Appendix D

AVIATION DEMAND FORECASTS

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This appendix presents the Aviation Demand Forecasts used for analysis in this Environmental Assessment (EA).

Air transportation is a unique industry that has experienced wide fluctuations in growth and recession. For this reason, it is important that from time to time an airport re-evaluate its current position and examine future demand trends and potential. The primary objective of this forecasting effort is to define the magnitude of change in aviation demand that can be expected over time at Double Eagle II Airport.

Because of the cyclical nature of the economy, it is virtually impossible to predict, with certainty, year-to-year fluctuations in activity when looking more than 20 years into the future. However, a trend can be established which delineates long-term growth potential. While a single line is often used to express the anticipated growth, it is important to remember that actual growth may fluctuate above and below this line. The point to remember about forecasts is that they serve only as guidelines, and planning and implementation must remain flexible to respond to unforeseen facility needs. This is because aviation activity is affected by many external influences, as well as by the types of aircraft used and the nature of available facilities.

In order to fully assess current and future aviation demand for Double Eagle II Airport, an examination of several key factors is needed. These include national and regional aviation trends, historical and forecast socioeconomic and demographic information of the area, and historical trends at the airport.

NATIONAL GENERAL AVIATION TRENDS

In the 13 years since the passage of the *General Aviation Revitalization Act of 1994* (federal legislation which limits the liability on general aviation aircraft to 18 years from the date of manufacture), it is clear that the Act has successfully infused new life into the general aviation industry. This legislation sparked an interest to renew the manufacturing of general aviation aircraft due to the reduction in product liability, as well as renewed optimism for the industry.

After the passage of this legislation, annual shipments of new aircraft rose every year between 1994 and 2000. According to the General Aviation Manufacturers Association (GAMA), between 1994 and 2000, general aviation aircraft shipments increased at an average annual rate of more than 20 percent, increasing from 928 shipments in 1994 to 3,140 shipments in 2000. As shown in **Table A**, the growth in the general aviation industry slowed considerably after 2000, negatively impacted by the national economic recession and the events surrounding 9/11. In 2003, there were over 450 fewer aircraft shipments than in 2000, a decline of 14 percent.

TABLE A
Annual General Aviation Airplane Shipments
Manufactured Worldwide and Factory Net Billings

Year	Total	SEP	MEP	TP	J	Net Billings ($ millions)
2000	3,140	1,862	103	415	760	13,497.0
2001	2,994	1,644	147	421	782	13,866.6
2002	2,687	1,601	130	280	676	11,823.1
2003	2,686	1,825	71	272	518	9,994.8
2004	2,963	1,999	52	321	591	11,903.8
2005	3,580	2,326	139	365	750	15,140.0
2006	4,042	2,508	242	407	885	18,793.0

SEP - Single Engine Piston; MEP - Multi-Engine Piston; TP - Turboprop; J – Turbofan/Turbojet

Source: GAMA

In 2004, the general aviation production showed a significant increase, returning to near pre-9/11 levels for most indicators. With the exception of multi-engine piston aircraft deliveries, deliveries of new aircraft in all categories increased. In 2006, total aircraft deliveries increased 13 percent. The largest increase was in single engine piston aircraft deliveries that increased seven percent, or by over 180 aircraft. Turbojet and multi-engine piston aircraft also increased significantly from the previous year. As evidenced in the table, new aircraft deliveries in 2006 exceeded pre-9/11 levels by over 900 aircraft.

On July 21, 2004, the Federal Aviation Administration (FAA) published the final rule for sport aircraft: The *Certification of Aircraft and Airmen for the Operation of Light-Sport Aircraft* rules, which went into effect on September 1, 2004. This final rule establishes new light-sport aircraft categories and allows aircraft manufacturers to build and sell completed aircraft without obtaining type and production certificates. Instead, aircraft manufacturers will build to industry consensus standards. This reduces development costs and subsequent aircraft acquisition costs. This new category places specific conditions on the design of the aircraft to limit them to "slow (less than 120 knots maximum) and simple" performance aircraft. New pilot training times are reduced and offer more flexibility in the type of aircraft the pilot would be allowed to operate.

Viewed by many within the general aviation industry as a revolutionary change in the regulation of recreational aircraft, this new rule is anticipated to significantly increase access to general aviation by reducing the time required to earn a pilot's license and the cost of owning and operating an aircraft. Since 2004, there have been over 30 new product offerings in the airplane category alone. These regulations are aimed primarily at the recreational aircraft owner/operator. By 2020, there are expected to be 13,200 of these aircraft in the national fleet.

While impacting aircraft production and delivery, the events of 9/11 and the subsequent economic downturn have not had the same negative impact on the business/corporate side of general aviation. The increased security measures placed on commercial flights have increased interest in fractional and corporate aircraft ownership, as well as on-demand charter flights. According to GAMA, the total number of corporate operators increased by approximately 2,200 between 2000 and 2006. Corporate operators are defined as those companies that have their own flight departments and utilize general aviation aircraft to enhance productivity. **Table B** summarizes the number of U.S. companies operating fixed-wing turbine aircraft between 1991 and 2006.

TABLE B
U.S. Companies Operating Fixed-Wing Turbine Business Aircraft and Number of Aircraft, 1991-2005

Year	Number of Operators	Number of Aircraft
1991	6,584	9,504
1992	6,492	9,504
1993	6,747	9,594
1994	6,869	10,044
1995	7,126	10,321
1996	7,406	11,285
1997	7,805	11,774
1998	8,236	12,425
1999	8,778	13,148
2000	9,317	14,079
2001	9,709	14,837
2002	10,191	15,569
2003	10,661	15,870
2004	10,735	16,369
2005	10,809	16,867
2006	11,611	16,965

Source: GAMA/NBAA

The growth in corporate operators comes at a time when fractional aircraft programs are experiencing significant growth. Fractional ownership programs sell a share in an aircraft at a fixed cost. This cost, plus monthly maintenance fees, allows the shareholder a set number of hours of use per year and provides for the management and pilot services associated with the aircraft's operation. These programs guarantee the aircraft is available at any time, with short notice. Fractional ownership programs offer the shareholder a more efficient use of time (when compared with commercial air service) by providing faster point-to-point travel times and the ability to conduct business confidentially while flying. The lower initial startup costs (when compared with acquiring and establishing a flight department) and easier exiting options are also positive benefits.

Since beginning in 1986, fractional jet programs have flourished. **Table C** summarizes the growth in fractional shares between 1986 and 2006. The number of aircraft in fractional jet programs grew rapidly from 2001 to 2006, increasing by approximately 288 aircraft.

TABLE C
Fractional Shares and Number of Aircraft in Use

Year	Number of Shares	Number of Aircraft
1986	3	N/A
1987	5	N/A
1988	26	N/A
1989	51	N/A
1990	57	N/A
1991	71	N/A
1992	84	N/A
1993	110	N/A
1994	158	N/A
1995	285	N/A
1996	548	N/A
1997	957	N/A
1998	1,551	N/A
1999	2,607	N/A
2000	3,834	N/A
2001	3,415	696
2002	4,098	776
2003	4,516	826
2004	4,765	865
2005	4,691	949
2006	4,903	984

Source: GAMA

Very light jets (VLJs) entered the operational fleet in 2006. Also known as microjets, the VLJ is commonly defined as a jet aircraft that weighs less than 10,000 pounds. There are several new aircraft that fall in this category, including the Eclipse 500 and Adams 700 jets. While not categorized by Cessna Aircraft as a VLJ, the Cessna Mustang is a competing aircraft to many of the VLJs expected to reach the market. These jets cost between $1 and $2 million, can takeoff on runways less than 3,000 feet, and cruise at 41,000 feet at speeds in excess of 300 knots. The VLJ is expected to redefine the business jet segment by expanding business jet flying and offering operational costs that can support on-demand air taxi point-to-point service. The FAA projects 350 VLJs in service in 2007.

In August 2007, the United States Government Accountability Office (GAO) issued a report GAO-07-1001, *Very Light Jets*, subtitled, Several Factors Could Influence Their Effect on the National Airspace System. This report was conducted in response to the VLJ phenomenon as many aviation forecasters feared the VLJ would eventually lead to significant airspace congestion. The report was not put forth to provide recommendations, but rather to provide information on the industry.

The following is the summary provided by the GAO report:

> *"The eight very light jet forecasts GAO examined provided a range of both the number of very light jets projected to be delivered (roughly 3,000 to 7,600) and the dates by which those numbers would be reached (from 2016 to 2025). The forecasts were based on limited information about the market for very light jets and varied based on a number of assumptions, particularly regarding the development of the air taxi market.*
>
> *The studies GAO reviewed and the experts GAO contacted expressed varying opinions about the impact of very light jets on NAS capacity; however, most of the experts believed that very light jets would have little overall effect on safety. The studies found that the type of airports used by very light jets will influence very light jets' effect on capacity. Experts also mentioned other factors that could affect capacity such as aircraft usage, trip length, and altitude. Most experts GAO contacted believed that very light jets will likely have little impact on safety due to FAA's certification procedures for aircraft, pilots, and maintenance. "*

The report provided limited forecast information developed by eight entities, one being the FAA projections presented in the previous section. All forecasts assumed moderate to strong economic growth. Other factors which will impact the VLJ industry were also considered.

Many believed that the replacement market will be positive for the VLJ industry as older twin engine piston and turboprop aircraft are retired, and some aircraft owners will likely replace them with VLJ aircraft. Another factor is the influence of high numbers of available VLJ models on the market. Rolls-Royce indicated in their analysis that there tends to be a correlation between total aircraft deliveries and number of models on the market. Other factors which will positively influence VLJ growth will be dissatisfaction with other transportation modes, low purchase price of VLJ aircraft, and access to airports with appropriate infrastructure. These factors will be more positive influences to the growth of VLJ markets. Negative factors could include uncertainty of success leading to hesitations in acquiring the VLJ, new training and high cost of insurance, as well as production constraints associated with new aircraft manufacturers.

The eight VLJ forecasts examined by the GAO were somewhat divergent. These forecasts ranged between 3,106 and 7,649 VLJ deliveries. The difficulty with comparing the forecasts, however, is that several have differing "out years." Some forecast through 2016, while others projected to 2020 and even 2025. **Table D** presents the VLJ forecast figures provided by the eight groups.

The FAA forecast assumes that the regulatory environment affecting general aviation will not change dramatically. It is expected that the U.S. economy will continue to expand through 2007 and 2008, and then continue to grow moderately (near three percent annually) thereafter. This will positively influence the aviation industry, leading to passenger, air cargo, and general aviation growth throughout the forecast period (assuming that there will not be any new successful terrorist incidents against either the U.S. or world aviation). The FAA does recognize that a major risk to continued economic growth is upward pressure on commodity prices, including the price of oil. However, FAA economic models predict a 4.8 percent decrease in the price of oil in 2007, followed by a 7.1 percent increase in 2008. The price of oil is expected to become somewhat less volatile through the remainder of the forecast period.

TABLE D
Total Forecast Number of VLJ Deliveries

Forecasting Entity	Forecast End Year	Forecast VLJs Delivered
Embraer – Without strong air taxi demand	2016	~3,000
Embraer – With strong air taxi demand	2016	~6,000
Forecast International (aerospace consulting firm)	2016	~6,000
Honeywell (manufacturer of airspace products)	2016	~5,000
PMI Media (aerospace/defense publisher)	2016	4,124
Teal Group (aerospace consulting firm)	2016	~3,000
Velocity Group (consulting firm) – Moderate air taxi growth	2016	~4,000
Velocity Group (consulting firm) – Strong air taxi growth	2016	~6,000
FAA	2020	6,300
Rolls-Royce	2025	~7,500

Source: FAA

The FAA projects the active general aviation aircraft fleet to increase at an average annual rate of 1.4 percent over the 14-year forecast period, increasing from 226,422 in 2006 to 274,914 in 2020. FAA forecasts identify two general aviation economies that follow different market patterns. The turbine aircraft fleet is expected to increase at an average annual rate of 6.0 percent, increasing from 18,058 in 2006 to 31,558 in 2020. Factors leading to this substantial growth include expected strong U.S. and global economic growth, the continued success of fractional-ownership programs, the growth of the VLJ/microjet market, and a continuation of the shift from commercial air travel to corporate/business air travel by business travelers and corporations. Piston-powered aircraft are projected to show minimal growth through 2020 at 0.3 percent annually. Single engine piston aircraft are projected to grow at 0.3 percent annually, while multi-engine piston aircraft are projected to decrease in number by 0.2 percent annually. Piston-powered rotorcraft aircraft are forecast to increase by 5.7 percent annually through 2020.

Aircraft utilization rates are projected to increase through the 14-year forecast period. The number of general aviation hours flown is projected to increase at 3.4 percent annually. Similar to active aircraft projections, there is projected disparity between piston and turbine aircraft hours flown. Hours flown in turbine aircraft are expected to increase at 6.1 percent annually, compared with 1.3 percent for piston-powered aircraft. Jet aircraft are projected to increase at 9.4 percent annually over the next 14 years, being the largest increase in any one category for total aircraft hours flown.

The total pilot population is projected to increase by 51,000 in the next 14 years, from an estimated 455,000 in 2006 to 506,000 in 2020, which represents an average annual growth rate of 0.8 percent. The student pilot population is forecast to increase at an annual rate of 1.2 percent, reaching a total of 100,181 in 2020. Growth rates for other pilot categories over the forecast period are as follows: recreational pilots declining 0.1 percent; commercial pilots increasing 0.8 percent; airline transport pilots increasing 0.2 percent; rotorcraft-only pilots increasing 3.1 percent; glider-only pilots increasing 0.4 percent; and private pilots showing no change. The sport pilot is expected to grow significantly through 2020 at 22.6 percent annually. The decline in recreational pilots and no increase in private pilots is the result of the expectation that most new general aviation pilots will choose to obtain the sport pilot license instead.

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

LOCAL SOCIOECONOMIC PROJECTIONS

Similar to other industries, the size of the local population, that population's income, and employment levels are indicators of the underlying viability of the aviation industry. Projected growth in these areas can provide comparative growth rates for estimating future growth potential in aviation activity.

The local population relates to the size of the pilot population and aircraft ownership. Aircraft ownership is typically associated with a small portion of the total population; given a larger population, there is a greater likelihood of increased aircraft ownership. Strong employment levels support both business and recreational aircraft ownership and use.

Table E summarizes historical and forecast population, households, housing units, and total employment for Sandoval and Bernalillo Counties. **Table E** indicates that the total population of the two-county area has grown consistently over the past five years, growing from approximately 646,586 in 2000 to 704,875 in 2004. Metro projects the population to grow to 909,748 by 2025, or at an average annual rate of 1.2 percent.

TABLE E
Socioeconomic Summary
Airport Service Area (Sandoval and Bernalillo County)

	2000	2004	2010	2015	2025
Bernalillo County					
Population	556,678	602,413	631,851	666,084	729,750
Households	220,936	240,987	257,449	274,175	306,377
Housing Units	239,074	260,982	376,672	294,490	328,754
Employment	344,911	347,831	402,543	425,146	466,591
Sandoval County					
Population	89,908	102,462	126,288	144,381	179,998
Households	31,411	36,096	45,180	52,179	66,391
Housing Units	34,866	39,579	50,702	58,529	74,418
Employment	27,447	30,361	38,231	42,987	52,418
Total Service Area					
Population	646,586	704,875	758,139	810,465	909,748
Households	252,347	277,083	302,629	326,354	372,768
Housing Units	273,940	300,561	427,374	353,019	403,172
Employment	372,358	378,192	440,774	468,133	519,009

Source: Mid-Region Council of Governments Small Area (DASZ) Data and Forecasts

There has also been consistent growth in households and employment. **Table F** presents the expected growth rates in each of these categories through 2025. Employment growth is expected to outpace growth in housing and population. The higher growth in employment versus population indicates a trend towards declining unemployment rates.

When comparing Bernalillo County and Sandoval County growth, Sandoval County is expected to grow at a stronger rate. For example, Sandoval County's population is expected to grow at 2.7 percent annually through 2025, whereas Bernalillo County is expected to growth at less than 1.0 percent annually. Similar disparities are projected for households, housing units, and total employment. These growth rates are summarized in **Table F**.

TABLE F
Socioeconomic Summary
Sandoval and Bernalillo Counties

	Population	Households	Housing Units	Employment
Forecast Period Summary				
Bernalillo Change (2004-2025)	127,337	65,390	67,772	118,760
Bernalillo % Change (2004-2015)	17.4%	21.3%	20.6%	25.5%
Bernalillo Avg. Annual Rate (2004-2015)	0.9%	1.1%	1.1%	1.4%
Sandoval Change (2004-2025)	77,536	30,295	34,839	22,057
Sandoval % Change (2004-2015)	43.1%	45.6%	46.8%	42.1%
Sandoval Avg. Annual Rate (2004-2015)	2.7%	2.9%	3.1%	2.6%
Total Change (2015-2025)	204,873	95,685	102,611	140,817
Total % Change (2015-2015)	22.5%	25.7%	25.5%	27.1%
Avg. Annual Rate (2004-2015)	1.2%	1.4%	1.4%	1.5%

Source: Mid-Region Council of Governments Small Area (DASZ) Data and Forecasts

AIRPORT SERVICE AREA

The local airport service area is defined by the proximity of other airports and the facilities they are able to provide owners/operators of general aviation aircraft. General aviation service areas are limited by nearby airports, which provide similar aircraft tie-down, fuel, and hangar services.

Bernalillo County is served by two public use airports providing general aviation services: Albuquerque International Sunport and Double Eagle II Airport. Albuquerque International Sunport provides general aviation services in addition to being the primary commercial airline and air cargo airport in the state. The Sunport also accommodates military activity from Kirtland Air Force Base. Double Eagle II Airport is the designated reliever airport for the Sunport, primarily accommodating general aviation activity. Double Eagle II Airport also accommodates some military training activities. There are no existing or planned airports in Sandoval County.

The zip code of Double Eagle II Airport based aircraft owners was collected to gain an understanding of the existing service area for based aircraft demand. This review indicated that the airport's based aircraft service area encompasses almost the entire Albuquerque Metropolitan Area. Double Eagle II Airport drew favorably from the western areas of the community and the West Mesa. Lower ownership rates existed for zip codes on the eastern side of the City. It is assumed that aircraft owners on the eastern side of the City choose to base at the Sunport, which is located closer to this portion of the City, rather than Double Eagle II Airport. Double Eagle II Airport also draws from Rio Rancho and other communities in Sandoval County. Presently, approximately 77 percent of the based aircraft owners reside in Bernalillo County; most of the remaining aircraft owners reside in Sandoval County.

A feasibility study for a new airport in Sandoval County was underway when this analysis was prepared. A new airport in Sandoval County could compete for based aircraft that now go to Double Eagle II Airport. The extent that this would impact Double Eagle II Airport is unknown until this airport is developed and competitive factors such as cost, access, hangar availability, and service levels are established. This feasibility study is ongoing and no decision has been made on the development of this new airport at the time of this printing.

As expected through this analysis, the Double Eagle II Airport based aircraft service area overlaps the service areas of Albuquerque International Sunport, which is located in zip codes of Double Eagle II Airport based aircraft owners. This is primarily due to these being the only public use airports in the metropolitan area serving general aviation.

The service area for transient aircraft users of Double Eagle II Airport can comprise a slightly larger area, extending into all the eastern portions of the metropolitan area and overlapping the general aviation service area of Albuquerque International Sunport. Typically, transient users will use the airport located closest to their destination. However, airport capabilities, general aviation services, and aircraft owner preferences are also factored into their decision. The Sunport is more conveniently located to eastern metropolitan areas than Double Eagle II Airport and provides adequate runway length, navigational aids, and general aviation services. Therefore, some transient users coming to the metropolitan area will choose the Sunport over Double Eagle II Airport, especially if they are accessing the eastern portions of the metropolitan area. However, since the Sunport is centrally located and provides a longer runway length than Double Eagle II Airport, the Sunport presently serves a larger portion of the transient general aviation users to the local community than Double Eagle II Airport. This is especially true for business and corporate users whose business jet aircraft cannot operate at Double Eagle II Airport.

FORECASTING APPROACH

The development of aviation forecasts proceeds through both analytical and judgmental processes. A series of mathematical relationships are tested to establish logic and a rationale for projected growth. However, the judgment of the forecast analyst, based upon professional experience, knowledge of the aviation industry, and assessment of the local situation, is important in the final determination of the preferred forecast.

The most reliable approach to estimating aviation demand is through the utilization of more than one analytical technique. Methodologies frequently considered include trend line/time-series projections, correlation/regression analysis, and market share analysis.

Trend line/time-series projections are probably the simplest and most familiar of the forecasting techniques. By fitting growth curves to historical data, then extending them into the future, a basic trend line projection is produced. A basic assumption of this technique is that outside factors will continue to affect aviation demand in much the same manner as in the past. As broad as this assumption may be, the trend line projection does serve as a reliable benchmark for comparing other projections.

Correlation analysis provides a measure of direct relationship between two or more separate sets of historical data. Should there be a reasonable correlation between the data sets, further evaluation using regression analysis may be employed.

Regression analysis measures statistical relationships between dependent and independent variables yielding a "correlation coefficient." The correlation coefficient (Pearson's "r") measures association between the change in a dependent variable and the independent variable(s). The higher the "r^2" value (coefficient determination), the greater the predictive reliability.

Market share analysis involves a historical review of the airport activity as a percentage, or share, of a larger regional, state, or national aviation market. A historical aviation market share trend is determined providing an expected market share for the future. These shares are then multiplied by the forecasts of the larger geographical area to produce a market share projection. This method has the same limitations as trend line projections, but can provide a useful check on the validity of other forecasting techniques.

AVIATION ACTIVITY FORECASTS

The following forecast analysis examines each of the aviation demand categories expected at Double Eagle II Airport through 2025. Each segment will be examined individually, and then collectively, to provide an understanding of the overall aviation activity at the airport.

The remainder of this chapter presents the forecasts for aviation demand, which includes the following:

- Based Aircraft
- Based Aircraft Fleet Mix
- Local and Itinerant Operations
- Peak Activity
- Operational Mix and Critical Airport Reference Code
- Annual Instrument Approaches

AIRCRAFT OWNERSHIP

The number of aircraft based at an airport is, to some degree, dependent upon the nature and magnitude of aircraft ownership in the local service area. Therefore, the process of developing forecasts of based aircraft for Double Eagle II Airport begins with a review of historical aircraft registrations in the area.

Historical records of aircraft ownership in Bernalillo County were obtained from the FAA-maintained database of aircraft ownership. **Table G** summarizes total aircraft registrations from 1993 to 2004 for Bernalillo County. In examining the specific type of aircraft growth, it is evident that turbine-powered aircraft have enjoyed the strongest growth rates. The number of turboprop aircraft registered to residents of the county has grown at an average annual rate of 2.9 percent, while the number of registered turbojet aircraft has grown at an annual rate of 11.6 percent. Single engine piston-powered aircraft have had the largest numerical growth, growing by 48 aircraft, yet have grown at an average annual rate of only 0.8 percent. There was a net addition of 20 helicopters in the County between 1993 and 2004.

TABLE G
Registered Aircraft
Bernalillo County

Year	Total	Single Engine Piston	Multi-Engine Piston	Turboprop	Turbojet	Helicopter
1993	666	532	81	22	6	25
1994	682	536	93	21	7	25
1995	703	547	94	29	8	25
1996	729	574	92	29	9	25
1997	704	554	82	32	8	28
1998	706	559	80	29	9	29
1999	747	587	81	36	12	31
2000	780	608	91	34	12	35
2001	789	603	95	42	12	37
2002	785	596	97	41	13	38
2003	785	590	105	30	17	43
2004	784	580	109	30	20	45
Avg. Ann.	1.5%	0.8%	2.7%	2.9%	11.6%	5.5%
% Growth	15.05%	8.28%	25.69%	26.67%	70.00%	44.44%
Actual	118	48	28	8	14	20

Source: FAA Records

A review of the aircraft registrations reveals a couple of trends. First, business class aircraft registrations (turboprop and turbojet) are growing faster than all other types of aircraft in the county. Secondly, aircraft registrations in the county are growing. This indicates a potential growing demand for based aircraft at Double Eagle II Airport.

Since there are no recent forecasts of Bernalillo County registered aircraft, new forecasts of aircraft registrations have been prepared for this study. First, a time series analysis of aircraft registrations since 1993 was completed, which resulted in a correlation coefficient of 0.874. Next, a regression analysis was completed which compared historical registered aircraft to population in Bernalillo County since 1993. This resulted in a correlation coefficient of 0.773. Since neither of these analyses achieved a correlation coefficient higher than 0.90 (which indicates good predictive potential), these analyses were discarded from consideration, and forecasts of future registered aircraft were considered by making comparisons against local population and U.S. Active Aircraft.

Table H compares registered aircraft in Bernalillo County to U.S. active general aviation aircraft. As shown in the table, the percentage of U.S. active general aviation aircraft registered in Bernalillo County has fluctuated annually since 1993 from a low of 0.34 percent to a high of 0.394

percent. Since 1993, U.S. active aircraft have grown on average 1.9 percent annually, and Bernalillo County registered aircraft have grown at 2.1 percent annually.

As shown in **Table H**, maintaining the average share of U.S. active aircraft from 1993 to 2005 (0.385 percent) constant through the planning period results in 1,081 registered aircraft in Bernalillo County by the year 2025.

TABLE H
Share of U.S. Active Aircraft
Airport Service Area

Year	Bernalillo County Registered Aircraft	U.S. Active Aircraft	Bernalillo County Share
HISTORICAL			
1993	666	177,119	0.376%
1994	682	172,936	0.394%
1995	703	188,089	0.374%
1996	729	191,129	0.381%
1997	704	192,414	0.366%
1998	706	204,710	0.345%
1999	747	219,464	0.340%
2000	780	217,533	0.359%
2001	789	211,447	0.373%
2002	785	211,244	0.372%
2003	785	209,606	0.375%
2004	784	212,390	0.369%
2005	795	214,591	0.370%
2006	872	226422	0.385%
Avg. Ann. Growth Rate	2.1%	1.9%	
FORECAST			
2010	901	234,030	0.385%
2015	955	248,120	0.385%
2020	1,018	264,324	0.385%
2025	1,081	280,876	0.385%
Avg. Ann. Growth Rate	1.5%	1.2%	

Source for Historical Registered Aircraft: FAA Records
Source for Historical and Forecast U.S. Active Aircraft: 2006 FAA Aerospace Forecasts, Selected Years, 2020 and 2025 Extrapolated
Registered Aircraft Forecasts: Coffman Associates analysis

Table J presents a forecast for future registered aircraft in Bernalillo County based upon the ratio of registered aircraft to forecast population in Bernalillo County. This forecast projects the ratio of registered aircraft to 10,000 residents remaining static through 2025 at approximately 13.3 registered aircraft per 10,000 residents. This represents the average ratio since 1993. This forecast projects registered aircraft growing at 1.0 percent annually, or by 99 aircraft, over the next 20 years.

The share of U.S. active aircraft has been selected as the preferred planning forecast. Registered aircraft in Bernalillo County have grown at a steady but slow rate since 1993, growing at

2.1 percent annually. This compares favorably with growth nationally in U.S. active aircraft, which grew at 1.9 percent annually during the same period. Therefore, for planning purposes, it is expected that registered aircraft will continue this trend through 2025.

TABLE J
Registered Aircraft Per 10,000 Residents
Airport Service Area

Year	Bernalillo County Registered Aircraft	Service Area Population	Ratio
HISTORICAL			
1993	666	515,914	12.9
1994	682	528,842	12.9
1995	703	538,615	13.1
1996	729	544,201	13.4
1997	704	547,997	12.8
1998	706	551,298	12.8
1999	747	556,002	13.4
2000	780	556,870	14.0
2001	789	561,881	14.0
2002	785	572,195	13.7
2003	785	581,663	13.5
2004	784	592,538	13.2
2005	795	603,562	13.2
2006	872	615,099	13.3
Avg. Ann. Growth Rate	2.1%	1.4%	
FORECAST			
2010	840	631,851	13.3
2015	886	666,084	13.3
2020	928	697,917	13.3
2025	971	729,750	13.3
Avg. Ann. Growth Rate	1.0%	1.0%	

Source for Historical Population: U.S. Dept. Of Commerce, Bureau of the Census, Population Estimates Program, Population Division.
Source For Forecast Population: Mid Region Council of Governments *Small Area Data and Forecasts,* 2020 Extrapolated
Source for Historical Registered Aircraft: FAA Records
Registered Aircraft Forecasts: Coffman Associates analysis

BASED AIRCRAFT

The number of based aircraft is the most basic indicator of general aviation demand at an airport. By first developing a forecast of based aircraft, the growth of other factors can be projected. **Table K** summarizes based aircraft totals at Double Eagle II Airport for 1996, 1999, 2000, 2003, 2005, and 2006. The 2006 based aircraft total was derived from the FAA Form 5010 which is based upon the national based aircraft inventory. As shown in **Table K**, based aircraft totals have fluctuated during this time period, reaching as high as 254 in 2006, and as low as 115 in 1996. Based aircraft levels have ranged from a low of 217 to a high of 254 since 1999. Since 1993, based aircraft have grown at an annual average rate of 8.2 percent.

TABLE K
Share of Bernalillo County Registered Aircraft

Year	Double Eagle II Based Aircraft	Registered Aircraft (Powered)	Double Eagle II Share
HISTORICAL			
1996	115	729	15.8%
1999	227	747	30.4%
2000	231	780	29.6%
2003	217	785	27.6%
2005	224	795	28.2%
2006	254	872	29.1%
Average Annual Growth Rate	8.2%	1.8%	
SCENARIO I			
2010	262	901	29%
2015	277	955	29%
2020	295	1,018	29%
2025	313	1,081	29%
Average Annual. Growth Rate	1.1%	1.1%	
SCENARIO II			
2010	288	901	32%
2015	353	955	37%
2020	428	1,018	42%
2025	530	1,081	49%
Average Annual Growth Rate	3.9%	1.1%	

Source for Historical Based Aircraft: 2002 Master Plan (1996, 1999, 2000), Airport Records (2003, 2005), FAA 2006
Source for Historical Registered Aircraft: FAA
Source for Forecast Registered Aircraft: Coffman Associates analysis
Based Aircraft Forecasts: Coffman Associates analysis

Because actual based aircraft levels were not available on an annual basis, statistical methods of projected based aircraft (such as time-series and regression analyses) were not performed. Furthermore, past based aircraft trends are most likely not indicative of future growth potential at Double Eagle II Airport. Statistical measures such as time-series analysis and regressions analyses rely on past performance, in part, for establishing indicators of future demand. Several factors will influence growth at Double Eagle II Airport in the future which has not occurred at the airport in the past. This includes the development of the Aerospace Technology Park at the south end of Runway 17-35, reliever status of Double Eagle II Airport, and Sandoval County population and economic growth.

The Aerospace Technology Park is currently planned for the ultimate Eclipse Aviation aircraft manufacturing, testing, training, and maintenance. The Aerospace Technology Park is also designed for taxiway access which could add additional users to the airport.

As a reliever airport, Double Eagle II Airport is designed to serve general aviation aircraft that would normally use Albuquerque International Sunport. In this manner, Double Eagle II Airport reserves capacity at the Sunport for commercial airline and air cargo activity by providing an alternate landing area for general aviation. The Sunport presently accommodates a significant amount of general aviation activity for the region due to its central location in the City. There are nearly 350 based aircraft at the Sunport, and the Sunport has accommodated more than 50,000 annual general aviation operations each of the past five years. The City and Aviation Department's policy is to encourage the use of Double Eagle II Airport by general aviation aircraft.

The transfer of existing general aviation demand from the Sunport will affect future growth at Double Eagle II Airport. Factors which would affect a transfer of demand include a cost difference between Double Eagle II Airport and the Sunport and/or increased air carrier, military, and air cargo demand at the Sunport affecting general aviation users.

Incentives for relocating aircraft to Double Eagle II Airport are primarily related to costs. Fuel and hangars are cheaper at Double Eagle II Airport when compared to Albuquerque International Sunport. Air access to Double Eagle II Airport is much easier given that there are not all the large commercial airline and air cargo operations at Double Eagle II Airport that occur at Albuquerque International Sunport.

A transient pilot survey was conducted to determine the use patterns of Double Eagle II Airport. The results of this survey are provided in the table below. The survey was sent to approximately 1,000 aircraft owners that used the Double Eagle II Airport or Albuquerque International Sunport in 2005. As shown in the table, 52 percent of the survey respondents noted that the lack of runway length at Double Eagle II Airport prevented them from using the airport. Twenty-nine percent of the survey respondents noted that they would prefer to use Double Eagle II Airport rather than Albuquerque International Sunport (which they currently use) if the runway were longer.

Survey Results

Total Surveys Sent	1,000
Survey Responses	31
Percent of Total	3%
Respondents that use ABQ now but prefer to use AEG	9
Percent of responders	29%
Reasons for not using AEG	Insufficient runway length at AEG
AEG users that indicated need for longer runway	7
Percent of Responders	23%
Total Respondents desiring longer runway at AEG	**16**
Percent of Responders	**52%**
Respondents that would continue to use ABQ	13
Percent of Responders	42%
Respondents that did not indicate any preferences	2

Source: Coffman Associates analysis

An indicated in the survey, 29 percent of the users that presently use Albuquerque International Sunport would rather use Double Eagle II Airport. While preferences for use are different, ideally a greater percentage of traffic from Albuquerque International Sunport should be using Double Eagle II Airport.

Population growth will undoubtedly have an impact on future based aircraft growth. Sandoval County is expected to grow at a faster rate than the City of Albuquerque and is anticipated to account for nearly 40 percent of all population growth in the service area. Double Eagle II Airport is ideally situated to serve demand for portions of Sandoval County, which is currently without an existing public use general aviation airport. Although a general aviation airport is under study, it will be many years before that airport, if ever, comes to fruition.

Future based aircraft potential has been examined as a share of Bernalillo County registered aircraft. The Double Eagle II Airport share of Bernalillo County registered aircraft has generally remained static since 2000, ranging between 27 and 30 percent of registered aircraft. As shown in **Table K,** maintaining the 2006 share of Bernalillo County registered aircraft constant through the planning period results in based aircraft growing at a rate similar to that projected for Bernalillo County registered aircraft. This results in approximately 313 based aircraft at Double Eagle II Airport by the year 2025. An increasing share yields 530 aircraft by 2025.

The FAA and the New Mexico Department of Transportation Aviation Division have each independently examined future based aircraft for Double Eagle II Airport. The 2007 FAA *Terminal Area Forecast* (TAF) used a base year total of 254 based aircraft growing to 347 by 2025. The *2003 New Mexico State Airport System Plan* (NMASP) contained two projections of based aircraft for Double Eagle II Airport. The low growth forecast had based aircraft growing to 277 by 2021. The high range forecast had based aircraft growing to 451 by 2025.

The 2002 Double Eagle II Master Plan also contained two projections for based aircraft growth. The low growth forecast had based aircraft growing to 277 by 2021. The high range forecast had based aircraft growing to 451 by 2025 (similar to the 2003 NMASP).

A summary of all forecasts for based aircraft at Double Eagle II Airport and the selected planning forecast are shown on **Table L**. These forecasts indicate a wide growth opportunity for the airport. The lower range forecasts (Share of Bernalillo Registered Aircraft - Scenario I, 2003 NMASP Low Range Forecast), yield growth rates less than 1.1 percent annually with based aircraft increasing by less than 60 aircraft over the 20-year forecast period. Since 1996, nearly 140 based aircraft have been added at Double Eagle II Airport. This further indicates a greater growth potential than provided by these forecast scenarios. Considering the regional population growth and the potential for transfer of existing based aircraft at the Sunport, these forecasts would appear to underestimate future demand.

TABLE L
Based Aircraft Forecast Summary

Forecast	Existing	2010	2015	2020	2025
Share of Bernalillo Registered Aircraft (Scenario I)		262	277	295	313
Share of Bernalillo Registered Aircraft (Scenario II)		288	353	428	530
2002 Master Plan (Low Range Forecast)*		260	268	277	N/A
2002 Master Plan (High Range Forecast)*		300	430	451	N/A
2003 NMASP (Low Range Forecast)*		251	260	277	N/A
2003 NMASP (High Range Forecast)*		257	300	451	N/A
2007 FAA Terminal Area Forecast (TAF)		283	303	323	347
Preferred Planning Forecast (Airport Service Area)	**254**	**300**	**348**	**371**	**399**

These forecasts are for 2011, 2016, and 2021
NMASP - *New Mexico Aviation System Plan*

A planning forecast has been prepared which has based aircraft growing to 399 in 2025. The selected planning forecast begins at the lower end of the envelope, consistent with the FAA 2007 TAF for Double Eagle II Airport. This forecast results in based aircraft growing at an average annual rate of 2.9 percent through 2025.

Many factors appear to support future growth in based aircraft demand for Double Eagle II Airport. As shown earlier, there is growing aircraft ownership in the Bernalillo County area that could possibly be captured. In fulfilling its role as a reliever airport, Double Eagle II Airport could potentially be the base for aircraft located at Albuquerque International Sunport. Finally, the local population and economy is expected to continue to grow through the planning period. Strong growth for Sandoval County is projected, and Double Eagle II Airport is positioned to serve aviation demand that is not presently served by a public-use airport in this County.

Attachments to this chapter compare the Preferred Planning Forecast and the TAF. The December 23, 2004 memorandum from the Director of Airport Planning and Programming, *Revision to Guidance on Review and Approval of Aviation Forecasts*, states that "…locally developed forecasts for operations, based aircraft, and enplanements are considered consistent with the TAF if they … differ by less than 10 percent in the 5-year forecast period and 15 percent in the 10-year period." The 2010 forecast differs by 6 percent, whereas the 2015, 2020, and 2025 forecasts differ by 14.8, 14.8, and 14.9 percent, respectively.

BASED AIRCRAFT FLEET MIX

Knowing the aircraft fleet mix expected to utilize the airport is necessary to properly plan facilities that will best serve the level of activity and the type of activities occurring at the airport. **Table M** indicates the 2006 based aircraft fleet mix as being comprised mainly of single engine piston-powered aircraft. Comparing the 2006 fleet mix to the 2003 fleet mix indicates that the number of single engine piston aircraft and helicopters grew, while turboprop and multi-engine piston stayed static.

TABLE M
Total Based Aircraft Fleet Mix

Year	Total	Single Engine Piston	Multi-Engine Piston	Turboprop	Turbojet	Helicopter	Other*
HISTORICAL							
2003	217	178	20	1	2	15	1
2005	224	200	15	1	0	8	0
2006	254	212	20	1	0	17	4
Percentage Share							
2003	100%	82.0%	9.2%	0.5%	0.9%	6.9%	0.5%
2005	100%	89.3%	6.7%	0.4%	0.0%	3.6%	0.0%
2006	100%	83.5%	7.9%	0.4%	0.0%	6.7%	1.6%
FORECAST							
2010	300	252	21	3	3	18	3
2015	348	284	24	7	11	19	3
2020	371	292	26	11	18	20	3
2025	399	302	26	16	28	21	4
Percentage Share							
2010	100%	84.0%	7.0%	1.0%	1.0%	6.0%	1.0%
2015	100%	81.5%	7.0%	2.0%	3.0%	5.5%	1.0%
2020	100%	78.7%	7.0%	3.0%	5.0%	5.3%	1.0%
2025	100%	75.8%	7.0%	4.0%	7.0%	5.2%	1.0%
Change	145	90	8	15	28	4	0

Source: Coffman Associates analysis
* Gyroplanes, balloons, ultralights

The projected based aircraft fleet mix has been examined as a share of total based aircraft. This projection closely follows the national trend of growing business class aircraft (turboprops and turbojets) and declining percentages of single engine piston aircraft. Turboprop and turbojet aircraft are the fastest growing segments of active aircraft nationally. These categories are expected to grow significantly at Double Eagle II Airport. Based on national trends, more businesses will own and operate turboprop and turbojet aircraft through the planning period. This national trend will add turbine-powered aircraft through the planning period. Many of the new microjet owners are expected to be existing single engine and multi-engine piston aircraft owners upgrading their aircraft.

While the single engine piston category declines as a percentage of total based aircraft, the total number of single engine piston aircraft is expected to grow by 90, the highest numerical change of all aircraft categories. Local economic and population growth will add new private aircraft ownership. The new regulations for sport aircraft should increase single engine based aircraft levels as well. Multi-engine piston aircraft remain static as a percentage of total based aircraft, adding eight new aircraft through the planning period. The cost of a new multi-engine piston aircraft is comparable to many used turboprops, which has led to their decline in use. The operational costs are also too high for widespread recreational aircraft ownership and use. Nationally, a net addition of only 333 new multi-engine aircraft is expected over the next 12 years. This slow growth rate will cause slow growth in this category at the airport. For perspective, GAMA reports that only 242 new multi-engine piston aircraft were built and delivered worldwide in 2006. This compares with over 2,500 new single engine piston aircraft and over 1,200 business jets and turboprops. Multi-engine piston aircraft will always have a place in new pilot training and some aircraft charter activities. Both are important components of activity at Double Eagle II Airport. Nationally, helicopters are growing at nearly three times the rate of fixed-wing piston-powered aircraft. This will lead to increases in helicopters at Double Eagle II Airport over the planning period.

ANNUAL OPERATIONS

An aircraft operation is either a takeoff or landing. Aircraft operations can be classified as either local or itinerant. Local operations are performed by aircraft which:

(a) Operate in the local traffic pattern or within sight of the airport;

(b) Are known to be departing for, or arriving from, flight in local practice areas located within a 20-mile radius of the airport;

(c) Execute simulated instrument approaches or low passes at the airport.

Itinerant operations are all other operations and essentially represent the originating or departing aircraft.

Generally, local operations are characterized by training operations. Typically, itinerant operations increase with business and commercial use since business aircraft are used primarily to carry people from one location to another.

Due to an absence of an airport traffic control tower (ATCT), actual historical counts of operations are not available for Double Eagle II Airport. Instead, only estimates of operations are available. In 2001, 2003, and 2005, the New Mexico Department of Transportation Aviation Division sampled air traffic levels at various times throughout the year to estimate annual operations. Their procedure included placing an acoustical counter on each runway which would record the takeoff and landing of an aircraft. The acoustical recording was used to verify that an aircraft set off the counter. A tally of operations over a two-week period was made and these totals extrapolated to derive an annual average. Since helicopters do not normally use the runway for departure, a factor was added to the overall count derived through the acoustical counter method to derive total annual operations. The 2006 total was obtained from the FAA TAF.

Table N summarizes historical operational estimates for Double Eagle II Airport. The method for estimating annual operations prior to 2001 is not readily known. As shown in the table, it is estimated that annual operations at Double Eagle II Airport exceed 100,000 annually.

TABLE N
Annual Operations

Year	Based Aircraft	Annual Operations	Operations Per Based Aircraft
Historical			
1996	115	51,100	444
1999	227	93,000	410
2001	229	120,900	528
2005	224	100,700	450
2006	254	131,600	518
Forecast			
2010	300	155,400	518
2015	348	180,300	518
2020	371	192,200	518
2025	399	206,700	518
Avg. Annual Growth Rate	2.4%	3.8%	

Source Historical Operations: 2002 Master Plan, NMDOT Estimates

Table N examines the relationship of annual operations to based aircraft. As shown in this table, the number of annual operations per based aircraft has varied from 410 operations in 1999 to 528 operations per based aircraft in 2001. These ratios are indicative of an airport that experiences a high number of local (training) operations which occur at Double Eagle II Airport. Double Eagle II Airport has active flight schools and training aircraft based at the airport and also accommodates training operations from aircraft based at the Sunport. The average number of operations per based aircraft in these selected years is 470. A forecast for annual operations has been made by carrying forward the 2006 average operation per based aircraft ratio through 2025. **Table N** indicates that general aviation itinerant operations could grow to 206,700 by 2025 under this scenario.

Table P depicts this historical share of Double Eagle II Airport total general aviation operations as a percentage of total general aviation operations at towered airports across the country. The Double Eagle II Airport share has grown during this period from a low of 0.18 percent to a high of 0.40 percent. The average market share over the period has been 0.26 percent. **Table P** presents a projection for Double Eagle II Airport based upon maintaining the peak 2006 share of the itinerant market at 0.40 percent through the planning period. This results in annual operations growing at 2.1 percent annually to 194,600 by 2025. A projection which continues the Double Eagle II Airport trend of a growing share of the itinerant market results in annual operations growing at 3.3 percent annually to 243,300 annual operations in 2025.

TABLE P
Share of U.S. Tower Total General Aviation Operations

Year	Double Eagle II Annual Operations	U.S. Total General Aviation Operations	Double Eagle II Share
1996	51,100	28,672,500	0.18%
1997	65,100	36,833,300	0.18%
1998	79,000	38,046,500	0.21%
1999	93,000	39,999,600	0.23%
2000	107,000	39,878,500	0.27%
2001	120,900	37,621,300	0.32%
2002	99,000	37,606,000	0.26%
2005	100,700	34,101,900	0.30%
2006	131,600	33,130,700	0.40%
Avg. Annual Rate	9.9%	1.5%	
Constant Share Forecast			
2010	148,000	36,994,700	0.40%
2015	164,600	41,150,300	0.40%
2020	179,400	44,856,600	0.40%
2025	194,600	48,661,700	0.40%
Avg. Annual Rate	2.1%	2.0%	
Increasing Share Forecast			
2010	155,400	36,994,700	0.42%
2015	185,200	41,150,300	0.45%
2020	215,300	44,856,600	0.48%
2025	243,300	48,661,700	0.50%
Avg. Annual Rate	3.3%	2.0%	

Source Historical Operations: 2002 Master Plan, NMDOT Estimates
Source for Forecast FAA Tower Operations: FAA Aerospace Forecasts, Selected Years

The FAA projects an increase in aircraft utilization and the number of general aviation hours flown nationally. These trends, along with projected growth in based aircraft, support future growth in annual operations at Double Eagle II Airport. Additionally, a larger share of general aviation activity now occurring at Albuquerque International Sunport is expected to transfer to Double Eagle II Airport as commercial aviation activity grows at the Sunport.

Table Q summarizes all annual operations forecasts for Double Eagle II Airport, including those forecasts prepared for the 2007 TAF and 2002 Master Plan. The 2003 (NMASP) operations forecasts were identical to the 2002 Master Plan forecasts.

TABLE Q
General Aviation Operations Forecast Summary

Forecast	Existing	2010	2015	2020	2025
Operations Per Based Aircraft		155,400	180,300	192,200	206,700
Share of U.S. General Aviation Operations (Scenario I)		148,000	164,600	179,400	194,600
Share of U.S. General Aviation Operations (Scenario II)		155,400	185,200	215,300	243,300
2002 Master Plan (Low Range Forecast)*		133,363	141,001	149,832	N/A
2002 Master Plan (High Range Forecast)*		147,786	181,917	240,458	N/A
2007 FAA Terminal Area Forecast (TAF)		157,340	177,040	197,487	218,643
Preferred Planning Forecast (Airport Service Area)	**131,600**	**164,100**	**201,800**	**225,300**	**249,600**

* These forecasts are for 2011, 2016, and 2021,
Source: Coffman Associates analysis

The selected planning forecast anticipates growth in annual operations due to the factors considered above. This forecast provides for an average annual growth rate of 3.3 percent.

MILITARY OPERATIONS

Military activity accounts for the smallest portion of the operational traffic at Double Eagle II Airport. While a specific historical estimate is unknown, Double Eagle II Airport has been used for military helicopter transient activity in the past. The military also uses the airport for night training using C-130 aircraft. Consistent with industry practices, annual military operations have been projected to remain static at 1,800 annual operations through the planning period due to the frequently changing missions of the military.

TOTAL ANNUAL OPERATIONS

Table R combines the annual general aviation operations forecasts with military operations to derive the total annual operations forecast for Double Eagle II Airport. Due to the high number of operations per based aircraft at Double Eagle II Airport, local operations are expected to account for approximately 65 percent of annual operations at the airport. For planning purposes, general aviation local operations are projected to account for the majority of operations through the planning period, although declining slightly to 63 percent by 2025, consistent with the 2007 TAF. All military operations are projected to be itinerant, consistent with the 2007 TAF.

TABLE R
Total Annual Operations

	2006	2010	2015	2020	2025
General Aviation Itinerant		57,400	70,600	81,100	92,400
General Aviation Local		106,700	131,200	144,200	157,200
Subtotal General Aviation		**164,100**	**201,800**	**225,300**	**249,600**
Military Itinerant		1,800	1,800	1,800	1,800
Subtotal Military		**1,800**	**1,800**	**1,800**	**1,800**
Total Itinerant		59,200	72,400	82,900	94,200
Total Local		106,700	131,200	144,200	157,200
Total Annual Operations	**131,600**	**165,900**	**203,600**	**227,100**	**251,400**
GA Itinerant Operations Percentage		35%	35%	36	37
GA Local Operations Percentage		65%	65%	64%	63%

Source: Coffman Associates analysis

OPERATIONAL MIX

The number and type of aircraft operating at the airport and how this might change over time is important to understand. This type of information is used in determining future noise emissions and air quality analyses. An estimate of the existing operational mix is provided in **Table S**. This estimate was derived from a review of filed instrument flight plans to the airport as well as actual observations of aircraft activity over a seven-day period in November 2005. This analysis concluded that the fixed wing aircraft represented approximately 95 percent of the total operations at the airport, while helicopters represented the remaining five percent. Single engine piston aircraft represent the majority of fixed-wing aircraft operations.

A forecast of the operational mix is also shown in **Table S**. This projection assumes that fixed wing aircraft will grow in number and percentage of the total mix through the planning period. This is consistent with projected based aircraft fleet mix changes for Double Eagle II Airport and national trends showing stronger growth rates for the number of active fixed wing aircraft versus rotorcraft.

For Double Eagle II Airport, jet aircraft use is expected to grow faster than all other categories at the airport. This is the result of the initiation and growth of Eclipse Aviation operations. Nearly all of their operations will consist of turbojet operations. Business/corporate use of the airport is also expected to increase as aircraft currently using Albuquerque International Sunport begin to use Double Eagle II Airport.

TABLE S
Operational Mix

Aircraft Type	Annual Operations	% of Mix
2006		
Single Engine Piston	119,200	90.5%
Multi-Engine Piston	3,900	3.0%
Turboprop	1,300	1.0%
Turbojet	700	0.5%
Helicopter	6,600	5.0%
Total	**131,700**	**100%**
2010		
Single Engine Piston	141,000	85.9%
Multi-Engine Piston	4,900	3.0%
Turboprop	2,500	1.0%
Turbojet	8,400	5.1%
Helicopter	9,100	5.0%
Total	**165,900**	**100%**
2015		
Single Engine Piston	161,200	79.9%
Multi-Engine Piston	6,100	3.0%
Turboprop	3,900	1.5%
Turbojet	21,400	10.6%
Helicopter	11,000	5.0%
Total	**203,600**	**100%**
2020		
Single Engine Piston	170,400	75.6%
Multi-Engine Piston	6,800	3.0%
Turboprop	5,400	2.0%
Turbojet	32,300	14.4%
Helicopter	12,200	5.0%
Total	**227,100**	**100%**
2025		
Single Engine Piston	180,800	72.4%
Multi-Engine Piston	7,500	3.0%
Turboprop	7,100	2.5%
Turbojet	42,600	17.1%
Helicopter	13,400	5.0%
Total	**251,400**	**100%**

AIRPORT REFERENCE CODE

Table T classifies 2006 and forecast fixed wing operations by FAA airport reference code (ARC). Rotorcraft are not assigned an ARC; therefore, the number of annual operations attributable to rotorcraft is removed from this analysis. Military aircraft operations have also been removed from this analysis as the FAA does not include military aircraft in airfield development funding decisions.

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

TABLE T
Forecast by Airport Reference Code (Civil Aircraft)

Airport Reference Code	2006	2010	2015	2020	2025
A-I, A-II, B-I, B-II	124,869	153,580	187,364	207,425	228,425
C-I, C-II, D-I, D-II	224	2,265	4,238	6,377	8,300
C-III, D-III	7	55	98	198	375
Total	125,100	155,900	191,700	214,000	237,100

Source: Coffman Associates analysis
Note: Military operations and helicopters excluded

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

Category A: Speed less than 91 knots.

Category B: Speed 91 knots or more, but less than 121 knots.

Category C: Speed 121 knots or more, but less than 141 knots.

Category D: Speed 141 knots or more, but less than 166 knots.

Category E: Speed greater than 166 knots.

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

Group I: Wingspan up to but not including 49 feet or tail heights up to but not including 20 feet.

Group II: Wingspan above 49 feet but including 79 feet or tail heights above 20 but not including 30 feet.

Group III: Wingspan above 79 feet but including 118 feet or tail heights above 30 but not including 45 feet.

Group IV: Wingspan above 118 feet but including 171 feet or tail heights above 45 but not including 60 feet.

Group V: Wingspan above 171 feet but including 214 feet or tail heights above 60 but not including 66 feet.

Group VI: Wingspan above 214 feet but including 262 feet or tail heights above 66 but not including 80 feet.

All approach category C and D aircraft, as well as some category B aircraft, are turbojets. All civilian turboprop and piston engine aircraft are in categories A and B.

The most demanding ARC (highest approach category and ADG) with over 500 annual operations is used in determining the applicable FAA airport design criterion. As shown in the table, ARC C-I/D-II is expected to comprise the planning ARC through the planning period as this is expected to be the most demanding ARC with over 500 annual operations.

PEAKING CHARACTERISTICS

Many airport facility needs are related to the levels of activity during peak periods. The periods used in developing facility requirements for an airport are as follows:

- **Peak Month -** The calendar month when peak activity occurs.
- **Design Day -** The average day in a peak month. The indicator is easily derived by dividing the peak month activity by the number of days in the month.
- **Design Hour -** The peak hour within the design day.
- **Busy Day -** The busy day of a typical week in the peak month.

It is important to note that only the peak month is an absolute peak within a given year. All other peak periods will be exceeded at various times during the year. However, they do represent reasonable planning standards that can be applied without overbuilding or being too restrictive.

Without an airport traffic control tower, adequate operational information is not available to directly determine peak operational activity at the airport. Therefore, peak period forecasts have been determined according to trends experienced at similar airports. Typically, the peak month for activity at general aviation airports approximates 10 to 15 percent of the airport's annual operations. General aviation operations and total operations were estimated at 12 percent of total annual operations. The forecast of busy day operations was calculated as 1.25 times the design day activity. Existing design hour operations were estimated at 15 percent of design day operations. Over time, it is expected that the peak hour percentage would decline to approximately 12 percent of design day operations. **Table U** summarizes peak operations forecasts for the airport.

TABLE U
Peak Period Forecasts

		Forecasts			
	2006	**2010**	**2015**	**2020**	**2025**
Annual	131,600	165,900	203,600	227,100	251,400
Peak Month	15,792	19,908	24,432	27,252	30,168
Design Day	509	642	788	879	973
Busy Day	637	803	985	1,099	1,216
Design Hour	76	96	110	114	117

Source: Coffman Associates analysis

ANNUAL INSTRUMENT APPROACHES FORECASTS

An instrument approach as defined by the FAA is "an approach to an airport with the intent to land an aircraft in accordance with an Instrument Flight Rule (IFR) flight plan, when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude."

Available data on actual instrument approaches (AIAs) was obtained from the FAA for the period from 1996 to 2005. During this period, AIAs have ranged from a low of two in 1996 to a high of 30 in 1998. In 2005, there were four AIAs. No records are available for 2006. Future air taxi AIAs have been projected at 0.6 percent of future itinerant general aviation operations. The projected increase in AIAs is based upon the expectation of an increase in business jet operations at the airport and the relocation of Eclipse Aviation aircraft production to Double Eagle II Airport. Every aircraft produced by Eclipse Aviation requires a production certification flight and customer acceptance flight which are expected to require an instrument landing system (ILS) approach. Eclipse Aviation will also conduct transition flight training. It is expected that some of these certification and flight training flights may occur during actual instrument conditions, increasing the number of AIAs at the airport. These projections are consistent with general aviation AIAs experienced at the Albuquerque International Sunport in the past. **Table V** summarizes the annual instrument approach forecast.

TABLE V
Actual Instrument Approaches Forecast

		Forecasts			
	2005	**2010**	**2015**	**2020**	**2025**
Annual Itinerant Operations		59,200	72,400	82,900	94,200
Actual Instrument Approaches	4	355	434	497	565

SUMMARY

This chapter has provided forecasts for each sector of aviation demand anticipated to use Double Eagle II Airport through 2025. **Table W** presents a summary of the aviation forecasts developed for Double Eagle II Airport. The airport is expected to experience an increase in total based aircraft and annual operations throughout the planning period.

TABLE W
Forecast Summary

	2006	2010	2015	2020	2025
Annual Operations					
Itinerant		59,200	72,400	82,900	94,200
Local		106,700	131,200	144,200	157,200
Total Annual Operations	**131,600**	**165,900**	**203,600**	**227,100**	**251,400**
Peak Periods					
Peak Month	15,792	19,908	24,432	27,252	30,168
Design Day	509	642	788	879	973
Busy Day	637	803	985	1,099	1,216
Design Hour	76	96	110	114	117
Actual Instrument Approaches					
Total	4	355	434	497	565
Based Aircraft Fleet Mix					
Single Engine Piston	212	252	284	292	302
Multi-Engine Piston	20	21	24	26	28
Turboprop	1	3	7	11	16
Turbojet	0	3	11	18	28
Helicopter	17	18	19	20	21
Other	4	3	3	4	4
Total	**254**	**300**	**349**	**370**	**399**
Aircraft Mix					
Single Engine Piston	119,200	141,000	161,200	170,400	180,800
Multi-Engine Piston	3,900	4,900	6,100	6,800	7,500
Turboprop	1,300	2,500	3,900	5,400	7,100
Turbojet	700	8,400	21,400	32,300	42,600
Helicopter	6,600	9,100	11,000	12,200	13,400
Total	**131,600**	**165,900**	**203,600**	**227,100**	**251,400**

Appendix E

WIND ANALYSIS AND AIRFIELD CAPACITY

Appendix E
WIND ANALYSIS AND AIRFIELD CAPACITY

During the Environmental Assessment (EA) process for the construction of the Airport Traffic Control Tower (ATCT) at Double Eagle II Airport, assurances were made by the FAA to the National Park Service (NPS) that runway length and alignment alternatives would be fully evaluated within future EAs prepared for the airport. With the City of Albuquerque, the NPS cooperatively manages the Petroglyph National Monument which is located adjacent to the airport. The Monument contains numerous cultural, tribal, and archaeological resources. To ensure the future viability of the Monument and Double Eagle II Airport, the development of both facilities needs to consider its neighbor.

This appendix includes an analysis of the prevailing wind conditions at Double Eagle II Airport as well as an analysis of airfield capacity. These analyses, developed according to FAA methodologies, identifies the wind coverage of each runway alignment to the prevailing winds at the airport and the annual service volume of various runway configurations at the airport to meet projected long term needs. Combined, the wind analysis and airfield capacity analyses contributed to the determination of a Proposed Action Alternative.

The purpose of the following analysis was to analyze the current runway alignments at Double Eagle II Airport to determine if Runway 4-22 needed to remain the longest runway at the airport or if Runway 17-35 could also safely serve the airport. The goal of the alternatives analysis was to identify which runway alignment at Double Eagle II Airport provides the best wind coverage at the airport for the prevailing wind conditions, while at the same time protecting the uses and contents of the Monument.

WIND ANALYSIS

This appendix contains a wind analysis prepared by Coffman Associates as well as a report prepared by the National Weather Service Forecast Office in Albuquerque, New Mexico. This report, titled, *East Wind Events at Double Eagle II Airport*, May 2008 is included at the end of this appendix. This report examined the effects of easterly wind flows at Double Eagle II Airport and the runway alignment that is best used during easterly wind conditions.

For the operational safety and efficiency of an airport, it is desirable for the primary runway of an airport's runway system to be oriented as close as possible to the direction of the prevailing wind. This reduces the impact of wind components flowing across, or at an angle, to the direction of travel of an aircraft that is landing or taking off (defined as a crosswind).

Paragraph 203(b) of Federal Aviation Administration (FAA) Advisory Circular 5300-13 Change 14, *Airport Design*, states that, "…when a runway orientation provides less than 95 percent coverage for any aircraft forecasted to use the airport on a regular basis, a crosswind runway is recommended. The 95 percent wind coverage is computed on the basis of the crosswind not exceeding 10.5 knots for Airport Reference Codes (ARCs) A-I and B-I, 13 knots for ARCs A-II and B-II, 16 knots for ARCs A-III, B-III, and C-I through D-III, and 20 knots for ARCs A-IV through D-VI." For Double Eagle II Airport, consideration of crosswind components through 16 knots is critical as this includes all the aircraft expected to use the airport on a regular basis through the planning period. A description of ARC is provided on Page D-24 of **Appendix D**.

Wind data specific to Double Eagle II Airport has been collected to determine wind coverage for the airport. The source for the data is the Automated Weather Observation System (AWOS) located on the airport. For the analysis, data was collected between August 2001 and August 2006. Nearly 112,000 individual observations were collected and analyzed.

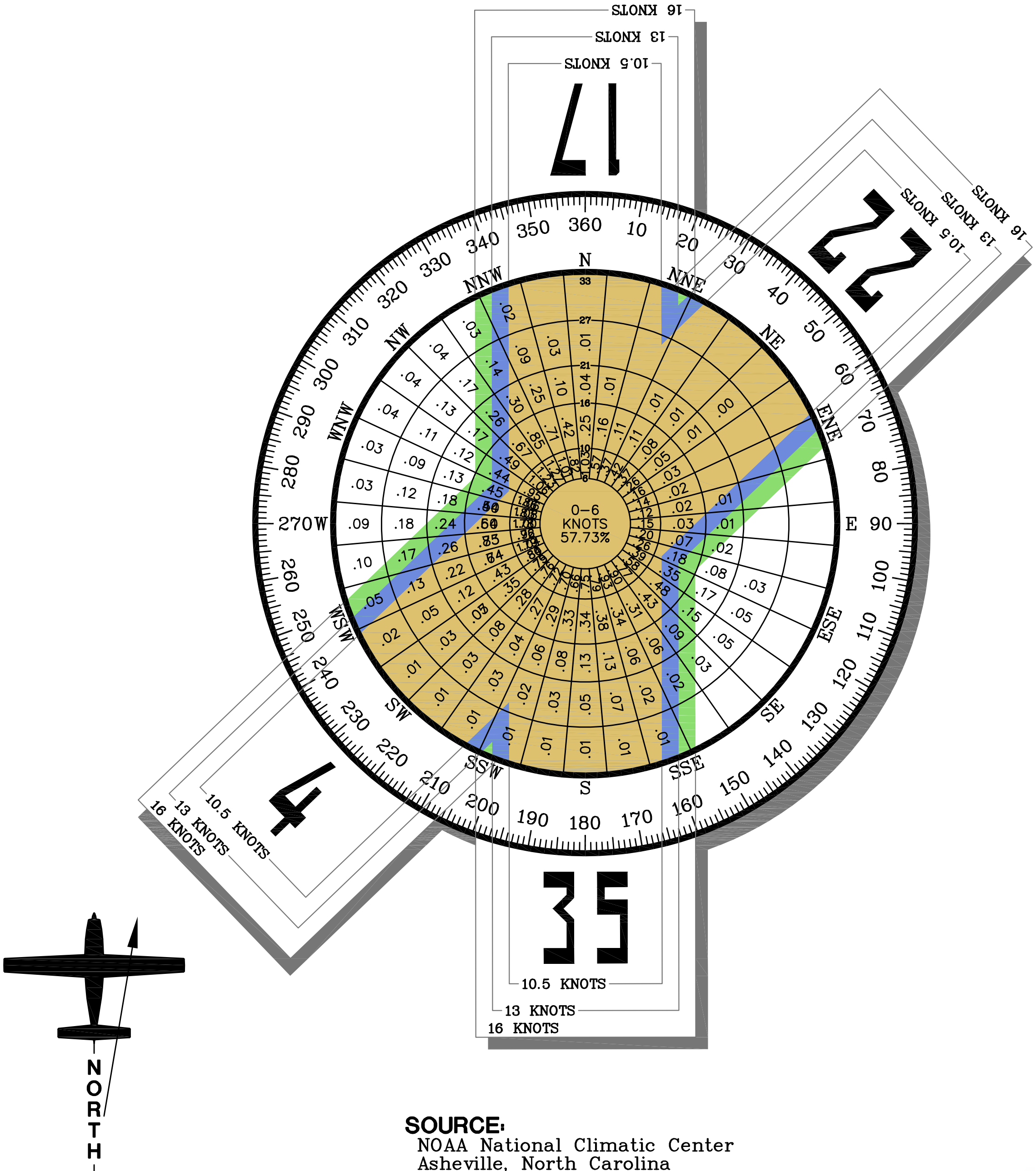
All-Weather Wind Coverage

Exhibit E1 depicts the wind rose for all-weather conditions at the airport utilizing the wind data collected through the on-airport AWOS. **Exhibit E1** also summarizes the all-weather wind coverage for Runway 4-22 and Runway 17-35, individually and combined, for all available observations. As shown on the exhibit, Runway 4-22 alone provides 88.49 percent coverage for the 10.5 knot crosswind component, 92.71 percent coverage for the 13.0 knot crosswind component, and 96.97 percent wind coverage for the 16.0 knot crosswind component. Individually, Runway 17-35 provides 90.78 percent coverage for the 10.5 knot crosswind component, 94.27 percent coverage for the 13.0 knot crosswind component, and 97.24 percent wind coverage for the 16.0 knot crosswind component.

EAW 05SP12-E1-01/20/09

ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots
Runway 4–22	*88.49%*	*92.71%*	*96.97%*
Runway 17–35	*90.78%*	*94.27%*	*97.24%*
Combined	*94.50%*	*97.21%*	*98.89%*



Magnetic Variance
09° 34' East (January 2009)
Annual Rate of Change
00° 07' West (January 2009)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Double Eagle II (AEG)
Albuquerque, New Mexico

OBSERVATIONS:
111,946 All Weather Observations
2001–2006

Coffman Associates R:\CAD\LallyR\Master Plans\AEG (Double Eagle II)\Exhibits\AEG Exhibits E1, E2 and E3.dwg Printed Date: 1-04-10 02:56:39 PM dhopkins

Exhibit E1
ALL WEATHER WINDROSE
EXISTING RUNWAYS

TABLE E1
Wind Coverage Summary

		Knots								
		Runway 17-35			**Runway 4-22**			**Runways 4-22/17-35 Combined**		
		10.5	**13**	**16**	**10.5**	**13**	**16**	**10.5**	**13**	**16**
Annual All-Weather		90.78%	94.27%	**97.24%**	88.49%	92.71%	**96.97%**	94.50%	**97.21%**	**98.89%**
	January	94.36%	**96.57%**	**98.43%**	88.93%	93.03%	**97.37%**	**96.11%**	**98.04%**	**99.37%**
	February	90.94%	94.14%	**96.67%**	87.68%	91.76%	**96.02%**	93.75%	**96.26%**	**98.25%**
	March	85.97%	90.97%	**95.22%**	83.53%	88.85%	94.80%	90.71%	**95.09%**	**98.02%**
	April	83.31%	88.90%	**93.93%**	83.90%	89.36%	94.94%	90.85%	94.67%	**97.59%**
	May	86.04%	90.86%	**95.78%**	87.08%	92.62%	**97.38%**	93.84%	**97.04%**	**99.02%**
	June	87.81%	92.50%	**96.78%**	86.90%	92.30%	**97.35%**	92.82%	**96.53%**	**98.77%**
	July	94.53%	**97.00%**	**98.84%**	93.27%	**96.04%**	**98.93%**	**96.65%**	**98.56%**	**99.46%**
	August	92.81%	**96.35%**	**99.04%**	91.14%	94.85%	**98.57%**	**95.71%**	**98.36%**	**99.62%**
	September	**95.06%**	**97.25%**	**99.00%**	92.06%	**95.49%**	**98.82%**	**97.31%**	**98.97%**	**99.66%**
	October	**95.33%**	**97.44%**	**99.11%**	92.86%	**95.95%**	**98.70%**	**97.69%**	**99.08%**	**99.81%**
	November	92.97%	**95.68%**	**97.59%**	87.45%	91.73%	**96.48%**	**95.31%**	**97.60%**	**99.99%**
	December	94.30%	**96.49%**	**98.00%**	91.50%	93.95%	**96.79%**	**96.03%**	**98.06%**	**99.19%**
Annual IFR		**95.07%**	**96.79%**	**98.61%**	94.17%	**97.13%**	**99.16%**	**96.84%**	**98.60%**	**99.91%**

Source: Double Eagle II Airport AWOS
Note: Numbers in bold exceed 95% Wind Coverage

IFR CAT I Wind Coverage

Category I Instrument Flight Rules (IFR) conditions occur at Double Eagle II Airport when the cloud ceiling is 200 feet above the ground and/or the visibility is reduced to one-half mile. As shown on **Exhibit E2** and within **Table E1**, during these low visibility and cloud situations, Runway 17-35 provides 95.07 percent coverage for the 10.5 knot crosswind component, 96.79 percent coverage for the 13.0 knot crosswind component, and 98.91 percent wind coverage for the 16.0 knot crosswind component. Runway 4-22 alone provides 84.17 percent coverage for 10.5 knot crosswind component, 97.13 percent coverage for the 13.0 knot crosswind component, and 99.16 percent wind coverage for the 16.0 knot crosswind component.

Crosswind Runway

As indicated above, neither Runway 4-22 nor Runway 17-35 individually provides more than 95 percent coverage for the 10.5 knot or 13.0 knot crosswind components. When combined, Runway 4-22 and Runway 17-35 provide only 94.50 percent coverage for the 10.5 knot crosswind component. Even when combining the existing two runway orientations at the airport, the airport still does not provide 95 percent coverage for the 10.5 knot crosswind component.

The primary reason for not meeting 95 percent wind coverage for a single runway, or the two existing runway orientations combined, is the lack of a runway orientation at the airport that can accommodate the strong winds from the west/northwest and east/southeast. Winds above the 10.5 knot crosswind component that cannot be served by either Runway 4-22 or Runway 17-35 occur approximately 7.0 percent of the time. Essentially, during these times the Double Eagle II Airport is closed to small aircraft operations as the crosswind components are excessive for aircraft such as the Cessna 150, which fall within this range. Since the airport is not usable during these situations, this reduces overall airport capacity. A later section in this appendix reveals that the addition of Runway 8-26 can increase the annual capacity of the airport due to the ability to use more runways simultaneously.

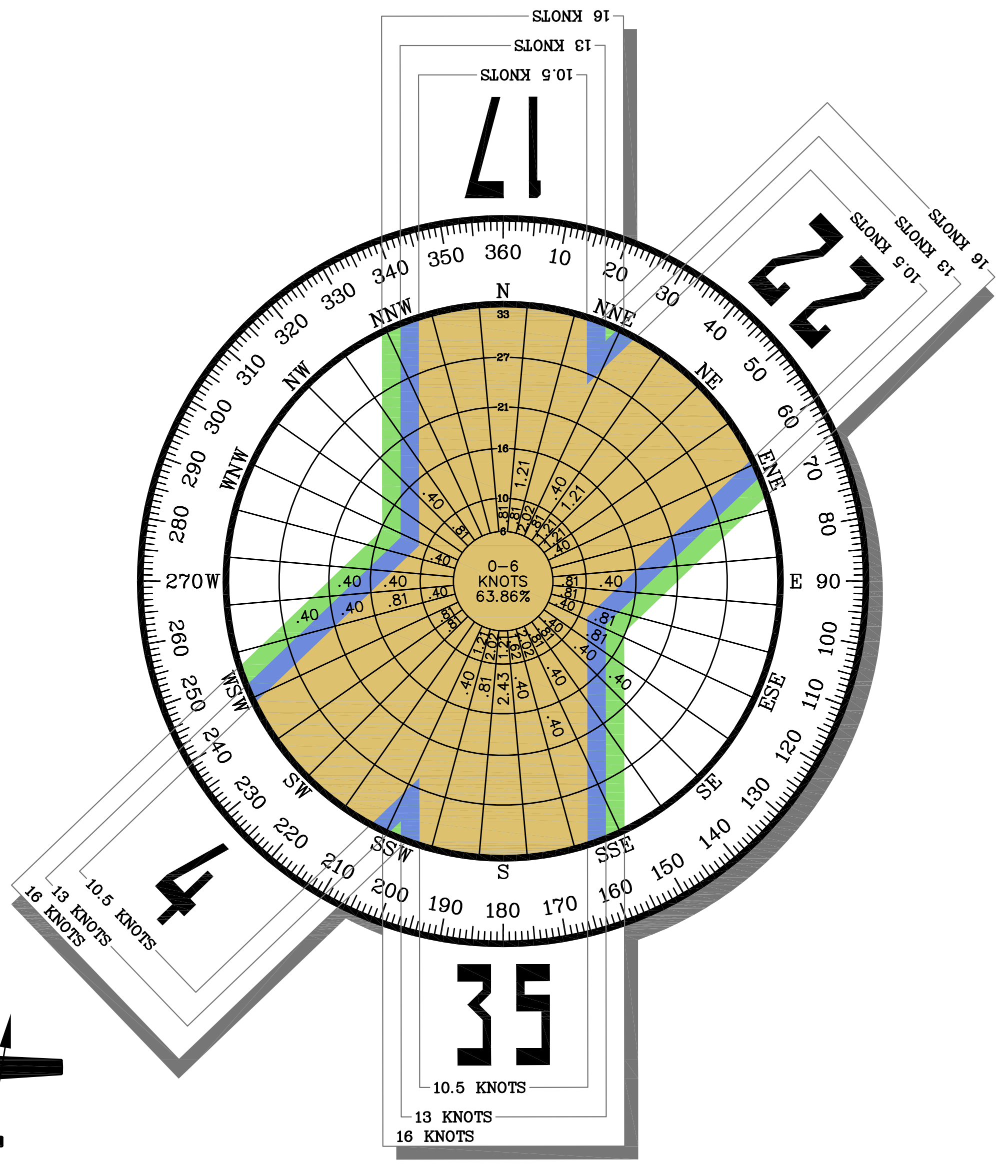
Exhibit E3 depicts the all-weather wind rose and wind coverage considering the addition of an east-west aligned runway. As shown in the wind coverage summary table, individually Runway 8-26 provides 91.57 percent coverage for the 10.5 knot crosswind component, and greater than 95 percent coverage for the 13 knot and 16 knot crosswind component. When combined with Runway 4-22 and Runway 17-35, Runway 8-26 increases the overall wind coverage for the airport to 98.55 percent coverage for the 10.5 crosswind component, 99.49 for the 13.0 knot crosswind component, and 99.87 percent coverage for the 16.0 knot crosswind component. This is considerably better coverage than provided by the existing two runway orientations. For the 10.5 knot crosswind component, the addition of Runway 8-26 increases wind coverage by 4.05 percent. Overall, wind coverage is increased by 2.28 percent and 0.98 percent for the 13 knot crosswind component and 16.0 knot crosswind component, respectively.

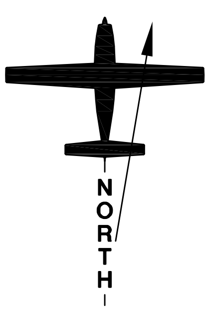
The primary benefit of an east-west oriented runway would be the reduction in crosswind components at the airport. **Table E2** demonstrates a specific example of the reduction in crosswind components with the development of Runway 8-26. The example assumes wind speeds between 11 and 16 miles per hour, which occur at the airport approximately 11.6 percent of the time. With the addition of Runway 8-26, crosswind components are reduced when the winds are between 070 and 120 and 250 and 300. For example, when the wind is from 070, the lowest crosswind component of 8.0 miles per hour is achieved when landing on Runway 4. However, if Runway 8-26 was constructed, this crosswind component would be reduced to 2.8 miles per hour when landing on Runway 8. As shown in the table, more significant reductions in crosswind components are achieved when the wind is from 080 to 120. Similar reductions in crosswinds components are experienced when the wind is from the west.

05SP12-E2-01/20/09

IFR CAT-I WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots
Runway 4–22	*95.07%*	*96.79%*	*98.61%*
Runway 17–35	*94.17%*	*97.13%*	*99.16%*
Combined	*96.84%*	*98.60%*	*99.91%*





Magnetic Variance
09° 34' East (January 2009)
Annual Rate of Change
00° 07' West (January 2009)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Double Eagle II (AEG)
Albuquerque, New Mexico

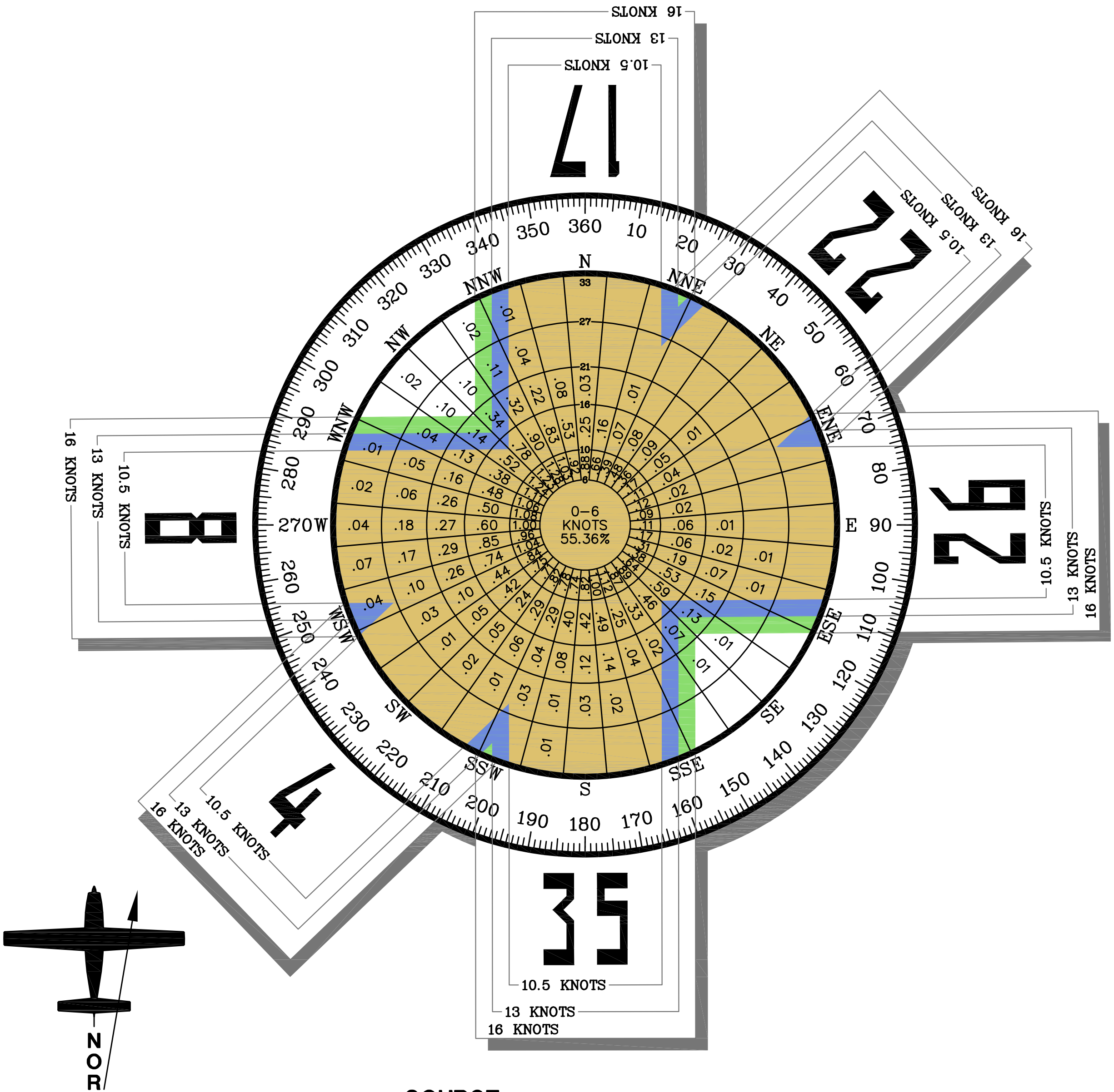
OBSERVATIONS:
247 IFR CAT–I Observations

Exhibit E2
IFR CAT-I WINDROSE

05SP12-E3-01/20/09

ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots
Runway 4-22	*88.49%*	*92.71%*	*96.97%*
Runway 8-26	*91.57%*	*95.12%*	*98.29%*
Runway 17-35	*90.78%*	*94.27%*	*97.24%*
Rwys 17-35, 4-22 & 8-26	*98.55%*	*99.49%*	*99.87%*
Rwys 17-35 & 8-26	*98.26%*	*99.41%*	*99.86%*
Rwys 8-26 & 4-22	*94.05%*	*97.09%*	*98.96%*



Magnetic Variance
09° 34' East (January 2009)
Annual Rate of Change
00° 07' West (January 2009)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Double Eagle II (AEG)
Albuquerque, New Mexico

OBSERVATIONS:
25,488 All Weather Observations
2001-2005

Exhibit E3
ALL WEATHER WINDROSE
RUNWAY 4-22, RUNWAY 17-35, RUNWAY 8-26

TABLE E2
Crosswind Component Example

	Wind Speed - 11 to 16 Miles Per Hour			
	Existing Airfield		Add Runway 8-26	
Wind Direction	**Runway In Use**	**Crosswind Component**	**Runway In Use**	**Crosswind Component**
010	35	5.5	35	5.5
020	4	5.5	4	5.5
030	4	2.8	4	2.8
040	4	0.0	4	0.0
050	4	2.8	4	2.8
060	4	5.5	8	**5.5**
070	4	8.0	**8**	2.8
080	4	10.3	**8**	0.0
090	4	12.3	**8**	2.8
100	4	13.9	**8**	5.5
110	17	13.9	**8**	8.0
120	17	12.3	**8**	10.3
130	17	10.3	17	10.3
140	17	8.0	17	8.0
150	17	5.5	17	5.5
160	17	2.8	17	2.8
170	17	0.0	17	0.0
180	17	2.8	17	2.8
190	17	5.5	17	5.5
200	22	5.5	22	5.5
210	22	2.8	22	2.8
220	22	0.0	22	0.0
230	22	2.8	22	2.8
240	22	5.5	26	5.5
250	22	8.0	**26**	2.8
260	22	10.3	**26**	0.0
270	22	12.3	**26**	2.8
280	22	13.9	**26**	5.5
290	35	13.9	**26**	8.0
300	35	12.3	**26**	10.3
310	35	10.3	35	10.3
320	35	8.0	35	8.0
330	35	5.5	35	5.5
340	35	2.8	35	2.8
350	35	0.0	35	0.0
360	35	2.8	35	2.8

Source: Coffman Associates analysis
Notes:
Runway In Use – Runway with the lowest crosswind component
Crosswind component is determined by the wind speed multiplied by the *Sine* of the wind angle

WIND ANALYSIS SUMMARY

The 10.5 knot crosswind component is most important for runway alignment considerations at Double Eagle II Airport. The greatest majority of aircraft using Double Eagle II Airport fall within the 10.5 knot crosswind component. Therefore, facility planning and development should consider the single runway alignment that provides the best coverage for the 10.5 crosswind component.

When compared with Runway 4-22, Runway 17-35 provides better wind coverage. As shown in **Table E3**, Runway 17-35 provides 2.29 percent higher coverage than Runway 4-22 for the 10.5 knot crosswind component and 1.56 percent higher coverage for the 13.0 knot crosswind component. On a monthly basis, Runway 17-35 provides 95 percent or higher wind coverage in September and October for the 10.5 knot crosswind component, while Runway 4-22 never provides greater than 95 percent coverage for the 10.5 knot crosswind component in any month. For the 13.0 knot crosswind component, Runway 17-35 provides 95 percent or higher wind coverage for seven of the 12 months, whereas Runway 4-22 only provides the same coverage for three of 12 months. For low visibility and cloud ceiling situations, Runway 17-35 provides greater than 95 percent wind coverage for all crosswind components. Runway 4-22 only achieves this for the 13.0 and 16.0 knot crosswind components.

From this analysis, it can be concluded that Runway 17-35 can be safely used by all aircraft piloted at Double Eagle II Airport. In particular, Runway 17-35 provides the highest wind coverage for the small aircraft within the 10.5 knot crosswind component. These aircraft are most susceptible to crosswind conditions. Runway 17-35 also provides 95 percent or higher wind coverage during instrument flight rules (IFR) conditions.

TABLE E3
Wind Coverage Summary

	Annual All-Weather
10.5 Knots	
Runway 17-35	90.78%
Runway 4-22	88.49%
Difference	2.29%
13 Knots	
Runway 17-35	94.27%
Runway 4-22	92.71%
Difference	1.56%
16 Knots	
Runway 17-35	97.24%
Runway 4-22	96.97%
Difference	0.27%

A positive number indicates that Runway 17-35 provides better wind coverage.

As shown in **Table E4**, the best combination of runways for wind coverage is Runway 8-26 and Runway 17-35. Combined, Runway 8-26 and Runway 17-35 provide 98.26 percent coverage at 10.5 knots on an annual basis compared with 94.05 percent for the combination of Runways 4-22 and 8-26. This is a difference of 4.21 percent, and only 0.29 percent lower than when all three runways are combined. Moreover, the combination of Runways 8-26 and 17-35 achieve 95 percent or higher wind coverage for the 10.5 knot crosswind component for each month throughout the year. The combination of Runway 4-22 and Runway 8-26 achieve 95 percent or higher wind coverage for only five of 12 months. Considering the fact that a maximum of two runway orientations can be used at any one time for operational safety, operating the airport in such a manner that maximizes the use of Runway 17-35 and Runway 8-26 will provide greater capacity and less delay than operating the airport in any other manner. This is due to the fact that these two runways allow the airport to be used 4.21 percent of the time more than the combination of Runways 4-22 and 8-26. This will be explored further in the next section.

	Runway 8-26			Runways 8-26/4-22 Combined			Runways 8-26/17-35 Combined		
	10.5	13	16	10.5	13	16	10.5	13	16
Annual All-Weather	91.57%	**95.12%**	**98.29%**	94.05%	**97.09%**	**98.96%**	**98.26%**	**99.41%**	**99.86%**
January	91.21%	**95.13%**	**98.65%**	92.96%	**96.67%**	**98.95%**	**98.54%**	**99.52%**	**99.91%**
February	90.95%	94.61%	**98.01%**	92.98%	**96.34%**	**98.45%**	**97.41%**	**98.69%**	**99.56%**
March	89.78%	93.94%	**97.78%**	91.83%	**95.56%**	**98.19%**	**96.68%**	**98.80%**	**99.72%**
April	88.67%	93.10%	**96.77%**	92.61%	**96.20%**	**98.50%**	**97.25%**	**99.10%**	**99.80%**
May	89.25%	93.47%	**97.48%**	93.54%	**96.82%**	**98.83%**	**98.58%**	**99.52%**	**99.89%**
June	91.57%	**95.50%**	**98.82%**	94.96%	**98.10%**	**99.50%**	**98.82%**	**99.82%**	**100.00%**
July	**95.70%**	**97.89%**	**99.53%**	**97.43%**	**99.13%**	**99.91%**	**99.25%**	**99.84%**	**99.97%**
August	94.04%	**97.00%**	**99.27%**	**96.15%**	**98.56%**	**99.73%**	**98.74%**	**99.71%**	**99.95%**
September	93.36%	**96.45%**	**99.09%**	**95.53%**	**98.15%**	**99.58%**	**99.22%**	**99.81%**	**99.98%**
October	92.52%	**95.65%**	**98.47%**	**95.72%**	**98.09%**	**99.42%**	**99.16%**	**99.80%**	**99.97%**
November	90.55%	94.65%	**98.31%**	92.64%	**96.34%**	**98.74%**	**98.41%**	**99.55%**	**99.87%**
December	93.94%	**96.00%**	**98.21%**	**95.02%**	**96.92%**	**98.70%**	**98.38%**	**99.44%**	**99.86%**
Annual IFR	92.57%	**96.02%**	**99.29%**	**97.47%**	**99.27%**	**99.68%**	**99.42%**	**99.87%**	**100.00%**

Source: Double Eagle II Airport AWOS 25,488 All-Weather Observations.
Note: Numbers in bold exceed 95% wind coverage

AIRFIELD CAPACITY

An airport's airfield capacity is expressed in terms of its annual service volume (ASV). Annual service volume is a reasonable estimate of the maximum level of aircraft operations that can be accommodated in a year without incurring significant delay factors. As aircraft operations surpass the ASV, delay factors increase exponentially. Annual service volume accounts for annual differences in runway use, aircraft mix, and weather conditions. The airport's annual service volume was examined utilizing Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*.

Model Inputs

Various factors are included in the calculation of an airport's ASV. These include the airfield characteristics, meteorological conditions, aircraft mix, and demand characteristics (aircraft operations). The following describes the input factors as they relate to Double Eagle II Airport:

Runway Configuration – The airport presently is served by two runways which do not intersect. This allows for increased capacity as both runways can be used simultaneously. One runway can be used for takeoffs and landings while the other runway can be used for departures. For example, aircraft could depart Runway 22 when aircraft are in the pattern on Runway 17.

Three future runway configurations are included in this analysis. This includes the addition of Runway 8-26 and two potential parallel runway configurations. The first is a parallel to Runway 4-22 and the next is a parallel to Runway 17-35.

Runway Use – Wind direction and speed dictate runway use. Presently, Runway 22 accommodates the majority of operations at the airport as it is located in close proximity to the terminal area and is designated as the runway to be used under calm wind conditions.

Table E5 summarizes runway use based upon wind speed and direction. The base data for this analysis was all recorded hourly wind observations from the on-airport AWOS between 2001 and 2006. This totaled nearly 112,000 observations. For this analysis, it is assumed that pilots would choose the runway with the lowest crosswind component. This assumption led to the preferred runway determination, which was related to the occurrence of wind observations that the runway would support to derive the percentage of time that the particular runway may be in use. This analysis shows that calm winds occur 41 percent of the time. Based upon historical wind data collected on the airport, Runway 17 would be used 12 percent of the time, and Runway 35 would be used 17 percent of the time. **Table E5** summarizes runway use for the remaining runways at the airport, including Runway 8-26. This analysis confirms that actual wind occurrences that dictate the use of Runway 4 or Runway 22 occur less than 10 percent of the time. Runway 17-35 and Runway 8-26 could be used 19 percent of the time.

TABLE E5
Preferred Runway Use by Wind Speed

	Number of Wind Occurrences							
Runway	**<6 Knots**	**% Time**	**6-10 knots**	**% Time**	**>11 knots**	**% Time**	**Totals**	**% Time**
17	3,814	6%	6,014	22%	4,071	20%	13,899	12%
35	4,807	7%	8,238	31%	6,039	29%	19,084	17%
4	1,756	3%	1,340	5%	466	2%	3,562	3%
22	2,185	3%	3,329	12%	1,800	9%	7,314	7%
8	2,172	3%	1,423	5%	1,207	6%	4,802	4%
26	3,425	5%	6,410	24%	6,995	34%	16,830	15%
Calm	46,446	72%	NA	NA	NA	NA	46,446	41%
Totals	64,605	100%	26,754	100%	20,578	100%	111,937	100%

Source: Double Eagle II Airport AWOS Wind Collection (August 2001 to June 2006), Coffman Associates analysis

Notes:

Number of occurrences relates to the number of recorded wind observations within the wind speed category that dictated runway use.

While the previous analysis examined individual runway uses, more than one runway can be used simultaneously at Double Eagle II Airport. **Table E6** summarizes the operational scenarios at the airport that are used in the four separate capacity calculations in this report.

TABLE E6
Runway Use Scenarios

Existing Airfield Configuration				
Runway In Use	**Number of Occurrences**	**% Time In Use**	**Hourly Capacity**	
Runway 22 and Runway 17 In Use				
All Wind < 6 knots	64,605	**66%**	Base Year	168
Runway 17 6-10 knots	6,014		2010	159
Runway 22 6-10 Knots	3,329		2015	161
Subtotal	**73,948**		2025	161
Single Runway In Use				
Runway 17 > 10 knots	4,071	**27%**	Base Year	136
Runway 35 > 6 knots	14,277		2010	129
Runway 4 > 6 knots	3,229		2015	132
Runway 22 > 10 Knots	8,210		2025	132
Subtotal	**29,787**			
Airfield Unusable				
Winds from West or East above 10 knots	8,202	**7%**	Base Year	0
			2010	0
			2015	0
			2025	0
Total	**111,937**	**100%**		

Source: FAA AC 150/5060-5 Change 2, Coffman Associates analysis

TABLE E6 (Continued)
Runway Use Scenarios

Runway In Use	Number of Occurrences	% Time In Use	Hourly Capacity	
Add Runway 8-26				
Runway 22 and Runway 17 In Use				
All Wind < 6 knots	64,605		Base Year	168
Runway 17 6-10 knots	6,014		2010	159
Subtotal	**70,619**	**63%**	2015	161
			2025	161
Runway 22 and Runway 26 In Use				
Runway 22 6-10 knots	3,329		Base Year	168
Runway 26 6-10 knots	6,410	**9%**	2010	159
Subtotal	**9,739**		2015	161
			2025	161
Runway 4 and Runway 8 In Use				
Runway 4 6-10 knots	1,340		Base Year	209
Runway 8 6-10 knots	1,423		2010	203
Subtotal	**2,763**	**2%**	2015	205
			2025	205
Single Runway In Use				
Runway 17 > 10 knots	4,071			
Runway 35 > 6 knots	14,277		Base Year	136
Runway 4 > 10 knots	466		2010	129
Runway 22 >10 Knots	1,800	**26%**	2015	132
Runway 8 > 10 knots	1,207		2025	132
Runway 26 >10 Knots	6,995			
Subtotal	**28,816**			
Total	**111,937**	**100%**		

Source: FAA AC 150/5060-5 Change 2, Coffman Associates analysis

TABLE E6 (Continued)
Runway Use Scenarios

Parallel 4-22

Runway In Use	Number of Occurrences	% Time In Use	Hourly Capacity	
Parallel 22 and Runway 17 In Use				
All Wind < 6 knots	64,605	**58%**	Base Year 2010 2015 2025	340 327 331 331
Parallel 4 or Parallel 22 In Use				
Runway 4 >10 knots Runway 22 >10 knots **Subtotal**	466 1,800 **2,266**	**2%**	Base Year 2010 2015 2025	256 245 249 249
Parallel 22 and Runway 26 In Use				
Runway 22 6-10 knots Runway 26 6-10 knots **Subtotal**	3,329 6,410 **9,739**	**9%**	Base Year 2010 2015 2025	340 327 331 331
Parallel 4 and Runway 8 In Use				
Runway 4 6-10 knots Runway 8 6-10 knots **Subtotal**	1,340 1,423 **2,763**	**2%**	Base Year 2010 2015 2025	283 277 279 279
Single Runway In Use				
Runway 17 > 6 knots Runway 35 > 6 knots Runway 8 > 10 knots Runway 26 >10 Knots **Subtotal**	10,085 14,277 1,207 6,995 **32,564**	**29%**	Base Year 2010 2015 2025	136 129 132 132
Total	**111,937**	**100%**		

Source: FAA AC 150/5060-5 Change 2, Coffman Associates analysis

TABLE E6 (Continued)
Runway Use Scenarios

Parallel 17-35

Runway In Use	Number of Occurrences	% Time In Use	Hourly Capacity	
Parallel 17 and Runway 22 In Use				
All Wind < 6 knots	64,605	**58%**	Base Year 2010 2015 2025	256 245 249 249
Parallel 17 or Parallel 35 In Use				
Runway 17 > 6 knots Runway 35 > 6 knots **Subtotal**	10,085 14,277 **24,362**	**22%**	Base Year 2010 2015 2025	256 245 249 249
Parallel 22 and Runway 26 In Use				
Runway 22 6-10 knots Runway 26 6-10 knots **Subtotal**	3,329 6,410 **9,739**	**9%**	Base Year 2010 2015 2025	168 159 161 161
Parallel 4 and Runway 8 In Use				
Runway 4 6-10 knots Runway 8 6-10 knots **Subtotal**	1,340 1,423 **2,763**	**2%**	Base Year 2010 2015 2025	209 203 205 205
Single Runway In Use				
Runway 4 >10 knots Runway 22 >10 knots Runway 8 > 10 knots Runway 26 >10 Knots **Subtotal**	466 1,800 1,207 6,995 **10,468**	**9%**	Base Year 2010 2015 2025	136 129 132 132
Total	**111,937**	**100%**		

Source: FAA AC 150/5060-5 Change 2, Coffman Associates analysis

- **Exit Taxiways** - Based upon mix, only taxiways between 2,000 feet and 4,000 feet count in the exit rating. There are three exits available within this range at the airport. This reduces hourly capacity by approximately six to seven percent.

- **Weather Conditions** - The airport operates under visual meteorological conditions (VMC) over 99.5 percent of the time. Instrument meteorological conditions (IMC) occur when cloud ceilings are between 500 and 1,000 feet. Poor visibility conditions (PVC) apply for minimums below 500 feet and one mile. Consistent with the capacity model described in FAA AC 5060-5 and because IMC and PVC occur less than one percent of the time combined, they are considered negligible for this analysis and the airport is assumed to be VMC 100 percent of the time for capacity calculations.

- **Aircraft Mix** - Description of the classifications and the percentage mix for each planning horizon is presented on **Table E7**.

- **Percent Arrivals** - Generally follows the typical 50-50 percent split.

- **Touch-and-Go Activity** - Percentages of touch-and-go activity are presented in **Table E6**. This level of activity increases hourly capacity.

- **Operational Levels -** Operational planning horizons are outlined in **Appendix D**. General aviation operations and total operations were estimated at 12 percent of total annual operations. The forecast of busy day operations was calculated as 1.25 times the design day activity. Existing design hour operations were estimated at 15 percent of design day operations. Over time, it is expected that the peak hour percentage would decline to approximately 12 percent of design day operations. This increases ASV as peak periods become more spread-out throughout the day.

TABLE E7
Aircraft Operational Mix - Capacity Analysis

Aircraft Classification	Base Year	2010	2015	2025
VMC				
Classes A & B	99.5%	98.9%	97.9%	97.2%
Class C	0.5%	1.1%	2.1%	2.8%
Class D	0%	0%	0%%	0%%
Percent Local Operations (Touch-and-Go's)	65%	64%	64%	63%

Definitions:
Class A: Small single-engine aircraft with gross weights of 12,500 pounds or less.
Class B: Small twin-engine aircraft with gross weights of 12,500 pounds or less.
Class C: Large aircraft with gross weights over 12,500 pounds up to 300,000 pounds.
Class D: Large aircraft with gross weights over 300,000 pounds.

Hourly Runway Capacity

Based upon the input factors, current and future hourly capacities for the various operational scenarios at Double Eagle II Airport were determined. As the mix of aircraft operating at an airport changes to include a higher percentage of large aircraft (weighing over 12,500 pounds), the hourly capacity of the system declines slightly. As indicated on **Table E7**, the percentages of Class C aircraft will increase over time as business jet operations are projected to grow at the airport as activity is captured at Double Eagle II Airport that would have otherwise used Albuquerque International Sunport due to the available longer runway lengths. The current and future hourly capacities were depicted previously in **Table E6** for each runway use scenario.

Annual Service Volume

Annual service volume is determined by the following equation:

$$ASV = C \times D \times H$$

C = weighted hourly capacity;
D = ratio of annual demand to the average daily demand during the peak month; and
H = ratio of average daily demand to the design hour demand during the peak month.

The ratio of annual demand to average daily demand (D) and the ratio of average daily demand to average peak hour demand (H) is summarized in **Table E8**. The ratio of average daily demand to average peak hour demand increases due to the projected decrease in peak hour demand discussed above.

TABLE E8 Average Demand Ratios	Base Year	2010	2015	2025
Ratio of Annual to Daily Demand	258	258	258	258
Ratio of Daily to Peak Hour Demand	6.7	6.7	7.1	8.3

- **Existing ASV**

The base year ASV was determined to be approximately 135,000 operations following the calculation methodology and runway use scenarios described above. The lack of an east-west oriented runway is the primary factor affecting annual service volume now. This is due to the fact that crosswind conditions in excess of 10.5 knots occur approximately 7.0 percent of the time. This essentially closes the airport to small aircraft operations. Over time, if no capacity enhancements were developed, airport operations would be expected to gradually grow beyond its ASV. At projected 2025 operational levels, the airport would exceed its ASV by 154 percent. The slight increase in Class C aircraft to operate at the airport in 2010 temporarily reduces ASV in that same year. As peak periods begin to spread out throughout the day, the ASV increases. **Table E9** summarizes the airport's ASV based upon the existing airfield configuration through the planning period.

TABLE E9 Runway Capacity Calculations	Base Year	2010	2015	2025
Operations	131,600	165,900	203,600	251,400
Existing Runway System				
Weighted Hourly Capacity	78	74	76	76
Annual Service Volume	135,000	128,000	140,000	163,000
Percent Capacity	97.5%	129.6%	145.4%	154.2%
Runway 17-35/Ruwnay 4-22/Runway 8-26				
Weighted Hourly Capacity	142	134	137	137
Annual Service Volume	244,000	231,000	253,000	295,000
Percent Capacity	53.9%	71.8%	80.5%	85.2%
Parallel Runway 4-22/Runway 17-35/Runway 8-26				
Weighted Hourly Capacity	117	112	114	114
Annual Service Volume	273,000	260,000	284,000	332,000
Percent Capacity	48.2%	63.8%	71.7%	75.7%
Parallel Runway 17-35/Ruwnay 4-22/Runway 8-26				
Weighted Hourly Capacity	169	160	163	163
Annual Service Volume	291,000	276,000	301,000	351,000
Percent Capacity	45.2%	60.1%	67.6%	71.6%
Source: FAA AC 150/5060-5, Coffman Associates analysis				

- **Add Runway 8-26**

Table E9 also summarizes the ASV with the addition of Runway 8-26. While Runway 8-26 allows for the airport to remain open to small aircraft use virtually all of the time, it allows added operational flexibility where Runway 8-26 can be used simultaneously with other runways at the airport. These factors increase the ASV to 273,000 operations considering base year activity and mix. The ASV grows to 310,000 operations considering the projected 2025 mix and activity.

- **Parallel Runway 4-22**

A third scenario considers the development of a “small aircraft only” runway, parallel to existing Runway 4-22, 700 feet northwest of the existing Runway 4-22 centerline. This closely follows previous facility planning which has included a parallel to Runway 4-22 to meet capacity needs. Adding a parallel runway to Runway 4-22 provides for an ASV of 257,000 considering Base Year operational mix and activity, and an ASV of 332,000 considering projected 2025 operations and mix.

- **Parallel Runway 17-35**

As shown in **Table E9**, constructing a parallel runway to Runway 17-35 instead of Runway 4-22 provides the highest hourly capacity and ASV for Double Eagle II Airport. Adding a parallel runway to Runway 17-35 provides for an ASV of 291,000 considering base year operational mix and activity, and an ASV of 351,000 considering projected 2025 operations and mix.

Capacity Analysis Conclusions

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems* (*NPIAS*), indicates that improvements for airfield capacity purposes should begin to be considered once operations reach 60 to 75 percent of the annual service volume. Double Eagle II Airport is already within this range. Therefore, the airport should be considering capacity enhancements. The construction of Runway 8-26 provides this needed capacity enhancement and also increases safety at the airport by providing for a reduction in crosswind components.

Even with the construction of Runway 8-26, the airport would be expected to exceed 75 percent capacity at operational levels above 189,000 operations. This is projected to occur in 2010. The only means to provide the necessary capacity to accommodate projected long term growth and reduce delays is through the construction of a parallel runway. As shown above, there are two different configurations possible for parallel runways at Double Eagle II Airport, with the greatest capacity achieved with Runway 17-35 in a parallel runway configuration. This achieves higher capacity than Runway 4-22 in a parallel configuration as it reduces the occurrences of a single runway in operation. As shown previously in **Table E6**, with parallel Runway 4-22, the airport would operate in a single runway configuration approximately 29.0 percent of the time, whereas with parallel Runway 17-35, the airport would operate in a single runway configuration only 9.0 percent of the time. Primarily, this is due to the fact that winds supporting Runway 4-22 occur only 9.0 percent of the time, whereas winds supporting Runway 17-35 occur 19.0 percent of the time.

East Wind Events at Double Eagle II Airport

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May 2008

1. Introduction

East canyon wind events are notorious for their strength and sudden onset in New Mexico's Rio Grande Valley. Locations below canyons opening into the valley from the east commonly experience surface winds at speeds from 15 to 25 mph with gusts around 35 mph during east canyon wind events, and these gap winds can be much stronger depending on the strength of the surface pressure gradient and other factors. Along with their gusty nature, east canyon winds can significantly impact aviation operations in the Albuquerque area because of the turbulence and wind shear they produce within the lowest few thousand feet of the atmosphere. Their quick development also forces changes in runway usage at both the Albuquerque International Sunport (Sunport) and Albuquerque's Double Eagle II Airport (Double Eagle). Furthermore, east canyon winds can produce significant crosswinds on takeoff and landing at Double Eagle. Forecasters at the Albuquerque National Weather Service Forecast Office are knowledgeable about both the development and impact of east winds on the Sunport, but less is known about east winds at Double Eagle. Therefore, this study focused on understanding the development and impact of east canyon wind events on Double Eagle II Airport. To help weather forecasters, Double Eagle management, and pilots better anticipate east wind events and their impacts, this web feature quantifies and describes the effects of 14 east wind events on Double Eagle II Airport. The feature begins by briefly describing the method used to obtain the data. Then, results are explained and findings summarized. View Full Length Report

2. Methodology

This study examined hourly wind reports from 14 east canyon wind events in the Rio Grande Valley to better understand the development and impact of east canyon winds at Double Eagle II Airport. Because weather observations at the Sunport respond quickly to the development and demise of east canyon winds in the Rio Grande Valley, Sunport weather observations were reviewed from 2002 to 2005 to identify numerous east wind events for potential study. Sunport observations of generally east winds (50^o – 130^o) with speeds greater than or equal to 15 m/s (29.2 kt) for at least one hour were identified. Consecutive observations were included until they trended below 9 m/s (17.5 kt) and/or their directions trended away from the generally easterly direction (i.e., out of the 50^o – 130^o range). The events for which Double Eagle also had data were included in the study. The number of events was increased by searching the Sunport data set for the top 34 east wind gusts within the range 50^o – 130^o, and identifying other time periods with matching data at Double Eagle II Airport. Two east wind events that occurred during June 2007 were later added to the list of events for study, even though the strength of the June 2007 events did not rank them among the top east wind events at the Sunport.

3. Results

Using observations from all 14 cases simultaneously, the wind roses and wind gust roses in Fig. 1 (below) illustrate wind direction and wind speed tendencies at both airports during east wind events. The wind roses depict the percentage of time that the sustained wind blew from various directions and at certain ranges of speed. The wind gust roses depict the same information for wind gusts.

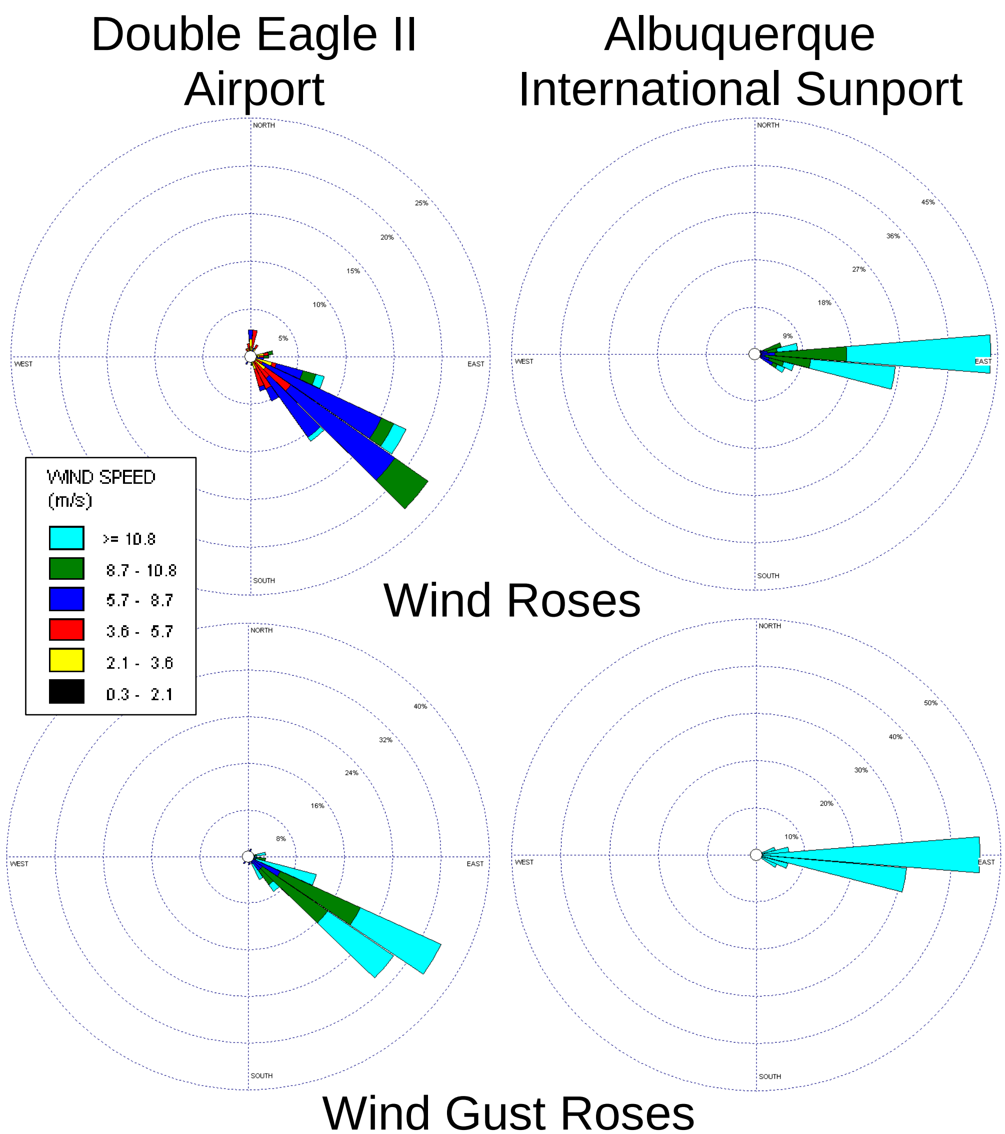


Figure 1. Wind roses (top) and wind gust roses (bottom) from Albuquerque's Double Eagle II Airport (left) and International Sunport (right) for the 14 east wind events studied. Plotted using Lakes Environmental's WRPlot View (Version 5.3).

a. Wind Direction Characteristics – As illustrated in Fig. 1, the wind direction data from these 14 east wind events indicates: (1) Winds blow primarily from the southeast at Double Eagle during east wind events, rather than the easterly direction common at the Sunport. (2) Double Eagle wind direction also tends to be more variable than winds at the Albuquerque Sunport during east wind events.

These wind direction and directional-variability differences between the two airports can be explained by differences in their distance and direction from Tijeras Canyon, and possibly also by the proximity of Double Eagle II Airport to the volcanoes and escarpment of the Petroglyph National Monument. Fig. 2 (below) depicts the location of both airports with respect to the Petroglyph National Monument and Tijeras Canyon. Since Tijeras canyon is only 12 miles due east of the Sunport, and there are no topographic obstructions between the canyon and the Sunport, the Sunport experiences persistent east winds as they exit the canyon. In contrast Double Eagle is approximately twice as far from Tijeras Canyon, is located northwest of the canyon's opening into the Rio Grande Valley, and east winds must cross over the Petroglyph National Monument in order to reach Double Eagle. As a result, Double Eagle experiences southeast winds after they exit the canyon. The volcanoes and southeast-to-northwest-oriented protrusions in the escarpment of the Petroglyph National Monument may also help to funnel east winds toward Double Eagle from the southeast after they exit Tijeras Canyon (see Photo 1 below). Upon exiting the canyon, as the east canyon wind spreads toward the northwest to reach Double Eagle, it tends to weaken and the direction becomes more variable due to frictional effects within the lowest levels of the atmosphere. Wind reports received by the National Weather Service during east canyon wind events consistently reflect this effect in weaker readings for portions of Albuquerque located northwest of Tijeras Canyon. Additionally, friction influences the east wind more significantly as terrain rises west of the Rio Grande River, and especially over the Petroglyph National Monument in route to Double Eagle.

Upon closer inspection, the Double Eagle wind rose indicates that there was a small percentage of time that the Double Eagle Automated Weather Observing System (AWOS) reported winds from the north and other directions besides the southeast during the 14 east wind events. This variability may have occurred at times when east canyon winds weakened enough to allow other influences to override them, like early morning drainage winds flowing southward across the airport from higher terrain further north, precipitation outflow boundaries and smaller scale pressure gradients. At times, east winds may also have washed around the northern end of the Sandia Mountains and into the Rio Grande Valley in a broad eddy with a northerly component to the wind flow in the vicinity of Double Eagle. When they occurred, winds from directions other than the southeast were generally much weaker than the southeasterly winds that commonly developed at Double Eagle during the east wind events. We will discuss the strength of east canyon winds at Double Eagle next.

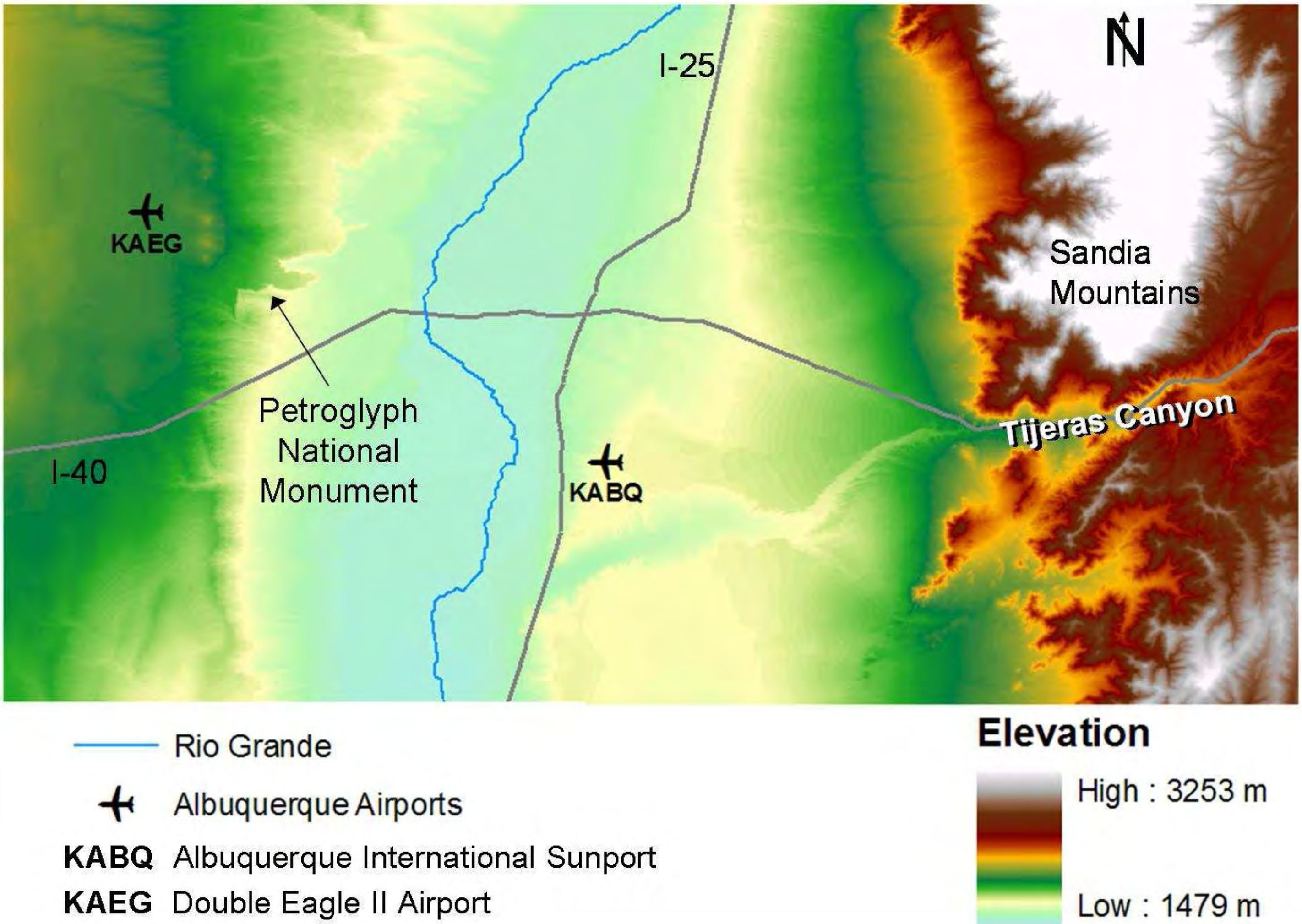


Figure 2. Topographic map of Tijeras Canyon, the Rio Grande Valley and Albuquerque's Airports.

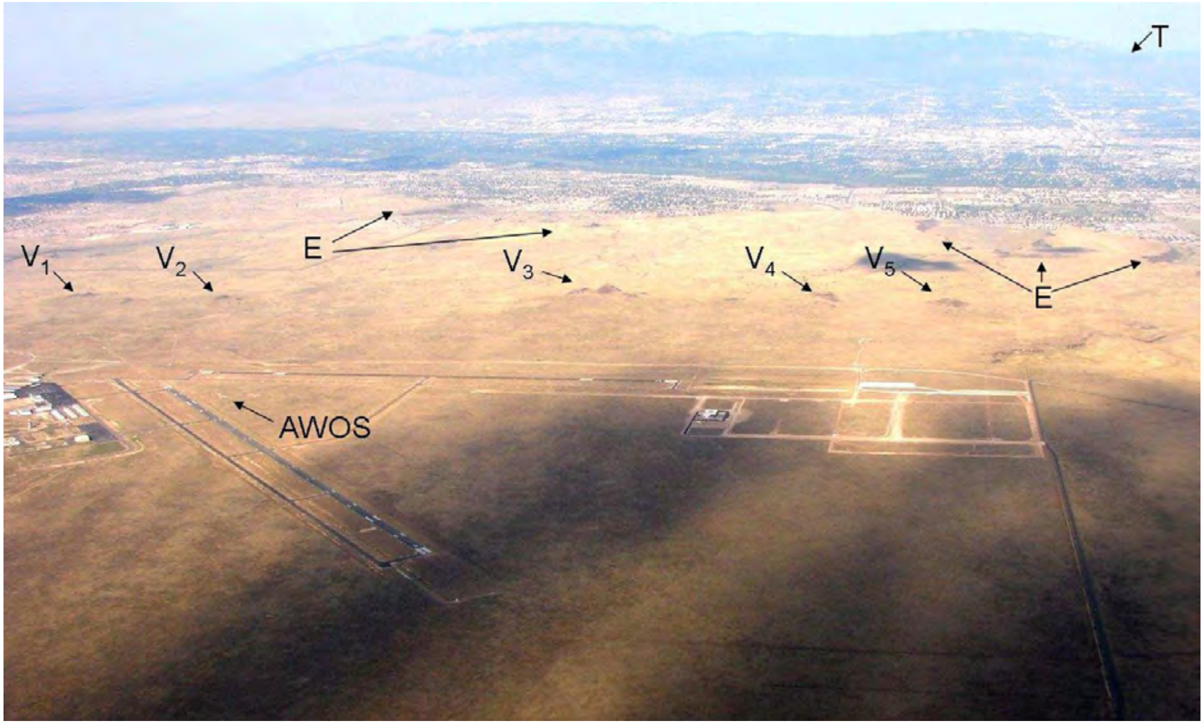
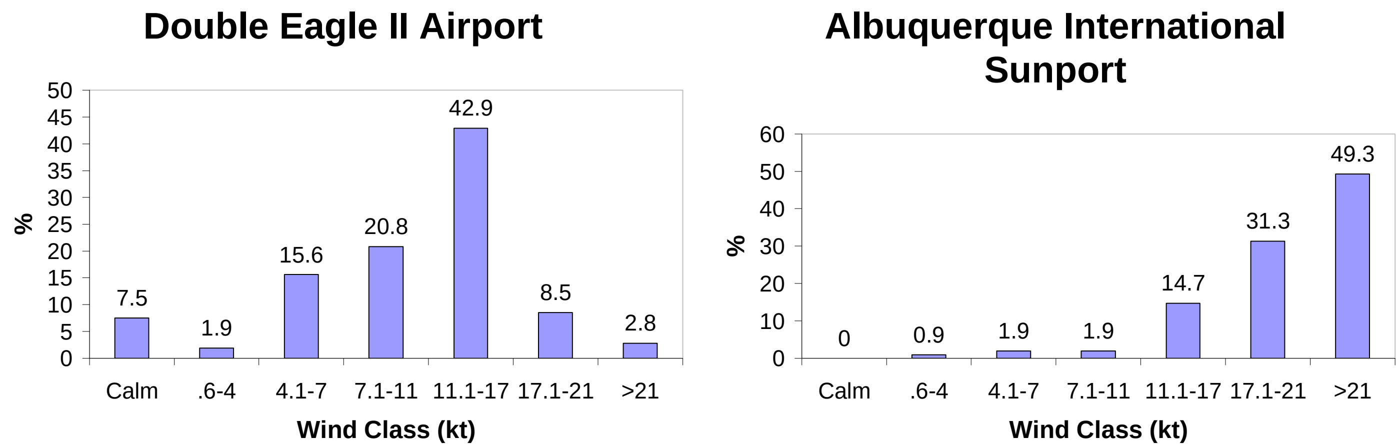


Photo 1. View of Double Eagle II Airport looking toward the east and northeast with the Rio Grande, Albuquerque and Sandia Mountains in the background. Note the location of the AWOS with respect to the volcanoes (V1 – V5) and the escarpment (E) of the Petroglyph National Monument. T points to Tijeras Canyon. Not shown are the Manzano Mountains south of Tijeras Canyon, and the Albuquerque International Sunport on the southeast end of Albuquerque. Photo taken in August 2007, courtesy of Gary Hoe.

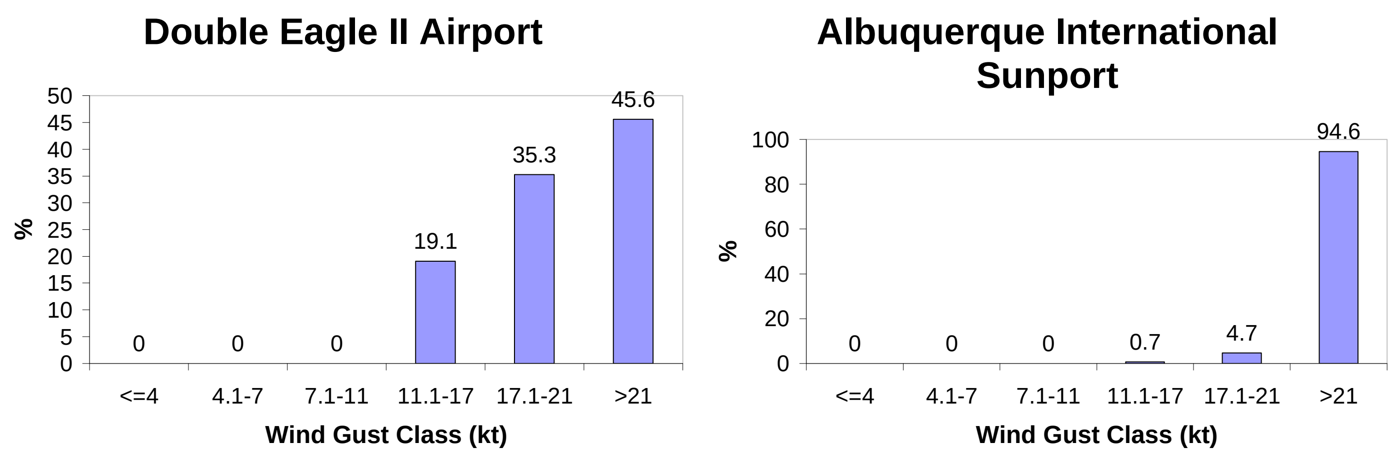
b. Wind Speed Characteristics – Wind speed data from these 14 east canyon wind events indicates that east winds tend to be weaker, less gusty, and less persistent at Double Eagle than they are at the Sunport. The wind class frequency distributions in Fig. 3 (below) illustrate this most clearly, with 80.6% of the Sunport's hourly wind reports in the two highest wind classes (greater than 17 kt) compared to only 11.3% at Double Eagle. At 42.9%, the third highest wind class was by far the most common wind class observed at Double Eagle. Meanwhile, Double Eagle wind gusts reached the highest wind class (greater than 21 kt) in 45.6% of observations with gusts, compared to 94% at the Sunport. During the east wind events studied, 32% of the hourly wind readings from Double Eagle reported gusts, compared to 70% at the Sunport. Also noticeable in Figure 3, is the difference in the percentage of hourly wind reports with calm winds at Double Eagle (7.5%) compared to the Sunport (0%). Thus, Double Eagle's winds tend to be more sporadic than the Sunport's during east wind events, sometimes changing directions (as mentioned previously) or briefly calming.

As described earlier, wind direction and directional-variability differences between the two airports can be explained by differences in their distance and direction from Tijeras Canyon, and possibly also by the proximity of Double Eagle II Airport to the volcanoes and escarpment of the Petroglyph National Monument. Double Eagle is located northwest of

Tijeras Canyon, which accounts for the southeast winds common at Double Eagle during east wind events, and it is almost twice as far from the mouth of the canyon, which results in friction having a greater influence on Double Eagle's wind speeds. Winds also encounter greater friction as they rise up the west bank of the Rio Grande and over the escarpment and volcanoes of the Petroglyph National Monument in order to reach Double Eagle. Pilots have reported that east and southeast winds interact with the terrain of the Petroglyph National Monument to produce updrafts with significant turbulence and wind shear along the volcanoes and the escarpment, especially on the approach end of Double Eagle's Runway 17/35. If these obstructions to the low level winds can impact airflow aloft, they should be able to influence the strength and direction of the surface winds at the AWOS location, which is only a little over a mile northwest of the widest and tallest volcano (V_3 in Photo 1). It is also worth noting that aircraft approaching Runway 17/35 from the south cross the main stream of the east wind in the vicinity of Interstate 40 (I-40), which is due west of Tijeras Canyon at that range. Since this runway approach encounters stronger winds near I-40, it is reasonable to expect greater turbulence and wind shear as the stronger winds rise over the higher terrain on the western edge of the Rio Grande Valley. The tendency for southeast winds to strengthen during east wind events not only impacts Double Eagle through greater wind shear and turbulence, but also through greater crosswinds.



Frequency Distribution of Wind Speeds

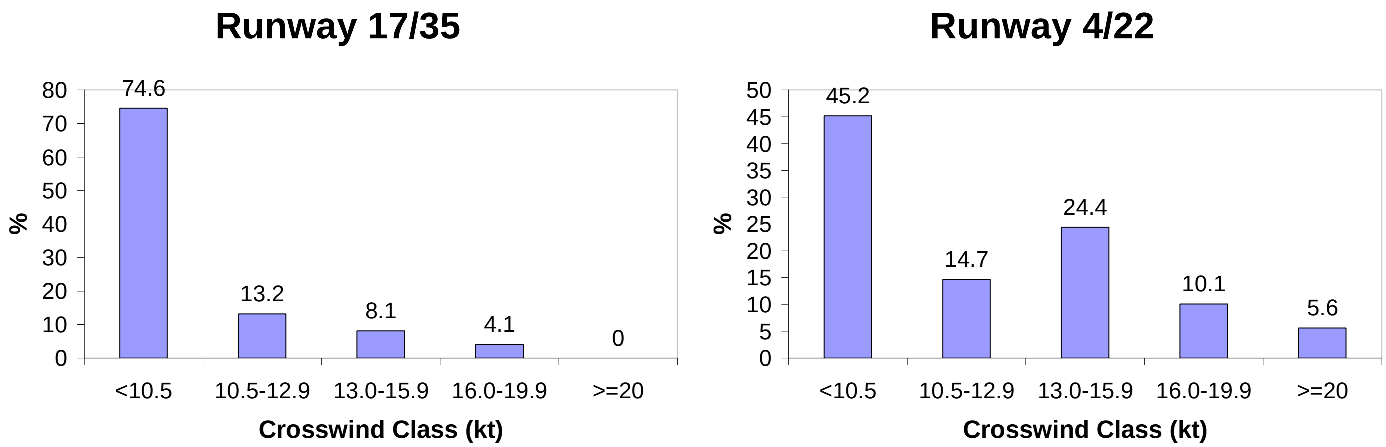


Frequency Distribution of Wind Gusts

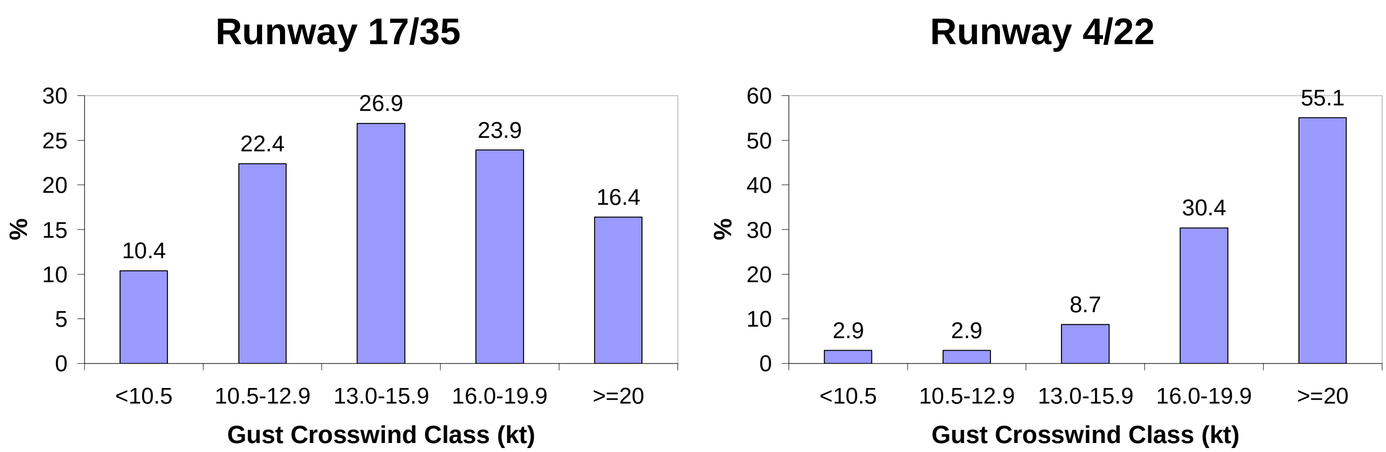
Figure 2. Frequency Distribution of wind speeds and wind gusts at Double Eagle II Airport and the Albuquerque International Sunport for the 14 Rio Grande Valley east wind events studied.

c. Crosswinds – According to the National Transportation Safety Board's accident database, 60.7% of the weather-related aircraft accidents that occurred in New Mexico between 1996 and 2006 were primarily attributed to strong and gusty winds or crosswinds. This is much more than any other weather hazard. Because crosswinds pose such a significant threat to aviation safety, this study also examined the occurrence of crosswinds at Double Eagle II Airport during the Rio Grande Valley east wind events. The Albuquerque International Sunport uses an east/west runway during east wind events, which mitigates the impact of crosswinds. However, this study found that Double Eagle's runway configuration can leave the airport susceptible to significant crosswinds during east wind events.

Fig. 4 (below) plots the frequency distribution of crosswind components for the sustained wind and wind gusts on Double Eagle's two runways: 17/35 and 4/22. Crosswinds generally have a greater impact on small aircraft, like those used at Double Eagle, than on large aircraft. Nearly all small general aviation aircraft can operate safely with crosswinds under 10.5 knots. With 74.6% of crosswinds under 10.5 knots, the data indicates that Runway 17/35 had the fewest crosswind problems during the east wind events, compared to only 45.2% on Runway 4/22. Crosswind components over 10.5 knots can become problematic for small aircraft, and crosswinds over 20 knots are especially dangerous. Fortunately, during the 14 east wind events studied, crosswind components of the sustained wind did not exceed 20 knots on Runway 17/35. However, 16.4% of wind gusts had crosswind components greater than or equal to 20 knots on 17/35. Because of its perpendicular orientation to the southeast wind that develops at Double Eagle during Rio Grande Valley east wind events, Runway 4/22 faired significantly worse, with 5.6% of sustained winds bearing crosswind components greater than or equal to 20 knots and over 55% of wind gusts exceeding that threshold. For this reason, aviators have indicated they prefer to use Runway 17/35 during east wind events. However, as mentioned previously, using Runway 17/35 during east wind events exposes aircraft more directly to wind shear and turbulence as east winds rise over the escarpment and volcanoes of the Petroglyph National Monument.



Frequency Distribution of Sustained Crosswinds



Frequency Distribution of Crosswinds due to Wind Gusts

Figure 3. Frequency distribution of crosswind components plotted by class (top) for the two runways at Double Eagle II Airport, from the 14 Rio Grande Valley east wind events studied. The frequency distribution of wind gust crosswind components is also plotted (bottom).

4. Summary

In this study, wind reports from 14 east canyon wind events in the Rio Grande Valley were analyzed to better understand the development and impact of east canyon winds at Double Eagle II Airport. The data revealed that east canyon winds blow from a southeasterly direction at Double Eagle (120^o-140^o), rather than an easterly direction like the Albuquerque International Sunport (90^o-100^o). Double Eagle winds also tend to be weaker, less gusty, and more variable than winds at the Sunport during east wind events, sometimes changing to another direction or becoming calm. The data also showed that significant crosswinds can develop during Rio

Grande Valley east wind events at Double Eagle II Airport. Because of their tendency to gust out of the southeast at this airport, Rio Grande Valley east wind events have a greater impact on Runway 4/22 than on Runway 17/35. Using Runway 17/35 will help pilots minimize the impact of crosswinds during east wind events; however, users of this runway must also deal with greater wind shear and turbulence on approach and landing because it is located very closely along the escarpment and volcanoes of the Petroglyph National Monument (see Photo 1).

There are many reasons why east canyon wind events impact Double Eagle II Airport differently than the Albuquerque International Suport. Some of the more important reasons discussed in this report include: (1) Double Eagle is almost twice as far from Tijeras Canyon as the Sunport, enabling frictional effects to more strongly influence Double Eagle's winds. (2) Unlike the Sunport, Double Eagle is not located directly in the main flow of the low level east wind exiting Tijeras Canyon, and instead is impacted by an east canyon wind that spreads in a northwesterly direction prior to reaching the airport. (3) The volcanoes and escarpment of the Petroglyph National Monument lie between Double Eagle and Tijeras Canyon, and probably block and channel the east canyon wind to some extent before reaching the Double Eagle AWOS.

5. References

a. Benchmark Maps, 2006: *New Mexico Road and Recreation Atlas*, Fifth Edition. Benchmark Maps, pp. 88-89.

b. Hoe, G., 2007: e-mail consultation.

c. McVinnie, D., 2007: e-mail consultation.

d. Slad, G. W., 2007: e-mail consultation.

e. Telfair, D., 2007: phone and e-mail consultations.

Appendix F

FLIGHT TRACK ANALYSIS

Appendix F
FLIGHT TRACK ANALYSIS

At the onset of this Environmental Assessment (EA), the airport's Airport Traffic Control Tower (ATCT) was not yet operational. To obtain information regarding the manner in which aircraft operate at Double Eagle II Airport, flight track data was obtained from the Albuquerque International Sunport Airport Surveillance Radar (ASR) facility. Obtaining this data was important to this study as it allowed for a detailed analysis of the current flight patterns at the airport. The information was used to formulate flight paths for input into the Integrated Noise Model (INM) for the noise analysis and also provided information regarding the current overflights of the Petroglyph National Monument. As discussed throughout this EA, the National Park Service (NPS) indicated concerns regarding the potential impacts of airport development on the neighboring Monument. The NPS recognizes the presence and value of Double Eagle II Airport, but wants to ensure the protection of resources contained within the Monument. This was communicated to the FAA and the City of Albuquerque Aviation Department during the preparation of the EA for the ATCT at Double Eagle II Airport.

Flight track data was requested for three periods to allow for a comparison of seasonal differences in the operational characteristics of the airport. Between requests, adjustments were made to the requested coverage area to include all critical portions of the study area. Copies of the letters sent to the FAA Southwest Region Freedom of Information Act (FOIA) Coordinator requesting the data are included at the end of this appendix.

Periods analyzed include the following:

- May 1, 2006 – May 10, 2006
- October 18, 2007 – October 31, 2007
- January 1, 2008 – January 19, 2008

The first two data sets were evaluated utilizing a process developed by Coffman Associates for use primarily in 14 CFR Part 150 Studies. The third data set was analyzed through a geographic information system (GIS) process developed in early 2008. The differences in analysis tools are indicated by the different manners in which the following data is presented.

<u>May 1, 2006 through May 10, 2006 Data</u>

Exhibits F1, F2, F3, and **F4** depict the flight track information obtained from May 1, 2006 through May 10, 2006. As indicated on the exhibits, the flight track window stopped at the northernmost edge of the Petroglyph National Monument and did not include overflights of the Northern Geologic Window. The arrival tracks depicted on **Exhibit F1** illustrate the predominant usage of Runway 4-22 for arrivals. This is likely due to the proximity of the Runway 22 end to the fixed base operator (FBO) facilities, the length of the runway, and the presence of the instrument landing system (ILS) on Runway 22. The departure tracks depicted on **Exhibit F2** were limited due to the manner in which the data was processed by the ASR facility. The tracks do verify the heavy use of Runway 4-22 for operations at the airport. **Exhibit F3** depicts the touch-and-go flight tracks. As indicated on the exhibit, these practice maneuvers utilized both runways during the period analyzed. The manner in which helicopters operated at the airport during the data period is depicted on **Exhibit F4**. As indicated by the flight tracks, helicopter operators at the airport currently fly “point to point.”

<u>October 18, 2007 through October 31, 2007 Data</u>

The data obtained for this period was not able to be processed due to formatting issues.

<u>January 1, 2008 – January 19, 2008 Data</u>

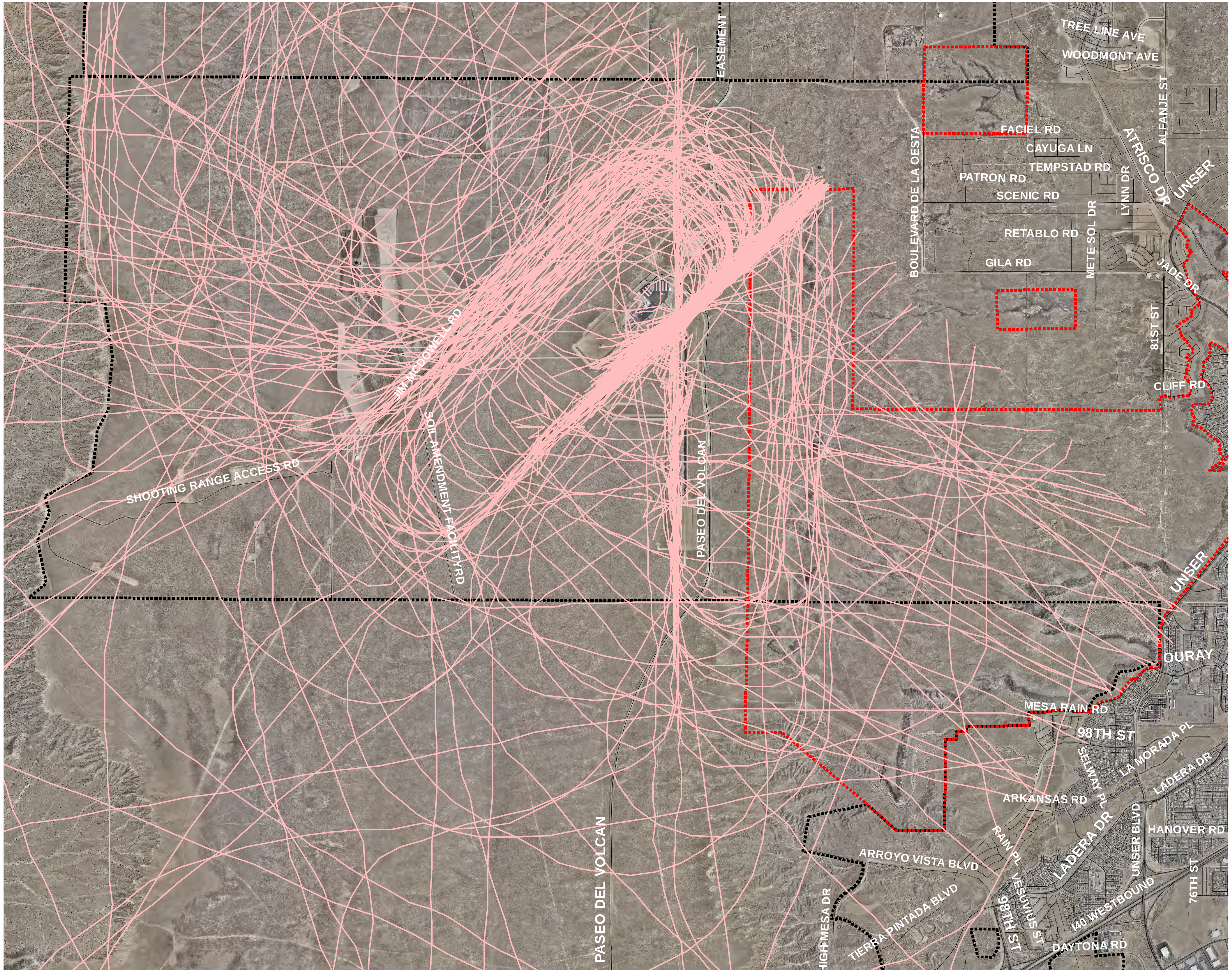
As previously mentioned, the data obtained during this time period was analyzed through a GIS process which allowed the analysis to be refined and actually assess which runway end was utilized for aircraft operation. **Exhibits F5, F6, F7**, and **F8** depict the results of the analysis. It is apparent from the exhibits that during the data period the winds were predominantly out of the north and the southwest, thereby resulting in heavier use of Runways 22 and 35.

Data obtained for this period provided a larger window which allowed for an evaluation of the overflights of the Northern Geologic Window.

FLIGHT TRACKS DEVELOPED FOR THE NOISE ANALYSIS

Utilizing the flight track information from the time periods described above, generalized flight tracks were developed for input into the INM. Using the data from the ASR allowed for a more detailed noise analysis that would more likely reflect the actual operating environment. **Exhibits F9, F10, F11**, and **F12** depict the flight tracks as well as the number of operations assigned to each track to model the existing and 2015 Alternative A, Alternative B, and No Action Alternative noise scenarios.

05SP12-F1-01/21/09



LEGEND

- Municipal Boundary
- Monument Boundry
- Radar Arrival Tracks

Source: Coffman Associates Analysis.
Radar Track Data 1-10 March 2006.

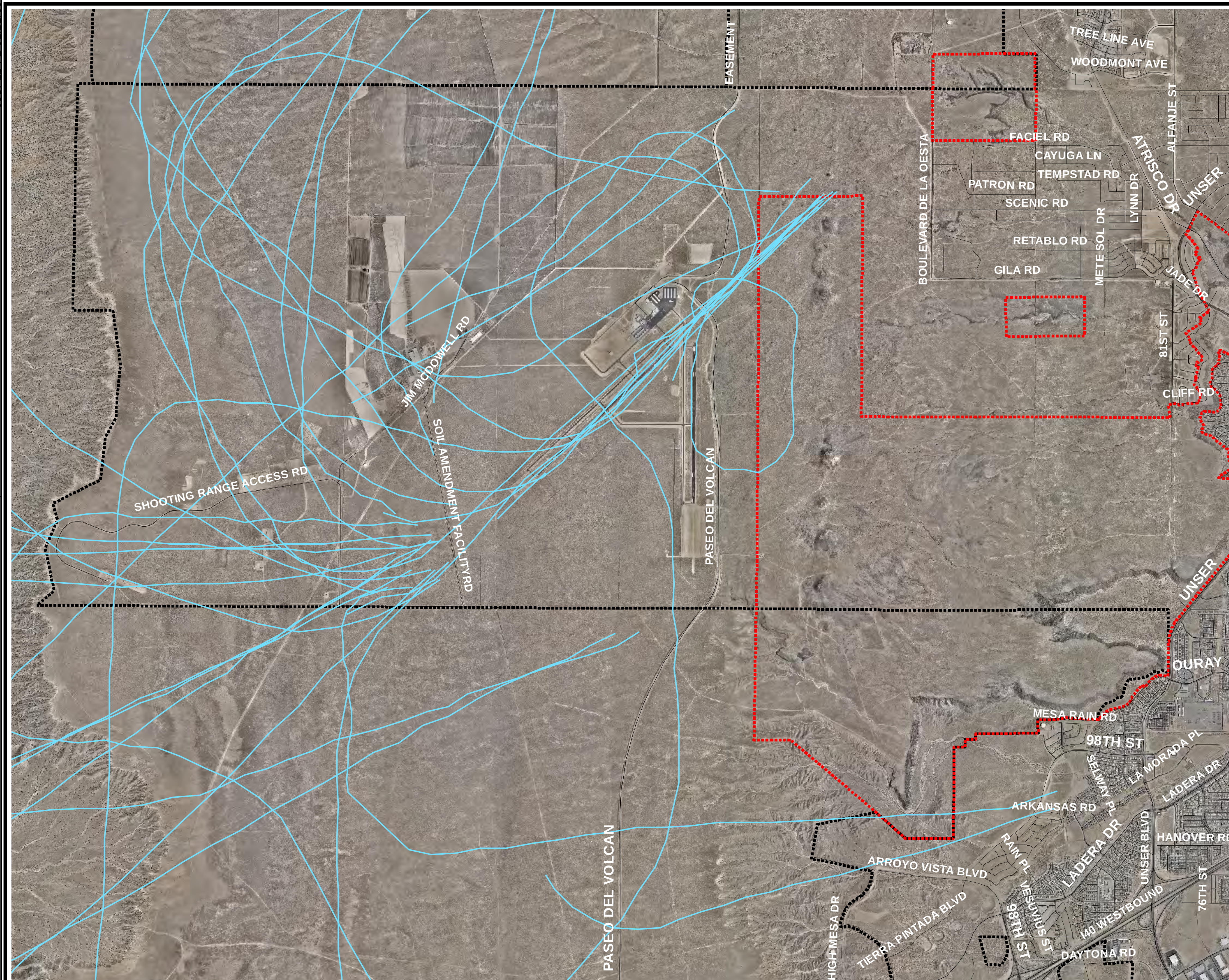
NORTH

0 4,000
1" = 4000'

Double Eagle II Airport

Exhibit F1
ARRIVAL STARS DATA

05SP12-F2-01/21/09



LEGEND

- Municipal Boundary
- Monument Boundry
- Radar Departure Tracks

Source: Coffman Associates Analysis.
Radar Track Data 1-10 March 2006.

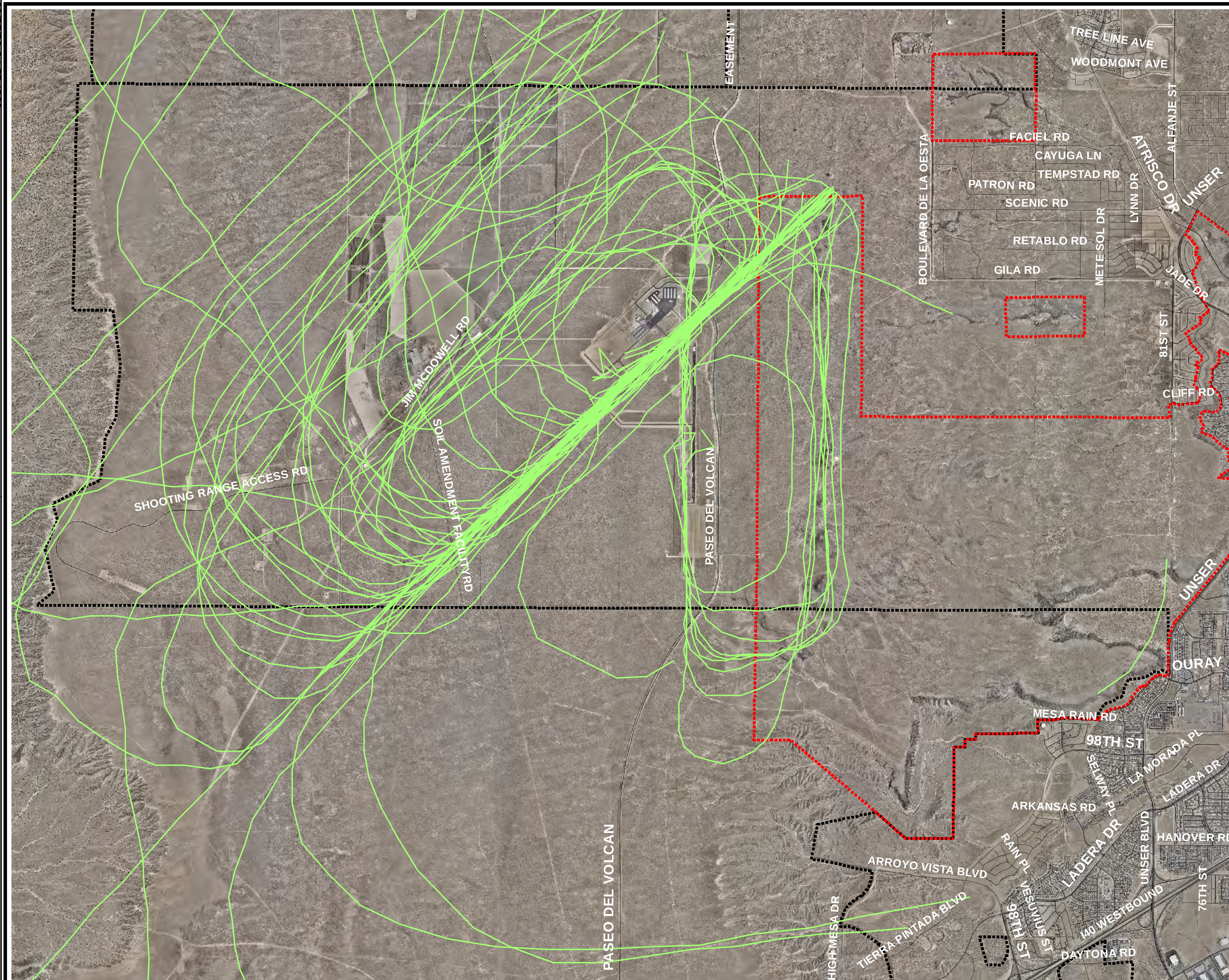
NORTH

0 4,000
1" = 4000'

Double Eagle II Airport

Exhibit F2
DEPARTURE STARS DATA

05SP12-F3-01/21/09



LEGEND

- Municipal Boundary
- Monument Boundry
- Radar Touch-and-Go Tracks

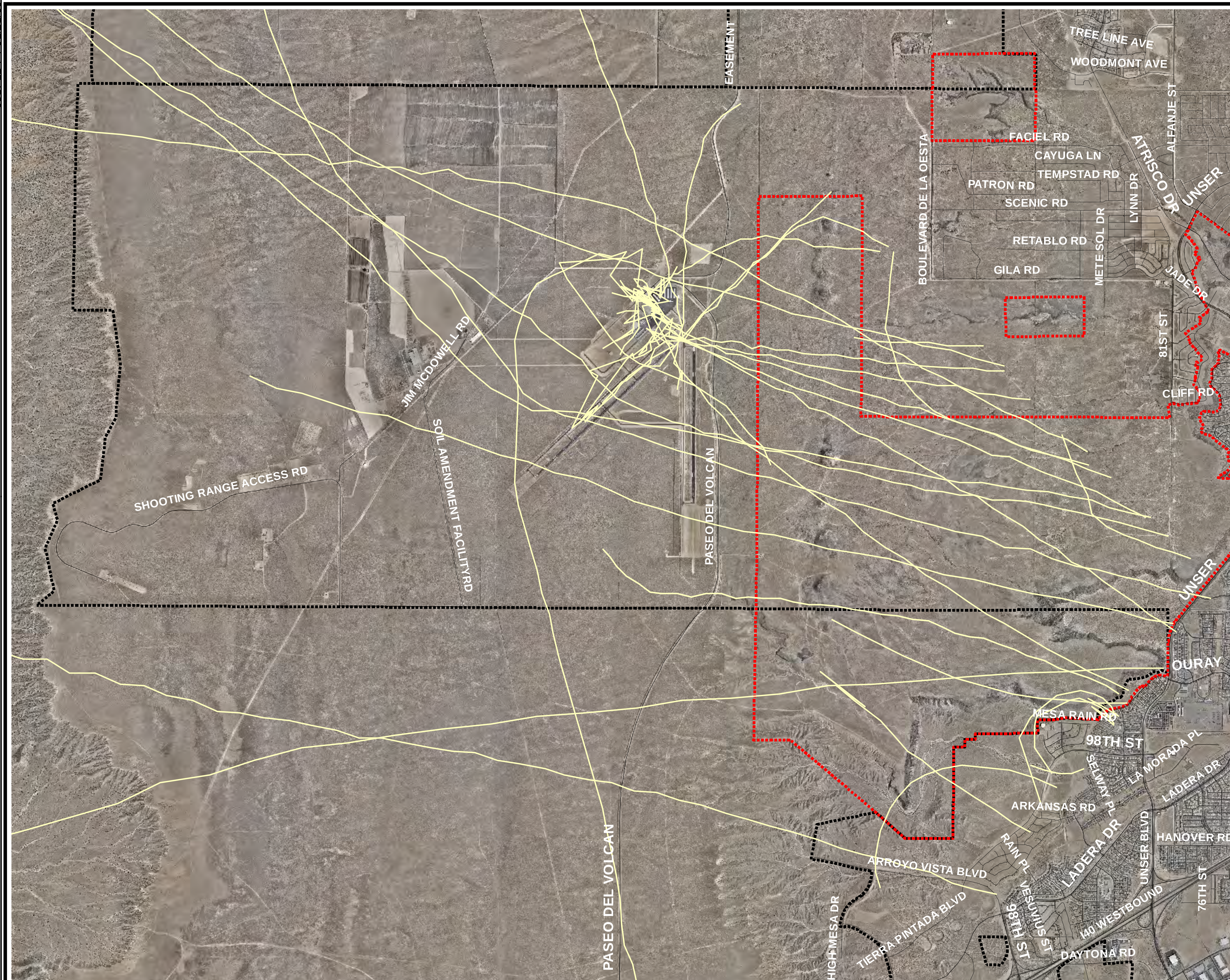
Source: Coffman Associates Analysis.
Radar Track Data 1-10 March 2006.

NORTH

0 4,000
1" = 4000'

Exhibit F3
TOUCH-AND-GO STARS DATA

05SP12-F4-01/21/09



LEGEND

- Municipal Boundary
- Monument Boundry
- Radar Helicopter Tracks

Source: Coffman Associates Analysis.
Radar Track Data 1-10 March 2006.

NORTH

0 4,000
1" = 4000'

Double Eagle II Airport

Exhibit F4
HELICOPTER STARS DATA

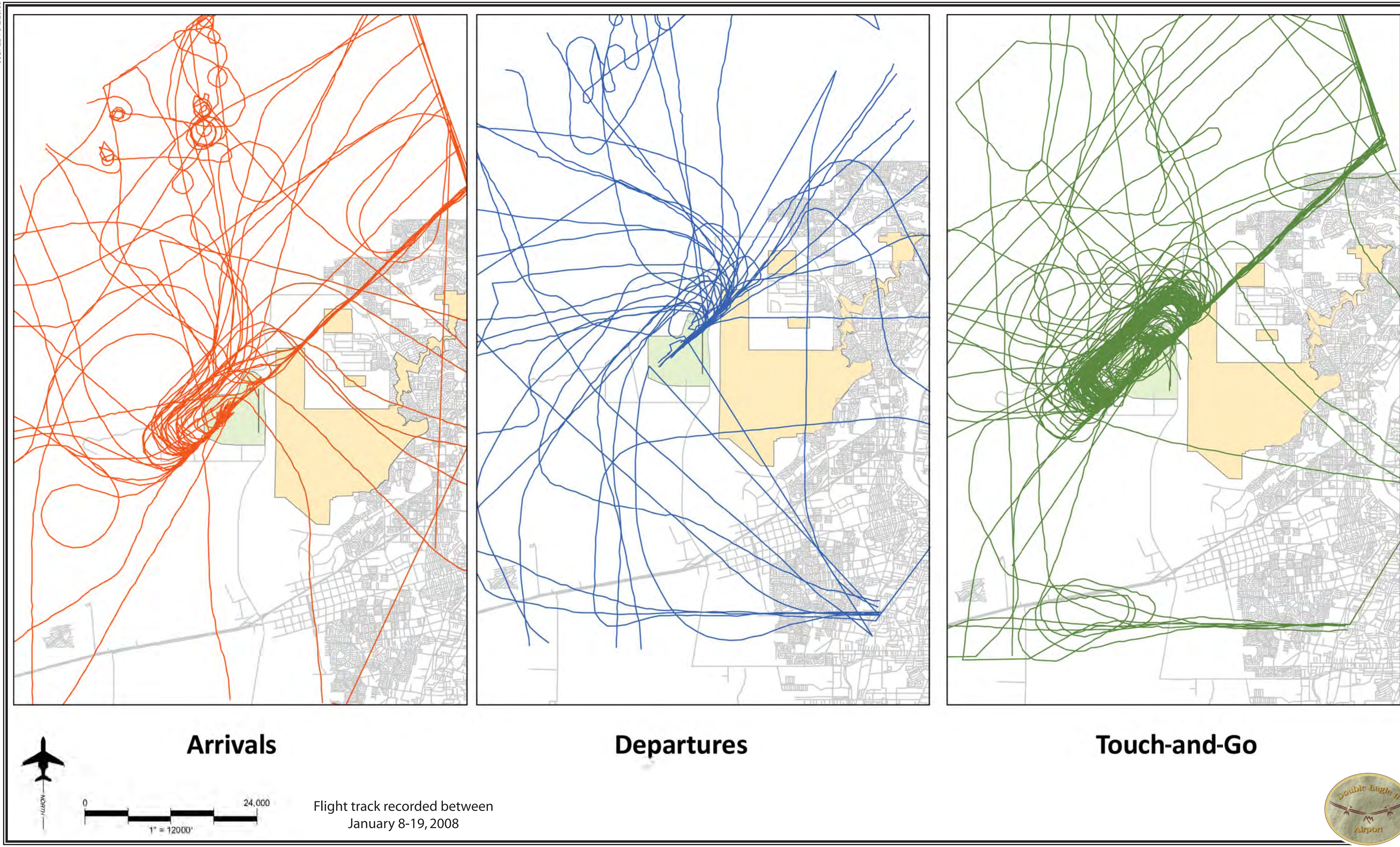
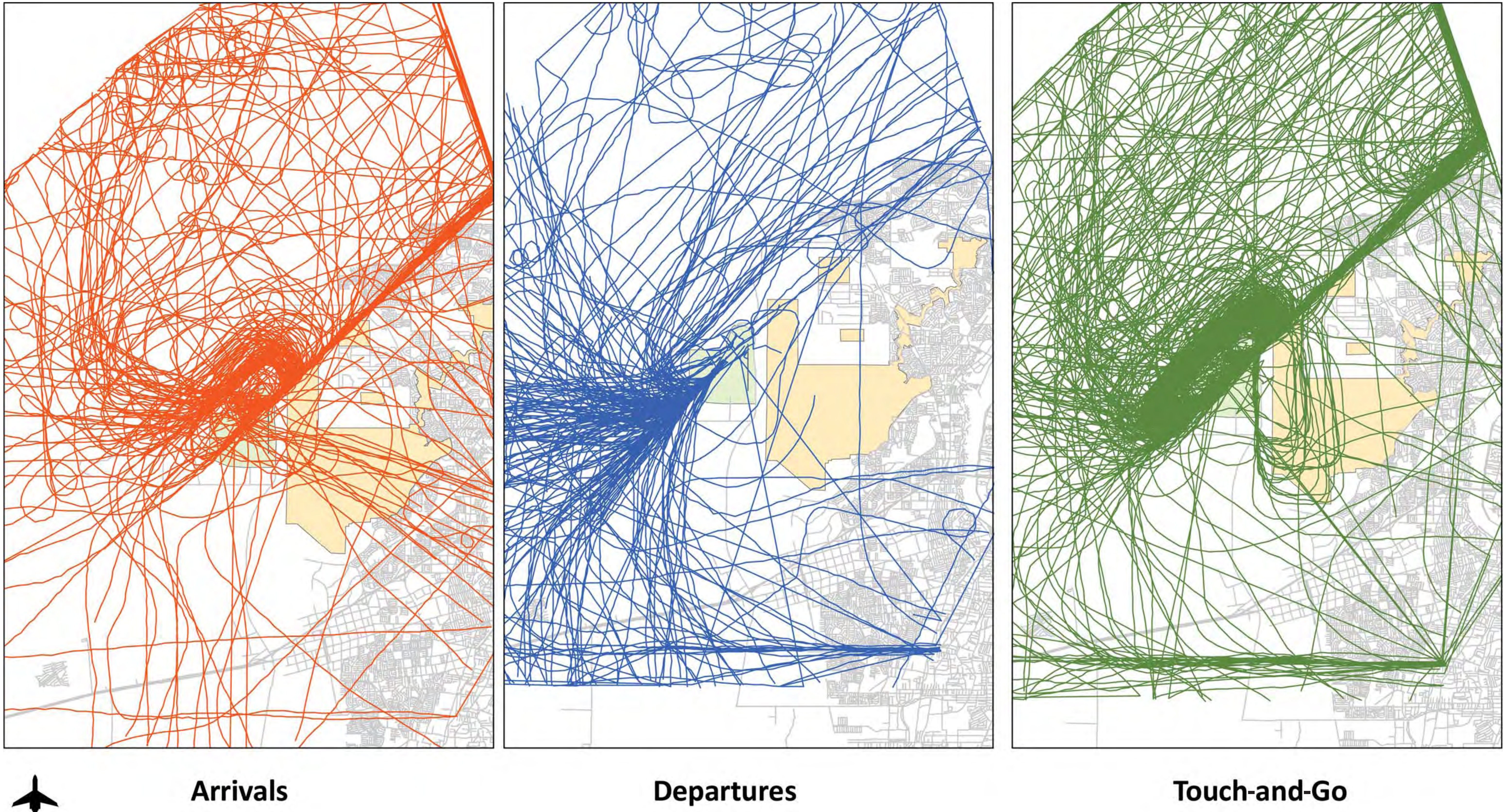


Exhibit F5
FLIGHT TRACK DATA
RUNWAY 4

05SP12-F6-1/20/09



NORTH

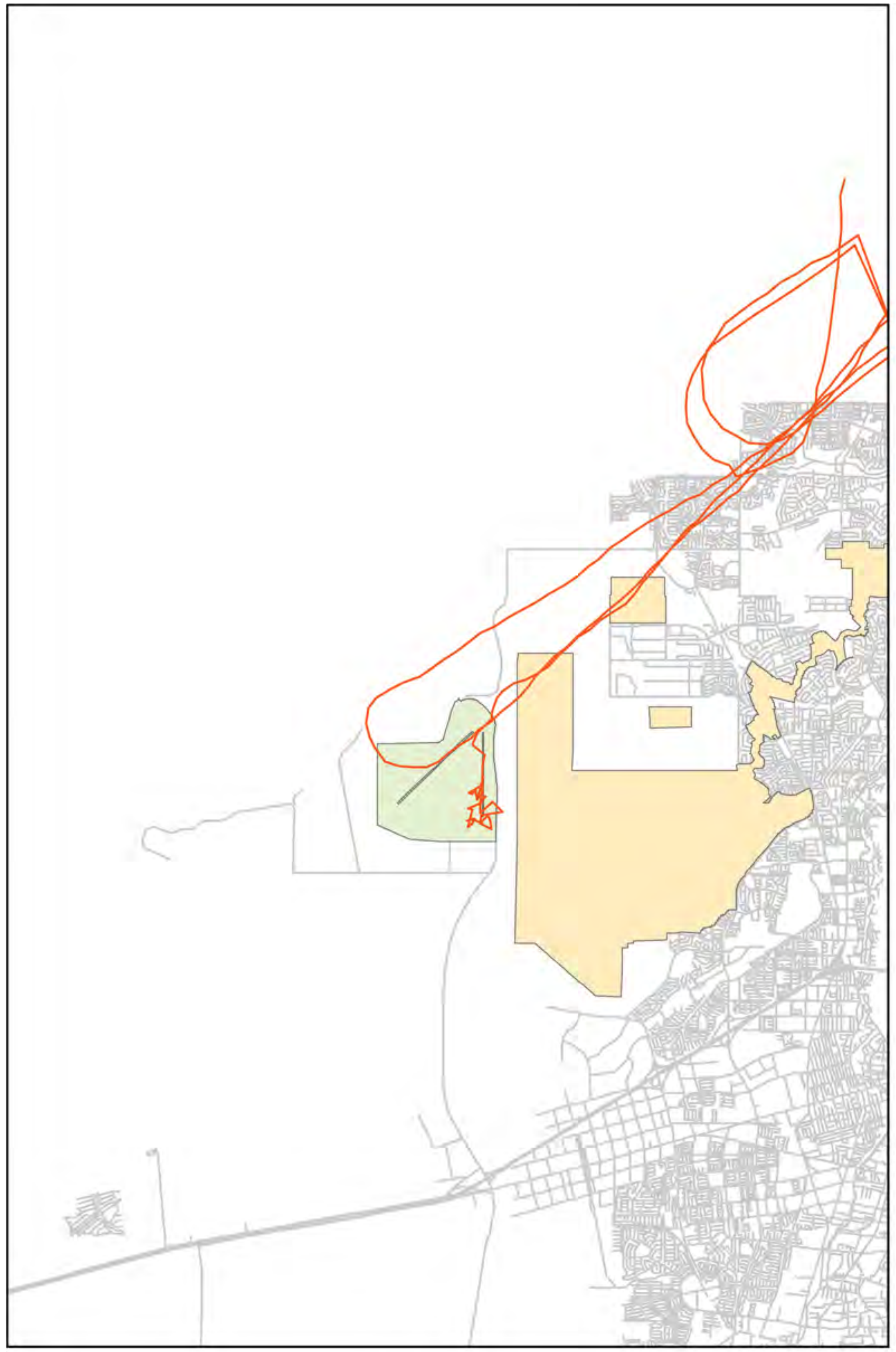
0 24,000
1" = 12000'

Flight track recorded between
January 8-19, 2008

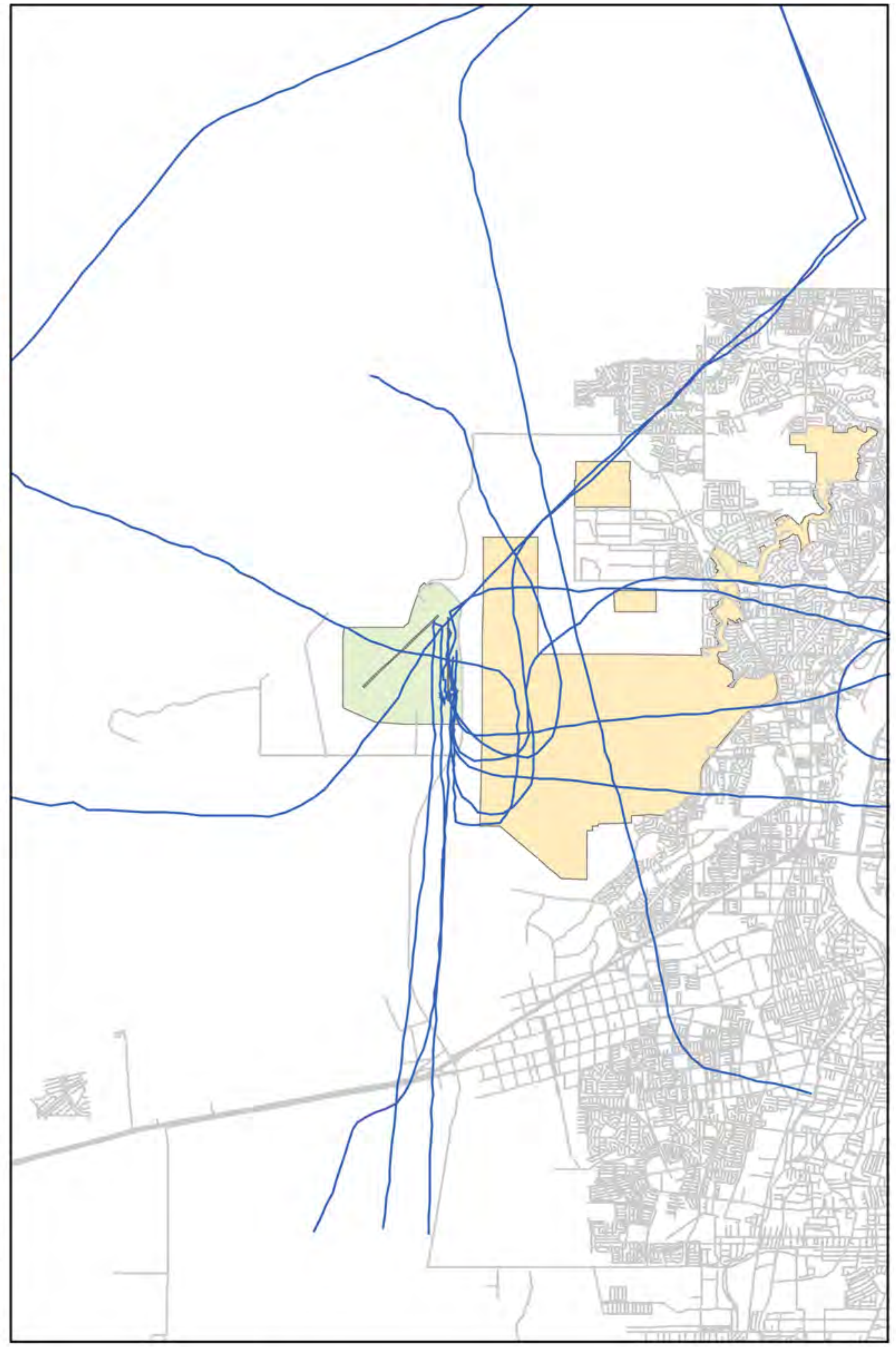
Double Eagle II Airport

Exhibit F6
FLIGHT TRACK DATA
RUNWAY 22

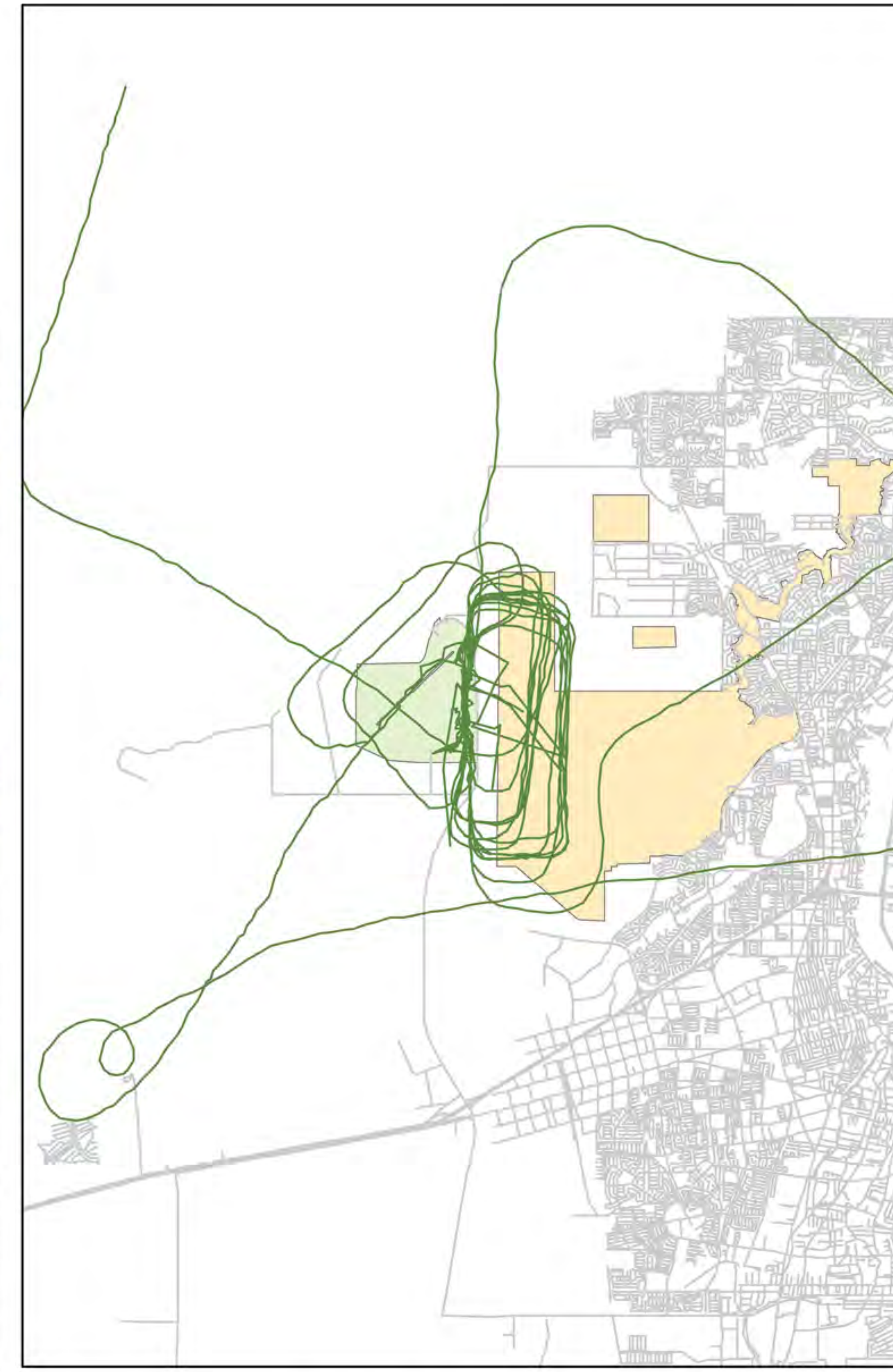
05SP12-F7-1/20/09



Arrivals



Departures



Touch-and-Go

NORTH

0 24,000

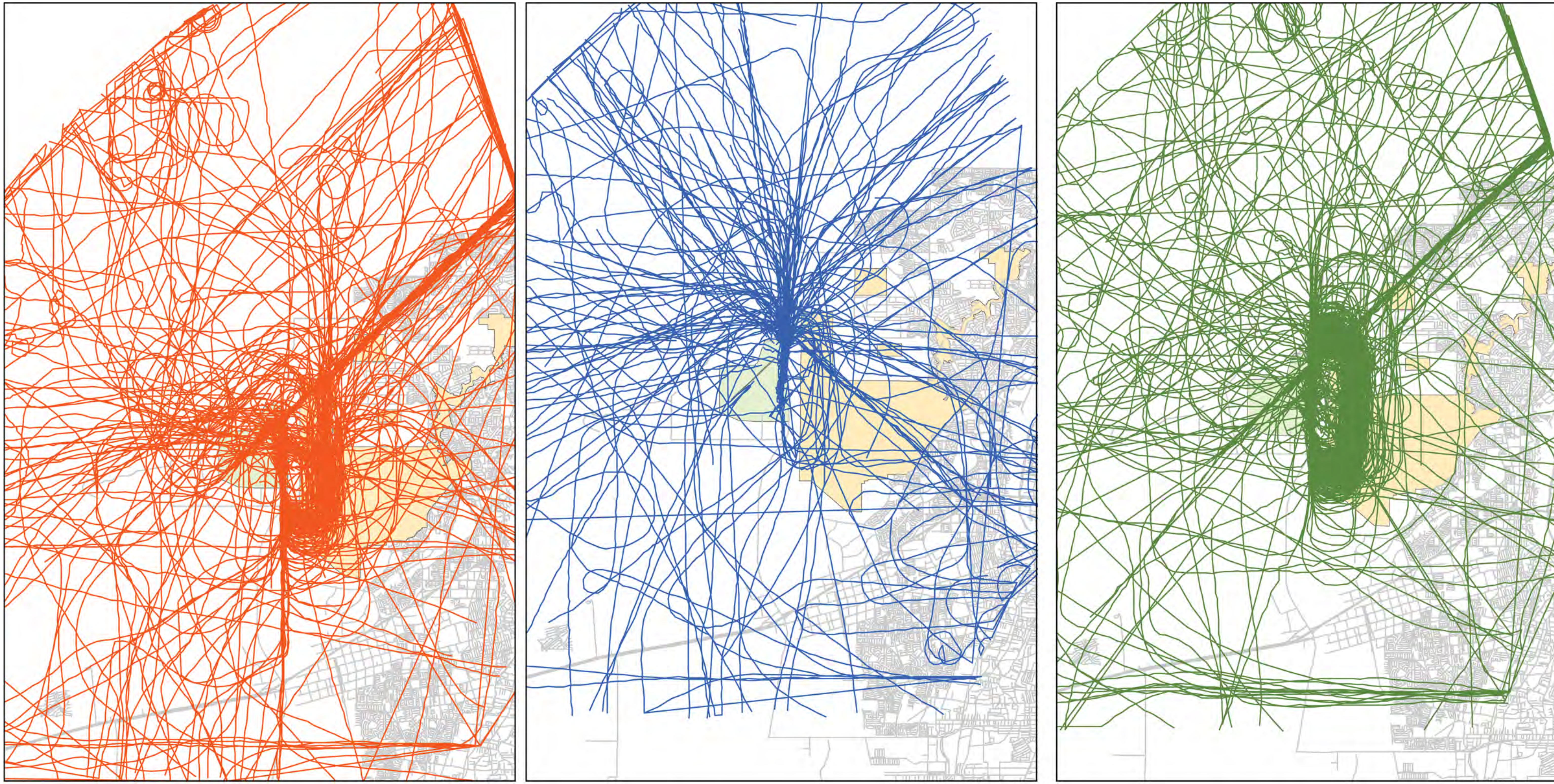
1" = 12000'

Flight track recorded between
January 8-19, 2008

Double Eagle II Airport

Exhibit F7
FLIGHT TRACK DATA
RUNWAY 17

05SP12-F8-1/20/09



Arrivals

Departures

Touch-and-Go

NORTH

0 24,000

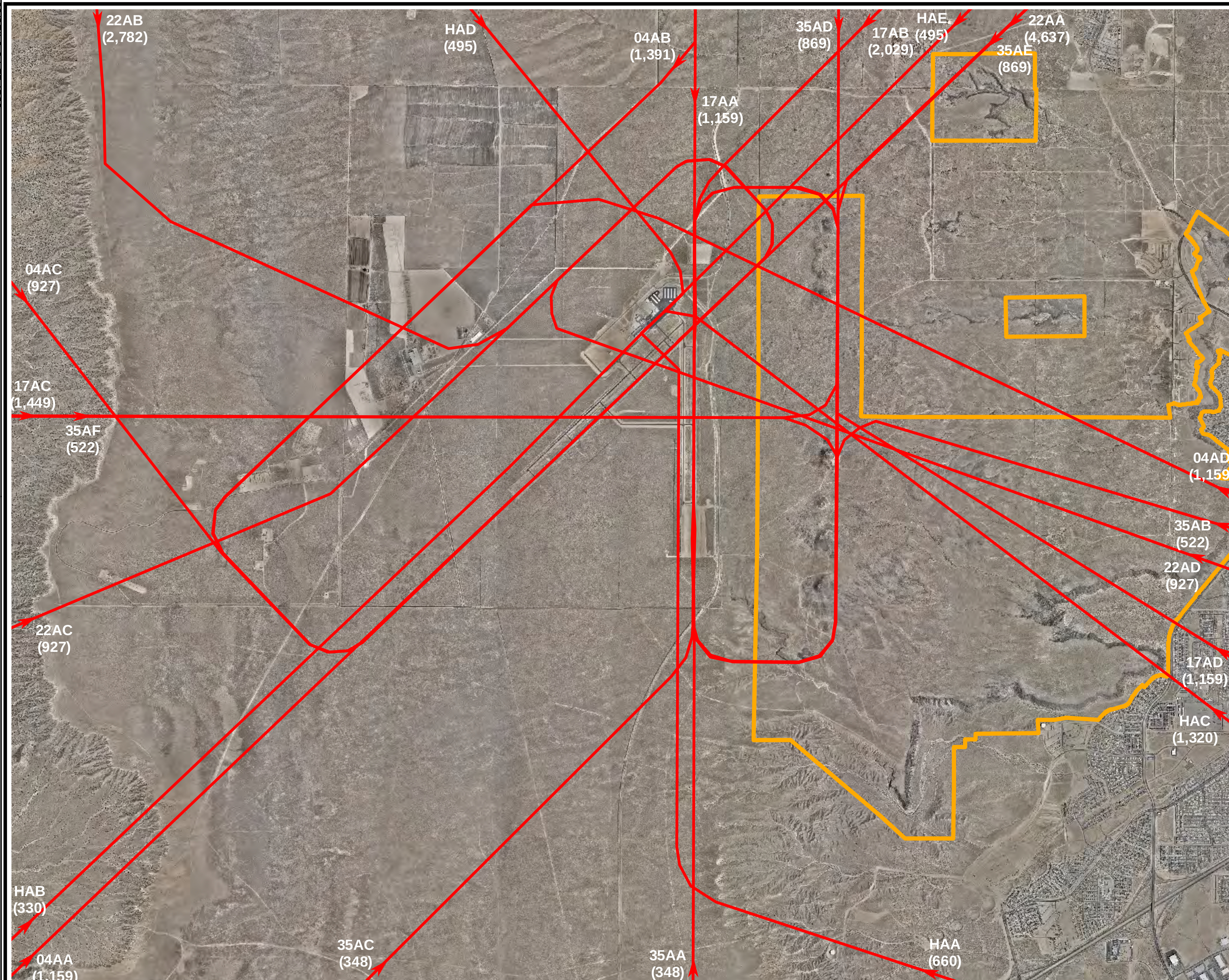
1" = 12000'

Flight track recorded between
January 8-19, 2008

Double Eagle II Airport

Exhibit F8
FLIGHT TRACK DATA
RUNWAY 35

05SP12-F9-04/23/09



LEGEND

- Monument Boundary
- INM Arrival Tracks
- **HAA** Track ID
- **(660)** Number of Annual Operations

Flight Track Assignments

Track	Existing
04AA	1,159
04AB	1,391
04AC	927
04AD	1,159
17AA	1,159
17AB	2,029
17AC	1,449
17AD	1,159
22AA	4,637
22AB	2,782
22AC	927
22AD	927
35AA	348
35AB	522
35AC	348
35AD	869
35AE	869
35AF	522
HAA	660
HAB	330
HAC	1,320
HAD	495
HAE	495

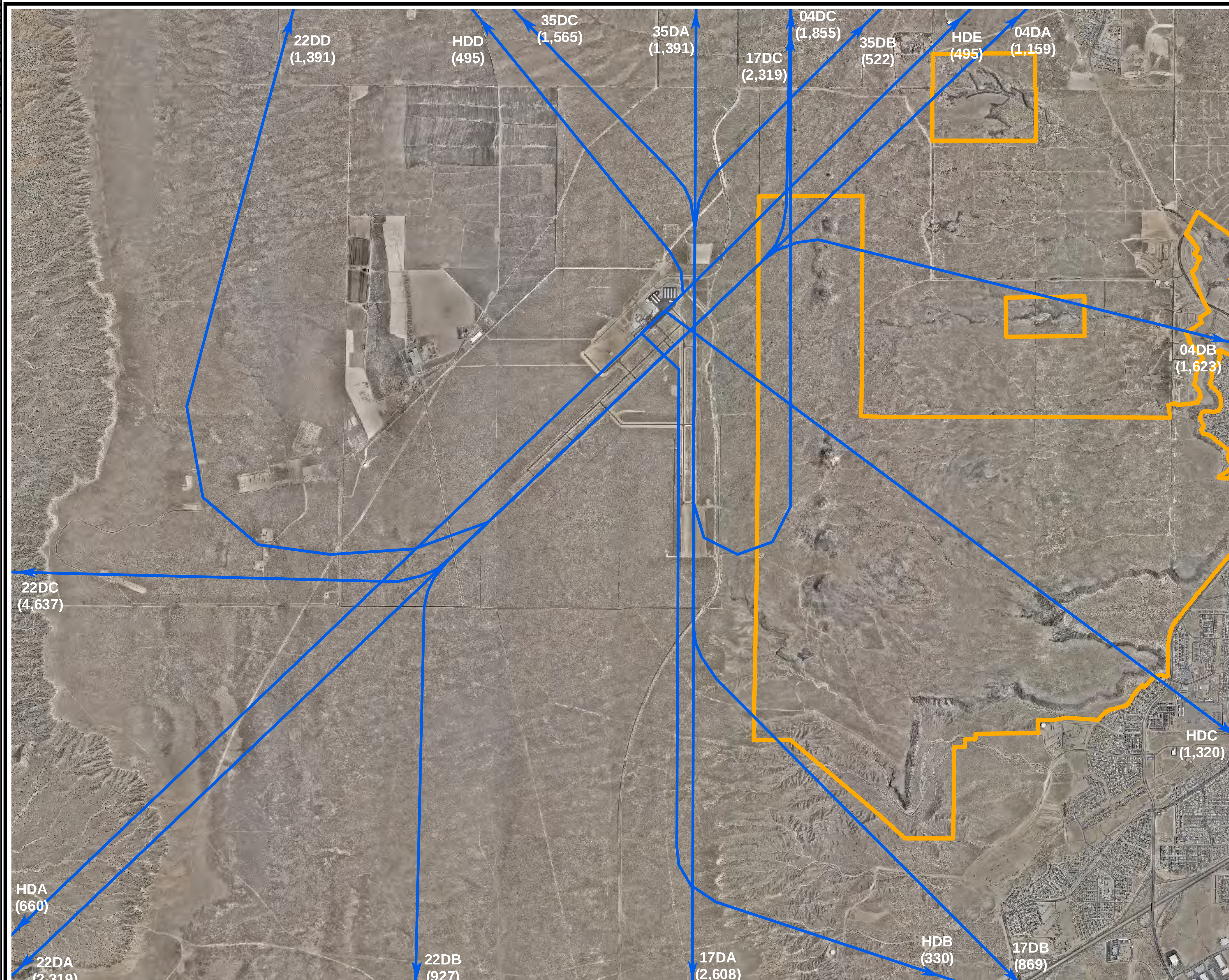
Source: Coffman Associates Analysis.

NORTH

0 4,000
1" = 4000'

Exhibit F9
EXISTING 2006
INM ARRIVAL TRACKS

05SP12-F10-04/23/09



LEGEND

Monument Boundary

INM Departure Tracks

HAA Track ID

(660) Number of Annual Operations

Flight Track Assignments

Track	Existing
04DA	1,159
04DB	1,623
04DC	1,855
17DA	2,608
17DB	869
17DC	2,319
22DA	2,319
22DB	927
22DC	4,637
22DD	1,391
35DA	1,391
35DB	522
35DC	1,565
HDA	660
HDB	330
HDC	1,320
HDD	495
HDE	495

Source: Coffman Associates Analysis.

NORTH

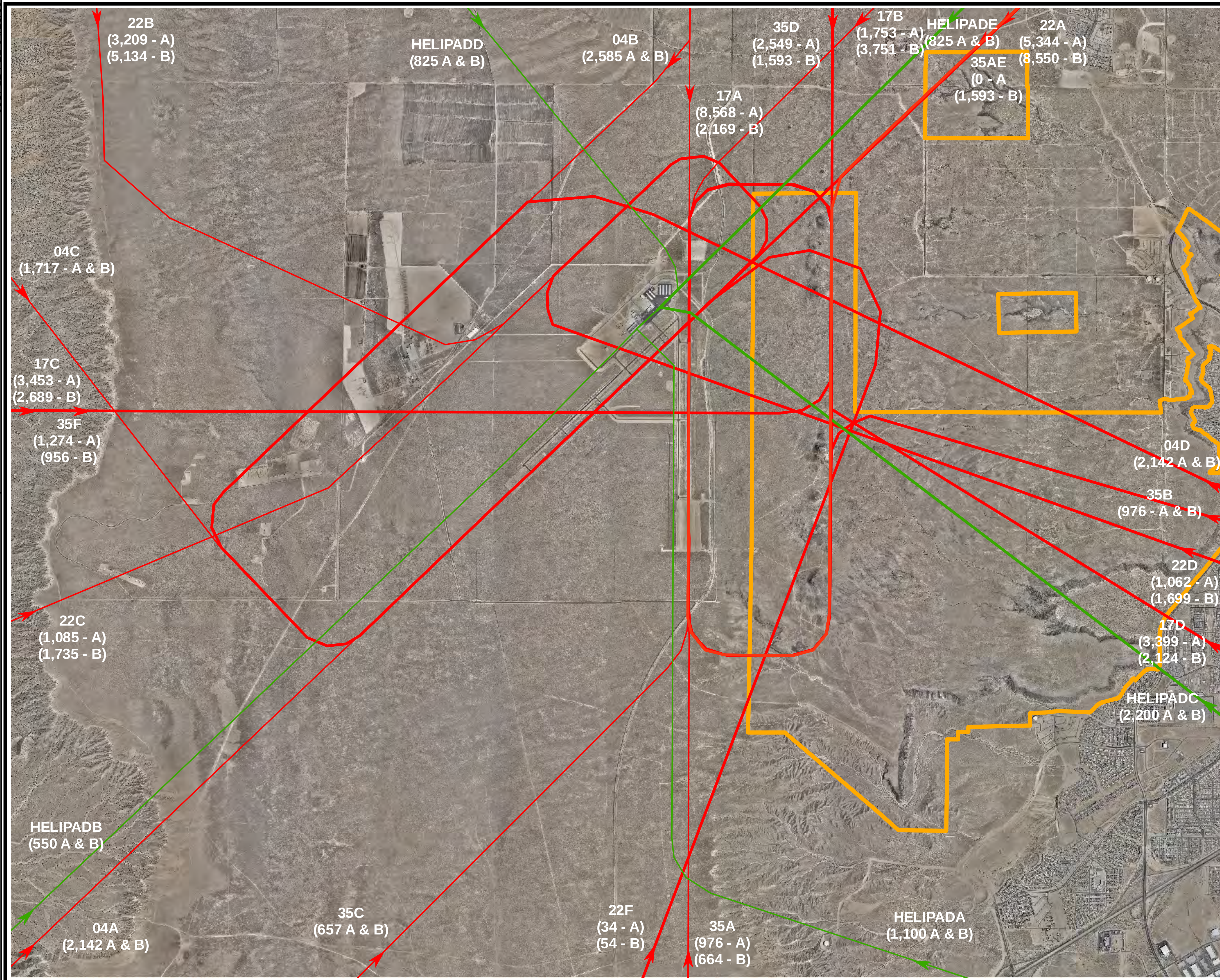
0 4,000

1" = 4000'

Double Eagle II Airport

Exhibit F10
EXISTING 2006
INM DEPARTURE TRACKS

05SP12-F11-04/23/09



LEGEND

- Monument Boundary
- INM Fixed Wing Arrival Tracks
- INM Helicopter Arrival Tracks

HAA Track ID
(660 - A) Number of Annual Operations - Alt.

Flight Track Assignments

Track	Alternative A	Alternative B
04AA	2,142	2,142
04AB	2,585	2,585
04AC	1,717	1,717
04AD	2,142	2,142
17AA	8,568	2,169
17AB	1,753	3,751
17AC	3,453	2,689
17AD	3,399	2,124
22AA	5,344	8,550
22AB	3,209	5,134
22AC	1,085	1,735
22AD	1,062	1,699
22AF	34	54
35AA	983	664
35AB	976	976
35AC	657	657
35AD	2,549	1,593
35AE	0	1,593
35AF	1,274	956
HAA	1,100	1,100
HAB	550	550
HAC	2,200	2,200
HAD	825	825
HAE	825	825

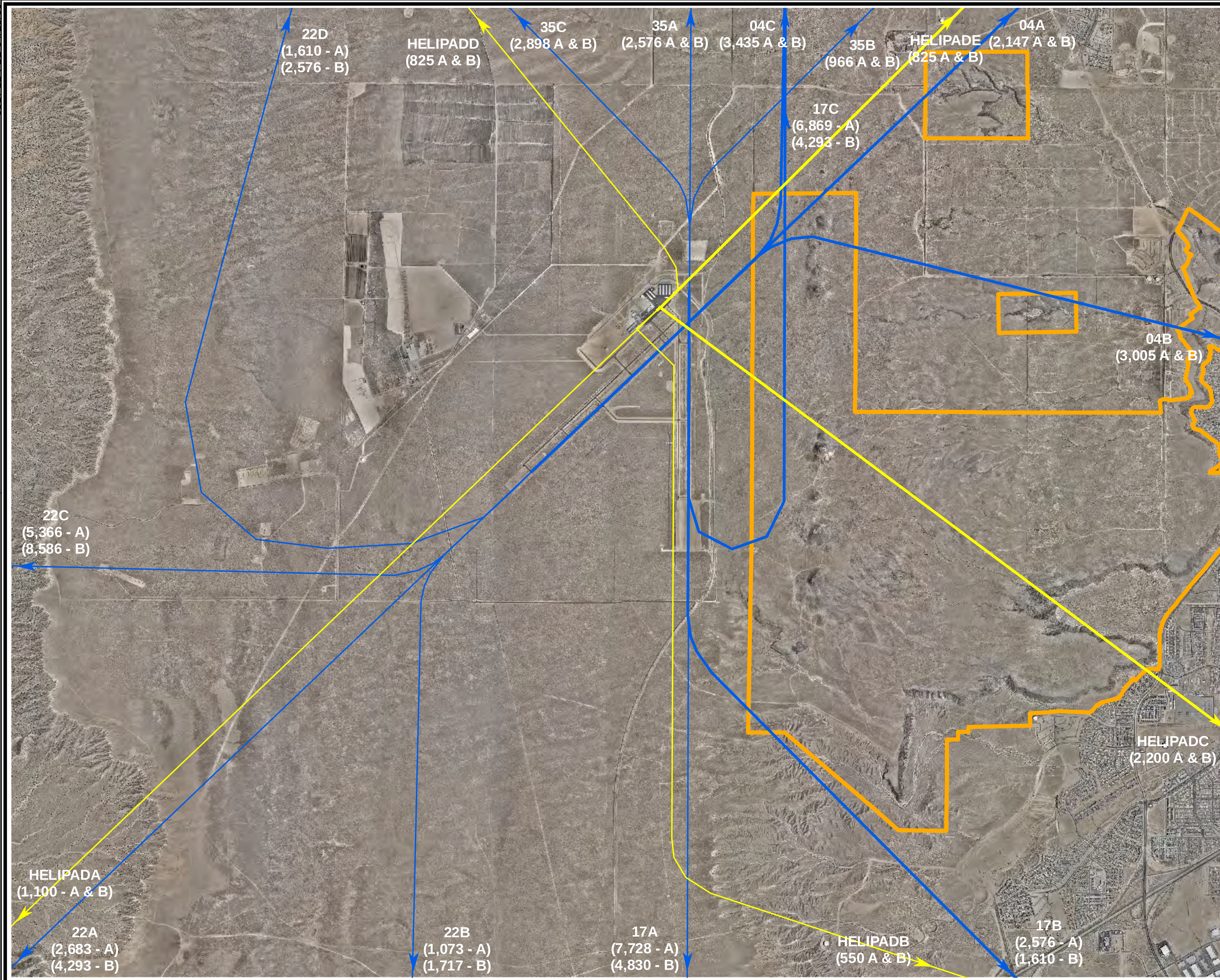
Source: Coffman Associates Analysis.

NORTH

0 4,000
1" = 4000'

Exhibit F11
2015 INM ARRIVAL TRACKS

05SP12-F12-04/23/09



LEGEND

- Monument Boundary
- INM Fixed Wing Departure Tracks
- INM Helicopter Departure Tracks

HAA Track ID
(660 - A) Number of Annual Operations - Alt.

Flight Track Assignments

Track	Alternative A	Alternative B
04DA	2,147	2,147
04DB	3,005	3,005
04DC	3,435	3,435
17DA	7,728	4,830
17DB	2,576	1,610
17DC	6,869	4,293
22DA	2,683	4,293
22DB	1,073	1,717
22DC	5,366	8,586
22DD	1,610	2,576
35DA	2,576	2,576
35DB	966	966
35DC	2,898	2,898
HDA	1,100	1,100
HDB	550	550
HDC	2,200	2,200
HDD	825	825
HDE	825	825

Source: Coffman Associates Analysis.

NORTH

0 4,000
1" = 4000'

Exhibit F12
2015 INM DEPARTURE TRACKS

Of particular note are the operational assignments for the 2015 arrival and departure tracks as these assignments translate to how the airport would likely operate under the two alternative scenarios. **Exhibit F11** depicts the modeled 2015[1] arrival tracks and operation assignment. As depicted on the exhibit, many of the operation assignments remain the same, (i.e., Track 04A 04B, and 04C). Differences in the flight track assignments occur primarily to the tracks that overfly the Monument or the Northern Geologic Window. For example, Track 22A is assigned 5,344 arrivals for Alternative A and 8,550 arrivals for Alternative B, and Track 17A is assigned 8,568 tracks for Alternative A and 2,169 tracks for Alternative B. This difference in operational assignment is attributed to the relocation of the instrument landing system from Runway 22 to Runway 17 and the lengthening of Runway 17-35 that is proposed through Alternative A. These changes to Runway 17-35 would result in increased use of this runway and a decrease in the use of Runway 4-22. This translates to fewer operations on Track 22A which overflies the Northern Geologic Window as well as the northernmost portions of the Petroglyph National Monument and more operations on Track 17A which does not overfly either of these sensitive areas.

Exhibit F12 depicts the modeled departure tracks and operational assignments. The changes in the departure operation assignments are directly related to which runway is the longest runway for each alternative. Aircraft require longer runway length for departure than arrival due to the increased weight of the aircraft resulting from fuel load. (Aircraft land lighter than they take off because of fuel usage.) For safety reasons, pilots typically prefer to take off on the longest runway to allow for a safe stop in case of an aborted take-off. The flight track assignments depicted on **Exhibit F12** allot a larger operational load to the longer runway for each alternative. Runway 17-35 is assigned more departures in Alternative A as it is the longest runway and vice versa for Alternative B.

[1] The 2015 forecast year is used in this discussion as it contains the higher activity level of those modeled within the noise analysis.

File

February 24, 2006

Ms. Nancy Reilly
FOIA Coordinator
FAA Southwest Region, ASW-43D
2601 Meacham Boulevard
Ft. Worth, TX 76193-0041

Re: Freedom of Information Request

Dear Ms. Reilly:

Pursuant to the Freedom of Information Act, 5 U.S.C. § 552, [and/or the Privacy Act, 5 U.S.C. § 552a], I request access to and copies of ARTS data for the Double Eagle II Airport (AEG) environs. Specifically we would like the following:

- Coverage window: 275 to 315 degrees from the ABQ ASR.
- Range: 8 to 18 nautical miles from ABQ ASR.
- Altitude: from the surface (approximately 5,837 feet MSL) to 9,837 feet MSL.
- Amount of coverage: fourteen consecutive days (preferably the first two weeks in March 2006).

Attached to this letter is a sample of the format in which we would like to receive this data; I would like to receive the data in an electronic format.

I am requesting this data on behalf of the City of Albuquerque Aviation Department for use in an ongoing Environmental Assessment (EA) which is being prepared for various improvements at the airport. The data will be used to assist in the development of aircraft noise contours to be included in the EA.

I agree to pay reasonable fees for the processing of this request in an amount not to exceed $500. However, please notify me prior to your incurring any expense in excess of that amount.

I look forward to your reply within 20 business days, as the statute requires. If my request is denied in whole or in part, I request a detailed justification for withholding the records. I also request and segregable portions that are not exempt to be disclosed.

Thank you for your prompt attention to this matter.

Sincerely,

Molly Waller
Airport Environmental Planner

Cc: Jim Hinde, Albuquerque Aviation Department
Steve Benson, Coffman Associates
Jerry Muse, FAA, ABQ ATCT

file

Coffman Associates
Airport Consultants

May 15, 2006

Ms. Nancy Reilly
FOIA Coordinator
FAA Southwest Region, ASW-43D
2601 Meacham Boulevard
Ft. Worth, TX 76193-0041

Re: ***Freedom of Information Request***

Dear Ms. Reilly:

We are in receipt of the STARS data for Double Eagle II Airport (AEG) for ten calendar days in March 2006. After reviewing the data we realized that the window of coverage does not contain critical portions of our study area. This is likely a mistake on our part. In order to provide thorough information within our Environmental Assessment (EA) we are requesting additional STARS data for the Double Eagle II Airport (AEG) environs pursuant to the Freedom of Information Act, 5 U.S.C. § 552, [and/or the Privacy Act, 5 U.S.C. § 552a]. Specifically we would like the following information:

- Operation types: All operations, including overflights. (IFR and VFR operations).
- Coverage window: Radius of five (5) miles centered on AEG.
- Altitude: From the surface (approximately 5,837 feet MSL) to 9,837 feet MSL.
- Amount of coverage: Ten consecutive days.

I am requesting this data on behalf of the Albuquerque Aviation Department for use in an ongoing Environmental Assessment (EA) which is being prepared for various improvements at the airport. The data will be used to assist in the development of aircraft noise contours to be included in the EA.

I would like to receive the data in an electronic format.

I agree to pay reasonable fees for the processing of this request in an amount not to exceed $500. However, please notify me prior to your incurring any expense in excess of that amount.

Thank you for your assistance. If you or anyone else have any questions, please do not hesitate to contact me at (816) 524-3500.

Sincerely,

Molly Waller

Molly Waller
Airport/Environmental Planner

Cc: Jim Hinde, Albuquerque Aviation Department
Steve Benson, Coffman Associates
Troy Erwin, Coffman Associates
Jerry Muse, FAA, ABQ ATCT

Kansas City • Phoenix
237 N.W. Blue Parkway, Suite 100, Lee's Summit, MO 64063 • Phone: 816.524.3500 • FAX: 816.524.2575

Coffman Associates
Airport Consultants

October 18, 2007

Ms. Sandra E. Freeman, FOIA Coordinator
FAA Southwest Region, ASW-31
2601 Meacham Boulevard
Ft. Worth, TX 76193-0030

Re: Freedom of Information Request

Dear Ms. Reilly:

We are in receipt of the STARS data for Double Eagle II Airport (AEG) for ten calendar days in October 2007. After reviewing the data previously obtained, we realized that the window of coverage does not contain critical portions of our study area. This is likely a mistake on our part. In order to provide thorough information within our Environmental Assessment (EA) we are requesting additional STARS data for the Double Eagle II Airport (AEG) environs pursuant to the Freedom of Information Act, 5 U.S.C. § 552, [and/or the Privacy Act, 5 U.S.C. § 552a]. Specifically we would like the following information:

- Operation types: all operations including overflights. (IFR and VFR operations)
- Coverage window: 270 to 340 degrees from the ABQ ASR.
- Range: 5 to 19 nautical miles from ABQ ASR.
- Altitude: from the surface (approximately 5,837 feet MSL) to 9,837 feet MSL.
- Amount of coverage: fourteen consecutive days (preferably the first two weeks in March 2006).

I am requesting this data on behalf of the Albuquerque Aviation Department for use in an ongoing Environmental Assessment (EA) which is being prepared for various improvements at the airport. The data will be used to assist in the development of aircraft noise contours to be included in the EA.

I would like to receive the data in an electronic format.

I agree to pay reasonable fees for the processing of this request in an amount not to exceed $500. However, please notify me prior to your incurring any expense in excess of that amount.

Thank you for your assistance. If you, or anyone else, have any questions please do not hesitate to contact me at (816) 524-3500.

Sincerely,

Molly Waller
Airport/Environmental Planner

Cc: Jim Hinde, Albuquerque Aviation Department
Steve Benson, Coffman Associates
Troy Erwin, Coffman Associates
Jerry Muse, FAA, ABQ ATCT

Appendix G

REQUIRED ANALYSIS FOR EACH ENVIRONMENTAL IMPACT CATEGORY

Appendix G
REQUIRED ANALYSIS FOR EACH ENVIRONMENTAL IMPACT CATEGORY

The purpose of this appendix is to provide detailed descriptions of the analyses undertaken for each of the impact categories in Chapter Four of this Environmental Assessment (EA). Appendix A of Federal Aviation Administration (FAA) Order 1050.1E, *Environmental Impacts: Policies and Procedures*, summarizes the requirements and procedures to be used in environmental impacts analysis. This appendix summarizes the pertinent sections of this FAA Order. Also provided within the following sections are established FAA "thresholds of significance." These thresholds assist the FAA in determining when an impact should be considered significant.

Following is a list of impact categories discussed in Chapter Four and the page number the discussion can be found:

NOISE

Aircraft sound emissions are often the most noticeable environmental impact an airport will produce on a surrounding community. If the sound is sufficiently loud or frequent in occurrence, it may interfere with various activities or otherwise be considered objectionable. To determine noise-related impacts that the proposed action could have on the environment surrounding the airport, noise exposure patterns based on projected future aviation activity should be analyzed. 49 USC Sections 47101 (a)(2), (c) and (h) establish policies to minimize current and projected noise impacts on nearby communities resulting from building and operating aviation facilities. This section also requires the Secretary of Transportation to consult with the Secretary of the Interior and the EPA Administrator about projects involving new airports, new runways, or major runway extensions that may cause significant environmental impacts.

AIRCRAFT NOISE ANALYSIS METHODOLOGY

The standard methodology for analyzing noise conditions at airports involves the use of a computer simulation model. The FAA has approved the Integrated Noise Model (INM) for use in EAs.

The INM describes aircraft noise in the Yearly Day-Night Average Sound Level (DNL). DNL accounts for the increased sensitivity to noise at night (10:00 p.m. to 7:00 a.m.) and is the metric preferred by the FAA, Environmental Protection Agency (EPA), and Department of Housing and Urban Development (HUD), among others, as an appropriate measure of cumulative noise exposure.

The INM works by defining a network of grid points at ground level around the airport. It then selects the shortest distance from each grid point to each flight track and computes the noise exposure for each aircraft operation by aircraft type and engine thrust level, along each flight track. Corrections are applied for air-to-ground acoustical attenuation, acoustical shielding of the aircraft engines by the aircraft itself, and aircraft speed variations. The noise exposure levels for each aircraft are summed at each grid location. The DNL at all grid points is used to develop noise exposure contours for selected values (e.g., 65, 70, and 75 DNL). Noise contours are then plotted on a base map of the airport environs using the DNL metrics.

In addition to the mathematical procedures defined in the model, the INM has another very important element. This is a database containing tables correlating noise, thrust settings, and flight profiles for most of the civilian aircraft and many common military aircraft operating in the United States. This database, often referred to as the noise curve data, has been developed under FAA guidance based on rigorous noise monitoring in controlled settings. In fact, the INM database was developed through more than a decade of research, including extensive field measurements of more than 10,000 aircraft operations. The database also includes performance data for each aircraft to allow for the computation of airport-specific flight profiles (rates of climb and descent). The most recent version of the INM, Version 7.0a, was used for modeling the noise condition for purposes of this EA.

INM Input

A variety of user-supplied input data is required to use the INM. This includes the airport elevation, average annual temperature, airport area terrain, a mathematical definition of the airport runways, the mathematical description of ground tracks above which aircraft fly, and the assignment of specific take-off weights to individual flight tracks. In addition, aircraft not included in the model's database may be defined for modeling, subject to FAA approval.

- **Activity Data**

Airport activity is defined as the take-offs and landings by aircraft operating at the facility; this is also referred to as aircraft operations. Activity is further described as either *local*, indicating aircraft practicing take-offs and landings (i.e., performing touch-and-go's), or *itinerant*, referring to the initial departure from or final arrival at the airport.

Existing and forecast airport activity (i.e., take-offs and landings, or operations by aircraft) are discussed in **Appendix D**. **Table G1** provides a summary of operations for the existing condition and two forecast years (2010 and 2015) for Alternatives A and B.

Existing airport activity (i.e., take-offs and landings, or operations by aircraft) for 2008 was estimated using data prepared during the development of the airport's Master Plan in 2002. **Table G1** provides a summary of operations for the existing condition as well as the two forecast years (2010 and 2015) for Alternative A, Alternative B, and the No Action Alternative. Additional information regarding the forecasts can be found in **Appendix D**.

- **Fleet Mix**

The selection of individual aircraft types is important to the modeling process because different aircraft types generate different noise levels. The aircraft fleet mix was derived from an inventory of existing operations at the airport. **Table G1** summarizes the generalized fleet mix data input into the noise analysis.

- **Database Selection**

In order to select the proper aircraft from the INM database, a review of the current fleet mix for Double Eagle II Airport was conducted. Different aircraft types generate different noise levels; therefore, selection of individual aircraft plays an important role in the noise modeling process. The following paragraphs outline the database selections used for input into the INM.

TABLE G1
Operational Fleet Mix
Double Eagle II Airport

Aircraft	INM Designator	2008	2010 Action	2010 No Action	2015 Action	2015 No Action	Day-time %	Night-time %
Itinerant								
Single Engine, Fixed Propeller	GASEPF	32,471	38,281	38,281	43,767	43,767	97.0%	3.0%
Single Engine, Variable Pitch Propeller	GASEPV	10,786	12,762	12,762	14,589	14,589	97.0%	3.0%
Multi-Engine Piston	BEC58P	1,413	1,775	1,775	2,207	2,207	97.0%	3.0%
Turboprop	CNA441	1,300	1,600	1,600	3,000	3,000	97.0%	3.0%
Military Turboprop	C130	0	900	900	900	900	100.0%	0.0%
Very Light Jet	CNA510	100	6,900	6,900	19,100	19,100	100.0%	0.0%
Business Jet, Stage 3	CIT3	24	225	100	345	75	100.0%	0.0%
Business Jet, Stage 3	CNA500	60	300	100	529	115	100.0%	0.0%
Business Jet, Stage 3	GIV	4	30	0	276	60	100.0%	0.0%
Business Jet, Stage 2	LEAR25	4	15	0	0	0	100.0%	0.0%
Business Jet, Stage 3	LEAR35	208	930	300	1,150	250	97.0%	3.0%
Helicopter, Military	UH60	0	900	900	900	900	80.0%	20.0%
Helicopter, Civilian	B206	6,600	8,200	8,200	10,100	10,100	97.0%	3.0%
Itinerant Subtotal		52,970	72,817	71,817	96,863	95,063		
Local								
Single Engine, Fixed Propeller	GASEPF	57,229	67,470	67,470	77,133	77,133	97.0%	3.0%
Single Engine, Variable Pitch Propeller	GASEPV	19,014	22,489	22,489	25,711	25,711	97.0%	3.0%
Multi-Engine Piston	BEC58P	2,487	3,125	3,125	3,893	3,893	97.0%	3.0%
Local Subtotal		78,730	93,083	93,083	106,737	106,737		
GRAND TOTAL		131,700	**165,900**	**164,900**	**203,600**	**201,800**		

Source: Coffman Associates analysis

Business Jet Aircraft. The INM provides data for most of the business jet aircraft in the national fleet. The following INM designators were selected to represent business jet operations at Double Eagle II Airport. In addition to Lear 35 operations, LEAR35 was used to model operations for the Lear 36, 45, 55, Falcon 10, 50, 900, and Beechjet 400. The CIT3 was used to model operations for the Cessna 650. Stage 2 Lear 25 operations were represented by the LEAR25 profile. Cessna 500, 501, 525, and 550 were modeled using the CNA500. The Eclipse Very Light Jet was modeled using the CNA510 profile. The GIV profile was used to represent Gulfstream IV and other large business jet aircraft.

Turbo-Prop Aircraft. The CNA441, typically the Cessna 441, effectively represents the light turbo-prop aircraft such as the Beech King Air, Cessna 402, Gulfstream Commander, and others.

Twin Piston Aircraft. The database list recommends the BEC58P, the Beech Baron, to represent the light twin piston aircraft such as the Piper Navajo, Beech Duke, Cessna 31, and others.

Single-Engine Aircraft. Because single-engine aircraft in the general aviation fleet vary widely in their noise characteristics, the INM utilizes two composite single-engine models. The FAA's substitution list indicates that the general aviation single-engine variable pitch propeller model, the GASEPV, represents a number of single-engine general aviation aircraft such as: Beech Bonanza, Cessna 177 and 180, Piper Cherokee Arrow, Piper PA-32, and the Mooney. The general aviation single-engine fixed pitch propeller model, the GASEPF, represents the Cessna 150 and 172, Piper Archer, Piper PA-28-140 and -180, and the Piper Tomahawk among others.

Military. The UH-60 Blackhawk helicopter was modeled using the UH60 profile. For military turboprop operations, the C130E was used.

Helicopter. Helicopter profiles are also included in the INM. The B206L (Bell 206) and Eurocopter EC130 (EC130) identifiers were used to model general aviation helicopter operations.

All the above choices conform to the Pre-Approved Substitution List published by the FAA Office of Environment and Energy (AEE) branch in Washington, D.C.

- **Time-of-Day**

The time-of-day which aircraft operations occur is an important component of the INM model and depends on the noise metric used to represent noise conditions. The average day-night noise level (DNL) adds additional weight to operations that occur during nighttime hours (10:00 p.m. to 7:00 a.m.). During this time, an additional 10 dB is added to all aircraft operations to represent the increased sensitivity that residents might have during nighttime hours. When calculating aircraft noise exposure, one nighttime operation is equal to ten daytime operations resulting from the penalty.

Because Double Eagle II Airport does not have the means to track flights at the airport, time-of-day information was gathered from conversations with the airport staff and fixed base operators. **Table G1** summarizes the time-of-day percentages assumed in the model. As shown in the table, a majority of operations occur during the daytime hours.

- **Runway Use**

Runway usage data is also an essential component for developing noise exposure contours in the INM. Local wind data can be used as a general guideline for determining runway use percentages. However, local wind data provides only the directional availability of a runway and does not consider pilot selection, primary runway operations, or local operating conventions. A discussion of wind conditions at the airport is included in **Appendix E**. At Double Eagle II Airport, the crosswind configuration at the airport offers four directions of choice. Continuous runway use records are not maintained by the airport. Runway usage estimates were established through discussions with the airport staff and an evaluation of the airport historic wind data. **Table G2** summarizes the runway use percentages for the existing condition and the No Action Alternative for 2010 and 2015. **Table G3** summarizes the runway use percentages for Alternative A for 2010 and 2015, and **Table G4** summarizes the runway use percentages for Alternative B for 2010 and 2015.

TABLE G2
Existing Condition and No Action (2008, 2010, 2015) Runway Use
Double Eagle II Airport

Runway	Business Jet	Military	General Aviation
Departures			
17	25%	25%	25%
35	15%	15%	15%
04	20%	20%	20%
22	40%	40%	40%
Arrivals			
17	25%	25%	25%
35	15%	15%	15%
04	20%	20%	20%
22	40%	40%	40%

Source: Runway usage was established through discussions with the Airport Manager and an evaluation of the wind conditions at Double Eagle II Airport.

TABLE G3
Alternative A (2010, 2015) Runway Use
Double Eagle II Airport

Runway	Business Jet	Military	General Aviation
Departures			
17	40%	40%	40%
35	15%	15%	15%
04	20%	20%	20%
22	25%	25%	25%
Arrivals			
17	40%	40%	40%
35	15%	15%	15%
04	20%	20%	20%
22	25%	25%	25%

Source: Runway usage was established through discussions with the Airport Manager and an evaluation of the wind conditions at Double Eagle II Airport.

TABLE G4 Alternative B (2010, 2015) Runway Use Double Eagle II Airport			
Runway	**Business Jet**	**Military**	**General Aviation**
Departures			
17	25%	25%	25%
35	15%	15%	15%
04	20%	20%	20%
22	40%	40%	40%
Arrivals			
17	40%	36%	36%
35	60%	54%	54%
04	0%	7%	7%
22	0%	3%	3%

Source: Runway usage was established through discussions with the Airport Manager and an evaluation of the wind conditions at Double Eagle II Airport.

- **Flight Tracks**

Local and standard air traffic procedures, radar flight track data from the Albuquerque International Sunport Airport Surveillance Radar (ASR) facility, and input from the Airport Manager and fixed base operators were used to develop consolidated flight tracks for use in the INM. A detailed discussion of the flight tracks and their development is included in **Appendix F**.

- **Flight Profiles**

The standard arrival profile used in the INM program is a three-degree approach. No indication was given by airport staff that there was any variation on this standard procedure; therefore, the standard approach was included in the model as representative of local operating conditions.

INM Version 7.0a computes the take-off profiles based on the user-supplied airport elevation and average annual temperature entries in the input batch. At Double Eagle II Airport, the elevation is 5,837 feet mean sea level (MSL) and the average annual temperature is 56.8 degrees Fahrenheit (F), based on information from the National Oceanic and Atmospheric Administration. If other than standard conditions (temperature of 59 degrees F and elevations of zero feet MSL) are specified by the user, the profile generator automatically computes the take-off profiles using the airplane performance coefficients in the database and equations in the Society of Aeronautical Engineers, *Aerospace Information Report 1845* (SAE/AIR 1845).

The INM computes separate departure profiles (altitude at a specified distance from the airport with associated velocity and thrust settings) for each of the various types of aircraft using the airport.

INM Output

Output data selected for calculation by the INM are annual average noise contours in DNL. The DNL is a measure of the 24-hour noise level of a community to allow for comparison between the No Action and proposed development alternatives.

Computer files developed from data described in the previous section provided input to the INM, which generated output files for years and alternatives being evaluated. In accordance with FAA Orders 1050.1E and 5050.4B, the 65, 70, and 75 DNL noise contours were produced for each alternative. Contours were prepared for the following: existing condition (2008); Alternative A year of implementation (2010) and five years beyond (2015); Alternative B year of implementation (2010) and five years beyond (2015); and the No Action Alternative for the years 2010 and 2015.

THRESHOLDS OF SIGNIFICANCE

FAA Orders 1050.1E and 5050.4B define a significant noise impact as one which would occur if the Proposed Action would cause noise-sensitive areas to experience an increase in noise of 1.5 DNL or more, at or above the 65 DNL noise exposure level when compared to the No Action Alternative for the same timeframe.

COMPATIBLE LAND USE

An airport's compatibility with surrounding land uses is usually associated with the extent of the airport's noise impacts. Airport projects such as those needed to accommodate fleet mix changes, an increase in operations at the airport, or air traffic changes are examples of activities which can alter noise impacts and affect surrounding land uses. Typically, if the noise analysis concludes that there is no significant impact, a similar conclusion usually can be made with respect to compatible land use. However, if the proposed action would result in other impacts exceeding thresholds of significance which have land use ramifications, such as disruption of communities, relocation of businesses or residences, and induced socioeconomic impacts, the effects of the land use impacts shall also be discussed within this section.

THRESHOLDS OF SIGNIFICANCE

When the noise analysis determines that a significant impact will occur over noise-sensitive areas within the 65 DNL noise contour, the compatible land use discussion should include a discussion on mitigation measures to be taken along with other land use controls. Special consideration needs to be given to unique and sensitive Section 4(f) properties.

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

Socioeconomic impacts known to result from airport improvements are often associated with relocation activities or other community disruptions, including alterations to surface transportation patterns, division or disruption of existing communities, interferences with orderly planned development, or an appreciable change in employment related to the project. Social impacts are generally evaluated based on areas of acquisition and/or areas of significant project impact, such as areas encompassed by noise levels in excess of 65 DNL.

Executive Order 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations,* and the accompanying Presidential Memorandum, and Order DOT 5610.2, *Environmental Justice*, require FAA to provide for meaningful public involvement by minority and low-income populations as well as analysis that identifies and addresses potential impacts on these populations that may be disproportionately high and adverse.

Pursuant to Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks,* federal agencies are directed to identify and assess environmental health and safety risks that may disproportionately affect children. These risks include those that are attributable to products or substances that a child is likely to come in contact with or ingest, such as air, food, drinking water, recreational waters, soil, or products they may be exposed to.

The acquisition of the residences and farmland is required to conform with the *Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970* (URARPAPA). These regulations mandate that certain relocation assistance services be made available to homeowners/tenants of the properties. This assistance includes help finding comparable and decent substitute housing for the same cost, moving expenses, and in some cases, loss of income.

THRESHOLDS OF SIGNIFICANCE

The thresholds of significance for this impact category are reached if the project negatively affects a disproportionately high number of minority or low-income populations or if children would be exposed to a disproportionate number of health and safety risks. Significant socioeconomic impacts would result if an extensive number of residents need to be relocated and sufficient replacement housing is unavailable; if extensive relocation of business is required and this relocation would create a severe economic hardship for the affected communities; if disruptions of local traffic patterns would substantially reduce the level of service of the roads serving the airport and the surrounding community; or, if there would be a substantial loss in the community tax base.

SECONDARY (INDUCED) IMPACTS

Major development proposals often involve the potential for induced or secondary impacts on surrounding communities. When such potential exists, the EA shall describe in general terms such factors. Examples include: shifts in patterns of population movement and growth; public service demands; and changes in business and economic activity to the extent influenced by the airport development. Induced impacts will normally not be significant except where there are also significant impacts in other categories, especially noise, land use, or direct social impacts.

No threshold of significance has been established for this impact category.

AIR QUALITY

The FAA is responsible for ensuring that appropriate analysis be contained within *National Environmental Policy Act* (NEPA) documents to disclose the potentially significant impact of a proposed action on the attainment and maintenance of air quality standards established by law or administrative determination. It is also the FAA's responsibility to assure that proposed actions conform with applicable State Implementation Plans (SIPs) when they have been prepared and adopted.

Air quality in a given location is described by the concentrations of various pollutants in the atmosphere. The significance of a pollutant concentration is determined by comparing it to the state and federal ambient air quality standards. The United States Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for six pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), lead (Pb), ozone (O_3), and particulate matter (PM_{10} and $PM_{2.5}$).

Based upon both federal and state air quality standards, a specific geographic area can be classified under the federal and state *Clean Air Act* (CAA) as either being an "attainment," "non-attainment," or "maintenance" area for each criteria pollutant. The criterion for non-attainment designation varies by pollutant.

AIR QUALITY STANDARDS AND REGULATORY SETTING

The U.S. Environmental Protection Agency (EPA) has adopted air quality standards that specify the maximum permissible near-term and long-term concentrations of various air contaminants. The National Ambient Air Quality Standards (NAAQS) consist of primary and secondary standards for each pollutant as presented in **Table G5**. Primary air quality standards are established at levels to protect the public health from harm with an adequate margin of safety. Secondary standards are set at levels necessary to protect the public health and welfare from any known or anticipated adverse effects of a pollutant. All areas of the country are required to demonstrate attainment with the NAAQS. New Mexico has adopted the federal ambient air quality standards.

The federal air quality standards focus on limiting the quantity of six criteria pollutants:

- Ozone (O_3)
- Carbon Monoxide (CO)
- Sulfur Dioxide (SO_x)
- Nitrogen Dioxide (NO_x)
- Particulate Matter (PM_{10} and $PM_{2.5}$)
- Lead (Pb)

Air contaminants increase the aggravation and production of respiratory and cardiopulmonary diseases. The standards also establish the level of air quality which is necessary to protect the public health and welfare including, among other things, effects on crops, vegetation, wildlife, visibility, and climate, as well as effects on materials, economic values, and on personal comfort and well-being.

THRESHOLDS OF SIGNIFICANCE

Potentially significant air quality impacts associated with an FAA project or action would occur if the project or action exceeds one or more of the NAAQS for any of the time periods analyzed.

TABLE G5 National Ambient Air Quality Standards			
Pollutant	**Averaging Time**	**Primary Standard**	**Secondary Standard**
Carbon Monoxide (CO) in parts per million (ppm)	8-hour 1-hour	9 35	– –
Nitrogen Dioxide (NO_x) in ppm	Annual	0.053	0.053
Ozone (O_3) in ppm	1-hour 8-hour	0.12 0.08	0.12 0.08
Lead (Pb) in micrograms per cubic meter	Quarterly Average	1.5	1.5
Particulate Matter (PM_{10}) in micrograms per cubic meter	Annual 24-hour	50 150	50 150
Particulate Matter ($PM_{2.5}$) in micrograms per cubic meter	Annual 24-Hour	65 15	65 15
Sulfur Dioxide (SO_x) in ppm	Annual 24-hour 3-hour	0.03 0.14 –	– – 0.50
Source: U.S. Environmental Protection Agency			

WATER QUALITY

The *Clean Water Act* provides the authority to establish water quality standards, control discharges, develop waste treatment management plans and practices, prevent or minimize the loss of wetlands, and regulate other issues concerning water quality. Water quality concerns related to airport development most often relate to the potential for surface runoff and soil erosion as well as the storage and handling of fuel, petroleum products, solvents, etc.

THRESHOLDS OF SIGNIFICANCE

Water quality regulations and issuance of permits will normally identify any deficiencies in the proposed development with regard to water quality or any additional information necessary to make judgments on the significance of impacts. Difficulties in obtaining needed permits for the project, such as National Pollutant Discharge Elimination System (NPDES) or Section 404 permits, typically indicate a potential for significant water quality impacts.

HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Determination of a project's environmental impact to historic and cultural resources is made under guidance in the *National Historic Preservation Act* (NHPA) *of 1966*, as amended, the *Archaeological and Historic Preservation Act* (AHPA) *of 1974*, the *Archaeological Resources Protection Act* (ARPA), and the *Native American Graves Protection and Repatriation Act* (NAGPRA) *of 1990*. In addition, the *Antiquities Act of 1906*, the *Historic Sites Act of 1935*, and the *American Indian Religious Freedom Act of 1978* also protect historical, architectural, archaeological, and cultural resources.

Section 106 of the NHPA of 1966, as amended, requires federal agencies to take into account the effects of their undertakings on historic properties and determine if any properties in, or eligible for inclusion in, the National Register of Historic Places are present in the area. In addition, it affords the Advisory Council on Historic Preservation a reasonable opportunity to comment. The historic preservation review process mandated by Section 106 is outlined in regulations issued by the council.

The ARPA is triggered by the presence of archaeological resources on federal or Indian lands. The AHPA describes the process when consultation with resource agencies indicates that there may be an impact on significant scientific, prehistoric, historic, archaeological, or paleontological resources. The process provides for the preparation of a professional resource survey of the area. Should the survey identify significant resources, the National Register process described above will be followed. Should the survey be inconclusive, a determination is made whether it is appropriate to provide a commitment to halt construction if resources are recovered, in order for a qualified professional to evaluate their importance and provide for data recovery, as necessary.

The NAGPRA is triggered by the possession of human remains or cultural items by a federally funded repository or by the discovery of human remains or cultural items on federal or tribal lands and provides for the inventory, protection, and return of cultural items to affiliated Native American Groups. The Act includes provisions that, upon inadvertent discovery of remains, the action will cease in the area where the remains were discovered and the appropriate agency will be notified.

The *Antiquities Act of 1906* was the first general law providing protection for archaeological resources. It protects all historic and prehistoric sites on federal lands and prohibits excavation or destruction of such antiquities without the permission of the Secretary of the department having jurisdiction.

The *Historic Sites Act of 1935* declares as national policy the preservation for public use of historic sites, buildings, objects, and properties of national significance. It gives the Secretary of the Interior authority to make historic surveys, to secure and preserve data on historic sites, and to acquire and preserve archaeological and historic sites. This Act also establishes the National Historic Landmarks program for designating properties having exceptional value in commemorating or illustrating the history of the United States.

The *American Indian Religious Freedom Act of 1978* requires consultation with Native American groups concerning proposed actions on sacred sites, on federal land, or affecting access to sacred sites. It establishes federal policy to protect and preserve for American Indians, Eskimos, Aleuts, and Native Hawaiians their right to free exercise of their religion. It allows these peoples to access sites, use and possess sacred objects, and freedom to worship through ceremonial and traditional rites. The Act requires federal agencies to consider the impacts of their actions on religious sites and objects that are important to Native Americans regardless of the eligibility for the NRHP. Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, and the Presidential Memorandum of April 29, 1994, *Government to Government Relations with Native American Tribal Governments,* outline the government-to-government consultation process between the federal agency and the potentially affected tribe.

THRESHOLDS OF SIGNIFICANCE

The action would affect a property that is on or eligible for inclusion in the NRHP if it has the potential to alter the characteristics of the property which make it eligible for listing. Federal agencies can make one of three types of "effects findings" for an action: "no properties effected," "no adverse effect," and "adverse effect." The level of finding depends upon how severely a project would alter the characteristics of a property that make it eligible for the NRHP. Although the FAA works closely with the State Historic Preservation Officer (SHPO) and/or the Tribal Historic Preservation Officer (THPO), the FAA is ultimately responsible for the effect decision, not the SHPO or THPO.

The Section 106 consultation process includes consideration of alternatives to avoid adverse effects on National Register listed or eligible properties; of mitigation measures; and of accepting adverse effects. The FAA makes the final determination on the level of effect, and advice from the SHPO/THPO may assist FAA in making that determination.

DEPARTMENT OF TRANSPORTATION ACT: SECTION 4(f)

Section 4(f) of the DOT Act, which was recodified and renumbered as Section 303(c) of 49 USC, provides that the Secretary of Transportation will not approve any program or project that requires the use of any publicly owned land from a historic site, public parks, recreation areas, or waterfowl and wildlife refuges of national, state, regional, or local importance unless there is no feasible and prudent alternative to the use of such land, and the project includes all possible planning to minimize harm resulting from the use.

THRESHOLDS OF SIGNIFICANCE

A significant impact would occur when a proposed action either involves more than a minimal use of a Section 4(f) property or is deemed a "constructive use," thereby substantially impairing the Section 4(f) property, and mitigation measures do not eliminate or reduce the effects. Substantial impairment would occur when impacts to Section 4(f) lands are sufficiently serious so that the value of the site in terms of its prior significance and enjoyment are reduced or lost.

FISH, WILDLIFE, AND PLANTS

Section 7 of the *Endangered Species Act* (ESA), as amended, applies to federal agency actions and sets forth requirements for consultation to determine if the proposed action "may affect" a federally endangered or threatened species. If an agency determines that an action "may affect" a federally protected species, then Section 7(a)(2) requires each agency to consult with the U.S. Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NMFS), as appropriate, to ensure that any action the agency authorizes, funds, or carries out is not likely to jeopardize the continued existence of any federally listed endangered or threatened species, or result in the destruction or adverse modification of critical habitat. If a species has been listed as a candidate species, Sec. 7 (a)(4) states that each agency must confer with the FWS and/or NMFS.

The *Sikes Act* and various amendments authorize states to prepare statewide wildlife conservation plans, and the Department of Defense (DOD) to prepare similar plans, for resources under their jurisdiction. Airport improvement projects should be checked for consistency with the State or DOD Wildlife Conservation Plans where such plans exist.

The *Fish and Wildlife Coordination Act* requires that agencies consult with the state wildlife agencies and the Department of the Interior concerning the conservation of wildlife resources where the water of any stream or other water body is proposed to be controlled or modified by a federal agency or any public or private agency operating under a federal permit.

The *Migratory Bird Treaty Act* (MBTA) prohibits private parties and federal agencies in certain judicial circuits from intentionally taking a migratory bird, their eggs, or nests. The MBTA prohibits activities which would harm migratory birds, their eggs, or nests unless the Secretary of the Interior authorizes such activities under a special permit.

Executive Order 13112, *Invasive Species*, directs federal agencies to use relevant programs and authorities, to the extent practicable and subject to available resources, to prevent the introduction of invasive species and provide for restoration of native species and habitat conditions in ecosystems that have been invaded. FAA is to identify proposed actions that may involve risks of introducing invasive species on native habitat and populations. "Introduction" is the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity. "Invasive species" are alien species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health.

THRESHOLDS OF SIGNIFICANCE

A significant impact to federally listed threatened or endangered species would occur when the FWS or NMFS determines that the proposed action would likely jeopardize the continued existence of the species in question or would result in the destruction or adverse modification of critical habitat for the species. However, an action need not involve a threat to extinction to federally listed species to result in a significant impact; lesser impacts, including impacts on non-listed species, could also constitute a significant impact. Consultation with agencies or organizations having jurisdiction or special expertise concerning the protection and/or management of the species should be utilized in cases such as this.

NATURAL RESOURCES AND ENERGY SUPPLY

Energy requirements associated with the proposed action alternative generally fall into two categories: (1) those that relate to changed demands 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). In addition to fuel, the use of natural resources includes construction materials, water, and manpower.

THRESHOLDS OF SIGNIFICANCE

An impact arises where a project will have a measurable effect on local energy supplies or would require the use of an unusual material or one in short supply. Increased consumption of fuel by aircraft is examined where ground movement or run-up times are increased substantially without offsetting efficiencies in operational procedures or if the faction includes a change in flight patterns. Ground vehicles' fuel consumption is examined only if the action would add appreciably to access time or if there would be a substantial change in movement patterns for on-airport service or other vehicles.

LIGHT EMISSIONS AND VISUAL IMPACTS

Airport lighting is characterized as either airfield lighting (i.e., runway, taxiway, approach and landing lights) or landside lighting (i.e., security lights, building interior lighting, parking lights, and signage). Generally, airport lighting does not result in significant impacts unless a high intensity strobe light, such as a Runway End Identifier Light (REIL), would produce a glare on any adjoining site, particularly residential uses.

Visual impacts relate to the extent that the proposed development contrasts with the existing environment and whether a jurisdictional agency considers this contrast objectionable. The visual sight of aircraft, aircraft contrails, or aircraft lights at night, particularly at a distance that is not normally intrusive, should not be assumed to constitute an adverse impact.

No specific impact thresholds have been established for this resource category.

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 statutes of most importance to the FAA in proposing actions to construct and operate facilities and navigational aids are the *Resource Conservation Recovery Act* (RCRA) (as amended by the *Federal Facilities Compliance Act of 1992*) and the *Comprehensive Environmental Response, Compensation, Liability Act* (CERCLA), as amended (also known as Superfund). RCRA governs the generation, treatment, storage, and disposal of hazardous wastes. CERCLA provides for cleanup of any release of a hazardous substance (excluding petroleum) into the environment.

Consideration should be given regarding the hazardous nature of any materials or wastes to be used, generated, or disturbed by the proposed action, as well as the control measures to be taken.

THRESHOLDS OF SIGNIFICANCE

Thresholds of significance are typically only reached when the resource agency has indicated that it would be difficult to issue a permit for the proposed development. A significant impact may also be realized if the proposed action would affect a property listed on the National Priorities List (NPL).

CONSTRUCTION IMPACTS

Temporary environmental impacts may occur as a result of construction activities. Primarily, these impacts would relate to noise resulting from heavy construction equipment, fugitive dust emissions, and potential impacts on water quality from runoff and soil erosion from exposed surfaces.

THRESHOLDS OF SIGNIFICANCE

Construction impacts alone are rarely significant. Refer to the air quality, water, fish, plants, wildlife, and other relevant impact categories for discussions regarding potential construction impacts.

CUMULATIVE IMPACTS

Cumulative impacts may result from individually minor but collectively significant actions taking place over a period of time. In determining whether a proposed action will have a significant impact, consideration should be given to whether the proposed action is related to other actions with individually insignificant but cumulatively significant impacts. The analysis should include identification and consideration of the cumulative impacts of ongoing, proposed, and reasonably foreseeable future actions and may include information garnered from FAA NEPA processes and, where available, environmental management systems.

THRESHOLDS OF SIGNIFICANCE

There is no significance threshold established for this category.

COASTAL RESOURCES

Coastal zones are those waters and their bordering areas in states along the coastlines of the Atlantic and Pacific Oceans, the Gulf of Mexico, and the shorelines of the Great Lakes. These zones include islands, beaches, transitional and intertidal areas and salt marshes. Under most conditions, airport actions that would occur in or would affect a coastal zone within a state having an approved coastal zone management program must comply with the requirements of the *Coastal Zone Management Act* (CZMA) *of 1972*, as amended. The CZMA requires that direct federal activities and development projects must be consistent with approved state coastal programs to the maximum extent practicable. *The Coastal Barriers Resources Act* (CBRA) and Executive Order 13089 also have been adopted to protect coastal resources. The CBRA prohibits, with some exceptions, federal financial assistance for development within the Coastal Barrier Resources System that contains undeveloped coastal barriers along the Atlantic and Gulf coasts and Great Lakes. Executive Order 13089, Coral Reef Protection, requires federal agencies to ensure that any actions that they authorize, fund, or carry out will not degrade the conditions of coral reef ecosystems.

THRESHOLDS OF SIGNIFICANCE

There is no significance threshold established for this category.

FARMLAND

Under the *Farmland Protection Policy Act* (FPPA), federal agencies are directed to identify and take into account the adverse effects of federal programs on the preservation of farmland, to consider appropriate alternative actions which could lessen adverse effects, and to assure that such federal programs are, to the extent practicable, compatible with state or local government programs and policies to protect farmland. The FPPA guidelines developed by the Department of Agriculture apply to farmland classified as prime or unique, or of state or local importance as determined by the appropriate government agency, with concurrence by the Secretary of Agriculture.

THRESHOLDS OF SIGNIFICANCE

A significant impact to farmland would occur when the total combined score on Form AD 1006 ranges between 200 and 260 points. Impact severity increases as the total combined score approaches 260 points.

FLOODPLAINS

Executive Order 11988 directs federal agencies to take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values served by the floodplains. Department of Transportation (DOT) Order 5650.2 contains DOT's policies and procedures for implementing the executive order. Agencies are required to make a finding that there is no practicable alternative before taking action that would encroach on a base floodplain.

THRESHOLDS OF SIGNIFICANCE

Floodplain impacts would be considered significant if the encroachment would result in either: (1) a high probability of loss of human life; or (2) substantial encroachment-associated costs or damage, including interrupting aircraft service or loss of a vital transportation facility; or (3) 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.

WETLANDS

The U.S. Army Corps of Engineers (COE) regulates the discharge of dredged and/or fill material into Waters of the United States, including adjacent wetlands, under Section 404 of the *Clean Water Act*.

Wetlands are defined by Executive Order 11990*, Protection of Wetlands*, as those areas that are inundated by surface or groundwater with a frequency sufficient to support, and under normal circumstances does or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Categories of wetlands include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mud flats, natural ponds, estuarine areas, tidal overflows, and shallow lakes and ponds with emergent vegetation. Wetlands exhibit three characteristics: hydrology, hydrophytes (plants able to tolerate various degrees of flooding or frequent saturation), and poorly drained soils.

THRESHOLDS OF SIGNIFICANCE

As outlined within FAA Orders 1050.1E and 5050.4B, a significant impact to wetlands would occur when the proposed action causes any of the following:

- The action would adversely affect the function of a wetland to protect the quality or quantity of municipal water supplies, including sole source, potable water aquifers.

- The action would substantially alter the hydrology needed to sustain the functions and values of the affected wetland or any wetlands to which it is connected.

- The action would substantially reduce the affected wetland's ability to retain floodwaters or storm-associated runoff, thereby threatening public health, safety, or welfare.

- The action would adversely affect the maintenance of natural systems that support wildlife and fish habitat or economically important timber, food, or fiber resources in the area or surrounding wetlands.

- The action would be inconsistent with applicable state wetland strategies.

WILD AND SCENIC RIVERS

The *Wild and Scenic Rivers Act*, as amended, describes those river segments designated or eligible to be included in the Wild and Scenic Rivers System. The National Park Service maintains a Nationwide Rivers Inventory (NRI) of river segments that appear to qualify for inclusion in the National Wild and Scenic River System but have not been designated as a Wild and Scenic River or studied under a Congressional authorized study. Federal agencies are required to cooperate with the Secretary of the Interior and appropriate state agencies for the purpose of eliminating or minimizing pollution in protected NRI rivers. Additionally, all agencies, as part of their environmental review process, should consult with the Department of Interior and other federal and state agencies with jurisdiction prior to taking any action that could effectively foreclose or downgrade wild, scenic or recreational river status of rivers in the Wild and Scenic River System, study rivers, river segments in the NRI, or other rivers eligible for inclusion in the Wild and Scenic Rivers System but not on the NRI or under study.

THRESHOLDS OF SIGNIFICANCE

There is no significance threshold established for this category.

Appendix H

BIOLOGICAL RESOURCES

Appendix H
BIOLOGICAL RESOURCES

This appendix contains the September 2007 *Biological Evaluation Memorandum* prepared by Taschek Environmental Consulting (this firm was recently acquired by Parametrix). The memorandum was prepared to document field surveys undertaken in the project area in May 2007. Based on the field survey findings, it was determined that no habitat was present in the project area which would support any state or federally-listed species; therefore, impacts to listed species would not occur with development of either alternative under consideration. The FAA concurred with the "no effect" finding. FAA Order 1050.1E, Appendix A, Paragraph 8.2d, states that if the proposed action is not likely to adversely affect any listed species or critical habitat, no consultation needs to occur with the Fish and Wildlife Service (see 50 CFR 402.14).

BIOLOGICAL EVALUATION MEMORANDUM

Double Eagle II Airport, Bernalillo County, New Mexico

Prepared by: **Jesse Shuck, Taschek Environmental Consulting**
For: **City of Albuquerque**

September 11, 2007

BIOLOGICAL EVALUATION MEMORANDUM

Double Eagle II Airport Improvements, Bernalillo County, New Mexico

Prepared by: Taschek Environmental Consulting

September 11, 2007

INTRODUCTION AND PROJECT DESCRIPTION

The City of Albuquerque Aviation Department proposes improvements to the Double Eagle II Airport that are aimed at meeting the runway length needs of business jets that experience operating limitations at the airport. Two alternatives are under consideration (Figure 1). The first is a 3001-foot (ft) extension of Runway 17-35, including a 2001-ft segment at the northern end of the runway and a 1000-ft segment at the southern end, which would also require a realignment of the airport's existing access road. The second alternative is a 1600-ft extension of Runway 4-22 (see Figure 1). Both alternatives would result in runways that total 9000 ft in length. Additionally, the airport access road is being relocated to improve safety and reduce vehicular accidents.

BIOLOGICAL RECONNAISSANCE SURVEY

A biological survey was conducted on May 22, 2007 by Jesse Shuck of TEC in order to locate and identify any state or federally protected species or their habitats, noxious weeds and any Waters of the United States. State (New Mexico Department of Game and Fish BISON-M [Biota Information System of New Mexico]) and Federal (United States Fish and Wildlife Service [USFWS]) lists of threatened, endangered, and sensitive species, as well as the Natural Heritage New Mexico rare plants lists, were consulted prior to the field survey and a list of target species for Bernalillo County was developed based on habitat preferences of the listed species (Table 1).

Desert Grasslands and Plains-Mesa Grasslands biotic communities characterize the project vicinity. Shrub and grass species such as sagebrush, saltbush, and grama grasses dominate the landscape, while juniper, yucca and various cacti occasionally occur (Dick-Peddie 1993).

The project area is located in Bernalillo County, New Mexico on the West Mesa (also known as the Ceja Mesa or the Llano de Albuquerque), overlooking the Rio Grande Valley and the city of Albuquerque. Elevation in the project area averages approximately 1743 meters (m) (5720 feet [ft]). The Rio Grande floodplain is located approximately 11.3 kilometers (km) (7.0 miles [mi]) to the east.

Soils in the project area are derived chiefly from Santa Fe Formation alluvium, weathered basalt, and aeolian materials and include the Latene sandy loam, the Wink fine sandy loam, the Alameda sandy loam, the Madurez loamy fine sand, and the Kokan-Rock outcrop association. The Latene sandy loam is moderately permeable, moderately alkaline, and strongly calcareous. It is on nearly level to gentle slopes with moderate erosion. The Wink fine sandy loam occurs on the sides of low ridges with moderate to severe wind erosion. This soil is calcareous and permeability is moderate. The Madurez loamy fine sand occurs primarily on convex piedmont fans. It is also calcareous and moderately permeable. The Alameda sandy loam is a level to undulating soil overlying basalt flows. Water erosion is slight while wind erosion is moderate to severe. Permeability is moderate, and the soil is strongly calcareous and moderately alkaline. The Kokan-Rock outcrop association consists of the Kokan gravelly sand in association with basalt rock outcrops. Kokan soils have high permeability and are slightly calcareous and alkaline (Bennett 1986).

The climate in the vicinity is classified as semiarid to arid (Tuan et al. 1973), with annual precipitation averaging 178 to 250 millimeters (mm) (7 to 10 inches) (Bennett 1986). The majority of the rainfall occurs during afternoon summer thunderstorms. The frost-free season averages 170 to 195 days (Bennett 1986). The warm-temperate conditions for the area encompass a wide range of variation, with temperatures in the vicinity of the project area sometimes climbing to 100^{o} Fahrenheit in the summer and dropping to below freezing in the winter, with elevation the strongest influence on temperature (Bennett 1986). The combined effect of elevation on temperature and precipitation results in high seasonality and marked variations in resource availability.

The plant community in the survey area was made up primarily of sand sage (*Artemesia filifolia),* four-wing saltbush (*Atriplex canescens*), broom snakeweed (*Gutierrezia sarothrae*) and tumbleweed (*Salsola tragus*). A total of 20 plant species were observed during the field survey (Table 2, Figures 2 through 4). One coyote (*Canis latrans*), several horned larks (*Eremophila alpestris*), several Gunnison's prairie dogs (*Cynomys gunnisoni*), several lark buntings (*Calamospiza melanocorys*) and a pair of burrowing owls (*Athene cunicularia hypugaea*) were observed in the project area (Table 3). The pair of burrowing owls that were observed during the field survey is considered a Sensitive Species by the United States Fish and Wildlife Service. The prairie dogs that were observed during the field survey are not protected by the State of New Mexico or the Federal Government, but the City of Albuquerque maintains a "no-kill" policy towards prairie dogs that are on City of Albuquerque property. According to the project map (Figure 1), the small prairie dog colony is adjacent to the proposed road project (Figure 2). These burrows should be avoided during the construction activities. If the prairie dog colony is within the proposed road project and disrupted from the construction activities, coordination with the City of Albuquerque may be required to trap and relocate these prairie dogs.

No threatened or endangered species were observed during the field survey; nor was any critical habitat identified within the project area. Burrowing owls, which are designated as a sensitive species by the USFWS, were observed during the field survey and the potential burrows were mapped for avoidance.

NOXIOUS WEEDS

A single Class C State Listed Noxious Weed, field bindweed (*Convulvus arvensis*), was observed during the field survey. No other state-listed noxious weeds were observed within the project limits. These plants may be controlled according to the local agency's discretion.

MIGRATORY BIRDS

Three species of birds were observed during the field survey. Several lark buntings, several horned larks, and a pair of burrowing owls were identified in the project area. There were no bird nests observed during the field survey and there was little vegetation-based (or ground-based) nesting habitat within the project area. The burrowing owls that were observed during the field survey are classified as a sensitive species by the USFWS and protected under the Migratory Bird Treaty Act. As currently planned, runway extensions will not impact the owl nest site. But if at some point the taxiway construction should be added to the project, its construction should occur outside of the nesting season, which is April 15 to September 1. If construction activities do occur during these dates, a reconnaissance field survey is recommended to make sure that no burrowing owls are present before construction takes place.

JURISDICTIONAL WETLANDS AND WATERS OF THE UNITED STATES

There were no wetland plants, soils, or hydrology observed within the project area. All three criteria are required for a wetland to be defined; therefore, there is no wetland issues associated with this project. Also, no arroyos or Waters of the United States were identified in the project area.

CONCLUSIONS

There were no threatened or endangered species or their habitat observed during the field survey, but there were two burrowing owls, a species of special concern, observed during the field survey near the taxi way for the runway. The prairie dog colony observed on the side of the road may fall within the footprint of the proposed road construction activities. If these burrows are going to be disturbed, coordination with the City of Albuquerque may be required to trap and relocate these animals. There is no critical habitat within the project area according to USFWS critical habitat data and no consultation with Federal or State entities will be required. The Class C State Listed Noxious Weed, field bindweed, may be controlled according to the local agency's discretion and further propagation of this weed as a result of this project is expected to be minimal.

Literature Cited

Bennett, I.
1986 Annual Precipitation, Frost, and Maximum-Minimum Temperatures. In New Mexico in Maps, Second Edition. Edited by J. Williams, pp. 37-47. University of New Mexico Press, Albuquerque.

Dick-Peddie, W.A.
1993 New Mexico Vegetation: Past, Present, and Future. University of New Mexico Press, Albuquerque.

Tuan, Y.F., C.E. Everard, J.G. Widdison, and I. Bennet.
Table 3. *The Climate of New Mexico*. New Mexico State Planning Office, Santa Fe.

Table 1. Target list of Threatened, Endangered or Species of Concern in Bernalillo County.

SPECIES	STATUS	PRESENCE/ ABSENCE
Astragalus feensis Santa Fe milkvetch	New Mexico State Species of Concern	Not observed
Dalea scariosa La Jolla prairie clover	Special status by Bureau of Land Management	Not observed
Athene cunicularia hypugaea Western Burrowing Owl	USFWS Sensitive Species BLM Sensitive	Observed and Mapped
Cynomys gunnisoni Gunnison's Prairie Dog	State Sensitive	Not observed
Lanius ludovicianus Loggerhead Shrike	USFWS Sensitive Species BLM Sensitive	Not observed
Thomomys bottae connectens Botta's Pocket Gopher	State Sensitive	Not observed

Table 2. List of flora observed during field survey.

Common Name	Scientific Name	Abundance
Blue grama	*Bouteloua gracilis*	5
Broom Snakeweed	*Gutierrezia sarothrae*	2
Cheatgrass	*Bromus tectorum*	3
Four-wing Saltbush	*Atriplex caniscens*	2
Globe Mallow	*Sphaeralcea grossulariifolia*	3
Goathead	*Tribulus sp*	4
Hairy-blue Aster	*Machearanthera canescens*	5
Hidden flower	*Cryptantha sp*	3
Bermuda grass	*Cynodon dactylon*	4
Nightshade	*Solanum elaeagnifolium*	4
Perennial Goldenweed	*Machaeranthera pinnatifida*	4
Field bindweed	*Convulvus arvensis*	3
Plains Prickly Pear	*Opuntia polycantha*	5
Rubber Rabbitbrush	*Chrysothamnus nauseosus*	4
Sand Dropseed	*Sporobolus cryptandrus*	4
Sand Sage	*Artemesia filifolia*	2
Scorpionweed	*Phacelia integrifolia*	3
Squirreltail Grass	*Sitanion hystrix*	4
Summer Cypress	*Kochia scoparia*	3
Tumble Weed	*Salsola tragus*	2

1	Abundant 75-100%
2	Common 50-75%
3	Frequent 25-50%
4	Occasional 5-25%
5	Rare 1-5%
6	Very rare 1 sighting

Table 3. List of fauna observed during the field survey.

Common Name	**Scientific Name**	**Abundance**
Coyote	*Canis latrans*	One
Horned lark	*Eremophila alpestris*	several
Lark bunting	*Calamospiza melanocorys*	Several
Burrowing owl	*Athene cunicularia hypugaea*	pair
Gunnison's prairie dog	*Cynomys gunnisoni*	several

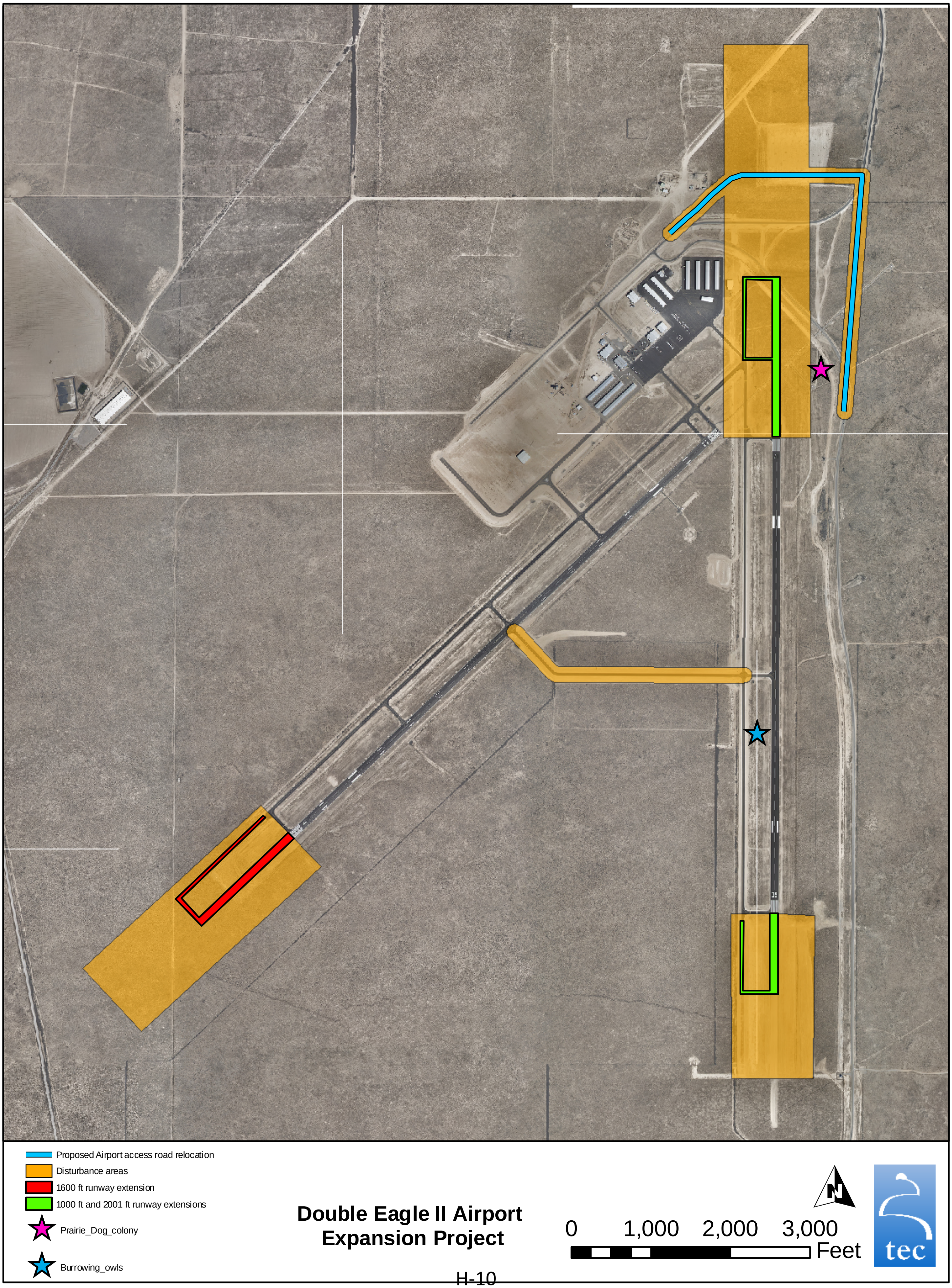


Figure 1. Project area map with biological observations.

Figure 3. South end of project area facing north at Runway 4-22.

Figure 4. North end of project area facing northwest at the end of Runway 17-35.

Figure 5. North end of project area facing north at Runway 17-35.

Results of County Search

BERNALILLO	
Scientific name	County-NM
Astragalus feensis	Bernalillo, Hidalgo, Sandoval, Santa Fe, Torrance
Dalea scariosa	Bernalillo, Sandoval, Socorro, Valencia
Delphinium sapellonis	Bernalillo, Los Alamos, Mora, San Miguel, Sandoval, Santa Fe
Heuchera pulchella	Bernalillo, Sandoval, Torrance
Mentzelia todiltoensis	Bernalillo, Cibola, Santa Fe, Socorro
Silene plankii	Bernalillo, Dona Ana, Sandoval, Sierra, Socorro, Torrance

Photo credits in header *Peniocereus greggii var. greggii* © T. Todsen, *Lepidospartum burgessii* © M. Howard, *Argemone pleiacantha ssp. pinnatisecta* © R. Sivinski

New Mexico Ecological Services Field Office

Listed and Sensitive Species in Bernalillo County

Total number of species: 16

Print

Common Name	Scientific Name	Group	Status
Yellow-billed cuckoo	*Coccyzus americanus*	Bird	Candidate
New Mexican meadow jumping mouse	*Zapus hudsonius luteus*	Mammal	Candidate
Southwestern willow flycatcher	*Empidonax traillii extimus*	Bird	Endangered
Rio Grande silvery minnow Designated Critical Habitat	*Hybognathus amarus*	Fish	Endangered
Black-footed ferret [2]	*Mustela nigripes*	Mammal	Endangered
Mexican spotted owl Designated Critical Habitat	*Strix occidentalis lucida*	Bird	Threatened

Species of Concern

Species of Concern are included for planning purposes only.

Common Name	Scientific Name	Group	Status
Millipede	*Comanchelus chihuanus*	Arthropod - Invertebrate	Species of Concern
American peregrine falcon	*Falco peregrinus anatum*	Bird	Species of Concern
Arctic peregrine falcon	*Falco peregrinus tundrius*	Bird	Species of Concern
Baird's sparrow	*Ammodramus bairdii*	Bird	Species of Concern
Black tern	*Chlidonias niger*	Bird	Species of Concern
Mountain plover	*Charadrius montanus*	Bird	Species of Concern
Northern goshawk	*Accipiter gentilis*	Bird	Species of Concern
Western burrowing owl	*Athene cunicularia hypugaea*	Bird	Species of Concern

Pecos River muskrat	*Ondatra zibethicus ripensis*	Mammal	Species of Concern
Townsend's big-eared bat	*Corynorhinus townsendii*	Mammal	Species of Concern

Endangered	Any species which is in danger of extinction throughout all or a significant portion of its range.	**Threatened**	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
Candidate	Candidate Species (taxa for which the Service has sufficient information to propose that they be added to list of endangered and threatened species, but the listing action has been precluded by other higher priority listing activities).	**Proposed**	Any species of fish, wildlife or plant that is proposed in the Federal Register to be listed under section 4 of the Act. This could be either proposed for endangered or threatened status.
Species of Concern	Taxa for which further biological research and field study are needed to resolve their conservation status OR are considered sensitive, rare, or declining on lists maintained by Natural Heritage Programs, State wildlife agencies, other Federal agencies, or professional/academic scientific societies. Species of Concern are included for planning purposes only.		

Foot Notes:

D Designated Critical Habitat.

P Proposed Critical Habitat.

1 Introduced population.

3 Extirpated in this county.

2 Survey should be conducted if project involves impacts to prairie dog towns or complexes of 200-acres or more for the Gunnison's prairie dog (*Cynomys gunnisoni*) and/or 80-acres or more for any subspecies of Black-tailed prairie dog (*Cynomys ludovicianus*). A complex consists of two or more neighboring prairie dog towns within 4.3 miles (7 kilometers) of each other.

Biota Information System Of New Mexico

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Report County TES Table for

Bernalillo

65 species returned.

Taxonomic Group	# Species	Taxonomic Group	# Species
Fish	3	Mammals	16
Amphibians	1	Molluscs	1
Reptiles	2	Myriapoda; centipedes, millipedes, etc.	1
Birds	41		

Common Name	Scientific Name	FWS-ESA	NM WCA	FS-R3	BLM-NM	NM-Sen	FWS-SOC
Chub, Flathead	Platygobio gracilis	-	-	-	s	-	-
Chub, Rio Grande	Gila pandora	-	-	-	-	s	-
Minnow, Silvery, Rio Grande	Hybognathus amarus	E	-	-	-	-	-
Frog, Leopard, Northern	Rana pipiens	-	-	s	-	-	-
Massasauga, Desert	Sistrurus catenatus edwardsii (NM,AZ)	-	-	s	-	-	-
Kingsnake, Desert	Lampropeltis getula splendida (NM,AZ)	-	-	s	-	-	-
Bittern, American	Botaurus lentiginosus	-	-	s	-	-	-
Bittern, Least	Ixobrychus exilis exilis (NM)	-	-	s	-	-	-
Black-Hawk, Common	Buteogallus anthracinus anthracinus (NM)	-	-	-	-	-	s
Catbird, Gray	Dumetella carolinensis ruficrissa (NM)	-	-	s	-	-	-
Cormorant, Neotropic	Phalacrocorax brasilianus	-	-	s	-	-	-
Cuckoo, Yellow-billed	Coccyzus americanus occidentalis (western pop)	C	-	-	-	-	-
Curlew, Long-billed	Numenius americanus americanus (NM)	-	-	s	-	-	-
Eagle, Bald	Haliaeetus leucocephalus alascanus (NM)	-	-	s	-	-	-
Egret, Snowy	Egretta thula brewsteri (NM)	-	-	s	-	-	-
Falcon, Aplomado	Falco femoralis septentrionalis (NM)	E	-	-	-	-	-
Falcon, Peregrine	Falco peregrinus anatum	-	-	-	-	-	s
Falcon, Peregrine, Arctic	Falco peregrinus tundrius	-	-	-	-	-	s

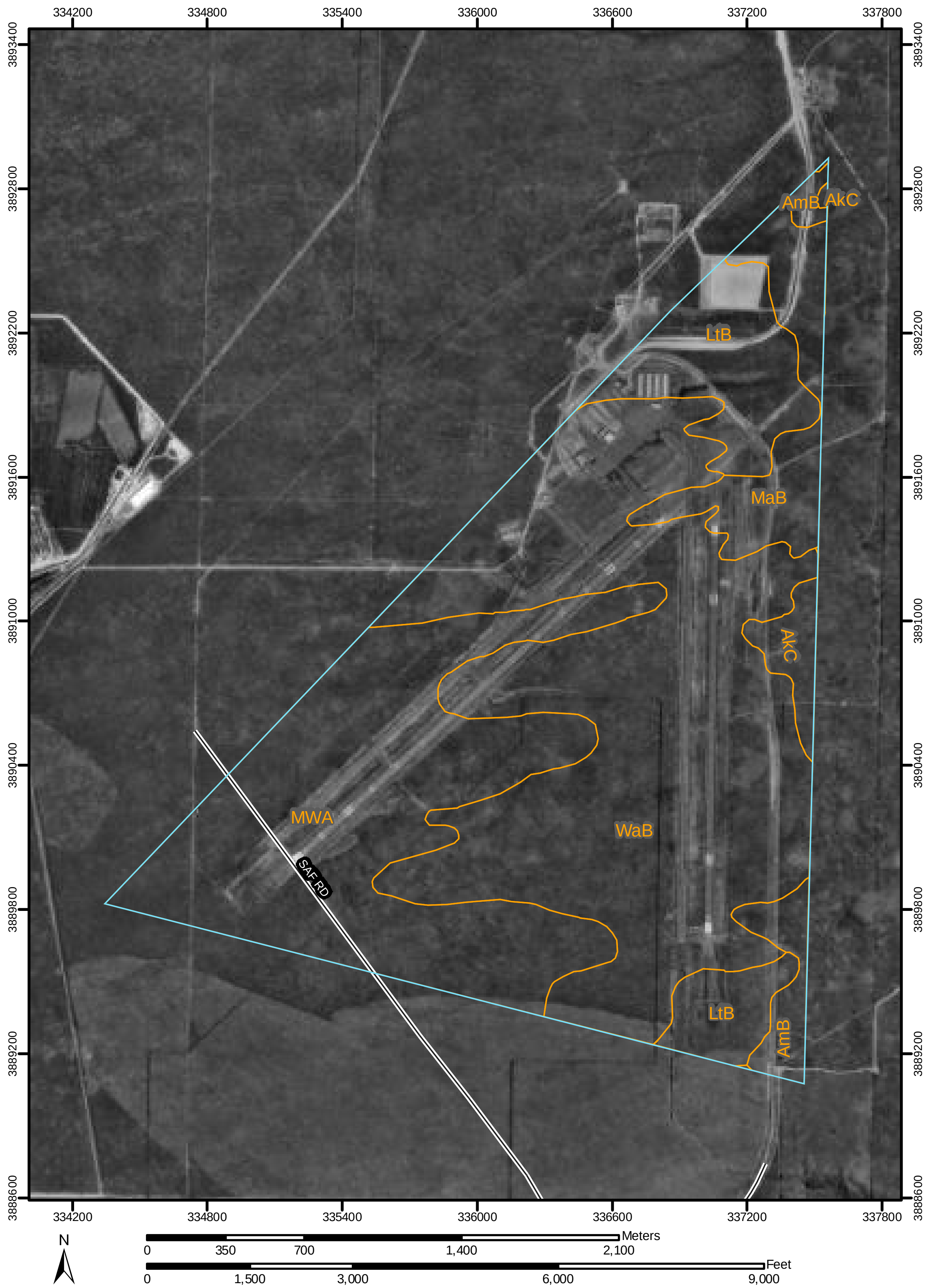
Flycatcher, Willow, SW.	Empidonax traillii extimus	E	-	-	-	-	-
Goshawk, Northern	Accipiter gentilis atricapillus (NM,AZ);apache (NM,AZ)	-	-	-	-	-	s
Grebe, Clark's	Aechmophorus clarkii	-	-	s	-	-	-
Hawk, Ferruginous	Buteo regalis	-	-	s	-	-	-
Hawk, Swainson's	Buteo swainsoni	-	-	s	-	-	-
Hawk, Zone-tailed	Buteo albonotatus	-	-	s	-	-	-
Heron, Green	Butorides virescens virescens (NM);anthonyi (NM)	-	-	s	-	-	-
Night-Heron, Black-crowned	Nycticorax nycticorax hoactli (NM)	-	-	s	-	-	-
Hummingbird, Broad-billed	Cynanthus latirostris magicus (NM)	-	-	s	-	-	-
Hummingbird, White-eared	Hylocharis leucotis borealis (NM)	-	-	s	-	-	-
Ibis, White-faced	Plegadis chihi	-	-	s	-	-	-
Kingfisher, Belted	Ceryle alcyon caurina (NM);alcyon (NM)	-	-	s	-	-	-
Kite, Mississippi	Ictinia mississippiensis	-	-	s	-	-	-
Osprey	Pandion haliaetus carolinensis (NM)	-	-	s	-	-	-
Owl, Burrowing	Athene cunicularia hypugaea (NM,AZ)	-	-	-	-	-	s
Owl, Flammulated	Otus flammeolus	-	-	s	-	-	-
Owl, Spotted, Mexican	Strix occidentalis lucida (NM,AZ)	T	-	-	-	-	-
Pelican, Brown	Pelecanus occidentalis carolinensis (NM)	-	-	s	-	-	-
Plover, Mountain	Charadrius montanus	-	-	-	-	-	s
Plover, Snowy, Western	Charadrius alexandrinus nivosus (NM,AZ)	-	-	s	-	-	-
Redstart, American	Setophaga ruticilla tricolora (NM)	-	-	s	-	-	-
Shrike, Loggerhead	Lanius ludovicianus excubitorides (NM);sonoriensis (NM);gambeli (NM)	-	-	-	s	-	-
Sora	Porzana carolina	-	-	s	-	-	-
Sparrow, Baird's	Ammodramus bairdii	-	-	-	-	-	s
Stilt, Black-necked	Himantopus mexicanus	-	-	s	-	-	-
Swift, Black	Cypseloides niger borealis (NM)	-	-	-	-	s	-
Tern, Black	Chlidonias niger surinamensis (NM)	-	-	-	-	-	s
Vireo, Bell's	Vireo bellii arizonae (NM,AZ);medius (NM)	-	-	-	-	-	s
Vireo, Gray	Vireo vicinior	-	-	s	-	-	-
Bat, Big-eared, Townsend's, Pale	Corynorhinus townsendii pallescens (NM,AZ)	-	-	-	-	-	s
Bat, Myotis, Brn., Little, Occult	Myotis lucifugus occultus (NM,AZ)	-	-	s	-	-	-
Bat, Free-tailed, Big	Nyctinomops macrotis	-	-	-	s	-	-
Bat, Myotis, Fringed	Myotis thysanodes thysanodes (NM,AZ)	-	-	-	s	-	-

H-17

Bat, Myotis, Long-legged	Myotis volans interior (NM,AZ)	-	-	-	s	-	-
Bat, Myotis, Small-footed, W.	Myotis ciliolabrum melanorhinus (NM,AZ)	-	-	-	s	-	-
Bat, Spotted	Euderma maculatum	-	-	s	-	-	-
Bat, Myotis, Yuma	Myotis yumanensis yumanensis (NM,AZ)	-	-	-	s	-	-
Prairie Dog, Gunnison's	Cynomys gunnisoni gunnisoni (NM);zuniensis (NM)	-	-	-	-	s	-
Fox, Red	Vulpes vulpes fulva (NM);macroura (NM)	-	-	-	-	s	-
Mouse, Jumping, Meadow	Zapus hudsonius luteus (NM,AZ)	C	-	-	-	-	-
Rat, Wood, White Sands	Neotoma micropus leucophaea	-	-	-	-	-	s
Ringtail	Bassariscus astutus arizonensis (NM,AZ);flavus (NM);yumanensis (AZ);nevadensis (AZ)	-	-	s	-	-	-
Sheep, Bighorn, Rocky Mtn.	Ovis canadensis canadensis (NM,AZ)	-	-	s	-	-	-
Skunk, Hog-nosed, Common	Conepatus leuconotus meamsi (NM);venaticus (NM,AZ)	-	-	-	-	s	-
Skunk, Spotted, Western	Spilogale gracilis	-	-	-	-	s	-
Mountainsnail, Socorro	Oreohelix neomexicana	-	-	-	-	s	-
Millipede, Slate	Comanchelus chihuanus	-	-	-	-	-	s

Close Window

Soil Map–Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico
(DE2)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features

- Gully
- Short Steep Slope
- Other

Political Features

Municipalities

- Cities
- Urban Areas

Water Features

- Oceans
- Streams and Canals

Transportation

- Rails

Roads

- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico
Survey Area Data: Version 7, Jan 13, 2007

Date(s) aerial images were photographed: 10/6/1996

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico (NM600)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AkC	Akela-Rock outcrop complex, 1 to 9 percent slopes	29.1	1.8%
AmB	Alemeda sandy loam, 0 to 5 percent slopes	43.5	2.7%
LtB	Latene sandy loam, 1 to 5 percent slopes	165.0	10.2%
MaB	Madurez loamy fine sand, 1 to 5 percent slopes	103.2	6.4%
MWA	Madurez-Wink associatin, gently sloping	497.4	30.9%
WaB	Wink fine sandy loam, 0 to 5 percent slopes	772.8	48.0%
Totals for Area of Interest (AOI)		1,611.0	100.0%