

Final



Glendale

Municipal Airport



Airport Master Plan



AIRPORT MASTER PLAN

for

GLENDALE MUNICIPAL AIRPORT Glendale, Arizona

Prepared for the

CITY OF GLENDALE

by

Coffman Associates, Inc.

Final

**Adopted and Approved by the
Council of the City of Glendale
May 12, 2009
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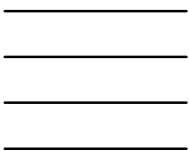
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INTRODUCTION

Glendale municipal airport

INTRODUCTION

The Glendale Municipal Airport (GEU) Master Plan Study has been undertaken to evaluate the airport's capabilities and role, to forecast future aviation demand, and to plan for the timely development of new or expanded facilities that may be required to meet that demand. The ultimate goal of the master plan is to provide systematic guidelines for the airport's overall maintenance, development, and operation.

The master plan is intended to be a proactive document which identifies and then plans for future facility needs well in advance of the actual need for the facilities. This is done to ensure that the City of Glendale can coordinate project approvals, design, financing, and construction to avoid experiencing detrimental effects due to inadequate facilities.

An important result of the master plan is reserving sufficient areas for future facility needs. This protects development areas and ensures they will be readily available when required to meet future needs. The



intended result is a detailed land use concept which outlines specific uses for all areas of airport property.

The preparation of this master plan is evidence that the City of Glendale recognizes the importance of air transportation to the community, as well as the unique challenges operating an airport presents. The investment in an airport yields many benefits to the community and the region. With a sound and realistic master plan, Glendale Municipal Airport can maintain its role as an important link to the national air transportation system for the community, and maintain the existing public and private investments in its facilities.



The City of Glendale initiated this master plan to re-evaluate and adjust as necessary the future development plan for Glendale Municipal Airport. The last master plan for Glendale Municipal Airport was completed in January 1998. The City has owned and operated the airport since its opening in 1986 and is responsible for funding all capital improvements at the airport and obtaining matching Federal Aviation Administration (FAA) and Arizona Department of Transportation (ADOT) - Aeronautics development grants. This master plan is intended to provide guidance through an updated capital improvement and financial program to demonstrate the future investments required by the City of Glendale at Glendale Municipal Airport. Many national, regional, and local aviation factors have changed significantly since the completion of the previous master plan. The City has undertaken this master plan to account for those changes in future planning for the airport.

On a national level, the events of September 11, 2001 and the repercussions to the national aviation system have affected general aviation. The most significant effect is the growth of business jet activity and the expansion of fractional-ownership companies. Many companies find it economical to transport their employees via business jet in order to save time and money when compared to utilizing commercial airlines.

More recently, the introduction of a new class of business jet, the Very Light Jets (VLJs), may also have a significant impact on general aviation

airports across the country. VLJs were introduced to the national fleet beginning in 2006 and initial orders for the aircraft are by companies wishing to provide on-demand air-taxi service. Part of the appeal of these air-taxi companies is the ability to utilize the national network of small general aviation airports and, thus, further save the consumer time.

On a regional level, the Phoenix metropolitan area is one of the fastest growing areas of the country. This growth in population and employment needs to be considered in this master plan update.

On a local level, the City of Glendale is itself experiencing continued growth. A number of large national companies have relocated to the Glendale area. The development of the city's sports and entertainment district that includes the Westgate City Center complex, Jobing.com Arena (home of the Phoenix Coyotes National Hockey League team), the University of Phoenix Stadium (home to the Arizona Cardinals National Football League team), and numerous hotel, restaurant, office and retail outlets, including a Cabela's outdoor mega store, has diversified Glendale's economy. These facilities hosted significant national events including the 2008 Super Bowl, the 2007 National Bowl Championship Series (BCS) college football game, the Fiesta Bowl, international soccer matches and big name concerts. Glendale is now a major destination city and the City of Glendale wants these potential impacts to the airport to be considered in the master plan since this area is only one and one-half miles to the east of the airport.

In addition, the airport itself has changed significantly since the previous master plan. The runway has been lengthened from 5,350 feet to 7,150 feet in order to accommodate growing activity by business jets. The City is also interested in potential options for development of the east side of the airport.

MASTER PLAN OBJECTIVES

The primary objective of the master plan is to provide the community and its leadership with guidance for operating the airport in a safe and efficient manner while planning for future demand levels. To accomplish this objective requires a comprehensive evaluation of the existing airport and a determination of what actions should be taken to maintain a safe and reliable airport facility while meeting the aviation needs of the region. This master plan will provide a vision for the airport covering the next 20 years and, in some cases, beyond. With this vision, the City of Glendale will have advance notice of potential future airport funding needs so that appropriate steps can be taken to ensure that adequate funds are budgeted and planned.

Specific objectives of the Glendale Municipal Airport Master Plan are:

- **Preserve Public and Private Investments**

The City of Glendale, United States Government (through the Federal Aviation Administration [FAA]), and State of Arizona (through the Depart-

ment of Transportation – Aeronautics Division [ADOT]) have made considerable investments in the airport's infrastructure. Private individuals and businesses have made investments in buildings and other facilities. The master plan will provide for continued maintenance and necessary improvements to the airport's infrastructure to ensure maximum utility of the private facilities at Glendale Municipal Airport and ensure the continued use of publicly funded facilities.

- **To Ensure that Future Development Will Not Negatively Impact Luke Air Force Base's Mission**

Luke Air Force Base is located four miles to the west of the airport. Any recommended development for Glendale Municipal Airport must be mindful of not only the national security importance of the AFB but also the fact that the AFB is the largest employer in the City of Glendale.

- **Be Reflective of Community Goals and Objectives**

Glendale Municipal Airport is a public facility serving the needs of the local residents and businesses. The master plan needs to be reflective of the desires and visions the local communities have for quality of life, business development, and land use. The master plan will consider existing community planning documents for surrounding communities and the County in the ultimate design and use of the airport.

- **Maintain Safety**

Safety is an essential consideration in planning and development at the airport. The master plan will focus on maintaining the highest levels of safety for airport users, visitors, employees, and surrounding communities.

- **Preserve the Environment**

Protection and preservation of the local environment are essential concerns in the master plan. Any improvements called for in the master plan will be mindful of environmental requirements.

- **Attract Public Participation**

To ensure that the master plan reflects the concerns of the public, the local communities, airport tenants, airport users, and businesses throughout the region, the master plan process will include an active public outreach program to solicit comments and suggestions and include them in the final master plan, to the extent possible.

- **Strengthen the Economy**

In continuing support of the area's growing economy, the master plan is aimed at retaining and increasing jobs and revenue for the region and its businesses.

- **Develop Aviation Forecasts**

To insure that the unprecedented growth in both population and employment in the West Valley area and

the City of Glendale, in particular, is addressed when developing aviation demand forecasts.

- **Detailed Facility Planning**

To develop detailed alternatives for facility development, based on forecast aviation demand, for both the east and west sides of the airport.

- **Football and Hockey Team Impacts to the Airport**

Analyze information related to the potential aviation demand that could be generated by the close proximity of the Phoenix Coyotes and the Arizona Cardinals professional sports franchises.

- **Corporate Aviation**

Address the needs of corporate aviation operators as it relates to Glendale Municipal Airport.

BASELINE ASSUMPTIONS

A study such as this typically requires some baseline assumptions that will be used throughout the analysis. The baseline assumptions for the Glendale Municipal Airport master plan are listed below:

- Glendale Municipal Airport will continue to operate as a publicly owned general aviation reliever airport in western Maricopa County, Arizona.
- Nearby Phoenix Sky Harbor International Airport will continue to be a commercial service

airport with minimal general aviation activity.

- Other regional general aviation airports in Maricopa County will remain open for the foreseeable future.
- Glendale Municipal Airport will continue to seek general aviation and corporate business aviation based tenants and transient operations.
- The general aviation industry will grow as forecast by the Federal Aviation Administration in its annual Aerospace Forecasts.
- Population and employment will continue to grow as forecast by the Maricopa Association of Governments and the State of Arizona.
- Both a federal program and a state program will be in place through the planning period to assist in funding future capital development needs.
- The mission of Luke Air Force Base will not change substantially during the planning period.

MASTER PLAN ELEMENTS AND PROCESS

The Glendale Municipal Airport master plan is being prepared in a systematic fashion following FAA guidelines and industry-accepted principles and practices, as shown on **Exhibit IA**. The master plan has six chapters that are intended to assist in the discovery of future facility needs and provide the supporting rationale for their implementation.

Chapter One - Inventory summarizes the inventory efforts. The inventory efforts are focused on collecting and assembling relevant data pertaining to the airport and the area it serves. Information is collected on existing airport facilities and operations. Local economic and demographic data is collected to define the local growth trends. Planning studies which may have relevance to the master plan are also collected.

Chapter Two - Forecasts examines the potential aviation demand at the airport. The analysis utilizes local socioeconomic information, as well as national air transportation trends, to quantify the levels of aviation activity which can reasonably be expected to occur at Glendale Municipal Airport through the year 2025. The results of this effort are used to determine the types and sizes of facilities which will be required to meet the projected aviation demand at the airport through the planning period.

Chapter Three - Facility Requirements comprises the demand capacity and facility requirements analyses. The intent of this analysis is to compare the existing facility capacities to forecast aviation demand and determine where deficiencies in capacities (as well as excess capacities) may exist. Where deficiencies are identified, the size and type of new facilities to accommodate the demand are identified. The airfield analysis focuses on improvements needed to safely serve the type of aircraft expected to operate at the airport in the future, as well as navigational aids to increase the safety and efficiency of operations. This

element also examines the general aviation terminal, hangar, apron, and support needs.

Chapter Four - Alternatives considers a variety of solutions to accommodate the projected facility needs. This element proposes various facility and site plan configurations which can meet the projected facility needs. An analysis is completed to identify the strengths and weaknesses of each proposed development alternative, with the intention of determining a single direction for development.

Chapter Five - Airport Plans provides both a graphic and narrative description of the recommended plan for the use, development, and operation of the airport. An environmental overview is also provided. The master plan also includes the official Airport Layout Plan (ALP) and detailed technical drawings depicting related airspace, land use, and property data. These drawings are used by the Federal Aviation Administration (FAA) in determining grant eligibility and funding.

Chapter Six - Financial Plan focuses on the capital needs program which defines the schedules, costs, and funding sources for the recommended development projects.

COORDINATION

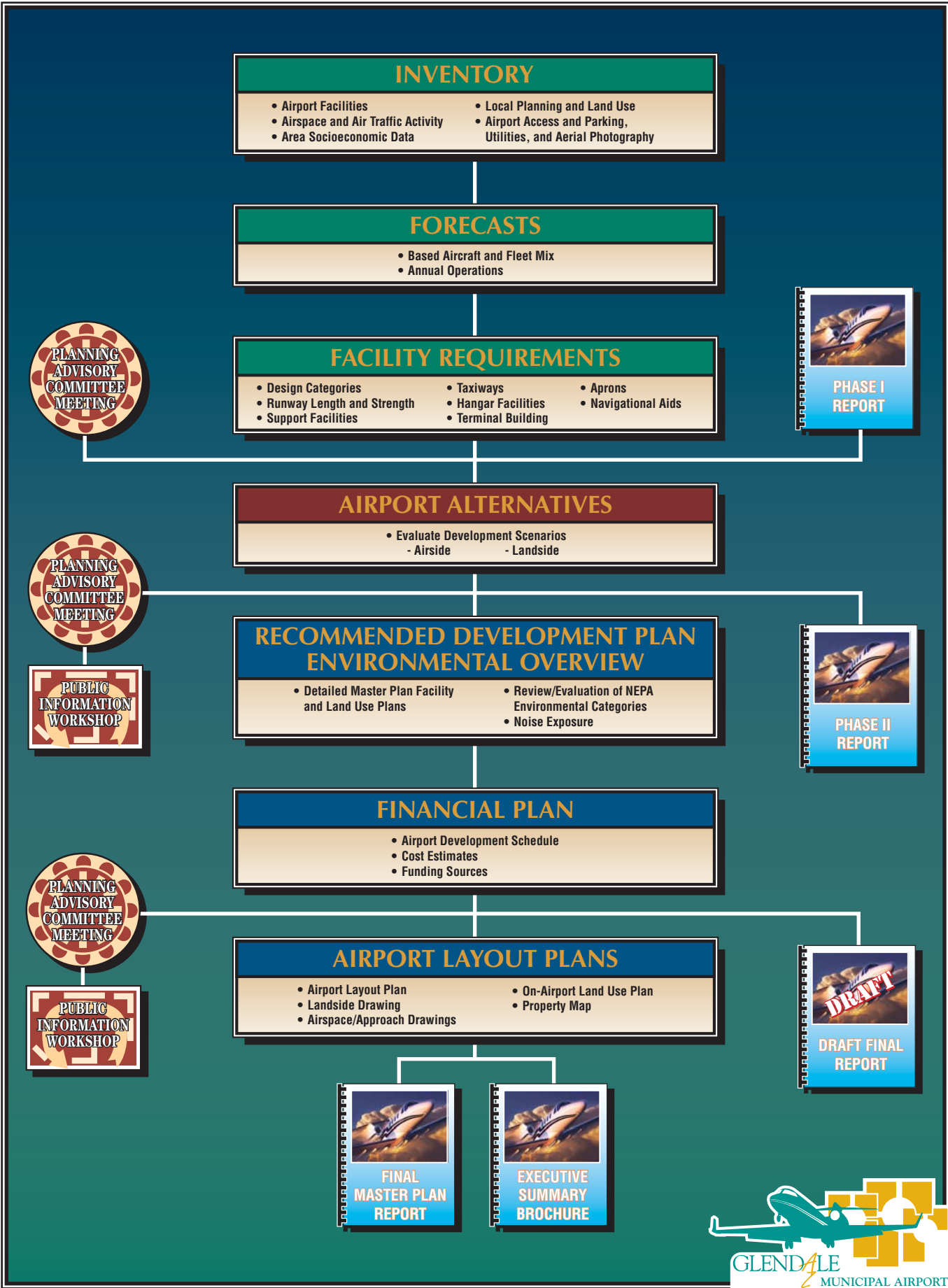
The Glendale Municipal Airport master plan is of interest to many within the local community. This includes local citizens, community organizations, airport users, airport tenants, area-

wide planning agencies, and aviation organizations. As an important component of the regional, state, and national aviation systems, the Glendale Municipal Airport is of importance to both state and federal agencies responsible for overseeing air transportation.

To assist in the development of the master plan, the City of Glendale has identified a group of community members and aviation interest groups to act in an advisory role in the development of the master plan. Members of the Planning Advisory Committee (PAC) will review phase reports and provide comments throughout the study to help ensure that a realistic, viable plan is developed.

To assist in the review process, draft phase reports will be prepared at the various milestones in the planning process. The phase report process allows for timely input and review during each step within the master plan to ensure that all master plan issues are fully addressed as the recommended program develops.

A series of public information workshops will also be held as part of the plan coordination. The public information workshops are designed to allow any and all interested persons to become informed and provide input concerning the master plan. Notices of meeting times and locations will be advertised through the media as well as local neighborhood associations. The draft phase reports will also be made available to the public online at www.coffmanassociates.com.



INVENTORY

- Airport Facilities
- Local Planning and Land Use
- Airspace and Air Traffic Activity
- Airport Access and Parking, Utilities, and Aerial Photography
- Area Socioeconomic Data

FORECASTS

- Based Aircraft and Fleet Mix
- Annual Operations

FACILITY REQUIREMENTS

- Design Categories
- Taxiways
- Aprons
- Runway Length and Strength
- Hangar Facilities
- Navigational Aids
- Support Facilities
- Terminal Building

**PHASE I
REPORT**

AIRPORT ALTERNATIVES

- Evaluate Development Scenarios
 - Airside
 - Landside

RECOMMENDED DEVELOPMENT PLAN ENVIRONMENTAL OVERVIEW

- Detailed Master Plan Facility and Land Use Plans
- Review/Evaluation of NEPA Environmental Categories
- Noise Exposure

**PHASE II
REPORT**

FINANCIAL PLAN

- Airport Development Schedule
- Cost Estimates
- Funding Sources

AIRPORT LAYOUT PLANS

- Airport Layout Plan
- On-Airport Land Use Plan
- Landside Drawing
- Property Map
- Airspace/Approach Drawings

**DRAFT
FINAL
REPORT**

**FINAL
MASTER PLAN
REPORT**

**EXECUTIVE
SUMMARY
BROCHURE**



NOTE: Due to transitions within the City of Glendale and at the airport, development of the master plan was put on hold from approximately November 2006 through April 2008. Several significant changes occurred during this timeframe including the change of use of 240 acres of property located to the southeast of the airport across the New River channel that had been acquired by the city from the City of Phoenix for noise protection purposes. The land is now being used for development of a spring training baseball facility. In addition, approximately seven acres to the immediate northeast of the runway was acquired.

To reflect these and other changes, this document and the associated exhibits have been updated to reflect the current airport condition.

The aviation forecasts presented in Chapter Two have been re-examined for any significant deviations when compared to actual activity over the previous two years. The growth in activity has generally trended well with the forecasts. The forecasts have been approved by the FAA for planning purposes; therefore, the approved forecasts will remain as originally presented.



Chapter One

INVENTORY

Glendale municipal airport

Chapter 1

INVENTORY

The initial step in the preparation of the airport master plan for Glendale Municipal Airport is the collection of information that will provide a basis for the analysis to be completed in subsequent chapters. For the master plan, information is gathered regarding not only the airport, but also the region it serves. This chapter will begin with an overview of the airport location, competing airports, and typical weather conditions. This will be followed by a discussion of demographic and socioeconomic factors relevant to the region. A comprehensive overview of the national aviation system for general aviation airports and the role of Glendale Municipal Airport in the national system is also presented. Finally, an inventory of the existing conditions at the airport will be discussed.

The information outlined in this chapter was obtained through on-site inspections of the airport, including interviews with



airport management, airport tenants, and representatives of various government agencies. Information was also obtained from existing studies. Additional information and documents were provided by Federal Aviation Administration (FAA), Maricopa Association of Governments (MAG), Arizona Department of Transportation - Aeronautics Division (ADOT), the City of Glendale - Economic Development Department, and the City of Glendale - Planning Department.

REGIONAL SETTING

The purpose of this section is to summarize various studies and data col-



lected to provide an understanding of the characteristics of the regional area. Within this section is a description of the airport setting, the ground access systems near the airport, the existing and future land uses around the airport, and the local climate. This information is important baseline data when developing forecasts for critical airport infrastructure to support demand over the planning period.

AIRPORT LOCATION

As depicted on **Exhibit 1A**, Glendale Municipal Airport is located on approximately 447 acres of property in the City of Glendale, Arizona. The airport is approximately six miles to the west of the City of Glendale's central business district. The City of Glendale is part of the greater Phoenix metropolitan area within Maricopa County.

The City of Glendale is bounded on the east and south by the City of Phoenix, on the north and west by Peoria, Sun City, Youngstown, and El Mirage. To the south are the Cities of Litchfield Park, Goodyear, Avondale, Cashion, and Tolleson.

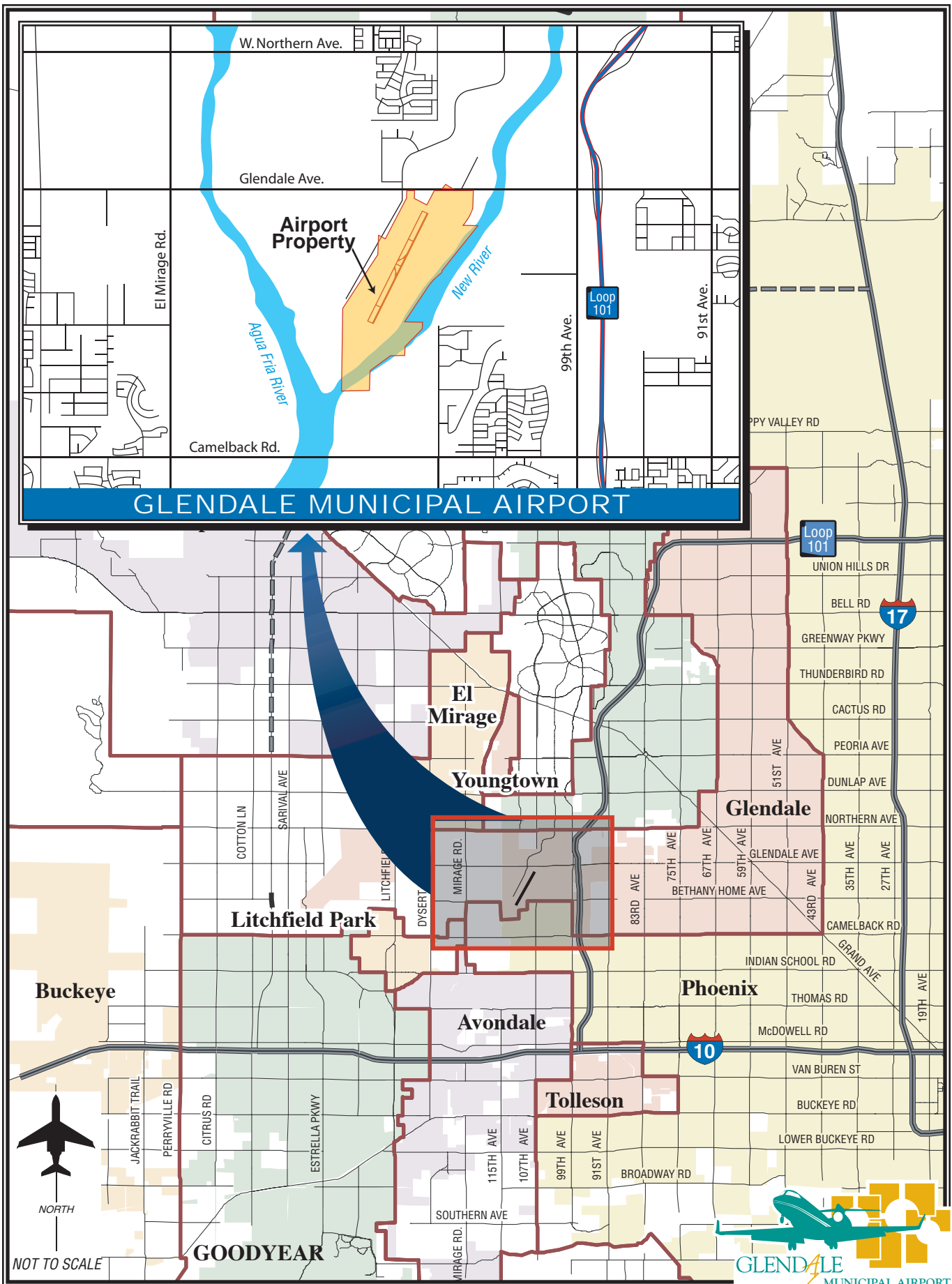
Approximately four miles directly to the west is Luke Air Force Base, which is home to the 56th Fighter Wing and the Air Force Reserve. There are more than 200 F-16s assigned to the base, and the base population includes 7,500 military members and 15,000 family members. The base is an integral part of the identity of Glendale and the greater Phoenix region.

Glendale Municipal Airport is directly accessed via Glen Harbor Boulevard which extends along the western edge of the airport site. Glen Harbor intersects with Glendale Avenue to the north of the airport. Approximately 1.5 miles to the east is Arizona Highway 101 (the Agua Fria Expressway). Other regional access is provided by Interstate Highway 10, approximately 5 miles to the south, and U.S. Highway 60, approximately four miles to the north.

The airport is bordered on the north by Glendale Avenue, to the east by the New River, to the south by the Agua Fria River and the City of Glendale Water Reclamation Facility, and on the west by aboveground high-voltage electric power lines which run alongside Glen Harbor Boulevard. West of Glen Harbor Boulevard is undeveloped land that is zoned for light industrial uses.

GROUND TRANSPORTATION

Union Pacific rail lines extend through the City of Glendale approximately six miles to the east of the airport. There are no rail spurs extending in the vicinity of the airport. Amtrak service is not available in the Phoenix Metropolitan Area. The initial starter line for a light rail system is scheduled to open in December 2008. This line will serve the central Phoenix region. There are no plans to extend light rail to western Glendale at this time. Greyhound bus line provides a depot in the City of Glendale, approximately six miles to the east on Glendale Avenue.



GLENDALE MUNICIPAL AIRPORT

Local transportation service includes several taxi companies, some of which cater to customers with special needs. Valley Metro operates a local bus line that extends from Luke Air Force Base through the Glendale central business district. There is a stop on this route at the intersection with Glen Harbor Boulevard. There are directional signs to the airport on the major arterials and highways in the vicinity of the airport. Both north and south Loop 101 have written signs indicating the exit to access the airport. Glendale Avenue has universal green airport directional signs.

REGIONAL CLIMATE

Weather conditions must be considered in the planning and development of an airport, as daily operations are affected by local weather. Temperature is a significant factor in determining runway length needs, while

local wind patterns (both direction and speed) dictate the orientation of the runway.

The regional climate is typical of the desert southwest, warm and dry. The normal daily minimum temperature ranges from 41 degrees in January to 81 degrees in July. The normal daily maximum temperature ranges from 68 degrees in December and January to 108 degrees in July. The region averages approximately 9 inches of precipitation annually. On average, 86 percent of the year, Glendale experiences sunshine. Calm wind conditions between zero and three miles per hour (mph) are experienced at the airport 22 percent of the time. Winds registering between four and 13 mph are experienced 59 percent of the time. The monthly average wind speed is 6.2 mph and the predominant wind direction is from southwest to northeast. A summary of climactic data is presented in **Table 1A**.

TABLE 1A
Climate Summary
City of Glendale, Arizona

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
High Temp. Avg.	68	73	78	86	95	105	108	106	101	90	77	68
Low Temp. Avg.	41	45	49	54	63	72	81	78	71	59	47	41
Precip. Avg. (in.)	1.03	1.15	1.15	0.29	0.14	0.05	0.82	1.06	0.75	0.81	0.69	1.09
Wind Speed (mph)	5.2	5.7	6.6	6.9	7.0	6.8	7.1	6.6	6.5	5.8	5.2	5.0
Sunshine (%)	77	80	84	89	93	94	85	86	90	88	83	77

Source: *The Weather Channel; www.city-data.com*

AREA LAND USE

Land uses in the vicinity of the airport can have a significant impact on airport operations and growth. The following section identifies baseline information relating to both existing and future land uses in the vicinity of Glendale Municipal Airport. By un-

derstanding the land use issues surrounding the airport, more appropriate recommendations can be made for the future of the airport.

The Glendale Airpark business park is located directly north of the airport, across Glendale Avenue. Immediately to the west of the business park is the

City of Glendale Landfill, and to the southwest of the airport is the City of Glendale West Area Water Reclamation Facility. To the immediate west of the airport is vacant property that is zoned for light industrial uses. Northeast of the runway is undeveloped airport property and, to the southeast, across the New River, is a new baseball spring training facility. A residential community is located to the east of the baseball facilities. **Exhibit 1B** presents existing land uses surrounding the airport.

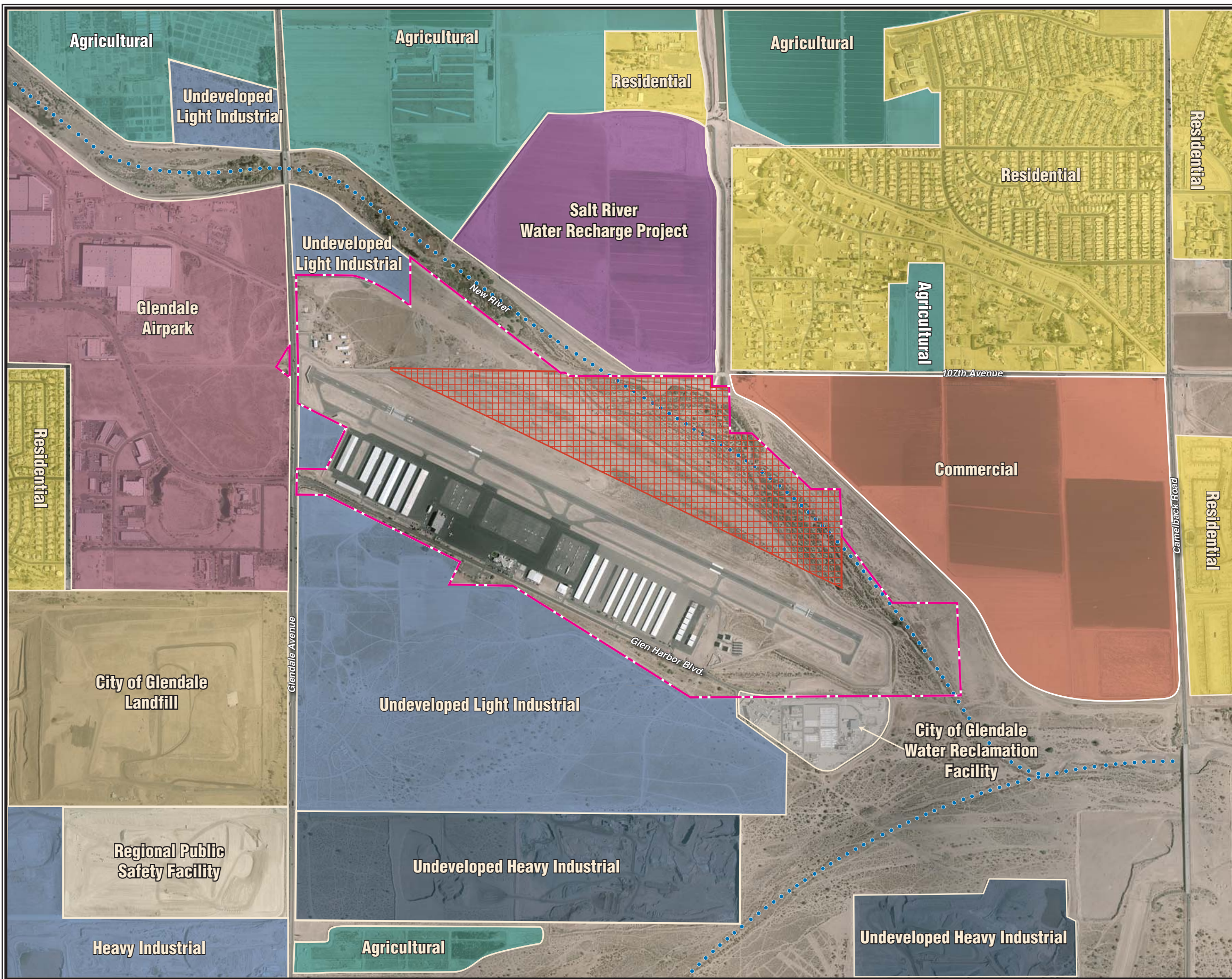
Arizona Revised Statute (ARS) 28-8486, Public Airport Disclosure, requires public airport owners to publish a map depicting the “territory in the vicinity of the airport.” This area is defined as the traffic pattern airspace and the property that experiences a 60 day-night noise level (DNL) or higher in counties with a population of more than 500,000, and 65 DNL or higher in counties with less than 500,000 residents. The DNL is calculated for a 20-year forecast condition. ARS 28-8486 requires the State Real Estate Office to prepare a disclosure map, in conjunction with the airport owner that is recorded with the county. The Glendale Municipal Airport public disclosure boundary is depicted on **Exhibit 1C**.

Under ideal conditions, the development immediately surrounding the airport can be controlled and limited to compatible uses. Compatible uses would include light and heavy industrial development and some commercial development.

There are a number of methods by which governmental entities can ensure that land uses in and around airports are developed in a compatible manner. The objective of enforcing land use restrictions is to protect designated areas for the maintenance of operationally safe and obstruction-free airport activity.

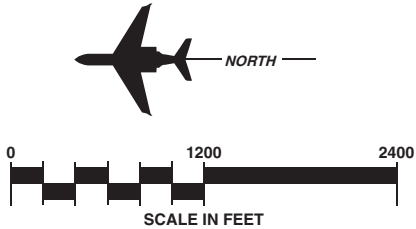
Zoning is the most common land use control. Zoning is the exercise of the jurisdictional powers granted state and local governments to designate permitted land uses on each parcel. Typically, zoning is developed through local ordinances and is often included in comprehensive plans. The primary advantage of zoning is that it can promote compatibility with the airport while leaving the land in private ownership. Zoning is subject to change; therefore, any potential alterations to the zoning code near the airport should be monitored closely for compatibility.

Section 6.100 of the City of Glendale Zoning Ordinance establishes the Airport Impact Overlay district. The district is designed to protect public health, safety, and general welfare of the area surrounding the airport by minimizing exposure to high noise levels and the hazards generated by airport operations. Also, it is to further the development of compatible land uses around the airport. In addition to the restriction of the Airport Impact Overlay district, existing zoning on all sides of the airport is for light industrial activity, which is considered compatible with airport activity.



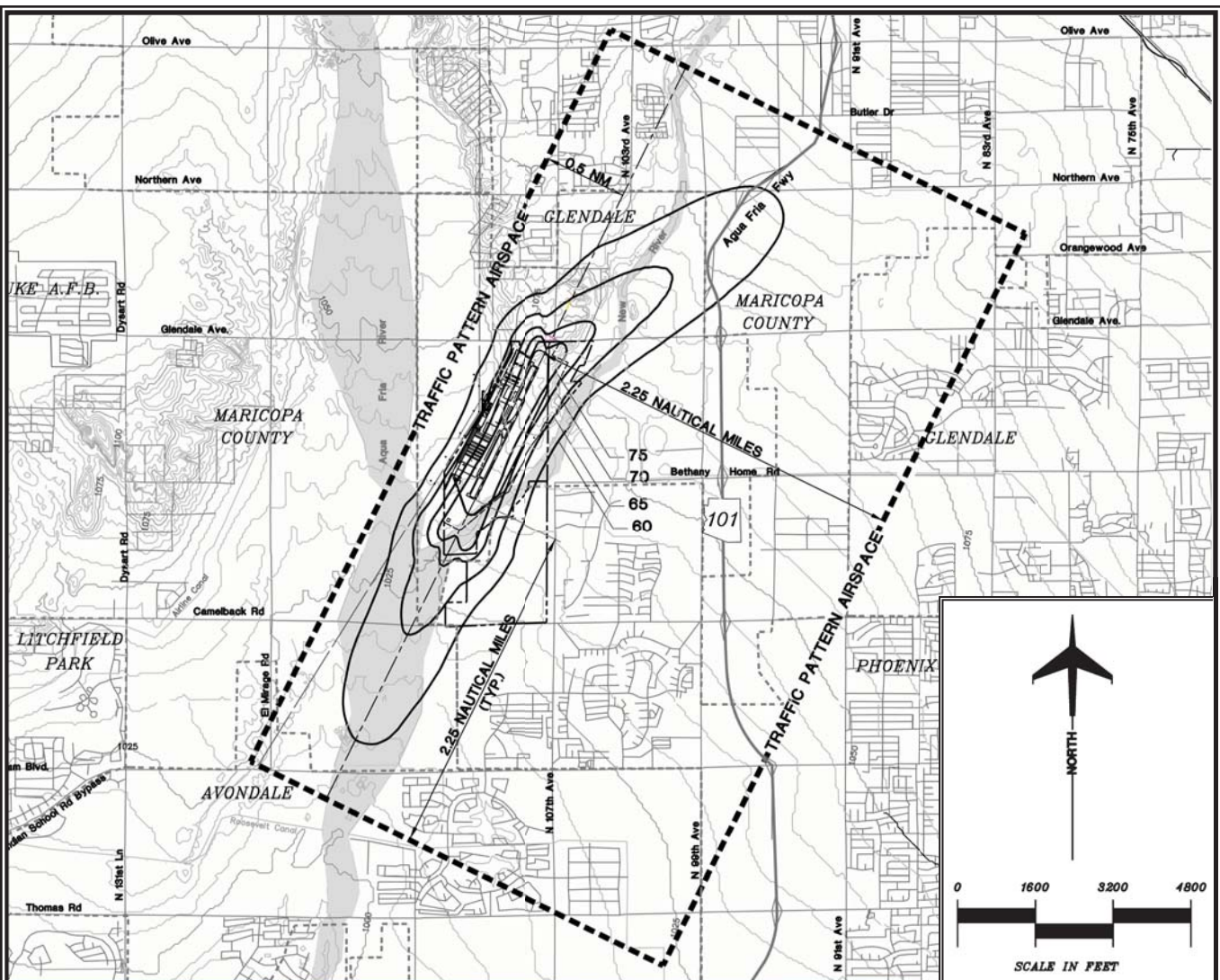
Legend

- Airport Property Line
- River Bed
- Restricted Use Airport Property



Date of Photo: 5/1/06





- Notes:**
1. This map has been prepared in accordance with the Arizona Revised Statutes, Section 28-8486, relating to Public Disclosure.
 2. Traffic Pattern Airspace Boundaries have been established in accordance with the guidelines provided in the FAA Order 7400.2D.
 3. The Airport Noise Countours have been developed with the Inegrated Noise Model (Version 5.2a) and are based on Total Annual Operations (Take-offs and Landings) of 215,000.
 4. One Nautical mile = 6,076 feet or 1.15 statute miles.

- Legend:**
- TRAFFIC PATTERN AIRSPACE
 - 65 NOISE CONTOURS - DAY/NIGHT LEVEL
 - EXISTING AIRPORT PROPERTY LINE
 - EXTENDED RUNWAY CENTERLINE
- Electronic USGS Map base Edited and Published by Sylvan Ascent Inc. Map base used by permission (license agreement) of Sylvan Ascent Inc. Transportation and Hydrography Source data from U.S. Census Bureau Coordinate System: Arizona central.....202



There are three airport noise overlay areas and one clear zone overlay area within the Airport Overlay District. The three noise overlay areas are defined by the current and future noise contours developed for the airport. The clear zone overlay approximates the runway protection zones beyond each runway end.

Height restrictions are necessary to insure that objects will not impair flight safety or decrease the operational capability of the airport. Title 14 of the Code of Federal Regulations (CFR) Part 77, *Objects Affecting Navigable Airspace*, defines a series of imaginary surfaces surrounding airports. The imaginary surfaces consist of the approach zone, conical zones, transitional zones, and horizontal zones. Objects such as trees, towers, buildings, or roads, which penetrate any of these surfaces, are considered by the FAA to be a potential obstruction to air navigation. Current City of Glendale ordinances adhere to and support the height restriction guidelines as set forth in 14 CFR Part 77. Height restrictions can be accomplished through height and hazard zoning, aviation easements, or fee simple acquisition.

AIRPORT SYSTEM PLANNING ROLE

Airport planning exists on four primary levels: local, regional, state and national. Each level has a different emphasis and purpose. An airport master plan is the primary local airport planning document. This master plan

will provide a vision of both the airfield and landside facilities over the course of the next twenty years.

At the regional level, Glendale Municipal Airport is included in the MAG *Regional Aviation System Plan* (RASP). The RASP evaluates the region's capacity and ability to meet aviation demand. Glendale Municipal Airport is one of 16 airports included in the RASP which MAG considers important to meeting the region's demand for aviation services.

At the state level, the airport is included in the *Arizona State Aviation System Plan* (SASP). The purpose of the SASP is to ensure that the State has an adequate and efficient system of airports to serve its aviation needs well into the 21st century. The SASP defines the specific role of each airport in the State's aviation system and establishes funding needs. Through the State System Planning Process, the SASP is updated every five years. The most recent update to the SASP is the 2000 *Arizona State Aviation Needs Study* (SANS). The purpose of the SANS is to provide policy guidelines that promote and maintain a safe aviation system in the State, assess the State's airports' capital improvement needs, and identify resources and strategies to implement the plan. Glendale Municipal Airport is one of 88 public use airports within the state's aviation system plan. The 2000 SANS included all public and private airports and public heliports in Arizona, including Native American and recreational airports.

At the national level, the airport is included in the *National Plan of Integrated Airport Systems* (NPIAS). The NPIAS includes a total of 3,344 airports which are significant to national air transportation. The NPIAS plan is used by the FAA in administering the Airport Improvement Program (AIP). The NPIAS supports the FAA's strategic goals for safety, system efficiency, and environmental compatibility by identifying specific airport improvements. An airport must be included in the NPIAS to be eligible for federal funding assistance through the AIP program.

Glendale Municipal Airport is one of 47 general aviation airports in Arizona included in the NPIAS. The NPIAS includes estimates on the total development needs of the nation's airports which are eligible for federal funding assistance. Glendale Municipal Airport has been designated by the NPIAS as a reliever airport for Phoenix Sky Harbor International Airport. Reliever airports are high-capacity general aviation airports in major metropolitan areas. These specialized airports serve as attractive alternatives to using congested hub airports for general aviation aircraft.

Glendale Municipal Airport is one of seven designated reliever airports in the Phoenix metropolitan area. According to the NPIAS, 278 reliever airports across the country have an average of 219 based aircraft and account for 29 percent of the nation's general aviation fleet.

AIRPORT HISTORY

The City of Glendale constructed its first municipal airport in 1971 on a 27-acre parcel of land obtained through a bankruptcy sale. Located in what is now the City of Peoria, the original airport facilities consisted of a 2,300-foot-long, 75-foot-wide paved north/south runway, full-length parallel taxiway, and aircraft parking apron. In 1972, the City purchased an adjoining 13-acre parcel of land, increasing the size of the airport to 40 acres. Rapid growth coupled with restricted expansion possibilities and opposition to airport expansion required the City of Glendale to begin a search for an alternative airport site. A site analysis study completed between 1976 and 1978 concluded that the rapidly growing community precluded locating an airport near the City center and recommended a site west of the City.

In 1980, with federal and state grant assistance, the City of Glendale began the process of conducting a site selection and master plan study for a new Glendale airport. Eight potential airport sites, including the present airport site, were evaluated in the site selection process. Potential airspace conflicts with Luke Air Force Base were evaluated for the present airport site by the FAA during the site selection process. The study indicated that any potential airspace conflicts could be resolved by operating the new Glendale airport under visual flight conditions only and having an operational air traffic control tower during

periods when Luke Air Force is conducting training operations. The present airport site was supported by the Maricopa Association of Governments (MAG) during the site selection process.

Construction of existing airfield facilities began in 1983, and the airport opened for operations on June 30, 1986. The old airport site was subsequently closed and converted to private industrial uses. The City of Glendale completed the construction of the airport terminal building in 1986 and Fixed Base Operator (FBO) facilities in 1987. In the early 1990s, the aircraft wash rack/maintenance bay facility was covered, the old air traffic control tower was removed and a replacement tower was relocated from Scottsdale Airport, and a nondirectional beacon (NDB) was installed on the east side of the airport. In 1994, the apron was expanded to the north. A helipad was constructed on the south side of the terminal in 1995, and a reserve banquet area within the terminal/administration building was converted to office space.

In 1997, with federal and state grant assistance, the City of Glendale purchased approximately 59 acres of land along the northeast side of the airport.

The City completed the grading, paving, and extension of utilities for hangar development north of the FBO hangar, along Glen Harbor Boulevard. The City also constructed a taxiway south of the existing shade and T-hangars for the private development of aircraft storage hangars. A taxiway south of the terminal/administration building was also constructed to pro-

vide access to privately developed general aviation facilities. Future facilities may provide various general aviation services such as avionics and aircraft interior repair. The City also constructed a 5,000-square-foot airport maintenance facility adjacent to the covered aircraft wash facility.

In 1998, the previous airport master plan was completed. That master plan recommended significant airfield design changes to accommodate a larger class of business jet aircraft. To this end, Runway 1-19 was widened in 2003 from 75 feet to 100 feet and extended from 5,350 feet to the current 7,150 feet. Other projects of significance since 1998 include new perimeter fencing, installation of an Automated Weather Observation System (AWOS), and various pavement maintenance projects.

AIRPORT ADMINISTRATION

Glendale Municipal Airport is owned and operated by the City of Glendale. The City of Glendale employs a full-time Airport Manager who reports to the Director of City Manager Relations for the City. The Airport Manager is directly responsible for three full-time airport operations personnel and a senior secretary.

A seven-member Airport Advisory Commission, appointed to two-year terms by the City Council, meets once a month to review and discuss issues related to the airport. The Airport Advisory Commission provides recommendations to the full City Council on issues related to the airport.

ECONOMIC IMPACTS

The last formal economic impact study of the airport was completed by ADOT in 2002. This study analyzed the direct, indirect, and induced economic impact of all public use airports in Arizona, including Glendale Municipal Airport. At the time, it was estimated that Glendale Municipal Airport had an impact of \$52.2 million annually on the local economy.

The total economic impact of the airport includes the direct-effect employment, payroll, and sales. Indirect benefits would include visitor spending, which leads directly to off-airport employment, payroll, and sales. The cumulative economic benefit of an airport includes a multiplier effect which is essentially the recycling of money within the local economy to create more jobs in nearly every economic sector.

On-airport direct economic benefits include 124 jobs, with a direct payroll of \$4.8 million and sales of \$11 million. Visitor spending accounts for 116 additional jobs, \$2.3 million in payroll, and \$5.7 million in sales. When the multiplier effect is applied, economic activity generated by Glendale Municipal Airport accounts for 516 local jobs, \$15.5 million in payroll, and \$36.7 million in sales.

AIRPORT LAND USE RESTRICTIONS

Much of the property that is on the east side of the runway was donated to the airport in 1982. In June of 2005, the donator of this property and the

City of Glendale agreed to abide by a contingent Use Restriction on the property. According to the agreement, this east side property is to remain available for a parallel runway until January 31, 2025 unless a parallel runway is determined to be unfeasible. Prior to this time, permissible uses under the agreement include construction of structures that can reasonably be removed should the development of a second runway be undertaken.

The agreement also stipulates that a study will be undertaken sometime between 2010 and 2012, to determine if a second runway is feasible and needed sometime prior to 2025. If it is determined that a second runway is not feasible and/or not needed, then the restriction on the eastside property would be lifted.

The FAA has stated that the City is not eligible for FAA grant funding for capital improvement projects on the east side of the airport until such a time that the Use Restriction is removed either by agreement between the parties or through expiration of the agreement in 2025. Specifically, the FAA has stated that the City is unable to meet Grant Assurances related to the acceptance of FAA grant funding due to the Use Restriction agreement between the City of Glendale and the land donor.

In accordance with Assurance 4, Good Title, the City must hold good title to the airport land in order to be eligible for an airport improvement grant. The Use Restriction agreement places a limited encumbrance on the deeded property. Grant Assurance 5, Rights and Powers, requires that the City

avoid any action that would deprive it of its rights and powers to discharge the duties mandated by the grant assurance. The FAA states, "In effect, the City has diminished its power to fully direct the capital improvement plan of Glendale Municipal Airport. The City's prerogative is encumbered because it cannot freely redevelop the deeded property as it wishes for a certain period of time."

The letter of agreement between the City of Glendale and the land donor, as well as the FAA response letter, are presented in Appendix B.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

Stormwater runoff is simply rainwater that runs off the land and into streams, rivers, and lakes. When stormwater runs through sites of industrial or construction activity it may pick up pollutants and transport them into national waterways and affect water quality.

Mandated by Congress under the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) Stormwater Program is a comprehensive two-phased national program for addressing the non-agricultural sources of stormwater discharges which adversely affect the quality of our nation's waters. The program uses the NPDES permitting mechanism to require the implementation of controls designed to prevent harmful pollutants from being washed by stormwater runoff into local water bodies.

The State of Arizona has been delegated the authority to administer the NPDES program. Administratively, this is the responsibility of the Arizona Department of Environmental Quality (ADEQ). The ADEQ's Arizona Pollutant Discharge Elimination System (AZDES) program now has regulatory authority over discharges of pollutants to Arizona surface water.

Under the regulations, separate permits are required for construction activities that disturb one or more acres of land and for general stormwater permits. Airports are included as an industrial facility under the AZDES and must obtain a Multi-Sector General Permit. This permit requires the development of a SWPPP.

The airport has a SWPPP in place which is updated annually. The SWPPP for the airport includes the other tenants on the airport, and the City of Glendale provides annual training and inspection services. The airport has a Multi-Sector General Permit.

SPILL PREVENTION

Glendale Municipal has an approved spill prevention plan in place to direct airport staff in case of a chemical or fuel spill.

AIRPORT FACILITIES

Airport facilities can be functionally classified into two broad categories: airside and landside. The airside category includes those facilities which

are needed for the safe and efficient movement of aircraft, such as runways, taxiways, lighting and navigational aids. The landside category includes those facilities necessary to provide a safe transition from surface to air transportation and support aircraft servicing, storage, maintenance, and operational safety on the ground.

AIRSIDE FACILITIES

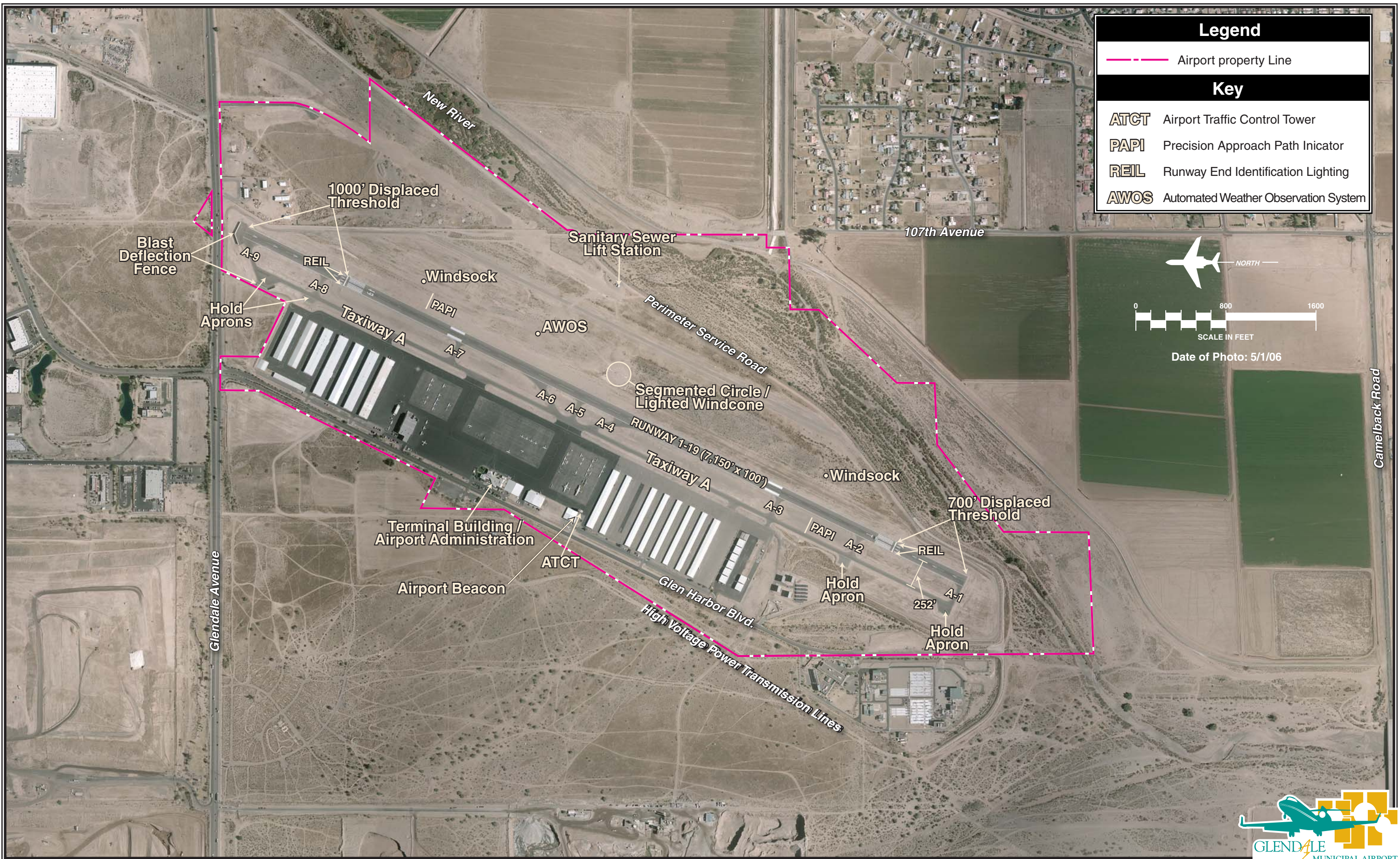
Existing airside facilities are identified on **Exhibit 1D**. **Table 1B** summarizes airside facility data for Glendale Municipal Airport.

TABLE 1B Airside Facility Data Glendale Municipal Airport	
	RUNWAY 1-19
Runway Length (feet)	7,150
Runway Width (feet)	100
Runway Surface	Asphalt
Surface Treatment	None
Condition	Good
Runway Load Bearing Strength (pounds)	
Single Wheel Loading (SWL)	40,000
Dual Wheel Loading (DWL)	60,000
Runway Lighting	Medium intensity runway lights
Runway Markings	Non-precision instrument in good condition
Visual Approach Aids	
Approach Slope Indicators	Precision approach path indicator (2-box unit)
Approach Lighting	None
Instrument Approach Aids	RNAV (GPS) RWY 19
Weather or Navigational Aids	AWOS
Visual Aids	Runway end identifier lights Universal rotating beacon Segmented circle 3 lighted wind cones
Taxiways	Medium intensity taxiway lights; centerline striping
Taxilanes	Centerline striping
GPS - Global Positioning System	
AWOS - Automated Weather Observation System	
<i>Source: Airport/Facility Directory; Southwest U.S., (April 13, 2006)</i>	

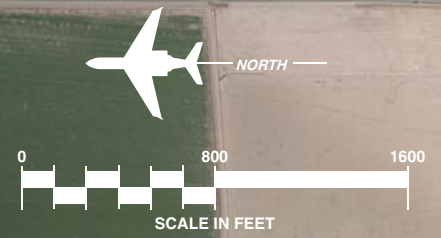
Runway

Glendale Municipal Airport is served by a single asphalt runway, Runway 1-19. The runway is 7,150 feet long by 100 feet wide. The runway is in “good” condition, the highest rating the FAA designates for runway condition. The

pavement has been strength rated at 40,000 pounds single wheel loading (SWL) and 60,000 pounds dual wheel loading (DWL). These strength ratings refer to the configuration of the aircraft landing gear. For example, SWL indicates an aircraft with a single wheel on each landing gear.



Legend	
	Airport property Line
Key	
ATCT	Airport Traffic Control Tower
PAPI	Precision Approach Path Indicator
REIL	Runway End Identification Lighting
AWOS	Automated Weather Observation System



Date of Photo: 5/1/06



The landing threshold for Runway 1 is displaced 700 feet. The Runway 19 landing threshold is displaced 1,000 feet. The displaced landing thresholds were implemented in order to provide for FAA required safety areas surrounding the usable runway.

Taxiways

The taxiway system at Glendale Municipal Airport includes a full-length parallel taxiway, identified as Taxiway A, located 252.5 feet west of the runway centerline. There are nine entrance/exit taxiways from the runway designated as Taxiways A1 through A9 from south to north. Taxiways A4 and A6 provide high-speed exits from the runway near the midpoint of the runway. High-speed taxiways are angled to allow aircraft to exit the runway at a greater speed than if the taxiway were at a right angle. This configuration adds to the overall capacity of the airfield and increases aircraft movement efficiency.

All taxiways are 35 feet wide. Both ends of Taxiway A provide aircraft hold aprons. The hold aprons are areas where pilots can perform pre-flight checks including engine run-up, and where airport traffic control tower personnel can instruct pilots to wait for clearance to enter the runway.

Pavement Markings

Pavement markings aid in the movement of aircraft along airport surfaces and identify closed or hazardous areas on the airport. The non-precision

markings on Runway 1-19 identify the runway designations, centerline, edges, touchdown point, and landing thresholds. Taxiway markings include aircraft holding positions and centerline markings.

Airfield Lighting

Airfield lighting systems extend an airport's usefulness into periods of darkness and/or poor visibility. A variety of lighting systems are installed at the airport for this purpose. These lighting systems, categorized by function, are summarized as follows:

Identification Lighting: The location of the airport at night is universally identified by a rotating beacon. The rotating beacon projects two beams of light, one white and one green, 180 degrees apart. The rotating beacon at Glendale Municipal Airport is located on the top of the airport traffic control tower (ATCT).

Both ends of the runway are equipped with runway end identification lighting (REIL). REILs provide a visual identification of the runway end for landing aircraft. The system consists of two flashing light assemblies located approximately 40 feet to either side of the runway landing threshold.

Runway and Taxiway Lighting: Runway and taxiway lighting utilizes light fixtures placed near the edge of the pavement to define the lateral limits of the pavement. This lighting is essential for safe operations during night and/or times of low visibility in order to maintain safe and efficient

access to and from the runway and aircraft parking areas.

Runway 1-19 is equipped with medium intensity runway lighting (MIRL). These are lights set atop a pole that is approximately one foot above the ground. The light poles are frangible, meaning if one is struck by an object, such as an aircraft wheel, they can easily break away, thus limiting the potential damage to an aircraft.

Medium intensity taxiway lighting (MITL) is associated with the taxiways. These lights are mounted on the same type of structure as the runway lights.

Visual Approach Lighting: On the left side of Runway 1 and Runway 19 is a two-box precision approach path indicator (PAPI-2L). The PAPI displays two sets of lights designed so that viewing from above a specific approach angle will indicate to the pilot whether he or she is on the correct glide slope. There are no approach lighting systems prior to the runways.

Airfield Signs: Airfield identification signs assist pilots in identifying their location on the airfield and direct them to their desired location. The airfield signs, including the runways, taxiways, and distance-to-go markings, are lighted at Glendale Municipal Airport.

Pilot-Controlled Lighting: When the air traffic control tower (ATCT) is closed, the airfield lights are turned off. With the pilot-controlled lighting system (PCL), pilots can control air-

field lights from their aircraft, through a series of clicks of their radio transmitter. Typically the airfield lights will remain on for approximately 15 minutes.

Weather and Communication Aids

Glendale Municipal Airport has three lighted wind cones, one inside the segmented circle and one closer to each end of the runway. The lighted wind cone provides information to pilots regarding wind conditions, such as direction and speed. The segmented circle provides traffic pattern information to pilots. Having three wind cones spread out equally along the runway is advantageous because wind indications can be determined from anywhere along the runway.

Glendale Municipal Airport is equipped with an Automated Weather Observation System III (AWOS-III). An AWOS will automatically record weather conditions such as wind speed, wind gust, wind direction, temperature, dew point, and altimeter setting. The AWOS-III also calculates density altitude. In addition, the AWOS-III will record visibility, precipitation, and cloud height. This information is then transmitted at regular intervals (usually once per hour). Aircraft in the vicinity can receive this information if they have their radio tuned to the correct frequency (119.425 MHz). In addition, pilots and individuals can call a published telephone number and receive the information via an automated voice recording.

Glendale Municipal Airport is also equipped with an automated terminal information service (ATIS), which is a recorded message updated hourly, and broadcast on 119.425 MHz. ATIS broadcasts are used by airports to notify arriving and departing pilots of the current surface weather conditions, runway and taxiway conditions, communication frequencies, and other information of importance to arriving and departing aircraft. The ATIS broadcast includes the AWOS information and can be accessed on the same frequency.

Glendale Municipal Airport also utilizes a common traffic advisory frequency (CTAF). This radio frequency (121.0 MHz) is used by pilots in the vicinity of the airport to communicate with each other about approaches or take-offs from the airport when the ATCT is closed. The same frequency will reach the ATCT if the tower is open. Ground control can be reached via 118.0 MHz during tower hours. In addition, a UNICOM frequency is also available (122.95 MHz) where a pilot can obtain FBO information.

Navigational Aids

Navigational aids are electronic devices that transmit radio frequencies, which pilots of properly equipped aircraft can translate into point-to-point guidance and position information. The types of electronic navigational aids available for aircraft flying in the vicinity of Glendale Municipal Airport include non-directional beacons (NDBs), a very high frequency omni-

directional range (VOR) facility, and the global positioning system (GPS).

The NDB transmits nondirectional radio signals whereby the pilot of an aircraft equipped with direction-finding equipment can determine their bearing to or from the NDB facility in order to track to the beacon station. The Falcon Field NDB is approximately 28 nautical miles (nm) to the east of the airport. The Chandler NDB is approximately 29 nm to the southeast. The NDB that was located on the east side of the airport has been decommissioned.

The very high omnidirectional range (VOR), in general, provides azimuth readings to pilots of properly equipped aircraft transmitting a radio signal at every degree to provide 360 individual navigational courses. Frequently, distance measuring equipment (DME) is combined with a VOR facility (VOR/DME) to provide distance as well as direction information to the pilot. Military tactical air navigation aids (TACANs) and civil VORs are commonly combined to form a VORTAC. The VORTAC provides distance and direction information to both civil and military pilots.

The Phoenix VORTAC is located approximately 17 nm to the east of the airfield at Phoenix Sky Harbor International Airport. The Buckeye VORTAC is 27 nm to the west of Glendale Municipal Airport. The Willie VORTAC is approximately 35 nm to the southeast of the airport at Williams Gateway Airport, and the Gila Bend VORTAC is 40 nm to the south.

GPS is an additional navigational aid for pilots. GPS was initially developed by the United States Department of Defense for military navigation around the world. GPS differs from an NDB or VOR in that pilots are not required to navigate using a specific ground-based facility. GPS uses satellites placed in orbit around the earth that transmit electronic radio signals, which pilots of properly equipped aircraft use to determine altitude, speed, and other navigational information. With GPS, pilots can directly navigate to any airport in the country and are not required to navigate using a ground-based navigational facility.

Loran-C is another point-to-point navigation system available to pilots. Where GPS utilizes satellite-based transmitters, Loran-C uses a system of ground-based transmitters.

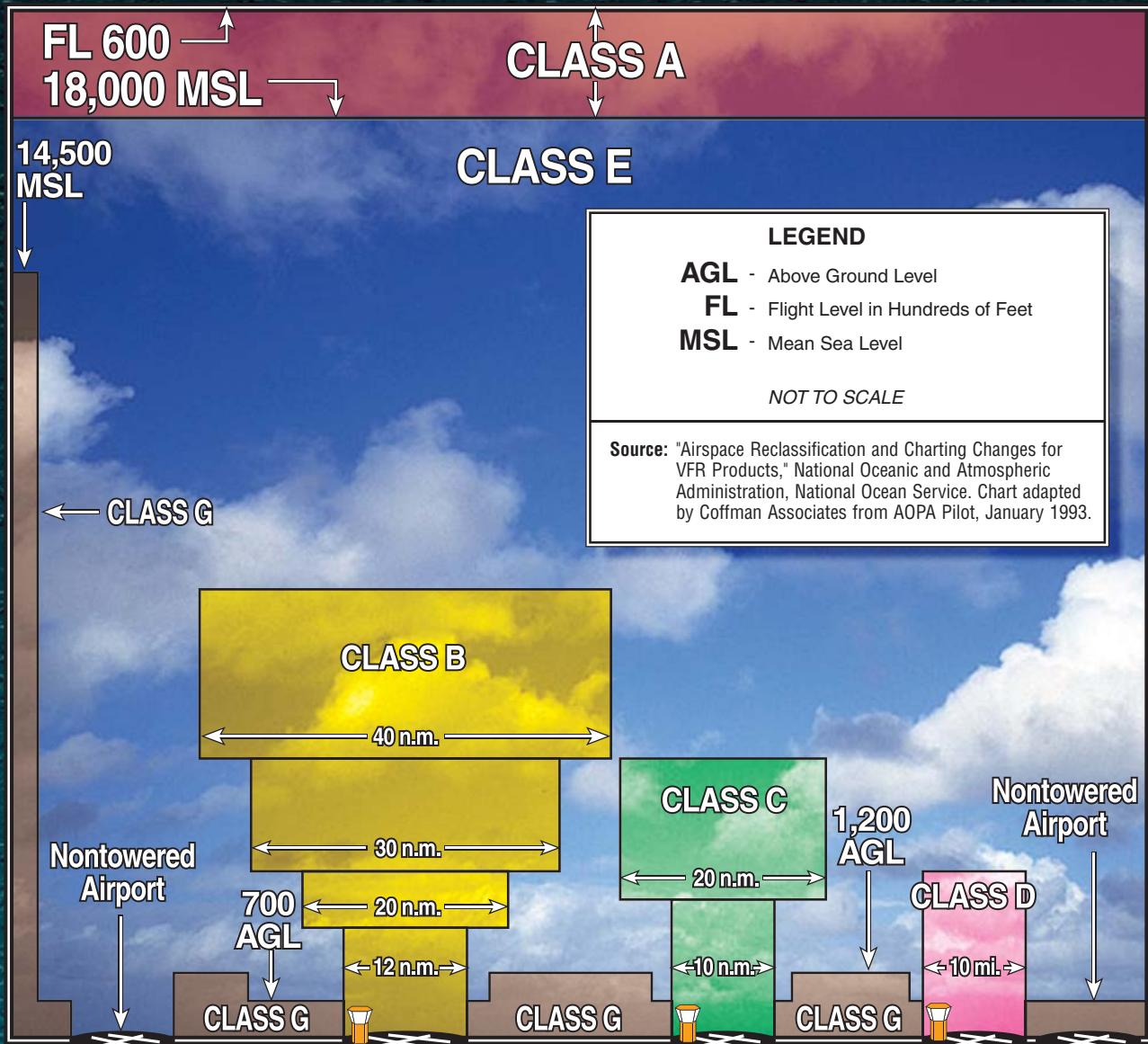
Area Airspace

The Federal Aviation Administration (FAA) Act of 1958 established the FAA as the responsible agency for the control and use of navigable airspace within the United States. The FAA has established the National Airspace System (NAS) to protect persons and property on the ground and to establish a safe environment for civil, commercial, and military aviation. The NAS is defined as the common network of U.S. airspace, including air navigational facilities; airports and landing areas; aeronautical charts; associated rules, regulations, and procedures; technical information; and personnel and material. System compo-

nents shared jointly with the military are also included as part of this system.

To ensure a safe and efficient airspace environment for all aspects of aviation, the FAA has established an airspace structure that regulates and establishes procedures for aircraft using the National Airspace System. The U.S. airspace structure provides for categories of airspace, controlled and uncontrolled, and identifies them as Classes A, B, C, D, E, and G as described below. **Exhibit 1E** generally illustrates each airspace type in three-dimensional form.

- Class A airspace is controlled airspace and includes all airspace from 18,000 feet mean sea level (MSL) to Flight Level 600 (approximately 60,000 feet MSL).
- Class B airspace is controlled airspace surrounding high-activity commercial service airports (i.e., Phoenix Sky Harbor International Airport).
- Class C airspace is controlled airspace surrounding lower-activity commercial service (i.e., Tucson, AZ) and some military airports.
- Class D airspace is controlled airspace surrounding low-activity commercial service and general aviation airports with an airport traffic control tower (ATCT), such as Glendale Municipal Airport.









LEGEND

AGL - Above Ground Level
FL - Flight Level in Hundreds of Feet
MSL - Mean Sea Level

NOT TO SCALE

Source: "Airspace Reclassification and Charting Changes for VFR Products," National Oceanic and Atmospheric Administration, National Ocean Service. Chart adapted by Coffman Associates from AOPA Pilot, January 1993.

CLASSIFICATION	DEFINITION
 CLASS A	Generally airspace above 18,000 feet MSL up to and including FL 600 .
 CLASS B	Generally multi-layered airspace from the surface up to 10,000 feet MSL surrounding the nation's busiest airports.
 CLASS C	Generally airspace from the surface to 4,000 feet AGL surrounding towered airports with service by radar approach control.
 CLASS D	Generally airspace from the surface to 2,500 feet AGL surrounding towered airports.
 CLASS E	Generally controlled airspace that is not Class A, Class B, Class C, or Class D.
 CLASS G	Generally uncontrolled airspace that is not Class A, Class B, Class C, Class D, or Class E.



All aircraft operating within Classes A, B, C, and D airspace must be in constant contact with the air traffic control facility responsible for that particular airspace sector.

- Class E airspace is controlled airspace surrounding an airport that encompasses all instrument approach procedures and low-altitude federal airways. Only aircraft conducting instrument flights are required to be in contact with air traffic control when operating in Class E airspace. While aircraft conducting visual flights in Class E airspace are not required to be in radio contact with air traffic control facilities, visual flight can only be conducted if minimum visibility and cloud ceilings exist.
- Class G airspace is uncontrolled airspace that does not require communication with an air traffic control facility.

Airspace within the vicinity of Glendale Municipal Airport is depicted on **Exhibit 1F**. When the ATCT is open, the airport is located under Class D airspace. This Class D airspace extends to a three nautical mile radius from the ATCT and to an elevation of 1,929 feet above ground level (AGL).

When the tower is closed, the airport operates in Class E airspace with a floor of 700 feet AGL and extending to 18,000 feet MSL, or where Class B airspace begins. The Class E airspace surrounding the airport extends approximately four nm in radius. The

western portion of this airspace is overlapped and superseded by Class D airspace for Luke Air Force Base.

Victor Airways

Victor Airways are designated navigational routes extending between VOR facilities. Victor Airways have a floor of 1,200 feet above ground level and extend upward to an altitude of 18,000 feet MSL. Victor Airways are eight nautical miles wide.

As previously discussed, there are a number of VOR facilities within the airport region. V16 runs between the Phoenix VORTAC and the Buckeye VORTAC and is located approximately six miles to the south of the airport. Nine other Victor Airways lead to and from the Phoenix VORTAC.

Military Operations Areas (MOAs)

Glendale Municipal Airport is located near military operations areas (MOAs). An MOA is an area of airspace designated for military training use. This is not restricted airspace; pilots can use the airspace, however, they should be on alert for the possibility of military traffic. A pilot may need to be aware that military aircraft can be found in high concentrations, conducting aerobatic maneuvers, and possibly operating at high speeds at lower elevations. The activity status of an MOA is advertised by a *Notice to Airmen* (NOTAM) and noted on Sectional Charts.

To the northwest, the Gladden 1 and Bagdad 1 MOA has a floor of 5,000 feet AGL or 7,000 feet above mean sea level (MSL), whichever is higher, to 18,000 feet MSL. It is published in use Monday-Friday from 6:00 a.m. to 7:00 p.m., and is normally extended to 11:30 p.m. by NOTAM. Other MOA airspace to the east and south of Glendale is depicted on Sectional Charts.

Alert Areas

Alert Area A-231 is located to the immediate north and west of the Glendale Municipal Airport. This alert area is associated with Luke Air Force Base. Within the boundaries of the Alert Area there is likely to be large concentrations of military jet aircraft performing training maneuvers. The military activity in this area will be at lower altitudes, up to 6,500 feet AGL, and may occur anytime of the day or night. It is strongly recommended that VFR aircraft transitioning the Alert Area contact Luke AFB Radar Approach Control (RAPCON) for traffic advisories.

Military Training Routes

A Military Training Route, or MTR, is a specified training route for military pilot proficiency. Aircraft operate on the MTR at speeds in excess of 250 knots and from 300 feet AGL up to 10,000 feet MSL. Many MTRs are within a short distance of Glendale

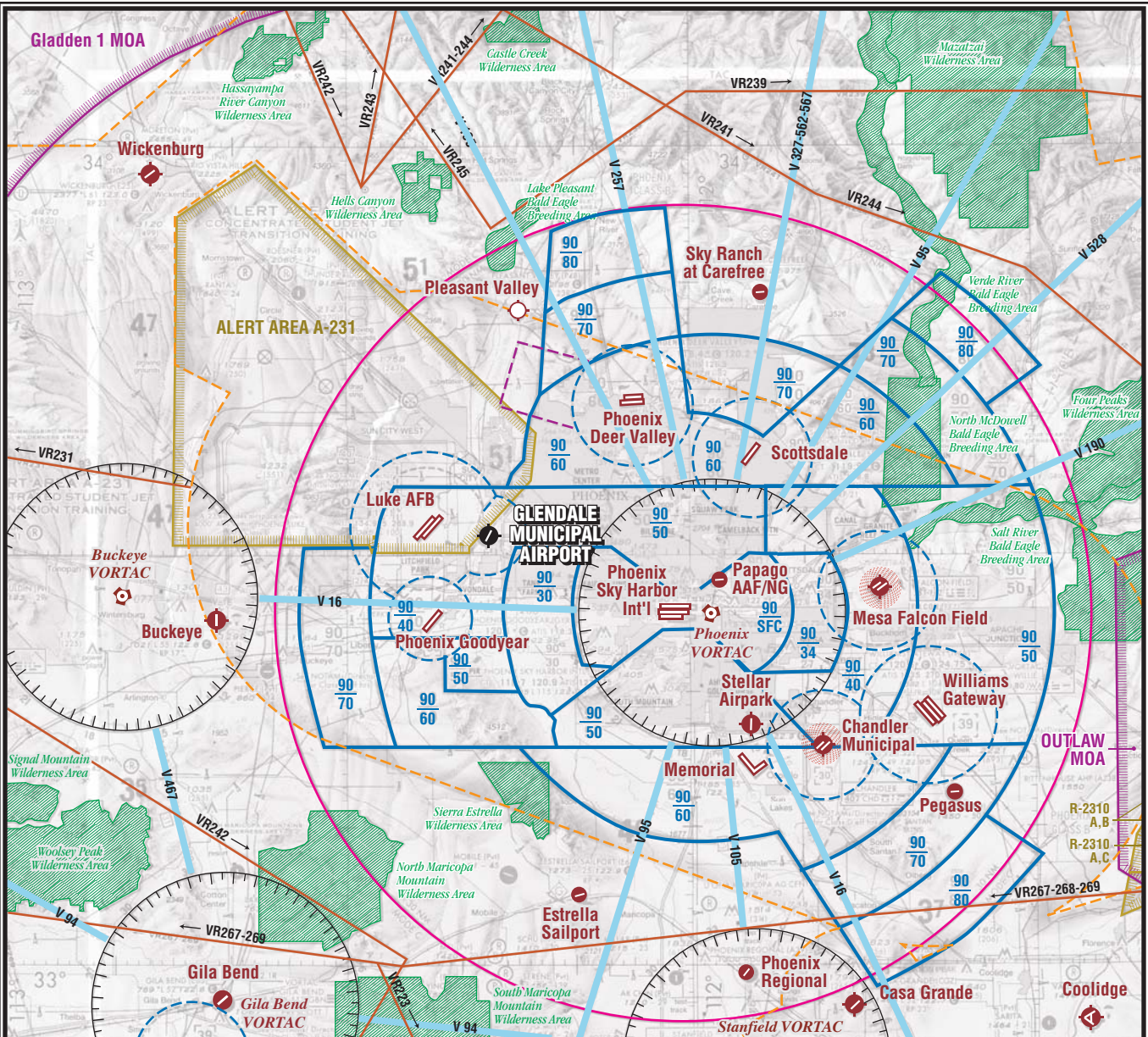
Municipal Airport. General aviation pilots should be aware of the locations of the MTRs and exercise special caution if they need to cross them.

Exhibit 1F further identifies the local airspace area, restricted areas, Victor Airways, military training routes, obstructions, and the Class D airspace under which Glendale Municipal Airport falls.









Instrument Approach Procedures









Instrument approach procedures are a series of predetermined maneuvers established by the FAA using electronic navigational aids to assist pilots in locating and landing at an airport during low visibility and cloud ceiling conditions. The capability of an instrument approach is defined by the visibility and cloud ceiling minimums associated with the approach. Visibility minimums define the horizontal distance that the pilot must be able to see to complete the approach. Cloud ceilings define the lowest level a cloud layer (defined in feet above the ground) can be situated for a pilot to complete the approach. If the observed visibility or cloud ceiling is below the minimums prescribed for the approach, the pilot cannot complete the instrument approach.

Two instrument approaches have been approved for the Glendale Municipal Airport. The detail of these approaches is presented in **Table 1C**.



LEGEND

-  Airport with other than hard-surfaced runways
-  Airport with hard-surfaced runways 1,500' to 8,069' in length
-  Airports with hard-surfaced runways greater than 8,069' or some multiple runways less than 8,069'
-  VORTAC
-  Non-Directional Radiobeacon (NDB)
-  Compass Rose
-  Military Operations Area (MOA)
-  Prohibited, Restricted, Warning and Alert Areas

-  Wilderness Areas
-  Mode C
-  Military Training Routes
-  Victor Airways
-  Class B Airspace
-  Class D Airspace
-  Class E (sfc) Airspace
-  Class E Airspace with floor 700' above surface



NOT TO SCALE

Source: Phoenix Sectional Chart,
US Department of Commerce,
National Oceanic and Atmospheric
Administration, May 7, 2009



TABLE 1C Instrument Approach Data Glendale Municipal Airport						
	WEATHER MINIMUMS BY AIRCRAFT TYPE					
	Categories A and B		Category C		Category D	
	CH	VIS	CH	VIS	CH	VIS
RNAV (GPS) Runway 1						
LPV	1,378	1.25	1,378	1.25	1,378	1.25
LNAV/VNAV	1,457	1.5	1,457	1.5	1,457	1.5
LNAV MDA	1,440	1	1,440	1	1,440	1
Circling	1,460/1,540	1	1,540	1.5	1,640	2
RNAV (GPS) Runway 19						
LPV	1,339	1	1,339	1	1,339	1
LNAV/VNAV	1,572	1.75	1,572	1.75	1,572	1.75
LNAV MDA	1,540	1	1,540	1.25	1,540	2
Circling	1,540	1	1,540	1.5	1,640	2
Aircraft categories are based on 1.3 times the stall speed in landing configuration as follows:						
Category A/B: 0-120 knots						
Category C: 121-140 knots						
Category D: 141-165 knots						
MDA - Minimum Descent Altitude						
CH - Cloud Height						
VIS - Visibility minimums (miles)						
LPV - Localizer performance with vertical guidance						
<i>Source: U.S. Terminal Procedures, Southwest (11 April, 2008)</i>						

Both runways provide non-precision instrument approach capability by use of the Global Positioning System (GPS). The RNAV (GPS) approaches to the runways provide both straight-in procedures and circling procedures. Several straight-in GPS approaches are available to each runway end.

The LPV approach (meaning localizer performance with vertical guidance) provides lateral containment areas comparable to an ILS localizer and decision heights between those of LNAV/VNAV approaches and Cat I ILS approaches. RNAV refers to the ability to fly more direct routes (at optimum altitudes) than can be achieved

by flying point-to-point using ground-based navigational aids.

The LPV approach is a sophisticated instrument approach that relies on GPS positioning technology on aircraft to provide both lateral and vertical information. The LNAV approaches do not provide the vertical component, thus the visibility minimums are slightly higher.

The airport has approved instrument approaches for aircraft with approach speeds up to and including 165 knots. This means the airport has a design capacity for some of the larger business jets such as the Gulfstream II, IV, and V.

Arrival and Departure Procedures

Because of the possibility of congested airspace over the greater Phoenix Metropolitan area, the FAA has established a series of Standard Terminal Arrival (STAR) and Departure Procedures. The STAR is a preplanned air traffic control arrival procedure designed to provide for the transition from the enroute phase of the flight to an outer fix or an instrument approach fix in the terminal area. The two published STARs are: JCOBS TWO and SUNSS SIX.

A Departure Procedure is a preplanned air traffic control pattern that provides for the transition from the terminal area to the enroute phase of the flight. The DRAKE ONE departure procedure for Glendale Municipal Airport is designed to direct departing aircraft around the airspace associated with Luke Air Force Base. Aircraft departing Runway 1 are to use the DRAKE ONE departure procedure.

Local Operating Procedures

Glendale Municipal Airport is situated at 1,070 feet mean sea level (MSL). The traffic pattern altitude for all turbine and piston aircraft is 2,100 feet MSL. The traffic pattern for high-performance aircraft, including jet-powered aircraft is at 2,600 feet MSL. The helicopter/ultralight traffic pattern is designated at 1,700 feet MSL. The airport utilizes a non-standard right-hand traffic pattern for Runway 1 and a left-hand traffic pattern for Runway 19. This traffic pattern is in-

tended to avoid the high-voltage power lines to the immediate west of the airport and to prevent civilian aircraft from overflying Luke Air Force Base.

Air Traffic Control

The airport traffic control tower (ATCT) is located to the west of the mid-point of the runway, approximately 950 feet from the runway centerline. The ATCT is owned by the City of Glendale and its operation is contracted to Serco Group, Inc. The tower operates from 6:00 a.m. to 8:30 p.m., Monday through Friday, and from 7:00 a.m. to 7:00 p.m. on the weekends. Tower personnel provide an array of control services, including approach and departure clearances (121.0 MHz) and ground control (118.0 MHz).

The ATCT located at the airport controls air traffic within the Class D airspace that surrounds Glendale Municipal Airport. Tower personnel also direct aircraft in complying with the noise abatement procedures recommended by the *1994 Noise Compatibility Study*. The tower cab floor is 45 feet high and all portions of the runway are visible.

During construction of the southwest hangar complex accessed by Taxiway A3, it became apparent that the hangar closest to the runway would obstruct a portion of Taxiway A from the view of tower personnel. Construction was halted on this hangar. The hangar immediately to the west obstructs visibility to the stub taxiway to the west of Taxiway A2. The portion of

Taxiway A between Taxiway A-4 and A-2 is not fully visible. A NOTAM has been published to alert pilots of the non-visibility condition. In addition, the run-up area serving Runway 19 is obstructed from the tower.

Aircraft operating within the Class B airspace surrounding Phoenix Sky Harbor International Airport are controlled by the Phoenix Terminal Radar Approach Control (TRACON) facility located at the Phoenix Sky Harbor International Airport. Aircraft operating in the vicinity of Glendale Municipal Airport are handled by the Luke AFB Radar Approach Control (RAPCON) facility located on Luke AFB.

Luke AFB RAPCON is servicing approach control for Glendale Municipal Airport Monday through Friday and other times by NOTAM. RAPCON provides air traffic services to include radar vectoring, separation, and traffic advisories. The RAPCON uses direct radio communications and the Standard Terminal Automation Replacement System (STARS) tracking system to control aircraft within its jurisdiction. While VFR aircraft arriving and departing Glendale Municipal Airport are not required to contact Luke RAPCON, they may do so to expedite their progress through the area.

Aircraft arriving and departing the Phoenix Metropolitan area are controlled by the Albuquerque Center Air Route Traffic Control Center (ARTCC). The Albuquerque ARTCC controls aircraft in a large multi-state area.

LANDSIDE FACILITIES

Landside facilities are the ground-based facilities that support the aircraft and pilot/passenger handling functions. These facilities typically include the fixed based operators (FBOs), aircraft storage hangars, aircraft maintenance hangars, aircraft parking aprons, and support facilities such as fuel storage, automobile parking, roadway access, and aircraft rescue and firefighting. Landside facilities are identified on **Exhibit 1G**.

TERMINAL BUILDING

A two-story general aviation terminal building is located along Glen Harbor Boulevard, approximately at the midpoint of Runway 1-19. The 21,900-square-foot terminal building was constructed in 1986 by the City of Glendale and is in excellent condition. Located on the ground floor of the terminal are a restaurant, pilot supplies shop, office space, and a public lounge. Airport administration offices, flight planning room, and additional office space are located on the second floor of the terminal building.

Approximately 80 vehicle parking spaces are available adjacent to the terminal building. Approximately 120 vehicle parking spaces are available in an overflow parking lot located west of Glen Harbor Boulevard. The main airport electrical vault is located adjacent to the east side of the terminal building along the aircraft parking apron. **Exhibit 1H** provides a depiction of the terminal building.

tion of the general aviation terminal building floor plan. The following provides a description of the businesses located in the terminal building:

Airsafety Flight Academy - Flight training

Glendale Airport Café - Restaurant
Gold Coast Helicopters - Flight training, charter, and aerial tours and photography

The Pilot Shoppe - Gift and pilot shop

Arnold and Arnold - Aviation insurance adjuster

Premier - Property Management

Cirrus Aircraft - Aircraft sales office

FIXED BASE OPERATORS

Lux Air is the only full-service FBO serving Glendale Municipal Airport. Lux Air provides essential services to the general aviation community and provides for safe and efficient operations at the airport. Lux Air operates from facilities located directly north of the terminal building on the west side of the airfield. They have 11,000 square feet of hangar space for aircraft storage and maintenance and an additional 9,000 square feet of office and public space. In 2007, Lux Air completed a multi-million dollar renovation of these facilities.

A 20,000-square-yard transient aircraft apron is available and primarily used for transient jet and turboprop parking. Lux Air offers complete line services including aircraft fueling (Avgas and Jet A), towing, and storage. Some of the amenities provided include passenger lounge, public tele-

phones, rental car arrangements, conference room, fax machine, and pilot supplies.

AIRCRAFT PARKING APRON

The main aircraft apron at the airport is centrally located, with the airport terminal building facing the center of the apron. The apron is constructed of asphaltic concrete and totals approximately 130,000 square yards. The main apron provides 187 aircraft tie-down positions.

AIRCRAFT HANGAR FACILITIES

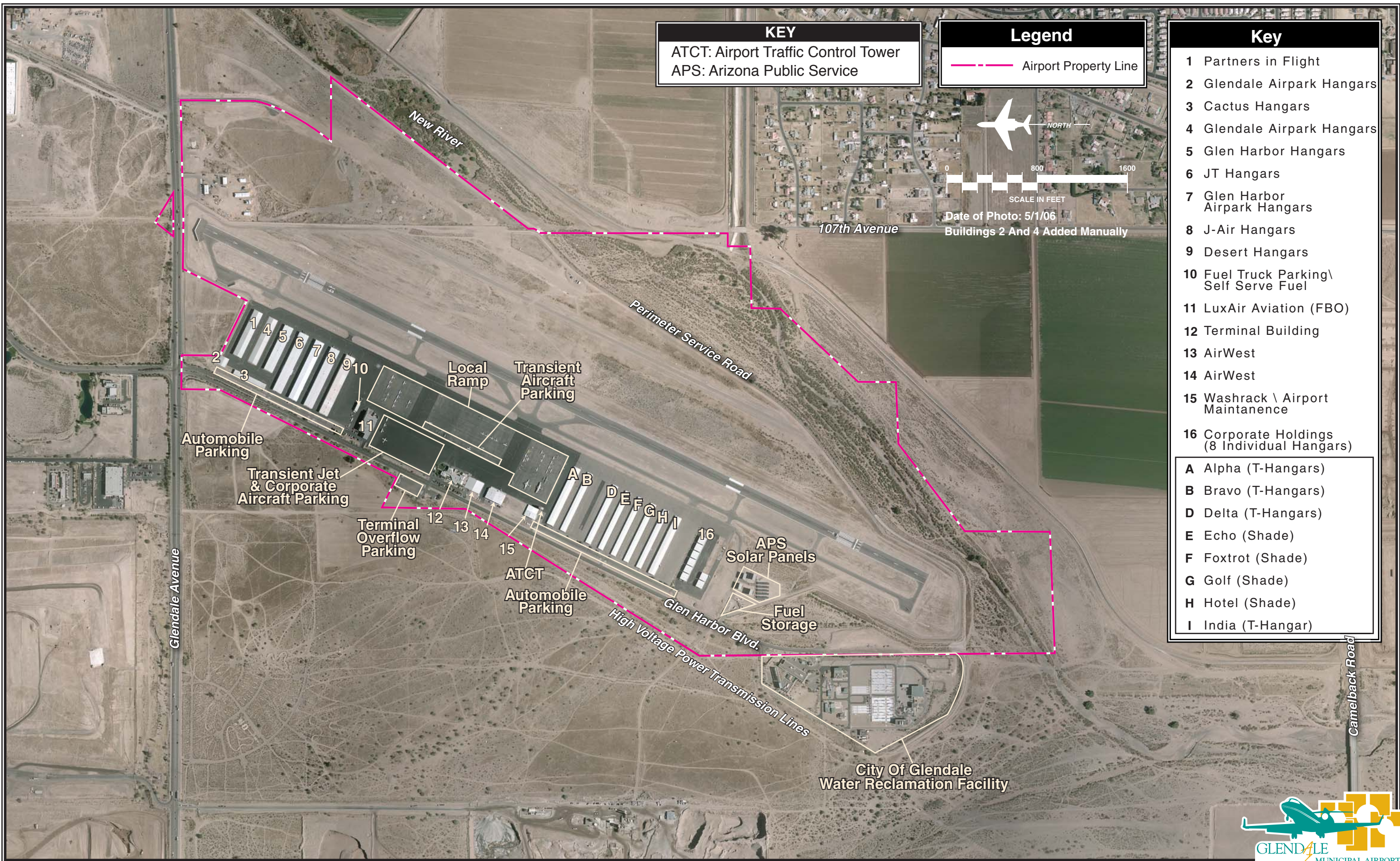
Hangar facilities at Glendale Municipal Airport are comprised of conventional hangars, box hangars, connected box hangars, T-hangars, and shade hangars. T-hangars and connected box hangars provide for separate hangar facilities within a larger contiguous facility. Shade hangars are tie-down spaces with a protective roof covering. Conventional hangars provide a large open space, free from roof support structures, and have the capability to accommodate several aircraft simultaneously. Conventional hangars are typically 10,000 square feet or greater. The airport also has eight 60-foot by 60-foot box hangars. This type of hangar is becoming much more popular at general aviation airports. Box hangars provide the same type of aircraft storage as conventional hangars in that the structure is free from roof supports, but are normally much less than 10,000 square feet. The hangar facilities are identified on **Exhibit 1G**.

KEY
 ATCT: Airport Traffic Control Tower
 APS: Arizona Public Service

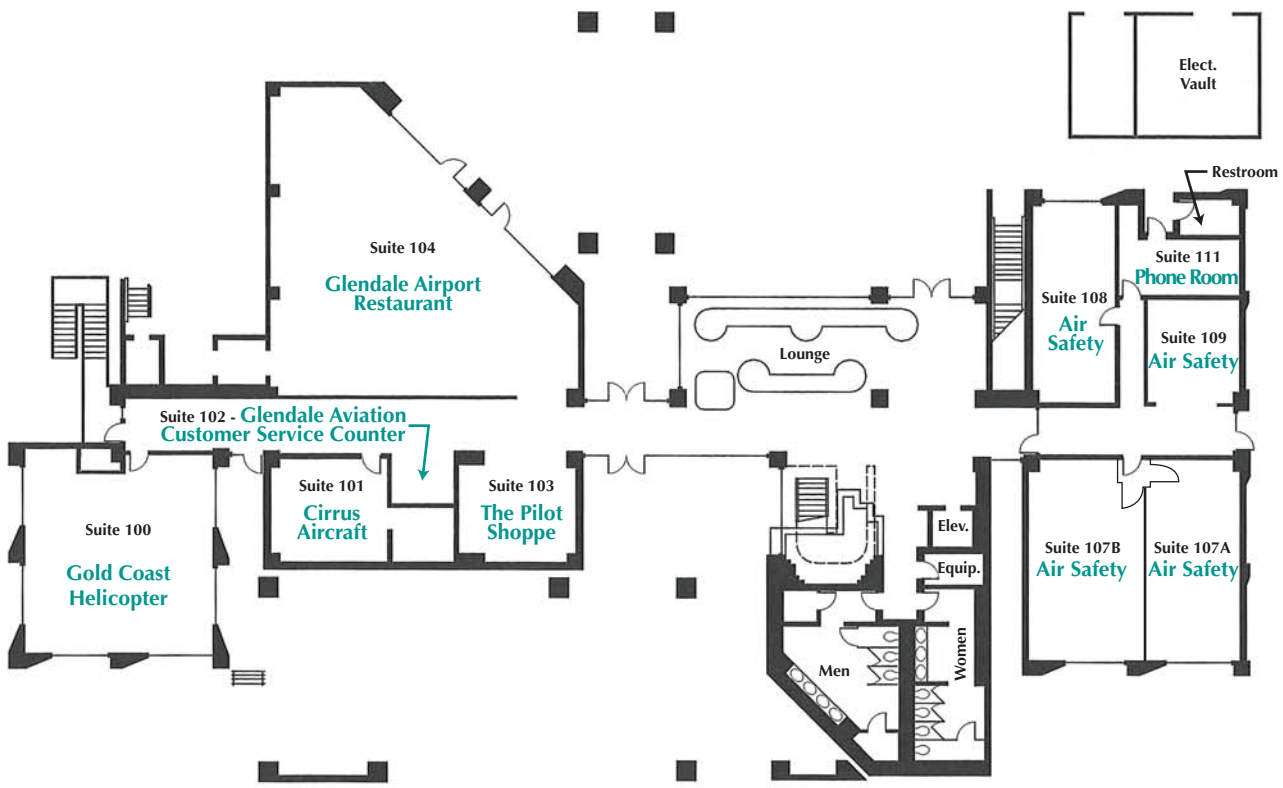
Legend
 - - - - - Airport Property Line

0 800 1600
 SCALE IN FEET
 Date of Photo: 5/1/06
 Buildings 2 And 4 Added Manually

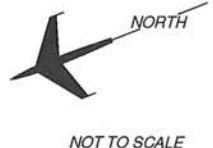
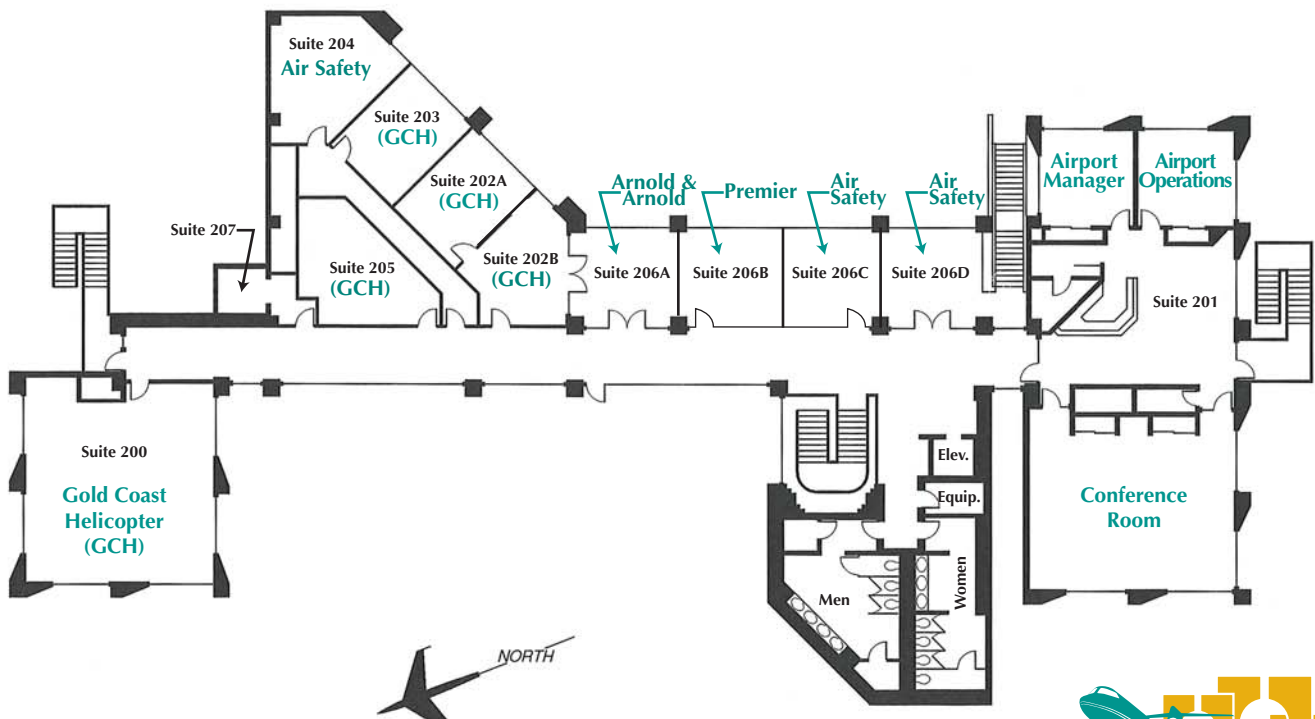
- Key**
- 1 Partners in Flight
 - 2 Glendale Airpark Hangars
 - 3 Cactus Hangars
 - 4 Glendale Airpark Hangars
 - 5 Glen Harbor Hangars
 - 6 JT Hangars
 - 7 Glen Harbor Airpark Hangars
 - 8 J-Air Hangars
 - 9 Desert Hangars
 - 10 Fuel Truck Parking\ Self Serve Fuel
 - 11 LuxAir Aviation (FBO)
 - 12 Terminal Building
 - 13 AirWest
 - 14 AirWest
 - 15 Washrack \ Airport Maintenance
 - 16 Corporate Holdings (8 Individual Hangars)
- A** Alpha (T-Hangars)
B Bravo (T-Hangars)
D Delta (T-Hangars)
E Echo (Shade)
F Foxtrot (Shade)
G Golf (Shade)
H Hotel (Shade)
I India (T-Hangar)



FIRST FLOOR



SECOND FLOOR



NOT TO SCALE



The box hangar complex to the south and the FBO hangar are owned by the airport; all other hangar storage facilities are privately owned. The leasing of private hangar space is managed by

the hangar operators. All of the hangar structures on the north end are connected box hangars. The number of individual units available is presented in **Table 1D**.

TABLE 1D
Aircraft Hangar Facilities
Glendale Municipal Airport

Hangar Name	Hangar Type	Total Footprint (s.f.)	Units
Cactus Hangars	Connected Box	12,000	7
Partners in Flight	Connected Box	38,000	18
Glen Harbor Hangars	Connected Box	38,000	20
JT Hangars	Connected Box	48,000	24
Glen Harbor Airpark	Connected Box	48,000	22
J-Air Hangars	Connected Box	48,000	26
Desert Hangars	Connected Box	48,000	26
Lux Air	Conventional	11,000	1
AirWest	Conventional	15,000	8
Alpha	T-Hangars	34,000	24
Bravo	T-Hangars	29,000	28
Delta	T-Hangars	29,000	28
Echo	Shade	29,000	27
Foxtrot	Shade	29,000	28
Golf	Shade	29,000	28
Hotel	Shade	29,000	28
India	T-Hangars	34,000	24
Executive Hangars	Box Hangars	29,000	8

Source: Airport records

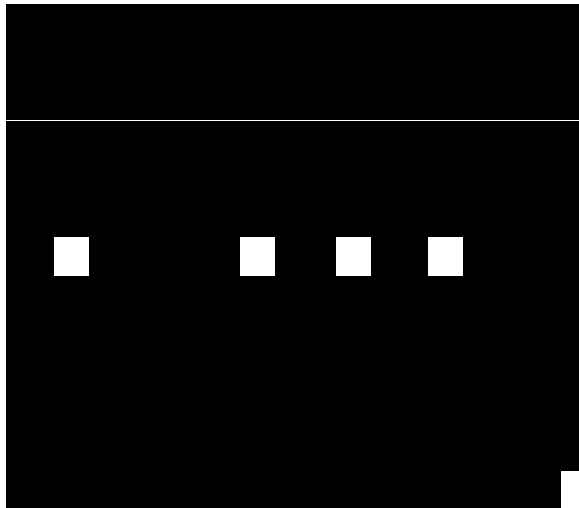
Lux Air leases an 11,000-square-foot conventional hangar which is utilized for aircraft storage and aircraft maintenance. To the immediate south of the terminal building is the AirWest hangar which is a 15,000-square-foot facility with dual folding doors. This facility has an estimated capacity of eight aircraft parking spaces. This hangar is privately owned.

South of the airport traffic control tower are a series of T-hangars and shade hangars. These facilities are privately owned. The last hangar complex is a group of eight box hangars. These hangars are not connected and encompass approximately 3,600 square feet of space each. These hangars are currently owned by the airport.

AUTOMOBILE PARKING

There are several lots available for automobile parking at Glendale Municipal Airport. As previously mentioned, the airport terminal building offers approximately 200 parking spaces. The FBO building provides approximately 30 spaces. Approximately 420 additional spaces are located along Glen Harbor Boulevard in order to accommodate other airport users. The ATCT tower and other individual aircraft hangars also offer some vehicle parking.

FUEL FACILITIES



AIRCRAFT RESCUE AND FIREFIGHTING (ARFF)

There are presently no fire and rescue services located at the airport. The City of Glendale Fire Station No. 158 is located approximately three miles to the east of the airport and can respond to airport emergencies within ap-

proximately five minutes. The City of Phoenix Fire Station No. 54, home to Engine 54, is located approximately three miles to the southeast of the airport on Campbell Avenue. Through inter-governmental agreements, fire stations in the Phoenix area are coordinated so that the closest fire station responds to an emergency. The City and the airport have plans to locate a new fire station with ARFF capability near the corner of Glendale Avenue and Glen Harbor Boulevard.

UTILITIES

Electricity, natural gas, water, and sanitary sewer services are available at the airport. Electrical service is provided by Arizona Public Service (APS). Southwest Gas provides natural gas service. The City of Glendale provides water and sanitary sewer services. Telephone and communications services are provided by Quest Communications.

There are two emergency generators on the airport. The first is located in the electrical vault adjacent the terminal building and is capable of running the runway and taxiway lights as well as essential areas within the terminal building. The generator is diesel gas operated and is tested once a week. Routine maintenance is conducted on the generator once a month.

The second back up generator is at the base of the ATCT and runs the systems in the tower.

FENCING

In 2006, the airport had new perimeter fencing installed with a federal grant from the FAA. The fence is six feet high and is topped with three strand barbed wire. There are six electric vehicle gates which are capable of being operated by utilizing a key punch or a pre-programmed card. The gate nearest the FBO facilities can also be opened remotely by personnel inside the FBO building. Pedestrian gates are also provided and can be locked.

All of the vehicle gates are equipped with a strobe system that allows fire and rescue responders to open the gates remotely.

PAVEMENT MANAGEMENT PROGRAM

The Arizona Department of Aeronautics has implemented the Arizona Pavement Preservation Program (APPP) to assist in the preservation of the Arizona airport system infrastructure. Public Law 103-305 requires that airports requesting Federal Airport Improvement Program (AIP) funding for pavement rehabilitation or reconstruction have an effective pavement maintenance management system. To this end, ADOT-Aeronautics has completed and is maintaining an Airport Pavement Management System (APMS) which, coupled with monthly pavement evaluations by the airport sponsor, fulfills this requirement.

The Arizona Airport Pavement Management System uses the Army Corps of Engineers' "Micropaver" program as a basis for generating a Five-Year Airport Pavement Preservation Program (APPP). The APMS consists of visual inspections of all airport pavements. Evaluations are made of the types and severities observed and entered into a computer program database. Pavement Condition Index (PCI) values are determined through the visual assessment of pavement condition in accordance with the most recent FAA Advisory Circular 150/5380-6 and range from 0 (failed) to 100 (excellent). Every three years a complete database update, with new visual observations, is conducted. Individual airport reports from the update are shared with all participating system airports. The Aeronautics Division ensures that the APMS database is kept current, in compliance with FAA requirements.

Every year the Aeronautics Division, utilizing the APMS, will identify airport pavement maintenance projects eligible for funding for the upcoming five years. These projects will appear in the State's Five-Year Airport Development Program. Once a project has been identified and approved for funding by the State Transportation Board, the airport sponsor may elect to accept a state grant for the project and not participate in the Airport Pavement Preservation Program (APPP), or the airport sponsor may sign an Inter-Government agreement (IGA) with the Aeronautics Division to participate in the APPP.

Glendale Municipal Airport participates in the State pavement maintenance program for AIP eligible pavement rehabilitation projects. On a daily basis, airport personnel complete an operations log for the airport, a portion of which includes visual observations of the pavement condition. The City of Glendale will perform routine pavement maintenance such as crack sealing and repair on an as-needed basis.

OPERATING STANDARDS

The airport maintains Minimum Operating Standards which provide rules and guidelines for commercial activity conducted on the airport by tenants. The Rules and Regulations for Glendale Municipal Airport apply to all airport tenants whether they are engaged in commercial activity or not. Both documents were revised in 2004.

REGIONAL AIRPORTS

There are a number of airports of various sizes, capacities, and functions within the vicinity of Glendale Municipal Airport, as indicated on **Exhibit 1F**. In an urban/suburban setting, airports within 30 nautical miles of each other will generally have some influence on the activity of the other airport. The airports described below are those within approximately 30 nautical miles of Glendale Municipal Airport or are important to the airspace and control environment of the area. Information pertaining to each airport was obtained from the *MAG*

RASP Update (2002) and FAA's *5010-Airport Master Record* forms.

Luke Air Force Base (LUF) is located four nautical west of Glendale Municipal Airport and serves as a major tactical jet training base for the U.S. Air Force. Luke AFB is equipped with two parallel runways oriented in a northeast-southwest direction, with one runway measuring 10,000 feet in length. While Luke AFB is closed to the public, the proximity of the base to Glendale Municipal Airport and the high level of high-speed jet aircraft training impacts airspace and operations at Glendale Municipal Airport. Coordination with Luke AFB is essential in all proposed projects of Glendale Municipal Airport.

Phoenix Goodyear Airport (GYR) is located seven nautical miles (nm) to the south of Glendale Municipal Airport and is owned and operated by the City of Phoenix. Runway 3-21 is 8,500 feet long. Served by an ATCT, the airport is a base to 209 aircraft including three jets and four helicopters. The full range of FBO services is available.

Phoenix Deer Valley Airport (DVT) is located 14 nm northeast of Glendale Municipal Airport. Owned and operated by the City of Phoenix, the airport is served by parallel runways, with Runway 7R-25L providing the greatest runway length at 8,208 feet. Approximately 1,252 aircraft are based at the airport, including 26 business jets and eight helicopters. The airport is served by an air traffic control tower and provides a full range of FBO services.

Sky Harbor International Airport (PHX) is located 15 nm southeast of the Glendale Municipal Airport in the heart of Phoenix. The airport is owned and operated by the City of Phoenix and is the largest air carrier airport within the State of Arizona. Sky Harbor is served by all of the major airlines, with Southwest and USAirways utilizing the airport as a hub. In 2003, the airport ranked as the fifth busiest domestic airport, with 18.3 million passenger enplanements.

Phoenix Sky Harbor International Airport is equipped with three parallel runways, two of which are over 10,000 feet in length; the third is 7,800 feet long. An array of instrument approach aids, including an instrument landing system (ILS), aid pilots on approach during inclement weather conditions. The airport is served by seventeen published instrument approaches, three of which provide Category I weather minimums (200-foot cloud ceiling and one-half mile visibility).

Although the airport's primary role is to provide commercial service to the area, the airport also serves general aviation activity. The airport has approximately 237 based aircraft, including 55 jets and 15 helicopters. FBO services and aircraft tie-down and hangar storage are also available.

Pleasant Valley Airport (P48) is 17 nm to the north and is owned and operated by the City of Peoria. The airport supports four dirt runways, the longest of which is 4,200 feet. There are 64 based aircraft, including 14

single engine aircraft, 34 gliders, and 15 ultralights.

Scottsdale Airport (SDL), located 20 nm northeast, is owned and operated by the City of Scottsdale. The airport is served by Runway 3-21 (which is 8,249 feet long) and has a control tower. Approximately 439 aircraft, including 64 business jets, are based at the airport.

Buckeye Municipal Airport (BXK) is located 21 nm southwest of Glendale Municipal Airport and is owned by the Town of Buckeye. A single runway, 5,500 feet long, is available for use. Approximately 62 aircraft are based at the airport.

Stellar Airpark (P19) is a privately owned airport open to public use. Located 24 nm southeast of Glendale Municipal Airport, the airport is served by Runway 17-35, which is 3,913 feet long. Approximately 152 aircraft are based at the airport, including 86 single engine, ten multi-engine, five jets, and three helicopters.

Mesa Falcon Field Airport (FFZ), located 29 nm east of Glendale Municipal Airport, is owned and operated by the City of Mesa. The airport is supported by parallel runways oriented in a northeast-southwest direction. Runway 04R-22L provides the greatest length at 5,100 feet. An estimated 947 aircraft are based at the airport, of which five are jets and 56 are helicopters. The airport is served by a control tower, an on-site NDB, and a full range of FBO services.

Chandler Municipal Airport (CHD) is located 29 nm southeast of Glendale Municipal Airport. Owned and operated by the City of Chandler, the airport is equipped with two parallel runways, the longest being 4,870 feet in length. Approximately 449 aircraft are based at Chandler Municipal Airport. The airport is served by a control tower and a full-range of FBO services.

Phoenix-Mesa Gateway Airport (IWA), located 35 nm southeast of Glendale Municipal Airport, is owned and operated by the Williams Gateway Airport Authority. The airport is served by three parallel runways, with

Runway 12R-30L providing the greatest runway length at 10,401 feet. The airport is a converted Air Force Base, with long range planning calling for support of air carrier service, general aviation, and cargo operators. There are approximately 111 based general aviation aircraft, including 24 jets and 18 helicopters.

A number of private airports, typically with dirt landing strips, are within the vicinity of Glendale Municipal Airport. These landing strips are also presented on **Exhibit 1F**. **Table 1E** presents the regional airport data in tabular format.

Airport Name	FAA Classification	Relational Location	Longest Runway	Based Aircraft	Annual Operations
Luke Air Force Base	Military	4 nm W	10,000	200+	NA
Phoenix Goodyear	GA-Reliever	7 nm S	8,500	209	136,000
Phoenix Deer Valley	GA-Reliever	14 nm NE	8,208	1,252	352,000
Phoenix Sky Harbor	Commercial	15 nm SE	11,000	237	657,000
Pleasant Valley	Non-NPIAS	17 nm N	4,200	64	75,000
Scottsdale	GA-Reliever	20 nm NE	8,249	439	184,000
Buckeye	General Aviation	21 nm SW	5,500	62	40,000
Stellar	Non-NPIAS	24 nm SE	3,913	152	39,000
Falcon Field	GA-Reliever	29 nm E	5,100	947	263,000
Chandler	GA-Reliever	29 nm SE	4,870	449	223,000
Phoenix-Mesa Gateway	GA-Reliever	35 nm SE	10,401	111	241,000

GA: General Aviation
Source: FAA Form 5010 Airport Master Record (2006)

AIRPORT CAPITAL IMPROVEMENT HISTORY

Table 1F presents an overview of capital improvements undertaken with federal and state grant funding at Glendale Municipal Airport since the previous master planning effort in 1998. The most notable project is the lengthening and widening of the runway project that was undertaken in 2003 and completed in 2004. This project brought the runway from 5,350 feet long by 75 feet wide to 7,150 feet long by 100 feet wide. This project was developed to accommodate an existing and increasing demand by operators of larger aircraft, particularly business jets. This project addressed

the potential transition of the airport from serving a critical aircraft (defined by the FAA as 500 or more annual operations) represented by small, single and multi-engine piston powered aircraft to a critical aircraft represented by more demanding business jets.

Another project of significance was infrastructure improvements to the east side of the airfield, including the extension of a four-inch water line approximately 3,700 feet, to accommodate potential hangar development. Engineering design for a potential east side parallel taxiway has been completed, but construction has been delayed until it is determined how the City would like to develop the land.

Year Completed	Grant Number	Project Description
1998	ADOT: N 865	Design/build northwest parking lot for new hangars located off Glen Harbor Blvd.
1998	ADOT: NE 9060	Environmental Assessment for runway extension/widening.
1998	FAA AIP: 11 ADOT: NE 9067	Gabions for flood protection for south runway extension.
1999	ADOT: NE 9079	Design Runway and Taxiway extension for FAA AIP Grant Number 13.
1999	ADOT: NE 9080	Design and install eastside 12" water line for service to eastside business park.
2001	ADOT: EO154	Northeast land acquisition.
2002	FAA AIP: 12 ADOT: E1132	Install Automated Weather Observation System (AWOS).
2004	FAA AIP: 13 ADOT: E2F46	Runway extension/widening.
2004	ADOT: E1109	Apron paving.
2005	FAA AIP: 15	Design eastside taxiway.
2006	FAA AIP: 14,15 ADOT: E3F38, E3S06	Fencing and gates.

Source: ADOT: Arizona Department of Transportation - Aeronautics Division

SOCIOECONOMIC CHARACTERISTICS

A variety of historical and forecast socioeconomic data has been collected for use in various elements of this master plan. This information provides essential background for use in determining aviation service level requirements. Aviation forecasts are related to the population base, economic strength of the region, and the ability of the region to sustain a strong economic base over an extended period of time. Historical and forecast data were primarily obtained from the Maricopa Association of Governments, which is the regional metropolitan planning organization, and the City of

Glendale and the Arizona Department of Economic Security. Other resources included the U.S. Census Bureau, the Bureau of Labor Statistics, as well as pertinent internet sites.

POPULATION

Population is one of the most important socioeconomic factors to consider when planning for future needs of an airport. Historical and forecast trends in population provide an indication of the potential of the region to sustain growth in aviation activity. Historical population data for the City of Glendale, Maricopa County, and the State of Arizona is shown in **Table 1G**.

	1990	1995	2000	2005	Annual % Growth Rate
City of Glendale	148,000	189,000	219,000	236,000	3.16%
Maricopa County	2,122,000	2,529,000	3,072,000	3,649,000	3.68%
State of Arizona	3,665,000	4,229,000	5,131,000	6,045,000	3.39%
* All figures rounded to nearest 1,000					
<i>Source: State of Arizona Department of Economic Safety; U.S. Census Bureau; MAG</i>					

The table indicates that all three entities have grown at greater than three percent annually. This is substantial growth that translated into 63 percent growth in the overall population of the City of Glendale between 1990 and 2005. This translates into the addition of 88,000 new residents in the city. Maricopa County, as a whole, has also shown substantial growth since 1990, adding over 1.5 million people.

Since 1990, Arizona is regularly at the top of the list of states with the highest growth rates. In 2005, Arizona was the second fastest growing state, with just under a 3.5 percent annual growth rate.

In 2005, the overall U.S. population grew at 0.9 percent as a point of comparison. These positive growth trends have been attributed to the availability of affordable quality homes, excel-

lent educational institutions, and enjoyable recreational amenities.

EMPLOYMENT

Analysis of a community's employment base can be valuable in determining the overall economic well-

being of that community. In most cases, the community make-up and health are significantly impacted by the availability of jobs, the variety of employment opportunities, and the types of wages provided by local employers. **Table 1H** provides historical employment characteristics from 1990 to 2005 in four analysis categories.

TABLE 1H Historical Employment Statistics* Glendale Municipal Airport					
	1990	1995	2000	2005	Annual % Growth Rate
City of Glendale	NA	NA	85,000	106,000	4.51%
Maricopa County	NA	1,188,000	1,565,000	1,833,000	4.43%
Phoenix-Mesa MSA	1,013,000	1,225,000	1,578,000	1,916,000	4.34%
State of Arizona	1,483,000	1,795,000	2,243,000	2,844,000	4.44%
* All figures rounded to nearest 1,000					
<i>Source: State of Arizona Department of Economic Safety</i>					

Total employment in the region has outpaced population growth. The City of Glendale has grown 4.5 percent annually since 2000. Maricopa County, the Phoenix MSA, and the State of Arizona have all added jobs at a rate better than 4.3 percent annually since 1990. These statistics reveal a long-term, positive employment growth trend, not only for the City, but for the region and state.

Table 1J presents information related to employers in the City of Glendale. The single largest employer is Luke Air Force Base. The base supports nearly 7,000 active-duty Air Force personnel. There are more than 1,000

civilian support positions. The City is also supported by a number of large internationally known companies.

INCOME

Table 1K compares historical per capita personal income (PCPI) for Maricopa County, the Phoenix MSA, the State of Arizona, and the United States between 1990 and 2004. As indicated in the table, the PCPI for Maricopa County has exceeded that of the United States and Arizona. Income trends can often be an indicator of the growth potential of an airport.

TABLE 1J
Major Employers
City of Glendale

Organization	Employees	Description
Luke Air Force Base	6,836 Military 1,071 Civilian	National security, pilot training
Honeywell	2,762	Aviation controls and space systems
Arrowhead Towne Center	2,500	Retail
Banner Health Systems	2,036	Hospital systems
City of Glendale	2,021	City government
Glendale Union High School District #205	1,862	Education
Glendale Elementary School District #40	1,684	Education
Deer Valley Unified School District #97	1,432	Education
Glendale Community College	1,220	Education
Schuck and Sons	1,150	Manufacture prefab wood trusses and doors
Corning Gilbert Engineering Co., Inc.	800	Electrical equipment
Arrowhead Community Hospital	650	Health services
Younger Brothers Construction	600	Cabinet and finish carpentry
Wal-Mart Supercenter	525	Department Store
USPS Encoding Center	500	US Mail Service
Betchel Corp	430	Administrative Office

Source: City of Glendale Economic Development

TABLE 1K
Historical Per Capita Personal Income Statistics
Glendale Municipal Airport

	1990	1995	2000	2004	Annual % Growth Rate
Maricopa County (DES)	\$18,998	\$22,107	\$28,993	\$34,334	4.02%
Phoenix-Mesa MSA	18,645	21,682	28,363	31,133	3.48%
State of Arizona	17,005	19,929	25,660	28,658	3.54%
United States	19,477	23,076	29,845	33,050*	3.59%

Source: Regional Economic Information System, Bureau of Economic Analysis, U.S. Dept. of Commerce

ENVIRONMENTAL INVENTORY

Available information about the existing environmental conditions at Glendale Municipal Airport has been derived from the 2001 and 2005 Environmental Assessments (EAs) pre-

pared for various projects at the airport, as well as from internet resources, agency maps, and existing literature. The intent of this task is to inventory potential environmental sensitivities that might affect future improvements at the airport.

Air Quality

The U.S. Environmental Protection Agency (EPA) has adopted air quality standards that specify the maximum permissible short-term and long-term concentrations of various air contaminants. The National Ambient Air Quality Standards (NAAQS) consist of primary and secondary standards for six criteria pollutants which include: Ozone (O₃), Carbon Monoxide (CO), Sulfur Dioxide (SO₂), Nitrogen Oxide (NO), Particulate matter (PM10), and Lead (Pb). Various levels of review apply within both National Environmental Policy Act (NEPA) and permitting requirements.

Glendale Municipal Airport is located in Maricopa County which is in non-attainment for Ozone (both 8-hour and 1-hour) and Particulate Matter. The non-attainment area for both criteria pollutants is centered on the City of Phoenix.

Department of Transportation Act: Section 4(f)

Section 4(f) properties includes publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance, or any land from a historic site of national, state, or local significance. There are no Section 4(f) resources located on or in the vicinity of airport property, or in an area that may be considered for future acquisition.

Farmlands

The *Farmland Protection Policy Act* (FPPA) authorizes the Department of Agriculture to develop criteria for identifying the effects of federal programs on the conversion of farmland to non-agricultural uses. Farmland protected by the FPPA is classified as either unique farmland, prime farmland (which is not already committed to urban development or water storage), or farmland which is of state or local importance (as determined by the appropriate government agency and the Secretary of Agriculture).

Undeveloped areas surrounding the airport are not classified as prime or unique farmland by the Natural Resources Conservation Service.

Fish, Wildlife, and Plants

The Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) are charged with overseeing the requirements contained within Section 7 of the Endangered Species Act. This act was put into place to protect animal or plant species whose populations are threatened by human activities. Along with the FAA, the FWS and the NMFS review projects to determine if a significant impact to these protected species will result with implementation of a proposed project. Significant impacts occur when the proposed action could jeopardize the continued existence of a protected species or would result in the destruction or adverse modification of federally designated critical habitat in the area.

Vegetation surrounding the airport is limited to shrub-scrub species and native desert grasses and crops which are not anticipated to contain any unique or significant biological features. Correspondence received from the U.S. Fish and Wildlife Service during preparation of the 2001 EA stated that the "terrain along the project area is mainly undeveloped and highly disturbed."

A study done by EcoPlan Associates in 2001 for the 2001 EA revealed that "the project area does not appear to support suitable habitat for the species included in the U.S. Fish and Wildlife Service Endangered, Threatened, Proposed, and Candidate Species List for Maricopa County." The current list, dated August 2006, includes additional species that were not included in the list obtained for the 2001 EA. Additional field surveys would be needed to eliminate their potential existence within the airport environs.

A search conducted utilizing the *State of Arizona On-line Environmental Review Tool* indicated that no special status species have been documented as occurring within the vicinity of the airport; however, further field investigations are highly recommended. Additionally, no proposed or designated critical habitat exists within the airport environs.

Floodplains

Floodplains are defined in *Executive Order 11988, Floodplain Management*, as "the lowland and relatively flat

areas adjoining inland and coastal waters...including at a minimum, that area subject to a one percent or greater chance of flooding in any given year" (i.e., that area would be inundated by a 100-year flood). Federal agencies, including the FAA, are directed to "reduce the risk of loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains." The recent construction of a levee system for the Agua Fria and New River channels has resulted in the airport no longer being located within an area prone to 100-year floods.

Wetlands/Waters of the U.S.

The U.S. Army Corps of Engineers regulates the discharge of dredged and/or fill material into waters of the United States, including adjacent wetlands, under Section 404 of the Clean Water Act. Wetlands are defined in *Executive Order 11990, Protection of Wetlands*, as "those areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetation or aquatic life that requires saturated or seasonably saturated soil conditions for growth and reproduction." Categories of wetlands include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mud flats, natural ponds, estuarine areas, tidal overflows, and shallow lakes and ponds with emergent vegetation. Wetlands exhibit three characteristics: hydrology, hydrophytes

(plants able to tolerate various degrees of flooding or frequent saturation), and poorly drained soils. Previous studies completed for the airport have determined that no wetlands are present on existing airport property.

Wild and Scenic Rivers

The Verde River is the only designated Wild and Scenic River in Arizona. This river is located in northern Arizona well outside of the areas which are impacted by airport operations.

Historical, Architectural, and Cultural Resources

Determination of a project's impact to historic and cultural resources is made in compliance to with the *National Historic Preservation Act (NHPA) of 1966*, as amended for federal undertakings. Two state acts also require consideration of cultural resources. The NHPA requires that an initial review be made of an undertaking's *Area of Potential Effect (APE)* to determine if any properties in or eligible for inclusion in the National Register of Historic Places are present in the area. Previous studies and coordination with the State Historic Preservation Officer (SHPO) have determined that areas within existing airport property do not likely contain protected resources. No known surveys have been conducted for areas outside of airport property.

SUMMARY

The information discussed in this inventory chapter provides a foundation upon which the remaining elements of the planning process will be constructed. Information on current airport facilities and utilization will serve as a basis, with additional analysis and data collection, for the development of forecasts of aviation activity and facility requirement determinations.

DOCUMENT SOURCES

As mentioned earlier, a variety of different sources were utilized in the inventory process. The following listing reflects a partial compilation of these sources. This does not include data provided by airport management as part of their records, nor does it include airport drawings and photographs which were referenced for information. On-site inventory and interviews with staff and tenants contributed to the inventory effort.

Airport/Facility Directory, Southwest, U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office, April 13, 2006 Edition.

Phoenix Sectional Aeronautical Chart, U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office, May 11, 2006.

National Plan of Integrated Airport Systems (NPIAS), U.S. Department of Transportation, Federal Aviation Administration, 2005-2009.

U.S. Terminal Procedures, Southwest U.S., U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office, April 13, 2006.

Glendale 2025 The Next Step - General Plan. Adopted by the Glendale City Council on May 28, 2002.

A number of internet Web sites were also used to collect information for the inventory chapter. These include the following:

FAA 5010 Airport Master Record Data:
<http://www.airnav.com>

Maricopa Association of Governments
<http://www.mag.maricopa.gov/display.cms>

U.S. Census Bureau:
<http://www.census.gov>

The City of Glendale, Arizona
<http://www.ci.glendale.az.us/>

Maricopa County, Arizona
<http://www.maricopa.gov/>

Arizona Department of Economic Security
<http://www.de.state.az.us/ASPNew/default.asp>

Arizona Workforce Informer
<http://www.workforce.az.gov/>

Bureau of Economic Analysis, U.S. Department of Commerce
<http://www.bea.gov/bea/regional/data.htm>



Chapter Two
FORECASTS

Glendale municipal airport

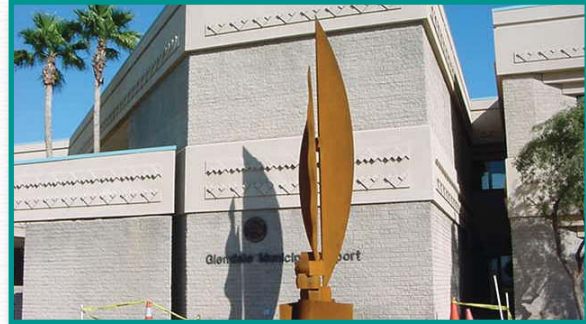
Chapter 2

FORECASTS

Facility planning begins with a definition of demand that may reasonably be expected to occur during the useful life of its key components. In airport master planning, this involves projecting potential aviation activity over at least a twenty-year time frame. For a general aviation reliever airport such as Glendale Municipal Airport (GEU), forecasts of based aircraft and operations (takeoffs and landings) serve as the basis for facility planning.

FAA Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, outlines six standard steps involved in the forecast process, including:

- 1) Obtain existing FAA and other related forecasts for the area served by the airport.
- 2) Determine if there have been significant local conditions or changes in the forecast factors.
- 3) Make and document any adjustments to the aviation activity forecasts.
- 4) Where applicable, consider the effects of changes in uncertain factors affecting demand for airport services.
- 5) Evaluate the potential for peak loads within the overall forecasts of aviation activity.
- 6) Monitor actual activity levels over time to determine if adjustments are necessary in the forecasts.



Aviation activity can be affected by many influences on the local, regional, and national level, making it virtually impossible to predict year-to-year fluctuations of activity over twenty years with any certainty. Therefore, it is important to remember that forecasts are to serve only as guidelines, and planning must remain flexible enough to respond to a range of unforeseen developments.

The following forecast analysis examines recent developments, historical information, and current aviation trends, to provide an updated set of aviation-demand projections for Glendale Municipal Airport. The intent is to permit the City of Glendale to make planning adjustments as necessary to ensure that the facility meets projected demands in an efficient and cost-effective manner.

NOTE: The original forecasts for Glendale Municipal Airport were developed in 2006 with 2005 as the base year. Considering the often volatile nature of the aviation industry, this chapter has been updated to include information now available for years 2006 and 2007. This reexamination was undertaken to determine if there was a compelling reason to change the original forecasts that were approved by the FAA in April 2007. After applying and analyzing the most recent FAA forecasts, in particular, there is no significant reason to change the FAA approved forecasts as originally submitted.

NATIONAL AVIATION TRENDS

Each year, the FAA updates and publishes a national aviation forecast. Included in this publication are forecasts for the large air carriers, regional/commuter air carriers, general aviation, and FAA workload measures. The forecasts are prepared to meet the budget and planning needs of the constituent units of the FAA and to provide information that can be used by state and local authorities, the aviation industry and the general public. The current edition is *FAA Aerospace Forecasts-Fiscal Years 2008-2025*, published in March 2008. The forecasts use the economic performance of the United States as an indicator of future aviation industry growth. Similar economic analyses are applied to the outlook for aviation growth in international markets.

Glendale Municipal Airport is not intended to provide commercial passenger service or significant air cargo capability; therefore, the FAA forecasts regarding general aviation are most applicable.

GENERAL AVIATION

According to figures published by the General Aviation Manufacturers Association (GAMA), U.S. manufacturers of general aviation aircraft delivered 3,279 aircraft in 2007, which is 4.2 percent higher than in 2006. This

respectable increase was the lowest increase in the last four years. Jets and turboprops were up 34.9 and 13.3 percent, respectively. Piston aircraft deliveries were down five percent for single engine and down 2.5 percent for

multi-engine aircraft. Total billings for general aviation aircraft was \$11.9 billion, up 15.2 percent over 2006. **Table 2A** additionally shows worldwide general aviation manufacturing information over the last eight years.

Year	Total	SEP	MEP	TP	J	Net Billings (\$millions)
2000	3,140	1,862	103	415	760	\$13,497.0
2001	2,994	1,644	147	421	782	\$13,866.6
2002	2,687	1,601	130	280	676	\$11,823.1
2003	2,686	1,825	71	272	518	\$9,994.8
2004	2,963	1,999	52	321	591	\$11,903.8
2005	3,580	2,326	139	365	750	\$15,140.0
2006	4,042	2,508	242	407	885	\$18,792.9
2007	4,272	2,417	258	459	1,138	\$21,910.7

SEP - Single Engine Piston; MEP - Multi-Engine Piston; TP - Turboprop; J - Turbofan/Turbojet
Source: General Aviation Manufacturers Association

The trend in general aviation manufacturing and billing over the previous eight years is clear. After a drop in total aircraft manufactured from 2001 through 2003, strong growth has occurred each year beginning in 2004. From 2003 through 2007, worldwide net billings have grown by 55 percent. In 2007, business jet manufacturing reached more than 1,000 units for the first time. Also notable is the resurgence of both turboprop and multi-engine piston aircraft.

certificates. Instead, aircraft manufacturers will build to industry consensus standards. This reduces development costs and subsequent aircraft acquisition costs. This new category places specific conditions on the design of the aircraft, to limit them to “slow (less than 120 knots maximum) and simple” performance aircraft. New pilot training times are reduced and offer more flexibility in the type of aircraft which the pilot would be allowed to operate.

On July 21, 2004, the FAA published the final rule for sport aircraft. The *Certification of Aircraft and Airmen for the Operation of Light-Sport Aircraft* rules, which went into effect on September 1, 2004. This final rule establishes new light-sport aircraft categories and allows aircraft manufacturers to build and sell completed aircraft without obtaining type and production

Viewed by many within the general aviation industry as a revolutionary change in the regulation of recreational aircraft, this new rule is anticipated to significantly increase access to general aviation by reducing the time required to earn a pilot’s license and the cost of owning and operating an aircraft. Since 2004, there have been over 30 new product offerings in this

airplane category alone. These regulations are aimed primarily at the recreational aircraft owner/ operator. By 2025, there is expected to be 14,700 of these aircraft in the national fleet.

While impacting aircraft production and delivery, the events of 9/11 and economic downturn have not had the same negative impact on the business/corporate side of general aviation. The increased security measures placed on commercial flights have increased interest in fractional and corporate aircraft ownership, as well as on-demand charter flights. According to GAMA, the total number of corporate operators has increased every year since 1992. Corporate operators are defined as those companies that have their own flight departments and utilize general aviation airplanes to enhance productivity. **Table 2B** summarizes the number of U.S. companies operating fixed-wing turbine aircraft since 1991.

The growth in corporate operators comes at a time when fractional aircraft programs are experiencing significant growth. Fractional ownership programs sell a share in an aircraft at a fixed cost. This cost, plus monthly maintenance fees, allows the shareholder a set number of hours of use per year and provides for the management and pilot services associated with the aircraft's operation. These programs guarantee the aircraft is available at any time, with short notice. Fractional ownership programs offer the shareholder a more efficient use of time (when compared with

commercial air service) by providing faster point-to-point travel times and the ability to conduct business confidentially while flying. The lower initial startup costs (when compared with acquiring and establishing a flight department) and easier exiting options are also positive benefits.

Year	Number of Operators	Number of Aircraft
1991	6,584	9,504
1992	6,492	9,504
1993	6,747	9,594
1994	6,869	10,044
1995	7,126	10,321
1996	7,406	11,285
1997	7,805	11,774
1998	8,236	12,425
1999	8,778	13,148
2000	9,317	14,079
2001	9,709	14,837
2002	10,191	15,569
2003	10,661	15,870
2004	10,735	16,369
2005	10,809	16,867

Source: GAMA/NBAA

Since beginning in 1986, fractional jet programs have flourished. **Table 2C** summarizes the growth in fractional shares since 1986. The number of aircraft in fractional jet programs has grown rapidly. In 2001, there were 696 aircraft in fractional jet programs. This grew to 776 aircraft in fractional jet programs at the end of 2002, and 823 in 2003. There were 949 aircraft at the end of 2005.

TABLE 2C
Fractional Shares and Number of Aircraft In Use

Year	Number of Shares	Number of Aircraft
1986	3	NA
1987	5	NA
1988	26	NA
1989	51	NA
1990	57	NA
1991	71	NA
1992	84	NA
1993	110	NA
1994	158	NA
1995	285	NA
1996	548	NA
1997	957	NA
1998	1,551	NA
1999	2,607	NA
2000	3,834	NA
2001	3,415	696
2002	4,098	776
2003	4,516	826
2004	4,765	865
2005	4,691	949

Source: GAMA

Very light jets (VLJs) are expected to enter the operational fleet in 2006. Also known as microjets, the VLJ is defined as a jet aircraft that weighs less than 10,000 pounds. There are several new aircraft under development, with the Eclipse 500, Cessna Mustang, and Adams 700 jets entering service in 2006. These jets cost between \$2 and \$3 million, can takeoff on runways less than 3,000 feet, and cruise at 41,000 feet at speeds in excess of 300 knots. The VLJ is expected to redefine the business jet segment by expanding business jet flying and offering operational costs that can support on-demand air taxi point-to-point service. The FAA indicated that 143 VLJs entered service in 2007.

This category of aircraft is expected to expand to 450 to 500 aircraft per year, reaching nearly 8,145 aircraft by 2025.

The FAA expects the U.S. economy to continue to expand through 2018 with moderate growth rates between 2.7 and 3.0 percent and then slowing to 2.5 percent annually through 2025. The long term stability of the U.S. economic growth is dependent on continued growth in the workforce, the capital stock, and improved productivity. A major risk is the “upward pressure on commodity prices, including the price of oil worldwide.”

The FAA forecasts assume there will not be a significant terrorist attack on the aviation industry or an international pandemic. The FAA warns that if either of these occur, “It is likely that severe limits on aviation would be enacted and would have a significant impact on the demand for aviation services.” The FAA also considered the influence of rising oil and fuel prices. The forecasts were developed when oil first reached \$100/barrel in January 2008. Oil prices reached over \$140/barrel but have since settled down to below \$110/barrel as of August 2008. Nonetheless, fuel prices today are 20 percent higher than what the FAA used in their forecasts.

According to the FAA forecasts, “High fuel prices and concerns about the economy are dampening the near-term prospects for the general aviation industry, but the long-term outlook remains favorable.” The FAA sees strong growth in business aviation demand, including continued growth in fractional jet ownership programs. The entrance to the market of the first

VLJ in late 2006 could have a significant impact on general aviation, especially for “on-demand” air taxi service to smaller general aviation airports.

Overall, the general aviation fleet is estimated by the FAA to have increased 1.4 percent in 2007 to 225,007. General aviation flight hours are estimated to have increased 0.6 percent in 2007 to 27.7 million. Of all the statistical markers tracked by the FAA, only the number of student pilots decreased for the third consecutive year, down 0.6 percent in 2007.

The FAA forecasts through 2025 show positive growth trends in every category tracked. The business jet fleet is projected to grow 5.6 percent annually. The total number of piston-powered aircraft is forecast to slow slightly over the next two years, then show annual growth averaging 0.5 percent growth through 2025. Total general aviation hours flown is projected to increase 3.0 percent annually with business jets representing the strongest growth, estimated at 7.7 percent annually. Piston powered hours flown are estimated to grow 1.1 percent annually, while other turbine powered aircraft (turboprops and helicopters) are projected to show an annual increase of 5.3 percent in hours flown. **Exhibit 2A** shows the FAA forecast for growth in general aviation aircraft.

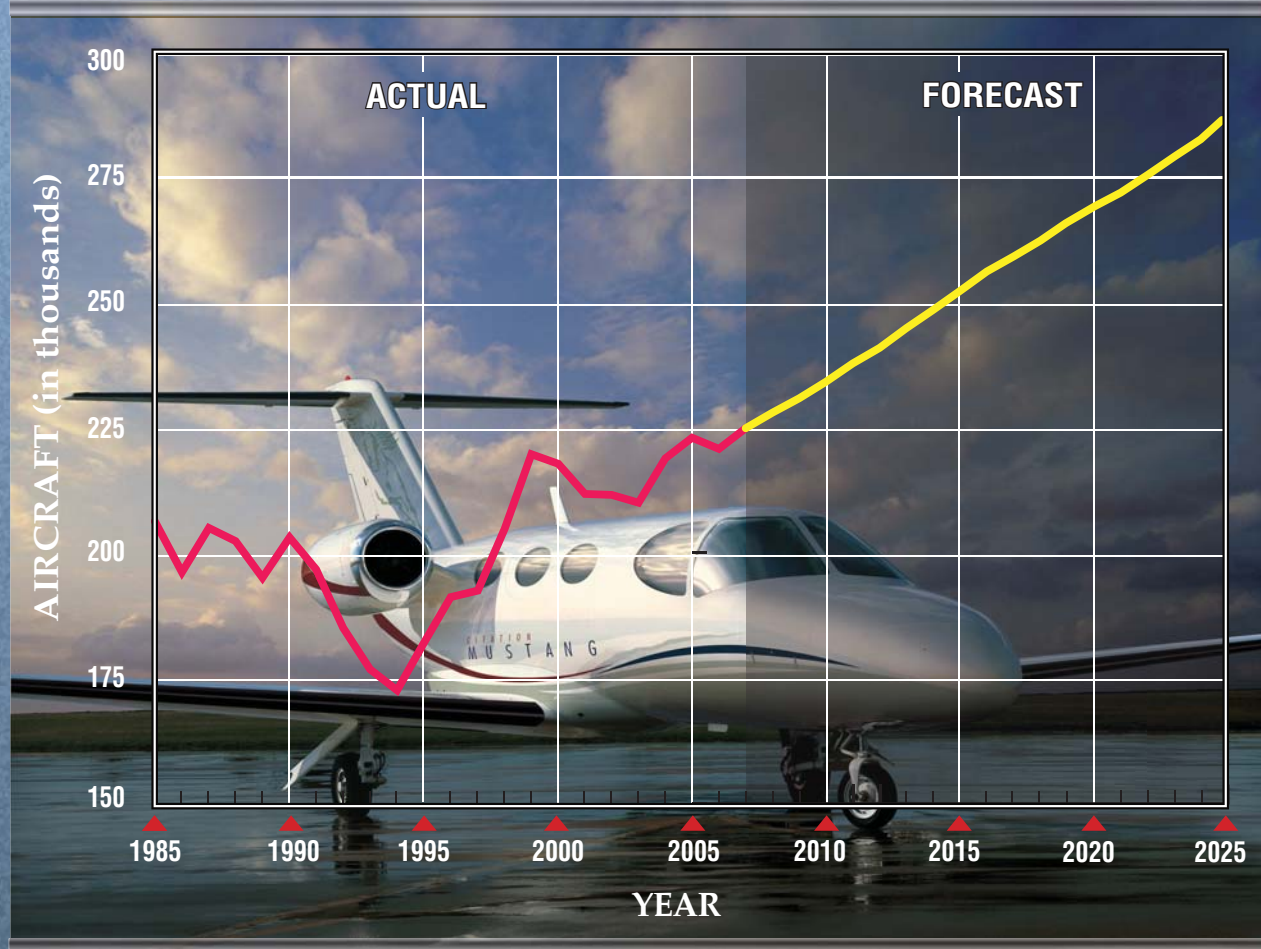
The FAA forecasts continue on to note that the substantial growth in business jet hours flow is reflective in increases in VLJ activity and continued growth in fractional ownership programs. “Fractional ownership aircraft fly about 1,200 hours annually com-

pared to approximately 350 hours for all business jets in all applications.”

The number of general aviation pilots is also expected to increase over the FAA forecast period at an annual rate of 0.7 percent. This growth rate would add a total of 61,000 new pilots to the field.

Over the past several years, the general aviation industry has launched a series of programs and initiatives whose main goals are to promote and assure future growth within the industry. The “No Plane, No Gain”, is an advocacy program created in 1992 by the General Aviation Manufacturers Association (GAMA) and the National Business Aircraft Association (NBAA) to promote acceptance and increased use of general aviation as an essential, cost-effective tool for businesses. Other programs are intended to promote growth in new pilot starts and introduce people to general aviation. “Project Pilot,” sponsored by the Aircraft Owners and Pilots Association (AOPA), promotes the training of new pilots in order to increase and maintain the size of the pilot population. The “Be a Pilot” program is jointly sponsored and supported by more than 100 industry organizations. The NBAA sponsors “AvKids,” a program designed to educate elementary school students about the benefits of business aviation to the community and career opportunities available to them in business aviation. Over the years, programs such as these have played an important role in the success of general aviation and will continue to be vital to its growth in the future.

U.S. ACTIVE GENERAL AVIATION AIRCRAFT



U.S. ACTIVE GENERAL AVIATION AIRCRAFT (in thousands)

Year	FIXED WING				ROTORCRAFT			Sport Aircraft	Other	Total
	PISTON		TURBINE		Piston	Turbine	Experimental			
	Single Engine	Multi-Engine	Turboprop	Turbojet						
2007 (Est.)	144.6	18.5	8.2	11.0	3.6	6.0	23.9	2.7	6.4	225.0
2015	145.6	17.2	9.3	19.8	6.2	7.3	29.7	10.5	6.5	252.3
2020	150.0	16.5	10.1	24.9	7.3	7.9	32.6	13.2	6.4	268.9
2025	157.4	15.6	10.8	29.5	8.3	8.6	35.2	14.7	6.4	286.5

Source: FAA Aerospace Forecasts, Fiscal Years 2008-2025.

Notes: An active aircraft is one that has a current registration and was flown at least one hour during the calendar year.



STATE AND REGIONAL TRENDS

The Arizona Department of Transportation (ADOT) Aeronautics Division assists airports in the state in identifying infrastructure needs with a state aviation needs study and other special aviation studies. The most recent study on a statewide basis is the *State Aviation Needs Study (SANS) - 2000*.

The SANS-2000 includes forecasts of aviation activity in the state. The Maricopa Association of Governments (MAG) is charged with preparing and updating a *Regional Aviation System Plan (RASP)* for the Phoenix metropolitan area. The most recent aviation forecasts for the MAG-RASP were prepared in late 2001, after the events of September 11. The forecasts were adopted by MAG in 2003.

Table 2D depicts the based aircraft forecasts prepared from the SANS - 2000 for the State of Arizona and Maricopa County. The base year for

these forecasts was 1998. The SANS 2000 forecasts that based aircraft in the state would grow at an annual average rate of 1.3 percent through 2020. This is in-line with current FAA forecasts of 1.4 percent annual growth over the next 12 years.

The percentage of Arizona-based aircraft in Maricopa County was actually forecast to decline over the years from 57.6 percent in 1998 to 54.8 percent in 2020. Thus, the average growth rate for based aircraft in Maricopa County was projected to be lower, at 1.07 percent.

Table 2D also presents the more recent forecast of Maricopa County based aircraft prepared for the MAG-RASP. The base year for this forecast was 2000. It is clear from the table that the more recent MAG-RASP forecasts are somewhat higher than those of the SANS-2000. In fact, the actual based aircraft from the MAG-RASP in 2000 were more than the SANS -2000 forecast for 2010.

TABLE 2D						
State and Regional Based Aircraft Forecasts						
Arizona and Maricopa County						
	Base Year	2005	2010	2015	2020	2025
SANS 2000						
Arizona	6,700	7,156	7,674	8,247	8,896	NA
Maricopa County	3,857	4,065	4,303	4,568	4,877	NA
MAG-RASP						
Maricopa County	4,133	4,615	5,240	5,950	6,585	7,288
<i>Sources: State Aviation Needs Study - 2000, ADOT, 1999.</i>						
<i>Regional Airport System Plan, Maricopa Association of Governments, 2001.</i>						
* Base Year: SANS-1998; MAG RASP-2000						

The MAG RASP forecast projects total based aircraft in the region to reach 7,288 by 2025. This would be an an-

nual average increase of 2.16 percent, significantly stronger than the nation-

al or statewide growth rates projected by FAA and ADOT, respectively.

The MAG-RASP projects fixed-wing turbine aircraft based in the county to grow from 170 in 2000, to 427 by 2025. This would be an increase of 151 percent (3.75 percent annually). Turbine aircraft would also grow as a percentage of all based aircraft from 3.9 percent in 2000, to 9.3 percent in 2025.

SERVICE AREA

The generalized service area of an airport is defined by its proximity to other airports providing similar service. Glendale Municipal Airport is one of several airports serving the general aviation needs of the West Valley.

Exhibit 2B depicts Glendale Municipal Airport in relationship to other airports that serve the West Valley. The airports with comparable capabilities

are Goodyear to the south, Buckeye to the west, Deer Valley to the northeast, Scottsdale and Phoenix Sky Harbor International Airport to the east. Pleasant Valley Airport is also included in the list as there are a significant number of based aircraft. **Table 2E** presents the regional airports.

These seven airports base a total of 2,536 aircraft. Phoenix Deer Valley Airport has the most with 1,252 based aircraft, more than the other five combined. Phoenix Sky Harbor International Airport (PHX) had the most annual operations in 2004 with 564,000, of which approximately 100,000 were conducted by general aviation aircraft. Phoenix Deer Valley Airport was next at 378,000. Both of these airports have parallel runways available, allowing them to better accommodate higher traffic levels than the other five airports.

TABLE 2E
Public Use Airports Serving West Phoenix Valley Area
Glendale Municipal Airport

Airport	FAA Classification	Approach Minimums (feet-miles)	Location	Longest Runway	Based Aircraft (2005)	Annual Operations (2005)
Phoenix Goodyear	Reliever	Visual	7 nm SW	8,500	209	101,000
Phoenix Deer Valley	Reliever	600-1.5	14 nm NE	8,208	1,252	378,000
Phoenix Sky Harbor Intl.	Commercial	200-1/2	15 nm E	11,489	237	564,000
Pleasant Valley	GA	Visual	17 nm N	4,200 (dirt)	64	75,000
Scottsdale	Reliever	700-1 3/4	20 nm E	8,249	460	166,000
Glendale	Reliever	474-1	NA	7,150	380	133,000
Buckeye	GA	Visual	21 nm WSW	5,500	62	40,000

GA: General Aviation

nm: Nautical Miles

Source: FAA Form 5010, AirNav.com; FAA Tower Records; Airport records

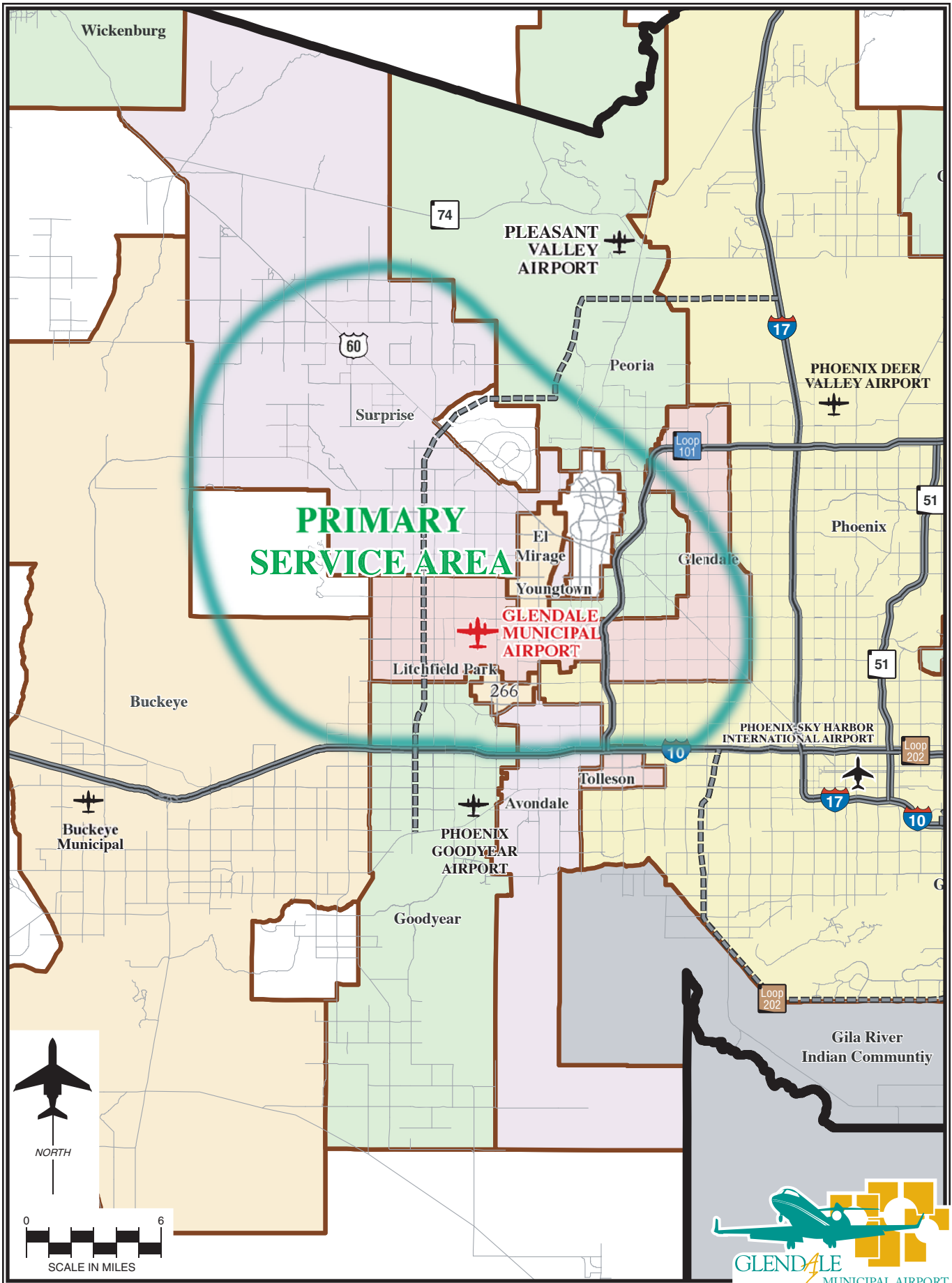


Exhibit 2B
GENERALIZED AIRPORT SERVICE AREA

The MAG-RASP has considered alternatives for developing new airports in the north valley. There are no specific sites, but the MAG-RASP includes a potential new general aviation airport in an area east of Fountain Hills in the vicinity of Highway 87, and north-east of the Salt River-Maricopa Indian Community. The study recognized an airport in this area would have only moderate potential for implementation because of the location in the Tonto National Forest and the proximity to Indian communities.

Considerations to the northwest include either the expansion of the Pleasant Valley Airport or a replacement airport in that same general area. A draft study was prepared for the City of Peoria in 2000 which recommended improvement of the existing private airport, but that study was tabled and has never been adopted.

A number of factors are considered when defining the airport service area. The number one factor for an aircraft owner looking to rent aircraft storage space is convenience to home or place of business. Based upon this consideration the airport service area is limited by comparable airports such as Phoenix Deer Valley and Phoenix Goodyear. As a result, the primary

service area for Glendale Municipal Airport is generally comprised of western Phoenix, Glendale, Avondale, Peoria, and the northern portion of Goodyear as shown on **Exhibit 2B**.

In July of 2003, MAG adopted a new set of population, housing, and employment forecasts for the county. This included not only the county and city totals but also a breakdown of Regional Analysis Zones (RAZ). Each RAZ is typically smaller than a city and allows a more accurate socio-economic analysis of the airport service area. For example, the primary airport service area only includes the northern portion of the City of Goodyear (since there is already a capable GA airport in Goodyear) and the RAZ analysis allows the inclusion of only this portion.

As shown on **Table 2F**, the population of the service area totaled 410,220 in 2000. This represented 13.25 percent of the population of Maricopa County. Through the year 2030, the population of the service area is projected to grow at a greater percentage annually than Maricopa County and is projected to account for nearly 16.5 percent of the entire county population. This anticipates strong growth for the West Valley.

TABLE 2F**Population Forecasts for the Service Area
Glendale Municipal Airport**

	Actual	Forecast			
	2000	2010	2020	2025	2030
Avondale	25,054	48,800	62,240	71,124	79,707
East Buckeye	2,119	8,759	23,548	51,668	74,858
County Areas	64,753	68,638	75,191	77,349	79,849
El Mirage	8,723	29,686	31,383	32,211	33,075
Glendale	183,467	237,124	253,737	255,321	257,452
North Goodyear	8,868	16,998	32,724	36,824	41,578
Litchfield Park	3,831	7,048	13,686	13,702	14,210
South Peoria	79,072	97,473	99,237	99,649	100,118
Surprise	26,322	100,617	177,327	253,047	316,077
Tolleson	4,998	6,146	6,231	6,241	6,257
Youngstown	3,013	5,415	6,197	6,336	6,557
Total	410,220	626,704	781,501	903,472	1,009,738
Avg. Annual % Change	NA	4.33%	2.23%	2.94%	2.25%
Maricopa County	3,096,613	4,134,388	5,164,142	5,663,999	6,139,971
Avg. Annual % Change	NA	2.93%	2.25%	1.87%	1.63%
Service Area % of County	13.25%	15.16%	15.13%	15.95%	16.45%

Source: Interim Projections of Population, Housing, and Employment, Maricopa Association of Governments, July 2003

Table 2G indicates that employment in the Glendale Municipal Airport service area was 146,512 in 2000, or 9.36 percent of the total employment in Maricopa County. By 2030, employment in the service area is projected to account for more than 14.5 percent of Maricopa County. Both the population and employment figures for the airport service area indicate that the West Valley area is a high growth area for the entire Phoenix Metropolitan area.

Population and employment are projected to increase through 2010 at average annual rates of 4.33 percent and 5.04 percent, respectively. The growth rates decrease slightly between 2010

and 2020, to 2.23 and 3.58 percent annually. Between 2020 and 2025, the average annual growth rate for population increases to 2.94 percent for population and increases to 3.71 percent for employment.

The percentage of the county population in the Glendale Municipal Airport service area is projected to increase significantly over the entire forecast period. Thus, population in the airport service area is expected to grow at a greater rate than that of the entire County. The percentage of county employment in the airport service area is also expected to increase, even out pacing population.

TABLE 2G**Employment Forecasts for the Service Area
Glendale Municipal Airport**

	Actual	Forecast			
	2000	2010	2020	2025	2030
Avondale	5,865	13,694	36,350	39,277	44,398
East Buckeye	250	2,477	7,753	13,863	20,817
County Areas	20,315	20,829	21,879	22,887	23,853
El Mirage	1,885	4,541	9,168	15,710	23,560
Glendale	70,021	107,141	133,209	147,170	165,131
North Goodyear	6,299	9,893	21,521	24,817	29,652
Litchfield Park	1,178	3,612	4,321	4,423	4,263
South Peoria	20,572	35,007	41,873	43,143	44,833
Surprise	6,126	24,634	42,630	70,688	100,977
Tolleson	12,777	16,046	20,278	25,085	30,904
Youngstown	1,224	1,698	1,623	1,649	1,679
Total	146,512	239,572	340,605	408,712	490,067
Avg. Annual % Change	NA	5.04%	3.58%	3.71%	3.70%
Maricopa County	1,564,836	2,112,000	2,705,000	3,002,000	3,377,000
Avg. Annual % Change	NA	3.04%	2.51%	2.11%	2.38%
Service Area % of County	9.36%	11.34%	12.59%	13.61%	14.51%

Source: Interim Projections of Population, Housing, and Employment, Maricopa Association of Governments, July 2003

The West Valley, including much of the airport service area, represents one of the fastest growing regions in one of the fastest growing metropolitan areas in the country. According to the U.S. Census Bureau, Arizona ranks behind only Nevada for both population growth and employment opportunities as of 2006. The Phoenix metropolitan area has consistently ranked in the top five for these growth factors over the last 10 ten years.

BASED AIRCRAFT

The number of based aircraft is one of the most basic indicators of general aviation demand. By first developing a forecast of based aircraft, the growth of other general aviation activities and

needs can be projected. **Table 2H** presents a history of based aircraft at Glendale Municipal Airport dating back to 1986. The based aircraft totals at Glendale Municipal Airport have fluctuated from a low of 160 in 1992 to a high of 380 in 2005.

A substantial increase in based aircraft in the previous years can be attributed to a number of factors. First for much of 2003 the airport was closed while the runway was extended. Since the previous master plan in 1998, seven connected box hangar structures with 143 individual storage units were constructed. In addition, eight box hangars have been constructed on the south end of the airport. This has provided the capacity to base approximately 155 more

aircraft at the airport since the last master plan when there were just 180 based aircraft.

TABLE 2H
Based Aircraft History
Glendale Municipal Airport

Year	Total Based	Source
1986	205	MAG
1987	209	MAG
1988	197	MAG
1989	167	MAG
1990	202	MAG
1991	167	MAG
1992	160	MAG
1993	143	MAG
1994	178	MAG
1995	184	MAG
1996	188	MAG
1997	184	MAG
1998	180	MAG
1999	197	MAG
2000	208	MAG
2001	269	TAF
2002	269	TAF
2003	271	TAF
2004	324	GEU
2005	380	GEU
2006	402	TAF
2007	405	TAF

MAG: Maricopa Association of Governments
TAF: FAA Terminal Area Forecast
ADOT: Arizona Department of Transportation

Table 2J compares the based aircraft at each of the airports serving the West Valley from 1994-2005. The total number of based aircraft at these airports has increased by 53 percent since 1994. As can be seen from the table, only Phoenix Sky Harbor International Airport is forecast to lose

based aircraft. This can be attributed to the growth of air carrier service at Sky Harbor and the City policy of accommodating general aviation aircraft at regional reliever airports. Typically, operators of smaller piston powered aircraft will choose to base at an airport without air carrier service in order to avoid the interaction with larger aircraft.

Buckeye Municipal Airport and Phoenix Goodyear Airports are projected to grow substantially in the forecast years. This can be attributed to significant population increases in the West Valley, ample landside development opportunity, and a loss of based aircraft at Phoenix Sky Harbor. Phoenix Deer Valley Airport is projected to experience the greatest addition of based aircraft going from 1,267 to 2,084 aircraft between 2004 and 2025.

It should be noted that growth of based aircraft at Phoenix Deer Valley Airport, in particular, is dependent upon adequate aircraft storage being made available and improvements in airfield capacity being made. Recent forecasts in the Phoenix Deer Valley Airport Master Plan, currently under development, indicate that the current two runway system may only be capable of accommodating a total of 1,521 based aircraft. This means a total of 664 aircraft forecast to be based at Phoenix Deer Valley Airport in the long term may need to be accommodated elsewhere.

Year	West Valley Total	Phoenix Goodyear	Phoenix Sky Harbor	Phoenix Deer Valley	Buckeye	Pleasant Valley
1994	1,449	153	224	803	70	21
1997	1,627	198	265	908	46	26
2000	2,031	198	237	1,206	55	45
2005	2,220	208	231	1,267	70	64
% Change 1994-2005	53%	36%	3%	58%	0%	205%
2010	2,513	411	205	1,457	96	69
2015	2,843	498	183	1,675	101	86
2025	3,488	657	135	2,084	132	116
% Change 2005-2025	57%	216%	-42%	64%	89%	81%

The MAG-RASP forecast first projected the total aircraft based at public airports in Maricopa County, then distributed these aircraft to the airports within the county. A strong correlation was found between Maricopa County based aircraft and the County's population. Thus, the county-wide based aircraft forecasts were derived from a linear regression, using the county population as the independent variable.

The MAG-RASP was prepared based on population forecasts from 1997. At the time a very strong correlation between county population and county based aircraft was found to result from regression analysis ($r^2 = 0.97$). In July of 2003, the MAG adopted updated population forecasts. The population forecasts used by the MAG-RASP in 1997 projected 4.95 million

residents in the county by 2025. The updated population forecast expects 5.66 million residents, or 12.5 percent higher than previously forecast.

Because the MAG-RASP found a very high correlation ($r^2 = 0.97$) between population and based aircraft, this regression was updated with additional based aircraft and population data that became available in 2003. The correlation coefficient of expanded historic data remained at 0.97. A new projection utilizing the updated county population forecast was then developed. This results in an updated projection of 7,641 based aircraft at the airports in the county by 2025. This figure is 4.8 percent higher than the original MAG-RASP projection. The original MAG-RASP forecast and the updated MAG-RASP forecast are presented in **Table 2K**.

TABLE 2K Glendale Based Aircraft Forecasts Maricopa Association of Governments						
	2000	2005	2010	2015	2020	2025
SANS-2000						
GEU	258	280	314	352	395	N/A
County	3,857	4,065	4,303	4,568	4,877	N/A
GEU % of County	6.69%	6.89%	7.30%	7.71%	8.10%	N/A
MAG-RASP Forecasts						
GEU	208	237	275	300	332	364
County	4,133	4,615	5,282	5,950	6,618	7,288
GEU % of County	5.03%	5.14%	5.21%	5.04%	5.02%	4.99%
FAA-TAF (2008)	208	269	415	442	459	478
1998 Master Plan	225	260	300	340	375	NA
Updated MAG-RASP Forecasts*						
GEU	208	380	454	534	617	703
County	4,133	4,737	5,474	6,211	6,937	7,641
GEU % of County	5.03%	8.02%	8.30%	8.60%	8.90%	9.20%
<i>Source: *Coffman Associates update to account for 2003 interim socioeconomic data.</i>						

The SANS-2000 presents forecasts of based aircraft for both Maricopa County and Glendale Municipal Airport. The SANS-2000 forecasts based aircraft for Glendale Municipal Airport increasing from 6.89 percent of the county based aircraft to 8.10 percent by 2020. The SANS-2000 forecasts 280 based aircraft for 2005 and 395 for 2020. With 380 existing based aircraft the 2005 and 2010 projections have already been reached.

All forecast levels for the MAG-RASP have been exceeded. Based on this, these forecasts cannot be used to determine future based aircraft levels for Glendale Municipal airport and have been removed from consideration.

In addition to the MAG-RASP and the SANS-2000, the FAA presents a forecast of based aircraft for Glendale Municipal Airport in the Terminal Area Forecast (TAF). The TAF forecasts 415, 442, and 478 based aircraft

in the years 2010, 2015 and 2025 respectively. The previous airport master plan forecast 260 based aircraft in 2005 and 375 by 2020. The FAA forecast was updated in 2008 and will be considered when forecasting based aircraft into the future.

The MAG-RASP projected that Glendale Municipal Airport's market share of based aircraft in Maricopa County would remain steady at approximately five percent through the planning period. This percentage is increased in the updated MAG-RASP forecasts to account for the fact that the airport service area is projected to grow at a greater rate in both population and employment than Maricopa County. This growth would actually justify a more substantial growth in based aircraft for the airport as a percentage of county based aircraft but a number of factors lead to the tempering of the based aircraft growth rate.

Both Phoenix Goodyear and Buckeye Municipal Airports are beginning to emerge as strong growth airports in the region. Both of the airports have ample room to expand aircraft storage facilities. Because of this the Glendale Municipal Airport's percentage of based aircraft as a share of county based aircraft incrementally increases from 8.02 percent in 2005 to 9.2 percent in 2025. This results in 703 based aircraft for Glendale Municipal Airport by 2025.

This forecast represents an overall annual growth rate of 3.1 percent between 2005 and 2025. This compares favorably with the 3.3 percent growth rate experienced at the airport between 1986 and 2006. The following forecast for based aircraft at Glendale Municipal Airport will be utilized to determine facility needs at the airport over the next 20 years.

- **2010 - 454 Based Aircraft**
- **2015 - 534 Based Aircraft**
- **2025 - 703 Based Aircraft**

This forecast represents an unconstrained forecast and does not consider the potential limitations, if any, for construction of aircraft storage hangars at Glendale Municipal Airport. In the airport development alternatives to be presented in Chapter Four of this master plan, constraints will be considered. Thus, if hangar development is unable to keep pace with demand, based aircraft numbers will not increase as forecast. The comparable based aircraft forecasts and the selected forecast are depicted on **Exhibit 2C**.

BASED AIRCRAFT FLEET MIX

The based aircraft fleet mix at Glendale Municipal Airport is presented in **Table 2L**. The forecast fleet mix utilizes existing local trends as well as forecast U.S. general aviation trends as presented in *FAA Aerospace Forecasts Fiscal Years 2008-2025*. The FAA projects that business jets will continue to be the fastest growing general aviation aircraft type in the future. The number of business jets in the U.S. fleet is expected to more than double in the next 12 years. This represents an annual growth rate of 5.6 percent. Turboprop aircraft are the next fastest growing segment at 1.6 percent annually. Piston powered aircraft are also expected to grow but at only 0.5 percent for single engine and -0.9 percent for multi-engine annually.

While single engine piston powered aircraft are projected to continue to dominate the based aircraft fleet mix at Glendale Municipal Airport, business jets and turboprop aircraft are expected to experience significant growth. Currently there are no business jets but there are two Navy A-6s and three Russian Migs based at the airport that are in various states of renovation. There are five turboprop aircraft based at the airport. The fleet mix forecast indicates that as many as 16 turboprops and 20 jets, including the historic warbirds, could base at the airport by 2025.

**TABLE 2L
Based Aircraft Fleet Mix
Glendale Municipal Airport**

	Current	%	2010	%	2015	%	2025	%
Single Engine Piston	338	88.9%	404	89.0%	474	88.8%	624	88.8%
Multi-Engine Piston	16	4.2%	17	3.7%	18	3.4%	20	2.8%
Turboprop	5	1.3%	8	1.8%	11	2.1%	16	2.3%
Jet	5	1.3%	8	1.8%	12	2.2%	20	2.8%
Helicopter/Other	16	4.2%	17	3.7%	19	3.6%	23	3.3%
Totals	380	100.0%	454	100.0%	534	100.0%	703	100.0%

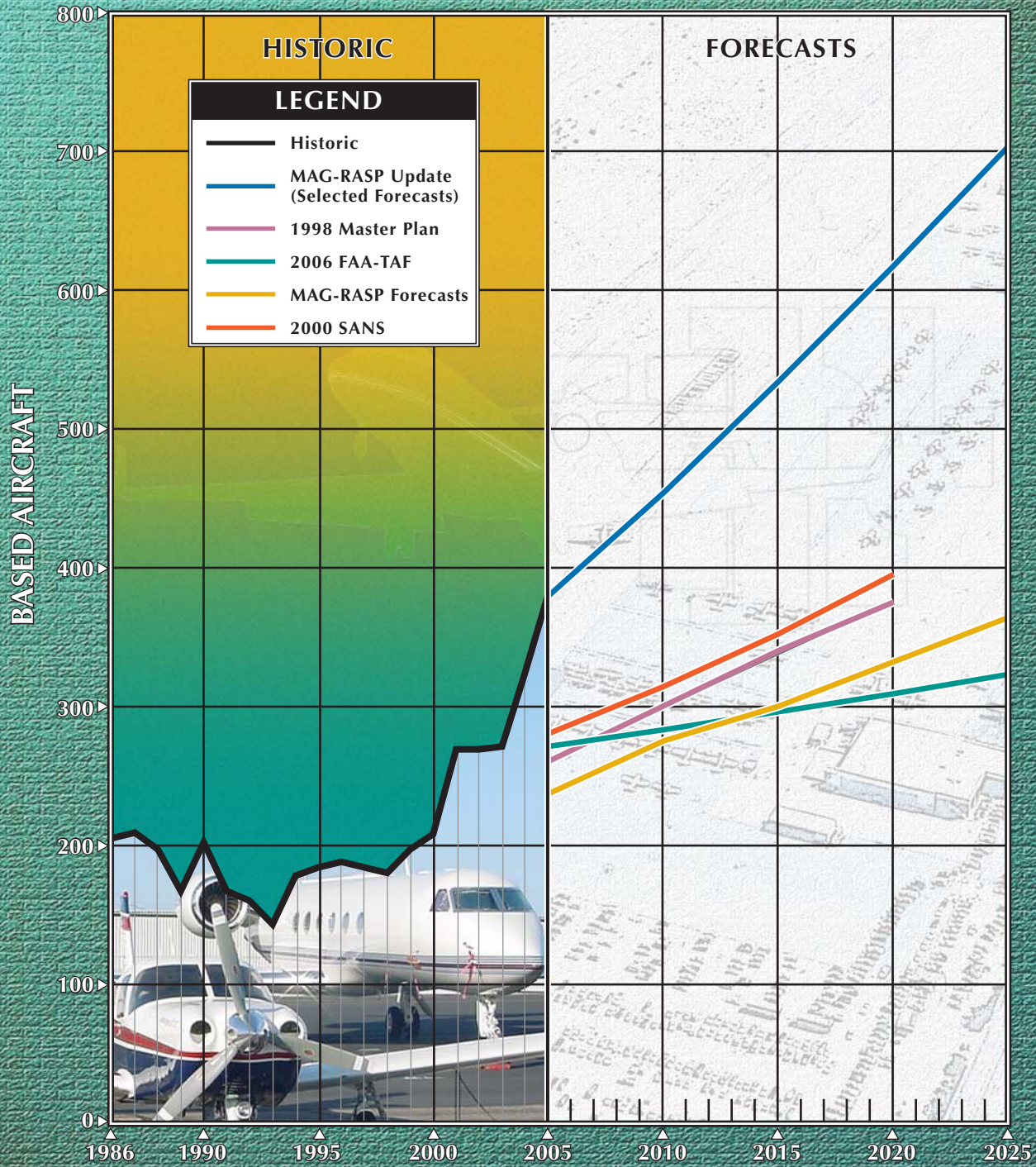
The growth in based jets is forecast to out pace the growth in turboprop aircraft for a number of reasons. Nationally, the introduction of business jets to the fleet is expected to out-pace turboprops. The introduction of very light jets (VLJ) will likely attract buyers who might otherwise purchase a turboprop due to the similarity of cost. Glendale Municipal Airport is also perfectly positioned to attract VLJ activity because of the excellent general aviation facilities including the airport terminal building, adequate runway length, and the airport traffic control tower (ATCT). In addition, Glendale is growing substantially in terms of employment and population. These factors add to the optimism for business jet growth at the airport.

ANNUAL OPERATIONS

General aviation operations are classified by the airport traffic control tower (ATCT) as either local or itinerant. A local operation is a take-off or landing performed by an aircraft that operates

within sight of the airport, or which executes simulated approaches or touch-and-go operations at the airport. Itinerant operations are those performed by aircraft with a specific origin or destination away from the airport. Generally, local operations are characterized by training operations. Typically, itinerant operations increase with business and commercial use.

Table 2M depicts the history of general aviation operations, as counted by the ATCT, at Glendale Municipal Airport since 1996. Itinerant operations increased from 38,901 in 1996, to 45,561 in 2007. Local operations dropped significantly in 2003, primarily due to the runway extension project. Itinerant operations reached a new high of 47,035 in 2006. Overall operations have increased over the last five years from a low of 92,823 in 2003 to 150,729 in 2007. These operational statistics are the actual ATCT counts conducted when the tower is open and do not reflect operations that occur while the tower is closed.



FAA-TAF: Federal Aviation Administration - Terminal Area Forecast
MAG-RASP: Maricopa Association of Governments - Regional Aviation System Plan
SANS: State Aviation Needs Study



TABLE 2M
Historical Operations
Glendale Municipal Airport

Year	Itinerant Operations				Local Operations			Total Operations
	Air Taxi	GA	Military	Total	GA	Military	Total	
1996	0	38,779	122	38,901	78,176	1,240	79,416	118,317
1997	315	41,327	321	41,963	80,941	8,806	89,747	131,710
1998	1	43,744	139	43,884	72,133	806	72,939	116,823
1999	14	45,992	46	46,052	86,174	19	86,193	132,245
2000	2,311	40,290	232	42,833	73,269	20	73,289	116,122
2001	2,062	39,518	329	41,909	68,287	1,368	69,655	111,564
2002	1,813	36,221	137	38,171	72,784	426	73,210	111,381
2003	1,766	40,883	25	42,674	50,135	14	50,149	92,823
2004	1,712	42,538	235	44,485	71,955	95	72,050	116,535
2005	1,801	43,339	21	45,161	83,694	29	83,723	128,884
2006	1,473	45,445	117	47,035	97,598	52	97,650	144,685
2007	1,021	44,480	60	45,561	105,137	31	105,168	150,729

Source: Airport Tower Records/TAF

Glendale Municipal Airport has realized approximately 36 percent of total operations as itinerant and 64 percent as local over the previous ten years. This is a common ratio for urban/suburban reliever airports with significant training activity.

The Maricopa Association of Governments and the Arizona Department of Transportation - Aeronautics Division, have developed operational forecasts for Glendale Municipal Airport as pre-

sented in **Table 2N**. The MAG-RASP forecasts strong growth for both local and itinerant operations. The 2001 MAG-RASP, forecast 128,100 operations in 2005, increasing to 197,000 by 2025. The MAG RASP 2005 forecast was nearly the same as the 128,884 operations counted by the ATCT in 2005. The SANS-2000 forecast a total of 166,340 operations in 2005 and 226,836 by 2020. The TAF presents the most conservative forecast with 179,751 operations by 2025.

TABLE 2N Previous General Aviation Operations Forecasts Glendale Municipal Airport						
	2000	2005	2010	2015	2020	2025
Itinerant GA Operations						
MAG-RASP (2001)	41,993	47,397		60,162		73,500
FAA-TAF (2008)	42,833	45,161	49,050	54,912	58,971	63,338
Local GA Operations						
MAG-RASP (2001)	70,577	80,703		102,438		123,500
FAA-TAF (2008)	73,289	83,723	106,965	110,028	113,178	116,413
Total GA Operations						
MAG-RASP (2001)	112,570	128,100		162,600		197,000
FAA-TAF (2008)	116,122	128,884	156,015	164,940	172,149	179,751
1998 Master Plan	135,000	155,000	175,000	195,000	215,000	
SANS-2000 (1998)		166,340	184,460	204,553	226,836	
<i>Sources: Maricopa Association of Governments - Regional Aviation System Plan (MAG-RASP); Federal Aviation Administration - Terminal Area Forecast (FAA-TAF); State Aviation Needs Study - 2000 (SANS-2000)</i>						

ITINERANT OPERATIONS

Table 2P outlines the history of itinerant operations in relation to the total general aviation itinerant operations at towered airports in the U.S. The Glendale Municipal Airport market share, as a percentage of general aviation itinerant operations at towered airports across the country, increased from a low of 0.1689 percent in 2002, to a high of 0.2425 percent in 2006. This shows that overall itinerant operations in the U.S. have declined slightly since 9/11 but Glendale Municipal Airport has not experienced this decline. In fact, Glendale Municipal Airport has actually experienced an increase in itinerant operations. Many factors contribute to this trend

including the significant growth of population and employment in the airport service area.

In an effort to further confirm or modify as necessary the existing operational forecasts from MAG, ADOT and the FAA TAF, additional forecasts comparing Glendale Municipal Airport itinerant operations to itinerant operations at towered U.S. airports has been completed. As presented on **Table 2P**, the first forecast considers Glendale Municipal Airport maintaining its current share of national itinerant operations. This scenario results in 46,206 itinerant operations in 2010, increasing to 59,742 itinerant operations in 2025.

TABLE 2P**General Aviation Itinerant Operations Forecast
Glendale Municipal Airport**

Year	Glendale GA Itinerant Ops	US GA Itinerant Ops	Market Share Itinerant Ops	Based Aircraft	Itinerant Ops Per Based Aircraft
1998	43,744	22,086,500	0.1981%	180	243
1999	45,992	23,019,400	0.1998%	197	233
2000	40,290	22,844,100	0.1764%	208	194
2001	39,518	21,433,300	0.1844%	269	147
2002	36,221	21,450,500	0.1689%	269	135
2003	40,883	20,231,300	0.2021%	271	151
2004	42,538	20,007,200	0.2126%	324	131
2005	43,339	19,315,000	0.2244%	380	114
2006	45,445	18,741,100	0.2425%	402	113
2007	44,480	18,577,200	0.2394%	405	110
Constant Market Share of Total U.S. Itinerant Operations					
2010	46,206	19,297,900	0.2394%	454	103
2015	50,108	20,927,800	0.2394%	534	99
2025	59,742	24,951,500	0.2394%	703	90
Constant Itinerant GA Operations Per Based Aircraft					
2010	56,212	19,297,900	0.2913%	454	124
2015	66,117	20,927,800	0.3159%	534	124
2025	87,042	24,951,500	0.3488%	703	124
Selected Forecast					
2010	54,000	19,297,900	0.2798%	454	119
2015	63,000	20,927,800	0.3010%	534	118
2025	79,000	24,951,500	0.3166%	703	112

Source: FAA Aerospace Forecasts 2008-2025. Coffman Associates analysis.

A second forecast was completed taking a constant number of itinerant operations per based aircraft. The average of the last five years was utilized in this forecast. This forecast results in 54,212 itinerant operations in 2010, increasing to 87,042 in 2025.

The market share of U.S. itinerant general aviation operations forecasts would likely represent the low end of potential operations. The itinerant operations per based aircraft would likely represent a high end as the potential for based aircraft is out pacing U.S. growth. The selected forecasts for itinerant general aviation opera-

tions at Glendale Municipal Airport is within this forecast envelope. Itinerant operations in 2010 are forecast at 54,000; in 2015, 63,000 and in 2025, 79,000. This equates to an average annual growth rate of 3.2 percent. This is comparable to the 3.1 percent projected for based aircraft growth.

The selected forecast is slightly higher than both the MAG-RASP and the FAA-TAF primarily due to these forecasts applying national growth rates to the Glendale Municipal Airport without consideration for local trends. Itinerant operations forecasts are presented on **Exhibit 2D**.

LOCAL OPERATIONS

Table 2Q outlines the history of local operations in relation to the total general aviation local operations at towered airports in the U.S. The Glendale Municipal Airport market share, as a percentage of general aviation itinerant operations at towered airports across the country, increased from a low of 0.3278 percent in 2003,

to a high of 0.7222 in 2007. This substantial increase in local operations percent can be directly attributed to the introduction of a significant helicopter training school locating at the airport in 2002 as well as the opening of the extended runway. Not only have local operations gone up in the last five years but they have increased while the national trend has been slightly down.

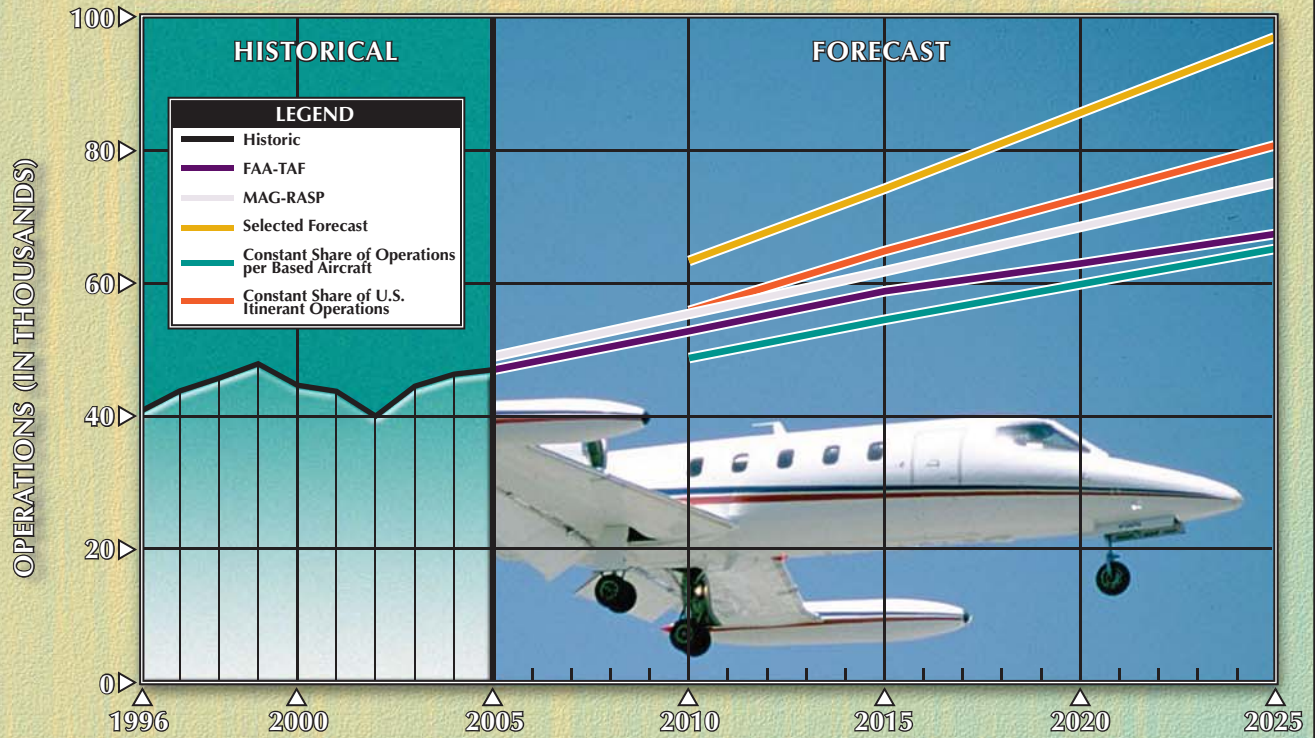
TABLE 2Q					
General Aviation Local Operations Forecast					
Glendale Municipal Airport					
Year	Glendale GA Local Ops	US GA Local Ops	Market Share Local Ops	Based Aircraft	Local Ops Per Based Aircraft
1998	72,133	15,960,000	0.4520%	180	401
1999	86,174	16,980,200	0.5075%	197	437
2000	73,269	17,034,400	0.4301%	208	352
2001	68,287	16,193,700	0.4217%	269	254
2002	72,784	16,172,800	0.4500%	269	271
2003	50,135	15,292,100	0.3278%	271	185
2004	71,955	14,960,400	0.4810%	324	222
2005	83,694	14,845,900	0.5638%	380	220
2006	97,598	14,378,900	0.6788%	402	243
2007	105,137	14,557,300	0.7222%	405	260
Constant Market Share of U.S. General Aviation Local Operations					
2010	110,486	15,297,900	0.7222%	454	243
2015	110,718	15,330,100	0.7222%	534	207
2025	122,063	16,900,900	0.7222%	703	174
Constant Local General Aviation Operations Per Based Aircraft					
2010	102,604	15,297,900	0.6707%	454	226
2015	120,684	15,330,100	0.7872%	534	226
2025	158,878	16,900,900	0.9401%	703	226
Selected Forecast					
2010	98,000	15,297,900	0.6406%	454	216
2015	112,000	15,330,100	0.7306%	534	210
2025	141,000	16,900,900	0.8343%	703	201

Source: FAA Aerospace Forecasts 2008-2025. Coffman Associates analysis.

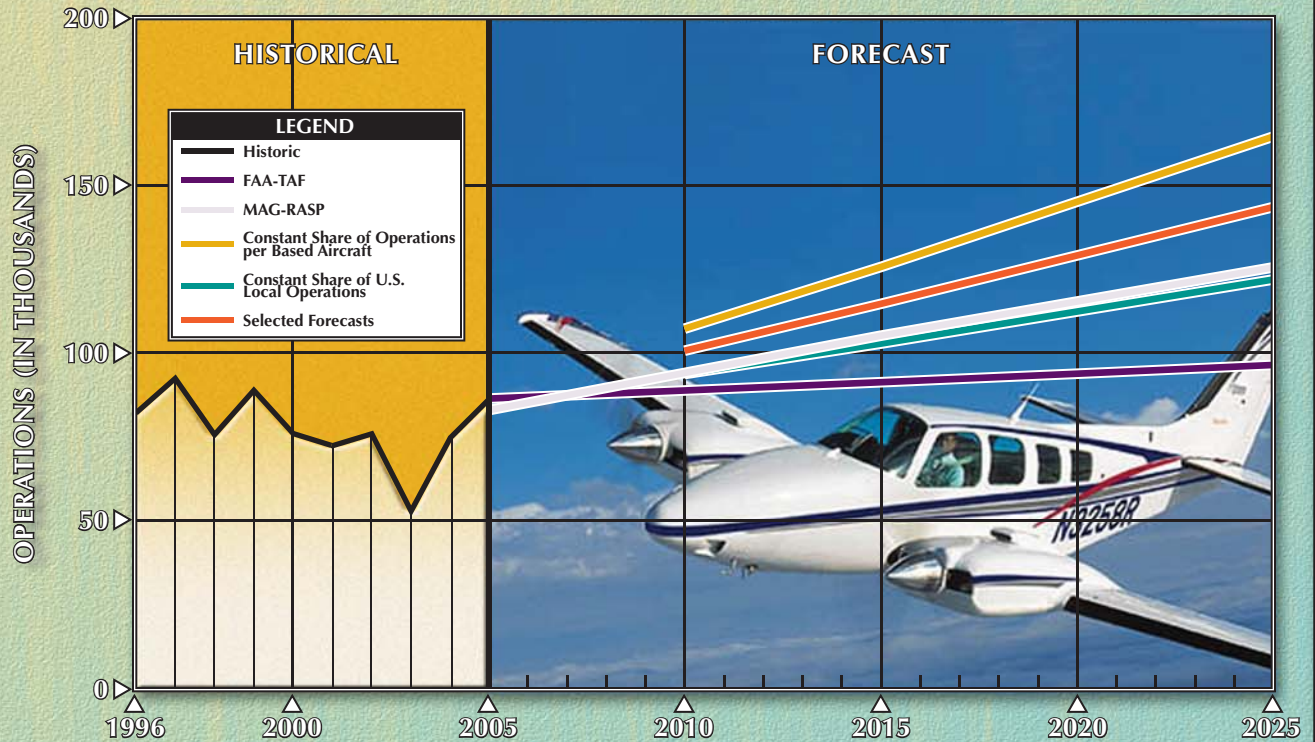
In an effort to further confirm or modify as necessary, the existing operational forecasts from MAG, ADOT and the FAA-TAF, additional forecasts comparing Glendale Municipal Airport local operations to local operations at towered U.S. airports has been com-

pleted. As presented on **Table 2Q**, the first forecast considers Glendale Municipal Airport maintaining its current share of national local operations. This scenario results in 110,486 local operations in 2010, increasing to 122,063 local operations in 2025.

ITINERANT OPERATIONS



LOCAL OPERATIONS



FAA-TAF: Federal Aviation Administration - Terminal Area Forecast
 MAG-RASP: Maricopa Association of Governments - Regional Aviation System Plan



A second forecast was completed taking a constant number of local operations per based aircraft. An average of the previous five years of local operations per based aircraft (226) was used in this forecast. This forecast results in 102,604 local operations in 2010, increasing to 158,878 in 2025.

The selected forecast for local operations at Glendale Municipal Airport falls within the envelope generated by the previous two forecasts as shown in **Table 2Q**. Thus, local operations in 2010 are forecast at 98,000; in 2015, 112,000 and in 2025, 141,000. Local operations forecasts are presented on **Exhibit 2D**.

AIR TAXI OPERATIONS

The air taxi category includes aircraft involved in on-demand passenger, small parcel transport, and air ambulance activity. The history of air taxi operations at Glendale Municipal Airport was previously presented in **Table 2M**. Since 2000, air taxi operations have averaged 1,745 per year. The FAA-TAF projects air taxi activity to remain level at 1,021 operations annually.

Many general aviation airports are experiencing increases in air taxi activity. More charter service is occurring due to the inconvenience of commercial airports. Some fractional ownership aircraft operate under air taxi regulations, and these programs have grown substantially in recent years.

As mentioned earlier, an entire new category of very light jets (VLJ) entered the general aviation fleet in 2006. A number of companies are proceeding with business plans to offer on-demand air taxi service utilizing these types aircraft. The VLJs are relatively inexpensive compared to larger cabin class business jets and they will have access to more airports as the required runway length is much less. Glendale Municipal Airport is well positioned to attract operations by VLJs with a terminal building, restaurant and most importantly, a substantial growth in business opportunities in the airport service area.

Overall, the seven towered reliever airports in the Phoenix metropolitan area have experienced a 29 percent increase in air taxi activity from pre-9/11 levels. Glendale Municipal Municipal, Phoenix Deer Valley and Chandler Municipal Airports have not experienced any significant increase in air taxi activity. Phoenix Goodyear, Scottsdale, and Phoenix-Mesa Gateway Airports, as well as Falcon Field in Mesa have each experienced increases of 35 percent or more.

The relatively steady air taxi activity at Glendale Municipal Airport over the previous eight years does not produce a statistical trend line that can be relied upon to predict future activity levels. A low range forecast would be in line with the FAA-TAF air taxi forecast of level activity through the planning period.

Another scenario considers air taxi operations growing at a rate similar to general aviation itinerant operations. Air taxi operations at Glendale Municipal Airport have generally been equivalent to three to five percent of the itinerant general aviation operations at the airport each year. In the past four years, the ratio has been in the four percent range. For the seven reliever airports combined, however, air taxi operations have grown from 4.8 percent of itinerant GA operations in 2000, to 6.4 percent in 2004.

For planning purposes, the air taxi master plan forecast considers an increasing growth scenario. In 2010, air taxi operations represent 4.5 percent of itinerant general aviation operations. By 2025, 6,730 air taxi operations are planned, which is 8.5 percent of itinerant general aviation operations.

	2010	2015	2025
FAA-TAF	1,021	1,021	1,021
Master Plan Forecast	2,617	3,585	6,730

MILITARY

Military activity accounts for the smallest portion of the operational traffic at Glendale Municipal Airport. **Table 2M** presents the history of military operations since 1996. When excluding a spike of 8,806 local military operations in 1997, the airport has averaged approximately 600 annual operations. Of these operations, 36 percent were itinerant and 64 percent were local.

The majority of the military operations are conducted by the C-12 Huron, a twin engine turboprop similar to a King Air. There was a specialized maintenance business at the airport that catered to these military aircraft. Other military operations include transient helicopter activity. Due to the unpredictable nature of military operations, a constant of 600 total operations annually will be utilized in forecasting.

OPERATIONS ADJUSTMENT AND SUMMARY

Since the Glendale Municipal Airport traffic control tower (ATCT) is not a 24-hour tower, its air traffic counts are not all-inclusive of aircraft operations at the airport. Some aspects of the master plan analysis require that all airport activity be considered. For these evaluations, it is necessary to estimate and adjust for operations that occur when the tower is closed. The Glendale Municipal Airport tower currently operates from 6:00 a.m. to 8:30 p.m. on week days and from 7:00 a.m. to 7:00 p.m. on Saturdays and Sundays. For planning purposes, operations after the tower has closed are estimated at 3 percent of total operations. This estimate is based on experience at other West Valley airport where after hours operational counts have been conducted.

General aviation operations for Glendale Municipal Airport have been forecast through 2025. A number of existing resources have been consulted including the MAG-RASP, the SANS-2000, and the FAA-TAF. The selected operations forecast are slightly higher

than the MAG-RASP forecast, due to the fact that recent trends indicate a higher growth rate for the airport.

Table 2S presents a summary of forecast annual operations at Glendale Municipal Airport.

TABLE 2S				
Operations Activity Forecast Summary				
Glendale Municipal Airport				
	Actual	Forecast		
Annual Operations	2005	2010	2015	2025
General Aviation				
Itinerant	43,175	54,000	63,000	79,000
Local	87,567	98,000	112,000	141,000
Military				
Itinerant	58	160	160	160
Local	66	440	440	440
Air Taxi	1,869	2,617	3,585	6,730
Totals				
Total Local	87,633	98,440	112,440	141,440
Total Itinerant	45,102	56,777	66,745	85,890
Evening 3% Adjustment	3,983	4,657	5,376	6,820
TOTAL OPERATIONS	136,718	160,000	185,000	234,000
Note: Future operations totals are rounded to nearest 1,000				

PEAKING CHARACTERISTICS

Many airport facility needs are related to the levels of activity during peak periods (busy times). The periods used in developing facility requirements for this study are as follows:

- **Peak Month** - The calendar month when peak aircraft operations occur.
- **Design Day** - The average day in the peak month. This indicator is derived by dividing the peak month operations by the number of days in the month.

- **Busy Day** - The busy day of a typical week in the peak month.
- **Design Hour** - The peak hour within the design day.

The peak month is an absolute peak within a given year. All other peak periods will be exceeded at various times during the year. However, they do represent reasonable planning standards that can be applied without overbuilding or being too restrictive. The peak periods forecast has been determined utilizing operations reported by the ATCT to the FAA. Hourly peaking characteristics are maintained by the ATCT and were provided for use in this analysis.

The peak month at Glendale Municipal Airport has historically been during the winter months but overall operations are spread fairly evenly throughout the year. In 2005 the peak month was December. The average peak month operations level from 2002-2004 was 13,407. This peak month average accounted for 10.1 percent of the annual operations.

The design day operations were calculated by dividing the peak month (De-

ember) by the number of days in the month (31). The busiest day of each week accounts for approximately 18 percent of weekly operations. Thus to determine the typical busy day, the design day is multiplied by 1.25, which represents 18 percent of the days in a week (7×0.18). Design hour operations were determined to be approximately 13 percent of the design day operations. The peaking operations characteristics are summarized in **Table 2T**.

	2005	Short Term	Intermediate Term	Long Term
Annual Operations	132,751	160,000	185,000	234,000
Peak Month	13,407	16,160	18,685	23,634
Busy Day	541	673	779	985
Design Day	432	539	623	788
Design Hour	56	70	81	102

ANNUAL INSTRUMENT APPROACHES

An instrument approach, as defined by the FAA, is “an approach to an airport with the intent to land by an aircraft in accordance with an Instrument Flight Rule (IFR) flight plan, when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude.” To qualify as an instrument approach at Glendale Municipal Airport, aircraft must land at the airport after following one of the published instrument approach procedures and then properly close their flight plan on the ground. The approach must be conducted in weather conditions which necessitate the use of the instrument approach. If the flight plan is closed prior to landing, then the AIA is not

counted in the statistics. Forecasts of annual instrument approaches (AIAs) provide guidance in determining an airport’s requirements for navigational aid facilities. It should be noted that practice or training approaches do not count as annual AIAs.

Typically, AIAs for airports with available instrument approaches utilized by advanced aircraft will average between one and two percent of itinerant operations. In the Phoenix area, weather conditions rarely necessitate an instrument approach. In fact, there is no FAA record of instrument approach operations in instrument weather conditions having occurred at Glendale Municipal Airport. In environments similar to the Phoenix area, four tenths of one percent of itinerant operations has been utilized to esti-

mate potential future instrument approaches. A forecast utilizing this percentage is shown on **Exhibit 2E**.

The increased availability of low-cost navigational equipment could allow for smaller and less sophisticated aircraft to utilize instrument approaches. National trends indicate an increasing percentage of approaches given the greater availability of approaches at airports with GPS and the availability of more cost-effective equipment.

SUMMARY

Exhibit 2E provides a summary of the aviation activity forecasts for Glendale Municipal Airport. These forecasts will be utilized in establishing planning horizon milestones that will then be used to determine future facility needs and potential solutions.

Based aircraft at Glendale Municipal Airport are projected to grow from 380 in 2005, to 703 in 2025. Business jets are anticipated to show the strongest rate of growth into the future, reflective of what is happening in the industry. Based jets are expected to increase from five in 2005 to 20 in 2025 or growing from 1.3 percent to 2.2 percent of the Glendale Municipal Airport based aircraft fleet.

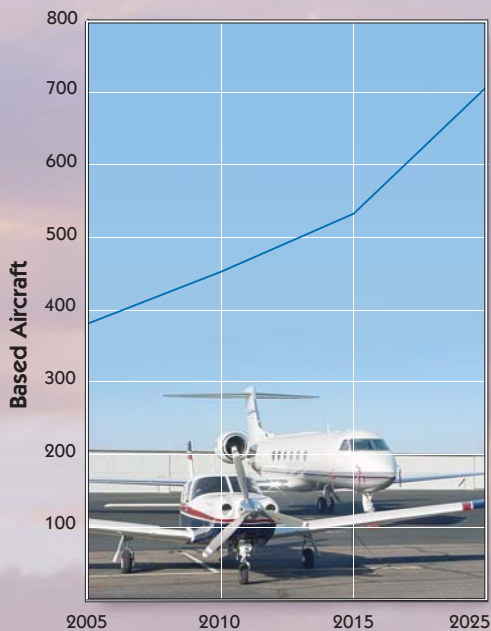
Annual operations are forecast to grow from 132,751 in 2005, to 234,000 by 2025. Military operations will remain a minor part of activity at the Glendale Municipal Airport, but air taxi operations are expected to increase moderately, particularly with growth in on-demand charters and the introduction of very light jets to the national general aviation fleet.

Flight training is expected to be prominent at Glendale Municipal Airport into the future. Local operations have accounted for 63 percent of all operations over the past several years, and are expected to maintain a similar share throughout the planning period. The next chapter will examine the operational capabilities of the airfield in relation to both existing and projected aviation activity.

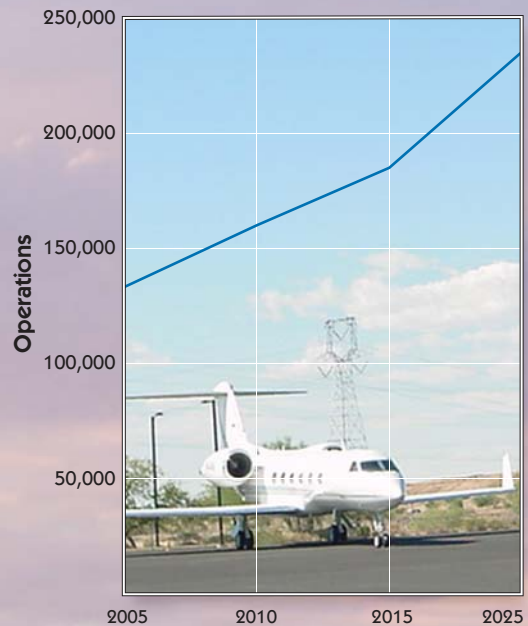
NOTE: It is the considered opinion of the master plan project team that changes in the aviation industry over the previous two years are reasonably within the planning envelope for the primary local demand indicators, those being based aircraft and annual operations. Therefore, the planning horizons will remain as originally forecast.

	2005	2010	2015	2025
BASED AIRCRAFT FORECASTS				
Single Engine	338	404	474	624
Multi-Engine	16	17	18	20
Turbo-Prop	5	8	11	16
Turbo-Jet	5	8	12	20
Helicopters/Others	16	17	19	23
Total Based Aircraft	380	454	534	703
OPERATIONS FORECASTS				
Itinerant				
Air Taxi	1,869	2,617	3,585	6,730
General Aviation	43,175	54,000	63,000	79,000
Military	58	160	160	160
Total Itinerant	45,102	56,777	66,745	85,890
Local				
General Aviation	87,567	98,000	112,000	141,000
Military	66	440	440	440
Total Local	87,729	98,440	112,440	141,440
3% Nighttime Ops	3,983	4,657	5,376	6,820
Total Operations	136,718	160,000	185,000	234,000
PEAK OPERATIONS				
Peak Month	13,407	16,160	18,685	23,634
Busy Day	541	673	779	985
Design Day	432	539	623	788
Design Hour	56	70	81	102
AIA's	0	227	267	344

Total Based Aircraft



Total Operations





Chapter Three

AIRPORT FACILITY REQUIREMENTS

Glendale municipal airport

Chapter 3

AIRPORT FACILITY REQUIREMENTS

To properly plan for the future of Glendale Municipal Airport, it is necessary to translate forecast aviation demand into the specific types and quantities of facilities that can adequately serve this identified demand. This chapter uses the results of the forecasts presented in Chapter Two, as well as established planning criteria, to determine the airfield (i.e., runways, taxiways, navigational aids, marking and lighting) and landside (i.e., hangars, aircraft parking apron, and automobile parking) facility requirements.

The objective of this effort is to identify, in general terms, the adequacy of the existing airport facilities, outline what new facilities may be needed, and when these may be needed to accommodate forecast demands. Having established these facility requirements, alternatives for providing these facilities will be evaluated in Chapter Four to determine the most cost-effective and efficient means for implementation.



PLANNING HORIZONS

Cost-effective, safe, efficient, and orderly development of an airport should rely more upon actual demand at an airport than a time-based forecast figure. In order to develop a master plan that is demand-based rather than time-based, a series of planning horizon milestones has been established for Glendale Municipal Airport that take into consideration the reasonable range of aviation demand projections prepared in Chapter Two.



It is important to consider that the actual activity at any given time at the airport may be higher or lower than projected activity levels. By planning according to activity milestones, the resulting plan can accommodate unexpected shifts or changes in the area's aviation demand. It is important that the plan accommodate these changes so that the airport staff can respond to unexpected changes in a timely fashion. These milestones provide flexibility while potentially extending this plan's useful life if aviation trends slow over time.

The most important reason for utilizing milestones is that they allow

the airport to develop facilities according to need generated by actual demand levels. The demand-based schedule provides flexibility in development, as development schedules can be slowed or expedited according to actual demand at any given time over the planning period. The resulting plan provides airport officials with a financially responsible and need-based program. **Table 3A** presents the planning horizon milestones for each aircraft activity category. The planning milestones of short, intermediate, and long term generally correlate to the five, ten, and twenty-year periods used in the previous chapter.

TABLE 3A Planning Horizon Activity Summary Glendale Municipal Airport				
	2005	Short Term	Intermediate Term	Long Term
Itinerant Operations				
General Aviation	43,175	54,000	63,000	79,000
Air Taxi	1,869	2,617	3,585	6,730
Military	58	160	160	160
Total Itinerant	45,102	56,777	66,745	85,890
Local Operations				
General Aviation	87,567	98,000	112,000	141,000
Military	66	440	440	440
Total Local	87,633	98,440	112,440	141,440
Nighttime 3% Adjustment	3,982	4,657	5,376	6,820
TOTAL OPERATIONS	136,718	160,000	185,000	234,000
TOTAL BASED AIRCRAFT	380	454	534	703
Note: Future operations are rounded to nearest 1,000				

In this chapter, existing components of the airport are evaluated so that the capacities of the overall system are identified. Once identified, the existing capacity is compared to the planning horizon milestones to determine

where deficiencies currently exist or may be expected to materialize in the future. Once deficiencies in a component are identified, a more specific determination of the approximate sizing

and timing of the new facilities can be made.

CRITICAL AIRCRAFT

The selection of appropriate Federal Aviation Administration (FAA) design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using or are expected to use the airport. The critical design aircraft is used to define the design parameters for the airport. **The critical design aircraft is defined as the most demanding category of aircraft, or family of aircraft, which conducts at least 500 operations per year at the airport.** Planning for future aircraft use is of particular importance since design standards are used to plan separation distances between facilities. These future standards must be considered now to ensure that short term development does not preclude the long range potential needs of the airport.

The FAA has established a coding system to relate airport design criteria to the operational and physical characteristics of aircraft expected to use the airport. This airport reference code (ARC) has two components. The first component, depicted by a letter, is the aircraft approach category and relates to aircraft approach speed (operational characteristic); the second component, depicted by a Roman numeral, is the airplane design group and relates to aircraft wingspan (physical characteristic). Generally, aircraft approach speed applies to runways and runway-related facilities, while airplane

wingspan primarily relates to separation criteria involving taxiways, taxi-lanes, and landside facilities.

According to FAA Advisory Circular (AC) 150/5300-13, *Airport Design*, Change 9, an aircraft's approach category is based upon 1.3 times its stall speed in landing configuration at that aircraft's maximum certificated weight. The five approach categories used in airport planning are as follows:

- Category A:** Speed less than 91 knots.
- Category B:** Speed 91 knots or more, but less than 121 knots.
- Category C:** Speed 121 knots or more, but less than 141 knots.
- Category D:** Speed 141 knots or more, but less than 166 knots.
- Category E:** Speed greater than 166 knots.

The airplane design group (ADG) is based upon the aircraft's wingspan. The six ADGs used in airport planning are as follows:

- Group I:** Up to but not including 49 feet.
- Group II:** 49 feet up to but not including 79 feet.
- Group III:** 79 feet up to but not including 118 feet.
- Group IV:** 118 feet up to but not including 171 feet.
- Group V:** 171 feet up to but not including 214 feet.
- Group VI:** 214 feet or greater.

Exhibit 3A summarizes representative aircraft by ARC. As shown on the exhibit, the airport does not currently, nor is it expected to, regularly serve aircraft in ARCs C-IV, D-IV, or D-V.

These are large transport aircraft commonly used by commercial air carriers and air cargo carriers, which do not currently use, nor are they expected to use, Glendale Municipal Airport through the planning period.

In order to determine airfield design requirements, the critical aircraft and critical ARC should first be determined, then appropriate airport design criteria can be applied. This begins with a review of aircraft currently using the airport and those expected to use the airport through the 20-year planning period.

CURRENT CRITICAL AIRCRAFT

The critical design aircraft is defined as the most demanding category of aircraft which conduct 500 or more operations at the airport each year. In some cases, more than one specific make and model of aircraft comprises the airport's critical design aircraft. One category of aircraft may be the most critical in terms of approach speed, while another is most critical in terms of wingspan, which affects runway/taxiway width and separation design standards. While smaller general aviation piston-powered aircraft within approach categories A and B and ADG I conduct the majority of operations at Glendale Municipal Airport, these aircraft do not comprise the critical design aircraft. Business turboprops and turbojets comprise the current critical design aircraft due to the longer wingspans and higher approach speeds than the remaining general aviation aircraft that use the airport.

General aviation aircraft using the airport include a variety of small single and multi-engine piston-powered aircraft, turboprops, and turbojet aircraft. While the airport is used by a number of helicopters, helicopters are not included in this determination as they are not assigned an ARC.

The majority of the based aircraft are single and multi-engine piston-powered aircraft which fall within approach categories A and B and ADG I. There are no business jets based at the airport, but there are five warbirds: three Russian Migs and Two Navy A-6s. The warbirds are not considered in the critical aircraft determination because they are in various states of restoration. The based aircraft with the largest wingspan is a DC-3 (ARC B-III); again, this aircraft is in a state of restoration and not considered for critical aircraft determination. There are five turboprop aircraft based at the airport, the largest of which are a Pilatus and a King Air C90. Both of these aircraft are ARC B-II aircraft.

A wide range of transient turbojet aircraft operate at the airport. In order to discern the number and type of business jet operations at Glendale Municipal Airport, an analysis of instrument flight plan data was conducted. Flight plan data was acquired for this study from the subscription service, *AirportIQ*. The data available includes documentation of flight plans that are opened and closed on the ground at the airport. Flight plans that are opened or closed from the air are not credited to the airport. Therefore, it is likely that there are more business jet operations at the airport

A-I




- Beech Baron 55
- Beech Bonanza
- Cessna 150
- Cessna 172
- Cessna Citation Mustang
- **Eclipse 500**
- Piper Archer
- Piper Seneca

C-I, D-I



- Beech 400
- **Lear** 25, 31, **35**, 45, 55, 60
- Israeli Westwind
- HS 125-400, 700

B-I *less than 12,500 lbs.*



- Beech Baron 58
- Beech King Air 100
- Cessna 402
- **Cessna 421**
- Piper Navajo
- Piper Cheyenne
- Swearingen Metroliner
- Cessna Citation I

C-II, D-II



- Cessna Citation III, VI, VIII, X
- **Gulfstream II, III, IV**
- Canadair 600
- ERJ-135, 140, 145
- CRJ-200, 700, 900
- Embraer Regional Jet
- Lockheed JetStar
- Super King Air 350

B-II *less than 12,500 lbs.*



- **Super King Air 200**
- Cessna 441
- DHC Twin Otter

C-III, D-III



- ERJ-170, 190
- Boeing Business Jet
- B 727-200
- B 737-300 Series
- MD-80, DC-9
- Fokker 70, 100
- A319, A320
- **Gulfstream V**
- Global Express

B-I, B-II *over 12,500 lbs.*



- Super King Air 300
- Beech 1900
- Jetstream 31
- Falcon 10, 20, 50
- Falcon 200, 900
- **Citation II, III, IV, V**
- Saab 340
- Embraer 120

C-IV, D-IV



- **B-757**
- B-767
- C-130
- DC-8-70
- DC-10
- MD-11
- L1011

A-III, B-III



- DHC Dash 7
- **DHC Dash 8**
- DC-3
- Convair 580
- Fairchild F-27
- ATR 72
- ATP

D-V



- **B-747 Series**
- B-777

Note: Aircraft pictured is identified in bold type.



that are not captured by this methodology. Additionally, some business jets and turboprops conduct operations within the traffic pattern at the airport. These local operations are also not captured on instrument flight plans. Experience with airports similar in characteristics to Glendale Municipal Airport indicates that increasing the raw flight plan information by one-third is more representative of actual operations at the airport.

Table 3B shows general aviation business jets completing instrument flight plans conducted 892 operations at Glendale Municipal Airport in the 12-month period (June 14, 2005 - June 15, 2006) used for this study. The highest number of operations were conducted within approach category C with 452 operations. Business jets within approach category D conducted an additional 126 operations.

TABLE 3B Business Jet Operations By Design Category June 14, 2005 - June 15, 2006 Glendale Municipal Airport	
Design Category	Operational Count*
Approach Category B	314
Approach Category C	452
Approach Category D	126
Total	892
Airplane Design Group I	390
Airplane Design Group II	482
Airplane Design Group III	20
Total	892
* Increased by 33% to account for flight plans closed in air.	
<i>Source: Airport IQ; Coffman Associates analysis.</i>	

The combination of approach category C (452 operations) and D (126 operations) exceeds the 500 operational

threshold for a critical aircraft in approach category C. The combination of 482 operations by aircraft in ADG II and 20 operations by aircraft in ADG III exceeds the threshold of 500 operations by aircraft in ADG II. Therefore, the critical design standards for Glendale Municipal Airport are defined by transient cabin-class aircraft in ARC C-II. **The most demanding ARC for Glendale Municipal Airport is currently expressed as ARC C-II.**

FUTURE CRITICAL AIRCRAFT

The aviation demand forecasts indicate the potential for continued growth in business jet activity at the airport. This includes the addition of 15 based business jets and 11 based turboprops through the long term planning horizon. Transient business jet activity is expected to continue to be strong, especially in fractional-ownership activity. Therefore, it is expected that business jets will continue to define the critical design parameters for Glendale Municipal Airport through the planning period.

The type and size of the business jet activity in the future is difficult to precisely identify. Factors such as the significant population and employment growth in the airport service area and the 2006 completion of the new football stadium likely will result in an increase in business jet activity to the airport.

In 2005, there were approximately 126 operations by approach category D aircraft. This includes aircraft such as the Learjet 60, Gulfstream II, IV, and V. There were only 26 operations by

aircraft in ADG III, which includes the Bombardier Global Express and the Gulfstream V. These very large business jets represent a small portion of the national business jet fleet. Projecting their activity in the long term to exceed the FAA threshold of 500 annual operations, even with many positive factors in the region, is not justified at this time. **Thus, the future critical aircraft will continue to be expressed as ARC C-II.**

AIRFIELD CAPACITY

An airport's airfield capacity is expressed in terms of its annual service volume. Annual service volume is a reasonable estimate of the maximum level of aircraft operations that can be accommodated in a year. Annual service volume accounts for annual differences in runway use, aircraft mix, and weather conditions. The airport's annual service volume was examined utilizing Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*.

FACTORS AFFECTING ANNUAL SERVICE VOLUME

Exhibit 3B graphically presents the various factors included in the calculation of an airport's annual service volume. These include the airfield characteristics, meteorological conditions, aircraft mix, and demand characteristics (aircraft operations). These factors are described below.

Airfield Characteristics

The layout of the runways and taxiways directly affects an airfield's capacity. This not only includes the location and orientation of the runways, but the percent of time that a particular runway or combination of runways is in use, and the length, width, weight bearing capacity, and instrument approach capability of each runway at the airport. The length, width, weight bearing capacity, and instrument approaches available to a runway determine which type of aircraft may operate on the runway and if operations can occur during poor weather conditions.

- **RUNWAY CONFIGURATION**

The existing runway configuration consists of a single north-south oriented runway: Runway 1-19. A full-length parallel taxiway is available along the west side of the runway. This runway can accommodate all small general aviation aircraft and most business jet aircraft.

- **RUNWAY USE**

Runway use is normally dictated by wind conditions. The direction of take-offs and landings is generally determined by the speed and direction of wind. It is generally safest for aircraft to takeoff and land into the wind, avoiding a crosswind (wind that is blowing perpendicular to the travel of the aircraft) or tailwind components

AIRFIELD LAYOUT

Runway Configuration



Runway Use



Number of Exits



WEATHER CONDITIONS

VFR



IFR



PVC



AIRCRAFT MIX

A&B



Single Piston



Small Turboprop



Twin Piston

C



Business Jet



Commuter



Regional Jet



Commercial Jet

D



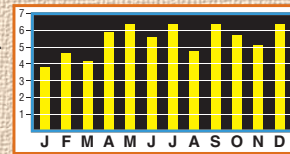
Wide Body Jet

OPERATIONS

Arrivals and Departures



Total Annual Operations



Touch-and-Go Operations



during these operations. Prevailing winds are from the south. As recommended by the 1994 Part 150 Noise Compatibility Study, Runway 1 is the designated calm wind runway. Approximately 75 percent of operations utilize Runway 1, while Runway 19 is utilized 25 percent of the time.

- **EXIT TAXIWAYS**

Exit taxiways have a significant impact on airfield capacity since the number and location of exits directly determines the occupancy time of an aircraft on the runway. Nine entrance/exit taxiways are available for use along the runway. The airfield capacity analysis gives credit to exits located within a prescribed range from a runway's threshold. This range is based upon the mix index of the aircraft that use the runway. For Glendale Municipal Airport, those exit taxiways located between 2,000 and 4,000 feet of the landing threshold count in the capacity determination. The exits must be at least 750 feet apart to count as separate exits. Under these criteria, operations to Runway 1 are credited with two exits and operations to Runway 19 are credited with one exit taxiway. The presence of four or more exit taxiways within the prescribed distance and with proper separation will receive maximum credit for exit taxiways in the capacity and delay model.

Meteorological Conditions

Weather conditions can have a significant effect on airfield capacity. Airport capacity is usually highest in

clear weather, when flight visibility is at its best. Airfield capacity is diminished as weather conditions deteriorate and cloud ceilings and visibility are reduced. As weather conditions deteriorate, the spacing of aircraft must increase to provide allowable margins of safety. The increased distance between aircraft reduces the number of aircraft which can operate at the airport during any given period. This consequently reduces overall airfield capacity.

There are three categories of meteorological conditions, each defined by the reported cloud ceiling and flight visibility. Visual Flight Rule (VFR) conditions exist whenever the cloud ceiling is greater than 1,000 feet above ground level, and visibility is greater than three statute miles. VFR flight conditions permit pilots to approach, land, or take off by visual reference and to see and avoid other aircraft.

Instrument Flight Rule (IFR) conditions exist when the reported ceiling is less than 1,000 feet above ground level and/or visibility is less than three statute miles. Under IFR conditions, pilots must rely on instruments for navigation and guidance to the runway. Other aircraft cannot be seen and safe separation between aircraft must be assured solely by following air traffic control rules and procedures. As mentioned, this leads to increased distances between aircraft, which diminishes airfield capacity.

Poor Visibility Conditions (PVC) exist when the cloud ceiling is less than 500 feet and visibility is less than one mile.

According to regional data, VFR conditions exist approximately 99 percent of the time, whereas IFR conditions and PVC conditions occur the remaining 1 percent of the time. The FAA capacity model disregards weather conditions that occur less than 2 percent of the time. Therefore, airfield capacity for Glendale Municipal Airport has been determined assuming that VFR conditions occur 100 percent of the time.

Aircraft Mix

Aircraft mix refers to the speed, size, and flight characteristics of aircraft operating at the airport. As the mix of aircraft operating at an airport increases to include larger aircraft, airfield capacity begins to diminish. This is due to larger separation distances that must be maintained between aircraft of different speeds and sizes.

Aircraft mix for the capacity analysis is defined in terms of four aircraft classes. Classes A and B consist of single and multi-engine aircraft weighing less than 12,500 pounds. Aircraft within these classifications are primarily associated with general aviation operations, but does include some business turboprop and business

jet aircraft (e.g. the Cessna Citation business jet and Beechcraft King Air). Class C consists of multi-engine aircraft weighting between 12,500 and 300,000 pounds. This broad classification includes business jets, turboprops, and large commercial airline aircraft. Most of the business jets in the national fleet are included within this category. Class D includes all aircraft over 300,000 pounds and includes wide bodies and jumbo jets. There are no Class D aircraft currently operating or forecast to operate from the airport. **Exhibit 3B** depicts representative aircraft in each aircraft class.

For the capacity analysis, the percentage of Class C aircraft operating at the airport is critical in determining the annual service volume as this class includes the larger and faster aircraft in the operational mix. The existing and projected operational fleet mix for the airport is summarized in **Table 3C**. Consistent with projections prepared in the previous chapter, the operational fleet mix at the airport is expected to slightly increase its percentage of Class C aircraft as business and corporate use of general aviation aircraft increases at the airport.

TABLE 3C Aircraft Operational Mix (Capacity Analysis) Glendale Municipal Airport			
	A & B	C	D
Existing (2005)	99.04%	0.96%	0.00%
Short Term	98.50%	1.50%	0.00%
Intermediate Term	97.75%	2.25%	0.00%
Long Term	96.36%	3.64%	0.00%

Demand Characteristics

Operations, not only the total number of annual operations, but the manner in which they are conducted, have an important effect on airfield capacity. Peak operational periods, touch-and-go operations, and the percent of arrivals impact the number of annual operations that can be conducted at the airport.

- **PEAK PERIOD OPERATIONS**

For the airfield capacity analysis, average daily operations and average peak hour operations during the peak month is calculated. These operational levels were calculated previously in Chapter Two for existing and forecast levels of operations. Typical operational activity is important in the calculation of an airport's annual service level as "peak demand" levels occur sporadically. The peak periods used in the capacity analysis are representative of normal operational activity and can be exceeded at various times through the year.

- **TOUCH-AND-GO OPERATIONS**

A touch-and-go operation involves an aircraft making a landing and an immediate take-off without coming to a full stop or exiting the runway. These operations are normally associated with general aviation training operations and are included in local operations data recorded by the air traffic control tower.

Touch-and-go activity is counted as two operations since there is an arrival and a departure involved. A high percentage of touch-and-go traffic normally results in a higher operational capacity because one landing and one takeoff occurs within a shorter time than individual operations. Touch-and-go operations currently account for approximately 63 percent of annual operations.

- **PERCENT ARRIVALS**

The percentage of arrivals as they relate to the total operations in the design hour is important in determining airfield capacity. Under most circumstances, the lower the percentage of arrivals, the higher the hourly capacity. However, except in unique circumstances, the aircraft arrival-departure split is typically 50-50. At the airport, traffic information indicated no major deviation from this pattern, and arrivals were estimated to account for 50 percent of design period operations.

CALCULATION OF ANNUAL SERVICE VOLUME

The preceding information was used in conjunction with the airfield capacity methodology developed by the FAA to determine airfield capacity for Glendale Municipal Airport.

Hourly Runway Capacity

The first step in determining annual service volume involves the computa-

tion of the hourly capacity of each runway in use configuration. The percentage use of each runway, the amount of touch-and-go training activity, and the number and locations of runway exits become important factors in determining the hourly capacity of each runway configuration.

As the mix of aircraft operating at an airport changes to include a greater utilization of Class C aircraft, the hourly capacity of the runway system is reduced. This is because larger aircraft require longer utilization of the

runway for takeoffs and landings, and because the greater approach speeds of the aircraft require increased separation. This contributes to a slight decline in the hourly capacity of the runway system over the planning period.

Annual Service Volume

Once the hourly capacity is known, the annual service volume can be determined. Annual service volume is calculated by the following equation:

Annual Service Volume = C x D x H	
C =	weighted hourly capacity
D =	ratio of annual demand to average daily demand during the peak month
H =	ratio of average daily demand to average peak hour demand during the peak month

Following this formula, the current annual service volume for Glendale Municipal Airport has been estimated at 299,000 operations. The increasing percentage of larger Class C aircraft over the planning period will contribute to a decline in the annual service volume, lowering it to a level of 278,000 operations by the end of the planning period.

Delay

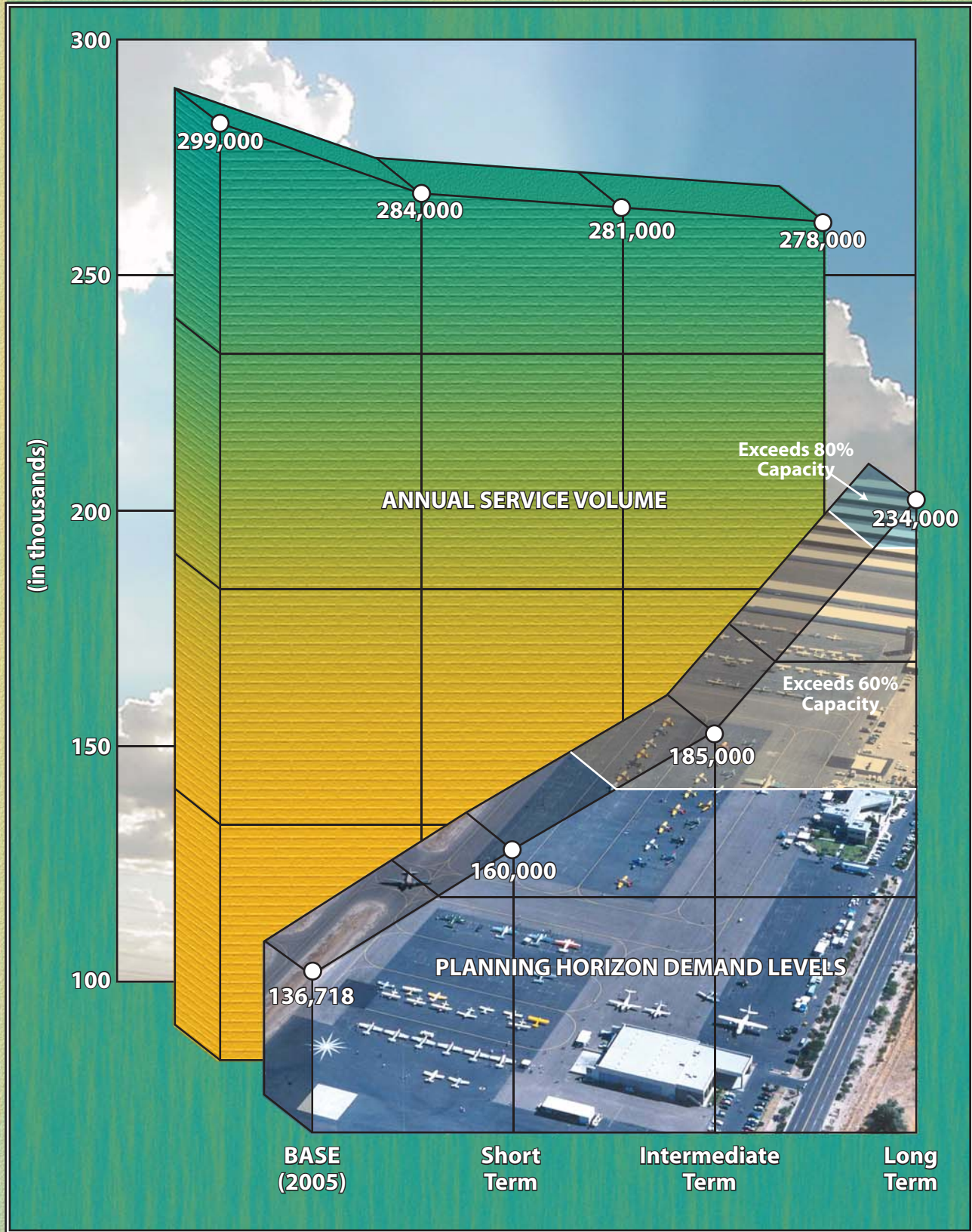
As the number of annual aircraft operations approaches the airfield's capacity, increasing amounts of delay to aircraft operations begin to occur. Delays occur to arriving and departing aircraft in all weather conditions. Arriving aircraft delays result in aircraft holding outside of the airport traffic

area. Departing aircraft delays result in aircraft holding at the runway end until released by the air traffic control tower.

Currently, total annual delay at the airport is estimated at 332 hours. If no capacity improvements are made, annual delay can be expected to reach 4,133 hours by the long range planning horizon. This calculates to an average delay of slightly more than one minute per aircraft.

Conclusion

Table 3D summarizes annual service volume values. **Exhibit 3C** compares annual service volume to existing and forecast operational levels. The 2005 total of 136,718 operations



represented 44.4 percent of the existing annual service volume. By the end of the long term planning period, total

annual operations are expected to represent 84.2 percent of annual service volume.

TABLE 3D Airfield Demand/Capacity Summary Glendale Municipal Airport				
	PLANNING HORIZON			
	2005	Short Term	Intermediate Term	Long Term
Operational Demand				
Annual	136,718	160,000	185,000	234,000
Design Hour	56	70	81	102
Capacity				
Annual Service Volume	299,000	284,000	281,000	278,000
Percent Capacity	44.4%	56.3%	65.8%	84.2%
Weighted Hourly Capacity	126	124	123	121
Delay				
Per Operation (Minutes)	0.15	0.25	0.36	1.06
Total Annual (Hours)	332	667	1,110	4,133

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems* (NPIAS), indicates that improvements for airfield capacity purposes should be considered when operations reach 60 to 75 percent of the annual service volume. Should operations occur as forecast, the airport is expected to exceed this threshold at approximately 170,000 annual operations.

Local (touch-and-go training) operations and increased business aircraft use of the airport will drive the need for additional runway capacity. Chapter Four – Airport Alternatives will examine the potential for increasing runway capacity.

AIRFIELD REQUIREMENTS

Airfield requirements include the need for those facilities related to the arrival and departure of aircraft. The ade-

quacy of existing airfield facilities at Glendale Municipal Airport has been analyzed from a number of perspectives, including:

- Safety Area Design Standards
- Runways
- Taxiways
- Navigational Approach Aids
- Airfield Lighting, Marking, and Signage

SAFETY AREA DESIGN STANDARDS

The FAA has established several imaginary surfaces to protect aircraft operational areas and keep them free from obstructions or incompatible land uses that could affect an aircraft's safe operation. These include the runway safety area (RSA), object free area (OFA), obstacle free zone (OFZ), and runway protection zone (RPZ).

The entire RSA, OFA, and OFZ should be under the direct control of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel. It is not required that the RPZ be under airport ownership, but it is strongly recommended. An alternative to outright ownership of the RPZ is the purchase of aviation easements (acquiring control of designated airspace within the RPZ) or having sufficient land use control measures in places which ensures that the RPZ remains free of incompatible development. **Exhibit 3D** visually depicts the limits of the RSA, OFA, and RPZ at Glendale Municipal Airport.

The City of Glendale has established an Airport Impact Overlay district as a zoning measure to protect the air-

port environment. There are three airport noise overlay areas and one clear zone overlay area that comprises the Airport Impact Overlay district. These areas include the 2025 noise contours out to the 65 DNL (Day-Night Noise Level) for the airport and the Runway Protection Zones (clear zones). These areas are to remain free from development. The Airport Impact Overlay District should be maintained to protect the airport and its environment.

Dimensional standards for the various safety areas associated with the runways are a function of the Airport Reference Code (ARC) as well as the approach visibility minimums. At Glendale Municipal Airport, Runway 1-19 should meet design standards for ARC C-II and one mile visibility minimums, which are presented in **Table 3E**.

TABLE 3E Safety Area Design Standards Glendale Municipal Airport		
	Runway 1-19	
Airport Reference Code (ARC)	C-II	
Runway Safety Area		
Width (ft.)	400	
Length Beyond Runway End (ft.)	1,000	
Length Prior to Landing Threshold (ft.)	600	
Object Free Area		
Width (ft.)	800	
Length Beyond Runway End (ft.)	1,000	
Obstacle Free Zone		
Width (ft.)	400	
Length Beyond Runway Pavement End (ft.)	200	
Runway Protection Zones		
Approach Visibility Minimums	Visual	1 Mile (GPS)
Inner Width (ft.)	500	500
Outer Width (ft.)	1,010	1,010
Length (ft.)	1,700	1,700
Source: FAA AC 150/5300-13, Airport Design, Change 9		

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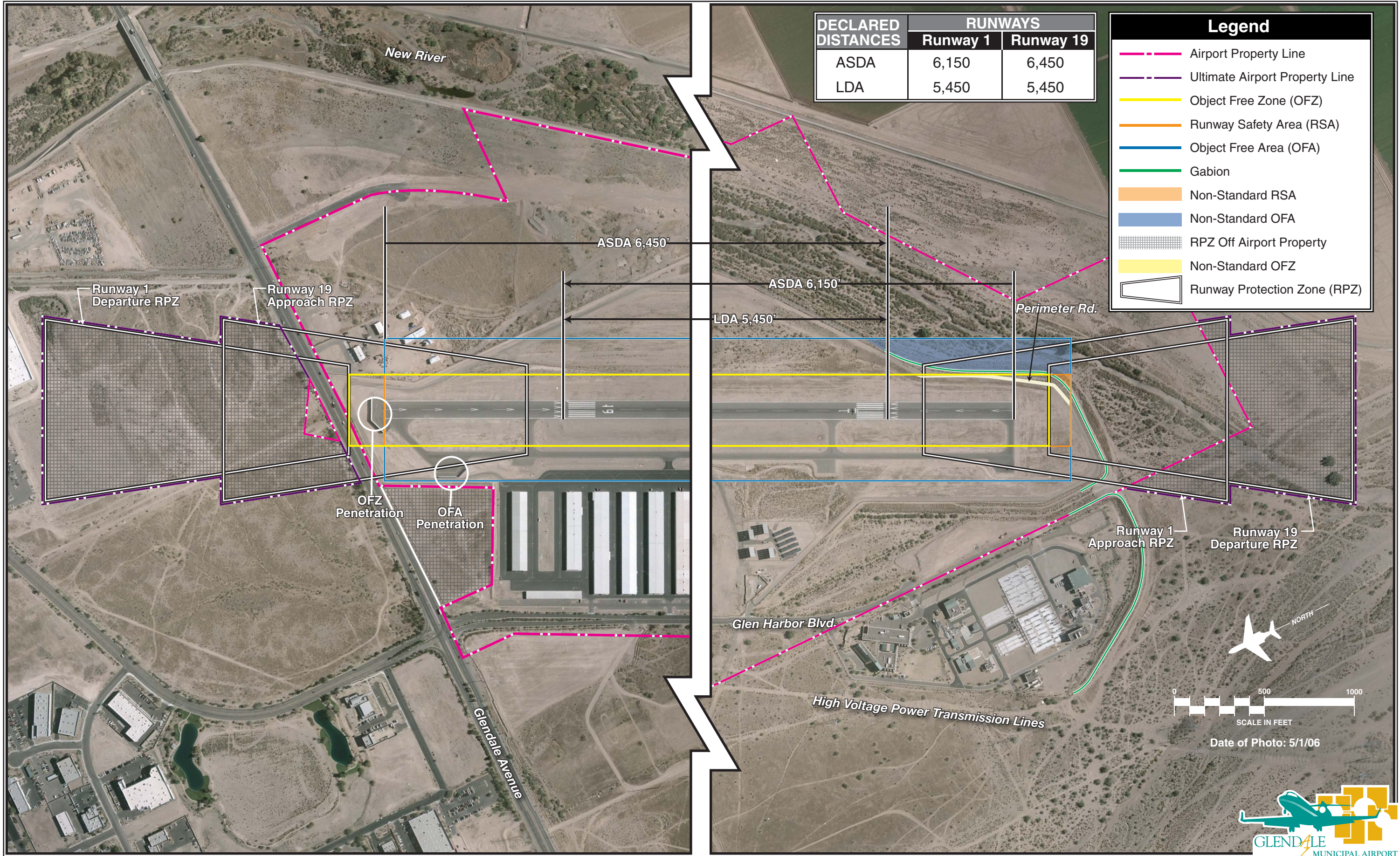


Exhibit 3D
AIRPORT SAFETY AREAS
AND PLANNED DECLARED DISTANCES

Runway Safety Area (RSA)

The RSA is defined in FAA Advisory Circular (AC) 150/5300-13, *Airport Design*, Change 9, as a “surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway.” The RSA is centered on the runway and dimensioned in accordance to the approach speed of the critical aircraft using the runway. The FAA requires the RSA to be cleared and graded, drained by grading or storm sewers, capable of accommodating the design aircraft and fire and rescue vehicles, and free of obstacles not fixed by navigational purpose.

The FAA has placed a higher significance on maintaining adequate RSAs at all airports. Under Order 5200.8, effective October 1, 1999, the FAA established the *Runway Safety Area Program*. The Order states, “The objective of the Runway Safety Area Program is that all RSAs at federally-obligated airports . . . shall conform to the standards contained in Advisory Circular 150/5300-13, *Airport Design*, to the extent practicable.” Each Regional Airports Division of the FAA is obligated to collect and maintain data on the RSA for each runway at the airport and perform airport inspections.

For ARC C-II, AC 150/5300-13 requires the RSA to be 400 feet wide and centered along the runway centerline. This AC requires 600 feet of RSA prior to the landing threshold. However, the RSA on the far end of a landing or

departure operation must extend 1,000 feet beyond the declared runway end. The following subsections examine compliance with RSA standards at Glendale Municipal Airport.

- **RSA Width:** At Glendale Municipal Airport, the ARC C-II RSA extends beyond existing airport property east of the Runway 1 end. The existing perimeter fencing and perimeter service road are also located within the limits of the RSA. East of the Runway 19 end, the perimeter fencing and service road also extend into the RSA. Therefore, the RSA width standard is not fully met at Glendale Municipal Airport.
- **RSA Length Prior to Landing Threshold:** Based upon the existing displaced landing threshold locations, the Runway 1 RSA and Runway 19 RSA extend unobstructed 600 feet prior to each landing threshold. Therefore, Glendale Municipal Airport fully complies with this RSA standard.
- **RSA Length beyond the Far End of a Landing or Departure Operation:** Essentially, this standard requires 1,000 feet of RSA beyond the Runway 1 end when aircraft are landing or departing Runway 19, and 1,000 feet of RSA beyond the Runway 19 end when aircraft are landing or departing Runway 1. Currently, 1,000 feet of RSA is not available beyond the physical end of either Runway 1 or Runway 19. Behind the Runway 19 end, there is a blast fence and Glendale

Avenue. There is only approximately 200 feet of graded RSA behind the Runway 1 end before the location of the New River gabion. The airport cannot get credit for the area beyond the gabion for the RSA due to the grade differences between the New River bed and runway end.

The 1998 airport master plan for Glendale Municipal Airport anticipated that due to the above mentioned site constraints, the RSA could not extend 1,000 feet beyond each runway end. To ensure 1,000 feet of RSA was available at the far end of the departure or landing operation, the 1998 Airport Master Plan utilized declared distances to limit the landing and departure distances available so that the full 1,000 feet of RSA would be available.

Declared distances are the effective runway distances that the airport operator declares are available for take-off run, take-off distance, accelerate stop distance, and landing distance requirements. These are defined by the FAA as:

Take-off run available (TORA) - The length of the runway declared available and suitable to accelerate from brake release to lift-off, plus safety factors.

Take-off distance available (TODA) - The TODA plus the length of any remaining runway or clearway beyond the far end of the TORA available to accelerate from brake release past lift-off to start of take-off climb, plus safety factors.

Accelerate-stop distance available (ASDA) - The length of the runway plus stopway declared available and suitable to accelerate from brake release to take-off decision speed, and then decelerate to a stop, plus safety factors.

Landing distance available (LDA) - The distance from threshold to complete the approach, touchdown, and decelerate to a stop, plus safety factors.

The ASDA and the LDA are the primary considerations in determining the runway length available for use by aircraft, as the RSA must be considered in the calculations. The ASDA and LDA can be figured as the usable portions of the runway minus the area required to maintain adequate RSA beyond the ends of the runway. **Exhibit 3D** depicts the declared distances for Glendale Municipal Airport as envisioned in the 1998 Master Plan. While the runway extension, runway lighting, and runway markings were constructed with consideration to the declared distances, declared distances have not yet been implemented for Glendale Municipal Airport. Implementation of the declared distances is required for Glendale Municipal Airport. As shown, even with the implementation of declared distances, RSA standards are not fully met. The RSA to the east of the Runway 19 pavement end extends beyond airport property and is penetrated by the airport service road and the perimeter fencing. The southeast corner of the RSA extends beyond the New River gabion and is also penetrated by the airport service road and the perimeter fence.

Object Free Area (OFA)

The runway OFA is “a two-dimensional ground area, surrounding runways, taxiways, and taxilanes, which is clear of objects except for objects whose location is fixed by function (i.e., airfield lighting).” The OFA does not have to be graded and leveled as does the RSA; instead, the primary requirement for the OFA is that no object in the OFA penetrates the lateral elevation of the RSA. The runway OFA is centered on the runway, extending out in accordance to the critical aircraft design category utilizing the runway.

For ARC C-II, AC 150/5300-13 specifies that the OFA be 800 feet wide, centered along the runway centerline, and extend 1,000 feet beyond the far end of the landing or departure runway. Similar to the RSA, the OFA cannot extend 1,000 feet beyond either runway end due to the location of Glendale Avenue to the north and perimeter fencing along the gabion to the south.

While implementing declared distances is expected to address the extension of the OFA beyond the far end of a landing or departure operation, there are still considerations with full compliance with OFA standards. To the east of the Runway 19 end, the OFA extends off airport property and is obstructed by three buildings, the airport perimeter service road, and the perimeter fencing. To the east of the Runway 1 end, the OFA is obstructed by the perimeter service road and perimeter fence. West of the Runway 19

end, a blast fence extends into the OFA.

Obstacle Free Zones (OFZ)

The OFZ is an imaginary surface which precludes object penetrations, including taxiing and parked aircraft. The only allowance for OFZ obstructions is navigational aids mounted on frangible bases which are fixed in their location by function, such as airfield signs. The OFZ is established to ensure the safety of aircraft operations. If the OFZ is obstructed, the airport’s approaches could be removed or approach minimums could be increased.

For all runways serving aircraft over 12,500 pounds, the OFZ is 400 feet wide, centered on the runway, and extends 200 feet beyond the runway ends. Behind the Runway 19 end, the OFZ is penetrated by the Glendale Avenue, the perimeter fence, and a blast deflection fence.

Runway Protection Zones (RPZ)

The RPZ is a trapezoidal area centered on the runway, typically beginning 200 feet beyond the runway end. The RPZ has been established by the FAA to provide an area clear of obstructions and incompatible land uses in order to enhance the protection of approaching aircraft, as well as people and property on the ground. The dimensions of the RPZ vary according to the visibility minimums serving the runway and the type of aircraft operating on the runway.

Where possible, the airport should have positive control over the RPZ, through acquisition. Approximately 25 acres of the 29-acre RPZ to the north is not on airport property. On the south end, Approximately 11 acres of the RPZ are off airport property. The south RPZ traverses, almost entirely, the New River channel which is managed by the Maricopa Flood Control District. The likelihood of any incompatible land uses being developed here are remote. Thus, an aviation easement should suffice. The north end RPZ, on the other hand, extends through the Glendale Airpark business park. This land should be acquired if possible.

In cases where fee simple property acquisition is not feasible, the airport should pursue the purchase of an aviation easement. An aviation easement will allow the airport to positively prevent any penetrations to the approach slope to the runway ends.

RUNWAYS

The adequacy of the existing runway system at Glendale Municipal Airport has been analyzed from a number of perspectives, including runway orientation, runway length, pavement strength, width, and adherence to safety area standards. From this information, requirements for runway improvements were determined for the airport.

Runway Orientation

The airport is served by a single runway, Runway 1-19, oriented in a

northeast to southwest manner. For the operational safety and efficiency of an airport, it is desirable for the primary runway to be oriented as close as possible to the direction of the prevailing wind. This reduces the impact of wind flowing perpendicular to the direction of travel of an aircraft that is landing or taking off.

FAA Advisory Circular 150/5300-13, *Airport Design*, Change 9, recommends that a crosswind runway should be made available when the primary runway orientation provides for less than 95 percent wind coverage for specific crosswind components. The 95 percent wind coverage is computed on the basis of the crosswind component not exceeding 10.5 knots (12 mph) for ARCs A-I and B-I; 13 knots (15 mph) for ARCs A-II and B-II; and 16 knots (18 mph) for ARC C-I through D-II.

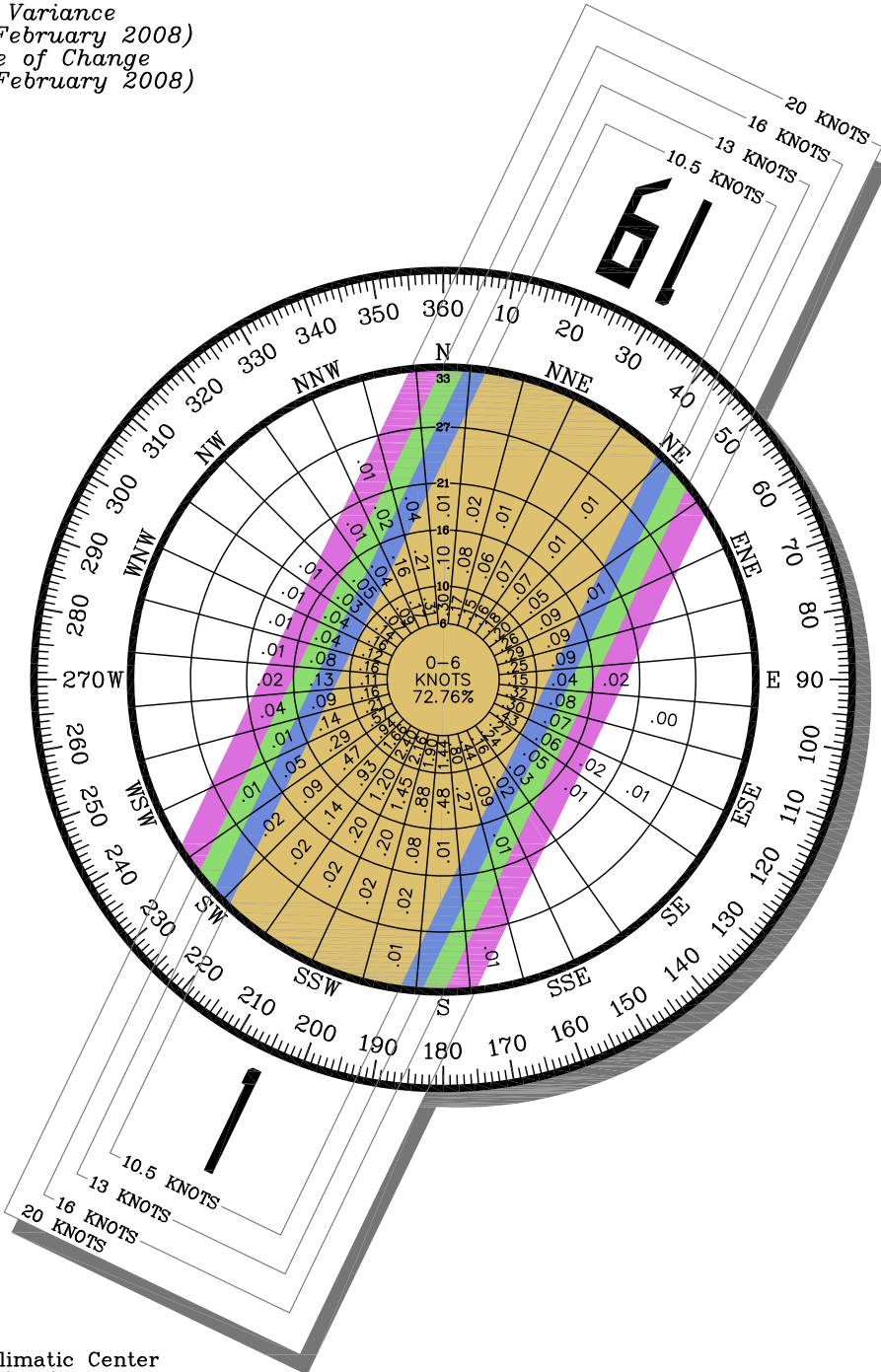
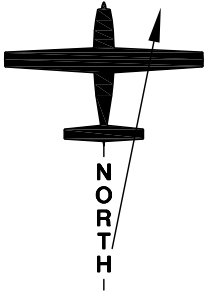
All-weather wind data specific to Glendale Municipal Airport was obtained for the range from 1999 through 2006. The wind coverage is presented on **Exhibit 3E**. Runway 1-19 provides 98.7 percent wind coverage for 10.5 knot crosswinds and 99.34 percent coverage at 13 knots. Since this runway provides at least 95 percent wind coverage for the 10.5-knot, no crosswind runway is necessary.

Runway Length

Runway length requirements are based upon five primary elements: airport elevation, the mean maximum daily temperature of the hottest month, runway gradient, critical air-

ALL WEATHER WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 1-19	98.70%	99.34%	99.79%	99.94%

Magnetic Variance
 11° 23' East (February 2008)
 Annual Rate of Change
 00° 06' West (February 2008)



SOURCE:
 NOAA National Climatic Center
 Asheville, North Carolina
 Glendale Municipal Airport (GEU)
 Glendale, Arizona

OBSERVATIONS:
 24,417 All Weather Observations
 1999-2006



craft type expected to use the runway, and aircraft loading. Aircraft performance declines as elevation, temperature, and runway gradient factors increase. Therefore, these factors increase runway length requirements. For calculating runway length requirements at Glendale Municipal Airport, elevation is 1,070 feet above mean sea level (MSL) and the mean maximum daily temperature of the hottest month is 108 degrees Fahrenheit. At the airport, the Runway 1 end is located at 1,040 feet MSL, while the Runway 19 end is located at 1,070 feet MSL. This is a difference of 30 feet, or an effective runway gradient of 0.4 percent.

FAA Advisory Circular (AC) 150/5235-4B, *Runway Length Requirements for Airport Design*, provides guidelines to determine runway lengths for civil airports. It states, “For airport projects receiving Federal funding, the use of this AC is mandatory.”

The first step in determining runway length is to identify the list of critical design aircraft that will make regular use of the runway. Regular use is defined in AC 150/5325-4B as at least 500 or more annual itinerant operations.

For Glendale Municipal Airport, Runway 1-19 is used by all categories of aircraft using the airport, each with different runway length requirements. Small single and multi-engine piston-powered aircraft conduct over 500 annual operations on Runway 1-19. As shown in **Table 3F**, only 4,800 feet of runway length is needed for these aircraft to operate at the airport. At 7,150 feet, Runway 1-19 adequately provides for this mix of aircraft to operate at the airport. Therefore, no additional length is needed on Runway 1-19 to serve these aircraft now or into the future.

The increased use of the airport by privately owned business jets must be considered in this analysis. Business jets have proven themselves to be an asset to corporations by meeting the needs of companies for flexibility in scheduling, time savings, and privacy. In response to these types of needs, AC 150/5325-4B recommends that “general aviation (GA) airports that receive regular use by large airplanes over 12,500 pounds, in addition to business jets, should provide a runway length comparable to non-GA airports.” Therefore, business jet aircraft will be critical for determining the future critical runway length for the airport.

TABLE 3F	
Runway Length from FAA Airport Design Computer Program	
Glendale Municipal Airport	
AIRPORT AND RUNWAY DATA	
Airport elevation	1,070 feet
Mean daily maximum temperature of the hottest month	108 F
Maximum difference in runway centerline elevation	30 feet
Length of haul for airplanes of more than 60,000 pounds	1,000 miles
Wet/Dry Runway	
RUNWAY LENGTH ESTIMATES	
Small airplanes with less than 10 passenger seats	
75 percent of these small airplanes	3,100 feet
95 percent of these small airplanes	3,700 feet
100 percent of these small airplanes	4,300 feet
Small airplanes with 10 or more passenger seats	4,800 feet
Large airplanes of 60,000 pounds or less	
75 percent of business jets at 60 percent useful load	5,500 feet
75 percent of business jets at 90 percent useful load	8,700 feet
100 percent of business jets at 60 percent useful load	7,400 feet
100 percent of business jets at 90 percent useful load	11,300 feet
Airplanes of more than 60,000 pounds	6,400 feet
<i>Source: FAA Airport Design computer program Version 4.2D</i>	

Runway length requirements for business jets are determined according to a “family grouping of airplanes” having similar performance characteristics and operating weights. For Glendale Municipal Airport, the majority of business jet operations are expected to be conducted by aircraft weighing less than 60,000 pounds. As shown in **Table 3G**, aircraft over 60,000 pounds only conducted approximately 82 operations in the 12-month period from June 14, 2005 to June 15, 2006. Therefore, the runway length requirements for the family of general aviation business jets weighing less than 60,000 pounds are critical for determining runway length for Glendale Municipal Airport.

The AC further segregates business jets into two categories: 1) aircraft that make up 75 percent of the national fleet; and 2) aircraft that make up 100 percent of the national fleet. As shown in **Table 3G**, the majority of the business jet operations during the latest 12-month period were from business jets comprising “75 percent of the national fleet.”

Having established the critical “family grouping of airplanes” the useful load must be determined. Useful load is the difference between the maximum structural takeoff weight and the operating empty weight. Useful load typically consists of the fuel, passengers, baggage, and cargo that can be carried. Higher useful loading increases the takeoff weight and runway length requirements.

TABLE 3G
Business Jet Flight Plans To/From GEU
Critical Design Family Grouping of Airplanes
Glendale Municipal Airport

Aircraft Make	Aircraft Model	12-Month Operational Count		
		Private Jets	Fractionals & Charters	Totals
Airplanes that Make Up 75 Percent of the Fleet				
Aerospatale	Sn-601 Corvette	0	0	0
BAe	125-700	10	0	10
Beech Jet	400A	26	30	56
Beech Jet	Premier I	8	0	8
Bombardier	Challenger 200	0	0	0
Cessna	500 Citation/501 Citation Special	24	12	36
Cessna	Citation I/II/III	10	0	10
Cessna	525A II (CJ-2)	18	0	18
Cessna	550 Citation Bravo	12	2	14
Cessna	550 Citation II	20	8	28
Cessna	551 Citation II/Special	0	0	0
Cessna	552 Citation	0	0	0
Cessna	560 Citation Encore	12	26	38
Cessna	560/560 XL Citation Excel	16	34	50
Cessna	560 Citation V Ultra	18	0	18
Cessna	650 Citation VII	2	0	2
Cessna	680 Citation Sovereign	0	2	2
Dassault	Falcon 10	8	0	8
Dassault	Falcon 20	0	0	0
Dassault	Falcon 50/50 EX	12	0	12
Dassault	Falcon 900/900B	10	0	10
IAI	Jet Commander 1121	0	0	0
IAI	Westwind 1123/1124	10	0	10
Learjet	20 Series	4	2	6
Learjet	31/31A/31A ER	32	0	32
Learjet	35/35A/36/36A	16	18	34
Learjet	40/45	26	4	30
Mitsubishi	Mu-300 Diamond	0	0	0
Raytheon	390 Premier	0	0	0
Raytheon/Hawker	400/400XP	0	0	0
Raytheon/Hawker	600	8	0	8
Sabreliner	40/60	0	0	0
Sabreliner	75A	0	0	0
Sabreliner	80	0	0	0
Sabreliner	T-39	0	0	0
Subtotal Operations		302	138	440

Note: No adjustment for flight plans closed in the air.

Source: Airport IQ June 14, 2005 - June 15, 2006

TABLE 3G (Continued)
Business Jet Flight Plans To/From GEU
Critical Design Family Grouping of Airplanes
Glendale Municipal Airport

Aircraft Make	Aircraft Model	12-Month Operational Count		
		Private Jets	Fractionals & Charters	Totals
Airplanes that Make Up 100 Percent of the Fleet				
BAe	Corporate 800/1000	4	0	4
Bombardier	Challenger 600	6	2	8
Bombardier	Challenger 604	0	0	0
Bombardier	BD-100 Continental	0	0	0
Cessna	S550 Citation S/II	0	0	0
Cessna	650 Citation III/IV	2	4	6
Cessna	750 Citation X	2	66	68
Dassault	Falcon 900C/900EX	4	0	4
Dassault	Falcon 2000/2000EX	2	0	2
IAI	Astra 1125	0	0	0
IAI	Galaxy 1126	0	8	8
Learjet	45XR	0	2	2
Learjet	55/55B/55C	8	2	10
Learjet	60	10	8	18
Raytheon/Hawker	Horizon	0	0	0
Raytheon/Hawker	800/800XP	12	0	12
Raytheon/Hawker	1000	2	0	2
Sabreliner	65/75	4	0	4
Subtotal Operations		56	92	148
Business Jets over 60,000 pounds				
Gulfstream	II	2	0	2
Gulfstream	III	0	6	6
Gulfstream	IV	60	0	60
Gulfstream	V	8	0	8
Embraer (ERJ)	Legacy (135)	0	6	6
Subtotal Operations		70	12	82
Total ALL Operations		428	242	670
Note: No adjustment for flight plans closed in the air.				
Source: Airport IQ June 14, 2005 - June 15, 2006				

AC 150/5325-4B provides for determining runway length requirements at 60 percent useful load and 90 percent useful load. The FAA does not provide for determining runway lengths based upon 100 percent useful load. This is due to the fact that many of the aircraft used in determining the curves are weight restricted during the climb after takeoff. In other

words, due to the need to maintain a certain positive climb rate after departure, the aircraft can never be fully loaded.

The 60 percent useful load is used when flights from the airport are departing to regional locations and full fuel loading is not required. The 90 percent useful load represents higher

passenger and fuel loading. A review of departure destinations for business aircraft from Glendale Municipal Airport for the past 12-month period revealed that destinations are primarily regional. This indicates that full loading is not required for the majority of flights conducted at the airport. However, it is still recognized that some operators desire to make long-haul non-stop flights, and this should be factored into the runway length to the extent practicable.

As shown in **Table 3F**, at 7,150 feet long, Runway 1-19 exceeds the runway length requirement for 75 percent of business jets at 60 percent useful load (5,500 feet). Runway 1-19 is only 250 feet short of the 7,400 feet of runway specified for 100 percent of business jets at 60 percent useful load. Therefore, the airport is able to accommodate nearly all business jets in the national fleet, albeit with limited useful loading. For most of the year, when daily temperatures do not reach the lower 100s, the useful load of business jets is not greatly affected by operations at the airport. However, on the warm summer days, aircraft operators must reduce useful load to be able to depart on the 7,150 feet of runway at the airport. This means that business jet operators must reduce fuel or passenger loading to ensure that they can depart on the available runway length. This increases operator costs as they must stop enroute to their final destination to take on the additional fuel needed. For business jet operators to operate with higher loading requires up to

8,700 feet of runway for 75 percent of business jets at 90 percent useful load and 11,300 feet for 100 percent of business jets at 90 percent useful load.

The 1998 Master Plan and subsequent Environmental Assessment (EA) examined the physical constraints to extending Runway 1-19. A gabion was constructed in the New River channel to allow for the extension of Runway 1-19 to 7,150 feet in 2003. This gabion cannot be extended farther south without impacting flow in the New River basin. The Maricopa Flood Control District was opposed to any further extension of the gabion to the south. Extending Runway 1-19 to the north is limited by the location of Glendale Avenue. The primary constraint is the Glendale Avenue bridge over the New River channel which carries many of the primary utility lines. While Glendale Avenue could be re-routed to the north, the primary utility lines could not be re-routed as they must cross this bridge. The primary utility lines cannot extend under the runway.

Considering these constraints, the 1998 Master Plan determined that the existing 7,150 feet of length was the maximum length obtainable at the airport. As summarized earlier, this length allows for nearly all business jets in the national fleet to use Runway 1-19. They must however incur weight restrictions. As shown in **Table 3G**, the weight restrictions caused by the runway length have not prevented use of the airport by nearly all business jets within the national fleet.

Updated Runway Length Analysis (2008)

Since the completion of Chapters 1-4 of this master plan in October 2006, updated information has become available for analysis of the runway length needs. This updated information is current as of May 2008.

Utilizing the FAA Design Standards computer program, as shown in **Table 3F**, several runway length scenarios were presented. To accommodate 75 percent of business jets at 60 percent useful load a runway length of 5,500

feet is needed. To accommodate 100 percent at 60 percent useful load, a runway length of 7,400 feet is estimated. To accommodate aircraft of more than 60,000 pounds, a runway length of 6,400 feet is estimated.

Table 3H presents a comparison of business jet operations from two one-year periods of time. The 2005-2006 figures were presented in Chapter Three – Facility Requirements. These figures are from the time period of June 14, 2005 to June 15, 2006. The 2007 figures are for the calendar year.

TABLE 3H Business Jet Operations Comparison Glendale Municipal Airport		
	2005-2006*	2007
Business jets that make up 0-75 percent of the national fleet		
Private Jets	302	464
Fractionals and Charters	138	182
Subtotal	440	646
Business jets that make up 75-100 percent of the national fleet		
Private Jets	56	230
Fractionals and Charters	92	150
Subtotal	148	380
Business Jets over 60,000 pounds		
Private Jets	70	78
Fractionals and Charters	12	20
Subtotal	82	98
TOTAL	670	1,124
*June 14, 2005 - June 15, 2006 Source: GCR - Airport IQ		

As can be seen in the table, total business jet operations have increased by more than 60 percent over the course of 18 months. Of particular note is the fact that operations by business jets in the 75-100 percent category have increased by 150 percent. These jets represented 380 operations in 2007. When adding operations by large

business jets, such as the Gulfstream aircraft, the large business jets conducted at least 478 operations in 2007.

These operational figures are documented by flight plans that were opened or closed on the ground at the airport. Flight plans that were opened or closed in the air are not credited to

the airport. While most business jet operators will file flight plans on the ground, some will not file a flight plan when visual conditions apply or they will file while in the air in order to save time. Therefore, these operations figures represent the most conservative estimate.

From this conservative estimate, it is clear that Glendale Municipal Airport is trending toward a critical aircraft for runway length determination in the 75-100 percent category of the national fleet. To accommodate these aircraft, a minimum runway length of 7,400 feet is recommended.

Runway Width

Runway 1-19 is 100 feet wide and constructed of asphalt. FAA design standards call for a runway width of 100 feet for aircraft in approach category C and airplane design groups I and II. The existing width meets the current and future critical aircraft needs.

Runway Strength

The FAA pavement strength rating for Runway 1-19 is 40,000 pounds single wheel loading (SWL). As previously mentioned, SWL refers to the aircraft weight based upon the landing gear configuration with a single wheel on the landing strut. The strength rating for dual wheel configurations (DWL) is 60,000 pounds.

The strength rating of a runway does not preclude aircraft weighing more than the published strength rating from using the runway. All federally

obligated airports must remain open to the public, and it is typically up to the pilot of the aircraft to determine if a runway can support their aircraft safely. An airport sponsor cannot restrict an aircraft from using the runway simply because its weight exceeds the published strength rating. On the other hand, the airport sponsor has an obligation to properly maintain the runway and protect the useful life of the runway, typically for 20 years.

According to the FAA published *Airport/Facility Directory*, "Runway strength-rating is not intended as a maximum allowable weight or as an operating limitation. Many airport pavements are capable of supporting limited operations with gross weights in excess of the published figures." The directory goes on to say that those aircraft exceeding the pavement strength should contact the airport sponsor for permission to operate at the airport.

The strength rating of a runway can change over time. Regular usage by heavier aircraft can decrease the strength rating, while periodic runway resurfacing can increase the strength rating. The current strength ratings of the runways are adequate to serve the critical aircraft in ARC C-II as well as occasional operations by larger aircraft.

Runway/Taxiway Separation

FAA AC 150/5300-13, *Airport Design*, Change 9, also discusses separation distances between a taxiway centerline and various areas on the airport.

The separation distances are a function of the approaches approved for the airport and the critical design aircraft. Runway 1-19, with a current and future critical aircraft in ARC C-II and with a one mile GPS instrument approach, should have a parallel taxiway located at least 300 feet from the runway centerline. The edge of aircraft parking areas should be at least 400 feet from the runway centerline. Taxiway A, the parallel taxiway to Runway 1-19, is located 252.5 feet from the runway centerline. This distance does not meet FAA standard.

Effective on January 1, 2002, the City of Glendale and the Glendale Municipal Airport FAA Contract Tower entered into a Letter of Agreement. The purpose of the agreement was to “provide operating procedures on Taxiway A when aircraft classified as B-II or greater are arriving or departing at the Glendale Municipal Airport.” The agreed procedure restricts aircraft from Taxiway A when B-II or larger aircraft are arriving or departing the airport.

TAXIWAYS

Taxiways are constructed primarily to facilitate aircraft movements to and from the runway system. Some taxiways are necessary simply to provide access between the aprons and runways, whereas other taxiways become necessary as activity increases at an airport to provide safe and efficient use of the airfield.

All taxiways at Glendale Municipal Airport are at least 35 feet wide, meet-

ing FAA standards for ADG II aircraft. A taxiway object free area (TOFA) applies to taxiways and taxilanes. The width of the TOFA is dependent on the wingspan of critical aircraft. For ADG II aircraft, the TOFA is 131 feet wide, 65.5 feet on either side of centerline. The taxiway shoulder width requirements are 10 feet for ADG II aircraft. The shoulders need to be traversable by vehicles and aircraft, should they veer off the taxiway.

The type and frequency of runway entrance/exit taxiways can affect the efficiency and capacity of the runway system. As previously presented in the capacity analysis, additional exit taxiways will benefit the airport by adding approximately eight percent to the overall annual service volume. Chapter Four - Airport Alternatives will address the optimal location of additional entrance/exit taxiways.

In the future, the east side of the airport may be developed for either a parallel runway, if necessary, or for additional landside facilities. There is a need for an east side parallel taxiway in either circumstance. An east side parallel taxiway should be located at least 300 feet from the runway centerline. This parallel taxiway would be required to provide efficient and direct access to the airfield for any facilities planned on the east side in the future.

Hold aprons have been constructed at the Runway 1 and 19 thresholds. Holding aprons provide an area for aircraft to prepare for departure off the taxiway and allow other aircraft which are ready for departure to pass. Additional holding aprons are located

to the west of Taxiways A-8 and A-2. These areas should be maintained through the planning period.

NAVIGATIONAL AIDS AND INSTRUMENT APPROACH PROCEDURES

Navigational Aids

Navigational aids are electronic devices that transmit radio frequencies which properly equipped aircraft and pilots translate into point-to-point guidance and position information. The very high frequency omnidirectional range (VOR), global positioning system (GPS), and LORAN-C are available for pilots to navigate to and from Glendale Municipal Airport. These systems are sufficient for navigation to and from the airport; therefore, no other navigational aids are needed at the airport.

Instrument Approach Procedures

Instrument approach procedures consist of a series of predetermined maneuvers established by the FAA for navigation to an airport, particularly during inclement weather conditions. There is currently a GPS-based approach to each runway at the airport.

The GPS approaches allow for visibility minimums not lower than one mile. Depending on the specific procedure followed, the cloud height minimum can range from 1,378 feet to 1,540 feet. Both of the GPS approaches have an LPV component available. Loosely defined, LPV stands for localizer perfor-

mance with vertical guidance. This component provides both vertical descent and lateral guidance to properly equipped aircraft.

The Runway 19 (RNAV) GPS approach is rarely utilized because of the complexities of the area airspace. The approach originates in Phoenix TRACON airspace while the majority of the approach is in Luke RAPCON airspace, with the missed approach returning to Phoenix TRACON airspace.

The existing approaches are adequate to serve the airport now and into the future. More sophisticated approaches, including an Instrument Landing System (ILS), are not considered for the airport at this time for several reasons. 1) Any ILS approach would potentially interfere with operations of other regional airports including Phoenix Sky Harbor and Luke Air Force Base. 2) The design standards for the airfield, including the separations standards for the runway and taxiway, could become more stringent, thus potentially placing the airfield layout in non-compliance with FAA design standards. 3) The prevailing visual conditions make justification for a more sophisticated approach challenging.

Weather Reporting Aids

Glendale Municipal Airport has a lighted wind cone and segmented circle as well as two lighted supplemental wind cones. The lighted wind cones provide information to pilots regarding wind conditions, such as di-

rection and speed. The segmented circle consists of a system of visual indicators designed to provide traffic pattern information to pilots. A wind cone and segmented circle are required since the airport traffic control tower (ATCT) is not open 24 hours per day. These should be maintained through the planning period.

Glendale Municipal Airport is equipped with an Automated Weather Observation System III (AWOS-III). The AWOS automatically records weather conditions such as wind speed, wind gust, wind direction, temperature, dew point, barometric pressure, visibility, precipitation, and cloud height. This system should be maintained through the planning period.

AIRPORT TRAFFIC CONTROL TOWER (ATCT)

The ATCT will likely be in need of replacement during the term of this master plan. The tower is aging as it was transferred to Glendale Municipal Airport in 1986 from Scottsdale Airport when a new tower was constructed there. As previously presented, there are a number of visual obstructions to primary operating areas on the airfield due to the cab eye elevation of the tower. In the future, as operations increase, it is recommended that a replacement tower be sited. The airport alternatives will include potential locations for a replacement tower.

AIRFIELD LIGHTING AND MARKING

There are a number of lighting and pavement marking aids serving pilots using the airport. These assist pilots in locating the airport and runway at night or in poor visibility conditions. They also assist in the ground movement of aircraft.

Runway and Taxiway Lighting

Runway identification lighting provides the pilot with a rapid and positive identification of the runway and its alignment. Runway 1-19 is equipped with medium intensity runway lighting (MIRL). This lighting should be maintained. Medium intensity taxiway lighting (MITL) is provided on all taxiways and should be maintained.

Pavement Markings

Runway markings are designed according to the type of instrument approach available on the runway. FAA AC 150/5340-1F, *Marking of Paved Areas on Airports*, provides guidance necessary to design an airport's markings. Runway 1-19 provides non-precision instrument markings. These markings should be properly maintained through the planning period.

Taxiway markings include a center-line stripe to aid pilots in ground movements and aircraft hold posi-

tions. Hold position markings are defined in AC 150/5340-18D, *Standards for Airport Sign Systems*. According to the AC, "Hold position markings must be placed in order to restrict the largest aircraft (tail or body) expected to use the runway from penetrating the Obstacle Free Zone." Thus, the hold position marking should be at least 200 feet from the runway centerline. At Glendale Municipal Airport, the taxiway hold position markings meet this standard.

Visual Approach Aids

To provide pilots with visual glide slope and descent information, precision approach path indicators (PAPIs) are located to the side of the runway near the touch down zone. These systems can consist of four-box units. Four-box PAPIs are recommended for runways utilized by business jet aircraft. These systems should be maintained on both runway ends.

Runway end identification lighting (REILs) provides rapid and positive identification of the approach end of the runway. The REIL system consists of two synchronized flashing lights, located laterally on each side of the runway threshold facing the approaching aircraft. REILs are located on both ends of Runway 1-19. REILs should be located at each runway landing threshold not served by a more sophisticated approach lighting system. The REILs serving Glendale Municipal Airport should be maintained as there is not a need for an approach lighting system.

The green and white airport beacon provides positive airport location information to pilots at night. The existing airport beacon should be maintained through the planning period.

Distance-To-Go Markers

Glendale Municipal Airport has distance-to-go markers on the east side of the runway. These markers identify remaining runway length available to the pilot of a departing aircraft. The markers are positioned every 1,000 feet and reflect the implementation of declared distances at the airport. These markers should be maintained through the planning period.

Helipad

Glendale Municipal Airport does not have a designated helipad. Transient helicopters and other locally based helicopters must operate in the same area as fixed-wing aircraft. Parking areas for helicopters and aircraft are typically segregated to the extent practicable to avoid the effects of helicopter rotor wash on fixed-wing aircraft. Facility planning will consider methods to segregate helicopter and fixed wing aircraft to the extent practicable.

LANDSIDE REQUIREMENTS

Landside facilities are those necessary for the handling of aircraft and passengers while on the ground. These

facilities provide the essential interface between the air and ground transportation modes. The capacity of the various components of each area was examined in relation to projected demand to identify future landside facility needs. This includes components for general aviation needs such as:

- Aircraft Hangars
- Aircraft Parking Aprons
- General Aviation Terminal
- Auto Parking and Access
- Airport Support Facilities

HANGARS

Utilization of hangar space varies as a function of local climate, security, and owner preferences. The trend in general aviation aircraft, whether single or multi-engine, is toward more sophisticated aircraft (and consequently, more expensive aircraft); therefore, many aircraft owners prefer enclosed hangar space to outside tie-downs.

The demand for aircraft storage hangars is dependent upon the number and type of aircraft expected to be based at the airport in the future. For planning purposes, it is necessary to estimate hangar requirements based upon forecast operational activity. However, hangar development should be based upon actual demand trends and financial investment conditions.

While a majority of aircraft owners prefer enclosed aircraft storage, a number of based aircraft owners will still tie-down outside (due to the lack of hangar availability, hangar rental rates, and/or operational needs). Therefore, enclosed hangar facilities

do not necessarily need to be planned for each based aircraft. At Glendale Municipal Airport, it is estimated that 89 percent of the based aircraft are stored in hangars. In the future it is estimated that 90 percent of the based aircraft at the airport will be stored in a hangar.

T-hangars and shade hangars are similar in size and will typically house a single engine piston powered aircraft. Some multi-engine aircraft owners may elect to utilize these facilities as well. There is a total of 215 individual storage units and 242,000 square feet of space in this category of aircraft storage. For determining future aircraft storage needs, a planning standard of 1,200 square feet per based aircraft is utilized for T-hangars and shade hangars.

Glendale Municipal Airport has both stand alone box hangars and connected box hangars, both of which are open-space facilities with no supporting structure interference. Currently, there are 151 box hangar positions, including eight positions provided by the stand alone box hangars on the south end of the airport. In total, these hangars provide 309,000 square feet of hangar storage space. Since a larger aircraft or multiple aircraft can be stored in a box hangar, a planning standard of 2,500 square feet per based aircraft is utilized.

There are two conventional hangars on the airfield. The Lux Air hangar is approximately 11,000 square feet. It is used primarily for aircraft maintenance activities. The second conventional hangar is approximately 15,000 square feet and is used primarily for helicopter storage by Air West.

A portion of executive and conventional hangars often are utilized for maintenance or for office space. A planning standard of 175 square feet per based aircraft is considered for these purposes and is in addition to the aircraft storage needs. **Table 3J** provides a summary of the aircraft storage needs through the long term planning horizon.

In order to meet the demand typical of a general aviation reliever airport such as Glendale Municipal Airport, additional storage space is needed. The most immediate need is for more

conventional and box hangar storage space. A total of 241,000 square feet of storage space is needed in the short term, while a total of 713,000 square feet may be needed by the long term planning period.

NOTE: As of summer 2008, several new hangars have been constructed at the airport since the hangar analysis was undertaken. These include a conventional hangar to the immediate south of the terminal building, a box hangar located in the northwest corner and a row of connected box hangars in the north area.

TABLE 3J Aircraft Storage Hangar Requirements Glendale Municipal Airport				
	Future Requirements			
	Currently Available	Short Term	Intermediate Term	Long Term
Total Based	380	454	534	703
Aircraft to be Hangared	338	412	485	639
T/Shade Hangar Positions	215	191	224	294
Box Hangar Positions	151	186	219	289
Conventional Hangar Positions	9	34	41	55
Hangar Area Requirements				
T/Shade Hangar Area	242,000	222,100	261,000	344,000
Box Hangar Area	309,000	450,300	532,400	705,600
Conventional Hangar Area	26,000	78,500	95,300	129,200
Maintenance Area	11,500	79,450	93,450	123,025
Total Hangar Area (s.f.)*	589,000	830,000	982,000	1,302,000
* Total rounded to nearest 1,000.				

AIRCRAFT PARKING APRON

FAA Advisory Circular 150/5300-13, *Airport Design*, Change 9, suggests a methodology by which transient apron requirements can be determined from knowledge of busy-day operations. At Glendale Municipal Airport, the number of itinerant spaces required was determined to be approximately 13 percent of the busy-day itinerant operations. A planning criterion of 800 square yards per aircraft was applied to determine future transient apron requirements for single and multi-engine aircraft. For business jets (which can be much larger), a planning criterion of 1,600 square yards per aircraft position was used. For planning purposes, 85 percent of these spaces are assumed to be utilized by non-jet aircraft, which is in line with national trends. Locally based tie-downs typically will be utilized by smaller single engine aircraft; thus, a planning standard of 650 square yards per position is utilized.

A parking apron should provide space for the number of locally based aircraft that are not stored in hangars, transient aircraft, and for maintenance activity. For local tie-down needs, an additional ten spaces are identified for maintenance activity. Maintenance activity would include the movement of aircraft into and out of hangar facilities and temporary storage of aircraft on the ramp.

Total apron parking requirements are presented in **Table 3K**. Currently, there are 10 transient positions available for single and multi-engine aircraft. For planning purposes, six of these are in the first row of terminal building parking and an additional four are adjacent the fixed base operator (FBO) hangar. A total of nine business jet positions are available with three of these near the terminal building and the remaining six south of the FBO building. There are a total of 187 tie-down positions on the main aircraft apron.

TABLE 3K
Aircraft Parking Apron Requirements
Glendale Municipal Airport

	Available	Short Term	Intermediate Term	Long Term
Single, Multi-engine Transient Aircraft Positions	10	28	32	40
Apron Area (s.y.)	8,000	22,000	25,500	32,200
Transient Business Jet Positions	9	12	15	18
Apron Area (s.y.)	20,000	19,200	24,000	28,800
Locally-Based Aircraft Positions	187	52	59	74
Apron Area (s.y.)	122,000	33,900	38,500	48,400
Total Positions	206	92	106	132
Total Apron Area (s.y.)	150,000	75,100	88,000	109,400

As shown in the table, transient parking for single and multi-engine aircraft is deficient. Transient business

jet parking appears to be adequate, but it should be recognized that at specific times, such as around the an-

nual NASCAR races, NFL football games, and NHL hockey games, this apron may become over crowded. To accommodate the increasing frequency of these busy periods considerations will be given to conversion of some of the local tie-down space to transient aircraft parking.

The adequacy of locally based tie-down positions is primarily dependant on the availability of aircraft storage hangar space. If hangar construction is unable to keep pace with demand, then the tie-down positions may fill rapidly. But for those aircraft owners that prefer a tiedown, space appears appropriate through the long term planning horizon.

An additional consideration for the main apron is the adequacy of the existing lighting system. Lighting of the main apron will aid pilots in taxiing during the nighttime hours and provide for security. The current apron lighting system consists of 12 light poles disbursed throughout the main apron and the south aircraft tie-down apron. Each of these light poles extends approximately 20 feet in the air. Glendale Municipal Airport experiences significant helicopter operations around these apron areas. During the day, the light poles can be difficult to see. Considerations should be given to relocating the light poles to the apron edges to improve flight safety or relocating helicopter activity.

GENERAL AVIATION TERMINAL FACILITIES

General aviation terminal facilities have several functions. Space is required for a pilots' lounge, flight planning, concessions, management, storage, and various other needs. This space is not necessarily limited to a single, separate terminal building, but can include space offered by fixed base operators (FBOs) for these functions and services.

The methodology used in estimating general aviation terminal facility needs is based on the number of airport users expected to utilize general aviation facilities during the design hour. General aviation space requirements were then based upon providing 120 square feet per design hour itinerant passenger. Design hour itinerant passengers are determined by multiplying design hour itinerant operations by the number of passengers on the aircraft (multiplier). An increasing passenger count (from 1.9 to 2.2) is used to account for the likely increase in the number of passengers utilizing general aviation services. **Table 3L** outlines the general aviation terminal facility space requirements for Glendale Municipal Airport.

As presented in the table, the existing public spaces appear adequate through the long term of the master plan. Of the 14,000 square feet currently available, 9,000 square feet is provided by the FBO, and 5,000 square feet is provided by the airport terminal building.

An additional consideration for terminal space is the anticipated emergence of a new class of aircraft. A number of aircraft manufacturers will be producing low cost microjets or very light jets (VLJs). The VLJs typically have a capacity of up to six passengers. A number of new companies are positioning themselves to utilize the VLJs for on-demand air taxi services. The air taxi businesses are banking on a desire by business travelers to avoid

delays at major commercial service airports by taking advantage of the nationwide network of general aviation airports such as Glendale Municipal Airport. General aviation airports with appropriate terminal building services are better positioned to meet the needs of this new class of business traveler. The current terminal building serving Glendale Municipal Airport should be adequate to meet these needs.

TABLE 3L
General Aviation Terminal Area Facilities
Glendale Municipal Airport

	Available	Short Term	Intermediate Term	Long Term
Design Hour Operations	56	70	81	102
Design Hour Itinerant Operations	21	26	30	38
Multiplier	1.8	1.9	2	2.2
Total Design Hour				
Itinerant Passengers	37	49	60	83
General Aviation*				
Building Spaces (s.f.)	14,000	5,900	7,200	10,000

* Includes space provided by the FBO and the terminal buildings.

SUPPORT REQUIREMENTS

Various facilities that do not logically fall within classifications of airside or landside facilities have also been identified. These other areas provide certain functions related to the overall operation of the airport.

AUTOMOBILE PARKING

General aviation vehicular parking demands have been determined for Glendale Municipal Airport. Space determinations were based on an evaluation of existing airport use, as well as industry standards. Terminal automobile parking spaces required to

meet general aviation itinerant demands were calculated by taking the design hour itinerant passengers and using a multiplier of 1.9, 2.0, and 2.2 for each planning period. This multiplier represents the anticipated increase in corporate operations and thus, passengers.

Currently the terminal building has approximately 200 parking spaces including the overflow lot to the west of Glen Harbor Boulevard. The FBO facility has approximately 30 spaces, some of which are utilized by the rental car agency. Even though it appears there are plenty of spaces for transient airport users, the location may not be ideal. It seems clear that

the FBO may need additional parking spaces, particularly since most of the business jet and turboprop transient activity utilize their services.

The parking requirements of based aircraft owners should also be considered. Although some owners prefer to park their vehicles in their hangars, safety can be compromised when automobile and aircraft movements are intermixed. For this reason, separate parking requirements which consider a parking space for one-half of

the based aircraft at the airport were applied to general aviation automobile parking space requirements.

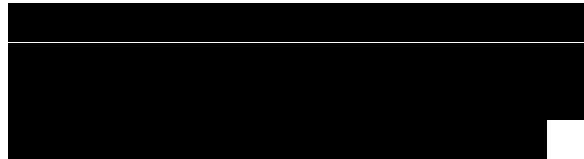
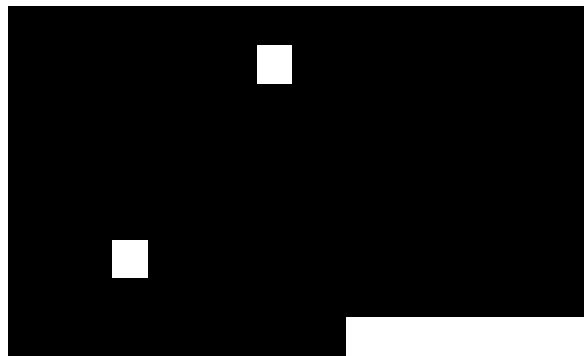
Most of the general aviation parking is located in a linear fashion along Glen Harbor Boulevard. Although these parking lots may not be close enough for some airport users, the location and position of these lots provides for an increased level of airport security by limiting vehicular traffic on the aprons. Parking requirements for the airport are summarized in **Table 3M**.

TABLE 3M
GA Vehicle Parking Requirements
Glendale Municipal Airport

	Future Requirements			
	Available	Short Term	Intermediate Term	Long Term
Design Hour Itinerant Passengers	37	49	60	83
Terminal Vehicle Spaces	230	89	108	149
Parking Area (s.f.)	82,000	35,400	43,200	59,800
General Aviation Spaces	420	227	267	352
Parking Area (s.f.)	195,000	90,800	106,800	140,600
Total Parking Spaces	650	316	375	501
Total Parking Area (s.f.)	277,000	126,200	150,000	200,400

The number of parking spaces appears to be adequate, but the location of those lots may not be convenient or efficient. The FBO facility could certainly benefit for additional parking and any new hangar development should consider additional parking or utilization of existing parking.

FUEL STORAGE





AIRCRAFT RESCUE AND FIREFIGHTING (ARFF)

There are presently no aircraft fire and rescue services located at the airport. The City of Glendale Fire Station No. 158 is located approximately three miles to the east of the airport and can respond to airport emergencies within approximately five minutes. The City of Phoenix Fire Station No. 54, home to Engine 54, is located approximately three miles to the southeast of the airport on Campbell Avenue. Through mutual aid agreements, fire stations in the Phoenix area are coordinated so that the closest fire station responds to an emergency.

Only airports that are certified under 14 CFR Part 139 are required to have ARFF facilities on or adjacent the airport. The requirements of Index A, the lowest level of conformance for firefighting material under Part 139, are listed in section 139.317, *Aircraft Rescue and Firefighting: Equipment and Agents*. Index A requires at least one vehicle carrying at least 500 pounds of sodium-based dry chemical, halon 1211, or clean agent; or 450 pounds of potassium-based dry chemical and water with a commensurate quantity of Aqueous Film Forming

Foam (AFFF) to total 100 gallons for simultaneous dry chemical and AFFF application.

Some corporate flight departments request ARFF services at the airports they utilize. Although not required for a general aviation airport such as GEU, some airport sponsors also promote ARFF certification for their firefighters.

WASH RACK

The airport has an aircraft wash rack and self-maintenance bay which should be maintained.

PERIMETER FENCING/GATES

Glendale Municipal Airport is currently surrounded by standard six-foot chain link fencing with barbed wire lining the top. There are six west side gated access points to the airfield. The access gates have a key pad to allow access to those with a proper code to access the airfield.

Airport fencing and restricted access gating provides an additional level of safety beyond what the FAA requires for general aviation airports. With Glendale Municipal Airport being located on the suburban edge of the city, it is prudent to maintain the fencing. By limiting access to the airport from non-aviation related traffic and pedestrians, airport safety and security is enhanced. This fencing is adequate and should be maintained through the planning period.

While the number of access entry points may be adequate, the location of the northwest gate is problematic. Vehicles wishing to enter the airport at this location must perform a U-turn on Glen Harbor Avenue. The airport should consider relocating this access gate so that potentially unsafe U-turns are not required. A second option would be to remove a portion of the road separator to allow access to the specified gate.

The next gate to the south is reserved for the exclusive use by tenants of one T-hangar structure. The airport should examine this situation and, if feasible, make this gate an access point for all tenants of the airport.

Many busy urban/suburban airports are also utilizing security camera surveillance to improve the safety and security of airport users. Currently, Lux Air utilizes these cameras to protect their interests. The City of Glendale may wish to consider a similar system to cover the entirety of airport property.

AIRPORT MAINTENANCE BUILDING

The primary airport maintenance building is located adjacent the airport traffic control tower and is attached to the designated aircraft wash rack. This facility provides approximately 5,000 square feet for the storage of airport maintenance equipment. This facility should be maintained through the long term planning period.

UTILITIES

Access to appropriate utilities for future development is available to the east and west sides of the airport.

VEHICLE ACCESS

Primary access to the airport is provided via Glen Harbor Boulevard. This road is a divided road that presents an attractive entrance to the airport. This road should be maintained. Any future development should include appropriate road construction to provide appropriate access. Directional signage is provided on the major roads leading to the airport, including Glendale Avenue and Loop 101. These signs should be maintained.

Vehicle access to aircraft hangars is available via movable security gates. While the security gates should be maintained, the location of the gates should be addressed. Of primary concern is the gate providing access to the northern connected box hangars. To access this gate from Glen Harbor Boulevard, airport users must perform a U-turn because of the nature of the divided road. Either the gate should be relocated or the appropriate portion of the divided road should be replaced with a turn lane.

SUMMARY

The intent of this chapter has been to outline the facilities required to meet

potential aviation demands projected for Glendale Municipal Airport for the planning horizon. A summary of the airside and landside requirements is presented on **Exhibits 3F** and **3G**.

Following the facility requirements determination, the next step is to de-

termine a direction of development which best meets these projected needs through a series of Airport Development Alternatives. The remainder of the master plan will be devoted to outlining this direction, its schedule, and its cost.

EXISTING	SHORT TERM NEED	LONG TERM NEED
Runway 1-19		
ARC C-II 7,150' x 100' 40,000 lbs. SWL 60,000 lbs. DWL	Same Same Same Same	Same Same Same Same
Runway Safety Area (RSA)		
125' to East of Runway 19 600' prior to landing threshold 600' behind Runway 19 200 Feet Behind Runway 1	200' each side of runway centerline Same 1,000' behind Runway 19 1,000' behind Runway 1	Same Same Same Same
Object Free Area (OFA)		
125' East of Runway 19/ 300' West of Runway 19 300' behind Runway 19 Zero feet behind Runway 1	400' each side of runway centerline 1,000' behind Runway 19 1,000' behind Runway 1	Same Same Same
Obstacle Free Zone (OFZ)		
125' East of Runway 19 Zero feet behind both runway ends	200' each side of runway centerline 200' behind both runways	Same Same
Runway Protection Zone (RPZ)		
Inner Width - 500' Outer Width - 1,010' Length - 1,700'	Same Same Same	Same Same Same
TAXIWAYS		
Full-length West side parallel taxiway (50' wide) 252.5' from runway centerline Connecting Taxiways A-1, A-2, A-3, A-7, A-8, A-9; 35' wide Hi-speed exit Taxiways A-4, A-5, A-6 Holding aprons at Taxiways A-1, A-2, A-8, A-9 No East side parallel taxiway	Same 300' from runway centerline Add two connecting Taxiways Same Same Same	Same Same Same Same Same Full length East side parallel taxiway (300' separation)
HELIPAD		
No Helipad	Helipad Two parking positions Lighted	Same Same Same
NAVIGATIONAL AIDS & INSTRUMENT APPROACHES		
Airport Traffic Control Tower Automated Surface Observation System 1 mile (RNAV) GPS/LPV approach to Rwy 19 1 mile (RNAV) GPS/LPV approach to Rwy 1	Same Same Same Same	Replacement Tower Same Same Same
LIGHTING AND MARKING		
Airport Beacon Segmented Circle MIRL/MITL Non-precision markings REIL's PAPI-2	Same Same Same Same Same Same	Same Same Same Same Same Same
KEY	SWL: Single Wheel Load Bearing DWL: Dual Wheel Load Bearing GPS: Global Positioning System ARC: Airport Reference Code	MIRL: Medium Intensity Runway Lighting MITL: Medium Intensity Taxiway Lighting REIL: Runway End Identifier PAPI: Precision Approach Path Indicator



AIRCRAFT STORAGE HANGARS



	AVAILABLE	SHORT TERM NEED	INTERMEDIATE NEED	LONG TERM NEED
Aircraft to be Hangared	338	412	485	639
T/Shade Hangar Positions	215	191	224	294
Box Hangar Positions	151	186	219	289
Conventional Hangar Positions	9	34	41	56
T/Shade Hangar Area (s.f.)	242,000	222,100	261,000	344,000
Box Hangar Area (s.f.)	309,000	450,300	532,400	705,600
Conventional Hangar Area (s.f.)	26,000	78,500	95,300	129,200
Maintenance Area (s.f.)	11,500	79,450	93,450	123,025
Total Hangar Area (s.f.)	589,000	830,000	982,000	1,302,000

APRON AREA



	AVAILABLE	SHORT TERM NEED	INTERMEDIATE NEED	LONG TERM NEED
Transient Apron Positions	19	40	47	58
Transient Apron Area (s.f.)	28,000	41,200	49,500	61,000
Locally Based Positions	187	52	59	74
Locally Based Area (s.f.)	122,000	33,900	38,500	48,400
Total Positions	206	92	106	133
Total Apron Area (s.f.)	150,000	75,100	88,000	109,400

TERMINAL SERVICES AND VEHICLE PARKING



	AVAILABLE	SHORT TERM NEED	INTERMEDIATE NEED	LONG TERM NEED
Terminal Building Space (s.f.)	14,000	5,900	7,200	10,000
Terminal Auto Parking Spaces (s.f.)	230	89	108	149
Terminal Auto Parking Area (s.f.)	82,000	35,400	43,200	59,800
Based GA Auto Parking	420	227	267	352
Based GA Auto Spaces (s.f.)	195,000	90,800	106,800	140,600
Total Parking Spaces	650	316	375	501
Total Parking Area (s.f.)	277,000	126,000	150,000	200,400



Chapter Four

ALTERNATIVES

Glendale municipal airport

Chapter 4

ALTERNATIVES

In the previous chapter, airside and landside facilities required to satisfy the demand for the long range planning period were identified. The next step in the planning process is to evaluate reasonable ways these facilities can be provided. There can be countless combinations of design alternatives, but the alternatives presented here are those with the greatest potential for implementation.

Any development proposed for a master plan is evolved from an analysis of projected needs for a set period of time. Though the needs were determined by the best methodology available, it cannot be assumed that future events will not change these needs. The master planning process attempts to develop a viable concept for meeting the needs caused by projected demands for the next twenty years. However, no plan of action should be developed which may be inconsistent with the future goals and objectives of the City of Glendale and its citizens, who have a vested interest in the development and operation of the airport.



The development alternatives for Glendale Municipal Airport can be categorized into two functional areas: the **airside** (runways, navigational aids, taxiways, etc.) and **landside** (general aviation hangars, apron, and terminal area). Within each of these areas, specific facilities are required or desired. In addition, the utilization of the airport property to provide revenue support for the airport and to benefit the economic development and well-being of the regional area must be considered.

Each functional area interrelates and affects the development potential of the others. Therefore, all areas must be examined individually, then coordinated as a whole to ensure the final



plan is functional, efficient, and cost-effective. The total impact of all these factors on the existing airport must be evaluated to determine if the investment in Glendale Municipal Airport will meet the needs of the community, both during and beyond the planning period.

The alternatives considered are compared using environmental, economic, and aviation factors to determine which of the alternatives will best fulfill the local aviation needs. With this information, as well as the input and direction from local government agencies and airport users, a final airport concept can evolve into a realistic development plan.

REVIEW OF PREVIOUS MASTER PLAN

The previous master plan for Glendale Municipal Airport was completed and adopted by the Glendale City Council in early 1998. At the time, the airport provided a single runway that was 5,350 feet long by 75 feet wide. Single engine piston powered aircraft dominated the based aircraft mix total of 188 aircraft. Operations at the airport had increased from 33,000 during its inaugural year in 1986, to 118,000 in 1996, the base year for the plan. Annual operations were forecast to reach 215,000 by 2020. **Exhibit 4A** presents the recommended 1998 master plan.

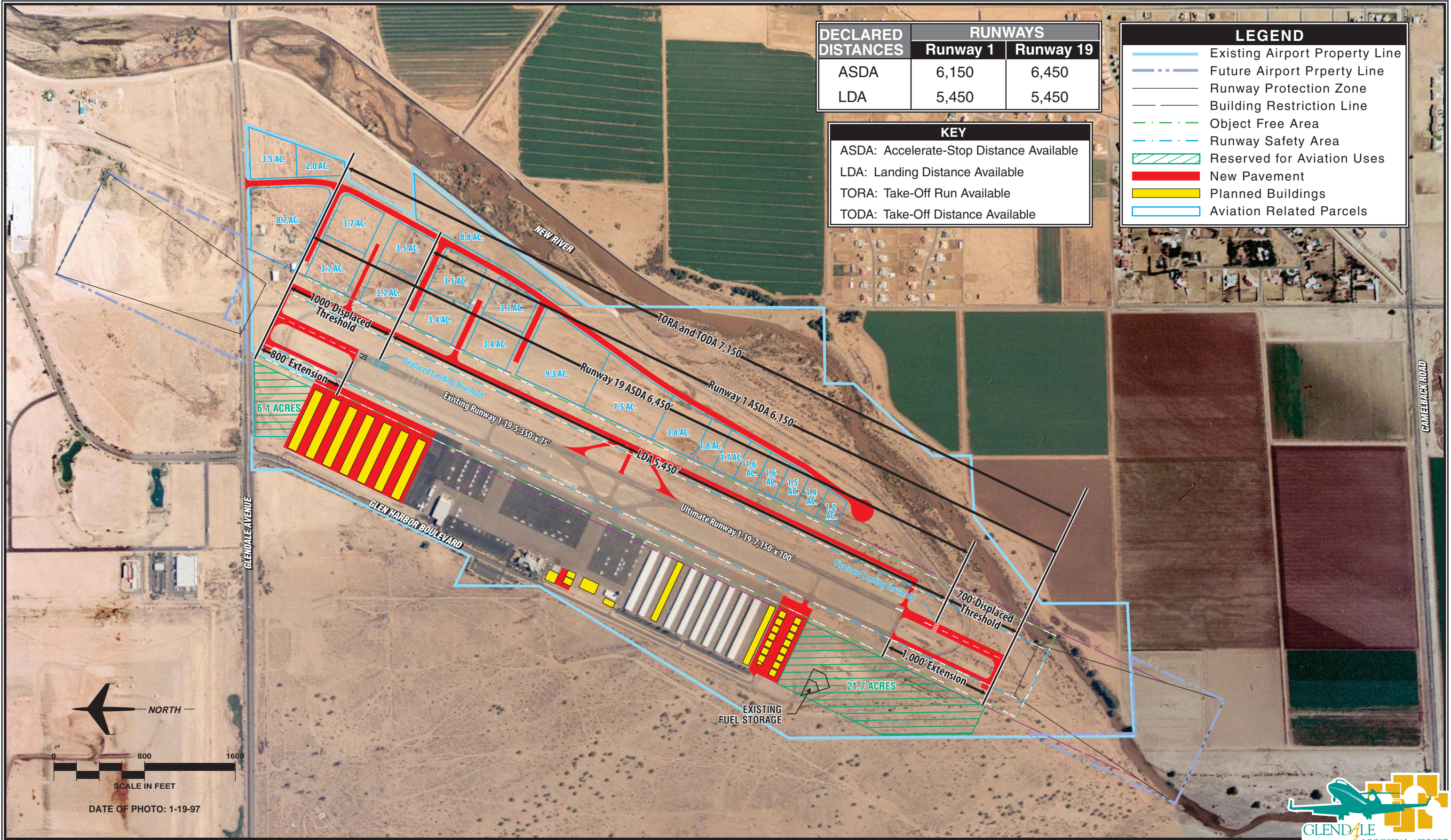
The previous master plan recommended maximizing the runway and taxiway system to accommodate projected growth in business jet and turboprop

activity at the airport. To accomplish this, the runway was recommended for extension and widening. Along with accommodating business jets comes the requirement to meet more stringent Federal Aviation Administration (FAA) standards for safety area beyond the runway ends. The runway safety area (RSA) and object free area (OFA) surrounding the runway increased from 300 feet to 1,000 feet as business jet activity reached 500 or more annual operations.

The runway was recommended to be extended to a length of 7,150 feet long by 100 feet wide. This included a 1,000-foot extension to the south and an 800-foot extension to the north.

Most of the airside projects associated with the previous master plan have been undertaken. The runway was extended to a total of 7,150 feet and widened to 100 feet. This length represents the realistic maximum for the site. Displaced landing thresholds were marked in order to provide for RSA and OFA, and runway lighting was installed to reflect the use of declared distances. Where possible, airfield improvements were intended to fully accommodate business jet aircraft in ARC C-II.

One area where the construction differed from the previous master plan is the location of the south gabion. This gabion was intended to accommodate a 500-foot wide RSA and extend 300 feet beyond the south pavement end. Due to post-master plan analysis, it was necessary to construct the gabion to accommodate a 400-foot wide RSA with a length beyond the runway

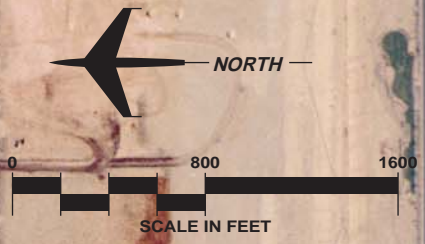


DECLARED DISTANCES	RUNWAYS	
	Runway 1	Runway 19
ASDA	6,150	6,450
LDA	5,450	5,450

KEY

ASDA: Accelerate-Stop Distance Available
 LDA: Landing Distance Available
 TORA: Take-Off Run Available
 TODA: Take-Off Distance Available

LEGEND	
	Existing Airport Property Line
	Future Airport Property Line
	Runway Protection Zone
	Building Restriction Line
	Object Free Area
	Runway Safety Area
	Reserved for Aviation Uses
	New Pavement
	Planned Buildings
	Aviation Related Parcels



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pavement end of approximately 200 feet. As a result, the south RSA extends over the gabion and into the New River channel.

Many of the landside recommendations of the previous master plan have also been completed. Over 140 individual aircraft parking positions have been provided on the north end of the airfield. Conventional hangars have been constructed on the main apron and many box hangars have been constructed on the south end of the airfield. None of the east side development has taken place due to the uncertain disposition of the property. It is now known that much of the east side property must be reserved for a potential parallel runway until at least 2012, when further analysis of the need for the runway must be conducted.

AIRPORT DEVELOPMENT OBJECTIVES

It is the goal of this effort to produce a balanced airside and an appropriate landside aircraft storage mix to best serve forecast aviation demands. However, before defining and evaluating specific alternatives, airport development objectives should be considered. As owner and operator, the City of Glendale provides the overall guidance for the operation and development of the Glendale Municipal Airport. It is of primary concern that the airport is marketed, developed, and operated for the betterment of the community and its users. With this in mind, the following development ob-

jectives have been defined for this planning effort:

- To preserve and protect public and private investments in existing airport facilities.
- To develop a safe, attractive, and efficient aviation facility in accordance with applicable federal, state, and local regulations.
- To develop a balanced facility that is responsive to current and long term needs of all general aviation users.
- To be reflective and supportive of the City of Glendale Comprehensive Plan, *2025 The Next Step*.
- To ensure that future development will not negatively impact Luke Air Force Base's mission.
- To develop a facility with a focus on self-sufficiency in both operational and developmental cost recovery.
- To ensure that future development is environmentally compatible.

AIRSIDE PLANNING ISSUES

Developing the existing airport site to meet the long term aviation demand will consider the airside planning issues presented on **Exhibit 4B**. The overall capacity of the airport is of primary importance. Analysis in the previous chapter indicated that during the term of this master plan (20 years), the ability of the current runway/taxiway system to support growth may become constrained. A number of

capacity enhancements will be considered, including the addition of a parallel runway and taxiway improvements.

Adherence to airport design standards, as prescribed by the FAA, is of critical importance. As described previously in Chapter Three - Facility Requirements, the airport does not fully comply with Airport Reference Code (ARC) C-II (aircraft with approach speeds less than 140 knots and wingspans less than 79) design standards. The FAA has placed a great deal of emphasis on meeting these standards, especially with the publicity of recent aircraft accidents occurring at airports with inadequate runway safety areas (RSAs).

Once specific analysis on the potential for a parallel runway and solutions to design standard deficiencies is complete, those results will be applied to the airport development alternatives to be presented. The airport development alternatives will individually address additional airside issues such as the possibility of improved instrument approaches and further capacity enhancements through runway and/or taxiway improvements.

RUNWAY/TAXIWAY SEPARATION ANALYSIS

Runway 1-19 is planned to accommodate aircraft through ARC C-II. FAA standards specify that the runway/parallel taxiway separation for aircraft in ARC C-II should be 300 feet, as measured from centerline to

centerline. At the time of the previous master plan, the Runway 1-19/ Taxiway A separation was 240 feet. When the runway was widened to 100 feet in 2003, an additional 25 feet of pavement was added entirely to the east side of the runway. This increased the runway/taxiway separation to 252.5 feet.

For aircraft in ARC C-II, FAA standards specify that a parallel taxiway/taxilane be separated by a distance of 105 feet and 57.5 feet between the centerline of a taxilane and a fixed or movable object, such as a hangar or aircraft parking. These distances apply at Glendale Municipal Airport where the apron taxilane extends parallel to Taxiway A. Presently, the apron edge taxilane is located 105 feet west of Taxiway A. The apron taxilane and nearest hangars or tie-down spaces are separated by 103 feet. In order to maintain proper separation between the runway and parallel taxiway and the parallel taxiway and the apron taxilane, 462.5 feet is needed between the runway and the nearest object. The current distance to the nearest building from the Runway 1-19 centerline is 460.5 feet.

During the design of the runway lengthening and widening project, consideration was given to increasing the Runway 1-19 and Taxiway A separation. The Design Concept Report produced by the engineer of record for the project dated January 2002, indicated that, "A request for an approval for a modification to this standard was submitted to the FAA." In lieu of ap-

AIRSIDE PLANNING ISSUES

- ➔ Analyze the ability of the airport to meet design standards for critical aircraft represented by Airport Reference Code (ARC) C-II. This includes the Runway Safety Area, Object Free Area, Obstacle Free Zone, and Runway Protection Zone.
- ➔ Analyze the ability of the airport to meet runway to parallel taxiway separation standards for a critical aircraft represented by ARC C-II.
- ➔ Analyze current and future capacity constraints. Present capacity improvement projects such as additional taxiways, high speed taxiway exits, and the potential for a parallel runway.
- ➔ Consider improved instrument approaches.
- ➔ Identify strategic land acquisition needs.

LANDSIDE PLANNING ISSUES

- ➔ Maximize available property for facility development.
- ➔ Provide for appropriate separation of activity levels.
- ➔ Provide a variety of aircraft storage options including T-hangars, shade hangars, box hangars, conventional hangars, and corporate aviation parcels.
- ➔ Identify potential helipad site.
- ➔ Identify site for a replacement airport traffic control tower.
- ➔ Consider the location of taxiway access from the property immediately West of Glen Harbor Boulevard.



proving the design modification, the FAA requested that operational procedures be followed by the airport to maintain safe operations when C-II aircraft are using the runway. Operational procedures can include holding aircraft on the ramp area, short of Taxiway Alpha.

A Letter of Agreement between the City of Glendale and the contracted airport traffic control tower operator, Serco Management Services, was subsequently executed and took effect January 1, 2002. Procedures were put into place that would require tower personnel to hold all aircraft short of Taxiway A when "high performance aircraft" (B-II or greater) are on approach or take-off. It should be noted that this agreement is more restrictive than the request from the FAA for special procedures related to aircraft in ARC C-II.

This operational agreement is non-standard and may lead to operational concerns, particularly during peak periods, such as when events are held at the football and/or hockey stadium. The potential operational concerns include: 1) Holding a business jet on the apron can lead to additional jet blast, which may shorten the useful life of the pavement and markings. 2) Idling aircraft increase air emissions and reduces air quality. 3) Holding aircraft prior to the taxiway or on the ramp can lead to pilot confusion as it is an unusual procedure, as holding usually takes place on the taxiway or on a designated holding apron. 4) This procedure will lead to a reduction in overall airport capacity by adding to aircraft delay, as aircraft are held on the apron and not allowed to simulta-

neously taxi to the runway end when certain aircraft are departing or landing the runway. 5) Finally, this procedure cannot be fully enforced as the tower is closed at nighttime. With operations forecast to continue growing, this procedure may be detrimental to overall capacity and delay.

The runway/taxiway separation standard is intended to prevent the possibility of an aircraft operating on the runway from coming into contact with the wing of an aircraft operating on the taxiway. Also, the separation standard should prevent the wing of a taxiing aircraft from penetrating the RSA or OFZ surrounding the runway. At Glendale Municipal Airport, the RSA and OFZ are both 400 feet wide, and centered on the runway centerline. Four options for addressing the runway/taxiway separation issue are presented on **Exhibit 4C**.

Option 1

Two aircraft with the maximum wingspan of 79 feet (ARC C-II) can operate on the runway and parallel taxiway at the same time without any penetration to the RSA or OFZ. In fact, the minimum separation for an ARC C-II aircraft on the parallel taxiway would be 239.5 feet (200 feet of OFZ/RSA and 39.5 feet for the maximum ARC C-II wingspan). The existing runway/taxiway separation provides an additional 13 feet of distance between the wing of an ARC C-II aircraft taxiing on the parallel taxiway and the OFZ/RSA surfaces surrounding the runway. Based on these calculations and forecasts indicating that

the critical aircraft will remain in ARC C-II, a modification to standard for runway/taxiway separation could be sought for maintaining the existing runway taxiway separation.

Option 2

A second option would be to relocate Taxiway A to a separation of 300 feet from the runway. This would require the relocation of the terminal area taxilane to a distance of 105 feet from Taxiway A. An additional 57.5 feet is needed from the taxilane centerline to an object, such as the hangars, which would only be 55.5 feet from the relocated taxilane. A modification to standard could be sought for a deficiency in the separation between the taxiway and the taxilane. The current standard is 105 feet, the modification to standard would allow this distance to be 103 feet, thus maintaining 57.5 feet between the hangars and taxilane.

Option 3

A third option is to obtain a modification to standard for the separation distance between a taxilane and an object. The current standard is 57.5 feet for Group II aircraft where the modification to standard would allow for the 55.5 feet.

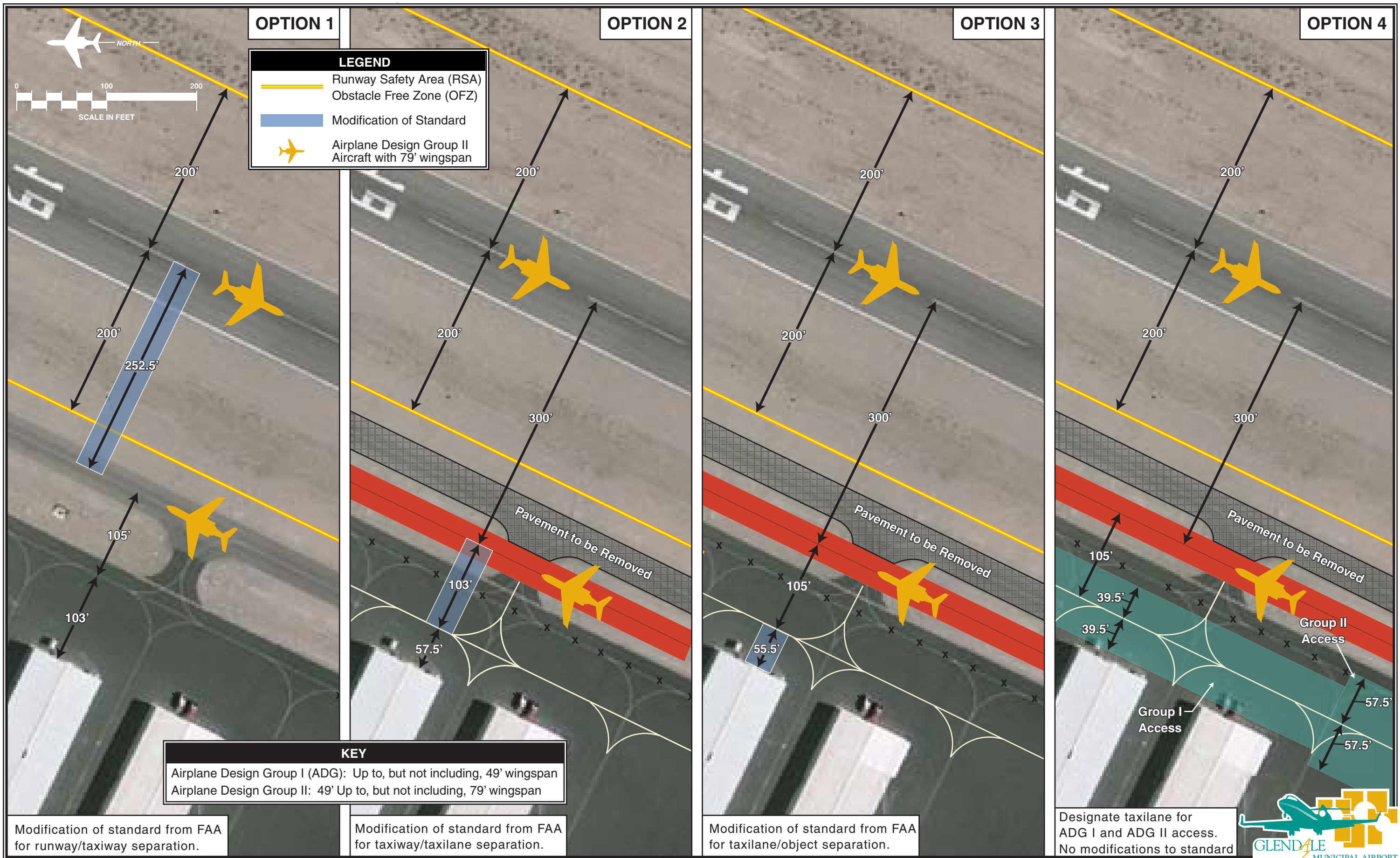
Option 4

The fourth option is to relocate Taxiway A to a separation distance of 300 feet. The terminal area taxilane

would then be relocated to a distance of 105 feet from the parallel taxiway. The remaining distance to the buildings is 55.5 feet, where 57.5 feet are necessary. The areas accessed by the taxilane are T-hangars, shade hangars, and connected box hangars. All of these are likely to house aircraft in Airplane Design Group (ADG) I (wingspans up to 49 feet). The separation standard between a taxilane and an object is 39.5 feet for ADG I aircraft, not the more restrictive 57.5 feet for Group II aircraft. Thus, this option considers designating those taxilanes providing access to hangar complexes as Group I taxilanes. This is the only option that does not require an FAA-approved modification to standard, while providing for a full 300-foot separation between Runway 1-19 and Taxiway A.

Summary

Relocation of Taxiway A to a separation distance of 300 feet would be costly. It is estimated that the relocated taxiway would encompass at least 28,000 square yards of pavement. A conservative estimate is that the taxiway would cost \$4.2 million to construct. In addition, the terminal area taxilane would need to be relocated at additional expense. Approximately 10 aircraft tie-down positions closest to the runway would also need to be removed or relocated. Finally, either a modification of standard for taxilane separation standards or designation of portions of the taxilane for use by Group I aircraft would have to be undertaken.



RUNWAY SAFETY AREA (RSA) CONSIDERATIONS

The runway safety area (RSA) is a designated area surrounding the runways. According to the FAA, the RSA is to be:

- (1) cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations;
- (2) drained by grading or storm sewers to prevent water accumulation;
- (3) capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and fire-fighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft, and;
- (4) free of objects, except for objects that need to be located in the RSA because of their function (in aiding air navigation).

The dimension of the RSA surrounding the runway is a function of the critical aircraft. The current and future critical aircraft for Glendale Municipal Airport falls in ARC C-II. The RSA serving Runway 1-19 should be 400 feet wide (centered on the runway centerline) and extend 1,000 feet beyond the far end of the runway and 600 feet prior to the landing threshold. Since operations are performed to/from both runway ends, depending on wind conditions, the RSA effectively needs to extend 1,000 feet beyond each runway end.

FAA Order 5300.1F, *Modification of Agency Airport Design, Construction, and Equipment Standards*, indicates in Paragraph 6.d the following:

“. . . Runway safety areas at both certificated and non-certificated airports that do not meet dimensional standards are subject to FAA Order 5200.8, *Runway Safety Area Program*. Modification of Standards is not issued for nonstandard runway safety areas.”

The FAA placed a greater emphasis on meeting RSA standards with the publication of FAA Order 5200.8, *Runway Safety Area Program*, in 1999, following congressional direction. The Order states in Paragraph 5, “The object of the Runway Safety Area Program is that all RSAs at federally obligated airports and all RSAs at airports certified under 14 Code of Federal Regulations (CFR) Part 139 shall conform to the standards contained in AC 150/5300-13, *Airport Design*, to the extent practicable.”

The Order goes on to state in Paragraph 8.b:

“The Regional Airports Division Manager shall review all data collected for each RSA in Paragraph 7, along with the supporting documentation prepared by the region for that RSA, and make one of the following determinations:

- (1) The existing RSA meets the current standards contained in AC 150/5300-13, *Airport Design*.

- (2) The existing RSA does not meet the current standards, but it is practicable to improve the RSA so that it will meet current standards.
- (3) The existing RSA can be improved to enhance safety, but the RSA will still not meet current standards.
- (4) The existing RSA does not meet current RSA standards, and it is not practicable to improve the RSA.”

The findings of this master plan will aid the Regional Airports Division Manager for the FAA’s Western Pacific Region in making a determination on the existing condition of the RSAs at Glendale Municipal Airport.

Appendix 2 of FAA Order 5200.8 provides the direction for an RSA determination. This includes the alternatives that must be evaluated. Paragraph 3 of Appendix 2 states:

“The first alternative that must be considered in every case is constructing the traditional graded runway safety area surrounding the runway. Where it is not practicable to obtain the entire safety area in this manner, as much as possible should be obtained. Then the following alternatives shall be addressed in the supporting documentation”

- Construct the traditional graded runway safety area surrounding the runway.
- Relocation, shifting, or realignment of the runway.

- Reduction in runway length where the existing runway length exceeds that which is required for the existing or projected design aircraft.
- A combination of runway relocation, shifting, grading, realignment, or reduction.
- Implementation of declared distances.
- Installation of Engineered Materials Arresting Systems (EMAS).

The following subsections will discuss the application of the above FAA-recommended alternatives for mitigating RSA deficiencies. Runway 1-19 is designed to serve the critical aircraft which falls in ARC C-II. As previously presented on Exhibit 3D, there are a number of areas where the RSA surrounding the runway does not meet standard. To the south and southeast, the perimeter fence, perimeter road, and gabion penetrate the RSA.

One area where the construction differed from the previous master plan is the location of the south gabion. This gabion was intended to accommodate an RSA that would extend 250 feet to each side of the runway centerline and extend 300 feet beyond the Runway 1 pavement end. Following the master plan, the gabion was constructed to only accommodate an RSA that extends 200 feet to each side of the runway centerline and approximately 200 feet beyond the pavement end. As a result of this reduction and shifting of the Runway 1-19 centerline to the east when the runway was widened, the RSA at the Runway 1 end extends over the gabion and into the New River channel and is obstructed by an un-

paved service road and the perimeter fence.

It should be noted that the following mitigation alternatives specifically apply to the RSA, but where practicable, consideration will be given to meeting OFA and obstacle free zone (OFZ) standards as well. The obstacle free zone (OFZ) is 400 feet wide, centered on the runway, and extends 200 feet beyond the runway ends. According to FAA AC 150/5300, *Airport Design*, "The OFZ clearing standard precludes taxiing and parked airplanes and object penetrations..." The OFZ currently is penetrated by the north end blast deflection fence and Glendale Avenue. In order to preserve the blast deflection fence, the runway would need to be shortened by 200 feet, thus bringing the OFZ onto airport property. If 200 feet of runway were removed prior to the blast deflection fence, its effectiveness would be reduced. Thus, if the blast deflection fence were removed, then the runway could then be reduced by only 100 feet on the Runway 19 end in order to bring the OFZ onto airport property and off of Glendale Avenue. The OFZ also extends beyond airport property to the northeast and is obstructed by the perimeter fence.

The object free area (OFA) is also penetrated in a number of areas surrounding the runway. The OFA is 800 feet wide, centered on the runway, and extends 1,000 feet beyond the runway ends. The OFA extends off airport property and is obstructed by buildings and a perimeter fence.

An ongoing issue with the OFA is the presence of the perimeter fence on the

southeast side of the airfield. The fence currently provides for general airport security and prevents wildlife from accessing the active runway. To relocate the fence outside the OFA on the south, the fence would need to be relocated into the New River channel. During heavy river flows, the fence would be washed out. Thus, the only method of maintaining the perimeter fence would be to request a Modification of Standard from the FAA.

The runway protection zone (RPZ) is a trapezoidal area beyond both runway ends where incompatible land uses should be removed. Currently, there is no development in either RPZ at the airport. If possible, the airport should acquire the full RPZ through fee-simple acquisition.

All alternatives assume the acquisition of property northeast of the Runway 19 end along Glendale Avenue. Acquisition of this property will allow the airport to clear obstructions to the RSA and OFA, such as buildings and perimeter fencing.

RSA Alternative A: Provide Full RSA

Providing the full RSA and OFA beyond the runway ends was examined fully during the previous master plan and subsequent design process. On the north end, consideration was given to realigning Glendale Avenue farther north so that the road does not penetrate the RSA or OFA behind the extended Runway 19 end. This action would have limited planned expansion of a company lo-

cated in the Glendale Airpark immediately north of the airport. Since this would have required land acquisition for the airport and the company's existing lot would have been reduced, the company would have been in violation of zoning rules established by the City of Glendale requiring that covered buildings comprise no more than 50 percent of the total parcel area. In addition, primary City utilities such as water, sanitary sewer, storm sewer, and telecommunication lines are located along Glendale Avenue. These would require relocation. Land acquisition and construction costs were estimated at nearly \$20 million in 2000 for the relocation of Glendale Avenue and land acquisition.

A second alternative for the north end was the possibility of tunneling Glendale Avenue under the RSA and OFA. Similar to the relocation alternative described above, this alternative would have also required acquisition of approximately 12 acres of property in the business park to the north, which would limit the expansion possibilities of the company currently owning the land. The cost of this alternative was estimated at \$42 million in 2000.

On the south end of the runway, two options were considered for accommodating the extension to the Runway 1 end and the longer RSA and OFA. The first option considered construction of a pier into the New River channel to accommodate the RSA. This pier may have altered flows in the New River channel to such a degree that additional alteration to the channel would have been necessary and the bridge crossing Camelback

Road would have to be reconstructed to allow for the change in flow. This alternative was estimated at nearly \$60 million.

The second alternative considered on the south end was the extension of the gabion to the south, further into the New River Channel. The gabion on the east side of the airport was designed in 1998 to accommodate the planned runway extension shown in the 1998 master plan. This construction was considered by the Maricopa County Flood Control District as the maximum extension of the gabion possible without affecting flows in the New River Channel. Extending the gabion would alter the flows in the New River channel similar to the pier concept above, necessitating the reconstruction of the Camelback Road bridge. This alternative was estimated at \$47 million.

Providing full RSA beyond the runway ends is impractical. The cost to alter the surface road system, utility lines, and/or the New River channel would exceed the benefit provided. Therefore, the remaining alternatives are considered in accordance with FAA guidance.

RSA Alternative B: Relocate, Shift, or Realign the Runway

During the design process for the runway extension project, consideration was given to constructing a new runway and taxiway system to meet RSA and OFA standards and accommodate the proposed runway length of 7,150 feet in a northeast-southwest

manner. Impacts of this alternative included the acquisition of 72 acres of land to the north, realigning Glendale Avenue, and construction of a new Glendale Avenue bridge over the New River to maintain roadway radius standards. Changing the runway orientation would create new flight patterns that could have potentially conflicted with Luke Air Force Base operations. Noise exposure patterns would have been altered, potentially requiring an Environmental Impact Statement (EIS), and the high-voltage transmission lines to the immediate west of the airport may have created additional safety concerns.

As shown in Chapter Three - Facility Requirements, the runway is aligned in the ideal direction as determined by the wind analysis. Relocating or realigning the runway is impractical due to limited airport property available and the physical constraints of Glendale Avenue to the north and the river to the south. Shifting the runway is not practicable either as there is no available land to add runway length at the north or south end.

RSA Alternative C: Decrease Runway Length

As presented in Chapter Three - Facility Requirements, a preferred runway length to serve the current and future critical aircraft is approximately 7,400 feet. This length would accommodate 100 percent of large business jet aircraft (those under 60,000 pounds) at 60 percent useful load. The runway is currently 7,150 feet long, allowing for

the majority of these business jets to operate at the airport, but with weight restrictions. A reduction in runway length would have negative impacts on the capability of the runway to serve the critical aircraft. Therefore, no reduction in runway length can be considered to meet RSA and OFA standards. Advisory Circular 150/5220-22A, *Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns*, published in September 2005, further states: "The FAA does not require an airport sponsor to reduce the length of a runway or declare its length to be less than the actual pavement length to meet runway safety area standards if there is an operational impact to the airport."

RSA Alternative D: Combination Method

The combination method provides the flexibility to combine runway relocation, shifting, realignment, or reduction in order to provide the full RSA. As discussed above, relocation, shifting, realigning, or a significant runway length reduction are not practicable.

RSA Alternative E: Implement Declared Distances

Declared distances are the effective runway distances that the airport operator declares available for take-off run, take-off distance, accelerate stop distance, and landing distance requirements. These are defined by the FAA as:

Take-off run available (TORA) - The length of the runway declared available and suitable to accelerate from break release to lift-off, plus safety factors.

Take-off distance available (TODA) - The TODA plus the length of any remaining runway or clearway beyond the far end of the TORA available to accelerate from break release past lift-off to start of take-off climb, plus safety factors.

Accelerate-stop distance available (ASDA) - The length of the runway plus stopway declared available and suitable to accelerate from break release to take-off decision speed, and then decelerate to a stop, plus safety factors.

Landing distance available (LDA) - The distance from the threshold to complete the approach, touchdown, and decelerate to a stop, plus safety factors.

The TORA and TODA are equal to the actual runway length as a clearway is not provided at the airport. The ASDA and the LDA are the primary considerations in determining the runway length available for use by aircraft, as pilots must consider providing the full RSA and OFA in operational calculations. The ASDA and LDA can be figured as the usable portions of the runway length less the distance required to maintain adequate RSA and OFA beyond the ends of the runway. By regulations, a full 1,000 feet of OFA and RSA must be available at the far end of a departure operation in the ASDA calculation. For LDA calculations, 600 feet of RSA

and OFA is required prior to the landing threshold and 1,000 feet of RSA and OFA is required beyond the far end of the landing operation. **Table 4A** presents the declared distances at Glendale Municipal Airport considering the existing site limitations and runway markings. It should be noted that these declared distances have not been published by the FAA.

The previous master plan concluded that declared distances should be used to meet RSA and OFA standards at the airport. While the runway has been constructed assuming declared distances, declared distances have not been published for the airport. Furthermore, the declared distances do not currently provide for full compliance with RSA standards. Since the last master plan, the FAA has changed the standard for RSA necessary prior to landing to 600 feet instead of the previous standard of 1,000 feet. Thus, declared distances for the airport can be changed to reflect the new standard and provide for full safety area compliance.

Assuming this design standard change, the LDA for Runway 1 would increase to 5,750 feet. This calculation is determined by displacing the Runway 1 landing threshold 400 feet from the Runway 1 pavement end. This distance, in combination with the 200 feet of RSA available behind the runway end, provides the full 600 feet of RSA necessary prior to the landing threshold. As is currently the case, the last 1,000 feet of the runway would be declared for RSA and would not be available as part of the landing operation.

TABLE 4A Declared Distances Glendale Municipal Airport		
	Runway 1	Runway 19
Declared Distances (Not Published)		
ASDA	6,150'	6,450'
LDA	5,450'	5,450'
TORA/TODA	7,150'	7,150'
Alt A: Provide Full RSA	Not Applicable	
Alt B: Relocate, Realign, Shift Runway	Not Applicable	
Alt C: Decrease Runway Length	Not Applicable	
Alt D: Combination Method	Not Applicable	
Alt E: Declared Distances with 600-foot displaced landing threshold		
ASDA	6,150'	6,350'
LDA	5,750'	5,750'
TORA/TODA	7,150'	7,150'
Alt F: Engineering Materials Arresting System (EMAS) *		
ASDA	6,530'	6,530'
LDA	6,365'	6,365'
TORA/TODA	6,530'	6,530'
TORA: Take-off run available TODA: Take-off distance available ASDA: Accelerate-stop distance available LDA: Landing distance available		* Refined in Chapter Five to reflect new EMAS product.

The LDA for Runway 19 is calculated by providing the landing threshold 600 feet from the current pavement end. The end of the runway would then be declared 800 feet prior to the far pavement end since the remaining 200 feet of RSA would be available beyond the Runway 1 pavement end. Thus, the LDA for Runway 19 would also be 5,750 feet.

An ASDA of 6,150 feet in length for Runway 1 is calculated from the pavement end to a departure point that is 1,000 feet from the far pavement end, as 1,000 feet of RSA is necessary on the far end of the runway. This is the same as the declared distances in use today. The ASDA for Runway 19 would be 6,350 feet. This is 100 feet less than is currently avail-

able due to fact that 100 feet of the RSA behind Runway 1 extends over the gabion.

When implementing declared distances under the most recent update provided by the FAA, the airport would gain 300 feet of operational length for landing in both directions. The ASDA for Runway 1 would remain the same at 6,150 feet, while for Runway 19 the ASDA would be 100 feet shorter.

RSA Alternative F: Engineered Materials Arresting System (EMAS)

EMAS is an engineered compressible concrete material that is located be-

yond the runway end with the purpose of safely stopping an aircraft overrun. EMAS functions similar to the sandy, high-speed exits provided on highways in mountainous terrain in order to safely stop a runaway tractor trailer. The FAA considers the installation of EMAS as an acceptable substitute to providing the full RSA. EMAS is designed to stop an aircraft overrun by exerting predictable deceleration forces on the landing gear as the EMAS material crushes. It is designed to minimize the potential for structural damage to the aircraft, since such damage could result in injuries to passengers and/or affect the predictability of deceleration forces.

Guidance for the design of an EMAS bed is provided in FAA Order 5200.9, *Financial Feasibility and Equivalency of Runway Safety Area Improvements and Engineered Material Arresting Systems*. The length of the EMAS bed is established by the maximum takeoff weight of the largest aircraft to use the airport. At Glendale Municipal Airport, the design weight of the runway is 60,000 pounds single wheel loading and 75,000 pounds dual wheel loading.

For Glendale Municipal Airport the EMAS bed length must be 400 feet long and 100 feet wide. An additional 10 feet of paved surface is necessary to the sides of the EMAS bed. The EMAS bed begins at least 35 feet from the runway pavement end, according to the manufacturer. The EMAS bed is considered an appropriate substitute for meeting RSA standards on the far runway end. It is not considered as a substitute for aircraft under-shoots; thus, 600 feet of RSA is still

necessary prior to the landing threshold.

The cost of installing EMAS at the airport is estimated at approximately \$4 million per runway end. In Order 5200.9, approximately \$11 million is the maximum amount the FAA would consider feasible for both ends of Glendale Municipal Airport.

Installing EMAS at Glendale Municipal Airport would provide greater operational capacity for aircraft currently using the airport by making available much more runway for take-off and landing calculations by pilots, since the full 1,000 feet of RSA at the far end of the takeoff or landing operation is not required. **Table 4A** presents the declared distances that can be achieved with an EMAS installation.

NOTE: This EMAS discussion is based on manufacturer information available at the time of original writing (October 2006). Since this time, the manufacturer has developed a new EMAS product that is better suited to stopping business jets more rapidly. A complete description of this product and the impact to the airport is presented in Chapter Five. The EMAS discussion presented here in Chapter Four is for information and concept purposes only and not for final runway length calculations.

RSA Alternative Conclusion

Table 4B summarizes the RSA alternatives discussed above. This examination of the alternatives available to

meet RSA standards indicates that two of the six methods available for meeting RSA standards are available for application to Glendale Municipal Airport. Each of the alternatives

would require the implementation of declared distances. The airport development alternatives to follow will each present a development option utilizing these possible RSA alternatives.

TABLE 4B Runway Safety Area Analysis Glendale Municipal Airport	
	Runway 1-19
Provide full RSA	Not practicable (gabion and Glendale Avenue are fixed)
Relocate, shift, or realign runway	Not practicable (property limitations)
Reduce runway length	Not practicable (runway already short of ideal length)
Combination method of runway reduction, relocation, or shifting	Not practicable
Declared distances	Can be implemented
EMAS	Can be implemented
<i>Source: Coffman Associates analysis of FAA Order 5200.8 Runway Safety Area Program</i>	

AIRFIELD CAPACITY

As indicated previously in the airfield capacity analysis in Chapter Three, the airport may reach 84 percent of its annual service volume (ASV) by the end of the long term planning horizon. FAA Order 5090.3C, *Field Formula-tion of the National Plan of Integrated Airport Systems (NPIAS)*, indicates that planning of improvements for air-field capacity purposes should be considered when operations reach 60 percent of the ASV. Should operations occur as forecast, the airport is expected to exceed the FAA recommend-ed planning threshold of 60 percent in the intermediate planning horizon. Therefore it is necessary to consider capacity improvements to accommo-date forecast demand.

Prior to addressing physical capacity improvements, a “no-action” alterna-

tive should be considered. Basically, this involves maintaining the current single runway configuration. As previ-ously discussed, as the number of operations increase, increasing amounts of delay to aircraft operations can occur. Additionally, as the mix of aircraft utilizing the airport changes to include a greater percentage of larger and faster business jets, delay will increase as larger separation dis-tances must be maintained.

As shown in **Table 4C**, the average delay per aircraft operation in 2005 was estimated at nine seconds per air-craft. Should no capacity improve-ments be made, the average delay would exceed one minute per aircraft by the long term planning period. Ac-cording to FAA Order 5090.3C, signifi-cant delay is experienced when the average delay per aircraft exceeds four minutes.

TABLE 4C Comparison of Capacity Improvements Glendale Municipal Airport				
	2005	Short Term	Intermediate Term	Long Term
Annual Operations	136,718	160,000	185,000	234,000
Existing Airfield (No Action)				
Annual Service Volume	299,000	284,000	281,000	278,000
Operations % of ASV	44.4%	56.3%	65.8%	84.2%
Annual Aircraft Delay (hours)	332	667	1,110	4,133
Average Delay per Aircraft (seconds)	9	15	22	64
Taxiway Improvements				
Annual Service Volume	325,000	311,000	306,000	301,000
Operations % of ASV	40.8%	51.4%	60.5%	77.7%
Annual Aircraft Delay (hours)	310	640	1,048	2,028
Average Delay per Aircraft (seconds)	8	14	20	31
Add Parallel Runway				
Annual Service Volume	455,000	437,000	434,000	429,000
Operations % of ASV	29.2%	36.6%	42.6%	54.5%
Annual Aircraft Delay (hours)	265	613	925	1,482
Average Delay per Aircraft (seconds)	7	14	18	23
<i>Source: AC 150/5060-5, Airport Capacity and Delay</i>				

Taxiway Improvements

The addition or relocation of exit taxiways are one means of improving the operational efficiency of the airfield. Adequate runway exits and circulation are essential to achieving optimal capacity potential for any runway system. Since taxiway improvements are generally far less expensive than runway improvements, it is important to ensure maximum capabilities are being derived from the taxiway system before making capacity improvements through runway changes.

The ideal taxiway system would include a full-length parallel taxiway with appropriately spaced exit taxiways. As previously presented, the capacity and delay model from the

FAA gives credit for those exit taxiways located between 2,000 and 4,000 feet from the landing threshold and for taxiways separated by at least 750 feet within this area.

Currently, Runway 1 offers two exit taxiways, and Runway 19 offers only one for calculation in the FAA model. The FAA model was run considering the maximum of four exit taxiways for the calculation. Under this scenario, overall capacity can immediately be increased by eight percent, raising the ASV to 325,000 annual operations. This would mean that current operational levels would account for approximately 41 percent of the ASV. By the long term planning period, operations would account for 77 percent of ASV.

Parallel Runway

The single most beneficial capacity improvement is the construction of a parallel runway for small aircraft (under 12,500 pounds). Under ideal circumstances, a parallel runway can provide nearly 35 percent more capacity to the runway system. As presented in **Table 4C**, a parallel runway could increase overall airfield capacity from 299,000 ASV to 455,000 ASV. Long term delay could be reduced by as much as 65 percent.

There are a number of factors that are unique to Glendale Municipal Airport that the FAA capacity model does not consider. Military Alert Airspace A-231 is situated to the immediate north and west of the airport. Because of this, the traffic pattern for both runways would need to be located to the south and east. Having traffic patterns on the same side of the runway with an inner and outer pattern is very unusual for a two-runway system. In fact, the full benefit of two runways would not be realized primarily due to spacing needs of aircraft in the vicinity of the airport.

Another unique factor to Glendale Municipal Airport is that there is currently no aviation-related development on the east side of the airport. Furthermore, with a parallel runway, there would be limited development area on the east side of the runway. As a result, most aircraft destined for the parallel runway would need to cross the primary runway to access the parallel runway. This would cause significant aircraft movements across the primary runway, which would fur-

ther reduce the benefit of a parallel runway and increase the potential for runway incursions.

Exhibit 4D presents a possible alignment for a parallel runway, measuring 3,500 feet long by 75 feet wide. The runway would be located 700 feet to the east of the primary runway. This distance is the minimum allowed by the FAA for simultaneous visual approaches to both runways. At this distance, it is more evident that there is little space on the east side for facility development along the runway flight line. The cost to construct the east side runway and taxiways, including lighting and visual glideslope indicators, would be in excess of \$8.53 million. This includes more than 52,000 square yards of pavement.

Capacity Summary

Three options addressing airport capacity have been presented. The no-action alternative is the least desirable as operations are forecast to exceed 84 percent of the ASV by the long term planning horizon. When operations exceed 60 percent of the ASV, the FAA indicates that planning should begin for improvements.

Average delay is also addressed in the three capacity options. The average delay experienced by each aircraft does not approach the four minute level considered significant by the FAA. In fact, current delay levels are probably imperceptible by most pilots, except at peak times. Even in the long term, when capacity reaches 84 per-

cent of ASV, delay is only slightly more than one minute.

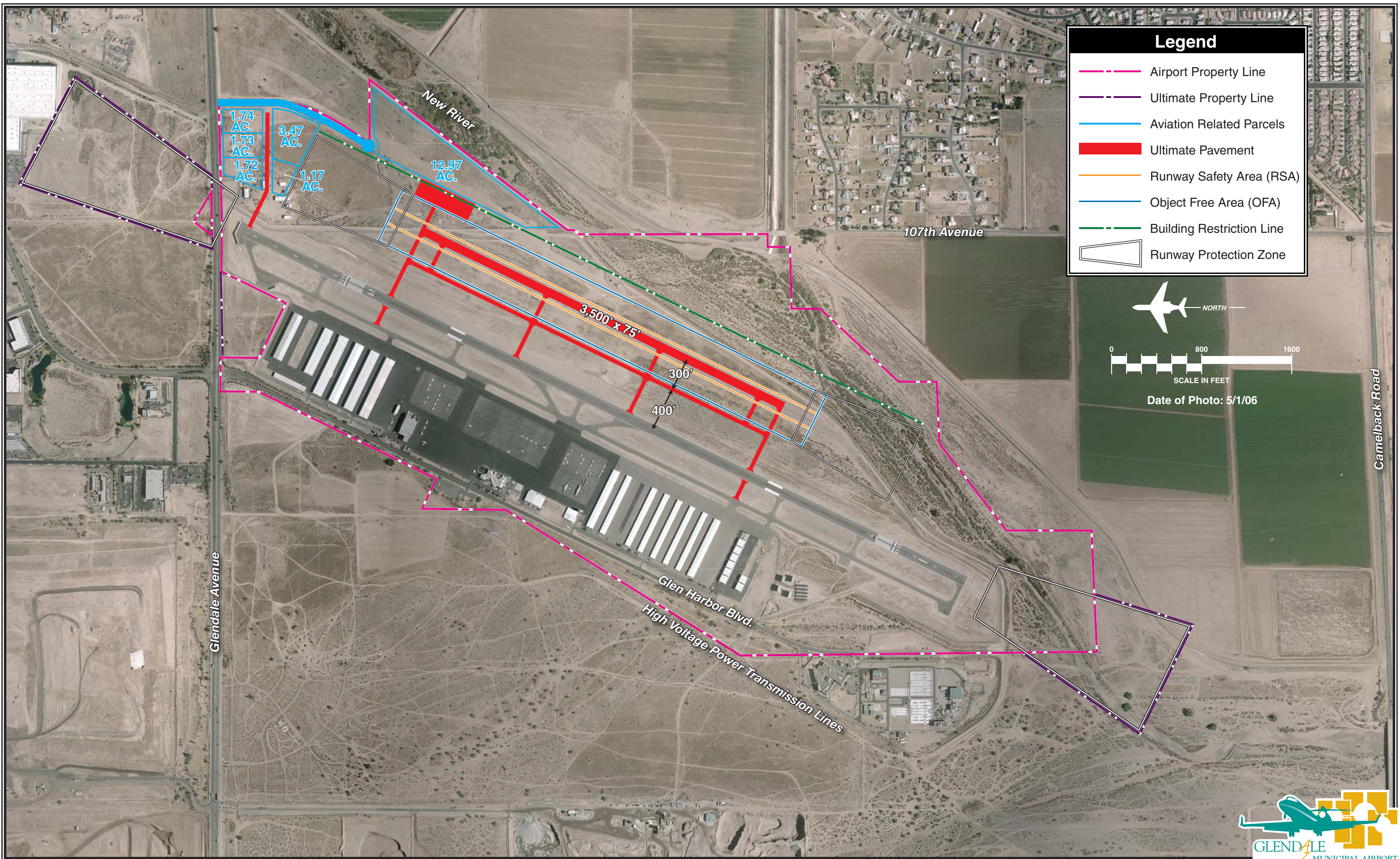
Improvements to the taxiway system can have positive benefits to capacity levels at the airport. An optimized taxiway system at Glendale Municipal Airport can improve capacity by as much as eight percent. Under this condition, operations reach only 77 percent of ASV through the long term planning period. Average delay in the long term is only 31 seconds per aircraft.

A parallel runway would potentially increase overall airport capacity by approximately 35 percent. There are a number of constraints to the airport realizing this benefit, particularly the restricted airspace to the north and west of the airport. The opportunity for development of support services to accommodate users of the parallel runway is severely limited by the proximity of the New River and the steeply sloping terrain in the north-east portion of the airport.

One additional consideration for the east side of the current runway is a determination of what is the highest and best use for the land. The capacity of a single runway can accommodate the projected long term activity levels of this master plan. Delay is estimated at less than one minute per operation. The previous master plan did not include the construction of a parallel runway located on the east side of the existing runway system, even though very similar capacity calculations were reached. The recommended master plan concept did not ultimately include a parallel runway for the reasons which follow:

- Even though the airport was projected to exceed 60 percent of capacity, average delay was anticipated to be less than one minute per operation and considerably below levels considered to be significant;
- An overall decline in local operations at the airport at the time;
- The adequacy of other airports to provide training runways in the region;
- The unique economic development opportunities provided by the availability of east side industrial/commercial development with airfield access provided a higher and better use for airport property;
- The City of Glendale policy which prevents active marketing by the airport to attract large flight school operators to the airport;
- Potential airspace conflicts with Luke Air Force Base which would require most of the air traffic pattern activity to be located to the east of the airport for both runways, thus limiting the capacity benefit of a parallel runway;
- Lack of availability of east side land for revenue enhancement once a parallel runway is in place, thus adding to overall airport maintenance costs without providing new revenue streams to support those costs.

The Temporary Use Restriction on the land east of Runway 1-19 should be considered in facility planning. This use restriction requires that much of the land east of Runway 1-19 be reserved for a potential parallel runway.



The use restriction also requires that the need for a parallel runway be reassessed sometime between 2010 and 2012. Thus, the only permanent development that can currently be considered for that portion of the airport with the use restriction is a parallel runway.

AIRSIDE DEVELOPMENT ALTERNATIVES

The alternatives presented consider the previous discussion of meeting airport design standards, particularly as they relate to the RSA, OFZ, OFA, and RPZ. The possible alternatives are limitless, but the four airside alternatives presented are believed to be the alternatives that best consider all factors specific to the airport, while being financially reasonable and within FAA standards. The recommended development plan, which will be presented in Chapter Five, may be one of these alternatives as presented, or it may be a combination of critical elements from each alternative.

AIRSIDE ALTERNATIVE 1A

Airside Alternative 1A applies declared distances to meet design standards on the airfield. As previously presented, the airport does not fully meet design standards for the RSA, OFA, RPZ, and OFZ. The top portion of **Exhibit 4E** presents Airside Alternative 1A.

To the southeast of the Runway 1 end, all but the last 100 feet of RSA is located within the limits of the gabion. To provide for the full safety area on the Runway 1 end, declared distances are utilized. Implementing declared distances would relocate the departure threshold for Runway 19, 100 feet to the north of the current departure threshold. To reflect this change, the runway end lighting would have to be changed.

The location of the perimeter service road traverses the RSA southeast of the Runway 1 end. Due to the location of the gabion, the service road cannot be relocated outside the RSA. Thus, this alternative considers closing the service road at those points where it crosses the RSA. Access to the east side of the airport would then only be available around the north end.

A small portion of the northeast RSA extends beyond airport property. This property was acquired by the airport in 2008 through fee-simple acquisition. To meet RSA, OFA, and OFZ standards, this area would then need to be cleared, graded, and drained to FAA specifications, a project expected to be completed in 2008.

This alternative addresses the options available for meeting OFA standards. To the northeast, the OFA was penetrated by the perimeter fence. As the structures are removed from the recently acquired property, the perimeter fence will be relocated outside of

the OFA. The blast fence serving Taxiway A is also an OFA penetration and is planned to be removed in this alternative.

To the southeast, the OFA is penetrated by the perimeter fence again. The southeast perimeter fence serves to keep wildlife off the active runway and to provide airport security. For these reasons, a fence securing this portion of the airport needs to remain in place. Simply removing the fence in this portion of the airfield is not considered. Relocating the fence outside the OFA would place the fence in the New River channel. This would be unacceptable as the fence may get washed out during heavy flows. Construction of a new gabion approximately 400 feet east of the existing one to accommodate a new fence is also unacceptable, as the location of the existing gabion represents the maximum distance from the runway that the Maricopa County Flood Control District would allow. Thus, the only option available for mitigating the OFA penetration in this location is to obtain a Modification to Standards from the FAA.

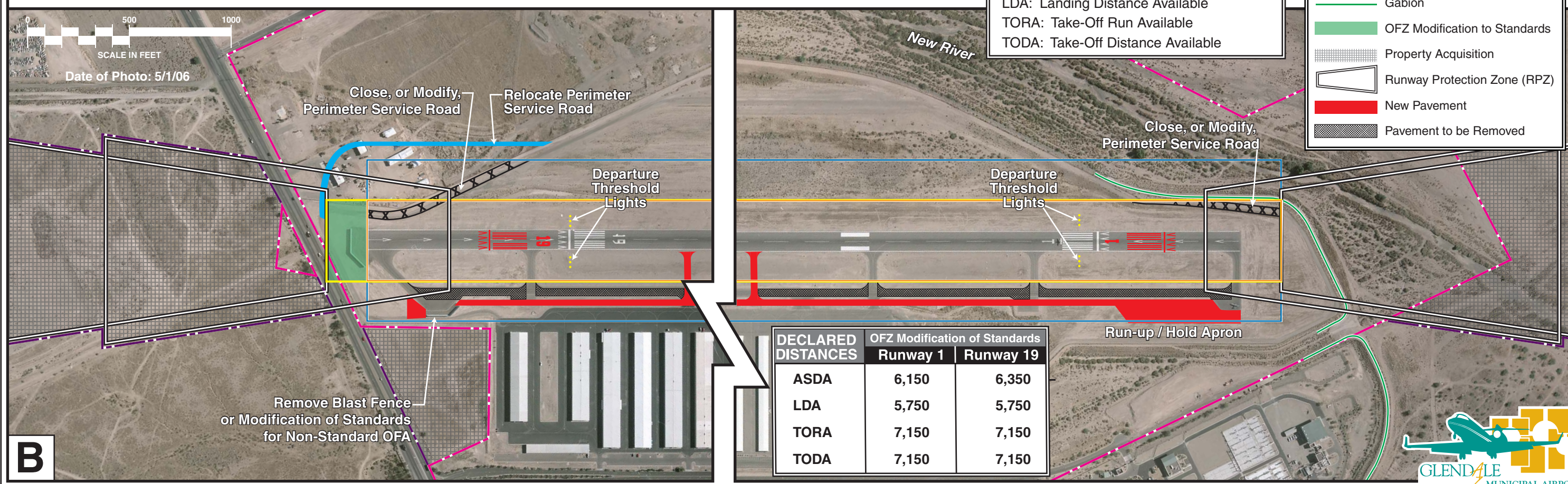
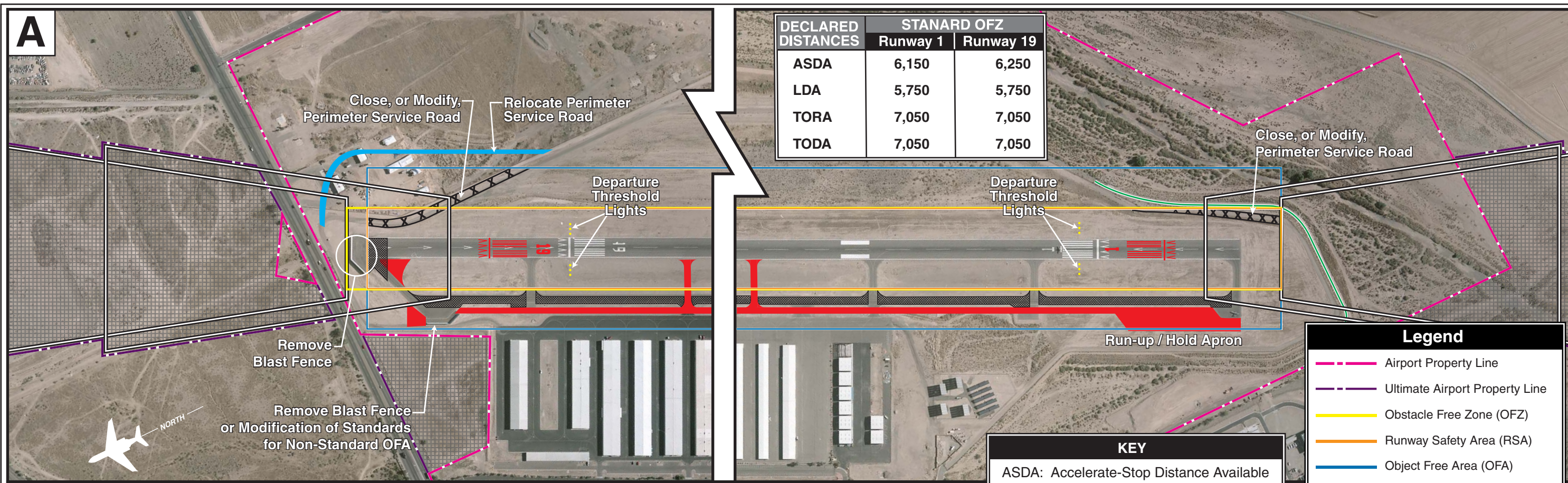
FAA Order 5300.1F, *Modifications to Agency Airport Design, Construction, and Equipment Standards*, provides guidance on the subject. As quoted from the Order, "Modification to standards" means any change to FAA standards, other than dimensional standards for runway safety area, applicable to an airport design, construction, or equipment procurement project that results in lower costs, greater efficiency, or is necessary to

accommodate an unusual local condition on a specific project, when adopted on a case-by-case basis." The Order continues on to say, "Modification to Standards are not issues for nonstandard runway safety areas."

A Modification to Standards is formal acceptance by the FAA that the airport does not fully meet design standards. A Modification to Standards will only be issued for design standards when justified by an unusual local condition and if the design will provide an acceptable level of safety.

The OFZ is a 400-foot-wide area centered on the runway and extending 200 feet beyond the runway ends. Only those objects necessary for navigation, such as runway edge lighting and approach lights, can be in this area, and only then if they are on a frangible base. The OFZ beyond the Runway 19 end is penetrated by Glendale Avenue, the blast deflection fence and the perimeter service road.

Since the OFZ extends 200 feet beyond the runway pavement end even when declared distances are utilized, the only method available to bring the OFZ onto airport property is to physically shorten the runway. Consideration was given to shortening Runway 19 by 200 feet in order to provide for the OFZ and to leave the runway end blast fence in place. Under this scenario, the effectiveness of the blast fence is significantly reduced. Thus, further consideration was given to removing the blast fence all together and removing only 100 feet of pavement as presented on the top half of **Exhibit 4E**.



Some additional property acquisition is recommended. Approximately 30 acres encompassing the Runway 19 RPZ is recommended for fee-simple acquisition. Approximately 11 acres of the RPZ serving Runway 1 is off airport property. All but one acre is in the flood control district. If feasible, the airport should acquire the full 11 acres, but the likelihood of an incompatible land use developing in the river channel is remote. Thus, this acquisition should be a low priority. While fee-simple acquisition ensures that no incompatible development will occur in the RPZ, the Clear Zone Overlay district, as provided by Section 6.102 of the City of Glendale Zoning Ordinance Code, ensures that the RPZ to each runway end and the parallel runway must be kept clear of incompatible development as defined by the FAA.

There are 6.1 acres of undeveloped land on the southeast corner of Glendale Avenue and Glen Harbor Boulevard. This is recommended for acquisition as it is located on the flight line and would allow for further landside development.

This alternative implements Option 4 from the runway/taxiway separation discussion presented previously in this chapter. Option 4 relocates the taxiway to a distance of 300 feet from the runway in order to meet separation standards for an aircraft with a wingspan in airplane design group (ADG) II. In order to meet standard for the separation between the terminal area taxiway and an object (buildings), the taxiway is designated for use by aircraft in ADG I.

Finally, two entrance/exit taxiways are added to the airfield. As previous analysis indicated, the addition of entrance/exit taxiways can increase overall airfield capacity by as much as eight percent.

Airside Alternative 1A shows how declared distances would then be applied to the new runway/taxiway configuration. The total runway length would be reduced from 7,150 feet to 7,050 feet. This is represented by the TORA and TODA. The landing distance available (LDA) would increase from the current 5,450 feet to 5,750 feet for landings to both runway ends.

The accelerate-stop distance available (ASDA) for Runway 1 is 6,150 feet and for Runway 19, 6,250 feet would be available. For Runway 1, this is the same as the current declared distances. For Runway 19, this is a reduction of 200 feet in ASDA. The 200-foot reduction is accounted for by the loss of 100 feet on the south, due to the gabion location, and 100 feet on the north, due to bringing the OFZ onto airport property.

When considering the operational impact of declared distances, consideration was given to the requirements of a variety of business jets that currently utilize the airport. Based on operations manuals specific to each aircraft type, runway lengths for the ASDA and LDA were determined. The runway length requirements represent operations in maximum performance conditions. The aircraft are assumed to be at their maximum take-off and landing weight, the temperature is assumed to be 108 degrees, and

the runway is assumed to be contaminated, which means the runway has at least 1/10 inch of rain on it.

Table 4D presents the runway length requirements for a variety of business jets which currently utilize the airport. As can be seen, on hot days and fully loaded, several aircraft require

more runway length for takeoff than is available. Conversely, all of the representative aircraft, except the Cessna Citation X, are able to land at the airport on a contaminated runway at maximum landing weight. This table reveals that most large business jets when operating at the airport on the hottest days will be weight restricted.

TABLE 4D Runway Length Requirements (Max. Take-off/Landing Weights) Glendale Municipal Airport		
Aircraft Type	Runway Length Required for (feet):	
	Take-off @ 108 F	Landing on Contaminated Runway
Beechjet 400	5,500	4,600
Challenger CL600	8,200	4,300
Cessna 550 Bravo	5,200	5,000
Cessna 650	5,000	5,000
Cessna Citation X	8,100	6,000
Gulfstream IV	7,500	5,000
Gulfstream V	8,600	4,300
Hawker 800	7,100	3,700
Falcon 900EX	7,400	3,700
Falcon 2000EX	7,600	4,100
Embraer Legacy	7,900	4,200
Lear 45	6,300	4,200
Lear 60	7,700	5,300

Source: Aircraft Operating Manuals

Instrument approach procedures are a series of predetermined maneuvers for landing by properly equipped aircraft. Although instrument procedures may be utilized in visual flight conditions, they are optimally followed when weather conditions are less than visual flight rule (VFR) conditions. VFR conditions are minimally defined as three-mile visibility and 1,000-foot cloud ceilings.

Currently, there is a Global Positioning System (GPS)/RNAV instrument approach to Runway 19. Although it is understood that this approach is

rarely used in sub-visual weather conditions, this approach should be maintained. Many corporate flight departments and charter and fractional businesses will restrict flights to those airports with instrument approaches. GPS technology will ultimately allow for this existing approach to provide vertical descent guidance in addition to the existing course guidance. No change to the airfield markings or design standards is required as long as any instrument approach provides greater than ¾-mile visibility minimums. An approach from the south is also included in facility planning.

The recent publication of Change 9 to AC 150/5300-13, *Airport Design*, included a departure surface. The departure surface is represented by a trapezoidal shape that slopes up and away from the runway pavement end at a 40:1 ratio. The purpose of the departure slope is to provide an added measure of safety for departing aircraft. The departure surface is applied to those airports with instrument approach or departure procedures.

The departure surface begins at the end of the usable pavement, is 1,000 feet wide, and extends 10,200 feet to an ultimate width of 6,466 feet. The blast deflection fence on the north end of Runway 19 is a penetration to this surface. There are three recommended methods to mitigate penetrations to the departure surface:

1. The object is removed or lowered;
2. The Takeoff Distance Available (TODA) is decreased (i.e., pilots are instructed to lift-off prior to the runway end in order to avoid the obstruction); and
3. Instrument departure minimums are raised.

Existing obstacles of 35 feet or less would not require the above mitigation methods; instead, new departure procedures may be introduced or existing departure procedures may be altered. Existing penetrations of greater than 35 feet require either object removal (i.e., remove a portion of the hill) or TODA reduction (i.e.,

shorten the runway) to within the 35-foot threshold. Airport Development Alternative 1 does not consider the removal of the blast deflection fence, but departure procedures may be altered to provide clearance.

AIRSIDE ALTERNATIVE 1B

Airside Alternative 1B is presented on the bottom half of **Exhibit 4E**. This alternative differs from Airfield Alternative 1A in that it considers the approval of a Modification to Standards for the north end OFZ in addition to a Modification to Standards to the OFA for the southeast perimeter fence. As depicted, the OFZ Modification to Standards would allow the north perimeter service road, Glendale Avenue, and the runway end blast fence to remain in place.

The implementation of declared distances for this alternative would be slightly different than for Airside Alternative 1A. The overall runway length would be increased from 7,050 feet to 7,150 feet. The ASDA for Runway 1 would remain the same at 6,150 feet. The ASDA for Runway 19 would be increased by 100 feet to 6,350 feet. The LDA for both runways would remain at 5,750 feet.

All other considerations from Airside Alternative 1A apply to this alternative including the relocation of the taxiway to 300 feet from the runway, closure or modification of the southeast service road, and protection of the RPZs.

AIRSIDE ALTERNATIVE 2

The primary feature of Airside Alternative 2 is the use of an Engineered Materials Arresting System (EMAS) to meet FAA airport safety area design standards. This alternative is presented on **Exhibit 4F**.

The use of EMAS is considered by the FAA to be equivalent to full RSA standards. Since EMAS is most effective for departure operations, the FAA requires that the landing threshold be displaced 600 feet, as measured from the back of the EMAS bed, to provide an adequate RSA prior to the landing threshold. Guidance for the design of an EMAS bed is provided in FAA Order 5200.9, *Financial Feasibility and Equivalency of Runway Safety Area Improvements and Engineered Material Arresting Systems*. The length of the EMAS bed is established by the maximum takeoff weight of the EMAS critical aircraft to use the airport.

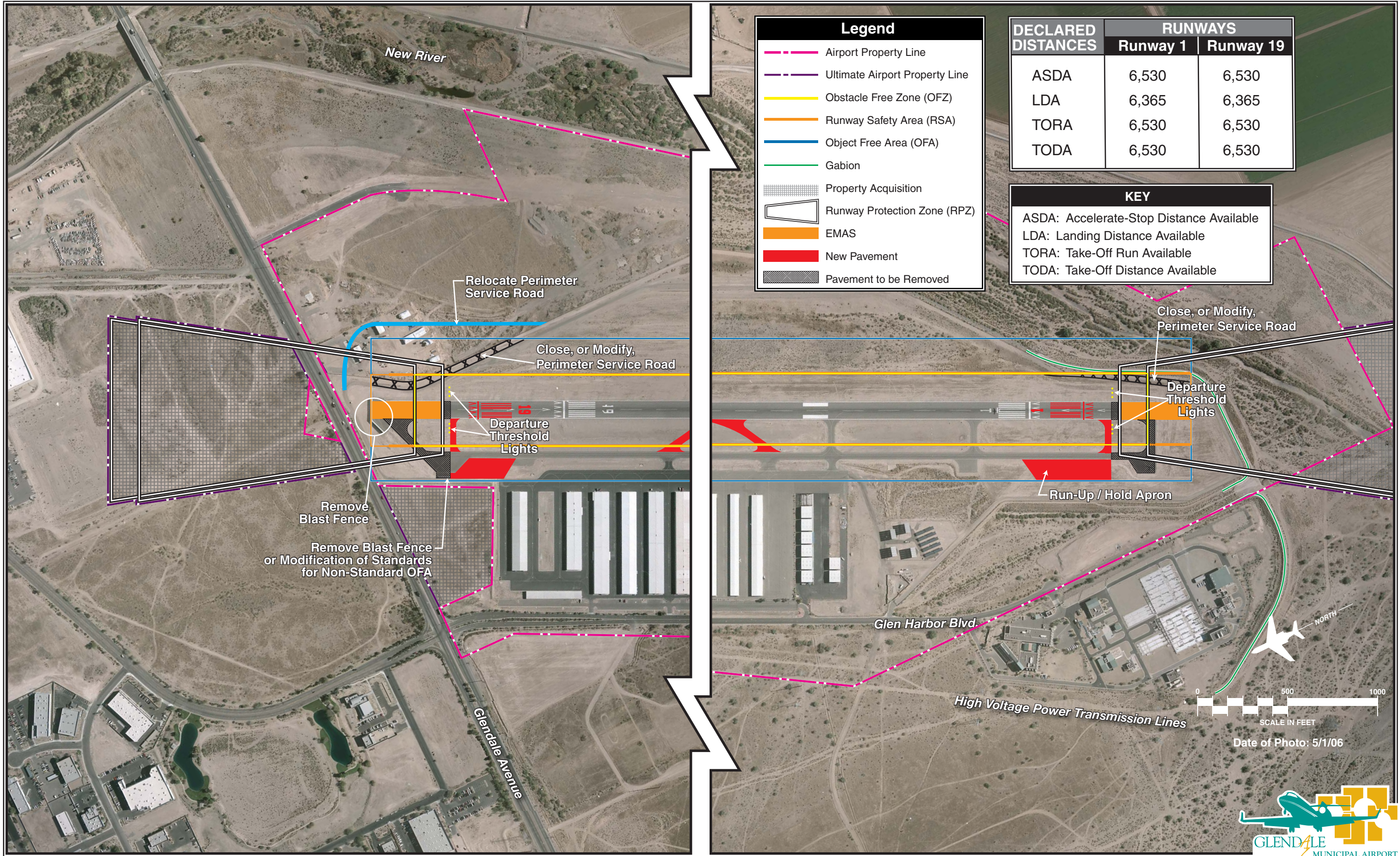
At Glendale Municipal Airport, business jets in ARC C-I and C-II represent the critical aircraft. For the design of the EMAS bed, the critical aircraft would be the Lear 35. The Lear 35 has a maximum takeoff weight of 17,000 pounds as compared to heavier business jets such as the Gulfstream IV with a maximum takeoff weight of 73,000 pounds. An EMAS bed length of 250 feet could accommodate the Gulfstream IV because the weight of the aircraft would allow rapid sinking into the EMAS. The Lear 35, on the other hand, actually requires an EMAS bed of 400 feet because the lighter weight of the aircraft requires a greater distance to sink into

the EMAS. **NOTE:** A new EMAS product that allows lighter aircraft stop more quickly is now available. A discussion of the benefits of this product is presented in Chapter Five. The EMAS alternatives presented in Chapter Four are for information purposes only. The dimensions of EMAS and the subsequent available runway lengths are revised on Chapter Five.

For Glendale Municipal Airport, the EMAS bed length must be 400 feet long and 100 feet wide. An additional 10 feet of paved surface is necessary to the sides of the EMAS bed. The EMAS bed begins 35 feet from the runway pavement end to provide for blast protection from jet aircraft. The EMAS bed behind Runway 19 would require the removal of approximately 385 feet of runway pavement. The Runway 1 EMAS bed would require the removal of 235 feet of pavement.

As a result of the removal of 385 feet of pavement, the north end OFZ would be pulled back onto airport property. Thus, no Modification to Standard would be necessary for the OFZ. The width of the OFZ would be provided with the acquisition of the property to the northeast. The south end OFZ would meet FAA design standard with the closure of the perimeter service road. This service road closure would also provide for RSA standards.

Utilizing EMAS to meet RSA standards provides for the possibility of significant improvements in landing distance available (LDA). Currently, 5,450 feet of runway is available for LDA calculations in either direction. With EMAS, the LDA for landing op-



Legend	
	Airport Property Line
	Ultimate Airport Property Line
	Obstacle Free Zone (OFZ)
	Runway Safety Area (RSA)
	Object Free Area (OFA)
	Gabion
	Property Acquisition
	Runway Protection Zone (RPZ)
	EMAS
	New Pavement
	Pavement to be Removed

DECLARED DISTANCES	RUNWAYS	
	Runway 1	Runway 19
ASDA	6,530	6,530
LDA	6,365	6,365
TORA	6,530	6,530
TODA	6,530	6,530

KEY	
ASDA	Accelerate-Stop Distance Available
LDA	Landing Distance Available
TORA	Take-Off Run Available
TODA	Take-Off Distance Available



Date of Photo: 5/1/06



erations in both directions is 6,365 feet. The ASDA in both directions would also increase. Runway 1 ASDA would increase from 6,150 feet to 6,530 feet, and Runway 19 would increase from 6,450 feet to 6,530 feet.

The cost of installing EMAS at the airport is estimated at approximately \$8 million. In FAA Order 5200.9, approximately \$11 million is the maximum amount the FAA would consider feasible for both ends of Glendale Municipal Airport.

This alternative utilizes Option 1 for meeting runway/taxiway separation standards. Option 1 previously demonstrated that when two aircraft, both with a 79-foot wingspan, the widest wingspan for ADG II aircraft, are on the runway and parallel taxiway at the same time, there is adequate clearance. The wings of the aircraft are 173.5 feet from each other and the aircraft on the parallel taxiway is 13 feet from the RSA and OFZ. Thus, a Modification to Standards would allow the runway, taxiway, and terminal area taxilane to remain in their current location.

This alternative would meet OFA standards in the same manner as Airside Alternative 1A. On the Runway 19 end, the property acquisition and fence relocation will provide for OFA compliance. The perimeter fence on the south end cannot be relocated; thus, a Modification to Standards to the OFA should be sought. The blast deflection fence around the hold apron serving the northwest end of Taxiway A creates an obstruction to the OFA. This fence would need to be removed,

relocated, or included in the Modification to Standards. In addition, the OFA Modification to Standards would need to include a very small portion of the northwest OFA, which may cross airport property onto Glendale Avenue.

Each alternative considers an instrument approach to Runways 1 and 19 and fee-simple acquisition of the property in the associated RPZs. On the north, this is approximately 25 acres in the Glendale Airpark. On the south, this is approximately 11 acres, most of which is in the New River channel.

While fee-simple acquisition ensures that no incompatible development will occur in the RPZ, the Clear Zone Overlay district, as provided by Section 6.102 of the City of Glendale Zoning Code, ensures that the RPZ to each runway end and those serving a potential parallel runway must be kept clear of incompatible development as defined by the FAA.

There are 6.1 acres of undeveloped land on the southeast corner of Glendale Avenue and Glen Harbor Boulevard. This is recommended for acquisition as it is located on the flight line and would allow for further landside development.

Finally, two entrance/exit taxiways are added to the airfield. As previous analysis indicated, the addition of entrance/exit taxiways can increase overall airfield capacity by as much as eight percent. High speed exit taxiways are considered in order to provide for additional efficiency.

AIRSIDE ALTERNATIVE 3

Airside Alternative 3 considers the installation of an EMAS bed only on the north end of the runway in order to reduce development costs when compared with Airside Alternative 2. This alternative presents a compromise between a full EMAS installation and no EMAS. This alternative is presented on **Exhibit 4G**.

There are two primary benefits to locating the single EMAS bed to the north. First, this is the runway end with the least available RSA currently. Secondly, engineering may be easier than on the south end where the gabion is located. An additional benefit to the north EMAS bed is that the majority of operations are to the north utilizing Runway 1. This means that a higher percentage of operations would benefit from the increases in operational length provided by the EMAS bed.

As discussed in detail in Airside Alternative 2, EMAS meets the equivalency of full RSA standards on the far end of the runway where aircraft are landing or departing. Since EMAS is most effective for departure operations, the FAA requires that the landing threshold be displaced 600 feet, as measured from the back of the EMAS bed, to provide an adequate RSA prior to the landing threshold. For Glendale Municipal Airport, the EMAS bed length must be 400 feet long and 100 feet wide. An additional 10 feet of paved surface is necessary to the sides of the EMAS bed. The EMAS bed begins 35 feet from the runway pavement end to provide for blast protec-

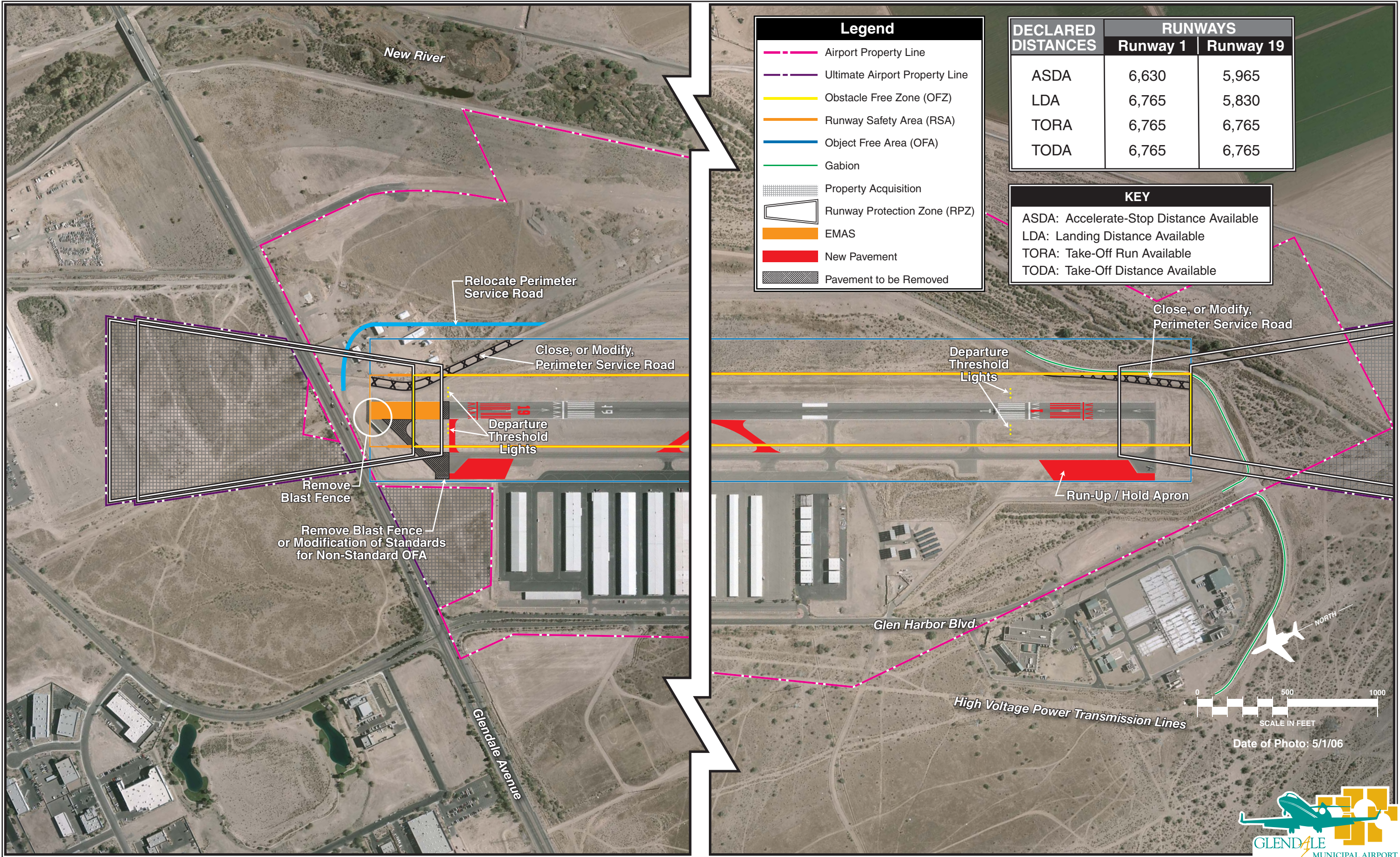
tion from jet aircraft. This alternative considers an EMAS bed behind Runway 19 which would require the removal of approximately 385 feet of runway pavement.

The removal of 385 feet of runway pavement on the north end would have the added benefit of pulling the OFZ onto airport property, thus meeting OFZ standards. Meeting OFZ standards for the south end would require closure or modification of the perimeter service road.

As previously discussed, if the runway end blast fence were to remain in place in this alternative, it would be 435 feet from the runway end. Since the effectiveness of the fence would be greatly reduced, consideration could be given to removing or relocating the blast fence.

Declared distances would continue to be implemented. The ASDA for Runway 1 would be 6,630 feet and the ASDA for Runway 19 would be 5,965 feet. The LDA for Runway 1 would be 6,765 feet and the LDA for Runway 19 would be 5,830 feet.

This alternative considers meeting runway/taxiway standards by obtaining approval for a Modification to Standards from the FAA. This is Option 1 as previously presented on **Exhibit 4C**. It was shown that adequate separation can be maintained even when the largest critical airplanes capable of operating at the airport are on the runway and parallel taxiway at the same time. A formal Modification to Standards may replace the current operational procedures currently in



Legend	
	Airport Property Line
	Ultimate Airport Property Line
	Obstacle Free Zone (OFZ)
	Runway Safety Area (RSA)
	Object Free Area (OFA)
	Gabion
	Property Acquisition
	Runway Protection Zone (RPZ)
	EMAS
	New Pavement
	Pavement to be Removed

DECLARED DISTANCES	RUNWAYS	
	Runway 1	Runway 19
ASDA	6,630	5,965
LDA	6,765	5,830
TORA	6,765	6,765
TODA	6,765	6,765

KEY	
ASDA:	Accelerate-Stop Distance Available
LDA:	Landing Distance Available
TORA:	Take-Off Run Available
TODA:	Take-Off Distance Available



place which limit concurrent operations on the runway and taxiway by certain aircraft types.

The northeast OFA standards have been met through acquisition of the adjacent northeast property and relocation of the perimeter fence in the area. The perimeter fence on the southeast cannot be relocated due to the presence of the New River channel gabion; thus, a Modification to Standards would need to be sought. The blast deflection fence on the hold apron on the north end of Taxiway A would need to be removed or included in the Modification to Standards. In addition, a small portion of the OFA to the northwest extends beyond airport property and should be included in the Modification to Standards.

It is recommended by the FAA that the airport have control of the land encompassing the RPZs. To accomplish this, approximately 25 acres to the north is recommended for fee-simple purchase. Approximately 11 acres of the south RPZ extends beyond airport property and is similarly recommended for fee-simple acquisition.

Although fee-simple acquisition of the area encompassing the RPZs is suggested, other methods of obtaining positive control of the RPZs is available and has been effectively implemented by the City of Glendale in the past. The current Clear Zone Overlay district has effectively prevented development in the RPZs. This land use control may be adequate in moving forward.

The undeveloped land on the southwest corner of Glendale Avenue and

Glen Harbor Boulevard is recommended for acquisition. This property is located on the northwest flight line and could be made available for further landside development. This property is also at the entrance to the airport and could be improved to enhance the appearance of the airport.

As with other alternatives, the southeast perimeter service road is depicted as being closed in order to meet FAA standards for the RSA. Since the gabion is fixed in its location, it is unlikely that the service road could be relocated outside the RSA. One additional option for consideration may be to require vehicles traversing this portion of the service road to be in contact with the tower to receive clearance to proceed. Under this option, the road would have to be closed when the tower is closed. Any option other than road closure would require negotiation with, and approval from, the FAA.

Finally, two entrance/exit taxiways are added to the airfield. The addition of these taxiways could increase overall airfield capacity by as much as eight percent. As presented, these taxiways are angled in order to provide a high-speed exit function, further improving capacity.

AIRSIDE ALTERNATIVE 4A

Airside Alternative 4A, as presented on the top half of **Exhibit 4H**, considers the option of locating a single EMAS bed on the south end of the runway behind Runway 1 while limiting the need for Modification to Standard to the north. The south location

for an EMAS bed provides the benefit of increasing operational length in the predominant operational direction to the south. It should be noted that engineering of a south EMAS bed may be complicated by the proximity of the gabion, but this is not considered a fatal flaw to this location.

Construction of the south EMAS bed would require the removal of approximately 235 feet of runway pavement. This will provide for a 35-foot lead-in and a 400-foot-long EMAS bed. Declared distances would then be implemented, as in previous alternatives, in order to provide adequate safety area beyond the declared runway ends.

The ASDA for Runway 1 would be 5,915 feet. The ASDA for Runway 19 would be 6,815 feet. The LDA for Runway 1 would be 5,750 feet and the LDA for Runway 19 would be 6,315 feet. The application of these declared distances provide significant benefits for operations to the south.

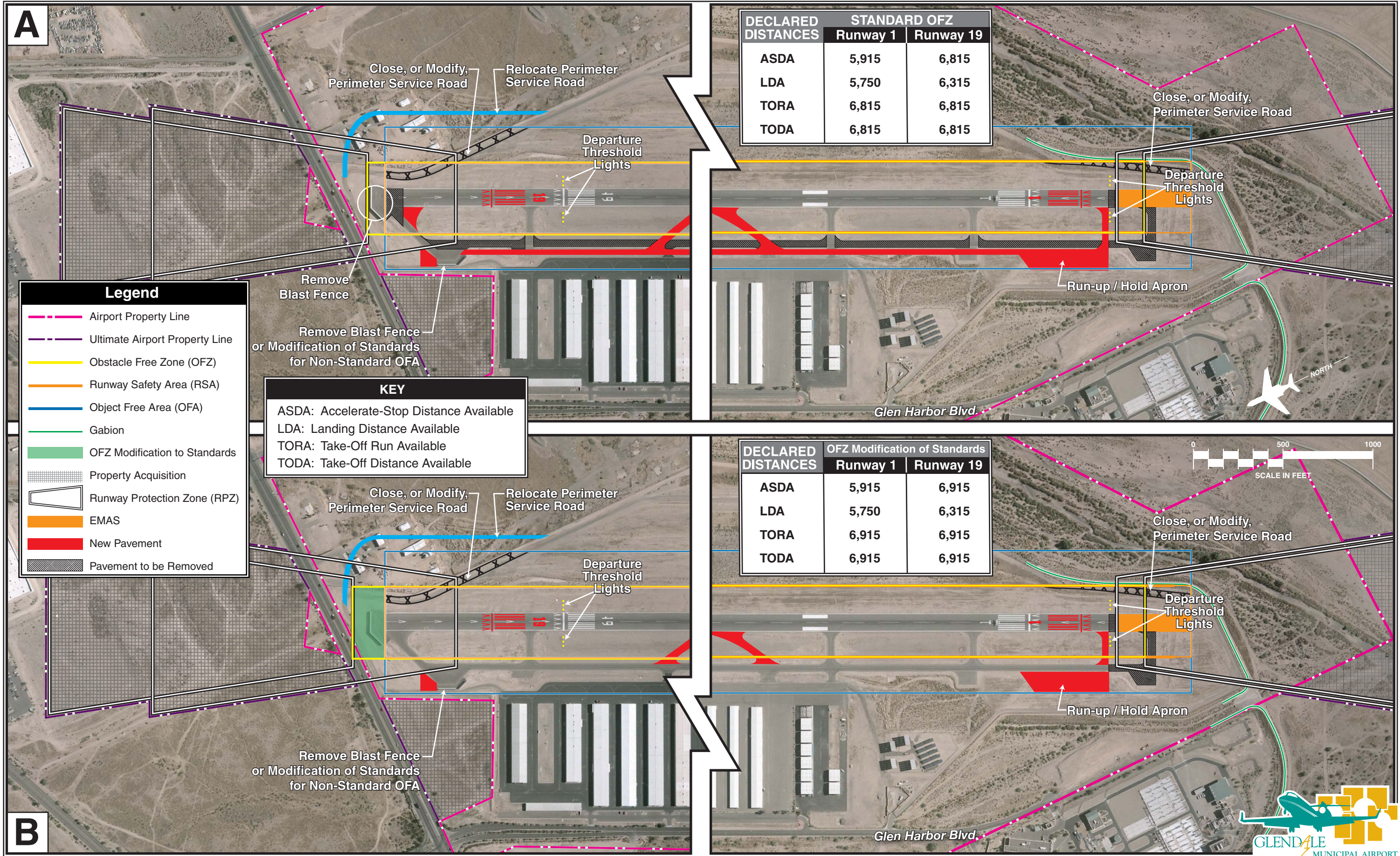
This alternative implements Option 4 from the runway/taxiway separation discussion presented previously on **Exhibit 4C**. Option 4 relocates the taxiway to a distance of 300 feet from the runway in order to meet separation standards for an aircraft with a wingspan in airplane design group (ADG) II. In order to meet standard for the separation between the terminal area taxilane and an object (buildings), the taxilane is designated for use by aircraft in ADG I.

Solutions to meeting design standards on the north end of the runway are the same as those presented on Airside

Alternative 1A. The OFZ beyond the Runway 19 end is penetrated by Glendale Avenue, the blast deflection fence, the perimeter service road, and it extends onto private property northeast of the airport. The only method available for meeting the OFZ standard is to bring the OFZ onto airport property by removing 100 feet of runway length. This would also allow the removal of the runway end blast deflection fence, as it would no longer be as effective since it would be over 200 feet from the runway end.

Other airfield issues are addressed similarly to other alternatives. As previously discussed, fee-simple acquisition of the RPZs is suggested, but other methods of obtaining positive control of the RPZs are available and have been effectively implemented by the City of Glendale in the past. The undeveloped land on the southeast corner of Glendale Avenue and Glen Harbor Boulevard is recommended for acquisition.

As with other alternatives, the perimeter service road southeast of the runway is depicted as being closed or modified in order to meet FAA standards for the RSA. Since the gabion is fixed in its location, it is unlikely that the service road could be relocated outside the RSA. One option other than closure may be to require vehicles traversing this portion of the service road to be in contact with the tower to receive clearance to proceed. Under this option, the road would have to be closed when the tower is closed. Any option other than road closure would require negotiation with, and approval from, the FAA.



A

DECLARED DISTANCES	STANDARD OFZ	
	Runway 1	Runway 19
ASDA	5,915	6,815
LDA	5,750	6,315
TORA	6,815	6,815
TODA	6,815	6,815

- Legend**
- Airport Property Line
 - Ultimate Airport Property Line
 - Obstacle Free Zone (OFZ)
 - Runway Safety Area (RSA)
 - Object Free Area (OFA)
 - Gabion
 - OFZ Modification to Standards
 - Property Acquisition
 - Runway Protection Zone (RPZ)
 - EMAS
 - New Pavement
 - Pavement to be Removed

KEY

ASDA: Accelerate-Stop Distance Available
 LDA: Landing Distance Available
 TORA: Take-Off Run Available
 TODA: Take-Off Distance Available

B

DECLARED DISTANCES	OFZ Modification of Standards	
	Runway 1	Runway 19
ASDA	5,915	6,915
LDA	5,750	6,315
TORA	6,915	6,915
TODA	6,915	6,915



Finally, two entrance/exit taxiways are added to the airfield. The addition of these taxiways could increase overall airfield capacity by as much as eight percent. As presented, these taxiways are angled in order to provide a high-speed exit function, further improving capacity.

AIRSIDE ALTERNATIVE 4B

Airside Alternative 4B, as presented on the bottom half of **Exhibit 4H**, also depicts a south end EMAS installation but would also require a Modification to Standards from the FAA for the OFZ on the north end of the runway. Currently, the blast fence, Glendale Avenue, and the perimeter service road are obstructions to the OFZ. Without an FAA approved Modification to Standards, the runway would need to be shortened by at least 100 feet and the blast fence would need to be removed. To keep the blast fence in place at the end of the runway, the runway would need to be shortened by a total of 200 feet, thus further reducing the effectiveness of the fence. Reducing the runway by 100 feet and removing the blast fence will bring the OFZ onto airport property.

Airside Alternative 4B shows how declared distances would then be applied to the runway/taxiway configuration. The total runway length would be 6,915 feet, as 235 feet of pavement is removed from the south end to accommodate the EMAS bed. The ASDA for Runway 1 would 5,915 feet and the ASDA for Runway 19 would be 6,915 feet. The LDA for Runway 1 would be

5,750 feet and the LDA for Runway 19 would be 6,315 feet.

Airside Alternative 4B uses Option 1 from the runway/taxiway separation discussion presented previously on **Exhibit 4C**. With this, the runway/taxiway separation is allowed to remain nonstandard through a Modification to Standards from the FAA.

Remaining airfield issues are addressed similarly to other alternatives. Fee-simple acquisition of the RPZs is suggested, but other methods of obtaining positive control of the RPZs are available and have been effectively implemented by the City of Glendale in the past. The undeveloped land on the southeast corner of Glendale Avenue and Glen Harbor Boulevard is recommended for acquisition, as it is along the runway flight line. The perimeter service road southeast of the runway is depicted as being closed or modified in order to meet FAA standards for the RSA.

Finally, two entrance/exit taxiways are added to the airfield. The addition of these taxiways could increase overall airfield capacity by as much as eight percent. As presented, these taxiways are angled in order to provide a high-speed exit function, further improving capacity.

AIRSIDE SUMMARY

The previous master plan provided for expansion of the airport to meet the growing demand by larger and faster business jet aircraft. At that time, the

airport was classified as an ARC B-II airport based on the critical aircraft family performing at least 500 annual operations. Since the completion of the airport improvements in 2003, the critical aircraft family utilizing the airport has transitioned to ARC C-II. With this transition come significant changes in FAA design criteria.

The previous master plan forecasted this transition to ARC C-II and recommended expansion of the airport to meet the ARC C-II standards to the extent practicable at the time.

The airside alternatives present six different options for meeting FAA defined design criteria as they apply to Glendale Municipal Airport. All alternatives necessarily utilize declared distances in order to provide for adequate safety areas surrounding the runway. **Exhibit 4J** presents a summary of the declared distances associated with each alternative. The necessary Modification to Standards for each alternative is also presented.

NOTE: The preceding EMAS discussion was based on the best information available at the time of writing (October 2006). Since that time, the manufacturer has developed an EMAS material more suited to business jets rather than commercial type aircraft. In Chapter Five, a discussion of this new EMAS and the potential application to Glendale Municipal Airport is presented in detail. In an effort to maintain the continuity of the evolution of the recommended concept for Glendale, it was decided to maintain the EMAS alternatives in this chapter.

LANDSIDE PLANNING ISSUES

Landside planning issues, summarized on **Exhibit 4B**, will focus on facility locating strategies following a philosophy of separating activity levels. The number of structures and the storage capacity potentially available is not limitless. Without the acquisition of property, development is constrained by the airport boundary. Potential landside alternatives will be developed that will consider both the existing restriction on constructing permanent structures on eastside property and the possibility of that area becoming available for aviation-related development.

The orderly development of the airport terminal area (those areas parallel to the runway and along the flight line) can be the most critical, and probably the most difficult development to control on the airport. A development approach of “taking the path of least resistance” can have a significant effect on the long term viability of an airport. Allowing development without regard to a functional plan can result in a haphazard array of buildings and small ramp areas, which will eventually preclude the most efficient use of the valuable space along the flight line.

Activity in the terminal area should be divided into three categories at an airport. 1) The high-activity area should be planned and developed as the area providing aviation services on the airport. An example of the high-activity

	Runway 1	Runway 19	Modification To Standards
AIRSIDE ALTERNATIVE 1A			
ASDA	6,150	6,250	OFZ: None
LDA	5,750	5,750	OFA: Southeast perimeter fence
TORA/TODA	7,050	7,050	RSA: None
AIRSIDE ALTERNATIVE 1B			
ASDA	6,150	6,350	OFZ: North blast fence, North perimeter service road, Northwest Glendale Avenue, Northwest perimeter fence
LDA	5,750	5,750	OFA: Taxiway A blast fence, Southeast perimeter fence
TORA/TODA	7,150	7,150	RSA: None
AIRSIDE ALTERNATIVE 2			
ASDA	6,530	6,530	OFZ: None
LDA	6,365	6,365	OFA: Southeast perimeter fence, Northwest Glendale Ave., Northwest perimeter fence
TORA/TODA	6,530	6,530	RSA: None
AIRSIDE ALTERNATIVE 3			
ASDA	6,630	5,965	OFZ: None
LDA	6,765	5,830	OFA: Southeast perimeter fence, Northwest Glendale Ave., Northwest perimeter fence
TORA/TODA	6,765	6,765	RSA: None
AIRSIDE ALTERNATIVE 4A			
ASDA	5,915	6,815	OFZ: None
LDA	5,750	6,315	OFA: Southeast perimeter fence,
TORA/TODA	6,815	6,815	RSA: None
AIRSIDE ALTERNATIVE 4B			
ASDA	5,915	6,915	OFZ: North blast fence, North perimeter service road, Glendale Avenue, North perimeter fence
LDA	5,750	6,315	OFA: Taxiway A blast fence, Southeast perimeter fence
TORA/TODA	6,915	6,915	RSA: None
BASELINE DECLARED DISTANCES AS CURRENTLY LIGHTED AND MARKED			
ASDA	6,150	6,450	OFZ: Non-Standard
LDA	5,450	5,450	OFA: Non-Standard
TORA/TODA	7,150	7,150	RSA: Non-Standard
ASDA: Accelerate-Stop Distance Available			
LDA: Landing Distance Available			
TORA: Take-Off Run Available			
TODA: Take-Off Distance Available			



area is the aircraft parking apron, which provides outside storage and circulation of aircraft. In addition, large conventional hangars housing FBOs, other airport businesses, or for aircraft storage would be considered high-activity uses. A conventional hangar structure in the high-activity area should be a minimum of 6,400 square feet (80 feet by 80 feet). If space is available, it is more common to plan these hangars for up to 200 feet by 200 feet. The best location for high-activity areas is along the flight line near midfield, for ease of access to all areas of the airfield.

2) The medium-activity category defines the next level of airport use and primarily includes corporate aircraft operators that may desire their own executive or conventional hangar storage on the airport. A hangar in the medium-activity use area should be at least 50 feet by 50 feet, or a minimum of 2,500 square feet. The best location for medium-activity use is off the immediate flight line, but still with ready access to the runway/taxiway system. Typically these areas will be adjacent to the high-activity areas. Parking and utilities such as water and sewer should also be provided in this area.

3) The low-activity use category defines the area for storage of smaller single and twin-engine aircraft. Low-activity users are personal or small business aircraft owners who prefer individual space in T-hangars or small executive hangars. Low-activity areas should be located in less-conspicuous areas, or to the ends of the flight line. This use category will require electricity, but may not require water or sewer utilities.

In addition to the functional compatibility of the terminal area, the proposed development concept should provide a first-class appearance for Glendale Municipal Airport. Consideration to aesthetics should be given high priority in all public areas, as the airport can many times serve as the first impression a visitor may have of the community.

The existing terminal area at Glendale Municipal Airport has, for the most part, followed the separation of activity levels philosophy. The terminal building faces a large central ramp area. To the side of the terminal building are conventional buildings housing airport FBOs and other airport businesses. On the north end is a complex of connected box hangars and on the south is a complex of T-hangars and shade hangars. The box hangar development farthest south is appropriately separated from other areas.

Ideally, terminal area facilities at general aviation airports should follow a linear configuration parallel to the primary runway. The linear configuration allows for maximizing available space, while providing ease of access to terminal facilities from the airfield. Each landside alternative will address development issues, such as the separation of activity levels and efficiency of layout.

When identifying potential development locations, consideration will be given to creating facility layout mix that accommodates all airport users. Layout mix considers the intended use of a potential facility, thus expounding upon the "separation of activity levels" philosophy. Consideration is given to

recreational users, small business aircraft owners, corporate aviation needs, and airport business operators. Thus aircraft storage types from tie-downs to privately developed corporate aviation parcels will be considered.

Potential locations for a replacement airport traffic control tower (ATCT) will be identified in conjunction with proposed landside alternatives. Care has been given in development of the landside alternatives to meet both mandatory and non-mandatory ATCT siting requirements as provided in FAA Order 6480.4, *Airport Traffic Control Tower Siting Criteria*. As new structures are planned, exterior noise should be maintained at a minimum; thus, all proposed development locations are set some distance from the ATCT location. All proposed structure locations assume that line-of-sight from the ATCT will not be impeded by the height of facilities.

Glendale Municipal Airport has a number of based helicopters. These helicopters support two helicopter flight schools and an air ambulance business. Currently, there is no designated area for helicopters to arrive and depart. Landside alternatives will include the potential location of a helipad. Typically, a helipad should be in relative close proximity to terminal services which is typically the destination of transient helicopters. The helipad design should follow guidance provided in AC 150/5390-2B, *Helipad Design*.

Each of the landside alternatives will address the forecast needs from the previous chapter of this plan. This will include long term needs for more

aircraft storage facilities. With the growth in jet traffic utilizing Glendale Municipal Airport, there is an additional need for executive hangars or corporate parcels for development of hangars. Elements such as automobile parking, security, and aircraft apron areas are addressed in order to appropriately support new facility development.

VEHICULAR ACCESS AND PARKING

A planning consideration for any master plan is the segregation of vehicles and aircraft operational areas. This is both a safety and security consideration for the airport. Aircraft safety is reduced and accident potential increased when vehicles and aircraft share the same pavement surfaces. Vehicles contribute to the accumulation of debris on aircraft operational surfaces, which increases the potential for Foreign Object Debris (FOD), especially for turbine-powered aircraft. The potential for runway incursions is increased, as vehicles may inadvertently access active runway or taxiway areas if they become disoriented once on the aircraft operational area (AOA). Finally, airfield security is compromised as there is loss of control over the vehicles as they enter the secure AOA. The greatest concern is for public vehicles, such as delivery vehicles and visitors, which may not fully understand the operational characteristics of aircraft and the markings in place to control vehicle access. The best solution is to provide dedicated vehicle access roads to each landside facility that is separated from the air-

craft operational areas with security fencing.

The segregation of vehicle and aircraft operational areas is supported by FAA guidance established in June 2002. FAA AC 150/5210-20, *Ground Vehicle Operations on Airports*, states, "The control of vehicular activity on the airside of an airport is of the highest importance." The AC further states, "An airport operator should limit vehicle operations on the movement areas of the airport to only those vehicles necessary to support the operational activity of the airport."

The landside alternatives for Glendale Municipal Airport have been developed to reduce the need for vehicles to cross an apron or taxiway area. Dedicated vehicle parking areas, which are outside the airport fence line, are considered for all potential hangars.

OFF-AIRPORT TAXIWAY ACCESS CONSIDERATIONS

Some airports permit private developers immediately adjacent airport property to have taxiway access from their property. This is commonly referred to as "through-the-fence" access. Granting "through-the-fence" access is a decision the City of Glendale, as the airport sponsor, would have to make. Historically, the FAA has encouraged airports to own all property with access to the airfield, but where "through-the-fence" access is available, the airport sponsor should codify regulations that prevent the "through-the-fence" operator from gaining an unfair economic advantage over those

businesses located on airport property. In general, the FAA strongly discourages "through-the-fence" access.

If the City of Glendale were to pursue the possibility of granting "through-the-fence" access to the Glendale Municipal Airport, the City should have controls and standards in place to limit the types of uses allowed to those which are directly aviation-related. The City should codify the fact that the airport is a public transportation facility and is available as a base for aviation and aviation-related operations, and the City has an obligation to protect the municipal environment from unwanted and inappropriate aviation uses. Other cities and airports which have allowed "through-the-fence" access have codified the requirements for that access. The following is one example of the rules for a "through-the-fence" operation.

The parcels with access rights to the taxiway should be restricted to aeronautical uses only. Aeronautical uses would include: aircraft manufacturing, aircraft parts manufacturing (where taxiway access is needed), wholesale aircraft and parts distributing, aircraft parking, and storage solely for aircraft used for these allowable uses. Land uses which provide aeronautical services to the general public are typically not allowed. This includes, but is not limited to, sales promotions of aircraft, sale of aircraft to the public, aircraft maintenance, aircraft parts rebuilding, aircraft electronic sales and services, flight schools, aircraft fuel or lubricant sales, aircraft

agricultural services, aircraft parking, including storage or hangar facilities, and any other activity which promotes or engages on-site public participation in an aircraft-related activity.

The alternative options will include potential access points intended for “through-the-fence” operations from the private property immediately west of Glen Harbor Boulevard.

HELICOPTER OPERATIONS

There is currently no designated helipad at the airport and helicopters must use the existing apron areas for arrival and departure operations. Proper facility planning suggests that fixed-wing aircraft and rotary aircraft should be segregated to the extent practical. FAA AC 150/5390-2B, *Helipad Design*, defines the requirements for the design of a helipad on the airport. A helipad is made up of several different components: the touchdown and liftoff area (TLOF), final approach and takeoff area (FATO), safety area, and helipad protection zone. The dimensions of these areas are a function of the diameter of the main rotor and the overall length of the design helicopter. For this analysis, a main rotor diameter of 50 feet and an overall length of 60 feet was assumed. This would provide for the operation of helicopters such as the Bell 212 (main rotor diameter of 48 feet, overall length of 57 feet), Bell 205A (main rotor diameter of 48 feet, overall length of 57 feet), American Eurocopter 330 Puma (main rotor diameter of 50 feet, overall length of 60 feet), and Sikorsky S-76B

(main rotor diameter of 44 feet, overall length of 53 feet).

The TLOF is the load bearing area where the helicopter lands or takes off. The TLOF is equal to the diameter of the main rotor. In this case, the TLOF is 50 feet wide by 50 feet long.

The FATO surrounds the TLOF and is the area over which the final phase of the approach to a hover, or a landing, is completed and from which the takeoff is initiated. The FATO does not need to be paved. The FATO is 1.5 times the overall length of the design helicopter. For Glendale Municipal Airport, the FATO is 90 feet long by 90 feet wide.

The FATO is surrounded by a safety area extending 20 feet in each direction. The safety area for this analysis is 130 feet long and 130 feet wide. Similar to the FATO, the safety area does not need to be paved. The FATO and the safety area must be free and clear of objects such as parked helicopters, buildings, fences, or objects which could be struck by the main or tail rotor, or catch the skids of an arriving or departing helicopter.

The helipad protection zone begins at the FATO edge and is 280 feet long and 119 feet wide at its outer width. Similar to the RPZ, the helipad protection zone is required to be kept clear of incompatible objects that cause the congregation of people and property on the ground. The helipad protection zones would be located to the north and to the south of the TLOF, as helicopter operations take place both north and south.

Obstruction clearance is also a consideration for the helipad. The approach and departure path off each end of the helipad extends upward and outward at a ratio of eight-to-one. A transitional surface extends off the sides of the helipad at a ratio of two-to-one.

Consideration is also given to the location of helicopter hardstands, which are designated helicopter parking areas. Navigation to and from hardstands should be done either through hover taxiing or towing. Take-off and landing operations should not be done to and from hardstands. Hardstands are typically the same size as the diameter of the design helicopter rotor. The hardstand is then further identified with a circle. For Glendale Municipal Airport, the hardstands will be 50 feet long by 50 feet wide.

The following three options, depicted on **Exhibit 4K**, have been considered for the location of a helipad and hardstands. These are not the only options available, but they do represent those areas where helipad design requirements can most closely be met. Any identified site for a helipad would have to be approved by the FAA.

Helipad Option A

The first helipad location option is considered on the main apron to the immediate east of the airport terminal building. It is ideal for a helipad to be located in an area that is convenient to terminal or hangar services. Long towing or taxiing times are undesirable

to helicopter operators and long walks to facilities are undesirable by helicopter travelers.

Initial consideration was given to replacing the first row of transient and local aircraft tie-down positions immediately fronting the terminal building. Placing the helipad in this location would require the removal of approximately 30 aircraft parking positions. This would reduce the convenience of the terminal building for both local and transient aircraft operators. Instead, six tie-down positions fronting the terminal building are replaced by three helicopter hardstands. **Exhibit 4K** depicts the location of the helicopter hardstands in front of the terminal building.

The main apron helipad is then considered for the area on the eastern edge of the main aircraft apron, as presented on the exhibit. This location will also require the removal of 30 aircraft tie-down positions, but the first row, closest to the terminal building, is preserved primarily for local and transient fixed-wing aircraft and the three helicopter hardstands. It is likely that any helipad on the main apron will require the relocation of most, if not all, of the existing light poles.

Helipad Option B

The next two options consider a helipad located on the northeast airport property. Option B considers the area for use by both fixed-wing and helicopters. The helipad is located in an open area to the northeast, positioned in

such a manner that hangar and terminal facilities can be located along Glendale Avenue.

This option considers the development of a partial parallel taxiway to allow fixed-wing access to the northeast helicopter area. This could be advantageous when serving a clientele that flies in on an airplane, then uses a helicopter to reach their final destination. This service is often available for large events such as professional football games, professional golf tournaments, conventions of all types, and the Super Bowl. With the opening of the stadium and the associated development, this service may become more popular.

This helipad option would likely require significant fill as the location is 15-20 feet below the elevation of the runway and proposed hangar facilities. This fill would be necessary to allow for helicopter towing operations to and from the helipad to the hangar area. Hardstand parking areas are also considered for the apron area.

Helipad Option C

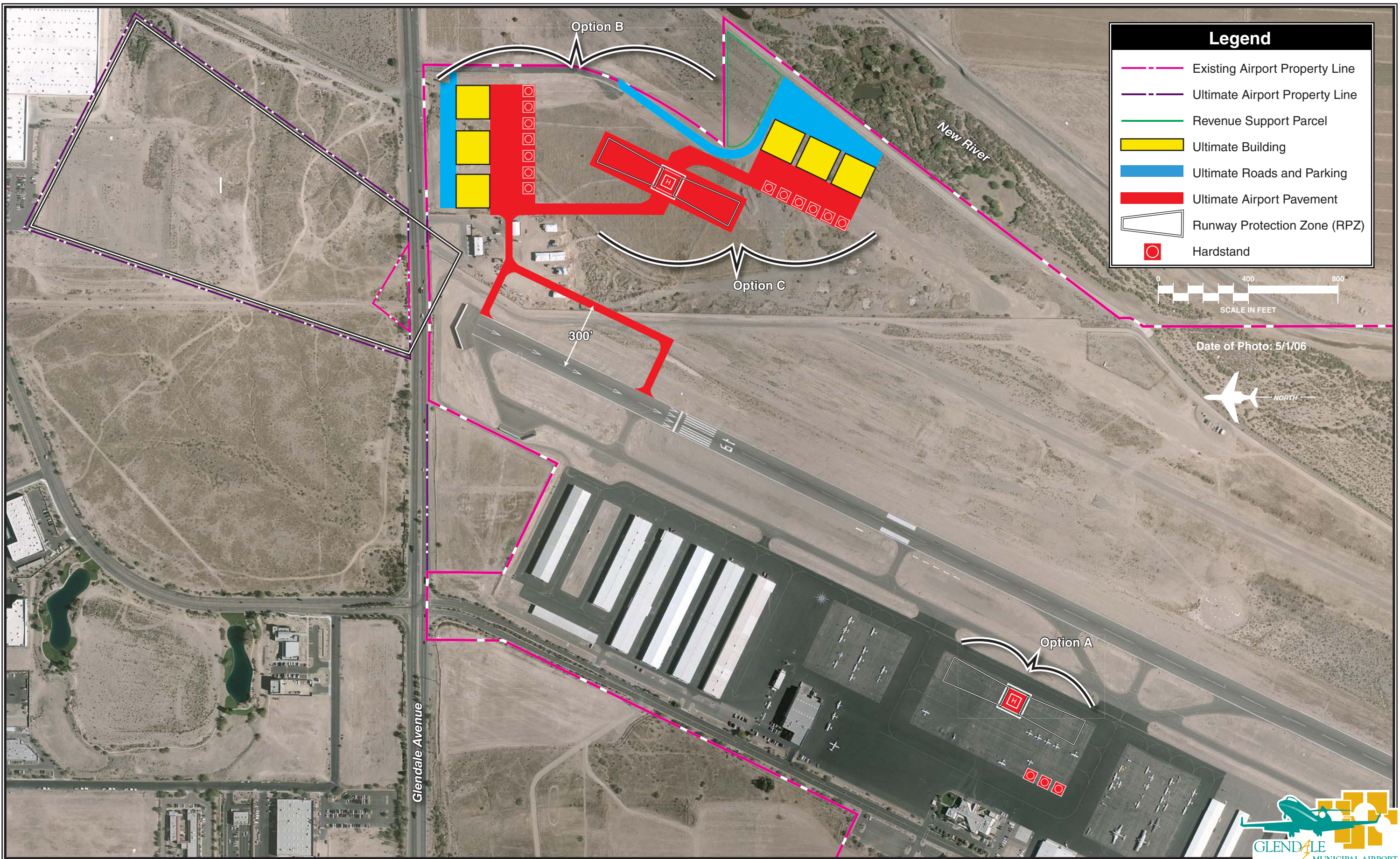
The third helipad option considers initial development of the northeast area for exclusive use by helicopters. Under this scenario, the helipad can be constructed in the same location as in Option B, but the hangar and terminal facilities would be located to the east along the New River channel. This would be at approximately the same elevation as the helipad, thus reducing the need for fill.

Both of the northeast development alternatives provide a segregated area for helicopter training and operation. The helipad is oriented in the same direction as the runway and the visibility to the ATCT would be good. Providing for helicopter operations to the northeast also eliminates helicopter operations directly to the apron fronting the terminal building and avoids the potential hazard of the main apron light poles. The helipad could also be designed with a long, paved operational area to accommodate flight training activities.

Prior to development of any helicopter-related facilities in the area to the northeast, a determination should be made regarding the use-restricted land on the east side of the airport. If the use-restricted land is ultimately intended for a parallel runway, then helipads to the northeast would be an obstruction to the approach to the parallel runway.

LANDSIDE DEVELOPMENT ALTERNATIVES

The possibilities for landside development alternatives are endless. The following development alternatives analysis utilizes accepted airport planning methodologies in conjunction with FAA AC 5300/13, *Airport Design*, Change 9. The three alternatives presented are based upon meeting safety standards, the goals of the City of Glendale, and consideration of fiscal realities.



Legend

- Existing Airport Property Line
- Ultimate Airport Property Line
- Revenue Support Parcel
- Ultimate Building
- Ultimate Roads and Parking
- Ultimate Airport Pavement
- Runway Protection Zone (RPZ)
- Hardstand



Date of Photo: 5/1/06



It should be noted that landside facility development is the purview of the City of Glendale. The FAA will not approve or comment on the landside development alternatives except to conduct airspace analysis when specific structures are proposed. As a result, these alternatives represent an organized development plan for the future. The alternatives are conceptual in nature. If a developer desires to build a smaller hangar or locate a hangar in a different place than the plan indicates, their proposal should be considered in terms of the overall development objectives.

LANDSIDE ALTERNATIVE A

Landside Alternative A is presented on **Exhibit 4L**. This alternative considers the possibility that the Temporary Use Restriction on the east side property will remain in place. As a result, all landside development takes place on the west side and available airport property to the northeast. Any development of the northeast corner of airport property would require significant fill in order to bring the area up to grade with the runway and taxiway system. Opportunities for development on the west side are limited to mostly in-fill within existing hangar complexes.

Two new areas for west side development are considered. The first is the northwest parcel, which would require acquisition by the airport. As pictured, this area is considered for additional connected box hangars. On the southwest end is located a public apron and six box hangars. The han-

gars depicted are 60 feet by 60 feet. This area would be intended for aviation-related businesses.

Development of the east side is currently restricted to those areas not included in the Temporary Use Restriction. As depicted, several corporate aviation parcels are available with taxiway access. These parcels would be ideally suited to individuals or companies wishing to enter into a long term land lease and then construct a hangar to meet their specific needs.

Future planning considered a replacement airport traffic control tower (ATCT). This alternative locates the tower next to the current tower. The replacement tower would need to be somewhat taller in order to provide visual clearance to all runway and taxiway areas. The new tower would have to meet current design standards, including security standards.

LANDSIDE ALTERNATIVE B

Landside Alternative B provides an alternative for development of the east side airport property. This development pattern, as presented on **Exhibit 4M**, would require the release of the Temporary Use Restriction prior to construction.

The east side parallel taxiway would begin at the Runway 19 pavement end and extend south to within 1,000 feet of the Runway 1 pavement end. It is not possible to provide for a full east side parallel taxiway due to the location of the gabion. The parallel taxiway is 35 feet wide and separated

from the runway by 300 feet. Both of these distances meet design standards for a critical aircraft in ARC C-II.

Centrally located to the runway on the east side is a large public apron fronted by five large conventional hangars. The hangars depicted measure 150 feet by 100 feet and would be intended to house direct airport service businesses such as an FBO. Immediately south of the public apron, space is reserved for a replacement ATCT when that becomes necessary. It should be noted that an east side tower would reverse the field of view for controllers and the traffic pattern would be behind them.

South of the high-activity public apron, consideration is given for medium-activity box hangars. Further to the south is a series of connected box hangars. To the north of the public apron is a complex of shade and T-hangars. These would be considered low-activity areas and are grouped as such. An area to the northeast is considered for two connected box hangar facilities, with a public apron. These hangars would ideally be utilized by specialty operators conducting direct aviation-related business.

West side development is limited to those areas previously considered on Landside Alternative A. The area to the northwest is considered for acquisition and development as conventional hangars for aviation businesses. To the southwest is located a public apron and several individual box hangars. This area would again be intended for airport businesses catering directly to aircraft owners. All other hangar areas are filled in as available.

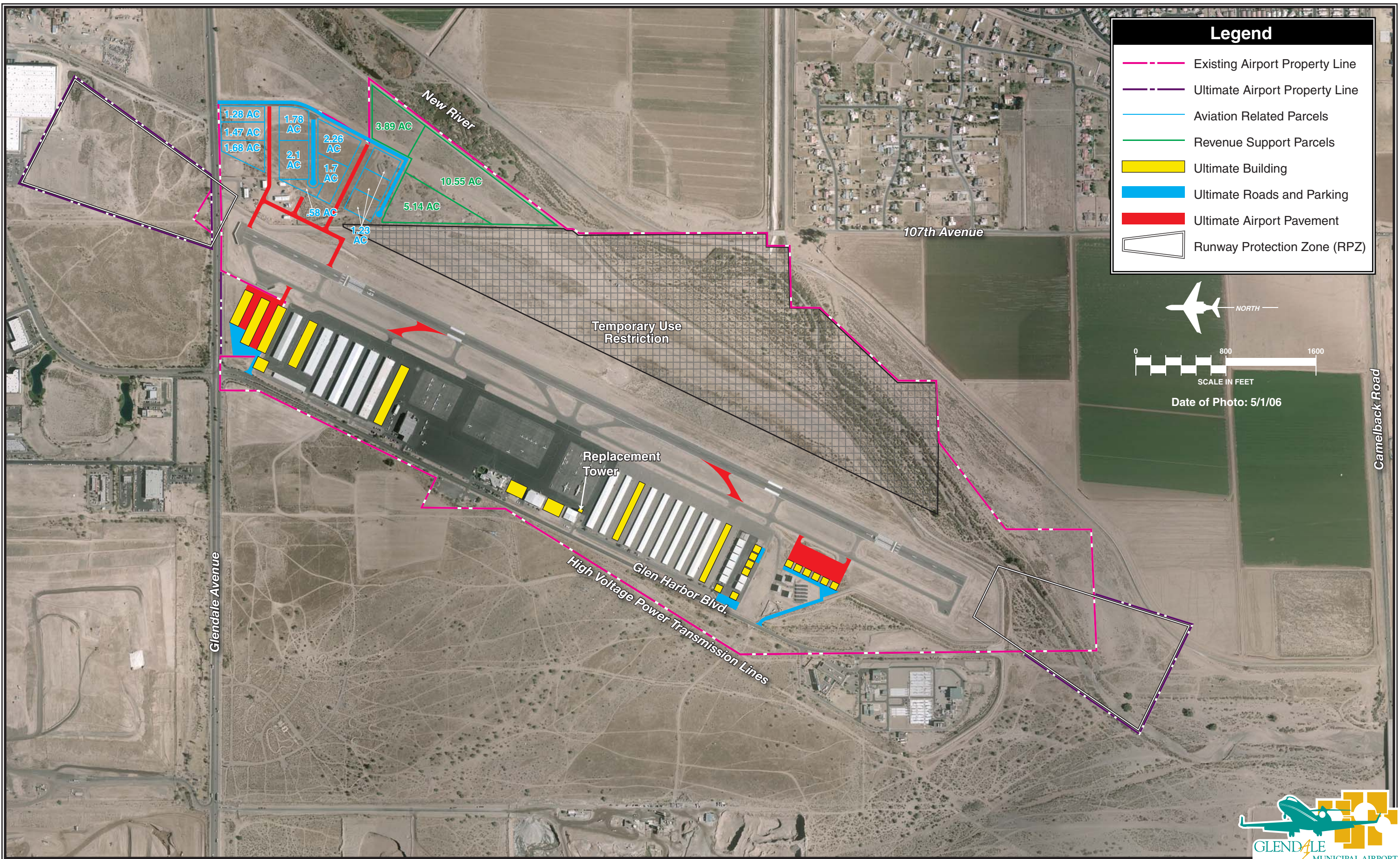
This alternative also considers the possibility of a south end taxiway extending from Taxiway A across Glen Harbor Boulevard to the airport property line. The purpose of this taxiway is to make “through-the-fence” options available to the owner of the private property immediately west of the airport. This taxiway would require closure of Glen Harbor Boulevard, thus a secondary airport access road is depicted on the exhibit which would allow access to the southernmost airport property.

LANDSIDE SUMMARY

Table 4E presents the facility requirements and quantifies how each landside alternative addresses that need. Chapter Three - Facility Requirements indicated a need for a total of 639 covered aircraft storage positions through the long term planning period. Currently there are 375 covered positions available. In addition to the number of positions needed, the aircraft storage mix is also considered based on local and national trends. In an area such as metropolitan Phoenix, where all elements of general aviation activity are supported, storage facilities for large and small aircraft needs are considered.

Landside Alternative A provides a total of 179 new aircraft storage positions. This total is 85 positions short of the forecast need. This is primarily due to a lack of development space on the east side of the runway.

Landside Alternative B provides a total of 568 aircraft storage positions.



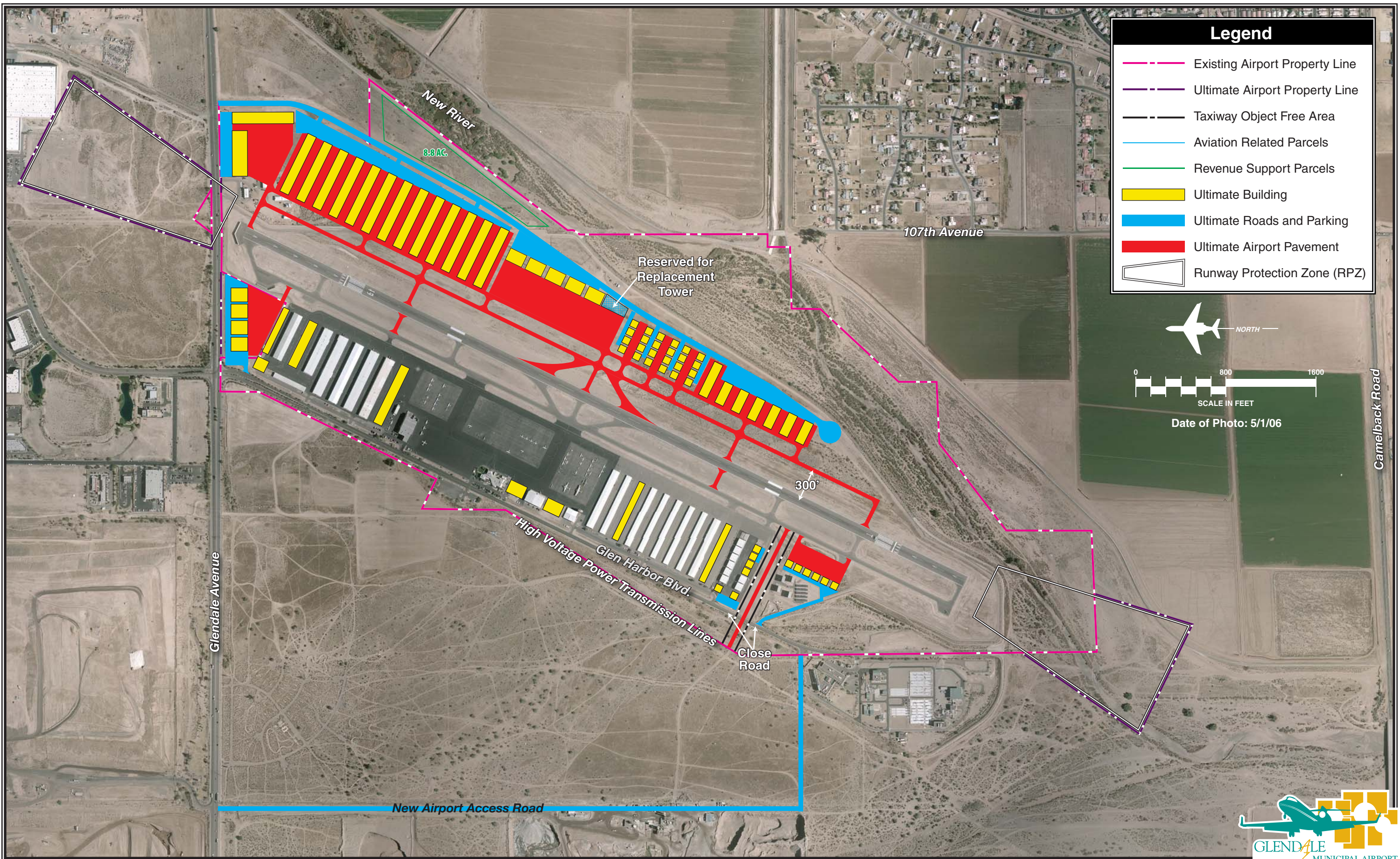
Legend

- - - Existing Airport Property Line
- - - Ultimate Airport Property Line
- Aviation Related Parcels
- Revenue Support Parcels
- Ultimate Building
- Ultimate Roads and Parking
- Ultimate Airport Pavement
- Runway Protection Zone (RPZ)

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 SCALE IN FEET

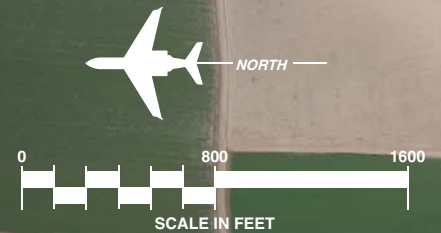
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Legend

- - - Existing Airport Property Line
- - - Ultimate Airport Property Line
- - - Taxiway Object Free Area
- Aviation Related Parcels
- Revenue Support Parcels
- Ultimate Building
- Ultimate Roads and Parking
- Ultimate Airport Pavement
- Runway Protection Zone (RPZ)



Date of Photo: 5/1/06



This includes 69 positions provided by conventional hangars and corporate parcels, 308 T-hangar/shade hangar positions, and 191 box hangar positions. All these facilities exceed the forecast need, thus Landside Alternative B represents a vision beyond the 20-year planning horizon.

Landside Alternative B presents a full build-out scenario if the east side Temporary Use Restriction were lifted. The west side development is similar to Landside Alternative A.

The west side is fully developed with groupings of similar activity levels. To the northwest is a specialty airport business operator section. Moving south is a complex of T-hangars and shade hangars, followed by some connected box hangar structures. Four large conventional hangars are located central to the runway/taxiway system, intended to serve as FBO facilities. The southeast portion of the east side is further developed with individual and connected box hangars.

TABLE 4E Facility Forecast Comparison Glendale Municipal Airport				
AIRCRAFT STORAGE POSITIONS				
Individual Hangar Positions	Available Today	Forecast Need	Landside A	Landside B
T/Shade Hangars	215	79	87	308
Box Hangars	151	138	60	191
Conventional	9	47	10	69
Corporate Parcel Hangars	NA	0*	22	0*
Total Hangar Positions	375	264	179	568
Box Hangars = 1 position per hangar Conventional Hangars = 2,500 s.f. per position Corporate Parcels = 1 position per acre 15 percent service/maintenance hangar area has been deducted from conventional hangar totals				
* Included in Conventional Hangar Needs				

Landside Alternative B exceeds forecast needs for T-hangars, shade hangars, and box hangars. Space for conventional hangar aircraft parking positions is also met.

Actual demand levels will dictate facility development. For example, if the airport needed to house a large number of small aircraft, the decision to build (or allow private developers to build) T-hangars would be prudent. However, if corporate aircraft are more demanding, box hangar or con-

ventional hangar development would be necessary.

The City of Glendale has a history of allowing facility development only in accordance with the airport master plan. This has allowed the airport to maximize limited space for facility development while providing for aircraft movement efficiency. The ultimate plan is a continuation of the ongoing planning effort that the City has undertaken. As a result, the City will be capable of maintaining a first-class

airport which maximizes airport property.

ALTERNATIVES SUMMARY

The process utilized in assessing the airside and landside development alternatives involved a detailed analysis of short and long term requirements, as well as future growth potential. Current airport design standards were considered at every stage in the analysis. Safety, both air and ground, were given the highest priority in the analysis of alternatives.

After review and input from the Planning Advisory Committee (PAC), City officials, and the public, a recommended concept will be developed by the consultant. The resultant plan will represent an airside facility that fulfills safety design standards, and a landside complex that can be developed as demand dictates.

The following chapters will be dedicated to refining the basic concept into a final plan, with recommendations to ensure proper implementation and timing for a demand-based program.



Chapter Five

**RECOMMENDED MASTER
PLAN CONCEPT**

Glendale municipal airport

Chapter 5

RECOMMENDED MASTER PLAN CONCEPT

The airport master planning process for Glendale Municipal Airport (GEU) has evolved through the development of forecasts of future demand, an assessment of future facility needs, and an evaluation of airport development alternatives to meet those future facility needs. The planning process has included the development of two phase reports which were presented to the Planning Advisory Committee (PAC) and discussed at several coordination meetings and a public information workshop. The City of Glendale has participated in each of these meetings and has been actively involved in the master planning process.

The PAC is comprised of several constituencies with an investment or interest in the Glendale Municipal Airport. Groups represented on the PAC include the Federal Aviation Administration (FAA), the Arizona Department of Transportation - Department of Aeronautics (ADOT), the Maricopa Association of Governments, the Arizona Military Airspace Working Group,



the City of Glendale, airport management, airport traffic control tower personnel, airport businesses, and local and national pilot associations. This diverse group has provided extremely valuable input into this recommended plan.

In the previous chapter, several development alternatives were analyzed to explore options for the future growth and development of Glendale Municipal Airport. The development alternatives have been refined into a single recommended concept for the master plan. This chapter describes, in narrative and graphic form, the recommended direc-



tion for the future use and development of Glendale Municipal Airport.

RECOMMENDED MASTER PLAN CONCEPT

The recommended master plan concept incorporates elements from each of the airside and landside alternatives presented in the previous chapter. This concept provides the airport with the ability to meet the increasing demands on the airport by larger corporate aircraft, while also providing adequate space for the majority users of the airport which include piston-powered aircraft operators. The recommended master plan concept, as presented on **Exhibit 5A**, presents an ultimate configuration for the airport that preserves and enhances the role of the airport while meeting FAA defined design standards to the greatest extent practicable. A phased program to implement the recommended development configuration will be presented in Chapter Six - Capital Improvement Program. The following sections will describe the recommended master plan concept in detail.

AIRSIDE CONCEPT

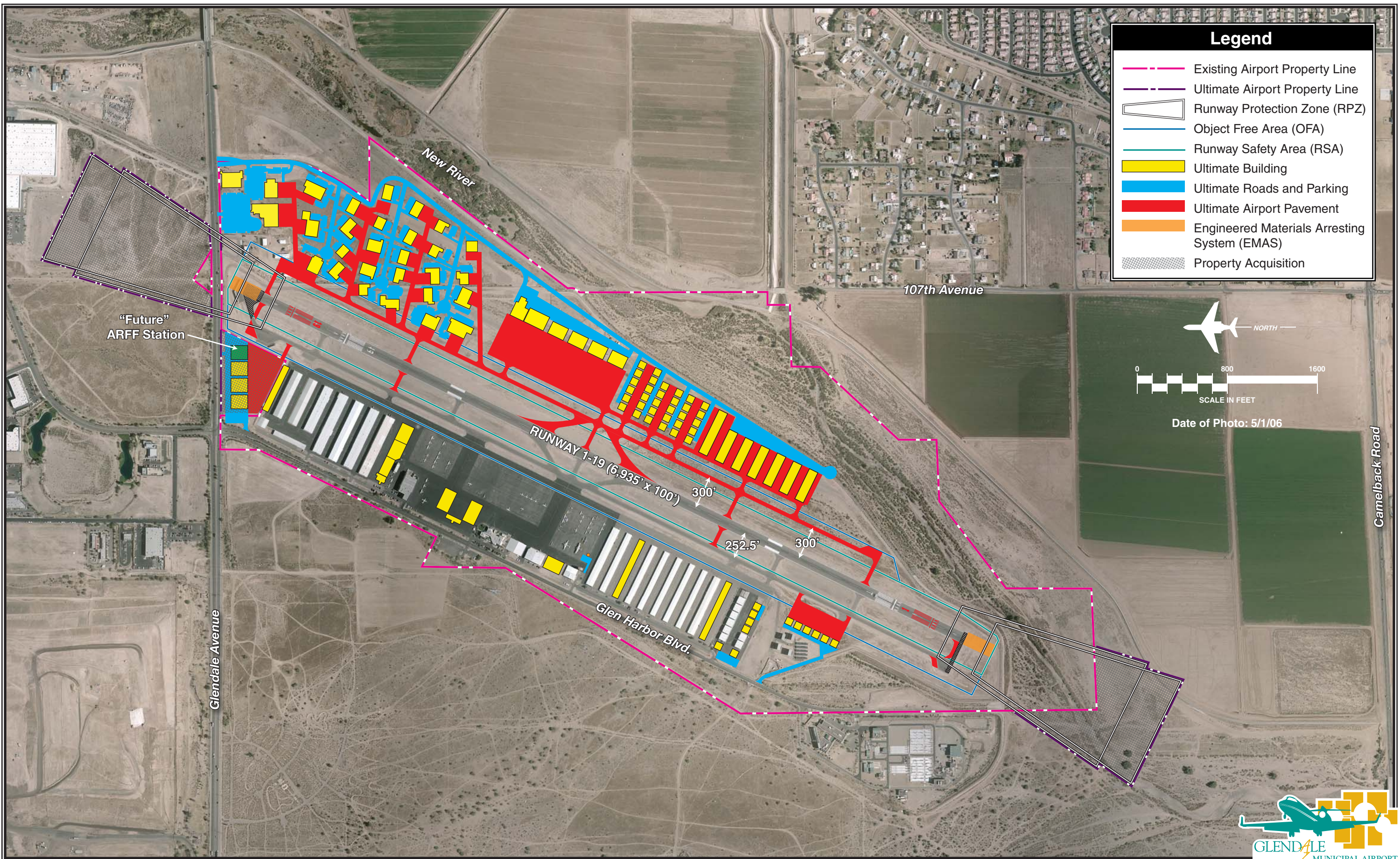
The FAA has established design criteria to define the physical dimensions of runways and taxiways, as well as the imaginary surfaces surrounding them which protect the safe operation of aircraft at the airport. These design standards also define the separation criteria for the placement of landside facilities.

As discussed previously, FAA design criteria primarily center around the airport's critical design aircraft. The

critical aircraft is the most demanding aircraft or family of aircraft which currently, or are projected to, conduct 500 or more operations (take-offs and landings) per year at the airport. Factors included in airport design are an aircraft's wingspan, approach speed, tail height and, in some cases, the instrument approach visibility minimums for each runway. The FAA has established the Airport Reference Code (ARC) to relate these critical aircraft factors to airfield design standards.

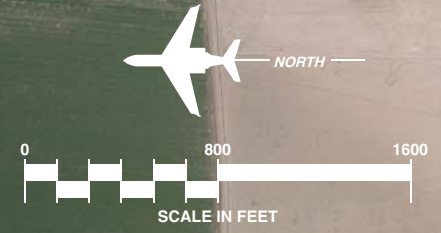
Analysis conducted in Chapter Three - Facility Requirements, concluded that the current and future critical aircraft is defined by general aviation business jets that fall into ARC C-II (approach speeds less than 120 knots, wingspans less than 79 feet, and tail heights less than 30 feet). This category of aircraft includes models such as the Cessna 650, 680, and 750; Falcon 900EX and F-Series; and Hawker 800XP and 1000. Larger business jet aircraft, such as the Gulfstream II, IV, and V, and Bombardier Global Express and Learjet 60, also contribute to the current critical aircraft determination based on their higher approach speeds. The master plan anticipates that the number of business jet aircraft using the airport will increase in the future, consistent with national trends and FAA forecasts. Significant business growth in the immediate Glendale area and the western metropolitan Phoenix area will also contribute to strong growth in aviation activity at Glendale Municipal Airport.

While airfield elements must meet design standards associated with a critical aircraft in ARC C-II, landside elements can be designed to accommodate specific categories of aircraft. For example, a



Legend

- Existing Airport Property Line
- Ultimate Airport Property Line
- Runway Protection Zone (RPZ)
- Object Free Area (OFA)
- Runway Safety Area (RSA)
- Ultimate Building
- Ultimate Roads and Parking
- Ultimate Airport Pavement
- Engineered Materials Arresting System (EMAS)
- Property Acquisition



Date of Photo: 5/1/06



taxilane leading to a T-hangar area does not need to meet the object free area width standard for ARC C-II since only smaller single and multi-engine piston aircraft are likely to access these areas. This area only needs to meet requirements for ADG I (wingspans less than 49 feet). The apron areas associated with the Fixed Base Operator (FBO) and larger hangar areas for the storage of corporate aircraft need to meet ADG II requirements.

Table 5A presents the ARC C-II design standards to be applied to Glendale Municipal Airport. It also highlights those areas where the airport does not currently meet FAA design standards. Each of the non-standard conditions was presented in detail in the previous chapter.

The recommended airport concept provides a 300-foot gain of safety area on both ends of the runway. This is significant as it creates space for the airport to enhance overall operational safety by installing Engineering Materials Arresting Systems (EMAS). The EMAS is intended to add a level of safety to the runway system that is nearly equivalent to providing the full 1,000-foot RSA beyond the runway ends.

Runway Safety Area

The recommended concept presents a two-step approach to providing adequate runway safety area (RSA) and maximum runway length at the airport. The first step is to update and publish declared distances at the airport so that RSA standards are considered in departure and landing calculations at the airport. The existing runway lighting,

marking, and distance-to-go markets all reflect the implementation of declared distances at the airport in accordance with FAA design standards. However, the declared distances have not been published in the FAA Airport/Facilities Directory. Without the publication of declared distances, pilots are computing their available runway length for take-off as the full 7,150 feet of pavement length. This means that in pilot calculations, the availability of RSA is not considered. The first step of the project is to implement these declared distances so that RSA standards are considered in the operations at the airport. This does not require a significant capital investment by the airport and can be implemented quickly.

As described in Chapter Four, when the previous master plan was completed, 1,000 feet of RSA was required beyond both ends of the runway and prior to the landing threshold. Since that time, the RSA standard has changed so that only 600 feet of RSA is required prior to landing. The length beyond the far end of the runway remains at 1,000 feet. This change in design standard will directly benefit the airport by making more runway length available for landing in each direction.

Updating and publishing the new declared distances will necessitate declaring the Accelerate-Stop Distance Available (ASDA) for Runway 19 to be 100 feet shorter than planned in the previous master plan. This is because after the completion of the previous master plan, the New River channel gabion was relocated approximately 100 feet closer to the runway than originally planned due to the need to accommodate a certain flow threshold.

TABLE 5A
Airfield Planning Design Standards*
Glendale Municipal Airport

	FAA ARC C-II Design Standard	Current Condition	Ultimate Condition
Runway 1-19			
Width	100	100	100
Shoulder Width	10	10	10
Runway Centerline to:			
Hold Position	200	200	200
Parallel Taxiway Centerline	300	252.5	252.5
Edge of Aircraft Parking Area	400	400	400
Runway 1			
Runway Safety Area			
Width	400	240	240
Length Beyond End	1,000	300	300
Length Prior to Landing	600	1,000	600
Object Free Area			
Width	800	500	500
Length Beyond End	1,000	300	300
Length Prior to Landing	600	1,000	600
Obstacle Free Zone			
Width	400	340	350
Length Beyond End	200	200	200
Runway 19			
Runway Safety Area			
Width	400	340	300
Length Beyond End	1,000	0	300
Length Prior to Landing	600	1,000	600
Object Free Area			
Width	800	560	500
Length Beyond End	1,000	0	300
Length Prior to Landing	600	1,000	600
Obstacle Free Zone			
Width	400	340	400
Length Beyond End	200	200	200
Taxiways			
Width	35	35	35
Shoulder Width	10	10	10
Safety Area Width	79	79	79
Object Free Area Width	131	131	131
Edge Safety Margin	7.5	7.5	7.5
Taxiway Centerline to:			
Fixed or Movable Object	65.5	65.5	65.5
Parallel Taxiway/Taxilane	105	105	105
Taxilanes			
Object Free Area Width	115	115	115
Taxilane Centerline to:			
Fixed or Movable Object	57.5	57.5	57.5
Parallel Taxiway/Taxilane	97	97	97

TABLE 5A (Continued)
Airfield Planning Design Standards*
Glendale Municipal Airport

	FAA ARC C-II Design Standard	Current Condition	Ultimate Condition
Runway Protection Zones			
Visibility Minimum	1-mile	1-mile	1-mile
Inner Width	500	500	500
Outer Width	1,010	1,010	1,010
Length	1,700	1,700	1,700

* As measured from the narrowest associated point.

Note: All measurements in feet. **BOLD** = Does not meet standard

Source: *FAA Advisory Circular (AC) 150/5300 - 13, Change 12, Airport Design*

Updating the declared distances will provide adequate runway length to accommodate 75 percent of the business jets at 60 percent useful load as described in Chapter Three. The activity trend at the airport indicates that large business jets in the 75 to 100 percent category may represent the critical aircraft (500 or more annual operations) in the near future. As shown in Chapter Three, these aircraft require up to 7,400 feet of runway length.

The second step in improving the runway safety area and maximizing runway length for the 75 to 100 percent category of the national fleet involves the installation of an EMAS beyond each runway end. The FAA considers the EMAS to provide an equivalent level of safety as a full 1,000 feet of RSA beyond the runway end.

The planning and design of EMAS has changed since the alternatives analysis was prepared in October 2006. The manufacturer of EMAS has introduced a new product that is more ideally suited to business jet aircraft and general aviation airports. Referred to as “50-Strength” EMAS, the crushable concrete blocks will compress more rea-

dily, thus providing a greater margin of safety for non-commercial type aircraft. Prior to the development of the 50-Strength EMAS, fast but light business jets, such as the Lear 35, would not sink into the material as quickly. The 50-Strength EMAS has a greater capability to stop most business jets with a shorter EMAS bed.

While EMAS is effective in providing an equivalent level of safety for the heavier business jets, it is not as effective in stopping lighter aircraft below 25,000 pounds. This is because the lighter aircraft will not sink into the EMAS bed as predictably. Therefore, when possible, it is desirable to provide at least 300 feet of RSA beyond the runway end for these lighter aircraft. This recommendation is based on the RSA standard of 300 feet beyond the runway end for aircraft in ARC B-II. The recommended airside concept provides for 300 feet of RSA beyond each runway end.

Considering these recent planning and design changes for EMAS, the manufacturer was consulted to determine several minimum EMAS circumstances. **Table 5B** presents this information.

TABLE 5B EMAS Capability and Cost Glendale Municipal Airport			
EMAS within 300 feet			
Aircraft Type	Predicted Runway Exit Speeds		
Citation X	69-70 knots		
Challenger 604	68-69 knots		
Gulfstream IV	67-68 knots		
Lear 35	64-65 knots		
EMAS Size	Length	Width	Setback
Site Prep Area	300'	150'	35'
EMAS Bed	265'	120'	35'
Cost Estimate	Dollars		
Installation and Materials	\$3,100,000		
EMAS for 70-knot performance for large business jets			
Aircraft Type	Predicted Runway Exit Speeds		
Citation X	70 knots		
Challenger 604	70 knots		
Gulfstream IV	70 knots		
EMAS Size	Length	Width	Setback
Site Prep Area	315'	150'	35'
EMAS Bed	280'	120'	35'
Cost Estimate	Dollars		
Installation and Materials	\$3,300,000		
EMAS for 70-knot performance for small business jets			
Aircraft Type	Predicted Runway Exit Speeds		
Lear 35	70 knots		
EMAS Size	Length	Width	Setback
Site Prep Area	340'	150'	35'
EMAS Bed	305'	120'	35'
Cost Estimate	Dollars		
Installation and Materials	\$3,600,000		
<i>Source: Zodiac-ESCO (Engineering Arresting Systems Corporation)</i>			

The first EMAS alternative considers the capability of an EMAS bed within a 300-foot space beyond the runway end. As can be seen, a 265-foot EMAS bed with a 35-foot setback provides stopping capability in the mid-to-high 60-knot range.

The second and third alternatives were developed to indicate the minimum EMAS bed size, regardless of the space

available, needed to stop business jets entering it at 70 knots, the RSA equivalency standard. As can be seen in the middle section of **Table 5B**, an EMAS bed that is 285 feet long with a 35-foot setback provides this capability for larger business jets. The bottom section of the table shows that an EMAS bed of 305 feet in length is needed to meet the 70-knot standard for all business jets including the lighter Lear 35.

A standard EMAS installation is capable of safely stopping a design aircraft that leaves the runway end traveling at 70 knots or less. The RSA where the EMAS is located should also provide for potential short landings to runway ends with vertical guidance. Vertical guidance to both runway ends is available visually from the precision approach path indicator (PAPI) lights. Therefore, a standard EMAS bed would be a portion of the 600-foot RSA needed prior to landing. The remaining portion of the 600-foot area needed prior to landing would be provided with displaced landing thresholds.

According to FAA Order 5200.9, *Financial Feasibility and Equivalency of RSA Improvements and EMAS*:

“It will often not be practicable to provide either a standard RSA or a standard EMAS installation, either because the cost of both is above the maximum feasible cost, or because displacing the landing threshold will adversely affect operations. When neither a standard RSA nor a standard EMAS system can be provided ... a non-standard EMAS that will stop the design aircraft traveling at 40 knots or more should be considered.”

Because of the location of Glendale Avenue and the New River gabion, providing the full 1000-foot safety area without adversely affecting operations is not practicable. A standard EMAS capable of stopping the critical aircraft entering at 70 knots is also not practicable as more runway length is lost. Therefore, it is recommended that the first EMAS option presented in **Table 5D** be utilized.

The installation of EMAS will gain runway length over using declared distances alone at the airport. The ASDA for Runway 1 would be increased from 6,150 feet to 6,935 feet. The ASDA on Runway 19 would be increased from 6,350 feet to 6,935 feet. The LDA for both runway ends would increase from 5,750 feet to 6,335 feet. The TORA and TODA would be reduced from 7,150 feet to 6,935 feet, but this is less consequential as these do not consider safety factors.

Exhibit 5B provides detail on the changes to each runway end when installing the EMAS beds. On the Runway 19 end, 180 feet of physical runway pavement would need to be removed. The threshold taxiway would need to be modified to provide access to the new runway end. The blast deflection fence would need to be removed to make way for the EMAS bed. The relocation of the runway pavement end will effectively eliminate the need for the blast fence as potential jet blast will be moved further away from Glendale Avenue. The landing threshold is then displaced from the new runway pavement end by an additional 300 feet to provide for the required 600-foot RSA prior to the landing threshold.

On the Runway 1 end, 35 feet of existing runway pavement is removed in order to provide the necessary setback for the EMAS bed. The current threshold taxiway will need to be modified to provide access to the new runway pavement end. Again, the landing threshold is displaced 300 feet to meet RSA standards prior to the landing threshold.

Financial consideration must be made prior to a final recommendation for the use of EMAS. FAA Order 5200.9, *Financial Feasibility and Equivalency of RSA Improvements and EMAS*, provides guidance on the maximum feasible expenditure (cost) for improving the RSA with an EMAS component. The maximum cost is applied to the entire RSA, including both runway ends and the full width of the RSA. The maximum feasible cost is a function of the EMAS bed length. The maximum feasible cost for utilizing EMAS at Glendale Municipal Airport is approximately \$8 million.

The manufacturer of EMAS (ESCO-Zodiac) was contacted and provided with the specifications for Glendale Municipal Airport. Their estimate includes materials and installation. Site preparation is not included. Each EMAS bed is estimated to cost \$3.1 million. The manufacturer has indicated that the life cycle of EMAS is the same as concrete pavement, or approximately 20 years.

Object Free Area and Obstacle Free Zone

Unlike the RSA, requesting a modification to standards from the FAA for the object free area (OFA) and obstacle free zone (OFZ) is permissible. The modification to standards will only be granted if other practicable alternatives have been considered. Due to the physical constraints of the airport, meeting design standards for the OFA is not feasible. The OFA will continue to be penetrated by the perimeter fence along the New River channel. A modification to standard for the OFA will also be

needed for the blast fence on the hold apron on the north end of Taxiway A if the fence is to remain in place.

There are two primary options for addressing the disposition of the service road nearest the Runway 1 end. Previous alternatives considered closing that portion of the service road that crosses the RSA and OFA. This action could reduce the efficiency of airport personnel but it would prevent potential incursions into the RSA and OFA while aircraft are operating. A second option would be to require contact with the tower by airport personnel utilizing this service road. Tower personnel could then clear airport vehicles to proceed as needed.

The OFZ is an area centered on the runway extending 200 feet from the pavement end at a width of 400 feet. The OFZ associated with the Runway 1 end is constrained by the New River channel, perimeter fence, and airport service road. An additional 10 feet of OFZ is gained by the EMAS installation. The OFZ associated with Runway 1 would be brought up to standard by the removal of the blast fence and removal of 180 feet of runway pavement. Both of these are associated with the installation of EMAS.

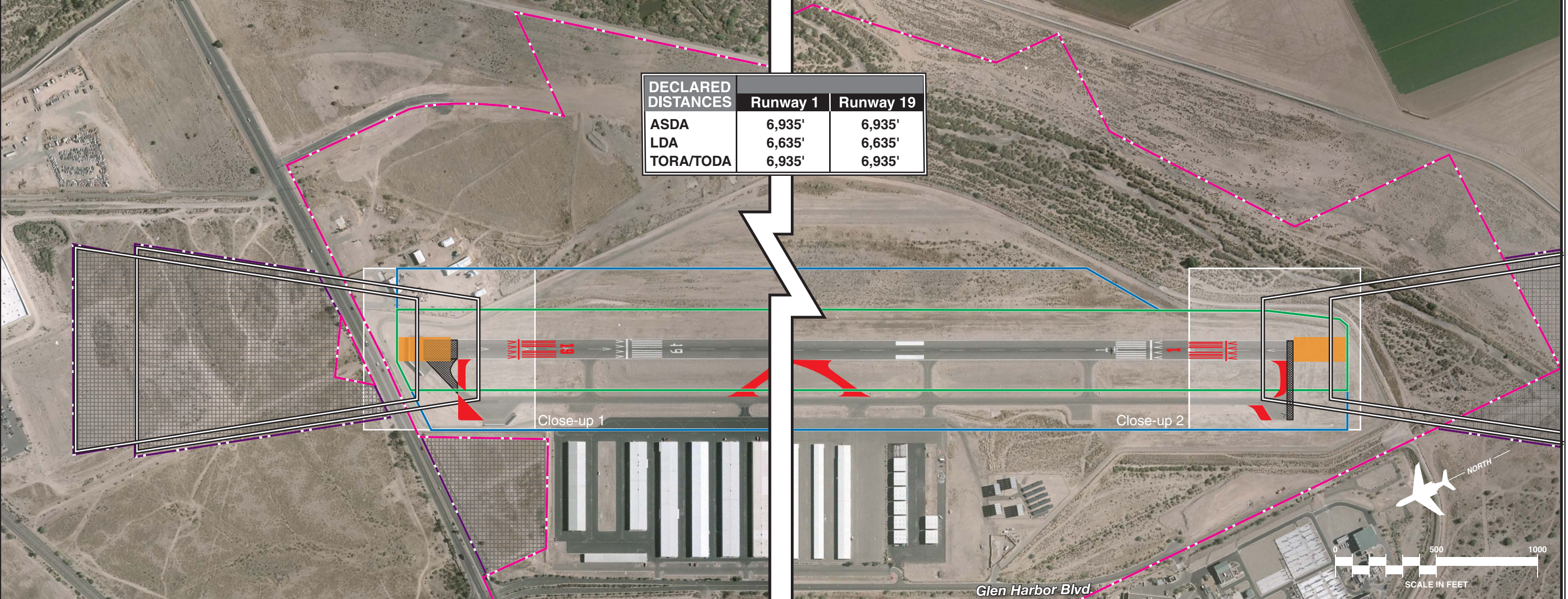
Runway/Taxiway Separation

There are two factors that primarily influence the FAA standard for runway/taxiway separation. The first is the type and frequency of aircraft operations as described by the applicable ARC and the second is the capability of the instrument approaches available at the airport. The current and future

Runway 19: EMAS 265' with 35' Set-Back (Remove 180' of Runway)

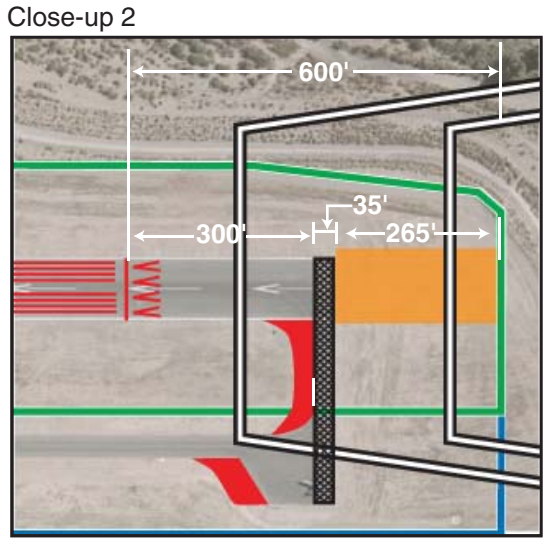
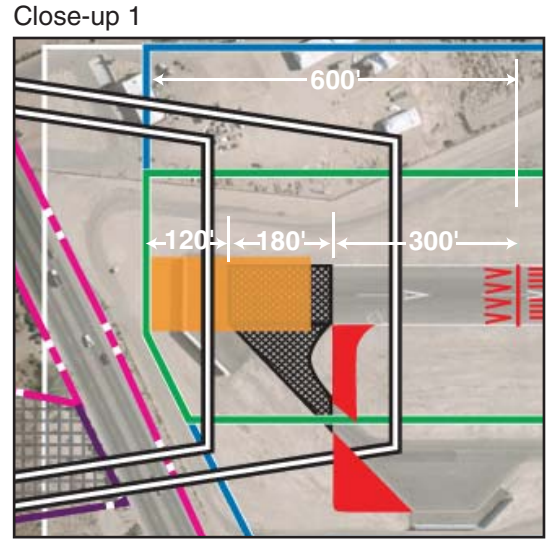
Runway 1: EMAS 265' with 35' Set-Back (Remove 35' of Runway)

DECLARED DISTANCES	Runway 1	Runway 19
ASDA	6,935'	6,935'
LDA	6,635'	6,635'
TORA/TODA	6,935'	6,935'



- Legend**
- - - Airport Property Line
 - - - Ultimate Airport Property Line
 - Runway Safety Area (RSA)
 - Object Free Area (OFA)
 - Property Acquisition
 - Runway Protection Zone (RPZ)
 - EMAS
 - New Pavement
 - Pavement to be Removed

ASDA: Accelerate-Stop Distance Available
 LDA: Landing Distance Available
 TORA: Take-Off Run Available
 TODA: Take-Off Distance Available



ARC is C-II and the instrument approaches are planned to offer not lower than one mile visibility minimums.

The planning standard for runway/taxiway separation is 300 feet from centerline to centerline. Runway 1-19 and parallel Taxiway A are currently separated by 252.5 feet. Several alternatives were considered in Chapter Four – Alternatives and presented on Exhibit 4C, to meet FAA standards. It is recommended that a modification to standard be sought from the FAA allowing the airport to maintain the current separation distance.

The existing separation distance provides the necessary safety margin between two aircraft operating on the runway and taxiway at the same time. In addition, the cost to relocate the taxiway to a distance of 300 feet would be difficult to justify through a benefit-cost analysis. Relocating the taxiway would also impact the front portion of most of the west side hangar structures.

In determining if a modification to standard will be granted, the FAA will require that the airport demonstrate that safety is not compromised. The runway/taxiway separation standard is intended to prevent the possibility of an aircraft operating on the runway from coming into contact with the wing of an aircraft operating on the taxiway. The separation standard should prevent the wing of a taxiing aircraft from penetrating the RSA or OFZ surrounding the runway. At Glendale Municipal Airport, the RSA and OFZ are both 400 feet wide, centered on the runway.

Two aircraft with a maximum wingspan of 79 feet (Airplane Design Group –

ADG-II) can operate on the runway and parallel taxiway at the same time without any penetration to the RSA or OFZ. The minimum acceptable separation would be 239.5 feet (200 feet of RSA/OFZ and 39.5 feet for the maximum ADG-II wingspan). The existing runway/taxiway separation provides an additional 13 feet of distance between the wing of an ADG-II aircraft taxiing and the RSA/OFZ surfaces surrounding the runway.

A parallel taxiway is planned for the east side of the airfield. This taxiway is planned at a separation of 300 feet from the runway, centerline to centerline, to meet the standard for the current and future critical aircraft. Two “high-speed” exits are available at mid-field to allow aircraft to exit the runway sooner. Two right-angled exits along with threshold taxiways are provided as well.

All buildings and aircraft parking on the east side should be considered at a distance of at least 400 feet from the runway centerline. This will insure that the runway object free area conforms to FAA design standard.

Runway Protection Zones

The function of the runway protection zone (RPZ) is to enhance the protection of people and property on the ground. According to AC 150/5300-13, *Airport Design*, “this is achieved through airport owner control over the RPZs. Such control includes clearing RPZ areas (and maintaining them clear) of incompatible objects and activities. Control is preferably exercised through the acquisition of sufficient property interest in the RPZ.”

The RPZ standards prohibit residences and places of public assembly such as churches, schools, hospitals, office buildings, shopping centers, and other uses with similar concentrations of persons. Fuel storage is not permitted within the RPZ.

The RPZ is comprised of the central portion and the controlled activity area. The central portion of the RPZ is laterally defined by the extended object free area. The controlled activity area is the remaining edge portions of the RPZ. The central portion of the RPZ must remain clear of all objects and incompatible land uses. The controlled activity area may accommodate limited uses such as auto parking, although any use is discouraged.

The Western Pacific Region of the FAA has indicated that roads are not allowed through the central portion of the RPZ except for those roads that were in place prior to the release of AC 150/5300-13, *Airport Design*, Change 12, on January 3, 2008. Therefore, the location of Glendale Avenue through the Runway 19 RPZ is permissible.

Because it is strongly recommended that the airport have ownership of the RPZs, this master plan recommends fee-simple acquisition of the property to the immediate north of the airport encompassing the RPZ. Based on the recommended concept, this area is approximately 30 acres. An additional six acres may need to be acquired in order to not leave uneconomic remnants. Basically, the property owner can reasonably request that they are not left with small or unconnected land remnants due to the acquisition.

It should be noted that while it is recommended to acquire the RPZs, the most important element is to have enforceable restrictions on land uses within the RPZ. The City of Glendale has excellent zoning restriction in place for land occupying the RPZs.

The RPZ associated with Runway 1 extends beyond airport property over the New River channel. Because of the location of this property, it is highly unlikely that any incompatible land use could emerge. Therefore, while acquisition of the Runway 1 RPZ is shown on **Exhibit 5A**, the capital improvement program will consider that expenditure only as the need warrants.

Airside Conclusion

Design standards for Glendale Municipal Airport are determined by the frequency of activity by the critical aircraft and the sophistication of the instrument approaches. The current critical aircraft falls in airport reference code (ARC) C-II. The future critical aircraft also falls in ARC C-II. For runway length determination, the critical aircraft are divided into two groups. The current critical aircraft is represented by business jets that comprise 75 percent of the national fleet. The future critical aircraft is represented by business jets that comprise up to 100 percent of the national fleet. Providing the necessary runway length to meet the needs of these aircraft at 60 percent useful load is the planning standard applied to Glendale Municipal Airport.

There is currently at least 5,400 feet of runway length available for operations in all directions. This meets the need of

the current critical aircraft family. In the near future, up to 7,400 feet of runway length is desirable.

In the previous chapters, it was determined that it was not feasible to gain additional pavement length or area beyond the runway ends for safety area consideration. The New River channel cannot be moved or encroached upon due to a need to maintain flow rates. It was also deemed too costly to relocate Glendale Avenue, primarily because the Glendale Avenue bridge over the New River channel would have to be relocated and this bridge currently carries major utility, water, and sewer lines. Therefore, the recommended airside concept gains the maximum feasible runway length and safety area within these constraints.

The recommended airside concept plans a two-step process to meeting airfield design standards and providing maximum runway length. The first step is to publish updated declared distances that consider recent changes in FAA design criteria (i.e., change from 1,000 feet of RSA prior to landing to 600 feet). The second step is to install EMAS on both runway ends in order to provide maximum runway length to accommodate large business jets which are forecast to represent the critical aircraft in the near future.

The installation of EMAS will preserve the maximum runway length possible, while providing RSA that is nearly equivalent to the full 1,000-foot beyond the runway end RSA standard.

LANDSIDE CONCEPT

The primary goal of landside facility planning is to provide adequate aircraft storage space to meet the forecast need while also maximizing operational efficiencies and land uses. Achieving this goal yields a development scheme which segregates aircraft activity levels while maximizing the airport's revenue potential. **Exhibit 5A** depicts the recommended landside development plan for the airport.

The recommended landside concept most closely resembles Exhibit 4M – Landside Alternative B, previously presented in Chapter Four. The recommended plan provides for maximizing airport property for aviation-related development.

On the west side, hangar development consists of mostly in-fill opportunities. In addition to the in-fill opportunities, two new hangar areas are considered. The northwest corner of the airport is currently privately owned. This location occupies runway frontage and, if possible, should be acquired by the airport. Three medium-size conventional hangars with ramp area are depicted. In the past, the City of Glendale has considered a fire station in this location and this layout also accommodates that possibility.

On the southwest side of the airport, a small ramp with six box hangars is depicted. These hangars could be private executive hangars or airport business hangars.

Between this small ramp and the existing box hangars to the north is an open space extending from Taxiway A to Glen Harbor Boulevard. This space is intentionally left undeveloped in order to maintain the possibility of extending a taxiway to the west and opening up additional aviation development opportunities.

The east side of the airfield is considered for full build-out aviation development. One of the highest priority items for the east side is a large aircraft ramp. Several times throughout the year, local events such as concerts and sporting events draw upward of 100 transient business jets. The existing ramp space is severely limited in its capacity to accommodate this transient activity. This is especially true when considering that much of the existing ramp is also utilized by aircraft tie-down positions.

The planned east side ramp encompasses approximately 70,000 square feet of space and is fronted by several large conventional hangars. These hangars should be utilized by airport businesses providing primary services such as a full service fixed base operator.

To the south of the FBO area are three taxilanes extending from the parallel taxiway to accommodate box hangars. Box hangars are typically a medium activity use accommodating corporate needs or specialty airport businesses. The southeast portion of the east side depicts low activity T-hangars.

The northeast portion of the layout depicts a series of corporate hangars. This layout is one suggested by the current

airport FBO operator. The availability of corporate hangars is in high demand in the Phoenix metropolitan area and fits the needs of the airport.

The landside plan also includes a replacement airport traffic control tower (ATCT) on the west side of the airfield. While an east side location was considered, significant operational and safety issues could develop; therefore, a replacement tower is planned in the vicinity of the current tower.

A replacement ATCT will likely be the financial responsibility of the City of Glendale. Should the City pursue the construction of a replacement ATCT, a formal site selection study should be undertaken prior to a final site determination. During the study, consideration should be given to control tower operating procedures. Relocating the tower to the east side would reverse radar views for tower personnel and may be justification for maintaining the tower on the west side by either constructing a replacement tower near the current location or raising the cab height for the existing tower.

It should be noted that development of the east side may be constrained by the restrictions placed on the property by agreement with the original land donor and the City of Glendale.

SUMMARY

The recommended master plan concept has been developed in conjunction with the Planning Advisory Committee, airport management, and numerous City officials, and it is designed to assist in making decisions on future development

and growth of Glendale Municipal Airport. This plan provides the necessary development to accommodate and satisfy the anticipated growth over the next 20 years and beyond.

Flexibility will be very important to future development at the airport. Activity projected over the next 20 years may not occur as predicted. The plan has attempted to consider demands that

may be placed on the airport even beyond the 20-year planning horizon to ensure that the facility will be capable of handling a wide range of circumstances. The recommended plan provides the airport stakeholders with a general guide that, if followed, can maintain the airport's long term viability and allow the airport to continue to provide air transportation service to the region.



Chapter Six

CAPITAL PROGRAM

Glendale municipal airport

Chapter 6

CAPITAL PROGRAM

The analyses completed in previous chapters evaluated development needs at the airport over the next 20 years and beyond, based on forecast activity and operational efficiency. Next, basic economic, financial, and management rationale are applied to each development item so the feasibility of each item contained in the plan can be assessed.

The analyses completed in the previous chapters presented the needs of the airport, on both the airside and the landside, over the course of the next 20 years. In this chapter, a capital program will be developed to present specific projects recommended for the airport to achieve the master plan vision. The master plan vision is based on the airport achieving specific demand-based triggers such as a growth in based aircraft, an increase in

business jet activity, and an overall increase in operations.

This chapter will present specific detail on the capital projects needed based on demand. Each project will be prioritized, with immediate need for safety related projects having the highest priority. Cost estimates associated with each project will be presented. A discussion of the available funding sources will conclude this chapter.

AIRPORT DEVELOPMENT SCHEDULES AND COST SUMMARIES

With the establishment of a recommended concept, the next step is to determine a realistic schedule and the associated costs for implementing the



plan. This section will examine the overall cost of each item in the development plan and present a development schedule. The recommended improvements are grouped by planning horizon:

short term, intermediate term, and long term. **Table 6A** summarizes the key milestones for each of the three planning horizons.

TABLE 6A				
Activity Summary				
Glendale Municipal Airport				
	Baseline (2005)	Short Term	Intermediate Term	Long Term
ANNUAL OPERATIONS				
Total Itinerant	47,094	59,169	69,653	89,225
Total Local	89,625	100,832	115,348	144,775
Total Operations	136,718	160,000	185,000	234,000
BASED AIRCRAFT				
Single Engine	338	404	474	624
Multi-Engine	16	17	18	20
Turboprop	5	8	11	16
Jet	5	8	12	20
Helicopters/Others	16	17	19	23
Total Based Aircraft	380	454	534	703
<i>Source: Coffman Associates Analysis</i>				

A key aspect of this planning document is the use of demand-based planning milestones. The short term planning horizon contains items of highest priority, such as safety design standards. As short term activity levels are reached, it will then be time to program for the intermediate term projects based upon the next activity milestones. Similarly, when the intermediate term milestones are reached, it will be time to program for the long term activity milestones.

Many development items included in the recommended concept will need to follow demand indicators. For example, the plan anticipates construction of new hangars and taxilanes. Based aircraft will be the indicator for additional hangar needs. If based aircraft growth occurs as projected, additional hangars

will need to be constructed to meet the demand.

If growth slows or does not occur as projected, hangar-related construction projects can be delayed. As a result, capital expenditures will be undertaken as needed, which leads to a responsible use of capital assets. Some development items do not depend on demand, such as pavement maintenance and projects intended to meet FAA design standards. These types of projects typically are associated with day-to-day operations and should be monitored and identified by airport management.

As a master plan is a conceptual document, implementation of these capital projects should only be undertaken after further refinement of their design and

costs through architectural and engineering analyses. Moreover, some projects may require further environmental study, such as property acquisition.

The cost estimates presented in this chapter have been increased by 15 percent to allow for contingencies that may arise on the project. The cost estimates also include 25 percent for design and engineering and construction inspection and project management. Capital costs presented here should be viewed only as estimates subject to further refinement during design. Nevertheless, these estimates are considered reasonable for planning purposes. Cost estimates for each of the development projects listed in the capital program are in 2008 dollars. **Exhibit 6A** presents the proposed capital improvement program (CIP) for the Glendale Municipal Airport.

SHORT TERM IMPROVEMENTS

The proposed CIP has been divided into three planning horizons: short, intermediate, and long term. By grouping the projects, airport administration can accelerate projects that become critical or delay projects that are not priorities. The development staging is presented on **Exhibit 6B**.

On an annual basis, Arizona airports submit a five year capital improvement plan to both the FAA and ADOT Aeronautics. The CIP submittal is intended to alert the FAA and ADOT to priority projects for which the airport intends to request grant funding. Items from the most recent airport CIP submittal (Oc-

tober 2008) that are compatible with the master plan concept are included in this 20-year CIP.

The short term projects have been segmented by year from 2010 through 2014. The intermediate and long term projects have been grouped by planning horizon in order to allow greater flexibility in implementation.

The first two projects considered for the 2010 fiscal year are the surfacing of the runway and taxiway shoulders. Currently the shoulders are provided by grading which is not enough to prevent damage from erosion or to prevent dust. In addition, the soil surrounding the runway system is rocky in nature and the presence of Foreign Object Debris (FOD) is a daily concern. The paved shoulders will provide an added measure of safety and reduce the possibility of aircraft damage from FOD.

The next project is the acquisition and installation of perimeter security cameras along the north and west airport property line. Additional security cameras along the east and south property line are not necessary at this time as the existing fencing and the New River channel provide security.

Environmental documentation, typically in the form of an environmental assessment is needed for the purchase of approximately 36 acres of undeveloped property to the north of the airport and 6.8 acres of land at the corner Glendale Avenue and Glen Harbor Boulevard. The 36 acres of property are within the Runway 19 approach and departure runway protection zones. The 6.8 acres of land is necessary for landside devel-

opment. The FAA requires an environmental assessment for the acquisition of any property over three acres in size. There is a possibility that a Categorical Exclusion will meet the environmental documentation requirements and would be less expensive. Conversely, if an Environmental Impact Statement (EIS) is required, the cost could be somewhat higher but the potential for this is remote.

The next item in the 2010 CIP is the commission of an airport capacity study. By agreement with the donor of the east side property, an airport capacity study is to be undertaken to determine if a parallel runway may be needed on the site to accommodate forecast growth in operations. This master plan does not draw any conclusions regarding the need for a parallel runway but it does proceed under the assumption that any short term development would be temporary in nature, per the agreement.

The blast fence currently in place immediately north of Runway 1 is within the object free zone (OFZ). This area must be free of surface penetration, except those elements necessary for navigation, such as light stands. This project has been identified by the FAA Runway Safety Action Team as a high priority.

The last project identified in 2010 is annual pavement maintenance. Pavement maintenance is an ongoing need for the airport, and the actual cost will vary from year to year. As a result, an estimate based on consultation with the airport engineer and based on historical expenditures, has been developed. The same cost is therefore included for each

year of the CIP with the understanding that some years may require a greater expenditure while other years may require little or no maintenance.

New environmental documentation will be needed prior to the development of the east side of the airport. In 2011, this documentation covers areas planned for the east side parallel taxiway. Again, an Environmental Assessment (EA) is assumed but the less expensive Categorical Exclusion may suffice or the more expensive EIS may be needed. The need for an EIS is rare for existing airport property.

The main terminal ramp area is in need of replacement lighting. The current configuration has 12 light poles evenly spaced across the ramp area. This area is heavily used by helicopters and fixed wing aircraft. The replacement apron lighting will be located on the perimeter of the apron and the light poles are planned to be removed. This will eliminate the potential of an aircraft wing or helicopter rotor coming into contact with a light pole.

The airport plans to begin the acquisition of property adjacent the airport in 2011. The first property identified is approximately 18 acres of the undeveloped property to the north of the airport that falls within the runway protection zone. This property is necessary to insure compatible land uses and for approach protection. This total area identified for acquisition could encompass as much as 36 acres but the minimum required is the area entirely within the RPZ which is approximately 30 acres.

Year/ Project #	Project	Total Project Cost	FAA Eligible	ADOT Eligible	Local Share
Short Term					
2010 - 1	Runway Shoulder - Design/Construct	\$1,336,000	\$1,269,200	\$33,400	\$33,400
2010 - 2	Taxiway Shoulder - Design/Construct	\$1,783,000	\$1,693,850	\$44,575	\$44,575
2010 - 3	Security Equipment/Install	\$1,500,000	\$1,425,000	\$37,500	\$37,500
2010 - 4	EA - Land Acquisition: 36 RPZ Acres & NW Corner 7 Acres	\$200,000	\$190,000	\$5,000	\$5,000
2010 - 5	Capacity Study	\$100,000	\$95,000	\$2,500	\$2,500
2010 - 6	Blast Fence Removal - RSA Improvement	\$300,000	\$285,000	\$7,500	\$7,500
2010 - 7	Pavement Maintenance	\$200,000	\$190,000	\$5,000	\$5,000
Subtotal		\$5,419,000	\$5,148,050	\$135,475	\$135,475
2011 - 8	EA - Eastside Taxiway	\$250,000	\$237,500	\$6,250	\$6,250
2011 - 9	Main Ramp Lighting	\$302,000	\$286,900	\$7,550	\$7,550
2011 - 10	Land Acquisition: 18 RPZ Acres	\$7,500,000	\$7,125,000	\$187,500	\$187,500
2011 - 11	Pavement Maintenance	\$200,000	\$190,000	\$5,000	\$5,000
Subtotal		\$8,252,000	\$7,839,400	\$206,300	\$206,300
2012 - 12	Land Acquisition: 18 Acres RPZ	\$7,500,000	\$7,125,000	\$187,500	\$187,500
2012 - 13	Land Acquisition: 7 Acres NW Corner	\$2,833,000	\$2,691,350	\$70,825	\$70,825
2012 - 14	Pavement Maintenance	\$200,000	\$190,000	\$5,000	\$5,000
Subtotal		\$10,533,000	\$10,006,350	\$263,325	\$263,325
2013 - 15	Master Plan Update	\$300,000	\$285,000	\$7,500	\$7,500
2013 - 16	EA - RSA Improvements	\$200,000	\$190,000	\$5,000	\$5,000
2013 - 17	NW Corner Ramp - Design/Construct	\$1,596,000	\$1,516,200	\$39,900	\$39,900
2013 - 18	East Side Taxiway - Design/Construct	\$5,812,000	\$5,521,400	\$145,300	\$145,300
2013 - 19	Pavement Maintenance	\$200,000	\$190,000	\$5,000	\$5,000
Subtotal		\$8,108,000	\$7,702,600	\$202,700	\$202,700
2014 - 20	EMAS Rwy 1 - Design/Construct	\$3,600,000	\$3,420,000	\$90,000	\$90,000
2014 - 21	EMAS Rwy 19 - Design/Construct	\$3,600,000	\$3,420,000	\$90,000	\$90,000
2014 - 22	Taxiway Pavement Design/Construct for EMAS	\$637,000	\$605,150	\$15,925	\$15,925
2014 - 23	ARFF Building (3,500 s.f.) - Design/Construct	\$1,401,000	\$0	\$0	\$1,401,000
2014 - 24	Pavement Maintenance	\$200,000	\$190,000	\$5,000	\$5,000
Subtotal		\$9,438,000	\$7,635,150	\$200,925	\$1,601,925
Short Term Totals		\$41,750,000	\$38,331,550	\$1,008,725	\$2,409,725
Intermediate Term					
1	EA East Ramp and Taxilanes	\$200,000	\$190,000	\$5,000	\$5,000
2	East Side Access Road	\$1,170,000	\$1,111,500	\$29,250	\$29,250
3	East Side Ramp Construction	\$7,041,000	\$6,688,950	\$176,025	\$176,025
4	East Side Ramp Lighting	\$126,000	\$119,700	\$3,150	\$3,150
5	Connecting Taxilanes to Box Hangar Area	\$111,000	\$105,450	\$2,775	\$2,775
6	East Side Corporate Taxiway (Phase 1)	\$340,000	\$323,000	\$8,500	\$8,500
7	East Side Box Hangar Taxilanes	\$1,155,000	\$1,097,250	\$28,875	\$28,875
8	Pavement Maintenance	\$1,000,000	\$950,000	\$25,000	\$25,000
Intermediate Term Totals		\$11,143,000	\$10,585,850	\$278,575	\$278,575
Long Term					
1	Master Plan Update	\$400,000	\$380,000	\$10,000	\$10,000
2	Crossing Taxiways	\$296,000	\$281,200	\$7,400	\$7,400
3	East Side Corporate Taxiways (Phase 2)	\$1,213,000	\$1,152,350	\$30,325	\$30,325
4	East Side T-hangar Taxilanes	\$4,541,000	\$4,313,950	\$113,525	\$113,525
5	Southwest Public Apron	\$1,330,000	\$1,263,500	\$33,250	\$33,250
6	Southwest Access Road	\$123,000	\$116,850	\$3,075	\$3,075
7	Replacement ATCT	\$4,200,000	\$3,990,000	\$105,000	\$105,000
8	Pavement Maintenance	\$2,000,000	\$1,900,000	\$50,000	\$50,000
Long Term Totals		\$14,103,000	\$13,397,850	\$352,575	\$352,575
Total Development Costs		\$66,996,000	\$62,315,250	\$1,639,875	\$3,040,875
ADOT: Arizona Department of Transportation - Aeronautics Division		FAA: Federal Aviation Administration		EA: Environmental Assessment	
EMAS: Engineered Materials Arresting System		RPZ: Runway Protection Zone		ARFF: Aircraft Rescue Fire Fighting	
Source: GEU 2008 ACIP and Coffman Associates Analysis		ATCT: Airport Traffic Control Tower			

Legend

- - - Existing Airport Property Line
- - - Ultimate Airport Property Line
- Runway Protection Zone (RPZ)
- Object Free Area
- Runway Safety Area
- Property Acquisition

Date of Photo: 5/1/06

Short Term

2010

- ① Runway Shoulder - Design/Construct
- ② Taxiway Shoulder - Design/Construct
- ③ Security Equipment/Install
- ④ EA - Land Acquisition: 36 RPZ Acres & NW Corner 7 Acres - NP
- ⑤ Capacity Study - NP
- ⑥ Blast Fence Removal - RSA Improvement
- ⑦ Pavement Maintenance - NP

2011

- ⑧ EA - Eastside Taxiway - NP
- ⑨ Main Ramp Lighting
- ⑩ Land Acquisition: 18 RPZ Acres
- ⑪ Pavement Maintenance - NP

2012

- ⑫ Land Acquisition: 18 Acres RPZ
- ⑬ Land Acquisition: 7 Acres NW Corner
- ⑭ Pavement Maintenance - NP

2013

- ⑮ Master Plan Update - NP
- ⑯ EA - RSA Improvements - NP
- ⑰ NW Corner Ramp - Design/Construct
- ⑱ East Side Taxiway - Design/Construct
- ⑲ Pavement Maintenance - NP

2014

- ⑳ EMAS Rwy 1 - Design/Construct
- ㉑ EMAS Rwy 19 - Design/Construct
- ㉒ Taxiway Pavement Design/Construct for EMAS
- ㉓ ARFF Building (3,500 s.f.) - Design/Construct
- ㉔ Pavement Maintenance - NP

Intermediate Term

- ① EA East Ramp and Taxilanes - NP
- ② East Side Access Road
- ③ East Side Ramp Construction
- ④ East Side Ramp Lighting
- ⑤ Connecting Taxilanes to Box Hangar Area
- ⑥ East Side Corporate Taxiway (Phase 1)
- ⑦ East Side Box Hangar Taxilanes
- ⑧ Pavement Maintenance - NP

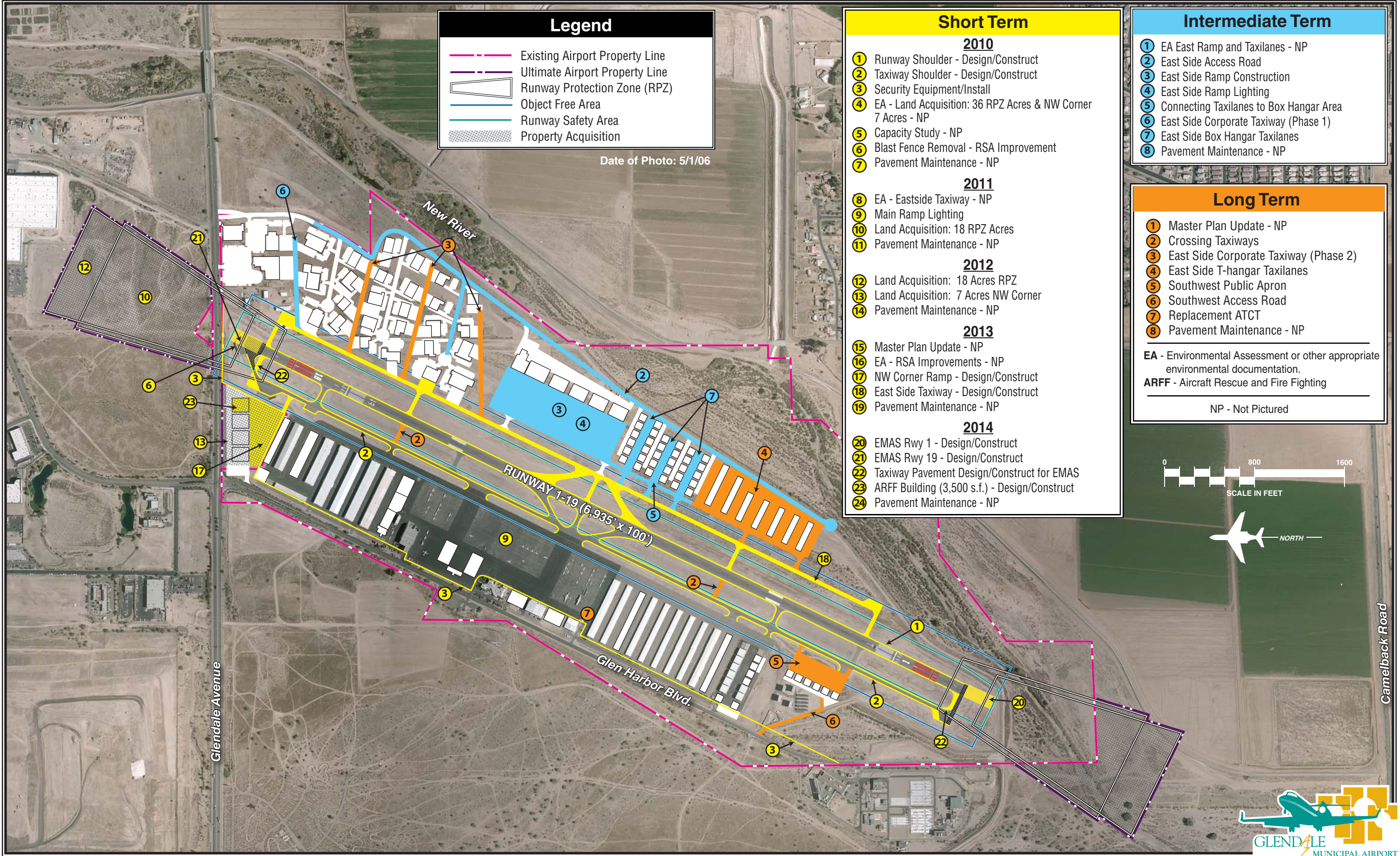
Long Term

- ① Master Plan Update - NP
- ② Crossing Taxiways
- ③ East Side Corporate Taxiway (Phase 2)
- ④ East Side T-hangar Taxilanes
- ⑤ Southwest Public Apron
- ⑥ Southwest Access Road
- ⑦ Replacement ATCT
- ⑧ Pavement Maintenance - NP

EA - Environmental Assessment or other appropriate environmental documentation.

ARFF - Aircraft Rescue and Fire Fighting

NP - Not Pictured



The CIP for 2012 is dedicated exclusive to further property acquisition. An additional 18 acres to the north would complete the acquisition of the RPZs. The property on the northwest corner is also identified for acquisition in this time frame. This is flight-line property that should be reserved for aviation purposes. This property is also identified at the potential location for a new city fire station that could also serve the needs of the airport.

The first project identified in 2013 is an update to this master plan. By this timeframe, the aviation demand forecasts, approved by the FAA, for this master plan will be seven years old. This would be an appropriate time to revisit the assumptions and identify any changes to design standards and their applicability to the airport.

In preparation for the installation of EMAS designed for the enhanced safety and for runway length preservation, further environmental documentation is required. An EA should cover both ends of the runway.

The construction of the northwest ramp is planned in 2013. This ramp is planned to accommodate three medium sized aircraft hangars and a future city fire station.

The planned east side taxiway is scheduled for construction in 2013. This taxiway has already been designed in large part, by the airport engineer. The cost estimate does include revisiting that design and updating it as necessary to accommodate any changes since that original design was undertaken.

The last year of the short term CIP includes the installation of EMAS and the construction of the fire station on the northwest parcel. EMAS will provide a near equivalent level of safety to meeting the full 1,000-foot RSA standard beyond the runway ends. The EMAS beds will require changes to the current runway ends. The threshold taxiways will need to be relocated. During this project, pavement that will no longer be used is planned to be removed.

One of the parcels on the northwest site is reserved for a new fire station. Since Glendale Municipal Airport is not required to provide airport rescue and firefighting services (ARFF) by federal regulations, this project is not eligible for FAA grant funding assistance.

The total investment necessary for the short term capital improvement program is approximately \$41.8 million. Of this total, \$38.3 million is eligible for FAA grant funding, and approximately \$1.0 million is eligible for ADOT funding. The remaining \$2.4 million would be the responsibility of the City of Glendale.

It should be noted that while projects may be eligible for federal grant assistance there is no guarantee that funds will be available on the specified timeframe. If a project is identified as a priority but full grant funding is not available from the identified source, then often projects can be phased over multiple years or other funding sources can be sought.

INTERMEDIATE TERM IMPROVEMENTS

Analyzing the impact to the environment is necessary for most improvement projects at federally obligated airports. The first project in the intermediate term is development of the appropriate environmental documentation related further development of the east side of the airport. Projects related to the construction of an east side public ramp and the taxilanes will require environmental documentation.

Surface access to the landside facilities on the east side will be necessary in conjunction with apron and potential hangar development. The access road is considered to be the responsibility of the airport. A large public apron area is planned to accommodate aircraft tie-down positions and transient aircraft parking. Appropriate ramp lighting is also planned with the apron construction.

Several public use taxilanes are planned for the intermediate planning horizon. The first taxilane extends to the northeast from the planned parallel taxiway. The second is a partial taxilane to the south of the east side terminal ramp. This taxilane will provide access to the terminal area for the planned box hangar development. Three additional taxilanes leading to the box hangar development area is also planned. These taxilanes would be planned to accommodate aircraft in airplane design group (ADG) II with wingspans up to 79 feet.

Finally, the intermediate term planning horizon includes a place holder for ma-

ior pavement maintenance that may need to be undertaken during this time-frame. It is the airport's responsibility to preserve the useful life of airport pavements. To this end, some surfaces may need significant repair or replacement during the intermediate planning horizon.

The total investment for the intermediate term capital improvement program is approximately \$11.1 million. Of this total, \$10.6 million is eligible for FAA grant funding, and \$280,000 is eligible for ADOT funding. The remaining \$280,000 would be the responsibility of the City of Glendale.

LONG TERM IMPROVEMENTS

By the long term planning period much is planned to have been accomplished at the airport. This will be a good time for the airport to revisit their master plan and make any adjustment needed based on changes in aviation activity and the aviation industry. Therefore a master plan update is the first project considered in the long term planning period.

The next project is the construction of two taxiways leading from the runway to the west side. By the long term planning period, additional runway capacity may be necessary and taxiway improvements is one way to increase the utilization of the runway by allowing aircraft to exit the runway quicker.

Three taxiways leading to the planned northeast corporate hangar area are considered in the long term. While these taxiways would be eligible for

FAA grant funding, timing and funding availability is always an issue. If it were desired to make the corporate hangar parcels available sooner, a private developer could undertake the construction of these taxiways. That developer could then maintain the taxiways privately and include the land in their land lease with the airport or the constructed taxiway could be deeded to the airport and the airport could maintain the pavement.

The southeast portion of the airfield is planned for a T-hangar complex. The taxiways and pavement areas needed to support this development are considered in the long term planning period.

There is an opportunity to develop a small aircraft ramp and hangar area on the southwest portion of the airport. This apron is planned in the long term. Once again, a private developer could endeavor to construct this apron in a more timely fashion.

Other than the placeholder for annual pavement maintenance, the final project in the master plan is the construction of a replacement airport traffic control tower. First a formal airport traffic control tower site selection study should be undertaken. This study would follow criteria set forth in *FAA Handbook 7031.2C, Airway Planning Standard Number One - Terminal Air Navigation Facilities and Air Traffic Control Services*. This study will develop justification for a replacement ATCT and present a benefit-cost analysis.

Once justification for a replacement ATCT is established, operational and

spatial requirements are planned following guidance provided in FAA Order 6480.4, *Airport Traffic Control Tower Siting Criteria*. Factors such as visibility, size, height, signal strength, and height and hazard compliance will be considered.

The west side location for the existing tower is adequate but it does not meet current tower specifications. When the siting study is undertaken consideration should be given to a west side location.

The total investment for the long term capital needs program is approximately \$14.1 million. Of this total, \$13.4 million is eligible for FAA grant funding. The remaining portion is evenly split between ADOT and the City of Glendale.

CAPITAL IMPROVEMENT PROGRAM SUMMARY

The 20-year capital improvement program for Glendale Municipal Airport focuses heavily on meeting FAA design standards for safety, improving overall airfield capacity, and providing developable space for landside facilities to accommodate forecasted growth in based aircraft.

On the airside, the runways and taxiways shoulders are planned to be paved. This is a potential safety issue because of the frequency FOD and of visibility reduction due to dust. An east side parallel taxiway is planned in order to allow for expansion of landside facilities.

Improvements to the RSA are planned in the intermediate planning horizon. In order to maintain the maximum runway length for a future critical aircraft represented by large business jets, EMAS is planned on both runway ends.

The EMAS provides a level of safety nearly equivalent to providing the full 1,000-foot RSA beyond the runway ends.

On the landside, new aircraft storage hangars are planned to accommodate forecast growth. On the west side, several infill hangars are planned. A small new ramp to the southwest is also planned. On the east side, a mix of hangar development is planned. The northeast portion is planned for corporate aviation parcels. The middle portion of the east side is planned for a large aircraft ramp intended to accommodate local tie-down aircraft and transient aircraft parking. The southeast portion is planned for small individual box hangars and T-hangars.

The 20-year investment total is approximately \$67.0 million. Projects eligible for FAA grant assistance total \$62.4 million. ADOT eligible capital improvement projects total \$1.6 million. The local responsibility totals \$3.0 million.

CAPITAL IMPROVEMENT FUNDING SOURCES

Financing capital improvements at the airport will not rely solely on the financial resources of the airport. Capital improvement funding is available through various grant-in-aid programs on both the state and federal levels.

The following discussion outlines key sources of funding potentially available for capital improvements at Glendale Municipal Airport.

FEDERAL GRANTS

Through federal legislation over the years, various grant-in-aid programs have been established to develop and maintain a system of public airports across the United States. The purpose of this system and its federally based funding is to maintain national defense and to promote interstate commerce. The most recent legislation affecting federal funding was enacted in late 2003 and was titled *Century of Aviation Re-authorization Act*, or *Vision 100*.

The four-year bill covered FAA fiscal years 2004, 2005, 2006, and 2007. This bill presented similar funding levels to the previous bill - *Air 21*. Airport Improvement Program (AIP) funding was authorized at \$3.4 billion in 2004, \$3.5 billion in 2005, \$3.6 billion in 2006, and \$3.7 billion in 2007. This bill provided the FAA the opportunity to plan for longer term projects versus one-year re-authorizations.

Vision 100 expired at the end of fiscal year 2007. A series of continuing resolutions were passed in order to carry the program through June 2008 at 75 percent of authorized funding levels. In December 2007, AIP was included in the omnibus appropriation act and authorized \$3.5 billion in 2008 for airport improvements. While this one-year bill provided AIP funding it did not provide the legislative authority to continue the program. This issue was temporarily

solved in February 2008 with a bill that provided AIP authority through the end of fiscal 2008. As of May 2008, a new multi-year AIP authorization and authority bill had not been passed.

The source for airport improvement funds from the federal government is the Aviation Trust Fund. The Aviation Trust Fund was established in 1970 to provide funding for aviation capital investment programs (aviation development, facilities and equipment, and research and development). The Aviation Trust Fund also finances the operation of the FAA. It is funded by user fees, including taxes on airline tickets, aviation fuel, and various aircraft parts.

Funds are distributed each year by the FAA from appropriations by Congress. A portion of the annual distribution is to primary commercial service airports based upon enplanement (passenger boarding) levels. When Congress appropriates the full amounts authorized by *Vision 100* and the extension bills, eligible general aviation airports could receive up to \$150,000 of funding each year in Non-Primary Entitlement (NPE) funds (*National Plan of Integrated Airport Systems* [NPIAS] inclusion is required for general aviation entitlement funding). Glendale Municipal Airport qualified for full NPE funding as the NPIAS includes over \$150,000 in yearly capital projects.

The remaining AIP funds are distributed by the FAA based upon the priority of the project for which they have requested federal assistance through discretionary apportionments. A national priority ranking system is used to evaluate and rank each airport project.

Those projects with the highest priority are given preference in funding.

Under the AIP program, examples of eligible development projects include the airfield, public aprons, and access roads. Additional buildings and structures may be eligible if the function of the structure is to serve airport operations in a non-revenue generating capacity, such as maintenance facilities.

Whereas entitlement monies are guaranteed on an annual basis, discretionary funds are not assured. If the combination of entitlement, discretionary, and airport sponsor match does not provide enough capital for planned development, projects may be delayed. Other supplemental funding sources are described in the following subsections.

STATE FUNDING PROGRAM

In support of the state aviation system, the State of Arizona also participates in airport improvement projects. The source for state airport improvement funds is the Arizona Aviation Fund. Taxes levied by the state on aviation fuel, flight property, aircraft registration tax, and registration fees (as well as interest on these funds) are deposited in the Arizona Aviation Fund.

Under the State of Arizona's grant program, an airport can receive funding for one-half (currently 2.5 percent) of the local share of projects receiving federal AIP funding. The state also provides 90 percent funding for projects which are typically not eligible for federal AIP funding or have not received federal funding.

State Airport Loan Program

The Arizona Department of Transportation (ADOT) -Aeronautics Division's Airport Loan Program was established to enhance the utilization of state funds and provide a flexible funding mechanism to assist airports in funding improvement projects. The loan program is intended to provide funding assistance for those projects that will contribute to the economic well being of the airport. Some examples are hangars, utility improvements, fuel farms, terminals, revenue generating auto parking, terminal building restaurants, and recreational improvements.

Unlike the Federal AIP funding mechanism, revenue-generating improvements, such as hangars and fuel storage facilities, are eligible under the State Airport Loan Program. Projects which are not currently eligible for the State Airport Loan Program are considered if the project would enhance the airport's ability to be financially self-sufficient.

There are three ways in which the loan funds can be used: Grant Advance, Matching Funds, or Revenue-Generating Projects. The Grant Advance loan funds are provided when the airport can demonstrate the ability to accelerate the development and construction of a multi-phase project. The project(s) must be compatible with the airport master plan and be included in the ADOT Five-Year Airport Development Program. The Matching Funds are provided to meet the local matching fund requirement for securing federal airport improvement grants or other federal or state grants. The Revenue-Generating funds are provided for air-

port-related construction projects that are not eligible for funding under another program.

Pavement Maintenance Program

The airport system in Arizona is a multi-million dollar investment of public and private funds that must be protected and preserved. State aviation fund dollars are limited, and the State Transportation Board recognizes the need to protect and extend the maximum useful life of the airport system's pavement. The Arizona Pavement Preservation Program (APPP) has been established to assist in the preservation of the Arizona airport system infrastructure. Glendale Municipal Airport participates in this program.

Public Law 103-305 requires that airports requesting Federal AIP funding for pavement rehabilitation or reconstruction have an effective pavement maintenance management system. To this end, ADOT-Aeronautics maintains an Airport Pavement Management System (APMS). This system requires monthly airport inspections, which are conducted by airport management and supplied to ADOT.

The Arizona Airport Pavement Management System uses the Army Corps of Engineers' "Micropaver" program as a basis for generating a Five-Year Airport Pavement Preservation Program (APPP). The APMS consists of visual inspections of all airport pavements. Evaluations are made of the types and severities observed and entered into a computer program database. Pavement Condition Index (PCI) values are de-

terminated through the visual assessment of pavement conditions in accordance with the most recent FAA Advisory Circular 150/5380-7, *Pavement Management System*, and range from 0 (failed) to 100 (excellent). Every three years, a complete database update with new visual observations is conducted. Individual airport reports from the update are shared with all participating system airports. The Aeronautics Division ensures that the APMS database is kept current, in compliance with FAA requirements.

Every year, the Aeronautics Division, utilizing the APMS, will identify airport pavement maintenance projects eligible for funding for the upcoming five years. These projects will appear in the State's Five-Year Airport Development Program. Once a project has been identified and approved for funding by the State Transportation Board, the airport sponsor may elect to accept a state grant for the project and not participate in the Airport Pavement Preservation Program (APPP), or the airport sponsor may sign an Inter-Government Agreement (IGA) with the Aeronautics Division to participate in the APPP.

LOCAL FUNDING

The balance of project costs, after consideration has been given to grants, must be funded through local resources (i.e airport revenues or City of Glendale revenues). The goal for the operation of the airport is to generate ample revenues to cover all operating and maintenance costs, as well as the local matching share of capital expenditures.

There are several alternatives for local financing options for future development at the airport, including airport revenues, direct funding from the City, issuing bonds, and leasehold financing. These strategies could be used to fund the local matching share or complete the project if grant funding cannot be arranged.

Local funding options may also include the solicitation of private developers to construct and manage hangar facilities. The airport has, in the past supported private development of hangars and in some cases taxilanes. Private hangar development should only be allowed within the definition of the airport master plan and within the rules and regulations of the airport in order to maintain an efficient airport facility layout.

SUMMARY

The best means to begin implementation of the recommendations in this master plan is to first recognize that planning is a continuous process that does not end with completion and approval of this document. Rather, the ability to continuously monitor the existing and forecast status of airport activity must be provided and maintained. The issues upon which this master plan is based will remain valid for a number of years. The primary goal is for the airport to best serve the air transportation needs of the region, while continuing to be economically self-sufficient. The actual need for facilities is most appropriately established by airport activity levels rather than a specified date. For example, projections have

been made as to when additional hangars may be needed at the airport. In reality, however, the timeframe in which the development is needed may be substantially different. Actual demand may be slower to develop than expected. On the other hand, high levels of demand may establish the need to accelerate the development. Although every effort has been made in this master planning process to conservatively estimate when facility development may be needed, aviation demand will dictate when facility improvements need to be delayed or accelerated.

The real value of a usable master plan is in keeping the issues and objectives in the minds of the managers, decision-makers, and the community, so that they are better able to recognize change and its effect. In addition to adjust-

ments in aviation demand, decisions made as to when to undertake the improvements recommended in this master plan will impact the period that the plan remains valid. The format used in this plan is intended to reduce the need for formal and costly updates by simply adjusting the timing. Updating can be done by the manager, thereby improving the plan's effectiveness.

In summary, the planning process requires that airport management consistently monitor the progress of the airport in terms of aircraft operations and based aircraft. Analysis of aircraft demand is critical to the timing and need for new airport facilities. The information obtained from continually monitoring airport activity will provide the data necessary to determine if the development schedule should be accelerated or decelerated.



Appendix A

GLOSSARY OF TERMS

Glossary of Terms

ABOVE GROUND LEVEL: The elevation of a point or surface above the ground.

ACCELERATE-STOP DISTANCE AVAILABLE (ASDA): See declared distances.

ADVISORY CIRCULAR: External publications issued by the FAA consisting of non-regulatory material providing for the recommendations relative to a policy, guidance and information relative to a specific aviation subject.

AIR CARRIER: An operator which: (1) performs at least five round trips per week between two or more points and publishes flight schedules which specify the times, days of the week, and places between which such flights are performed; or (2) transports mail by air pursuant to a current contract with the U.S. Postal Service. Certified in accordance with Federal Aviation Regulation (FAR) Parts 121 and 127.

AIRCRAFT: A transportation vehicle that is used or intended for use for flight.

AIRCRAFT APPROACH CATEGORY: An alphabetic classification of aircraft based upon 1.3 times the stall speed in a landing configuration at their maximum certified landing weight.

AIRCRAFT OPERATION: The landing, takeoff, or touch-and-go procedure by an aircraft on a runway at an airport.

AIRCRAFT OPERATIONS AREA: A restricted and secure area on the airport property designed to protect all aspects related to aircraft operations.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION: A private organization serving the interests and needs of general aviation pilots and aircraft owners.

AIRCRAFT APPROACH CATEGORY: A grouping of aircraft based on 1.3 times the stall speed in their landing configuration at their maximum certificated landing weight. The categories are as follows:

- *Category A:* Speed less than 91 knots.
- *Category B:* Speed 91 knots or more, but less than 121 knots.
- *Category C:* Speed 121 knots or more, but less than 141 knots.
- *Category D:* Speed 141 knots or more, but less than 166 knots.
- *Category E:* Speed greater than 166 knots.

AIRCRAFT RESCUE AND FIRE FIGHTING: A facility located at an airport that provides emergency vehicles, extinguishing agents, and personnel responsible for minimizing the impacts of an aircraft accident or incident.

AIRFIELD: The portion of an airport which contains the facilities necessary for the operation of aircraft.

AIRLINE HUB: An airport at which an airline concentrates a significant portion of its activity and which often has a significant amount of connecting traffic.

AIRPLANE DESIGN GROUP (ADG): A grouping of aircraft based upon wingspan. The groups are as follows:

- *Group I:* Up to but not including 49 feet.
- *Group II:* 49 feet up to but not including 79 feet.
- *Group III:* 79 feet up to but not including 118 feet.
- *Group IV:* 118 feet up to but not including 171 feet.
- *Group V:* 171 feet up to but not including 214 feet.
- *Group VI:* 214 feet or greater.

AIRPORT AUTHORITY: A quasi-governmental public organization responsible for setting the policies governing the management and operation of an airport or system of airports under its jurisdiction.

AIRPORT BEACON: A navigational aid located at an airport which displays a rotating light beam to identify whether an airport is lighted.

AIRPORT CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute funds for airport development and the needs of the National Airspace System to meet specified national goals and objectives.

AIRPORT ELEVATION: The highest point on the runway system at an airport expressed in feet above mean sea level (MSL).

AIRPORT LAYOUT DRAWING (ALD): The drawing of the airport showing the layout of existing and proposed airport facilities.

AIRPORT MASTER PLAN: The planner's concept of the long-term development of an airport.

AIRPORT MOVEMENT AREA SAFETY SYSTEM: A system that provides automated alerts and warnings of potential runway incursions or other hazardous aircraft movement events.

AIRPORT OBSTRUCTION CHART: A scaled drawing depicting the Federal Aviation Regulation (FAR) Part 77 surfaces, a representation of objects that penetrate these surfaces, runway, taxiway, and ramp areas, navigational aids, buildings, roads and other detail in the vicinity of an an airport.

AIRPORT REFERENCE CODE (ARC): A coding system used to relate airport design criteria to the operational (Aircraft Approach Category) to the physical characteristics (Airplane Design Group) of the airplanes intended to operate at the airport.

AIRPORT REFERENCE POINT (ARP): The latitude and longitude of the approximate center of the airport.

AIRPORT SPONSOR: The entity that is legally responsible for the management and operation of an airport, including the fulfillment of the requirements of laws and regulations related thereto.

AIRPORT SURFACE DETECTION EQUIPMENT: A radar system that provides air traffic controllers with a visual representation of the movement of aircraft and other vehicles on the ground on the airfield at an airport.

AIRPORT SURVEILLANCE RADAR: The primary radar located at an airport or in an air traffic control terminal area that receives a signal at an antenna and transmits the signal to air traffic control display equipment defining the location of aircraft in the air. The signal provides only the azimuth and range of aircraft from the location of the antenna.

AIRPORT TRAFFIC CONTROL TOWER (ATCT): A central operations facility in the terminal air traffic control system, consisting of a tower, including an associated instrument flight rule (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 ROUTE TRAFFIC CONTROL CENTER: A facility which provides enroute air traffic control service to aircraft operating on an IFR flight plan within controlled airspace over a large, multi-state region.

AIRSIDE: The portion of an airport that contains the facilities necessary for the operation of aircraft.

AIRSPACE: The volume of space above the surface of the ground that is provided for the operation of aircraft.

AIR TAXI: An air carrier certificated in accordance with FAR Part 121 and FAR Part 135 and authorized to provide, on demand, public transportation of persons and property by aircraft. Generally operates small aircraft "for hire" for specific trips.

AIR TRAFFIC CONTROL: A service operated by an appropriate organization for the purpose of providing for the safe, orderly, and expeditious flow of air traffic.

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 flight.

AIR TRAFFIC HUB: A categorization of commercial service airports or group of commercial service airports in a metropolitan or urban area based upon the proportion of annual national enplanements existing at the airport or airports. The categories are large hub, medium hub, small hub, or non-hub. It forms the basis for the apportionment of entitlement funds.

AIR TRANSPORT ASSOCIATION OF AMERICA: An organization consisting of the principal U.S. airlines that represents the interests of the airline industry on major aviation issues before federal, state, and local government bodies. It promotes air transportation safety by coordinating industry and governmental safety programs and it serves as a focal point for industry efforts to standardize practices and enhance the efficiency of the air transportation system.

ALERT AREA: See special-use airspace.

ALTITUDE: The vertical distance measured in feet above mean sea level.

ANNUAL INSTRUMENT APPROACH (AIA): An approach to an airport with the intent to land by an aircraft in accordance with an IFR

flight plan when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude.

APPROACH LIGHTING SYSTEM (ALS): An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams by which the pilot aligns the aircraft with the extended centerline of the runway on his final approach and landing.

APPROACH MINIMUMS: The altitude below which an aircraft may not descend while on an IFR approach unless the pilot has the runway in sight.

APPROACH SURFACE: An imaginary obstruction limiting surface defined in FAR Part 77 which is longitudinally centered on an extended runway centerline and extends outward and upward from the primary surface at each end of a runway at a designated slope and distance based upon the type of available or planned approach by aircraft to a runway.

APRON: A specified portion of the airfield used for passenger, cargo or freight loading and unloading, aircraft parking, and the refueling, maintenance and servicing of aircraft.

AREA NAVIGATION: The air navigation procedure that provides the capability to establish and maintain a flight path on an arbitrary course that remains within the coverage area of navigational sources being used.

AUTOMATED TERMINAL INFORMATION SERVICE (ATIS): The continuous broadcast of recorded non-control information at towered airports. Information typically includes wind speed, direction, and runway in use.

AUTOMATED SURFACE OBSERVATION SYSTEM (ASOS): A reporting system that provides frequent airport ground surface weather observation data through digitized voice broadcasts and printed reports.

AUTOMATED WEATHER OBSERVATION STATION (AWOS): Equipment used to automatically record weather conditions (i.e. cloud height, visibility, wind speed and direction, temperature, dewpoint, etc.)

AUTOMATIC DIRECTION FINDER (ADF): An aircraft radio navigation system which senses and indicates the direction to a non-directional radio beacon (NDB) ground transmitter.

AVIGATION EASEMENT: A contractual right or a property interest in land over which a right of unobstructed flight in the airspace is established.

AZIMUTH: Horizontal direction expressed as the angular distance between true north and the direction of a fixed point (as the observer's heading).

BASE LEG: A flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline. See "traffic pattern."

BASED AIRCRAFT: The general aviation aircraft that use a specific airport as a home base.

BEARING: The horizontal direction to or from any point, usually measured clockwise from true north or magnetic north.

BLAST FENCE: A barrier used to divert or dissipate jet blast or propeller wash.

BLAST PAD: A prepared surface adjacent to the end of a runway for the purpose of eliminating the erosion of the ground surface by the wind forces produced by airplanes at the initiation of takeoff operations.

BUILDING RESTRICTION LINE (BRL): A line which identifies suitable building area locations on the airport.

CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute Airport Improvement Program funds for airport development and the needs of the National Airspace System to meet specified national goals and objectives.

CARGO SERVICE AIRPORT: An airport served by aircraft providing air transportation of property only, including mail, with an annual aggregate landed weight of at least 100,000,000 pounds.

CATEGORY I: An Instrument Landing System (ILS) that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 100 feet above the horizontal plane containing the runway threshold.

CATEGORY II: An ILS that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 50 feet above the horizontal plane containing the runway threshold.

CATEGORY III: An ILS that provides acceptable guidance information to a pilot from the coverage limits of the ILS with no decision height specified above the horizontal plane containing the runway threshold.

CEILING: The height above the ground surface to the location of the lowest layer of clouds which is reported as either broken or overcast.

CIRCLING APPROACH: A maneuver initiated by the pilot to align the aircraft with the runway for landing when flying a predetermined circling instrument approach under IFR.

CLASS A AIRSPACE: See Controlled Airspace.

CLASS B AIRSPACE: See Controlled Airspace.

CLASS C AIRSPACE: See Controlled Airspace.

CLASS D AIRSPACE: See Controlled Airspace.

CLASS E AIRSPACE: See Controlled Airspace.

CLASS G AIRSPACE: See Controlled Airspace.

CLEAR ZONE: See Runway Protection Zone.

COMMERCIAL SERVICE AIRPORT: A public airport providing scheduled passenger service that enplanes at least 2,500 annual passengers.

COMMON TRAFFIC ADVISORY FREQUENCY: A radio frequency identified in the appropriate aeronautical chart which is designated for the purpose of transmitting airport advisory information and procedures while operating to or from an uncontrolled airport.

COMPASS LOCATOR (LOM): A low power, low/medium frequency radio-beacon installed in conjunction with the instrument landing system at one or two of the marker sites.

CONICAL SURFACE: An imaginary obstruction-limiting surface defined in FAR Part 77 that extends from the edge of the horizontal surface outward and upward at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

CONTROLLED AIRPORT: An airport that has an operating airport traffic control tower.

CONTROLLED AIRSPACE: Airspace of defined dimensions within which air traffic control services are provided to instrument flight rules (IFR) and visual flight rules (VFR) flights in accordance with the airspace classification. Controlled airspace in the United States is designated as follows:

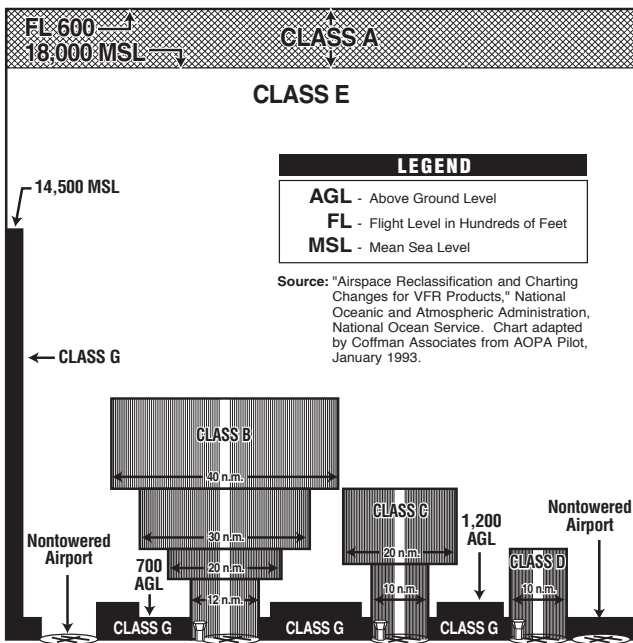
- **CLASS A:** Generally, the airspace from 18,000 feet mean sea level (MSL) up to but

not including flight level FL600. All persons must operate their aircraft under IFR.

- **CLASS B:** Generally, the airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports. The configuration of Class B airspace is unique to each airport, but typically consists of two or more layers of air space and is designed to contain all published instrument approach procedures to the airport. An air traffic control clearance is required for all aircraft to operate in the area.
- **CLASS C:** Generally, the airspace from the surface to 4,000 feet above the airport elevation (charted as MSL) surrounding those airports that have an operational control tower and radar approach control and are served by a qualifying number of IFR operations or passenger enplanements. Although individually tailored for each airport, Class C airspace typically consists of a surface area with a five nautical mile (nm) radius and an outer area with a 10 nautical mile radius that extends from 1,200 feet to 4,000 feet above the airport elevation. Two-way radio communication is required for all aircraft.
- **CLASS D:** Generally, that airspace from the surface to 2,500 feet above the air port elevation (charted as MSL) surrounding those airports that have an operational control tower. Class D airspace is individually tailored and configured to encompass published instrument approach procedures. Unless otherwise authorized, all persons must establish two-way radio communication.
- **CLASS E:** Generally, controlled airspace that is not classified as Class A, B, C, or D. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be configured to contain all instrument

procedures. Class E airspace encompasses all Victor Airways. Only aircraft following instrument flight rules are required to establish two-way radio communication with air traffic control.

- **CLASS G:** Generally, that airspace not classified as Class A, B, C, D, or E. Class G airspace is uncontrolled for all aircraft. Class G airspace extends from the surface to the overlying Class E airspace.



CONTROLLED FIRING AREA: See special-use airspace.

CROSSWIND: A wind that is not parallel to a runway centerline or to the intended flight path of an aircraft.

CROSSWIND COMPONENT: The component of wind that is at a right angle to the runway centerline or the intended flight path of an aircraft.

CROSSWIND LEG: A flight path at right angles to the landing runway off its upwind end. See "traffic pattern."

DECIBEL: A unit of noise representing a level relative to a reference of a sound pressure 20 micro newtons per square meter.

DECISION HEIGHT: The height above the end of the runway surface at which a decision must be made by a pilot during the ILS or Precision Approach Radar approach to either continue the approach or to execute a missed approach.

DECLARED DISTANCES: The distances declared available for the airplane's takeoff runway, takeoff distance, accelerate-stop distance, and landing distance requirements. The distances are:

- **TAKEOFF RUNWAY AVAILABLE (TORA):** The runway length declared available and suitable for the ground run of an airplane taking off;
- **TAKEOFF DISTANCE AVAILABLE (TODA):** The TORA plus the length of any remaining runway and/or clear way beyond the far end of the TORA;
- **ACCELERATE-STOP DISTANCE AVAILABLE (ASDA):** The runway plus stopway length declared available for the acceleration and deceleration of an aircraft aborting a takeoff; and
- **LANDING DISTANCE AVAILABLE (LDA):** The runway length declared available and suitable for landing.

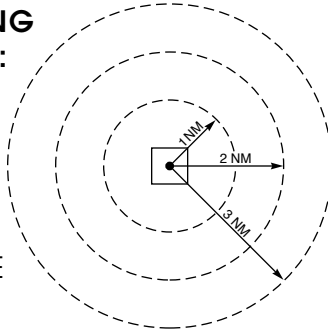
DEPARTMENT OF TRANSPORTATION: The cabinet level federal government organization consisting of modal operating agencies, such as the Federal Aviation Administration, which was established to promote the coordination of federal transportation programs and to act as a focal point for research and development efforts in transportation.

DISCRETIONARY FUNDS: Federal grant funds that may be appropriated to an airport based upon designation by the Secretary of Transportation or Congress to meet a specified national priority such as enhancing capacity, safety, and security, or mitigating noise.

DISPLACED THRESHOLD: A threshold that is located at a point on the runway other than the designated beginning of the runway.

DISTANCE MEASURING EQUIPMENT (DME):

Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.



DNL: The 24-hour average sound level, in A-weighted decibels, obtained after the addition of ten decibels to sound levels for the periods between 10 p.m. and 7 a.m. as averaged over a span of one year. It is the FAA standard metric for determining the cumulative exposure of individuals to noise.

DOWNWIND LEG: A flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg. Also see "traffic pattern."

EASEMENT: The legal right of one party to use a portion of the total rights in real estate owned by another party. This may include the right of passage over, on, or below the property; certain air rights above the property, including view rights; and the rights to any specified form of development or activity, as well as any other legal rights in the property that may be specified in the easement document.

ELEVATION: The vertical distance measured in feet above mean sea level.

ENPLANED PASSENGERS: The total number of revenue passengers boarding aircraft, including originating, stop-over, and transfer passengers, in scheduled and non-scheduled services.

ENPLANEMENT: The boarding of a passenger, cargo, freight, or mail on an aircraft at an airport.

ENTITLEMENT: Federal funds for which a commercial service airport may be eligible based upon its annual passenger enplanements.

ENVIRONMENTAL ASSESSMENT (EA): An environmental analysis performed pursuant to the National Environmental Policy Act to determine whether an action would significantly affect the environment and thus require a more detailed environmental impact statement.

ENVIRONMENTAL AUDIT: An assessment of the current status of a party's compliance with applicable environmental requirements of a party's environmental compliance policies, practices, and controls.

ENVIRONMENTAL IMPACT STATEMENT (EIS): A document required of federal agencies by the National Environmental Policy Act for major projects or legislative proposals affecting the environment. It is a tool for decision-making describing the positive and negative effects of a proposed action and citing alternative actions.

ESSENTIAL AIR SERVICE: A federal program which guarantees air carrier service to selected small cities by providing subsidies as needed to prevent these cities from such service.

FEDERAL AVIATION REGULATIONS: The general and permanent rules established by the executive departments and agencies of the Federal Government for aviation, which are published in the Federal Register. These are the aviation subset of the Code of Federal Regulations.

FINAL APPROACH: A flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. See "traffic pattern."

FINDING OF NO SIGNIFICANT IMPACT (FONSI): A public document prepared by a Federal agency that presents the rationale why a proposed action will not have a

significant effect on the environment and for which an environmental impact statement will not be prepared.

FIXED BASE OPERATOR (FBO): A provider of services to users of an airport. Such services include, but are not limited to, hangaring, fueling, flight training, repair, and maintenance.

FLIGHT LEVEL: A designation for altitude within controlled airspace.

FLIGHT SERVICE STATION: An operations facility in the national flight advisory system which utilizes data interchange facilities for the collection and dissemination of Notices to Airmen, weather, and administrative data and which provides pre-flight and in-flight advisory services to pilots through air and ground based communication facilities.

FRANGIBLE NAVAID: A navigational aid which retains its structural integrity and stiffness up to a designated maximum load, but on impact from a greater load, breaks, distorts, or yields in such a manner as to present the minimum hazard to aircraft.

GENERAL AVIATION: That portion of civil aviation which encompasses all facets of aviation except air carriers holding a certificate of convenience and necessity, and large aircraft commercial operators.

GLIDESLOPE (GS): Provides vertical guidance for aircraft during approach and landing. The glideslope consists of the following:

1. Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS; or
2. Visual ground aids, such as VASI, which provide vertical guidance for VFR approach or for the visual portion of an instrument approach and landing.

GLOBAL POSITIONING SYSTEM (GPS): A system of 24 satellites used as reference points to enable navigators equipped with GPS receivers to determine their latitude, longitude, and altitude.

GROUND ACCESS: The transportation system on and around the airport that provides access to and from the airport by ground transportation vehicles for passengers, employees, cargo, freight, and airport services.

HELIPAD: A designated area for the takeoff, landing, and parking of helicopters.

HIGH INTENSITY RUNWAY LIGHTS: The highest classification in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

HIGH-SPEED EXIT TAXIWAY: A long radius taxiway designed to expedite aircraft turning off the runway after landing (at speeds to 60 knots), thus reducing runway occupancy time.

HORIZONTAL SURFACE: An imaginary obstruction-limiting surface defined in FAR Part 77 that is specified as a portion of a horizontal plane surrounding a runway located 150 feet above the established airport elevation. The specific horizontal dimensions of this surface are a function of the types of approaches existing or planned for the runway.

INSTRUMENT APPROACH PROCEDURE: A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually.

INSTRUMENT FLIGHT RULES (IFR): Procedures for the conduct of flight in weather conditions below Visual Flight Rules weather minimums. The term IFR is often also used to define weather conditions and the type of flight plan under which an aircraft is operating.

INSTRUMENT LANDING SYSTEM (ILS): A precision instrument approach system which normally consists of the following electronic components and visual aids:

1. Localizer.
2. Glide Slope.
3. Outer Marker.
4. Middle Marker.
5. Approach Lights.

INSTRUMENT METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specific visibility and ceiling conditions that are less than the minimums specified for visual meteorological conditions.

ITINERANT OPERATIONS: Operations by aircraft that are not based at a specified airport.

KNOTS: A unit of speed length used in navigation that is equivalent to the number of nautical miles traveled in one hour.

LANDSIDE: The portion of an airport that provides the facilities necessary for the processing of passengers, cargo, freight, and ground transportation vehicles.

LANDING DISTANCE AVAILABLE (LDA): See declared distances.

LARGE AIRPLANE: An airplane that has a maximum certified takeoff weight in excess of 12,500 pounds.

LOCAL AREA AUGMENTATION SYSTEM: A differential GPS system that provides localized measurement correction signals to the basic GPS signals to improve navigational accuracy, integrity, continuity, and availability.

LOCAL OPERATIONS: Aircraft operations performed by aircraft that are based at the airport and that operate in the local traffic pattern or within sight of the airport, that are known to be departing for or arriving from flights in local practice areas within a prescribed distance from the airport, or that execute simulated instrument approaches at the airport.

LOCAL TRAFFIC: Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from the local practice areas, or aircraft executing practice instrument approach procedures. Typically, this includes touch-and-go training operations.

LOCALIZER: The component of an ILS which provides course guidance to the runway.

LOCALIZER TYPE DIRECTIONAL AID (LDA): A facility of comparable utility and accuracy to a localizer, but is not part of a complete ILS and is not aligned with the runway.

LONG RANGE NAVIGATION SYSTEM (LORAN): Long range navigation is an electronic navigational aid which determines aircraft position and speed by measuring the difference in the time of reception of synchronized pulse signals from two fixed transmitters. Loran is used for enroute navigation.

LOW INTENSITY RUNWAY LIGHTS: The lowest classification in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

MEDIUM INTENSITY RUNWAY LIGHTS: The middle classification in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

MICROWAVE LANDING SYSTEM (MLS): An instrument approach and landing system that provides precision guidance in azimuth, elevation, and distance measurement.

MILITARY OPERATIONS: Aircraft operations that are performed in military aircraft.

MILITARY OPERATIONS AREA (MOA): See special-use airspace.

MILITARY TRAINING ROUTE: An air route depicted on aeronautical charts for the conduct of military flight training at speeds above 250 knots.

MISSED APPROACH COURSE (MAC): The flight route to be followed if, after an instrument approach, a landing is not effected, and occurring normally:

1. When the aircraft has descended to the decision height and has not established visual contact; or
2. When directed by air traffic control to pull up or to go around again.

MOVEMENT AREA: The runways, taxiways, and other areas of an airport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports with a tower, air traffic control clearance is required for entry onto the movement area.

NATIONAL AIRSPACE SYSTEM: The network of air traffic control facilities, air traffic control areas, and navigational facilities through the U.S.

NATIONAL PLAN OF INTEGRATED AIRPORT SYSTEMS: The national airport system plan developed by the Secretary of Transportation on a biannual basis for the development of public use airports to meet national air transportation needs.

NATIONAL TRANSPORTATION SAFETY BOARD: A federal government organization established to investigate and determine the probable cause of transportation accidents, to recommend equipment and procedures to enhance transportation safety, and to review on appeal the suspension or revocation of any certificates or licenses issued by the Secretary of Transportation.

NAUTICAL MILE: A unit of length used in navigation which is equivalent to the distance spanned by one minute of arc in latitude, that is, 1,852 meters or 6,076 feet. It is equivalent to approximately 1.15 statute mile.

NAVAID: A term used to describe any electrical or visual air navigational aids, lights, signs, and associated supporting equipment (i.e. PAPI, VASI, ILS, etc.)

NOISE CONTOUR: A continuous line on a map of the airport vicinity connecting all points of the same noise exposure level.

NON-DIRECTIONAL BEACON (NDB): A beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his or her bearing to and from the radio beacon and home on, or track to, the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator.

NON-PRECISION APPROACH PROCEDURE: A standard instrument approach procedure in which no electronic glide slope is provided, such as VOR, TACAN, NDB, or LOC.

NOTICE TO AIRMEN: 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 considered essential to personnel concerned with flight operations.

OBJECT FREE AREA (OFA): An area on the ground centered on a runway, taxiway, or taxilane centerline provided to enhance the safety of aircraft operations by having the area free of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.

OBSTACLE FREE ZONE (OFZ): The airspace below 150 feet above the established airport elevation and along the runway and extended runway centerline that is required to be kept clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance for aircraft landing or taking off from the runway, and for missed approaches.

OPERATION: A take-off or a landing.

OUTER MARKER (OM): An ILS navigation facility in the terminal area navigation system located four to seven miles from

the runway edge on the extended centerline, indicating to the pilot that he/she is passing over the facility and can begin final approach.

PILOT CONTROLLED LIGHTING: Runway lighting systems at an airport that are controlled by activating the microphone of a pilot on a specified radio frequency.

PRECISION APPROACH: A standard instrument approach procedure which provides runway alignment and glide slope (descent) information. It is categorized as follows:

- **CATEGORY I (CAT I):** A precision approach which provides for approaches with a decision height of not less than 200 feet and visibility not less than 1/2 mile or Runway Visual Range (RVR) 2400 (RVR 1800) with operative touchdown zone and runway centerline lights.
- **CATEGORY II (CAT II):** A precision approach which provides for approaches with a decision height of not less than 100 feet and visibility not less than 1200 feet RVR.
- **CATEGORY III (CAT III):** A precision approach which provides for approaches with minima less than Category II.

PRECISION APPROACH PATH INDICATOR (PAPI): A lighting system providing visual approach slope guidance to aircraft during a landing approach. It is similar to a VASI but provides a sharper transition between the colored indicator lights.

PRECISION APPROACH RADAR: A radar facility in the terminal air traffic control system used to detect and display with a high degree of accuracy the direction, range, and elevation of an aircraft on the final approach to a runway.

PRECISION OBJECT FREE AREA (POFA): An area centered on the extended runway centerline, beginning at the runway threshold

and extending behind the runway threshold that is 200 feet long by 800 feet wide. The POFA is a clearing standard which requires the POFA to be kept clear of above ground objects protruding above the runway safety area edge elevation (except for frangible NAVAIDS). The POFA applies to all new authorized instrument approach procedures with less than 3/4 mile visibility.

PRIMARY AIRPORT: A commercial service airport that enplanes at least 10,000 annual passengers.

PRIMARY SURFACE: An imaginary obstruction limiting surface defined in FAR Part 77 that is specified as a rectangular surface longitudinally centered about a runway. The specific dimensions of this surface are a function of the types of approaches existing or planned for the runway.

PROHIBITED AREA: See special-use airspace.

PVC: Poor visibility and ceiling. Used in determining Annual Service Volume. PVC conditions exist when the cloud ceiling is less than 500 feet and visibility is less than one mile.

RADIAL: A navigational signal generated by a Very High Frequency Omni-directional Range or VORTAC station that is measured as an azimuth from the station.

REGRESSION ANALYSIS: A statistical technique that seeks to identify and quantify the relationships between factors associated with a forecast.

REMOTE COMMUNICATIONS OUTLET (RCO): An unstaffed transmitter receiver/facility remotely controlled by air traffic personnel. RCOs serve flight service stations (FSSs). RCOs were established to provide ground-to-ground communications between air traffic control specialists and pilots at satellite airports for delivering enroute clearances, issuing departure authorizations, and

acknowledging instrument flight rules cancellations or departure/landing times.

REMOTE TRANSMITTER/RECEIVER (RTR): See remote communications outlet. RTRs serve ARTCCs.

RELIEVER AIRPORT: An airport to serve general aviation aircraft which might otherwise use a congested air-carrier served airport.

RESTRICTED AREA: See special-use airspace.

RNAV: Area navigation - airborne equipment which permits flights over determined tracks within prescribed accuracy tolerances without the need to overfly ground-based navigation facilities. Used enroute and for approaches to an airport.

RUNWAY: A defined rectangular area on an airport prepared for aircraft landing and takeoff. Runways are normally numbered in relation to their magnetic direction, rounded off to the nearest 10 degrees. For example, a runway with a magnetic heading of 180 would be designated Runway 18. The runway heading on the opposite end of the runway is 180 degrees from that runway end. For example, the opposite runway heading for Runway 18 would be Runway 36 (magnetic heading of 360). Aircraft can takeoff or land from either end of a runway, depending upon wind direction.

RUNWAY ALIGNMENT INDICATOR LIGHT: A series of high intensity sequentially flashing lights installed on the extended centerline of the runway usually in conjunction with an approach lighting system.

RUNWAY END IDENTIFIER LIGHTS (REIL): Two synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification of the approach end of a particular runway.

RUNWAY GRADIENT: The average slope, measured in percent, between the two ends of a runway.

RUNWAY PROTECTION ZONE (RPZ): An area off the runway end to enhance the protection of people and property on the ground. The RPZ is trapezoidal in shape. Its dimensions are determined by the aircraft approach speed and runway approach type and minima.

RUNWAY SAFETY AREA (RSA): A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway.

RUNWAY VISIBILITY ZONE (RVZ): An area on the airport to be kept clear of permanent objects so that there is an unobstructed line-of-sight from any point five feet above the runway centerline to any point five feet above an intersecting runway centerline.

RUNWAY VISUAL RANGE (RVR): An instrumentally derived value, in feet, representing the horizontal distance a pilot can see down the runway from the runway end.

SCOPE: The document that identifies and defines the tasks, emphasis, and level of effort associated with a project or study.

SEGMENTED CIRCLE: A system of visual indicators designed to provide traffic pattern information at airports without operating control towers.

SHOULDER: An area adjacent to the edge of paved runways, taxiways, or aprons providing a transition between the pavement and the adjacent surface; support for aircraft running off the pavement; enhanced drainage; and blast protection. The shoulder does not necessarily need to be paved.

SLANT-RANGE DISTANCE: The straight line distance between an aircraft and a point on the ground.

SMALL AIRPLANE: An airplane that has a maximum certified takeoff weight of up to 12,500 pounds.

SPECIAL-USE AIRSPACE: Airspace of defined

dimensions identified by a surface area wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. Special-use airspace classifications include:

- **ALERT AREA:** Airspace which may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft.
- **CONTROLLED FIRING AREA:** Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons or property on the ground.
- **MILITARY OPERATIONS AREA (MOA):** Designated airspace with defined vertical and lateral dimensions established outside Class A airspace to separate/segregate certain military activities from instrument flight rule (IFR) traffic and to identify for visual flight rule (VFR) traffic where these activities are conducted.
- **PROHIBITED AREA:** Designated airspace within which the flight of aircraft is prohibited.
- **RESTRICTED AREA:** Airspace designated under Federal Aviation Regulation (FAR) 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use. When not in use by the using agency, IFR/VFR operations can be authorized by the controlling air traffic control facility.
- **WARNING AREA:** Airspace which may contain hazards to nonparticipating aircraft.

STANDARD INSTRUMENT DEPARTURE (SID): A preplanned coded air traffic control IFR departure routing, preprinted for pilot use in graphic and textual form only.

STANDARD TERMINAL ARRIVAL (STAR): A preplanned coded air traffic control IFR arrival

routing, preprinted for pilot use in graphic and textual or textual form only.

STOP-AND-GO: A procedure wherein an aircraft will land, make a complete stop on the runway, and then commence a takeoff from that point. A stop-and-go is recorded as two operations: one operation for the landing and one operation for the takeoff.

STOPWAY: An area beyond the end of a takeoff runway that is designed to support an aircraft during an aborted takeoff without causing structural damage to the aircraft. It is not to be used for takeoff, landing, or taxiing by aircraft.

STRAIGHT-IN LANDING/APPROACH: A landing made on a runway aligned within 30 degrees of the final approach course following completion of an instrument approach.

TACTICAL AIR NAVIGATION (TACAN): An ultra-high frequency electronic air navigation system which provides suitably-equipped aircraft a continuous indication of bearing and distance to the TACAN station.

TAKEOFF RUNWAY AVAILABLE (TORA): See declared distances.

TAKEOFF DISTANCE AVAILABLE (TODA): See declared distances.

TAXILANE: The portion of the aircraft parking area used for access between taxiways and aircraft parking positions.

TAXIWAY: A defined path established for the taxiing of aircraft from one part of an airport to another.

TAXIWAY SAFETY AREA (TSA): A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway.

TERMINAL INSTRUMENT PROCEDURES: Published flight procedures for conducting

instrument approaches to runways under instrument meteorological conditions.

TERMINAL RADAR APPROACH CONTROL: An element of the air traffic control system responsible for monitoring the en-route and terminal segment of air traffic in the airspace surrounding airports with moderate to high-levels of air traffic.

TETRAHEDRON: A device used as a landing direction indicator. The small end of the tetrahedron points in the direction of landing.

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

TOUCH-AND-GO: An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway. A touch-and-go is recorded as two operations: one operation for the landing and one operation for the takeoff.

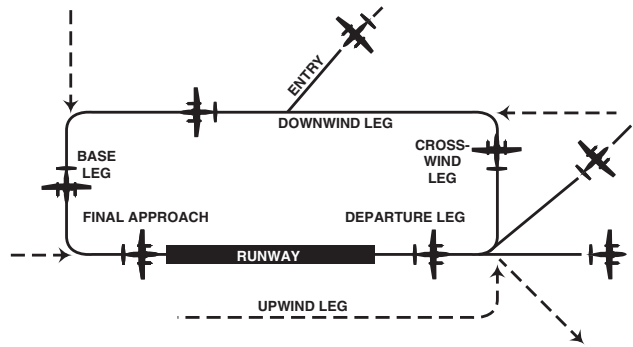
TOUCHDOWN: The point at which a landing aircraft makes contact with the runway surface.

TOUCHDOWN ZONE (TDZ): The first 3,000 feet of the runway beginning at the threshold.

TOUCHDOWN ZONE ELEVATION (TDZE): The highest elevation in the touchdown zone.

TOUCHDOWN ZONE (TDZ) LIGHTING: Two rows of transverse light bars located symmetrically about the runway centerline normally at 100-foot intervals. The basic system extends 3,000 feet along the runway.

TRAFFIC PATTERN: The traffic flow that is prescribed for aircraft landing at or taking off from an airport. The components of a typical traffic pattern are the upwind leg, crosswind leg, downwind leg, base leg, and final approach.

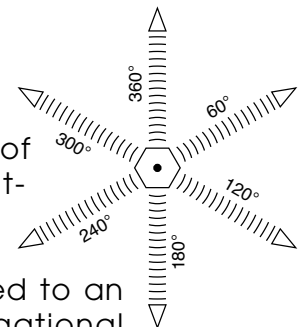


UNCONTROLLED AIRPORT: An airport without an air traffic control tower at which the control of Visual Flight Rules traffic is not exercised.

UNCONTROLLED AIRSPACE: Airspace within which aircraft are not subject to air traffic control.

UNIVERSAL COMMUNICATION (UNICOM): A nongovernment communication facility which may provide airport information at certain airports. Locations and frequencies of UNICOM's are shown on aeronautical charts and publications.

UPWIND LEG: A flight path parallel to the landing runway in the direction of landing. See "traffic pattern."



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

VERY HIGH FREQUENCY/ OMNIDIRECTIONAL RANGE STATION (VOR): A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the national airspace system. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature.

VERY HIGH FREQUENCY OMNI-DIRECTIONAL RANGE STATION/ TACTICAL AIR NAVIGATION (VORTAC): A navigation aid providing VOR azimuth, TACAN azimuth, and TACAN distance-measuring equipment (DME) at one site.

VICTOR AIRWAY: A control area or portion thereof established in the form of a corridor, the centerline of which is defined by radio navigational aids.

VISUAL APPROACH: An approach wherein an aircraft on an IFR flight plan, operating in VFR conditions under the control of an air traffic control facility and having an air traffic control authorization, may proceed to the airport of destination in VFR conditions.

VISUAL APPROACH SLOPE INDICATOR (VASI): An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot that he is on path if he sees red/white, above path if white/white, and below path if red/red. Some airports serving large aircraft have three-bar VASI's which provide two visual guide paths to the same runway.

VISUAL FLIGHT RULES (VFR): Rules that govern the procedures for conducting flight under visual conditions. The term VFR is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

VISUAL METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specific visibility and ceiling conditions which are equal to or greater than the threshold values for instrument meteorological conditions.

VOR: See "Very High Frequency Omnidirectional Range Station."

VORTAC: See "Very High Frequency Omnidirectional Range Station/Tactical Air Navigation."

WARNING AREA: See special-use airspace.

WIDE AREA AUGMENTATION SYSTEM: An enhancement of the Global Positioning System that includes integrity broadcasts, differential corrections, and additional ranging signals for the purpose of providing the accuracy, integrity, availability, and continuity required to support all phases of flight.

Abbreviations

- AC:** advisory circular
- ADF:** automatic direction finder
- ADG:** airplane design group
- AFSS:** automated flight service station
- AGL:** above ground level
- AIA:** annual instrument approach
- AIP:** Airport Improvement Program
- AIR-21:** Wendell H. Ford Aviation Investment and Reform Act for the 21st Century
- ALS:** approach lighting system
- ALSF-1:** standard 2,400-foot high intensity approach lighting system with sequenced flashers (CAT I configuration)
- ALSF-2:** standard 2,400-foot high intensity approach lighting system with sequenced flashers (CAT II configuration)
- APV:** instrument approach procedure with vertical guidance

ARC: airport reference code	GS: glide slope
ARFF: aircraft rescue and firefighting	HIRL: high intensity runway edge lighting
ARP: airport reference point	IFR: instrument flight rules (FAR Part 91)
ARTCC: air route traffic control center	ILS: instrument landing system
ASDA: accelerate-stop distance available	IM: inner marker
ASR: airport surveillance radar	LDA: localizer type directional aid
ASOS: automated surface observation station	LDA: landing distance available
ATCT: airport traffic control tower	LIRL: low intensity runway edge lighting
ATIS: automated terminal information service	LMM: compass locator at middle marker
AVGAS: aviation gasoline - typically 100 low lead (100LL)	LOC: ILS localizer
AWOS: automated weather observation station	LOM: compass locator at ILS outer marker
BRL: building restriction line	LORAN: long range navigation
CFR: Code of Federal Regulations	MALS: medium intensity approach lighting system
CIP: capital improvement program	MALSR: medium intensity approach lighting system with runway alignment indicator lights
DME: distance measuring equipment	MIRL: medium intensity runway edge lighting
DNL: day-night noise level	MITL: medium intensity taxiway edge lighting
DWL: runway weight bearing capacity for aircraft with dual-wheel type landing gear	MLS: microwave landing system
DTWL: runway weight bearing capacity fo aircraft with dual-tandem type landing gear	MM: middle marker
FAA: Federal Aviation Administration	MOA: military operations area
FAR: Federal Aviation Regulation	MSL: mean sea level
FBO: fixed base operator	NAVAID: navigational aid
FY: fiscal year	NDB: nondirectional radio beacon
GPS: global positioning system	NM: nautical mile (6,076 .1 feet)
	NPES: National Pollutant Discharge Elimination System

NPIAS: National Plan of Integrated Airport Systems

NPRM: notice of proposed rulemaking

ODALS: omnidirectional approach lighting system

OFA: object free area

OFZ: obstacle free zone

OM: outer marker

PAC: planning advisory committee

PAPI: precision approach path indicator

PFC: porous friction course

PFC: passenger facility charge

PCL: pilot-controlled lighting

PIW: public information workshop

PLASI: pulsating visual approach slope indicator

POFA: precision object free area

PVASI: pulsating/steady visual approach slope indicator

PVC: Poor visibility and ceiling.

RCO: remote communications outlet

REIL: runway end identifier lighting

RNAV: area navigation

RPZ: runway protection zone

RSA: Runway Safety Area

RTR: remote transmitter/receiver

RVR: runway visibility range

RVZ: runway visibility zone

SALS: short approach lighting system

SASP: state aviation system plan

SEL: sound exposure level

SID: standard instrument departure

SM: statute mile (5,280 feet)

SRE: snow removal equipment

SSALF: simplified short approach lighting system with sequenced flashers

SSALR: simplified short approach lighting system with runway alignment indicator lights

STAR: standard terminal arrival route

SWL: runway weight bearing capacity for aircraft with single-wheel type landing gear

STWL: runway weight bearing capacity for aircraft with single-wheel tandem type landing gear

TACAN: tactical air navigational aid

TDZ: touchdown zone

TDZE: touchdown zone elevation

TAF: Federal Aviation Administration (FAA) Terminal Area Forecast

TODA: takeoff distance available

TORA: takeoff runway available

TRACON: terminal radar approach control

VASI: visual approach slope indicator

VFR: visual flight rules (FAR Part 91)

VHF: very high frequency

VOR: very high frequency omni-directional range

VORTAC: VOR and TACAN collocated



Appendix B

SETTLEMENT AGREEMENT

SETTLEMENT AGREEMENT AND MUTUAL RELEASE

This Settlement Agreement and Mutual Release is made and entered into between: (1) John F. Long (“Mr. Long”); and (2) the City of Glendale (the “City”) this 14th day of June, 2005, in consideration of the mutual promises contained herein, and for other good and valuable consideration, the receipt and adequacy of which are hereby acknowledged. (Mr. Long and the City are collectively referred to as the “Parties.”)

I. RECITALS.

A. In 1984, Mr. John F. Long and Mary P. Long donated to the City a parcel of land included within the Glendale Airport (the “Airport”), which has and is commonly referred to as Parcel B-3 (the “Parcel”). The donation is reflected in a Warranty Deed dated January 5, 1984 (the “Deed”) and Recorded in the Official Records of Maricopa County, Arizona on July 9, 1984 at 84-296588.

B. In 2002, Mr. Long brought suit in Superior Court in Maricopa County asserting various legal and equitable claims, which the court designated as CV 02-001368 (the “Lawsuit”).

C. The City disputes and is prepared to defend against all claims brought in the Lawsuit.

D. Mr. Long and the City desire to resolve this disputed matter under the terms set forth herein.

II. SETTLEMENT TERMS.

A. Until January 31, 2025, or earlier as provided below, pursuant to the terms of this Agreement, the City will hold the Parcel for the potential future construction of, and use as, a second runway and the City shall not take any action that will permanently prohibit such construction on, and use of, the Parcel as a second runway (the “Use Restriction”).

Notwithstanding this Use Restriction, the City is entitled to make use of the Parcel in any manner that will not unreasonably interfere with the potential future construction of and use of the Parcel as a second runway. Permissible uses under this Agreement include construction of structures on the Parcel that could be reasonably removed in the event of redevelopment of the land into a second runway, if such a runway is justified and approved as stated herein.

B. The Use Restriction shall be deemed incorporated in paragraphs (1)(a) and (2)(a) of Exhibit A of the Deed. Should the City violate Section II(A) of this Agreement, the Parcel shall revert to Mr. Long consistent with the other terms and conditions of the Deed and the applicable law. Except as released herein, Mr. Long may pursue any other remedy available to him under the Deed or pursuant to law. A Memorandum of this Agreement agreed to by the Parties, in the form attached as Exhibit A, shall be recorded in the offices of the County Recorder.

C. At a mutually agreed upon time during the years 2010 through 2012, Mr. Long and the City will jointly and equally fund a study by a qualified, experienced airport consultant for the purpose of assessing the need for a second runway to be constructed on the Parcel no later than January 31, 2025 (the "Study"), and which may or may not be configured consistent with previous plans, renderings, studies, or other materials related to the Airport. The Study shall, at a minimum, consider the following factors: (1) the impact upon the mission, current and future air space needs of Luke Air Force Base; (2) the current and future air space needs of the City of Phoenix with respect to Sky Harbor International Airport and other area airports; (3) development plans and impact upon the City and adjacent jurisdictions not otherwise served by a general aviation airport; (4) the economic and market feasibility to the City of the potential construction of a second runway; (5) all applicable governmental regulations and industry

standards; and (6) any other Federal Aviation Administration or other governmental regulations then in effect (collectively, the "Factors"). As part of the Study, this airport consultant shall also assess the availability of federal funding for the construction of a second runway, solely for the City Council's consideration in connection with its exercise of legislative authority as provided in paragraph II(F), below. Prior to the submission of a final Study, the consultant shall deliver drafts to Mr. Long and the City. The Parties shall then have twenty (20) days to provide comments to the consultant. The consultant shall give whatever weight, if any, to the Parties' comments the consultant believes in its own discretion should be given, and thereafter deliver a final Study to the Parties.

D. The cost of the Study shall not exceed One Hundred Thousand Dollars (\$100,000) (or \$50,000 to each party). The consultant retained to conduct the Study shall be selected in accordance with the City's IFB or RFP process, and all other applicable regulations. Both Parties shall work together in good faith to determine the scope of the IFB or RFP. If the Parties cannot agree on the scope of the IFB or RFP, or if the cost exceeds \$100,000 and neither party is willing to pay for the amount in excess, there will be no airport study as outlined above.

E. If the Study determines there will be no need for a second runway or, recommends against construction of a second runway because it would be incompatible with the Factors, or if a Study is not conducted because the cost will exceed \$100,000 (but is less than \$200,000) and Mr. Long elects not to fund one-half of the cost of the Study, Mr. Long will be deemed to have waived and forever released the requirement that the Parcel be held for the development of a second runway and the Use Restriction set forth in Section 11 (A) and (B) above shall terminate and be considered null and void. If the consultant determines that there is or may be a need for a second runway before January 31, 2025 and finds that the Factors should

not preclude construction of a second runway, or if a Study is not conducted because the cost will exceed \$200,000 and either party elects not to fund the Study, or if there is no study for the reasons set forth in paragraph D above, the terms of Section II(A) and (B) above will remain in full force and effect until the later of (i) January 31, 2025, (ii) the time the second runway is built, if, by January 31, 2025, the City determines to construct a second runway as provided in Section II(F) below, or (iii) the Parties hereto mutually agree to terminate the Use Restriction. Notwithstanding anything to the contrary herein, the City shall have no obligation to fund or construct a second runway following the Study, or at any other time unless and until it determines and authorizes, in the exercise of its legislative discretion, that such a runway be constructed.

F. The City agrees to make a decision with respect to the construction, planning of construction, or potential construction of a second runway in the proper exercise of its legislative authority. The City will give Mr. Long or his designee prior notice of any meeting at which the second runway will be discussed or considered. Absent demonstrating by clear and convincing evidence that the City has abused its discretion in exercising legislative authority, Mr. Long acknowledges that the City's decision is conclusive with respect to the decision to build or not to build a second runway. It is mutually understood and agreed that there is no intent by this Agreement or the Parties to preempt future legislative authority.

G. The City represents and warrants that the development agreement between the City and Ryan Companies U.S., Inc., as referenced in paragraph 26 of the Verified Complaint filed in the Lawsuit, is not currently in effect.

H. Mr. Long, for himself, his heirs, executors, administrators and assigns, releases and forever discharges the City from any and all past, present and future actions, causes of

action, claims, party actions, suits at law or in equity, including claims or suits for contribution and/or indemnity, of whatever nature, and all general, special, and consequential damages, whether known or unknown at this time, which have or may result from any acts, actions, errors, and omissions of the City to the date of this Agreement and that are in any way related to the Airport, Lawsuit, the Deed, or Mr. Long's donation of the Parcel to the City to use for airport purposes. This release extends to all claims that were or could have been asserted in the Lawsuit. Notwithstanding the foregoing, Mr. Long does not release the City from future violations of the Deed or this Agreement.

I. Upon execution by the Parties to this Agreement, the parties shall dismiss the Lawsuit with Prejudice, each party to bear its own fees and costs, and shall file a Stipulation for Dismissal, in the form attached as Exhibit B.

J. The City releases and forever discharges Mr. Long, his heirs, executors, administrators, conservators, assigns, agents, attorneys and spouses of such individuals, from any and all past, present and future actions, causes of action, claims, party actions, suits at law or in equity, including claims or suits for contribution and/or indemnity, of whatever nature, and all general, special, and consequential damages, whether known or unknown at this time, which have or may result from any acts, actions, errors, and omissions of Mr. Long to the date of this Agreement and that are in any way related to the Airport, Lawsuit, the Deed, or Mr. Long's donation of the Parcel to the City to use for airport purposes. This release extends to all claims that were or could have been asserted in the Lawsuit. Notwithstanding the foregoing, the City does not release Mr. Long from future violations of the Deed or this Agreement.

III. ACKNOWLEDGMENTS AND ADDITIONAL PROVISIONS.

A. The Parties hereto represent that they were represented by counsel of their own choosing in the negotiations for and preparation of this Settlement Agreement and Mutual Release, that they have read this Settlement Agreement and Mutual Release, that they are fully aware of its contents and of its legal effect, and that they freely and voluntarily enter into it.

B. The City expressly denies any liability for any and all of the claims asserted against it in the Lawsuit. It is understood and agreed that this is a compromised settlement of a dispute(s), claims(s), or disputed claim(s), and that neither this Settlement Agreement and Mutual Release itself nor the furnishing of the consideration for this Settlement Agreement and Mutual Release shall be deemed or construed at any time for any purpose as an admission of the Parties' liability or responsibility for any wrongdoing of any kind.

C. This Settlement Agreement and Mutual Release constitutes the entire agreement related to the subject matter hereof and, as such, supersedes all prior oral and written agreements or understandings between and amongst the Parties regarding such matters. This Settlement Agreement and Mutual Release may not hereafter be modified except in writing signed by each of the Parties hereto.

D. Mr. Long and the City shall bear their own costs and attorney's fees associated with this matter and the Lawsuit. Mr. Long expressly warrants that no assignment or transfer of any part of any claim or any potential claim against the City for circumstances surrounding the claim has been made.

E. All of the provisions of this instrument shall be binding upon and inure to the benefit of the Parties and their respective heirs, executors, administrators, conservators, agents, attorneys and assigns. No other party shall be a third-party beneficiary to this Settlement Agreement and Mutual Release, except as specifically provided herein.

This instrument was acknowledged before me this 9th day of June, 2005, by John F. Long. In witness whereof I herewith set my hand and official seal.

Valerie J. Riedler
Notary Public

My Commission Expires: Oct. 13, 2007



ACKNOWLEDGED AND AGREED:

CITY OF GLENDALE, a municipal corporation

By: Pam Navas
Its: ASA City Manager

Attested:
[Signature]
City Clerk



U.S. Department
of Transportation
**Federal Aviation
Administration**

Western-Pacific Region
Airports Division

Federal Aviation Administration
P.O. Box 92007
Los Angeles, CA 90009-2007

July 25, 2005

Mark S. Ripley
Airport Manager
Glendale Municipal Airport
6801 N. Glen Harbor Blvd., Suite 201
Glendale, AZ 85307

Dear Mr. Ripley:

**Glendale Municipal Airport
Settlement Agreement and Mutual Release**

We are responding to your letter dated June 28, 2005 and the request you made at our meeting on July 14, 2005, for a determination of the effect on grant eligibility of the Settlement Agreement and Mutual Release (Agreement) that was executed between Mr. John F. Long and the City of Glendale (City) on June 14, 2005. In accordance with the terms of a Warranty Deed dated January 5, 1984, Mr. Long donated land to Glendale Municipal Airport (GEU) that was to be used for airport purposes. To settle a dispute over the definition of airport purposes and avoid litigation, Mr. Long and the City entered into an Agreement that constrains development of the deeded property for a period of five to twenty years. The City wishes to know whether or not the Agreement also restricts federal grant eligibility for projects on the deeded property.

In accordance with Assurance 4, *Good Title*, the City must hold good title to airport land in order to be eligible for an airport improvement grant. It would appear that the Agreement places a limited encumbrance on the deeded property. The City has agreed to reserve this parcel while the parties study the merits of a second runway. Therefore, other permanent non-runway improvements cannot be constructed on the deeded property.

The City has also reduced its rights and powers to direct the airport's capital improvement plan. Assurance 5, *Rights and Powers*, requires that the City avoid any action that would deprive it of its rights and powers to discharge the duties mandated by the grant assurances. In effect, the City has diminished its power to fully direct the capital improvement plan of GEU. The City's prerogative is encumbered because it cannot freely redevelop the deeded property as it wishes for a certain period of time.

We have determined that the Agreement has placed some limitations, although not permanent, on the City's powers and title to the deeded property. We must now determine the duration of

the encumbrance. The Agreement stipulates that the parties will jointly conduct a study during the period 2010 to 2012 to evaluate whether or not a second runway is needed.

If the study determines that a second runway is not needed or the other conditions in the Agreement eliminate the runway option, the encumbrance on the City's good title will be eliminated. There should no longer be any restrictions on the City's use of the deeded property, and the City should be eligible to apply for grants to develop the property.

If the study determines that there is or may be a need for a second runway before 2025, the encumbrance on good title to the deeded property will continue and prevent permanent redevelopment of the property for other airport purposes. Based on the Agreement, the encumbrance's expiration date is uncertain at this time because the Agreement may remain in effect until 2025, the time period that a second runway is built, or the date the parties terminate the Agreement. As long as the City is obligated by the terms of the Agreement to accept the runway option, the City may not receive a grant to improve or develop any part of the deeded property that can potentially be affected by the proposed runway.

The City has reserved to itself the right to decide if a second runway will be funded or built. This right does not diminish the encumbrance because Mr. Long will still have rights that could allow him to seek recompense under the terms of the Agreement or the original Warranty Deed. A prolonged dispute or litigation would, in all likelihood, prevent any development from taking place on the deeded property until the dispute is settled by a new agreement or judicial decision.

In conclusion, it is our determination that the FAA cannot fund airport development projects on the deeded property while the City is obliged to reserve the land for a second runway. The City is legally obliged by the Agreement to reserve the deeded property for a period from 5 to 20 years. The City has encumbered its title to the deeded property by legally agreeing to conduct a study and perhaps build a runway on the deeded property. As a result, the City may not enter into a grant agreement with the FAA while the obligations of the grant and the terms of the Agreement are in conflict.

The City does not presently have good title to the deeded property. Furthermore, the City could not pledge to uphold the terms of a grant agreement for a period of 20 years, as required by federal law. While the City remains obliged to accept the possibility of building a second runway, the land that is reserved for the runway will not be eligible for airport improvement grants. Once Mr. Long loses his rights or the City is released from its obligations under the Agreement, the City will be eligible to apply for grant funding to develop the deeded property.

If you have any questions, please call me at (310) 725-3634.

Sincerely,

A handwritten signature in cursive script that reads "Tony Garcia". The signature is written in black ink and is positioned above the typed name.

Tony Garcia
Airports Compliance Specialist



Appendix C

FORECAST APPROVAL LETTER



U.S Department
of Transportation
**Federal Aviation
Administration**

Western-Pacific Region
Los Angeles District Office

P.O. Box 92007
Los Angeles, CA 90009

April 24, 2007

Mr. Mark Ripley
Airport Manager
6801 N. Glen Harbor Blvd
Suite #201
Glendale, AZ 85307

Glendale Municipal Airport
Aviation Activity Forecast

Dear Mr. Ripley:

The Federal Aviation Administration (FAA) is in receipt of your consultant's letter dated October 13, 2006, which enclosed Chapter Two, *Forecasts*, from the draft Glendale Municipal (GEU) Airport Master Plan. The letter requests FAA approval of GEU Airport Master Plan future aviation forecast methodology and data.

The FAA has reviewed the aforementioned documentation and approves the forecast for long-term planning purposes. However, it should be noted that there is a significant difference between the actual numbers of based aircraft stated in the master plan versus FAA Form 5010 data (Airport Master Record). Thus, it is recommended that FAA Form 5010 data is annually updated since the FAA's Terminal Area Forecast references the number of based aircraft and operations from FAA Form 5010. (Enclosed.)

If you have any questions or would like to discuss this letter in more detail, I can be contacted at (310) 725-3771.

Sincerely,

**Original Signed By
George W. Buley**

George W. Buley
Program Manager/Planner

Enclosure

cc: Mr. Patrick Taylor, Coffman Associates
LAX-600.11



Appendix D

ENVIRONMENTAL EVALUATION

Appendix D

ENVIRONMENTAL

EVALUATION

Master Plan
Glendale Municipal Airport

A review of the potential environmental impacts associated with proposed airport projects is an essential consideration in the airport master planning process. The primary purpose of this evaluation is to review the planned improvement program for Glendale Municipal Airport to determine whether the planned actions could, individually or collectively, have the potential to significantly affect the quality of the environment.

Construction of the improvements depicted on the Airport Layout Plan will require compliance with the *National Environmental Policy Act (NEPA) of 1969*, as amended, to receive federal financial assistance. For projects not categorically excluded under Federal Aviation Administration (FAA) Order 1050.1E, *Environmental Impacts: Policies and Procedures*, compliance with NEPA is generally satisfied through the preparation of an Environmental Assessment (EA). For instances in which significant environmental impacts are expected, an Environmental Impact Statement (EIS) may be required. While this portion of the master plan is not designed to satisfy the NEPA requirements for a categorical exclusion, EA, or EIS, it is intended to supply a preliminary review of environmental issues that would need to be analyzed in more detail within the NEPA process. This evaluation considers all environmental categories required for the NEPA process as outlined in FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures* and FAA Or-

der 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*. Of the 19 plus environmental categories, the following resources are not found within the airport environs.

- Coastal Resources
- Department of Transportation Act, Section 4(f) properties
- Environmental Justice Areas
- Wild and Scenic Rivers

The following sections describe potential impacts to the remaining resources (as outlined within Appendix A of FAA Order 1050.1E) as development at the airport is undertaken. Exhibit 5A in Chapter Five depicts the proposed future development of the airport.

AIR QUALITY

The U.S. Environmental Protection Agency (EPA) has adopted air quality standards that specify the maximum permissible near-term and long-term concentrations of various air contaminants. Primary air quality standards are established at levels to protect the public health from harm with an adequate margin of safety. Secondary standards are set at levels necessary to protect the public health and welfare from any known or anticipated adverse effects of a pollutant. All areas of the country are required to demonstrate attainment with the National Ambient Air Quality Standards (NAAQS). The federal air quality standards focus on limiting the quantity of six criteria pollutants:

- Ozone (O₃)
- Carbon Monoxide (CO)
- Sulfur Dioxide (SO_x)
- Nitrogen Dioxide (NO_x)
- Particulate Matter (PM₁₀ and PM_{2.5})
- Lead (Pb)

The Maricopa County Air Quality Department has adopted the federal ambient air quality standards, the primary and secondary standards for each pollutant as presented in **Table D1**.

Pollutant	Averaging Time	Primary Standard	Secondary Standard
Carbon Monoxide (CO) in parts per million (ppm)	8-hour	9	–
	1-hour	35	–
Nitrogen Dioxide (NO _x) in ppm	Annual	0.053	0.053
Ozone (O ₃) in ppm	1-hour	0.12	0.12
	8-hour	0.08	0.08
Lead (Pb) in micrograms per cubic meter	Quarterly Average	1.5	1.5
Particulate Matter (PM ₁₀) in micrograms per cubic meter	Annual	50	50
	24-hour	150	150
Particulate Matter (PM _{2.5}) in micrograms per cubic meter	Annual	65	65
	24-Hour	15	15
Sulfur Dioxide (SO _x) in ppm	Annual	0.03	–
	24-hour	0.14	–
	3-hour	–	0.5

Source: U.S. Environmental Protection Agency

Air contaminants increase the aggravation of and production of respiratory and cardiopulmonary diseases. The standards also establish the level of air quality which is necessary to protect the public health and welfare including, among other things, effects on crops, vegetation, wildlife, visibility, and climate, as well as effects on materials, economic values, and on personal comfort and well-being.

Potentially significant air quality impacts associated with an FAA project or action would occur if the project or action exceeds one or more of the NAAQS for any of the time periods analyzed.

Glendale Municipal Airport is located in Maricopa County, which is in non-attainment for Ozone (both 8-hour and 1-hour) and Particulate Matter (PM₁₀). Additional air quality analysis is needed to determine potential impacts to air quality that may result from construction of the planned parallel taxiway, additional hangars and associated connecting taxiways, and service roads. Projects planned at the airport that would result in the demolition or construction of new facilities could have temporary air quality impacts during construction. Emissions from the operation of construction vehicles and fugitive dust from pavement removal are common air pollutants during construction. However, with the use of best management practices (BMPs) during construction, these air quality impacts can be significantly lessened.

COMPATIBLE LAND USE AND NOISE

An airport's compatibility with surrounding land uses is usually associated with the extent of the airport's noise impacts. Airport projects such as those needed to accommodate fleet mix changes, an increase in operations at the airport, or air traffic changes are examples of activities which can alter noise impacts and affect surrounding land uses. Typically, if the noise analysis concludes that there is no significant impact, a similar conclusion usually can be made with respect to compatible land use. FAA Orders 1050.1E and 5050.4B define a significant noise impact as one which would occur if proposed airport development would cause noise-sensitive areas to experience an increase in noise of 1.5 DNL or more, at or above the 65 DNL noise exposure level when compared to the no action alternative for the same time-frame. The Integrated Noise Model (INM) describes aircraft noise in the *Yearly Day-Night Average Sound Level* (DNL). DNL is defined as the average A-weighted sound level as measured in decibels (dB) during a 24-hour period. A 10-dB penalty applies to noise events occurring at night (10:00 p.m. to 7:00 a.m.). DNL is a summation metric which allows objective analysis and can describe noise exposure comprehensively over a large area. Is the noise metric preferred by the FAA, EPA, and Department of Housing and Urban Development (HUD), among others, as an appropriate measure of cumulative noise exposure.

Since noise decreases at a constant rate in all directions from a source, points of equal DNL noise levels are routinely indicated by means of a contour line. The various contour lines are then superimposed on a map of the airport and its environs. It is important to recognize that a line drawn on a map does not imply that a particular noise condition exists on one side of the line and not on the other. DNL calculations do not precisely define noise impacts. Nevertheless, DNL contours can be used to: (1) highlight existing or potential incompatibilities between an airport and any surrounding development; (2) assess relative exposure levels; (3) assist in the preparation of airport environs land use plans; and (4) provide guidance in the development of land use control devices, such as zoning ordinances, subdivision regulations, and building codes.

The noise contours for Glendale Municipal Airport were developed with INM Version 7.0. The INM was developed by the Transportation Systems Center of the U.S. Department of Transportation at Cambridge, Massachusetts, and has been specified by the FAA as one of the two models acceptable for federally funded noise analysis. The INM is a computer model which accounts for each aircraft along flight tracks during an average 24-hour period. These flight tracks are coupled with separate tables contained in the database of the INM, which relate to noise, distances, and engine thrust for each make and model of aircraft type selected.

Computer input files for the noise analysis contain operational data, runway utilization, aircraft flight tracks, and fleet mix as projected in the plan. The operational data and aircraft fleet mix are summarized in **Table D2**. These estimates were de-

rived after review of instrument flight plans maintained by the FAA and existing airport records.

TABLE D2			
Noise Model Input: Aircraft Operations			
Glendale Municipal Airport			
Aircraft Type	INM Descriptor	Base Year (2007)	Long Term (20 Years)
ITINERANT OPERATIONS			
<i>Turbojet</i>			
Business Jet	LEAR35	400	1,700
Business Jet	CNA500	400	1,700
Business Jet	MU3001	200	500
Business Jet	CNA55B	300	900
Business Jet	CL600	300	800
Business Jet	GIV	150	400
Business Jet	LEAR25	50	0
Subtotal		1,800	6,000
<i>Piston/Turboprop</i>			
Single Engine Variable	GASEPV	18,649	30,430
Single Engine Fixed	GASEPF	18,648	30,430
Multi-engine	BEC58P	3,000	8,000
Turboprop	DHC6	2,000	8,000
Helicopter	H500D	1,000	3,000
Helicopter	R-22	1,000	3,000
Subtotal		44,297	82,860
<i>Military</i>			
Helicopter	S70	26	240
Turboprop	1900D	20	200
Subtotal		46	440
TOTAL ITINERANT		46,143	89,300
LOCAL OPERATIONS			
Single Engine Variable	GASEPV	45,240	58,350
Single Engine Fixed	GASEPF	45,241	58,350
Multi-engine Fixed	BEC58P	5,000	8,000
Helicopter	R-22	10,000	20,000
TOTAL LOCAL		105,481	144,700
TOTAL ACTIVITY		151,624	234,000
<i>Source: Coffman Associates analysis utilizing Integrated Noise Model (INM) v. 7.0</i>			

The control tower on the airport utilizes Runway 1 as the calm wind runway. When taking this into consideration, approximately 65 percent of annual operations are to this runway end. The remaining 35 percent are to the Runway 19 end. These runway use percentages are utilized for all aircraft in the fleet mix, both local and itinerant, and for the future airport condition.

The existing and forecast noise exposure contours for Glendale Municipal Airport are depicted on **Exhibits D1** and **D2**. In the current condition, portions of the 65 DNL noise contour, considered the threshold of significance, extends off airport

property to the north and south. The noise contour covers approximately 437 acres. There are no noise-sensitive land uses within the portions of the contour that extend beyond airport property.

The long term forecast results in an increase of the area impacted by the 65 DNL contour to 552 acres. The increase in size is related to the forecast increase in operations. The resulting long range contour extends off airport property to the north and south. There are no noise-sensitive land uses within the portions of the contour and based on the current *City of Glendale General Plan*, there are no noise-sensitive land uses planned for these areas. Additionally, based on the City of Glendale zoning maps, the parcels encompassed by the noise exposure contours are zoned for industrial land uses.

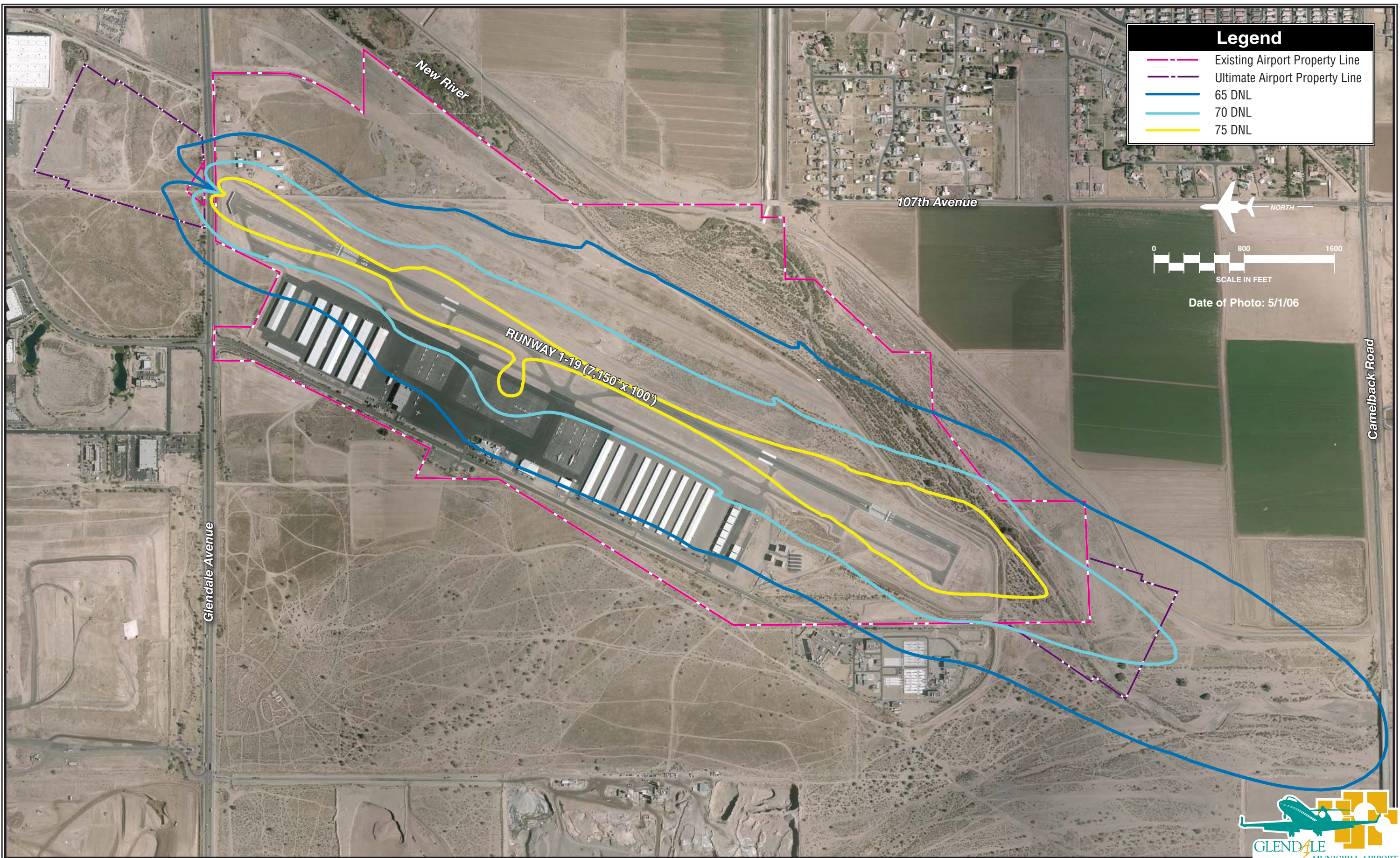
In conclusion, it is recognized that some portions of the future 65 DNL extend beyond airport property. These areas have been examined in terms of their current and potential future land use. Development of incompatible land uses is not foreseen. As a result, it is not a high priority to purchase these areas beyond the future airport property line.

COMPATIBLE LAND USE

Title 14 of the Code of Federal Regulations (14 CFR), Part 150 recommends guidelines for planning land use compatibility within various levels of aircraft noise. As the name indicates, these are guidelines only; Part 150 explicitly states that determinations of noise compatibility and regulation of land use are purely local responsibilities.

As previously discussed, the existing and future noise exposure contours extend off airport property. Many land uses such as parking lots, roadways, commercial, manufacturing, and industrial development are compatible within the 65 DNL noise contour. A residential land use would be non-compatible and strongly discouraged within the 65 DNL. Often, mixed land uses can include some residential development. This circumstance should be avoided either through zoning or airport acquisition.

The primary goal of compatible land use planning is to achieve and maintain compatibility between the airport and its surrounding community. Inherent in this goal is the assurance that the airport can maintain or expand its size and level of operations to satisfy existing and future aviation demand. The protection of the investment in a facility such as an airport is of great importance. At the same time, a person who lives, works, or owns property near an airport should be able to enjoy the location without infringement by noise or other adverse impacts of the airport.



Legend

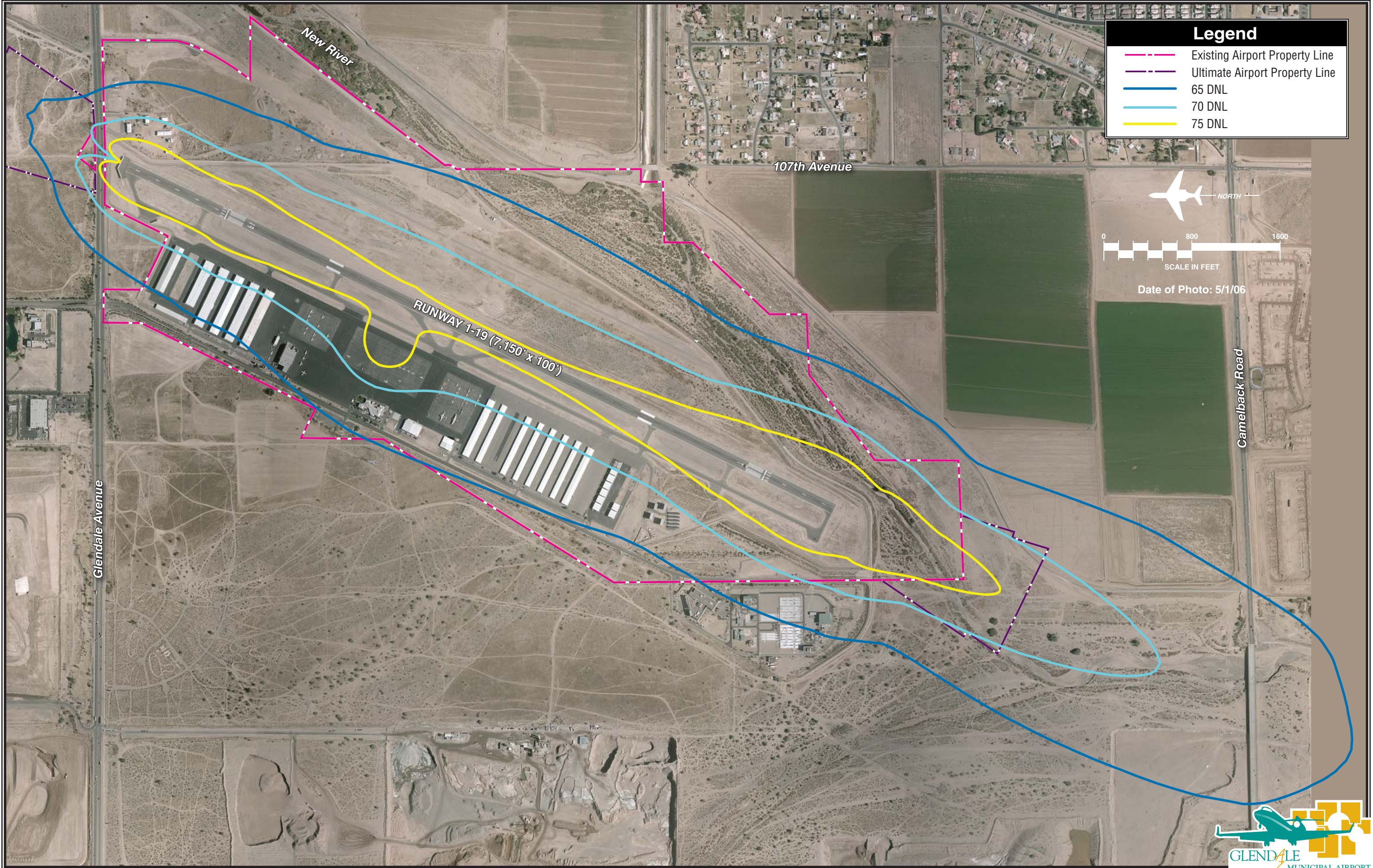
- - - Existing Airport Property Line
- - - Ultimate Airport Property Line
- 65 DNL
- 70 DNL
- 75 DNL

0 800 1600
SCALE IN FEET

North

Date of Photo: 5/1/06





Legend

- - - Existing Airport Property Line
- - - Ultimate Airport Property Line
- 65 DNL
- 70 DNL
- 75 DNL

0 800 1600
SCALE IN FEET

North

Date of Photo: 5/1/06



Noise and Land Use Summary

As the airport grows in the overall number of operations and as the fleet mix changes to include more operations by larger general aviation aircraft, such as turboprops and business jets, the extent of noise is forecast to grow accordingly. Advancements in aircraft engine technology are also advancing and the noise generated by today's sophisticated jet aircraft is far less than that generated just ten years ago. Further noise reduction technology can be expected to be applied in the future to aircraft.

CONSTRUCTION IMPACTS

Construction impacts typically relate to the effects on specific impact categories, such as air quality or noise, during construction. The use of BMPs during construction is typically a requirement of construction-related permits such as a National Pollutant Discharge Elimination System (NPDES) permit. Use of these measures typically alleviates potential resource impacts.

Short-term construction-related noise impacts could occur with implementation of the planned taxiway, hangar and service road construction on the east side of the runway as there is an existing residential development southeast of this area. However, these impacts typically do not arise unless construction is being undertaken during early morning, evening, or nighttime hours. Furthermore, the proposed projects will be undertaken on a demand basis and will not be constructed simultaneously.

Construction-related air quality impacts can be expected. Air emissions related to construction activities will be short-term in nature and will be included in the air emission inventory, if one is requested.

FARMLAND

Under the *Farmland Protection Policy Act* (FPPA), federal agencies are directed to identify and take into account the adverse effects of federal programs on the preservation of farmland, to consider appropriate alternative actions which could lessen adverse effects, and to assure that such federal programs are, to the extent practicable, compatible with state or local government programs and policies to protect farmland. The FPPA guidelines apply to farmland classified as prime or unique, or of state or local importance as determined by the appropriate government agency, with concurrence by the Secretary of Agriculture.

The 54.3 acres identified for property acquisition are not classified as prime or unique farmland by the Natural Resources Conservation Service. The remaining

areas planned for development are on airport property and are dedicated to airport uses; therefore, FPPA does not apply.

FISH, WILDLIFE, AND PLANTS

A number of acts and executive orders have been put into place to protect threatened or endangered species and their habitat. Following is a brief description of these various levels of protection:

- Section 7 of the *Endangered Species Act* (ESA), as amended, applies to federal agency actions and sets forth requirements for consultation to determine if the proposed action “may affect” a federally endangered or threatened species. If an agency determines that an action “may affect” a federally protected species, then Section 7(a)(2) requires each agency to consult with the U.S. Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NMFS), as appropriate, to ensure that any action the agency authorizes, funds, or carries out is not likely to jeopardize the continued existence of any federally listed endangered or threatened species, or result in the destruction or adverse modification of critical habitat. If a species has been listed as a candidate species, Section 7 (a)(4) states that each agency must confer with the FWS and/or NMFS.
- The *Sikes Act* and various amendments authorize states to prepare statewide wildlife conservation plans, and the Department of Defense (DOD) to prepare similar plans, for resources under their jurisdiction. Airport improvement projects should be checked for consistency with the State or DOD Wildlife Conservation Plans where such plans exist.
- The *Fish and Wildlife Coordination Act* requires that agencies consult with the state wildlife agencies and the Department of the Interior concerning the conservation of wildlife resources where the water of any stream or other water body is proposed to be controlled or modified by a federal agency or any public or private agency operating under a federal permit.
- The *Migratory Bird Treaty Act* (MBTA) prohibits private parties and federal agencies in certain judicial circuits from intentionally taking a migratory bird, their eggs, or nests. The MBTA prohibits activities which would harm migratory birds, their eggs, or nests unless the Secretary of the Interior authorizes such activities under a special permit.
- Executive Order 13112, *Invasive Species*, directs federal agencies to use relevant programs and authorities to the extent practicable and subject to available resources to prevent the introduction of invasive species and provide for restoration of native species and habitat conditions in ecosystems that have been invaded. The FAA is to identify proposed actions that may involve risks of intro-

ducing invasive species on native habitat and populations. “Introduction” is the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity. “Invasive Species” are alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

According to FAA Order 1050.1E, a significant impact to listed threatened or endangered species would occur when the FWS or NMFS determines that the proposed action would likely jeopardize the continued existence of the species in question or would result in the destruction or adverse modification of critical habitat for the species. However, an action need not involve a threat to extinction to federally listed species to result in a significant impact; lesser impacts, including impacts on non-listed species, could also constitute a significant impact.

As described in Chapter One, vegetation surrounding the airport is limited to shrub-scrub species and native desert grasses and crops which are not anticipated to contain any unique or significant biological species. A study prepared by EcoPlan Associates for the 2001 EA for Glendale Municipal Airport stated that the “project area does not appear to support suitable habitat for the species included in the U.S. Fish and Wildlife Service Endangered, Threatened, Proposed and Candidate Species List for Maricopa County.” The current list, as of April 2008, includes five species that were not included on the list compiled for the 2001 EA. Two of these species are fish. The habitat for these species is shallow desert pool. This habitat is not located within the project area; therefore, these species will not be affected by the proposed development. A third species, the Mexican spotted owl, will also not be affected by the proposed development. The Mexican spotted owl’s habitat is canyon and forested mountain areas, which are not present at the airport. The lesser long-nosed bat and Sonoran pronghorn are unlikely to occur within the project area; however, field surveys may be required to determine the presence of these or other listed species. The habitat for these species is desert scrub and alluvial valley areas, respectively. These habitats are not present within the planned project areas.

A search conducted using the Arizona Game and Fish Department’s (AGFD) State of Arizona Online Environmental Review Tool indicated that no special status species have been documented within the project vicinity. Additionally, no proposed or designated critical habitat exists within the airport environs. Prior to project implementation, further coordination with the FWS and AGFD is required.

HAZARDOUS MATERIALS, POLLUTION PREVENTION, AND SOLID WASTE

The airport must comply with applicable pollution control statutes and requirements. Impacts may occur when changes to the quantity or type of solid waste generated, or type of disposal, differ greatly from existing conditions.

Solid waste disposal facilities can cause a hazard to aircraft by attracting wildlife and, most importantly, birds. A bird hazard exists if the landfill is located approximately 5,000 feet from runways used by piston aircraft and 10,000 feet from runways used by turbojet aircraft.

The airport will need to continue to comply with a National Pollution Discharge Elimination System (NPDES) permit, which will ensure that pollution control measures are in place at the airport. As development occurs at the airport, the permit will need to be modified to reflect the additional impervious surfaces and storm water retention facilities. The addition and removal of impervious surfaces may require modifications to this permit should drainage patterns be modified. Net increases in impervious surfaces are minimized by the removal of old pavement.

A Phase I report prepared by Four Corners Environmental, Inc. for the 2005 property acquisition EA for Glendale Municipal Airport identified areas with stained soils associated with oil disposal and in areas of drum and tank storage. The stained soils are located on a parcel south of Glendale Avenue, northeast of the approach end of Runway 19. There are no planned improvements on this parcel. It was recommended that these areas be tested to determine if liquids contained in these drums and tanks have impacted subsurface soil prior to construction.

A large amount of solid waste was also identified in the recently acquired area. The Four Corners Environmental study recommended that all solid waste be removed from the site and disposed of in accordance with applicable federal, state, and local regulations. It was also recommended that monitoring take place to identify potential buried hazardous or regulated materials during construction. Additionally, during the demolition of structures in this area, the location and condition of septic systems should be observed and documented. Plans are underway to remove the solid waste from the site taking the precautions outlined in the Phase I report.

For the proposed property acquisition areas for the runway protection zones and the parcel south of Glendale Avenue, an Environmental Due Diligence Audit (EDDA) will need to be conducted to determine if activities involving hazardous materials have occurred or have resulted in environmental contamination on these sites.

As a result of increased operations at the airport, solid waste output may slightly increase; however, these increases are not anticipated to be significant.

HISTORICAL, ARCHITECTURAL, AND CULTURAL RESOURCES

Determination of a project's environmental impact to historic and cultural resources is made under guidance in the *National Historic Preservation Act* (NHPA) of 1966, as amended, the *Archaeological and Historic Preservation Act* (AHPA) of 1974, the *Archaeological Resources Protection Act* (ARPA), and the *Native American Graves Protection and Repatriation Act* (NAGPRA) of 1990. In addition, the *Antiquities Act of 1906*, the *Historic Sites Act of 1935*, and the *American Indian Religious Freedom Act of 1978* also protect historical, architectural, archaeological, and cultural resources.

Section 106 of the NHPA of 1966, as amended, requires federal agencies to take into account the effects of their undertakings on historic properties and determine if any properties in, or eligible for inclusion in, the National Register of Historic Places (NRHP) are present in the area. In addition, it affords the Advisory Council on Historic Preservation a reasonable opportunity to comment. The historic preservation review process mandated by Section 106 is outlined in regulations issued by the council.

The ARPA is triggered by the presence of archaeological resources on federal or Indian lands. The AHPA describes the process when consultation with resource agencies indicates that there may be an impact on significant scientific, prehistoric, historic, archaeological, or paleontological resources. The process provides for the preparation of a professional resource survey of the area. Should the survey identify significant resources, the National Register process described above will be followed. Should the survey be inconclusive, a determination is made whether it is appropriate to provide a commitment to halt construction if resources are recovered, in order for a qualified professional to evaluate their importance and provide for data recovery as necessary.

The NAGPRA is triggered by the possession of human remains or cultural items by a federally funded repository or by the discovery of human remains or cultural items on federal or tribal lands and provides for the inventory, protection, and return of cultural items to affiliated Native American Groups. The Act includes provisions that, upon inadvertent discovery of remains, the action will cease in the area where the remains were discovered and the appropriate agency will be notified.

The *Antiquities Act of 1906* was the first general law providing protection for archaeological resources. It protects all historic and prehistoric sites on federal lands and prohibits excavation or destruction of such antiquities without the permission of the secretary of the department having jurisdiction.

The *Historic Sites Act of 1935* declares as national policy the preservation for public use of historic sites, buildings, objects, and properties of national significance. It gives the Secretary of the Interior authority to make historic surveys, to secure and

preserve data on historic sites, and to acquire and preserve archaeological and historic sites. This Act also establishes the National Historic Landmarks program for designating properties having exceptional value in commemorating or illustrating the history of the United States.

The *American Indian Religious Freedom Act of 1978* requires consultation with Native American groups concerning proposed actions on sacred sites, on federal land, or affecting access to sacred sites. It establishes federal policy to protect and preserve for American Indians, Eskimos, Aleuts, and Native Hawaiians their right to free exercise of their religion. It allows these peoples to access sites, use and possess sacred objects, and freedom to worship through ceremonial and traditional rites. The Act requires federal agencies to consider the impacts of their actions on religious sites and objects that are important to Native Americans regardless of the eligibility for the NRHP. Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, and the Presidential Memorandum of April 29, 1994, *Government to Government Relations with Native American Tribal Governments*, outline the government-to-government consultation process between the federal agency and the potentially affected tribe.

Development of projects would affect a property that is in, or eligible for inclusion in, the NRHP if it has the potential to alter the characteristics of the property which make it eligible for listing. Federal agencies can make one of three types of “effects findings” for an action: “no properties affected,” “no adverse effect,” and “adverse effect.” The level of finding depends upon how severely a project would alter the characteristics of a property that make it eligible for the NRHP. Although the FAA works closely with the State Historic Preservation Officer (SHPO) and/or the Tribal Historic Preservation Officer (THPO), the FAA is ultimately responsible for the effect decision, not the SHPO or THPO.

The Section 106 consultation process includes consideration of alternatives to avoid adverse effects on National Register listed or eligible properties; of mitigation measures; and of accepting adverse effects. The FAA makes the final determination on the level of effect, and advice from the SHPO/THPO may assist the FAA in making that determination.

As discussed within Chapter One, previous studies and coordination with the SHPO indicate that areas within the existing airport property do not likely contain protected resources. Coordination was undertaken for an Environmental Assessment for the extension of Runway 1-19 to the north and south, and acquisition of the parcels located northeast of the approach end of Runway 19. The master plan indicates that the acquisition of property will be needed for the airport to control the runway protection zones for each end of the runway and to expand development to the north on the west side of the runway. The proposed acquisition areas were not included as part of previous coordination. It is anticipated that a cultural resource survey will be requested as the proposed acquisition areas have not been surveyed for cul-

tural resources, and further coordination with the SHPO is required regarding potential impacts to cultural or archaeological resources in these areas.

LIGHT EMISSIONS AND VISUAL EFFECTS

Airport lighting is characterized as either airfield lighting (i.e., runway, taxiway, approach and landing lights) or landside lighting (i.e., security lights, building interior lighting, parking lights, and signage). Generally, airport lighting does not result in significant impacts unless a high intensity strobe light, such as a Runway End Identifier Light (REIL), would produce glare on any adjoining site, particularly residential uses.

Visual impacts relate to the extent that the proposed development contrasts with the existing environment and whether a jurisdictional agency considers this contrast objectionable. The visual sight of aircraft, aircraft contrails, or aircraft lights at night, particularly at a distance that is not normally intrusive, should not be assumed to constitute an adverse impact.

The planned development projects on the east side of the airport will occur approximately one-quarter mile from existing residential development. If the potential for lighting or visual impacts is determined to be associated with the planned development, consultation with local residents and the owners of light-sensitive sites may be needed to determine possible alternatives to minimize these effects without risking aviation safety or efficiency. Additional coordination with state, regional, or local art or architecture councils, tribes, or other organizations having an interest in airport-associated visual effects may be necessary.

NATURAL RESOURCES AND ENERGY SUPPLY

In instances of major proposed actions, power companies or other suppliers of energy will need to be contacted to determine if the proposed project demands can be met by existing or planned facilities.

There are no existing powerlines near the airport that would need to be relocated as a result of the planned development at the airport.

Increased use of energy and natural resources are anticipated as the operations at the airport grow. None of the planned development projects are anticipated to result in significant increases in energy consumption.

SOCIOECONOMIC, ENVIRONMENTAL JUSTICE, AND CHILDREN'S HEALTH AND SAFETY RISKS

Socioeconomic impacts known to result from airport improvements are often associated with relocation activities or other community disruptions, including alterations to surface transportation patterns, division or disruption of existing communities, interferences with orderly planned development, or an appreciable change in employment related to the project. Social impacts are generally evaluated based on areas of acquisition and/or areas of significant project impact, such as areas encompassed by noise levels in excess of 65 DNL.

Executive Order 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations*, and the accompanying Presidential Memorandum, and Order DOT 5610.2, *Environmental Justice*, require the FAA to provide for meaningful public involvement by minority and low-income populations as well as analysis that identifies and addresses potential impacts on these populations that may be disproportionately high and adverse.

Pursuant to Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, federal agencies are directed to identify and assess environmental health and safety risks that may disproportionately affect children. These risks include those that are attributable to products or substances that a child is likely to come in contact with or ingest, such as air, food, drinking water, recreational waters, soil, or products they may be exposed to.

The thresholds of significance for this impact category are reached if the project negatively affects a disproportionately high number of minority or low-income populations or if children would be exposed to a disproportionate number of health and safety risks. Significant socioeconomic impacts would result if an extensive number of residents need to be relocated and sufficient replacement housing is unavailable; if extensive relocation of businesses is required and this relocation would create a severe economic hardship for the affected communities; if disruptions of local traffic patterns would substantially reduce the level of service of the roads serving the airport and the surrounding community; or if there would be a substantial loss in the community tax base.

It is not anticipated that the proposed airport development projects would result in significant impacts within this impact category. The airport is not located within an area which would be considered an "environmental justice" area.

Approximately 54.3 acres would need to be acquired to accommodate the planned development. There are no existing residences or businesses on the parcels to be acquired.

Potential risks to children from the development of the airport will be minimized through the use of standard security measures such as fencing and locks on cabinets or structures which contain hazardous materials.

WATER QUALITY

The *Clean Water Act* provides the authority to establish water quality standards, control discharges, develop waste treatment management plans and practices, prevent or minimize the loss of wetlands, and regulate other issues concerning water quality. Water quality concerns related to airport development most often relate to the potential for surface runoff and soil erosion, as well as the storage and handling of fuel, petroleum products, solvents, etc.

Water quality regulations and issuance of permits will normally identify any deficiencies in the proposed development with regard to water quality or any additional information necessary to make judgments on the significance of impacts. Difficulties in obtaining needed permits for the project, such as National Pollutant Discharge Elimination System (NPDES) or Section 404 permits, typically indicate a potential for significant water quality impacts.

There are no Waters of the U.S. located on airport property. The proposed development on the east side of the airport is adjacent to the New River. Based on a review of aerial photography, the New River appears to be dry. Best management practices should be employed during the development of this area to minimize impacts to the New River during construction.

Prior to commencing construction of all proposed projects, the airport and all applicable contractors will need to obtain and comply with the requirements of the construction-related NPDES General Permit, including the preparation of a Notice of Intent and a Storm Water Pollution Prevention Plan.

WETLANDS

The U.S. Army Corps of Engineers (COE) regulates the discharge of dredged and/or fill material into Waters of the United States, including adjacent wetlands, under Section 404 of the *Clean Water Act*.

Wetlands are defined by Executive Order 11990, *Protection of Wetlands*, as those areas that are inundated by surface or groundwater with a frequency sufficient to support, and under normal circumstances does or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Categories of wetlands include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mud flats, natural ponds, estuarine areas, tidal overflows, and shallow lakes and ponds with emergent

vegetation. Wetlands exhibit three characteristics: hydrology, hydrophytes (plants able to tolerate various degrees of flooding or frequent saturation), and poorly drained soils.

As outlined within FAA Orders 1050.1E and 5050.4B, a significant impact to wetlands would occur when the proposed action causes any of the following.

- The action would adversely affect the function of a wetland to protect the quality or quantity of municipal water supplies, including sole source, potable water aquifers.
- The action would substantially alter the hydrology needed to sustain the functions and values of the affected wetland or any wetlands to which it is connected.
- The action would substantially reduce the affected wetland's ability to retain floodwaters or storm-associated runoff, thereby threatening public health, safety, or welfare.
- The action would adversely affect the maintenance of natural systems that support wildlife and fish habitat or economically important timber, food, or fiber resources in the area or surrounding wetlands.
- The action would be inconsistent with applicable state wetland strategies.

There are no wetlands present in the airport vicinity as the airport is located on a high, dry, desert plain. As previously discussed, the planned development on the east side of the airport is adjacent to the New River. Best management practices should be used during construction to mitigate any potential impacts.



Appendix E

AIRPORT PLANS

Appendix E

AIRPORT PLANS

Airport Master Plan
Glendale Municipal Airport

As part of this master plan, the Federal Aviation Administration (FAA) requires the development of several computer drawings detailing specific parts of the airport and its environs. These drawings were created on a computer-aided drafting system (CAD) and serve as the official depiction of the current and planned condition of the airport. These drawings will be delivered to the FAA for their review and inspection. The FAA will critique the drawings from a technical perspective to be sure all applicable federal regulations are met. The FAA will use the CAD drawings as the basis and justification for funding decisions.

It should be noted that the FAA requires any changes to the airfield (i.e., runway and taxiway system, etc.) be represented on the drawings. The landside configuration, developed during this master planning process, is also depicted on the drawings, but the FAA recognized that landside development is much more fluid and dependent upon developer needs. Thus, an updated drawing set is not necessary for future landside alterations.

The following is a description of the CAD drawings included with this master plan.

AIRPORT LAYOUT PLAN

An official Airport Layout Plan (ALP) drawing has been developed for Glendale Municipal Airport. The ALP drawing graphically presents the existing and ultimate airport layout plan. The ALP drawing includes such elements as the physical airport features, wind data tabulation, location of airfield facilities (i.e., runways, taxiways, navigational aids), and existing general aviation development (and commercial development for air carrier airports). Also presented on the ALP are the runway safety areas, airport property boundary, and revenue support areas. The ALP is used by the FAA to determine funding eligibility for future capital projects.

The computerized plan provides detailed information on existing and future facility layouts on multiple layers that permit the user to focus on any section of the airport at a desired scale. The plan can be used as base information for design and can be easily updated in the future to reflect new development and more detail concerning existing conditions as made available through design surveys.

LANDSIDE FACILITY DRAWING

The landside facility drawing is a larger scale plan view drawing of existing and planned aprons, buildings, hangars, parking lots, and other landside facilities. It is prepared in accordance with FAA AC 150/5300-13, *Airport Design*.

AIRSPACE DRAWING

Federal Aviation Regulation (F.A.R.) Part 77, *Objects Affecting Navigable Airspace*, was established for use by local authorities to control the height of objects near airports. The Part 77 Airspace Drawing included in this master plan is a graphic depiction of this regulatory criterion. The Part 77 Airspace Drawing is a tool to aid local authorities in determining if proposed development could present a hazard to aircraft using the airport. The Airspace Drawing can be a critical tool for the airport sponsor's use in planning against future development limitations.

The City of Glendale should do all in its power to ensure development stays below the Part 77 surfaces to protect the future role of the airport. The following discussion will describe those approach surfaces that make up the recommended F.A.R. Part 77 operations at Glendale Municipal Airport.

The Part 77 Airspace Drawing assigns three-dimensional imaginary areas to each runway. These imaginary surfaces emanate from the runway centerline and are dimensioned according to the visibility minimums associated with the approach to the runway end and size of aircraft to operate on the runway. The Part 77 imaginary surfaces include the primary surface, approach surface, departure surface,

transitional surface, horizontal surface, and conical surface. Part 77 imaginary surfaces are described as follows.

Primary Surface

The primary surface is an imaginary surface longitudinally centered on the runway. The primary surface extends 200 feet beyond each runway end. The elevation of any point on the primary surface is the same as the elevation along the nearest associated point on the runway centerline. Under Part 77 regulations, the width of the primary surface is 1,000 feet and it is centered on the runway.

Approach Surface

An approach surface is also established for the runway. The approach surface is the same width as the primary surface and begins at the primary surface end. The approach surface will extend upward and outward from the primary surface end and is centered along the extended runway centerline. The current and future approach slope to both runway ends extends to a distance of 10,000 feet and a width of 3,500 feet at a slope of 34:1.

Departure Surface

The departure surface is represented by a trapezoidal shape that slopes up and away from the runway pavement end at a 40:1 ratio. The purpose of the departure slope is to provide an added measure of safety for departing aircraft. The departure surface is only applicable at airports with instrument departure procedures in place such as Glendale Municipal Airport.

The departure surface begins at the end of the usable pavement, is 1,000 feet wide, and extends 10,200 feet to an ultimate width of 6,466 feet.

There are three recommended methods to mitigate penetrations to the departure surface:

1. The object is removed or lowered;
2. The Takeoff Distance Available (TODA) is decreased (i.e., pilots are instructed to lift-off prior to the runway end in order to avoid the obstruction);
3. Instrument departure minimums are raised.

Existing obstacles of 35 feet or less would not require the above mitigation methods; instead, new departure procedures may be introduced or existing departure procedures may be altered. Existing penetrations of greater than 35 feet require either object removal or TODA reduction (i.e., shorten the runway) to within the 35-foot threshold.

Transitional Surface

Each runway has a transitional surface that begins at the outside edge of the primary surface at the same elevation as the runway. The transitional surface also connects with the approach surfaces of each runway. The surface rises at a slope of 7:1, up to a height 150 feet above the highest runway elevation. At that point, the transitional surface is replaced by the horizontal surface.

Horizontal Surface

The horizontal surface is established at 150 feet above the highest elevation of the runway surface. Having no slope, the horizontal surface connects the transitional and approach surfaces to the conical surface at a distance of 10,000 feet from the end of the primary surfaces of each runway.

Conical Surface

The conical surface begins at the outer edge of the horizontal surface. The conical surface then continues for an additional 4,000 feet horizontally at a slope of 20:1. Therefore, at 4,000 feet from the horizontal surface, the elevation of the conical surface is 350 feet above the highest airport elevation.

INNER APPROACH SURFACE DRAWINGS

The Inner Portion of the Approach Surface Plan is a scaled drawing of the runway protection zone (RPZ), the runway safety area (RSA), the obstacle free zone (OFZ), and the object free area (OFA) for each runway end. A plan and profile view of each RPZ is provided to facilitate identification of obstructions that lie within these safety areas. Detailed obstruction and facility data is provided to identify planned improvements and the disposition of obstructions. A drawing of each runway end is provided.

AIRPORT PROPERTY/ BOUNDARY MAP

The Property Map provides information on the acquisition and identification of all land tracts under control of the airport. Easement interests in areas outside the fee property line are also included. The primary purpose of the drawing is to provide information for analyzing the current and future aeronautical use of land acquired with federal funds.

ON-AIRPORT LAND USE DRAWING

The Airport Land Use Drawing will be prepared in accordance with FAA standards. The on-airport land uses will be depicted by general use categories.

UPDATE THE PUBLIC AIRPORT DISCLOSURE MAP

The existing Public Airport Disclosure Map for the Glendale Municipal Airport will be updated to reflect new operational forecasts, noise contours, airfield facility changes, and changes to the airport traffic pattern airspace.

AIRPORT LAYOUT PLANS FOR THE GLENDALE MUNICIPAL AIRPORT Glendale, Arizona



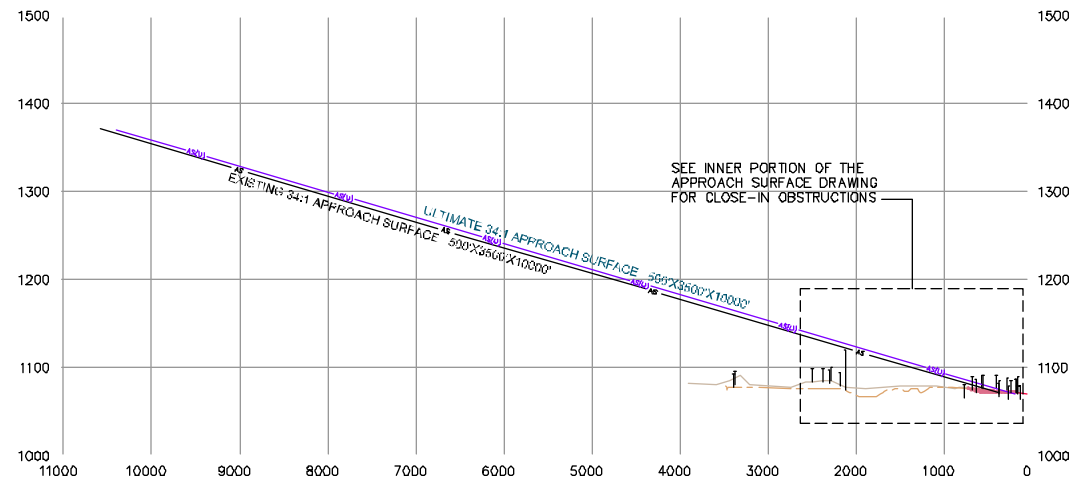
*Prepared for
the City of Glendale, Arizona*

DRAWING INDEX

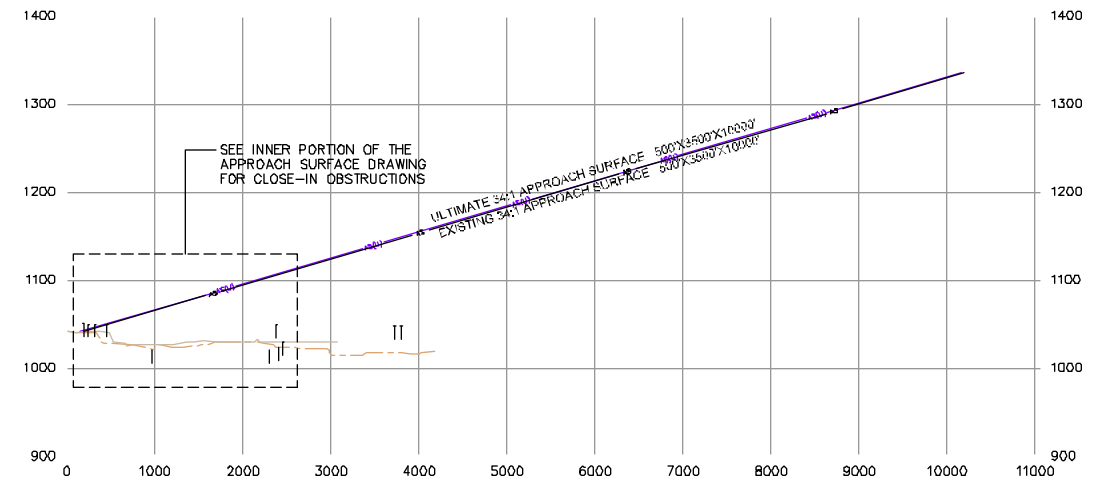
- COVER
1. AIRPORT LAYOUT DRAWING
 2. AIRPORT DATA SHEET
 3. TERMINAL AREA DRAWING
 4. AIRPORT AIRSPACE DRAWING
 5. APPROACH PROFILE DRAWING
 6. RUNWAY 1
INNER PORTION OF THE APPROACH SURFACE DRAWING
 7. RUNWAY 19
INNER PORTION OF THE APPROACH SURFACE DRAWING
 8. DEPARTURE SURFACE DRAWING
 9. AIRPORT LAND USE
 10. EXHIBIT "A" AIRPORT PROPERTY MAP

MAY 14, 2009

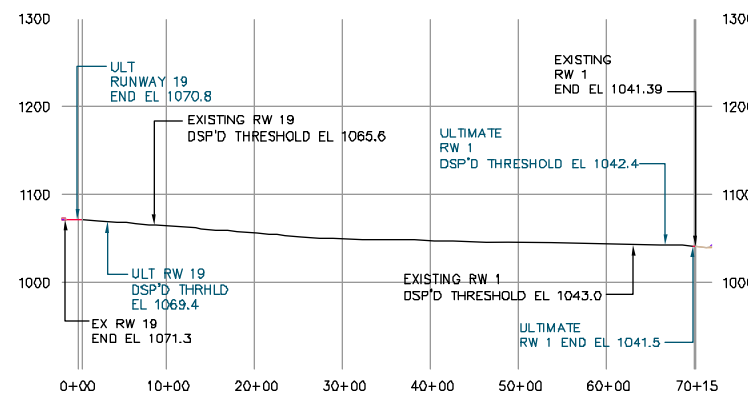




RUNWAY 19 PROFILE



RUNWAY 1 PROFILE



RUNWAY 1-19 PROFILE

GENERAL NOTES
 SEE INNER PORTION OF APPROACH SURFACE DRAWINGS FOR CLOSE-IN OBSTRUCTIONS
 ALL DISTANCE MEASUREMENTS IN FEET

EXISTING RUNWAY 19 OBSTRUCTION TABLE						
No.	Description	Top Elevation	Distance from Exist RW End	Offset from RW Centerline	34:1 A pp Penetration	Proposed Remediation
	NONE FOUND					

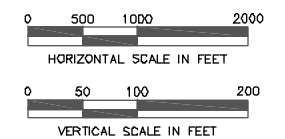
EXISTING RUNWAY 1 OBSTRUCTION TABLE						
No.	Description	Top Elevation	Distance from Exist RW End	Offset from RW Centerline	34:1 A pp Penetration	Proposed Remediation
	NONE FOUND					

ULTIMATE RUNWAY 19 OBSTRUCTION TABLE						
No.	Description	Top Elevation	Distance from Exist RW End	Offset from RW Centerline	34:1 A pp Penetration	Proposed Remediation
	NONE FOUND					

ULTIMATE RUNWAY 1 OBSTRUCTION TABLE						
No.	Description	Top Elevation	Distance from Exist RW End	Offset from RW Centerline	34:1 A pp Penetration	Proposed Remediation
	NONE FOUND					



MAGNETIC DECLINATION
 11° 19' E (NOVEMBER 2008)
 ANNUAL RATE OF CHANGE
 0° 6' W (NOVEMBER 2008)



No.	REVISIONS	DATE	BY	APP'D

GLENDALE MUNICIPAL AIRPORT

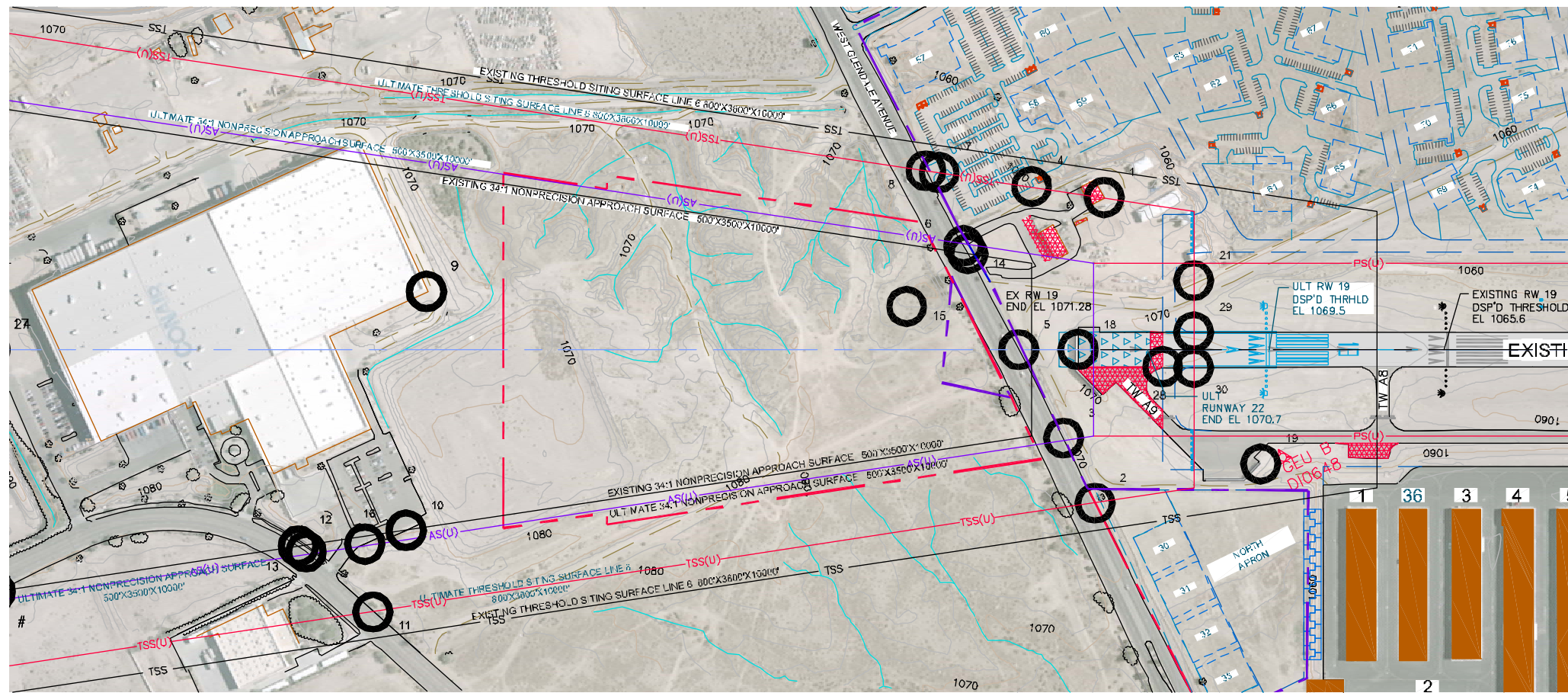
APPROACH PROFILE DRAWING

GLENDALE, ARIZONA

PLANNED BY: Patrick J. Talar
 DETAILED BY: Chris L. Boske
 APPROVED BY: James V. Lane

Coffman Associates
 Airport Consultants
www.coffmanassociates.com

MAY 2009 **SHEET 5** OP 10



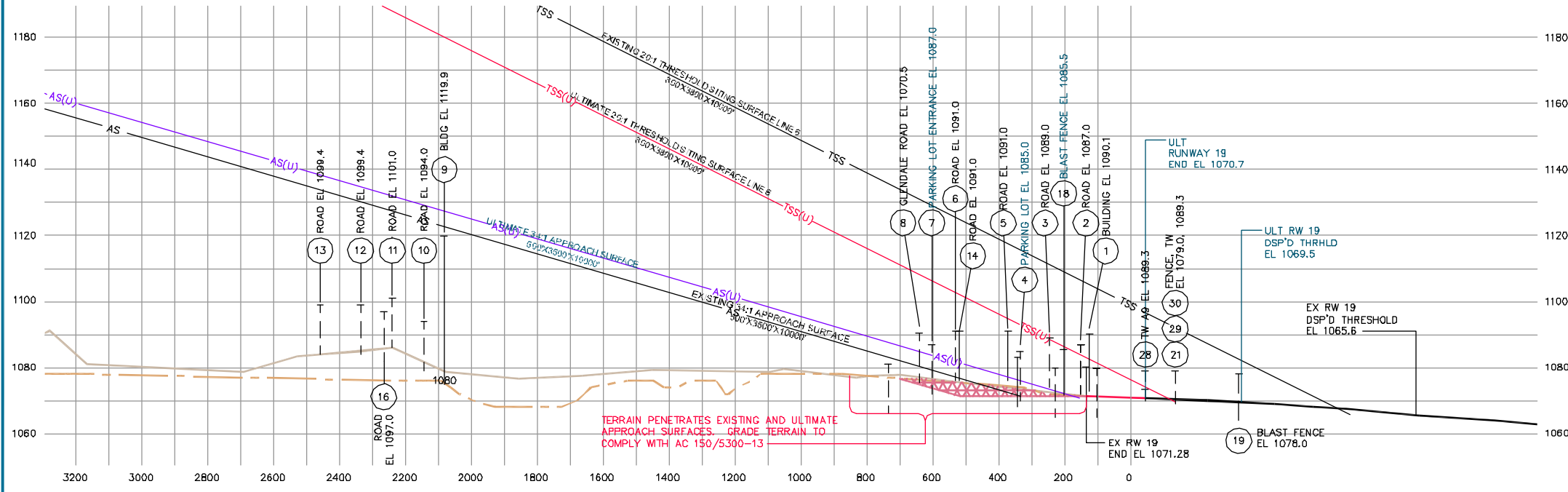
RUNWAY 19 PLAN

EXISTING RUNWAY 19 OBSTRUCTION TABLE							
No.	Description	Top Elevation	Distance from Exist RW End	Offset from RW Centerline	34:1 A pp Penetration	20:1 TSS Penetration	Proposed Remediation
5	GLENDALE AVE	1091.0	237	0	24.0	NONE	REQUEST AERONAUTICAL STUDY
14	GLENDALE AVE	1091.0	384	278 L	14.0	NONE	CLEAR 20:1 TSS NO ACTION REQUIRED
15	TERRAIN	VARIABLES SEE PROFILE VIEW	VARIABLES SEE PROFILE VIEW	VARIABLES	1-18.3	NONE	GRADE TERRAIN TO COMPLY WITH AC 150/5300-13

ULTIMATE RUNWAY 19 OBSTRUCTION TABLE							
No.	Description	Top Elevation	Distance from Ult RW End	Offset from RW Centerline	34:1 A pp Penetration	20:1 TSS Penetration	Proposed Remediation
1	BLDG	1090.1	169	440 L	NA	5	TO BE REMOVED
2	GLENDALE AVE	1091.0	196	444 R	NA	1	REQUEST AERONAUTICAL STUDY
5	GLENDALE AVE	1091.0	417	0	14	NONE	CLEAR 20:1 TSS NO ACTION REQUIRED
6	GLENDALE AVE	1091.0	577	301 L	9	NONE	CLEAR 20:1 TSS NO ACTION REQUIRED
14	GLENDALE AVE	1091.0	564	278 L	10	NONE	CLEAR 20:1 TSS NO ACTION REQUIRED

GENERAL NOTES

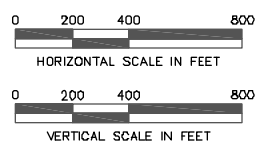
- ELEVATIONS ADJUSTED UPWARD 10' FOR PRIVATE ROAD, 15' FOR PUBLIC ROADWAY, 17' FOR INTERSTATE HIGHWAY, 23' FOR RAILROADS
- OFFSETS ARE DESCRIBED RIGHT OR LEFT OF THE RUNWAY CENTERLINE AS SEEN BY A PILOT APPROACHING THE RUNWAY TO LAND
- ALL DISTANCE MEASUREMENTS IN FEET.



RUNWAY 19 PROFILE



MAGNETIC DECLINATION
11° 21' E (JULY 2008)
ANNUAL RATE OF CHANGE
0° 6' W (JULY 2008)



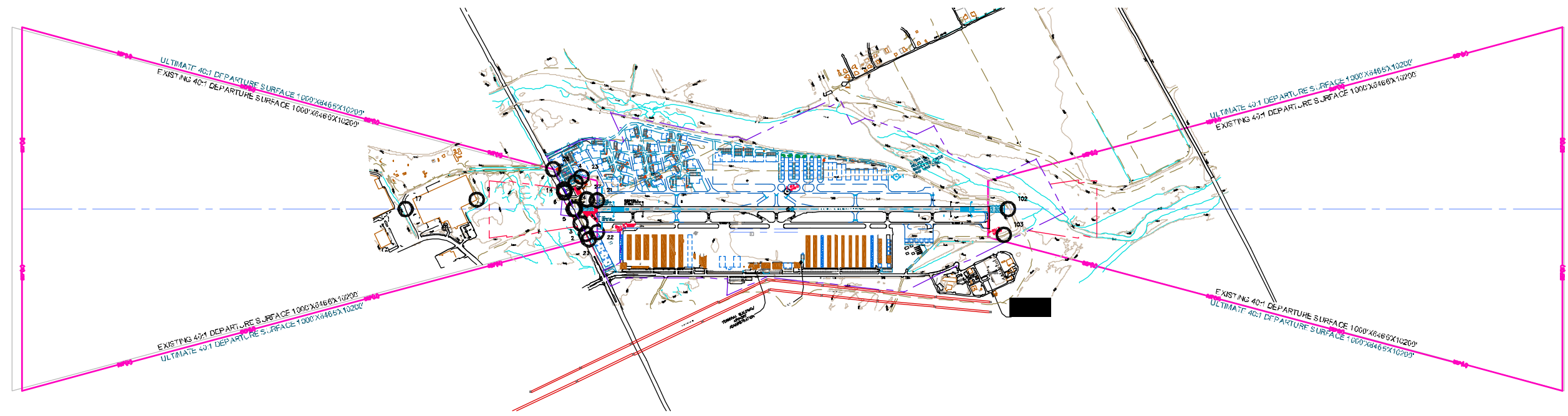
**GLENDALE MUNICIPAL AIRPORT
RUNWAY 19 INNER PORTION
OF THE APPROACH SURFACE
GLENDALE, ARIZONA**

PLANNED BY: Patrick C. Taylor
DETAILED BY: Patrick C. Taylor
APPROVED BY: [Signature]

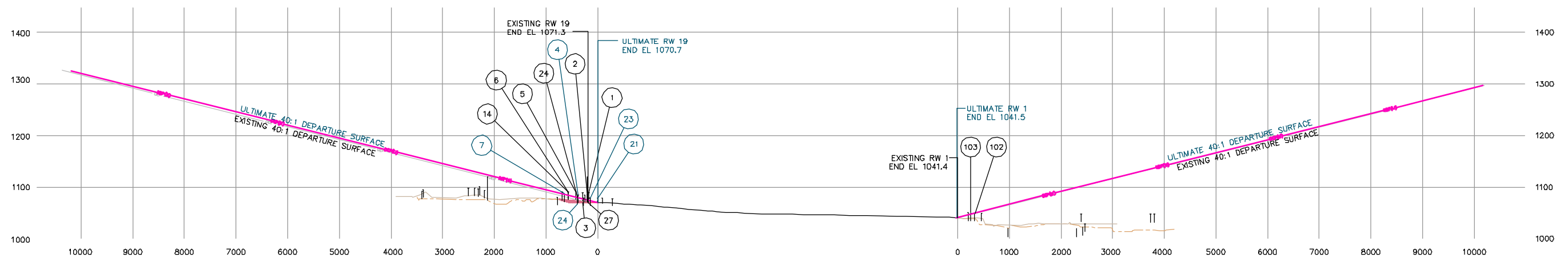
Coffman Associates
Airport Consultants
www.coffmanassociates.com

No.	REVISIONS	DATE	BY	APP'D.

Coffman Associates, Inc. \CASA\CAD Files\CAD\Projects\MPA\GCU\RUNWAY 19.dwg Printed Date: 6-28-09 08:45:32 AM daniel@cs



RUNWAY 19 PLAN



RUNWAY 19 PROFILE

RUNWAY 19'S EXISTING DEPARTURE SURFACE TABLE						
No.	Description	Los Elevation	Distance from L/R RW End	Offset from Centerline	Penetration	Remediation
2	GLENDALE ROAD	1087	16	444 R	15	NO ACTION REQUIRED
3	GLENDALE ROAD	1089	110	256 R	15	NO ACTION REQUIRED
5	GLENDALE ROAD	1091	237	0	14	NO ACTION REQUIRED
6	GLENDALE ROAD	1091	397	301 L	10	NO ACTION REQUIRED
14	GLENDALE ROAD	1091	384	278 L	10	NO ACTION REQUIRED
24	FENCE	1050	354	0	3	NO ACTION REQUIRED
27	PERIMETER FENCE	1080	0	171 L	9	NO ACTION REQUIRED

* OBJECTS PENETRATE DEPARTURE SURFACE BY LESS THAN 35'

RUNWAY 19'S EXISTING DEPARTURE SURFACE TABLE						
No.	Description	Los Elevation	Distance from L/R RW End	Offset from Centerline	Penetration	Remediation
101	PERIMETER ROAD	1051	200	147 R	5	NO ACTION REQUIRED
102	PERIMETER ROAD	1050	329	0	< 1	NO ACTION REQUIRED
103	PERIMETER ROAD	1050	254	458 L	2	NO ACTION REQUIRED

* OBJECTS PENETRATE DEPARTURE SURFACE BY LESS THAN 35'

RUNWAY 19'S ULTIMATE DEPARTURE SURFACE TABLE						
No.	Description	Los Elevation	Distance from U/L RW End	Offset from Centerline	Penetration	Remediation
101	PERIMETER ROAD	1051	200	147 R	5	NO ACTION REQUIRED
103	PERIMETER ROAD	1050	289	458 L	< 1	NO ACTION REQUIRED

* OBJECTS PENETRATE DEPARTURE SURFACE BY LESS THAN 35'

RUNWAY 19'S ULTIMATE DEPARTURE SURFACE TABLE						
No.	Description	Los Elevation	Distance from U/L RW End	Offset from Centerline	Penetration	Remediation
1	PARKING LOT	1090	169	440 L	15	NO ACTION REQUIRED
2	GLENDALE ROAD	1087	198	444 R	11	NO ACTION REQUIRED
3	GLENDALE ROAD	1089	290	256 R	11	NO ACTION REQUIRED
4	ULT PARKING LOT	1085	380	472 L	5	NO ACTION REQUIRED
5	GLENDALE ROAD	1091	417	0	10	NO ACTION REQUIRED
6	GLENDALE ROAD	1091	577	301 L	6	NO ACTION REQUIRED
7	ULT PARKING LOT	1087	649	512 L	< 1	NO ACTION REQUIRED
14	GLENDALE ROAD	1091	564	278 L	8	NO ACTION REQUIRED
21	PERIMETER FENCE	1079	254	458 L	5	TO BE REMOVED
23	GLENDALE ROAD	1080	292	540 R	2	NO ACTION REQUIRED
27	PERIMETER FENCE	1080	180	171 L	5	NO ACTION REQUIRED

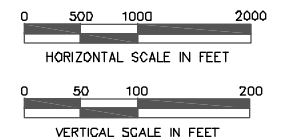
* OBJECTS PENETRATE DEPARTURE SURFACE BY LESS THAN 35'

GENERAL NOTES:

- HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83; VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88 AS SHOWN FOR RUNWAY ELEVATIONS. FROM ASIS DATASHEET SYSTEMS, <http://avnwww.jccbl.gov/datasheet/>
- ELEVATIONS ADJUSTED UPWARD 10' FOR A PRIVATE ROAD, 15' FOR PUBLIC ROADWAY, 17' FOR INTERSTATE HIGHWAY, 23' FOR RAILROADS PER PART 77-OBJECTS AFFECTING NAVIGABLE AIRSPACE, SUBPART C, SECTION 77.23.
- OFFSETS ARE DESCRIBED RIGHT OR LEFT OF THE RUNWAY CENTERLINE AS SEEN BY A PILOT APPROACHING THE RUNWAY TO LAND.
- ALL DISTANCE MEASUREMENTS IN FEET.
- ULTIMATE DEVELOPMENT ELEVATIONS ARE ESTIMATES AND CONTINGENT UPON DEVELOPMENT, APPROVAL, IMPLEMENTATION AND CONSTRUCTION OF AN ENGINEERED DESIGN OF THE ULTIMATE PLAN AS PROPOSED BY THIS ALP.



MAGNETIC DECLINATION
11° 19' E (NOVEMBER 2008)
ANNUAL RATE OF CHANGE
0° 6' W (NOVEMBER 2008)



**GLENDALE MUNICIPAL AIRPORT
DEPARTURE SURFACE DRAWING**

GLENDALE, ARIZONA

PLANNED BY: Patrick C. Taylor
DETAILED BY: Daniel A. Decker
APPROVED BY: James M. Adams

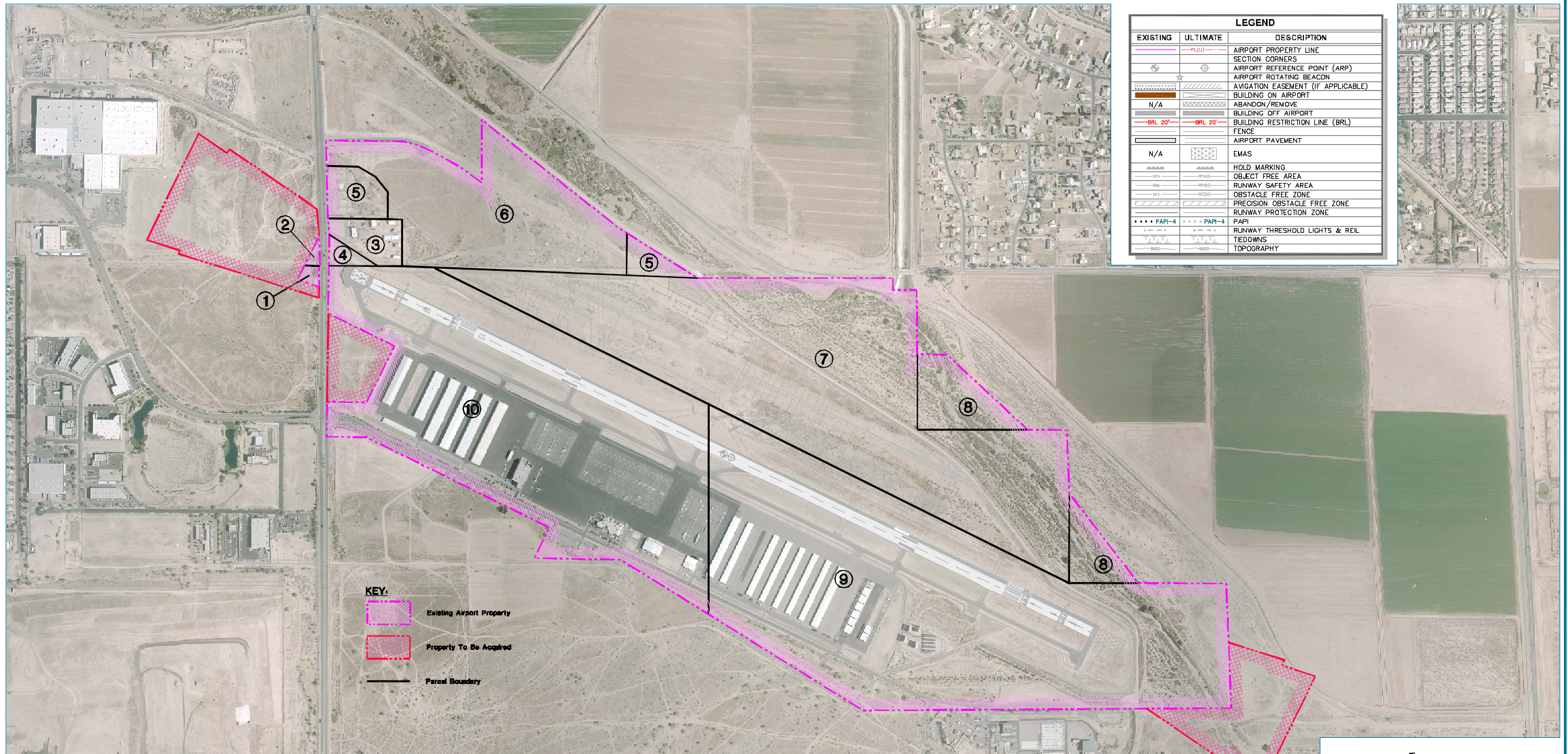
No.	REVISIONS	DATE	BY	APP'D.

THE CONTENTS OF THIS PLAN DO NOT NECESSARILY REFLECT THE OFFICIAL NEWS OR POLICY OF THE FAA OR ADOT AERONAUTICS. ACCEPTANCE OF THIS DOCUMENT BY THE FAA AND ADOT AERONAUTICS DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES OR STATE OF ARIZONA TO PARTICIPATE IN ANY DEVELOPMENT EXPECTED HEREON NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS.



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EXISTING	ULTIMATE	DESCRIPTION
---	PL(U)---	AIRPORT PROPERTY LINE
+	+	SECTION CORNERS
+	+	AIRPORT REFERENCE POINT (ARP)
+	+	AIRPORT ROTATING BEACON
---	---	AVIGATION EASEMENT (IF APPLICABLE)
N/A	---	BUILDING ON AIRPORT
N/A	---	ABANDON/REMOVE
N/A	---	BUILDING OFF AIRPORT
---	---	BUILDING RESTRICTION LINE (BRL)
---	---	FENCE
---	---	AIRPORT PAVEMENT
N/A	---	EMAS
---	---	HOLD MARKING
---	---	OBJECT FREE AREA
---	---	RUNWAY SAFETY AREA
---	---	OBSTACLE FREE ZONE
---	---	PRECISION OBSTACLE FREE ZONE
---	---	RUNWAY PROTECTION ZONE
---	---	PAPI
---	---	RUNWAY THRESHOLD LIGHTS & REIL
---	---	TIEDOWNS
---	---	TOPOGRAPHY

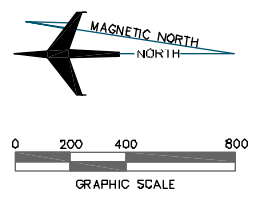
KEY:

	Existing Airport Property
	Property To Be Acquired
	Parcel Boundary

RECORDING INFORMATION (County Assessor - Mohave County, Arizona.)

Parcel	Owner	Acreage	Date Recorded	Recording Information	Grantor/Method	Notes	Parcel	Owner	Acreage	Date Recorded	Recording Information	Grantor/Method	Notes
1	City of Glendale, AZ	±0.36	10/15/1984	Maricopa County Official Records Parcel #142-75-006-F Deed #840448062	City of Glendale Donated	Special Warranty Deed	8	City of Glendale, AZ	±18.76	04/15/1987	Maricopa County Official Records Parcel #102-59-009-B, 102-59-010-J & K Deed #870230453	Condemnation FAA Grant	---
2	City of Glendale, AZ	±0.27	10/15/1984	Maricopa County Official Records Parcel #142-58-003-G Deed #840448063	City of Glendale Donated	Special Warranty Deed	9	City of Glendale, AZ	±160.87	12/29/1983	Maricopa County Official Records Parcel #102-59-008-N & Y Deed #830522846	John F. Long FAA & ADOT Grant	Warranty Deed
3	City of Glendale, AZ	±4.84	04/21/2007	Maricopa County Official Records Parcel #102-60-003-K,N,P&T Deed #070507933	Condemnation FAA Grant	---	10	City of Glendale, AZ	±124.24	12/29/1983	Maricopa County Official Records Parcel #102-59-001-W Deed #830522847	John F. Long Donated	Warranty Deed
4	City of Glendale, AZ	±1.20	07/09/1984	Maricopa County Official Records Parcel #102-60-003-Q Deed #840287785	Riviera Chemical Co. FAA Grant	Warranty Deed	Total Acreage ± 614.80						
6	City of Glendale, AZ	±7.32	07/22/1999	Maricopa County Official Records Parcel #102-60-003-S, 102-60-021 & 102-60-023 Deed #980891439	Condemnation FAA Grant	---							
8	City of Glendale, AZ	±41.62	02/23/1999	Maricopa County Official Records Parcel #102-60-003-Q Deed #030747223	Condemnation Purchased	---							
7	City of Glendale, AZ	±155.20	07/09/1984	Maricopa County Official Records Parcel #102-59-001-V & U, 102-59-008-P & F Deed #840286588	John F. Long Donated	Warranty Deed							

Please note: The total acreage shown in this table is the cumulative sum of the above described parcels, whose individual acreages were obtained from legal description and other legal documents by Maricopa County Arizona.



GLENDALE MUNICIPAL AIRPORT
EXHIBIT "A"
AIRPORT PROPERTY MAP
 GLENDALE, ARIZONA

PLANNED BY: Patrick C. Fair
 DETAILED BY: Faye L. Rydholm/ Maura Baur
 APPROVED BY: James M. Harte



No.	REVISIONS	DATE	BY	APP'D.



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