

# **State of Arizona Exceptional Event Documentation of a High Wind Dust Event PM<sub>10</sub> Exceedance on July 29, 2016 in the Maricopa County PM<sub>10</sub> Nonattainment Area**

Produced by:

Arizona Department of Environmental Quality  
Maricopa County Air Quality Department  
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**July 29, 2016 High Wind Dust Event**

(Image source: <http://www.12news.com/weather/monsoon/phoenix-area-cleaning-up-storm-damage/284542242>)

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## I. INTRODUCTION

This documentation is being submitted to the Environmental Protection Agency (EPA) to demonstrate that an exceedance of the 24-hour PM<sub>10</sub> standard at the Zuni Hills monitor in the Maricopa County PM<sub>10</sub> nonattainment area on July 29, 2016 should be excluded from use in determinations of exceedances or violations of the 24-hour PM<sub>10</sub> National Ambient Air Quality Standards (NAAQS) as an exceptional event caused by a high wind dust event. This documentation serves to meet the requirements of Clean Air Act Section 319(b) (Air quality monitoring data influenced by exceptional events) and the EPA final rule, *Treatment of Data Influenced by Exceptional Events* (81 FR 68216), as codified in 40 CFR Sections 50.1 and 50.14. Additionally, state and local agencies are in the process of developing a mitigation plan for the Maricopa County PM<sub>10</sub> nonattainment area to meet the requirements of 40 CFR Section 51.930. The mitigation plan will be submitted to EPA by September 30, 2018, as required by 40 CFR Section 51.930(b)(3).

### Summary of the Exceptional Event

On July 29, 2016, strong to severe evening thunderstorms materialized over south-central Arizona as a result of an active monsoon season weather pattern. The National Weather Service issued a dust storm warning in the Maricopa nonattainment area as a result of the thunderstorm outflows. The warning predicted wind gusts over 40 mph and localized visibilities falling below one quarter of a mile. Two main outflow boundaries generated rapidly forming cells across the nonattainment area. Widespread sustained winds of 40 to 55 mph were reported across the nonattainment area by the National Weather Service along with gusts as high as 70 mph as reported at Sky Harbor Airport. The outflows were fast-moving and associated with heavy rain in some areas.

PM<sub>10</sub> concentrations were elevated throughout the evening (7:00 – 10:30 PM) within the Maricopa County nonattainment area in response to the dust storm generated by the thunderstorm outflow winds, but quickly returned to normal levels once the outflows exited the nonattainment area and precipitation followed the outflow boundaries. The largest PM<sub>10</sub> concentrations were focused on the northwest side of the nonattainment area where the first main outflow was centered and where recorded precipitation was the least. One monitor (Zuni Hills) located in the northwestern-most portion of the nonattainment area (nearest to the source area of the first main thunderstorm outflow) exceeded the 24-hour PM<sub>10</sub> standard as a result of the high wind dust event, as listed in Table 1-1. Source areas identified as contributing to the windblown dust that caused the high and exceeding PM<sub>10</sub> concentrations are the northern deserts areas of Maricopa County and to a lesser degree the deserts of Pinal County where the second outflow originated. As the strength of the thunderstorm outflows would normally qualify the high wind event as a “large scale and high-energy” event (focus of a dust storm warning, sustained winds 40 mph or greater, and visibilities less than a half mile), the event does not technically qualify for this designation as only one monitor in the nonattainment area exceeded the PM<sub>10</sub> standard. However, the strength of the winds clearly demonstrates that the event was not reasonably controllable or preventable, overwhelming any and all controls on anthropogenic sources that may have contributed to the exceedance.

**Table 1-1.** PM<sub>10</sub> Monitors Affected by the High Wind Dust Event.

Monitor Name	County	Operating Agency	Monitor ID	Exceeding 24-Hour PM <sub>10</sub> Concentration
Zuni Hills	Maricopa	Maricopa County Air Quality Department	04-013-4016	174 µg/m <sup>3</sup>

## **Statutory and Regulatory Requirements**

Clean Air Act Section 319(b) defines an exceptional event as an event that:

- (i) affects air quality;
- (ii) is not reasonably controllable or preventable.;
- (iii) is an event caused by human activity that is unlikely to recur at a particular location or a natural event; and
- (iv) is determined by the Administrator through the process established in the regulations promulgated under paragraph (2) [Regulations] to be an exceptional event.

EPA regulation in 40 CFR Section 50.1(j) further defines an exceptional event as:

“...an event(s) and its resulting emissions that affect air quality in such a way that there exists a clear causal relationship between the specific event(s) and the monitored exceedance(s) or violation(s), is not reasonably controllable or preventable, is an event(s) caused by human activity that is unlikely to recur at a particular location or a natural event(s), and is determined by the Administrator in accordance with 40 CFR 50.14 to be an exceptional event. It does not include air pollution relating to source noncompliance. Stagnation of air masses and meteorological inversions do not directly cause pollutant emissions and are not exceptional events. Meteorological events involving high temperatures or lack of precipitation (*i.e.*, severe, extreme or exceptional drought) also do not directly cause pollutant emissions and are not considered exceptional events. However, conditions involving high temperatures or lack of precipitation may promote occurrences of particular types of exceptional events, such as wildfires or high wind events, which do directly cause emissions.”

EPA regulation in 40 CFR Section 50.14(c)(3)(iv) states that a demonstration to justify the exclusion of monitor data as an exceptional event must include:

- (A) A narrative conceptual model that describes the event(s) causing the exceedance or violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s);
- (B) A demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation;
- (C) Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times to support the requirement at paragraph (c)(3)(iv)(B) [clear causal relationship] of this section. The Administrator shall not require a State to prove a specific percentile point in the distribution of data;
- (D) A demonstration that the event was both not reasonably controllable and not reasonably preventable; and
- (E) A demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event.

Additionally, specific regulatory requirements related to demonstrations for high wind dust events are included in 40 CFR Section 50.14(b)(5). Details on how the statutory and regulatory requirements are addressed in this documentation are presented in the bulleted list below:

- Chapter II of this assessment includes a narrative conceptual model that describes the genesis of the high wind dust event and how PM<sub>10</sub> emissions from the high wind dust event caused the PM<sub>10</sub> exceedance on July 29, 2016 in the Maricopa County nonattainment area.
- Chapter III provides a detailed body of evidence that the event affected air quality through the clear causal relationship between the PM<sub>10</sub> emissions from the high wind dust event and the exceedance at the Zuni Hills monitor in the Maricopa County PM<sub>10</sub> nonattainment area. Section III also includes an analysis comparing the event-influenced exceeding PM<sub>10</sub> concentration at the Zuni Hills monitor to historical PM<sub>10</sub> concentrations at the monitor.
- Chapter IV presents evidence that the high wind dust event was a natural event and that the high wind dust event was neither reasonably controllable nor preventable.
- Chapter V includes a summary conclusion of the evidence presented in Chapters II-IV.

### **Procedural Requirements**

This procedural requirements for submitting a demonstration to EPA for an exceptional event are included in 40 CFR Section 50.14(c). The procedural requirements include the schedules and procedures for notifying the public when an event occurs; for providing EPA with the initial notification of a potential exceptional event; and for documenting the public comment process. Specific procedural requirements are presented below:

- 40 CFR Section 50.14(c)(1)(i) – Public notification that event was occurring:

The Arizona Department of Environmental Quality (ADEQ) issued an ensemble air quality forecast for the Greater Phoenix area on July 28, 2016 and a dust control forecast for Maricopa County that discuss the possibility of blowing dust and elevated PM<sub>10</sub> concentrations as a result of thunderstorm outflows from the monsoon season weather pattern. The forecast products that were issued on July 28, 2016 are included in Appendix A.

- 40 CFR Section 50.14(c)(2)(i) – Initial notification of potential exceptional event by creating an initial event description and flagging the associated data that have been submitted to the AQS database:

The Maricopa County Air Quality Department (MCAQD) has created an initial event description (high wind dust event) and flagged the associated air quality monitoring data for July 29, 2016 as an exceptional event in AQS. The following monitor has been flagged as exceeding the PM<sub>10</sub> standard on July 29, 2016 as a result of a high wind dust event:

Zuni Hills (04-013-4016)

- 40 CFR Section 50.14(c)(2)(i)(A) – Regular communication with the EPA Regional office to identify data that have been potentially influenced by an exceptional event, to determine



whether the identified data may affect a regulatory determination and to discuss whether the State should develop and submit an exceptional events demonstration:

ADEQ began initial discussions with EPA about this event on May 18, 2017. ADEQ submitted formal initial notification of the July 29, 2016 high wind dust event to EPA Region IX on at that time.

- 40 CFR Section 50.14(c)(2)(i)(B) – For data that may affect an anticipated regulatory determination or where circumstances otherwise compel EPA to prioritize the resulting demonstration, EPA shall respond to the State’s initial notification with a demonstration due date:

EPA did not provide a due date for this demonstration.

- 40 CFR Section 50.14(c)(2)(i)(C) – EPA may waive the initial notification of potential exceptional event process on a case-by-case basis:

EPA did not waive the initial notification of potential exceptional event process.

- 40 CFR Section 50.14(c)(3)(v) – With submission of the demonstration containing the elements in 40 CFR Section 50.14(c)(3)(iv), the State must document that a public comment process was followed, submit any public comments received, and address in the submission to EPA those comments disputing or contradicting factual evidence provided in the demonstration:

ADEQ will post this assessment report on the ADEQ webpage and placed a hardcopy of the report in the ADEQ Records Management Center for public review. The 30-day public comment period is to TBD. A copy of the public notice certification, along with any comments received and responses to those comments, will be submitted to EPA, consistent with the requirements of 40 CFR Section 50.14(c)(3)(v).

## **Mitigation Requirements**

Per the requirements of 40 CFR Section 51.930(b)(1)(B)(ii), EPA provided written notification in the Federal Register notice for the EPA final rule, *Treatment of Data Influenced by Exceptional Events* (81 FR 68216), that the Maricopa County PM<sub>10</sub> nonattainment area is required to develop a mitigation plan for high wind dust events that satisfy the requirements of 40 CFR Section 51.930(b)(2). A high wind dust event mitigation plan for the Maricopa County PM<sub>10</sub> nonattainment area is required to be submitted to EPA by September 30, 2018. State and local agencies are in the process of developing the mitigation plan. The documentation for the July 29, 2016 high wind dust event is being submitted to EPA before a mitigation plan for the Maricopa County PM<sub>10</sub> nonattainment area is in place as allowed under 40 CFR Section 50.14(b)(9)(ii)(B).

## II. CONCEPTUAL MODEL

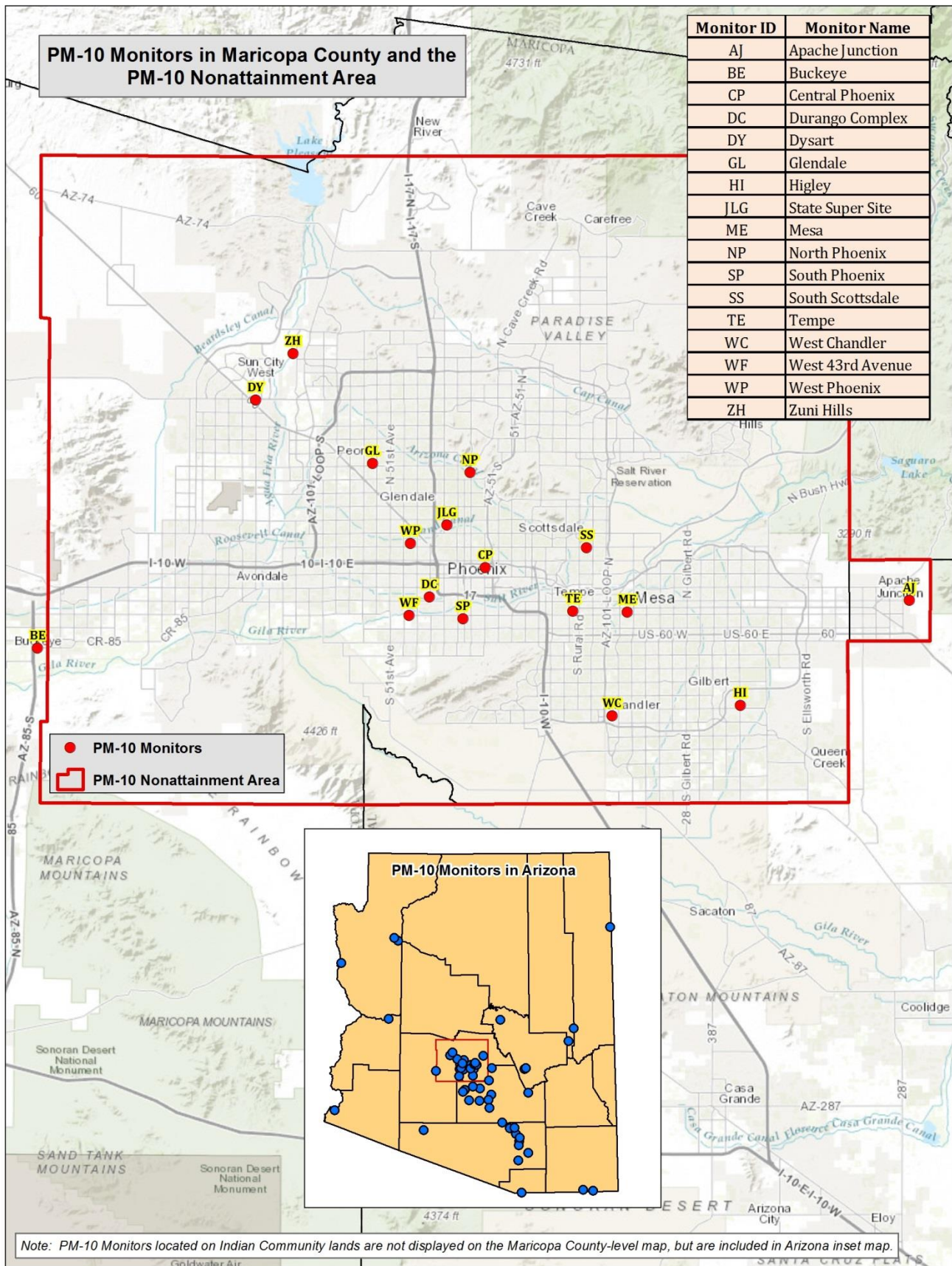
### Geographic Setting and Climate

#### *Geographic Setting*

The Maricopa County PM<sub>10</sub> nonattainment area is located in the Salt River Valley in south-central Arizona. It lies at a mean elevation of 1,090 feet above mean sea level (msl) in the northeastern part of the Sonoran Desert. Other than the mountains in and around the area, the topography of the area is generally flat. The area is surrounded by the McDowell Mountains (~4,200 ft msl) to the northeast, the foothills of the Bradshaw (~7,900 ft msl) and Mazatzal (~7,900 ft msl) ranges to the north, the White Tank Mountains (~4,500 ft msl) to the west, the Sierra Estrella (~4,450 ft msl) to the southwest, and the Superstition Mountains (~5,000 ft msl) far to the east. Within the area are the Phoenix Mountains (~2,600 ft msl) and South Mountain (~2,600 ft msl). Current development is pushing north, west, and south into Pinal County.

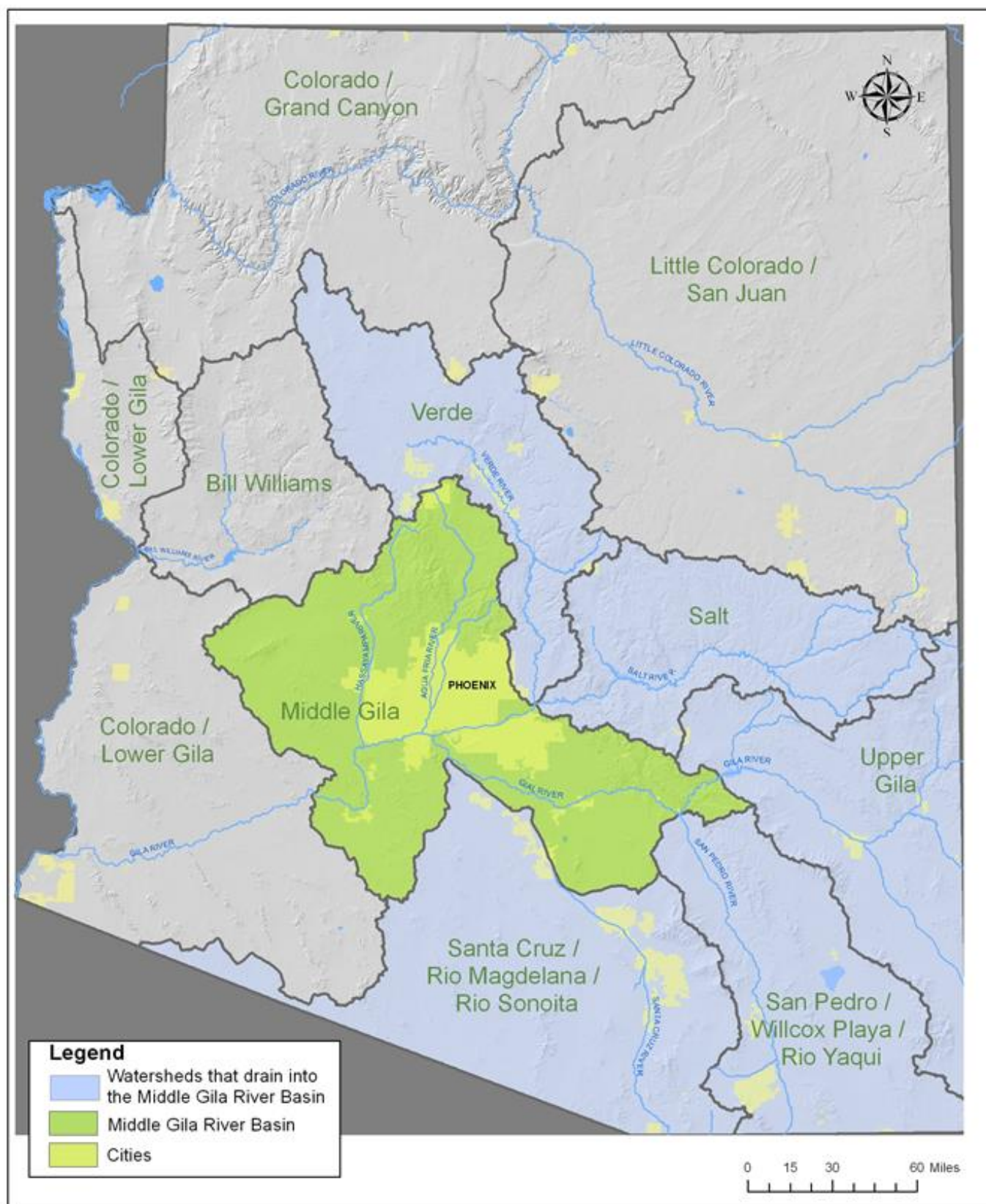
The PM<sub>10</sub> nonattainment area contains a fairly dense network of PM<sub>10</sub> monitors throughout the area, with a much less dense network of monitors located throughout the rest of the state. Figure 2–1 shows the general geographic setting of the nonattainment area, as well as the locations of PM<sub>10</sub> monitors in the nonattainment area and throughout the state.

Figure 2–2 depicts the drainage systems or watersheds for the State of Arizona. Many of the rivers that form Arizona's drainage system are dry for most of the year and, consequently, are sources of silt and fine soils that become suspended and add to regional PM<sub>10</sub> loadings during high wind events. Much of this alluvial matter and fine soil is deposited in the low lying areas of central and southern Arizona, with larger depositional areas focused in and around the confluences of dry river channels.



**Figure 2-1.** Maricopa County PM<sub>10</sub> nonattainment area geographic setting and PM<sub>10</sub> monitor locations.



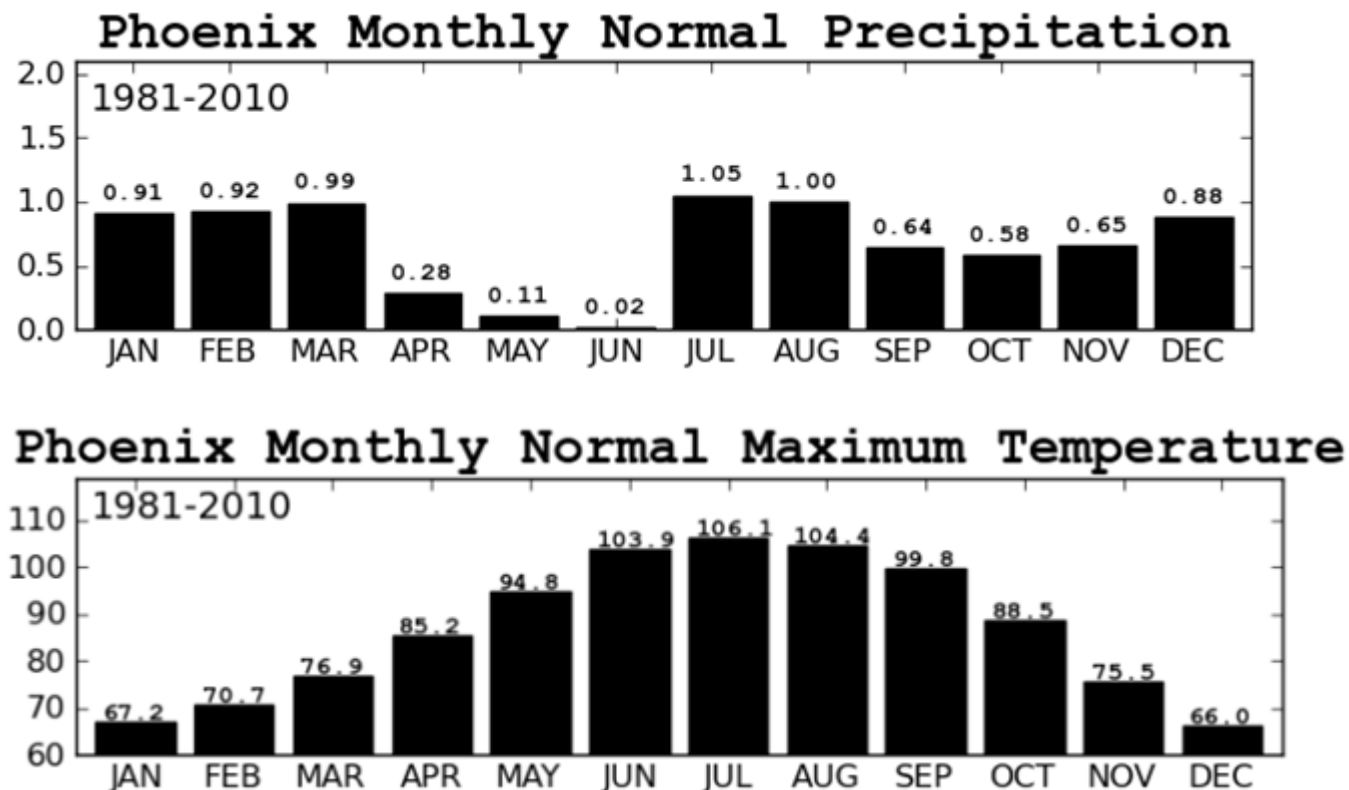


**Figure 2-2.** Drainage basins of the State of Arizona.

## Climate

The Maricopa County PM<sub>10</sub> nonattainment area has an arid climate, with very hot summers and temperate winters. The average summer high temperature is among the hottest of any populated area in the United States. The temperature reaches or exceeds 100°F an average of 110 days during the year and highs top 110°F an average of 18 days during the year. The area receives an average of 7.66 inches of rain per year.

Precipitation is sparse during the first part of the summer, but the influx of monsoonal moisture, which generally begins in early July and lasts until mid-September, raises humidity levels and can cause heavy localized precipitation and flooding. Although thunderstorms are possible at any time of the year, they are most common during the monsoon season from July to mid-September as humid air is advected from the Gulf of California, Gulf of Mexico, and large thunderstorm complexes from the Sierra Madre Occidental Mountains in Mexico. This influx in moisture, combined with intense solar heating, often creates a very unstable environment that is ripe for thunderstorm development. These thunderstorms can bring strong winds and blowing dust, large hail, and heavy rain. Dust storms associated with these thunderstorms typically occur in the early part of the monsoon season (July) before soaking rains help keep soil particles bound to one another. However, depending on the amount of precipitation received during the monsoon season, extremely hot temperatures act to dry out the surface quickly, and dust storms can occur at any time. During the December through March period, winter storms moving inland from the Pacific Ocean can bring strong winds, blowing dust and significant rains throughout Arizona. This December – March time period, and July – August time period are typically the wettest parts of the year. Meanwhile, a distinct dry season occurs during the period April through June for the nonattainment area and the rest of Arizona. While these weather patterns describe the general climatology for the nonattainment area over a long period of time, the area and the entire state of Arizona is also prone to a high degree of variability in these weather patterns from year to year.

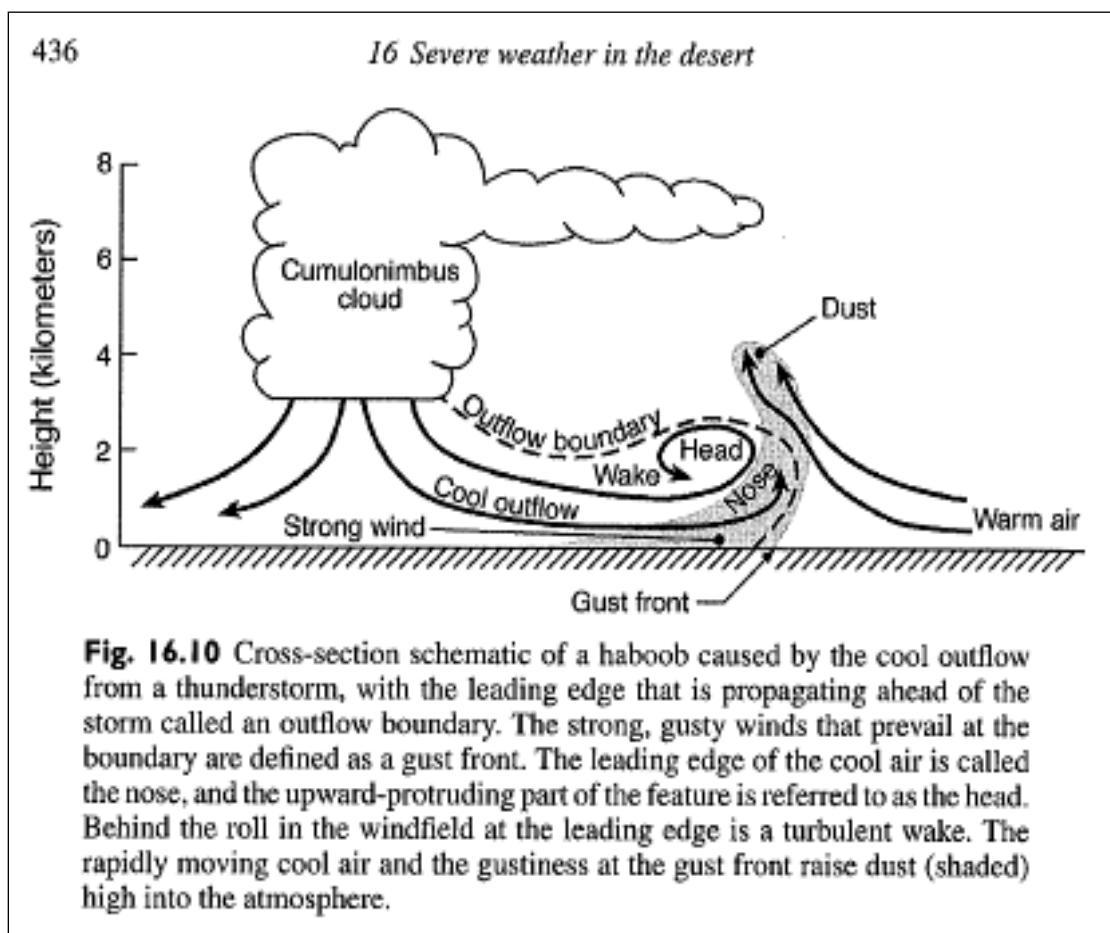


**Figure 2-3** Phoenix monthly precipitation (top) and maximum temperature (bottom) climatology (source: National Weather Service).

## Monsoon Season High Wind Dust Event Summary

The North American Monsoon is a shift in wind patterns in the summer which occurs as Mexico and the southwest U.S. warm under intense solar heating. As this happens, low level moisture is transported primarily from the Gulf of California and eastern Pacific Ocean into the southwestern U.S. Mid and upper level moisture is also transported into the region, mainly from the Gulf of Mexico by easterly winds aloft. This combination causes a distinct rainy season over large portions of western North America, which develops rather quickly and sometimes dramatically. There are usually distinct “burst” periods of heavy rain during the monsoon, and “break” periods with little or no rain. Even during active monsoon periods, some areas can go without receiving any significant precipitation while other nearby areas experience heavy rains and flooding.

In addition to bringing precipitation, active thunderstorms can produce downbursts, or sometimes more concentrated and severe microbursts, which are rapidly descending bursts of air spreading away from the thunderstorm clouds. These downward bursts of air hit the ground and then disperse away from the storms as areas of outflow. These outflow boundaries from the thunderstorms can generate large walls of dust, sometimes called haboobs, and transport that dust for long distances from the initiating thunderstorms (see Figure 2–4).



**Figure 2-4.** Cross-section of a thunderstorm creating an outflow boundary and haboob (Desert Meteorology. Thomas T. Warner. 2004.)

According to the National Weather Service (NWS), strong to severe evening thunderstorms materialized on July 29, 2016 over south-central Arizona as a result of an active monsoon season weather pattern. Two main outflows, one from the north-northeast and the other from the southeast, brought windblown dust to the Maricopa County PM<sub>10</sub> nonattainment area on fast-moving winds. In response, The NWS issued a dust storm warning for northwest Maricopa County, the Greater Phoenix area, and northwest and north central Pinal County at 7:43 PM and at 8:19 PM. The dust storm warnings predicted wind gusts over 40 mph and localized visibilities falling below one quarter of a mile.

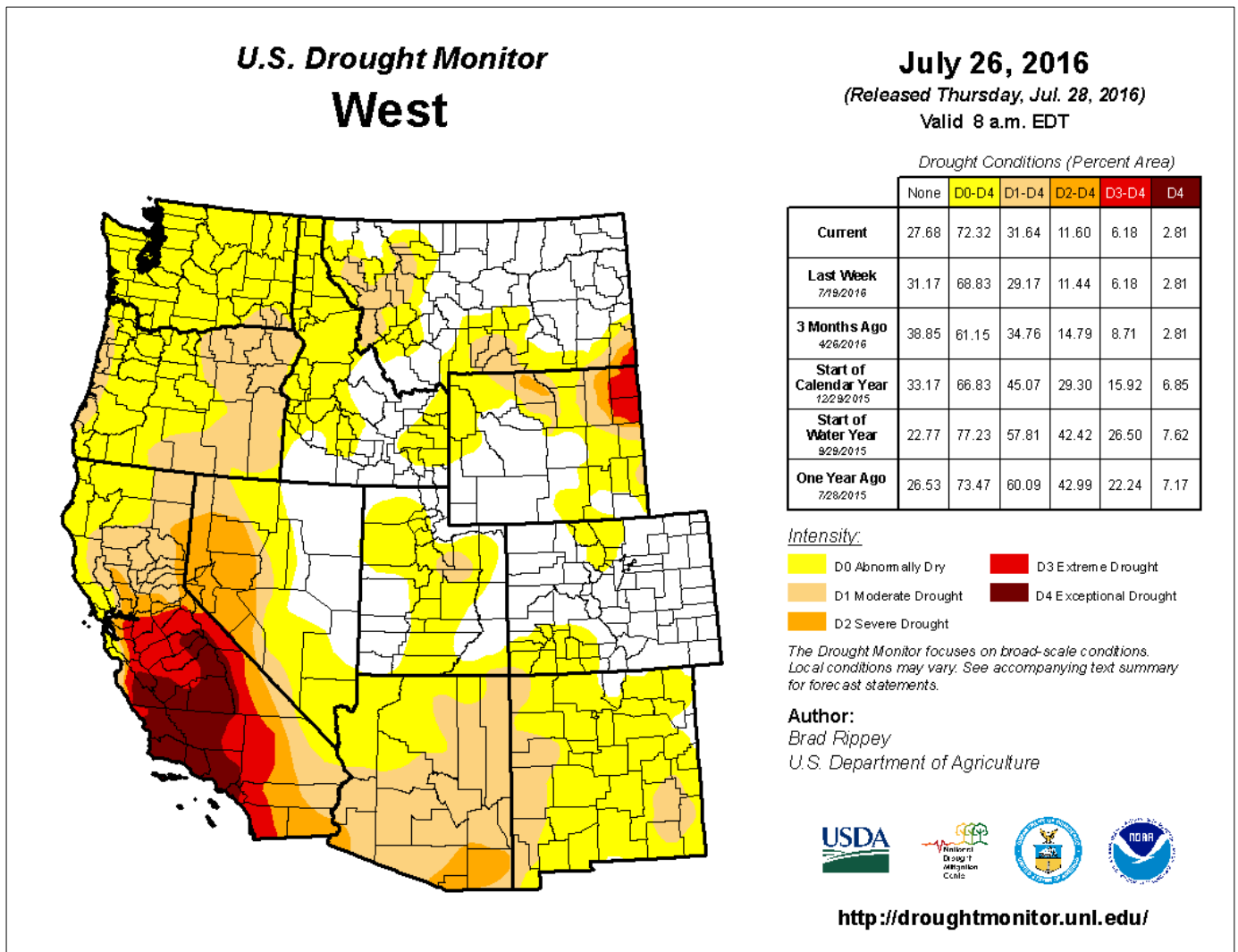
Widespread sustained winds of 40 to 55 mph were reported across the nonattainment area by the National Weather Service along with gusts of 70 mph as reported at the Sky Harbor Airport. Additionally, at 7:41 PM, a trained NWS spotter reported a dust storm with visibility less than one eighth of a mile approximately within four miles of the exceeding Zuni Hills monitor (See Appendix B). This blowing dust moved quickly through the nonattainment area with the thunderstorm outflows, raising PM<sub>10</sub> concentrations at monitors in the nonattainment area and in Pinal County. The fast-moving nature and heavy rain that followed the thunderstorm outflows prevented many nonattainment area monitors from otherwise exceeding the PM<sub>10</sub> standard.

PM<sub>10</sub> concentrations in the nonattainment area from the outflow-generated windblown dust were densest at the exceeding Zuni Hills monitor (located closest to the first main outflow boundary), peaking at 7:25 PM with an extraordinary five-minute concentration of 7,651  $\mu\text{g}/\text{m}^3$ . Concentrations were generally highest on the northwest side of the nonattainment area where the first outflow was located and the least amount of precipitation was recorded, significantly impacting the Zuni Hills, Dysart and Buckeye monitors. The Zuni Hills monitor was affected by the second main outflow boundary as well, recording a second five-minute concentration peak of 836  $\mu\text{g}/\text{m}^3$  at 9:10 PM.

The second outflow originated in Pinal County and caused exceedances at Pinal County monitors and affected concentrations throughout the Maricopa nonattainment area, but did not lead to exceedances in the nonattainment area as the outflow was fast-moving and generally followed by significant rain. Concentrations at the affected nonattainment area monitors quickly returned to normal after the thunderstorm outflows passed over the monitors. The first main thunderstorm outflow, which was largely responsible for the exceedance at the Zuni Hills monitor, generated sustained winds as high as 48 mph and gusts as high as 68 mph as recorded at the Humboldt Mountain monitor near the area where the first outflow boundary originated. As stated above, NWS text reports of the event stated widespread sustained winds of 40 to 55 mph and gusts as high as 70 mph. Visibility readings in synch with the passage of the dust storm outflows were reported to be as low as zero miles in Pinal County and one eighth of a mile in Maricopa County by the NWS.

The intensity of the thunderstorm outflows would normally qualify the high wind event as a “large scale and high-energy” event (focus of a dust storm warning, sustained winds 40 mph or greater, and visibilities less than a half mile), but the event does not technically qualify for this designation as only one monitor in the nonattainment area exceeded the PM<sub>10</sub> standard (largely because of the fast-moving nature of the outflows and the precipitation which followed in many areas). However, the strength of the winds (sustained winds easily over 25 mph) clearly demonstrates that the event was not reasonably controllable or preventable, overwhelming any and all controls on any possible anthropogenic source that may have contributed to the exceedance.

As seen in Figure 2–5, moderate drought conditions throughout Maricopa and Pinal counties likely exacerbated the amount of dust the thunderstorm outflow was able to entrain. Significant precipitation associated with the thunderstorm outflows were recorded at many PM<sub>10</sub> nonattainment area NWS stations after the dust storm had passed through the nonattainment area.



**Figure 2-5.** Western states drought monitor as of July 26, 2016.

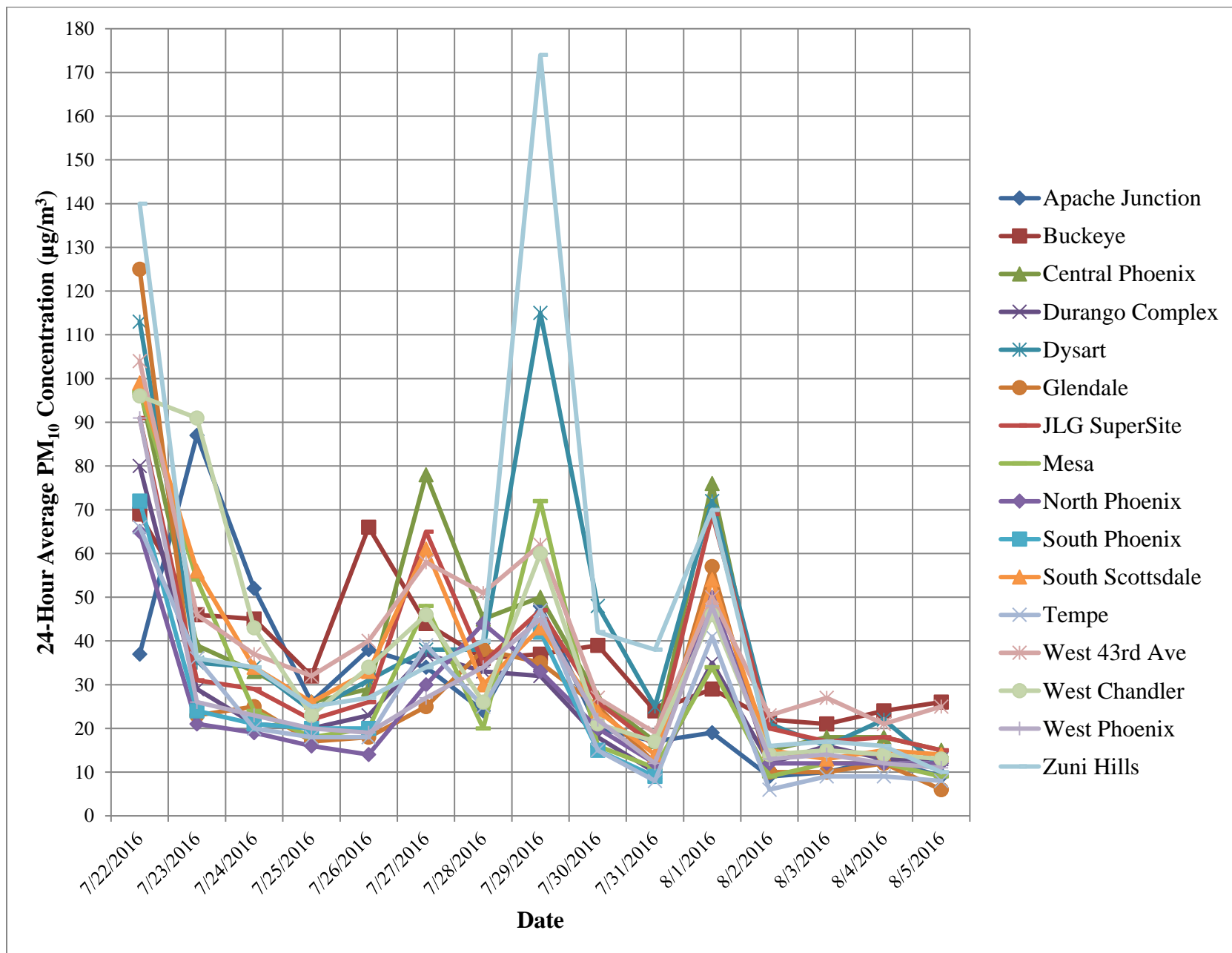
As a summary of the PM<sub>10</sub> concentrations during the event, Table 2–1 contains PM<sub>10</sub> concentration data at Maricopa County and nonattainment area monitors from July 22 – August 5, 2016, indicating the high levels of PM<sub>10</sub> seen on July 29, 2016 as compared to the prior and following week. Figure 2–6 displays those same 24-hour average PM<sub>10</sub> concentrations while Figure 2–7 contains the diurnal pattern of PM<sub>10</sub> at the Maricopa County and PM<sub>10</sub> nonattainment area monitors on July 29, 2016. Lastly, Figure 2–8 displays hourly average PM<sub>10</sub> concentrations, maximum hourly 5-minute wind speeds, and maximum hourly gusts as recorded at the exceeding Zuni Hills monitor.



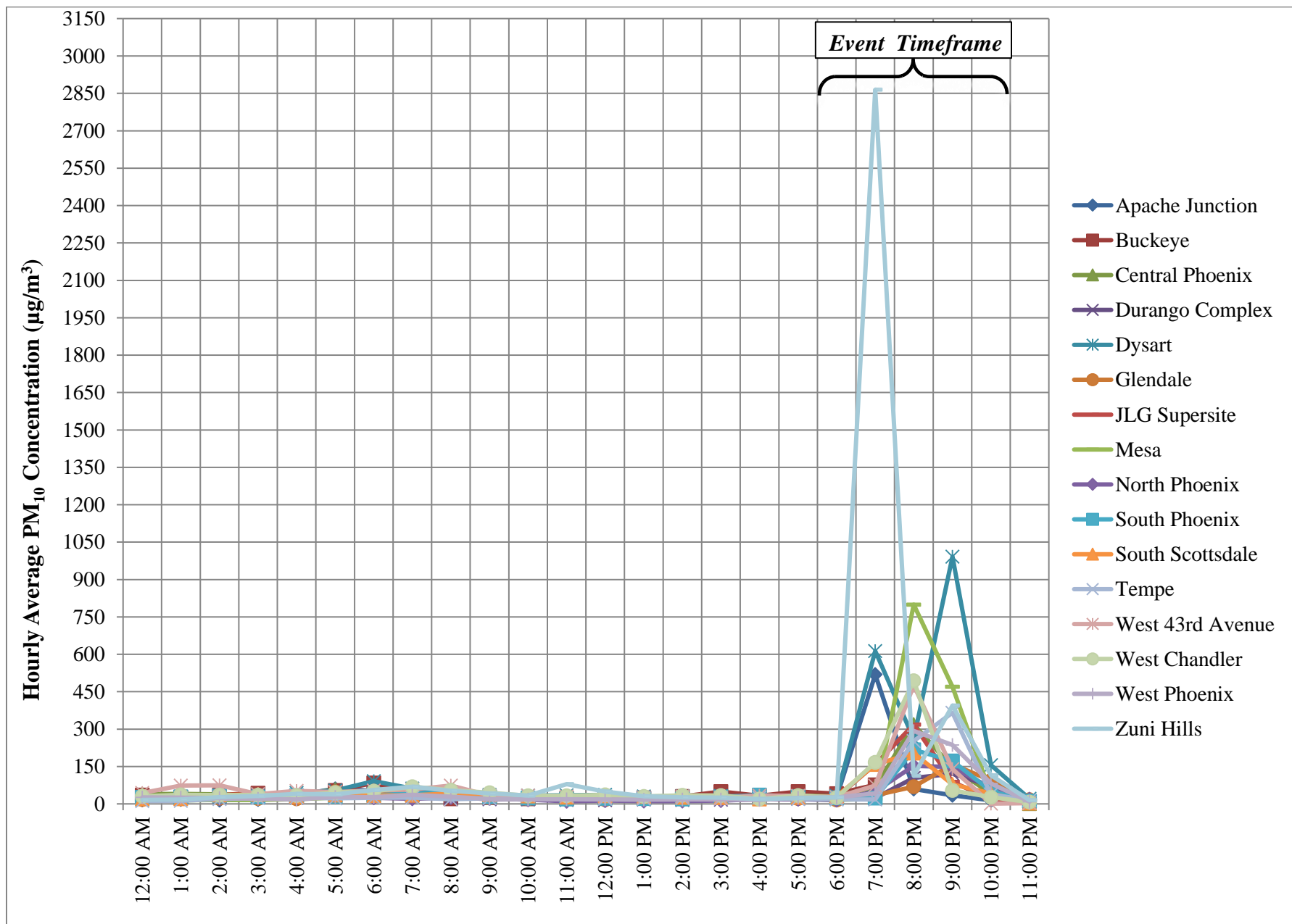
**Table 2-1.** 24-Hour Average PM<sub>10</sub> Concentrations (µg/m<sup>3</sup>) at Maricopa County and PM<sub>10</sub> Nonattainment Area Monitors on July 22-August 5, 2016.

Monitor	July 22	July 23	July 24	July 25	July 26	July 27	July 28	July 29	July 30	July 31	Aug 1	Aug 2	Aug 3	Aug 4	Aug 5
Apache Junction	37	87	52	26	38	34	24	48	20	17	19	9	10	13	9
Buckeye	69	46	45	32	66	44	36	37	39	24	29	22	21	24	26
Central Phoenix	98	39	33	26	29	78	45	50	27	17	76	15	18	18	15
Durango Complex	80	29	21	20	23	37	33	32	18	10	35	12	16	13	13
Dysart	113	35	34	24	31	38	38	115	48	25	72	21	16	22	11
Glendale	125	23	25	17	18	25	38	35	25	12	57	10	10	15	6
JLG Supersite	91	31	29	22	26	65	35	47	26	16	69	20	17	18	15
Mesa	97	54	24	18	20	48	20	72	16	11	34	9	12	12	9
North Phoenix	65	21	19	16	14	30	44	33	20	12	50	12	12	12	12
South Phoenix	72	24	21	20	20	NA	NA	42	15	9	NA	NA	NA	NA	NA
South Scottsdale	99	56	34	26	33	61	30	43	24	14	54	15	13	15	14
Tempe	66	36	20	18	18	39	25	47	15	8	41	6	9	9	8
West 43rd Avenue	104	46	37	32	40	58	51	62	27	19	50	23	27	21	25
West Chandler	96	91	43	23	34	46	26	60	21	17	46	14	15	14	13
West Phoenix	91	26	23	20	19	27	34	45	22	12	48	13	14	12	11
Zuni Hills	140	36	34	25	27	34	40	174	42	38	70	16	17	16	10

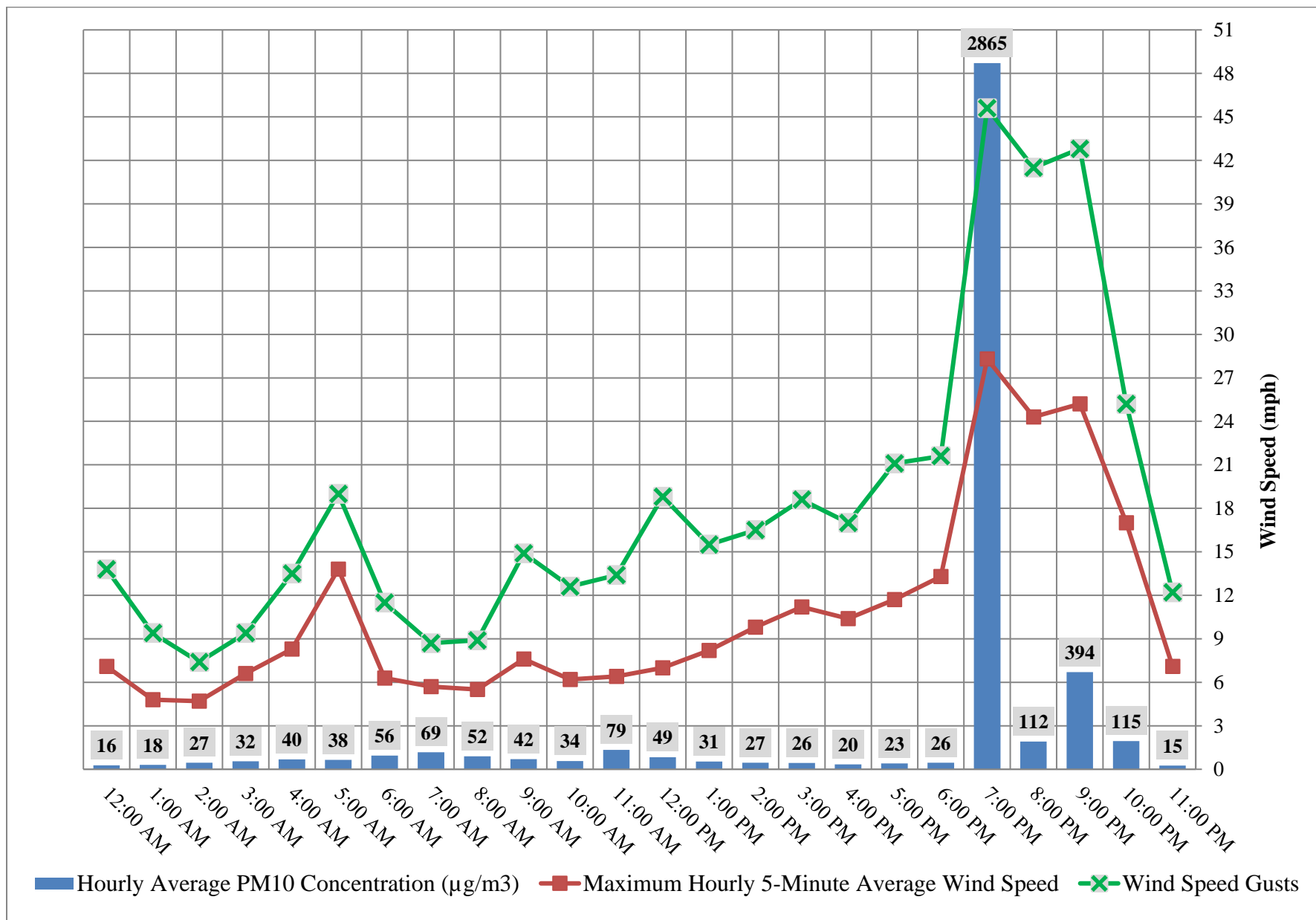
*Monitoring Data Notes: The Buckeye monitor shut down when the during the time period when the dust storm reached the monitor, invalidating data during the hours of 8:00 PM to 12:00 AM on July 29, 2016. If the monitor had been operating it is likely the monitor would have been very near an exceedance value based upon available 5-minute PM<sub>10</sub> before the monitor shut down.*



**Figure 2-6.** 24-hour average PM<sub>10</sub> concentrations (µg/m³) at Maricopa County and nonattainment area monitors on July 22-August 5, 2016.



**Figure 2-7.** Diurnal profile of monitors on July 29, 2016.



**Figure 2-8.** Hourly average PM<sub>10</sub> concentrations, maximum hourly 5-minute average wind speeds, and maximum hourly gusts as recorded at the exceeding Zuni Hills monitor.

### III. CLEAR CAUSAL RELATIONSHIP

#### Introduction

One of the core statutory elements that must be addressed to exclude a monitored exceedance or violation caused by an exceptional event is a demonstration that the exceptional event “affected air quality in such a way that there exists a clear causal relationship between the event and the monitored exceedance or violation.” The requirement to include this demonstration is codified in 40 CFR Section 50.14(c)(3)(iv)(B). To support the clear causal relationship requirements in 40 CFR Section 50.14(c)(3)(iv)(B), analyses comparing the claimed event-influenced concentration to concentrations at the same monitoring site at other times are required as stated in 40 CFR Section 50.14(c)(3)(iv)(C).

Additionally, specific to high wind dust events, the preamble to the revised exceptional events rule states that “EPA expects air agencies to provide relevant wind data...showing how the observed sustained wind speed compares to the established high wind threshold and demonstrates a relationship between the sustained wind speeds and measured PM concentrations at a particular monitoring location”. Demonstrations covering all of the required elements of a clear causal relationship are presented in the sections below.

#### Comparison of High Wind Dust Event Concentrations with Historical Concentrations

In Table 2 of the preamble to the revised exceptional events rule, EPA includes as guidance seven categories of “historical concentration evidence” that should be addressed in order to meet the requirement in 40 CFR Section 50.14(c)(3)(iv)(C) to provide analyses comparing the claimed event-influenced concentration to concentrations at the same monitoring site at other times. The seven categories listed by EPA and where they are addressed in this documentation are listed below:

1. Compare the concentrations on the claimed event day with past historical data (included in Figure 3–1).
2. Demonstrate spatial and/or temporal variability of the pollutant of interest in the area (included in Figures 3–3 through 3–16 and Figure 2-6).
3. Determine percentile ranking: 99th percentile (based upon five years of data, July 29, 2011 – July 29, 2016).
4. Plot annual time series to show the range of “normal” values (included in Figure 3–1).
5. Identify all “high” values in all plots (included in Figure 3–1).
6. Identify historical trends (optional, included in Figure 3–1).
7. Identify diurnal or seasonal patterns (included in Figures 3–1 and 3–2).

The bulk of the seven categories listed above are addressed in Figure 3–1. Figure 3–1 includes all 24-hour average PM<sub>10</sub> concentrations at the exceeding Zuni Hills monitor from January 1, 2011 through December 31, 2016. This period includes the most recent five calendar years of concentration data at the exceeding monitoring site, as recommended by EPA in the preamble to the revised exceptional events rule. Within the time period presented, Figure 3–1 identifies all days that have been flagged as high wind dust events (including the concurrence status of those days by EPA) and all exceedance days.

All exceedances in Figure 3–1 have been identified as high wind dust events. Figure 3–1 generally indicates that high wind dust events normally occur in spring and summer (when dry cold fronts and the

summer monsoon season are most active), but may occur at any time. The high wind dust events are relatively rare occurring on 8 days out of 2,192, or 0.3% of the time. The specific percentile ranking of this high wind dust event 24-hour average PM<sub>10</sub> concentration is in the 99th percentile, based upon five years of data (July 29, 2011 – July 29, 2016).

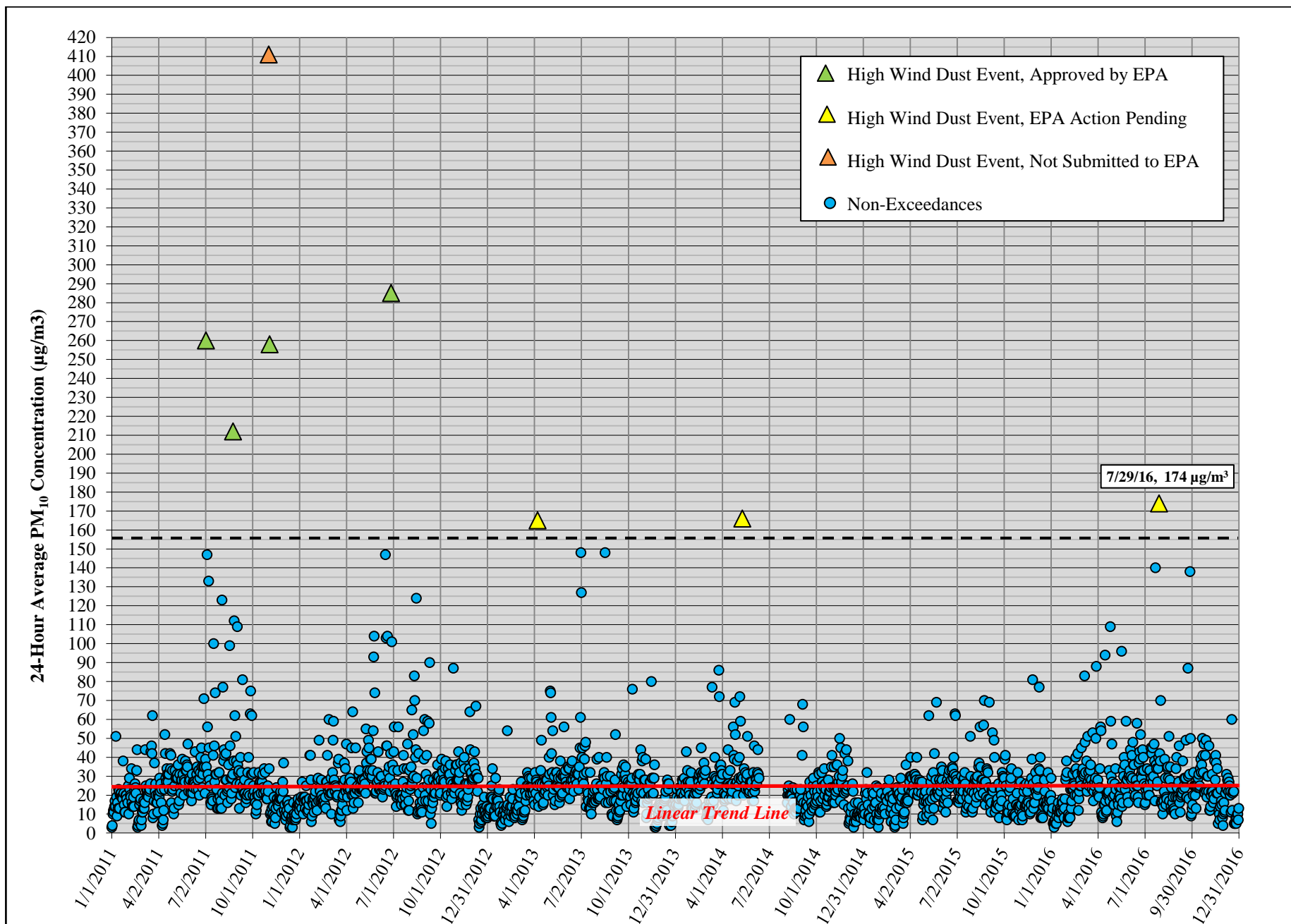
While not specifically indicated in Figure 3–1, it is important to note that some of the other high, but not exceeding PM<sub>10</sub> concentrations (75-150 µg/m<sup>3</sup>) at the Zuni Hills monitor, occurred on days when high wind dust events nearly caused an exceedance, or on days when high wind dust events caused exceedances at other monitors in the Maricopa County PM<sub>10</sub> nonattainment area. Because of the vast size of the nonattainment area, it is rare that a high wind dust event will cause all monitors within the nonattainment area to exceed the PM<sub>10</sub> standard. As seen in this high wind dust event, PM<sub>10</sub> concentrations were elevated at all nonattainment area monitors within the path of the thunderstorm outflow, particularly at the western nonattainment area monitors (e.g., Dysart monitor at 115 µg/m<sup>3</sup>), but only the Zuni Hills monitor exceeded on July 29, 2016.

Figure 3–1 also includes a linear trend line of the 24-hour average PM<sub>10</sub> concentration data at the Zuni Hills monitor. This trend line is generally flat based upon data from January 1, 2011 to December 31, 2016. While the trend line represents an average of concentration data that can vary significantly from day to day, the trend line does indicate that overall PM<sub>10</sub> concentrations at the Zuni Hills monitor have been steady through time, despite an increase in population, employment and vehicle traffic throughout the nonattainment area. This is not unexpected given that the Zuni Hills monitor is located in a suburban/semi-rural setting, where PM<sub>10</sub> concentrations are generally low and well controlled. This location is also near natural, undeveloped desert areas, making it susceptible to windblown dust that originates in the desert areas north and west of the nonattainment area.

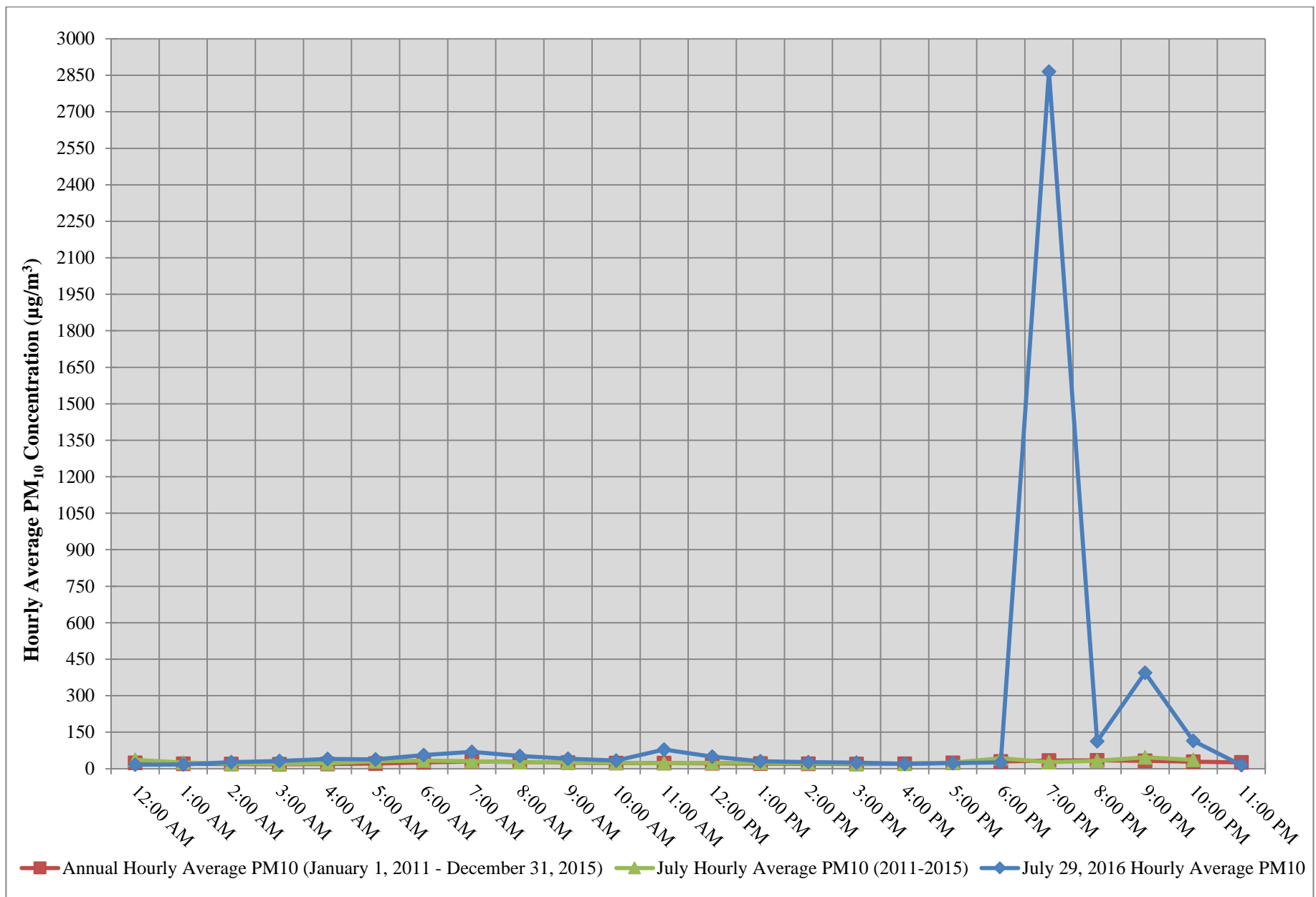
As can be seen in Figure 3–1, there is not a distinct seasonal pattern for PM<sub>10</sub>, but rather concentrations can vary daily in all seasons. In general terms, wintertime inversion conditions can elevate PM<sub>10</sub> on stagnant days in the winter months, and elevated winds particularly during the monsoon season produce the highest overall PM<sub>10</sub> concentrations. However, these meteorological conditions are not constant enough to create a definite “season” when PM<sub>10</sub> is elevated or suppressed.

Figure 3–2 displays the average diurnal patterns of PM<sub>10</sub> as observed over 5 years from January 1, 2011 through December 31, 2015 at the Zuni Hills monitor. The figure includes annual hourly average concentrations, average hourly concentrations in July (the month the event occurred), and the diurnal pattern observed on the event day (July 29, 2016). Hourly PM<sub>10</sub> concentrations that were flagged in AQS as being the result of an exceptional event have been removed from the averages. As can be seen in the Figure 3–2, there is little difference between the annual hourly averages and the hourly averages in the month of July over the 5 year period. Diurnal emissions on the high wind dust event day (July 29, 2016) were very similar to the annual and July averages, except during the hours when high winds were present (6pm to 10pm), providing evidence that no unusual anthropogenic activity was occurring around the exceeding Zuni Hills monitor on the high wind dust event day (i.e., no elevated hourly PM<sub>10</sub> concentrations during non-windy conditions on the event day as compared to historical hourly averages).

In addition to the data presented in Figures 3–1 and 3–2, data in Figure 2–6 displays the 24-hour average PM<sub>10</sub> concentrations at all nonattainment area monitors a week before and after the high wind dust event on July 29, 2016. The peaks seen throughout the week before and after the exceedance day are also due to monsoon season activity, although no other days exceeded during this time frame. The Zuni Hills monitor experienced the highest increase in PM<sub>10</sub> concentrations on July 29, 2016 (in comparison to other nonattainment area monitors) due to being located near the center of the windblown dust from the first thunderstorm outflow.



**Figure 3-1.** Plot of 24-hour average PM<sub>10</sub> concentrations at the Zuni Hills monitor, January 2011 – December 2016.



**Figure 3-2.** Plot of annual hourly average PM<sub>10</sub> concentrations (1/1/2011 – 12/31/2015), hourly average PM<sub>10</sub> concentrations in July (2011 – 2015), and diurnal PM<sub>10</sub> concentrations at the Zuni Hills monitor on the July 29, 2016 high wind dust event day.



### **Chronological and Spatial Presentation of Wind, Visibility, and PM<sub>10</sub> Concentration Data During the High Wind Dust Event in the Maricopa County PM<sub>10</sub> Nonattainment Area**

In addition to the analyses focused on comparison of the high wind dust event PM<sub>10</sub> concentration to historical concentrations, Figure 3–3 through 3–14 display the chronological and spatial distribution of wind, visibility and PM<sub>10</sub> concentration data throughout the nonattainment area in mapped form. The figures establish a clear causal relationship between elevated PM<sub>10</sub> concentrations, elevated wind speeds and reduced visibility in the nonattainment area. The figures also establish the transport of PM<sub>10</sub> across the nonattainment area with the thunderstorm outflow winds.

PM<sub>10</sub> concentrations in the figures were highest at the exceeding Zuni Hills monitor when wind speeds were also at their highest. In 40 CFR Section 50.14(b)(5)(iii), EPA establishes a default high wind threshold of a sustained wind of 25 mph, as the wind speed necessary to entrain significant amounts of dust from undisturbed, natural areas, as well as disturbed, anthropogenic source areas that are subject to reasonable controls. Sustained winds, as represented in the figures, were above 25 mph at multiple locations throughout the nonattainment and at the exceeding Zuni Hills monitor, indicating that reasonable controls on anthropogenic sources of windblown dust were overwhelmed and that emissions of dust from natural desert areas would be expected. In summary, the figures make it clear that without the high wind dust event caused by the thunderstorm outflow, there would have been no exceedance at the Zuni Hills monitor.

The data displayed in the following figures were gathered from five data sources. All available meteorological and air quality data were used in order to present the most complete story of the event. Table 3–1 displays the types of data used from each agency in creating the maps. Each map in the figures represents the chronological and spatial distribution of wind, visibility and PM<sub>10</sub> concentration in a 30-minute period. The figures start with the 6:00-6:30 PM period and end with the 11:30 PM-12:00 AM period, covering the arrival and passing of the thunderstorm outflow generated windblown dust across the Maricopa County PM<sub>10</sub> nonattainment area.

**Table 3-1.** Data Sets Used in the Creation of Chronological and Spatial Maps.

<b>Agency</b>	<b>Data Sets</b>
Arizona Department of Environmental Quality (ADEQ)	Hourly PM <sub>10</sub> Concentrations, Wind Speed, Wind Direction and Wind Gusts
Arizona Meteorological Network (AZMET)	Hourly Wind Speed, Wind Direction and Wind Gusts
Maricopa County Air Quality Department (MCAQD)	5-Minute PM <sub>10</sub> Concentrations, 5-Minute Wind Speed and Wind Direction, and Maximum Hourly Wind Gusts
Pinal County Air Quality Control District (PCAQCD)	5-Minute and Hourly PM <sub>10</sub> Concentrations, 5-Minute and Hourly Wind Speed, Wind Direction and Wind Gusts
National Weather Service (NWS)	Point in Time Wind Speed, Wind Direction, Wind Gusts, Visibility, and Radial Velocity Radar

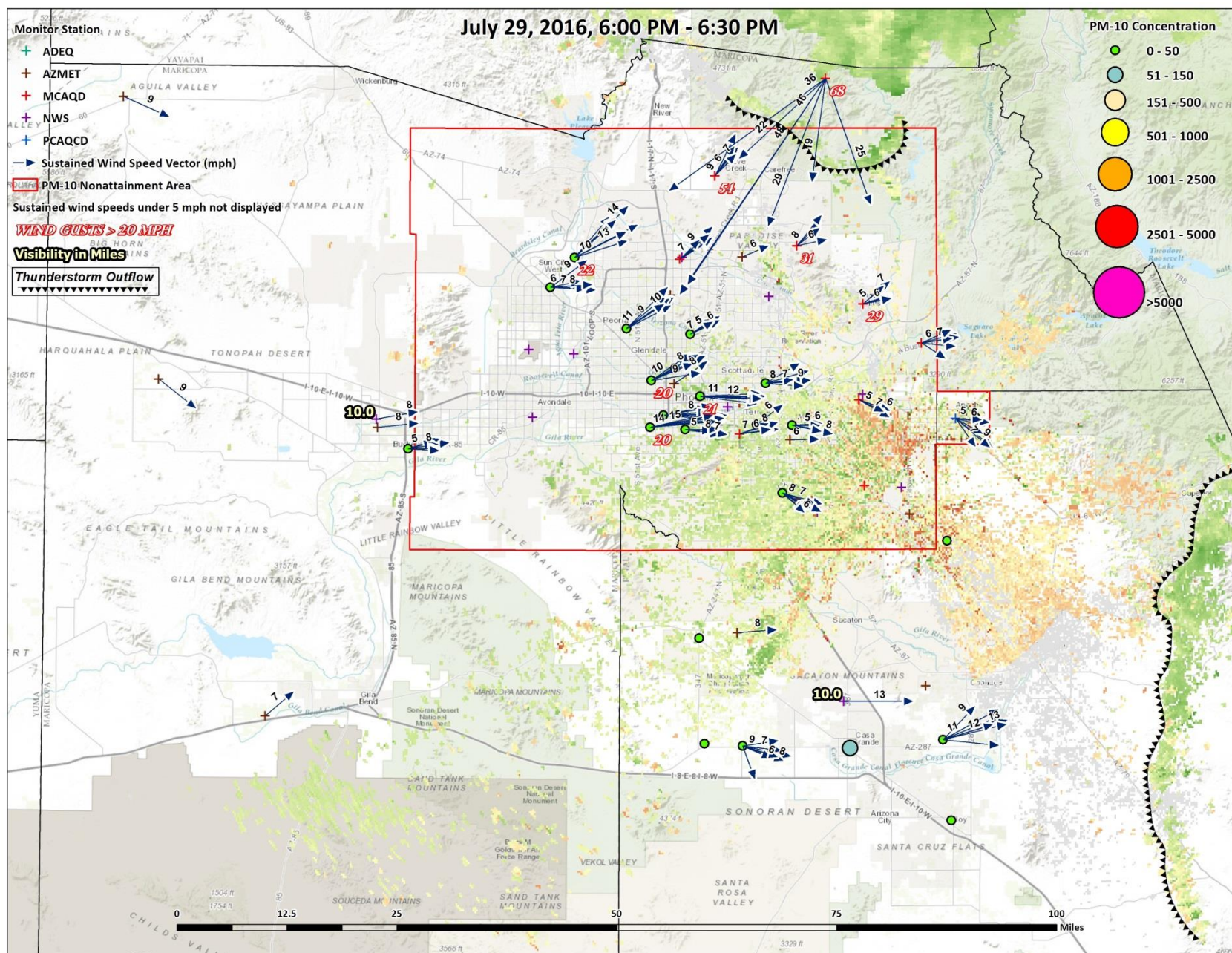
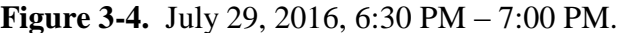


Figure 3-3. July 29, 2016, 6:00 PM – 6:30 PM.







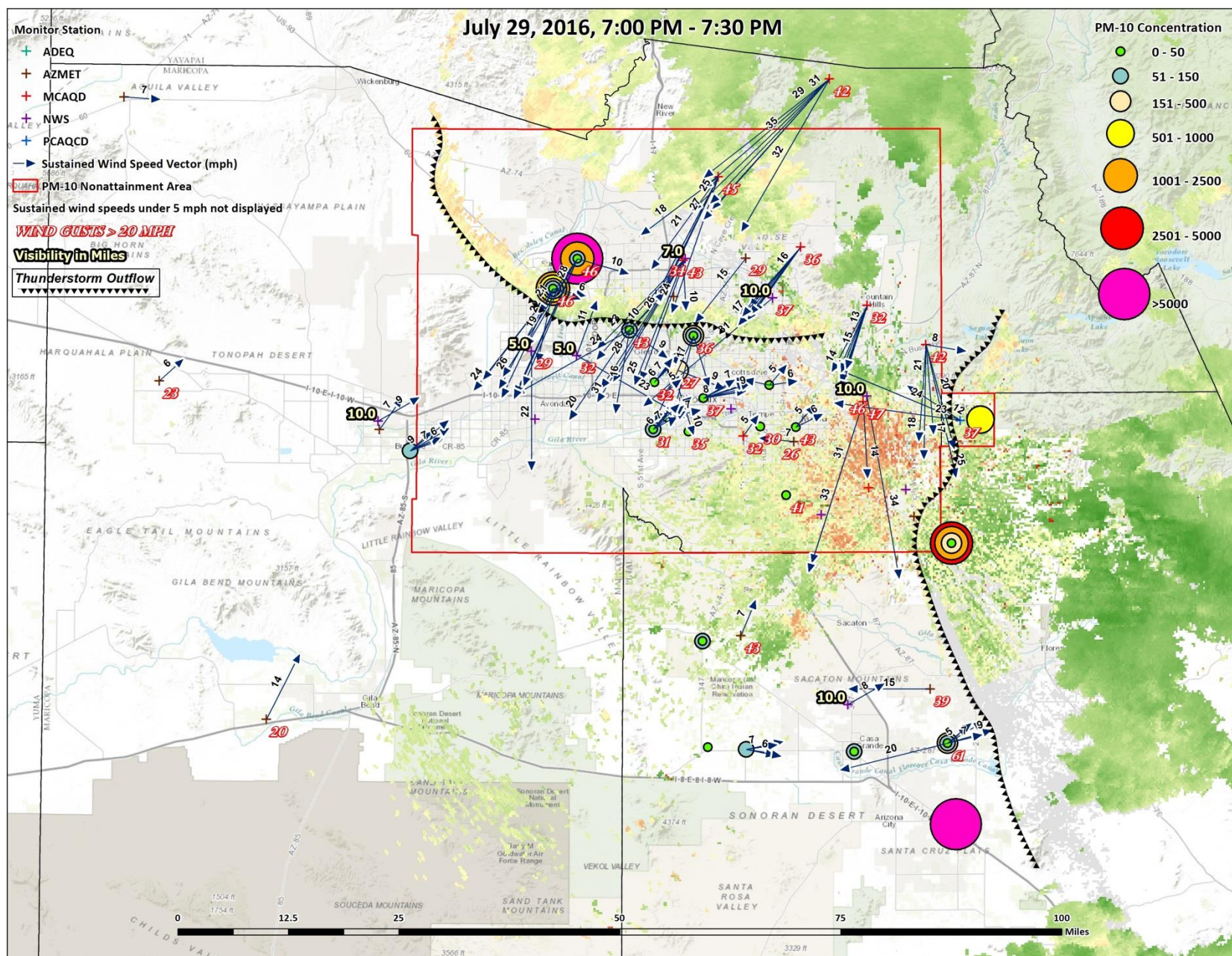


Figure 3-5. July 29, 2016, 7:00 PM – 7:30 PM.



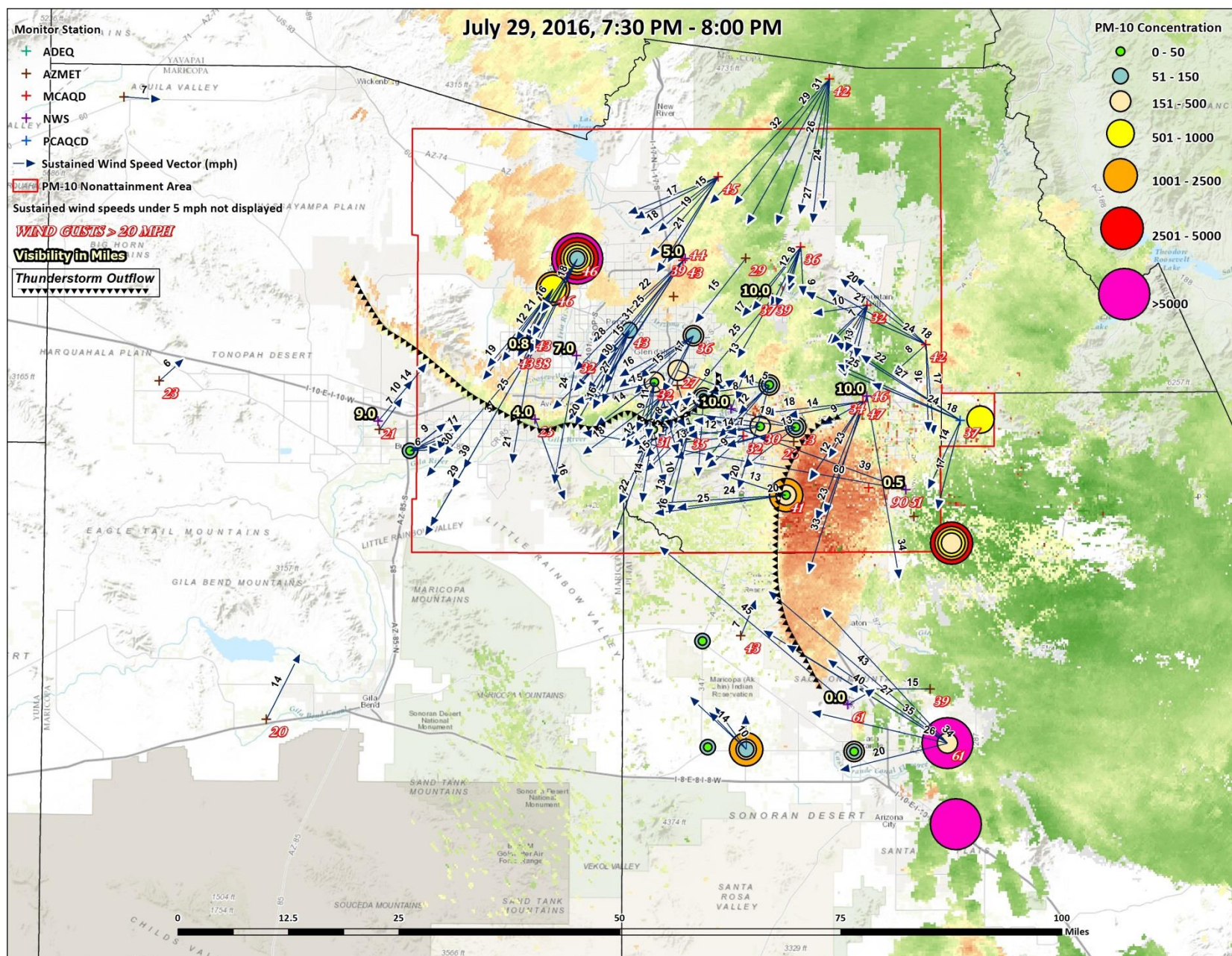


Figure 3-6. July 29, 2016, 7:30 PM – 8:00 PM.



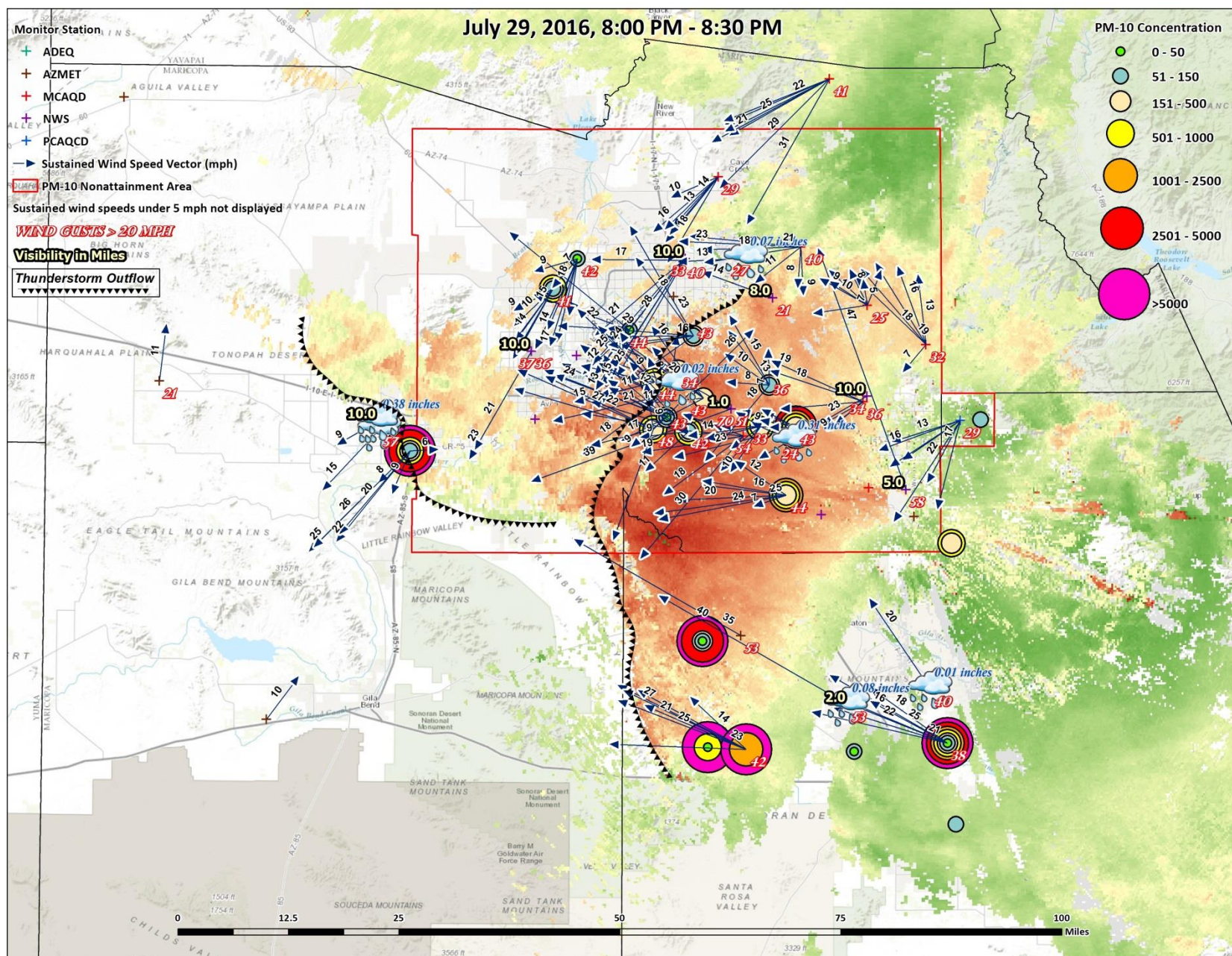


Figure 3-7. July 29, 2016, 8:00 PM – 8:30 PM.



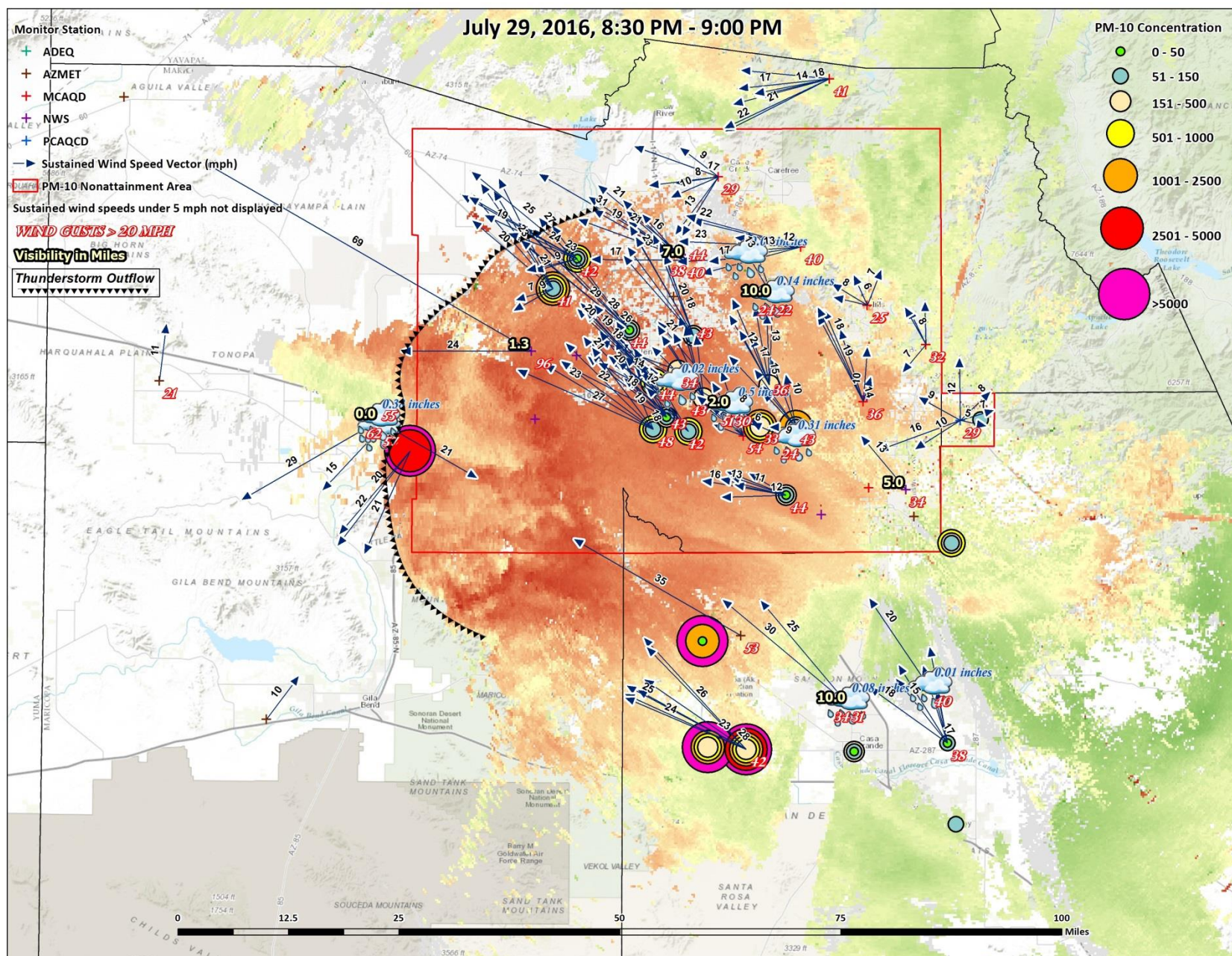
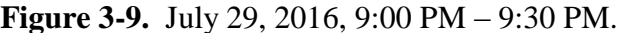
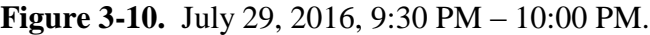


Figure 3-8. July 29, 2016, 8:30 PM – 9:00 PM.

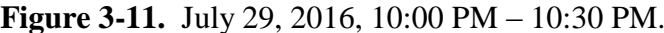




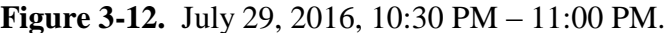














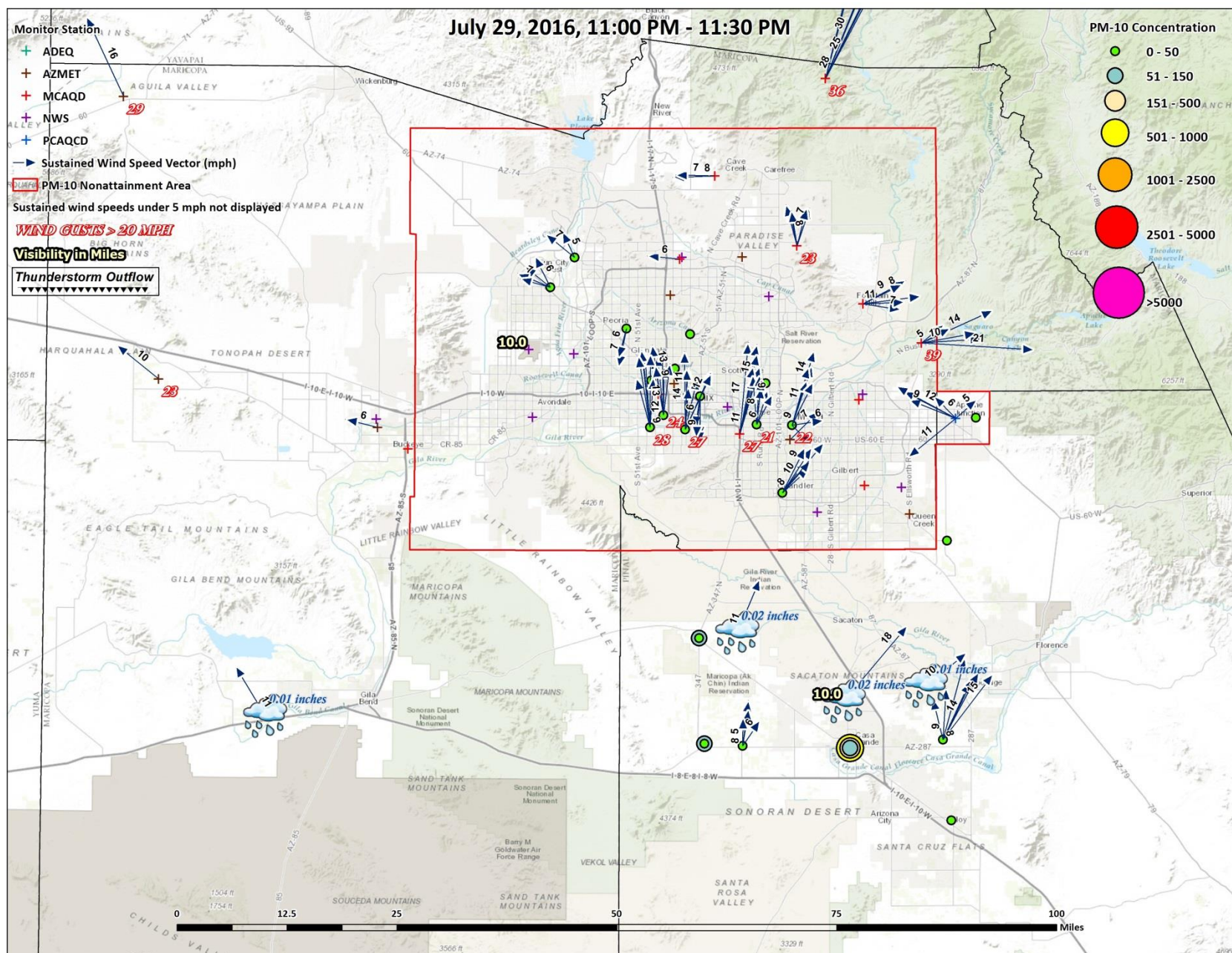


Figure 3-13. July 29, 2016, 11:00 PM – 11:30 PM.



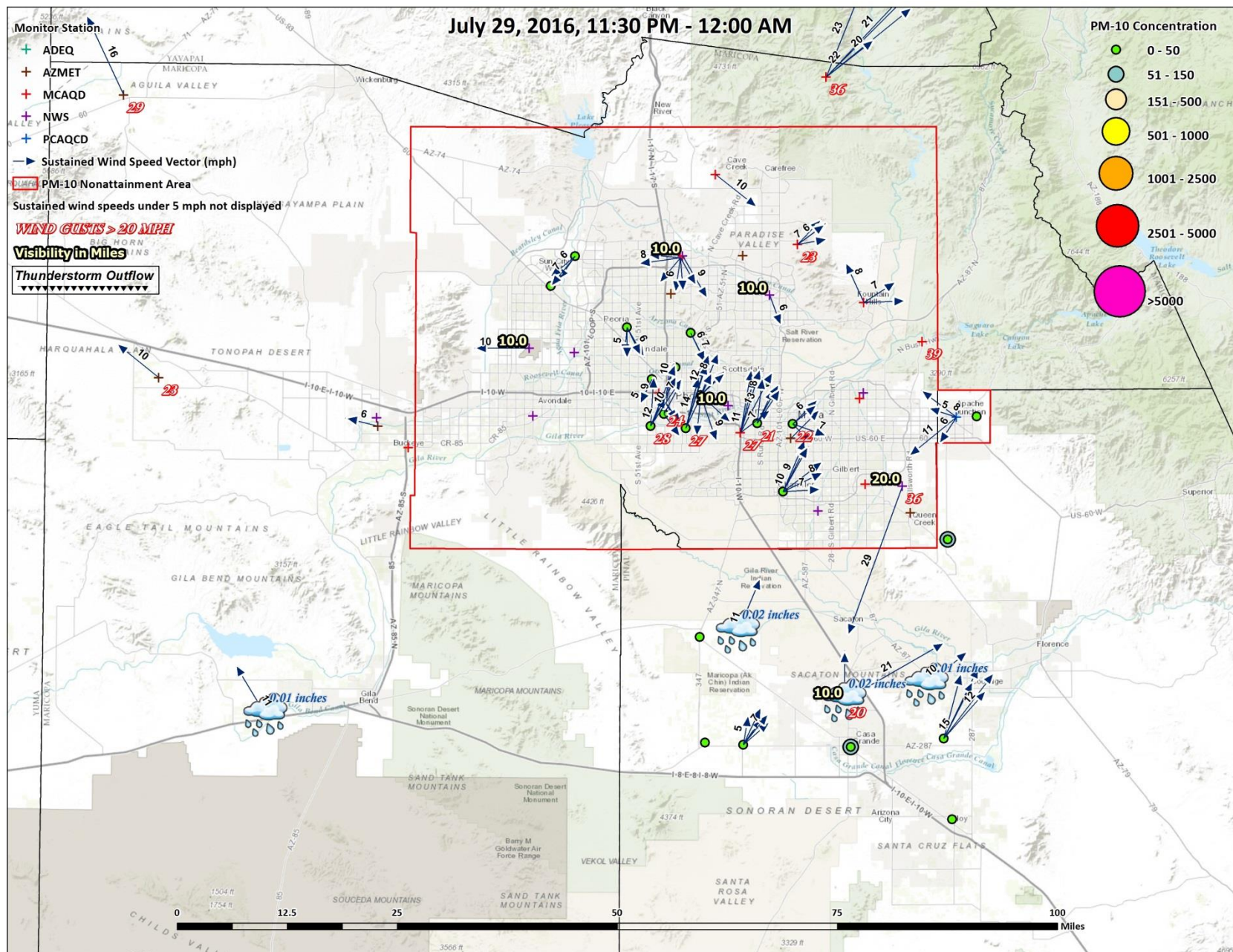
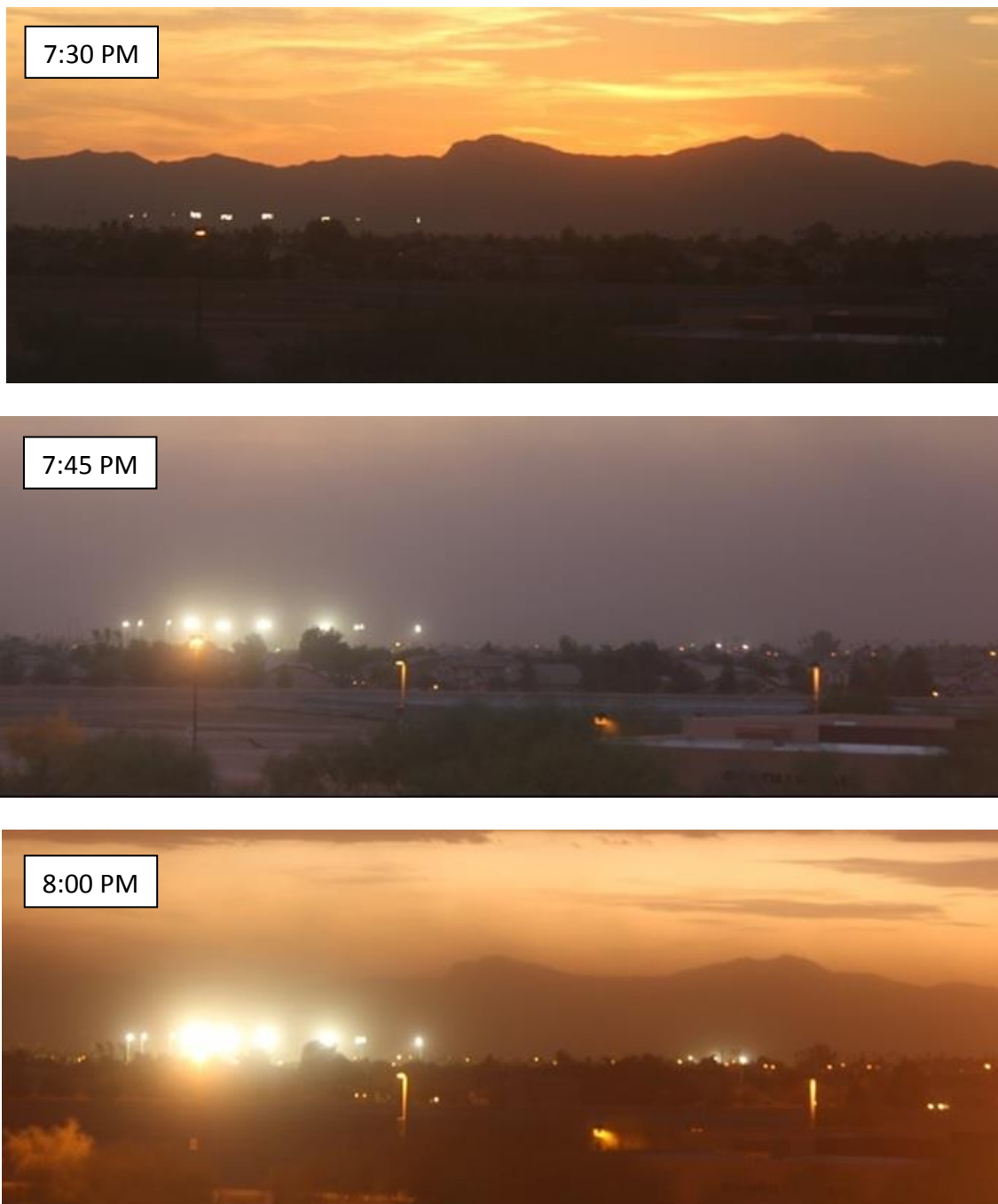


Figure 3-14. July 29, 2016, 11:30 PM – 12:00 AM.

## **Visibility Photos**

ADEQ Visibility photos (White Tank Mountain) taken within the Maricopa County PM<sub>10</sub> nonattainment area show the degradation of visibility as windblown dust from the fast-moving outflow passes through the nonattainment area. These photos provide additional evidence of the clear causal relationship between transported windblown dust from the high wind dust event and the exceedance at the Zuni Hills monitor. Figure 3–15 displays visibility conditions on July 29, 2016 before (7:30 PM), during (7:45 PM) and immediately after arrival (8:00 PM) of the high wind dust event. The area of the visibility photo is south of the exceeding Zuni Hills monitor. As such, the timing of the photos is after the main outflow has passed over the Zuni Hills monitor and is approaching the southern Buckeye monitor.



**Figure 3-15.** Visibility photos on July 29, 2016 at 7:30, 7:45 and 8:00 PM, respectively.

## **Conclusion**

In summary, on July 29, 2016 an intense high wind dust event passed through the Maricopa County PM<sub>10</sub> nonattainment area which generated and transported windblown dust in the form of PM<sub>10</sub> resulting in elevated concentrations of PM<sub>10</sub> across the nonattainment area and an exceedance of the PM<sub>10</sub> standard at the Zuni Hills monitor. The monitored PM<sub>10</sub> concentrations on July 29, 2016 at the exceeding Zuni Hills monitor were compared to historical concentrations at the site in several analyses. The analyses confirm a clear causal relationship between the exceedance and the high wind dust event as compared to historical high wind dust event days and non-exceedance days.

In addition to the comparison to historical concentrations, figures displaying the chronological and spatial distribution of wind, visibility and PM<sub>10</sub> concentration data confirm that (1) sustained winds above 25 mph were high enough to entrain significant windblown dust from natural desert areas and disturbed, anthropogenic source areas subject to reasonable controls; (2) PM<sub>10</sub> concentrations peaked when winds speeds peaked; and (3) visibility conditions at nonattainment area monitors where the thunderstorm outflow generated windblown dust passed over or by were degraded as a result of the transported windblown dust from the high wind dust event. These analyses taken as a whole provide strong weight of evidence that the high wind dust event affected air quality in such a way that there exists a clear causal relationship between the high wind dust event on July 29, 2016 and the PM<sub>10</sub> exceedance at the Zuni Hills monitor on July 29, 2016, thus satisfying the clear causal relationship criterion.

## **IV. NATURAL EVENT AND NOT REASONABLY CONTROLLABLE OR PREVENTABLE CRITERIA**

### **Natural Event**

40 CFR Section 50.14(c)(3)(iv)(E) requires a demonstration that the exceptional event was either a human activity that is unlikely to recur at a particular location or was a natural event. The revised exceptional events rule defines a natural event at 40 CFR Section 50.1(k) as “an event and its resulting emissions, which may recur at the same location, in which human activity plays little or no direct causal role. For purposes of the definition of a natural event, anthropogenic sources that are reasonably controlled shall be considered to not play a direct role in causing emissions.” Additionally, specific to high wind dust events, 40 CFR Section 50.14(b)(5)(ii) states that “[t]he Administrator will consider high wind dust events to be natural events in cases where windblown dust is entirely from natural undisturbed lands in the area or where all anthropogenic sources are reasonably controlled as determined in accordance with paragraph b(8) of this section.”

The clear causal relationship demonstration in the prior chapter found that high wind dust events can recur at the exceeding Zuni Hills monitor. Figure 3–1 indicates that 7 prior high wind dust events have occurred in the past five years at the monitor. The clear causal relationship demonstration also found that the PM<sub>10</sub> emissions which caused the exceedance at the Zuni Hills monitor were associated with windblown dust generated and transported by sustained wind speeds that exceeded the default high wind threshold of 25 mph established in 40 CFR Section 50.14(b)(5)(iii). EPA states in the preamble to the revised exceptional events rule that, “[f]or high wind dust events, if sustained wind speeds are above the high wind threshold and the anthropogenic emissions sources are reasonably controlled, it is more likely that human activity plays little or no direct role in causing emissions.” The following section of this chapter demonstrates that reasonable controls were in place on all windblown dust anthropogenic sources in the Maricopa County PM<sub>10</sub> nonattainment area during the high wind dust event. For these reasons, the high wind dust event on July 29, 2016, qualifies as a natural event.

### **Not Reasonably Controllable or Preventable**

40 CFR Section 50.14(c)(3)(iv)(D) requires a demonstration that the exceptional event was both not reasonably controllable and not reasonably preventable. 40 CFR Section 50.14(b)(8) provides the demonstrations needed to establish that the exceptional event was not reasonably controllable or preventable for all exceptional events. Additionally, specific requirements regarding the not reasonably controllable or preventable criterion related to high wind dust events are provided in 40 CFR Section 50.14(b)(5).

40 CFR Sections 50.14(b)(8)(i) through (iii) states that “[t]he not reasonably controllable or preventable criterion has two prongs that the State must demonstrate: prevention and control. (ii) The Administrator shall determine an event is not reasonably preventable if the State shows that reasonable measures to prevent the event were applied at the time of the event. (iii) The Administrator shall determine that an event is not reasonably controllable if the State shows that reasonable measures to control the impact of the event on air quality were applied at the time of the event.”



Regarding whether the event was not reasonably preventable, the revised exceptional events rule has specific regulations for high wind dust events that exempt a State from needing to provide a case-specific justification that the event was not reasonably preventable (40 CFR Section 50.14(b)(5)(iv)). In keeping with the specific high wind dust event regulation, and because the high winds that entrain the windblown dust are by nature unpreventable, a case-specific justification that the high wind dust event on July 29, 2016 was not preventable is not needed or presented in this documentation.

Regarding whether the event was not reasonably controllable, 40 CFR Section 50.14(b)(8)(iv) states that EPA “shall assess the reasonableness of available controls for anthropogenic sources based on information available as of the date of the event”. Additionally, 40 CFR Section 50.14(b)(8)(v) provides deference to controls in a state implementation plan that have been approved by EPA within five years of the event date, “the Administrator shall consider enforceable control measures implemented in accordance with a state implementation plan...approved by the EPA within 5 years of the date of the event, that address the event-related pollutant and all sources necessary to fulfill the requirements of the Clean Air Act for the state implementation plan...to be reasonable controls with respect to all anthropogenic sources that have or may have contributed to the monitored exceedance or violation.”

The *MAG 2012 Five Percent Plan for PM-10 for the Maricopa County Nonattainment Area* contains a wide variety of control measures and projects that have been implemented to reduce and control PM<sub>10</sub> emissions, including PM<sub>10</sub> emissions generated under high wind conditions, which were in place and implemented at the time of the event. Requirements to reduce and control PM<sub>10</sub> emissions in the plan apply to a broad range of sources including: unpaved roads and shoulders, leaf blowers, unpaved parking lots, vacant lots, sweeping streets with certified sweepers, off-road vehicle use, open and recreational burning, residential wood burning, covered vehicle loads, dust generating operations, nonmetallic mineral processing, and other unpermitted sources. EPA published final approval of the MAG 2012 Five Percent Plan on June 10, 2014 (79 FR 33107).

On September 12, 2016 the U.S. Court of Appeals for the Ninth Circuit issued an opinion in the lawsuit filed by the Arizona Center for Law in the Public Interest (*Bahr v. U.S. EPA*) to challenge the Environmental Protection Agency approval of the MAG 2012 Five Percent Plan. The Court upheld EPA’s determination that the control measures in the plan did not need to be updated and also upheld EPA’s exclusion of PM<sub>10</sub> exceedances in 2011 and 2012 as exceptional events caused by high wind dust events. The Court remanded the contingency measures in the plan to EPA for further consideration. Because EPA has approved the MAG 2012 Five Percent Plan within five years of the high wind dust event, and the approved plan addresses the event-related pollutant and all sources necessary to fulfill the requirements of the Clean Air Act, and because the State is not currently under obligation to revise the state implementation plan, the controls in the MAG 2012 Five Percent Plan are considered reasonable controls with respect to all anthropogenic sources that have or may have contributed to the monitored exceedance.

Specific to high wind dust events, 40 CFR Section 50.14(b)(5)(v) states that “[w]ith respect to the not reasonably controllable criterion of paragraph (c)(3)(iv)(D) of this section, dust controls on an anthropogenic source shall be considered reasonable in any case in which the controls render the anthropogenic source as resistant to high winds as natural undisturbed lands in the area affected by the high wind dust event. The Administrator may determine lesser controls reasonable on a case-by-case basis.”

When evaluating this regulation, EPA considers whether wind speeds were above the high wind threshold (25 mph default) during the event as an important indicator for whether or not the implemented controls

were reasonable. In the preamble to the revised exceptional events rule, EPA states that, “[t]he EPA will continue to consider an area’s high wind threshold when reviewing demonstrations for events in a nonattainment or maintenance area where the EPA has approved a SIP, TIP or FIP within 5 years of the date of the event. For a demonstration in such a case, the not reasonably controllable criterion hinges only on implementation of the control measures in the SIP, TIP or FIP, not on the content of those measures. For events with sustained wind speeds above the high wind threshold that occur simultaneously with high monitored PM concentrations, it is very plausible that SIP, TIP, or FIP controls were being implemented and the high PM concentrations resulted from emissions generated by sources in the area despite implementation of those controls...Therefore, the comparison of sustained wind speeds during an event to the high wind threshold will help the EPA Regional offices determine what evidence must be included in a demonstration. Specifically, it will inform the evidence required for the not reasonably controllable or preventable criteria, the possibility of noncompliance, or emissions from non-event sources.”

The clear causal relationship demonstration in Chapter III of this documentation clearly establishes that high PM<sub>10</sub> concentrations at the exceeding monitor and throughout the nonattainment area occurred when sustained wind speeds were over the high wind threshold of 25 mph. This provides evidence that (1) the controls in place within the Maricopa County PM<sub>10</sub> nonattainment area and at the exceeding monitor during the high wind dust event on July 29, 2016 meet the requirements of 40 CFR Section 50.14(b)(5)(v) by rendering anthropogenic sources as resistant to high winds as natural undisturbed lands, and that (2) source noncompliance is less likely given the severity of the wind speeds.

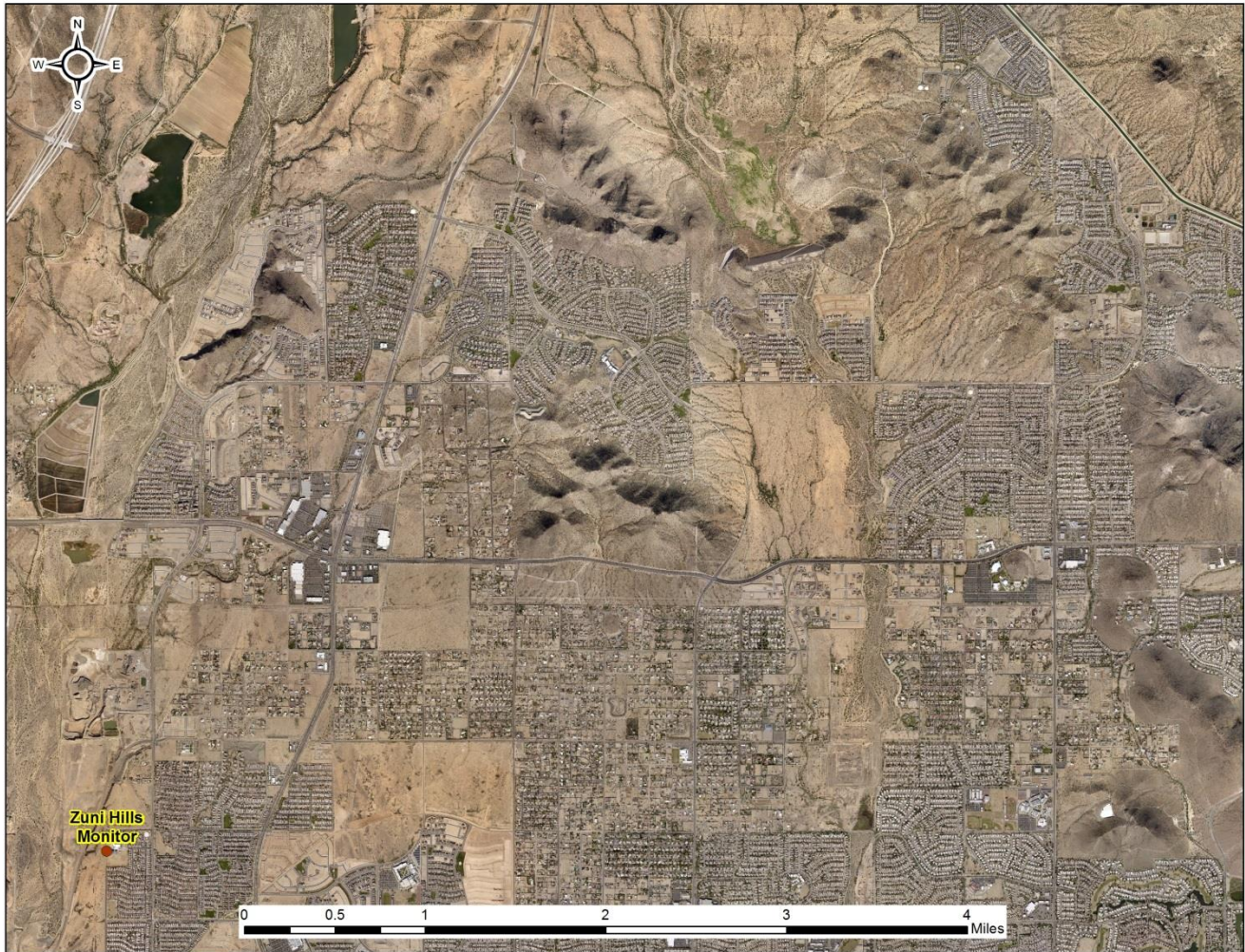
Lastly, 40 CFR Section 50.14(b)(8)(viii) requires that the State must include the following components in a demonstration that addresses the not reasonably controllable or preventable criterion for prescribed fire events and certain high wind dust events: “(A) Identification of the natural and anthropogenic sources of emissions causing and contributing to the monitored exceedance or violation, including the contribution from local sources. (B) Identification of the relevant state implementation plan, tribal implementation plan, or federal implementation plan or other enforceable control measures in place for sources identified in paragraph...(A) of this section and the implementation status of these controls. (C) Evidence of effective implementation and enforcement of the measures identified in paragraph...(B) of this section.” The following sections satisfy the requirements of 40 CFR Section 50.14(b)(8)(viii).

### ***Identification of Natural and Anthropogenic Sources of Emissions***

As discussed in the narrative conceptual model and the clear causal relationship demonstration, due to the high intensity of the high wind event, the sources of the windblown dust during the event on July 29, 2016 are the natural desert areas of Maricopa County (first main outflow event) and Pinal County (second main outflow event). If any anthropogenic source contributed to the event, any and all controls on those sources were uniformly overwhelmed by sustained winds in the 40 to 55 mph range, as reported by the NWS. Windblown dust was both transported to, and generated within, the Maricopa County PM<sub>10</sub> nonattainment area. Thunderstorm outflows originating in rural, northern Maricopa County and central Pinal County are the initial source areas of the windblown dust transported to the Maricopa County PM<sub>10</sub> nonattainment area.

The most likely natural sources given the prevailing wind patterns of the high wind event include the desert areas of northern Maricopa County and central Pinal County. The most likely anthropogenic sources to contribute to the exceedance at the Zuni Hills monitor include those sources located immediately upwind (northeast) of the monitor. The immediate area (within four miles) around the Zuni Hills monitor is suburban/semi-rural and includes scattered housing developments and open desert areas. Anthropogenic PM<sub>10</sub> emission sources in this area may likely include, but are not limited to, vacant lots,

landscaping activities, and unpaved/paved road dust. Large tracks of undeveloped and developing desert lands immediately northeast of the Zuni Hills monitor exist that would be subject to the creation of windblown dust during a high wind event. Figure 4–1 displays a recent aerial photo (2015) of the area upwind (approximately five to six miles) of the Zuni Hills monitor.



**Figure 4-1.** Aerial photo of the immediate area upwind of the exceeding Zuni Hills monitor.

### ***Identification of Relevant Control Measures***

As discussed above, the *MAG 2012 Five Percent Plan for PM-10 for the Maricopa County Nonattainment Area* is the latest state implementation plan approved by EPA. This plan contains a wide variety of control measures and projects that have been, and are being, implemented to reduce and control PM<sub>10</sub> emissions, including PM<sub>10</sub> emissions generated under high wind conditions, which were in place and implemented at the time of the event. Requirements to reduce and control PM<sub>10</sub> emissions in the plan apply to a broad range of sources including: unpaved roads and shoulders, leaf blowers, unpaved parking lots, vacant lots, sweeping streets with certified sweepers, off-road vehicle use, open and recreational burning, residential wood burning, covered vehicle loads, dust generating operations, nonmetallic mineral processing, and other unpermitted sources. Table 4–1 lists the control measures included in the MAG 2012 Five Percent Plan.

**Table 4-1.** Control Measures included in the MAG 2012 Five Percent Plan for PM-10 for the Maricopa County Nonattainment Area.

<b>Arizona Revised Statutes (A.R.S.)</b>	<b>Description</b>
A.R.S. § 9-500.04. Only A.3., A.5., A.6., A.7., A.8., A.9. and H.	Air quality control; definitions [city and town requirements in Area A regarding targeting unpaved roads and shoulders; leaf blower restrictions; restrictions related to parking, maneuvering, ingress and egress areas and vacant lots; requirement for certified street sweepers]
A.R.S. § 9-500.27.	Off-road vehicle ordinance; applicability; violation; classification
A.R.S. § 11-871. Only A., B. and D.4.	Emissions control; no burn; exemptions; penalty [no burn restriction for any HPA day, increased civil penalty]
A.R.S. § 11-877.	Air quality control measures [county leaf blower restrictions]
A.R.S. § 28-1098. Only A. and C.1.	Vehicle loads; restrictions; civil penalties [for safety or air pollution prevention purpose]
A.R.S. § 49-424. Only 11.	Duties of department [develop and disseminate air quality dust forecasts for the Maricopa County PM-10 nonattainment area]
A.R.S. § 49-457.01.	Leaf blower use restrictions and training; leaf blower equipment sellers; informational material; outreach; applicability
A.R.S. § 49-457.03.	Off-road vehicles; pollution advisory days; applicability; penalties
A.R.S. § 49-457.04.	Off-highway vehicle and all-terrain vehicle dealers; informational material; outreach; applicability
A.R.S. § 49-457.05. Only A., B., C., D. and I.	Dust action general permit; best management practices; applicability; definitions
A.R.S. § 49-474.01. Only A.4., A.5., A.6., A.7., A.8., A.11., B. and H.	Additional board duties in vehicle emissions control areas; definitions [county requirements for stabilization of targeted unpaved roads, alleys and shoulders; restrictions related to parking, maneuvering, ingress and egress areas and vacant lots; requirement for certified street sweepers]
A.R.S. § 49-474.05.	Dust control; training; site coordinators
A.R.S. § 49-474.06.	Dust control; subcontractor registration; fee
A.R.S. § 49-501. Only A.2., B.1., C., F. and G.	Unlawful open burning; exceptions; civil penalty; definitions [ban on outdoor fires from May 1 to September 30; deletion of recreational purpose exemption; no burn day restrictions; penalty provision]
A.R.S. § 49-541. Only 1.	Definitions [Area A]
<b>Maricopa County Air Quality Department Rules</b>	<b>Description</b>
310	Fugitive Dust from Dust-Generating Operations Adopted 1/27/10 and submitted to EPA 4/12/10 [Notice of Final Rulemaking 75 FR 78167; 12/15/10]
310.01	Fugitive Dust From Non-Traditional Sources of Fugitive Dust Adopted 1/27/10 and submitted to EPA 4/12/10 [Notice of Final Rulemaking 75 FR 78167; 12/15/10]
314	Open Outdoor Fires and Indoor Fireplaces at Commercial and Institutional Establishments Adopted 3/12/08 and submitted to EPA 7/10/08 [Notice of Final Rulemaking 74 FR 57612; 11/9/09]



**Table 4–1 (Continued)**

<b>Maricopa County Air Quality Department Rules</b>	<b>Description</b>
316	Nonmetallic Mineral Processing Adopted 3/12/08 and submitted to EPA 7/10/08 [Notice of Final Rulemaking 74 FR 58553; 11/13/09]
Appendix C	Fugitive Dust Test Methods Adopted 3/26/08 and submitted to EPA 7/10/08 [Notice of Final Rulemaking 75 FR 78167; 12/15/10]
<b>Maricopa County Ordinance</b>	<b>Description</b>
P-26	Residential Woodburning Restriction Adopted 3/26/08 and submitted to EPA 7/10/08; [Notice of Final Rulemaking 74 FR 57612; 11/9/09]
<b>Appendices to the Plan</b>	<b>Description</b>
Appendix C, Exhibit 1	Arizona Revised Statutes Listed in Table 4-1
Appendix C, Exhibit 2	Maricopa County Resolution to Evaluate Measures in the MAG 2012 Five Percent Plan for PM-10 for the Maricopa County Nonattainment Area
Appendix C, Exhibit 3	Arizona Department of Environmental Quality Dust Action General Permit
Appendix C, Exhibit 4	Arizona Department of Environmental Quality Commitment to Revise the MAG 2012 Five Percent Plan for PM-10 for the Maricopa County Nonattainment Area if Necessary for the Emerging and Voluntary Measure

In addition to the statutes, rules and regulations listed in Table 4–1, other PM<sub>10</sub> reducing control measures (e.g., paving of unpaved roads, Agricultural Best Management Practices Program, Pinal County Fugitive Dust rules, etc.) have been committed to, and implemented by, local jurisdictions throughout the Maricopa County PM<sub>10</sub> nonattainment area, and incorporated into the Arizona SIP through prior PM<sub>10</sub> plans, such as the *Revised MAG 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area*, and in separate EPA actions.

### ***Implementation and Enforcement of Control Measures***

The Maricopa County Air Quality Department (MCAQD) is prepared to proactively respond to high wind events and protect human health and well-being. MCAQD's approach consists of two primary components: routine proactive inspections, as well as surveillance inspections, conducted both during and after significant events. MCAQD routinely inspects dust control-permitted sites and increases the frequency of inspections for permits covering areas of ten acres or more. Non-metallic surface mining sources under Rule 316 are also regularly inspected multiple times every year. Maricopa County also responds to the majority of air quality complaints within 24 hours.

Maricopa County monitors the five-day Maricopa County Dust Control Forecast issued by ADEQ to identify the potential for elevated PM<sub>10</sub> pollution levels due to high winds or stagnant conditions. When a High Pollution Advisory (HPA) is issued for Maricopa County, MCAQD conducts additional increased

surveillance before, during, and after the forecast event(s). MCAQD also conducts event surveillance and post-event activities after an exceptional event that had not been forecast (i.e., those instances in which an HPA had not been issued).

The Maricopa County Dust Control Forecast issued on July 28, 2016, indicated a Moderate risk for unhealthy PM<sub>10</sub> levels, due to possible gusty winds associated with thunderstorm outflows. Actual wind speeds were very intense on July 29, 2016 (sustained winds of 40 to 55 mph), leading to the exceedance at the Zuni Hills monitor.

Pre-event surveillance consists of surveying high-risk areas for any dust-generating activities, educating sources of the impending HPA event, and issuing violations for failure to comply with local, state, or federal regulations. During the event, MCAQD inspectors survey high-risk areas to confirm that control measures are in place, document any violations, and contact other regulatory agencies if necessary. Post-event activities include continued surveys of high-risk areas, re-inspecting sources within two business days of receiving a violation, and an internal MCAQD debriefing of event activities.

Currently, a total of 15 MCAQD air monitoring sites are equipped to allow the automatic reporting of monitored readings at 5-minute intervals. The real-time data reporting system includes a mechanism to alert MCAQD inspectors when PM<sub>10</sub> concentrations are elevated. The system allows MCAQD inspectors to review concentrations at the monitor and to consult the National Weather Service website to check for weather event activity. This capability allows the MCAQD responder to identify regional events and monitor specific issues. If necessary, the MCAQD responders can inform nearby stakeholders and local governments of the elevated PM<sub>10</sub> concentrations.

An evaluation of all inspection reports, air quality complaints, compliance reports, and other documentation indicate no evidence of unusual anthropogenic-based PM<sub>10</sub> emissions. During the time period of July 26 to August 1, 2016, MCAQD inspectors conducted a total of 327 inspections of permitted facilities, of which 218 were at fugitive dust sources.

During this 7-day period, a total of 43 Notice of Violations were issued county-wide for PM<sub>10</sub>- and non-PM<sub>10</sub>-related violations. No violations were issued to fugitive dust sources within a 4-mile radius of the exceeding Zuni Hills site.

Also during this 7-day period, a total of 143 vacant lots were inspected, but only four 60-day letters were issued for non-compliant vacant lots and/or unpaved parking lots. These vacant lots were not located within 4-miles of the exceeding Zuni Hills site.

MCAQD was prepared for any complaints received due to the high wind event. During the 7-day period from July 26 through August 1, 2016, MCAQD received 32 complaints, of which 25 were windblown dust or PM<sub>10</sub> related. Two of these complaints, located for the same construction source, were located within 4 miles of the exceeding Zuni Hills monitor. These complaints consisted of:

- A construction site at Happy Valley Rd and Lake Pleasant Pkwy was creating dust. The complaint occurred on 7/26/16.
- A construction site (same construction project as previous complaint) at 93rd Ave and Happy Valley Rd was creating dust. The complaint occurred on 7/26/16.

Inspections were completed for each of these complaints and no issues or violations were noted. Both complaints were closed out. Additionally, during the period of July 26, 2016 through August 1, 2016, no

unusual agricultural activity in the upwind vicinity of the exceeding Zuni Hills monitor was noted by the Arizona Department of Environmental Quality.

### ***Conclusion***

In summary, the information presented in this chapter addresses whether the high wind dust event on July 29, 2016 was not reasonably preventable or controllable. EPA's approval of the *MAG 2012 Five Percent Plan for PM-10 for the Maricopa County Nonattainment Area* on June 10, 2014 allows the control measures in that plan to be established as reasonable controls. Sustained wind speeds were above the high wind threshold during the event, making it less likely that uncontrolled anthropogenic sources were the main source of the windblown dust emissions. The natural and anthropogenic sources of windblown dust during the event were identified, along with the enforceable control measures in place and implemented during the event. Extensive documentation of enforcement of the implemented control measures was provided by the Maricopa County Air Quality Department and the Arizona Department of Environmental Quality, revealing no evidence of unusual anthropogenic-based PM<sub>10</sub> emissions. For these reasons, the information presented in this chapter clearly demonstrates that the high wind dust event on July 29, 2016 was neither reasonably preventable nor controllable.

## V. SUMMARY CONCLUSION

The documentation presented in the preceding chapters provides ample weight of evidence that the exceedance of the PM<sub>10</sub> standard on July 29, 2016 at the Zuni Hills monitor in the Maricopa County nonattainment area was caused by a high wind dust event, qualifying the exceedance for exclusion under the revised exceptional events rule. A bulleted summary of the demonstrations included in this documentation that meet the requirements of 40 CFR Sections 50.14(c)(3)(iv)(A) through (E) is provided below:

- The narrative conceptual model discussed the meteorological conditions (thunderstorm outflows) that led to the creation of the high wind dust event on July 29, 2016. The narrative highlighted that intense sustained winds of 40 to 55 mph and gusts up to 70 mph were sufficient to transport and generate windblown dust from natural sources and overwhelm reasonable controls on anthropogenic sources. The two main thunderstorm outflows which generated windblown dust originated in the desert areas of northern Maricopa County and central Pinal County. The windblown dust then transported into the Maricopa County PM<sub>10</sub> nonattainment area with the passing of the thunderstorm outflows. Tables and figures showing PM<sub>10</sub> concentrations during the event were included with the narrative, indicating the PM<sub>10</sub> concentrations on July 29, 2016 were elevated in conjunction with high winds and as compared to concentrations before and after the event.
- The monitored PM<sub>10</sub> concentration on July 29, 2016 at the exceeding Zuni Hills monitor was compared to historical concentrations at the site in several analyses. The analyses confirm a clear causal relationship between the exceedance and the high wind dust event as compared to historical high wind dust event days and non-exceedance days.

In addition to the comparison to historical concentrations, figures displaying the chronological and spatial distribution of wind, visibility and PM<sub>10</sub> concentration data confirm that (1) sustained winds above 25 mph were high enough to entrain significant windblown dust from natural desert areas and disturbed, anthropogenic source areas subject to reasonable controls; (2) PM<sub>10</sub> concentrations peaked when winds speeds peaked; and (3) visibility conditions at nonattainment area monitors where the thunderstorm outflow generated windblown dust passed over or by were degraded as a result of the transported windblown dust from the high wind dust event. These analyses taken as a whole provide strong weight of evidence that the high wind dust event affected air quality in such a way that there exists a clear causal relationship between the high wind dust event on July 29, 2016 and the PM<sub>10</sub> exceedance at the Zuni Hills monitor on July 29, 2016, thus satisfying the clear causal relationship criterion.

- The comparison to historical concentrations and the clear causal relationship demonstration found that high wind dust events can frequently recur at the exceeding Zuni Hills monitor and that the PM<sub>10</sub> emissions which caused the exceedance at the Zuni Hills monitor were associated with windblown dust generated and transported by sustained wind speeds that exceeded the default high wind threshold of 25 mph. EPA states that, “[f]or high wind dust events, if sustained wind speeds are above the high wind threshold and the anthropogenic emissions sources are reasonably controlled, it is more likely that human activity plays little or no direct role in causing emissions.” Since reasonable controls were in place on all significant anthropogenic sources of windblown



dust in the Maricopa County PM<sub>10</sub> nonattainment area during the event and sustained winds were greater than 25 mph, the high wind dust event on July 29, 2016, qualifies as a natural event.

- EPA's approval of the *MAG 2012 Five Percent Plan for PM-10 for the Maricopa County Nonattainment Area* on June 10, 2014 allows the control measures in that plan to be established as reasonable controls. Intense sustained wind speeds were well above the high wind threshold during the event, making it unlikely that uncontrolled anthropogenic sources were the main source of the windblown dust emissions. The natural and anthropogenic sources of windblown dust during the event were identified, along with the enforceable control measures in place and implemented during the event. Extensive documentation of enforcement of the implemented control measures was provided by the Maricopa County Air Quality Department and the Arizona Department of Environmental Quality, revealing no evidence of unusual anthropogenic-based PM<sub>10</sub> emissions. For these reasons, the high wind dust event on July 29, 2016 was neither reasonably preventable nor controllable.