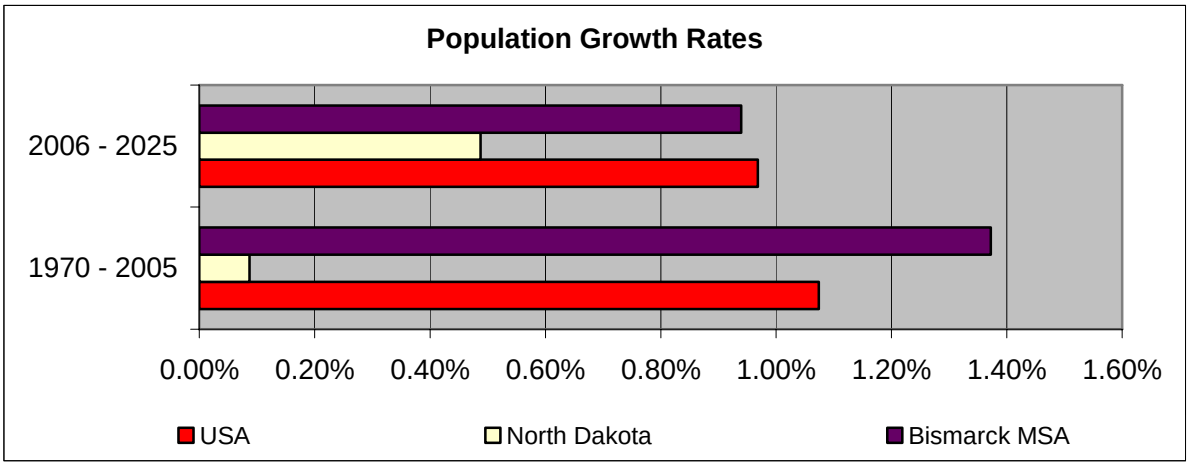
According to the Bureau of Economic Analysis, the US GDP grew at 4.6 percent annually in 2005. The FAA and other national forecasts anticipate GDP to level off in 2006 and 2007 between 3.1 and 3.4 percent. The long-term forecast period anticipates a growth rate of 3.1 percent. These forecasts have been considered in calculating future annual growth rates at the Airport. The timing, extent, and rate of annual growth in the US economy and future changes in real disposable income will affect the rate of future airline traffic both nationally and at Bismarck Airport.

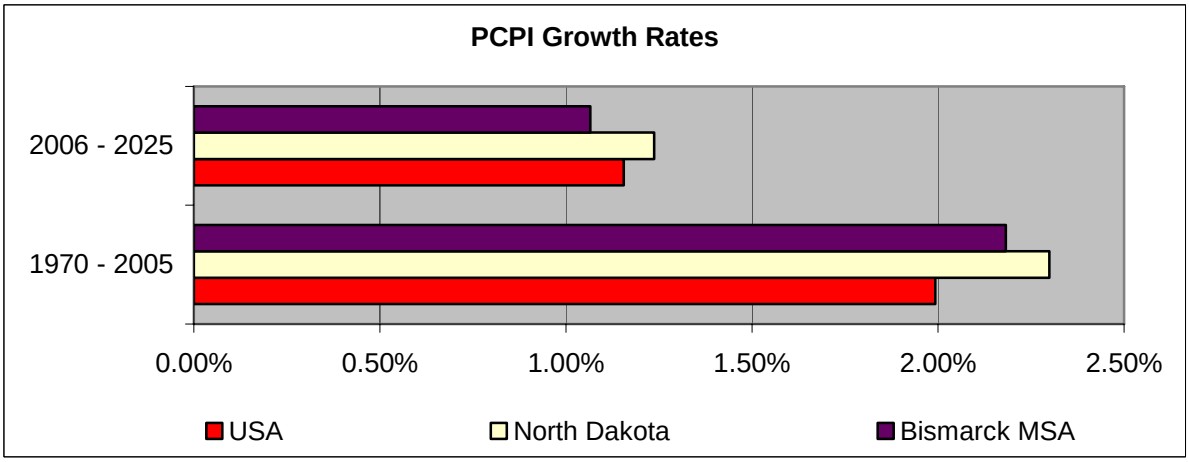
Passengers concerns for safety have largely diminished; however, the problematic economic conditions within the airline industry still persist. Most airlines struggled to remain solvent during the economic downturn made worse by September 11th. Several airlines have been particularly hard hit by the economic slowdown discussed above and filed for bankruptcy protection (United Airlines in 2002, US Airways in 2002, ATA Airlines in 2004, Delta Air Lines and Northwest in 2005). While conditions are now improving, past occurrences illustrates the severity of the airline industry's economic condition. The very high cost of fuel continues to be a major economic problem for the airline industry.

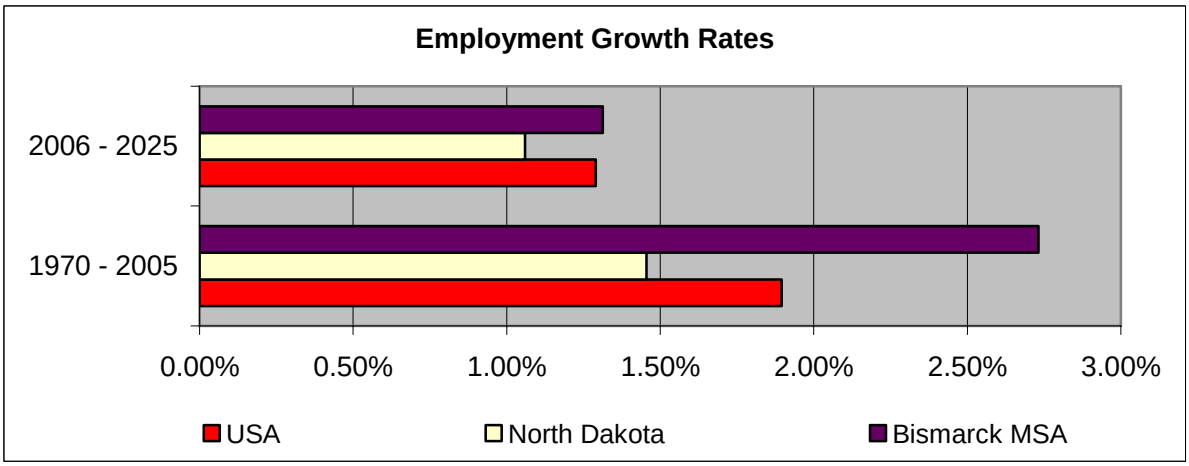
2.2.3 Local Socioeconomic Conditions

Consideration of a community's economic character is particularly important to the determination of business travel, general aviation, and air cargo levels. Prior to developing the aviation demand forecasts for the Airport, current and projected economic trends and population projections associated with the Airport's primary air service area were examined. The Airport's primary service area is the City of Bismarck and includes Burleigh County and the central region of North Dakota. Table 2-8 shows historical and projected information for the Bismarck metropolitan statistical area, North Dakota, and the US.

Table 2-8
HISTORICAL AND DEMOGRAPHIC INFORMATION







Source: Woods & Poole

The following summarizes demographic information depicted in Table 2-8:

- Population growth rates for the Bismarck air service area are lower than they are for the US, for the historical period from 1970 through 2005. Population growth rates in the Bismarck air service area are projected to rise above the rates projected for the US and for North Dakota.
- Historical per capita personal income (PCPI) is higher for the US and North Dakota when compared to the Bismarck air service area. However, PCPI for the Bismarck air service area is projected to increase above the rate projected for the US and North Dakota.
- Historical and projected growth rates for employment for the air service area are higher than the US and North Dakota from 1970 through 2005 and are projected to remain higher.

The local socioeconomic picture derived from examination of the historical trends and forecasts presented in Table 2-8 presents positive outlooks for the air service area. It is expected that population and the economy will continue to grow at a moderate rate as experienced over the last 30 years.

2.2.4 Airline Hubs

The disadvantage of air service from a spoke city is the necessity to make a connection. Bismarck Airport is located quite a distance from several hub airports (Northwest Airline's hub at Minneapolis International Airport and United's hub at Denver International Airport). As a result, no other airports can be identified as significant sources of passenger diversion for Bismarck Airport.

2.2.5 Air Fares

Air fare levels have an important effect on the demand for airline service nationally and at the Airport. Air fares are influenced by airline operational costs such as aircraft maintenance, industry competition, and fuel. Overall, aviation fuel has dramatically increased in price since 1980. A slight increase in fuel prices was recorded in the early 1990s as a result of the Persian Gulf War; however, fuel prices have risen sharply over the past three years. The FAA's long range fuel cost forecast acknowledges the short range increases and calls for cost stability for the balance of the forecast period. Other costs impacting air fares, such as labor costs, are forecast to increase nominally during the forecast period. Significant competition from low-cost carriers will limit the industry's ability to pass on higher operating costs to passengers via higher air fares.

Low-cost, on demand passenger service airlines have survived with small passenger service growth since September 11, 2001. These operators have increased the enplanements by offering affordable direct flights to vacation and resort locations from non-airline hub airports like Bismarck Airport. Allegiant Airlines offers this type of service at Bismarck Airport with direct flights to Las Vegas, Nevada.

2.2.6 Airline Competition

Competitive factors have a significant influence on air fares. On routes that are more competitive or in a city with a competitive environment such as one to two major air carriers and a low-fare carrier, airfares are significantly lower. Changes in competitive forces such as airline bankruptcies, mergers, and acquisitions would significantly influence, positively or negatively, airline traffic at the Airport.

2.2.7 Summary

The variables discussed in this portion of the master plan play an important role in the future demand for aviation activity at the Airport. The air service area has experienced steady population, economic, and employment growth since 1969 to the present and these socioeconomic factors are projected to continue to grow through the forecast period. Air service provided at Bismarck has also grown considerably from 2000 to the present. During periods of expanded air service, the Airport's enplanements increased rapidly. Air service retractions have a corresponding downward impact on enplanements.

2.3 ENPLANED PASSENGER FORECAST

The forecast of enplaned passengers is the foundation upon which other commercial service activity forecasts are developed. The enplaned passenger forecasts are also the basis for determination of the future facilities needed to accommodate projected passenger demands. Each of the following analytical techniques is employed in the preparation of enplanement projections for Bismarck Airport:

- Historical trend line analyses including time series and historical growth
- Regression analyses, which examine various socioeconomic indicators to determine if strong relationships exist between the indicators and elements of aviation activity
- Market share analyses, which compare the performance of the local market to the national market
- Comparable market analyses of other regional airport markets
- The FAA's February 2006 Terminal Area Forecasts

A preferred forecast is subsequently selected based on the results of the above analytical techniques.

2.3.1 Trend Analysis Projections

Trend line analysis is one of the simplest and most familiar forecasting techniques. This technique provides projections of the aviation demand element by extrapolating long-term historical data trends into the future. A fundamental assumption of this technique is that historical stimuli for aviation demand will continue to exert a similar influence on future demand levels. As broad as this assumption may be, this projection technique serves as a benchmark against which the results of other projection methods may be compared. The two different types of trend analyses utilized are ratio and growth rate projections and time series analyses.

2.3.1.1 Ratio and Growth Rate Projections

Six enplanement scenarios were developed using ratio and growth rate projections. Ratio and growth rate projections rely on historical trends and the forecaster's judgment to develop possible future activity levels. Each projection is associated with a scenario relating to historical data.

The first two scenarios relate historical annual ratios of air passengers to Bismarck area population totals and calculate the potential annual enplanement growth (see Table 2-9). The first scenario assumes the enplanements per capita ratio will return to the above average ratios experienced in the past. The second scenario grows to the historical maximum enplanements per capita ratio of 2.4 by 2025.

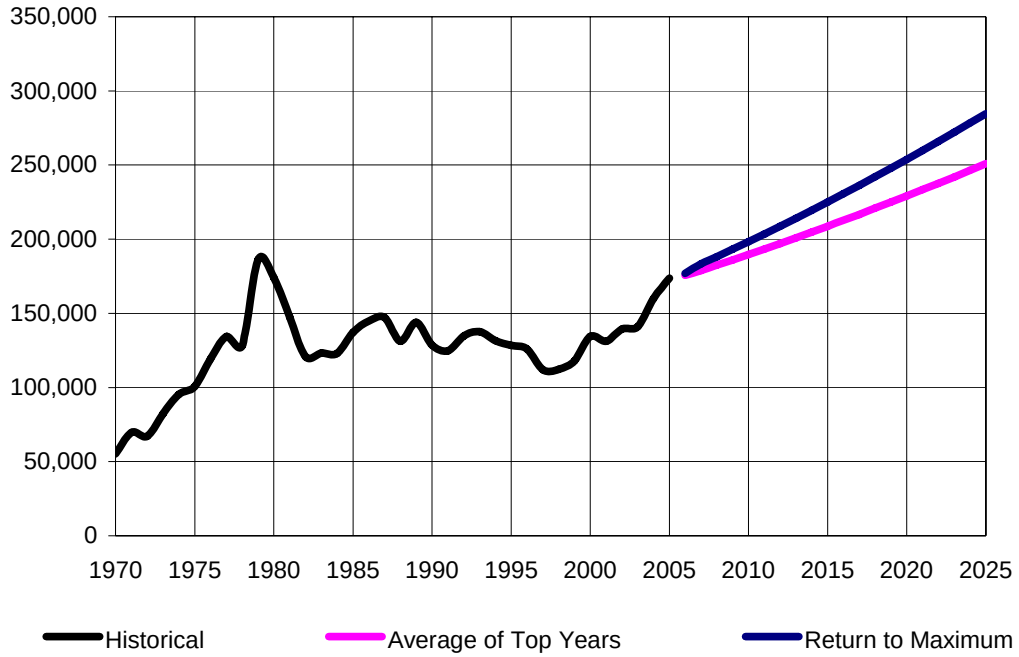
Average annual compound growth rate scenarios were used to develop the enplanement projections presented in Table 2-10. The first scenario using this trend analysis technique assumes the 35-year historical average growth rate (3.3 percent per year from 1970 to 2025) would continue through the planning period. The second scenario reflects an annual growth rate (1.6 percent per year from 1982 to 2005). The final scenario using this trend analysis technique assumes the eight-year annual growth rate (5.6 percent per year from 1997 to 2005) would continue through the planning period.

2.3.1.2 Time Series Analysis

A time series analyses of historical enplanements was performed to project future enplanements by examining the 35 year period from 1970 through 2005 and the 23 year period from 1982 through 2005 (see Table 2-11).

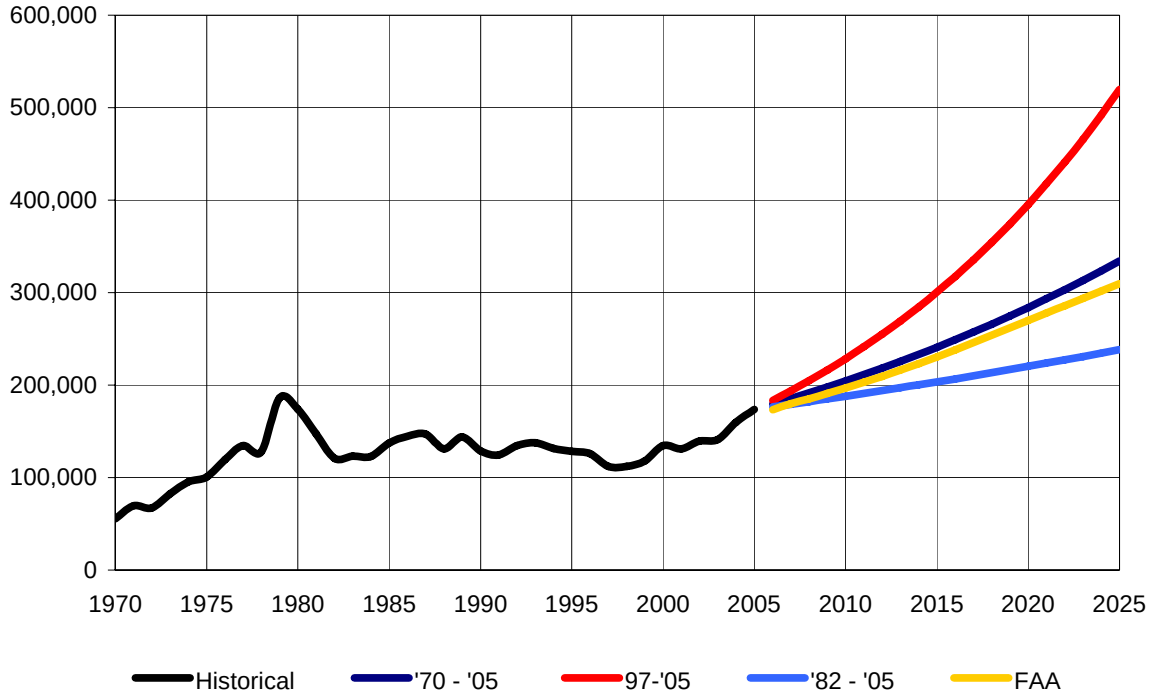
These projection analyses provide a look at future enplanement growth without the dramatic peaks and valleys from national and regional events. The variances in the analyses are due to the selected time series with the largest growth forecast (1970 – 2005) anticipating 200,000 enplanements and the total historical time series forecast (1982 – 2005) anticipating 185,300 enplanements by the end of the planning period. Note that both time series "underprojected" 2005 annual enplanements and were indexed upward to adjust for this fact.

Table 2-9
ENPLANEMENT PROJECTIONS USING PER CAPITA TRENDS



				Per Capita Trend Scenarios			
				Average of Top Years		Return to Maximum	
Year	Enplanements	Pop	Enpl / Capita	Enpl / Capita	Enpl	Enpl / Capita	Enpl
1970	55,271	61,210	0.90				
1975	100,755	69,095	1.46				
1980	174,199	80,234	2.17				
1985	137,245	85,323	1.61				
1990	128,691	83,965	1.53				
1995	128,369	90,288	1.42				
2000	134,483	94,831	1.42				
2005	173,738	98,627	1.76				
2010		103,265		1.85	189,700	1.92	198,300
2015		108,275		1.95	208,700	2.08	225,100
2025		118,847		2.13	250,900	2.40	284,700
Avg Growth Rate							
2005 - 2010					1.7%		2.7%
2005 - 2015					1.8%		2.6%
2005 - 2025					1.9%		2.5%

Table 2-10
ENPLANEMENT PROJECTIONS USING AVERAGE ANNUAL GROWTH RATES



Year	Enplanements	Avg Annual Growth Rate	BIS Average Annual Growth Rates '70 - '05	'82 - '05	'97 - '05	FAA National Growth Rate
1970	55,271					
1975	100,755	12.8%				
1980	174,199	11.6%				
1985	137,245	- 4.7%				
1990	128,691	- 1.3%				
1995	128,369	- 0.1%				
2000	134,483	0.9%				
2005	173,738	5.3%				
2010			204,600	188,000	228,500	196,800
2015			241,000	203,500	300,500	230,400
2025			334,300	238,400	519,900	309,700
Avg Growth Rate						
2005 - 2010			3.3%	1.6%	5.6%	2.5%
2005 - 2015			3.3%	1.6%	5.6%	2.9%
2005 - 2025			3.3%	1.6%	5.6%	2.9%

2.3.1.3 Time Series Analysis

A time series analyses of historical enplanements was performed to project future enplanements by examining the 35 year period from 1970 through 2005 and the 23 year period from 1982 through 2005 (see Table 2-11).

These projection analyses provide a look at future enplanement growth without the dramatic peaks and valleys from national and regional events. The variances in the analyses are due to the selected time series with the largest growth forecast (1970 – 2005) anticipating 200,000 enplanements and the total historical time series forecast (1982 – 2005) anticipating 185,300 enplanements by the end of the planning period. Note that both time series "underprojected" 2005 annual enplanements and were indexed upward to adjust for this fact.

2.3.2 Econometric and Socioeconomic Regression Analysis

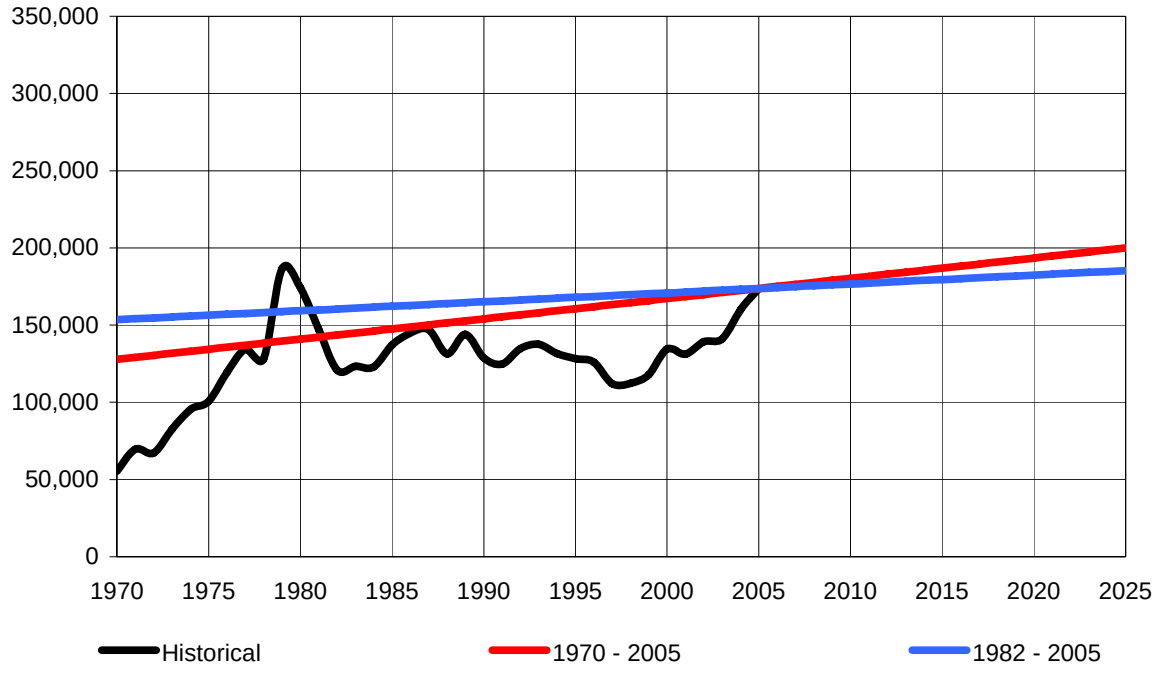
Several local socioeconomic indicators were reviewed and analyzed to determine if a statistically significant relationship exists between historical enplanements at Bismarck Airport and the selected indicators. The indicators reviewed in this analysis included: population, employment, per capita personal income (PCPI), and airline yields. These independent variables typically are good predictors of enplanement levels, absent air service constraints. Airline yield is defined as total passenger revenue divided by total passenger miles. The US carriers' domestic yield is assumed to continue its historical long term decline based on an extension of the FAA yield projections from 11.26 cents per mile in 2005 to 9.37 cents per mile in 2016.

The statistical significance of projections produced by a regression analysis is assessed using the coefficient of determination, or R^2 value. The R^2 value is the square of the correlation coefficient and measures the contribution of the independent variables in the prediction of the dependent variable. The R^2 value will range between 0.00 and 1.00 with 1.00 indicating a perfect correlation between the independent and dependent variables. R^2 values of less than 0.70 generally indicate there is little correlation between the two variables.

Table 2-12 presents the results of this projection technique for predicting future enplanements at the Airport. Two socioeconomic independent variables were examined using a single independent variable regression analysis. In addition, several multi-variable analyses are illustrated.

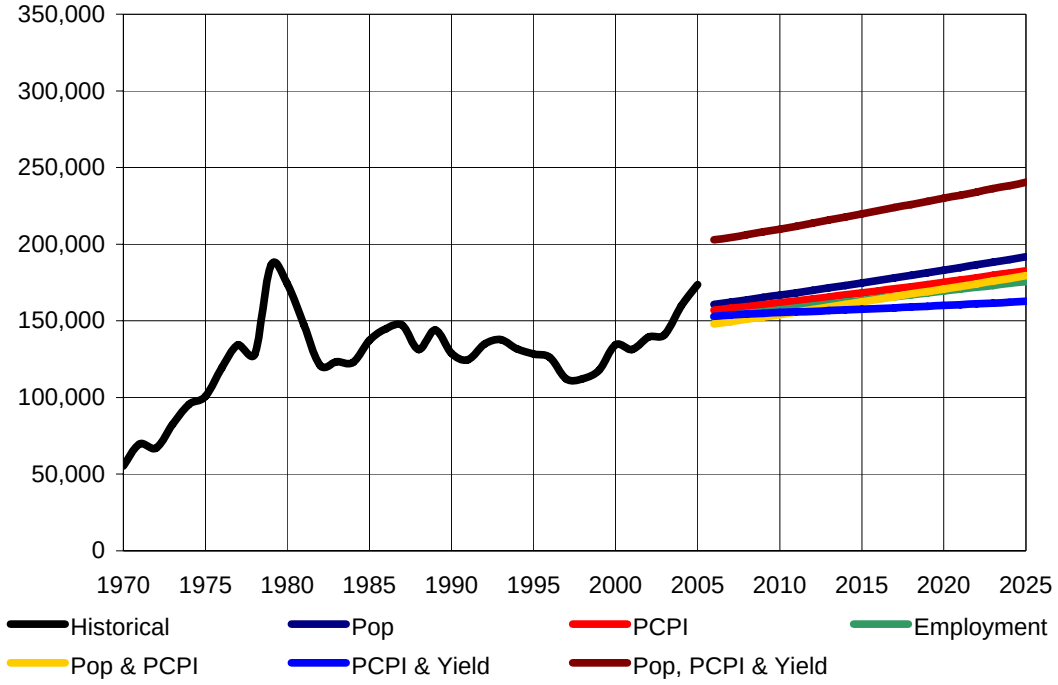
The R^2 value for all six regression analyses range between 0.23 to 0.40, which indicates very little statistical correlation between the independent and dependent variables. The absence of statistical correlation between the independent variables (socioeconomic and yield data) and enplanements indicates that factors other than local socioeconomics have impacted enplanement levels at the Airport.

Table 2-11
TIME SERIES ANALYSIS



		Time Series	
Year	**Enplanements**	**1970 - 2005**	**1982 - 2005**
1970	55,271		
1975	100,755		
1980	174,199		
1985	137,245		
1990	128,691		
1995	128,369		
2000	134,483		
2005	173,738		
2010		180,298	176,600
2015		186,859	179,500
2025		199,980	185,300
Avg Growth Rate			
2005 - 2010		0.7%	0.3%
2005 - 2015		0.7%	0.3%
2005 - 2025		0.7%	0.3%

Table 2-12
REGRESSION ANALYSIS PROJECTION SUMMARY



		Independent Variables					
Year	**Enpl**	**Population**	**PCPI**	**Employment**	**Population & PCPI**	**PCPI & Yield**	**Population, PCPI & Yield**
1970	55,271						
1975	100,755						
1980	174,199						
1985	137,245						
1990	128,691						
1995	128,369						
2000	134,483						
2005	173,738						
2010		166,700	161,800	157,200	154,100	155,400	209,800
2015		174,700	168,200	163,300	162,400	157,600	219,800
2025		191,800	182,700	175,600	179,400	162,700	240,400
R^2 Values		0.39	0.30	0.28	0.40	0.33	0.23
Average Annual Growth							
2005 - 2010		- 0.8%	- 1.4%	- 2.0%	- 2.4%	3.8%	- 2.2%
2005 - 2015		0.1%	- 0.3%	- 0.6%	- 0.7%	2.4%	- 1.0%
2005 - 2025		0.5%	0.3%	0.1%	0.2%	1.6%	- 0.3%

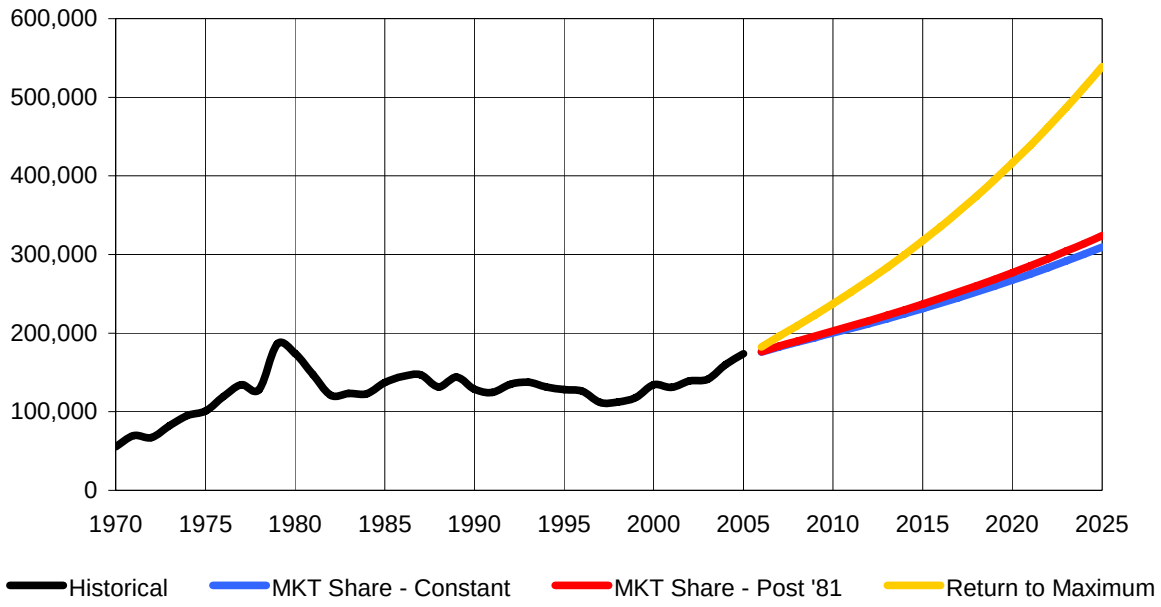
2.3.3 Market Share Analysis

The historical market share for the Airport is calculated by dividing each year's enplanements at the Airport by total domestic US commercial enplanements for the corresponding year. The resulting historical market share percentages were reviewed and a projection of future market share percentages were applied to the FAA's forecast of total US enplanements.

Table 2-13 presents the historical market share of commercial service enplanements at the Airport as well as three different scenarios to project future enplanements. The first scenario assumes the future market share of enplanements would remain at the existing 2005 level of 0.024 percent. The second scenario assumes that the current market share of enplanements at the Airport will return to the average market share (0.025 percent) experienced at the Airport from 1982 through 2005. The final scenario assumes that the current market share of enplanements at the Airport will return to the maximum, market share (0.041 percent) experienced in 1981.

The information from these analyses shows the range from maintaining current to attaining maximum enplanement levels based on Bismarck Airport to US market share ratios.

Table 2-13
MARKET SHARE COMPATIBILITY



	Bismarck		US Enpl	Market Share Scenarios					
				Constant Current		Return to Post '81 Avg		Return to Post '81 Max	
Year	Enpl	US Share	(000s)	Enpl	Share	Enpl	Share	Enpl	Share
1970	55,271								
1975	100,755								
1980	174,199	0.053%	326,249						
1985	137,245	0.039%	355,786						
1990	128,691	0.027%	481,131						
1995	128,369	0.022%	582,014						
2000	134,483	0.019%	704,888						
2005	173,738	0.024%	731,698						
2010			843,236	200,200	0.024%	202,600	0.024%	237,400	0.028%
2015			974,580	231,400	0.024%	237,000	0.024%	317,400	0.033%
2025			1,302,402	309,200	0.024%	324,100	0.025%	539,000	0.041%
Average Annual Growth									
2005 - 2010					2.9%		3.1%		6.4%
2005 - 2015					2.9%		3.2%		6.2%
2005 - 2025					2.9%		3.2%		5.8%

2.3.4 FAA Terminal Area Forecast

The FAA prepares the Terminal Area Forecast (TAF), which is the official aviation activity forecast for all airports in the National Plan of Integrated Airport Systems. The TAF is the forecast of the overall national aviation system growth, breaking that growth down into the numerous categories, and then distributing the growth to the individual airports according to size and activity levels. The February 2006 TAF enplanements forecast for Bismarck Airport is presented on Table 2-14. Note that the TAF understates the number of enplanemets for 2005. Therefore the TAF is also indexed upward, to match 2005 actual enplanements on this table for illustrative purposes.

2.3.5 Preferred Annual Enplanement Forecast and Alternative Forecasts

The projections of future enplanements developed through use of the various analytical methods are shown in Table 2-15. The process of developing a preferred forecast is interpretative and is based on knowledge of aviation trends and understanding of the factors that affect those trends. Therefore, the accuracy of the forecasts depends greatly upon how well future trends are predicted and how these trends impact traffic at the Airport. The enplanement forecast analyses are separated into the following three categories:

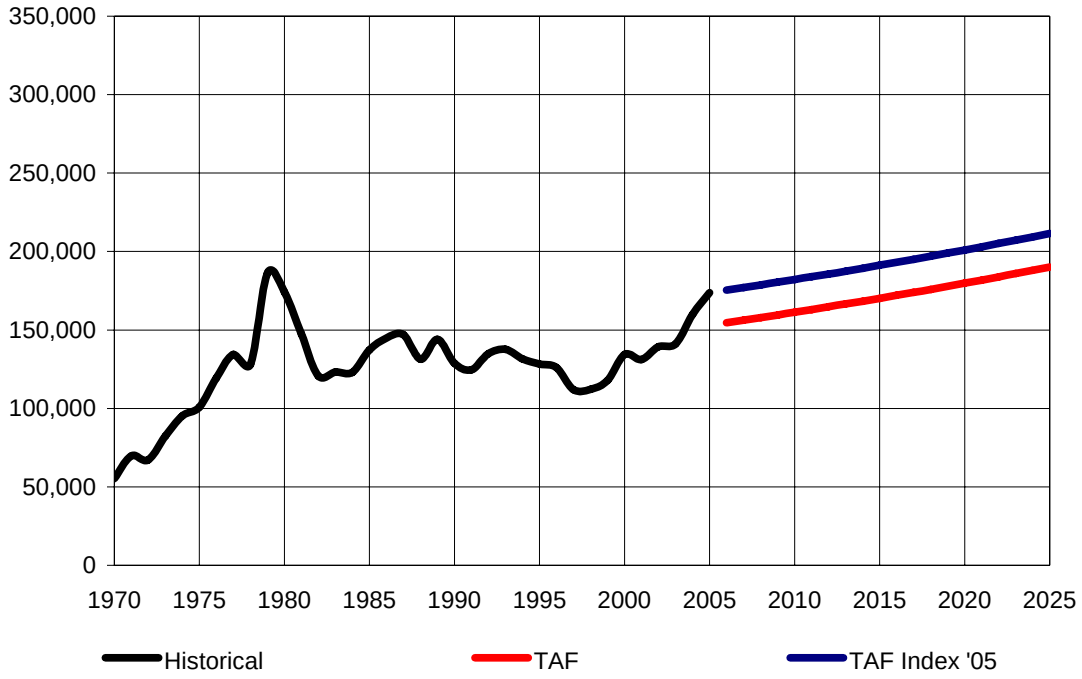
- **"Doldrums"** – Where Airport enplanement levels follow long-term, low-growth trends with few changes in air service. Two forecast methodologies support this scenario, with an increase to approximately 200,000 annual passenger enplanements by the end of the planning period.
- **"Current Trends"** – This scenario reflects the continuation of the positive air service and passenger growth trends of the past 10 years. Four forecast methodologies support this scenario with increases to approximately 280,000 to 320,000 annual passenger enplanements by the end of the planning period.
- **"Super-Growth"** – This scenario represents a break-out of the current air service model with the entrance of several air carriers providing low fare, frequent service. These additional operators would add competition, reduce existing fares, and provide a wider selection of service for passengers using Bismarck Airport. While unlikely, it does indicate an upper limit for the forecast period.

For the purposes of this study, the "Current Trends" scenario will serve as the basis for planning. There are a number of economic and socioeconomic trends that indicate that the basic character of the Bismarck service area has changed in a way that more readily supports and relies on air travel. This change is judged to be more pronounced in the past 10 to 15 years, and judged to be a fundamental and permanent shift in the character of the market. Therefore, the "Current Trends" scenario, with its focus on a 10 to 15 year historical period, is most reflective of likely future conditions. (Note that "Doldrums" scenario has a 30 to 40-year historical focus and the "Super-Growth" scenario is based on trends evident in the very short term past.)

The preferred enplaned passenger forecast is Enplanement per Capita technique from the "Current Trends" scenario. The enplanement forecast predicts an overall 2.5 percent growth rate for the planning period. Enplanements are projected to increase from 173,738 annual enplanements in 2005 to approximately 284,700 in 2025.

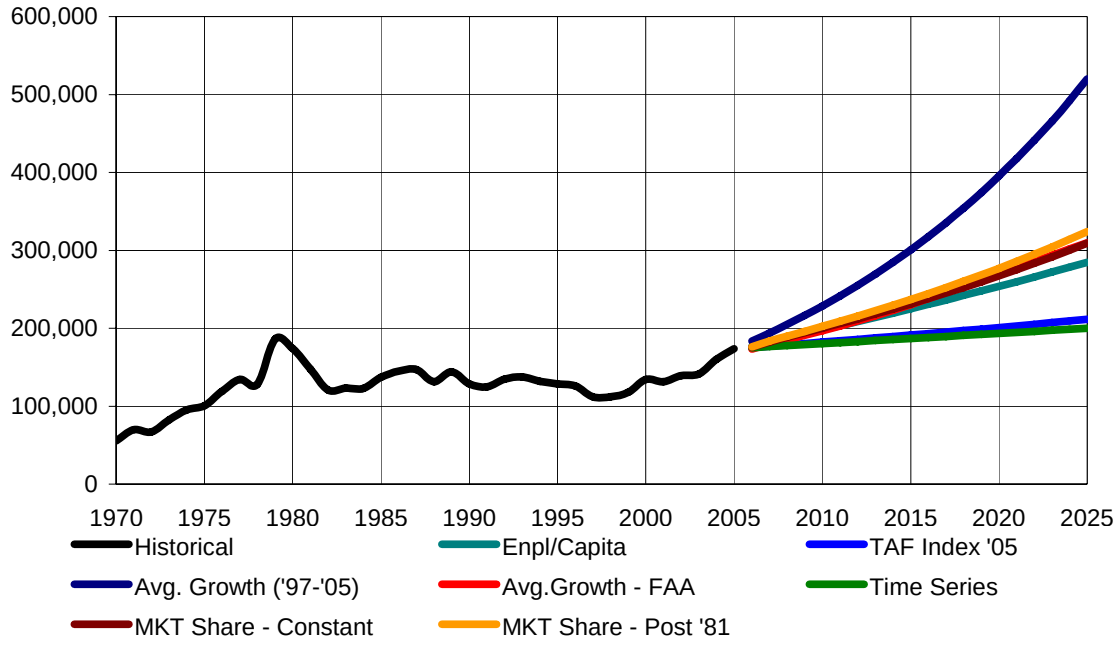
In addition to the preferred forecast, the master plan also establishes a higher and lower forecast range. The preferred enplanement forecast and sensitivity ranges are shown in Table 2-16.

Table 2-14
FAA TERMINAL AREA FORECAST



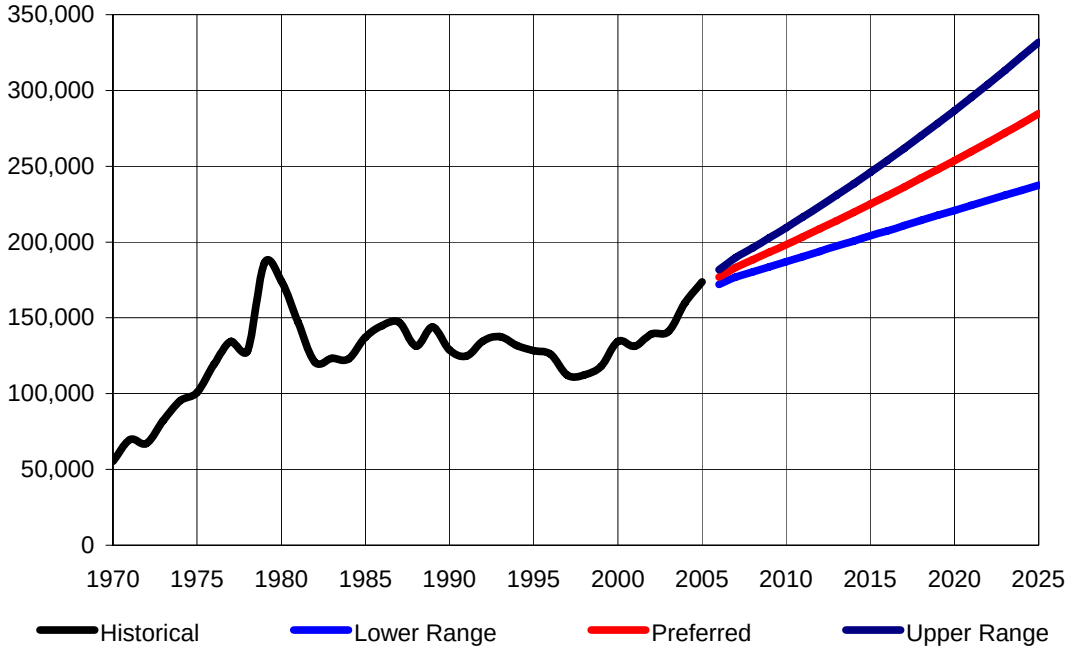
Year	Historical Enplanements	TAF	TAF Indexed to 2005
1970	55,271		
1975	100,755		
1980	174,199		
1985	137,245		
1990	128,691		
1995	128,369		
2000	134,483		
2005	173,738		
2010		163,007	182,163
2015		172,068	191,224
2025		192,333	211,489
Avg Growth Rates			
2005 - 2010		- 1.3%	1.0%
2005 - 2015		- 0.1%	1.0%
2005 - 2025		0.5%	1.0%

Table 2-15
ENPLANEMENT PROJECTIONS



		"Doldrums"		"Current Trends"				"Super-Growth"
					U.S. Market Share		Average Annual Growth	
Year	**Enpl**	**Time Series**	**TAF Indexed**	**Enpl / Capita**	**Constant**	**Post '81**	**FAA**	**1997-2005**
1970	55,271							
1975	100,755							
1980	174,199							
1985	137,245							
1990	128,691							
1995	128,369							
2000	134,483							
2005	173,738							
2010		180,298	182,163	198,300	200,200	202,600	196,800	228,500
2015		186,859	191,224	225,100	231,400	237,000	230,400	300,500
2025		199,980	211,489	284,700	309,200	324,100	309,700	519,900
Avg Growth Rates								
2005 - 2010		0.7%	1.0%	2.7%	2.9%	3.1%	2.5%	5.6%
2005 - 2015		0.7%	1.0%	2.6%	2.9%	3.2%	2.9%	5.6%
2005 - 2025		0.7%	1.0%	2.5%	2.9%	3.2%	2.9%	5.6%

Table 2-16
PREFERRED ENPLANEMENT PROJECTION AND ALTERNATIVE SCENARIOS



Year	Historical Enplanements	Lower Range	Preferred	Upper Range
1970	55,271			
1975	100,755			
1980	174,199			
1985	137,245			
1990	128,691			
1995	128,369			
2000	134,483			
2005	173,738			
2010		187,000	198,300	209,500
2015		204,100	225,100	246,000
2025		237,500	284,700	331,900
Avg Growth Rates				
2005 - 2010		0.7%	2.7%	2.5%
2005 - 2015		0.7%	2.6%	2.9%
2005 - 2025		0.7%	2.5%	2.9%

2.4 AIR CARGO FORECAST

Bismarck, like many similar size airports, has extensive operations by full-service cargo operators (DHL, FedEx, UPS, and USPS) and very limited activity beyond these full-service cargo operations. Because the facilities needed to support cargo operations at Bismarck Airport are driven more by the type of operation rather than pounds of cargo (the traditional measure), this section focuses on the size and type of cargo operation and does not address pounds of cargo.

The quick turn around and highly flexible nature of the full-service cargo operations at Bismarck make records of historical cargo poundage difficult to maintain and of very limited value for long term planning. The Airport maintains records of cargo aircraft landed weight, but very limited enplaned cargo statistics are available. This focus on aircraft landed weight is appropriate, because FAA Cargo Grants are based on cargo aircraft landed weight. While it is not anticipated that Bismarck will reach the threshold for FAA Cargo Grant eligibility, such record keeping should continue[1].

Air cargo activity at Bismarck Airport reflects several fundamental and likely permanent industry trends. The first trend is the long-term emergence and dominance of the cargo package industry by full-service carriers like DHL, FedEx, ICS, UPS, and USPS. These door-to-door shippers now carry the preponderance of packages shipped by air, and a very large volume of the time sensitive packages shipped by truck or combination of air and truck. A second trend is the long-term reduction in cargo carried by passenger airlines, partially accelerated by the temporary shipping restrictions placed on cargo carriage following the events of September 11, 2001, and partially as the US Mail contracts have shifted away from passenger airlines to other carriers. A final trend impacting air cargo carriage is the Check Clearing for the 21st Century Act (Check 21)[2] which drastically diminished the need to quickly move canceled bank checks from bank to a Federal Reserve Bank to bank. The elimination of this banking requirement in late 2004 reduced the demand for specialized air cargo carriers that provide this service.

A large potential future impact on air cargo activity at Bismarck is the Northern Plains Commerce Center. While in the very early stages, activity at such an intermodal facility has the potential to support a more extensive cargo operation at the Airport as well as increase activity by the full-service carriers. Therefore, the air cargo forecast examines both the full-service carriers and the potential impacts of the Northern Plains Commerce Centre.

[1] Cargo Service Airports are airports that, in addition to any other air transportation services that may be available, are served by aircraft providing air transportation of only cargo with a total annual landed weight of more than 100 million pounds.

[2] The Check Clearing for the 21st Century Act (Check 21) was signed into law on October 28, 2003, and became effective on October 28, 2004. Check 21 is designed to foster innovation in the payments system and to enhance its efficiency by reducing some of the legal impediments to check truncation. The law facilitates check truncation by creating a new negotiable instrument called a substitute check, which permits banks to truncate original checks, to process check information electronically, and to deliver substitute checks to banks that want to continue receiving paper checks.

2.4.1 Full Service Carriers

The predominate and most notable cargo activity at Bismarck Airport is the air-to-truck services conducted by DHL, FedEx, ICS, UPS, and USPS and their respective contract airlines. The airlines providing air cargo carriage for DHL, FedEx, and UPS are under contract to provide the service. As the contracts are competitively bid from time to time, changes in the serving airlines occur frequently.

Air-to-truck cargo services at Bismarck Airport follow a similar pattern where a relatively small "feeder" cargo aircraft (Beech 1900, Cessna 208 Caravan, Metro III, etc.) connect Bismarck cargo with one of the full-service carrier's mainline flights (at Grand Forks or Fargo). This cargo is typically transferred from/to the aircraft to/from trucks at Bismarck early in the morning (in bound) and late in the evening (out bound). The carrriers conduct these transfers on the ramp, as is typical nation wide for similar size airports. In some cases the Bismarck feeder cargo aircraft may continue beyond Bismarck to connect with other area airports (Williston, Dickinson, etc.).

In addition, the Airport continues to accommodate a very limited bank document cargo operation. As noted above, Check 21 has almost completely eliminated the need for this type of air cargo service nationwide.

Approximately 3,600 operations by aircraft supporting DHL, FedEx, ICS, UPS, and USPS, and others were conducted at the Airport in 2005. There were two major and one small air-to-truck connecting operations occurring on the Bismarck twice per weekday and three at limited times over the weekend. Each of the air-to-truck operations involved one or two aircraft and one to six trucks. Typical daily loads vary from carrier to carrier, and the numbers of aircraft and trucks change in response to varying needs.

When examining future trends in the full-service cargo industry overall, it is likely that the historical pressure to consolidate will continue. The initial number of full-service cargo companies that were established soon after FedEx was founded, have diminished. What remains is a handful of dominant companies with substantial domestic and international shipping holdings and capabilities. Bismarck is fortunate in that it currently is serviced by three of the most dominate carriers. However, it is possible that a fourth full-service carrier could establish service in the future (such as Purolator or an international carrier). Such an operation would add about 600 to 700 annual operations per year. This potential increase is reflected in the subsequent commercial service operations forecast.

2.4.2 Northern Plains Cargo Centre

A large potential future impact on air cargo activity at Bismarck is the Northern Plains Commerce Centre. While in the very early stages, activity at such an intermodal facility has the potential to support a more extensive cargo operation at the Airport as well as increased activity by the full-service carriers.

Estimating cargo activity for the Northern Plains Commerce Centre is extremely difficult given that the concept is in the formative stages, and the exact nature and extent of the business that will locate there is not known. Therefore, the master plan contemplates a possible scenario based on judgment and knowledge of cargo operations at other US airports.

The Bismarck Airport master planning scenario for the Northern Plains Commerce Centre, once the Centre is fully established, the envisions a positive impact on the full-service carriers as well as the possible establishment of a heavy-lift or more traditional air cargo operation. The scenario calls for an additional aircraft to be added to each carrier's air-to-truck connecting operation each weekday night within 10 years (a total of approximately 1,600 annual operations). This potential increase is reflected in the subsequent commercial service operations forecast.

In terms of a heavy-lift or traditional air cargo operation, the master plan scenario envisions a three aircraft feed to traditional air cargo hubs or to destination-specific locations driven by the nature of the yet to be determined businesses at the Centre. These destinations could be domestic or international airports; however, it is likely that international destinations would be served through a domestic gateway or tech stop point (an east coast airport for European cities, Anchorage for the Far East). The types of aircraft envisioned by the scenario include typical mid to large cargo aircraft such as the B-757-300, B-767-300, or A-300. The scenario calls for six daily operations by these example types of aircraft six days per week within 10 years (a total of approximately 3,100 annual operations). This potential increase is reflected in the subsequent commercial service operations forecast. Note that activity levels of this nature would make Bismarck Airport eligible for FAA Cargo Grants.

2.5 BASED AIRCRAFT FORECAST

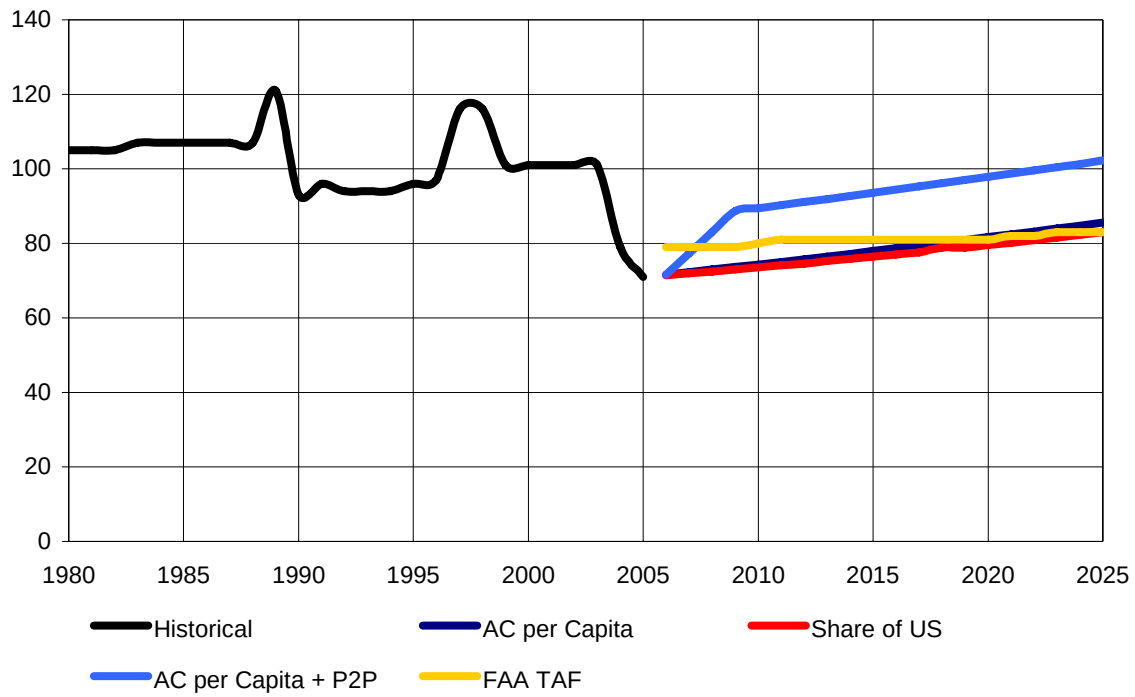
Based aircraft at an airport represent the total number of active civil aircraft permanently located or projected to be located at an airport during a specific period. Based aircraft categories include single-engine, multi-engine, jet, rotorcraft, and other. The national general aviation industry has experienced declines in nearly all measures of activity since the early 1980s including new aircraft shipments, active fixed base operators (FBOs), hours flown, etc. The number of aircraft based at individual airports also dropped at many facilities, including Bismarck Airport.

According to FAA records, the number of based aircraft at the Airport varied around 100 aircraft from 1980 through 2004 with year to year variances of 15 to 20 aircraft. However, airport managements reports that actual based aircraft may have been somewhat lower than the FAA records due in part to a move from Bismarck Airport to Mandan Airport by a number of recreational aircraft. A detailed count of based aircraft in early 2006 by airport management indicates approximately 71 based aircraft. This figure serves as the base year for the forecast. Three methodologies were utilized to forecast future based aircraft, all with similar results for 2025 (see Table 2-17).

Aircraft per capita is the preferred forecast. To that forecast, the Master Plan adds the potential numbers of based aircraft in the on demand passenger service long range business plan. This adjustment increases the forecast number of based aircraft from 74 to 89 for 2010, from 78 to 94 in 2015, and from 86 to 102 in 2025.

Estimates of future types of based aircraft at Bismarck Airport are presented on Table 2-18. Because Mandan Airport is assumed to continue its role as the airport of choice for recreational flying, the future fleet at Bismarck Airport is anticipated to become increasingly oriented toward the more sophisticated single engine aircraft, and multi-engine aircraft. The fleet mix forecast calls for no increase in the number of single engine aircraft and material increases in the numbers of based multi-engine and jet aircraft.

Table 2-17
BASED AIRCRAFT PROJECTIONS



Year	Based Aircraft	Percentage Change	FAA TAF	AC per Capita	Share of US	AC per Capita + On Demand
1980	105					
1985	107	1.9%				
1990	93	- 13.1%				
1995	96	3.2%				
2000	101	5.2%				
2005	71	- 29.7%				
2010			80	74	74	89
2015			81	78	76	94
2025			83	86	83	102
Avg Growth Rate						
2005 - 2010			2.4%	0.9%	0.7%	4.7%
2005 - 2015			1.3%	0.9%	0.7%	2.8%
2005 - 2025			0.8%	0.9%	0.8%	1.8%

Table 2-18
BASED CIVIL AIRCRAFT

Year	Single Engine	Multi Engine	Jet	Rotorcraft	Other	Total
2005	51	13	7	0	0	71
2010	66	15	8	0	0	89
2015	67	18	9	0	0	94
2025	68	22	13	0	0	102
Avg Growth Rate						
2005 - 2010	0.0%	2.9%	3.6%	0.0%	0.0%	4.7%
2005 - 2015	0.0%	3.3%	2.5%	0.0%	0.0%	2.8%
2005 - 2025	0.0%	2.7%	3.0%	0.0%	0.0%	1.8%

2.6 ANNUAL AIRCRAFT OPERATIONS FORECAST

Forecasts of annual aircraft operations were prepared for three categories of aviation activity. The three categories include commercial service (air carrier and commuter) operations, general aviation operations, and military operations. General aviation operations represent all civil aviation aircraft takeoffs and landings not classified as commercial (air carrier or commuter) or military.

2.6.1 Commercial Service Operations Forecast

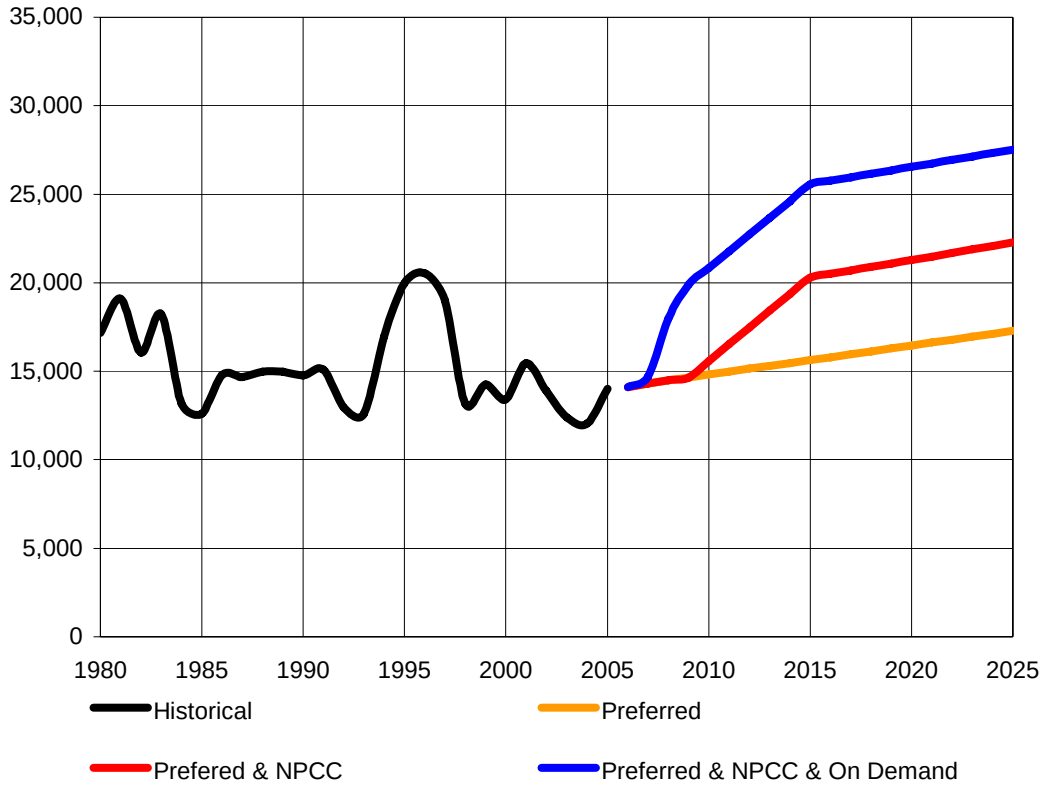
The total forecast commercial service operations are based on the passenger enplanement forecast and the air cargo forecast. The commercial service operations forecast is dependent on the number of passengers carried on air carrier and commuter aircraft, or the air carrier / commuter "split". Note that the FAA defines air carrier and commuter operations based on the size of the aircraft.

The number of air carrier and commuter operations at the Airport inverted by 1995 when the number of commuter operations exceeded the number of air carrier operations. This was a common occurrence at many airports as the airlines shifted from air carrier category aircraft to increasing numbers of commuter aircraft. At first this shift was to turbo-prop commuter aircraft, a trend replaced by a shift to more desirable regional jets.

The preferred commercial service forecast calls for this reliance on a mix of regional jets (commuter category) and larger jets (air carrier category) to continue into the future at Bismarck.

In addition to the preferred commercial service forecast, the master plan also considers the possible impact of an extensive air cargo operation associated with an intermodal facility such as the Northern Plains Commerce Centre and the planned long range operations associated with the on demand passenger service business plan. As illustrated on the commercial service forecast table, the air cargo operation associated with the Northern Plains Commerce Centre is estimated to moderately increase the numbers of air carrier and commuter operations. The increase in commercial service operations associated with on demand passenger service are anticipated to impact only the commuter operations category as the business plan calls for the use of smaller aircraft only.

Table 2-19
COMMERCIAL SERVICE OPERATIONS FORECAST



Year	Historical & Preferred			Preferred & NPCC Cargo			Preferred, Cargo & On Demand		
	Air Carrier	Commuter	Total	Air Carrier	Commuter	Total	Air Carrier	Commuter	Total
1980	14,878	2,296	17,174						
1985	8,541	4,072	12,613						
1990	8,175	6,593	14,768						
1995	3,361	16,608	19,969						
2000	3,059	10,354	13,413						
2005	3,009	11,008	14,017						
2010	3,220	11,590	14,810	3,740	11,850	15,590	3,740	17,100	20,840
2015	3,430	12,200	15,630	6,550	13,760	20,310	6,550	19,010	25,560
2025	3,860	13,440	17,300	7,178	15,099	22,277	7,178	20,349	27,527
Avg Growth Rate									
2005 - 2010			1.1%			2.1%			8.3%
2005 - 2015			1.1%			3.8%			6.2%
2005 - 2025			1.1%			2.3%			3.4%

2.6.2 General Aviation Forecast

Except for several spikes in growth from year to year, general aviation operations at the Airport generally declined from 1976 though 2000 and remained generally flat at approximately 35,000 operations from 2000 through 2005 (see Table 2-20). This overall decline is similar to trends nationwide.

Future general aviation operations at the Airport are projected to grow at a moderate rate similar to the average annual growth rate projected by the FAA nationwide for general business and corporate aviation operations at airports with an air traffic control tower. Bismarck Airport general aviation operations are projected to increase from the 2005 level of 35,018 to 44,500 annual operations by 2025. In addition, significant growth is expected to occur in Very Light Jets (VLJ).

2.6.3 Military Operations Forecast

Annual activity by military aircraft is a function of Department of Defense policy, military appropriations, and the mission assigned to a particular flying unit. As such, projections of future operations by military aircraft are not reliably predictable through use of socioeconomic indicators or trend analyses.

Military activity at Bismarck Airport has historically ranged between approximately 4,000 and 9,000 annual operations with lower annual counts in recent years.

Annual military operations have remained relatively flat at approximately 3,900 to 4,000 operations over the past 10 years. The master plan forecast holds the military operations forecast constant throughout the planning period at 3,990 annual operations.

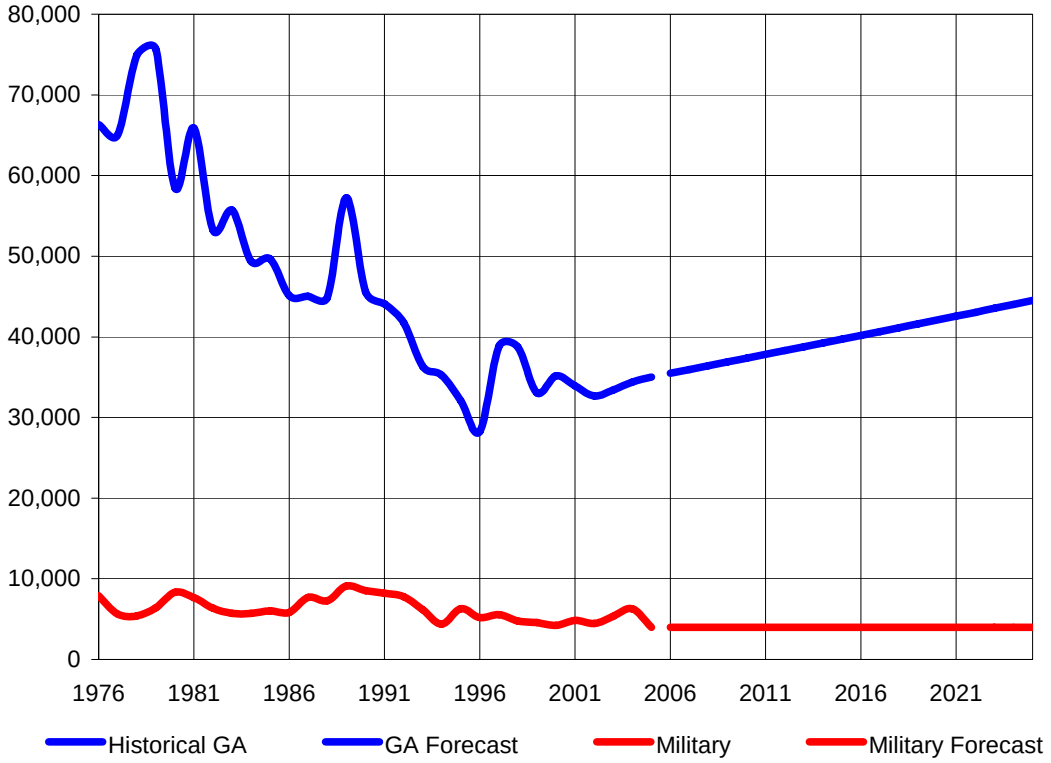
2.6.4 Itinerant and Local Operations Forecast

Aircraft operations are classified in this chapter as commercial service, general aviation, or military operations. General aviation and military operations can be further segregated into two additional categories -- local or itinerant. Aircraft operating in the traffic pattern or within sight of the tower, aircraft known to be departing to or arriving from local practice areas, or aircraft executing practice instrument approaches at the Airport are classified by the FAA air traffic controllers as local operations. Itinerant operations are all other aircraft operations and represent takeoffs and landings from one airport to another. All commercial service operations are itinerant operations.

Local and itinerant general aviation and military operations are shown in Table 2-21. General aviation itinerant operations have made up about 65 percent of total operations for the past 10 years. This trend is projected to continue into the future.

The proportion of itinerant and local military operations has varied significantly over the past 25 year period, with a greater proportion of itinerant operations in recent years. Consistent with this general trend, itinerant operations are assumed to make up 64.4 percent of future military operations.

Table 2-20
FORECAST OF GENERAL AVIATION AND MILITARY OPERATIONS



Year	General Aviation	Military	Total
1980	58,450	8,321	74,200
1985	49,625	6,007	55,632
1990	45,566	8,514	54,080
1995	32,073	6,287	38,360
2000	35,184	4,206	39,390
2005	35,018	3,985	39,003
2010	37,350	3,990	41,340
2015	39,700	3,990	43,690
2025	44,500	3,990	48,490
Avg Growth Rate			
2005 - 2010	1.3%	0.0%	1.2%
2005 - 2015	1.3%	0.0%	1.1%
2005 - 2025	1.2%	0.0%	1.1%

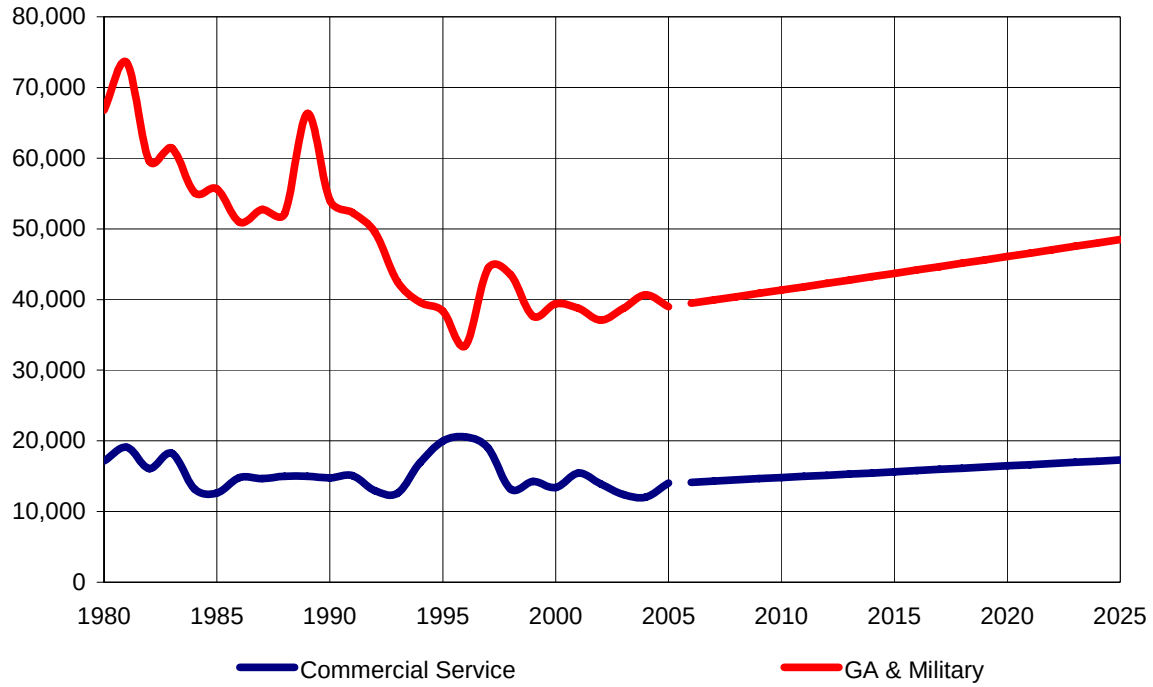
Table 2-21
GENERAL AVIATION MILITARY OPERATIONS – LOCAL AND ITINERANT

	General Aviation				Military				Total General Aviation and Military Ops
	Itinerant		Local		Itinerant		Local		
Year	Ops	Percent	OPS	Percent	Ops	Percent	Ops	Percent	
1980	40,971	70.1%	17,479	29.9%	2,557	30.7%	5,764	69.3%	66,771
1985	35,592	71.7%	14,033	28.3%	2,844	47.3%	3,163	52.7%	55,632
1990	32,524	71.4%	13,042	28.6%	3,336	39.2%	5,178	60.8%	54,080
1995	22,939	50.3%	9,134	28.5%	3,105	49.4%	3,182	50.6%	38,360
2000	22,627	64.3%	12,557	35.7%	2,571	61.1%	1,635	38.9%	39,390
2005	22,605	64.6%	12,413	35.4%	2,569	64.5%	1,416	35.5%	39,003
2010	24,300	65.1%	13,050	34.9%	2,570	64.4%	1,420	35.6%	41,340
2015	26,000	65.5%	13,700	34.5%	2,570	64.4%	1,420	35.6%	43,690
2025	29,390	66.1%	15,110	33.9%	2,570	64.4%	1,420	35.6%	48,490
Avg Growth Rate									
2005-2010	1.5%		1.0%		0.0%		0.1%		1.2%
2005-2015	1.6%		1.0%		0.0%		0.0%		1.1%
2005-2025	1.3%		1.0%		0.0%		0.0%		1.1%

2.6.5 Total Operations Forecast

Table 2-22 presents the forecast of total operations at the Airport for the combined elements of commercial service operations, general aviation operations, and military operations.

Table 2-22
FORECAST TOTAL OPERATIONS



	Commercial Service			GA and Military		
Year	**Air Carrier**	**Commuter**	**Total**	**General Aviation**	**Military**	**Total**
1980	17,761	1,324	19,085	58,450	8,321	66,771
1985	8,230	6,571	14,801	49,625	6,007	55,632
1990	8,302	6,785	15,087	45,566	8,514	54,080
1995	4,487	16,061	20,548	32,073	6,287	38,360
2000	3,163	12,292	15,455	35,184	4,206	39,390
2005	2,982	10,621	13,603	35,018	3,985	39,003
2010	3,220	11,590	14,810	37,350	3,990	41,340
2015	3,430	12,200	15,630	39,700	3,990	43,690
2025	3,860	13,440	17,300	44,500	3,990	48,490
Avg Growth Rate						
2005-2010	1.4%	4.1%	1.1%	1.3%	0.0%	1.2%
2005-2015	2.7%	1.0%	1.1%	1.3%	0.0%	1.1%
2005-2025	1.3%	1.0%	1.1%	1.2%	0.0%	1.1%

2.7 INSTRUMENT APPROACH FORECAST

An instrument approach, as defined by the FAA for towered airports, is an approach to an airport by an aircraft with an instrument flight plan where visibility is less than three miles or the ceiling is at or below the minimum initial approach altitude. Instrument approaches are used by the FAA to determine an airport's eligibility for enhanced instrument approach capability and additional navigational aides.

Historical and forecast instrument approach data for the Airport are presented in Table 2-23. Annual instrument approaches have decreased from 2,548 operations in 1995 to 358 operations in 2005. Because instrument approaches are recorded only when an approach is conducted in instrument conditions, it is likely that the extremely low numbers of instrument approaches in 2002, 2004 and 2005 are attributable to dry weather conditions rather than a fall off in activity. Therefore, the forecast is based on the ratio of instrument approaches to total operations in more typical weather years.

Table 2-23
INSTRUMENT APPROACHES

Year	Air Carrier	Commuter	General Aviation	Military	Total
1995	350	1,164	914	120	2,548
1996	245	913	567	57	1,782
1997	261	820	843	93	2,017
1998	252	1,087	1,306	115	2,760
1999	314	815	1,088	142	2,359
2000	145	420	420	67	1,052
2001	239	642	573	73	1,527
2002	122	438	392	37	989
2003	155	492	766	68	1,481
2004	83	242	242	38	605
2005	37	121	177	23	358
2010	185	623	806	85	1,699
2015	197	656	862	85	1,800
2025	222	723	974	85	2,004
Average Growth Rates					
2005 - 2010	38.0%	38.8%	35.4%	29.9%	36.5%
2005 - 2015	18.2%	18.4%	17.2%	14.0%	17.5%
2005 - 2025	9.4%	9.3%	8.9%	6.8%	9.0%

2.8 DESIGN DAY/DESIGN HOUR ACTIVITY FORECASTS

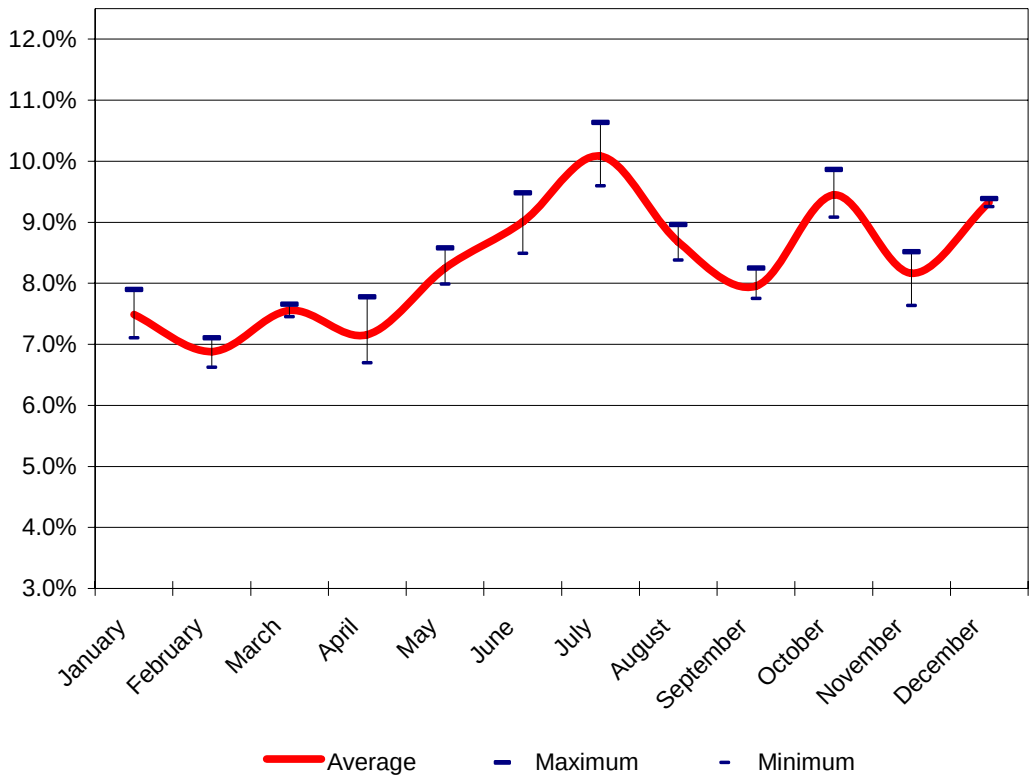
Capacity analyses and determination of future facility requirements of various elements of airport facilities are often based on design day or design hour activity levels. To avoid the construction and operational cost of acquiring capacity that would be rarely used, design day and design hour activity levels should not be the absolute busiest period at the Airport. Rather the design day and design hour activity levels should be representative of busy periods but not the absolute peak periods. Often the design day is generally equivalent to the 85th percentile of activity for the design year. Facilities designed to accommodate this level of activity in the design year will provide a comfortable level of service for the large majority of the time. During unusually high activity periods such as the Wednesday before and the Sunday after Thanksgiving Day, Airport facilities can be expected to experience more crowded conditions and longer, but not unreasonable or intolerable, processing times.

The design day level of activity is often calculated in airport planning efforts using a peak month/average day definition. Tables 2-24 through 2-26 show the high, low, and average monthly distributions of annual enplanements, annual total operations, and annual commercial service operations from 2002 to 2005 at the Airport. As is common when evaluating such data at various airports, the calendar month that experienced the highest level of activity in a given year often varies. However, the annual activity in the peak month expressed as a percentage of annual activity is usually fairly constant from year to year. If annual activity were equally distributed among all 12 months in a year, monthly activity would be approximately 8.0 percent.

For passenger enplanements and commercial service operations, the peak hour is projected to be 24.8 percent and 20.0 percent respectively, of the average day activity. This figure is based on the current 2006 peak weekday flight schedule, which had approximately 24.8 percent of total daily departing seats in the peak 60-minute period (12:15 pm to 1:15 pm).

The total operations percentage for peak hour is 15.0 percent. The design day and design hour activity levels that result from the application of these factors to annual forecasts of the respective demand elements are presented on Table 2-27.

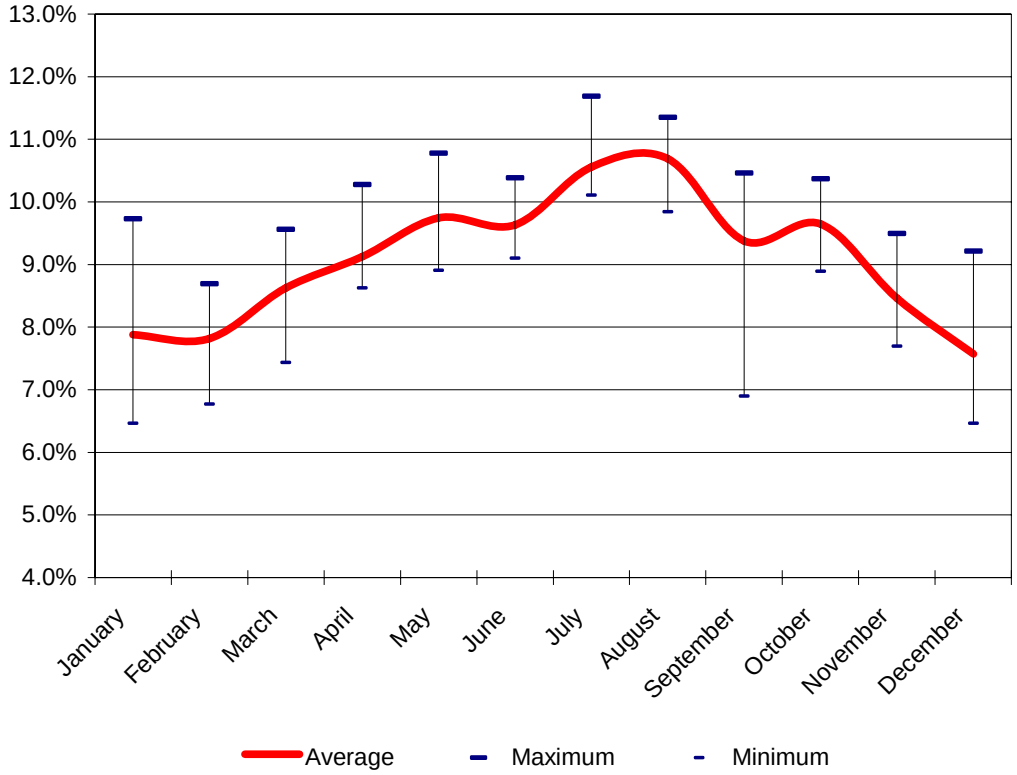
Table 2-24
MONTHLY DISTRIBUTION OF ANNUAL ENPLANEMENTS



Month	Average	Maximum	Minimum
January	7.5%	7.9%	7.1%
February	6.9%	7.1%	6.6%
March	7.6%	7.7%	7.5%
April	7.2%	7.8%	6.7%
May	8.2%	8.6%	8.0%
June	9.0%	9.5%	8.5%
July	**10.1%**	**10.6%**	**9.6%**
August	8.7%	9.0%	8.4%
September	8.0%	8.2%	7.7%
October	9.4%	9.9%	9.1%
November	8.2%	8.5%	7.6%
December	9.3%	9.4%	9.3%

Source: Bismarck Airport Records, 2002 to 2005

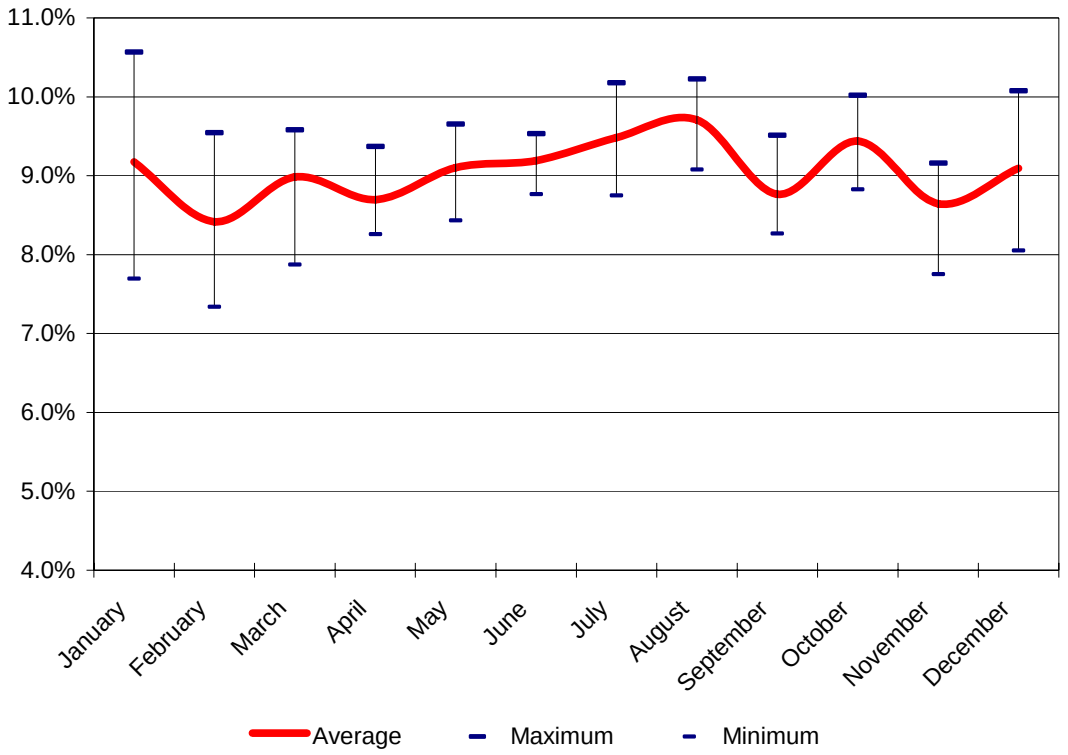
Table 2-25
MONTHLY DISTRIBUTION OF TOTAL OPERATIONS



Month	Average	Maximum	Minimum
January	7.9%	9.7%	6.5%
February	7.8%	8.7%	6.8%
March	8.6%	9.6%	7.4%
April	9.1%	10.3%	8.6%
May	9.7%	10.8%	8.9%
June	9.6%	10.4%	9.1%
July	10.6%	11.7%	10.1%
August	**10.7%**	**11.3%**	**9.8%**
September	9.4%	10.5%	6.9%
October	9.6%	10.4%	8.9%
November	8.5%	9.5%	7.7%
December	7.6%	9.2%	6.5%

Source: FAA, 2002 to 2005

Table 2-26
MONTHLY DISTRIBUTION OF COMMERCIAL SERVICES OPERATIONS



Month	Average	Maximum	Minimum
January	9.2%	10.6%	7.7%
February	8.4%	9.5%	7.3%
March	9.0%	9.6%	7.9%
April	8.7%	9.4%	8.3%
May	9.1%	9.7%	8.4%
June	9.2%	9.5%	8.8%
July	9.5%	10.2%	8.7%
August	**9.7%**	**10.2%**	**9.1%**
September	8.8%	9.5%	8.3%
October	9.4%	10.0%	8.8%
November	8.6%	9.2%	7.8%
December	9.1%	10.1%	8.1%

Source: Airport Records, 2000 to 2005 (excluding 2001)

Table 2-27
DESIGN DAY/DESIGN HOUR ACTIVITY FORECASTS

		Planning Activity Level		
Description	**2005**	**2010**	**2015**	**2025**
Enplanements				
Annual Enplanements	173,738	198,300	225,100	284,700
Peak Month (10.1% of annual)	17,517	19,994	22,696	28,705
Average Day (31 days)	565	645	732	926
Peak Hour Passenger Enplanements (24.8%)	140	160	182	230
Peak 20 Minute Passenger Enplanements (18.7%)	106	121	137	173
Total Operations				
Annual Operations	39,003	41,340	43,690	48,490
Peak Month (10.7% of annual)	4,169	4,419	4,670	5,183
Average Day (31 days)	134	143	151	167
Peak Hour (15.0%)	20	21	23	25
Passenger Airline Operations				
Annual PAX Airline Operations	9,561	10,190	10,850	12,220
Peak Month (9.7% of annual)	928	989	1,053	1,186
Average Day (31 days)	30	32	34	38
Peak Hour Departures (20.0%)	3	3	3	4
Peak Hour Passenger Arrivals (20.0%)	3	3	3	4

2.9 COMPARISON WITH OTHER FORECASTS

Forecasts prepared in a master plan are reviewed by the FAA and compared to the Terminal Area Forecast (TAF) projections. The FAA Revision to Guidance on Review and Approval of Aviation Forecasts letter states that the FAA Office of Aviation Policy and Plans will find a locally developed forecast for operations, based aircraft, and enplanements consistent with the TAF if it meets any of the following three conditions for a commercial service airport.

- First, the forecast differs less than 10 percent in the 5-year forecast period and 15 percent in the 10-year period.
- Second, the forecast activity levels do not affect the timing or scale of an airport project.
- Third, the forecast activity levels do not affect the role of the Airport as defined in FAA Order 5090.3C.

Table 2-28 presents a comparison of the enplanements forecasts prepared in this chapter with FAA projections, as published in the February 2006 TAF, and the forecasts prepared in the previous master plan undertaken for the Airport in 1996. Actual enplanements at Bismarck Airport have tracked below the previous master plan's forecast for the period 1994 through 2005. Conversely, actual enplanements for 2003, 2004, and 2005 are higher than predicted by the February 2006 TAF for 2006.

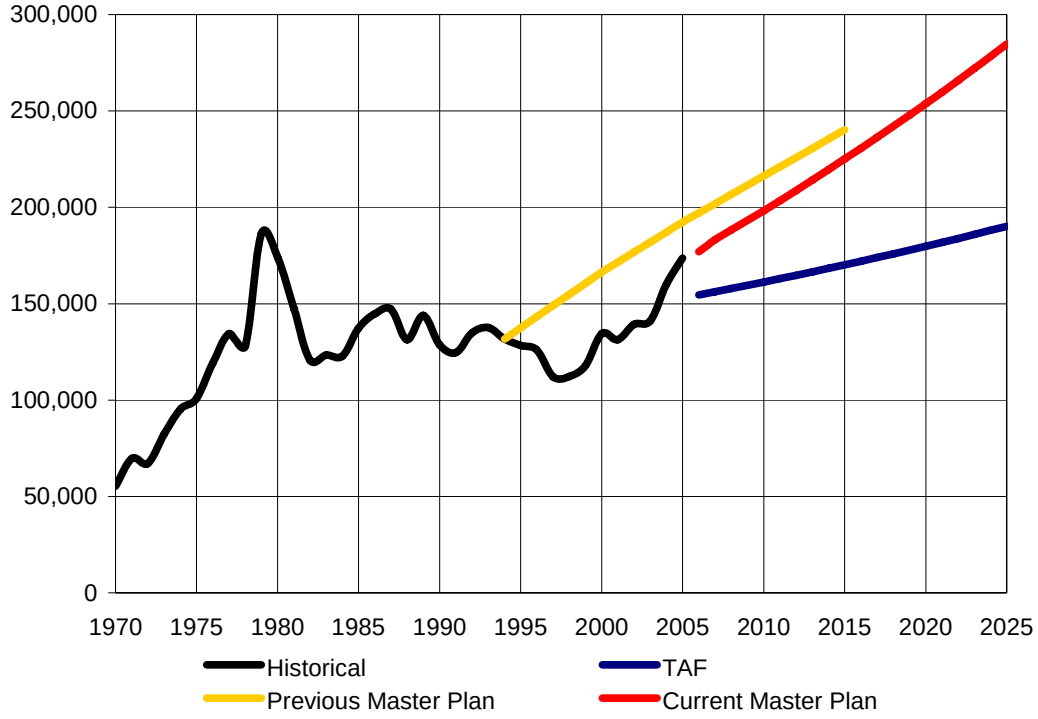
The forecasts of aircraft operations prepared in this chapter are lower than the previous master plan forecasts and very similar to the February 2006 TAF (see Table 2-29).

To illustrate conformance with the FAA's TAF, a comparison between the enplanements, operations, and based aircraft projections in this master plan and the February 2006 TAF are presented in Table 2-30.

- The enplanement projections in the master plan are somewhat higher than of those contained in the TAF. A portion of this margin of difference is the 12.4 percent difference in base year projections (as the TAF understates actual enplanements by about 12.4 percent). The difference in future years is attributable to the TAF's more pessimistic outlook for future Bismarck enplanements.
- Total operations projections in this master plan are within the TAF five and 10-year threshold limits.
- Based aircraft projections are higher in the TAF than in the master plan forecast. A portion of this margin of difference is the 10.4 percent difference in base year projections (as the TAF overstates actual based aircraft by about 10.4 percent).

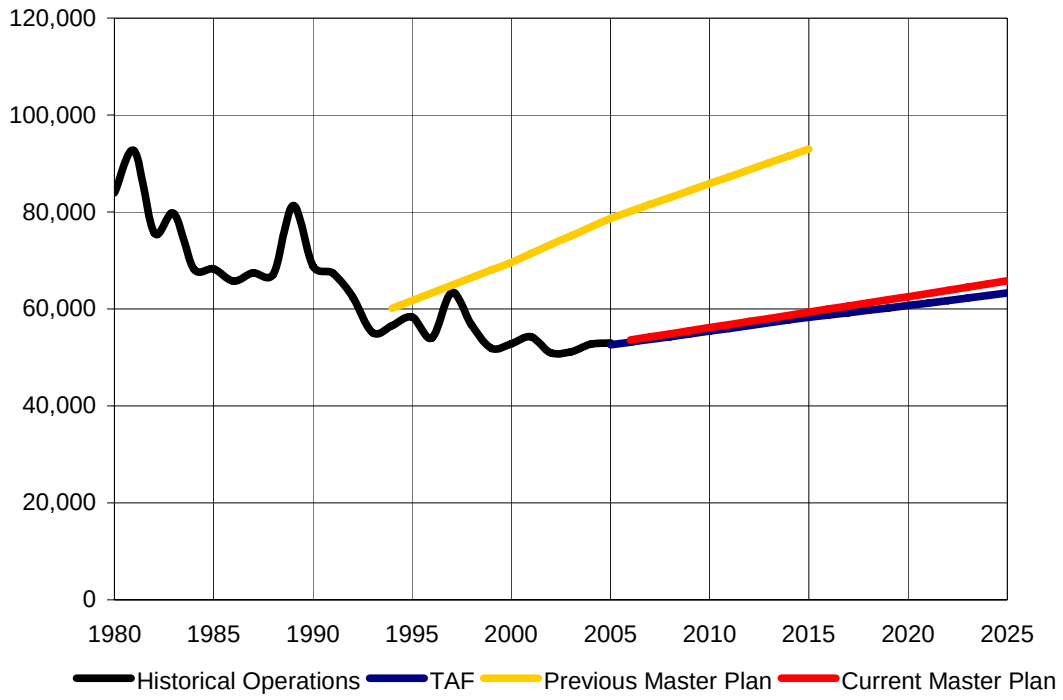
FAA guidance on the review and approval of locally produced aviation forecasts is that the forecast must meet one or more of the conditions stated above to be consistent with the TAF. This master plan's enplanement forecast meets conditions two and three; the operations forecast meets conditions one, two, and three; and the based aircraft forecast meets conditions one, two, and three.

Table 2-28
ENPLANEMENT COMPARISON



Year	Historical	TAF	Previous Master Plan	Current Master Plan
1975	100,755			
1980	174,199			
1985	137,245			
1990	128,691			
1995	128,369		137,434	
2000	134,483		166,400	
2005	173,738	154,582	192,300	
2010		163,007	216,250	198,300
2015		172,068	240,200	225,100
2020		181,822		253,800
2025		192,333		284,700

Table 2-29
OPERATIONS COMPARISON



Year	Historical	TAF	Previous Master Plan	Current Master Plan
1980	83,945			
1985	68,245			
1990	68,848			
1995	58,329		61,728	
2000	52,803		69,600	
2005	53,020	52,606	78,700	
2010		55,415	85,850	56,150
2015		58,251	93,000	59,320
2020		60,705		62,540
2025		63,273		65,790

Table 2-30
TAF COMPARISON

Description	Year	Master Plan Forecast	TAF Forecast	Percent Higher / (Lower)
ENPLANEMENTS				
Base Year	2005	173,738	154,582	12.4%
Base Year + 5 Years	2010	198,300	163,007	21.7%
Base Year + 10 Years	2015	225,100	170,202	32.3%
Base Year + 20 Years	2025	284,700	190,167	49.7%
TOTAL OPERATIONS				
Base Year	2005	53,020	52,606	0.8%
Base Year + 5 Years	2010	56,150	55,415	1.3%
Base Year + 10 Years	2015	59,320	58,251	1.8%
Base Year + 20 Years	2025	65,790	63,273	4.0%
BASED AIRCRAFT (excludes On Demand Passenger Service))				
Base Year	2005	71	79	-10.1%
Base Year + 5 Years	2010	74	80	- 7.1%
Base Year + 10 Years	2015	78	81	- 3.8%
Base Year + 20 Years	2025	86	83	3.1%

2.10 SUMMARY OF FORECASTS

Table 2-31 presents a summary listing of the aviation demand forecasts at the Airport. These projections are used in the next chapter of the master plan to assess the capacity of existing facilities and determine facility expansions or improvements needed to satisfy future activity levels.

Table 2-31
FORECAST SUMMARY

Description	2005	Planning Activity Level 1	2	3	Average Annual Growth (2005 - 2025)
ENPLANEMENTS					
Annual	173,738	198,300	225,100	284,700	2.5%
Peak Month	17,517	19,994	22,696	28,705	
Average Day	565	645	732	926	
Peak Hour	140	160	182	230	
ANNUAL OPERATIONS					
Commercial Service					
Air Carrier	3,009	3,220	3,430	3,860	1.3%
Commuter	11,008	11,590	12,200	13,440	1.0%
Annual Subtotal	14,017	14,810	15,630	17,300	1.1%
General Aviation					
Local	12,413	13,050	13,700	15,110	1.0%
Itinerant	22,605	24,300	26,000	29,390	1.3%
Annual Subtotal	35,018	37,350	39,700	44,500	1.2%
Military					
Local	1,416	1,420	1,420	1,420	0.0%
Itinerant	2,569	2,570	2,570	2,570	0.0%
Annual Subtotal	3,985	3,990	3,990	3,990	0.0%
Total Annual Operations	53,020	56,150	59,320	65,790	1.1%
PEAK OPERATIONS					
Total Operations	39,003	41,340	43,690	48,490	1.1%
Peak Month	4,169	4,419	4,670	5,183	
Average Day	134	143	151	167	
Peak Hour	20	21	23	25	
Total PAX Operations	9,561	10,190	10,850	12,220	1.2%
Peak Month	928	989	1,053	1,186	
Average Day	30	32	34	38	
Peak Hour	3	3	3	4	
BASED AIRCRAFT (includes On Demand Passenger Service)	71	89	94	102	1.8%

CHAPTER 3
FACILITY REQUIREMENTS

This chapter focuses on the existing and future facility needs of Bismarck Airport. The facility needs and direction for the future of the Airport are based on the existing facilities, forecast aviation activity, and the City's strategic vision and goals for the future of the Airport. Specific facility expansion and airport development alternatives to meet the future facility requirements are addressed in the subsequent chapter.

As discussed in the Aviation Demand Forecast, the master plan derives forecasts and facility needs based on planning activity levels (PALs). This ensures facilities are not built until justifying activity levels exist. Base on the forecast of activity, PALs 1, 2, and 3 correspond to 2010, 2015, and 2025, respectively.

3.1 SUMMARY

A summary of the facility development needed to accommodate the forecast activity at the Airport is provided in this section. Certain identified facilities will need further analysis based on the recommended development alternative. Key conclusions that overarch the detailed facility requirements include:

- The terminal facilities are sufficient to accommodate the forecast 20-year demand.
- Additional vehicle parking in the terminal area is needed.
- The length of the primary runway, Runway 13/31, is sufficient for existing operations. The master plan recommends protecting for a 1,206-foot extension based on the City of Bismarck's strategic vision for air cargo aircraft operations associated with the Northern Plains Commerce Centre (NPCC).
- The crosswind runway, Runway 3/21, should be extended to 7,200 feet and widened an additional 50 feet to facilitate the City of Bismarck's strategic vision to accommodate expanded cargo operations.
- Not withstanding the proposed runway extensions mentioned previously, the existing airfield is sufficient to accommodate existing and forecast aircraft operations, aircraft parking, and ground handling.
- Taxiway "C" separation near the Runway 13 end needs to be increased to comply with FAA design standards.
- Existing cargo aircraft parking, ground handling operations, and corporate aircraft hangars should be segregated from other general aviation facilities.
- Facility improvements are needed to provide a clear line of sight from the air traffic control tower to all controlled aircraft movement areas.
- General aviation ramp should be realigned to aid in the segregation of cargo aircraft operations from the general aviation facilities
- The aircraft rescue and firefighting facility is in need of upgrades to meet federal operating regulations, accommodate existing and future vehicles, and efficiently conduct operations.
- Airport maintenance facilities are currently in need of expansion.

- Airfield pavements and access roads need continued maintenance.
- Continue to implement new GPS approaches to all runway ends as the FAA reactivates Navaids and improves ADS-B radar separation.

3.2 GENERAL

The remainder of this chapter provides the detailed methods and logic upon which the facility requirements are based. After establishing the Airport's role and service level and evaluating the recommended FAA design standards, the chapter describes the needs of the Airport to meet both demand and the City of Bismarck's strategic vision for the Airport. Areas examined include airfield and airspace, passenger service, general aviation, aviation support facilities, and airport access needs.

3.2.1 Airport Role and Service Level

Bismarck Airport is identified in the FAA's National Plan of Integrated Airports System (NPIAS) as a commercial service primary airport. A commercial service primary airport is defined as a passenger service airport that has more than 10,000 annual passenger enplanements in the U.S. on aircraft in service in air commerce.

3.2.2 Critical Aircraft Identification and Airport Reference Code

To determine airfield facility requirements, FAA planning guidelines recommend the identification of an existing and future design aircraft. The design aircraft is typically defined as the most demanding aircraft in terms of size and/or facility needs that performs, or is projected to perform, at least 500 annual operations at an airport. At airports designed to accommodate multiple types of traffic, the runways, taxiways, and aprons, may have different design aircraft. For example, one runway may be designed to accommodate general aviation aircraft and another designed to serve commercial service aircraft.

The airport reference code (ARC) is a coding system used by the FAA to relate airport design criteria to the operational and physical characteristics of the aircraft intended to operate at an airport. The ARC is defined by a letter designating the aircraft approach category, which relates to the approach speed of an aircraft, and a Roman numeral designating the design group, which refers to the wingspan and tail height. The FAA's aircraft approach categories and airplane design groups are listed in Table 3-1.

Table 3-1
AIRCRAFT APPROACH CATEGORY AND AIRPLANE DESIGN GROUP

Approach Category	Approach Speed	
Category A	Speed less than 91 knots	
Category B	Speed 91 knots to less than 121 knots	
Category C	Speed 121 knots to less than 141 knots	
Category D	Speed 141 knots to less than 166 knots	
Category E	Speed 166 knots or more	
Design Group	**Wingspan**	**Tail Height**
Group I	Less than 49 feet	Less than 20 feet
Group II	49 feet to less than 79 feet	20 feet to less than 30 feet
Group III	79 feet to less than 118 feet	30 feet to less than 45 feet
Group IV	118 feet to less than 171 feet	45 feet to less than 60 feet
Group V	171 feet to less than 214 feet	60 feet to less than 66 feet
Group VI	214 feet to less than 262 feet	66 feet to less than 80 feet

The existing design aircraft at Bismarck Airport is the Airbus A320. The A320 is an ARC C-III aircraft; it has a wingspan of 112 feet and an approach speed of 138 knots. Based on the design group criteria alone it could be recommended that the airfield be designed to meet Design Group III standards. However, the majority of the Airport is currently designed to ARC D-IV standards and, while not conducting enough operations to be the design aircraft, there are a number of ARC D-IV aircraft currently operating at the Airport.

In addition, the forecast anticipates the use of B767-300F, a widely used cargo aircraft designed to provide excellent fuel efficiency and operational flexibility. Therefore, the future design aircraft for Bismarck Airport is the B767-300F. The B767-300F is an ARC D-IV; it has a wingspan of 156 feet and an approach speed of 147 knots. Therefore, based on existing airfield design characteristics and the future design aircraft, it is recommended that the existing and future design ARC remain a D-IV.

3.2.3 Wind Coverage

The prevailing winds generally determine runway orientation and the need for a crosswind runway. FAA planning standards recommend that a runway system should provide a minimum of 95 percent wind coverage. If a single runway cannot provide this level of coverage, than an additional crosswind runway may be needed.

A runway wind coverage analysis was conducted using the FAA's Airport Design Microcomputer Program Version 4.2D and data supplied by National Climatic Data Center from the weather reporting station at Bismarck Airport. Weather data covered the 10 year period between 1995 and 2004.

Acceptable maximum crosswind components are generally defined as they relate to the size and performance of an individual aircraft. Smaller general aviation aircraft have a maximum crosswind component of 10.5 knots, while larger and higher performance aircraft can sustain higher crosswinds. Considering the smaller aircraft and a 10.5 knot crosswind, Runway 13/31 provides 94 percent or better wind coverage for all-weather conditions and 88 percent or better wind coverage for Instrument Flight Rules (IFR) conditions, as shown in Table 3-2. For the primary runway, at 13 and 20 knots components, coverage is nearly 100 percent. The combined runway system at the Airport provides

100 percent wind coverage during all-weather and IFR conditions. Therefore, the current runway configuration at the Airport is adequate with respect to providing sufficient wind coverage.

Table 3-2
WIND COVERAGE FOR INDIVIDUAL RUNWAY ENDS

	All Weather				IFR			
	Crosswind Component (kts)				Crosswind Component (kts)			
Runway	**10.5**	**13**	**16**	**20**	**10.5**	**13**	**16**	**20**
3/21	79.3%	86.7%	94.1%	97.0%	78.7%	85.9%	92.5%	96.2%
13/31	94.0%	97.2%	99.3%	99.9%	87.7%	93.3%	97.9%	99.5%
Combined	98.3%	99.8%	99.9%	100.0%	97.6%	99.4%	99.9%	100.0%

Source: National Climatic Data Center
Bismarck Airport Reporting Period: 1995-2004

3.3 AIRFIELD REQUIREMENTS

The airfield is the system of components upon which aircraft operate. Airfield requirements are affected by demand capacity; runway and taxiway design standards; airspace; and navigational and visual aids. For planning purposes, it is assumed that airfield components generally do not affect the capacity of another component. Therefore, the capacity of the entire airfield is governed by the component that is most restrictive.

3.3.1 Airfield Demand Capacity

Airfield capacity is an estimate of the number of aircraft that can be processed through the airfield system during a specific period of time with acceptable levels of delay. The airfield demand capacity analysis prescribed for use by the FAA in Advisory Circular 150/5060-5, *Airport Capacity and Delay*, identifies the existing annual capacity, referred to as the annual service volume, and hourly capacity at an airport based on the current operational characteristics. The level of delay that is acceptable to a particular airport may differ from the level deemed acceptable at a similar airport. As a result, the level of delay can influence the estimated capacity for a given airfield.

Major factors that affect airfield capacity include the runway configuration, air traffic control operating procedures, weather conditions, and aircraft fleet mix. For instance, required separation distances between aircraft are greatly increased during inclement weather. As a result, the number of aircraft that can operate at an airport under instrument meteorological conditions will be much less than during visual meteorological conditions. Similarly, the other factors identified would have an effect on overall airfield capacity.

The goal of this analysis is to determine the airfield capacity, annual service volume, and the sufficiency of the runways to handle the peak hour and annual demand. The values developed are compared to the long-range forecasts for the Airport to determine whether any shortfalls exist.

Airfield capacity calculations use a metric referred to as the mix index. The mix index is equivalent to the percent of medium-sized aircraft in the mix, such as large corporate jets and the A320, plus three times the percent of large-sized aircraft in the mix, such as the 767-300. The mix index is a factor in the annual service volume and hourly capacity for an airfield. The mix index can range between zero and 180, where smaller indexes reflect predominately small aircraft in the operational fleet mix and higher indexes represent a larger aircraft fleet mix.

This master plan employs the FAA capacity and delay calculations for long range planning. This method identifies several ranges for mix indexes, with fixed annual service volume (ASV) and hourly capacity with each range. The master plan analysis focuses on the capacity and ASV for a single runway. Bismarck Airport had a mix index of 42.8 in 2005. This index is at the high end of the methodology's second range, which includes mix index values between 21 and 50. A nominal decrease in the mix index from 42.8 to 41.4 is expected over the planning period. With implementation of cargo operations associated with the NPCC and increased regional passenger service, the mix index decreases further to 38.8. In either scenario, the mix indexes remain in the same FAA planning range so the capacity and annual service volume remain the same. Results of the long-range capacity analysis are shown in Table 3-3.

Table 3-3
COMPARISON OF FORECAST OPERATIONS AND AIRFIELD CAPACITY

		Planning Activity Level		
	2005	**1**	**2**	**3**
Hourly Capacity				
VFR	74	74	74	74
IFR	57	57	57	57
Peak Hour Operational Demand / Hourly Demand Capacity	20	21	23	25
VFR	27%	28%	31%	34%
IFR	35%	37%	40%	44%
Annual Operational Capacity	195,000	195,000	195,000	195,000
Forecast Annual Operational Demand	53,020	56,150	59,320	65,790
Annual Demand / Capacity	27%	29%	30%	34%

Source: FAA Advisory Circular 150/5060-5 Airport Capacity and Delay
Note: VFR = Visual Flight Rules, IFR = Instrument Flight Rules

Table 3-3 also shows that the forecast annual operations are well below the ASV throughout the planning period. Similarly, forecast peak hour demand is well below the hourly capacity throughout the planning period. Therefore, additional airfield capacity is not needed.

3.3.2 Runway Analysis

The runway analysis addresses the ability of the existing runways at the Airport to accommodate the forecast demand. At a minimum, runways must have the proper length, width, and strength to meet FAA recommended design standards to safely accommodate the design aircraft. This section analyzes specific runway criteria and makes recommendations based on the forecast.

3.3.2.1 Runway Designation

Runway designations provided on each runway, indicate the runway orientation according to the magnetic azimuth. Since the magnetic azimuth changes over time, this section examines the amount of magnetic drift that has occurred to assure that the current designations are appropriate. The runway designation consists of a number and, on parallel runways, is supplemented with a letter. The designation number represents the whole number nearest the magnetic azimuth, divided by 10, when

viewed from the direction of approach. For example, where the magnetic azimuth is 163°, the runway designation is 16, and for a magnetic azimuth of 27°, the runway designation is 3.

The magnetic azimuth is determined by correcting the runway's true bearing for magnetic declination. At Bismarck Airport the current magnetic declination is 7° 18' East or 7.33°. Since the magnetic declination is easterly, the magnetic azimuths associated with the runways at the Airport are determined by subtracting the declination value from the true bearing values. The analysis conducted to determine the designations of the runways at the Airport is predicated on information obtained from the National Oceanic and Atmospheric Administration (NOAA).

The true bearing information, shown in Table 3-4 for all runways, is obtained from actual survey data. The runway magnetic azimuths for Runway 13/31 and 3/21 are currently several minutes from requiring runway markings re-designation. With the Airport's annual magnetic declination rate of change of 0^0 9' West per year, it is unlikely that either runway will require re-designation during the planning period. However, at the time either runway is rehabilitated or re-marked, the magnetic azimuth should be reevaluated to ensure that it meets the current magnetic azimuth.

Table 3-4
TRUE RUNWAY BEARING

Runways	Runway True Bearing	Magnetic Declination	Runway Magnetic Azimuth
Runway 13	137° 34' 48.00"	7° 18' East	130° 16' 48.00"
Runway 31	317° 36' 00.00"	7° 18' East	310° 18' 00.00"
Runway 3	039° 01' 12.00"	7° 18' East	031° 43' 12.00"
Runway 21	219° 02' 24.00"	7° 18' East	211° 44' 24.00"

Source: National Geophysical Data Center

3.3.2.2 Design Standards

The FAA recommends runway design standards based upon the design aircraft. The existing design aircraft at Bismarck Airport is the A320 and the future design aircraft is the B767-300F. The FAA recommended design standards shown in Table 3-5 reflect the recommended design standards for the primary and crosswind runway. In addition, the existing design standards for each runway are identified. As portions of an airfield may be designed to meet one standard, while other areas may be designed for another, additional taxiway and taxilane design standards may be identified to serve particular development areas on the airfield.

Table 3-5
RUNWAY DESIGN STANDARDS

Items	D-IV	Rwy 13/31	Rwy 3/21
Runway Width	150'	150'	100'
Runway Shoulder Width	25'	0'	0'
Runway Blast Pad Width	200'	150'	140'
Runway Blast Pad Length	200'	200'	200'
Runway Safety Area Width	500'	500'	500'
Runway Safety Area Length*	600'	600'	600'
Runway Safety Area Length**	1,000'	1,000'	1,000
Runway Object Free Area Width	800'	800'	800'
Runway Object Free Area Length**	1,000'	1,000'	1,000'
Runway Obstacle Free Zone (ROFZ) Length**	200'	250'	200'
ROFZ Inner-Approach OFZ Length**	NA	1,600' / 2,600'	NA
Runway Obstacle Free Zone Width	400'	400'	400'

Source: FAA Advisory Circular 150/5300-13
NA = not applicable
* portion prior to the runway threshold
* * portion beyond the runway end

SHOULDERS

Runway shoulders are typically provided to support aircraft that may inadvertently run off the primary pavement, to improve drainage, and/or provide erosion protection control during aircraft takeoff and landing operations. The Airport's runways do not currently have shoulders. The master plan recommends the addition of shoulders as part of the next runway rehabilitation projects.

BLAST PADS

Blast pads are added at the end of the runways to provide erosion protection control during aircraft takeoff operations. None of the blast pads are compliant with the ARC D-IV standard of 200 feet. It is recommended that all of the blast pads be upgraded to meet D-IV design standards at the time of major runway rehabilitation or runway extension.

3.3.2.3 Runway Protection Zone Analysis

For the protection of people and property on the ground, the FAA has identified an area of land off each runway end as the runway protection zone (RPZ). The size of the zones vary according to the design aircraft characteristics and the lowest instrument approach visibility minimum defined for each runway. It is desirable to have all areas within the RPZ cleared, or at a minimum, maximize ground safety through land use control measures, such as property deeds or avigation easements. The Airport should acquire all property within the RPZs as it becomes available. For paved runways, the trapezoidal-shaped RPZ is centered on the extended runway centerline starting 200 feet from the runway end. Departure surfaces and Transitional surfaces along the RPZ up to the 35' – 50' building or tree line are suggested to be acquired by the FAA as the property becomes available.

Runway 13 and 31 and have precision instrument approach procedures which utilize the instrument landing system (ILS). Runway 13 approach has a visibility minimum of ¾ mile and Runway 31 has a visibility minimum of ½ mile. Visibility minimums of less than ¾ miles have the largest runway protection zone surface, encompassing approximately 79 acres.

Runway 3 and Runway 21 both have non-precision instrument approach procedures with the lowest visibility being one mile. If Runway 3/21 non-precision approaches are upgraded to precision approach procedures, it is likely that the approaches will provide a minimum visibility of ½ mile, similar to Runway 31. The RPZ dimensional standards for the existing and forecast approach minimums are shown in Table 3-6.

Table 3-6
RUNWAY PROTECTION ZONE DIMENSIONS

	Runway 13/31		Runway 3/21	
	Existing	**Forecast**	**Existing**	**Forecast**
Length	2,500	2,500	1,700	2,500
Inner Width	1,000	1,000	500	1,000
Outer Width	1,510	1,750	1,010	1,510

Source: FAA AC 150/5300-13

It is recommended that the Airport purchase all land located within both the existing and future RPZ, departure surfaces, and transitional surfaces. If it is not feasible to own the property, avigation easements should be in place to limit equipment and building heights and ensure compatible land use.

3.3.2.4 Runway Length Requirement

The required runway length is defined by the FAA as that sufficient to accommodate 90 percent of the operational fleet on the longest reasonably expected flight stage length. For airports that need to accommodate new service opportunities to the greatest extent practical, such as Bismarck Airport, the availability to accommodate new service that would enhance airport revenues and community service is very important.

Bismarck Airport has several existing and forecast, aircraft types and destinations that figure prominently into runway length requirements. For this analysis, the master plan process preliminarily screens aircraft types using the Airport and identifies those which have greater runway length requirements.

- The current scheduled airline passenger service is provided by medium size air carrier aircraft and regional jet aircraft. Service is provided primarily to the airline hub cities of Minneapolis, Denver, and Las Vegas located between 300 and 900 nautical miles from Bismarck. The aviation forecast does not anticipate that the aircraft types providing the service or the distance to the primary destination will change throughout the planning period.
- The planned introduction of on-demand passenger service with North Dakota and adjoining states will utilize small general aviation aircraft, for which the existing runway length is sufficient.
- The North Dakota Army National Guard occasionally requires the use of large military transport aircraft for logistical support. Operations by these aircraft are infrequent.
- Large, high-performance corporate aircraft can have significant runway length requirements.
- For the anticipated large, high-performance, long range, heavy air cargo operations associated with the Northern Plains Commerce Centre, the available runway length is insufficient.

Two methods were used to determine the recommended runway lengths. The first method utilizes the FAA's Airport Design Microcomputer Program 4.2D data that supports the runway stage length

requirements based on general groups of aircraft (i.e., small and large aircraft) and is helpful in making an overall airfield assessment. The second method utilizes the aircraft manufacturers' planning manuals to determine the specific runway lengths needed for typical aircraft stage lengths and payloads and is a more accurate method to determine the recommended runway length because it is based on aircraft currently using and forecast to use Bismarck Airport.

FAA AIRPORT DESIGN MICROCOMPUTER PROGRAM

Runway length requirements based on the FAA Airport Design Microcomputer Program 4.2D, runway length calculation software, is provided in Table 3-7. This information is calculated by entering the airport elevation, average daily maximum temperature of the hottest month, the maximum difference in runway centerline elevation, and the length of haul for airplanes weighing more than 60,000 pounds.

Table 3-7
RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN

Aircraft Category	Recommended Runway Length (FT)
Small Airplanes (Less than 12,500 lbs.)	
100% of Fleet (Less than 10 Seats)	3,810
Small Airplanes (Less than 12,500 lbs.)	
100% of Fleet (10 or More Seats)	4,280
Large airplanes (Between 12,501 lbs.-60,000 lbs.)	
75% of Fleet @ 60% Useful Load	4,900
75% of Fleet @ 90% Useful Load	6,500
100% of Fleet @ 60% Useful Load	5,540
100% of Fleet @ 90% Useful Load	8,210
Large Airplanes (Greater than 60,000 lbs.)	
500 Mile Stage Length	5,250
1,000 Mile Stage Length	6,230
2,000 Mile Stage Length	7,960
3,000 Mile Stage Length	9,380
4,000 Mile Stage Length	10,480
5,000 Mile Stage Length	11,260
6,000 Mile Stage Length	11,740
7,000 Mile Stage Length	11,890

Source: FAA Airport Design Microcomputer Program 4.2D

The stage length from Bismarck to Las Vegas is approximately 1048 nautical miles. Therefore, utilizing the FAA data, the recommended runway length for large aircraft weighing more than 60,000 pounds used to serve comparably distant markets is approximately 6,230 feet.

The master plan identified potential cargo markets which could be served from Bismarck associated with the NPCC. The markets, their significance, and the associated runway length requirement are as follows:

- Memphis, as a primary hub for package freight forwarding, has a runway length requirement of approximately 6,200 feet.

- Los Angeles or New York, as major U.S. cities and primary gateways for cargo forwarding, has a runway length requirement of approximately 6,700 feet.
- Anchorage, as the primary technical stopping point aircraft bound for Pacific Rim nations, has a runway length requirement of approximately 8,100 feet.
- London, as a primary European access location, has a runway length requirement of approximately 10,700 feet.

Based on the FAA Airport Design Microcomputer Program 4.2D, the primary runway length of 8,794 feet is sufficient to serve the domestic market. In addition, the 6,600-foot long crosswind runway exceeds the length required to accommodate the lower crosswind capable aircraft.

AIRCRAFT MANUFACTURERS RUNWAY LENGTH CALCULATIONS

The second method for determining runway length requirements is based on the design aircraft. The existing design aircraft for Bismarck Airport is the Airbus A320, a typically mid-size passenger aircraft. In addition to the Airbus A320, Bismarck is also currently served by the Boeing MD-83 aircraft, which is more demanding in terms of runway length requirement and has the longest stage length of current scheduled operations. The forecast anticipates the use of B767-300F a widely used cargo aircraft, designed to provide excellent fuel efficiency, and operational flexibility. The B767-300F is more demanding in terms of runway length than both the A320 and MD-83 currently in use. The runway length requirement analysis will consider these aircraft and their potential cargo destinations.

Once the design aircraft are determined, the aircraft specific performance characteristics provided by the aircraft manufacturers are analyzed to determine specific runway lengths based on airport characteristics and operating conditions, load carried by the aircraft, and the route segment distance.

As shown in Table 3-8, the maximum payload required runway length for the existing design aircraft is 7,292 feet, and for the future design aircraft length ranges from 7,500 feet, for domestic flights to over 12,000 feet for international flights. The existing primary runway at 8,794 feet is capable of supporting both the existing and future design aircraft within the 48 contiguous states. However, to meet the City of Bismarck's strategic vision of accommodating international cargo and charter operations and to remain consistent with the existing FAA approved ALP, this master plan recommends protecting for a runway extension to 10,000 feet. This length will accommodate large aircraft over 60,000 pounds in weight and a stage length of nearly 4,000 miles.

AC 150/5325-4B, *Runway Length Requirements for Aircraft Design,* states that the crosswind runway needs to accommodate the largest ARC that does not have 95 percent wind coverage on the primary runway. Based on the wind analysis, at a minimum the crosswind runway must accommodate ARC B-II aircraft. Therefore, as the primary runway is extended to meet the City of Bismarck's strategic vision to accommodate international cargo operators utilizing ARC D-IV aircraft, the crosswind runway should also be extended. This master plan recommends protecting for a crosswind runway extension to 7,200 feet. A length that is sufficient to accommodate most large aircraft with a stage length less than 2,000 miles.

Table 3-8
SPECIFIC RUNWAY LENGTH REQUIREMENTS

Aircraft Type	Destination	Stage Length (NM)	Take-Off Length Standard Day (FT)	Take-Off Length Hot Day (FT)	Landing Length[1] (FT)
A-320	Minneapolis	386	5,000	7,292	5,000
	Denver	516	5,100	6,642	5,000
MD-83	Las Vegas	1,048	6,825	7,350	6,000
767-300	Memphis	984	7,085	7,500	6,550
	Los Angeles	1,280	7,560	8,050	6,550
	New York	1,394	7,800	8,225	6,550
	Mexico City	1,886	8,250	8,780	6,550
	Anchorage	2,173	8,785	9,840	6,550
	London	4,195	12,830[2]	12,440[2]	6,550

Notes: 1 Distance based on maximum gross landing weight and wet runway.
2 Take distance limited by maximum weight.

3.3.2.5 Pavement Strength

Pavement strength is an important criterion in determining the usability of the runways. As shown in Table 3-9, Runway 13/31 and Runway 3/21 have bearing capacities designed for the typical large air carrier aircraft using the Airport. A list of sample aircraft, gear configurations, and maximum certificated weights are listed in Table 3-10.

Table 3-9
RUNWAY WEIGHT BEARING CAPACITY

Item	Runway 13/31	Runway 3/21
Runway Length	8,794'	6,600'
Runway Width	150'	100'
Pavement Type	Asphalt	Asphalt
Pavement Strength (lbs)		
Single Wheel Gear	130,000	130,000
Dual Wheel Gear	180,000	180,000
Dual Wheel Tandem Gear	340,000	340,000

Table 3-10
AIRCRAFT BEARING CRITERIA

Aircraft Type	Gear Configuration	Maximum Weight (LBS)
Cessna 150	Single Wheel Gear	1,600
Cessna Citation III	Single Wheel Gear	22,000
Piper Seneca	Single Wheel Gear	12,050
Beech King Air C-90-1	Single Wheel Gear	9,650
Lear 35	Dual Wheel Gear	18,300
DC-9	Dual Wheel Gear	110,000
A320	Dual Wheel Gear	145,505
B-727-200	Dual Wheel Gear	209,500
A-300-600	Dual Tandem Wheel	363,763
B-767-300	Dual Tandem Wheel	350,000
DC-8-73F	Dual Tandem Wheel	355,000
DC-10-30	Dual Tandem Wheel	590,000
B-747-200	Double Dual Tandem	833,000

Source: FAA Advisory Circular 150/5300-13 & Aircraft Manufacturers

Runway 13/31 currently has weight ratings of 130,000 lbs single-wheel, 180,000 lbs dual-wheel, and 340,000 lbs dual-tandem-wheel. In order to accommodate potential cargo operations using B767-300 and B747 aircraft, the runway would require an asphalt overlay of four to six inches.

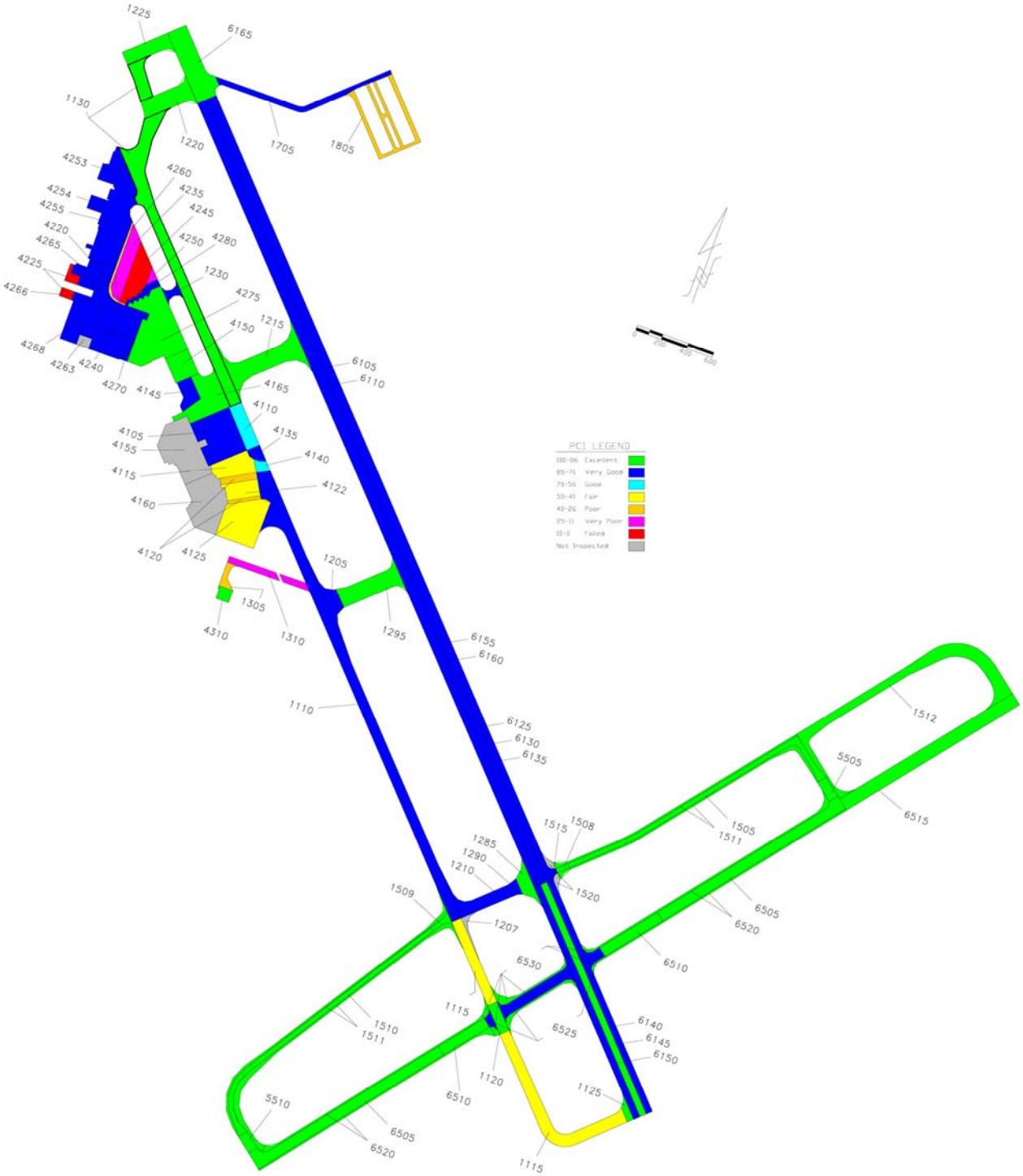
A pavement condition evaluation is a visual analysis of the primary distress manifestations exhibited on the surface of a pavement. It serves as an indicator of pavement failure mode and mechanism. The data collected is computed and presented in the form of a pavement condition index (PCI), a numerical rating index.

The pavement condition evaluation for the Airport was prepared in February 2006 and indicated that most pavement was in excellent to very good condition (see Exhibit 3-1). The pavement which was not rated as excellent or very good consists of:

- Service Road leading west from Taxiway Exit C4 to the ARFF, which was rated poor and very poor
- Southern half of terminal apron, which was rated fair and poor
- Northern half of general aviation apron, which was rated very poor to failed

It is important to note that the southern section of Taxiway C and exit Taxiway C5 had been rated fair. However, since publication of the pavement condition report, these taxiways have been improved.

Exhibit 3-1
PAVEMENT CONDITION



Source: North Dakota Aeronautics Commission

3.3.3 Taxiway Analysis

The taxiway analysis addresses specific requirements relative to the ability of the existing taxiways to accommodate the current and projected demand. At a minimum, taxiways must provide efficient circulation, have the proper strength, and meet recommended FAA design standards to safely accommodate the design aircraft.

Taxiways are classified as either:

- **Parallel** - these taxiways facilitate the movement of aircraft to and from the runway.
- **Connector** - these taxiways connect the parallel taxiways with the aprons and aircraft storage facilities.
- **Apron Taxiways** - these taxiways provide primary aircraft access on an aircraft parking apron.
- **Apron Taxilanes** - these taxilanes provide access to individual aircraft parking positions and/or hangar areas.
- **Exits** – these taxiways provide a means of entering and exiting the runway (does not include those taxiways designated as connector, parallel, or apron edge taxiway).

The Airport currently has a sufficient system of taxiways to facilitate general movement on the airfield.

3.3.3.1 Design Standards

The airport design aircraft determines taxiway design standards and dimensional criteria. Since Bismarck Airport has been built to Design Group IV standards, it is recommended that critical airfield taxiways also be designed and built to the standard FAA Design Group IV taxiway parameters. See Table 3-11.

Table 3-11
TAXIWAY DESIGN STANDARDS

	Design Group	Taxiway	
	IV	C	D
Centerline Separation			
Runway to Taxiway	400	700	600
Taxiway to Taxiway	215	NA	NA
Taxiway Width	75	75	60
Taxiway Shoulder Width	25	0	0
Taxiway Safety Area Width	171	171	171
Taxiway Object Free Area Width	259	259	259

Source: FAA Advisory Circular 150/5300-13

With the exception of Taxiway D width, both taxiways comply with the recommended design standards for ARC D-IV.

SHOULDERS

Taxiway shoulders are typically provided to support aircraft that may inadvertently run off the primary pavement, to improve drainage, and/or provide erosion protection control. The Airport's taxiways do not have shoulders. It is recommended that shoulders be added at the time of taxiway reconstruction or improvement.

3.3.4 Airfield Electrical Service

The existing electrical vault is located adjacent to the recently constructed terminal. Its location encroaches on the air carrier apron and limits expansion. It is recommended that the electrical vault be relocated during Planning Activity Level 1.

3.3.5 Airfield Signage

The FAA recommends that all airports install a system of runway and taxiway guidance signs in accordance with the standards found in FAA Advisory Circular 150/5340-18C, *Standards for Airport Signage Systems*. Guidance signs include mandatory holding position signs for runway/runway and runway/taxiway intersections, ILS critical areas, and runway approach areas. Additional taxiway guidance signs include runway and taxiway location, runway exit, taxiway direction, inbound/outbound destination, and information signage. The signage plan for the Airport was completed in 2006 and is filed with the FAA.

3.4 AIRSPACE

The national airspace system consists of various classifications of airspace that are regulated by the FAA. Airspace classification is necessary to ensure the safety of all aircraft utilizing the facilities during periods of inclement weather.

3.4.1 Capacity Enhancements / Operational Efficiency

The current Class D Airspace is adequate for the existing and future operational requirements expected at the Airport. When the ATCT is not in operation between 12AM and 6AM, Class E airspace applies and is adequate for the existing operational requirements. At the time that there is a significant increase in cargo activity the adequacy of the Class D airspace and part time tower will need to be revisited. A significant increase in cargo activity could demand a 24-hour operational tower.

3.4.2 Navigational Aids

NAVAIDs consist of equipment that helps pilots locate the Airport and provides horizontal or a combination of horizontal and vertical guidance information. The runways have appropriate navigational aids that are properly sited and in working condition. Both ends of Runway 13/31 have an ILS that utilizes glide slope, approach lighting systems, and localizers. Runway 13 and Runway 31 meet Category I landing requirements, which require ceilings above 200 feet and visibility greater than 1/2 statute miles.

In addition to the traditional ground based approaches currently in place at Bismarck Airport, the Airport currently has wide area augmentation system (WAAS) localizer performance with vertical guidance (LPV) instrument approaches. These approaches are the equivalent of ground based ILS

approaches. LPV approaches as well as a GPS approach is currently in place on Runways 3 and 31. The Airport is currently awaiting the release of an LPV approach for Runway 21.

3.4.3 Visual Aids

Visual aids enhance the pilot's visual information when visibility is poor and at night, it is essential to provide visual aids that will be as meaningful to a pilot as possible. These aids can provide pilots information based on their horizontal and vertical position by providing data regarding the aircraft's alignment, height and distance, rotation, and information concerning the rate of descent and the rate of closure with the desired path. The visual aids at the Airport include runway lighting, rotating beacon, threshold lights, visual approach slope indicator (VASI), precision approach path indicator lights (PAPI), and runway end identifier lights (REIL). With the exception of the VASI, all of the existing visual aids are in serviceable condition and need only routine maintenance.

The VASI system at the Airport consists of four bars that appear to project a red or white light depending on the position of the aircraft in reference to the glideslope. Runway 13 is equipped with visual approach slope indicator system (VASI-4) to provide visual descent guidance to the runway. PAPIs are the current standards for visual descent guidance and are already installed on Runways 3, 21, and 31. The FAA is currently scheduled to replace the VASI on Runway 13 with a PAPI.

3.5 PASSENGER TERMINAL

Passenger terminal facilities at the Airport include the terminal building, terminal curbfront, main aircraft gate positions, and commercial service apron. These areas are specifically designed to serve passengers utilizing commercial airline service at the Airport.

Given that the terminal is new and well designed to accommodate current needs, this section evaluates the future ability of the existing passenger terminal building to accommodate the forecast commercial service operations and enplanements. The critical forecast demand areas include the aircraft gates, terminal curbfront, and vehicle parking availability. A brief discussion of the terminal building is provided below, followed by detailed analysis of the aircraft gates, apron, terminal curbfront, and vehicle parking.

3.5.1 Terminal Building

The terminal building at Bismarck Airport was constructed in 2005 and is anticipated to meet the activity demand throughout the planning horizon. As such, no new expansion efforts are anticipated. However, the Airport has expressed a need for the establishment of Federal Inspection Services (FIS).

3.5.2 Aircraft Gate Positions

The terminal provides flexibility for accommodating a variable fleet mix and currently provides parking for regional jet, narrowbody, and widebody (accommodated on Gate Number One only) aircraft. The current configuration provides for four aircraft parking positions, served by three passenger loading bridges. Given the Air Transport Association's guidance that a gate should accommodate between four and six departures per gate per day, Bismarck Airport meets the current demand and no additional gates are needed at this time.

3.5.2.1 Existing Gates

Bismarck Airport accommodates a variety of aircraft, including regional jets, narrowbody, and widebody aircraft (see Table 3-12). Gate 1, located on the southern side of the terminal building, can accommodate aircraft ranging in size from a regional jet to a widebody. Gate 2, the southern gate on the face of the building, and Gate 3, the northern gate on the face of the building, can accommodate aircraft ranging in size from a regional jet to a large narrowbody. The passenger loading bridge located at Gate 3 serves two aircraft parking positions.

Table 3-12
EXISTING GATE DEMAND AND CAPACITY

Aircraft Size Categories	Typical Aircraft	Gate Count		
		Demand	RON[1]	Existing
Turboprop	Dash 8	0	0	0
Small Regional Jet	CR200	1	1	0
Large Regional Jet	CR700	0	0	0
Small Narrowbody	B737-300, DC-9	0	1	0
Large Narrowbody	A320, B737-800, B757	2	1	3
Widebody	B767	0	0	1
Total		3	3	4

[1] RON (Remain Over Night)

Gate frontage is a measure of the linear length along the terminal within which aircraft may be parked and is an additional measure of gate capability for the existing terminal. The gate frontage demand is a function of the quantity and types of aircraft parked at the terminal at a given time, and the space required for each aircraft. A comparison of the available gate frontage relative to the demand offers a measure of gate utilization.

The gate frontages required by the existing peak hour demand and remain over night (RON) aircraft are 351 feet and 331 feet, respectively, and are shown in Table 3-13. This table also shows the existing terminal apron configured for the parking of four large narrowbody aircraft, and the associated frontage of 532 feet. The total available gate frontage at Bismarck Airport as measured along the face of the concourse is approximately 438 feet. However, as aircraft parking at the terminal wraps around the building, the available frontage is not simply the 438 foot distance along the face of the building. Instead, the available frontage is based on the ability to park additional aircraft wrapping around the building corners, and the actual available frontage is 668 feet.

Table 3-13
EXISTING GATE FRONTAGE DEMAND

Aircraft Size Categories	Wingspan (LF)	Gate Count			Frontage (LF)		
		Demand	RON	Existing	Demand	RON	Existing
Turboprop	70	0	0	0	0	0	0
Small Regional Jet	85	1	1	0	85	85	0
Large Regional Jet	92	0	0	0	0	0	0
Small Narrowbody	113	0	1	0	0	113	0
Large Narrowbody	133	2	1	3	266	133	399
Widebody	160	0	0	1	0	0	160
Total		3	3	4	351	331	559

3.5.2.2 Future Gate Requirements

Three forecasts of peak hour operations were developed in Chapter 2, Aviation Demand Forecasts, and defined as planning activity levels. These forecasts are based on a growth in the number of airlines serving the Airport, an increase in markets served, or a combination thereof.

The facility requirement analysis is based on peak hour operations equaling approximately 80 percent of the peak hour arrivals and departures, and peak hour gate requirements equaling approximately 75 percent of peak operations. Table 3-14 shows that at the forecast operation levels, the daily gate utilization is five to six turns per day. Air Transport Association guidance indicates that gate utilization rates between four and six departures per gate per day are considered good utilization. The recommended gate sizes for the forecast demand are shown in Table 3-15..

Table 3-14
FUTURE GATE REQUIREMENTS AND UTILIZATION

		Planning Activity Level		
	2005	1	2	3
Average Day Operations	30	32	34	38
Peak Hour Departures	3	3	3	4
Peak Hour Arrivals	3	3	3	3
Peak Hour Operations	3	3	3	4
Number of Gates	3	3	3	3
Utilization				
Per Day	5	5	6	6
Per Hour	1	1	1	1

Table 3-15
FUTURE OPERATIONAL GATE SIZE REQUIREMENTS

Aircraft Size Categories	2005	Planning Activity Level		
		1	2	3
Turboprop	0	0	0	0
Small Regional Jet	1	2	1	0
Large Regional Jet	0	0	1	2
Small Narrowbody	0	0	0	1
Large Narrowbody	2	1	1	1
Widebody	0	0	0	0
Total	3	3	3	4

The gate frontage requirements associated with the forecast operation fleet mix demand are presented in Table 3-16. During Planning Activity Level 2 and 3 the gate utilization is forecast to reach the high end of the recommended guidance of six departures per gate per day and it is recommended that planning occur to provide additional gates. The existing terminal has sufficient frontage to accommodate the forecast growth under all three planning activity levels; therefore, it is recommended that the planning for additional gates consist of a realignment of the existing aircraft parking and gate positions to accommodate the increased demand.

Table 3-16
FUTURE GATE FRONTAGE REQUIREMENTS

Aircraft Size Categories	Wingspan (LF)	2005	Planning Activity Level		
			1	2	3
Turboprop	70	0	0	0	0
Small Regional Jet	85	85	170	85	0
Large Regional Jet	92	0	0	92	184
Small Narrowbody	113	0	0	0	113
Large Narrowbody	133	266	133	133	133
Widebody	160	0	0	0	0
		351	303	310	430

3.5.3 Apron

Frontage associated with the terminal gates is a measure of the linear feet of terminal apron interface needed. This dimension can vary as a function of the gate operational mode (i.e. power-in/power-out versus power-in/push-out) and the minimum wingtip clearances between aircraft. Industry standards for wingtip clearances are:

- Turboprops and regional jets = 10 feet
- Narrowbody and B757 = 20 feet
- Widebody = 25 feet

The gate frontage, discussed in detail in the preceding section, is a dimension measured across the face of the terminal within the aircraft parking area. This dimension indicates the number of aircraft that can be parked at the same time. The total gate frontage available at Bismarck Airport is 668

linear feet, of which 438 linear feet is prime frontage and the remaining 230 feet is located on the sides of the terminal building. Future gate frontage requirements, identified in Table 3-16, require only 430 linear feet of frontage.

An additional measure of the ability for a terminal apron to accommodate forecast growth is the depth of the apron. In addition to aircraft length, clearance from service roads within the aircraft parking must be accounted for. Typically clearance from service road area is 10 feet for all aircraft types. The existing apron depth at Bismarck Airport is 453 feet, excluding Taxiway C and the associated object free area. The largest widebody aircraft is approximately 230 feet. Therefore, with the addition of the 10 foot service road, the apron provides an additional 213 feet of depth. With the assumption that the apron depth is fully usable and not subject to other FAA design standards it is more than adequate for the forecast demand.

3.5.4 Terminal Curbfront

The terminal curbfront at Bismarck Airport was reconstructed in 2005. The existing curbfront is configured as six at-grade lanes, all one directional with 16-foot lane widths. The inner circulation loop has four lanes servicing departures and arrivals. The inner lanes are used for loading and unloading passengers and the outer two lanes are used as through lanes. The outer circulation loop has two lanes servicing taxis and shuttle vans, the inner lane is used for passenger loading and unloading and the outer lane is used as a through lane. The inner four lanes and outer two lanes are separated by a curbed median. The frontage allocation is shown in Table 3-17.

Table 3-17
TERMINAL CURBFRONT ALLOCATION

	Inner Curb	Outer Curb
Crosswalk	42	10
Effective Length	558	250
Total Length	600	260

A total physical length of 600 feet is available on the inner curb, including the walkway that extends approximately 140 feet to the west and east of the terminal. The outer curb is approximately 260 feet in length. Excluding the crosswalks, the effective length of the inner and outer curb is 558 feet and 250 feet, respectively. Considering that double parking is possible with the inner curb second lane configuration, an additional 50 percent of effective curb length is available for enplaning or deplaning passenger traffic.

The capacity of the curbfront is estimated using the foot-minute concept. This method reflects the dynamic operations uses of curbfront area by vehicles of multiple length and variable dwell times. A summary of the terminal curbfront capacity is provided in Table 3-18.

Table 3-18
TERMINAL CURBFRONT CAPACITY

	Capacity (Vehicles)			Peak 20 Minute Capacity (Vehicles)		
	Single Lane		Dual Lane	Single Lane		Dual Lane
	Inner	Outer	Inner	Inner	Outer	Inner
Enplaning	14	6	17	14	6	17
Deplaning	14	6	17	14	6	17
Total	28	13	34	28	13	34
	Hourly Capacity (ft-min)			**Peak 20 Minute Capacity (ft-min)**		
	Single Lane		Dual Lane	Single Lane		Dual Lane
	Inner	Outer	Inner	Inner	Outer	Inner
Enplaning	16,740	7,500	25,110	5,580	2,500	8,370
Deplaning	16,740	7,500	25,110	5,580	2,500	8,370
Total	33,480	15,000	50,220	11,160	5,000	16,740

Vehicle demand for curbfront space tends to surge within an hour time frame, creating peaking that coincides with typical movements associated with passenger enplanements and deplanements. However, the surges are limited in time and abate quickly. In addition, security procedures limiting the permitted dwell time of curb vehicles has had a positive effect on curbfront operations.

Based on the available terminal curbfront capacity, the terminal curbfront demand capacity is shown in Table 3-19.

Table 3-19
TERMINAL CURBFRONT DEMAND CAPACITY

Curb	2005	Planning Activity Level		
		1	2	3
Peak Hour				
Enplaning	11.2%	12.7%	14.5%	18.3%
Deplaning	11.2%	12.7%	14.5%	18.3%
Peak 20 Minutes				
Enplaning	16.7%	19.1%	21.7%	27.5%
Deplaning	16.7%	19.1%	21.7%	27.5%

As a result of the surge characteristics, the peak 20-minute relationship is the more important indicator of requirements than the peak hour relationship, and it is a better basis for the definition of facility requirements. The enplaning curb presently operates at 17 percent of capacity. It is forecast to increase to 28 percent by the third planning activity level and will remain adequate. Similarly, the deplaning curb is presently operating at approximately 17 percent capacity. The deplaning curb is forecasted to increase to 28 percent by the third planning activity level, and will also remain adequate.

Since the walkway between the terminal and the terminal curb extends approximately 140 feet to the west and east of the terminal, an analysis of only the 320 feet of inner curbfront immediately south of the terminal was also undertaken. In brief, the existing peak 20-minute terminal curbfront demand

capacity would still be acceptable at 37 percent. By Planning Activity Level 3, the demand/capacity ratio is approximately 55 percent.

3.5.5 Vehicle Parking

In order to determine the future parking requirements a ratio of parking spaces per enplanements has been utilized. The industry norm for medium to small hub airports is a ratio of 3.5 to 4.0 spaces per 1,000 enplanements. Several factors, such as the high percentage of passengers driving to Bismarck Airport, lack of private off-airport parking, and lack of mass transit availability affect the standard ratio. Therefore, for the purposes of facilities planning the higher ratio of 4.0 spaces per 1,000 enplanements is applied to determine existing and future parking requirements.

As an additional consideration, each parking area is assumed to have a maximum utilization rate of 90 percent. This utilization rate, which is also an industry norm, is intended to avoid excessive circulation of vehicles in search of parking. Therefore, the maximum 90 percent utilization has been applied to each planning activity level.

Based on the passenger forecast for annual enplanement levels, the existing parking capacity is not capable of supporting the forecast demand. The existing and future parking demand levels for the passenger forecast are shown in Table 3-20.

Table 3-20
VEHICLE PARKING

	2005	Planning Activity Level		
		1	2	3
Annual Enplanements	173,738	198,300	225,100	284,700
Public Parking				
Required	764	873	990	1,253
Available	518	518	518	518
Additional Needed	246	355	472	735
Employee				
Required	78	89	101	128
Available	78	78	78	78
Additional Needed	0	11	23	50
Total				
Required	842	962	1,091	1,381
Available	596	596	596	596
Additional Needed	246	366	495	785

Note: An additional 77 parking spaces were added in 2007.

The difference in the number of short-term and long-term parking spaces typically varies between 10 to 20 percent. The short-term parking ratio at Bismarck Airport, including the additional 77 parking spaces added in 2007, is 32 percent of the total spaces. The increased ratio is a result of the Airport providing 20 minutes of free parking in the short term parking lot to aid passenger pick up and drop off. Therefore, to maintain the same level of service, it is recommended that the Airport continue to

provide a similar short-term parking ratio of 30 percent. The forecast number of required short-term spaces and long-term sparking paces is provided in Table 3-21.

Table 3-21
SHORT AND LONG-TERM PARKING REQUIREMENTS

	2005	Planning Activity Level		
		1	2	3
Total Parking Required	764	873	990	1,253
Short-Term Parking				
Required	229	262	297	376
Available	193	193	193	193
Additional Needed	36	69	104	183
Long-Term Parking				
Required	535	611	693	877
Available	325	325	325	325
Additional Needed	210	286	368	552

Since both short and long-term parking is inadequate throughout the planning horizon for the passenger forecast, it is recommended that the Airport begin planning for additional parking expansion in the immediate future to accommodate the current demand, as well as prepare for the forecast increase in enplanement levels.

3.6 GENERAL AVIATION

General aviation itinerant and based aircraft facility requirements at an airport primarily consist of fixed base operator services, hangar storage, and apron space. Future facility requirements require an analysis of the existing and future general aviation operations, based aircraft levels, and the capacity and condition of existing facilities.

3.6.1 Fixed Base Operators

The current provision of services to general aviation is considered sufficient to meet existing demand. However, business opportunities exist to provide differing types of FBO services than those that are currently provided at the Airport. It is recommended that the Airport identify sites suitable for additional FBO development.

3.6.2 Hangars

The amount of general aviation hangar space required at an airport is often a function of the local weather conditions, aircraft type, airport security, and user preference. Airports that experience moderate weather conditions generally store less than 20 percent of the based aircraft in hangars. Airports that experience extreme weather conditions, such as severe winter temperatures and precipitation, generally store greater than 80 percent of the based aircraft in hangars.

The smaller single-engine aircraft and light multi-engine aircraft may be stored in individual t-hangar units. However, conventional hangars, which can vary in size from small box hangars to large corporate hangars, are capable of storing multiple aircraft.

Nearly 100 percent of all based aircraft at Bismarck Airport are stored in either conventional or t-hangars. Analysis conducted to determine the number and type of hangar facilities required assumed that the existing ratio of aircraft in hangars would remain consistent throughout the planning period and that based aircraft covered storage will continue to consist of a combination of conventional and t-hangars. At Bismarck Airport, on average, each conventional hangar stores an average of six single or multi-engine aircraft, or three jets. The forecast facility requirements are shown in Table 3-22.

Table 3-22
GENERAL AVIATION HANGAR REQUIREMENTS

	2005				Planning Activity Level											
					1				2				3			
	SEP	MEP	Jet	Total	SEP	MEP	Jet	Total	SEP	MEP	Jet	Total	SEP	MEP	Jet	Total
Total Based Aircraft	51	13	7	71	66	15	8	74	67	18	9	78	68	22	13	86
Based Aircraft in Hangars	48	12	7	68	63	14	8	85	64	17	9	90	65	21	13	99
T-Hangar:																
Required Units	9	0	0	9	14	0	0	14	14	0	0	14	14	0	0	14
Total Available Units				10				10				10				10
Total Additional Units Needed				0				4				4				4
Conventional Hangars[1]:																
Required Units	7	2	2	11	8	2	3	13	8	3	3	14	8	3	4	16
Total Available Units				10				10				10				10
Total Additional Units Needed				1				3				4				6

[1] Assumes six SEP/MEP or three jet aircraft per conventional hangar.

Based on this assumption, four additional t-hangars and two additional conventional hangars will be needed to accommodate additional aircraft by Planning Activity Level 3. Although this analysis assumes that each conventional hangar will store six propeller or three jet aircraft, it is important to note that conventional hangars may be built to accommodate more or less than these quantities. Therefore, the conventional hangar size and capacity numbers are dependent upon the tenants demand requirements.

3.6.3 Apron

Existing general aviation aircraft apron at the Airport consist of various areas for parking, aircraft tie-down, circulation, and general aircraft movement to and from parking and storage hangars. Demand for general aviation apron space is driven by itinerant aircraft and based aircraft not desiring hangar storage. Determination of future general aviation apron requirements necessitates an assessment of the general aviation aircraft fleet mix, daily aircraft parking demand, and space planning considerations. Apron sizing for tie-down positions varies according to the aircraft size and also includes space for circulation.

The general aviation apron located north of the commercial passenger terminal provides approximately 62,000 square yards of usable apron. Based on the general aviation demand forecast for both based and itinerant aircraft, no additional general aviation aircraft apron is required throughout the 20-year planning horizon. However, as aircraft user types are segregated on the airfield it will be necessary to construct additional apron space to accommodate new hangar development.

3.6.3.1 Pavement Strength

Existing general aviation aprons are predominantly rigid pavement; however, the areas of flexible pavement are in poor to failed condition and are scheduled for removal/replacement. The rigid pavement apron areas have pavement strengths sufficient to support 60,000 pound single wheel or 75,000 pound dual wheel aircraft.

3.7 NORTH DAKOTA ARMY NATIONAL GUARD

The North Dakota Army National Guard facilities are adequate at the current time and no future expansion is anticipated.

3.8 AVIATION SUPPORT FACILITIES

Support facilities at an airport encompass a broad set of functions that exist to ensure the smooth and efficient operation of an airport's primary role and mission. Support facilities at Bismarck Airport include:

- Rental cars
- Aircraft rescue and fire fighting
- Airport maintenance and snow removal equipment storage
- Intermodal and cargo facilities
- Airport fuels
- Air traffic control tower
- Utilities
- Storm water pollution prevention
- Fencing

3.8.1 Rental Cars

The required rental car demand fluctuates based upon passenger demand and time of year. Historical estimates indicate that approximately seven percent of all enplanements utilize rental cars. This historical rate is applied to the average day enplanements to determine the ready/return lot parking space demand. Table 3-23 provides the projected rental car parking demand for the forecast of annual enplanements. Additional ready/return lot parking space is needed by the first planning activity level. It is recommended that the Airport begin planning for additional parking.

Table 3-23
RENTAL CAR PARKING DEMAND

	2005	Planning Activity Level		
		1	2	3
Annual Enplanements	173,738	198,300	225,100	284,700
Average Day	565	645	732	926
Peak Hour	140	160	182	230
Average Day				
Demand	266	304	345	436
Available	266	266	266	266
Additional Needed	0	38	79	170

In addition to the ready/return lot, the Airport is designing and constructing a consolidated rental car service area. This area will be utilized to service rental cars; including washing facilities, fueling, and storage.

3.8.2 Aircraft Rescue and Fire Fighting

Airports that serve scheduled and unscheduled air carrier flights are required to provide aircraft rescue and fire firefighting (ARFF) facilities and equipment. For FAR 139 certified airports, ARFF equipment requirements are identified by an airport's index ranking. The length of the largest air carrier aircraft operating at the airport and the number of daily departures conducted by the aircraft determines the index.

The ARFF facility and equipment at Bismarck Airport currently meet FAA Index B criteria in terms of the capacity of the equipment and staffing defined in FAR Part 139.315, *Aircraft Rescue and Firefighting: Index Determination*. FAR 139 requires the Airport to have either one of two vehicles available. If one vehicle is available, then it must be able to carry at least 500 pounds of sodium-based dry chemical, halon 1211, or clean agent and 1,500 gallons of water and the commensurate quantity of aqueous film forming foam (AFFF) for foam production.

If there are two vehicles available, then one vehicle is required to carry either 500 pounds of sodium-based dry chemical, halon 1211, or 450 pounds of potassium-based dry chemical and water with a commensurate quantity of AFFF to total 100 gallons for simultaneous dry chemical and AFFF application. The second vehicle is required to carry an amount of water and the commensurate quantity of AFFF so the total quantity of water for foam production carried by both vehicles is at least 1,500 gallons. Based on current required facility improvements, the Airport will continue to need to meet the FAA Index B criteria.

The ARFF building consists of two sides, the personnel side and the vehicle side. The personnel side contains a kitchen, living and dining space, sleeping quarters, and offices. The vehicle side has three bays for indoor vehicle parking and maintenance. Vehicles parked in these bays include one 3,000 gallon Oshkosh Airport Rescue trucks, one 1,500 gallon Oshkosh Airport Rescue truck, and an SUV.

The Airport plans to procure a telescoping snorkel truck, which will necessitate adding a bay on the vehicle side of the ARFF building. During the addition, upgrades should be made to the existing vehicle side. The present condition is not in compliance with OSHA regulations, especially as they pertain to venting of vehicle exhaust inside the building. Also, the doors are too small for today's larger ARFF vehicles and should be replaced with larger doors. On the personnel side of the building,

another office is needed, for airfield operations. It is recommended that the Airport begin planning for these improvements during Planning Activity Level 1

3.8.3 Airport Maintenance

The demand for airport maintenance facilities is directly related to the amount of pavement, lighting equipment, terminal building size, and overall grounds maintenance that is required by the Airport. It can be assumed that as the airfield and/or facilities increase in size, the existing maintenance facility may require expansion or relocation.

Currently, the Bismarck Airport has fewer pieces of snow removal equipment than recommended by the FAA's calculation method. Table 3-24 compares the current equipment with the recommended existing and future equipment level. The future represents the recommended runway extension previously identified. In addition, to the existing equipment listed, the Airport has one runway sander, one runway de-icer truck, and one plane de-icer/boom truck. Along with the snow removal equipment, the Bismarck Airport has two 15-feet rotary mowers/tractors. These are used for maintaining grass and landscape areas.

Table 3-24
AIRPORT MAINTENANCE EQUIPMENT

Equipment	Existing	FAA Allowance		Difference	
		Existing	Future	Existing	Future
Snow Blower	2	4	6	2	4
Plow	6	8	12	2	6
Sweeper	2	6	7	4	5
Loader	1	1	2	0	1

All of this equipment is stored in the maintenance facility. This facility exceeds its design capacity with the storage of existing equipment. To accommodate the existing equipment, the plows have to be parked side-by-side, alternating nose-in rear-in to get them to fit. If the Airport acquires any additional equipment, this maintenance facility would not be able to contain it.

In addition to exceeding its storage capacity the facility has other operational and safety deficiencies which included:

- Inadequate ventilation of exhaust fumes and welding fumes
- Lack of a sand/oil separator
- Inadequate lighting
- Building use is limited and not optimized

Therefore, it is recommended that the Airport continue to obtain additional maintenance equipment as needed and, in doing so, construct a new maintenance storage building that can adequately store all recommended equipment and provide a safe operational environment. It is recommended that the airport obtain the additional maintenance equipment as funding becomes available and demand warrants.

3.8.4 Cargo

Air cargo service is currently provided by DHL, FedEx, UPS, Integrated Commercial Solutions (ICS), and the United States Postal Service (through a contractor). Cargo is flown primarily by contract

carriers for each of these major service providers. Cargo loading, off-loading, and, in some cases, sortation is conducted on the general aviation apron. This process involves the movement of cargo vehicles on the apron mixing with general aviation activities. To enhance safety of the general aviation community and the cargo operators, it is recommended that the cargo operations are segregated from the general aviation activities.

The Transportation Security Administration (TSA) recently enacted rules requiring specific air cargo operations to occur in Secure Identification Display Area (SIDA). These rules require all persons in a pre-designated cargo area to have proper security clearance and identification badges and only permits cargo activity to occur in that area. Although the current criteria of these rules do not include cargo operations at Bismarck due to existing aircraft used, this master plan anticipates that future operations at Bismarck will be subject to these rules and, therefore, recommends identification of a separate, secure cargo area. It is recommended that the segregation of cargo activity occur in the intermediate-term.

The forecast of cargo activity considers the potential for future growth of cargo activity in its current mode of operation. Growth will occur through either an additional cargo carrier or expansion of activity by existing carriers, producing 15 to 20 percent growth through the end of the planning period. The facility requirement based on this growth is the provision of six additional aircraft apron position.

The forecast of cargo activity also considers the establishment of a heavy lift, more traditional cargo operation, likely associated with the intermodal function of the NPCC. The NPCC will have direct access to road, rail, and air transportation. Road access is provided via U.S. Interstate 94 and U.S. Highway 83; rail service through Burlington Northern Santa Fe, Canadian Pacific, and the Dakota Missouri Valley & Western Railroads; and passenger, air freight, and cargo transportation service at the Bismarck Airport. Once the NPCC is fully established, one forecast scenario calls for an additional aircraft to be added to each carrier's air-to-truck connecting operation each weekday night (a total of approximately 1,600 annual operations). In terms of a heavy-lift or traditional air cargo operation, the master plan envisions a three-aircraft feed to traditional air cargo hubs. The types of aircraft envisioned in this scenario include typical mid to large cargo aircraft such as the B-757-300, B-767-300, and A-300. The scenario calls for six daily operations by these example types of aircraft, six days per week, a total of approximately 3,100 annual operations.

Table 3-25 presents the apron space requirements for the existing and future growth scenario considering the existing cargo operation. The table also presents the area requirement based on establishment of a heavy lift, more traditional cargo operation likely associated with the intermodal function of the NPCC.

Table 3-25
CARGO SPACE DEMAND

	Cargo Scenarios		
		Traditional	
	Existing	Air Cargo	Intermodal/ NPCC
Apron Space (SY)	5,993	15,095	136,000

3.8.5 Airport Fuels

Analysis for future fuel storage requirements requires an analysis of future operational demand and an analysis of how fuel is delivered to the Airport. Airport records indicate an average of 62 gallons of

Jet A per itinerant general aviation operation and an average of 81 gallons of Jet A per commercial service operation. The Airport's records of 100LL consumption indicate an average of 18 gallons of 100LL per general aviation operation. These calculations were applied to forecast operations at the Airport and the future fuel requirements determined are as shown in Table 3-26.

Table 3-26
FUEL REQUIREMENTS

	2005	Planning Activity Level		
		1	2	3
Total Annual Operations	53,020	56,150	59,320	65,790
100 LL				
Operations	12,413	13,050	13,700	15,110
Gallons	251,182	240,995	252,999	279,037
Three-Day Storage Capacity	2,285	2,400	2,520	2,780
Available Storage	34,000	34,000	34,000	34,000
Additional Storage Needed	0	0	0	0
Jet A				
Operations	36,622	39,110	41,630	46,690
Gallons	2,474,285	2,564,549	2,728,525	3,058,001
Three-Day Storage Capacity	23,950	25,560	27,200	30,480
Available Storage	85,000	85,000	85,000	85,000
Additional Storage Needed	0	0	0	0

Typical planning guidelines for fuel storage units recommend a two- to seven-day storage capacity. It is recommended that the fuel storage capacity for the Airport provide enough storage for three days of operations. Given a three-day storage capacity at the current fuel flowage volumes, a total of 990 gallons of storage capacity for 100LL and 23,950 gallons of Jet A is required. The current storage capacity exceeds this requirement and, based on the planning forecast, the current three-day storage capacities for 100LL and Jet A are sufficient throughout the planning period.

3.8.6 Air Traffic Control Tower

The existing air traffic control tower (ATCT) has a height of 78 feet above ground level. The tower serves as a combination terminal radar approach control (TRACON) and ATCT, commonly referred to as a TRACAB. The tower is beyond its structural life span. The tower cab is also at its control equipment capacity. Due to the age, inability to accommodate additional equipment, and line-of-sight problems to the north end of Taxiway C, the need for a replacement ATCT at the Airport has been identified.

In addition to the air traffic control tower, the airport surveillance radar, a system used to detect and display the position of aircraft in the terminal area, is scheduled to be relocated. The existing site conflicts with the development of the NPCC. The proposed site is located south of Airway Avenue and compatible with planned land use for the area.

3.8.7 Utilities

Utilities provided at the Airport include water, sanitary sewer, gas, electric, storm water drainage, phone, fiber, and cable television. All of the existing utilities are currently adequate to meet the existing demand. However, all of the utilities will need further evaluation coinciding with design and development of recommended improvements at the Airport.

3.8.8 Storm Water Pollution Prevention Plan

A storm water management plan has been developed for the Bismarck Airport. The airport drainage system was modeled as conditions exist today and as they are projected to exist within the next 10 to 20 years. The system was analyzed to insure that no adverse condition will occur as phased development of the airport property moves forward.

The hydrology and hydraulics of the airport system were analyzed and modeled following FAA AC 150/5320-5C, *Surface Drainage Design,* and the City of Bismarck's *Storm Water Design Manual.* The use of these two manuals insures that the proposed airport development will not adversely impact airport facilities or downstream properties.

3.8.9 Aircraft Deicing

Airports that commonly experience snow and/or freezing rain, such as Bismarck Airport, should provide designated deicing areas for aircraft in order to facilitate safe and efficient deicing procedures in accordance with environmental regulations. Aircraft deicing is conducted on the terminal and general aviation aprons. Spent deicing fluid and stormwater runoff flow southeast via open ditches and pipe passing under runways and taxiways. While the open ditches facilitate the natural decomposition of the deicing fluids, they also can act as a bird attractant which could result in their removal and the associated need for alternate deicing fluid disposal methods. It is recommended that in the long term planning activity level future apron development include the capability of deicing fluid containment and recycling facilities.

3.8.10 Fencing

Airport perimeter fencing is instrumental to overall airport security and wildlife control. It aids in meeting the security requirements of the Transportation Security Administration (TSA, 49 CFR 1542), complies with Title 14 Part 139 of the Code of Federal Aviation Regulations, *Certification and Operations; Land Airports Service Certain Air Carriers*, and assists in keeping people and wildlife outside of the operations areas on an airport.

The airfield at Bismarck Airport is currently encompassed by security fencing and provides access to the airfield through a series of access control gates. The wildlife fencing is made of chain link and is 10-feet tall around the terminal area and eight feet tall around the other areas of the Airport. The fence is generally in good condition and subject to routine maintenance.

3.9 AIRPORT ACCESS

Airport access systems consist of connecting roadways that enable originating and terminating airport users to enter and exit the airport landside facilities and parking facilities. Surface access is comprised of the following two stages: off-airport access roads and on-airport access roads.

3.9.1 Off-Airport Access

Facility requirements for off-airport access involves a determination of capacity levels associated with the major interstates, highways, and auxiliary roadways provided in the vicinity of an airport.

3.9.1.1 Local Roadway Grid System

Individuals accessing the Airport from the Bismarck metropolitan area generally use the collectors and arterials, which comprise the transportation grid system. Since Bismarck Airport is located approximately two miles due south of the metropolitan area, the Airport can also be easily accessed via Interstate 94 and Bismarck Expressway (Highway 810). Local travelers are familiar with the area and do not need significant signage to reach the Airport, regardless of whether they are traveling along Interstate 94 or Bismarck Expressway. The Airport, in conjunction with the Chamber of Commerce, North Dakota Department of Transportation, and Bismarck City traffic engineer, conducted a study to determine where additional airport signage on major arterials would benefit the community. The results of the study were implemented in 2006. Therefore, access from the grid is considered adequate.

3.9.1.2 Regional Roadways

Regional travel to and from Bismarck Airport is provided predominately via Interstate 94, State Route 83, and the Bismarck Expressway.

EAST-WEST ROUTES

The primary east-west routes include Interstate 94 (I-94), and those routes that serve the area west of the Bismarck metropolitan area and the areas east (towards Fargo). The I-94 interchange at State Street is the most frequently used exit since it provides indirect access to the Airport. State Street, also referred to as University, Drive south of Bismarck Expressway, is a minor arterial that travels south through the Bismarck metropolitan area and connects with the Airport approximately two miles south of I-94.

As supported by the Bismarck-Mandan Metropolitan Planning Organization (MPO) 2006 - 2008 Transportation Improvement Program (TIP) and the Bismarck-Mandan MPO 2011-2030 Long Range Transportation Plan, there are three east-west roadway construction projects scheduled that will significantly improve future local and regional access to Bismarck Airport. The most recent improvement project is on Bismarck Expressway. This four-lane roadway, also designated as a truck route, is scheduled to be reconstructed in the spring of 2009 between 5th Street and Airport Road. Given a 30 to 36-month construction period, this mile-long roadway segment will likely be completed near spring of 2012.

The two long range projects supported by the MPO are at Airway Avenue and Lincoln Road. Airway Avenue is a two-lane road that is located immediately south of the Airport. The mile long segment between Airport Road and Yegen Road is scheduled to be reconstructed sometime before 2030. Lincoln Road is a two-lane road that is located southeast of the Airport. This two mile long segment between Airway Avenue and 66th Street is also scheduled to be reconstructed sometime before 2030.

NORTH-SOUTH ROUTES

The primary north-south routes include State Route 83 and Highway 6. State Route 83 serves the areas north of the Bismarck metropolitan area and the areas south and southeast (towards Fargo).

Highway 6 serves the area to the south and southwest of Bismarck Airport. No additional access roads are needed for this route and the current service level is adequate.

As supported by the Bismarck-Mandan 2008-2011 Short Range Transportation Plan and the 2011-2030 Long Range Transportation Plan, there are two north-south roadway construction projects that will significantly improve local and regional access to Bismarck Airport.

26th Street is a two-lane road that is located immediately north of the Airport. The one-mile long construction project will include the construction of an extension across Bismarck Expressway and reconstruction of the roadway. Reconstruction work is expected to begin sometime before 2011.

12th Street is a two-lane road that is located approximately 1.5 miles west of the Airport. The two-mile long construction project between Boulevard and 48th Street is expected to begin sometime before 2030.

3.9.2 On-Airport Access Roads

On-airport access roads are further subdivided into two categories: public and restricted access roads. Public roads are, as the name indicates, available for public use and provide access to general aviation, cargo, military, and commercial service facilities. Restricted access roads are located within airport property and generally provide access to on-airport facilities, such as navigational aids, perimeter fencing, and aprons that cannot be accessed by the general public.

3.9.2.1 Public Roads

Access to the Airport from public roads is adequate and currently operates at an acceptable level of service. Additional public roads should be developed to provide improved access to each of the Airport's four quadrants to facilitate future revenue generating development. Future expansion or modification to these roads is dependent upon other identified airport facility development requirements and is further discussed in following chapters.

3.9.2.2 Restricted Access Roads

It is recommended that the secure airport perimeter service road be extended to provide complete access around the airport perimeter.

3.10 STRATEGIC VISION

It is critical that the City of Bismarck continue to provide for the protection and future expansion of Bismarck Airport beyond the planning horizon identified in this master planning effort in order to ensure the viability of the Airport. As such, it is important that additional revenue generating development associated with the Airport and the community be identified.

3.10.1 Northern Plains Commerce Centre

The City of Bismarck is developing The Northern Plains Commerce Centre (NPCC), which is beginning to build on the city-owned Airport Industrial Park located adjacent to Bismarck Airport. The intent of the NPCC will be to become a full service commerce center offering practical location with the ability to reach potential markets anywhere in North America and around the world. The NPCC will become a first-class transportation hub and business park, providing companies that compete in today's global economy with a proficient network of transportation modes, centered on this well

thought-out and practical facility. This 243 acre park will have intermodal capabilities with air, rail, and highway service in addition to warehousing and transferring facilities. The NPCC clearly can accommodate all domestic needs and is to be a gateway to the entire world via air transport.

The objective of the NPCC is to increase the regions ability to compete on a global level due to the ability to ship/import products more competitively. Access to seaports via rail will give companies the ability to use the local labor pool and competitive transportation rates. National and international companies who previously could not locate in Bismarck due to shipping costs caused by the geographic location will now be able to locate in Bismarck and remain competitive in the marketplace.

The NPCC would allow the Airport to pursue this new source of revenue. With NPCC's ability to facilitate the attraction and future retention of large commercial or industrial operations, it is important for the airport to identify entrepreneurial development opportunities both on and near airport property. It is recommended that the development plan for the Airport identify both aviation and non-aviation development areas that are capable of supporting large single and multiple users.

Part of the strategic vision for Bismarck Airport is the ability to not only continue to support the existing domestic air passenger service and air cargo service, but also provide for expanded cargo operations capabilities associated with the NPCC. In order to meet this strategic vision for the Airport, it is necessary to plan for a runway length sufficient for the potential cargo aircraft to conduct non-stop operations to representative domestic and international markets. Consequently, the recommendations within this chapter were developed in conjunction with the NPCC and describe the needs of the Airport above and beyond the minimum required to meet FAA design standards.

3.10.2 Commercial Air Service

Competitive air service is a goal for all commercial service airports and the City of Bismarck shares in this vision. Service to new hubs, like Chicago O'Hare, is a vital goal to enhance competition and open access to more one-stop markets. Other airports in the region have demonstrated success to Chicago for business and international travel. Expanding non-schedule charter service to Phoenix and Orlando would also benefit leisure travel growth.

3.10.3 General Aviation

Development of general aviation (GA) is a key growth component at Bismarck Airport. Local businesses have continued to upgrade aircraft to corporate jets to off-set airlines delays, raising the demand for large corporate hangar development at the Airport. In addition, state and federal government aircraft based at Bismarck Airport are substantial. Finally, the city provides strong medical transfers by GA aircraft within a 200 mile range in rural North and South Dakota. Medical flights and energy flights are anticipated to continue to grow.

CHAPTER 4
IDENTIFICATION AND EVALUATION OF ALTERNATIVES

This chapter identifies and evaluates development alternatives for Bismarck Airport that will satisfy the facility requirements outlined in the previous chapter, satisfy the strategic vision and goals of the Airport, adhere to safe operational standards set by the FAA and Bismarck Airport, and conform to sound planning and business principals. The result of this analysis is a cohesive plan for airport development that functionally combines all recommended improvements with the existing facilities.

The facility requirements identified in the previous chapter are accommodated within the preferred development plan for the Airport. This preferred development plan will allow the City of Bismarck to continue to meet the existing and forecast aviation needs of the region, protect for long-term future needs, and remain the leading air transportation complex for the area.

4.1 PREFERRED DEVELOPMENT PLAN OVERVIEW

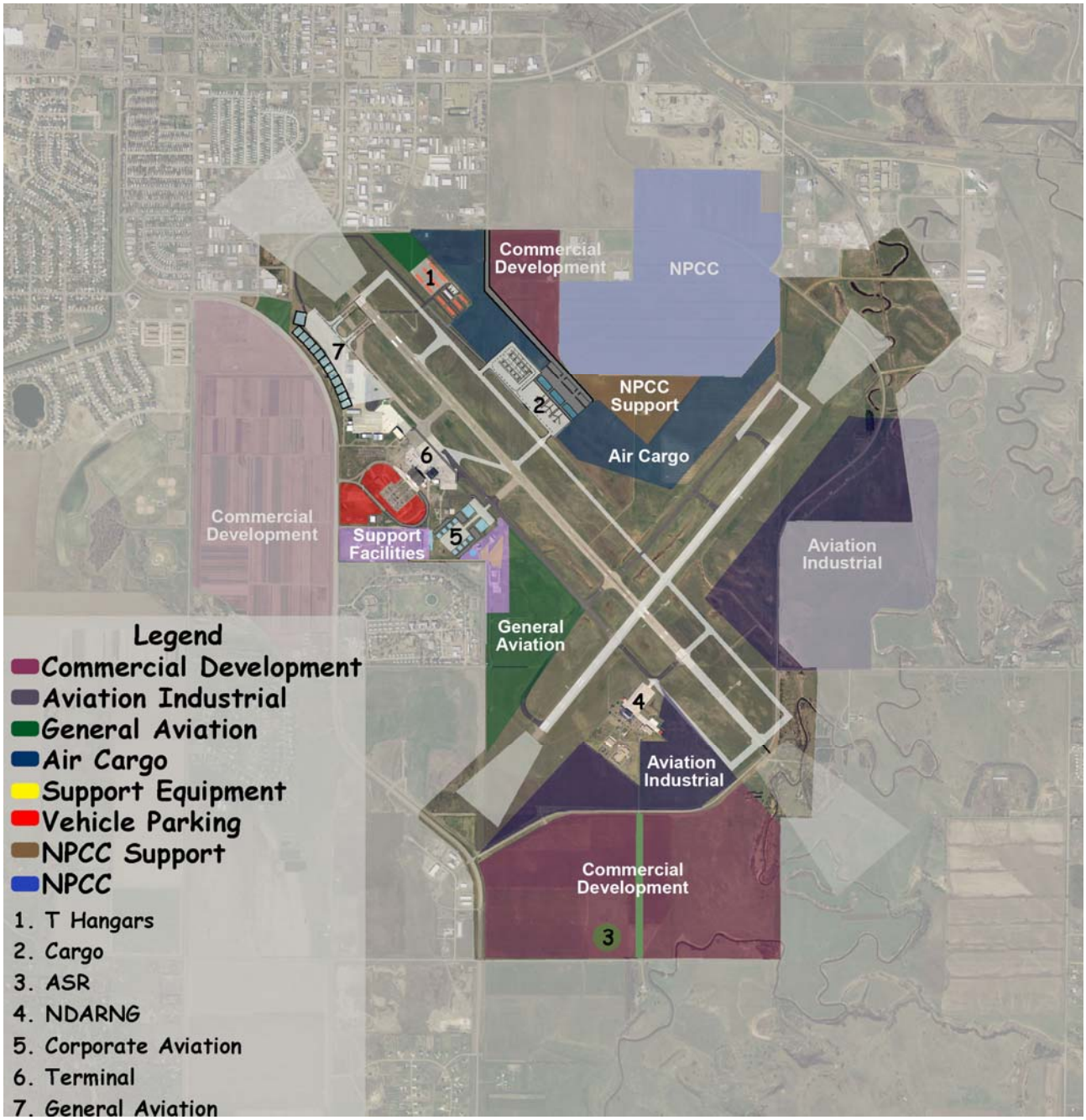
The preferred development plan summarized below and described more fully in the balance of this chapter accommodates the multiple existing and future service roles that the Airport fills for the region. In addition to the more obvious roles of passenger service, all cargo operations, public safety flying, and general aviation needs, the Airport also accommodates a number of businesses supporting the economy and needs of the area. The Airport is home to the North Dakota Army National Guard, and will act as the key air transportation component of the Northern Planes Commerce Centre (NPCC). Given the Airport's multiple service roles, the preferred development plan for the Airport incorporates a significant amount of future flexibility to ensure that the Airport will be able to meet these and other demands that may arise in the future by identifying areas capable of accommodating long-term facility improvements and an optimal future land use pattern by federal, local and state partnerships.

The most notable items shown in the preferred development plan include the construction of 600 foot extension on Runway 21 and widening of Runway 3/21 from 100 feet to 150 feet, as well as protecting for a 1,206 foot extension on Runway 31 and realigning the primary airport access roadways. Primary land use designations include terminal, air cargo, general aviation, support facilities, aviation industrial, commercial development, and NPCC.

The preferred development plan looks beyond the forecast 20 year horizon identified in this Master Plan to assure all planned development will continue to conform to the land use patterns identified as part the master planning process. By conforming to the long-term land use pattern and facility development planned in the preferred development plan for the Airport, the City of Bismarck can continue to ensure the Airport's position as a well organized, efficiently run component of the Nation's air transportation system.

The primary development items and designated land acquisition associated with the preferred development plan are depicted in Exhibit 4-1.

Exhibit 4-1
STRATEGIC VISION DEVELOPMENT PLAN



4.2 ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS

Airfield development is the most important and least flexible land use and development item at most airports, including Bismarck Airport. Once the airfield specific needs and locations are established, the remaining secondary requirements (such as air cargo, general aviation, aviation support facilities, and airport access) can be addressed. The interrelationship between the preferred airfield alternative and the secondary planning elements becomes the basis for the preferred development plan.

The process of determining the preferred airfield alternative is performed in a series of interrelated steps. The first step creates conceptual airfield derivatives based upon the existing runway configurations and airport strategic vision. These derivatives are then evaluated and the least desirable derivatives are removed. The remaining derivatives are developed into conceptual alternatives with goals to meet the facility requirements while minimizing negative impacts.

The creation of the development plan combines the preferred airfield development alternative with secondary planning elements. The preferred development plan is documented visually as a graphic airport layout plan (ALP) and as a summary capital improvement plan (CIP). The ALP displays the size and location of the proposed projects discussed in this chapter and the previous chapter. The CIP provides a description of the scope, timing, and cost of each proposed project.

4.3 AIRFIELD DEVELOPMENT

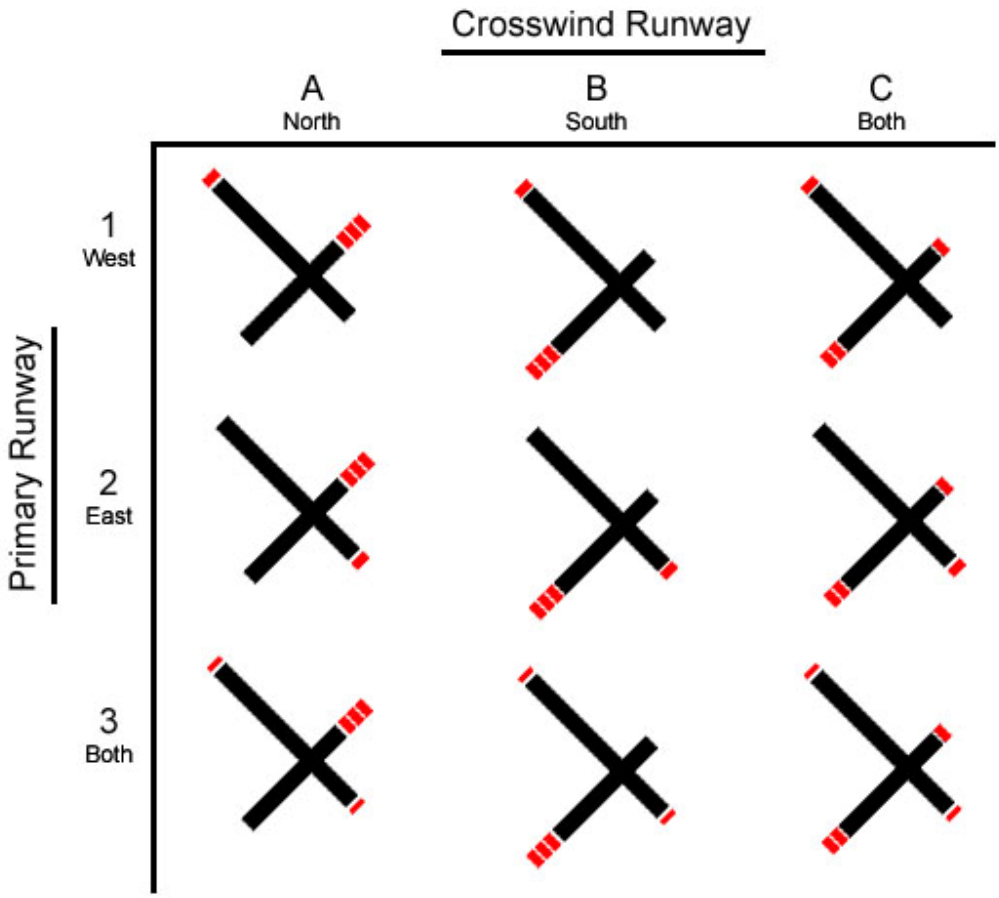
Airfield development, including location, spacing, and size of various controlled surfaces, airspace, runways, and taxiways, establishes the outer boundaries of the airfield. These are the primary and most critical portions of an airport and largely dictate the locations, alignments, sizes, and orientations of the secondary planning elements.

The facility requirements identified a need for a 1,206 foot extension to the primary runway (13/31) and a 600 foot extension to the crosswind runway (3/21). There are nine possible runway extensions, shown in Exhibit 4-2, that are possible given Bismarck Airport's runway configuration. To determine the preferred direction for runway extensions compatibility with aircraft operations, existing airport infrastructure, and off airport land development must be considered when evaluating the possible runway extensions.

The City of Bismarck is located immediately northwest of the Airport and associated residential development is located within the existing runway protection zone for Runway 13. Any portion of the recommended 1,206 foot extension to Runway 13 would require acquisition of a significant number of residences and commercial development. In addition, the runway protection zone would be repositioned closer to the city center and would be located on land that is currently developed for both residential and commercial use. While an extension of 1,206 feet to Runway 31 would bring the threshold of the primary runway in close proximity to Apple Creek, it is the preferred runway extension. This extension would prevent additional impacts to the City of Bismarck and would minimize the development costs and environmental impacts.

While there is significant land available beyond either threshold of the crosswind runway, past planning efforts for Bismarck Airport have shown an extension of the crosswind runway to the northeast. As such, some of the needed site preparation for an extension on Runway 21 has already been accomplished. In addition, an extension on Runway 21 would support the development of the Northern Plains Commerce Centre (NPCC). Therefore, the preferred development alternative is for a 600 foot crosswind runway extension to Runway 21.

Exhibit 4-2
LEADING ELEMENT ALTERNATIVES



4.3.1 Conceptual Alternatives Identification and Evaluation

The next step in the selection process is to develop, analyze, and evaluate the conceptual alternatives based on the established criteria. The conceptual alternatives are developed utilizing known and/or likely environmental factors, availability of existing airport property, and future on-airport land use and development patterns. Specific development plans within the land uses shown are analyzed further during the secondary planning evaluation.

Both of the conceptual alternatives in Exhibit 4-3 and Exhibit 4-4 are supported by a brief summary that outlines the design intentions of the alternative. Both of the concepts extend the primary runway to the southeast, identify generic on-airport land uses that are refined in the secondary planning elements, meet the runway length strategic goals, and provide for development of the NPCC.

- **Concept 1** – This concept extends Runway 3/21 to both the northeast and the southwest to utilize existing airport property, identifies logical expansion of the existing on-airport land uses, and provides for the establishment of a commercial development area to the south.

- **Concept 2** – Similar to Concept 1, Runway 3/21 is extended to both the northeast and the southwest to utilize existing airport property and logical expansion of the existing on-airport land uses are identified. However, in addition to the establishment of a commercial development area to the south, Concept 2 also provides additional commercial development to the west of the Airport.

Following technical discussions with the Airport Sponsor, North Dakota Aeronautics Commission, and the technical advisory committee regarding the operational and strategic goals of the conceptual alternatives, a refined conceptual alternative was developed. This alternative, defined as Concept 3, combines elements from both Conceptual Alternative 1 and Conceptual Alternative 2.

In Conceptual Alternative 3, Runway 3/21 is extended to the northeast to utilize existing airport property and minimize adverse impacts to land currently owned by the United Tribes Technical College. The future air cargo area to the north of the runway intersection is reduced in size to facilitate the development of support areas for the NPCC. In addition, an area for corporate development to the north and south of the terminal area is identified. Conceptual Alternative 3 is illustrated in Exhibit 4-5.

Exhibit 4-3
CONCEPTUAL ALTERNATIVE 1

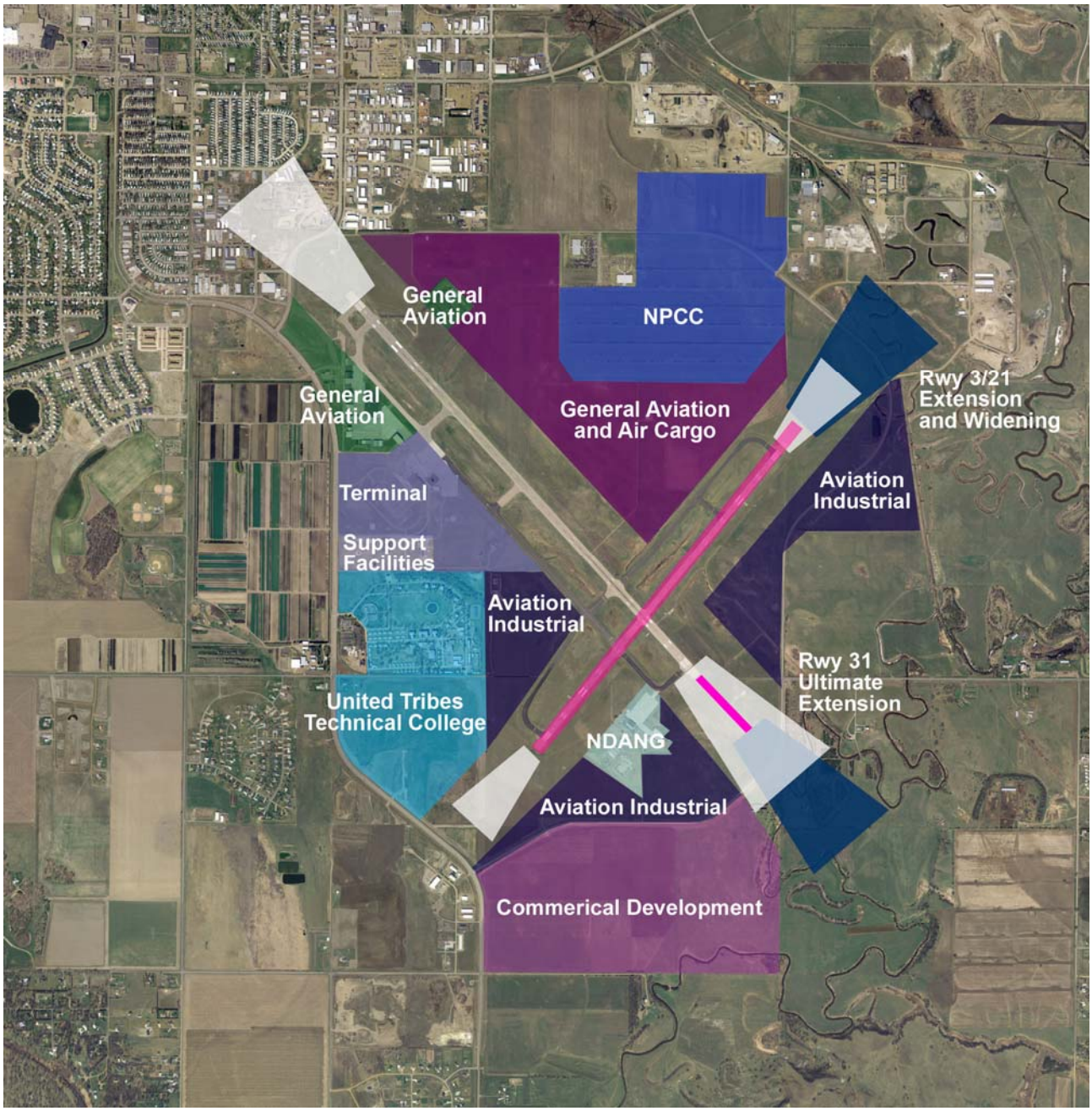


Exhibit 4-4
CONCEPTUAL ALTERNATIVE 2

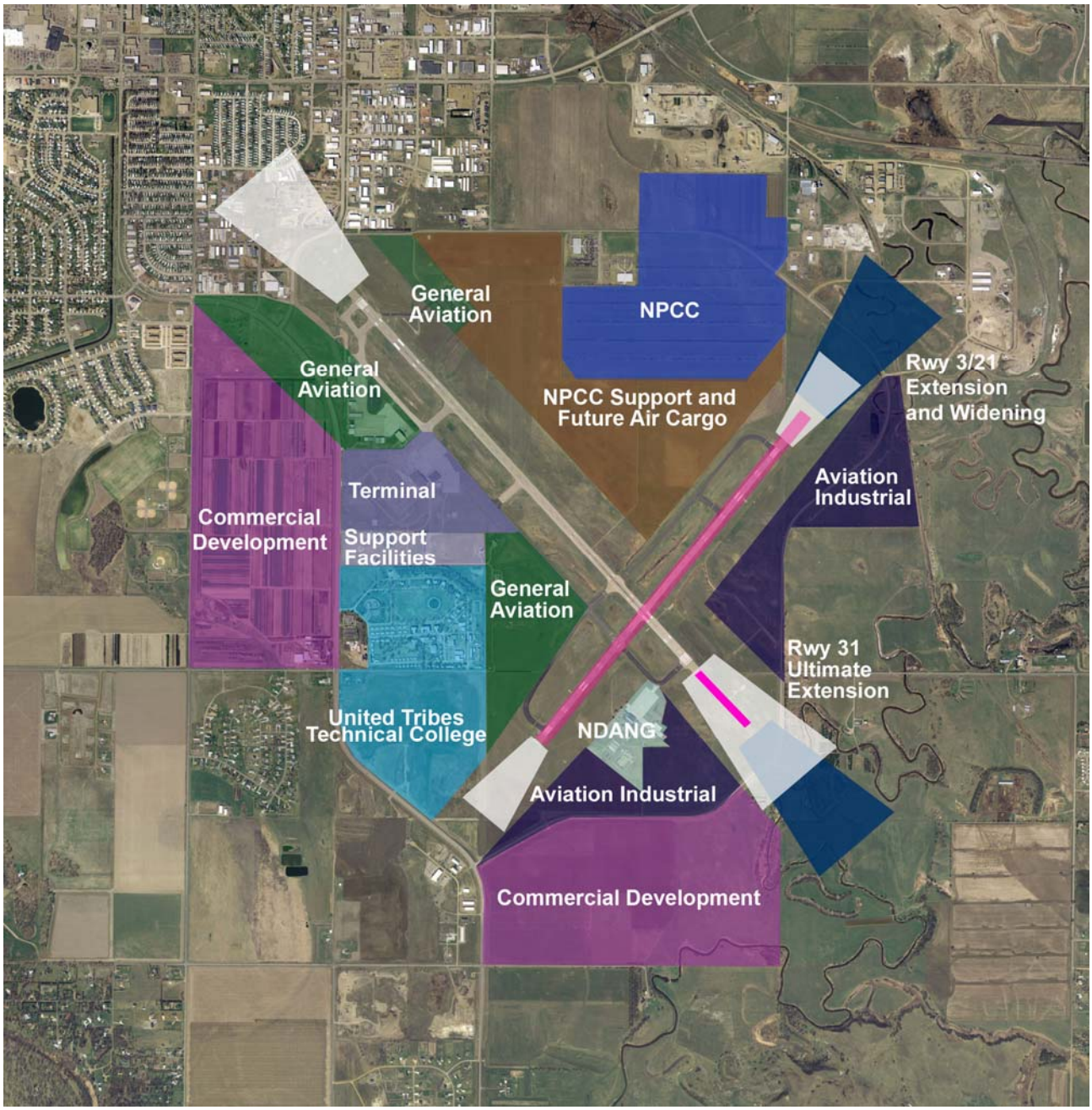
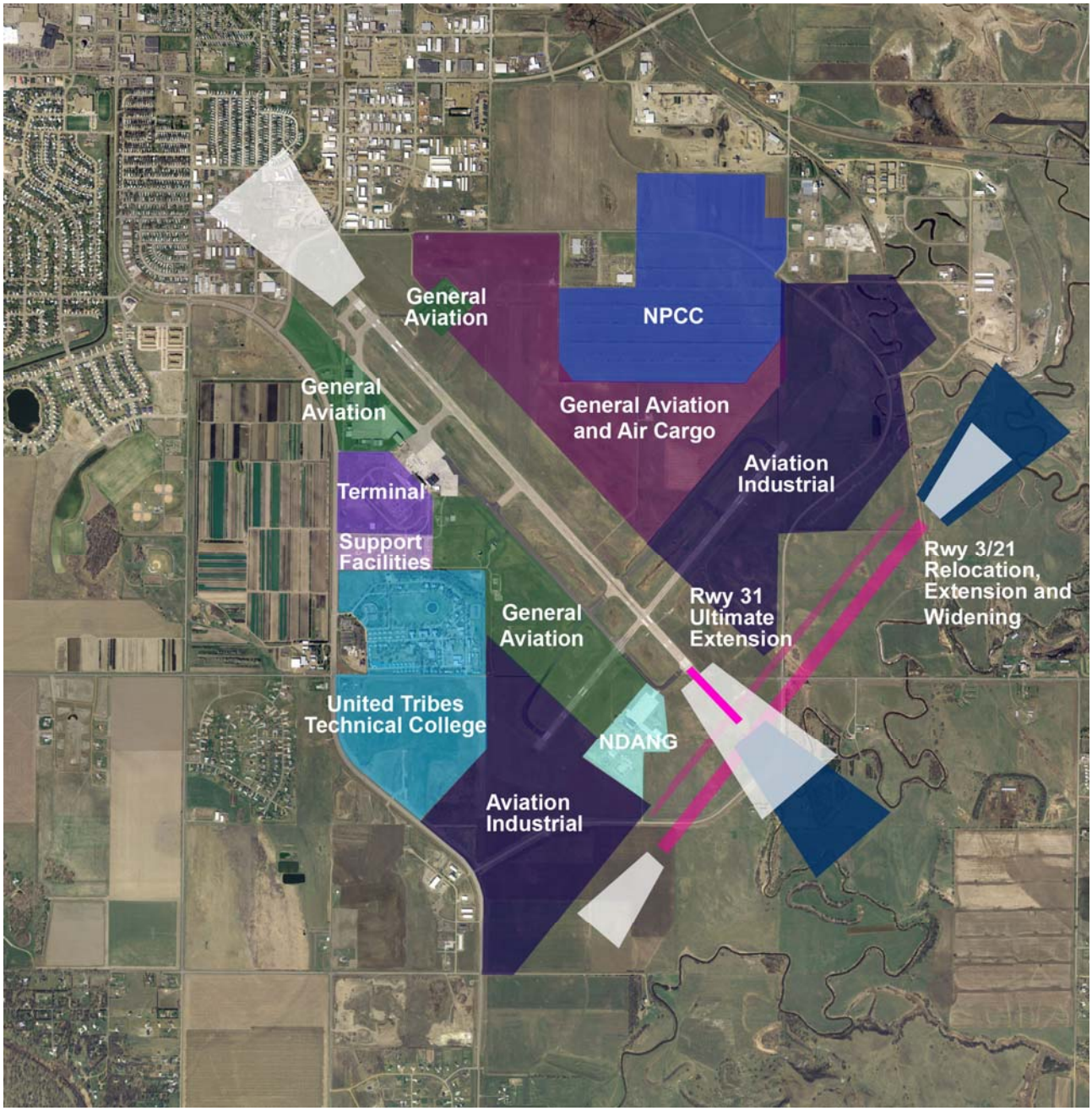


Exhibit 4-5
CONCEPTUAL ALTERNATIVE 3



4.4 SECONDARY PLANNING ELEMENTS

Following selection of the preferred Conceptual Alternative 3, less constraining issues can be considered. The secondary planning elements are evaluated and screened relative to the preferred alternative. They are then combined with the preferred conceptual alternative to create the development plan for the Airport. The following sections provide a brief overview of suggested considerations when developing the secondary planning elements. The secondary planning elements include: establishment of Federal Inspection Services (FIS), additional vehicle parking in the passenger terminal area, development of planned cargo facilities, expansion of both corporate and general aviation, and expansion and relocation of support facilities as appropriate.

4.4.1 Passenger Terminal Facilities

The new passenger terminal building was opened in 2005 and is anticipated to meet the basic travel needs throughout the planning horizon. However, the strategic vision for Bismarck Airport includes the ability to handle international charter flights, which requires the establishment of a FIS within the terminal building. In addition, the facility requirements have identified a need for additional public vehicle parking and rental car facilities.

4.4.1.1 Federal Inspection Services

FIS, part of US Customs and Border Protection, an agency of the Department of Homeland Security, provides for the processing of passengers arriving directly from a foreign country. The FIS includes the services of immigration and naturalization services, customs and border control, fish and wildlife services, agricultural department, and public health. The latter three categories are typically dependent upon the port of entry or the country of origin. As such, it is unlikely that fish and wildlife, agricultural, or public health services will be required on a regular basis at Bismarck Airport. Therefore the alternatives illustrated below, and followed by a short description, are based on providing both immigration and naturalization services and customs and border patrol.

A recommended area for a full FIS facility is approximately 27,400 square feet. However, the recommended area for Bismarck Airport is between the range of 5,400 and 6,400 square feet. The area can be greatly reduced as a result of being able to utilize existing areas within the terminal and the ability to eliminate non-essential functional areas. The non-essential areas include in-transit lounges, connecting service luggage check-in and associated facilities, and exclusive use departing passenger holdrooms. Note that these figures are estimates and may materially change depending upon Department of Homeland Security, US Customs and Border Protection coordination that will be necessary prior to undertaking an FIS at Bismarck Airport.

Exhibit 4-6
FIS ALTERNATIVE 1

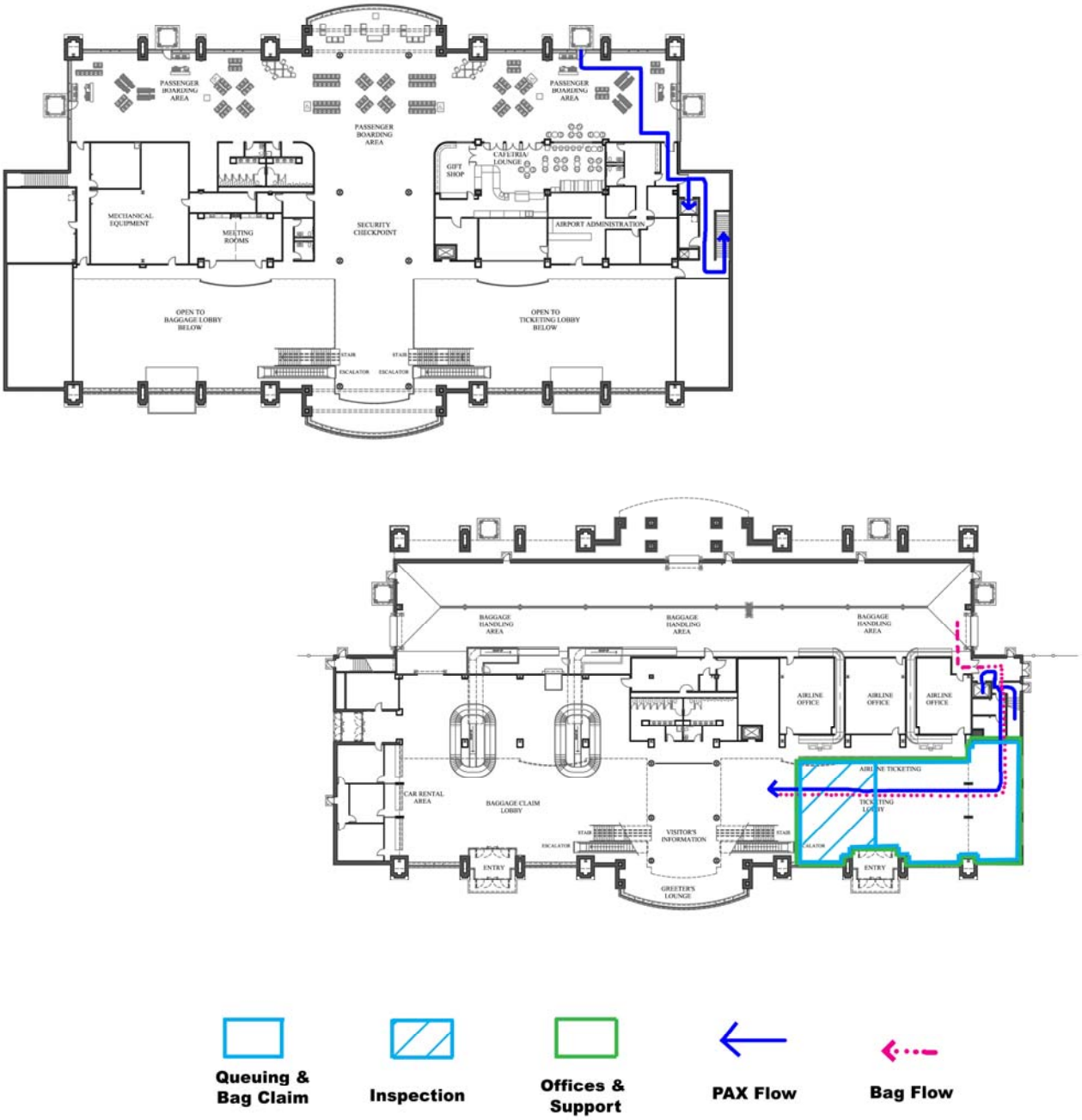
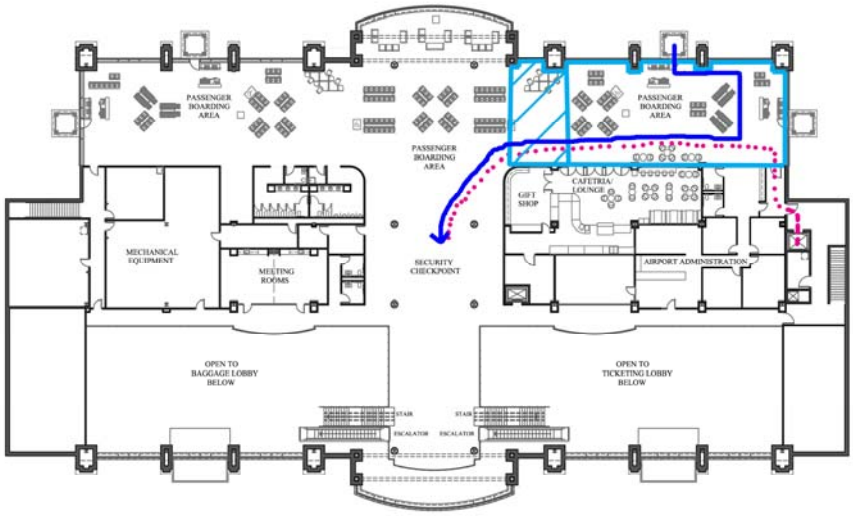


Exhibit 4-7
FIS ALTERNATIVE 2



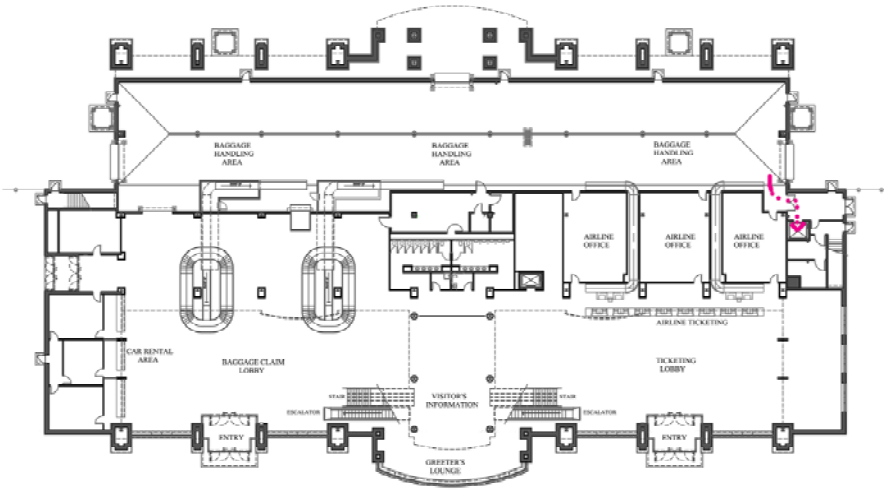
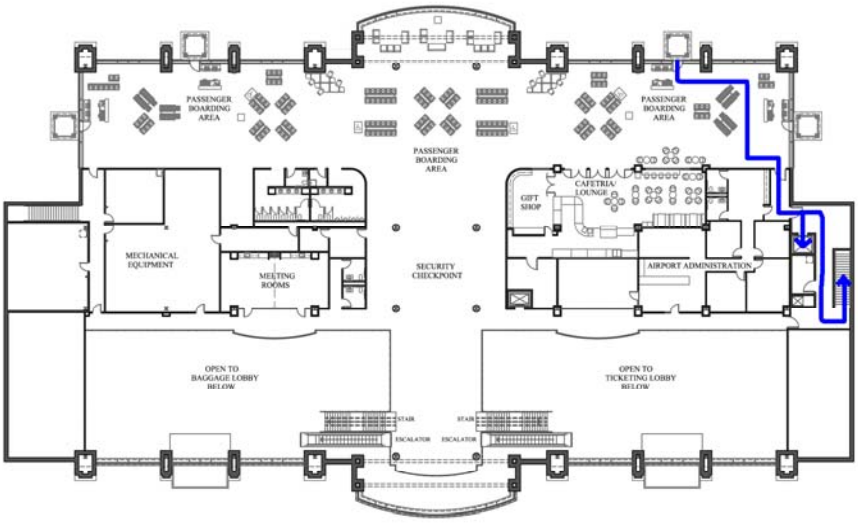


Exhibit 4-8
FIS ALTERNATIVE 3



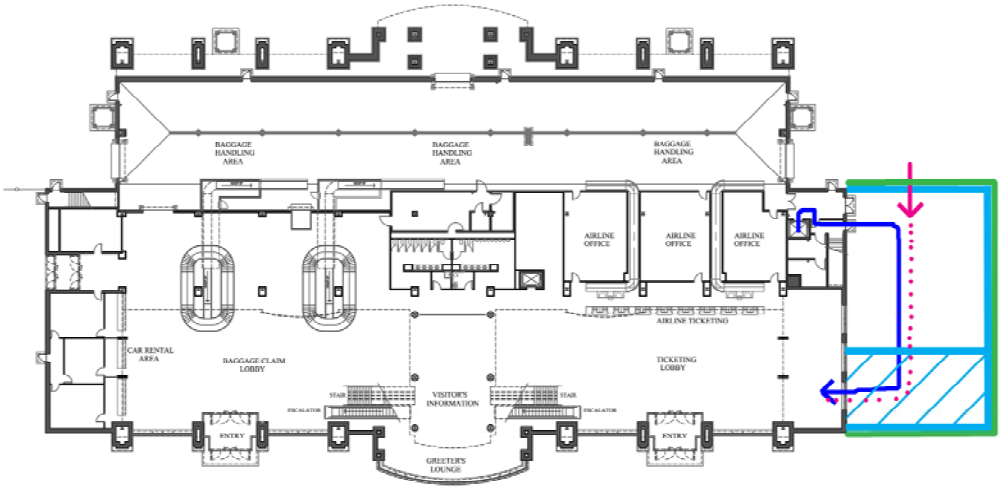
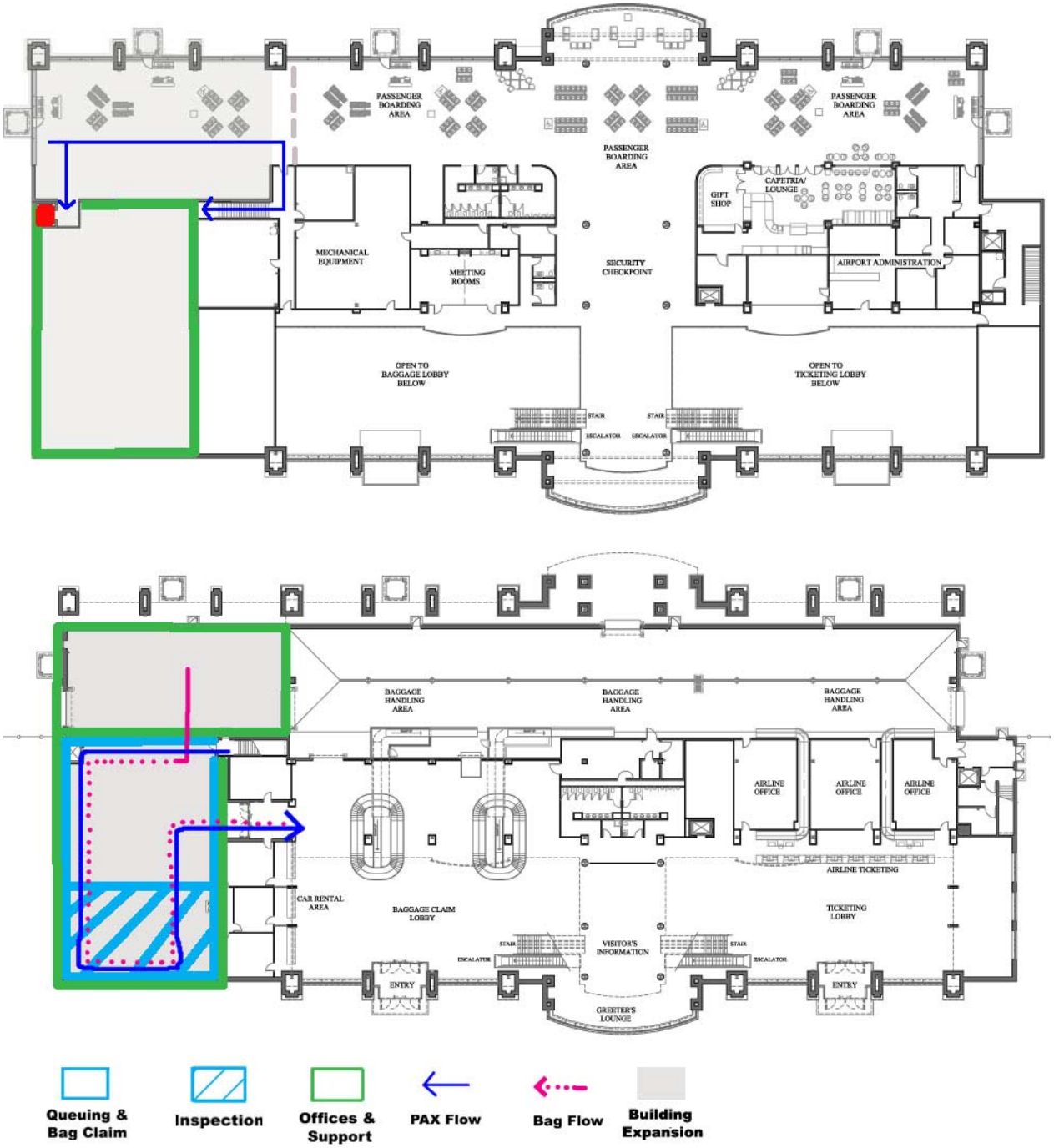


Exhibit 4-9
FIS ALTERNATIVE 4



- **Alternative 1** - Deplaning passengers exit the aircraft via the passenger loading bridge, travel to the first level of the terminal building via the stairs on the east side of the terminal and the elevator. Upon reaching the first level passengers reclaim their baggage in the airline ticketing lobby, which has been brought to them through the first level. The passengers would then be processed in the airline ticketing lobby and exit the terminal through either the southwest exit or the west exit located between the rental car counters.
- **Alternative 2** - Deplaning passengers exit the aircraft via the passenger loading bridge and wait for their baggage to be delivered to them in the passenger holdroom. The passengers would be processed in the holdroom and then reach the first level via the escalator, stairs, or elevator and exit the terminal building though any door.
- **Alternative 3** - Deplaning passengers exit the aircraft via the passenger loading bridge and travel to the first level via the stairs and elevator located on the east side of the terminal building. The staircase would exit into a new addition to the east side of the terminal building where the passenger would be reunited with their baggage and processed in the new addition. Passenger would then exit the terminal through the airline ticketing lobby.
- **Alternative 4** – An expansion of both the first and second floor of the west side of the terminal building would allow deplaning passengers to exit the aircraft via the passenger loading bridge and travel to the first level by the existing stairs or future elevator located on the west side of the terminal building. Passenger would be reunited with their baggage and processed in the new addition on the west side of the terminal building. After processing passengers would exit the terminal building through the doors currently used by the rental car agencies.

All of the identified alternatives allow the passengers to exit via passenger loading bridges. Alternative 1 requires that the airline ticketing lobby be closed completely during the FIS process, effectively limiting flight arrivals to early morning or late evening when no other aircraft are arriving or departing the Airport. In addition, Alternative 1 requires Customs and Border Patrol to sterilize the area each time the reopen the processing area. Similarly, Alternative 2 utilizes the passenger boarding area for processing, which requires Customs and Border Patrol to sterilize the area each time the processing area is reopened. In addition, baggage would need to be brought to the second floor prior to passengers clearing customs and then passengers would need to carry their baggage to the first floor to leave the terminal building. The logistics involved with sterilizing the processing area and baggage handling make both Alternative 1 and Alternative 2 unviable alternatives for a long-term FIS solution.

Alternative 3 and Alternative 4 require the extension of the terminal building to the east and west, respectively, to accommodate the processing area. While similar in both passenger unloading and processing, the modifications to the terminal building differ slightly. While Alternative 4 requires the addition of an elevator, it is the preferred alternative because of the location and the overall ability to continue the operational flow of the terminal building with minimal disruption to the existing passenger traffic flow.

4.4.1.2 Public Vehicle Parking Expansion

Commercial passenger terminal parking requirements are based on peak hour and annual enplanement levels. There are 764[1] public vehicle parking spaces available, and there is an existing shortage of 246 long-term parking spaces. By Planning Activity Level 3, there will be a long-term parking shortage of 735 spaces. Given that the public vehicle parking activity is

[1] An additional 77 spaces were constructed in 2007, bringing the total available parking space count to 841 and reducing the shortage to 169 spaces.

expected to nearly double by Planning Activity Level 3, there is a need to increase the number of available public vehicle parking spaces.

Expansion of the vehicle parking lots can be accomplished within the footprint of the existing parking lot with slight modifications including the extension and realignment of the existing terminal loop roadway. Realigning the terminal loop roadway allows expansion of the parking lot symmetrically about the face of the terminal building and continues to provide the same level of service currently provided at Bismarck Airport by limiting the walking distance to the terminal. Construction impacts would also be minimized as the project could be phased. The ultimate parking lot expansion shown provides reserves additional parking space that can be provided for future use.

Exhibit 4-10
VEHICLE PARKING

4.4.2 General Aviation

Land use at the Airport has identified logical areas for expansion of both corporate and general aviation facilities. These areas include the continued expansion of the t-hangars located east of

the Runway 13 threshold, the conventional hangars located northwest of the commercial passenger terminal area, the cargo development area located adjacent to the t-hangars, the future corporate aviation located southeast of the commercial passenger terminal, and the general aviation area located northwest of the commercial passenger terminal area. Expansion of the general aviation t-hangars and the cargo development area are depicted in Exhibit 4-11.

The new t-hangar area provides for a logical expansion of the existing t-hangars. This expansion will provide continuity in land use and taxilanes. The primary goals of the northern cargo development is to eliminate the need to sort cargo on the ramp, segregate the cargo facilities from the general aviation facilities, and to locate the facilities in close proximity to the NPCC. The cargo area depicted in Exhibit 4-12 is conceptual in nature and provides for a likely development pattern. Actual facility development will be dependent upon the individual tenant demands and preferences.

Exhibit 4-11
GENERAL AVIATION HANGAR DEVELOPMENT

The general aviation area located northwest of the commercial passenger terminal serve aircraft that require conventional hangar storage instead of t-hangars. Some of the existing conventional hangars block the line of sight between the air traffic control tower and the end of Taxiway C and, therefore, are in need of relocation. As such it is important to evaluate the development pattern in the area as a whole and determine the optimal alignment of future hangars to provide the maximum development area. In addition, the current alignment provides for a single row of

conventional hangars with no taxilane access for additional development to the west. The preferred development in this area is to provide a linear development of conventional hangars that provide taxilane access to the west for additional future conventional hangar development.

Exhibit 4-12
NORTH GENERAL AVIATION

The southeast corporate development area is intended for the use of corporations requiring airfield access in close proximity to the commercial terminal. The area proposed for development is constrained by the existing and proposed location of the air traffic control tower to the south and the North Dakota DOT hangar and lift station to the north. Therefore, detailed evaluation of the development plan is necessary to ensure that the demands of the potential tenants can be met within the constrained site. Alternatives for the development of the southeast corporate aviation are identified in Exhibits 4-13 through 4-15.

Exhibit 4-13
SOUTH CORPORATE AVIATION ALTERNATIVE 1

Exhibit 4-14
SOUTH CORPORATE AVIATION ALTERNATIVE 2

Exhibit 4-15
SOUTH CORPORATE AVIATION ALTERNATIVE 3

- **Alternative 1** – Provides a Design Group III taxilane from the primary runway to the large corporate hangars that are parallel with the taxiway and provides a Design Group II taxiway further into the development where smaller aircraft are located. This alternative provides vehicle parking for all of the hangars along the north and south face and requires the realignment of several access roads.
- **Alternative 2** – Provides a Design Group II taxilane from the primary runway to the furthest limit of the available development area. Vehicle parking is provided along the north and south face.
- **Alternative 3** – Provides a Design Group III taxilane from the primary runway to the furthest limit of the available development area. Large corporate hangars are provided at the furthest limit and small corporate hangars are located along the southern portion of the taxilane. Vehicle parking is provided along the western and southern face of the hangars.

Alternative 2 provides a systematic development of hangars, apron, and taxilane to meet Design Group II criteria. While this alternative provides for the highest quantity of hangars and maximize the use of the available land, Bismarck Airport has corporate tenants in need of hangar and apron space to accommodate aircraft in Design Group III. Therefore, Alternative 2 is not considered a viable alternative for corporate aviation development.

By placing the largest hangars furthest back, the taxilane must meet Design Group III requirements for the entire length of the taxilane. With the increased clearance required by the taxilane, additional smaller corporate hangar development is severely limited. Therefore, Alternative 3 is not the best use of the available land and places additional limitations on future development.

Therefore, the preferred corporate aviation development is Alternative 1. This alternative provides for large Design Group III aircraft parallel to the primary runway and provides ample aircraft and vehicle parking, hangar space, and flexibility along the Design Group II taxilane that extends to the west.

4.4.3 Support Facilities

Support facilities needs requiring alternative analysis include the relocation of the air traffic control tower (ATCT) and improvements to the access roads impacted by the runway extensions. There are additional support facilities demands; however, these demands are fixed by function and do not require alternative analysis.

4.4.3.1 Air Traffic Control Tower Replacement

The existing air traffic control tower is antiquated and will have line of sight issues once the runway extensions have been completed. Three alternative sites were evaluated for a new air traffic control tower facility.

Exhibit 4-16
AIR TRAFFIC CONTROL TOWER ALTERNATIVE SITES

- **Alternative 1** – The control tower would be relocated in close proximity to the existing tower west of the middle of the primary runway and north of the crosswind runway
- **Alternative 2** – The control tower would be relocated to a midfield location on the north side of the runway intersection.
- **Alternative 3** – The control tower would be relocated east of the center of the crosswind runway and north of the southern end of the primary runway

In locations with a high northern latitude it is best to avoid an air traffic control tower that requires controllers to face south over the airfield. This direction causes numerous sight problems associated with the sun. Therefore, Alternative 2 is not considered an optimal tower location. Both Alternative 1 and Alternative 3 would maintain a clean line-of-sight to all of the existing and planned controlled aircraft movement areas. However, Alternative 3 is currently located in an undeveloped area of the airfield which requires extensive infrastructure and access roads to be constructed; in addition, the primary runway would still require a southern view. Therefore, Alternative 1 is the preferred future air traffic control tower location.

4.4.3.2 Access Routes

Airport access is important to the viability of airport operations and airport businesses. Special consideration is made to ensure continued, reliable, and efficient access to commercial passenger service terminal, cargo facilities, general aviation facilities, and commercial and industrial development facilities. In areas where planned development impacts existing roads, careful evaluation is given to provide the best realignment of the roadway.

The proposed development at Bismarck Airport requires the realignment of Airway Avenue / 48th Avenue. Airway Avenue must be relocated outside of the future runway protection zone for Runway 31 and to provide sufficient space for the construction of a service road and 10-foot high perimeter fence. It is recommended that the future alignment tie into the future beltway that is proposed along 48th Avenue.

Exhibit 4-17
AIRWAY AVENUE REALIGNMENT

4.5 PREFERRED DEVELOPMENT PLAN REFINEMENT

The preferred development plan, shown in Exhibit 4-1, accommodates the multiple existing and future service roles that the Airport fills for the region. The preferred development plan is further refined and documented visually as a graphic airport layout plan (ALP) and as a summary capital improvement plan (CIP). The ALP displays the size and location of the proposed projects discussed in this chapter and the previous chapter. The CIP provides a description of the scope, timing, and cost of each proposed project.

CHAPTER 5
AIRPORT LAYOUT PLAN

The Airport Layout Plan (ALP) serves several roles for Bismarck Airport, North Dakota DOT, and the FAA. As presented in the FAA Master Plan Advisory Circular, there are five primary functions of the ALP that define its purpose:

- The approved plans are necessary in order to receive financial assistance under the terms of the Airport and Airway Improvement Act of 1982 (AIP), as amended, and specific Passenger Facility Charge actions. The maintenance of a current plan and conformity to the plan are grant assurance requirements at an airport on which Federal funds have been expended under the AIP and the previous airport development programs, including the 1970 Airport Development Aid Program (ADAP) and Federal Aid Airports Program (FAAP) of 1946, as amended. While ALPs are not required for airports other than those developed with assistance under the aforementioned Federal programs, this guidance can be applied to all airports.
- The plans create a blueprint for airport development by depicting proposed facility improvements consistent with the strategic vision of the airport sponsor. The plans provide a guideline by which the airport sponsor can assure that development maintains airport design standards and safety requirements, and is consistent with airport and community land use plans.
- The ALP serves as a public document that is a record of aeronautical requirements, both present and future, and as a reference for community deliberations on land use proposals and budget resource planning.
- The approved ALP provides the FAA with a plan for airport development. This will allow compatible planning for FAA owned facility improvements at the airport. It also allows the FAA to anticipate needs for budgetary and procedural needs. The approved ALP will also allow the FAA to protect necessary airspace for planned facility or approach procedure improvements.
- The plans can be a working tool for use by the airport sponsor, including development and maintenance staff.

Development of the ALP is a direct result of the master plan processes presented in the previous chapters. The ALP reflects the Airport technical requirements defined through the master planning process and the strategic vision for the Airport as defined throughout the master planning process and the strategic vision for the Airport as defined by the Airport Board and Staff.

ALP approval independent from the master plan is required. As such, review of the ALP drawing set is accomplished through several intermediate steps, including reviews by the Airport, the FAA Airports District Office (ADO), and several other FAA office involved in the associated airspace review. A current ALP that has airport sponsor and FAA approval from the standpoint of safety, utility, and efficiency of the Airport is required by United States Code, Title 49, 47107(a)(16).

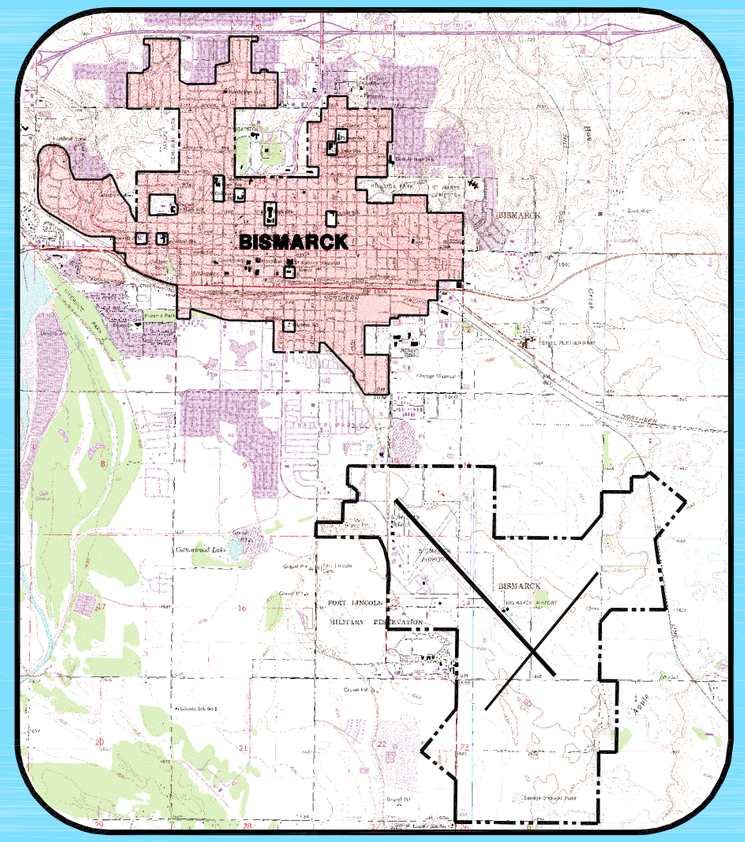
The Bismarck Airport Layout Plan is prepared using several applicable guidelines and checklists. These sources include:

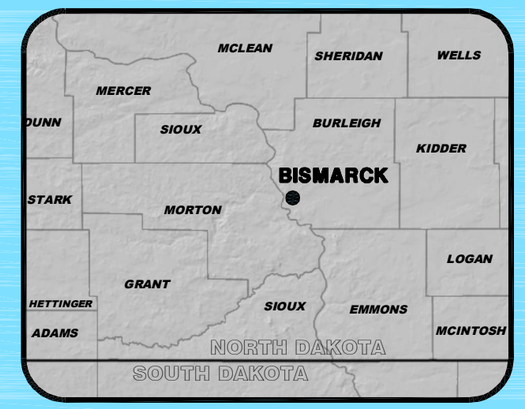
- FAA Advisory Circular 150/5300-13, *Airport Design*
- FAA Advisory Circular 150/5070-6B, *Airport Master Plans*

- FAA Great Lakes Region Policy and Procedures Memorandum 5050.5C, *Planning: Airport Layout Plan Approval and Airport Master Plan Acceptance*

This chapter present the Airport's compliance with FAA design standards and presents reduced size copies of the ALP drawing set in draft form. The final approved ALP drawing set is not included in this documentation. The FAA approval letter and associated drawing set are on file at Bismarck Airport and the Bismarck Airports District Office.

AIRPORT LAYOUT PLAN
FOR
BISMARCK AIRPORT
BISMARCK, NORTH DAKOTA
MARCH 14, 2008





SHEET NUMBER	INDEX TO SHEETS	REVISION DATE
1	TITLE SHEET	
2	AIRPORT DATA SHEET	
3	EXISTING FACILITIES LAYOUT PLAN	
4	AIRPORT LAYOUT PLAN	
5	TERMINAL AREA PLAN	
6	TERMINAL ACCESS PLAN	
7	FAR PART 77 IMAGINARY SURFACE	
8	FAR PART 77 IMAGINARY SURFACE	
9	RUNWAY 13 APPROACH/DEPARTURE PROFILES	
10	RUNWAY 31 APPROACH/DEPARTURE PROFILES	
11	RUNWAY 3 APPROACH/DEPARTURE PROFILES	
12	RUNWAY 21 APPROACH/DEPARTURE PROFILES	
13	EXISTING LAND USE PLAN	
14	AIRPORT PROPERTY MAP	

ALP Checklist Certification for Airspace Review

On behalf of Reynolds, Smith and Hills, Inc., this Airport Layout Plan (ALP) was prepared for Bismark Airport according to the applicable Advisory Circulars, the current version of the Great Lakes Region ALP Checklist, and accurately depicts the proposed use of airspace at the time of submittal. The ALP conforms with FAA design standards, expect as noted:

None.

Signed: _____ Date: _____

CITY of BISMARCK

APPROVED _____ DATE _____

APPROVED _____ DATE _____

PLANS PREPARED BY:

RS&H
IMPROVING YOUR WORLD

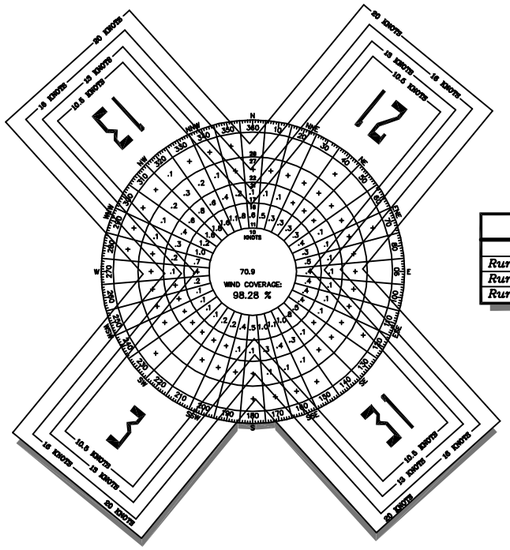
RS&H Chicago (Naperville)
850 East Diehl Road
Suite 120
Naperville, IL 60563
(630) 505-1991 (800) 598-4313

APPROVED _____ NAME _____ DATE _____

REVISIONS

NO.	DESCRIPTION	DATE

Drawing: T:\P\Bismarck\Cadd\V01-cover.dwg
Plotted by: Mancha, Jessy
Plotted on: 5/19/2008 10:01 AM

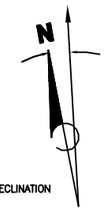


SOURCE:
NOAA National Climatic Center
Asheville, N.C.

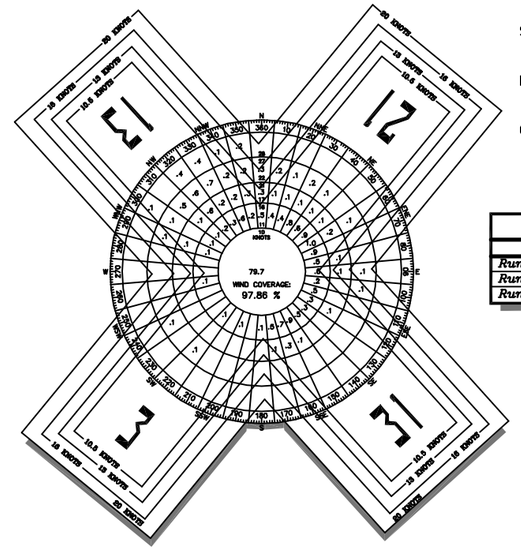
DATA STATION:
Bismarck Airport
Bismarck, North Dakota

OBSERVATIONS:
81,620 Observations
1995 – 2004

ALL WEATHER WIND COVERAGE	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 3–21	*79.3%*	*86.7%*	*94.1%*	*97.0%*
Runway 13–31	*94.0%*	*97.2%*	*99.3%*	*99.9%*
Runways Combined	*98.3%*	*99.8%*	*99.9%*	*100.0%*



MAGNETIC DECLINATION
7° 18' EAST
MAY 2007
ANNUAL CHANGE 0° 8' WEST



SOURCE:
NOAA National Climatic Center
Asheville, N.C.

DATA STATION:
Bismarck Airport
Bismarck, North Dakota

OBSERVATIONS:
4,985 Observations
1995 – 2004

IFR CAT–I WIND COVERAGE	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 3–21	*78.7%*	*85.9%*	*92.5%*	*96.2%*
Runway 13–31	*87.7%*	*93.3%*	*97.9%*	*99.5%*
Runways Combined	*97.6%*	*99.4%*	*99.9%*	*100.0%*

RUNWAY DATA	RUNWAY 13–31		RUNWAY 3–21	
	EXISTING	ULTIMATE	EXISTING	FUTURE
AIRCRAFT APPROACH CATEGORY–DESIGN GROUP	D–IV	D–IV	C–II	D–IV
RUNWAY AZIMUTH (TRUE)	137°/ 317° 35' 45.921"	137°/ 317° 35' 45.921"	39°/ 219° 00' 51.044"	39°/ 219° 00' 51.044"
RUNWAY BEARING (TRUE)	N 42 ° 24' 14.08" W	N 42 ° 24' 14.08" W	N 39 ° 00' 51.04" E	N 39 ° 00' 51.04" E
RUNWAY DIMENSIONS	8,794' x 150'	10,000' x 150'	6,600' x 100'	7,200' x 150'
APPROACH VISIBILITY MINIMUMS [2]	1 Mile, 1/2 Mile	1 Mile, 1/24 Mile	3/4 Mile, 1 Mile	1/2 Mile, 1/2 Mile
RUNWAY APPROACH SURFACES	34:1/ 50:1	50:1/ 50:1	34:1/ 34:1	50:1/ 50:1
AIRPORT SURVEILLANCE RADAR (ASR) (RUNWAY 13 ONLY)	A, B = 1 MILE C = 1 1/4 MILE D = 1 1/2 MILE	A, B = 1 MILE C = 1 1/4 MILE D = 1 1/2 MILE	NONE	NONE
RUNWAY THRESHOLD DISPLACEMENT	None	None	None	None
RUNWAY SAFETY AREA	10,794' x 500'	12,000' x 500'	8,600' x 500'	9,200' x 500'
RUNWAY OBSTACLE FREE ZONE	9,194' x 400'	10,400' x 400'	7,000' x 400'	7,600' x 400'
RUNWAY OBJECT FREE AREA (ROFA)	10,794' x 800'	12,000' x 800'	8,600' x 800'	9,200' x 800'
PRECISION OBSTACLE FREE ZONE	200' x 800'	200' x 800'	200' x 800'	200' x 800'
TAXI WAY SAFETY AREA WIDTH	171'	171'	171'	171'
PAVEMENT MATERIAL	Asphalt	Asphalt	Asphalt	Concrete
PAVEMENT SURFACE TREATMENT	Grooved	Grooved	Grooved	Grooved
PAVEMENT STRENGTH (in thousand lbs.) [1]	117(S)/153(D)/252(DT)	117(S)/153(D)/252(DT)	100(S)/140(D)/200(DT)	117(S)/153(D)252(DT)
RUNWAY EFFECTIVE GRADIENT	0.09097%	0.01852%	0.21539%	0.0133%
RUNWAY MARKING	Precision	Precision	Precision	Precision
RUNWAY LIGHTING	HIRL	HIRL, TDZ, Centerline	MIRL, REIL	MIRL, REIL
RUNWAY APPROACH LIGHTING	MALS(13)/MALSR (31)	MALSR (13–31)	None	None
TAXI WAY LIGHTING	MITL	MITL	MITL	MITL
TAXI WAY MARKING	Centerline, Signage	Centerline, Signage	Centerline, Signage	Centerline, Signage
RUNWAY PROTECTION ZONE	1000'x2500'x1750'	1000'x2500'x1750'	R/W 3 1000'x1700'x1510' R/W 21 500'x1700'x1010'	R/W 3 1000'x1700'x1510' R/W 21 500'x1700'x1010'
APPROACH TYPE	Precision	Precision	Non–precision	Non–precision
ELECTRONIC NAVIGATIONAL AIDS	ILS (13–31) GPS (31)	ILS (13–31) GPS (31)	GPS	GPS
TAIL HEIGHT	45'–<60'	45'–<60'	45'–<60'	45'–<60'
VISUAL NAVIGATIONAL AIDS	VASI–4L (13) PAPI–4L (31)	PAPI–4L (13) PAPI–4L (31)	PAPI–4L (3) PAPI–4L (21)	PAPI–4L (3) PAPI–4L (21)

1 Pavement strengths are expressed in Single (S), Dual (D), and Dual Tandem (DT) wheel loading capacities.

RUNWAY TOUCHDOWN STATIONING AND ELEVATIONS	EXISTING		FUTURE / ULTIMATE	
RUNWAY 13	100+00.0 to 130+00.0	1,653.3'	100+00.0 to 130+00.0	1,653.3'
RUNWAY 31	187+92.2 to 157+92.2	1,647.2'	200+00.0 to 170+00.0	1,650.0'
RUNWAY 3	200+00.0 to 230+00.0	1,659.3'	200+00.0 to 230+00.0	1,659.3'
RUNWAY 21	266+00.0 to 236+00.0	1,660.0'	272+00.0 to 242+00.0	1,660.0'

OBSTACLE FREE ZONE PENETRATION DATA						
OBJECT	ELEVATION	ROFZ	50:1	3:1	CAT I/II/III	DISPOSITION
TREE	*1700 MSL*		*16'*			*OBSTRUCTION 20, SHEET 9. ULT. RWY. 31. TO BE REMOVED*

THRESHOLD SITTING REQUIREMENTS		EXISTING	ULTIMATE
RUNWAY 13–31	CATEGORY	9	9
RUNWAY 03–21	CATEGORY	6	6

MODIFICATIONS OF FAA AIRPORT DESIGN STANDARDS			
DEVIATION DESCRIPTION	EFFECTED DESIGN STANDARD	AIRSPACE CASE NUMBER	APPROVAL DATE
None	–	–	–

THRESHOLD SITTING PENETRATION DATA					
OBJECT	ELEVATION	15:1	20:1	34:1	DISPOSITION
TREE	*1700 MSL*			*24'*	*OBSTRUCTION 22, SHEET 5. ULTIMATE RWY. 31. TO BE REMOVED*

DECLARED DISTANCES	RUNWAY 13–31		RUNWAY 3–21	
	EXISTING	ULTIMATE	EXISTING	FUTURE
TAKEOFF RUN AVAILABLE (TORA)	8,794' – 8,794'	10,000' – 10,000'	6,600' – 6,600'	7,200' – 7,200'
TAKEOFF DISTANCE AVAILABLE (TODA)	8,794' – 8,794'	10,000' – 10,000'	6,600' – 6,600'	7,200' – 7,200'
ACCELERATE–STOP DISTANCE AVAILABLE (ASDA)	8,794' – 8,794'	10,000' – 10,000'	6,600' – 6,600'	7,200' – 7,200'
LANDING DISTANCE AVAILABLE (LDA)	8,794' – 8,794'	10,000' – 10,000'	6,600' – 6,600'	7,200' – 7,200'

AIRPORT DATA			
CITY: Bismarck, North Dakota	*COUNTY: Burleigh, North Dakota*		
RANGE: 80 West TOWNSHIP: 138 North	*CIVIL TOWNSHIP: Hay Creek*		
BISMARCK AIRPORT	EXISTING	FUTURE	ULTIMATE
AIRPORT SERVICE LEVEL	Commercial Service	SAME	SAME
AIRPORT REFERENCE CODE	D–IV	SAME	SAME
AIRPORT ELEVATION	1,660' MSL	SAME	SAME
MEAN MAXIMUM TEMPERATURE OF HOTTEST MONTH	84.4 ° F (July)	SAME	SAME
MISCELLANEOUS FACILITIES	Wind Indicator, Beacon, RTR	SAME	SAME
AIRPORT REFERENCE POINT (ARP) COORDINATES (NAD 83) — *Latitude*	46 ° 46' 21.8" N	46 ° 46' 22.5" N	46 ° 46' 20.5" N
AIRPORT REFERENCE POINT (ARP) COORDINATES (NAD 83) — *Longitude*	100 ° 44' 44.7" W	100 ° 44' 42.7" W	100 ° 44' 40.5" W
AIRPORT and TERMINAL NAVIGATIONAL AIDS	ILS (13–31) RNAV or GPS (31) RNAV (GPS) (3–21)	SAME	SAME

RUNWAY END COORDINATES (NAD 83)		EXISTING	ELEVATION	FUTURE / ULTIMATE	ELEVATION
Datums: NAD 83 ,NAVD 88					
BISMARCK AIRPORT					
Runway 3	*Latitude*	46° 45' 45.420" N	1,659.3'	46° 45' 45.420" N	1,659.3'
	Longitude	100° 44' 54.292" W		100° 44' 54.292" W	
Runway 21	*Latitude*	46° 46' 36.018" N	1,660.0'	46° 46' 40.618" N	1,660.0'
	Longitude	100° 43' 54.586" W		100° 43' 49.156" W	
Runway 13	*Latitude*	46° 47' 02.229" N	1,653.3'	46° 47' 02.229" N	1,653.3'
	Longitude	100° 45' 42.431" W		100° 45' 42.431" W	
Runway 31	*Latitude*	46° 45' 58.145" N	1,643.8'	46° 45' 49.355" N	1,650.0'
	Longitude	100° 44' 17.229" W		100° 44' 05.549" W	

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Bismarck

REVISIONS

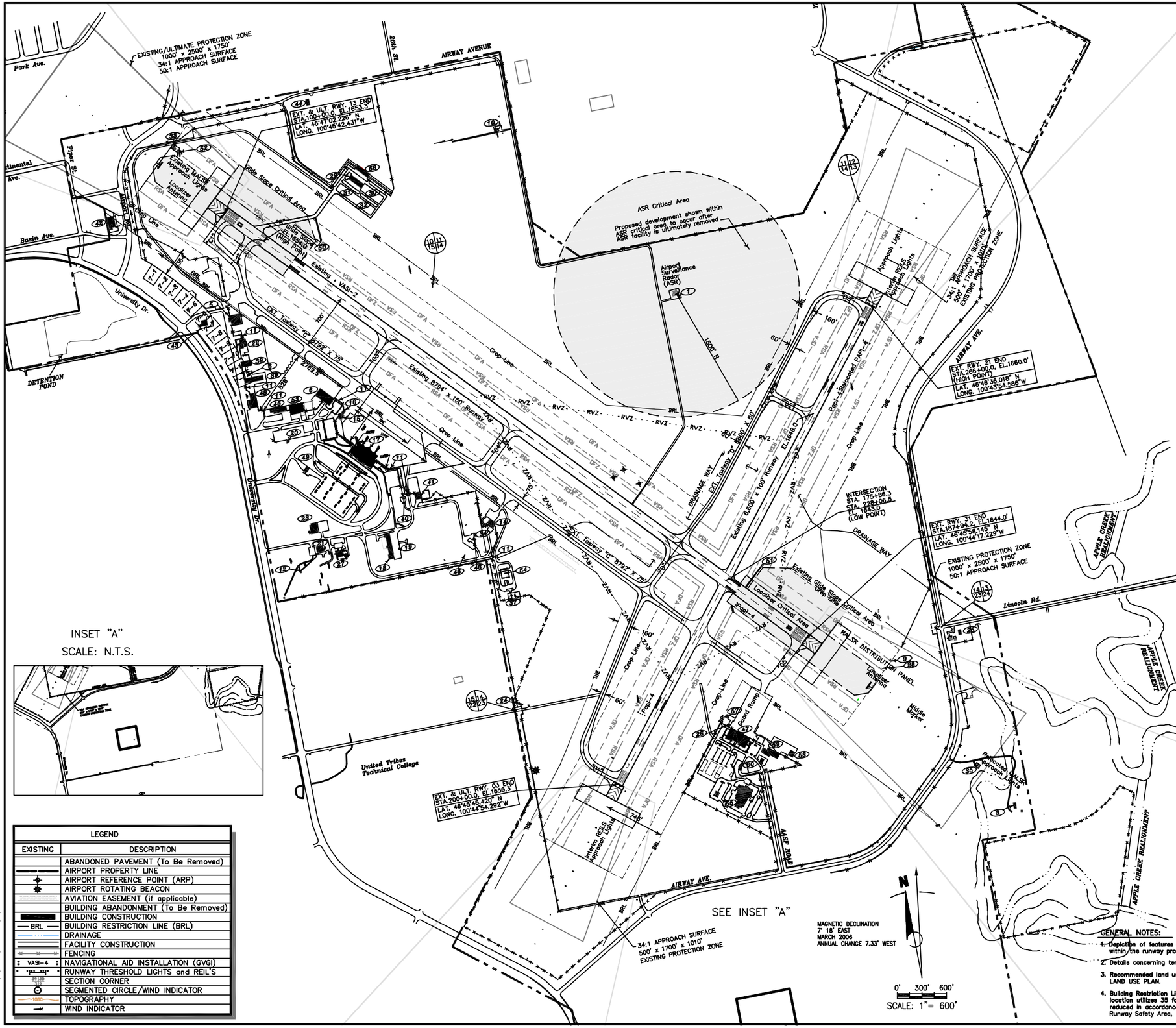
NO.	DESCRIPTION	DATE

DATE ISSUED: 03-14-08
REVIEWED BY: M.L.S
DRAWN BY: D.C.C.
DESIGNED BY: N.A.W

SHEET TITLE
AIRPORT DATA SHEET

SHEET NUMBER
2 OF 14

Drawing: T:\P\Bismarck\Cadd\VA02-data.dwg
Plotted by: Monday, January
Plotted on: 5/20/2008 7:48 AM



INSET "A"
SCALE: N.T.S.

BUILDINGS/FACILITIES	
EXT	DESCRIPTION
1*	FAA APPROACH SURVEILLANCE RADAR
3	RENTAL PROPERTY #3
5*	CITY HANGAR
6	EXECUTIVE AIR TAXI
9	MALSR BUILDING / ENGINE GENERATOR
10	FAA REMOTE TRANSMITTAL/RECEIVER (RTR)
11	
12	NWS INFLATION SHELTER
13*	U.S. WEST TELEPHONE BUILDING
14	AIRPORT FIRE DEPARTMENT (ARFF)
15*	
16*	GARAGE
17	AIRLINE TERMINAL BUILDING
18	AIRPORT MAINTENANCE BUILDING
19	LIFT STATION #2
20	LIFT STATION #1
21	EMER. MANAGEMENT & COMBINED COMM. CENTER
22	
23	FAA AIRWAY FACILITIES SECTOR
24	ELECTRICAL VAULT – RWY. 3/21
25	STORAGE GARAGE
26	LIFT STATION #3
27	NATIONAL WEATHER SERVICE
28	FAA LOCALIZER – RWY. 13
29	NIC HANGAR
30	T–HANGAR SITE B
31	T–HANGAR SITE C
32	T–HANGAR SITE D
33	FAA LOCALIZER – RWY. 31
34	FAA ATCT GARAGE & EMERGENCY GENERATOR
35	FAA MIDDLE MARKER – RWY. 31
37	BISMARCK AIRPORT FUEL TANK FARM
38*	WAY–POINT AVIONICS
39*	BISMARCK AIRPORT T–HANGARS
40	FAA REMOTE TRANSMITTER
41	NDDOT HANGAR
42	GAS STATION
43*	MEISNER OFFICE BUILDING
44	STORAGE BUILDING
45	BASIN COOPERATIVE SERVICES
46	
47	ND NATIONAL GUARD A.A.S.F.
48	EXECUTIVE AIR TAXI
49	PAY PARKING LOT EXIT PLAZA
50	FAA GLIDE SLOPE – RWY. 13
51	FAA GLIDE SLOPE – RWY. 31
52	FAA MALS – RWY. 13
53	SIMMERS HANGAR
54	EXECUTIVE AIR FUEL FARM
55	ND NATIONAL GUARD A.A.S.F. READINESS CENTER
56	BYERS HANGAR
57	ND NG AASF FUEL TRUCK CONTAINMENT AREA
58	ND NATIONAL GUARD A.A.S.F. AIRCRAFT WASH RACK
59	ND NATIONAL GUARD A.A.S.F.
* TO BE REMOVED OR RELOCATED	

LEGEND	
EXISTING	DESCRIPTION
	ABANDONED PAVEMENT (To Be Removed)
	AIRPORT PROPERTY LINE
	AIRPORT REFERENCE POINT (ARP)
	AIRPORT ROTATING BEACON
	AVIATION EASEMENT (if applicable)
	BUILDING ABANDONMENT (To Be Removed)
	BUILDING CONSTRUCTION
BRL	BUILDING RESTRICTION LINE (BRL)
	DRAINAGE
	FACILITY CONSTRUCTION
	FENCING
VASI-4	NAVIGATIONAL AID INSTALLATION (GVGI)
	RUNWAY THRESHOLD LIGHTS and REIL'S
	SECTION CORNER
	SEGMENTED CIRCLE/WIND INDICATOR
1000	TOPOGRAPHY
	WIND INDICATOR

GENERAL NOTES:

1. Depiction of features and objects, including related elevations and clearances, within the runway protection zones are depicted on the RUNWAYS END AREA PLANS.
2. Details concerning terminal improvements are depicted on the TERMINAL AREA PLAN.
3. Recommended land uses within the airport environs are depicted on the AIRPORT LAND USE PLAN.
4. Building Restriction Line (BRL) is established in accordance with F.A.R. Part 77 criteria, location utilizes 35 foot vertical object height. Building Restriction Line location may be reduced in accordance to Part 77 criteria, to limits of the Runway Object Free Area, Runway Safety Area, and/or Runway Protection Zone criteria.

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Bismarck

REVISIONS

NO.	DESCRIPTION	DATE

DATE ISSUED: 03-14-08
REVIEWED BY: M.L.S
DRAWN BY: D.C.C.
DESIGNED BY: N.A.W

SHEET TITLE

EXISTING FACILITY LAYOUT PLAN

SHEET NUMBER

3 OF 14

Drawing: T:\P\Bismarck\Cadd\V\03-dlp-4.dwg
Plotted by: Monchin, Jeremy
Plotted on: 5/20/2008 7:49 AM

BUILDINGS/FACILITIES		
EXT	ULT	DESCRIPTION
1*	1	FAA APPROACH SURVEILLANCE RADAR
3		RENTAL PROPERTY #3
5*		CITY HANGAR
6	6	EXECUTIVE AIR TAXI
7		REVENUE SUPPORT DEVELOPMENT
9		MALSR BUILDING / ENGINE GENERATOR
10		FAA REMOTE TRANSMITTAL/RECEIVER (RTR)
11		ACCESS CONTROLLED GATE
12		NWS INFLATION SHELTER
13*		U.S. WEST TELEPHONE BUILDING
14		AIRPORT FIRE DEPARTMENT (ARFF)
15*		VAULT, COOLING TOWER, EMERGENCY GENERATOR
16*		GARAGE
17		AIRLINE TERMINAL BUILDING
18		AIRPORT MAINTENANCE BUILDING
19		LIFT STATION #2
20		LIFT STATION #1
21		EMER. MANAGEMENT & COMBINED COMM. CENTER
22	17	AIRPORT ADMINISTRATION
23		FAA AIRWAY FACILITIES SECTOR
24		ELECTRICAL VAULT – RWY. 3/21
25		STORAGE GARAGE
26		LIFT STATION #3
27		NATIONAL WEATHER SERVICE
28		FAA LOCALIZER – RWY. 13
29		NIC HANGAR
30		T–HANGAR SITE B
31		T–HANGAR SITE C
32		T–HANGAR SITE D
33		FAA LOCALIZER – RWY. 31
34		FAA ATCT GARAGE & EMERGENCY GENERATOR
35		FAA MIDDLE MARKER – RWY. 31
37		BISMARCK AIRPORT FUEL TANK FARM
38*		WAY–POINT AVIONICS
39*		BISMARCK AIRPORT T–HANGARS
40		FAA REMOTE TRANSMITTER
41		NDDOT HANGAR
42		GAS STATION
43*		WEISNER OFFICE BUILDING
44		STORAGE BUILDING
45		BASIN COOPERATIVE SERVICES
46		FAA AIR TRAFFIC CONTROL TOWER
47		ND NATIONAL GUARD A.A.S.F.
48		EXECUTIVE AIR TAXI
49		EXISTING PAY PARKING LOT EXIT PLAZA
50		FAA GLIDE SLOPE – RWY. 13
51		FAA GLIDE SLOPE – RWY. 31
52		FAA MALS – RWY. 13
53		SIMMERS HANGAR
54		EXECUTIVE AIR FUEL FARM
55		ND NATIONAL GUARD A.A.S.F. READINESS CENTER
56		BYERS HANGAR
57		ND NG AASF FUEL TRUCK CONTAINMENT AREA
58		ND NATIONAL GUARD A.A.S.F. AIRCRAFT WASH RACK
59		ND NATIONAL GUARD A.A.S.F.
	60	AIR CARGO FACILITY
	61	T–HANGARS
	62	GENERAL AVIATION AREA
	63	CORPORATE AVIATION AREA
	64	ELECTRICAL VAULT AREA
	65	CAR WASH FACILITY
	66	ULTIMATE PAY PARKING LOT EXIT PLAZA
	67	RENTAL CAR STORAGE LOT

* TO BE REMOVED OR RELOCATED

LEGEND			
EXISTING	FUTURE	ULTIMATE	DESCRIPTION
			AIRPORT PROPERTY LINE
			AIRPORT REFERENCE POINT (ARP)
			AIRPORT ROTATING BEACON
			AVIATION EASEMENT (if applicable)
			BUILDING ABANDONMENT (To Be Removed)
			BUILDING CONSTRUCTION
BRL			BUILDING RESTRICTION LINE (BRL) EL.1703'
RSA	RSA	RSA	RUNWAY SAFETY AREA
OFZ	OFZ	OFZ	OBJECT FREE ZONE
RVR	RVR	RVR	RUNWAY VISIBILITY ZONE
			DRAINAGE
			FACILITY CONSTRUCTION
			FENCING
VASI-4	VASI-4	VASI-4 PAPI	NAVIGATIONAL AID INSTALLATION (GVGI)
THL	THL	THL	RUNWAY THRESHOLD LIGHTS and REIL'S
			SECTION CORNER
			SEGMENTED CIRCLE/WIND INDICATOR
1050	1050		TOPOGRAPHY
			WIND INDICATOR
			CRITICAL AREA

GENERAL NOTES:

1. Depiction of features and objects, including related elevations and clearances, within the runway protection zones are depicted on the RUNWAYS END AREA PLANS.
2. Details concerning terminal improvements are depicted on the TERMINAL AREA PLAN.
3. Recommended land uses within the airport environs are depicted on the AIRPORT LAND USE PLAN.
4. Building Restriction Line (BRL) is established in accordance with F.A.R. Part 77 criteria, location utilizes 35 foot vertical object height. Building Restriction Line location may be reduced in accordance to Part 77 criteria, to limits of the Runway Object Free Area, Runway Safety Area, and/or Runway Protection Zone criteria.

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Bismarck

REVISIONS		
NO.	DESCRIPTION	DATE

DATE ISSUED: 03-14-08
REVIEWED BY: M.L.S
DRAWN BY: D.C.C.
DESIGNED BY: N.A.W

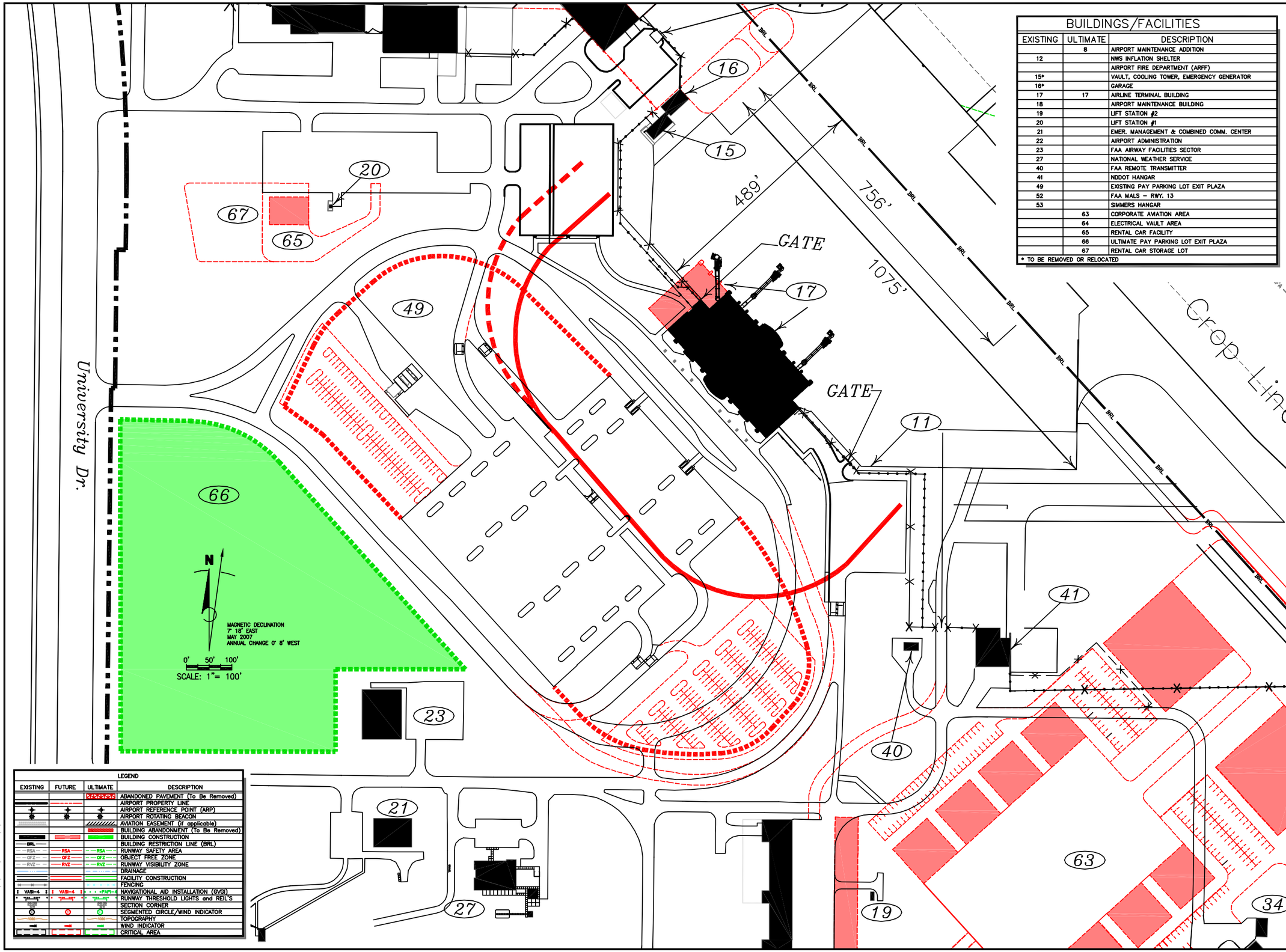
SHEET TITLE

AIRPORT LAYOUT PLAN

SHEET NUMBER

4 OF 14

Drawing: T:\P\Bismarck\Code1\V\04-alp.dwg
Plotted by: Marcho, Jeremy
Plotted on: 5/21/2008 11:00 AM



BUILDINGS/FACILITIES		
EXISTING	ULTIMATE	DESCRIPTION
	8	AIRPORT MAINTENANCE ADDITION
12		NWS INFLATION SHELTER
		AIRPORT FIRE DEPARTMENT (ARFF)
15*		VAULT, COOLING TOWER, EMERGENCY GENERATOR
16*		GARAGE
17	17	AIRLINE TERMINAL BUILDING
18		AIRPORT MAINTENANCE BUILDING
19		LIFT STATION #2
20		LIFT STATION #1
21		EMER. MANAGEMENT & COMBINED COMM. CENTER
22		AIRPORT ADMINISTRATION
23		FAA AIRWAY FACILITIES SECTOR
27		NATIONAL WEATHER SERVICE
40		FAA REMOTE TRANSMITTER
41		NDDOT HANGAR
49		EXISTING PAY PARKING LOT EXIT PLAZA
52		FAA MALS – RWY. 13
53		SIMMERS HANGAR
	63	CORPORATE AVIATION AREA
	64	ELECTRICAL VAULT AREA
	65	RENTAL CAR FACILITY
	66	ULTIMATE PAY PARKING LOT EXIT PLAZA
	67	RENTAL CAR STORAGE LOT

* TO BE REMOVED OR RELOCATED

LEGEND			
EXISTING	FUTURE	ULTIMATE	DESCRIPTION
			ABANDONED PAVEMENT (To Be Removed)
			AIRPORT PROPERTY LINE
			AIRPORT REFERENCE POINT (ARP)
			AIRPORT ROTATING BEACON
			AVIATION EASEMENT (if applicable)
			BUILDING ABANDONMENT (To Be Removed)
			BUILDING CONSTRUCTION
BRL			BUILDING RESTRICTION LINE (BRL)
RSA	RSA	RSA	RUNWAY SAFETY AREA
OFZ	OFZ	OFZ	OBJECT FREE ZONE
RVZ	RVZ	RVZ	RUNWAY VISIBILITY ZONE
			DRAINAGE
			FACILITY CONSTRUCTION
			FENCING
VASI-4	VASI-4	PAPI-4	NAVIGATIONAL AID INSTALLATION (GVGI)
			RUNWAY THRESHOLD LIGHTS and REIL'S
			SECTION CORNER
			SEGMENTED CIRCLE/WIND INDICATOR
			TOPOGRAPHY
			WIND INDICATOR
			CRITICAL AREA

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(952) 835-3000 FAX (952) 835-4515
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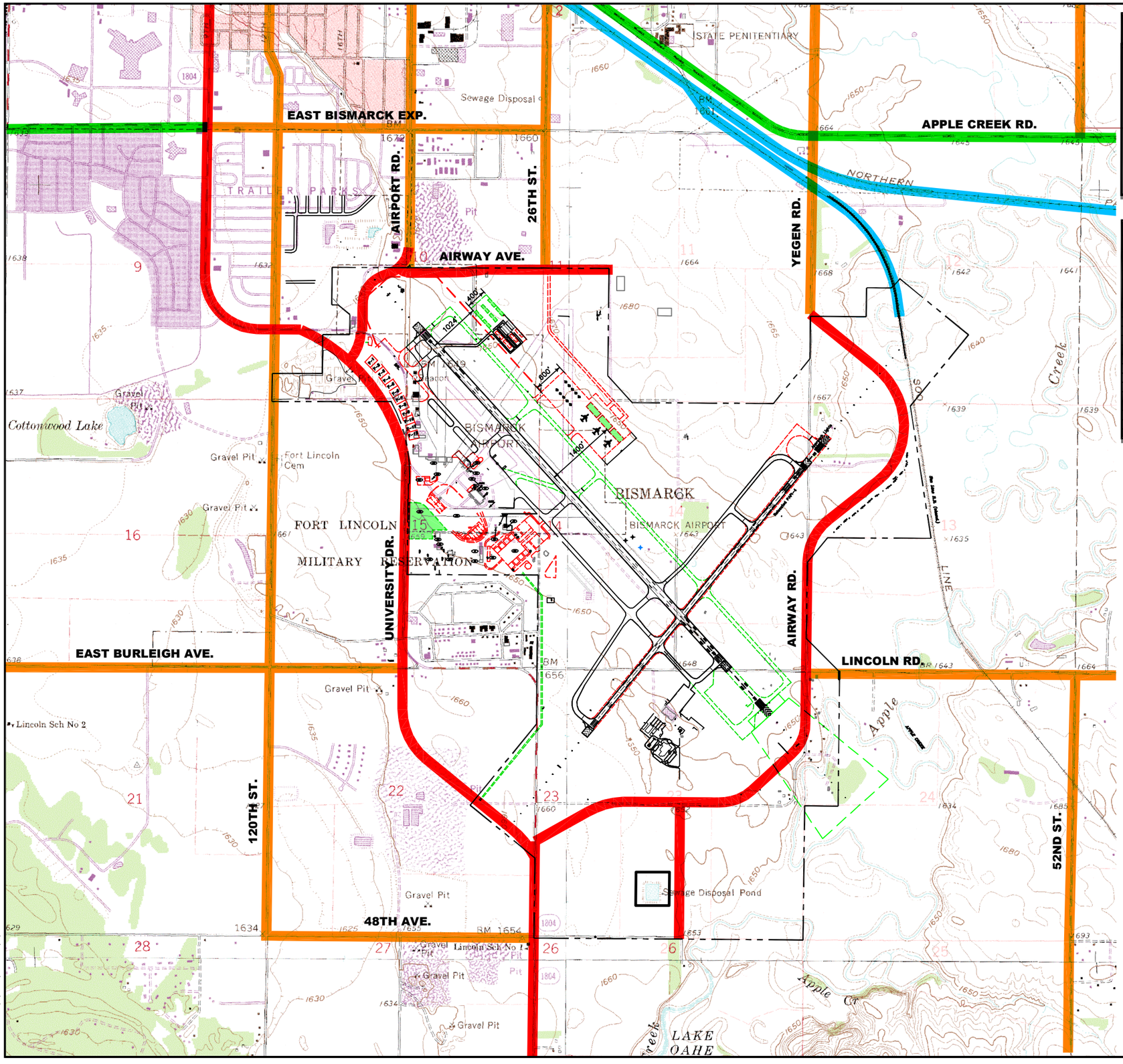
REVISIONS		
NO.	DESCRIPTION	DATE

DATE ISSUED: 03-14-08
REVIEWED BY: M.L.S
DRAWN BY: D.C.C.
DESIGNED BY: N.A.W

SHEET TITLE
TERMINAL AREA PLAN

SHEET NUMBER
5 OF 14

Drawing: T:\P\Bismarck\Codd\V\05-Term-100-4.dwg
Plotted by: Manrho, Jesse
Plotted on: 5/20/2008 7:54 AM



AIRPORT ACCESS LEGEND

- REGIONAL ROUTES
- ACCESS ROUTES
- LOCAL ROADS
- RAILROADS

LEGEND

EXISTING	FUTURE	ULTIMATE	DESCRIPTION
			AIRPORT PROPERTY LINE
			AIRPORT REFERENCE POINT (ARP)
			AIRPORT ROTATING BEACON
			AVIATION EASEMENT (if applicable)
			BUILDING ABANDONMENT (To Be Removed)
			BUILDING CONSTRUCTION
BRL			BUILDING RESTRICTION LINE (BRL)
RSA	RSA	RSA	RUNWAY SAFETY AREA
OFZ	OFZ	OFZ	OBJECT FREE ZONE
			DRAINAGE
			FACILITY CONSTRUCTION
			FENCING
VASI-4		PAPI-4	NAVIGATIONAL AID INSTALLATION (GVGI)
			RUNWAY THRESHOLD LIGHTS and REIL'S
			SECTION CORNER
			SEGMENTED CIRCLE/WIND INDICATOR
1080		1080	TOPOGRAPHY
			WIND INDICATOR
			CRITICAL AREA

MAGNETIC DECLINATION
7° 18' EAST
MAY 2007
ANNUAL CHANGE 0° 8' WEST

N

0' 500' 1000'
SCALE: 1"= 1000'

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REVISIONS

NO.	DESCRIPTION	DATE

DATE ISSUED: 03-14-08
REVIEWED BY: M.L.S
DRAWN BY: D.C.C.
DESIGNED BY: N.A.W

SHEET TITLE
TERMINAL ACCESS PLAN

SHEET NUMBER
6 OF 14

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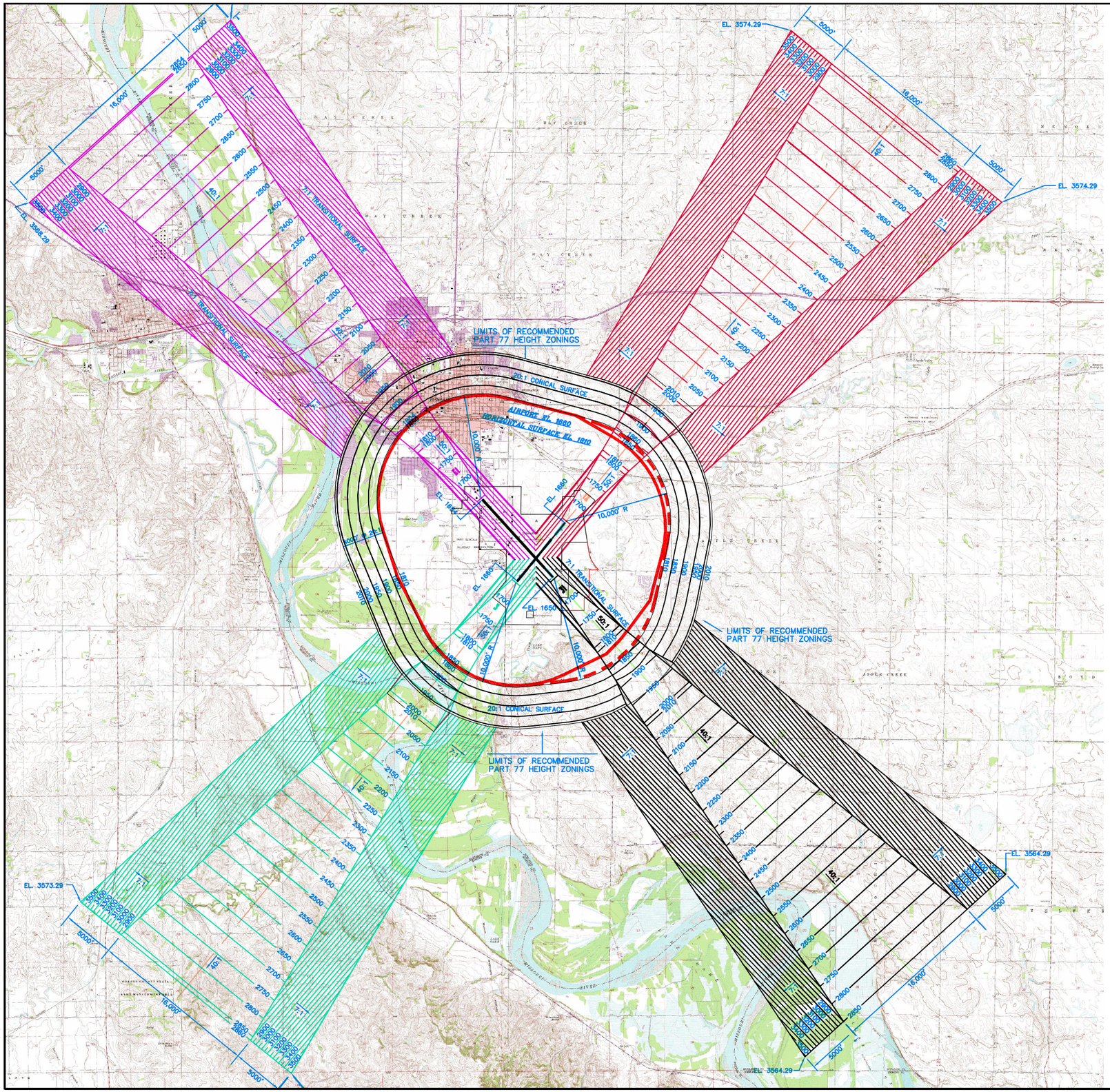
Plotted by: Manotha, Jeffrey
Plotted on: 5/20/2008 7:56 AM



N

ANNUAL CHANGE 0° 8' WEST
MAGNETIC DECLINATION
7° 18' EAST
MAY 2007

0' 2500' 5000'
SCALE: 1"= 5000

OBSTRUCTION LEGEND

- OBSTRUCTION
- GROUP or MULTIPLE OBSTRUCTIONS
- TOPOGRAPHIC OBSTRUCTION

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted.
2. Depiction of features and objects within the primary, transitional, and horizontal Part 77 surfaces, is illustrated on the FAR PART 77 IMAGINARY SURFACES, sheet 7 and 8 of these plans.
3. Depiction of features and objects within the inner portion of the approach surfaces, is illustrated on the APPROACH PROFILES, sheet 9 and 10 of these plans.
4. Additional obstruction data is illustrated on National Ocean Survey document OC 51, AIRPORT OBSTRUCTION CHART (September 1993).
5. Existing and future height and hazard ordinances are to be amended and/or referenced upon approval of updated FAR PART 77 IMAGINARY SURFACES.

WILDLIFE HAZARD ZONE

- EXISTING
- FUTURE

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REVISIONS

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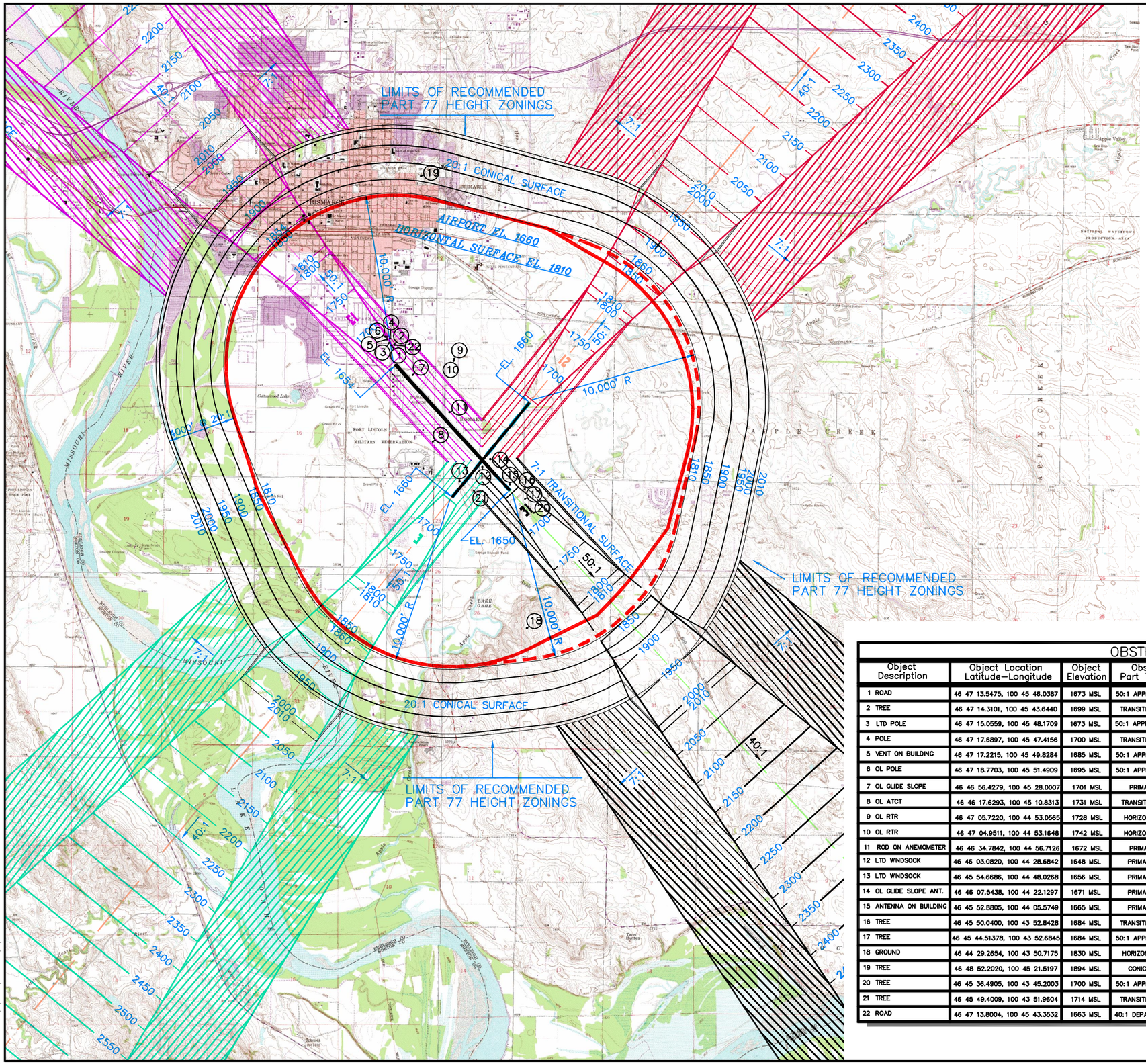
SHEET TITLE

FAR PART 77
IMAGINARY SURFACE

SHEET NUMBER
7 OF 14

Drawing: T:\P\Bismarck\Cadd\V\07-part77.dwg
Plotted by: Mancha, Jessy
Plotted on: 5/19/2008 11:10 AM



N

ANNUAL CHANGE 0° 8' WEST
MAGNETIC DECLINATION
7° 18' EAST
MAY 2007

0' 1500' 3000'
SCALE: 1"= 3000

EXISTING PROPERTY LINE
ULTIMATE PROPERTY LINE

OBSTRUCTION LEGEND

- OBSTRUCTION
- GROUP or MULTIPLE OBSTRUCTIONS
- TOPOGRAPHIC OBSTRUCTION

WILDLIFE HAZARD ZONE

- EXISTING
- FUTURE

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted.
2. Depiction of features and objects within the primary, transitional, and horizontal Part 77 surfaces, is illustrated on the FAR PART 77 IMAGINARY SURFACES, sheet 7 and 8 of these plans.
3. Depiction of features and objects within the inner portion of the approach surfaces, is illustrated on the APPROACH PROFILES, sheet 9 and 10 of these plans.
4. Additional obstruction data is illustrated on National Ocean Survey document OC 51, AIRPORT OBSTRUCTION CHART (September 1993).
5. Existing and future height and hazard ordinances are to be amended and/or referenced upon approval of updated FAR PART 77 IMAGINARY SURFACES.

OBSTRUCTION TABLE

Object Description	Object Location Latitude—Longitude	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
1 ROAD	46 47 13.5475, 100 45 46.0387	1673 MSL	50:1 APPROACH SURFACE	1669 MSL	4'	RELOCATE (ULTIMATE)
2 TREE	46 47 14.3101, 100 45 43.6440	1699 MSL	TRANSITIONAL SURFACE	1690 MSL	9'	REMOVE (ULTIMATE)
3 LTD POLE	46 47 15.0559, 100 45 48.1709	1673 MSL	50:1 APPROACH SURFACE	1673 MSL	0'	NONE
4 POLE	46 47 17.6897, 100 45 47.4156	1700 MSL	TRANSITIONAL SURFACE	1695 MSL	5'	BURIED LINES/REMOVE POLE
5 VENT ON BUILDING	46 47 17.2215, 100 45 49.8284	1685 MSL	50:1 APPROACH SURFACE	1678 MSL	7'	INSTALL OBSTRUCTION LIGHTING
6 OL POLE	46 47 18.7703, 100 45 51.4909	1695 MSL	50:1 APPROACH SURFACE	1682 MSL	13'	TO REMAIN LIGHTED
7 OL GLIDE SLOPE	46 46 56.4279, 100 45 28.0007	1701 MSL	PRIMARY SURFACE	1654 MSL	47'	TO REMAIN LIGHTED
8 OL ATCT	46 46 17.6293, 100 45 10.8313	1731 MSL	TRANSITIONAL SURFACE	1785 MSL	CLEAR	TO REMAIN LIGHTED
9 OL RTR	46 47 05.7220, 100 44 53.0565	1728 MSL	HORIZONTAL SURFACE	1810 MSL	CLEAR	TO REMAIN LIGHTED
10 OL RTR	46 47 04.9511, 100 44 53.1648	1742 MSL	HORIZONTAL SURFACE	1810 MSL	CLEAR	TO REMAIN LIGHTED
11 ROD ON ANEMOMETER	46 46 34.7842, 100 44 56.7126	1672 MSL	PRIMARY SURFACE	1654 MSL	18'	INSTALL OBSTRUCTION LIGHTING
12 LTD WINDSOCK	46 46 03.0820, 100 44 28.6842	1548 MSL	PRIMARY SURFACE	1543 MSL	5'	TO REMAIN LIGHTED
13 LTD WINDSOCK	46 45 54.6686, 100 44 48.0268	1656 MSL	PRIMARY SURFACE	1651 MSL	5'	TO REMAIN LIGHTED
14 OL GLIDE SLOPE ANT.	46 46 07.5438, 100 44 22.1297	1671 MSL	PRIMARY SURFACE	1644 MSL	27'	TO REMAIN LIGHTED
15 ANTENNA ON BUILDING	46 45 52.8805, 100 44 05.5749	1665 MSL	PRIMARY SURFACE	1644 MSL	21'	RELOCATE (ULTIMATE)
16 TREE	46 45 50.0400, 100 43 52.8428	1684 MSL	TRANSITIONAL SURFACE	1678 MSL	6'	REMOVE (ULTIMATE)
17 TREE	46 45 44.51378, 100 43 52.6845	1684 MSL	50:1 APPROACH SURFACE	1665 MSL	19'	REMOVE (PRESENT)
18 GROUND	46 44 29.2654, 100 43 50.7175	1830 MSL	HORIZONTAL SURFACE	1810 MSL	20'	REQUEST AERONAUTICAL STUDY
19 TREE	46 48 52.2020, 100 45 21.5197	1894 MSL	CONICAL SURFACE	1865 MSL	29'	REMOVE (ULTIMATE)
20 TREE	46 45 36.4905, 100 43 45.2003	1700 MSL	50:1 APPROACH SURFACE	1684 MSL	16'	REMOVE (ULTIMATE)
21 TREE	46 45 49.4009, 100 43 51.9604	1714 MSL	TRANSITIONAL SURFACE	1693 MSL	21'	REMOVE (ULTIMATE)
22 ROAD	46 47 13.8004, 100 45 43.3532	1663 MSL	40:1 DEPARTURE SURFACE	1676 MSL	2'	TO BE RELOCATED (ULTIMATE)

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REVISIONS

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REVIEWED BY: M.L.S
DRAWN BY: D.C.C.
DESIGNED BY: N.A.W

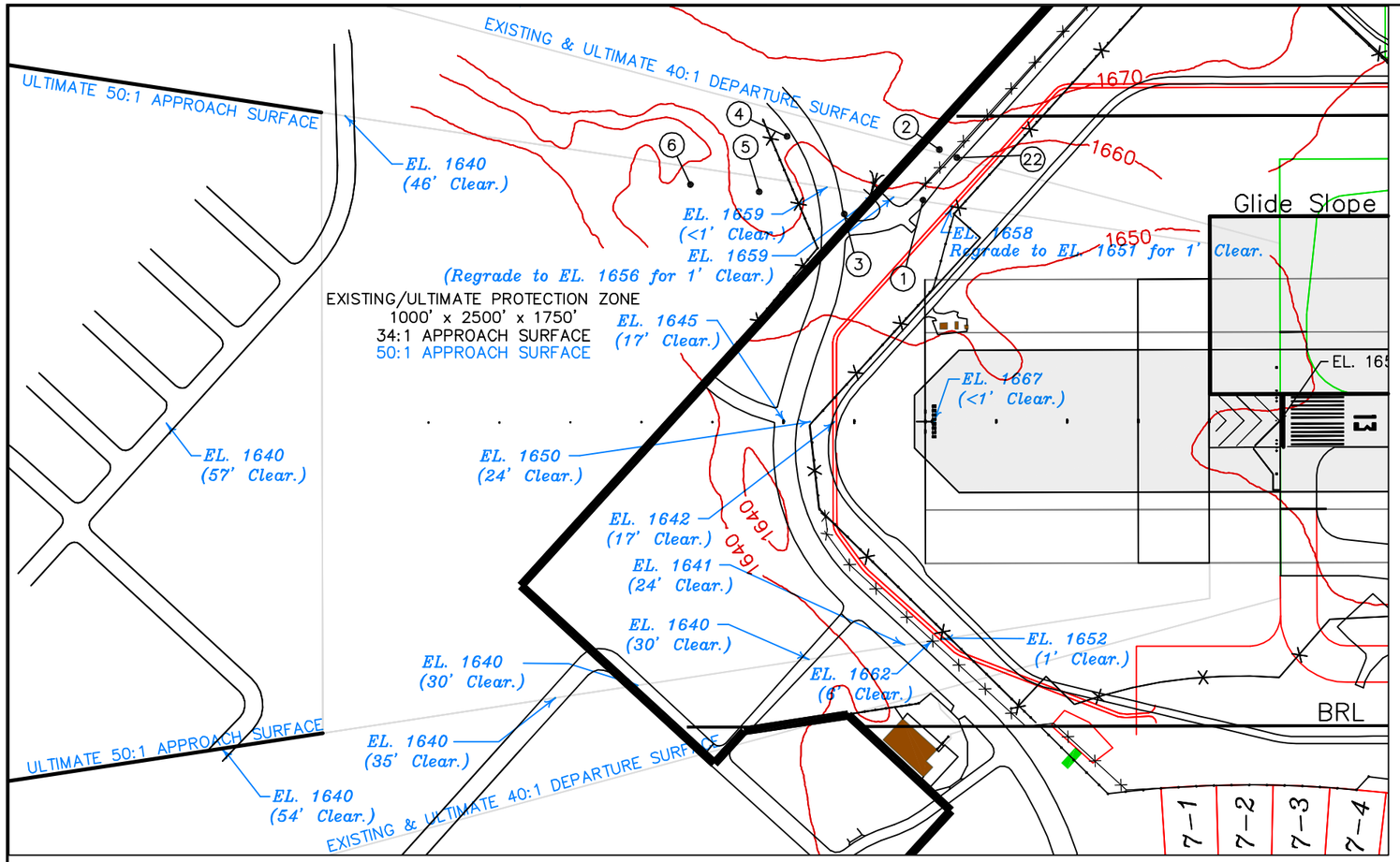
SHEET TITLE

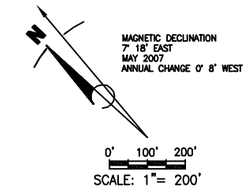
FAR PART 77
IMAGINARY SURFACE

SHEET NUMBER

8 OF 14

Drawing: T:\P\Bismarck\Cadd\V1.08-part77.dwg
Plotted by: Mancha, Jesse
Plotted on: 5/19/2008 2:27 PM

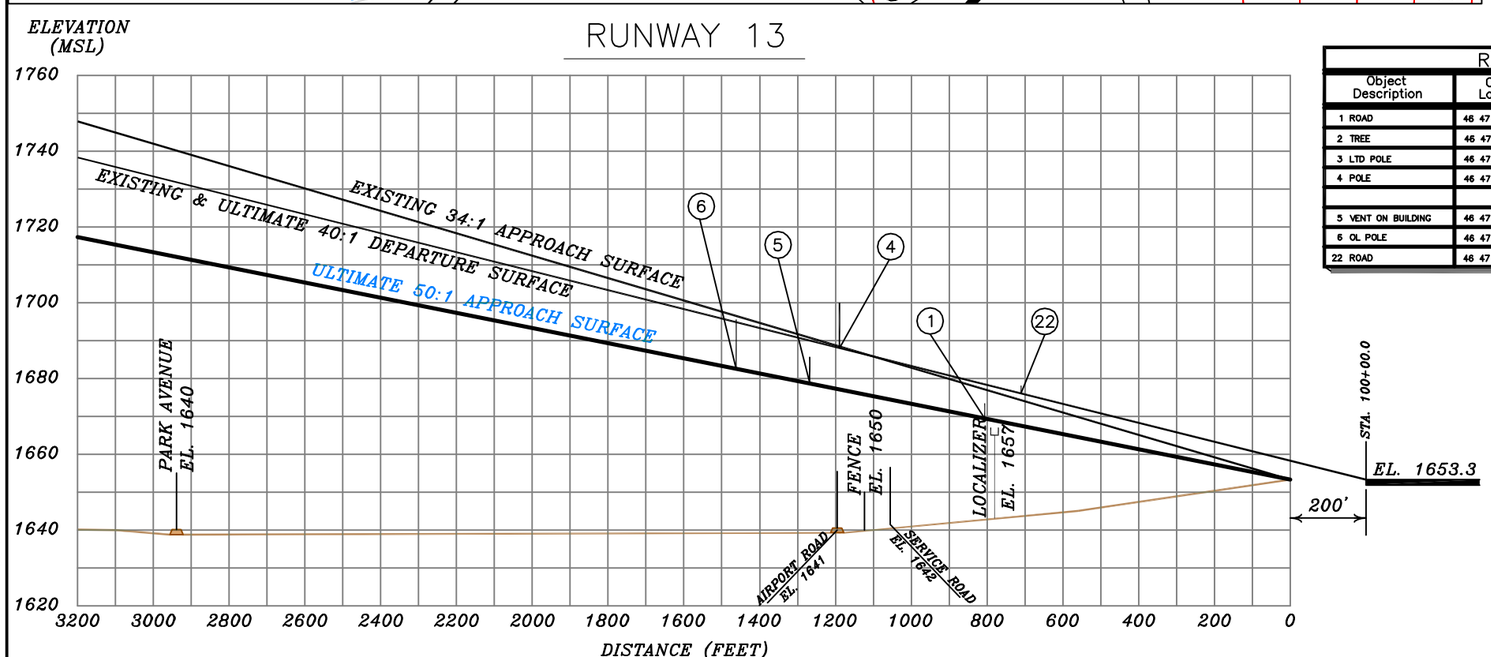




LEGEND			
EXISTING	FUTURE	ULTIMATE	DESCRIPTION
			ABANDONED PAVEMENT (To Be Removed)
			AIRPORT PROPERTY LINE
			AIRPORT REFERENCE POINT (ARP)
			AIRPORT ROTATING BEACON
			AVIATION EASEMENT (if applicable)
			BUILDING ABANDONMENT (To Be Removed)
			BUILDING CONSTRUCTION
BRL			BUILDING RESTRICTION LINE (BRL)
RSA	RSA	RSA	RUNWAY SAFETY AREA
OFZ	OFZ	OFZ	OBJECT FREE ZONE
RVR	RVR	RVR	RUNWAY VISIBILTY ZONE
			DRAINAGE
			FACILITY CONSTRUCTION
			FENCING
VASI-4		PAPI-4	NAVIGATIONAL AID INSTALLATION (GVGI)
			RUNWAY THRESHOLD LIGHTS and REIL'S
			SECTION CORNER
			SEGMENTED CIRCLE/WIND INDICATOR
			TOPOGRAPHY
			WIND INDICATOR
			CRITICAL AREA

GENERAL NOTES:

1. For runway 13 end, the existing and ultimate runway end elevation was used in combination with an ultimate 50:1 approach slope for clearance calculations. For runway 31 end the existing runway 31 elevation combined with a 50:1 approach slope was used for clearance calculations. In addition, the ultimate runway end elevation combined with a 50:1 approach slope was used for clearing ultimate obstacles.
2. Depiction of features and objects within the primary, transitional, and horizontal Part 77 surfaces, is illustrated on the FAR PART 77 IMAGINARY SURFACES, sheet 7 and 8 of these plans.
3. Depiction of features and objects within the inner portion of the approach surfaces, is illustrated on the APPROACH PROFILES, sheets 9 and 10, of these plans.
4. Additional obstruction data is illustrated on National Ocean Survey document OC 51, AIRPORT OBSTRUCTION CHART (April 1994).



RUNWAY 13 OBSTRUCTION TABLE

Object Description	Object Location Latitude–Longitude	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
1 ROAD	46 47 13.5475, 100 45 46.0387	1673 MSL	50:1 APPROACH SURFACE	1669 MSL	4'	RELOCATE (ULTIMATE)
2 TREE	46 47 14.3101, 100 45 43.6440	1699 MSL	TRANSITIONAL SURFACE	1690 MSL	9'	REMOVE (ULTIMATE)
3 LTD POLE	46 47 15.0559, 100 45 48.1709	1673 MSL	50:1 APPROACH SURFACE	1673 MSL	0'	NO LONGER OBSTRUCTION
4 POLE	46 47 17.6897, 100 45 47.4156	1700 MSL	TRANSITIONAL SURFACE	1695 MSL	5'	BURY LINES/REMOVE POLE
			40:1 DEPARTURE SURFACE	1688 MSL	12'	BURY LINES/REMOVE POLE
5 VENT ON BUILDING	46 47 17.2215, 100 45 49.8284	1685 MSL	50:1 APPROACH SURFACE	1678 MSL	7'	INSTALL OBSTRUCTION LIGHTING
6 OL POLE	46 47 18.7703, 100 45 51.4909	1695 MSL	50:1 APPROACH SURFACE	1682 MSL	13'	TO REMAIN LIGHTED
22 ROAD	46 47 13.8004, 100 45 43.3532	1663 MSL	40:1 DEPARTURE SURFACE	1676 MSL	2'	TO BE RELOCATED (ULTIMATE)

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REVISIONS

NO.	DESCRIPTION	DATE

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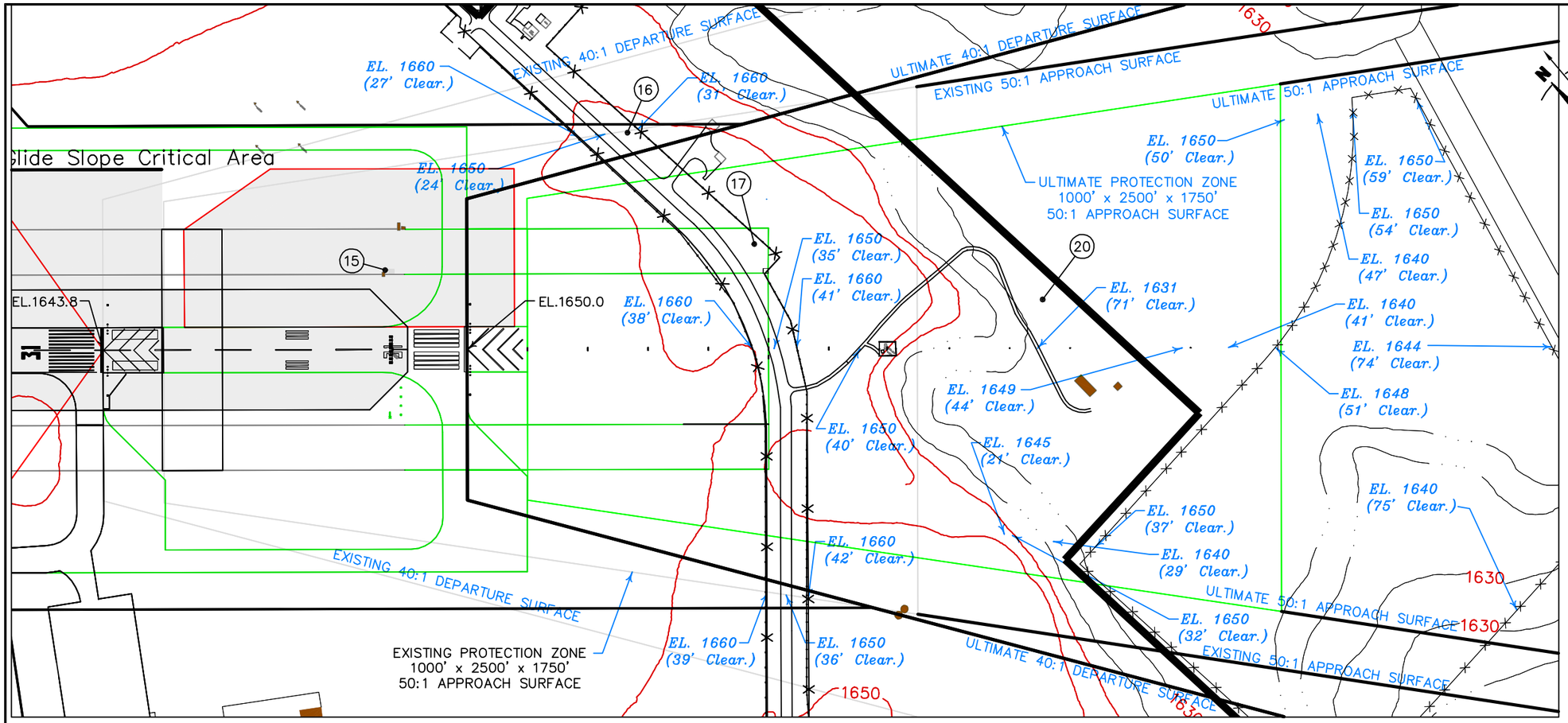
DRAWN BY: D.C.C.
DESIGNED BY: M.A.W

SHEET TITLE
RUNWAY 13 APPROACH/DEPARTURE PROFILES

SHEET NUMBER
9 OF 14

Drawing: T:\P\Bismarck\Cadd\V09-10-BISdgn-dep1331 (2).dwg
Plotted by: Pauline, Jessy
Plotted on: 5/13/2008 11:16 AM

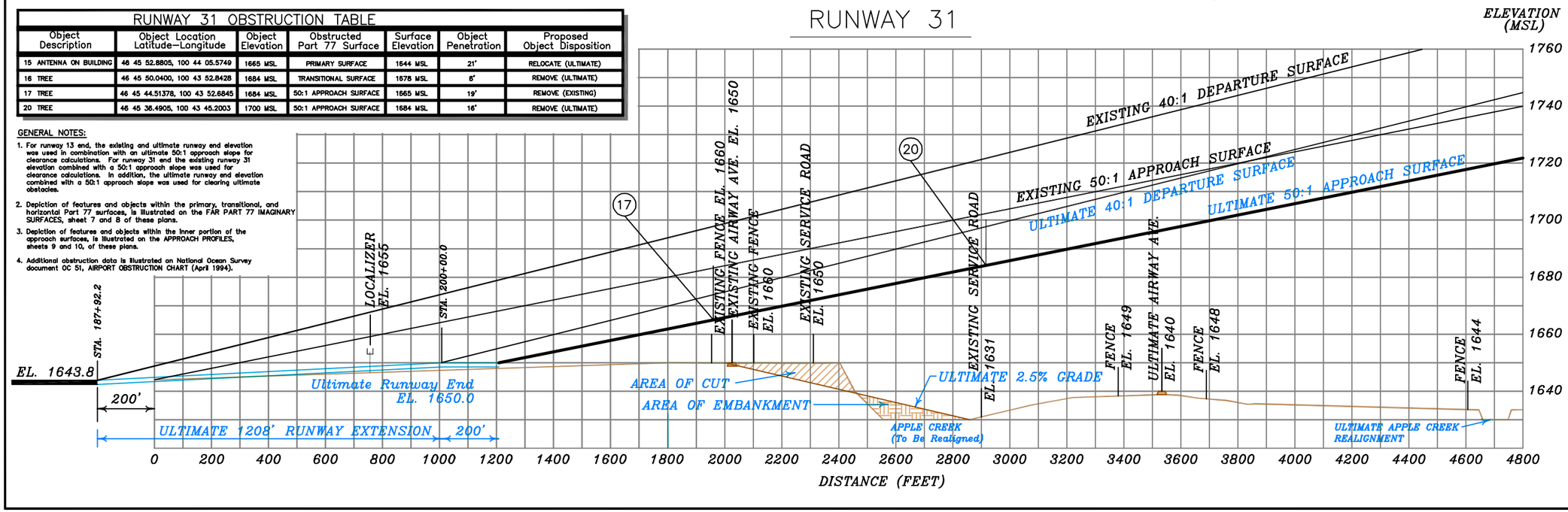


RUNWAY 31 OBSTRUCTION TABLE

Object Description	Object Location Latitude–Longitude	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
15 ANTENNA ON BUILDING	46 45 52.8805, 100 44 05.5749	1665 MSL	PRIMARY SURFACE	1644 MSL	21'	RELOCATE (ULTIMATE)
16 TREE	46 45 50.0400, 100 43 52.8428	1684 MSL	TRANSITIONAL SURFACE	1678 MSL	6'	REMOVE (ULTIMATE)
17 TREE	46 45 44.51378, 100 43 52.6845	1684 MSL	50:1 APPROACH SURFACE	1665 MSL	19'	REMOVE (EXISTING)
20 TREE	46 45 36.4905, 100 43 45.2003	1700 MSL	50:1 APPROACH SURFACE	1684 MSL	16'	REMOVE (ULTIMATE)

GENERAL NOTES:

1. For runway 13 end, the existing and ultimate runway end elevation was used in combination with an ultimate 50:1 approach slope for clearance calculations. For runway 31 end the existing runway 31 elevation combined with a 50:1 approach slope was used for clearance calculations. In addition, the ultimate runway end elevation combined with a 50:1 approach slope was used for clearing ultimate obstacles.
2. Depiction of features and objects within the primary, transitional, and horizontal Part 77 surfaces, is illustrated on the FAR PART 77 IMAGINARY SURFACES, sheet 7 and 8 of these plans.
3. Depiction of features and objects within the inner portion of the approach surfaces, is illustrated on the APPROACH PROFILES, sheets 9 and 10, of these plans.
4. Additional obstruction data is illustrated on National Ocean Survey document OC 51, AIRPORT OBSTRUCTION CHART (April 1994).



Drawing: T:\P\Bismarck\Cadd\V\09-10-BISapp-dep1331 (2).dwg
Plotted by: Mancha, Jessy
Plotted on: 5/19/2008 11:17 AM

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REVISIONS

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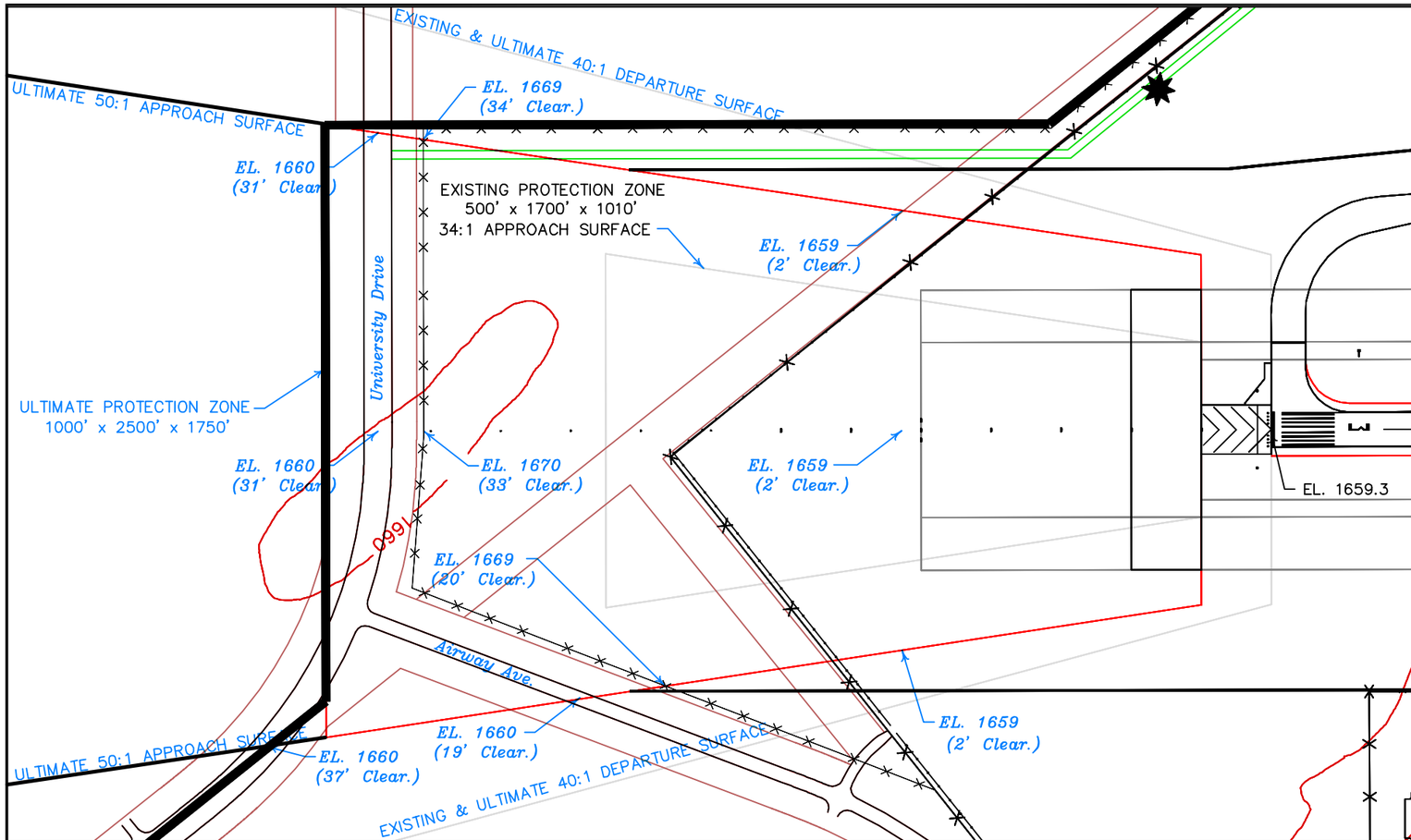
DRAWN BY: D.C.C.
DESIGNED BY: N.A.W

SHEET TITLE

RUNWAY 31 APPROACH/DEPARTURE PROFILES

SHEET NUMBER

10 OF 14



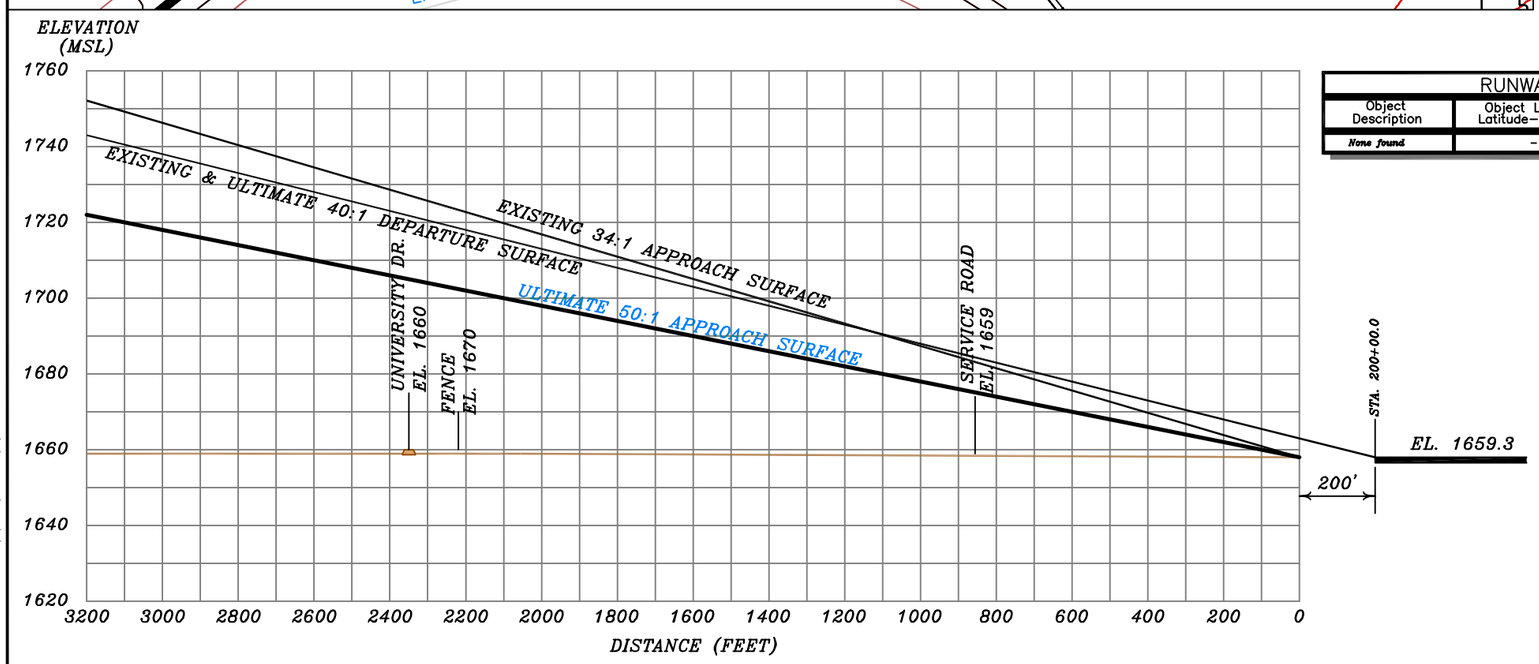
MAGNETIC DECLINATION
7° 18' EAST
MAY 2007
ANNUAL CHANGE 0° 8' WEST

0' 100' 200'
SCALE: 1"= 200'

LEGEND			
EXISTING	FUTURE	ULTIMATE	DESCRIPTION
			ABANDONED PAVEMENT (To Be Removed)
			AIRPORT PROPERTY LINE
			AIRPORT REFERENCE POINT (ARP)
			AIRPORT ROTATING BEACON
			AVIATION EASEMENT (if applicable)
			BUILDING ABANDONMENT (To Be Removed)
			BUILDING CONSTRUCTION
BRL			BUILDING RESTRICTION LINE (BRL)
RSA	RSA	RSA	RUNWAY SAFETY AREA
OFZ	OFZ	OFZ	OBJECT FREE ZONE
RVR	RVR	RVR	RUNWAY VISIBILTY ZONE
			DRAINAGE
			FACILITY CONSTRUCTION
			FENCING
VASI-4		PAPI-4	NAVIGATIONAL AID INSTALLATION (GVGI)
			RUNWAY THRESHOLD LIGHTS and REIL'S
			SECTION CORNER
			SEGMENTED CIRCLE/WIND INDICATOR
			TOPOGRAPHY
			WIND INDICATOR
			CRITICAL AREA

GENERAL NOTES:

1. For runway 3 end, the existing and ultimate runway end elevation was used in combination with an ultimate 50:1 approach slope for clearance calculations. For runway 21 end the existing runway 21 elevation combined with a 50:1 approach slope was used for clearance calculations. In addition, the ultimate runway end elevation combined with a 50:1 approach slope was used for clearing ultimate obstacles.
2. Depiction of features and objects within the primary, transitional, and horizontal Part 77 surfaces, is illustrated on the FAR PART 77 IMAGINARY SURFACES, sheet 7 and 8 of these plans.
3. Depiction of features and objects within the inner portion of the approach surfaces, is illustrated on the APPROACH PROFILES, sheets 9 and 10, of these plans.
4. Additional obstruction data is illustrated on National Ocean Survey document OC 51, AIRPORT OBSTRUCTION CHART (April 1994).



RUNWAY 3 OBSTRUCTION TABLE

Object Description	Object Location Latitude–Longitude	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
None found	-	-	-	-	-	-

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REVISIONS

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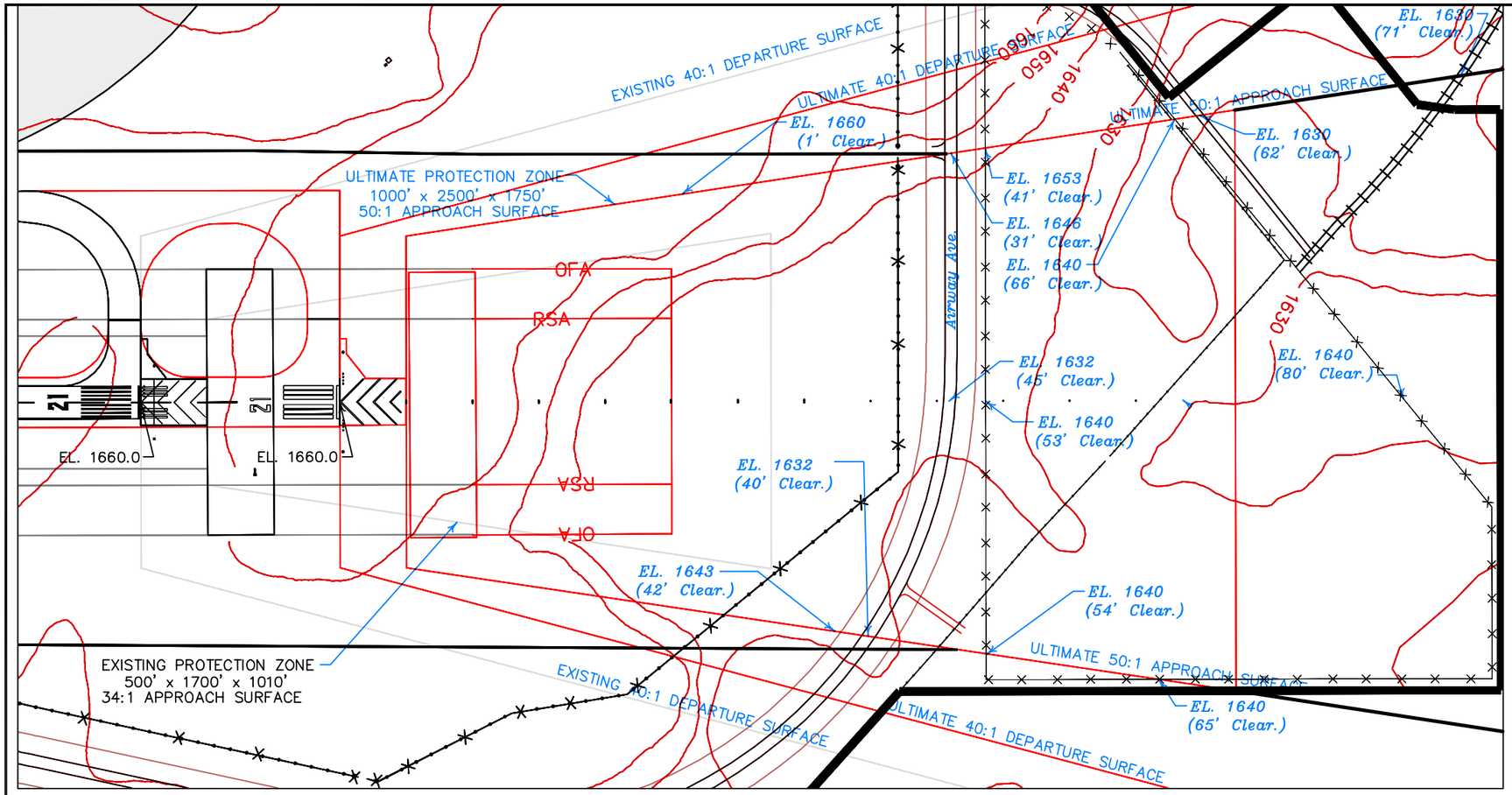
DRAWN BY: D.C.C.
DESIGNED BY: N.A.W

SHEET TITLE
RUNWAY 3
APPROACH/DEPARTURE
PROFILES

SHEET NUMBER
11 OF 14

Drawing: T:\P\Bismarck\Cadd\V\11-12-BSccp-dep321.dwg
Plotted by: Mandhu, Jeffrey
Plotted on: 5/19/2008 11:18 AM



MAGNETIC DECLINATION
7° 18' EAST
MAY 2007
ANNUAL CHANGE 0° 8' WEST

N

0' 100' 200'
SCALE: 1"= 200'

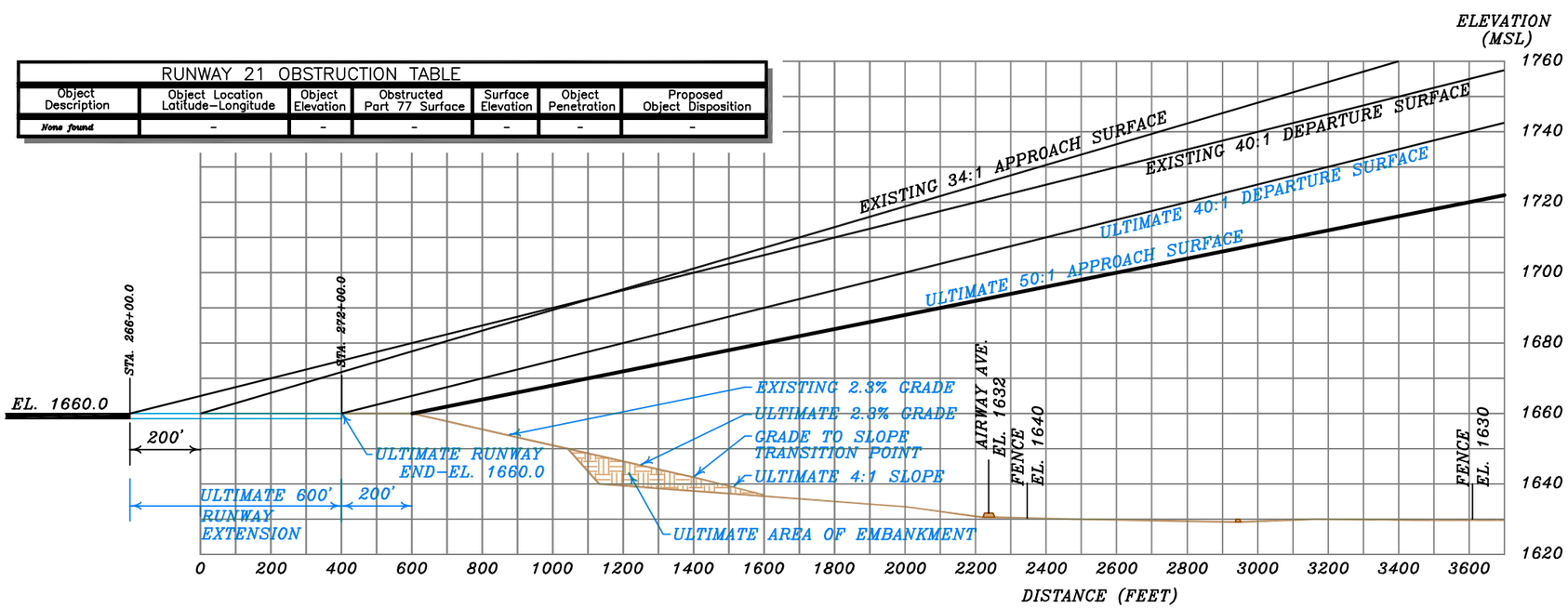
LEGEND			
EXISTING	FUTURE	ULTIMATE	DESCRIPTION
			ABANDONED PAVEMENT (To Be Removed)
			AIRPORT PROPERTY LINE
			AIRPORT REFERENCE POINT (ARP)
			AIRPORT ROTATING BEACON
			AVIATION EASEMENT (if applicable)
			BUILDING ABANDONMENT (To Be Removed)
			BUILDING CONSTRUCTION
BRL		BRL	BUILDING RESTRICTION LINE (BRL)
RSA	RSA	RSA	RUNWAY SAFETY AREA
OFZ	OFZ	OFZ	OBJECT FREE ZONE
RVR	RVR	RVR	RUNWAY VISIBILTY ZONE
			DRAINAGE
			FACILITY CONSTRUCTION
			FENCING
VASI-4		PAPI-4	NAVIGATIONAL AID INSTALLATION (GVGI)
			RUNWAY THRESHOLD LIGHTS and REIL'S
			SECTION CORNER
			SEGMENTED CIRCLE/WIND INDICATOR
			TOPOGRAPHY
			WIND INDICATOR
			CRITICAL AREA

GENERAL NOTES:

1. For runway 3 end, the existing and ultimate runway end elevation was used in combination with an ultimate 50:1 approach slope for clearance calculations. For runway 21 end the existing runway 21 elevation combined with a 50:1 approach slope was used for clearance calculations. In addition, the ultimate runway end elevation combined with a 50:1 approach slope was used for clearing ultimate obstacles.
2. Depiction of features and objects within the primary, transitional, and horizontal Part 77 surfaces, is illustrated on the FAR PART 77 IMAGINARY SURFACES, sheet 7 and 8 of these plans.
3. Depiction of features and objects within the inner portion of the approach surfaces, is illustrated on the APPROACH PROFILES, sheets 9 and 10, of these plans.
4. Additional obstruction data is illustrated on National Ocean Survey document OC 51, AIRPORT OBSTRUCTION CHART (April 1994).

RUNWAY 21 OBSTRUCTION TABLE

Object Description	Object Location Latitude–Longitude	Object Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
None found	-	-	-	-	-	-



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REVISIONS

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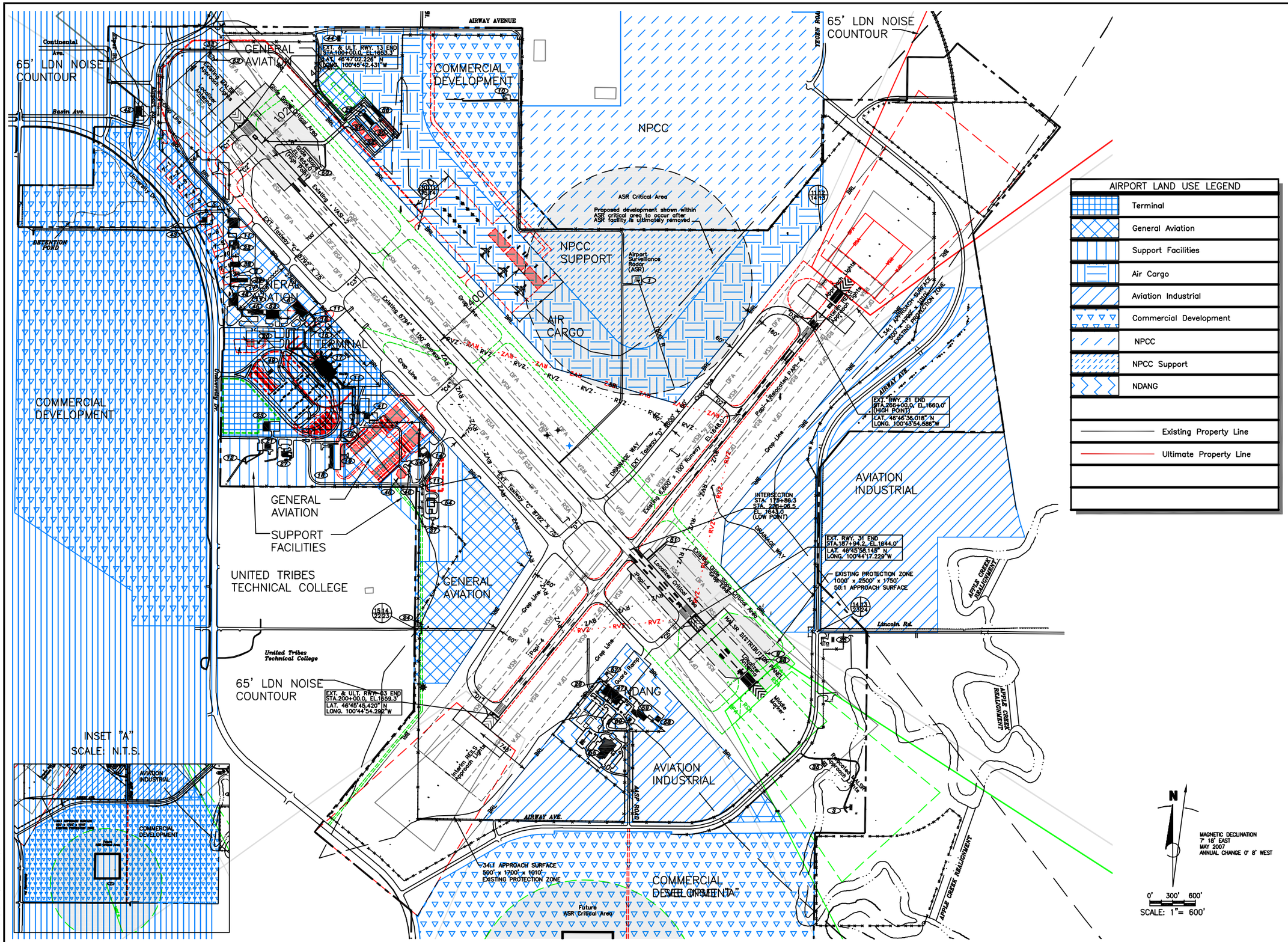
DESIGNED BY: N.A.W

SHEET TITLE
RUNWAY 21 APPROACH/DEPARTURE PROFILES

SHEET NUMBER
12 OF 14

Drawing: T:\P\Bismarck\Cadd\V11-12-BiSapp-dap321.dwg
Plotted by: Mancha, Jessy
Plotted on: 5/19/2008 11:20 AM



AIRPORT LAND USE LEGEND
Terminal
General Aviation
Support Facilities
Air Cargo
Aviation Industrial
Commercial Development
NPCC
NPCC Support
NDANG
Existing Property Line
Ultimate Property Line

N

MAGNETIC DECLINATION
7° 18' EAST
MAY 2007
ANNUAL CHANGE 0° 8' WEST

0' 300' 600'
SCALE: 1"= 600'

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Naperville, IL 60563
(630) 505-1901 FAX (630) 505-4313
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DATE ISSUED: 03-14-08
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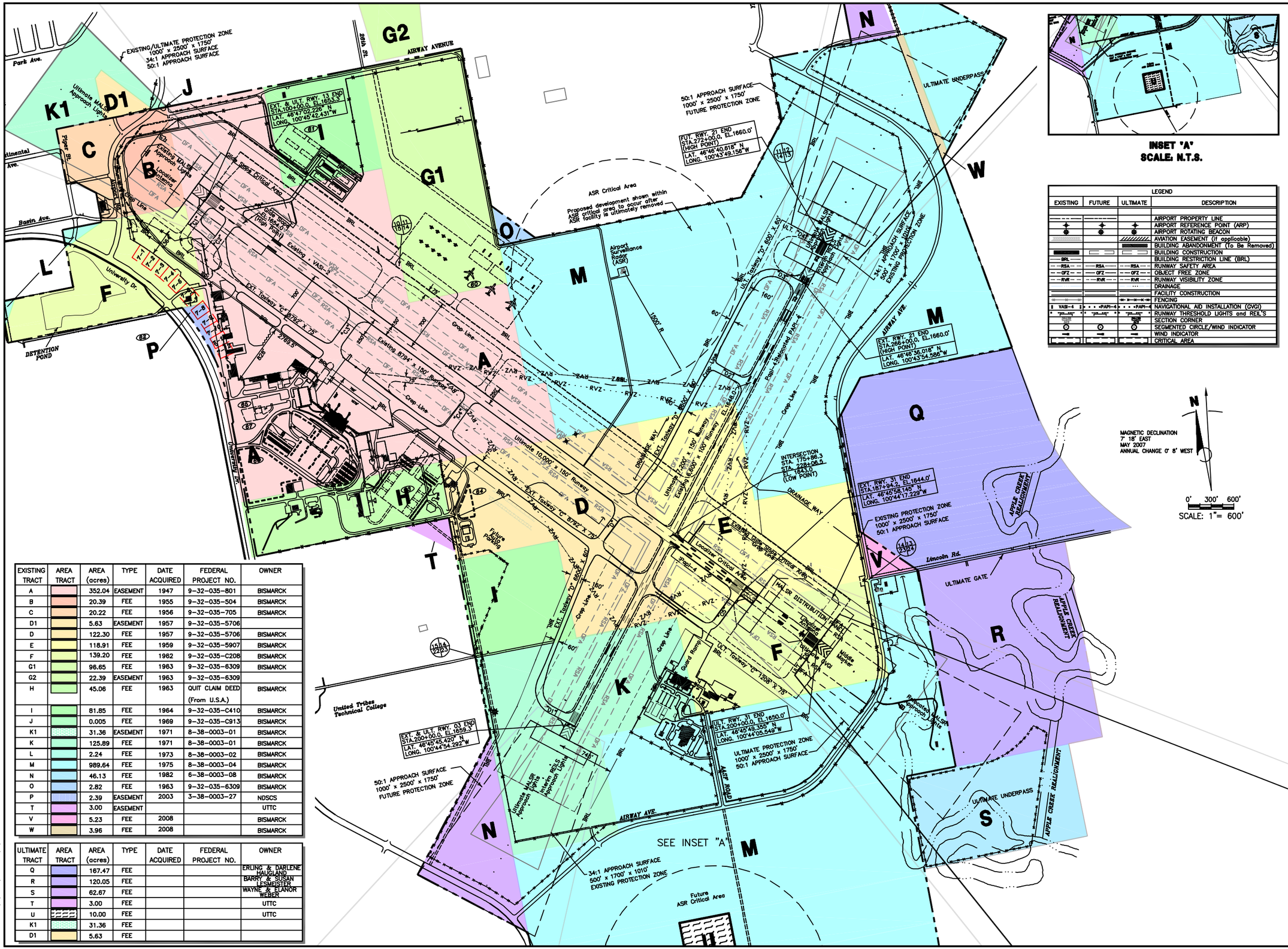
DESIGNED BY: N.A.W

SHEET TITLE

LAND USE PLAN

SHEET NUMBER
13 OF 14

Drawing: T:\P\Bismarck\Cadd\V\13-Ind.dwg
Plotted by: Mancha, Jessy
Plotted on: 5/21/2008 11:06 AM



INSET 'A'
SCALE: N.T.S.

LEGEND			
EXISTING	FUTURE	ULTIMATE	DESCRIPTION
			AIRPORT PROPERTY LINE
			AIRPORT REFERENCE POINT (ARP)
			AIRPORT ROTATING BEACON
			AVIATION EASEMENT (if applicable)
			BUILDING ABANDONMENT (To Be Removed)
			BUILDING CONSTRUCTION
BRL			BUILDING RESTRICTION LINE (BRL)
RSA	RSA	RSA	RUNWAY SAFETY AREA
OFZ	OFZ	OFZ	OBJECT FREE ZONE
RVR	RVR	RVR	RUNWAY VISIBILITY ZONE
			DRAINAGE
			FACILITY CONSTRUCTION
			FENCING
VASI-4	PAPI-4	PAPI-4	NAVIGATIONAL AID INSTALLATION (GVGI)
			RUNWAY THRESHOLD LIGHTS and REIL'S
			SECTION CORNER
			SEGMENTED CIRCLE/WIND INDICATOR
			WIND INDICATOR
			CRITICAL AREA

EXISTING TRACT	AREA TRACT	AREA (acres)	TYPE	DATE ACQUIRED	FEDERAL PROJECT NO.	OWNER
A		352.04	EASEMENT	1947	9-32-035-801	BISMARCK
B		20.39	FEE	1955	9-32-035-504	BISMARCK
C		20.22	FEE	1956	9-32-035-705	BISMARCK
D1		5.63	EASEMENT	1957	9-32-035-5706	
D		122.30	FEE	1957	9-32-035-5706	BISMARCK
E		118.91	FEE	1959	9-32-035-5907	BISMARCK
F		139.20	FEE	1962	9-32-035-C208	BISMARCK
G1		96.65	FEE	1963	9-32-035-6309	BISMARCK
G2		22.39	EASEMENT	1963	9-32-035-6309	
H		45.06	FEE	1963	QUIT CLAIM DEED (From U.S.A.)	BISMARCK
I		81.85	FEE	1964	9-32-035-C410	BISMARCK
J		0.005	FEE	1969	9-32-035-C913	BISMARCK
K1		31.36	EASEMENT	1971	8-38-0003-01	BISMARCK
K		125.89	FEE	1971	8-38-0003-01	BISMARCK
L		2.24	FEE	1973	8-38-0003-02	BISMARCK
M		989.64	FEE	1975	8-38-0003-04	BISMARCK
N		46.13	FEE	1982	6-38-0003-08	BISMARCK
O		2.82	FEE	1963	9-32-035-6309	BISMARCK
P		2.39	EASEMENT	2003	3-38-0003-27	NDSCS
T		3.00	EASEMENT			UTTC
V		5.23	FEE	2008		BISMARCK
W		3.96	FEE	2008		BISMARCK

ULTIMATE TRACT	AREA TRACT	AREA (acres)	TYPE	DATE ACQUIRED	FEDERAL PROJECT NO.	OWNER
Q		167.47	FEE			ERLING & DARLENE HAUGLAND
R		120.05	FEE			BARRY & SUSAN LESMEISTER
S		62.67	FEE			WAYNE & ELANOR WEBER
T		3.00	FEE			UTTC
U		10.00	FEE			UTTC
K1		31.36	FEE			
D1		5.63	FEE			

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Bismarck

REVISIONS		
NO.	DESCRIPTION	DATE

DATE ISSUED: 03-14-08
REVIEWED BY: M.L.S
DRAWN BY: D.C.C.
DESIGNED BY: N.A.W

SHEET TITLE

AIRPORT PROPERTY MAP

SHEET NUMBER

14 OF 14

CHAPTER 6
IMPLEMENTATION PLAN

The implementation plan consists of a project phasing plan, which identifies likely time frames for facility development identified in the master plan.

6.1 DEVELOPMENT PHASING PLAN

The identified capital improvement projects are phased over the course of the 20-year planning horizon to facilitate systematic development of the Airport. All development, other than those assigned to short-term development, should be considered demand driven projects and tied to activity levels. The appropriate time for development should be reviewed periodically and adjusted as appropriate to account for changing circumstances.

6.1.1 Short-Term Development

Short-term capital improvements include those development items that will begin within the next five years. These projects primarily include the rehabilitation of existing pavement or modification or improvements to existing infrastructure.

- Taxiway C Realignment **–** This project realigns the northern end of Taxiway C with the southern portion of Taxiway C.
- General Aviation Expansion – Phase I **–** This project begins the realignment of the north general aviation area to parallel University Drive. It includes apron expansion and realignment, relocating utilities, and installing an access road parallel to University Drive.
- Emergency Generator and Vault Building**–** This project consists of the acquisition of an emergency generator and the relocation of the electric vault building.
- SRE Building Rehabilitation and Construction **–** This project rehabilitates the existing snow removal equipment building and constructs an additional building directly east of the existing facility. Both SRE buildings will share a common driveway and access route.
- Wetland Mitigation – This project mitigates wetlands on airport property to eliminate wildlife hazards.
- Drainage Improvements, Phase I – This project improves drainage near the southeastern corner of the Airport to reduce standing water and eliminate wildlife attractants.
- Corporate Area Development **–** This project provides the infrastructure for corporate hangar development south of the commercial terminal.
- Taxiway B, C, and D Rehabilitation – This project consists preparing a categorical exclusion checklist and completing the design and construction for the rehabilitation of the taxiways on the airfield. No dimensional or strength changes are anticipated at this time. The project is proposed as routine maintenance to restore the existing degraded pavement.
- Rehabilitation and Expansion of General Aviation Apron – Phase II – This project replaces, refurbishes, and improves deteriorated pavement and adds new pavement to the general aviation ramp.
- ARFF Building Modification – This project modifies the equipment bay doors to the ARFF in anticipation of the acquisition of larger, more modern ARFF equipment. It also provides

improvements to meet OSHA vehicle exhaust ventilation requirements and add an additional bay to the truck storage area.

- South Side Service Road Construction – This project prepares a categorical exclusion checklist and completes the design and construction for the southern portion of the private, on-airport perimeter service road.
- Drainage Improvements, Phase II – This project improves drainage in the southern half of the Airport to eliminate standing water and wildlife attractants.
- Taxiway Lights Rehabilitation – This project consists of the rehabilitation of the taxiway lights.
- "B" T-Hangar Access Road Construction – This project consists of the construction of a public access road to the "B" t-hangars located on the northeast side of the Airport.
- Land Acquisition – This project will purchase land in the runway protection zones, in accordance with FAA recommendations.
- Airway Avenue/Airport Road Intersection Relocation – This project relocates the intersection of Airport Road and Airway Avenue and lowers Airway Avenue to remove the airspace obstruction of the road/intersection.
- LPV Surveys **–** This project provides the necessary surveys and associated paperwork to establish LPV approaches for the runways.

6.1.2 Intermediate-Term Development

Intermediate-term development improvements include those development items that demand warrants within the five year period following the short-term development planning horizon. If not previously stated, the environmental processing detailed below will need to be completed within the same timeframe to allow for project completion in accordance with applicable environmental rules and regulations. Projects include development items that will support the continued development, rehabilitation, and maintenance of the Airport.

- Cargo Apron Expansion and Taxiway Extension – This project includes the categorical exclusion checklist, design, and construction to extend Taxiway C and expand the cargo apron north of the commercial terminal.
- Holding Apron at Runway 31 Threshold Construction – This project constructs a holding apron at the end of Runway 31 to improve aircraft operations.
- Terminal Ramp Panel Replacement – This project consists of the replacement of ramp panels on the commercial service terminal. No dimensional or strength changes are anticipated at this time. The project is proposed as routine maintenance to restore the existing degraded pavement.
- Terminal Parking Expansion, Phase I – This project involves the categorical exclusion checklist, design, and construction to expand the existing vehicle parking lot at the commercial service terminal to meet the demand identified in the facility requirements chapter. This project is demand driven and its development will occur when demand warrants expansion. The actual number of parking positions needed is based on facility needs and will determine the required acreage. This project is anticipated to include the realignment of terminal roadway loop and associated on-airport access roads.
- Runway 3/21 Environmental Assessment – This project prepares an environmental assessment for the extension of Runway 3/21 and associated projects.

- Runway 13/31, Runway 3/21, Taxiway C, Service Road, Parking Lot Surface Treatment and Painting – This project consists of preparing a categorical exclusion checklist and completing the design and construction for continued maintenance on paved surfaces, including asphalt pavement rejuvenation and pavement marking.
- General Aviation Terminal Construction – Following the removal of the existing general aviation terminal, this project constructs a new general aviation terminal in alignment with University Drive. It includes the categorical exclusion checklist, design, and construction necessary to complete the project.
- Access and Cargo Apron Expansion – This project creates access to the northeast side of the Airport and expands cargo operations into this area.
- FIS Expansion – This project will expand both floors of the commercial terminal building on the northern side to provide room for the establishment of an FIS. It includes the categorical exclusion checklist, design, and construction necessary to complete the project.
- Runway 3/21 Extension and Widening – This project will widen Runway 3/21 to 150 feet and provide for a 600-foot extension. The parallel taxiway, associated connector taxiways, and visual and navigational aids will need to be extended or relocated as appropriate. It includes the categorical exclusion checklist, design, and construction necessary to complete the project.
- Hangar #5 Relocation – Relocate the historic City hangar to the northwest corner of the Airport, along University Drive. This move will provide space needed to continue general aviation development along the desired path. The movement of the hangar will provide the opportunity to convert the hangar to an air museum.
- General Aviation Apron Expansion – Phase III – Continued growth of general aviation in the northwest part of the airport necessitates additional expansion of the general aviation apron.
- Airway Avenue Relocation – Construct a new north-south roadway between the existing Airway Avenue and 48th Street. This will serve as the connector for the eventual closure of Airway Avenue that traverses the runway protection zone for Runway 31.
- Land Acquisition for Runway 31 Extension – Acquisition of land located within the future runway protection zone for the extension of Runway 31.
- Service Road Construction – Phase II – Phase II of the service road expansion will continue the construction of the private, on-airport service road. Once completed this roadway will provide for airport maintenance vehicles and fuel trucks to have access to all development areas without utilizing runways or taxiways. This project includes the categorical exclusion checklist, design, and construction necessary to complete the project.
- "B" T-Hangar Expansion – This project is demand driven and its development will occur when demand warrants expansion. The actual number of t-hangars needed will determine the required acreage and is based on facility needs. It includes the categorical exclusion checklist, design, and construction necessary to complete the project.
- Extension of Runway 13/31 Environmental Assessment – This project prepares an environmental assessment for the extension of Runway 13/31 and associated projects.
- Commercial / General Aviation Ramp Panel Replacement – This project consists of the replacement of ramp panels on the commercial service terminal and general aviation aprons. No dimensional or strength changes are anticipated at this time. The project is proposed as routine maintenance to restore the existing degraded pavement. It includes the categorical exclusion checklist, design, and construction necessary to complete the project.

- ARFF Truck Acquisition – This project consists of the acquisition of a new ARFF truck with an extendable/penetrating nozzle.
- Commercial Terminal Rehabilitation – This project involves updating the physical plant of the commercial terminal; including flooring, wall coverings, heating/ventilation/cooling, plumbing fixtures, lighting fixtures, minor structural repairs, etc.
- Deicing Pad Environmental Assessment – This project prepares an environmental assessment for the construction of dedicated deicing pad(s).
- Runway Guard Lights – This project installs runway guard lights at each of the taxiway/runway intersections to improve safety and reduce the chances of incursions.

6.1.3 Long-Term Development

Long-term development improvements include those development items that demand warrants within the final 10 years of the planning horizon. If not previously stated, the environmental processing detailed below will need to be completed within the same timeframe to allow for project completion in accordance with applicable environmental rules and regulations. Projects include development items that will support the continued development, rehabilitation, and maintenance of the Airport.

- Runway and Taxiway Rehabilitation – This project involves the rehabilitation and resurfacing of runways and taxiways to comply with safety and operational regulations.
- General Aviation Ramp Panel Replacement – This project consists of the replacement of ramp panels on the general aviation apron. No dimensional or strength changes are anticipated at this time. The project is proposed as routine maintenance to restore the existing degraded pavement.
- Deicing Pad / Glycol Recovering System Construction – Dependent upon additional study, this project consists of the construction of deicing pads, as appropriate, and an associated glycol recovering system.
- Runway 3/21 Holding Apron Construction – A holding apron will be constructed on the ends of Runway 3 and Runway 21 to facilitate aircraft run-up operations.
- Runway 13/31 Extension – Phase I – Phase I of the extension of Runway 31 will consist of land acquisition (if determined necessary from the environmental processing), site preparation, and relocation of Airway Avenue.
- Runway 13/31 Extension – Phase II – Phase II of the extension of Runway 31 will consist of the paving and marking of the extend runway and parallel taxiway system and the relocation of appropriate visual and navigational aids.
- ATCT Relocation – This project consists of the environmental processing, design, and construction to relocate the Air Traffic Control Tower. The updated facility will provide also better line of sight to the airfield.
- Terminal Parking Lot Expansion – Phase II – The final planned expansion phase of the terminal parking lot will be construct a service parking lot due west of the western portion of the terminal roadway loop. Access to the terminal from this economy lot can still be accomplished on foot. This project includes the categorical exclusion checklist, design, and construction necessary to complete the project.
- Service Road Expansion – Phase III – Phase III of the service road expansion will complete the construction of the private, on-airport service road. Once completed this roadway will provide

for airport maintenance vehicles and fuel trucks to have access to all development areas without utilizing runways or taxiways. This project includes the categorical exclusion checklist, design and construction necessary to complete the project.

- High Speed Taxiway Exit – This project will construct a high speed taxiway exit for northwest bound traffic on Runway 31 to the commercial passenger apron. This project will facilitate the rapid exiting of commercial traffic from the runway operating environment. It includes the categorical exclusion checklist, design, and construction necessary to complete the project.
- Update Approach Lights and Install Centerline Lights – This project updates existing approach lighting systems to more modern systems and installs centerline lights. These changes improve safety and potentially provide lower minimums.

6.2 CAPITAL IMPROVEMENT PROGRAM

Based on the facility requirements and alternatives developed in previous chapters of this master plan and the Airport's existing airport capital improvement program (ACIP), a CIP and phasing plan are recommended that incorporate the facility requirements during the 20-year planning horizon. Each project has been assigned to a particular planning period as previously described.

Based on the identified capital improvement projects, their associated costs, and eligible funding amounts, a proposed funding plan is provided. In development of a financial plan, the overriding objective is to maximize the use of external sources and to minimize local funding requirements.

The Airport's CIP is presented in Table 6-1 through Table 6-3. Table 6-1 presents a list of projects for each year of the short term planning period with estimated project costs and eligible funding sources. Before a specific project commences, detailed costs should be determined. As shown in Table 6-1, total costs for the short term development is estimated at $21.7 million, of which $20.6 million is eligible for federal funding and $1.1 million would be the local responsibility. Table 6-2 provides a list of intermediate term planning project which are estimated to cost $35.5 million. Federally eligible projects constitute $33.7 million and local funding is approximately $1.8 million. Table 6-3 identifies long term projects total cost estimated at $31.8 million, of which $30.2 is federally eligible, and $1.6 is the local responsibility. The Airport's CIP project that utilizes federal funding can also qualify for up to 5 percent state funding. As well as airport maintenance project can qualify for up to 50 percent state funding share.

It should be noted that the actual timing of development should be reassessed each year based on availability of funds, as well as actual need and demand for facilities and improvement. It is important to note that the review of funding eligibility produces an estimate of the minimum local share funds that must be available through the airport sponsor to undertake the various projects. Actual funding received is often less than the maximum eligible due to competition for limited funds, low project priority rankings, or incomplete lobbying efforts to secure maximum funding. The CIP and funding sources for the intermediate and long-term development phases are presented in Table 6-2 and 6-3.

Table 6-1
AIRPORT CAPITAL IMPROVEMENT PLAN (ACIP) – PHASE I

Item	Project	Total	Federal	State	Local
1	Taxiway C Realignment	$ 3,500,000	$ 3,325,000	$ 0	$ 175,000
2	General Aviation Expansion - Phase I	$ 1,300,000	$ 1,235,000	$ 0	$ 65,000
3	Emergency Generator and Vault Building	$ 500,000	$ 475,000	$ 0	$ 25,000
4	SRE Building Rehabilitation and Construction	$ 600,000	$ 570,000	$ 0	$ 30,000
5	Wetland Mitigation	$ 2,900,000	$ 2,755,000	$ 0	$ 145,000
6	Drainage Improvements - Phase I	$ 1,000,000	$ 950,000	$ 0	$ 50,000
7	Corporate Area Development	$ 1,200,000	$ 1,140,000	$ 0	$ 60,000
8	Taxiway B, C, and D Rehabilitation	$ 350,000	$ 332,500	$ 0	$ 17,500
9	General Aviation Expansion - Phase II	$ 3,500,000	$ 3,325,000	$ 0	$ 175,000
10	ARFF Building Modification	$ 300,000	$ 285,000	$ 0	$ 15,000
11	South Side Service Road	$ 1,500,000	$ 1,425,000	$ 0	$ 75,000
12	Drainage Improvements - Phase II	$ 600,000	$ 570,000	$ 0	$ 30,000
13	Taxiway Lights Rehabilitation	$ 200,000	$ 190,000	$ 0	$ 10,000
14	"B" T-Hangar Access Road	$ 600,000	$ 570,000	$ 0	$ 30,000
15	Land Acquisition	$ 3,000,000	$ 2,850,000	$ 0	$ 150,000
16	Airway Avenue/Airport Road Intersection Relocation	$ 450,000	$ 427,500	$ 0	$ 22,500
17	LPV Approach Surveys	$ 180,000	$ 171,000	$ 0	$ 9,000
	Short-Term Total	**$21,680,000**	**$20,596,000**	**$ 0**	**$ 1,084,000**

Table 6-2
AIRPORT CAPITAL IMPROVEMENT PLAN (ACIP) – PHASE II

Item	Project	Total	Federal	State	Local
18	Cargo Apron Expansion and Taxiway Extension	$ 4,300,000	$ 4,085,000	$ 0	$ 215,000
19	Holding Apron at Runway 31 Threshold	$ 200,000	$ 190,000	$ 0	$ 10,000
20	Terminal Ramp Panel Replacement	$ 1,500,000	$ 1,425,000	$ 0	$ 75,000
21	Terminal Parking Expansion - Phase I	$ 300,000	$ 285,000	$ 0	$ 15,000
22	Runway 3/21 Environmental Assessment	$ 500,000	$ 475,000	$ 0	$ 25,000
23	Runway 13/31, Runway 3/21, Taxiway C, Service Road, Parking Lot Surface Treatment and Painting	$ 700,000	$ 665,000	$ 0	$ 35,000
24	General Aviation Terminal Construction	$ 700,000	$ 665,000	$ 0	$ 35,000
25	Access and Cargo Apron Expansion	$ 3,250,000	$ 3,087,500	$ 0	$ 162,500
26	FIS Expansion	$ 2,750,000	$ 2,612,500	$ 0	$ 137,500
27	Runway 3/21 Extension and Widening	$ 2,250,000	$ 2,137,500	$ 0	$ 112,500
28	Hangar #5 Relocation	$ 1,600,000	$ 1,520,000	$ 0	$ 80,000
29	General Aviation Apron Expansion - Phase III	$ 3,500,000	$ 3,325,000	$ 0	$ 175,000
30	Airway Avenue Relocation	$ 5,400,000	$ 5,130,000	$ 0	$ 270,000
31	Land Acquisition for Runway 31 Extension	$ 500,000	$ 475,000	$ 0	$ 25,000
32	Service Road - Phase II	$ 700,000	$ 665,000	$ 0	$ 35,000
33	"B" T-Hangar Expansion	$ 1,650,000	$ 1,567,500	$ 0	$ 82,500
34	Runway 13/31 Extension Environmental Assessment	$ 500,000	$ 475,000	$ 0	$ 25,000
35	Commercial and GA Ramp Panel Replacement	$ 1,250,000	$ 1,187,500	$ 0	$ 62,500
36	ARFF Truck Acquisition	$ 1,400,000	$ 1,330,000	$ 0	$ 70,000
37	Commercial Terminal Rehabilitation	$ 1,750,000	$ 1,662,500	$ 0	$ 87,500
38	Deicing Pad Environmental Assessment	$ 300,000	$ 285,000	$ 0	$ 15,000
39	Runway Guard Lights	$ 500,000	$ 475,000	$ 0	$ 25,000
	Intermediate Term Total	**$35,500,000**	**$33,725,000**	**$ 0**	**$ 1,775,000**

Table 6-3
AIRPORT CAPITAL IMPROVEMENT PLAN (ACIP) – PHASE III

Item	Project	Total	Federal	State	Local
40	Runway and Taxiway Rehabilitation	$ 1,600,000	$ 1,520,000	$ 0	$ 80,000
41	General Aviation Ramp Panel Replacement	$ 550,000	$ 522,500	$ 0	$ 27,500
42	Deicing Pad / Glycol Recovering System Construction	$ 1,150,000	$ 1,092,500	$ 0	$ 57,500
43	Runway 3/21 Holding Apron Construction	$ 550,000	$ 522,500	$ 0	$ 27,500
44	Runway 13/31 Extension - Phase I	$ 8,000,000	$ 7,600,000	$ 0	$ 400,000
45	Runway 13/31 Extension - Phase II	$ 8,000,000	$ 7,600,000	$ 0	$ 400,000
46	ATCT Relocation	$ 5,500,000	$ 5,225,000	$ 0	$ 275,000
47	Terminal Parking Expansion - Phase II	$ 400,000	$ 380,000	$ 0	$ 20,000
48	Service Road Expansion - Phase III	$ 500,000	$ 475,000	$ 0	$ 25,000
49	High Speed Exit Taxiway Construction	$ 3,000,000	$ 2,850,000	$ 0	$ 150,000
50	Update Approach Lights, Install Centerline Lights	$ 2,500,000	$ 2,375,000	$ 0	$ 125,000
	Long Term Total	**$31,750,000**	**$30,162,500**	**$ 0**	**$ 1,587,500**

CHAPTER 7
ENVIRONMENTAL OVERVIEW

This chapter provides an overview of the environmental documentation necessary to implement the major development items identified in the Airport Capital Improvement Program (ACIP). This chapter does not replace the completion of an environmental analysis in compliance with National Environmental Policy Act (NEPA) guidelines, but rather identifies the likely required studies.

Required environmental analysis can take the form of one of three formats prescribed by NEPA, briefly explained below, and identified in FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*, and FAA Order 5050.4B, *Airport Environmental Handbook*. Identification of an environmental process in this chapter does not preclude the possibility that the environmental study may result in the requirement for additional environmental processing. Therefore, it is recommended that all environmental processing be completed well in advance of the anticipated construction date but not so far in advance that an unforeseen delay in construction would result in the requirement for revalidation of the environmental study.

- **Categorical Exclusion –** Categorical exclusions are Federal actions that meet the criteria contained in FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*, Paragraphs 307 through 312. These are actions that, based on historical experience, the FAA has found do not normally require an environmental assessment or environmental impact statement. As part of this format, the FAA requires the submission of a Categorical Exclusion Checklist.

  Federal processing for a categorical exclusion can typically be completed within three to six months. The actual processing time is dependent upon the scope of the proposed project and the level of agency coordination required. In addition, if federal, state, or local permits are required the process may take additional time.

- **Environmental Assessment –** At a minimum, an environmental assessment (EA) must be prepared when the proposed action: 1) is not categorically excluded, 2) is normally categorically excluded but involves at least one extraordinary circumstance, or 3) the action is not known to require an environmental impact statement but is not categorically excluded. Following the submission and acceptance of the EA, the FAA will issue a Finding of No Significant Impact (FONSI).

  Upon completion and the issuance of a FONSI, an EA is considered a federal document. Processing for the EA normally takes 12 to 18 months. The processing time varies dependent upon the scope of the proposed project, the level and responsiveness of agency coordination efforts, and the public involvement process. Additional federal, state, or local permitting and agency review time may also impact the typical timeframe.

  An EA is assumed valid for a period of three years. If major steps towards the implementation of all project phases have not commenced within three years, a written reevaluation from the responsible FAA official may be required.

- **Environmental Impact Statement –** An environmental impact statement (EIS) is required when the proposed action, including mitigation, would continue to have a significant impact on the environment. Following the publication of the accepted EIS in the Federal Register, the FAA will issue a Record of Decision (ROD).

  Federal processing for an EIS is largely dependent upon the nature of the proposed project and the environmental category that required the preparation of an EIS. Time variances may also result from the scope of the proposed project, the depth of analysis required, and the public involvement process.

  Similar to an EA, the final decision on an EIS is considered valid for a period of three years. If major steps towards the implementation of all project phases have not commenced within three years, a written reevaluation from the responsible FAA official may be required at each major approval phase.

7.1 ENVIRONMENTAL CONCERNS

The identification of areas of environmental concern associated with master plan projects enables the City of Bismarck to implement a plan for airport development that will minimize conflicts with the environment. The areas identified in this section are recognized environmental concerns and should be avoided, or where avoidance is impossible, future impacts should be minimized. This list is not exclusive and other, currently unknown, areas of environmental concerns may become apparent with the passage of time or unforeseen circumstances.

In FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*, the FAA has identified 18 potential environmental impact categories. These categories must be evaluated as part of an environmental analysis according to the guidelines and thresholds identified.

Table 7-1 provides a list of the 18 impact categories, a brief explanation of applicable thresholds, and a ranking based on the likeliness of occurring in the vicinity of the Bismarck Municipal Airport. The rankings refer to the impact category occurrence in the airport environs and have been listed as “yes”, “no”, or “uncertain”. Those categories receiving a “yes” are known to exist in the area and will likely require mitigation if affected. Those categories receiving a “no” do not exist in the area and will not be affected under any circumstances. The remaining categories were listed as “uncertain” and will require further analysis and/or coordination with Federal, state, and local agencies based on the development project. A brief overview of those categories known to exist in the airport environs is provided in Chapter 1.

Table 7-1
ENVIRONMENTAL IMPACT CATEGORIES

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Category	Threshold	In Airport Environ
Air Quality	Areas listed by the EPA as non-attainment areas and have development projects that will exceed one or more of the National Ambient Air Quality Standards for the six criteria pollutants require analysis. The Airport is not located in a non-attainment area and impacts to air quality resulting from airport improvements are unlikely.	No
Coastal Resources	The State of North Dakota does not have a coastal zone management program in effect.	No
Compatible Land Use	Determination of compatible land use in the vicinity of the Airport is required based on the identified traffic patterns and noise analysis completed as part of a formal environmental analysis.	Uncertain
Construction Impacts	All construction related to future airport development projects will comply with guidelines set forth in FAA AC 150/5370-10A, *Standards for Specifying the Construction of Airports* . This category is inevitable with any new development; however, all construction will adhere with applicable regulations and guidelines and typically there are no significant adverse impacts.	Yes
Section 4(f) Land	Coordination with affected jurisdictions should be conducted regarding the potential of planned airport development to affect existing or planned parks, recreational facilities, historic resources, wildlife refuges, or any other Section 4(f) properties.	Uncertain
Farmlands	It is recommended that contact be made with the local branch of the United States Department of Agriculture (USDA) to determine if prime or unique farmland exists in the vicinity of the Airport. Acquisition or conversion of prime or unique farmland becomes a significant impact when the combined score on Form AD 1006 ranges between 200 and 260 points.	Uncertain
Fish, Wildlife, and Plants	While future development at the Airport is unlikely to jeopardize the continued existence of any species found in the area, determination of impacts on fish, wildlife, and plant resources will require careful coordination with applicable agencies as part of a formal environmental analysis.	Uncertain
Floodplains	Federal insurance rate maps indicate the presence of floodplains in close proximity to the existing airport property line. Floodplain impacts would be significant pursuant to NEPA if resulting in a notable impact. All future development plans should avoid or minimize impacts to the drainage in the area.	Yes
Hazardous Materials, Pollution Prevention, and Solid Waste	A complete analysis of hazardous materials, chemicals, substances, and waste should be completed as part of a formal environmental analysis. This analysis should include identification of any known or likely sites and appropriate review regarding the hazardous nature of any materials or wastes to be used, generated, or disturbed by airport development.	Uncertain

Table 7-1 (cont'd)
ENVIRONMENTAL IMPACT CATEGORIES

Category	Threshold	In Airport Environ
Historical, Architectural, Archeological, and Cultural Resources	Coordination with the North Dakota State Historic Preservation Office in accordance with Section 106 of the National Historic Preservation Act is required as part of the complete environmental analysis.	Uncertain
Light Emissions and Visual Impacts	Normally, improvements or relocations to lighting systems used at the Airport will not have a negative impact on people or property located in the vicinity of the Airport. Future aesthetics at the Airport should attempt to adhere to existing design, art, and architecture at the Airport and in the vicinity in order to minimize any perceived negative impacts.	Uncertain
Natural Resources and Energy Supply	Coordination with natural resource and energy supply companies may be recommended prior to the construction of new facilities requiring these services.	Uncertain
Noise	A significant noise impact would occur if noise sensitive areas were to experience an increase in the day/night noise level (DNL) of 1.5 decibels or more at or above a DNL of 65 decibels when compared to the no action alternative for the same timeframe. Detailed noise analysis is recommended as part of an environmental analysis as appropriate.	Uncertain
Secondary (Induced)	Typically impacts are not considered significant unless there are also significant impact in other categories, especially noise, land use, or direction socioeconomic impacts.	Uncertain
Socioeconomic, Environmental Justice, and Children's Environmental Health and Safety Risks	If proposed airport development requires land acquisition it is necessary to evaluate the impacts of the acquisition on the adjacent community. If the proposed development would result in relocation or community disruptions further analysis is required. if there are significant impacts that would occur as a result of the development, a determination regarding whether these significant impacts disproportionately affect low income or minority populations needs to be addressed. A discussion of the affects of the development on children's environmental health and safety is required.	Uncertain
Water Quality	Early coordination with federal, state, and local agencies responsible for the implementation of water quality regulations and the issuance of permits is recommended for any development affecting bodies of water. Further permits also may be required depending on the type of waterway that is affected. It is recommended that all future airport development projects coordinate proposed improvements with local or state agencies as appropriate.	Uncertain
Wetlands	The National Wetlands Inventory and previous field observations and delineations have indicated the possible presence of wetland-like areas on and around airport property. Formal delineation of wetlands in planned development areas and coordination with the U.S. Army Corps of Engineers is required as part of the NEPA process.	Yes
Wild and Scenic Rivers	There are no eligible wild and scenic rivers in North Dakota. Thus, future development at the Airport will not affect any rivers included in the National Wild and Scenic River System.	No

7.2 ANTICIPATED ENVIRONMENTAL PROCESSING

The following section provides an overview of the anticipated environmental processing required during each environmental phase: short-term, intermediate-term, and long-term. Each section provides a brief description of the project and anticipated environmental processing required.

7.2.1 Short-Term Capital Improvements

Short-term capital improvements include those development items that will need environmental analysis within the next five years. These projects primarily include the rehabilitation of existing infrastructure and the acquisition of needed maintenance and snow removal equipment.

7.2.1.1 Rehabilitation of Taxiways B, C, and D and General Aviation Apron

This project rehabilitates Taxiways B, C, and D and the northwest general aviation apron. Rehabilitation includes measures to return the pavement to its original strength and design characteristics.

Normally construction or repair of existing taxiways and aprons, including extension, strengthening, reconstruction, resurfacing, marking grooving, fillets, and jet blast facilities, that do not create environmental impacts outside of airport property and do not result in any extraordinary circumstances is categorically excluded from further environmental processing. Therefore, this project will likely require the preparation of a Categorical Exclusion Checklist (FAA Order 1050.1E, Paragraph 310e).

7.2.1.2 Construction of South Side Service Road and B Hangar Area Access Road

This project constructs a private, on-airport service road along the south perimeter of the Airport; constructs a public and on-airport access road to the t-hangars located in the northeast corner of the Airport.

Normally access road construction and construction, relocation, or repair of entrance and service roadways that do not reduce the level of service on local traffic systems below acceptable levels and do not result in any extraordinary circumstances is categorically excluded from further environmental processing. Therefore, these projects will likely require the preparation of a Categorical Exclusion Checklist (FAA Order 1050.1E, Paragraph 310a).

7.2.2 Intermediate-Term Capital Improvements

Intermediate-term capital improvements include those development items that are anticipated to be constructed within the next 10 years. The environmental processing detailed below will need to be completed within the same timeframe to allow for project completion in accordance with applicable environmental rules and regulations.

7.2.2.1 Construction of Cargo Apron and Parallel Taxiway System

The proposed project will construct a cargo apron on the northeast side of the primary runway, north of the crosswind runway. This apron will be constructed to meet the demands of the cargo tenant. In addition to the apron, a full-length parallel taxiway and connector taxiways will be constructed to serve the primary runway on the east side.

Normally construction or repair of existing taxiways and aprons, including extension, strengthening, reconstruction, resurfacing, marking grooving, fillets, and jet blast facilities, that do not create environmental impacts outside of airport property and do not result in any extraordinary circumstances is categorically excluded from further environmental processing. Therefore, this project will likely require the preparation of a Categorical Exclusion Checklist (FAA Order 1050.1E, Paragraph 310e).

7.2.2.2 Extension and Widening of Runway 3/21

The proposed project will provide for a 600-foot extension on Runway 3 and widen the runway to 150 feet. In addition, this project includes the extension of the parallel taxiway and connector taxiway system to coincide with the new runway threshold.

A major runway extension requires an environmental assessment (FAA Order 1050.1E, Paragraph 401k). Compliance with FAA and environmental regulations will be required. Complete evaluation of the ability for the extension to increase air traffic is a key component of the environmental review process for this project.

7.2.2.3 Commercial and General Aviation Ramp Rehabilitation

This project rehabilitates the existing commercial and general aviation ramps. Rehabilitation includes measures to return the pavement to its original strength and design characteristics.

Normally construction or repair of pavement, including extension, strengthening, reconstruction, resurfacing, marking grooving, fillets, and jet blast facilities, that do not create environmental impacts outside of airport property and do not result in any extraordinary circumstances is categorically excluded from further environmental processing. Therefore, this project will likely require the preparation of a Categorical Exclusion Checklist (FAA Order 1050.1E, Paragraph 310e).

7.2.2.4 Rehabilitation of Runway 13/31, 3/21, Taxiway C, Service Road, and Terminal Parking Lot

This project rehabilitates Runway 13/31, Runway 3/21, Taxiway C, the on-airport service road, and the terminal parking lot. Rehabilitation includes measures to return the pavement to its original strength and design characteristics.

Normally construction or repair of pavement, including extension, strengthening, reconstruction, resurfacing, marking grooving, fillets, and jet blast facilities, that do not create environmental impacts outside of airport property and do not result in any extraordinary circumstances is categorically excluded from further environmental processing. Therefore, this project will likely require the preparation of a Categorical Exclusion Checklist (FAA Order 1050.1E, Paragraph 310a/e/f).

7.2.2.5 Construction of General Aviation Terminal and FIS

This project will construct a general aviation terminal and expand the existing commercial service terminal building to accommodate Federal Inspection Services. Both buildings will be constructed on existing airport property.

Normally construction of on-site structures and minor development that receive federal financial assistance, are on an approved airport layout plan, and do not result in any extraordinary circumstances are categorically excluded from further environmental processing. Therefore, this

project will likely require the preparation of a Categorical Exclusion Checklist (FAA Order 1050.1E, Paragraph 310f).

7.2.2.6 Runway 13/31 Extension

The proposed project extends Runway 31 by approximately 1,206 feet. In addition, this project includes the extension of the parallel and connector taxiway system to coincide with the new runway threshold, and the relocation of the approach lighting system and related visual and navigational aids.

Typically minor runway and taxiway extensions and installation of visual approach aids that do not affect the surrounding non-airport property and do not result in any extraordinary circumstances are categorically excluded from environmental processing (FAA Order 1050.1E, Paragraph 309b). However, considering the complexity of the proposed project, including the relocation of the existing approach lighting system, and impacts to public roadways it is likely that the project will require the preparation of an Environmental Assessment (FAA Order 1050.1E, Paragraph 401i).

7.2.2.7 Expansion of General Aviation Apron

This project expands the existing general aviation apron to meet tenant facility requirements. This project is demand driven and its development will occur when demand warrants expansion. The actual size of the apron expansion is also demand driven and will be based on facility needs.

Provided the expansion of the general aviation apron does not create environmental impacts outside of airport property and does not result in any extraordinary circumstances it is likely that this action will require the preparation of a Categorical Exclusion Checklist (FAA Order 1050.1E, Paragraph 310e).

7.2.2.8 Expansion of B Hangars and Extension of Service Road

This project consists of the construction of additional t-hangars located adjacent to the existing t-hangars located in the northeast corner of the Airport. The project will also require the extension of the on-airport perimeter service road to accommodate the new t-hangars.

Normally access road construction that does not reduce the level of service on local traffic systems below acceptable levels and construction of on-site structures that receive federal financial assistance, are on an approved airport layout plan, and do not result in any extraordinary circumstances are categorically excluded from further environmental processing. Therefore, these projects will likely require the preparation of a Categorical Exclusion Checklist (FAA Order 1050.1E, Paragraph 310a/e/f).

7.2.2.9 Construction of Deicing Pad

This project consists of the construction of deicing pads and appropriate treatment facilities. FAA and environmental regulations must be complied with. This project should include a Deicing Facility Study to analyze current deicing practices at the Airport, including locations and disposal of spent aircraft deicing fluid. Future deicing related regulations should be investigated and various deicing locations and treatment options should be evaluated in order to comply with these regulations.

Typically FAA installation of deicing facilities that comply with National Pollutant Discharge Elimination Systems permits or other permits protecting the quality of receiving waters, and for

which related water detention or retention facilities are designed not to attract wildlife hazardous to aviation and do not result in any extraordinary circumstances are categorically excluded from further environmental processing. However, with the establishment of a new treatment system installed by the Airport it is likely that an Environmental Assessment will be required (FAA Order 10501.1E, Paragraph 401f).

7.2.3 Long-Term Capital Improvements

Long-term capital improvements include those development items that demand warrants within the final 10 years of the master planning horizon. Projects include development items that will support the long-term growth and viability of the airfield.

7.2.3.1 ATCT Relocation

This project will construct a new air traffic control tower adjacent to the existing facility. The project provides for a modernized facility that allows needed equipment expansion and facility that will enable a clear line of sight to all aircraft operating areas.

Normally the relocation of an air traffic control tower requires the preparation of an Environmental Assessment (FAA Order 1050.1E, Paragraph 401g). However, given that the new facility will be constructed immediately adjacent to the existing facility and is essentially a replacement of the existing structure, it is likely that the preparation of a Categorical Exclusion will be sufficient for the proposed project (FAA Order 1050.1E, Paragraph 310v).

7.2.3.2 Perimeter Service Road Extension

This project completes the private, on-airport perimeter service road. The completion of the perimeter service road will significantly decrease the probability of aircraft and vehicle incursions by effectively removing non-essential vehicles from movement areas controlled by the air traffic controllers.

Normally construction, relocation, or repair of service roadways that do not reduce the level of service on local traffic systems below acceptable levels and do not result in any extraordinary circumstances are categorically excluded from further environmental processing. Therefore, this project will likely require the preparation of a Categorical Exclusion Checklist (FAA Order 1050.1E, Paragraph 310e).

7.2.3.3 Construction of High Speed Exit

This project consists of the construction of a high speed exit taxiway from the primary runway to the commercial passenger terminal area. While high speed exits are often added to increase the capacity of the airfield, the construction of the proposed exit taxiway will increase the level of service provided at the Airport, but is not anticipated to have direct impacts on the number of operations on the airfield.

Normally construction of taxiways, including extension, strengthening, reconstruction, resurfacing, marking, and grooving, that do not create environmental impacts outside of airport property and do not result in any extraordinary circumstances are categorically excluded from further environmental processing. Therefore, this project will likely require the preparation of a Categorical Exclusion Checklist (FAA Order 1050.1E, Paragraph 310e).

7.3 AGENCY COORDINATION

Acceptance of Federal grant funding requires compliance with the requirements set forth in the Council of Environmental Quality regulations for implementing the provisions of the National Environmental Policy Act of 1969, 40 Code of Federal Regulations Parts 1500 through 15088, Department of Transportation Order DOT 5610.1C, and other related statutes and directives. The likely environmental processing identified in this chapter does not eliminate the possibility of additional or more detailed environmental processing. Careful coordination with the responsible FAA official should be conducted for every project utilizing federal funds. In addition, it is recommended that coordination with the following agencies also be conducted as part of development actions utilizing federal funding or requiring environmental processing:

- Applicable Parks and Recreation Departments concerning planned public parks and recreational areas
- Natural Resource Conservation District if land currently used for agricultural purposes becomes necessary
- United States Fish and Wildlife Service and other applicable agencies concerning impacts to flora or fauna and biotic communities associated with proposed development
- North Dakota State Historic Preservation Officer in accordance with Section 106 of the National Historic Preservation Act
- Natural resource and energy suppliers prior to construction of new facilities requiring an extension of those services
- Federal, state, and local agencies responsible for the implementation of water quality regulations and issuance of permits.
- Completion of a wetland delineation for the proposed development areas and coordination with the U.S. Army Corps of Engineers

While the guidelines identified in this chapter are in compliance with the National Environmental Policy Act requirements, additional coordination and environmental processing may be necessary with state and/or local agencies to comply with their rules and regulations.

APPENDIX A
GLOSSARY

Above Ground Level (AGL)	Elevation above the surface of the ground.
Advisory Circular (AC)	A series of external FAA publications consisting of all non-regulatory material of a policy, guidance, and informational nature.
Aircraft	A device that is used or intended to be used for flight in the air.
Aircraft Operation	A landing or takeoff by an aircraft.
Aircraft Owners and Pilots Association (AOPA)	A not-for-profit individual membership association serving the interests and needs of general aviation pilots and aircraft owners.
Aircraft Rescue and Fire Fighting (ARFF)	A facility designed to house emergency vehicles, extinguishing agents, and personnel responsible for minimizing the effects of an aircraft accident or incident.
Airport Advisory Area	The area within 10 statute miles of an airport where a flight service station is located, but where there is no control tower in operation.
Airport Authority	Similar to a port authority but with the single purpose of setting policy and management direction for airports within its jurisdiction.
Airport Beacon	A visual navigation aid displaying alternating lights used to identify the type of airport.
Airport Elevation	The highest point of an airport's usable runways measured in MSL.
Airport Improvement Program (AIP)	A program created under the Airport and Airway Improvement Act of 1982 to provide continued funding for airport planning and development.
Airport Layout Plan (ALP)	A plan for an airport showing boundaries and proposed additions to all areas owned or controlled by the sponsor for airport purposes, the location and nature of existing and proposed airport facilities and structures, and the location on the airport of existing and proposed non-aviation areas and improvements thereto.

Airport Master Plan (AMP)	A plan of the ultimate development of a specific airport. It presents the research and logic from which the plan was evolved and displays the plan in a graphic and written format.
Airport Movement Area Safety System (AMASS)	Enhances the function of the ground mapping radar by providing automated alerts and warnings of potential runway incursions and other hazards.
Airport Obstruction Chart (AOC)	A 1:12,000 scale graphic depicting Federal Aviation Regulations Part 77 surfaces, a representation of objects that penetrate these surfaces, runway, taxiway, and ramp areas, navigational aids, prominent airport buildings, plus a selection of roads and other planimetric detail in the airport vicinity.
Airport Surveillance Radar (ASR)	Approach and departure control radar used to detect and display an aircraft's position in the terminal area.
Airport Reference Point (ARP)	The latitude and longitude of the approximate center of the airport.
Airport Sponsor	A public agency or tax-supported organization, such as an airport authority, that is authorized to own and operate the airport, to obtain property interests, to obtain funds, and to be legally, financially, and otherwise able to meet all applicable requirements of current laws and regulations.
Airport Surveillance Radar (ASR)	Radar providing position of aircraft by azimuth and range data. It does not provide elevation data. It is designed for range coverage up to 60 nautical miles and is used by terminal area air traffic control.
Air Route Traffic Control Center (ARTCC)	A facility established to provide air traffic control service to aircraft operating on an IFR flight plan within controlled airspace and principally during the enroute phase of light.
Airspace	Space in the air above the surface of the earth or a particular portion of such space, usually defined by the boundaries of an area on the surface projected upward.

Air Taxi Aircraft	An aircraft operated by the holder of an Air Taxi Operating Certificate, which authorizes the carriage of passengers, mail, or cargo for revenue in accordance with FAR Parts 135 and 121.
Air Traffic Control (ATC)	A service operated by appropriate authority to promote the safe, orderly, and expeditious flow of air traffic.
Air Traffic Control System Command Center (ATCSCC)	A facility responsible for the operation of four distinct but integrated functions: central flow control, central altitude reservations, airport reservation position, and the air traffic service contingency command post.
Air Traffic Control Tower (ATCT)	A central operations facility in the terminal air traffic control system, consisting of a tower cab structure including an associated IFR room if radar equipped, using air/ground communications and/or radar, visual signaling, and other devices to provide safe and expeditious movement of terminal air traffic.
Air Transport Association (ATA)	An organization for the principal U.S. airlines that supports and assists its members by promoting the air transport industry and the safety, cost effectiveness, and technological advancement of its operations; advocating common industry positions before state and local governments; conducting designated industry-wide programs; and assuring governmental and public understanding of all aspects of air transport.
Alert Area	Special use airspace that may contain a high volume of pilot training activities or an unusual type of aerial activity.
Altitude	Height expressed in units of distance above a reference plane, usually above mean sea level or above ground level.
Approach Lighting System (ALS)	An airport lighting facility that provides visual guidance to landing aircraft by radiating light beams in a directional pattern by which the pilot aligns the aircraft with the extended centerline of the runway on the final approach and landing.
Approach Surface	An imaginary surface longitudinally centered on the extended centerline of the runway, beginning at the end of the primary surface and rising outward and

	upward to a specified height above the established airport elevation.
Apron	A defined area, on a land airport, intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking, or maintenance.
Area Navigation (RNAV)	Application of the navigation process providing the capability to establish and maintain a flight path on any arbitrary chosen course that remains within the coverage area of navigation sources being used.
Automated Terminal Information Service (ATIS)	The continuous broadcast of recorded non-control information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information.
Automatic Dependent Surveillance - Broadcast (ADS-B)	A satellite-based technology that broadcasts aircraft identification, position, and speed with once-per-second updates. A national ADS-B program office has been established.
Automated Weather Observing System (AWOS)	Gathers weather data from unmanned sensors, automatically formulates weather reports, and distributes them to airport control towers.
Automatic Direction Finder (ADF)	An aircraft radio navigation system which senses and indicates the direction to an L/MF non-directional radio beacon (NDB) or commercial broadcast station.
Avigation Easement	A grant or property interest in land over which a right of unobstructed flight in the airspace is established.

B

Based Aircraft	The total number of active general aviation aircraft that use or may be expected to use an airport as a home base.
Basic Utility (BU) Airport	An airport that accommodates most single-engine and many of the small twin-engine aircraft.
Bearing	The horizontal direction to or from any point, usually measured clockwise from true north (true bearing), magnetic north (magnetic bearing), or some other reference point, through 360 degrees.

Blast Fence	A barrier that is used to divert or dissipate jet or propeller blast.
Blast Pad	A specially prepared surface placed adjacent to the ends of runways to eliminate the erosive effect of the high wind forces produced by airplanes at the beginning of their takeoff rolls.
Building Restriction Line	A line shown on the airport layout plan beyond which airport buildings must not be positioned in order to limit their proximity to aircraft movement areas.

C

Category I (CAT-I)	An ILS that provides acceptable guidance information from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a height of 100 feet above the horizontal plane containing the runway threshold. Supports landing minima as low as 200 feet HAT and 1,800 feet RVR.
Category II (CAT-II)	An ILS that provides acceptable guidance information from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a height of 50 feet above the horizontal plane containing the runway threshold. Supports landing minima as low as 100 feet HAT and 1,200 feet RVR.
Category III (CAT-III)	An ILS that provides acceptable guidance information from the coverage limits of the ILS with no decision height specified above the horizontal plane containing the runway threshold.
Capital Improvement Plan (CIP)	The primary planning tool used by the Federal Aviation Administration for systematically identifying, prioritizing, and assigning funds to critical airport development and associated capital needs for the National Airspace System. Also serves as the basis for distribution of grant funds under the Airport Improvement Program.
Ceiling	The height above the earth's surface of the lowest layer of clouds which is reported as broken or overcast or the vertical visibility into an obscuration.
Common Traffic Advisory Frequency (CTAF)	A frequency designed for the purpose of carrying out airport advisory practices while operating to or from an uncontrolled airport. The CTAF may be a

	UNICOM, MULTICOM, FSS, or tower frequency and it is identified in appropriate aeronautical publications.
Conical Service	A surface extending from the periphery of the horizontal surface outward and upward at a slope of 20 to 1 for the horizontal distances and to the elevations above the airport elevation as prescribed in FAR Part 77.
Controlled Airport	An airport that has an operating control tower.
Controlled Airspace	Airspace designed as a continental control area, control area, control zone, terminal control area, or transition area, within which some or all aircraft may be subject to air traffic control.
Crosswind	A wind which is not parallel to a runway or the path of an aircraft.
Crosswind Component	A wind component which is at a right angle to the runway or the flight path of an aircraft.

D

Decibel (dB)	A unit of noise level representing a relative quantity. This reference value is a sound pressure of 20 micronewtons per square meter.
Decision Height (DH)	With respect to the operating of aircraft means the height at which a decision must be made, during the ILS or PAR instrument approach, to either continue the approach or to execute a missed approach.
Department of Transportation (DOT)	Established in 1966 to promote coordination of existing federal programs and to act as a focal point for future research and development efforts in transportation.
Discretionary Funds	Grants that go to projects that address goals established by Congress, such as enhancing capacity, safety, and security or mitigating noise at all types of airports
Displaced Threshold	When the landing area begins at a point on the runway other than the designated beginning of the runway.
Distance Measuring Equipment (DME)	Equipment (airborne and ground) to measure, in nautical miles, the slant range distance of an

aircraft from the navigational aid.

E

Emergency Locating Transmitter (ELT)	A battery-operated radio transmitter attached to the aircraft structure that transmits on 121.5 MHz and 243.0 MHz. It aids in locating downed aircraft.
Environmental Assessment (EA)	A concise public document for which a Federal agency is responsible that serves to briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement of a finding of no significant impact.
Environmental Impact Statement (EIS)	A federal document that reflects the FAA's final evaluation of the environmental impact of a proposed action.
Essential Air Service (EAS)	Guarantees air carrier service to selected small cities and provides subsidies if needed so as to prevent these cities from losing service.

F

Federal Aviation Administration (FAA)	Created by the act that established the DOT. Assumed all of the responsibilities of the form Federal Aviation Agency.
Federal Aviation Regulations (FAR)	The codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the Federal Government for aviation.
Federal Inspection Services (FIS)	Conducts customs and immigration services including passport inspection, inspection of baggage, and collection of duties on certain imported items, and sometimes inspection for agricultural materials, illegal drugs, or other restricted items.
Final Approach Fix (FAF)	Designated point at which the final approach segment begins for a non-precision approach.
Finding of No Significant Impact (FONSI)	A federal document prepared by a Federal agency that briefly presents the reasons why an action will not have a significant effect on the human environment and for which an environmental impact statement will not be prepared.

Fixed Base Operator (FBO)	A business located at an airport that provides a variety of services to pilots, which may include aircraft rental, training, fueling, maintenance, parking, and the sale of pilot supplies.
Flight Level (FL)	Designations for altitudes within controlled airspace Class A.
Flight Service Station (FSS)	A central operations facility in the national flight advisory system utilizing data interchange facilities for the collection and dissemination of NOTAM, weather, and administrative data and providing preflight and inflight advisory service and other services to pilots via air/ground communication facilities.

G

General Aviation (GA)	That portion of civil aviation that encompasses all facets of aviation except air carriers holding a certificate of convenience and necessity and large aircraft commercial operators.
General Utility (GU) Airports	Accommodates all general aviation aircraft.
Global Positioning System (GPS)	A satellite-based navigation system that will enhance user preferred routing, reduce separation standards, and increase access to airports under instrument meteorological conditions through more precision approaches.

H

Height Above Touchdown (HAT)	A designated height measured from the touchdown zone elevation or the threshold elevation of the runway served by the instrument approach.
High Intensity Runway Lights (HIRL)	The highest classification for the intensity of the lights bordering the sides of the runway.
Horizontal Surface	A specified portion of a horizontal plane located 150 feet above the established airport elevation which established the height above which an object is determined to be an obstruction to air navigation.

I

Initial Approach Fix (IAP)	The designated point at which the initial approach segment begins for an instrument approach.

Instrument Approach Procedures (IAP)	A procedure that allows an aircraft to descend safely by reference to instruments from the enroute altitude to a point near the runway at the pilot's discretion from which a landing can be made visually.
Instrument Flight Rules (IFR)	FAR rules that govern the procedures of conducting flight in weather conditions below VFR weather minimums. The term IFR is also used to define weather conditions and the type of flight plan under which an aircraft is operating.
Instrument Landing System (ILS)	A system that provides, in the aircraft, the lateral, longitudinal, and vertical guidance necessary for a landing.
Instrument Meteorological Conditions (IMC)	Meteorological conditions expressed n terms of visibility and ceiling less than the minimum specified for visual meteorological conditions.
Itinerant Operation	Operation by an aircraft other than local operations.

J

K

Knots (Kts)	A unit of length used in navigation equivalent to the distance spanned by one minute of arc in latitude (1,852 meters or 6,076 feet)

L

Large Aircraft	Aircraft of more than 12,500 pounds maximum certificated takeoff weight.
Lateral Precision Performance with Vertical Guidance (LPV)	The Wide Area Augmentation System (WAAS) offers an opportunity for airports to gain an instrument landing system (ILS) like approach capability without the purchase or installation of any ground-based navigation equipment at the airport. The WAAS-enabled vertically-guided approach procedures provide approach minimums as low as 200 feet at qualifying airports.
Local Operation	Operations performed by aircraft that (1) operate in the local traffic pattern or within sight of the airport; (2) are known to be departing for, or arriving from, flight in local practice areas within a 20-mile radius of the airport; or (3) execute simulated instrument approaches or low passes at the airport.

Longitude	Measurement east or west of the Prime Meridian in degrees, minutes, and seconds. Lines of longitude are also called meridians. The Prime Meridian is zero degrees longitude and runs through Greenwich, England.
Long Range Navigation System (LORAN)	A navigational system by which lines of position are determined by measuring the difference in the time of reception of synchronized pulse signals from fixed transmitters.
Low Intensity Runway Lights (LIRL)	The lowest classification for the intensity of the lights bordering the sides of the runway.

M

Mean Sea Level (MSL)	The average height of the surface of the sea for all stages of tide.
Medium Intensity Runway Lights (MIRL)	The middle classification for the intensity of the lights bordering the sides of the runway.
Microwave Landing System (MLS)	An instrument approach and landing system operating in the microwave frequencies that provides guidance in azimuth, elevation, and distance measurement.
Military Operations Area (MOA)	Special use airspace of defined vertical and lateral limits established to help VFR traffic identify locations where military activities are conducted.
Military Training Route (MTR)	Route depicted on an aeronautical chart for the conduct of military flight training at speeds above 250 knots.

N

National Airspace System (NAS)	A network of navigational aids and a number of air traffic control facilities designed to operate in conjunction with the various defined classes of airspace.
National Plan of Integrated Airport Systems (NPIAS)	A national airport system plan published and revised every two years by the Secretary of Transportation for the development of public-use airports in the United States.
National Transportation Safety Board (NTSB)	Created by the act that established the DOT to determine the cause of transportation accidents and review on appeal the suspension or revocation

	of any certificates or licenses issued by the Secretary of Transportation.
Nautical Mile (Nm)	A unit of length equivalent to 3.45 statute miles.
Navigational Aid (NAVAID)	Any facility used as, available for use as, or designed for use as an aid to air navigation, including landing area, lights, any apparatus or equipment for disseminating weather information, for signaling, for radio direction-finding, or for radio or other electronic communication, and any other structure or mechanism having similar purpose for guiding and controlling flight in the air or the landing or takeoff of aircraft
Non-Directional Beacon (NDB)	Ground-based navigational aid
Non-Precision Approach (NPA)	Provides an aircraft with horizontal course guidance to a runway surface.
Notice to Airmen (NOTAM)	A notice containing information concerning the establishment, condition, or change in any component of, or hazard in, the National Airspace System, the timely knowledge of which is essential to personnel concerned with flight operations.

O

Obstruction Light	A light, or one of a group of lights, usually red or white, mounted on a surface structure or natural terrain to warn pilots of the presence of a flight hazard.

P

Pilot Controlled Lighting	Runway lighting systems which are controlled by keying the aircraft's microphone on a specific frequency.
Precision Approach (PA)	A standards instrument approach procedure in which an electronic glideslope is provided.
Precision Approach Path Indicator (PAPI)	A visual-approach slope aid system consisting of four lights on either side of the approach runway that gives precise indication to the pilot of the approach path of the aircraft.
Precision Approach Radar (PAR)	A radar facility in the terminal air traffic control system used to detect and display, with a high degree of accuracy, azimuth, range, and elevation

	of an aircraft on the final approach to a runway.
Primary Surface	A rectangular surface longitudinally centered about a runway.
Prohibited Area	Airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited.

Q

R

Radial	A navigational signal generated by a VOR or VORTAC, measured as a magnetic bearing from the station.
Restricted Area	Designated special use airspace within which aircraft flight, while not prohibited, is subject to restrictions.
Runway (RWY)	A defined rectangular area on a land airport prepared for the landing and taking off of aircraft along its length.
Runway Alignment Indicator Light (RAIL)	A series of five or more sequenced flashing light installed on the extended centerline of the runway. The maximum spacing between lights is 200 feet, extending out from 1,600 feet to 3,000 feet from the runway threshold.
Runway End Identifier Lights (REIL)	An airport lighting facility in the terminal area navigation system consisting of one flashing white high-intensity strobe light installed at each approach end corner of a runway and directed toward the approach zone, which enable the pilot to identify the threshold of a usable runway.
Runway Gradient	The amount of change in elevation over the length of the runway.
Runway Visibility Zone (RVZ)	An area formed by imaginary lines connecting two intersecting runways' visibility points.
Runway Visual Range (RVR)	An instrumentally derived value that represents the horizontal distance a pilot can see down the runway from the approach end.

S

Sectional Chart	Most commonly used chart for VFR flight. Each chart covers six degrees to eight degrees of longitude and approximately four degrees of latitude and is given the name of a primary city within its coverage. The scale of a sectional chart is 1:500,000.
Segmented Circle	A set of visual indicators that provide traffic pattern information at airports without operating control towers.
Single Wheel Gear (SWG)	
Special Use Airspace	Defined airspace areas where aircraft operations may be limited.
Small Aircraft	Aircraft of 12,500 pounds or less maximum certificated takeoff weight.
Standard Instrument Departure Procedures (SIDS)	A procedure used after takeoff to provide a transition between the airport and the enroute structure.
Standard Terminal Arrival Route (STAR)	A procedure for departing the enroute structure and navigating to a destination.
Stopway	An area beyond the takeoff runway which is designed to support an airplane during an aborted takeoff without causing structural damage to the airplane. It cannot be used for takeoff, landing, or taxiing.

T

Terminal Instrument Procedures Standards (TERPS)	Procedures used for conducting independent instrument approaches to converging runways under instrument meteorological conditions.
Terminal Radar Approach Control (TRACON)	An air navigation system facility responsible for monitoring the enroute and terminal segment of air traffic in the airspace surrounding airports with moderate to high-density traffic
Threshold	The designated beginning of the runway that is available and suitable for the landing of airplanes.
Threshold Crossing Height (TCH)	The height of the straight-line extension of the

	visual or electronic glideslope above the runway threshold.
Touchdown	The point at which an aircraft first makes contact with the landing surface.
Touchdown Zone (TDZ)	The area of a runway near the approach end where aircraft normally alight.
Traffic Pattern	The traffic flow that is prescribed for aircraft landing and taking off from an airport. The usual components are the departure, crosswind, downwind, and base legs; and the final approach.

U

Uncontrolled Airport	A nontower airport where control of VFR traffic is not exercised.
Uncontrolled Airspace	Airspace within which aircraft are not subject to air traffic control.
Universal Communication (UNICOM)	A non-government communications facility which may provide airport information at certain airports.

V

Very High Frequency Omnidirectional Ranging (VOR)	Ground based navigational system consisting of very high frequency omnidirectional range stations that provide course guidance.
Victor Airway	An airway system based on the use of VOR facilities.
Visual Approach Slope Indicator (VASI)	An airport lighting facility in the terminal area navigation system used primarily under VFR conditions. It provides vertical visual guidance to aircraft during approach and landing by radiating a direction pattern of high intensity red and white focused light beams that indicate to the pilot that the aircraft is on path, above path, or below path.
Visual Flight Rules (VFR)	Rules that govern the procedures for conducting flight under visual conditions.
Visual Meteorological Conditions (VMC)	Meteorological conditions expressed in terms of visibility and ceiling equal o or better than specified minima.

VORTAC	Combined VOR and TACAN

W

Warning Area	Airspace of defined dimensions, extending from three nautical miles outward from the coast of the United States, which contains activity that may be hazardous to nonparticipating aircraft.
Wide-Area Augmentation System (WAAS)	An augmentation of GPS that includes integrity broadcasts, differential corrections, and additional ranging signals; its primary objective is to provide accuracy, integrity, availability, and continuity required to support all phases of flight.
World Aeronautical Chart (WAC)	Similar to a sectional chart, but with a scale of 1:1,000,000 provides less detail and is best suited for flight planning.

X

Y

Z

APPENDIX B
NATIONAL PLAN OF INTEGRATED AIRPORT SYSTEMS

The Airport and Airway Improvement Act of 1982 directed the Secretary of Transportation to prepare, publish, and revise every two years a national airport system plan – the National Plan of Integrated Airport Systems (NPIAS) - for the development of pubic-use airports in the United States. The NPIAS is a system that emphasizes system planning and development to meet current and future aviation needs; it includes development considered necessary to provide a safe, efficient, and integrated airport system meeting the needs of civil aviation, national defense, and the United States Postal Service. It takes into account, amongst other things, the relationship of each airport to the rest of the transportation system in a particular area, the forecast of technological developments in aeronautics, and the development forecast in other modes of transportation.

Projects eligible for funding under the Airport Improvement Program (AIP) must be included in the NPIAS. The NPIAS currently includes 3,364 of the 5,314 airports open to the public. Approximately 1,000 publicly owned, public use airports are not included because they do not meet the minimum entry criteria of ten based aircraft, are within 20 miles of a NPIAS airport, or are located at inadequate sites and cannot be expanded and improved to provide safe and efficient airport facilities. The remaining airports that are excluded from the NPIAS are privately owned, public use airports that are not included because they are located at inadequate sites, are redundant to publicly owned airports, or have too little activity to qualify for inclusion. In addition, nearly 14,000 civil landing areas are not open to the general public and are not included in the NPIAS.

Airport facilities included in the NPIAS are classified under two different categories: service level and airport role.

B.1 SERVICE LEVEL

The airport service level reflects the type of public use the airport provides to the community and the funding categories established by Congress to assist in airport development. The following list defines the different types of service levels:

- Commercial service airports are public airports that enplane in excess of 2,500 or more annual passengers and receive aircraft offering scheduled passenger service.
- Primary airports are commercial service airports that have more than 10,000 annual enplaned passengers.
- Large hub airports are those primary airports that enplane at least one percent of total U.S. passenger enplanements.
- Medium hub airports are those primary airports that enplane between 0.25 percent and one percent of total U.S. passenger enplanements.
- Small hub airports are those primary airports that enplane between 0.05 percent and 0.25 percent of the total U.S. passenger enplanements.
- Non-hub primary service airports are those primary airports that enplane less than 0.05 percent of all commercial passenger enplanements but more than 10,000 annual enplanements.

- Cargo service airports are served by aircraft providing air transportation of property only, including mail, with an aggregate annual aircraft landing weight in excess of 100,000 thousand pounds.
- Reliever airports provide substantial capacity or instrument training relief to a commercial service airport that serves a metropolitan statistical area with a population of at least 250,000 persons or has at least 250,000 annual enplaned passengers and operates at 60 percent of its capacity; or would be operated at such a level before being relieved by one or more reliever airports; or is subject to restrictions that limit activity that would otherwise reach 60 percent of capacity. An airport not meeting these criteria may be included in the NPIAS as a reliever airport if it is so designed in a state, regional, or metropolitan system plan and the FAA concurs with that portion of the plan.
- General aviation airports that receive U.S. mail services, are listed as a scheduled stop by an air carrier transporting mail pursuant to a current contract with the U.S. Postal Service, or area otherwise designated by USPS and served through a public airport are included in the plan. A general aviation airport can also be listed if it is included in a state system plan, serves a community more than 30 minutes from the nearest existing or proposed airport included in the NPIAS, is forecasted to have 10 based aircraft during the short-term planning period, and has an eligible sponsor willing to undertake ownership and development of the airport.
- Public use heliports that do not meet other service level criteria but are included in the plan if they make significant contributions to public transportation. Helicopter landing areas are included in the plan if they have at least four based rotorcrafts or 800 annual itinerant operations, or 400 itinerant operations by air taxi rotorcraft.

There are currently 546 commercial service airports included in the NPIAS; of these, 422 have more than 10,000 enplanements and are classified as primary airports. Primary airports receive an annual apportionment of at least one million dollars in AIP funding, when funding levels meet or exceed $3.2 billion, with the exact amount determined by the number of enplaned passengers. Of these, 31 are classified as large hub commercial airports and account for nearly 70 percent of all passenger enplanements. Large hub airports tend to focus on airline passenger and freight operations and have limited general aviation activity.

Reliever airports are typically high capacity general aviation airports in major metropolitan areas. These specialized airports provide pilots with attractive alternatives to using the congested hub airports. There are 260 reliever airports that average 228 based aircraft and together account for 27 percent of the Nation's general aviation fleet.

General aviation airports are typically located in communities that do not have commercial service and account for enough activity, usually at least ten based aircraft, and are located a minimum of 20 miles from the nearest NPIAS airport. There are 2,558 general aviation airports included in the NPIAS and tend to be distributed on a one-per-county basis in rural areas. These airports average 32-based aircraft and account for nearly 38 percent of the Nation's general aviation fleet. These airports tend to be of particular importance to rural areas.

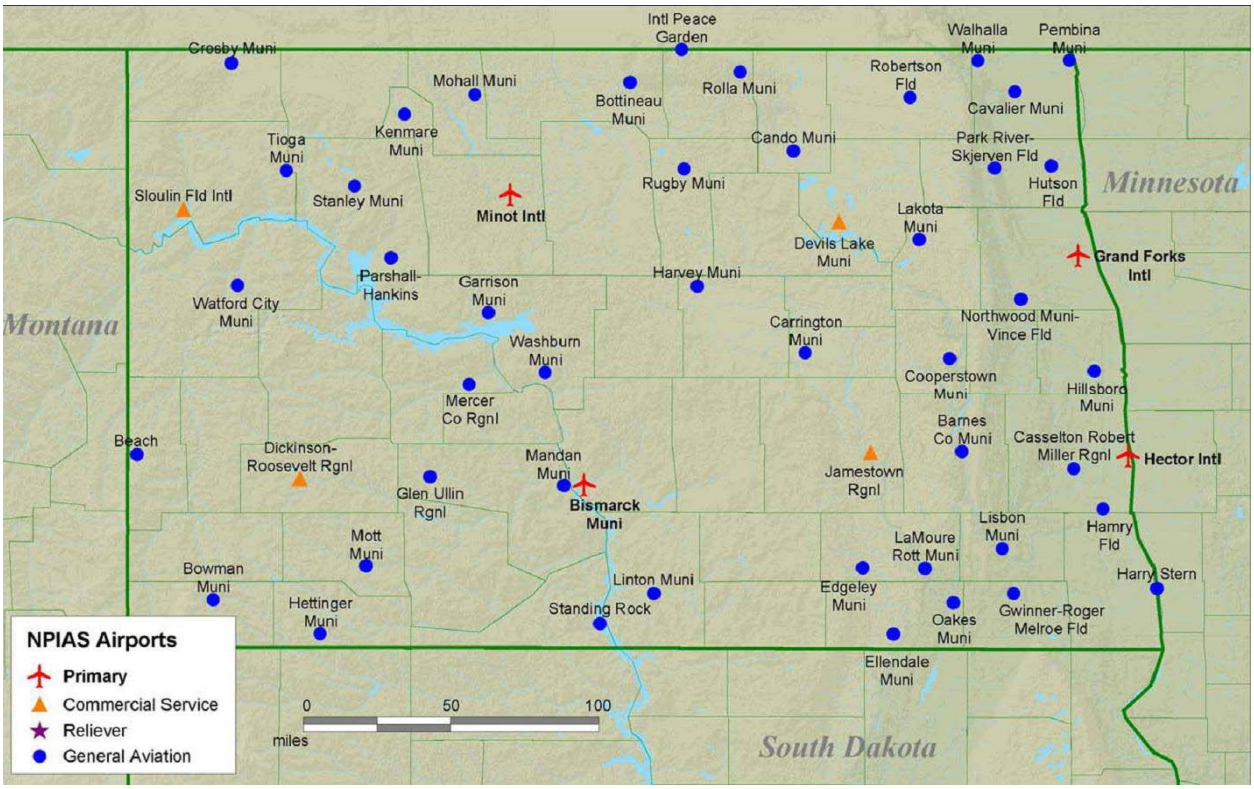
B.2 ROLE

An airport included in the NPIAS is further classified into one of four basic service levels, which describe the type of service that the airport currently provides to the community and is anticipated to provide to the community at the end of the five-year planning period. The four roles include:

- PR – primary commercial service

- CM – non-primary commercial service
- RL – reliever
- GA – general aviation airport

NPIAS Airports in North Dakota



Source: FAA 2007-2011NPIAS Report

APPENDIX C
VISUAL AND NAVIGATIONAL AIDS

An integral part of the airport system is the visual and navigational aids provided to assist pilots in navigating both on the airfield and en route.

C.1 VISUAL AIDS

To enhance visual information during the day when visibility is poor and at night, it is essential to provide visual aids that will be as meaningful to a pilot as possible. These aids can provide pilots information based on their horizontal and vertical position by providing data regarding the aircraft's alignment, height and distance, rotation, and information concerning the rate of descent and the rate of closure with the desired path. This system consists of a variety of lighting and marking aids used to guide the pilot both in the air and on the ground.

C.1.1 Airport Beacon

Airport beacons are used to guide pilots to lighted airports with a sequence of yellow, green, and/or white lights. A beacon is normally operated from dusk until dawn. If the beacon is on during other hours it typically indicates that the airport is operating under instrument flight rules.

C.1.2 Approach Lighting

Approach lighting systems are a configuration of high-intensity or medium-intensity sequenced flashing signal lights designed to guide the pilot from the approach zone to the runway threshold. Approach lights can also provide additional visual guidance for nighttime approaches under visual flight rules.

This system consists of a variety of approach lighting systems approved for use in the United States. These include a high-intensity approach lighting system with sequenced flashing lights (ALSF-2) for use on category II and category III precision-instrument approaches, a high-intensity sequenced flashing lights (ALSF-1), and three medium-intensity approach lighting systems (MALSR, MALS, and MALSF).

C.1.3 Visual-Approach Slope Aids

The visual approach slope indicator (VASI) is an optical reference device located on the ground adjacent to the sides of the runway. There are a variety of VASI designs dependent upon the desired visual range and the type of aircraft utilizing the runway. Each unit consist of a "bar" of one, two, or three light units, referred to as boxes. Each box appears a certain color depending upon the pilot's position. If the pilot is too low all of the bars will appear red, if the pilot is too high all of the bars will appear white, and if the pilot is on the desired path half of the bars will appear red and half will appear white. The most common systems found in the United States include VASI-2, VASI-4, VASI-12, and VASI-16. The number following the acronym indicates the number of boxes in the system.

The precision approach path indicator (PAPI) is a visual-approach slope aid approved for use in the United States. This system gives more precise indication to the pilot of the approach path of the aircraft and utilizes only one bar. The system consists of four lights on either side of the

approach runway. The lighting indications still consist of a series of white and/or red lights to indicate the pilot's position.

C.1.4 Threshold Lights

Threshold lights consist of a single row of green lights extending across the entire width of the runway used to indicate the beginning of the usable landing surface. At small airports, threshold lights may consists of four green lights located on either side of the threshold. These lights are two-directional and appear red from the opposite end of the runway to mark the end of the usable runway.

C.1.5 Runway and Taxiway Lighting

Runway end identifier lights (REIL) consist of high intensity white strobe lights placed on each side of the runway to enable rapid and positive identification of the runway threshold. REILs are typically installed on runways where an approach lighting system is not available.

Touchdown zone lights are white lights located 36 feet on either side of the runway centerline and extend 3,000 feet from the runway threshold or half the runway distance if the runway is less than 6,000 feet long.

Runway edge lights consist of a single row of two-directional lights bordering each side of the runway and can be classified according to three intensity levels. High intensity runway lights (HIRL) are the brightest runway lights available. Medium intensity runway lights (MIRL) and low intensity runway lights (LIRL) are, as their names indicate, lower in intensity. Instrument runway edge lights incorporate yellow runway remaining lights on the last half of the runway or last 2,000 feet, whichever is less, to inform the pilot of the amount of runway remaining. If the runway threshold is displaced but the area that is displaced is usable for takeoffs and taxiing then the runway edge lights, in the direction of operations, are red.

Runway centerline lights are white lights offset a maximum of two feet from the runway centerline. To indicate the distance remaining, the last 1,000 feet the centerline lights are red and the previous 2,000 feet alternative between red and white.

Taxiway lighting consists of blue edge lights and may also consists of green centerline lights.

C.1.6 Runway and Taxiway Markings

The FAA classifies runways based on the type of approaches they are capable of handling: visual, non-precision instrument, or precision instrument. All markings are white in color. A visual runway is intended solely for the operation of aircraft using visual approach procedures. These runways are marked only with the standard markings, which include a centerline, a number designator, and holding indications. Non-precision instrument runways are runways that have instrument approach procedures using air navigation facilities that only provide horizontal guidance. Markings include the standard markings and the addition of threshold markings and fixed distance markers. A precision instrument runway is one that has instrument approach procedures using an instrument landing system (ILS) or precision approach radar (PAR). These runway include all of the markings on a non-precision instrument runway with the addition of touchdown zone markers and side stripes.

All taxiway markings are yellow in color and consist of single-continuous centerline marking and dashed yellow holding lines. Additional yellow markings are used to indicate various movement areas and holding positions.

C.2 NAVIGATIONAL AIDS

Navigational systems vary considerably in terms of accuracy, coverage, reliability, and capabilities. The majority of navigational systems are currently designed around the geographic location and technical characteristics of ground-based navigational aids. Newer technology increasing in usage is designed around satellite-based systems that are augmented by ground-based systems.

C.2.1 VHF Omnidirectional Range (VOR)

Very high frequency omnidirectional range (VOR) is the primary ground-based en route navigational aid used throughout the United States. VOR is a system made up of a series of ground stations that broadcast directional signals used by aircraft in determining bearings to or from a station. If the VOR station is equipped with distance measuring equipment (DME), the signals can also be used for determining the distance to the station. Navigation utilizing VORs typically consists of flying airways, which are specific radials connecting VOR stations.

C.2.2 Non-Directional Beacon (NDB)

Non-directional beacons (NDB) are another ground-based navigational aid used throughout the United States. The NDB system is the oldest form of electronic navigation still in regular use. By transmitting low to medium frequencies to an automatic direction finder located in the aircraft, pilots can use the NDB system to navigate to and from the ground-based station.

C.2.3 Instrument Landing System (ILS)

The instrument landing system is a precision approach navigational aid that provides highly accurate course, glide slope, and distance guidance information to a given runway. There are three general classifications of ILS approach systems – Category I, Category II, and Category III. Category I is the basic ILS approach system and can be used by any aircraft with the appropriate equipment. Category II and Category III ILS approach systems are more precise and require special certification for operators, pilots, aircraft, and air to ground equipment.

C.2.4 Global Positioning System (GPS)

The global positioning system (GPS) is a satellite-based radio positioning, navigation, and time-transfer station developed and maintained by the Department of Defense (DOD). GPS, at any given time, utilizes three of the strategically placed 24 satellites to calculate the aircraft's position and, from there, determine the distance, bearing, and estimated time en route to the next waypoint.

C.2.5 Wide Area Augmentation System (WAAS)

Wide area augmentation system (WAAS) is an expansion of GPS that includes integrity broadcasts, differential corrections, and additional ranging signals. Its primary objective is to provide the accuracy, integrity, availability, and continuity required to support all phases of flight. WASS consists of a network of ground reference stations that monitor GPS signals. Data from these reference stations are data-linked to master stations where the validity of the signals from each satellite is assessed and wide area corrections provide a direct verification of the integrity of the signal from each satellite in view. The WAAS also enables airports to gain an instrument

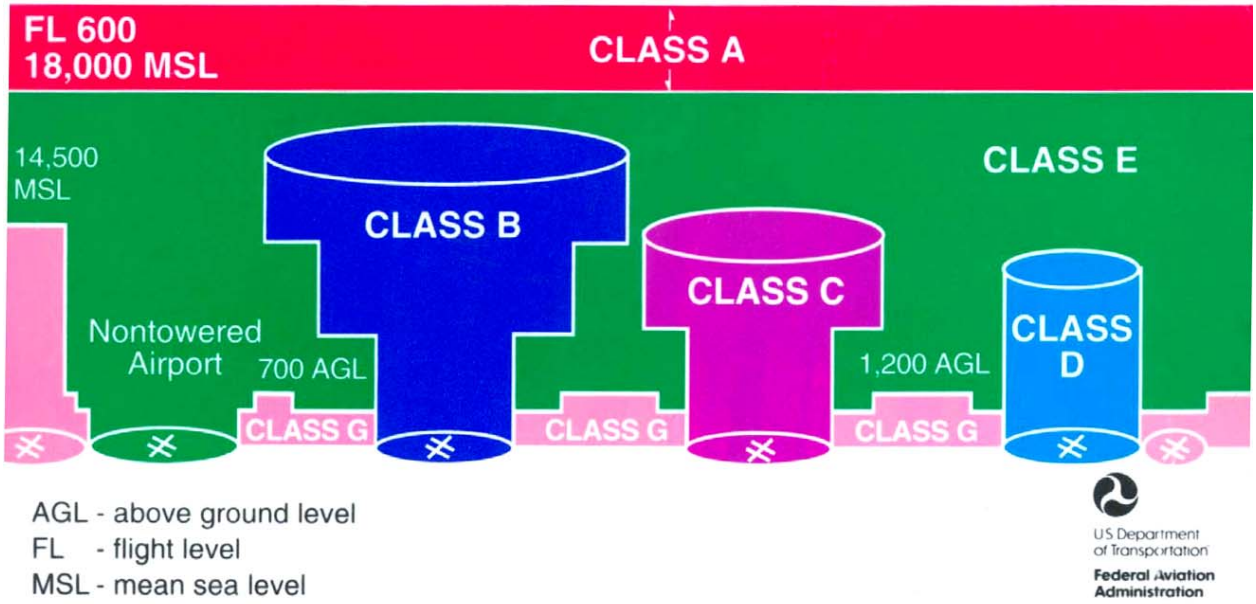
landing system (ILS) like approach capability, called lateral precision performance with vertical guidance (LPV), without the purchase or installation of any ground-based navigation equipment at the airport. The WAAS-enabled LPV procedures provide approach minimums as low as 200 feet at qualifying airports.

C.2.6 Local Area Augmentation System (LAAS)

Local area augmentation system (LAAS) is a differential GPS that provides localized measurement correction signals to the basic GPS. LAAS relies on precisely surveyed ground stations, called pseudolites, which are located within the airport area and are used to calculate differential correction and integrity information. This system can be used within an approximate 30 nautical mile radius to supplement the normal GPS and enable the airport to provide precision instrument capabilities.

APPENDIX D
NATIONAL AIRSPACE SYSTEM

The national airspace system consists of a network of navigational aids and a number of air traffic control facilities designed to operate in conjunction with the various defined classes of airspace. These classes are subdivided into controlled, uncontrolled, special use, and other airspace categories.



D.1 CONTROLLED AIRSPACE

Controlled airspace includes all airspace categorized as either Class A, Class B, Class C, Class D, or Class E airspace. While operating in controlled airspace pilots are subject to certain operating rules as well as pilot qualification and aircraft equipment requirements. In accordance with each airspace classification, ATC service is provided to aircraft operating under instrument flight rules (IFR) and visual flight rules (VFR).

D.1.1 Class A Airspace

Class A airspace includes the airspace over the United States and the airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous states, from 18,000 feet mean sea level (MSL) up to and including 60,000 feet MSL, also known as flight level 600 (FL600).

The Federal Aviation Regulations (FAR) requires all persons operating an aircraft in Class A airspace to be flying under IFR. Operations in Class A airspace can only be conducted under an air traffic control (ATC) clearance received prior to entering the airspace and each aircraft must be equipped with a two-way radio capable of communicating with ATC on an assigned frequency and an operating transponder. Class A airspace is not depicted on aeronautical charts.

D.1.2 Class B Airspace

Class B airspace typically has two or more levels of airspace that are portrayed as a series of interconnected circular patterns around primary airports. Terrain, the amount and flow of air traffic, and the location of other airports all influence the design of Class B airspace. Generally, Class B airspace begins at the surface and extends vertically to 10,000 feet MSL surrounding the nation's busiest airports in terms of IFR operations or passenger enplanements. The floor and ceiling of each layer of Class B airspace are depicted on charts by MSL altitudes with each layer serving as a building block for funneling air traffic into the terminal area.

Aircraft desiring to operate in Class B airspace must receive clearance from ATC and their aircraft must have a two-way radio capable of communications on an assigned frequency, an operable transponder with automatic altitude reporting equipment, and a VOR or TACAN receiver for IFR operations. Class B airspace is charted on Sectional Aeronautical Charts, IFR Enroute Low Altitude Charts, and Terminal Area Charts with a solid blue circle.

D.1.3 Class C Airspace

Class C airspace surrounds those airports that have an operating control tower serviced by radar approach control and facilitate a given number of annual IFR operations or passenger enplanements. Class C airspace is individually tailored for each airport; however, Class C airspace generally consists of a five nautical mile radius core area that extends from the surface to 4,000 feet above the ground level (AGL) and a ten nautical mile radius shelf that normally extends from 1,200 feet to 4,000 feet above the airport elevation. The outer shelf usually extends out to 20 nautical miles from the primary airport.

Aircraft desiring to operate within Class C airspace must establish and maintain two-way radio communications with ATC prior to operations. Class C airspace is charted on Sectional Aeronautical Charts, IFR Enroute Low Altitude charts, and Terminal Area Charts with solid magenta circle.

D.1.4 Class D Airspace

Class D airspace normally extends from the surface up to approximately 2,500 feet AGL and surrounds those airports with an operating control tower that does not provide radar service. This airspace is classified as Class D only when the tower is operational.

Prior to operating within Class D airspace, aircraft must establish and maintain two-way radio communications with ATC. The lateral dimensions of Class D airspace are based on the instrument procedures for which the controlled airspace is established. Class D airspace is depicted on Sectional Aeronautical Charts and Terminal Charts with a segmented blue circle and on IFR En Route Low Altitude Charts with a boxed [D].

D.1.5 Class E Airspace

Class E airspace consists of all controlled airspace that is not associated with Class A, Class B, Class C, or Class D airspace. This airspace is typically found around airports that do not have an operating control tower or en route airspace above 700 feet AGL or 1,200 feet AGL. The weather minimums a pilot must maintain when operating in Class E airspace is dependent upon whether they are operating at an altitude below 10,000 feet MSL or at or above 10,000 feet MSL.

While direction communications are not required to operate within Class E airspace under VFR, aircraft desiring to operate under IFR must contact the area air traffic control facility for clearance information. Class E airspace below 14,500 feet MSL is charted in a variety of forms on Sectional Aeronautical Charts, Terminal Charts, World Charts, and IFR En Route Low Altitude Charts.

Victor airways are also designated Class E airspace and are based on VOR or VORTAC navigational aids. These airways usually extend to four nautical miles on each side of the airway centerline and, unless otherwise indicated, extend from 1,200 feet AGL up to, but not including, 18,000 feet MSL.

D.2 UNCONTROLLED AIRSPACE

Uncontrolled airspace is designated Class G airspace. Typically, Class G airspace includes all airspace not classified as Class, A, Class B, Class C, Class D, or Class E airspace. Whereas ATC services are provided with controlled airspace, no air traffic control services are provided within Class G airspace. Class G airspace typically extends from the surface to the base of the overlying controlled airspace, which is normally 700 or 1,200 feet AGL. In some areas of the western United States and Alaska, Class G airspace may extend from the surface to 14,500 feet MSL.

Specific VFR weather minimums apply in Class G airspace below 1,200 feet AGL, between 1,200 feet AGL and 10,000 feet AGL, and above 10,000 feet AGL. The minimums a pilot must maintain are also dependent upon whether operations are conducted during the day or night.

D.3 SPECIAL USE AIRSPACE

Special use airspace consists of areas in which activities within the airspace must be confined because of their nature, or limitations are imposed upon aircraft operations, which are not part of the specific activities taking place within the segregated area. With the exception of Controlled Firing Areas, utilized during military training or testing exercises, special use airspace areas are depicted on aeronautical charts. The following list identifies the different types of special use airspace.

- Alert Areas are depicted on aeronautical charts to inform nonparticipating pilots of areas that may contain a high volume of pilot training or unusual types of aerial activity.
- Controlled Firing Areas contain activity, which if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft.
- Military Operations Areas consist of airspace with defined vertical and lateral limits established for the purpose of separating certain military training activities from civilian air traffic.
- National Security Areas consist of airspace with defined vertical and lateral dimensions established at locations where there is a requirement for increased security and safety of ground facilities.
- Prohibited Areas contain airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. In addition to being depicted on aeronautical charts, Restricted Areas are published in the Federal Register and constitute FAR Part 73.
- Restricted Areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Restricted Areas denote the existence of unusual, often invisible hazards to aircraft such as artillery firing, aerial

gunnery, or guided missiles. Similar to Prohibited Areas, Restricted Areas are published in the Federal Register and constitute FAR Part 73.

- Warning Areas are airspace extending three nautical miles outward from the coast of the United States. A Warning Area contains activity deemed hazardous to nonparticipating aircraft. Furthermore, a Warning Area may be established over domestic waters, international waters or a combination of both.

D.4 OTHER AIRSPACE

Airspace designated as Other Airspace is primarily composed of airport advisory areas and military training routes. All military training routes positioned above 1,500 feet AGL are depicted on IFR Low Altitude Enroute Charts. These routes have been established to provide a means for military aircraft to practice low level combat tactics. Generally, military training routes are established below 10,000 feet MSL for operations at speeds in excess of 250 knots.

Airport Advisory Areas extend 10 statue miles from airports where there is a flight service station located on the field and no operating tower. The flight service station provides advisories on wind direction and velocity, favored runways, altimeter setting, and reported traffic within the area.

In addition to military training routes and Airport Advisory Areas, other airspace also includes temporary flight restrictions, flight limitations and restrictions, and parachute jump aircraft areas. Temporary flight restrictions are imposed by the FAA to protect persons or property on the surface or in the air from a specific hazard or situation. Flight limitations and restrictions are normally issued in the proximity of space flight operations and Presidential or other government parties. Parachute jump areas that are used on a frequent basis and have existed for a period of at least one year are depicted on aeronautical charts.

APPENDIX E
NATIONAL AIR TRAFFIC CONTROL SYSTEM

The national airspace system consists of a network of navigational aids and a number of air traffic control facilities. The specific purpose of the air traffic control service is twofold: to prevent collisions between aircraft and, in the maneuvering area, between aircraft and obstructions and to expedite and maintain an orderly flow of air traffic. To properly manage the traffic in the system, the jurisdiction of control is divided into three parts, en route, terminal, and oceanic. Terminal air traffic control may be further sub-divided into terminal radar approach control (TRACON), and air traffic control tower (ATCT) operations.

E.1 AIR ROUTE TRAFFIC CONTROL CENTER

Air route traffic control centers (ARTCC) are established primarily to provide air traffic service to aircraft operating under instrument flight rules (IFR) on flight plans within controlled airspace, including airways and jet routes, and principally during the en route phase of flight. In addition, ARTCC can provide approach control services to non-towered airports and to non-terminal radar approach control airports.

There are 21 ARTCCs located throughout the United States. Each of these centers is responsible for controlling en route traffic over the United States and parts of the Atlantic and Pacific Oceans in a definitive amount of geographical area that can be in excess of 100,000 square miles. At the boundary point of their definitive area, ARTCC will provide the pilot in command of the aircraft with the option of terminating service or transferring to an adjacent ARTCC or approach control facility for continued service.

Each ARTCC geographic area is divided into sectors. The division into sectors is determined by an attempt to equalize the workload of the controllers. Control of aircraft is passed from sector to sector within the ARTCC area with each sector being staffed with one or more controllers. The average number of aircraft that each sector can handle depends largely on the number of individuals assigned to each sector, the complexity of the traffic, and the degree of automation provided.

Communications between the controllers and the aircraft is via voice transmittals. Therefore each ARTCC is assigned a number of very high and ultra high frequencies. The controller, in turn, assigns a frequency to each pilot.

E.2 TERMINAL RADAR APPROACH CONTROL

Terminal radar approach control (TRACON) is responsible for monitoring the en route and terminal segment of air traffic in the airspace surrounding airports with moderate to high-density traffic. The primary responsibilities of a TRACON include the control and separation of air traffic within a 50 nautical mile radius of their facility and up to an altitude of 17,000 feet, exclusive of the airspace controlled by air traffic control towers.

There are approximately 185 TRACON facilities located throughout the United States. Each of the stations has varying degrees of automation dependent upon the volume of traffic typically handled. Similar to ARTCC, the geographic area presided over by TRACON is divided into sectors to equalize the workload of the controllers.

TRACON facilities use radar and air-to-ground communications to ensure separation between aircraft arriving, departing, or transitioning through the airspace controlled by the facility. TRACON responsibilities will terminate once the aircraft in their control is aligned with the runway approximately five miles out from the airport. At this point continued service is provided by the airport air traffic control tower.

E.3 AIR TRAFFIC CONTROL TOWER

Airport air traffic control towers (ATCT) are responsible for supervising, directing, and monitoring the arrival and departure of air traffic at the airport and in the immediate airspace within five nautical miles of the airfield. The tower is responsible for issuing clearances to all arriving and departing aircraft, providing pilots with meteorological information, and controlling all aircraft movement on the surface of the airport, with the exception of the ramp area.

There are currently over 648 air traffic control towers operating in the United States. There are 265 federally operated and staffed control towers employing approximately 8,230 individuals. Another 164 towers are operated and staffed by the United States military. The remaining towers are part of the Contract Tower Program began in 1982 as an effort to meet the demand for air traffic controllers. This program is regulated and staffed using the same standards and directives that govern the federally staffed towers. There are currently 219 contract towers in place that employ nearly 1,200 employees.

E.4 FLIGHT SERVICE STATION

Flight service stations (FSS) are air traffic facilities responsible for providing a variety of services to pilots; including pilot weather briefings, en route communication, and VFR search and rescue services. Weather data disseminated by flight service is obtained from the National Weather Service and Weather Service International. In addition to pilot weather briefings, flight service stations maintain other responsibilities, which are related to the different components of flight operations. The following is a list of these additional responsibilities.

- VFR search and rescue services
- En route communications
- Originate Notices to Airmen (NOTAM)
- Receive and process VFR and IFR flight plans
- Take weather observations
- Issue airport advisories
- Provide assistance to lost aircraft
- Relay ATC clearances
- Broadcast aviation weather and national airspace system information
- Monitor NAVAIDs
- Provide en route flight advisory service
- Advise U.S. Customs of transborder

On October 4, 2005, Lockheed Martin assumed the operation of FSS across the United States (except for Alaska) with plans on modernizing flight service stations nationwide. Over the following 18 months, Lockheed Martin consolidated the FSS to 3 regional hubs and 18 continuing sites.

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