Marana Regional Airport

Airport Master Plan

Final Draft

Prepared for

Town of Marana, Arizona

By

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In association with

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Chapter 1 – Marana Regional Airport Master Plan Overview

1.1 Introduction

The 2010 Town of Marana General Plan includes a strategic vision for the community - New Focus, New Thinking, New Direction. This fresh perspective and vision will also be used in preparation of the Airport Master Plan for the Marana Regional Airport. Once completed, the Airport Master Plan will ensure future airport development is designed to improve air and ground operations and enhance safety and airport services for the Town, as well as the public users of the airport.

1.2 Purpose

An airport master plan describes and depicts the overall concept for the long-term development of an airport. It presents the concepts graphically in the airport layout plan (ALP) drawing set, and also within a detailed and well thought out narrative report. The goal of the plan is to provide direction for future airport development that will satisfy aviation demand in a financially feasible manner and meet the needs of the Town of Marana with respect to the airport. This Airport Master Plan updates and replaces the September 2007 Airport Master Plan.

1.3 Objectives

The primary objectives of an airport master plan are to produce an attainable phased development plan that will satisfy the airport needs in a safe, efficient, economical, and environmentally sound manner. The plan serves as a guide to decision makers, airport users, and the general public for implementing airport development actions while considering the Town's goals and objectives. There are a number of objectives that the Town of Marana would like to achieve as a result of this Airport Master Plan for the Marana Regional Airport.

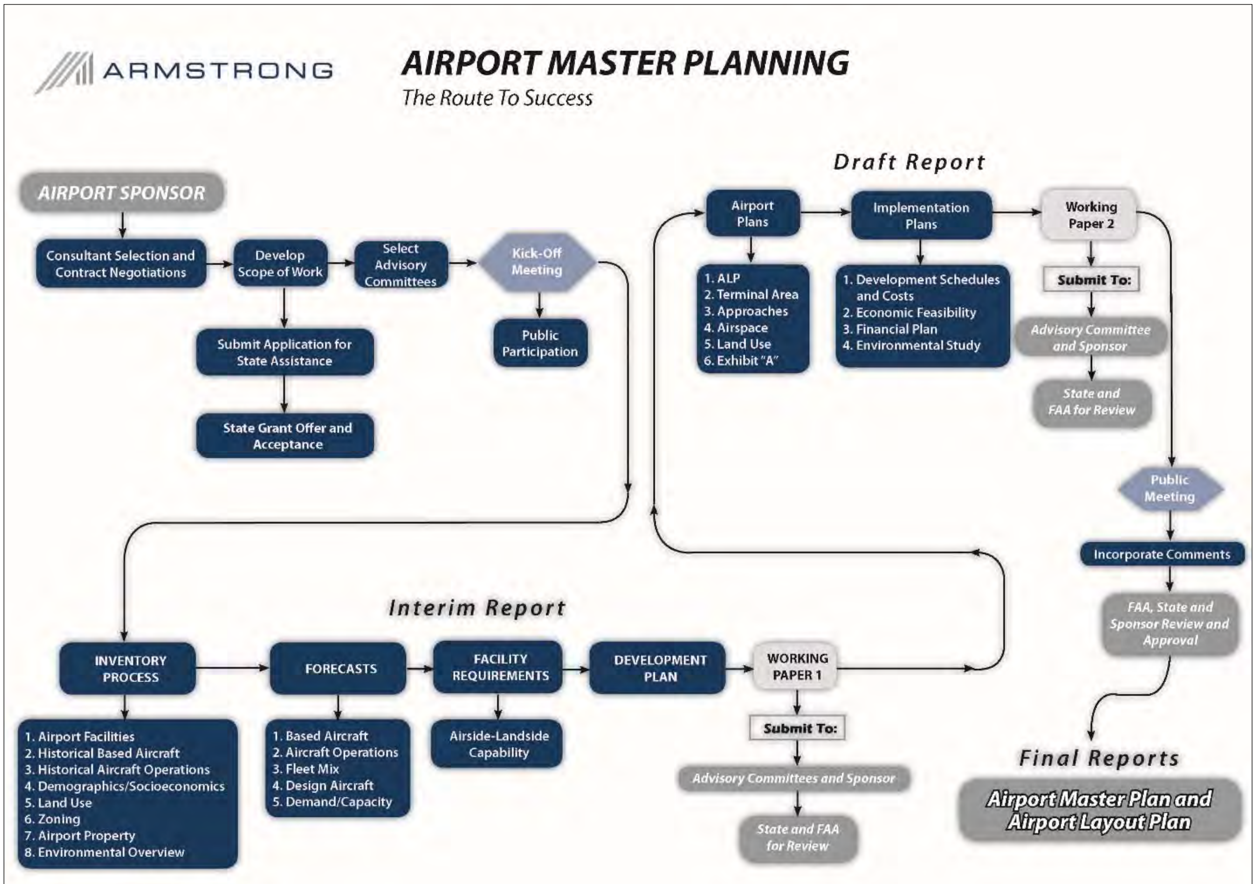
Specific goals and objectives of the project include, but are not limited to:

- Capture the issues that will determine proposed development;
- Justify the proposed development through the technical, economic, and environmental investigation of concepts and alternatives;
- Provide an effective graphic presentation of the proposed development and anticipated land uses in the vicinity of the airport;
- Establish a realistic timeframe for the implementation of the development proposed in the plan, particularly the short-term capital improvement program;
- Propose a realistic and achievable financial plan to support the prioritized implementation schedule;
- Provide sufficient project definition and detail for subsequent environmental evaluations that may be required before a project is approved;

- Present a plan that adequately addresses the issues and satisfies local, state, and Federal regulations;
- Document policies and future aeronautical demand to support municipal or local deliberations on spending, debt, land use controls, and other policies necessary to preserve the integrity of the airport and its surroundings;
- Set the stage and establish the framework for a continuing planning process that will monitor key activities and permit changes to the plan recommendation as required; and
- Review existing land uses surrounding the airport for compatibility and control.

1.4 Airport Master Plan Process and Schedule

Airport planning takes place at the national, state, regional, and local levels. These plans are formulated on the basis of overall transportation demands and are coordinated with other transportation planning and comprehensive land use planning. The National Plan of Integrated Airport Systems (NPIAS) is a ten-year plan updated biennially and published by the Federal Aviation Administration (FAA). The NPIAS lists developments at public use airports that are considered to be of national interest and thus eligible for financial assistance for airport planning and development under the Airport and Airway Improvement Act of 1982. Statewide Integrated Airport Systems Planning (SIASP) identifies the general location and characteristics of new airports and the general expansion needs of existing airports to meet statewide air transportation goals. This planning is performed by state transportation or aviation planning agencies. Regional Integrated Airport Systems Planning (RIASP) identifies airport needs for a large regional or metropolitan area. Needs are stated in general terms and incorporated into statewide systems plans. Airport master plans and ALPs are prepared by the operators of individual airports and are usually completed with the assistance of consultants. The Town of Marana completed this Airport Master Plan with the assistance of Armstrong Consultants, Inc. The last airport master plan was completed in September 2007. The airport master plan process involves collecting readily available data, forecasting future aviation demand, determining facility requirements, studying various alternatives, and developing plans and schedules. **Figure 1-1** depicts the steps in the airport master plan process. This process takes into consideration the needs and concerns of the airport sponsor, airport tenants and users, as well as the general public.



Source: Armstrong Consultants, Inc., 2015

Figure 1-1 Airport Master Plan Flow Diagram

1.5 Advisory Committees

As a part of the planning process, the airport master plan established two advisory committees to assist with the overall future development plan for Marana Regional Airport. The Planning Advisory Committee (PAC) provided high-level guidance and advice on development plans for the future of the airport. The Technical Advisory Committee (TAC) consisted of members representing various interests in and around the airport who were very familiar with the airfield and who were able to provide technical guidance and suggestions in more detail. Both committees' involvement throughout this Airport Master Plan process helped to keep interested parties informed and fostered consensus for future development actions. Representatives for both committees are shown in **Table 1-1**.

Table 1-1 Marana Regional Airport Master Plan PAC/TAC Committee Members

Name	Title	Affiliation	PAC	TAC
Steve Miller	Airport Manager	Town of Marana	X	X
Curt Woody	Economic Development Manager	Town of Marana	X	
Galen Beem	Airport Operations Coordinator	Town of Marana		X
Jamsheed Mehta	Deputy Town Manager	Town of Marana	X	X
Erik Montague	Finance Director	Town of Marana		
Keith Brann	Director of Engineering	Town of Marana		X
Shannon Shula	Planner	Town of Marana	X	X
Ryan Benavides	Public Works Director	Town of Marana	X	
Morris Reyna	Construction Division Manager	Town of Marana		X
Jennifer Christelman	Engineering Division Manager	Town of Marana		X
Heath Vescovi-Chiordi	Management Assistant	Town of Marana	X	
Toby Parks	Tourism and Marketing Manager	Town of Marana	X	
Lisa Shafer	Director of Community Development	Town of Marana	X	
Kyler Erhard	Community Planner	FAA	X	X
Brad Davis	Engineer	FAA	X	X
Scott Driver	Airport Grants Manager	ADOT Aeronautics	X	X
Michael Ostermeyer	Airspace Manager/Aviation Safety Officer	Arizona Army National Guard		X
Lt. Col. Chad Smith	State Aviation Officer	Arizona Army National Guard		X
Ron Anders	Director of Maintenance	Tucson Aeroservice Center	X	
Don Kriz	Engineer	DOWL	X	X
Victor Palma	Engineer	DOWL	X	X
Peter Barbier	Director of Operations	Tucson Aeroservice Center	X	
Ed Stolmaker	President/CEO	Marana Chamber of Commerce	X	
Lt. Col. David Stine	Airspace Manager	Arizona Air National Guard – 162nd Fighter Wing		X
Tim Bolton	Principal Planner	AZ State Land Department		X
Stuart Rodeffer	Battalion Chief	Northwest Fire District		X
Bruce Hensel	Lead Pilot	LifeNet		X
Mike Matthews	Owner/Flight Instructor -CFII	Marana Flight School		X
Dr. Allen Aven	Pilot	Retired Physician	X	
Jim Petty	Airport Manager	Pinal Airpark	X	
Mike McDougall	Owner	Fighting Classics	X	
Gary Abrams	President/CEO	Tucson Aeroservice Center	X	
Jaime Brown	Senior Transportation Planner	Pima Association of Governments	X	
Bill Muszala	Owner	ATW Aviation, Inc.	X	

Source: Armstrong Consultants, Inc., 2015

Chapter 2 – Inventory of Airport Assets

2.1 Airport History and Ownership

Marana Regional Airport (the Airport) was built during World War II by the U.S. Army as part of a system of auxiliary airfields to Pinal Airpark (originally Marana Airbase). The Airport was formerly known as Avra Valley Airport and also Marana Auxiliary No.2[1]. Primarily a flight training base for military aviators during World War II, Pinal Airpark also served as the home base for operations. The related system of auxiliary fields acted as remote facilities to alleviate flight congestion at Pinal Airpark.

A businessman from Tucson leased the Airport in 1968 from the Bureau of Land Management (BLM) and reactivated it for personal and public use. He subsequently formed Avra Air to operate the Airport. In 1974, the BLM authorized the assignment of the original lease from Avra Air to Pima County which in turn maintained it as a public-use airport. In 1982, Pima County acquired fee simple interest in the Airport. In 1999, a master plan was prepared for the Avra Valley Airport. Later in 1999, the Airport was purchased by the Town of Marana and renamed the Marana Regional Airport. The Town of Marana currently owns and maintains the Airport.

2.2 Airport Service Levels and ASSET Category

2.2.1 Federal Service Level

Since 1970, the FAA has classified a subset of the 5,400 public-use airports in the United States as being vital to serving the public needs for air transportation, either directly or indirectly, and therefore may be made eligible for federal funding to maintain their facilities. These airports are classified within the National Plan of Integrated Airport Systems (NPIAS), where the airport service level reflects the type of public use the airport provides. The service level also reflects the funding categories established by Congress to assist in airport development.

The categories of airports listed in the NPIAS are:

- **Commercial Service** – These are public airports that accommodate scheduled air carrier service provided by the world's certificated air carriers. Commercial service airports are either:
  - Primary – a public-use airport that enplanes more than 10,000 passengers annually, or
  - Non-primary - a public-use airport that enplanes between 2,500 and 10,000 passengers annually.
- **Reliever** – This is an airport designated by the FAA as having the function of relieving congestion at a commercial service airport by providing more general aviation access. These airports comprise a special category of general aviation (GA) airports and are generally located within a relatively short distance of primary airports. Privately owned airports may also be identified as reliever airports.

[1] Marana Regional Airport Master Plan, September 2007

- **General Aviation** – These are public airports that do not have scheduled service, or have scheduled service with less than 2,500 passenger enplanements per year.

According to the Report of the Secretary of Transportation to the United States Congress on the National Plan of Integrated Airport Systems (NPIAS) 2015-2019, dated September 2014, there are 3,331 existing NPIAS airports and 14 proposed airports that are anticipated to open within the 5-year period covered by this report.

Arizona has a total of 59 airports included in the NPIAS according to the Report to the US Congress. The Marana Regional Airport is also one of eight airports in the state classified as a Reliever airport. To be eligible for reliever designation, an airport must be open to the public, have 100 or more based aircraft, or have 25,000 annual itinerant operations. All of the reliever airports in Arizona are publicly owned. The existing 264 reliever airports in the NPIAS have an average of 177 based aircraft, which in total represent 23 percent of the Nation's general aviation fleet according to the Report to the US Congress.

2.2.2 Federal ASSET Category

In 2010, the FAA began examining the roles general aviation plays in our national airport system. At the time, general aviation airports had not been thoroughly studied at the national level for more than 40 years. The original report identified 497 unclassified airports that did not fit into one of the newly established categories and for which a separate category could not be defined. As a result, the FAA initiated a follow-on initiative known as ASSET 2 which began in early 2013. The results of ASSET 2 concluded that 212 of the original 497 unclassified airports met the criteria for inclusion as regional, local, or basic.

The new ASSET categories are:

- **National –** Supports the national and state system by providing communities with access to national and international markets in multiple states and throughout the United States.
- **Regional –** Supports regional economies by connecting communities to statewide and interstate markets.
- **Local –** Supplements local communities by providing access primarily to intrastate and some interstate markets.
- **Basic –** Supports general aviation activities such as emergency service, charter or critical passenger service, cargo operations, flight training and personal flying.

In Arizona, there are two airports in the national category, 10 in the regional, 18 in the local, and 17 in the basic. Two NPIAS airports remain unclassified. The Marana Regional Airport is one of 10 regional airports classified in the new ASSET categories.

2.2.3 State Service Level

At the State level, the Arizona Department of Transportation Multi-modal Planning Division – Aeronautics Group has long recognized the importance of planning as a proactive approach to ensuring aviation continues its role in the statewide transportation system. They created a similar plan to the FAA's NPIAS in 1978 called the Arizona State Airports System Plan (ASASP). The purpose of the ASASP is to provide a framework for the integrated planning, operation, and development of Arizona's aviation assets. The most current version of the ASASP was published in 2008.

The ASASP concluded that five airport roles best meet the needs of Arizona. The five airport roles are defined as follows:

- **Commercial Service Airports –** Publicly owned airports which enplane 2,500 or more passengers annually and receive scheduled passenger air service.
- **Reliever Airports –** FAA-designated airports that relieve congestion at a commercial service airport.
- **GA-Community Airports -** Airports that serve regional economies, connecting to state and national economies, and serve all types of general aviation aircraft.
- **GA-Rural Airports –** Airports that serve a supplemental role in local economies, primarily serving smaller businesses, recreational, and personal flying.
- **GA-Basic –** Airports that serve a limited role in the local economy, primarily serving recreational and personal flying.

Marana Regional Airport is categorized as a Reliever airport. There are a total of 82 airports included in the ASASP. The Airport is also one of eight reliever airports in Arizona.

2.2.4 Regional Service Level

The Pima Association of Governments (PAG) prepared a Regional Aviation System Plan (RASP) in 2002 for eight airports in the region. The RASP classifies airports as either Level I or Level II. Level I airports should be able to accommodate a full range of business/corporate general aviation aircraft. Level II airports should be able to accommodate all single-engine and small twin-engine general aviation aircraft. According to the RASP, Marana Regional Airport is one of four public-use airports classified as a Level I airport. It should be noted that since Davis-Monthan AFB does not play a role within the Regional System, in terms of satisfying general aviation needs, it was not included in the classification of airports in the region.

In reviewing the various service levels, ASSET categories, and classifications from the Federal, State, and regional perspectives, they all appear to accurately describe the role Marana Regional Airport plays in the country, state, region, and the local community.

2.3 Aeronautical Activities

The aircraft using the Airport are predominately single-engine piston, multi-engine piston, turbo-prop, light turbo-jet, and rotorcraft. On occasion, large corporate jets such as the Gulfstream V and Bombardier Global Express also use the airport. The role of a general aviation reliever airport lends itself to specific aeronautical activities. The types of aeronautical activities found at the Airport include the following:

- **Business Transportation** - Business aviation users must travel to or from commerce centers to conduct activities in a single day, usually without requiring an overnight stay or extensive ground travel time. This includes travel by state and federal government agency officials. Generally, single-engine and multi-engine piston or turbo-prop aircraft are used by local or small business travelers; large corporations may utilize a wide variety of jet aircraft.

- **Recreational and Tourism** – This category includes transient pilots and passengers flying into the region to visit recreational and tourist attractions. Single-engine piston aircraft are the most common aircraft used within this category; however, a small percentage of multi-engine piston or turbo-prop aircraft may be used. Other types of aircraft in this category include home-built, experimental aircraft, gliders, and ultralights.
- **Flight Training** - Local and itinerant flights conducted in order to meet flight proficiency requirements for obtaining FAA pilot certifications are included in this category. These flights include touch-and-go operations, day and night local and cross-country flights, and practice instrument approach procedures. The most common aircraft operating in this category include single- or multi-engine piston or turbo-prop aircraft.
- **Military** - Military operations are those conducted by U.S. or foreign military aircraft and personnel for the purposes of national security and defense. Almost all military operations are training or proficiency activities. A wide range of aircraft may be used for these operations, including multi-engine piston or turbo-prop, turbo-jet, jet, or rotary.
- **Air Medevac Services** – Air medical evacuation (medevac) services provide essential emergency medical transportation for life threatening situations and assists in patient transfers by air to higher level care facilities using both fixed-wing and helicopters. The most common aircraft operated in this category include turbine-engine rotorcrafts and multi-engine piston or turbo-prop aircraft. Lifenet is an air medevac company who currently has a base on the Airport.

2.4 Airport Setting

Marana is located approximately 15 miles northwest of the City of Tucson. The Town of Marana is located in Pima County. The County covers a total area of 9,189 square miles and contains five incorporated cities. The elevation in the County ranges from 1,200 feet to the peak of Mount Lemmon at 9,185 feet above mean sea level (MSL). Approximately 15 percent of the population of Arizona resides in Pima County[2].

The Marana Regional Airport encompasses approximately 570 acres and is located at an elevation of 2,031 feet MSL. The Airport is located off of Avra Valley Road, which is approximately 11 miles west of Interstate 10 (I-10). The geographic location of the Airport is depicted in **Figure 2-1**.

[2] According to the U.S. Census Quick Facts 2014 population estimates for Arizona and Pima County.

Source: Google Earth, 2015

Figure 2-1 Marana Regional Airport Location Map

2.5 Compatible Land Use

Land use compatibility conflicts are a common problem around many airports, including smaller general aviation facilities. In urban areas, as well as some rural settings, airport owners find that essential expansion to meet the demands of airport traffic is difficult to achieve due to the nearby development of incompatible land uses. Aircraft noise is generally a deterrent to residential development and other noise sensitive uses. In accordance with State of Arizona airport compatibility legislation, residential development should be placed outside of the 65 day-night average sound level (DNL) noise contour.

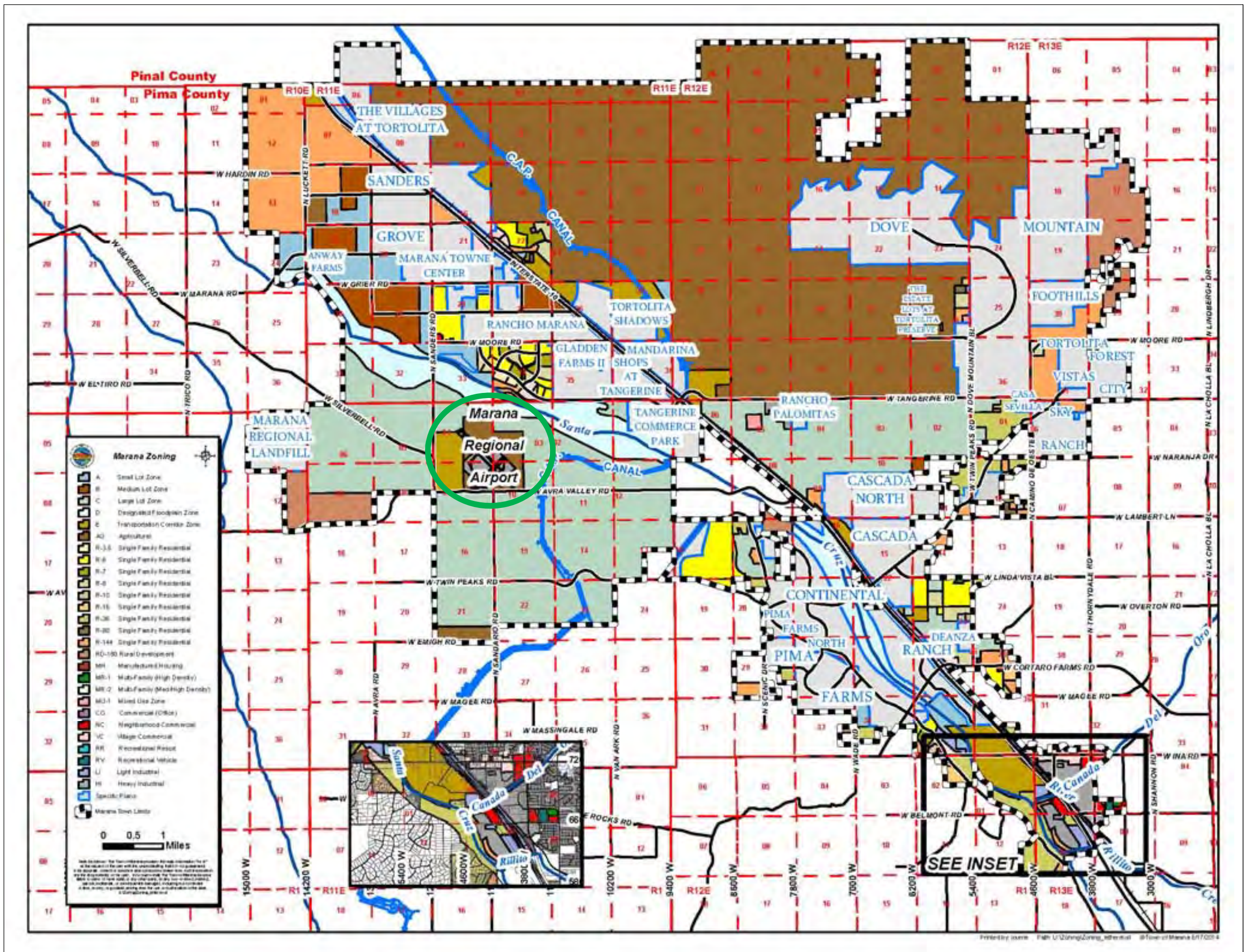
The Town of Marana received a Record of Approval for the Marana Regional Airport Noise Compatibility Program (NCP) in November 2008. The NCP describes the current and future non-compatible land uses based on the parameters as established in Title 1, Code of Federal Regulations (CFR), Part 150, *Airport Noise Compatibility Planning*. According to the Record of Approval, the NCP includes one recommended noise abatement element, five land use planning elements, and two program management elements. The recommended elements will be taken into consideration during the development of this study.

Conflicts may also exist in the protection of runway approach/departure and transition zones to ensure the safety of both the flying public and the adjacent property owners. Adequate land for this use should be either owned in fee or controlled through easements, as recommended in this and future sections of this Airport Master Plan.

In the Town of Marana, the Land Development Code (LDC) is the regulating document for any land that is not part of a Specific Plan (Zone F). The LDC regulates land use with respect to zoning, subdivision regulations, signage, parking, landscaping, and other critical standards that promote public health, safety and welfare. The Town of Marana LDC, *Title 5 – Zoning* was last updated in April of 2014. All references to zoning contained in the Airport Master Plan will be to the April 2014 version.

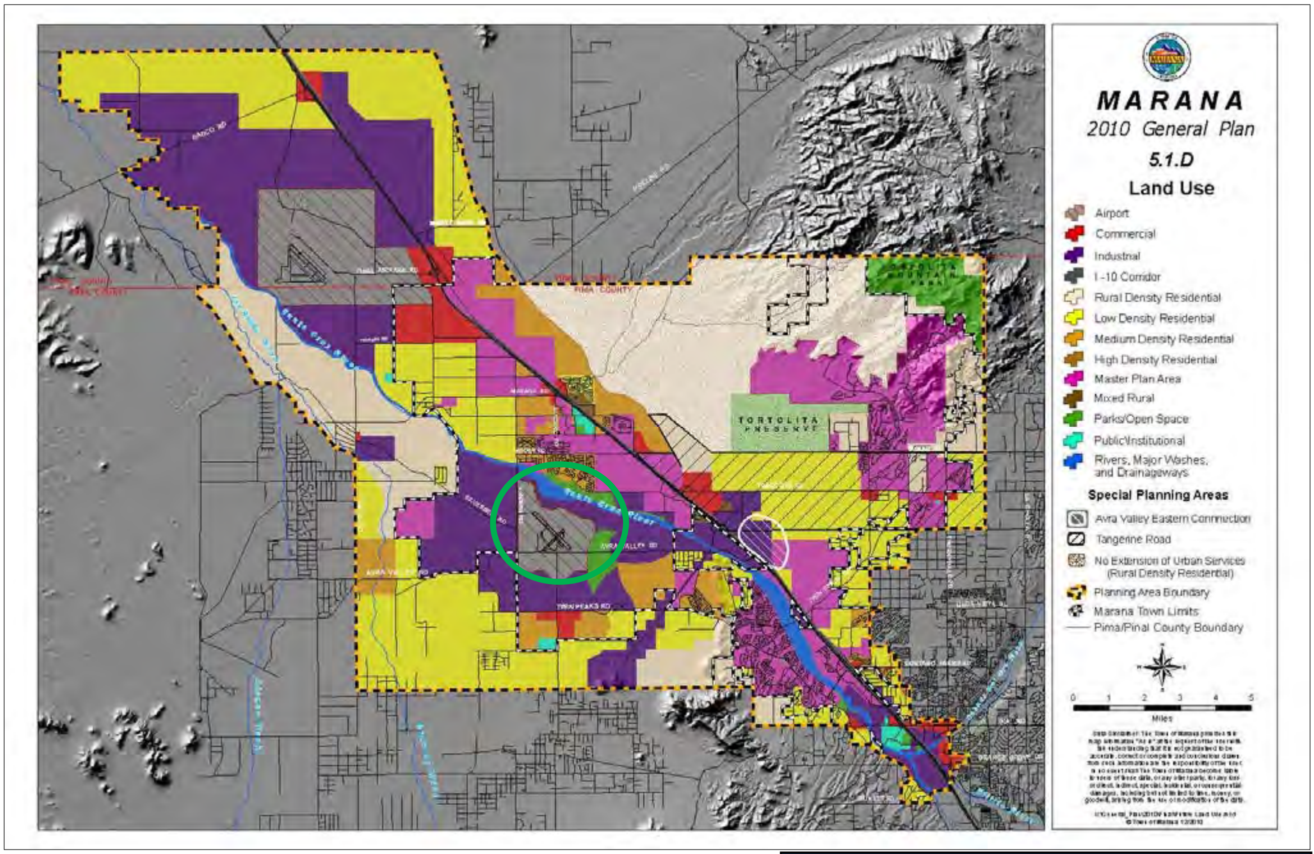
Prior to April 6, 1993, the Town of Marana was divided into five zones. These zones were as follows: Zone A, Small Lot Zone; Zone B, Medium Sized Lot Zone; Zone C, Large Lot Zone; Zone D, Designated Flood Plain

Zone; and Zone E, Transportation Corridor Zone. According to the LDC, these zones shall remain in place until reclassified by the property owner, or the Town. Subsequent to April 6, 1993, the Town of Marana established a new set of zones and criteria for those zones which are reflected in Section 5.10 through 5.12, inclusive of the LDC. The most recent zoning map reveals that the Airport is bordered to the north, east, and south by Zone C – Large Lot Zone, AG – Agricultural, and farther to the north, Zone D – Designated Flood Plain Zone. To the west of the airport resides Zone E – Transportation Corridor Zone. The existing zoning for the land surrounding the Airport is depicted on **Figure 2-2.** The Marana 2010 General Plan also contains a review of the land uses and their categories. The review includes the Airport as depicted on **Figure 2-3.** The closest residential developments are located approximately 1 ½ miles north of the airport. The residential developments are also north of the Santa Cruz River.



Source: Town of Marana, July 2015

Figure 2-2 Town of Marana Zoning Map



Source: Town of Marana, 2010 General Plan, July 2015

Figure 2-3 Town of Marana Land Use Plan Categories

2.6 Socioeconomic Characteristics

The socioeconomic makeup of the community surrounding an airport is always an important aspect to examine during the airport master planning process. Examining the specific socioeconomic characteristics of the Town of Marana will help determine the factors influencing aviation activity in the area and the extent to which aviation facility developments are needed. Characteristics such as employment, demographic patterns, and income will help in establishing the potential growth rate of aviation within the area. By analyzing the information in this Chapter, forecasts of aviation activity can be developed. The forecasts are provided in Chapter 3, Forecasts of Aviation Activity.

2.6.1 Local Profile

Although a relatively young municipality, the community has a long and rich history with more than 4,200 years of continuous human occupation in Marana and the surrounding middle Santa Cruz Valley.

During World War II, the impact of the rising importance of the military came quickly to Marana. The Marana airfield (1942-1945) was one of the largest pilot-training centers during WWII, training some 10,000 flyers, and Titan missile sites were later located in the area as part of a complex of ballistic missile installations built around Tucson.

In March 1977, the Town incorporated about 10 square miles and in August of that year, the 1,500 townspeople elected their first Town council. The Town is now a little more than 120 square miles with a population of 35,000[3].

2.6.2 Population

Population is a fundamental demographic element to consider when planning for the future needs of an airport. The State of Arizona has historically been one of the fastest growing states in the country. According to 2010 U.S. Census data, there are 980,263 people residing in Pima County and 34,961 in the Town of Marana; the Town of Marana's population increased at a double-digit annual growth rate from 2000-2010. Population growth in the Town has been far ahead of Pima County and the State of Arizona historically. The population trends are illustrated in **Table 2-1.**

Table 2-1 Historical Population

Location	Year 2000	Year 2010	Average Annual Growth Rate 2000-2010
Arizona	5,130,632	6,392,017	2.5%
Pima County	843,746	980,263	1.6%
Town of Marana	13,556	34,961	15.8%

Source: U.S. Census Bureau, 2000 and 2010 Census Briefs

Population projections for Pima County and Arizona were obtained from the Arizona Department of Administration, Office of Employment and Population Statistics. Based upon 2012 data, the population of Pima County is projected to grow on average 1.4 percent annually between 2015 and 2030; the population of Arizona is projected to grow on average 1.8 percent annually between 2015 and 2030.

Long-range population projections for the Town of Marana were taken from the Arizona Department of Economic Security (DES) and were approved by the DES Director in August of 1997. The projections are dated, but are still considered valid for comparison purposes. Based on the approved projections, the population was expected to be 46,078 by 2010 and 62,328 by 2015. Based on the Census data in **Table 2-1**, the Town of Marana is approximately 31.7 percent below the projected population for 2010. Therefore, to arrive at the projected populations over the course of the planning period, the data from the approved projections from 2015 to 2035 were also reduced by 31.7 percent to arrive at an approximate population for that period. These population projections are shown in **Table 2-2**.

Traditionally, population growth in an area is advantageous to airports; an increase in an area's population often means the potential for increases in an airport's user base and aviation and non-aviation related businesses.

[3] Town of Marana Web Site, www.maranaaz.gov, 2015

Table 2-2 Population Projections

	2015	2020	2025	2030	2035	Average Annual Growth Rate 2015-2035
Arizona	6,777,534	7,485,163	8,168,354	8,852,645	9,540,800	2.0%
Pima County	1,022,100	1,100,000	1,172,500	1,243,100	1,312,100	1.4%
Town of Marana	47,325	58,126	67,333	75,420	82,782	3.7%

Source: Arizona Department of Administration, Office of Employment and Population Statistics (medium series projections), retrieved July 2015

2.6.3 Employment

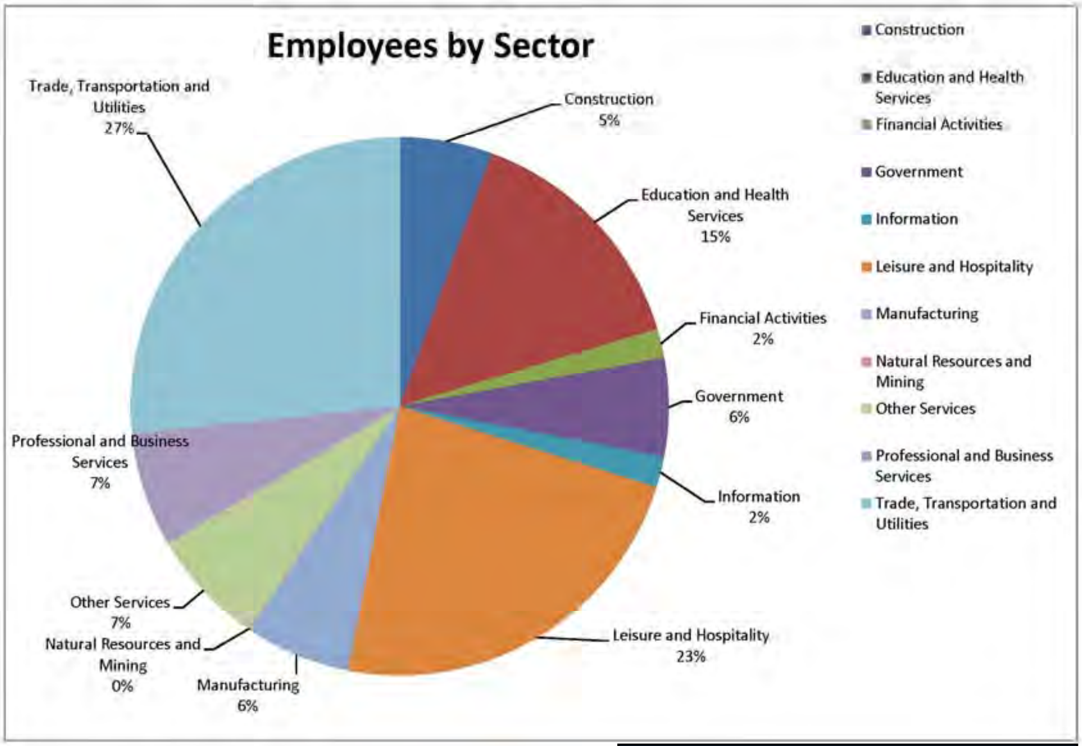
According to the U.S. Census Bureau 2012 American Community Survey 5-year Estimates, the largest industry sectors in the Town of Marana are the trade, transportation, and utilities sector, followed by leisure and hospitality, and education and health services. Employment distribution by industry sector for the Town of Marana is shown in **Table 2-3** and **Figure 2-4.**

As of April 2015, the seasonally adjusted unemployment rate in Arizona was 6 percent. For the same period the national unemployment rate was 5.4 percent. The unemployment rate in Arizona has been trending lower from a high of 7.6 percent in April 2013.

Table 2-3 Pima County Employment by Sector

	Pima County % By Sector	% Of Total
Construction	5	.05
Education and Health Services	15	.15
Financial Activities	2	.02
Government	6	.06
Information	2	.02
Leisure and Hospitality	23	.23
Manufacturing	6	.06
Natural Resources and Mining	0	0
Other Services	7	.07
Professional and Business Services	7	.07
Trade, Transportation and Utilities	27	.27
Total		100%

Source: U.S. Census Bureau, 2012 American Community Survey 5 year Estimates, retrieved July 2015



Source: U.S. Census Bureau, 2012 American Community Survey 5 year Estimates, retrieved July 2015

Figure 2-4 Pima County Employment by Sector

2.6.4 Income

According to the U.S. Census for 2011-2013, the median household income in Arizona was approximately $49,774. Likewise, according to the same data, the median household income in Pima County was $45,841 and $73,149 in the Town of Marana. The per capita income (2013 dollars) for 2009-2013 was $25,269 for Pima County, $32,868 for the Town of Marana, and $25,358 for the State of Arizona.

The average number of persons per household was 2.5 in Pima County, 2.69 in the Town of Marana, and 2.67 for Arizona as a whole. The percentage of families living below the poverty line for 2009-2013 was 19.2 percent for Pima County, 4.3 percent for the Town of Marana, and 17.9 percent for the State of Arizona.

2.7 Climate and Meteorological Conditions

Meteorological conditions play an important role in the planning and development of an airport. Wind direction and speed are essential in determining optimum runway orientation. Temperatures substantially affect aircraft performance and are a major factor in runway length determination. The percentage of time an airport experiences low visibility because of meteorological conditions is a key factor in determining the need for instrument approach procedures and the type of procedure and facilities needed. The type of instrument approach procedure that might be needed, in turn, determines airspace and imaginary surface requirements. The amount and type of precipitation that occurs at an airport affects visibility and runway friction, or runway braking effectiveness. It also affects the type of maintenance equipment required, for example, snow and ice removal equipment.

2.7.1 Local Climatic Data

According to the Western Regional Climate Center, the monthly average maximum temperature for the hottest month (July) is 101.4 degrees Fahrenheit. August is the month with the largest amount of precipitation (2.84 inches). The total annual average precipitation is 12.69 inches. The temperature and precipitation is summarized in **Table 2-4**.

Table 2-4 Temperature and Precipitation

Month	Mean Maximum Temperature (Fahrenheit)	Mean Minimum Temperature (Fahrenheit)	Precipitation (Inches)
January	66.7	40.8	0.97
February	69.2	43.0	0.97
March	75.0	47.1	0.92
April	82.7	53.0	0.38
May	92.2	61.1	0.22
June	100.9	70.1	0.33
July	101.4	75.0	2.00
August	99.0	73.4	**2.84**
September	96.3	69.0	1.29
October	86.6	58.0	0.90
November	74.4	46.6	0.70
December	65.4	39.7	1.17
Annual	84.1	56.4	12.69

Source: Western Regional Climate Center, retrieved July 2015

2.8 Neighboring Airports/Service Area

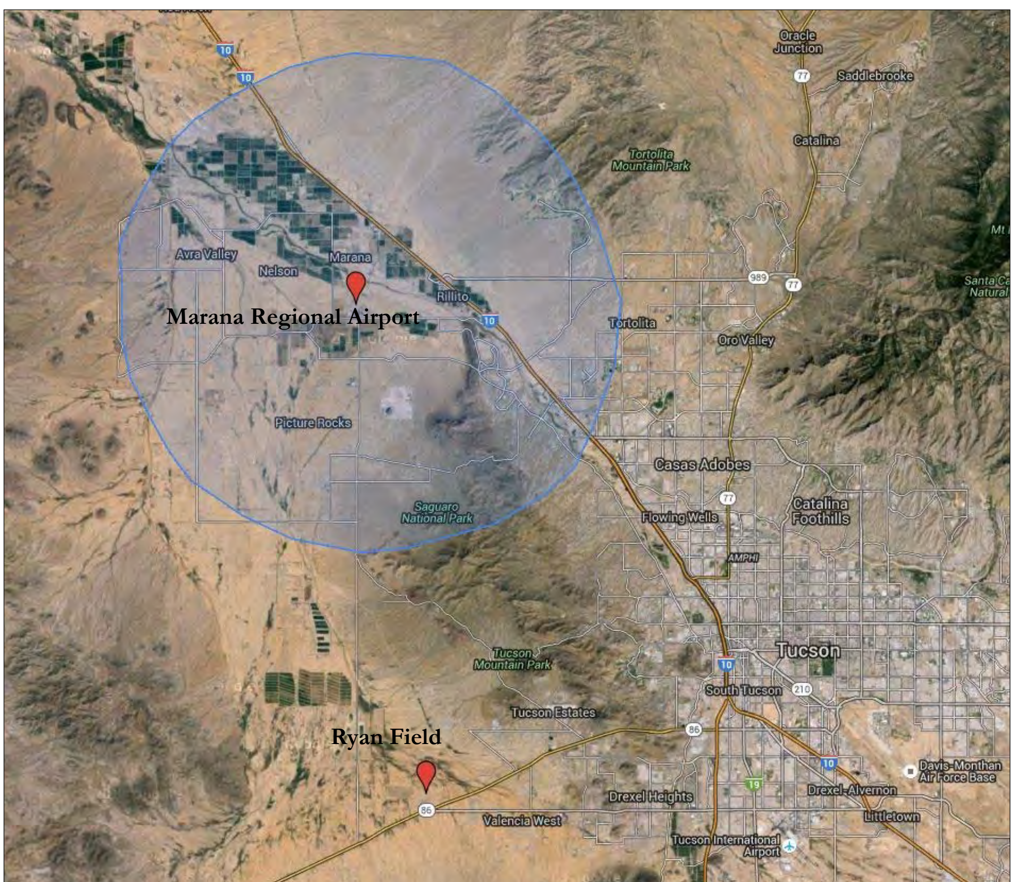
As previously discussed, Marana Regional Airport is located in the southern region of Arizona. The region's mild climate and terrain serve as an ideal location for an airport. A general comparison of several other notable public airports in the vicinity of Marana Regional Airport was conducted in order to illustrate their proximity to the study airport and to give an overall picture of the types of aeronautical facilities available to the surrounding communities. This type of comparison is typically performed in order to define an airport's service area. An airport service area is defined by the communities and surrounding areas served by the airport facility. For example, factors such as the airport's surrounding topographical features (mountains, rivers, etc.), proximity to its users, quality of ground access, required driving time to the airport and the proximity of the facility to other airports that offer the same or similar services can all affect the size of a particular airport's service area. To define the service area for Marana Regional Airport, the public airports in the area and the general services and facilities they provide were reviewed. **Table 2-5** summarizes the closest public airports and their services.

The service area includes the area within half the distance (in nautical miles) of the nearest airport with a published instrument approach procedure as shown on **Figure 2-5.** In this instance, Ryan Field is the closest airport with published instrument approach procedures.

Table 2-5 Neighboring Airports

	FAA Identifier	Distance (Nautical Miles and Direction)	Distance (Highway Miles)	Federal Service Level (NPIAS)	Primary Runway (Length and Width)	Pavement Type	Instrument Procedures	Fuel
Pinal Airpark	MZJ	8 NW	12	GA	6,849′ x 150′	Asphalt	None	No
Ryan Field	RYN	16 S	24	R	5,503′ x 75′	Asphalt	ILS or LOC, NDB/DME, GPS	Yes
Tucson International Airport	TUS	23 SE	30	P	10,996′ 150′	Asphalt	ILS, RNP, GPS, VOR/DME	Yes
Eloy Municipal Airport	E60	30 NW	40	GA	3,901′ x 75′	Asphalt	None	Yes
Coolidge Municipal Airport	P08	33 NW	58	GA	3,873′ x 75′	Asphalt	GPS, VOR/DME	Yes

Note. Abbreviations: P=Commercial Service - Primary, GA=general aviation, R=Reliever, N/A=not applicable.
Source: www.AirNav.com, 2015



Source: Google Maps, 2015

Figure 2-5 Service Area for Marana Regional Airport

2.9 Airport Ownership and Management

Marana Regional Airport is owned, operated, and maintained by the Town of Marana. The Town Council is responsible for the administration and financial oversight of the airport. The Town Council is made up of seven members who serve four-year terms. The Mayor of the Town also serves a four-year term. The Town of Marana currently employs an airport manager (who reports to the Town Council on matters pertaining to the Airport), two airport maintenance workers, and a part-time administrative person. The airport manager handles the administrative duties at the airport.

2.10 Grant History

The Town of Marana has received numerous grants from the Federal Aviation Administration (FAA) over the years through the Airport Improvement Program (AIP) for the development of the Airport. The AIP is funded through the Aviation Trust Fund which was established in 1970 to provide funding for eligible projects as defined in the AIP Handbook.

The Arizona Department of Transportation (ADOT) has also provided numerous grants to the Town of Marana for the development of the Airport. The Arizona Revised Statutes (A.R.S.) are laws established by the state of Arizona which encourage and advance the safe and orderly development of aviation in the state.

The combined grant history for the last 10 years of capital improvements at Marana Regional Airport is depicted in **Table 2-6.**

Table 2-6 Marana Regional Airport 10-year Grant History

Federal Fiscal Year	State Fiscal Year	Federal AIP Grant Number	State Grant Number	Grant Description and Project Type	Federal Grant Amount	State Grant Amount	Local Share Amount	Total Amount
-	2005	-	ADOT E 5S09	Update Master Plan	-	$180,000	$20,000	$200,000
-	2005	-	ADOT E 5S10	Apron Reconstruct	-	$450,000	$50,000	$500,000
-	2005	-	ADOT E 5S80	EA for Land Acquisition	-	$465,388	$51,710	$517,098
2004	2005	3-04-0058-10	ADOT E 5F71	Rehabilitate Runway 12-30	$175,000	$4,606	$4,605	$184,211
2004	2005	3-04-0058-10	ADOT E 5F72	Acquire Land for Approaches	$125,000	$3,290	$3,290	$131,579
-	2005	-	ADOT E 5S87	APMS	-	$248,409	$0	$248,409
2005	2006	3-04-0058-013	ADOT E 6F57	Construct Taxiway E	$2,157,395	$56,776	$56,775	$2,270,946
2005	2006	3-04-0058-012	ADOT E 6F56	Conduct PAR Part 150 Study	$200,000	$5,264	$5,263	$210,527
-	2006	-	ADOT E 6S24	Construct Security Fence	-	$315,000	$35,000	$350,000
-	2006	-	ADOT E 6S26	Taxiway B Electrical Upgrades	-	$1,080,000	$120,000	$1,200,000

Table 2-6 Marana Regional Airport 10-year Grant History - Continued

Federal Fiscal Year	State Fiscal Year	Federal AIP Grant Number	State Grant Number	Grant Description and Project Type	Federal Grant Amount	State Grant Amount	Local Share Amount	Total Amount
-	2006	-	ADOT E 6S88	Replacement of Runway 12-30 MIRLS	-	$397,736	$44,193	$441,929
-	2007	-	ADOT E 7S147	Fire Protection – Phase 1	-	$1,350,000	$150,000	$1,500,000
-	2007	-	ADOT E 7S75	New Airport Terminal – Design Only	-	$360,000	$40,000	$400,000
-	2007	-	ADOT E 7S15	Large Aircraft Apron Reconstruct	-	$1,250,000	$138,888	$1,388,888
2006	2007	3-04-0058-014	ADOT E 7F66	Rehabilitate Runway 03-21. Taxiway A, E and others (Design); Taxiway E Apron and Access Road (Design & Construct)	$5,007,750	$131,787	$131,787	$5,271,324
2007	2008	3-04-0058-15	ADOT E 8F63	Construct Air Traffic Control Tower – Design Only (Phase I)	$150,000	$3,948	$3,947	$157,895
-	2008	-	ADOT E 8S09	Fire Protection - Phase II	-	$540,000	$60,000	$600,000
-	2008	-	ADOT E 8S10	Bypass Apron (Design & Construct)	-	$760,387	$84,487	$844,874
-	2008	-	ADOT E 8S11	Construct Security Fence and Gates	-	$220,000	$24,444	$244,444
-	2008	-	ADOT E 8S12	Reconstruct & Expand South Apron	-	$429,613	$47,734	$477,347
2007	2008	3-04-0058-015	ADOT E 8F6	Acquire Land for Approaches (90 acres)	$880,000	$23,159	$23,158	$926,317
2008	2009	3-04-0058-016	ADOT E 9F24	Construct Air Traffic Control Tower - Design Only (Phase II)	$111,240	$2,928	$2,927	$117,095
2008	2009	3-04-0058-017	ADOT E 9F65	Construct Air Traffic Control Tower - Design Only (Phase III)	$68,073	$1,792	$1,791	$71,656
2009	2010	3-04-0058-018	ADOT E 10F25	Construct Air Traffic Control Tower - Design Only (Phase IV)	$120,687	$3,176	$3,176	$127,039

Table 2-6 Marana Regional Airport 10-year Grant History - Continued

Federal Fiscal Year	Fede ral Fiscal Year	Federal Fiscal Year	Federal Fiscal Year	Federal Fiscal Year	Federal Fiscal Year	Federal Fiscal Year	Federal Fiscal Year	Federal Fiscal Year
-	2012	-	ADOT E 2S81	APMS	-	$539,679	$59,964	$599,643
-	2015	-	ADOT E 5S1C	APMS	-	$1,382,725	$153,636	$1,536,361
-	2015	-	ADOT E 5S10	Runway/Taxiway Guidance Sign Replacement and Taxiway In-pavement Light Replacement	-	$463,500	$51,500	$515,000
-	2015	-	ADOT E 5S3N	Master Plan Update, GIS, Business Plan, Rates and Charges	-	$414,000	$46,000	$460,000
				Total amount	$8,995,145	$11,083,163	$1,414275	$21,492,582

Note: Grant amounts represent the original amount granted to the Sponsor. The final close-out amounts may be different and are not shown.
Source: ADOT MPD - Aeronautics Group, July 2015

2.11 Airport Financial Data

Financial data was obtained for the Marana Regional Airport from 2012 to 2014 in order to conduct a review of the revenue and expenditures. The data provides a baseline for the financial status of the airport and allows for further evaluation in the Airport Development and Financial Plan chapter. It is important to note that Town of Marana fiscal year is from July 1st to June 30th.

Revenue reports for the last three fiscal years (2012 through 2014) were fairly consistent indicating between $251,000 and $285,000 in annual revenue, or approximately an 11% maximum variance over the period. Operating expenses over the same period have been on the rise with the largest increases in the Fuel and Supplies categories. The net difference of expenses over income has risen from $26,600 in 2012 to $138,500 annually in 2014 due to general increases in airfield maintenance, operating costs, and salaries.

The airport's aging infrastructure and need for new capital programs will continue to contribute to increasing costs associated with the airport's operational and maintenance requirements. However, opportunities for new revenue source development to offset operating and development costs, including new proposed Capital Improvement Projects, also exist and will be evaluated in the Strategic Business Plan for the Marana Regional Airport which is also currently under development.

Table 2-7 Marana Regional Airport Financial Data

	2014	2013	2012
Annual Revenues			
Fuel (Jet A, AVGAS)	$26,000	$26,000	$24,000
Open tie-downs	$25,000	$37,000	$30,000
Land Leases for Private Hangars	$180,000	$185,000	$184,000
Charges for Services	$20,000	$37,000	$19,000
Total Revenue	$251,000	$285,000	$257,000
Operating Expenditures			
Salaries and Benefits	$144,000	$138,000	$135,000
Fuel and Supplies	$89,500	$16,000	$15,000
Maintenance	$109,000	$100,000	$85,000
Insurance	$12,000	$12,000	$12,000
General Administration	$24,000	$23,000	$22,000
Equipment	$11,000	$15,000	$14,000
Total Operating Expenditures	$389,500	$304,000	$283,000
Net - Loss/+ Gain	**-$138,500**	**-$19,000**	**-$26,000**

Source: Marana Airport Manager, June 2015

2.12 Based Aircraft and Operations

There are various federal, state, and local sources available for determining existing activity levels at an airport. These include, but are not limited to, FAA Form 5010-1 *Airport Master Record*, FAA Terminal Area Forecast (TAF), on-site inventory, and airport management records.

The FAA Form 5010-1 *Airport Master Record* is the official record kept by the FAA to document airport physical conditions and other pertinent information. The information is typically collected from the airport sponsor and includes an annual estimate of aircraft activity as well as the number of based aircraft. The accuracy of the information contained in the 5010-1 form varies directly with the airport manager's record keeping system and the date of its last revision. The current (August 2015) FAA 5010-1 Form for Marana Regional Airport indicates there are 227 based aircraft. The 5010-1 form also reports 90,000 annual operations; this is based upon a 12-month reporting period which ended in April of 2015.

The TAF is a historical record and contains forecast projections of based aircraft and annual operations. The TAF is maintained and utilized by the FAA for planning and budgeting purposes. The 2015-2035 TAF data for the Airport projects 237 based aircraft in 2015, increasing to 356 by 2035, and approximately 114,000 annual operations in 2015, increasing to approximately 165,000 by 2035. The TAF data may not accurately reflect the based aircraft and operations numbers, as it is dependent on when it was last updated by the FAA. Furthermore, it is difficult to accurately record aircraft operations at airports that are not equipped with an air traffic control tower. Normally, operations are recorded by air traffic controllers and reported to the FAA. Marana Regional Airport does not have an air traffic control tower.

According to discussions with airport management, there were 260 based aircraft and 80,000 annual operations in 2014. Historical based aircraft and operations are discussed in more detail in Chapter 3, Forecasts of Aviation Demand.

2.13 Certified Pilots and Registered Aircraft

The FAA databases of certificated airmen and registered aircraft were reviewed to determine the current distribution of pilots and registered aircraft in Pima County. This data indicates that there are 2,379 certificated pilots and 1,224 aircraft registered in Pima County as of June 2015. Aircraft are not always based where they are registered.

2.14 Design Standards

Airport design standards provide basic guidelines for a safe, efficient, and economic airport system. The standards cover the wide range of size and performance characteristics of aircraft that are anticipated to use an airport. Various elements of airport infrastructure and their functions are also covered by these standards. Choosing the correct aircraft characteristics for which the airport will be designed needs to be done carefully so that future requirements for larger and more demanding aircraft are taken into consideration; furthermore, planners must remain mindful that designing for large aircraft that may never serve the airport is not economical.

2.14.1 Design Aircraft

According to FAA Advisory Circular 150/5300-13A, *Airport Design*, planning a new airport or improvement to an existing airport requires the selection of one or more "design aircraft." In most cases, the design aircraft (for the purpose of airport geometric design) is a composite aircraft representing a collection of aircraft classified by the parameters:

- Aircraft Approach Category (AAC)
- Airplane Design Group (ADG)
- Taxiway Design Group (TDG)

For the purpose of selecting a design aircraft, the FAA recommends that the most demanding aircraft, or family of aircraft, which conducts at least 500 operations per year at the airport be selected as the design aircraft. Additionally, when an airport has more than one active runway, a design aircraft is selected for each runway.

According to the 2007 Airport Master Plan, the existing design aircraft for Runway 12-30 is a Canadair Challenger CL-600, which has a maximum take-off weight of 41,250 pounds. The existing design aircraft for Runway 3-21 is a Beechcraft King Air 100, which has a maximum take-off weight of 11,800 pounds.

2.14.2 Runway Design Code (RDC)

To arrive at the RDC, the AAC, ADG, and approach visibility minimums are combined to form the RDC of a particular runway. The RDC provides the information needed to determine certain design standards that apply. The first component, depicted by a letter, is the AAC and relates to aircraft approach speed (operational characteristics). The second component, depicted by a Roman numeral, is the ADG and relates to the aircraft wingspan or tail height (physical characteristics). The final component relates to the visibility minimums expressed by runway visual range (RVR) values in feet of 1,200, 1,600, 2,400, 4,000, and 5,000. If a runway is only used for visual approaches, the term "VIS" should appear as the third component. The FAA AC 150/5300-13A, *Airport Design*, RDC components are illustrated in **Table 2-8**.

Table 2-8 Runway Design Code

Aircraft Approach Category	Approach Speed	
Category A	less than 91 knots	
Category B	91 to 120 knots	
Category C	121 knots to 140 knots	
Category D	141 knots to 165 knots	
Category E	165 knots or more	
Airplane Design Group	**Wingspan**	**Tail Height**
Group I	< 49 feet	<20 feet
Group II	49 to 78 feet	20 to 29 feet
Group III	79 to 117 feet	30 to 44 feet
Group IV	118 to 170 feet	45 to 59 feet
Group V	171 to 213 feet	60 to 65 feet
Group VI	214 to 261 feet	66 to 79 feet
Runway Visual Range (ft)	**Flight Visibility Category (statute mile)**	
VIS	Visual approach only	
5000	Not lower than 1 mile	
4000	Lower than 1 mile but not lower than 3/4 mile	
2400	Lower than 3/4 mile but not lower than 1/2 mile (CAT-I PA)	
1600	Lower than 1/2 mile but not lower than 1/4 mile (CAT-II PA)	
1200	Lower than 1/4 mile (CAT-III PA)	

Source: FAA Advisory Circular 150/5300-13A, *Airport Design*, 2015

Based on the above criteria the existing RDC for the Runways at the Airport are as follows:

- Runways 12 is C/II/5000
- Runway 30 is C/II/VIS

- Runways 3 and 21 are B/I/5000

2.14.3 Taxiway Design Group (TDG)

The TDG design standards are based on the overall main gear width (MGW) and the cockpit-to-main gear (CMG) distance. Taxiway/taxilane width and fillet standards, and in some instances, runway to taxiway and taxiway/taxilane separation requirements, are determined by the TDG. The FAA advises that it is appropriate for a series of taxiways on an airport to be built to a different TDG standards based on anticipated use.

For airports with two or more active runways, it is advisable to design all airport elements to meet the requirements of the most demanding RDC and TDG. However, it may be more practical and economical to design some airport elements such as a secondary runway to standards associated with a lesser demanding RDC and TDG. For example, it would not be prudent for an air carrier airport that has a separate general aviation runway, or a crosswind runway for general aviation traffic, to design that runway for air carrier traffic.

The existing taxiways at the Airport vary in width from 35 to 50 feet. Taxiway design standards have been revised by the FAA since the previous Airport Master Plan was prepared; therefore, a TDG was not previously established for the Airport. Based on the existing taxiway widths, the TDGs for the Airport are TDG 2 and 3. However, it should be noted that the existing design aircraft for Runway 12-30 (Canadair Challenger CL-600) falls within TDG-1B, and the design aircraft for Runway 3-21 (Beechcraft King Air 100) falls within TDG-1A. As such, the existing taxiway widths appear to exceed the minimum design standards. Further analysis on the existing TDG and the recommended TDG will be further discussed in the Facility Requirements chapter.

2.14.4 Airport Reference Code (ARC)

The ARC is not a design standard, rather it is an airport designation that signifies the airport's highest Runway Design Code (RDC), minus the third (visibility) component of the RDC. The ARC is used for planning purposes only, and does not limit the aircraft that may be able to operate safely on the airport.

According to the previous Airport Master Plan, the current ARC for the Airport is C-II. Examples of the types of design aircraft and their corresponding ARC are depicted in **Figure 2-6**.

AI

Primarily Single-Engine Propeller Aircraft, some light twins

BI

Primarily Light Twin-Engine Propeller Aircraft

Example Type: Cessna 172 Skyhawk

Example Type: Piper Navajo

BII

(<12,500 lbs)

Primarily Light Turboprops

BII

(>12,500 lbs)

Mid-sized corporate jets and commuter airliners

Example Type: Beechcraft King Air

Example Type: Cessna Citation II

A/BIII

Primarily large commuter-type aircraft

CI, DI

Primarily small and fast corporate jets

Example Type: De Havilland Dash 8

Example Type: Lear Jet 36

C/DII

Large corporate jets and regional-type commuter jets

C/DIII

Commercial airliners (approx. 100-200 seats)

Example Type: Gulfstream IV

Example Type: Boeing 737

C/DIV

Large commercial airliners (approx. 200-350 seats)

DV

Jumbo commercial airliners (approx. 350+ seats)

Example Type: Boeing 767

Example Type: Boeing 747

Source: Armstrong Consultants, Inc., 2015

Figure 2-6 Typical Design Aircraft and Corresponding ARC

2.14.5 Safety Areas

Runway and Taxiway Safety Areas (RSAs and TSAs) are defined surfaces surrounding the runway and taxiway prepared specifically to reduce the risk of damage to aircraft in the event of an undershot, overshot, or excursion from the runway or taxiway. The safety areas must be:

- Cleared and graded and have no potentially hazardous surface variations;
- Drained so as to prevent water accumulation;
- Capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and fire fighting (ARFF) equipment, and the occasional passage of aircraft without causing structural damage to the aircraft; and
- Free of objects, except for objects that need to be located in the runway or taxiway safety area because of their function.

The runway safety areas for Runway 12 and Runway 3-21 at the Airport are in good condition and appear to meet FAA standards. The runway safety area for Runway 30 however does not currently meet design standards; portions of Avra Valley Road, the dirt public access road to the east parking apron, the dirt on-airport perimeter road, and the perimeter fence cross through the existing RSA. Recommendations to correct this non-standard condition will be discussed further in Chapter 5, Development Alternatives. The taxiway safety areas were also reviewed and no apparent deficiencies were noted. The Airport did undergo a FAA Airport Master Record 5010 Update whereby Aviation Technologies, LLC performed a site visit and published their findings via a letter dated April 16, 2015. Based on the letter, some fill material is needed just prior to the thresholds for Runways 12 and 30 in order to meet FAA criterion for a maximum drop-off from a pavement. No other safety area concerns were presented in the letter from Aviation Technologies, LLC.

2.14.6 Obstacle Free Zone (OFZ) and Object Free Area (OFA)

The OFZ is a three-dimensional volume of airspace which supports the transition of ground to airborne aircraft operations. The clearing standard precludes taxiing and parked airplanes and object penetrations, except for frangible visual Navigational Aids (NAVAIDs) that need to be located in the OFZ because of their function. The OFZ is similar to the 14 CFR Part 77 primary surface in that it represents the volume of space longitudinally centered on the runway. It extends 200 feet beyond the end of each runway. The Runway Object Free Area (ROFA) is a two-dimensional ground area surrounding the runway. The ROFA standard precludes parked airplanes, agricultural operations and objects, except for objects that need to be located in the ROFA for air navigation or aircraft ground maneuvering purposes.

The OFZ and OFA for each runway appear to be in good condition and appear to meet FAA standards, with the exception of Runway 30, as noted above, and Runway 3. As with the RSA, portions of Avra Valley Road, the dirt public access road to the east parking apron, the dirt on-airport perimeter road, and the perimeter fence cross through the existing ROFA for Runway 30. Likewise, a small portion of existing perimeter fencing penetrates the corner of the existing ROFA near the end of Runway 3. Again, recommendations to correct these non-standard conditions will be discussed further in Chapter 5.

2.14.7 Runway Protection Zone (RPZ)

The Runway Protection Zone (RPZ) is trapezoidal in shape and centered about the extended runway centerline. The RPZ dimension for a particular runway end is a function of the type of aircraft and approach visibility minimums associated with that runway end. Based on a site visit, all of the existing RPZ appear to be incompliance with current FAA standards.

The land uses currently not recommended by FAA to be within the RPZ include residences and places of public assembly (churches, schools, hospitals, office buildings, shopping centers, and other uses with similar concentrations of persons typifying places of public assembly). The FAA also recommends the Sponsor (Town of Marana) control the RPZs through fee simple ownership, or avigation easements.

The FAA issued a memorandum on September 27, 2012, regarding land uses within a RPZ. The memorandum outlines interim policy guidance to address what constitutes a compatible land use and how to evaluate proposed land uses that would reside in an RPZ.

Based on a site visit, all of the existing RPZs appear to be incompliance with current FAA standards with the exception of the Runway 3 and Runway 30 existing RPZs. West Avra Valley Road goes through both Runway 3 and Runway 30 RPZs. The FAA recommends in their interim policy guidance that airport sponsor work with FAA to remove or mitigate the risk of any existing incompatible land uses in the RPZ as practical. Therefore, as part of the Alternative Development process, this topic will be further evaluated to determine if any action is necessary.

2.14.8 Summary of Existing Design Standards

In summary, the FAA has numerous design standards in which airports must comply with. A review of the existing design standards for the Airport's runways and taxiways are depicted in Table 2-9 and Table 2-10.

Table 2-9 Existing Dimensional Standards – Runways

Design Standards	Runway 12-30		Runway 3-21	
	Existing Conditions (ft)	Standard Dimension (ft)[1]	Existing Conditions (ft)	Standard Dimension (ft)[1]
Runway Design Code (RDC)	C-II	C-II	B-I	B-I
Runway length	6,901	--	3,893	--
Runway width	100	100	75	60
Runway Safety Area (RSA) width	500	500	120	120
Runway Safety Area (RSA) length beyond runway end	495[2]	1,000	240	240
Runway Object Free Area (ROFA) width	800	800	400	400
Runway Object Free Area (ROFA) length beyond runway end	300[2]	1,000	200[2]	240
Runway Obstacle Free Zone (ROFZ) width	400	400	400	400
Runway Obstacle Free Zone (ROFZ) length beyond runway end	200	200	200	200
Approach Runway Protection Zone (RPZ) length	1,700	1,700	1,000	1,000
Approach Runway Protection Zone (RPZ) inner width	500	500	500	500
Approach Runway Protection Zone (RPZ) outer width	1,010	1,010	700	700

[1] Standard dimensions are based on visual and not lower than 1-mile visibility minimums. [2] Non-standard conditions exist at the approach ends of Runway 30 and Runway 3 as described in Section 2.14.5 and 2.14.6.
Source: FAA AC 150/5300-13A, *Airport Design*, 2015

Table 2-10 Existing Dimensional Standards – Taxiways/Taxilanes

Design Standards Based On Airplane Design Group (ADG)	Design Standard Dimensions (ft) ADG-I	Design Standard Dimensions (ft) ADG-II
Taxiway Protection		
Taxiway Safety Area (TSA)	49	79
Taxiway Object Free Area (TOFA)	89	131
Taxilane Object Free Area (OFA)	79	115
Taxiway Separation		
Taxiway Centerline to Parallel Taxiway/Taxilane Centerline	70	105
Taxiway Centerline to Fixed or Movable Object	44.5	65.5
Taxilane Centerline to Parallel Taxilane Centerline	64	97
Taxilane Centerline to Fixed or Movable Object	39.5	57.5
Wingtip Clearance		
Taxiway Wingtip Clearance	20	26
Taxilane Wingtip Clearance	15	18
Existing AVQ Taxiway System	Existing Conditions (ft)	TDG Design Standard Dimensions (ft)[1]
Taxiway A		**TDG 3**
Taxiway Width	50	50
Taxiway Edge Safety Margin (TESM)	10	10
Taxiway Shoulder Width	None	20
Taxiway B		**TDG 2**
Taxiway Width	Varies (35 – 50)	35
Taxiway Edge Safety Margin (TESM)	7.5	7.5
Taxiway Shoulder Width	Varies (12.5 – 15)	15
Taxiway C (Non-standard)		**TDG 3**
Taxiway Width	40	50
Taxiway Edge Safety Margin (TESM)	10	10
Taxiway Shoulder Width	None	20
Taxiway E		**TDG3**
Taxiway Width	50	50
Taxiway Edge Safety Margin (TESM)	10	10
Taxiway Shoulder Width	15	20
Taxiway H		**TDG3**
Taxiway Width	50	50
Taxiway Edge Safety Margin (TESM)	10	10
Taxiway Shoulder Width	12.5	20

[1]The existing design aircraft for each runway fall within TDG 1A and 1B categories; thus, it appears that the taxiways at AVQ exceed the minimum TDG standards.

Source: FAA AC 150/5300-13A, *Airport Design*, 2015

2.15 Title 14, Code of Federal Regulations (14 CFR) Part 77 Imaginary Surfaces

The 14 CFR Part 77 *Safe, Efficient Use, and Preservation of Navigable Airspace* establishes several imaginary surfaces that are used as a guide to provide a safe and unobstructed operating environment for aviation. These surfaces, which are typical for civilian airports, are shown in **Figure 2-7**. The primary, approach, transitional, horizontal and conical surfaces identified in 14 CFR Part 77 are applied to each runway at both existing and new airports on the basis of the type of approach procedure available or planned for that runway and the specific 14 CFR Part 77 runway category criteria. For the purpose of this section, a utility runway is a runway that is constructed for and intended for use by propeller driven aircraft of a maximum gross weight of 12,500 pounds or less. A larger-than-utility runway is a runway constructed for and intended for the use of aircraft of a maximum gross weight of 12,500 pounds or greater. A visual runway is a runway intended for the operation by aircraft of any weight and using only visual approach procedures, with no straight-in instrument approach procedure and no instrument designation indicated on an FAA approved airport layout plan, a military service approved military airport layout plan, or by any planning document submitted to the FAA by competent authority. A non-precision instrument runway is a runway with an approved or planned straight-in instrument approach procedure.

Runway 12-30 and Runway 3-21 are the runways currently in use at Marana Regional Airport. Runway 12 is classified as a larger-than-utility, non-precision instrument runway and has a RNAV (GPS) and a NDB non-precision instrument approach. Runway 30 is classified as a larger-than-utility, visual runway. Runways 3 and 21 are larger than utility, non-precision instrument runways each with a RNAV (GPS) approach. The 14 CFR Part 77 imaginary surfaces for these classifications are further described below.

2.15.1 Primary Surface

The primary surface is an imaginary surface of specific width, longitudinally centered on a runway. The primary surface extends 200 feet beyond each end of the paved surface of runways, but does not extend past the end of soft field runways. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline. The width is 1,000 feet for precision runways, 500 feet for visual, larger-than-utility runways, and 250 feet for visual-utility runways.

2.15.2 Approach Surface

The approach surface is a surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface. An approach surface is applied to each end of the runway based upon the type of approach available or planned for that runway, with approach gradients of 20:1, 34:1, or 50:1. The inner edge of the surface is the same width as the primary surface. It expands uniformly to a width corresponding to the 14 CFR Part 77 runway classification criteria. At Marana Regional Airport, these dimensions are 500 feet by 3,500 feet by 10,000 feet, with a 34:1 approach surface gradient for Runway 12, 3, and 21, and 500 feet by 1,500 feet by 5,000 feet, with a 20:1 approach surface gradient for Runway 30.

2.15.3 Transitional Surface

The transitional surface extends outward and upward at right angles to the runway centerlines from the sides of the primary and approach surfaces at a slope of 7:1 and end at the horizontal surface.

2.15.4 Horizontal Surface

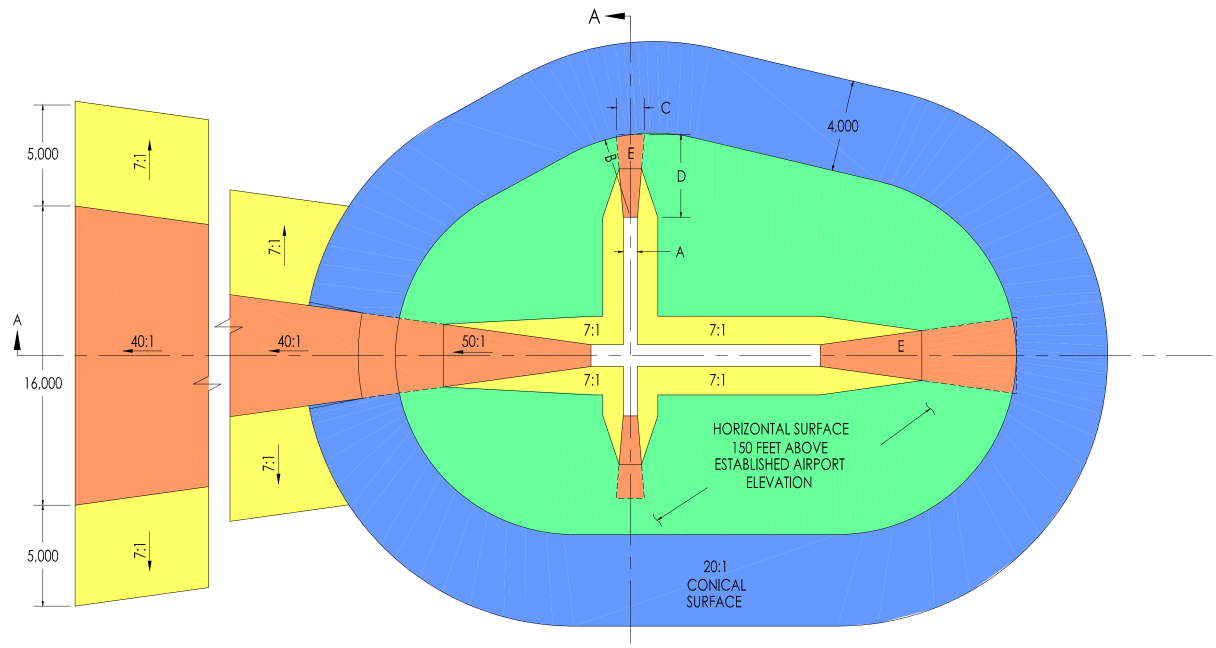
The horizontal surface is considered necessary for the safe and efficient operation of aircraft in the vicinity of an airport. As specified in 14 CFR Part 77, the horizontal surface is a horizontal plane 150 feet above the established airport elevation. The airport elevation is defined as the highest point of an airport's useable runways, measured in feet above mean sea level. The perimeter is constructed by arcs of specified radius from the center of each end of the primary surface of each runway. The radius of each arc is 5,000 feet for runways designated as utility or visual, and 10,000 feet for all other runways.

2.15.5 Conical Surface

The conical surface extends outward and upward from the periphery of the horizontal surface at a slope of 20:1 for a horizontal distance of 4,000 feet.

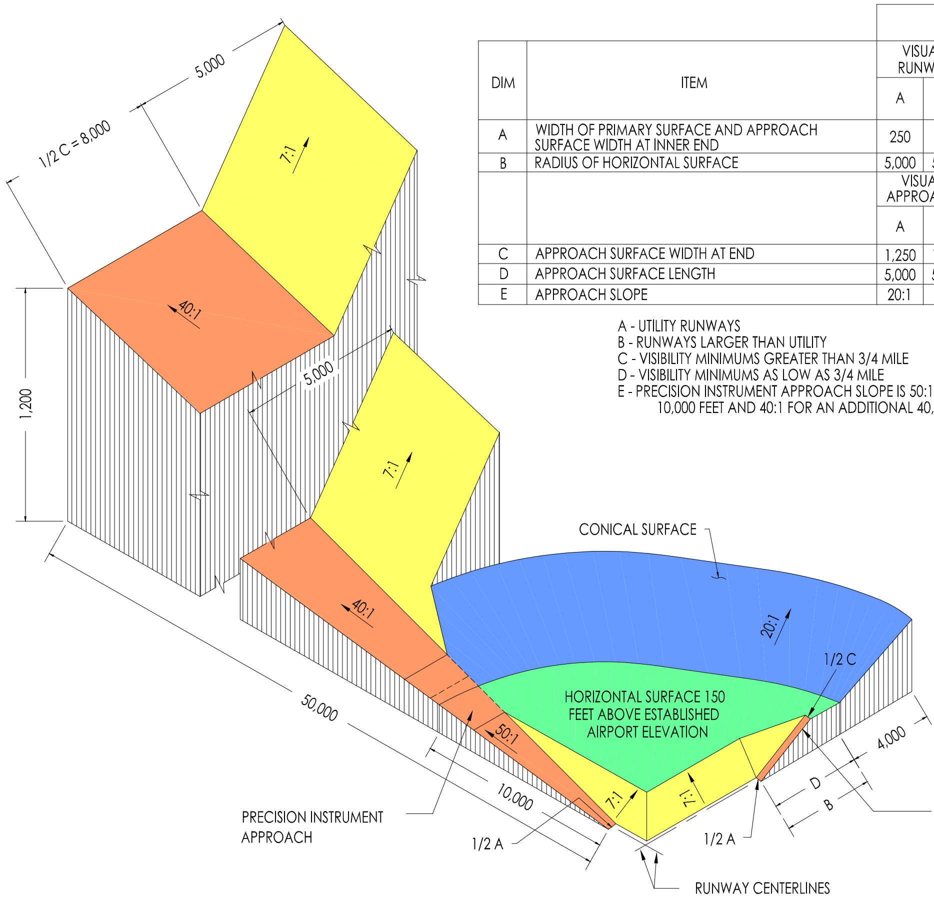
2.15.6 Penetrations to Imaginary Surfaces

A preliminary review of the airspace around the Airport was performed based on available information. Based on the preliminary review, only one minor penetration was discovered. The small conventional hangar located directly to the east of the end of Runway 3 penetrates the transitional surface. A more detailed penetration analysis will be conducted as part of the FAA Airports Geographic Information Systems (AGIS) data gathering. That portion of the master plan is currently underway; this section will be updated to describe any known penetrations to imaginary surfaces once that analysis is completed.

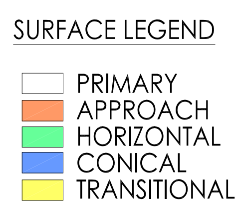


DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B		
					C	D	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL APPROACH		NON-PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		A	B	A	B		
					C	D	
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:1	34:1	34:1	*

A - UTILITY RUNWAYS
B - RUNWAYS LARGER THAN UTILITY
C - VISIBILITY MINIMUMS GREATER THAN 3/4 MILE
D - VISIBILITY MINIMUMS AS LOW AS 3/4 MILE
E - PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET



ISOMETRIC VIEW OF SECTION A-A



Source: 14 CFR, Part 77 *Safe, Efficient Use, and Preservation of Navigable Airspace*, 2015

Figure 2-7 14 CFR Part 77 Imaginary Surfaces

2.15.7 Summary of Dimensional Criteria

The 14 CFR Part 77 imaginary surfaces depicted in **Table 2-11** represent the existing dimensions for the Marana Regional Airport. These surfaces will be used to determine if any existing or potential obstacles exist depending on the planned development at the Airport. Any changes to the existing dimensions based on the selection of a different RDC for the Airport will be noted on the Airport Data Table included on the Airport Layout Plan set. Obstacles will be identified on the Airport Layout Plan and any potential mitigation will also be identified, such as obstruction marking or the recommended removal of an obstacle.

Table 2-11 14 CFR Part 77 Imaginary Surfaces

	Runway 12; Runway 3-21	Runway 30
Primary Surface width	500	500
Primary Surface beyond RW end	200	200
Radius of Horizontal Surface	10,000	5,000
Approach Surface dimensions	500 x 3,500 x 10,000	500 x 1,500 x 5,000
Approach Surface slope	34:1	20:1
Transitional Surface slope	7:1	7:1
Conical Surface slope	20:1	20:1

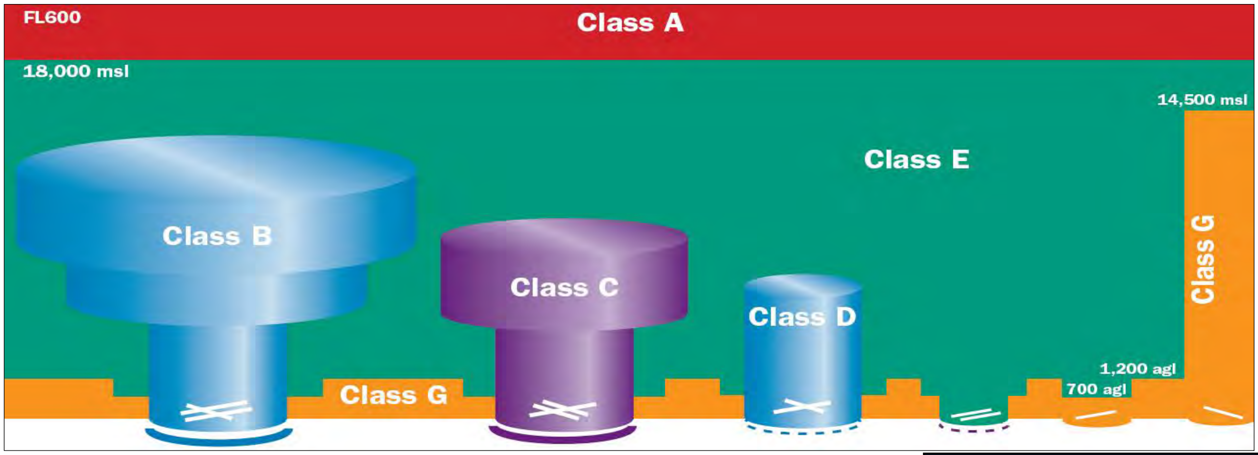
Note. All dimensions are in feet.
Source: 14 CFR, Part 77 *Safe, Efficient Use, and Preservation of Navigable Airspace*, 2015

2.16 Airspace Characteristics

The National Airspace System consists of various classifications of airspace that are regulated by the FAA. Airspace is either controlled or uncontrolled. Pilots flying in controlled airspace are subject to Air Traffic Control (ATC) and must follow either Visual Flight Rules (VFR) or Instrument Flight Rules (IFR) requirements. These requirements include combinations of operating rules, aircraft equipment and pilot certification, and vary depending on the Class of airspace. These rules are described in Federal Aviation Regulations (FAR) Part 71, *Designation of Class A, Class B, Class C, Class D, and Class E Airspace Areas; Airways; Routes; and Reporting Points* and FAR Part 91, *General Operating and Flight Rules*. A graphical representation of the different airspace classes is shown in **Figure 2-8**. General definitions of the classes of airspace are provided below:

- **Class A Airspace** - Airspace from 18,000 feet MSL up to and including flight level (FL) 600.
- **Class B Airspace** - Airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports in terms of IFR operations or passenger enplanements.
- **Class C Airspace** - Generally, airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower.
- **Class D Airspace** - Airspace from the surface up to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports with an operational control tower.
- **Class E Airspace** - Generally, controlled airspace that is not Class A, Class B, Class C or Class D.

- **Class G Airspace** - Generally, uncontrolled airspace that is not designated Class A, Class B, Class C, Class D or Class E.
- **Victor Airways** - These airways are low altitude flight paths between ground based VHF Omni-directional Range receivers (VORs).



Source: Aircraft Owners and Pilots Association, 2015

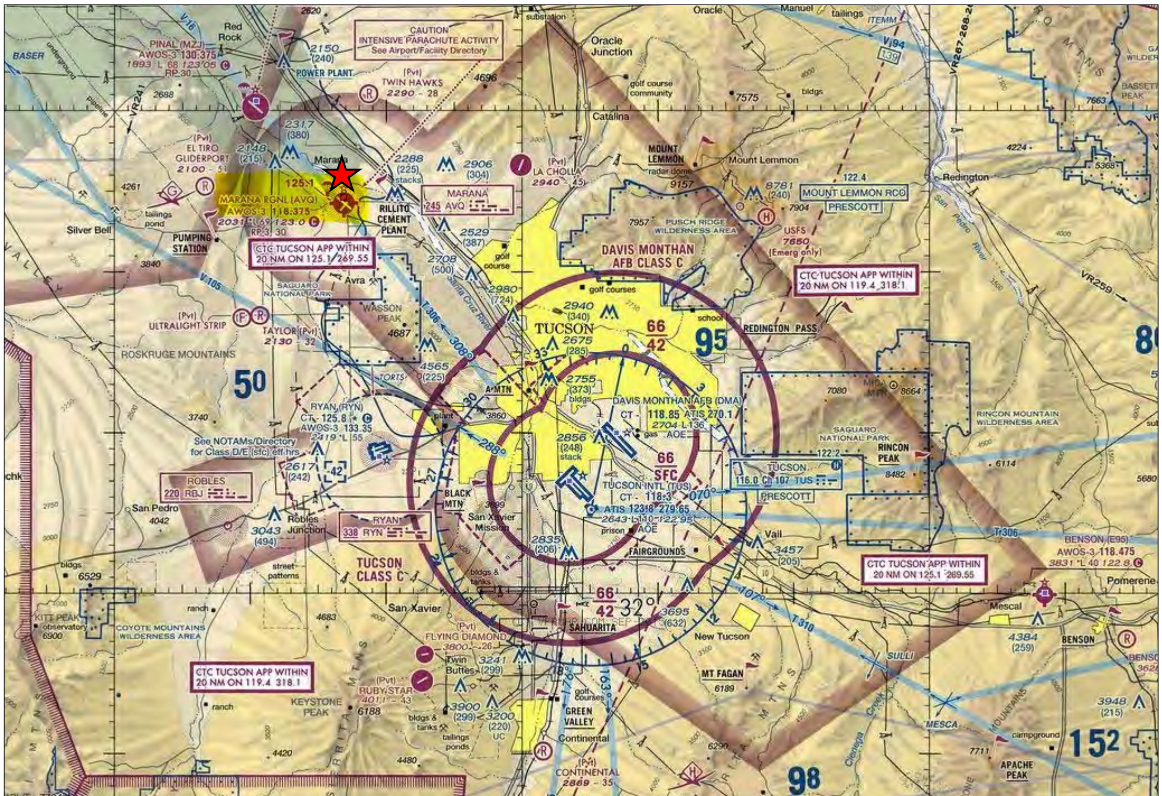
Figure 2-8 Classes of Airspace

The Airport is situated under Class E airspace starting at 700 feet above ground level (AGL) and extends to Class A airspace. Class E airspace consists of controlled airspace designed to contain IFR operations near an airport, and while aircraft are transitioning between the airport and enroute environments. This transition area is intended to provide protection for aircraft transitioning from enroute flights to the airport for landing. Glass G airspace extends below the floor of the Class E airspace and extends to the surface at the Airport. Pilots should check Notices to Airmen (NOTAMs) or the Airport/Facility Directory (A/FD) for Class E (surface) effective hours.

The traffic patterns at the Airport are standard left traffic for Runways 12 and 21, and right traffic for Runways 3 and 30. Traffic Pattern Altitude (TPA) is 2,800 feet MSL according to the A/FD for all aircraft. Pilots should also be aware of high levels of parachute training at high and low levels during all hours in the northwest quadrant of the airport from the surface up to 5,000 feet MSL.

A Victor Airway is a special kind of Class E airspace and is like a "highway" in the sky. Many powered aircraft follow these routes. The routes connect VOR stations that radiate a signal in all directions. These stations are usually located at or near airfields. North-South Victor Airways have odd numbers while East-West airways have even numbers. These federal or Victor Airways are used by both IFR and VFR aircraft. The airspace set aside for a Victor Airway is eight miles wide with a floor at 1,200 feet AGL and extend up to FL 180 (18,000 feet MSL).

Victor Airway 16 (V16) transverses the Airport directly overhead; V16 connects the Tucson (TUS) VORTAC located approximately 24 nautical miles (nm) southeast of the Airport at Tucson International Airport to other VORTACs located further north. V105, also originating at the TUS VORTAC, is located southwest of the Airport (approximately 10 nm). Increased air traffic can be expected in and around Victor Airways and the originating and terminating VOR/VORTAC.



Source: www.VFRmap.com, retrieved 2015

Figure 2-9 FAA Phoenix Sectional Chart

2.16.1 Airspace Jurisdiction

Marana Regional Airport is located within the jurisdiction of the Albuquerque Air Route Traffic Control Center (ARTCC) and the Prescott Flight Service Station (FSS). The altitude of radar coverage by the Albuquerque ARTCC may vary as a result of the FAA navigational/radar facilities in operation, weather conditions and surrounding terrain. The Prescott FSS provides additional weather data and other pertinent information to pilots on the ground and en route.

2.16.2 Airspace Restrictions

Military Operation Areas (MOAs) and Military Training Routes (MTRs) are established for the purpose of separating certain military training activities, which routinely necessitate acrobatic or abrupt flight maneuvers, from IFR traffic. IFR traffic can be cleared through an active MOA if IFR separation can be provided by Air Traffic Control (ATC), otherwise ATC will reroute or restrict the IFR traffic. Restricted areas are defined as "airspace designated under FAR Part 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint-use and IFR/VFR operations in the area may be authorized by the controlling ATC facility when it is not being utilized by the using agency." Restricted areas are typically associated with military operations and indicate the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles.

The closest MOA to the Airport is the Sells 1/Sells Low MOA to the southwest. The MOAs do not overly influence the civilian aircraft activity that occurs in the vicinity of the Airport.

In addition to MOAs, pilots should be aware of Military Training Routes. The MTR program is a joint venture by the FAA and the Department of Defense (DOD). MTRs are mutually developed for use by the military to conduct low-altitude, high-speed training. Increased vigilance is recommended for pilots operating in the vicinity of these training routes. The nearest MTR (VR 239-244) passes within approximately 14 nm northwest of the Airport and is operational when the visibility is 5 statute miles or more and the ceiling is at least 3000 feet AGL. Each of these VR routes is flown at altitudes ranging from 300 feet AGL to 9500 above MSL. Aircraft announce their flight intensions on a UHF frequency intended for air-to-air communications, a frequency that is not typically monitored by civilian aircraft. Again, the MTRs do not have a significant impact on civilian aircraft within the airspace in close proximity of the Airport.

Special Conservation Areas are also located in the vicinity of the Airport. This type of airspace surrounds many national parks, wildlife refuges, and other noise sensitive areas. Pilots are requested to avoid flight below 2,000 feet AGL in these areas. The Saguaro National Park is located approximately 5 nm south-southeast of the Airport, and the Pusch Ridge Wilderness Area is located approximately 13 nm east of the Airport.

2.16.3 Instrument Approach Procedures

Airport safety and capacity are greatly enhanced at airports where instrument approach procedures (IAP) are available during times of inclement weather. As the ceiling and visibility around an airport decreases, electronic guidance provided by specialized equipment to aircraft (also equipped with specialized equipment) allows pilots to safely operate and land in weather where visibility is restricted. Additionally, the availability of instrument approach capabilities at an airport increases capacity by allowing continued use of the airport by aircraft equipped to fly instrument procedures because they can still land at the airport while aircraft which can only fly during visual conditions cannot.

The instrument capabilities of an airport are typically broken into two categories: precision and non-precision. Precision instrument approach procedures provide very accurate electronic lateral and vertical guidance to aircraft. Non-precision instrument approach procedures also provide electronic guidance to aircraft, but the accuracy is less refined and is mainly limited to lateral guidance only. The type and accuracy of an instrument approach is highly dependent upon the airspace obstructions in the vicinity of the airport. Runways with no instrument approach capabilities are considered visual runways. Airports with published instrument approach procedures are known as Instrument Flight Rules (IFR) airports while airports with no published instrument approach procedures are considered Visual Flight Rules (VFR) airports.

The most common type of precision approach in use today is the Instrument Landing System (ILS). Non-precision approach capabilities have been greatly increased by the evolution of satellite technology, specifically Global Positioning System (GPS). The FAA has recently developed new approach procedures know as Localizer, or Lateral Performance with Vertical Guidance (LPV). This new capability utilizes the Wide Area Augmentation System (WAAS). While not considered a precision approach, LPV provides vertical guidance to aircraft to “near precision” accuracy. Another type of instrument approach is area navigation (RNAV). This is a method of instrument flight rules (IFR) navigation that allows an aircraft to choose any course within a network of navigation beacons, rather than navigating directly to and from the beacons. RNAV can be defined as a method of navigation that permits aircraft operation on any desired course within the coverage of station-referenced navigation signals or within the limits of a self-contained system capability, or a combination of these. This can conserve flight distance, reduce congestion, and allow flights into airports without navigational beacons.

Instrument approach procedures are developed by the FAA. GPS/RNAV and/or LPV approaches require no ground based equipment; thus, the FAA can now develop approach procedures at airports where it was previously not economically feasible. Combined with evolving technology, more and more aircraft are able to safely operate in more airport environments.

The types of instrument approaches found at the Airport were described in Section 2.15. To view the published instrument approach procedures for the Airport, please see **Appendix B**.

2.17 Runway Wind Coverage

Wind direction and speed determine the desired alignment and configuration of the runway system. Aircraft land and takeoff into the wind and therefore can tolerate only limited crosswind components (the percentage of wind perpendicular to the runway centerline). The ability to land and takeoff in crosswind conditions varies according to pilot proficiency and aircraft type.

FAA Advisory Circular 150/5300-13, *Airport Design*, recommends that a runway should yield 95 percent wind coverage under stipulated crosswind components. If one runway does not meet this 95 percent coverage, then construction of an additional runway may be advisable. The crosswind component of wind direction and velocity is the resultant vector, which acts at a right angle to the runway. It is equal to the wind velocity multiplied by the trigonometric sine of the angle between the wind direction and the runway direction. The allowable crosswind component for each RDC is shown in **Table 2-12**. The allowable crosswind component and corresponding wind coverage percentage for the Airport is shown in **Table 2-13**.

Historical wind data from Tucson International Airport was used to create a wind rose and corresponding wind coverage data as seen in **Figure 2-10**. The existing runway configuration provides a combined 99.24 percent crosswind coverage for 10.5 knots, 99.83 percent for 13.0 knots, and 99.97 percent for 16.0 knots. This is more than the recommended 95 percent coverage for A-I through C-II aircraft.

Table 2-12 Crosswind Component

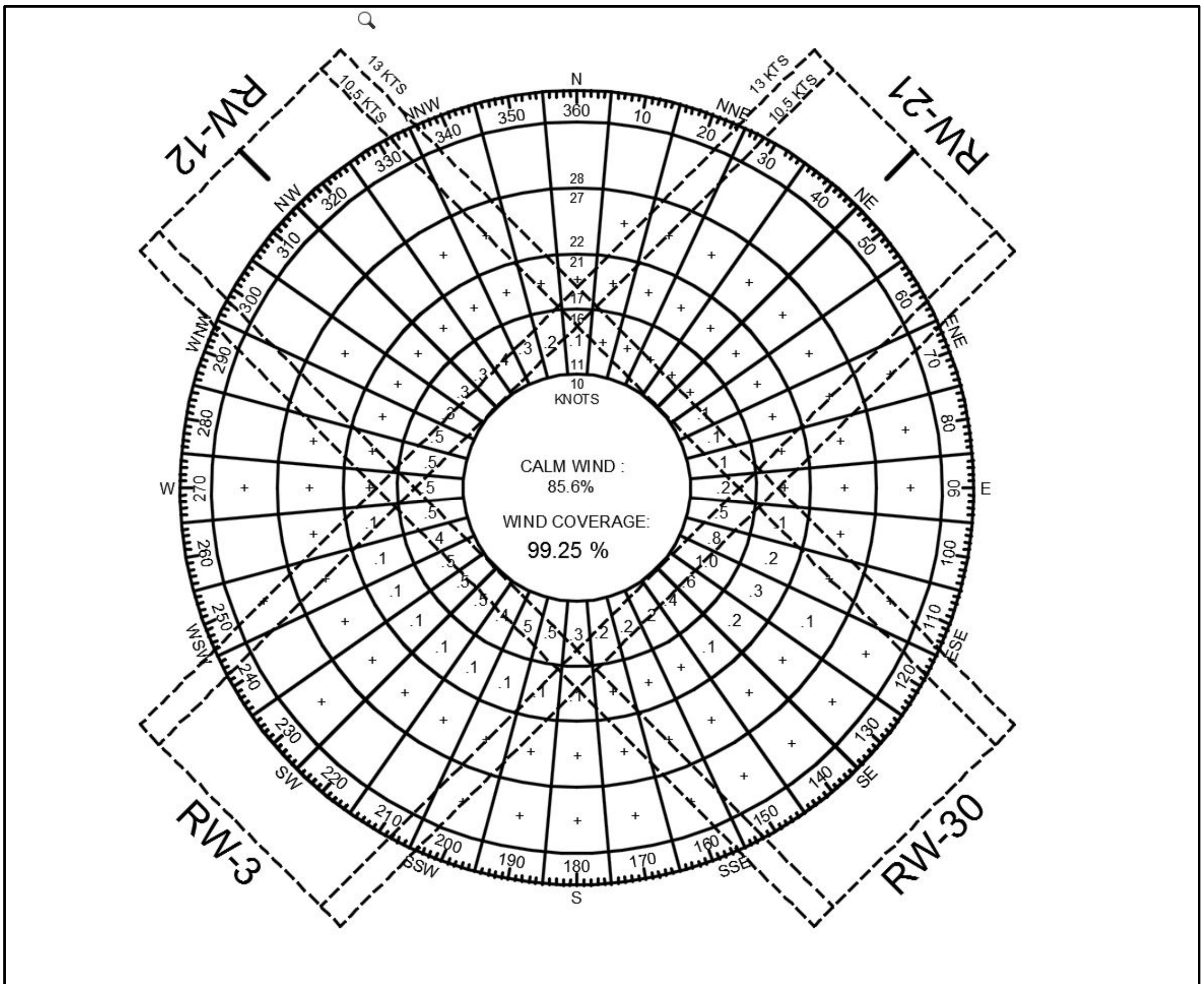
Allowable Crosswind	Runway Design Code (RDC)
10.5 knots	A-I & B-I
13 knots	A-II & B-II
16 knots	A-III, B-III & C-I through D-III
20 knots	A-IV through D-VI, E-I through E-VI

Source: FAA AC 150/5300-13A, *Airport Design*, 2015

Table 2-13 Wind Coverage – All Weather

Runway	Crosswind (knots)	Wind Coverage
12-30	10.5	94.61%
12-30	13.0	96.93%
12-30	16.0	98.88%
3-21	10.5	92.25%
3-21	13.0	95.61%
3-21	16.0	98.67%
Combined	10.5	99.24%
Combined	13.0	99.83%
Combined	16.0	99.97%

Source: Tucson International Airport; 2,643' MSL; Time Period: 2005-2014; 97,864 wind observations



Source: Armstrong Consultants, Inc., 2015

Figure 2-10 Wind Rose

2.18 Existing Airside Facility Inventory

The definition of airside is that portion of the airport (typically within the public safety and security fenced perimeter) in which aircraft, support vehicles, and equipment are located, and in which aviation-specific operational activities take place. The inventory of airside facilities provides the basis for the airfield demand/capacity analysis and the determination of any facility change requirements that might be identified. The various airside facilities are depicted on **Exhibit 1** at the end of this section.

Some of the unique physical constraints and/or apparent FAA design standard concerns at the Airport are also identified herein, as applicable. It is important to note that no subsurface investigations or topographic surveys were performed as part of this study or inventory. Furthermore, any physical constraints identified are based on visual observations made only during onsite-visits to the Airport.

Airfield pavements consist of runways, taxiways/taxilanes, and aircraft aprons. The pavements are essentially the skeleton of an airport, supporting and connecting airside activities to landside facilities. The maintenance and preservation of an airport's system of pavement is essential in order to provide safe and efficient operational capabilities. A general description and condition of the existing airside facilities are described below.

2.18.1 Runways

There are two active runways at Marana Regional Airport: Runway 12-30 and Runway 3-21. According to latest FAA *Airport Master Record,* Form 5010-1 dated August 20, 2015, Runway 12-30 is 6,901 feet long, 100 feet wide, is orientated in a northwest to southeast direction, and serves as the primary runway for the Airport. Runway 12-30 is also equipped with non-precision runway pavement markings on both ends. It was noted at the time of the site visit that the pavement markings are faded; recommendations for improvements are discussed in a later chapter. The overall general condition of Runway 12-30 appears fair as depicted in **Figure 2-11.**

Source: Armstrong Consultants, Inc., 2015

Figure 2-11 Runway 12-30

Runway 3-21 serves as the Airport's crosswind runway and is 3,892 feet long, 75 feet wide, and intersects Runway 12-30 at a right angle. The threshold on Runway 3 is displaced 494 feet to meet extended safety area requirements according to the previous Airport Master Plan. At the time of the site visit it was observed that Runway 3-21 is also equipped with basic runway pavement markings on both ends. This was noted as a non-standard condition since both Runway 3 and 21 both have published non-precision instrument approaches. Recommendations to correctly mark the runway pavement will be further discussed in Chapter 4, Facility Requirements. The overall general condition of Runway 3-21 appears poor as depicted in **Figure 2-12.**

Source: Armstrong Consultants, Inc., 2015

Figure 2-12 Runway 3-21

According to FAA guidance on pavement strength, the aircraft types and the critical aircraft expected to use the airport during the planning period are used to determine the required pavement strength, or weight bearing capacity, of airfield surfaces. The required pavement design strength is an estimate based on average levels of activity and is expressed in terms of aircraft landing gear type and configurations. Pavement design strength is not the maximum allowable weight; limited operations by heavier aircraft other than the critical aircraft may be permissible. It is important to note that frequent operations by heavier aircraft will shorten the lifespan of the pavement. The existing runway pavement composition and strength ratings for the Airport are illustrated in **Table 2-14**.

Table 2-14 Runway Pavement Composition and Strength

Runway	Pavement Composition	Existing Pavement Strength (Landing Gear Configuration in Thousands of Pounds)
12-30	Asphalt	75.0-SW; 100.0-DW; 300.0-DTW
3-21	Asphalt	75.0-SW; 100.0-DW; 150.0-DTW

Abbreviations: SW = single-wheel landing gear, DW = dual-wheel landing gear, DTW = dual-tandem wheel landing gear
Source: FAA Airport Master Record, August 2015

2.18.2 Taxiway System

The Airport is equipped with two full-length parallel taxiways and a series of connector taxiways. The pavement widths and the presence of paved shoulders vary depending on location. The following is a brief summary of each existing taxiway:

- **Taxiway A:** Taxiway A is parallel to Runway 12-30 and is located 400 feet from the runway centerline, 50 feet wide (no shoulders), and is in good condition.
- **Taxiway B:** Taxiway B is parallel to Runway 3-21 and is located 240 feet from the runway centerline. The taxiway is 35 feet wide from the Runway 3 end to the intersection of Taxiway A, and is in poor condition. Taxiway B is 50 feet wide between Taxiway A and Runway 12-30, and is in poor condition. Taxiway B from the intersection of Runway 12-30 to the end of Runway 21 is 35 feet wide, and is also in poor condition. Taxiway B has 12 ½-foot wide shoulders from the Runway 3 end to the south hangar apron. Taxiway B also has 15-foot wide shoulders from the end of Runway 21 to the intersection of Runway 12-30. All shoulder pavements on Taxiway B are in poor condition.
- **Taxiway C:** Taxiway C begins on the north side of Runway 3-21 across from taxiway connector B-2 and continues to the intersection of taxiway connector A-3. The taxiway is 40 feet wide, and is in fair condition.
- **Taxiway E:** Taxiway E is a partial-parallel taxiway beginning at the Runway 30 end and continuing to the intersection of Taxiways B and B-3. Taxiway E is 50 feet wide and is in fair condition. Taxiway E also has 15-foot wide shoulders.
- **Taxiway H:** Taxiway H provides access to existing T-hangars and conventional hangars on the north-west side of the airport. Taxiway H is 50 feet wide and is in fair condition. Taxiway H also has 12 ½-foot wide shoulders.

In addition, there are a series of connector taxiways serving the Airport. **Table 2-15** lists the connector taxiways and their general condition.

Table 2-15 Connector Taxiways

Connector Taxiway Designation	Pavement Width (ft)	Shoulder (Y/N)/ Width (ft)	General Pavement Condition
A-1	50	N	Good
A-2	50	N	Good
A-3	50	N	Good
A-4	50	N	Good
B-1	35	Y / 12.5	Poor
B-2	35	Y / 15	Poor
B-3	50	Y / 15	Poor
E-1	50	Y / 15	Fair
E-2	50	Y / 15	Fair

Source: Armstrong Consultants, Inc., 2015

All of the taxiways and taxiway connectors are constructed of asphalt and appear to have the correct pavement markings, although many of the pavement markings are faded.

2.18.3 Aircraft Aprons

The Airport has several aircraft parking aprons for transient and based aircraft. A list of airport aprons and their commonly referred to name are shown on **Table 2-16**. All of the aircraft parking aprons are asphalt and appear to have adequate pavement markings to guide aircraft movement.

Table 2-16 Aircraft Parking Aprons

Aircraft Aprons	Approximate Apron Size (sy)	General Pavement Condition
Terminal/FBO Apron	8,200	Poor
Itinerant Parking Apron	34,000	Poor
Helicopter Apron	35,200	Fair
West Hangar Apron	66,800	Good
South Hangar Apron	58,300	Poor
East Hangar Apron	25,800	Good
East Apron	90,000	Very Good
Bypass Apron (T/W A & C)	6,600	Very Good

Note: Apron size is inclusive of the existing hangars that reside on the pavement.
Source: Armstrong Consultants, Inc., 2015

2.18.4 Pavement Condition Index (PCI)

According to the Arizona Department of Transportation (ADOT), the airport system in Arizona is a multimillion dollar investment of public and private funds that must be protected and preserved. The

Arizona Pavement Preservation Program (APPP) has been established to assist in the preservation of the Arizona airport system infrastructure. Every year ADOT's Aeronautics Group, using the Airport Pavement Management System (APMS), identifies airport pavement maintenance projects eligible for funding for the upcoming five years. These projects will appear in the state's Five-Year Airport Capital Improvement 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 APPP, or the airport sponsor may sign an inter-government agreement (IGA) with the Aeronautics Group to participate in the APPP.

ADOT also conducts pavement surveys using the procedure as documented in the following publications:

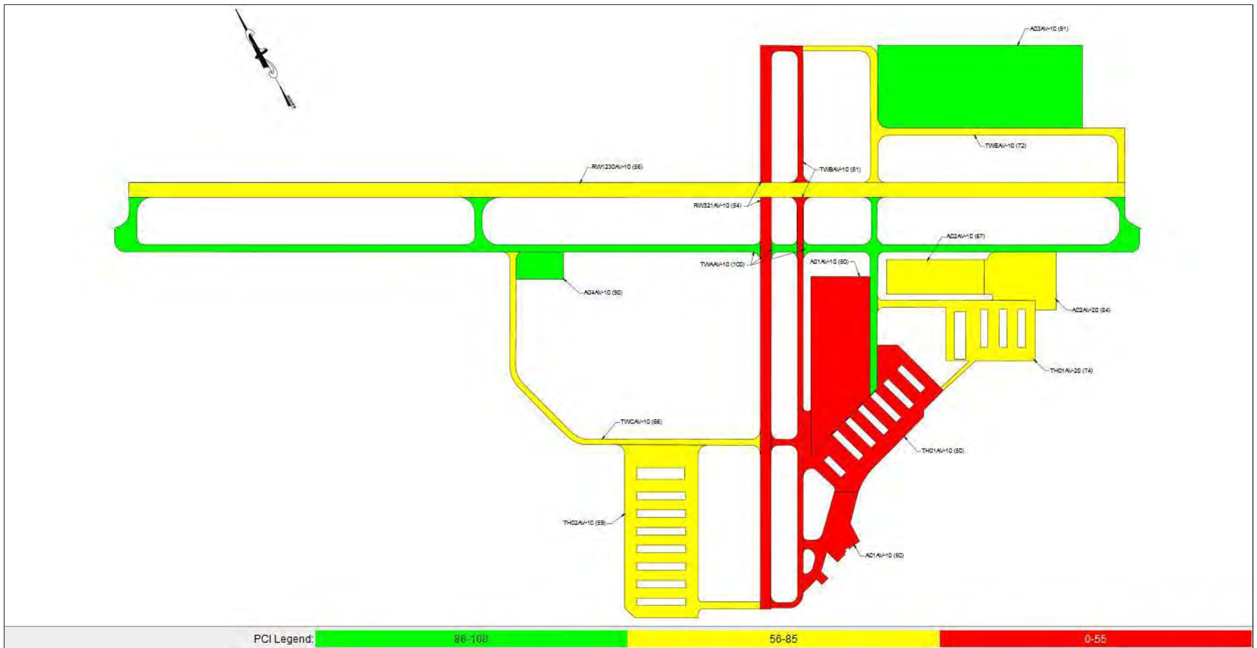
- The FAA's Advisory Circular 150/5380-6B, Guidelines and Procedures for Maintenance of Airport Pavements.
- The American Society for Testing and Material's (ASTM's) standard D-5340, Standard Test Method for Airport Pavement Condition Index Surveys.

The PCI procedure is the standard used by the aviation industry to visually assess pavement condition. It was developed to provide engineers with a consistent, objective, and repeatable tool to represent the overall pavement condition. During a PCI survey, visible signs of deterioration within a selected sample area are identified, recorded, and analyzed.

According to ADOT, the results of a PCI evaluation provide an indication of the structural integrity and functional capabilities of the pavement. However, it should be recognized that during a PCI inspection only the top layer of the pavement is examined and that no direct measure is made of the structural capacity of the pavement system. Nevertheless, the PCI does provide an objective basis for determining maintenance and repair needs as well as for establishing rehabilitation priorities in the face of constrained resources. Furthermore, the results of repeated PCI monitoring over time can be used to determine the rate of deterioration and to estimate the time at which certain rehabilitation measures can be implemented.

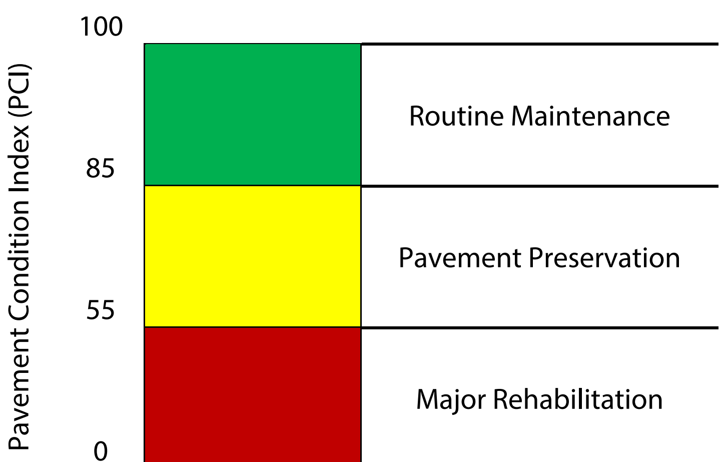
Pavement defects are characterized in terms of type of distress, severity level of distress, and amount of distress. This information is then used to develop a composite index (PCI number) that represents the overall condition of the pavement in numerical terms, ranging from 0 (failed) to 100 (excellent). In general terms, pavements above a PCI of 85 that are not exhibiting significant load-related distress will benefit from routine maintenance actions, such as periodic crack sealing or patching. Pavements with a PCI of 56 (65 for PCC pavements) to 85 may require pavement preservation, such as a surface treatment, thin overlay, or PCC joint resealing. Often, when the PCI is 55 or less, major rehabilitation, such as a thick overlay, or reconstruction are the only viable alternatives due to the substantial damage to the pavement structure.

For Marana Regional Airport, **Figure 2-13** depicts the most recent PCI inspection reported in the 2013 APMS update. **Figure 2-14** depicts how the appropriate repair type varies with the PCI of a pavement section.



Source: ADOT MPD – Aeronautics Group, retrieved 2015 from ADOT APMS IDEA website
http://wwwa.azdot.gov/applications/Airports/APTech_DAP/index.html#path=3/4

Figure 2-13 Existing PCI



Source: ADOT MPD – Aeronautics Group, 2013 Arizona APMS Update Statewide Summary Report, retrieved 2015

Figure 2-14 PCI Repair Scale

In addition to determining the PCI for airfield pavement, the Arizona Pavement Preservation Program includes determining the Pavement Classification Number (PCN) for the same airfield pavement. The Aircraft Classification Number-Pavement Classification Number (ACN-PCN) system of reporting pavement strength was developed by the International Civil Aviation Organization (ICAO). Since the United States is a member of this organization, the FAA is obligated to adhere to this system. The

ACN-PCN procedure is structured so that a pavement with a given PCN can support an aircraft that has an ACN equal or less than the PCN. The PCN should be recalculated if the aircraft mix or volume changes significantly at an airport.

The ADOT APPP program is provided to give the airport sponsor sound pavement repair recommendations and is accepted by the FAA as complying with Public Law 103-305's requirement regarding airport pavement maintenance management as related to AIP funding eligibility. The APPP is not meant to replace a sponsor's efforts for preserving the pavement infrastructure at the airport, but to assist the sponsor in prioritizing and scheduling pavement maintenance and reliable actions. The airport sponsor is expected to provide routine inspections, monitoring, and routine maintenance as part of this joint effort.

Table 2-17 summarizes the Pavement Condition Index data and **Table 2-18** summarizes the Pavement Condition Number results from the Marana Regional Airport Pavement Classification Number Report dated October 2014, prepared by Applied Pavement Technology, Inc.

Table 2-17 Summary of Pavement Condition Index Data

Location	Section	2013 PCI Index
A01AV (Terminal/FBO & Itinerant Parking Apron)	10	50 - Major Rehabilitation
A02AV (Helicopter (10)/East Hangar Apron (20))	10	67 - Pavement Preservation
	20	84 - Pavement Preservation
A03AV (East Apron)	10	91 - Routine Maintenance
A04AV (Bypass Apron)	10	90 - Routine Maintenance
RW 1230AV (Runway 12-30)	10	56 - Pavement Preservation
RW 321 AV (Runway 3-21)	10	54 - Major Rehabilitation
TWAAV (Taxiway A)	10	100 - Routine Maintenance
TWBAV (Taxiway B)	10	51 - Major Rehabilitation
TWCAV (Taxiway C)	10	66 - Pavement Preservation
TWEAV (Taxiway E)	10	72 - Pavement Preservation

Source: Marana Regional Airport Pavement Classification Number Report, Applied Pavement Technology, Inc., October 2014

Table 2-18 Summary of Pavement Condition Number Results

Branch	Section	PCN Designation
A01AV (Terminal/FBO & Itinerant Parking Apron)	10	2/F/D/Y/T[1]
A02AV (Helicopter/East Hangar Apron)	10	4/F/D/X/T
	20	3/F/D/X/T[1]
A03AV (East Apron)	10	3/F/D/X/T[1]
A04AV (Bypass Apron)	10	5/F/C/X/T
RW 1230AV (Runway 12-30)	10	2/F/C/Y/T[1]
RW 321 AV (Runway 3-21)	10	3/F/C/Y/T
TWAAV (Taxiway A)	10	4/F/D/W/T
TWBAV (Taxiway B)	10	2/F/D/Y/T[1]
TWCAV (Taxiway C)	10	2/F/D/Y/T[1]
TWEAV (Taxiway E)	10	3/F/D/X/T[1]

[1]This section is not structurally adequate to handle regular operations of the analyzed traffic according to the October 2014 report.
Source: Marana Regional Airport Pavement Classification Number Report, Applied Pavement Technology, Inc., October 2014

2.18.5 Airfield Lighting, Signage, and Visual Aids

2.18.5-1 Airfield Lighting

Pavement edge lighting is essential for the safe operation of aircraft during night and/or periods of low visibility. Edge lighting is placed along the edge of pavement to define the lateral limits of the pavement. Threshold lights are also placed at the end of a runway (either in-bound or out-bound) to delineate the usable runway.

Runways 12-30 and 3-21 are both equipped with Medium Intensity Runway Lights (MIRL) that appear to be in good condition (**Figure 2-15**). The MIRLs are all incandescent fixtures.

The taxiways that are equipped with based mounted (incandescent) Medium Intensity Taxiway Lights (MITL) include:

- Taxiway A (and all taxiway connectors)
- Taxiway B (and all taxiway connectors)
- Taxiway E (and all taxiway connectors)
- Taxiway H

Taxiway E also has omni-directional semi-flush medium intensity taxiway edge lights delineating the edge of the taxilane and aircraft parking apron (East Hangar Apron). Taxiway C does not currently have either taxiway edge lighting or retro-reflective markers. An example of a MITL found at the Airport is shown in **Figure 2-16**.

Source: Armstrong Consultants, Inc., 2015

Figure 2-15 Existing Runway Edge Light

Source: Armstrong Consultants, Inc., 2015

Figure 2-16 Existing Taxiway Edge Light

2.18.5-2 Signage

Lighted airfield destination signs are installed at some of the connector taxiways. These signs are in poor condition. The Airport is currently in the process of replacing the airfield guidance signs. The new signs will be light-emitting diode (LED) fixtures.

Source: Armstrong Consultants, Inc., 2015

Figure 2-17 Existing Airfield Destination Signage

2.18.5-3 Visual Aids

Precision Approach Path Indicators

Precision Approach Path Indicator (PAPI) systems equip the pilot with visual slope information to provide safe descent guidance. It provides vertical visual guidance to aircraft during approach and landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot that they are "on path" if they see red/white, "above path" if they see white/white and "below path" if they see red/red.

The Airport is equipped with precision approach path indicators (PAPI-4) on Runways 12 and 30. Precision approach path indicators (PAPI-2) are provided on Runways 3 and 21 and they appear to be in good condition.

Source: Armstrong Consultants, Inc., 2015

Figure 2-18 Existing 4-Box Precision Approach Path Indicator

Runway End Identifier Lights

Runway End Identifier Lights (REIL) are flashing strobe lights which aid the pilot in identifying the runway end at night or in bad weather conditions. REILs are typically used on runways with no other approach lighting system and are located laterally on each side of the runway threshold facing the approaching aircraft. The Airport is equipped with REILs on Runway 12 and 30 and they appear to be in good condition.

Source: Armstrong Consultants, Inc., 2015

Figure 2-19 Existing Runway End Identifier Light

Wind Cone and Segmented Circle

Wind cones are conical textile tubes designed to indicate wind direction and relative wind speed. Wind direction is the opposite of the direction in which the wind cone is pointing. There are two styles of wind cones – lighted and unlighted. Typically found surrounding a wind cone is a segmented circle. A segmented circle is a visual indicator designed to show a pilot in the air the direction of the traffic pattern at that airport. The primary wind cone at an airport will typically have a segmented circle. If an airport has more than one wind cone, the additional ones are referred to as supplemental wind cones and are normally found near the runway threshold.

The Airport is equipped with two lighted wind cones; a primary (internally lighted) wind cone with a segmented circle is located at the mid-field of the Airport, and one supplemental (externally lighted) wind cone is located near the Runway 3 threshold. Both wind cones and the segmented circle appear to be in good condition.

Source: Armstrong Consultants, Inc., 2015

Figure 2-20 Existing Primary Wind Cone and Segmented Circle

Rotating Airport Beacon

A rotating airport beacon is a visual navigational aid (NAVAID) operated at many airports. At civil airports, alternating white and green flashes indicate the location of the airport. Rotating beacons are designed primarily for night operation as identification and location markers for airports and will have a visibility range of 30 to 40 miles and a candlepower range from 190,000 to 400,000.

The rotating beacon is located adjacent to the existing electrical building. The rotating beacon appears to be in good condition, although the fixture and tower are considered to be outdated.

Source: Armstrong Consultants, Inc., 2015

Figure 2-21 Existing Rotating Beacon

2.18.6 Weather Reporting Systems

Automated airport weather stations are automated sensor suites which are designed to serve aviation and meteorological observing needs for safe and efficient aviation operations, weather forecasting, and climatology. There are several types of automated airport weather reporting stations. These include the Automated Weather Observing System (AWOS), the Automated Surface Observing System (ASOS), and the Automated Weather Sensor System (AWSS).

During the inventory of the Airport, it was observed that the airport has an AWOS-III. This system generally reports the following parameters: barometric pressure, altimeter setting, wind speed and direction, temperature and dew point in degrees Celsius, density altitude, visibility, and cloud ceiling), while also having the additional capabilities of reporting temperature and dew point in degrees Fahrenheit, present weather, icing, lightning, sea level pressure and precipitation accumulation. Data dissemination is usually via an automated VHF air band radio frequency (108-137 MHz) at each airport, broadcasting the automated weather observation. This is often times via the Automatic Terminal Information Service (ATIS). Most automated weather stations also have discrete phone numbers to retrieve real-time observations over the phone or through a modem. The data output, monitoring equipment, and the modem for the AWOS is located in the FBO building. A METAR data broadcast service was installed in November 2014. METAR is the primary observation code used in the United States to satisfy requirements for reporting surface meteorological data. METAR contains a report of wind, visibility, runway visual range, present weather, sky condition, temperature, dew point, and altimeter setting collectively referred to as "the body of the report." In addition, coded and/or plain language information which elaborates on data in the body of the report may be appended to the METAR.

The radio frequency for the Airport AWOS is 118.375, and the phone number is (520) 682-4104. The AWOS is located on the west of the Runway 21 threshold. The AWOS is in good working condition.

Source: Armstrong Consultants, Inc., 2015

Figure 2-22 Existing Automated Weather Observing System

2.18.7 Radio Navigational Aids

A navigational aid (NAVAID) is any ground based visual or electronic device used to provide course or altitude information to pilots. Radio NAVAIDs include Very High Omni-directional Range (VORs), Very High Frequency Omni-directional Range with Tactical Information (VOR-TACs), Non-directional Beacons (NDBs), and Tactical Air Navigational Aids (TACANs), as examples.

The NDB at the Airport is located adjacent to the existing AWOS-III west of the Runway 21 threshold. The NDB transmits non-directional radio signals, whereby the pilot of properly equipped aircraft can determine the bearing to or from the NDB facility and then track to or from the station. The NDB is in good condition.

The Tucson VORTAC serves the Tucson metropolitan area including the Marana Regional Airport. The Tucson VORTAC is located approximately 24 nautical miles southeast of the Marana Regional Airport.

Source: Armstrong Consultants, Inc., 2015

Figure 2-23 Existing Non-Directional Beacon (NDB)

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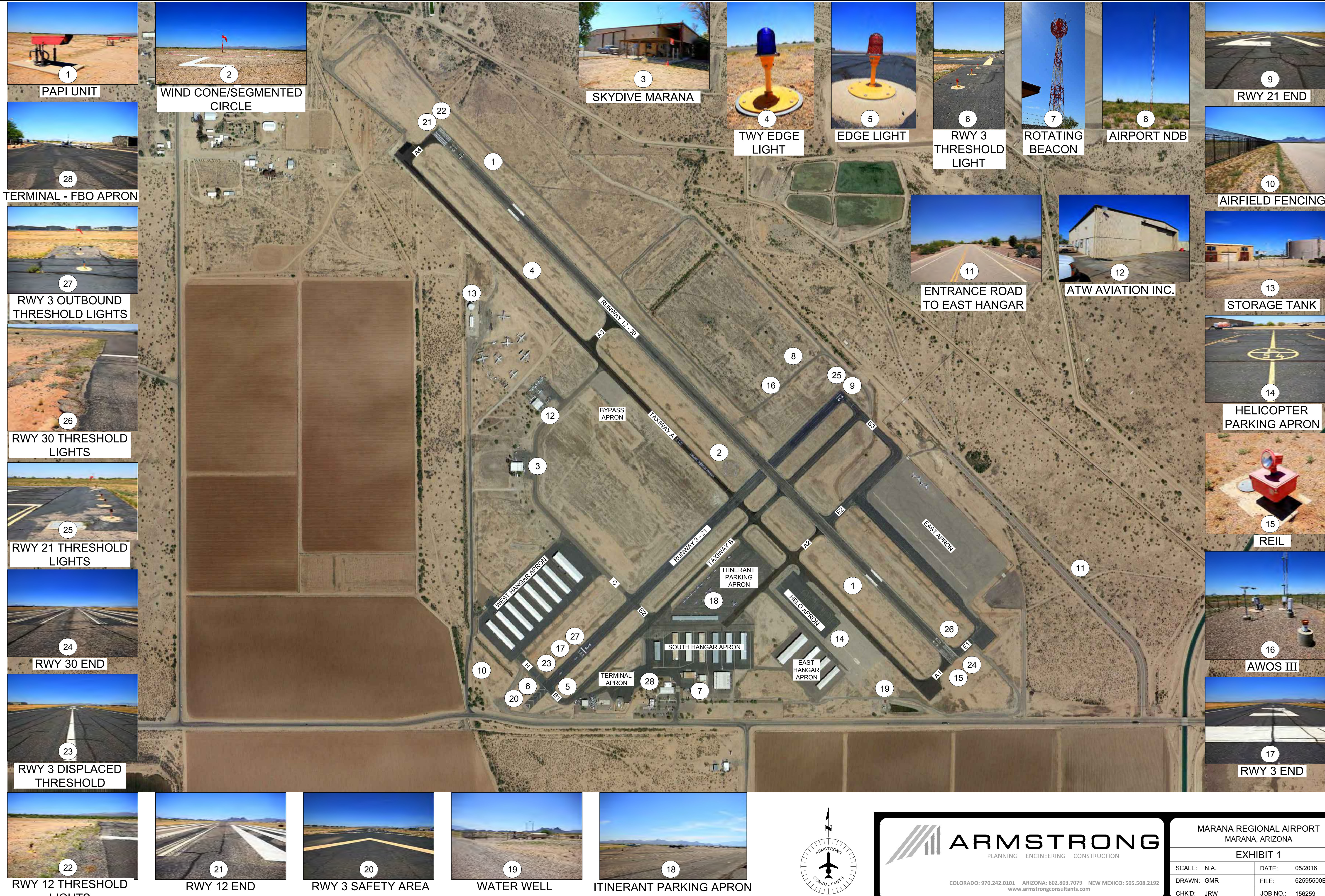

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MARANA REGIONAL AIRPORT
MARANA, ARIZONA

EXHIBIT 1

SCALE:	N.A.	DATE:	05/2016
DRAWN:	GMR	FILE:	62595500E
CHK'D:	JRW	JOB NO.:	156259

2.19 Existing Landside Facility Inventory

The definition of landside is that portion of the airport designed to serve passengers or other airport users typically located outside of the public safety and security fenced perimeter; landside facilities include terminal buildings, parking areas, entrance roadways, and other buildings that may not necessarily conduct aviation related activities. The inventory of landside facilities provides the basis for the airfield demand/capacity analysis and the determination of any facility change requirements that might be identified. The various landside facilities are depicted on **Exhibit 2** at the end of this section.

2.19.1 Terminal Building

The existing terminal building is approximately 9,500 square-feet and is located at the entrance of the Airport off Avra Valley Road. The terminal building was constructed in 1982 and consists of a lobby, restrooms, conference rooms, pilot's lounge, and multiple offices. The Tucson Aeroservice Center is the Fixed Based Operator (FBO) and is located in the building. The terminal building is a steel-frame, metal-sided building and is in good condition.

Source: Armstrong Consultants, Inc., 2015

Figure 2-24 Existing Terminal Building

2.19.2 Airport Services/Fixed Base Operator

A fixed base operator (FBO) is usually a private or commercial enterprise that leases land from the airport sponsor on which to provide services to based and transient aircraft. The extent of the services provided varies from airport to airport. These services frequently include aircraft fueling, minor maintenance and repair, aircraft rental and/or charter services, flight instruction, pilot lounge and flight planning facilities, and aircraft tie-down and/or hangar storage. Tucson Aeroservice Center is the FBO at the Airport and is located in the terminal building, as mentioned above. With an employment base of 20, they provide the following services:

- Aviation fuel
- Oxygen service
- Passenger terminal and lounge area
- Aerial tours
- Aircraft charters
- Aircraft rental
- Aircraft maintenance
- Flight training
- Avionics sales and services

2.19.3 Aircraft Hangars

There are three types of hangar facilities found at most airports – conventional hangars, T-hangars, and shade structures. Conventional hangars provide aircraft storage and are often referred to as box hangars, which are square or rectangular in shape and can be built in various sizes. T-hangars are rectangular aircraft storage hangars with several interlocking "T" units that minimize the need to build individual units; they are usually two-sided with either bi-fold or sliding doors. Shade structures provide a more economical way to keep an aircraft protected from the elements because they only have a roof over an aircraft. Power may or may not be available under a shade structure. The Airport has conventional hangars, T-hangars, and a shade structure available. The following is a description of the hangars and structures currently available.

Conventional hangars

There are six conventional hangars at the Airport. The cumulative size of the hangars is nearly 52,000 square-feet. All of the conventional hangars are steel-framed, metal-sided buildings. All six hangars are currently owned by Pima Aviation; the Town has ground lease agreements with the owner. The location, current occupants, and general condition of the conventional hangars are summarized in **Table 2-19.**

Table 2-19 Summary of Conventional Hangars

	Location	Current Occupant(s)	General Condition
Hangar 1	Adjacent to Taxiway C	ATW Aviation Inc.	Good
Hangar 2	Adjacent to Taxiway C	Marana Skydiving	Fair
Hangar 3	Adjacent to Taxiway B	Pacific Aero Ventures	Fair
Hangar 4	South hangar apron	Pima Aviation Inc./Tucson Aeroservice Center (maintenance)	Good
Hangar 5	South hangar apron	Skywords Aviation	Good
Hangar 6	South hangar apron	Tucson Aeroservice Center (maintenance)	Good

Source: Airport management, June 2015

Source: Armstrong Consultants, Inc., 2015

Figure 2-25 Existing Conventional Hangar Facility

T-hangars

There are 19 T-hangars at the Airport. The cumulative size of the T-hangars is nearly 300,000 square-feet. All of the T-hangars are steel-framed, metal-sided buildings. The T-hangars are grouped into three areas on the Airport. Four T-hangars are located on the east hangar apron, seven T-hangars are located on the south hangar apron, and eight T-hangars are located on the west hangar apron. Three of the T-hangars on the west hangar apron also have restroom facilities incorporated into the buildings. All T-hangars are currently owned by Pima Aviation; the Town has ground lease agreements with the owner.

Source: Armstrong Consultants, Inc., 2015

Figure 2-26 Existing T-hangar Facility

Shade Structure

In addition to aircraft hangars, the Airport also provides one shade structure. The shade structure is approximately 17,000 square-feet and can accommodate up to 27 aircraft. The shade structure is steel-framed with a metal roof and appears to be in good overall condition. The shade structure is owned by Pima Aviation. A summary of the aircraft hangars and structures available at the Airport is contained in **Table 2-20**.

Source: Armstrong Consultants, Inc., 2015

Figure 2-27 Existing Shade Structure

Table 2-20 Summary of Aircraft Hangars

	Conventional Hangars	T-hangars	Shade Structure	Total
Hangar Area (sf)	52,000	300,000	17,000	369,000
Number of Units (ea.)	6	232	27	265

Source: Marana Regional Airport Management, 2015

2.19.4 Other Airport Buildings

Airport Restaurant

The Sky Rider Coffee Shop is also located at the Airport adjacent to the terminal building. The restaurant is open seven days a week from 6:30 am to 3:00 pm. The building is approximately 2,900 square-feet and is a masonry building with a flat roof and appears to be in good condition. Adjacent to the restaurant is an outdoor seating/viewing area for public use. There are also approximately 12 vehicle parking spaces dedicated to the restaurant located in front of the building. The Town of Marana owns the building and leases it to the restaurant.

Source: Armstrong Consultants, Inc., 2015

Figure 2-28 Existing Airport Restaurant and Outdoor Seating Area

Airport Electrical Building

Electrical power for the Airport is fed from an existing concrete block electrical building located next to the Tucson Aeroservice Center maintenance hangar and adjacent to the south hangar apron. The electrical building houses the airfield regulators and is in overall good condition.

Source: Armstrong Consultants, Inc., 2015

Figure 2-29 Existing Electrical Building Equipment

Source: Armstrong Consultants, Inc., 2015

Figure 2-30 Existing Electrical Building

2.19.5 Access Roads and Signage

The Airport can be accessed directly from Avra Valley Road, which is a two-lane paved road and runs along the south side of the Airport; Avra Valley Road serves as the main entrance road. From Exit 242 on Interstate 10, the Airport is approximately two miles west. A concrete sign that displays the name of the Airport is located at the entrance from Avra Valley Road. It is in good condition.

Source: Armstrong Consultants, Inc., 2015

Figure 2-31 Airport Main Entrance Sign

2.19.6 Automobile Parking

There are approximately 40 vehicle parking spaces located adjacent to the terminal building. The lot serves as parking for the restaurant as well. A dirt and gravel overflow parking lot is located just east of the main paved parking lot. To increase safety and convenience overhead lighting of the parking lot is provided. The asphalt pavement is in good condition.

Source: Armstrong Consultants, Inc., 2015

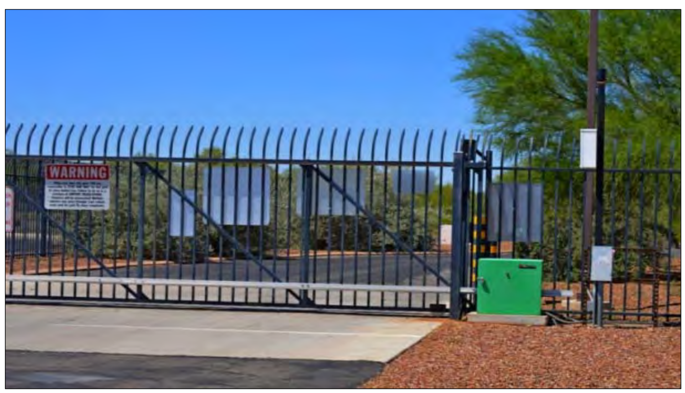
Figure 2-32 Existing Airport Vehicle Parking Lot

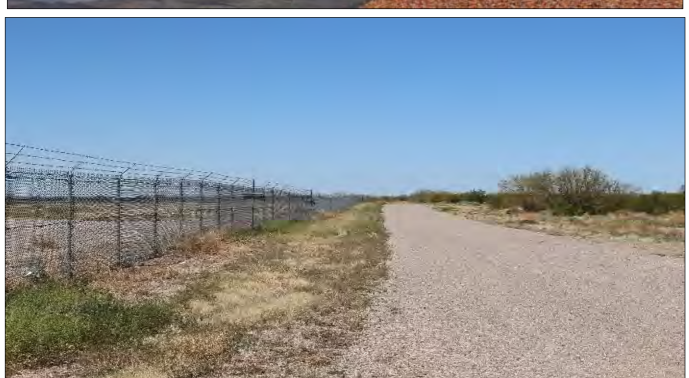
2.19.7 Utilities

Electricity, water, sewer, refuse, telephone, natural gas, and Internet services are available at the Airport. Electrical service is provided by Trico Electric Cooperative Inc., and the Town of Marana Water Department provides the water and sewer service. Southwest Gas Corporation provides natural gas, VoIP is the telephone service provider, and Centurylink provides Internet service. Additionally, there is an existing fire protection underground waterline which extends south from the fire pump house on the Northwest side of the airport and ends in the middle of the Northeast side of the airport. Airport management also suggested that there may be an additional water protection line which runs from the pump house across Taxiway A and Runway 12-30 to the Northeast side of the Airport; however, this has never been verified.

2.19.8 Fencing and Security

Keeping the aircraft operations area (AOA) clear of non-essential and/or un-authorized vehicles and pedestrians is very important at all airports. As a result, fencing and access control gates are very effective at reducing inadvertent entry of non-authorized people and vehicles, and wildlife as well. The Airport has two types of fencing around the perimeter of the Airport. The majority of the fencing consists of 6-foot high, chain-link fence with three strands of barbed wire. Additionally, ornamental security fencing is also in place. It was noted that there is approximately 3,000 linear feet of perimeter fencing missing on the north side of the airfield. Typical fencing and security access gates found at the Airport are illustrated in **Figure 2-33**.





Source: Armstrong Consultants, Inc., 2015

Figure 2-33 Airport Access Gate and Perimeter Fence

2.19.9 Aviation Fuel Facilities

There are currently two fuel storage tanks on the Airport that are owned and operated by the FBO. Each fuel tank has a capacity of 12,500 gallons; 100LL AvGas and Jet A are available. A self-service system is also available 24 hours per day for AvGas. After hours fueling is available, but for a fee. Three fuel trucks are available: two 1,200-gallon capacity trucks with 100LL AvGas and one 5,000-gallon capacity truck with Jet A. The Airport also has a Spill Prevention, Control and Countermeasure (SPCC) Plan on location with airport operations staff.

Source: Armstrong Consultants, Inc., 2015

Figure 2-34 Fuel Storage Tanks

Source: Armstrong Consultants, Inc., 2015

Figure 2-35 Self-Serve Fuel Island

Source: Armstrong Consultants, Inc., 2015

Figure 2-36 Fuel Truck - Jet A

2.19.10 Emergency Services

Emergency response is provided by the Northwest Fire District via Station 36 located approximately 5.5 miles north of the Airport. The District currently provides emergency and community services to 110,000 residents and 3,300 commercial occupancies over a 140 square-mile area. Ten strategically located stations are staffed 365 days a year with 192 firefighters that are Paramedics or Emergency Medical Technicians. Despite explosive growth, the District's ratio of Paramedics to residents remains one of the best in the state at 1:9000.

Station 36 was built in anticipation of projected growth of north Marana and includes capacity for additional apparatus and personnel as the region expands. Station 36 provides coverage for the Airport with a light Aircraft Rescue and Firefighting Response Truck (ARFF) capable of handling small airplane crash fires. The District's Metropolitan Medical Response System (MMRS) truck is also housed at Fire Station 36 along with a Water Tender for additional water supply that might be needed in some of the outlying areas. Station members are trained in the deployment of the MMRS apparatus (used for mass casualty incidents), and the associated equipment it carries.

The nearest hospital is the Oro Valley Hospital located at 1551 E. Tangerine Road and is approximately 20 miles east of the Airport. The Oro Valley Hospital Emergency Room is a Level IV Trauma Center, as designated by the Southern Arizona Emergency Medical Services. Designation as a Level IV means the facility is capable of handling the less serious traumatic injuries and has procedures in place to quickly transfer patients requiring a higher level of care to a higher level facility. In addition, the Marana Health Center located at 11981 W Grier Road is approximately 5 miles to the north of the Airport.

2.19.11 Airport Support and Maintenance

The airport has limited staff to perform airport support and maintenance. In addition, the Airport does not have a dedicated airport maintenance facility. All airfield maintenance equipment is currently stored in an existing hangar. The location for a future airport maintenance facility will be included in the development plan of the airfield and will be presented in the Alternatives Chapter of the master plan.

The following large maintenance equipment is used at the Airport:

- Ford 350 Crew Cab Truck, Ford 150 Extended Cab Truck, and a Chevy Tahoe
- Tiger Tractor Mower (older model) and an Ex-Mark Zero Turn Mower
- Polaris Brutus with attachments (kick broom, mower, bucket, and forks)
- Five trailers for various equipment hauling

2.19.12 Airport Leases

Within the airport boundaries are a number of ground leases that the Town has executed with various entities. Leases are an important way for the Town to generate revenue while supporting a growing aviation industry at the Airport. The total number of acres leased on the Airport is approximately 133.42 acres.

The following are the current leases:

- The Master Development Lease is comprised of three separate parcels;
- Parcel 1 equals approximately 9.73 acres,
- Parcel 2 equals approximately 31.10 acres,
- Parcel 3 equals approximately 25.10 acres,
- FBO lease equals approximately 33.82 acres;
- Jumpsite lease identified as Parcel 5 equals approximately 10 acres;
- T-hangar lease equals approximately 8.16 acres;
- Lease identified as Parcel 4 equals approximately 8 acres;
- Maricopa Aircraft Services equals approximately 5 acres; and
- Woodcrafters lease equals approximately 2.51 acres.

As part of the development plan, additional land will be identified for future leases. The goal of the development plan flexibility thereby allowing the Town to lease parcels of various sizes and configuration based on demand.

2.19.13 Airport Sustainability

The FAA began focusing on sustainability at airports in 2010, and has said that their objective is to make sustainability a core objective in airport planning. The FAA has provided airports across the United States with funding to develop comprehensive sustainability planning documents. These documents, called sustainability master plans and airport sustainability plans, include initiatives for reducing environmental impacts, achieving economic benefits, and increasing integration with local communities. To date, the FAA has funded 45 airports across the United States.

The FAA Reform and Modernization Act of 2012, Section 133 of H.R. 658, requires airport master plans to address the feasibility of solid waste recycling at an airport, minimizing the generation of waste, operation and maintenance requirements, the review of waste management contracts, and the potential for cost savings or revenue generation. The FAA is in the process of crafting guidance for airport sponsors to use in developing a recycling program at their airport as part of an airport master plan. Solid waste is being collected from the terminal building and disposed of by a waste collection company, however, it is not known if any recycling is taking place by any of the airport tenants. Recommendations for ways to implement a recycling program and other sustainability practices will be discussed in the Facility Requirements chapter.

Source: Armstrong Consultants, Inc., 2015

Figure 2-37 Airport Solid Waste Disposal Practice

2.19.14 Dark-Sky Compliance

The International Dark-Sky Association's work includes initiatives to protect the night skies and fragile ecosystems in parks and protected areas worldwide. In Arizona there are three International Dark Sky Communities:

- City of Flagstaff, established in 2001
- City of Sedona, established in 2014
- Big Park/Village of Oak Creek, established in 2016
- In addition, there are three International Dark Sky Parks in Arizona:
- Oracle State Park, a Silver-tier International Dark Sky Park, established in 2014
- Grand Canyon – Parashant National Monument, a Gold-tier International Dark Sky Park, established in 2014
- Flagstaff Area National Monuments, established in 2016

The Town of Marana is a regional leader in adopting a lighting ordinance to help reduce light emissions from residential, commercial, and industrial properties. The Town of Marana Outdoor Lighting Code

Ordinance 2008.18, adopted in 2008, provides regulations about the types of light fixtures and lamps that will help reduce light emissions.

Although the Town of Marana code is meant to reduce light emissions throughout the town, large portions of the Airport are exempt from these standards. The FAA has strict lighting regulations for airports related to airfield lighting. Therefore, modification to airfield lighting to reduce illumination and glare cannot be considered. The Airport can explore ways to reduce light emissions (and costs) by considering FAA approved energy efficient lighting such as LEDs.

Based on a cursory review of the existing lighting at the Airport, there may be some opportunities to replace existing light fixtures to shielded light fixtures. These recommendations will be discussed further in the Facility Requirements chapter.

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AIRPORT RESTAURANT

EAST HANGAR APRON T-HANGAR

ELECTRICAL BUILDING

FBO MAINTENANCE HANGAR 1

AIRCRAFT SHADE STRUCTURE

NORTH ACCESS ROAD

WEST HANGAR APRON T-HANGARS

TERMINAL - FBO FACILITY

SELF-SERVE FUEL ISLAND

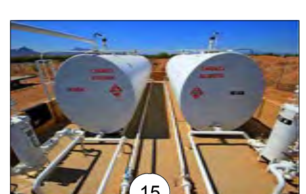
FBO AVIONICS SHOP, HANGAR AND AIRPORT ADMINISTRATION OFFICE

AIRPORT VEHICLE PARKING LOT

AIRPORT ENTRANCE SIGN

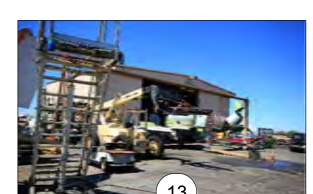
SOUTH HANGAR APRON T-HANGARS

OUTDOOR SEATING AREA



FUEL STORAGE TANKS

FBO HANGAR 2



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MARANA REGIONAL AIRPORT
MARANA, ARIZONA

EXHIBIT 2

SCALE:	N.A.	DATE:	05/2016
DRAWN:	GMR	FILE:	62595500E
CHK'D:	JRW	JOB NO.:	156259

2.20 Environmental Inventory

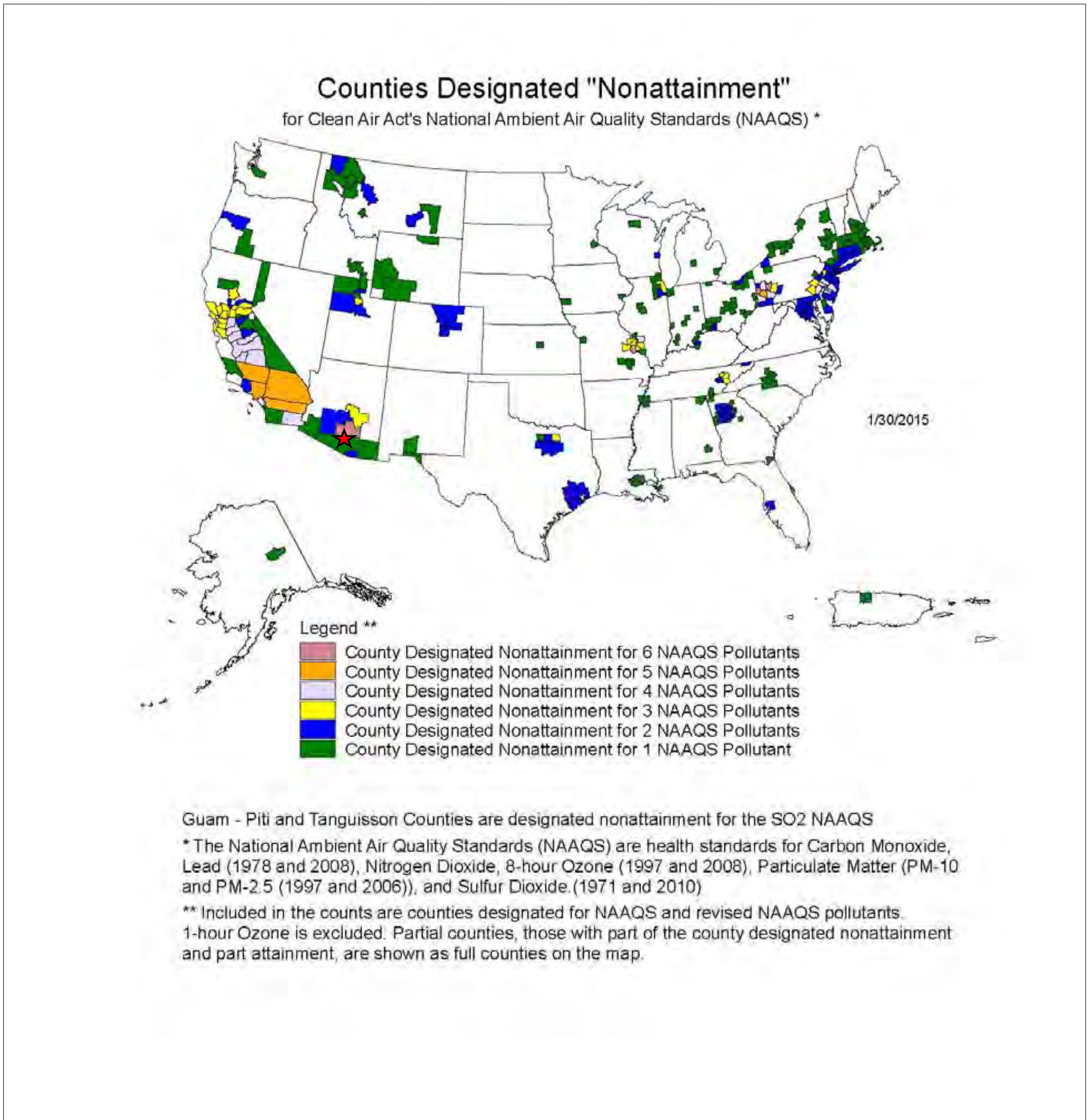
In the airport master planning process, it is required to identify potential key environmental impacts of the various airport development alternatives so that those alternatives can avoid or minimize impacts on sensitive resources. The evaluation of potential environmental impacts should only be done to the level necessary to evaluate and compare how each alternative would involve sensitive environmental resources. The data compiled in this section will be used in evaluating proposed airport development alternatives and to identify any required environmental permits for the recommended projects.

2.20.1 Air Quality

The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) based on health risks for six pollutants: carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, ozone, and two sizes of particulate matter (PM) measuring 10 micrometers or less in diameter and PM measuring 2.5 micrometers in diameters.

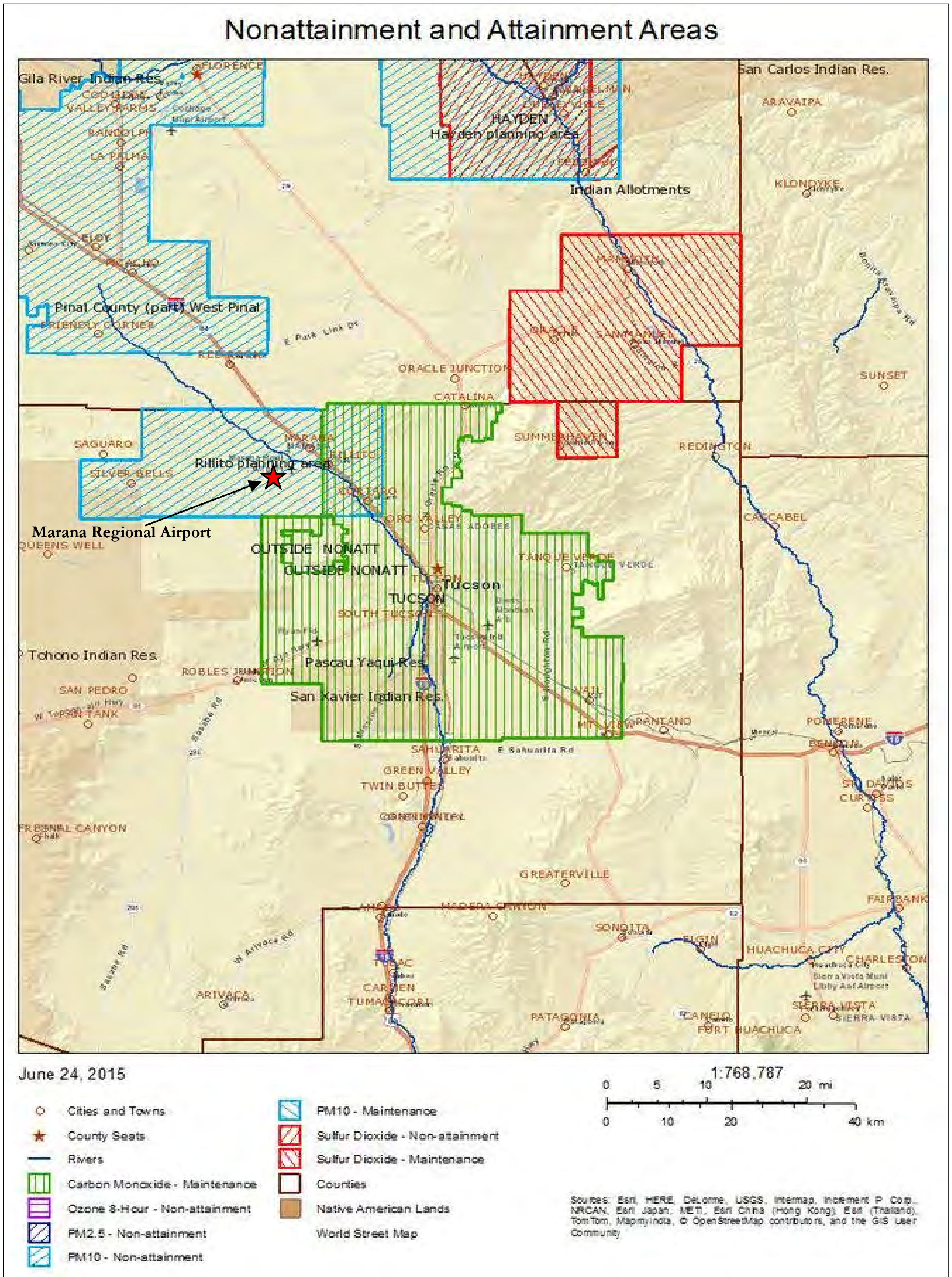
According to the EPA, an area with ambient air concentrations exceeding the NAAQS for a criteria pollutant is said to be a nonattainment area for the pollutant's NAAQS, while an area where ambient concentrations are below the NAAQS is considered an attainment area. The EPA requires areas designated as nonattainment to demonstrate how they will attain the NAAQS by an established deadline. To accomplish this, states prepare State Implementation Plans (SIPs) which are typically a comprehensive set of reduction strategies and emissions budgets designed to bring the area into attainment.

According to NAAQS, Marana Regional Airport is located in a nonattainment area for one NAAQS pollutant. A graphical illustration of counties designated nonattainment for NAAQS are depicted in **Figure 2-38**. Likewise, according to the Arizona Department of Environmental Quality (ADEQ), the Airport is located in a nonattainment area. A graphical illustration of the ADEQ nonattainment and attainment areas are depicted in **Figure 2-39**. Further evaluation of any potential air quality impacts will be discussed in the Environmental Overview chapter.



Source: U.S.EPA, June 2015

Figure 2-38 EPA - Counties Designated Nonattainment (NAAQS)



Source: ADEQ, June 2015

Figure 2-39 ADEQ - Nonattainment and Attainment Areas

2.20.2 Biotic Communities/Endangered and Threatened Species of Flora and Fauna

Consideration of biotic communities and endangered and threatened species is required for all proposals under the Endangered Species Act as Amended. Section 7 of the Endangered Species Act as Amended requires each Federal agency to ensure that any action the agency carries out "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat" of critical species.

All of the federally listed threatened and endangered species within Pima County are shown in **Table 2-21**. Pima County encompasses a large area, and therefore all of the threatened, endangered, and candidate species listed on **Table 2-21** are not necessarily found at the Marana Regional Airport.

Table 2-21 Threatened, Endangered, and Candidate Species (Pima County, Arizona)

Common Name	Scientific Name	Status
Chiricahua leopard frog	Rana chiricahuensis	Threatened
Masked bobwhite (quail)	Colinus virginianus ridgwayi	Endangered
American peregrine falcon	*Falco peregrinus anatum*	Recovery
California least tern	Sterna antillarum browni	Endangered
Yellow-billed Cuckoo	Coccyzus americanus	Threatened
Mexican spotted owl	Strix occidentalis lucida	Threatened
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered
Gila topminnow	Poeciliopsis occidentalis	Endangered
Gila chub	Gila intermedia	Endangered
Desert pupfish	Cyprinodon macularius	Endangered
Acuna Cactus	Echinomastus erectocentrus var. acunensis	Endangered
Nichol's Turk's head cactus	*Echinocactus horizonthalonius var. nicholii*	Endangered
Kearney's blue-star	Amsonia kearneyana	Endangered
Pima pineapple cactus	*Coryphantha scheeri var. robustispina*	Endangered
Huachuca water-umbel	*Lilaeopsis schaffneriana var. recurva*	Endangered
Sonoran pronghorn	Antilocapra americana sonoriensis	Endangered
Jaguar	Panthera onca	Endangered
Ocelot	Leopardus Felis	Endangered
Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*	Endangered
Northern Mexican gartersnake	*Thamnophis eques megalops*	Threatened
Sonoyta mud turtle	Kinosternon sonoriense longifemorale	Candidate
Sonoran Desert tortoise	*Gopherus morafkai*	Candidate

Source: US Fish and Wildlife Service, June 2015

2.20.3 Coastal Zone Management Program and Coastal Barriers

Marana Regional Airport is not located within or adjacent to a coastal zone. Any proposed action and reasonable alternatives will not adversely impact the coastal zone natural resources protected by the National Oceanic and Atmospheric Administration (NOAA) regulations under 15 CFR Part 930.

2.20.4 Department of Transportation (DOT) Act, Section 4(f)

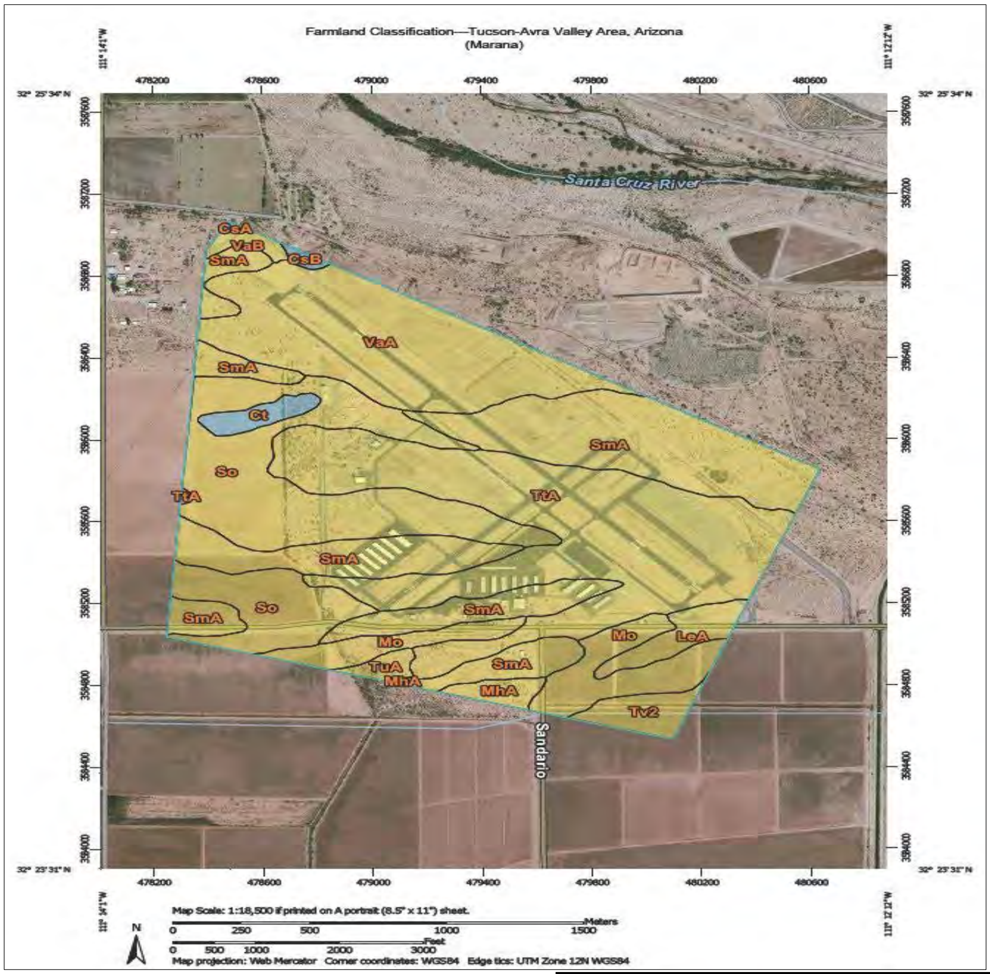
Section 4(f) of the DOT Act places restrictions on the use of any publicly-owned recreational land, public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance. There are no Section 4(f) resources in the near vicinity of the Marana Regional Airport. The nearest Section 4(f) resource is Marana Park, which is located approximately six miles north of the Airport.

2.20.5 Farmland

The Farmland Protection Policy Act (Public Law 97-98) directs federal agencies to use criteria developed by the U.S. Department of Agriculture to identify and analyze impacts related to the conversion of farmland to nonagricultural uses. According to the U.S. Department of Agriculture, Natural Resources Conservation Services (NRCS), the area consists of the following soil ratings:

- Three small areas with farmland of unique importance; soils found include Cowan loamy sand/sandy loam
- The large remainder of the area prime farmland if irrigated; soils found include Laveen loam, Mohave loam/clay loam, Sonoita sandy loam/sandy clay loam, Tubac sandy loam/sandy clay loam/clay, and Valencia sandy loam

It is important to note that there are currently no active farming activities taking place on the Airport property. According to the Farmland Protection Policy Act, the regulation does not apply to land already committed to "urban development or water storage," i.e., airport developed areas, regardless of its importance as defined by the NRCS. The farmland soil classifications in the vicinity of the Marana Regional Airport are shown on **Figure 2-40**.



Source: U.S. Department of Agriculture, Natural Resources Conservation Services, June 2015

Figure 2-40 Farmland Soil Classification Map

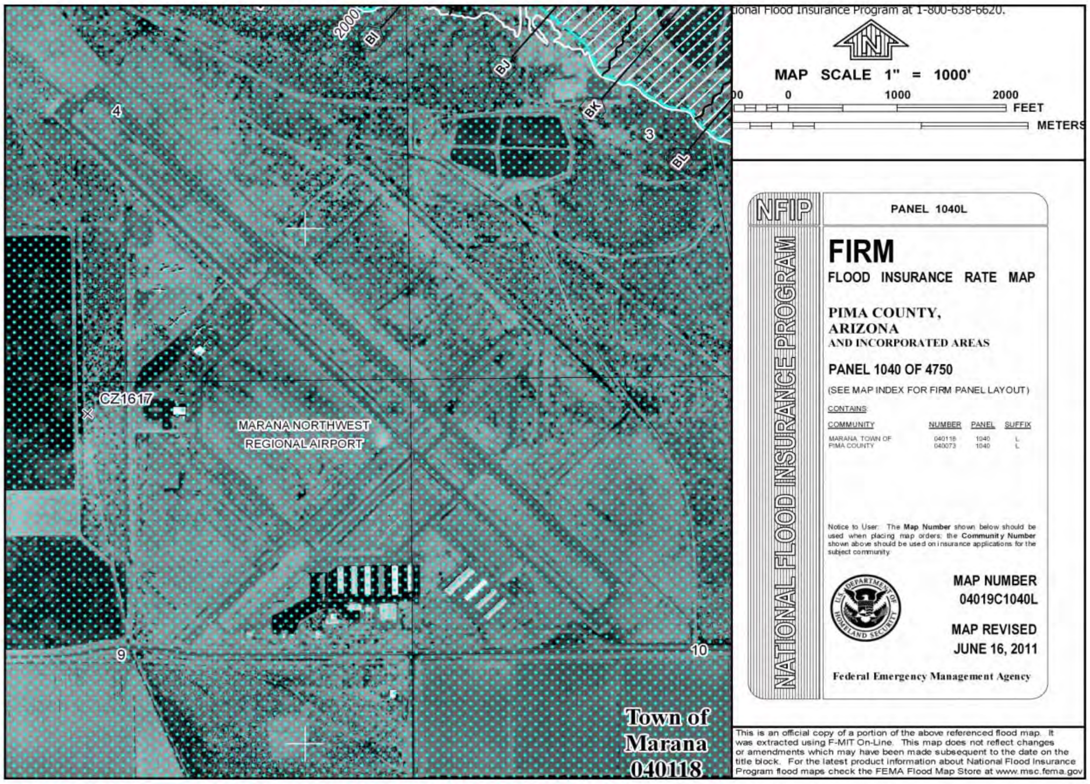
2.20.6 Floodplains

Floodplains are defined as "the lowland and relatively flat areas adjoining inland and coastal waters including flood-prone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year."

The Threshold of Significance (TOS) is exceeded when there is an encroachment on a base floodplain (100-year flood). An encroachment involves:

- A considerable probability of loss of life;
- Likely future damage associated with encroachment that could be substantial in cost or extent, including interruption of service or loss of vital transportation facilities; or
- A notable adverse impact on natural and beneficial flood plain values.

According to the Federal Emergency Management Agency (FEMA) National Flood Insurance Rate Map, the Airport property is located in Special Flood Hazard Area labeled Zone AO, which according to FEMA is defined as the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year. The FEMA designated floodplains in the vicinity of the Marana Regional Airport are illustrated in **Figure 2-41**.



Source: FEMA, June 2015

Figure 2-41 FEMA National Flood Insurance Rate Map

2.20.7 Hazardous Materials

According to the EPA, there are no existing hazardous materials located on the Airport. If hazardous materials are encountered during construction on future projects, the Arizona Department of Environmental Quality will be contacted regarding procedures for the handling and the disposal of the hazardous materials.

2.20.8 Stormwater Pollution Prevention Plan (SWPPP)

Stormwater runoff is rainfall that flows over the ground surface. It is created when rain falls on roads, driveways, parking lots, rooftops and other paved surfaces that do not allow water to soak into the ground. When stormwater runs through property that is being used for industrial or that is under construction it has the potential to carry pollutants into national waterways thereby affecting water quality.

2.20.8-1 Governing Law

In 1972, Congress passed the Clean Water Act (CWA). The CWA seeks to protect and improve the quality of the nation's waters. Toward this end, the Clean Water Act prohibits the discharge of any pollutants to waters of the United States unless that discharge is authorized by a National Pollutant Discharge Elimination System (NPDES) permit. Initial efforts under the NPDES program focused on reducing pollutants in discharges of industrial process wastewater and municipal sewage. As pollution control measures were implemented, it became evident that there were other sources contributing to the degradation of water quality.

In 1990, the U.S. Environmental Protection Agency (EPA) published regulations governing storm water discharges under the NPDES program. These regulations established requirements for permitting storm water discharges from industrial facilities, construction sites, and municipal storm sewer systems (not affiliated with the Airport system).

In December 2002, EPA delegated the State's NPDES storm water program to the Arizona Department of Environmental Quality (ADEQ). The Arizona Pollutant Discharge Elimination System (AZPDES) program now has regulatory authority other discharges of pollutants to Arizona surface water.

2.20.8-2 Airport SWPPP

The Marana Regional Airport is eligible to be covered under the Arizona Department of Environmental Quality (ADEQ) Arizona Pollutant Discharge Elimination System General Permit for Stormwater Discharges Associated with Industrial Activity from Non-Mining Facilities to Waters of the United States, also referred to as the General Permit. The General Permit became effective on February 1, 2011, and expires on January 31, 2016. The Airport has a Multi-Sector General Permit which requires the preparation of a SWPPP. The Airport has a SWPPP in place that is updated annually according to airport management. The Airport SWPPP also includes the tenants on the Airport. Separate permits are required for construction activities that disturb one or more acres of land.

2.20.8-3 Spill Prevention

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

2.20.8-4 Drainage Plan

The Town of Marana prepared a Master Drainage Plan in 2007. The Plan looked at the existing drainage pattern on the Airport and made recommendations for improving the overall drainage on the Airport. The Airport Master Plan will incorporate any applicable recommendations from the Master Drainage Plan in the development of the new Airport Layout Plan.

2.20.9 Historic, Architectural, Archeological, and Cultural Resources

The National Historic Preservation Act (NHPA) of 1966, as amended, requires that an initial review be made to determine if any properties that are in, or eligible for inclusion in, the National Register of Historic Places are within the area of a proposed action's potential environmental impact. The

Archeological and Historic Preservation Act (AHPA) of 1974 provides for the survey, recovery, and preservation of significant scientific, prehistoric, historical, archeological, or paleontological data when such data may be destroyed or irreparably lost due to a federally licensed or funded project.

The Preliminary Draft Environmental Assessment for Property Acquisition and Airport Traffic Control Tower conducted in 2008 for the Airport was referenced regarding historic and cultural resources. An archaeological records review and pedestrian survey was conducted. The report states that eligibility for listing in the National Register of Historic Places cannot be determined without subsurface testing to determine whether intact archaeological deposits are present. There were no sites listed that would be eligible on the National Register of Historic Places according to the 2008 Environmental Assessment. No other cultural resource surveys are known to have been conducted at the Airport.

2.20.10 Noise

Most land uses are considered to be compatible with airport noise that does not exceed 65 decibels (dB), although FAR Part 150 declares that "acceptable" sound levels should be subject to local conditions and community decisions. Nevertheless, 65 dB is generally identified as the threshold level of aviation noise which is "significant." The FAA has established 65 DNL as the threshold above which aircraft noise is considered to be incompatible with residential areas. In addition, the FAA has determined that a significant impact occurs if a proposed action would result in an increase of 1.5 DNL or more on any noise-sensitive area within the 65 DNL exposure areas.

As mentioned in Section 2.5, the Airport prepared a CFR Part 150 *Airport Noise Compatibility Planning* study resulting in the publication of the Marana Regional Airport Noise Compatibility Program (NCP). According to the Federal Register, the Town of Marana submitted to the FAA on October 11, 2006, the Noise Exposure Maps, descriptions, and other documentation produced during the noise compatibility planning study conducted from December 13, 2005 through July 27, 2006. The Marana Regional Airport Noise Exposure Maps were determined by FAA to be in compliance with applicable requirements on December 7, 2007. Notice of this determination was published in the Federal Register on December 17, 2007. This information will be used in the planning process to evaluate any potential noise impacts resulting from the proposed development plan.

2.20.11 Light Emissions

Light emissions are expected to be localized and should not have any impacts beyond the area of concern. Lighting is confined to area of illumination generally runways, parking aprons, and roadway lighting as required. No impacts are known to occur based on the existing configuration of the airfield.

2.20.12 Wetlands

Wetlands are defined in Executive Order 11990, Protection of Wetlands, as "those areas that are inundated by surface or ground water with a frequency sufficient to support...a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas..."

As depicted on **Figure 2-42**, and according to the U.S. Fish and Wildlife Service's National Wetlands Inventory, some wetlands exists on the north and east sides of the Airport. Two of the wetlands are designated as "freshwater pond" and "lake" according to the U.S. Fish and Wildlife Service vicinity map. In fact, the areas are water recharge basins; The smaller area designated as "freshwater pond" are recharge basins belonging to the Avra Valley Recharge Project, and the larger area designated as "lake" are recharge basins belonging to the Lower Santa Cruz Recharge Project. A "riverine" is also depicted east of the Airport which is an irrigation canal belonging to the Central Arizona Project (CAP). Lastly, a small portion of the Santa Cruz River basin is located northeast of the larger recharge basin, which is designated as "riverine" and "freshwater forested/shrub." No other wetlands exist on or adjacent to the Airport property.

Source: U.S. Fish and Wildlife Service, June 2015

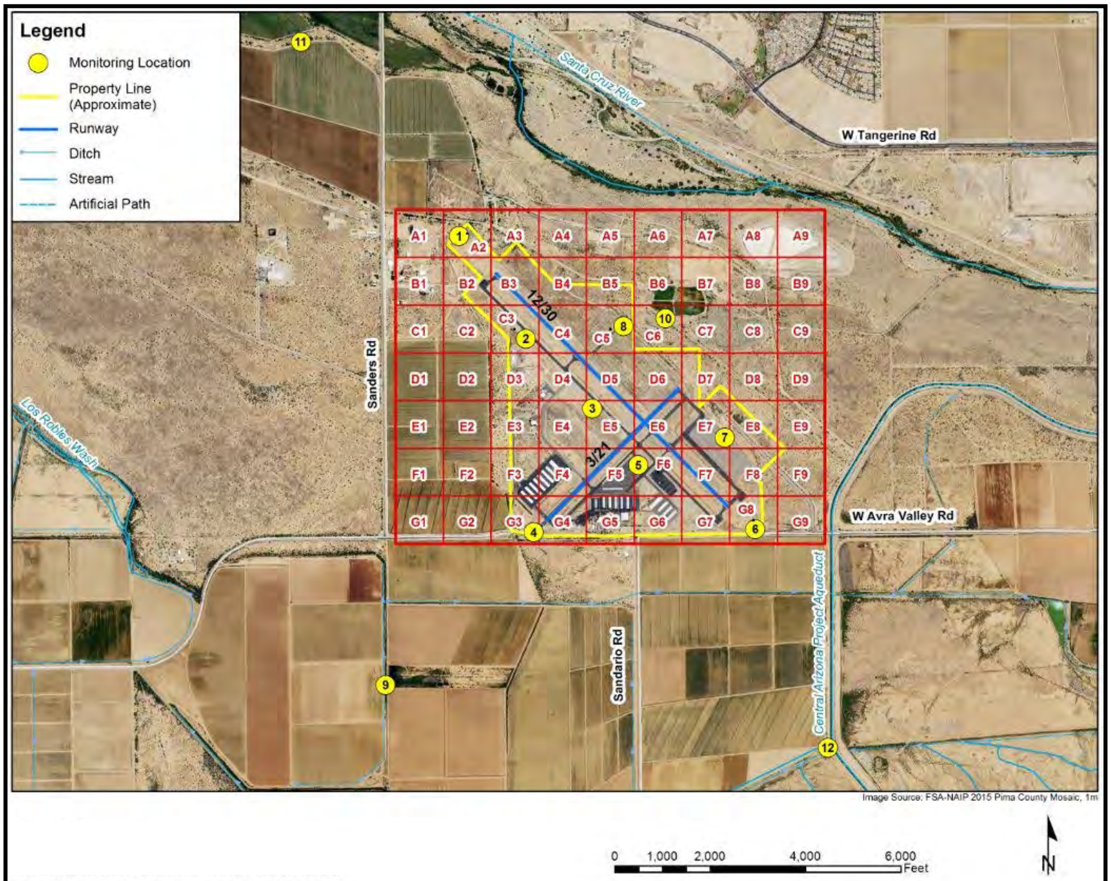
Figure 2-42 National Wetlands Inventory Vicinity Map

2.20.13 Wildlife Hazard Assessment

In 2014, ADOT received a grant from the FAA to conduct Wildlife Hazard Assessments (WHA) at eight reliever airports, including Marana Regional. A WHA includes 12-months of ongoing monitoring to identify the presence of wildlife species, especially migratory birds, and seasonal fluctuations in the behaviors and abundance of species that occur at the airport and in its vicinity. Based on the results of the 12-month monitoring effort, specific measures or recommendations are formulated to reduce wildlife hazards at the airport.

The WHA for Marana Regional was prepared by Mead & Hunt with assistance from Logan Simpson. At the time of this writing, the draft final report was issued in February of 2016. Prior to the field monitoring efforts at the Airport, a site reconnaissance survey was performed by the project team. The team identified potential on-site wildlife attractants, and several off-site attractants such as the recharge ponds to the north and northeast, the Santa Cruz River to the north, agricultural land to the west and south, and the canal to the southeast. Each wildlife attractant and its potential effect on aircraft operations was considered during the 12-month monitoring period.

Fieldwork for the WHA was performed during a 12-month monitoring period that began in November 2014 and concluded in October 2015. Based on the results of the preliminary site visit, the team identified 12 survey locations for the twice-monthly surveys and large mammal monitoring events. Eight monitoring locations within the aircraft operations area (AOA) and four monitoring locations outside the AOA were identified (**Figure 2-43**).



Source: Draft Wildlife Hazard Assessment – Marana Regional Airport, February 2016

Figure 2-43 WHA Monitoring Location Site Map

Field observations and an analysis of the survey data for the WHA concluded that wildlife is present on and near the Airport that can pose hazards to aircraft operations. As such, the report indicated additional wildlife hazard management measures are needed to reduce the overall risk posed by wildlife, and suggested an integrated wildlife hazard management program be implemented. Such a program includes ongoing administrative and technical measures, as well as short-term operational measures to reduce immediate or critical risks as they are observed and long-term measures to reduce risks over time. In addition to the devolvement of a wildlife hazard management plan/program, three additional general recommendations were presented. These include:

- Develop and implement ongoing wildlife hazard management policies and procedures that can be incorporated into daily operations;
- Implement site-specific recommendations for proposed habitat modification that would make the airport environment less attractive to potentially hazardous wildlife; and
- Implement species-specific recommendations and management techniques.

Other notable recommendations within the WHA include the review of land use changes on and near the Airport, improve and maintain the perimeter fence, and to monitor the nearby recharge ponds, Santa Cruz River and CAP Aqueduct, and nearby agricultural land for the presence of hazardous wildlife. Of these recommendations, improving and maintaining the perimeter fencing and monitoring the recharge ponds are listed as critical and high priorities for the Airport.

Chapter 3 - Forecasts of Aviation Demand

3.1 Introduction

The forecast chapter presents projections of aviation activity at Marana Regional Airport. These projections are used for evaluating the capability of the existing Airport facilities to meet current and future demand, and to estimate the extent to which facilities should be provided in the future.

Activity projections are made based on historical data, estimated growth rates, area demographics, industry trends, and other indicators. Forecasts are prepared for the short-term (0-5 years), the medium-term (6-10 years), and the long-term (11-20 years) planning period. Using forecasts within these time frames allows airport improvements to be phased in order to meet demand.

There are four types of aircraft operations considered in the planning process – local, based, itinerant, and transient. They are defined as follows:

- ***Local operations*** - are defined as aircraft movements (departures or arrivals) for the purpose of training, pilot currency, or leisure flying within the immediate area of the local airport. These operations typically consist of touch-and-go operations, practice instrument approaches, flights to and within local practice areas and leisure flights that originate and terminate at the airport under study.
- ***Based operations*** - are defined as the total operations made by aircraft based (stored at the airport on a permanent, seasonal, or long-term basis) with no attempt to classify the operations as to purpose.
- ***Itinerant operations*** - are defined as arrivals and departures other than local operations and generally originate or terminate at another airport. These types of operations are closely tied to local demographic indicators, such as local industry and business use of aircraft and usage of the facility for recreational purposes.
- ***Transient operations*** - are defined as the total operations made by aircraft other than those based at the airport under study. These operations typically consist of business or leisure flights originating at other airports, with termination or a stopover at the study airport.

The terms transient and itinerant are sometimes erroneously used interchangeably. This study will confine analysis to local and itinerant operations.

Aviation activity forecasting is an analytical and subjective process. Actual activity that develops in future years may differ from the forecasts developed in this section as a result of future changes in local conditions, the dynamics of the general aviation industry, as well as economic and political changes for the local service area and the nation as a whole. Future facility improvements should be implemented as demand warrants rather than at set future timeframes. This will allow the Airport to respond to changes in demand, either higher or lower than the forecast, regardless of the year in which those changes take place.

3.2 National and General Aviation Trends

3.2.1 National Trends

As the economy recovers from the most serious economic downturn since World War II and the slowest expansion in recent history, aviation will continue to grow over the long run. Fundamentally, over the medium and long-term, demand for aviation is driven by economic activity. According to the *FAA Aerospace Forecast, Fiscal Years 2015-2035*, the forecast calls for U.S. carrier passenger growth over the next 20 years to average 2.0 percent per year, slightly lower than last year's forecast. The U.S. economy began to show improvement in the latter half of 2014 while the economies in the rest of the world showed mixed results. With lower energy prices, U.S. carrier profitability should remain steady or increase as an economy in its sixth year of recovery leads to strengthening demand and increased revenues, while operating costs are falling or stable. Over the long term, the industry should see a competitive and profitable aviation industry characterized by increasing demand for air travel and airfares growing more slowly than inflation, reflecting over the long term a growing U.S. economy.

3.2.1 General Aviation Trends

The general aviation market continues its recovery. Again, according to the *FAA Aerospace Forecast, Fiscal Years 2015-2035*, the general aviation industry has made some notable gains within the past few years. For example, in 2014, the turbo jet sector recorded its first increase in deliveries by U.S. manufacturers since 2008. Furthermore, for a third year in a row, single-engine piston deliveries have increased. The long-term outlook for general aviation is favorable, and the near-term also looks promising especially for piston aircraft activity which is sensitive to fuel price movements. While it is slightly lower than predicted last year, the growth in business aviation demand over the long-term continues. As the fleet grows, the number of general aviation hours flown is projected to increase an average of 1.4 percent per year through 2035.

The general aviation market showed improvements in business jet and single-engine piston segments, while declines in turboprop and multi-engine piston markets translated into a slight overall improvement. Overall deliveries were up by 1.0 percent in calendar year (CY) 2014; with a 5.6 percent increase in U.S. billings. Single-engine piston shipments were up for the third year in a row, by 6.2 compared to the previous year. Because of a 10.0 percent decrease in the smaller multi-engine category, total piston aircraft shipments by U.S. manufacturers went up by 4.5 percent. Business jet shipments increased by 12.3 percent. However, an 11.2 percent decline in the turboprop deliveries generated a 2.1 percent decrease in turbine aircraft shipments (total of turboprop and business jets) by U.S. manufacturers in CY 2014. Turboprop shipments, which had increased by 13.8 percent in 2013, were nearly back to their 2012 levels. General aviation activity at FAA and contract tower airports recorded a 1.1 percent decline in 2014, which was caused by a decrease in itinerant activity; local operations were slightly down (0.6 percent) compared to previous year.

The active general aviation fleet is projected to increase at an average annual rate of 0.4 percent over the 21-year forecast period, growing from an estimated 198,860 in 2014 to 214,260 aircraft by 2035 (**Figure 3-1**). The more expensive and sophisticated turbine-powered fleet (including rotorcraft) is projected to grow to a total of 45,905 aircraft at an average rate of 2.4 percent a year over the forecast period, with the turbine jet portion increasing at 2.8 percent a year, reaching a total of 20,815 by 2035.

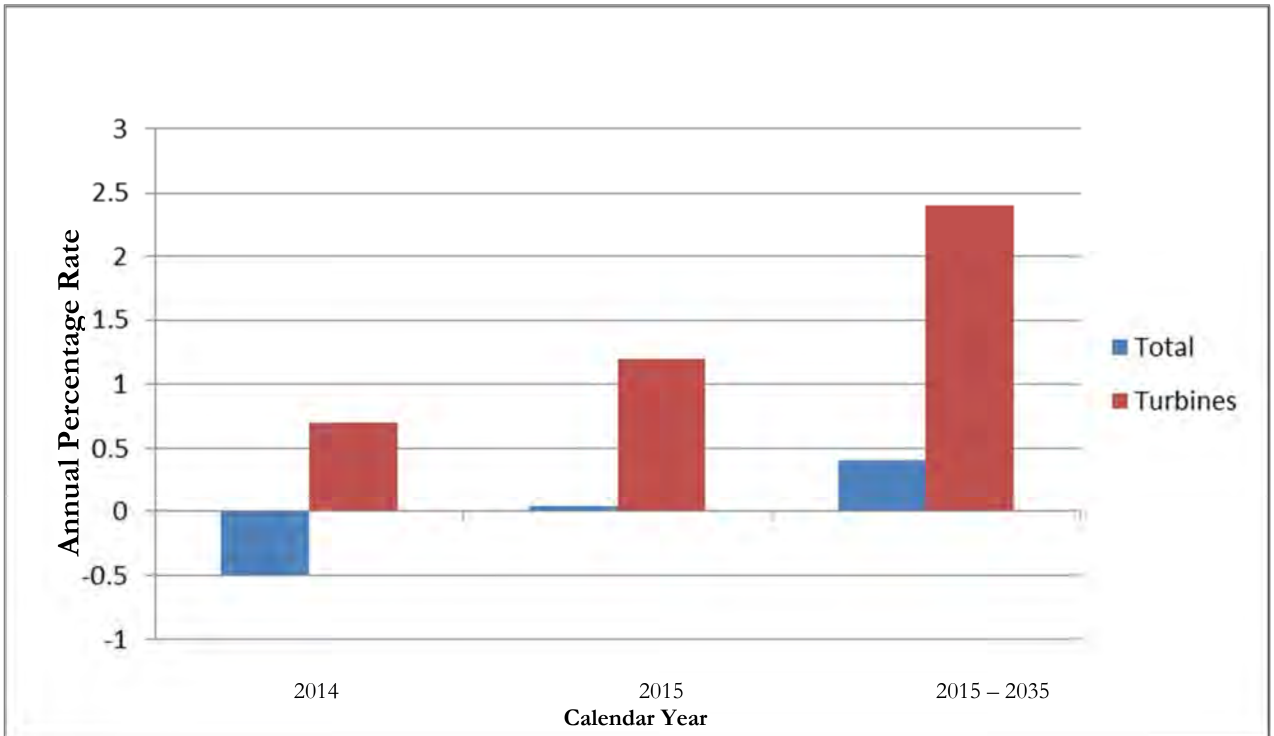
The number of active piston-powered aircraft (including rotorcraft) is projected to decrease at an average annual rate of 0.5 percent from the 2014 total of 139,890 to 125,935 by 2035, with declines in both single and multi-engine fixed wing aircraft, but with the smaller category of piston-powered rotorcraft growing at 2.1 percent a year. Single-engine, fixed-wing piston aircraft, which are much more numerous within this group, are projected to decline at a rate of 0.6 percent, while multi-engine fixed wing piston aircraft are projected to decline by 0.4 percent a year.

The total number of general aviation hours flown is projected to increase by 1.4 percent yearly over the forecast period. The FAA projects faster growth in hours will occur after 2023 with increases in the fixed wing turbine aircraft fleet, as well as increasing utilization of both single and multi-engine piston aircraft as the aging of this fleet starts to slow down. In the medium-term, much of the increase in hours flown reflects strong growth in the rotorcraft and turbine jet fleets. It is also expected that declining fuel prices will slow down the decrease in piston flight hours over the short to medium term.

Hours flown by turbine aircraft (including rotorcraft) are forecast to increase 2.9 percent yearly over the forecast period, compared with a decline of 0.3 percent for piston-powered aircraft. Although hours flown by piston rotorcraft are forecast to increase an average of 2.2 percent per year during the forecast period, they have a relatively small share (less than 10 percent) in this segment of hours flown by general aviation aircraft; and thus have a small impact on the overall trend. Jet aircraft are forecast to account for most of the increase, with hours flown increasing at an average annual rate of 3.6 percent over the forecast period. The large increases in jet hours result mainly from the increasing size of the business jet fleet, along with continued recovery in utilization rates from recession induced record lows. Turboprop hours are also expected to continue their increase, as indicated by the 2013 GA Survey.

Rotorcraft hours were less impacted by the economic downturn when compared to other categories and rebounded earlier. However, the 2013 GA survey recorded declines in the active rotorcraft fleet and utilization rates. It is uncertain if the decrease in utilization is permanent. The decline in oil prices has different effects on various segments of this sector. While decreasing activity is expected in oil exploration area, and some other functions such as aerial mapping/photography, patrol, and surveillance may see decreasing use of rotorcrafts, yet other uses, including corporate, air taxi, air medical, and air tours, may experience offsetting increases. Rotorcraft hours are projected to grow by 3.0 percent yearly over the forecast period with utilization of rotorcraft projected to increase by 0.4 percent a year. Turbine rotorcraft hours are forecast to grow at an average annual rate of 3.2 percent over the forecast period.

Lastly, the light sport aircraft category, which now includes only the special light sport (experimental light-sport aircraft is now considered as part of the experimental aircraft category), is expected to see an increase of 5.1 percent a year in hours flown, primarily driven by growth in the fleet.



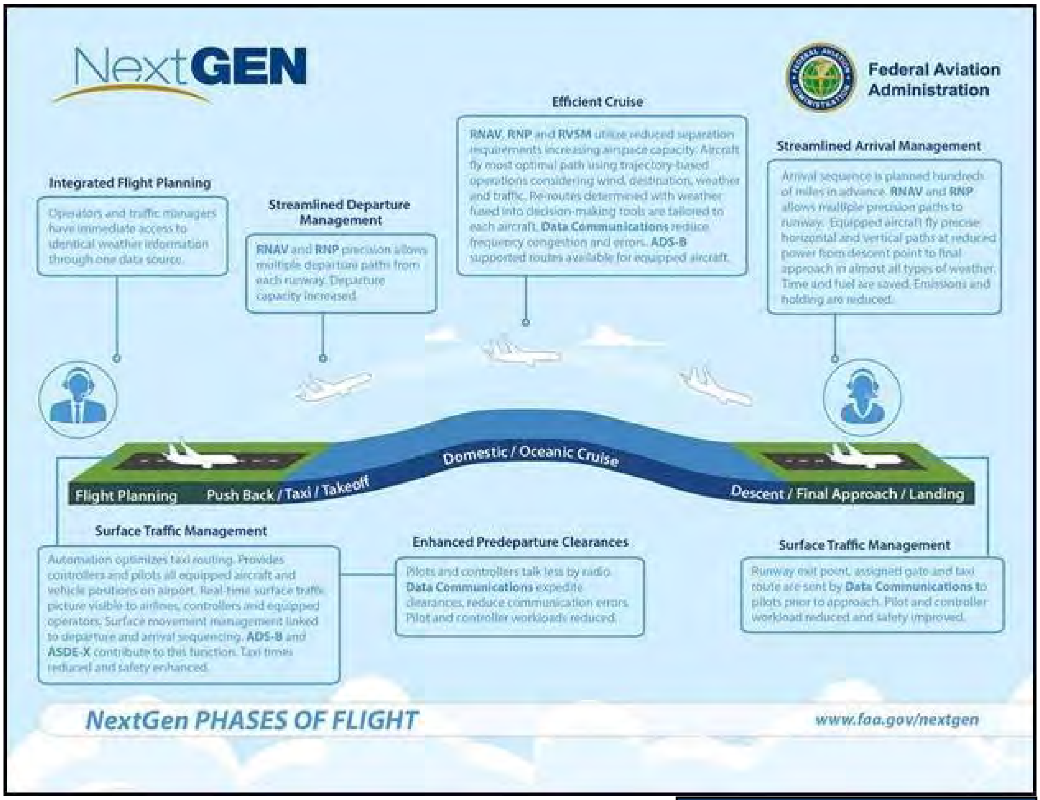
Source: FAA Aerospace Forecasts 2015 - 2035

Figure 3-1 Active General Aviation Aircraft

3.2.3 Other Aviation Industry Trends

Other aviation industry trends in the U.S. include new emerging technologies and the acknowledgement of the importance aviation has on the economy. New technologies such as NextGen and unmanned aerial systems (UAS) continue to expand in a positive direction. Likewise, the aviation industry continues to be economically beneficial for not only the U.S. as a whole, but also for the state of Arizona; the aviation industry has been found to contribute a sizable amount of jobs and money, either by primary or induced impacts, to the State. Both new emerging technologies and studies documenting the economic impacts of aviation are anticipated to remain trends within the industry in the near future.

Next Generation Air Transportation System (NextGen) is a new era in flight that is transforming how aircraft navigate the sky and is a replacement to the World War II era technology that has until recently been the primary navigation technology. NextGen utilizes satellite technology which allows pilots to know the precise locations of other aircraft around them. This allows more planes to operate in the sky while enhancing the safety of air travel. Satellite landing procedures also allow pilots to arrive at airports more efficiently by providing more direct flight routes. **Figure 3-2** illustrates the various stages of the NextGen technology.



Source: Federal Aviation Administration, 2016

Figure 3-2 NextGen Phases of Flight

3.3 Historical and Existing Aviation Activity and Fleet Mix

The first step in preparing aviation forecasts is to examine historical and existing activity levels and available forecasts from other sources. The aviation forecasts developed as part of the 2007 Airport Master Plan (AMP) serve as the historical basis for the updated forecasts in this chapter. Current local and regional demographic information and aviation activity at the Airport, as well as other FAA and State aviation forecasts, were also used to update the forecast.

General aviation activity includes a variety of aircraft, ranging from single-engine piston to multi-engine turbojets and rotorcraft. General aviation operations at Marana Regional Airport include personal and business transportation, flight instruction and training, air ambulance, law enforcement, and skydiving, as well as special events such as fly-ins and air shows.

The definition of based aircraft as taken from the FAA's National Based Aircraft Inventory Program is defined as: an aircraft that is operational and air worthy, which is typically based at a facility for a **majority** of the year. An aircraft operation is defined as either a landing or take-off by an aircraft. The fleet mix for an airport is comprised of the various types of aircraft that are based at the airport.

Historically, according to the 2007 AMP for the Airport, there were 218 based aircraft in 2000 and 295 in 2004 (base year data for the AMP). Likewise, there were an estimated 71,300 total annual operations in 2000 and 101,400 in 2004. A decade later, the existing based aircraft and total annual operations have declined slightly, which is briefly explained later in the chapter.

According to the airport manager, there were approximately 80,000 aircraft operations in calendar year 2014. This number was derived from baseline operations data gathered by airport personnel in recent years. Furthermore, according to airport records, there were 260 based aircraft on the airfield at the end of 2014. FAA Form 5010-1, *Airport Master Record*, is the official record kept by the FAA to document airport physical conditions and other pertinent information. The record normally includes an annual estimate of aircraft activity as well as the number of based aircraft. This information is normally obtained from the airport sponsor and depending on the sponsor's record keeping system, the accuracy will vary. The current FAA Form 5010-1 for Marana Regional Airport indicates 227 based aircraft and 90,000 annual aircraft operations as of August of 2015. Besides Form 5010-1, the FAA also relies on data found on their sponsored website for the National Based Aircraft Inventory Program (www.basedaircraft.com). Non-primary NPIAS airports are required to enter and keep up-to-date based aircraft numbers via this database so that Form 5010-1 can be accurately updated by the FAA. At the time of this writing, the airport manager was in the process of compiling the 2015 based aircraft numbers, which will at some point be updated on the basedaircraft.com website, and ultimately on the Form 5010-1. According to the airport manager, the numbers on the 5010-1 are outdated; once updated, the 2015 based aircraft and total annual operations should closely resemble those of 2014. Further discussion on the reasoning behind the difference between the actual reported numbers by airport management and those reflected on the 5010-1, and the TAF for that matter, can be found in following section.

3.4 Federal and State Forecasts and Projections

As previously mentioned, aviation forecasting also takes place on the national and state level. The FAA makes projections for based aircraft and annual operations using the Terminal Area Forecast (TAF), the official forecast of aviation activity for U.S. airports. The TAF is commonly used by the FAA as a planning and budgeting tool. At the State level, the Arizona Department of Transportation (ADOT) Aeronautics Group also maintains a State Aviation System Plan (SASP), in which forecasts for all airports in the state are available. Data from the January 2015 TAF and 2008 Arizona SASP (most current available) for the Airport were reviewed for this Airport Master Plan Update.

- The 2015-2035 TAF data for the Airport projects 237 based aircraft in 2015, which increases to 356 over the course of the 20-year forecast period. Likewise, the projected total annual operations occurring in 2015 is 114,032, with an ultimate projection of 165,060 over the 20-year forecast period.
- According to the medium forecast contained in the Arizona SASP, in 2012 the Airport was projected to have 338 based aircraft and 121,200 annual operations; in 2017, it was projected to have 374 based aircraft and 133,600 annual operations. Extrapolation of these figures indicates approximately 356 forecast based aircraft for the year 2015.

The actual number of based aircraft and related operations according to airport management for calendar year 2014 are reported as 260 based aircraft and approximately 80,000 annual operations; These numbers are substantially less than the Arizona SASP forecasts, which may be attributed to a variety of economic conditions that occurred in the Nation and the state after a general economic downturn beginning in 2008.

For aircraft operations, the TAF and SASP data may not be as accurate for airports that do not have an air traffic control tower; normally aircraft operations are recorded by air traffic controllers and reported to the FAA. As such, for an airport that does not have an air traffic control tower, like Marana Regional Airport, aircraft operations are more difficult to record and are often estimates made by airport management and staff.

Knowing this, the FAA Statistics and Forecast Branch developed Equation #15, *Model for Estimating General Aviation Operations at Non-Towered Airports*. The model was used to estimate the number of operations at 2,789 non-towered general aviation airports included in the FAA TAF. Local factors such as the number of based aircraft, population, location, and the number of flight schools is applied to the equation resulting in an estimated number of annual operations.

In the case of the Marana Regional Airport, management feels that previous operation counts and forecasts have proven to be artificially high in the light of the economic conditions from 2008 onward; the aviation industry has only started to recover within the past couple of years. During 2014, management made spot checks of daily aviation activity, consulted fuel sales records, and reviewed historical IFR activity records for the facility in order to estimate the total annual operations.

Fuel sales at the Marana Regional Airport have actually increased from approximately 237 thousand gallons of Jet-A in 2008, rising to 346 thousand gallons of Jet-A in 2014; this represents a net gain of more than 32 percent. However, an analysis of jet IFR traffic indicated that 418 jets filed flight plans to Marana in 2010, and only 295 filed in 2014. FAA records indicate a major increase in jet traffic in 2015, showing approximately 732 jet aircraft filed IFR flight plans into or out of Marana; this increase could be an indicator that the aviation industry has started to recover from the downturn which occurred in 2008. Approximately half of those flights were conducted with larger jet aircraft that included Gulfstream IV and V series aircraft, Cessna Citation X, Canadair Challenger 600 series, Bombardier Global Express, and Falcon 900 aircraft. Management believes that this new mix of heavier jets, which consume more fuel, accounts for the increased fuel sales even though actual annual operations appear to be lower.[4]

To summarize, management believes fewer annual operations are occurring compared to the projections made in the TAF and SASP. However, more of the larger jet aircraft are frequenting the airport, which provides an explanation for the increased fuel sales. The net result supports management's belief that fewer annual operations occurred at the airport in 2014 due to a change in the composition of aircraft using the facility, which therefore led to the reassessment of the 2014 annual operations numbers to be approximately 80,000 as compared to the 90,000 reported on the 5010-1.

A summary of the historical, existing, and forecasted based aircraft and annual operations data generated from all sources described above are shown in **Table 3-1.** The aircraft type data for the 2015 TAF was estimated by using the ratio of current aircraft types and numbers as reported by airport management for 2014.

[4] GCR AirportIQ Data Center, 2010-2015 jet IFR flight plan data

Table 3-1 Historical, Existing, and Forecasted Aviation Activity Data

Based Aircraft						
	2000[1]	2004[1]	2014[2]	2015[3]	2015[4]	2035[4]
Single-engine	189	229	214	189	195	242
Multi-engine	25	28	35	22	28	28
Turboprop	0	12	_	3	3	6
Jet	3	22	4	3	4	41
Rotorcraft	1	4	2	4	2	28
Other	0	0	5	6	5	11
Total Based Aircraft	218	295	260	227	237	356
Annual Operations						
	2000[1]	2004[1]	2014[2]	2015[3]	2015[4]	2035[4]
Itinerant general aviation	17,500	27,090	28,000	30,000	36,484	55,276
Local general aviation	48,500	72,310	32,000	40,000	62,548	94,784
Total General Aviation	66,000	99,400	60,000	70,000	99,032	150,060
Air Taxi and Commuter	5,000	0	8,000	10,000	10,000	10,000
Military	300	2,000	12,000	10,000	5,000	5,000
Total Annual Operations	71,300	101,400	80,000	90,000	114,032	165,060

Sources: [1]Marana Regional Airport Master Plan, 2007; [2]Marana Regional Airport management – June, 2015; [3] FAA Form 5010-1 – August, 2015; [4]FAA Terminal Area Forecast Detail Report – January, 2015

3.5 Factors Potentially Affecting Future Aviation Operations at Marana Regional Airport

Many factors have the potential to influence aviation activity at general aviation airports such as Marana Regional Airport. Based on projected national and state trends in the general aviation industry, and from discussions with Town of Marana and airport personnel, several factors have been identified which may potentially affect aviation activity at the Airport in the future.

First, the projected growth of the general aviation industry is expected to grow at a modest pace over the next 20 years. This assumption is made by projections found within the FAA's *Aerospace Forecast Fiscal Years 2015-2035* and the 2008 Arizona SASP. Specifically, according to the *Aerospace Forecast*, the active general aviation fleet is projected to increase at an average annual rate of 0.4 percent over the 20-year forecast period, growing from an estimated 198,860 in 2014 to 214,260 aircraft by 2035. In addition, the total number of general aviation hours flown is projected to increase by 1.4 percent yearly over the forecast period. Hours flown by turbine aircraft (including rotorcraft) are forecast to increase 2.9 percent annually over the forecast period, compared with a decline of 0.3 percent for piston-powered aircraft. Jet aircraft are forecast to account for most of the increase, with hours flown increasing at an average annual rate of 3.6 percent over the forecast period. Turboprop hours are also expected to continue to increase, more so than originally foreseen. An increase in the general aviation fleet and total number of general aviation hours flown could potentially mean more based aircraft and increased operations at the Airport.

The second factor is the strong historical growth occurring in the area. The Town of Marana is located in Pima County, northwest of Tucson. According to the 2010 census, the population of the town is 34,961. Marana was the fourth fastest-growing city among all cities and towns in Arizona of any size from 1990 to 2000. The Town of Marana also boasts a strong local economy where agriculture, retail trade, government, technology, and tourism are the top employers. The southern portion of Marana has grown considerably since the early 1990s with the addition of businesses and some housing, much of it due to annexation of existing unincorporated areas. In 1992, the Marana Town Council voted to annex an area of unincorporated Pima County that was located to the southeast of the town limits. These areas were mainly high density commercial businesses and shopping centers, including large retailers such as Costco Wholesale, Target, and Home Depot. The Town of Marana has also recently annexed a small portion of Pinal County northeast of where Interstate 10 enters Pima County.[5] The continued increases in population for both the Town of Marana and Pima County has the potential to include a portion of its population that uses general aviation aircraft for recreational or business purposes, and who may be inclined to either base an aircraft or fly to or from the Airport on a regular basis, thus increasing the Airport's aviation activity.

A third factor which may influence aviation activity at the Airport is the development and implementation of an Airport Business Plan. In conjunction with other economic development efforts by the Town of Marana, the county, and state, this effort may pave the way for attracting additional businesses and related flight activity to the area.

Specifically, the Business Plan development process will analyze the assets and resources of the Marana Regional Airport, along with outside factors and opportunities that may be leveraged to increase the effectiveness of the Airport as an economic engine and catalyst for future growth. Properly orchestrated this plan will provide a framework for attracting new businesses and services to the airport, and increase levels of aeronautic activity. The net result will be an improved revenue stream for the Airport, and new aeronautical access and services in support of future economic development opportunities in Marana.

3.6 Based Aircraft Forecast

Forecasts for based aircraft for the Marana Regional Airport were determined from data comprised of current based aircraft combined with existing forecasts from the Arizona SASP and FAA TAF, which consider growth rates for the community. In addition to the state and federal forecasts listed above, several other types of forecasting platforms were analyzed including a Per Capita forecast and a Cohort forecast. A comparative analysis of this body of data led to the development of a preferred forecast for the Marana Regional Airport.

3.6.1 Per Capita Forecast

A per capita forecast was developed that projects the number of based aircraft in direct proportion to the projected population for Pima County. As previously mentioned, Marana has experienced a significant amount of growth over the past decade, and Pima County is the second-most populous county in Arizona. According to the Arizona Department of Administration, Office of Employment and Population Statistics, the 2015 population estimate for Pima County is 1,007,162. The 2015 estimated population of Pima County and the existing based aircraft figure of 260 as reported by airport management were used to calculate the based aircraft per capita. The result of this calculation indicates approximately one based aircraft per 3,874 persons residing in Pima County. This figure was then applied to the estimated Pima County population for each year in the forecast period. The results of the per capita forecast are shown in **Table 3-2.**

[5] Source: Town of Marana Web Site; www.maranaaz.gov, retrieved August 2015

Table 3-2 Per Capita Forecast

Year	Pima County Population[1]	Based Aircraft
2015	1,007,162	260[2]
2020	1,100,021	284
2025	1,172,515	303
2030	1,243,099	321
2035	1,312,101	339

Source: [1]Pima County Population Projections: 2012 to 2050, Medium Series, Arizona Department of Administration, Office of Employment and Population Statistics, 2015. [2] Total based aircraft as reported by airport management, 2015.

A review of historic based aircraft from previous years dating back to 2000 and populations for the same years produced positive and relatively constant based aircraft per capita figures over this time period with some variations. However, this data provides a fairly strong correlation between population and based aircraft that has existed in the past, and therefore, using the based aircraft per capita as a forecasting tool for the future seems reasonable.

3.6.2 Arizona State Airport System Plan Forecast

For the second forecast, the preferred based aircraft forecast from the 2008 Arizona SASP for Marana Regional Airport was used. The 2008 Arizona SASP calculated a low, medium, and high based aircraft forecast for each airport included in the SASP through the year 2030. Various factors were used to project these forecasts, such as population projections, nationwide aviation trends, and historic growth of based aircraft at Arizona's system airports. The medium forecast was selected as the preferred forecast in the SASP for the following reasons: 1) it was based on historic based aircraft growth and FAA industry forecasts, and 2) of the three forecasts (low, medium, and high), it was most likely to reflect how based aircraft will grow at Arizona airports, especially over the long-term.

The Arizona SASP medium based aircraft forecast was analyzed for use in this update because of the reasons listed above. Although the forecast years are different from the ones for this update, the results for 2012 and 2017 are an indication of how the SASP forecasts differ from the actual 2014 based aircraft data for the Airport as supplied by airport management. For example, the SASP projected 338 based aircraft in 2012 and 374 in 2017; actual based aircraft in 2014 according to airport management totaled 260. An average of the projected based aircraft in 2012 and 2017 from the ASASP results in 356. The CAGR (Compound Annual Growth Rate) used in the medium forecast in the SASP for the Airport was 2.03 percent; this percentage was applied to airport management numbers currently reflecting 260 based aircraft and forecast through the year 2035 as shown in **Table 3-3**.

Table 3-3 Arizona State Airport System Plan Forecast

Year	Based Aircraft
2015	260
2020	288
2025	318
2030	352
2035	390

Source: Extrapolations from the Arizona State Airport Systems Plan, 2008

3.6.3 Cohort Forecast

A third forecast was developed using the cohort method; this method uses the average of based aircraft from the per capita forecast and the extrapolations from the Arizona State Aviation System Plan forecast. The results of the cohort method are shown in **Table 3-4**.

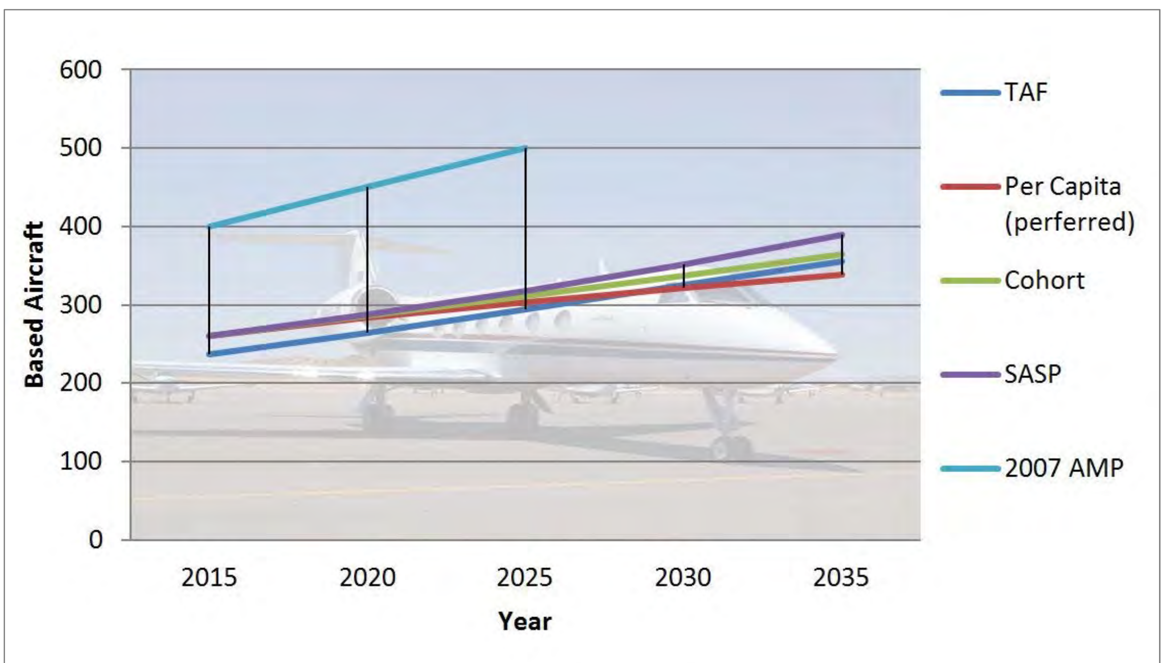
Table 3-4 Cohort Forecast

Year	Based Aircraft
2015	260
2020	286
2025	311
2030	337
2035	365

Source: Armstrong Consultants, 2015

3.6.4 Based Aircraft Forecast Summary

For comparative purposes, the three forecast methods were evaluated against the FAA TAF forecast for the years 2015-2035, which estimates a total of 237 based aircraft in 2015, increasing to approximately 356 based aircraft across the 20-year planning period. Also for comparative purposes, the based aircraft forecasted in the 2007 AMP were incorporated into the review. Based on the three forecasts and their corresponding methodologies, the Per Capita forecast has been selected as the preferred forecast. The Per Capita forecast is slightly more conservative compared to the TAF, and may also reflect more accurate population growth rates. Thus, it is believed this method best represents how based aircraft may increase at the Airport in the future. **Figure 3-3** illustrates the variation in based aircraft for each type of forecasting method.



Source: Armstrong Consultants, Inc., 2015

Figure 3-3 Based Aircraft Forecast

Determination of the future based aircraft fleet mix under the preferred forecast was based on several factors including the current mix and the percentage of aircraft types that exist today in each category. Long-range national forecasts indicate that it is likely that the older single and twin-engine fleet will decline slightly in future years, and that turbine and jet aircraft production and use will increase slightly. Based on extrapolations from current configurations, single and multi-engine aircraft will therefore make up a smaller percentage of the total aircraft fleet mix in the year 2035; likewise, turbine (jet) aircraft will account for a slightly larger percentage of the total aircraft fleet mix in the year 2035, as shown in **Table 3-5**.

Table 3-5 Preferred Forecast – Projected Based Aircraft Mix

	2015	% Total	2035	% Total
Single-engine	214	82.3%	277	81.7%
Multi-engine	35	13.4%	45	13.3%
Turboprop	-	0%	1	.3%
Jet	4	1.6%	6	1.8%
Rotorcraft	2	.8%	3	.9%
Other	5	1.9%	7	2%
Total Base Aircraft	**260**	100%	**339**	100%

Note. Future based aircraft estimates extrapolated from Per Capita Preferred Forecast.
Source: Marana Regional Airport management based aircraft count, June 2015

For future planning purposes it should be noted that the Marana Regional Airport represents a "high end" market attracting many itinerant users of heavier turbine and jet aircraft to the area's attractions on a regular basis. While the actual number of based jet aircraft is relatively low, it is not unusual to see six or more of the heavier Gulfstream IV and V type jets, along with other smaller turbine and jet aircraft, on the airport for the many special events offered in the area.[6] As previously mentioned, FAA records indicated that approximately 732 jet aircraft had filed IFR flight plans into or out of Marana in 2015. Approximately half of those flights were conducted with larger jet aircraft that included Gulfstream IV and V series aircraft, Cessna Citation X, Canadair Challenger 600 series, Bombardier Global Express, and Falcon 900 aircraft. These aircraft represent a much larger presence at the Marana Regional Airport than has existed in previous years.

Additionally, national trends indicate an increase in more turbine and jet aircraft within the national aircraft fleet mix. It is the hope of the Town and airport management that as Marana Regional Airport's market continues to develop, the corporate and personal jet traffic will also increase. All of these factors represent important considerations when evaluating the Airport's Capital Improvement Program, and the needs of runway, taxiway, and apron repairs and upgrades.

3.7 Aircraft Operations Forecast

The last Marana Regional Airport Master Plan published in 2007 calculated current and forecast airport operations to climb from 101,400 total operations in the year 2004 to 277,000 total operations in the year 2025. Due to major changes in the United States economy and other factors affecting aviation, in the long term these

[6] For a summary of the most common aircraft utilizing the airport on a regular basis, see Table 4-1, *Design Specifications of Aircraft Using Marana Regional Airport on a Frequent Basis*, in Chapter Four, Facility Requirements.

forecasts fell short of the mark. However, it is useful to compare this data with current projections and forecasts in order to create a more functional and realistic picture of future growth based on current data.

The forecast methodology used to project general aviation operations at the Airport was calculated using the current ratio of total annual operations per based aircraft (OPBA). This is a standard forecasting methodology used by the FAA. This ratio is multiplied by the projected number of based aircraft for each year in the forecast period (from the preferred based aircraft forecast). This forecast assumes that this ratio of operations per based aircraft will remain constant over the forecast period. Based on existing data of 260 based aircraft and approximately 80,000 total annual operations, the existing OPBA at Marana Regional Airport is 307.

The existing 307 OPBA at the Airport does not imply that each based aircraft performs 307 operations; rather, the ratio represents one based aircraft to 307 operations. This OPBA ratio is consistent with the moderate amount of flight training and corporate activity that occurs at the airport, as well as steady recreational activity.

In order to develop a preferred forecast of aircraft operations at the Marana Regional Airport using the OPBA methodology, three different methods were analyzed. These methods are summarized as follows:

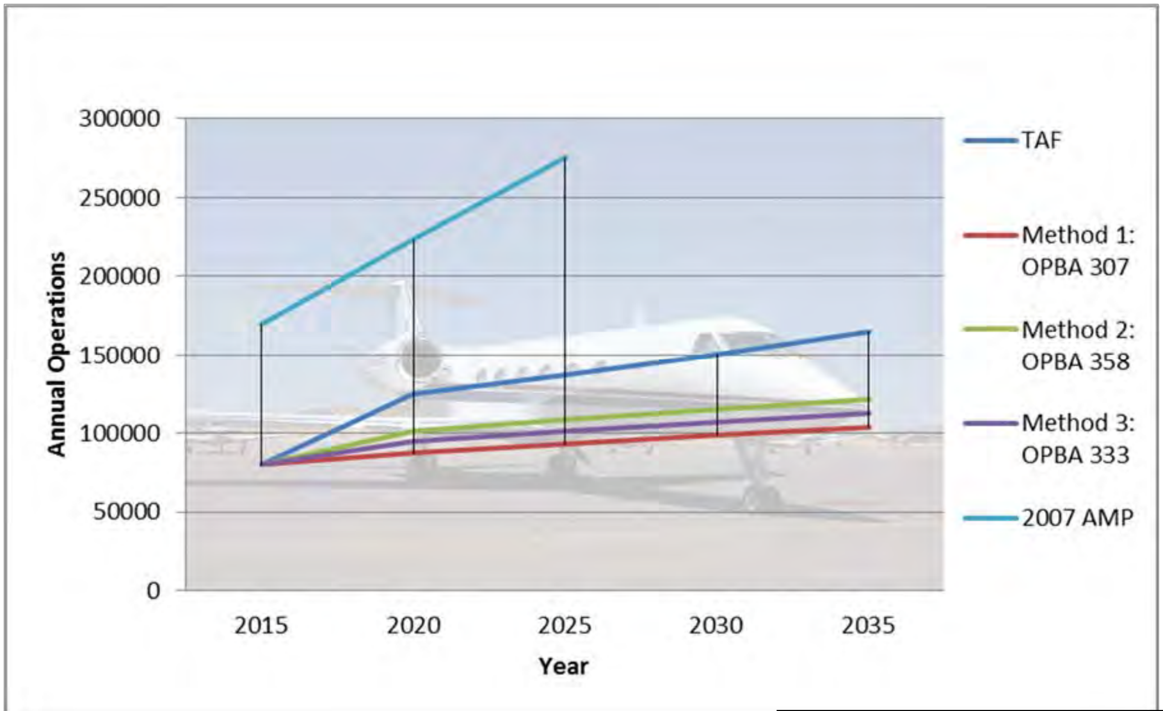
- Method 1: Existing operations per based aircraft (OPBA 307)
- Method 2: Arizona State Airports System Plan for Marana Regional Airport (OPBA 358)[7]
- Method 3: Average between existing and Arizona State Airport System Plan (OPBA 333)

For Method 1, the OPBA of 307 was applied to the preferred based aircraft forecast over the forecast period. This ultimately results in 104,073 operations per year in 2035 (307 x 339 = 104,073). Data from the Arizona SASP indicates an OPBA in excess of 7,000; this estimate appears to be excessively high, especially when considering the current factors that exist at the Marana Regional Airport. In an effort to determine a more appropriate OPBA specific to Marana Regional Airport, the SASP OPBA was modified by extrapolating forecast based aircraft against forecast annual operations which resulted in an estimated OPBA of 358. This ultimately results in 121,362 operations per year in 2035 (358 x 339 = 121,362). Finally, Method 3 uses the average OPBA between Method 1 and Method 2, which equals an OPBA of 333. This ultimately results in 112,887 operations per year in 2035 (333 x 339 = 112,887).

3.7.1 Aircraft Operations Forecast Summary

These methods provide a likely range of projected future aircraft operations at the Airport. The results of each method are illustrated in **Figure 3-4**. The FAA TAF and 2007 AMP projections were also incorporated for comparison. Upon review, Method 3 was selected as the preferred forecast, as it assumes reasonable growth in correlation with the existing local and itinerant operations currently being conducted at the Airport, and the likelihood of aircraft operations growing at a faster rate than based aircraft in the state of Arizona as predicted by the SASP.

[7]Actual estimated OPBA for Marana Regional Airport as reported in the 2008 Arizona SASP is 7,296. However, as explained above, a modified OPBA was used to determine the total annual operations for Method 2 data.



Source: Armstrong Consultants, Inc., 2015

Figure 3-4 Aircraft Operations Forecast

3.8 Instrument Operations Forecast

An instrument approach, as defined by FAA, is "an approach to an airport with the intent to land 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." An aircraft landing at an airport must follow one of the published instrument approach procedures to qualify as an instrument approach. According to the FAA TAF, approximately 25 percent of the total aircraft operations in Arizona were instrument operations in 2014. Since virtually all commercial and business jet flights and most military aircraft flights are IFR (since they fly at or above 18,000 feet MSL), the number of instrument operations does not reflect the occurrence of instrument weather or the provision of instrument approaches at airports. Additionally, this percentage is influenced by the high traffic levels at the major commercial airports in Arizona. At most general aviation airports with an instrument approach and minimal commercial service or military activity, instrument operations will comprise approximately 2.5 percent of total operations. As shown in **Table 3-6**, the estimated historical IFR activity was derived from the FAA TAF's for years 2010 through 2015. Future IFR activity for years 2020 through the end of the forecast period in 2035 was estimated based on 2.5% of the annual operations for each year based on the preferred operational forecast.

Table 3-6 Estimated IFR Activity at Marana Regional Airport

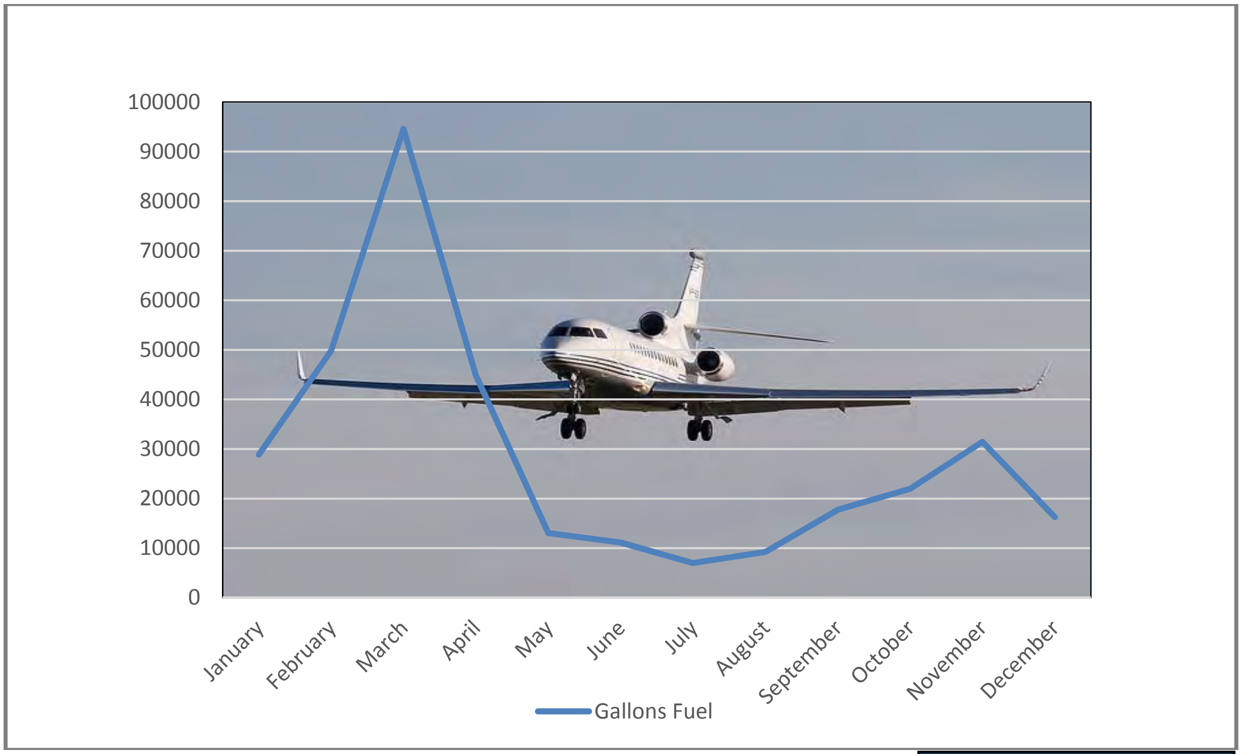
Year	Annual Operations	Estimated Annual IFR Operations
2010	112,000	2,800
2011	112,000	2,800
2012	112,000	2,800
2013	110,000	2,750
2014	111,995	2,780
2015	90,000	2,250
2020	94,572	2,364
2025	100,899	2,522
2030	106,893	2,672
2035	112,877	2,821

Source: Years 2010 – 2015, FAA TAF 2015; Years 2020 – 2035 Armstrong Preferred Aircraft Operations Forecast @ 2.5%

3.9 Airport Seasonal Use Determination

Seasonal fluctuations in aircraft operations are not unusual at any airport. Such fluctuation is most apparent in regions with severe winter weather patterns at non-towered general aviation airports. It is less pronounced at major airports, with a high percentage of commercial and scheduled airline activity where the operational numbers that tend to smooth out the seasonal fluctuations.

Non-towered general aviation airports generally experience a substantially higher number of operations in summer months than off-season months. In Arizona the opposite is true, when the best weather often times occurs in the winter. A review of the Marana Regional Airport's total fuel sales from 2014 provided a reasonable depiction of the airport's seasonal use trends. **Figure 3-5** depicts these seasonal use trends and reveals that the greatest quantity of fuel was sold in the month of March.



Source: Marana Regional Airport management, 2015

Figure 3-5 Total Jet Fuel Sales

3.10 Hourly Demand and Peaking Tendencies

A common method used in aviation forecasting to determine reasonable estimates of demand at an airport is accomplished by calculating the levels of activity during peak periods. The periods normally used to determine peaking characteristics are defined below:

- **Peak Month**: The calendar month when peak enplanements or operations occur.
- **Design Day**: The average day in the peak month derived by dividing the peak month enplanements or operations by the number of days in the month.
- **Busy Day:** The Busy Day of a typical week in the peak month. In this case, the Busy Day is equal to the Design Day.
- **Design Hour:** The peak hour within the Design Day. This descriptor is used in airfield demand/capacity analysis, as well as in determining terminal building, parking apron, and access road requirements.
- **Busy Hour:** The peak hour within the Busy Day. In this case, the Busy Hour is equal to the Design Hour.

A formula is used to calculate the average daily operations in a given month, based on the percentage of the total annual operations for the month. In this instance, fuel sales data was used to estimate the approximate number of operations for a given month. The airport provided total fuel sales for Jet-A and AvGas data for calendar year 2014 and it was used to determine the percent use calculation. The results of all calculations are shown in **Table 3-7**. As is evident in Table 3-7, the Design Day and Design Hour peak demand in the planning period occurs under VFR weather conditions in the month of March (highlighted in bold), with an average of 835 daily operations and approximately 94 operations per hour in 2035.

Table 3-7 Estimate of Monthly/Daily/Hourly Demand at Non-Towered General Aviation Airport

Planning Year: 2020					Planning Year: 2025				
Operations: 94,572					Operations: 100,899				
		Operations					Operations		
Month	% Use	Monthly	Daily	Hourly	Month	% Use	Monthly	Daily	Hourly
January	9.13%	8,637	283.9	32.0	January	9.13%	9,215	302.9	34.1
February	12.87%	12,168	400.0	45.0	February	12.87%	12,982	426.8	48.0
March	**22.50%**	**21,281**	**699.6**	**78.7**	**March**	**22.50%**	**22,704**	**746.4**	**84.0**
April	12.12%	11,464	376.9	42.4	April	12.12%	12,231	402.1	45.3
May	5.04%	4,771	156.9	17.7	May	5.04%	5,090	167.4	18.8
June	4.40%	4,163	136.9	15.4	June	4.40%	4,442	146.0	16.4
July	3.48%	3,287	108.0	12.2	July	3.48%	3,506	115.3	13.0
August	3.73%	3,530	116.1	13.1	August	3.73%	3,766	123.8	13.9
September	5.46%	5,163	169.8	19.1	September	5.46%	5,509	181.1	20.4
October	7.00%	6,620	217.6	24.5	October	7.00%	7,063	232.2	26.1
November	9.00%	8,510	279.8	31.5	November	9.00%	9,079	298.5	33.6
December	5.26%	4,979	163.7	18.4	December	5.26%	5,312	174.6	19.7
Planning Year: 2030					Planning Year: 2035				
Operations: 106,893					Operations: 112,877				
		Operations					Operations		
Month	% Use	Monthly	Daily	Hourly	Month	% Use	Monthly	Daily	Hourly
January	9.13%	9,762	320.9	36.1	January	9.13%	10,308	338.9	38.1
February	12.87%	13,753	452.2	50.9	February	12.87%	14,523	477.5	53.7
March	**22.50%**	**24,053**	**790.8**	**89.0**	**March**	**22.50%**	**25,400**	**835.1**	**94.0**
April	12.12%	12,957	426.0	47.9	April	12.12%	13,683	449.8	50.6
May	5.04%	5,393	177.3	20.0	May	5.04%	5,695	187.2	21.1
June	4.40%	4,706	154.7	17.4	June	4.40%	4,969	163.4	18.4
July	3.48%	3,715	122.1	13.7	July	3.48%	3,923	129.0	14.5
August	3.73%	3,990	131.2	14.8	August	3.73%	4,213	138.5	15.6
September	5.46%	5,836	191.9	21.6	September	5.46%	6,163	202.6	22.8
October	7.00%	7,482	246.0	27.7	October	7.00%	7,901	259.8	29.2
November	9.00%	9,619	316.2	35.6	November	9.00%	10,157	333.9	37.6
December	5.26%	5,628	185.0	20.8	December	5.26%	5,943	195.4	22.0

Note. Fuel sales data for calendar year 2014 was provided by airport management and used to determine the approximate monthly operations and percent use.
Source: Armstrong Consultants, 2015

3.11 Preferred Forecast Summary

The preferred based aircraft and annual operations forecasts for Marana Regional Airport are summarized in **Table 3-8**. These preferred forecasts estimate aviation activity levels at the Airport over the 20-year planning period using existing data as reported by airport management. Base year (2015) activity estimates for itinerant operations are 35% of total annual operations, and local operations are 40% of total annual operations. The remaining 25% of total operations are military and commercial operations. Given the difficulty in determining the actual operations at non-towered general aviation airports, the proposed forecasts are considered reasonable as they represent moderate growth in operations and based aircraft and take into consideration the potential economic growth in the region.

Table 3-8 Summary of Preferred Forecasts for Marana Regional Airport (2015-2035)

Year	Itinerant Operations	Local Operations	Military and Commercial Operations	Total Annual Operations	Total Based Aircraft
2015	28,000	32,000	20,000	80,000	260
2020	36,604	42,968	15,000	94,572	284
2025	39,514	46,385	15,000	100,899	303
2030	42,270	49,623	15,000	106,893	321
2035	45,023	52,854	15,000	112,877	339

Source: Armstrong Consultants, Inc., 2015

Chapter 4 – Facility Requirements

4.1 Introduction

This chapter identifies the requirements for airfield and landside facilities to accommodate the forecast demand levels at the Marana Regional Airport. In order to meet the demand levels, an assessment of the existing airport facilities to meet current and future demand was conducted. The facility requirements were based on information derived from capacity and demand calculations, information from FAA advisory circulars and design standards, the sponsor's vision for the future of the airport, the condition and functionality of existing facilities, and other pertinent information.

Facility requirements have been developed for the various airport functional areas listed below:

- General aviation requirements;
- Support facilities;
- Ground access, circulation, and parking requirements;
- Infrastructure and utilities; and
- Land use compatibility and control

The time frame for addressing development needs usually involves short-term (up to five years), medium-term (six to ten years), and long-term (eleven to twenty years) planning periods. Long-term planning primarily focuses on the ultimate role of the airport and is related to development. Medium-term planning focuses on a more detailed assessment of needs, while the short-term analysis focuses on immediate action items. Most important to consider is that a good plan is one that is based on actual demand at an airport rather than time-based predictions. Actual activity at the Airport will vary over time and may be higher or lower than what the demand forecast predicts. Using the three planning milestones (short-term, medium-term, and long-term) the airport sponsor can make an informed decision regarding the timing of development based on the actual demand. This approach will result in a financially responsible and demand-based development of the Airport.

4.2 Design Standards

Airport design standards provide basic guidelines for a safe, efficient, and economic airport system. The standards cover the wide range of size and performance characteristics of aircraft that are anticipated to use an airport. Various elements of airport infrastructure and their functions are also covered by these standards. Choosing the correct aircraft characteristics for which the Airport will be designed needs to be done carefully so that future requirements for larger and more demanding aircraft are taken into consideration, while at the same time remaining mindful that designing for large aircraft that may never serve the Airport is not economical.

As discussed previously in Chapter 2, Sections 2.14.1 and 2.14.2, the design aircraft(s) and Runway Design Code (RDC) are key components of the FAA's design standards. The design aircraft (or family of design aircraft), along with the RDC, provide the information needed to determine which FAA design standards apply to the airfield, and in turn can be used to determine some of the necessary facility requirements. As mentioned, the existing RDC for Runway 12 is C/II/5000 and Runway 30 is C/II/VIS; the RDC for Runways 3 and 21 are B/I/5000. The existing design aircraft for Runway 12-30 is a Canadair Challenger CL-600, and the existing design aircraft for Runway 3-21 is a Beechcraft King Air 100. Examples of the various types of aircraft that frequent the Airport on a regular basis and their specifications are illustrated in **Table 4-1**.

Table 4-1 Design Specifications of Aircraft Using Marana Regional Airport on a Frequent Basis

Aircraft	AAC/ADG[1]	Approach Speed (kts)	Wingspan (ft)	Tail Height (ft)	Max. Take Off Weight (lbs.)
Beech Bonanza V35B	A-I	70	33.5	6.6	3,400
Cessna 172	A-I	60	36.0	9.8	2,200
Eclipse 500 Jet	A-I	90	37.9	13.5	5,920
Piper Archer II	A-I	86	35.0	7.4	2,500
Pilatus PC-12	A-II	85	52.3	14.0	9,920
Beech King Air B100[2]	**B-I**	**111**	**45.9**	**15.3**	**11,799**
Cessna 182	B-I	64	36.0	9.2	2,950
Mitsubishi MU-2	B-I	119	39.1	13.8	10,800
Swearingen Merlin	B-I	105	46.3	16.7	12,500
Beech Super King Air B200	B-II	103	54.5	14.1	12,500
Cessna 441	B-II	100	49.3	13.1	9,925
Cessna Citation 525A	B-II	118	49.8	14.0	12,500
Cessna Citation 560XL	B-II	107	55.8	17.2	16,830
Cessna Citation 650	B-II	126	53.6	16.8	23,000
Dassault Falcon 50	B-II	113	61.9	22.9	37,480
Dassault Falcon 2000	B-II	114	63.3	23.2	35,888
Grumman Gulfstream I	B-II	113	78.5	23.0	35,100
Hawker 125-400A	C-I	124	47.0	16.5	23,300
Learjet 25	C-I	137	35.6	12.6	15,000
Learjet 55	C-I	128	43.7	14.7	21,500
Bombardier CL-604	C-II	132	64.3	20.3	47,600
Canadair CL-600[3]	**C-II**	**125**	**61.8**	**20.7**	**41,250**
Cessna Citation 750 X	C-II	131	63.6	18.9	36,100
Dassault Falcon 900 EX	C-II	126	63.5	24.2	48,300
Gulfstream IV	C-II	128	77.1	24.1	73,200
Gulfstream 450	D-II	149	77.1	24.1	74,600

Note. [1] The RDC is made up of the Aircraft Approach Category (AAC), the Airplane Design Group (ADG), and the runway visibility minimums expressed as the runway visual range (RVR); the RVR component has been removed since the visibility minimums of the runway do not apply when comparing aircraft types. [2] Existing design aircraft for Runway 3-21. [3] Existing design aircraft for Runway 12-30 (primary runway).
Source: FAA AC 150/5300-13A, *Airport Design*, 2015; GCR AirportIQ Data Center, 2010-2014; Armstrong Consultants, 2016

Based on existing and forecasted demand levels, these aircraft represent the most likely types of aircraft to use the facility in the planning period, and it is reasonable to maintain the existing RDCs over the course of the planning period and apply them to the existing and future development plans for the Airport. Additionally, from discussions with airport management and the likely hood of corporate jet traffic to increase beyond the 20-year planning period, it is suggested that Runway 3-21 ultimately be upgraded to accommodate B-II aircraft (which include midsize corporate jets), in which case the ultimate RDC for Runway 3-21 would become B/II/5000. The Development Alternatives chapter will outline the necessary changes to design standards needed and the areas on the airfield which should be preserved to accommodate this recommendation. Furthermore, a recommendation to create a RNAV/GPS instrument approach for Runway 30 is discussed later in the chapter, in which case the future RDC for Runway 30 would change to C/II/5000.

4.3 Airfield Capacity

The airfield capacity analysis is determined by using an airport's annual service volume (ASV). An airport's ASV has been defined by the FAA as "a reasonable estimate of an airport's annual capacity. It accounts for differences in runway use, aircraft mix, weather conditions, etc., that would be encountered over a year's time." ASV is a function of the hourly capacity of the airfield and the annual, daily, and hourly demands placed upon it. According to FAA Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*, the ASV for an airfield configuration similar to Marana Regional Airport (a single primary runway with a crosswind runway configuration) is approximately 230,000 operations.

Based on the 80,000 existing aircraft operations (landings and takeoffs) and the 230,000 ASV per AC 150/5060-5, Marana Regional Airport's current airfield capacity is 35 percent. By 2035, the capacity is estimated at approximately 49 percent using the forecasted annual operations for 2035 and the same 230,000 ASV (per the Airport's airfield configuration). For most airports, once this ratio reaches around 75 percent, a need to start planning for additional airfield components (such as runways) becomes apparent. It is evident that airfield capacity will not be a constraining factor to growth of the Airport. No additional runways are needed (from a capacity perspective) to accommodate the existing or forecasted activity. **Table 4-2** summarizes the ASV and airfield capacity relationship developed in this section.

Table 4-2 Airfield Capacity Analysis Summary

Year	Annual Operations	Annual Service Volume[1]	Annual Capacity Ratio
2015	80,000	230,000	35%
2020	94,572	230,000	41%
2025	100,899	230,000	44%
2030	106893	230,000	46%
2035	112,877	230,000	49%

Note. [1]FAA AC 150/5060-5, *Airport Capacity and Delay* data
Source: Armstrong Consultants, 2016

4.4 Airside Facility Requirements

All airports are comprised of both airside and landside facilities as presented in Chapter 2. Airside facilities consist of those facilities that are related to aircraft arrival, departure, and ground movement, along with all associated navigational aids, airfield lighting, pavement markings, and signage.

4.4.1 Runway Length

There are many factors that may determine the runway length for an airport. FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, provides guidance for determining runway length requirements. The information required to determine the recommended runway length(s) includes airfield elevation, mean maximum temperature of the hottest month, and the effective gradient for the runway. Also, the performance characteristics and operating weight of an aircraft impacts the amount of runway length needed. The following information for the Airport was used for the analysis:

- Field elevation: 2,031 feet mean sea level (MSL)
- Mean maximum temperature of hottest month (July): 101° F
- Maximum difference in runway centerline elevation (Runway 12-30): 21 feet
- Maximum difference in runway centerline elevation: (Runway 3-21) 6 feet
- Performance characteristics and operating weight of aircraft

The process to determine recommended runway lengths for a selected list of critical design aircraft begins with determining the weights of the critical aircraft that are expected to use the airport on a regular basis. For aircraft weighing 60,000 pounds or less, the runway length is determined by family groupings of aircraft having similar performance characteristics. The first family grouping is identified as small aircraft, which is defined by the FAA as airplanes weighing 12,500 pounds or less at maximum takeoff weight (MTOW). The second family grouping is identified as large aircraft, which is defined by the FAA as aircraft exceeding 12,500 pounds but weighing less than 60,000 pounds. For aircraft weighing more than 60,000 pounds, the required runway length is determined by aircraft-specific length requirements. **Table 4-3** depicts the aircraft weight categorization as recommended by the FAA.

Table 4-3 Airplane Weight Categorization for Runway Length Requirements

Airplane Weight Category MTOW			Aircraft Grouping
≤ 12,500 Pounds	Approach Speed < 30 knots		Family groupings of small airplanes
	Approach Speed ≥ 30 knots, but < 50 knots		Family groupings of small airplanes
	Approach Speed ≥ 50 knots	With < 10 Passengers	Family groupings of small airplanes
		With ≥ 10 Passengers	Family grouping of small airplanes
Over 12,500 pounds, but < 60,000 pounds			Family groupings of large airplanes
≥ 60,000 pounds or more, or Regional Jets[1]			Individual large airplane

Note. [1]All regional jets, regardless of their MTOW, are assigned to the 60,000 pounds or more weight category.
Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, 2005

Recommended runway lengths are determined using charts in AC 150/5325-4B based on the seating capacity and the mean daily maximum temperature of the hottest month of the year at the airport. The small airplanes with an approach speed of greater than or equal to 50 knots with less than 10 passenger seats and a MTOW less than 12,500 pounds recommends a runway length of 4,020 feet in order to accommodate 95 percent of the fleet; the 95 percent of fleet category applies to airports that are primarily intended to serve medium size population communities with a diversity of usage and greater potential for increased aviation activities. Also included in this category are those airports that are primarily intended to serve low-activity locations, small population communities, and remote recreational areas. The approach speed of greater than or equal to 50 knots with less than 10 passenger seats and a MTOW less than 12,500 pounds recommends a runway length of 4,660 feet in order to accommodate 100 percent of the aircraft fleet. The 100 percent of fleet category is a type of airport that is primarily intended to serve communities located on the fringe of a metropolitan area or a relatively large population remote from a metropolitan area. With an existing runway length of 6,901 feet, Runway 12-30 can accommodate 100 percent of the small airplanes.

Recommended runway lengths to serve large aircraft weighing over 12,500 pounds, but less than 60,000 pounds, are determined using a certain percentage of the useful load. The term useful load, as defined by the FAA, is the difference between the maximum allowable structural gross weight and the operating empty weight. A typical operating empty weight includes the airplane's empty weight, crew, baggage, other crew supplies, removable passenger service equipment, removable emergency equipment, engine oil and unusable fuel. According to the above referenced Advisory Circular, 75 percent of fleet at 60 and 90 percent useful load requires runway lengths of 5,500 and 8,020 feet respectively. Similarly, the Advisory Circular indicates that 100 percent of fleet at 60 and 90 percent useful load requires runway lengths of 7,070 and 10,780 feet respectively. Again, for aircraft weighing more than 60,000 pounds, which do on occasion utilize the airport, the required runway length is determined by aircraft-specific length requirements. Still, FAA calculations for this category of aircraft determined an approximate required runway length of 5,730 feet. With an existing runway length of 6,901 feet, Runway 12-30 can accommodate the majority of the aircraft that fall within the large aircraft category (over 12,500 pounds, but less than 60,000 pounds), and also aircraft that weigh more than 60,000 pounds according to FAA calculations. However, some aircraft may be somewhat constrained if they desire to take off at a higher percentage of useful load, i.e. aircraft that may wish to carry the maximum number of passengers over a great distance with full fuel tanks during the hotter summer months.

Based on the analysis, Runway 12-30 seems adequate for the existing conditions and those likely to continue in the planning period. Thus, no additional runway length is likely to occur over the course of the 20-year planning period. However, if the types and frequencies of operations change significantly at the airport, the need to revisit the runway length analysis may be warranted. The recommended runway length information for Runway 12-30 as discussed above is summarized in **Table 4-4**. Additionally, recommendations to bring Runway 30 into compliance with regard to its RSA and ROFA will be provided in Chapter 5, Development Alternatives.

Table 4-4 Runway 12-30 Length Analysis

Existing Runway 12-30 Length (ft)	**6,901**
Aircraft Grouping:	**Recommended Runway Length (ft)**
Small Aircraft (<12,500 lbs., < 10 passenger seats)	
75 percent of these small airplanes	3,340
95 percent of these small airplanes	4,020
100 percent of these small airplanes	**4,660**
Large Aircraft (<60,000 lbs.)	
75 percent of these planes at 60 percent useful load	**5,500**
75 percent of these planes at 90 percent useful load	8,020
100 percent of these planes at 60 percent useful load	7,070
100 percent of these planes at 90 percent useful load	10,780
Aircraft more than 60,000 lbs.	**5,730 (approx.)**

Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, 2005

The AC 150/5325-4B recommends the same guidelines be followed to determine the recommended runway length for crosswind runways. Small aircraft weighing less than 12,500 pounds primarily have less crosswind performance capabilities. As such, it is usually recommended that a crosswind runway accommodate 100 percent of small aircraft. The runway length requirement for Runway 3-21 based on AC 150/5325-4B reveals that the runway length of 3,892 feet is adequate for 75 percent of the small aircraft. In fact, the existing length of crosswind Runway 3-21 (3,892 feet) can accommodate approximately 84 percent of small aircraft weighing less than 12,500 pounds. According to AC 150/5325-4B, to accommodate 100 percent of small aircraft weighing less than 12,500 pounds, Runway 3-21 would need to be a lengthened to 4,660 feet. However, due to the prevailing winds in the area, the Runway 3-21 is only utilized a small percentage of the time, and therefore its ability to accommodate approximately 84 percent of the small aircraft is adequate for the planning period.

On the contrary, based on conversations with the airport management, occasional operations by larger aircraft are increasing. To accommodate larger aircraft on Runway 3-21 in the future, and to enhance the overall reliability of the Airport, an extension to Runway 3-21 should be considered if demand arises. As such, to accommodate 75 percent of large aircraft (greater than 12,500 pounds, but less than 60,000 pounds) at 60 percent useful load, Runway 3-21 would need to be extended 1,608 feet to provide an overall runway length of 5,500 feet as shown in **Table 4-5**. The recommended runway length information for Runway 3-21 as discussed above is summarized in **Table 4-5**. Furthermore, recommendations to bring Runway 3 into compliance with regard to its ROFA will be addressed in Chapter 5.

Table 4-5 Runway 3-21 Length Analysis

Existing Runway 3-21 Length (ft)	3,892[1]
Aircraft Grouping:	Recommended Runway Length (ft)
Small Aircraft (<12,500 lbs., < 10 passenger seats)	
75 percent of these small airplanes	**3,340**
95 percent of these small airplanes	4,020
100 percent of these small airplanes	4,660
Large Aircraft (<60,000 lbs.)	
75 percent of these planes at 60 percent useful load	**5,500**
75 percent of these planes at 90 percent useful load	7,870
100 percent of these planes at 60 percent useful load	6,920
Aircraft more than 60,000 lbs.	5,730 (approx.)

Note. [1] Existing runway length of 3,892 feet represents actual runway length without displacement of 494 feet.
Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, 2005

4.4.2 Runway Orientation

The FAA AC 150/5300-13A, *Airport Design*, recommends that a runway's orientation provide at least 95 percent crosswind coverage. Based on the wind data presented in Table 2-12 in Chapter 2, Runway 12-30 provides 94.61 percent wind coverage for A-I and B-I aircraft (10.5 knots), 96.93 percent wind coverage for A-II and B-II aircraft (13 knots), and 98.88 percent wind coverage for A-III, B-III, and C-I through D-III aircraft (16 knots).

With the addition of the existing crosswind Runway 3-21, the combined wind coverage is 99.24 percent, 99.83 percent, and 99.97 percent for 10.5 knots, 13 knots, and 16 knots respectively. The existing airfield configuration exceeds the FAA's recommended crosswind coverage of 95 percent; additional runways are not needed over the course of the planning period based on the Airport's existing configuration.

4.4.3 Runway Width

The required runway width is a function of airplane approach category, airplane design group, and the approach minimums for the design aircraft expected to use the runway on a regular basis. The existing runway pavement width of 100 feet for Runway 12-30 meets the existing and future FAA design standards and should be maintained over the planning period. Runway 3-21 is 75 feet wide and exceeds the B-I design standard of 60 feet. Maintaining the existing runway width is allowable, although when the runway requires reconstruction, the additional pavement width may be problematic from a funding eligibility perspective. However, since it is recommended that Runway 3-21 ultimately accommodate B-II aircraft, maintaining the 75-foot wide design standard for the potential use of the runway beyond the planning period is advisable.

4.4.4 Runway Pavement Strength and Condition

According to FAA guidance on pavement strength, the aircraft types and the critical aircraft expected to use the airport during the planning period are used to determine the required pavement strength, or weight bearing capacity, of airfield surfaces. The required pavement design strength is an estimate based on average levels of activity and is expressed in terms of aircraft landing gear type and configurations. As previously mentioned in Chapter 2, pavement design strength is not the maximum allowable weight; limited operations by heavier aircraft other than the critical aircraft may be permissible. However, it is important to note that frequent operations by heavier aircraft will shorten the lifespan of the pavement.

The existing runway pavement strengths are reported (FAA Airport Master Record – August 2015) to be:

- Runway 12-30: 75,000 pounds gross weight single-wheel landing gear, 100,000 pounds gross weight dual-wheel landing gear, and 300,000 pounds dual-tandem wheel landing gear configuration.
- Runway 3-21: 75,000 pounds gross weight single-wheel landing gear, 100,000 pounds gross weight dual-wheel landing gear, and 150,000 pounds dual-tandem wheel landing gear configuration.

Based on the existing and planned RDCs for each runway and the aircraft most likely to use the airport on a regular basis (illustrated in **Table 4-1**), the pavement strength ratings for both Runways 12-30 and

3-21 are adequate. Many A-I and B-I aircraft likely to use Runway 3-21 have a maximum takeoff weight of 12,500 pounds or less. Likewise, the majority of C-I and C-II, and even some D-II type aircraft likely to use Runway 12-30 have a maximum takeoff weight far below the 160,000 pounds dual-wheel landing gear rating for the runway. For planning purposes, the existing pavement strength ratings for both runways should be maintained over the planning period.

Although the pavement strength ratings for Runways 12-30 and 3-21 are classified correctly for the types of aircraft serving the airport, it does not indicate that either runway is currently in excellent condition. As shown in **Table 2-17,** *Summary of Pavement Condition Index Data*, found in Chapter 2, Runway 12-30's PCI index is listed as 56, which falls within the pavement preservation portion of the PCI index repair scale, but is at the very bottom of this scale. Furthermore, as shown on **Table 2-18,** *Summary of Pavement Condition Number Results*, the existing pavement structure of Runway 12-30 is not adequate for many of the regular aircraft operations which occur at the Airport; therefore, major rehabilitation should be considered to strengthen the runway pavement in the short-term. Additionally, **Table 2-17** shows Runway 3-21's PCI index as 54; this falls within the major rehabilitation portion of the PCI index repair scale. The results of the PCN classification for Runway 3-21 as shown in **Table 2-18** indicate that none of the analyzed traffic for this runway had aircraft classification numbers (ACNs) exceeding the recommended PCN; i.e. the types of aircraft utilizing this runway are not causing the runway any structural damage based on their weight, the runway itself is just in need of rehabilitation due to age and other factors which occur over the life-cycle of airfield pavement. Again, major rehabilitation of Runway 3-21 may be needed in the short term to improve the overall condition of the pavement. The ability of the airfield pavement to handle the existing and projected pavement loads is a critical component to prudent planning.

4.4.5 Taxiway and Taxilane Requirements

By definition, a taxiway is a defined path established for the taxiing of aircraft from one part of an airport to another. A taxilane is a taxiway designated for low speed and precise taxiing. Taxilanes are usually, but not always, located outside the movement area, providing access from taxiways to aircraft parking positions, hangars, and terminal areas.

FAA AC 150/5300-13A, *Airport Design*, provide planners with guidance on recommended taxiway and taxilane layouts to avoid runway incursions and to enhance the overall safety at the airport. According to the FAA, a runway incursion is "any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft." In addition, according to *Airport Design*, "good airport design practices keep taxiway intersections simple by reducing the number of taxiways intersecting at a single location and allows for proper placement of airfield markings, signage, and lighting." Existing taxiway geometry should be improved whenever feasible with emphasis on "hot spots," and to the extent practical, the removal of existing pavement to correct confusing layouts is advisable.

Based on the Airport's existing taxiway configuration, there are two taxiway connectors that provide direct access from an apron to a runway. These have been identified as taxiway connectors A-2 and B-2. Per AC 150/5300-13A, taxiways that lead directly from an apron to a runway without requiring a turn can lead to confusion and are a safety hazard. The AC recommends that any taxiway which meets this condition be relocated to a new location which then would require a turn from the taxiing aircraft, eliminating the direct access to the runway. It is therefore suggested that airport management plan to relocate and reconstruct taxiway connectors A2 and B2 in the immediate future in order to comply with FAA design standards.

As discussed previously in Chapter 2, Section 2.14.3, to arrive at the TDG, the undercarriage dimensions of the aircraft are used. The TDG design standards are based on the overall main gear width (MGW) and the cockpit-to-main gear (CMG) distance. Taxiway/taxilane width and fillet standards, and in some instances, runway-to-taxiway and taxiway/taxilane separation requirements, are determined by the TDG. The FAA advises that it is appropriate for a series of taxiways on an airport to be built to a different TDG standards based on anticipated use. On the other hand, the Airplane Design Group (ADG) is based on the wingspan and tail height and determines the safety area, object free area, and separation standards for a taxiway.

The existing design aircraft for both Runways 12-30 and 3-21 fall within the TDG 1A and 1B design standards. As illustrated in Table 2-10, *Existing Dimensional Standards – Taxiways/Taxilanes*, found in Chapter 2, it is evident that all taxiways, taxiway connectors, and several taxilanes have been built to meet TDG 2 and 3 design standards (except Taxiway C, which does not conform to either group as its dimensions fall between those of the TDG 2 and TDG 3).

For now, the Airport should continue to maintain the taxiways as is; however, when it comes time to reconstruct any taxiways/lanes in the future, it should be noted that the FAA may require that they be reconstructed to a width that accommodates the existing design aircraft and its corresponding TDG, which in this case would be TDG 1A and 1B.

In addition, the PCN Report dated October 2014 also indicated that Taxiways B, C, and E are not structurally adequate to handle regular operations of the analyzed traffic at the Airport (see **Table 2-18**). It is recommended that further review and verification of the pavement strength be undertaken in the near future. In order for the airport to accommodate heavier aircraft on a regular basis in the future, the pavement strength of the taxiways may need to be increased.

4.4.6 Aircraft Apron

An aircraft apron is typically located in the non-movement area of an airport near or adjacent to the terminal area. The function of an apron is to accommodate aircraft during loading and unloading of passengers and/or cargo. Activities such as fueling, maintenance, and short to long-term parking take place on an apron. The layout and size of an apron depends on aircraft and ground vehicle circulation needs and specific aircraft clearance requirements. There are several types of aircraft aprons:

- ***Terminal/itinerant aircraft apron –*** These aprons are adjacent to the terminal where passengers board and deplane from the aircraft. The apron also accommodates multiple activities such as fueling, maintenance, limited aircraft service, etc. Itinerant aprons handle itinerant aircraft activities which are usually only on the airport for a few days. At general aviation airports, this type of apron can also provide some tie-down locations for both itinerant and based aircraft.
- ***Tie-down apron –*** An apron area for both short-term and long-term aircraft parking (based and itinerant aircraft).

- ***Other services apron –*** Apron areas that will accommodate aircraft servicing, fueling, and the loading/unloading of cargo.
- ***Hangar aprons –*** This is an area on which aircraft move into and out of a storage hangar.

FAA AC 150/5300-13A, *Airport Design*, provides design criteria to assist in apron layout and capacity. For the purpose of calculating the aircraft apron size, the following planning criterions were used:

- 800 square yards of apron per aircraft for single-engine and multi-engine aircraft
- 1,500 square yards per aircraft for turbo-props and business jets
- 30% of single-engine (forecasted) based aircraft will require apron parking
- 10% of multi-engine (forecasted) based aircraft will require apron parking
- 10% of turbojet (forecasted) based aircraft will require apron parking
- Itinerant aircraft apron requirements are based on the design hour operations

Based on the above criterion, additional based aircraft parking apron is likely needed in the planning period. The Airport and the Town of Marana should monitor the utilization of the apron and based on the above criterion, make adjustments in the apron size as needed. It is recommended that routine reconstruction and pavement maintenance projects take place on the existing apron as well. **Table 4-6** depicts the aircraft parking apron requirements for the Airport; the best course of action regarding aircraft parking apron pavement will be included in the Development Alternatives chapter.

Table 4-6 Aircraft Parking Apron Requirements

Aircraft Parking Apron Requirements (Based on Forecasts)	Available in 2015	Year			
		2020	2025	2030	2035
Existing Apron Parking Positions	140	-	-	-	-
Designated Parking Positions for SE/ME Aircraft	140	74	78	82	87
Designated Parking Positions for Turboprops and Business Jets	0	1	1	1	1
Based Aircraft Parking Apron Area (approx. sy)[1]	34,000	61,000	64,000	67,000	71,000
Itinerant Aircraft Parking Apron Area (approx. sy)[2]	124,000	92,000	98,000	104,000	110,000
Total Aircraft Parking Apron Area (approx. sy)	158,000	153,000	162,000	171,000	181,000

Note. Apron development will depend on actual demand. SE/ME = single-engine/multi-engine.
[1]Planning period calculations are based on 800 square yards per forecasted SE/ME aircraft, plus a constant 1,500 square feet for turbojet aircraft; calculations have been rounded and are approximate. [2]Planning period calculations are based on the forecasted design hour operations multiplied by an average apron requirement of 1,150 square feet per aircraft; calculations have been rounded and are approximate.
Source: Armstrong Consultants, Inc., 2016

Besides the apron space requirements, it is evident based on the 2014 PCN Report for the Airport that several of the Airport's aprons are not structurally adequate to handle regular operations of the aircraft using these apron areas. These aprons include (referred to by their common names by airport users/personnel) the Terminal/FBO and Itinerant Parking Apron, the East Hangar Apron, and the East Apron. As mentioned in the previous section, further review and verification of the pavement strength should be undertaken in the near future. In order for the airport to accommodate heavier aircraft on a regular basis in the future, the pavement strength of the aforementioned aprons may also need to be increased.

4.4.7 Instrument Aids to Navigation

The airport has non-precision, GPS and NDB instrument approach procedures to Runway 12 and 3-21. These approaches provide for visibility minimums as low as one mile and cloud ceiling down to 500 feet. These approaches should be maintained in the future as they provide all-weather capabilities for the airport.

Non-precision Global Positioning System (GPS) approaches do not require ground-based facilities on or near the airport for navigation. The GPS receiver uses satellites for navigation, and it involves little or no cost for the airport sponsor. GPS was developed by the United States Department of Defense for military use and is now available for civilian use. GPS approaches are rapidly being commissioned at airports across the United States with typical approach minimums of 350-foot ceilings and one-mile visibility. An instrument approach increases the utility of the airport by providing for the capability to operate in inclement weather conditions. This is especially important for air ambulance, physician transport, and business flights. It is also useful for conducting training and maintaining instrument currency.

Development of an Area Navigation (RNAV) approach with one-mile visibility minimums to Runway 30 is recommended, as it would provide enhanced safety and utility during hours of darkness and adverse weather conditions. Visibility minimums of lower than one mile are not necessary based on the weather conditions which typically occur in southern Arizona. Further investigation as to whether or not a non-precision instrument approach can in fact be created for Runway 30 will be determined by the FAA Flight Procedures Office.

4.4.8 Airfield Lighting, Signage, Markings, and Visual Aids to Navigation

Based on findings from the airport inventory as discussed in Chapter 2, several recommendations for improvements to the airfield lighting, signage, markings, and visual aids to navigation are recommended for the Airport. These recommendations include the following:

- ***Airfield Lighting:*** During the inventory process, it was noted that all of the MIRL and MITL on the airfield use incandescent light fixtures. There has been much advancement in light emitting diode (LED) fixtures on airports over the last several years. LED fixtures are much more energy efficient and have a longer life span than traditional incandescent fixtures. The Airport may want to consider replacing the existing incandescent MIRL and MITL in the medium- to long-term planning period. Should any new MIRL/MITL be needed as part of a runway or taxiway reconstruction project, it is recommended that the LED version of MIRL/MITL be installed. It should be noted that at the time of this writing, the Airport was in the process of replacing the existing semi-flush MITL on Taxiway E and portions of Taxiway A near the Runway 30 end with LED fixtures with new base cans.

  Taxiway C currently does not have any MITL or retro-reflectors installed. It is recommended that one of these options be installed along Taxiway C in the short-term planning period to enhance safety for pilots using this part of the airfield at night or during inclement weather.

- ***Airfield Signage:*** As previously mentioned in the Inventory Chapter, the lighted airfield destination signs are in the process of being replaced; the new signs will be internally lit with LED fixtures. No further recommendation for the airfield signage is necessary at this time.

- ***Pavement Markings:*** The majority of airfield pavement markings, especially those on the runways and the taxiways (except for Taxiway A), are heavily faded. Runway and taxiway pavement markings are intended to safely guide pilots as they take-off, land, and taxi around the airfield. Clear, clean, highly visible airfield markings are imperative in preventing runway and other airfield incursions.

  It was noted at the time of the inventory that Runway 12-30's pavement markings are faded. Runway 3-21's markings are also faded; however, in addition to the existing markings faded condition, it was also observed that the runway is incorrectly marked. Currently basic pavement markings are found on the pavement, which indicates the runway is used for Visual Flight Rules (VFR). However, considering that there are two published non-precision GPS approaches to both Runway 3 and 21, the correct pavement markings should be that of non-precision. It is recommended that Runway 3-21 be correctly marked in the short-term planning period in order to comply with current FAA design standards. Runway 12-30's pavement markings should also be repainted in the short-term planning period.

  All of the taxiways (except for Taxiway A) have varying degrees of faded pavement markings. The taxiway system is quite expansive and covers a great deal of ground on the airfield; airport management should consider repainting the taxiway pavement markings at some point over the course of the planning period, or at least portions of them, in a manner that is most feasible and economical to them.

  Although pavement markings on the aprons were noted as good to fair during the inventory, airport management should most likely plan to repaint these markings at some point over the course of the planning period as well.

- ***Visual Aids to Navigation:*** The PAPIs and REILs mentioned in Chapter 2 are currently in good working condition. They should be maintained until they have reached the end of their useful life-cycle. However, it should be noted that at the time of this writing, the Airport was in the process of replacing the existing REILs on both ends of Runway 12-30 with new LED models. It is anticipated that some or all of the components of these systems may need to be replaced in the medium- to long-term planning period (the new LED REILs installed on Runway 12-30 should last until the end of the planning period in 2036). The wind cones and segmented circle are also in relatively good condition. The Airport should maintain and replace/paint as needed over the course of the planning period. Finally, the airport rotating beacon is also in adequate condition, although it was noted that the fixture and tower are outdated. Possible replacement in the medium-term planning period may be warranted.

4.4.9 Weather Aids

The existing Airport AWOS meets the existing and projected needs of the Airport and is in good overall condition as stated in the Inventory Chapter. Replacement of the AWOS equipment may be necessary during the planning period due to technological improvements.

4.5 Landside Facility Requirements

Landside facilities are another important aspect of any airport as they handle aircraft and passengers while on the ground at the airport. Landside facilities serve as the processing interface between two modes of transportation – air and ground. Likewise, landside facilities also offer travelers the first impression of the airport and the local community.

The capacity, condition, and functionality of the various facilities were examined in relation to the anticipated aviation demand presented in Chapter 3 to identify future facility needs.

4.5.1 Terminal Building

The terminal building at general aviation airports typically offers various amenities to passengers, local and transient pilots, and airport management. Terminal buildings (often called pilot lounges at general aviation airports) most often house public restrooms, public telephones, a pilot lounge area, and information regarding airport services. The existing terminal building at the Marana Regional Airport also serves as the Airport's FBO (Tucson Aeroservice Center) and is used by transient and local aircraft operators. It is recommended that an airport's terminal building be able to satisfy the forecasted peak-hour general aviation pilot and passenger demand.

The accepted methodology used to project terminal building facility needs for general aviation airports is based on the number of airport users anticipated to use the facility during the design hour. The design hour is typically defined as the peak hour of an average day of the peak month. The design hour measures the number of passengers departing or arriving on aircraft in an elapsed hour of a typical busy (design) day. Estimating design hour passengers is typically a three-step process involves the following:

- Determine the peak month,
- Determine the design day to be used, and
- Estimate the amount of daily activity that occurs in the design hour.

The number of peak hour passengers and pilots was derived by assuming 3.4 passengers and pilots per design hour. The terminal function size is based on providing 75 square feet per peak design hour. This process is applied to both the existing (base year) conditions, as well as activity in future years. **Table 4-7** depicts the terminal building requirements.

Table 4-7 General Aviation Terminal Building Requirements

Year	Design Hour Operations	Peak Hour Pilots and Passengers	Terminal Function Size (approx. sf)
2015	67.5	232	17,000
2020	79.8	274	21,000
2025	85.1	293	22,000
2030	90.2	310	23,000
2035	95.2	328	25,000

Note. Calculations for the terminal function size have been rounded to the nearest whole number.
Source: Armstrong Consultants, Inc., 2016

According to the calculations above, the existing 9,500 square-foot terminal building does not meet the space requirements through the planning period. Overall the building appears to be in good condition, although it may be somewhat dated (originally built in 1982). It is likely that typical energy and water efficiency improvements may be needed such as: mechanical, electrical, and plumbing upgrades. Energy efficient exterior lighting which meets the Town's light pollution code should be installed to enhance safety and reduce energy costs. The Development Alternatives chapter will consider various terminal concepts and will present additional recommendations.

Access from the vehicle parking area and from the aircraft apron to the terminal is adequate. The concrete sidewalk from the landside allows the public easy access to the terminal building. Native/drought tolerant landscaping is already in place around the terminal building and should be maintained in the future.

The Airport should consider implementing a recycling program if it does not already exist to reduce the solid waste that will be generated. The program should also be suggested as a requirement for each tenant. The Airport should also make sure that the dumpsters for the terminal building are adequately sized and coordinated with tenant activities to keep the overall number of dumpsters to a minimum, thereby reducing the waste haulers maneuvers and emissions on airport property.

4.5.2 Hangar Facilities

As previously mentioned in Chapter 2, the Airport has six conventional hangars, 19 T-hangars, and one shade structure located on the airport. The six conventional hangars are occupied by long-standing tenants of the Airport, and therefore no other conventional hangars are available on the airfield at this time. The existing T-hangars and shade structure seem to be adequate at meeting the current demand for hangars at this time. The estimated hangar needs of the Airport are discussed further below.

Prefabricated conventional and T-hangar units are available from a variety of manufacturers throughout the nation. Storage space for based aircraft was determined using guidelines suggested in manufacturer's literature. Typical aircraft sizes were also reviewed in light of the evolution of business aircraft sizes.

Conventional hangar standards:

- 1,200 square feet for single-engine aircraft
- 1,400 square feet for multi-engine aircraft
- 1,800 square feet for turboprop or turbojet aircraft
- T-hangar standards:
- 1,400 square feet for single- and multi-engine aircraft

The assumptions that were made regarding the type of storage needed for each type of aircraft at Marana Regional Airport is illustrated in **Table 4-8**.

Table 4-8 Breakdown of Aircraft Storage Types

Percent of Aircraft Type	Type of Storage
100% of turbojet	Conventional hangar
55% of multi-engine	Conventional hangar
35% of multi-engine	T-hangar
10% of multi-engine	Parking apron
10% of single-engine	Conventional hangar
60% of single-engine	T-hangar
30% of single-engine	Parking apron

Source: Armstrong Consultants, Inc., 2016

Using the above criterion and the based aircraft forecasts, combined with consideration of the potential fleet mix, **Table 4-9** depicts the demand requirements for hangar space at the Airport. It can be inferred from the table that the existing number of T-hangars at the Airport is predicted to meet the space requirements over the planning period; however, the Airport may need to add additional T-hangars at the very end of the planning period based on forecasted demand. On the other hand, it is evident from the table, and from discussions with airport management, that the existing number of conventional hangars does not meet the space requirements at present nor over the course of the planning period. It is recommended that conventional hangars be planned at the Airport over the course of the 20-year planning period. The exact size and number of hangars will ultimately be determined by demand; however, the Development Alternatives chapter will consider and propose various hangar configurations and locations for airport management and the Town to consider. It should be noted that these requirements are not rigid, meaning that shifting of the space requirements between conventional and T-hangars is something that the Town will need to consider as operations fluctuate and the need to satisfy user's specific requirements are identified.

Table 4-9 Aircraft Hangar Requirements

	Year				
	2015 (existing)	2020	2025	2030	2035
Based Aircraft	260	284	303	321	339
Total Hangared Aircraft (approx. 70%)	185	199	212	225	237
T-hangared Aircraft (approximation)	140	152	162	170	180
Conventional Hangared Aircraft (approximation)	45	47	50	55	57
Hangar Size Requirements					
T-hangar 4 to 8 bays (approx. sf)[1]	300,000	0	0	0	10,000
Conventional Hangar (approx. sf)[1]	52,000	80,000	80,000	90,000	100,000
Total Hangar Storage (approx. sf)[2]	352,000	80,000	80,000	90,000	110,000

Note. Hangar development will depend on actual demand.

[1]A minimum hangar size of approximately 10,000 square feet is recommended. [2]This does not include square footage of the existing shade structure, which is not by definition a true hangar, however it does provide some protection form the elements.

Source: Armstrong Consultants, Inc., 2016

4.5.3 Aviation Fuel Facilities

As discussed in Chapter 2, there are currently two fuel storage tanks on the Airport that are owned and operated by the FBO (Tucson Aeroservice Center). Each fuel tank has a capacity of 12,500 gallons; 100LL AvGas and Jet A are available. A self-service system with a credit card reader is available for 100LL (AvGas) fuel only. The FBO also owns and operates a total of three fuel trucks; two are designated for AvGas and holds 1,200 gallons of fuel each, and the third is designated for Jet A and holds 5,000 gallons of fuel.

Additional fuel storage capacity should be planned when the airport is unable to maintain an adequate supply and reserve. For general aviation airports such as Marana Regional Airport, typically a 14-day supply is common. If the need for additional fuel storage becomes necessary, additional tanks should be added in 10,000 or 12,500 gallon increments. These increments will be the most economical to install. Should the East Apron be developed over the course of the planning period for corporate operations, it may make logistical sense to add additional fuel storage tanks, especially Jet A, to an area near the East Apron. Potential locations for additional fuel storage will be discussed in the next chapter, Development Alternatives.

4.5.4 Airport Access and Vehicle Parking

The Marana Regional Airport is accessed from Avra Valley Road, which if taken east for approximately five miles will intersect with Interstate 10 (I-10). Traffic approaching the airport on Avra Valley Road is directed off the roadway and on to the airport entrance road. The two lane entrance leads to a paved vehicle parking area adjacent to the FBO/airport terminal building and Sky Rider Coffee Shop. Also adjacent to the main entrance on the east side is a dirt and gravel lot that is on occasion used for additional parking; this is usually when a large meeting or special event is being held at the airport. Although not officially an entrance road, another paved, two-lane roadway is located approximately one mile east of the main entrance. This roadway was built in 2008. Some private airport businesses have access to their facilities via ancillary access roads, which also are accessed from Avra Valley Road. The existing entrance road is expected to be adequate to accommodate current and future activity for the planning period.

The existing vehicle parking area can accommodate approximately 40 vehicles. Normally, an airport's vehicle parking area should be able to satisfy the forecasted peak-hour (design-hour) general aviation pilot and passenger demand. Using planning methods commonly accepted for calculating parking space requirements, **Table 4-10** depicts the vehicle parking space requirements for the 20-year planning period.

Table 4-10 Vehicle Parking Requirements

Year	Parking Space Requirements	Parking Lot Requirements[1] (sy)
2015	154	5,500
2020	183	6,500
2025	195	7,000
2030	207	7,500
2035	219	8,000

Note. Parking space requirements = 2/3 of the design hour for pilot and passenger flow. Parking lot requirements have been rounded and are approximate.
[1]Each parking space = 35.5 square yards
Source: Armstrong Consultants, Inc., 2016

Based on the vehicle parking requirements, the existing parking area is inadequate to handle passenger and pilot flow at a peak busy hour of the day. It is recommended that the Airport add additional vehicle parking spaces over the 20-year planning period. The Development Alternatives chapter will provide more information on potential locations for the additional parking spaces.

4.5.5 Fencing

According to FAA AC 150/5300-13A, *Airport Design*, the primary purpose of airport fencing is to restrict inadvertent entry to the airport by unauthorized people and wildlife. There are several types of airport fencing that are eligible for FAA funding as part of the AIP program depending on the airport's classification (commercial service, GA, etc.) and fencing needs. The different types include wire fencing (with wooden or steel posts), chain-link fencing with steel posts, and wildlife deterrent fencing. Wildlife deterrent fencing usually consists of installing chain-link fence fabric along an existing chain-link fence, and constructing concrete pads at existing fence gates.

The Airport has six-foot high, chain-link fence with three strands of barbed wire around the majority of the perimeter of the airfield. Additionally, ornamental security fencing is also in place near the terminal/FBO area. Several gates with access control systems are located at various locations around the perimeter as well. The existing perimeter fencing is currently adequate for the needs of the Airport. However, it was noted in the Wildlife Hazard Assessment (WHA) completed in early 2016, that there are portions of the perimeter fence that need maintenance, as certain areas have dirt that has washed-out from below the fencing and is allowing wildlife such as javelinas and coyotes to access the AOA. Furthermore, it was also noted within the report that there are sections of the Airport that do not have fencing, which is also allowing wildlife to enter the AOA.

Since wildlife in the area is somewhat of an issue according to the WHA, wildlife deterrent fencing may also be an option. The specific location, extent, type, and height of wildlife deterrent fencing shall be designed for the purpose intended based on and in general conformance with accepted guidelines and recommendations of the Arizona Game and Fish Department or other recognized public wildlife specialists for preventing intrusion of the specific targeted animals known to inhabit the area. It is recommended that the Airport maintain the existing chain-link and ornamental security fencing and access control gates, and repair sections that have become an entry point for wildlife. Additional fencing should also be added as outlined within the WHA where it does not currently exist in order to prevent wildlife from accessing the AOA.

4.5.6 Security

There are several programs designed to increase general aviation airport security. For example, the Aircraft Owners and Pilots Association (AOPA) Airport Watch program created an around the clock telephone hotline answered by federal authorities for pilots and other airport users to report suspicious activity at GA airports. Also, the Transportation Security Administration's (TSA) *Security Guidelines for General Aviation Airports* provides a set of federally-endorsed recommendations to enhance security for municipalities, owners, operators, sponsors, and other entities charged with oversight of general aviation airports. The TSA's guidance provides nationwide consistency with regard to security at general aviation facilities, as well as a rational method for determining when and where these enhancements may be appropriate based upon the operational profile of differing airports. The guidelines offer an extensive list of options, ideas, suggestions, and proven best practices for the airport operator, sponsor, tenant and/or user to choose from when considering security enhancements. The TSA's guidelines are updated and modified as new security enhancements are developed and as input from the general aviation community is received. It is recommended that Town review the latest version of the TSA's *Security Guidelines for General Aviation Airports* in order to assess the suggested security enhancements, if any, at the Airport.

4.5.7 Aircraft Rescue and Fire Fighting (ARFF) Equipment

According to FAA guidance, operators of Part 139 certificated airports must provide Aircraft Recue and Fire Fighting (ARFF) services. Marana Regional Airport is not a Part 139 certificated airport, therefore ARFF equipment is not required. Local municipal or volunteer fire departments typically provide fire protection to general aviation airports in their district. Mutual aid agreements may also be provided and developed with nearby fire departments to assist in emergency situations. In any case, procedures should be in place to ensure emergency response in case of an accident or emergency at the airport. Although statistically very safe, the most likely emergency situations at general aviation airports are an aircraft accident, fuel or aircraft fire, or a hazardous material (fuel) spill. The level of protection recommended in FAA AC 150/5210-6D, *Aircraft Fire and Rescue Facilities and Extinguisher Agents*, for small general aviation airports is 190 gallons of aqueous film forming foam (AFFF) supplemented with 300 pounds of dry chemical. Proximity suits should be utilized for fire fighter protection. Aviation rated fire extinguishers should be immediately available in the vicinity of the aircraft apron and fueling facilities.

Some members of the PAC and TAC encouraged the Airport to consider providing on-site ARFF capabilities. Although not an FAA requirement, enhancing the Airport's ability to respond to emergencies is reasonable given the existing and projected corporate aircraft activity.

4.5.8 Airport Support and Maintenance Building

As mentioned in the Inventory chapter, the Airport does not have a dedicated support and maintenance building. It is recommended that the Airport construct such a building in the short-term planning period in order to have a secure, functional, and organized location for the airfield's maintenance equipment. It is recommended that the building be approximately 10,000 – 20,000 square feet, although this is flexible. The location will be discussed more in the Development Alternatives chapter. The maintenance equipment mentioned in the Inventory chapter, along with any other pertinent equipment the Town finds essential to the upkeep and maintenance of the airfield and airport property, should be evaluated to determine if it has reached the end of its useful lifecycle. After evaluation, any piece of equipment that has reached the end of its lifecycle should be replaced in a timely fashion.

4.6 Infrastructure Needs

The existing electric, water, and telecommunication utilities are considered adequate for the existing facility. Upgrades and improvements to the existing utilities are recommended, as needed, in order to accommodate recommended development. The need for additional utilities, or modifications to existing utilities, will be evaluated in more detail in the Development Alternatives chapter, if applicable.

4.7 Land Use Compatibility and Control

As previously discussed in Chapter 2, Section 2.15, 14 CFR Part 77 establishes several imaginary surfaces that are used as a guide to provide a safe and unobstructed operating environment for aviation. In addition to ensuring that penetrations to these imaginary surfaces are avoided or appropriately marked and lighted, the FAA recommends that the airport sponsor make reasonable efforts to prevent incompatible land uses, such as residential encroachment, from developing in the immediate area of the airport. Many times this can be achieved by the municipality creating an airport overlay zone. It is recommended that the Town consider creating an airport overlay zone to preserve compatible land uses around the airport.

Private development proposals should also be reviewed to ensure compatibility in the vicinity of the airport. Land use compatibility considerations include safety, height hazards, and noise exposure. Although extremely rare, most aircraft accidents occur within 5,000 feet of a runway. Therefore, the ability of the pilot to bring the aircraft down in a manner that minimizes the severity of an accident is dependent upon the type of land uses within the vicinity of the Airport.

The RPZ is a trapezoidal area extending beyond the ends of the runway and is typically included within the airport property boundary. Residential and other uses that result in congregations of people are restricted from the RPZ. As previously mentioned in Chapter 2, Section 2.14.7, guidance from the FAA on what constitutes a compatible land use and how to evaluate proposed land uses that would reside in a RPZ is contained within a memorandum dated September 2012.

In addition, according to FAA Advisory Circular 150/5200-33B, *Hazardous Wildlife Attractants On or Near Airports,* landfills and/or transfer stations are incompatible land uses with airports. According to the FAA, these types of facilities should be located at least 5,000 feet from any point on a runway that serves piston type aircraft and 10,000 feet from any point on a runway that serves turbine powered aircraft. Furthermore, the FAA recommends that any facility which may attract wildlife (especially birds), such as sewage treatment ponds and wastewater treatment plants, should also be located this same distance from any point on the runway. It is known that two recharge ponds are located just northeast of the airport. According to the Wildlife Hazard Assessment that was completed for the Airport in early 2016, the settlement ponds are a wildlife attractant and will need to be closely monitored going forward, which is discussed in more detail in Chapter 2 and the WHA final report itself. Overall, the Town should remain diligent to ensure future land use remains compatible with airport facilities.

4.7.1 Airport Property

The existing airport property encompasses approximately 630. From a review the of airport property map, it appears that the existing Runway Protection Zone (RPZ) on Runway 12 is owned in fee simple. The existing RPZs for Runway ends 30, 3, and 21 each extend off airport property. FAA recommends that airports control the land within the RPZ. This was also discussed in Chapter 2, Inventory, Section 2.14.7, Runway Protection Zone (RPZ).

Furthermore, there are portions of the Airport property that are currently owned by the State of Arizona. According to the Pima County Assessor's office, the following parcels are owned by the State:

- Parcel No. 215-04-001K (Parcel A) comprised of approximately 16 acres
- Parcel No. 215-04-001L (Parcel B) comprised of approximately 40 acres
- Parcel No. 215-10-051J comprised of approximately 44 acres

At present, based on a review of the County Assessor's records, no easements have been granted by the Arizona State Land Department to the Town of Marana for the above referenced parcels, all of which are located within the airport property boundary. Thus, it is recommended that the aforementioned parcels be acquired in fee-simple or that an easement (perpetual right-of-way) be granted from the Arizona State Land Department.

Additional land and/or avigation easements required to accommodate existing or future design surfaces, such as RPZs, and all other proposed development can be found on Exhibit A – Airport Property Map contained within the ALP drawing set found in Chapter 6. Additionally, an American Land Title Association (ALTA)/American Congress of Surveying and Mapping (ACSM) Land Title Survey was completed for the Airport in October 2013. Please see **Appendix E** for the findings.

4.7.2 Airport Zoning

Airport zoning ordinances should include height restrictions and land use compatibility regulations. Development around airports can pose certain hazards to air navigation if appropriate steps are not taken to ensure that existing, as well as future, buildings and other types of structures do not penetrate 14 CFR Part 77 imaginary surfaces.

The FAA recommends that airport sponsors implement height restrictions in the vicinity of the airport to protect all 14 CFR Part 77 imaginary surfaces. The airport is zoned accordingly for airport use and is considered to be adequate for the planning period. There are currently no incompatible land uses in the vicinity of the airport. The surrounding land uses and zoning are compatible with airport operations.

4.8 Summary of Facility Requirements

The facility requirements for the Airport are summarized in **Table 4-11**. The recommendations are based on the types and volume of aircraft currently using, and expected to use, the airport in the short- and long-term time frames. In the next chapter, Development Alternatives, various airside and landside improvements will be presented and evaluated, which will in turn lead to the recommended airside and landside development for the

Airport. The recommended facilities will enable the Airport to continue to serve its current and future users in a safe and efficient manner.

Table 4-11 Facility Requirements Summary

ITEM	BASE YEAR (2015)	SHORT-TERM (0 – 5 yrs.)	MEDIUM-TERM (6 – 10 yrs.)	LONG-TERM (11 – 20 yrs.)
RUNWAYS				
12-30				
Runway Design Code (RDC)	Rwy 12: C-II/5000; Rwy 30: C-II/VIS	Same as existing; Maintain		
		C-II/5000		Maintain
Length (ft)	6,901	Same as existing		
Width (ft)	100	Same as existing		
Pavement Strength (lbs.) as reported on Form 5010-1	75,000 S, 100,000 D, 300,000 DT	Verify per PCN report; strengthen where needed[1]		Maintain
Lighting	MIRL	Replace with LED	Maintain	
Markings	Non-precision	Non-precision	Maintain	
3-21				
Runway Design Code (RDC)	B-I/5000	Same as existing; (B-II ultimate)		
Length (ft)	3,892[2]	Same as existing; potentially lengthen to 5,500' beyond 20-year planning horizon (ultimate)		
Width (ft)	75	Same as existing; Maintain		
Pavement Strength (lbs.) as reported on Form 5010-1	75,000 S, 100,000 D 150,000 DT	Verify per PCN report; strengthen where needed[1]		Maintain
Lighting	MIRL	Replace with LED	Maintain	
Markings	Basic	Non-precision	Maintain	
TAXIWAYS				
Taxiway A, E, & H				
Taxiway Design Group (TDG)	TDG 3[3]	Maintain existing[3]		
Width (ft)	50	Maintain existing		
Lighting	MITL	Replace with LED		Maintain
Markings	Existing	Repaint	Maintain	
Taxiway B				
Taxiway Design Group (TDG)	TDG 2[3]	Maintain existing[3]		
Width (ft)	Varies (35'-50')	Maintain existing		
Lighting	MITL	Replace with LED		Maintain
Markings	Existing	Repaint	Maintain	
Taxiway C				
Taxiway Design Group (TDG)	N/A	Reconstruct to TDG-1[3]		Maintain
Width (ft)	40	Reconstruct to 25		Maintain
Lighting	None	Install MITL (LED)	Maintain	
Markings	Existing	Repaint	Maintain	

Table 4-11 Facility Requirements Summary - Continued

CONNECTOR TAXIWAYS A-2 & B-2				
	Non-standard; provides direct access from apron to runway	Remove	N/A	
NAVIGATIONAL AND WEATHER AIDS				
AWOS-3	Yes	Maintain existing		
Rotating Beacon	Yes	Replace	Maintain	
NDB	Yes	Maintain existing	Decommission	N/A
Approaches	Rwy 3-21: GPS Rwy 12: GPS & NDB	Add RNAV/GPS Runway 30	Maintain (GPS only)	
VISUAL AIDS				
REIL	12-30: Yes[4] 3-21: No	Install on Runway 3-21	Maintain	Replace
PAPI	12-30: 4-light 3-21: 2-light	Replace	Maintain	
Wind cone/segmented circle	Yes	Maintain	Replace	
TERMINAL				
General Aviation (sf)	9,500	17,000	21,000	25,000
HANGARS (sf)[5]				
Conventional (total approx. sf)	52,000	80,000	90,000	100,000
T-hangars/shade (total approx. sf)	317,000	Maintain existing		10,000
APRONS[5]				
Total Aircraft Parking Area (approx. sy)	158,000	Maintain existing	Depending on demand, construct additional parking apron	
VEHICLE PARKING				
Total (spaces/appox. sy)	40/2,500	183-195/ 6,500-7,000	207/7,500	219/8,000
FUEL FACILITY				
Jet A (gal)	12,500	Same as existing	12,500 (East Apron)	
AvGAS (100LL) (gal)	12,500	Same as existing	10,000 (East Apron)	
Total (gal)	25,000	Same as existing	22,500 (East Apron)	
Self-fueling/Credit card reader	Yes; AvGas Only	Maintain existing		
FENCING				
Perimeter	Yes	Repair/Install	Maintain	
Access Controls	Yes	Maintain existing		Replace

Abbreviations: S = Single-wheel landing gear, D = Dual-wheel landing gear, DT = Dual-tandem landing gear, NDB = Non-directional beacon, N/A=not applicable

Note. [1] This also applies to certain taxiways and aprons mentioned in this Chapter; the Airport should also verify and strengthen where needed. [2] This is the physical total runway length; does not account for the 494-foot displacement at the Runway 3 end. [3] According to the existing design aircraft for the Airport, the taxiways should conform to the standards of TDG 1; the Airport is advised to maintain the existing pavement as is, however it should be noted that the FAA may require that any future reconstruction of taxiways should be designed and built to TDG 1 (or whichever TDG corresponds to the existing design aircraft). [4] New LED model REILs were installed on both ends of Runway 12-30 in early 2016; these should last for the remainder of the 20-year planning period. [5] Hangar and apron development will depend on actual demand.

Source: Armstrong Consultants, Inc., 2016

Chapter 5 – Development Alternatives

5.1 Introduction

A combination of effective airside and landside planning is essential to the successful development of the Airport. Airside components for the most part include areas of the airfield where aircraft takeoff or land, taxi, and park. Landside components generally consist of a system of buildings, fueling facilities, roadways, and vehicle parking areas. This chapter contains the description and evaluation of various development alternatives for the Marana Regional Airport. The basis for the airside and landside alternatives were derived from the recommendations contained in the Facility Requirements chapter.

According to FAA AC 150/5070-6B, *Airport Master Plans*, each identified alternative's technical feasibility, economic and fiscal soundness, and aeronautical utility should be examined. Ultimately, development alternatives will only be considered that meet the Town's planning needs and those that the FAA or Town will be realistically able to implement.

5.2 Development Concepts

The overall objective of the alternatives analysis is to 1) review the facility requirements that have been determined necessary to meet FAA design standards, and to safely and efficiently accommodate aviation demand over the planning period and 2) evaluate the best way to implement the facility requirements as presented in Chapter 4.

Furthermore, the following best planning tenets, as recommended in FAA AC 150/5070-6B, *Airport Master Plans*, apply to the evaluation of the development alternatives:

- Conforms to best practices for safety and security;
- Conforms to the intent of FAA and other appropriate design standards;
- Provides for the "highest and best" land use on and off airport;
- Allows for forecast growth throughout the planning period;
- Provides for growth beyond the planning horizon;
- Provides balance between developmental elements;
- Provides flexibility to adjust to unforeseen changes;
- Conforms to the airport owner's strategic vision;
- Conforms to relevant local, regional, and state transportation plans;
- Is technically and financially feasible;
- Is socially and politically feasible; and
- Satisfies user's needs.

A range of airside and landside alternatives are typically created and evaluated in both a quantitative and qualitative manner for implementing the different facility requirements. In other instances, where less robust development is anticipated, the selection of a preferred development plan can result from a more logical evaluation of the various options resulting from discussions with the sponsor, Technical Advisory Committee (TAC), Public Advisory Committee (PAC), and input from the public. After evaluating the demonstrated needs in a qualitative manner, the future development needs and recommendations are presented herein for implementing the facility requirements described in Chapter 4.

An alternative for the Town of Marana involving both the airside and landside portions of the Airport is a scenario where no improvements, alterations, or enhancements are made to the airfield at all, i.e. the airport remains in its current state with the existing airfield configuration and existing facilities. This would be considered a no-action alternative for development at the airport. However, over the last decade, the FAA, ADOT, and the Town have made a significant investment in the airport infrastructure. To preserve the infrastructure and to ensure that additional federal funding is granted, it is in the best interest of the Town to maintain the Airport and make any necessary improvements. Thus, the option of a no-action alternative was not explored or described in any of the major future proposed development alternatives.

5.3 Airside Development

Airside development is typically the most critical and physically dominant feature of airport development and therefore a focal point of an airport's planning process. This section discusses the airside development alternatives and addresses the needs of the existing and future aviation demand identified in Chapter 4, Facility Requirements.

Alternative Considerations – Airside Development

- Extension of Runway 3-21 by 1,608 feet
- Additional taxiway pavement on the east and west sides of Runway 3-21
- Rehabilitation and strengthening of Runway 12-30 and 3-21 pavement
- Rehabilitation and strengthening of all taxiway and apron pavements
- Removal of non-standard taxiway configuration (Taxiway A2 and Taxiway B2)
- Removal of portion of itinerant parking apron which falls within the runway visibility zone (RVZ); identify areas to replace removed apron and open tie-downs
- Reconfigure helicopter parking apron to allow for parking of large corporate jets (short-term)
- Identify location for additional conventional box hangars and shade structure with taxiway access
- Upgrade all airfield lighting fixtures and lighted signage, including the rotating beacon and PAPIs, to light-emitting diode (LED) fixtures

5.3.1 Runway Development

5.3.1-1 Runway 12-30

As previously identified in **Table 4-4,** Runway 12-30 is currently 6,901 feet long and provides adequate runway length to satisfy 75 percent of large aircraft (greater than 12,500 pounds, but less than 60,000 pounds) at 60 percent useful load. Furthermore, according to FAA estimates, aircraft weighing 60,000 pounds or more need approximately 5,730 feet for takeoff operations, although they would be somewhat constrained from taking off at MTOW during the hottest months of the year. In conclusion, the existing runway length is adequate for the planning period.

Correction of existing non-standard RSA and ROFA for Runway 30

As previously mentioned in Section 2.14.5 and 2.14.6, the RSA and ROFA must remain clear of objects, except for frangible NAVAIDS or aircraft during ground maneuvering, according to FAA design standards. Likewise, it was noted that both the RSA and ROFA for Runway 30 currently do not meet these standards due to portions of Avra Valley Road, the dirt public access road to the east parking apron, the dirt on-airport perimeter road, and the perimeter fence being located within both of these safety areas. In order to bring Runway 30 into compliance with RSA and ROFA design standards, it is recommended that the threshold be displaced 700 feet. As a result of this displacement, in accordance with FAA guidance, this will result in declared distances for Runway 12-30.

According to *AC 150/5300-13A,* declared distances represent the maximum distances available to meet the safety requirements of the runway design standards. These distances are calculated for each individual operational direction of the runway based off of previously determined design standards and safety surfaces established for the runway. The declared distances that are published are Takeoff Run Available (TORA), Takeoff Distance Available (TODA), Accelerate-Stop Distance Available (ASDA), and Landing Distance Available (LDA). Takeoff Run Available, or TORA, is the distance to accelerate from brake release to lift-off, plus safety factors. Takeoff Distance Available, or TODA, is the distance to accelerate from brake release past lift-off to start of takeoff climb, plus safety factors. Accelerate-Stop Distance Available, or ASDA, is defined as the distance to accelerate from brake release to V_1 and then decelerate to a stop, plus safety factors. "V_1" is a term determined by the aircraft manufacturer and confirmed during certification as the speed at which a decision will have been made to continue flight if an engine fails. Landing Distance Available, or LDA, is the distance from the threshold to complete the approach, touchdown, and decelerate to a stop, plus safety factors. The recommended declared distances for Runway 12-30 are shown in the ALP drawing set, which can be found in Chapter 6.

As a result of the declared distances, a small percentage of aircraft weighting more than 60,000 pounds may be restricted from landing on Runways 12 and 30 due to high density altitude caused by hot temperatures during the summer months. The hotter temperatures decrease aircraft performance and subsequently increase landing length. The larger aircraft would be restricted from landing on Runway 12 and 30 at maximum landing weights during the warmest hours of the day, in the hottest months of the year. These aircraft may still land on Runway 12 and 30 during the hottest hours, only when operated at less than maximum landing weights that would permit adequate landing distance in accordance with the declared distances. Furthermore, with the addition of the 700-foot displacement of Runway 30's threshold in order to meet RSA and ROFA design standards, and the resulting declared distances, it should be noted that the amount of runway available for takeoff on Runway 12 will be reduced. Again, please refer to the declared distances table on the ALP found in Chapter 6.

5.3.1-2 Runway 3-21

Currently Runway 3-21 is 3,892 feet long, and the Runway 3 threshold is displaced 494 feet as mentioned in Section 4.4.1. With the displaced runway threshold, only 3,398 feet of runway is available for landing on Runway 3. Furthermore, a small portion of perimeter fencing penetrates the existing ROFA at the Runway 3 end. Finally, it was determined to satisfy 75 percent of large aircraft (greater than 12,500 pounds, but less than 60,000 pounds) at 60 percent useful load, the runway would need to be 5,500 feet long as recommended in **Table 4-5**.

Runway 3 displacement

A review of the Runway 3 displacement reveals that the displacement should be 330 feet, as opposed to the existing 494 feet, to accommodate Category A and B aircraft. A displacement of 330 feet is based on Threshold Siting Surface (TSS) criteria for runways expected to support instrument night operations, serving approach Category A and B aircraft only and takes into consideration the recommended 15-foot clearance over Avra Valley Road. It is recommended that the threshold be moved to the 330-foot location in the short-term planning period in order to continue accommodating Category A and B aircraft with the correct displacement. Should the runway be upgraded to accommodate B-II aircraft as suggested in earlier chapters beyond the 20-year planning period, the location of the displacement will not be affected. The TSS criteria for clearance over Avra Valley Road will remain the controlling obstacle.

Correction of existing non-standard ROFA for Runway 3-21

The existing perimeter fencing penetrates the south-east corner of Runway 3-21's ROFA by 50 feet under B-I design standards. In order to mitigate this penetration, the ROFA for Runway 3-21 should be shifted 50 feet north. Because the ROFA is an imaginary surface, accounting for this required safety area must be done with declared distances. This will allow the physical end of the runway to remain in its current location, but also maintain the required 240-foot length standard needed for the ROFA. Likewise, if and when the runway is upgraded to meet B-II design standards, the increase in the ROFA length and width will require an additional 50-foot shift in order to clear the fencing. This ultimately equates to adjusting the various declared distances for the runway by 160 feet. The recommended declared distances for Runway 3-21 are shown in the ALP drawing set, which can be found in Chapter 6.

Runway 3-21 extension

An increase in corporate jet traffic at some point in the future may result in Runway 3-21's use by these aircraft. To accommodate small-to-medium sized corporate jet aircraft, it is recommended that an overall runway length of 5,500 feet be provided. For planning purposes, the Airport Layout Plan (ALP) depicts an extension to an overall runway length of 5,500 feet. With the planned runway extension, the majority of B-II aircraft would be capable of landing on Runway 3 unconstrained.

Consequently, extending the runway may have several impacts. For example, the need to acquire approximately 40 acres of land to accommodate the runway, parallel taxiways, and the runway protection zone would be needed. The land needed for the extension is vacant land owned by the Town of Marana and State of Arizona. The relocation of businesses and or residents would not be required. There is also an existing irrigation canal that would need to be either relocated around the runway extension, or more likely, be piped and left in its current alignment beneath the new airfield pavement. The terrain in the area also appears relatively flat making construction straightforward. Consideration to extend the Runway 3 end is not recommended. It is not practical to extend the Runway 3 end given the location of Avra Valley Road. Relocating or terminating the road is not feasible and would be cost prohibitive given the abundance of land available on the Runway 21 end. Therefore, it is recommended the Runway 21 end be extended as shown on Exhibit 3.

On September 27, 2012, the FAA published *Interim Guidance on Land Uses Within a Runway Protection Zone*. The interim policy only addresses the introduction of new or modified land uses to an RPZ and proposed changes to the RPZ size or location. The existing runway protection zone on the Runway 3 end crosses Avra Valley Road. The size and location of the Runway 3 RPZ is not recommended to change, therefore the interim policy doesn't apply to the Runway 3 RPZ. If it was desirable to remove Avra Valley Road from the Runway 3 RPZ, then the Runway 3 threshold would need to be relocated approximately 1,000 feet, and thereby in turn require that the Runway 21 be extended an additional 1,000 feet. Because the land use within the Runway 3 RPZ is compatible with the exception of Avra Valley Road, it is recommended that the Runway 3 RPZ remain in its current location.

5.3.1-3 Other Runway Recommendations

The existing runway width and wind coverage for Runway 12-30 and Runway 3-21 are both adequate for the planning period. Regarding pavement strength and condition, Section 4.4.4 discussed the need to consider rehabilitating and strengthening the pavement of Runway 12-30 to accommodate the current operations by large aircraft. Furthermore, Section 4.4.4 also recommended rehabilitation in the short-term of Runway 3-21; as of today, the pavement strength is adequate for the types of aircraft utilizing Runway 3-21. However, should the runway ever be extended to accommodate large aircraft (over 12,500 pounds, but less than 60,000 pounds) as is proposed, the runway pavement strength would need to be increased as well.

5.3.2 Taxiway Development

Section 4.4.5 recommends that the TDG for new pavement meet the design standards for TDG 1A and 1B, and separation standards for Airplane Design Group (ADG) II. As such, new taxiway pavement should be constructed to a width of 25 feet. The proposed development plan recommends a new partial-parallel taxiway be constructed on the west side of Runway 3-21 to provide access from the existing west hangar apron to the Runway 21 threshold. In addition, it is recommended that a partial-parallel taxiway be constructed on the east side of Runway 3-21 from the threshold of Runway 21 to Taxiway B3, ultimately making Taxiway B a full-parallel taxiway. This is illustrated on **Exhibit 3**.

The removal of two connector taxiways is recommended to comply with FAA guidance about runway incursions. The recommended connectors slated for removal are shown on the proposed development plan (**Exhibit 3**) and should be addressed in the short-term.

Taxiway C currently begins at the approximate mid-point of parallel Taxiway A and continues to Runway 3-21, providing access to the existing specialized aviation related businesses off of Wright Way and the west hangar apron. The proposed development plan recommends terminating Taxiway C approximately 100 feet short of the west hangar apron. With the removal of this portion of pavement, access to the infield will be established allowing additional aviation related development to take place as shown on the proposed development plan (**Exhibit 3**). Access to the infield would be via a new entrance road off of Wright Way.

5.3.3 Aircraft Apron

Based on the findings from Chapter 4, Facility Requirements, the Airport may need to add additional apron parking at some point in the planning period (**Table 4-6** estimates sometime in the 2025 timeframe). As such, this chapter presents an improved allocation of apron use at the Airport, which improves aircraft flow and parking availability. Various apron configurations were developed with the best locations in mind to park the different types of aircraft using the Airport, i.e., fixed-wing, rotor, single-engine aircraft, and corporate jets. The Town of Marana should monitor the utilization of the apron and make adjustments in the apron size as needed throughout the planning period. Likewise, as presented in Chapter 2, portions of the existing apron are in fair to poor condition and will require either rehabilitation or reconstruction and strengthening in the planning period.

As previously mentioned, a portion of the existing itinerant parking apron is within the Runway Visibility Zone (RVZ). The apron is approximately 34,000 square yards and provides parking primarily for itinerant traffic. Based on current FAA guidance, the RVZ must be clear of all obstacles, both permanent and temporary (such as parked aircraft). An analysis was conducted to determine if the line-of-sight was clear within the RVZ; it was revealed that approximately 12,000 square yards of the apron do not comply with the line-of-sight guidelines. Thus, that portion of the apron that violates the line-of-sight requirement must be removed. In an effort to replace this portion of apron that must be removed, the preferred alternative recommends constructing approximately the same number of square yards of apron to the east of the existing T-hangars on the itinerant parking apron and to the west of the existing helicopter parking apron as shown on **Exhibit 4**. This is the preferred alternative because it is the only option which replaces the same amount of apron that will be lost due to the removal of the apron within the RVZ. As discussed further in Section 5.4.7 later in this chapter, the proposed air traffic control tower as shown on **Exhibit 5** limits the option to replace the removed RVZ apron parking due to the presence of the proposed tower, parking lot, and access road. Therefore, the only viable option is the preferred alternative shown on **Exhibit 4**.

5.3.4 Airfield Lighting and Signage

The Airport is currently replacing all airfield signage, semi-flush taxiway lights, and the Runway 12-30 Runway End Identifier Lights (REILs) on both ends. All of the new fixtures and signs will be light-emitting diode (LED) type fixtures and signs.

As mentioned in Section 4.4.8, Taxiway C should have MITL installed to improve visibility during nighttime operations. It is also recommended that the existing rotating beacon be replaced with a more energy efficient fixture. Likewise, the aerial lighting located above the existing shade structure should also be replaced with a more energy efficient fixture. Additionally, any new pavement shown on the proposed development plan should also include the installation of LED lighting and signage. Finally, it is also recommended that all PAPIs should be replaced with LED models.

5.3.5 Miscellaneous Airfield Development Projects

The proposed development plan also depicts the preferred location for the following recommended airfield improvements (with the exception of the pavement markings) as shown on **Exhibit 3**:

- Refresh runway and taxiway pavement markings;
- Removal of hangar (building No. 6) for CFR Part 77 transitional surface obstruction violation;
- Relocation of hangar (building No. 20) to increase utilization of apron area for larger aircraft parking in the short-term planning period;
- Identify future land acquisitions and easements (RPZs and state land parcels); and
- Identify areas for retention basins according to 2007 Master Drainage Plan study.

5.4 Landside Development

Landside development is an important aspect of a well-functioning airport. This section discusses the landside development alternatives and addresses the needs of the existing and future aviation demand identified in Chapter 4, Facility Requirements.

Alternative Considerations – Landside Development

- Identify areas for specific aeronautical function, e.g. general aviation, corporate, and maintenance and specialty operations;
- Propose new corporate terminal site and related east apron development for corporate aviation operations;
- Addition of fuel facility to east apron complex;
- Identify locations for aeronautical and non-aeronautical related revenue generating parcels;
- Identify locations for a future air traffic control tower (ATCT);
- Identify locations for an airport-owned maintenance and equipment building and an aircraft rescue and fire fighting (ARFF) building; and
- Identify areas for expansion and/or addition of vehicle parking areas.

5.4.1 Proposed Development Strategy

The development strategy for the Airport is focused on grouping similar operations, businesses, and functions together to improve aircraft movements and parking, thereby enhancing the overall safety and efficiency of the Airport. Once the strategy is fully implemented, the level of customer service should also improve, primarily to the corporate aircraft using the Airport. To achieve this development strategy, the Airport will be grouped into three sectors:

- Corporate Development Complex
- General Aviation Complex
- Specialty Aviation Services Complex

Corporate Development Complex

To reduce the congestion of mixing corporate aircraft and smaller general aviation aircraft, the development strategy is to move all corporate aircraft to the southeast side of the Airport where the existing east apron is located. This area on the Airport is more conducive to accommodating the corporate aircraft due to its proximity to Runway 12-30 and the large amount of space provided by the east apron. Additionally, the long-term strategy includes development of a passenger terminal and aviation related services targeted to the corporate aircraft clientele.

General Aviation Complex

The long-term objective is to consolidate all general aviation parking, services, and storage to the south side of the Airport. This would include the continued use of the itinerant parking apron, terminal apron, south hangar apron, east hangar apron, west hangar apron, and conversion of the existing helicopter apron to general aviation parking. Currently, corporate aircraft are required to circulate and maneuver among the general aviation aircraft on the south side of the Airport making parking and servicing of the corporate aircraft challenging.

Specialty Aviation Services Complex

There are several businesses on the Airport that provide specialized aviation related services such as aircraft restoration and repair. Two of these specialized businesses are currently located on the west side of the Airport located along Wright Way. The proposed development plan recommends that this area of the Airport continue to be further developed for businesses that provide specialized aviation related services.

Summary

The boundaries of the three aviation related sectors on the Airport are represented on **Exhibit 6**. Although the sectors are not actual boundaries, they are meant to illustrate areas on the Airport that best target development to meet the unique needs of the aviation community over the course of the planning period.

5.4.2 Terminal Building

Terminal buildings often provide visitors with a first impression of an airport. As discussed in Chapter 2, the existing terminal/FBO building is located off Avra Valley Road. The terminal building is in good condition and should meet the needs for general aviation customers for the planning period. Therefore, no expansion is recommended for the existing terminal/FBO building.

However, as stated above, the development strategy for the Airport is focused on grouping similar aviation operations, businesses, and functions into defined sectors on the airfield. The terminal building is a key component of an airport and should be located closest to the customers its serves. For that reason, it is recommended that a second corporate terminal building be constructed adjacent to the east apron. The new corporate terminal, along with additional development, is shown on **Exhibits 7** and **8**. **Exhibit 7** was created during this master plan process after several discussions with airport management and several site visits; this layout provides for efficient use of the land while also taking into consideration the panoramic scenery of the area. **Exhibit 8** illustrates a rendering of the proposed development when the airport first began exploring the idea of relocating corporate operations to the east apron; this layout is similar, however does not maximize the potential of some of the existing land parcels. Therefore, the layout as shown on **Exhibit 7** is the preferred alternative.

The new corporate terminal building should be designed with at least a 20-year lifespan with minimal renovation and upgrades needed. Attention should be given in the design phase to ensure the building's functionality throughout the entire planning period is met. A new corporate terminal building will also allow the opportunity to incorporate numerous sustainable features such as a high-energy efficient heating and cooling system, solar hot water, LED lighting, drought tolerant landscaping, and the use of low VOC and recycled materials in the construction of the building. The proposed terminal should include the following at a minimum:

- Common area/lobby
- Airport Administration offices
- Meeting rooms
- Outdoor public space
- Restrooms
- Pilot lounge
- Flight planning room
- Storage

5.4.3 Hangar Development

Hangar development is an important aspect at nearly every airport, including GA airports. When properly utilized, hangars are often a good source of revenue for the airport sponsor. The demand for additional hangars will be based on the Town's ability to attract and retain new tenants. To that end, the proposed development plan (**Exhibit 3**) shows where an additional shade structure, T-hangars, conventional box hangars, and corporate hangars could be constructed on the airfield if demand warranted. Furthermore, the preferred layout for additional hangars within each of the three development sectors are also illustrated.

The preferred alternative location of a shade structure and additional T-hangars within the general aviation complex is shown on **Exhibit 4**. The location of each structure was chosen due to the proximity to the other existing T-hangars and the ease in which aircraft would be able to taxi to/from the apron and taxiways from these locations. The preferred alternative location of corporate hangars within the corporate development complex is shown on **Exhibit 7**. The location of these hangars best utilizes the amount of space on the east apron for large corporate aircraft that may be taxiing and parking in this area. Finally, the preferred alternative location of an additional T-hangar and conventional box hangars within the specialty aviation services complex is shown on **Exhibit 9**. This layout illustrates hangar options both with and without additional land; this option gives potential tenants ease of access to both runways, and for those with a specialty aviation business, the option to own a larger parcel of land with taxiway access. This preferred layout optimizes a developable portion of aeronautical revenue generating on-airport land, whilst also remaining clear of the RVZ.

5.4.4 Airport Support and Maintenance Equipment Building/ARFF Building

The support and maintenance equipment building serves an important function for most airports. The need to protect existing equipment, as well as future equipment, is crucial to the upkeep of the airfield and other areas of the airport. Currently, the Town does not own a storage building at the Airport for this purpose; a private building is currently leased by the Town in order to accommodate the Airport's support and maintenance equipment. It is recommended that a new 3,000 to 5,000 square-foot support and maintenance building be constructed. In addition, although the airport does not currently require the presence of an aircraft rescue and fire fighting (ARFF) facility and crew, it is an optional feature that some GA airports choose to have in order to enhance the airport's ability to respond to emergencies. Given the existing and continued use of the airport by large corporate aircraft, airport management and the PAC and TAC committees would like to see an ARFF facility constructed at the Airport at some point in the future. Should the ARFF facility ever be built, it is recommended that the Town verify the existence and functionality of the additional underground fire protection waterline that is believed to run from the pump house across Taxiway A and Runway 12-30 to the northeast side of the airport; if this additional waterline does exist and is functional, this would potentially save the Airport from having to add to the waterline where the existing waterline at the northwest end of the airport is located; completing this loop to the northeast side was previously mentioned in the previous master plan.

The preferred alternative for the location of both buildings is shown on **Exhibit 4**, and is the only option which seemed to make the most logical sense for the airport. This location is centrally located on the airfield within the general aviation complex. It will have quick access to the apron and the airport perimeter road. Furthermore, it will also have access to Avra Valley Road via a proposed paved access road, which will ease the process of getting large equipment onto and off of the airport with very little interference to the aircraft operations area. This is also crucial for emergency vehicles in order to reach hospitals in the fastest manner possible.

5.4.5 Fuel Facility

The existing fuel facility and fuel truck parking area located west of the terminal building and restaurant are recommended to remain in the same location for the planning period. The location of the facility adequately serves the needs of the general aviation community.

On the other hand, with development of the corporate development complex, the need for additional fueling capabilities will be needed. It is not practical for fuel trucks to travel from the existing fuel facility to the east parking apron on a routine basis because of the need to cross the active runway (Runway 30). It is recommended that the east parking apron provide both Jet A and AvGas, although because of the expected use of the apron, it is likely that the need for Jet A will be considerably higher than AvGas. The location of the fuel facility on the preferred alternative, as shown on **Exhibit 7**, is ideal because it is located in a more secure and remote area which will not take away from the aesthetics of the new terminal area. Furthermore, the preferred location does not hinder the potential development of the desirable land adjacent to the taxiway.

5.4.6 Expansion of Vehicle Parking Areas

Additional vehicle parking is recommended for the planning period. Three areas on the Airport have been identified to address the demand. These include:

- Expansion of the existing vehicle parking area to the east of the existing vehicle parking area in front of the existing terminal building;

- To provide vehicle parking for aircraft owners located in hangar facilities 10 through 13 a vehicle parking area is planned with direct access from W. Avra Valley Road; and
- Additional vehicle parking will be needed in the area of the corporate development complex once development occurs.

The alternative drawings depict the recommended locations for the additional vehicle parking as described above.

5.4.7 Air Traffic Control Tower

Marana Regional Airport does not have an air traffic control tower (ATCT). An ATCT is a staffed facility that uses air/ground communications and other air traffic control systems to provide air traffic services on and in the vicinity of an airport. The previous airport master plan for the Marana Regional Airport explored the possibility of constructing an ATCT at the Airport. Subsequent to the airport master plan, the Town of Marana underwent the preparation of a benefit-cost analysis and an environmental assessment to identify the potential environmental impacts associated with constructing an ATCT. The benefit-cost analysis concluded that full funding of an ATCT would be likely if air traffic levels represented in the previous master plan were realized. The environmental assessment was not finalized and a Federal finding was never issued.

During the PAC and TAC meetings held for the current master plan, considerable discussion took place regarding the need for an ATCT at the Airport. Because of the history behind the desire for an ATCT and recent discussions at the PAC and TAC meetings, it was agreed that the location for a future ATCT should be considered as part of the planning process. Thus, two locations have been identified within the proposed development plans for the location of an ATCT. The first location, which is the preferred alternative, is illustrated on **Exhibit 4**. The second location illustrates the ATCT as originally conceived within the draft environmental assessment completed in 2008 as shown on **Exhibit 5**. As mentioned previously, a portion of the existing itinerant aircraft parking apron resides in the RVZ and therefore needs to be removed. To make up for this loss of apron, new apron has been proposed east of the existing T-hangars as shown on **Exhibit 4**. Thus, the original location of ATCT described within the 2008 EA (**Exhibit 5**) would not be feasible due to the need to construct new apron to replenish the apron removed from the RVZ, which makes the location as shown in **Exhibit 4** the preferred alternative.

For the construction of an ATCT to take place, an updated benefit-cost analysis would need to be prepared taking into consideration the forecasted air traffic contained in this master plan. The results of the benefit-costs analysis will determine funding eligibility of an ATCT. It's important to note that a benefit-cost analysis is not part of the current master plan. Additionally, a new environmental assessment will need to be prepared for the ATCT to be constructed.

5.4.8 Aeronautical/Non-Aeronautical Development

The two areas on the airport property that lend themselves best to economic development are located within the specialty aviation services complex and the corporate development complex as shown on **Exhibit 6**. The first area includes an abundance of state land north and east of the corporate development complex that, if acquired, would allow for significant expansion of this area. The type of development in this area could be a mix of aeronautical and non-aeronautical revenue generating development. All development in this area must be compatible with the Airport, as defined by the FAA, and will be a key element for growth. The second area is within the specialty aviation services complex located off of Wright Way and the west side of the Airport. With the newly created access to the infield between Taxiway C and Taxiway A, this area becomes available for aviation related development provided that all development remains outside of the RVZ.

Any land that is proposed to be developed for non-aeronautical development that is located on airport property adjacent to Wright Way will need to be approved for non-aeronautical use by the FAA. Again, it is important that any redevelopment of the vacant land be compatible with the airport, as defined by the FAA.

5.4.9 Miscellaneous Landside Development Projects

The following landside improvements are also recommended, but may not necessarily be illustrated on the alternative drawings:

- Additional aerial lighting around the expanded vehicle parking areas;
- Install airport entrance signage for the corporate development complex and the specialized aviation business development complex;
- Enhance security fencing and gate access as necessary around landside buildings; and
- Improve recycling efforts and coordinate receptacle locations with tenants to reduce excessive travel by haulers.

5.5 Environmental Impacts

The proposed development projects will likely cause limited short-term effects resulting from construction activities. These short-term construction impacts would not persist beyond the construction period, and no long-term impacts are expected as a result of the proposed development at the Airport. The proposed projects are not expected to exceed the significant impact threshold for the impact resource categories defined by FAA Order 5050.4B, *National Environmental Protection Act (NEPA) Implementing Instructions for Airport Projects* and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. The resource impact categories and potential environmental impacts are evaluated in Chapter 7, Environmental Overview.

5.6 Development Costs

The planning costs for the proposed development presented in this Chapter will be discussed in more detail in Chapter 8, Airport Development and Financial Plan. Development costs discussed in this Chapter are for planning purposes only, are based on 2016 dollars, and reflect level of magnitude costs. The costs in **Table 5-1** are derived from the consultant's knowledge of contactors, construction material suppliers, and work performed at comparable facilities. The costs presented are not intended to be the full range of costs associated with each project. Additional costs such as operating and maintenance are not included. The objective of quantifying construction costs is to aid the Town in the decision making process. A recommended development phasing plan, along with refined probable costs, will be presented in Chapter 8.

Table 5-1 Estimated Development Costs Summary

Development Feature	Project Description	Estimated Cost (2016 Dollars)
Fencing	Install airfield perimeter fencing, gates, and appurtenances	$420,000
Shade Structure	Construct new shade structure	$300,000
Building Demolition	Demolish building	$100,000
Land Acquisition	Acquire approximately 175 acres of land (fee simple and avigation easements)	$437,500
Runway 21 Extension	Extend Runway 21 including edge lighting and signage	$1,292,000
Runway 3-21 Parallel Taxiway (west side)	Construct parallel taxiway (west side) including edge lighting and signage	$1,084,000
Runway 3-21 Parallel Taxiway (east side)	Construct parallel taxiway (east side) including edge lighting and signage	$484,000
Aircraft Apron	Construct approximately 44,500 SY of new aircraft parking apron; install edge lighting and signage	$2,700,000
Fuel Storage Facility	Construct new fuel storage facility adjacent to east apron	$500,000
Visual and Navigational Aids	Install four (4) LED PAPIs, relocate segmented circle, and install new LED rotating beacon	$110,000
Hangar Development	Construct aircraft storage hangars (average SF costs)	$10,080,000
Terminal Building	Construct new airport terminal building adjacent to east apron (average SF cost)	$20,000,000
Vehicle Access Road and Parking	Construct new access roads and vehicle parking areas	$841,500
Airport Maintenance Building	Construct new airport maintenance building	$1,200,000
Airport ARFF Building	Construct new airport rescue and firefighting building	$1,200,000
Pavement Removal	Removal of airfield pavement (apron or taxiway)	$64,000
Taxiway C edge lighting	Install taxiway edge lighting and signage	$140,000

Note. Fencing is based on an average cost of $20 per linear foot; hangar construction cost is approximately $80 per square foot, and hangar development will depend on actual demand; terminal buildings are not typically paid for with FAA or State grants.
Source: Armstrong Consultants, Inc., 2016

5.7 Alternative Development Summary

Development alternatives presented in this Chapter addressed both airside and landside needs for the planning period, as well as several miscellaneous needs. Airside alternatives include additional partial-parallel taxiways to Runway 3-21, removal of apron within the RVZ, apron expansion to improve aircraft maneuvering, and development of the east apron area (designated as the corporate development complex) to provide better services to corporate aircraft users. Landside alternatives include proposed hangar development locations (as demand warrants), a new corporate terminal building, a new ARFF and maintenance support and equipment buildings, a location for an ATCT, additional vehicle parking areas, and proposed areas for aeronautical and non-aeronautical revenue generating development.

The recommended development alternatives have been incorporated into the draft Airport Layout Plan (ALP) based on input that was gathered from the Sponsor (Town of Marana), FAA, ADOT, the Technical Advisory Committee (TAC), and the Public Advisory Committee (PAC) during a scheduled alternative development review meeting. The proposed development plan (**Exhibit 3**), along with the other Exhibits found in this chapter, were used for discussion at this review meeting.

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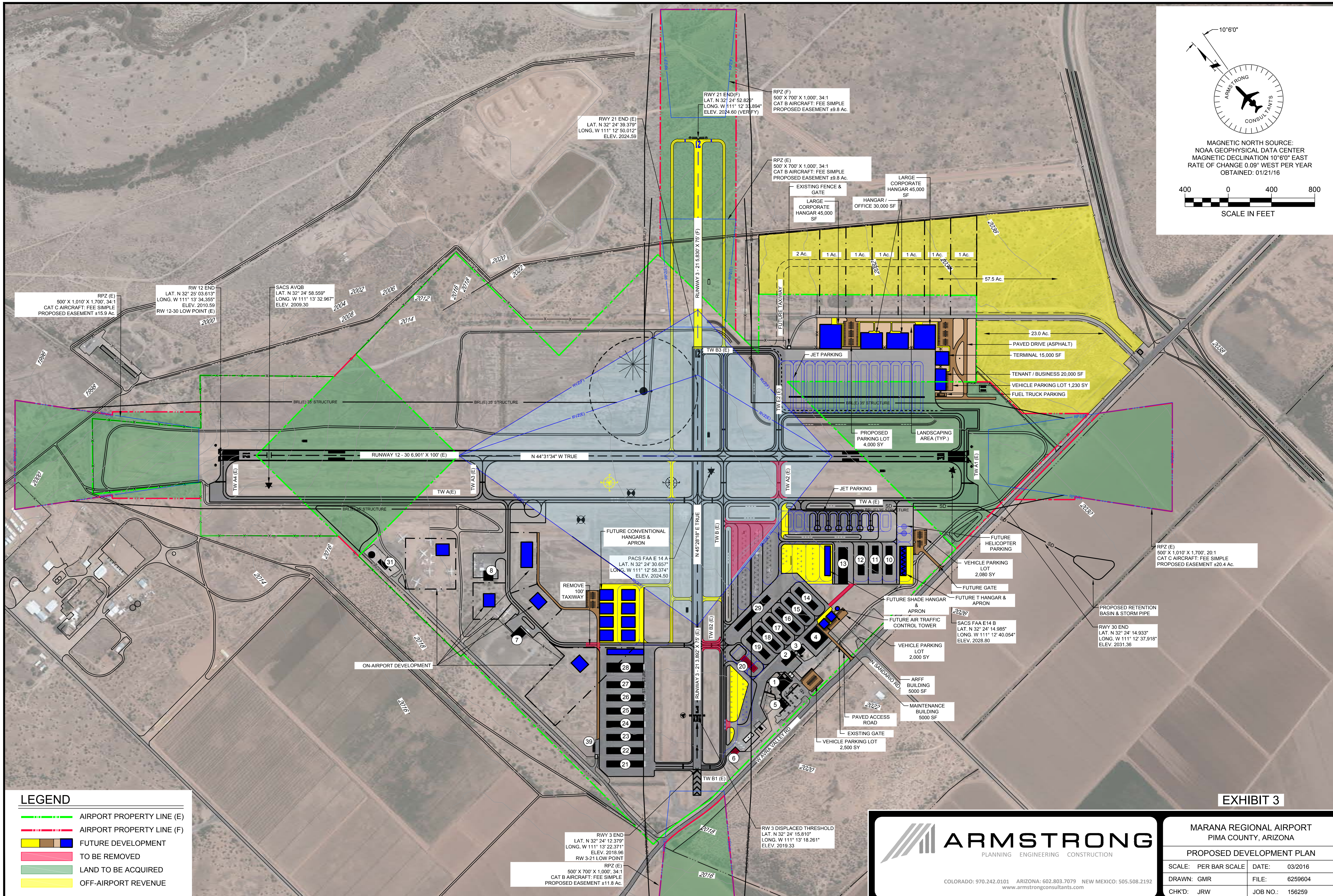

MAGNETIC NORTH SOURCE:
NOAA GEOPHYSICAL DATA CENTER
MAGNETIC DECLINATION 10°6'0" EAST
RATE OF CHANGE 0.09° WEST PER YEAR
OBTAINED: 01/21/16
10°6'0"
400 0 400 800
SCALE IN FEET
RPZ (F)
500' X 700' X 1,000', 34:1
CAT B AIRCRAFT: FEE SIMPLE
PROPOSED EASEMENT ±9.8 Ac.
RWY 21 END(F)
LAT. N 32° 24' 52.826"
LONG. W 111° 12' 33.894"
ELEV. 2024.60 (VERIFY)
RWY 21 END (E)
LAT. N 32° 24' 39.379"
LONG. W 111° 12' 50.012"
ELEV. 2024.59
RPZ (E)
500' X 700' X 1,000', 34:1
CAT B AIRCRAFT: FEE SIMPLE
PROPOSED EASEMENT ±9.8 Ac.
EXISTING FENCE & GATE
LARGE CORPORATE HANGAR 45,000 SF
HANGAR / OFFICE 30,000 SF
LARGE CORPORATE HANGAR 45,000 SF
2 Ac.
1 Ac.
57.5 Ac.
23.0 Ac.
PAVED DRIVE (ASPHALT)
TERMINAL 15,000 SF
TENANT / BUSINESS 20,000 SF
VEHICLE PARKING LOT 1,230 SY
FUEL TRUCK PARKING
JET PARKING
FUTURE TAXIWAY
TW B3 (E)
TW E2 (F)
RPZ (E)
500' X 1,010' X 1,700', 34:1
CAT C AIRCRAFT: FEE SIMPLE
PROPOSED EASEMENT ±15.9 Ac.
RW 12 END
LAT. N 32° 25' 03.613"
LONG. W 111° 13' 34.355"
ELEV. 2010.59
RW 12-30 LOW POINT (E)
SACS AVQB
LAT. N 32° 24' 58.559"
LONG. W 111° 13' 32.967"
ELEV. 2009.30
BRL(E) 35' STRUCTURE
BRL(E) 25' STRUCTURE
RUNWAY 3 - 21 5,830' X 75' (F)
RUNWAY 12 - 30 6,901' X 100' (E)
N 44°31'34" W TRUE
N 45°28'18" E TRUE
RUNWAY 3 - 21 3,892' X 75' (E)
PROPOSED PARKING LOT 4,000 SY
LANDSCAPING AREA (TYP.)
TW A4 (E)
TW A3 (E)
TW A(E)
TW A2 (E)
TW A1 (E)
TW B (E)
TW B2 (E)
TW B1 (E)
JET PARKING
TW A (E)
FUTURE CONVENTIONAL HANGARS & APRON
PACS FAA E 14 A
LAT. N 32° 24' 30.657"
LONG. W 111° 12' 58.374"
ELEV. 2024.50
REMOVE 100' TAXIWAY
FUTURE HELICOPTER PARKING
VEHICLE PARKING LOT 2,080 SY
FUTURE GATE
FUTURE SHADE HANGAR & APRON
FUTURE T HANGAR & APRON
FUTURE AIR TRAFFIC CONTROL TOWER
SACS FAA E14 B
LAT. N 32° 24' 14.985"
LONG. W 111° 12' 40.054"
ELEV. 2028.80
RPZ (E)
500' X 1,010' X 1,700', 20:1
CAT C AIRCRAFT: FEE SIMPLE
PROPOSED EASEMENT ±20.4 Ac.
PROPOSED RETENTION BASIN & STORM PIPE
RWY 30 END
LAT. N 32° 24' 14.933"
LONG. W 111° 12' 37.918"
ELEV. 2031.36
VEHICLE PARKING LOT 2,000 SY
ARFF BUILDING 5000 SF
MAINTENANCE BUILDING 5000 SF
PAVED ACCESS ROAD
EXISTING GATE
VEHICLE PARKING LOT 2,500 SY
ON-AIRPORT DEVELOPMENT
N SANDARIO RD
W AVRA VALLEY RD
RW 3 DISPLACED THRESHOLD
LAT. N 32° 24' 15.810"
LONG. W 111° 13' 18.261"
ELEV. 2019.33
RWY 3 END
LAT. N 32° 24' 12.379"
LONG. W 111° 13' 22.371"
ELEV. 2018.96
RW 3-21 LOW POINT
RPZ (E)
500' X 700' X 1,000', 34:1
CAT B AIRCRAFT: FEE SIMPLE
PROPOSED EASEMENT ±11.8 Ac.
LEGEND
AIRPORT PROPERTY LINE (E)
AIRPORT PROPERTY LINE (F)
FUTURE DEVELOPMENT
TO BE REMOVED
LAND TO BE ACQUIRED
OFF-AIRPORT REVENUE
EXHIBIT 3
ARMSTRONG
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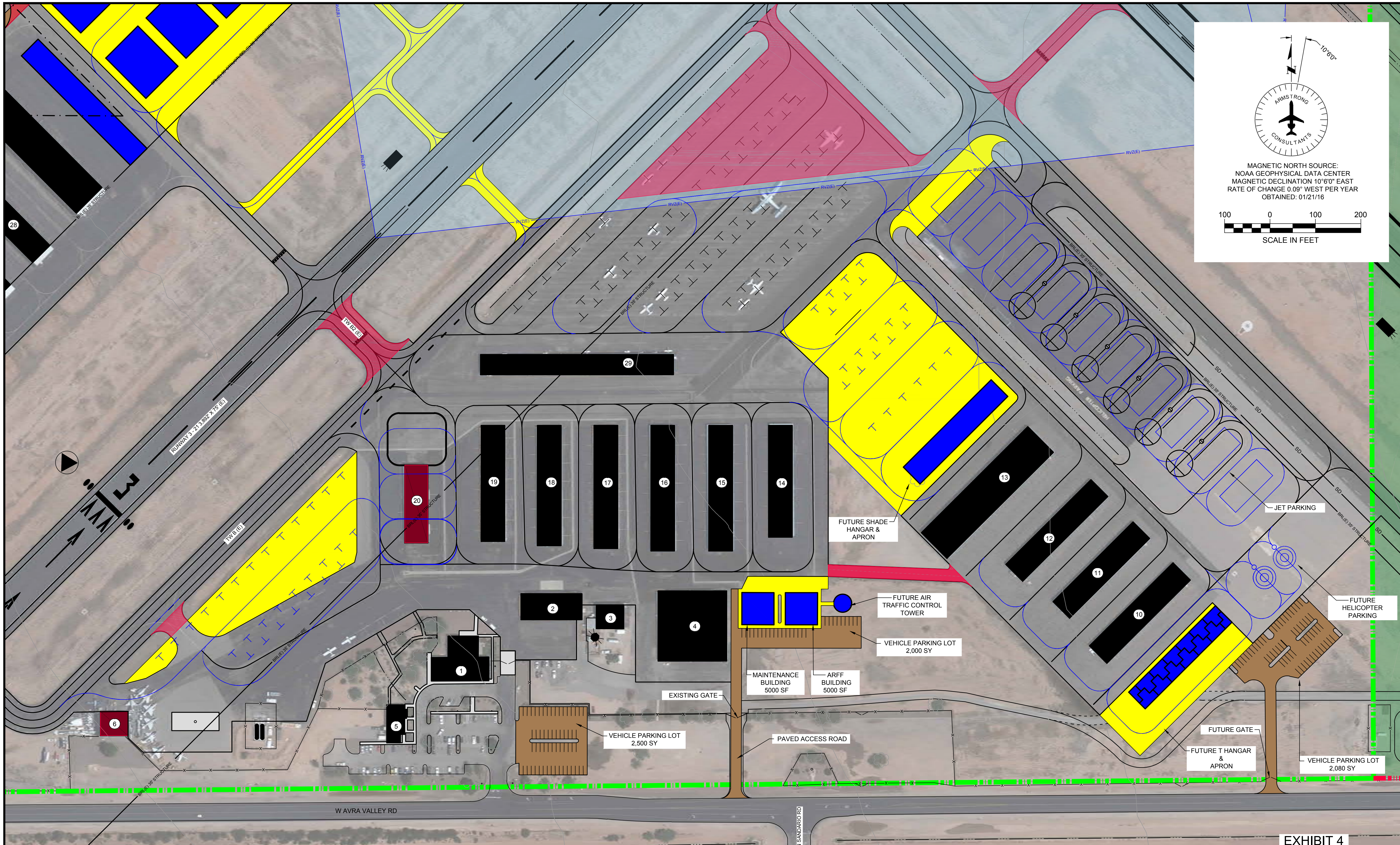
MARANA REGIONAL AIRPORT
PIMA COUNTY, ARIZONA
PROPOSED DEVELOPMENT PLAN
SCALE: PER BAR SCALE
DATE: 03/2016
DRAWN: GMR
FILE: 6259604
CHK'D: JRW
JOB NO.: 156259



LEGEND

- AIRPORT PROPERTY LINE (E)
- AIRPORT PROPERTY LINE (F)
- FUTURE DEVELOPMENT
- TO BE REMOVED

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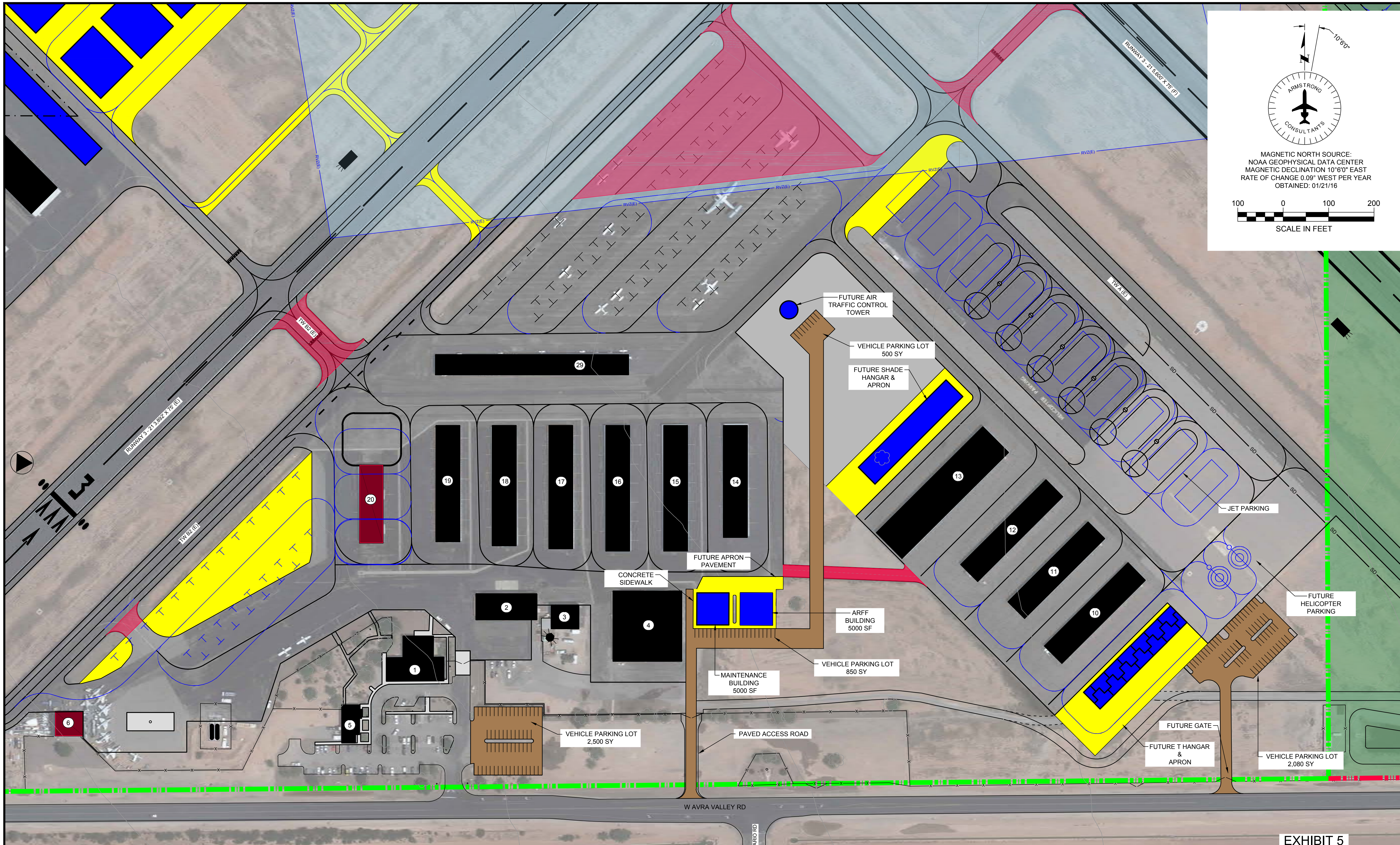
MARANA REGIONAL AIRPORT
PIMA COUNTY, ARIZONA

LANDSIDE / TERMINAL ALT. 1

SCALE:	PER BAR SCALE	DATE:	03/2016
DRAWN:	GMR	FILE:	6259604
CHK'D:	JRW	JOB NO.:	156259



LEGEND

- AIRPORT PROPERTY LINE (E)
- AIRPORT PROPERTY LINE (F)
- FUTURE DEVELOPMENT
- TO BE REMOVED
- FUTURE LAND ACQUISITION

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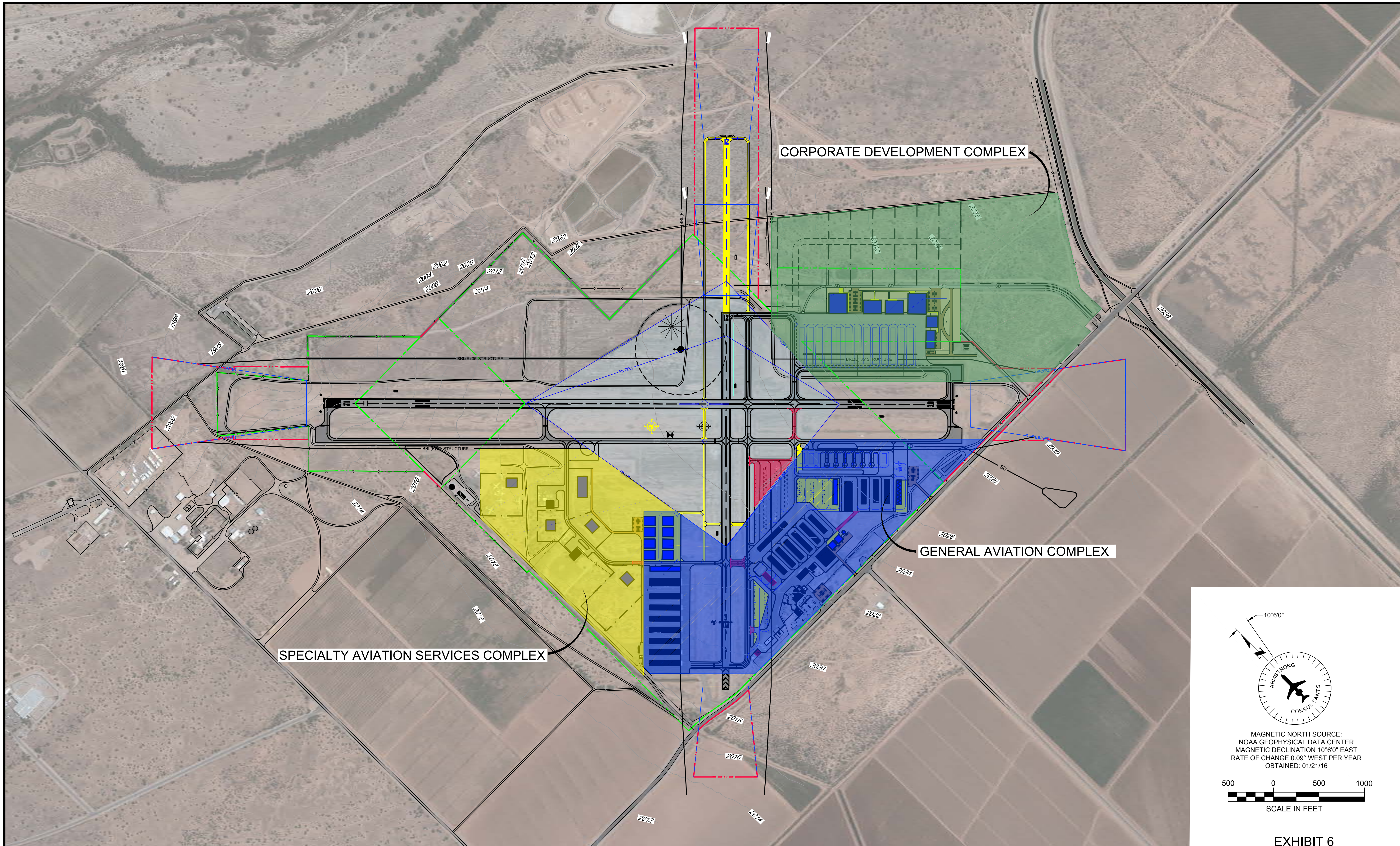
MARANA REGIONAL AIRPORT
PIMA COUNTY, ARIZONA

LANDSIDE / TERMINAL ALT. 2

SCALE:	PER BAR SCALE	DATE:	03/2016
DRAWN:	GMR	FILE:	6259605
CHK'D:	JRW	JOB NO.:	156259



LEGEND

AIRPORT PROPERTY LINE (E)		CORPORATE DEVELOPMENT COMPLEX	
AIRPORT PROPERTY LINE (F)		GENERAL AVIATION COMPLEX	
FUTURE DEVELOPMENT		SPECIALTY AVIATION SERVICES COMPLEX	
TO BE REMOVED			

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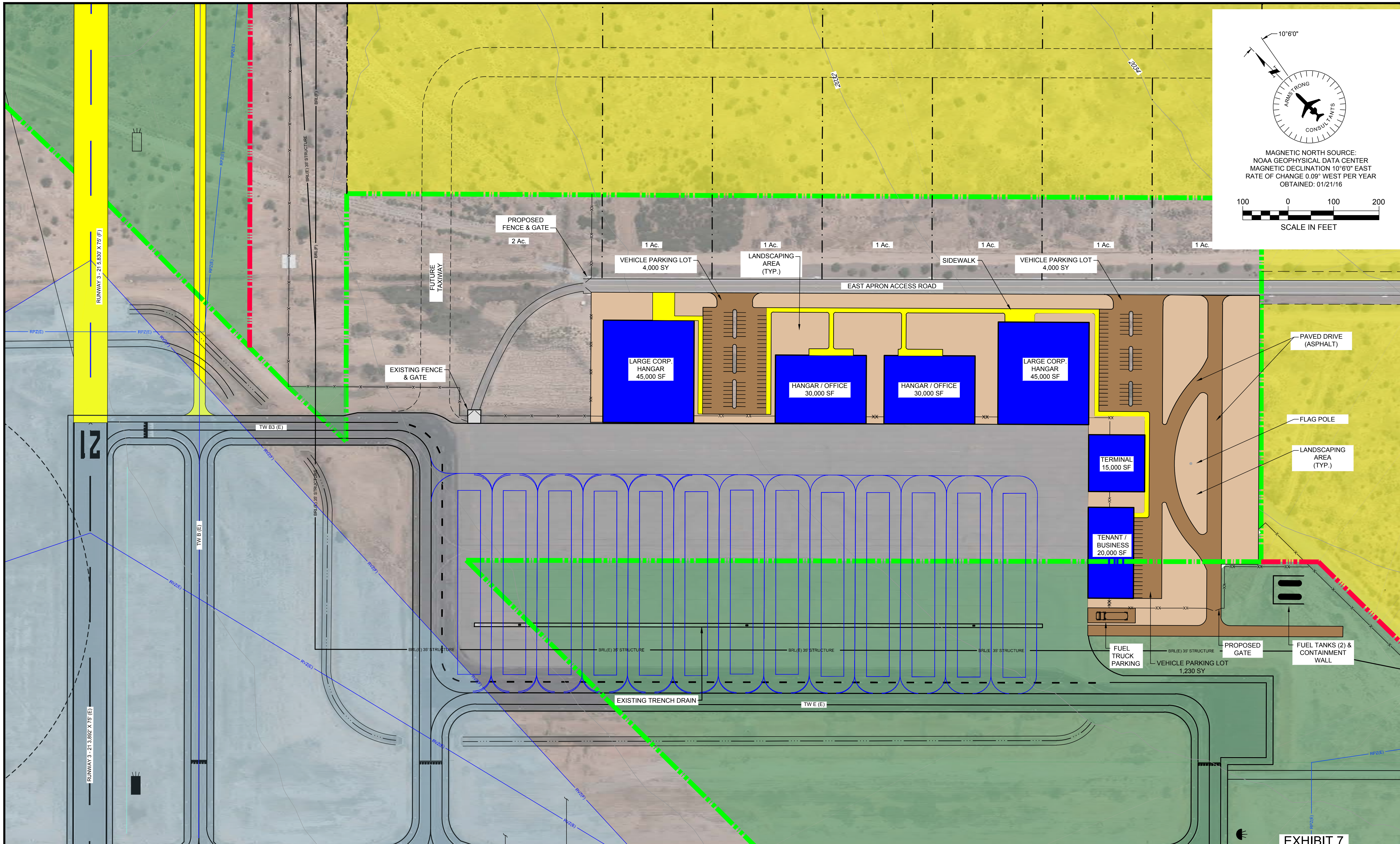
MARANA REGIONAL AIRPORT
PIMA COUNTY, ARIZONA

DEVELOPMENT COMPLEXES

SCALE:	PER BAR SCALE	DATE:	04/2016
DRAWN:	GMR	FILE:	6259603
CHK'D:	JRW	JOB NO.:	156259



LEGEND

- AIRPORT PROPERTY LINE (E)
- AIRPORT PROPERTY LINE (F)
- FUTURE DEVELOPMENT
- TO BE REMOVED
- FUTURE LAND ACQUISITION

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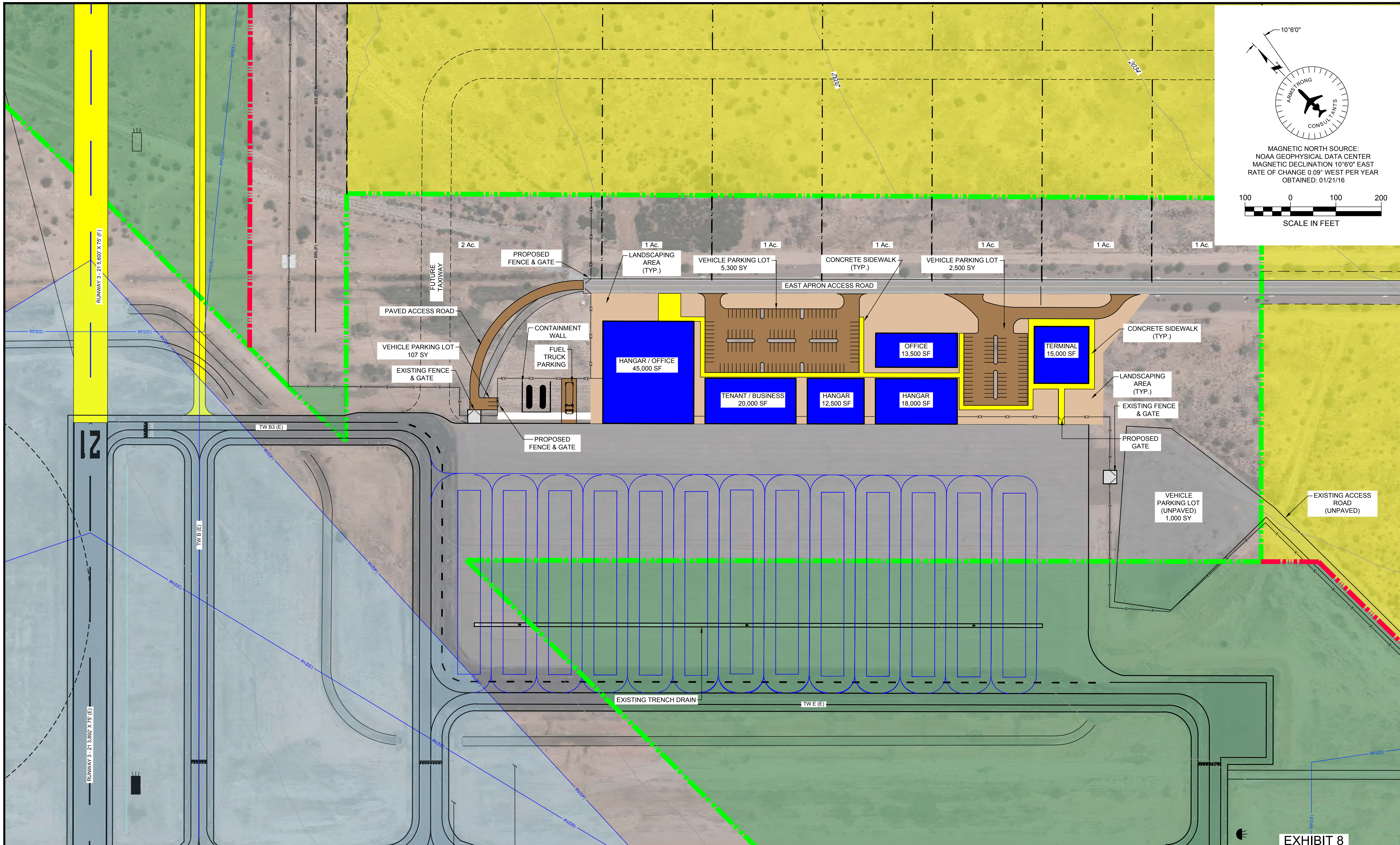
MARANA REGIONAL AIRPORT
PIMA COUNTY, ARIZONA

LANDSIDE / EAST APRON ALT. 1

SCALE:	PER BAR SCALE	DATE:	03/2016
DRAWN:	GMR	FILE:	6259604
CHK'D:	JRW	JOB NO.:	156259



LEGEND

- AIRPORT PROPERTY LINE (E)
- AIRPORT PROPERTY LINE (F)
- FUTURE DEVELOPMENT
- TO BE REMOVED
- FUTURE LAND ACQUISITION

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MARANA REGIONAL AIRPORT
PIMA COUNTY, ARIZONA

LANDSIDE / EAST APRON ALT. 2

SCALE:	PER BAR SCALE	DATE:	03/2016
DRAWN:	GMR	FILE:	6259605
CHK'D:	JRW	JOB NO.:	156259

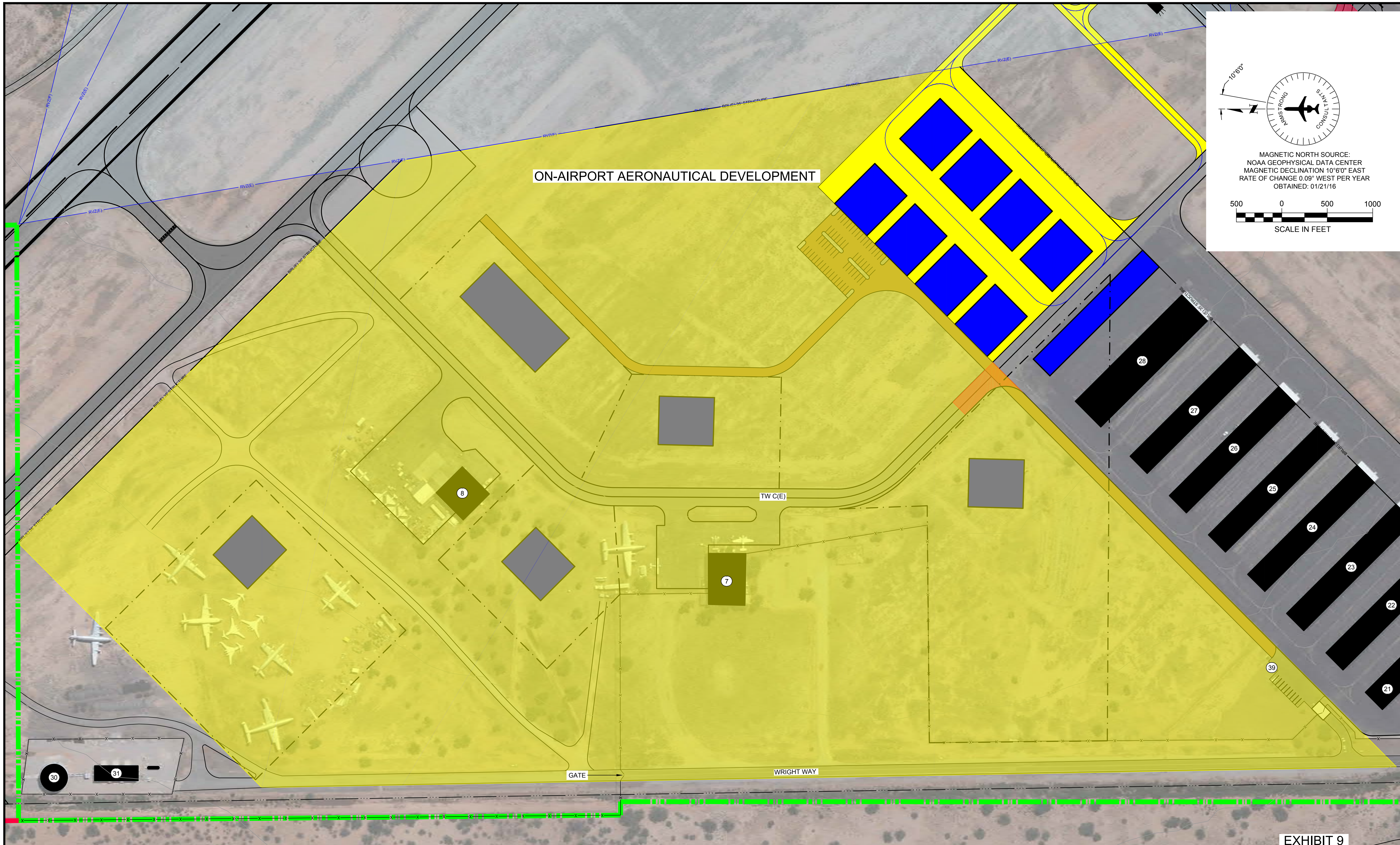

EXHIBIT 9

LEGEND

- AIRPORT PROPERTY LINE (E)
- AIRPORT PROPERTY LINE (F)
- FUTURE DEVELOPMENT
- TO BE REMOVED
- ON-AIPRORT AERONAUTICAL DEVELOPMENT

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MARANA REGIONAL AIRPORT
PIMA COUNTY, ARIZONA

LANDSIDE / S.A.S.C. ALT. 1

SCALE:	PER BAR SCALE	DATE:	04/2016
DRAWN:	GMR	FILE:	6259603
CHK'D:	JRW	JOB NO.:	156259

Chapter 6 – Airport Layout Plan Drawing Set

6.1 Airport Layout Plan Drawing Set Contents

This chapter contains the ALP drawing set. There are nineteen drawings, or sheets, which make up the entire set. The drawings within the set adhere to the guidelines set forth in the FAA's Standard Operating Procedures entitled *FAA Review and Approval of Airport Layout Plans (ALPs)* and *FAA Review of Exhibit 'A' Airport Property Inventory Maps* (ARP SOP 2.00 and 3.00). After the cover sheet, the remaining sheets include the following:

- Airport Layout Plan
- Airport Data Sheet
- Terminal Area Drawing – GA
- Terminal Area Drawing - Corporate
- 14 CFR Part "77" Airspace Drawing
- 14 CFR Part "77" Profiles: RW 12-30
- 14 CFR Part "77" Profiles: RW 3-21
- Runway 12 Inner Approach (E) (F)
- Runway 30 Inner Approach (E)
- Runway 30 Inner Approach (F)
- Runway 3 Inner Approach (E)
- Runway 21 Inner Approach (E) (F)
- Runway 3 Inner Approach (F) (U)
- Runway 21 Inner Approach (U)
- On Airport Land Use Drawing
- Off Airport Land Use Drawing
- Airport Property Map
- Aerial Photograph

MARANA REGIONAL AIRPORT

MARANA, AZ

AIRPORT LAYOUT PLAN

DRAFT

PREPARED BY:

ARMSTRONG CONSULTANTS, INC.

ADOT NO. E5S3N

A.C.I. PROJECT NO. 156259

DATE: SEPTEMBER 2016

INDEX TO SHEETS

DRAWING	SHEET
COVER SHEET	1
AIRPORT LAYOUT PLAN	2
AIRPORT DATA SHEET	3
TERMINAL AREA DRAWING-GA	4
TERMINAL AREA DRAWING-CORPORATE	5
14 CFR PART 77 AIRSPACE DRAWING	6
14 CFR PART 77 PROFILES: RW 12-30	7
14 CFR PART 77 PROFILES: RW 3-21	8
RUNWAY 12 INNER APPROACH (E)(F)	9
RUNWAY 30 INNER APPROACH (E)	10
RUNWAY 30 INNER APPROACH (F)	11
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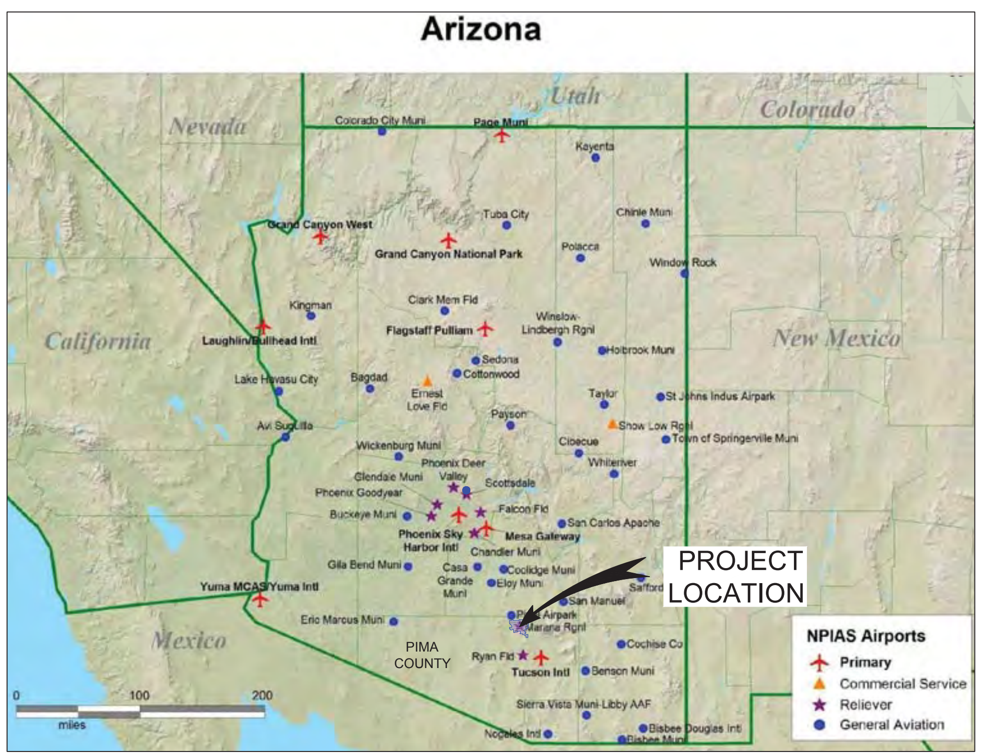
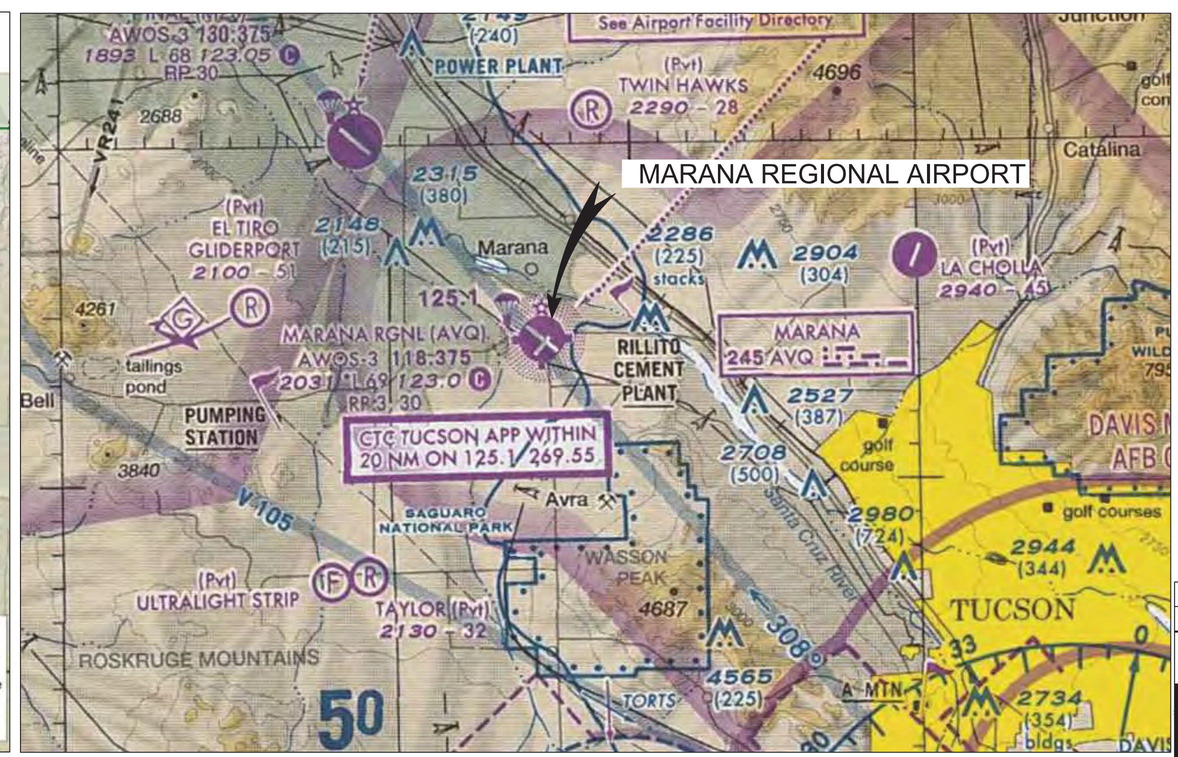
AERIAL PHOTOGRAPH	19

(E = EXISTING, F = FUTURE, U = ULTIMATE)



LOCATION MAP

NTS



VICINITY MAP

NTS

0	156259	09/2016	ORIGINAL ISSUE	6259501	GMR	CRM	JZP
No.	Project No.	Date	Revision / Description	File	Drwn.	Chkd.	Apprvd.

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