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INTRODUCTION

GRAND CANYON WEST AIRPORT
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ARMSTRONG CONSULTANTS, INC.
AIRPORT ENGINEERING AND PLANNING

INTRODUCTION

The Hualapai Nation and Grand Canyon Resort Corporation (GCRC), as the Airport Sponsor, is continuing its effort to plan for future development of the Grand Canyon West Airport (1G4). Armstrong Consultants, Inc. was tasked to undertake the Airport Master Plan (AMP) for the Airport. The overall study will follow the process outlined in the Federal Aviation Administration's (FAA) Advisory Circular 150/5070-6B, *Airport Master Plans*. The AMP is intended to help revalidate and redefine the demand-driven development priorities at the Airport in conjunction with enhancing air service operations; enhance safety; provide improved airport services; and, stimulate the local economy through potential air service and business growth in a financially viable and cost-effective manner. The preparation of this AMP is evidence that the Airport and Tribe recognizes the significance of air transportation to the community as well as the requirement for a systematic approach to evaluating the Airport's unique operating and improvement needs.

An AMP is intended to be a proactive document which identifies and plans for future facility needs in advance of the actual need for the facilities. The AMP outlines a strategic plan for the Airport that assess the growth patterns, demand characteristics, and facility and infrastructure requirements at Grand Canyon West Airport, taking into consideration trends in the aviation industry and operating conditions at the Airport. This is done to ensure that the Hualapai Tribe can coordinate project approvals, design, financing and construction to avoid experiencing unfavorable effects due to inadequate or constrained airport facilities. With a sound and realistic AMP, Grand Canyon West Airport can maintain its role as a tourism hub and an important link to the national air transportation system for the region.

PURPOSE

The purpose of the AMP is to provide a framework to guide future airport development that cost-effectively satisfies local and regional aviation demand, while producing an efficient, economical and environmentally compliant facility. The AMP considers the possible environmental and socioeconomic costs associated with alternative development concepts as well as the possible means of avoiding, minimizing, or mitigating impacts to sensitive resources at the appropriate level of detail for facilities planning.

The document describes and depicts the overall concept for long-term development of an airport. It presents the concepts graphically in the Airport Layout Plan (ALP) drawing set and reports the data and logic upon on which the concept is based in the AMP report.

OBJECTIVES

The primary objectives of the AMP are to produce an attainable phased development plan concept that will satisfy the airport's needs in a safe, efficient, economical and environmentally sound manner. Goals and objectives are integral to the definition and validity of any plan and serve to frame and direct the definition of options, and more importantly, to establish evaluation criteria to be used in assessing the viability and benefits of such options. The plan serves as a guide to decision makers, airport users and the general public for implementing airport development actions while considering both airport and community concerns and objectives. There are a number of objectives that the Airport would like to achieve as a result of this AMP.

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

- Document the issues that the proposed development will address.
- Justify the proposed development through the technical, economic, and environmental investigation of concepts and alternatives.
- Provide an effective graphic presentation of the development of the airport and anticipated land uses in the vicinity of the airport.
- Establish a realistic schedule for the implementation of the development proposed in the plan, particularly the short-term capital improvement program.
- Propose an achievable financial plan to support the prioritized implementation schedule.
- Provide sufficient project definition and detail for subsequent environmental evaluations that may be required before the 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 Tribe 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 conditions and permit changes in plan recommendations as required.
- Evaluate passenger circulation and function use of the existing and future terminal building.
- Evaluate the feasibility, justification and siting for a new air traffic control tower (ATCT).
- Obtain aerial photogrammetry and obstruction survey in accordance with current standards for base mapping and the development of an LPV and/or ILS instrument approach procedure into the airport.

AIRPORT MASTER PLAN PROCESS AND SCHEDULE

Airport planning takes place at a national, state, regional and local level. These plans are formulated on the basis of overall transportation demands and are coordinated with other transportation planning and comprehensive land use planning agencies. The National Plan of Integrated Airport Systems (NPIAS) is a ten-year plan continually updated and published by the 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 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 identifies airport needs for a large regional or metropolitan area. Needs are stated in general terms and incorporated into statewide systems plans. The Airport Master Planning process involves collecting data, forecasting demand, determining facility requirements, studying various alternatives and developing plans and schedules. The flow chart in **Figure i-1** depicts the steps in the master planning process. This process will take into consideration the needs and concerns of the airport sponsor, airport tenants and users, as well as the general public. The AMP is prepared by the operators of individual airports and is usually completed with the assistance of consultants. The Grand Canyon Resort Corporation is completing this master plan with the assistance of Armstrong Consultants, Inc.

PLANNING ADVISORY COMMITTEE

The Grand Canyon West Airport Planning Advisory Committee (PAC) for this AMP consists of members representing varied interests in the Airport and the community. Their involvement throughout the Airport Master Plan process will help to keep interested parties informed and will foster consensus for future development actions.

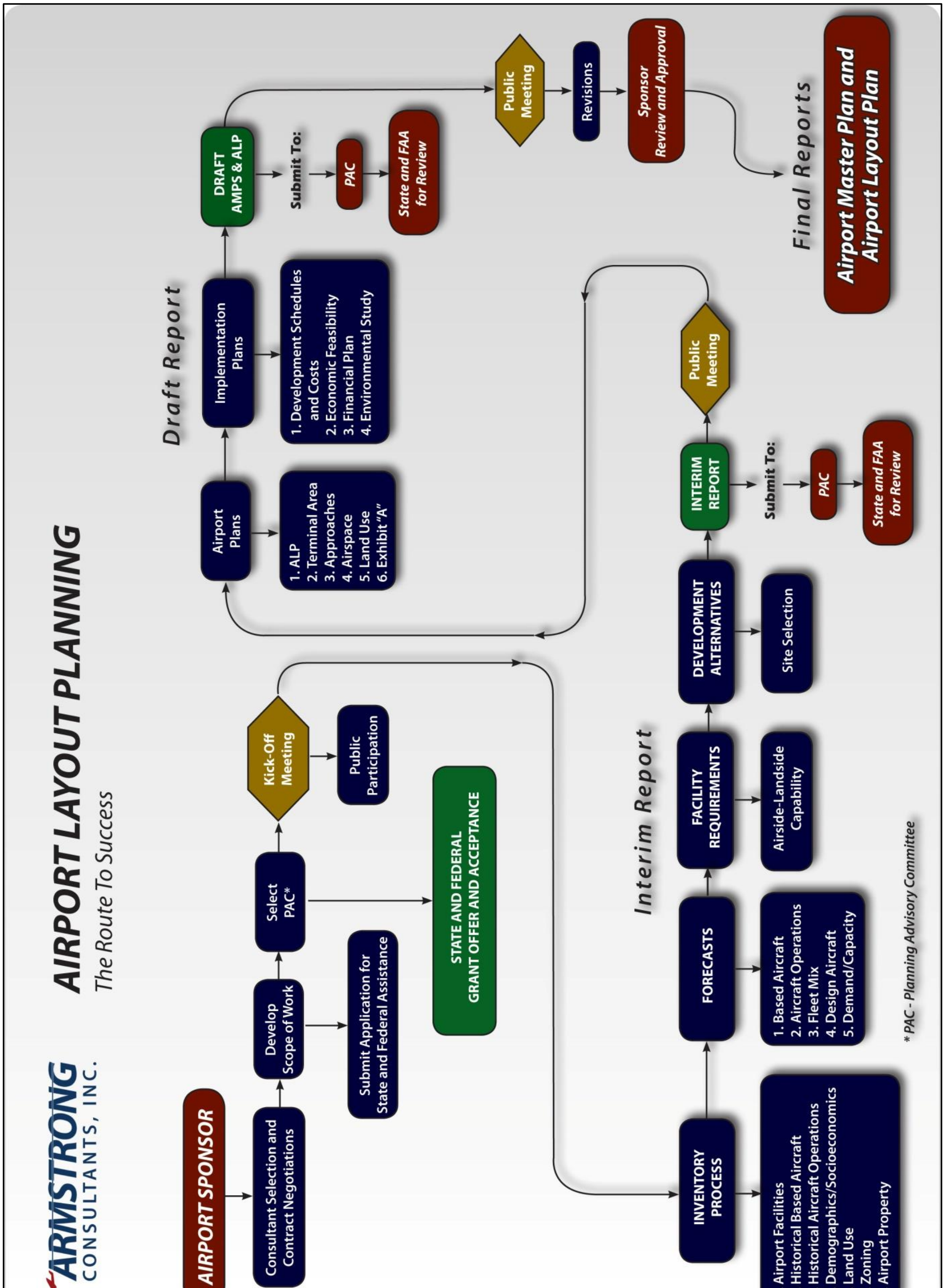


FIGURE 1 AIRPORT MASTER PLAN SCHEDULE

CHAPTER 1
INVENTORY

GRAND CANYON WEST AIRPORT
AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS, INC.
AIRPORT ENGINEERING AND PLANNING

Chapter One
Inventory

1.1 INTRODUCTION AND AIRPORT HISTORY

Grand Canyon West Airport (1G4) is a primary commercial service airport located in northwest Arizona approximately 60 miles northwest of Peach Springs, Arizona. The Airport is located in the northwest corner of Arizona at the West Rim of the Grand Canyon on the Hualapai Indian Reservation. The Airport is approximately 121 miles southeast of Las Vegas, Nevada, 70 miles north of Kingman, Arizona and 60 miles north of the Peach Springs, Arizona which is capital to the Hualapai Tribe **(see Figure 1-1)**.

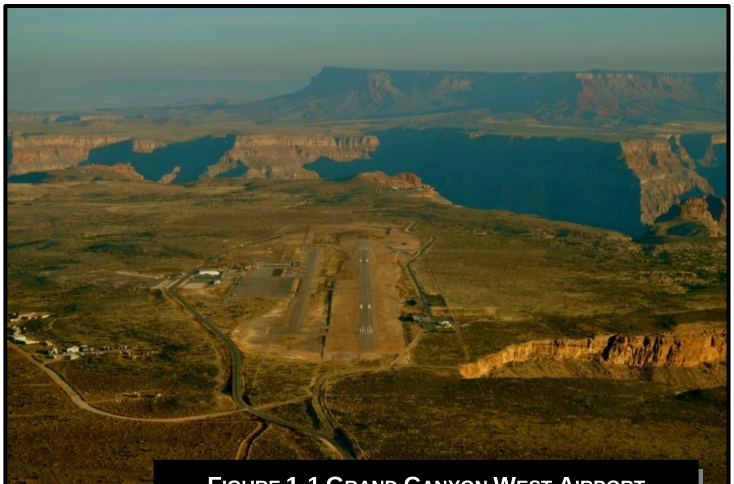


FIGURE 1-1 GRAND CANYON WEST AIRPORT

The Airport is publically owned and operated by the Hualapai Tribe and managed and operated by the Grand Canyon Resort Corporation (GCRC), a Tribal enterprise. Grand Canyon West Airport provides access by air to the area and is situated immediately adjacent to the West Rim of the Grand Canyon. The primary factor which is driving aviation activity at Grand Canyon West Airport is Grand Canyon tourism demand. A review of the history of the Hualapai Tribe is important to identify how development of the Airport provides a socioeconomic benefit, both directly and indirectly, to the Tribe and community.

The creation and the origin accounts of the Hualapai, or Walapai, Tribe are crucial to the Hualapai experience and culture. The Hualapai Reservation was created in 1883 and is a descendant of the 14 bands of the Pai (people) from the original territories in northwestern Arizona. Each band had their own versions of the creation story, Wikahme (or Wikahmi), and the origin story, Madwida (or Merriwitica). Today, most of the Hualapai may recognize either Wikahme, or Madwida, or both depending on which of the bands they descends from. The band associated with Grand Canyon West is the dinyikda Baja (Grass Spring Band) of the Ga' Odva Bay (Rim/Plateau People). The Hualapai, meaning "People of The Tall Pines," are native people of the southwest.[1]

Traditionally hunter-gathers, they inhabited an area of more than five million acres. The Tribe's reservation stretched from the Grand Canyon southward to the San Francisco Peaks. The Hualapai Indian Reservation was and still is one of rugged and varied terrain between Peach Springs and the Colorado River west of the Grand Canyon National Park. The Reservation is owned in undivided shares by enrolled Indians and held in trust by the federal government. In 1947, the Reservation was consolidated when the title of 500,000+ acres was put in trust, which had previously been held by the Santé Fe Railroad, increasing its acreage to 997,045.

The Hualapai Trading Company at Peach Springs (Tribal Capital) was established in 1944 by the Tribe. It was established as a "provider" for groceries and other merchandise, while allowing

[1] 1998 Airport Master Plan

credit privileges. The cattle on the Reservation are owned by members of the Hualapai Livestock Association, except the tribal herd.

The Hualapai American Indian Tribe became organized as a tribe on December 17, 1938, when a constitution and by-laws were approved, which was later followed by a ratification of their corporate charter on June 6, 1943. Individuals listed on the roles as of 1938 are members, and children born to any member after January 1, 1938 (who are of one-quarter degree or more of American Indian blood), are also members.

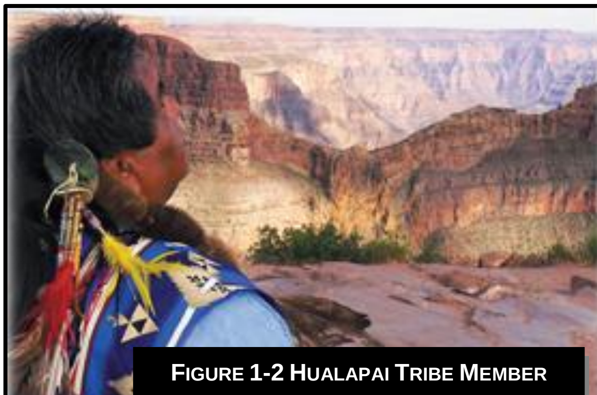


FIGURE 1-2 HUALAPAI TRIBE MEMBER

Source: Hualapai Tribe

The Tribal Council consists of nine members. Councilmen must be voters of 25 years of age and must be members of the Tribe and residents of the Reservation (see **Figure 1-2)**. All officers, committees and tribal employees are selected by the Council. Council officers include a Chairman, Vice-Chairperson, Secretary, Treasurer, Judge, Police Chief, and Tribal Assistant Administrator. The Council has jurisdiction over matters pertaining to management of tribal property, conduct of Indians and non-Indians on the Reservation, tribal business enterprise, and the welfare of the tribal members. Limits of the Council's power are instances where the Secretary of the Interior must give approval.

Today, the Hualapai American Indian Reservation encompasses 1,000,000 acres that includes 108 miles of the Grand Canyon and Colorado River. There are two airports located within the Hualapai Reservation: Hualapai Airport and Grand Canyon West Airport.

Serving as the gateway to the west rim of the Grand Canyon and the world-renowned Skywalk, the Grand Canyon West Airport started as a gravel air strip in the early 1990's serving scenic air tours in fixed-wing aircraft and helicopters from Las Vegas. Air traffic grew quickly and the Tribe paved the airstrip and aircraft parking apron in the late 90's. Since then the airport was accepted into the national airport system and has received over $40 million in Federal Aviation Administration grant funds to enhance the safety and utility of the airport.

The Airport recently completed the final phases of the initial construction process. Over 400,000 cubic yards of solid limestone were blasted and excavated to construct a replacement runway that meets the FAA recommended length, width and gradient standards. All of the excavated material was stockpiled and recycled into the base course and asphalt for the facility. The recent addition was the completion of a 75-foot wide and 5,000-foot long runway with a full-length parallel taxiway. During the recent landside development on the west side of the Runway, the addition of four heliports and 15 helicopter parking pads were constructed to accommodate the increasing demand. The apron was expanded to 53,061 square yards with 43 aircraft tiedown locations.

The airport is the seventh busiest airport in AZ (in terms of enplanements) and accommodates over 100,000 annual operations. Many transient fixed wing aircraft (Twin Otters, Dornier 228s, C-206s) and helicopters operate to and from Las Vegas and Phoenix; and extensive local air tour helicopter flights are conducted from the airport to the bottom of the Canyon (called down and ups).

Passengers are currently accommodated in an interim air structure terminal building which is expected to be converted to a permanent structure and integrated into the landside facilities after the new terminal building is completed.

FIGURE 1-3 WHITEWATER RAFTING TOUR

Source: Grand Canyon West, 2011

The Airport's economic drive is tourism. Visitors to the Airport can arrive via air transportation, personal or motor coach vehicle. Attractions at Grand Canyon West consist of the SkyWalk, Guano Point, river boat, horseback rides, and concerts at the amphitheater, Native American Village, overnight cabins at the Hualapai Range, pontoon ride and whitewater rafting down the Colorado River, and Hummer tours (See **Figure 1-3**). The primary means of transportation for visitors is personal transportation and motor coach. Air transportation is provided by air tour operators who transport passengers in and out of the Airport as well as down and up into the Canyon.

1.2 AIRPORT GRANT HISTORY

This Airport Master Plan (AMP) replaces the original 1998 Airport Master Plan (see **Figure 1-4**). In 2012, the FAA approved the Modernization and Report Act which changed the AIP funding allocation. Capital improvement projects are now funded at 91.06 percent by the Federal Aviation Administration (FAA) in the state of Arizona, and 8.94 percent by the Sponsor. The State of Arizona Department of Transportation Aeronautics Group (ADOT) does not fund projects for airports owned and operated by a Native American Tribes. A federal grant history for the capital improvements at Grand Canyon West Airport is provided in **Table 1-1**.

FIGURE 1-4 ORIGINAL AIRPORT

The Airport Improvement Program (AIP) is the FAA grant program which provides grants to public agencies for the planning and development of public-use airports included in the National Plan of Integrated Airport Systems (NPIAS). Eligible projects include improvements related to enhancing airport safety, capacity, security, and environmental concerns. Airports can use AIP funds on most airfield capital improvements or repairs and in some specific situations, for terminals, hangars, and non-aviation development. Professional services necessary for eligible projects such as planning, surveying, and design are eligible; however, aviation demand at the airport must justify the projects which must also meet federal environmental and procurement requirements.[2]

[2] Reference - Federal Aviation Administration - *Airport Improvement Program Overview* (www.faa.com)

TABLE 1-1 AIRPORT GRANT HISTORY

FAA Grant No.	Year	Project Description	Entitlement	Discretionary	Federal Amount
001-1995	1996	Conduct Airport Master Plan Study	$55,746	$0	$55,746
		Total:	**$55,746**	**$0**	**$55,746**
002-2001	2001	Conduct Airport Master Plan Study	$30,000	$0	$30,000
		Construct ARFF Building	$50,000	$0	$50,000
		Acquire ARFF Vehicle	$233,000	$0	$233,000
		Conduct Environmental Study	$95,000	$0	$95,000
		Acquire Security Equipment	$319,467	$0	$319,467
		Construct SRE Building	$50,000	$0	$50,000
		Total:	**$777,467**	**$0**	**$777,467**
003-2003	2003	Rehabilitate Terminal Building	$100,000	$0	$100,000
		Rehabilitate Apron	$100,000	$0	$100,000
		Rehabilitate Runway	$700,000	$0	$700,000
		Rehabilitate Taxiway	$100,000	$0	$100,000
		Construct Taxiway	$1,000,000	$0	$1,000,000
		Total:	**$2,000,000**	**$0**	**$2,000,000**
004-2004	2004	Construct Access Road	$463,143	$0	$463,143
		Construct Apron	$759,390	$208,638	$968,028
		Construct Taxiway	$0	$843,931	$843,931
		Total:	**$1,222,533**	**$1,052,569**	**$2,275,102**
005-2006	2006	Acquire ARFF Safety Equipment	$0	$14,250	$14,250
		Construct Runway	$2,000,000	$4,388,572	$6,388,572
		Total:	**$2,000,000**	**$4,402,822**	**$6,402,822**
006-2006	2006	Construct Runway	$0	$1,805,308	$1,805,308
		Total:	**$0**	**$1,805,308**	**$1,805,308**
007-2007	2007	Improve Airport Drainage	$1,000,000	$5,118,416	$6,118,416
		Construct Runway	$0	$3,740,823	$3,740,823
		Total:	**$1,000,000**	**$8,859,239**	**$9,859,239**
008-2008	2008	Construct Runway Safety Area	$0	$3,610,000	$3,610,000
		Construct Runway	$0	$2,320,656	$2,320,656
		Total:	**$0**	**$5,930,656**	**$5,963,656**
009-2008	2008	Construct Parking Lot	$600,406	$0	$600,406
		Remove Obstructions	$141,200	$0	$141,200
		Total:	**$741,606**	**$0**	**$741,606**
010-2008	2008	Install Weather Reporting Equip.	$195,011	$0	$195,011
		Total:	**$195,011**	**$0**	**$195,011**
011-2009	2009	Construct Runway	$355,321	$2,644,679	$3,000,000
		Construct Taxiway	$0	$325,000	$325,000
		Total:	**$355,321**	**$2,969,679**	**$3,325,000**
012-2010	2010	Construct Runway	$1,706,080	$6,410,838	$8,116,918
		Total:	**$1,706,080**	**$6,410,838**	**$8,116,918**
013-2011	2011	Update Airport Master Plan Study	$665,642	$0	$665,642
		Total:	**$665,642**	**$0**	**$665,642**
		TOTAL FAA FUNDING	**$10,719,406**	**$31,431,111**	**$42,183,517**

Source: Federal Aviation Administration Airport Improvement Plan, 2011
Prepared by: Armstrong Consultants, Inc., October 2011

1.3 AIRPORT CLASSIFICATION

Arizona has a variety of aviation facilities ranging from small rural unpaved airstrips serving isolated portions of the State to busy rooftop heliports and large, long-haul commercial service airports. Because of this diversity of facilities with broad ranges of operating parameters and design standards, an identity of facility classification is necessary.

The FAA and ADOT use three basic aviation facility classifications. The National Plan of Integrated Airport Systems (NPIAS) for 2008-2012 includes 59 of the 83 airports in the Arizona State Airports System Plan. The NPIAS defines an airport's role by its service level, and the airport's service level reflects the type of service the airport provides to the nation, state, and local community. The service level, in addition, reflects the funding categories established by Congress to assist in airport development. The Arizona State Airports Systems Plan (SASP) for Arizona establishes the service levels by the following criteria: 1) NPIAS category; 2) Current Airport Reference Code, which is a coding system used by the FAA to relate airport design criteria to the operational and physical characteristics of the aircraft operating at the airport; 3) State Primary and Secondary categories and; 4) old FAA airport categories (GA Community, GA Rural, and GA Emergency). This supplements the FAA's classification by providing a further detailed division of airport types based on activities served, economic factors, facilities, accessibility to the users, and surrounding demographics.

1.3.1 SERVICE LEVEL (NPIAS)

The Airport's NPIAS service level reflects the type of public use an airport provides to the community. The service level also reflects the funding categories established by Congress to assist in airport development. The following list identifies the different types of airport service levels:

- **Primary Service (PR)** - Primary service airports are public use airports receiving scheduled airline passenger service, enplaning 10,000 or more passengers per year.
- **Commercial Service (CM)** - Commercial service airports are public use airports which receive scheduled airline passenger service and which enplane 2,500 or more passengers annually.
- **Reliever (RL)** - Reliever airports are general aviation or commercial service airports which serve to relieve congestion for a Primary Service airport by providing a general aviation and non-airline commercial operators with alternative access to the community.
- **General Aviation (GA)** - General Aviation airports are either publically or privately owned public use airports that primarily serve general aviation users.

Grand Canyon West Airport is listed in the NPIAS as a Primary Service airport. The Airport meets all of the NPIAS criteria for this service level.

1.3.2 AIRPORT REFERENCE CODE

The Airport Reference Code (ARC) is a coding system established by the FAA and used to relate airport design criteria to the operational and physical characteristics of the aircraft intended to operate at the airport. The ARC has two (2) components relating to the airport design aircraft.

The first component, depicted by a letter (e.g. A, B, C, D, or E) is the aircraft approach category and relates to the aircraft approach speed based upon operational characteristics. An aircraft fits into a category based on 1.3 times the stall speed of that aircraft at maximum gross weight in the landing configuration.

The second component of the ARC is the aircraft design group and is depicted by a Roman numeral (e.g. I, II, III, IV V or VI). The aircraft design group is based on an aircraft's physical characteristics (wingspan or tail height, whichever is most demanding). **Table 1-2** provides a definition of both Aircraft Approach Categories and Aircraft Design Groups.

Grand Canyon West Airport is currently an Airport Reference Code (ARC) B-II facility serving primarily small aircraft. A small aircraft is defined as an airplane of 12,500 pounds or less maximum certificated takeoff weight. The SASP classifies Grand Canyon West as a Commercial Service Airport.

TABLE 1-2 AIRPORT REFERENCE CODE

Approach Category	Approach Speed (knots)
Category A	Less than 91
Category B	91 to 120 knots
Category C	121 to 140 knots
Category D	141 to 165
Category E	166 or more

Design Group	Wingspan (feet)	Tail Height (feet)
Group I	Less than 49	Less than 20
Group II	49 to 78	20 to 29
Group III	79 to 117	30 to 44
Group IV	118 to 170	45 to 59
Group V	171 to 213	60 to 65
Group VI	214 to 261	66 to 79

Source: FAA AC 150/5300-13, Design Standards
Prepared by: Armstrong Consultants, Inc., October 2011

1.4 AIRPORT ROLE

The airport serves single engine piston, multi-engine piston, turbo prop aircraft, Very Light Jets (VLJ) and helicopters. Users include:

Air Tour Operators: Air tour operators make up close to 100 percent of the aviation activity at the Airport. Fixed wing and helicopter air tour operators (in and out) originate from Las Vegas and Phoenix. There are twelve air tour operators who utilize fixed wing aircraft ranging from the Piper Saratoga to DCH-6 Twin Otter, and helicopters range from the AS350 to the EC-130. There are two types of operations at the airport: in and out (transient) and down and up (local) operations into the Canyon. **Figure 1-5** is an illustration of the down and up operation. This operation consists of passengers boarding a Papillion or Sundance helicopter and flying to the floor of the Canyon. **Figure 1-6** illustrates the transient operation, also known as in and out, where fixed wing and helicopters arrive from Phoenix or Las Vegas

Business Transportation: Business, contractors and professionals serving Grand Canyon West Airport benefit by being able to travel to or from business centers to conduct business activities in a single day, without requiring an overnight stay or extensive ground travel time. Local and other small businesses generally utilize single-engine and multi-engine piston aircraft. This user category also includes state and federal agencies and travel by government officials.

General Aviation: These users include transient pilots flying into the region to visit recreational and tourist attractions. These users mostly utilize single-engine piston aircraft; however, a small percentage may operate multi-engine piston aircraft. Other types of aircraft in this category include home-built, experimental aircraft, gliders and ultralights. Airport users are primarily air tour operators and the Airport is considered a destination point for tourists visiting the southwestern U.S.

FIGURE 1-5 DOWN AND UP OPERATION

1.5 AIRPORT LOCATION

Grand Canyon West Airport is located in Mohave County which is in the northwest corner of Arizona at the West Rim of the Grand Canyon and approximately 60 miles from Peach Springs, Arizona. The Airport is situated in Township 30 North, Range 14 West of the Gila and Salt River Base Meridians. **Figure 1-7** provides a graphic depiction of the Airport's location. The Airport is designated by the FAA as Site Number 00749.*A with a three letter identifier 1G4, and is classified as a public-use airport. The Airport's location is Latitude 35° 59' 08.67" North and Longitude 113° 49' 01.595" West according to the latest version of the Airport Layout Plan (2011). The Airport's elevation is 4,813 feet (surveyed August, 2001) Mean Sea Level (MSL). The existing airport property encompasses approximately 334 acres which is owned and operated by the Hualapai Tribe.

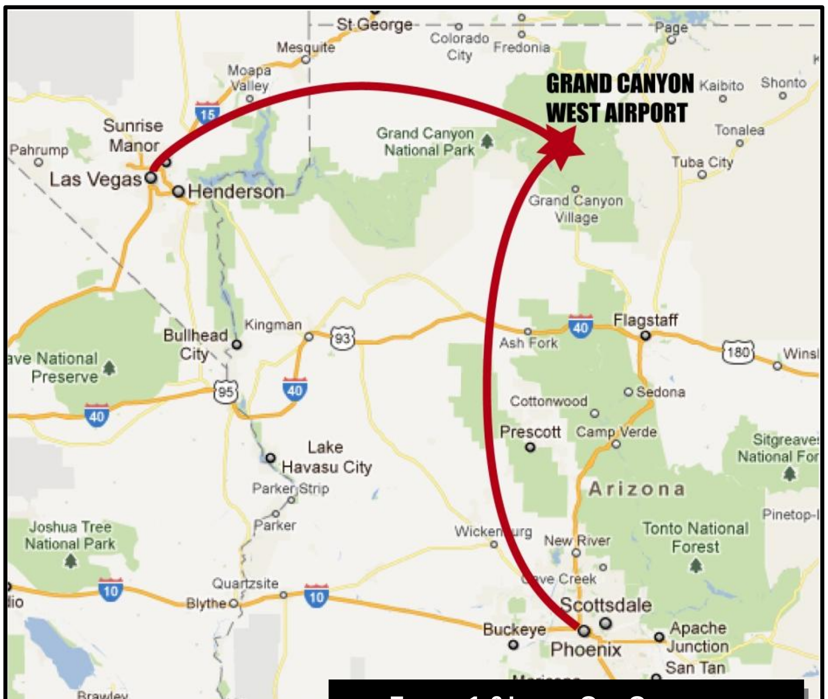


FIGURE 1-6 IN AND OUT OPERATION

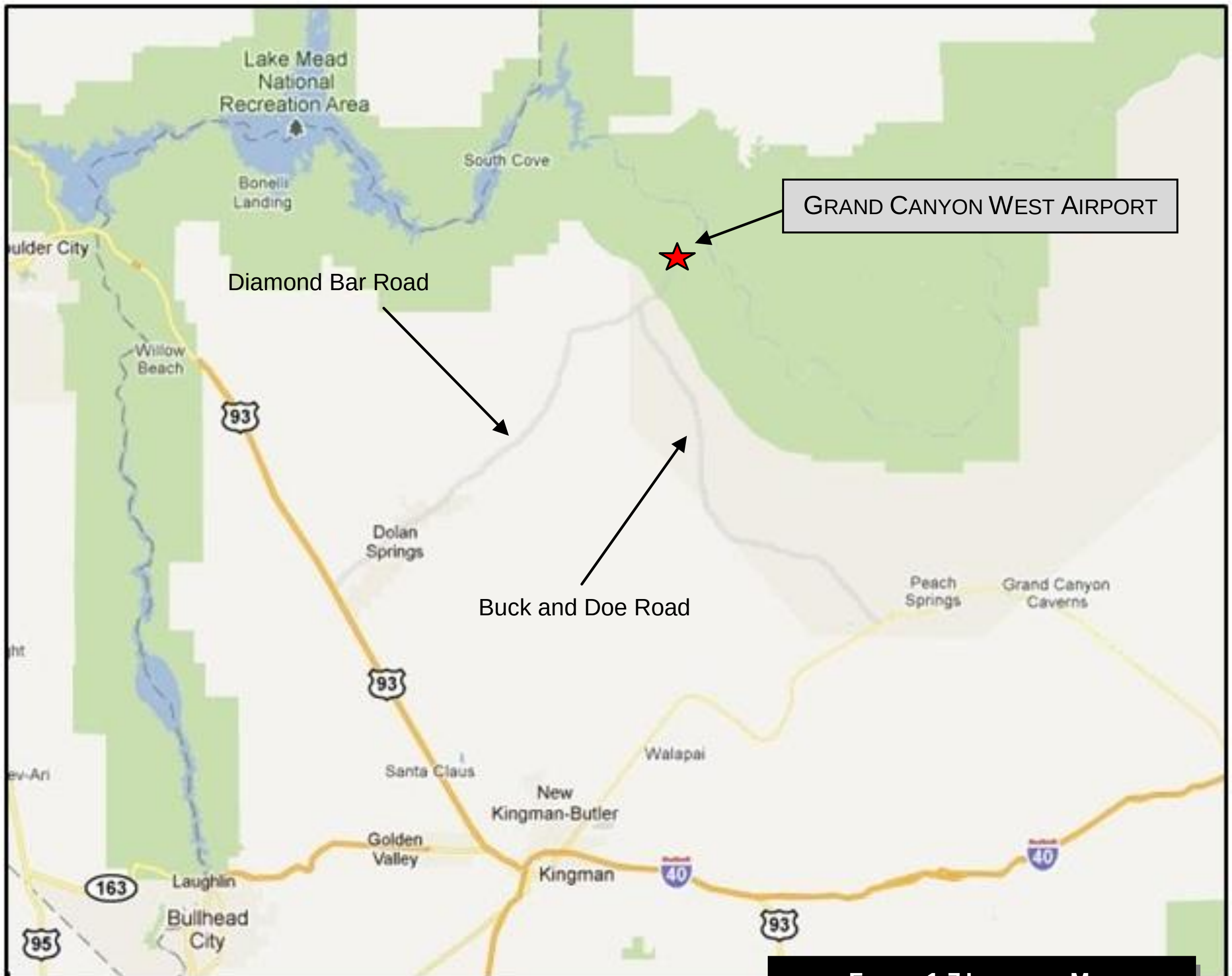


FIGURE 1-7 LOCATION MAP

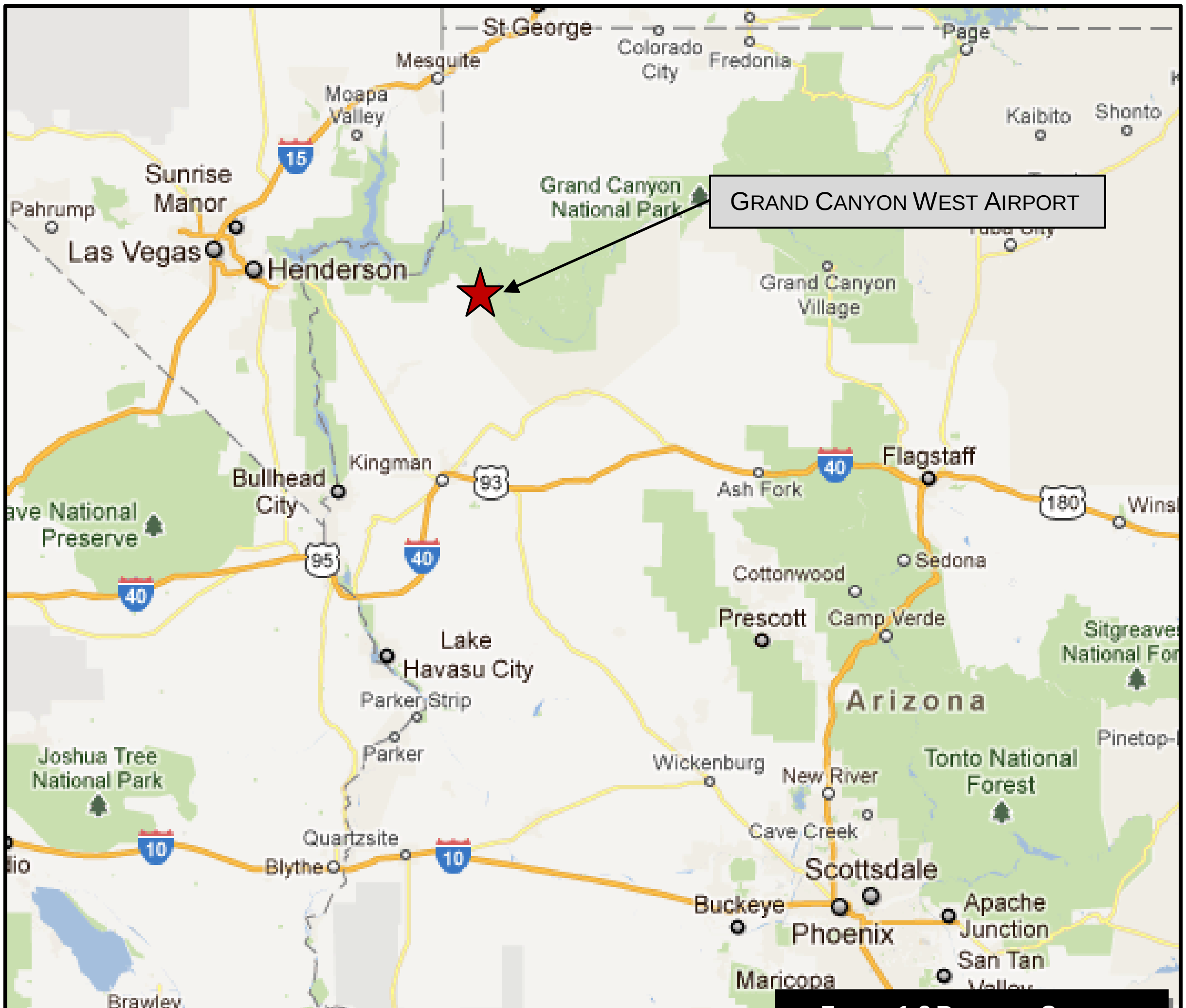
Source: Google Maps, 2011

1.6 REGIONAL SETTING

As mentioned, the Airport is located approximately 60 miles northeast of Peach Springs, Arizona in Mohave County (see **Figure 1-8**). Peach Springs, Home of the Hualapai Indian Tribe was at one time a western terminal of the Santé Fe Railroad. In town, some Hualapai Tribal buildings can still be seen. A distinctive stone building is where the Hualapai Wildlife and Outdoor Recreation Permits for sightseeing, hiking, camping, fishing, and hunting on the reservation can be obtained. The Hualapai Indian Reservation encompasses approximately one million acres along 108 miles of the Colorado River and the Grand Canyon.

Grand Canyon West Airport is located in the Hualapai Indian Reservation at the western Grand Canyon Corridor approximately 121 miles east of Las Vegas, Nevada and 60 miles north of Kingman, Arizona. Due to the location and proximity to the Grand Canyon, the Airport and the Reservation's primary function are to serve tourism destination visitors from Las Vegas and Phoenix.

The main access road to the Airport is Diamond Bar Road. Diamond Bar Road is 21 miles long and at one time was entirely gravel and in poor condition which limited vehicle access to the Airport. The Tribe paved a majority of the road except for seven miles which is still gravel. The paving of the road increased motor coach and personal vehicle traffic to the Airport; however, activity is still constrained by the lack of paved access to the area. Diamond Bar Road becomes Buck and Doe Road within the last four miles of the road as you approach the Airport.



Source: *Google Maps, 2011*

FIGURE 1-8 REGIONAL SETTING

1.7 SOCIOECONOMIC CHARACTERISTICS

Socioeconomic characteristics, such as tourism activity from Las Vegas, NV, Phoenix, AZ and the Grand Canyon National Park are the primary drivers for the Airport and will aid in establishing the potential growth rate of aviation within the region. By analyzing the information in this chapter, forecasts of aviation activity can be developed. Those forecasts are provided in Chapter 2 – Forecasts of Aviation Activity.

1.7.1 LOCAL PROFILE

The largest employer in Grand Canyon West is the Hualapai Tribe and associations with the Airport. The Tribal's economy is based on tourism, river rafting, the SkyWalk, cattle ranching, hunting, expeditions, and timber cutting, as well as crafting of traditional and modern folk art. The Grand Canyon West area is solely based and supported by the tourism industry. The Hualapai Tribe has capitalized on the proximity of the Grand Canyon West Rim and the area to the spectacular views of the Grand Canyon, the natural rugged terrain, and direct access to the Colorado River. The Tribal economy is based on tourism, river rafting, cattle ranching, hunting expeditions, and timber cutting, as well as arts and crafts.

1.7.2 POPULATION

Population data for the Hualapai Tribe was obtained from the 2010 U.S. Census and Bureau of Indian affairs. According to the U.S Census, in 2010 there were 2,337 (enrolled) Hualapai Indians residing in the Grand Canyon West region. Peach Springs, the Hualapai Tribe capital, has had an average annual growth (AAG) of 2.2 percent over the past ten years. The visitor data from Las Vegas greatly impacts the operation of the Airport due to the high number of air tours and ground visitors originating from Las Vegas. Data shows that Las Vegas has experienced 4.4 percent increase between 2010 and 2011 in visitor volume, currently totaling 35,971,217 in 2011. **Table 1-3** depicts the population changes that have occurred over the periods of 2000 - 2010 for the state of Arizona, Hualapai Tribe, Peach Springs, Mohave County and Kingman. **Table 1-4** illustrates the comparison of visitor volume growth of Las Vegas, Phoenix and the Grand Canyon for 2000 through 2011.

TABLE 1-3 HISTORICAL POPULATION DATA

	Arizona	Hualapai Tribe Enrollment	Peach Springs	Mohave County	Kingman
Historical					
2000	5,130,632	1,921	600	155,032	20,069
2005	5,153,209	2,004	809	188,305	24,569
2010	6,392,017	2,337	1,090	200,186	29,068
Avg. Annual Growth	**2.5%**	**2.2%**	**6.2%**	**2.9%**	**4.5%**

Source: Bureau of Indian Affairs, U.S. Census Bureau, Armstrong Consultants, Inc.
Prepared by: Armstrong Consultants, Inc., October 2011

Table 1-4 Historical Visitor Volume Data

	Las Vegas	Phoenix	Grand Canyon National Park	Grand Canyon West Airport
Historical				
2000	35,500,000	17,900,000	4,816,559	268,400[1]
2005	38,566,717	29,800,000	4,672,910	220,209[2]
2011	39,971,217	34,000,000	4,470,265	783,997[3]
Avg. Annual Growth	**4.4%**	**8.1%**	**-0.7%**	**17.4%**

Source: Las Vegas Conventions and Visitors Authority: 2011, 2005 and 2000
Prepared by: Armstrong Consultants, Inc., October 2011
1/ 1998 Airport Master Plan Update
2/ 2004 Capacity Assessment
3/ Airport Management, 2012

1.7.3 EMPLOYMENT

Employment data for the Hualapai Tribe was obtained from the Bureau of Indian Affairs. **Table 1-5** depicts the labor force changes that have occurred over the period of 2000 and 2010. During the relocation of the runway; construction of the parallel taxiway and apron as well as the heliports, short-term direct and indirect employment benefits were created. Long-term benefits included the addition of 13 full-time employment positions at the Airport which include the airport manager, assistant airport manager, maintenance and fire fighting staff. Approximately 53 percent of the Hualapai Indians in the area are not in any type of labor force. Tribal, public school, state and federal governmental services provide the bulk of current full-time employment within the Hualapai Tribe labor force.

Managed by the Hualapai Enterprise Board, a committee of business-minded Tribal members and non-members, the Hualapai's have established a popular sightseeing tour with the development of the SkyWalk. The Skywalk is a glass bridge that juts out into the open space of the canyon edge 4,000 feet above the canyon floor and the Colorado River. Additional tours are led by Hualapai Indian guides and encompass several miles of scenic visits along the edge of the Canyon. Multiple companies provide air and ground service to the Grand Canyon West Airport and are discussed in detail later in the chapter.

Table 1-5 Labor Force Data for the Hualapai Tribe

	2001	2003	2005	2010	'01-'10 Change %
Labor Force	1,273	597	410	2,100	65%
Employed	303	153	400	987	226%
Unemployed	970	444	10	1,113	15%
Below Poverty	202	37	31	756	274%
Unemployment Rate	76%	74%	2%	53%	-23%

Source: U.S. Census Bureau, 2010
Prepared by: Armstrong Consultants, Inc., March 2012

1.7.4 TOURISM SPENDING

Grand Canyon West Airport serves as a unique operation with the Airport focus on air and helicopter tour operations. The driving economic impact of the Airport depends on the tourist demand from Las Vegas, Nevada and Phoenix, Arizona to conduct air tours to the Grand Canyon. There is a direct correlation with the growth pertaining to tourist spending and willingness to utilize disposable income on air tour packages. **Table 1-6** depicts the visitor spending historical data for the Las Vegas and Phoenix over the course of the past 10 years.

Tourism is a primary reason visitors come to Grand Canyon West Airport. Tourism includes the Grand Canyon SkyWalk (see **Figure 1-9**), white water rafting down the Colorado River, hunting expeditions, and lodging on the historical Route 66. The Tribe has no casinos present on the reservation.

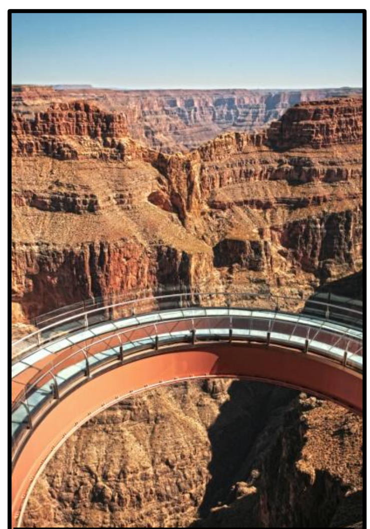


FIGURE 1-9 SKYWALK

Source: Grand Canyon West, 2011

TABLE 1-6 HISTORICAL TOURISM SPENDING DATA

	Las Vegas	Phoenix
Historical		
2000	$73,720,000,000	$13,301,607,500
2005	$36,733,453,000	$10,459,000,000
2011	$36,900,000,000	$17,700,000,000
Avg. Annual Growth	**-4.5%**	**3.0%**

Source: Las Vegas Conventions and Visitors Authority: 2011, 2005 and 2000; Phoenix Tourism and Visitors Authority
Prepared by: Armstrong Consultants, Inc., March 2012

1.8 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 due to 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 (e.g., snow and ice removal equipment). On average, there are 303 sunny days per year at Grand Canyon West Airport according to the Western Regional Climate Center.

1.8.1 LOCAL CLIMATE DATA

Grand Canyon West Airport is located in the northwest quadrant of the State and experiences a mainly dry climate. The area experiences, on average, between 10 and 15 inches of precipitation annually. Great extremes in temperature occur between day and night temperatures depending on the time of year, according to data obtained from the Western Regional Climate Center. During the winter months, daytime temperatures average around 40 degrees Fahrenheit with night temperatures falling into the freezing levels. In the summer, temperatures average around 88 degrees Fahrenheit. The mean maximum temperature for the hottest month (July) is 97.5 degrees Fahrenheit and the average daily temperature is 34 degrees Fahrenheit in the coldest month (January).

Density altitude is a factor at Grand Canyon West Airport and results in increased takeoff and landing rolls and a reduced rate of climb. Air density is determined by air pressure, temperature and humidity. As altitude increases, the air density decreases; however, air density also decreases with high temperatures and high humidity. Contributing factors to density altitude include heavy aircraft loads, calm winds, short runways, unfavorable runway surface conditions, and obstructions near the end of the runway. Density altitude is a concern at the Grand Canyon West Airport given the elevation, high summer temperatures and runway length.

Ceiling and visibility conditions at Grand Canyon West Airport are important considerations since the occurrence of low-ceilings and/or poor visibility conditions limit the use of the Airport to instrument approach and departure operations. Under poor visibility conditions or Instrument Meteorological Conditions (IMC), the pilot must operate under Instrument Flight Rules (IFR), rather than Visual Flight Rules (VFR). Grand Canyon West Airport has a visual approach for Runway 17/35. There are approximately 30 days in the year that are considered Instrument

Flight Rules (IFR). MVFR occurs when ceilings are between 1,000 feet and 3,000 feet and IFR occurs when ceilings are below 1,000 feet.

1.8.2 WIND CONDITIONS

The FAA Advisory Circular 15/5300-13 recommends that sufficient runway orientation be provided to achieve 95 percent wind coverage using all available runways. Wind coverage is the percent of time when the crosswind component is at an acceptable speed. The crosswind component is defined as the maximum permissible wind velocity occurring at right angles, left or right of the heading, of a landing or departing aircraft. The allowable crosswind component is expressed in knots and is based on the ARC of the airport, as shown in **Table 1-7**.

TABLE 1-7 CROSSWIND COMPONENTS

Allowable Crosswind in Knots	Airport Reference Code
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

Source: FAA, Advisory Circular 150/5300-13, Design Standards
Prepared by: Armstrong Consultants, Inc., September 2011

When conducting a wind coverage evaluation analysis, the FAA suggests that historical weather information for the last ten consecutive years be utilized. Records of lesser duration may be acceptable on a case-by-case basis. In some instances, it may be desirable to obtain and assemble wind information for periods of particular significance, for example: seasonal variations; instrument weather conditions; daytime versus nighttime; and regularly occurring gusts.

Wind data coverage was collected from Grand Canyon Resort Corporation. This wind data is comparable to Grand Canyon West due to terrain and location. Grand Canyon West's Automated Weather Observation System (AWOS-3) is currently not connected to the National Airspace Data Interchange Network (NADIN). The wind rose for all weather conditions are shown in **Table 1-8** and **Figures 1-10**.

Analysis of this data generated the wind rose resulting in 10.5 knot crosswind coverage of 97.55 percent and 13.0 knot crosswind coverage of 99.01 percent for Runway 17/35 at Grand Canyon West Airport; however, in the summer the winds prevail from the south and in the winter season, the winds prevail from the north. Crosswinds occasionally occur during the spring and fall and during the passage of weather fronts.

TABLE 1-8 WIND ROSE ALL WEATHER CONDITIONS

Runway 17/35	Crosswind Coverage	
	10.5 Knots	**13 Knots**
All Weather	97.55%	99.01%
Condition	All Observations (All Weather)	
Number of Observations	28,464 observations between 2006-2011	

Source: Grand Canyon West Resort Corporation 2012
Prepared by: Armstrong Consultants, Inc., 2012

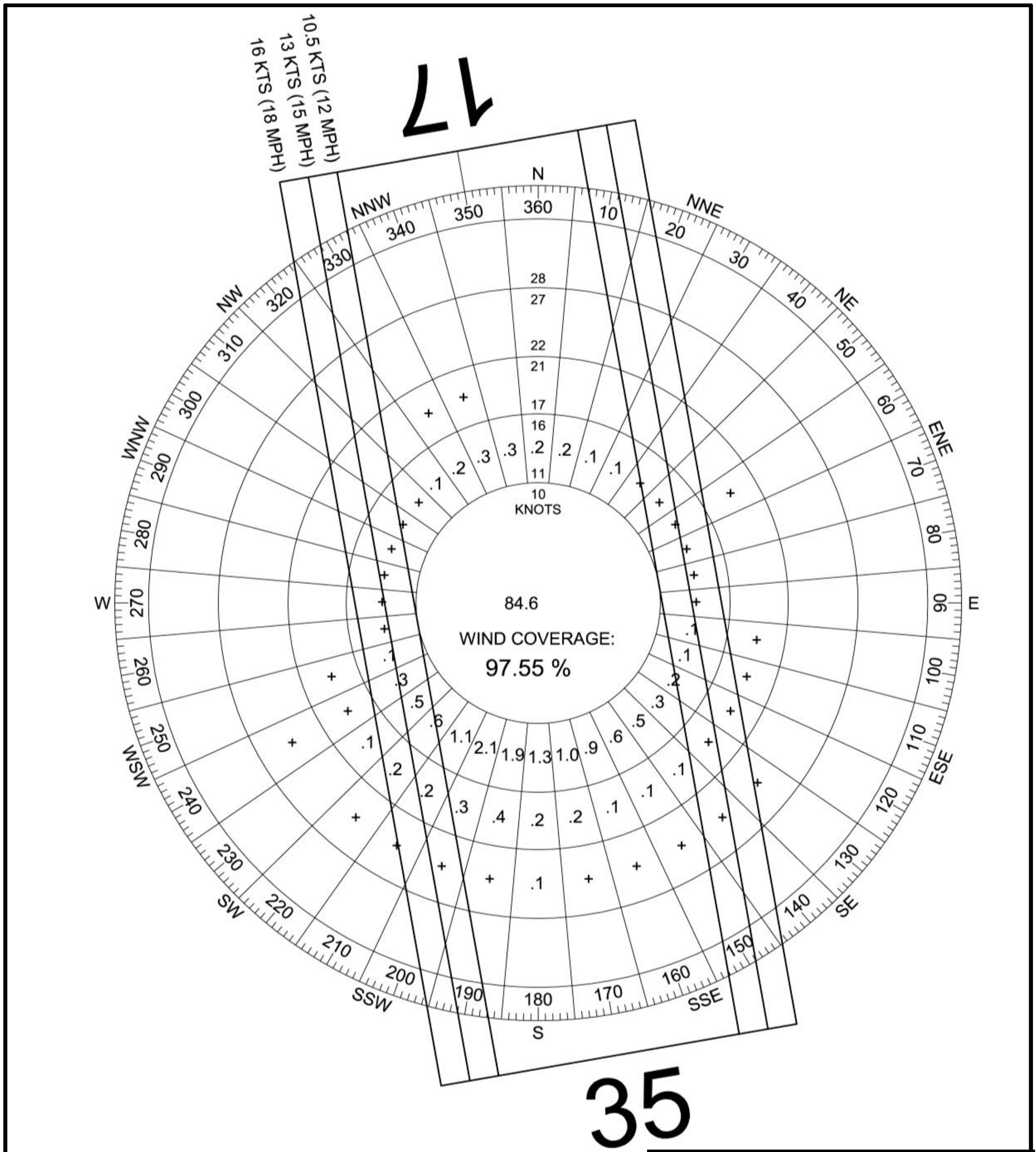
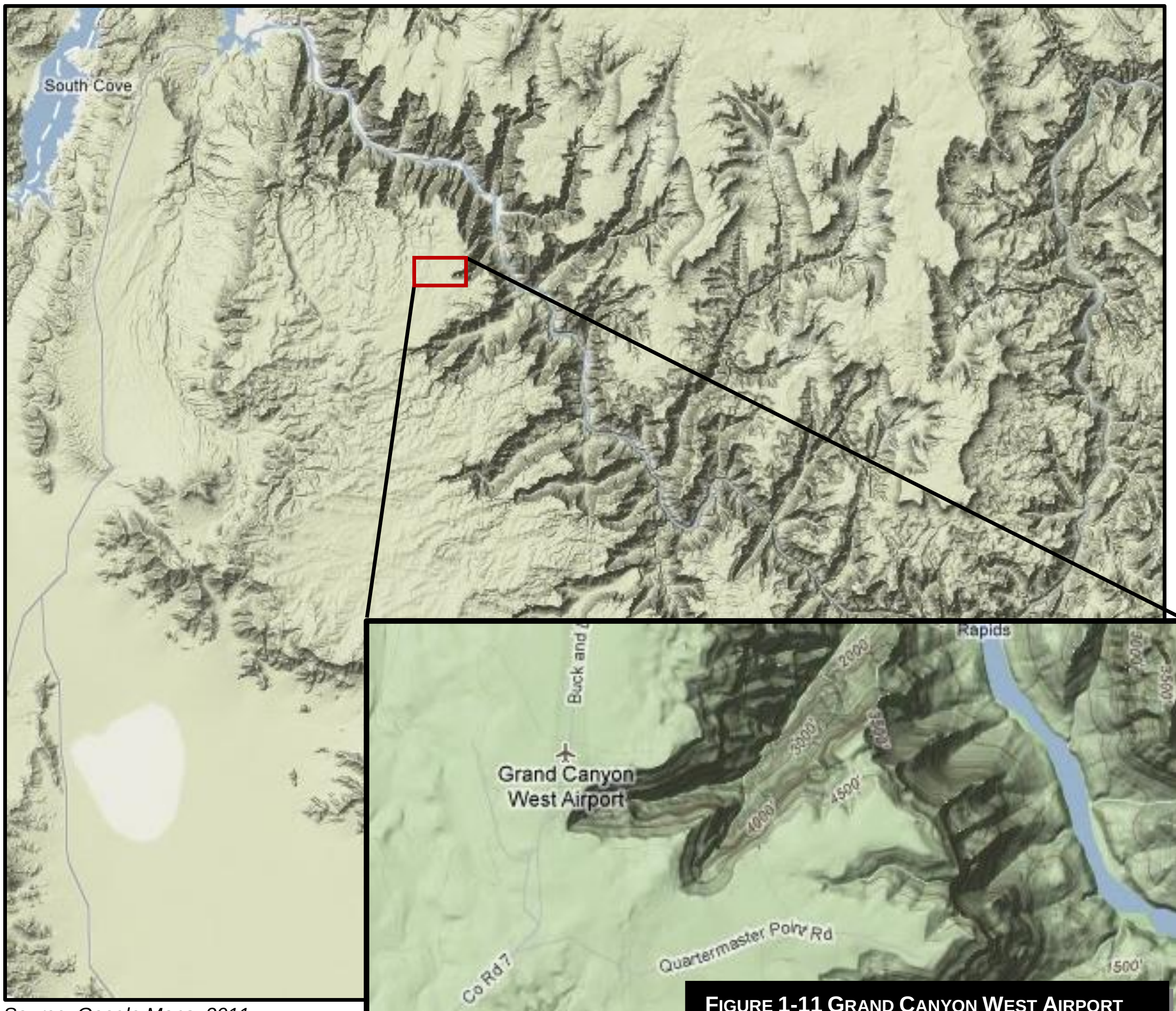


FIGURE 1-10 10.5 KNOT WIND ROSE

1.8.3 Topography and Terrain

The elevation of Grand Canyon West Airport is 4,813 feet MSL. The Airport is located along the West Rim of the Grand Canyon (see **Figure 1-11**). The terrain surrounding Grand Canyon West Airport is rocky and rough with sheer cliff edges along the Canyon's ridge. The area consists of slightly rolling topography with natural desert-type vegetation. The existing runway slopes upwards toward the south with rising terrain continuing off the south end of the runway. Adjacent to the airport property to the east, the terrain drops vertically over 3,000 feet into the south rim of the Grand Canyon. To the north, the terrain continues relatively flat for approximately 3,800 feet, then slightly rising up to Guano Point, a popular scenic outlook. Southeast of the Airport lies Quartermaster Point, another popular scenic overlook. Along the Grand Canyon rim lies three miles of viewing trails connecting Quartermaster and Guano Points.



Source: Google Maps, 2011

Figure 1-11 Grand Canyon West Airport Surrounding Topography and Terrain

1.9 BASED AIRCRAFT, OPERATIONS AND FLEET MIX

The number of based aircraft, total number of operations and fleet mix baseline was used based on the data obtained from Airport Management. As a comparison, the based aircraft and operations from the 2007 Airport State Systems Plan are depicted in **Table 1-10**.

According to the Airport Master Record Form 5010-1 there are no based aircraft at Grand Canyon West Airport and 130,300 annual operations and between June 2009 and June 2010. According to the Airport Manager, there were 114,996 annual operations between June, 2010 and June, 2011 and 15 based helicopters.

TABLE 1-9 BASED AIRCRAFT AND OPERATIONS

		Local Operations			Itinerant Operations					
Fiscal Year	Based Aircraft	Civil	MIL	Total	AT&C	Civil	MIL	Total	Total Ops	Inst. Ops
2011	15	84,756	0	84,756	29,440	300	0	29,740	114,996	0

Source: Airport Management, 2011
Prepared by: Armstrong Consultants, Inc., December 2011

1.10 ENPLANEMENTS

Grand Canyon West Airport receives both scheduled and unscheduled passenger service. The Airport is serviced by eight fixed wing air tour operators and four helicopter tour operators:

Fixed Wing Tour Operators	**Aircraft Type**
▪ Dakota Territory Tours/Sky Safari, Sedona, AZ	Beechcraft 1900
▪ Grand Canyon Airlines, Boulder City, NV	DHC-6 Twin Otter
▪ Maverick Airlines, Las Vegas, NV	Beechcraft 1900
▪ Sedona Sky Treks, Sedona, AZ	Cessna 206 and Cessna 210
▪ Story Airways, Henderson, NV	Piper Saratoga
▪ Vegas 500, LLC, Henderson, NV	Cessna 208 Caravan
▪ Vision Air, North Las Vegas, NV	Dornier 228
▪ Westwind Air Service, Phoenix, AZ	Cessna 206 / Grand Caravan

Helicopter Air Tour Operators	**Helicopter Type**
▪ Papillion Grand Canyon Helicopters, Boulder City, NV	Bell 206, A-Star 350 & EC-130
▪ Maverick Helicopters, Boulder City, NV	EcoStar 130
▪ Serenity Helicopters, Boulder City, NV	A-Star 350B2
▪ Sundance Helicopters, Las Vegas, NV	A-Star 350B2 & EC-130

Passenger enplanements are defined as the total number of revenue passengers boarding aircraft, including originating, stopover and transfer passengers, in scheduled and nonscheduled service and are recorded by service providers and reported to the FAA. The number of enplanements depends on several factors including socioeconomic, tourism trends aviation trends and ticket prices amongst other things.

Air tour operators (fixed wing and helicopter) originate from the Phoenix and Las Vegas metropolitan areas and conducted approximately 12,000 in and out round trip flights in 2011 to Grand Canyon West Airport. In 2011, the Airport served 322,822 total passengers, a 21.31 percent average annual growth from 2010 (266,122 total passengers).

There are two types of enplanements, those passengers who board a return flight back to their origin city (an “out” flight) and those that board a helicopter flight into the Canyon (a “down” flight) which are considered enplanements. Arriving passengers (“in” flights) are not counted as enplanements, nor are passengers re-boarding helicopters in the Canyon returning to the Airport (an “up” flight). Currently, for passenger facility charges (PFC) purposes, both “out” and “down” passengers are considered for PFC collection. However, the FAA is currently reviewing the opportunity for PFC collection for “down” passengers.

Currently, Grand Canyon West only includes passengers who are boarding an itinerant aircraft or helicopter departing the Airport as an enplanement; however, the FAA is currently in the process of determining whether or not passengers boarding a down and up helicopter could be counted as an enplanement.

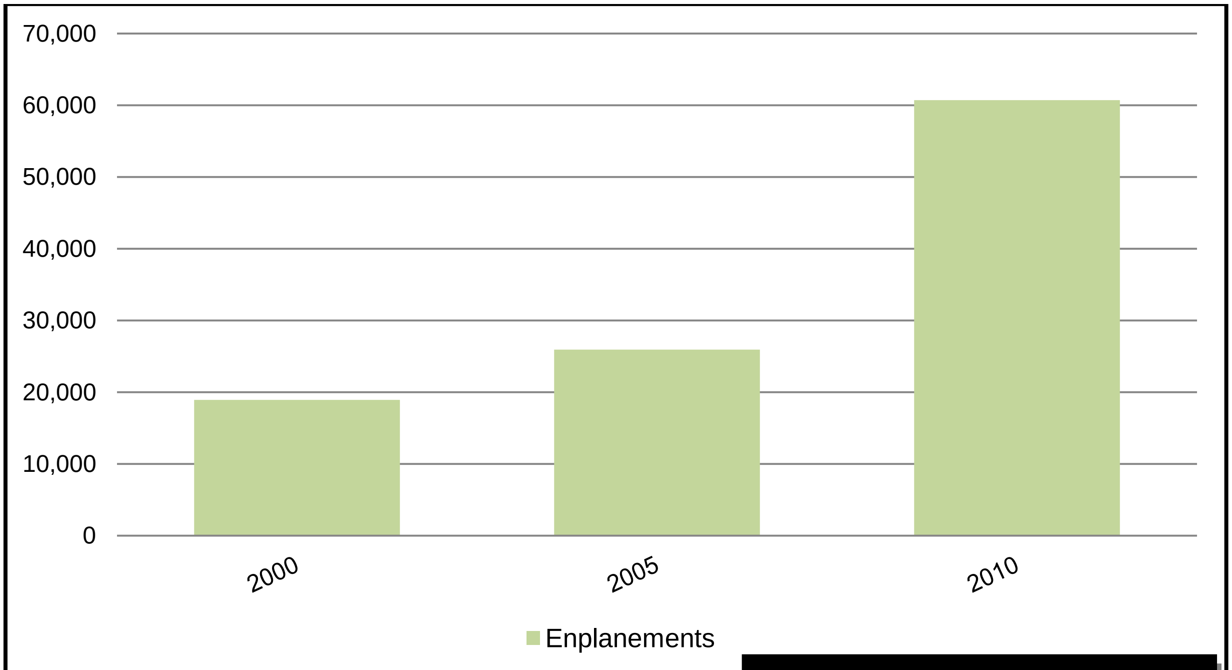
The Airport currently collects a $3.00 Passenger Facility Charge (PFC) on only departures from Grand Canyon West to another airport, including down and up flights. The PFC program allows the collection of PFC fees up to $4.50 for every enplaned passenger at commercial airports and. The Tribe is in the process of applying for an increase authorized PFC collection from $3.00 to $4.50 per passenger. Airports use these fees to fund FAA-approved projects that enhance safety, security, or capacity; reduce noise; or increase air carrier competition.

Table 1-10 and Figure 1-12 show the Airport’s historical enplanement data, as reported by the FAA. Chapter 2 – Forecasts of Aviation Activity, includes the enplanement forecast for the 20-year planning period. It should be noted that the total enplanements counted by the FAA only include “out” passengers (passengers boarding an airplane departing the Airport). This number does not include the “down” passengers who tour the Canyon.

TABLE 1-10 HISTORICAL ENPLANEMENTS

Year	Enplanements	Annual Percent Change	National Ranking
2000	18,898	4.4%	346
2005	25,945	7.5%	315
2010	60,682	26.8%	255

FAA Airports Planning and Capacity - Passenger Boarding data for U.S. Airports, October 2011
Prepared by: Armstrong Consultants, Inc., December 2011



Source: FAA Airport's Planning and Capacity, 2011

FIGURE 1-12 HISTORICAL ENPLANEMENTS

1.11 AIRPORT SERVICE AREA

A typical airport service area is defined by the communities and surrounding areas served by the airport facility. Typically 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. However, Grand Canyon West Airport does not play a typical airport role for the community. As previously described GCW is a destination point for tourism, therefore the airport service area is not the standard drive time for the community it serves but rather the location to the Canyon for tourism. The Airport primarily pulls tourism traffic from large, metropolitan cities including Las Vegas and Phoenix, see **Table 1-11**. The majority of demand for the Airport is driven by the air tour activity generated in Las Vegas.

TABLE 1-11 HISTORICAL VISITOR VOLUME DATA

	2000	2005	2010	2011
Visitor Volume	214,000	299,003	619,960	783,997
Ground	93,000	74,594	268,939	659,792
Aircraft	121,000	224,409	351,021	124,205
Down and Up	TBD	TBD	145,728	198,617

Source: Airport Management, 2012
Prepared by: Armstrong Consultants, Inc., March 2012

Table 1-12 depicts additional airports within 80 NM of Grand Canyon West Airport. However, these airports do not serve the same type of activity as Grand Canyon West

TABLE 1-12 GRAND CANYON WEST AIRPORT AND SURROUNDING AIRPORTS

	ID	Distance (NM)	Distance (Highway Miles)	NPIAS Status[1]	Runway Length(s) Width(s)	Pavement Type	Instrument Approaches	Fuel
Grand Canyon West Airport	1G4	-	-	P	5,000' x 75'	Asphalt	None	Jet-A
Temple Bar Airport (AZ)	U30	26 W	99	Not Listed	3,500' x 50'	Asphalt	N/A	N/A
Kingman Airport (AZ)	IGM	44 S	74	CM	6,827' x 150' 6,725' x 75'	Asphalt Asphalt	GPS/VOR/ DME	100LL Jet-A
Boulder City Municipal Airport (NV)	BVU	51 W	100	P	4,800' x 75' 3,850' x 75' 2,220' x 60'	Asphalt Asphalt Asphalt	VOR	100LL Jet-A
Mesquite Airport (NV)	67L	53 NW	204	GA	5,151' x 75'	Asphalt	N/A	100LL Jet -A
Laughlin/Bullhead International Airport (AZ)	IFP	62 SW	103	P	7,500' x 150'	Asphalt	GPS/VOR/ DME	100LL Jet-A
Henderson Executive Airport (NV)	HND	64 W	119	R	6,501' x 100' 5,001' x 75'	Asphalt Asphalt	GPS/VOR-C	100LL Jet-A
McCarran Int'l Airport (NV)	LAS	65 W	121	P	14,510' x 150' 10,526' x 150' 9,775' x 150' 8,995' x 150'	Asphalt Concrete Concrete Concrete	ILS/LOC/ DME-A/ GPS/VOR	100 100LL Jet-A
North Las Vegas Air Terminal (NV)	VGT	68 NW	128	P	5,004' x 75' 5,000' x 75' 4,202' x 75'	Asphalt Asphalt Asphalt	ILS/LOC/ GPS	100LL Jet-A
St. George Municipal (UT)	DXZ	68 N	241	P	9,300' x 150'	Asphalt	GPS/LDA/ DME/VOR/D ME-A	100LL Jet-A
Grand Canyon National Park (AZ)	GCN	80 E	245	P	8,991' x 150'	Asphalt	ILS/LOC/ DME/GPS/ VOR	100LL Jet-A

Source:AirNav.com, October 2011
Prepared by: Armstrong Consultants, Inc., December 2011
Note 1: P-Primary; GA-General Aviation; Pvt.-Private/Permission to Land Required; R-Reliever; CM-Commercial Service

1.12 DESIGN STANDARDS INVENTORY

FAA AC 150/5300-13, *Airport Design*, establishes design standards for airports based on the ARC of the airport. When design standard deficiencies exist, the FAA recommends correction of such deficiencies as soon as practicable. Design standards are based on the ARC and approach visibility minimums of the airport. The ARC is a combination of the wingspan, tail height and approach speed of the critical aircraft.

1.12.1 SAFETY AREAS

AC 150/5300-13, *Airport Design*, defines a Runway Safety Area (RSA) as "an identified surface surrounding the runway preparation and suitable for reducing risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway".[3] The RSA has dimensional requirements as well as clearing, grading, and drainage requirements.

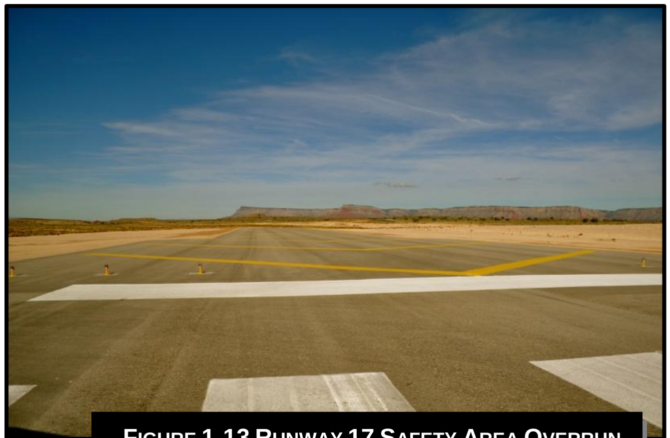


FIGURE 1-13 RUNWAY 17 SAFETY AREA OVERRUN

The dimensional requirements for an RSA (and a subsequent Taxiway Safety Area) reflect the aircraft types accommodating the runway. As defined in AC 150/5300-13, the ARC is the basis for establishing RSA dimensions.

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, ARFF equipment and the occasional passage of aircraft without causing structural damage to the aircraft;
- Free of objects, except for objects that need to be located in the runway or taxiway safety area because of their function; and,
- Installation of storm sewers is permissible within the RSA, but elevation of the storm water inlets may not vary more than three inches from surface elevation.

The RSAs off the ends of Runway 17/35 at Grand Canyon West Airport are clear of obstructions, are in good condition and satisfy the requirements defined by the standards (see **Figure 1-13**). The Taxiway Safety Area (TSA) is clear of obstructions, is in good condition and satisfies the requirements defined by the standards. The RSA dimensions are 150 feet wide and 300 feet beyond the runway ends, and satisfy B-II requirements. The TSA width is 79 feet and satisfies B-II requirements.

1.12.2 OBSTACLE FREE ZONE (OFZ) AND OBJECT FREE AREA (OFA)

The Obstacle Free Zone (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 Code of Federal Regulation (CFR) Part 77 Primary Surface insofar that it represents the volume of space longitudinally centered on the runway and 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 Taxiway Object Free Area (TOFA) standards prohibit service vehicle roads, parked airplanes, and above ground objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes. Both the OFZ and OFA at Grand Canyon West Airport meet the requirements defined within the

[3] *Reference* - FAA AC 150/5300-13, *Airport Design* – Chapter 1, page 3

FAA AC 150/5300-13, *Airport Design*. The TOFA dimensions at the Airport are 131 feet and satisfy B-II requirements; and the OFA dimensions are based on the ARC of the airport.

1.12.3 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 minimum associated with that runway end. On Runway 17/35, the RPZs begin 200 feet from the end of the runway, 500 feet wide at the inner end, 700 feet wide at the outer end and extend 1,000 feet beyond the runway end. These dimensions are based on the ARC of the Airport.

The land uses not recommended within the RPZ are residences and places of public assembly (e.g., churches, schools, hospitals, parking lots, office buildings, shopping centers and other uses with similar concentrations of persons typify places of public assembly). The FAA recommends that airports control RPZs through fee simple ownership or avigation easements.

As shown in **Table 1-13**, the approach and departure RPZs for Runway 17/35 begin at 200 feet from the pavement edge and are located on Airport property. The RPZs are currently clear of incompatible development and the Tribe controls the RPZs through fee simple ownership.

TABLE 1-13 CURRENT AIRFIELD DESIGN STANDARDS DIMENSIONS FOR RUNWAY 17/35

	Current Dimension	Standard
Airport Reference Code (ARC)	B-II	B-II
Approach Visibility Minimums	Visual	Visual
Runway length	5,000’	-
Runway width	75’	75’
Runway Safety Area (RSA) width	150’	150’
Runway Safety Area (RSA) length beyond runway end	300’	300’
Runway Object Free Area (ROFA) width	500’	500’
Runway Object Free Area (ROFA) length beyond runway end	300’	300’
Obstacle Free Zone (OFZ) width	400’	400’
Obstacle Free Zone (OFZ) length beyond runway end	200’	200’
Runway Protection Zone (RPZ)	500’ x 700’ x 1,000	500’ x 700’ x 1,000’
Taxiway Safety Area (TSA) width	79’	79’
Taxiway Object Free Area (TOFA) width	131’	131’
Taxilane Object Free Area width	115’	115’
Runway centerline to hold line	250’	200’
Runway centerline to taxiway/taxilane centerline	400’	240’
Runway centerline to aircraft parking area	510’	250’
Taxiway centerline to parallel taxiway/taxilane centerline	105’	105’
Taxiway centerline to fixed or movable object	65.5’	65.5’
Taxilane centerline to parallel taxilane centerline	N/A	97’
Taxilane centerline to fixed or movable object	57.5’	57.5’

Source: FAA AC 150/5300-13, Airport Design & Site Visit, October 2011
Prepared by: Armstrong Consultants, Inc., December 2011

1.13 CODE OF FEDERAL REGULATIONS (CFR) PART 77 IMAGINARY SURFACES

Code of Federal Regulation (CFR) Part 77 establishes several Imaginary Surfaces that are used as a guide to provide a safe, unobstructed operating environment for aviation activity. The Primary, Approach, Transitional, Horizontal and Conical Surfaces identified in 14 CFR Part 77 are applied to each runway. The FAA defines runway types as the following:

- *Visual/utility runway* is a runway that is intended to be used by aircraft of 12,500 pound maximum gross weight or less during Visual Meteorological Conditions (VMC).
- *Non-precision instrument/utility runway* is a runway that is intended to be used by aircraft of 12,500 pounds maximum gross weight and less with a straight-in instrument approach procedure and 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.
- *Non-precision instrument/larger-than-utility runway* is a runway intended for the operation of aircraft weighing more than 12,500 pounds that also has a straight-in instrument approach procedure.
- *Precision Instrument* is a runway intended for the operation of aircraft weighing more than 12,500 pounds that also has a straight-in instrument approach procedure.

The *Primary Surface* is an imaginary surface of specific width longitudinally centered on a runway. Primary Surfaces extend 200 feet beyond each end of the paved surface of runways, but do not extend past the end of non-paved 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 of the Primary Surface varies from 250, 500 or 1,000 feet depending on the type of approach and approach visibility minimums.

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 slope is applied to each end of the runway based upon the type of approach available or planned for that runway, either 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 FAR Part 77 runway classification criteria.

The *Transitional Surfaces* extend 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.

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.

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.

Table 1-14 depicts the breakdown of current 14 CFR Part 77 Airspace Surfaces for Runway 17/35. Based on the current fleet mix, pavement strength and instrument approach procedures, Runway 17/35 is a visual, larger than utility runway.

TABLE 1-14 14 CFR PART 77 AIRSPACE SURFACES FOR RUNWAY 17/35

	Runway 17/35 Existing
14 CFR Part 77 Category	Visual, larger than utility
Primary Surface width	500'
Primary Surface length beyond runway ends	200'
Approach Surface Dimensions	500' x 1,500' x 5,000'
Approach Surface slope	20:1
Transitional Surface slope	7:1
Horizontal Surface radius from runway	5,000'
Conical Surface width	4,000'
Conical Surface slope	20:1

Source: FAA, 2011
Prepared by: Armstrong Consultants, Inc., December 2011

1.14 EXISTING AIRSIDE FACILITIES INVENTORY

The "airside" of an airport is that portion of the airport, typically within the security fenced perimeter, in which aircraft, support vehicles and equipment are located; and in which aviation-specific operational activities take place. This inventory of airside facilities, as illustrated in **Figure 1-18**, provides the basis for the airfield demand/capacity analysis and the determination of any facility change requirements that might be identified.

1.14.1 RUNWAY

Grand Canyon West Airport has a single runway configuration with a full-length parallel taxiway. Runway 17/35 is 5,000 feet long, 75 feet wide, oriented north-south and is constructed with asphalt with a weight bearing capacity of 30,000 pounds single-wheel gear (SWG). Runway 17/35 is equipped with Medium Intensity Runway Lights (MIRL) and nonprecision runway markings. The runway slopes up toward the south at an effective gradient of 1.10 percent. The pavement and markings are in excellent condition. The approach to Runway 17 can be found in **Figure 1-14** and the pavement marking can be found in **Figure 1-15**.

Both ends of Runway 17/35 are equipped with paved overruns within the RPZ. A paved overrun is an area beyond the end of the runway with a stabilized surface of the same width as the runway and centered on the extended runway centerline.

1.14.2 TAXIWAY SYSTEM

In 2010, Taxiway A (see **Figure 1-16**) was extended to a full-length parallel taxiway providing access to Runway 17/35 and relocated 400 feet (taxiway centerline to runway centerline) – exceeding current FAA ARC B-II standards and providing for the ability to accommodate future lower approach minimums or an ARC increase. The taxiway is 35 feet wide, constructed with asphalt to the same strength as the runway, and is in good condition. The taxiways at Grand Canyon West Airport are:

- Taxiway A – Full-length parallel taxiway to Runway 17/35
- Taxiway A1 – Entrance/Exit taxiway at the approach/departure end of Runway 35
- Taxiway A2 – Connector taxiway between the aircraft parking apron and Taxiway A
- Taxiway A3 – Connector taxiway between the aircraft parking apron and Taxiway A
- Taxiway A4 – Entrance/Exit taxiway at the approach/departure end of Runway 17

All taxiways are equipped with LED Medium Intensity Taxiway Edge Lights (MITL) (see **Figure 1-17**) as well as hold bar signage and signs on all taxiway connectors. Each departure end of the runway is equipped with a run-up pad.

FIGURE 1-14 RUNWAY 17 APPROACH

FIGURE 1-15 RUNWAY PAVEMENT MARKING

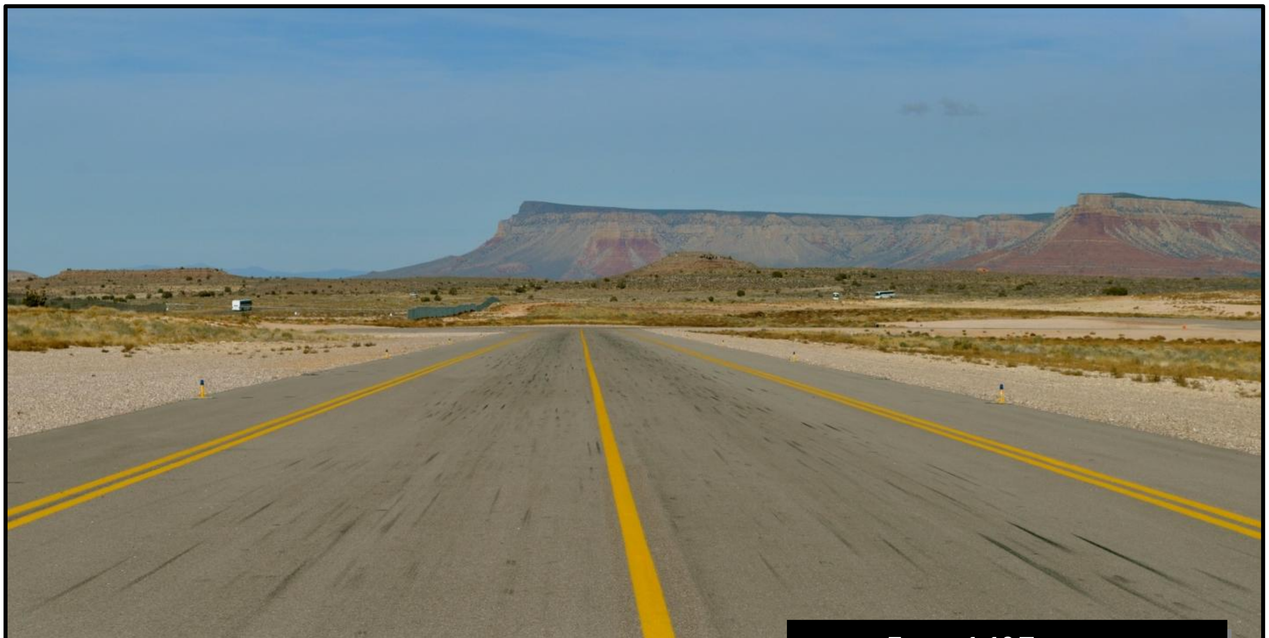


FIGURE 1-16 TAXIWAY A

FIGURE 1-17 TAXIWAY EDGE LIGHT

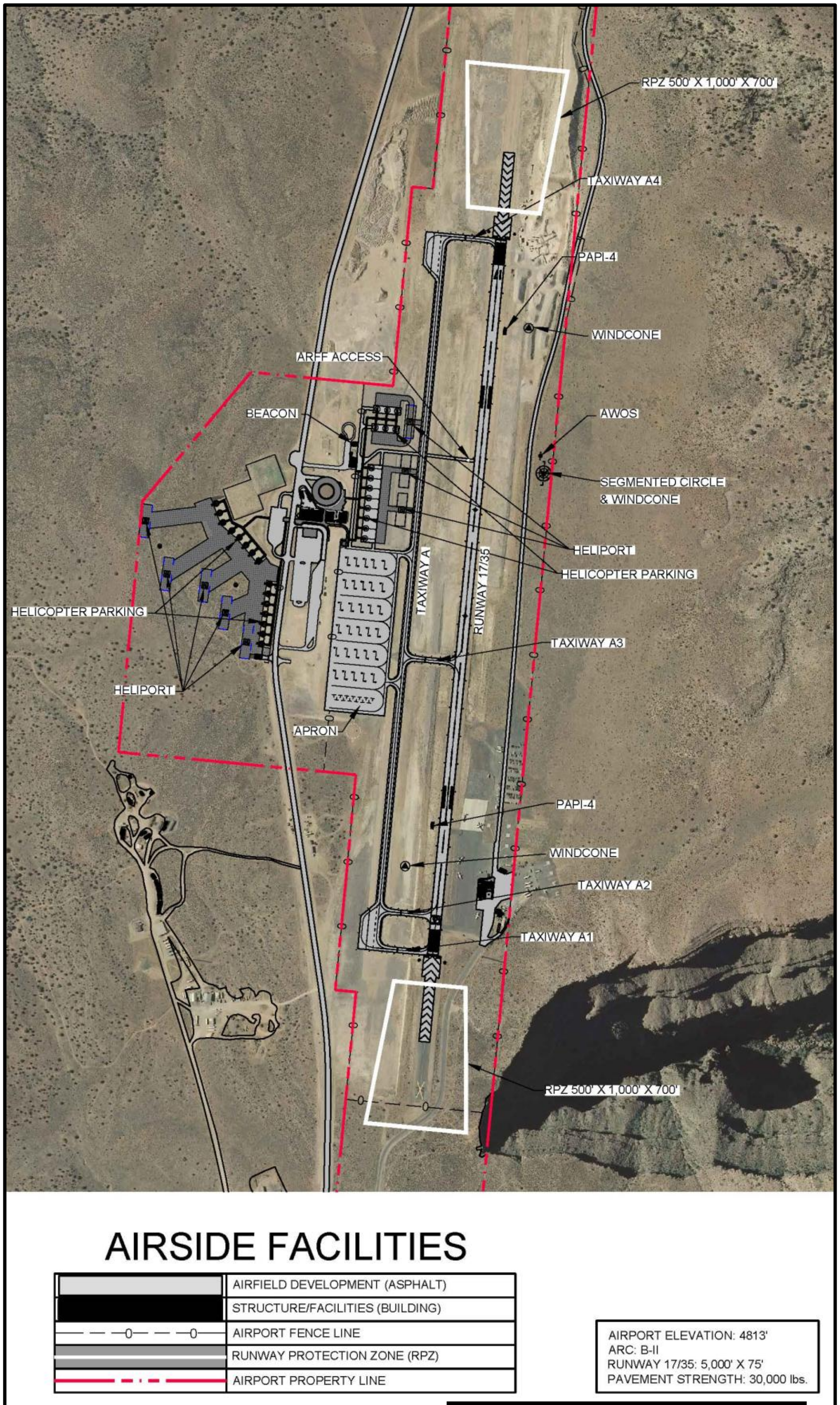


FIGURE 1-18 AIRSIDE FACILITIES

1.14.3 AIRCRAFT APRON

The aircraft apron is constructed of asphalt and encompasses approximately 53,061 square yards, providing 43 tiedown spaces for transient aircraft on the south portion of the apron, three heliports, and 14 helicopter parking pads for transient in and out helicopters on the north apron (see **Figure 1-19**). Floodlights are located along the apron to enhance safety and security at night. The apron is in excellent condition (see **Figure 1-20**).

FIGURE 1-19 AIRCRAFT APRON

FIGURE 1-20 AIRCRAFT TIEDOWN

1.14.4 HELIPORT AND HELICOPTER PARKING

Grand Canyon West Airport has a high level of helicopter operations, both in and out of the airport and down and up into the Canyon. Helicopters fly to and from the Airport from Phoenix and Las Vegas fly to designated eight (8) Heliports. There are 29 helicopter parking pads around the Airport which provide service down and up from the Canyon. All heliport and helicopter parking pads are in excellent condition (see **Figure 1-21**). Each air tour operator is assigned a respective parking pad which they must adhere to and park on. The down and up helicopters fly to the five heliports located on the west side of Buck and Doe Road at the helicopter parking pad adjacent to the road. The in and out helicopter operations fly to the helicopter parking pads adjacent to Taxiway A and the fixed wing apron. There is a Standard Operating Procedure in place for all helicopter companies which establish standardized helicopter flight routes, attitudes and radio calls for flights in and around the Grand Canyon West heliport.

The medivac parking pad was laid out by Grand Canyon West Airport to provide a designated parking location for medivac operations; however, the marking could be confused as a heliport rather than a helicopter parking pad (see **Figure 1-22**).

FIGURE 1-21 HELICOPTER PARKING PADS

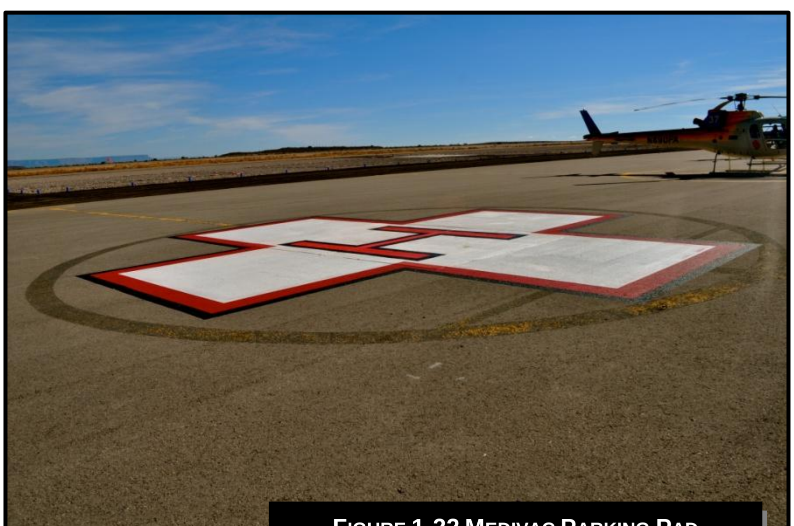


FIGURE 1-22 MEDIVAC PARKING PAD

1.14.5 PAVEMENT CONDITION INDEX (PCI)

In 2000, ADOT conducted a study of pavement conditions statewide which resulted in the Arizona Airport Pavement Management System (APMS). ADOT Aeronautics Division uses the APMS each year to identify necessary pavement upgrades and repairs within the airport system. In Arizona, a pavement condition index (PCI) is available for primary runways and all pavement averages (including runways, taxiways, and apron areas). PCI levels are ranked numerically between 0 and 100. This measure set is that runways should have a PCI grade of 70 or greater.

The APMS was most recently updated in 2010; however, since Grand Canyon West Airport is owned by the Hualapai Resort Corporation and is categorized as “Native” by the Arizona Department of Transportation, the weighted PCI values for the Airport was not included in the update.

During the field inventory, a visual assessment of the runway, taxiway system and apron indicated the recently constructed (2010) Runway 17/35 is in excellent condition; the parallel taxiway and connector taxiway system are in excellent condition; and, the apron sections are also all in excellent condition, as illustrated in **Table 1-15** and **Figure 1-23**. Pavement maintenance recommendations will be discussed in Chapter 3 - Facility Requirements.

TABLE 1-15 PAVEMENT CONDITION INDEX

Airfield Area	Pavement Strength	Condition*
Runway 17/35	30,000 SWG	Excellent
Taxiway A	30,000 SWG	Excellent
Aircraft Apron	30,000 SWG	Excellent
Heliport Apron Area 2	20,000 SWG	Excellent
Heliport Apron Area 3	20,000 SWG	Excellent
Heliport Apron Area 4	20,000 SWG	Excellent
Connector Taxiways A1-A4	30,000 SWG	Excellent

Source: Armstrong Consultants, Inc, November 2011
Prepared by: Armstrong Consultants, Inc., November 2011
** PCI Numbers were not provided and condition is based on a visual inspection*

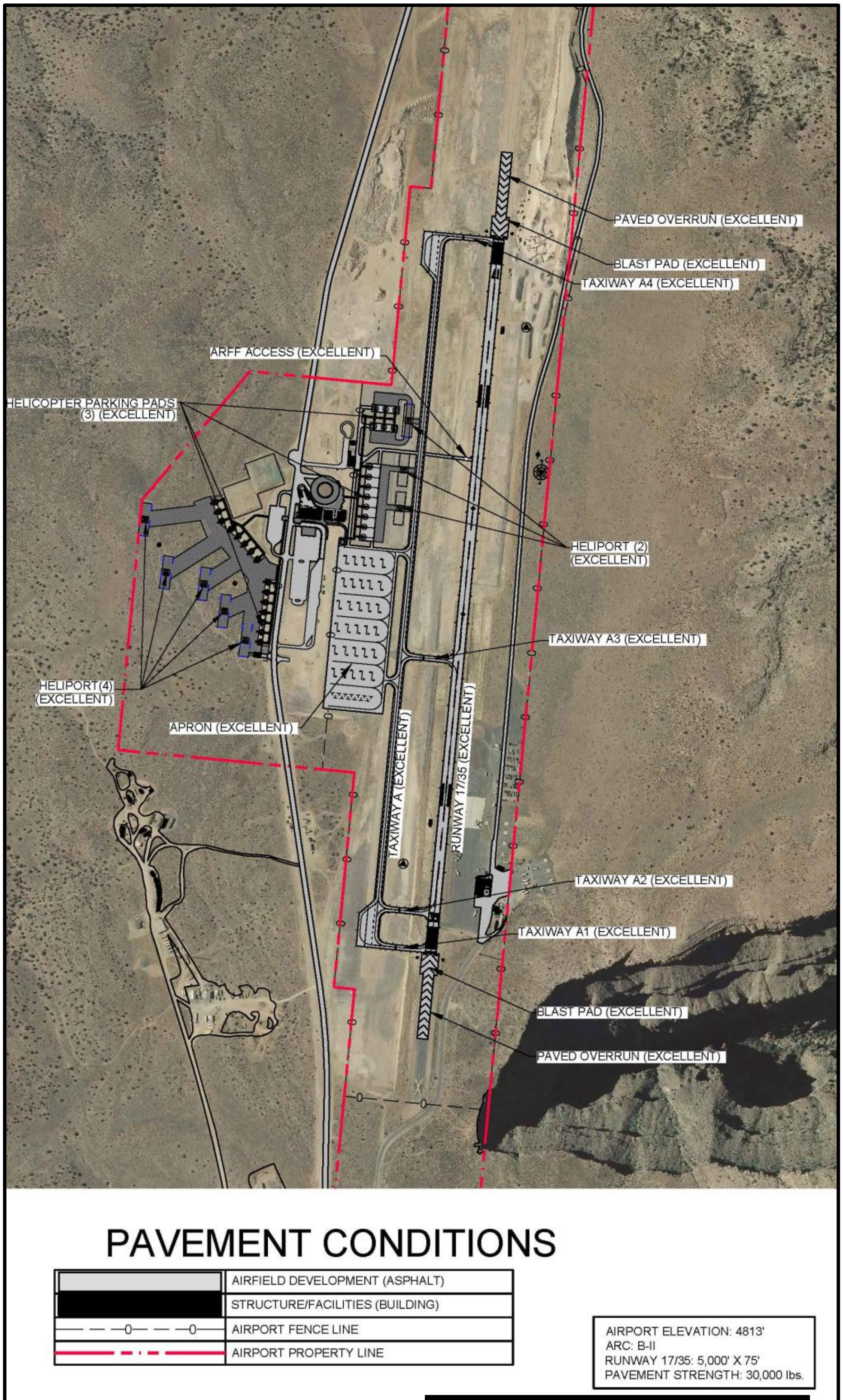


FIGURE 1-23 PAVEMENT CONDITIONS

1.14.6 AIRFIELD LIGHTING, SIGNAGE AND VISUAL AIDS

Grand Canyon West Airport is equipped with an airport rotating beacon, PAPI-4s and REILs, one lighted wind cone with a segmented circle for visual indications of airport conditions and traffic pattern indicators.

Rotating Beacon. This visual aid is equipped with high intensity lamps mounted on an assembly which rotates 360 degrees every six seconds while emitting flashes of light (see **Figure 1-24**). The designation for 1G4, a civilian land airport, is alternating green and white lights in equal duration. The airport rotating beacon is located to the north of the Aircraft Rescue and Fire Fighting (ARFF) building.

FIGURE 1-24 AIRPORT BEACON

Wind Cone. This visual aid provides visual surface wind information to pilots. The primary wind cone is collocated with a segmented circle on the east side of the Airport in the center of the Runway next to the AWOS-3. There are two wind cones located at helicopters to the west of the terminal. The segmented circle is a basic marking device used to aid pilots in locating the wind cone. The wind cone and segmented circle are in good condition.

The segmented circle is located around the wind cone and has two purposes; including identifying the location of the wind direction indicator and identifying any non-standard traffic patterns using traffic pattern indicators. As previously stated, 1G4 is equipped with a segmented circle on the east side of the Airport next to the AWOS-3. The typical traffic pattern is left-hand; however, at Grand Canyon West a non-standard right hand traffic pattern is observed for Runway 17. This is denoted through the traffic pattern indicator collocated with the windsock and segmented circle (see **Figure 1-25**).

FIGURE 1-25 WIND CONE, SEGMENTED CIRCLE AND TRAFFIC PATTERN INDICATORS

Precision Approach Path Indicator (PAPI). This visual aid is located on the left side of the runway and consists of two or four lights installed in a single row. A PAPI provides visual approach path guidance by emitting a series of white and red lights. On a four light PAPI, four white lights denote the aircraft is above the glide path. Four red lights denote the aircraft as being below the glide path. A split two red lights and two white lights mean the aircraft is on the glide path. These lights have an effective visual range of five miles during the day and up to 20 miles at night. A four box PAPI is installed on Runways 17 and 35. The PAPIs at Grand Canyon West Airport are owned and maintained by the Airport.

Runway Edge Lights. This visual aid consist of a single row of white lights bordering each side of the runway and can be classified according to three intensity levels: High intensity runway lights (HIRL) are the brightest runway lights available; medium intensity runway lights (MIRL); and, low intensity runway lights (LIRL) are the lowest in intensity. Runway lights are activated from the aircraft cockpit by transmitting a series of “clicks” on the radio transmitter on the common traffic advisory frequency (CTAF/ATCT: 122.9 MHz). Runway 17/35 is equipped with MIRL and the runway edge lights have white colored lenses (with amber/white lights on the last 2,000 feet). The lights are located 10 feet from the edge of pavement on Runway 17/35.

Runway End Identifier Lights (REILs). This visual aid is installed at many airports and provides rapid and positive identification of the approach end of a particular runway. The system consists of a pair of synchronized flashing lights located laterally on each side of the runway threshold. The REILs at Grand Canyon West Airport are LED and can be found on both ends of Runway 17/35 (see **Figure 1-26**).

Taxiway Edge Lights. This visual aid consists of a single row of blue lights bordering each side of the taxiway. These lights mark the edge of the taxiways and guide aircraft from the runway to the ramp or apron area. Taxiway A is equipped with LED Medium Intensity Taxiway Lights (MITL) (see **Figure 1-27**). The installation of LED lighting systems include many advantages such as lower energy consumption, longer lifetime, improved robustness, smaller size and faster switching.

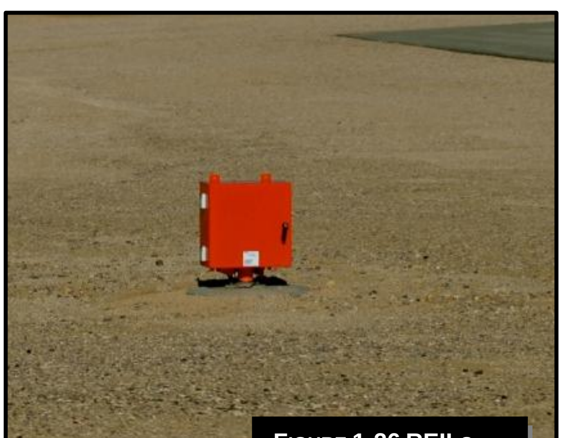


FIGURE 1-26 REILS

FIGURE 1-27 TAXIWAY EDGE LIGHTS

Threshold Lights. This visual aid consists of a single row of green lights used to indicate the beginning of the usable landing surface. These lights are bi-directional and appear red from the opposite end of the runway to mark the end of the usable runway (see **Figure 1-28**).

FIGURE 1-28 THRESHOLD LIGHTS

Marking. Runway 17/35 is marked with nonprecision markings and includes the runway centerline, numerical designation, aiming bars, threshold stripes, and blast pads and overrun marking. Taxiway marking includes aircraft hold bar markings, surface painted hold signs and enhanced centerline marking. Taxiway and apron taxilane centerline markings are provided to assist aircraft using these airport surfaces. Pavement markings on the apron identify aircraft parking positions and air tour operator with specific aircraft type.

Signage. Signs serve as a visual aid providing guidance for aircraft and vehicles on the airfield. Airfield signs include: mandatory instruction, location, direction, destination, information and runway distance remaining signs. Grand Canyon West Airport is equipped with lighted runway entrance signs, runway hold position signs, taxiway and runway location, directional and destination signs, runway boundary signs, and runway distance remaining signs (see Figure **1-29**).

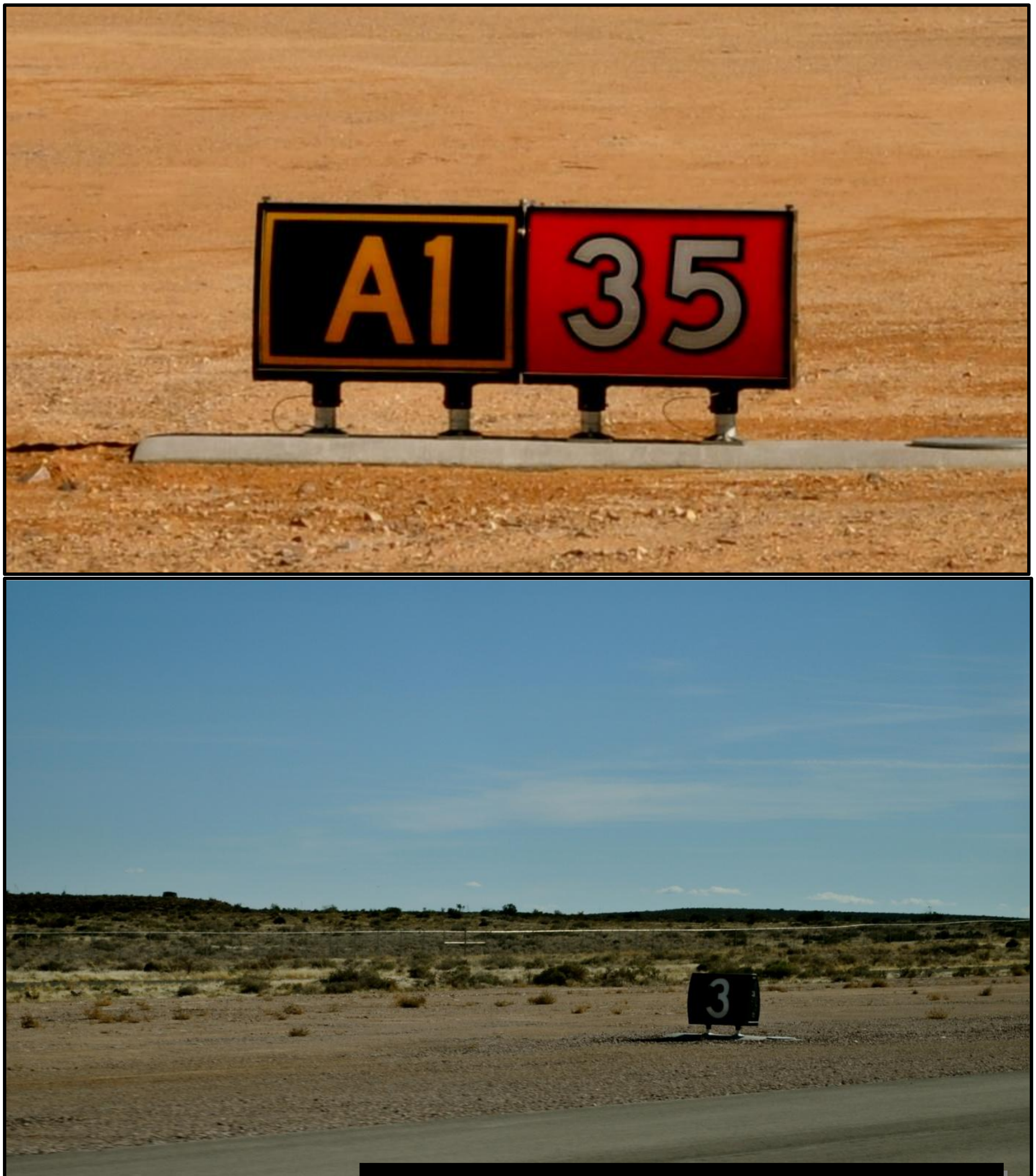


FIGURE 1-29 AIRFIELD SIGNAGE AND DISTANCE REMAINING MARKERS

1.14.7 WEATHER REPORTING SYSTEMS

The weather reporting system at Grand Canyon West Airport includes an Automated Weather Observation System (AWOS-3) that uses various sensors, a voice synthesizer and a radio transmitter to provide real-time weather data (see **Figure 1-30**). The AWOS is located on the east side of the Airport. There are four types of AWOS. An AWOS-A only reports altimeter setting while an AWOS-1 also measures and reports wind speed, direction, gusts, temperature and dew point. AWOS-2 provides visibility information in addition to everything reported by an

AWOS-1. The most capable system, the AWOS-3 also includes cloud and ceiling data. The AWOS transmits over a VHF frequency or the voice portion of a NAVAID. The transmission can be received within 25 nautical miles of the site or above 3,000 feet above ground level (AGL). The frequency for the AWOS is published on Aeronautical charts as well as in the Airport/Facility Directory. The AWOS-3 (frequency 119.425 MHz) is available at Grand Canyon West Airport; however, the AWOS-3 is not currently connected to the National Airspace Data Interchange Network (NADIN). Historical wind data was obtained from the Truxton Canyon, Arizona Remote Automated Weather Station (RAWS).

FIGURE 1-30 AWOS-3

1.14.8 NAVIGATIONAL AIDS

A Navigational Aid (NAVAID) is the primary means of enroute navigation and includes any ground based or satellite based electronic device used to provide course or altitude information to pilots. There are no existing ground-based NAVAIDs on the property. However, there are several NAVAIDs within the Grand Canyon West area which provide directional aid to the Airport. The closest NAVAID to Grand Canyon West Airport is the Peach Springs Very High Frequency Omnidirectional Range with Tactical (VORTAC) information approximately 24 nautical miles (NM) to the southeast. Approximately 52 NM to the west of the Airport is the Boulder City VORTAC near Boulder City, Nevada. Additionally, a VOR with Distance Measuring Equipment (DME) is located at Kingman Airport approximately 52 NM to the southwest.

1.15 LANDSIDE FACILITIES

Landside characteristics of an airport are described as those facilities not included as airside characteristics. Examples of landside facilities are any structures adjoining the airfield, the access routes to and from the facility, terminal buildings, and auto parking areas. **Figure 1-32** illustrates the landside facilities at Grand Canyon West Airport.

1.15.1 PASSENGER TERMINAL BUILDING

The airport passenger terminal building space is used to transfer passengers between aircraft and ground transportation and provide facilities for passengers enplaning and deplaning aircraft. The existing terminal building, located to the west of the runway, is considered an interim air structure and was constructed in 2009 to replace the previous 3,840 square foot terminal building on the east side of the runway. The 7,972 square foot existing air structure provides access doors and passageways for passengers traversing to and from the aircraft. Passengers and visitors arriving via the fixed wing aircraft apron and helicopter pads utilize a pedestrian gate and walkway to the terminal building. Passengers and visitors arriving via personal vehicle, motor coach and down and up helicopter operations enter the terminal through an entrance on the west side of the building. The interim terminal building houses a retail shop, food and beverage services (see **Figure 1-31**). **Figure 1-33, Figure 1-34** and **Figure 1-35** illustrates the flight ops building, the retail building and the interim terminal building layout and retail/gift facilities. A 3,955 square foot Flight Operations building is located to the east of the interim terminal building and serves as an area for air tour operators to conduct briefings to passengers regarding aircraft safety. East of the Flight Operations building is 4,017 square foot retail and concessionaire building that is used by the Airport and air charter companies to serve passengers. A breakdown of square footage for each of buildings can be found in **Table 1-17** and existing passenger flow from the aircraft personal vehicle and motor coach arrivals can be found in **Figure 1-36**, **Figure 1-37** and **Figure 1-38**.

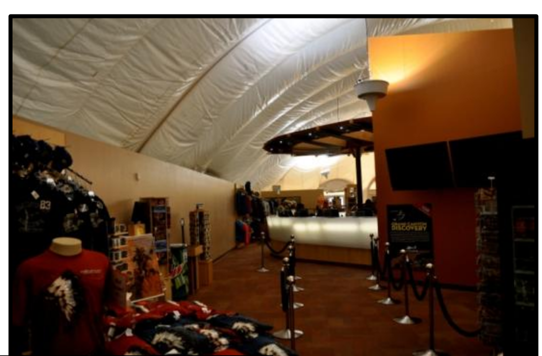
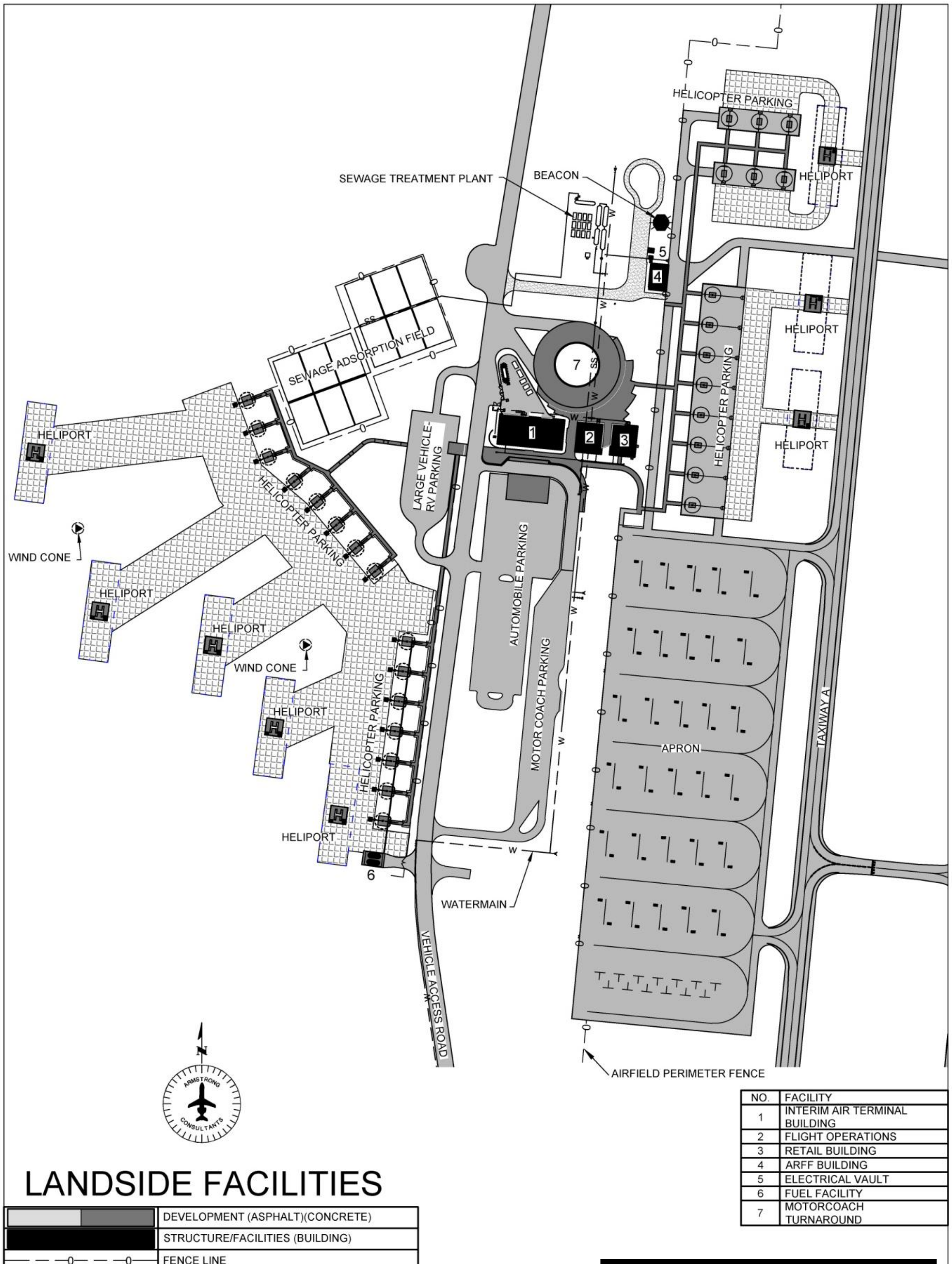


FIGURE 1-31 INTERIM TERMINAL BUILDING



NO.	FACILITY
1	INTERIM AIR TERMINAL BUILDING
2	FLIGHT OPERATIONS
3	RETAIL BUILDING
4	ARFF BUILDING
5	ELECTRICAL VAULT
6	FUEL FACILITY
7	MOTORCOACH TURNAROUND

FIGURE 1-32 LANDSIDE FACILITIES

TABLE 1-16 EXISTING BUILDING INVENTORY – SQUARE FOOTAGE

Interim Terminal	Square Footage
Office	1,391
Retail	4,788
Circulation	798
Support	872
Total	7,849

Flight Operations	Square Footage
Office	1,430
Retail	256
Circulation	312
Support	610
Holdroom	1,347
Total	3,955

Concessions/Retail	Square Footage
Office	252
Retail	1,758
Circulation	129
Support	1,045
Storage	833
Total	4,017

Source: DWL Architects, April 2012
Prepared by: Armstrong Consultants, Inc., April 2012

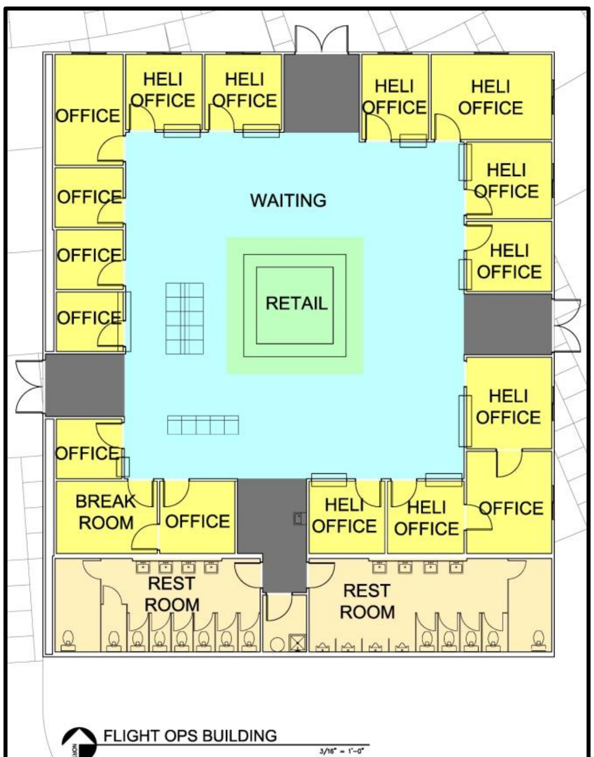


FIGURE 1-33 FLIGHT OPERATIONS BUILDING

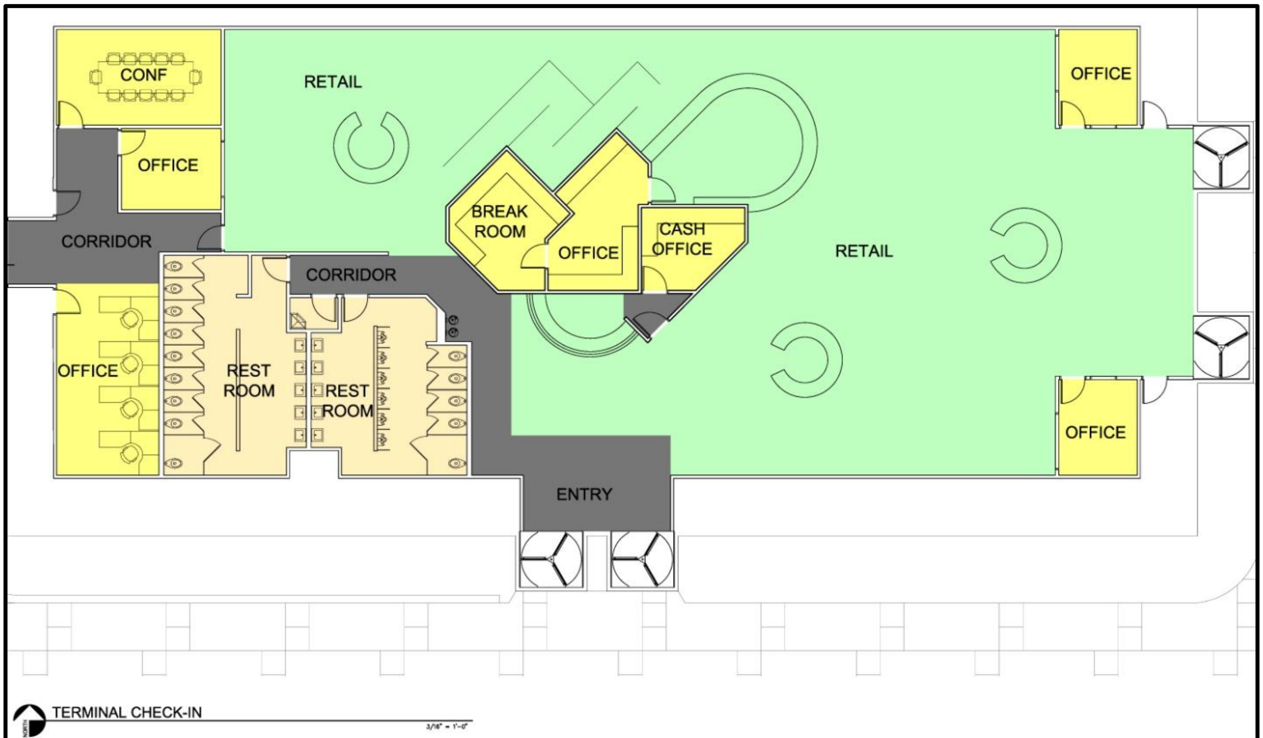


FIGURE 1-34 INTERIM TERMINAL BUILDING

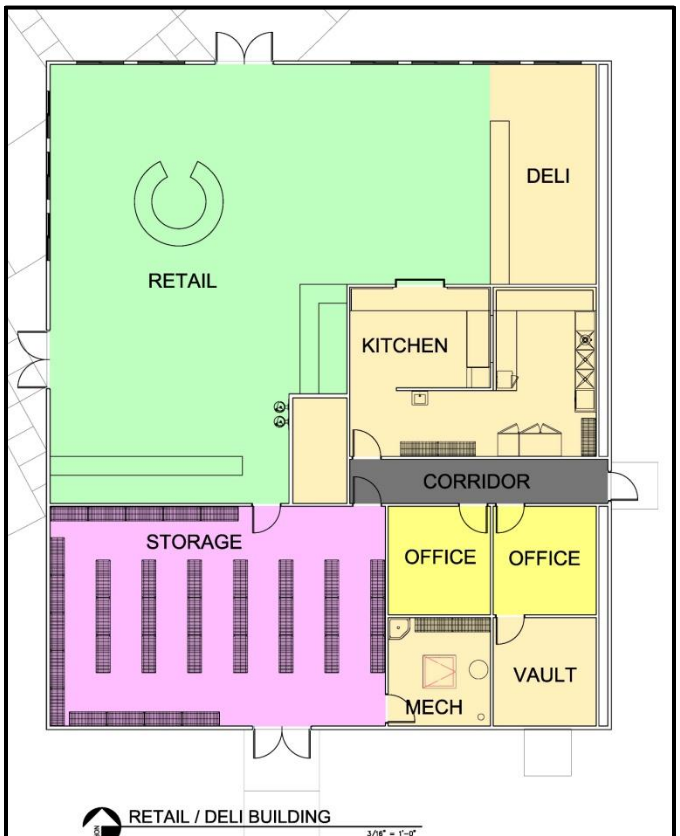
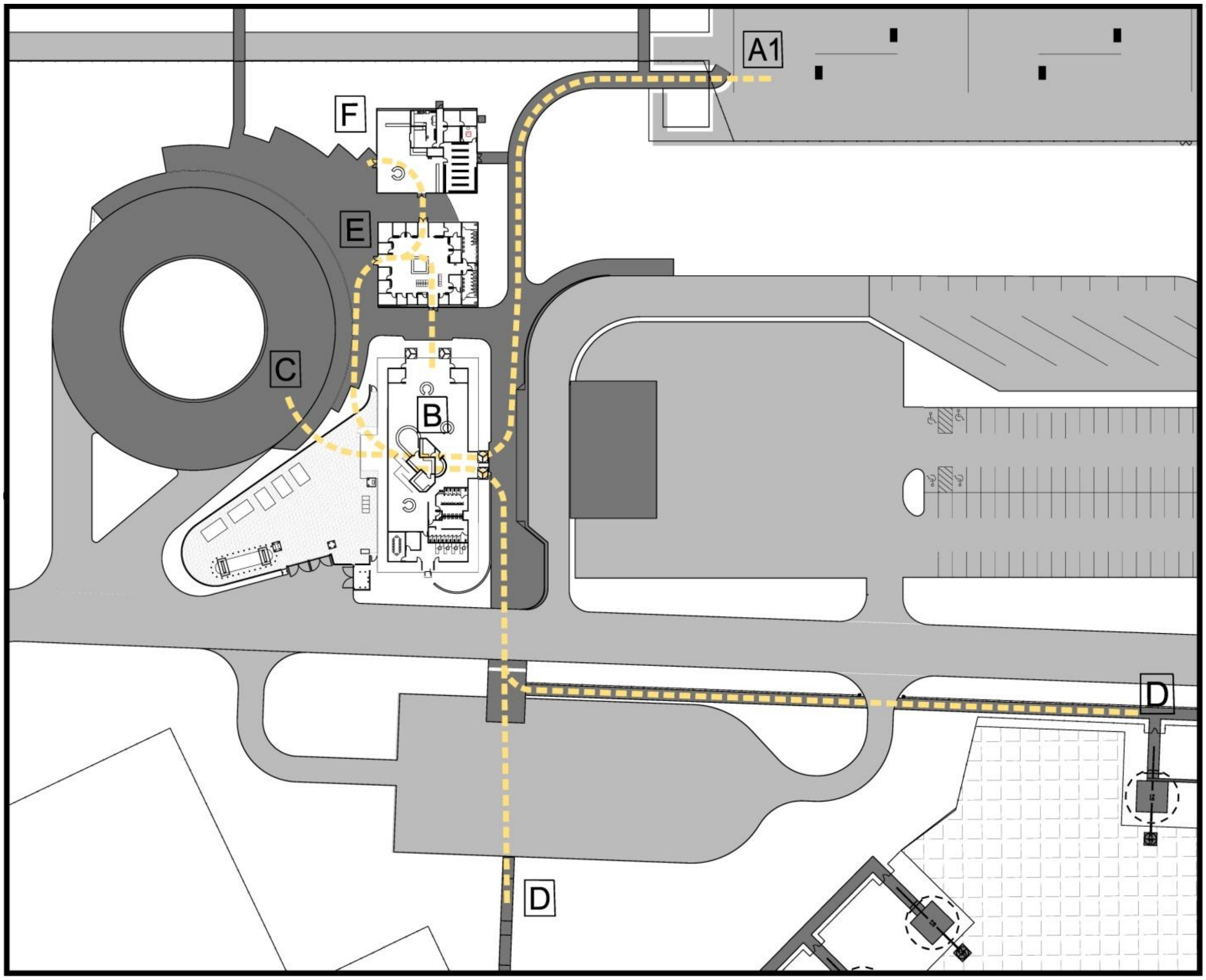


FIGURE 1-35 RETAIL/CONCESSIONS BUILDING



SITE PLAN - PATH OF AIRCRAFT ARRIVAL

1" = 30'-0"

LOCATION POINTS	
A1	AIRCRAFT ARRIVAL
A2	PERSONAL VEHICLE ARRIVAL
A3	COACH ARRIVAL
B	TERMINAL CHECK-IN
C	SKYWALK BUS SERVICE
D	HELICOPTER PARKING
E	FLIGHT OPS BUILDING
F	RETAIL / DELI BUILDING

FIGURE 1-36 PASSENGER AIRCRAFT ARRIVAL FLOW

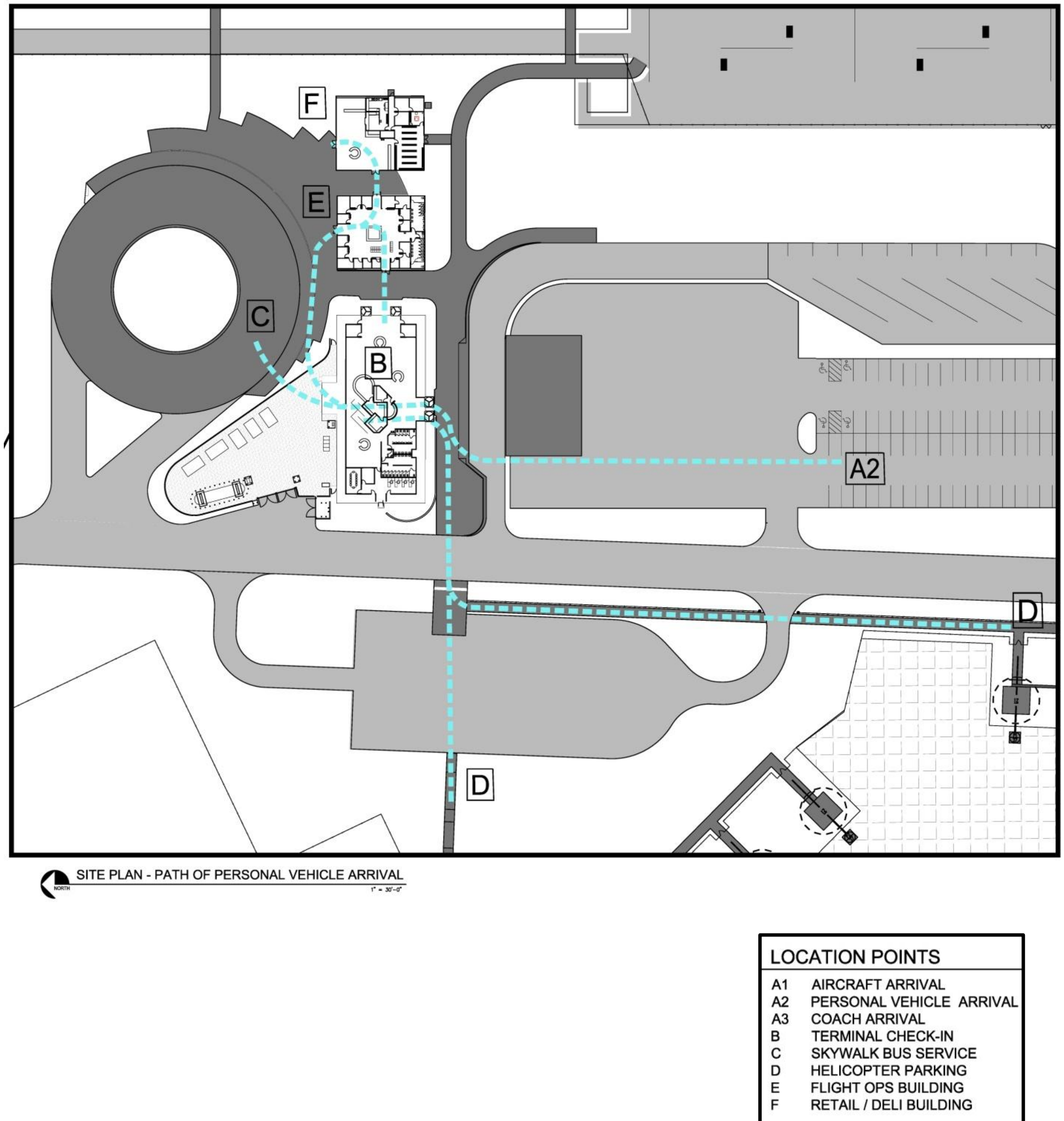
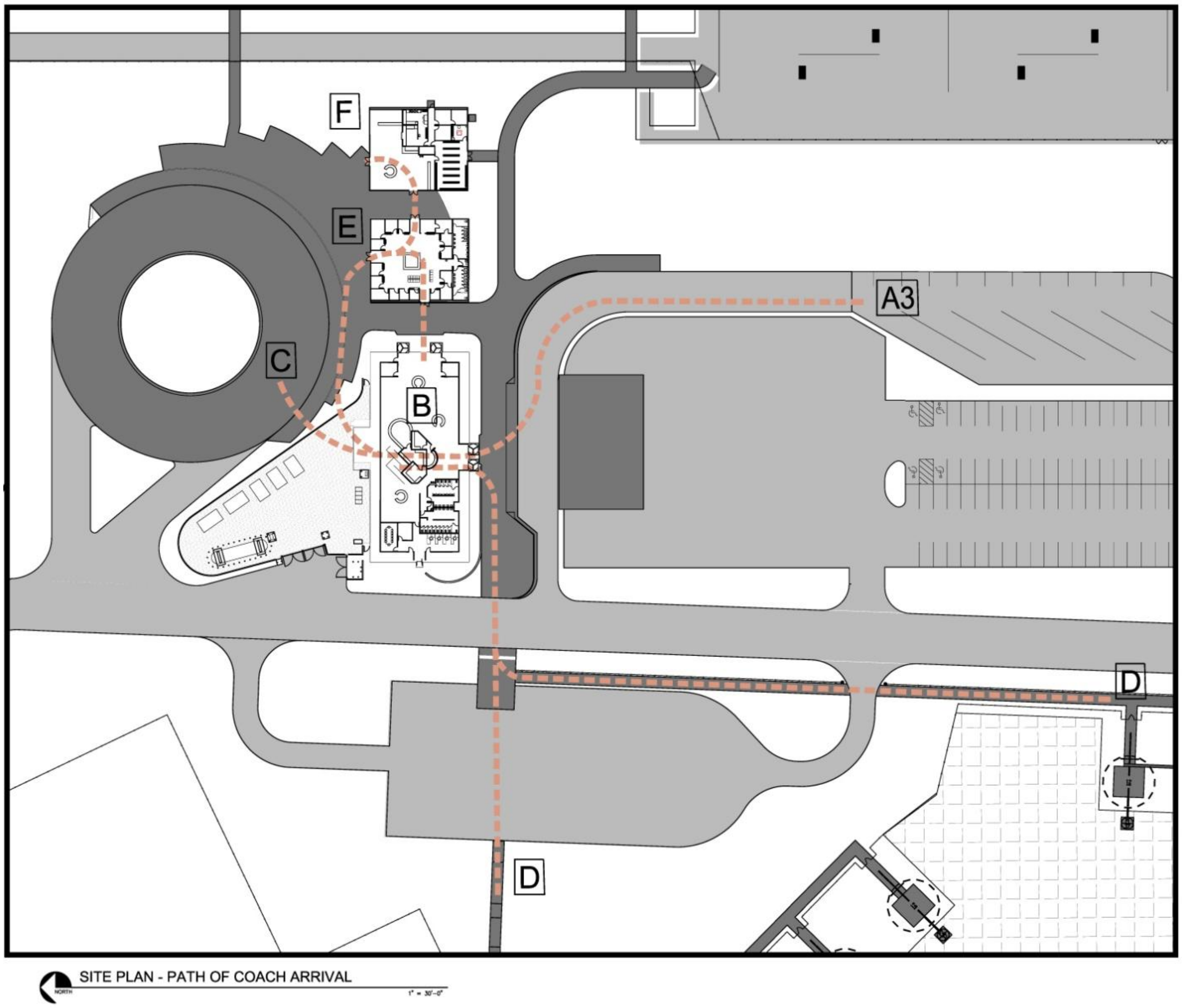


FIGURE 1-37 PASSENGER VEHICLE ARRIVAL FLOW



LOCATION POINTS

A1	AIRCRAFT ARRIVAL
A2	PERSONAL VEHICLE ARRIVAL
A3	COACH ARRIVAL
B	TERMINAL CHECK-IN
C	SKYWALK BUS SERVICE
D	HELICOPTER PARKING
E	FLIGHT OPS BUILDING
F	RETAIL / DELI BUILDING

FIGURE 1-38 PASSENGER MOTOR COACH ARRIVAL FLOW

1.15.2 AIRPORT SERVICES/FIXED BASE OPERATOR

A Fixed Base Operator (FBO) is usually a private enterprise which leases land from the airport on which to provide services to based and transient aircraft. The extent of the services provided vary from airport to airport; however, 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 tiedown and or hangar storage. The Airport currently does not have a fixed base operator on site and there are no services provided to transient aircraft.

1.15.3 HANGARS

Grand Canyon West Airport has a unique operation in the aspect there are no based fixed wing aircraft and no existing hangar development. Airport hangar development typically consists of a mix of T-hangars and conventional box hangars. Hangars are usually constructed privately on land leased by the airport. Aircraft hangars provide protection against the elements and are usually designed to serve as personal or corporate storage and maintenance facilities, and fixed base operators.

1.15.4 ACCESS ROUTES AND SIGNAGE

Airport access systems typically consist of terminal curbs, parking facilities and connecting roadways that enable originating and terminating airport users to enter and exit the airport's landside facilities. The Airport has two access roads, Diamond Bar Road and Buck and Doe Road. The Airport is located at the end of a 21 mile road, Diamond Bar Road off of N. Pierce Ferry Road. The road is comprised of a seven mile gravel pass, and the remainder of the road is paved. Buck and Doe Road is approximately 40 miles long, is in poor to marginal condition and originates in Peach Springs. The last four miles of Diamond Bar Road turns into Buck and Doe Road. The main entry point to the Airport is Diamond Bar Road and the roads leading to the Airport currently do not have directional signs. There is an access security booth operated by the Hualapai Tribe which monitors ground traffic entering or exiting the Airport (see **Figure 1-39**). Private vehicles and motor coach busses are not permitted north beyond the terminal. Hualapai shuttle buses transport visitors to the various venues.

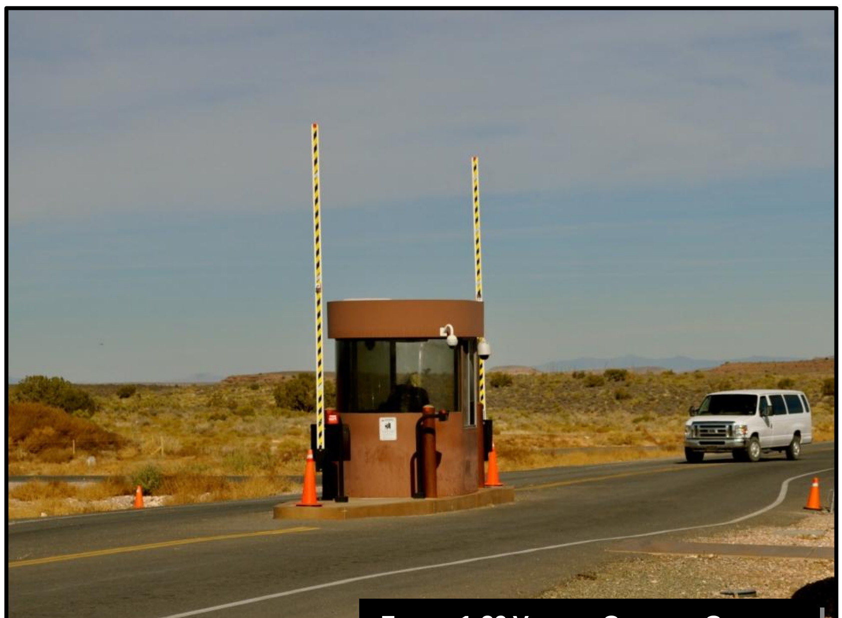


FIGURE 1-39 VEHICLE CONTROL GATE

1.15.5 AUTOMOBILE PARKING

Automobile parking facilities are necessary for originating and terminating airport users. It is important that automobile parking is adequate to serve the needs of all airport users. Grand Canyon West Airport currently has three designated parking areas for personal vehicles, RV and oversized vehicles, and motor coach parking totaling 16,429 square yards (see **Figure 1-40**). The Airport is highly utilized by motor coach and tour busses (see **Figure 1-41**). The motor coach parking lot is located west of the aircraft apron and is a one-way strip totaling 4,648 square yards and consisting of approximately 15 parking spaces. RV and oversized vehicle parking is located to the west of the passenger parking lot and is 3,039 square yards and does not have designated parking positions marked. Passenger vehicle parking totals 8,742 square yards and consists of portions that are concrete, gravel and treated aggregate overlay. There are approximately 411 parking spaces located to the west of the motor coach lot and to the south of the interim terminal. The Airport does not charge a fee for personal vehicles to park at the Airport.

FIGURE 1-40 VEHICLE PARKING LOT

FIGURE 1-41 HUALAPAI SHUTTLE BUS

1.15.6 UTILITIES

All utility requirements are currently met on site, or are transported to the site. The Airport is supplied electricity through the use of four generators. One generator supplies electricity to the interim terminal building by a 250 kilowatt (KW) generator which operates on diesel fuel. There is one 319 KW generator which supplies power to the airfield, and one 250 KW generator serves as a back-up. A 12,000 gallon tank provides storage for diesel fuel which is also used for the local tour busses and maintenance vehicles. A ten inch water line providing 100 gallons per minute is available in addition to a 230,000 gallon tank to provide potable and industrial water for the terminal area. A waste water leach field located west of the terminal building is utilized for domestic waste disposal. Solid waste and refuse is removed weekly via dumpster sized truck from the site by a waste management and disposal company based in Kingman, Arizona. There is landline telephone service available at the Airport. Heat and hot water are provided through an above ground 250 gallon propane storage tank located at the centralized fuel farm to the north of the interim terminal building.

1.15.7 SECURITY

The primary purpose of airport fencing is to prevent unwanted intrusions by persons or wildlife onto airport property. Airport fencing provides increased safety and security for the Airport. It is normally installed along the perimeter of the airport property and outside any of the safety areas defined by the FAA in Advisory Circular (AC) 150/5300-13 and 14 CFR Part 77. As previously mentioned, there is a security booth located at the entrance of the roadway leading beyond the terminal. This booth is monitored by Grand Canyon West Airport security personnel who prevent unauthorized vehicles beyond the terminal on Buck and Doe Road.

The Airport is currently fenced with an eight-foot chain linked fence with 3-strand barbed wire along the top (see **Figure 1-42**). There are five pedestrian and vehicle gates located on the Airport (see **Figure 1-43**).

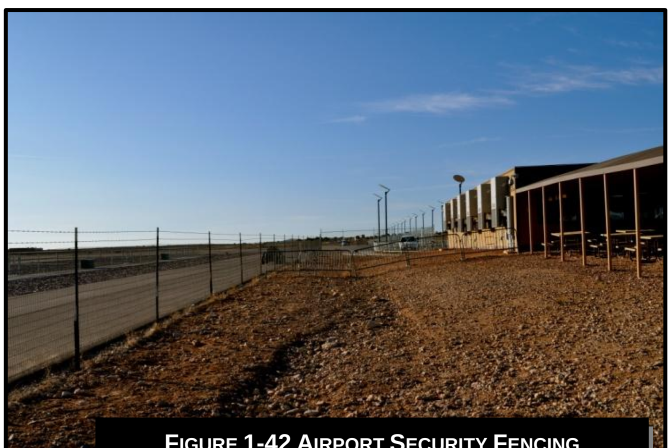


FIGURE 1-42 AIRPORT SECURITY FENCING

FIGURE 1-43 PEDESTRIAN GATE

1.15.8 AVIATION FUEL FACILITIES

Aircraft fueling services are often provided by a Fixed Based Operator (FBO) or airport sponsor. Combinations of 100 low-lead and/or Jet-A fuel are usually provided depending on the aircraft traffic mix. Storage for these fuels may consist of underground storage tanks, above storage tanks, fuel trucks, or a combination of the three (see **Figure 1-44**).


FIGURE 1-44 AIRPORT FUEL FACILITY

There are currently two above ground Jet-A fuel storage tanks with capacities of 12,000 gallons and 9,000 gallons. The fuel tanks are privately owned and operated by Papillion and Sundance Helicopters. **Table 1-17** depicts a breakdown of aviation fuel storage facilities. The two fuel tanks are located to the southeast of the down and up helicopter pads, and to the south of the terminal building across Buck and Doe Road.

TABLE 1-17 AVIATION FUEL TANKS ON AIRPORT

Facility	Product	Quantity/Capacity
Papillion Fuel Farm	Jet-A	12,000 gallons
Sundance Fuel Farm	Jet-A	9,000 gallons

Source: Grand Canyon West Airport Emergency Plan, June 2011
Prepared by: Armstrong Consultants, Inc., December 2011

1.15.9 AIRCRAFT RESCUE AND FIRE FIGHTING

Operators of FAR Part 139 certificated airports are required to provide aircraft rescue and fire fighting (ARFF) services during air carrier operations that require a FAR Part 139 certificate. Grand Canyon West Airport is classified as a Class III FAR Part 139 Airport which means the Airport is certificated to serve scheduled operations of small air carrier aircraft (e.g. 10-30 passenger seats). As a result of being classified as a Class III airport certain criteria must be met by the Airport including providing a certain level of emergency response. Under the revised Part 139, Class III airports must comply with the following Part 139 operational and safety requirements:

- A recordkeeping system and new personnel training
- Paved and unpaved surfaces
- Safety areas
- Marking, lighting and signs
- Snow and ice control plan
- Aircraft rescue and fire fighting response – alternative compliance measures allowed
- HAZMAT handling/storage
- Traffic/wind indicators
- Airport Emergency Plan but no triennial exercise required
- Self-inspections
- Pedestrian and ground vehicles
- Obstructions
- NAVAIDS
- Public protection
- Wildlife hazard management
- Airport condition reporting
- Construction/unserviceable areas

FAR Part 139 also establishes the level of aircraft rescue and fire fighting (ARFF) equipment and agents required for an airport. The ARFF Index level required is determined by the longest passenger aircraft with an average of five daily departures serving the airport as follows:

- Index A – Aircraft less than 90 ft in length
- Index B – Aircraft at least 90 ft but less than 126 ft,
- Index C – Aircraft at least 126 ft but less than 159 ft,
- Index D – Aircraft at least 159 ft but less than 200 ft, and
- Index E – Aircraft greater than 200 ft in length.

The Grand Canyon West Airport Fire Department is responsible for all fires on the Airport including structural and fuel farm fires and aircraft emergencies. The Grand Canyon West Airport Fire Department utilizes ten ARFF and emergency related vehicles (see **Table1-18** and **Figure 1-45**). The Airport also utilizes a 1986 E-1 Titan III on loan from Phoenix Gateway Mesa Airport. The E-1 Titan III stores 1,500 gallons of water, 200 gallons of foam and 400 pounds of dry chemical (see **Figure 1-46**). Fire Fighters are trained and certified as structural fire fighters, airport fire fighters, and first responders, EMT's and Paramedics. Agreements are in place with the Hualapai Tribe Fire and EMS to respond to structural and fuel farm fires.

TABLE 1-18 ARFF EQUIPMENT INVENTORY

Vehicle	Year	Condition
Ford CAFS F-550 Fire Truck	2003	Good
International Fire Truck (200 gal ender)	1999	Good
F250 Super Duty 4x4 Truck (3)	2007, 2007, 2010	Good
Ford Ambulance (2)	1992, 1996	Good
Polaris Sportsman 500-ATV	2006	Good
E-1 Titan III	1986	Good
Ford 350 XLT Super Duty Ambulance	2011	Good

Source: Airport Management, 2012
Prepared by: Armstrong Consultants, Inc., April 2012

The Grand Canyon West Airport Fire Department is responsible for all fire protection on the airport. Mutual aid is available from the Hualapai Tribe Fire Departments. Other agencies roles include fire suppression, rescue, water supply, etc. as assigned by the Incident Commander. The Incident Commander shall normally be the Shift Commander for the Airport Fire Department.

FIGURE 1-45 ARFF EQUIPMENT

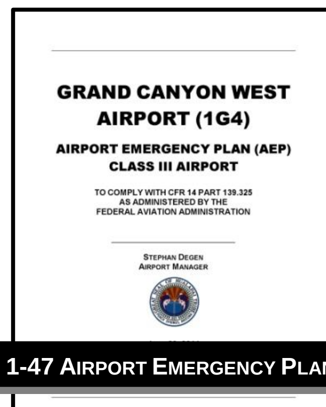
FIGURE 1-46 ARFF E-I TITAN III

Grand Canyon West Airport currently meets Index B requirements with the truck on loan from Phoenix Gateway Mesa Airport, although the Airport is only required to meet the requirements of an Index A airport. The ARFF station is located on the Airport and provides fire fighting and rescue services for aircraft, buildings located on the Airport (main terminal, storage hangars), parking areas, and the fuel farm with a three minute response time to any area of the Airport. Ambulance services are also provided by the Airport. The ARFF building is 40 foot by 60 foot two-bay pre-engineered steel building.

The 4,800 square foot building is in good condition. The ARFF building was constructed in 2009 and is located 300 feet north of the existing terminal building. There are four firefighters based at the Airport fire station. ARFF operations are provided from 15 minutes prior to scheduled arrivals until 15 minutes after departures. The ARFF building is not occupied 24-hours a day; however, ARFF personnel are located approximately one mile away, 24-hours a day. There is ambulance service provided by the Airport and two ambulances are based on-site.

1.15.10 EMERGENCY SERVICES

Kingman Regional Medical Center serves as the closest hospital to the Airport located approximately 60 miles south in Kingman, Arizona. The hospital houses 235 beds and employs 123 physicians. Kingman Regional Medical Center has an on-call helicopter service providing emergency medivac to the Airport. Transportation and medical assistance are provided by multiple entities to include, but not limited to:


GRAND CANYON WEST AIRPORT (1G4)

AIRPORT EMERGENCY PLAN (AEP)
CLASS III AIRPORT

TO COMPLY WITH CFR 14 PART 139.325
AS ADMINISTERED BY THE
FEDERAL AVIATION ADMINISTRATION

STEPHAN DEGEN
AIRPORT MANAGER

FIGURE 1-47 AIRPORT EMERGENCY PLAN

- Truxton Canyon Agency Fire Department - 55 ground miles
- Hualapai Tribe Fire/EMS Department - Peach Springs, AZ
- Papillon Helicopter Company
- Sundance Helicopter Company
- Las Vegas Helicopter Company
- Maverick Helicopter Company
- Kingman Regional Medical Center Flight for Life - 60 miles away in Kingman, AZ
- Mercy Air Service - 40 miles away in Las Vegas, NV
- Flight for Life Las Vegas - Las Vegas, NV
- Ranger 43 - Kingman, AZ
- Nellis Air Force Base Helicopter - Las Vegas, NV
- Mohave Sheriff’s Department - Kingman, AZ

Ambulance service is provided by multiple companies and two ambulances are located on the Airport. Grand Canyon West Airport, as part of the FAR Part 139 requirements, has and maintains an Airport Emergency Plan (AEP) (see **Figure 1-47**).

1.15.11 AIRPORT SUPPORT AND MAINTENANCE

Airport maintenance is conducted under the authority of the Airport Operations Manager. The Airport owns and operates several pieces of maintenance equipment including, as shown in **Figure 1-48**. The maintenance equipment inventory can be found below in **Table 1-19**. The existing maintenance building is located 300 feet north of the terminal building. The old terminal facility to the east of Runway 35 is utilized as an Airport kitchen and the previous access road, Buck and Doe, is no longer accessible to the general public.

FIGURE 1-48 MAINTENANCE EQUIPMENT

TABLE 1-19 MAINTENANCE EQUIPMENT INVENTORY

Vehicle

Type	Model	Year	Condition
Ford	F350 4WD	1991	Fair
Chevy	Caprice	1995	Fair
Polaris	Sportsman 500	2006	Good
Ford	F250 4x4 Super Duty	2007	Good
Ford	F250 Super Duty XL 4x4	2011	Good
Ford	F250 4x4 Super Duty	2008	Good

Equipment

Model	Type	Year	Condition
M11 Cummins	Tow behind Sweeper/Blower	2003	Good
Halibrite	Runway closure lights	2011	Good
Halibrite	Runway closure lights	2011	Good
Toro	Walk behind snow blower	2011	Good
Toro	Walk behind snow blower	2011	Good
Toro	Walk behind snow blower	2011	Good
Toro	Walk behind snow blower	2011	Good
Western	Truck mount snow plow	2011	Good
Western	Truck mount snow plow	2011	Good

Source: Airport Management, 2012
Prepared by: Armstrong Consultants, Inc., April 2012

1.15.12 AIRPORT MANAGEMENT

Grand Canyon West Airport is managed and operated by the Grand Canyon Resort Corporation (GCRC). The daily maintenance of the Airport is the responsibility of the Airport Manager and staff. The Airport Manager's duties are to oversee lease agreements, enforce rules and regulations and provide oversight of daily operation and safety of the Airport. GCRC is responsible for the administrative and financial oversight of the Airport. The airport management office is located within the operations building. Airport management consists of the airport manager, assistant airport manager, airport administrative assistant, two airport maintenance personnel, three EMS personnel and paramedics, dispatch and ARFF personnel.

1.15.13 AIRPORT INVENTORY

A compilation of Airport facilities are found in **Table 1-20** below.

TABLE 1-20 GRAND CANYON WEST AIRPORT FACILITIES

Facility Information		
Identifier	1G4	
FAA Site Number	00749*A	
NPIAS Number	04-0068	
ARC	B-II	
Owner/Sponsor	Hualapai Indian Nation	
Airport Elevation	4,813-feet Mean Sea Level (MSL)	
Runway and Taxiway Data		
Runway 17/35	Length: 5,000' feet / Width: 75 feet Surface: Asphalt/Grooved Marking: Nonprecision Runway lighting: MIRL	
Pavement Strength	Runway 17/35 30,000 lbs. (SWG)	
Visual Aids	Beacon/PAPI-4/REILs	
Approach Minimums	Visual	
Taxiways	A, A1, A2, A3 and A4 (35 feet wide)	
Taxiway Lighting	Medium intensity taxiway lights (MITL) & Retroreflectors	
Aircraft Apron	53,061 square yards	
Tie Downs	43	
Navigational Aids		
Air Navigation Aids	None	
Airport Beacon	Clear-Green (Civil Airport)	Dusk to dawn
Wind Indicator	Lighted	Good condition
Segmented Circle	Yes (Orange-White)/Traffic Pattern Indicators	Good condition
Unicom / CTAF	122.90 MHz	
Airport Buildings and Services		
T-Hangars	None	
Hangars	None	
Terminal Area	10,400 square feet	Good condition
Automobile Parking	400	
Perimeter Fencing	8 foot chain link fence with 3 strand barbed wire on top	Good condition
Fuel	Jet-A 12,000 gallon tank 9,000 gallon tank	Good condition
Services	Restrooms, tours, concessions, Skywalk	
Weather Equipment	AWOS-3	Good condition
FBO	None	
Utilities	Power (diesel generator), water, solid waste, waste water, propane and phone (landline) and limited cell phone reception	Limited Capacity

Source: Armstrong Consultants, Inc., December 2011
Prepared by: Armstrong Consultants, Inc., December 2011

1.16 AIRSPACE

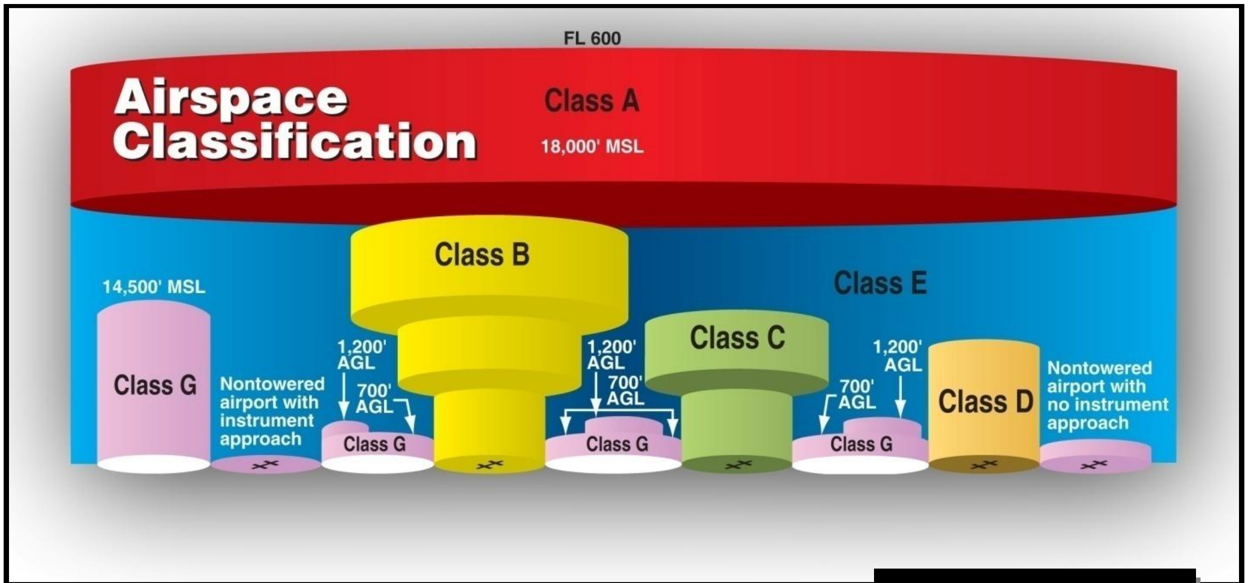
1.16.1 NATIONAL AIRSPACE SYSTEM

The National Airspace System consists of various classifications of airspace that are regulated by the FAA and is considered controlled or uncontrolled airspace. Pilots flying in controlled airspace are subject to Air Traffic Control (ATC) regulations and must follow either Visual Flight Rule (VFR) or Instrument Flight Rule (IFR) requirements. These requirements include combinations of operating rules, aircraft equipment and pilot certification and vary depending on the Class of airspace and are described in 14 CFR Part 71, Class designations; Airways; Routes; and Reporting Points and FAR Part 91, General Operating and Flight Rules. **Figure 1-49** illustrates the different airspace classes and gives a graphical representation.
General definitions of the Classes of airspace are provided below:

- **Class A Airspace**. Airspace from 18,000 feet Mean Sea Level (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, are serviced by radar approach control and that have a certain number of IFR operations or passenger enplanements. The airspace usually consists of a 5 nautical mile (nm) radius core surface area that extends from the surface up to 1,200 feet above the airport elevation and a 10 nm radius shelf area that extends from 1,200 feet up to 4,000 feet above the airport elevation.
- **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 Omnidirectional Receivers (VORs).

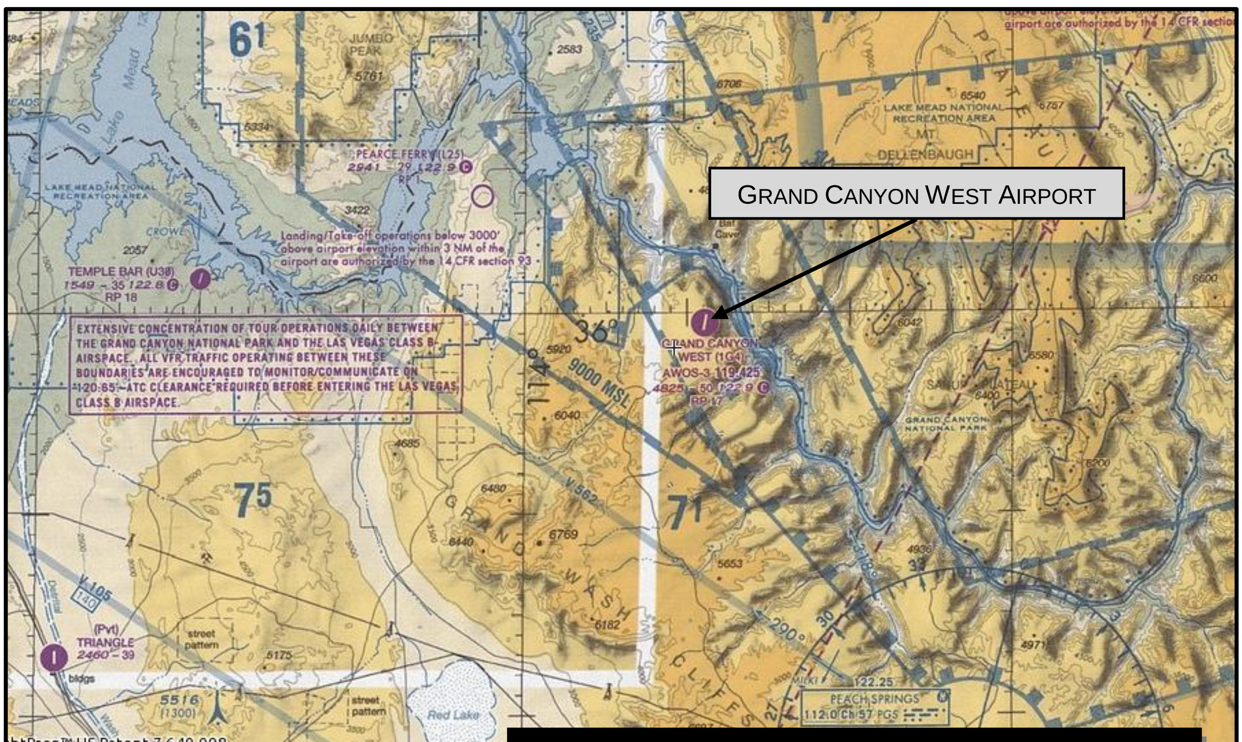
Figure 1-50 illustrates that the airspace surrounding the Grand Canyon West Airport is Class G from the ground to 1,200 feet Above Ground Level (AGL) and Class E airspace between 1,200 feet AGL and 18,000 feet MSL. All VFR traffic operating between the Grand Canyon National Park and the Las Vegas Class B airspace are encouraged to monitor/communicate on 120.65 MHz due to the heavy volume of tour operations.

The Airport is situated at 4,813 feet MSL. The typical traffic pattern altitude for all aircraft at general aviation airports is 1,000 feet MSL above the airfield elevation. The air tour operators have a traffic pattern altitude of 5,000 feet AGL. Runway 35 utilizes a standard left hand traffic pattern and Runway 17 utilizes a non-standard right hand traffic pattern to avoid over flight of the Canyon as aircraft are arriving and departing the Airport.



Source: Armstrong Consultants, Inc., 2011

FIGURE 1-49 AIRSPACE



Source: FAA, 2011

FIGURE 1-50 GRAND CANYON WEST SURROUNDING AIRSPACE

1.16.2 AIRSPACE JURISDICTION

Grand Canyon West Airport is located within the jurisdiction of the Los Angeles Air Route Control Center (ARTCC) and the Prescott Flight Service Station (CCFSS). The current frequencies for Los Angeles ARTCC are 124.2 MHz and 124.85 MHz. The altitude of radar coverage by the Los Angeles 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 enroute. Pilots can contact the Prescott FSS directly on radio frequency 122.4 MHz. Helicopters will operate on the frequency 122.9 MHz for position reports and movement inside the heliport in the interest of safety.

1.16.3 AIRSPACE RESTRICTIONS

Military Operations Areas (MOAs) consist of airspace with defined vertical and lateral limits established for the purpose of separating certain military training activities from general IFR traffic which separate certain nonhazardous military activities from IFR traffic and to identify for VFR traffic where these activities are conducted.

Whenever an MOA is being used, nonparticipating IFR traffic may be cleared through an MOA if IFR separation can be provided by Air Traffic Control (ATC). Otherwise, ATC reroutes or restricts nonparticipating IFR traffic. MOAs are depicted on sectional, VFR terminal area, and en route low altitude charts. The MOAs are also further defined on the back of the sectional charts with times of operation, altitudes affected, and the controlling agency. There are no MOAs currently in place within the surrounding Grand Canyon West Airport airspace.

Restricted Areas denote the existence of unusual, often invisible, hazards to aircraft (e.g., artillery firing). Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted Areas may not be entered into by civilian aircraft without specific permission from the controlling entity. There are no restricted areas in the vicinity of Grand Canyon West Airport airspace.

Grand Canyon West Airport is surrounded on three sides by the Grand Canyon National Park Special Flight Rules Area (SFRA), Federal Aviation Regulation FAR No. 50-2 “Special Flight Rules In The Vicinity Of the Grand Canyon National Park, AZ” has been established to restrict flights over the Grand Canyon National Park. The Airport is outside the area which includes the surface up to, but not including, 18,000 feet MSL. Operators conduct tour operations into the Canyon; however, designated flight paths and routes are followed for all helicopter operations from the Airport to the Canyon floor. **Figure 1-51** illustrates the airspace surrounding Grand Canyon West Airport. Particular attention should be given to the specific regulation in the Special Flight Rules that apply to all aircraft operations below 14,500-feet MSL.

The air tour operators utilize a standard operating procedure (SOP) for helicopters to and from the Grand Canyon West heliports. The SOP establishes a standard for route, attitudes, and radio calls used by helicopter operators. The SOP for the Airport can be found in **Appendix C**.

Detailed commercial air tour limitations for the Grand Canyon National Park Special Flight Rules can be found in 14 CFR Subpart U – Special Flight Rules in the Vicinity of the Grand Canyon National Park, AZ.

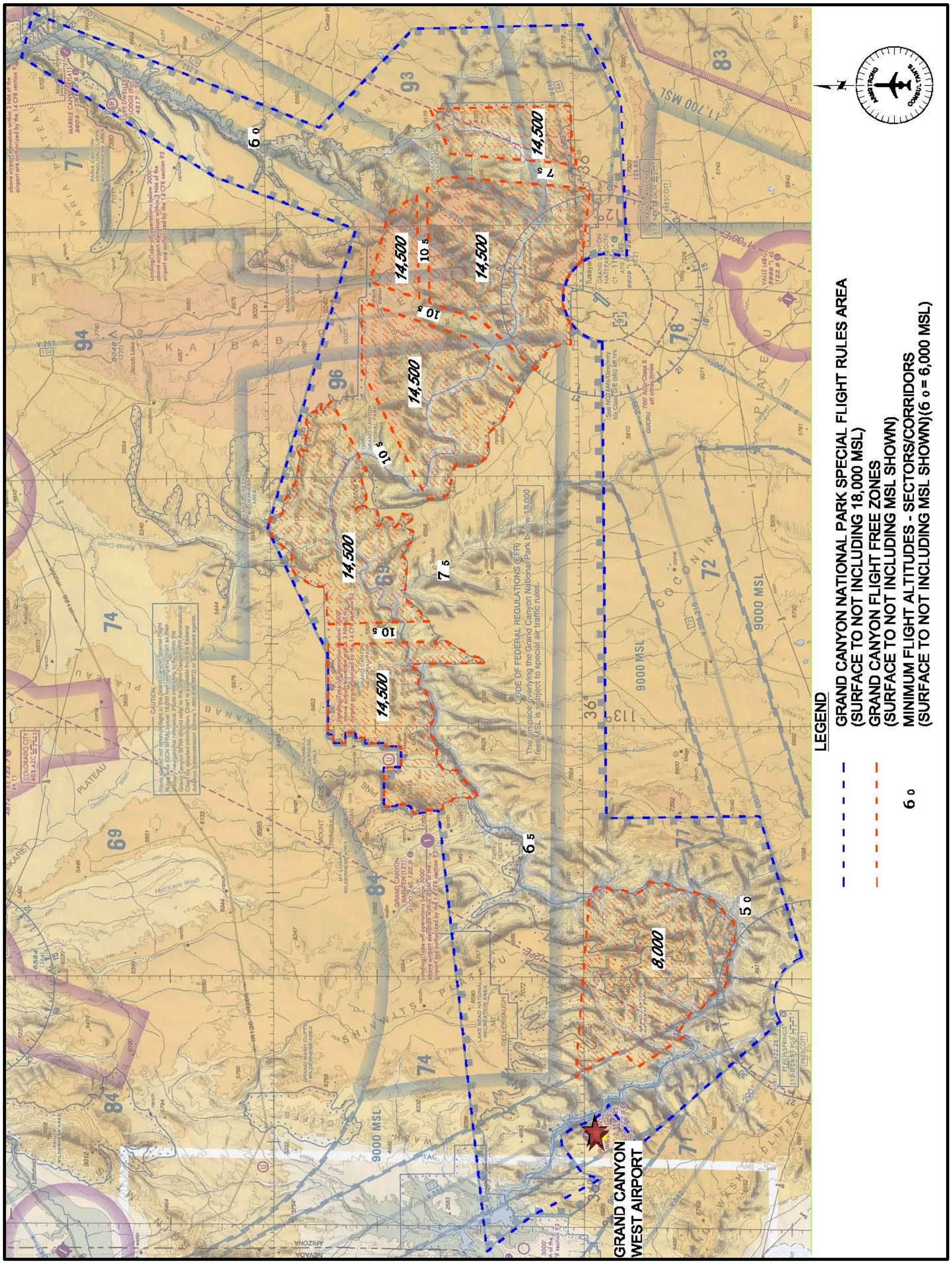


FIGURE 1-51 AIRSPACE RESTRICTIONS

1.17 ENVIRONMENTAL INVENTORY

The requirements of the National Environmental Policy Act (NEPA) require an environmental determination before implementing proposed airport improvement projects. The purpose of the environmental inventory is to identify key environmental resources that may be affected by potential airport development. The data compiled in this section will be used later in this study. Background research was completed by reviewing available documentation from the U.S. Environmental Protection Agency (EPA), Flood Insurance Rate Maps (FIRM), National Register of Historic Places (NHRP), and Federal Emergency Management Agency (FEMA).

The level of the NEPA documentation required is usually based on the results of the environmental overview and the requirements specified in FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures,* and FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*. Typical levels of analysis and determinations include Categorical Exclusions (CatEx), Environmental Assessments (EA) with Finding of No Significant Impacts (FONSI), and Environmental Impact Statements (EIS).

In 2003, an Environmental Assessment was completed for the proposed runway relocation and reconstruction; taxiway and apron construction; relocation of landside facilities; and other related airport improvements. A Finding of No Significant Impact (FONSI) was issued by the FAA. Environmental concerns are especially important for the Grand Canyon West Airport due to the proximity to the Grand Canyon which is considered to be an environmentally sensitive area. Minimizing existing and future environmental impacts at the Airport will be a specific goal for the Airport Master Plan.

1.17.1 AIR QUALITY

The National Ambient Air Quality Standards (NAAQS) are set forth by the Clean Air Act Amendments of 1997 and establish the pollutant concentrations that states, cities and towns must comply with within specified timeframes.

Air quality attainment maps were obtained from the U.S. Environmental Protection Agency's (EPA) Green Book's 2010 map of non-attainment and attainment areas. The project is located within nonattainment/maintenance area for Fine Particulate Matter (PM2.5) as depicted in **Figure 1-52**. The Clean Air Act and Amendments of 1990 define a "nonattainment area" as a locality where air pollution levels persistently exceeds, or that contributes to ambient air quality in a nearby area that fails to meet standards. Designating an area as nonattainment is a formal rulemaking process, and EPA normally takes this action only after air quality standards have been exceeded for several consecutive years.

Nonattainment areas are given a classification based on the severity of the violation and the type of air quality standard they exceed. Air pollutants are emitted by a variety of means and sources: aircraft, ground support equipment (GSE), auxiliary power units, motor vehicle operations, and construction activities.

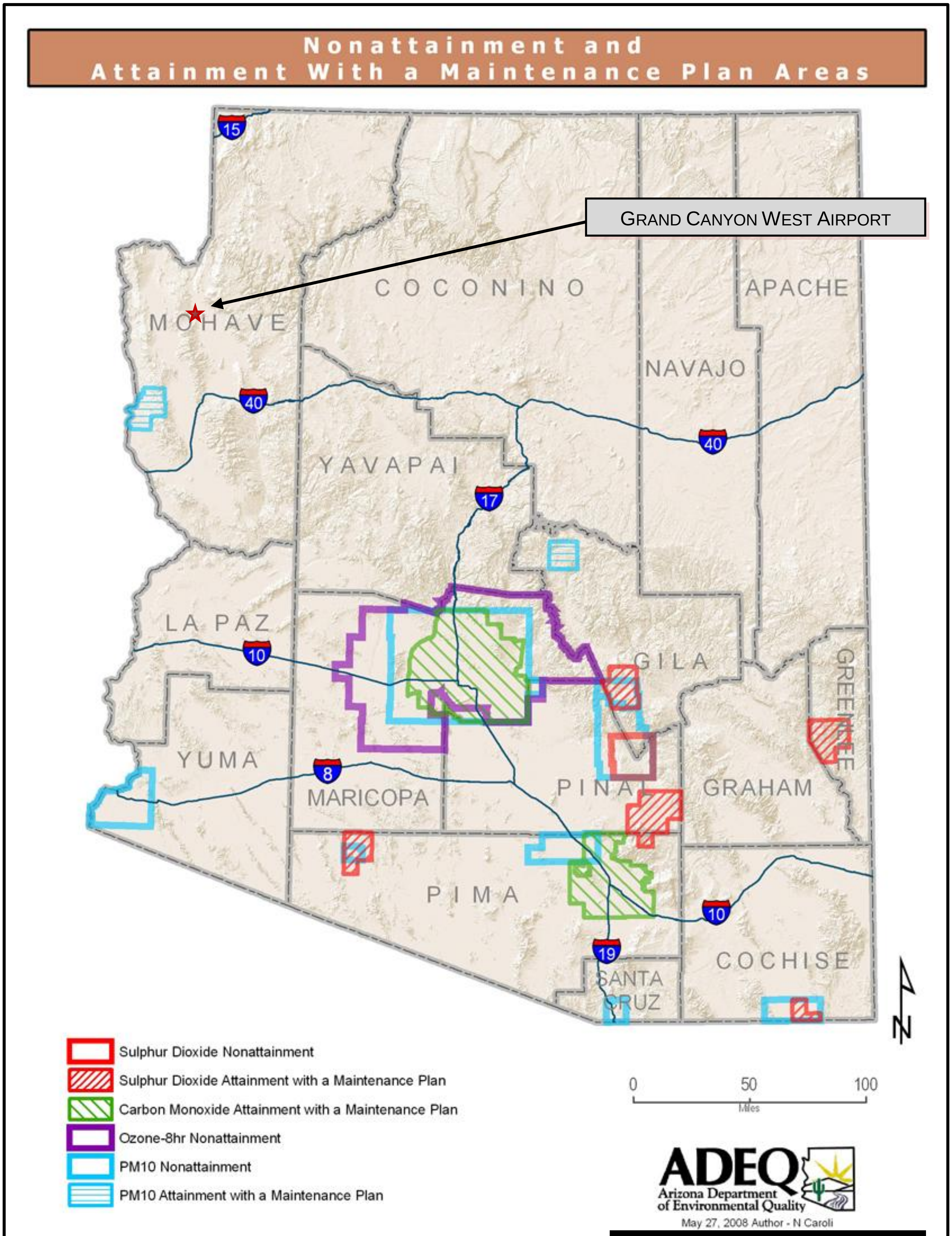


FIGURE 1-52 AIR QUALITY MAP

Source: EPA, 2012

1.17.2 FLOODPLAINS

Executive Order 11988, *Federal Floodplain Management*, states that agencies must reduce the risk of flood loss, minimize the impacts of floods on human safety, health, and welfare, and restore and preserve natural and beneficial values served by floodplains. The Available Federal Emergency Management Agency (FEMA) floodplain maps indicate that the Airport property does not encroach upon any 100-year floodplains. The Airport is not located within a special flood hazard area (SFHA) subject to inundation by the one percent annual chance of a flood for the 100-year floodplain proving there is no great threat to the area. Additionally, a 2003 Environmental Assessment concluded the Airport is not subject to impact any designated floodplains (see **Figure1-53**).

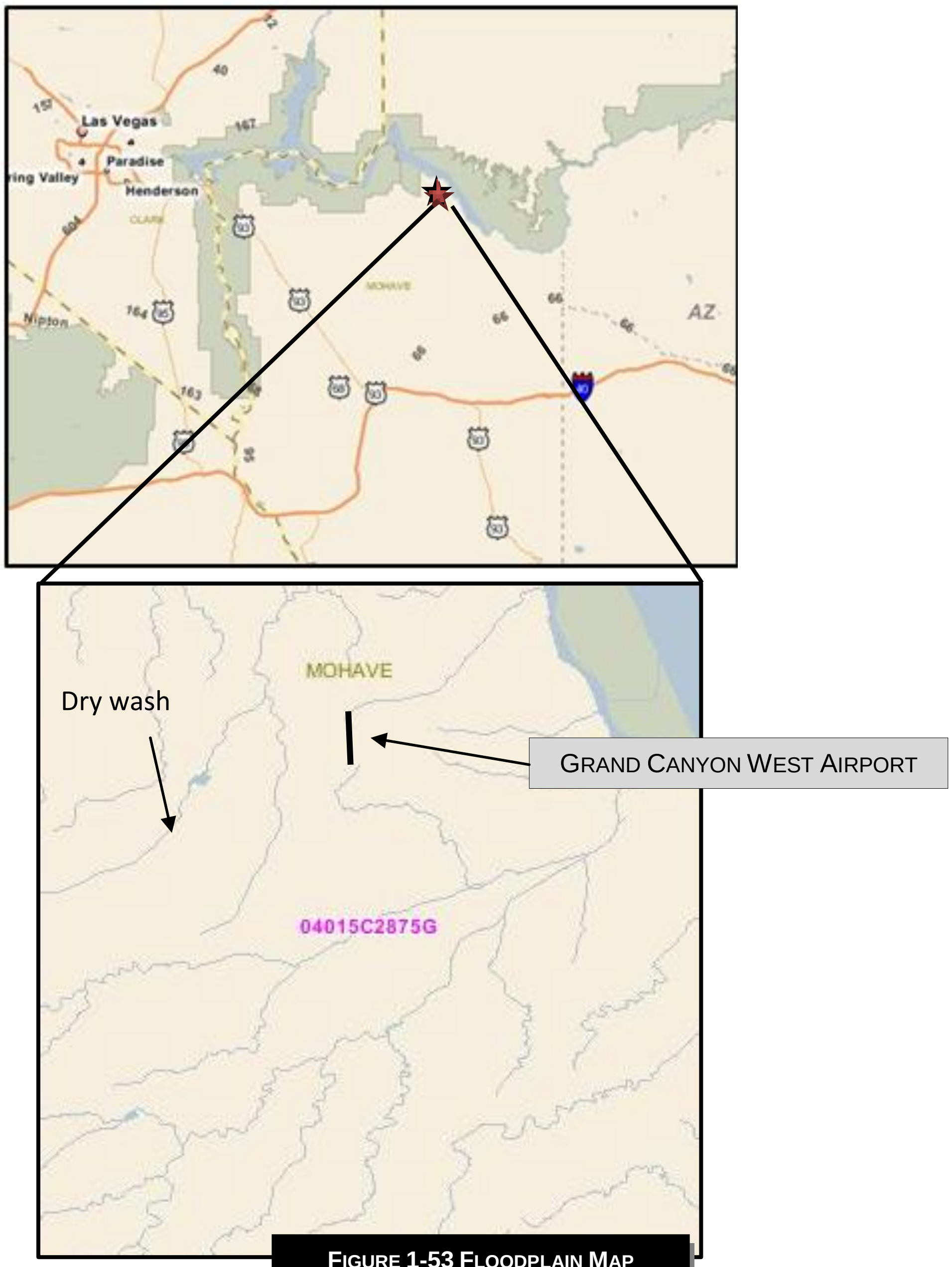


FIGURE 1-53 FLOODPLAIN MAP

Source: Federal Emergency Management Agency, 2011

1.17.3 Fish, Wildlife and Plants

The *Endangered Species Act* (16 U.S.C. §1531 et. Seq. (1973)) provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The law requires federal agencies, in consultation with the U.S. Fish and Wildlife Service, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designed critical habitat of such species.[4]

The U.S. Fish and Wildlife Service website was consulted concerning the possibility of any impacts to threatened and endangered species and candidate species that may occur within the Airport environment. A list of federally threatened or endangered species was obtained for Mohave County. Future development projects should be evaluated to determine if any of the listed species occur or would be impacted. The species shown in **Table 1-21** are currently listed for Mohave County but do not necessarily occur in the vicinity of the Grand Canyon West Airport.

Table 1-21 Endangered and Threatened Species List for Mohave County

Common Name	Scientific Name	Species	Status
Relict leopard Frog	*Lithobates onca*	Amphibians	Candidate
California condor	*Gymnogyps californianus*	Birds	Endangered
Yuma clapper rail	*Rallus longirostris yumanensis*	Birds	Endangered
American peregrine falcon	*Falco peregrinus anatum*	Birds	Recovery
Brown pelican	*Pelecanus occidentalis*	Birds	Recovery
California least tern	*Sterna antillarum browni*	Birds	Endangered
Yellow-billed cuckoo	*Coccyzus americanus*	Birds	Candidate
Mexican spotted owl	*Strix occidentalis lucida*	Birds	Threatened
Southwestern willow flycatcher	*Empidonax traillii extimus*	Birds	Endangered
Humpback chub	*Gila cypha*	Fishes	Endangered
Gila topminnow (incl. Yaqui)	*Poeciliopsis occidentalis*	Fishes	Endangered
Woundfin	*Plagopterus argentissimus*	Fishes	Endangered
Bonytail chub	*Gila elegans*	Fishes	Endangered
Virgin River chub	*Gila seminuda (robusta)*	Fishes	Endangered
Roundtail chub	*Gila robusta*	Fishes	Candidate
Razorback sucker	*Xyrauchen texanus*	Fishes	Endangered
Fickeisen plains cactus	*Pediocactus peeblesianus fickeiseniae*	Flowering Plants	Candidate
Jones cycladenia	*Cycladenia jonesii (=humilis)*	Flowering Plants	Threatened
Siler pincushion cactus	*Pediocactus (=Echinocactus,=Utahia) sileri)*	Flowering Plants	Threatened
Arizona Cliff-rose	*Purshia (=Cowania) subintegra*	Flowering Plants	Endangered
Holmgren milk-vetch	*Astragalus holmgreniorum*	Flowering Plants	Endangered
Gierisch mallow	*Sphaeralcea gierischii*	Flowering Plants	Candidate
Hualapai Mexican vole	*Microtus mexicanus hualpaiensis*	Mammals	Endangered
Desert tortoise	*Gopherus agassizii*	Reptiles	Threatened

Source: U.S. Fish and Wildlife Service, 2011
Prepared By: Armstrong Consultants, Inc., December 2011

4 Reference - United States Environmental Protection Agency (EPA), *Endangered Species Act,* (epa.gov), 2011

1.17.4 HISTORICAL, ARCHITECTURAL, ARCHEOLOGICAL AND CULTURAL RESOURCES

An important component of cultural heritage is cultural resources, which are artifacts and places that have significance to people within a specific community, and heritage. Cultural resources include archaeological sites, historic buildings and structures, rock art, shrines, trails, human made artifacts (such as pottery, metal objects, tools, projectile points, and grinding stones), traditional cultural places, and traditional cultural landscapes.

Traditional cultural places and traditional cultural landscapes are places and areas that have significant meaning to one or more cultural group, and often incorporate aspects of the natural and the human-made worlds. For example, a traditional cultural landscape may include a mountain that contains archaeological sites, human burials, herb gathering places and other important cultural resources. Human burials are a special type of cultural resource, which are usually, but certainly not always, found in archaeological sites or graveyards.

Based on the 2003 Environmental Assessment, the Tribal Historic Preservation Office (THPO) concurred with FAA's determination that the previous improvement projects did not affect any historic properties and the previous improvements resulted in a "No Effect" to cultural resources.

1.17.5 WETLANDS

Executive Order 11990, *Protection of Wetlands,* requires federally supported projects to preserve wetlands and to avoid and minimize wetland impacts to the maximum extent practicable. The use of National Wetlands Inventory (NWI) mapping, field reconnaissance, and county soil survey can aid in identifying potential wetlands and jurisdictional waters of the U.S. subject to the permitting jurisdiction of the U.S. Corp of Engineers (USACE). There do not appear to be any jurisdictional wetlands within the Airport boundary as shown in **Figure 1-54**.

Figure 1-54 National Wetlands Inventory

Source: U.S Fish and Wildlife Services, 2011

1.17.6 Compatible Land Use Planning

The FAA recommends that airport sponsors protect the areas surrounding an airport from incompatible development. Incompatible development includes those land uses which would be sensitive to aircraft noise or over flight, such as residences, schools, churches and hospitals and those uses which could attract wildlife and cause a hazard to aircraft operations such as landfills, ponds and wastewater treatment facilities.

The issue of aircraft noise is generally the most apparent and perceived environmental impact upon the surrounding community. Conflicts may also exist in the protection of runway approach and transitional zones to assure the safety of both the flying public and adjacent property owners. Adequate land for this use should be owned in fee simple or protected through zoning. Land use around the Airport is currently owned through fee simple.

Code of the Federal Regulations (CFR) Part 150, *Airport Noise Compatibility Planning* recommends guidelines for planning land use compatibility within various levels of aircraft noise exposure. Although the FAA provides these guidelines, it is the local jurisdictions' responsibility for determining and implementing compatible land use. A land use assurance letter provided by the Hualapai Indian Reservation per the Airport and Airway Improvement Act of 1982 is included in Appendix C.

No incompatible land uses currently exist at the Grand Canyon West Airport. The Airport property and surrounding development land are all owned by the Hualapai Indian Reservation.

1.17.7 DEPARTMENT OF TRANSPORTATION ACT – SECTION 4(F)

The Department of Transportation Act (DOT Act) of 1966, *Public Recreation Areas*, included a special provision - Section 4(f) - which stipulated that the Federal Highway Administration (FHWA) and other DOT agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites unless the following conditions apply:

- There is no feasible and prudent alternative to the use of land.
- The action includes all possible planning to minimize harm to the property resulting from use.[5]

The Airport is located adjacent to the Grand Canyon National Park; therefore, consultation with the National Park Service should be undertaken to ensure potential impacts to the Park are considered in the planning and development process. In 2004, a comprehensive planning effort was undergone to establish recreation areas at the Grand Canyon West Airport, which were compatible with the Airport. Recent reconstruction and redevelopment projects did not result in a significant environmental impact to the public recreation areas.

1.17.8 NOISE

CFR Part 150 is a program that U.S. airports may undertake to seek a balance between their operational needs and the noise impacts their operations are having on the surrounding community. The study of airport noise and land use compatibility authorized under the Code of Federal Regulations (14 CFR) Part 150, *Airport Noise Compatibility Planning*, which sets out rules and guidelines and authorizes Federal assistance for the preparation of airport noise compatibility programs. Avoiding noise impacts over the Grand Canyon, the SkyWalk and Guano Point are advised. There are two principal technical elements:

- Noise Exposure Maps (NEM) – describe existing noise conditions are the Airport area and projected future conditions if no noise abatement actions were taken.
- Noise Compatibility Program (NCP) – provides guidelines for the mitigation of existing incompatible land uses and the prevention of development that would introduce new incompatible uses.

The level of sound can be measured objectively, but noise, unwanted sound, is a very subjective matter. Techniques have been developed that measure single events in an effort to measure the noise in objective terms, giving extra weight to those sound frequencies that are most annoying to the human ear. The FAA has suggested, but not mandated, guidelines for determining land use compatibility with a given Ldn or DNL level (day/night average sound level). Ideally, residentially areas should be located in areas below 65 DNL.

Noise contours for Grand Canyon West Airport were prepared as part of this Airport Master Plan using the FAA Integrated Noise Model (INM) program version 7.0C. The 65 DNL contour was determined for existing conditions at the Airport. The input files include aircraft operational data, flight tracks, runway utilization, and fleet mix.

The existing 65 DNL noise contour (see **Figure 1-55**) encompasses approximately 0.15 square

[5] U.S. Department of Transportation, Federal Highway Administration, 2011

miles and does not include any incompatible or noise sensitive receptors. Flight tracks are directed away from the Grand Canyon and thus resulting in no significant environmental impacts due to noise. The noise abatement rules in place surrounding Grand Canyon West Airport include the restriction that all aircraft fly a minimum 2,000 feet AGL.

1.18 FINANCIAL DATA

The primary goal of gathering financial data is to develop an understanding of the financial structure, constraints, requirements, and opportunities for airport activities as it relates to the development of the future airport improvements.

Table 1-22 provides a brief overview of historical financial information for the Airport. Financial statements have been gathered for fiscal years 2006 through 2010. A review of the financial documentation for Grand Canyon West indicates the primary sources of revenue for the Airport include terminal sales (gift shop) and concessions. Primary expenses include: salaries and wages, benefits, operations and maintenance and funding local match on airport capital improvement projects. PFCs are being collected to help offset the local match on capital improvement projects.

FIGURE 1-55 EXISTING NOISE CONTOUR

TABLE 1-22 FINANCIAL DATA

AIRPORT REVENUE	2006	2007	2008	2009	2010
Capital Improvement Revenue (Grants)	$2,075,881	$8,946,536	$12,061,435	$6,752,835	$7,748,115
Rentals and Leases	N/A	N/A	$22,050	$42,479	$37,323
Miscellaneous Revenue*	$1,209,315	$2,268,951	$2,348,163	$2,363,222	$3,053,443
Passenger Facility Charge	$163,848	$322,628	$391,555	$157,500	$216,640
Total Airport Revenue	**$3,449,044**	**$11,538,115**	**$14,823,203**	**$9,316,036**	**$11,055,521**

AIRPORT EXPENDITURES	2006	2007	2008	2009	2010
Salaries and Wages*	N/A	N/A	$1,184,911	$1,035,578	$1,331,836
Benefits*	N/A	N/A	$353,881	$364,410	$378,293
Operating Expense	$473,074	$886,579	$1,081,365	$1,003,269	$1,450,499
Capital Improvement Costs	$2,195,709	$9,653,828	$12,785,170	$8,743,185	$9,788,744
Retirement Fund*	N/A	N/A	$4,015	$36,945	$46,941
Total Airport Expenditures	**($2,668,783)**	**($10,540,407)**	**($15,409,342)**	**($11,183,387)**	**($12,996,313)**
Net Total Airport	**$780,261**	**$997,708**	**($586,139)**	**($1,867,351)**	**($1,940,792)**

Source: Hualapai Resort Corporation, January 2012
Prepared by: Armstrong Consultants, Inc., January 2012
**Miscellaneous revenue includes gift shop, food and beverage sales at the terminal.*
***Salaries and related benefits for airport employees were not readily broken out prior to 2008.*

CHAPTER

2

FORECASTS OF AVIATION ACTIVITY

GRAND CANYON WEST AIRPORT
AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS, INC.
AIRPORT ENGINEERING AND PLANNING

Chapter Two
Forecast of Aviation Activity

2.1 INTRODUCTION

Forecasts of aviation activity provide the basis for evaluating the adequacy of existing airport facilities and their capability to handle increased traffic levels or diverse types of traffic. Forecasting is the foundation for effective planning and is used to help determine when and if capital improvement projects are needed.

While forecast information is necessary for successful comprehensive airport planning, it is important to recognize that forecasts are only approximations of future activity based upon historical data and viewed through present situations. They must therefore be used with careful consideration, as they may lose their validity with the passage of time.

Commercial and commuter aviation forecasts and assumptions are typically developed from econometric models that explain and incorporate emerging trends from the different segments of the industry while integrating historical data and broadly accepted industry and governmental estimates of aviation activity, as well as the primary socioeconomic drivers of general aviation activity.

General aviation and air tour aviation forecasts vary in approach. The starting point for developing general aviation forecasts rely on discussions with industry experts and the results of the 2011 General Aviation and Part 135 Activity Survey as well as the socioeconomic impacts from hub markets. The assumptions in this are tailored to the unique operation at Grand Canyon West Airport. The Airport is primarily a resort destination airport with little to no general aviation activity. Activity is primarily comprised of air tour operations from Las Vegas, Nevada and Phoenix, Arizona. These two markets are considered the driving force behind the projections.

At airports served by air traffic control towers comprehensive logs of aircraft operations are available. The existing aviation activity levels are based upon this data to form the baseline to which forecasted aviation activity trends are applied. Grand Canyon West Airport does not currently have an Air Traffic Control Tower (ATCT) and the existing aviation activity data was provided by Airport Management.

Forecast methodologies and analysis consider historical aviation trends at Grand Canyon West Airport as well as throughout the nation. Local historical data was collected from the following sources: Federal Aviation Administration (FAA) Terminal Area Forecast (TAF) records; FAA Form 5010-1, Airport Master Record; 2008 Arizona State Airports Systems Plan (SASP); and Airport Management records. Aviation activity projections are made based upon estimated growth rates, and Las Vegas and Phoenix tourism socioeconomics. Forecasts are prepared for the Initial-Term (0-5 years); the Intermediate-Term (6-10 years); and, the Long-Term (11-20 years) time frames. Utilizing forecasts within these time frames will allow the Airport's improvements to be timed in order to efficiently meet demand, but not prematurely as to remain idle for an unreasonable length of time.

Types of operations that are forecasted within the report are: based aircraft, operations (local and itinerant for air carrier commuter, air taxi, general aviation and military), passenger enplanements and instrument operations.

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

1) *Local operations* pertains to air traffic operations, aircraft operating in the local traffic pattern or within sight airport; aircraft known to be departing for, or arriving from, flight in local practice areas located within a 20-mile radius of the airport; aircraft executing simulated instrument approaches or low passes at the airport.

2) *Based aircraft* 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.

3) *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.

4) *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 recreational flights originating at other airports, with termination or a stopover at the study airport. The terms transient and itinerant are sometimes erroneously used interchangeably.

At Grand Canyon West Airport, operations primarily consist of “in and out” fixed wing and helicopter operations by air carrier, air taxi and general aviation operations, and “down and up” operations by air taxi helicopters. Although down and ups are technically itinerant in that they make an intermediate stop at designated heliports in the Canyon, categorizing them as local operations in this study would effectively illustrate and forecast the two types of operations. Delineating down and up helicopter activity as local operations is a way to segregate in and out from down and up for reporting and forecasting purposes.

Within this Master Plan, forecasting activity will focus on overall annual visitor totals (ground and air visitors), in and out operations and passengers, down and up operations and passengers, general aviation operations and instrument operations.

2.2 NATIONAL AND REGIONAL TRENDS

The FAA annually convenes expert panels in aviation and develops forecasts for future activity in all areas of aviation. The national trends listed below are from the *FAA Forecast Fiscal Years 2012-2032*. Given the current instability in the global economy, uncertainty remains in the timing for the recovery of demand in the aviation industry; therefore, the FAA has placed a larger variance around these forecasts than in previous years.

2.2.1 GENERAL AVIATION AND AIR TAXI/TOUR SERVICE

General Aviation (GA) encompasses and touches nearly every aspect of the populations’ lives and economy. GA is simply defined as all aviation other than military and scheduled commercial airlines. There are over 320,000 general aviation aircraft worldwide with nearly 223,000 of those aircraft based in the United States; including aircraft ranging from the Boeing Business Jet (B737) to the Piper Cub.

According to factors such as aircraft production, pilot activity and hours' flown, general aviation reached a peak in the late 1970s. This peak was followed by a long downturn that persisted through most of the 1980s and the early 1990s and has been attributed to high manufacturing costs associated with product liability issues as well as other factors. The General Aviation Revitalization Act (GARA) of 1994 was enacted with the goal of revitalizing the industry by limiting product liability costs. The Act established an 18-year statute of repose on liability related to the manufacture of all general aviation aircraft and their components. According to a 2001 report to Congress by the General Accounting Office (GAO), trends in general aviation since GARA was enacted suggest that liability costs have been less burdensome to manufacturers, shipments of new aircraft have increased and technological advances have been made. Indicators of general aviation activity, such as the numbers of hours flown and active pilots, have also increased in the years since GARA, but their growth has not been as substantial as the growth in manufacturing. Despite signs of economic recovery, the general aviation and the air taxi industry suffered through a difficult 2010-11.

After the price of oil increased by 29 percent in 2011, the FAA projects the price to be over $100 per barrel in 2012 (up 6.0 percent from 2011). The increases are relatively modest, with the price of oil approaching $115 per barrel by 2020 and then gradually increase to over $118 per barrel by 2025. Thereafter, prices will begin to escalate gradually, approaching $138 per barrel by the end of the forecast period in 2032. While lower oil prices give consumers in impetus for additional spending, including air travel, and increases the chances for industry profitability, higher oil prices could lead to further shifts in consumer expenditures away from aviation, dampening a recovery in air transport demand.[1]

After suffering through a significant downturn in 2009, business and corporate aviation saw a partial recovering in 2010-11. The pace of the recovery in business and corporate aviation is largely based upon the future prospects of economic growth and corporate profits. The global economic recovery serves as the foundation for the length of slow down and growth within the aviation sector. These types of risk serve as major players within the forecast model. Perception of the public regarding the business and corporate aviation industry, unknown and potential environmental mitigation, regulation and taxes, and increased security measures placed on the business jet community and airports that service this sector will also put downward pressure on the forecast. General aviation activity is projected to grow 1.5 percent per year, reflecting growth in business aviation.

Within the last decade, environmental regulations and mitigation surrounding the regulations of noise, air quality, aviation emissions, and water quality concerns have impacted new construction and renovation for airports; each providing an impact on forecasting. The lack of progress on improving the environmental and energy outlook for the future can drive more restrictions via standards or operating limitations on the aircraft fleets in service, which in turn can depress activity. While many of the issues are more pronounced at commercial service airports, they do not go overlooked at local and regional airports where it has the potential to be a contentious issue with stakeholders and the airport alike.

The FAA annually convenes expert panels in aviation and develops forecasts for future activity in all sectors of aviation, including general aviation. The FAA forecasts the fleet and hours flown for single-engine piston aircraft, multi-engine piston, turboprops, turbojets, rotorcraft (piston, turbine), sport, experiment and other (glider, balloon) aircraft. The FAA forecasts "active aircraft," not total aircraft, and uses estimates of fleet size, hours flown, and utilization from the

[1] Reference - FAA *Aerospace Forecast Fiscal Years 2012-2032*

General Aviation and Air Taxi Activity and Avionics Survey (GA Survey). This survey serves as baseline figures upon which assumed growth rates can be applied.

According to the *FAA Aerospace Forecast Fiscal Years 2012-2032*, the demand for business jets has grown over the past several years due to new product offerings, the introduction of the very light jets (VLJ), and increasing foreign demand have all contributed in driving this growth; additionally, the current forecast assumes that business use of general aviation aircraft will expand at a more rapid pace than that for personal/sport use. In addition, corporate safety/security concerns for corporate staff, combined with increasing flight delays at some U.S. airports have made fractional, corporate, and on-demand charter flights practical alternatives to travel on commercial flights.

Based on the latest FAA assumptions about fleet attrition and aircraft utilization along with the GAMA aircraft shipment statistics, the active general aviation fleet is estimated to have decreased 0.4 percent in 2011. The FAA projects the general aviation fleet to increase at an average annual rate of 0.6 percent over the 21 year forecast period, growing from an estimated 225,520 in 2011 to 253,205 aircraft by 2032. The more expensive and sophisticated turbine-powered fleet (including rotorcraft) is projected to grow at an average of 2.9 percent a year over the forecast period with the turbine jet fleet increasing at 4.0percent a year (see **Figure 2-1**).

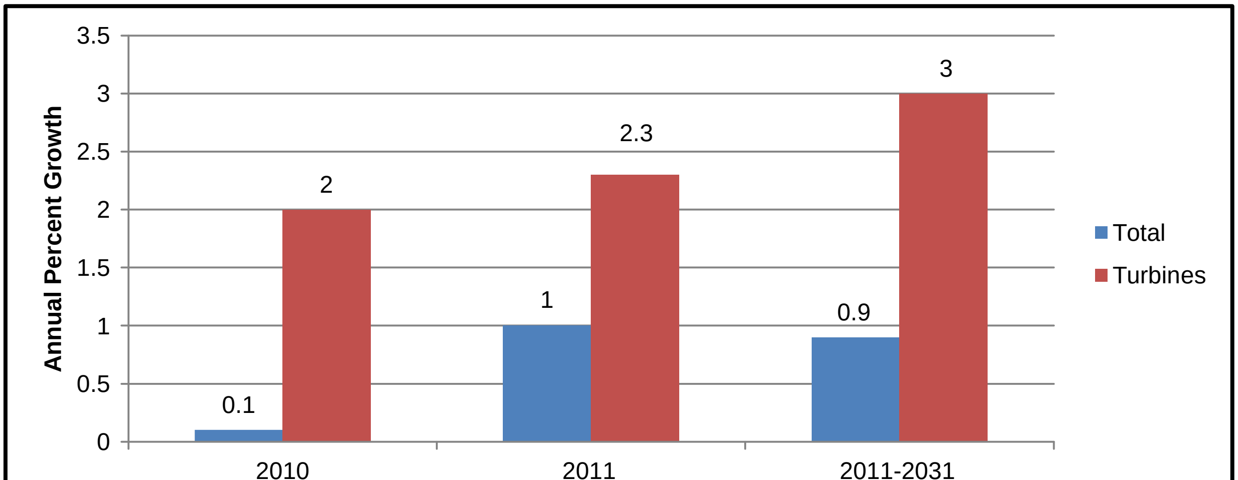


FIGURE 2-1 U.S. GENERAL AVIATION & ON-DEMAND PART 135 PROJECTED OPERATIONS AND ENPLANEMENTS

Source: FAA Aerospace Forecast Fiscal Years 2012-2032
Prepared by: Armstrong Consultants, Inc., April 2012

As recently as 2009, industry experts suggested the market for new VLJs could add 440 aircraft to the US fleet over the next three years, with an average of 216 aircraft a year for the balance of the forecast period. The relatively inexpensive twin-engine VLJs (priced between $1 and $2 million) were believed by many to have the potential to redefine the business jet segment by expanding business jet flying and offering performance that could support a true on-demand air-taxi business service. However, events since that time have dampened original expectations for a rapid penetration of VLJs into the market, most notably the recession and the bankruptcy of Eclipse and the demise of DayJet. Recently the introduction of Embraer's Phenom 100 to the market has reignited the outlook and increased worldwide deliveries of the aircraft.[2]

[2] Reference - FAA *Aerospace Forecast Fiscal Years 2012-2032*

By 2025 the annual utilization rate for all VLJs is forecast to be 432 hours. Traditional (non-VLJ) turbojets are expected to average approximately 368 hours per year by 2025, as VLJs are expected to have a greater share of their use in on-demand air taxi and shared ownership than the traditional turbojets.

The number of active piston-powered aircraft (including rotorcraft) is projected to decrease from 2010 total of 159,007 to 151,685 through 2023, with declines in both single and multi-engine fixed wing aircraft, but with the small category of piston-powered rotorcraft growing. Beyond 2023, active piston-powered aircraft are forecasted to increase to 155,395 by 2032. This accounts for just 28.2 percent of the regional declines in both single and multi-engine aircraft. Over the forecast period, the average annual increase in piston-powered aircraft is 0.1 percent. Although piston rotorcrafts are projected to increase by 2.1 percent a year, they are a relatively small part of this segment of general aviation aircraft. Single-engine fixed-wing piston aircraft, which are much more common, are projected to decline at a rate of 0.1 percent, while multi-engine fixed wing piston aircraft are projected to decline by 0.5 percent a year. In addition, it is assumed that VLJs and new light sport aircraft could erode the replacement market for traditional piston aircraft at the high and low ends of the market respectively.[3] **Figure 2-2** depicts the current general aviation fleet-mix percentages that are currently active and are broken down by aircraft type. **Table 2-1** depicts the breakdown for all active general aviation and air taxi aircraft showing representation of the historical and future outlook during the forecast period.

The number of general aviation hours flown is projected to increase by 1.7 percent yearly over the forecast period. The FAA projects above average growth in hours will occur after 2023 with increases in the fixed wing turbine aircraft fleet, as well as a rebounding single engine piston fleet and increasing utilization of single 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. Hours flown by turbine aircraft (including rotorcraft) are forecast to increase 3.6 percent yearly over the forecast period, compared with essentially no growth (0.03 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 5.3 percent over the forecast period. The large increases in jet hours result mainly from the increasing size of the business jet fleet, along with a measured recovery in utilization rates from recession induced record lows. Rotorcraft hours, which were less impacted by the economic downturn when compared to other categories and rebounded earlier, are projected to grow by 2.6 percent yearly. An expected decline in utilization rates of turbine rotorcraft is due to the assumption that recently improved affordability at the lower end of the turbine market will sustain the recent market share shift toward turbines; however, as turbine powered rotorcraft replaces the pistons, and since most of their functions will remain unchanged, utilization rates of some of the new turbines will be closer to those of the pistons. Lastly, the light sport aircraft category is expected to see an increase in hours flown of 3.5 percent a year; this is primarily driven by growth in the fleet. Fractional ownership is defined as the opportunity for an individual or a company to purchase a share of an aircraft; most prominently found in the business jet sector.

The number of active general aviation pilots (excluding air transport pilots) is projected to be 510,295 in 2032, an increase of almost 35,000 (up 0.3 percent yearly) over the forecast period. Commercial pilots are projected to increase from 120,865 in 2011 to 130,100 in 2032, an average annual increase of 0.4 percent. In addition, FAA is projecting that by the end of the forecast period a total of 13,900 sport pilots will be certified. As of December 31, 2011, the number of sport pilot certificates issued was 4,066 reflecting steady increase in this new "entry level" pilot certificate that was only created in 2005. The number of private pilots' is projected to

[3] Reference - FAA *Aerospace Forecast Fiscal Years 2012-2032*

grow at an average yearly rate of 0.1 percent over the forecast period to total 199,300 in 2032 from 194,441 in 2011.

TABLE 2-1 FAA FORECAST: U.S. GENERAL AVIATION AND AIR TAXI AIRCRAFT ACTIVITY

	Fixed Wing				Rotorcraft					
	Piston		Turbine							
	Single Engine	Multi Engine	Prop	Jet	Piston	Turbine	Experimental	Light Sport Aircraft	Other	Total General Aviation Fleet
Historical										
2008	145,497	17,515	8,907	11,042	3,498	6,378	23,364	6,811	5,652	228,664
2009	140,649	16,474	9,055	11,282	3,499	6,485	24,419	6,547	5,480	223,876
2010	139,519	15,900	9,369	11,484	3,588	6,514	24,784	6,528	5,684	223,370
2011	138,560	15,810	9,430	11,760	3,685	6,725	24,225	6,645	5,680	222,520
2012	137,600	15,735	9,505	12,050	3,780	6,940	24,480	6,930	5,670	222,690
2013	136,650	15,660	9,570	12,410	3,875	7,165	24,810	7,180	5,665	222,985
2014	135,790	15,615	9,645	12,835	3,975	7,415	25,170	7,365	5,655	223,465
2015	135,010	15,570	9,720	13,340	4,075	7,675	25,500	7,530	5,650	224,070
2016	134,285	15,500	9,795	13,880	4,165	7,930	25,835	7,690	5,640	224,720
2017	133,650	15,425	9,870	14,470	4,250	8,180	26,162	7,845	5,635	225,490
2018	133,090	15,340	9,950	15,060	4,335	8,435	26,500	8,000	5,630	226,340
2019	132,645	15,260	10,030	15,650	4,420	8,685	26,830	8,160	5,625	227,305
2020	132,335	15,175	10,120	16,265	4,505	8,940	27,160	8,315	5,615	228,430
2021	132,125	15,090	10,205	16,915	4,590	9,200	27,490	8,470	5,610	229,695
2022	132,010	15,010	10,300	17,620	4,680	9,465	27,825	8,630	5,605	231,145
2023	131,975	14,935	10,400	18,370	4,775	9,745	28,155	8,785	5,600	232,740
2024	132,015	14,875	10,515	19,170	4,875	10,040	28,490	8,940	5,590	234,510
2025	132,150	14,815	10,625	20,020	4,975	10,345	28,820	9,100	5,585	236,435
2026	132,370	14,745	10,740	20,865	5,075	10,650	29,150	9,255	5,580	238,430
2027	132,660	14,680	10,860	21,760	5,180	10,965	29,480	9,410	5,575	240,570
2028	133,020	14,610	10,975	22,700	5,285	11,275	29,815	9,570	5,570	242,820
2029	133,470	14,540	11,090	23,690	5,390	11,590	30,145	9,725	5,560	245,200
2030	134,000	14,470	11,205	24,730	5,495	11,905	30,480	9,880	5,555	247,720
2031	134,625	14,405	11,320	25,805	5,600	12,225	30,810	10,040	5,550	250,380
2032	135,340	14,350	11,445	26,935	5,705	12,550	31,140	10,195	5,545	253,205
AAG	**-0.1%**	**-0.5%**	**0.9%**	**4.0%**	**2.1%**	**3.0%**	**1.2%**	**2.1%**	**-0.1%**	**0.6%**

Source: 2012-2032 FAA Aerospace Forecast
Notes / AAG – Average Annual Growth ; Historical data is from 2000-2009, FAA General Aviation and Air Taxi (and Avionics) Surveys
Prepared by: Armstrong Consultants, Inc., March 2012

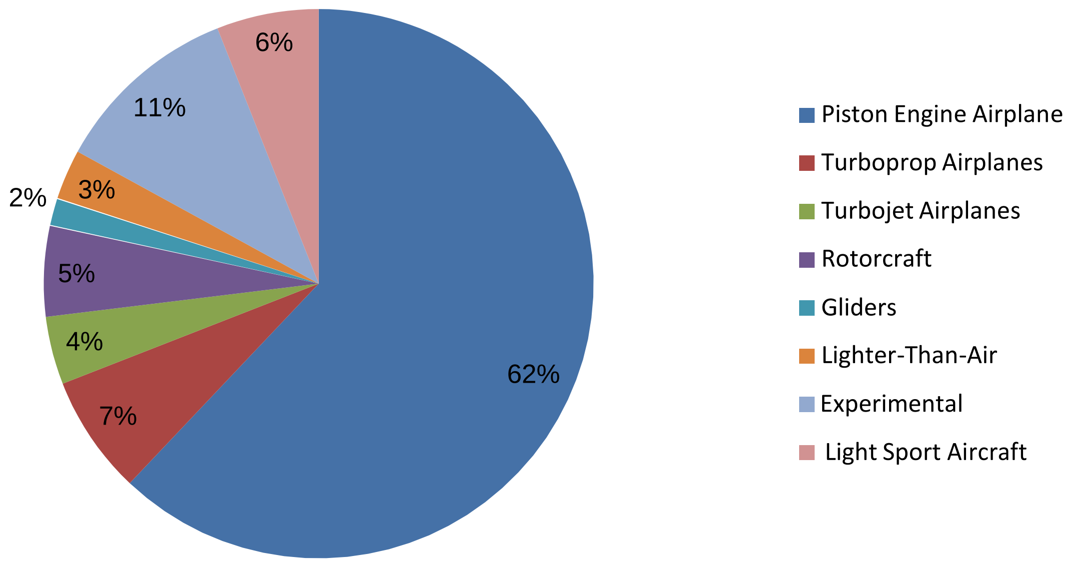


FIGURE 2-2 U.S. GENERAL AVIATION FLEET MIX

Source: FAA Aerospace Forecast 2012-2032
Prepared by: Armstrong Consultants, Inc., March 2012

Another industry trend is the increasing amount of research funding for programs like the Small Aircraft Transportation System (SATS), as illustrated in **Figure 2-3**. The National Aeronautics and Space Administration (NASA), Federal Aviation Administration, States, industry and academic partners have joined forces to pursue the NASA National General Aviation Roadmap leading to a Small Aircraft Transportation System. This long-term strategic undertaking seeks to bring next-generation technologies and improved air access to small communities. The envisioned outcome is to improve travel between remote communities and transportation centers in urban areas by utilizing a new generation of single-pilot light aircraft for personal and business transportation between the nation's 5,400 public use general aviation airports. Current NASA investments in aircraft technologies are enabling industry to bring affordable, safe and easy-to-use features to the marketplace, including "Highway in the Sky" glass cockpit operating capabilities, affordable crashworthy composite airframes, more efficient IFR flight training and revolutionary aircraft engines.

FIGURE 2-3 SATS CONCEPTUALIZATION

Source: NASA Nebraska Space Grant & EPSCoR

To facilitate this initiative, a comprehensive upgrade of public infrastructure must be planned, coordinated and implemented within the framework of the national air transportation system. State partnerships are proposed to coordinate research support in key public infrastructure areas. Ultimately, SATS may permit more than tripling aviation system throughput capacity by tapping the under-utilized general aviation facilities to achieve the national goal of doorstep-to-destination travel at four times the speed of highways for the nation's suburban, rural and remote communities.

2.3 FORECASTING APPROACH

Projections of aviation demand incorporate local, regional and national trends assessing existing and future demand. Unique methods have been applied in the development of the forecasts presented in this chapter. Socioeconomic factors and tourism projections for the Las Vegas and Phoenix markets were analyzed; the comparison of relationships among these various indicators provides the initial step in the development of realistic forecasts of demand. Activity levels generated by each forecasting approach are presented in the following sections. Methodologies used to develop forecasts described in this chapter include:

- Socioeconomic Trends
- FAA Aerospace Forecast
- 2008 Arizona State Systems Plan
- Travel Propensity Factor (TPF)
- 2012 Terminal Area Forecast (TAF)

The base year for the forecasts is 2011 and the forecast period is 20 years, with reporting periods at five-year increments of 2016, 2021, 2026, and 2031 and the preferred forecasts are presented at the end of each activity section. The average annual growth rate (AAG) forecasting utilizes historical data to establish a growth rate for future years. AAG is determined by the first and the last years in the historical period, and the length of the time in between those years. Future projections are determined by applying the AAG to a base level of activity and forecasting levels for the desired number of years.

Grand Canyon West has a unique situation in that nearly 100 percent of the operation is based on tour operations with visitors from Las Vegas and Phoenix. The tourism market for Las Vegas and Phoenix are the driving force to the passenger and operations forecast for the Airport. The forecasted tourism growth for those two metropolitan cities will determine the growth of Grand Canyon West Airport. It should be noted, however, that consumer spending is by far the largest component of the U.S. economy. Burdened by high debt and rising unemployment, consumer spending increased only 1.3 percent in 2010. The recovery in consumer spending is projected to be modest with increases of 2.3 percent in both 2011 and 2012 as households continue to struggle to reduce debt burdens and rebuild retirement assets.

2.3.1 SOCIOECONOMIC TRENDS

Socioeconomics examine the direct relationship between economic and social factors that examine and develop an understanding of the service area. Local conditions that are examined typically focus on the population, economic strength of the area (per capita personal income) and the ability of the focus area to sustain economic growth throughout the planning period. Based upon the observed and projected correlation between historical aviation activity and the socioeconomic data, projected aviation forecasts are developed.

Due to Grand Canyon West Airport's unique operation, local socioeconomic trends for Peach Springs do not have an impact on the future growth of the Airport. Metropolitan cities such as Las Vegas and Phoenix and potentially Los Angeles, San Francisco, or Chicago in the future and will provide the majority of the visitors to the Airport. Utilizing socioeconomic trends in terms of tourism projections from these metropolitan cities provide for a more accurate future forecast for Grand Canyon West Airport.

2.3.2 FAA AEROSPACE FORECAST

The FAA Terminal Area Forecast (TAF) is an annual publication that outlines the FAA's future expectations for airports in the National Plan of Integrated Airport Systems (NPIAS). The 2011 TAF serves as the baseline for forecasting methodologies. Data from the TAF will generate the growth rates used to forecast future aviation activity. The 2011 TAF is used to analyze historical correlation between aviation activity and the independent variables in the forecast methodology.

The first step in preparing aviation forecasts is to examine historical and existing activity levels and current available forecasts from other sources. The FAA TAF (December 2011) indicates 21 existing based aircraft at Grand Canyon West Airport, 144,800 existing annual operations and 64,543 annual enplanements. The TAF forecasts no growth over the projected planning period cumulating with 21 based aircraft, 64,543 annual enplanements and 144,800 annual operations in 2030 (see **Figure 2-4**).

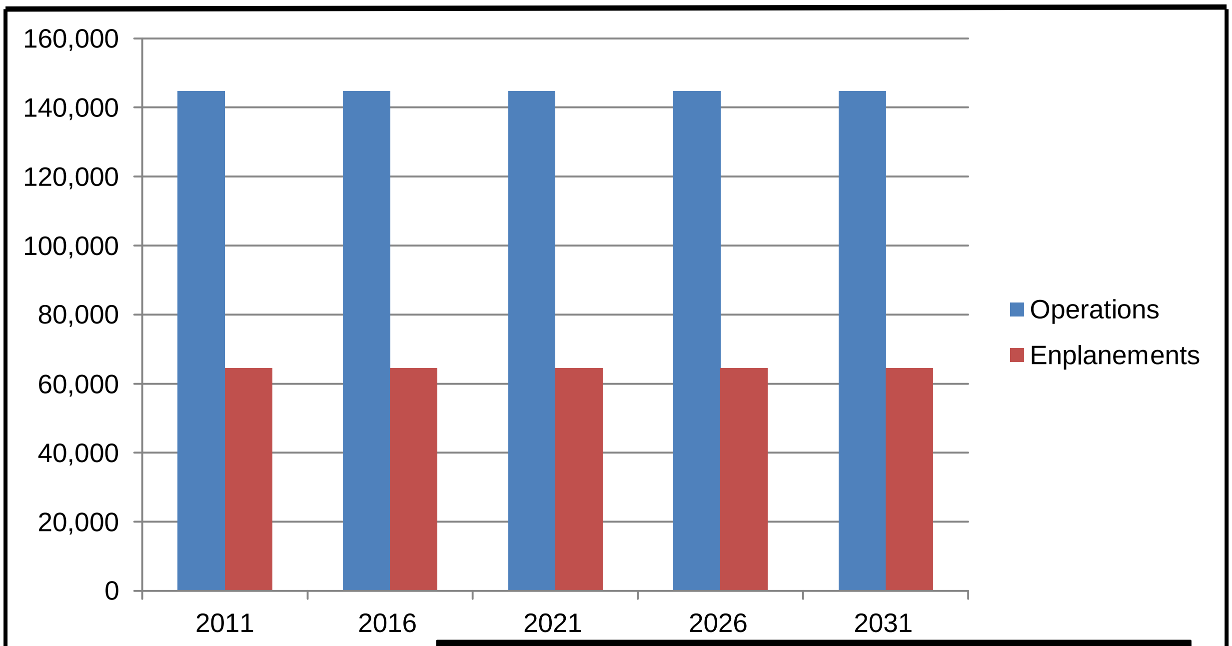


FIGURE 2-4 FAA TAF PROJECTED OPERATIONS AND ENPLANEMENTS

Source: FAA, 2012
Prepared by: Armstrong Consultants, Inc., March 2012

2.3.3 ARIZONA STATE AIRPORTS SYSTEMS PLAN FORECAST

The 2008 Arizona State Airports System Plan (SASP) is a document that summarizes the needs of Arizona's airports and provides each airport with valuable information such as the economic importance of the airport and projected forecasted growth. **Figure 2-5** shows the forecast for Grand Canyon West Airport with a base year of 2007 in terms of enplanements and operations. The SASP project enplanements to increase at an average annual growth rate of 2.5 percent; while the total operations are projected to grow at much slower average annual rate of 1.9 percent.

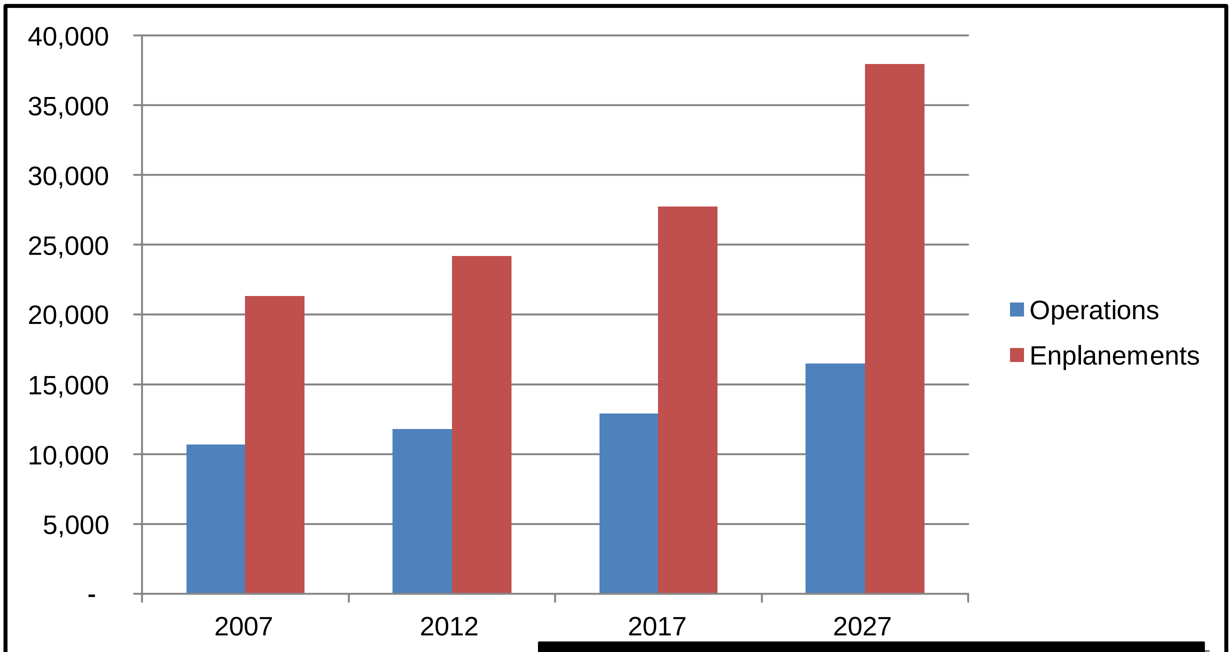


FIGURE 2-5 2008 SASP FORECAST FOR AIR TOUR SERVICE

Source: SASP, 2008
Prepared by: Armstrong Consultants, Inc., March 2012

2.3.4 TRAVEL PROPENSITY FACTOR

The Travel Propensity Factor (TPF) method is defined as an individual's ability and willingness to travel based on various factors pertaining to life-style and socioeconomic conditions. This method may be used in determining forecast scenarios pertaining to enplanements and operations. In this report, historical enplanement and operations data was used in determining the average load factor over the course of the past ten years. Future projections are forecasted based on the average load factor over the past ten years applied to the planning period.

2.3.5 2012 TERMINAL AREA FORECAST (TAF)

The FAA Terminal Area Forecast (TAF) is an annual publication that outlines the FAA's future expectations for airports in the National Plan of Integrated Airport Systems (NPIAS). The 2011 TAF serves as the baseline for forecasting methodologies. Data from the TAF will generate the growth rates used to forecast future aviation activity. The 2011 TAF is used to analyze historical correlation between aviation activity and the independent variables in the forecast methodology.

The first step in preparing aviation forecasts is to examine historical and existing activity levels and current available forecasts from other sources. The FAA TAF (January 2012) indicates 10 existing based aircraft for Grand Canyon West Airport, 140,300 existing annual operations and 54,977 annual enplanements. The TAF shows zero growth over the projected planning period except for based aircraft which is projected to grow 40 percent over the planning period. In 2031, the TAF projects 14 based aircraft, 64,543 annual enplanements and 140,300 annual operations in 2031.

2.4 FAA RECORDS OF BASED AIRCRAFT AND OPERATIONS

FAA Form 5010-1, Airport Master Record, is the official record kept by the Federal Aviation Administration 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 and this information is generally obtained from the airport sponsor. The accuracy of these documents varies directly with the sponsor's record keeping system. The FAA Form

5010-1 (January 2012) for Grand Canyon West Airport indicates there are no based aircraft and 130,300 annual aircraft operations for the year 2010. This form also breaks down the airport's operations to 130,000 air taxi and 300 general aviation Itinerant operations.

2.5 EXISTING AVIATION ACTIVITY

According to Airport Management there are 15 based helicopters and 114,496 annual operations at Grand Canyon West Airport. Between 2010 and 2011, helicopter and fixed wing operations and enplanement increased over 20 percent, as shown in **Table 2-2**. This annual growth was utilized as the baseline determinant for future projections. The Airport serves predominately single-engine piston and multi-engine piston aircraft, turbojet and turbo prop aircraft and rotorcraft. The primary users of the Airport include:

Air Tour Operators: Air tour operators make up close to 100 percent of the aviation activity at the Airport. Fixed wing and helicopter air tour operators originate from Las Vegas and Phoenix. There are eleven air tour operators who utilized fixed wing aircraft ranging from the Piper Saratoga to DCH-6 Twin Otter. Helicopters range from the AS350 to the EC-130. The operations at the airport range from in and out (origin and destination) and down and up operations into the Canyon.

General Aviation: Tourism within state of Arizona plays a significant role in the economic vitality of regions and communities. Individual communities rely on tourism more than others; however, in almost every section of the State, tourism includes a significant portion of the local employment and economic activity. These users include transient pilots flying into the region to visit recreational and tourist attractions. These users mostly utilize single-engine piston aircraft; however, a small percentage may operate multi-engine piston aircraft and rotorcraft. Other types of aircraft in this category include home-built, experimental aircraft, gliders and ultralights. Grand Canyon West Airport's operation is entirely tourism driven. General aviation users make up strictly in and out operations at that Airport and do not account for significant aviation activity.

Table 2-3 illustrates the FAA formatted breakdown of existing activity at the Airport. Within the table, local operations are considered helicopter down and up activity for the purpose for clearly differentiating the two activities (in and out/down and up). As previously mentioned, down and up operations are technically itinerant operations due to the intermediate stop in the Canyon; however, to accurately determine the capacity and forecast for this Master Plan, down and up operations are considered local.

TABLE 2-2 HISTORICAL AVIATION ACTIVITY GROWTH

2010		2011		AAG
Operations		**Operations**		
Helicopter In and Out	11,512	Helicopter In and Out	14,444	25.5%
Helicopter Down and Up	64,090	Helicopter Down and Up	84,756	32.3%
Fixed Wing	17,404	Fixed Wing	14,996	13.9%
2010		**2011**		
Enplanements		**Enplanements**		
Helicopter In and Out	29,102	Helicopter In and Out	35,259	21.2%
Helicopter Down and Up	145,728	Helicopter Down and Up	198,617	36.3%
Fixed Wing	91,282	Fixed Wing	88,946	2.6%
Total Operations	93,006	Total Operations	114,196	22.8%
Total Enplanements	266,112	Total Enplanements	322,822	21.3%

Source: Airport Management, 2011
Prepared by: Armstrong Consultants, Inc., March 2012

TABLE 2-3 EXISTING AVIATION ACTIVITY

		Local Operations			Itinerant Operations					
Fiscal Year	Based Aircraft	Civil	MIL	Total	AT&C	Civil	MIL	Total	Total Ops	Inst. Ops
2011	15	84,756	0	84,756	29,440	300	0	29,740	114,996	0

Source: Airport Management, December 2011
Prepared by: Armstrong Consultants, Inc., March 2012

2.6 FACTORS INFLUENCING AVIATION DEMAND

Factors influencing aviation demand at Grand Canyon West Airport are based on the growth and operation of the air tour operators who serve the Airport. Las Vegas and Phoenix along with the addition of new origin cities, and increases in ground transportation visitors (motor coach bus, and personal vehicle) will control the demand and growth of the future operation and enplanement projections at the Airport.

Air tour operations serviced by Maverick Airlines, Grand Canyon Airlines, Story Airways, Vegas 500, Vision Air, Papillion Grand Canyon Helicopters, Maverick Helicopters, Serenity Helicopters and Sundance Helicopters connect visitors from the Las Vegas metropolitan area to Grand Canyon West Airport. Service from the Phoenix metropolitan area to Grand Canyon West Airport is provided by Dakota Territory Tours/Sky Safari, Sedona Sky Treks, and Westwind Air Service. The driving factor to forecasted in and out aviation demand at Grand Canyon West is the tourist industry outlook from Las Vegas and Phoenix as well as new cities offering regular service or periodic larger aircraft charter flights.

Additional Grand Canyon West amenities that would influence demand include the development and expansion of the resort activities. Potential future amenities include the addition of lodging at the resort, thrill rides, golf course and future VIP high-end tours.

Diamond Bar Road is 21-miles long and currently connects the Airport to Pierce Ferry Road. Seven miles of this road is currently gravel and limits vehicle access to the Airport. It is anticipated within the initial-term planning period the road will be paved and ground traffic will spike due to the accessibility of a paved road, the return to a more conservative growth trend through the intermediate-, and long-term time frame.

Visitor volume is dependent on the ground and aircraft traffic throughout the planning period. It is anticipated that ground traffic will increase at 15 percent within the initial-term and trend down to 7.5 percent within the intermediate-term, and 4.5 percent within the long-term planning period. This projection is based on the historic growth trend at the Airport, and the capacity analysis completed in 2004. As previously mentioned, the completed paving of Diamond Bar Road will significantly increase the ground traffic for visitors entering Grand Canyon West Airport.

Table 2-4 and **Figure 2-6** illustrates the high-growth, the preferred growth and the low-growth for the visitor volume forecast through the planning period. Ground and aircraft traffic were split and represent the existing breakdown of activity at the Airport.

TABLE 2-4 VISITOR VOLUME FORECAST

High Growth

	2011	AAG	2016	AAG	2021	AAG	2026	AAG	2031
Ground	659,792	22.5%	1,820,067	10%	2,931,237	7.5%	4,208,170	5%	5,370,809
Aircraft	124,205	7.5%	178,312	6%	238,622	5%	304,549	4.5%	388,690
Annual Visitors	783,997	-	1,998,380	-	3,169,859	-	4,512,719	-	5,759,500

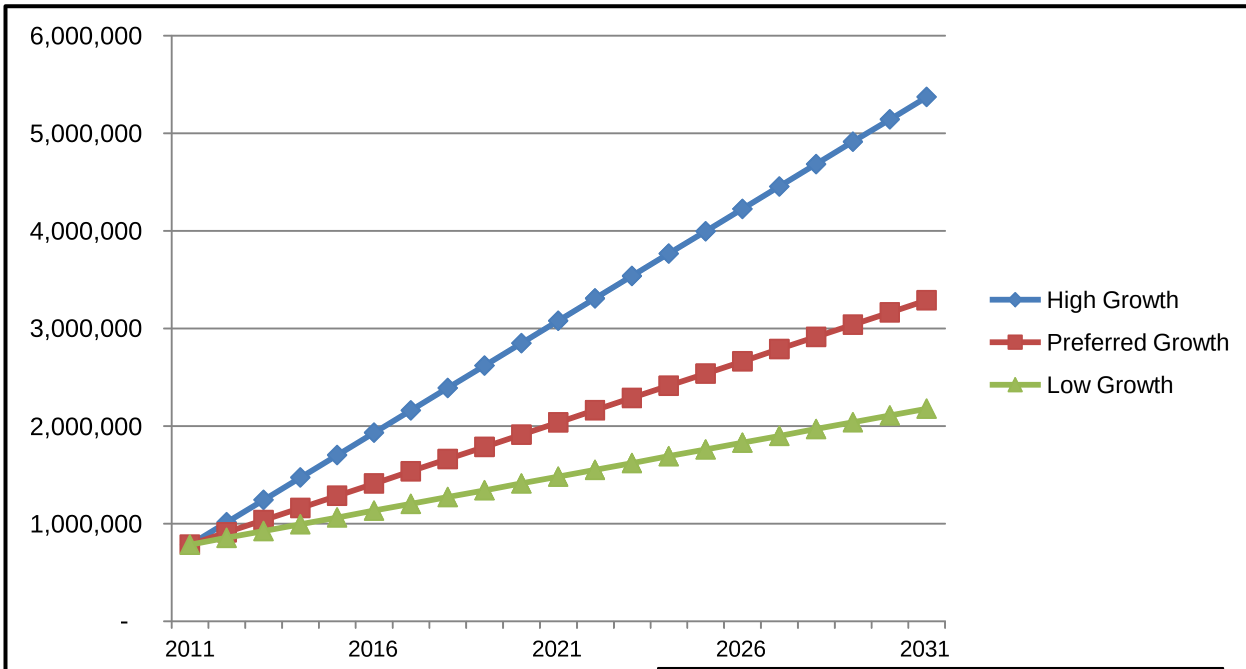
Preferred Growth

		AAG		AAG		AAG		AAG	
Ground	659,792	15%	1,327,077	7.5%	1,905,191	4.5%	2,374,215	4.5%	2,958,704
Aircraft	124,205	5%	158,521	5%	202,317	5%	258,213	5%	329,553
Annual Visitors	783,997	-	1,485,598	-	2,107,508	-	2,632,428	-	3,288,257

Low Growth

		AAG		AAG		AAG		AAG	
Ground	659,792	7.5%	947,217	5%	1,208,915	4.5%	1,506,528	4.5%	1,877,408
Aircraft	124,205	4.5%	154,782	4.5%	192,887	4.5%	240,372	4.5%	299,547
Annual Visitors	783,997	-	1,101,999	-	1,401,802	-	1,746,900	-	2,176,955

Source: 2010-2011 Las Vegas Conventions and Visitors Authority / Arizona Tourism Statistics, 2009
Prepared by: Armstrong Consultants, Inc., March 2012



Source: Armstrong Consultants, Inc.
Prepared by: Armstrong Consultants, Inc., March 2012

FIGURE 2-6 VISITOR VOLUME GROWTH PROJECTIONS

2.7 FORECASTS OF AVIATION ACTIVITY

2.7.1 ENPLANEMENT FORECAST

Passenger enplanements are the total number of revenue passengers boarding an aircraft, including originating, stopover, and transfer passengers, in scheduled and nonscheduled aircraft. The FAA characterizes enplanements as air carrier and commuter. The Airport experiences commuter passenger activity which are defined as those that occur on an aircraft with 60 or fewer seats; total enplanements at Grand Canyon West Airport are provided by commuter enplanements in the form of fixed wing and helicopters. Currently, Grand Canyon West only includes passengers who are boarding an itinerant aircraft or helicopter departing the Airport as an enplanement; however, the FAA is currently in the process of determining whether or not passengers boarding a down and up helicopter could be counted as an enplanement.

There are two types of enplanements, those passengers who board a return flight back to their origin city (an “out” flight) and those that board a helicopter flight into the Canyon (a “down” flight) which are considered enplanements. Arriving passengers (“in” flights) are not counted as enplanements, nor are passengers re-boarding helicopters in the Canyon returning to the Airport (an “up” flight). Currently, for passenger facility charges (PFC) purposes, both “out” and “down” passengers are considered for PFC collection. However, the FAA is currently reviewing the opportunity for PFC collection for “down” passengers.

A typical comparative analysis of passenger forecasts utilizing local population and per capita income would not effectively gauge the forecast for passenger activity at the Airport since the majority of activity conducted at the Airport is tourism driven. Methods to derive the forecasted passenger activity consist of analyzing the anticipated tourism forecast for Las Vegas and Phoenix metropolitan areas. The forecast was determined comparing the growth within the last ten years and determining average annual growth (AAG) expectancy over the 20-year planning period.

Within the passenger forecast, expected AAG was broken down into subgroups 1) in and out passenger forecast broken down by fixed wing and helicopter and 2) down and up passenger forecast. In and out passenger forecast AAG is based on the Las Vegas tourism historical data and projections for the planning period. It is projected to increase at an AAG rate of 4.5 percent, as depicted in **Table 2-5** and **Figure 2-7**. Through the planning period the in and out fixed wing growth will make up 74 percent of the total, and helicopter passenger totals will make up 26 percent of the total in and out passenger numbers for Grand Canyon West Airport.

TABLE 2-5 IN AND OUT PASSENGER GROWTH

	2011	AAG	2016	AAG	2021	AAG	2026	AAG	2031
Fixed Wing	88,946	-	117,305	-	149,714	-	191,078	-	243,869
Helicopter	35,259	-	41,215	-	52,602	-	67,135	-	85,684
In and Out Total	124,205	4.5%	158,521	4.5%	202,317	4.5%	258,213	4.5%	329,553

Source: 2010-2011 Las Vegas Conventions and Visitors Authority / Arizona Tourism Statistics, 2009
Prepared by: Armstrong Consultants, Inc., March 2012

Down and up passengers consist of those who are at the Airport and board a helicopter for a flight down, into the canyon, for an excursion and then re-board the aircraft to fly back to the Airport. The number of combined in and out visitors and ground visitors has a direct impact on the down and up forecast for the Airport. It is projected that the down and up passengers will consist of 25 percent of the total visitor volume within the initial-term of the planning period (following the completion of the paving of Diamond Bar Road), and then trend down to 20 percent of the total visitor volume through the intermediate-, and long-term period, as illustrated in **Table 2-6**. Total passenger growth combining the in and out (fixed wing and helicopter) and down and up (helicopter) passenger growth is found in **Table 2-7.** It is additionally assumed a higher percentage of in and out air passenger's purchase down and up tours, than ground visitors during the planning period.

TABLE 2-6 DOWN AND UP HELICOPTER PASSENGER GROWTH

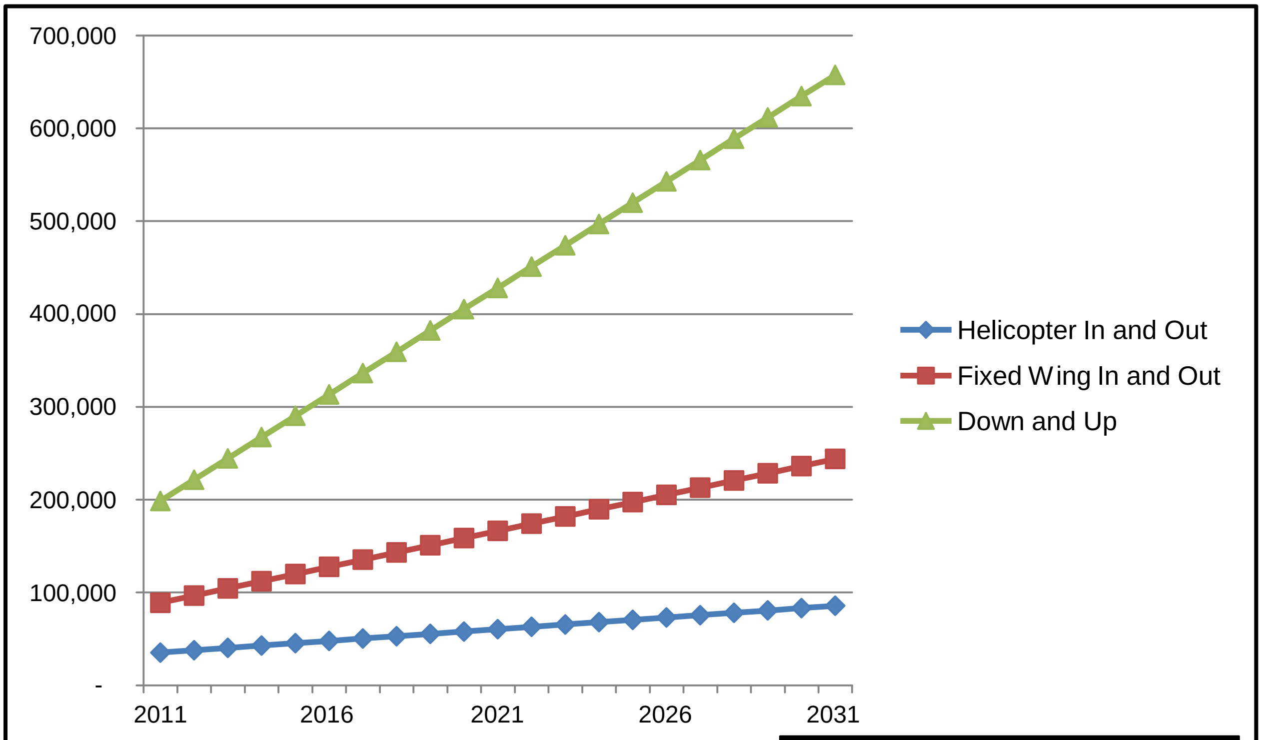
	2011	2016*	2021**	2026**	2031**
Down and Up	198,617	371,399	421,502	526,486	657,651

Source: 2011 Vegas Economic Recovery Study / Arizona Travel Impacts 1998-2010
Prepared by: Armstrong Consultants, Inc., March 2012
**25 percent of total visitor volume*
***20 percent of total visitor volume*

TABLE 2-7 TOTAL PROJECTED PASSENGER GROWTH

	2011	2016	2021	2026	2031
Total Passenger Growth	329,278	529,920	623,818	784,699	987,204

Source: 2011 Vegas Economic Recovery Study / Arizona Travel Impacts 1998-2010
Prepared by: Armstrong Consultants, Inc., March 2012



Source: Armstrong Consultants, Inc.
Prepared by: Armstrong Consultants, Inc., March 2012

FIGURE 2-7 ENPLANEMENT FORECAST

2.7.2 AIRCRAFT OPERATIONS FORECAST

Forecasts of aircraft operations were prepared for air tour operations at Grand Canyon West Airport. Military operations are not present at the Airport, and general aviation operations currently make up approximately 0.2 percent of the total aircraft operations at the Airport. For this forecast, general aviation operations were included within the total aircraft operations forecast. Operations consist of in and out and down and up activity. In and out operations are broken out into fixed wing and helicopter activity, and down and up operations only consist of helicopter activity.

Forecasted activity and operation is based on the passenger load factor for fixed wing and helicopter operations. Passenger load factor (PLF) is defined as a measure of how much of an airline's passenger carrying capacity is used. Although typically expressed as a percentage, it is expressed as passengers per aircraft (load factor) for this analysis. The projected PLF for in and out helicopter activity through the planning period is 4.8 passengers per helicopter. The projected PLF for in and out fixed wing activity during the initial-term is 11.9 passengers per aircraft; however, should the runway be extended, an Air Traffic Control Tower (ATCT) be constructed, and instrument approach published, the forecasted PLF has a likely potential of increasing due to the use of larger aircraft with greater passenger capacity, in turns potentially slowing down the growth of total number of aircraft operations through the planning period. The projected PLF for fixed wing aircraft within the intermediate-term is 12.5 passengers per aircraft and the projected load factor within the long-term is 13.5 passengers per aircraft. These numbers were generated based on the type of aircraft that is anticipated to utilize the Airport over the 20-year planning period such as Dornier 328 (30 seat aircraft), the 50 seat regional jet and the Boeing 737-300 (128 seat aircraft). Over the course of the planning period, operations are expected to grow at an annual average growth rate of 12.3% a year.

Down and up operations are anticipated to increase through the planning period with the addition of helicopter parking pads as well as the potential construction of an ATCT facility.

ATCT will provide for additional communication and an increase in the capacity threshold for in and outs as well as down and up operations into the Canyon. The forecast for operations can be found below in **Table 2-8**.

TABLE 2-8 FORECASTED OPERATIONS GROWTH

	2011	2016	2021	2026	2031
Fixed Wing In and Out	14,996	19,715	23,954	30,572	36,129
Helicopter In and Out	14,444	17,173	21,918	27,973	35,702
In and Out Total	29,440	36,888	45,872	58,546	71,830
Down and Up	84,756	158,042	179,362	224,036	279,852
Total	**114,196**	**194,931**	**225,234**	**282,582**	**351,682**

Source: 2010-2011 Las Vegas Conventions and Visitors Authority / Arizona Tourism Statistics, 2009
Prepared by: Armstrong Consultants, Inc., March 2012

2.7.3 ITINERANT AND LOCAL OPERATIONS

Itinerant operations are defined as all aircraft arrivals and departures other than local operations. These flights typically include those by locally based aircraft; primarily consisting of airline, cargo, personal transportation, air tours and charters, business transportation and recreational flights to and from other airports. At Grand Canyon West Airport, itinerant operations account for approximately 25 percent of the total operation and local operations consist of 75 percent of the total operation, and it is expected to remain fairly constant over the 20-year planning period.

Aircraft operations within this report are defined by transient air tour operations. Typically, general aviation and military operations can be segregated into two further categories - local or itinerant should they be found at the Airport. Local operations are defined as air traffic operating in the local traffic pattern or within sight of the Airport; aircraft known to be departing for, or arriving from, flight in local practice areas located within a 20-mile radius of the Airport; aircraft executing simulated instrument approaches or low passes at the airport and air tours without stops. Local operations at Grand Canyon West are made-up of, air tours, flights in the area. There are 15 based helicopters (down and up activity) at Grand Canyon West Airport and there are no military operations. Within this analysis, local operations consist of the down and up operations that tour the Canyon.

2.7.4 INSTRUMENT OPERATIONS FORECAST

According the 2011 FAA TAF, 23 percent of the total aircraft operations in Arizona are instrument operations. This number is forecast to increase to 28 percent by 2031. Since almost all commercial and business jet flights are Instrument Flight Rules (IFR), the number of instrument operations does not reflect the occurrence of instrument weather or the provisions of instrument approaches at airports. MVFR occurs when the ceiling is 1,000 feet and 3,000 feet. Grand Canyon West Airport does not have an instrument approach to the Airport; however, approximately 30 days of the year are considered IFR/MVFR which totaled approximately 3,060 flights in 2011 affected by IFR/MVFR conditions. As the aircraft fleet mix includes larger aircraft in the future, an instrument approach may be desirable.

2.8 AIRPORT SEASONAL USE DETERMINATION

A seasonal fluctuation in aircraft operations may be expected at any airport. This fluctuation is most apparent in regions with severe winter weather patterns and at non-towered general aviation airports. The fluctuation is less pronounced at major airports, with a high percentage of commercial and scheduled airline activity.

The average seasonal use trend for FAA towered airports from the 1979-1984 records (total aircraft operations handled by tower facilities nationally from FAA Statistical Handbook of Aviation) was used as a baseline for determining seasonal use trends. As discussed above, the seasonal fluctuation is less pronounced at towered airports than non-towered airports.

Grand Canyon West Airport's season activity is most prominent and steady through the summer months (July – September). Tourism is the driving factor at the Airport, and the timing of summer vacation indicates that seasonal traffic should be highest during this time of the year. The winter and spring depict lower traffic numbers, similar to that of towered and non-towered airport activity. This information is presented in **Table 2-9** and in **Figure 2-8**.

TABLE 2-9 SEASONAL USE TREND

Month	Non-Towered	Towered	Grand Canyon West Airport
January	3.5%	7.2%	9.4%
February	4.0%	8.2%	6.2%
March	4.8%	8.6%	4.1%
April	7.5%	9.0%	8.4%
May	11.3%	9.1%	8.6%
June	13.5%	9.4%	9.8%
July	14.8%	9.1%	10.2%
August	13.0%	8.7%	10.6%
September	10.0%	8.7%	10.4%
October	8.0%	7.8%	9.5%
November	5.8%	7.1%	6.6%
December	3.8%	7.1%	6.0%

Source: FAA Statistical Handbook of Aviation, 1979-1984; Airport Management, 2012
Prepared by: Armstrong Consultants, Inc., March 2012.

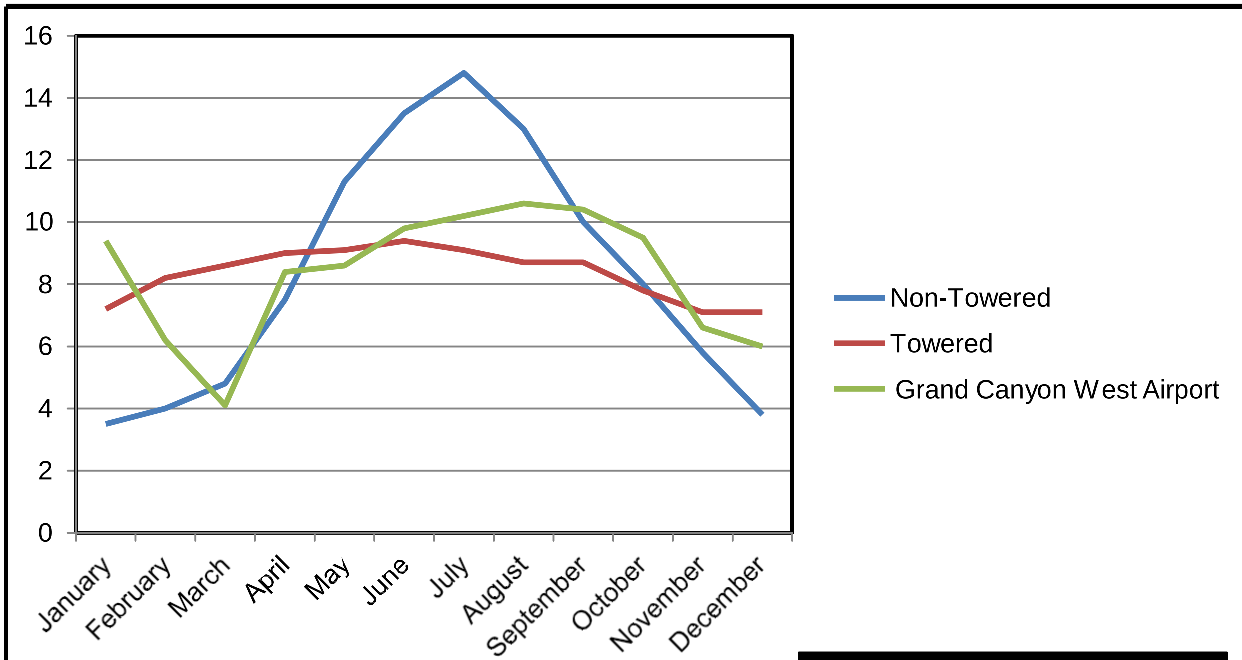


FIGURE 2-8 SEASONAL USE TREND

Source: FAA Statistical Handbook of Aviation, 1979-1984
Prepared by: Armstrong Consultants, Inc., March 2012.

2.9 HOURLY DEMAND AND PEAKING TENDENCIES

In order to arrive at a reasonable estimate of demand at the airport facilities, it was necessary to develop a method to calculate 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.

Approximately 90 percent of total daily operations occur between the hours of 7:00 AM and 7:00 PM (12 hours) at a typical commercial service airport; meaning the maximum peak hourly occurrence may be 50 percent greater than the average of the hourly operations calculated for this time period.

The Estimated Peak Hourly Demand (P) in a given month was, consequently, determined by compressing 90 percent of the Average Daily Operations (D) in a given month into the 12-hour peak use period, reducing that number to an hourly average for the peak use period and increasing the result by 50 percent as follows:

	P	=	1.5 (0.90D / 12)
Where	D	=	Average Daily Operations in a given month.
	P	=	Peak Hourly Demand in a given month.

These calculations were prepared for each month of each phase of the planning period. The results of the calculations are shown in **Table 2-10** and **Table 2-11**. As is evident in the tables, the Design Day and Design Hour peak demand in the planning year occurs under VFR weather conditions in the month of August (highlighted in bold in each Table), with 1,226 daily operations and approximately 138 operations per hour in 2031.

TABLE 2-10 ESTIMATED HOURLY DEMAND/MONTH (PASSENGERS)

Total Visitors	**2011**	**2016**	**2021**	**2026**	**2031**
Annual	783,997	1,478,924	2,096,082	2,618,634	3,271,634
Peak Month (August)	83,104	156,766	222,185	277,575	346,793
Peak Month Average Day	2,732	5,154	7,305	9,126	11,401
Peak Hour	307	580	822	1,027	1,283
In and Out Fixed Wing	**2011**	**2016**	**2021**	**2026**	**2031**
Annual	88,946	117,305	149,714	191,078	243,869
Peak Month (August)	9,482	12,434	15,870	20,524	25,850
Peak Month Average Day	310	409	522	666	850
Peak Hour	35	46	59	75	96
In and Out Helicopters	**2011**	**2016**	**2021**	**2026**	**2031**
Annual	35,529	41,215	52,602	67,135	85,684
Peak Month (August)	3,766	4,369	5,576	7,116	9,083
Peak Month Average Day	124	144	183	234	299
Peak Hour	14	16	21	26	34
Down and Up Helicopters	**2011**	**2016**	**2021**	**2026**	**2031**
Annual	198,617	371,399	421,502	526,486	657,651
Peak Month (August)	21,053	39,368	44,679	55,808	69,711
Peak Month Average Day	692	1,294	1,469	1,835	2,292
Peak Hour	78	146	165	206	258
Total Passengers	**2011**	**2016**	**2021**	**2026**	**2031**
Annual	322,822	529,920	623,818	784,699	987,204
Peak Month (August)	34,219	56,172	66,125	83,178	104,644
Peak Month Average Day	1,125	1,847	2,174	2,735	3,440
Peak Hour	127	2,08	245	308	387

Source: FAA Statistical Handbook of Aviation, 1979-1984 & Data extrapolated from previous section
Prepared by: Armstrong Consultants, Inc., March 2012.

TABLE 2-11 ESTIMATED HOURLY DEMAND/MONTH (OPERATIONS)

In and Out Fixed Wing	**2011**	**2016**	**2021**	**2026**	**2031**
Annual	14,996	19,715	23,954	30,572	36,129
Peak Month (August)	1,590	2,090	2,539	3,241	3,830
Peak Month Average Day	52	69	83	107	126
Peak Hour	6	8	9	12	14
In and Out Helicopters	**2011**	**2016**	**2021**	**2026**	**2031**
Annual	14,444	17,173	21,918	27,973	35,702
Peak Month (August)	1,531	1,820	2,323	2,965	3,784
Peak Month Average Day	50	60	76	97	124
Peak Hour	6	7	9	11	14
Down and Up Helicopters	**2011**	**2016**	**2021**	**2026**	**2031**
Annual	84,756	158,042	179,362	224,036	279,852
Peak Month (August)	8,984	16,752	19,012	23,748	29,664
Peak Month Average Day	295	551	625	781	975
Peak Hour	33	62	70	88	110
Total Operations	**2011**	**2016**	**2021**	**2026**	**2031**
Annual	114,196	194,931	225,234	282,582	351,682
Peak Month (August)	12,105	20,663	23,875	29,954	37,278
Peak Month Average Day	398	679	785	985	1,226
Peak Hour	45	76	88	111	138

Source: FAA Statistical Handbook of Aviation, 1979-1984 & Data extrapolated from previous section
Prepared by: Armstrong Consultants, Inc., March 2012.

2.10 FORECAST SUMMARY

Forecasts were prepared for Grand Canyon West Airport to determine projected aircraft activity levels. Activity estimates were made for passenger enplanements, operations, and the long-term fleet mix. A summary of the forecasts of aviation activity are provided in accordance with the FAA forecast format in **Appendix B**. A review of the Airport Master Plan forecast and TAF indicates that the Airport Master Plan exceeds the TAF in operations and based aircraft. The FAA shows a slow, marginal growth in based aircraft and operations. Actual activity data and projected growth from existing activity levels explains why the Master Plan preferred forecasts exceed the TAF by more than 10 percent. A summary of the preferred growth aviation forecast through the 20-year planning period can be found in **Table 2-13.**

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CHAPTER 3

FACILITY REQUIREMENTS

GRAND CANYON WEST AIRPORT
AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS, INC.
AIRPORT ENGINEERING AND PLANNING

Chapter Three
Facility Requirements

3.1 INTRODUCTION

One of the primary objectives of this planning study is to determine the size and configuration of airport facilities needed to accommodate the types and volume of aircraft expected to utilize the airport. Data from Chapter 1 and forecasts from Chapter 2 are coupled with established planning criteria to determine what improvements are necessary to airside and landside areas. Then, having established the facility requirements, alternatives for providing these facilities are provided in Chapter 4 to determine the viability of meeting the facility needs.

The time frame for addressing development needs usually involves initial-term (0-5 years), intermediate-term (6-10 years) and long-term (11-20 year) periods. Long range planning primarily focuses on the ultimate role of the airport and is related to development. Intermediate-term planning focuses on a more detailed assessment of needs, while the initial-term analysis focuses on immediate action items and may include details not geared towards long-term development. The facility requirements described in the initial sections of this Chapter are based on those facilities needed to accommodate the air tour operators pertaining to fixed wing and helicopter aircraft demand at the Airport.

3.2 DESIGN STANDARDS

FAA Advisory Circular 150/5300-13, *Airport Design*, specifies standards for the planning and design of airport facilities. The design standards are based on the Airport Reference Code (ARC), which is based on the most critical aircraft utilizing the airport on a regular basis (500 operations a year) (see **Table 3-1**). Airport design standards exist to promote the development of safe and efficient air transportation. The existing design standards for Runway 17/35 are B-II with the runway pavement strength of 30,000 pounds.

TABLE 3-1 AIRCRAFT APPROACH CATEGORY & DESIGN GROUPS

Approach Category	Approach Speed (knots)
Category A	less than 91
Category B	91 to 120
Category C	121 to 140
Category D	141 to 165
Category E	166 or more

Design Group	Wingspan (ft)	Tail Height (ft)
Group I	less than 49	Less than 20
Group II	49 to 78	20 to 29
Group III	79 to 117	30 to 44
Group IV	118 to 170	45 to 59
Group V	171 to 213	60 to 65
Group VI	214 to 261	66 to 79

Source: FAA, 2012

To ensure that all airport facilities are designed to accommodate the expected air traffic and to meet FAA criteria, the specific ARC for the airport must be determined. In order to designate a specific ARC for an airport, aircraft in that ARC should perform a minimum of 500 annual itinerant operations (250 takeoffs and 250 landings). The majority of aircraft currently utilizing Grand Canyon West Airport have an ARC of A-I through B-II including Twin Otters, Beech 1900's, and Dornier 328's. Examples of aircraft with an ARC of A-I and B-I are listed in **Table 3-2**. Examples of aircraft with an ARC of A-II and B-II are listed in **Table 3-3**. Examples of aircraft with an ARC of C-II and D-II are listed in **Table 3-4**. Examples of aircraft with an ARC of A-III and B-III are listed in **Table 3-5.** Examples of aircraft with an ARC of C-III and D-III are listed in **Table 3-6**. Aircraft with an ARC of A-I through B-II are expected to continue utilizing the Airport in the initial-, intermediate-, and long-term time frames, with an expectation that B-II through C-III operations will continue to increase. Maintaining the existing B-II ARC with the Dornier 328 as the design aircraft in the initial-term is recommended. However, it is recommended that Grand Canyon West Airport be upgraded to ARC C-II in order to accommodate the Canadair 200 Regional Jet (CRJ-200) as the design aircraft during the intermediate time frame and then ultimately upgrade the ARC to C-III within the long-term planning period in order to accommodate the Boeing 737-700 Jet (B737-700). The upgrades in ARC should occur based on actual demand by the air carriers providing service to the airport. Based on activity level forecasts from Chapter 2 fixed wing operations are anticipated to grow from the existing of approximately 15,000 annual operations to over 36,000 annual operations at the end of the 20 year planning period.

TABLE 3-2 ARC A-I AND B-I AIRCRAFT

Aircraft	Approach Speed (knots)	Wingspan (feet)	Tail Height (feet)	Max T.O. Weight (pounds)
Beech Baron 58P	101	37.8	9.1	6,200
Beech Bonanza V35B	70	33.5	6.6	3,400
Beech Airliner C99	107	45.9	14.4	11,277
Cessna 170	60	36.0	9.8	2,200
Cessna 182	64	36.0	9.2	2,950
Cessna 206	68	35.1	9.7	3,612
Cessna 207	75	35.8	9.6	3,800
Cessna 402	95	39.8	11.6	6,300
Cessna 421	96	41.7	11.6	7,450
Cessna Citation I	108	47.1	14.3	11,850
Gates Learjet 28/29	120	43.7	12.3	15,000
Piper Archer II	86	35.0	7.4	2,500
Piper Cheyenne	110	47.6	17.0	12,050
Raytheon Beech Jet	105	43.5	13.9	16,100
Eclipse 500 Jet	90	37.9	13.5	5,920
Mustang	98	43.2	13.5	8,645

Source: FAA AC 150/5300-13, Airport Design & Aircraft Manufacturer's Data
Prepared by: Armstrong Consultants, Inc., May 2012

TABLE 3-3 ARC A-II AND B-II AIRCRAFT

Aircraft	Approach Speed (knots)	Wingspan (feet)	Tail Height (feet)	Max T.O. Weight (pounds)
Beech Airliner 1900D	120	57.9	14.9	17,120
Beech Super King Air B200	103	54.5	14.1	12,500
Cessna 208	79	52.1	14.2	7,300
Cessna 441	100	49.3	13.1	9,925
Cessna Citation II	108	51.6	15.0	13,300
Cessna Citation III	114	50.6	16.8	17,000
Cessna Citation Bravo	112	52.2	15.0	14,800
Cessna Grand Caravan(2B)	90	52.1	15.5	8,750
Dassault Falcon 50	113	61.9	22.9	37,480
Dassault Falcon 200	114	53.5	17.4	30,650
Dassault Falcon 900DX	100	63.4	24.8	45,500
DHC-6 Twin Otter	75	65.0	19.5	12,500
Dornier 228	101	55.7	15.9	12,570
Dornier 328	100	68.8	23.8	30,843
Gulfstream I	113	78.5	23.0	35,100
Pilatus PC-12	85	52.3	14.0	9,920

Source: FAA AC 150/5300-13, Airport Design & Aircraft Manufacturer's Data
Prepared by: Armstrong Consultants, Inc., May 2012

TABLE 3-4 ARC C-II AND D-II AIRCRAFT

Aircraft	Approach Speed (knots)	Wingspan (feet)	Tail Height (feet)	Max T.O. Weight (pounds)
Canadair CL-600	125	61.8	20.7	41,250
Bombardier CRJ 200ER	142	69.7	20.5	47,000
Bombardier CRJ 700	135	76.1	24.8	67,000
Bombardier CRJ 900	142	76.3	24.7	82,500
Embraer ERJ-145	133	65.9	22.2	42,460
Gulfstream G350	136	77.8	24.4	70,900
1329 JetStar	132	54.5	20.4	43,750
Sabre 80	128	50.4	17.3	24,500
Gulfstream G250	141	63.0	21.4	39,600
Gulfstream G450	145	77.1	25.2	74,600
Rockwell 980	121	52.1	14.9	10,325
Cessna Citation 650	126	53.6	20.4	23,000
Cessna 750 Citation X	131	63.6	19.3	36,100
Astra 1125	126	52.5	18.2	23,500
Hawker 125-1000	130	61.9	16.6	36,000
Falcon 900 EX	126	63.5	24.9	48,300

Source: FAA AC 150/5300-13, Airport Design & Aircraft Manufacturer's Data
Prepared by: Armstrong Consultants, Inc., May 2012

TABLE 3-5 ARC A-III AND B-III AIRCRAFT

Aircraft	Approach Speed (knots)	Wingspan (feet)	Tail Height (feet)	Max T.O. Weight (pounds)
DCH-8 Dash 8-400	100	93.2	27.3	64,500
Embraer 170	119	83.2	32.4	79,300
MDC-DC-3	72	95.0	16.4	25,200

Source: FAA AC 150/5300-13, Airport Design & Aircraft Manufacturer's Data
Prepared by: Armstrong Consultants, Inc., May 2012

TABLE 3-6 ARC C-III AND D-III AIRCRAFT

Aircraft	Approach Speed (knots)	Wingspan (feet)	Tail Height (feet)	Max T.O. Weight (pounds)
Gulfstream V	160	98.6	25.1	89,000
Airbus 320-100	138	111.2	39.0	145,464
Bombardier Global Express	126	94.0	24.1	93,500
Boeing 737-700	130	112.6	41.6	154,500
Boeing 737-300	135	94.8	37.6	138,500
Embraer 190/200	160	92.2	33.9	103,593
Airbus A320-100	138	111.2	39.0	145,200

Source: FAA AC 150/5300-13, Airport Design & Aircraft Manufacturer's Data
Prepared by: Armstrong Consultants, Inc., May 2012

3.3 AIRSIDE FACILITY REQUIREMENTS

3.3.1 DEMAND AND CAPACITY ANALYSIS

Annual Service Volume. The Annual Service Volume (ASV) is a calculated reasonable estimate of an airport's annual capacity; taking into account differences in runway utilization, weather conditions and aircraft mix that would be encountered in one year. When compared to the forecasts or existing operations of an airport, the ASV will give an indication of the adequacy of a facility in relationship to its activity level. The ASV is determined by reference to the charts contained in FAA Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*.

The FAA has developed a computer software program entitled "Airport Design." The program provides the user with recommended runway lengths according to FAA design standards. The FAA Airport Design Program was used to calculate the ASV for a single runway airport with the forecasted operation levels determined in Chapter 2 - Forecasts of Aviation Activity. ASV for the existing single runway configuration is 230,000 operations per year with a long-term forecasted annual demand of 36,129 operations or 15 percent of capacity. Under these conditions, the existing runway facilities will adequately meet the demand within the time frame of this study.

The demand/capacity relationship provides airport's with valuable planning tools that will aid in determining the timing of airfield capacity enhancing projects. Demands that approach and/or exceed the ASV will result in significant delays at the airport; and demands can occur before an airport has reached its capacity. According to FAA Order 5090.3C, *Field Formation of the National Plan of Integrated Airport Systems (NPIAS),* planning for capacity enhancing projects should begin once the airfield has reached 60 percent of its current capacity and construction of capacity enhancing projects should be complete prior to reaching 80 percent of ASV.

3.3.2 RUNWAY LENGTH REQUIREMENTS

Runway Length. Runway length at an airport is determined by evaluating the requirements of the critical design aircraft having more than 500 annual itinerant operations. FAA Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design*, provides guidance for determining runway length requirements. The FAA Airport Design Program was used to calculate recommended runway length requirements. The information required to execute the program for recommended runway lengths, includes airfield elevation, mean maximum temperature of the hottest month and the effective gradient for the runway[1]. The input data for Grand Canyon West Airport is as follows:

Elevation: 4,813 feet MSL
Mean Maximum Temperature of Hottest Month: 97.5˚ F
Effective Gradient: 61.7 feet

With this data, the Airport Design Program provides several runway length recommendations for both small and large aircraft according to varying percentages of aircraft fleet and associated takeoff weights. According to the runway length analysis, Runway 17/35 at the existing length can accommodate over 75 percent of the small aircraft with less than 10 passenger seats. The existing runway length can also accommodate large aircraft up to 30,000 pounds, such as the Dornier 328. A summary of the data provided by the program is listed in **Table 3-7** for the runway length requirements during summer months (peak temperature) and **Table 3-8** illustrates the runway length requirements during spring and fall temperatures.

TABLE 3-7 RUNWAY LENGTH ANALYSIS – SUMMER MONTHS

Airport and Runway Data	
Existing Runway Length	5,000 feet
Airport Elevation	4,813 feet
Mean daily maximum temperature of the hottest month	97.5 ˚F
Maximum difference in runway centerline elevation	61.7 feet
Length of haul for airplanes of more than 60,000 pounds	500 miles
Runway Lengths Recommended for Airport Design	
Small airplanes with less than 10 passenger seats, < 12,500 pounds	
75 percent of these small airplanes	4,640 feet
95 percent of these small airplanes	6,180 feet
100 percent of these small airplanes	6,390 feet
Small airplanes with 10 or more passenger seats	6,390 feet
Large airplanes of 60,000 pounds or less	
75 percent of these large airplanes at 60 percent useful load	7,490 feet
75 percent of these large airplanes at 90 percent useful load	9,220 feet
100 percent of these large airplanes at 60 percent useful load	11,620 feet
100 percent of these large airplanes at 90 percent useful load	11,620 feet
Airplanes of more than 60,000 pounds	Approximately 7,700 feet

Source: FAA Computer Software Program, Airport Design Version 4.2D
Prepared by: Armstrong Consultants, Inc., May 2012

[1] The actual difference in feet from runway end to runway end is required to run the FAA software program and is listed as the effective gradient. However, the effective gradient is usually shown as a percent

TABLE 3-8 RUNWAY LENGTH ANALYSIS – SPRING AND FALL MONTHS

Airport and Runway Data	
Existing Runway Length	5,000 feet
Airport Elevation	4,813 feet
Mean daily maximum temperature of the hottest month	75.0 ˚F
Maximum difference in runway centerline elevation	61.7 feet
Length of haul for airplanes of more than 60,000 pounds	500 miles
Runway Lengths Recommended for Airport Design	
Small airplanes with less than 10 passenger seats, < 12,500 pounds	
75 percent of these small airplanes	4,320 feet
95 percent of these small airplanes	5,590 feet
100 percent of these small airplanes	5,800 feet
Small airplanes with 10 or more passenger seats	5,800 feet
Large airplanes of 60,000 pounds or less	
75 percent of these large airplanes at 60 percent useful load	6,730 feet
75 percent of these large airplanes at 90 percent useful load	9,030 feet
100 percent of these large airplanes at 60 percent useful load	8,700 feet
100 percent of these large airplanes at 90 percent useful load	10,300 feet
Airplanes of more than 60,000 pounds	Approximately 7,700 feet

Source: FAA Computer Software Program, Airport Design Version 4.2D
Prepared by: Armstrong Consultants, Inc., May 2012

As shown on **Figure 3-1** and **Figure 3-2**, based on the required runway lengths for these categories of aircraft, the current length of Runway 17/35 does not satisfy the takeoff runway length requirements for some B-II aircraft, as well as anticipated C-III aircraft during high summertime temperatures. Therefore, a future runway length of 6,500 feet is recommended to accommodate C-II (CRJ-200) aircraft with a stage length of 260 nautical miles (which is the distance from Grand Canyon West Airport to Los Angeles International Airport) with full passengers during the majority of the year. An ultimate runway length of 7,700 feet is recommended to accommodate C-III (B737-400) aircraft with a stage length of 260 nautical miles and full passengers during the majority of the year. While these would be the ideal runway lengths, various physical, environmental, financial or political constraints may limit the Airport's ability to achieve these lengths. Alternatives for achieving the recommended runway lengths are evaluated in the next chapter.

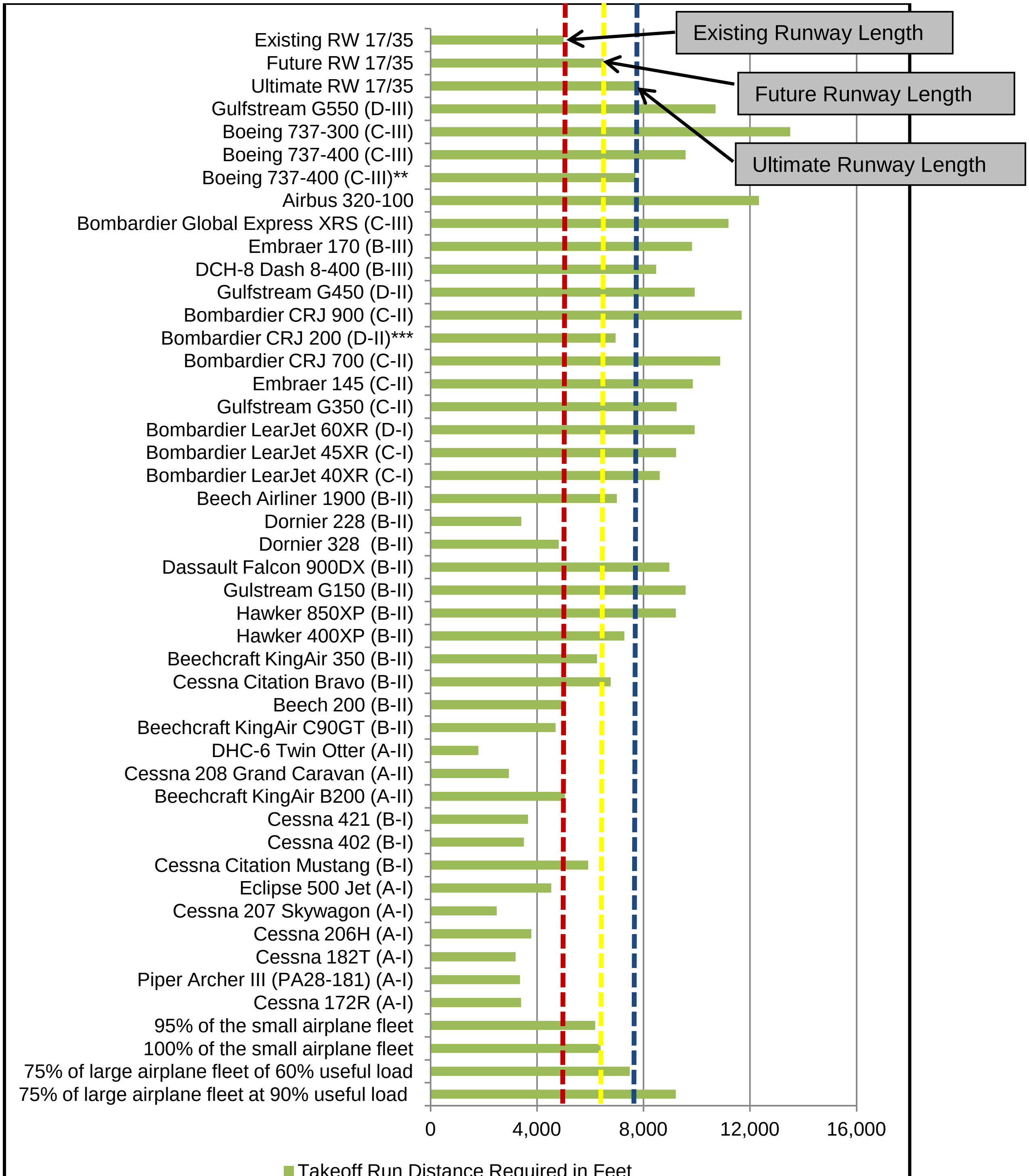


FIGURE 3-1 RUNWAY LENGTH REQUIREMENTS – SUMMER MONTHS

Source: Armstrong Consultants, Inc., May 2012
Prepared by: Armstrong Consultants, Inc., May 2012
Note/Takeoff distances are shown at Maximum Certificated Takeoff Weight (MCTW).
***Boeing 737-700 with a full passenger load and 260 nm stage length to Los Angeles.*
**** Canadair Regional Jet 200 with full passenger load and 260 nm stage length to Los Angeles.*

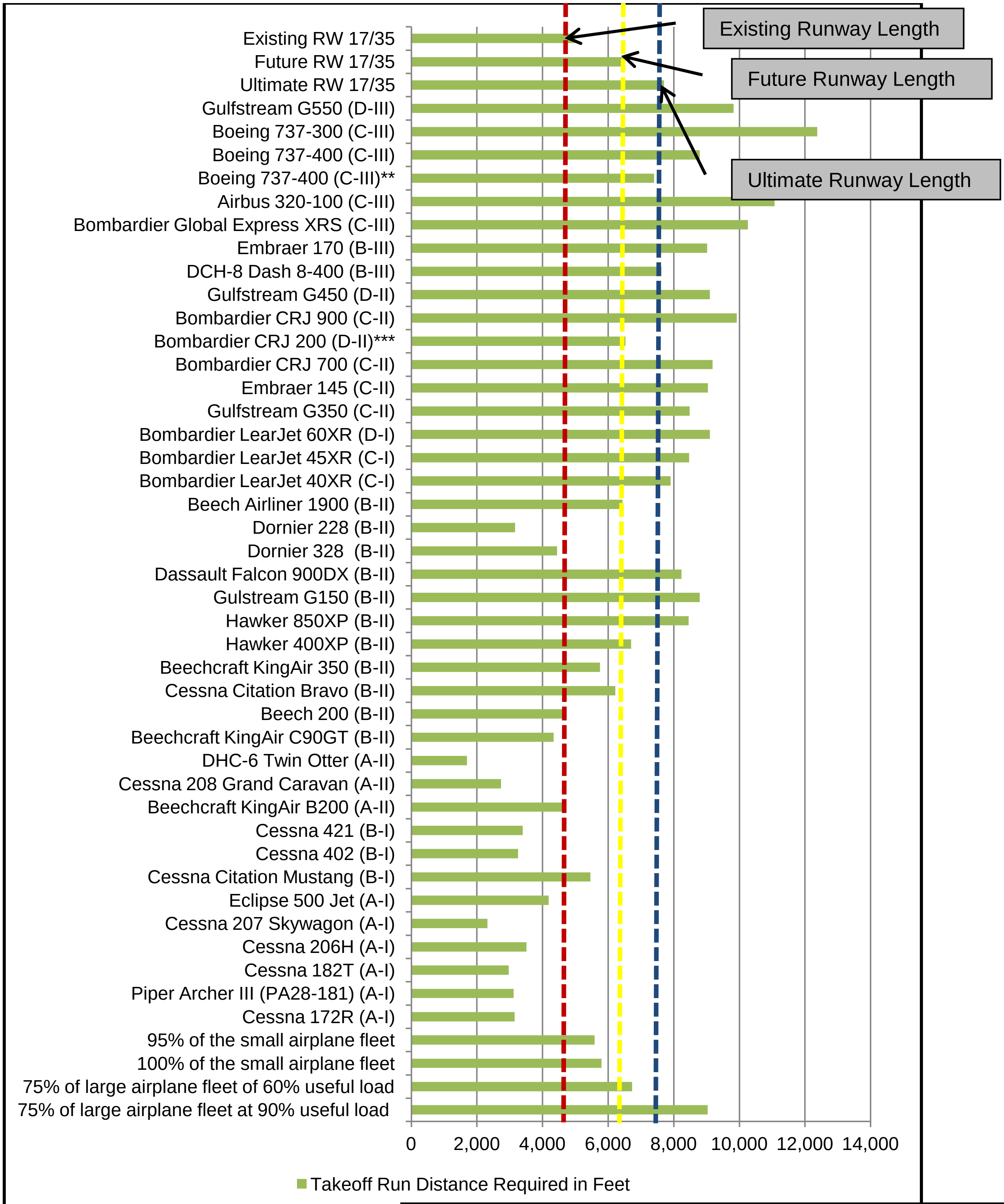


FIGURE 3-2 RUNWAY LENGTH REQUIREMENTS – SPRING AND FALL MONTHS

Source: Armstrong Consultants, Inc., May 2012
Prepared by: Armstrong Consultants, Inc., May 2012
Note/Takeoff distances are shown at Maximum Certificated Takeoff Weight (MCTW)
***Boeing 737-700 with a full passenger load and 260 nm stage length to Los Angeles.*
****Canadair Regional Jet 200 with full passenger load and 260 nm stage length to Los Angeles.*

3.3.3 RUNWAY STRENGTH AND WIDTH. Runway strength requirements are normally based upon the design aircraft expected to utilize the airport on a regular basis. The existing strength of Runway 17/35 is 30,000 pounds Single Wheel Gear (SWG) and is considered adequate during the initial- time frame based on the existing Dornier 328 being the existing design aircraft. In order to accommodate the CRJ-200 (C-II) aircraft in the future the runway strength should be increased to 45,000 pounds SWG and 60,000 pounds Dual Wheel Gear (DWG). In order to accommodate the B737-400 (C-III) aircraft in the ultimate configuration the runway pavement strength should be increased to 110,000 DWG.

FAA design standards for runways serving aircraft having an ARC of B-II require a runway width of 75 feet and 100 feet for runways serving aircraft having an ARC of C-II or C-III; Runway 17/35 is currently 75 feet wide and is constructed with asphalt and is in excellent condition. The runway edge lights are located 10 feet beyond the runway edge. A runway width of 100 feet is recommended to coincide with C-II and C-III design standards.

3.3.4 CROSSWIND RUNWAY REQUIREMENTS

Wind data was collected through equipment monitored and provided by NRG Energy. The equipment that collected the wind data is the NRG Symphonie and an NRG 9300, and the tower is located approximately 6.5 miles southwest from the Runway at an elevation of 5,784 feet. The FAA recommends that the runway orientation provide at least 95 percent crosswind coverage. If the wind coverage of the runway does not meet this 95 percent minimum for the appropriate ARC, then a crosswind runway should be considered. Runway 17/35 currently meets the crosswind component criteria with 99.06 percent coverage; therefore, a crosswind runway is not justified per FAA guidelines.

3.3.5 RUNWAY INCURSIONS

The Airport is not controlled by an Air Traffic Control Tower (ATCT), therefore all pilots and ground vehicles are responsible for maintaining communication on the common traffic advisory frequency (CTAF: 122.9) to avoid runway incursions. An ATCT is recommended and will be discussed later in the chapter.

3.3.6 TAXIWAY AND TAXILANES

The primary function of a taxiway system is to provide access between runways and the terminal area. The taxiways should be located so that aircraft exiting the runway will have minimal interference with aircraft entering the runway to expedite exit from active runway or minimize time aircraft is on active runway. Taxiways expedite aircraft departures from the runway and increase operational safety and efficiency.

Taxiways and taxilanes serving Group III aircraft should be constructed 50 feet wide while maintaining a 118 feet wide Taxiway Safety Area (TSA). The design standard for Group III Taxiway Object Free Area (OFA) is 186 feet wide while Taxilane (OFA) is 162 feet wide. It is recommended that Group III design standards be planned for and that Group III separations and widths be implemented when justified by Group III aircraft activity levels.

According to FAA Advisory Circular 150/5300-13, *Airport Design*, the required runway to taxiway centerline separation for a runway with an ARC of C-III is 400 feet. Taxiway A, the full-length parallel taxiway, is 35 feet in width and is located 400 from taxiway centerline to runway centerline. Grand Canyon West Airport currently exceeds ARC B-II runway to taxiway centerline separation standards for the current and future visibility minimums of 1-statue miles. The 400 foot taxiway runway separation meets the requirements for C-III lower than 1-statue mile; however, it is recommended Taxiway A be widened to 50 feet to meet Group III requirements in the long-term.

The strength of the taxiway should be maintained at strength equal to that of the associated runway pavement. Currently, the pavement strength of the parallel taxiway at Grand Canyon West Airport is 30,000 pounds SWG. It is recommended that when the runway strength is increased the taxiway strength should be increased to match. It is recommended that the full-length parallel taxiway be extended to match the future runway length to enhance safety and efficiency by minimizing back-taxiing on the runway in the long-term. It is recommended that the parallel taxiway maintain 400 feet separation from the taxiway centerline to the runway centerline. This separation distance will satisfy a future upgrade to an ARC of C-III. It is also recommended that the taxiway fillets be widened to meet Group III requirements when the taxiway is widened.

Should a general aviation development area be constructed to the east of the runway, it would be recommended to initially construct a partial parallel taxiway and ultimately a full length parallel taxiway to the east of the runway, at 400 foot separation, to mitigate runway crossings and to separate air tour operations from general aviation activity.

3.3.7 AIRCRAFT AND HELICOPTER APRON DESIGN

The apron space requirements included in **Table 3-9** were developed according to the standards given in AC 150/5300-13, *Airport Design*. Consideration must be made in the overall apron requirements for aircraft parking and tiedown requirements, helicopter parking area and heliports, taxilanes, adjacent taxiways and proximity to all aircraft expected to use the Airport.

Apron Requirements. The aircraft parking apron should provide enough parking for accommodating the peak month average day arrivals assuming 80 percent of the peak day aircraft are parked on the apron during the same time. Based on the forecast there are currently 26 daily arrivals during the peak month average forecasts indicated that by 2031 the airport could have 63 daily arrivals during the peak month average. **Table 3-9** shows the apron area requirements.

The aircraft apron area is in excellent condition and provides sufficient tiedown positions for existing transient aircraft. Grand Canyon West Airport does not have any based fixed wing aircraft, and due to the nature of the Airport and the unique operations, does not expect to have based fixed wing aircraft throughout the planning period. It is recommended the air tour aircraft apron be expanded from the existing size of 53,061 square yards to 88,020 square yards through the planning period to accommodate the forecasted demand of fixed wing air tour operations. The recommended square yards for the fixed wing parking apron would accommodate hardstand aircraft parking up to a Boeing 737 sized aircraft.

It is recommended a designated apron area be developed for segregation of air tour operators and general aviation aircraft to better enhance the service of both operations. General aviation operations are also expected to pick up during the planning period. It is recommended to accommodate the long-term demand, based on the 360 square yards per transient aircraft, that approximately 56,492 square yards of apron space be designed for general aviation fixed wing activity. This size is based on anticipated growth from general aviation activity over the 20 year planning period.

Tiedown Requirements. Aircraft tiedowns should be provided for small and medium size transient fixed wing aircraft utilizing the Airport. These aircraft risk being damaged or may cause damage or injury in sudden wind gusts if not properly secured. The current tiedown layouts on the aircraft ramp are based on Group II taxilane Object Free Area (OFA). The airport currently provides 43 designated parking spaces to handle aircraft up to a Dornier 328. Planning parameters identify that the fixed wing apron meets the needs of the initial-term; however, apron expansion is necessary for the Airport to accommodate the demand through the long-term planning period. It is recommended the aircraft apron accommodate 51 aircraft parking positions during peak daily transient aircraft throughout the planning period. Future apron configuration should include sufficient space for ground service equipment (GSE) for a Boeing 737 or Airbus 320 including, but not limited to, air stairs and fuel trucks.

General aviation operations are also expected to increase during the planning period. It is recommended to accommodate the long-term demand that approximately 31 tiedown spaces be provided for general aviation fixed wing activity.

Heliport and Helicopter Apron. FAA Advisory Circular (AC) 150/5390-2C, *Heliport Design*, is used to provide guidance on dimensions of areas surrounding heliport and helicopter parking area. The EcoStar 130 (EC130) is the design helicopter utilized by air tour operators and is expected to remain the design helicopter through the planning period. Helicopter operations are primarily used for air tour operators and medivac operations. The EC130 has a rotor diameter of 35 feet and a length of 41 feet.

An Airport capacity study was conducted by Aviation Safety Audit Specialists, LLC in May 2012 to determine the threshold of activity for helicopters conducting the Down and Up operation from the Grand Canyon as well as the In and Out operation to and from the Airport. It was determined that river landing pads and Guano Point were the constraining factors for helicopter down and up operations.

A heliport requires a TLOF, Final Approach and Takeoff Area (FATO) and Safety Area. Operations to/from a heliport are conducted just like a runway and require minimum separation design criteria when operations occur in close proximity to a runway serving fixed-wing aircraft. In and Out operations are located adjacent (North) to the fixed wing aircraft apron to the west of Runway 17/35. An In and Out operation is considered a transient fixed wing or helicopter operation that brings visitors to and from the Airport.

Down and up passenger operations consist of those who are at the Airport and board a helicopter for a flight down into the Canyon for an excursion and then re-board the helicopter to fly back to the Airport. There are currently 15 parking pads and five TLOFs accommodating the existing down and up helicopter passengers. To meet long-term demand, approximately 12 additional TLOF pads and 35 additional parking pads need to be developed to accommodate the down and up operations during the 20 year planning period.

In and out helicopters are transient helicopters which fly into the Airport from another airport. The in and out helicopter activity provides the same services as the fixed wing air tours except they arrive at the airport in a helicopter rather than a fixed wing aircraft. There are currently 14 parking pads designated for the in and out helicopter traffic and three TLOFs. In order to meet the long term demand approximately 2 additional TLOF pads and six additional parking pads need to be developed to accommodate the in and out helicopter passengers during the 20 year planning period.

The fixed wing and helicopter requirements are shown in **Table 3-9.**

TABLE 3-9 FIXED WING APRON AND HELICOPTER TLOF AND PARKING PAD REQUIREMENTS

Item	Base Year (2011 E)	Base Year (2011 R)	2016	2021	2026	2031
Fixed Wing Air Tour Apron Requirements						
Peak Month Average Day Operations	52	52	69	83	107	126
Peak Month Average Day Arrivals	26	26	35	42	54	63
Peak Month Average Day assuming 80 percent of the aircraft on the ground at the same time (includes tiedowns for small aircraft)	43 spaces	21 spaces	28 spaces	34 spaces	44 spaces	51 spaces
Total Fixed Wing Apron Required	**53,061**	**25,914 SY**	**34,552 SY**	**41,956 SY**	**54,295 SY**	**62,933 SY**
Helicopter Down and Up Requirements						
Annual Helicopter Down and Up Operations	84,756	84,756	158,042	179,362	224,036	279,852
Down and Up Helicopter Parking Pads Required	15	15	28	32	40	50
Total Down and Up Helicopter Parking Area Required	**807 SY**	**807 SY**	**1,507 SY**	**1,722 SY**	**2,152 SY**	**2,690 SY**
Helicopter In and Out Requirements						
Annual Helicopter In and Out Operations	14,444	14,444	17,173	21,918	27,973	35,702
In and Out Helicopter Parking Pads Required	14	8	10	12	16	20
Total In and Out Helicopter Parking Area Required	**752**	**430 SY**	**537 SY**	**645 SY**	**860 SY**	**1,074 SY**
TLOF Requirements						
Total TLOFs Required	**8**	**10**	**13**	**15**	**19**	**24**

Source: Armstrong Consultants, 2012
(E) = Existing
(F) = Future

3.3.8 NAVIGATIONAL AIDS

A Navigational Aid (NAVAID) is the primary means of enroute navigation and includes any ground based or satellite based electronic device used to provide course or altitude information to pilots. AC 150/5070-6B, A*irport Master Plans*, defines NAVAIDs as “aids to navigation [that] provide pilots with information to assist them in locating the airport and to provide horizontal and/or vertical guidance during landing.” The following sections provide an overview of existing instrumentation, airport approach capabilities, and the proposed improvements during the planning period.

There are no existing ground–based NAVAIDs located at Grand Canyon West Airport. There are, however, several NAVAIDs within the Grand Canyon West area which provide directional aid to the Airport. The closest NAVAID to the Airport is Peach Springs Very High Frequency Omnidirectional Range with Tactical (VORTAC) information located approximately 24 nautical miles (NM) to the southeast. Approximately 52 NM to the west of the Airport is the Boulder City VORTAC near Boulder City, Nevada. Additionally a VOR with Distance Measuring Equipment (DME) is located at Kingman Airport approximately 52 NM to the southeast.

Navigational aids assist the pilot with en-route navigation and approaches into and out of airports. There are no existing instrument approaches at Grand Canyon West Airport. An obstruction survey is being conducted to identify obstructions in the vicinity of the Airport and to evaluate the potential for establishing an instrument approach procedure (IAP) at the Airport.

The most common new instrument approach procedures utilize the global positioning system (GPS). These approaches utilize a system of orbiting satellites and receivers to provide the location of aircraft and airport facilities. It requires no additional ground-based facilities and can be accomplished with little additional cost. An aircraft GPS receiver can track the position of the aircraft by calculating and comparing signal distance from several satellites. The system is reliable in all terrain and all weather conditions and is typically accurate within 100 feet. If feasible, it is recommended that a Localizer Performance with Vertical Guidance (LPV) GPS approach with minimums as low as ¾-statue mile be established for Runway 17/35 within the future, and ½-statue mile precision approach within the ultimate time-frame. While tourist operations are visually driven, a lower approach would provide for the anticipated growth of corporate and general aviation aircraft to access the Airport whom may not be participating in the down and up helicopter operation, but enjoying all the other activities and lodging the Tribe and Resort have to offer that are not weather dependent. The feasibility of establishing an IAP to the Airport, given the proximity to the Grand Canyon, SFAR airspace, and surrounding terrain, will be evaluated in the next chapter. The development of an IAP at the Airport would also allow aircraft to descend below 1,000 or 2,000 foot ceilings to support down and up operations that are being conducted below the ceiling.

3.3.9 AIRFIELD LIGHTING, SIGNAGE AND VISUAL AIDS

Visual aids provide the pilot guidance once the aircraft is within sight of an airport, and aids only in the transition of flight to landing. Both Runway 17 and 35 are equipped with a Precision Approach Path Indicator (PAPI-4) and Runway End Identifier Lights (REILs). Runway 17/35 is equipped with Medium Intensity Runway Lights (MIRL), and there is also an airport rotating beacon located on the Airport which is in good condition. All marking and signage meet existing standards.

Other lighting and markings consist of Medium Intensity Taxiway Lights (MITLs); nonprecision runway markings; aircraft hold bar markings; wind cones and a segmented circle with traffic indicators; lighted runway entrance signs; surface painted hold position signs; runway hold position signs; taxiway and runway location, directional and destination signs; and, runway distance remaining signs. It is recommended that all existing signage be maintained in good operating condition.

It is recommended the Airport install High Intensity Runway Lights (HIRLs) and Medium Intensity Approach Lighting System (MALSR) to accommodate a precision approach with as low as ½-mile visibility minimums.

3.4 LANDSIDE FACILITY REQUIREMENTS

Landside facilities are an important compliment to airside facilities. Landside facilities serve as the processing interface between the surrounding community and the airport operating environment and often offer travelers the first impression of the area. These facilities house the support and infrastructure for airside operations and generate revenue for the airport.

Large portions of the Airport's property are undeveloped, providing potential for new future landside development. Recognizing market realities and development costs, an overall master plan can establish a low-risk, step-by-step approach to exploit this resource for beneficial results to the Airport, the Grand Canyon Resort Corporation and the Hualapai Tribe. New development at Grand Canyon West Airport should establish a sense of place, an abstract concept made up of the impressions one gets by the elements that make up the built environment.

It is important that any new development establish a positive impression through coordinated planning and design. By doing so, these responsible actions will make the Airport an attractive location for tourist and cultural activity. A sense of place with an allure to tourism will be established by simple actions directed at building design and placement, layout of roads, infrastructure and landscaping.

In addition to the passenger terminal programming and requirements discussed below, it is also recommended to construct a pilot's lounge/executive terminal building/fixed base operator (FBO) for general aviation transient visitors. The pilots lounge would offer services for pilots which include public restrooms, telephones, flight planning services, pilots lounge and information regarding airport services.

3.4.1 TERMINAL REQUIREMENTS

The terminal facility requirements for the Airport Master Plan are determined by an analysis of the following: existing terminal plans, on-site observations, data from comparable airports (size), industry standards, and planning guidelines. To establish the existing service level baselines, existing terminal facilities were analyzed to determine the current planning factors. Planning factors are based on August 2011 peak hour data and annual visitor volume. Every airport has unique operating characteristics requiring consideration when projecting future terminal requirements. The baseline planning factors determined for the design day peak hour (DDPH) are then compared to industry standards and other comparable airport planning factors to determine if deficiencies or excesses exist. These deficiencies or excesses are then reconciled with on-site observations to determine if they are providing acceptable Levels of Service (LOS) for the passengers of the facility. Existing and future planning factors can be found in **Table 3-10**. Table 3-10 depicts the existing conditions, the recommended conditions for the existing forecast and the projected requirements throughout the planning period.

As discussed throughout the Master Plan, Grand Canyon West Airport has a unique operation, which plays a large factor in the design and requirements of the future terminal. Functional areas of the terminal are based on the flow, and type of operation (in and out fixed wing and helicopter passengers, down and up helicopter passengers and ground visitors).

The functional components of the terminal are divided into the following categories: airline functions, concessions, secure public area, non-secure public area, and non-public area. For each functional area, an “existing factor” is shown based on the existing facilities and passenger/visitor demand levels. If required, the planning factors have been modified to increase or decrease facility requirements based on the standards discussed above.

Demand levels are based on the enplanement and/or visitor numbers based on the type of operation or passenger flow that would utilize the space. The breakdown for operation that will determine the requirements is as follow:

- **In and Out Passengers**: Secure Public Area, Non-Secure Public Areas, Concessions, and Airline Functions (Main Terminal Building)
- **Down and Up Passengers**: Non-Secure Public Areas, Concessions, and Airline Functions (Local Terminal Building)
- **Ground Visitors**: Concessions, General Circulation and Airline Functions.

The existing factors take into account the terminal building, the flight operations building and the concessions/retail building. It is assumed a majority of the airline functions will be located within the Air Terminal building (in and out operations) along with concession and retail space. The space requirements for the Helicopter Terminal (down and up passengers) and Ground Terminal (ground visitors) are also provided. The three functions are currently collocated within the existing terminal building(s). In the future these three functions may be collocated into a single terminal facility or may be segregated into two or three separate facilities. These options are further evaluated in Chapter 4 – Development Alternatives. Within this chapter, the terminal requirements were based on the preferred forecast selected (of 3.2 million annual visitors) for the Airport. Should the Airport experience a higher and/or accelerated growth, **Appendix D** illustrates the terminal planning requirements for high growth (5.7 million annual visitors) planning.

TABLE 3-10 EXISTING FACTORS AND FUTURE PLANNING FACTORS

Description	Passenger Demand Level	Existing Factor	SF	Planning Factor
Airline Functions				
Ticket Counter Area	127	2.40 SF/DDPH	312	3.85 SF/DDPH
Ticket Counter Length	322,822	N/A	N/A	0.35 LF/DDPH
Ticket Counter Queuing	322,822	N/A	N/A	7.00 SF/DDPH
Air Tour Ticket Office (ATO)	322,822	0.004 SF/ANNEP	1,430	11.28 SF/DDPH
Baggage Claim Area	N/A	N/A	N/A	19.00 SF/DDPH
Baggage Claim Frontage	N/A	N/A	N/A	0.60 LF/DDPH
Baggage Claim Devices	N/A	N/A	N/A	8.00 LF/DDPH
Baggage Claim Service Office	N/A	N/A	N/A	1.97 SF/DDPH
Outbound Baggage	N/A	N/A	N/A	19.79 SF/DDPH
Inbound Baggage	N/A	N/A	N/A	11.68 SF/DDPH
Air Tour Operations	322,822	0.004 SF/ANNEP	N/A	0.008 SF/ANNEP
Departure Lounges (Hold rooms)	N/A	N/A	1,347	(See Forecast Req.)
Concessions				
Concessions (Include Storage)	783,997	0.008 SF/ANNEP	6,802	0.008 SF/ANNEP
Secure Public Area				
Passenger Screening Checkpoint	N/A	N/A	N/A	160 DDPH/Lane
Passenger Screening Area	N/A	N/A	N/A	1,300 SF/Lane
Concourse Circulation	N/A	N/A	N/A	3,000 SF/Gate
Non-Secure Public Area				
Circulation – Ticketing	198,617	N/A	N/A	10.50 SF/DDPH
Circulation – Baggage	N/A	N/A	N/A	5.00 SF/DDPH
Circulation – General	198,617	0.005 SF/ANNEP	927	0.015/ANNEP
Non-Public Area				
TSA	N/A	N/A	N/A	1.85 SF/DDPH
Mech./Elec./Maint./Storage	N/A	25% of T. Area	3,360	12% of T. Area
Administration	N/A	10% of T. Area	1,643	3% of T. Area
Total of Terminal Area	N/A	N/A	**15,821**	N/A

Source: DWL Architects, April 2012 and Armstrong Consultants, Inc., May 2012
Prepared by: Armstrong Consultants, Inc., May 2012
Notes/ DDPH: Design Day Peak Hour; ANNEP: Annual Enplanements; SF: Square Feet; LF: Linear Feet

3.4.1.1 GROUND VISITOR TERMINAL BUILDING REQUIREMENTS

The Ground Visitor Terminal Building serves as the access point and facility for visitors arriving via personal vehicle and motor coach. The overall area for the ground visitor terminal requirement consists of concessions, restrooms, administration and air tour ticket counter space and circulation. Functional areas are broken down into circulation, concessions, restrooms and administration and the existing and future requirements and can be found in **Table 3-11**.

Concession space is based on DDPH. Concessions consist of food, beverage, retails, and gift shops. It is assumed that 0.008 square feet per annual passenger (ground visitor) will be used for the analysis. The 2031 forecast requirements for all concession facilities required for ground visitors are 23,669 square feet.

Restrooms space allocation is based on building occupancy and in accordance with local codes. The advisory circular recommends two square feet per visitor. The split between male and female is 50/50; however, there should be 25 percent more facility space made available for females based on functional layout.

Administration office space is generally based on the size of staff in the terminal building. The amount is a local determination. Administration space is not determined based on passenger or visitor forecast. It is also assumed that the majority of the administration space would be located in the Air Terminal building, and space in the ground visitor building would be auxiliary office space.

Circulation planning for all ground visitors was determined based on the assumption of four percent of the building square footage. It is assumed the requirements for circulation will provide a good level of service, condition of stable flow, acceptable flow and a good level of comfort.

TABLE 3-11 GROUND VISITOR TERMINAL BUILDING FACILITY REQUIREMENTS (SQUARE FEET)

	2011 (E)	2011 (R)	2016	2021	2026	2031
Forecast Ground Visitors						
Total Ground	659,792	659,792	1,327,077	1,905,191	2,374,215	2,958,704
Design Day Peak Hour	258	258	520	746	930	1,160
General Space Requirements (Sq ft.)						
Administration (As Needed)	1,391	400	400	400	400	400
Concessions (0.008 SF/ANNPAX)	4,788	5,278	10,616	15,241	18,993	23,669
Restrooms + Support (2.0 SF/DDPH)	872	516	1,040	1,492	1,860	2,320
Tour Ticket Counter (3.85 SF/DDPH)	206	933	2,002	2,872	3,581	4,466
Circulation (4.0% of Total SF)	586	288	562	800	993	1,234
Subtotal General Space Requirements	**7,843**	**7,475**	**14,621**	**20,806**	**25,828**	**32,090**

Source: AC 150/5300-9 and Armstrong Consultants Analysis
Prepared by: Armstrong Consultants, In, May 2012
Notes/ DDPH: Design Day Peak Hour; ANNPAX: Annual Passengers; SF: Square Feet; LF: Linear Feet; E: Existing; R: Required

3.4.1.2 AIR TERMINAL BUILDING REQUIREMENTS – IN AND OUT PASSENGERS

The Air Terminal serves as the location for passengers arriving via fixed wing aircraft or helicopter (i.e. in and out passengers). This terminal building may include secure and non-secure areas in the future, airline functions, public and non-public areas. Secure areas of a terminal building are areas considered sterile to general airport visitors. An increasing push by the Transportation Security Administration (TSA) for security measures within aviation provide an opportunity to plan for these functional areas that may be required within the intermediate and long-term planning period. Discussion regarding security at the Airport is evaluated later in this Chapter in Section 3.5.5.

The passenger screening checkpoint is based on the DDPH multiplier of 7.2 square feet per originating passenger over the course of the planning period. This will determine the number of lanes to provide adequate service within the planning period.

Secure public areas will need to accommodate increased demand and the possible mandate of Transportation Security Administration (TSA) requirements at Grand Canyon West Airport. The increased demand will require a total of three Security Screening Checkpoint (SSCP) lanes, and the area requirement will be increased to reflect lanes meeting TSA planning standards through the planning period. Secure area circulation is increased to reflect an average of 950 square feet per gate for turboprop service and 1,750 square feet per gate for regional jet service. Restroom requirements are based on DDPH passengers. The total programmed area requirement for the secure public area for the 2031 forecast is 8,526 square feet.

Non-public areas consisting of the TSA and administration space have area requirements based on the forecast of passenger demand using the current planning factors. Circulation, maintenance and storage, mechanical and electrical and other requirements (structure, walls, etc) are programmed as percentages of the terminal area based on design of comparable airports. The total programmed area requirement for the non-public area within the secure area for the 2031 forecast is 10,087 square feet.

Airline functional areas consist of ticket counter space, baggage claim area, and EDS in-line screening space. Ticket counter frontage is programmed at 3.85 square feet. Additional ticket counter areas, queuing, and airline ticketing office (ATO) will support the counters required to meet demand. One baggage claim device is required with development and construction of the baggage claim area, baggage service offices, and inbound baggage area. Additions to the future baggage area inspection will need to be included to assume implementation of an in-line EDS programmed at 50 percent of the total outbound baggage area. The airline operations area will be constructed as a result of the existing planning factors and the forecast annual passenger enplanements. Departure lounges (hold rooms) are programmed by the forecast aircraft mix and the departure lounge areas are estimated area requirements for a specific aircraft. The total Air Terminal building requirement for airline functions for the 2031 planning period forecast is 13,569 square feet, as shown in **Table 3-12**.

TABLE 3-12 AIR TERMINAL FACILITY PLANNING – IN AND OUT PASSENGERS (SQUARE FEET)

	2011 (E)	2011 (R)	2016	2021	2026	2031
Forecast In and Out						
In and Out Enplanements	124,205	124,205	158,521	202,317	258,213	329,553
Design Day Peak Hour Passengers	49	49	62	80	101	130
Secure Public Area						
Passenger Screening Chk Pt	N/A	N/A	1 Lanes	2 Lanes	2 Lanes	3 Lanes
Passenger Screening Area (1,300 SF/lane)	N/A	N/A	1,300	2,600	2,600	3,900
Departure Lounge (Holdroom)	N/A	N/A	950	950	2,700	2,700
Restrooms (2.0 SF/DDPH)	N/A	N/A	124	160	202	260
Concessions (0.008 SF/ANNEP)	N/A	N/A	1,268	1,619	2,066	2,636
Other (0.0010 SF/ANNEP)	N/A	N/A	159	202	258	330
Subtotal Secure Public Area	**N/A**	**N/A**	**3,801**	**5,531**	**7,826**	**8,526**
Non-Public Area						
TSA/EDS (1.85 SF/DDPH)	N/A	N/A	115	148	187	241
Administration (As Needed)	252	252	3,000	3,000	3,000	3,000
Circulation (4.0% of Total SF)	927	474	559	745	977	1,245
Maintenance/Storage (2.0% of Total SF)	833	237	280	372	488	622
Mechanical/Electrical (10% of Total SF)	1,045	1,186	1,399	1,862	2,442	3,112
Other (6% of Total SF)	183	128	839	1,117	1,465	1,867
Subtotal Non-Public Area	**3,240**	**2,277**	**6,192**	**7,244**	**8,559**	**10,087**
Non-Secure Public Area						
Circulation – Ticketing (10.5 SF/DDPH)	N/A	N/A	651	840	1,061	1,365
Circulation – Baggage Claim (5 SF/DDPH)	N/A	N/A	310	400	505	650
Circulation – General (0.015 Total SF)	129	60	2,377	3,034	3,873	4,943
Restrooms (2.0 SF/DDPH)	200	98	124	160	202	260
Concessions (.008 SF/ANNPAX)	1,758	994	1,268	1,619	2,066	2,636
Other (0.0010 SF/ANNEP)	100	124	159	202	258	330
Subtotal Non-Secure Public Area	**2,187**	**1,276**	**4,889**	**6,255**	**7,964**	**10,184**
Airline Functions						
Ticket Counter Area (3.85 SF/DDPH)	N/A	N/A	239	308	389	501
Ticket Counter Length (0.35 LF/DDPH)*	N/A	N/A	22	28	35	46
Ticket Counter Queuing (7 SF/DDPH)	N/A	N/A	434	560	707	910
Air Tour Ticket Office (11.28 SF/DDPH)	N/A	N/A	699	902	1,139	1,466
Baggage Claim Area (12 SF/DDPH)	N/A	N/A	744	960	1,212	1,560
Baggage Claim Frontage (0.60 SF/DDPH)	N/A	N/A	37	48	60	78
Baggage Claim Devices (8 SF/DDPH)	N/A	N/A	496	640	808	1,040
Outbound Baggage (19.79 SF/DDPH)	N/A	N/A	1,227	1,583	1,999	2,573
EDS In-Line Screening Area (9.9 SF/DDPH)	N/A	N/A	614	792	1,000	1,287
Inbound Baggage (11.68 SF/DDPH)	N/A	N/A	724	934	1,180	1,518
Air Tour Operations (0.008 SF/ANNEP)	N/A	N/A	1,268	1,619	2,066	2,636
Subtotal Airline Functions	**N/A**	**N/A**	**6,482**	**8,347**	**10,560**	**13,569**
Total Air Terminal Passenger Area	**5,427**	**3,553**	**21,363**	**27,376**	**34,909**	**42,366**

Source: Armstrong Consultants, Inc., May 2012
Prepared by: Armstrong Consultants, Inc., May 2012
Notes/ DDPH: Design Day Peak Hour; ANNEP: Annual Enplanements; SF: Square Feet; LF: Linear Feet; E: Existing; R: Required
**Linear feet totals are not included in the total square footage of the building.*

3.4.1.3 HELICOPTER TERMINAL BUILDING REQUIREMENTS – DOWN AND UP OPERATION

The Helicopter Terminal Building serves as the central point for passengers participating in down and up helicopter operations. Visitors utilizing this facility come from passengers transferring from the In and Out Terminal area (air passengers) as well as the Ground Terminal area (ground visitors). Non-Secure areas of the helicopter terminal are considered circulation, concessions, and restrooms that are available to all air passengers. This public area includes circulation in the ticketing lobby as well as general circulation such as entrance lobbies, fire stairs, vestibules, escalators, and elevators. The existing planning factors for circulation at airline operation areas, concessions and restrooms are increased to reflect new facilities that meet the standards of the expected growth, as shown in **Table 3-13**. Within the Helicopter Terminal building, secure areas do not apply to this terminal building.

TABLE 3-13 HELICOPTER TERMINAL BUILDING FACILITY PLANNING (DOWN AND UP PASSENGERS) (SQUARE FEET)

	2011 (E)	2011 (R)	2016	2021	2026	2031
Forecast Down and Up						
Down and Up Enplanements	198,617	198,617	371,399	421,502	526,486	657,651
Design Day Peak Hour	78	78	146	165	206	258
Airline Functions						
Ticket Counter Area (3.85 SF/DDPH)	N/A	300	562	635	793	993
Ticket Counter Length (0.35 LF/DDPH)**	N/A	27	51	58	72	90
Ticket Counter Queuing (7 SF/DDPH)	N/A	546	1,022	1,155	1,442	1,806
Air Tour Ticket Office (11.28 SF/DDPH)	1,430	880	1,647	1,861	2,324	2,910
Holdroom (0.008 SF/ANNEP)	1,347	1,589	2,971	3,372	4,212	5,261
Subtotal Airline Functions	**2,777**	**3,315**	**6,202**	**7,023**	**8,771**	**10,971**
Non-Secure Public Area						
Circulation – Ticketing (10.5 SF/DDPH)	N/A	819	1,533	1,733	2,163	2,709
Circulation – General (0.015 SF/ANNEP)	312	2,979	5,571	6,323	7,897	9,865
Restrooms (2.0 SF/DDPH)	256	156	292	330	412	516
Concessions (0.003 SF/ANNEP)*	0	596	1,114	1,265	1,579	1,973
Other (0.0010 SF/ANNEP)	N/A	199	371	422	526	658
Subtotal Non-Secure Public Area	**568**	**4,749**	**8,882**	**10,071**	**12,578**	**15,720**
Non-Public Area						
Circulation (4.0% of Total SF)	N/A	324	605	686	857	1,071
Maintenance/Storage (2.0% of Total SF)	610	161	303	343	428	536
Mechanical/Electrical (10% of Total SF)	NA	855	1,599	1,812	2,263	2,829
Subtotal Non-Public Area	**610**	**485**	**908**	**1,029**	**1,285**	**1,607**
Total Down and Up Requirements	**3,955**	**9,403**	**17,588**	**19,932**	**24,893**	**31,122**

Source: Armstrong Consultants, Inc., May 2012
Prepared by: Armstrong Consultants, Inc., May 2012
Notes/ DDPH: Design Day Peak Hour; ANNEP: Annual Enplanements; SF: Square Feet; LF: Linear Feet; E: Existing; R: Required
**Ground and Air Visitors Concession in Air and Ground Terminals Also*
***Linear feet totals are not included in the total square footage of the building.*

3.4.1.4 TERMINAL BUILDING SUMMARY

The overall terminal building facility requirements for the planning period can be found in **Table 3-14**. This includes the totals for the ground visitors, down and up helicopter operation and the in and out aircraft (fixed wing and helicopter) operation. The existing terminal is currently 3,200 square feet deficient in providing adequate space necessary to serve the existing demand. In order to accommodate immediate demand for the helicopter terminal building, the Resort is in the process of acquiring temporary mobile office space to be placed on the west side of Buck and Doe Road within the existing employee parking lot. The proposed buildings will provide 5,760 square feet of additional Helicopter Terminal building space.

TABLE 3-14 OVERALL TERMINAL BUILDING FACILITY PLANNING – DESIGN TOTALS (SQUARE FEET)

	2011 (E)	2011 (R)	2016	2021	2026	2031
Air Terminal Building	5,427	3,553	21,363	27,376	34,909	42,366
Helicopter Terminal Building	3,955	9,403	17,588	19,932	24,893	31,122
Ground Terminal Building	7,843	7,475	14,621	20,806	25,828	32,090
Total Terminal Requirements	**17,225***	**20,431**	**53,572**	**68,114**	**85,630**	**105,578**

Source: Armstrong Consultants, Inc., May 2012
Prepared by: Armstrong Consultants, Inc., May 2012
Notes/E: Existing; R: Required
Non-secure areas were counted more than once depending on the function.

3.4.2 GENERAL AVIATION AND EXECUTIVE HANGAR FACILITIES

Hangars are typically constructed in two forms: conventional box hangars or T-hangars. Conventional box hangars are inherently more flexible and can accommodate larger aircraft while T-hangars offer significant space savings. Hangars can be constructed through a variety of means. The airport sponsor can construct them with their own funds (a less common means) or choose to lease out portions of the airport property for hangars. In this case, an interested party obtains a long-term lease on the land and constructs a hangar (or hangars) on airport property.

At Grand Canyon West Airport fixed wing based aircraft are not anticipated throughout the planning period; however, general aviation hangar facilities are recommended within the planning period due to anticipated growth of overnight transient visitors. It is recommended, based on demand and operation/activity type, that four conventional box hangars be constructed to accommodate future overnight transient activity, and maintenance of air tour operator or airline aircraft. It is recommended a maintenance facility be constructed to offer maintenance services for transient general aviation and air tour aircraft. This maintenance hangar could also serve as a Fixed Base Operator (FBO).

With the increasing number of general aviation aircraft operations anticipated for Grand Canyon West Airport, and the Airport's remote location, a pilot's lounge/executive terminal building is recommended to serve the corporate activity that is anticipated throughout the planning period. This executive terminal should supply amenities such as restrooms, lounge, and flight planning room, small vending area, and telephones.

3.4.3 AVIATION FUEL FACILITIES

There are currently two temporary above ground tanker truck trailers of Jet-A fuel with capacities of 12,000 gallons each at Grand Canyon West. The Jet-A fuel is owned and operated by the Papillion and Sundance Helicopter companies. The current fuel storage area is considered adequate for the initial-term planning period. It is recommended the Airport develop a fuel system that is equipped to handle 32,000 gallons of Avgas and 56,000 gallons of Jet-A fuel through the planning period.

The development of an underground fuel hydrant system is recommended for the down and up helicopter areas. The future general aviation area should include two 12,000 gallon Jet-A and Avgas tanks with self-serve credit card readers and two fueling trucks during FBO hours of operation.

As mandated by the U.S. Environmental Protection Agency (EPA), a Spill Prevention, Control and Countermeasure (SPCC) Plan must be prepared by all facilities subject to regulation 40 CFR 112. The plan aids in preventing any discharge of oil into navigable waters or adjoining shorelines. The plan is intended to provide prevention as opposed to after-the-fact reactive measures commonly described in Oil Spill Contingency Plans. The owner or operator of the facility is responsible for preparing the SPCC Plan. The Plan must be certified by a registered Professional Engineer (PE). Grand Canyon West Airport is equipped with two, above ground storage tanks that handle up to 12,000 gallons each. Papillion and Sundance currently do not have an SPCC plan in place and it is recommended that one be prepared in accordance with the aforementioned regulation.

3.4.4 AIRPORT ACCESS AND VEHICLE PARKING

FAA AC 150/5360-9 provides information on the study of ground access. An important planning consideration in ground access development is proximity of parking sites to activity centers at the terminal and transportation between the two as well as the volume of vehicle traffic expected.

3.4.4.1 AIRPORT GROUND ACCESS

Grand Canyon West Airport is accessed via Diamond Bar Road which turns into Buck and Doe Road within the last four miles to the airport, which is a two lane, paved and gravel road. The road is approximately 21 miles long and connects the Airport to Pierce Ferry Road. The road is paved with the exception of seven miles. Buck and Doe Road enters the Airport from the east and it is recommended the gravel portion be paved within the initial-term planning period. Paving the remainder of Diamond Bar Road is expected to significantly increase the volume of ground visitors and ground vehicle traffic. It is recommended the Airport create a transportation system and facility that segregates the SkyWalk traffic and land excursion visitors to alleviate congestion around the terminal area to enhance safety and passenger flow.

Should the east side of the Airport be developed, a vehicle access road should be constructed to tie into the existing perimeter road. It is also recommended the Airport construct a path for pedestrians and passenger shuttle carts along the western fence line of the existing aircraft apron. This would provide to a safe pathway for passengers deplaning the aircraft and traversing to the Air Terminal.

3.4.4.2 VISITOR AND EMPLOYEE PARKING

Surface parking lots typically require 450 square feet per personal vehicle parking space, including room for automobile circulation within the lot. Adequate parking for employees, visitors by personal vehicle and motor coach tour busses are important criteria for the planning period at Grand Canyon West Airport. The forecast projects an increase in vehicle traffic by an average annual growth (AAG) of 17 percent over the planning period. Because Grand Canyon West Airport is a destination point versus an origin point, traditional planning formulas are not applicable in this case. Historically, visitors by automobile have averaged 500-600 cars daily with approximately three passengers per car, which equates to approximately 650,000 ground visitors a year. Assuming three passengers per vehicle stays the norm, and using seasonal use trends and peak daily demand equations from Chapter 2 - Forecasts of Aviation Activity, parking requirements were calculated. The existing parking capacity is currently deficient for the demand.

Based on calculations provided by the FAA AC 150/5360-9, vehicle parking spaces are routinely based on the total number of enplanements; however, because of Grand Canyon West's unique operation vehicle parking requirements are based on the total number of ground visitors.

During the planning period, it is forecasted that approximately 3 million annual visitors would arrive either by personal vehicle or motor coach. It is forecasted that 60 percent of the traffic would arrive via personal vehicle, and 40 percent would arrive via motor coach in 2031. Assuming three people per car, 1,621 total personal vehicle parking spaces would be needed in the long-term planning period. It is estimated that 147 motor coach spaces will be needed, assuming each motor coach will have an average load of 75 percent of capacity (see **Table 3-15)**.

Approximately 729,552 square feet (17 acres) of space will be required for personal vehicle parking spaces and driving lanes through the planning period, and 185,704 square feet will be required for motor coach parking. Determination of employee parking demand is based on 15 percent of the projected public parking space requirements. It is recommended that 265 parking spaces be provided for employee parking and a designated lot constructed to segregate visitor and employee parking.

TABLE 3-15 OVERALL GROUND VEHICLE PARKING DEMAND

	2011 (E)	2011 (R)	2016	2021	2026	2031
Personal Vehicle						
No. of Spaces	411	500	727	1,044	1,301	1,621
Total Square Feet	184,950	225,000	327,224	469,773	585,423	729,552
Acreage	4.2	5.1	7.5	10.7	13.4	16.7
Motor Coach						
No. of Spaces	15	25	66	95	118	147
Total Square Feet	18,900	31,500	83,294	119,579	149,017	185,704
Acreage	.4	.7	1.9	2.7	3.4	4.3
Employee						
No. of Spaces	N/A	75	119	171	213	265
Total Square Feet	N/A	5,063	8,032	11,531	14,369	17,907
Acreage	N/A	0.1	0.2	0.3	0.3	.4
Total Ground Vehicle Parking						
No. of Spaces	**426**	**600**	**912**	**1,310**	**1,632**	**2,034**
Total Square Feet	**203,850**	**261,563**	**418,550**	**600,883**	**748,809**	**933,164**
Acreage	**4.7**	**5.9**	**9.6**	**13.7**	**17.1**	**21.4**

Source: Armstrong Consultants, Inc., July 2012
Prepared by: Armstrong Consultants, Inc., July 2012
Notes/ (E): Existing ;(R): Required

3.4.5 SECURITY

The Airport is currently fenced with an eight foot chain link fence with three strands of barbed wire along the top. The chain link property fence is in good condition and there are currently four pedestrian gates and one vehicle gate. There is a perimeter road on the east and west side of the Airport. All future development that would expand the existing airport infrastructure and boundary should include the realignment and expansion of the security fence.

There is a security booth monitored by the Grand Canyon West Airport security personnel who prevent personal vehicles beyond the terminal area on Buck and Doe Road. It is recommended that based on the expansion, relocation of the booth might be necessary to maintain its purpose of not allowing personal vehicles beyond the terminal area. There are currently no existing requirements for security at the Grand Canyon West Airport. Future activity at the Airport may require a security plan, secured areas on the airport badges and controlled access.

For the long-term, depending on the security measure changes imposed by the Transportation Security Administration (TSA) upgraded security measures could be implemented at airports who service Part 135 aircraft specifically. Grand Canyon West Airport is a Part 139 airport; however, serves Part 135 and general aviation aircraft currently. Should the Airport expand its operation to serve passengers with baggage or to serve Part 121 service, upgrades to the Airport's security would be necessary based on 49 CFR Parts 1540, 1542 and 1544 which require airport management to establish operational and safety procedures and institute certain security measures to meet FAA and TSA requirements for airport certification.

Part 1540 provides rules that cover all segments of civil aviation security. Part 1542 provides the rules and regulations for airport operators and states that the airport operator must provide law enforcement personnel to support its security program and to support each system for screening persons and accessible property required under parts 1544 or 1546. Part 1544 implements the screening of checked baggage. It is recommended that the Airport monitor and comply with TSA requirements found in 49 CFR 1540, 1542 and 1544 through the planning period.

3.4.6 AIRPORT RESCUE AND FIRE FIGHTING (ARFF) BUILDING

Grand Canyon West Airport is classified as a Class III Part 139 Certificated Airport which means the Airport is certificated to serve scheduled operations of small air carrier aircraft (e.g. 10-30 passenger seats), and is required to provide ARFF services. The ARFF Index level required is determined by the longest passenger aircraft with an average of five daily departures serving the airport as follows:

- Index A – Aircraft less than 90 ft in length
- Index B – Aircraft at least 90 ft but less than 126 ft,
- Index C – Aircraft at least 126 ft but less than 159 ft,
- Index D – Aircraft at least 159 ft but less than 200 ft, and
- Index E – Aircraft greater than 200 ft in length.

The Dornier 328 is currently the most demanding passenger aircraft in terms of length, measuring 70 feet, utilizing the Airport on a daily basis. The Dornier 328 specifications fall within the Index A aircraft category. Should an aircraft that falls within the Index B category occur on a daily basis exceeding five daily flights, the Airport will need to upgrade in order to meet Index B standards.

An ARFF building was constructed at Grand Canyon West Airport in 2009 and has two vehicle bays capable of accommodating two ARFF trucks that allow the Airport to provide Index A level of service (as shown in **Table 3-16)**. The ARFF requirements for Indices A and B are shown in **Table 3-17.** It is, however, recommended that the Airport acquire an additional ARFF truck within Index B criteria (such as a Striker 1500 or Panther 1500) in the initial-term due to the high potential for additional daily flights the unique role the Airport serves with a high percentage of charter aircraft and helicopter flights, and the remote location of the Airport. The existing ARFF building is not suitable for the Initial-, Intermediate-, or Long-term. An expanded ARFF facility is recommended within the initial-term when the Airport purchases the new ARFF truck. It is recommended the facility include ARFF vehicle storage, equipment and living quarters for firefighters. It is recommended an auxiliary ARFF facility be considered should the Airport choose to expand its operation to the east side of the airfield. It is recommended that the Airport purchase an ARFF truck similar to the E-1 Titan III that is on loan to the Airport.

TABLE 3-16 ARFF EQUIPMENT INVENTORY

Vehicle	Year	Condition
Ford CAFS F-550 Fire Truck	2003	Good
International Fire Truck (200 gal ender)	1999	Good
F250 Super Duty 4x4 Truck (3)	2007, 2007, 2010	Good
Ford Ambulance (2)	1992, 1996	Good
Polaris Sportsman 500-ATV	2006	Good
E-1 Titan III (loaner)	1986	Good
Ford 350 XLT Super Duty Ambulance	2011	Good

Source: Airport Management, 2012
Prepared by: Armstrong Consultants, Inc., April 2012

TABLE 3-17 ARFF REQUIREMENTS

Index	Aircraft	Vehicles and Extinguishing Agent
A	Less than 90 ft	One Vehicle carrying the following: Once vehicle carrying at least 500 pounds of sodium based dry chemical, halon 1211, or clean agent, or One vehicle carrying 450 pounds of potassium based dry chemical and water with a commensurate quantity of ARFF to total 100 gallons.
B	At least 90 ft but less than 126 ft	Either of the following: One vehicle carrying at least 500 pounds of sodium based dry chemical or halon 1211 and 1,500 gallons of water and the commensurate quantity of AFFF for foam production Two vehicles: One vehicle carrying the extinguishing agents as specified for in Index A; and one vehicle carrying an amount of water and the commensurate quantity of AFFF so that the total quantity of water for foam production carried by both vehicles is at least 1,500 gallons

Source: 14 CFR Part 139, 2011
Prepared by: Armstrong Consultants, Inc., May 2012.

3.4.7 GROUNDS MAINTENANCE EQUIPMENT AND STORAGE BUILDING

Grand Canyon West Airport and the Hualapai Tribe are responsible for grounds maintenance and snow removal at the Airport. The Airport currently utilizes 15 pieces of maintenance equipment. No additional grounds maintenance equipment is recommended within the future planning period. Currently all the maintenance and snow removal equipment and its accessories are stored next to the existing ARFF building. A designated snow removal equipment (SRE) building (40 feet by 60 feet) for maintenance equipment is recommended to accommodate the future planning period. The Airport is in the process of acquiring new SRE and should continue replacing equipment as it wears out.

3.4.8 AIR TRAFFIC CONTROL TOWER

Air traffic control tower (ATCT) facilities, function, and airspace were described in Chapter 1 - Airport Inventory. Grand Canyon West Airport does not currently have an ATCT; however, it is recommended that one be constructed to enhance the safety for the various operations that occur at the Airport. Down and up operations and in and out operations (fixed wing and helicopter) are forecasted to increase through the planning period. Existing and future increases in operations support/indicate the need for a tower. Grand Canyon West has a unique high volume mix of traffic which includes slow moving helicopters conducting down and up operations, to various sized fixed wing aircraft and helicopters traveling at a faster speed arriving and departing the airport. Throughout the planning period, it is anticipated that total operations (In and Out, Down and Up as well as corporate and general aviation) will increase by 80 percent over the 20-year planning period which will increase the need for an ATCT.

An ATCT siting determination study and analysis was conducted to determine the optimal location for the Tower. Air traffic controllers must have a clear view of all arrival paths, departure paths and all ground (aircraft and vehicular) movements under their jurisdiction. In this regard, controller line-of-sight is an important factor for evaluating tower location and certain off-airport development projects. Five sites were initially studied as a possible location for the ATCT and results from the study would determine the optimal location of the tower. Based on evaluation and determination of necessary control cab height required by the FAA to meet visual requirements as well as each site's impact to the CFR Part 77 transitional surfaces, it is recommended that three sites are carried forward into Chapter 4 for further evaluation. It is also recommended that either the Airport request the FAA conduct a Benefit Cost Analysis (BCA) for the construction of an ATCT within the initial-term. The completion of a BCA could result in a portion of the air traffic controller salary being compensated by the FAA. It is also recommended that the Airport study further the development of an ATCT in addition to the existing site analysis. Following the initial siting of an ATCT it is recommended that the location be modeled utilizing the FAA Airway Facilities Tower Integration Laboratory (AFTIL). The FAA AFTIL facility can simulate the site in a realistic ATCT cab using airfield siting photographs and aircraft simulations. By combining all aspects of ATCT operations in one simulation facility, a much more complete evaluation of potential ATCT siting can be accomplished.

3.5 INFRASTRUCTURE NEEDS

3.5.1 UTILITIES

Grand Canyon West Airport's remote location does not provide for the typical municipal public utilities infrastructure at the Airport. As such all utility requirements are currently met on site, or are transported to the site. Electricity to the existing terminal building is supplied by a 250 kilowatt (KW) generator which operates on diesel fuel. A 319 KW generator serves power to the airfield and a 250 KW generator is used as a reserve generator. A 12,000 gallon tank provides storage for diesel fuel which is also used for the local tour busses and maintenance vehicles. A ten inch water line providing 100 gallon per minute water line is currently available in addition to the 230,000 gallon water tank that provides potable and industrial water for the terminal area.

A septic system located east of the terminal building is utilized for domestic waste disposal. The septic system is nearing its capacity and is currently in the process of being reevaluated as to whether or not the Airport wants to maintain the existing system, or expand and move the system to enable tying Guano Point and Eagle Point into it. There is an existing leach field located to the west of Buck and Doe Road where the sewer system releases waste through an infiltration system. The septic system is nearing its capacity and the Airport is in the process of determining whether to relocate the leach field or construct a lagoon system. Lagoon systems include one or more pond-like bodies of water or basins designed to receive, hold, and treat wastewater for a predetermined period of time. A lagoon was initially designed across Buck and Doe Road northwest of the terminal area. Solid waste and refuse is removed weekly via dumpster sized truck from the site.

Based on forecasted demand from Chapter 2 the terminal facility will generate 80,000 gallons per day of water demand for drinking, wash water, sanitary facilities plus 120,000 gallons per day for fire protection storage. Domestic demand is based upon the assumption that visitation at the terminal facility will average 9,000 visitors per day using 10 gallons per capita per day (gpcd). Additionally, approximately 200 employees will work at the facility as service workers, pilots, hosts, building maintenance works and supervisors. These personnel are anticipated to average 70 gpcd. Another 10 gpcd is assumed to be lost and wasted. A flow rate of 550 gallons per minute would be needed. The existing 10 inch water line was designed to provide sufficient delivery capacity of 610 gallons per minute; therefore, the existing water line is anticipated to be sufficient. An additional 250,000 gallon water storage tank is recommended to supplement the existing 230,000 gallon tank. Additionally the water source for the tank needs a minimum 56 gallon per minute flow to maintain adequate supply.

The forecasted demand for the terminal facility will generate 58,000 gallons per day of wastewater from domestic sewage, wash water, and other sources. This is based upon the assumption that the visitation at the terminal facility will average 9,000 visitors per day. Additionally, approximately 200 employees will work at the facility as services works, pilots, hosts, building maintenance works and supervisors. These visitors and works will necessitate provision of washroom and bathroom facilities. Other domestic waste generating activities may include food service provisions as well as gray water from washing of vehicles, and aircraft. Assumed wastewater production for the terminal is 20 gallons per day per employee plus 6 gallons per day per visitor resulting in an estimated wastewater flow of 58,000 gallons per day. The future wastewater facility should include low energy consumption, low maintenance and opportunity for expansion at a low cost. The existing 8 inch sewer line should be expanded to a 12 inch line to accommodate the projected demand.

An approximate 1.5 megawatt power service would be needed to serve the ultimate 105,000 square foot terminal building. Large power usage at the airport will include heating and cooling, lighting, computers, culinary uses, and security screening equipment. The development of two additional 1,000 gallon propane tanks at the airport is also recommended for heat.

It is also recommended the Airport evaluate the benefits in renewable energy, specifically photovoltaic (PV) solar, due to the climate and future Return on Investment (ROI) for the Airport. Renewable energy can supply a significant proportion of the Airport's energy needs, creating many benefits for the region and nation, including environmental improvement and economic development. Environmental benefits include the mitigation of burning fossil fuel (coal, oil and natural gas) which is used to generate electricity and dirty the region's air. Environmentally, solar energy shows a commitment to community stewardship. Economic development benefits can mean increased revenues for sponsors by reducing the costs pertaining to energy consumption.

Solar is a renewable energy source that contributes to national goals of sustainability, energy independence, and air quality improvement. It is particularly well-suited to airports because of the available space, unobstructed terrain, and energy demand. PV solar panels are a viable option for the reduction of energy costs at airports. Solar PV panels capture the sun's energy using photovoltaic cells, which then convert the sunlight into electricity and even on cloudy days can still produce some electricity, making it incredibly efficient. The system also generates no greenhouse gasses, helping the Airport reduce its carbon footprint.

Due to the climate of the Grand Canyon and the percentage of sunny days, it is recommended that the Airport consider solar panel options. Some benefits of solar panels are as follows:

- Not only sustainable, it is renewable and this means it will never run out.
- Generation of our own source of electricity via solar panels allows the Airport to live off the grid and not depended on utility companies and complex corridor development.

- The creation of solar energy requires little maintenance.
- Silent producer of energy which eliminates noise pollution.
- Large solar energy facilities can produce electricity regardless of whether the sun is shining or not making them sustainable and reliable electricity producers
- Solar electricity power plants and personal solar panels produce zero emissions and make no adverse mark on the environment.

The Airport benefits from renewable energy initiatives and arrangements through lower airport electric utility bills, lease revenues, and the delegation of maintenance costs. A detailed study is recommended to establish the output of electricity currently utilized by the Airport in order to determine the size and number of solar panels required to supply electricity to the Airport.

3.5.2 WEATHER REPORTING

The automated weather observation system found at Grand Canyon West Airport is an AWOS-3; however, the AWOS-3 system at Grand Canyon West Airport is not currently connected to the National Airspace Data Interchange Network (NADIN). It is recommended that the AWOS-3 be linked to the NADIN system in order to allow national dissemination of the AWOS observations and permit the NOAA to digitally record the hourly observations and disseminate real-time weather information to Flight Service Stations and other sources. The AWOS is connected via the telephone system by calling (928) 769-2674; however, the FAA is looking into various additional means of disseminating the information through more technologically advanced mediums.

3.6 AIRSPACE REQUIREMENTS

14 Code of Federal Regulations (CFR) Part 77 establishes several imaginary surfaces that are used as a guide to provide a safe, unobstructed operating environment for aviation. The overall goal is to prevent or minimize objects of height above ground level that penetrate the CFR Part 77 airspace surfaces, especially within the approach surfaces. When objects do penetrate these surfaces they are known as obstructions. The FAA reviews obstructions in the vicinity of an airport and makes determinations as to whether they are hazards to air navigation and negatively affect the approach minimums or aircraft operations or whether they can be appropriately marked and lighted with minimal impacts to the airport. These surfaces, which are typical for civilian airports are shown in **Figure 3-3**. The Primary, Approach, Transitional, Horizontal and Conical Surfaces identified in CFR Part 77 are applied to each runway. For the purpose of this section, a visual/utility runway is a runway that is intended to be used by propeller driven aircraft of 12,500 pound maximum gross weight and less. A nonprecision instrument/utility runway is a runway that is intended to be used by aircraft of 12,500 pounds maximum gross weight and less with a straight-in instrument approach procedure and 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 nonprecision instrument/larger-than-utility runway is a runway intended for the operation of aircraft weighing more than 12,500 pounds that also has a straight-in instrument approach procedure.

<u>Primary Surface</u>: An imaginary surface of specific width longitudinally centered on a runway. The primary surfaces extend 200 feet beyond each end of the paved surface of runways, but do not extend beyond the end of non-paved 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 instrument approach runways, 250 feet for visual approach "utility"

(12,500 pounds or less pavement strength) runways and 500 feet for visual approach larger than utility and nonprecision instrument approach runways.

Approach Surface: 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 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 CFR Part 77 runway classification criteria.

Transitional Surface: A surface that 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 150 feet above the airport elevation.

Horizontal Surface: A surface that is considered necessary for the safe and efficient operation of aircraft in the vicinity of an airport. As specified in 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 runway, 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.

Conical Surface: A surface that 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

The dimensions of the CFR Part 77 imaginary surfaces depend on the size of aircraft using the airport, the type of instrument approach procedures and the visibility minimums. Based on the future implementation of a GPS approach with ¾-statue mile visibility minimums, the Part 77 airspace surfaces would increase in size and slope as shown in **Table 3-18.**

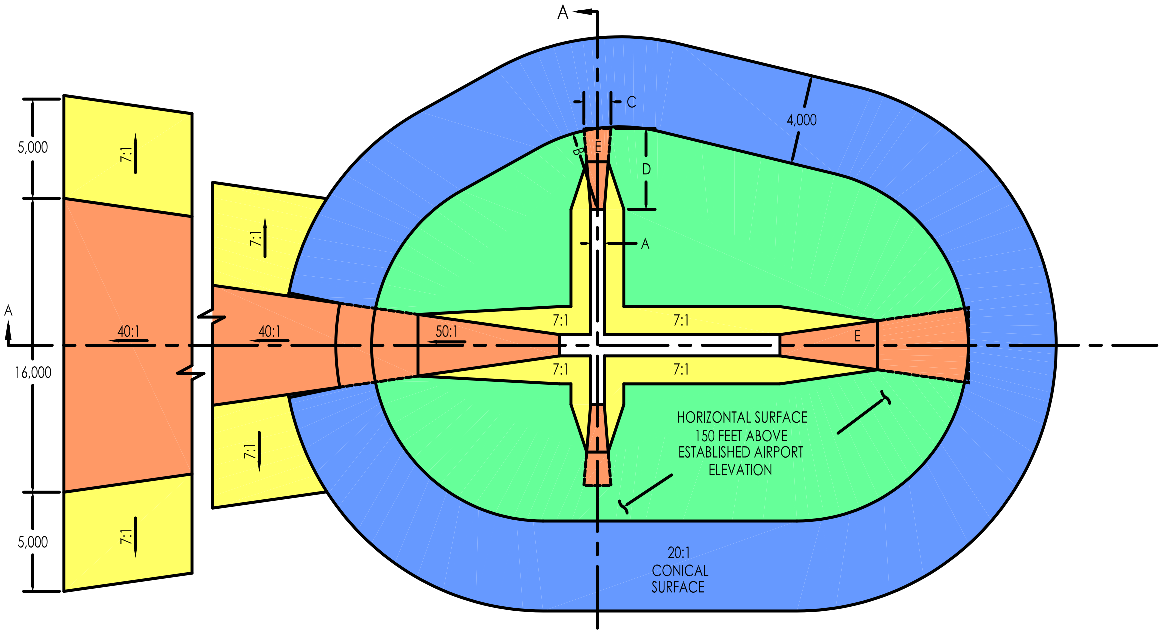
Runway Instrument Approach Procedure (IAP) is recommended to be lowered from the existing visual approach to a nonprecision ¾-statue mile with Localizer Performance with Vertical Guidance (LPV approach procedure in the future. LPVs are operationally equivalent to an Instrument Landing System (ILS) but are more economical because no navigation infrastructure has to be installed at the runway. The LPV enables descent to 200-250 feet about the runway, and can be flown with a Wide Area Augmentation System (WAAS) receiver. An obstruction survey was completed in May, 2012 and development of a new approach procedure should be coordinated with the FAA Flight Procedures office, assuming there are no identified constraints, including obstructions, terrain or airspace.

While these would be the ideal runway approach minimums, various physical, environmental, financial or political constraints may limit the Airport's ability to achieve these lengths. Alternatives for achieving the recommended runway lengths are evaluated in the next chapter.

TABLE 3-18 14 CFR PART 77 AIRSPACE SURFACES FOR RUNWAY 17/35

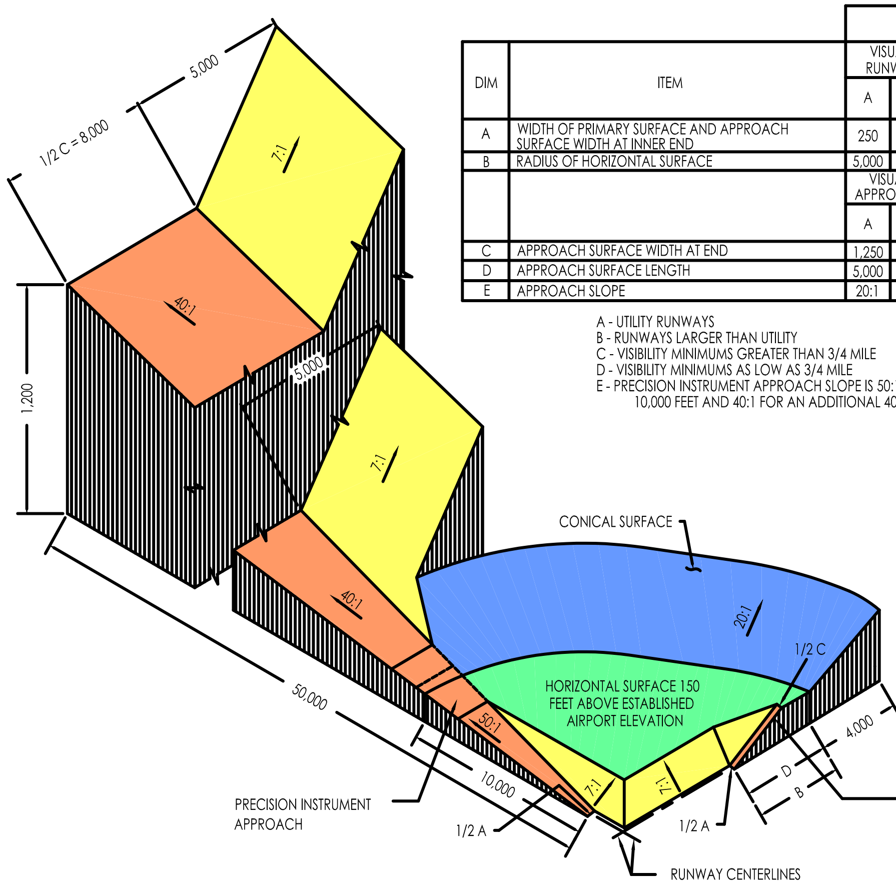
	Existing	Future	Ultimate
Runway 17/35 Part 77 Classification	Visual > Utility	NPI > Utility	NPI> Utility
Visibility Minimums	N/A	¾-Statue Mile	¾ -Statue Mile
Primary Surface Width	500’	1,000’	1,000’
Primary Surface Length Beyond RW Ends	200’	200’	200’
Approach Surface Dimensions	500’ x 1,500’ x 5,000’	1,000’ x 4,000’ x 10,000’	1,000’ x 4,000’ x 10,000’
Approach Surface Slope	20:1	34:1	34:1
Transitional Surface Slope	7:1	7:1	7:1
Horizontal Surface Radius from RW	5,000’	10,000’	10,000
Conical Surface Width	4,000’	4,000’	4,000’

Source: FAA, 2012
Prepared by: Armstrong Consultants, Inc., May 2012



		DIMENSIONAL STANDARDS (FEET)					
DIM	ITEM	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

SURFACE LEGEND
PRIMARY
APPROACH
HORIZONTAL
CONICAL
TRANSITIONAL

FIGURE 3-3 CFR PART 77 IMAGINARY SURFACES

3.7 LAND USE COMPATIBILITY AND CONTROL

3.7.1 AIRPORT PROPERTY

According to the Exhibit "A" Airport Property Map, the existing Airport property encompasses approximately 334 acres which is owned and occupied by the Hualapai Nation. Additional Airport property allocation is recommended for the Airport during the planning period to accommodate the runway extension and landside development. Certain portions and areas of the Airport property may be identified as not needed for aeronautical use and may be leased out for future non-aeronautical revenue generating development. The Airport property boundary would need to be expanded to meet future development needs. All land surrounding the Airport is Indian Trust land under the jurisdiction of the Hualapai Nation. Expanding the Airport property is an administrative tribal action and would not require the formal acquisition or purchase of the property.

3.7.2 HEIGHT RESTRICTION ZONING

Development around airports can pose certain hazards to air navigation if appropriate steps are not taken to ensure that buildings and other structures do not penetrate the 14 CFR Part 77 Airspace Surfaces (discussed in the previous Section 3.8). The FAA, therefore, recommends that all airport sponsors implement height restrictions in the vicinity of the Airport to protect these Part 77 Surfaces.

Since the Hualapai Nation owns and controls all of the land in the vicinity of the Airport, it is recommended that in addition to the required FAA notifications, the Tribe implement a procedure to internally review all development proposals in the vicinity of the Airport to ensure they comply with Part 77 airspace surfaces, FAA airport design standards, and are compatible with Airport and aircraft operations.

3.7.3 COMPATIBLE LAND USE

In addition to ensuring that obstructions to Part 77 Surfaces are avoided or appropriately marked and lighted, it is recommended that the Airport Sponsor make reasonable efforts to prevent incompatible land uses from the immediate area of the airport, including wildlife attractants and noise sensitive land uses such as residential developments, schools, churches and hospitals. For example, the FAA states in the FAA Advisory Circular 150/5200-33B*, Hazardous Wildlife Attractants On or Near Airports*, that landfills and/or transfer stations are incompatible land uses with airports. Therefore, 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 type aircraft. Furthermore, 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.

Development proposals should also be reviewed to ensure compatibility in the vicinity of the airport.

3.8 SUMMARY OF FACILITY REQUIREMENTS

The facility requirements for Grand Canyon West Airport are based on the types and volume of aircraft expected to use the Airport in the initial-, intermediate-, and long-term timeframes. These facilities will enable the Airport to serve its users in a safe and efficient manner. The recommended airside and landside facilities are summarized in **Table 3-19**. The various means to meet the Airport's needs and priority of importance are addressed in Chapter 4 – Development Alternatives and Chapter 7 – Airport Development and Financial Plan.

TABLE 3-19 SUMMARY OF AIRPORT FACILITY REQUIREMENTS – RUNWAY 17/35

Runways				
		Existing	**Future (5-11 Years)**	**Ultimate (12-20 Years)**
17/35	Length and Width	5,000' x 75'	6,500' x 100'	7,700' x 100'
17/35	Strength (pounds)	30,000 SWG	60,000 DWG	108,000 DWG
Markings	Runway 17	Nonprecision	Same	Same
	Runway 35	Nonprecision	Same	Same
Design Aircraft	Runway 17/35	Dornier 328	CRJ 200	B737-400
Taxiways				
	Parallel	Full Length	Same	Same
	Bypass Taxiways/Turnarounds	Yes	Same	Same
	Holding Bays	Yes	Yes	Yes
	Width (feet)	35'	35'	50'
	Strength (pounds)	30,000 SWG	60,000 DWG	108,000 DWG
Apron				
	Size	53,061 SY	53,061 SY	62,933 SY
	Tie Downs and Painted Parking	43	43	51
NAVAIDS				
	Approaches	Visual	Nonprecision (LPV)	Nonprecision (LPV)
	Minimums	Visual	¾-statue mile	¾-statue mile
Lighting & Visual Aids				
	Runway Edge	MIRL	Same	Same
	Taxiway/Apron Edge	MITL	Same	Same
	Threshold Lights	Yes	Same	Same
	REILs	Yes	Same	Same
	Approach Slope Indicator	PAPI-4L	Same	Same
	Segmented Circle/Wind Cone	Yes	Same	Same
	Rotating Beacon	Yes	Same	Same
	Approach Lighting System	No	Same	Same
Access and Parking				
	Parking Spaces Personal Vehicle Motor Coach Employee	 411 15 N/A	 1,044 95 171	 1,621 147 265
Hangar Facilities				
	T-Hangars	0	Same	Same
	Conventional-Small	0	Same	Same
	Conventional-Medium/Large	0	2	4
Fuel Storage				
	100 LL (gallons)	N/A	Same	Same
	Jet-A (gallons)	24,000	56,000	56,000
	Avgas (gallons)	No	32,000	32,000
	Self-Serve	No	Yes	Yes
Other				
	AWOS	AWOS-3	Same	Same
	Unicom	Yes	Same	Same
	Air Terminal Helicopter Terminal Ground Terminal **Total**	4,017 SF 3,955 SF N/A **7,972 SF**	21,363 SF 17,588 SF 14,621 SF **53,572 SF**	42,366 SF 31,122 SF 32,090 SF **105,578 SF**

CHAPTER 4

DEVELOPMENT ALTERNATIVES

GRAND CANYON WEST AIRPORT
AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS, INC.
AIRPORT ENGINEERING AND PLANNING

Chapter Four
Development Alternatives

4.1 INTRODUCTION

While there are theoretically a broad range of options and variations for each aspect of airport development, an organized approach to identifying and evaluating alternatives that reasonably meet future aviation demand and the airport's strategic goals and objectives is essential for effective airport master planning. The preceding chapters have established the projected activity levels at Grand Canyon West Airport and identified facilities that will be needed to accommodate growth for the 20-year planning horizon. Determining the preferred options for airside and landside development will allow the Airport to prioritize projects and develop the airport in an efficient manner.

Included herein is a comprehensive breakdown of alternatives and recommended development options for the airside and landside projects. The airside development primarily focuses on Runway 17/35's dimensional criteria, helicopter operating areas including Touchdown and Lift-Off Areas (TLOFs) and helicopter parking pads, taxiway extension and expansion, and instrument approach procedures. The landside development focuses on the terminal building development, parking facility, general aviation and air tour apron expansion and development.

4.2 DEVELOPMENT OBJECTIVES

The overall objectives of this chapter's analysis are to 1) review the facility requirements that have been determined necessary to safely and efficiently service aviation demand over the planning period; and 2) through investigation of available projects and options, where applicable, to determine the best way to implement the facility requirements and growth over the planning period.

There is countless variety for potential development options for any particular airport and Grand Canyon West is no exception. The selection of a favored project may result from a straightforward and logical discussion of the options at hand or upon extensive analysis of various alternatives.

A combination of effective airside and landside planning is critical to successful development. Airside facilities are those used during takeoff, landing and ground maneuvering of aircraft. Landside facilities generally support aircraft after they exit the runway and park, and typically consist of a system of hangars, terminal building, air traffic control tower, fuel systems, airport maintenance and support facilities, vehicle parking areas, utility infrastructure and revenue generating areas.

4.3 AIRSIDE DEVELOPMENT ALTERNATIVES

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 evaluates the airside development alternatives and addresses the needs of the existing and future aviation demand identified in Chapter 3 - Facility Requirements. Chapter 7 - Airport Development and Financial Plan will provide the recommended phasing of projects for projected scheduling and budgeting purposes.

4.3.1 Runway 17/35 Alternatives

As described in Chapter 3, Runway 17/35 is currently 5,000 feet long and 75 feet in width with pavement strength of 30,000 pounds single wheel gear (SWG). The runway is currently compliant in meeting Group II design standards in terms of width, length and strength to accommodate the existing critical aircraft and existing aircraft fleet mix.

To meet the needs of the planning period, the runway is deficient in length, width and strength. In the future it is recommended that the runway dimensions be increased to 6,500 feet by 100 feet and the pavement strength be increased to 60,000 dual wheel gear (DWG) in order to accommodate C-II aircraft. The ultimate plan for the airport recommends that the runway dimensions be increased to 7,700 feet by 100 feet and the pavement strength be increased to 108,000 DWG to accommodate C-III aircraft.

Three alternatives for extending Runway 17/35 have been evaluated to accommodate the future and ultimate development. The three alternatives are as follows and illustrated on **Figures 4-2** through **Figure 4-4**.

Alternative 1: Extend runway north 2,700 feet
Alternative 2: Extend runway south 2,700 feet
Alternative 3; Extend runway 1,500 feet north and 1,200 feet south

Alternative 1. This alternative would initially extend the Runway 17 end 1,500 feet north providing 6,500 feet of runway and then ultimately extending the Runway 17 end an additional 1,200 feet to the north for an ultimate runway length of 7,700 feet. The cost estimates for Alternative 1 are shown in **Table 4-1**.

The major advantages to this alternative are:

- Extends the runway in one direction
- The majority of the extension area has been previously graded
- Accommodates the recommended runway length
- Meets C-II initially and C-III ultimately
- Lowest development cost runway extension alternative

The major disadvantages to this alternative are:

- Impacts to existing roads surrounding the airport
- Moves the runway end toward Guano Point and Skywalk

TABLE 4-1 RUNWAY ALTERNATIVE 1 COST ESTIMATE

Grand Canyon West Airport
Airport Master Plan
Runway Extension Alternative 1
Engineers's Preliminary Estimate of Probable Construction Cost
September, 2012

ARMSTRONG CONSULTANTS, INC.

Prepared By: Amrstrong Consultants, Inc.
Armstrong Project Number: 116048
JLS

Item	Description of Work	Quantity	Unit	Unit Price	Extension
PROJECT I:	CONSTRUCT RUNWAY 17 EXTENSION 7,700 FT (U)				
SCHEDULE I:	**CONSTRUCT FUTURE EXTENSION 6,500 FT**				
1	Mobilization	L.S.	L.S.	$ 520,000.00	$ 520,000.00
2	Watering	Incidental	Incidental	Incidental	Incidental
3	Clearing and Grubbing	Incidental	Incidental	Incidental	Incidental
4	Excavation	0	C.Y.	$20.00	$ -
5	Embankment	71,450	C.Y.	$15.00	$ 1,071,750.00
6	Subgrade (Min 6" Thick)	64,395	S.Y.	$9.00	$ 579,555.00
7	Crushed Aggregate Base Course (6-Inches Thick)	64,395	S.Y	$13.00	$ 837,135.00
8	Bituminous Surface Course (50 Blow)(Min. 3" Thick)	11,110	Ton	$90.00	$ 999,900.00
9	Bituminous Material (PG 64-28)	725	Ton	$1,000.00	$ 725,000.00
10	Bituminous Prime Coat	19,320	Gallons	$2.50	$ 48,300.00
11	Bituminous Tack Coat	9,660	Gallons	$2.40	$ 23,184.00
12	Glass Beads	1,225	LBS	$5.50	$ 6,737.50
13	Pavement Marking	20,072	S.F.	$0.75	$ 15,054.00
14	Lighted Guidance Sign	4	E.A.	$4,000.00	$ 16,000.00
15	Unlighted Signs	1	E.A.	$2,500.00	$ 2,500.00
16	Taxiway Edge Light	42	E.A.	$1,200.00	$ 50,400.00
17	Remove Taxiway Edge Light	1	E.A.	$200.00	$ 200.00
18	Chain Link Fence	5,600	L.F.	$20.00	$ 112,000.00
19	Removal- Fencing	1,100	L.F.	$5.00	$ 5,500.00
20	Relocate AWOS	1	E.A.	$200,000.00	$ 200,000.00
21	Relocated Wind Cone & Segmented Circle	1	E.A.	$750,000.00	$ 750,000.00
22	Removal- Pavement Markings	10,390	S.F.	$2.00	$ 20,780.00
23	Runway Edge Light	18	E.A.	$1,200.00	$ 21,600.00
24	Remove Runway Edge Light	2	E.A.	$200.00	$ 400.00
25	Remove Threshold Light	6	E.A.	$200.00	$ 1,200.00
26	Threshold Light	6	E.A.	$1,200.00	$ 7,200.00
27	Pulverize, Remove, and Stockpile Asphalt Pavement	34,355	S.Y.	$11.00	$ 377,905.00
28	Hydraulic Seeding and Mulching	35	Acre	$5,000.00	$ 175,000.00
				Schedule I	**$ 6,567,300.50**
				Engineering & Contingency	$ 1,641,825.13
				Schedule I Subtotal	**$ 8,209,200.00**
SCHEDULE II:	**CONSTRUCT ULTIMATE EXTENSION 7,700 FT**				
Item	Description of Work	Quantity	Unit	Unit Price	Extension
1	Mobilization	L.S.	L.S.	$ 270,000.00	$ 270,000.00
2	Watering	Incidental	Incidental	Incidental	Incidental
3	Clearing and Grubbing	Incidental	Incidental	Incidental	Incidental
4	Excavation	9,900	C.Y.	$20.00	$ 198,000.00
5	Embankment	20,250	C.Y.	$15.00	$ 303,750.00
6	Subgrade (Min 6" Thick)	31,570	S.Y.	$9.00	$ 284,130.00
7	Crushed Aggregate Base Course (6-Inches Thick)	31,570	S.Y	$13.00	$ 410,410.00
8	Bituminous Surface Course (50 Blow)(Min. 3" Thick)	5,445	Ton	$90.00	$ 490,050.00
9	Bituminous Material (PG 64-28)	355	Ton	$1,000.00	$ 355,000.00
10	Bituminous Prime Coat	9,470	Gallons	$2.50	$ 23,675.00
11	Bituminous Tack Coat	4,735	Gallons	$2.40	$ 11,364.00
12	Glass Beads	1,120	LBS	$5.50	$ 6,160.00
13	Pavement Marking	18,385	S.F.	$0.75	$ 13,788.75
14	Lighted Guidance Sign	4	E.A.	$4,000.00	$ 16,000.00
15	Unlighted Signs	1	E.A.	$2,500.00	$ 2,500.00
16	Taxiway Edge Lights	38	E.A.	$1,200.00	$ 45,600.00
17	RemoveTaxiway Edge Light	1	E.A.	$200.00	$ 200.00
18	Chain Link Fence	9,555	L.F.	$20.00	$ 191,100.00
19	Removal- Fencing	4,565	L.F.	$5.00	$ 22,825.00
20	Removal- Pavement Markings	10,390	S.F.	$2.00	$ 20,780.00
21	Remove Runway Edge Light	2	E.A.	$200.00	$ 400.00
22	Runway Edge Light	14	E.A.	$1,200.00	$ 16,800.00
23	Threshold Light	6	E.A.	$1,200.00	$ 7,200.00
24	Remove Threshold Light	6	E.A.	$200.00	$ 1,200.00
25	Hydraulic Seeding and Mulching	18	Acre	$5,000.00	$ 90,000.00
				Schedule II Total	**$ 2,780,932.75**
	For Planning Purposes Only			Engineering & Contingency	$ 695,233.19
				Schedule II Subtotal	**$ 3,476,200.00**
				Project I Cost	**$ 11,685,400.00**

Alternative 2. This alternative would initially extend the Runway 35 end 1,500 feet to the south providing 6,500 feet of runway then ultimately extending the Runway 35 end an additional 1,200 feet to the south totaling an ultimate runway length of 7,700 feet. The cost estimates for Alternative 2 are shown in **Table 4-2**.

The major advantages to this alternative are:

- Extends the runway in one direction
- Extends the runway away from Guano Point and Skywalk
- Accommodates the recommended runway length
- Meets C-II initially and C-III ultimately

The major disadvantages to this alternative are:

- Large amount of earthwork for the runway extension
- Higher development costs
- Impacts Buck and Doe Road
- Potential impact to adjacent cultural site
- Highest development cost runway extension alternative

TABLE 4-2 RUNWAY ALTERNATIVE 2 COST ESTIMATE

Grand Canyon West Airport
Airport Master Plan
Runway Extension Alternative 2
Engineers's Preliminary Estimate of Probable Construction Cost
September, 2012

Prepared By: Amrstrong Consultants, Inc.
Armstrong Project Number: 116048
JLS

ARMSTRONG CONSULTANTS, INC.

PROJECT I:	CONSTRUCT RUNWAY 35 EXTENSION 7,700 FT (U)				
SCHEDULE I:	**CONSTRUCT FUTURE EXTENSION 6,500 FT**				
Item	Description of Work	Quantity	Unit	Unit Price	Extension
1	Mobilization	L.S.	L.S.	$ 380,000.00	$ 380,000.00
2	Watering	Incidental	Incidental	Incidental	Incidental
3	Clearing and Grubbing	Incidental	Incidental	Incidental	Incidental
4	Excavation	455,600	C.Y.	$20.00	$ 9,112,000.00
5	Embankment	0	C.Y.	$15.00	$ -
6	Subgrade (Min 6" Thick)	44,111	S.Y.	$9.00	$ 396,999.00
7	Crushed Aggregate Base Course (6-Inches Thick)	44,111	S.Y	$13.00	$ 573,443.00
8	Bituminous Surface Course (50 Blow)(Min. 3" Thick)	7,610	Ton	$90.00	$ 684,900.00
9	Bituminous Material (PG 64-28)	495	Ton	$1,000.00	$ 495,000.00
10	Bituminous Prime Coat	13,235	Gallons	$2.50	$ 33,087.50
11	Bituminous Tack Coat	6,620	Gallons	$2.40	$ 15,888.00
12	Glass Beads	1,210	LBS	$5.50	$ 6,655.00
13	Pavement Marking	19,885	S.F.	$0.75	$ 14,913.75
14	Lighted Guidance Sign	4	E.A.	$4,000.00	$ 16,000.00
15	Unlighted Signs	1	E.A.	$2,500.00	$ 2,500.00
16	Taxiway Edge Light	42	E.A.	$1,200.00	$ 50,400.00
17	Remove Taxiway Edge Light	1	E.A.	$200.00	$ 200.00
18	Chain Link Fence	2,960	L.F.	$20.00	$ 59,200.00
19	Removal- Fencing	1,205	L.F.	$5.00	$ 6,025.00
20	Relocate AWOS	1	E.A.	$200,000.00	$ 200,000.00
21	Relocated Wind Cone & Segmented Circle	1	E.A.	$750,000.00	$ 750,000.00
22	Removal- Pavement Markings	10,240	S.F.	$2.00	$ 20,480.00
23	Runway Edge Light	18	E.A.	$1,200.00	$ 21,600.00
24	Remove Runway Edge Light	2	E.A.	$200.00	$ 400.00
25	Remove Threshold Light	6	E.A.	$200.00	$ 1,200.00
26	Threshold Light	6	E.A.	$1,200.00	$ 7,200.00
27	Pulverize, Remove, and Stockpile Asphalt Pavement	21,965	S.Y.	$11.00	$ 241,615.00
28	Hydraulic Seeding and Mulching	28	Acre	$5,000.00	$ 140,000.00
				Schedule I	**$ 13,229,706.25**
				Engineering & Contingency	$ 3,307,426.56
				Schedule I Subtotal	**$ 16,537,200.00**
SCHEDULE II:	**CONSTRUCT ULTIMATE EXTENSION 7,700 FT**				
Item	Description of Work	Quantity	Unit	Unit Price	Extension
1	Mobilization	L.S.	L.S.	$ 180,000.00	$ 180,000.00
2	Watering	Incidental	Incidental	Incidental	Incidental
3	Clearing and Grubbing	Incidental	Incidental	Incidental	Incidental
4	Excavation	455,600	C.Y.	$20.00	$ 9,112,000.00
5	Embankment	0	C.Y.	$15.00	$ -
6	Subgrade (Min 6" Thick)	24,800	S.Y.	$9.00	$ 223,200.00
7	Crushed Aggregate Base Course (6-Inches Thick)	24,800	S.Y	$13.00	$ 322,400.00
8	Bituminous Surface Course (50 Blow)(Min. 3" Thick)	4,280	Ton	$90.00	$ 385,200.00
9	Bituminous Material (PG 64-28)	280	Ton	$1,000.00	$ 280,000.00
10	Bituminous Prime Coat	7,440	Gallons	$2.50	$ 18,600.00
11	Bituminous Tack Coat	3,720	Gallons	$2.40	$ 8,928.00
12	Glass Beads	1,189	LBS	$5.50	$ 6,539.50
13	Pavement Marking	19,540	S.F.	$0.75	$ 14,655.00
14	Lighted Guidance Sign	4	E.A.	$4,000.00	$ 16,000.00
15	Unlighted Signs	1	E.A.	$2,500.00	$ 2,500.00
16	Taxiway Edge Lights	38	E.A.	$1,200.00	$ 45,600.00
17	RemoveTaxiway Edge Light	1	E.A.	$200.00	$ 200.00
18	Chain Link Fence	7,430	L.F.	$20.00	$ 148,600.00
19	Removal- Fencing	1,015	L.F.	$5.00	$ 5,075.00
20	Removal- Pavement Markings	10,240	S.F.	$2.00	$ 20,480.00
21	Remove Runway Edge Light	2	E.A.	$200.00	$ 400.00
22	Runway Edge Light	14	E.A.	$1,200.00	$ 16,800.00
23	Threshold Light	6	E.A.	$1,200.00	$ 7,200.00
24	Remove Threshold Light	6	E.A.	$200.00	$ 1,200.00
25	Hydraulic Seeding and Mulching	20	Acre	$5,000.00	$ 100,000.00
	For Planning Purposes Only			**Schedule II Total**	**$ 10,915,577.50**
				Engineering & Contingency	$ 2,728,894.38
				Schedule II Subtotal	**$ 13,644,500.00**
				Project I Cost	**$ 30,181,700.00**

Alternative 3. This alternative would include extending the runway in both directions. Initially the Runway 17 end would be extended 1,500 feet to the north to provide the 6,500 feet of initial runway length. Ultimately Runway 35 would be extended an additional 1,200 feet to the south to provide the ultimate runway length of 7,700 feet. The cost estimates for Alternative 3 are shown in **Table 4-3**.

The major advantages to this alternative are:

- Requires no road relocation on the north end
- North end extension occurs in an area previously graded

The major disadvantages to this alternative are:

- Requires extending both ends of the runway
- South end extension requires relocation of Buck and Doe Road
- Moves the north end of the runway toward Guano Point and Skywalk
- Higher development costs
- Potential impact to adjacent cultural site

TABLE 4-3 RUNWAY ALTERNATIVE 3 COST ESTIMATE

Grand Canyon West Airport
Airport Master Plan
Runway Extension Alternative 3
Engineers's Preliminary Estimate of Probable Construction Cost
September, 2012

Prepared By: Amrstrong Consultants, Inc.
Armstrong Project Number: 116048
JLS

ARMSTRONG CONSULTANTS, INC.

PROJECT I:	CONSTRUCT RUNWAY 17 & 35 EXTENSIONS				
SCHEDULE I:	**CONSTRUCT RUNWAY 17 FUTURE EXTENSION 1500 FT**				
1	Mobilization	L.S.	L.S.	$ 250,000.00	$ 250,000.00
2	Watering	Incidental	Incidental	Incidental	Incidental
3	Clearing and Grubbing	Incidental	Incidental	Incidental	Incidental
4	Embankment	52,100	C.Y.	$15.00	$ 781,500.00
5	Subgrade (Min 6" Thick)	28,415	S.Y.	$9.00	$ 255,735.00
6	Crushed Aggregate Base Course (6-Inches Thick)	28,415	S.Y	$13.00	$ 369,395.00
7	Bituminous Surface Course (50 Blow)(Min. 3" Thick)	4,905	Ton	$90.00	$ 441,450.00
8	Bituminous Material (PG 64-28)	320	Ton	$1,000.00	$ 320,000.00
9	Bituminous Prime Coat	8,525	Gallons	$2.50	$ 21,312.50
10	Bituminous Tack Coat	4,265	Gallons	$2.40	$ 10,236.00
11	Glass Beads	930	LBS	$5.50	$ 5,115.00
12	Pavement Marking	15,280	S.F.	$0.75	$ 11,460.00
13	Lighted Guidance Sign	4	E.A.	$4,000.00	$ 16,000.00
14	Unlighted Signs	1	E.A.	$2,500.00	$ 2,500.00
15	Taxiway Edge Light	26	E.A.	$1,200.00	$ 31,200.00
16	Remove Taxiway Edge Light	1	E.A.	$200.00	$ 200.00
17	Chain Link Fence	5,330	L.F.	$20.00	$ 106,600.00
18	Removal- Fencing	1,120	L.F.	$5.00	$ 5,600.00
19	Removal- Pavement Markings	10,690	S.F.	$2.00	$ 21,380.00
20	Runway Edge Light	8	E.A.	$1,200.00	$ 9,600.00
21	Remove Runway Edge Light	1	E.A.	$200.00	$ 200.00
22	Remove Threshold Light	6	E.A.	$200.00	$ 1,200.00
23	Threshold Light	6	E.A.	$1,200.00	$ 7,200.00
24	Hydraulic Seeding and Mulching	21	Acre	$5,000.00	$ 105,000.00
				Schedule I	**$ 2,772,883.50**
				Engineering & Contingency	$ 693,220.88
				Schedule I Subtotal	**$ 3,466,200.00**
SCHEDULE II:	**CONSTRUCT RUNWAY 35 FUTURE EXTENSION 1200 FT INCL ACCESS ROAD**				
Item	Description of Work	Quantity	Unit	Unit Price	Extension
1	Mobilization	L.S.	L.S.	$ 450,000.00	$ 450,000.00
2	Watering	Incidental	Incidental	Incidental	Incidental
3	Clearing and Grubbing	Incidental	Incidental	Incidental	Incidental
4	Excavation	113,150	C.Y.	$20.00	$ 2,263,000.00
5	Subgrade (Min 6" Thick)	52,600	S.Y.	$9.00	$ 473,400.00
6	Crushed Aggregate Base Course (6-Inches Thick)	52,600	S.Y	$13.00	$ 683,800.00
7	Bituminous Surface Course (50 Blow)(Min. 3" Thick)	9,075	Ton	$90.00	$ 816,750.00
8	Bituminous Material (PG 64-28)	590	Ton	$1,000.00	$ 590,000.00
9	Bituminous Prime Coat	15,780	Gallons	$2.50	$ 39,450.00
10	Bituminous Tack Coat	7,890	Gallons	$2.40	$ 18,936.00
11	Glass Beads	1,145	LBS	$5.50	$ 6,297.50
12	Pavement Marking	18,770	S.F.	$0.75	$ 14,077.50
13	Lighted Guidance Sign	4	E.A.	$4,000.00	$ 16,000.00
14	Unlighted Signs	1	E.A.	$2,500.00	$ 2,500.00
15	Taxiway Edge Light	26	E.A.	$1,200.00	$ 31,200.00
16	Remove Taxiway Edge Light	1	E.A.	$200.00	$ 200.00
17	Chain Link Fence	6,545	L.F.	$20.00	$ 130,900.00
18	Removal- Fencing	1,015	L.F.	$5.00	$ 5,075.00
19	Relocate AWOS	1	E.A.	$200,000.00	$ 200,000.00
20	Relocated Wind Cone & Segmented Circle	1	E.A.	$750,000.00	$ 750,000.00
21	Removal- Pavement Markings	10,690	S.F.	$2.00	$ 21,380.00
22	Runway Edge Light	8	E.A.	$1,200.00	$ 9,600.00
23	Remove Runway Edge Light	1	E.A.	$200.00	$ 200.00
24	Remove Threshold Light	6	E.A.	$200.00	$ 1,200.00
25	Threshold Light	6	E.A.	$1,200.00	$ 7,200.00
26	Pulverize, Remove, and Stockpile Asphalt Pavement	21,965	S.Y.	$11.00	$ 241,615.00
27	Hydraulic Seeding and Mulching	21	Acre	$5,000.00	$ 105,000.00
				Schedule II	**$ 6,877,781.00**
	For Planning Purposes Only			Engineering & Contingency	$ 1,719,445.25
				Schedule II Subtotal	**$ 8,597,300.00**
				Project Cost	**$ 12,063,500.00**

RECOMMENDED RUNWAY ALTERNATIVE

A planning meeting will be held with Grand Canyon West and the FAA in order to determine the recommended runway alternative. A flight track evaluation was also conducted in order to determine the flight path and over flight altitude of aircraft approaching the alternative runway end locations. This is intended to help determine what the potential environmental impacts would be associated with each alternative. **Figure 4-1** shows the proposed flight tracks.

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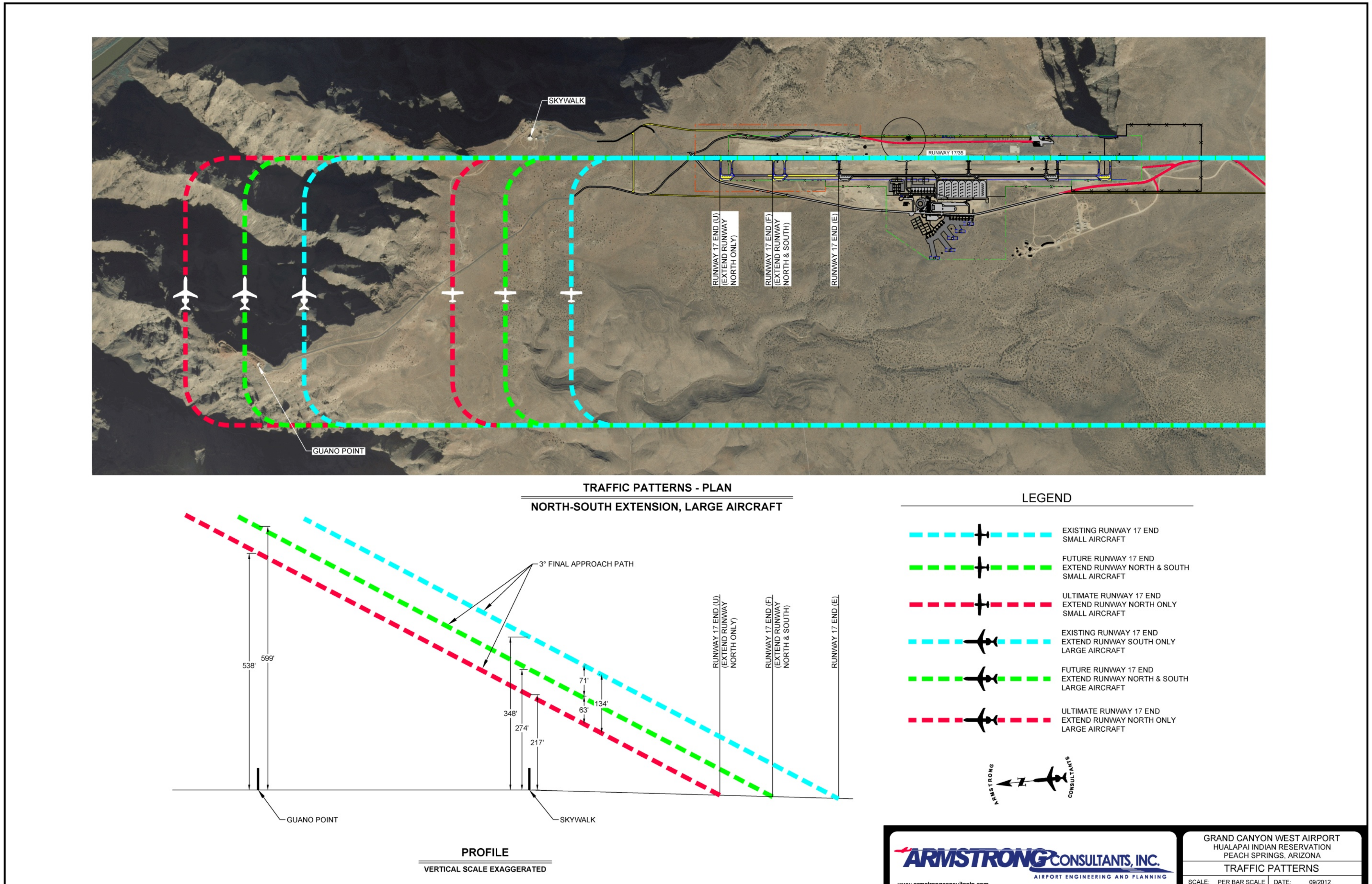


Figure 4-1 Runway Alternative Flight Track Analysis

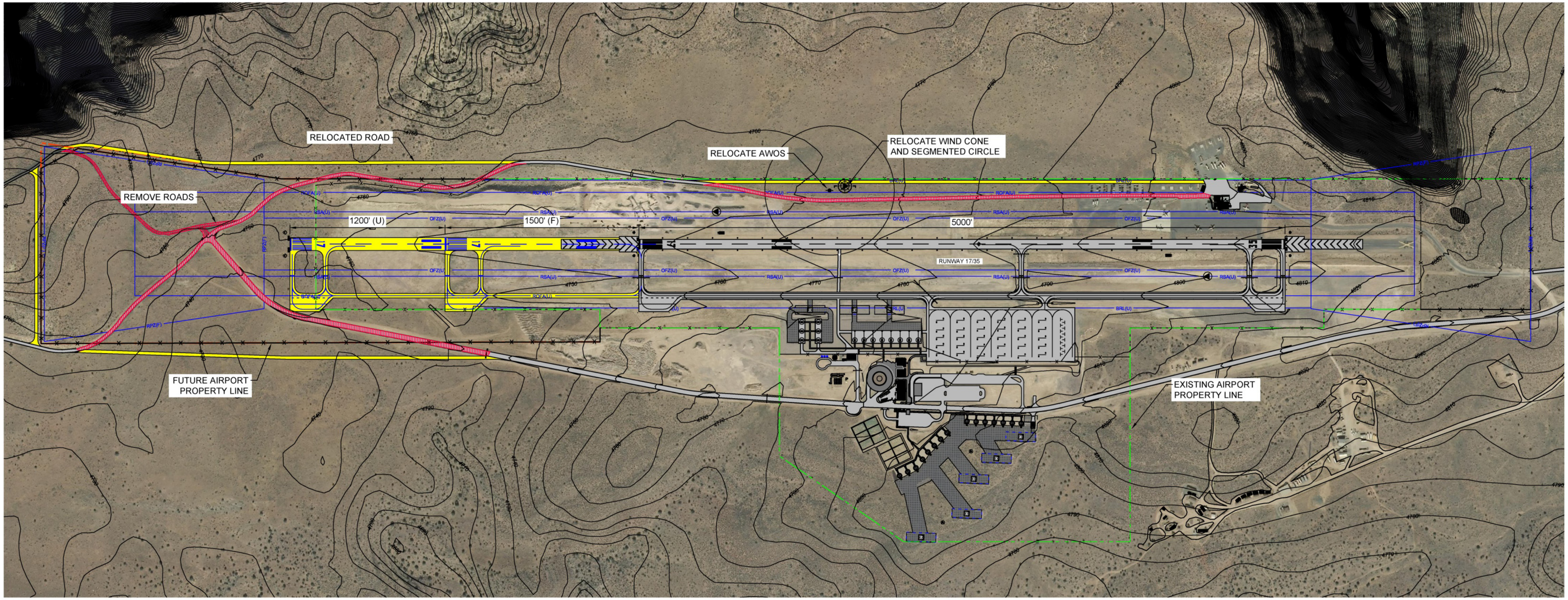
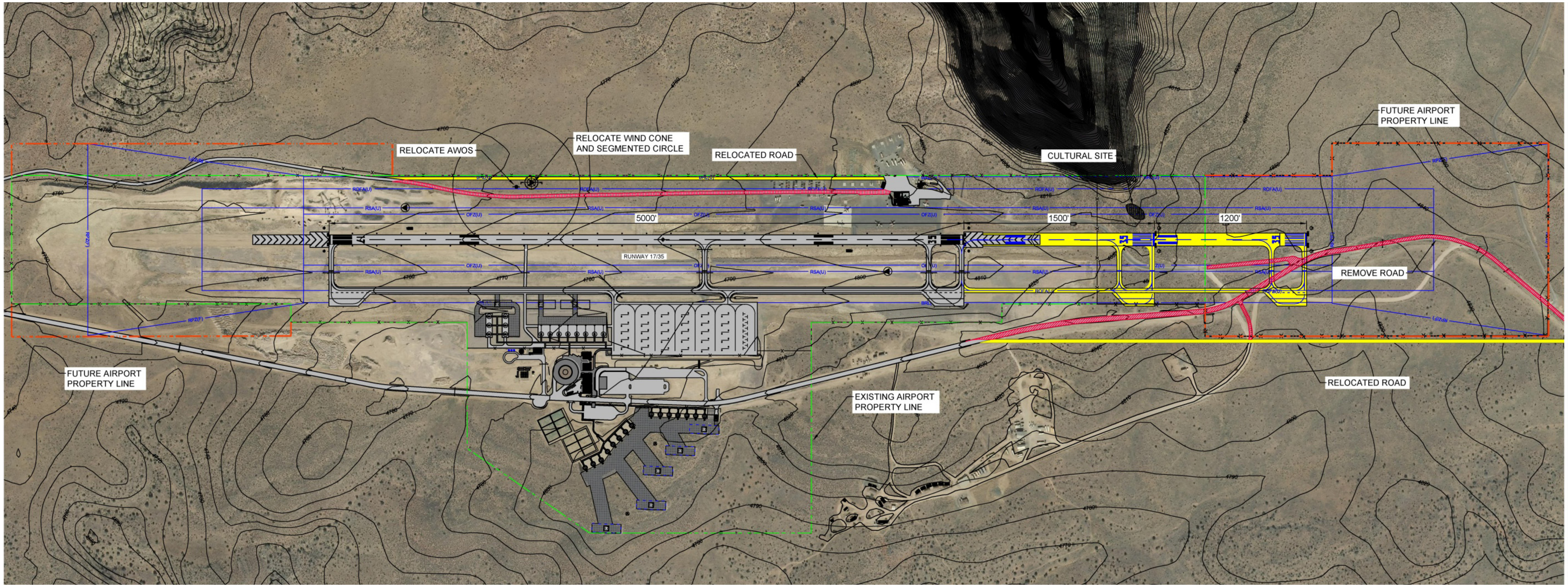


FIGURE 4-2 RUNWAY ALTERNATIVE 1



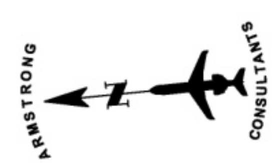


FIGURE 4-3 RUNWAY ALTERNATIVE 2

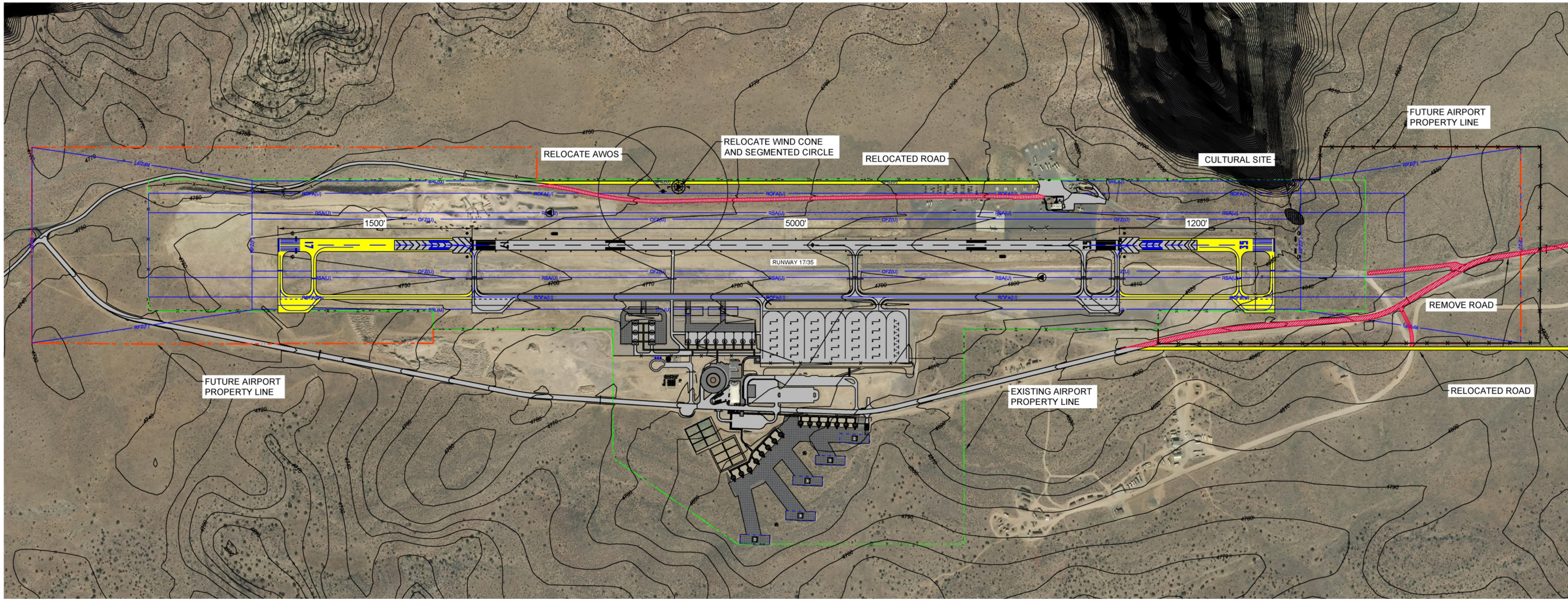


FIGURE 4-4 RUNWAY ALTERNATIVE 3

4.3.2 INSTRUMENT APPROACH PROCEDURES

Because instrument approach visibility minimums influence the airfield design standards, it is important to first consider the effects of developing an instrument approach at the airport. An aeronautical survey was conducted as part of the Airport Master Plan. The information collected from the aeronautical survey will be used by FAA Flight Procedures Office for the development of an instrument approach should the airport decide this is a project they would like to further pursue. The initial instrument approach minimums of ¾-mile are recommended and ultimate instrument approach minimums of ½-mile are recommended. Following the implementation of the initial instrument approach development a medium intensity approach lighting system (MALSR) could be installed to lower the visibility to as low as ½-mile. A MALSR system is usually 2,400 feet long array of lights (can be shorter depending on terrain) that typically consists of nine light bars with five steady burning white light fixtures; five sequence flashing white light fixtures and threshold bar of 18 steady burning light fixtures. Key considerations will be proximity to SFAR, noise exposure and surrounding terrain. The alternatives are discussed in more detail below. The instrument approach development options are shown in **Figure 4-5**.

Alternative 1. This alternative would include the development of a future instrument approach procedure from the north to serve Runway 17.

Alternative 1.A. This would include the development of a GPS Localizer Performance with Vertical Guidance (LPV) approach procedure from the north. The only cost would be associated with the installation of a MALSR in order to obtain lower than ¾-mile visibility. *Estimated cost for this development: $400,000.*

The major advantages to this alternative are:

- Allows flights to occur at the airport during low cloud heights
- Increases the utility of the airport
- Enhances safety especially during nighttime operations
- Phasing allows development of an initial approach procedure without any cost
- Consistent with recommendations from the facility requirements

The major disadvantages to this alternative are:

- Potential impacts to surrounding airspace
- Potential environmental impacts associated with future aircraft over flight
- Increased CFR Part 77 airspace surfaces surrounding the airport

Alternative 1.B. This would include the development of an Instrument Landing System (ILS) approach procedure from the north. The installation of an ILS requires ground station installation and a MALSR in order to obtain lower than ¾-mile visibility. *Estimated cost for this development: $2,400,000.*

The major advantages to this alternative are:

- Allows flights to occur at the airport during low cloud heights
- Increases the utility of the airport
- Enhances safety especially during nighttime operations
- Consistent with recommendations from the facility requirements
- Serves large airliners with ILS capability

The major disadvantages to this alternative are:

- Potential impacts to surrounding airspace

- Potential environmental impacts associated with future aircraft over flight
- Increased CFR Part 77 airspace surfaces surrounding the airport
- Significant cost associated with ILS development

Alternative 2. This alternative would include the development of a future instrument approach procedure from the south to serve Runway 35.

Alternative 2.A. This would include the development of a GPS Localizer Performance with Vertical Guidance (LPV) approach procedure from the south. The only cost would be associated with the installation of a MALSR in order to obtain lower than ¾-mile visibility. *Estimated cost for this development: $400,000.*

The major advantages to this alternative are:

- Allows flights to occur at the airport during low cloud heights
- Increases the utility of the airport
- Enhances safety especially during nighttime operations
- Phasing allows development of an initial approach without any cost
- Consistent with recommendations from the facility requirements

The major disadvantages to this alternative are:

- Potential impacts to surrounding airspace
- Potential environmental impacts associated with future aircraft over flight
- Increased CFR Part 77 airspace surfaces surrounding the airport

Alternative 2.B. This would include the development of an Instrument Landing System (ILS) approach procedure from the south. The installation of an ILS requires ground station installation and a MALSR in order to obtain lower than ¾-mile visibility. *Estimated Cost for this development: $2,400,000.*

The major advantages to this alternative are:

- Allows flights to occur at the airport during low cloud heights
- Increases the utility of the airport
- Enhances safety especially during nighttime operations
- Consistent with recommendations from the facility requirements
- Serves large airliners with ILS capability

The major disadvantages to this alternative are:

- Potential impacts to surrounding airspace
- Potential environmental impacts associated with future aircraft over flight
- Increased CFR Part 77 airspace surfaces surrounding the airport
- Significant cost associated with ILS development

Alternative 3. This alternative would not include the development of an instrument approach procedure to the airport. The airport would continue operating during visual flight rules (VFR). *Estimated cost of this development: N/A*

The major advantages to this alternative are:

- Avoids potential impact to airspace
- Avoids potential environmental impacts from aircraft over flight
- No cost associated with development
- No increased CFR Part 77 airspace surfaces surrounding the airport

The major disadvantages to this alternative are:

- Does not provide future instrument approach procedures
- Does meet the recommendations from the facility requirements
- Does not provide for enhanced safety or increased utility at the airport

RECOMMENDED INSTRUMENT APPROACH ALTERNATIVE

A planning meeting will be held with Grand Canyon West and the FAA in order to determine the recommended instrument approach alternative. Depending on instrument approach procedure selected coordination with FAA would be required.

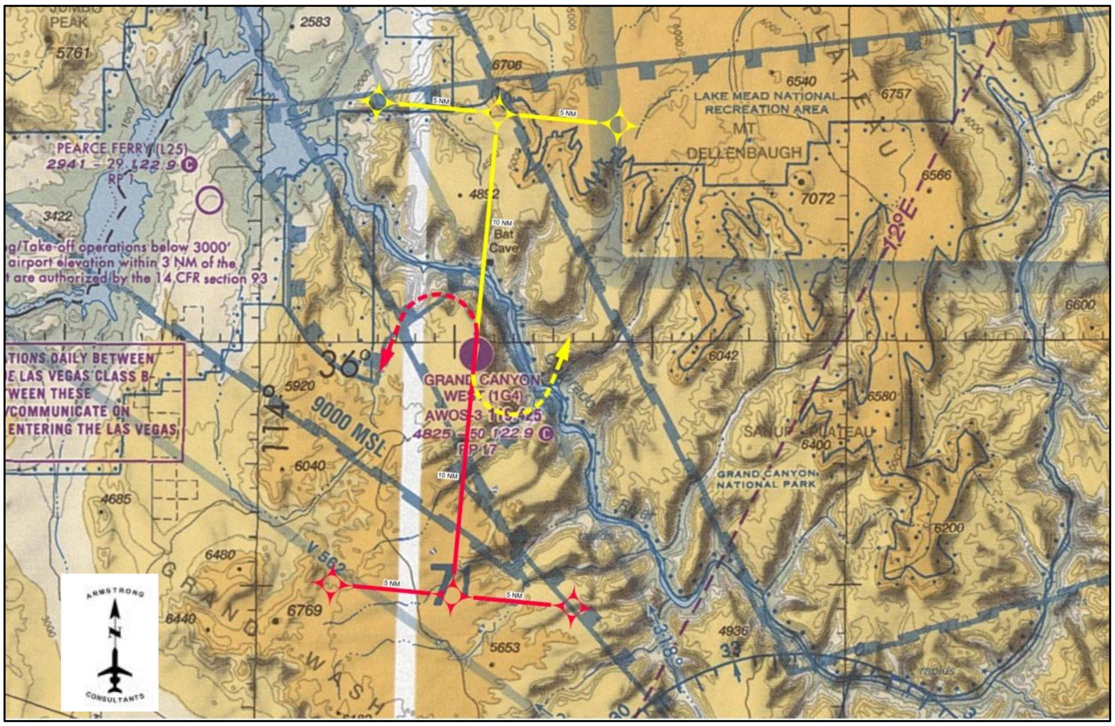


FIGURE 4-5 FUTURE INSTRUMENT APPROACH PROCEDURES ALTERNATIVES

4.3.3 TAXIWAY SYSTEM

The development of bypass taxiways and holding bays at the ends of Runway 17 and 35 are recommended. Bypass taxiways provide for efficient circulation of aircraft to and from the runway and holding bays provide room for aircraft engine run-up. The extension of the parallel Taxiway A is recommended to meet the future length of the runway. It is also recommended the taxiway be widened to 50 feet to meet Group III criteria during the C-III ARC upgrade.

The construction of a 2,000 foot partial parallel taxiway (Taxiway B) on the east side of the runway, 400 feet from the runway centerline is recommended. Taxiway B should be constructed at an initial width of 35 feet and an ultimate width of 50 feet in order to provide access to the general aviation facility. This taxiway would minimize runway crossings and separate general aviation/executive aircraft and air tour operations. Two connector taxiways, separated at 200 feet, off the east side of Runway 17 end (at the same width and strength of Taxiway B) should be constructed to provide access to the future general aviation apron area (see **Figure 4-12)**.

4.3.4 HELICOPTER DEVELOPMENT

A large portion of Grand Canyon West's operations consist of in and out (itinerant operation) and down and up (local operation) helicopter operations. The down and up operation are currently located on the west side of Buck and Doe Road. The in and out operations are currently located on the north side of the fixed wing aircraft parking apron east of the terminal building. Several alternatives have been evaluated for future helicopter development areas. The alternatives and cost estimates are shown in **Figures 4-6 and 4-7 and Tables 4-4 and 4-5**.

4.3.4.1 DOWN AND UP HELICOPTER ALTERNATIVES

There are currently 15 parking pads and 5 TLOFs serving the down an up helicopter operations on the west side of Buck and Doe Road. The forecasted demand from Chapter 2 and facilities needed to accommodate the forecasted demand show the airport will need to provide for a total of 50 parking pads and 17 TLOFs for down and up helicopter activity over the 20-year planning period. The two alternatives listed below evaluate possible locations for these additional facilities.

1) ***Alternative 1***. This alternative would include the continuing to develop the down and up helicopter operations on the west side of Buck and Doe Road. Alternative 1 would include the development of an additional 35 helicopter parking pads and 12 TLOFs. *Estimated cost of this development: $3.3 million*

The major advantages to this alternative are:

- Continues the use of the existing down and up helicopter facilities
- Keeps the fixed wing and helicopter operations together, reducing travel time to and from fixed wing and helicopter
- Accommodates the recommended future development
- Consistent with existing airport development
- Minimizes development costs

The major disadvantages to this alternative are:

- Does not alleviate congestion on the west side of the airport
- Impacts the existing wastewater absorption field

TABLE 4-4 DOWN AND UP HELICOPTER ALTERNATIVE 1 COST ESTIMATE

Grand Canyon West Airport
Airport Master Plan
Down and Up Helicopter Development Alternative 1
Engineers's Preliminary Estimate of Probable Construction Cost
September, 2012

Prepared By: Amrstrong Consultants, Inc.
Armstrong Project Number: 116048
JLS

SCHEDULE I:					
Item	Description of Work	Quantity	Unit	Unit Price	Extension
1	Mobilization	L.S.	L.S.	$ 235,000.00	$ 235,000.00
2	Clearing and Grubbing	Incidental	Incidental	Incidental	Incidental
3	Watering	Incidental	Incidental	Incidental	Incidental
4	Excavation	1,000	C.Y.	$5.00	$ 5,000.00
5	Embankment	9,000	C.Y.	$15.00	$ 135,000.00
6	Crushed Rock Cover (3" thick)	68,840	S.Y.	$7.00	$ 481,880.00
7	Crushed Aggregate Base Course (6-Inches Thick)	635	S.Y.	$13.00	$ 8,255.00
8	Bituminous Surface Course (50 Blow)(Min. 3" Thick)	75	Ton	$75.00	$ 5,625.00
9	Bituminous Material (PG 64-28)	5	Ton	$850.00	$ 4,250.00
10	Bituminous Prime Coat	20,810	Gallons	$2.50	$ 52,025.00
11	Bituminous Tack Coat	95	Gallons	$2.40	$ 228.00
12	Concrete Helicopter Parking or Landing Pad	5,350	S.Y.	$115.00	$ 615,250.00
13	Concrete Sidewalk	4,010	S.Y.	$47.00	$ 188,470.00
14	Concrete Trench	288	L.F.	$70.00	$ 20,160.00
15	6" x 5' Marking Block	396	EA	$40.00	$ 15,840.00
16	12" x 6' Marking Block	72	EA	$50.00	$ 3,600.00
17	Concrete Joint Sealant	Incidental	Incidental	Incidental	Incidental
18	Pavement Marking	13,200	S.F.	$0.75	$ 9,900.00
19	Removal- Asphaltic Material Special 2c	9,000	S.Y.	$9.00	$ 81,000.00
20	Removal- Concrete	1,100	S.Y.	$15.00	$ 16,500.00
21	Special 17a Cobble Rock (9" thick)	26,860	S.Y.	$20.00	$ 537,190.20
22	Chain Link Fencing	5,950	L.F.	$20.00	$ 119,000.00
23	4x4-foot Chain Link Gate	36	EA	$500.00	$ 18,000.00
19	Hydraulic Seeding and Mulching	15	Acre	$5,000.00	$ 75,000.00
				Schedule I	**$ 2,627,173.20**
				Engineering & Contingency	$ 656,793.30
				Schedule I Subtotal	**$ 3,284,000.00**
	For Planning Purposes Only				
				Project I Cost	**$ 3,284,000.00**

2) ***Alternative 2***. This alternative would include relocating and expanding future down and up helicopter operations area on the east side of Runway 17/35 adjacent to the future general aviation development area. This alternative would include converting the existing down and up operations area into an in and out operations area. *Estimated cost of this development: $5.0 million*

The major advantages to this alternative are:

- Alleviates congestion of activity by placing down and up helicopters on the east side of the airport
- Accommodates the recommended future development requirements
- Cost savings on expanding future in and out helicopter operations area

The major disadvantages to this alternative are:

- Separates the fixed wing activity from the helicopter activity and increases travel time to and from fixed wing to helicopter
- Requires relocation of existing facilities and infrastructure
- Increased development costs

TABLE 4-5 DOWN AND UP HELICOPTER ALTERNATIVE 2 COST ESTIMATE

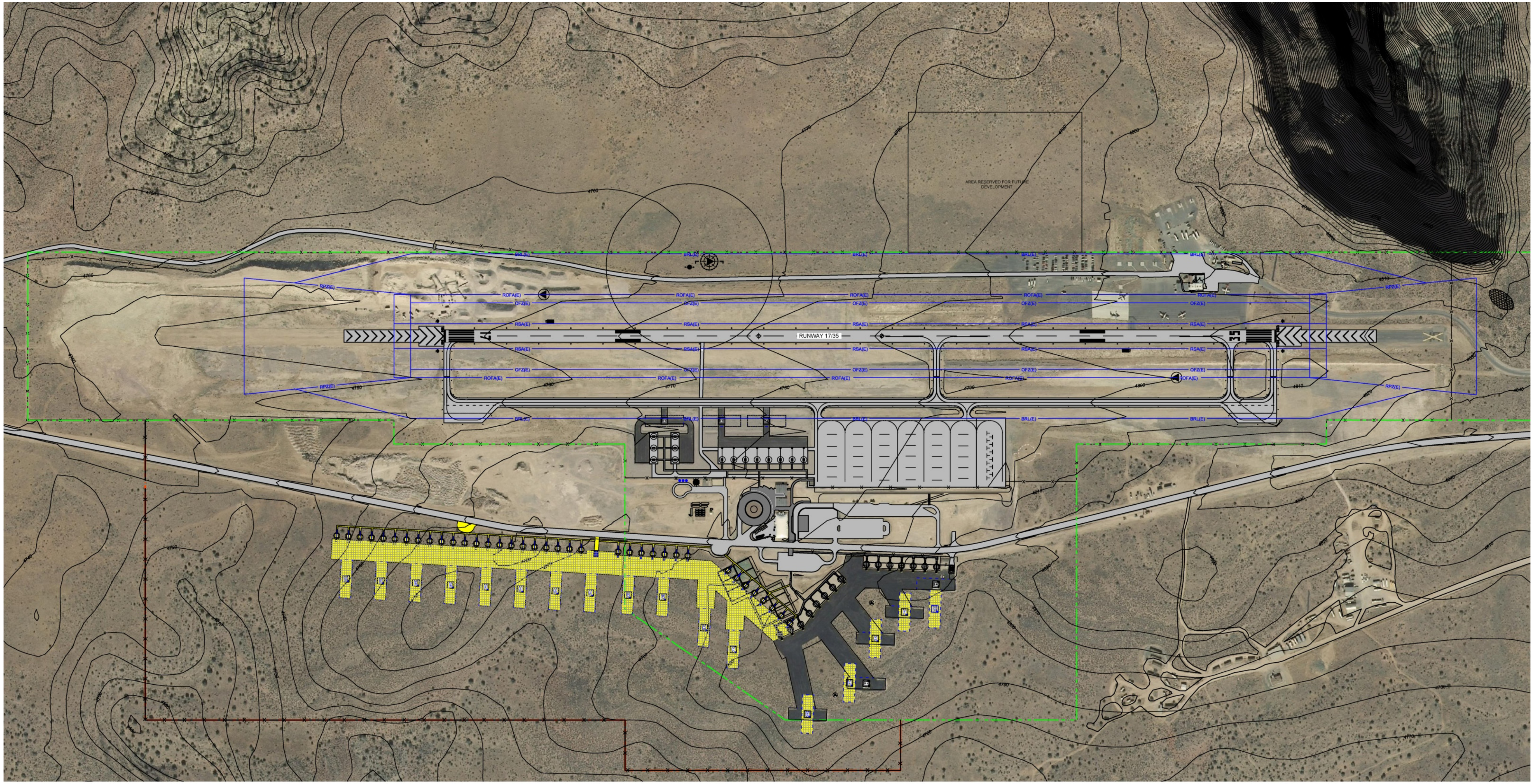
Grand Canyon West Airport
Airport Master Plan
Down and Up Helicopter Development Alternative 2
Engineers's Preliminary Estimate of Probable Construction Cost
September, 2012

Prepared By: Amrstrong Consultants, Inc.
Armstrong Project Number: 116048
JLS

SCHEDULE I:					
Item	Description of Work	Quantity	Unit	Unit Price	Extension
1	Mobilization	L.S.	L.S.	$ 270,000.00	$ 270,000.00
2	Clearing and Grubbing	Incidental	Incidental	Incidental	Incidental
3	Watering	Incidental	Incidental	Incidental	Incidental
4	Excavation	2,000	C.Y.	$3.00	$ 6,000.00
5	Embankment	12,000	C.Y.	$15.00	$ 180,000.00
6	Crushed Aggregate Base Course (6-Inches Thick)	14,873	S.Y.	$13.00	$ 193,349.00
7	Crushed Rock Cover (3" thick)	77,145	S.Y.	$7.00	$ 540,015.00
8	Special 17a Cobble Rock (9" thick)	39,165	S.Y.	$20.00	$ 783,300.00
9	Bituminous Surface Course (50 Blow)(Min. 3" Thick)	1,710	Ton	$70.00	$ 119,700.00
10	Bituminous Material (PG 64-28)	111	Ton	$850.00	$ 94,350.00
11	Bituminous Prime Coat	28,510	Gallons	$2.50	$ 71,275.00
12	Bituminous Tack Coat	22,231	Gallons	$2.40	$ 53,354.40
13	Concrete Helicopter Parking or Landing Pad	6,165	S.Y.	$115.00	$ 708,975.00
14	Concrete Sidewalk	5,150	S.Y.	$47.00	$ 242,050.00
15	Concrete Trench	400	LF	$70.00	$ 28,000.00
16	6" x 5' Marking Block	550	EA	$40.00	$ 22,000.00
17	12" x 6' Marking Block	100	EA	$50.00	$ 5,000.00
18	Concrete Joint Sealant	Incidental	Incidental	Incidental	Incidental
19	Pavement Marking	15,000	S.F.	$0.75	$ 11,250.00
20	Chain Link Fencing	3,700	L.F.	$20.00	$ 74,000.00
21	4x4-foot Chain Link Gate	50	EA	$500.00	$ 25,000.00
22	Relocate AWOS	1	EA	$200,000.00	$ 200,000.00
23	Relocate Wind Cone & Segmented Circle	1	EA	$75,000.00	$ 75,000.00
24	Pulverize, Remove, and Stockpile Asphalt Pavement	13,130	SY	$15.00	$ 196,950.00
25	Hydraulic Seeding and Mulching	12	Acre	$5,000.00	$ 60,000.00
				Schedule I	**$ 3,959,568.40**
				Engineering & Contingency	$ 989,892.10
	For Planning Purposes Only			**Schedule I Subtotal**	**$ 4,949,500.00**
				Project I Cost	**$ 4,949,500.00**

RECOMMENDED DOWN AND UP HELICOPTER ALTERNATIVE

A planning meeting will be held with the Grand Canyon West and the FAA in order to determine the recommended down and up helicopter alternative.



ARMSTRONG CONSULTANTS

FIGURE 4-6 DOWN AND UP HELICOPTER ALTERNATIVE 1

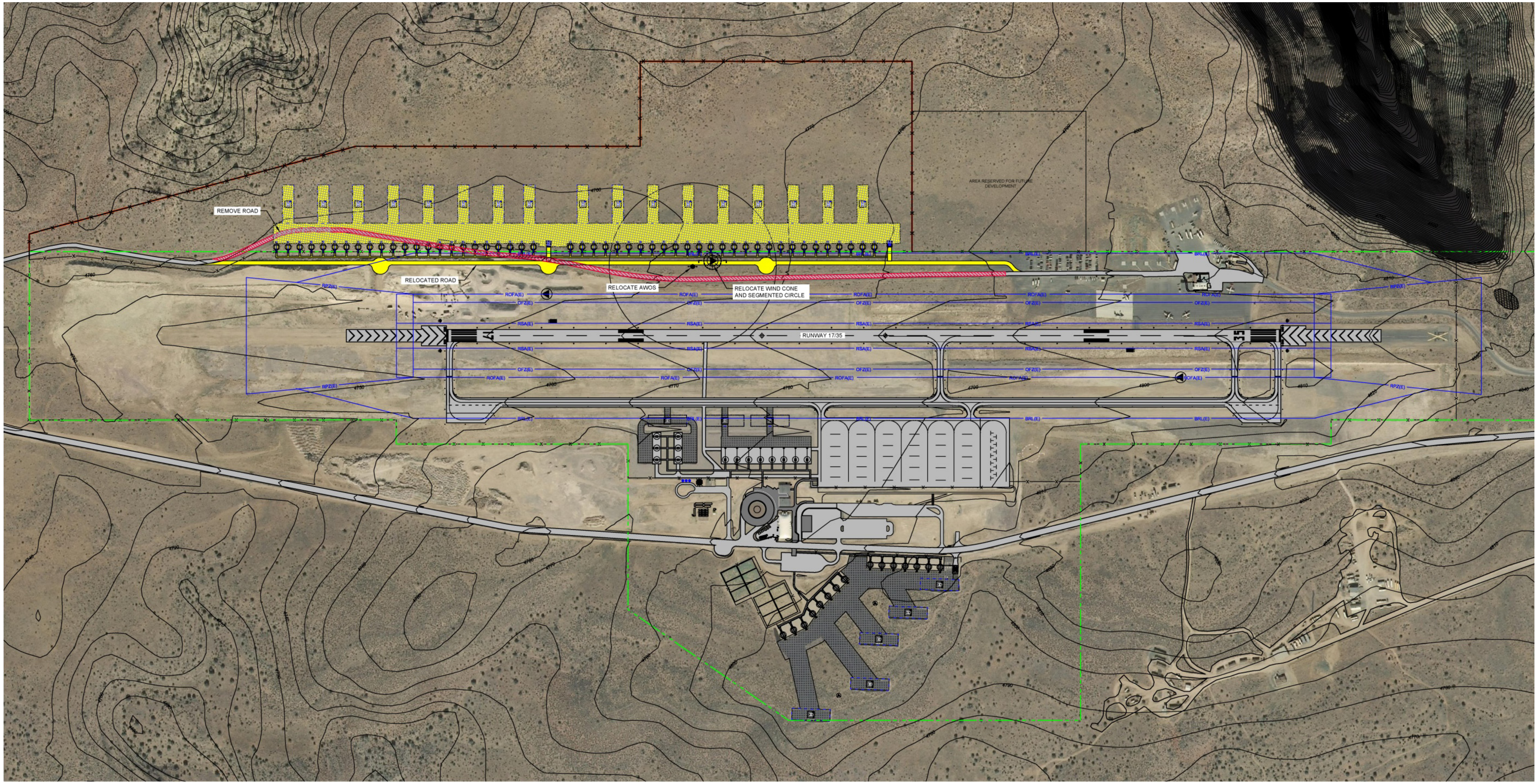


FIGURE 4-7 DOWN AND UP HELICOPTER ALTERNATIVE 2

4.3.4.2 In and Out Helicopter Recommended Development

As previously described the in and out operations are currently located adjacent to the fixed wing aircraft apron to the north. Based on the fixed wing apron expansion the helicopter parking positions and TLOFs would need to be relocated. In order to separate the fixed wing traffic and the in and out helicopter traffic relocating the in and out operations area to the east side of the runway is recommended. There are currently 14 parking pads serving the in and out activity. Based on the forecasted demand the airport will need to accommodate a total of 20 helicopter parking pads and seven TLOFs for the projected in and out traffic over the 20 year planning period. The recommended in and out helicopter development and future fixed wing air tour apron expansion is shown in **Figure 4-8**. The expanded fixed wing air tour apron is further discussed in section 4.4.3. The cost estimates for the development in and out helicopter development are included in **Table 4-8** along with the east side general aviation development area.

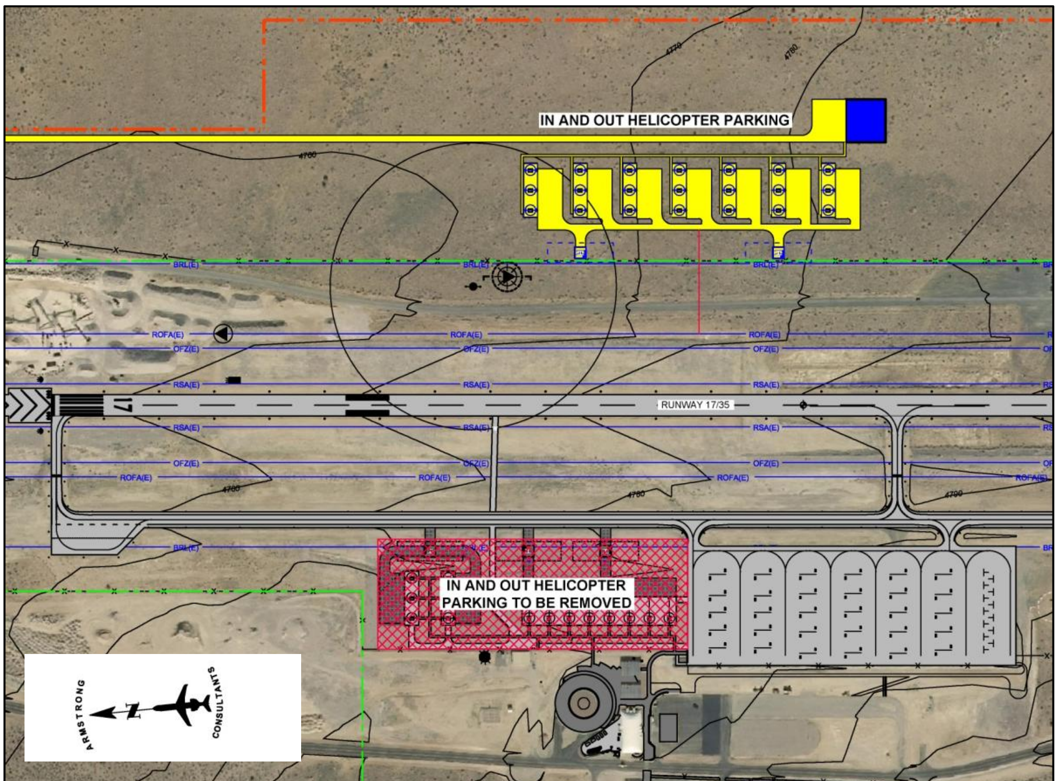


FIGURE 4-8 IN AND OUT HELICOPTER RECOMMENDED DEVELOPMENT AND FIXED WING AIR TOUR APRON EXPANSION

4.4 Landside Development Concepts

Landside development consists of all portions of the airport designed to serve the passengers and users. These areas consist of the passenger terminal building, vehicle roads, parking facilities and general aviation development areas. The following recommendations are necessary to meet future forecast of aviation, passenger activity and growth for landside development.

4.4.1 Terminal Building

There are three functions for the terminal building. The first function is the air terminal which serves as the location for passengers arriving via fixed wing aircraft or helicopter (i.e. in and out passengers). The second function is the helicopter terminal which serves as the location for passengers participating in down and up helicopter operations (i.e. down and up passengers). The third function is the ground visitor terminal which serves as the access point to the facility for visitors arriving via personal vehicle and motor coach. The options for the terminal building include providing three separate facilities, one single facility or a combination thereof. **Table 4-6** shows the recommended square footage for each facility over the 20-year planning period. In order to facilitate passenger flow, maximize use of existing facilities and infrastructure and accommodate required ground visitor parking needs. A phased, three building approach is recommended with an off-site ground terminal and vehicle parking facility, the down and up helicopter terminal utilizing the foundation and footprint of the existing air structure terminal and a new in and out passenger terminal to be constructed along the apron frontage (see **Figure 4-11**).

The air terminal building will house the in and out operation (itinerant fixed wing and helicopters) and interface with the existing and future aircraft apron. The terminal building will be designed to segregate secure and non-secure areas, public and non-public areas, and air tour functional areas, as explained in Chapter 3. The air terminal building is planned to be 42,366 square feet and would be designed to accommodate potential expansion beyond the planning period, as shown in **Figure 4-9**. The air terminal will have apron ramp access, and vehicle parking lot access. *Estimated cost for this development: $25,000,000.*

TABLE 4-6 TERMINAL BUILDING FACILITY PLANNING – DESIGN TOTALS (SQUARE FEET)

Function	20-Year Planning Period
Air Terminal Building (in and out)	42,366
Helicopter Terminal Building (down and up)	31,122
Ground Terminal Building (cars, RV and motor coach)	32,090
Total Terminal Requirements	**105,578**

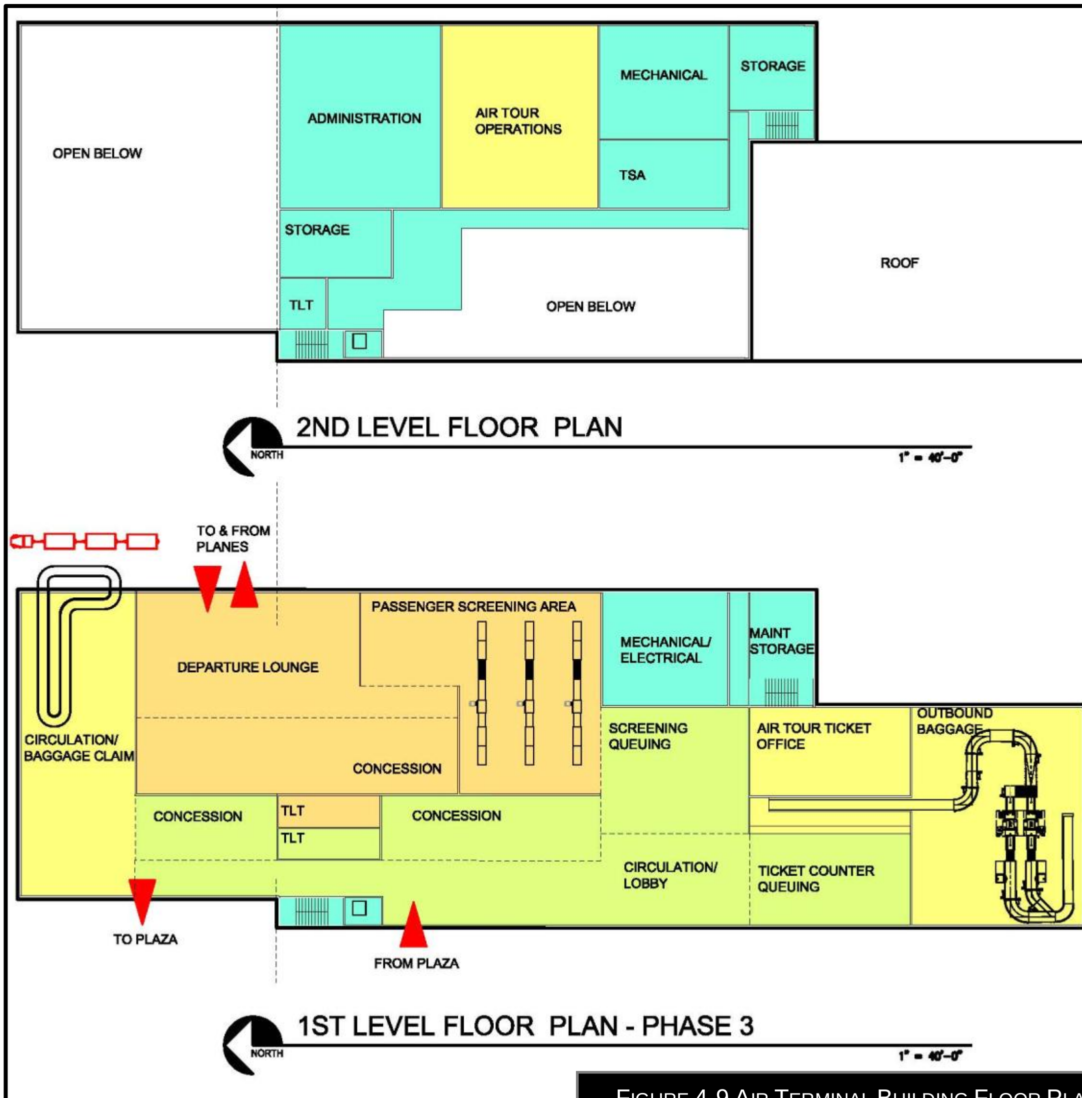
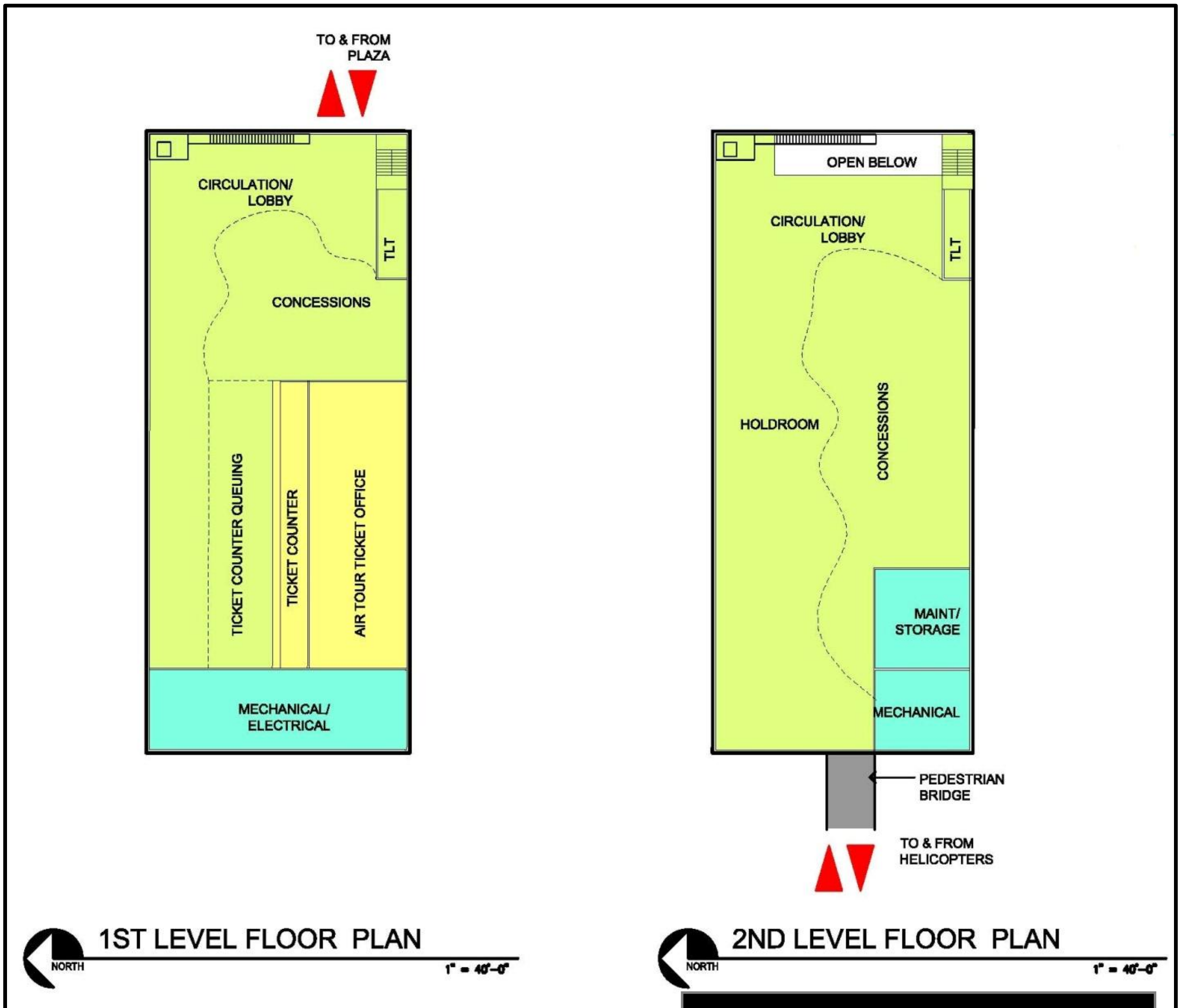


FIGURE 4-9 AIR TERMINAL BUILDING FLOOR PLAN

Source: DWL Architects, Inc., July 2012

The helicopter terminal building will serve down and up helicopter passengers and be located to the west of the future air terminal building. The helicopter terminal would be 31,122 square feet and house concessions, air tour functional area, public and non-public area. A majority of this terminal building development will consist of concession space and circulation space, as shown in **Figure 4-10**. *Estimated cost for this development: $19,000,000.*



DWL Architects, Inc., July 2012

FIGURE 4-10 HELICOPTER TERMINAL BUILDING

The ground visitor terminal building will serves as the access point for visitors arriving via personal vehicle and motor coach. As previously described the ground visitor terminal is recommended to be constructed off-site. This will allow for the development of a large visitor parking lot and segregate the passengers arriving via ground transportation from those arriving via helicopter and fixed wing. Visitors arriving via ground transportation will be able to purchase tickets and be shuttled from the ground visitor terminal to the local attractions without impacting airport operations. The resort corporation is underway in evaluating the options for the development of an offsite visitor center to accommodate those needs. *Estimated cost for this development: $19,000,000.*

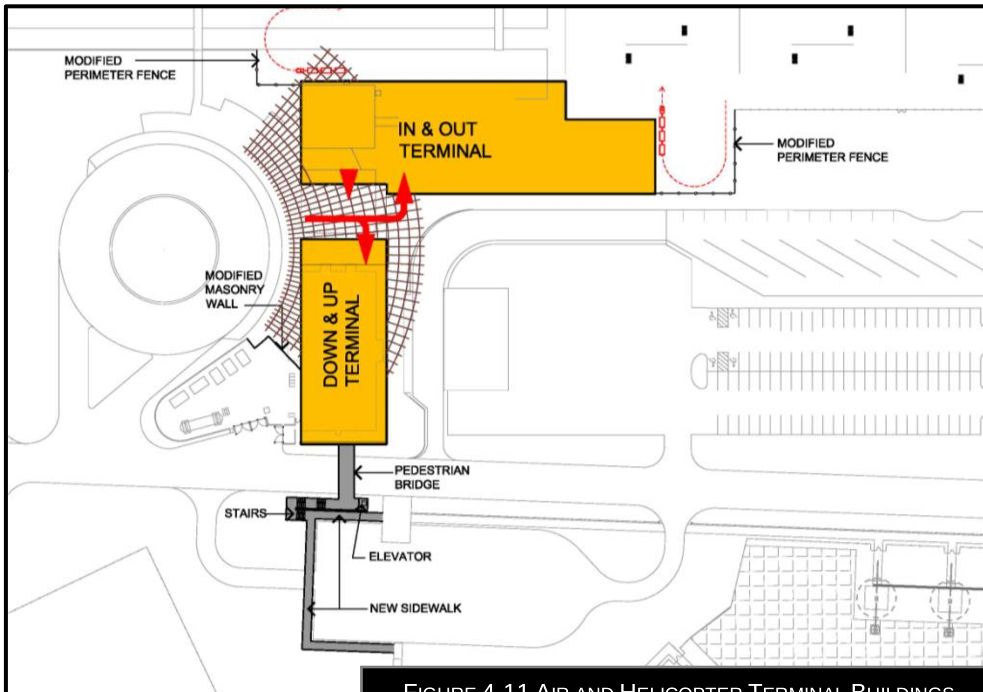


FIGURE 4-11 AIR AND HELICOPTER TERMINAL BUILDINGS

Source: DWL Architects, Inc., July 2012

4.4.2 GENERAL AVIATION APRON AND HANGAR DEVELOPMENT

The Forecasts of Aviation Activity and Facility Requirements Chapters identified the need for additional general aviation (GA) facilities throughout the planning period. The following alternatives describe the options for meeting the needs of the future general aviation growth while maintaining the strategic goals of the Airport.

A 56,492 square yards fixed wing aircraft apron is recommended on the east side of the airfield. This development would consist of the addition of a 70 foot by 150 foot executive pilot's lounge/executive pilot's lounge. The pilot's lounge would house utilities, lounge space, restrooms and vending area. The apron shall to accommodate Group I through Group III fixed wing aircraft. Two taxilanes would connect the aircraft from the airfield to the future hangar facilities. A Group III single taxilane will lead into the hangar area.

Four 100 foot by 100 foot general aviation hangar buildings to accommodate up to Group III aircraft would be constructed on the southeast quadrant of the general aviation pavement area and provide a taxilane 150 feet in front of the hangar for aircraft movement and access. New utility corridors consisting of power, water, gas and sewer would be constructed and provide full access to all hangars.

The apron area would also accommodate helicopter operations. One TLOF and 14 helicopter parking spaces would be constructed to the northwest of the apron area. This would accommodate any transient and itinerant general aviation helicopter operations and segregate the traffic from the air tour operations. Total development of this area is approximately 6,357 square yards of asphalt at pavement strength of 92,000 pounds DWG. This development area would also include the construction of two 50 foot connector taxiways on the west end of the expansion to provide access to the airfield (see **Figure 4-12**). The future general aviation development area cost estimates are listed in **Table 4-7** which includes the development of the future in and out helicopter operations area.

TABLE 4-7 EAST SIDE GENERAL AVIATION DEVELOPMENT AREA COST ESTIMATE

Grand Canyon West Airport
Airport Master Plan
East Side General Aviation Development Area
Engineers's Preliminary Estimate of Probable Construction Cost
September, 2012

Prepared By: Amrstrong Consultants, Inc.
Armstrong Project Number: 116048
JLS

PROJECT I:	CONSTRUCT GENERAL AVIATION DEVELOPMENT AREA				
SCHEDULE I:	**CONSTRUCT GENERAL AVIATION DEVELOPMENT AREA**				
Item	Description of Work	Quantity	Unit	Unit Price	Extension
1	Mobilization	L.S.	L.S.	$ 700,000.00	$ 700,000.00
2	Watering	Incidental	Incidental	Incidental	Incidental
3	Clearing and Grubbing	Incidental	Incidental	Incidental	Incidental
4	Excavation	47,500	C.Y.	$3.00	$ 142,500.00
5	Embankment	19,000	C.Y.	$15.00	$ 285,000.00
6	Concrete Helicopter Parking/Landing Pad/Tie Downs/Parking ID	5,500	S.Y.	$115.00	$ 632,500.00
7	Subgrade (Min 6" Thick)	112,895	S.Y.	$9.00	$ 1,016,055.00
8	Crushed Aggregate Base Course (6-Inches Thick)	112,895	S.Y	$13.00	$ 1,467,635.00
9	Bituminous Surface Course (50 Blow)(Min. 3" Thick)	19,475	Ton	$90.00	$ 1,752,750.00
10	Bituminous Material (PG 64-28)	1,270	Ton	$1,000.00	$ 1,270,000.00
11	Bituminous Prime Coat	33,870	Gallons	$2.50	$ 84,675.00
12	Bituminous Tack Coat	16,935	Gallons	$2.40	$ 40,644.00
13	Glass Beads	820	LBS	$5.50	$ 4,510.00
14	Pavement Marking	13,415	S.F.	$0.75	$ 10,061.25
15	Lighted Guidance Sign	15	E.A.	$4,000.00	$ 60,000.00
16	Unlighted Signs	3	E.A.	$2,500.00	$ 7,500.00
17	Taxiway Edge Light	73	E.A.	$1,200.00	$ 87,600.00
18	Remove Runway Edge Light	1	E.A.	$200.00	$ 200.00
19	Runway Edge Light	1	E.A.	$1,200.00	$ 1,200.00
20	Chain Link Fence	9,140	L.F.	$20.00	$ 182,800.00
21	Removal- Fencing	7,840	L.F.	$5.00	$ 39,200.00
22	Pulverize, Remove, and Stockpile Asphalt Pavement	18,370	S.Y.	$11.00	$ 202,070.00
23	Hydraulic Seeding and Mulching	56	Acre	$5,000.00	$ 280,000.00
				Schedule I	**$ 8,266,900.25**
				Engineering & Contingency	$ 2,066,725.06
				Schedule I Subtotal	**$ 10,333,700.00**
				Project I Cost	**$ 10,333,700.00**

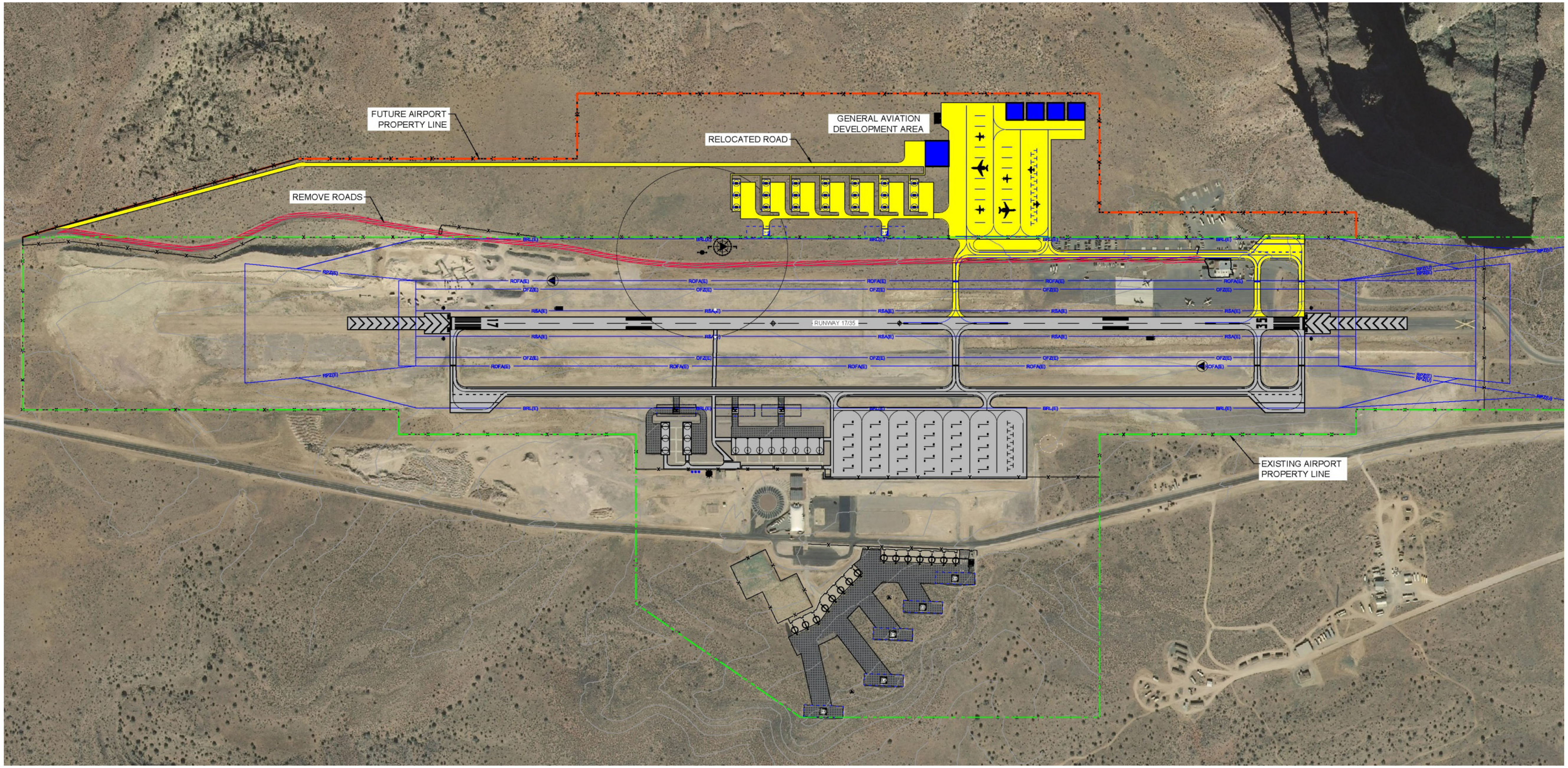


Figure 4-12 General Aviation Development Area

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4.4.3 COMMERCIAL/AIR TOUR FIXED WING APRON AREA

The existing air tour and general aviation fixed wing aircraft and helicopter apron located to the west of the Runway is not adequate to serve the growth anticipated for the planning period. The fixed wing apron area should be expanded to 62,933 square yards from its existing 53,061 square yards. The apron pavement strength should be increased initially to 60,000 DWG and ultimately 108,000 DWG. The apron should be developed in the ultimate to accommodate Group III aircraft wingtip clearance for aircraft as large as Boeing 737. Rising terrain to the south and west of the existing apron will make apron expansion in either of those directions challenging and expensive. The existing in and out helicopter parking pads would be converted to apron to accommodate the demand. The apron expansion area currently meets the FAA design standards for grade requirements. As previously described it is recommended that the in and out helicopter operations area be relocated to the east side of the runway. The future development is shown in **Figure 4-13** and costs are shown in **Table 4-8**.

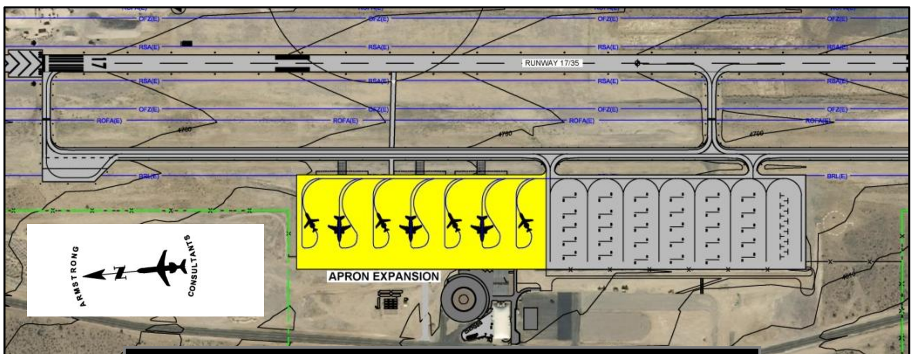

FIGURE 4-13 FIXED WING COMMERCIAL APRON EXPANSION

TABLE 4-8 FIXED WING COMMERCIAL APRON EXPANSION AREA COST ESTIMATE

Grand Canyon West Airport
Airport Master Plan
East Side General Aviation Development Area
Engineers's Preliminary Estimate of Probable Construction Cost
September, 2012

Prepared By: Amrstrong Consultants, Inc.
Armstrong Project Number: 116048
JLS

ARMSTRONG CONSULTANTS, INC.

PROJECT I:	CONSTRUCT GENERAL AVIATION DEVELOPMENT AREA				
SCHEDULE I:	**CONSTRUCT GENERAL AVIATION DEVELOPMENT AREA**				
Item	Description of Work	Quantity	Unit	Unit Price	Extension
1	Mobilization	L.S.	L.S.	$ 700,000.00	$ 700,000.00
2	Watering	Incidental	Incidental	Incidental	Incidental
3	Clearing and Grubbing	Incidental	Incidental	Incidental	Incidental
4	Excavation	47,500	C.Y.	$3.00	$ 142,500.00
5	Embankment	19,000	C.Y.	$15.00	$ 285,000.00
6	Concrete Helicopter Parking/Landing Pad/Tie Downs/Parking ID	5,500	S.Y.	$115.00	$ 632,500.00
7	Subgrade (Min 6" Thick)	112,895	S.Y.	$9.00	$ 1,016,055.00
8	Crushed Aggregate Base Course (6-Inches Thick)	112,895	S.Y	$13.00	$ 1,467,635.00
9	Bituminous Surface Course (50 Blow)(Min. 3" Thick)	19,475	Ton	$90.00	$ 1,752,750.00
10	Bituminous Material (PG 64-28)	1,270	Ton	$1,000.00	$ 1,270,000.00
11	Bituminous Prime Coat	33,870	Gallons	$2.50	$ 84,675.00
12	Bituminous Tack Coat	16,935	Gallons	$2.40	$ 40,644.00
13	Glass Beads	820	LBS	$5.50	$ 4,510.00
14	Pavement Marking	13,415	S.F.	$0.75	$ 10,061.25
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16	Unlighted Signs	3	E.A.	$2,500.00	$ 7,500.00
17	Taxiway Edge Light	73	E.A.	$1,200.00	$ 87,600.00
18	Remove Runway Edge Light	1	E.A.	$200.00	$ 200.00
19	Runway Edge Light	1	E.A.	$1,200.00	$ 1,200.00
20	Chain Link Fence	9,140	L.F.	$20.00	$ 182,800.00
21	Removal- Fencing	7,840	L.F.	$5.00	$ 39,200.00
22	Pulverize, Remove, and Stockpile Asphalt Pavement	18,370	S.Y.	$11.00	$ 202,070.00
23	Hydraulic Seeding and Mulching	56	Acre	$5,000.00	$ 280,000.00
				Schedule I	**$ 8,266,900.25**
				Engineering & Contingency	$ 2,066,725.06
				Schedule I Subtotal	**$ 10,333,700.00**
				Project I Cost	**$ 10,333,700.00**

4.4.4 Air Traffic Control Tower

An air traffic control tower (ATCT) site analysis was conducted in 2012 to determine the feasibility and possible location for an ATCT. A copy of the study can be found in **Appendix D**. The study initially identified five potential sites; however, based on various physical constraints the sites were narrowed down to three sites. The three sites are described below and show in **Figure 4-14**:

Site 3. This alternative is located at a site elevation of 4,774 feet MSL at the midpoint of the airfield approximately 430 feet east of the runway centerline. The tower is located approximately 2,000 feet from existing Runway 17 end and 2,900 feet from existing Runway 35 end. The cab eye height for this tower would be 87 feet AGL and encompasses a total of 3,284 square feet (shaft and base building). This alternative would be ideal for visual of the west helicopter area and both runway ends. This alternative would also be conducive for down and up helicopter operations into the Canyon based on the towers location. This alternative would require the most site work for construction. Alternative 1 would meet or exceed all of the required siting criteria. The site results in the tallest structure necessary to meet all FAA visual requirements. The site offers an unobstructed view of all airport operations. However, to view all airport operations ATC staff would frequently have to turn more than 180 degrees. The majority of airport traffic as well as airport movement areas are northwest to northeast. This would provide an acceptable viewing angle to minimize interference from the sun. Alternative 1 is easily accessible from the airport perimeter road, but it is likely that the road would require improvement to meet fire access requirements. Utilities are also not immediately available at the site. *Estimated cost of this development: $3,170,000*.

Site 4. This alternative is located at a site elevation of 4,798 feet MSL at the approach end of Runway 35 approximately 450 feet east of the runway centerline. The tower is located approximately 850 feet from existing Runway 35 end and 4,200 feet from existing Runway 17 end. The cab eye height for this tower would be 35 feet AGL and encompasses a total of 2,084 square feet (shaft and base building). This alternative would be ideal for fixed wing aircraft and transient helicopter operations, but can pose an issue for landing down and up helicopters. This alternative would require the minimal site work for construction. Alternative 2 would meet or exceed all of the required siting criteria. The site results in the second shortest structure necessary to meet all FAA visual requirements. The site offers an unobstructed view of all airport operations. However, to view all airport operations, ATC staff would frequently have to turn more than 180 degrees. The majority of airport traffic as well as airport movement areas are northwest through northeast. This is an acceptable viewing angle to minimize interference from the sun. Alternative 2 is easily accessible from the airport perimeter road, but it is likely that the road would require improvement to meet fire access requirements. Utilities are also not immediately available at the site. *Estimated cost of this development: $2,222,000.*

Site 5. This alternative is located at a site elevation of 4,815 feet MSL on the west side of the airport, south of the terminal area and parking lot. This alternative is approximately 730 feet west of the Runway 17/35 centerline, 3,800 feet from existing Runway 17 end and 1,450 feet from existing Runway 35 end. The cab eye height for this tower would be 23 feet AGL and encompasses a total of 2,084 square feet (shaft and base building). This alternative would be ideal for the arrival and departure of fixed wing aircraft and in and out helicopter operations; however, could prove an issue for down and up helicopter operations into the Canyon. Alternative 3 would meet or exceed all of the required siting criteria. The site results in the shortest structure necessary to meet all FAA visual requirements. The site offers an unobstructed view of all airport operations and the majority of airport traffic movement areas can be viewed with minimal need for ATC staff to turn more than 180 degrees. The majority of the airport traffic as well as movement areas are north through northeast. This is an optimal viewing angle to minimize interference from the sun. Alternative 3 is easily accessible from the airport perimeter road with utilities nearby. *Estimated cost of this development: $2,317,000*.

RECOMMENDED AIR TRAFFIC CONTROL TOWER ALTERNATIVE

A planning meeting will be held with the Grand Canyon West and the FAA in order to determine the recommended ATCT site. Based on physical data and operational capability, the recommended alternative would be Alternative 3.

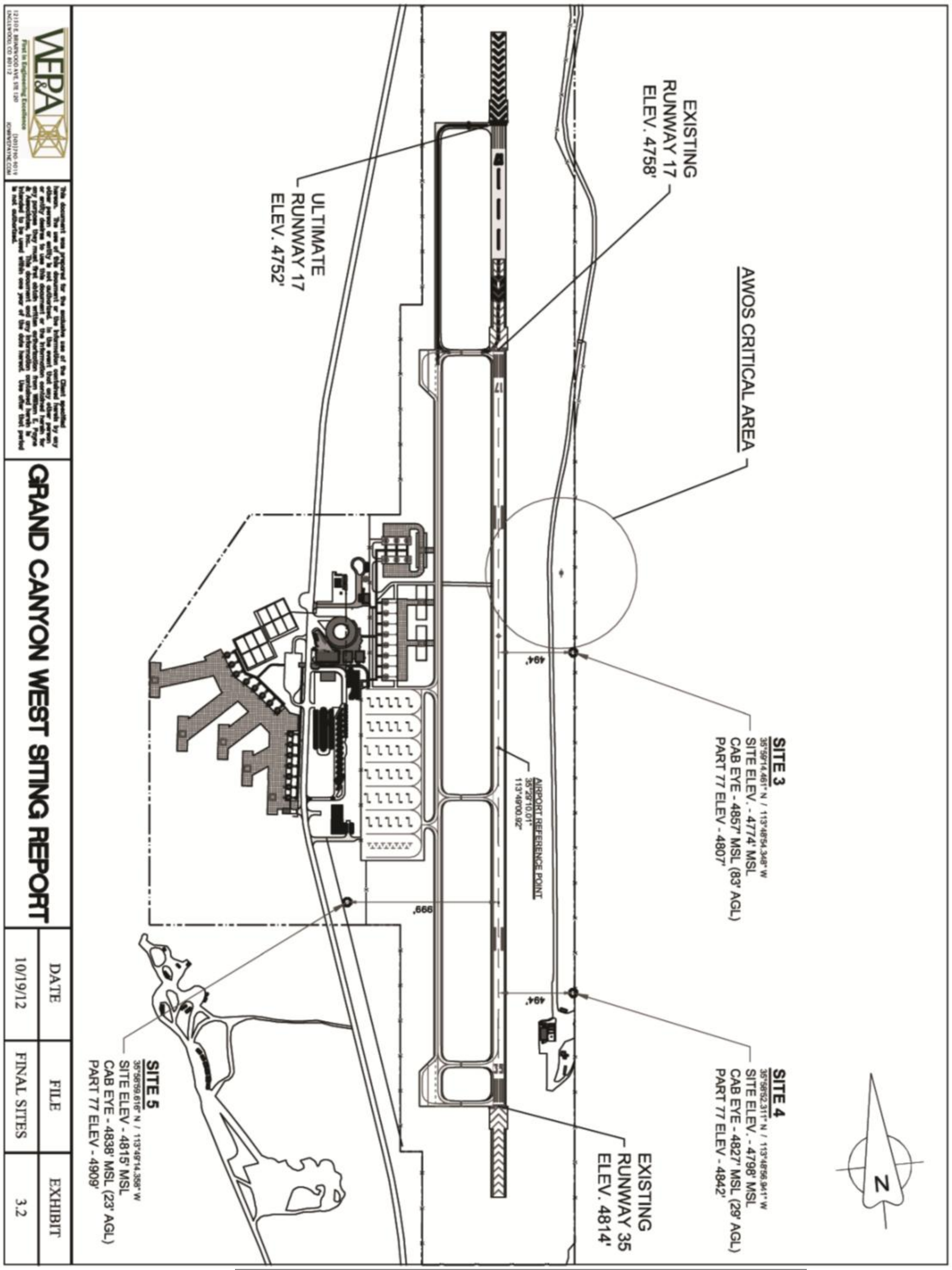


FIGURE 4-14 AIR TRAFFIC CONTROL TOWER SITES

4.4.5 Aviation Support Facilities

Expansion of the existing pre-engineered Aircraft Rescue and Fire Fighting (ARFF) equipment storage building was not deemed practicable for meeting the needed size and configuration of a manned ARFF facility. As such the Airport would construct a new ARFF facility.

The recommended location for ARFF facility is on the east side of the Airport near the existing runway midpoint. This location provides a central location for the ARFF to access all portions of the airport. The ARFF facility should measure 150 feet by 60 feet and The ARFF facility should also incorporate fire fighter living quarters in order to provide 24 hour fire response at the airport in the future. **Figure 4-15** shows a sample floor plan and conceptual sketch for the ARFF facility. The proposed location for the ARFF facility is shown in **Figure 4-18**. *Estimated cost for this development is $3,200,000.*

DWL Architects, Inc., August 2012

FIGURE 4-15 ARFF FACILITY FLOOR PLAN AND CONCEPTUAL SKETCH

The development of a 200 foot by 70 foot snow removal equipment (SRE) facility is recommended on the northwest quadrant of the expanded fixed wing and helicopter apron on the west side of the airfield. This maintenance building will house the existing 15 pieces of equipment as well as future equipment that will be acquired. The building will have direct access to the airfield. The building would be located approximately 570 feet west of the runway centerline. A sample SRE facility is shown in **Figure 4-16**. The proposed location for the SRE facility is shown in **Figure 4-18**. *Estimated cost of this development: $1,400,000.*

FIGURE 4-16 SAMPLE SRE FACILITY

The development of a hydrant fuel system is recommended for the west side airport development area. Based on existing and future activity at the airport the development of a 56,000 gallon Jet-A fuel tank is recommended. The system should supply fuel to a portion of the fixed wing apron, the in and out helicopter parking pads and the down and up helicopter parking pads. The remainder of the fixed-wing apron and general aviation facilities should be served with mobile refueling trucks. A sample fuel hydrant system is shown in **Figure 4-17** and the fuel hydrant system location is shown in **Figure 4-18**. *Estimated cost of this development: $2,000,000.*

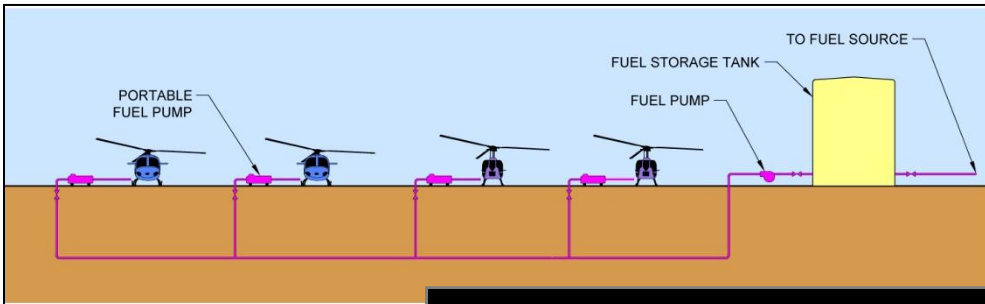


FIGURE 4-17 CONCEPTUAL FUEL HYDRANT SYSTEM

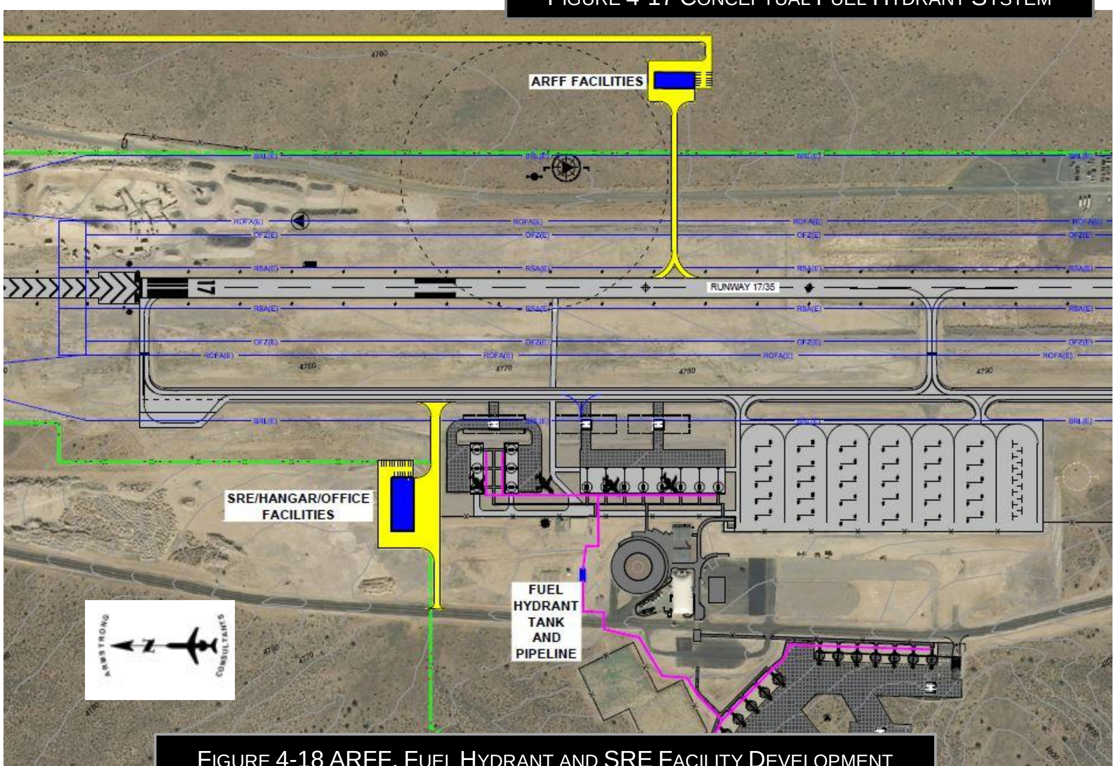


FIGURE 4-18 ARFF, FUEL HYDRANT AND SRE FACILITY DEVELOPMENT

4.5 GROUND TRANSPORTATION PROJECTS

The Airport currently operates one terminal area parking lot to accommodate personal vehicle, motor coach and employee parking. The forecasted increase in ground visitors at Grand Canyon West Airport will amplify the demand for short-term daily parking at the Airport. The existing parking lot is located to the south of the terminal building and west of the existing aircraft apron, and currently occupies 203,850 square feet with 426 paved surface parking spaces (personal vehicle and motor coach), with an additional 27,351 square feet (60 spaces) located to the south of the existing parking lot for overflow parking.

Based on ground visitor forecast and the facility requirements, long-term parking facilities should be developed to accommodate a minimum of 2,034 parking spaces (1,621 personal vehicle parking spaces and 147 motor coach spaces). Two alternatives have been recommended: a short-term alternative and a long-term alternative.

In the short-term the Airport would expand the personal vehicle and motor coach parking lots to the south. The personal vehicle parking lot would be expanded to add approximately 27,000 square feet of pavement (400 spaces) and the motor coach lot would be expanded to add 7,895 square feet of pavement (12 motor coach parking spaces). **Figure 4-19** shows the short-term airport parking expansion.

In the long-term, the development of a remote parking facility is recommended. The remote parking area will need to accommodate a total of 2,034 parking spaces with a total area of 933,164 square feet. Once the remote parking is developed a shuttle service should be provided by the Airport, or a third party provider, to transfer passengers to and from the terminal area. The possibility also exists for the development and use of mass transit transportation such as light rail, monorail or Personal Rapid Transit (PRT) in order to move passengers from the remote parking area to the airport, and possibly on from the airport to the local attractions including the Skywalk and Guano Point. A PRT system provides point-to-point transportation of up to 10,000 passengers per hour in eight passenger pods. A conceptual PRT route map is shown in **Figure 4-20**. The estimated PRT system cost is approximately $8 million per linear track mile. A roundtrip system from the remote vehicle parking area to the terminal, Skywalk and Guano Point would be estimated to cost approximately $64 million. The PRT system would reduce the personnel, maintenance, fuel and equipment cost of the existing shuttle bus system and provide enhanced visitor experience.

The development of a remote parking lot provides the Airport some alternatives in terms of ground visitor building development. Chapter 3 identified a visitor’s center be developed at 32,090 square feet which would accommodate space for concessions, administration, restrooms, air tour functional space, non-public areas and circulation. A second alternative would be to provide just shade and restroom accommodations for visitors arriving via personal vehicle or motor coach as they wait for the shuttle. The required 32,090 square feet for the ground visitor build could be transferred to the Helicopter Terminal building as a second story addition.

It is recommended an asphalt access and perimeter roadway be constructed on the east side of the airport to connect the general aviation development to the west side of the Airport. This road would be approximately 8,950 linear feet.

The construction of a cart path to the west of the fixed wing apron and to the east of the vehicle parking lot is recommended. This would provide a safe access route for air tour operators, airport personnel and visitors. The cart path would be ten feet wide and 1,585 linear feet long and constructed of asphalt. The cart path would provide access to the aircraft apron on the north end. The south end of the cart path will be constructed as a turnaround. Due to the elevation difference between the aircraft apron and the vehicle parking lot, stairs would be constructed between to two areas as well as an elevated cart ramp. The cart path will be lighted by the existing security lighting on the aircraft apron fence (see **Figure 4-19**).

The development and construction of a 115 foot pedestrian overpass suspending Buck and Road is recommended to connect passengers from the Helicopter terminal building to the down and up helicopter operations. This would provide pedestrians a safe passage over the street.

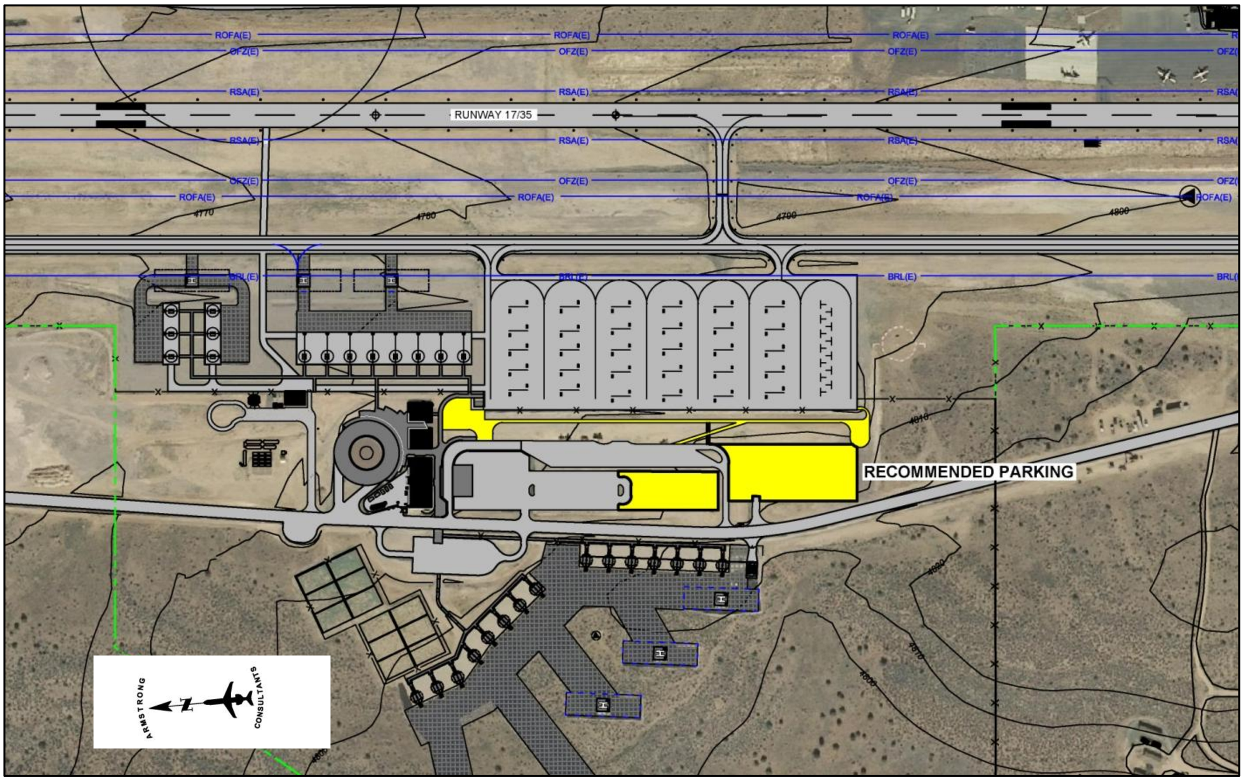


FIGURE 4-19 SHORT –TERM VEHICLE PARKING DEVELOPMENT

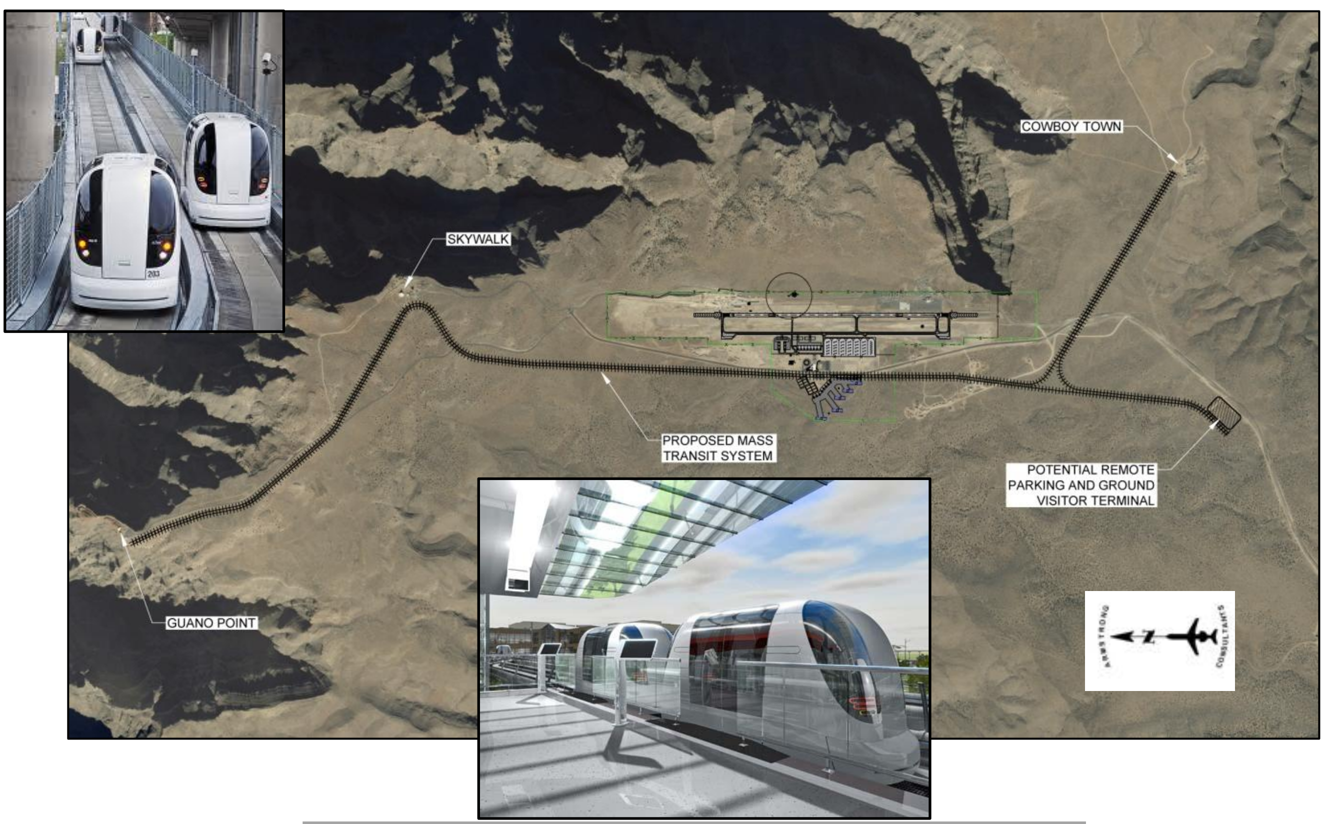


FIGURE 4-20 MASS TRANSIT SYSTEM

4.6 DEVELOPMENT IMPACTS

The recommended development projects meet the FAA's safety and design standards for the existing Airport Reference Code (ARC) B-II, C-II medium-term and long-term C-III development. This will allow the Airport to accommodate the existing and projected aircraft fleet mix.

4.6.1 ENVIRONMENTAL IMPACT

Development projects will likely cause short-term construction impacts, including mitigatable impacts to air quality. None of the projects are expected to cause significant environmental impacts based on the FAA's Order 5050.4B, Environmental Handbook or FAA Order 1050.1E, Environmental Impacts: Policies and Procedures. Environmental impact categories and potential impacts are further evaluated in Chapter 6 - Environmental Overview and include further discussion on potential environmental impacts.

4.7 DEVELOPMENT COSTS

Estimated development costs for each recommended project analyzed in this chapter will be further discussed in Chapter 7 - Airport Development and Financial Plan. Development costs discussed in this Chapter are preliminary estimates related to construction, engineering and administration.

A detailed phasing plan is recommended to accommodate budgetary constraints and will be delineated in Chapter 7. Phasing should mirror, to the extent practical, the requirements of users at the Airport by phasing in accordance to known and forecasted operations during the initial -, intermediate-, and long-term development. The summary of Alternatives is show in **Table 4-9**.

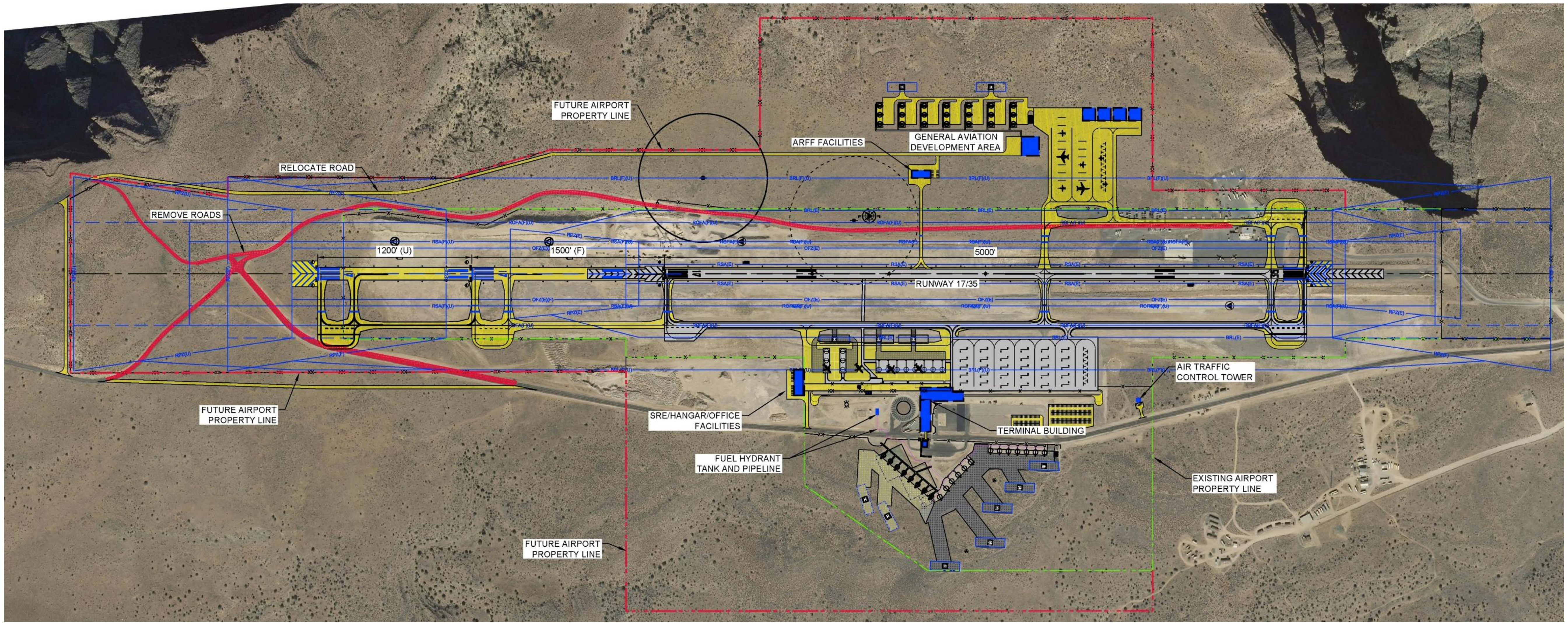
TABLE 4-9 SUMMARY OF ALTERNATIVES

Alternative	Project Description	Estimated Cost
Runway Alternative 1	Extend Runway 17 North	$11.7 Million
Runway Alternative 2	Extend Runway 35 South	$30.2 Million
Runway Alternative 3	Extend 17/35 North and South	$12.0 Million
Instrument Approach 1.A.	Develop LPV Approach North	$400,000
Instrument Approach 1.B.	Develop ILS Approach North	$2.4 Million
Instrument Approach 2.A.	Develop LPV Approach South	$40,000
Instrument Approach 2.B.	Develop ILS Approach South	$2.4 Million
Down and Up Helicopter Alternative 1	Expand West Side	$3.3 Million
Down and Up Helicopter Alternative 2	Develop and Expand East Side	$5.0 Million
In and Out Helicopter	Expand East Side	See GA Expansion
Terminal Alternative 1	Consolidated Terminal Building	$63.0 Million
Terminal Alternative 2	Individual Terminal Building	$63.0 Million
General Aviation	General Aviation East Side	$10.3 Million*
Commercial Apron	Apron Expansion North	$4.8 Million
ATCT Site 3	East Side Mid-Field	$3.2 Million
ATCT Site 4	East Side South End	$2.2 Million
ATCT Site 5	West Side South End	$2.3 Million
ARFF Facility	East Side	$3.2 Million
SRE Facility	Northwest Side	$1.4 Million

*Includes the cost associated with the in and out helicopter development/expansion.

4.8 CONCLUSION AND RECOMMENDATIONS

Feedback from Grand Canyon West Airport and concurrence from the FAA indicated moving forward with the recommended development for the Airport shown in **Figure 4-21**. The recommended development shown in **Figure 4-21** was considered to be the most realistic approach to future development at Grand Canyon West Airport from a financial, land use and feasibility stand point.



ARMSTRONG CONSULTANTS

FIGURE 4-21 RECOMMENDED DEVELOPMENT

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CHAPTER 5

AIRPORT LAYOUT PLAN

GRAND CANYON WEST AIRPORT
AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS, INC.
AIRPORT ENGINEERING AND PLANNING

GRAND CANYON WEST AIRPORT

HUALAPAI NATION, ARIZONA

AIRPORT LAYOUT PLANS

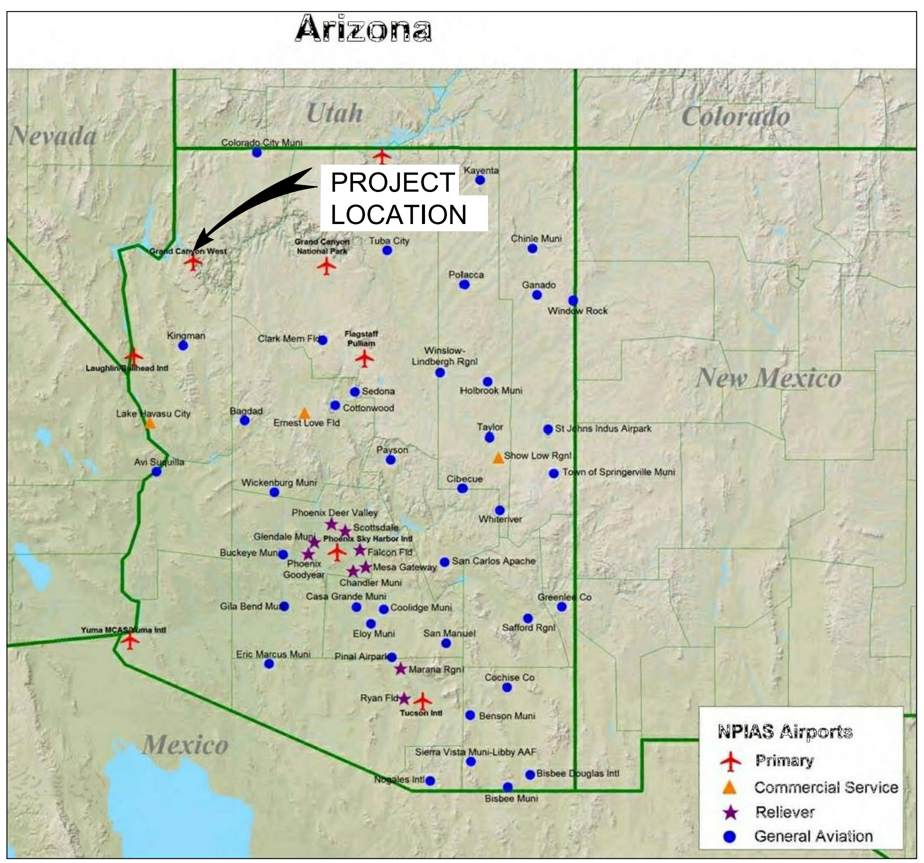
PREPARED BY:

ARMSTRONG CONSULTANTS, INC.

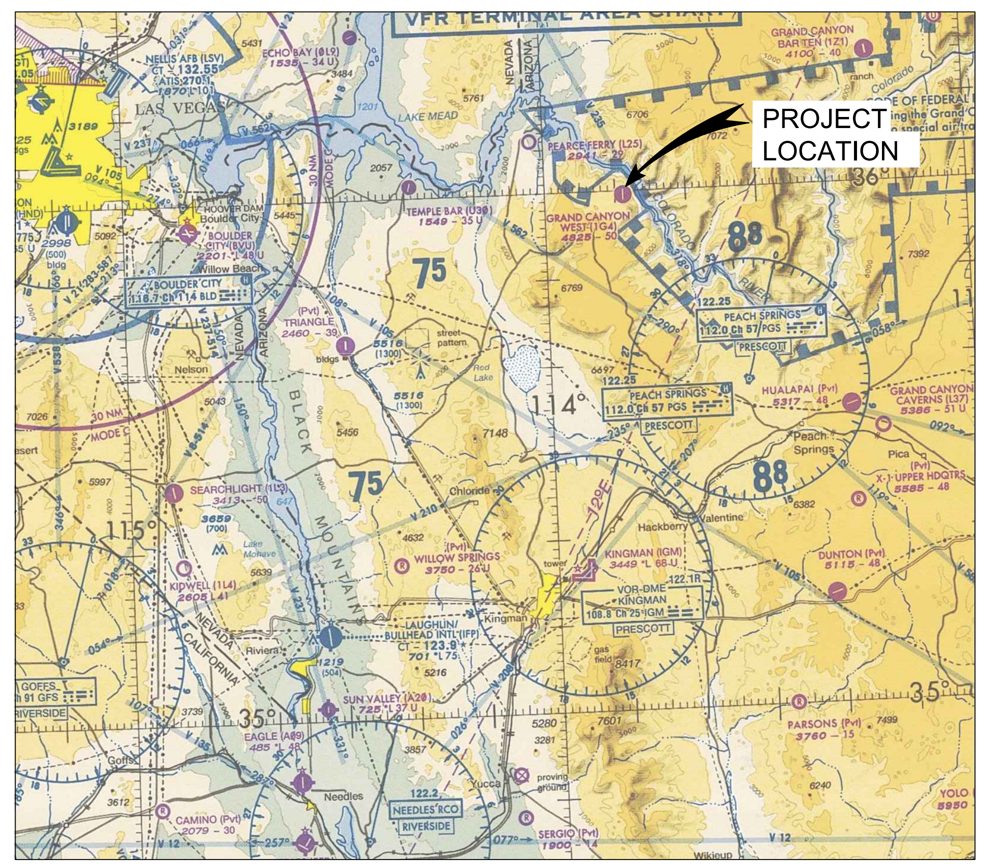
A.I.P. NO. 3-04-0068-013-2011

A.C.I. PROJECT NO. 116048

DATE: AUGUST, 2015



LOCATION MAP



VICINITY MAP

INDEX TO SHEETS

ARMSTRONG CONSULTANTS, INC.
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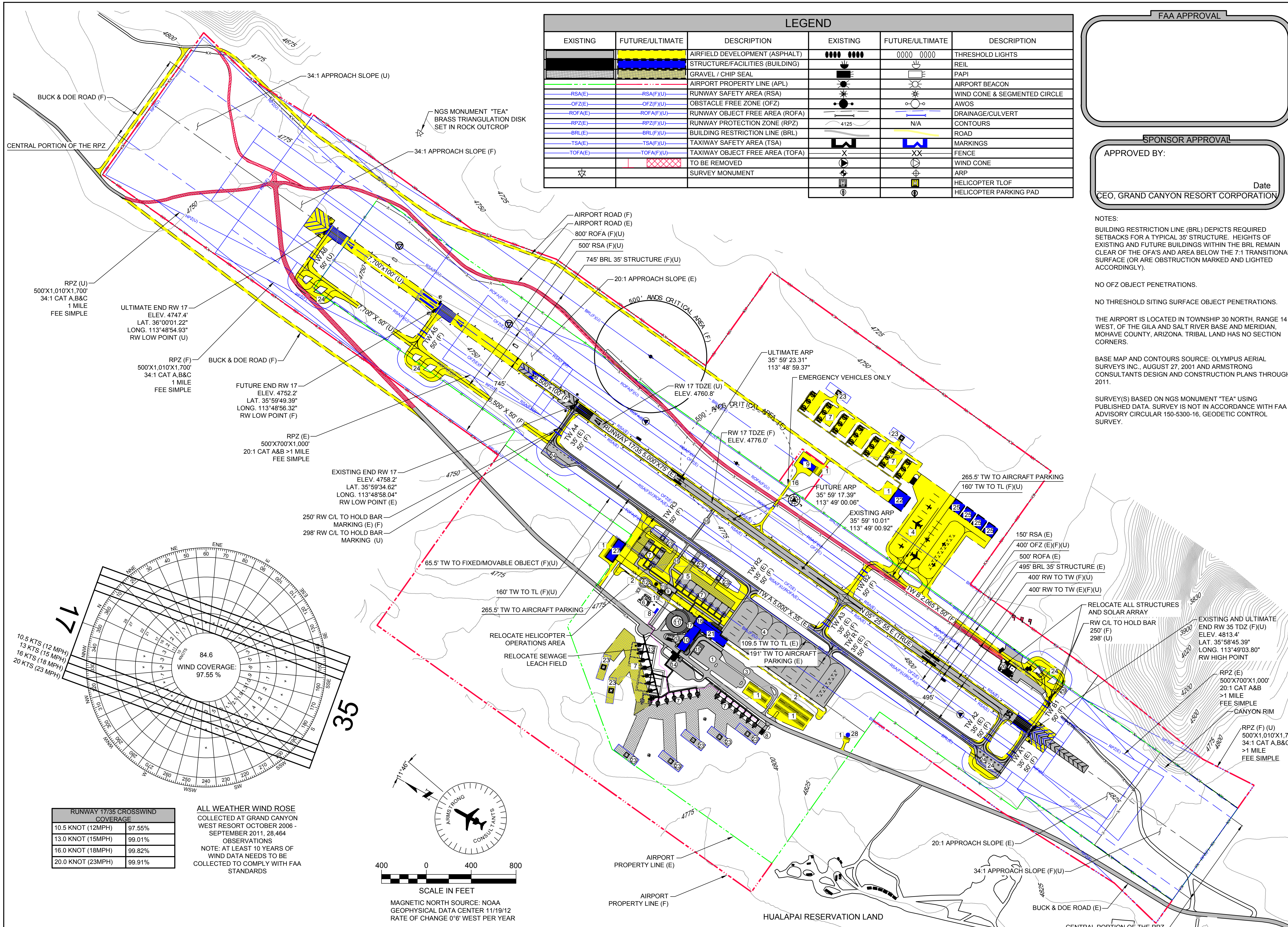
6048501



LEGEND

EXISTING	FUTURE/ULTIMATE	DESCRIPTION	EXISTING	FUTURE/ULTIMATE	DESCRIPTION
		AIRFIELD DEVELOPMENT (ASPHALT)			THRESHOLD LIGHTS
		STRUCTURE/FACILITIES (BUILDING)			REIL
		GRAVEL / CHIP SEAL			PAPI
		AIRPORT PROPERTY LINE (APL)			AIRPORT BEACON
RSA(E)	RSA(F)(U)	RUNWAY SAFETY AREA (RSA)			WIND CONE & SEGMENTED CIRCLE
OFZ(E)	OFZ(F)(U)	OBSTACLE FREE ZONE (OFZ)			AWOS
ROFA(E)	ROFA(F)(U)	RUNWAY OBJECT FREE AREA (ROFA)			DRAINAGE/CULVERT
RPZ(E)	RPZ(F)(U)	RUNWAY PROTECTION ZONE (RPZ)	4125	N/A	CONTOURS
BRL(E)	BRL(F)(U)	BUILDING RESTRICTION LINE (BRL)			ROAD
TSA(E)	TSA(F)(U)	TAXIWAY SAFETY AREA (TSA)			MARKINGS
TOFA(E)	TOFA(F)(U)	TAXIWAY OBJECT FREE AREA (TOFA)	X	XX	FENCE
		TO BE REMOVED			WIND CONE
		SURVEY MONUMENT			ARP
					HELICOPTER TLOF
					HELICOPTER PARKING PAD

FAA APPROVAL

SPONSOR APPROVAL

APPROVED BY:

Date

CEO, GRAND CANYON RESORT CORPORATION

NOTES:

BUILDING RESTRICTION LINE (BRL) DEPICTS REQUIRED SETBACKS FOR A TYPICAL 35' STRUCTURE. HEIGHTS OF EXISTING AND FUTURE BUILDINGS WITHIN THE BRL REMAIN CLEAR OF THE OFA'S AND AREA BELOW THE 7:1 TRANSITIONAL SURFACE (OR ARE OBSTRUCTION MARKED AND LIGHTED ACCORDINGLY).

NO OFZ OBJECT PENETRATIONS.

NO THRESHOLD SITING SURFACE OBJECT PENETRATIONS.

THE AIRPORT IS LOCATED IN TOWNSHIP 30 NORTH, RANGE 14 WEST, OF THE GILA AND SALT RIVER BASE AND MERIDIAN, MOHAVE COUNTY, ARIZONA. TRIBAL LAND HAS NO SECTION CORNERS.

BASE MAP AND CONTOURS SOURCE: OLYMPUS AERIAL SURVEYS INC., AUGUST 27, 2001 AND ARMSTRONG CONSULTANTS DESIGN AND CONSTRUCTION PLANS THROUGH 2011.

SURVEY(S) BASED ON NGS MONUMENT "TEA" USING PUBLISHED DATA. SURVEY IS NOT IN ACCORDANCE WITH FAA ADVISORY CIRCULAR 150-5300-16, GEODETIC CONTROL SURVEY.

RUNWAY 17/35 CROSSWIND COVERAGE	
10.5 KNOT (12MPH)	97.55%
13.0 KNOT (15MPH)	99.01%
16.0 KNOT (18MPH)	99.82%
20.0 KNOT (23MPH)	99.91%

ALL WEATHER WIND ROSE

COLLECTED AT GRAND CANYON WEST RESORT OCTOBER 2006 - SEPTEMBER 2011, 28,464 OBSERVATIONS

NOTE: AT LEAST 10 YEARS OF WIND DATA NEEDS TO BE COLLECTED TO COMPLY WITH FAA STANDARDS

MAGNETIC NORTH SOURCE: NOAA GEOPHYSICAL DATA CENTER 11/19/12
RATE OF CHANGE 0°6' WEST PER YEAR

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GRAND CANYON WEST AIRPORT
HUALAPAI NATION, ARIZONA

A.I.P. NO. 3-04-0068-013-2011
AIRPORT LAYOUT PLANS

No.	Project No.	Date	Revision / Description	File	Drwn.	Chkd.	Apprvd.
3	116048	8/24/15	ALP	6048502	BKR	JZP	DAC
2	095923	6/28/12	ALP UPDATE	5923502	JOS	DPS	DAC
1	065772	3/13/07	REVALIDATION	5772502	SLST	DPS	DAC
0	015566	9/16/03	ALP UPDATE	5666502	NOP	DAC	EAA

AIRPORT LAYOUT PLAN

Sheet: 2 of: 14

RUNWAY DATA

ITEM		RW 17/35 EXISTING (E)	RW 17/35 FUTURE (F)	RW 17/35 ULTIMATE (U)
RUNWAY DESIGN CODE		B-II	C-II	C-III
RUNWAY LENGTH		5,000'	6,500'	7,700'
RUNWAY WIDTH		75'	100'	100'
RUNWAY & TAXIWAY PAVEMENT		ASPHALT	ASPHALT	ASPHALT
PAVEMENT STRENGTH (LBS)		30,000 SWG	60,000 DWG	110,000 DTWG
RUNWAY LIGHTING		MIRL	SAME	SAME
RUNWAY MARKING	RW 17	NPI	SAME	SAME
	RW 35	NPI	SAME	SAME
% EFFECTIVE GRADIENT		1.10%	0.95%	0.86%
% MAXIMUM GRADE		1.3%	SAME	SAME
LINE OF SIGHT REQUIREMENTS MET		YES	SAME	SAME
VISUAL APPROACH AIDS		PAPI'S/REIL'S	PAPI'S/REIL'S	PAPI'S/REIL'S
INSTRUMENT APPROACH AIDS		NONE	GPS	GPS
DESIGN AIRCRAFT	CRITICAL AIRCRAFT	DORNIER 328	CRJ 200 ER	B737-400
	APPROACH SPEED (KNOTS)	75	148	139
	WINGSPAN	68.8'	69.67'	94.75'
	MAX. CERTIFIED TAKEOFF WT. (LBS.)	30,840	51,000	* 138,500
	UNDERCARRIAGE WIDTH	10.56'	10.42'	17.17'
	COCKPIT TO MAIN GEAR	23.48'	37.33'	43.25'
RUNWAY SAFETY AREA (RSA)	WIDTH	150'	500'	SAME
	LENGTH BEYOND RW END	300'	1,000'	SAME
RUNWAY OBJECT FREE AREA (ROFA)	WIDTH	500'	800'	SAME
	LENGTH BEYOND RW END	300'	1,000'	SAME
OBSTACLE FREE ZONE (OFZ)	WIDTH	400'	400'	SAME
	LENGTH BEYOND RW END	200'	200'	SAME
RUNWAY APPROACH				
APPROACH MINIMUMS RW 17/35		VISUAL	1 MILE	≥ 3/4 MILE
APPROACH TYPE	RW 17	VISUAL >UTILITY	NPI >UTILITY	NPI >UTILITY
	RW 35	VISUAL >UTILITY	NPI >UTILITY	NPI >UTILITY
FAR PART 77 APPROACH SLOPE	RW 17	20:1	34:1	34:1
	RW 35	20:1	34:1	34:1
RUNWAY PROTECTION ZONE DIMENSIONS	RW 17	500' X 700' X 1,000'	500' X 1,010' X 1,700'	SAME
	RW 35	500' X 700' X 1,000'	500' X 1,010' X 1,700'	SAME
APPROACH SURFACE DIMENSIONS (FAR 77)	RW 17	500' X 1,500' X 5,000'	500' X 3,500' X 10,000'	SAME
	RW 35	500' X 1,500' X 5,000'	500' X 3,500' X 10,000'	SAME
RUNWAY ELEVATIONS (NAVD 88)				
RUNWAY END	RW 17	4758.2	4752.2	4747.4
	RW 35	4813.4	SAME	SAME
DISPLACED THRESHOLD	RW 17	N/A	N/A	N/A
	RW 35	N/A	N/A	N/A
TOUCHDOWN ZONE (TDZE)	RW 17	N/A	4776.0	4759.4
	RW 35	N/A	4813.4	4813.4
HIGH POINT		4813.4	4813.4	4813.4
LOW POINT		4758.2	4752.2	4747.4
TAXIWAY DESIGN GROUP		II	III	III
RUNWAY C/L TO HOLD BARS AND SIGNS		250'	250'	298'
RUNWAY / PARALLEL TAXIWAY C/L SEPARATION		400'	400'	SAME
TAXIWAY OBJECT FREE AREA WIDTH		131'	186'	SAME
TAXIWAY SAFETY AREA WIDTH		79'	118'	SAME
TAXIWAY WING TIP CLEARANCE		26'	34'	SAME
TAXIWAY C/L TO FIXED OR MOVABLE OBJECT		65.5'	93'	SAME
TAXIWAY WIDTH		35'	50'	SAME

* DESIGN AIRCRAFT IS NOT INTENDED TO OPERATE AT MAXIMUM AIRCRAFT TAKEOFF WEIGHT

AIRPORT DATA

ITEM		EXISTING (E)	FUTURE (F)	ULTIMATE (U)
AIRPORT ELEVATION (NAVD 88)		4813.4'	4813.4'	4813.4'
AIRPORT REFERENCE POINT (ARP) COORDINATES (NAD 83)	LATITUDE	35° 59' 10.01"	35° 59' 17.39"	35° 59' 23.31"
	LONGITUDE	113° 49' 00.92"	113° 49' 00.06"	113° 48' 59.37"
MEAN MAX. TEMP: HOTTEST MONTH (JULY)		97.5° F		
RUNWAY WIND COVERAGE	12 MPH / 10.5 kts	97.55%		
	15 MPH / 13kts	99.01%		
	18 MPH / 16kts	99.81%		
AIRPLANE DESIGN GROUP		B-II	C-II	C-III
NPIAS ROLE		PRIM. COMM. SERV.	SAME	SAME
MAGNETIC VARIATION		11° 46' E (2012) CHANGING BY 0° 6' W PER YEAR		
TAXIWAY LIGHTING		MITL	SAME	SAME
AIRPORT IDENTIFIER		1G4		
RUNWAY MARKING		NPI	SAME	SAME
AIRPORT & TERMINAL NAVAIDS		BEACON	BEACON, GPS	BEACON, GPS, ALS

RUNWAY END COORDINATES (NAD 83)

	EXISTING		FUTURE		ULTIMATE	
	RW 17 END	RW 35 END	RW 17 END	RW 35 END	RW 17 END	RW 35 END
LATITUDE	35°59'34.62"	35°58'45.39"	35°59'49.39"	35°58'45.39"	36°00'01.22"	35°58'45.39"
LONGITUDE	113°48'58.04"	113°49'03.80"	113°48'56.32"	113°49'03.80"	113°48'54.93"	113°49'03.80"

NOTE NAD 83 COORDINATE DATA PUBLISHED BY AVN DATA SHEETS SYSTEM FOR EXISTING CONDITION.

NON-STANDARD CONDITIONS

ITEM	RW DESIGN CATEGORY	STANDARD	NON-STD CONDITION	PROPOSED ACTION
NONE				

NOTES

1. NO THRESHOLD SITING SURFACE OBJECT PENETRATIONS.
2. SEE TERMINAL AREA DRAWINGS FOR HANGAR/TERMINAL/FBO/HELIPORT DETAILS.
3. NO MODIFICATION TO DESIGN STANDARDS.
4. THE LONGITUDINAL GRADIENT FOR ARC C-III (INCLUDING 0.8% FOR THE FIRST AND LAST QUARTER OF THE RUNWAY) HAVE BEEN INCORPORATED INTO THE PLAN.
5. SURVEY MONUMENTS ARE UNPROTECTED BRASS NGS DISKS ANCHORED IN ROCK OUTCROPS

AIRPORT FACILITIES LIST

NO.	EXIST.	FUTURE	FACILITY DESCRIPTION	TOP ELEV. (MSL-EST.)	NO.	EXIST.	FUTURE	FACILITY DESCRIPTION	TOP ELEV. (MSL-EST.)
1	○	□	AUTO PARKING	-	15	○		F.I.T. PARKING	-
2		□	PEOPLE MOVER CARTWAY	-	16	○	□	ARFF ACCESS ROAD	-
3	○		MOTOR COACH PARKING	-	17	○		FLIGHT OPS BUILDING	4810
4	○	□	AIRCRAFT APRON/PARKING	-	18	○		RETAIL/DELI BUILDING	4808
5		□	AIRCRAFT APRON EXPANSION	-	19	○	□	ELECTRICAL VAULT	4788
6	○		SEWAGE TREATMENT PLANT	-	20	○		GENERATOR	4788
7	○	□	HELICOPTER PARKING	-	21		□	TERMINAL BUILDING	4815
8	○	□	FUEL FARM	-	22		□	G.A./CORPORATE TERMINAL	4806
9	○	□	ARFF BUILDING	4800	23	○	□	HELIPORT TLOF	-
10	○		TEMP. TERMINAL BUILDING	4812	24	○	□	HOLDING BAYS	-
11	○		MOTOR COACH TURNAROUND	-	25		□	HANGARS	4820
12	○		TURN AROUND	-	26	○		OLD TERMINAL AREA BLDS	-
13	○	□	LEACH FIELD	-	27		□	SRE	4820
14	○		HELICOPTER OPS BLDG	4814	28		□	AIR TRAFFIC CONTROL TOWER	4865
					29	○		SOLAR ARRAY	-

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1	065772	3/13/07	REVALIDATION	5772502	SLST	DPS	DAC
0	015566	9/16/03	ALP UPDATE	5666502	NOP	DAC	EAA

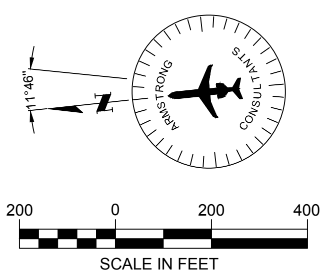
THE PREPARATION OF THIS DOCUMENT WAS FINANCED IN PART, THROUGH THE AIRPORT IMPROVEMENT PROGRAM FINANCIAL ASSISTANCE FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER TITLE 49, UNITED STATES CODE, SECTION 47104. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THIS PLAN BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED THEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE OR WOULD HAVE JUSTIFICATION IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS.

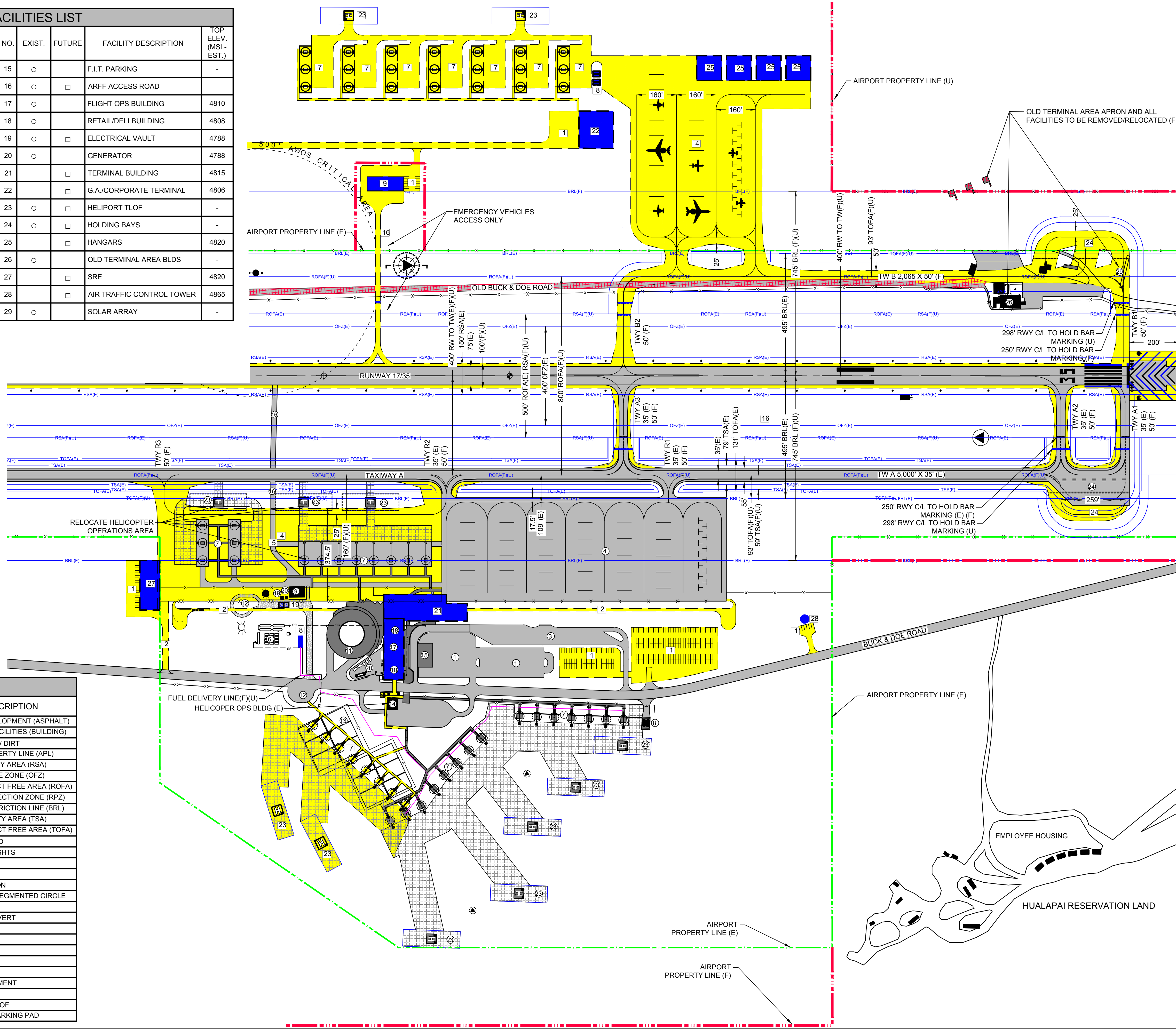
AIRPORT DATA SHEET

AIRPORT FACILITIES LIST

NO.	EXIST.	FUTURE	FACILITY DESCRIPTION	TOP ELEV. (MSL-EST.)	NO.	EXIST.	FUTURE	FACILITY DESCRIPTION	TOP ELEV. (MSL-EST.)
1	○	□	AUTO PARKING	-	15	○		F.I.T. PARKING	-
2		□	PEOPLE MOVER CARTWAY	-	16	○	□	ARFF ACCESS ROAD	-
3	○		MOTOR COACH PARKING	-	17	○		FLIGHT OPS BUILDING	4810
4	○	□	AIRCRAFT APRON/PARKING	-	18	○		RETAIL/DELI BUILDING	4808
5		□	AIRCRAFT APRON EXPANSION	-	19	○	□	ELECTRICAL VAULT	4788
6	○		SEWAGE TREATMENT PLANT	-	20	○		GENERATOR	4788
7	○	□	HELICOPTER PARKING	-	21		□	TERMINAL BUILDING	4815
8	○	□	FUEL FARM	-	22		□	G.A./CORPORATE TERMINAL	4806
9	○	□	ARFF BUILDING	4800	23	○	□	HELIPORT TLOF	-
10	○		TEMP. TERMINAL BUILDING	4812	24	○	□	HOLDING BAYS	-
11	○		MOTOR COACH TURNAROUND	-	25		□	HANGARS	4820
12	○		TURN AROUND	-	26	○		OLD TERMINAL AREA BLDS	-
13	○		LEACH FIELD	-	27		□	SRE	4820
14	○		HELICOPTER OPS BLDG	4814	28		□	AIR TRAFFIC CONTROL TOWER	4865
					29	○		SOLAR ARRAY	-

NOTE: BUILDING HEIGHTS ARE ESTIMATED





LEGEND

EXISTING	FUTURE	DESCRIPTION
		AIRFIELD DEVELOPMENT (ASPHALT)
		STRUCTURE/FACILITIES (BUILDING)
		GRAVEL / TURF / DIRT
		AIRPORT PROPERTY LINE (APL)
RSA(E)	RSA(F)	RUNWAY SAFETY AREA (RSA)
OFZ(E)	OFZ(F)	OBSTACLE FREE ZONE (OFZ)
ROFA(E)	ROFA(F)	RUNWAY OBJECT FREE AREA (ROFA)
RPZ(E)	RPZ(F)	RUNWAY PROTECTION ZONE (RPZ)
BRL(E)	BRL(F)	BUILDING RESTRICTION LINE (BRL)
TSA(E)	TSA(F)	TAXIWAY SAFETY AREA (TSA)
TOFA(E)	TOFA(F)	TAXIWAY OBJECT FREE AREA (TOFA)
		TO BE REMOVED
		THRESHOLD LIGHTS
		REIL
		PAPI
		AIRPORT BEACON
		WIND CONE & SEGMENTED CIRCLE
		AWOS
		DRAINAGE/CULVERT
4125	N/A	CONTOURS
		ROAD
		MARKINGS
X	XX	FENCE
		WIND CONE
		SURVEY MONUMENT
		ARP
		HELICOPTER TLOF
		HELICOPTER PARKING PAD

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GRAND CANYON WEST AIRPORT
HUALAPAI NATION, ARIZONA

A.I.P. NO. 3-04-0068-013-2011
AIRPORT LAYOUT PLANS

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1	065772	3/13/07	REVALIDATION	5772502	SLST	DPS	DAC
0	015566	9/16/03	ALP UPDATE	5666502	NOP	DAC	EAA

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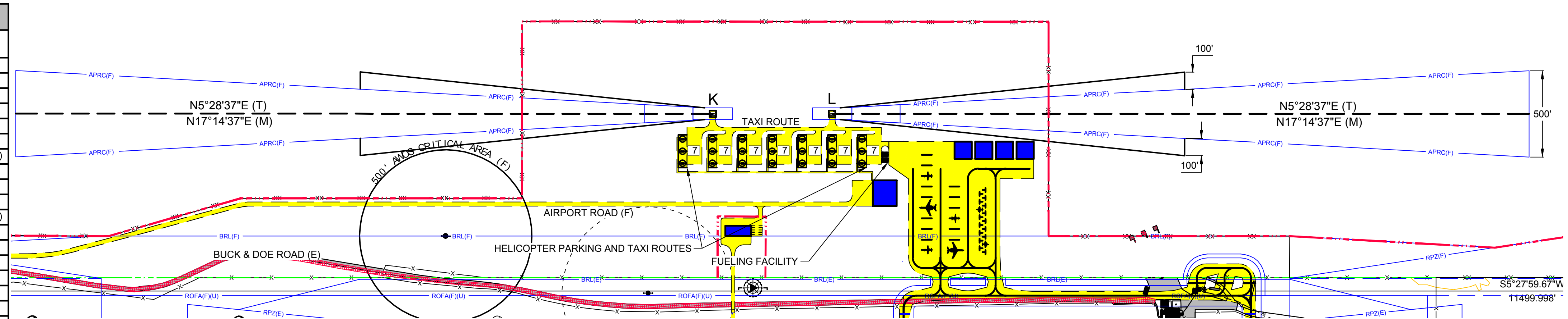
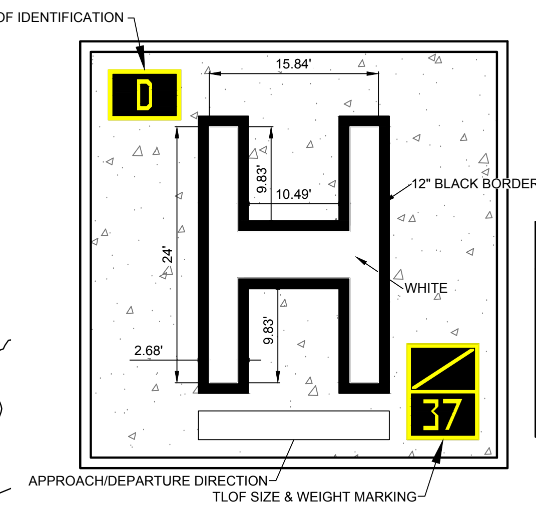
TERMINAL AREA DRAWING

LEGEND

EXISTING	FUTURE	DESCRIPTION
		AIRFIELD DEVELOPMENT (ASPHALT)
		STRUCTURE/FACILITIES (BUILDING)
		GRAVEL / TURF / DIRT
		AIRPORT PROPERTY LINE (APL)
RSA(E)	RSA(F)	RUNWAY SAFETY AREA (RSA)
OFZ(E)	OFZ(F)	OBSTACLE FREE ZONE (OFZ)
ROFA(E)	ROFA(F)	RUNWAY OBJECT FREE AREA (ROFA)
RPZ(E)	RPZ(F)	RUNWAY PROTECTION ZONE (RPZ)
BRL(E)	BRL(F)	BUILDING RESTRICTION LINE (BRL)
TSA(E)	TSA(F)	TAXIWAY SAFETY AREA (TSA)
TOFA(E)	TOFA(F)	TAXIWAY OBJECT FREE AREA (TOFA)
APRC(E)	APRC(F)	HELICOPTER APPROACH
HPZ(E)	HPZ(F)	HELICOPTER PROTECTION ZONE
		TO BE REMOVED
		THRESHOLD LIGHTS
		REIL
		PAPI
		AIRPORT BEACON
		WIND CONE & SEGMENTED CIRCLE
		AWOS
		DRAINAGE/CULVERT
4125	N/A	CONTOURS
		ROAD
		MARKINGS
X	XX	FENCE
		WIND CONE
		SURVEY MONUMENT
		ARP
		HELICOPTER TLOF
		HELICOPTER PARKING PAD



HELIPORT (EASTERLY SIDE IN/OUT)
APPROACH/DEPARTURE

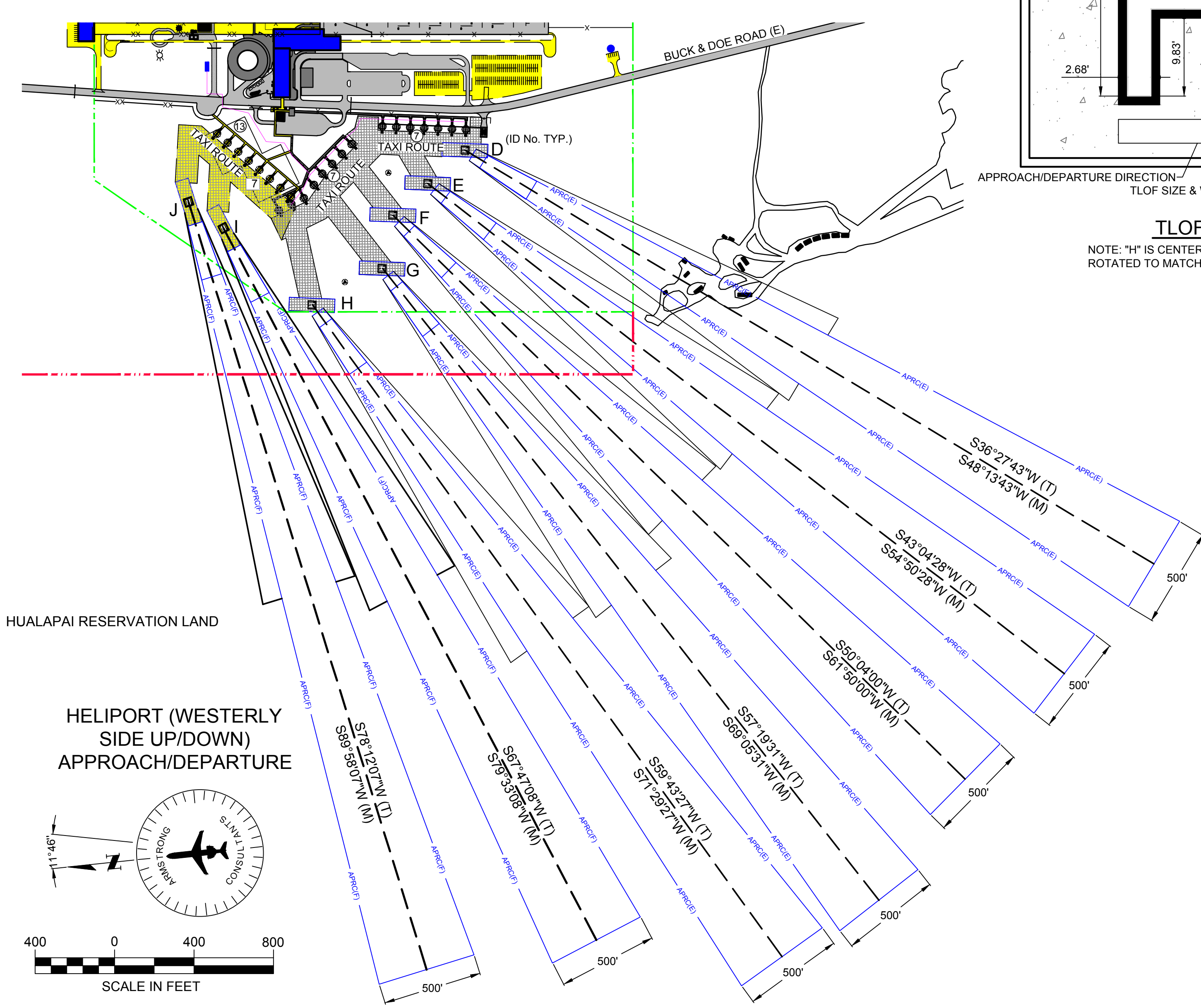


TLOF MARKING

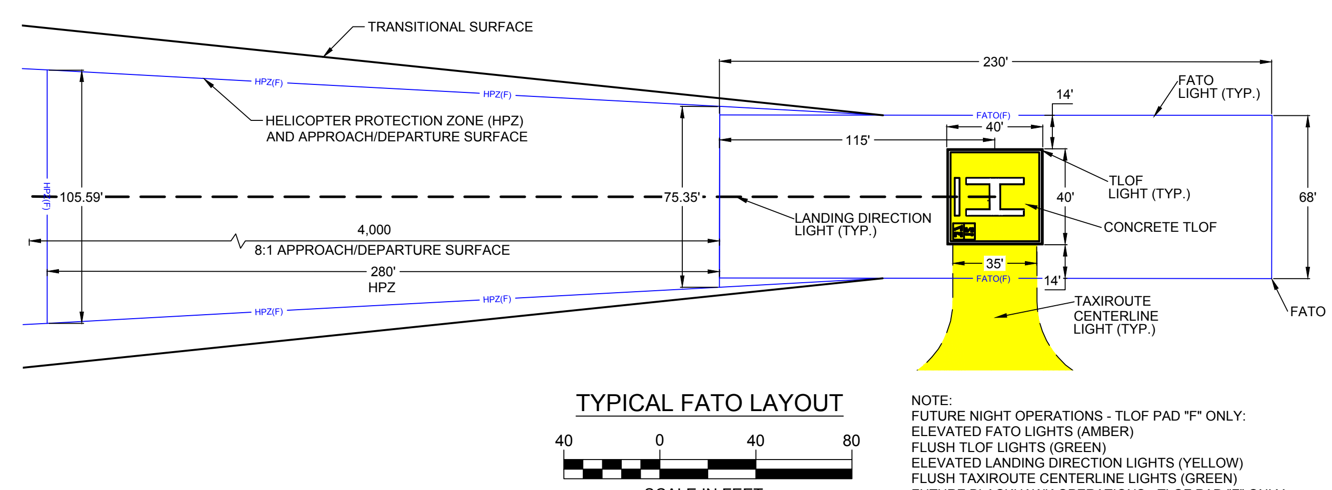
NOTE: "H" IS CENTERED ON CONCRETE PAD AND ROTATED TO MATCH APPROACH/DEPARTURE PATH.

DESIGN AIRCRAFT				
PARAMETER	BELL 206	EUROCOPTER B4	DESIGN	FUTURE (BLACKHAWK) (TLOF F ONLY)
LENGTH (ft.)	42.5'	41.47'	43'	64.82'
ROTOR DIA.	37'	35.08'	37'	53.67'
SKID/GEAR	7.7' x 9.9'	7.87' x 10.5'	8' x 11'	9.67' x 29'
ROTOR TO TAIL	24'	23.7'	25'	32.5'
WEIGHT	4,450 LBS	5,291 LBS	5,300 LBS	23,500

TLOF LOCATION			
ID No.	LATITUDE (N)	LONGITUDE (W)	ELEVATION(NAVD 88)
D	35°59'06.9373"	113°49'19.5301"	4815.30
E	35°59'08.9462"	113°49'21.3439"	4819.30
F	35°59'10.8203"	113°49'23.0715"	4821.00
G	35°59'11.5809"	113°49'26.2630"	4822.40
H	35°59'15.2326"	113°49'28.0648"	4820.90
I	35°59'19.273"	113°49'22.881"	4797.80
J	35°59'20.884"	113°49'21.090"	4793.5
K	35°59'15.055"	113°48'42.562"	4764.5
L	35°59'08.236"	113°48'43.361"	4770.5



HELIPORT (WESTERLY SIDE UP/DOWN) APPROACH/DEPARTURE



TYPICAL FATO LAYOUT

NOTE:
FUTURE NIGHT OPERATIONS - TLOF PAD "F" ONLY:
ELEVATED FATO LIGHTS (AMBER)
FLUSH TLOF LIGHTS (GREEN)
ELEVATED LANDING DIRECTION LIGHTS (YELLOW)
FLUSH TAXIROUTE CENTERLINE LIGHTS (GREEN)
FUTURE BLACKHAWK OPERATIONS - TLOF PAD "F" ONLY

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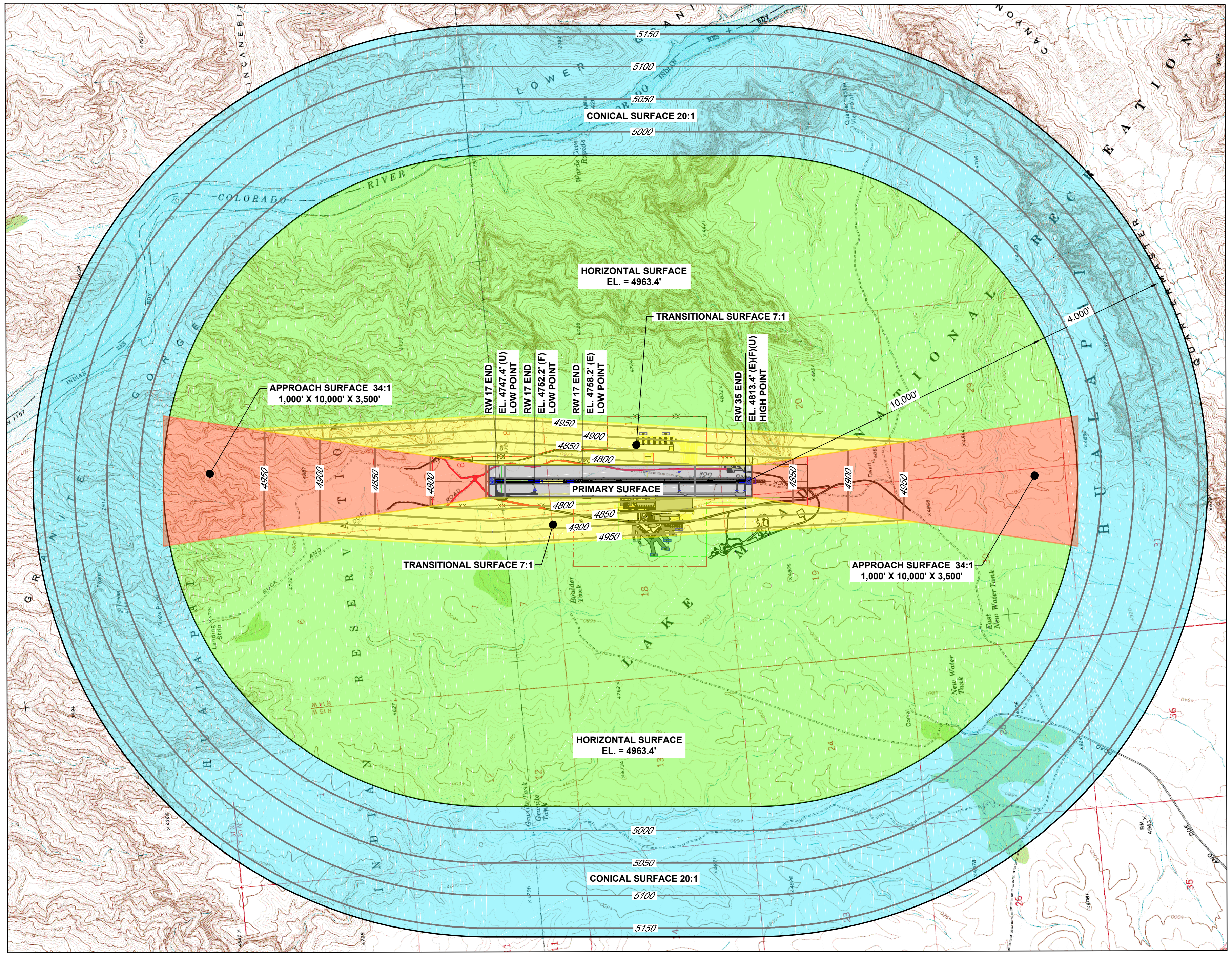
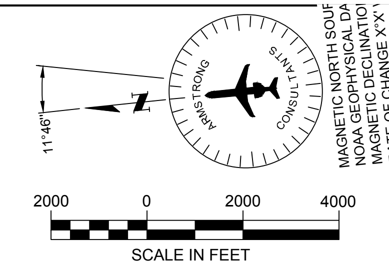
HELIPORT LAYOUT



RUNWAY 17/35 PLAN (U)

SCALE: BAR SCALE



LEGEND

HORIZONTAL SURFACE	TRANSITIONAL SURFACE
CONICAL SURFACE	APPROACH SURFACE
PRIMARY SURFACE	TERRAIN PENETRATION

OBSTRUCTION CHART

PART 77 SURFACE	ITEM No.	DESCRIPTION	ESTIMATED TOP ELEVATION (MSL)	PENETRATION (FEET)	REMARKS
PRIMARY		NO PENETRATIONS			
APPROACH		NO PENETRATIONS			
HORIZONTAL		NO PENETRATIONS			
TRANSITIONAL		NO PENETRATIONS			
CONICAL		NO PENETRATIONS			

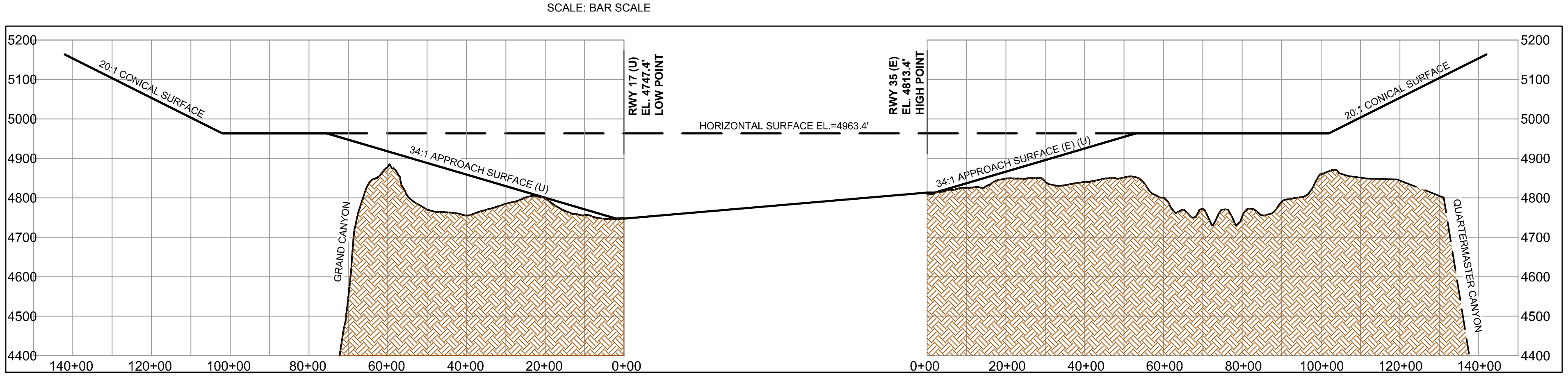
NOTES

A) REFER TO "INNER PORTION OF THE APPROACH SURFACE" DRAWINGS FOR DETAILS ON ANY CLOSE-IN APPROACH OBSTRUCTIONS.

B) AN FAA FORM 7460-1, "NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION" MUST BE SUBMITTED FOR ANY CONSTRUCTION OR ALTERATION (INCLUDING HANGARS AND OTHER ON-AIRPORT AND OFF-AIRPORT STRUCTURES, TOWERS, ETC.) WITHIN 20,000 HORIZONTAL FEET OF THE AIRPORT GREATER IN HEIGHT THAN AN IMAGINARY SURFACE EXTENDING OUTWARD AND UPWARD FROM THE RUNWAY AT A SLOPE OF 100 TO 1 OR GREATER IN HEIGHT THAN 200 FEET ABOVE GROUND LEVEL.

C) APPROACH SURFACES BASED ON ULTIMATE CONDITION.

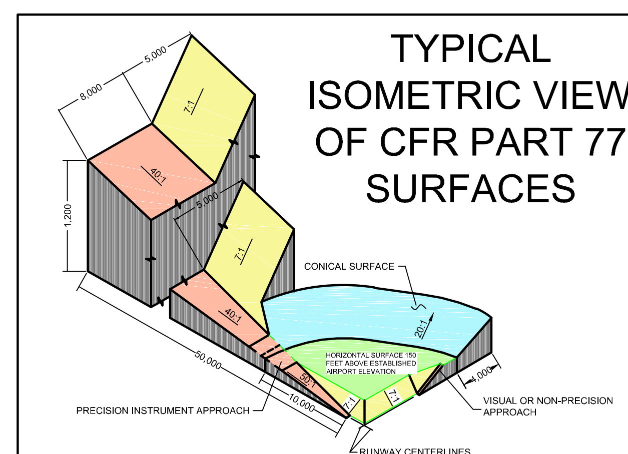
D) ALL PENETRATIONS WERE IDENTIFIED USING PREVIOUS OBSTRUCTION SURVEY INFORMATION AND AN INQUIRY OF THE FAA OE/AAA DATABASE.



RUNWAY 17/35 PROFILE (U)

SCALE: PER GRID

TYPICAL ISOMETRIC VIEW OF CFR PART 77 SURFACES



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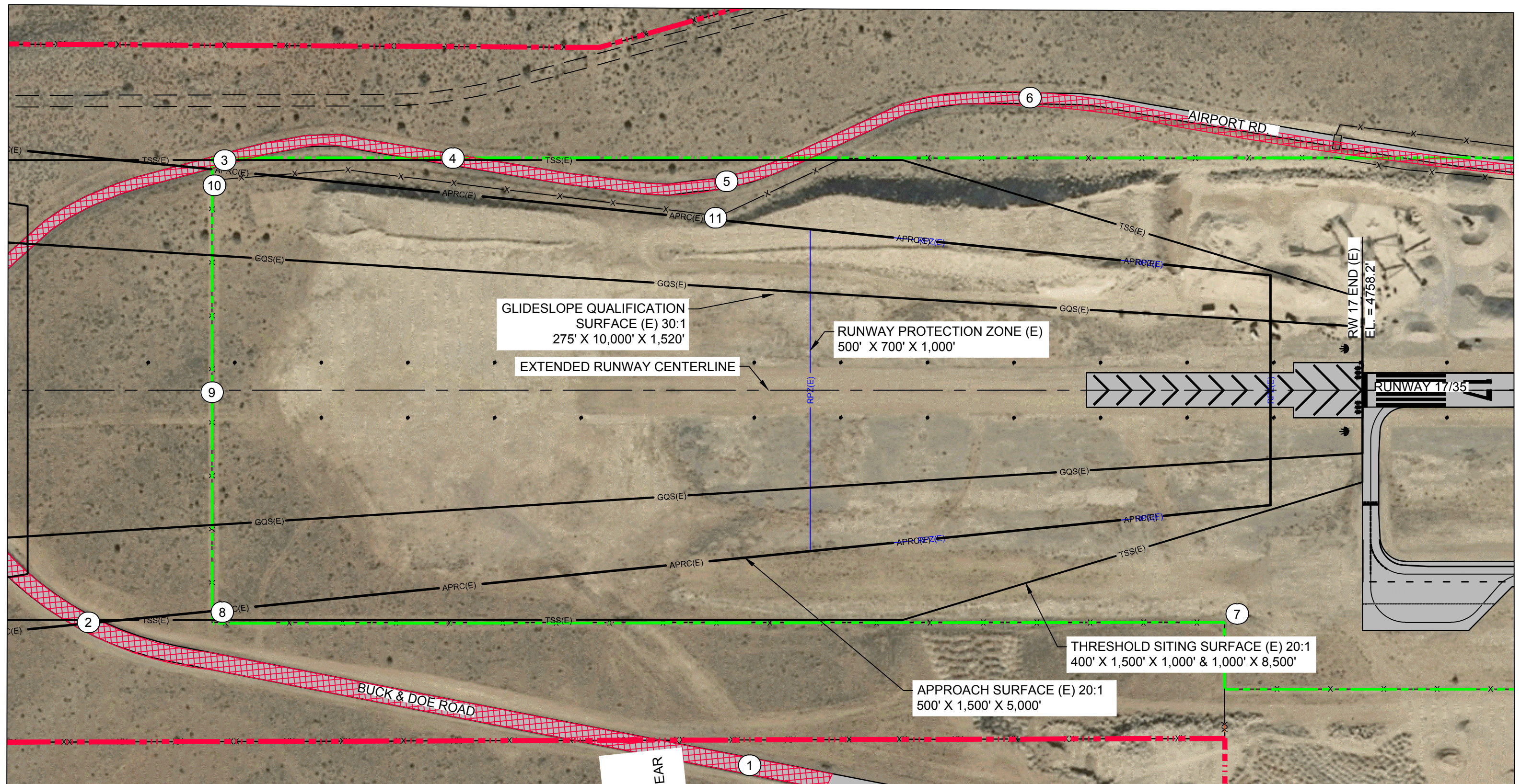
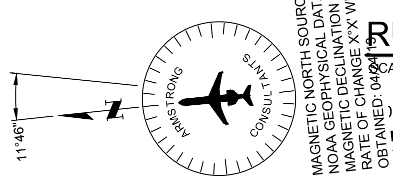
FAR 77 AIRSPACE DRAWING



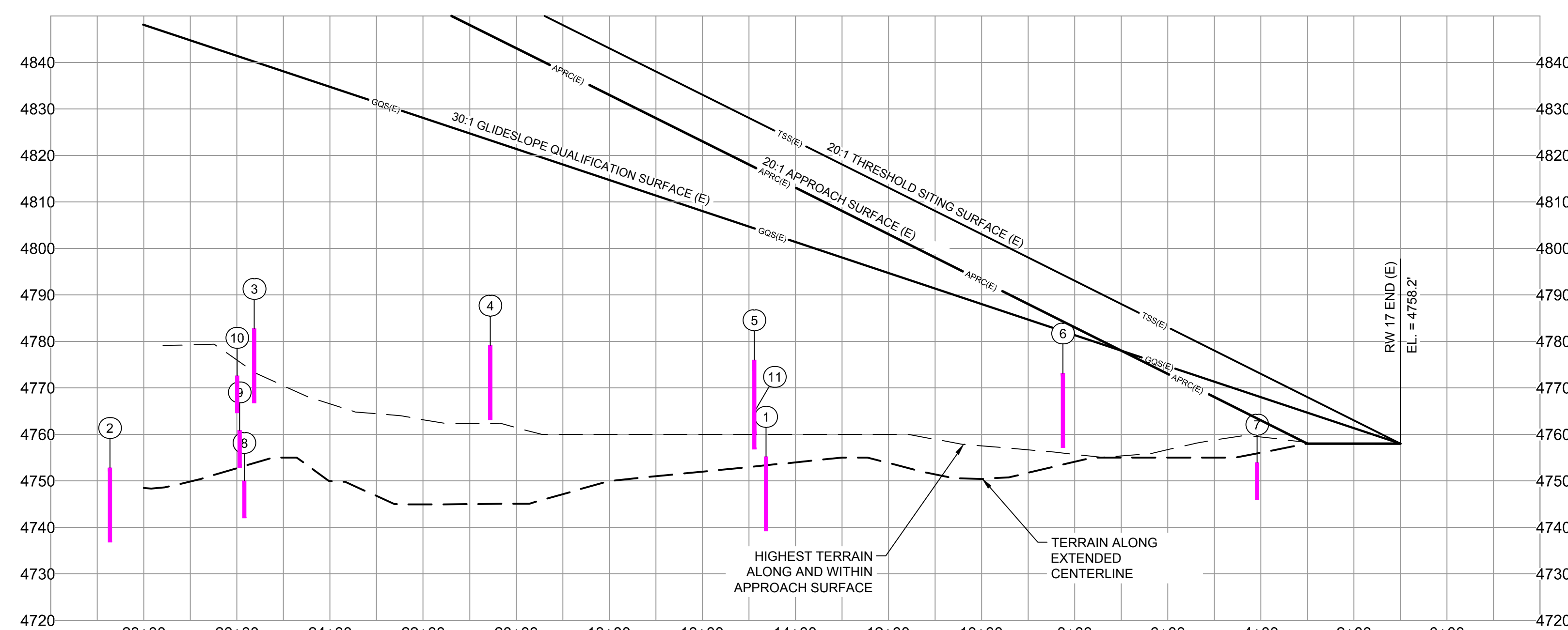


RUNWAY 17 PLAN (E)

SCALE: BARSCALE

200 0 200 400

SCALE IN FEET



RUNWAY 17 PROFILE (E)

SCALE: PER GRID

OBJECTS WITHIN RUNWAY 17 APRC,TSS, AND DEPARTURE SURFACES (U)							
No.	OBJECT	EST. OBJECT HT.	TOP ELEV. (MSL)	20:1 TSS PEN.	20:1 APRC SURFACE PEN.	30:1 GQS PEN.	PROPOSED ACTION
1	* ROAD	16'	4756	-	-	-	N/A
2	* ROAD	16'	4753	NONE	NONE	-	N/A
3	* ROAD	16'	4783	NONE	-	-	N/A
4	* ROAD	16'	4779	NONE	-	-	N/A
5	* ROAD	16'	4776	NONE	-	-	N/A
6	* ROAD	16'	4773	-	-	-	N/A
7	* FENCE	8'	4773	-	-	-	N/A
8	* FENCE	8'	4750	NONE	NONE	-	N/A
9	* FENCE	8'	4762	NONE	NONE	NONE	N/A
10	* FENCE	8'	4773	NONE	NONE	-	N/A
11	* FENCE	8'	4765	NONE	NONE	-	N/A

NOTE: OBJECT ELEVATIONS IN FEET MSL (VERTICAL DATUM NAVD88).
* HEIGHT BASED ON PHOTOGRAMMETRY PROVIDED BY OLYMPUS, INC. AUGUST, 2001. LOCATION AND HEIGHTS ESTIMATED.
- = OBJECT IS NOT LOCATED WITHIN THIS SURFACE.
= OBJECT PENETRATION LOCATION
EST. = ESTIMATED; ELEV. = ELEVATION; HT. = HEIGHT; PEN. = PENETRATION;
N/A = NOT APPLICABLE; O.L. = OBSTRUCTION LIGHT; GQS = GLIDESLOPE QUALIFICATION SURFACE; APRC = APPROACH SURFACE; TSS = THRESHOLD SITING SURFACE;
DPRT = DEPARTURE SURFACE

NOTES:

1. THERE ARE THRESHOLD SITING SURFACE PENETRATIONS IN THE ULTIMATE CONFIGURATION.
2. A REVIEW OF THE FAA OE/AAA DATABASE WAS CONDUCTED.

LEGEND		
EXISTING	FUTURE	DESCRIPTION
		AIRFIELD DEVELOPMENT (ASPHALT)
		STRUCTURE/FACILITIES (BUILDING)
		GRAVEL / TURF / DIRT
		AIRPORT PROPERTY LINE (APL)
RSA(E)	RSA(F)	RUNWAY SAFETY AREA (RSA)
OFZ(E)	OFZ(F)	OBSTACLE FREE ZONE (OFZ)
ROFA(E)	ROFA(F)	RUNWAY OBJECT FREE AREA (ROFA)
RPZ(E)	RPZ(F)	RUNWAY PROTECTION ZONE (RPZ)
BRL(E)	BRL(F)	BUILDING RESTRICTION LINE (BRL)
TSA(E)	TSA(F)	TAXIWAY SAFETY AREA (TSA)
TOFA(E)	TOFA(F)	TAXIWAY OBJECT FREE AREA (TOFA)
		TO BE REMOVED
		THRESHOLD LIGHTS
		REIL
		PAPI
		AIRPORT BEACON
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		DRAINAGE/CULVERT
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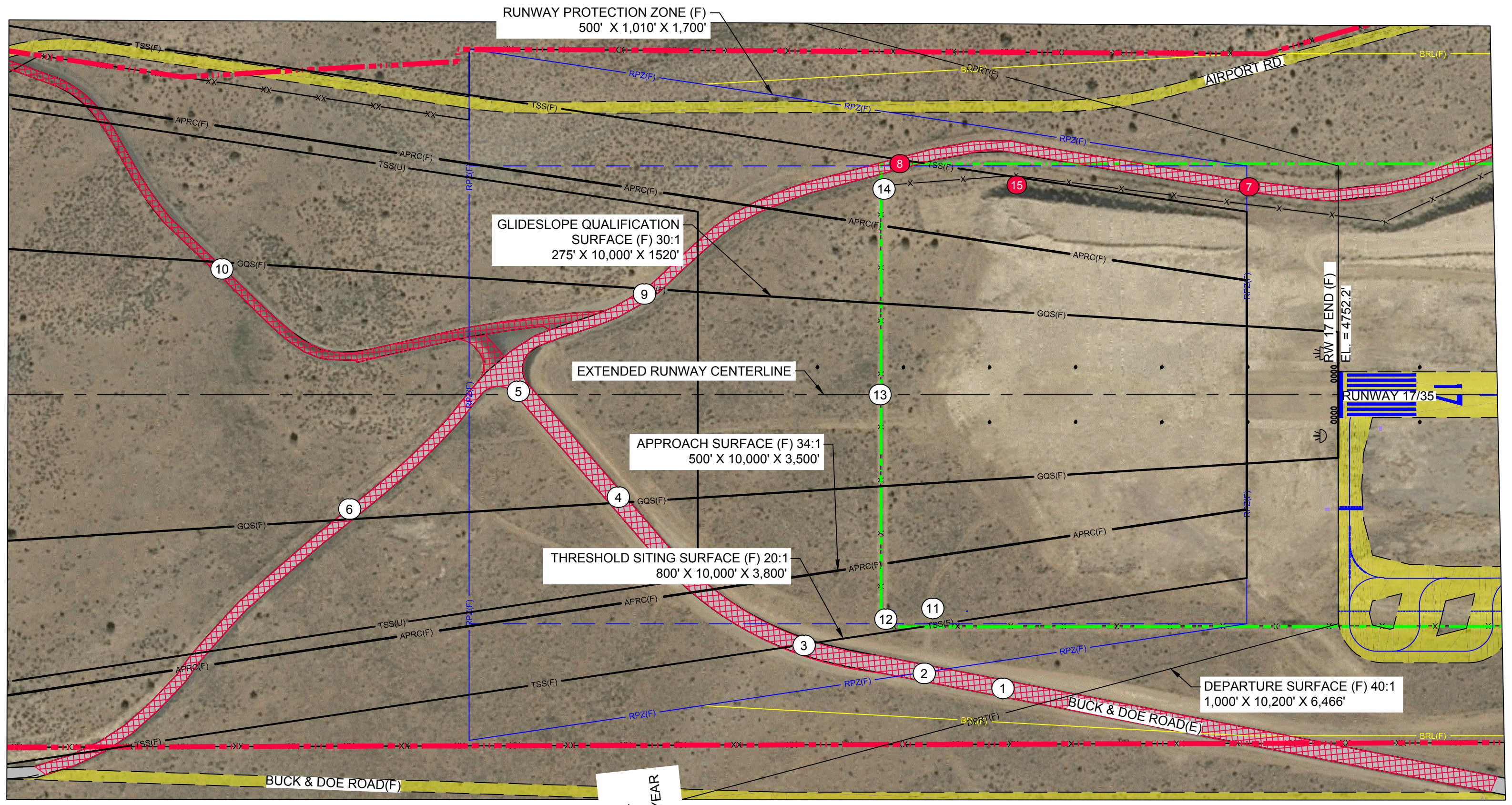
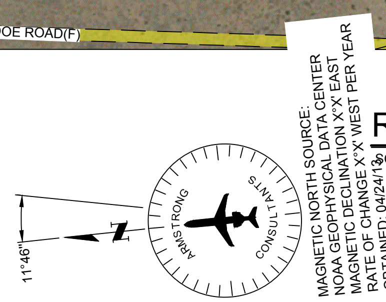
RWY 17 INNER APPROACH (EXISTING)



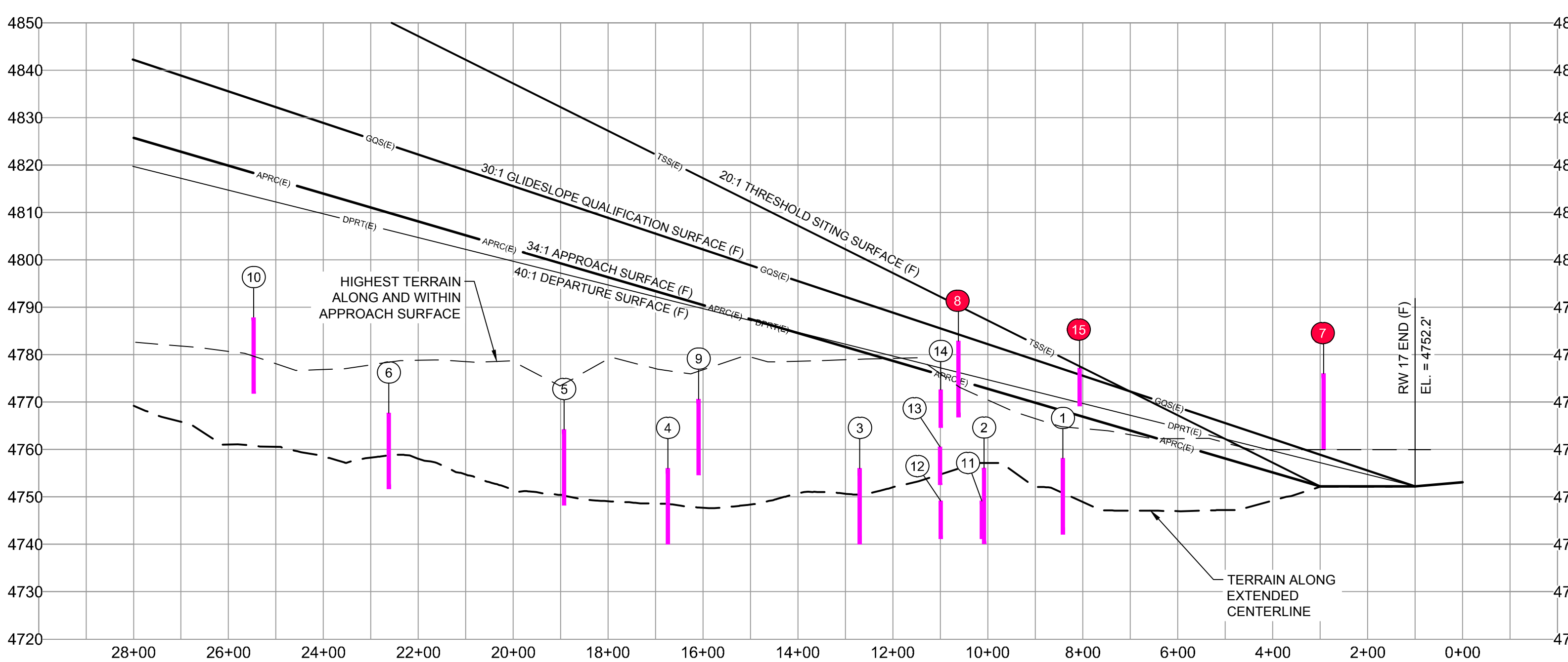


RUNWAY 17 PLAN (F)

SCALE: BARSCALE

0 200 400

SCALE IN FEET



RUNWAY 17 PROFILE (F)

SCALE: PER GRID

OBJECTS WITHIN RUNWAY 17 APRC,TSS, AND DEPARTURE SURFACES (F)

No.	OBJECT	EST. OBJECT HT.	TOP ELEV. (MSL)	20:1 TSS PEN.	34:1 APRC SURFACE PEN.	30:1 GQS PEN.	40:1 DPRT PEN.	PROPOSED ACTION
1	* ROAD	16'	4758	-	-	-	NONE	N/A
2	* ROAD	16'	4756	-	-	-	NONE	N/A
3	* ROAD	16'	4756	NONE	-	-	NONE	N/A
4	* ROAD	16'	4756	NONE	NONE	NONE	NONE	N/A
5	* ROAD	16'	4764	NONE	NONE	NONE	NONE	N/A
6	* ROAD	16'	4766	NONE	NONE	NONE	NONE	N/A
7	* ROAD	16'	4777	-	-	-	19'	REMOVE
8	* ROAD	16'	4783	NONE	-	-	7'	REMOVE
9	* ROAD	16'	4771	NONE	NONE	NONE	NONE	N/A
10	* ROAD	16'	4788	NONE	NONE	NONE	NONE	N/A
11	* FENCE	8'	4749	NONE	-	-	NONE	N/A
12	* FENCE	8'	4749	NONE	-	-	NONE	N/A
13	* FENCE	8'	4761	NONE	NONE	NONE	NONE	N/A
14	* FENCE	8'	4773	NONE	-	-	NONE	N/A
15	* FENCE	8'	4777	NONE	-	-	8'	REMOVE

NOTE: OBJECT ELEVATIONS IN FEET MSL (VERTICAL DATUM NAVD88).
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		TO BE REMOVED
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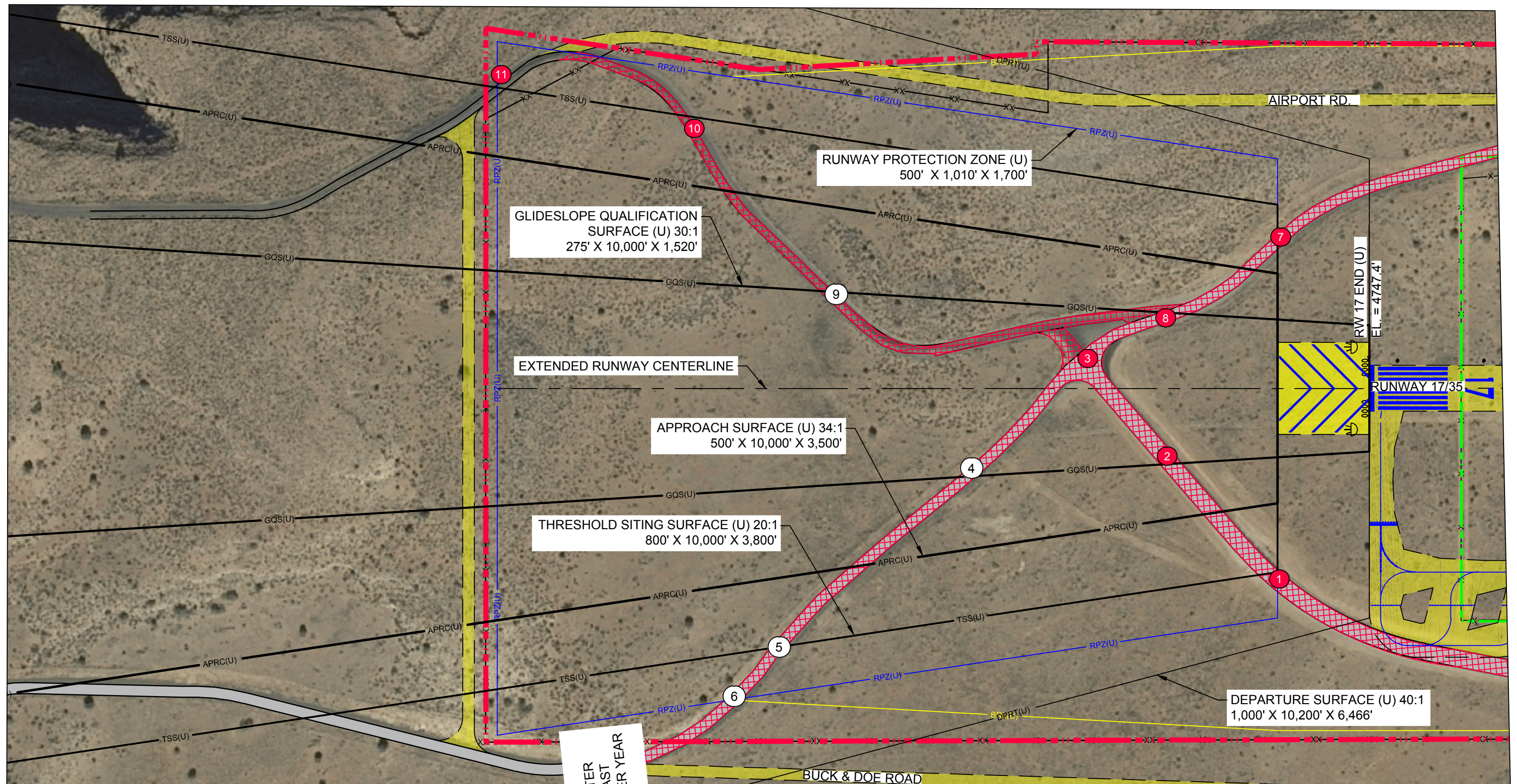
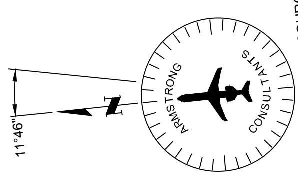
RWY 17 INNER APPROACH (FUTURE)





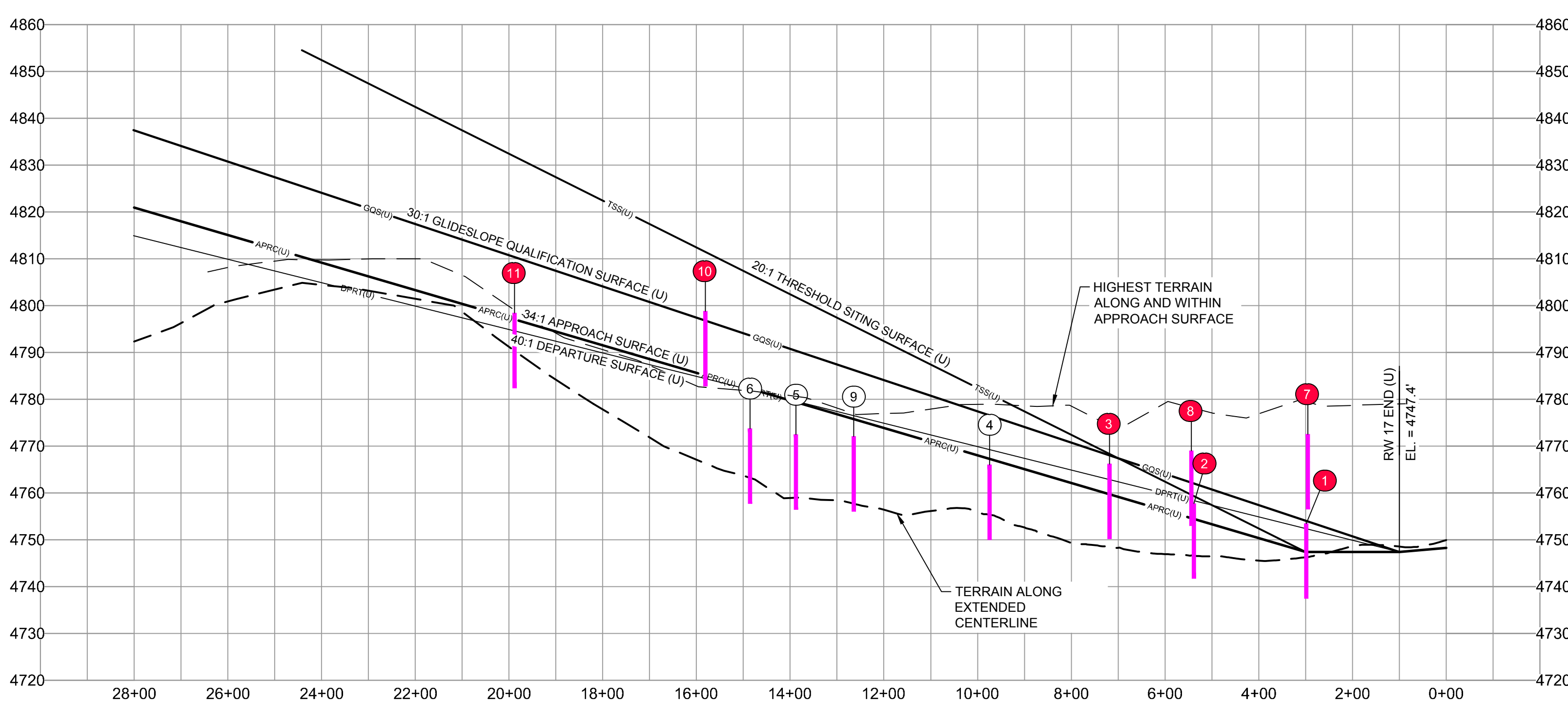
MAGNETIC NORTH SOURCE:
NOAA GEOPHYSICAL DATA CENTER
MAGNETIC DECLINATION X°X' EAST
RATE OF CHANGE X°X' WEST PER YEAR
OBTAINED: 04/24/13

RUNWAY 17 PLAN (U)

SCALE: BARSCALE

200 0 200 400

SCALE IN FEET



RUNWAY 17 PROFILE (U)

SCALE: PER GRID

OBJECTS WITHIN RUNWAY 17 APRC,TSS, AND DEPARTURE SURFACES (U)

No.	OBJECT	EST. OBJECT HT.	TOP ELEV. (MSL)	20:1 TSS PEN.	34:1 APRC SURFACE PEN.	30:1 GQS PEN.	40:1 DPRT PEN.	PROPOSED ACTION
1	* ROAD	16'	4753	6'	-	-	1'	REMOVE
2	* ROAD	16'	4758	NONE	3'	NONE	NONE	REMOVE
3	* ROAD	16'	4766	NONE	6'	NONE	4'	REMOVE
4	* ROAD	16'	4766	NONE	NONE	NONE	NONE	N/A
5	* ROAD	16'	4772	NONE	-	-	NONE	N/A
6	* ROAD	16'	4774	NONE	-	-	NONE	N/A
7	* ROAD	16'	4773	25'	-	-	20'	REMOVE
8	* ROAD	16'	4769	10'	14'	7'	11'	REMOVE
9	* ROAD	16'	4772	NONE	NONE	NONE	NONE	N/A
10	* ROAD	16'	4799	NONE	-	-	14'	REMOVE
11	* ROAD	16'	4798	NONE	-	-	4'	SEE NOTE 3

NOTE: OBJECT ELEVATIONS IN FEET MSL (VERTICAL DATUM NAVD88).
* HEIGHT BASED ON PHOTOGRAMMETRY PROVIDED BY OLYMPUS, INC. AUGUST, 2001. LOCATION AND HEIGHTS ESTIMATED.
- = OBJECT IS NOT LOCATED WITHIN THIS SURFACE.
= OBJECT PENETRATION LOCATION
EST. = ESTIMATED; ELEV. = ELEVATION; HT. = HEIGHT; PEN. = PENETRATION; N/A = NOT APPLICABLE; O.L. = OBSTRUCTION LIGHT; GQS = GLIDESLOPE QUALIFICATION SURFACE; APRC = APPROACH SURFACE; TSS = THRESHOLD SITING SURFACE; DPRT = DEPARTURE SURFACE

NOTES:

1. THERE ARE THRESHOLD SITING SURFACE PENETRATIONS IN THE ULTIMATE CONFIGURATION.
2. A REVIEW OF THE FAA OE/AAA DATABASE WAS CONDUCTED.
3. LESS THAN 35' LOW, CLOSE-IN DEPARTURE SURFACE PENETRATION. ADD NOTE TO DEPARTURE PROCEDURE OR LOWER, MARK AND LIGHT, OR REMOVE PER FAA FLIGHT PROCEDURES OFFICE DETERMINATION.

LEGEND

EXISTING	FUTURE	DESCRIPTION
		AIRFIELD DEVELOPMENT (ASPHALT)
		STRUCTURE/FACILITIES (BUILDING)
		GRAVEL / TURF / DIRT
		AIRPORT PROPERTY LINE (APL)
RSA(E)	RSA(F)	RUNWAY SAFETY AREA (RSA)
OFZ(E)	OFZ(F)	OBSTACLE FREE ZONE (OFZ)
ROFA(E)	ROFA(F)	RUNWAY OBJECT FREE AREA (ROFA)
RPZ(E)	RPZ(F)	RUNWAY PROTECTION ZONE (RPZ)
BRL(E)	BRL(F)	BUILDING RESTRICTION LINE (BRL)
TSA(E)	TSA(F)	TAXIWAY SAFETY AREA (TSA)
TOFA(E)	TOFA(F)	TAXIWAY OBJECT FREE AREA (TOFA)
		TO BE REMOVED
		THRESHOLD LIGHTS
		REIL
		PAPI
		AIRPORT BEACON
		WIND CONE & SEGMENTED CIRCLE
		AWOS
		DRAINAGE/CULVERT
4125	N/A	CONTOURS
		ROAD
		MARKINGS
X	XX	FENCE
		WIND CONE
		SURVEY MONUMENT
		ARP
		HELICOPTER TLOF
		HELICOPTER PARKING PAD

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GRAND CANYON WEST AIRPORT
HUALAPAI NATION, ARIZONA

A.I.P. NO. 3-04-0068-013-2011
AIRPORT LAYOUT PLANS

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1	065772	3/13/07	REVALIDATION	5772502	SLST	DPS	DAC
0	015566	9/16/03	ALP UPDATE	5666502	NOP	DAC	EAA

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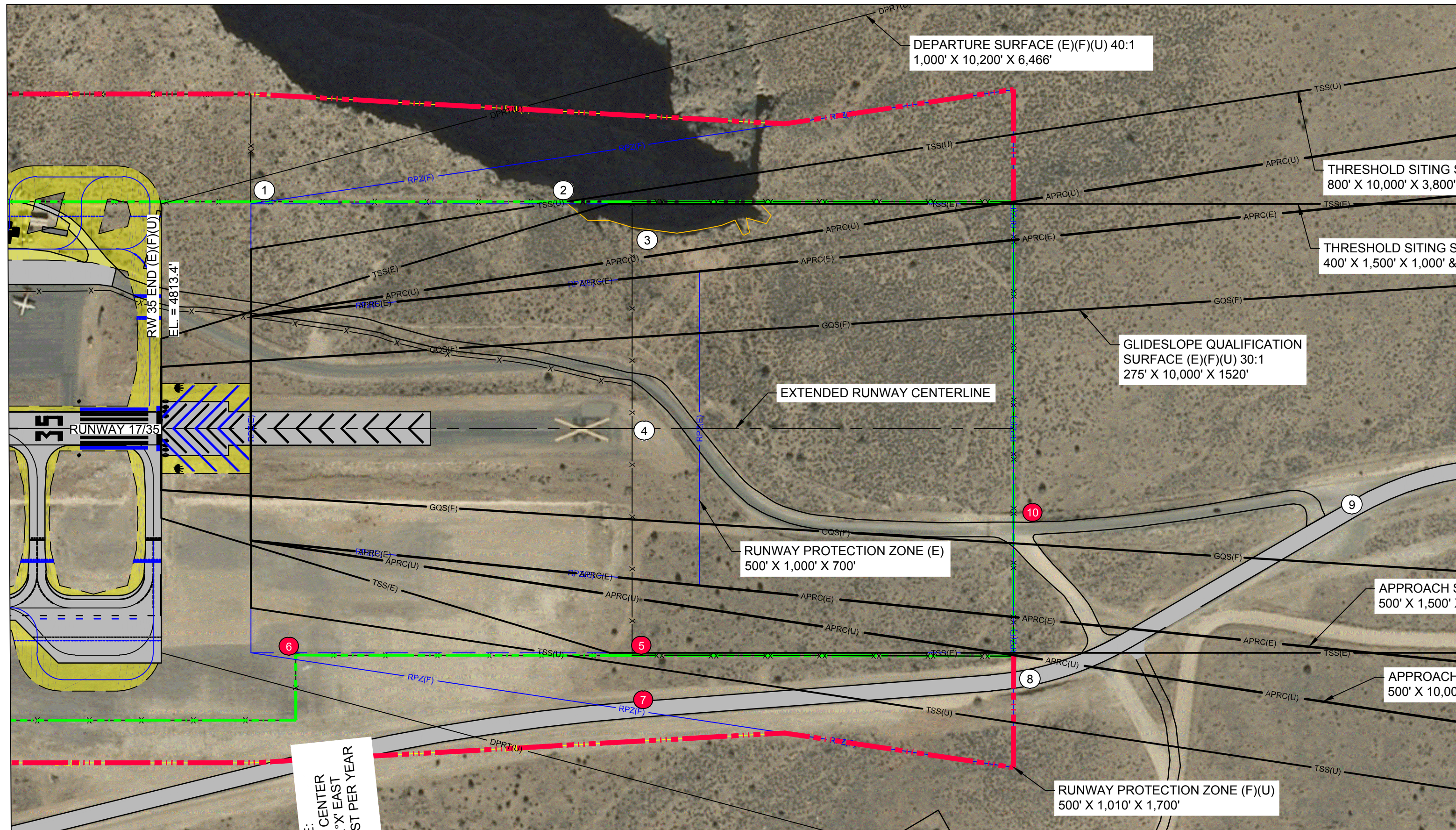
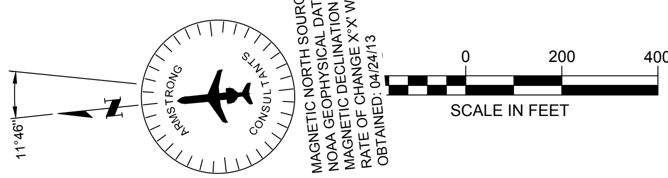
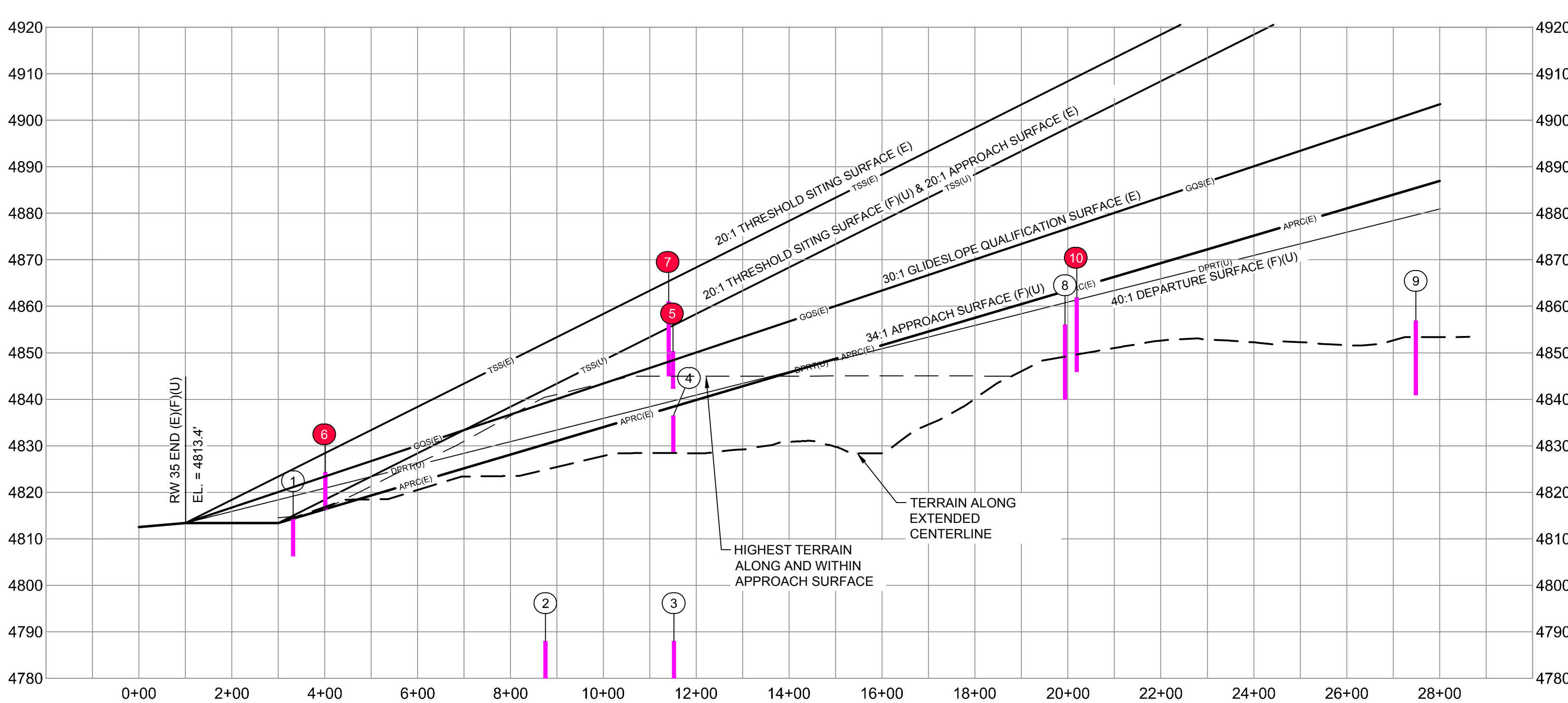
RWY 17 INNER APPROACH (ULTIMATE)





RUNWAY 35 PLAN (E)(F)(U)

SCALE: BARSCALE



RUNWAY 35 PROFILE (E)(F)(U)

SCALE: PER GRID

OBJECTS WITHIN RUNWAY 35 APRC,TSS, AND DEPARTURE SURFACES (E)(F)(U)

No.	OBJECT	EST. OBJECT HT.	TOP ELEV. (MSL)	20:1 TSS PEN.	34:1 APRC SURFACE PEN.	30:1 GQS PEN.	40:1 DPRT PEN.	PROPOSED ACTION
1	* FENCE	8'	4814	-	-	-	NONE	N/A
2	* FENCE	8'	4781	NONE	-	-	NONE	N/A
3	* FENCE	8'	4787	NONE	NONE	-	NONE	N/A
4	* FENCE	8'	4833	NONE	NONE	NONE	NONE	N/A
5	* FENCE	8'	4852	NONE		-	11'	RESET
6	* FENCE	8'	4822	-	-	-	3'	RESET
7	* ROAD	16'	4861	-	-	-	21'	SEE NOTE 3
8	* ROAD	16'	4856	NONE	NONE	-	NONE	N/A
9	* ROAD	16'	4857	NONE	NONE	NONE	NONE	N/A
10	* ROAD	16'	4859	NONE	NONE	NONE	1'	N/A

NOTE: OBJECT ELEVATIONS IN FEET MSL (VERTICAL DATUM NAVD88).
* HEIGHT BASED ON PHOTOGRAMMETRY PROVIDED BY OLYMPUS, INC. AUGUST, 2001. LOCATION AND HEIGHTS ESTIMATED.
- = OBJECT IS NOT LOCATED WITHIN THIS SURFACE.
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LEGEND

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		STRUCTURE/FACILITIES (BUILDING)
		GRAVEL / TURF / DIRT
		AIRPORT PROPERTY LINE (APL)
RSA(E)	RSA(F)	RUNWAY SAFETY AREA (RSA)
OFZ(E)	OFZ(F)	OBSTACLE FREE ZONE (OFZ)
ROFA(E)	ROFA(F)	RUNWAY OBJECT FREE AREA (ROFA)
RPZ(E)	RPZ(F)	RUNWAY PROTECTION ZONE (RPZ)
BRL(E)	BRL(F)	BUILDING RESTRICTION LINE (BRL)
TSA(E)	TSA(F)	TAXIWAY SAFETY AREA (TSA)
TOFA(E)	TOFA(F)	TAXIWAY OBJECT FREE AREA (TOFA)
		TO BE REMOVED
		THRESHOLD LIGHTS
		REIL
		PAPI
		AIRPORT BEACON
		WIND CONE & SEGMENTED CIRCLE
		AWOS
		DRAINAGE/CULVERT
4125	N/A	CONTOURS
		ROAD
		MARKINGS
X	XX	FENCE
		WIND CONE
		SURVEY MONUMENT
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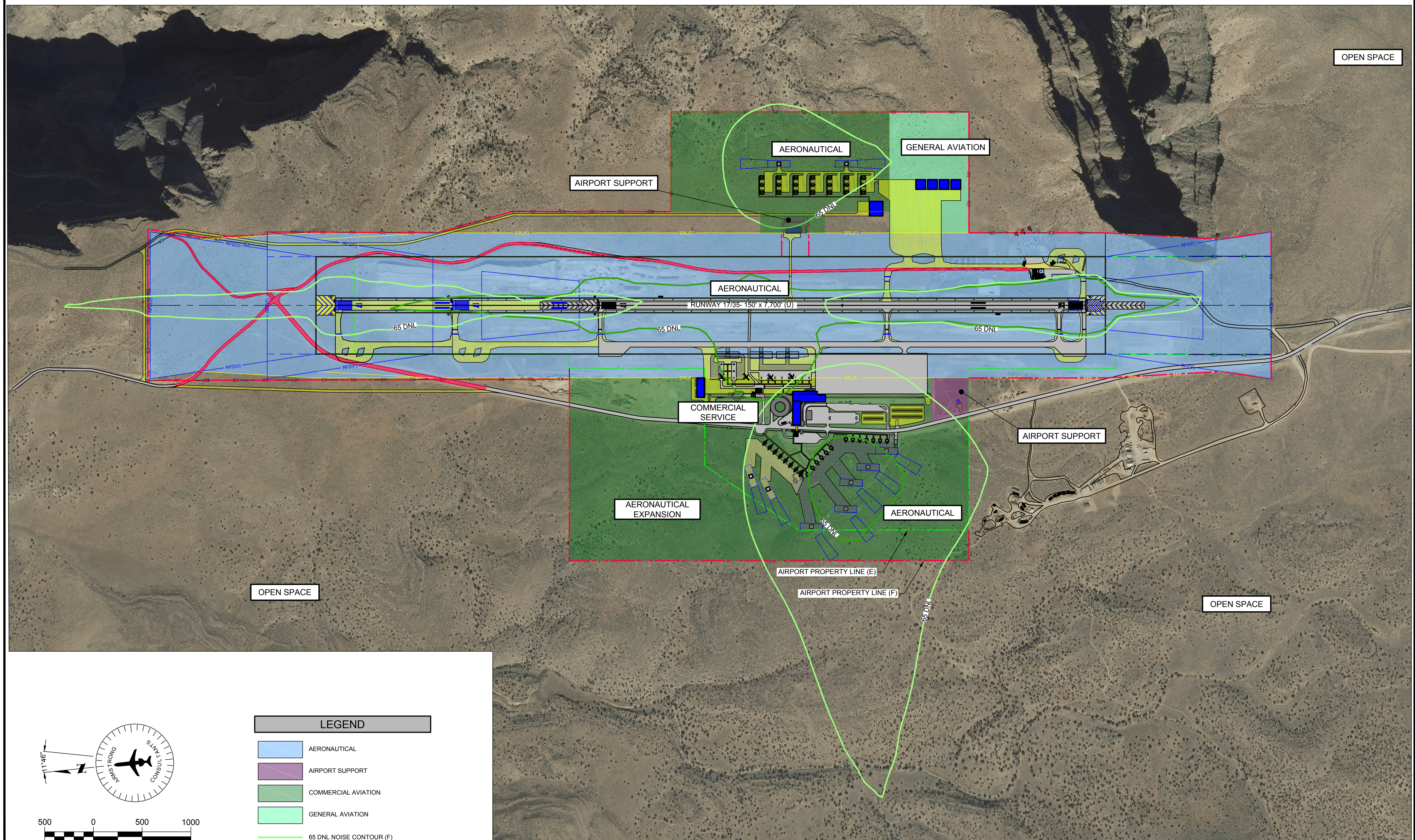
RWY 35 INNER APPROACH (E)(F)(U)



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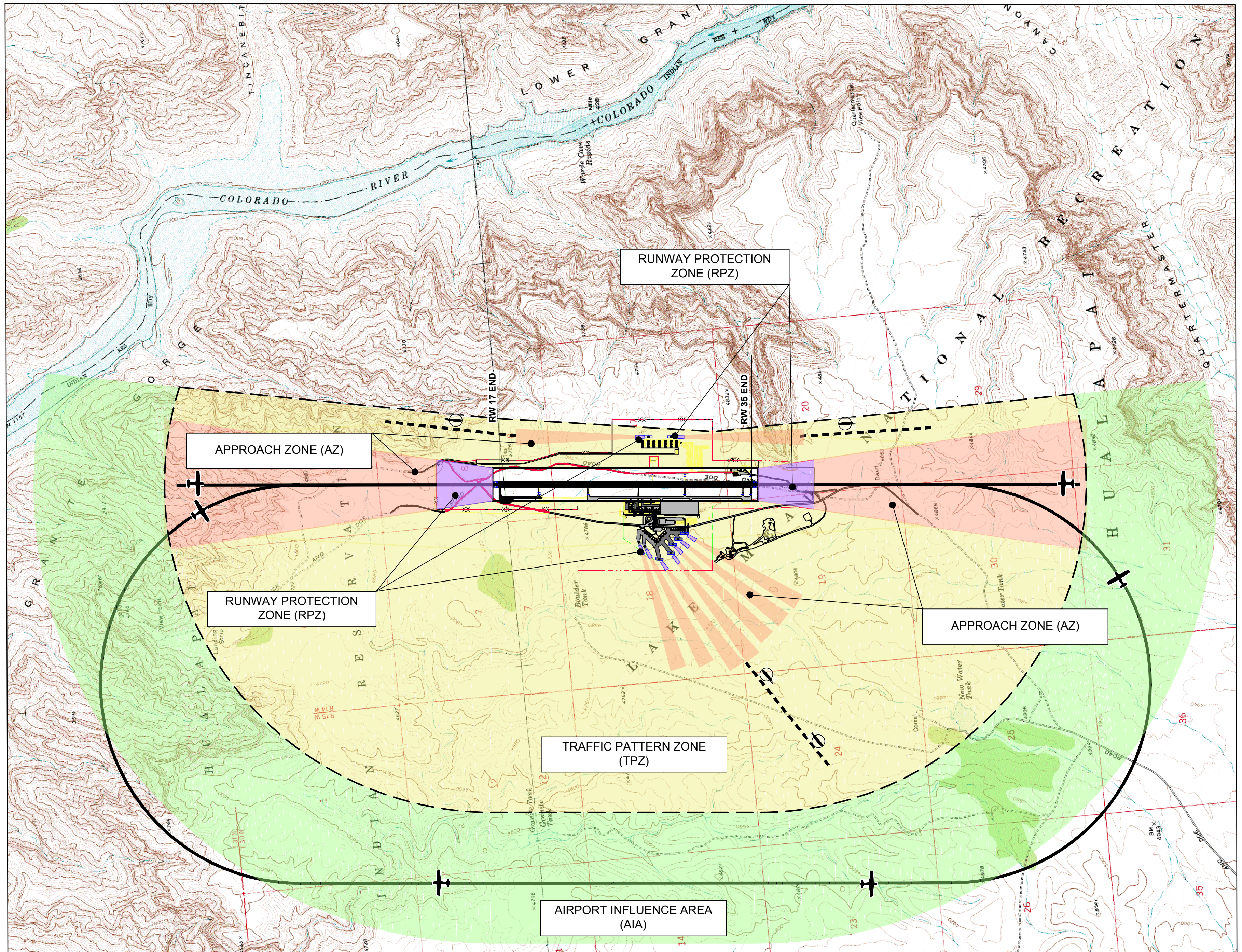
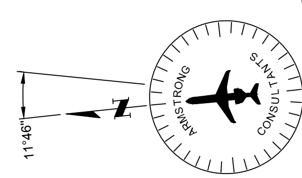
ON AIRPORT LAND USE



PLAN

SCALE: BAR SCALE



MAGNETIC NORTH SOURCE:
NOAA GEOPHYSICAL DATA CENTER
MAGNETIC DECLINATION X°X' EAST
RATE OF CHANGE X°X' WEST PER YEAR
OBTAINED: 04/24/13

2000 0 2000 4000
SCALE IN FEET

LAND USE COMPATIBILITY GUIDELINES

Land Use Category	ZONE D Airport Influence (AIZ)	ZONE C Traffic Pattern (TPZ)	ZONE B Approach (AZ)	ZONE A Runway Protection (RPZ)
Residential				
single-family, nursing homes, mobile homes, multi-family, apartments, condominiums	+	o (3)	- (1,3)	- -
transient lodging, hotel, motel	+	o (3)	- (1,3)	- -
Public				
schools, libraries, hospitals	+	o (3)	- (3)	- -
churches, auditoriums, concert halls	+	o (3)	- (3)	- -
transportation, parking, cemeteries	++	++	++	- (2,5)
Commercial and Industrial				
offices, retail trade, service commercial, wholesale trade, warehousing, light industrial, general manufacturing, utilities, extractive industry	++	+	o (3)	- -
Agricultural and Recreational				
cropland	++	++	++	++
livestock breeding	++	++	++	- (2)
parks, playgrounds, zoos, golf courses, riding stables, water recreation	++	++	++	- (2)
outdoor spectator sports	++	+	- (3)	- -
amphitheaters	o	- (4)	- -	- -
open space	++	++	++	++

NOTE: DEVELOPMENT PROJECTS WHICH ARE WILDLIFE ATTRACTANT, INCLUDING SEWERAGE PONDS AND LANDFILLS, WITHIN 10,000 FEET OF THE AIRPORT ARE UNACCEPTABLE. (REF.: FAA AC 150/5200-33)

(1) If allowed, avigation easements and disclosure must be required as a condition of development.
(2) Any structures associated with uses allowed in the RPZ must be located outside the RPZ.
(3) If no reasonable alternative exists, use should be located as far from extended centerline as possible.
(4) If no reasonable alternative exists, use should be located as far from extended runway centerline and traffic patterns as possible.
(5) Transportation facilities in the RPZ (i.e. roads, railroads, waterways) must be configured to comply with Part 77 requirements.

CRITERIA

Land Use Availability	Interpretation/Comments
++ Clearly Acceptable	The activities associated with the specified land use will experience little or no impact due to airport operations. Disclosure of airport proximity should be required as a condition of development.
+ Normally Acceptable	The specified land use is acceptable in this zone or area. Impact may be perceived by some residents. Disclosure of airport proximity should be required as a condition of development. Dedication of avigation easements may also be advisable.
o Conditionally Acceptable	If appropriate disclosure avigation easements and density limitations are put in place, residential uses and uses involving indoor public assemblies are acceptable.
- Normally Unacceptable	Specified use should be allowed only if no reasonable alternative exists. Disclosure of airport proximity and avigation easements must be required as a condition of development.
- - Clearly Unacceptable	Specified use must not be allowed. Potential safety or overflight nuisance impacts are likely in this area.

TYPICAL TRAFFIC PATTERN DIRECTION AND FLIGHT TRACK AREA.

- RUNWAY PROTECTION ZONE (RPZ) AS DIMENSIONED ON AIRPORT/HELIPORT LAYOUT PLANS.
- APPROACH SURFACE AS DESCRIBED ON THE FAR PART 77 DRAWING OF THE AIRPORT LAYOUT PLAN.
- EXISTING AIRPORT PROPERTY LINE
- FUTURE AIRPORT PROPERTY LINE
- NO HAZARDOUS WILDLIFE ATTRACTANT RING
- 100 YEAR FLOOD PLAN

ORDINANCES IN EFFECT

NO ZONING ORDINANCES ARE CURRENTLY IN EFFECT. Hualapai Tribe controls all land uses in vicinity of airport.

NOTICE OF PROPOSED CONSTRUCTION

An FAA Form 7460-1, "Notice of Proposed Construction or Alteration" must be submitted for any construction or alteration (including hangars and other on-airport and off-airport structures, towers, etc.) within 20,000 horizontal feet of the airport greater in height than an imaginary surface extending outward and upward from the runway at a slope of 100 to 1 or greater in height than 200 feet above ground level.

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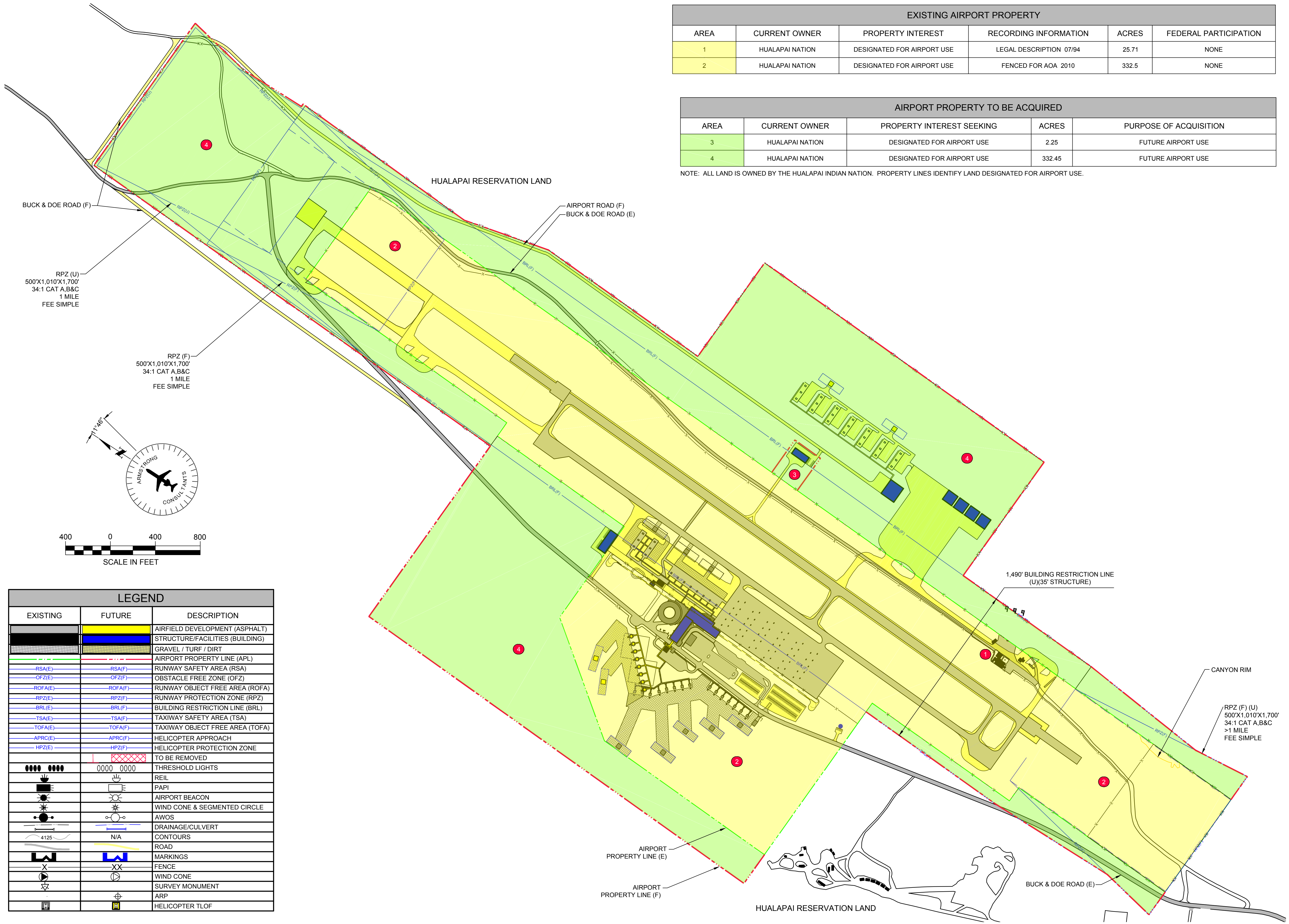
OFF AIRPORT LAND USE

EXISTING AIRPORT PROPERTY					
AREA	CURRENT OWNER	PROPERTY INTEREST	RECORDING INFORMATION	ACRES	FEDERAL PARTICIPATION
1	HUALAPAI NATION	DESIGNATED FOR AIRPORT USE	LEGAL DESCRIPTION 07/94	25.71	NONE
2	HUALAPAI NATION	DESIGNATED FOR AIRPORT USE	FENCED FOR AOA 2010	332.5	NONE

AIRPORT PROPERTY TO BE ACQUIRED				
AREA	CURRENT OWNER	PROPERTY INTEREST SEEKING	ACRES	PURPOSE OF ACQUISITION
3	HUALAPAI NATION	DESIGNATED FOR AIRPORT USE	2.25	FUTURE AIRPORT USE
4	HUALAPAI NATION	DESIGNATED FOR AIRPORT USE	332.45	FUTURE AIRPORT USE

NOTE: ALL LAND IS OWNED BY THE HUALAPAI INDIAN NATION. PROPERTY LINES IDENTIFY LAND DESIGNATED FOR AIRPORT USE.



LEGEND

EXISTING	FUTURE	DESCRIPTION
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ROFA(E)	ROFA(F)	RUNWAY OBJECT FREE AREA (ROFA)
RPZ(E)	RPZ(F)	RUNWAY PROTECTION ZONE (RPZ)
BRL(E)	BRL(F)	BUILDING RESTRICTION LINE (BRL)
TSA(E)	TSA(F)	TAXIWAY SAFETY AREA (TSA)
TOFA(E)	TOFA(F)	TAXIWAY OBJECT FREE AREA (TOFA)
APRC(E)	APRC(F)	HELICOPTER APPROACH
HPZ(E)	HPZ(F)	HELICOPTER PROTECTION ZONE
		TO BE REMOVED
		THRESHOLD LIGHTS
		REIL
		PAPI
		AIRPORT BEACON
		WIND CONE & SEGMENTED CIRCLE
		AWOS
		DRAINAGE/CULVERT
4125	N/A	CONTOURS
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EXHIBIT "A"
PROPERTY
MAP

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AERIAL MAP

GRAND CANYON WEST AIRPORT
HUALAPAI NATION, ARIZONA

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CHAPTER 6

ENVIRONMENTAL OVERVIEW

GRAND CANYON WEST AIRPORT
AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS, INC.
AIRPORT ENGINEERING AND PLANNING

Chapter Six
Environmental Overview

6.1 INTRODUCTION

This environmental overview chapter examines the potential environmental impacts associated with the proposed airport improvements discussed in Chapter 4 - Development Alternatives and in Chapter 7 - Airport Development and Financial Plan. This Chapter is intended to provide an overview of the potential impacts and identify additional environmental documentation that may be required as a prerequisite to development through the planning period.

6.2 AIR QUALITY

Air quality has become a major component of pollution control in the last 40 to 50 years. The passing of the Clean Air Act (CAA) in 1970 marked the beginning of a serious government regulation to ensure pollution is controlled to the maximum extent possible.

The Clean Air Act of 1970 was enacted to reduce emissions of specific pollutants via uniform Federal standards. These standards include the National Ambient Air Quality Standards (NAAQS) which set maximum allowable ambient concentrations of ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), lead (Pb) and particulate matter 10 microns or smaller (PM_{10}). Section 176(c) of the Act, in part, states that no Federal agency shall engage in, support in any way or provide financial assistance for, license or permit or approve any activity that does not conform to the State Implementation Plan.

Federal Aviation Administration Orders 5050.4B and 1050.1E require air quality analysis for projects in areas not in compliance with the Environmental Protection Agency (EPA) approved State Implementation Plan (SIP). Because the entire area is considered in attainment with the SIP, no further air quality analysis is required.

Construction emissions, specifically dust, are not a long-term factor. These emissions are described in the “Construction Impacts” section of this Chapter. The necessary permits will be obtained before construction begins and construction projects will conform to FAA Advisory Circular (AC) 150/5370-10F, Standards for Specifying Construction of Airports.

The following Best Management Practices (BMP) is recommended to minimize construction emissions:

I. Site Preparation
   A. Minimize land disturbance
   B. Use watering trucks to minimize dust
   C. Cover trucks when hauling dirt or debris
   D. Stabilize the surface of dirt piles and any disturbed areas
   E. Use windbreaks to prevent any accidental dust pollution, and
   F. Segregate storm water drainage from construction sites and material piles.

II. Construction Phase
   A. Cover trucks when transferring materials, and
   B. Minimize unnecessary vehicular and machinery activities.

III. Completion Phase
   A. Revegetate any disturbed land not used, and
   B. Remove unused material and dirt piles.

Temporary air pollution may occur as a result of the proposed action. The design and construction of the proposed improvements will incorporate BMP to reduce air quality impacts, including minimizing land disturbance, wetting down, using water trucks, dust suppressant, covering trucks when hauling soil and the use of wind breaks. These practices will be selected based on the site's characteristics. No significant air quality impacts are anticipated as a result of the proposed development.

The Airport is located within an attainment area. An attainment area is a zone within which the level of pollutant is considered to meet National Ambient Air Quality Standards. Air pollutants are emitted by a variety of means and sources: aircraft, ground support equipment (GSE), auxiliary power units, motor vehicle operations, and construction activities.

6.3 COASTAL RESOURCES

There are no coastal zones associated with the proposed development. Therefore, compliance with the Coastal Zone Management Act of 1972 and the Coastal Barriers Resources Act of 1982 is not a factor.

6.4 COMPATIBLE LAND USE

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. Land uses are reviewed in three zones surrounding the airport: the Runway Protection Zone (RPZ), the Approach Zone, Airport Influence Zone and the Traffic Pattern Zone. The RPZ is a trapezoidal area extending 1,200 feet 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 not recommended within the RPZ. The Approach Zone generally falls within the Code of Federal Regulations (CFR) Part 77 Approach Surface area. Within the Approach Zone, public land uses, such as schools, libraries, hospitals and churches should be avoided. New residential developments should include avigation easements and disclosure statements. The Traffic Pattern Zone is generally the area within one mile of the airport. Within the Traffic Pattern Zone, avigation easements should be considered for residential and public uses within this area and disclosure statements should be included. The Airport Influence Zone is the area where aircraft transition to or from an enroute altitude or airport over-flight altitude to or from the standard traffic pattern altitude of 800 to 1,000 feet above airport elevation.

Currently land surrounding the Grand Canyon West Airport is considered undeveloped open space. There is currently no incompatible development surrounding the airport. Maintain compatible land use around the airport in the future is recommended.

14 CFR Part 77, Objects Affecting Navigable Airspace, provides imaginary surfaces surrounding an airport that should be protected from penetration by objects. These include the primary, transitional approach surface, horizontal surface and conical surface. These surfaces were described in Chapter Three. Proposed structures in the vicinity of the airport should be reviewed against the Part 77 criteria to ensure hazards to air navigation are not created. No penetrations

to the approach surface currently exist. Objects penetrating these surfaces could result in a hazard to air navigation.

6.5 CONSTRUCTION IMPACTS

Local, State and Federal ordinances and regulations address the impacts of construction activities, including construction noise, dust and noise from heavy equipment traffic, disposal of construction debris and air and water pollution.

Construction operations for the proposed development will cause specific impacts resulting solely from and limited exclusively to the construction project. Construction impacts are distinct in that they are temporary in duration and the degree of adverse impacts decreases as work is concluded. The following construction impacts can be expected:

- A temporary increase in particulate and gaseous air pollution levels as a result of dust generated by construction activity and by vehicle emissions from equipment and worker's automobiles
- Increases in solid and sanitary wastes from the workers at the site
- Traffic volumes that would increase in the airport vicinity due to construction activity (workers arriving and departing, delivery of materials, etc.)
- Increase in noise levels at the airport during operation of heavy equipment, and
- Temporary erosion, scarring of land surfaces and loss of vegetation in areas that are excavated or otherwise disturbed to carry out future developments.

All construction projects will comply with guidelines set forth in FAA Advisory Circular 150/5370-10F, *Standards for Specifying the Construction of Airports*. The contractor will obtain the required construction permits as well as prepare a Storm Water Pollution Prevention Plan (SWPPP) and Fugitive Dust Control Plan for construction. These requirements will be specified in the contract documents for the construction of the proposed improvements.

6.6 DEPARTMENT OF TRANSPORTATION ACT – SECTION 4(F)

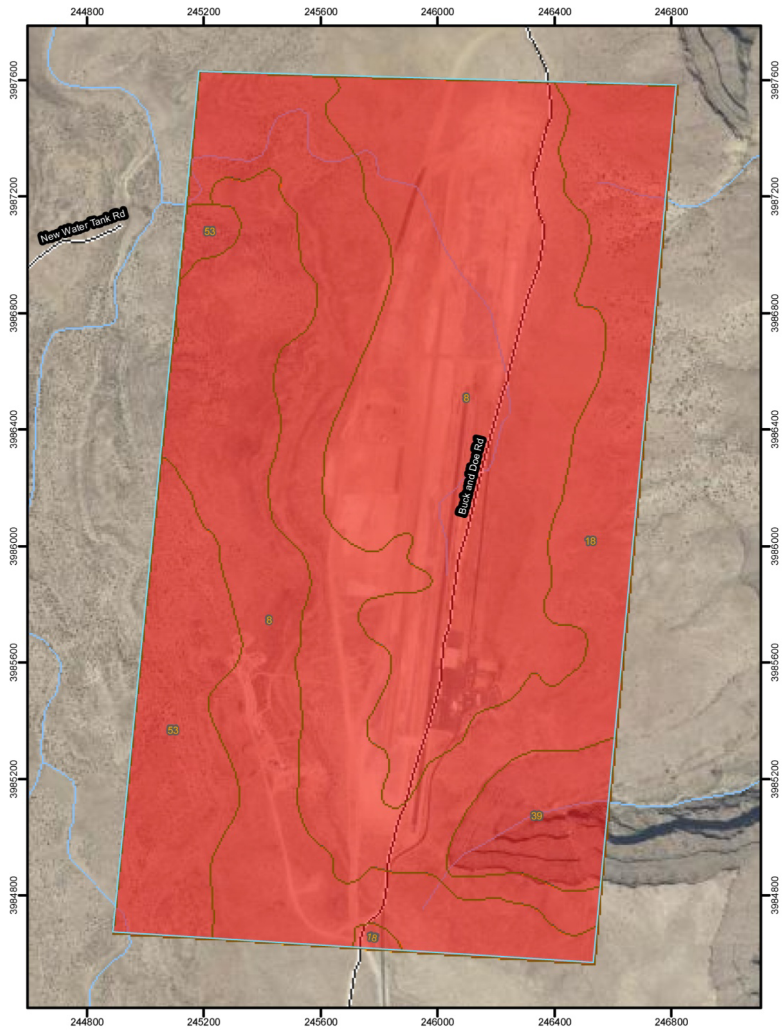
Section 303c of Title 49, U.S.C., formerly Section 4(f) of DOT Act of 1966, provides that the Secretary of Transportation shall not approve any program or project that requires the use of any publicly owned land from a public park, recreation area or wildlife or waterfowl refuge of National, State or Local significance or land from an historic site of National, State or Local significance, as determined by the officials having jurisdiction thereof, unless there is no feasible and prudent alternative to the use of such land and such project includes all possible planning to minimize impacts. The proposed improvements at Grand Canyon West Airport will not require land from any public park, recreation area or wildlife or waterfowl refuge.

6.7 FARMLANDS

The Farmland Protection Policy Act (FPPA) authorizes the Department of Agriculture to develop criteria for identifying the effects of Federal programs upon the conversion of farmland to uses other than agriculture.
Conversion of "Prime or Unique" farmland may be considered a significant impact. Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed or fiber without intolerable soil erosion as determined by the Secretary of Agriculture. Unique farmland is land other than prime farmland which is used to produce specific

high value food and fiber crops, such as citrus, tree nuts, olives, cranberries, fruits and vegetables.

Figure 6-1 illustrates that there is no prime or unique farmland on or surrounding the Grand Canyon West Airport. Therefore future development shown for the airport would have no impact on farmlands.



Farmland Classification— Summary by Map Unit — Hualapai-Havasupai Area, Arizona, Parts of Coconino, Mohave, and Yavapai Counties (AZ699)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
8	Curhollow-Rolie-Meriwhitica association, 1 to 35 percent slopes	Not prime farmland	641.4	52.9%
18	Hindu-Rock outcrop complex, 5 to 45 percent slopes	Not prime farmland	397.4	32.8%
39	Rock outcrop-Torriorthents complex, 35 to 120 percent slopes	Not prime farmland	52.1	4.3%
53	Winona-Curhollow complex, 1 to 12 percent slopes	Not prime farmland	121.7	10.0%
Totals for Area of Interest			**1,212.6**	**100.0%**

Soil Ratings

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained

Source:U.S. Department of Agriculture, 2012

FIGURE 6-1 PRIME AND UNIQUE FARMLAND

6.8 FISH, WILDLIFE AND PLANTS

This category concerns potential impacts to existing wildlife habitat and threatened and endangered species. Examining both the area of land to be altered or removed and its relationship to surrounding habitat quantify the significance of the impacts in this category. For example, removal of a few acres of habitat which represents a small percentage of the area's total similar habitat or which supports a limited variety of common species would not be considered significant. However, removal of a sizeable percentage of the area's similar habitat or habitat which is known to support rare species would be considered a significant impact.

Section 7 of the Endangered Species Act, as amended, requires each Federal agency to insure that "any action authorized, funded or carried out by such agency . . . is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat of such species . . ."

An *Endangered Species* is defined as any member of the animal or plant kingdoms determined to be in danger of extinction throughout all or a significant portion of its range. A *Threatened Species* is defined as any member of the animal or plant kingdoms that are likely to become endangered in the foreseeable future. A *Candidate Species* is defined as a plant or animal for which there is sufficient information on their biological status and threats to propose them as endangered or threatened but for which development of a proposed listing regulation is precluded by other higher priority listing activities. A *Candidate Conservation Agreement* is a formal agreement between the U.S. Fish and Wildlife Service and one or more parties to address the conservation needs of proposed or candidate species, or species likely to become candidates, before they become listed as endangered or threatened.

A list of federally threatened or endangered specifies was obtained for Mohave County, but do not necessarily occur in the vicinity of the Grand Canyon West Airport or within the project areas at the Airport.

<u>Federal Endangered:</u>

- California condor – *Gymnogyps californianus*
- Yuma clapper rail – *Rallus longirostris yumanensis*
- California least tern – *Sterna antillarum browni*
- Southwestern willow flycatcher – *Empidonax traillii extimus*
- Humpback chub – *Gila cypha*
- Gila topminnow – *Poeciliopsis occidentalis*
- Woundfin – *Plagopterus argentissimus*
- Bonytail chub – *Gila elegans*
- Razorback sucker – *Xyrauchen texanus*
- Arizona Cliff-rose – *Purshia subintegra*
- Holmgren milk-vetch – *Astragalus holmgreniorum*
- Hualapai Mexican vole – *Microtus mexicanus haulpaiensis*
- Virgin River chub – *Gila seminude*

<u>Federal Threatened:</u>

- Mexican Spotted Owl - *Strix occidentalis lucida*
- Jones cycladenia – *Cycladenia jonesii humilis*
- Siler pincushion cactus – *Pediocactus sileri*
- Desert Tortoise, Mohave population – *Gopherus agassizii*

Federal Candidate:

- Relict leopard Frog – *Lithobates onca*
- Yellow-billed cuckoo – *Coccyzus americanus*
- Roundtail chub – *Gila robusta*
- Desert Tortoise, Sonoran population – *Gopherus agassizii*

Proposed Endangered:

- Fickeisen plains cactus – *Pediocactus peeblesianus fickieseniae*
- Gierisch mallow – *Sphaeralcea gierischii*

All species listed under the Endangered Species Act (ESA) for Mohave County, Arizona were evaluated for their potential to be present in the Grand Canyon West Airport project area based on general geographic and elevation distribution, habitat requirements. **Table 6-1** lists each of the species and provides the biological basis for including or excluding each species from further evaluation of potential impacts from the project site.

TABLE 6-1 THREATENED, ENDANGERED, AND CANDIDATE SPECIES POTENTIALLY OCCURRING WITHIN OR ADJACENT TO THE PROJECT AREA

Species	ESA Status	Habitat Requirements	Project-specific Inclusion/Exclusion Justification
California condor *Gymnogyps californianus*	FE	High desert canyons and plateaus.	Not known to occur within the project area
Yuma clapper rail	FE	Fresh water and brackish marshes. < 4,500 ft.	No habitat present in project area
California least tern *Sterna antillarum browni*	FE	Open, bare or sparsely vegetated sand, sandbars, gravel pits, or exposed flats along shorelines of inland rivers, lakes, reservoirs or drainage systems < 2,000 ft.	No habitat present in project area
Southwestern willow flycatcher *Empidonax traillii extimus*	FE	Cottonwood/willow and tamarisk vegetation communities along rivers and streams. < 8,500 ft	No habitat present in project area
Humpback chub *Gila cypha*	FE	Large, warm turbid rivers especially canyon areas with deep fast water. < 4,000 ft.	No habitat present in project area
Gila topminnow *Poeciliopsis occidentalis*	FE	Small streams, springs, and cienegas, vegetated shallows. < 4,500 ft.	No habitat present in project area
Woundfin *Plagopterus argentissimus*	FE	Inhabits shallow, warm turbid, fast flowing water. Tolerates high salinity. < 4,500 ft.	No habitat present in project area
Bonytail chub *Gila elegans*	FE	Warm, swift, turbid mainstem rivers of the Colorado River basin, reservoirs in lower basin.	No habitat present in project area
Razorback sucker *Xyrauchen texanus*	FE	Riverine and lacustrine areas, generally not in fast moving water and may use backwaters. < 6,000 ft.	No habitat present in project area
Arizona Cliff-rose *Purshia subintegra*	FE	White limestone soils derived from tertiary lakebed deposits. < 4,000 ft.	No habitat present in project area

Holmgren milk-vetch *Astragalus holmgreniorum*	FE	Just under limestone ridges and along draws in gravelly clay hills. 2,700-2,800 ft.	No habitat present in project area
Hualapai Mexican vole *Microtus mexicanus haulpaiensis*	FE	Moist, grass/sedge habitats along permanent or semi-permanent waters. (springs or seeps) 3,500-7,000 ft.	No habitat present in project area
Virgin River chub *Gila seminuda*	FE	Deep swift waters but not turbulent, occurs over sand and gravel substrates in water less than 86 degrees F. < 4,500 ft.	No habitat present in project area
Mexican Spotted Owl *Strix occidentalis lucida*	FT	Nests in canyons and dense forests with multi-layered foliage structure. 4,100-9,000 ft.	No habitat present in project area
Jones cycladenia *Cycladenia jonesii humilis*	FT	Mixed desert scrub, juniper, or buckwheat-mormon tea. 4,390-6,000 ft.	Not known to occur within the project area
Siler pincushion cactus *Pediocactus sileri*	FT	Desertscrub transitional areas of Navajo, sagebrush and Mohave Deserts. 2,800-5,400 ft.	Not known to occur within the project area
Desert Tortoise, Mohave Population – *Gopherus agassizii*	FT	Mohave desertscrub (north and west of the Colorado River) in basin and bajadas but also found on rock slopes. < 4,000 ft.	No habitat present in project area
Relict leopard Frog *Lithobates onca*	FC	Permanent streams, springs and spring-fed wetlands with open shorelines and available pools. < 1,968 ft.	No habitat present in project area
Yellow-billed cuckoo *Coccyzus americanus*	FC	Large blocks of riparian woodlands (cottonwood, willow, or tamarisk galleries). < 6,500 ft.	No habitat present in project area
Roundtail chub *Gila robusta*	FC	Cool to warm waters of rivers streams, often occupy the deepest pools and eddies of large streams 1,000-7,500 ft.	No habitat present in project area
Desert Tortoise, Snoroan population – *Gopherus agassizii*	FC	Primarily rock hillsides and bajdas of Mohave and Sonoran desertscrub but may encroach into desert grassland, juniper, woodland, interior chaparral habitats, and even pine communities < 7,800 ft.	No habitat present in project area
Gierisch mallow *Sphaeralcea gierischii*	PE	Found only on gypsum outcrops associated with Harrisburg member of Kaibab Formation < 4,000 ft.	No habitat present in project area
Fickeisen plains cactus *Pediocactus peeblesianus fickieseniae*	PE	Shallow soils derived from exposed layers of Kaibab limestone. Found on canyon margins, well drained hills in Navajoan Desert, or Great Plains grasslands. 4,200-5,950 ft.	Not known to occur within the project area

Source: U.S. Fish and Wildlife Service (USFWS), 2012
Prepared by: Armstrong Consultants, Inc., 2012
Note1. ESA = Endangered Species Act: FE = Federally Endangered, FT = Federally Threatened, FC = Federal Candidate, PE = Proposed Endangered

6.9 FLOODPLAINS

Floodplains are defined by Executive Order 11988, *Floodplain Management*, as "the lowland and relatively flat areas adjoining coastal water… including at a minimum, that area subject to a one percent or greater chance of flooding in any given year…", that is, an area which would be inundated by a 100-year flood. If a proposed action involves a 100-year floodplain, mitigating measures must be investigated in order to avoid significant changes to the drainage system.

As described in FAA Order 5050.4B, *Airport Environmental Handbook*, an airport development project would be a significant impact pursuant to National Environmental Protection Agency (NEPA) if it results in notable adverse impacts on natural and beneficial floodplain values. Mitigation measures for base floodplain encroachments may include committing to special flood related design criteria, elevating facilities above base flood level, locating nonconforming structures and facilities out of the floodplain or minimizing fill placed in floodplains.

Grand Canyon West Airport and the surrounding area has been mapped by the Federal Emergency Management Agency (FEMA), which indicate the airport does not fall within any 100-year floodplain.

6.10 HAZARDOUS MATERIALS, POLLUTION PREVENTION AND SOLID WASTE

Four primary laws have been passed governing the handling and disposal of hazardous materials, chemicals, substances and wastes. The two statues of most importance to the FAA in proposing actions to construct and operate facilities and navigational aids are the Resource Conservation and Recovery Act (RCRA) (as amended by the Federal Facilities Compliance Act of 1992), and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) [as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA or Superfund) and the Community Environmental Response Facilitation Act of 1992]. RCRA governs the generation, treatment, storage and disposal of hazardous wastes. CERCLA provides for consultation with natural resource trustees and cleanup of any release of a hazardous substance (excluding petroleum) into the environment.

Airport development actions that relate only to construction or expansion of runways, taxiways, and related facilities do not normally include any direct relationship to solid waste collection, control or disposal other than that associated with the construction itself. The nature of the proposed airport meets these criteria and will not significantly increase net waste output for the Airport.

Any solid waste disposal facility (i.e. sanitary landfill) which is located within 5,000 feet of all runways planned to be used by piston-powered aircraft or within 10,000 feet of all runways planned to be used by turbine aircraft, is considered by the FAA to be an incompatible land use because of the potential for conflicts between bird habitat and low-flying aircraft. This determination is found in FAA Advisory Circular 150/5200-33, *Hazardous Wildlife Attractants On or Near Airports*. There are no solid waste disposal facilities within 10,000 feet of the Airport. Any planned solid waste disposal facilities should be located at least 10,000 feet from the runway.

A Stormwater Pollution Prevention Plan (SWPPP) is recommended for the airport. The SWPPP identifies structural and non-structural controls that will be put in place to minimize negative impacts caused by offsite storm water discharges to the environment. The purpose of these controls is to minimize erosion and run-off of pollutants and sediment.

Aircraft fuel is currently stored in above ground tanks at the Airport. A Spill Prevention Control and Countermeasure (SPCC) plan includes requirements for oil spill prevention, preparedness, and response to prevent oil discharges to navigable waters is recommended to be adopted in compliance with the U.S. EPA mandates.

6.11 Historical, Architectural, Archaeological and Cultural Resources

The National Historic Preservation Act of 1966 requires that an initial review be made in order to determine if any properties 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 area within which direct and indirect impacts could occur and thus cause a change in historic, architectural, archaeological or cultural properties).

The Archaeological and Historic Preservation Act of 1974 provides for the survey, recovery and preservation of significant scientific, prehistoric, historical, archaeological or paleontological data when such data may be destroyed or irreparably lost due to a Federal, Federally funded or federally licensed project.

A cultural survey was conducted for the airport during the 2003 Environmental Assessment. The majority of the airport was surveyed for cultural resources. It is recommended that a cultural survey be conducted for development within areas not previously surveyed.

6.12 Light Emissions and Visual Impacts

Airfield lighting is the main source of light emissions emanating from an airport. The purpose of evaluating the change in light emissions is to determine the extent to which lighting improvements associated with proposed airport development will create an annoyance for inhabitants of properties in the immediate vicinity of the Airport. The determination of impact was based on the nature and intensity of lighting facilities at the Airport and its physical characteristics and anticipated uses of adjacent properties.

Light emissions from any of the development projects are expected to be localized and should not have any impacts beyond the areas of concern. Given the nature of the projects, lighting will be confined to area illumination of runway ends, parking areas, aircraft apron areas, and roadway lighting as required.

Proposed improvements for the Airport include the development of an approach lighting system and additional runway lighting associated with the runway extension. If complaints are received, the lights can be shielded or baffled to minimize their impact.

6.13 Natural Resources, Energy Supply and Sustainable Design

Executive order 13123, *Greening the Government through Efficient Energy Management* (64 FR 30851, June 8, 1999), encourages each Federal agency to expand the use of renewable energy within its facilities and in its activities. Executive order 13123 also requires each Federal agency to reduce petroleum use, total energy use and associated air emissions and water consumption in its facilities.

It is also the policy of the FAA, consistent with NEPA and the CEQ regulations, to encourage the development of sustainability. All elements of the transportation system should be designed with a view to their aesthetic impact, conservation of resources such as energy, pollution prevention, harmonization with the community environment and sensitivity to the concerns of the traveling public.

Energy requirements associated with airport improvements generally fall into two categories: 1) changed demand for stationary facilities (i.e. airfield lighting and terminal building heating) and 2) those that involve the movement of air and ground vehicles (i.e. fuel consumption). The use of natural resources includes primarily construction materials and water.

Energy requirements are not expected to significantly increase as a result of the proposed improvements. Demand for electricity and aircraft fuel is expected to increase with future development; however, the increase will be minimal. Aircraft fuel should be stored in above ground tanks at the airport that conform to U.S. EPA regulations. Significant increases in ground vehicle fuel consumption are not anticipated.

Improvements and expansion to the terminal building should consider the application of Leadership in Energy and Environmental Design (LEED) certification. LEED design utilizes strategies aimed at achieving high performance in key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. LEED provides building owners and operators with a framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions.

Future development and improvement projects should take into account and apply sustainable design measures. Examples of sustainable design initiatives include, but are not limited to: adaptive shading, double skin walls, photovoltaic (PV) roof panels, induction lights on photocell, recycled flooring and carpets. Additional measures could also include reducing energy use through the installation of light-emitting diodes (LED) energy efficient airfield lighting.

6.14 NOISE

Noise analysis considerations include: 1) whether the Federal thresholds of noise exposure are exceeded, 2) whether the 65 day-night level (DNL) noise contour extends beyond airport property and 3) if there are any residences, churches, schools or hospitals within the 65 DNL noise contour. The basic measure of noise is the sound pressure level that is recorded in decibels (dBA). The important point to understand when considering the impact of noise on communities is that equal levels of sound pressure can be measured for both high and low frequency sounds. Generally, people are less sensitive to sounds of low frequencies than they are high frequencies. An example of this might be the difference between the rumble of automobile traffic on a nearby highway and the high-pitched whine of jet aircraft passing overhead. At any location, over a period of time, sound pressure fluctuates considerably between high and low frequencies. **Figure 6-2** depicts a Sound Level Comparison of different noise sources.

The identification of airport generated noise impacts and implementation of noise abatement measures is a joint responsibility of airport operators and users. FAA Order 5050.4B states that "no noise analysis is needed for proposals involving Design Group I and II airplanes operating at airports whose forecast operations in the period covered by the EA do not exceed 90,000 annual adjusted propeller operations or 700 annual adjusted jet operations…" Based on existing and forecasted aircraft operations, noise analysis is required for Grand Canyon West Airport and a future noise contour was developed as a part of this Airport Master Plan.

The future 65 DNL noise contour is shown in **Figure 6-3** and does not impact any residences, churches, schools or hospitals.

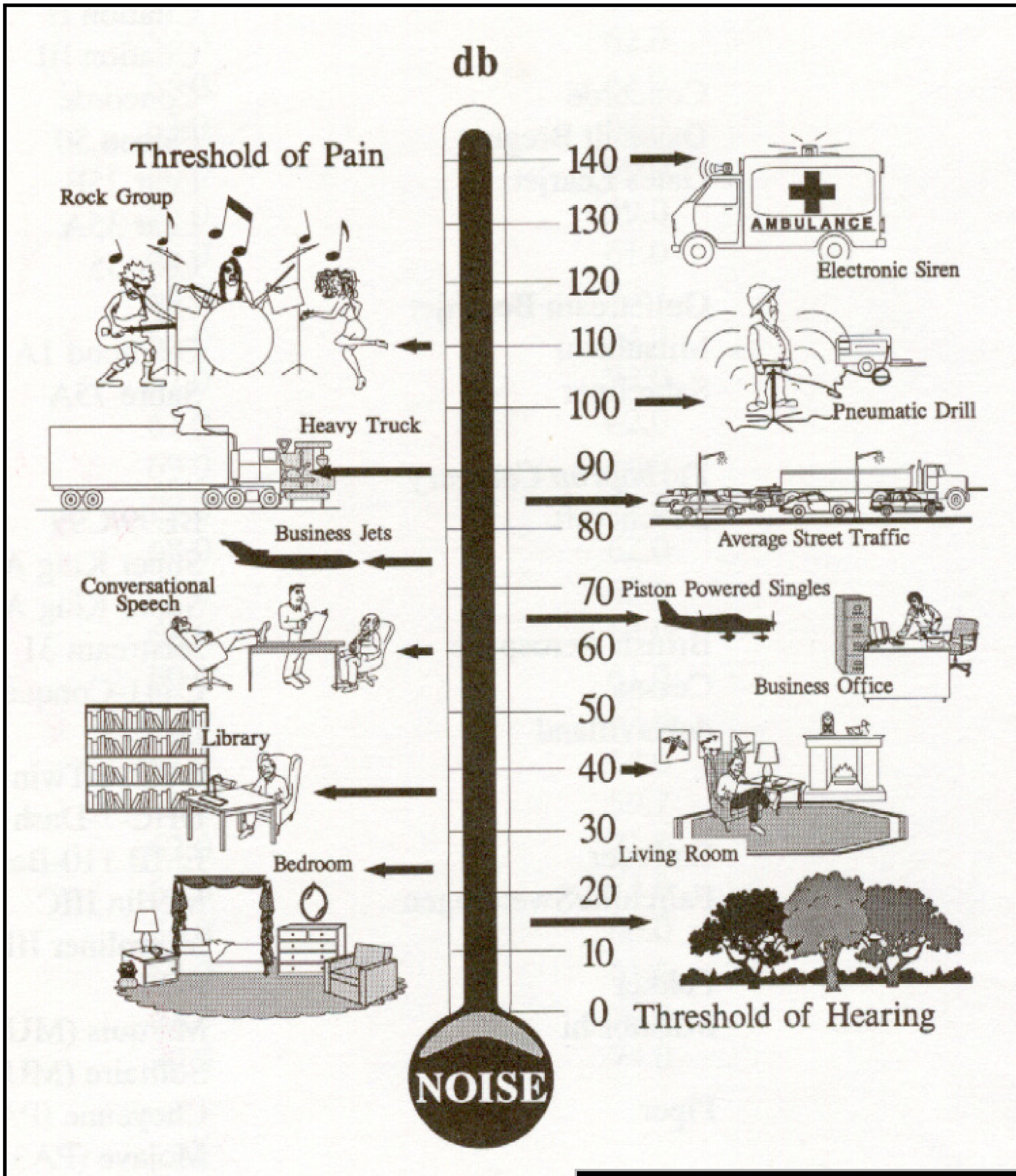


FIGURE 6-2 SOUND LEVEL COMPARISON

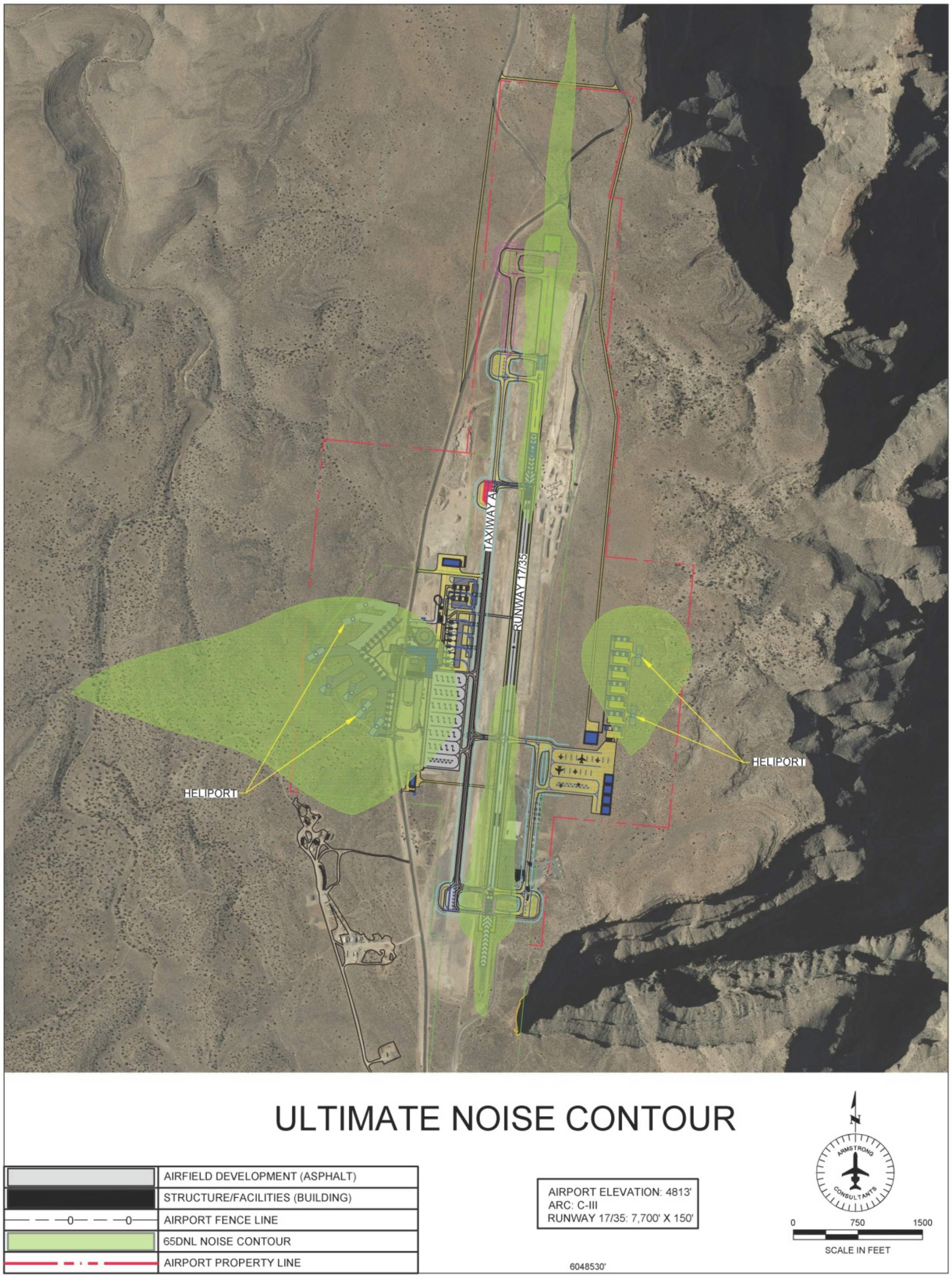


FIGURE 6-3 ULTIMATE 65 DNL NOISE CONTOUR

6.14.1 VOLUNTARY NOISE ABATEMENT PROGRAM

Although the noise exposure levels will not exceed 65 DNL over any noise sensitive area, several voluntary measures can be applied to minimize noise exposure to surrounding areas. Several of these measures are listed below. It is recommended that a voluntary noise abatement program be implemented for the airport and publicized to all based and transient pilots.[1]

Pilots:

- Be aware of noise sensitive areas, particularly residential areas near the airport and avoid low flight.
- Fly traffic patterns tight and high, keeping the aircraft as close to the field as possible.
- In constant-speed-propeller aircraft, do not use high RPM settings in the pattern. Propeller noise from high-performance singles and twins increases drastically at high RPM settings.
- On takeoff, reduce to climb power as soon as safe and practical.
- Climb after liftoff at best-angle-of-climb speed until crossing the airport boundary, then climb at best rate.
- Depart from the start of the runway rather than intersections, for the highest possible altitude when leaving the airport vicinity.
- Avoid prolonged run-ups and do them inside the airport area, rather than at its perimeter.
- Try low-power approaches and always avoid the low, dragged-in approach.

Instructors:

- Teach noise abatement procedures to all students, including pilots you take up for flight reviews.
- Know noise-sensitive areas and point them out to students.
- Assure students fly at or above the recommended pattern altitude.
- Practice maneuvers over unpopulated areas and vary practice areas so that the same locale is not constantly subjected to aircraft operations.
- During practice of ground-reference maneuvers, be particularly aware of houses or businesses in your flight path.
- Stress that high RPM propeller settings are reserved for takeoff and for short final but not for flying in the pattern. Pushing the propeller to high RPM results in significantly higher levels of noise.

Fixed Base Operators (FBOs):

- Identify noise-sensitive areas and work with customers to create voluntary noise abatement procedures.
- Post any noise abatement procedures in a prominently visible area and remind pilots of the importance of adhering to them.
- Call for the use of the least noise sensitive runway whenever wind conditions permit.
- Initiate pilot education programs to teach and explain the rationale for noise abatement procedures and positive community relations.

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[1] Aircraft Owners and Pilots Association (AOPA)

Airport Owner and Surrounding Jurisdictions:

- Maintain appropriate zoning in the vicinity of the airport and see that noise sensitive land uses are not authorized within pattern, approach and departure paths.
- Disclose the existence of the airport and the airport influence area to real estate purchasers.
- Publish voluntary noise procedures on the Internet.
- Publish voluntary calm runway use procedures.

6.15 SECONDARY (INDUCED) IMPACTS

These secondary or induced impacts involve major shifts in population, changes in economic climate or shifts in levels of public service demand. The effects are directly proportional to the scope of the project under consideration. Assessment of induced socioeconomic impacts is usually only associated with major development at large air carrier airports, which involve major terminal building development or roadway alignments and similar work. The extent of the indirect socioeconomic impacts of the proposed development is not of the magnitude that would normally be considered significant; however, positive impacts can be foreseen in the form of direct, indirect and induced economic benefits generated from the airport.

6.16 SOCIOECONOMIC IMPACTS, ENVIRONMENTAL JUSTICE AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, the accompanying Presidential Memorandum and Order DOT 5610.2, Environmental Justice, require the FAA to provide for meaningful public involvement by minority and low-income populations and analysis, including demographic analysis, which identifies and addresses potential impacts on these populations that may be disproportionately high and adverse. Included in this process is the disclosure of the effects on subsistence patterns of consumption of fish, vegetation or wildlife and effective public participation and access to this information. The Presidential Memorandum that accompanied E.O. 12898, as well as the CEQ and EPA Guidance, encourage consideration of environmental justice impacts in EA's, especially to determine whether a disproportionately high and adverse impact may occur. Environmental Justice is examined during evaluation of other impact categories, such as noise, air quality, water, hazardous materials and cultural resources.

6.16.1 SOCIOECONOMIC IMPACTS

Induced socioeconomic impacts are usually only associated with major development at large air carrier airports. The socioeconomic impacts produced as a result of the proposed improvements to the Grand Canyon West Airport are expected to be positive in nature and would include direct, indirect and induced economic benefits to the local area. These airport improvements are expected to attract additional users and in turn to encourage tourism, industry and to enhance the future growth and expansion of the community's economic base.

Positive impacts are expected from the proposed development by further enabling commercial activity, industry and enabling further enhancements in the future growth and expansion of the community's economic base.

6.16.2 ENVIRONMENTAL JUSTICE

The focus of the Environmental Justice evaluation is to determine whether the proposed action results in an inequitable distribution of negative effects to special population groups, as compared to negative effects on other population groups. These special population groups include minority or otherwise special ethnicity or low-income neighborhoods.

The proposed action is not expected to result in any significant negative impacts to any population groups and therefore, would not result in disproportionate negative impacts to any special population group. Socioeconomic and induced economic impacts are expected to be positive in nature and are expected to benefit all population groups in the area.

6.16.3 Children's Environmental Health and Safety Risks

Pursuant to Executive Order 13045, *Protection of Children from the Environmental Health Risks,* Federal agencies are directed, as appropriate and consistent with the agency's mission, to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children. Agencies are encouraged to participation in implementation of the Order by ensuring that result from environmental health risks or safety risks. The proposed improvements are not expected to result in any environmental health risks or safety risks on children.

6.17 Water Quality

Water quality considerations related to airport improvement often include increased surface runoff and erosion and pollution from fuel, oil, solvents and deicing fluids. Potential pollution could come from petroleum products spilled on the surface and carried through drainage channels off of the airport. State and Federal laws and regulations have been established to safeguard these facilities. These regulations include standards for above ground and underground storage tanks, leak detection and overflow protection. An effective Storm Water Pollution Prevention Plan (SWPPP) identifies storm water discharge points on the airport, describes measures and controls to minimize discharges and details spill prevention and response procedures.

In July of 2002, the EPA amended the Oil Pollution Prevention Regulation at Title 40 of the Code of Federal Regulations, Part 112 (40 CFR Part 112). Subparts A through C of this regulation is often referred to as the "SPCC rule" because they describe requirements for certain facilities (including airports) to prepare and implement Spill Prevention Control and Countermeasure (SPCC) Plans. Since there are above ground fuel storage facilities at the Airport, a SPCC Plan is required.

In accordance with Section 402(p) of the Clean Water Act, a National Pollution Discharge Elimination System (NPDES) General Permit is required from the EPA for construction projects that disturb one or more acres of land. Applicable contractors will be required to comply with the requirement and procedures of the NPDES General Permit, including the preparation of a Notice of Intent and a Storm Water Pollution Prevention Plan, prior to the initiation of construction activities.

Recommendations established in FAA Advisory Circular 150/5370-10F, *Standards for Specifying Construction of Airports*, item P-156, Temporary Air and Water Pollution, Soil Erosion and Siltation Control, will be incorporated into the project design and specifications. The design and construction of the proposed improvements will incorporate BMP to reduce erosion, minimize sedimentation, control non-storm water discharges and protect the quality of surface water features potentially affected. These practices will be selected based on the site's characteristics and those factors within the contractor's control and may include: construction scheduling, limiting exposed areas, runoff velocity reduction, sediment trapping and good housekeeping practices.

Future fuel storage and dispensing facilities should be designed, constructed, operated and maintained in accordance with applicable federal, state and local regulations. Waste fluids, including oils, coolants, degreasers and aircraft wash facility wastewater should be managed and disposed of in accordance with applicable federal, state and local regulations.

6.18 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 and under normal circumstances does or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs and similar areas such as sloughs, potholes, wet meadows, river overflows and natural ponds. Jurisdictional Waters of the United States may also include drainage channels, washes, ditches, arroyos or other waterways that are tributaries to Navigable Water of the United States or other waters where the degradation or destruction of which could affect interstate or foreign commerce.

According to the U.S. Fish and Wildlife Service’s National Wetlands Inventory, there are no impacts to wetlands within the recommended improvements for the Airport during the planning period, as shown in **Figure 6-4**.

Source: U.S. Fish and Wildlife Service, National Wetlands Inventory, 2012

FIGURE 6-4 WETLANDS MAP

6.19 WILD AND SCENIC RIVERS

The Wild and Scenic Rivers Act (PL 90-542) describes those river areas eligible for protection from development. As a general rule, these rivers possess outstanding scenic, recreational, geological, fish and wildlife, historical, cultural or other similar value.

The Wild and Scenic River list from the National Park Service indicated that there are two Wild and Scenic Rivers in the State of Arizona. The two Wild and Scenic Rivers in Arizona are the Verde and Fossil Creek Rivers which are located more than 140 miles southeast of the Grand Canyon West Airport. The closest Wild and Scenic River to the proposed project is the Virgin River, located more than 90 miles northeast in the State of Utah and would not be affected by the future improvements.

6.20 MEANS TO MITIGATE AND/OR MINIMIZE ADVERSE ENVIRONMENTAL IMPACTS

Where appropriate, the mitigation or minimization of environmental impacts was noted in the discussion of impacts. These actions are summarized below:

- Maintain compatible land uses in the vicinity of the airport.

- Adhere to FAA AC 150/5370-10F, *Standards for Specifying the Construction of Airports* and BMP to minimize or eliminate impacts to water quality and air quality during construction.
- Prepare and implement an SPCC plan in accordance with EPA guidelines.
- Incorporate practicable sustainably designed terminal building improvements and future lighting projects.

6.21 SUMMARY AND CONCLUSIONS OF ENVIRONMENTAL IMPACTS

Table 6-2 provides a summary of the analysis ratings for each of the environmental impact categories with respect to the proposed airport improvements. While some categories indicate a potential impact, they are all estimated to be below the threshold of significance as described in FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Projects.*

TABLE 6-2 SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

Impact Category		Description
Air Quality	⦿	Short-term dust and exhaust during construction
Coastal Resources	○	
Compatible Land Use	○	
Construction Impacts	⦿	Short-term dust, exhaust erosion
DOT Act Section 4(F)	○	
Farmlands	○	
Fish, Wildlife and Plants	○	
Floodplains	○	
Hazardous Material, Pollution Prevention and Cultural Resources	⦿	SWPPP, and SPCC Plan
Historical, Architectural, Archaeological and Cultural Resources	○	
Light Emissions and Visual Impacts	○	
Natural Resources and Energy Supply	○	
Noise	⦿	Increased aircraft operations
Secondary (Induced) Impacts	⦿	Positive - direct/indirect economic benefits
Socioeconomic Impacts, Environmental Justice and Children's Environmental Health	⦿	Increased employment short-term
Water Quality	⦿	Storm water runoff
Wetlands	○	
Wild and Scenic Rivers	○	
○- No Impact ⦿- Moderate Impact ● - Significant Impact		

Source: Armstrong Consultants, Inc., February 2012
Prepared by: Armstrong Consultants, Inc., February 2012

Based on this evaluation no significant environmental impacts are expected from the projects and improvements included in the Chapter 7 - Airport Development and Financial Plan during the planning period.

CHAPTER 7

AIRPORT DEVELOPMENT AND FINANCIAL PLAN

GRAND CANYON WEST AIRPORT
AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS, INC.
AIRPORT ENGINEERING AND PLANNING

Chapter Seven
Airport Development and Financial Plan

7.1 INTRODUCTION

The airport development plan and financial feasibility analysis provides a demonstration of the Airport's ability to fund the projects presented in the Airport Master Plan. The recommended capital plan for the Grand Canyon West Airport is based on the facility requirements identified earlier in this report. The assumptions within this Chapter are contingent upon the Federal Aviation Administration (FAA), the continuation of the existing capital funding programs and the growth of the Airport's aviation activity as projected within the report.

The intrinsic value that a well-maintained airport brings to a community or region goes far beyond the day-to-day operational costs. In other words, the money spent and benefits received in the community or region by individuals or businesses that use the airport equals or exceeds the expenses, which are a result of operations at the Airport.

The principal objective of this Chapter is to assess the financial ability of the proposed capital improvement projects for Grand Canyon West Airport. The analysis covers a 20-year planning period including the initial-, intermediate-, and long-term goals and objectives. This Chapter indicates the ability of the Airport to undertake such capital projects and improvements proposed within the Master Plan.

7.2 AIRPORT DEVELOPMENT PLAN

Future airport development at Grand Canyon West Airport as included in this Airport Master Plan covers a 20-year planning period. Development items are grouped into three phases:

- Phase I: Initial-term (1-5 years)
- Phase II: Intermediate-term (6-10 years)
- Phase III: Long-term (11-20 years)

Estimated development costs are based on the proposed improvements (as shown on the Airport Layout Plan) and are included for each item in the financial development plan. Proposed improvements are based on the recommended facility requirements discussed in Chapter 3-Facility Requirements. The phasing of projects assists the airport sponsor in budgetary planning for future construction projects. **Figure 7-1**, at the end of the Chapter, shows the phasing of each project and is included at the end of this Chapter. **Table 7-1** outlines the 20-year financial development plan. The sequence in which the projects are completed is important as the ultimate configuration of the Airport will require numerous projects.

Phase I Short-term Development Items

- A1: Expand Airport Terminal Building
- A2: Relocate In and Out Helicopter Pads
- A3: Expand Commercial Service Apron
- A4: Construct ARFF Facility
- A5: Construct SRE Facility
- A6: Conduct Pavement Maintenance

Phase II Initial-term Development Items

- B1: Expand Down and Up Helicopter Pads and Parking
- B2: Construct General Aviation Development Area East Side
- B3: Conduct Environmental Assessment for Airport Reference Code Upgrade (C-II)
- B4: Extend Runway Phase I (6,500'x100')
- B5: Conduct Pavement Maintenance
- B6: Update Airport Layout Plan

Phase III Long-term Development Items

- C1: Construct ATC Facility
- C2: Conduct Environmental Assessment for Airport Reference Code Upgrade (C-III)
- C3: Extend Runway Phase II (7,200'x150')
- C4: Acquire Snow Removal Equipment
- C5: Acquire ARFF Equipment
- C6: Conduct Pavement Maintenance
- C7: Update Airport Master Plan

TABLE 7-1 20 YEAR FINANCIAL DEVELOPMENT PLAN

Phase I, Initial-Term Development		Total	FAA	Local
A1	Expand Airport Terminal Building[1]	$63,000,000	$40,066,400	$22,933,600
A2	Relocate In and Out Helicopter Pads	$4,500,000	$4,097,700	$402,300
A3	Expand Commercial Service Apron	$4,800,000	$4,370,880	$429,120
A4	Construct ARFF Facility	$3,200,000	$2,913,920	$286,080
A5	Construct SRE Facility	$1,400,000	$1,274,840	$125,160
A6	Conduct Pavement Maintenance	$500,000	$455,300	$44,700
	Total Initial-Term Development	**$77,400,000**	**$53,179,040**	**$24,220,960**
Phase II, Intermediate-Term Development				
B1	Expand Down and Up Helicopter Area	$3,300,000	$3,004,980	$295,020
B2	Construct GA Development Area (East)	$5,800,000	$5,281,480	$518,520
B3	Conduct EA for ARC Upgrade C-II	$1,200,000	$1,092,720	$107,280
B4	Extend Runway Phase I (6,500'x100')	$8,200,000	$7,466,920	$733,080
B5	Conduct Pavement Maintenance	$500,000	$455,300	$44,700
B6	Update Airport Layout Plan	$250,000	$227,650	$22,350
	Total Intermediate-Term Development	**$19,250,000**	**$17,529,050**	**$1,720,950**
Phase III, Long-Term Development				
C1	Construct ATC Facility	$2,300,000	$2,094,380	$205,620
C2	Conduct EA for ARC Upgrade C-III	$1,200,000	$1,092,720	$107,280
C3	Extend Runway Phase II (7,200'x150')	$3,500,000	$3,187,100	$312,900
C4	Acquire Snow Removal Equipment	$300,000	$273,180	$26,820
C5	Acquire ARFF Equipment	$700,000	$637,420	$62,580
C6	Conduct Pavement Maintenance	$500,000	$455,300	$44,700
C7	Airport Master Plan Update	$800,000	$728,480	$71,520
	Total Long-Term Cost	**$9,300,000**	**$8,468,580**	**$831,420**
	TOTAL DEVELOPMENT COST	**$86,719,250**	**$79,176,670**	**$26,773,330**

Prepared by: Armstrong Consultants, Inc, 2012
Assumes 91.06 percent FAA funding for FAA eligible development
1/ The ground terminal building is not eligible for FAA grant funds

7.3 CAPITAL DEVELOPMENT

Potential funding sources for the recommended development projects indentified in Chapter 4 - Development Alternatives provided the bases for financial analysis. Funding sources come from the FAA and Local contribution. This section will identify and quantify the expected sources of capital funds. As previously indicated, FAA funds represent the majority of expected capital; however, a number of sources are identified and indicated below.

7.3.1 FEDERAL AVIATION ADMINISTRATION

In 2012, the FAA approved a Modernization and Report Act extending the reauthorization bill through September 2015. This bill returns the federal - local matching ratio to 90 percent/10 percent for AIP approved projects. The previous bill provided a 95 percent/5 percent federal - local matching ratio. The Federal Aviation Administration levies user charges on aviation that are returned to airports to pay for eligible projects. There are three types of FAA funding that may be used to pay for Master Plan projects; each is described below.

Entitlement – FAA entitlement funds are “earned” by airports based on the number of enplaned passengers using a sliding scale. An airport’s first 50,000 passengers per year earn $7.80 per passenger and the second 50,000 earn $5.20 per passenger. Additional passengers over certain levels earn $2.60 and $0.65 with passengers over 1,000,000 earning $0.50 each. The total earnings per airport are doubled if the AIP is funded over $3.35 billion per year, which has occurred in recent years. However, the minimum entitlement for FAA Primary airports (those that enplane at least 10,000 passengers per year) is $1,000,000.

Discretionary – Airport capacity, safety, and security projects are funded on a national priority system based on need. Many of the most expensive projects in the CIP such as the runway extension are expected to be funded from discretionary funds. Other CIP projects may be eligible for FAA discretionary dollars, but are less highly ranked or have portions of the project that may be funded from discretionary funds. Discretionary funds provide for 90 percent of the cost of eligible projects.

Special FAA Funding – The FAA has additional funds reserved for unique types of projects that may be applicable to the Airport’s CIP. Navigation aids are one of these special areas, but none of the Airport’s current capital projects appears to apply.

Grant eligible items typically include airfield and aeronautical related facilities such as runways, taxiways, aprons, lighting and visual aids, and equipment as well as land acquisition, planning and environmental tasks needed to accomplish the improvements. Public use (non-revenue generating) portions of passenger terminals are also grant eligible. In addition, fuel systems and hangars are also grant eligible; however, these items are considered a low priority for FAA funding.

7.3.2 GRAND CANYON WEST AIRPORT

The Airport sponsor has several methods available for funding the capital required to meet the local share of airport development costs. The most common methods involve cash (including Passenger Facility Charge (PFC) revenues, debt financing (which amortize the debt over the useful life of the project), force accounts, in-kind service, third-party support and donations.

The Airport will fund all remaining capital project amounts from annual earning or reserves. The Airport principally collects revenues from rental cars, general aviation users, and tenants such as airlines and Fixed Base Operators (FBO). As necessary, rate increases or new charges can be implemented to obtain the necessary capital funds. Borrowing can also occur, but such funds are ultimately repaid with operating earnings. Increased air traffic should also generate more revenue.

Local funding and financing alternatives are listed below:

Bank Financing. Some airport sponsors use bank financing as a means of funding airport development. Generally, two conditions are required. First, the sponsor must show the ability to repay the loan plus interest and second, capital improvements must be less than the value of the present facility or some other collateral used to secure the loan. These are standard conditions which are applied to almost all bank loan transactions.

General Obligation Bonds. General Obligation bonds (GO) are a common form of municipal bonds whose payment is secured by the full faith credit and taxing authority of the issuing agency. GO bonds are instruments of credit and because of the community guarantee, reduce the available debt level of the sponsoring community. This type of bond uses tax revenues to retire debt and the key element becomes the approval of the voters to a tax levy to support airport development. If approved, GO bonds are typically issued at a lower interest rate than other types of bonds.

Self-liquidating General Obligation Bonds. As with General Obligation bonds, Self-liquidating General Obligation Bonds are secured by the issuing government agency. They are retired, however, by cash flow from the operation of the facility. Providing the state court determines that the project is self-sustaining, the debt may be legally excluded from the community's debt limit. Since the credit of the local government bears the ultimate risk of default, the bond issue is still considered, for the purpose of financial analysis, as part of the debt burden of the community. Therefore, this method of financing may mean a higher rate of interest on all bonds sold by the community. The amount of increase in the interest rate depends, in part, upon the degree of risk of the bond. Exposure risk occurs when there is insufficient net airport operating income to cover the level of service plus coverage requirements, thus forcing the community to absorb the residual.

Revenue Bonds. Revenue Bonds are payable solely from the revenues of a particular project or from operating income of the borrowing agency, such as an airport commission which lacks taxing power. Generally, they fall outside of constitutional and statutory limitations and in many cases do not require voter approval. Because of the limitations on the other public bonds, airport sponsors are increasingly turning to revenue bonds whenever possible. However, revenue bonds normally carry a higher rate of interest because they lack the guarantees of municipal bonds. It should also be noted that the general public would usually be wary of the risk involved with a revenue bond issue for a general aviation airport. Therefore, the sale of such bonds could be more difficult than other types of bonds.

Combined Revenue/General Obligation Bonds. These bonds, also known as "Double-Barrel Bonds", are secured by a pledge of back-up tax revenues to cover principal and interest payments in cases where airport revenues are insufficient. The combined Revenue/General Obligation Bond interest rates are usually lower than Revenue Bonds, due to their back-up tax provisions.

Force Accounts, In-kind Service, Donations. Depending on the capabilities of the Sponsor, the use of force accounts, in-kind service, or donations may be approved by the FAA for the Sponsor to provide their share of the eligible project costs. An example of force accounts would be the use of heavy machinery and operators for earthmoving and site preparation of runways or taxiways; the installation of fencing; or the construction of improvements to access roads. In-kind service may include surveying, engineering or other services. Donations may include land or materials such as gravel or water needed for the project. The values of these items must be verified and approved by the FAA prior to initiation of the project.

Third-Party Support. Several types of funding fall into this category. For example, individuals or interested organizations may contribute portions of the required development funds (Pilot Associations, Economic Development Associations, Chambers of Commerce, etc.). Although not a common means of airport financing, the role of private financial contributions not only increases the financial support of the project, but also stimulates moral support to airport development from local communities. Because of the potential for hangar development, private developers may be persuaded to invest in hangar development. A suggestion would be that the City authorizes long-term leases to individuals interested in constructing a hangar on airport property. This arrangement generates revenue from the airport, stimulates airport activity, and minimizes the sponsor's capital investment requirements. Another method of third-party support involves permitting the fixed base operator (FBO) to construct and monitor facilities on property leased from the airport. Terms of the lease generally include a fixed amount plus a percentage of revenues and a fuel flowage fee. The advantage to this arrangement is that it lowers the sponsor's development costs, a large portion of which is building construction and maintenance.

The Airport funds some or all of the cost of capital projects by generating revenue from tenants, users and other sources. These airport funds can come from annual surplus, reserves, or borrowing. While capital projects are usually funded from variety of sources, in the end, Airport contributed funds have a role in almost all projects, particularly as seed money to initiate projects and to provide the match of FAA funds.

Other methods outside the traditional methods mentioned in the above paragraph are potential suppliers of money to construct capital improvements. These include users, tenants, investors, and other sources. Tenants often construct their own facilities particularly hangar facilities. Airport users such as corporate flight departments sometimes contribute funds for projects and agree to increased rents to recover the costs of improvements. Private capital can also be used for facilities such as general aviation and corporate hangar facilities.

7.4 PAVEMENT MAINTENANCE PLAN

Periodic maintenance is necessary to prolong the useful life of the airport pavements. The affects of weather, oxidation and usage cause the pavement to deteriorate. The accumulation of moisture in the pavement causes heaving and cracking and is one of the greatest causes of pavement distress. The sun's ultraviolet rays oxidize and break down the asphalt binder in the pavement mix. This accelerates raveling and erosion and can reduce asphalt thickness.

The appropriate pavement maintenance will minimize the effects of weather damage and oxidation. Crack sealing is accomplished to keep moisture from accumulating inside and underneath the pavement and should be accomplished at least every five years prior to fog sealing or overlaying the pavements. Fog seals, slurry seals and coal tar emulsion (fuel resistant) seals are spread over the entire paved area to replenish the binder lost through aggregate to increase the friction coefficient of the pavement. Asphalt overlays are accomplished near the end of the useful life of the pavement. A layer of new asphalt is placed over the existing pavement to renew the life of the pavement and to recover lost strength due to deterioration. Unless specially designed, the overlay is not intended to increase the weight bearing capacity of the pavement. Overlays may be supplemented with a porous friction course of grooving to increase friction and minimize hydroplaning. Remarking of the pavement is required following a fog seal or overlay.

The recommended pavement maintenance cycle time frames are listed below in **Table 7-2**. It should be noted that the time frames are recommendations only. Actual pavement deterioration will be affected by use of the Airport and weather exposure. Maintenance actions should be programmed as necessary through close monitoring and inspection of the pavements.

TABLE 7-2 PAVEMENT MAINTENANCE SCHEDULE

Pavement Maintenance Cycle	Approximate Time Frames
Crack Seal Pavement	1 - 2 years
Crack Seal, Seal Coat and Remark Pavements	3 - 8 years
Overlay Pavements	15 - 18 years
Seal Concrete Joints	6 - 8 years

Source: Armstrong Consultants, Inc.

7.5 FINANCIAL PLAN

The principal objective in this financial plan is to assess the feasibility of the proposed capital improvements at Grand Canyon West Airport. This analysis covers a 20 year planning period including the initial, intermediate, and long-term and indicates the ability of the Airport to undertake the improvements proposed in the Airport Master Plan Capital Improvement Program (CIP). The analysis considers several elements including the following:

- The Airport's historical financial structure including revenue sources, expense categories, debt service obligations, and recent trends in operating expenses and revenues.
- The phased plan of scheduled/proposed capital projects covering the Airport Master Plan period presented in the previous chapter. The phasing plan also includes a proposed funding plan for the initial term.
- An analysis of Passenger Facility Charge (PFC) revenue and its use in funding future Airport improvements.

An airport's financial structure can vary, perhaps significantly, from year to year as changes occur in air traffic, number of tenants, rates charged, construction costs, level of operating expenses, and other factors. Financial projections for the intermediate and long-term planning phases, in particular, should be viewed as tentative and updated frequently in the future. The capital project financial plan presented in this Chapter, while representative of today's best estimate, is subject to a wide variety of influences and may prove to need adjustment in the future for several reasons including, but not limited to, the following:

- The priorities in identified capital improvements may change. For example, market conditions may cause changes in maintenance of existing facilities, require new facilities, or redefine priorities.
- Safety and security improvements, whether they are reflected in the CIP or not, may require immediate funding and force postponement of other projects.
- Cost estimates to provide improvements can fluctuate particularly when considering factor such as technological advancements, economies of scale related to undertaking several improvements at once, and the cost of raw materials such as concrete, steel, and other building materials.
- Emergency repairs or changes required by new regulations may require funds that had been programmed for other projects are reallocated.

It is recommended that the financial plan, including the CIP, be utilized as a working tool, which should be updated as necessary. Capital improvements, their associated costs, and financial projections should be re-examined periodically throughout the planning period even though the figures contained herein present a reasonable forecast of needed initiatives to implement the Master Plan recommendations.

7.5.1 Projected Revenue and Expenditure

Airport operating expenditures typically include insurance, utilities, and maintenance and management costs. Insurance costs include liability insurance for the Airport and property insurance. Utility expenses primarily consist of electrical power to operate airfield lighting and visual aids and water for public use areas. Pavement maintenance consists of crack sealing on an annual basis and seal coating and remarking the pavements every five years. Facility maintenance consists of mowing, snow removal and repair and replacement of parts and equipment such as light bulbs, light fixtures, fences, etc. Management costs include an airport manager and staff members, maintenance and emergency response. Currently at Grand Canyon West Airport, there is a full-time airport management team which consists of an airport manager, security and operations supervisor and maintenance staff. **Table 7-3** shows the existing and projected revenue and expenditures for the airport.

Airport revenues at Grand Canyon West Airport consist of user fees, rentals and leases, PFCs, and miscellaneous revenue. Descriptions of airport revenue generating opportunities are found below:

<u>Rentals and Leases.</u> Property on the airport that is not devoted to airfield use, vehicle parking or contained within areas required to be cleared of structures may be leased to individual airport users or aviation related businesses. Typically, the individual is provided a long-term lease on which to construct a facility. At the termination of the lease, the lessee has the option to renew the lease, sell or lease the buildings or to remove the buildings. Grand Canyon West currently collects revenue through the form of land leases.

<u>Miscellaneous Revenue.</u> Miscellaneous revenue at Grand Canyon West Airport includes revenues generated from the gift shop, food and beverage sales at the terminal building.

<u>Passenger Facility Charges (PFC).</u> The Aviation Safety and Capacity Expansion Act of 1990 authorized the Secretary of Transportation to grant public agencies the authority to impose a Passenger Facility Charge (PFC) to fund eligible airport projects. The initial legislation set the maximum PFC level at $3.00 per enplaned passenger. AIR-21 increased the maximum PFC level form $3.00 to $4.50. In 2012, the FAA Modernization and Report Act retained the PFC cap at $4.50. Although the FAA is required to approve PFCs, the program allows for local collection of PFC revenue through the airlines operating at an airport and provides more spending flexibility to airport sponsors versus AIP funds. The Airport currently collects a $3.00 PFC on departures only from Grand Canyon West to another airport. As described in Chapter 1 the Tribe is in the process of increasing the authorization of PFC funds from $3.00 to $4.50. Grand Canyon West Airport is also waiting on a decision from FAA in order to allow the airport to collect PFCs on passengers departing the airport on helicopters and landing at approved heliports at the bottom of the Grand Canyon. These two changes would result in a significant increase in potential PFC collections.

TABLE 7-3 ANNUAL AIRPORT REVENUES AND EXPENSES

AIRPORT REVENUE	**2010**	**2016**	**2021**	**2031**
Capital Improvement Revenue [1]	$7,748,115	$10,635,808	$3,505,810	$1,693,716
Rentals and Leases	$37,323	$40,000	$42,000	$45,000
Miscellaneous Revenue	$3,053,443	$3,100,000	$3,300,000	$3,600,000
Passenger Facility Charge[2]	$216,640	$360,000	$455,000	$742,000
Total Airport Revenue	**$11,055,521**	**$14,135,808**	**$7,302,810**	**$6,080,716**
AIRPORT EXPENDITURES	**2010**	**2016**	**2021**	**2031**
Salaries and Wages	$1,331,836	$1,300,000	$1,300,000	$1,300,000
Benefits	$378,293	$380,000	$380,000	$380,000
Operating Expense	$1,450,499	$1,500,000	$1,500,000	$1,500,000
Capital Improvement Costs	$9,788,744	$15,480,000	$3,850,000	$1,860,000
Retirement Fund	$46,941	$47,000	$47,000	$47,000
Total Airport Expenditures	**$12,996,313**	**$18,707,000**	**$7,077,000**	**$5,087,000**
Net Total Airport	**$1,940,792**	**$4,571,192**	**$225,810**	**$993,716**

Prepared by: Armstrong Consultants, Inc., 2012
1/ Capital Improvement Revenue include FAA grants
2/ PFC growth assumes $4.50 collection and collection on down and up helicopter operations
3/ Includes the development cost of the ground terminal which is not eligible for FAA grant funding

7.6 CONTINUOUS PLANNING PROCESS

Airport planning is a continuous process that does not end with the completion of a major capital project. The fundamental issues upon which these airport master plans are based are expected to remain valid for several years; however, several variables, such as annual aircraft operations, and socioeconomic conditions are likely to change over time. The continuous planning process necessitates that Grand Canyon West Airport consistently monitor the progress of the Airport in terms of growth in based aircraft and annual operations, as this growth is critical to the exact timing and need for new airport facilities as recommended within the Airport Master Plan. The information obtained from this monitoring process will provide the data necessary to determine if the development schedule should be accelerated, decelerated or maintained as scheduled.

Periodic updates of the Airport Layout Plan, Capital Improvement Plan, and Airport Master Plan are recommended to document physical changes to the Airport, review changes in aviation activity and to update improvement plans for the Airport. The primary goal of the Airport Master Planning effort is to develop a safe and efficient airport that will meet the demands of its aviation users and stimulate economic development for Grand Canyon West. The continuous airport planning process is a valuable tool in achieving the strategic plans and goals for the Airport.

7.7 SUMMARY

This financial analysis is based on the continuation FAA funding at the current levels. However, there is a competition for FAA funds, so the Airport will need to aggressively communicate its CIP needs to the FAA and other relevant agencies as opportunities arise.

Based on the assumptions, the financial analysis presented herein, the CIP is considered practicable and it is anticipated that Grand Canyon West Airport will be able to construct the necessary aviation facilities as recommended herein. Of course, the continued monitoring of the Airport's financial status is necessary to adapt and adjust to condition change.

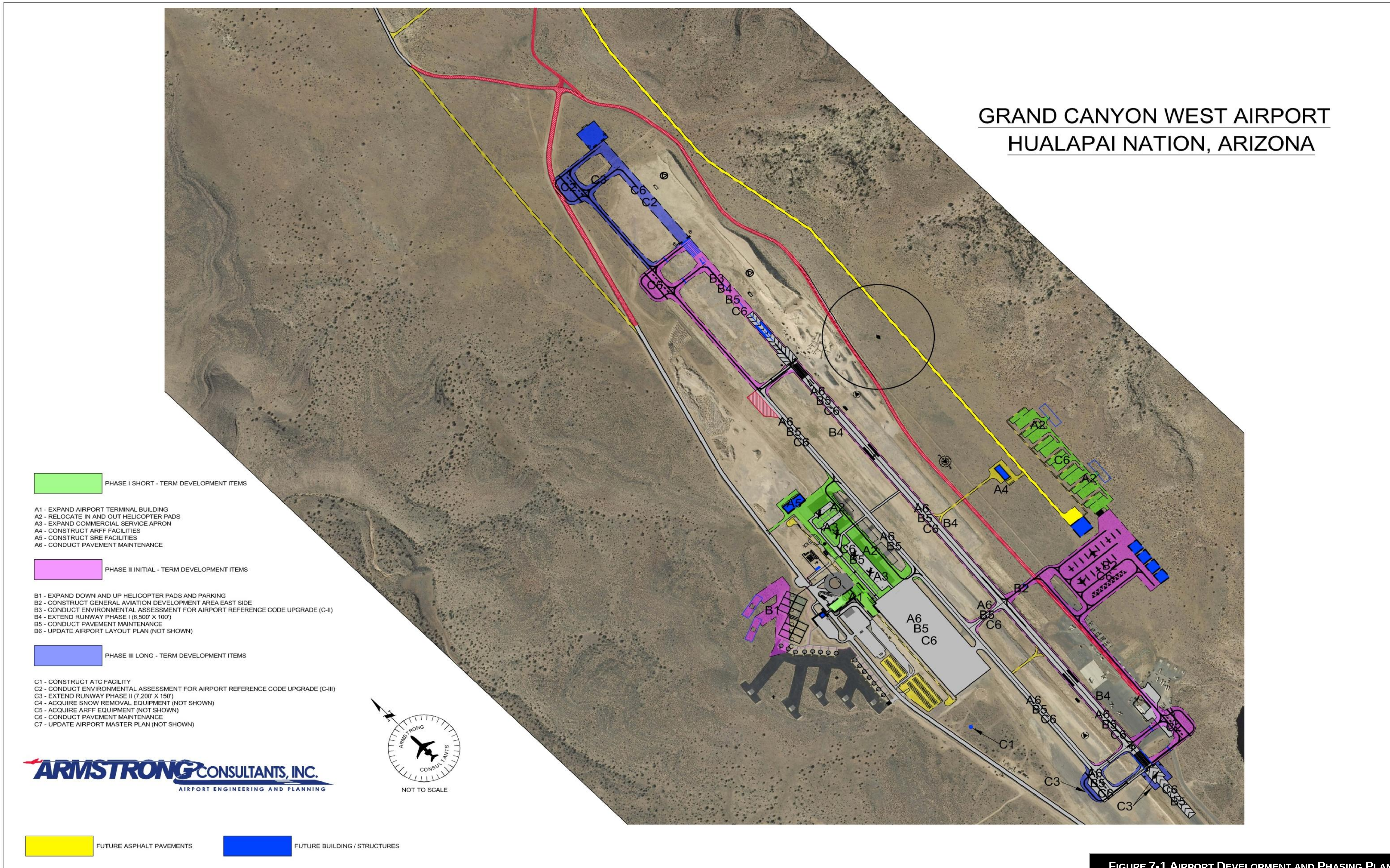

FIGURE 7-1 AIRPORT DEVELOPMENT AND PHASING PLAN

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APPENDIX

A

DESIGN STANDARDS INVENTORY

GRAND CANYON WEST AIRPORT
AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS, INC.
AIRPORT ENGINEERING AND PLANNING

Airside Inventory Checklist

Airport	Grand Canyon West Airport	ARC	B-II
City	Peach Springs, Arizona	Approach Type	Visual
Contact	Stephan Degan	Date Inventoried	November 16, 2011
Phone No.	(928) 769-2419 x216	Inspected By	SDM/JZP

Runway 17/35 Inventory	**Published**	**Required B-II**	**Actual**
Distance To:			
Hold lines from centerline		200'	250'
Parallel taxiway from centerline		240'	400'
Aircraft parking from centerline		250'	510'
Runway width	75'	75'	75'
Runway length	5,000'	--	5,000'
RSA width		150'	150'
ROFA width		500'	500'
Primary/transitional surface penetrations		Clear	Clear
Longitudinal grade - site distance problems		.8% - 1.5% -.8%	Met
OFZ Width		400'	400'
Pavement marking type	Yes	Nonprecision	Nonprecision
Pavement marking condition	Good	-	Good
Pavement strength	30,000 SWG	-	30,000 SWG
Pavement condition	Excellent	-	Excellent
Runway 17 End Inventory			
RSA beyond runway end	-	300'	300'
ROFA beyond runway end	-	300'	300'
Approach obstructions	-	--	-
Runway end elevation	-	--	4,758'
RPZ	-	Owned in Fee	Owned in Fee
Runway 35 End Inventory			
RSA beyond runway end	-	300'	300'
ROFA beyond runway end	-	300'	300'
Approach obstructions	-	-	-
Runway end elevation	-	-	4,813'
RPZ	-	Owned in Fee	Owned in Fee
Runway Lighting Inventory			
Distance from pavement edge	-	10' Max	10'
Maximum distance between lights	-	200' Max	120'
Type	MIRL	Optional	MIRL
Condition	-	-	Good
Color	-	White/Amber	White/Amber
Runway 17 Threshold			
Distance from pavement edge	-	10' Max	10'
Color / Number of lights	-	Red/Green/8	Red/Green/8
	-		
Runway 35 Threshold			
Distance from pavement edge	-	10' Max	10'
Color	-	Red/Green/8	Red/Green/8

COMMENTS

Airside Inventory Checklist

Airport	Grand Canyon West Airport	ARC	B-II
City	Peach Springs, Arizona	Approach Type	Visual
Contact	Stephan Degan	Date Inventoried	November 16, 2011
Phone No.	(928) 769-2419 x216	Inspected By	SDM/JZP

Taxiway A Inventory	Published	Required C-II	Actual
Taixway width	-	35'	35'
TSA width	-	79'	79'
TOFA width	-	131'	131'
Dist. from centerline to fixed or movable obj	-	65.5	65.5'
Pavement marking type	-	Centerline	Centerline
Pavement marking condition	-	-	Good
Pavement strength	30,000 SWG	-	30,000 SWG
Pavement condition	Excellent	-	Excellent
Taxiway Lighting Inventory			
Distance from pavement edge	-	10'	10'
Maximum distance between lights	Yes	100' Max	55'
Type	MITL / Retroflectors	-	MITL / Retroflectors
Condition	-	-	Good
Color	-	Blue	Blue
Miscellaneous			
Type of beacon	White-Green	Yes	White - Green
Visual Aids (i.e. PAPI, VASI, REIL, etc.)	Beacon / PAPI-4 / REIL	-	Beacon / PAPI-4 / REIL
Windcone (condition & compliance)	Yes-L	Yes	Yes-L
Segmented circle (condition & compliance)	Good & Yes	Yes	Good & Yes
Traffic Pattern Indicator	L	No	L / R
Fencing	-	Perimeter	Perimeter
Signs (type, condition)	-	Yes	Yes, Good

COMMENTS

Landside Inventory Checklist

Airport	Grand Canyon West Airport	ARC	B-II
City	Peach Springs, Arizona	Approach Type	Visual
Contact	Stephan Degan	Date Inventoried	November 16, 2011
Phone No.	(928) 769-2419 x216	Inspected By	SDM/JZP

Facilities	Existing	Notes
Tie-downs	43	
T-hangars	0	
Box hangars	0	
Apron		
Size	53,061 SY	
Pavement strength	Varies	Helicopter Apron: 20,000lbs / Aircraft Apron: 30,000 lbs
Pavement condition	Excellent	
Pavement marking	Tiedown and Helicopter	
Pavement marking condition	Excellent	
Automobile parking	426	
Weather equipment	Yes (AWOS-3)	
Fuel storage	Yes	
Fuel type available	Jet-A	
FBO/Terminal building	Yes	Temporary passenger terminal building

COMMENTS

APPENDIX

B

TAF FORECAST COMPARISON

GRAND CANYON WEST AIRPORT
AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS, INC.
AIRPORT ENGINEERING AND PLANNING

Template for Comparing Airport Planning and TAF Forecasts

AIRPORT NAME: GRAND CANYON WEST AIRPORT

	Year	Airport Forecast	TAF	AF/TAF (% Difference)
Itinerant Operations				
Base yr.	2011	29,440	2,400	1126.7%
Base yr. + 5yrs.	2016	38,650	2,400	1510.4%
Base yr. + 10yrs.	2021	46,929	2,400	1855.4%
Base yr. + 15yrs.	2026	58,482	2,400	2336.8%
Base yr. + 20yrs.	2031	70,060	2,400	2819.2%
Local Operations				
Base yr.	2011	84,756	137,900	-38.5%
Base yr. + 5yrs.	2016	147,825	137,900	7.2%
Base yr. + 10yrs.	2021	162,928	137,900	18.1%
Base yr. + 15yrs.	2026	230,567	137,900	67.2%
Base yr. + 20yrs.	2031	326,851	137,900	137.0%
Total Operations				
Base yr.	2011	114,196	140,300	-18.6%
Base yr. + 5yrs.	2016	186,475	140,300	32.9%
Base yr. + 10yrs.	2021	209,857	140,300	49.6%
Base yr. + 15yrs.	2026	289,049	140,300	106.0%
Base yr. + 20yrs.	2031	396,911	140,300	182.9%

NOTES: TAF data is on a U.S. Government fiscal year basis (October through September).
AF/TAF (% Difference) column has embedded formulas.

APPENDIX C

STANDARD OPERATING PROCEDURES

GRAND CANYON WEST AIRPORT
AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS, INC.
AIRPORT ENGINEERING AND PLANNING

GRAND CANYON WEST HELICOPTER STANDARDIZATION AGREEMENT

REVISION: 1
EFFECTIVE: June 30, 2010

1. **PURPOSE:** This agreement establishes standardized helicopter flight routes, altitude, and radio calls for tour flights in and around the Grand Canyon West heliport to enhance safety by reducing radio frequency congestion and confusion with the new flight procedures.

2. **SCOPE:** To describe for safety and standardization purposes the routes, altitudes, and radio calls used by helicopter operators conducting tour operations to/from Grand Canyon West heliport. This agreement does not constitute authorization to operate contrary to the requirements prescribed in Federal Aviation Regulations, in particular, the LAS FSDO Grand Canyon National Park Special Flight Rules Area (GCNP SFRA) Procedures Manual.

3. **SIGNIFICANT CHANGE:** Any significant changes will be through a revision process in which all operators must sign and agree to any changes.

4. **DEFINITIONS: See Appendix A**

5. **RESPONSIBILITIES:**

a. **Signatories *shall***: Ensure that all pilots they employ, including any operating under subcontract, are familiar with, and will comply with, the routes, altitudes, and radio calls contained herein.

b. **Pilots *shall*:**

1) Adhere strictly to tour routes.

2) Monitor correct radio frequencies.

3) Make all required position reports.

4) Adhere strictly to proper radio phraseology.

5) Make no unauthorized calls. Unnecessary "chatter" **will not** be tolerated.

6) Be considerate and respectful to other pilots and operators on the radio.

NOTE: Deviations are allowed for safety of flight. Additional radio calls are allowed for safety of flight.

6. **ATTACHMENTS:** Attached is the heliport layout, arrivals/departure drawings, and pictures with labels.

Revision History

Page Number	Revision Number	Date Inserted

HELIPORT LAYOUT

*See attached Heliport layout

Parking pads have been assigned to respective operators. Pads D1 thru F1 are being used with point of service fueling stations. While pads F2 thru H3 are parking pads.

Sundance has been assigned pads D1, D2, G1, G2, G3, and H1.

Papillon has been assigned pads E1, E2, E3, F1, F2, and F3.

Stars and Stripes has been assigned with pads H1, H2, and D3.
(Even though Stars and Stripes has been assigned D3, they will not be using it until further notice due to not having means of fuel at that pad).

Stars and Stripes will be repositioning between the heliport and the transient pads as its fueling truck is located on the transient helicopter pads.

Sundance will be repositioning from pads G1, G2, G3, or H1 for fuel at pads D1 or D2. They will be hovering on the western edge of the movement area to provide sufficient clearance from other helicopters on adjacent parking pads or air taxi from FATO G or H for FATO D.

Maverick, Serenity, and other general aviation helicopters will be utilizing the transient helicopter pads located east of the terminal. Other operators can utilize transient pads when necessary.

GCW TO RAMADA OR BEACH LANDING SITES

POSITION	Freq	Radio Call
1. Grand Canyon	122.9	"Company XX" Lifting ___________ for _____________ (Pad #) (FATO)
2a. North Departure	122.9	"Company XX" departing_____________ for Eternity (FATO)
2b. South Departure	122.9	"Company XX" departing _____________ for Point Alpha (FATO)
-- Point Alpha	122.9	"Company XX" Point Alpha for Eternity
4. Eternity Canyon	122.9	"Company XX" Eternity Canyon, Switch"
	121.95	"Company XX" Eternity Canyon 5,000 descending for the ________ (Ramada or Beach)

* Caution: Heli-USA "ranch" traffic merging into Eternity Canyon route. Heli-USA will make a blind radio call 1 mile South of Eternity Canyon at Point Alpha. Heli-USA makes a switch from 122.90 to 121.95 after making the blind radio call.

5. Bat Towers	121.95	"Company XX" Bat Towers at *or below* 4000, for the _____________. (Ramada or Beach)
6. Point Bravo	121.95	"Company XX" Point Bravo at _________ for the _________________. (altitude) (Ramada or Beach)
7a. Ramada/Beach	121.95	"Company XX" final for the _________________ upriver. (Ramada or Beach)
7b. Ramada/Beach	121.95	"Company XX" bottom of decent left 180 for the _____ downriver. (Ramada or Beach)

RAMADA OR BEACH LANDING SITES TO GCW.

POSITION	Freq	Radio Call
1a. Ramada or Beach	121.95	"Company XX" departing _______ (Ramada or Beach) upriver for the Quartermaster climb
1b. Ramada or Beach	121.95	"Company XX" departing _______ (Ramada or Beach) downriver left 180 for the climb

* All traffic departing the Canyon Floor will climb along the Canyon wall face.

POSITION	Freq	Radio Call
2. Quartermaster Point	121.95	"Company XX" Quartermaster Point _________ (altitude) for the Guzzler
3. Guzzler	121.95	"Company XX" Guzzler at ________ (altitude) for GCW, switch
	122.9	"Company XX" Guzzler at ________ (altitude) for GCW **** Fly to the right of the Guzzler. Watch for Traffic from Quartermaster landing sites for the Guzzler****
4. Buck & Doe Road	122.9	"Company XX" Buck & Doe Road for straight in (North Arrival) or Point Alpha (South Arrival), 5200
5a. North Arrival	122.9	"Company XX" housing, final for _________ (FATO)
5b. South Arrival	122.9	"Company XX" inside Point Alpha for _________ (FATO)
-Final	122.9	"Company XX" final for _________ (FATO)

GCW TO GRAND WASH OR SPIRIT MOUNTAIN

POSITION	Freq	Radio Call
1. Grand Canyon	122.9	"Company XX" Lifting ___________ for _____________ (Pad #) (FATO)
2a. North Departure	122.9	"Company XX" departing_____________ north takeoff left turn out (FATO) for Grand Wash / Spirit Mountain
2b. South Departure	122.9	"Company XX" departing _____________ for Point Alpha (FATO)
-- Point Alpha	122.9	"Company XX" Point Alpha Grand Wash / Spirit Mountain

* Caution: Heli-USA "ranch" traffic merging into Eternity Canyon route at ~5,500. Heli-USA will make a blind radio call 1 mile South of Eternity Canyon near Point Alpha. Heli-USA makes a switch from 122.90 to 121.95 after making the blind radio call.

4a. Four miles from GCW Airport	122.9	"Company XX" 4 miles from the airport for Grand Wash/Spirit, switch.
4b. Old Ranch	122.9	"Company XX" over the Old Ranch 5,600 climbing for Spirit, switch.

TRAFFIC TO/FROM TRANSIENT HELICOPTER PADS

Helicopter traffic that will be utilizing the transient helicopter pads located on the east side of the terminal will utilize the active runway for takeoffs/landings. Helicopters can “side-step” on final west of the runway and line up on the tar area to the east of the transient pads. Radio calls will be standard calls for a runway as set forth in the AIM chapter 4 section 3. Helicopters will use caution for traffic to/from the heliport and avoid fix wing traffic using the runway.

TRAFFIC TO TRANSIENT HELIPADS

***HELICOPTERS WILL AVOID THE FLOW OF FIX WING TRAFFIC**

POSITION	Freq	Radio Call
1. Buck & Doe Road	122.9	“Company XX” Buck & Doe Rd for straight in (North Arrival) or Point Alpha (South Arrival), transient
1a. North Arrival	122.9	“Company XX” final for runway 35; sidestep to transient
1b. South Arrival	122.9	“Company XX” inside Point Alpha turning base for runway 17.
-Final	122.9	“Company XX” final for runway 17; sidestep to transient.
2. Transient Pads	122.9	“Company XX” hovering to transient pads

TRAFFIC FROM TRANSIENT HELIPADS

***HELICOPTERS WILL AVOID THE FLOW OF FIX WING TRAFFIC**

POSITION	Freq	Radio Call
1. Transient Pads	122.9	“Company XX” hovering to transient pads
2a. North Departure	122.9	“Company XX” taking off north parallel runway 35 left turn for Eternity/Point Alpha
2b. North Departure	122.9	“Company XX” Point Alpha 5,300 for Grand Wash/Spirit.
2c. South Departure	122.9	“Company XX” taking off South parallel runway 17 for Buck and Doe
2d. Buck and Doe Road	122.9	“Company XX” Buck and Doe 5,300 for Grand Wash/Spirit.

HELIPORT RULES AND ETIQUETTE

Helicopters are to avoid the flow of fix wing traffic.

Helicopters are not to fly over any fix wing or rotor wing traffic with moving blades.

Helicopters will use the altimeter setting that is broadcasted on GCW AWOS (119.425)

--If altimeter is not available on AWOS, altimeter will be set to field elevation of 4,825ft.

It is up to the discretion of the operator regarding how a helicopter will position from the parking pads to a FATO (i.e. pedal turns, hover height, etc.)

Helicopter pilots will communicate with one another via GCW CTAF (122.9) for position reports and movement inside the heliport in the interest of safety.

Priority for a helicopter lifting for a FATO will be given to the helicopter that announced intentions on the CTAF first.

--Helicopters must be ready and willing to lift immediately at the time of the call.

Helicopters on approach have right of way over helicopter traffic at the heliport.

A helicopter cannot proceed to a FATO, if an approaching helicopter is landing at the same FATO, or if an approaching helicopter will be flying over the movement path to another FATO. Communication must be established between any hovering helicopter stating intentions and the helicopter on approach.

Even though there are parking pad assignments, the FATO's are not assigned to anyone. Helicopters can land/takeoff from any FATO in the interest of safety.

7. SIGNATORIES.

A. Hualapai Representative (GCRC) ______________________ Interim C.E.O
Signature Position

B. Sundance Helicopters ______________________ Director of Operations
Signature Position

C. Papillon Grand Canyon Helicopters ______________________ D.O.
Signature Position

D. Serenity Helicopters ______________________ Chief Pilot
Signature Position

E. Maverick Helicopters DALE COWLEY ______________________ DO
Signature Position

F. Stars & Stripes Helicopters ______________________ DO
Signature Position

8. DISTRIBUTION.

A. Hualapai Representative (GCRC)
B. Sundance Helicopters
C. Papillon Grand Canyon Helicopters
D. Serenity Helicopters
E. Maverick Helicopters
F. Stars & Stripes Helicopters

Appendix A. Definitions

FATO Final Approach and Takeoff Area

TLOF Touchdown and Lift-off Area

Beach A landing site along the south side of the Colorado River in the bottom of the Grand Canyon.
Latitude: N 35° 59.36' Longitude: W 113° 46.81'

Eternity Canyon The canyon just west of the Bat Towers which is;
--entered into while descenting for the Ramadas or the Beach,
--used to intercept the Green 4, or
--used to cross the Colorado River from south to north while on the Green 4 route. .
Latitude: N 36° 01.06' Longitude: W 113° 50.42'

GCW. The Grand Canyon West Airport located on the northeastern edge of the Hualapai Indian Reservation.
Latitude: N 35° 59.42' Longitude: W 113° 48.99'

Point Alpha A windsock located approx 1 mile west of the heliport.
Latitude: N 35° 59.080 Longitude: W 113° 50.230'

Point Bravo. A point inside the Grand Canyon approximately 1 mile east of the Bat Towers and 2 1/2 miles west of the Ramada's.
Latitude: N 36° 01.34' Longitude: W 113° 47.43'

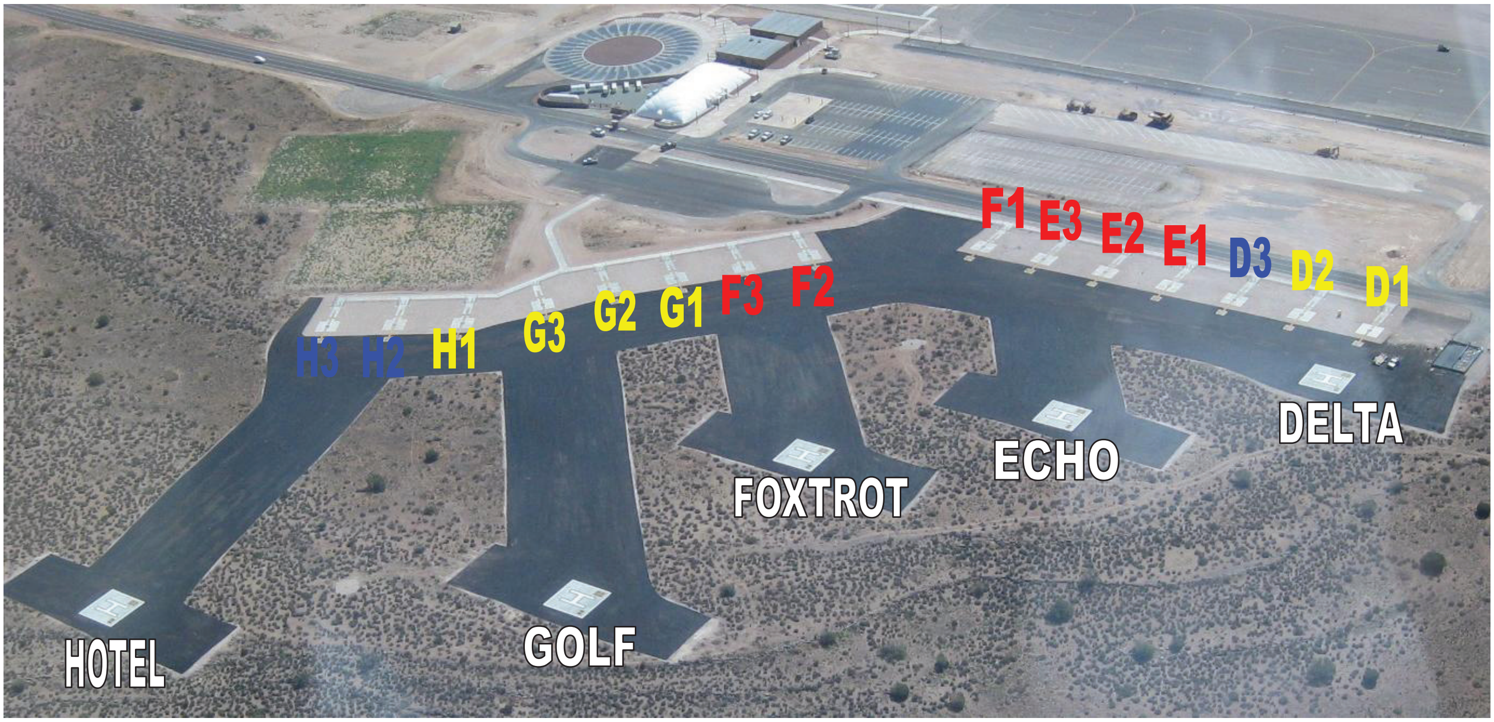
Ramada landing sites at the bottom of the Grand Canyon by the Colorado River.
Latitude: N 35° 59.72' Longitude: W 113° 46.88'

Guzzler A watering hole near the backside of Quartermaster Canyon
Latitude: N 35°56'55.52" Longitude: W 113°49'24.76"

Buck and Doe Road Windsock located near buck and doe road approx 1.5 miles south of the heliport.
Latitude: N 35° 57.855' Longitude: W 113° 49.589'

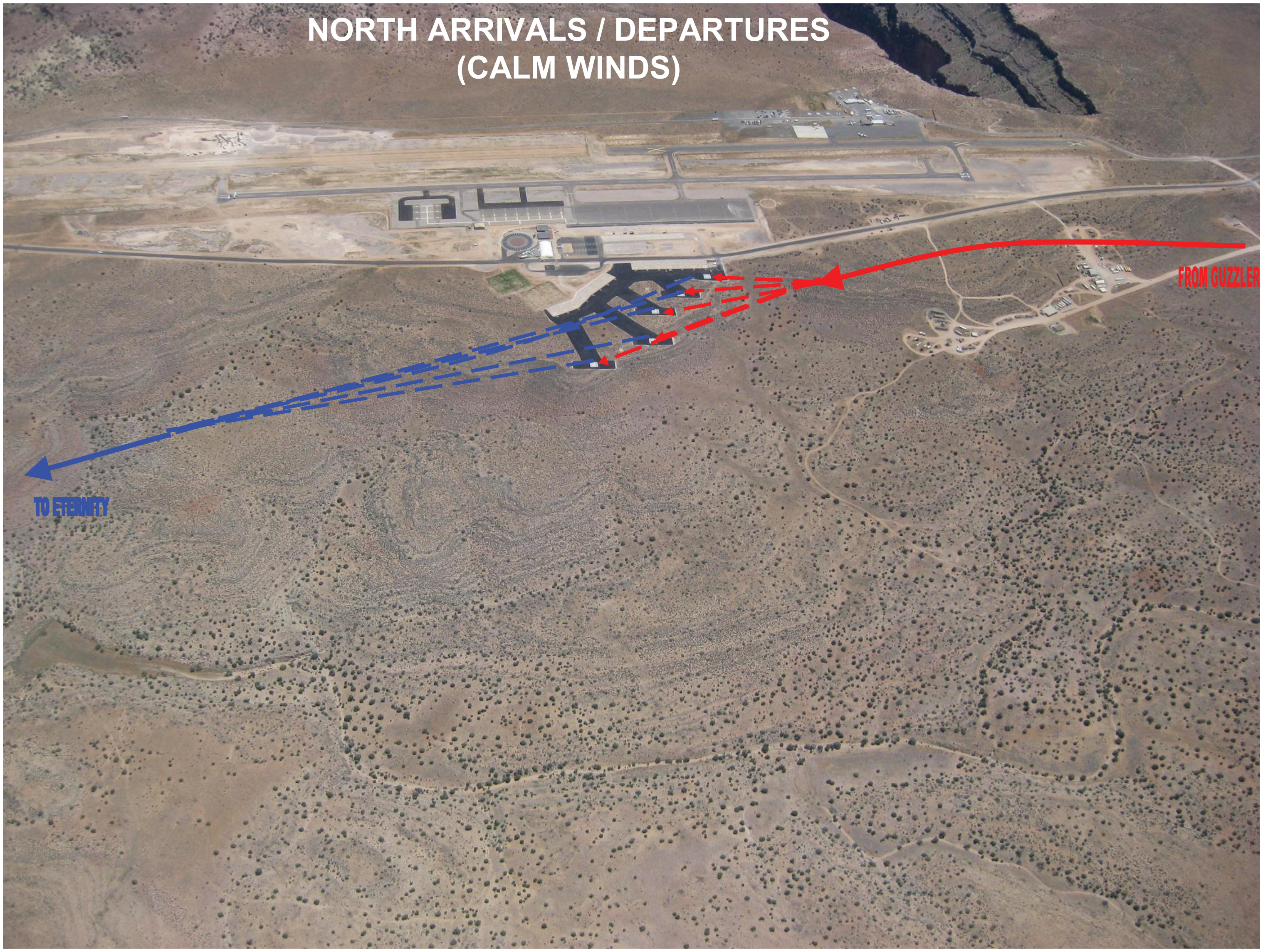
Transient Pads Helicopter pads located east of the terminal, west of runway 17/35, and north of fix wing parking ramp.

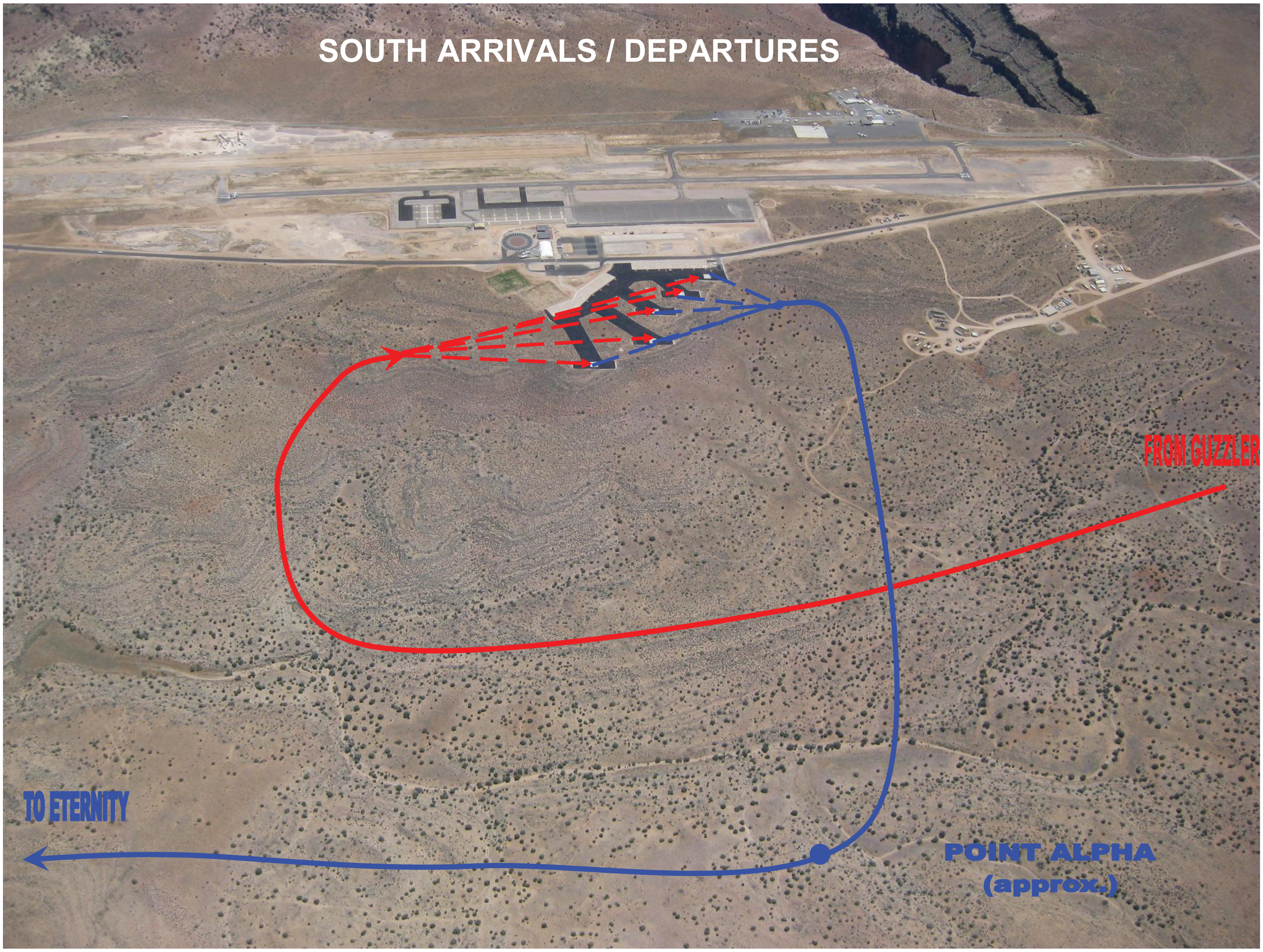
SUNDANCE PAPILLON



STARS & STRIPES

Revision 1
June, 2010


NORTH ARRIVALS / DEPARTURES
(CALM WINDS)
FROM GUZZLER
TO ETERNITY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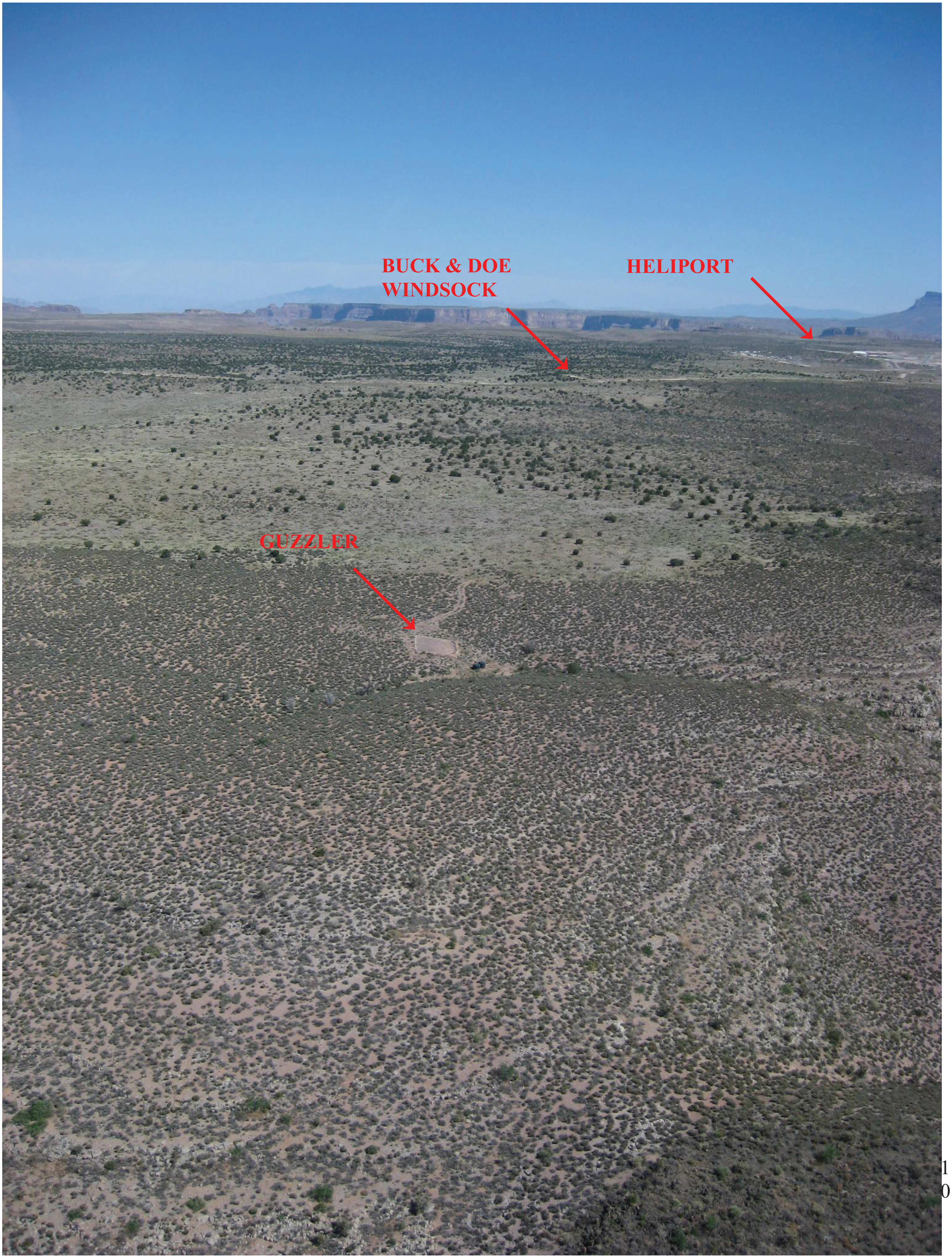
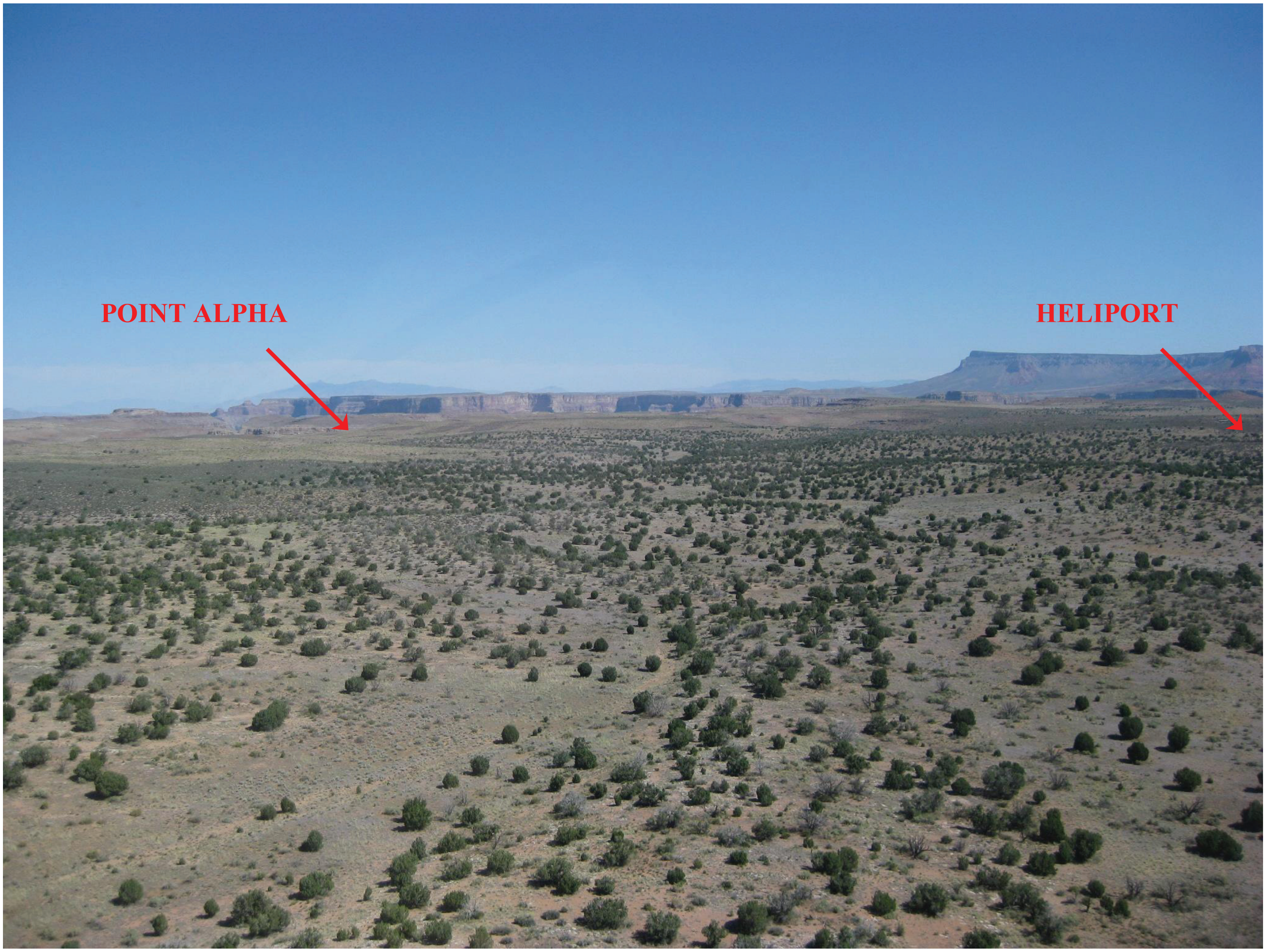
FROM GUZZLER
TO ETERNITY
POINT ALPHA
(approx.)


GUZZLER
BUCK & DOE
WINDSOCK


BUCK & DOE
WINDSOCK
HELIPORT
GUZZLER


POINT ALPHA
HELIPORT

APPENDIX

D

GRAND CANYON WEST ATC SITING STUDY

GRAND CANYON WEST AIRPORT
AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS, INC.
AIRPORT ENGINEERING AND PLANNING

Grand Canyon West Airport

Peach Springs, Arizona

ATCT Siting Study

First In Engineering Excellence

Issued 10/19/12

Grand Canyon West Airport
Airport Traffic Control Tower Siting Analysis

Table of Contents

Table of Contents (Continued)

SECTION 3 – INITIAL SITES CONSIDERED

3.1 SITING PROCEDURES

It is the objective of this Siting Study to evaluate, as concisely as possible, three site alternatives for a new Airport Traffic Control Tower (ATCT) at Grand Canyon West Airport. The individual sites were evaluated based on the criteria established in FAA Order 6480.4A, *Airport Traffic Control Tower Siting Criteria,* and to provide a minimum useful life of 25-years based on proposed and future development as shown on the approved Airport Layout Plan.

Three final sites were individually evaluated after elimination of the sites considered based on the criteria set forth in FAA Orders 6480.4A, 6480.7D, *Airport Traffic Control Tower and Terminal Radar Approach Control Facility Design,* and their possible impact on navigational aids (navaids) associated with instrument approaches at Nantucket. In order to fully investigate the new tower as it relates to Terminal Instrument Procedures (TERPS) surfaces and navaids, a FAA Form 7460-1, *Notice of Proposed Construction or Alteration,* was filed with the FAA for the preferred site and is included in Appendix F.

The alternatives resulting in the three sites examined in this report were modeled at the FAA AFTIL facility to verify visual performance with the FAA's site criteria.

All sites are located on Grand Canyon West Airport property and can be accessed without leaving the airport. Construction cost estimates included in Appendix D include access, site preparation, utilities, rerouting and connection to airfield controls and tower construction.

3.1.1 PLANNING CRITERIA

The FAA has developed various criteria for siting new ATCTs. These criteria are used to ensure the safe and efficient movement of aircraft in the air and within designated aircraft movement areas. Other key elements that affect the location of an ATCT relate to airport imaginary surfaces, existing and future navigation aids, unique airport environmental issues and TERPS. The following FAA guidance documents were used to determine the preferred site for the new ATCT for Nantucket:

- FAA Order 6480.4A, "Airport Traffic Control Tower Siting Criteria" establishes the mandatory and non-mandatory requirements for the location and height of a new ATCT.
- FAA Order 6480.7D, "Airport Traffic Control Tower and Terminal Radar Approach Control Facility Design" establishes the requirements for a new ATCT.
- FAA Order 5050.4A, "Airport Environmental Handbook" establishes the environmental procedures.
- FAA Advisory Circular 150/5300-13, "Airport Design" outlines FAA standards for airport design.
- FAR Part 77 "Objects Affecting Navigable Airspace" provides procedures for identifying obstruction to air navigation.

3.1.2 SITING CRITERIA

Each of the sites was evaluated using criteria from FAA Order 6480.4A, "Airport Traffic Control Tower Siting Criteria". The following lists each criterion evaluated along with a brief description:

1. Visual Performance: The ATCT should be located where views of airport operations are not diminished, natural or manmade objects do not obstruct viewing of key airport locations, relevant objects can be clearly identified and recognized, the viewing angle from the control cab meets minimum requirements, and there is sufficient separation between key airport locations to discriminate between objects at these locations.
2. TERPS Surfaces Penetrations: Site should be located where the height required does not penetrate TERPS surfaces.
3. FAR Part 77 Surface Penetrations: Site should be located where the height required does not penetrate FAR Part 77 surfaces.
4. Potential Interference with Communications, Navigation, and Surveillance Equipment (existing and future): Site should be located where the structure poses no interference with planned and existing wireless communications systems, navigational aid equipment, or airport surveillance equipment.
5. Environmental Impacts: Site should be located to minimize environmental impact.
6. Height: Control cab shall be at the minimum height necessary to meet all visual performance requirements.
7. ATCT Orientation: Tower cab is oriented to minimize visual interference including glare, external light sources, and thermal distortion. The optimum orientation for viewing is north or east.
8. Weather: Site should be located to minimize visual interference from typical weather patterns.
9. Look-down Angle: Site should be located to maximize viewing of ground operations near the base of the ATCT.
10. Look Across Line-of-Site (LOS): Site should be located so as to create a viewing angle of incidence equal to or greater than 0.80 degrees.
11. Cab Orientation: Control Cab shall be oriented to minimize interference from supporting structural mullions.
12. Look-up Angle for Missed Approaches: Site shall be located to maximize distance to the centerpoint of a given runway.
13. Construction: Site should be located to minimize interference with the existing ATCT during construction.
14. Access to Proposed Site Crossing Existing Ground/Air Traffic Patterns: Vehicles crossing existing traffic patterns for aircraft create the potential for interference with ground operations and increase the possibility for collisions.
15. Economic Considerations: Site should be located to minimize costs associated with ATCT height, future land use planning, proximity to existing utilities, site access, and required security implementations.

3.2 INITIAL ATCT SITES CONSIDERED

A comprehensive analysis of associated factors was conducted during the initial review. This included use of the Airport Layout Plan prepared by Armstrong Consultants, Inc. included in Appendix C, which proved very beneficial. Following careful review, five proposed sites were initially selected. Thereafter, an exhaustive examination of these five potential sites for a new Airport Traffic Control Tower (ATCT) at the Grand Canyon West Airport three sites emerged as viable candidates. The initial sites are shown on Figure 3.1.

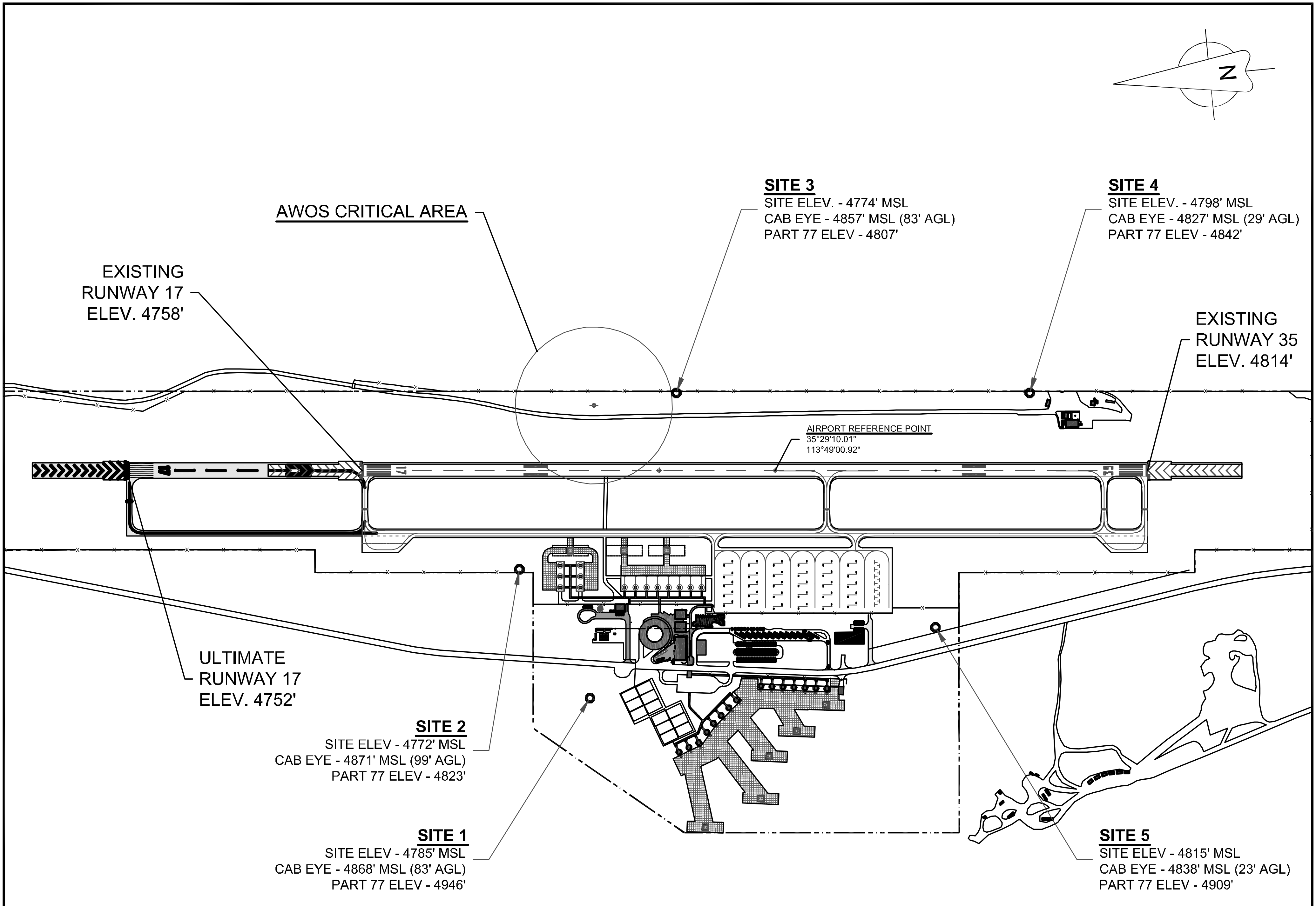
These initial sites were then eliminated for the following reasons:

Sites 1 and 2 – These sites were eliminated due to the excessive height necessary to construct each facility. Both sites would have created an unacceptable penetration of a FAR Part 77 Surface. Furthermore, both sites were located in areas where access considerations created the need for infrastructure work not found for Sites 3, 4, or 5.

The final sites evaluated in this report are Sites 3, 4 and 5. Site 3 was eliminated due to excessive FAR Part 77 penetration, cab viewing angle and high construction costs. Site 4 was removed primarily due to the resulting cab viewing angle.

As currently envisioned, development of the replacement ATCT will include a base building of sufficient size and configuration to accommodate the Technical Operations (Tech Ops) function currently in the existing ATCT, as well as the Air Traffic contingency. Limited funding may require that Tech Ops remain in the existing facility or be located in a separate existing building.

Sites 3, 4 and 8 are the remaining sites evaluated in this report. These sites are depicted on the Final ATCT Sites Considered drawing, Figure 3.2.



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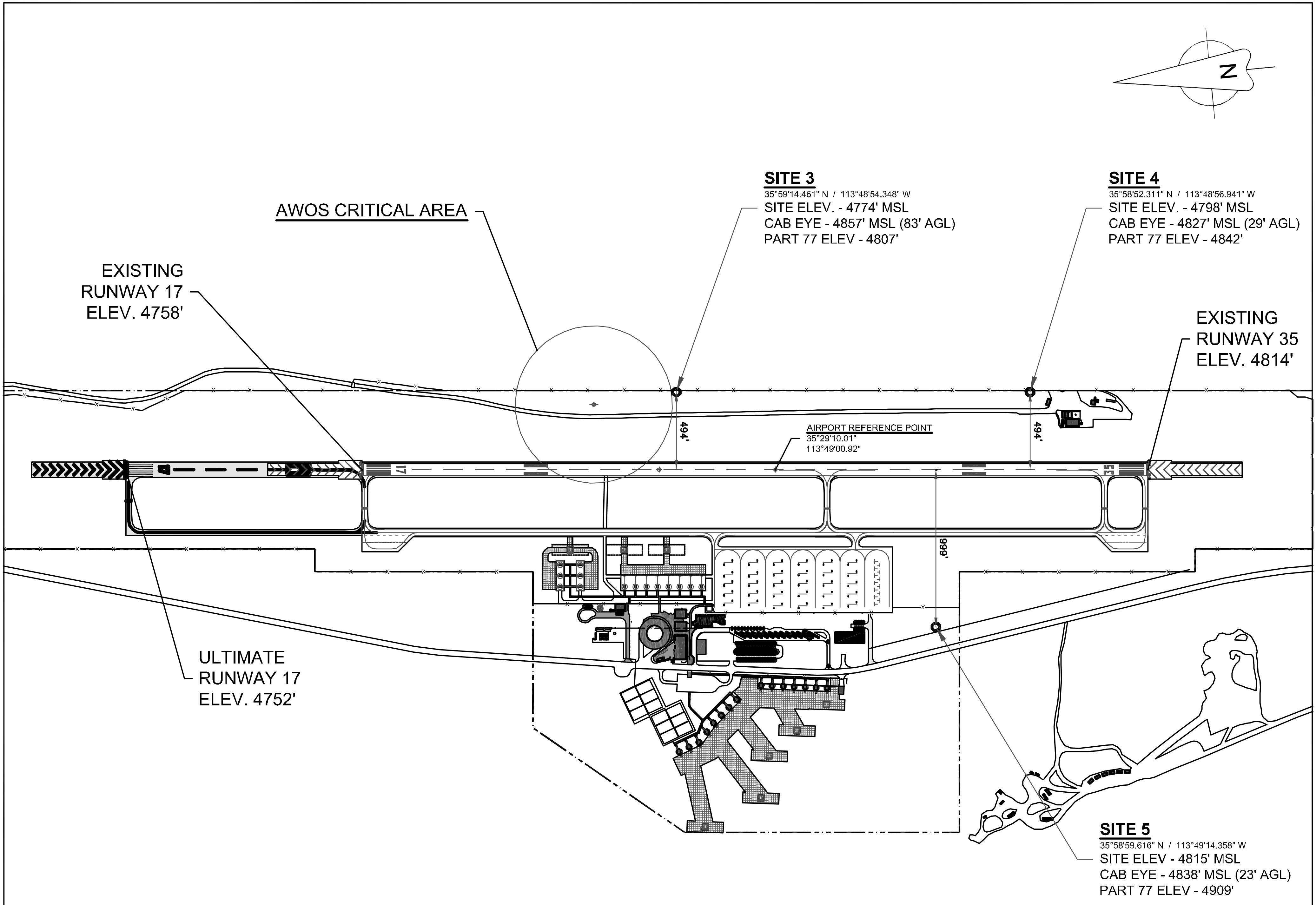
12150 E. BRIARWOOD AVE, STE 120
ENGLEWOOD, CO 80112
(303)790-9019
JON@WEPAYNE.COM

GRAND CANYON WEST SITING REPORT

DATE	FILE	EXHIBIT
10/19/12	INITIAL SITES	3.1



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JON@WEPAYNE.COM

GRAND CANYON WEST SITING REPORT

DATE	FILE	EXHIBIT
10/19/12	FINAL SITES	3.2

SECTION 4 - PREFERRED ATCT SITES

4.1 SITE 3 DESCRIPTION

Site 3 is located at the approximate mid-span of Runway 17/35 and approximately 495' from the runway centerline.

4.2.1 Site Reference Data

This site is approximately 1050′ northeast of the existing Airport Reference Point at N35°59'14.461", W113°48'54.348". This places the center of the tower 1,740′ east of the existing apron. This site has unobstructed views to all movement areas. The site is located approximately 500' to the Runway 17/35 and 940' to the closest movement area (Taxiway A). The site is located within the Airport Operations Area. The distance to the AOA fence line is approximately 5 feet to the closest point.

The ground elevation at this site is approximately 4,798' feet MSL. An ATCT located at this site requires a control cab eye height of 29′-0″ (AGL). An additional 30'-0" above the control cab eye height for the roof structure, antenna array, and lightning protection system results in an overall height of 59 feet AGL, or 4,827 feet MSL, including appurtenances (See Figure 4.2.3).

4.2.2 Siting Criteria - Site 3

Visibility Performance Requirements

a. **Unobstructed View:**

All movement areas are visible from the ATCT Control Cab at Site 3. See Figure 4.1.2.

b. **Object Discrimination:**

All Object Discrimination criteria exceed the 95.5% probability threshold for detection and the 11.5% probability threshold for recognition and 91% probability threshold for detection. See Appendix A.

c. **Line of Site (LOS) Angle of Incidence:**

All LOS Angle of Incidences met the minimum of 0.8 degrees above horizontal. See Appendix A.

Visibility Performance Considerations

a. **Two-Point Lateral Discrimination:**

The Two-Point Lateral Discrimination requirement of .13 degrees separation (minimum) between two key points is met. See Figure 4.1.2.

Federal Laws, Regulations, Orders and Standards that Pertain to the Siting of an ATCT

a. **Terminal Instrument Procedures (TERPS):**

An ATCT located at Site 3 is not anticipated to interfere with any Terminal Instrument Procedures.

b. **14 CFR (Code of Federal Regulations) Part 77, Objects Affecting Navigable Airspace, and Advisory Circular 150-5300-13, Airport Design Standards:**

An ATCT a Site 3 tall enough to meet all visibility requirements described in section 4.1.2 (a), (b) and (c) would result in a penetration of the FAR Part 77 Surface by approximately 75 feet.

c. **Communications, Navigation and Surveillance Equipment:**

An ATCT at Site 3 is not anticipated to affect any existing or proposed airport communications, navigation or surveillance systems.

d. **Environmental:**

Site 4 was not evaluated for environmental impacts.

Operational Requirements

a. **ATCT Orientation:**

The optimal cab orientation for this site results in primary operational viewing to the northwest.

According to FAA Order 6480.4A, an ATCT shall be oriented where the primary operational view faces north or alternately east, west, or finally south in that order of preference. Site 3 is located east of Runway 17/35. From Site 3, air traffic controllers would be facing primarily north and south for approaches and departures from Runway 17/35. ATC staff would face west to view ground movement. See Figure 4.1.2.

b. **Weather:**

Site 3 was not evaluated for impacts created by weather phenomenon.

c. Look-down Angle:

The look-down angle at Site 3 is adequate to see all movement areas.

d. Look Across Line-of-Site (LOS):

The LOS in the control cab is adequate to see all movement areas without turning more than 180̊.

e. Cab Orientation:

The proposed control cab orientation allows unimpeded visibility to all movement areas. See Figure 4.1.2.

f. Look-up angle for Missed Approaches:

The missed approach angles are visible from Site 3.

g. Construction:

Construction at Site 3 would not affect the visibility of current airport operations.

h. Access:

Site 3 would be accessible from the Airport Perimeter Road.

i. Non-Movement Areas:

No significant visual impairment of Non-Movement areas is anticipated from conditions expected at Site 3.

4.1.3 SITE 3 CONCLUSIONS

Site 3 results in an unacceptable FAR Part 77 Surface penetration. The height necessary to meet visibility requirements results in the tallest structure necessary when compared to Sites 4 or 5. The westerly viewing angle of ground movement areas is the least desirable angle for solar interference according to FAA 6480.4A.

4.1.4 Estimated Construction Cost:

The anticipated construction cost for a ATCT at Site 3 is approximately 3.2 million dollars. Please refer to Appendix B.

4.2 SITE 4 DESCRIPTION

Site 4 is located at the approximately 495' east of the Runway 35 threshold.

4.2.1 Site Reference Data

This site is approximately 2235′ southeast of the existing Airport Reference Point at N35°58'52.311", W113°48'56.941". This places the center of the tower 220′ beyond the runway safety area and 1,015′ east of the existing apron. This site has unobstructed views to all movement areas. The site is located approximately 500' to the Runway 17/35 and 865' to the closest movement area (Taxiway A). The site is located within the Airport Operations Area. The distance to the AOA fence line is approximately 5 feet to the closest point.

The ground elevation at this site is approximately 4,774' feet MSL. An ATCT located at this site requires a control cab eye height of 83′-0″ (AGL). An additional 30'-0" above the control cab eye height for the roof structure, antenna array, and lightning protection system results in an overall height of 113 feet AGL, or 4,887 feet MSL, including appurtenances (See Figure 4.1.3).

4.2.2 Siting Criteria - Site 1

Visibility Performance Requirements

d. **Unobstructed View:**

All movement areas are visible from the ATCT Control Cab at Site 4. See Figure 4.2.2.

e. **Object Discrimination:**

All Object Discrimination criteria exceed the 95.5% probability threshold for detection and the 11.5% probability threshold for recognition and 91% probability threshold for detection. See Appendix A.

f. **Line of Site (LOS) Angle of Incidence:**

All LOS Angle of Incidences met the minimum of 0.8 degrees above horizontal. See Appendix A.

Visibility Performance Considerations

b. **Two-Point Lateral Discrimination:**

The Two-Point Lateral Discrimination requirement of .13 degrees separation (minimum) between two key points is met. See Figure 4.2.2.

Federal Laws, Regulations, Orders and Standards that Pertain to the Siting of an ATCT

e. <u>Terminal Instrument Procedures (TERPS):</u>

An ATCT located at Site 4 is not anticipated to interfere with any Terminal Instrument Procedures.

f. <u>14 CFR (Code of Federal Regulations) Part 77, Objects Affecting Navigable Airspace, and Advisory Circular 150-5300-13, Airport Design Standards:</u>

An ATCT a Site 4 tall enough to meet all visibility requirements described in section 4.2.2 (a), (b) and (c) would result in a penetration of the FAR Part 77 Surface by approximately 16 feet.

g. <u>Communications, Navigation and Surveillance Equipment:</u>

An ATCT at Site 4 is not anticipated to affect any existing or proposed airport communications, navigation or surveillance systems.

h. <u>Environmental:</u>

Site 4 was not evaluated for environmental impacts.

Operational Requirements

j. <u>ATCT Orientation:</u>

The optimal cab orientation for this site results in primary operational viewing to the northwest.

According to FAA Order 6480.4A, an ATCT shall be oriented where the primary operational view faces north or alternately east, west, or finally south in that order of preference. Site 4 is located east of Runway 17/35. From Site 4, air traffic controllers would be facing primarily north and south for approaches and departures from Runway 17/35. ATC staff would face northwest to view ground movement. See Figure 4.2.2.

k. <u>Weather:</u>

Site 4 was not evaluated for impacts created by weather phenomenon.

l. Look-down Angle:

The look-down angle at Site 4 is adequate to see all movement areas.

m. Look Across Line-of-Site (LOS):

The LOS in the control cab is adequate to see all movement areas without turning more than 180°.

n. Cab Orientation:

The proposed control cab orientation allows unimpeded visibility to all movement areas. See Figure 4.2.2.

o. Look-up angle for Missed Approaches:

The missed approach angles are visible from Site 4.

p. Construction:

Construction at Site 4 would not affect the visibility of current airport operations.

q. Access:

Site 4 would be accessible from the Airport Perimeter Road.

r. Non-Movement Areas:

No significant visual impairment of Non-Movement areas is anticipated from conditions expected at Site 4.

4.2.3 SITE 4 CONCLUSIONS

Site 4 results in an acceptable FAR Part 77 Surface penetration. The height necessary to meet visibility requirements results in the 2nd tallest structure necessary when compared to Sites 3 or 5. The northwesterly viewing angle of ground movement areas is not a desirable angle for solar interference according to FAA 6480.4A.

4.1.4 Estimated Construction Cost:

The anticipated construction cost for a ATCT at Site 4 is approximately 2.2 million dollars. Please refer to Appendix B.

4.3 SITE 5 DESCRIPTION

Site 5 is located at the approximately 665' west of the Runway 17/35.

4.3.1 Site Reference Data

This site is approximately 1885' southeast of the existing Airport Reference Point at N35°58'59.616", W113°49'14.358". This places the center of the tower 365' east of the existing apron. This site has unobstructed views to all movement areas. The site is located approximately 665' to Runway 17/35 and 765' to the closest movement area (Taxiway A). The site is located within the Airport Operations Area.

The ground elevation at this site is approximately 4,815' feet MSL. An ATCT located at this site requires a control cab eye height of 23'-0" (AGL). An additional 30'-0" above the control cab eye height for the roof structure, antenna array, and lightning protection system results in an overall height of 53 feet AGL, or 4,868 feet MSL, including appurtenances (See Figure 4.3.3).

4.3.2 Siting Criteria - Site 5

Visibility Performance Requirements

g. Unobstructed View:

All movement areas are visible from the ATCT Control Cab at Site 5. See Figure 4.3.2.

h. Object Discrimination:

All Object Discrimination criteria exceed the 95.5% probability threshold for detection and the 11.5% probability threshold for recognition and 91% probability threshold for detection. See Appendix A.

i. Line of Site (LOS) Angle of Incidence:

All LOS Angle of Incidences met the minimum of 0.8 degrees above horizontal. See Appendix A.

Visibility Performance Considerations

c. Two-Point Lateral Discrimination:

The Two-Point Lateral Discrimination requirement of .13 degrees separation (minimum) between two key points is met. See Figure 4.3.2.

Federal Laws, Regulations, Orders and Standards that Pertain to the Siting of an ATCT

i. <u>Terminal Instrument Procedures (TERPS):</u>

An ATCT located at Site 5 is not anticipated to interfere with any Terminal Instrument Procedures.

j. <u>14 CFR (Code of Federal Regulations) Part 77, Objects Affecting Navigable Airspace, and Advisory Circular 150-5300-13, Airport Design Standards:</u>

An ATCT a Site 5 tall enough to meet all visibility requirements described in section 4.3.2 (a), (b) and (c) would result in no penetration of any FAR Part 77 Surface.

k. <u>Communications, Navigation and Surveillance Equipment:</u>

An ATCT at Site 5 is not anticipated to affect any existing or proposed airport communications, navigation or surveillance systems.

l. <u>Environmental:</u>

Site 5 was not evaluated for environmental impacts.

Operational Requirements

s. <u>ATCT Orientation:</u>

The optimal cab orientation for this site results in primary operational viewing to the northwest.

According to FAA Order 6480.4A, an ATCT shall be oriented where the primary operational view faces north or alternately east, west, or finally south in that order of preference. Site 5 is located west of Runway 17/35. From Site 5, air traffic controllers would be facing primarily north and south for approaches and departures from Runway 17/35. ATC staff would face northeast to view ground movement. See Figure 4.3.2.

t. <u>Weather:</u>

Site 5 was not evaluated for impacts created by weather phenomenon.

u. Look-down Angle:

The look-down angle at Site 5 is adequate to see all movement areas.

v. Look Across Line-of-Site (LOS):

The LOS in the control cab is adequate to see all movement areas without turning more than 180̊.

w. Cab Orientation:

The proposed control cab orientation allows unimpeded visibility to all movement areas. See Figure 4.2.2.

x. Look-up angle for Missed Approaches:

The missed approach angles are visible from Site 5.

y. Construction:

Construction at Site 5 would not affect the visibility of current airport operations.

z. Access:

Site 5 would be accessible from the Airport Perimeter Road.

aa. Non-Movement Areas:

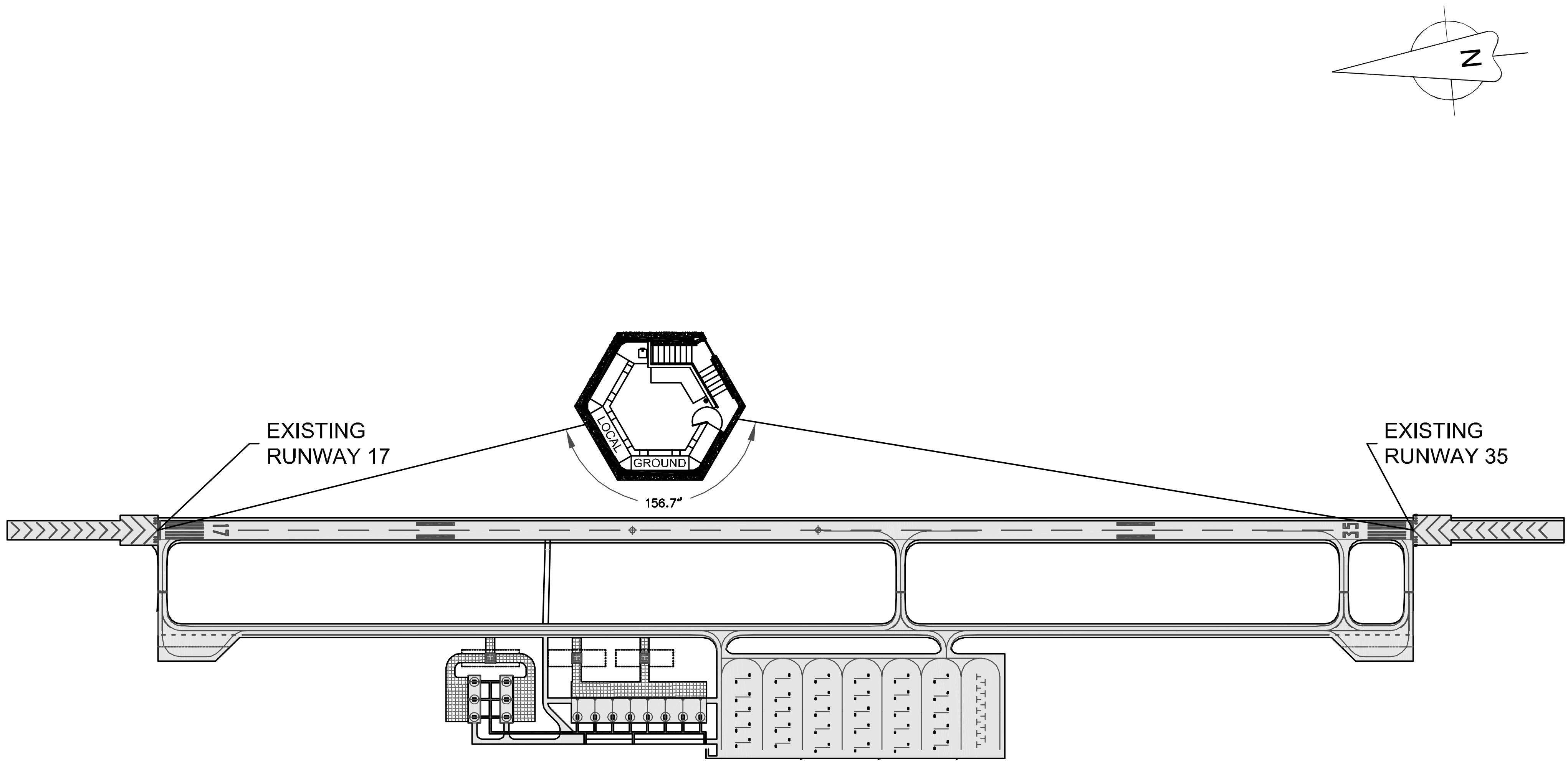
No significant visual impairment of Non-Movement areas is anticipated from conditions expected at Site 5.

4.3.3 SITE 5 CONCLUSIONS

Site 5 results in the shortest ATCT necessary to meet all visibility requirements. The height does not create a FAR Part 77 Penetration. Known available utilities are nearby. The perimeter road serving the ATCT is not anticipated to require rehabilitation to meet code requirements. The viewing angle resulting from an ATCT at Site 5 is optimal per FAA Order 6480.4A.

4.1.4 Estimated Construction Cost:

The anticipated construction cost for a ATCT at Site 5 is approximately 2.3 million dollars. Please refer to Appendix B.



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GRAND CANYON WEST SITING REPORT

DATE	FILE	EXHIBIT
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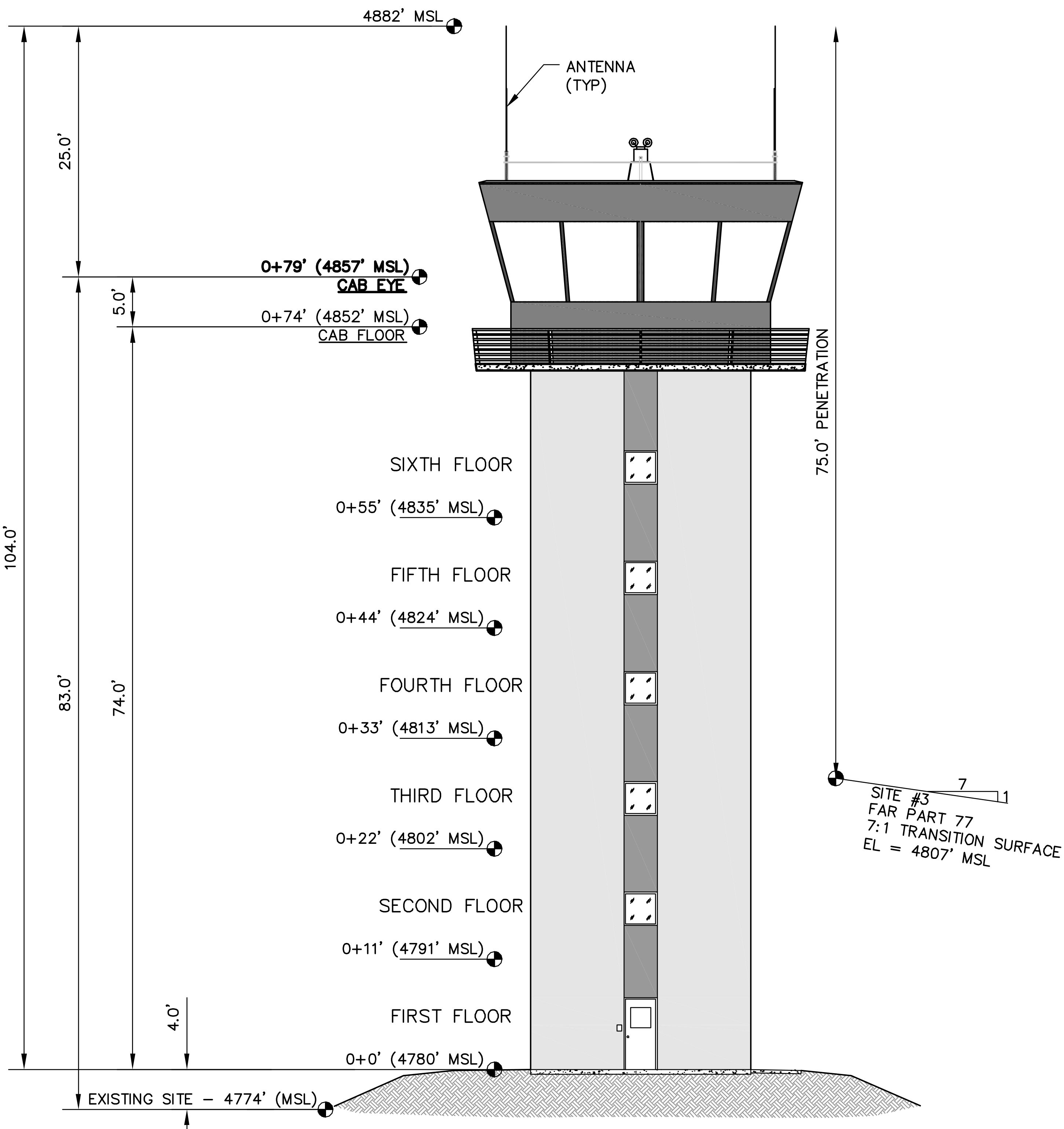

ATCT ELEVATION

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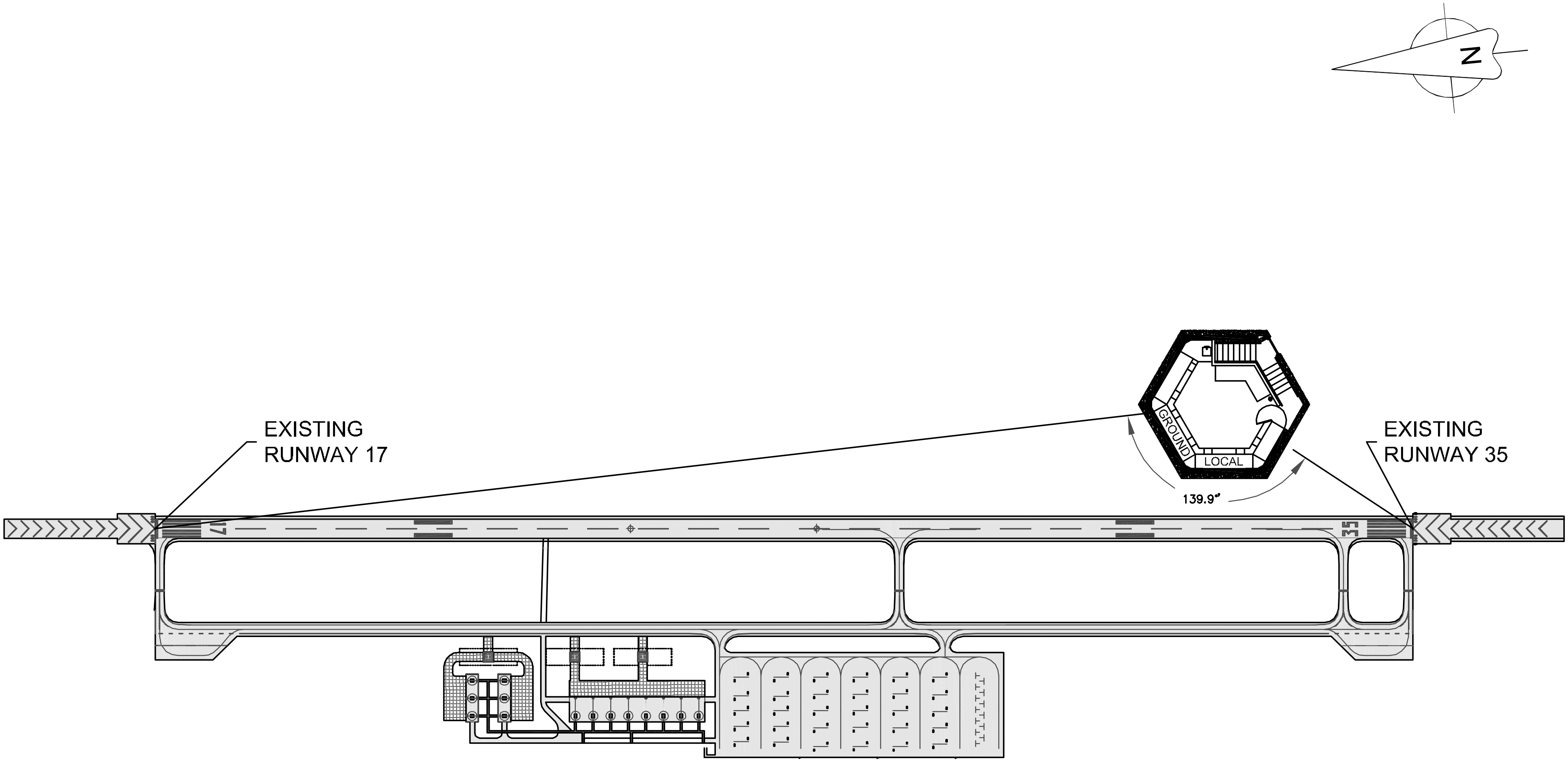
PART 77 ELEVATION - SITE 3

GRAND CANYON WEST AIRPORT
PEACH SPRINGS, ARIZONA

PROJECT NO. 12001

FIGURE 4.1.3

PAGE NA



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GRAND CANYON WEST SITING REPORT

DATE	FILE	EXHIBIT
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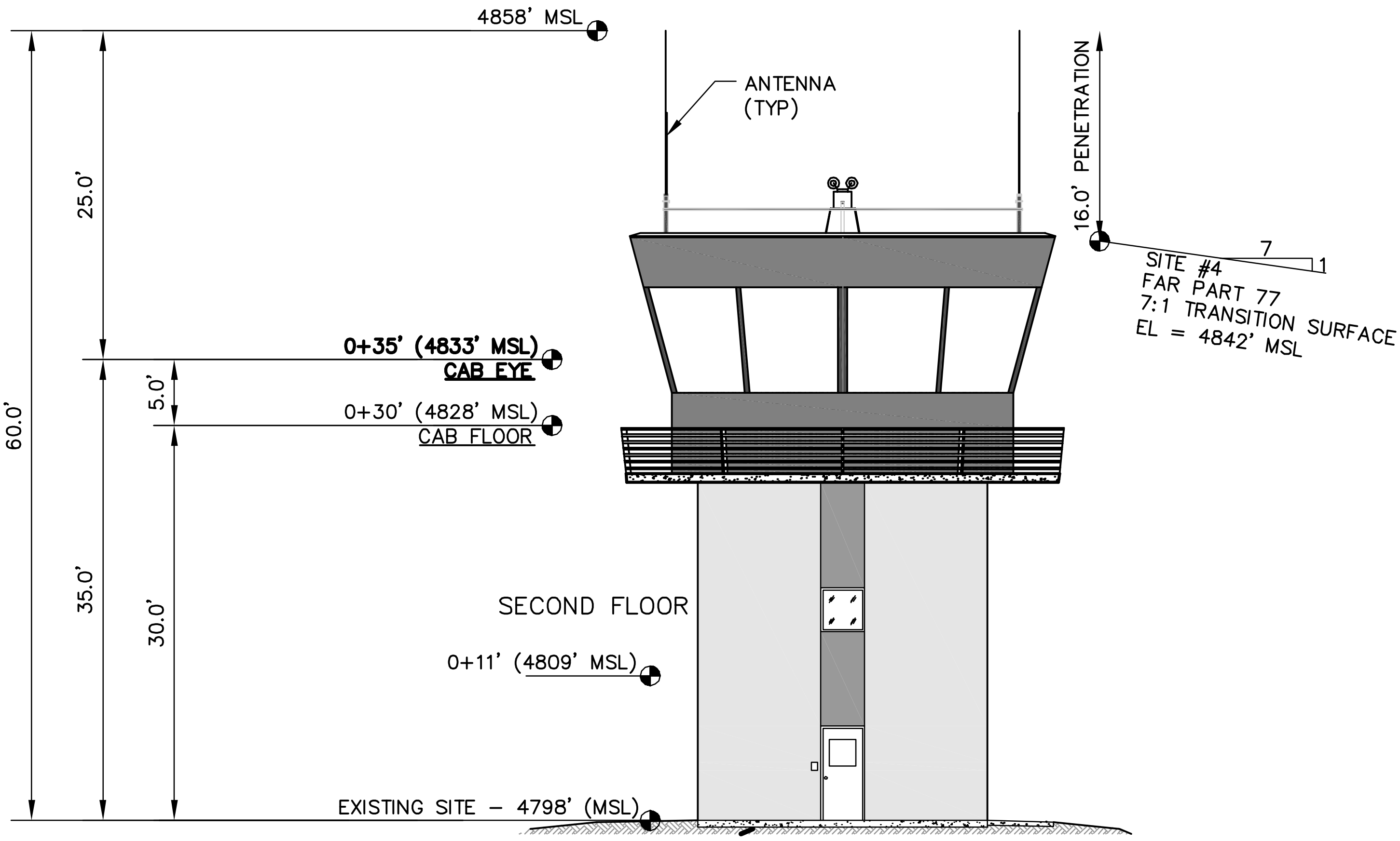

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PART 77 ELEVATION – SITE 4

GRAND CANYON WEST AIRPORT
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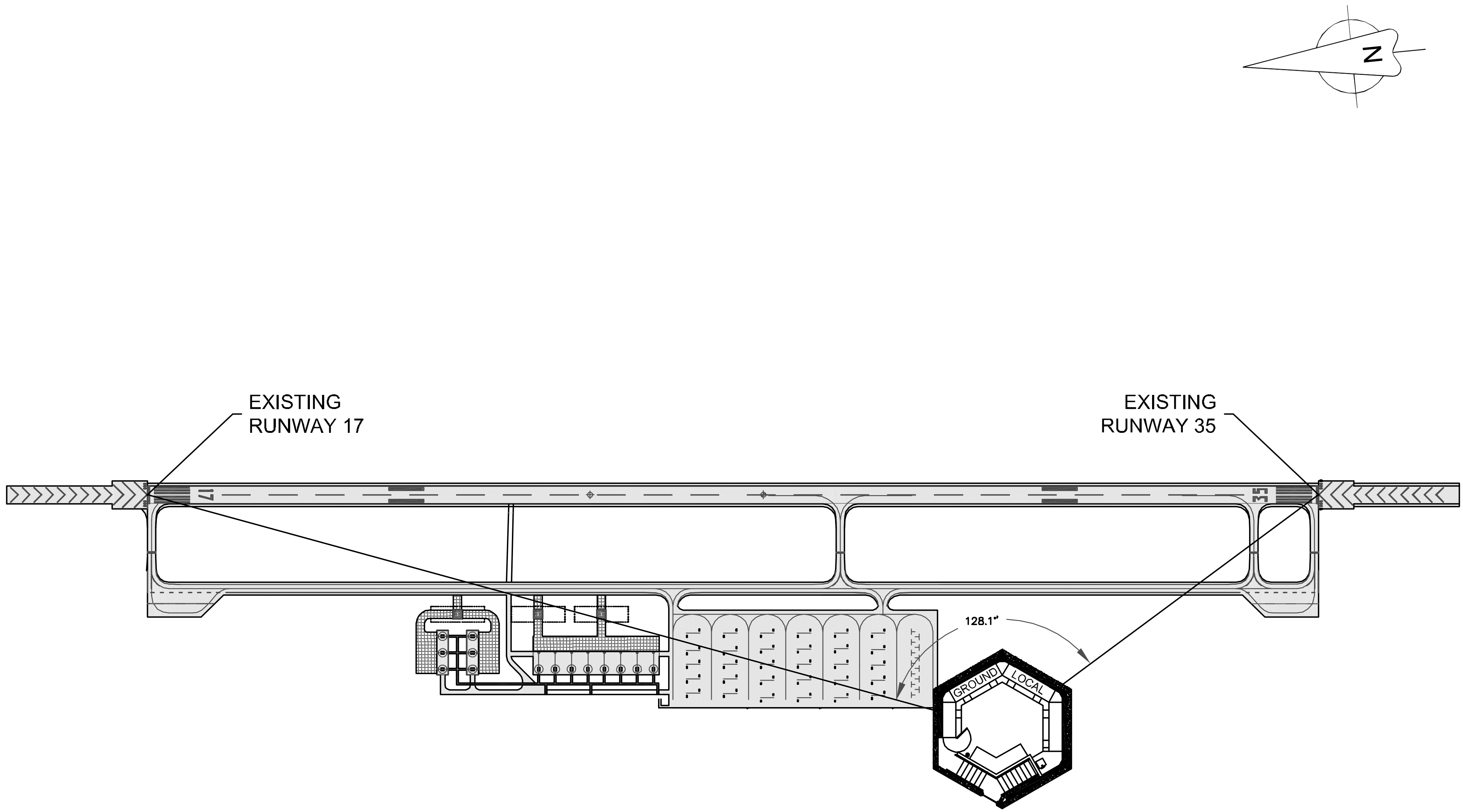
PROJECT NO.	12001
FIGURE	4.2.3
PAGE	NA



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GRAND CANYON WEST SITING REPORT

DATE	FILE	EXHIBIT
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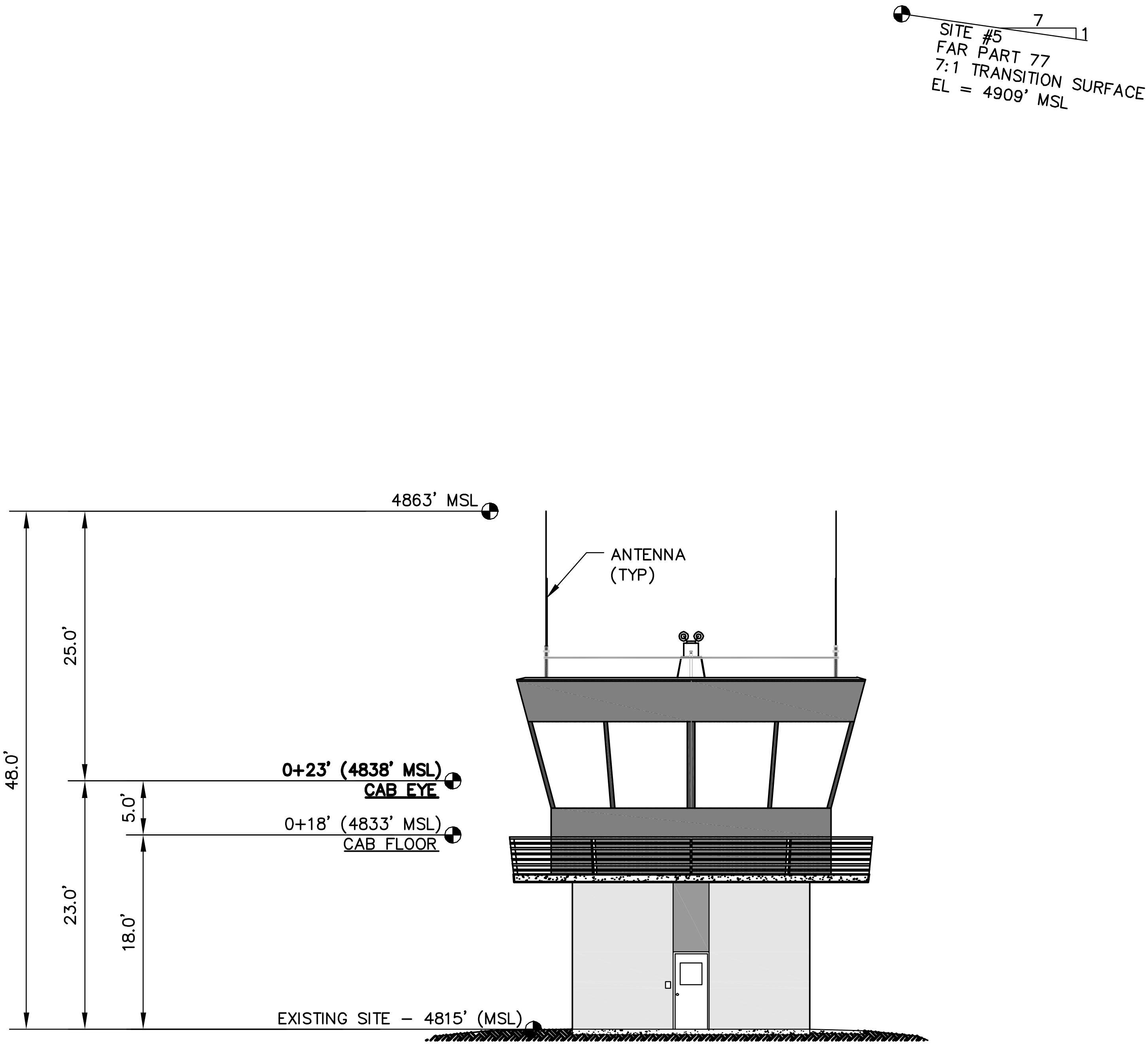

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PART 77 ELEVATION - SITE 4

GRAND CANYON WEST AIRPORT
PEACH SPRINGS, ARIZONA

PROJECT NO.	12001
FIGURE	4.3.3
PAGE	NA

5.1 FINAL SITE APPROVAL

After thoroughly examining the relative merits (excluding cost) of constructing a tower on each of the three sites, we have concluded that the best location is in the following order:

First: Site 5, which is west of Runway 17/35 and southwest of the existing apron is the best location. This site meets or exceeds all of required Siting Criteria. The site results in the shortest structure necessary to meet all FAA visual requirements. The site offers an unobstructed view of all airport operations and the majority of airport traffic and movement areas can be viewed without the need for ATC staff to turn more than 180̊. The majority of airport traffic as well as airport movement areas is north by northeast. This is an optimal viewing angle to minimize interference from the sun. Site 5 is easily accessible from the airport perimeter road with all utilities available nearby.

Second: Site 4, which is located east of the existing Runway is the second choice. This site meets or exceeds all of required Siting Criteria. The site results in the 2nd shortest structure necessary to meet all FAA visual requirements. The site offers an unobstructed view of all airport operations. However, to view all airport operations, ATC staff will frequently have to turn more than 180̊. The majority of airport traffic as well as airport movement areas is northwest by northeast. This viewing angle minimizes interference from the sun. This is an acceptable viewing angle to minimize interference from the sun. Site 4 is easily accessible from the airport perimeter road, but it is likely that the road would require reinforcement to meet Fire Access requirements. Available utilities are not nearby.

Third: Site 3, which is located east of the existing Runway is the third choice. This site meets or exceeds all of required Siting Criteria. The site results in the tallest structure necessary to meet all FAA visual requirements. The site offers an unobstructed view of all airport operations. However, to view all airport operations, ATC staff will frequently have to turn more than 180̊. The majority of airport traffic as well as airport movement areas is northwest by northeast. This viewing angle minimizes interference from the sun. This is an acceptable viewing angle to minimize interference from the sun. Site 5 is easily accessible. Available utilities are not nearby. Site 3 is easily accessible from the airport perimeter road, but it is likely that the road would require reinforcement to meet Fire Access requirements. Available utilities are not nearby.

ATCT Site #5 has been identified as the preferred location for a future airport traffic control tower at Grand Canyon West Airport.

Appendix A

Visibility Siting Requirements

Visibility Siting Requirements Human Factors Analyses

Objective: Two human performance metrics, Object Discrimination Analysis and Object Discrimination and Line of Sight (LOS) Angle of Incidence, were used to assess the impact of tower height on air traffic control tower specialist distance perception.

Technical Approach: the tower visibility analysis tool (http://www.hf.faa.gov/visibility) was used to assess the human performance metrics[1].

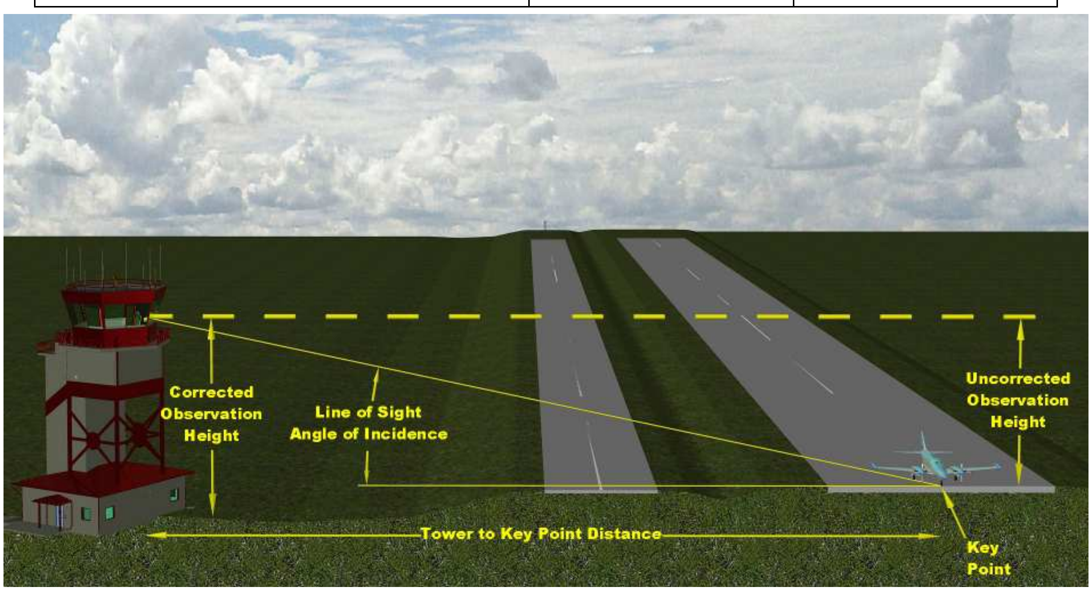
Air Traffic Control Tower: **Site 3 to 17**
Light Level: **Sunlight Clouds**
Ground Turbulence: **Medium**
Target Object: **Cessna 172**, target orientation: **Side View**
Observer Eye Height: **13**
Vertical Elevation Change Between Observer and Key Point (feet): **29**
Ground Elevation at Tower (MSL): **4774**
Ground Elevation at Key Point (MSL): **4758**
Tower to Key Point Distance: **2060** (feet) **0.63** (km)
Visibility Range: **10**(Miles) **16.09** (km)

1. Object Discrimination Analysis Results

Criteria	Threshold	Tower Results	Pass/Fail
probability(detection)	95.5%	100.0%	Pass
probability(recognition)	11.5%	99.9%	Pass

2. Line of Sight (LOS) Angle of Incidence

Threshold	Tower Results	Pass/Fail
0.8 degrees or 48 minutes	.81 degrees	PASS: Change in elevation between observer and key point should be no less than 28 feet.



[1]Krebs, Hewitt, Murrill, and Driggers, 2005. *How High is High Enough? Quantifying the Impact of Air Traffic Control Tower Observation Height on Distance Perception*, International Symposium on Aviation Psychology, 1-5.

Visibility Siting Requirements Human Factors Analyses

Objective: Two human performance metrics, Object Discrimination Analysis and Object Discrimination and Line of Sight (LOS) Angle of Incidence, were used to assess the impact of tower height on air traffic control tower specialist distance perception.

Technical Approach: the tower visibility analysis tool (http://www.hf.faa.gov/visibility) was used to assess the human performance metrics[1].

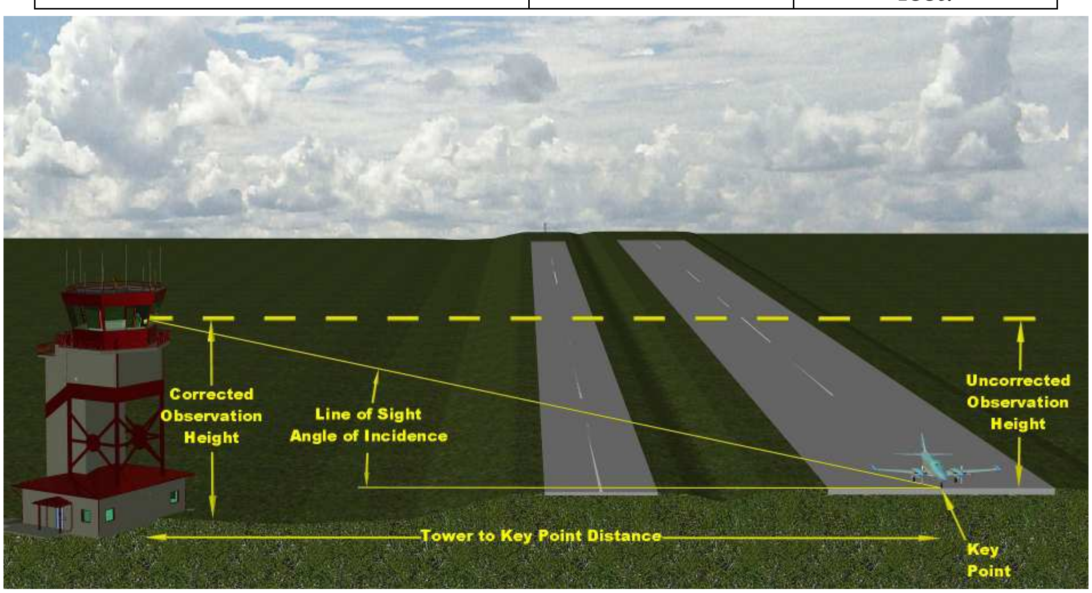
Air Traffic Control Tower: **Site 3 to 35**
Light Level: **Sunlight Clouds**
Ground Turbulence: **Medium**
Target Object: **Cessna 172**, target orientation: **Side View**
Observer Eye Height: **83**
Vertical Elevation Change Between Observer and Key Point (feet): **43**
Ground Elevation at Tower (MSL): **4774**
Ground Elevation at Key Point (MSL): **4814**
Tower to Key Point Distance: **3041** (feet) **0.93** (km)
Visibility Range: **10**(Miles) **16.09** (km)

1. Object Discrimination Analysis Results

Criteria	Threshold	Tower Results	Pass/Fail
probability(detection)	95.5%	100.0%	Pass
probability(recognition)	11.5%	99.6%	Pass

2. Line of Sight (LOS) Angle of Incidence

Threshold	Tower Results	Pass/Fail
0.8 degrees or 48 minutes	.81 degrees	PASS: Change in elevation between observer and key point should be no less than 42 feet.



[1]Krebs, Hewitt, Murrill, and Driggers, 2005. *How High is High Enough? Quantifying the Impact of Air Traffic Control Tower Observation Height on Distance Perception*, International Symposium on Aviation Psychology, 1-5.

Visibility Siting Requirements Human Factors Analyses

Objective: Two human performance metrics, Object Discrimination Analysis and Object Discrimination and Line of Sight (LOS) Angle of Incidence, were used to assess the impact of tower height on air traffic control tower specialist distance perception.

Technical Approach: the tower visibility analysis tool (http://www.hf.faa.gov/visibility) was used to assess the human performance metrics[1].

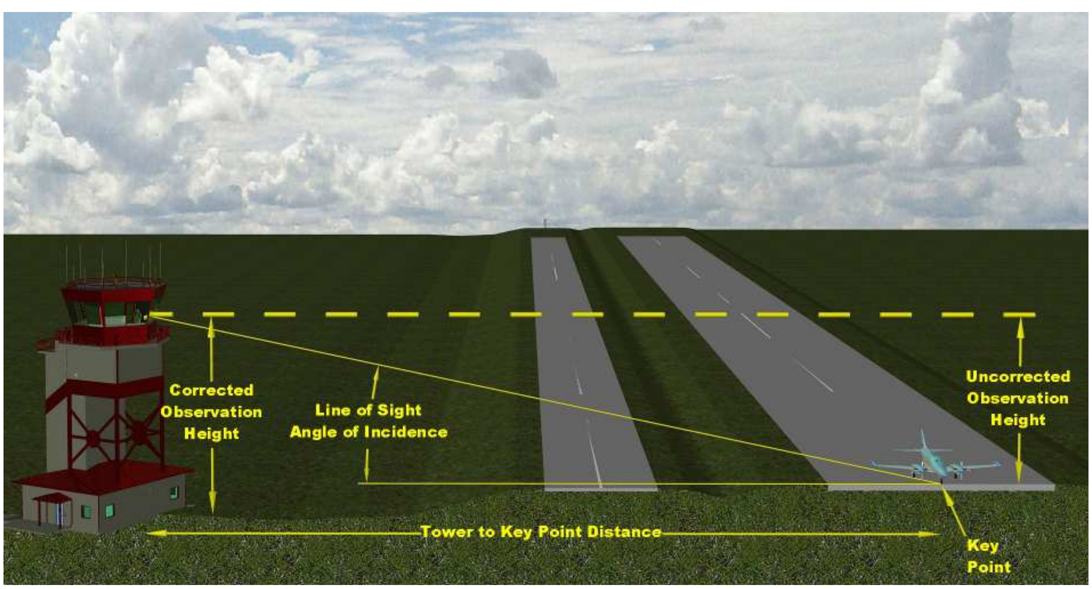
Air Traffic Control Tower: **Site 4 to 17**
Light Level: **Sunlight Clouds**
Ground Turbulence: **Medium**
Target Object: **Cessna 172**, target orientation: **Front View**
Observer Eye Height: **20**
Vertical Elevation Change Between Observer and Key Point (feet): **60**
Ground Elevation at Tower (MSL): **4798**
Ground Elevation at Key Point (MSL): **4758**
Tower to Key Point Distance: **4279** (feet) **1.3** (km)
Visibility Range: **10**(Miles) **16.09** (km)

1. Object Discrimination Analysis Results

Criteria	Threshold	Tower Results	Pass/Fail
probability(detection)	95.5%	100.0%	Pass
probability(recognition)	11.5%	99.1%	Pass

2. Line of Sight (LOS) Angle of Incidence

Threshold	Tower Results	Pass/Fail
0.8 degrees or 48 minutes	.80 degrees	Pass



[1]Krebs, Hewitt, Murrill, and Driggers, 2005. *How High is High Enough? Quantifying the Impact of Air Traffic Control Tower Observation Height on Distance Perception*, International Symposium on Aviation Psychology, 1-5.

Visibility Siting Requirements Human Factors Analyses

Objective: Two human performance metrics, Object Discrimination Analysis and Object Discrimination and Line of Sight (LOS) Angle of Incidence, were used to assess the impact of tower height on air traffic control tower specialist distance perception.

Technical Approach: the tower visibility analysis tool (http://www.hf.faa.gov/visibility) was used to assess the human performance metrics[1].

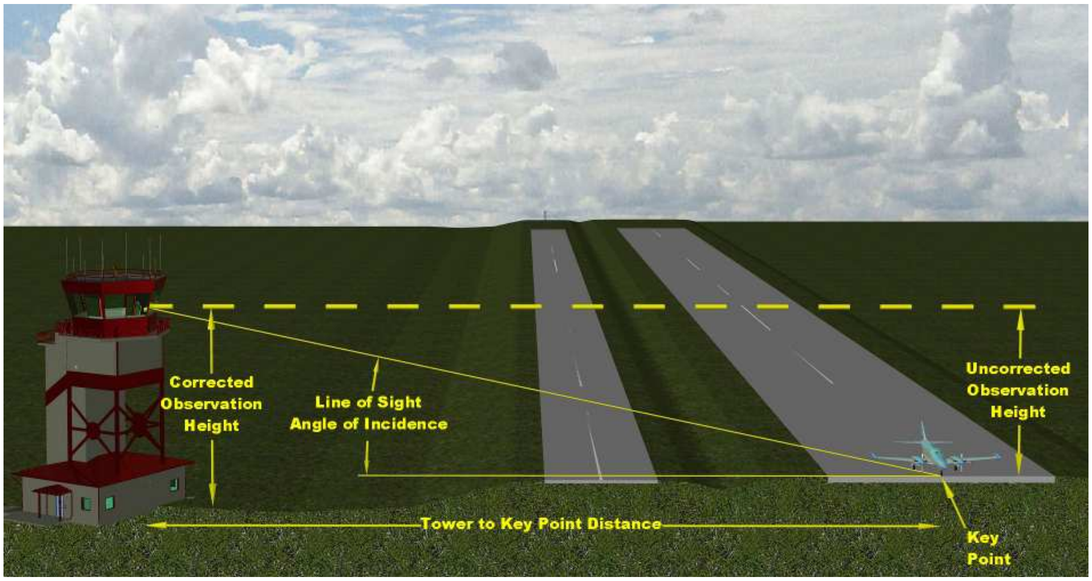
Air Traffic Control Tower: **Site 4 to 35**
Light Level: **Sunlight Clouds**
Ground Turbulence: **Medium**
Target Object: **Cessna 172**, target orientation: **Side View**
Observer Eye Height: **29**
Vertical Elevation Change Between Observer and Key Point (feet): **13**
Ground Elevation at Tower (MSL): **4798**
Ground Elevation at Key Point (MSL): **4814**
Tower to Key Point Distance: **899** (feet) **0.27** (km)
Visibility Range: **10**(Miles) **16.09** (km)

1. Object Discrimination Analysis Results

Criteria	Threshold	Tower Results	Pass/Fail
probability(detection)	95.5%	100.0%	Pass
probability(recognition)	11.5%	100.0%	Pass

2. Line of Sight (LOS) Angle of Incidence

Threshold	Tower Results	Pass/Fail
0.8 degrees or 48 minutes	.83 degrees	PASS: Change in elevation between observer and key point should be no less than 12 feet.



[1]Krebs, Hewitt, Murrill, and Driggers, 2005. *How High is High Enough? Quantifying the Impact of Air Traffic Control Tower Observation Height on Distance Perception*, International Symposium on Aviation Psychology, 1-5.

Visibility Siting Requirements Human Factors Analyses

Objective: Two human performance metrics, Object Discrimination Analysis and Object Discrimination and Line of Sight (LOS) Angle of Incidence, were used to assess the impact of tower height on air traffic control tower specialist distance perception.

Technical Approach: the tower visibility analysis tool (http://www.hf.faa.gov/visibility) was used to assess the human performance metrics[1].

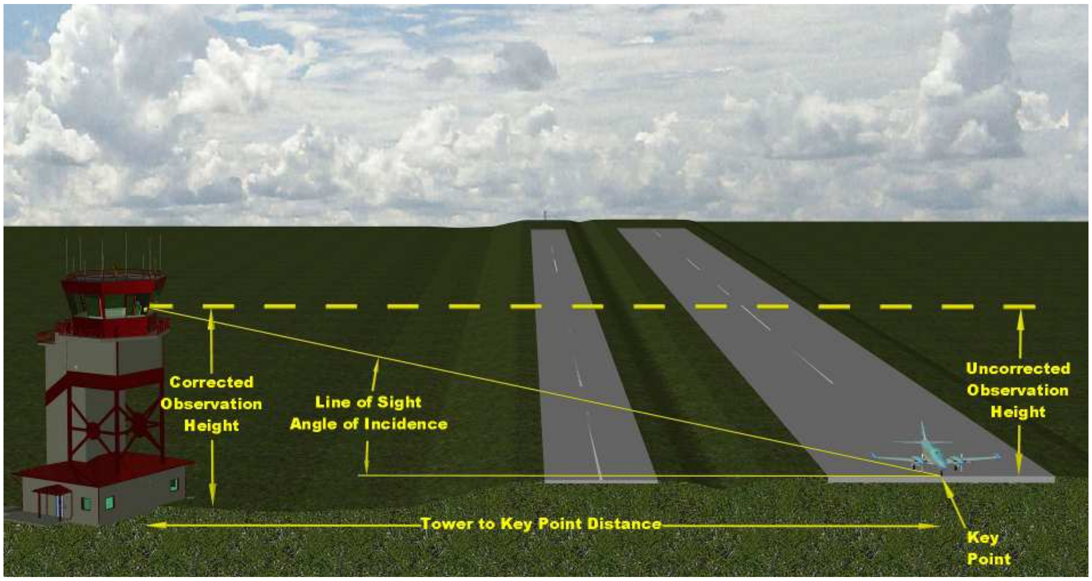
Air Traffic Control Tower: **Site 5 to 17**
Light Level: **Sunlight Clouds**
Ground Turbulence: **Medium**
Target Object: **Cessna 172**, target orientation: **Front View**
Observer Eye Height: **0**
Vertical Elevation Change Between Observer and Key Point (feet): **57**
Ground Elevation at Tower (MSL): **4815**
Ground Elevation at Key Point (MSL): **4758**
Tower to Key Point Distance: **3785** (feet) **1.15** (km)
Visibility Range: **10**(Miles) **16.09** (km)

1. Object Discrimination Analysis Results

Criteria	Threshold	Tower Results	Pass/Fail
probability(detection)	95.5%	100.0%	Pass
probability(recognition)	11.5%	99.4%	Pass

2. Line of Sight (LOS) Angle of Incidence

Threshold	Tower Results	Pass/Fail
0.8 degrees or 48 minutes	.86 degrees	PASS: Change in elevation between observer and key point should be no less than 53 feet.



[1]Krebs, Hewitt, Murrill, and Driggers, 2005. *How High is High Enough? Quantifying the Impact of Air Traffic Control Tower Observation Height on Distance Perception*, International Symposium on Aviation Psychology, 1-5.

<u>Visibility Siting Requirements Human Factors Analyses</u>

Objective: Two human performance metrics, Object Discrimination Analysis and Object Discrimination and Line of Sight (LOS) Angle of Incidence, were used to assess the impact of tower height on air traffic control tower specialist distance perception.

Technical Approach: the tower visibility analysis tool (http://www.hf.faa.gov/visibility) was used to assess the human performance metrics[1].

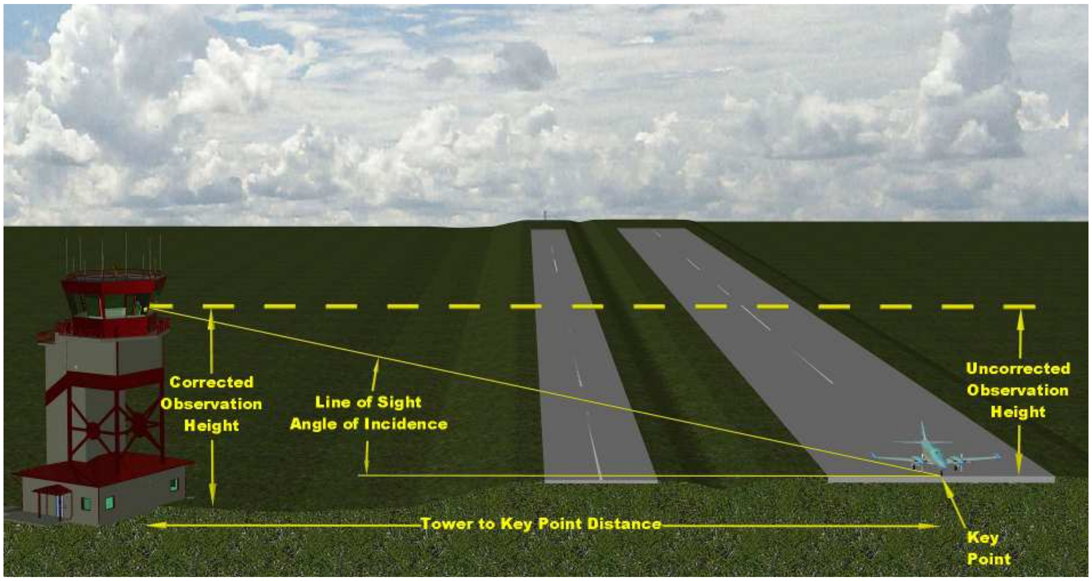
Air Traffic Control Tower: **Site 5 to 35**
Light Level: **Sunlight Clouds**
Ground Turbulence: **Medium**
Target Object: **Cessna 172**, target orientation: **Side View**
Observer Eye Height: **23**
Vertical Elevation Change Between Observer and Key Point (feet): **24**
Ground Elevation at Tower (MSL): **4815**
Ground Elevation at Key Point (MSL): **4814**
Tower to Key Point Distance: **1680** (feet) **0.51** (km)
Visibility Range: **10**(Miles) **16.09** (km)

1. Object Discrimination Analysis Results

Criteria	Threshold	Tower Results	Pass/Fail
probability(detection)	95.5%	100.0%	Pass
probability(recognition)	11.5%	100.0%	Pass

2. Line of Sight (LOS) Angle of Incidence

Threshold	Tower Results	Pass/Fail
0.8 degrees or 48 minutes	.82 degrees	PASS: Change in elevation between observer and key point should be no less than 23 feet.



[1]Krebs, Hewitt, Murrill, and Driggers, 2005. *How High is High Enough? Quantifying the Impact of Air Traffic Control Tower Observation Height on Distance Perception*, International Symposium on Aviation Psychology, 1-5.

Appendix B

Cost Estimates

Grand Canyon West Airport

ATCT Cost Estimate

ATCT Budgetary Cost Estimate - Site #3

83' AGL Cab Eye Height

Revision #1

July 12, 2012

Area	Total	
Base Building (Excluding Shaft)	*0*	SF
First Level Shaft	*400*	SF
Total First Level Area	**400**	SF
Second Level (Shaft)	*400*	SF
Third Level (Shaft)	*400*	SF
Fourth Level (Shaft)	*400*	SF
Fifth Level (Shaft)	*400*	SF
Sixth Level (Shaft)	*400*	SF
Junction Level (Shaft)	*400*	SF
Control Cab	*484*	SF
Total Area (Shaft & Base Building)	**3,284**	**SF**

DIVISION No.	Description	Estimated Quantity	Units	Unit Cost Estimate	Total Cost
ATCT Construction					
Base Building					
	Select Fill	0	CY	$50.00	$0.00
	Foundation - Grade Walls (Includes 3'-0" Walls with 3'-0"x8" Footings)	0	CY	$300.00	$0.00
	Concrete Floor (4") (Includes Shaft)	5	CY	$300.00	$1,500.00
	Exterior Walls (Finished)	0	SF	$20.00	$0.00
	Fire Wall Stud Framing, Drywall & Texture	0	SF	$18.00	$0.00
	Furring Wall w/Insulation @Exterior Wall	0	SF	$12.00	$0.00
	Standing seam roof	0	SF	$25.00	$0.00
	Drop Ceiling	0	SF	$12.00	$0.00
	Carpet (ESD)	0	SY	$60.00	$0.00
	Carpet (26 oz Nylon)	0	SY	$35.00	$0.00
	Tile & Base	0	SF	$20.00	$0.00
	Doors (90 minute B Label)	0	EA	$1,200.00	$0.00
	Fire Rated Access Panel	0	EA	$850.00	$0.00
	VE - Windows (Insulated glass)	0	EA	$1,000.00	$0.00
	Plumbing (Including bathroom fixtures)	0	SF	$50.00	$0.00
	Fire Protection (Standpipe)	105	LF	$55.00	$5,775.00
	Fire Pump	0	LS	$150,000.00	$0.00
	HVAC	0	SF	$45.00	$0.00
	Electrical	0	SF	$65.00	$0.00
	Telephone System	0	LS	$20,000.00	$0.00
	Sub Total	$2.22	/SF		$7,275.00

	Description	Estimated Quantity	Units	Unit Cost Estimate	Total Cost
	Tower Shaft				
	Stairs and Handrails **(Total Building)**	133	Rise	$575.00	$76,475.00
	Elevator (7 stop - Machine-Room-Less Traction Elevator)	1	EA	$325,000.00	$325,000.00
	Drilled Pier Foundation (10-20" dia Piers - 20'-0" long)	200	LF	$175.00	$35,000.00
	Fire Wall Stud Framing, Drywall & Texture	1,400	SF	$15.00	$21,000.00
	Exterior 8" Concrete Masonry Unit Walls	6,240	SF	$25.00	$156,000.00
	Interior 6" Concrete Masonry Unit Walls	1,560	SF	$20.00	$31,200.00
	Cast-in-place Concrete Floors	2,884	SF	$35.00	$100,940.00
	Cab Framing & Exterior Finishes	484	SF	$450.00	$217,800.00
	Roof (insulation, hatch, curb, cant.strips & flashings)	1	LS	$35,000.00	$35,000.00
	Fireproofing (Total Building)	1	LS	$20,000.00	$20,000.00
	Cab Glazing	1	EA	$275,000.00	$275,000.00
	Cab Window Shades	1	EA	$30,000.00	$30,000.00
	Millwork (Cab Consoles, Desk)	1	LS	$35,000.00	$35,000.00
	Doors (90 minute B Label)	20	EA	$1,200.00	$24,000.00
	Fire Rated Access Panel	14	EA	$850.00	$11,900.00
	Carpet (ESD) @ Control Cab & Cab Stairway)	70	SY	$60.00	$4,200.00
	Carpet (26 oz Nylon)	170	SY	$35.00	$5,950.00
	Tile & Base	300	SF	$25.00	$7,500.00
	Drop Ceiling	3,284	SF	$10.00	$32,840.00
	Painting (interior walls, doors, railings & complete)*(Total Building)*	3,284	SF	$15.00	$49,260.00
	Fire Suppression - Standpipe	3,284	SF	$45.00	$147,780.00
	Plumbing	3,284	SF	$50.00	$164,200.00
	HVAC	3,284	SF	$45.00	$147,780.00
	Electrical	3,284	SF	$85.00	$279,140.00
	Interior Signage	1	EA	$2,000.00	$2,000.00
	Security System	1	EA	$15,000.00	$15,000.00
	Interior Furnishing Allowance (refrigerator, microwave, etc.)	1	EA	$5,000.00	$5,000.00
	Sub-Total				$1,853,490.00
	Contractor Fees and Contingency				
	Contractor - General Conditions, Overhead & Profit (15%)	1	EA	$279,114.75	$279,114.75
	Contingency 15%	1	EA	$279,114.75	$279,114.75
	Sub-Total				$558,229.50
	Total Building	**$736.60**	**/SF**		**$2,418,994.50**

	Special Equipment				
	Generator & Auto transfer switch	1	LS	$39,000.00	$39,000.00
	Tower Equipment	1	LS	$325,000.00	$325,000.00
	FAA Lease Equipment (shout & ring down lines - Estimate)	1	LS	$25,000.00	$25,000.00
	Total Special Equipment				**$389,000.00**

	Description	Estimated Quantity	Units	Unit Cost Estimate	Total Cost
Site Work					
	Excavation	75	CY	$12.00	$900.00
	Fill	115	CY	$15.00	$1,725.00
	Finish Grading	55	SY	$8.00	$440.00
	Clear, Grub and Tree Removal	1.00	Acre	$3,000.00	$3,000.00
	Erosion Control	350	LF	$5.00	$1,750.00
	Electrical Service	150	LF	$45.00	$6,750.00
	50,000 Gallon Water Tank w/Foundation & Piping	1	LS	$125,000.00	$125,000.00
	Septic System	1	LS	$45,000.00	$45,000.00
	Fire Hydrant	1	EA	$5,500.00	$5,500.00
	Communication: Telephone - Commercial	1	EA	$25,000.00	$25,000.00
	Airfield Control Connectivity (Wireless)	1	LS	$7,500.00	$7,500.00
	Concrete Entry	80	SF	$10.00	$800.00
	Sidewalks	500	SF	$12.00	$6,000.00
	Paved 18' Access Road (6" Class 6 Road Base)	60	CY	$25.00	$1,500.00
	Paved 18' Access Road 4" Asphalt	300	SY	$18.00	$5,400.00
	Base Coarse - 6" (Class 6) (Parking Lot)	35	CY	$19.00	$665.00
	Paving (4" Asphalt - Highway Mix Design) (Parking Lot)	200	SY	$75.00	$15,000.00
	Parking Stops	8	Ea	$175.00	$1,400.00
	Signage & Striping	1	LS	$2,500.00	$2,500.00
	Seeding & Re-vegetation (Budget)	600	SF	$0.45	$270.00
	Security Fence (8' Chain Link)(Includes Gate)	500	LF	$45.00	$22,500.00
	Contractor - General Conditions, Overhead & Profit	1	LS	$41,790.00	$41,790.00
	Miscellaneous (Contingency 15%)	1	LS	$41,790.00	$41,790.00
	Total Site Work				**$362,180.00**

	ESTIMATED PROJECT CONSTRUCTION COST	**$965.34 /SF**		**$3,170,174.50**

Grand Canyon West Airport

ATCT Cost Estimate

ATCT Budgetary Cost Estimate - Site #4

35' AGL Cab Eye Height

Revision #1

July 12, 2012

Area	Total	
Base Building (Excluding Shaft)	*400*	SF
First Level Shaft	*400*	SF
Total First Level Area	**800**	SF
2nd Level (Shaft)	400	SF
Junction Level (Shaft)	*400*	SF
Control Cab	*484*	SF
Total Area (Shaft & Base Building)	**2,084**	**SF**

DIVISION No.	Description	Estimated Quantity	Units	Unit Cost Estimate	Total Cost
ATCT Construction					
Base Building					
	Select Fill	30	CY	$50.00	$1,500.00
	Foundation - Grade Walls (Includes 3'-0" Walls with 3'-0"x8" Footings)	8	CY	$300.00	$2,400.00
	Concrete Floor (4") (Includes Shaft)	10	CY	$300.00	$3,000.00
	Exterior Walls (Finished)	600	SF	$20.00	$12,000.00
	Fire Wall Stud Framing, Drywall & Texture	480	SF	$18.00	$8,640.00
	Furring Wall w/Insulation @Exterior Wall	600	SF	$12.00	$7,200.00
	Standing seam roof	530	SF	$25.00	$13,250.00
	Drop Ceiling	400	SF	$12.00	$4,800.00
	Carpet (ESD)	0	SY	$60.00	$0.00
	Carpet (26 oz Nylon)	45	SY	$35.00	$1,575.00
	Tile & Base	0	SF	$20.00	$0.00
	Doors (90 minute B Label)	6	EA	$1,200.00	$7,200.00
	Fire Rated Access Panel	0	EA	$1,000.00	$0.00
	VE - Windows (Insulated glass)	6	EA	$850.00	$5,100.00
	Plumbing (Including bathroom fixtures)	400	SF	$35.00	$14,000.00
	Fire Protection (Standpipe)	30	LF	$55.00	$1,650.00
	Fire Pump	0	LS	$150,000.00	$0.00
	HVAC	400	SF	$45.00	$18,000.00
	Electrical	400	SF	$65.00	$26,000.00
	Telephone System	1	LS	$5,000.00	$5,000.00
	Sub Total	$62.29	/SF		$129,815.00

	Description	Estimated Quantity	Units	Unit Cost Estimate	Total Cost
	Tower Shaft				
	Stairs and Handrails **(Total Building)**	52	Rise	$575.00	$29,900.00
	Elevator (3 stop - Machine-Room-Less Traction Elevator)	1	EA	$225,000.00	$225,000.00
	Foundation - Grade Walls (Includes 4'-0" Walls with 3'-0"x8" Footings)	10	CY	$325.00	$3,250.00
	Fire Wall Stud Framing, Drywall & Texture	700	SF	$15.00	$10,500.00
	Exterior 8" Concrete Masonry Unit Walls	2,400	SF	$25.00	$60,000.00
	Interior 6" Concrete Masonry Unit Walls	600	SF	$20.00	$12,000.00
	Cast-in-place Concrete Floors	884	SF	$35.00	$30,940.00
	Cab Framing & Exterior Finishes	484	SF	$450.00	$217,800.00
	Roof (insulation, hatch, curb, cant.strips & flashings)	1	LS	$35,000.00	$35,000.00
	Fireproofing (Total Building)	1	LS	$20,000.00	$20,000.00
	Cab Glazing	1	EA	$275,000.00	$275,000.00
	Cab Window Shades	1	EA	$30,000.00	$30,000.00
	Millwork (Cab Consoles, Desk)	1	LS	$35,000.00	$35,000.00
	Doors (90 minute B Label)	8	EA	$1,200.00	$9,600.00
	Fire Rated Access Panel	6	EA	$850.00	$5,100.00
	Carpet (ESD) @ Control Cab & Cab Stairway)	70	SY	$60.00	$4,200.00
	Carpet (26 oz Nylon)	90	SY	$35.00	$3,150.00
	Tile & Base	300	SF	$25.00	$7,500.00
	Drop Ceiling	1,284	SF	$10.00	$12,840.00
	Painting (interior walls, doors, railings & complete)*(Total Building)*	1,284	SF	$15.00	$19,260.00
	Fire Suppression - Standpipe	1,284	SF	$45.00	$57,780.00
	Plumbing	1,284	SF	$50.00	$64,200.00
	HVAC	1,284	SF	$45.00	$57,780.00
	Electrical	1,284	SF	$85.00	$109,140.00
	Interior Signage	1	EA	$2,000.00	$2,000.00
	Security System	1	EA	$15,000.00	$15,000.00
	Interior Furnishing Allowance (refrigerator, microwave, etc.)	1	EA	$5,000.00	$5,000.00
	Sub-Total				$1,102,040.00
	Contractor Fees and Contingency				
	Contractor - General Conditions, Overhead & Profit (15%)	1	EA	$184,778.25	$184,778.25
	Contingency 15%	1	EA	$184,778.25	$184,778.25
	Sub-Total				$369,556.50
	Total Building	**$768.43**	**/SF**		**$1,601,411.50**

	Special Equipment				
	Generator & Auto transfer switch	1	LS	$39,000.00	$39,000.00
	Tower Equipment	1	LS	$325,000.00	$325,000.00
	FAA Lease Equipment (shout & ring down lines - Estimate)	1	LS	$25,000.00	$25,000.00
	Total Special Equipment				**$389,000.00**

	Description	Estimated Quantity	Units	Unit Cost Estimate	Total Cost
Site Work					
	Excavation	75	CY	$12.00	$900.00
	Fill	115	CY	$15.00	$1,725.00
	Finish Grading	55	SY	$8.00	$440.00
	Clear, Grub and Tree Removal	1.00	Acre	$3,000.00	$3,000.00
	Erosion Control	350	LF	$5.00	$1,750.00
	Electrical Service	150	LF	$45.00	$6,750.00
	5,000 Gallon Water Tank w/Foundation & Piping	1	LS	$25,000.00	$25,000.00
	Septic System	1	LS	$45,000.00	$45,000.00
	Fire Hydrant	1	EA	$5,500.00	$5,500.00
	Communication: Telephone - Commercial	1	EA	$25,000.00	$25,000.00
	Airfield Control Connectivity (Wireless)	1	LS	$7,500.00	$7,500.00
	Concrete Entry	80	SF	$10.00	$800.00
	Sidewalks	500	SF	$12.00	$6,000.00
	Paved 18' Access Road (6" Class 6 Road Base)	60	CY	$25.00	$1,500.00
	Paved 18' Access Road 4" Asphalt	300	SY	$18.00	$5,400.00
	Base Coarse - 6" (Class 6) (Parking Lot)	35	CY	$19.00	$665.00
	Paving (4" Asphalt - Highway Mix Design) (Parking Lot)	200	SY	$75.00	$15,000.00
	Parking Stops	8	Ea	$175.00	$1,400.00
	Signage & Striping	1	LS	$2,500.00	$2,500.00
	Seeding & Re-vegetation (Budget)	1,200	SF	$0.45	$540.00
	Security Fence (8' Chain Link)(Includes Gate)	500	LF	$45.00	$22,500.00
	Contractor - General Conditions, Overhead & Profit	1	LS	$26,830.50	$26,830.50
	Miscellaneous (Contingency 15%)	1	LS	$26,830.50	$26,830.50
	Total Site Work				**$232,531.00**

	ESTIMATED PROJECT CONSTRUCTION COST	**$1,066.67 /SF**		**$2,222,942.50**

Grand Canyon West Airport

ATCT Cost Estimate

ATCT Budgetary Cost Estimate - Site #5

23' AGL Cab Eye Height

Revision #1

July 12, 2012

Area	Total	
Base Building (Excluding Shaft)	*800*	SF
First Level Shaft	*400*	SF
Total First Level Area	**1,200**	SF
Junction Level (Shaft)	*400*	SF
Control Cab	*484*	SF
Total Area (Shaft & Base Building)	**2,084**	**SF**

DIVISION No.	Description	Estimated Quantity	Units	Unit Cost Estimate	Total Cost
ATCT Construction					
Base Building					
	Select Fill	60	CY	$50.00	$3,000.00
	Foundation - Grade Walls (Includes 3'-0" Walls with 3'-0"x8" Footings)	16	CY	$300.00	$4,800.00
	Concrete Floor (4") (Includes Shaft)	16	CY	$300.00	$4,800.00
	Exterior Walls (Finished)	860	SF	$20.00	$17,200.00
	Fire Wall Stud Framing, Drywall & Texture	540	SF	$18.00	$9,720.00
	Furring Wall w/Insulation @Exterior Wall	860	SF	$12.00	$10,320.00
	Standing seam roof	970	SF	$25.00	$24,250.00
	Drop Ceiling	860	SF	$12.00	$10,320.00
	Carpet (ESD)	60	SY	$60.00	$3,600.00
	Carpet (26 oz Nylon)	35	SY	$35.00	$1,225.00
	Tile & Base	300	SF	$20.00	$6,000.00
	Doors (90 minute B Label)	10	EA	$1,200.00	$12,000.00
	Fire Rated Access Panel	0	EA	$1,000.00	$0.00
	VE - Windows (Insulated glass)	10	EA	$850.00	$8,500.00
	Plumbing (Including bathroom fixtures)	400	SF	$35.00	$14,000.00
	Fire Protection (Standpipe)	30	LF	$55.00	$1,650.00
	Fire Pump	0	LS	$150,000.00	$0.00
	HVAC	400	SF	$45.00	$18,000.00
	Electrical	400	SF	$65.00	$26,000.00
	Telephone System	1	LS	$5,000.00	$5,000.00
	Sub Total	$85.12	/SF		$177,385.00

	Description	Estimated Quantity	Units	Unit Cost Estimate	Total Cost
Tower Shaft					
	Stairs and Handrails **(Total Building)**	31	Rise	$575.00	$17,825.00
	Elevator (2 stop - Machine-Room-Less Traction Elevator)	1	EA	$150,000.00	$150,000.00
	Foundation - Grade Walls (Includes 4'-0" Walls with 3'-0"x8" Footings)	10	CY	$325.00	$3,250.00
	Fire Wall Stud Framing, Drywall & Texture	500	SF	$15.00	$7,500.00
	Exterior 8" Concrete Masonry Unit Walls	1,500	SF	$25.00	$37,500.00
	Interior 6" Concrete Masonry Unit Walls	400	SF	$20.00	$8,000.00
	Cast-in-place Concrete Floors	484	SF	$35.00	$16,940.00
	Cab Framing & Exterior Finishes	484	SF	$450.00	$217,800.00
	Roof (insulation, hatch, curb, cant.strips & flashings)	1	LS	$35,000.00	$35,000.00
	Fireproofing (Total Building)	1	LS	$20,000.00	$20,000.00
	Cab Glazing	1	EA	$275,000.00	$275,000.00
	Cab Window Shades	1	EA	$30,000.00	$30,000.00
	Millwork (Cab Consoles, Desk)	1	LS	$35,000.00	$35,000.00
	Doors (90 minute B Label)	4	EA	$1,200.00	$4,800.00
	Fire Rated Access Panel	6	EA	$850.00	$5,100.00
	Carpet (ESD) @ Control Cab & Cab Stairway)	70	SY	$60.00	$4,200.00
	Carpet (26 oz Nylon)	45	SY	$35.00	$1,575.00
	Tile & Base	300	SF	$25.00	$7,500.00
	Drop Ceiling	1,684	SF	$10.00	$16,840.00
	Painting (interior walls, doors, railings & complete)*(Total Building)*	1,684	SF	$15.00	$25,260.00
	Fire Suppression - Standpipe	1,684	SF	$45.00	$75,780.00
	Plumbing	1,684	SF	$50.00	$84,200.00
	HVAC	1,684	SF	$45.00	$75,780.00
	Electrical	1,684	SF	$85.00	$143,140.00
	Interior Signage	1	EA	$2,000.00	$2,000.00
	Security System	1	EA	$15,000.00	$15,000.00
	Interior Furnishing Allowance (refrigerator, microwave, etc.)	1	EA	$5,000.00	$5,000.00
	Sub-Total				$1,152,165.00
Contractor Fees and Contingency					
	Contractor - General Conditions, Overhead & Profit (15%)	1	EA	$199,432.50	$199,432.50
	Contingency 15%	1	EA	$199,432.50	$199,432.50
	Sub-Total				$398,865.00
	Total Building	**$829.37**	**/SF**		**$1,728,415.00**

	Description	Estimated Quantity	Units	Unit Cost Estimate	Total Cost
Special Equipment					
	Generator & Auto transfer switch	1	LS	$39,000.00	$39,000.00
	Tower Equipment	1	LS	$325,000.00	$325,000.00
	FAA Lease Equipment (shout & ring down lines - Estimate)	1	LS	$25,000.00	$25,000.00
	Total Special Equipment				**$389,000.00**

	Description	Estimated Quantity	Units	Unit Cost Estimate	Total Cost
Site Work					
	Excavation	75	CY	$12.00	$900.00
	Fill	115	CY	$15.00	$1,725.00
	Finish Grading	55	SY	$8.00	$440.00
	Clear, Grub and Tree Removal	1.00	Acre	$3,000.00	$3,000.00
	Erosion Control	350	LF	$5.00	$1,750.00
	Electrical Service	150	LF	$45.00	$6,750.00
	6" Waterline	1	LF	$35.00	$35.00
	Septic System	1	LS	$45,000.00	$45,000.00
	Fire Hydrant	1	EA	$5,500.00	$5,500.00
	Communication: Telephone - Commercial	1	EA	$25,000.00	$25,000.00
	Airfield Control Connectivity (Wireless)	1	LS	$7,500.00	$7,500.00
	Concrete Entry	80	SF	$10.00	$800.00
	Sidewalks	500	SF	$12.00	$6,000.00
	Paved 18' Access Road (6" Class 6 Road Base)	60	CY	$25.00	$1,500.00
	Paved 18' Access Road 4" Asphalt	300	SY	$18.00	$5,400.00
	Base Coarse - 6" (Class 6) (Parking Lot)	35	CY	$19.00	$665.00
	Paving (4" Asphalt - Highway Mix Design) (Parking Lot)	200	SY	$75.00	$15,000.00
	Parking Stops	8	Ea	$175.00	$1,400.00
	Signage & Striping	1	LS	$2,500.00	$2,500.00
	Seeding & Re-vegetation (Budget)	1,800	SF	$0.45	$810.00
	Security Fence (8' Chain Link)(Includes Gate)	500	LF	$45.00	$22,500.00
	Contractor - General Conditions, Overhead & Profit	1	LS	$23,126.25	$23,126.25
	Miscellaneous (Contingency 15%)	1	LS	$23,126.25	$23,126.25
	Total Site Work				**$200,427.50**

	ESTIMATED PROJECT CONSTRUCTION COST	**$1,112.21 /SF**		**$2,317,842.50**

Appendix C

Supporting Documents

RUNWAY DATA

	EXISTING (E) RW 17/35	ULT (U) RW 17/35
APPROACH CATEGORY	NPI>UTILITY	NPI>UTILITY
APPROACH VILIBILITY MINIMUMS	1 MILE	1 MILE
FAR PART 77 APPROACH SLOPE RW 17 / RW 35	20:1 / 20:1	34:1 / 34:1
RUNWAY LENGTH	5,000'	6,500'
RUNWAY WIDTH	75'	100'
RUNWAY & TAXIWAY PAVEMENT	ASPHALT	ASPHALT
PAVEMENT STRENGTH (LBS)	30,000	60,000
RUNWAY LIGHTING	MIRL	MIRL
RUNWAY MARKING RW 17 / RW 35	NPI / NPI	NPI / NPI
WIND COVERAGE 10.5 kt. (12 MPH) / 13 kt. (15 MPH)	92.91% / 96.19%	92.91% / 96.19%
% EFFECTIVE GRADIENT	1.10%	.95%
% MAXIMUM GRADE	1.30%	1.30%
LINE OF SITE REQUIREMENTS MET	YES	YES
VISUAL AIDS	BEACON/PAPI-4/REIL	BEACON/PAPI-4/REIL
NAVIGATIONAL AIDS	GPS	GPS
AIRPORT REFERENCE CODE (ARC)	B-II	C-II
AIRCRAFT	DORNIER 328	CRJ 200 ER
APPROACH SPEED	75 KTS.	148 KTS
WINGSPAN	68.8 FT.	69.67 FT.
MAX. CERTIFIED TAKEOFF WEIGHT	30,840 LBS.	51,000 LBS.
UNDER CARRIAGE WIDTH	23'	37'
RUNWAY SAFETY AREA: WIDTH	150'	500'
LENGTH BEYOND RWY ENDS	300'	1,000'
RUNWAY OBJECT FREE AREA: WIDTH	500'	800'
LENGTH BEYOND RWY ENDS	300'	1,000'
OBSTACLE FREE ZONE: WIDTH	400'	400'
LENGTH BEYOND RWY ENDS	200' NO OFZ PENETRATIONS	200' NO OFZ PENETRATIONS
RPZ DIMENSIONS RW 17	500' X 700' X1,000'	500' X 1,010' X 1,700'
RW 35	500' X 700' X1,000'	500' X 1,010' X 1,700'
APPROACH SURFACE DIMENSIONS RW 17	500' X 3,500' X 10,000'	500' X 3,500' X 10,000'
RW 35	500' X 3,500' X 10,000'	500' X 3,500' X 10,000'
RUNWAY ELEVATIONS (NAVD 88)	RW 17 RW 35	RW 17 RW 35
RUNWAY END	4758.2 4813.4	4751.7 4813.4
TOUCHDOWN ZONE	4760.83 4813.4	4752.93 4813.4
HIGH POINT	4813.4	4813.4
LOW POINT	4758.2	4751.7

LEGEND

EXISTING	FUTURE/ ULTIMATE	DESCRIPTION	EXISTING	FUTURE/ ULTIMATE	DESCRIPTION
		AIRFIELD DEVELOPMENT (ASPHALT / CONCRETE)		0000 0000	THRESHOLD LIGHTS
		STRUCTURE/FACILITIES (BUILDING)			REIL
		GRAVEL, CHIPSEAL			VASI/PAPI
		AIRPORT PROPERTY LINE (APL)			AIRPORT REFERENCE POINT (ARP)
RSA(E)	RSA(U)	RUNWAY SAFETY AREA (RSA)			AIRPORT BEACON
OFZ(E)	OFZ(U)	OBSTACLE FREE ZONE (OFZ)			WINDCONE & SEGMENTED CIRCLE
ROFA(E)	ROFA(U)	RUNWAY OBJECT FREE AREA (ROFA)		N/A	SECTION CORNER
RPZ(E)	RPZ(U)	RUNWAY PROTECTION ZONE (RPZ)			AWOS
RVZ(E)	RVZ(U)	RUNWAY VIZIBILITY ZONE (RVZ)		N/A	SURVEY CONTROL POINT
BRL(E)	(BRL(U)	BUILDING RESTRICTION LINE (BRL)			MARKINGS
TSA(E)	TSA(U)	TAXIWAY SAFETY AREA (TSA)	X X	XX XX	CHAIN LINK FENCE
TOFA(E)	TOFA(U)	TAXIWAY OBJECT FREE AREA (TOFA)			WIND CONE
X X	XX XX	FENCING	4760	N/A	GROUND CONTOUR
					ROAD

AIRPORT DATA

ITEM	EXISTING	ULTIMATE
AIRPORT ELEVATION (NAVD 88)	4813.4'	4813.4'
AIRPORT REFERENCE POINT (NAD '83) LATITUDE NORTH / LONGITUDE WEST	35° 59' 10.01" / 113° 49' 00.92"	35° 59' 17.39" / 113° 49' 00.06"
AIRPORT & TERMINAL NAVAIDS	GPS	GPS
MEAN MAXIMUM TEMPERATURE	97.5° F JULY	97.5° F JULY
AIRPORT REFERENCE CODE	B-II	C-II
DESIGN AIRCRAFT	DORNIER 328 JET	CRJ 200 ER
WINGSPAN	68.8 FT.	69.67 FT.
APPROACH SPEED	72 KTS.	148 KTS.
WEIGHT	35,000 LBS.	51,000 LBS.
UNDER CARRIAGE WIDTH	23.05'	37.42'
GPS AT AIRPORT	YES	YES
AIRPORT IDENTIFIER	1G4	1G4
AIRPORT CATEGORY	PRIM. COMM. SERV.	PRIM. COMM. SERV.

SURVEY WAS BASED ON NGS MONUMENT "TEA" USING PUBLISHED DATA ON THE NAD 83 AND NAVD 88 DATUMS. THE SURVEY OF THE ORIGINAL RUNWAY, NOW OBLITERATED, WAS COMPLETED BY RON WERNER, RLS, ON AUGUST 26, 2001. A COPY OF THE SURVEY INFORMATION IS AVAILABLE UPON REQUEST. ELEVATION INFORMATION FOR TEMPORARY, FUTURE, AND ULTIMATE RUNWAY ENDS IS FROM ARMSTRONG CONSTULTANTS DESIGN AND CONSTRUCTON DRAWINGS.

THE AIRPORT IS LOCATED IN TOWNSHIP 30 NORTH, RANGE 14 WEST, OF THE GILA AND SALT RIVER BASE AND MERIDIAN, MOHAVE COUNTY, ARIZONA.

(E)(F)(U) NO THRESHOLD SITING SURFACE OBJECT PENETRATION.

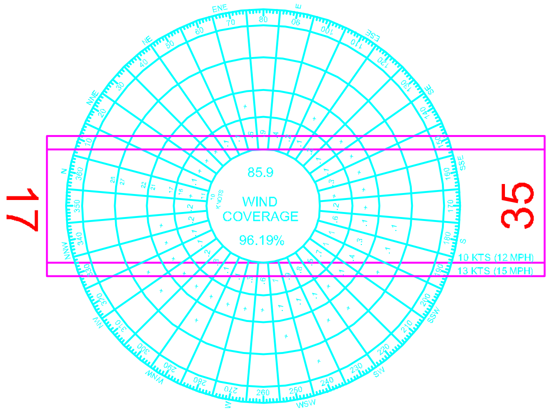
AIRPORT FACILITIES LIST

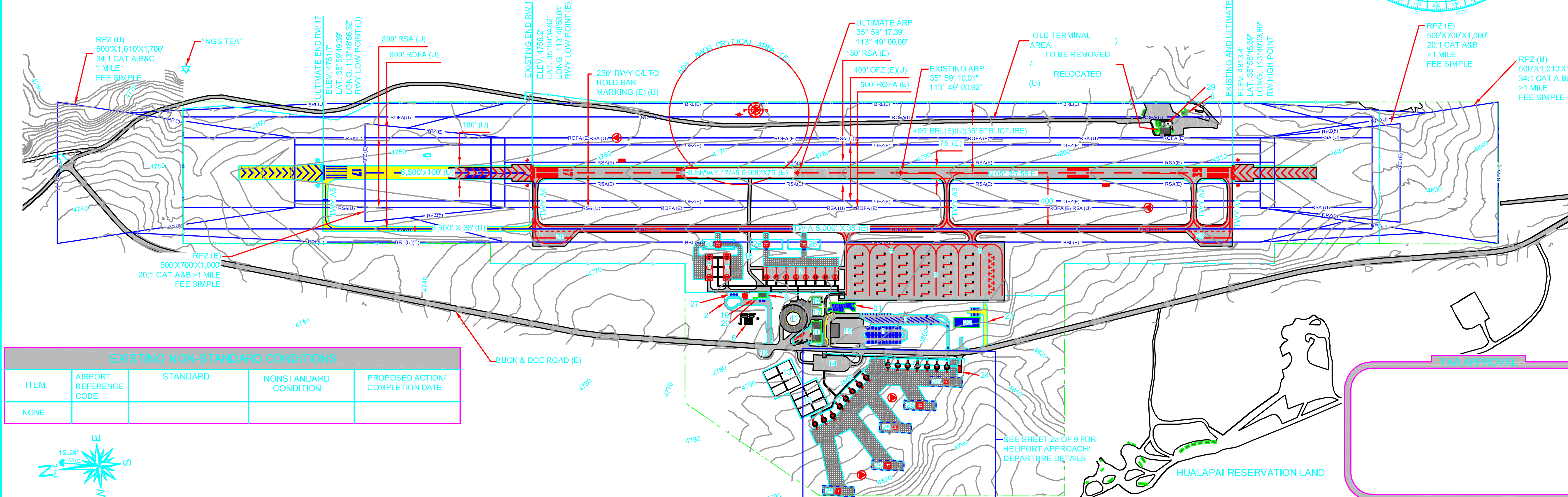
NO.	EXIST.	FUTURE	FACILITY DESCRIPTION	TOP ELEV. (MSL)	NO.	EXIST.	FUTURE	FACILITY DESCRIPTION	TOP ELEV. (MSL)
1	X		AUTO PARKING	-	23		X	SERVICE ROAD	-
2	X		SERVICE ROAD	-	24	X		FUEL FARM	-
3	X		MOTOR COACH PARKING	-	25	X		HELIPORT TLOF	-
4	X		AIRCRAFT PARKING	-	26	X		WARMUP PADS	-
5	X		AIRCRAFT APRON EXPANSION	-	27		X	FUEL FARM	-
6	X		SEWAGE TREATMENT PLANT	-	28	X		HELIPORT TLOF	-
7	X		HELICOPTER PARKING	-	29	X		OLD TERMINAL AREA BLDS	-
8	X		FUEL FARM	-					
9	X		ARFF BUILDING	-					
10	X		TEMP. TERMINAL BUILDING	-					
11	X		MOTOR COACH TURNAROUND	-					
12	X		TURN AROUND	-					
13	X		LEACH FIELD	-					
14	X		RV PARKING	-					
15	X		F.I.T. PARKING	-					
16	X		ARFF ACCESS ROAD	-					
17	X		FLIGHT OPS BUILDING	-					
18	X		RETAIL/DELI BUILDING	-					
19	X		ELECTRICAL VAULT	-					
20	X		GENERATOR	-					
21		X	TERMINAL BUILDING	-					
22		X	G.A. TERMINAL BUILDING	-					

ALL WEATHER WIND ROSE

COLLECTED AT NELSON, ARIZONA, LOCATED 7 MILES EAST.
JANUARY 1994 - SEPTEMBER 1996
NOTE: AT LEAST 10 YEARS OF WIND DATA NEEDS TO BE COLLECTED TO COMPLY WITH FAA STANDARDS

RUNWAY 17/35 CROSSWIND COVERGE	
10.5 KNOT (12MHP)	92.91%
13.0 KNOT (15MPH)	96.19%





EXISTING NON-STANDARD CONDITIONS

ITEM	AIRPORT REFERENCE CODE	STANDARD	NONSTANDARD CONDITION	PROPOSED ACTION/ COMPLETION DATE
NONE				

MAGNETIC NORTH SOURCE:
NOAA GEOPHYSICAL DATA CENTER
01-15-07 MAGNETICE DECLINATION = 12.24° EAST RATE OF CHANGE = 0°06' WEST / YEAR

400 0 400 800
SCALE IN FEET

BASE MAP AND CONTOURS SOURCE:
OLYMPUS AERIAL SURVEYS INC.
AUGUST 27, 2001 AND ARMSTRONG CONSULTANTS DESIGN AND CONSTRUCTION PLANS THROUGH 2010.

RUNWAY END COORDINATES NAD'83

RUNWAY		EXISTING	ULTIMATE
17	LATITUDE	35°59'34.62"	35°59'49.39"
	LONGITUDE	113°48'58.04"	113°48'56.32"
35	LATITUDE	35°58'45.39"	35°58'45.39"
	LONGITUDE	113°49'03.80"	113°49'03.80"

FAA APPROVAL

SPONSOR APPROVAL

APPROVED BY:

Date

CEO, GRAND CANYON RESORT CORPORATION

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GRAND CANYON WEST AIRPORT
HUALAPAI INDIAN RESERVATION
PEACH SPRINGS, ARIZONA

AIRPORT LAYOUT PLANS

No.	Project No.	Date	Revision / Description	File	Drwn.	Chkd.	Apprvd.
3	095923	06.27.11	AS-BUILT - PERMANENT RW	5923502A	JOS	DPS	DAC
2	095923	06.12.10	AS-BUILT - TEMP. RUNWAY	5923502	JOS	DPS	DAC
1	065772	03.13.07	REVALIDATION	5772502	SLST	DPS	DAC
0	015566	09.16.03	ALP UPDATE	5666502	NOP	DAC	EAA

AIRPORT LAYOUT PLAN

Sheet: 2 of: 9

APPENDIX

E

GLOSSARY OF TERMS

GRAND CANYON WEST AIRPORT
AIRPORT MASTER PLAN UPDATE

ARMSTRONG CONSULTANTS, INC.
AIRPORT ENGINEERING AND PLANNING

GLOSSARY OF TERMS

Above Ground Level (AGL)	A height above ground as opposed to MSL (height above Mean Sea Level).
Advisory Circular (AC)	Publications issued by the FAA to provide a systematic means of providing non-regulator guidance and information in a variety of subject areas.
Airport Improvement Program (AIP)	The AIP of the Airport and Airways Improvement Act of 1982 as amended. Under this program, the FAA provide funding assistance for the design and development of airports and airport facilities.
Aircraft Mix	The number of aircraft movements categorized by capacity group or operational group and specified as a percentage of the total aircraft movements.
Aircraft Operation	An aircraft takeoff or landing.
Airport	An area of land or water used or intended to be used for landing and takeoff of aircraft, includes buildings and facilities, if any.
Airport Elevation	The highest point of an airport's useable runways, measured in feet above mean sea level.
Airport Hazard	Any structural or natural object located on or near a public airport, or any use of land near such airport, that obstructs the airspace required for flight of aircraft on approach, landing, takeoff, departure, or taxiing at the airport.
Airport Land Use Regulations	Are designed to preserve existing and/or establish new compatible land uses around airports, to allow land use not associated with high population concentration, to minimize exposure of residential uses to critical aircraft noise areas, to avoid danger from aircraft crashes, to discourage traffic congestion and encourage compatibility with non-motorized traffic from development around airports, to discourage expansion of demand for governmental services beyond reasonable capacity to provide services and regulate the area around the airport to minimize danger to public health, safety, or property from the operation of the airport, to prevent obstruction to air navigation and to aid in realizing the policies of a County Comprehensive Plan and Airport Master Plan.
Airport Layout Plan (ALP)	A graphic presentation, to scale, of existing and proposed airport facilities, their location on the airport and the pertinent applicable standards. To be eligible for AIP funding assistance, an airport must have an FAA-approved ALP.

Airport Master Record, Form 5010	The official FAA document, which lists basic airport data for reference and inspection purposes.
Airport Reference Code (ARC)	The ARC is a coding system used to relate airport design criteria to the operational and physical characteristics of the airplanes intended to operate at the airport.
Airport Reference Point (ARP)	The latitude and longitude of the approximate center of the airport.
Airspace	Space above the ground in which aircraft travel; divided into corridors, routes and restricted zones.
Air Traffic	Aircraft operating in the air or on an airport surface, excluding loading ramps and parking areas.
Approach Surface	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 each runway based upon the type of approach available or planned for that runway end.
Automated Weather Observing System (AWOS)	This equipment automatically gathers weather data from various locations on the airport and transmits the information directly to pilots by means of computer generated voice messages over a discrete frequency.
Based aircraft	An aircraft permanently stationed at an airport.
Building Restriction Line	A line, which identifies suitable building area locations on airports.
Ceiling	The height above the earth's surface of the lowest layer of clouds or other phenomena which obscure vision.
Conical Surfaces	A surface extending outward and upward form the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet.
Controlled Airspace	Airspace in which some or all aircraft may be subject to air traffic control to promote safe and expeditious flow of air traffic.
Critical/Design Aircraft	In airport design, the aircraft which controls one or more design items such as runway length, pavement strength, lateral separation, etc., for a particular airport. The same aircraft need not be critical for all design items.

Day Night Level (DNL)	24-hour average sound level, including a 10 decibel penalty for sound occurring between 10:00 PM and 7:00 AM
Decibel	Measuring unit for sound based on the pressure level.
Design Type	The design type classification for an airport refers to the type of runway that the airport has based upon runway dimensions and pavement strength.
Federal Aviation Administration (FAA)	The federal agency responsible for the safety and efficiency of the national airspace and air transportation system.
FAR Part 77	A definition of the protected airspace required for the safe navigation of aircraft.
Fixed Base Operator (FBO)	An individual or company located at an airport and providing commercial general aviation services.
Fuel Flowage Fees	A fee charged by the airport owner based upon the gallons of fuel either delivered to the airport or pump at the airport.
General Aviation (GA)	All aviation activity in the United States, which is neither military nor conducted by major, national or regional airlines.
Glider	A heavier-than-air aircraft that is supported in flight by the dynamic reaction of the air against its lifting surfaces and whose free flight does not depend principally on an engine (FAR Part 1),
Global Positioning System (GPS)	The global positioning system is a space based navigation system, which has the capability to provide highly accurate three-dimensional position, velocity and time to an infinite number of equipped users anywhere on or near the Earth. The typical GPS integrated system will provide: position, velocity, time, altitude, groundspeed and ground track error, heading and variation. The GPS measures distance, which it uses to fix position, by timing a radio signal that starts at the satellite and ends at the GPS receiver. The signal carries with it, data that discloses satellite position and time of transmission and synchronizes the aircraft GPS system with satellite clocks.
Hazard to Air Navigation	An object which, as a result of an aeronautical study, the FAA determines will have a substantial adverse effect upon the safe and efficient use of navigable airspace by aircraft, operation of air navigation facilities or existing or potential airport capacity.
Horizontal Surface	A horizontal plane 150 feet above the established airport elevation, the perimeter which is constructed by swinging arcs of specified radii form the center of each end of the primary surface of each runway of each airport and connecting the adjacent arcs by lines tangent to those arcs.

Imaginary Surfaces	Surfaces established in relation to the end of each runway or designated takeoff and landing areas, as defined in paragraphs 77.25, 77.28 and 77.29 of FAR Part 77, *Objects Affecting Navigable Airspace*. Such surfaces include the approach, horizontal, conical, transitional, primary and other surfaces.
Itinerant Operations	All operations at an airport, which are not local operations.
Jet Noise	The noise generated externally to a jet engine in the turbulent jet exhaust.
Knots	Nautical miles per hour, equal 1.15 statute miles per hour.
Large Airplane	An airplane of more than 12,500 pounds maximum certified takeoff weight.
Local Operations	Operations by aircraft flying in the traffic pattern or within sight of the control tower, aircraft known to be arriving or departing from flight in local practice areas, or aircraft executing practice instrument approaches at the airport.
Location Identifier	A three-letter or other code, suggesting where practicable, the location name that it represents.
Maneuvering Area	That part of an airport to be used for the takeoff and landing of aircraft and for the movement of aircraft associated with takeoff and landing, excluding aprons.
Master Plan	A planning document prepared for an airport, which outlines directions and developments in detail for 5 years and less specifically for 20 years. The primary component of which is the Airport Layout Plan.
Mean/Maximum Temperature	The average of all the maximum temperatures usually for a given period of time.
Mean Sea Level (MSL)	Height above sea level.
Medium Intensity Runway Lights (MIRL)	For use on VFR runways or runway showing a nonprecision instrument flight rule (IFR) procedure for either circling or straight-in approach.
Minimum Altitude	That designated altitude below which an IFR pilot is not allowed to fly unless arriving or departing an airport or for specific allowable flight operations.

National Airspace System	The common network of United States airspace, navigation aids, communications facilities and equipment, air traffic control equipment and facilities, aeronautical charts and information, rules, regulations, procedures, technical information and FAA manpower and material.
National Plan of Integrated Airport Systems (NPIAS)	A plan prepared annually by the FAA which identifies, for the public, the composition of a national system of airports together with the airport development necessary to anticipate and meet the present and future needs of civil aeronautics, to meet requirements in support of the national defense and to meet the special needs of the Postal Service. The plan includes both new and qualitative improvements to existing airports to increase their capacity, safety, technological capability, etc.
NAVAID	A ground based visual or electronic device used to provide course or altitude information to pilots.
Noise	Defined subjectively as unwanted sound. The measurement of noise involve understanding three characteristics of sound: intensity, frequency and duration.
Noise Contours	Lines drawn about a noise source indicating constant energy levels of noise exposure. DNL is the measure used to describe community exposure to noise.
Noise Exposure Level	The integrated value, over a given period of time of a number of different events of equal or different noise levels and durations.
Non-Precision Instrument	A runway having an existing instrument approach procedure utilizing air navigation facilities with only horizontal guidance for which a straight-in nonprecision instrument approach procedure has been approved.
Notice to Airmen (NOTAM)	A notice containing information (not known sufficiently in advance to publicize by other means concerning the establishment, condition or change in any component (facility, service, or procedure) of or hazard in the National Airspace System, the timely knowledge of which is essential to personnel concerned with flight operations.
Object	Includes, but is not limited to, above ground structures, NAVAIDs, people, equipment, vehicles, natural growth, terrain and parked aircraft.
Object Free Area (OFA)	A two-dimensional ground area-surrounding runways, taxiways and taxilanes which is clear of objects except for object whose location is fixed by function.

Obstacle Free Zone (OFZ)	The airspace defined by the runway OFZ and, as appropriate, the inner-approach OFZ and the inner-transitional OFZ, which is clear of object penetrations other than frangible NAVAIDs.
Obstruction	An object which penetrates an imaginary surface described in the FAA's Federal Aviation Regulations (FAR), Part 77.
Parking Apron	An apron intended to accommodate parked aircraft.
Pattern	The configuration or form of a flight path flown by an aircraft or prescribed to be flown, as in making an approach to a landing
Precision Approach Path Indicators (PAPI)	The visual approach slope indicator system furnishes the pilot 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.
Primary Surface	A surface longitudinally centered on a runway. When the runway has a specially prepared hard surface, the primary surface extends 200 feet beyond each end of that runway, but when the runway has no specially prepared hard surface, or planned hard surface, the primary surface ends at each end of that runway.
Rotating Beacon	A visual navaid operated at many airports. At civil airports, alternating white and green flashes indicate the location of the airport.
Runway	A defined rectangular surface on an airport prepared or suitable for the landing or takeoff of airplanes.
Runway End Identifier Lights (REIL)	REILs are flashing strobe lights which aid the pilot in identifying the runway end at night or in bad weather conditions.
Runway Gradient	The average gradient consisting of the difference in elevation of the two ends of the runway divided by the runway length may be used provided that no intervening point on the runway profile lies more than five feet above or below a straight line joining the two ends of the runway. In excess of five feet the runway profile will be segmented and aircraft data will be applied for each segment separately.
Runway Lighting System	A system of lights running the length of a system that may be either high intensity (HIRL), medium intensity (MIRL), or low intensity (LIRL).
Runway Orientation	The magnetic bearing of the centerline of the runway.

Runway Protection Zone (RPZ)	An area off the runway end used to enhance the protection of people and property on the ground.
Runway Safety Area (RSA)	A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion form the runway.
Segmented Circle	A basic marking device used to aid pilots in locating airports and which provides a central location for such indicators and signal devices as may be required.
Small Aircraft	An airplane of 12,500 pounds or less maximum certified takeoff weight.
Taxiway	A defined path established for the taxiing of aircraft from one part of an airport to another.
Terminal Area	The area used or intended to be used for such facilities as terminal and cargo buildings, gates, hangars, shops and other service buildings, automobile parking, airport motels, restaurants, garages and automobile services and a specific geographical area within which control of air traffic is exercised.
Threshold	The beginning of that portion of the runway available for landing.
Touch and Go Operations	Practice flight performed by a landing touch down and continuous takeoff without stopping.
Traffic Pattern	The traffic flow that is prescribed for aircraft landing at, taxiing on or taking off form an airport. The usual components are the departure, crosswind, downwind, and base legs; and the final approach.
Transitional Surface	These surfaces extend outward and upward at right angles to runway centerline extended at a slope of 7 to 1 from the sides of the primary surface and from the sides of the approach surfaces.
Universal Communications (UNICOM)	A private aeronautical advisory communications facility for purpose other than air traffic control. Only one such station is authorized in any landing area. Service available are advisory in nature primarily concerning the airport services and airport utilization. Locations and frequencies of UNICOMs are listed on aeronautical charts and publications.
Visual Flight Rules (VFR)	Rules that govern flight procedures under visual conditions.
Visual Runway	A runway intended for visual approaches only with no straight-in instrument approach procedure either existing or planned for that runway.

APPENDIX

F

ACRONYMS

GRAND CANYON WEST AIRPORT
AIRPORT MASTER PLAN UPDATE

COMMONLY USED ACRONYMS

AC	Advisory Circular
AD	Airport Design
ADG	Airplane Design Group
AGL	Above Ground Level
AIP	Airport Improvement Program
ALP	Airport Layout Plan
ALS	Approach Lighting System
ARC	Airport Reference Code
ARP	Airport Reference Point
ARTCC	Air Route Traffic Control Center
ASDA	Accelerate Stop Distance
ASDE	Airport Surface Detection Equipment
ASR	Airport Surveillance Radar
ASV	Annual Service Volume
ATC	Air Traffic Control
ATCT	Airport Traffic Control Tower
AWOS	Automated Weather Observation system
BRL	Building Restriction Line
CAT	Category
CFR	Code of Federal Regulations
CWY	Clearway
CY	Calendar Year
DME	Distance Measuring Equipment
EL	Elevation
EMT	Emergency Medical Technician
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FBO	Fixed Base Operator
FSS	Flight Service System
FY	Fiscal Year
GA	General Aviation
GPS	Global Positioning System
HIRL	High Intensity Runway Lights
IEMT	Intermediate Emergency Medical Technician
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
LDA	Landing Distance Available
LOC	Localizer
MALS	Medium Intensity Approach Lighting System
MALSF	Medium Intensity Approach Lighting System
MALSR	Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
ME	Multi-Engine
MIRL	Medium Intensity Runway Lights
MITL	Medium Intensity Taxiway Lights
MLS	Microwave Landing System
MOA	Military Operating Area
MSL	Mean Sea Level
NAVAID	Navigational Aid
NDB	Nondirectional Beacon
NM	Nautical Mile
NPIAS	National Plan of Integrated Airport Systems
ODALS	Onmnidirectional Approach Lighting System
OFA	Object Free Area
OFZ	Obstacle Free Zone
PAPI	Precision Approach Path Indicator
PAR	Precision Approach Radar
RAIL	Runway Alignment Indicator Lights
REIL	Runway End Identifier Lights
ROFA	Runway Object Free Area
RPZ	Runway Protection Zone
RSA	Runway Safety Area
RVR	Runway Visual Range
RW	Runway
SWY	Stopway
TERPS	Terminal Instrument Procedures
TH	Threshold
TL	Taxilane
TODA	Takeoff Distance Available
TOFA	Taxiway Object Free Area
TORA	Takeoff Run Available
TSA	Taxiway Safety Area
TVOR	Very High Frequency Omnirange on an Airport
TW	Taxiway
USGS	United States Geological Society
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rules
VOR	Very High Frequency Omnirange
WAAS	Wide Area Augmentation System

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