PHOENIX SKY HARBOR
INTERNATIONAL AIRPORT

Chapter Three
NOISE IMPACTS

Chapter Three

NOISE IMPACTS

PHOENIX - SKY HARBOR INTERNATIONAL AIRPORT

The impacts of aircraft noise on existing and future land use and population are examined in this chapter. The effects of noise on people can include hearing loss, other ill health effects, and annoyance. While harm to physical health is generally not a problem in neighborhoods near airports, annoyance is a common problem. Annoyance is caused by sleep disruption, interruption of conversations, interference with radio and television listening, and disturbance of quiet relaxation.

Individual responses to noise are highly variable, thus making it very difficult to predict how any person is likely to react to environmental noise. However, the response by a large group of people to environmental noise is much less variable and has been found to correlate well with cumulative noise metrics such as DNL. The development of aircraft noise impact analysis techniques has been based on this relationship between average community response and cumulative noise exposure.

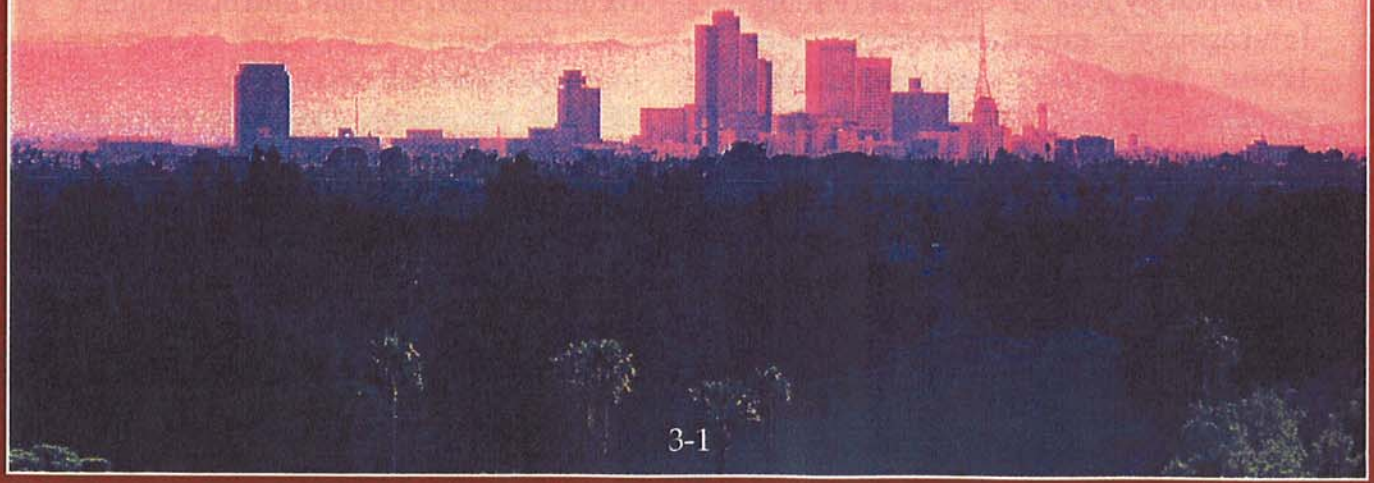
For more detailed information on the effects of noise exposure, refer to the **Technical Information Paper (T.I.P.), Effects of Noise Exposure.**

The major sections in this chapter include the following:

- Land Use Compatibility
- Noise Complaints
- Current Noise Exposure
- Potential Growth Risk
- 2004 Noise Exposure
- 2015 Noise Exposure

LAND USE COMPATIBILITY

The degree of annoyance which people suffer from aircraft noise varies depending on their activities at any given time. People rarely are as



disturbed by aircraft noise when they are shopping, working, or driving as when they are at home. Transient hotel and motel residents seldom express as much concern with aircraft noise as do permanent residents of an area.

The concept of "land use compatibility" has arisen from this systematic variation in human tolerance to aircraft noise. Studies by governmental agencies and private researchers have defined the compatibility of different land uses with varying noise levels. (A review of these guidelines is presented in the **T.I.P., Noise and Land Use Compatibility Guidelines**.) The FAA has established guidelines for defining land use compatibility for use in F.A.R. Part 150 studies.

F.A.R. PART 150 GUIDELINES

The FAA adopted land use compatibility guidelines when it promulgated F.A.R. Part 150 in the early 1980's. (The Interim Rule was adopted on January 19, 1981; the Final Rule was adopted on December 13, 1984, was published in the Federal Register on December 18, 1985 and became effective on January 18, 1985.) These new guidelines were based on earlier studies and guidelines developed by federal agencies (Federal Interagency Committee of Urban Noise, 1980). These land use compatibility guidelines are only advisory; they are not regulations. Part 150 explicitly states that determinations of noise compatibility and regulation of land use are purely local responsibilities. (See Section A150.101(a) and (d) and explanatory note in Table 1 of F.A.R. Part 150.) **Exhibit 3A** illustrates the FAA guidelines.

The FAA uses the Part 150 guidelines as the basis for defining areas within which noise compatibility projects may be eligible for federal funding through the noise set aside funds of the Airport Improvement Program (AIP). In general, noise compatibility projects must be within the 65 DNL contour to be eligible for federal funding. According to the AIP Handbook, "Noise compatibility projects usually must be located in areas where noise measured in day-night average sound level (DNL) is 65 decibels (dB) or greater." (See FAA Order 5100.38A, Chapter 7, paragraph 710.b.) Funding is permitted outside the 65 DNL contour only where the airport sponsor has determined that non-compatible land uses exist at lower levels and the FAA has explicitly concurred with that determination.

The FAA guidelines outlined in **Exhibit 3A** show that residential development, including standard construction (residential construction without special acoustical treatment), mobile homes and transient lodging, are incompatible with noise above 65 DNL. Homes of standard construction and transient lodgings may be considered compatible where local communities have determined these uses are permissible; however, sound insulation measures are recommended. Schools and other public use facilities are also generally incompatible with noise between 65 and 75 DNL, but, again, the guidelines note that, where local communities determine that these uses are permissible, sound insulation measures should be used.

Outdoor music shells and amphi-theaters are considered incompatible at levels exceeding 65 DNL. Several other

98SP14-3A-4/12/99

LAND USE	Yearly Day-Night Average Sound Level (DNL) in Decibels					
	Below 65	65-70	70-75	75-80	80-85	Over 85
RESIDENTIAL						
Residential, other than mobile homes and transient lodgings	Y	N[1]	N[1]	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N[1]	N[1]	N[1]	N	N
PUBLIC USE						
Schools	Y	N[1]	N[1]	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y[2]	Y[3]	Y[4]	Y[4]
Parking	Y	Y	Y[2]	Y[3]	Y[4]	N
COMMERCIAL USE						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail-building materials, hardware and farm equipment	Y	Y	Y[2]	Y[3]	Y[4]	N
Retail trade-general	Y	Y	25	30	N	N
Utilities	Y	Y	Y[2]	Y[3]	Y[4]	N
Communication	Y	Y	25	30	N	N
MANUFACTURING AND PRODUCTION						
Manufacturing, general	Y	Y	Y[2]	Y[3]	Y[4]	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y[6]	Y[7]	Y[8]	Y[8]	Y[8]
Livestock farming and breeding	Y	Y[6]	Y[7]	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL						
Outdoor sports arenas and spectator sports	Y	Y[5]	Y[5]	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts, and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

See other side for notes and key to table.

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Exhibit 3A
LAND USE COMPATIBILITY GUIDELINES

KEY

Y (Yes)	Land Use and related structures compatible without restrictions.
N (No)	Land Use and related structures are not compatible and should be prohibited.
NLR	Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25, 30, 35	Land Use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

NOTES

1 Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB to 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

2 Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

3 Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

4 Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

5 Land use compatible provided special sound reinforcement systems are installed.

6 Residential buildings require a NLR of 25.

7 Residential buildings require a NLR of 30.

8 Residential buildings not permitted.

Source: ***F.A.R. Part 150,*** *Appendix A, Table 1.*

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Exhibit 3A (Continued)
LAND USE COMPATIBILITY GUIDELINES

uses, including hospitals, nursing homes, places of worship, auditoriums, concert halls, livestock breeding, amusement parks, resorts, and camps are considered incompatible at levels above 75 DNL.

Many uses are considered compatible in areas subject to noise between 65 DNL and 75 DNL if prescribed levels of noise level reduction can be achieved through sound insulation. These include hospitals, nursing homes, places of worship, auditoriums, and concert halls.

Historic properties are identified in compliance with *FAR Part 150*, Section 4(f) of the *Department of Transportation Act* (DOT Act), and the *National Historic Preservation Act of 1966*, as amended. In general, these properties are not any more sensitive to noise than are other properties of the same use; however, these federal regulations require that noise effects on these properties be considered when evaluating the effects of an action, such as a noise abatement or land use management procedure.

The strictest of these requirements is the DOT Act. Section 4(f) of the DOT Act provides that the U.S. Secretary of Transportation shall not approve any program (such as a Noise Compatibility Plan) or project which requires the use of any historic site of national, state, or local significance unless there is no feasible and prudent alternative to the use of such land. The FAA is required to consider both the direct physical taking of eligible property (such as acquisition and demolition of historic structures) and the indirect use of or adverse impact to eligible property (such as the 65 DNL noise contour). When evaluating the effects of the noise abatement and land use management alternatives later in this report, it is necessary to also identify whether the proposed action conflicts with or is compatible with the normal activity or aesthetic value of any historical properties not already significantly effect by noise. The Noise Exposure Map (NEM) contours are not evaluated under Section 4(f).

NOISE COMPLAINTS

Before assessing the exposure of local land use and population to existing aircraft noise levels, a discussion of recent noise complaints is provided. By themselves, complaints cannot be taken as a complete assessment of a noise problem at an airport. Many unpredictable variables can influence whether a person chooses to file a noise complaint. Many people who are annoyed may find it inconvenient or intimidating to call and complain. Others who decide to complain may be unusually sensitive to noise or be especially anxious about aircraft over-flights. Others who complain may be motivated by unusual events rather than by a chronic, long-term situation. Despite the limits of complaint information, it can aid in understanding the geographic pattern of concern about the airport.

The Airport staff has a well-developed system for recording and responding to noise complaints. Phoenix Sky Harbor has an airport noise hotline available 24-hours a day to record noise complaints. In addition, the noise

abatement office also takes noise complaints during office hours. **Table 3A** lists the number of complaints and callers for the past three years.

Noise complaint callers from communities to the east (Scottsdale, Tempe, Mesa, Gilbert, Fountain Hills, Chandler, Apache Junction, Paradise Valley, and Cave Creek) have remained very consistent, having between 74 and 75 callers per year, in the past three years. For the same three-year period, noise complaints from the communities to the east spiked in 1997 to 183 before dropping down to 129 in 1998. Noise complaint callers from communities to the west (Phoenix, Glendale, and Goodyear) have more than doubled during the past three years. Noise complaints have also steadily increased from 1996 to 1998 from the communities to the west.

CURRENT NOISE EXPOSURE

This section describes the exposure of existing land uses and population to 1999 noise.

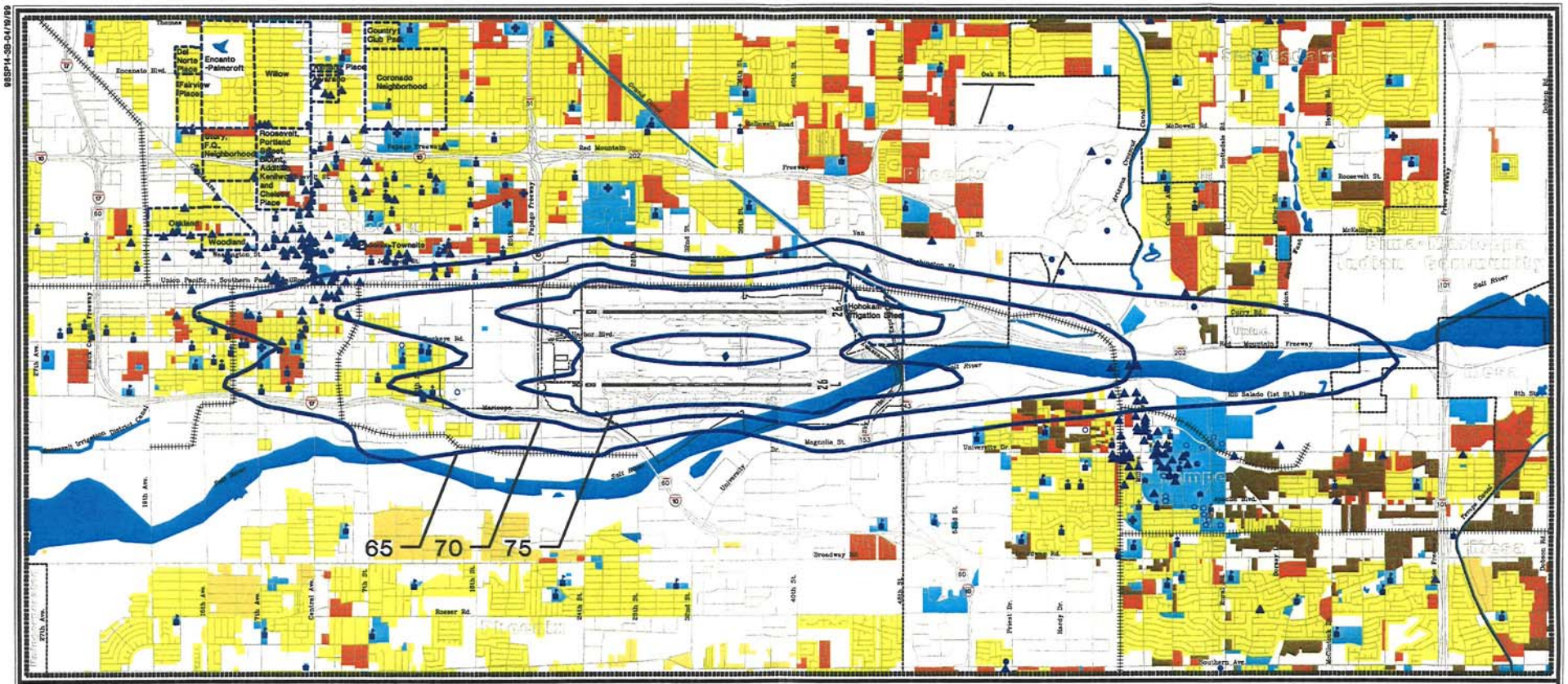
LAND USES EXPOSED TO 1999 NOISE

Exhibit 3B shows the location of existing noise-sensitive land uses and the 1999 noise contours at Phoenix Sky Harbor International Airport.

TABLE 3A
Noise Complaint Summary 1996-1998
Phoenix Sky Harbor International Airport

City	1996		1997		1998	
	Callers	Complaints	Callers	Complaints	Callers	Complaints
Cities to the West						
Phoenix	13	19	13	20	29	31
Glendale	0	0	1	1	1	2
Goodyear	0	0	1	1	0	0
Subtotal	13	19	15	22	30	33
Cities to the East						
Scottsdale	8	10	2	2	12	19
Tempe	46	84	51	151	39	81
Mesa	16	18	15	16	14	19
Gilbert	2	2	2	4	2	2
Fountain Hills	1	1	3	9	1	1
Chandler	1	1	0	0	4	4
Apache Junction	0	0	0	0	1	1
Paradise Valley	0	0	0	0	2	2
Cave Creek	0	0	1	1	0	0
Subtotal	74	116	74	183	75	129
Unknown	0	0	0	0	5	6
Total	87	135	89	205	110	168

Source: Phoenix Sky Harbor International Airport, Noise Complaint Data Base.



LEGEND

- Airport Property
- Municipal Boundaries
- Study Area
- DNL Noise Contour
- Historic District Boundaries
- Rural Residential (0-1 du/ac)
- Large Lot Residential (1.1-2 du/ac)
- Small Lot Residential (2.1-5 du/ac)
- Medium Density Residential (5.1-15 du/ac)
- High Density Residential (15+ du/ac)
- Water
- Noise-Sensitive Institutions
- Place of Worship
- School
- Hospital
- Museum
- Library
- Historic Structure
- Residence Halls
- Community Center

Source: Coffman Associates and Brown-Buntin Associates Analysis.

Aerial Photography Land Use Interpretation September 1998.

NORTH

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PHOENIX SKY HARBOR INTERNATIONAL AIRPORT

Exhibit 3B

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
1999 NOISE EXPOSURE MAP WITH EXISTING LAND USE

Noise-sensitive uses shown on the exhibit are based on the F.A.R. Part 150 land use compatibility guidelines and include uses considered incompatible with noise above 65 DNL.

The 65 DNL contour extends about 24,500 feet east of the airport property which is generally caused by the conversion of activity over the Salt River. To the west, the longest rounded lobe of the 65 DNL contour extends about 17,500 feet to 15th Avenue. To the north, the 65 DNL contour bows out just short of Van Buren Street. To the southeast, the 65 DNL contour bows out to University Avenue. The 65 DNL contour bows out past the Salt River to the Southwest.

The 70 DNL contour extends about 11,400 feet east of the airport property to Mill Avenue. To the west, the longest lobe of the 70 DNL contour extends about 10,500 feet to 2nd Street. To the north, the 70 DNL contour bows out just short of Jefferson Street. To the southeast, the 70 DNL contour bows approximately 400 feet beyond airport property. The 70 DNL contour bows out to Interstate 17 to the Southwest.

The majority of the 75 DNL contour remains on airport property. Spikes off each runway extend from 1,500 to 3,000 feet to the east and west. To the north, the 75 DNL contour lies approximately 300 feet beyond the Union Pacific/Southern Pacific Railroad tracks. The 75 DNL noise contours remain on airport property to the south.

1999 Land Use Impacts

The number of dwelling units (includes single family, mobile homes, apartment units, condominiums) within each noise contour range is determined by computer-generated counts. The housing database used in the counting routine was developed using aerial photography taken in September 1998 and field checked in December 1998 and January 1999. **Table 3B** summarizes the 1999 land use impacts.

A total of 5,231 dwelling units are located within the 65 DNL contour. The 65 to 70 DNL contour contains a majority of these dwelling units, 4,909. There are 322 dwellings within the70 to 75 DNL contour and no dwelling units exposed to noise above 75 DNL. A majority of the dwellings impacted by noise above 65 DNL (3,238) are located north and west of the airport within the City of Phoenix. The remaining dwellings impacted by noise above 65 DNL (1,993) are located east of the airport within the City of Tempe.

It is estimated that 35 noise-sensitive institutions are located within the 65 DNL contour, including, 20 places of worship, eight schools, one museum, three community centers, one library, one stadium, and a zoo. Thirty-one of the noise-sensitive institutions are located within the 65 to 70 DNL contour. The remaining four noise-sensitive institutions are all within the 70 to 75 DNL contour. There are 30 historic structures located within the 65 DNL contour. Twenty-

five historic structures are located within the 65 to 70 DNL contour, four are within the 70 to 75 DNL contour and one within the 75+ contour.

TABLE 3B
Noise-Sensitive Land Uses Exposed to 1999 Aircraft Noise
Phoenix Sky Harbor International Airport

LAND USE	65-70	70-75	75+	Total
Existing Dwelling Units				
Phoenix	2,916	322	0	3,238
Tempe	1,993	0	0	1,993
Total Existing Dwelling Units	4,909	322	0	5,231
Noise-Sensitive Institutions				
Place of Worship				
Phoenix	18	2	0	20
Tempe	0	0	0	0
Schools				
Phoenix	6	0	0	6
Tempe	2	0	0	2
Other (Library, Museum etc.)				
Phoenix	4	1	0	5
Tempe	1	1	0	2
Total Noise Sensitive Institutions	31	4	0	35
Historic Resources				
Phoenix	20	1	1	22
Tempe	5	3	0	8
Total Historic Resources	25	4	1	30

POPULATION EXPOSED TO 1999 NOISE

In assessing community noise impacts, the number of people exposed and the level of noise to which they are exposed must be considered. While lower noise levels cover a larger area and usually affect more people, they are less annoying than higher noise levels. To assess the intensity of the impact, it is helpful to have a way of jointly considering both population and noise level. The level-weighted population (LWP) methodology provides such an approach.

The LWP methodology assumes that increasing proportions of people are annoyed as noise increases. A detailed description of this methodology is provided in the **T.I.P., *Measuring the Impact of Noise on People***. In the 65 to 70 DNL range, it is assumed that 37.6 percent of people are annoyed by noise. In the 70 to 75 DNL range, 64.4 percent, and above 75 DNL, 100 percent of people are annoyed by noise.

Table 3C indicates the population, expressed in both absolute numbers and level-weighted population (LWP), exposed to existing noise. The population is calculated by counting the number of dwelling units within a given contour range and multiplying that number by the average population per dwelling unit. Population per dwelling unit was estimated for each city by Maricopa Association of Governments (MAG) designated regional analysis zone (RAZ). The total population exposed to noise above 65 DNL is 13,117. This corresponds to an LWP value of 5,147.

The majority of the affected population resides between the 65 and 70 DNL noise contours (12,312). Approximately 805 residents are located between the 70 and 75 DNL noise contours west of the airport within the City of Phoenix. There are no residents impacted by noise above 75 DNL.

POTENTIAL GROWTH RISK

Before evaluating the impact of future aircraft noise, the likelihood of future noise-sensitive development in the area must be understood. Development trends in the vicinity of the airport are critical to noise compatibility planning. Future residential growth can constrain the operation of the airport if it occurs beneath aircraft flight tracks and within areas subject to high noise levels. The following paragraphs describe population growth and potential Dwelling unit development within the study area in order to determine the potential growth risk. The focus of discussion includes population projections, residential development projects and other noise-sensitive development.

TABLE 3C
Population Exposed to 1999 Aircraft Noise
Phoenix Sky Harbor International Airport

	Noise Contour (DNL)			Total Above 65 DNL	
	65-70	70-75	75+	Residents	LWP
Existing Population					
Phoenix	7,290	805	0	8,095	3,259
Tempe	5,022	0	0	5,022	1,888
Total Population	12,312	805	0	13,117	5,147

Notes: LWP = Level-weighted population; an estimate of the number of people actually annoyed by aircraft noise. It is derived by multiplying the population in each DNL contour range by the appropriate LWP response factor. The factors used are as follows: 0.376 for 65-70 DNL, 0.644 for 70-75 DNL, and 1.000 for 75+ DNL.

Source: Coffman Associates analysis.

POPULATION PROJECTIONS

The population for both the State of Arizona and Maricopa County have steadily increased since 1980. The population of Maricopa County has increased at a slightly higher rate than Arizona, increasing at an average annual rate of 3.6 percent for the County compared to 3.2 percent for the State. Historical population for Arizona and Maricopa County are depicted in **Table 3D.**

Based on population forecasts developed by the Arizona Department of Economic Security presented in **Table 3D**, the population within Arizona and Maricopa County is expected to increase at a slightly slower rate between 1998 and 2015. According to the Arizona Department of Economic Security, Arizona is projected to increase at an average annual rate of 2.31 percent. The population of Maricopa County is projected to increase at a slightly higher rate, 2.57 percent.

Table 3D
State and County Population

Year	Arizona[1]	Percentage Increase	Maricopa County[1]	Percentage Increase
1980	2,716,546	3.4%	1,509,175	3.8%
1981	2,810,108	2.8%	1,566,036	2.9%
1982	2,889,860	2.7%	1,611,847	3.2%
1983	2,968,924	3.3%	1,663,973	4.4%
1984	3,067,134	3.8%	1,736,952	5.3%
1985	3,183,539	3.9%	1,828,748	4.2%
1986	3,308,261	3.9%	1,905,504	4.5%
1987	3,437,103	2.9%	1,991,400	2.9%
1988	3,535,183	2.5%	2,048,441	2.6%
1989	3,622,184	1.6%	2,101,787	1.4%
1990	3,680,800	2.3%	2,130,400	2.3%
1991	3,767,000	2.4%	2,179,975	2.5%
1992	3,858,850	2.6%	2,233,700	2.6%
1993	3,958,875	2.8%	2,291,200	2.8%
1994	4,071,650	5.8%	2,355,900	7.3%
1995	4,307,150	3.6%	2,528,700	4.2%
1996	4,462,300	3.1%	2,634,625	3.3%
1997	4,600,275	3.6%	2,720,575	3.1%
1998	4,764,025	4.2%	2,806,100	5.3%
Forecasts[2]				
2000	4,961,953	N.A.	2,954,157	N.A.
2005	5,553,849	11.9%	3,329,561	12.7%
2010	6,145,108	10.6%	3,709,566	11.4%
2015	6,744,754	9.8%	4,101,784	10.6%

Source:
1 Arizona Department of Economic Security Population Estimates (as of 10/98).
2 Arizona Department of Economic Security, Research Administration, Population Statistics Unit.

To accommodate this projected population growth in Maricopa County, it is anticipated that additional residential development will be needed. New and in-fill residential development located within the study area are expected to accommodate some of this anticipated growth.

RESIDENTIAL AND NOISE SENSITIVE LAND USE GROWTH RISK

The growth risk analysis focuses on undeveloped or nearly undeveloped land which is planned and zoned for residential or noise sensitive use. Additional development may occur through in-filling or redevelopment of developed areas. The areas which are most likely to experience any in-filling or redevelopment are the older neighborhoods to the west (Phoenix) and southeast (Tempe) of the airport. In order to identify growth in the in-fill areas within the study area a review of the officially adopted community general plans, existing zoning, and special area plans that encourage new residential development were conducted. The determination of the number of dwelling units per acre was computed using the highest density allowed in a given zoning district and land use plan designation, minus 30% for such amenities as roads, sidewalks, and utilities. In addition, material from each school district and the Phoenix Revitalization Corporation was also reviewed and incorporated into the analysis.

As seen on **Exhibit 3C**, most of the future new residential growth is expected near the intersection of State Highways 143 and 202 northeast of the airport, south of the Salt River within the City of Phoenix. Large areas available for residential development within Temp include areas zoned for mixed use north of the Salt River and the residential development in Rio Salado Project south of the Salt River The remaining growth areas are vacant or undeveloped lots planned or zoned for residential use scattered throughout the study area. There are no new schools planned in the study area.

2004 NOISE EXPOSURE

This section describes the exposure of existing and potential land uses and population to aircraft noise in 2004.

LAND USES EXPOSED TO 2004 NOISE

Exhibit 3C illustrates the forecast 2004 noise contours together with both existing and potential future noise-sensitive land uses within the Study Area. The 2004 noise contours are more spike-shaped and smaller than the 1999 noise contours due to the mandatory phase-out of turbojets weighing more than 75,000 pounds by the year 2000.

The longest spike of the 65 DNL contour extends about 17,500 feet east of the airport property. To the west, the longest spike of the 65 DNL contour extends about 15,500 feet to 12th Avenue. To the north, the 65 DNL contour bows out just short of Washington Street. To the southeast, the 65 DNL contour bows out to Magnolia Street. The 65 DNL contour

bows out to the edge of the Salt River to the Southwest.

The 70 DNL contour extends about 5,000 feet east of the airport property to Priest Drive. To the west, the longest lobe of the 70 DNL contour extends about 6,200 feet to 12th Street. To the north, the 70 DNL contour lies approximately 300 feet beyond the Union Pacific/Southern Pacific Railroad tracks. To the southeast, the 70 DNL contour remains on airport property. The 70 DNL contour bows out to Interstate 17 to the Southwest. The 75 DNL contour remains on airport property.

Noise-sensitive land uses potentially impacted by noise in 2004 are shown in **Table 3E**. The total number of dwellings impacted by noise above 65 DNL in 2004 decreases from 5,231 in 1999 to 3,103. The number of dwelling units within the 65 to 70 DNL contour decreases from 4,909 in 1999 to 3,103 in 2004. There are no dwellings within the 70 to 75 DNL contour in 2004 compared to 322 dwellings in 1999. There are no dwellings exposed to noise above 75 DNL in 2004.

A majority of the dwellings impacted by noise above 65 DNL (1,782) are located west of the airport within the City of Phoenix. The remaining dwellings impacted by noise above 65 DNL (1,321) are located east of the airport within the City of Tempe.

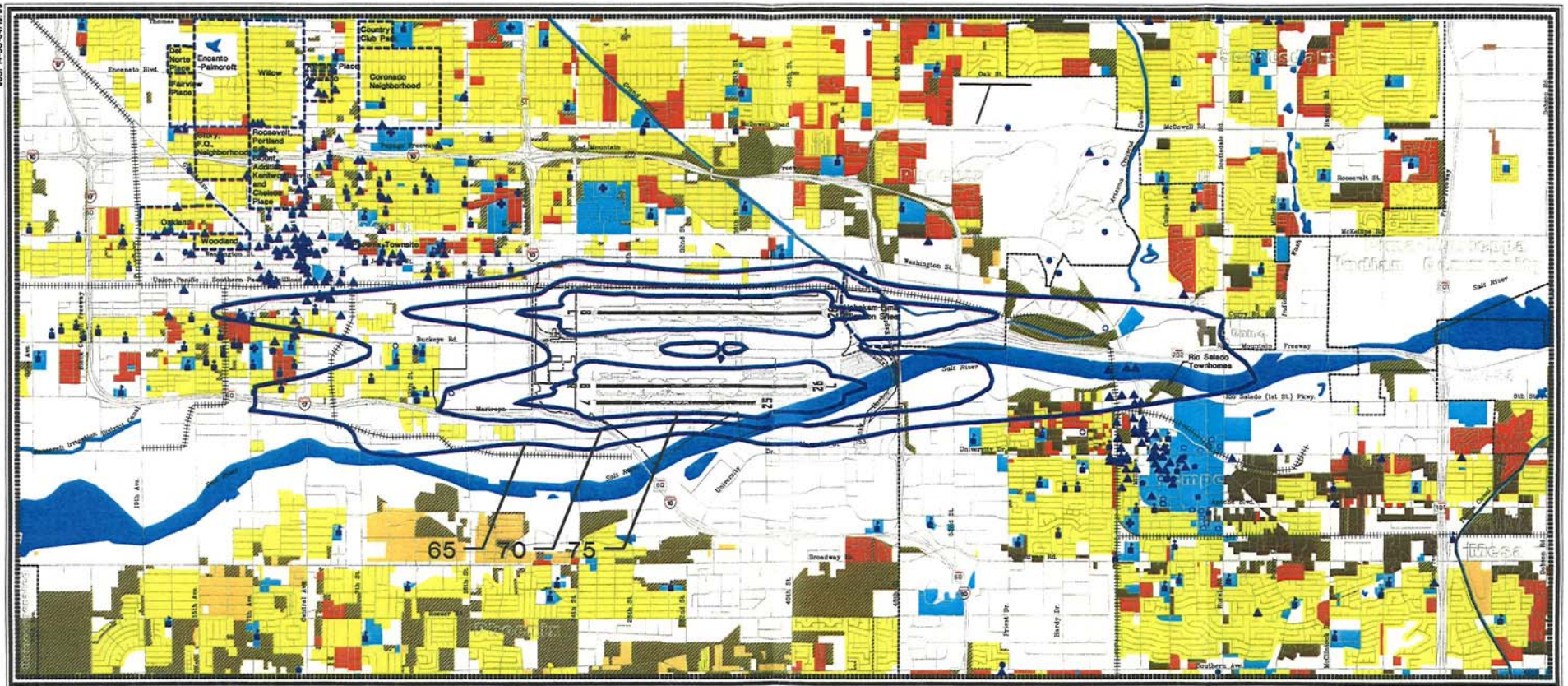
The number of noise-sensitive institutions within the 65 DNL contour decreases from 35 in 1999 to 19 in 2004. Most of the noise-sensitive institutions removed from the noise contours are located west of Central Avenue within Phoenix. Noise-sensitive institutions within the 65 DNL contour include nine places of worship, five schools, one museum, three community centers, and a zoo. Only one noise-sensitive institution, a community center, is located within the 70 to 75 DNL contour. There are no noise-sensitive institutions exposed to noise above the 75 DNL. There are 20 historic structures located within the 65 DNL contour. Nineteen historic structures are located within the 65 to 70 DNL contour and one within the 75+ DNL contour.

Based on the growth risk analysis, there is the potential for approximately 5,722 additional residential dwelling units within the 65 DNL contour. A majority of these units fall within the 65 to 70 DNL (5,676) noise contour. Within the 70 to 75 DNL contour, 46 additional dwelling units could potentially be developed. There are no growth risk areas impacted by noise above 75 DNL.

POPULATION EXPOSED TO 2004 NOISE

The future population impacts parallels the pattern observed for land use impacts. The total population exposed to noise above 65 DNL decreases from 13,117 in 1999 to 7,784 in 2004. This corresponds to a decrease in the LWP value from 5,147 to 2,927. **Table 3F** shows the impact of the 2004 noise on the existing local population.

The majority of the affected population continues to fall between the 65 and 70 DNL noise contours (7,784). There are no residents impacted by noise above 70 DNL.



LEGEND

- Airport Property
- Municipal Boundaries
- Study Area
- DNL Noise Contour
- Historic District Boundaries
- Rural Residential (0-1 du/ac)
- Large Lot Residential (1.1-2 du/ac)
- Small Lot Residential (2.1-5 du/ac)
- Medium Density Residential (5.1-15 du/ac)
- High Density Residential (15+ du/ac)
- Water
- Noise-Sensitive Institutions
- Place of Worship
- School
- Hospital
- Museum
- Library
- Historic Structure
- Residence Halls
- Community Center
- Proposed Residential Development Areas
- Proposed Noise-Sensitive Institutions

Source: Coffman Associates and Brown-Buntin Associates Analysis.

NORTH

0 5000

SCALE IN FEET

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT

Exhibit 3C

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
2004 NOISE EXPOSURE MAP WITH LAND USE

TABLE 3E
Noise-Sensitive Land Uses Exposed to 2004 Aircraft Noise
Phoenix Sky Harbor International Airport

LAND USE	65-70	70-75	75+	Total
Existing Dwelling Units				
Phoenix	1,782	0	0	1,782
Tempe	1,321	0	0	1,321
Total Existing Dwellings	3,103	0	0	3,103
Future Potential Dwelling Units				
Phoenix	475	0	0	475
Tempe	5,201	46	0	5,247
Total Future Potential Dwelling Units	5,676	46	0	5,722
Total Dwelling Units	8,779	46	0	8,825
Noise-Sensitive Institutions				
Place of Worship				
Phoenix	9	0	0	9
Tempe	0	0	0	0
Schools				
Phoenix	4	0	0	4
Tempe	1	0	0	1
Other (Library, Museum etc.)				
Phoenix	2	1	0	3
Tempe	2	0	0	2
Total Noise Sensitive Institutions	18	1	0	19
Historic Resources				
Phoenix	11	0	1	12
Tempe	8	0	0	8
Total Historic Resources	19	0	1	20

Due to the growth risk for the area, it is possible for additional dwelling units and population to be exposed to aircraft noise levels in the future. **Table 3F** provides an estimate of the number of residents which may potentially be exposed to 2004 aircraft noise. Approximately 13,341 additional residents could be exposed to noise above 65 DNL. The majority of the future potential population will fall within the 65 to 70 DNL noise contour (14,294). Approximately 117 future potential residents could be added between the 70 and 75 DNL noise contours. There are no growth risk areas impacted by noise above 75 DNL.

TABLE 3F
Population Exposed to 2004 Aircraft Noise
Phoenix Sky Harbor International Airport

	Noise Contour (DNL)			Total Above 65 DNL	
	65-70	70-75	75+	Residents	LWP
Existing Population					
Phoenix	4,455	0	0	4,455	1,675
Tempe	3,329	0	0	3,329	1,252
Total Existing Population	7,784	0	0	7,784	2,927
Potential Population					
Phoenix	1,188	0	0	1,188	447
Tempe	13,106	117	0	13,223	5,003
Total Potential Population	14,294	117	0	13,341	5,450
Total Population	22,078	117	0	21,125	8,377

Notes: LWP = Level-weighted population; an estimate of the number of people actually annoyed by aircraft noise. It is derived by multiplying the population in each DNL contour range by the appropriate LWP response factor. The factors used are as follows: 0.376 for 65-70 DNL, 0.644 for 70-75 DNL, and 1.000 for 75+ DNL.

Source: Coffman Associates analysis.

2015 NOISE EXPOSURE

This section describes the exposure of existing and potential land uses and population to aircraft noise in 2015.

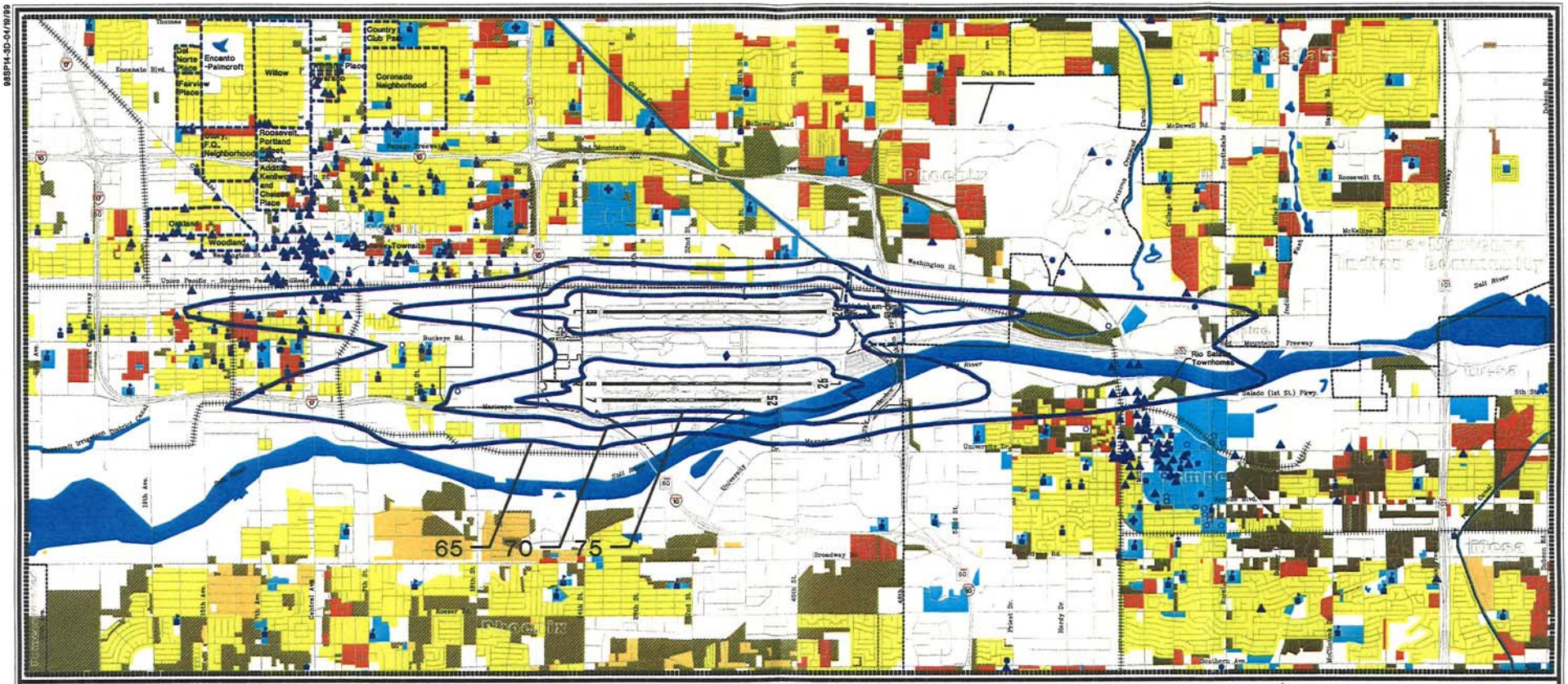
LAND USES EXPOSED TO 2015 NOISE

Exhibit 3D illustrates the forecast 2015 noise contours together with both existing and potential future noise-sensitive land uses within the Study Area. The 2015 noise contours are more spike shaped and smaller than the 1999 noise contours.

The longest pointed spike of 65 DNL contour extends about 18,000 feet east of the airport property. To the west, the longest spike of the 65 DNL contour extends about 15,500 feet to 15th Avenue. To the north, the 65 DNL contour bows out just short of Washington Street. To the southeast, the 65 DNL contour bows out to Magnolia Street. The 65 DNL contour bows out to the edge of the Salt River to the Southwest.

The 70 DNL contour extends about 5,000 feet east of the airport property to Priest Drive. To the west, the longest lobe of the 70 DNL contour extends approximately 150 feet past 12th Street. To the north, the 70 DNL contour lies approximately 300 feet beyond the Union Pacific/Southern Pacific Railroad tracks. To the southeast, the 70 DNL contour remains on airport property. The 70 DNL contour bows out to Interstate 10 to the Southwest. The 75 DNL contour remains on airport property.

Noise-sensitive land uses potentially impacted by noise in 2015 are shown in **Table 3G**. The total number of



LEGEND

- Airport Property
- Municipal Boundaries
- Study Area
- DNL Noise Contour
- Historic District Boundaries
- Rural Residential (0-1 du/ac)
- Large Lot Residential (1.1-2 du/ac)
- Small Lot Residential (2.1-5 du/ac)
- Medium Density Residential (5.1-15 du/ac)
- High Density Residential (15+ du/ac)
- Water
- Noise-Sensitive Institutions
- Place of Worship
- School
- Hospital
- Museum
- Library
- Historic Structure
- Residence Halls
- Community Center
- Proposed Residential Development Areas
- Proposed Noise-Sensitive Institutions

Source: Coffman Associates and Brown-Buntin Associates Analysis.

NORTH

0 5000

SCALE IN FEET

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT

Exhibit 3D

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
2015 NOISE EXPOSURE MAP WITH LAND USE

TABLE 3G
Noise-Sensitive Land Uses Exposed to 2015 Aircraft Noise
Phoenix Sky Harbor International Airport

LAND USE	65-70	70-75	75+	Total
Existing Dwelling Units				
Phoenix	2,142	3	0	2,145
Tempe	1,671	0	0	1,671
Total Existing Dwellings	3,813	3	0	3,816
Future Potential Dwelling Units				
Phoenix	479	5	0	484
Tempe	5,372	63	0	5,435
Total Future Potential Dwelling Units	5,851	68	0	5,919
Total Dwelling Units	9,664	71	0	9,735
Noise-Sensitive Institutions				
Place of Worship				
Phoenix	10	0	0	10
Tempe	0	0	0	0
Schools				
Phoenix	4	0	0	4
Tempe	1	0	0	1
Other (Library, Museum etc.)				
Phoenix	2	1	0	3
Tempe	2	0	0	2
Total Noise Sensitive Institutions	19	1	0	20
Historic Resources				
Phoenix	12	0	1	13
Tempe	8	0	0	8
Total Historic Resources	20	0	1	21

dwellings impacted by noise above 65 DNL in 2015 increases slightly from 3,103 in 2004 to 3,816. The number of dwelling units within the 65 to 70 DNL contour increases from 3,103 in 2004 to 3,813 in 2015. Although no dwelling units are impacted by noise above 70 DNL in 2004, three dwellings are within the 70-75 DNL contour in 2015. There are no dwellings exposed to noise above 75 DNL in 2015.

A majority of the dwellings impacted by noise above 65 DNL (2,142) are located west of the airport within the City of Phoenix. The remaining dwellings impacted by noise above 65 DNL (1,671) are located east of the airport within the City of Tempe.

The number of noise-sensitive institutions within the 65 DNL contour (20) increases by one in 2015 from 2004. Noise-sensitive institutions within the 65 DNL contour include ten places of worship, five schools, one museum, three community centers, and a zoo. One noise-sensitive institution is

located within the 70 to 75 DNL contour. There are no noise-sensitive institutions exposed to noise above 75 DNL.

There are 21 historic structures located within the 65 DNL contour. Twenty historic structures are located within the 65 to 70 DNL contour and one is within the 75+ DNL contour.

Based on the growth risk analysis, there is the potential for approximately 5,919 additional residential dwelling units within the 65 DNL contours. A majority of these units (5,851) fall between the 65 and 70 DNL noise contours. Within the 70 to 75 DNL contour, 68 additional dwelling units could potentially be developed. There are no growth risk area impacted by noise above 75 DNL.

POPULATION EXPOSED TO 2015 NOISE

The total population exposed to noise above 65 DNL in 2015 increases from 7,784 in 2004 to 9,574. This corresponds to an increase in the LWP value from 2,927 to 3,601. **Table 3H** shows the impact of the 2015 noise on the existing local population.

TABLE 3H
Population Exposed to 2015 Aircraft Noise
Phoenix Sky Harbor International Airport

	Noise Contour (DNL)			Total Above 65 DNL	
	65-70	70-75	75+	Residents	LWP
Existing Population					
Phoenix	5,355	8	0	5,363	2,018
Tempe	4,211	0	0	4,211	1,583
Total Existing Population	9,566	8	0	9,574	3,601
Potential Population					
Phoenix	1,198	13	0	1,211	459
Tempe	13,539	159	0	13,698	5,193
Total Potential Population	14,737	172	0	14,909	5,652
Total Population	24,303	180	0	24,483	9,253

Notes: LWP = Level-weighted population; an estimate of the number of people actually annoyed by aircraft noise. It is derived by multiplying the population in each DNL contour range by the appropriate LWP response factor. The factors used are as follows: 0.376 for 65-70 DNL, 0.644 for 70-75 DNL, and 1.000 for 75+ DNL.
Source: Coffman Associates analysis.

The majority of the affected population falls between the 65 and 70 DNL noise contours (9,566). Approximately eight residents are located between the 70 and 75 DNL noise contours west of the airport within the City of Phoenix. There are no residents impacted by noise above 75 DNL.

Approximately 14,909 additional residents could be exposed to noise above 65 DNL. The majority of the future potential population will fall within the 65 to 70 DNL noise contours (14,737). Approximately 172 future potential residents could be added to the 70 to 75 DNL noise contours. There are no growth risk areas impacted by noise above 75 DNL.

SUMMARY

This chapter has analyzed the impacts of aircraft noise on existing and future land use and population in the vicinity of Phoenix Sky Harbor International Airport. **Table 3J** summarizes the land use and population impacts. Due to the projected phase-out of Stage 2 jets over 75,000 pounds by the year 2000, the noise contours are expected to get smaller over the five-year planning period thus reducing the land use and population impacts. The long range forecast increase in the number of operations at the airport will increase the size of noise contours and impacts slightly by the year 2015. However, the land use and population impacts in 2015 still remain below the 1999 levels. **Exhibit 3E** depicts the 65 DNL contour the 1999, 2004, and 2015 noise exposure contours for comparison.

Given current zoning, planned land uses, and approved development plans within the study area, there is a potential for a significant amount of future residential development within the 65 to 70 DNL contour in 2004 and 2015. No other types of noise-sensitive land uses, other than residential, are currently planned to be located within the airport's 65 DNL contour in 2004 and 2015.

TABLE 3J
Land Uses and Population Impact Summary
Phoenix Sky Harbor International Airport

Land Use	1999	2004	2015
Existing Dwelling Units			
Phoenix	3,238	1,782	2,145
Tempe	1,993	1,321	1,671
Total Existing Dwellings	5,231	3,103	3,816
Future Potential Dwelling Units			
Phoenix	N/A	475	484
Tempe	N/A	5,247	5,435
Total Future Potential Dwelling Units	N/A	5,722	5,919
Noise-Sensitive Institutions			
Place of Worship			
Phoenix	20	9	10
Tempe	0	0	0
Schools			
Phoenix	6	4	4
Tempe	2	1	1
Other (Library, Museum etc.)			
Phoenix	5	3	3
Tempe	2	2	2
Total Noise Sensitive Institutions	35	19	20
Historic Resources			
Phoenix	22	12	13
Tempe	8	8	8
Total Historic Resources	30	20	21
Population			
Existing Population			
Phoenix	8,095	4,455	5,363
Tempe	5,022	3,329	4,211
Total Existing Population	13,117	7,784	9574
Total Existing LWP	5,147	2,927	3,601
Potential Population			
Phoenix	N/A	1,188	1,211
Tempe	N/A	13,223	13,698
Total Potential Population	N/A	13,341	14,909
Total Potential LWP	N/A	5,450	5,652

Notes: LWP = Level-weighted population; an estimate of the number of people actually annoyed by aircraft noise. It is derived by multiplying the population in each DNL contour range by the appropriate LWP response factor. The factors used are as follows: 0.376 for 65-70 DNL, 0.644 for 70-75 DNL, and 1.000 for 75+ DNL.

Source: Coffman Associates analysis.

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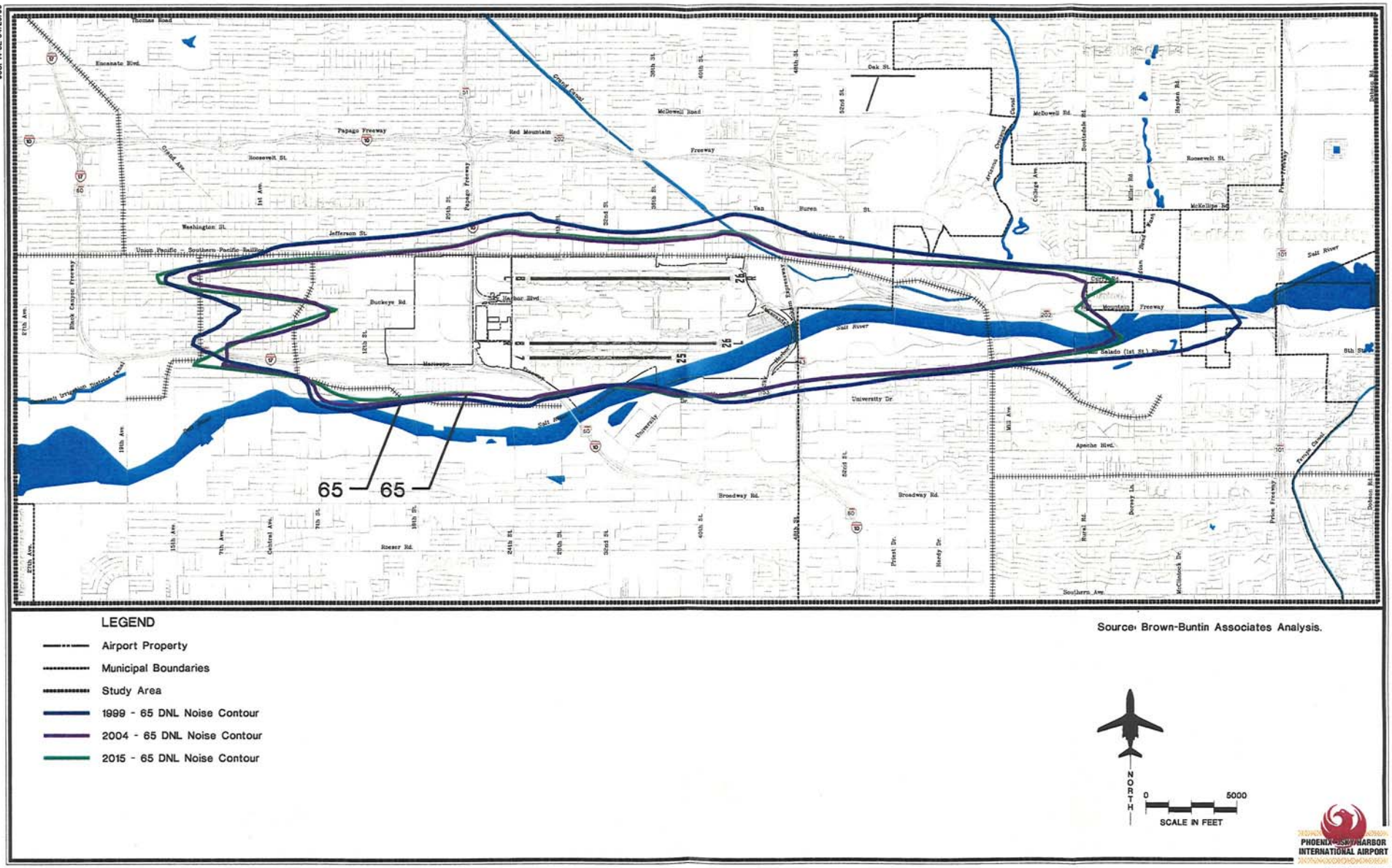

Exhibit 3E
PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
NOISE EXPOSURE CONTOUR COMPARISON

REFERENCES

Maricopa Association of Governments 1997. *Socioeconomic Projections, Interim Report*. MAG Regional Council, June 1997.

City of Tempe 1997. *City of Tempe General Plan 2020*. City of Tempe, AZ. Adopted December 18, 1997, Resolution No. 97.84.