

US EPA ARCHIVE DOCUMENT



Janet Napolitano  
Governor

# ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

1110 West Washington Street • Phoenix, Arizona 85007  
(602) 771-2300 • [www.adeq.state.az.us](http://www.adeq.state.az.us)



Stephen A. Owens  
Director

July 22, 2003

Wayne Nastri, Regional Administrator  
U.S. Environmental Protection Agency, Region IX  
ORA-1  
75 Hawthorne Street  
San Francisco, CA 94105-3901

Re: Technical Analysis in Support of Arizona's 8-Hour Ozone Area Designation  
Recommendations

Dear Mr. Nastri:

On July 11, 2003, Governor Napolitano signed an 8-hour area designation recommendation for all areas of Arizona outside of Indian Country. That recommendation was transmitted to you on July 15, 2003. At the time of the submittal, it was noted that a detailed, supporting analysis would be provided under separate cover. Enclosed is the document, "Arizona Air Quality Designations, Boundary Recommendations for the 8-Hour Ozone National Ambient Air Quality Standard, July 21, 2003," and appendices.

I look forward to working with you to finalize area designations by April 15, 2004. If you have any questions, please call me at (602) 771-2203 or Nancy C. Wrona, Director, Air Quality Division, at (602) 771-2308.

Sincerely,

Stephen A. Owens  
Director

Enclosure

Northern Regional Office  
1515 East Cedar Avenue • Suite F • Flagstaff, AZ 86004  
(928) 779-0313

Southern Regional Office  
400 West Congress Street • Suite 433 • Tucson, AZ 85701  
(520) 628-6733

**Arizona Air Quality Designations  
Boundary Recommendations for the  
8-Hour Ozone National Ambient Air Quality Standard**



**Air Quality Division  
Arizona Department of Environmental Quality  
Janet Napolitano, Governor  
Stephen A. Owens, Director**

**July 21, 2003**

**TABLE OF CONTENTS**

	<u>Page</u>
EXECUTIVE SUMMARY .....	ES-1
I. BACKGROUND AND REGULATORY HISTORY .....	1
II. AREA DESIGNATION CRITERIA .....	2
III. AREA DESIGNATION CRITERIA ANALYSIS .....	3
III.A FOR THOSE AREAS RECOMMENDED FOR ATTAINMENT/UNCLASSIFIABLE.....	3
III.B FOR THOSE AREAS RECOMMENDED FOR NONATTAINMENT .....	7
III.B.1. Emissions and Air Quality in Adjacent Areas .....	8
III.B.2. Population Density and Degree of Urbanization Including Commercial Development.....	11
III.B.3. Monitoring Data Representing Ozone Concentrations in Local Areas and Larger Areas .....	15
III.B.4. Location of Emissions Sources.....	19
III.B.5. Traffic and Commuting Patterns.....	20
III.B.6. Expected Growth .....	22
III.B.7. Meteorology .....	27
III.B.8. Geography/Topography .....	30
III.B.9. Jurisdictional Boundaries .....	31
III.B.10. Level of Control of Emissions Sources.....	33
III.B.11. Regional Emission Reductions.....	36
IV. AREA DESIGNATION RECOMMENDATIONS.....	36
IV.A ATTAINMENT/UNCLASSIFIABLE AREAS.....	36
IV.B NONATTAINMENT AREA .....	37

**LIST OF FIGURES**

	<u>Page</u>
ES1	8-Hour Nonattainment Area Recommendation ..... ES-4
III.B.a	Recommended 8-Hour Nonattainment Area ..... 7
III.B.1.a	Emissions Density estimates from SMOKE for Oxides of Nitrogen ..... 8
III.B.1.b	Emissions Density estimates from SMOKE for Volatile Organic Compounds ..... 9
III.B.2.a	Population Density in 2000 ..... 11
III.B.2.b	Commercial Land Use ..... 12
III.B.2.c	Employment Centers ..... 13
III.B.2.d	Study Area Land Ownership ..... 14
III.B.2.e	Current Residential Land Use – Maricopa and Pinal County Area ..... 15
III.B.3.a	Phoenix Area Ozone Monitoring Sites 1995-2002 ..... 17
III.B.3.b	Ozone trends in the Phoenix Area ..... 18
III.B.4	Current Land Use and VOC Emissions ..... 19
III.B.5.a	Study Area Annual Average Daily Traffic ..... 21
III.B.5.b	Population and Vehicle Miles Traveled Projections ..... 22
III.B.6.a	Change in Population 2000-2018 ..... 23
III.B.6.b	Current and Future Residential Land Use ..... 24
III.B.6.c	Study Area Annual Average Daily Traffic (excluding city center) ..... 25
III.B.6.d	Pinal County Annual Average Daily Traffic ..... 26
III.B.6.e	Annual Average Daily Traffic Count – City Center ..... 27
III.B.7.a	Morning Downslope Winds July 12, 2002 ..... 28
III.B.7.b	Transition Winds for July 12, 2002 ..... 29
III.B.7.c	Afternoon Upslope Winds July 12, 2002 ..... 29
III.B.9	Recommended 8-Hour Nonattainment Area with Area A and the 1-Hour Ozone Nonattainment Area ..... 32
IV.B	8-Hour Nonattainment Area Recommendation ..... 38

**LIST OF TABLES**

	<u>Page</u>
ES1	Recommended Attainment/Unclassifiable and Nonattainment Areas for Arizona ..... ES-5
I	Comparison of Ozone Standards ..... 1
III.A.1	2000-2002 8-Hour Ozone Design Values for Arizona Counties (except Maricopa County) ..... 4
III.A.2	1999 Arizona State and County Emissions Data ..... 5
III.A.3	2002 Arizona Population Data ..... 6
III.B.3	2000-2002 8-Hour Ozone Design Values for MSA ..... 15
III.B.5	2006 VMT Estimates for the MAG Planning Area (1,000) ..... 20
III.B.10	Existing Control Measures ..... 33
IV.B	Recommended Attainment/Unclassifiable and Nonattainment Areas for Arizona ..... 39

APPENDICES

Initial Reference Page

1.	Memo from John Seitz to EPA Air Directors, “Boundary Guidance on Air Quality designations for the 8-Hour Ozone National Ambient Air Quality Standards (NAAQS or Standard)”, March 28, 2000.....	2
2.	Arizona Monitoring Sites Map as of July 1, 2003 .....	3
3.	Annual Fourth Highest 8-Hour Ozone Concentrations .....	3
4.	Three-Year Average of the Annual Fourth Highest 8-Hour Ozone Concentrations .....	3
5.	Phoenix-Mesa Metropolitan Statistical Area Map .....	7
6.	Presentation from June 17, 2003, Stakeholder Meeting .....	7
7.	EPA’s January 19, 2001 and July 2, 2003 Letters .....	7
8.	Presentation from May 21, 2003, Stakeholder Meeting on CMAQ Modeling and Inventory Development .....	8
9.	Summaries of WRAP 1996 and MAG’s 1999 Emissions Inventories .....	8
10.	Presentation from May 21, 2003, Stakeholder Meeting on Socioeconomic Information .....	11
11.	Memo from Jeffrey R. Holmstead to EPA Regional Administrators, “Schedule for 8-Hour Designations and its Effect on Early Action Compacts,” November 14, 2002 .....	15
12.	MAG Regional Freeway Bottleneck Study, May 7, 2002 .....	20

# Arizona Air Quality Designations Boundary Recommendations for the 8-Hour Ozone National Ambient Air Quality Standard

## EXECUTIVE SUMMARY

Arizona recommends the majority of the State be designated attainment/unclassifiable for the 8-hour ozone national ambient air quality standard (NAAQS). The one recommended nonattainment area consists of the greater Phoenix metropolitan area, including from the west, the power plants near Tonopah and Palo Verde, Surprise and Buckeye, and continuing east and north, covering the rest of eastern Maricopa County.

This recommendation follows a stakeholder process that began in May 2002, the purpose of which was to develop an understanding of the new ozone standard, requirements for designation of nonattainment areas, and options available to the State for implementing the standard. One of the primary intents was to avoid a nonattainment area boundary based on EPA's default area definition, which is the metropolitan statistical area (MSA). For the metropolitan Phoenix area, this would be the Phoenix-Mesa MSA, which includes all of Maricopa and Pinal Counties, large portions of which are rural and sparsely populated. The recommendation also addresses EPA's concern that the current 1-hour ozone nonattainment boundary is inadequate for implementing the 8-hour average ozone standard.

Although tribal representatives participated in the Arizona Department of Environmental Quality's (ADEQ's) stakeholder process, Arizona is not making a recommendation for any tribal lands located in the described geographical area, as tribal lands are not within the State's jurisdiction for air quality purposes. ADEQ respects tribal sovereignty and has worked to develop cooperative relationships with tribal air quality programs throughout the State. Nothing in this analysis should be interpreted to affect the designation of Indian Country.

## Background

On March 28, 2000, The U.S. Environmental Protection Agency (EPA) issued guidance for states to use as they developed their recommendations - "Boundary Guidance on Air Quality Designations for the 8-Hour Ozone National Ambient Air Quality Standards." In addition, Section 107(d)(1)(A)(i) of the Clean Air Act (CAA) defines a nonattainment area as "... any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant..."

The March 28, 2000, guidance stated metropolitan statistical areas (MSAs) would be the presumptive default nonattainment areas. The U.S. Bureau of the Census defines MSAs. In order to avoid the default, a state must address the following eleven criteria listed in the guidance:

1. Emissions and air quality in adjacent areas (including adjacent C/MSAs),
2. Population density and degree of urbanization including commercial development (significant difference from surrounding areas),
3. Monitoring data representing ozone concentrations in local areas and larger areas (urban or regional scale),
4. Location of emission sources (emission sources and nearby receptors should generally be included in the same nonattainment area),
5. Traffic and commuting patterns,
6. Expected growth (including extent, pattern and rate of growth),
7. Meteorology (weather/transport patterns),
8. Geography/topography (mountain ranges or other air basin boundaries),
9. Jurisdictional boundaries (e.g., counties, air districts, existing 1-hour nonattainment areas, Reservations, etc.),
10. Level of control of emission sources,
11. Regional emission reductions (e.g., NO<sub>x</sub> SIP call or other enforceable regional strategies).

### **The Phoenix Mesa MSA Is Not an Appropriate Nonattainment Area Boundary**

The Phoenix Mesa MSA includes a total of 14,502 square miles, with Maricopa County accounting for 9,222 square miles and Pinal County with 5,380 square miles. Approximately 70% of the MSA includes large expanses of undeveloped desert or agricultural development, and isolated rural communities. A major portion of Pinal County includes two surface water basins that are relatively isolated from the greater Phoenix area. In addition, vast tracts of undeveloped desert and agricultural areas in the south and southeastern part of Pinal County predominate, and are not a significant source of ozone precursors. Finally, prevailing winds during the ozone season greatly limit the impact of emissions from the urbanized Phoenix area on these non-urbanized portions of Pinal County. Southwestern Maricopa County is largely undeveloped, and although in the same hydrologic basin as the western portion of the greater Phoenix area, is neither a receptor of ozone pollution nor includes significant sources of ozone precursors.

The air quality record for the MSA demonstrates that areas where exceedances of the eight-hour ozone standard are measured are concentrated in the urban core and areas to the north and east. With respect to the boundaries of the MSA, this area is confined to the north and central portion of the MSA. The one exception is the Hillside monitor, located approximately eighty miles northwest as the crow flies, from central Phoenix. With the data currently available, it is not possible to determine whether concentrations measured at Hillside are influenced by ozone precursors from the greater Phoenix area or from sources located outside of the State.

Sources of ozone precursors are located in the most heavily urbanized part of the MSA, which is also in its north central area. The highest emission densities are collocated with the densest residential and commercial development. While biogenic emissions of ozone precursors are distributed throughout the MSA and other anthropogenic sources may be found in association with rural communities and industrial sources, ozone modeling has demonstrated that these



sources are considerably less important than anthropogenic emissions in contributing to exceedances of the eight-hour ozone standard measured in the MSA.

Land ownership patterns have greatly influenced development patterns in the MSA and are expected to continue to do so. Only 29% of Maricopa County and 26% of Pinal County are privately owned. Indian reservations as well as State and federal lands create barriers to contiguous expansion of the urbanized core beyond the north central portion of the MSA. As a result, the majority of the MSA is expected to remain as neither a source nor a receptor of ozone pollution.

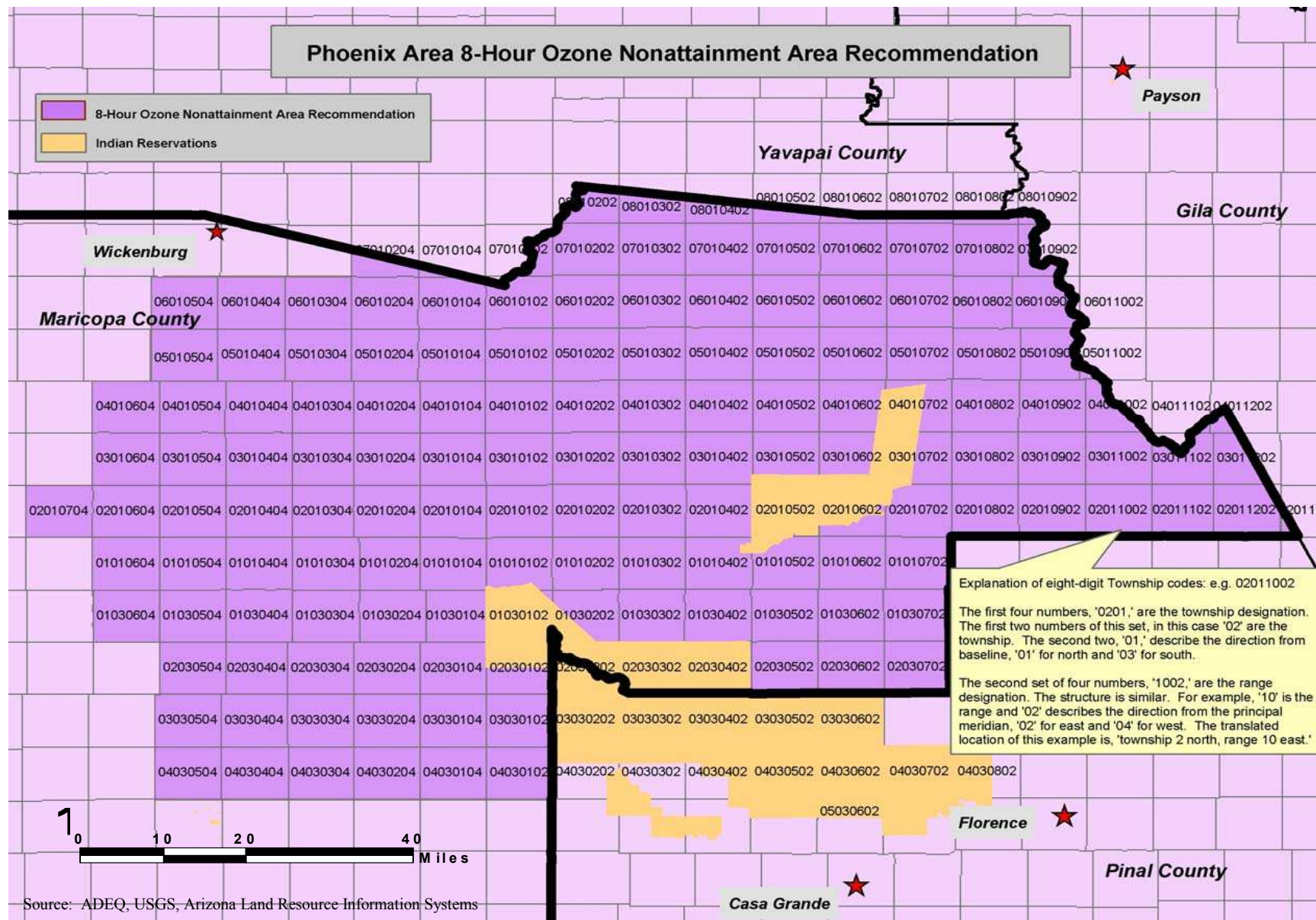
### **Recommended Alternative Eight-Hour Ozone Nonattainment Area Boundary**

The nonattainment area recommended by Arizona is smaller than the MSA, but still meets the definition in Section 107(d)(1)(A)(i) of the Clean Air Act and addresses the criteria identified in EPA's March 2000 guidance. The recommended area encompasses the existing one-hour ozone nonattainment area, the growing area to the west where several new power plants are located and substantial residential growth is planned, and to the north and east of the urban area where monitors are violating the 8-hour standard or have experienced exceedances in recent history. The recommended area excludes the Gila River Indian Community, Salt River Pima Maricopa Indian Community and the Fort McDowell Yavapai Nation.

In the absence of conclusive air quality modeling and additional monitoring, it is not possible at this time to determine the precise extent of nonattainment beyond the Maricopa County line. Arizona's alternative recommendation includes an attainment/unclassifiable designation for the rest of the State, as explained in Section IV.A.

Figure ES1 illustrates the recommended 8-hour nonattainment area. Table ES1 describes by county and township the areas of the State recommended for Attainment/Unclassifiable and Nonattainment.

Figure ES1: 8-Hour Nonattainment Area Recommendation



**Table ES1: Recommended Attainment/Unclassifiable and Nonattainment Areas for Arizona**

**Arizona-Ozone (8-Hour Standard)**

Designated Area	Designation Type	Classification Type
<p>Phoenix Area:                      Maricopa County (part).....</p> <p>T1N, R1E (except that portion in Indian Country)                      T1N, R2E                      T1N, R3E                      T1N, R4E (except that portion in Indian Country)                      T1N, R5E (except that portion in Indian Country)                      T1N, R6E                      T1N, R7E                      T1N, R1W                      T1N, R2W                      T1N, R3W                      T1N, R4W                      T1N, R5W                      T1N, R6W</p> <p>T2N, R1E                      T2N, R2E                      T2N, R3E                      T2N, R4E                      T2N, R6E (except that portion in Indian Country)                      T2N, R7E (except that portion in Indian Country)                      T2N, R8E                      T2N, R9E                      T2N, R10E                      T2N, R11E                      T2N, R12E (except that portion in Gila County)                      T2N, R13E (except that portion in Gila County)                      T2N, R1W                      T2N, R2W                      T2N, R3W                      T2N, R4W                      T2N, R5W                      T2N, R6W                      T2N, R7W</p>	<p>Nonattainment</p>	

Designated Area	Designation Type	Classification Type
<p>T3N, R1E  T3N, R2E  T3N, R3E  T3N, R4E  T3N, R5E (except that portion in Indian Country)  T3N, R6E (except that portion in Indian Country)  T3N, R7E (except that portion in Indian Country)  T3N, R8E  T3N, R9E  T3N, R10E (except that portion in Gila County)  T3N, R11E (except that portion in Gila County)  T3N, R12E (except that portion in Gila County)  T3N, R1W  T3N, R2W  T3N, R3W  T3N, R4W  T3N, R5W  T3N, R6W</p> <p>T4N, R1E  T4N, R2E  T4N, R3E  T4N, R4E  T4N, R5E  T4N, R6E (except that portion in Indian Country)  T4N, R7E (except that portion in Indian Country)  T4N, R8E  T4N, R9E  T4N, R10E (except that portion in Gila County)  T4N, R11E (except that portion in Gila County)  T4N, R12E (except that portion in Gila County)  T4N, R1W  T4N, R2W  T4N, R3W  T4N, R4W  T4N, R5W  T4N, R6W</p> <p>T5N, R1E  T5N, R2E  T5N, R3E  T5N, R4E  T5N, R5E</p>		

Designated Area	Designation Type	Classification Type
<p>T5N, R6E  T5N, R7E  T5N, R8E  T5N, R9E (except that portion in Gila County)  T5N, R10E (except that portion in Gila County)  T5N, R1W  T5N, R2W  T5N, R3W  T5N, R4W  T5N, R5W</p> <p>T6N, R1E (except that portion in Yavapai County)  T6N, R2E  T6N, R3E  T6N, R4E  T6N, R5E  T6N, R6E  T6N, R7E  T6N, R8E  T6N, R9E (except that portion in Gila County)  T6N, R10E (except that portion in Gila County)  T6N, R1W (except that portion in Yavapai County)  T6N, R2W  T6N, R3W  T6N, R4W  T6N, R5W</p> <p>T7N, R1E (except that portion in Yavapai County)  T7N, R2E (except that portion in Yavapai County)  T7N, R3E  T7N, R4E  T7N, R5E  T7N, R6E  T7N, R7E  T7N, R8E  T7N, R9E (except that portion in Gila County)  T7N, R1W (except that portion in Yavapai County)  T7N, R2W (except that portion in Yavapai County)</p> <p>T8N, R2E (except that portion in Yavapai County)  T8N, R3E (except that portion in Yavapai County)  T8N, R4E (except that portion in Yavapai County)  T8N, R5E (except that portion in Yavapai County)</p>		

Designated Area	Designation Type	Classification Type
<p>T8N, R6E (except that portion in Yavapai County)  T8N, R7E (except that portion in Yavapai County)  T8N, R8E (except that portion in Yavapai and Gila Counties)  T8N, R9E (except that portion in Yavapai and Gila Counties)</p> <p>T1S, R1E (except that portion in Indian Country)  T1S, R2E (except that portion in Pinal County and in Indian Country)  T1S, R3E  T1S, R4E  T1S, R5E  T1S, R6E  T1S, R7E  T1S, R1W  T1S, R2W  T1S, R3W  T1S, R4W  T1S, R5W  T1S, R6W</p> <p>T2S, R1E (except that portion in Indian Country)  T2S, R5E  T2S, R6E  T2S, R7E  T2S, R1W  T2S, R2W  T2S, R3W  T2S, R4W  T2S, R5W</p> <p>T3S, R1E  T3S, R1W  T3S, R2W  T3S, R3W  T3S, R4W  T3S, R5W</p> <p>T4S, R1E  T4S, R1W  T4S, R2W  T4S, R3W</p>		

Designated Area	Designation Type	Classification Type
<p>T4S, R4W T4S, R5W</p> <p>Rest of State (except those portions in Indian Country).....</p> <p>Apache County Cochise County Coconino County Gila County Graham County Greenlee County La Paz County Maricopa County (part)     Remainder of County Mohave County Navajo County Pima County Pinal County Santa Cruz County Yavapai County Yuma County</p>	<p>Attainment/ Unclassifiable</p>	

# Arizona Air Quality Designations Boundary Recommendations for the 8-Hour Ozone National Ambient Air Quality Standard

## I. BACKGROUND AND REGULATORY HISTORY

The U.S. Environmental Protection Agency (EPA) is charged with developing air quality standards for the protection of human health and welfare. EPA is also required to periodically evaluate those standards and revise them if scientific analyses indicate different standards would be more protective of public health and welfare.

Children are considered among those most at risk from exposure to ozone because they are active outdoors when ozone concentrations are highest. Adults who are outdoors and active during the summer months, as well as those with asthma or respiratory illnesses, are also at risk when exposed to relatively low ozone levels during periods of moderate exertion. Individuals can experience chest pain and cough or other adverse health effects including increased asthma attacks, chronic lung inflammation, decreased lung function, and decreased lung defenses against bacterial respiratory infections.

In 1997, EPA adopted a more stringent 8-hour standard. The averaging time for the new standard (peak ozone levels are calculated over eight hours rather than over one hour) better protects the public from longer periods of exposure to ozone and helps ensure the protection of those most vulnerable, such as children and the elderly.

<b>Standard</b>	<b>Level</b>	<b>Averaging Time</b>	<b>Form (attainment test)</b>
<b>One-Hour</b>	0.12 ppm	1 hour	Three exceedances at a monitor allowed in a three year period; fourth exceedance is a violation
<b>Eight-Hour</b>	0.08 ppm	8 hours	Three-year average of the annual fourth highest 8-hour concentration, calculated for each monitor*

\* Because of the rounding convention used, 0.085 is considered the level of a violation of the standard.

Following court challenges, the U.S. Supreme Court, in February 2001, affirmed EPA's new ozone national ambient air quality standard (Whitman v. American Trucking Associations, U.S. Supreme Court, Nos. 99-1257, 99-1426, February 27, 2001) and directed EPA to move forward with implementation. As part of the process, states and tribes were requested to recommend areas that do or do not meet the new standard by July 15, 2003. EPA must publish the



designations for all areas by April 15, 2004 (American Lung Association, et al, vs. Christine Todd Whitman, Administrator, EPA, v. EPA No. 02-2239 (D.D.C.) No. 02-2239, filed November 13, 2002).

## II. AREA DESIGNATION CRITERIA

On March 28, 2000, EPA issued guidance for states to use as they developed their recommendations - "Boundary Guidance on Air Quality Designations for the 8-Hour Ozone National Ambient Air Quality Standards" (see Appendix 1). In addition, Section 107(d)(1)(A)(i) of the Clean Air Act (CAA) defines a nonattainment area as "... *any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant...*"

The March 28, 2000, guidance stated metropolitan statistical areas (MSAs) would be the presumptive default nonattainment areas. The U.S. Bureau of the Census defines MSAs. In order to avoid the default, a state must address eleven criteria listed in the guidance.

- 1) Emissions and air quality in adjacent areas (including adjacent C/MSAs),
- 2) Population density and degree of urbanization including commercial development (significant difference from surrounding areas),
- 3) Monitoring data representing ozone concentrations in local areas and larger areas (urban or regional scale),
- 4) Location of emission sources (emission sources and nearby receptors should generally be included in the same nonattainment area),
- 5) Traffic and commuting patterns,
- 6) Expected growth (including extent, pattern and rate of growth),
- 7) Meteorology (weather/transport patterns),
- 8) Geography/topography (mountain ranges or other air basin boundaries),
- 9) Jurisdictional boundaries (e.g., counties, air districts, existing 1-hour nonattainment areas, Reservations, etc.),
- 10) Level of control of emission sources,
- 11) Regional emission reductions (e.g., NOx SIP call or other enforceable regional strategies).

ADEQ used these factors in developing the recommended nonattainment boundaries, as detailed in the following sections.

### III. AREA DESIGNATION CRITERIA ANALYSIS

#### III.A For Those Areas Recommended For Attainment/Unclassifiable

Arizona's recommendation for the State's attainment/unclassifiable areas is primarily based on guidance criteria related to monitoring data trends, jurisdictional boundaries, current and expected population growth, and available emissions information from EPA's national emissions inventory, as well as that from the Western Regional Air Partnership and County Air Quality Control Districts.

##### Monitoring Data Trends

ADEQ, local agencies and private industries currently operate monitoring sites in nine counties across Arizona. Monitor locations are shown on the map in Appendix 2. Using EPA's guidance, monitoring network design values for the 8-hour standard were determined through the following steps:

- 1) State and local agency daily ambient ozone concentrations were recorded for each of the monitoring sites across Arizona. All data were evaluated for completeness as specified in EPA's Guideline on Data Handling Conventions for the 8-hour Ozone NAAQS (U.S. EPA, December 1998);
- 2) Daily maximum 8-hour average ozone concentrations were calculated for each monitor, the fourth highest values for each year were determined, and the three-year average of the annual fourth highest values were calculated for the 2000-2002 period;
- 3) The design value for each monitor was compared to the NAAQS. The design value is the three-year average of the annual fourth highest 8-hour ozone concentration at the highest monitor (a calculated value less than 85 ppb is attainment of the standard, a calculated value of 85 ppb or greater is a violation of the standard).

An examination of the monitored air quality data shows that few of the counties outside Maricopa County have recorded exceedances and none have recorded violations of the 8-hour standard from 2000 through 2002. Appendix 3 summarizes monitored exceedances and Appendix 4 summarizes violations of the 8-hour standard from 1997 through 2002. The 2000-2002 design values for recommended attainment/unclassifiable areas are shown in Table II.A.1.

<b>Table III.A.1: 2000-2002 8-Hour Ozone Design Values for Arizona Counties (except Maricopa County)</b>	
<b>County</b>	<b>Design Value (ppb)</b>
<b>Apache</b>	n/a
<b>Cochise</b>	69
<b>Coconino</b>	73
<b>Gila</b>	n/a*
<b>Graham</b>	n/a
<b>Greenlee</b>	n/a
<b>La Paz</b>	n/a
<b>Mohave</b>	n/a
<b>Navajo</b>	n/a*
<b>Pima</b>	73
<b>Pinal</b>	80
<b>Santa Cruz</b>	n/a
<b>Yavapai</b>	82
<b>Yuma</b>	69***

\* Monitoring began in Gila and Navajo Counties in 2002.

\*\* Value is based on 1999-2001 data. The Yuma monitoring site was not operational in 2002 because of a location change, but is operational in 2003.

**Jurisdictional Boundaries**

In its analysis, ADEQ included consideration of existing political boundaries, such as county lines and existing control measure applicability areas, such as the 1-hour ozone nonattainment area and areas where pollution control programs are applied to address nonattainment with NAAQS in the greater Phoenix and Tucson areas, Areas A and B, respectively (See ARS §49-541). The applicability of the Area A boundary for defining the boundaries of the Greater Phoenix nonattainment area is addressed in Section III.B., below.

**Emissions Data**

Section 107 of the Clean Air Act also requires that areas not contribute to violations of ambient air quality in a nearby area. County emissions data show that while it is the 6<sup>th</sup> largest county, Maricopa County sources emit approximately 50% of the State's VOC and 32% of the NOx. Pinal County, which comprises the remaining portion of the MSA, is 10<sup>th</sup> out of 13 in size, and only 3.5% of VOCs and 3.6% of NOx emanates from that County. Similarly, as indicated in the following table, none of the other county totals equate to Maricopa County.

**Table III.A.2: 1999 Arizona State and County Emissions Data**

County/State	Size Ranking	Area (square miles)	Volatile Organic Compounds (VOC) Emissions (tons)	Nitrogen Oxides (NOx) Emissions (tons)
Apache	3	11,216	8,384	45,992
Cochise	8	6,215	9,155	17,509
Coconino	1	18,608	15,848	64,141
Gila	11	4,752	6,301	3,688
Graham	12	4,630	2,759	1,552
Greenlee	14	1,837	1,397	1,572
La Paz	13	4,518	2,461	3,278
Maricopa	5	9,222	128,043	135,220
Mohave	2	13,479	13,833	12,610
Navajo	4	9,949	18,911	59,180
Pima	6	9,184	39,410	39,486
Pinal	10	5,371	10,210	15,456
Santa Cruz	15	1,236	3,030	2,232
Yavapai	7	8,125	10,379	17,308
Yuma	9	5,522	8,431	10,171
<b>Arizona Total</b>		<b>113,864</b>	<b>278,552</b>	<b>429,394</b>

Source: U.S. Environmental Protection Agency 1999 National Emission Trends (NET) Tier Report

**Population Data**

Consistent with emissions patterns, the level of population density is low throughout the State with the exception of Maricopa County. Table 3 summarizes information on county population and density, and identifies the largest city for each county.

<b>Table III.A.3: 2002 Arizona Population Data</b>				
<b>County/Largest City</b>	<b>Area (square miles)</b>	<b>County Population</b>	<b>Largest City Population</b>	<b>Population Density (persons per square mile)</b>
<b>Apache County</b>	11,216	70,105		6.25
Eager			4,105	
<b>Cochise County</b>	6,215	124,040		19.96
Sierra Vista			40,415	
<b>Coconino County</b>	18,608	125,420		6.74
Flagstaff			59,160	
<b>Gila County</b>	4,752	53,015		11.16
Payson			14,510	
<b>Graham County</b>	4,630	34,070		7.36
Safford			9,395	
<b>Greenlee County</b>	1,837	8,605		4.68
Clifton			2,595	
<b>La Paz County</b>	4,518	20,365		4.51
Quartzsite			3,430	
<b>Maricopa County</b>	9,222	3,296,250		357.43
Phoenix			1,365,675	
<b>Mohave County</b>	13,479	166,465		12.35
Lake Havasu City			46,400	
<b>Navajo County</b>	9,949	101,615		10.21
Winslow			9,450	
<b>Pima County</b>	9,184	890,545		96.97
Tucson			507,085	
<b>Pinal County</b>	5,371	192,395		35.82
Apache Junction*			33,295	
<b>Santa Cruz County</b>	1,236	39,840		32.23
Nogales			21,110	
<b>Yavapai County</b>	8,125	180,260		22.19
Prescott			36,375	
<b>Yuma County</b>	5,522	169,760		30.74
Yuma			81,380	
<b>Arizona Total</b>	<b>113,864</b>	<b>5,472,750</b>		<b>48.06</b>

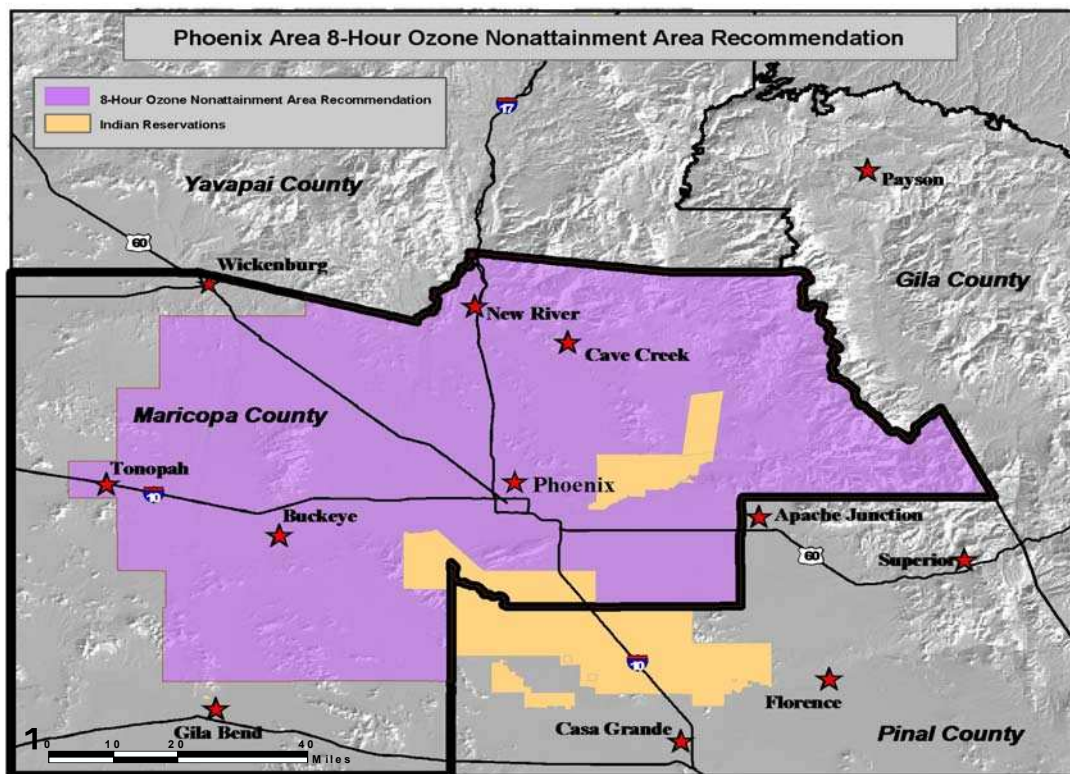
Source: Arizona Department of Commerce (ADOC), County profiles (Area Data); Arizona Department of Economic Security (ADES), Research Administration, Population Statistics Unit, mid-year 2002 population estimates, approved 12-06-02. Population density was calculated from ADOC and ADES data. There are few “urbanized areas” in Arizona. These include Avondale, Flagstaff, Phoenix-Mesa, Prescott, Tucson, and Yuma (67 FR 21962, May 1, 2002). An “urbanized area” is defined by the U.S. Office of Management and Budget as a continuously built-up area of 50,000 or more and generally has an overall population density of at least 1,000 persons per square mile.

\*This number represents the Pinal County portion only. A very small amount of acreage in Maricopa County is incorporated within the City of Apache Junction.

### III.B For Those Areas Recommended For Nonattainment

Monitoring data trends from 1997 to the present indicate that some portion of the Maricopa/Pinal MSA would be nonattainment for the 8-hour NAAQS (see Appendix 5). In mid-2002, ADEQ began a stakeholder process to review whether an early action compact (EAC), a strategy to attain the 8-hour standard earlier than what would be deemed necessary as a nonattainment area, would be a viable option for the area. Because of timing (the EAC would need to be developed and submitted by the end of 2002), it was deemed not possible and ADEQ's focus turned to the work of how to define and defend a viable 8-hour ozone nonattainment area. In October 2002, the stakeholder group began reviewing the eleven criteria in the March 2000 guidance and discussing ADEQ's suggested technical work approach. ADEQ contracted with Arizona State University and a consultant, Air Pollution Evaluations & Solutions, to assist in the analyses, which included an analysis of air quality modeling, land use, and population growth. Preliminary products were presented at subsequent stakeholder meetings and two boundary options were shown at the June 17, 2003, meeting (see Appendix 6). ADEQ received several comments following that meeting, which it considered in refining the recommendation for Governor Napolitano's consideration. Figure III.B.a illustrates the area recommended by the Governor. The recommendation also addresses EPA's concern (see Appendix 7) that the current 1-hour ozone nonattainment boundary is inadequate for implementing the 8-hour average ozone standard. What follows is an explanation of how each of the eleven criteria were addressed in the decision-making.

Figure III.B.a: Recommended 8-Hour Nonattainment Area

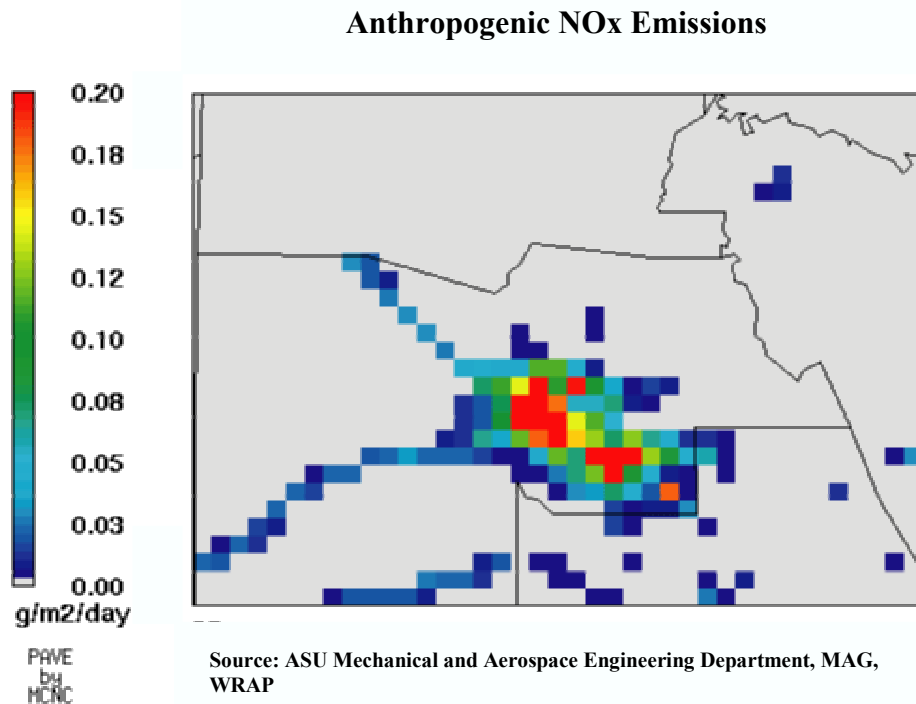


Source: ADEQ, USGS, Arizona Land Resource Information Systems

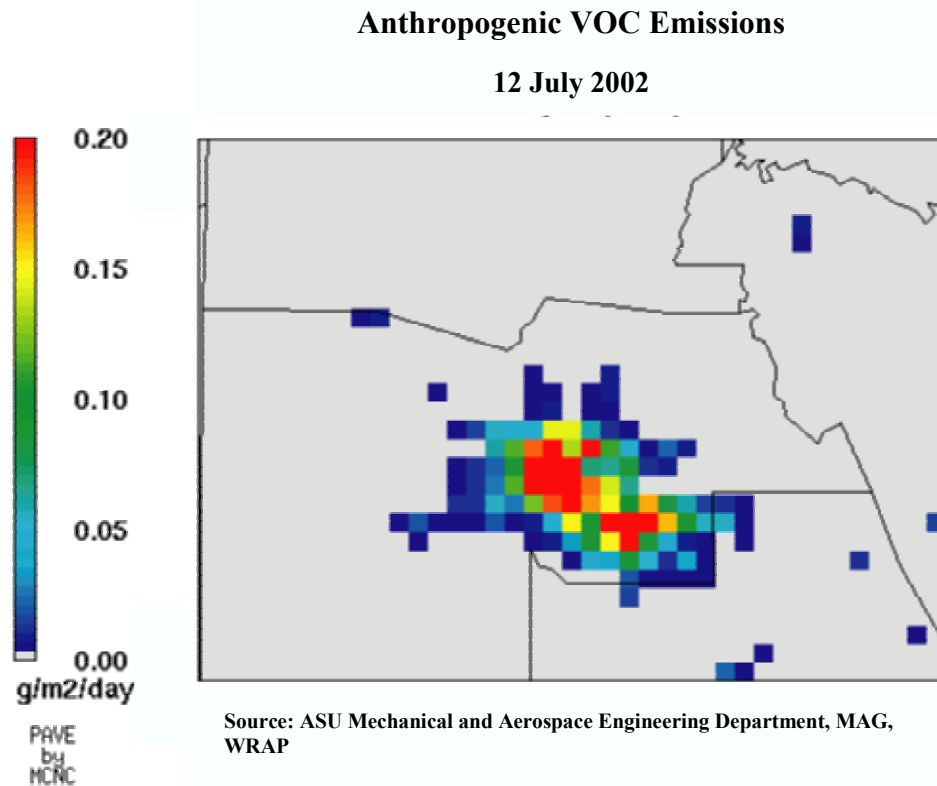
**III.B.1. Criterion #1 - Emissions and Air Quality in Adjacent Areas (including adjacent C/MSAs)**

Emissions, meteorological, and air quality modeling for the greater Phoenix area were conducted by Arizona State University for two design dates, June 6 and July 12, 2002. The air quality modeling domain for these simulations was approximately 350 miles wide in the east-west (New Mexico to Colorado River) and 200 km in the north-south (Flagstaff to Nogales) directions, with metropolitan Phoenix in the center. This area included all of Maricopa, Pima, and Pinal Counties, the most populous ones. A modeling domain of this size ensures that emissions and air quality in areas near greater Phoenix are taken into account in the analysis; as it captures source and receptor areas and includes information on boundary conditions. ASU’s Environmental Fluid Dynamics Program did emissions and ozone photochemical grid modeling for the two design days. A detailed description of the modeling analysis is included in Appendix 8. The emissions modeling tool used was the EPA approved Sparse Matrix Operator Kernel Emissions (SMOKE) model for anthropogenic and biogenic emissions of nitrogen oxides (NOx) and volatile organic compounds (VOCs). The emissions data sources used in the analysis were the 1999 MAG emissions inventory and 1996 WRAP “base-case scenario” emissions inventory (see Appendix 9). Additional information related to the location of sources may be found in Section III.B.4. The figures below illustrate the results of the emissions modeling for the two ozone precursors based on the WRAP base-case 1996 scenario emissions inventory.

**Figure III.B.1.a: Emissions Density estimates from SMOKE for Oxides of Nitrogen**



**Figure III.B.1.b: Emissions Density estimates from SMOKE for Volatile Organic Compounds**



The ozone photochemical grid modeling also employed EPA approved models, the Mesoscale Meteorological Model version 5 (MM5), which was used for the meteorological modeling, and the Community Multiscale Air Quality Modeling System (CMAQ) model to perform the ozone simulations. In order to establish boundary conditions, MM5 was modeled with nested domains of 36 Km, 6 Km and 2 Km. CMAQ was applied to the two smaller nested domains. Model performance, however was nearly identical for the 6 Km and 2 Km domains; as such, final results were based on 6 Km grid modeling. The input data for the meteorological portion of the modeling came from information gathered at wind sites in 2002 (see Appendix 8, [Simulation of 8-hour Ozone Concentrations for the State of Arizona](#), page 6). Both the MM5 and CMAQ modeling results were validated by comparison with measured meteorological and ozone data, and were found to meet or exceed EPA criteria for acceptable model performance. For each episode, the CMAQ simulation was executed for 69 hours, and the output was analyzed for 48 hours, which encompassed the day of interest and 12 hours ahead and behind of the episode day (see Appendix 8). Although the models performed well, the winds predicted by MM5 tended to be late on the timing of the daily wind shift from nighttime drainage winds, generally from the east, to upslope flow, generally from the southwest. Usually, this shift actually occurs within a few hours after sunrise at the beginning of the



daily ozone production period. For the June 6<sup>th</sup> case, however, due to the prolonged morning southeasterly flow, and delayed transition to westerly flow that was predicted by MMS, CMAQ over predicted the ozone concentrations in the northwestern part of the Valley, and slightly under predicted concentrations in the northeastern part where the Blue Point Ridge, Rio Verde, Fountain Hill, Humboldt Mountain monitoring sites are located

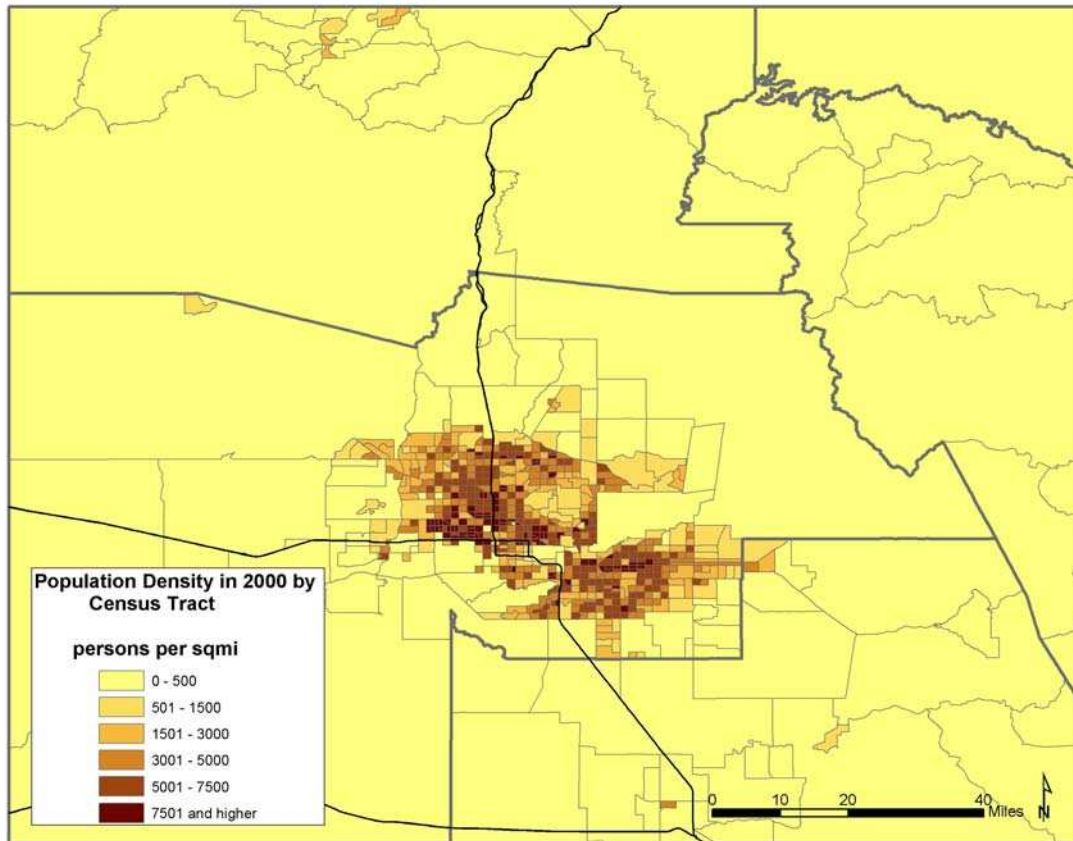
When averaged over an 8-hour period, depending on the meteorological conditions, the central part of the Maricopa County and its immediate surroundings were simulated to have 8-hour ozone concentrations higher than 85 ppb. The importance of the modeling in determining nonattainment area boundaries, however, was limited. The under predictions to the east on June 6 and to the north on July 12 provided no information on the extent of elevated ozone concentrations between and beyond the monitors in this mountainous area. What the modeling did do, though, was confirm that during ozone episodes a relatively broad area of metropolitan Phoenix is susceptible to elevated ozone concentrations.

**III.B.2. Criterion #2 - Population Density and Degree of Urbanization Including Commercial Development (significant difference from surrounding areas)**

For this criterion population density, commercial development and employment, and land use and ownership were examined throughout the study area. Appendix 10 details the process used to obtain the following information.

Population densities were reviewed for base year 2000. Population density is greatest in the urban core of the greater Phoenix area. Figure III.B.2.a shows population density by census tract based on 2000 U.S. Census Bureau data.

**Figure III.B.2.a: Population Density in 2000**

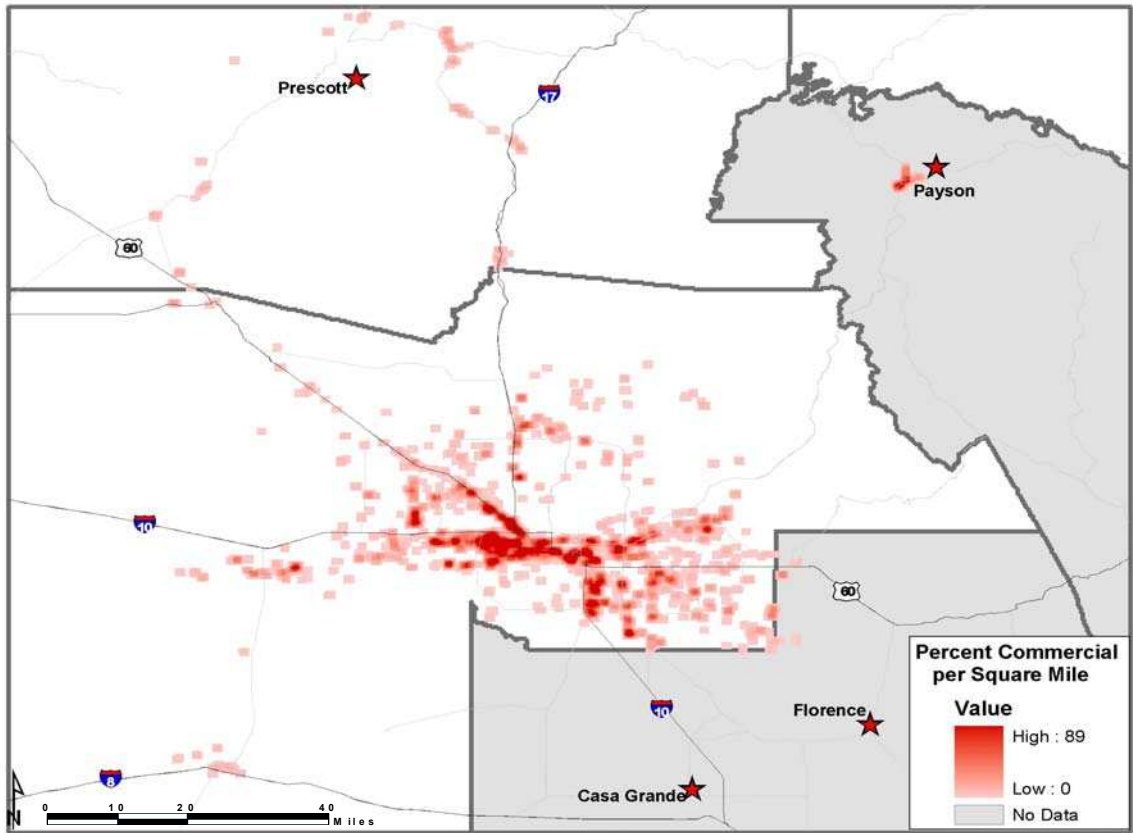


Source: U.S. Census Bureau

Commercial development is one of the surrogate factors that may serve as an indicator of the levels of activities generating ozone precursor emissions. The degree of commercial development was examined using 2002 “Commercial” zoning data for the City of Payson, MAG’s 2000 commercial land use data for Maricopa and Pinal Counties, including Specialty, Neighborhood, and Community Commercial land use categories, and commercial zoning data from Yavapai County, including neighborhood, general sales and

service, and minor industrial commercial categories. Figure III.B.2.b was created after converting the various data to a 100-foot resolution continuous surface representation, or “grid” to show the existing percentage of commercial area per square mile. As expected, the greatest level of commercial development closely follows the developed urban core and major transportation corridors in the study area.

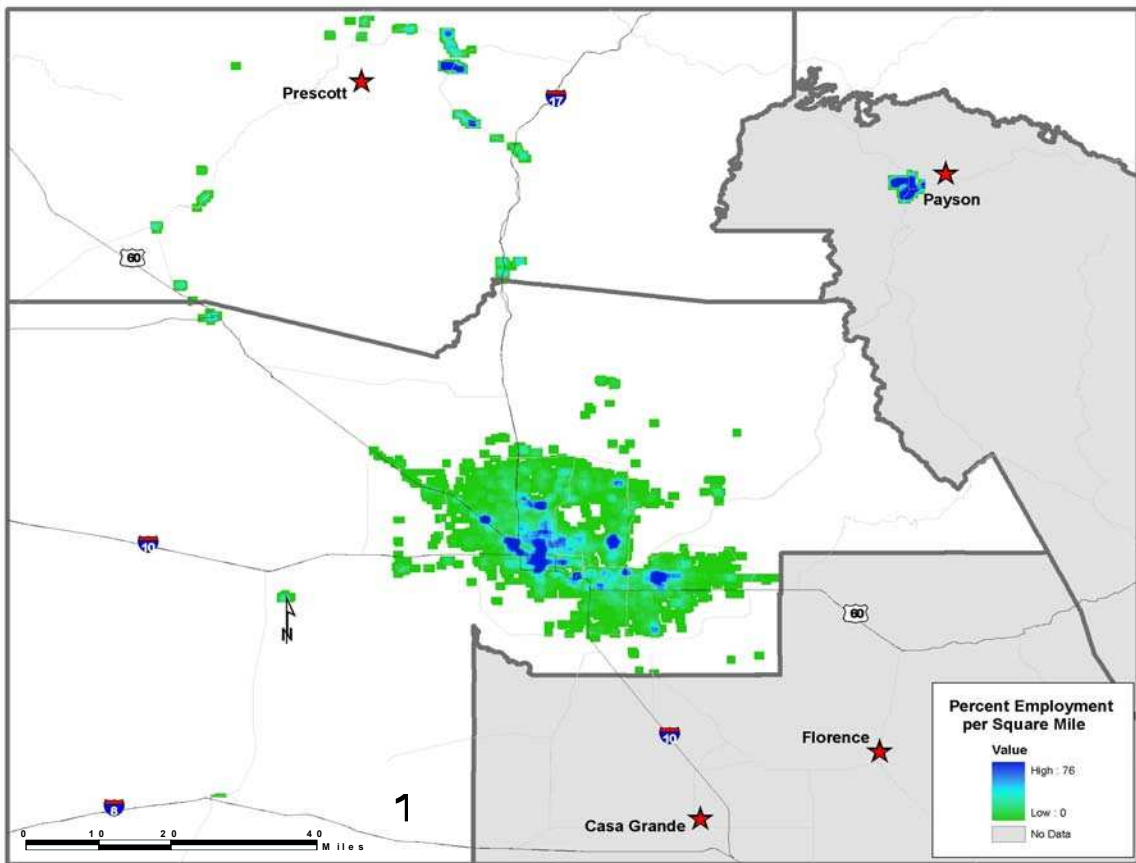
**Figure III.B.2.b: Commercial Land Use**



Source: MAG, Yavapai County, Town of Payson

A similar map was created to show the percent employment per square mile in the study area (see Figure III.B.2.c). This map was created using available data from a digital employment file for the year 2000 from MAG, the City of Payson's zoning map from November 2002, and a Yavapai County zoning digital file. Once again, the highest percent employment is concentrated in Maricopa County, and though dispersed throughout the urban core, is most concentrated in the centers of the major cities, especially downtown Phoenix. Also note, that like commercial land uses, employment also follows major transportation corridors.

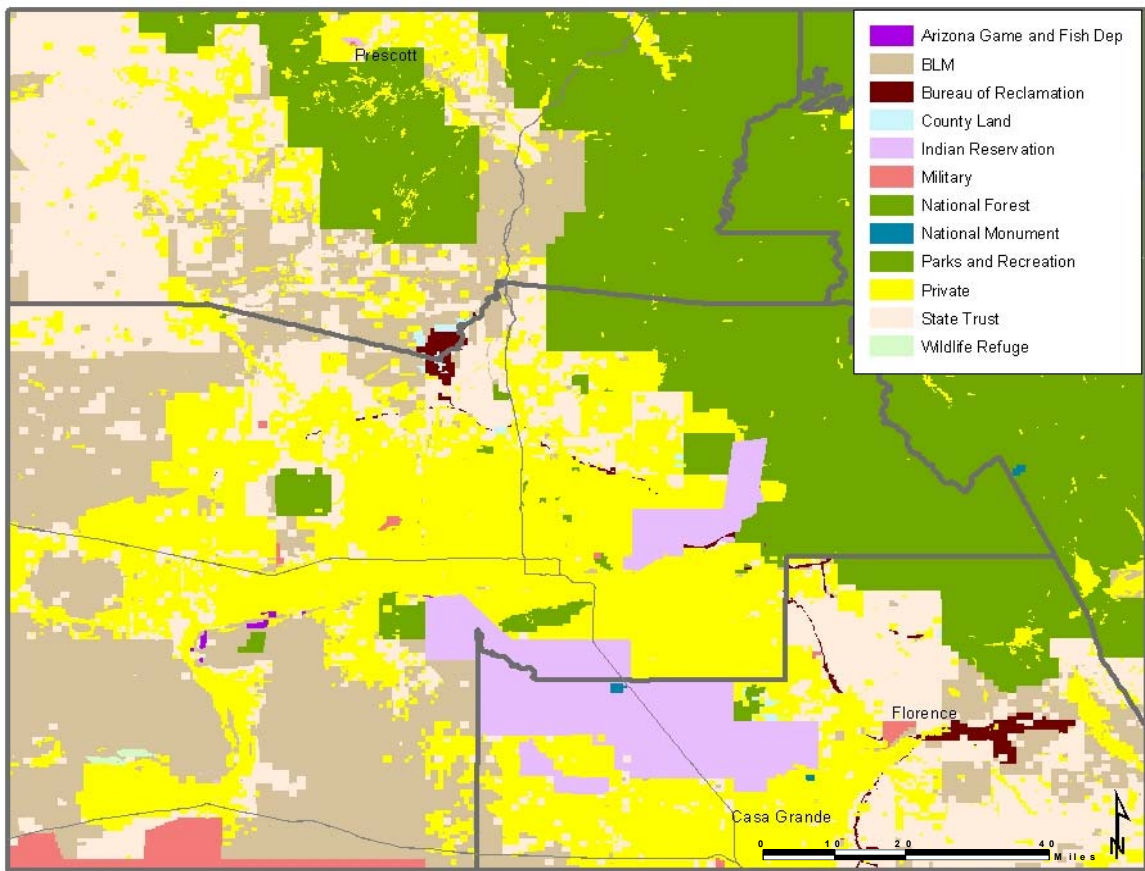
**Figure III.B.2.c: Employment Centers**



Source: MAG, Yavapai County, Town of Payson

The data for Figure III.B.2.d also came from MAG, Yavapai County, and Payson and shows the broad range of land ownership in the study area. Land ownership patterns have greatly influenced development patterns in the MSA and are expected to continue to do so. Only 29% of Maricopa County and 26% of Pinal County are privately owned. Indian reservations as well as State and federal lands create barriers to contiguous expansion of the urbanized core beyond the north central portion of the MSA. This pattern of ownership is evident in the distribution of population density, commercial land use, and employment centers as illustrated in Figures III.B.2.a through III.B.2.c and again in the distribution of current residential areas as shown in Figure III.B.2.e below. The existence of public lands and Indian reservations has directed, and is expected to continue to direct where growth occurs in the greater Phoenix area.

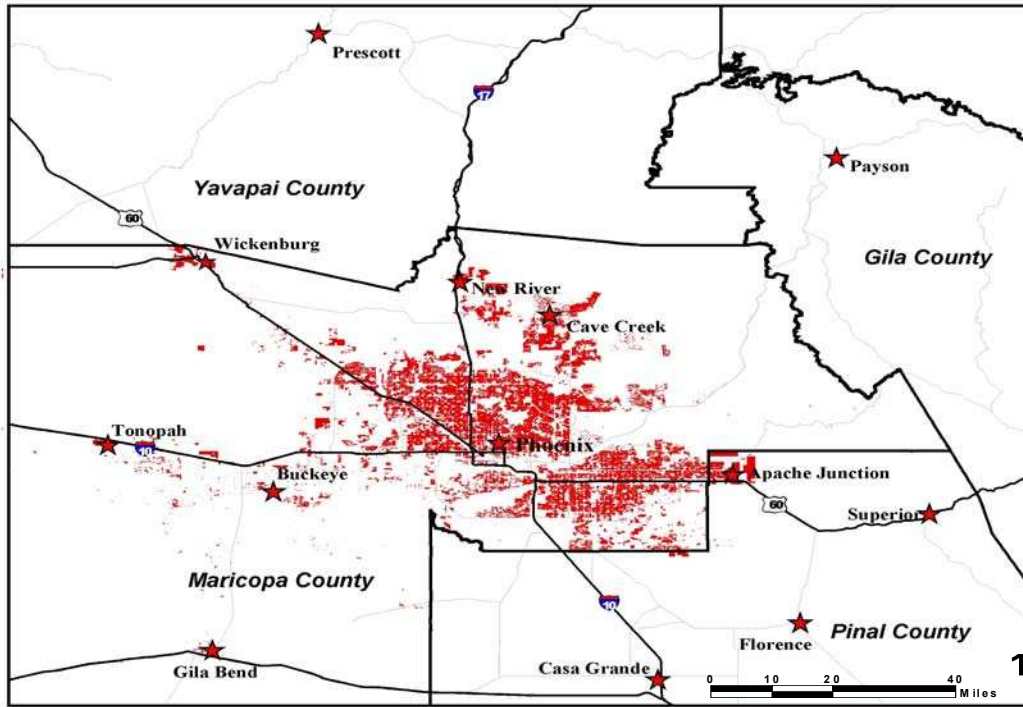
**Figure III.B.2.d: Study Area Land Ownership**



Source: MAG, Yavapai County, Town of Payson, Arizona Land Resource Information Systems

Figure III.B.2.e depicts residential land use in red. As with other human activity described above, residences are concentrated in the urban core and follow major transportation corridors.

**Figure III.B.2.e: Current Residential Land Use – Maricopa and Pinal County Area**



Source: MAG, Yavapai County, Town of Payson

Note: Residential areas in Gila and Yavapai Counties were not available and are not represented on this map. However, Table III.A.3 shows how sparsely populated the two counties are.

**III.B.3. Criterion #3 - Monitoring Data Representing Ozone Concentrations in Local Areas and Larger Areas (urban or regional scale)**

In his November 14, 2002, memo, EPA Assistant Administrator, Jeffrey Holmstead, stated that state and tribal recommendations should *generally* (emphasis added) be based on 2000-2002 monitoring data (see Appendix 11), updating the request to use 1998-2000 data in the Seitz March 2000 memo. States and EPA will work together to review 2003 data in anticipation of final designation action. For the period 2000-2002, there were three monitors with violations. The design value of each was calculated using the methodology described in Section III.A and is shown in the following table.

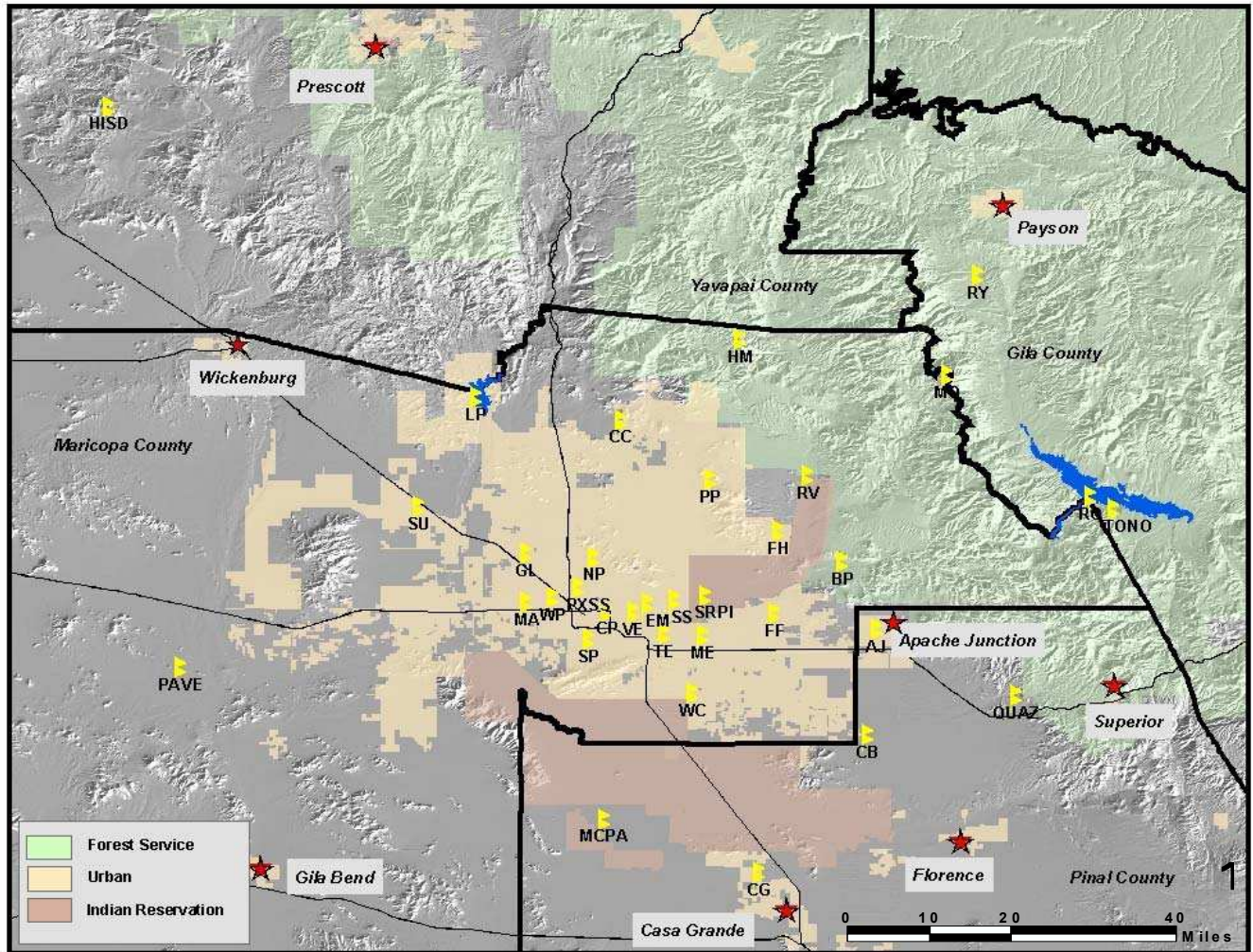
Table III.B.3: 2000-2002 8-Hour Ozone Design Values for MSA	
Monitor Site	Design Value (ppb)
Humboldt Mountain	85
North Phoenix	85
Pinnacle Peak	85

Maricopa County, Pinal County, and ADEQ operate an extensive network of ozone monitors in and around the Greater Phoenix Area. (see Figure III.B.3.a) Currently, there are 26 monitors in operation, mostly in the urbanized area, but three are located in rural and even remote locations as far as 80 miles (Hillside monitor) from central Phoenix. Since the implementation of the 8-hour ozone network, some sites have been closed and others moved, with EPA's concurrence, to attempt to do a better job of understanding the pollutant. Appendices 5 and 6 provide information for all monitors that have been or are in operation throughout the State.

Over time, peak ozone concentrations have decreased in the Phoenix area, as is evident by the attainment of the 1-hour standard since 1997. In looking at the monitoring record of 8-hour ozone concentrations from 1995 through 2002, though, data show that ozone concentrations decreased through 1996, but the apparent downward trend has failed to continue. Figure III.B.3.b provides trend-lines for the 4<sup>th</sup>-high 8-hour ozone concentrations in the greater Phoenix area. Because of the large number of ozone monitoring sites and the role of weather on spatial variation of ozone concentrations, providing a graphic that will allow the reader to interpret the presence or absence of a trend is best accomplished by averaging sites by area - urban center, east, and far east and north sites. This Figure indicates that no trend of either improving or worsening 8-hour average ozone concentrations is evident. Therefore, to provide a more complete picture of 8-hour ozone concentrations in the area, the 1997-2002 portion of the monitoring record was used in the development of the recommendation.

The density and distribution of ozone monitors in the urbanized area is adequate to determine compliance with the standard. However, in rural areas there are relatively large distances between monitors. The extensive areas with mountainous and complex terrain complicate the interpretation of the measurement data and require the consideration of such phenomenon as plume impingement on high terrain and ozone shadows on the leeward side of mountains. The first step in attempting to fill the gaps between and beyond the rural monitors is to determine the spatial representation of each monitor. This was accomplished by a careful review of the measurements record of each monitor and comparisons between measurements at different sites. This evaluation was done in the consideration of topographic influences, airflow patterns, and ozone formation dynamics. The results of the photochemical grid modeling and an analyses of wind conditions during the two ozone episode periods in 2002 were used in this exercise to interpret the ambient ozone data record (see Appendices 7 and 8).

Figure III.B.3.a: Phoenix Area Ozone Monitoring Sites 1995-2002



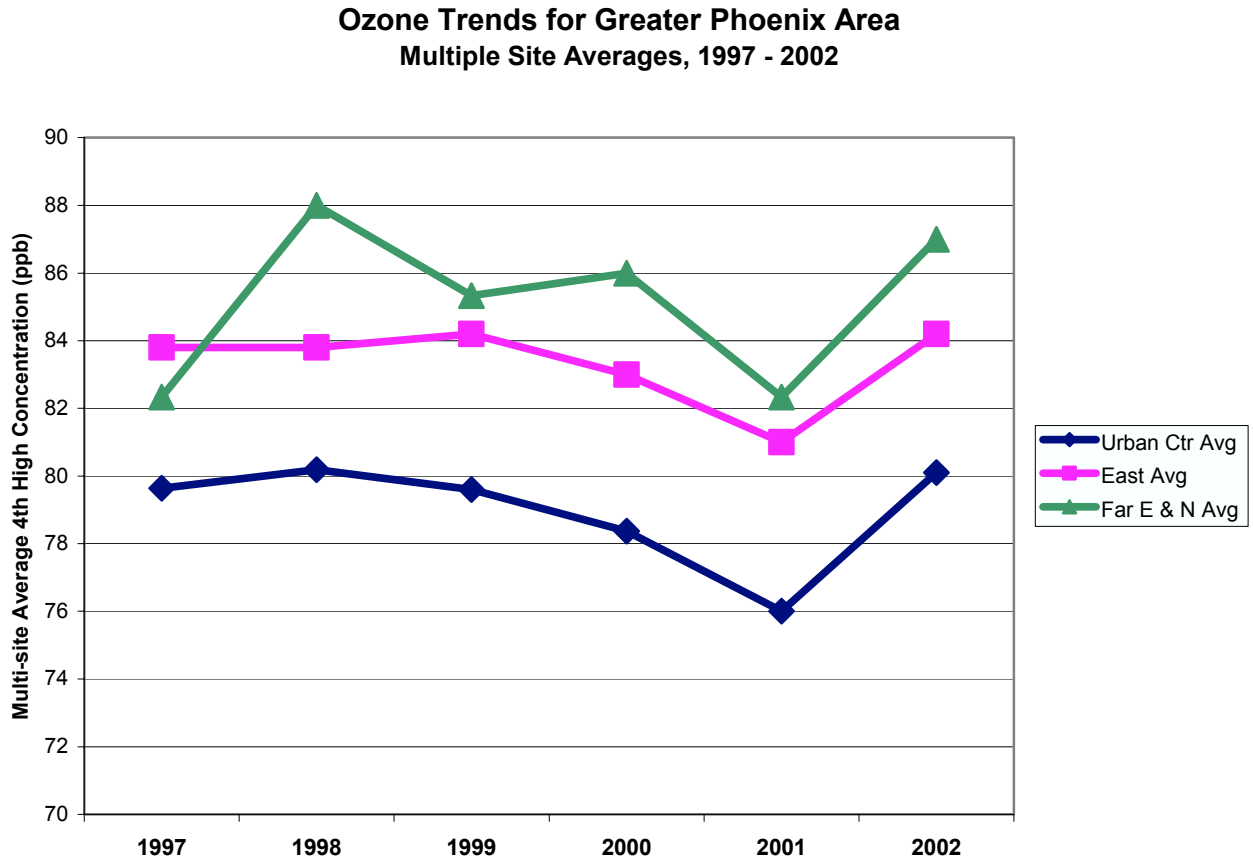
Source: Maricopa County, Pinal County, ADEQ, USGS, Arizona Land Resource Information Systems

Key to Monitoring Site Abbreviations on Map  
"Phoenix Area Ozone Monitoring Sites"

Abbreviation	Monitoring Site	Abbreviation	Monitoring Site
AJ	Apache Junction	NP	North Phoenix
BP	Blue Point	PAVE	Palo Verde
CG	Casa Grande	PP	Pinnacle Peak
CC	Cave Creek - new 8/01	QUAZ	Queen Valley - new 5/01
CP	Central Phoenix	RV	Rio Verde
CB	Combs - new 7/02	RO	Roosevelt – closed 1997
EM	Emergency Management - closed 6/01	RY	Rye – closed 11/99
FF	Falcon Field	SRPI	Salt River Pima – closed 10/99
FH	Fountain Hills	SP	South Phoenix
GL	Glendale	SS	South Scottsdale
HISD	Hillside - new 4/96	PXSS	Super Site
HM	Humboldt Mountain	SU	Surprise – new 4/01
LP	Lake Pleasant - closed 6/01	TE	Tempe
MCPA	Maricopa - new 7/02	TONO	Tonto N.M. - new 5/02
MA	Maryvale	VE	Vehicle Emissions – closed 1997
ME	Mesa	WC	West Chandler
MO	Mt. Ord – closed 10/01	WP	West Phoenix



Figure III.B.3.b: Ozone trends in the Phoenix Area



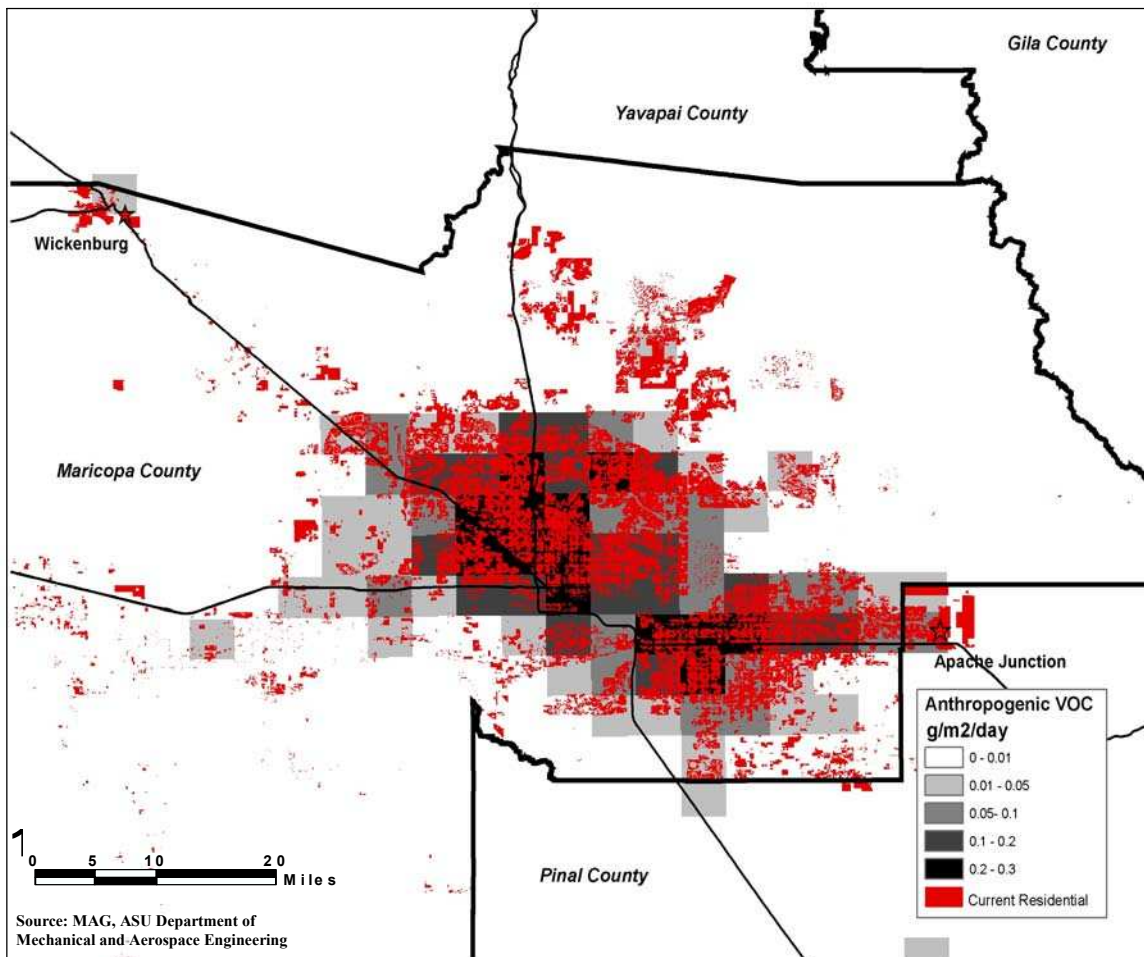
Sites Used to Generate Averages		
Urban Center	East	Far East and North
Central Phoenix	Apache Junction	Humboldt Mountain
Emergency Management	Blue Point	Mt. Ord
Glendale	Falcon Field	Pinnacle Peak
Maryvale	Fountain Hills	
Mesa	Rio Verde	
North Phoenix		
South Phoenix		
South Scottsdale		
Super Site		
West Chandler		
West Phoenix		

Source: Maricopa County, Pinal County, ADEQ

**III.B.4. Criterion #4 - Location of Emissions Sources (emissions sources and nearby receptors should generally be included in the same nonattainment area)**

The emissions inventory data used in addressing Criterion #1 and the land use data used in addressing Criterion #2 were reviewed, in tandem, to identify where the sources are located and their potential for greatest impact. Figure III.B.4.a shows the anthropogenic (i.e., human-caused) volatile organic compound (VOC) emissions that were produced by the SMOKE model overlain by current residential land use. This verifies that emissions tend to be concentrated where people live and work. This pattern is not expected to change in the future, meaning that future emissions will be associated with new residential and commercial development, when it occurs.

**Figure III.B.4: Current Land Use and VOC Emissions**



**III.B.5. Criterion #5 - Traffic and Commuting Patterns**

The Greater Phoenix area has developed and continues to develop with a concentrated urban center. That is to say the majority of economic activity and employment occurs in the urban core and following major corridors, radiating from the urban core (see Figures III.B.2.b and III.B.2.c). These commercial and employment centers are surrounded by concentric development of residential areas mixed with commercial development designed to serve the local populations. As a result, the traffic and commuting patterns involve movement of vehicles from throughout the urbanized area toward the urban core in the morning (morning “rush-hour”), continued traffic concentrated in the urban core during business hours, and the return of vehicles to residential areas from the urban core in the evening (evening “rush-hour”). This pattern is demonstrated in the MAG Regional Freeway Bottleneck Study, Task 5, Traffic Data Working Paper (May 7, 2002, see Appendix 12), which shows highest freeway traffic volumes in the urban core, and from 7 to almost 10 percent of traffic volume on freeways in the urban core occurs on inbound lanes during peak morning hour and outbound lanes during the peak evening hour (see Figures 1, 13 and 14 of MAG report referenced above). In addition, interstate traffic moves along Interstate 10, which connects California markets to Arizona and other southern states, and Interstate 17, which connects Interstate 40, another major east-west conduit, to Interstate 10. The vast majority of the traffic and vehicle miles traveled in the greater Phoenix area, however, are locally generated. Figure III.B.5.a illustrates where traffic is concentrated in the greater Phoenix area. In addition, VMT estimates for 2006 in the MAG Carbon Monoxide Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area (May 2003) demonstrate this fact:

<b>Table III.B.5 2006 VMT Estimates for the MAG Planning Area</b>				
Freeways	Arterials	Collectors	Locals	Total
30,090,000	47,679,000	2,919,000	9,329,000	90,017,000
33.4%	53.0%	3.2%	10.4%	100%

About two-thirds of all traffic occurs off of the freeways, and the majority of freeway traffic is of local origin as well.

This mode of traffic is expected to continue into the future. As is characteristic of concentric development around an urban core, development expanding beyond the urban fringe will result in greater average home-to-work commute distances. Figure III.B.5.b shows the growth trend for population and VMT, with VMT increasing at a faster rate than population. Average annual growth in VMT from 1995 to 2016 is expected to be 3.58%, approximately 46% greater than the average annual growth rate for population, which is expected to be 2.45%.

It may be concluded that, given the commuting and traffic patterns in the greater Phoenix area, the size of the nonattainment area should be sufficiently large to include the expected suburban frontier at the end of the maintenance period. Since on-road vehicles are the largest anthropogenic source category and account for about 25% of the VOC and 50% of the NOx inventories (see Appendix 9, Attachment 2), it may be necessary to

assure that appropriate Clean Air Act regulations apply to as many of these vehicles as possible.

**Figure III.B.5.a: Study Area Annual Average Daily Traffic**

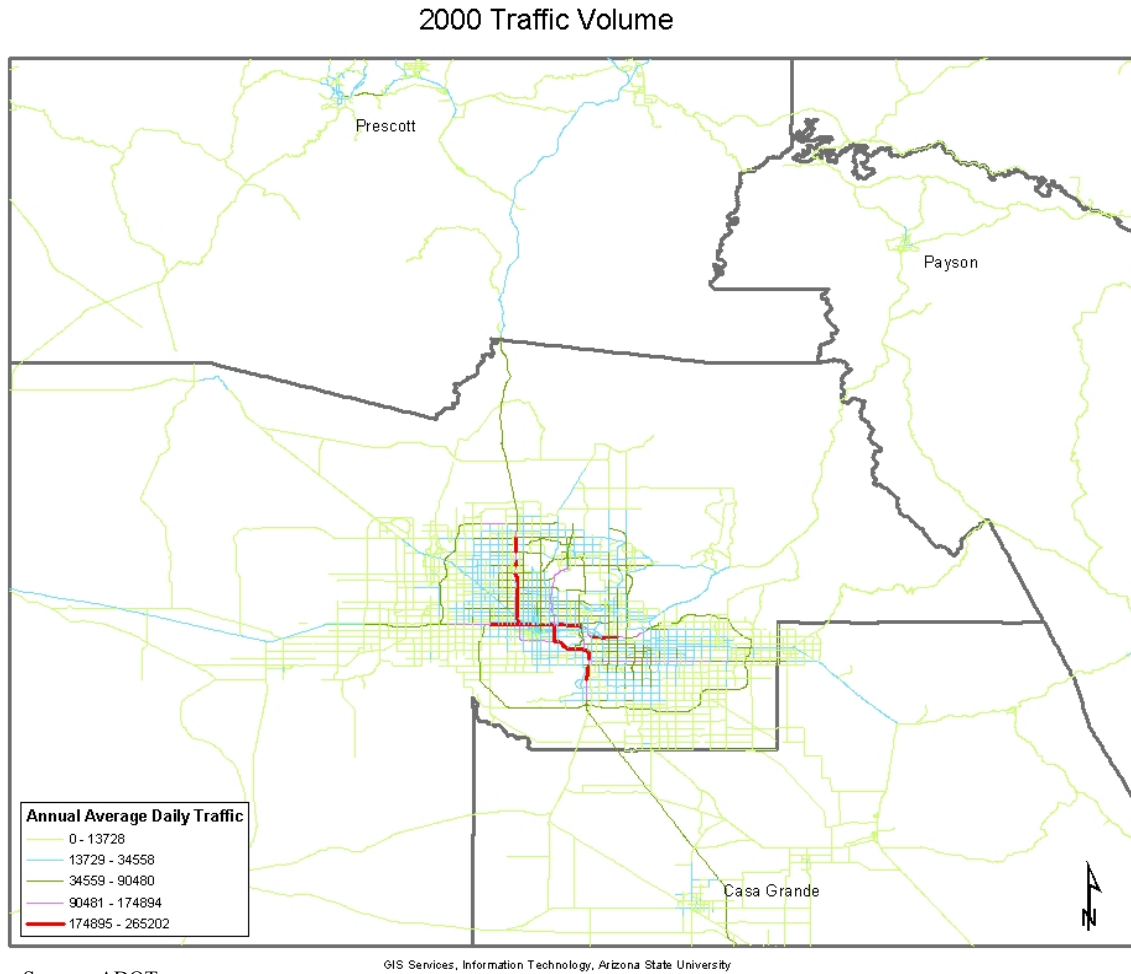
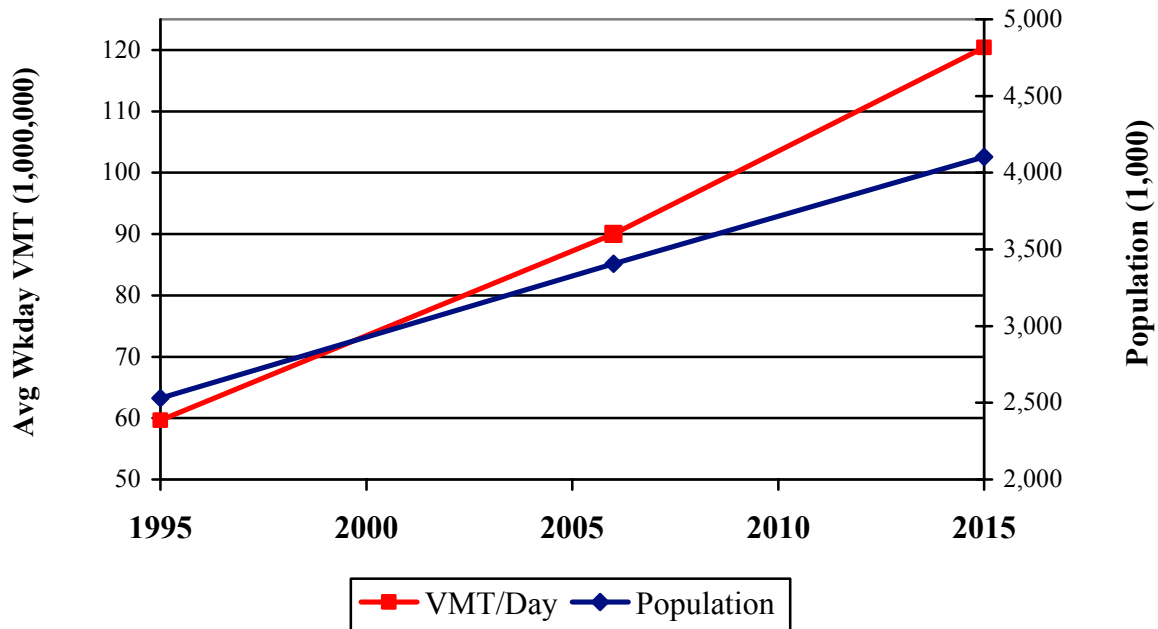


Figure III.B.5.b: Population and Vehicle Miles Traveled Projections

### Population & Vehicle Miles Travelled For MAG Planning Area, 1995 - 2015

Source: MAG CO Maintenance Plan (May 2003)



Year	1995	2006	2015
Population in thousands	2,529	3,406	4,102
VMT in millions	59.623	90.017	120.406

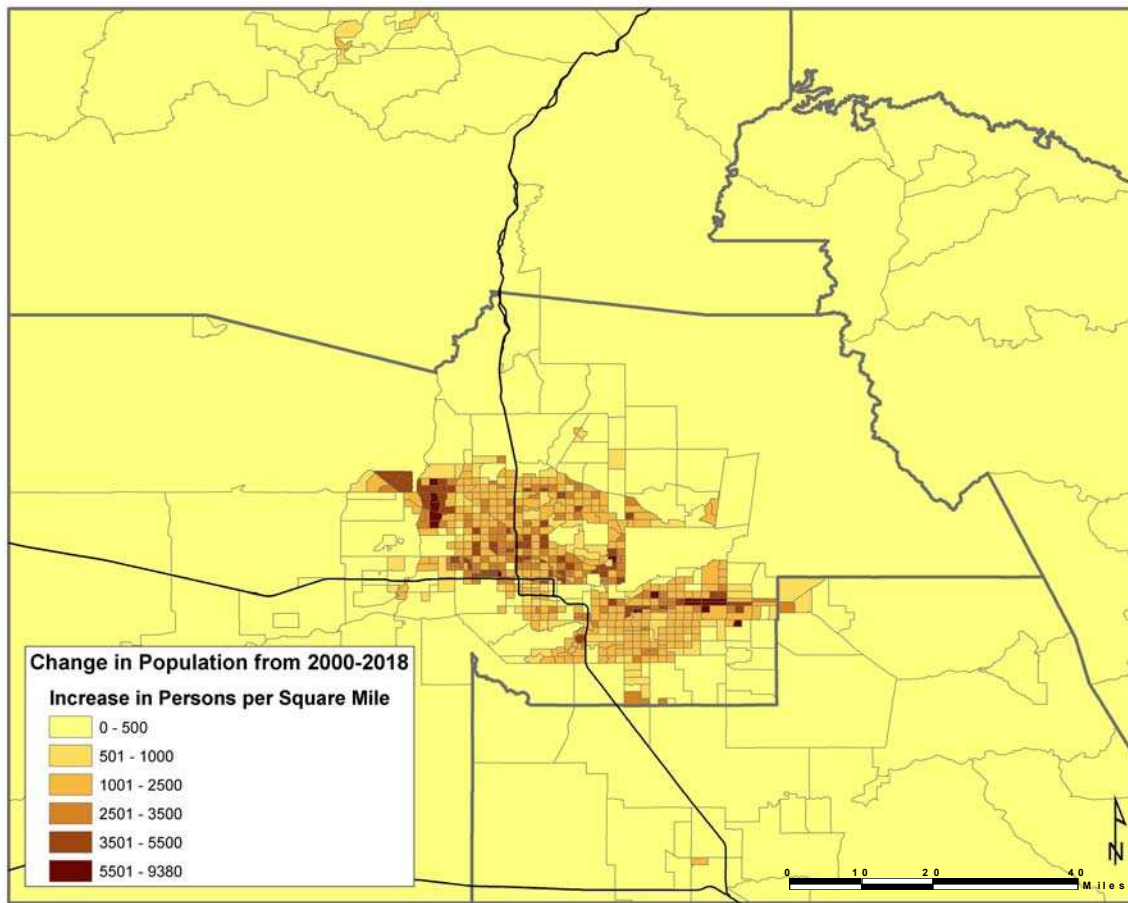
#### III.B.6. Criterion #6 - Expected Growth (including extent, pattern and rate of growth)

In its analysis of population density and the degree of urbanization, ADEQ took a long-term view, anticipating that a maintenance plan would be developed demonstrating that attainment would continue to be achieved for a growing urban area, through at least 2018. For this criterion, changes in population and density, land use, and traffic and commuting patterns throughout the area were examined. Appendix 10 details the processes used to obtain the following information.

Population density and projected population growth were reviewed for the period 2000–2018. Figure III.B.6.a shows the change in persons per square mile from 2000–2018, for the Phoenix area. The greatest projected growth is in the western and eastern fringe of the Phoenix urban area, with little to no increase in persons per square mile in Pinal, Gila, and Yavapai Counties. The figure was created using a population growth model whose performance was verified with the Arizona Department of Economic Security’s (DES)

growth model. Official 2000 U.S. Census and Immigration and Naturalization Service (INS) data were used as model inputs. As noted in section III.B.2, land ownership patterns have greatly influenced development patterns in the MSA and are expected to continue to do so. Only 29% of Maricopa County and 26% of Pinal County are privately owned. Indian reservations as well as State and federal lands (see Figure III.B.2.d), particularly to the north and south, create barriers to contiguous expansion of the urbanized core. As a result, the majority of growth in the MSA is expected to be primarily to the west of the central core with the majority of the remainder of the MSA continuing as neither a source nor a receptor of ozone pollution.

**Figure III.B.6.a: Change in Population 2000-2018**

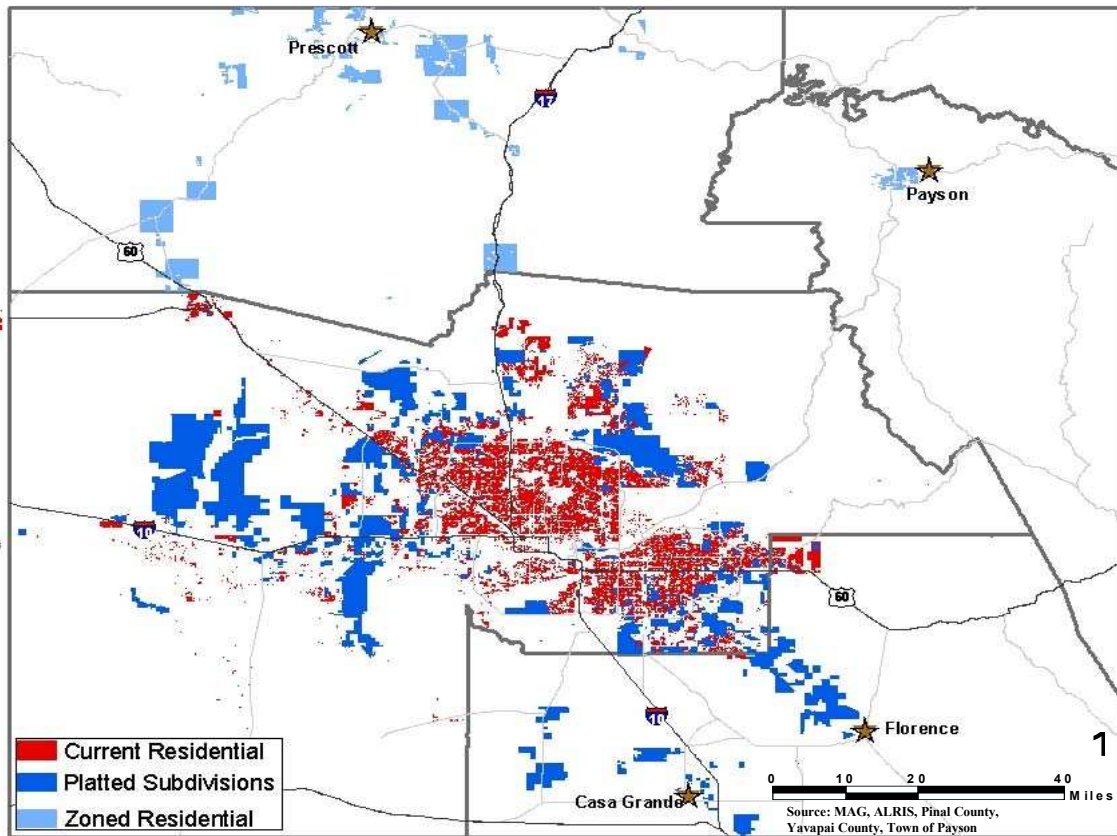


Source: U.S. Census Bureau, Immigration and Naturalization Service, Department of Economic Security

The land use analysis was narrowed to look at current and future residential land use, as shown in Figure III.B.6.b. This map was created using data obtained from the City of Payson, Yavapai County, and MAG. Two datasets from MAG were used for this map. The first was land use for the year 2000 and is shown in red. The second dataset used is

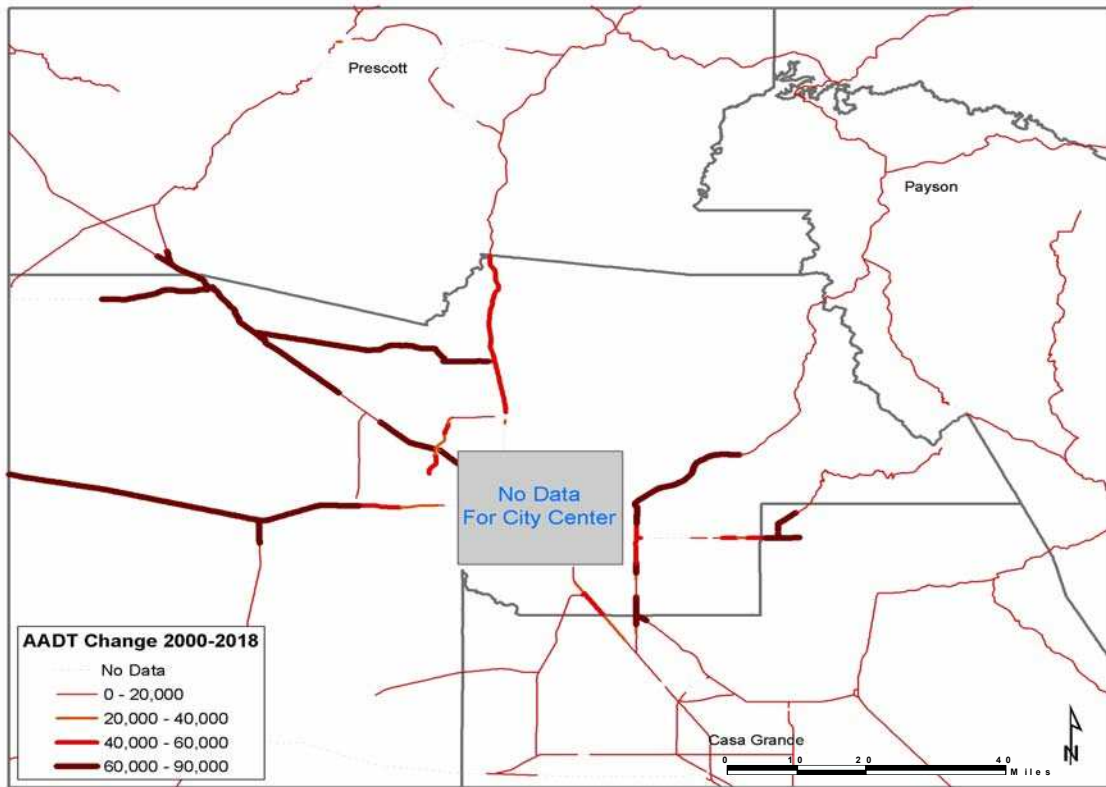
platted subdivisions, as shown in blue. Platted subdivisions have been through the planning process and are approved for development. The light blue represents areas zoned residential, which means a local government has approved the use of land as residential. These areas are not necessarily platted or planned, however. Both Gila and Yavapai Counties are shown as having minimal foreseeable growth. Even though the northeast corner of Pinal County has a platted subdivision corridor, it is dwarfed in comparison with the platted subdivision area in the western edge of the urban area.

**Figure III.B.6.b: Current and Future Residential Land Use**



ADEQ’s look at traffic and commuting patterns included reviewing Arizona Department of Transportation (ADOT), Pinal County, and central Phoenix existing and planned transportation routes. Figure III.B.6.c shows projected annual average daily traffic change from 2000-2018 for those routes of the Arizona State Highway System (those on which ADOT has jurisdiction over). The routes are forecasted for only rural, non-urbanized portions of those routes, but provide some idea of where traffic focus is headed.

Figure III.B.6.c: Study Area Annual Average Daily Traffic (excluding city center)

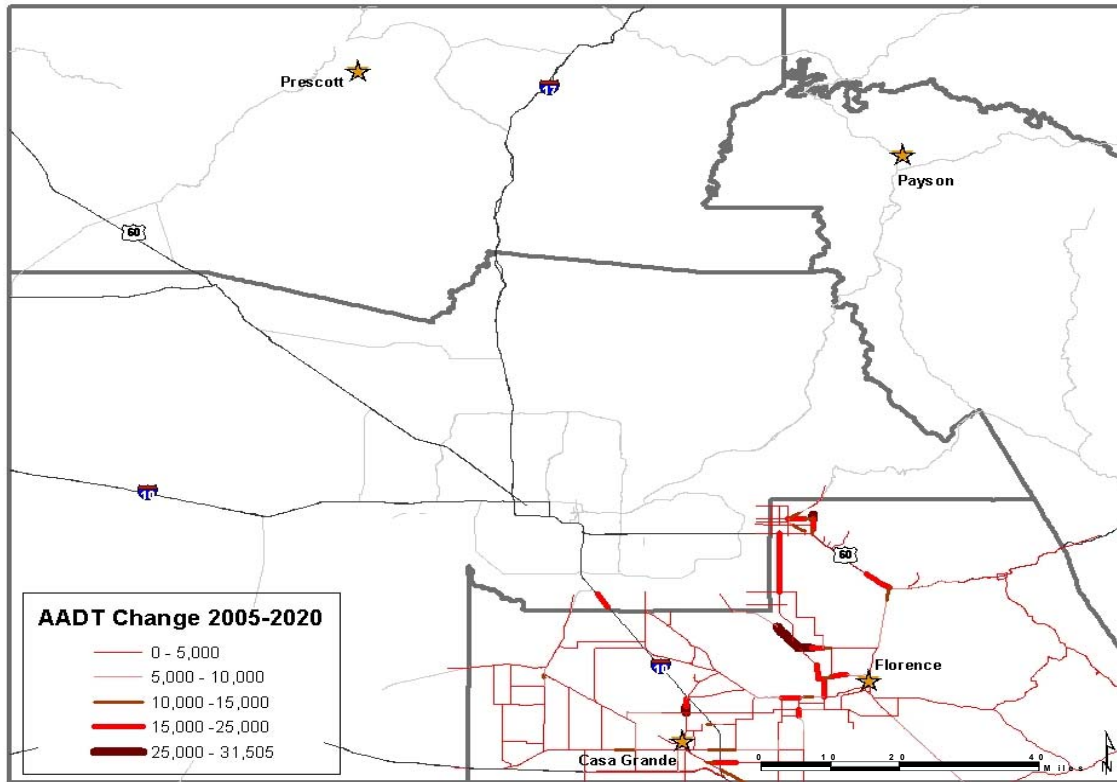


Source: ADOT, Arizona Land Resource Information Systems

A similar map (Figure III.B.6.d) was created from data available from the Pinal County Transportation Plan 2000 Update. The map depicts change for Annual Average Daily Traffic Counts for Pinal County from 2005-2020. There is only a 4.3-mile stretch of road southeast of Maricopa County where daily traffic is expected to reach high levels. At this point it is difficult to draw any conclusion regarding this projection.



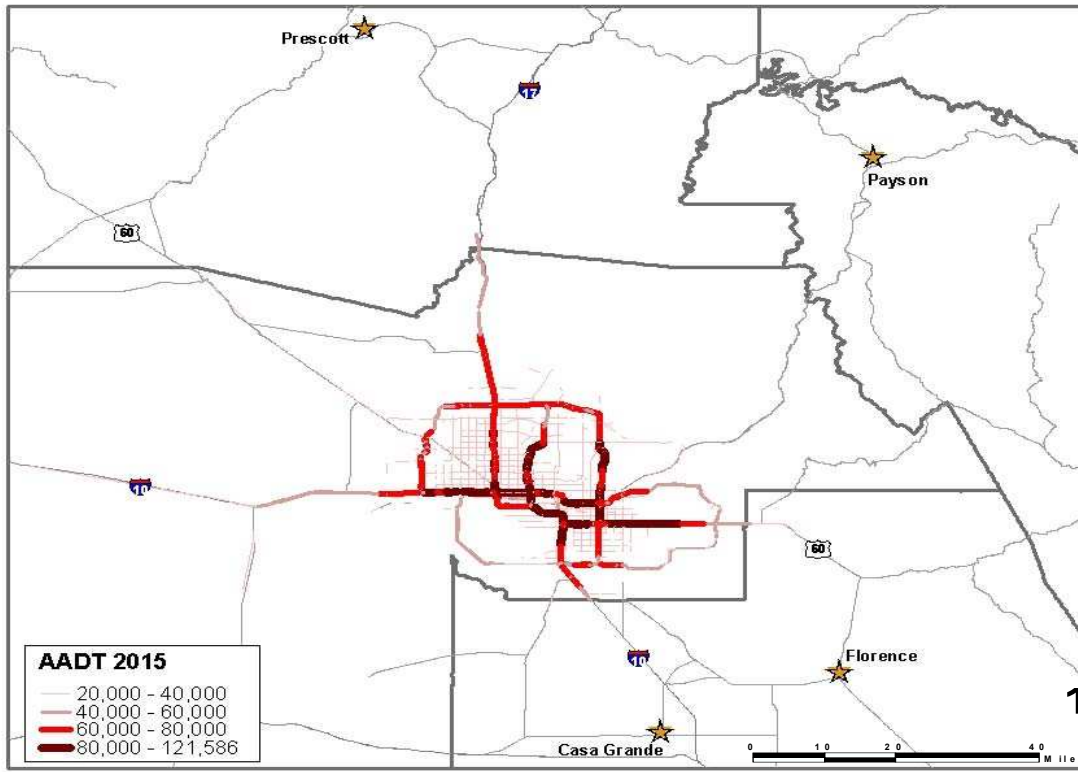
Figure III.B.6.d: Pinal County Annual Average Daily Traffic



Source: Lima and Associates

A third map, Figure III.B.6.e, based on preliminary estimates of average daily trips in eastern Maricopa County, depicts where traffic is expected to be concentrated in 2015. As discussed above, in Section III.B.5, this map indicates that commuting and traffic patterns will continue to concentrate traffic from outlying areas into the urban core. The data have not been used in any Air Quality Plan adopted by MAG and are subject to change. Regardless, no known plan exists that would modify this pattern of development and traffic movement.

**Figure III.B.6.e: Annual Average Daily Traffic Count – City Center**



Source: Maricopa Association of Governments

**III.B.7. Criterion #7 - Meteorology (weather/transport patterns)**

Meteorological patterns play a pivotal role in the formation of elevated ozone concentrations. Both synoptic flows and topographically driven surface winds have an influence on the speed and direction of the transport of urban ozone precursor emissions. Ultimately, since emissions are more or less constant from day to day, the meteorological variation dictates the days and locations that will experience elevated ozone. In this analysis, meteorology was considered in three ways. First, the choice of design dates for the air quality modeling was dictated by meteorological conditions that were conducive to elevated ozone formation. June 6, 2002, was chosen for its wind patterns that resulted in high ozone in the far eastern part of the network: Tonto National Monument and Queen Valley. July 12, 2002, was chosen for different wind conditions that led to high ozone concentrations in central and north Phoenix, as well as high concentrations to the north of the metropolitan area (Humboldt Mountain). Second, the meteorological and air quality modeling simulations necessitated a thorough examination of both surface wind and upper level wind measurements, of the meteorological model output, of the differences between the observations and the model, and of the general synoptic conditions that prevailed for the five days ending at each design date. Third, receptor areas, wind patterns and transport duration, and sunset times were considered in delineating the boundaries to the northwest, north, northeast, and east of metropolitan Phoenix.

Data were gathered from hourly records of wind direction and speed from instruments operated by Maricopa County, Salt River Project, University of Arizona, and ADEQ for the 9 days of the 2 ozone episode periods in 2002, which had ozone concentrations higher than 85 ppb. The location of the wind sites are shown on page 7 of the Technical Analysis Used to Develop Optional Nonattainment Boundaries for 8-Hour Ozone For the Greater Phoenix Area, contained in Appendix 6. The wind data were used to characterize general airflow patterns and their variations on the 9 days with 8-hour ozone values exceeding the standard. Each episode day exhibited the same general pattern and consequent ozone transport. Downslope or drainage winds, generally from the east, usually persisted until a few hours after sunrise, which is typical during the summer ozone season (see Figure III.B.7.a). The transition from drainage to upslope typically lasts for 2-3 hours, but during the 9 days studied the transition varied from 1-8 hours. The transitional period corresponds with the beginning of the daily photochemical ozone formation period. During the transition, winds rotate in a clockwise fashion through south before completing the shift to blowing from the southwest quadrant, which is typical upslope flow for this area (see Figure III.B.7.b). Upslope winds generally begin about noon and last till near sunset (see Figure III.7.c). During the 9 days studied, upslope flow varied from 6 to 12 hours duration.

**Figure III.B.7.a: Morning Downslope Winds July 12, 2002**

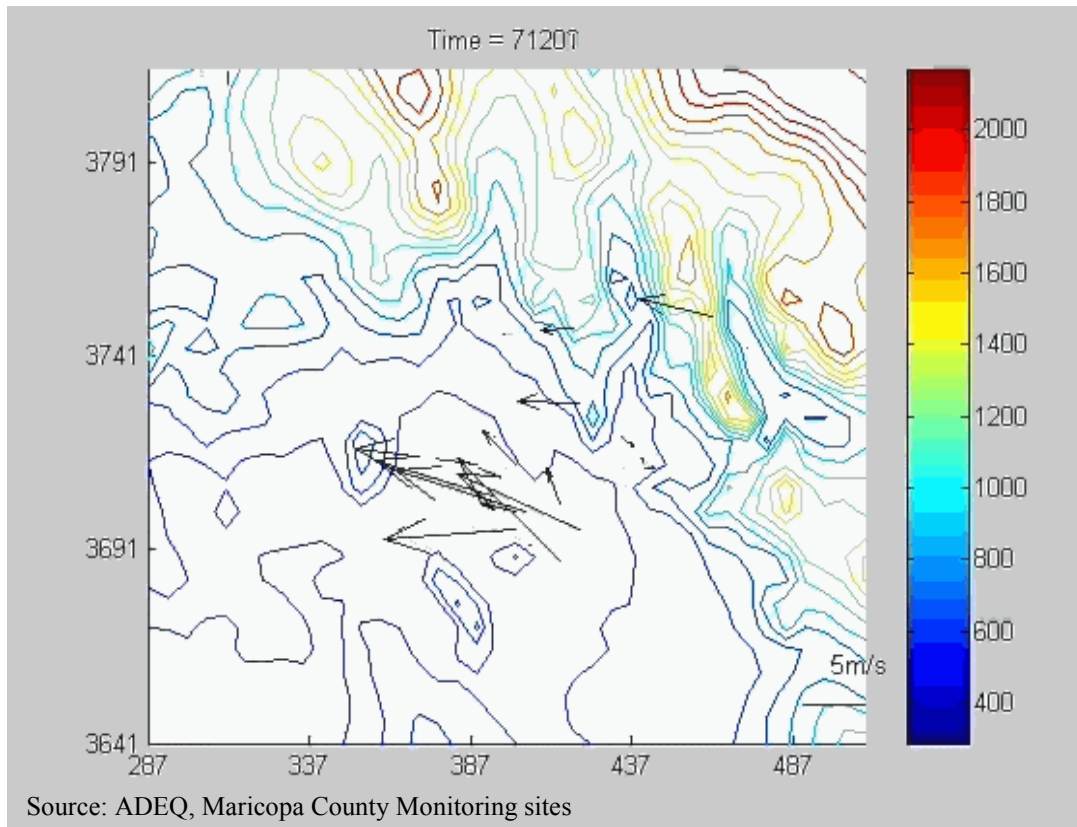


Figure III.B.7.b: Transition Winds for July 12, 2002

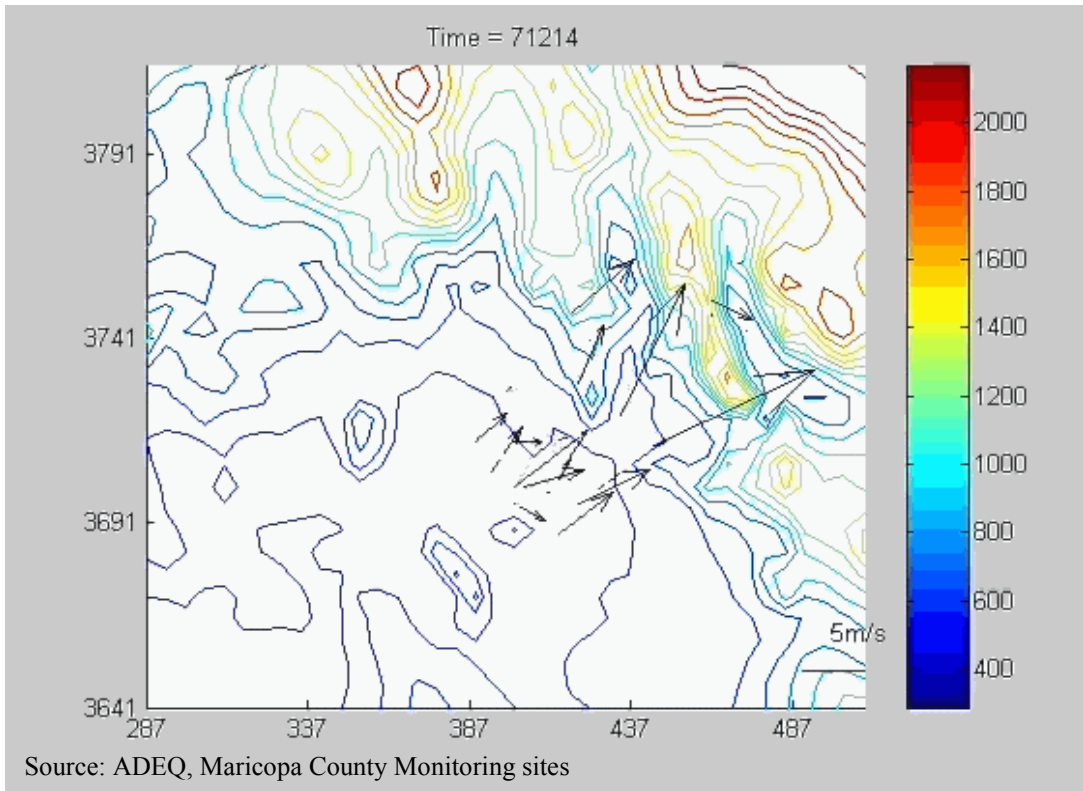
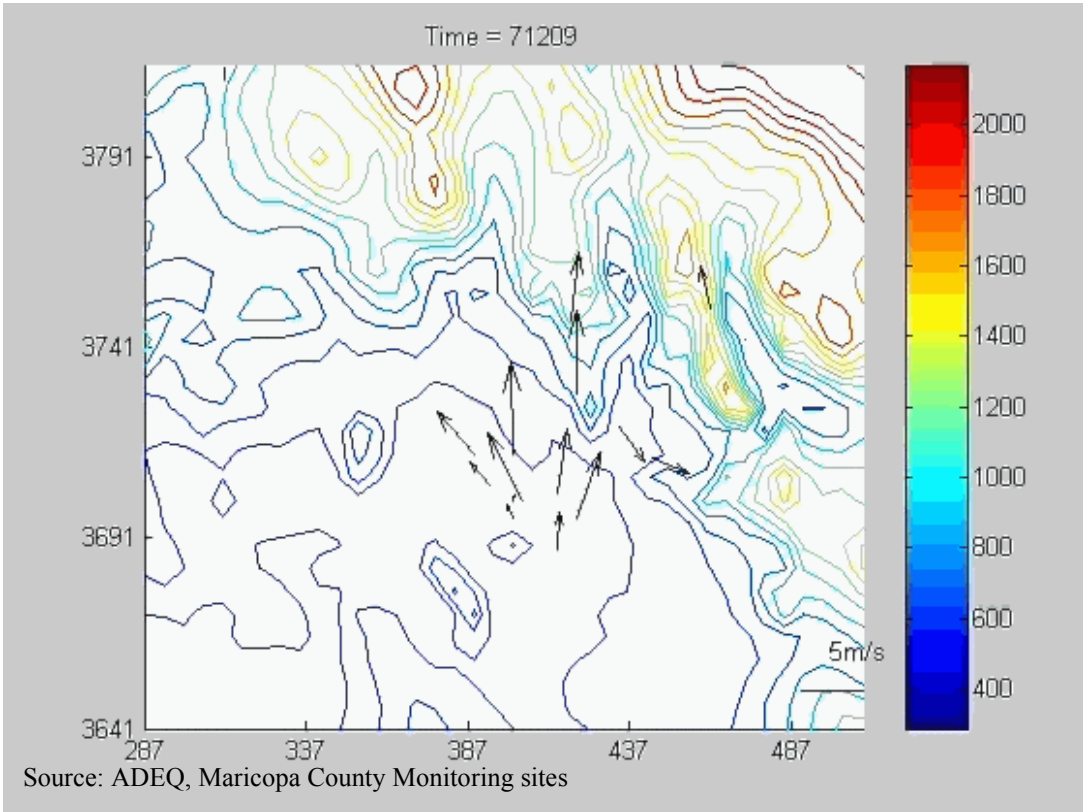


Figure III.B.7.c: Afternoon Upslope Winds July 12, 2002



The few hours of drainage flow during the early daylight hours added to the early portion of the transitional winds, transported the urban plume toward the northwest under ozone formation conditions for 3-10 hours on the episode days. The later part of the transition period coupled with the upslope period pushed the plume into the mountainous northeast quadrant for periods of time ranging from 8-12 hours. Wind speeds averaged 5-10 mph during the upslope period and were somewhat lighter during transition and drainage periods. These wind direction patterns were useful in interpreting the ozone measurements on these ozone episode days, and the persistence of wind in the different directions provided a sound basis for estimating the transport distance of the urban plume and the extent of geographic extent of ozone violations.

As previously mentioned, ozone concentration levels are well defined in the urbanized area by the relatively dense array of monitors. In the outlying areas there are large gaps between monitors. To better understand what happens in rural settings, the region was divided into four sectors. Each sector was then analyzed from a viewpoint of wind speed and direction, topography, modeling, and monitoring data (see Appendix 6). In all four sectors, it appears high ozone concentrations can occur in the elevated terrain outside the populated area.

### **III.B.8. Criterion #8 - Geography/Topography (mountain ranges or other air basin boundaries)**

Although in the broad and mostly flat Salt River Valley, metropolitan Phoenix lies close to mountainous, complex terrain on the north, northeast, east, and southwest. The highest of this higher ground is northeast, the area that typically receives the Phoenix urban plume because of the prevailing valley-to-mountain surface winds out of the south and southwest. In the absence of major storm fronts, topography dictates the strength and direction of these surface winds. Topography was part of the meteorological and air quality modeling work, as both models require an accurate depiction of the elevations throughout the modeling domain. Ozone monitoring on Humboldt Mountain and Mount Ord show that 8-hour ozone concentrations at higher elevations are likely to be higher than concentrations at lower elevations. This knowledge, when combined with the monitoring data from the peaks, provided a means by which to infer elevated ozone concentrations in areas lacking monitors. Thus, topography was an integral part of the boundary line choices.

### **III.B.9. Criterion #9 - Jurisdictional Boundaries (e.g., counties, air districts, existing 1-hour nonattainment areas, Reservations, etc.)**

Five major issues were taken into consideration relating to jurisdictional boundaries:

- Indian reservations;
- County boundaries;
- Ambient air quality monitoring data;
- Existing air pollution control programs; and
- Existing institutions and conventions for air quality and transportation planning.

First, as the State has no jurisdiction within the interior boundaries of Indian reservations, the proposed nonattainment area excludes all Indian Country. The three Indian reservations that are located within or adjacent to the proposed nonattainment area are the Salt River Pima-Maricopa Indian Community and the Fort McDowell Yavapai Nation, which are adjacent to each other and located in the eastern portions of the proposed nonattainment area; and the Gila River Indian Community, which lies along most of the southern boundary of the proposed nonattainment area.

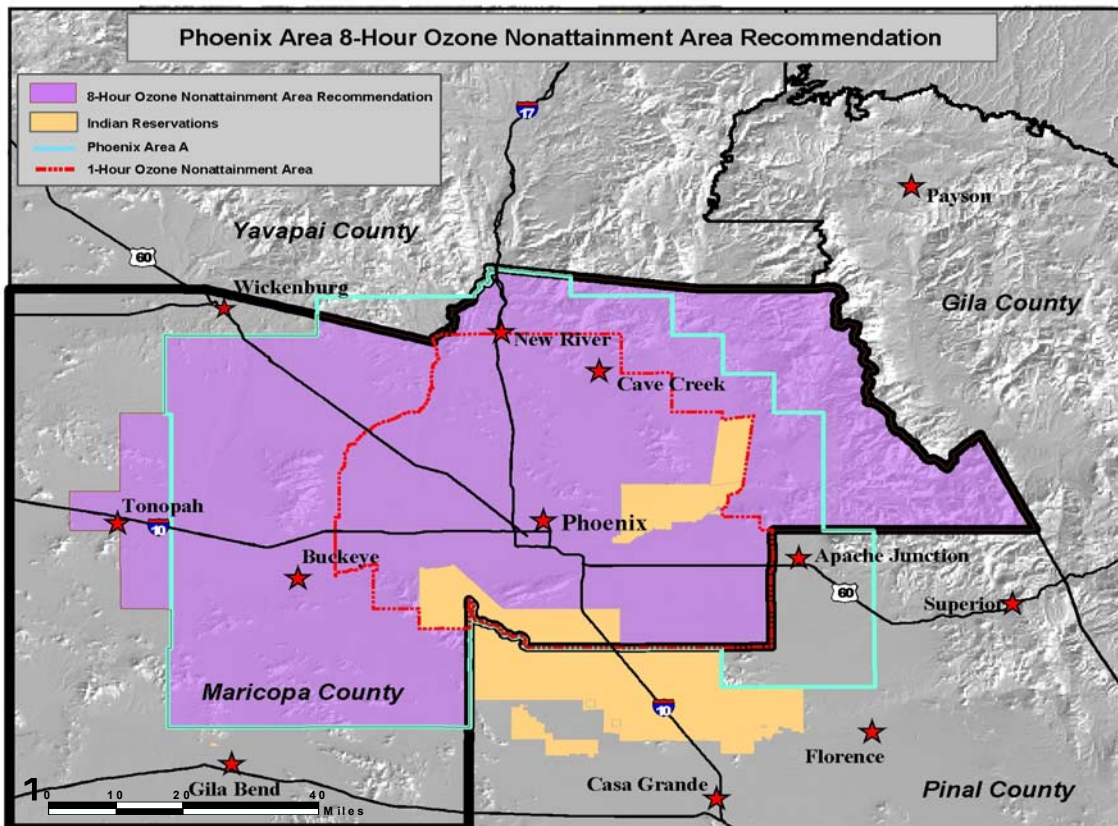
The Maricopa County boundaries were selected for the recommended outer boundary of the proposed nonattainment area on the southeast, east and northern sides. One issue that complicates this choice is the existence of Area A, defined in Arizona statutes (ARS §49-541.1) as the area where certain pollution control programs are required (See Section III.B.10, below, for details on the specific control programs). As can be seen in Figure III.B.9.a, Area A includes a small portion of Yavapai County, and a block of land in northeastern Pinal County that includes Apache Junction and areas platted for development between Apache Junction and Florence. These portions of Area A may be excluded from the nonattainment area because:

- No violations of the ozone standard have been measured in either of these parcels;
- The Yavapai County portion of area contains no platted subdivisions, is primarily public lands, and is not expected to contain significant, new anthropogenic sources of ozone precursors into the distant future;
- While substantial growth is expected in the Pinal County portion of Area A, it represents a relatively small percentage of the overall growth expected in the Maricopa County portion of Area A, and is about one fifth of the growth expected in incorporated Surprise and Buckeye, alone;

- Several air pollution control are being implemented in the parts of Area A outside of Maricopa County (see Section III.B.10, below), and, in compliance with Clean Air Act §110(l), must be maintained into the foreseeable future; and
- Arizona statutes ARS § 49-406(A) and 23 USCA §134 authorize MAG as the designated planning agency for air quality and transportation planning, respectively, within Maricopa County. A nonattainment area extending outside of Maricopa County would greatly complicate air quality and transportation planning, and would require development of new institutional arrangements for accomplishing these required tasks.

Finally, the ambient air quality monitoring record documents exceedances and violations of the 8-hour average ozone NAAQS at several locations on the Maricopa County boundary: Humboldt Mountain to the north-northeast; Mt. Ord to east-northeast; and Roosevelt Lake/Tonto National Monument to the east. ADEQ acknowledges that the areas where ozone exceedances and violations are likely to occur extends beyond the Maricopa County line, perhaps by a substantial distance. As the photochemical grid modeling results documented in Appendix 8 are imprecise, it is not possible at this time to determine with any confidence how far beyond the Maricopa County line to draw a nonattainment area boundary.

**Figure III.B.9: Recommended 8-hour Ozone Nonattainment Area with Area A and the 1-hour Ozone Nonattainment Area Depicted**



Sources: ADEQ, USGS, Arizona Land Resource Information Systems

**III.B.10. Criterion #10 - Level of Control of Emissions Sources**

Several control federally enforceable measures are measures included in the 1-hour nonattainment area State Implementation Plan (SIP) that was submitted to EPA in Dec 2000. In addition, there are other measures included as federally enforceable measures in the 2000 Maricopa County Carbon Monoxide SIP and 2002 Maintenance Plan, and 2001 Maricopa County PM10 SIP that have ozone-reducing benefits. As shown in the table below, the majority of existing control strategies are legislatively required to be implemented in Area A, which is larger than the 1-hour nonattainment area. Area A also includes a portion of Pinal County. Some programs listed are of voluntary nature, however, when implemented, have some positive impact on reducing ozone. It will be necessary to review the status and scope of implementation of each strategy as the 8-hour ozone plan is developed.

This list does not include federal measures in place, specifically gasoline and diesel vehicle engine and fuel standards.

**Table III.B.10: Existing Control Measures**

MEASURE	Area of Application
Vehicle Emissions Inspection program components, including: --Phased In Emission Test Cutpoints --Enhanced Emission Testing of Constant Four Wheel Drive Vehicles --Increased Waiver Repair Limit Options --Catalytic Converter Replacement Program --Voluntary Vehicle Repair and Retrofit Program --Tougher Enforcement of Vehicle Registration and Emissions Test Compliance --Snap Acceleration Test for Heavy Duty Diesel --One-Time Waiver from Vehicle Emissions Test --Gross Polluter Option for I/M Program Waivers	Area A
Require Pre-1988 Heavy-Duty Diesel Commercial Vehicles (>26,GVWR) Operating in Area A To Meet 1988 Federal Emissions Standards By 2004	Area A
Arizona Cleaner Burning Gasoline	Area A and balance of Maricopa County
Limit Sulfur Content of non-road Diesel Fuel to 500 ppm	Area A
Stage II Vapor Recovery Program	Area A
Alternative Fuel Vehicles for Local Governments, School Districts and Federal Government/Low Emission Vehicle Requirements	Area A
Coordinate Traffic Signal Systems	Area A



**Table III.B.10: Existing Control Measures**

<b>MEASURE</b>	<b>Area of Application</b>
Trip Reduction Program for Employers with 50 or more Employees at a Work Site	Area A
Oxidation Catalyst for Heavy Duty Diesel Vehicles	One Hour Ozone NA
Mass Transit Alternatives	One Hour Ozone NA
Develop Intelligent Transportation Systems	One Hour Ozone NA
Special Event Controls - Required Implementation from List of Approved Strategies	One Hour Ozone NA
Encourage the Use of Temporary Electrical Power Lines Rather than Portable Generators at Construction Sites	One Hour Ozone NA
Defer Emissions Associated With Governmental Activities	One-Hour Ozone NA
Encourage Limitations on Vehicle Idling	One-Hour Ozone NA
Voluntary No-Drive Days	One-Hour Ozone NA
Expansion of Public Transportation Programs	One-Hour Ozone NA
Employer Rideshare Program Incentives	One-Hour Ozone NA
Preferential Parking for Carpools and Vanpools	One-Hour Ozone NA
Reduce Traffic Congestion at Major Intersections	One-Hour Ozone NA
Site-Specific Transportation Control Measures	One-Hour Ozone NA
Encouragement of Bicycle Travel	One-Hour Ozone NA
Development of Bicycle Travel Facilities	One-Hour Ozone NA
Alternative Work Schedules	One-Hour Ozone NA
Land Use/Development Alternatives	One-Hour Ozone NA
Encouragement of Pedestrian Travel	One-Hour Ozone NA
Restrictions on the Use of Gasoline-Powered Blowers for Landscaping Maintenance	One-Hour Ozone NA
Voluntary Lawn and Garden Equipment Replacement Program	Area A
Alternative Fuels for Fleets	One-Hour Ozone NA
Areawide Public Awareness Programs (Clean Air Campaign)	One-Hour Ozone NA
Encouragement of Vanpooling	One-Hour Ozone NA
Park and Ride Lots	One-Hour Ozone NA
Encouragement of Telecommuting, Teleworking and Teleconferencing	One-Hour Ozone NA
Promotion of High Occupancy Vehicle Lanes and By-Pass Ramps	One-Hour Ozone NA
Improved Rule Effectiveness, Area Sources	One-Hour Ozone NA
State Procurement Code-Request for Low or No Volatile Organic Compound Products	One-Hour Ozone NA
Vehicle Idling Restriction Ordinances for Engines that Propel Heavy Duty Diesel Vehicles equal to or greater than to 14,000 lbs GVWR	Maricopa County and Area A Portion of Pinal County

<b>Table III.B.10: Existing Control Measures</b>	
<b>MEASURE</b>	<b>Area of Application</b>
New Source Performance Standards Maricopa County Rule 360  ADEQ Arizona Administrative Code, Title 18, Chapter, 2, Article 9	Maricopa County
<i>Maricopa County Rules:</i>  Permit Requirements for New Major Sources and Major Modifications to Existing Major Sources Rule 240 Permits for New Sources and Modifications to Existing Sources Rule 241 Municipal Solid Waste Landfills Rule 321 General VOC Rule 330 Solvent Cleaning Operations Rule 331 Petroleum Solvent Dry Cleaning Rule 333 Rubber Sport Ball Manufacturing Rule 334 Architectural Coatings Rule 335 Aerospace Surface Coating Rule 336 Graphic Arts Rule 337 Semiconductor Manufacturing Rule 338 Vegetable Extraction Processes Rule 339 Cutback and Emulsified Asphalt Rule 340 Metal Investment Casting Rule 341 Wood Coating Rules 342 and 346 Commercial Bread Bakeries Rule 343 Windshield Washer Fluid Rule 344 Vehicle and Mobile Equipment Coating (aka Automobile Refinish Coatings) Rule 345 Ferrous Sand Casting Rule 347 Aerospace Manufacturing and Rework Operations Rule 348 Pharmaceutical, Cosmetic, and Vitamin Manufacturing Operations Rule 349 Storage of Organic Liquids at Bulk Plants and Terminals Rule 350 Loading of Organic Liquids Rule 351 Gasoline Delivery Vessel Testing and Use Rule 352 Gasoline in Stationary Dispensing Tanks Rule 353 Federal Hazardous Air Pollutant Program Rule 370	Maricopa County
<i>ADEQ Rules:</i>  New Source Review Rules R18-2-401 thru 407 Existing Stationary Source Performance Standards R18-2-701 thru 732	Statewide (for sources under ADEQ's jurisdiction)

### **III.B.11. Regional Emission Reductions (e.g., NO<sub>x</sub> SIP call or other enforceable regional strategies)**

Because there are no enforceable regional strategies in place at this time, this criterion is not applicable. The State, however, is developing of its regional haze SIP in coordination with other states, federal agencies and Indian Tribes in the West through the Western Regional Air Partnership. Some regional strategies will be submitted in regional haze SIP revisions due December 31, 2003.

## **IV. AREA DESIGNATION RECOMMENDATIONS**

### **IV.A Attainment/Unclassifiable Areas**

Arizona recommends that all of the following counties (except for Indian Country) be designated attainment for the 8-hour ozone NAAQS:

- Apache County
- Cochise County
- Coconino County
- Gila County
- Graham County
- Greenlee County
- La Paz County
- Mohave County
- Navajo County
- Pima County
- Pinal County
- Santa Cruz County
- Yavapai County
- Yuma County

In addition, Arizona recommends that Maricopa County (except for Indian Country), except for the portion described in section IV.B be designated attainment for the 8-hour ozone NAAQS.

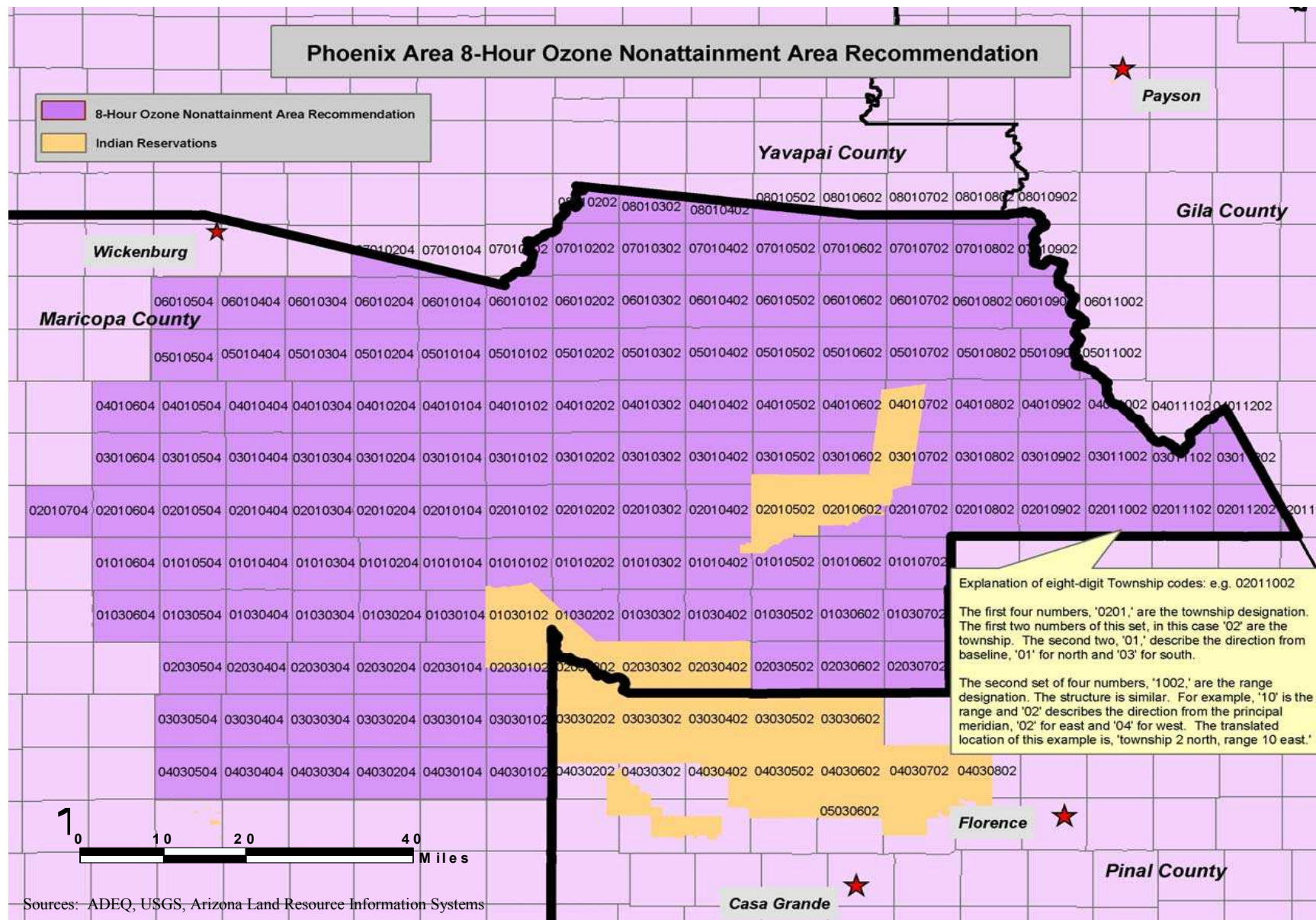
#### **IV.B Nonattainment Area**

The nonattainment area recommended by Arizona is smaller than the MSA, but still meets the definition in Section 107(d)(1)(A)(i) of the Clean Air Act and addresses the criteria identified in EPA's March 2000 guidance. The recommended area encompasses the existing one-hour ozone nonattainment area, the growing area to the west where several new power plants are located and substantial residential growth is planned, and to the north and east of the urban area where monitors are violating the 8-hour standard or have experienced exceedances in recent history. The recommended area excludes the Gila River Indian Community, Salt River Pima Maricopa Indian Community and the Fort McDowell Yavapai Nation.

In the absence of conclusive air quality modeling and additional monitoring, it is not possible at this time to determine the precise extent of nonattainment beyond the Maricopa County line. Arizona's alternative recommendation includes an attainment/unclassifiable designation for the rest of the State, as explained in Section IV.A.

Figure IV.B illustrates the recommended 8-hour nonattainment area. Table IV.B describes by county and township the areas of the State recommended for Attainment/Unclassifiable and Nonattainment.

Figure IV.B: 8-Hour Nonattainment Area Recommendation



**Table IV.B: Recommended Attainment/Unclassifiable and Nonattainment Areas for Arizona**

**Arizona-Ozone (8-Hour Standard)**

Designated Area	Designation Type	Classification Type
<p>Phoenix Area:                      Maricopa County (part).....</p> <p>T1N, R1E (except that portion in Indian Country)                      T1N, R2E                      T1N, R3E                      T1N, R4E (except that portion in Indian Country)                      T1N, R5E (except that portion in Indian Country)                      T1N, R6E                      T1N, R7E                      T1N, R1W                      T1N, R2W                      T1N, R3W                      T1N, R4W                      T1N, R5W                      T1N, R6W</p> <p>T2N, R1E                      T2N, R2E                      T2N, R3E                      T2N, R4E                      T2N, R6E (except that portion in Indian Country)                      T2N, R7E (except that portion in Indian Country)                      T2N, R8E                      T2N, R9E                      T2N, R10E                      T2N, R11E                      T2N, R12E (except that portion in Gila County)                      T2N, R13E (except that portion in Gila County)                      T2N, R1W                      T2N, R2W                      T2N, R3W                      T2N, R4W                      T2N, R5W                      T2N, R6W                      T2N, R7W</p>	<p>Nonattainment</p>	

Designated Area	Designation Type	Classification Type
<p>T3N, R1E  T3N, R2E  T3N, R3E  T3N, R4E  T3N, R5E (except that portion in Indian Country)  T3N, R6E (except that portion in Indian Country)  T3N, R7E (except that portion in Indian Country)  T3N, R8E  T3N, R9E  T3N, R10E (except that portion in Gila County)  T3N, R11E (except that portion in Gila County)  T3N, R12E (except that portion in Gila County)  T3N, R1W  T3N, R2W  T3N, R3W  T3N, R4W  T3N, R5W  T3N, R6W</p>		
<p>T4N, R1E  T4N, R2E  T4N, R3E  T4N, R4E  T4N, R5E  T4N, R6E (except that portion in Indian Country)  T4N, R7E (except that portion in Indian Country)  T4N, R8E  T4N, R9E  T4N, R10E (except that portion in Gila County)  T4N, R11E (except that portion in Gila County)  T4N, R12E (except that portion in Gila County)  T4N, R1W  T4N, R2W  T4N, R3W  T4N, R4W  T4N, R5W  T4N, R6W</p>		
<p>T5N, R1E  T5N, R2E  T5N, R3E  T5N, R4E  T5N, R5E</p>		

Designated Area	Designation Type	Classification Type
<p>T5N, R6E  T5N, R7E  T5N, R8E  T5N, R9E (except that portion in Gila County)  T5N, R10E (except that portion in Gila County)  T5N, R1W  T5N, R2W  T5N, R3W  T5N, R4W  T5N, R5W</p> <p>T6N, R1E (except that portion in Yavapai County)  T6N, R2E  T6N, R3E  T6N, R4E  T6N, R5E  T6N, R6E  T6N, R7E  T6N, R8E  T6N, R9E (except that portion in Gila County)  T6N, R10E (except that portion in Gila County)  T6N, R1W (except that portion in Yavapai County)  T6N, R2W  T6N, R3W  T6N, R4W  T6N, R5W</p> <p>T7N, R1E (except that portion in Yavapai County)  T7N, R2E (except that portion in Yavapai County)  T7N, R3E  T7N, R4E  T7N, R5E  T7N, R6E  T7N, R7E  T7N, R8E  T7N, R9E (except that portion in Gila County)  T7N, R1W (except that portion in Yavapai County)  T7N, R2W (except that portion in Yavapai County)</p> <p>T8N, R2E (except that portion in Yavapai County)  T8N, R3E (except that portion in Yavapai County)  T8N, R4E (except that portion in Yavapai County)  T8N, R5E (except that portion in Yavapai County)</p>		



Designated Area	Designation Type	Classification Type
<p>T8N, R6E (except that portion in Yavapai County)  T8N, R7E (except that portion in Yavapai County)  T8N, R8E (except that portion in Yavapai and Gila Counties)  T8N, R9E (except that portion in Yavapai and Gila Counties)</p> <p>T1S, R1E (except that portion in Indian Country)  T1S, R2E (except that portion in Pinal County and in Indian Country)  T1S, R3E  T1S, R4E  T1S, R5E  T1S, R6E  T1S, R7E  T1S, R1W  T1S, R2W  T1S, R3W  T1S, R4W  T1S, R5W  T1S, R6W</p> <p>T2S, R1E (except that portion in Indian Country)  T2S, R5E  T2S, R6E  T2S, R7E  T2S, R1W  T2S, R2W  T2S, R3W  T2S, R4W  T2S, R5W</p> <p>T3S, R1E  T3S, R1W  T3S, R2W  T3S, R3W  T3S, R4W  T3S, R5W</p> <p>T4S, R1E  T4S, R1W  T4S, R2W  T4S, R3W</p>		

Designated Area	Designation Type	Classification Type
<p>T4S, R4W T4S, R5W</p> <p>Rest of State (except those portions in Indian Country).....</p> <ul style="list-style-type: none"> <li>Apache County</li> <li>Cochise County</li> <li>Coconino County</li> <li>Gila County</li> <li>Graham County</li> <li>Greenlee County</li> <li>La Paz County</li> <li>Maricopa County (part) <ul style="list-style-type: none"> <li>Remainder of County</li> </ul> </li> <li>Mohave County</li> <li>Navajo County</li> <li>Pima County</li> <li>Pinal County</li> <li>Santa Cruz County</li> <li>Yavapai County</li> <li>Yuma County</li> </ul>	<p>Attainment/ Unclassifiable</p>	