Clark County Department of Air Quality

Exceptional Event Documentation for the April 15, 2013, PM_{10} High-Wind Transported Dust Exceedance Event

July 18, 2014

ACKNOWLEDGMENTS

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

Appendix A:	News & Media Coverage
Appendix B:	Summary of Refined Aeolian Emission Factors for Native Desert and Disturbed Vacant Land Areas (Final Report)
Appendix C:	Enforcement and Compliance Action, Air Quality Construction Advisories, Dust Advisories and Dust Alert notifications, and Photo Coverage for April 15, 2013
Appendix D:	Photo/Video Time Lapse Visibility Coverage from North Las Vegas Airport Cameras, and Clark County Wind Tunnel Studies DVDs
Appendix E:	30-Day Public Comment Period Website Postings and Responses to Comments Received during the 30-Day Comment Period

ACRONYMS AND ABBREVIATIONS

Acronyms

AQR	Clark County Air Quality Regulation
AQS	Air Quality System
BACM	Best Available Control Measures
CFR	Code of Federal Regulations
DAQ	Clark County Department of Air Quality
EPA	U.S. Environmental Protection Agency
HYSPLIT	Hybrid Single-Particle Lagrangian Integrated Trajectory
NAAQS	National Ambient Air Quality Standard
NCDC	National Climatic Data Center
NEAP	Natural Events Action Plan
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
PDT	Pacific Daylight Time
PST	Pacific Standard Time
VAR	variable winds/calm winds - no specific wind direction

Abbreviations

mb	millibar
mph	miles per hour
$PM_{2.5}$	particulate matter 2.5 microns or less in aerodynamic diameter
PM_{10}	particulate matter 10 microns or less in aerodynamic diameter
$\mu g/m^3$	micrograms per cubic meter

1.0 INTRODUCTION

1.1 CLARK COUNTY EXCEPTIONAL EVENT DOCUMENTATION OBJECTIVES

Clark County through its Department of Air Quality (DAQ) is requesting the U.S. Environmental Protection Agency (EPA) to review this exceptional event documentation. DAQ prepared this document for two purposes: first, Clark County wishes to obtain EPA concurrence that the 24-hour particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) concentration recorded on April 15, 2013, was an exceptional event caused by high winds and dust transported from a macro-weather event originating in southeast California and moved through the Baker, and Barstow, California area at 11:00 pm on April 14, 2013. This macro-weather event raised a large amount of dust and dropped visibility down to one-half mile. The large mass of suspended dust then moved north, east, and into parts of southern Nevada and northwest Arizona, hereinafter defined as "source area" (Figure 1). The high winds over the western Mojave Desert continued to transport suspended dust into Clark County throughout the remainder of the day of April 15, 2013. Second, Clark County wishes to eliminate consideration of the April 15, 2013, PM_{10} concentration in future assessments of historical fluctuations of PM_{10} concentrations.

1.2 DOCUMENT OVERVIEW

This document presents the justifications for classifying the high-wind transported dust event that occurred in the Ivanpah, Eldorado, and Las Vegas Valleys of Clark County, Nevada, on April 15, 2013, as an exceptional event. Subsection 1.3 reviews the conceptual model explaining the event, and Subsection 1.4 describes DAQ's notification and data-flagging processes. Subsection 1.5 summarizes the three valleys' climate, geography, and population.

Section 2.0, "Exceptional Event Documentation," discusses the exceptional event, Clark County's action plan, and EPA's documentation requirements. Subsection 2.1 summarizes the event. Subsection 2.2 outlines Clark County's Natural Event Action Plan (NEAP) for high winds with regard to notifying the public, posting of advisories/alerts, and the parameters for actions required by DAQ to protect public health. Subsection 2.3 describes the Exceptional Event Rule documentation requirements for demonstration submittals.

Subsection 2.4 contains EPA's four-part test as outlined in 40 Code of Federal Regulations (CFR) §50.14(c) (3) (iii). Specifically, Subsection 2.4.1 provides demonstration that the event satisfies the criteria set forth in 40 CFR §50.1(j); Subsection 2.4.1.1 describes how the event affected air quality; Subsection 2.4.1.2 explains why the event was not reasonably controllable or preventable; Subsection 2.4.2 describes the clear causal connection between the exceedances and the exceptional event; Subsection 2.4.3 explains how the event is associated with a measured concentration in excess of normal historical fluctuations, including background; and Subsection 2.4.4 describes how there would have been no exceedance or violation but for the event.

Section 3.0, "Event Data," presents data tables, graphs, and figures to make the case for the exceptional event finding. Subsection 3.1 covers the "Meteorology Assessment," an essential element of the conceptual model for the event demonstration. Subsection 3.1.1 summarizes weather associated with the event. Subsection 3.1.2 outlines the weather data resources used for the documentation package. Subsections 3.1.2.1–3.1.2.3 illustrate and highlight data sources, such as local climatological data, air quality monitoring stations' data, and weather charts used in this document. Subsection 3.2 contains the monitoring network measurement background and a description of how the system works and how data is obtained. Subsection 3.2.1 provides an explanation using data charts and maps of weather prior to the event of April 15, 2013. Subsection 3.2.2 presents weather data during the event using weather charts, data tables, graphs, and maps; and the National Oceanic and Atmospheric Administration (NOAA) Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) modeling results and graphical illustrations of the event. Subsection 3.2.3 presents weather data tables and the conditions after the event. Subsection 3.3 contains media coverage of the high-wind transported dust event. (Appendix A contains copies of the news releases from local newspapers and videos from local television stations.)

Section 4.0, "Emission Sources and Activity," covers all PM_{10} monitoring sites discussed in the report, including documentation of adjacent sources and activities, maps, and aerial photography.

Section 5.0, "Compliance and Enforcement Activity," covers the Best Available Control Measures (BACM) required by Clark County's state implementation plan. This Section describes the activities DAQ took regarding high-wind transported dust prior to, during, and after the forecast dust event. Subsection 5.1 outlines actions taken by the compliance and enforcement divisions of DAQ that ensured BACM was in effect throughout the local areas the day of and the day after the event. Subsection 5.2, "Precipitation in Potential Fugitive Dust Source Region," contains discussion of soil moisture contribution to fugitive dust in Clark County. Further, there is discussion of precipitation levels experienced in the County during 2012 and 2013 along with tables, maps, and figures to illustrate. Subsection 5.3, "Establishing Wind Thresholds for Clark County," outlines wind tunnel studies conducted in Clark County. These studies established thresholds of sustained winds of 25 miles per hour (mph) and/or gusts of 40 mph or more that overwhelm BACM, native desert, and disturbed stabilized vacant land. Appendix B contains the "Summary of Refined PM_{10} Aeolian Emission Factors for Native Desert and Disturbed Vacant Land Areas." (The full report is included in CD format in Appendix D, Section 3, "Photo/Video Event DVDs.")

Section 6.0, "Conclusion," summarizes the report's findings and requests EPA concurrence in flagging the April 15, 2013, exceedance as a high-wind transported dust exceptional event. The event was flagged in the EPA Air Quality System (AQS) on April 9, 2014, and was classified as "RJ" for high-wind and transported dust influenced event.

1.3 EXCEPTIONAL EVENT CONCEPTUAL MODEL

On April 15, 2013, an exceedance of the 24-hour National Ambient Air Quality Standard (NAAQS) for PM_{10} occurred in the Ivanpah Valley (Jean, Nevada), the Eldorado Valley (Boulder City) and the Las Vegas Valley. DAQ has conceptually characterized this as a high-wind regionally transported dust event. Monitored values were elevated throughout the Las Vegas Valley, where seven sites registered exceedances: Joe Neal (CAMS 0075) at 226 micrograms per cubic meter ($\mu g/m^3$); Jerome Mack (CAMS 0540) at 243 $\mu g/m^3$; Sunrise Acres (CAMS 0561) at 267 $\mu g/m^3$; J.D. Smith (CAMS 2002) at 237 $\mu g/m^3$; Paul Meyer (CAMS 0043) at 164 $\mu g/m^3$; Palo Verde (CAMS 0073) at 212 $\mu g/m^3$; and Green Valley (CAMS 0298) at 196 $\mu g/m^3$.

The monitoring site in Boulder City (CAMS 0601) in the Eldorado Valley experienced an exceedance concentration of 246 µg/m^3. In Jean, Nevada (CAMS 1019), 35 miles southwest of the Las Vegas Valley, the 24-hour PM_{10} measured exceedance concentration was 165 µg/m^3.

The high-wind regionally transported dust was caused by an strong pre-frontal trough that moved through the Baker and Barstow, California area at 11:00 pm on April 14, 2013, that raised a large amount of dust, dropping visibility down to one-half mile, as reported by the National Weather Service (NWS) observations and from the NWS forecast discussion. The large mass of suspended dust moved north and east and into parts of the southern Nevada and northwest Arizona "source area". The high winds over the western Mojave Desert continued to transport suspended dust into Clark County throughout the remainder of the day. Winds in Clark County reached and exceeded threshold levels by 6:00 pm and spurred a rapid increase in local dust levels, dropping visibility down to 1.5 miles. The elevated concentrations of dust continued throughout the night. Figure 2 illustrates the predominant dust and wind direction toward the Las Vegas Valley on April 14 and 15, 2013.

Anthropogenic sources in the vicinity of the monitoring sites played a small role in elevated PM_{10} levels due to average winds meeting threshold values for dust entrainment. Wind speeds during the day were at and above Clark County's established thresholds for dust re-entrainment, with an hourly average of 25 mph and greater, and with gusts at 30 mph and greater throughout all valleys affected. Figures 3 and 4 graphically illustrate the winds at Las Vegas airports on April 14, 2013, and into April 15, 2013.

DAQ has stringent controls in place to reduce dust from local anthropogenic sources, including BACM required by the PM_{10} Implementation Plan and the Clark County Air Quality Regulations (AQRs).

Section 5.0 documents how Dust Advisory notices were issued for this event. DAQ Compliance and Enforcement Division staff conducted visual inspections throughout all valleys to assure AQR compliance and to check that sources generated no additional dust. Photos from these inspections document the implementation of BACM on all relevant emission sources (Appendix C).

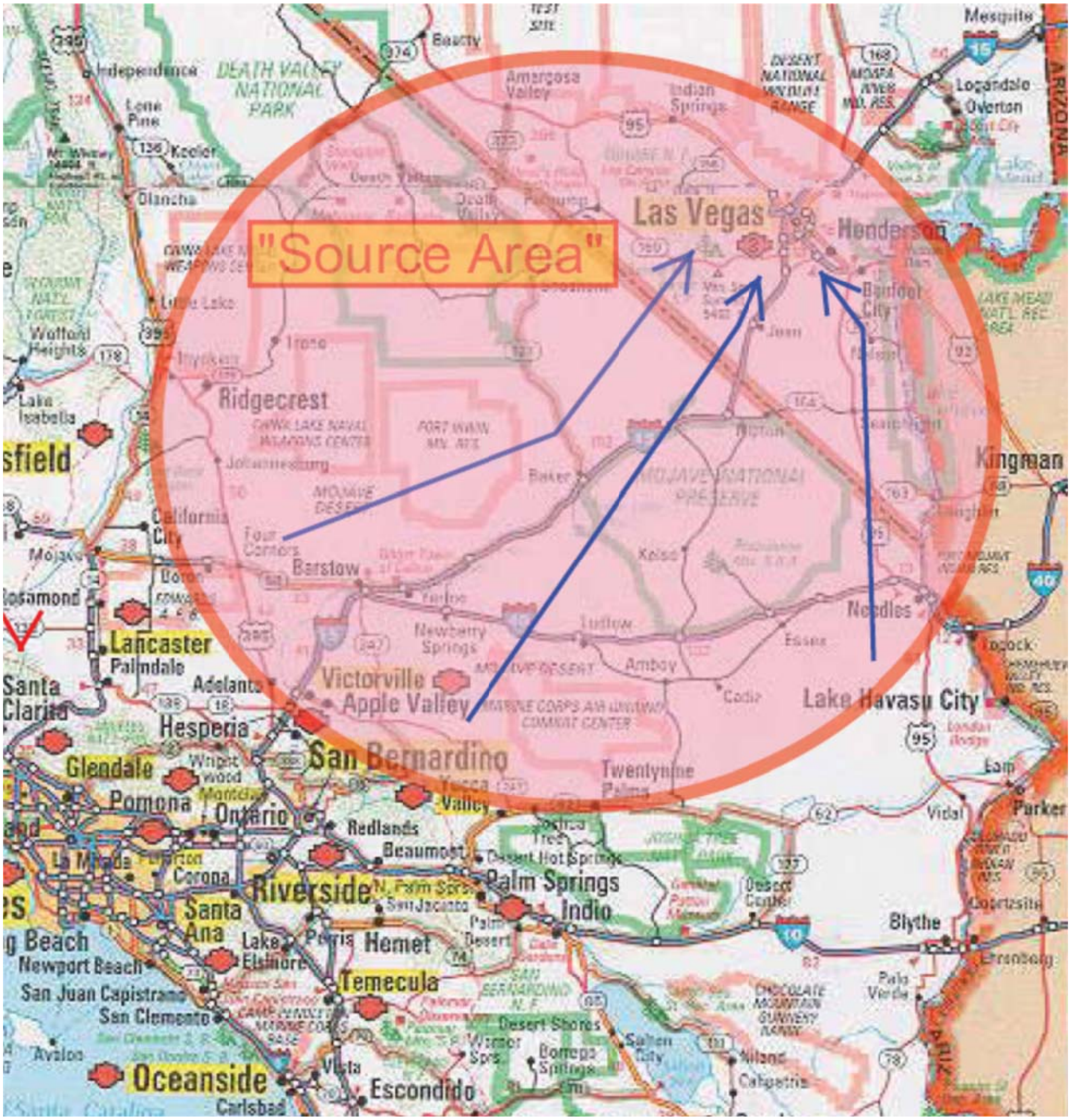

Figure 1. **"Source Area" on April 14–April 15, 2013**.

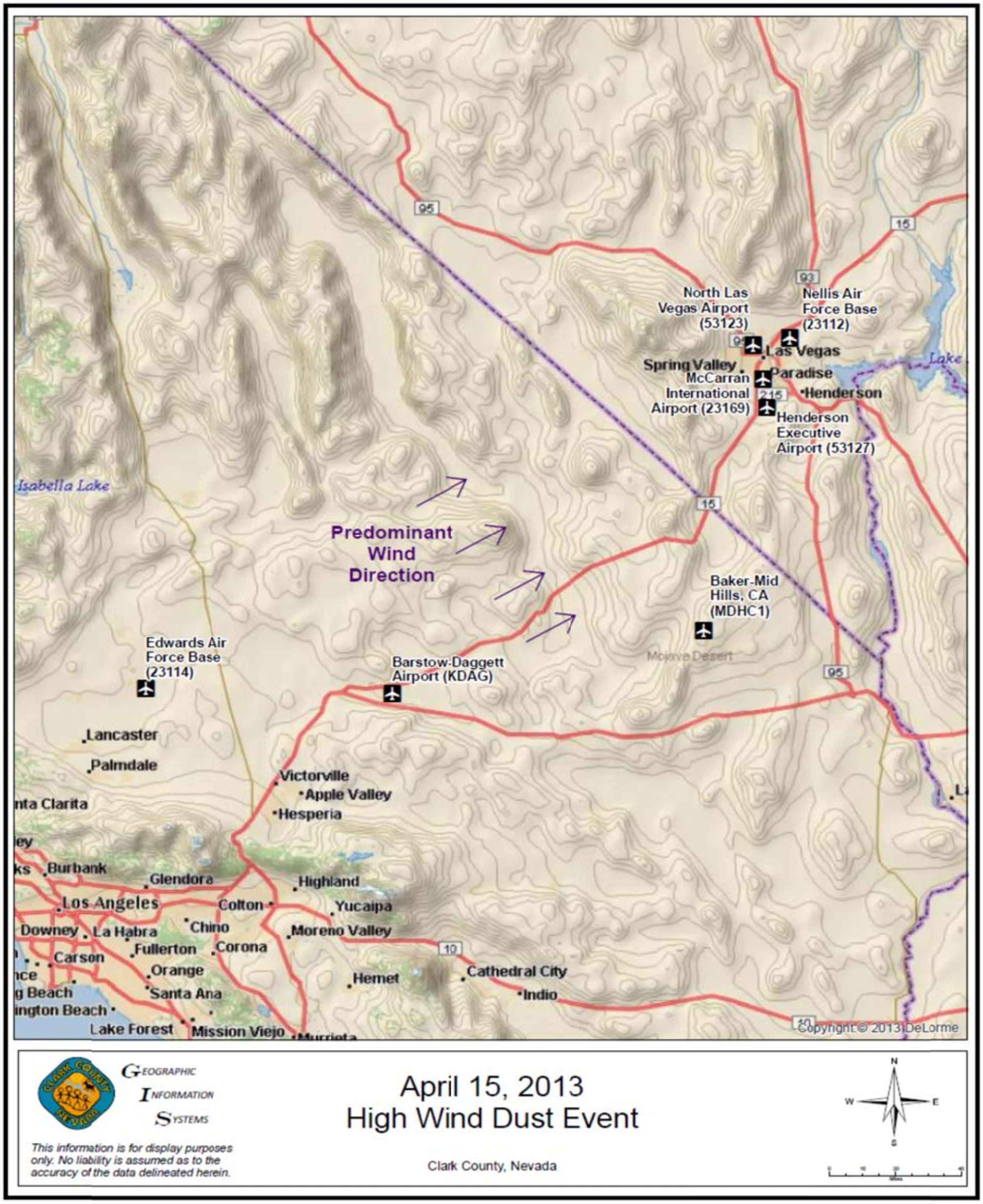

Figure 2. Predominant wind direction and dust flow on April 14–15, 2013.

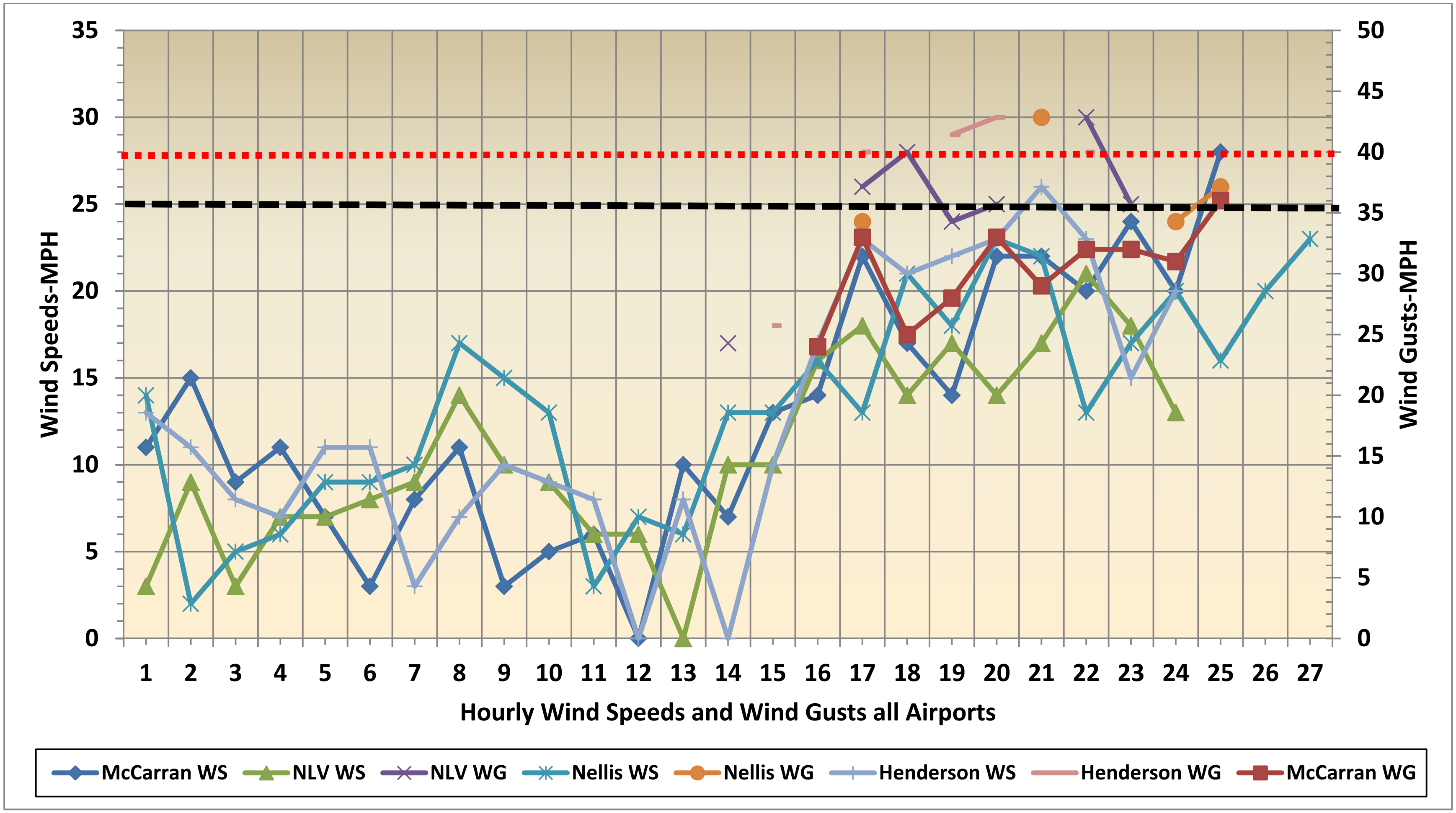

Figure 3. Las Vegas airports wind speeds on April 14, 2013.

Note in Figure 3 that the winds increased in the later hours of the day preceding the exceedance day with haze throughout the Las Vegas Valley.

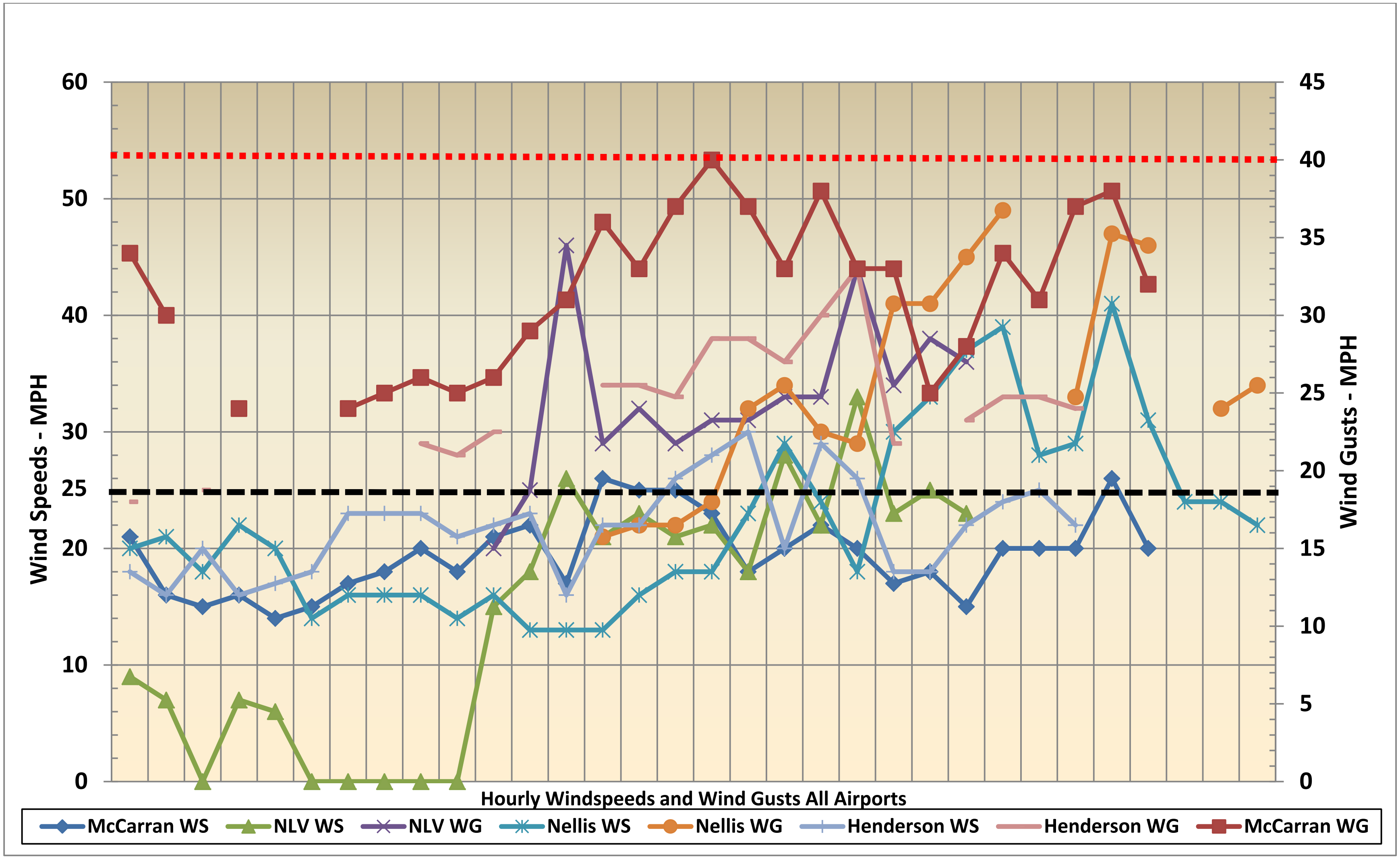

Figure 4. **Las Vegas airports wind speeds on April 15, 2013.**

Note in Figure 4 that winds were building in the early morning, peaked at midday, and remained consistently high. Individual meteorology at the monitoring sites remained high throughout the event and far exceeded Clark County's wind threshold for a high-wind event.

1.4 EXCEPTIONAL EVENT PROCESS

Clark County's *Natural Events Action Plan* (NEAP) and internal DAQ policy set forth the process for minimizing public health effects from high PM concentrations generated by high winds, sustained winds, and such meteorological anomalies as outflow boundaries or desert storms. DAQ performs meteorological forecasting to predict when winds or other meteorological events are likely to generate elevated PM concentrations; but this particular event was not evident until indicated by monitoring site instrument readings in the hours before sunrise (1:00–2:00 am) on April 15, 2013. The event started in the late evening of Sunday April 14, 2013, a time enforcement/compliance officers are not on duty.

Meteorological models and weather software can track desert storm conditions that can lead to dust transport, and sometimes can track dust storms for several miles if the event is already known or downwind of the monitoring domain. Normally, when wind speeds are predicted to reach established thresholds for high particulate concentrations, a wind advisory is broadcast to the public through multiple media channels. It is possible to forecast where and when desert storms will bring increased dust levels, but not always how long levels in an area will remain elevated, especially if wind speeds are moderate or high enough to distribute dust throughout a given area. DAQ broadcast an Air Quality Advisory during the early morning hours of the event day due to concentrations measured a few hours earlier; DAQ then broadcast an updated Air Quality Alert, necessary because PM_{10} concentrations and mass accumulations indicated that the PM_{10} monitoring network would record numerous exceedances, both outside the Las Vegas Valley and valley-wide, during the event day.

DAQ Compliance and Enforcement Division normally initiate a proactive enforcement program to ensure all applicable BACM are fully employed before high-wind events. Since this high-wind transported dust event occurred during the late hours before midnight on a Sunday and continued full force during the early hours of Monday, when compliance officers were off-duty, there was no pre-event compliance activity. However, Compliance deployed all available field enforcement staff during the event to inspect historically high emission sources and areas, and staff was able to document through photographs many obvious high dust concentration levels that were not coming from local sources (Appendix C).

Following the event, DAQ Planning and Engineering Divisions conduct a preliminary assessment to determine what may have caused the exceedance and whether an initial data flag in the EPA AQS is appropriate. If a data flag for high-dust conditions as a result of a high-wind transported dust event is warranted, the Planning Division initiates a more in-depth assessment to determine if all conditions necessary to document an exceptional event are applicable to the exceedance. The Planning Division, in collaboration with the Monitoring and Compliance Divisions, documents that timely advisories were issued; that there is a clear causal relationship between the high-wind transported dust and exceedance(s); that inspections/enforcement occurred; and that implementation of BACM was documented. If these requirements are met, the

Planning Division develops detailed exceptional events documentation. Following completion of the documentation, a minimum of 30 days is provided for public comment, after which DAQ may or may not make revisions to the documentation. The documentation is then submitted to EPA for review and consideration for concurrence finding.

1.5 GEOGRAPHY, POPULATION, AND CLIMATE

The Las Vegas Valley is located in Clark County, at the southern tip of Nevada. It encompasses about 600 square miles, running northwest to southeast. A downward slope from west to east affects local climatology, driving variations in wind, precipitation, and storm water runoff. The surrounding mountains extend 2,000 to 10,000 feet above the valley floor. The Sheep Range bounds the valley on the north, and the McCullough Range bounds it on the south. The Spring Mountains, at the west edge of the valley, include Mount Charleston, the region's highest peak at 11,918 feet. The east rim of valley is formed by the River Mountains.

The Las Vegas Valley remains one of the fastest-growing metropolitan areas in the nation, although growth slowed during the economic downturn of 2008–2010. The valley began to rebound in 2011, and continues to grow at a slower but continuous rate. The population expanded from about 400,000 in 1980 to 2.0 million in 2013.[1] The cities of Las Vegas, North Las Vegas, and Henderson comprise the Las Vegas metropolitan area, which is located in Hydrographic Area 212, a PM_{10} nonattainment area. Seven of the nine monitoring sites discussed in this exceptional event package are in the Las Vegas Valley.

Official weather observations in the Las Vegas area began in 1937 at what is now Nellis Air Force Base. In 1948, the U.S. Weather Bureau moved to McCarran Field (now McCarran International Airport), seven miles south of downtown Las Vegas. The airport is approximately five miles southwest of, and 300 feet higher than, the lowest part of the valley.

The valley climate is pleasant most of the year; however, during the summer (June–August), temperatures normally climb above 100°F, and the relative humidity can rise above 90%. Summers are characterized by hot days, warm nights, and mild winds, especially during the recent drier years. Strong wind episodes in the summer are usually connected with thunderstorms, and are thus more isolated and localized. The relative humidity increases for several weeks each summer in association with a moist monsoonal flow from the south, typically during July and August. These moist winds support the development of spectacular desert thunderstorms, which are frequently associated with significant flash flooding and/or strong downburst winds. Northwestern Arizona experiences the same type of weather, which can influence air quality; southeasterly winds and air flows from the southeast and/or southwesterly winds and air flows from the southwest move into southern Clark County during high-wind transported dust events.

Winters are mild and pleasant. Afternoon temperatures average near 60°F, and skies are mostly clear. Pacific storms occasionally produce rainfall in the Las Vegas Valley, but in general, the Sierra Nevada Mountains of eastern California and the Spring Mountains immediately west of the valley act as barriers to moisture.

[1] *Clark County, Nevada, 2013 Population Estimates*, Clark County Department of Comprehensive Planning.

Winter and spring wind events often generate widespread areas of blowing dust and sand. Problematic windstorms are common during late winter and spring, with winds predominantly coming from the southwest.

1.6 30-DAY PUBLIC COMMENT PERIOD

Clark County posted the April 15, 2013, PM_{10} High-Wind Transported Dust Exceedance Event document and the supporting Appendices on the Clark County DAQ Web site for a 30-day public comment period effective Wednesday, June 18, 2014 through Friday, July 18, 2014 at 5:00 pm. DAQ received no comments on the April 15, 2013 PM_{10} High-Wind Transported Dust Exceedance Event document including its Appendices. A statement in Appendix E documents this fact.

2.0 EXCEPTIONAL EVENT DOCUMENTATION

2.1 SUMMARY OF EVENT DAY

As noted in Subsection 1.3, high-wind regionally transported dust caused by a strong pre-frontal trough that moved through the Baker and Barstow, California area on April 14, 2013, raised a large amount of dust, which dropped visibility down to one-half mile. The large mass of suspended dust moved north and east and into parts of southern Nevada and northwest Arizona source area. High winds over the western Mojave Desert continued to transport suspended dust into Clark County throughout the remainder of the exceedance day and caused PM_{10} exceedances at nine PM_{10} sites in the Clark County monitoring network (Figure 5). The monitoring sites in Boulder City and Jean, Nevada, were the first affected by the predominant wind direction and dust flows. These two sites recorded very high PM_{10} masses at approximately 0000 (midnight) and high PM_{10} hourly concentrations through 8:00 pm. The rest of the PM_{10} sites in the Las Vegas Valley followed this trend, starting with the south-central valley sites (Green Valley) and eastern sites (JD Smith/Sunrise Acres and Jerome Mack), and then the western sites (Joe Neal, Paul Meyer and Palo Verde) which sampled high masses and the resultant high concentrations (Figure 6). Anthropogenic sources near the monitoring sites did not play a significant role in the elevated PM_{10} levels at the sites.

2.2 NATURAL EVENTS ACTION PLAN FOR HIGH-WIND EVENTS

The Clark County Board of County Commissioners adopted the NEAP in April 2005. Protection of the public health is the foundation of the NEAP, which outlines procedures for warning of impending wind events, notifying the public of wind events in progress, and educating the citizens of Clark County on the health hazards of particulate matter.

DAQ developed the NEAP with the assistance of stakeholders from many Clark County agencies, organizations, and private citizens. Its primary components are:

- A high-wind event notification system with an early warning procedure.
- Education and outreach programs.
- Enhanced enforcement and compliance programs to reduce emissions.
- A system to submit required documentation to EPA when an exceptional event causes a NAAQS exceedance.

Improvements or enhancements to Clark County's natural events program are made as needed, such as the future publishing of the Transported Dust Action Plan. One example of enhancement is the high-wind exceptional event exercise drill, conducted each year before the windy season to familiarize staff with procedures and identify potential problem areas. This drill, along with other enhancements, provides an essential tool to evaluate processes that help DAQ reduce the health and environmental effects of PM_{10}.

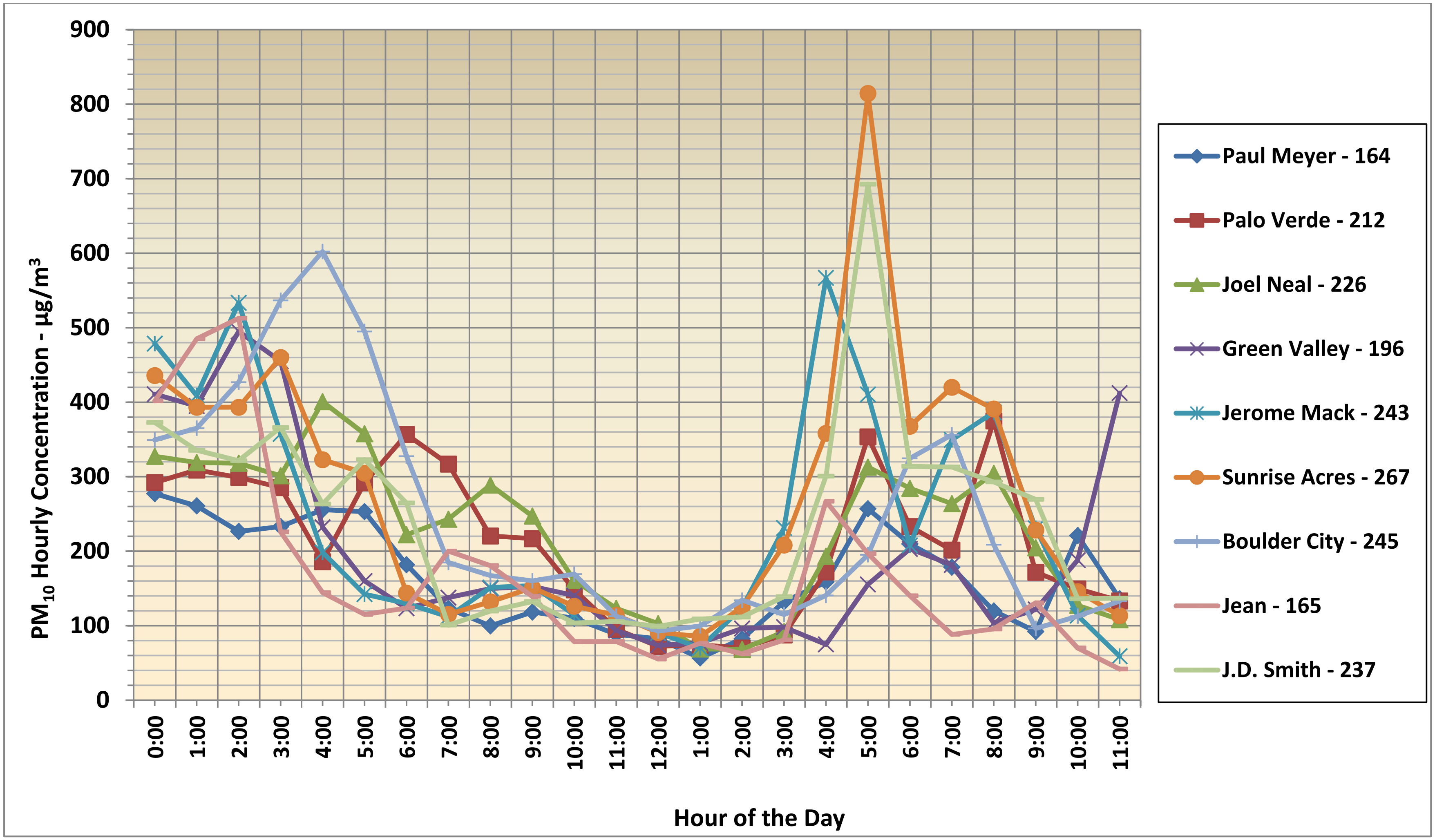

Figure 5. PM_{10} 24-hour NAAQS on April 15, 2013 (exceedance event day).

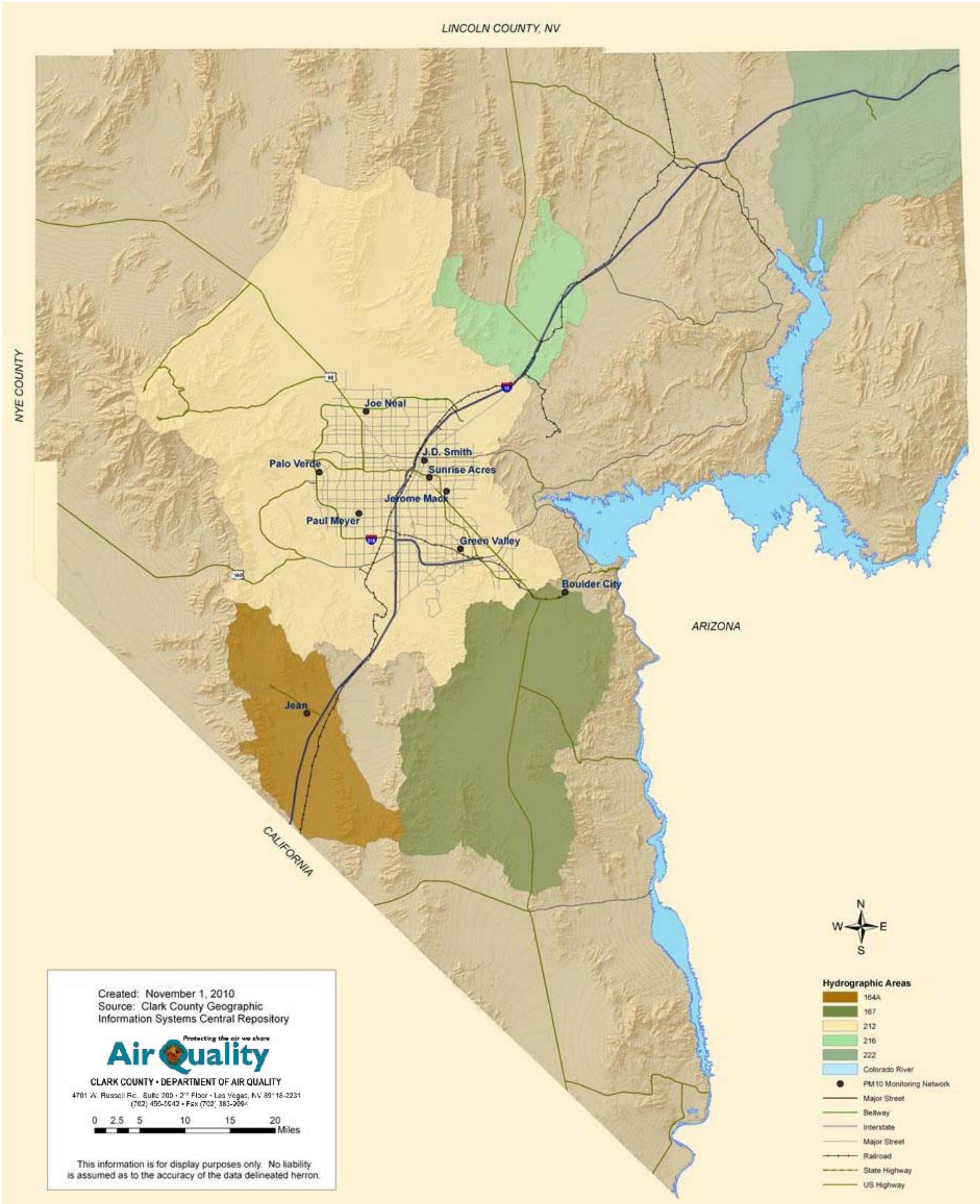

Figure 6. PM_{10} high-wind transported dust event monitoring sites, Clark County, NV.

The only EPA guidance in effect when the NEAP was developed was a 1996 EPA policy memorandum entitled "Areas Affected by PM_{10} Natural Events," which described the requirements for natural event data flagging and for developing a NEAP. The 1996 policy allowed air quality data to be flagged in the EPA AQS so NAAQS exceedances would not count toward an area's attainment status if it can be shown there was a clear causal relationship between the data and one of three categories of natural events: volcanic and seismic activity; unwanted wild land fires; and high-wind events.

On March 22, 2007, EPA promulgated the final rule addressing the review and handling of air quality monitoring data influenced by exceptional events in the *Federal Register*, volume 72, page 13560 (72 FR 13560). This rule defined exceptional events as those for which the normal planning and regulatory process established by the Clean Air Act are not appropriate.

Clark County NEAP procedures had been effective since their adoption, and the improvements DAQ made to comply with the exceptional event rule created an even stronger program. DAQ now provides more information to EPA in event submittals, and has enhanced early warning processes to better inform the regulated community and the public.

2.3 EXCEPTIONAL EVENTS RULE DOCUMENTATION REQUIREMENTS

In Title 40, Part 50.1(j) of the CFR, EPA defines an exceptional event as an event that affects air quality, is not reasonably controllable or preventable, is an event caused by human activity that is unlikely to recur at a particular location, or a natural event, and is determined by the Administrator in accordance with 40 CFR 50.14 to be an exceptional event. It does not include stagnation of air masses or meteorological inversions, a meteorological event involving high temperatures or lack of precipitation, or air pollution related to source noncompliance.

Subsection 319(b)(3)(B)(i) of the 1990 Clean Air Act Amendments requires a state air quality agency to demonstrate through "reliable, accurate data that is promptly produced" that an exceptional event occurred. Subsection 319(b)(3)(B)(ii) requires that "a clear causal relationship be established" between a measured exceedance of a NAAQS and an exceptional event, demonstrating "that the exceptional event caused a specific air pollution concentration at a particular location" (72 FR 13561).

2.4 EXCEPTIONAL EVENT CRITERIA

The data and analysis in this document show that the exceedances of the 24-hour PM_{10} NAAQS at the Boulder City (CAMS 0601), Jerome Mack (CAMS 0540 [NCore]), Sunrise Acres (CAMS 0561), J. D. Smith (CAMS2002), Joe Neal (CAMS 0075), Paul Meyer (CAMS 0043), Palo Verde (CAMS 0073), Jean (CAMS 1019), and Green Valley (CAMS 0298) monitoring sites on April 15, 2013, satisfied the following exceptional event criteria.

2.4.1 The Event Satisfies the Criteria Set Forth in 40 CFR 50.1(j).

2.4.1.1 <u>The Event Affected Air Quality.</u>

Table 1 shows that hourly PM_{10} concentrations at the Jean monitoring site were low, but began to climb at 7:00 pm on April 14, 2013, with the arrival of the high-wind transported dust from California and Arizona. Table 3 shows that the winds and PM_{10} concentrations the next day were back to daily values typical of the month of April in Clark County. Table 2 and Figure 7 show that hourly PM_{10} concentrations increased rapidly with the arrival of the transported dust, most significantly between the hours of midnight and 6:00 pm Pacific Standard Time (PST).[2] Figure 7a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the high wind speeds coincide with the high hourly PM_{10} concentrations caused by deposition. Source-generated dust was not a factor. By early afternoon, hourly sustained winds and hourly peak wind gusts had again increased, blowing the bulk of the dust out of the Ivanpah Valley, roughly 35 miles southwest of the Las Vegas Valley, toward both the Eldorado and Las Vegas Valleys. This trend continued to wash out the dusty mass of air pollution on a path to the northeast toward the Eldorado and Las Vegas Valleys (Figures 1 and 2).

Table 4 shows that hourly PM_{10} concentrations at the Boulder City monitoring site were low, but began to climb at 8:00 pm on April 14, 2013, with the arrival of the high-wind transported dust from California and Arizona and the Ivanpah Valley (Jean, Nevada). Table 6 shows that the following day the winds and PM_{10} concentrations were back to daily values typical of the month of April in Clark County. Table 5 and Figure 7 show that hourly PM_{10} concentrations increased rapidly with the arrival of the transported dust, most significantly between the hours of midnight and 8:00 pm. Figure 7a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the high wind speeds coincide with the high hourly PM_{10} concentrations caused by deposition. Source-generated dust was not a factor. By early afternoon, hourly sustained winds and hourly peak wind gusts had again increased, blowing the bulk of the dust out of the Eldorado Valley and into the Las Vegas Valley. This trend continued to wash out the dusty mass of air pollution on a path to the northeast and northwest of the Las Vegas Valley, causing exceedance-level concentrations at seven other monitoring sites within the predominant northeasterly and northwesterly air flows (Figures 1 and 2). It was not until 1:00 am on April 16, 2013, that the Boulder City monitoring site began to exhibit normal background concentrations.

Table 7 shows that hourly PM_{10} concentrations at the Green Valley monitoring site were low, but began to climb at 8:00 pm on April 14, 2013, with the arrival of the high-wind transported dust from California, Arizona, Ivanpah Valley (Jean, Nevada), and Boulder City. Table 9 shows that after 1:00 am on April 16, 2013, the winds and PM_{10} concentrations were back to daily values typical of the month of April in Clark County. Table 8 and Figure 8 show that hourly PM_{10} concentrations increased rapidly with the arrival of the transported dust, most significantly between the hours of midnight and 11:00 pm. Figure 8a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the high wind speeds coincide with the high hourly PM_{10} concentrations caused by deposition. Source-generated dust was not a factor. By late afternoon, hourly sustained winds and hourly peak wind gusts had again increased, blowing the bulk of the dust out of the Green Valley area into the other areas of the Las Vegas Valley. High concentrations and above average winds remained in the vicinity of the Green Valley monitor for most of the day. The dust mass pushed to the northeast and northwest

[2] DAQ monitoring network and EPA AQS system operate on PST throughout the year, although Nevada was on PDT at the time of the event. DAQ monitoring data is recorded and presented in PST unless otherwise noted.

of the Las Vegas Valley, causing exceedance-level concentrations at six other monitoring sites within the predominant northeasterly and northwesterly air flows (Figures 1 and 2). It was not until 1:00 am on April 16, 2013, that the Green Valley monitoring site began to exhibit normal background concentrations.

Table 10 shows that hourly PM_{10} concentrations at the Jerome Mack (NCore) monitoring site were low, but began to climb at 8:00 pm on April 14, 2013, with the arrival of the high-wind transported dust from California, Arizona, Ivanpah Valley (Jean, Nevada), and Boulder City into the Las Vegas Valley. Table 12 shows that after 0000 hours on April 16, 2013, the winds and PM_{10} concentrations were back to daily values typical of the month of April in Clark County. Table 11 and Figure 9 show that hourly PM_{10} concentrations increased rapidly with the arrival of the transported dust, most significantly between 0000 and 9:00 am on the event day. Figure 9a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the wind speeds coincide with the high hourly PM_{10} concentrations caused by deposition. Source-generated dust was not a factor. Hourly sustained winds and hourly peak wind gusts had increased again from 3:00 pm through approximately 9:00 pm, continually blowing the high-wind transported dust toward the next monitoring site in the network (Sunrise Acres). Increasing winds continued to wash out the dusty mass to the northeast and northwest of the valley. The Jerome Mack site had begun to exhibit normal background concentrations by approximately 11:30 pm on April 15, 2013.

Table 13 shows that hourly PM_{10} concentrations at the Sunrise Acres monitoring site were low, but began to climb at 8:00 pm on April 14, 2013, with the arrival of the high-wind transported dust from California, Arizona, Ivanpah Valley (Jean, Nevada), and Boulder City into the Las Vegas Valley on a predominant north by northeast direction from the Jerome Mack site toward the Sunrise Acres and the J.D. Smith monitoring sites. Table 15 shows that after 1:00 am on April 16, 2013, the winds and PM_{10} concentrations were back to daily values typical of the month of April in Clark County. Table 14 and Figure 10 show that hourly PM_{10} concentrations increased rapidly with the arrival of the transported dust, most significantly from 0000–9:00 am. Figure 10a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the high wind speeds coincide with the high hourly PM_{10} concentrations caused by deposition. Source-generated dust was not a factor. Hourly sustained winds and hourly peak wind gusts had increased again from 3:00 pm through approximately 9:00 pm, continually blowing the high-wind transported dust toward the next monitoring site (J.D. Smith) in a predominant north by northeast direction No significant local dust was coming from PM sources in the area. Increasing winds continued to wash out the dusty mass of air pollution, and by midnight the Sunrise Acres site had begun to exhibit normal background concentrations.

Table 16 shows that hourly PM_{10} concentrations at the J. D. Smith monitoring site were low, but began to climb at 8:00 pm on April 14, 2013, with the arrival of the high-wind transported dust from California, Arizona, Ivanpah Valley (Jean, Nevada), and Boulder City into the Las Vegas Valley on a predominant north by northeast direction from the Jerome Mack site toward the Sunrise Acres and the J.D. Smith monitoring sites. Table 18 shows that after 0000 on April 16, 2013, the winds and PM_{10} concentrations were back to daily values typical of the month of April in Clark County. Table 17 and Figure 11 show that hourly PM_{10} concentrations increased rapidly with the arrival of the transported dust, most significantly from 0000–9:00 am. Figure 11a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the high wind speeds coincide with the high hourly PM_{10} concentrations caused by deposition. Source-generated dust was not a factor. Hourly sustained winds and hourly peak wind gusts had increased again by 3:00 pm through approximately midnight, continually blowing the high-wind transported dust toward the next monitoring site (Joe Neal) in a predominant north by northwest direction. No significant local dust was coming from PM sources in the area. Increasing winds continued to wash out the dusty mass of air pollution, and by 0000 on April 16, 2013, the J.D. Smith site had begun to exhibit normal background concentrations.

Table 19 shows that hourly PM_{10} concentrations at the Joe Neal monitoring site were low, but began to climb at 8:00 pm on April 14, 2013, with the arrival of the high-wind transported dust from California, Arizona, Ivanpah Valley (Jean, Nevada), and Boulder City into the Las Vegas Valley on a predominant north by northeast direction from the Jerome Mack site toward the Sunrise Acres, the J.D. Smith, and the Joe Neal monitoring sites. Table 21 shows that after 0000 on April 16, 2013, the winds and PM_{10} concentrations were back to daily values typical of the month of April in Clark County. Table 20 and Figure 12 show that hourly PM_{10} concentrations increased rapidly with the arrival of the transported dust, most significantly from 0000–10:00 am. Figure 12a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the high wind speeds coincide with the high hourly PM_{10} concentrations caused by deposition. Source-generated dust was not a factor. Hourly sustained winds and hourly peak wind gusts had increased again by 4:00 pm through approximately 10:00 pm, continually blowing the high-wind transported dust in a predominant north by northwest direction with some residual winds blowing and drifting southwesterly. No significant local dust was coming from PM sources in the area. Increasing winds continued to wash out the dusty mass, and by 0000 on April 16, 2013, the Joe Neal site had begun to exhibit normal background concentrations.

Table 22 shows that PM_{10} hourly concentrations at the Paul Meyer monitoring site were low on the day before the high-wind transported dust event. Table 23 and Figure 13 show that the concentrations began to climb at 4:00 am on April 15, 2013, with the arrival of the high-wind transported dust from the source area. Most of the transported dust affecting the site had already been in the Las Vegas Valley since the early morning of April 15, 2013, and had distributed throughout western areas of the monitoring domain. Figure 13a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the high wind speeds coincide with the high hourly PM_{10} concentrations caused by deposition. Source-generated dust was not a factor. Table 24 shows that the winds and PM_{10} concentrations spike after midnight April 15, 2013, through 6:00 am, on April 16, 2013. It wasn't until 9:00 am on April 16, 2013, that the daily values were back to concentrations typical of the month of April in Clark County.

Table 25 shows that PM_{10} hourly concentrations at the Palo Verde monitoring site were low, but began to climb at 8:00 pm on April 14, 2013, with the arrival of the high-wind transported dust from the source area and the eastern Las Vegas Valley monitoring sites. The dust path was northwest from the northeastern area of the valley. Table 25 and Figure 14 show that hourly PM_{10} concentrations increased rapidly with the arrival of the transported dust from the general direction of the eastern valley monitoring sites, most significantly between 0000 am and 10:00

am. Figure 14a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the high wind speeds coincide with the high hourly PM_{10} concentrations experienced mid-afternoon and into the late evening. Source-generated dust was not a factor. Hourly sustained winds and hourly peak wind gusts had increased by mid-afternoon, blowing the transported dust out of the Palo Verde monitoring site area. Increasing winds continued to wash out the dusty mass of air pollution to the west to northwest of the valley, and by 2:00 am April 16, 2013, the Palo Verde site began to exhibit normal background concentrations.

2.4.1.2 The Event Was Not Reasonably Controllable or Preventable.

As described in Section 5.0 ("Compliance and Enforcement Activity"), there were no unusual emission activities on the event day. Due to BACM level controls, local sources within a mile and a half radius of any of the monitoring sites in the PM_{10} network were not contributing measurable dust to the mix of air pollution from the event. As a result of winds above Clark County's wind velocity threshold acting on regional sources, combined with the regionally transported dust, caused the exceptional event.

Table 1. Jean monitoring site data for April 14, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2013	4	14	0000	6.83	208.01	14.9	25.26	31.87
2013	4	14	0100	5.42	181.84	12	29.84	40.15
2013	4	14	0200	6.58	205.92	12.3	39.94	76.78
2013	4	14	0300	7.52	255.29	11.5	37.13	111.58
2013	4	14	0400	5.04	288.49	9.5	33.01	141.63
2013	4	14	0500	5.78	291.37	9	34.3	172.63
2013	4	14	0600	3.26	208.58	6.5	21.65	193.77
2013	4	14	0700	4.63	170.06	10.7	36.35	227.48
2013	4	14	0800	4.27	129.08	11	32.63	256.64
2013	4	14	0900	5.86	79.11	15	26.08	280.74
2013	4	14	1000	6.21	76.83	15.4	21.97	301.38
2013	4	14	1100	4.19	141.89	13.2	21.44	319.54
2013	4	14	1200	6.07	173.59	18.1	25.96	342.04
2013	4	14	1300	9.94	189.74	22.2	24.69	364.76
2013	4	14	1400	10.73	234.75	22.7	23.6	386.13
2013	4	14	1500	15.78	247.33	30.4	25.01	408.24
2013	4	14	1600	18.54	245.82	31.8	23.29	428.34
2013	4	14	1700	13.95	227.93	28	16.11	443.82
2013	4	14	1800	14.7	223.47	25.6	39.22	478.33
2013	4	14	1900	11.59	232.53	25.7	116.28	589.79
2013	4	14	2000	15.3	185.47	33.4	257.79	827.6
2013	4	14	2100	17	194.9	31.2	466.04	1252.97
2013	4	14	2200	15.65	208.01	27.5	533.6	241.96
2013	4	14	2300	15.49	181.84	25.8	447.38	642.36

Table 2. Jean monitoring site data for April 15, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m³)	PM_{10} Mass Accumulation (µg)
2013	4	15	0000	13.16	209.96	25.1	401.68	179.42
2013	4	15	0100	14.1	199.69	23.6	485.05	602.5
2013	4	15	0200	9.46	205.54	18	512.63	1064.66
2013	4	15	0300	10.32	200.51	21.9	225.85	1275.35
2013	4	15	0400	11.75	213.37	20.3	144.38	1410.26
2013	4	15	0500	12.5	193.9	19.3	115.03	402.52
2013	4	15	0600	14.73	212.89	24.9	123.68	138.22
2013	4	15	0700	16.46	209.29	30.1	200.11	323.58
2013	4	15	0800	11.78	197.29	21.7	180.57	489.21
2013	4	15	0900	13.11	186.8	21.7	139.39	613.69
2013	4	15	1000	13.23	242.48	31.6	78.52	690.01
2013	4	15	1100	16.93	239.59	28.5	78.78	757.91
2013	4	15	1200	20.28	239.42	34.7	55.25	810.56
2013	4	15	1300	19.88	236.97	36.2	76.56	878.38
2013	4	15	1400	21.18	245.47	36.3	62.27	935.92
2013	4	15	1500	23.56	240.14	39.3	80.8	1014.15
2013	4	15	1600	30.4	237.51	47.9	267.04	1248.48
2013	4	15	1700	26.02	234.69	43.6	196.63	1428.05
2013	4	15	1800	24.06	238.63	41.7	140.13	120.6
2013	4	15	1900	23.16	238.1	38.3	88.3	122.36
2013	4	15	2000	28.12	241.77	53.4	95.56	214.26
2013	4	15	2100	32.39	231.25	51.8	130.63	333.69
2013	4	15	2200	25.67	229.25	46	70.03	398.61
2013	4	15	2300	22.13	223.97	40.4	41.8	435.35

Table 3. Jean monitoring site data for April 16, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Mass Accumulation (μg)
2013	4	16	0000	16.01	235.16	35.5	31.94	35.02
2013	4	16	0100	10.81	237.69	23.3	39.57	52.15
2013	4	16	0200	7.8	225.94	20	38.26	88.12
2013	4	16	0300	6.12	199.4	15.7	51.49	136.44
2013	4	16	0400	9.18	223.89	16.5	68.67	203.3
2013	4	16	0500	9.24	247.08	20.1	72.88	272.05
2013	4	16	0600	16.33	254.21	29.3	57.3	324.14
2013	4	16	0700	19.27	276.59	32	45.95	368.25
2013	4	16	0800	22.21	285.08	34	37.8	403.35
2013	4	16	0900	19.67	288.07	32.7	25.38	427.63
2013	4	16	1000	19.81	279.27	34.7	10.75	438.74
2013	4	16	1100	16.09	271.48	33.6	9.33	445.23
2013	4	16	1200	16.48	272.82	35.8	4.63	449.65
2013	4	16	1300	18	264.83	34.7	14.14	461.77
2013	4	16	1400	17.36	260.11	34.1	8.71	470.69
2013	4	16	1500	14.22	268.65	32.5	6.85	476.95
2013	4	16	1600	15.1	285.13	27.6	9.3	485.2
2013	4	16	1700	12.57	280.57	21.9	16.01	499.93
2013	4	16	1800	11	19.52	21.4	10	508.98
2013	4	16	1900	13.6	34.64	24.8	4.16	513.31
2013	4	16	2000	16.45	34.14	30.9	8.38	521.88
2013	4	16	2100	9.07	55.28	19	11.5	532.63
2013	4	16	2200	4.9	98.62	11.4	5.88	537.19
2013	4	16	2300	6.89	64.47	11.6	7.54	544.62

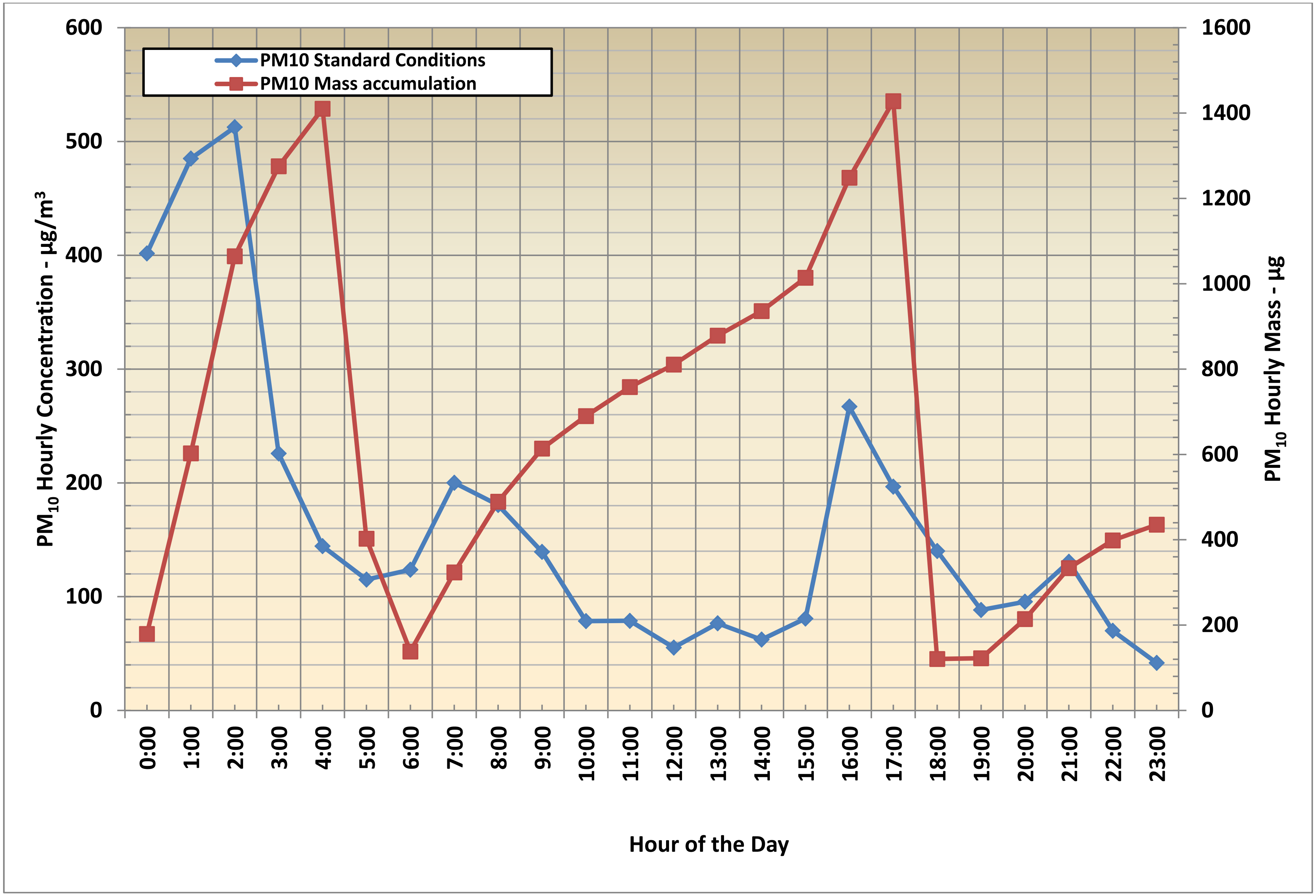

Figure 7. PM_{10} concentrations at Jean monitoring site, April 15, 2013.

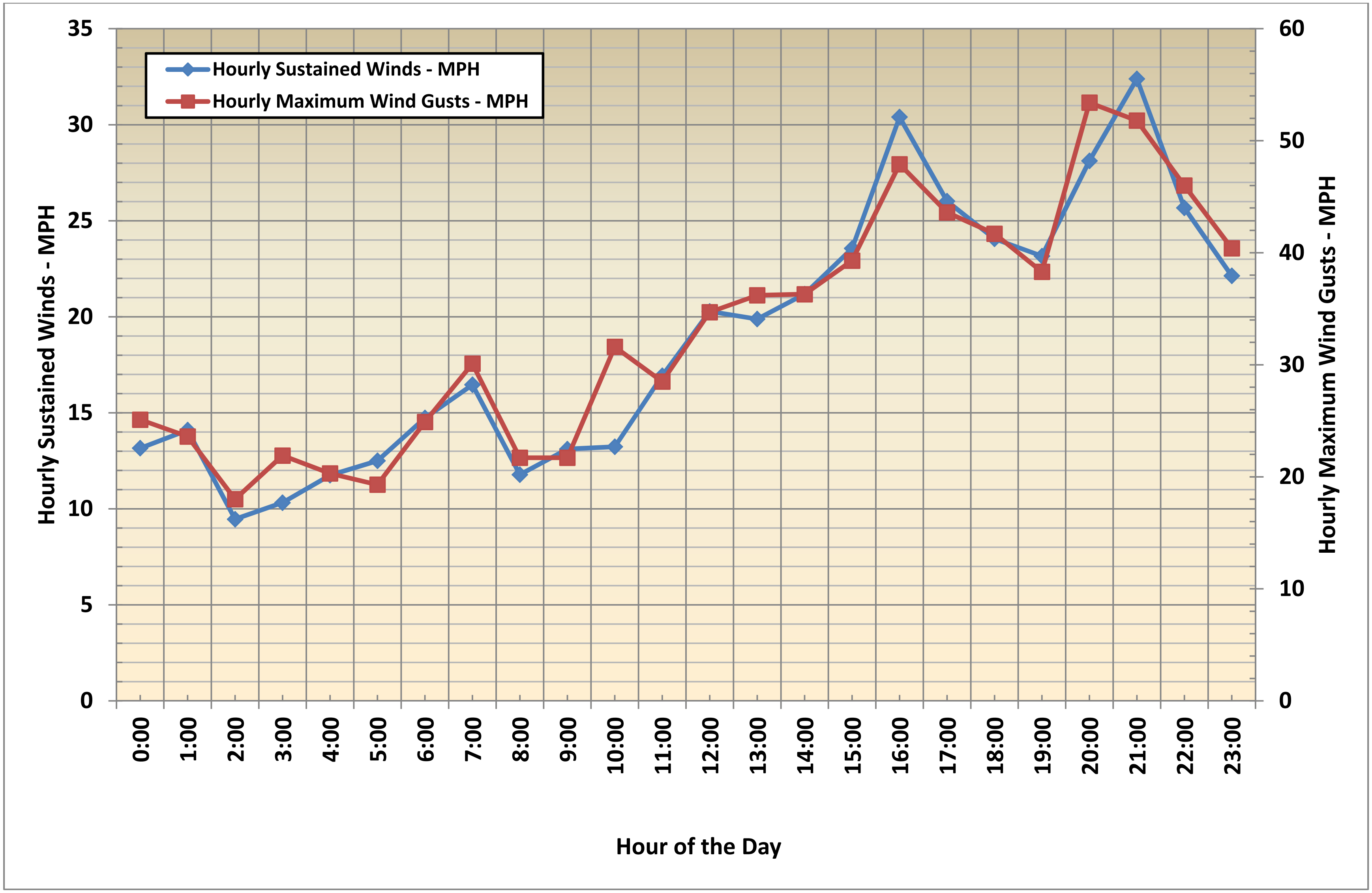

Figure 7a. Wind speeds at Jean monitoring site, April 15, 2013.

Table 4. Boulder City monitoring site data for April 14, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2013	4	14	0000	5.51	209.12	12.1	26.24	35.83
2013	4	14	0100	5.77	199.16	11.3	29.11	46.55
2013	4	14	0200	4.54	226.9	9.2	25.73	70.03
2013	4	14	0300	3.58	196.75	7.6	23.05	91.01
2013	4	14	0400	2.23	210.1	5.2	27.32	118.28
2013	4	14	0500	2.93	154.21	8	33.62	148.63
2013	4	14	0600	2.2	91.99	8	26.87	173.26
2013	4	14	0700	4.22	119.93	9.1	28.63	200.91
2013	4	14	0800	3.93	79.68	9.5	28.57	227.55
2013	4	14	0900	3.95	111.03	10.5	26.26	251.93
2013	4	14	1000	5.35	85.83	13.7	30.12	280.02
2013	4	14	1100	5.43	85.54	13.3	31.57	309.12
2013	4	14	1200	5.28	126.34	17.3	24.51	331.04
2013	4	14	1300	8	162.58	27.7	23.81	353.55
2013	4	14	1400	12.69	164.76	33.6	32.07	382.34
2013	4	14	1500	16.11	159.8	40.7	49.47	426.2
2013	4	14	1600	20.15	164.43	50.1	66.18	490.23
2013	4	14	1700	18.98	175.03	48	81.53	561.09
2013	4	14	1800	13.73	202.48	25.4	35.49	595.82
2013	4	14	1900	13.8	203.89	27.1	86.61	676.29
2013	4	14	2000	13.04	198.26	23.9	189.34	854.93
2013	4	14	2100	13.49	191.23	28.9	381.18	1209.78
2013	4	14	2200	11.38	189.86	34.4	503.96	373.76
2013	4	14	2300	9.29	185.06	20.3	419.65	562.36

Table 5. Boulder City monitoring site data for April 15, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2013	4	15	0000	5.87	199.32	11.7	349.32	177.82
2013	4	15	0100	7.58	191.2	14.1	365.03	493.86
2013	4	15	0200	8.08	200.78	16.2	426.93	894.54
2013	4	15	0300	8	195.98	14	536.79	930.67
2013	4	15	0400	8.48	202.1	15.3	602.22	455.11
2013	4	15	0500	6.22	206.82	11.8	495.02	916.9
2013	4	15	0600	7.69	196.45	15.8	327.61	1222.07
2013	4	15	0700	11.75	181.77	25.9	184.82	1394.79
2013	4	15	0800	11.53	168.31	23.1	167.32	212.85
2013	4	15	0900	10.29	189.86	40.6	160.12	207.88
2013	4	15	1000	9.82	193.79	23.9	169.32	363.64
2013	4	15	1100	13.31	216.38	27.4	112.73	467.38
2013	4	15	1200	13.02	216.56	26.6	92.65	551.86
2013	4	15	1300	14.18	208.97	29.8	99.67	645.39
2013	4	15	1400	17.32	214.71	45.9	134.17	765.8
2013	4	15	1500	19.06	216.89	38.3	115	871.25
2013	4	15	1600	17.48	205.34	37.8	140.64	999.87
2013	4	15	1700	21.63	204.28	39	195.17	1183.34
2013	4	15	1800	25.1	203.79	46.6	324.65	786.11
2013	4	15	1900	20.1	194.27	39	356.16	325.89
2013	4	15	2000	14.6	206.51	30.2	208.76	516.02
2013	4	15	2100	11.38	221.25	26.6	96.35	605.54
2013	4	15	2200	17.09	223.02	40	112.68	714.28
2013	4	15	2300	16.6	220.69	33.6	132.97	836.26

Table 6. Boulder City monitoring site data for April 16, 2013

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Mass Accumulation (μg)
2013	4	16	0000	16.14	222.75	30	62.53	57.01
2013	4	16	0100	14.95	221.61	29	40.58	63.27
2013	4	16	0200	15.58	224.45	28.8	38.76	99.21
2013	4	16	0300	11.93	218.95	22.6	31.1	128.68
2013	4	16	0400	12.46	219.26	23.5	32.22	161.22
2013	4	16	0500	11.48	218.48	22.3	54.52	213.57
2013	4	16	0600	9.49	204.44	20.5	68.4	278.61
2013	4	16	0700	10.57	201.55	20.3	61.61	338.93
2013	4	16	0800	6.98	219.76	20.5	39.86	376.42
2013	4	16	0900	7.37	253.49	20.8	30.91	405.13
2013	4	16	1000	5.83	267.53	17.3	24.14	427.35
2013	4	16	1100	6.93	319.51	20	19.38	446.77
2013	4	16	1200	6.18	321.98	17.2	19.23	465.67
2013	4	16	1300	8.07	304.83	22	21.16	485.07
2013	4	16	1400	12.22	312.78	30.2	23.01	508.9
2013	4	16	1500	12.59	336.79	33.1	38.35	542.58
2013	4	16	1600	11.41	330.97	30.4	8.74	552.17
2013	4	16	1700	14.41	18.87	38.2	18.55	569.04
2013	4	16	1800	10.56	4.45	30.4	7.83	576.77
2013	4	16	1900	14.79	13.71	35.9	16.71	592.72
2013	4	16	2000	13.88	19.28	34.2	14.9	607.43
2013	4	16	2100	11.62	25.24	21.4	2.02	609.2
2013	4	16	2200	4.81	8.85	17	0.93	609.89
2013	4	16	2300	6.79	337.03	20.4	1.69	609.29

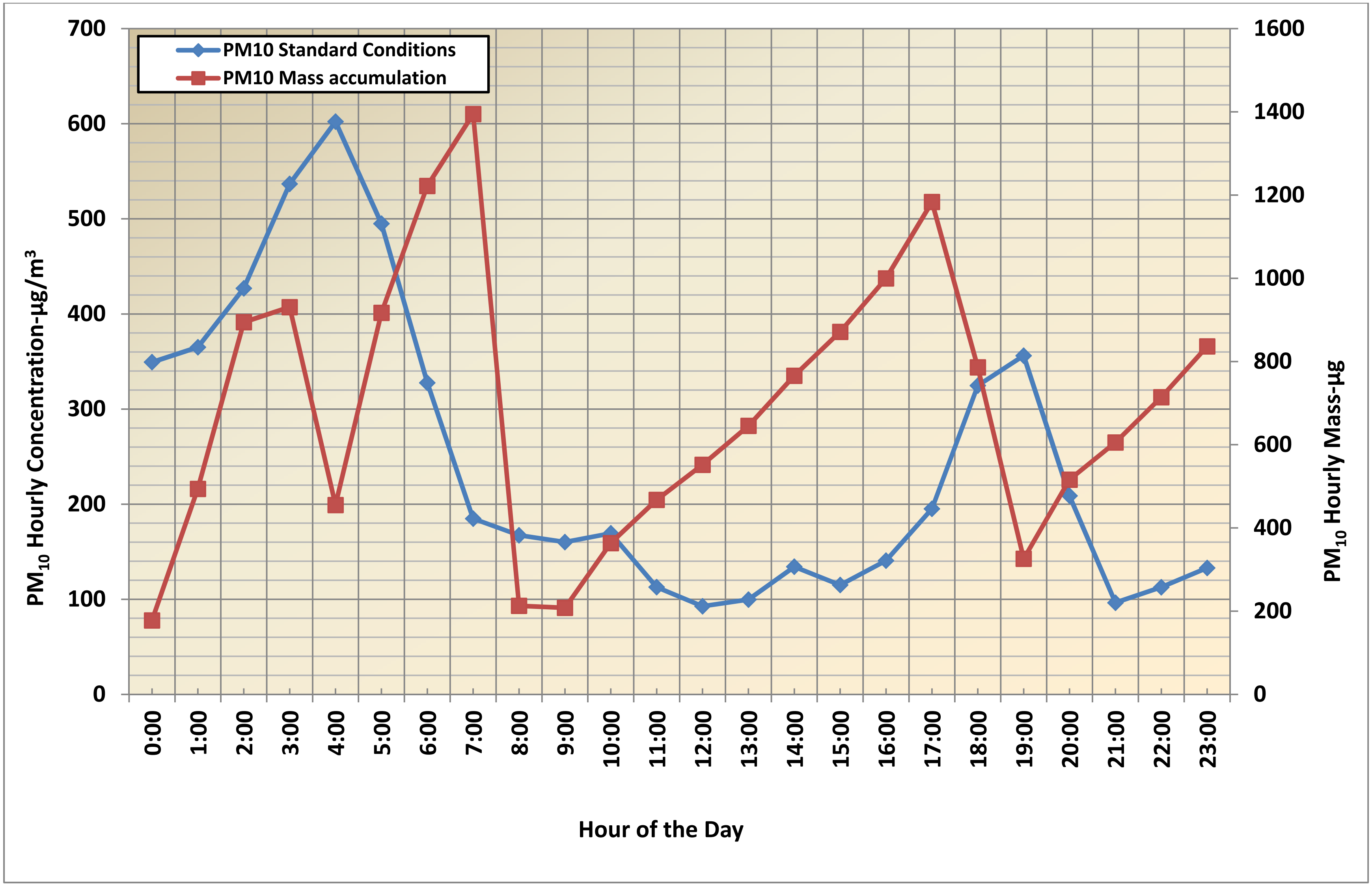

Figure 8. PM_{10} concentrations at Boulder City monitoring site, April 15, 2013.

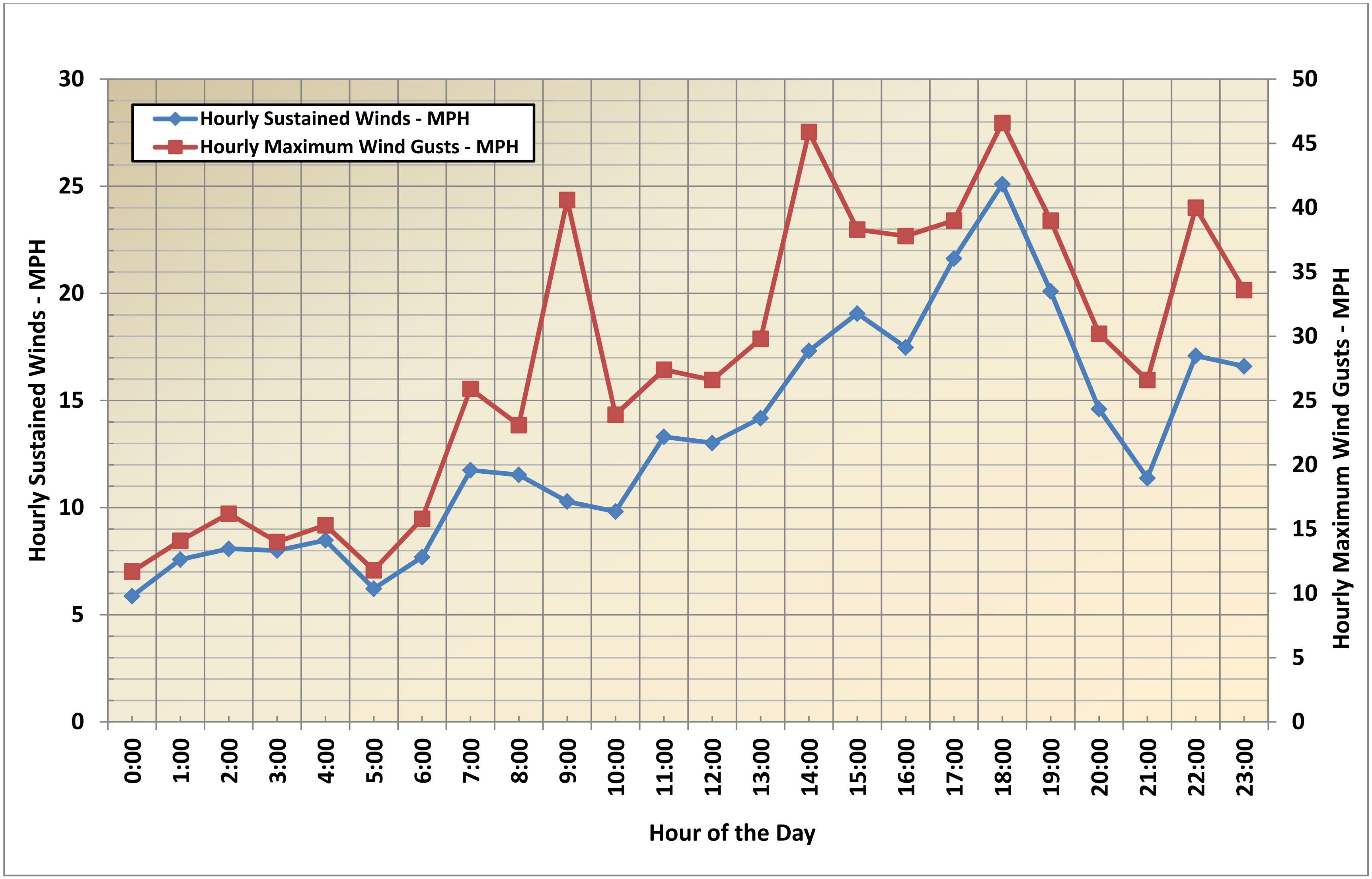

Figure 8a. **Wind speeds at Boulder City monitoring site April 15, 2013.**

Table 7. Green Valley monitoring site data for April 14, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Mass Accumulation (μg)
2013	4	14	0000	8.43	285.97	23.6	38.29	32.91
2013	4	14	0100	9.29	301.85	17.4	20.88	38.07
2013	4	14	0200	9.76	318.18	15.5	27.6	64.68
2013	4	14	0300	9.58	302.53	17	26.92	90.33
2013	4	14	0400	11.49	294.83	16.8	31.41	119.41
2013	4	14	0500	10.85	306.11	16.3	33.74	151.78
2013	4	14	0600	10.97	202.01	14.8	27.01	178.32
2013	4	14	0700	11.26	151.94	17.5	24.22	201.94
2013	4	14	0800	10.7	140.27	17.8	37.13	236.43
2013	4	14	0900	10.29	145.66	17.5	35.87	270.16
2013	4	14	1000	11.43	192.92	18	29.22	297.32
2013	4	14	1100	10.78	166.18	17.6	27.81	323.48
2013	4	14	1200	11.94	151.54	16.8	28.04	349.5
2013	4	14	1300	11.95	172.65	21.2	26.37	373.76
2013	4	14	1400	10.78	20.82	18.2	23.34	395.25
2013	4	14	1500	11.98	162.41	25.5	28.68	421.28
2013	4	14	1600	9.74	126.45	23.5	24.99	444.34
2013	4	14	1700	10.89	136.94	29.1	27.57	470.74
2013	4	14	1800	11.48	138.61	32.1	26	496.26
2013	4	14	1900	12.57	142.15	36.2	68.4	561.6
2013	4	14	2000	12.72	148.75	33.4	190.34	742.18
2013	4	14	2100	11.51	148.04	33.3	355.23	1077.94
2013	4	14	2200	10.79	154.82	33.4	501.62	645.62
2013	4	14	2300	8.37	231.22	32.1	468.92	470.13

Table 8. Green Valley monitoring site data for April 15, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2013	4	15	0000	10.22	225.92	31.1	410.8	191.29
2013	4	15	0100	10.03	239.06	29	394.88	558.27
2013	4	15	0200	9.34	253.98	30.1	495.02	1029.78
2013	4	15	0300	7.23	265.89	21.8	454.94	939.17
2013	4	15	0400	8.47	259.04	23.5	232.07	166.38
2013	4	15	0500	8.89	259.34	22.9	159.96	318.64
2013	4	15	0600	8.93	263.31	30.9	123.36	436.48
2013	4	15	0700	10.93	219.37	32.6	137.73	569.85
2013	4	15	0800	10.55	249.95	30.6	149.93	711.52
2013	4	15	0900	10.01	260.58	27.7	152.59	856.8
2013	4	15	1000	10.43	247.44	29.1	140.47	988.13
2013	4	15	1100	10.36	257.14	35.4	93.64	1076.36
2013	4	15	1200	10.48	279.2	31.5	73.57	1145.07
2013	4	15	1300	10.58	283.01	29.8	76.69	1218.57
2013	4	15	1400	12.28	280.58	34.2	96.22	1307.1
2013	4	15	1500	13.9	282.47	37	98.15	1396.98
2013	4	15	1600	11.38	292.05	27.9	74.94	818.12
2013	4	15	1700	11.57	280.07	33.7	155.46	153.05
2013	4	15	1800	10.93	275.81	34.4	203.15	343.84
2013	4	15	1900	11.53	288.49	27	181.58	509.23
2013	4	15	2000	14.67	262.33	36.3	103.82	610.88
2013	4	15	2100	12.2	247.37	42.5	121.79	726.02
2013	4	15	2200	17.33	241.67	44.7	188.07	916.5
2013	4	15	2300	13.8	264.76	40.8	412.21	1297.84

Table 9. Green Valley monitoring site data for April 16, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2013	4	16	0000	12.46	262.14	30.5	215.72	65.56
2013	4	16	0100	11.03	274.83	26.6	57.72	99.68
2013	4	16	0200	9.51	262.77	23.3	60.88	159.24
2013	4	16	0300	10.05	257.28	24.5	57.51	214.02
2013	4	16	0400	9.25	270.13	32.6	50.09	264.63
2013	4	16	0500	9.95	255.3	27.8	73.12	335.8
2013	4	16	0600	9.44	250.66	25.8	75.64	409.64
2013	4	16	0700	8.79	265.43	22.2	55.6	462.76
2013	4	16	0800	9.13	237.37	22.7	31.08	492.27
2013	4	16	0900	8	180.34	24.7	16.88	509.87
2013	4	16	1000	10.56	246.07	17.5	23.38	531.9
2013	4	16	1100	8.35	208.57	17	15.24	547.33
2013	4	16	1200	8.72	207.21	18.4	20.52	566.19
2013	4	16	1300	9.06	224.82	29.4	13.99	579.4
2013	4	16	1400	8.3	253.79	29.7	31.42	608.89
2013	4	16	1500	7.63	152.97	28.7	9.44	619.34
2013	4	16	1600	7.82	260.92	26.7	17.49	636.87
2013	4	16	1700	8.89	140.14	22.6	18.94	654.38
2013	4	16	1800	8.7	135.14	22.6	11.57	665.97
2013	4	16	1900	7.78	131.79	18	3.99	669.91
2013	4	16	2000	9.68	136.28	18.2	13.84	682.89
2013	4	16	2100	10.89	116.69	16.4	7.03	689.95
2013	4	16	2200	8.06	109.72	16.8	4.48	693.92
2013	4	16	2300	9.78	350.52	14.7	7.05	702.22

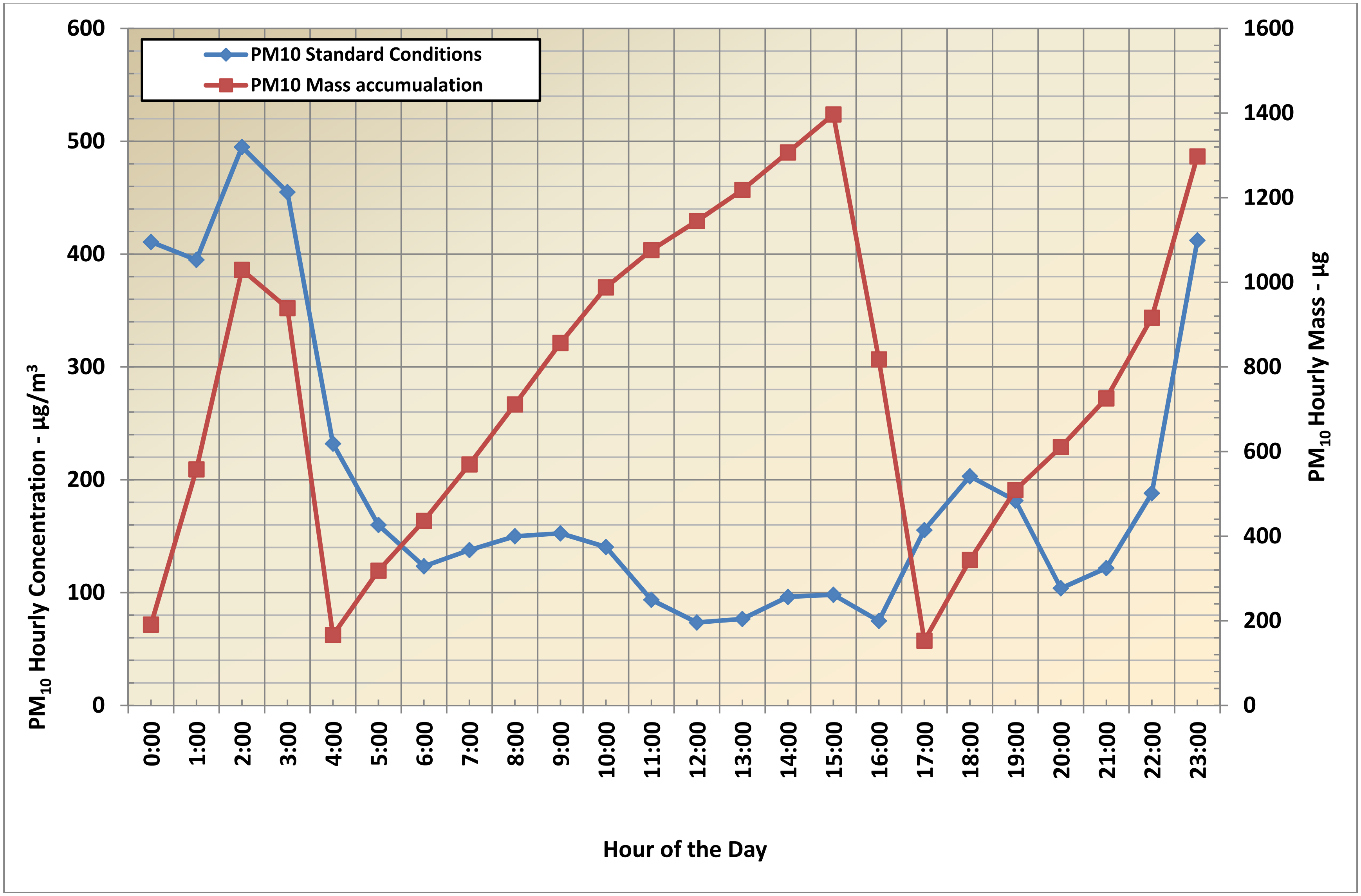

Figure 9. **PM_{10} concentrations at Green Valley monitoring site, April 15, 2013.**

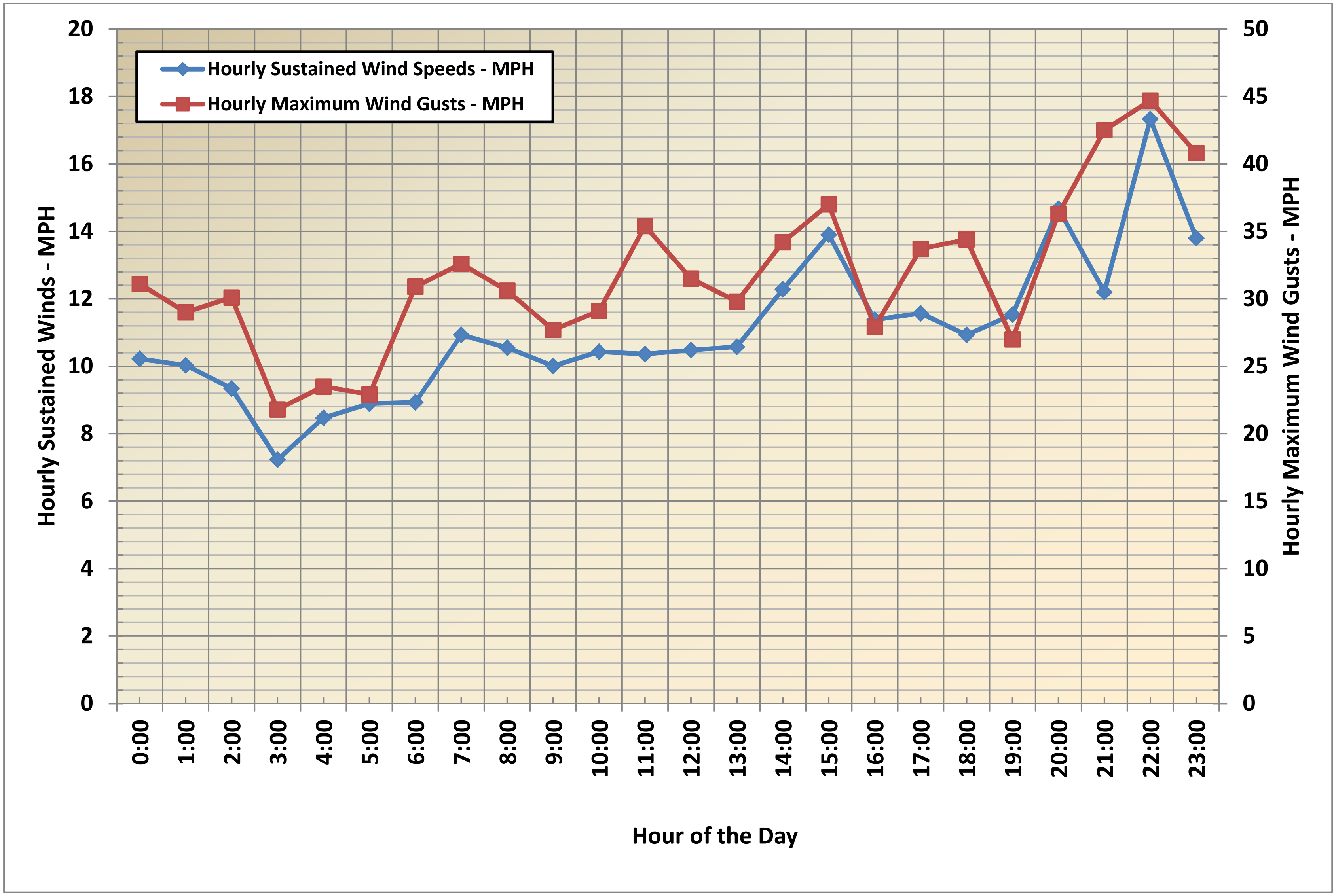

Figure 9a. Wind speeds at Green Valley monitoring site, April 15, 2013.

Table 10. Jerome Mack monitoring site data for April 14, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2013	4	14	0000	6.36	223.81	14.69	25.6	ND
2013	4	14	0100	3.15	193.57	11.68	22.2	ND
2013	4	14	0200	3.48	232.67	9.21	26	ND
2013	4	14	0300	3.61	256.07	10.36	41.5	ND
2013	4	14	0400	3.26	321.56	7.84	32.7	ND
2013	4	14	0500	3.75	325.19	6.01	32	ND
2013	4	14	0600	6.6	19.63	14.1	41.7	ND
2013	4	14	0700	6.99	47.46	16.92	37.4	ND
2013	4	14	0800	7.75	40.72	14.29	41.5	ND
2013	4	14	0900	4.62	84.71	12.43	35.1	ND
2013	4	14	1000	4.82	87.73	14.99	32	ND
2013	4	14	1100	4.96	64.79	14.77	29.2	ND
2013	4	14	1200	5.37	119.78	13.9	24.9	ND
2013	4	14	1300	6.81	124.03	17.1	29.7	ND
2013	4	14	1400	7.64	130.44	16.52	29.74	ND
2013	4	14	1500	8.92	160.02	22.43	29.1	ND
2013	4	14	1600	10.18	224.99	22.39	28.8	ND
2013	4	14	1700	13.32	230.08	28.35	41.7	ND
2013	4	14	1800	10.62	214.89	22.21	25.7	ND
2013	4	14	1900	11.13	197.63	21.86	72.7	ND
2013	4	14	2000	10.69	194.23	24.4	248.7	ND
2013	4	14	2100	14	206.07	27.12	436.4	ND
2013	4	14	2200	11.76	195.23	28.7	515.9	ND
2013	4	14	2300	12.1	183.97	25.4	474.1	ND

Table 11. Jerome Mack monitoring site data for April 15, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Mass Accumulation (μg)
2013	4	15	0000	15.26	194.47	28.68	478.6	ND
2013	4	15	0100	12.44	193.49	27.19	408.9	ND
2013	4	15	0200	9.06	184.85	20.15	533.4	ND
2013	4	15	0300	11.32	200.75	21.43	357.5	ND
2013	4	15	0400	8.31	205.91	16.29	198.4	ND
2013	4	15	0500	7.09	209.84	14.39	142.3	ND
2013	4	15	0600	9.73	207.11	20.5	129.9	ND
2013	4	15	0700	10.43	195.8	23.26	112.2	ND
2013	4	15	0800	12.64	197.2	25.18	151.2	ND
2013	4	15	0900	10.85	189.94	22.82	153.7	ND
2013	4	15	1000	10.32	189.43	22.92	114.6	ND
2013	4	15	1100	13.37	193.65	27.5	ND	ND
2013	4	15	1200	ND	ND	ND	90.3	ND
2013	4	15	1300	15.54	203.96	27.49	70.1	ND
2013	4	15	1400	16.04	218.58	29.18	124.1	ND
2013	4	15	1500	20.98	220.55	36.63	231.1	ND
2013	4	15	1600	17.44	207.63	35.37	566.9	ND
2013	4	15	1700	12.4	205.54	26.25	410.3	ND
2013	4	15	1800	13.34	206.11	29.09	207.9	ND
2013	4	15	1900	16.46	219.47	32.79	349.5	ND
2013	4	15	2000	21.3	226.49	38.87	386.4	ND
2013	4	15	2100	20.6	218.71	44.78	230.7	ND
2013	4	15	2200	17.06	219.08	34.81	113.6	ND
2013	4	15	2300	16.16	227.57	29.34	59	ND

Table 12. Jerome Mack monitoring site data for April 16, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2013	4	16	0000	14.47	227.58	27	59.9	ND
2013	4	16	0100	13.46	234.47	25.79	45.4	ND
2013	4	16	0200	11.39	226.56	21.08	60.1	ND
2013	4	16	0300	10.63	222.42	19.44	50.1	ND
2013	4	16	0400	10.23	228.8	19.56	41.1	ND
2013	4	16	0500	11.14	223.4	21.08	55.1	ND
2013	4	16	0600	10.46	214.23	18.38	58.5	ND
2013	4	16	0700	11.21	306.94	23.33	29.8	ND
2013	4	16	0800	12.87	329.54	23.79	29.31	ND
2013	4	16	0900	10.69	342.72	26.1	21.7	ND
2013	4	16	1000	10.53	301.58	19.89	17.6	ND
2013	4	16	1100	10.38	321.02	21.83	15.9	ND
2013	4	16	1200	8.01	284.8	18.67	14.55	ND
2013	4	16	1300	14.52	323.28	36.06	83.3	ND
2013	4	16	1400	15.93	333.49	30.28	27.4	ND
2013	4	16	1500	12.18	354.58	27.04	17.1	ND
2013	4	16	1600	13.62	336.61	28.24	10.9	ND
2013	4	16	1700	10.63	47.45	22.48	17.2	ND
2013	4	16	1800	9.19	41.56	22.55	10.7	ND
2013	4	16	1900	11.88	35.47	22.9	30.82	ND
2013	4	16	2000	6.79	21.73	19.51	5.7	ND
2013	4	16	2100	6.06	30.58	12.24	6.9	ND
2013	4	16	2200	4.22	15.79	8.77	6.1	ND
2013	4	16	2300	3.47	355.46	7.12	3.9	ND

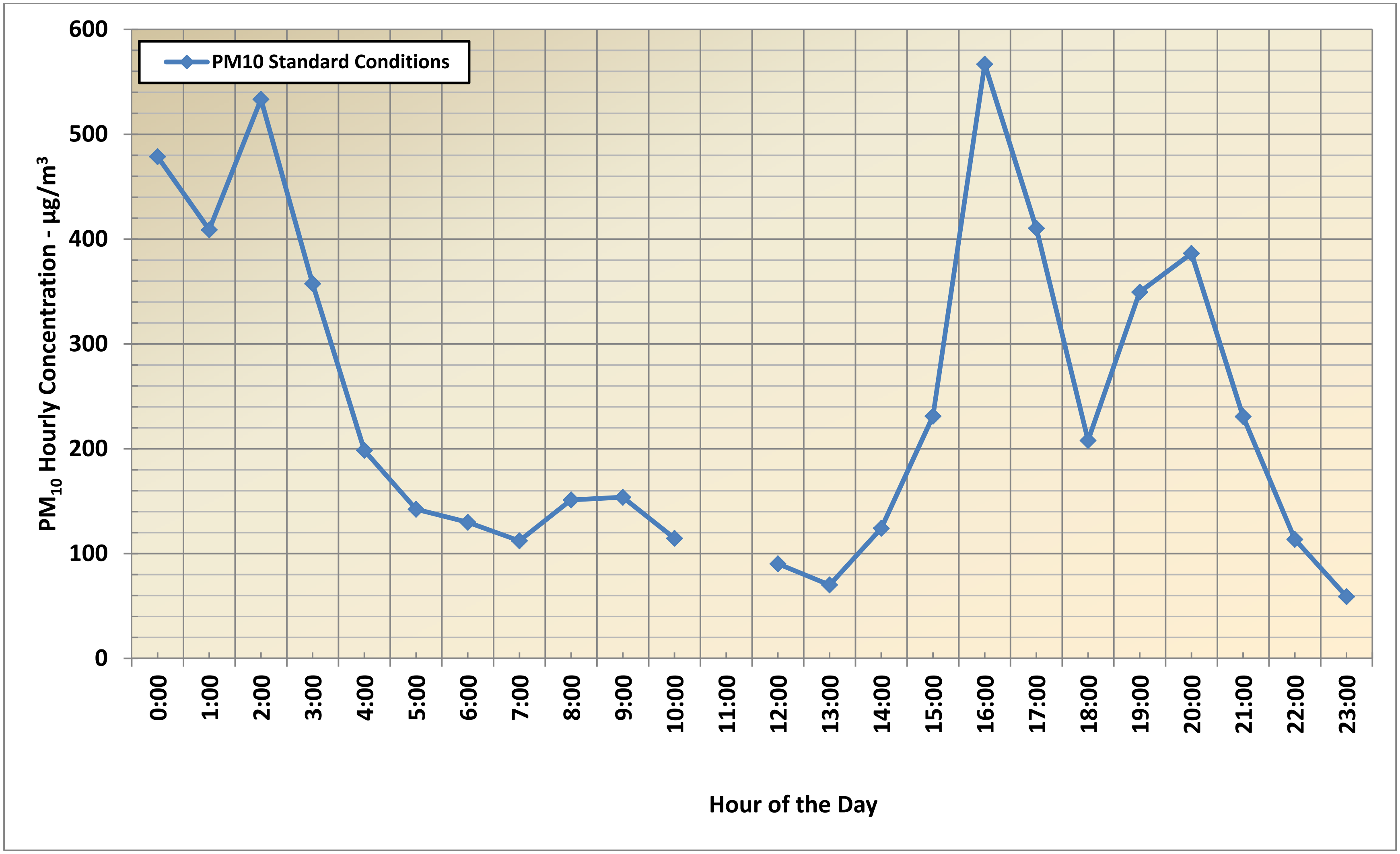

Figure 10. PM_{10} concentrations at Jerome Mack monitoring site, April 15, 2013.

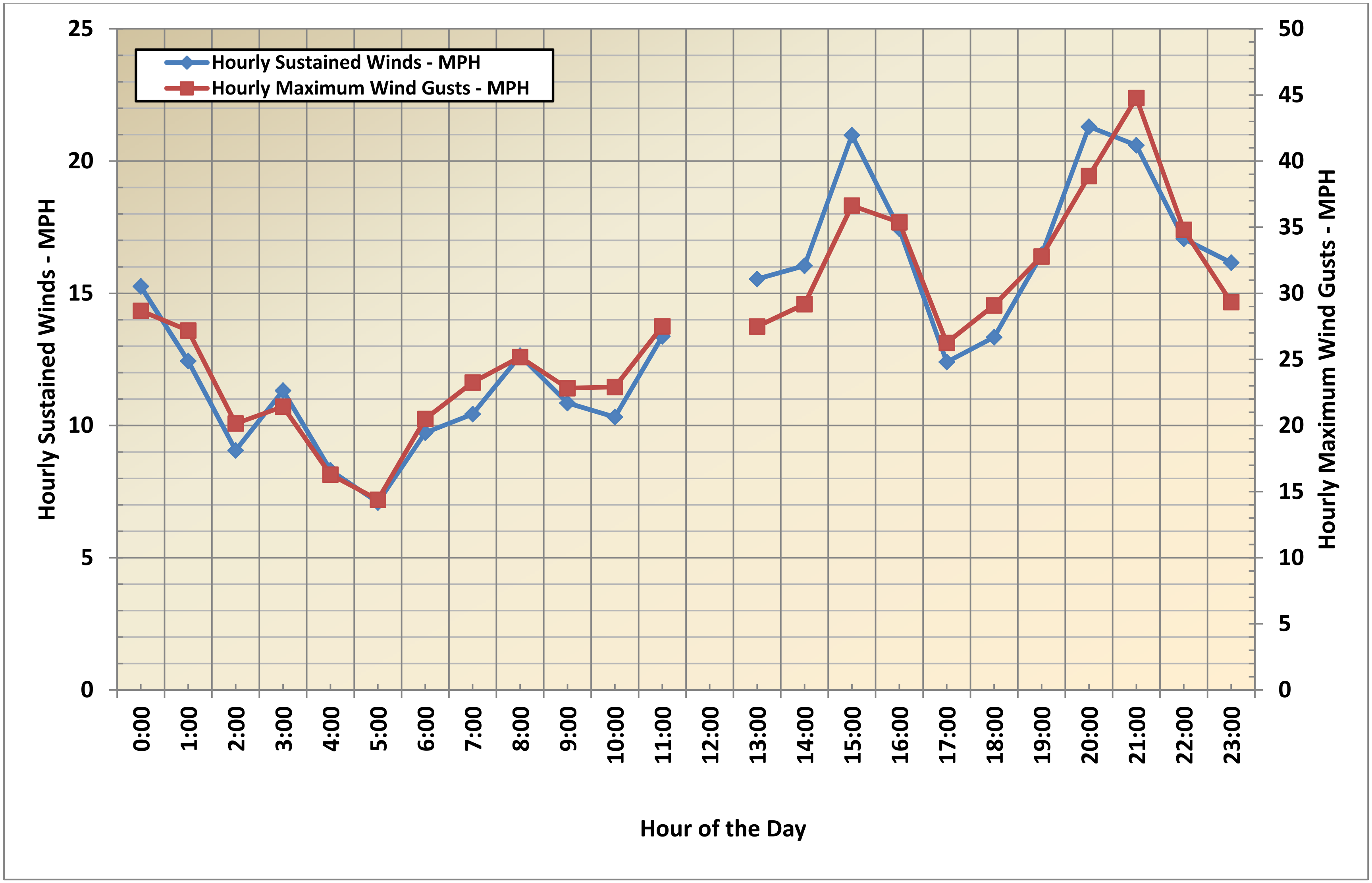

Figure 10a. **Wind speeds at Jerome Mack monitoring site, April 15, 2013.**

Table 13. Sunrise Acres monitoring site data for April 14, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2013	4	14	0000	9.17	99.61	14.3	44.5	47.99
2013	4	14	0100	2.41	112.99	13.9	43.87	55.37
2013	4	14	0200	8.13	296.36	19.7	40.69	95.44
2013	4	14	0300	4.42	297.17	14	45.98	139.87
2013	4	14	0400	4.13	326.61	9.6	46.36	183.73
2013	4	14	0500	4.61	331.6	9.4	33.5	217.03
2013	4	14	0600	7.07	28.79	15.1	33.62	248.47
2013	4	14	0700	6.94	51.53	16.9	36.59	284.21
2013	4	14	0800	8.76	62.59	20.6	41.64	323.5
2013	4	14	0900	7.81	291.53	15.2	42.49	364.32
2013	4	14	1000	9.71	288.31	15.2	35.98	397.51
2013	4	14	1100	9.76	277.68	14.9	35.98	431.63
2013	4	14	1200	8.71	262.15	18	29.68	459.73
2013	4	14	1300	9.53	231.48	16	33.49	490.92
2013	4	14	1400	9.06	233.72	15.3	31.26	519.99
2013	4	14	1500	10.85	177.77	23.1	28.76	546.69
2013	4	14	1600	8.8	143.1	25.2	29.89	576.21
2013	4	14	1700	11.08	149.66	24.7	38.3	613.2
2013	4	14	1800	12.48	144.73	24.6	63.58	668.8
2013	4	14	1900	12.32	145.22	23.2	43.58	712.78
2013	4	14	2000	15.16	157.12	32.6	183.19	888.38
2013	4	14	2100	15.24	162.31	32.9	301.91	1174.44
2013	4	14	2200	15.57	161.54	31.1	458.62	519.95
2013	4	14	2300	13.77	186.65	26.7	491.48	585.03

Table 14. Sunrise Acres monitoring site data for April 15, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Mass Accumulation (μg)
2013	4	15	0000	14.61	153.86	30.1	435.79	203.43
2013	4	15	0100	13.05	150.37	31.9	393.11	551.03
2013	4	15	0200	11.74	213.14	18.5	393.19	932.52
2013	4	15	0300	12.53	169.55	21.2	460.04	1251.46
2013	4	15	0400	10.48	114.77	15.6	322.82	142.31
2013	4	15	0500	10.69	120.06	16.3	304.65	426.81
2013	4	15	0600	11.24	134.18	17.6	143.82	567.41
2013	4	15	0700	12.11	144.49	19.4	115.21	678.41
2013	4	15	0800	12.88	163.96	20.6	132.05	807.35
2013	4	15	0900	12.75	187.86	21.1	151.01	950.39
2013	4	15	1000	12.07	191.46	22.3	126.08	1069.67
2013	4	15	1100	13.93	190.12	28.6	114.02	1176.4
2013	4	15	1200	15.66	174.84	32.3	90.83	1264.03
2013	4	15	1300	15.92	163.68	33.1	85.67	1345.47
2013	4	15	1400	13.63	166.74	34.5	124.7	1121.64
2013	4	15	1500	15.88	182.12	35.5	208.24	157.54
2013	4	15	1600	18.01	163.88	36.8	358.21	527.28
2013	4	15	1700	13.57	154.55	29.8	814.6	1250.88
2013	4	15	1800	14.88	158.37	42.6	367.77	341.6
2013	4	15	1900	22.19	170.45	46.9	420.01	473.21
2013	4	15	2000	21.08	173.59	47.3	390.81	838.18
2013	4	15	2100	20.06	173.52	47.1	228.38	1056.81
2013	4	15	2200	13.9	171.11	35.5	145.64	1198.35
2013	4	15	2300	9.82	159.97	32.2	113.45	1308.26

Table 15. Sunrise Acres monitoring site data for April 16, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2013	4	16	0000	9.68	174.19	26.7	90.75	94.64
2013	4	16	0100	9.75	175.34	25.8	68.75	117.29
2013	4	16	0200	7.47	154.44	24.3	48.05	165.93
2013	4	16	0300	7.21	137.81	20.4	50.86	215.65
2013	4	16	0400	7.77	135.65	18.7	45.58	260.25
2013	4	16	0500	9.43	125.49	14.3	38.81	298.07
2013	4	16	0600	11.91	158.22	18.6	42.05	339.29
2013	4	16	0700	11.58	22.99	23.6	34.13	374.17
2013	4	16	0800	13.01	23.14	30.2	49.32	423.78
2013	4	16	0900	12.12	26.54	20.9	32.62	456.82
2013	4	16	1000	8.37	30.02	22	22.38	478.03
2013	4	16	1100	10.47	25.31	22.2	24.38	502.01
2013	4	16	1200	9.28	62.44	25.6	13.5	515.47
2013	4	16	1300	13.52	352.28	34.7	49.96	580.44
2013	4	16	1400	15.16	6.97	32.2	162.25	720.67
2013	4	16	1500	13.21	20.32	30.3	12.63	735.31
2013	4	16	1600	13.65	14.99	27.4	22.75	756.4
2013	4	16	1700	11.6	321.49	25.2	10.43	766.78
2013	4	16	1800	9.88	304.87	23.5	15.03	781.88
2013	4	16	1900	10.88	318.67	23	18.69	801.44
2013	4	16	2000	10.86	315.72	18.9	23.07	823
2013	4	16	2100	7.67	282.09	14	7.83	831.05
2013	4	16	2200	10.55	285.64	13.7	7.67	839.66
2013	4	16	2300	10.47	39.83	16.1	7.88	847.12

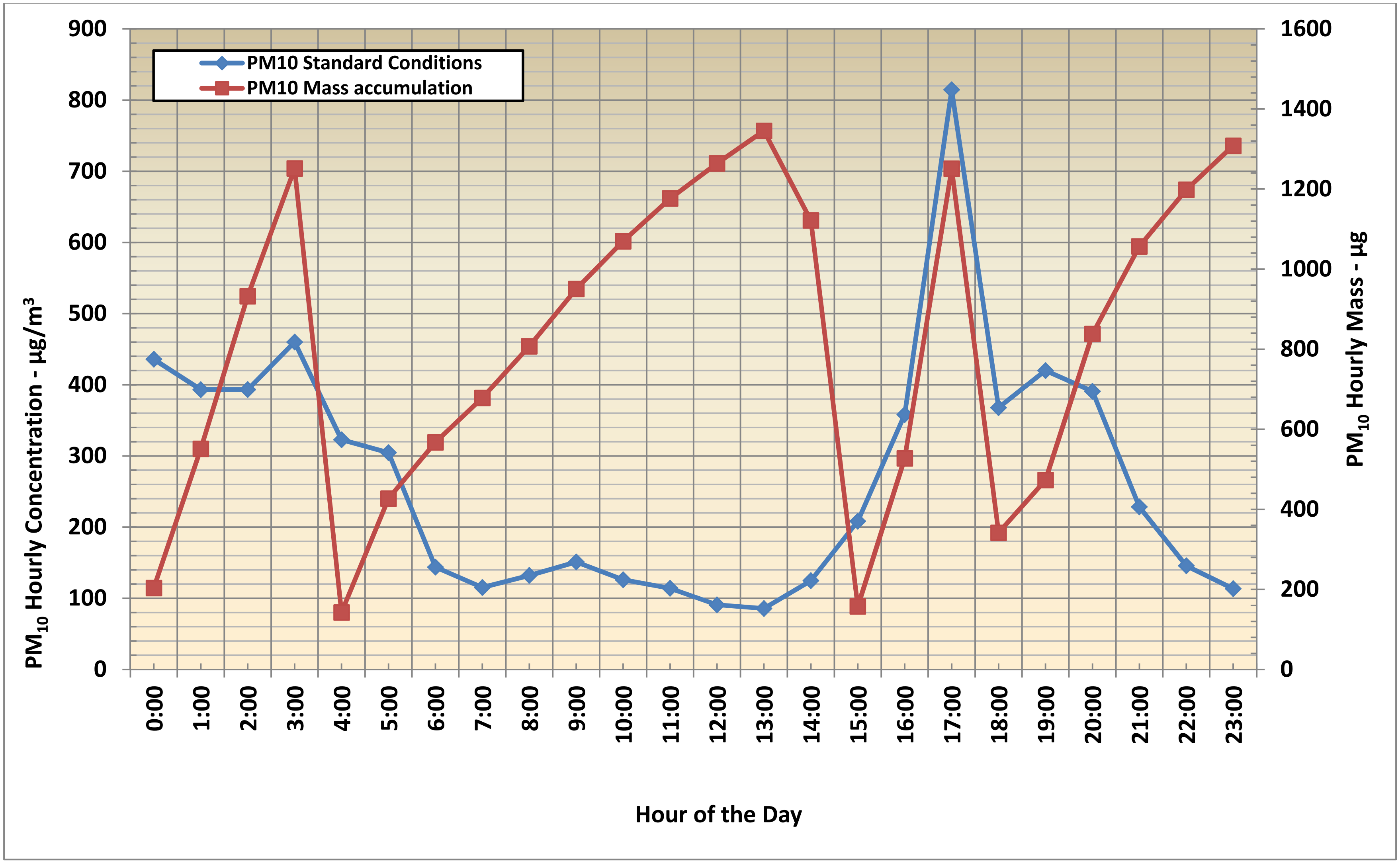

Figure 11. PM_{10} concentrations at Sunrise Acres monitoring site, April 15, 2013.

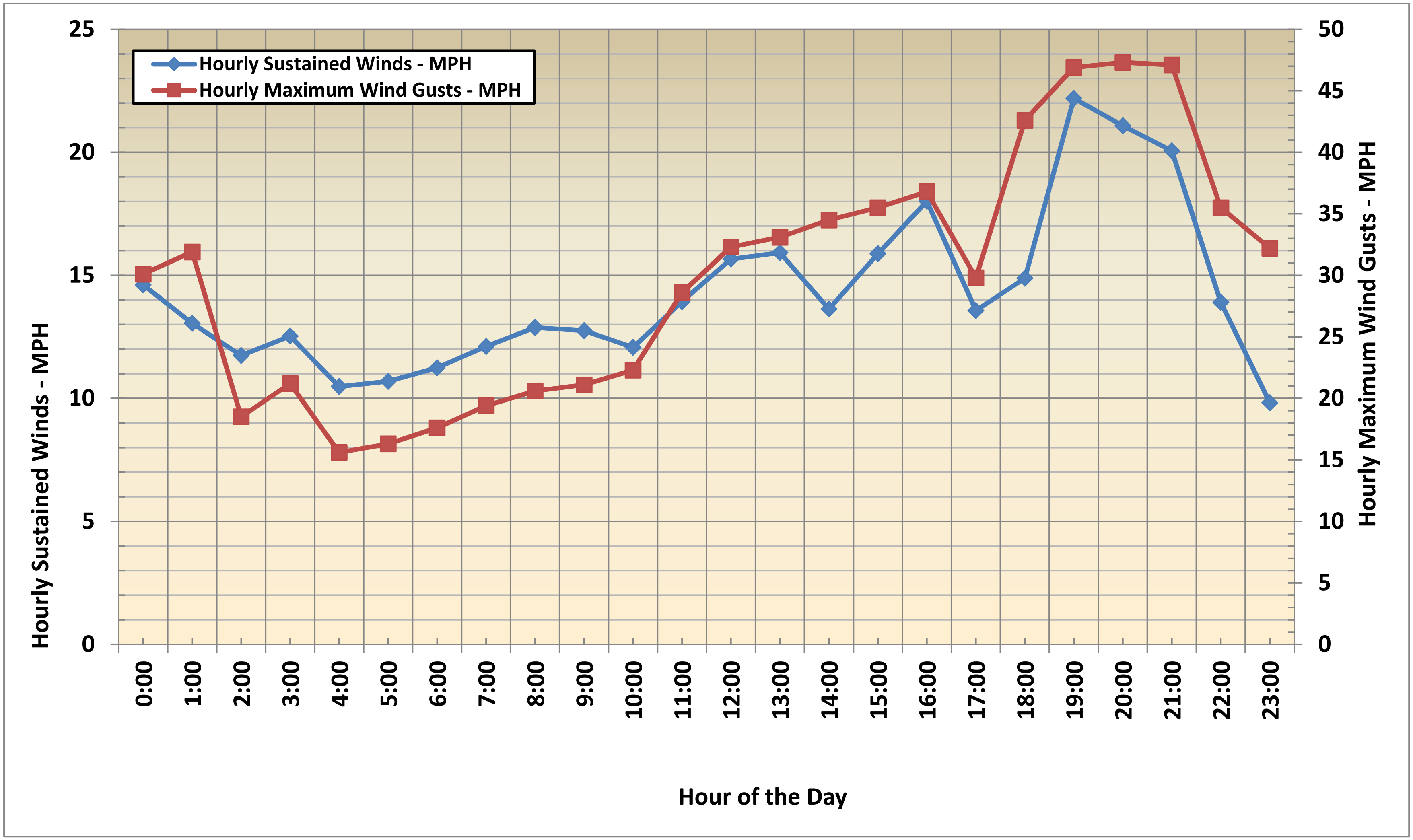

Figure 11a. Wind speeds at Sunrise Acres monitoring site, April 15, 2013.

Table 16. J. D. Smith monitoring site data for April 14, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Mass Accumulation (μg)
2013	4	14	0000	4.26	259.13	9	29.55	32.31
2013	4	14	0100	2.66	356.49	12.4	59.88	79.16
2013	4	14	0200	7.38	282.7	19.3	55.5	130.11
2013	4	14	0300	4.67	299.55	15.7	35.79	164.59
2013	4	14	0400	3.04	333.84	7.6	28.93	191.87
2013	4	14	0500	3.7	343.82	10.2	25.64	215.67
2013	4	14	0600	6.26	34.92	17	26.22	242.57
2013	4	14	0700	8.93	58.63	20.5	36.12	275.88
2013	4	14	0800	11.61	62.28	20.5	44.12	318.32
2013	4	14	0900	9.89	61.62	18.3	37.58	352.7
2013	4	14	1000	6.92	57.85	16.2	38.17	389.67
2013	4	14	1100	4.55	69.45	14.2	37.53	424.33
2013	4	14	1200	5.04	129.68	12.5	29.29	452.39
2013	4	14	1300	6.47	153.97	18.4	31.57	482.03
2013	4	14	1400	6.56	135.97	15.7	30.49	509.77
2013	4	14	1500	9.38	156.92	21.2	28.44	536.72
2013	4	14	1600	11.04	225.8	26.9	44.44	576.03
2013	4	14	1700	11.83	217.34	26.1	48.29	617.8
2013	4	14	1800	9.15	199.72	22.9	35.69	651.8
2013	4	14	1900	11.27	205.54	27.6	46.91	698.55
2013	4	14	2000	11.93	182.81	26.3	179.4	866.57
2013	4	14	2100	13.33	182.21	29.5	261.15	1114.33
2013	4	14	2200	12.5	183.92	32.7	409.08	725.38
2013	4	14	2300	9.04	166.34	23.2	448.99	395.57

Table 17. J. D. Smith monitoring site data for April 15, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Mass Accumulation (μg)
2013	4	15	0000	9.43	180.08	23.6	372.77	172.87
2013	4	15	0100	8.26	176.34	20.5	335.5	481.49
2013	4	15	0200	6.38	146.68	15.8	321.47	792.59
2013	4	15	0300	5.41	182.11	15.2	366.02	1134.2
2013	4	15	0400	3.58	220.86	8.2	263.34	1219.71
2013	4	15	0500	3.13	253.11	8.6	322.87	209.04
2013	4	15	0600	5.59	176.55	13.9	264.7	456.83
2013	4	15	0700	7.89	173.09	14	100.75	556.33
2013	4	15	0800	8.64	175.81	19.3	119.64	668.37
2013	4	15	0900	7.43	168.09	15.7	132.44	792.24
2013	4	15	1000	7.89	165.81	19.3	103.58	889.73
2013	4	15	1100	11.26	159.68	24	105.55	989.52
2013	4	15	1200	14.21	183.51	29.6	99.07	1085.05
2013	4	15	1300	15.64	194.36	31.5	109.02	1182.38
2013	4	15	1400	15.28	205.21	39.2	111.53	1286.68
2013	4	15	1500	18.04	214.55	43.8	138.89	1042.95
2013	4	15	1600	17.38	193.9	44.8	300.63	234.16
2013	4	15	1700	14.24	197.52	31.1	692.6	845
2013	4	15	1800	17.02	202.2	39.6	313.76	1138.29
2013	4	15	1900	20.36	204.22	50.3	312.9	912.52
2013	4	15	2000	21.59	204.35	44.9	292.93	212.05
2013	4	15	2100	17.85	194.22	46	269.57	458.71
2013	4	15	2200	16.08	226.62	39.3	136.09	591.38
2013	4	15	2300	14	234.08	31.3	136.86	721.23

Table 18. J. D. Smith monitoring site data for April 16, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2013	4	16	0000	14.03	236.65	31.8	96.8	55.27
2013	4	16	0100	12.71	235.58	30.3	76.31	115.63
2013	4	16	0200	11.29	239.59	24.5	41.97	157.64
2013	4	16	0300	9.07	238.1	19.5	50.45	205.28
2013	4	16	0400	7.85	236.16	18	35.85	240.41
2013	4	16	0500	5.28	227.38	13	37.39	276.75
2013	4	16	0600	4.47	141.95	18.1	20.39	295.75
2013	4	16	0700	12.27	301.03	28.8	24.44	319.47
2013	4	16	0800	10.38	310.89	28.7	26.2	347.7
2013	4	16	0900	9.47	307.51	29.3	32.48	377.4
2013	4	16	1000	8.57	271.95	26.7	22.34	398.22
2013	4	16	1100	6.28	246.41	19.6	6.83	405.82
2013	4	16	1200	5.87	279.84	23.9	1.23	405.66
2013	4	16	1300	13.43	288.16	42	33.72	439.18
2013	4	16	1400	13.97	305.16	35	56.83	490.44
2013	4	16	1500	11.34	313	29.3	12	503.31
2013	4	16	1600	12.07	304.97	29.1	15.3	518.23
2013	4	16	1700	8.56	342.52	23.7	11.17	527.32
2013	4	16	1800	8.15	41.21	23.2	17.76	545.95
2013	4	16	1900	9.36	30.4	26	19.15	565.16
2013	4	16	2000	5.72	340.91	17.7	17.87	582.04
2013	4	16	2100	5.53	73.41	10.2	0.42	581.46
2013	4	16	2200	3.78	31.94	10	9.03	590.46
2013	4	16	2300	6.46	303.23	17.6	5.56	596.78

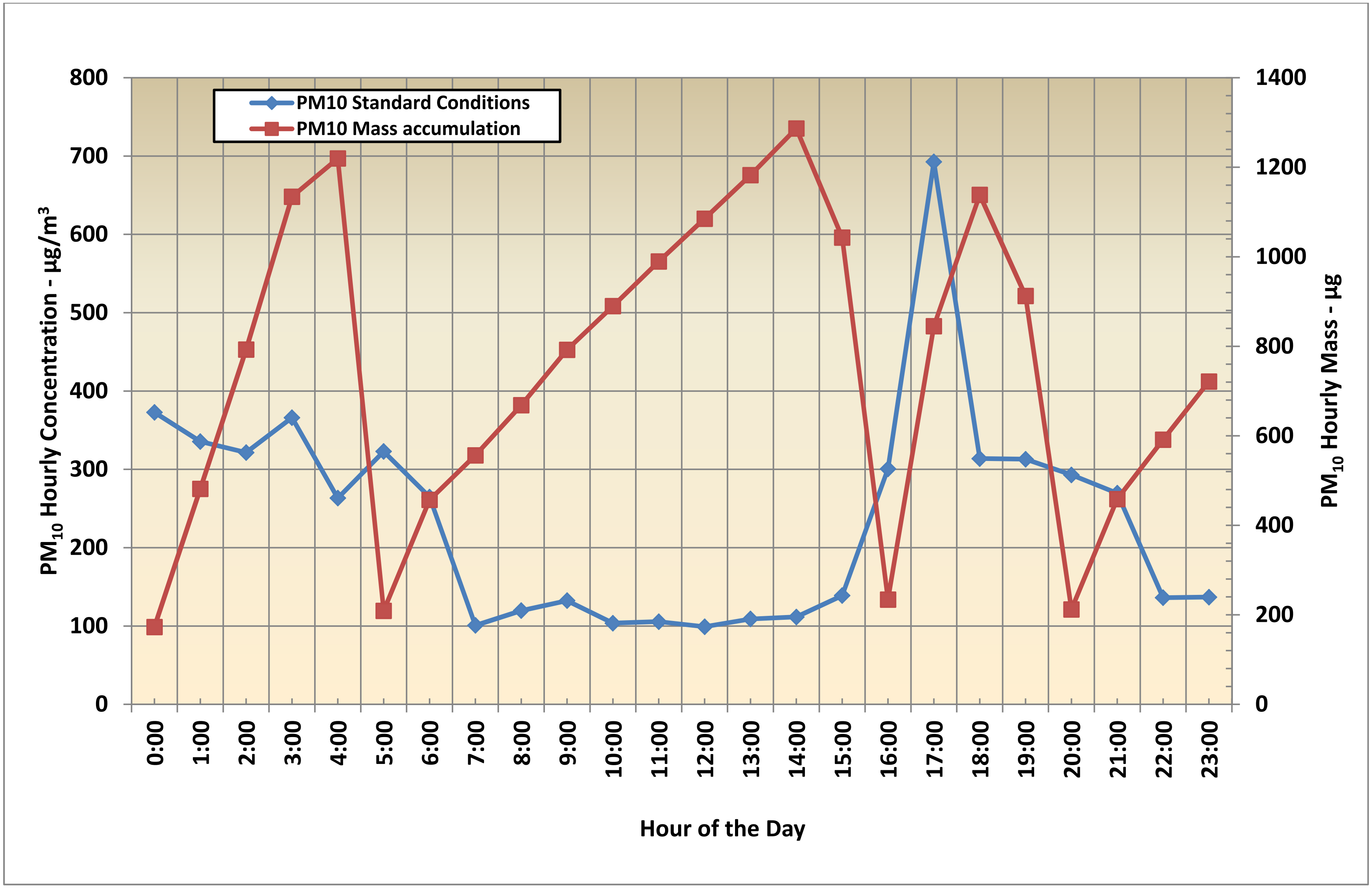

Figure 12. PM_{10} concentrations at J. D. Smith monitoring site, April 15, 2013.

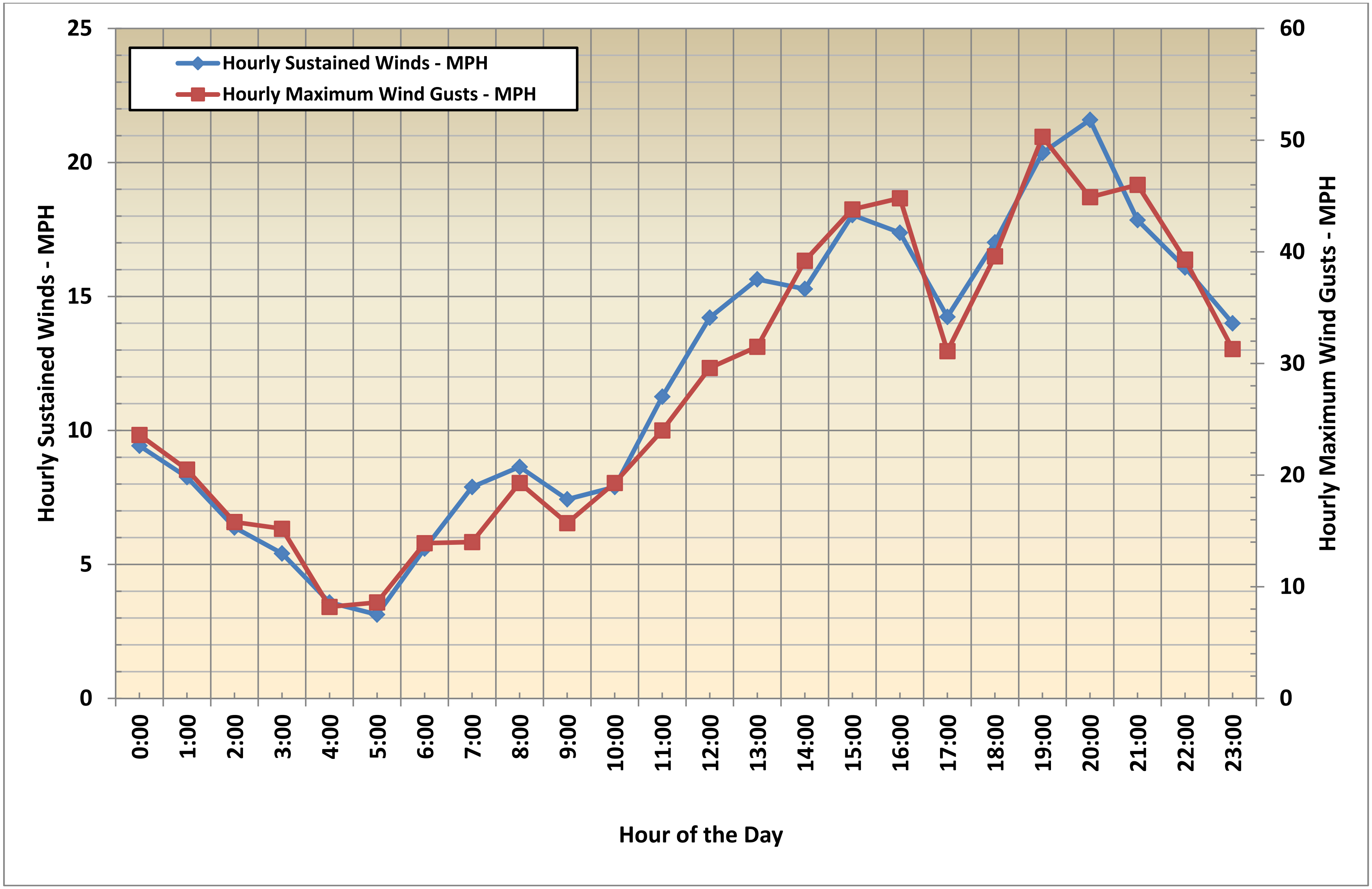

Figure 12a. Wind speeds at J. D. Smith monitoring site, April 15, 2013.

Table 19. Joe Neal monitoring site data for April 14, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Mass Accumulation (μg)
2013	4	14	0000	6.47	329.62	17.6	47.68	31.62
2013	4	14	0100	6.31	343.89	16	46.4	64.59
2013	4	14	0200	7.53	320.8	19.2	47.1	108.68
2013	4	14	0300	7.86	342.79	22.9	40.59	148.09
2013	4	14	0400	5.08	15.65	12.3	40.89	186.49
2013	4	14	0500	3.13	12.14	10.8	29.79	213.57
2013	4	14	0600	3.18	19.97	7.6	28.78	241.13
2013	4	14	0700	6.93	51.12	18.2	26.13	266.75
2013	4	14	0800	9.05	123.92	18.7	28.49	294.37
2013	4	14	0900	8.42	131.28	19.9	30.72	322.98
2013	4	14	1000	8.4	122.01	20.4	35.76	356.93
2013	4	14	1100	5.08	141.05	15.4	27.23	382.72
2013	4	14	1200	6.67	132.73	18.3	28.77	409.27
2013	4	14	1300	8.09	119.92	23.8	32.34	438.06
2013	4	14	1400	8.72	132.24	19.1	36.61	472.71
2013	4	14	1500	9.32	145.59	20	28.6	499.57
2013	4	14	1600	10.45	209.95	23.4	36.34	530.66
2013	4	14	1700	10.84	206.87	25.4	26.48	556.18
2013	4	14	1800	9.79	197.34	23.8	28.34	582.5
2013	4	14	1900	11.39	193.33	34.6	25.19	608.9
2013	4	14	2000	9.45	192.72	29.5	137.37	737.19
2013	4	14	2100	10.21	141.29	25.3	215.18	940.17
2013	4	14	2200	9.97	136.69	20.3	339.64	1259.28
2013	4	14	2300	8.4	98.6	18.4	401.2	372.76

Table 20. Joe Neal monitoring site data for April 15, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Mass Accumulation (μg)
2013	4	15	0000	7.28	73.22	17	327.43	158.98
2013	4	15	0100	6.87	48.74	13.2	318.94	455.55
2013	4	15	0200	5.21	8.98	10.1	318	753.87
2013	4	15	0300	4.72	18.84	9.2	301.24	1046.14
2013	4	15	0400	3.61	355.21	8.4	400.65	973.91
2013	4	15	0500	4.82	35.3	10.1	357.7	252.57
2013	4	15	0600	3.34	61.1	7.5	222.13	463.19
2013	4	15	0700	4.88	78.07	12	242.96	696.03
2013	4	15	0800	4.08	94.86	11.4	288.8	968.78
2013	4	15	0900	4.29	88.32	12.4	247.2	1197.54
2013	4	15	1000	5.68	107.78	18.6	160.67	1348.72
2013	4	15	1100	9.51	106.22	29.4	123.33	1206.18
2013	4	15	1200	13.42	163.73	33.7	102.77	43.33
2013	4	15	1300	14.43	192.98	31.5	68.71	105.61
2013	4	15	1400	13.34	183.83	32.3	68.17	169.52
2013	4	15	1500	12.96	200.54	39.3	91.94	259.09
2013	4	15	1600	17.32	205.57	38	193.17	438.81
2013	4	15	1700	15.13	193.65	43.4	312.82	727.63
2013	4	15	1800	18.06	188.98	44.5	284.42	990.71
2013	4	15	1900	20.19	197.37	55.1	263.82	1238.2
2013	4	15	2000	20.58	201.51	48.6	304.39	693.37
2013	4	15	2100	16.5	217.98	39.6	204.46	185.25
2013	4	15	2200	14.73	227.62	35.5	127.29	307.19
2013	4	15	2300	7.47	226.36	16.6	108.02	409.04

Table 21. Joe Neal monitoring site data for April 16, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Mass Accumulation (µg)
2013	4	16	0000	5.96	235.3	14	88.93	58.08
2013	4	16	0100	7.65	239.64	14.3	83.67	130.82
2013	4	16	0200	6.75	247.95	17.2	65.74	193.88
2013	4	16	0300	4.63	238.87	12.7	45.19	237.79
2013	4	16	0400	4.58	261.49	14.8	36.94	271.08
2013	4	16	0500	9.89	298.85	21.5	15.93	287.66
2013	4	16	0600	11.09	318.58	29.4	18.42	307.52
2013	4	16	0700	14.18	325.51	30.9	42.83	347.83
2013	4	16	0800	13.85	320.65	31.1	38.37	385.95
2013	4	16	0900	11.92	323.77	31.5	26.54	411.18
2013	4	16	1000	8.14	286.5	20.5	20.1	429.71
2013	4	16	1100	9.68	281.02	21.9	18.47	447.39
2013	4	16	1200	10.96	313.41	30.7	19.42	466.48
2013	4	16	1300	18.53	306.31	41	100.83	558.78
2013	4	16	1400	14.55	323.38	33.7	35.91	599.26
2013	4	16	1500	17.23	320.58	41.8	20.07	618.67
2013	4	16	1600	15.6	325.92	33.3	20.06	637.47
2013	4	16	1700	13.82	317.66	31.9	11.8	649.88
2013	4	16	1800	9.68	309.55	20.7	12.77	662.1
2013	4	16	1900	12.3	302.72	24.4	10.15	671.38
2013	4	16	2000	11.4	306.79	22.6	3.27	674.37
2013	4	16	2100	10.25	311.7	21.9	2.45	677.47
2013	4	16	2200	8.53	323.92	17.1	7.23	684.12
2013	4	16	2300	10.16	321.61	19.5	5.65	692.48

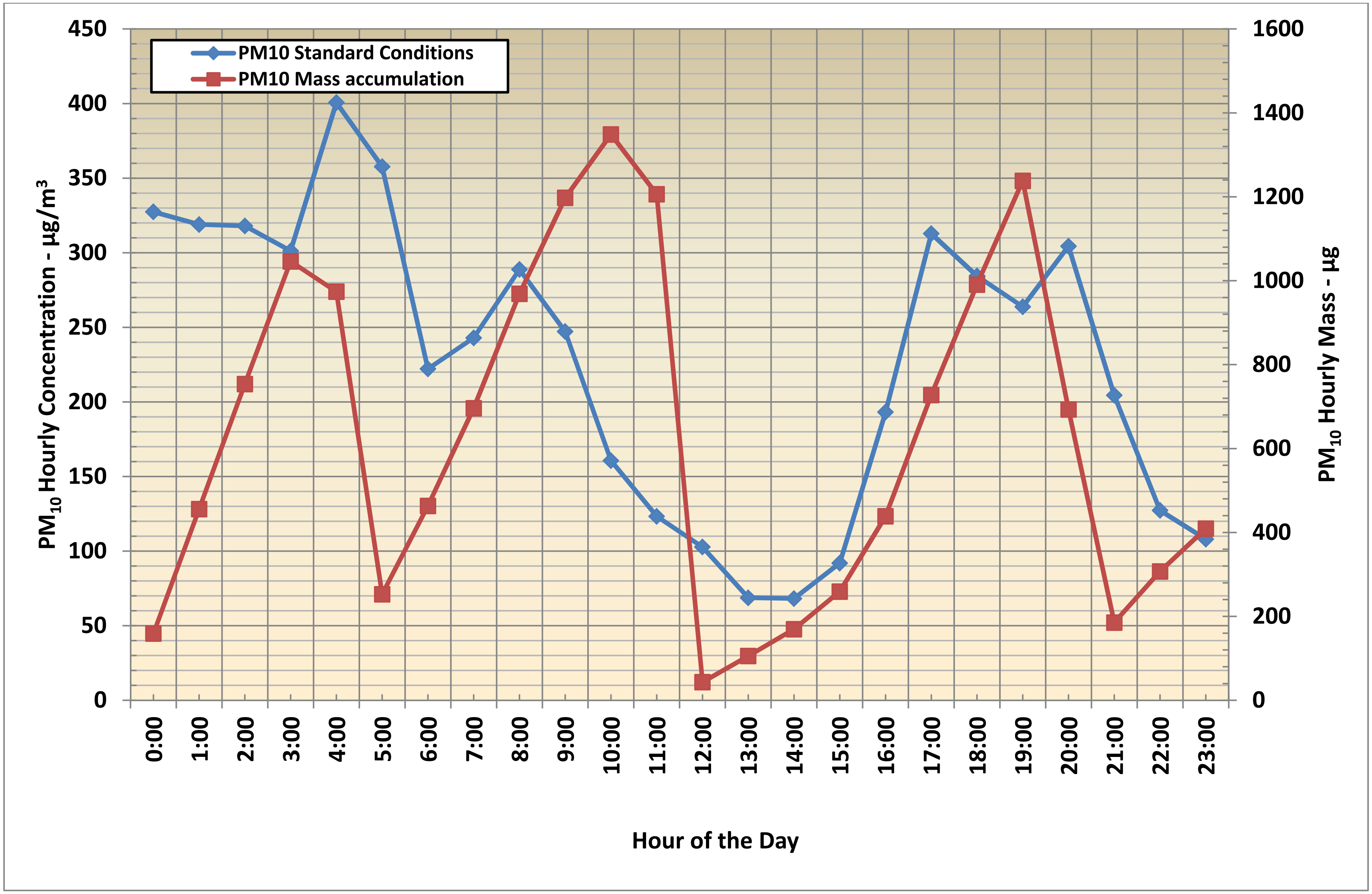

Figure 13. PM_{10} concentrations at Joe Neal monitoring site April 15, 2013.

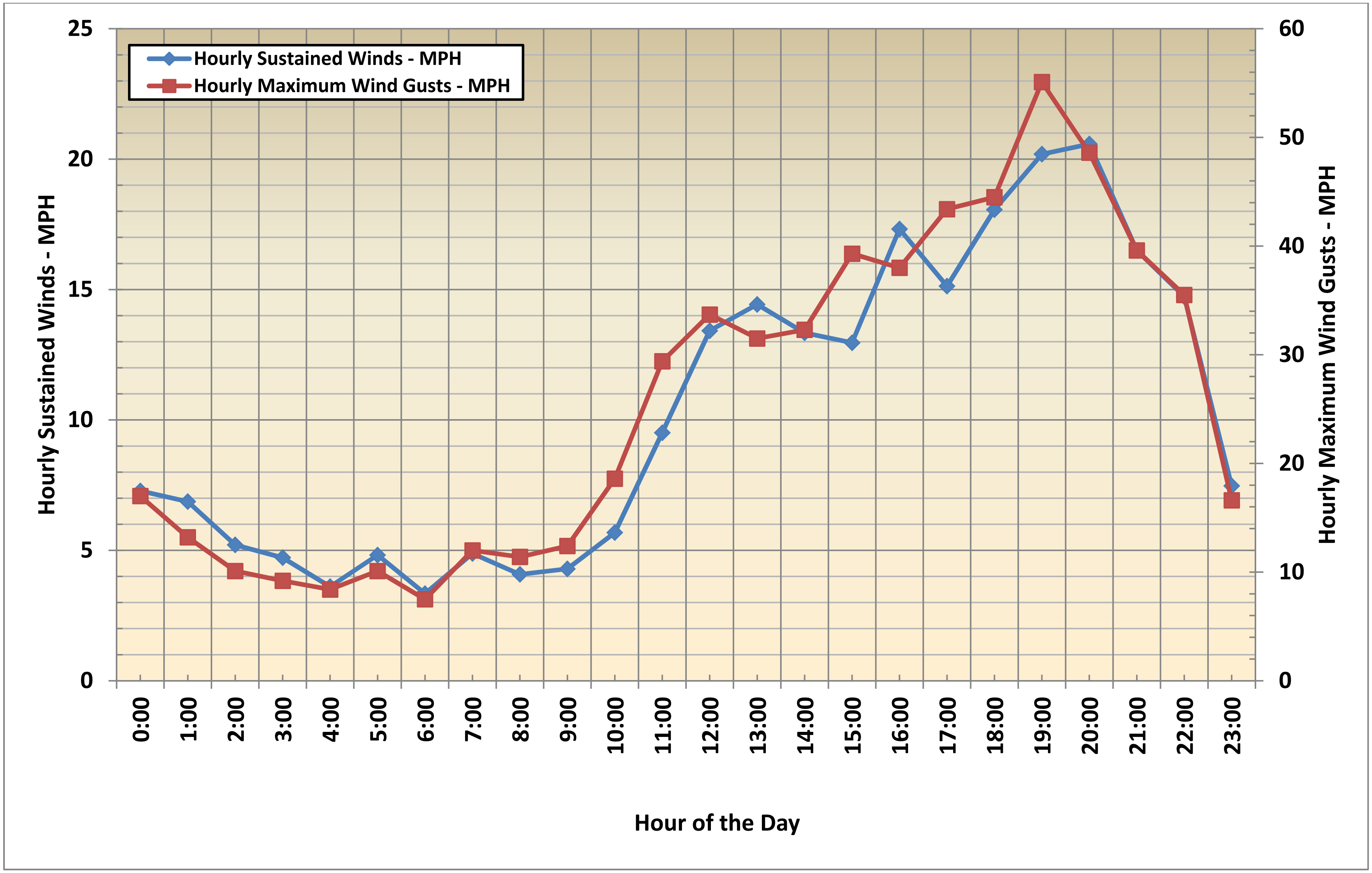

Figure 13a. Wind speeds at Joe Neal monitoring site, April 15, 2013.

Table 22. Paul Meyer monitoring site data for April 14, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2013	4	14	0000	3.02	211.96	7.6	18.44	18.71
2013	4	14	0100	3.72	60.74	13.8	27.68	43.34
2013	4	14	0200	5.11	213.83	12.5	48.04	73.13
2013	4	14	0300	4.46	214.89	11.1	47.72	97.11
2013	4	14	0400	3.7	206.3	8.6	56.29	124.13
2013	4	14	0500	2.4	48.38	6.6	43.39	150.15
2013	4	14	0600	2.48	318.37	12.6	42.45	172.25
2013	4	14	0700	5.83	66.94	18.4	37.82	200.12
2013	4	14	0800	5.72	87.21	16.9	26.32	226.04
2013	4	14	0900	3.98	51.73	13.7	35.37	255.06
2013	4	14	1000	3.77	61.68	12.9	31.51	278.98
2013	4	14	1100	4.41	119.08	16.1	25.63	306.39
2013	4	14	1200	5.83	144.29	18.6	29.82	329.07
2013	4	14	1300	6.03	133.69	17.1	27.41	358.82
2013	4	14	1400	8.41	172.97	21.4	24.09	382.89
2013	4	14	1500	9.71	199.28	22.7	29.99	400.54
2013	4	14	1600	11.79	206.76	24.2	27.51	424.47
2013	4	14	1700	11.12	195.88	27.9	30.52	446.11
2013	4	14	1800	10	198.23	22.9	26.42	465.43
2013	4	14	1900	12.81	201.98	32.8	29.82	533.37
2013	4	14	2000	11.73	206.5	28.5	24.78	724.73
2013	4	14	2100	11.53	175.72	25.8	31.99	989.58
2013	4	14	2200	10.35	172.19	25.7	27.49	1350.4
2013	4	14	2300	9.37	178.03	22.1	19.86	138.68

Table 23. Paul Meyer monitoring site data for April 15, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Mass Accumulation (µg)
2013	4	15	0000	9.13	180.41	18.7	27.88	126.04
2013	4	15	0100	8.78	191.52	14.5	23.1	364.43
2013	4	15	0200	3.27	248.93	4.4	21.08	578.31
2013	4	15	0300	1.9	258.44	6.5	69.2	798.36
2013	4	15	0400	2.95	223.6	3.6	210.36	1039.43
2013	4	15	0500	1.47	175.11	5.2	277.86	1278.79
2013	4	15	0600	1.99	193.96	10.9	407.63	1290.42
2013	4	15	0700	3.65	149.92	14.9	318.12	81.49
2013	4	15	0800	4.86	349.6	19.3	277.3	176.88
2013	4	15	0900	8.08	132.34	22.9	260.77	286.57
2013	4	15	1000	8.52	165.29	30.5	226.58	387.06
2013	4	15	1100	12.39	173.18	39.5	233.06	469.27
2013	4	15	1200	12.87	195.93	28.3	255.67	543.98
2013	4	15	1300	12.3	214.86	38.8	253.08	596.37
2013	4	15	1400	14.81	209.3	35.8	181.89	674.67
2013	4	15	1500	16.23	207.75	33.6	123.32	795
2013	4	15	1600	15.37	194.46	31.4	99.7	943.61
2013	4	15	1700	13.7	191.52	38.3	118.35	1179.67
2013	4	15	1800	14.57	187.09	31.9	109.96	1372.92
2013	4	15	1900	12.07	201.71	31.9	88.45	358.67
2013	4	15	2000	12.45	206.89	41.6	82.37	157.8
2013	4	15	2100	14.97	234.35	47.6	56.71	249.81
2013	4	15	2200	19.77	237.09	35.5	82.38	454.51
2013	4	15	2300	12.83	226.49	18.7	132.03	578.29

Table 24. Paul Meyer monitoring site data for April 16, 2013

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2013	4	16	0000	14.55	242.48	35.1	158.7	42.37
2013	4	16	0100	14.1	239.49	30.6	256.9	85.08
2013	4	16	0200	10.64	247.88	25.1	209.79	126.27
2013	4	16	0300	8.84	245.99	29.8	178.52	168.91
2013	4	16	0400	10.14	239.02	27.3	119.77	200.32
2013	4	16	0500	5.64	235.86	15.3	92.17	222.89
2013	4	16	0600	3.55	237.03	9.9	221.04	243.43
2013	4	16	0700	7.18	1.46	20.7	136.29	264.55
2013	4	16	0800	7.47	299.68	20.2	74.78	281.66
2013	4	16	0900	5.77	209.14	15.8	52.89	300.38
2013	4	16	1000	7.79	332.49	19	42.87	319.45
2013	4	16	1100	8.5	321.04	20.7	45.48	333.42
2013	4	16	1200	6.62	355.3	22.7	31.8	348.02
2013	4	16	1300	10.78	348.75	34.6	24.24	362.37
2013	4	16	1400	12.9	343.62	31.4	21.57	400.72
2013	4	16	1500	12.63	340.11	35.9	21.87	420.95
2013	4	16	1600	14.03	345.99	36.4	18.02	447.26
2013	4	16	1700	11.79	348.26	23.9	18.77	461.05
2013	4	16	1800	10.61	345.96	22.3	21.21	477.1
2013	4	16	1900	9.81	3.58	19.4	15.48	498.27
2013	4	16	2000	6.57	49.21	16.2	15.16	509.3
2013	4	16	2100	5.51	30.69	11.3	12.88	513.77
2013	4	16	2200	3.27	35.44	8.6	41.09	517.11
2013	4	16	2300	6.8	353.04	14.1	21.18	531.57

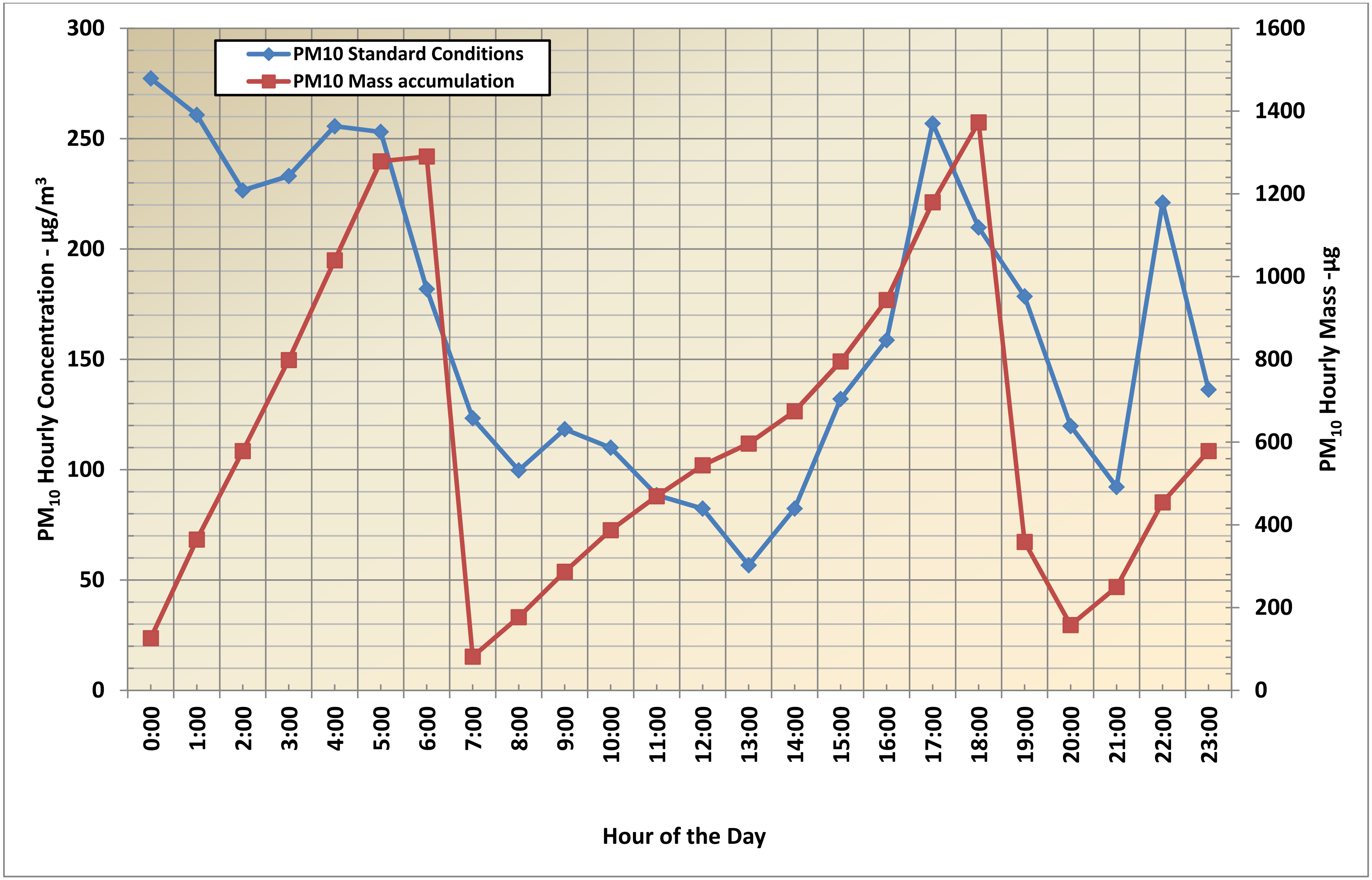

Figure 14. PM_{10} Concentrations at Paul Meyer monitoring site, April 15, 2013.

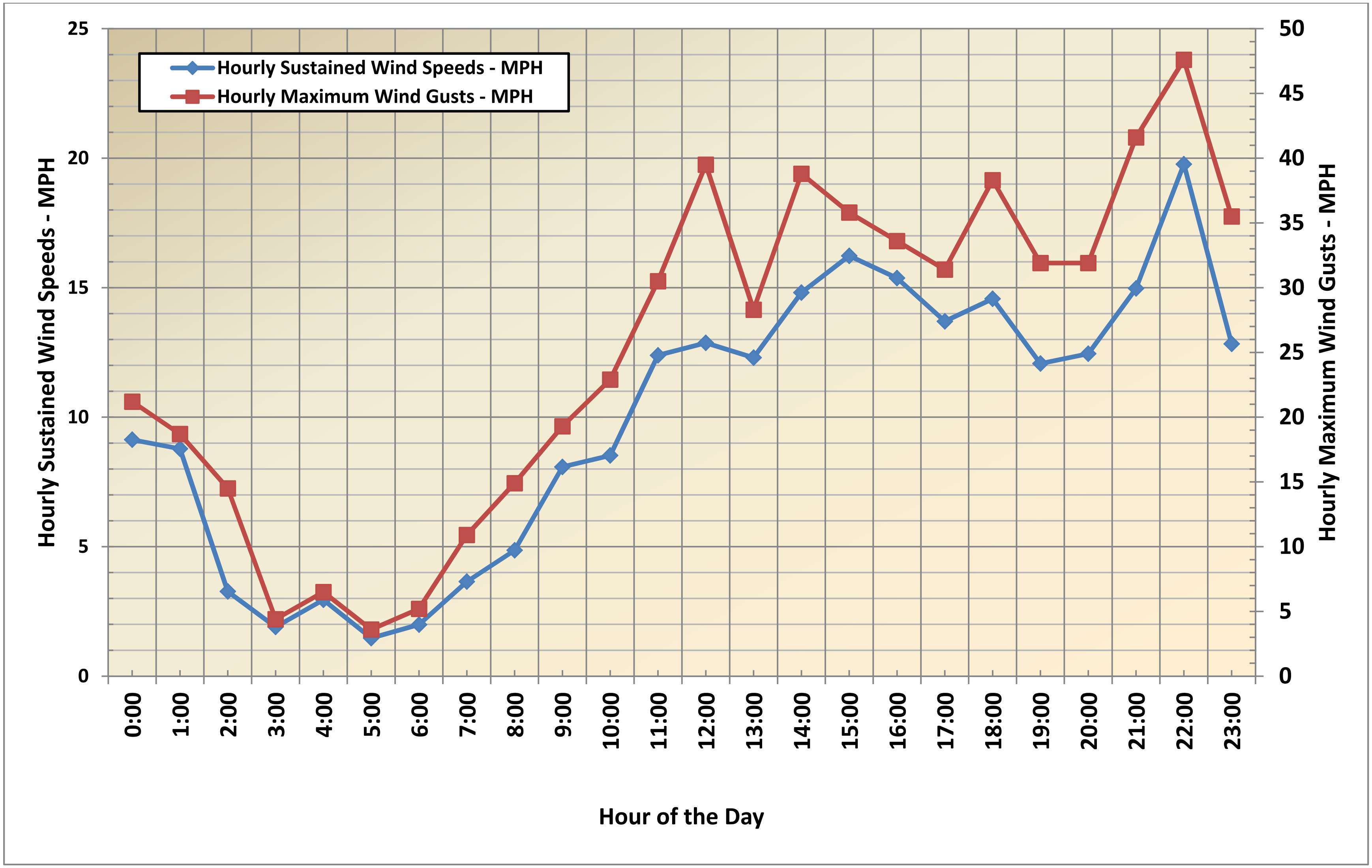

Figure 14a. Wind speeds at Paul Meyer monitoring site, April 15, 2013.

Table 25. Palo Verde monitoring site data for April 14, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2013	4	14	0000	2.33	278.57	6.1	44.63	39.96
2013	4	14	0100	2.55	265.54	6.4	39.14	67.32
2013	4	14	0200	3.77	286.94	8	25.21	91.19
2013	4	14	0300	2.69	196.34	6.8	31.77	120
2013	4	14	0400	2.98	303.2	7.6	24.85	142.33
2013	4	14	0500	3.67	25.36	7.6	19.64	160.93
2013	4	14	0600	3.11	73.1	7.1	20.43	179.36
2013	4	14	0700	3.7	99.85	9.6	22.83	199.65
2013	4	14	0800	5.1	140.12	11.9	25.4	224.46
2013	4	14	0900	5.29	124.65	12.6	32.53	253.77
2013	4	14	1000	4.86	102.27	15.1	34.29	285.77
2013	4	14	1100	4.85	117.39	15.2	31.8	313.76
2013	4	14	1200	4.99	162.86	19	26.88	338.06
2013	4	14	1300	8.48	165.71	22.5	27.87	361.67
2013	4	14	1400	9.63	166.85	21.3	26.68	386.73
2013	4	14	1500	11.72	225.73	24.6	24.68	409.03
2013	4	14	1600	12.74	243.49	28.8	24.63	430.92
2013	4	14	1700	13.82	242.61	29.8	24.78	452.31
2013	4	14	1800	10.53	227.75	27.5	19.71	470.02
2013	4	14	1900	10.37	221.17	21.1	31.82	501.32
2013	4	14	2000	10.05	243.93	23.6	152.71	638.79
2013	4	14	2100	9.66	224.69	26.3	175.78	795.77
2013	4	14	2200	13.51	210.44	24.6	151.57	932.97
2013	4	14	2300	5.86	239.28	24.5	193.5	1113.24

Table 26. Palo Verde monitoring site data for April 15, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Mass Accumulation (μg)
2013	4	15	0000	4.21	60.04	11.9	292.17	171.64
2013	4	15	0100	3.25	55.61	9.2	308.99	432.61
2013	4	15	0200	5.29	9.49	17.5	299.02	706.82
2013	4	15	0300	4.83	21.9	15.8	285.42	965.93
2013	4	15	0400	3.02	358.04	7.7	185.98	1141.07
2013	4	15	0500	1.92	348.41	4.3	291.93	1153.78
2013	4	15	0600	2.23	22.86	6.3	356.74	237.51
2013	4	15	0700	4.88	51.25	10.5	316.92	522.29
2013	4	15	0800	5	61.99	15	220.49	727.19
2013	4	15	0900	6.22	82.03	16.3	216.86	921.72
2013	4	15	1000	4.6	113.73	13.9	148.16	1055.05
2013	4	15	1100	4.46	148.45	13.5	95.33	1140.37
2013	4	15	1200	16.43	257.46	45.4	72.21	1206.49
2013	4	15	1300	20.44	247.88	47.3	74.2	1272.02
2013	4	15	1400	18.44	240.68	45.9	70.11	1334.42
2013	4	15	1500	13.53	199.25	32.1	87.65	1417.34
2013	4	15	1600	9.59	218.22	24	172.24	222.23
2013	4	15	1700	10.46	208.31	34.2	353.52	401.18
2013	4	15	1800	13.72	229.05	38.2	233.18	614.53
2013	4	15	1900	18.89	244.61	51.9	201.51	804.97
2013	4	15	2000	17.45	245.81	53.9	374.88	1133.21
2013	4	15	2100	15.67	240.85	41.7	171.78	1295.57
2013	4	15	2200	21.14	250.42	52.1	149.44	1331.29
2013	4	15	2300	18.74	271.99	50.8	133.27	74.52

Table 27. Palo Verde monitoring site data for April 16, 2013.

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Mass Accumulation (μg)
2013	4	16	0000	13.93	269.98	38.8	93.02	45.27
2013	4	16	0100	13.87	265.53	35.6	57.08	95.35
2013	4	16	0200	14.16	264.54	43.1	35.58	129.07
2013	4	16	0300	11.6	251.36	32.5	36.08	162.04
2013	4	16	0400	9.28	254.21	23.3	27.68	188.93
2013	4	16	0500	8.49	248.62	19.5	22.98	210.12
2013	4	16	0600	2.73	260.91	11.4	20.75	230.88
2013	4	16	0700	4.04	226.26	15.1	15.12	239.09
2013	4	16	0800	6.01	297.81	15	6.52	199.38
2013	4	16	0900	7.34	327.82	27.1	51.82	246.1
2013	4	16	1000	7.83	352.69	22.3	22.63	267.96
2013	4	16	1100	6.18	260.39	21.2	16.77	283.6
2013	4	16	1200	6.81	16.05	21	14.41	297.52
2013	4	16	1300	11.07	13.91	40	19.16	314.88
2013	4	16	1400	10.73	1.81	24.9	9.13	323.82
2013	4	16	1500	13.38	354.39	40.1	8.39	331.78
2013	4	16	1600	14.32	351.31	35.2	18.13	348.26
2013	4	16	1700	11.06	16.63	26.6	5.98	353.69
2013	4	16	1800	11.36	1.3	34.6	3.77	357.83
2013	4	16	1900	10.02	8.09	27	5.11	362.39
2013	4	16	2000	11.14	9.36	31.2	4.3	365.97
2013	4	16	2100	10	346.83	24.6	4.13	370.67
2013	4	16	2200	7.84	5.86	21.8	6.9	376.99
2013	4	16	2300	8.86	2.52	24.7	4.02	380.39

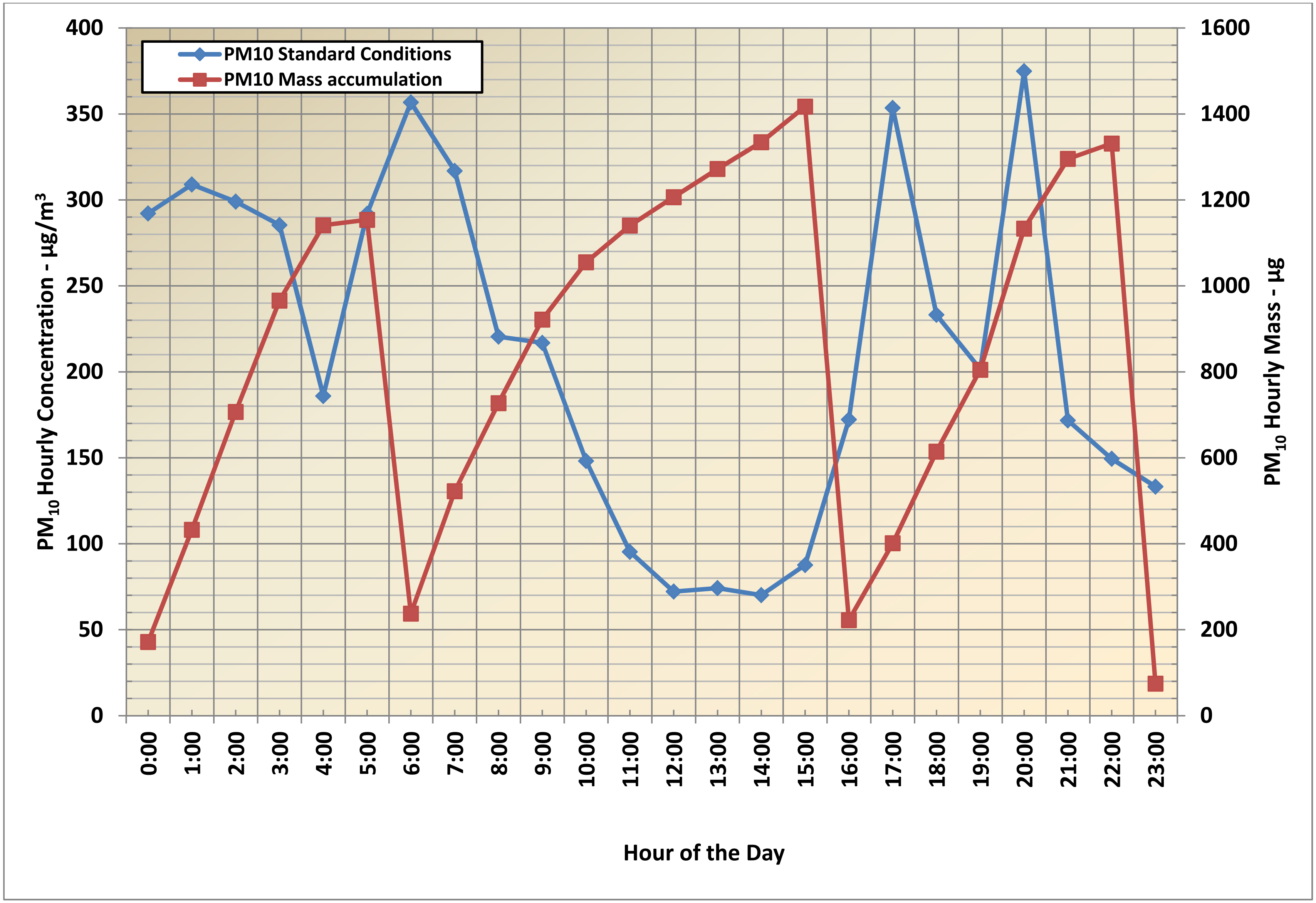

Figure 15. PM_{10} concentrations at Palo Verde monitoring site, April 15, 2013.

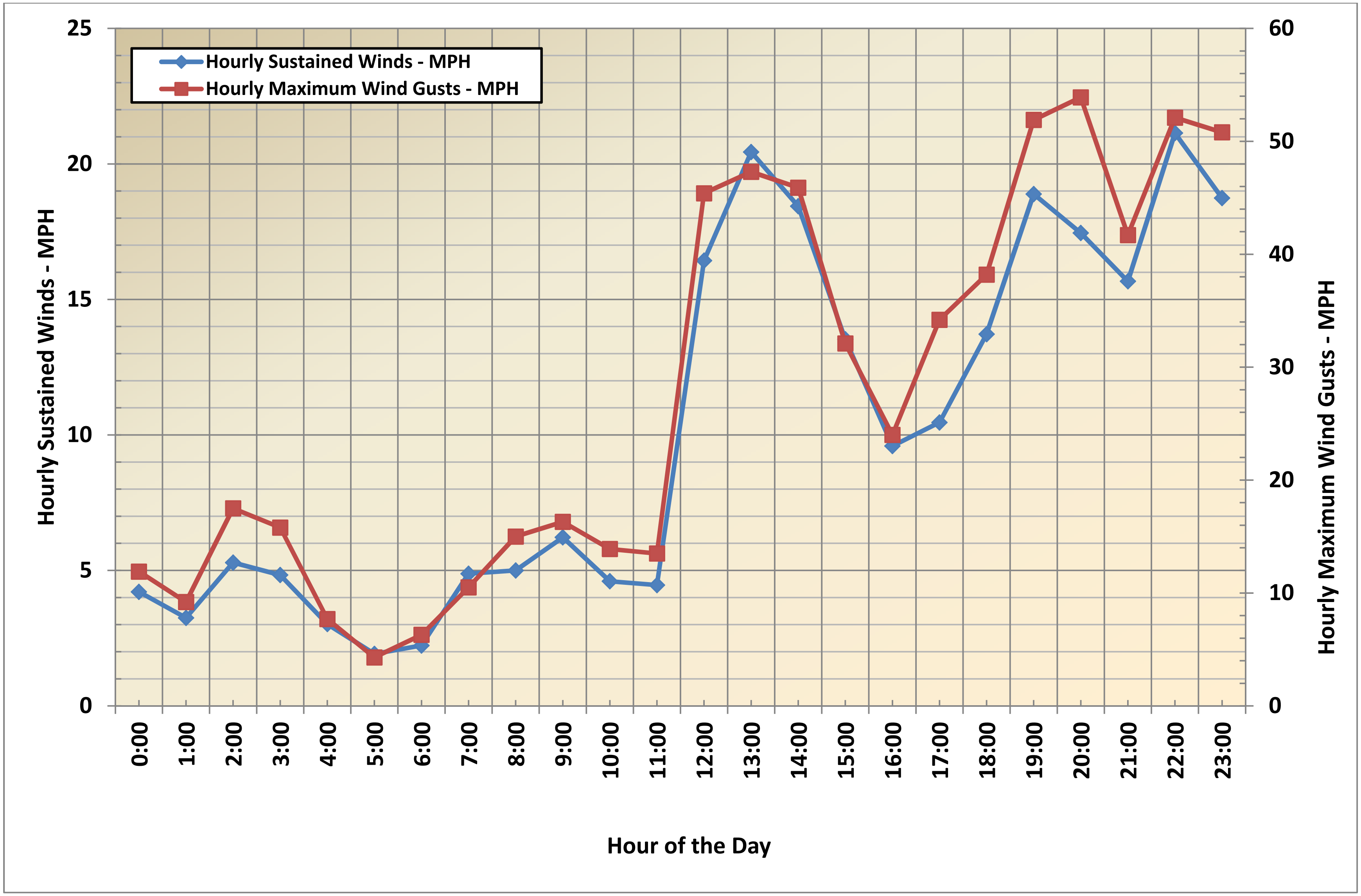

Figure 15a. Wind speeds at Palo Verde monitoring site, April 15, 2013.

2.4.2 Clear Causal Connection Between the Exceedances and the Event.

The causal connection is demonstrated by the dramatic increase in hourly PM_{10} concentrations that coincided with the high-wind dust transported from the desert storm in southeastern California and the northwestern desert of Arizona into the Ivanpah, Eldorado, and Las Vegas Valleys.

2.4.3 Measured Concentration in Excess of Normal Historical Fluctuations.

The 24-hour average PM_{10} concentration of 267 µg/m^3 at the Sunrise Acres monitoring site on April 15, 2013, was the highest recorded in the PM_{10} nonattainment area in Clark County between 2008 and 2013. It was also the highest concentration recorded at the site in over five years. The reading indicates an excess of normal historical fluctuation, including background (Figure 16).

The 24-hour average PM_{10} concentration of 245 µg/m^3 at the Boulder City monitoring site on April 15, 2013, was the second highest recorded in the Eldorado Valley in the Clark County PM_{10} monitoring network between years 2008 and 2013. Boulder City is located southeast of the Las Vegas Valley and is in a PM_{10} attainment area. The reading at the Boulder City monitoring site was the highest concentration recorded in over five years and indicates an excess of normal historical fluctuation, including background (Figure 17).

The 24-hour average PM_{10} concentration of 243 µg/m^3 at the Jerome Mack (NCore) monitoring site on April 15, 2013, was the third highest recorded in the Clark County monitoring network and the second highest recorded in the Las Vegas Valley during the April 15, 2013, exceedance day. The Jerome Mack site began operating January 1, 2012, so only two years of data are available for use in this document and in AQS. The reading indicates an excess of normal historical fluctuation, including background (Figure 18).

The 24-hour average PM_{10} concentration of 237 µg/m^3 at the J. D. Smith monitoring site on April 15, 2013, was the fourth highest recorded in the Clark County PM_{10} monitoring network between years 2008 and 2013. It was also the highest concentration recorded at the site in over five years. The reading indicates an excess of normal historical fluctuation, including background (Figure 19).

The 24-hour average PM_{10} concentration of 226 µg/m^3 at the Joe Neal monitoring site on April 15, 2013, was the fifth highest recorded in the Clark County PM_{10} monitoring network between years 2008 and 2013. It was also the highest concentration recorded at the site in over five years. The reading indicates an excess of normal historical fluctuation, including background (Figure 20).

The 24-hour average PM_{10} concentration of 212 µg/m^3 at the Palo Verde monitoring site on April 15, 2013, was the sixth highest recorded in the Clark County PM_{10} monitoring network between years 2008 and 2013. It was also the highest concentration recorded at the site in over five years. The reading indicates an excess of normal historical fluctuation, including background (Figure 21).

The 24-hour average PM_{10} concentration of 196 μg/m^3 at the Green Valley monitoring site on April 15, 2013, was the seventh highest recorded in the Clark County PM_{10} monitoring network between years 2008 and 2013. It was also the highest concentration recorded at the site in over five years. The reading indicates an excess of normal historical fluctuation, including background (Figure 22).

The 24-hour average PM_{10} concentration of 165 μg/m^3 at the Jean monitoring site on April 15, 2013, was the eighth highest recorded in the Clark County PM_{10} monitoring network between years 2008 and 2013. It was also the highest concentration recorded at the site in over five years. The reading indicates an excess of normal historical fluctuation, including background (Figure 23). The Jean site is located in the Ivanpah Valley, a PM_{10} attainment area.

The 24-hour average PM_{10} concentration of 164 μg/m^3 at the Paul Meyer monitoring site on April 15, 2013, was the ninth highest recorded in the Clark County PM_{10} monitoring network between years 2008 and 2013. It was also the highest concentration recorded at the site in over five years. The reading indicates an excess of normal historical fluctuation, including background (Figure 24).

2.4.4 There Would Have Been No Exceedance *But For* the Event.

There are several indications that the PM_{10} NAAQS would not have been exceeded on April 15, 2013, but for the presence of high-wind transported dust from the desert storm in the southeastern California desert out of Barstow and Baker along with the dust flows from the northwestern Arizona desert into the Las Vegas Valley. DAQ's exceptional event data shows that PM_{10} concentrations in Clark County were low in the hours prior to April 15, 2013, with the exception of a 3–5 hour period prior to midnight on April 14, 2013, when the dust started to arrive from the high-wind transported event. Wind speeds were high and constant, and the dust flowed into the Ivanpah, Eldorado, and the Las Vegas Valleys. Increasing wind speeds in the early morning into the afternoon pushed the dust through all valleys, and concentrations at all affected PM_{10} sites increased rapidly. DAQ concludes from the data in this report that the PM_{10} NAAQS would not have been exceeded on this event day if the high winds had not carried the additional dust from the transport event into the affected Clark County PM_{10} monitoring sites. No local sources were observed to be adding fugitive dust to the mix during the event day.

The meteorological analysis, the established scientific basis for high-wind transported particulate entrainment, and the implementation of BACM on particulate emissions sources detailed in the following sections of this document demonstrate that during this high-wind transported dust event, PM_{10} emissions were not reasonably controllable, and the exceedance was not reasonably preventable. Therefore, the April 15, 2013, exceedance would not have occurred *but for* the regional high-winds transported dust event.

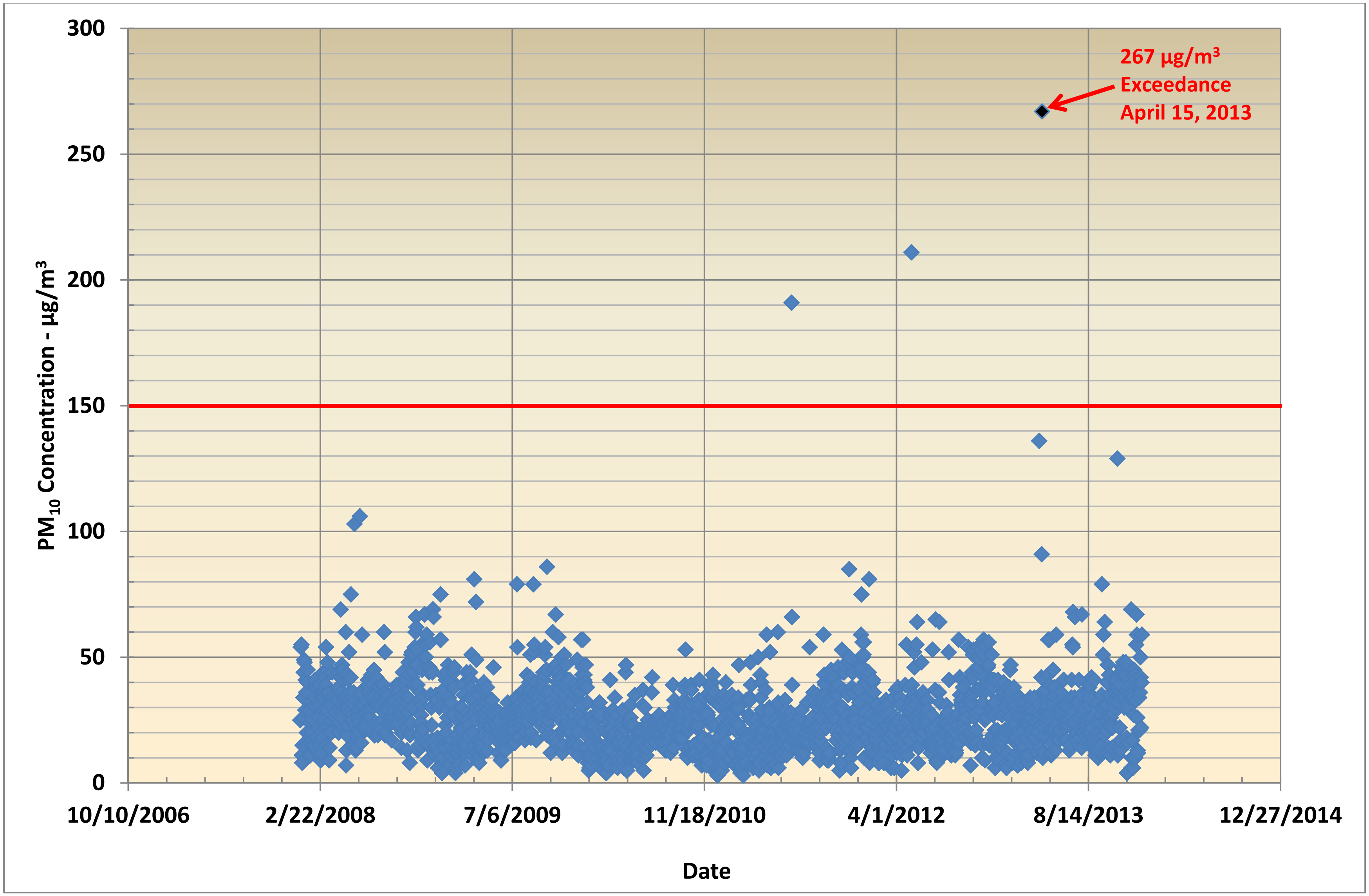

Figure 16. **Sunrise Acres monitoring site five-year historical trend in 24-hour PM_{10} concentrations.**

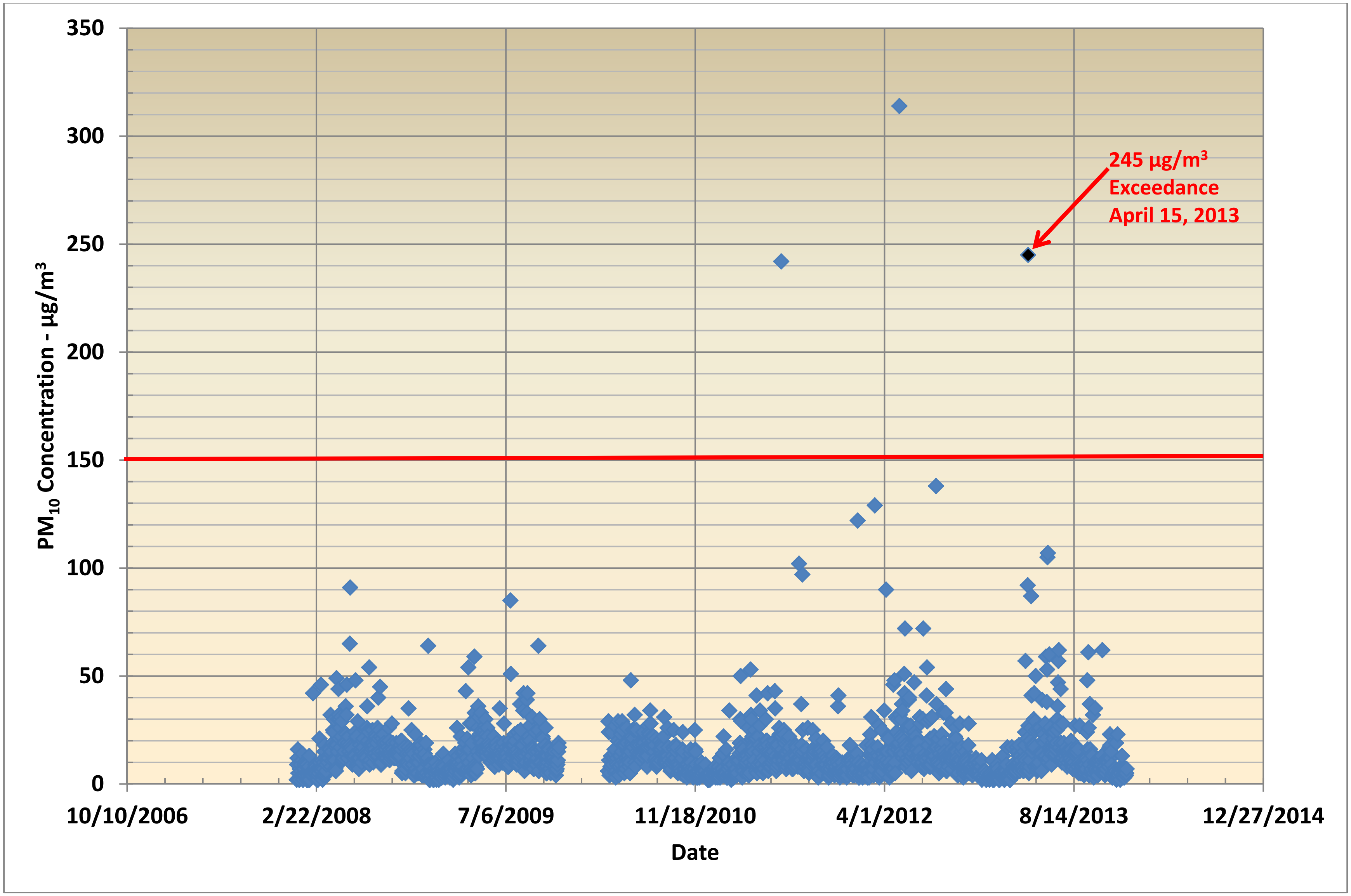

Figure 17. **Boulder City monitoring site five-year historical trend in 24-hour PM_{10} concentrations.**

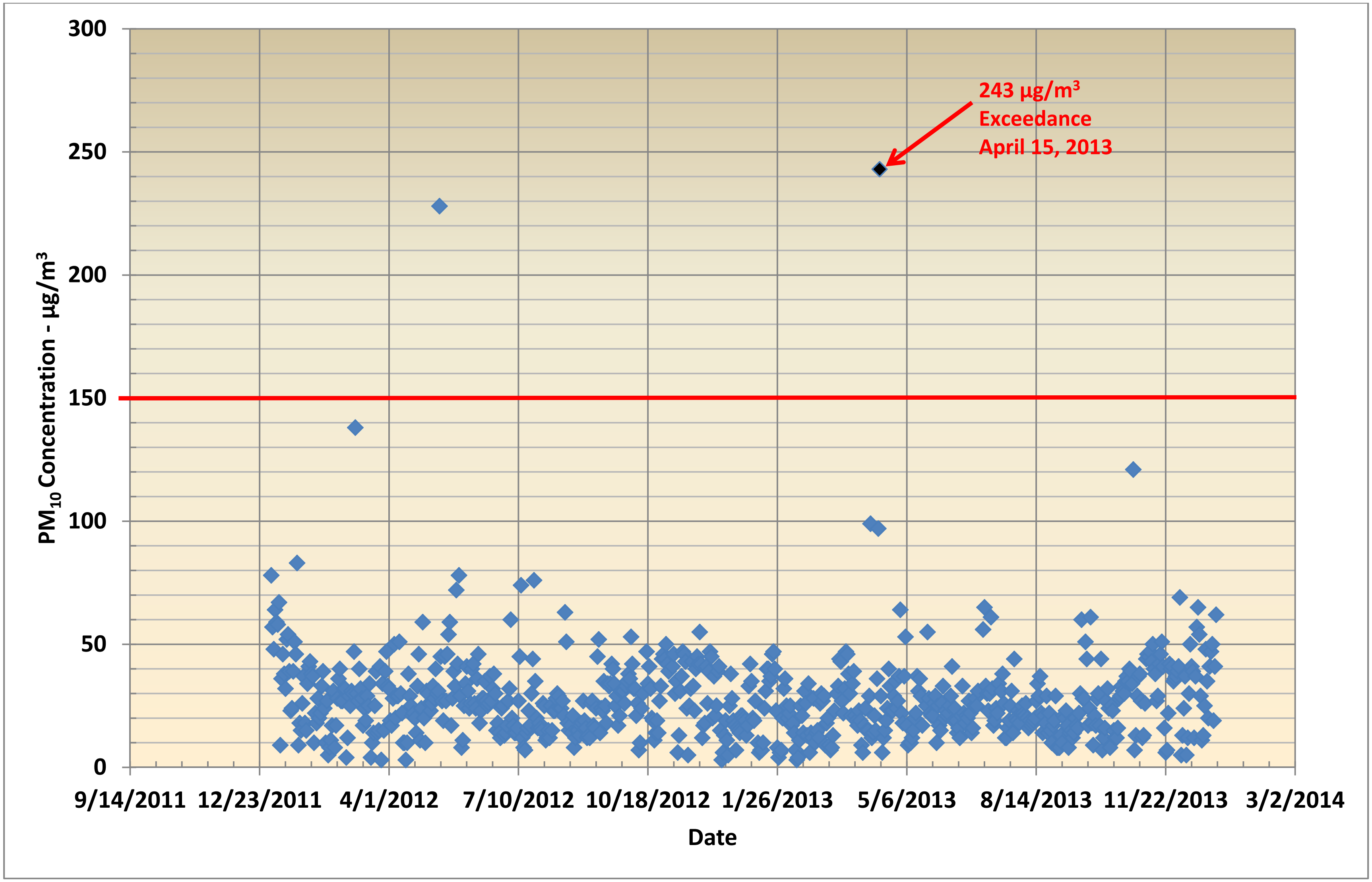

Figure 18. Jerome Mack monitoring site two-year historical trend in 24-hour PM_{10} concentrations.

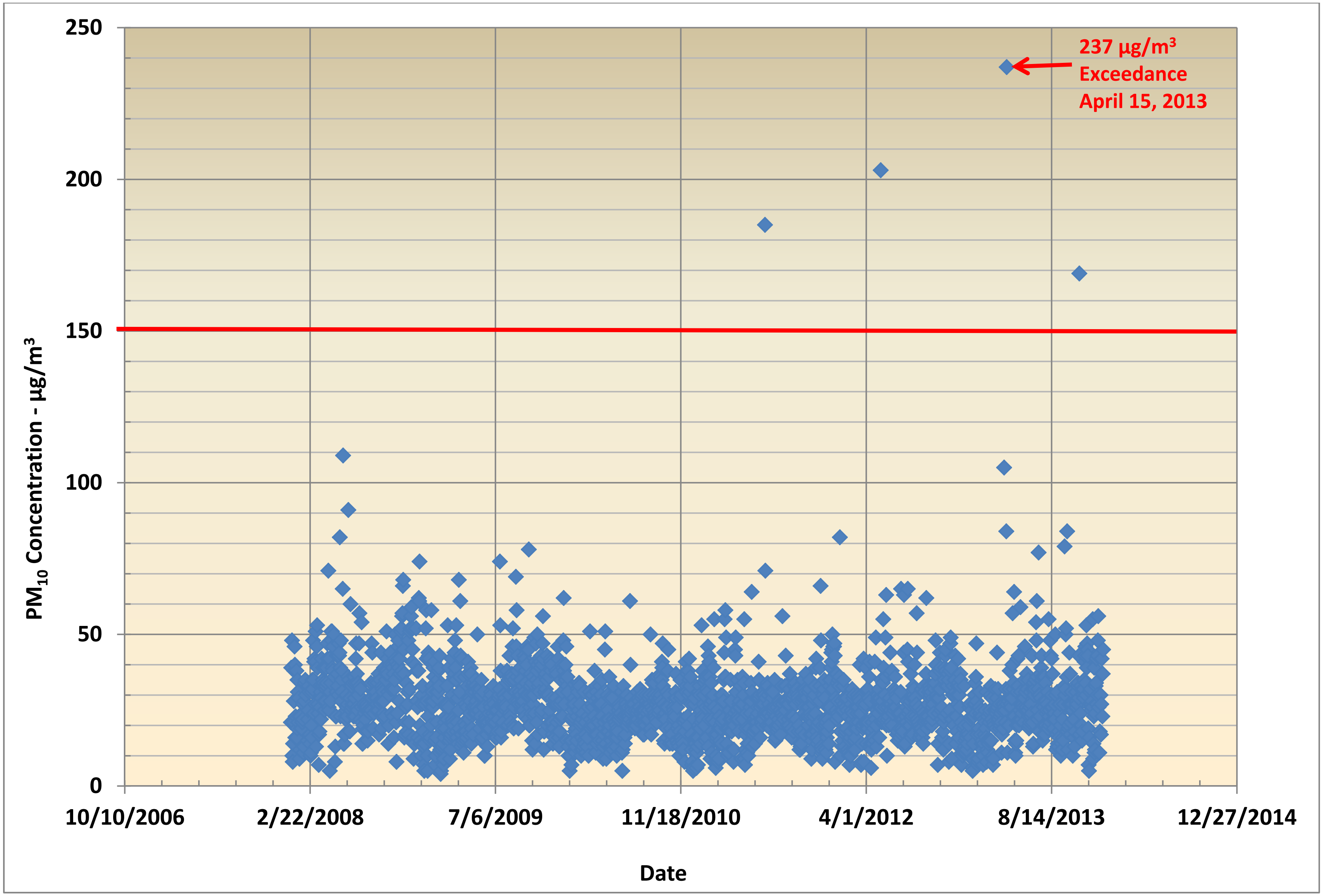

Figure 19. J. D. Smith monitoring site five-year historical trend in 24-hour PM_{10} concentrations.

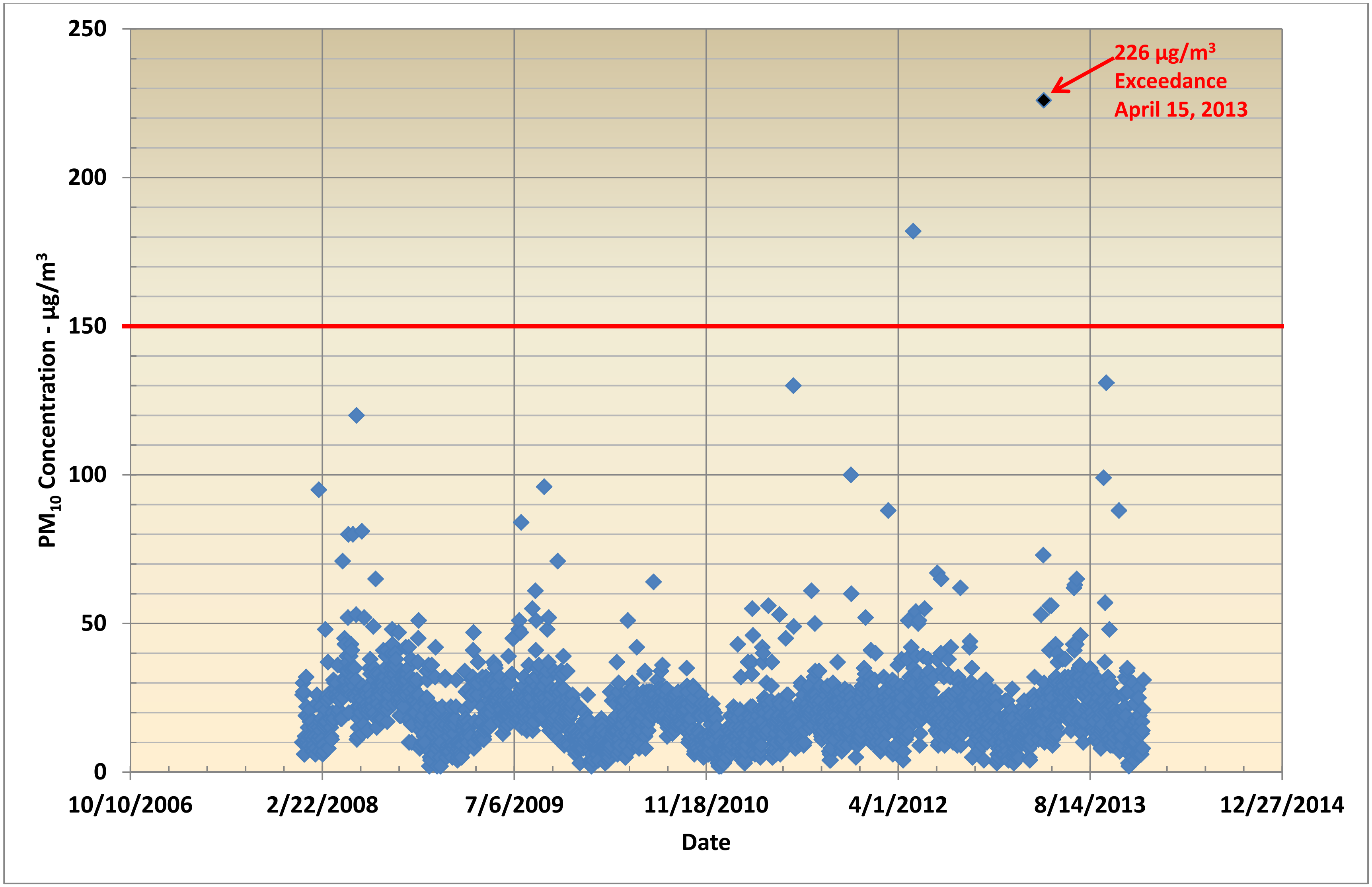

Figure 20. Joe Neal monitoring site five-year historical trend in 24-hour PM_{10} concentrations.

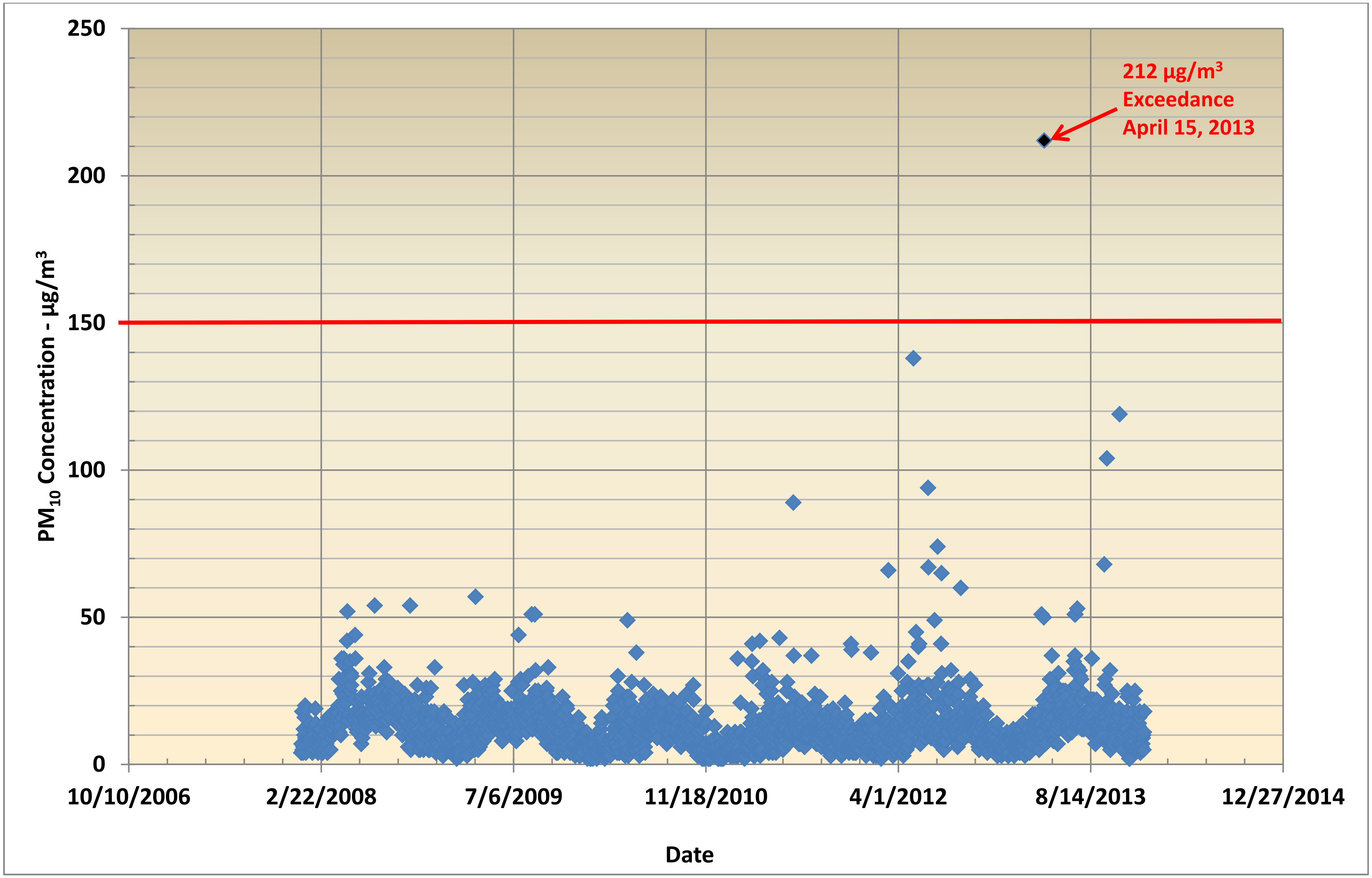

Figure 21. Palo Verde monitoring site five-year historical trend in 24-hour PM_{10} concentrations.

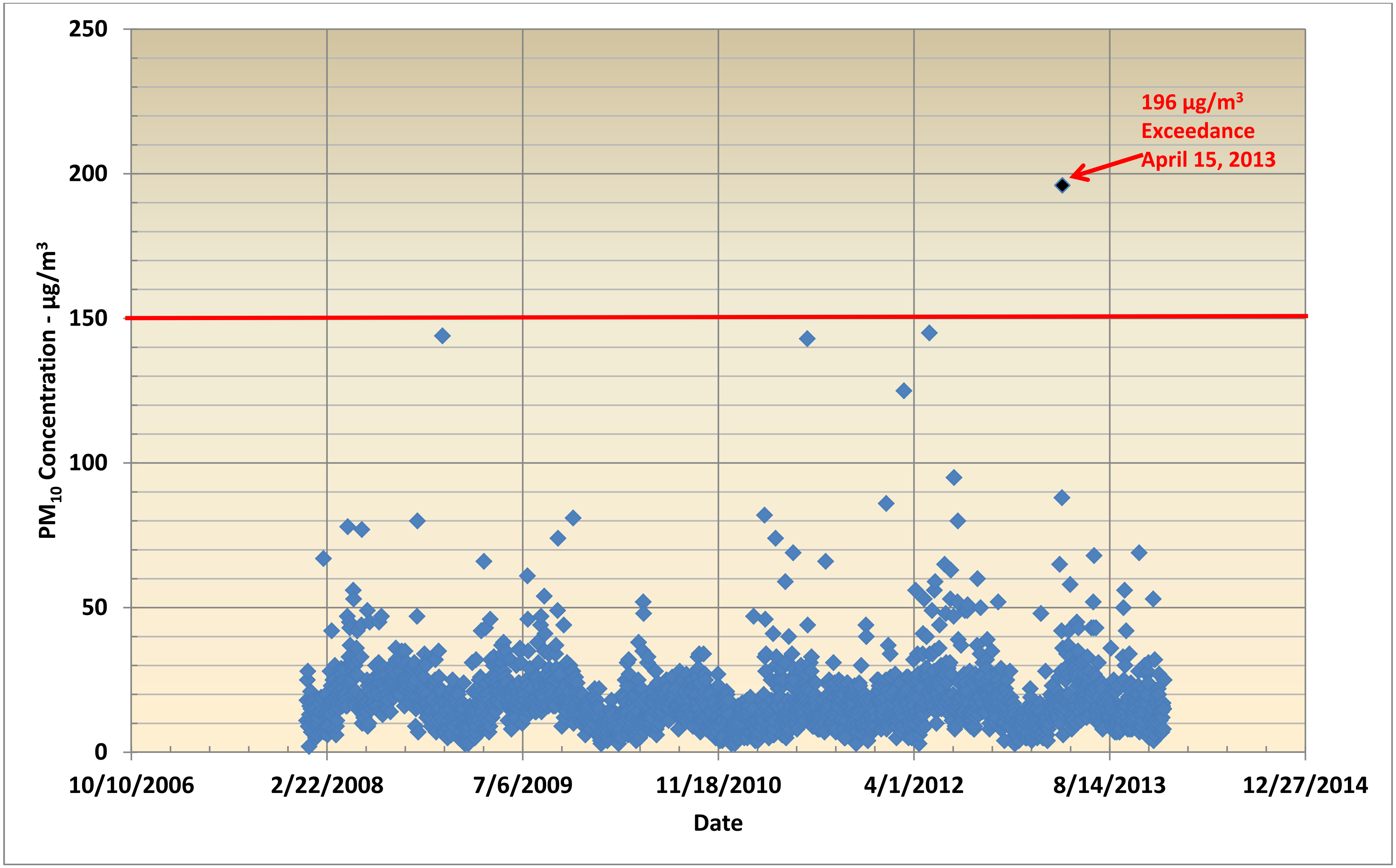

Figure 22. Green Valley monitoring site five-year historical trend in 24-hour PM_{10} concentrations.

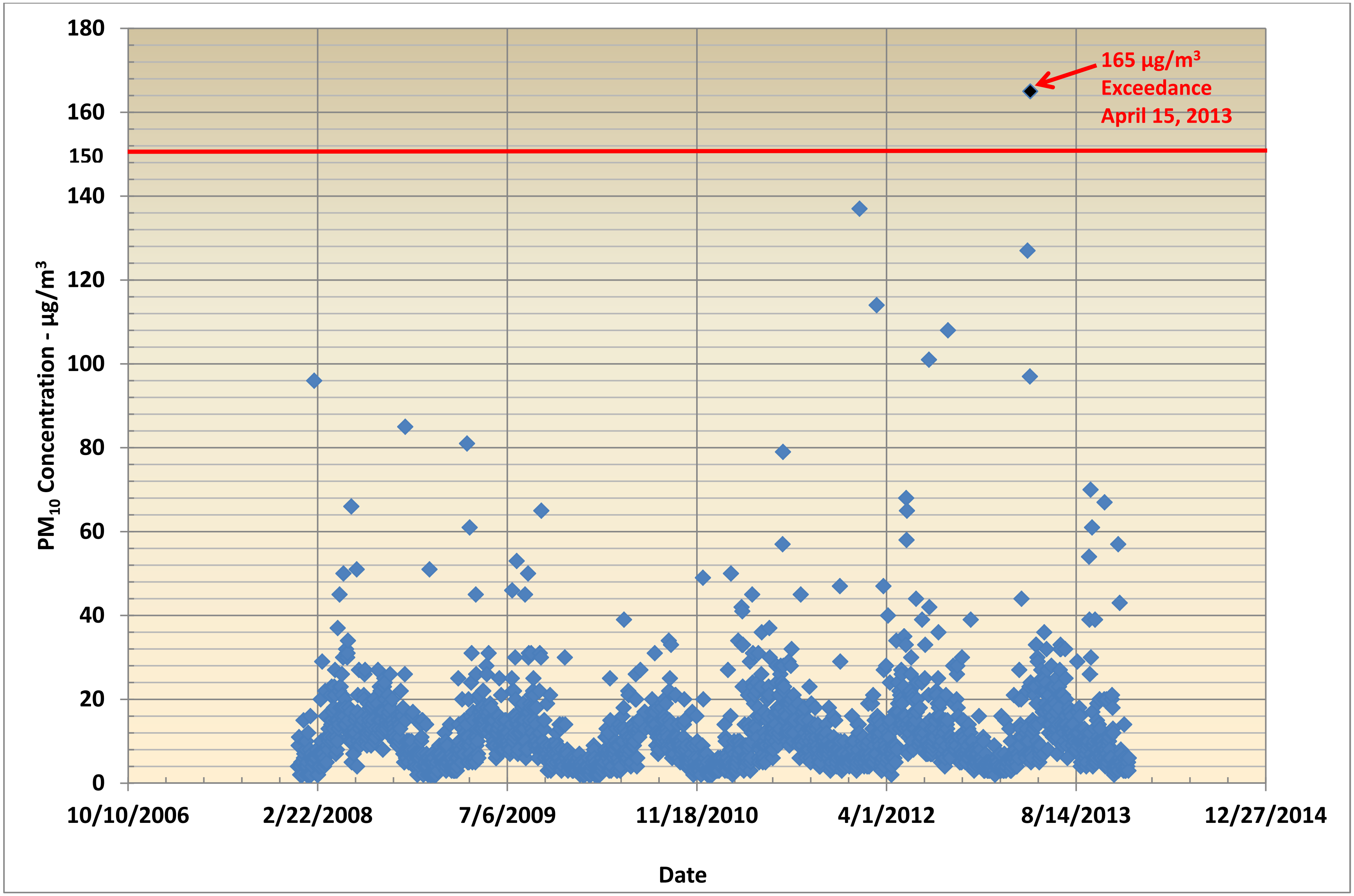

Figure 23. Jean monitoring site five-year historical trend in 24-hour PM_{10} concentrations.

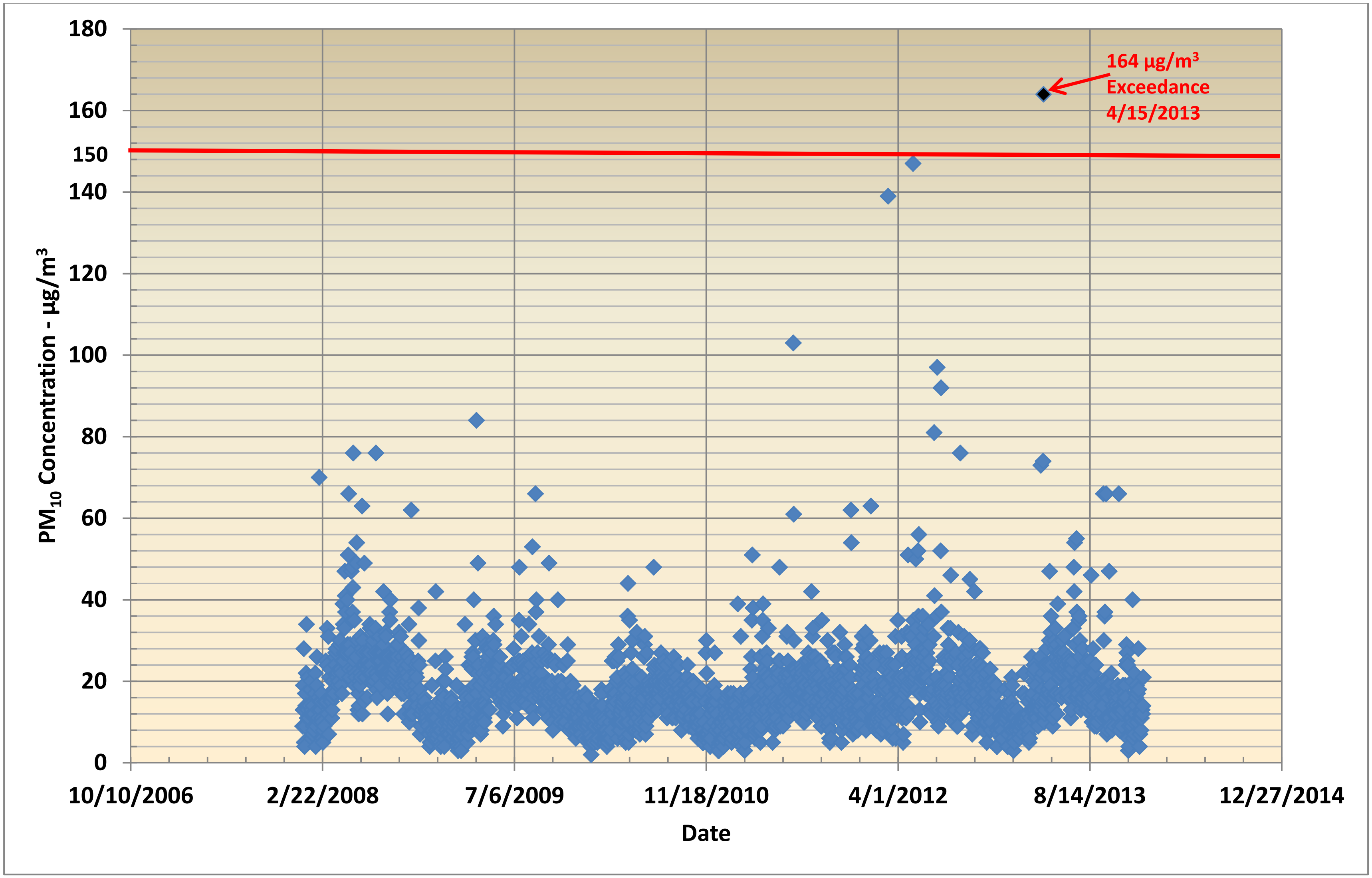

Figure 24. Paul Meyer monitoring site five-year historical trend in 24-hour PM_{10} concentrations.

Figure 25 illustrates the highest concentrations for PM_{10} recorded by an active air quality monitoring station in Clark County between 2008 and 2013; Table 28 contains the calculated 95th and 99th percentiles for PM_{10}, which are the values that exceed all but the highest five percent and one percent of the values, respectively. Maximum PM_{10} concentrations in Clark County have risen as high as 203 percent of the NAAQS. Like the number of exceedances (Figure 25), maximum concentrations vary from year to year, depending on meteorological conditions. Therefore, maximum concentrations are not the best indicators of long-term trends; the 95th percentile is less influenced by extreme events, and provides a better indication of underlying data trends.

Figures 26 and 27 show a 63 percent change in the 95th-percentile data in Las Vegas over the last five years for all exceedance events/days; Figures 28 and 29 show a 65 percent change in the 99th-percentile data during the same period for all exceedance events/days. Figure 30 shows what the combined 95th and 99th percentiles, with the corresponding concentration levels, were for applicable exceedance events in all hydrographic areas involved. Figure 31 shows the 95th and 99th percentiles for 2013, and where the exceedance fell that year at the Boulder City site. Figure 32 shows the 95th and 99th percentiles for 2013, and where the exceedance fell that year at the Jerome Mack site. Figure 33 shows the 95th and 99th percentiles for 2013, and where the exceedance fell that year at the Sunrise Acres site. Figure 34 shows the 95th and 99th percentiles for 2013, and where the exceedance fell that year at the J. D. Smith site. Figure 35 shows the 95th and 99th percentiles for 2013, and where the exceedance fell that year at the Joe Neal site. Figure 36 shows the 95th and 99th percentiles for 2013, and where the exceedance fell that year at the Green Valley site. Figure 37 shows the 95th and 99th percentiles for 2013, and where the exceedance fell that year at the Paul Meyer site. Figure 38 shows the 95th and 99th percentiles for 2013, and where the exceedance fell that year at the Palo Verde site. Figure 39 shows the 95th and 99th percentiles for 2013, and where the exceedance fell that year at the Jean site.

Figure 40 shows sustained wind speeds and maximum wind gusts in 2013, and contrasts the transported dust event on April 15, 2013, with other wind speed values (sustained winds of 19.3 mph and maximum wind gusts of 31 mph) measured during the year. (The 2013 mean sustained wind and maximum wind gust values in 2013 were 8.4 mph and 19 mph, respectively.) Dust reservoir values provided little or no causal link to the increase of fugitive dust in the area of influence around any of the monitoring sites. Hourly wind speed increases in the late evening helped clear dust out of the Ivanpah, Eldorado, and Las Vegas Valleys. The exceedance concentration values for PM_{10} for April 15, 2013, have occurred less than one percent of the time over the last five years, and fall outside normal seasonal variations.

Figures 41–44 show the sustained and maximum wind gusts for 2008–2012 for comparison with 2013 winds. Both sustained winds and maximum wind gusts for the represented years are typical for the Las Vegas Valley: sustained winds of 8 mph or more, with wind gusts of 25 mph or more.

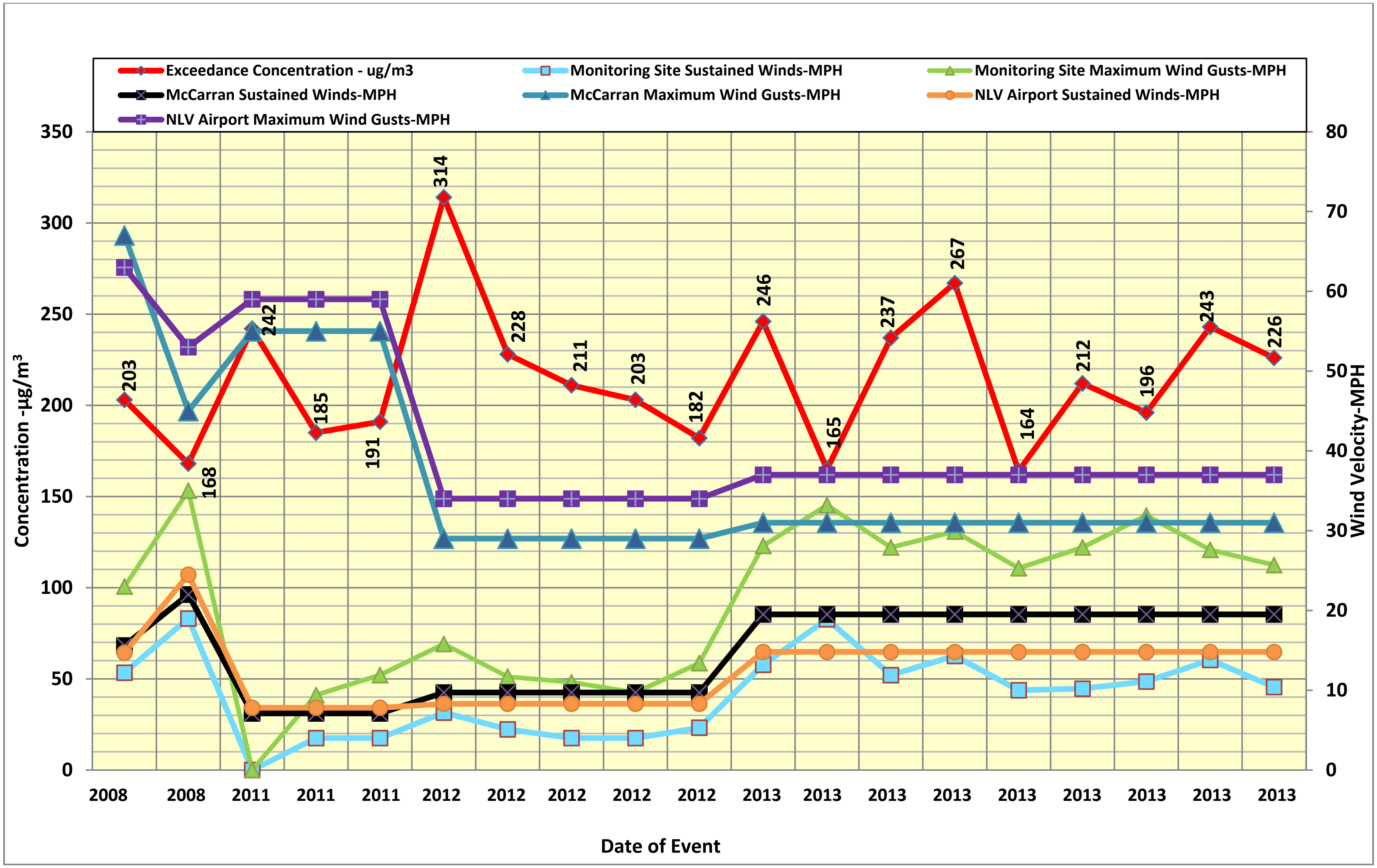

Figure 25. Clark County exceedance days in chronological order, 2008–2013.

Table 28. PM_{10} concentration percentages of NAAQS and 95th/99th percentiles data, 2008–2013.

Exceedance Value ($\mu g/m^3$)	% of 155 $\mu g/m^3$ NAAQS	Month & Year	95th Percentile $\mu g/m^3$	99th Percentile $\mu g/m^3$
314	203	May-12	37	122
267	172	Apr-13	55	91
246	159	Apr-13	41	92
243	157	Apr-13	51	97
242	156	Jul-11	30	53
237	153	Apr-13	50	84
228	147	May-12	54	78
226	146	Apr-13	41	88
212	137	Apr-13	30	68
211	136	May-12	53	65
203	131	Feb-08	67	124
203	131	May-12	46	65
196	127	Apr-13	42	68
191	123	Jul-11	47	60
185	119	Jul-11	44	64
182	117	May-12	39	65
168	108	May-08	67	124
165	107	Apr-13	32	70
164	106	Apr-13	36	66

Table 29 provides the 2008–2013 exceedance histories for the hydrographic areas affected by the high winds and transported dust events. The table indicates EPA pending action where applicable. Four prior events (on February 13, 2008, May 21, 2008, July 3, 2011, and May 10, 2012) have been submitted under the new Exceptional Event Rule, but EPA has not yet taken action on them.

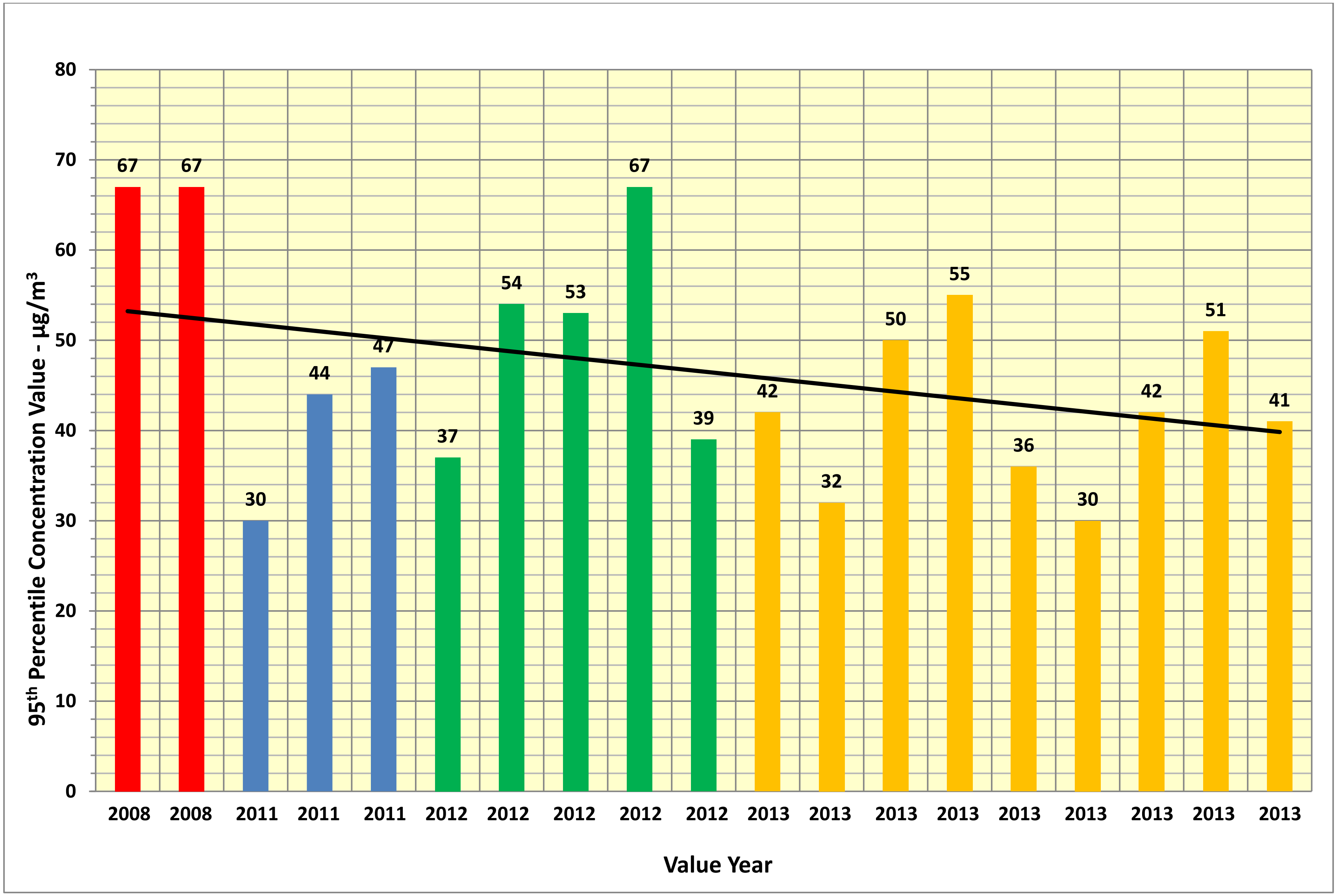

Figure 26. 95^{th} Percentile for all PM_{10} exceedances, 2008–2013.

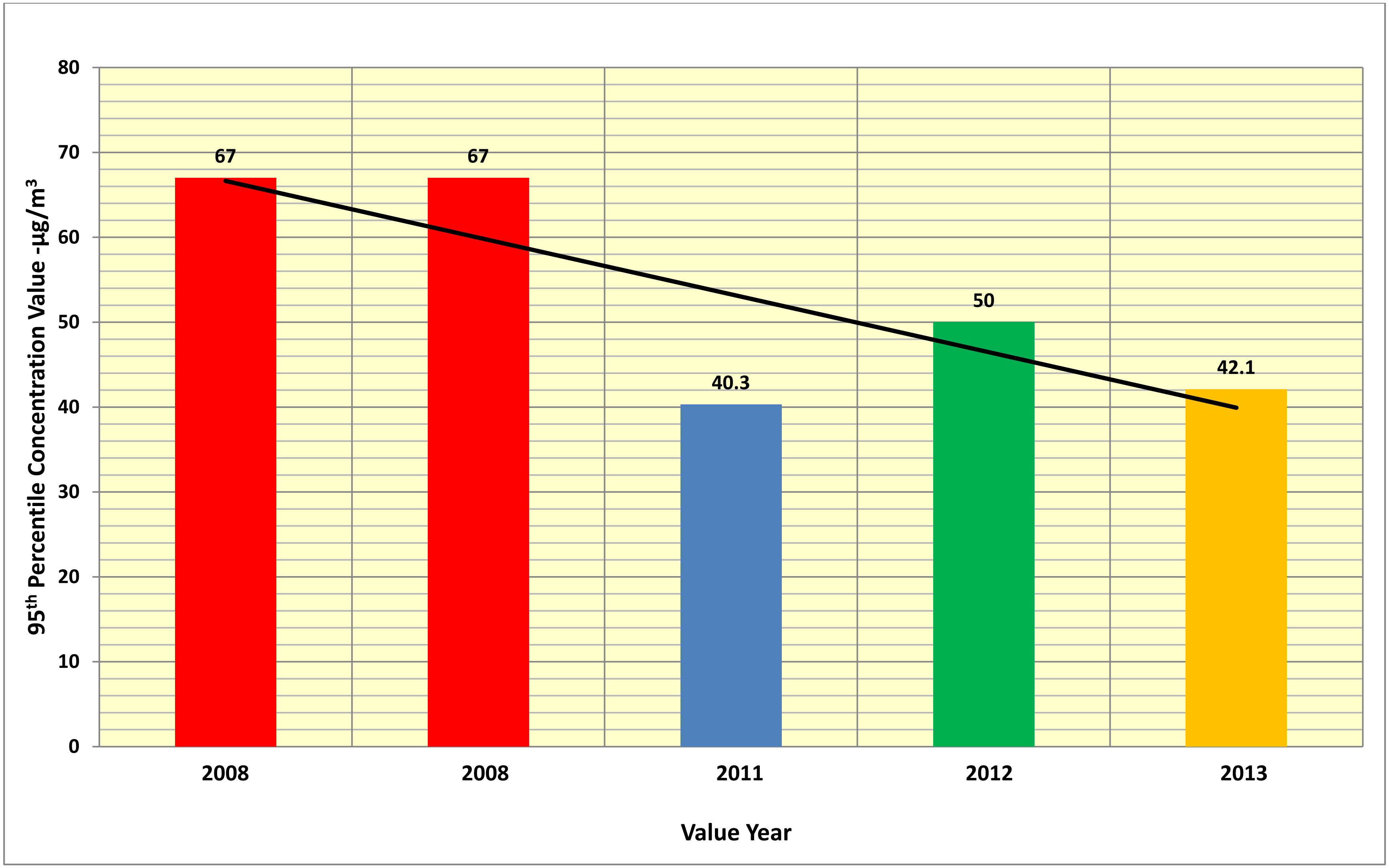

Figure 27. 95th Percentile for PM_{10} exceedance days, 2008–2013.

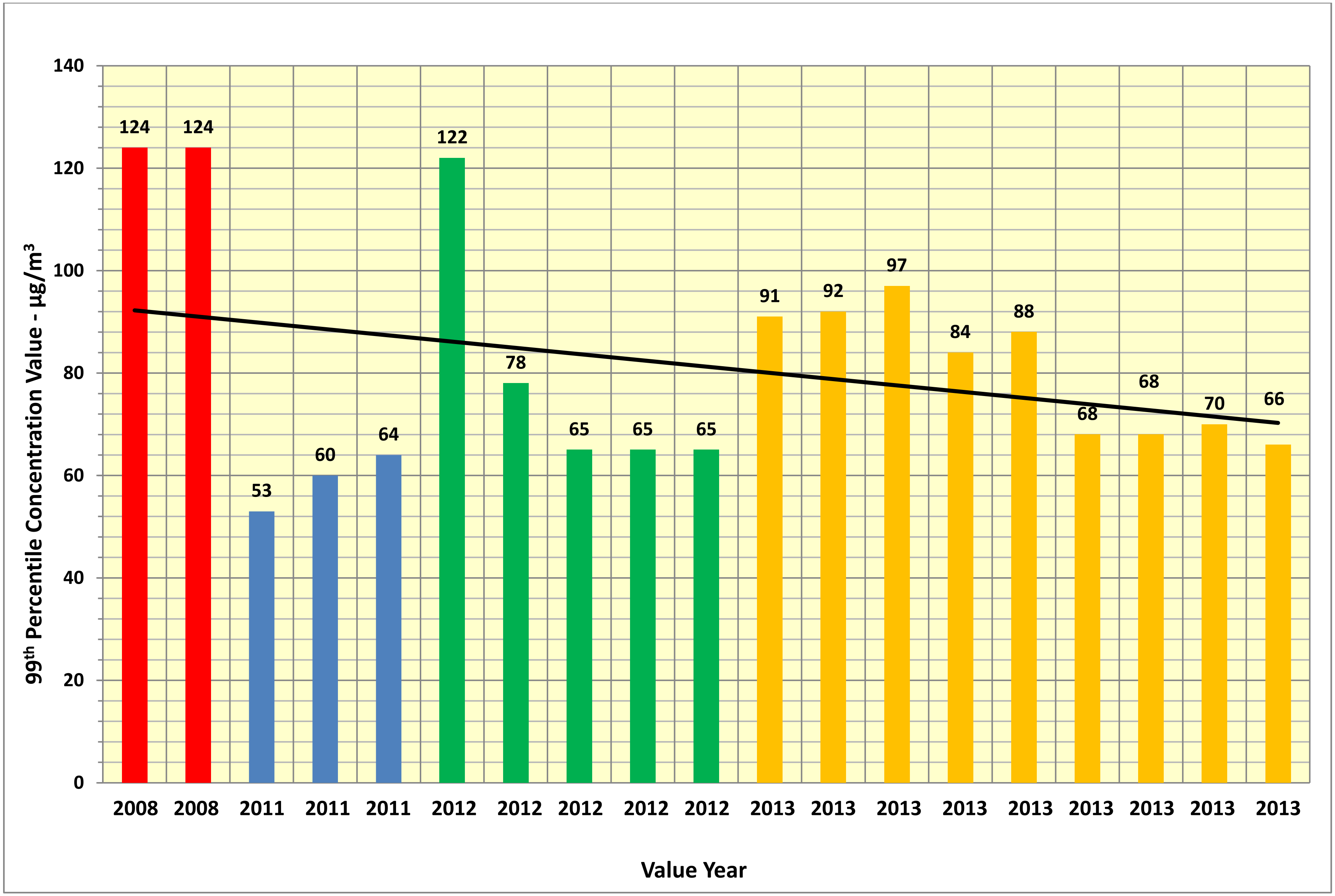

Figure 28. 99^{th} percentile for all PM_{10} exceedances, 2008–2013.

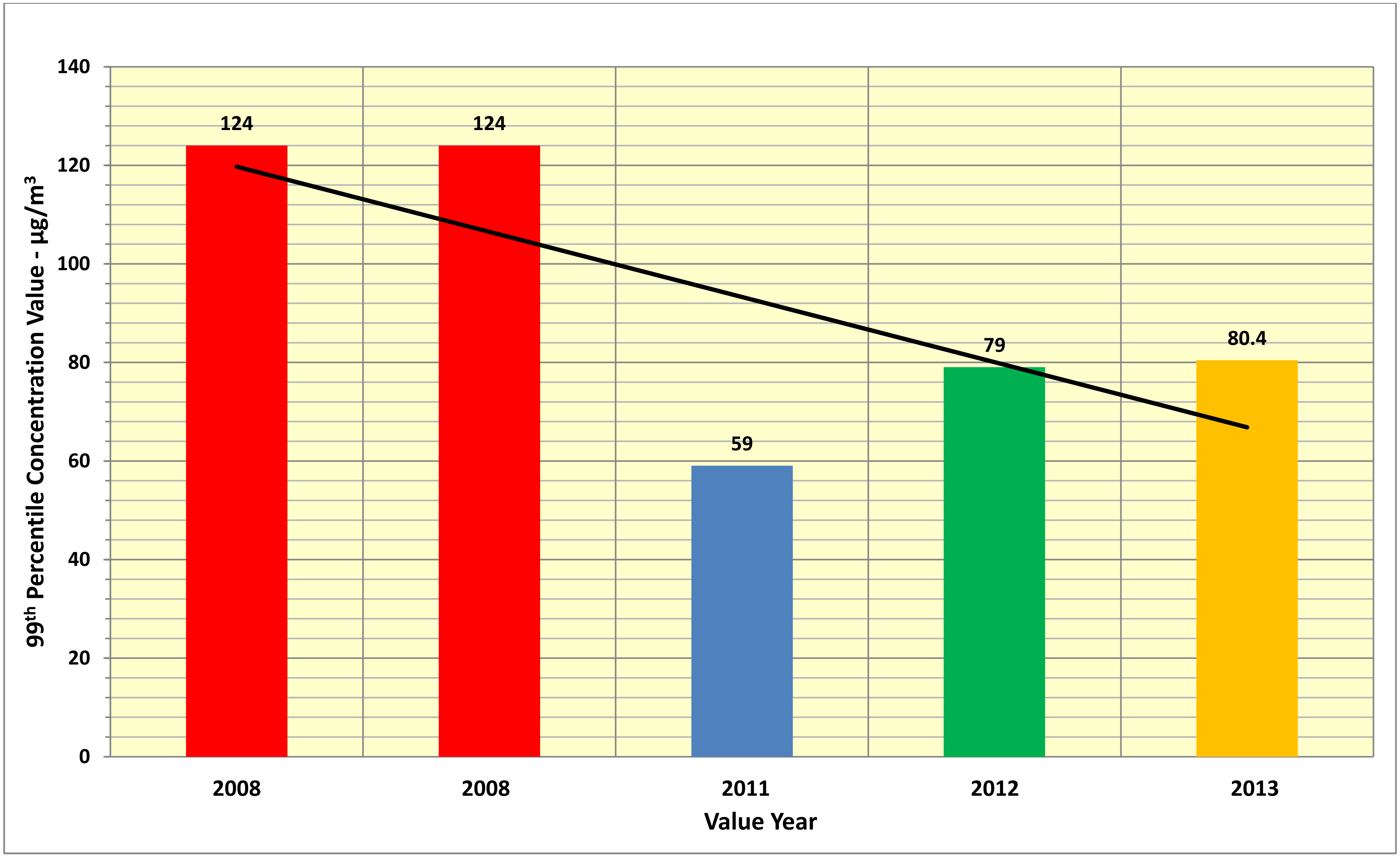

Figure 29. 99^{th} percentile for PM_{10} exceedance days, 2008–2013.

Table 29. Exceedance history of hydrographic areas, 2008–2013.

Date	µg/m^3	Site ID	Site Name	Active	Non-attainment Area?	EPA Concurrence	Event Type	MSSW[1]	MSMWG[2]	MCSWS[3]	MCMWG[4]	NLVSWS[5]	NLVMWG[6]
20080213	203	32-003-0020	East Craig Rd.	No	Yes/212	Pending EPA action	High wind	12.2	23	15.6	67	14.7	63
20080521	168	32-003-0020	East Craig Rd.	No	Yes/212	Pending EPA action	High wind	19.0	35.0	22	45	24.5	53
20110703	242	32-003-0601	Boulder City	Yes	No/167	**EPA Concurrence**	High-wind transported dust event	N/A	N/A	7.1	55	7.8	59
20110703	185	32-003-2002	J.D. Smith	Yes	Yes/212	**EPA Concurrence**	High-wind transported dust event	4.0	9.4	7.1	55	7.8	59
20110703	191	32-003-0561	Sunrise Acres	Yes	Yes/212	**EPA Concurrence**	High-wind transported dust event	4.0	11.9	7.1	55	7.8	59
20120510	314	32-003-0601	Boulder City	Yes	No/167	Pending EPA action	Transported dust event	7.2	15.8	9.7	29	8.3	34
20120510	228	32-003-0540	Jerome Mack	Yes	Yes/212	Pending EPA action	Transported dust event	5.1	11.7	9.7	29	8.3	34
20120510	211	32-003-0561	Sunrise Acres	Yes	Yes/212	Pending EPA action	Transported dust event	4.0	11.0	9.7	29	8.3	34
20120510	203	32-003-2002	J.D. Smith	Yes	Yes/212	Pending EPA action	Transported dust event	4.0	9.7	9.7	29	8.3	34
20120510	182	32-003-0075	Joe Neal	Yes	Yes/212	Pending EPA action	Transported dust event	5.3	13.4	9.7	29	8.3	34
20130415	246	32-003-0601	Boulder City	Yes	No/167	Pending	High wind	13.2	28.1	19.5	31.0	14.8	37
20130415	165	32-003-1019	Jean	Yes	164A/No	Pending	High wind	18.9	33.2	19.5	31.0	14.8	37
20130415	237	32-003-2002	J.D. Smith	Yes	Yes/212	Pending	High wind	11.9	27.9	19.5	31.0	14.8	37
20130415	267	32-003-0561	Sunrise Acres	Yes	Yes/212	Pending	High wind	14.3	29.9	19.5	31.0	14.8	37
20130415	164	32-003-0043	Paul Meyer	Yes	Yes/212	Pending	High wind	10.0	25.3	19.5	31.0	14.8	37
20130415	212	32-003-0073	Palo Verde	Yes	Yes/212	Pending	High wind	10.2	27.9	19.5	31.0	14.8	37
20130415	196	32-003-0298	Green Valley	Yes	Yes/212	Pending	High wind	11.1	31.9	19.5	31.0	14.8	37
20130415	243	32-003-0540	Jerome Mack	Yes	Yes/212	Pending	High wind	13.8	27.6	19.5	31.0	14.8	37
20130415	226	32-003-0075	Joe Neal	Yes	Yes/212	Pending	High wind	10.4	25.7	19.5	31.0	14.8	37

[1] MSWS = Monitoring site sustained winds (mph).
[2] MSMWG = Monitoring site maximum wind gusts (mph).
[3] MCSWS = McCarran International Airport sustained wind speed (mph).
[4] MCMWG = McCarran International Airport maximum wind gusts (mph).
[5] NLVSWS = North Las Vegas Airport sustained wind speed (mph).
[6] LVMWG = North Las Vegas Airport maximum wind gusts (mph).

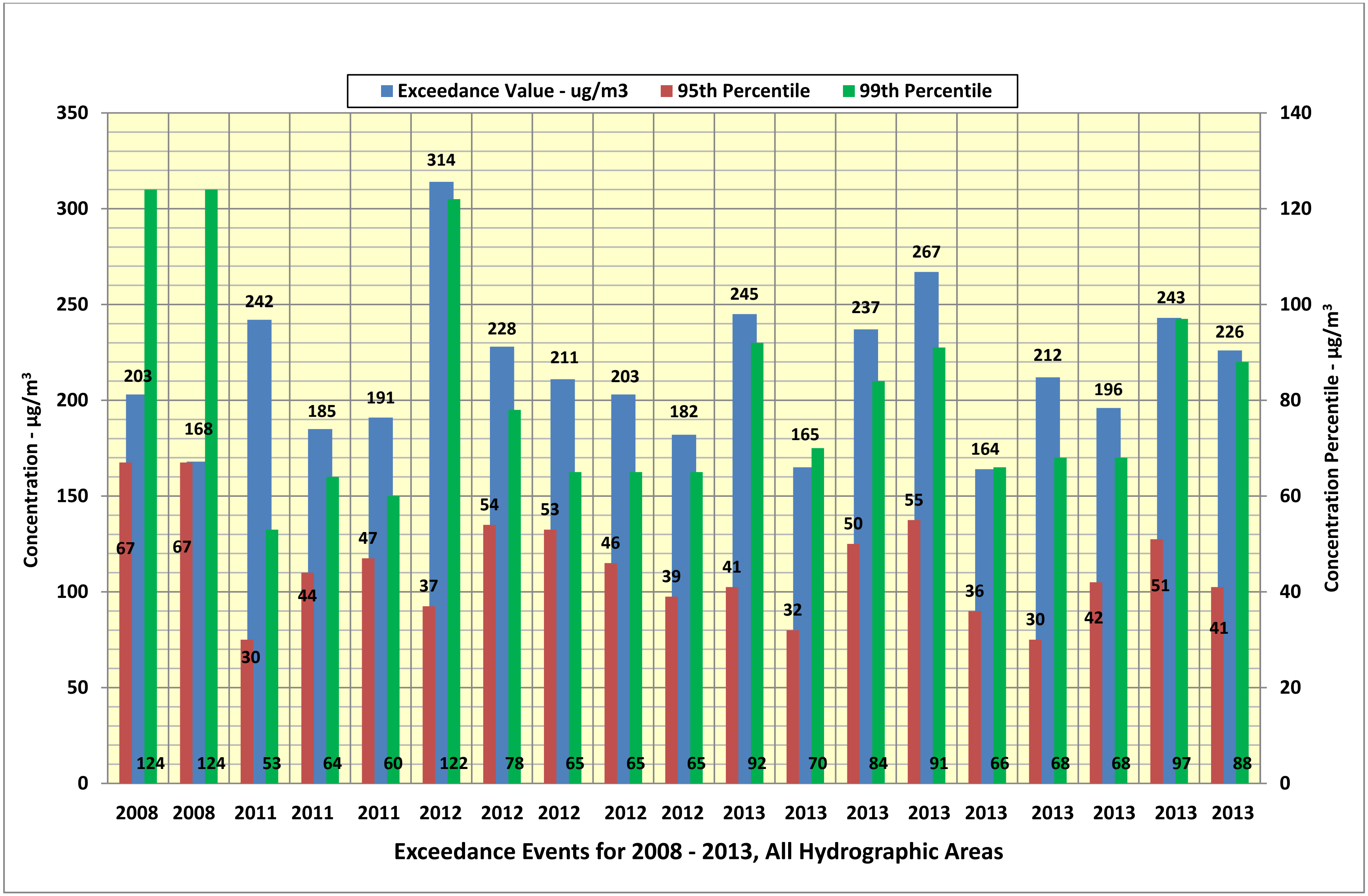

Figure 30. PM_{10} exceedance concentrations, 95th and 99th percentiles, 2008–2013.

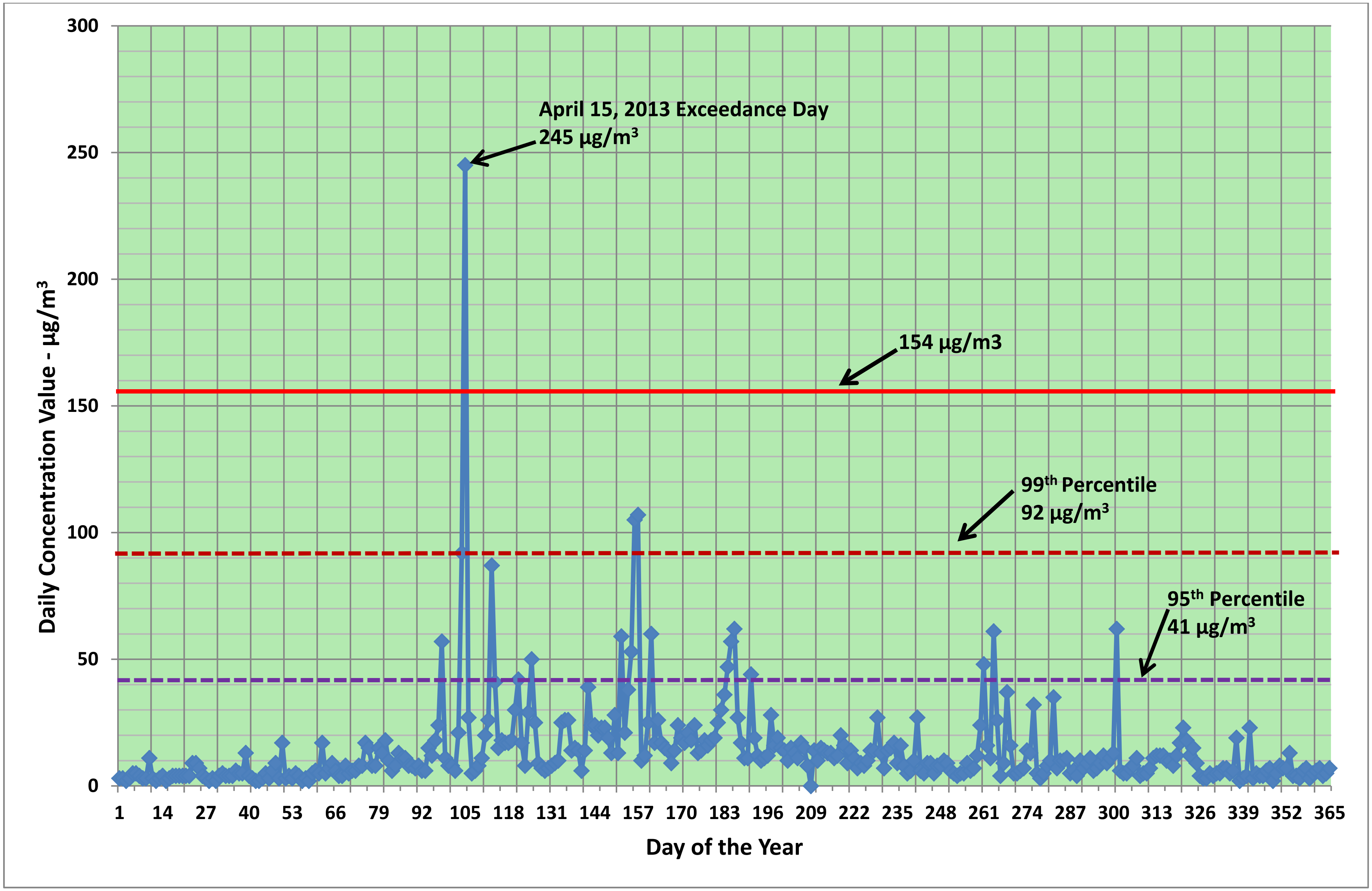

Figure 31. PM_{10} analysis for 95th and 99th percentiles, Boulder City monitoring site, 2013.

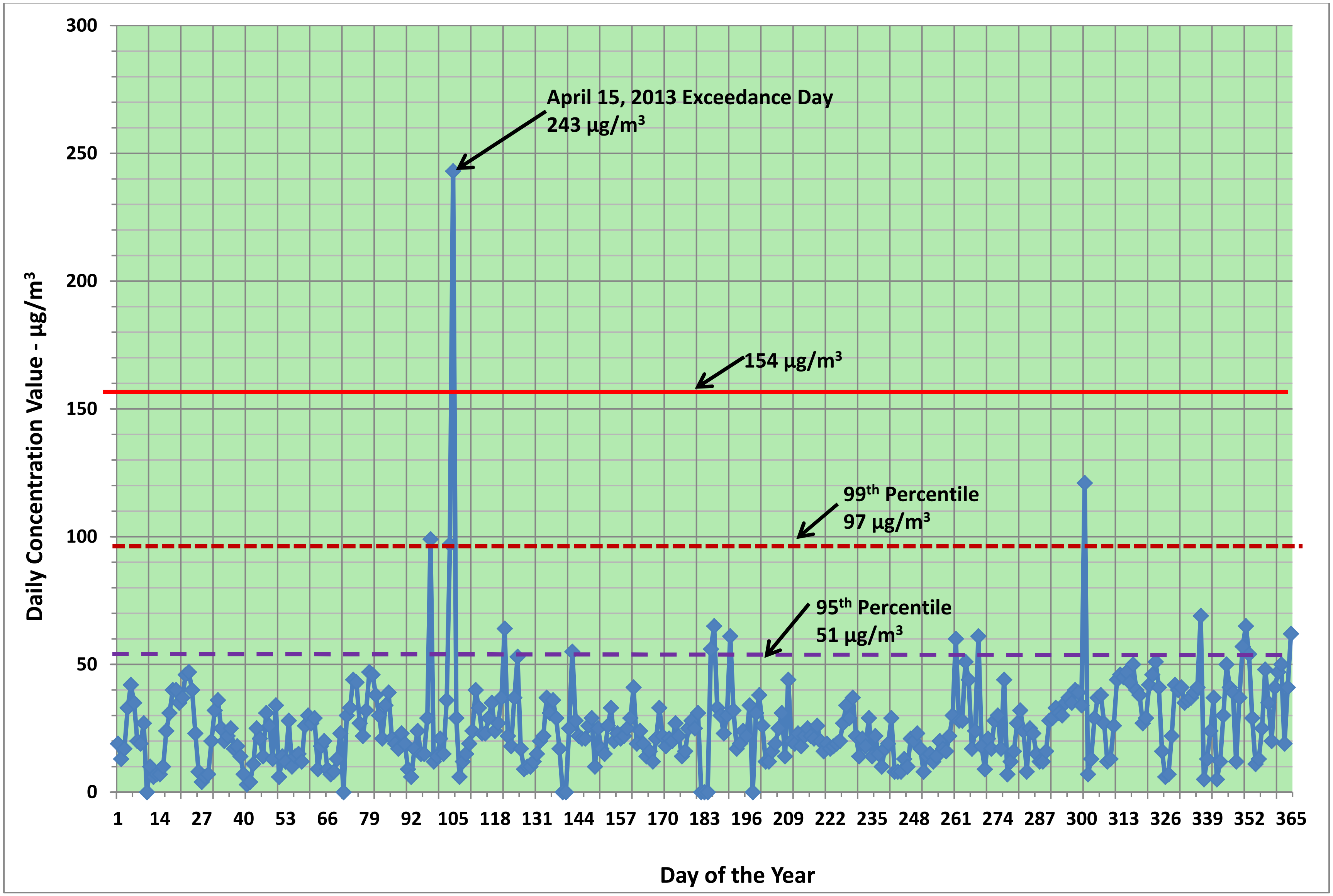

Figure 32. PM_{10} analysis for 95th and 99th percentiles, Jerome Mack monitoring site, 2013.

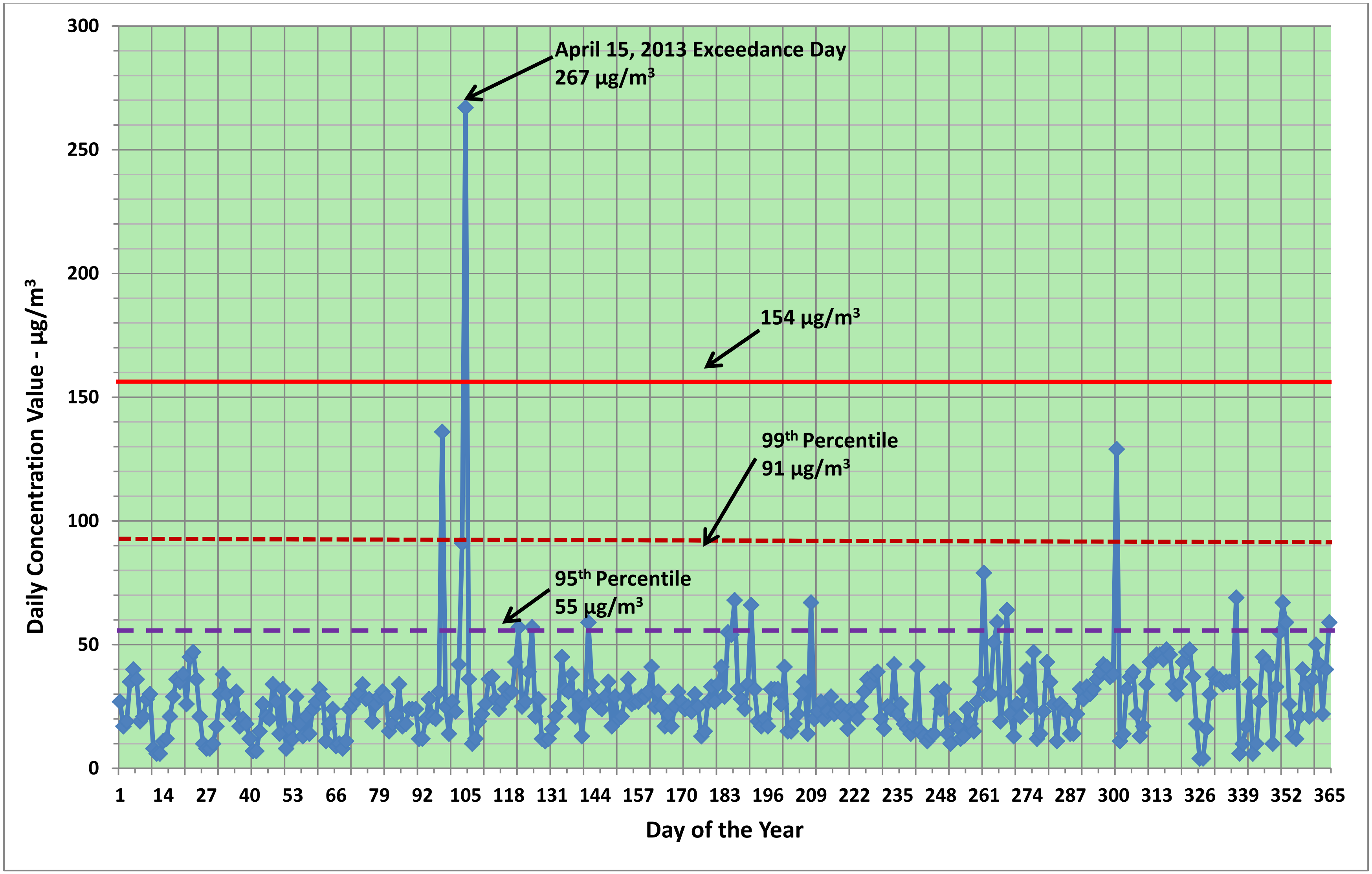

Figure 33. PM_{10} analysis for 95th and 99th percentiles, Sunrise Acres monitoring site, 2013.

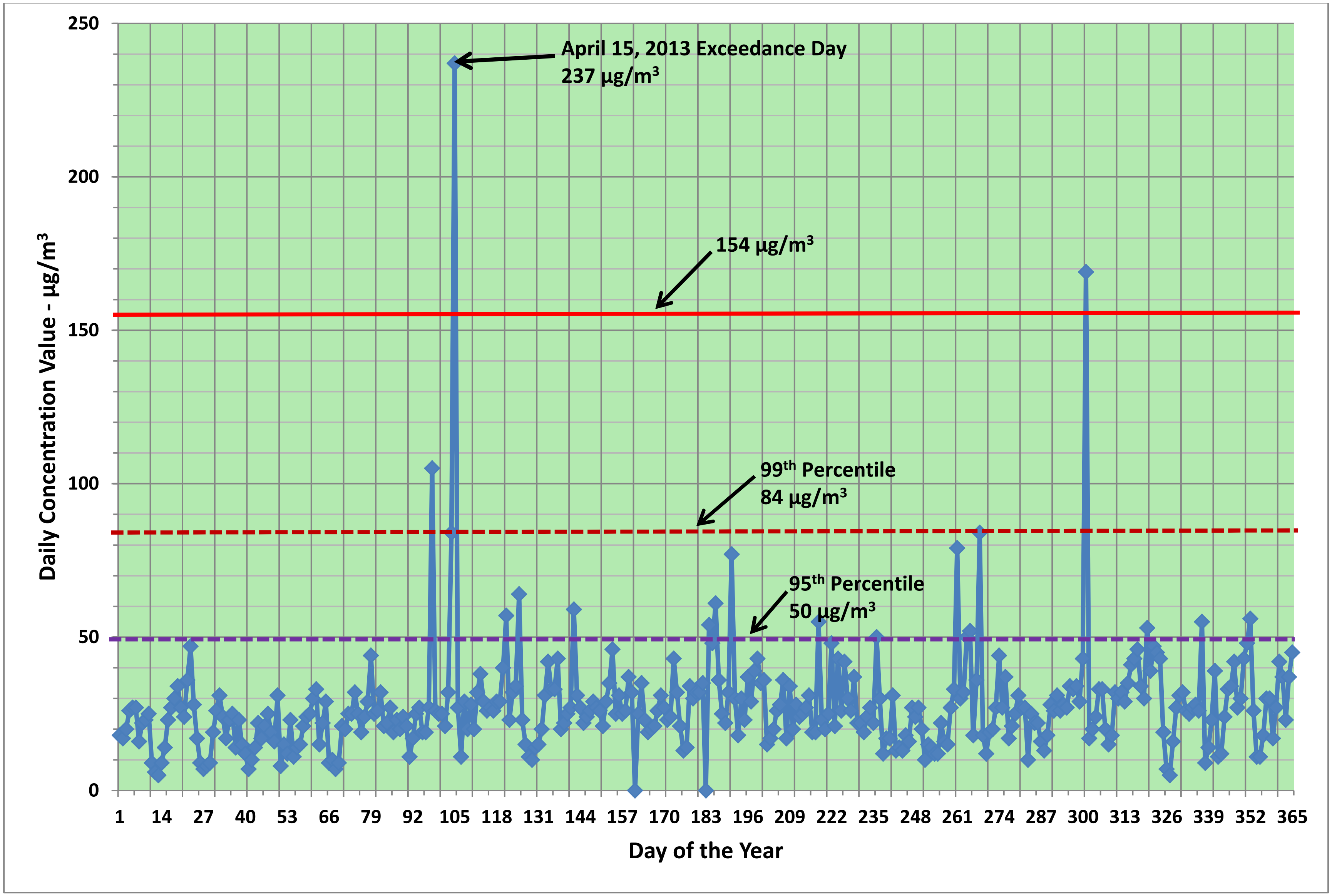

Figure 34. PM_{10} analysis for 95^{th} and 99^{th} percentiles, J.D. Smith monitoring site, 2013.

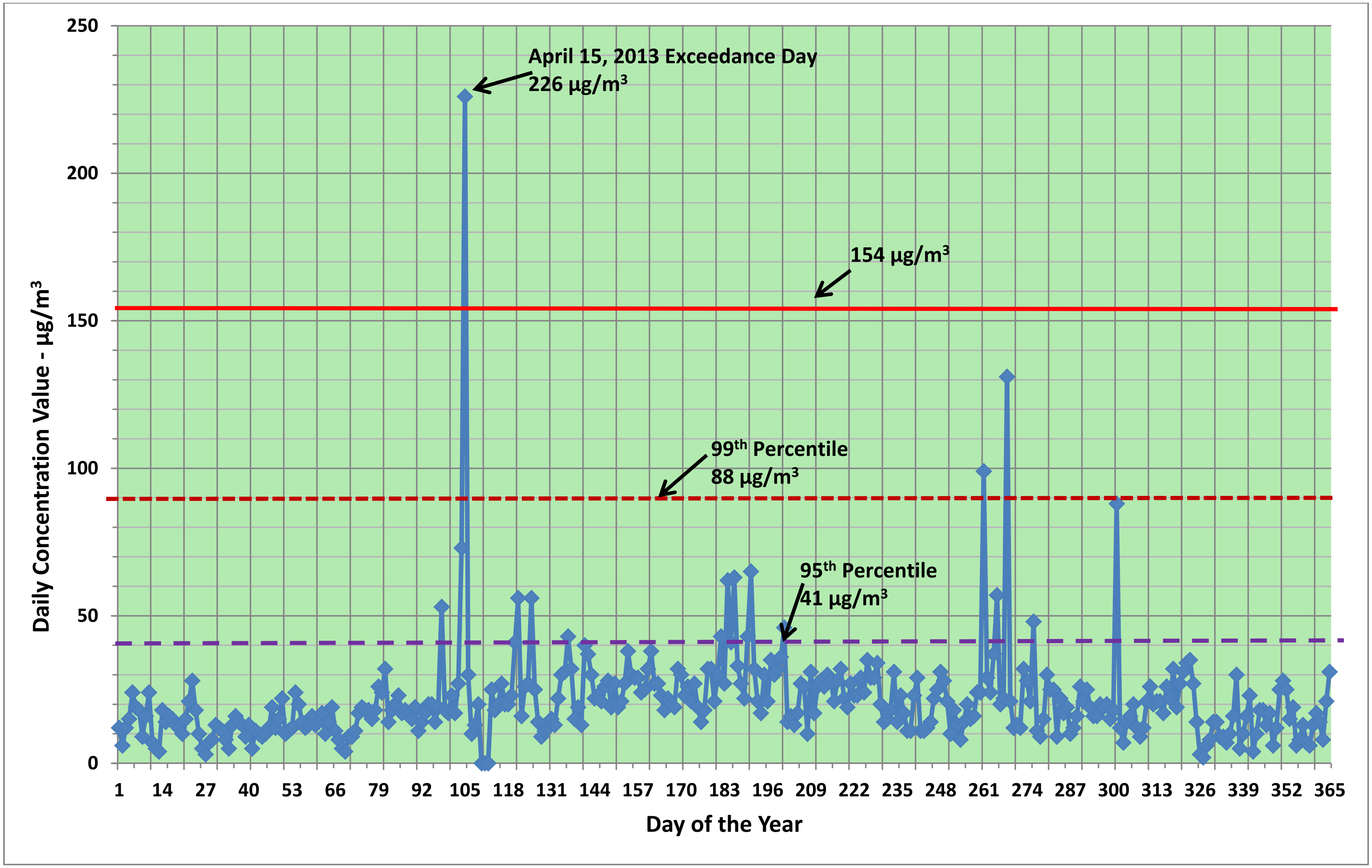

Figure 35. **PM_{10} analysis for 95th and 99th percentiles, Joe Neal monitoring site, 2013.**

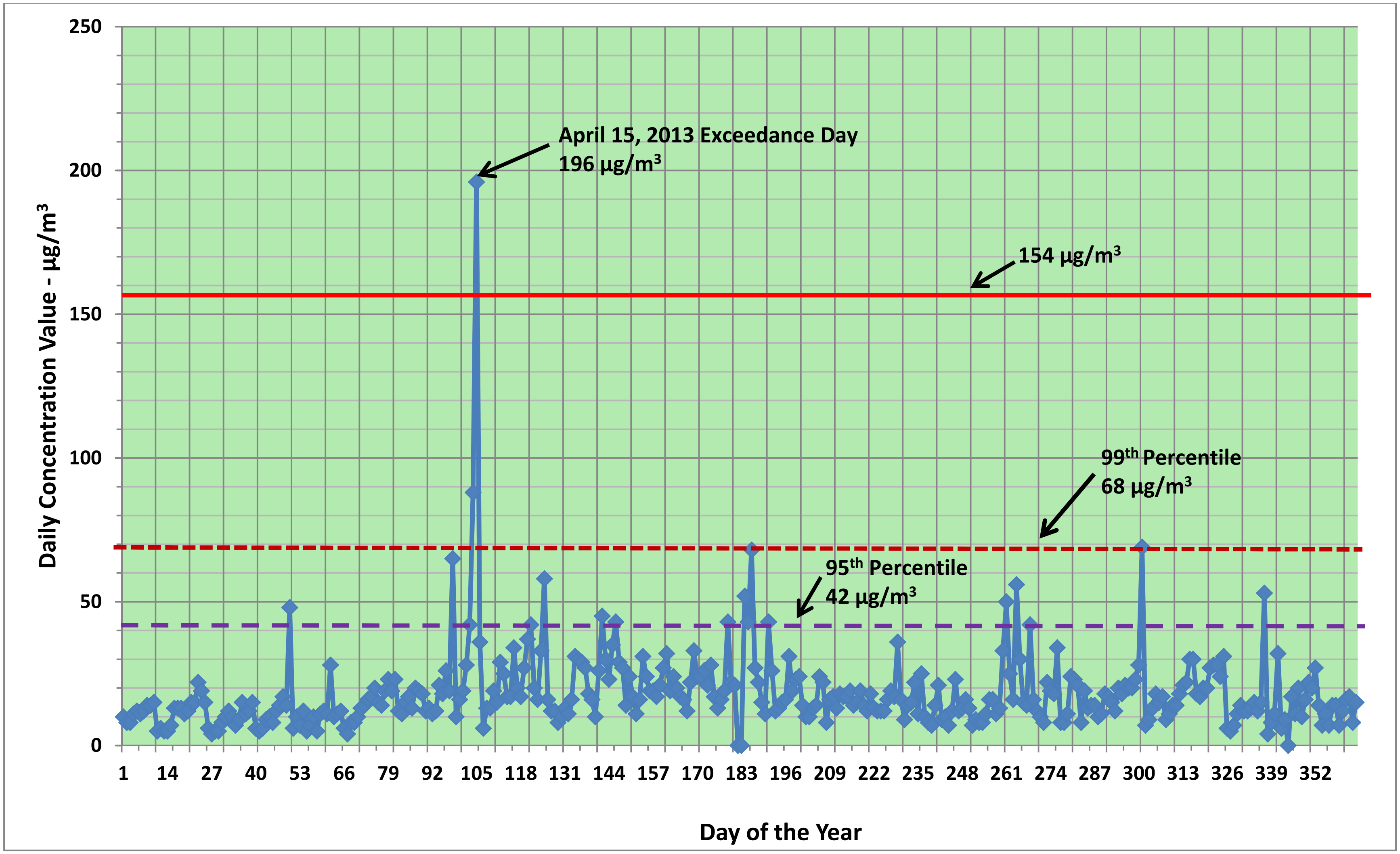

Figure 36. PM_{10} analysis for 95th and 99th percentiles, Green Valley monitoring site, 2013.

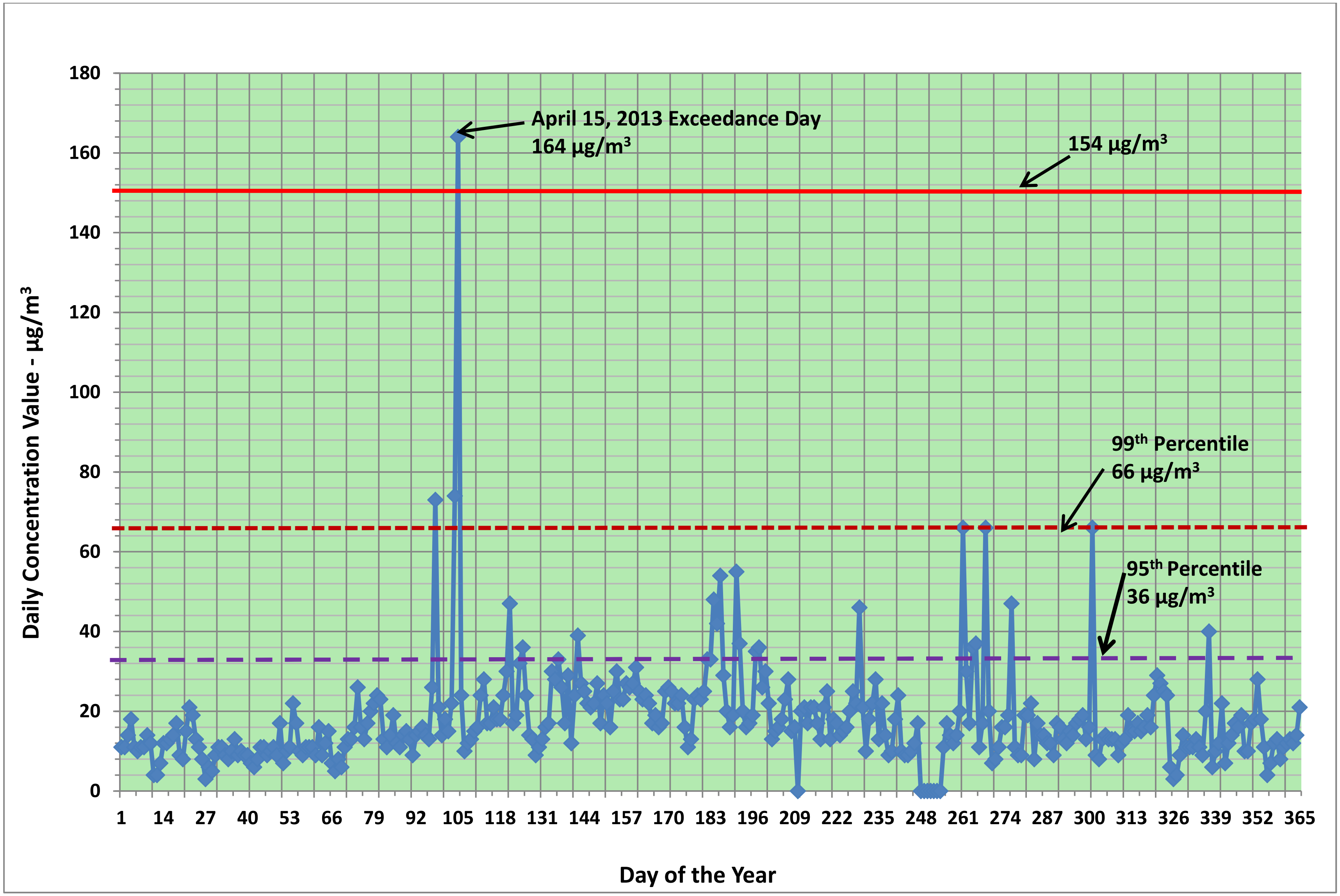

Figure 37. **PM_{10} analysis for 95th and 99th percentiles, Paul Meyer monitoring site, 2013.**

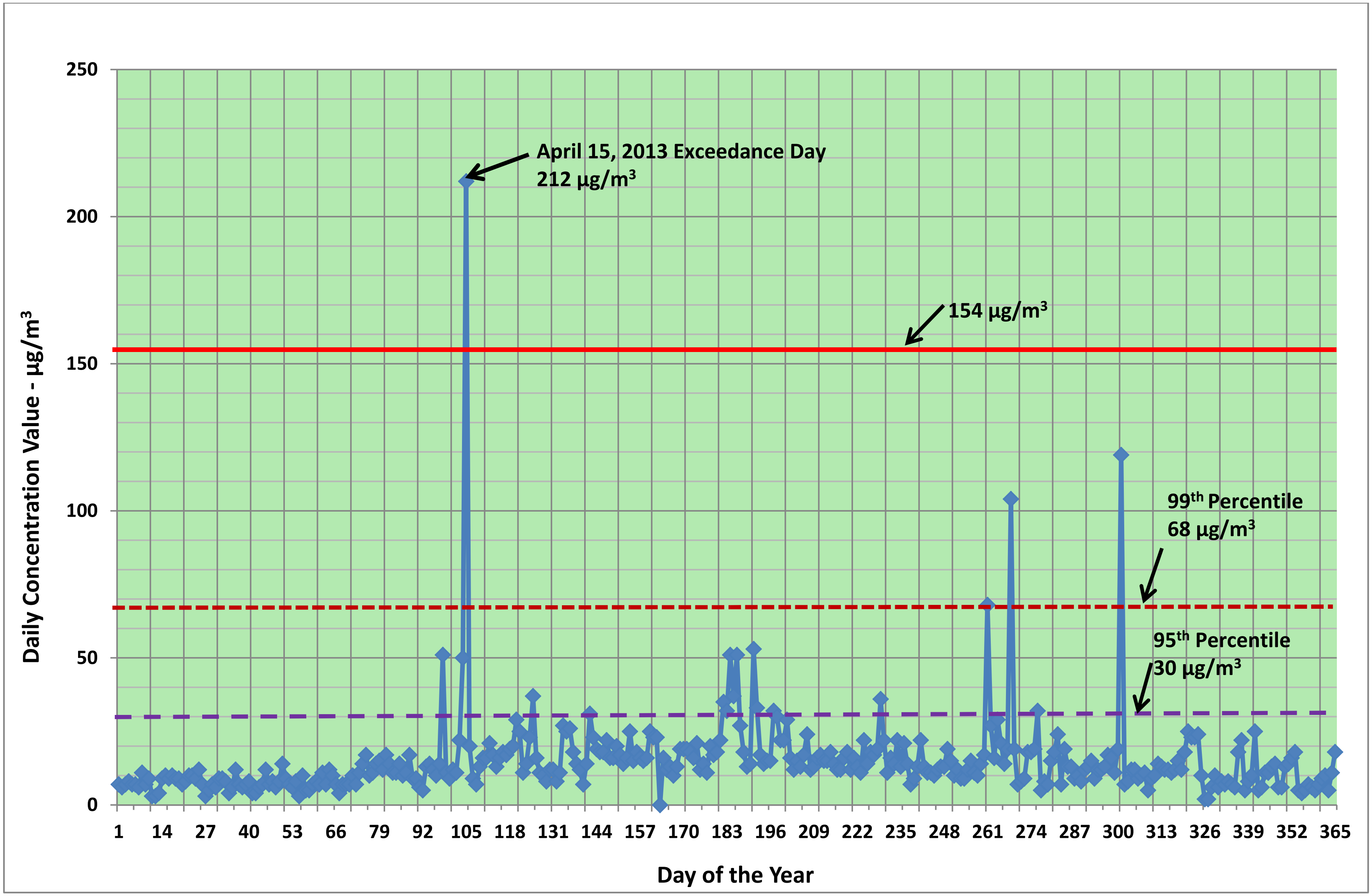

Figure 38. **PM_{10} analysis for 95th and 99th percentiles, Palo Verde monitoring site, 2013.**

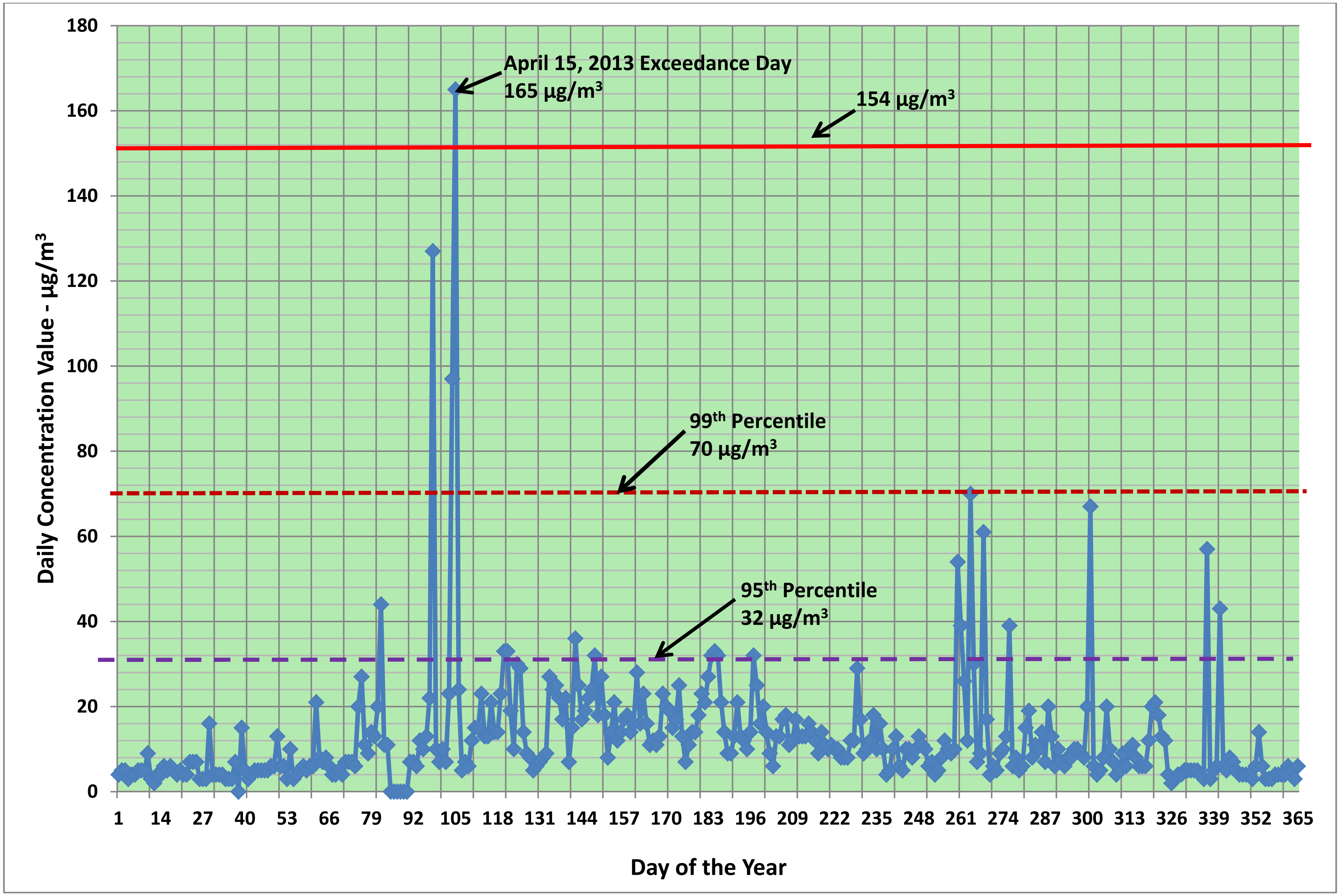

Figure 39. **PM_{10} analysis for 95th and 99th percentiles, Jean monitoring site, 2013.**

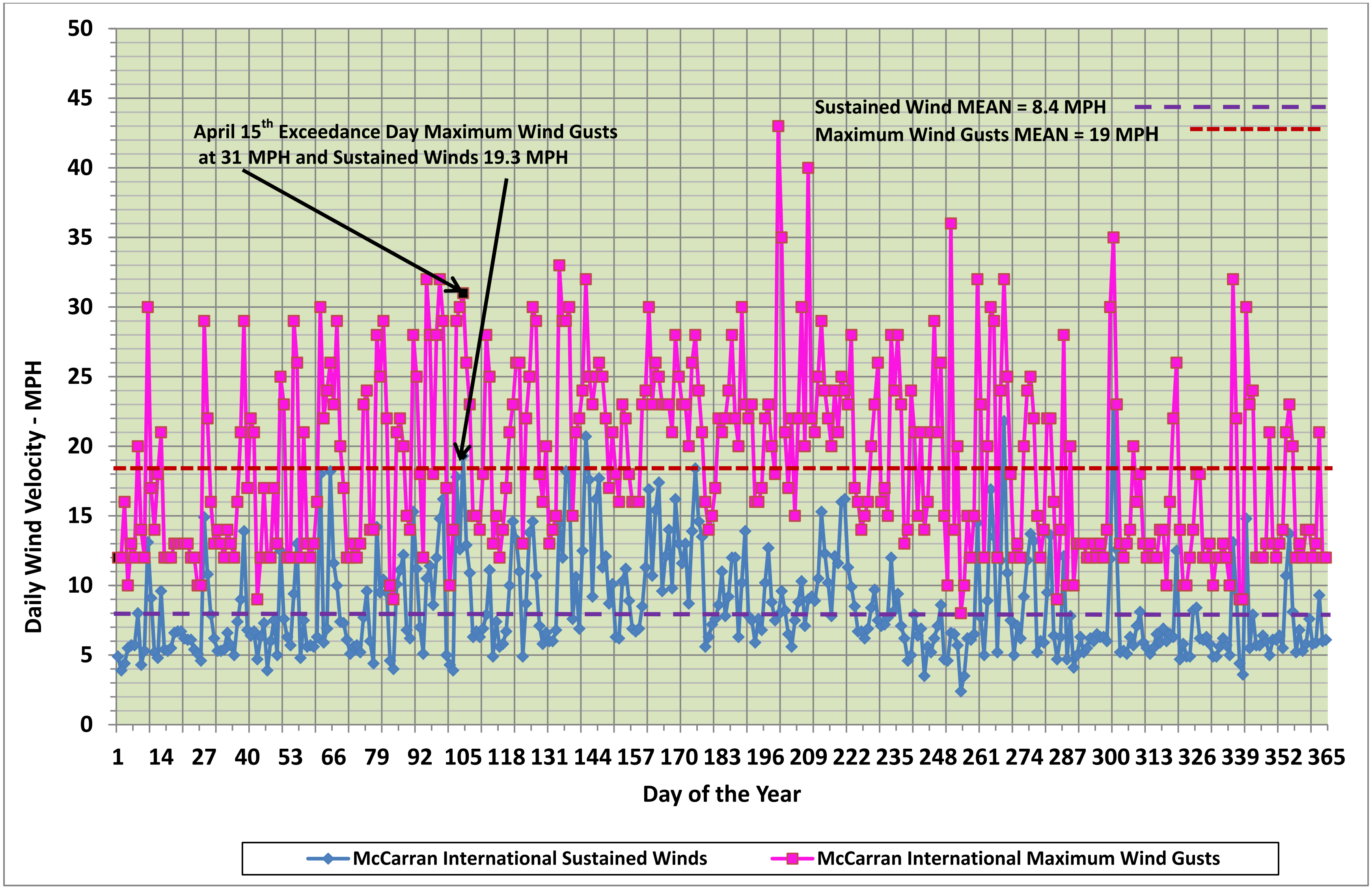

Figure 40. Sustained winds and maximum wind gusts at McCarran International Airport, 2013.

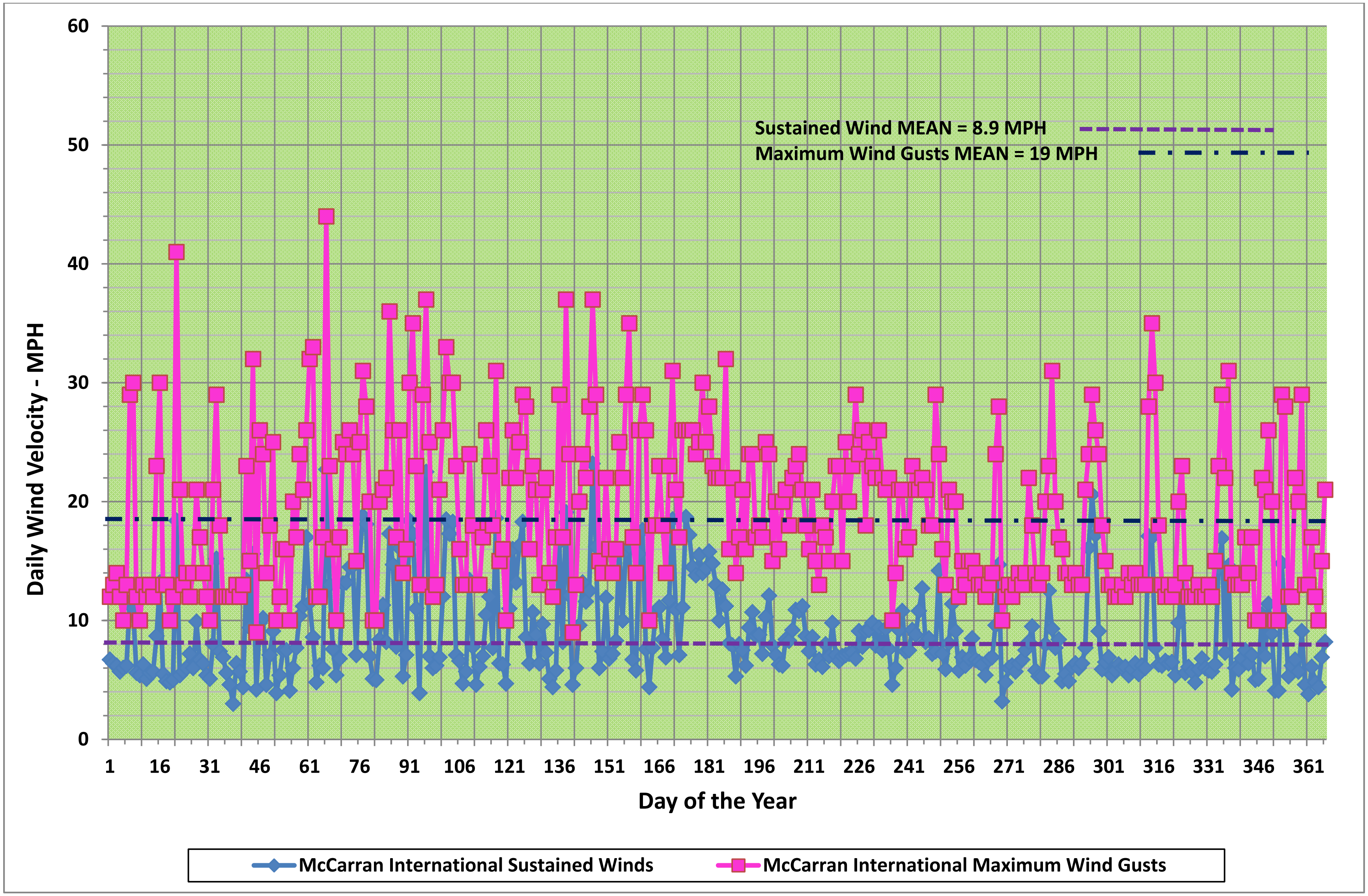

Figure 41. Sustained winds and maximum wind gusts at McCarran International Airport, 2012.

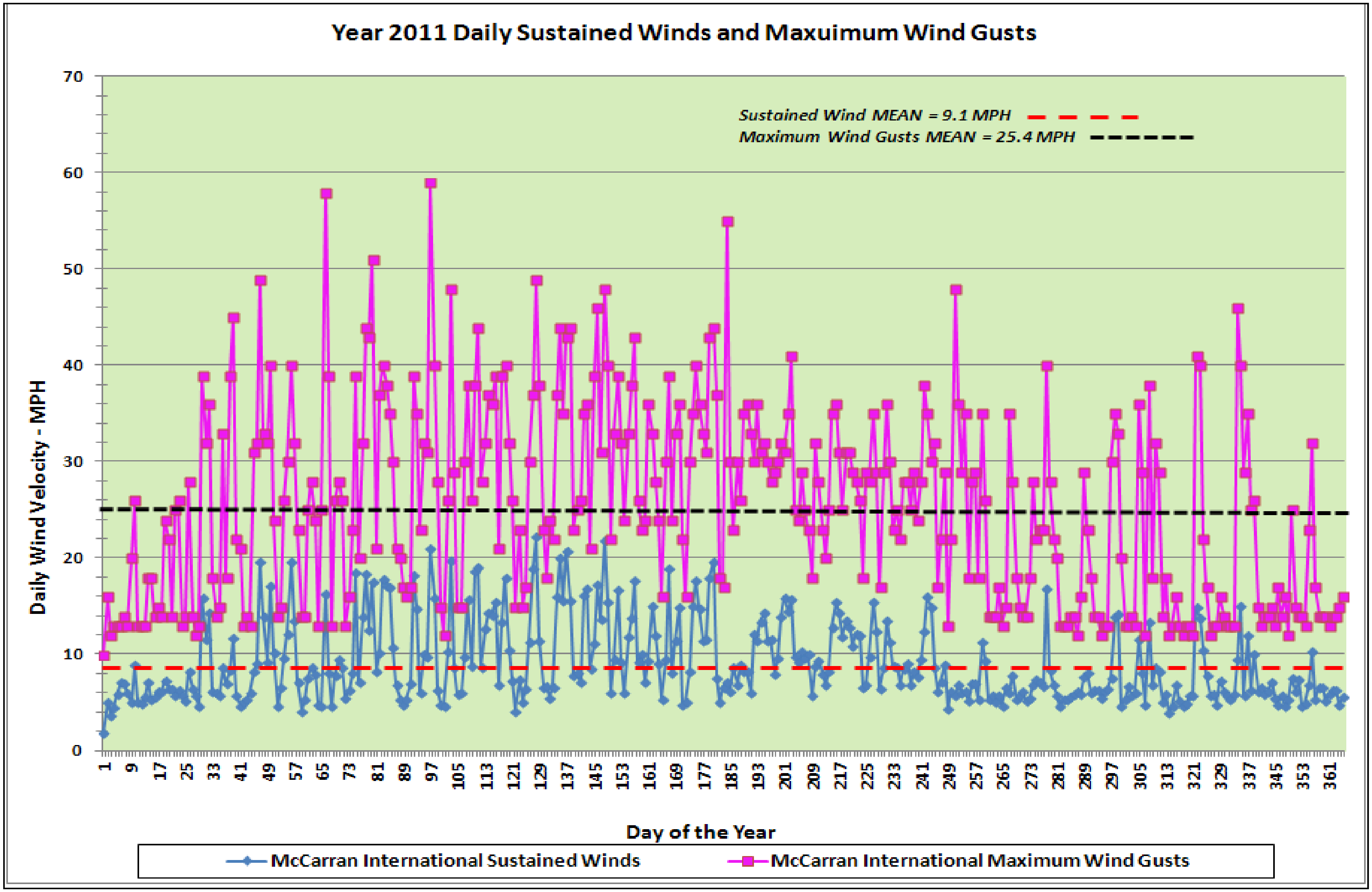

Figure 42. Sustained winds and maximum wind gusts at McCarran International Airport, 2011.

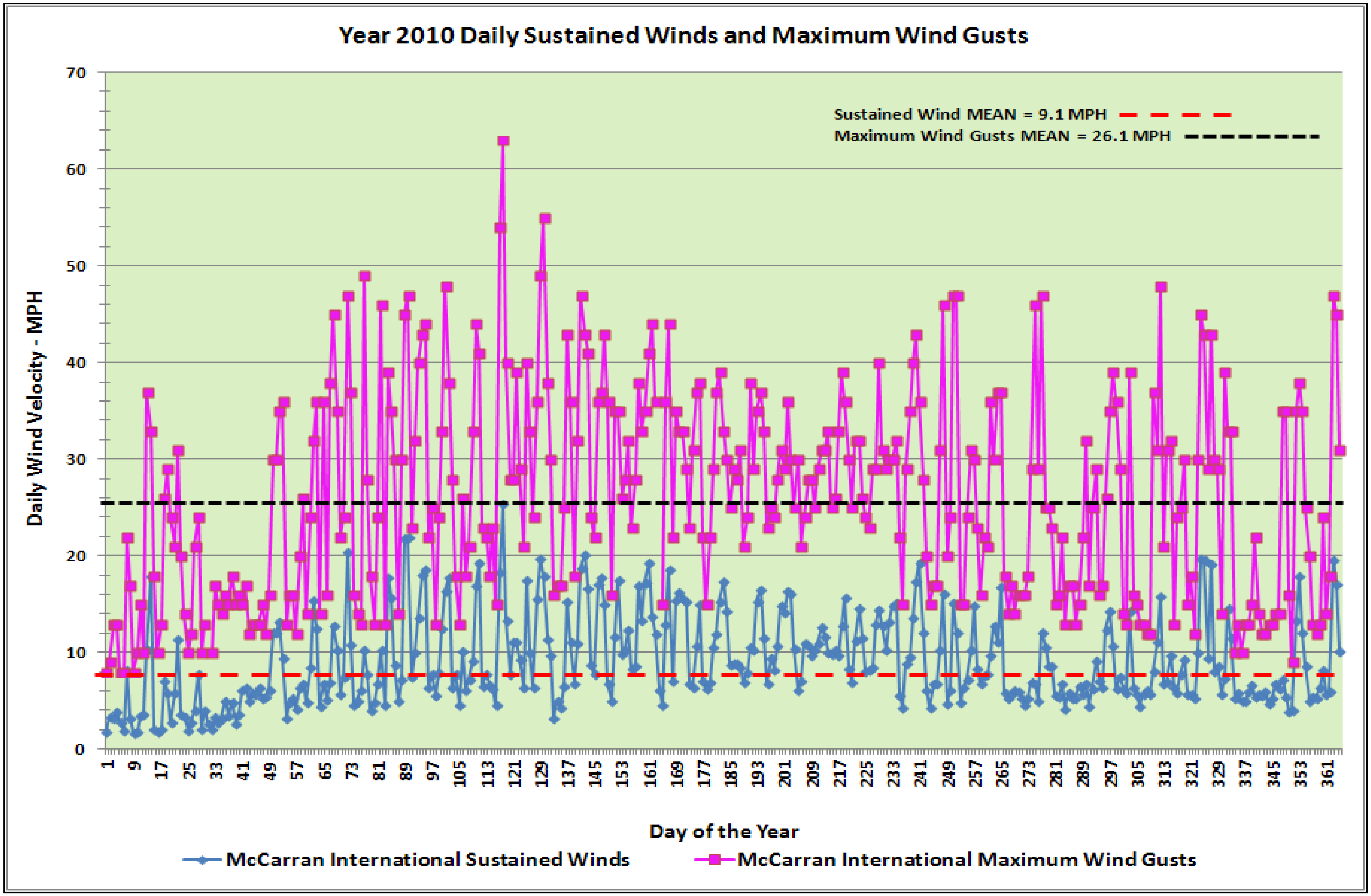

Figure 43. Sustained winds and maximum wind gusts at McCarran International Airport, 2010.

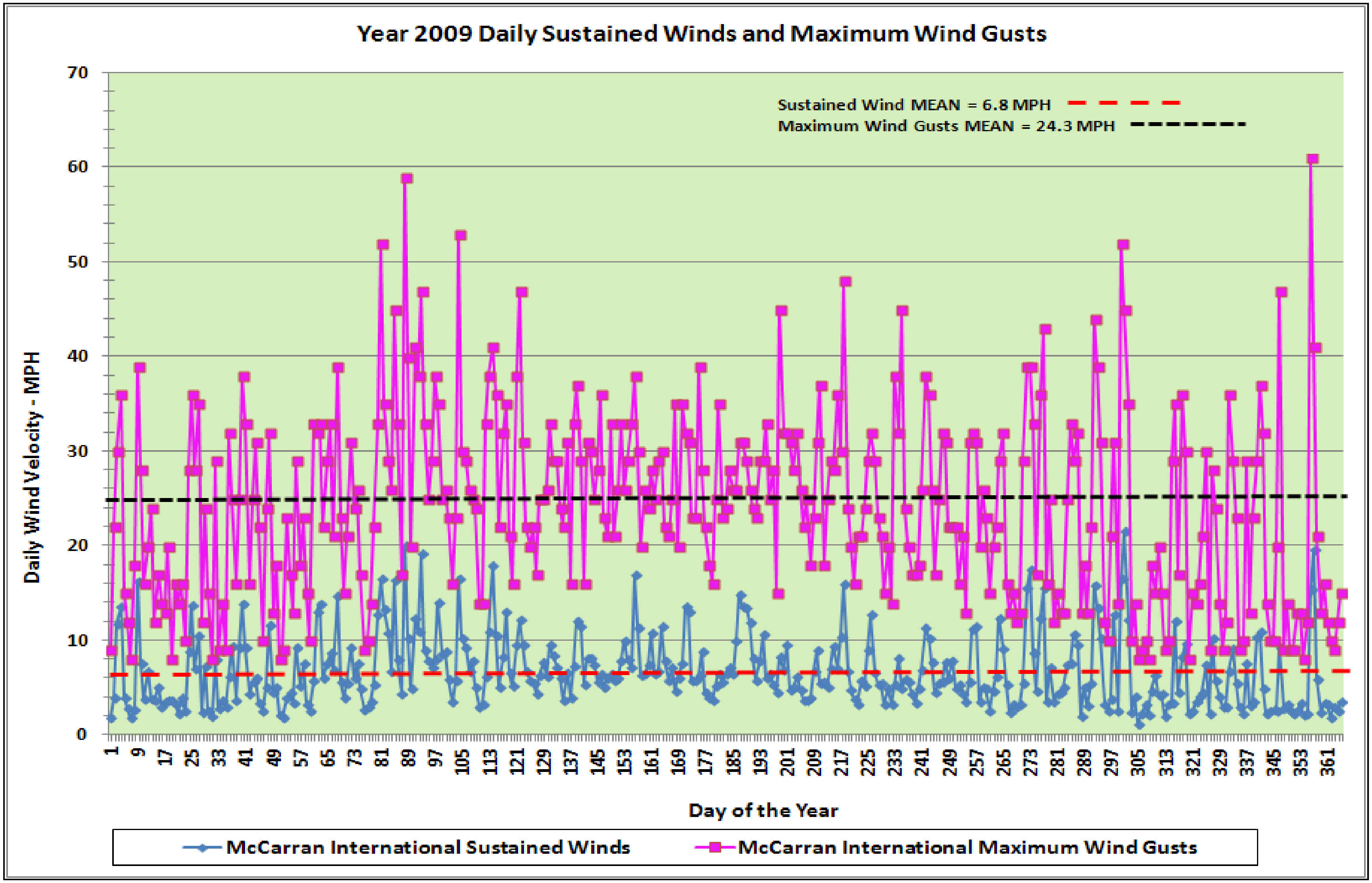

Figure 44. Sustained winds and maximum wind gusts at McCarran International Airport, 2009.

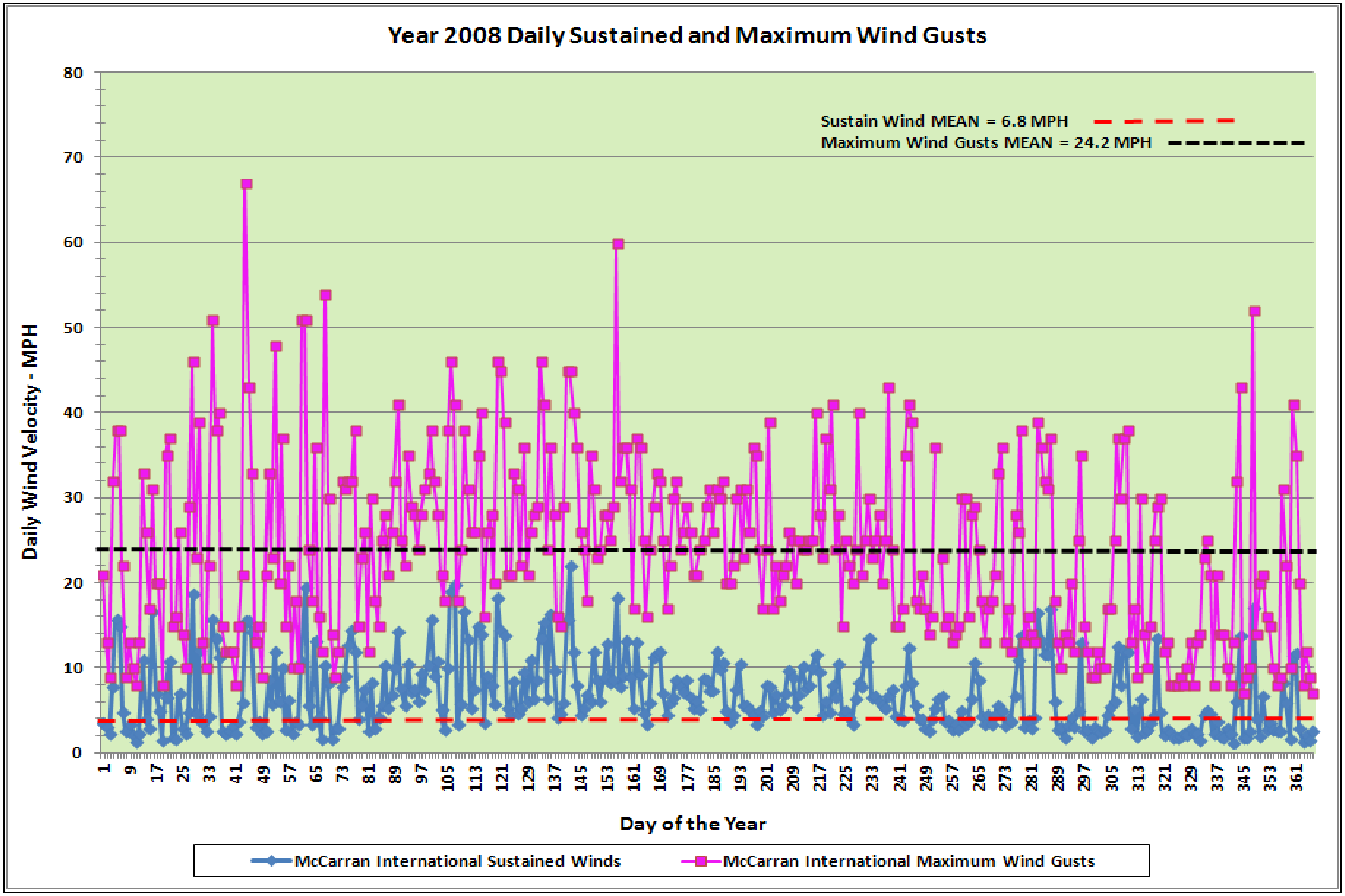

Figure 45. Sustained winds and maximum wind gusts at McCarran International Airport, 2008.

Table 30 lists the measured mean values for sustained winds and maximum wind gusts at McCarran International Airport from 2008–2013. Although the Las Vegas Valley often experiences elevated winds in April, the sustained winds and wind gusts on April 15, 2013, were above average and likely did contribute to the exceedances. Infrequent winds below threshold levels were sufficient to move the transported dust from southeastern California and northwestern Arizona to the Las Vegas Valley PM_{10} network monitoring sites.

Table 30. Annual mean wind velocities for sustained winds and maximum wind gusts at McCarran International Airport, 2008–2013.

Year[1]	MCWS[2] (mph)	MCMWG[3] (mph)
2008	6.8	24.2
2009	6.8	24.3
2010	9.1	26.1
2011	9.1	25.4
2012	8.9	19.0
2013	8.4	19.0
Six-year Average:	***8.2***	***23.0***

[1] Annual local climatological data for 2008–2013 from National Oceanic and Atmospheric Administration National Climatic Data Center.
[2] MCWS = McCarran daily average sustained winds.
[3] MCMWG = McCarran maximum daily average wind gusts.

3.0 EVENT DATA

Tables 1–27 list readings for the days before, during, and after the exceptional event at all Clark County PM_{10} network monitoring sites. These data clearly show that the event started on April 14, 2013, at approximately 8:00 pm local time, continued through midnight, and through most of April 15, 2013, until 9:00 pm local time. The wind direction was predominantly from the south to southwest from the southeast and then to the northwest and to a smaller extent, to the northeast of the Las Vegas valley (Figure 1 "Source Area"). The majority of the monitoring sites measured hourly peak gusts that varied from 25 to 50 mph and sustained two-minute winds of 20 to 25 mph and greater.

Other supporting documentation includes meteorological data and analysis (e.g., wind speed and wind direction); HYSPLIT model and trajectory runs with full meteorological analysis; hourly PM_{10} sampled mass compared to wind data to support a source/receptor relationship; precipitation data; and photographs and maps of the area showing emission sources. Appendix A contains news accounts of the event published by the *Las Vegas Review-Journal* and weather video coverage of the event day from local television stations.

This section demonstrates that the exceptional event on April 15, 2013, affected the monitoring sites that recorded a PM_{10} exceedance that day. Emissions generated by the event caused exceedances of the 24-hour PM_{10} NAAQS that would not have happened but for the regionally high-wind transported dust event.

DAQ sent the air quality data affected by the high-wind transported dust event to EPA for inclusion in the AQS database, as required by 40 CFR 50 and 51, and DAQ requested that EPA flag the data "RJ" to indicate that a high-wind exceptional event was involved.

3.1 METEOROLOGY ASSESSMENT FOR THE HIGH-WIND DUST EVENT

3.1.1 Weather Summary

The following subsections discuss the meteorological conditions associated with the April 15, 2013, exceedance of the 24-hour PM_{10} NAAQS at the Boulder City (CAMS 0601), Green Valley (CAMS 0298), JD Smith (CAMS 2002), Jean (CAMS 1019), Joe Neal (CAMS 0075), Palo Verde (CAMS 0073), Paul Meyer (CAMS 0043), Jerome Mack (CAMS 0540), and Sunrise Acres (CAMS 0561) monitoring stations. The applicable part of the Exceptional Event rule (40 CFR Part 50.14) addresses PM_{10} exceedances that affect ambient particulate matter concentrations through the raising of dust or re-entrainment of deposited material (72FR 13565, IV.E.5.c).

Several factors contributed to the significant ambient PM_{10} concentrations on the event day. A strong pre-frontal trough moved through the Baker, and Barstow, California area at 11:00 pm on April 14, 2013, which raised a large amount of dust and dropped visibility down to one-half mile (as reported by the NWS observations and forecast discussion). The large mass of suspended dust moved north, east, and into parts of southern Nevada and northwest Arizona (the "source area"). The high winds over the western Mojave Desert continued to transport suspended dust into Clark County throughout the remainder of the day. Winds in Clark County reached and exceeded threshold levels by 6:00 pm, spurring a rapid increase in local dust levels and dropping visibility down to 1.5 miles, and continued throughout the remainder of the night. All PM_{10} sites in Clark County experienced exceedance levels. Thus, there is a clear causal relationship between the PM_{10} exceedance, high-wind transported dust from the western Mojave Desert, and the area-wide high concentration of dust raised by the high winds in Clark County.

3.1.2 Weather Data Resources

3.1.2.1 Local Climatological Data

Hourly surface weather observations are documented in the Local Climatological Data reports from McCarran International and North Las Vegas Airports. These quality-controlled data were obtained from the National Climatic Data Center (NCDC). The hourly data are observations made over the period of a few minutes in the end of an hour; gusts are noted when the value exceeds 10 knots greater than the average during the observation. (Note: one knot is about 1.15 mph.)

Hourly values of wind speed average, wind speed gust, and resultant wind direction from DAQ monitoring stations are included in the analysis. The hourly sampling period at DAQ stations are an important distinction from the local climatological data that consist of observations made over the period of a few minutes.

3.1.2.2 Clark County Monitoring Stations

DAQ's exceptional event analysis includes hourly values for wind speed average, wind speed gust, and wind direction from seven of its monitoring stations in the Las Vegas Valley, one site in the Eldorado Valley, and one site in the Ivanpah Valley.

3.1.2.3 Weather Charts

DAQ used surface and upper-air pressure charts from NOAA in its analysis of the high-wind transported dust event, which are highlighted in the remainder of Section 3.0. The upper-air pressure charts illustrate systems at the 250 millibar (mb), 500 mb, and 850 mb levels. Features of the charts include the following depictions.

Surface Charts

The surface charts show weather conditions at or near the earth's surface.

- Areas of high and low pressure are shown with an H or L.
- Lines of equal pressure (reduced to sea level), isobars, are shown with pressure values in mb. Closely spaced isobars typically indicate areas of stronger winds.
- Cold fronts are shown in blue with triangular wedges, and warm fronts are shown in red with semi-circular shapes. Both shapes point toward the direction of motion. A red and

blue line with a mixture of cold and warm front symbols is a stationary front, showing a boundary between two air masses without appreciable motion.

- Purple lines with circles and wedges indicate an occluded front, which is a mixture of cold and warm fronts overlapping in the vertical direction.

- An orange dashed line indicates a trough, which is an area of low pressure.

Upper Air Synoptic-Scale Charts

The upper-air synoptic-scale charts show pressure systems that are aloft, which strongly influence near-surface conditions. The solid lines in each chart mark the heights of the corresponding pressure level in decameters; as in the surface charts, closely spaced lines indicate stronger winds.

The 200 mb chart elevation is near the level of the core of the jet stream, so the tracks of the jet streams can be seen very clearly on this chart. The jet stream indicates the direction of wind flow, which is generally from west to east throughout most of the subtropics, mid- and high-latitudes. It is the steering mechanism for low-pressure systems. Momentum of jet stream carves the trough ridge pattern. If the jet stream winds are greater on the left side of a trough, the trough will become more amplified and move further south. If the jet stream winds are greater on the right side of a trough, the trough will become less amplified with time and move further north. This pressure level in the 200 mb chart occurs approximately 12,000 meters (about 40,000 feet) above mean sea level.

The solid lines on the charts are heights of the 200 mb pressure surface in decameters (tens of meters). Thus, a height of 12,100 meters would appear as 1210.

The pressure level in the 500 mb charts occurs approximately 5,600 meters (18,000 feet) above mean sea level, and is approximately half of average sea-level pressure. The solid lines on the charts are heights of the 500 mb pressure surface in decameters. Thus, a height of 5,600 meters would appear as 560.

The pressure level in the 850 mb charts occurs approximately 1,500 meters (5,000 feet) above mean sea level. Each chart includes the following illustrations. The solid lines on the charts are heights of the 850 mb pressure surface in decameters (tens of meters). Thus, a height of 1,500 meters would appear as 150.

Each chart includes the following illustrations:

- As with the surface chart, closely spaced lines indicate stronger winds.

- Areas of low and high pressure are noted. A circular pattern of height lines around a Low-pressure area is called a "closed Low"; this indicates a strong system. A trough of low pressure typically appears as a V-shaped pattern of height lines. A ridge of high pressure typically appears an inverted V-shaped pattern.

- Wind data at the upper-air station are shown as arrow-shaped line figures. The shaft of the arrow shows the direction from which the wind blows, with the reference point being on the upper-air station location. The "feathers" on the back of the arrow shaft indicate speed: a solid line is ten knots, a triangle is 50 knots. A colored scale for wind speeds is located on the bottom of these charts.

3.2 MONITORING NETWORK MEASUREMENT BACKGROUND

Figures 46–56 are various maps of the Clark County PM_{10} monitoring network. All sites included in the analysis were selected to show representative conditions across Clark County.

DAQ's Thermo Fisher5014i Continuous Ambient Particulate Monitor PM_{10} and $PM_{2.5}$ (particulate matter 2.5 microns or less in aerodynamic diameter) samplers are operated to comply with the USEPA designation mode (Federal Equivalent Method (FEM)). This designated method for PM_{10} is an automated method (analyzer) that utilizes a measurement principle based on sample collection by filtration and analysis by beta-ray attenuation. As a designated equivalent method, this method is acceptable for use by states and other air monitoring agencies under the requirements of 40 CFR Part 58, Ambient Air Quality Surveillance.

Air samples are collected on filter media and simultaneously exposed to beta radiation to determine the mass of material on the filter. The airflow rate is one cubic meter per hour. The samplers have two analog voltage output channels that are sampled by the data system once every minute. The concentration channel signal is proportional to the running 60-minute average value that is scaled from zero to 1,500 $\mu g/m^3$. The mass accumulation channel signal passes through a digital filter with a two-minute time constant, and is scaled to an accumulated mass from zero to 1,500 micrograms.

Five-minute averages of the concentration and accumulated mass channels are calculated and recorded by the data system. Hourly values are subsequently calculated as the averages of the five-minute data. Since the concentration channel itself is a 60-minute running average, the hourly concentrations are calculated from a two-hour period. Since the volume of air sampled in one hour is one cubic meter, the hourly incremental mass accumulation (difference from one hour to the next) is equivalent to an ambient conditions concentration in $\mu g/m^3$.

The maximum signal value for the concentration channel is 1,500 $\mu g/m^3$, and is 1,500 micrograms for the mass channel. When the sampler registers the 1,500 micrograms mass value, it briefly interrupts sampling to advance the filter material and reset the mass signal to a zero base level. This cycle is evident in the five-minute data, and can readily be factored into hourly or daily concentration values based on the mass accumulation channel. Under typical operations, the directly measured concentration and the concentrations calculated from incremental mass accumulation values are virtually identical over a few hours. When rapidly increasing amounts of PM_{10} material occur, the reset process can produce erroneous values without corrections for short time periods. The official reported 24-hour value for April 15, 2013, calculated for standard conditions, was 267 $\mu g/m^3$ at Sunrise Acres in the Las Vegas Valley (Hydrographic Area 212), 245 $\mu g/m^3$ at Boulder City in the Eldorado Valley (Hydrographic Area 167), and 165 $\mu g/m^3$ at Jean, Nevada in the Ivanpah Valley (Hydrographic Area 164A).

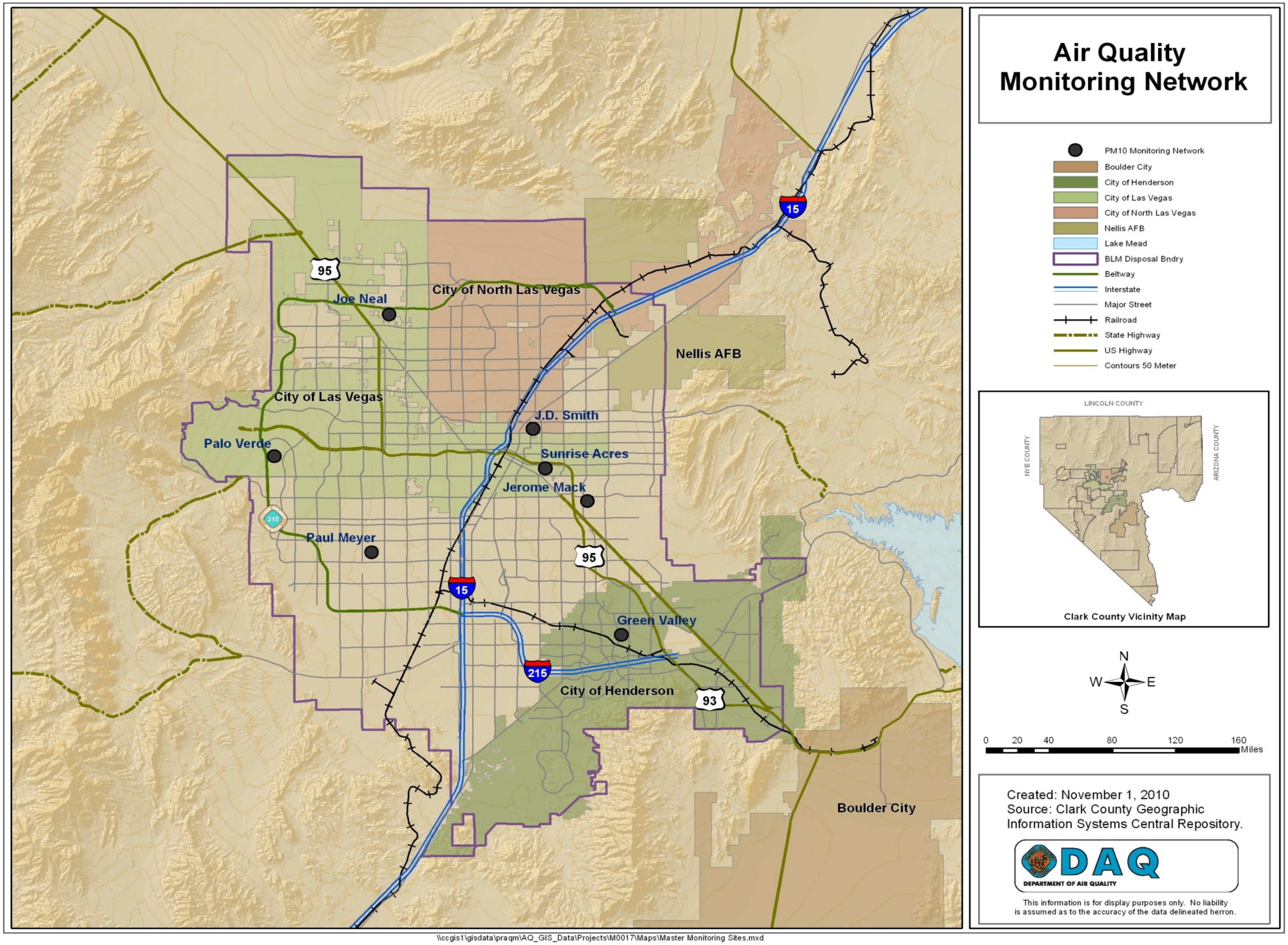

Figure 46. Air quality PM_{10} monitoring sites—Las Vegas Valley.

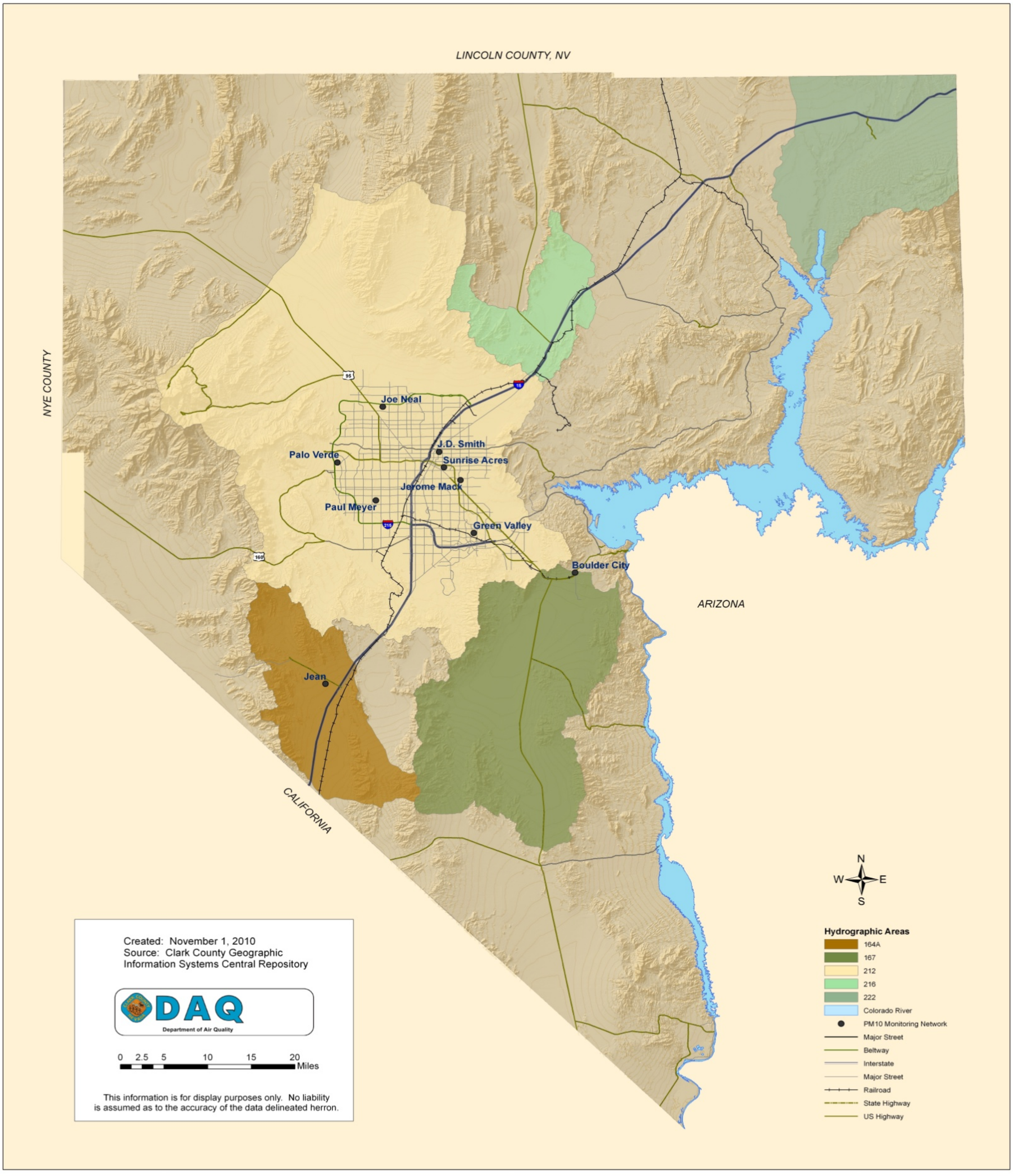

Figure 47. Air quality PM_{10} monitoring sites—Clark County.

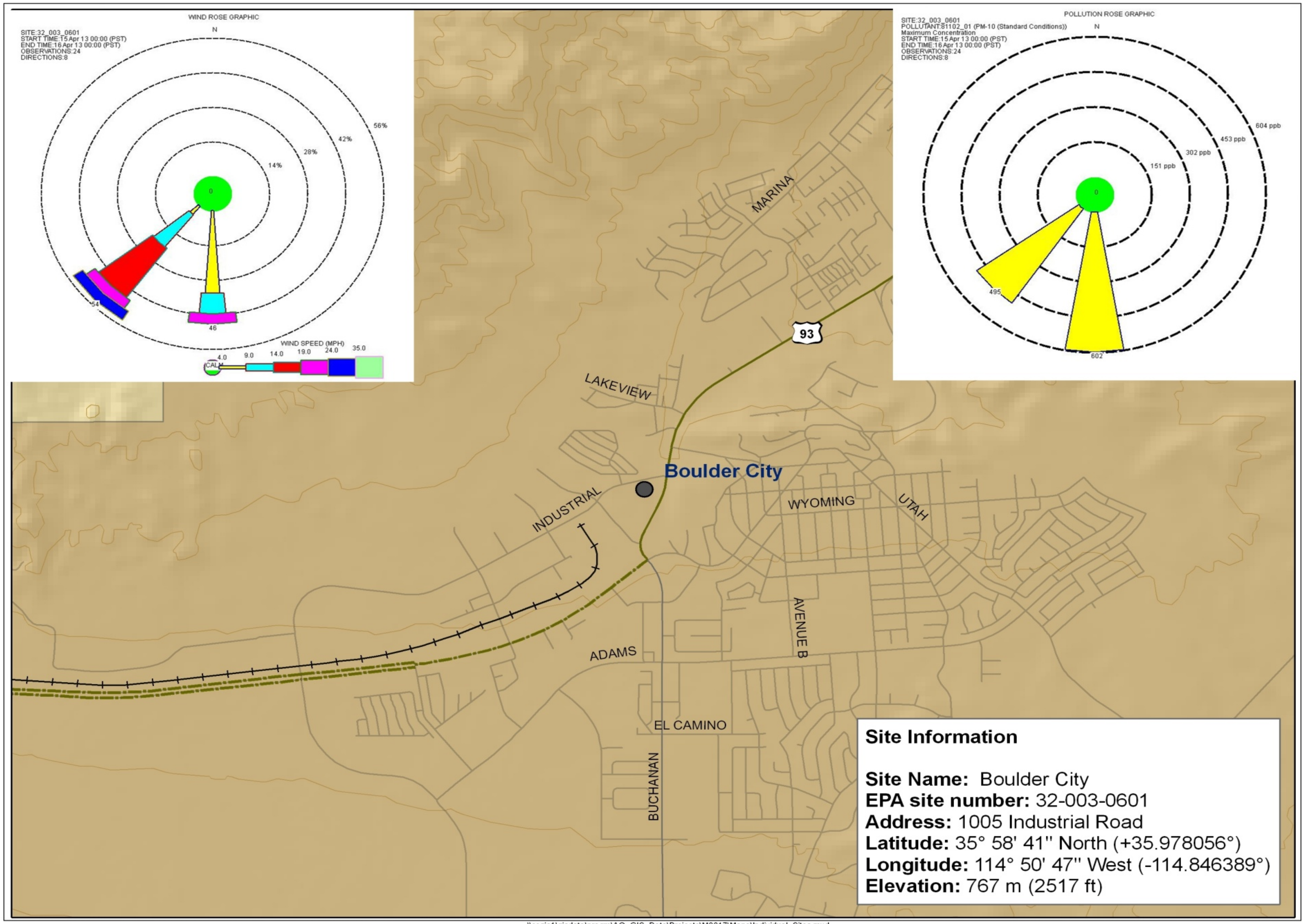

Figure 48. Air quality PM_{10} monitoring site—Boulder City, wind/pollution rose.

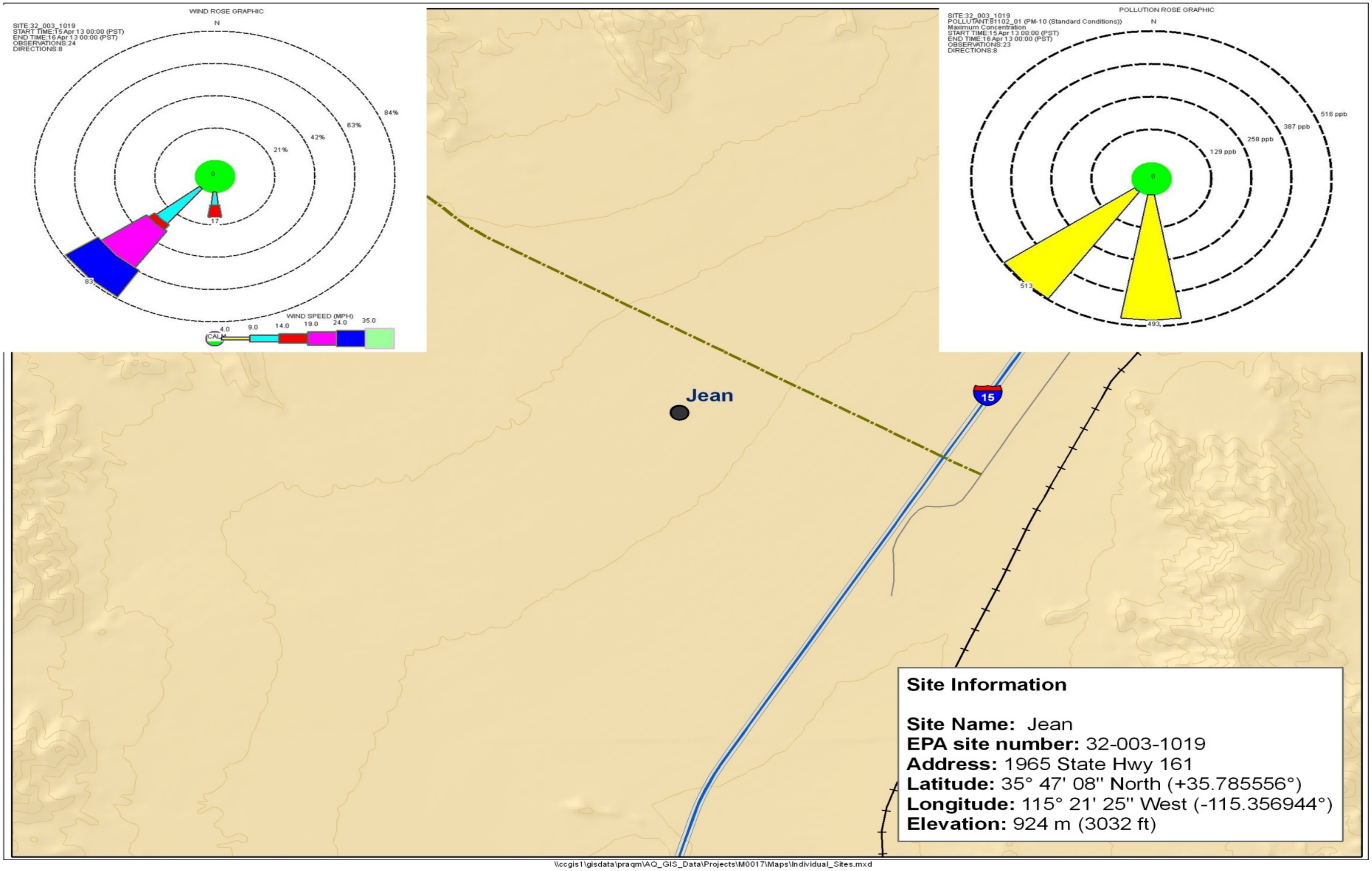

Figure 49. Air quality PM_{10} monitoring site—Jean, wind/pollution rose.

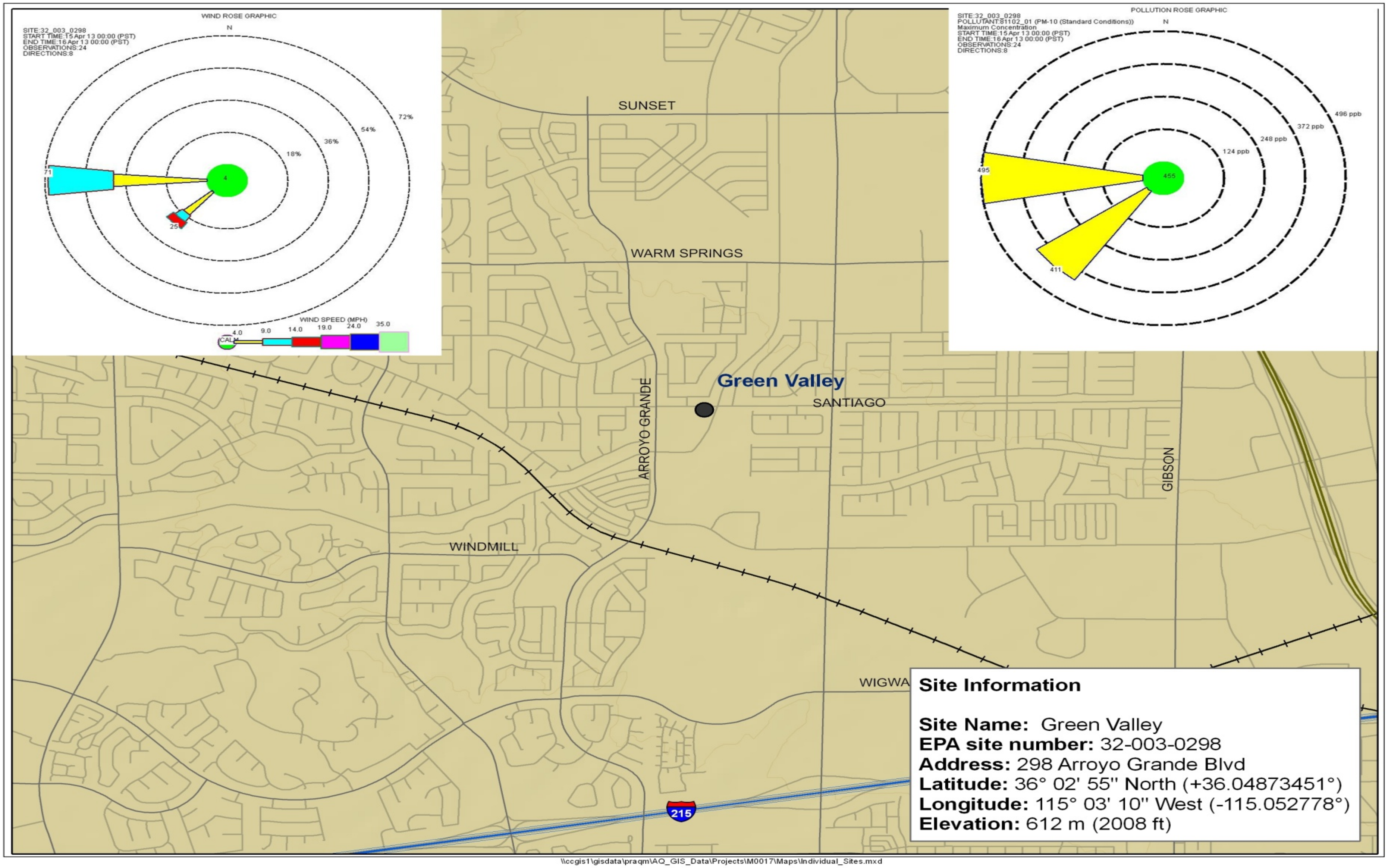

Figure 50. Air quality PM_{10} monitoring site—Green Valley, wind/pollution rose.

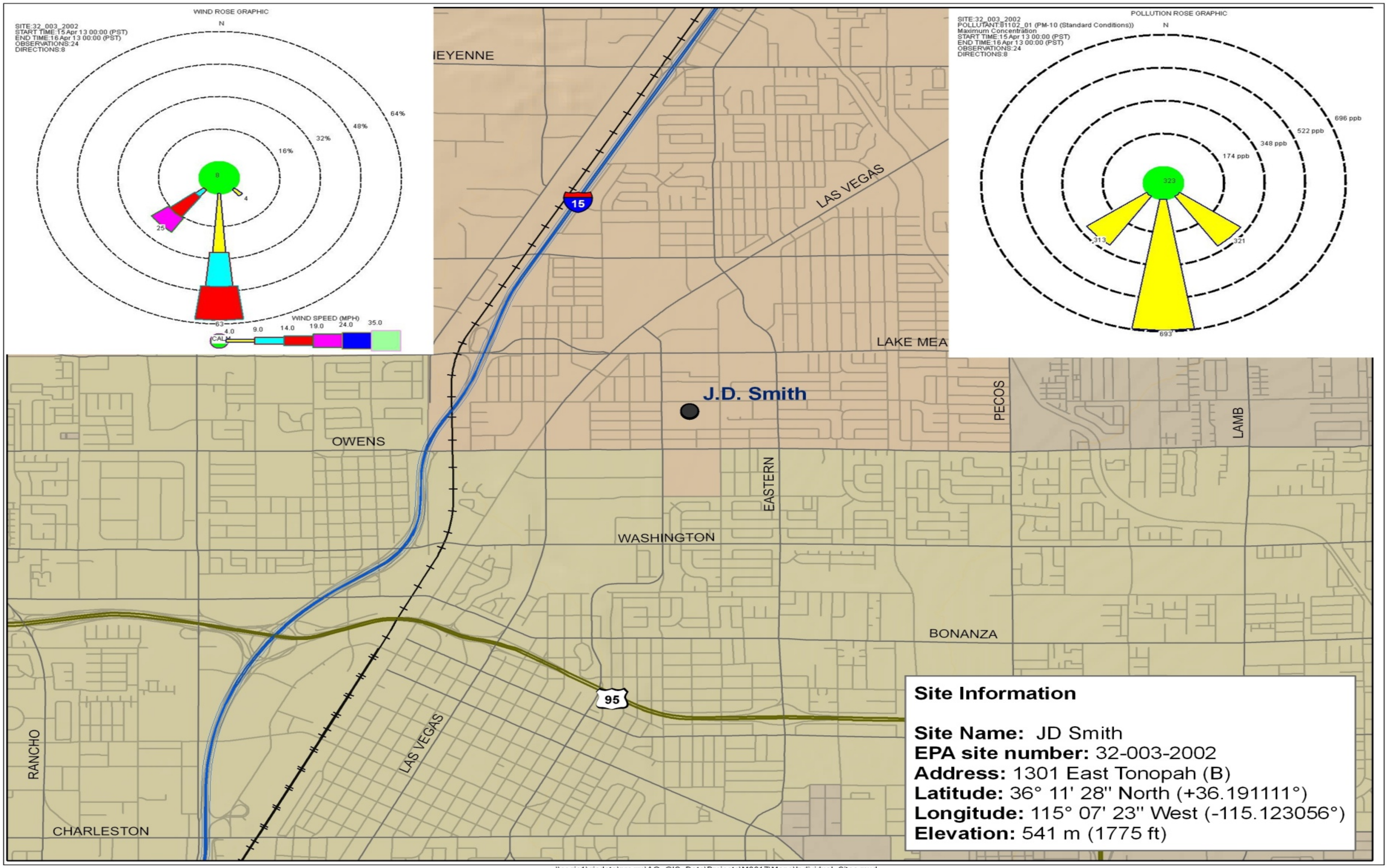

Figure 51. Air quality PM_{10} monitoring site—JD Smith, wind/pollution rose.

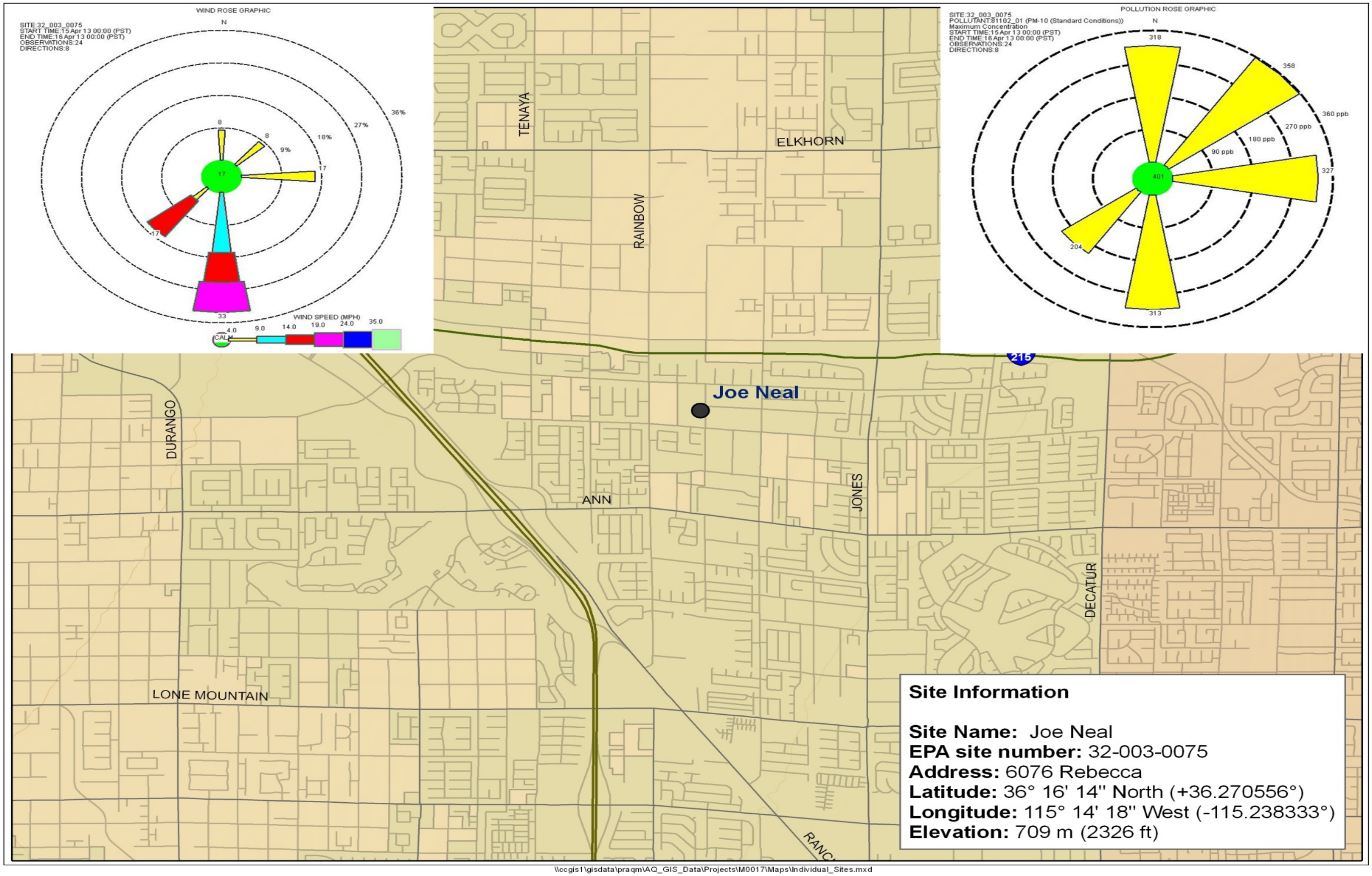

Figure 52. Air quality PM_{10} monitoring site—Joe Neal, wind/pollution rose.

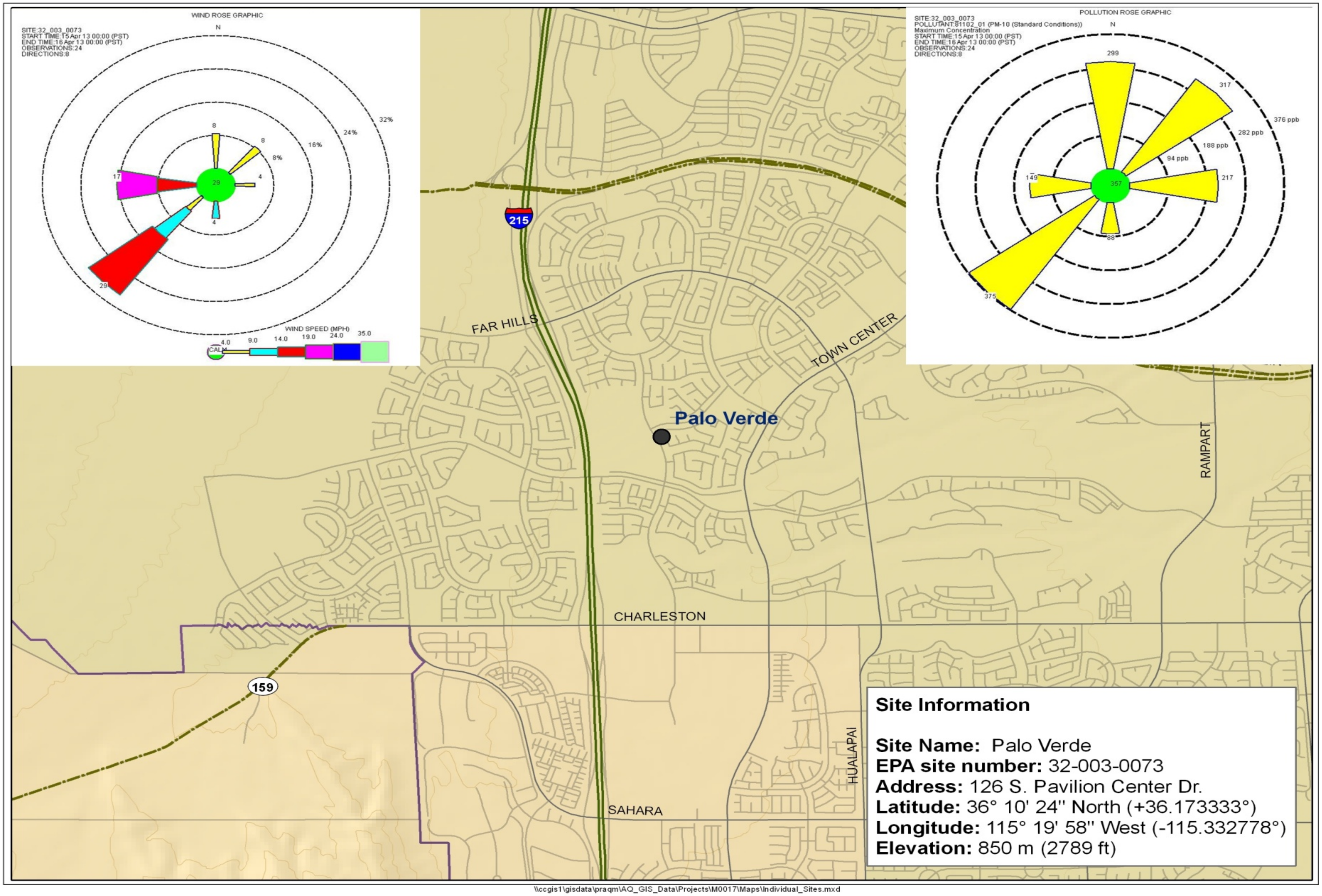

Figure 53. Air quality PM_{10} monitoring site—Palo Verde, wind/pollution rose.

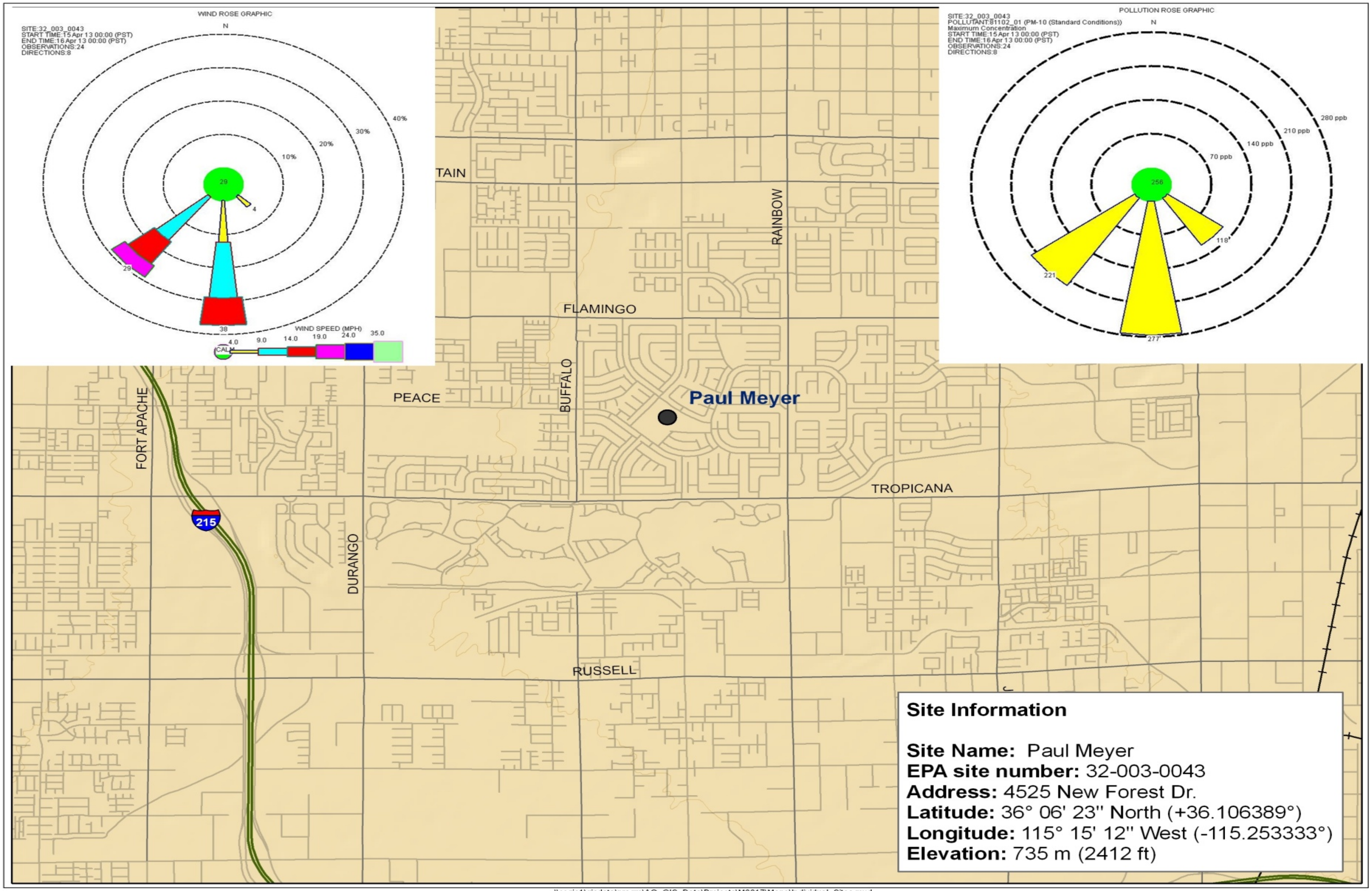

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Figure 54. Air quality PM_{10} monitoring site—Paul Meyer, wind/pollution rose.

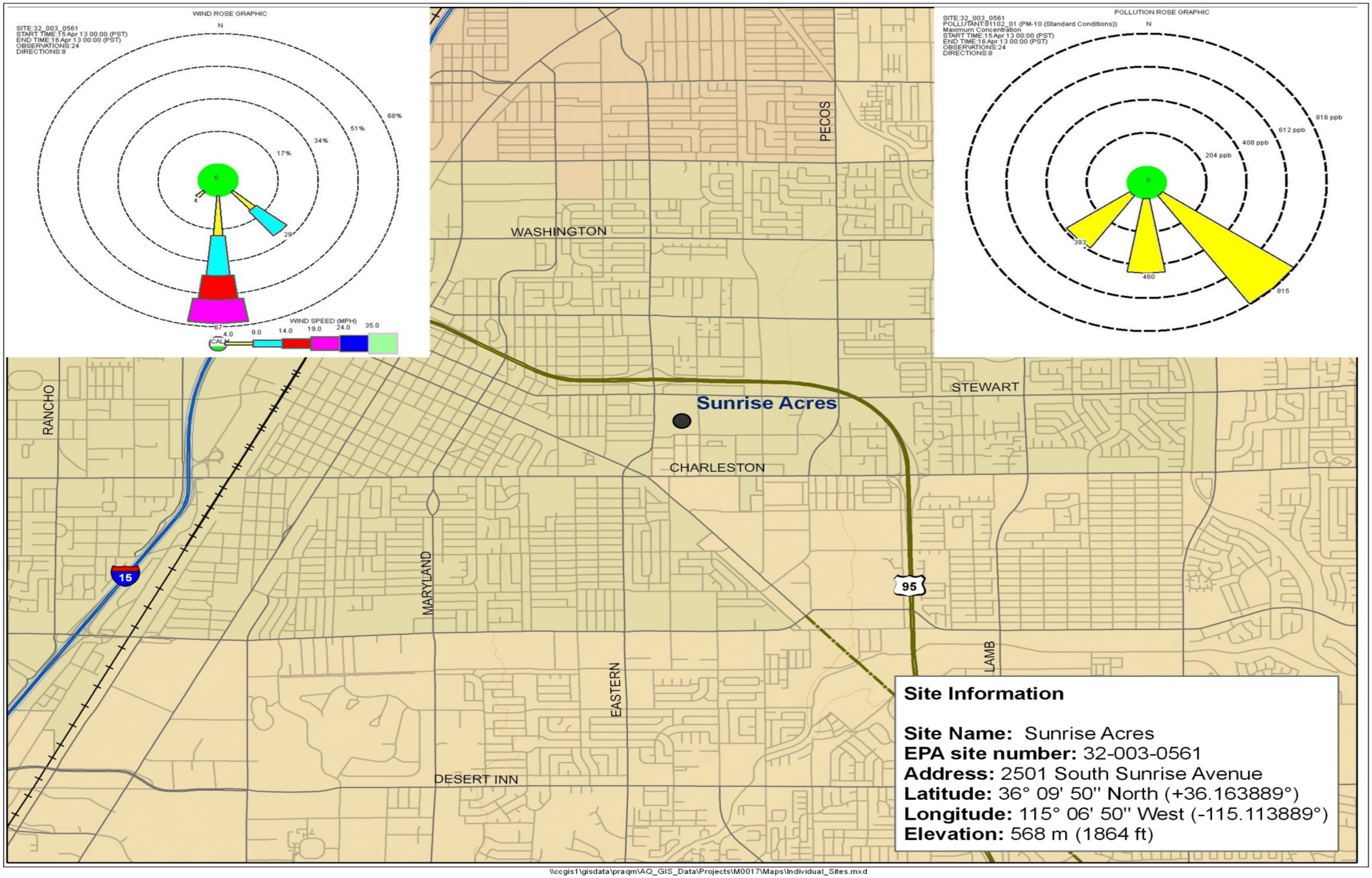


Figure 55. Air quality PM_{10} monitoring site—Sunrise Acres, wind/pollution rose.

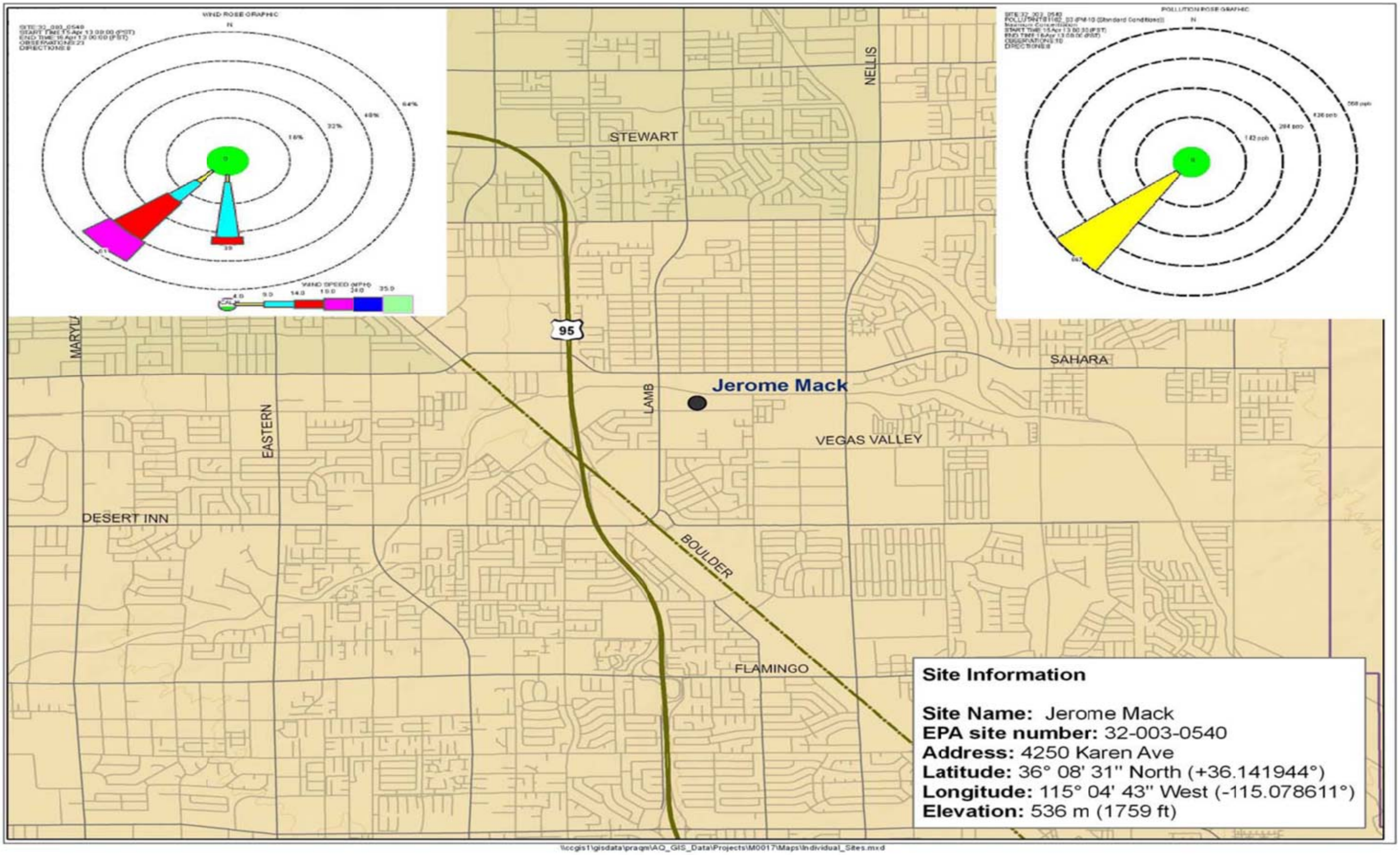


Figure 56. Air quality PM_{10} monitoring site—Jerome Mack, wind/pollution rose.

3.2.1 Weather Before Event

Weather in Clark County for the period preceding the exceptional event on April 15, 2013, was dominated by a low pressure system with an associated frontal boundary. As depicted on the 850 mb charts below, a strong pre-frontal trough moved through the Baker, and Barstow, California area at 2300 PST on April 14, 2013, which raised a large amount of dust and dropped visibility down to one-half mile (as reported by the NWS observations and forecast discussion.). Table 31 is the monthly summary Local Climatological Data for the North Las Vegas Airport, and Table 32 is the monthly summary Local Climatological Data for the McCarran International Airport.

Surface Charts (Figures 57–59)

These charts show a low-pressure system over southern Nevada, a cold front extending from New Mexico and through Southern California, and a trough extending down to the Gulf of California.

Upper Air Charts (Figures 60–65)

850 mb Charts
The 850 mb charts show the low-pressure system over southern Nevada, with toughing extending from New Mexico and through Southern California.

500 mb Charts
The 500 mb charts show a closed low north of Nevada migrating south and east.

250 mb Charts
The 250 mb charts show a closed low and associated trough digging down from the north to the southeast. The Jet Max (a point or area of relative maximum wind speeds within a jet stream) is orientated from the northwest to the southeast.

Table 31. Quality controlled monthly summary local climatological data for the North Las Vegas Airport for April, 2013.

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
(final)
NOAA, National Climatic Data Center
Month: 04/2013

Station Location: NORTH LAS VEGAS AIRPORT (53123)
LAS VEGAS, NV
Lat. 36.211 Lon. -115.195
Elevation(Ground): 2203 ft above sea level

Date	Temperature (Fahrenheit) Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Degree Days Base 65 Degrees Heating	Cooling	Sun Sunrise LST	Sunset LST	Significant Weather	Snow/Ice on Ground(In) 1200 UTC Depth	1800 UTC Water Equiv	Precipitation (In) 2400 LST Snow Fall	2400 LST Water Equiv	Pressure(inches of Hg) Avg. Station	Avg. Sea Level	Wind: Speed=mph Dir=tens of degrees Resultant Speed	Res Dir	Avg. Speed	max 5-second Speed	Dir	max 2-minute Speed	Dir	Date
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	74	57	66	M	31	49	0	1	-	-		0	M	0.0	0.00	27.60	29.92	4.7	30	9.6	23	350	22	160	01
02	78	58	68	M	29	49	0	3	-	-		0	M	0.0	0.00	27.65	29.97	8.3	35	9.8	30	320	25	330	02
03	82	56	69	M	31	51	0	4	-	-		0	M	0.0	0.00	27.72	30.05	0.7	31	3.1	15	140	9	100	03
04	86	57	72	M	30	51	0	7	-	-		0	M	0.0	0.00	27.63	29.94	3.6	24	6.9	29	250	22	260	04
05	83	61	72	M	28	51	0	7	-	-		0	M	0.0	0.00	27.55	29.86	4.5	32	7.7	28	190	23	230	05
06	83	59	71	M	24	50	0	6	-	-		0	M	0.0	0.00	27.56	29.87	4.4	34	6.2	22	350	18	340	06
07	85	61	73	M	23	50	0	8	-	-		0	M	0.0	0.00	27.42	29.73	3.2	28	8.7	29	180	23	180	07
08	68	47	58	M	29	46	7	0	-	-	RA BLDU	0	M	0.0	0.07	27.19	29.48	12.1	31	18.5	48	320	38	260	08
09	69	51	60	M	18	42	5	0	-	-		0	M	0.0	0.00	27.55	29.87	15.8	35	19.5	45	340	33	320	09
10	74	48	61	M	17	43	4	0	-	-		0	M	0.0	0.00	27.71	30.06	3.4	05	6.7	35	350	21	010	10
11	78	52	65	M	21	46	0	0	-	-		0	M	0.0	0.00	27.52	29.84	1.0	04	4.0	15	130	12	170	11
12	82	57	70	M	28	50	0	5	-	-		0	M	0.0	0.00	27.50	29.80	1.4	24	4.4	16	240	12	240	12
13	88	56	72	M	26	51	0	7	-	-		0	M	0.0	0.00	27.34	29.63	8.1	25	9.5	33	250	25	230	13
14	86	64	75	M	28	51	0	10	-	-		0	M	0.0	0.00	27.27	29.55	5.8	17	10.9	33	200	25	210	14
15	79	59	69	M	27	49	0	4	-	-	VCBLDU	0	M	0.0	0.00	27.21	29.50	13.0	23	14.8	46	180	37	210	15
16	63	51	57	M	23	43	8	0	-	-		0	M	0.0	0.00	27.45	29.76	10.4	33	14.5	40	330	32	330	16
17	65	49	57*	M	15	40	8	0	-	-		0	M	0.0	0.00	27.72	30.07	13.3	35	16.6	38	340	29	320	17
18	68	47	58	M	8	39	7	0	-	-		0	M	0.0	0.00	27.90	30.27	1.8	05	6.2	24	100	14	340	18
19	76	46*	61	M	13	43	4	0	-	-		0	M	0.0	0.00	27.76	30.12	0.5	27	4.3	13	160	10	160	19
20	80	57	69	M	19	48	0	4	-	-		0	M	0.0	0.00	27.66	29.99	3.8	03	7.1	26	350	20	010	20
21	89	55	72	M	19	49	0	7	-	-		0	M	0.0	0.00	27.63	29.95	1.3	28	4.1	17	240	14	240	21
22	90	62	76	M	18	51	0	11	-	-		0	M	0.0	0.00	27.50	29.80	3.4	31	6.4	35	330	26	340	22
23	74	58	66	M	9	44	0	1	-	-		0	M	0.0	0.00	27.68	30.00	5.7	04	10.0	46	050	30	010	23
24	80	50	65	M	7	44	0	0	-	-		0	M	0.0	0.00	27.60	29.93	1.4	05	4.6	16	120	13	110	24
25	84	57	71	M	13	47	0	6	-	-		0	M	0.0	0.00	27.58	29.89	1.6	24	5.5	18	190	14	200	25
26	87	60	74	M	17	49	0	9	-	-		0	M	0.0	0.00	27.75	30.07	1.2	01	4.2	15	070	12	100	26
27	91	59	75	M	15	50	0	10	-	-		0	M	0.0	0.00	27.73	30.05	0.6	05	5.2	16	140	13	120	27
28	95	63	79	M	17	52	0	14	-	-		0	M	0.0	0.00	27.57	29.86	1.8	28	3.9	15	320	12	330	28
29	98*	69	84*	M	19	54	0	19	-	-		0	M	0.0	0.00	27.41	29.69	5.6	25	8.4	28	270	21	190	29
30	95	68	82	M	M	M	0	17	-	-		0	M	0.0	0.00	27.34	29.60	7.0	28	9.1	39	320	31	330	30
	81.0	56.5	68.8		20.8	47.7	1.4	5.3	<-----Monthly Averages | Totals----->				M	M	0.07s	27.55	29.87	2.9	31	8.3	<Monthly Average				
	M	M	M	<-----------Departure From Normal---------->											M										

Table 32. Quality controlled monthly summary local climatological data for the McCarran International Airport for April, 2013.

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA

(final)

NOAA, National Climatic Data Center

Month: 04/2013

Station Location: **MCCARRAN INTERNATIONAL AIRPORT (23169)**
LAS VEGAS, NV

Lat. 36.071 Lon. -115.163

Elevation(Ground): 2180 ft above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
												1200 UTC	1800 UTC	2400 LST	2400 LST						max 5-second		max 2-minute		
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		Depth	Water Equiv	Snow Fall	Water Equiv	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	Speed	Dir	Speed	Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	76	57	67	5	33	50	0	2	0527	1802		0	M	0.0	0.00	27.60	29.84	10.1	21	11.2	33	220	25	210	01
02	79	57	68	5	29	50	0	3	0526	1802		0	M	0.0	0.00	27.65	29.89	2.0	23	7.0	25	010	18	360	02
03	82	58	70	7	31	51	0	5	0524	1803		0	M	0.0	0.00	27.72	29.96	4.8	19	5.1	13	220	12	220	03
04	87	61	74	11	30	52	0	9	0523	1804		0	M	0.0	0.00	27.63	29.85	9.1	21	10.5	41	230	32	230	04
05	83	61	72	9	31	52	0	7	0522	1805		0	M	0.0	0.00	27.56	29.78	9.4	21	11.4	37	230	28	230	05
06	84	60	72	9	28	51	0	7	0520	1806		0	M	0.0	0.00	27.55	29.79	7.8	21	8.6	22	200	18	190	06
07	86	61	74	10	26	51	0	9	0519	1807	BLDU	0	M	0.0	0.00	27.44	29.65	12.3	21	12.0	39	210	28	210	07
08	69	48	59	-5	29	45	6	0	0517	1807	RA BLDU VCBLDU	0	M	0.0	0.03	27.20	29.41	9.1	26	14.8	44	230	32	230	08
09	70	53	62	-3	18	42	3	0	0516	1808		0	M	0.0	0.00	27.55	29.79	12.2	35	16.2	38	340	29	330	09
10	74	51	63	-2	17	44	2	0	0515	1809		0	M	0.0	0.00	27.71	29.97	1.7	13	5.0	24	050	17	050	10
11	80	54	67	2	20	47	0	2	0513	1810		0	M	0.0	0.00	27.51	29.74	2.9	19	4.3	13	130	10	210	11
12	83	60	72	7	27	50	0	7	0512	1811		0	M	0.0	0.00	27.49	29.71	2.9	20	3.9	16	210	14	210	12
13	88	61	75	10	25	52	0	10	0510	1812		0	M	0.0	0.00	27.34	29.55	16.8	21	17.8	39	230	29	230	13
14	87	64	76	10	30	52	0	11	0509	1812	BLDU VCBLDU	0	M	0.0	0.00	27.27	29.47	10.5	19	12.6	37	190	30	200	14
15	78	58	68	2	28	49	0	3	0508	1813	HZ BLDU VCBLDU	0	M	0.0	0.00	27.24	29.43	19.0	20	19.3	43	210	31	220	15
16	64	51	58	-8	24	43	7	0	0506	1814	RA	0	M	0.0	T	27.45	29.68	4.3	29	12.9	35	350	26	340	16
17	66	50	58	-8	15	41	7	0	0505	1815		0	M	0.0	0.00	27.72	29.99	7.8	34	10.9	33	310	23	330	17
18	68	48*	58*	-8	9	40	7	0	0504	1816		0	M	0.0	0.00	27.90	30.18	2.5	10	6.3	21	090	15	080	18
19	77	49	63	-3	11	43	2	0	0503	1817		0	M	0.0	0.00	27.76	30.04	5.6	20	6.7	20	220	15	200	19
20	82	57	70	3	19	48	0	5	0501	1818		0	M	0.0	0.00	27.66	29.90	1.8	17	6.3	20	360	14	010	20
21	90	59	75	7	19	50	0	10	0500	1818		0	M	0.0	0.00	27.63	29.86	6.5	20	6.9	24	210	18	210	21
22	92	65	79	11	20	52	0	14	0459	1819	VCBLDU	0	M	0.0	0.00	27.50	29.71	3.4	23	7.9	35	060	28	060	22
23	75	59	67	-1	10	44	0	2	0458	1820		0	M	0.0	0.00	27.68	29.92	8.5	06	11.1	32	040	25	060	23
24	80	55	68	0	6	45	0	3	0456	1821		0	M	0.0	0.00	27.60	29.84	2.1	18	4.9	17	090	13	070	24
25	84	58	71	2	12	48	0	6	0455	1822		0	M	0.0	0.00	27.58	29.80	6.9	19	7.4	21	210	15	190	25
26	88	61	75	6	20	51	0	10	0454	1823		0	M	0.0	0.00	27.75	29.98	4.3	20	5.6	14	220	12	220	26
27	91	63	77	8	15	51	0	12	0453	1824		0	M	0.0	0.00	27.73	29.96	5.1	20	5.8	16	230	14	220	27
28	97	65	81	12	17	52	0	16	0452	1824		0	M	0.0	0.00	27.56	29.77	5.6	21	6.7	22	180	17	190	28
29	99*	72	86*	17	20	55	0	21	0451	1825		0	M	0.0	0.00	27.42	29.60	9.3	21	10.0	29	210	21	220	29
30	95	74	85	15	28	56	0	20	0449	1826		0	M	0.0	0.00	27.33	29.52	11.5	21	14.6	31	190	23	210	30
	81.8	58.3	70.1		21.6	48.6	1.1	6.5	<-----Monthly Averages | Totals----->				M	0.0	0.03	27.56	29.82	5.0	21	9.5	<Monthly Average				

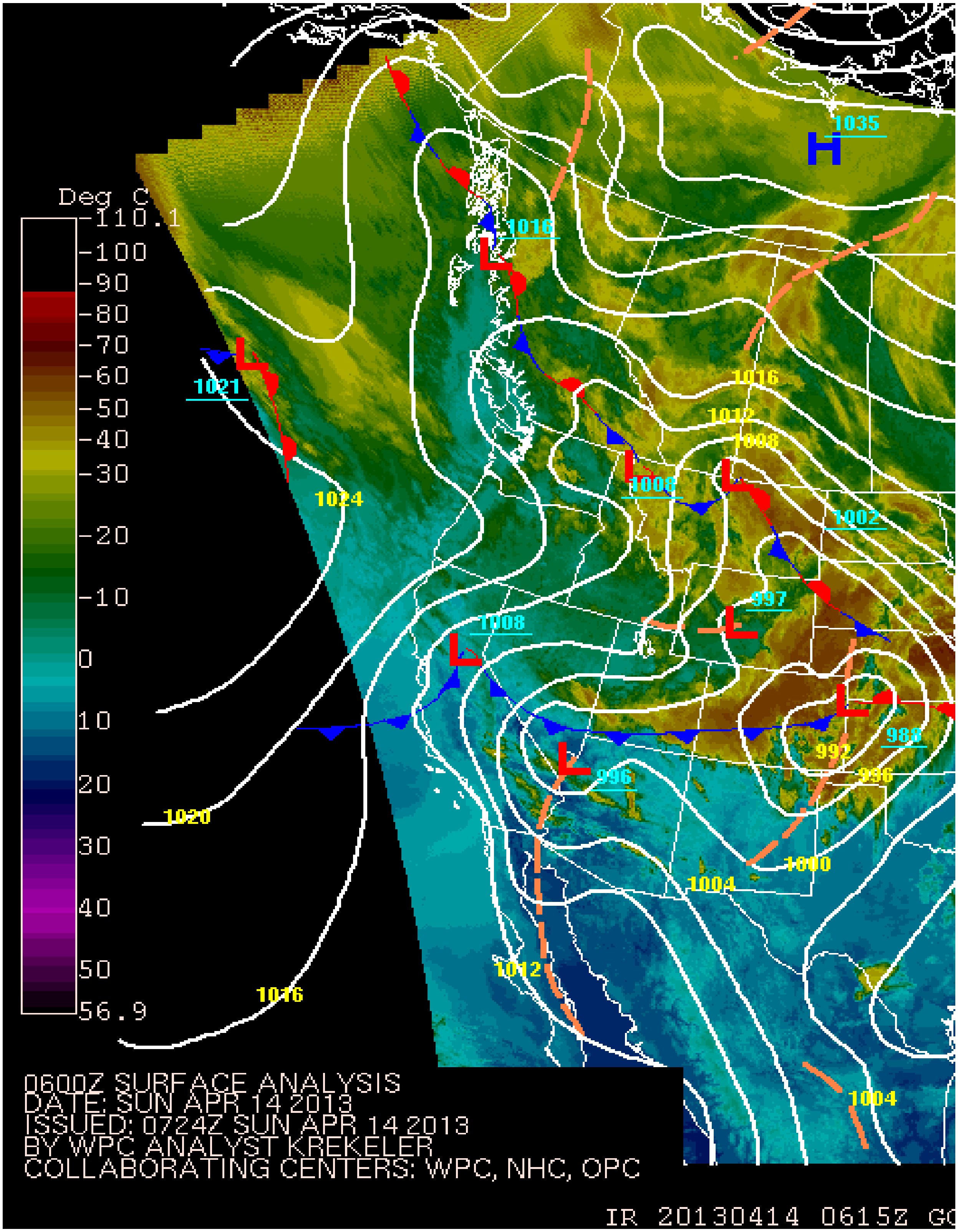


Figure 57. Surface prior to event weather charts with infrared overlays for April 14, 2013 06Z.

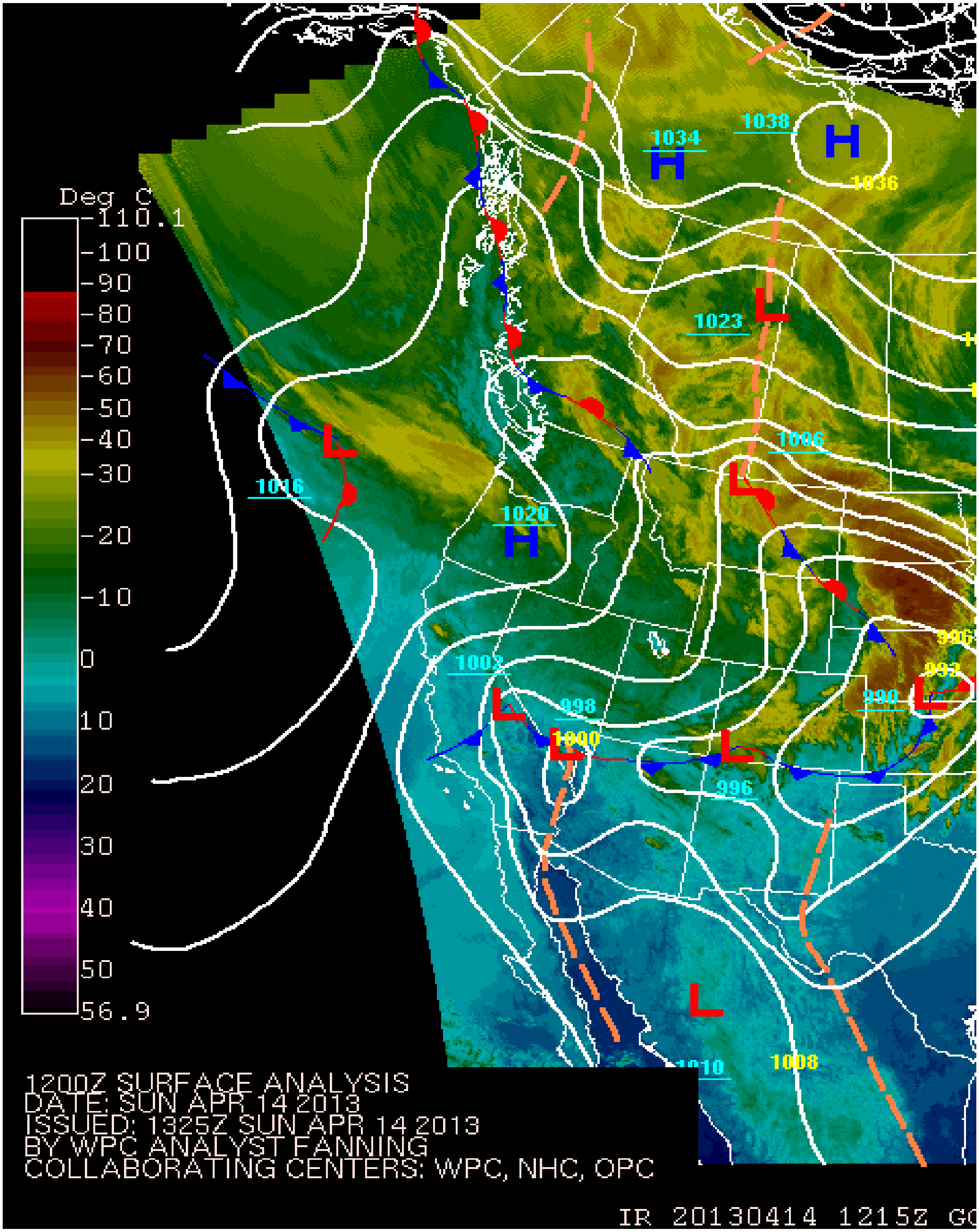


Figure 58. Surface prior to event weather charts with infrared overlays for April 14, 2013 12Z.

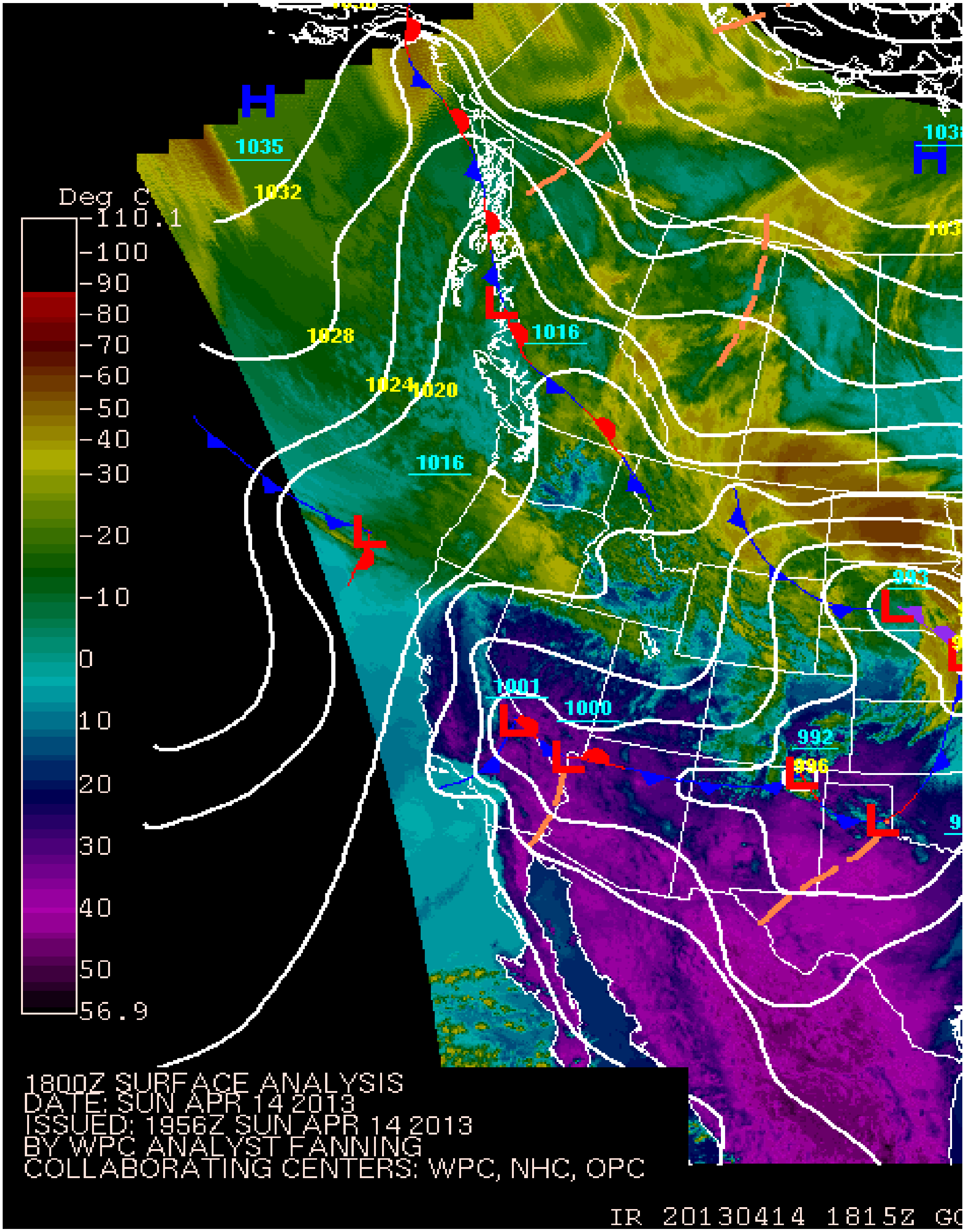


Figure 59. Surface prior to event weather charts with infrared overlays for April 14, 2013 18Z.

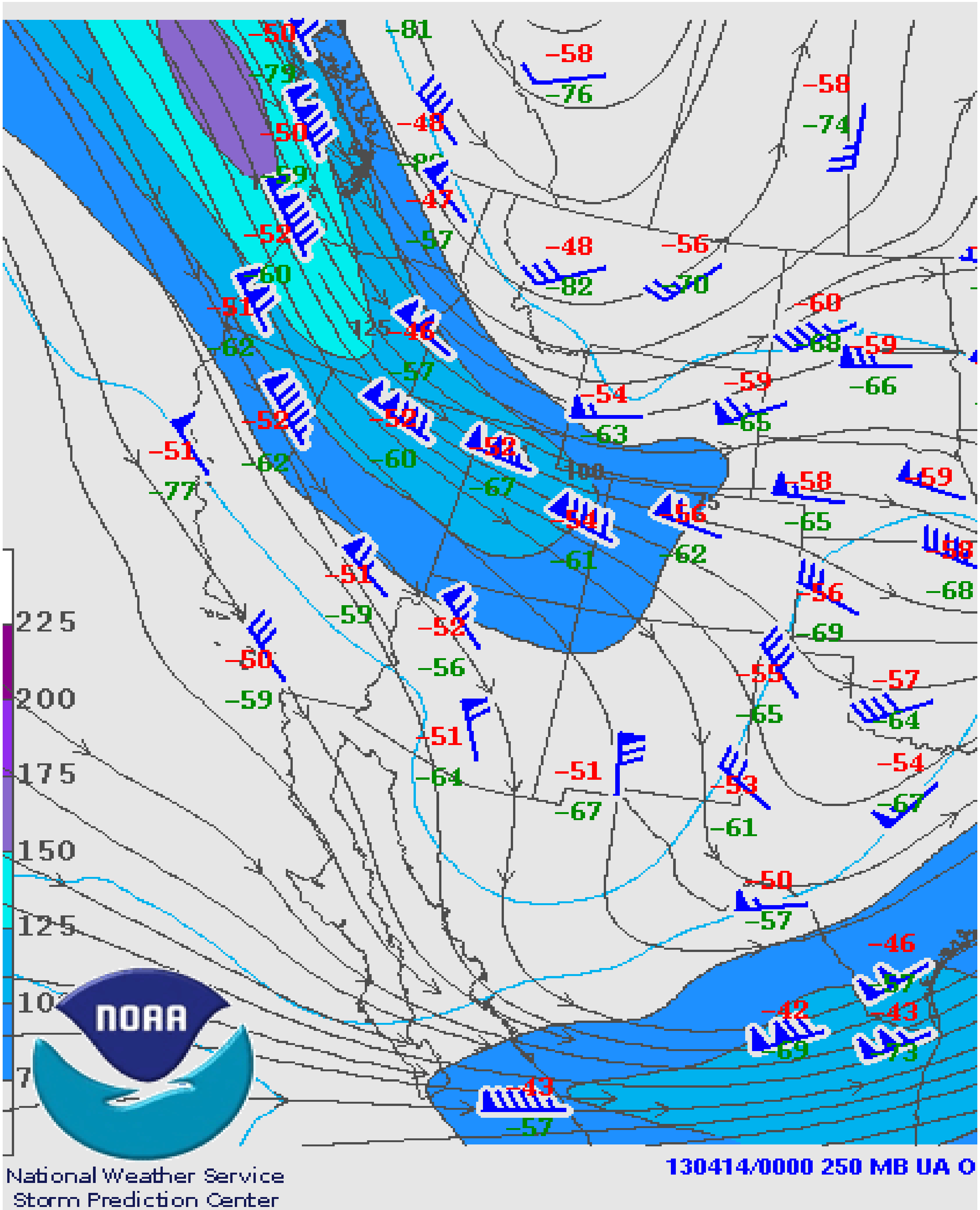


Figure 60. 250 mb prior to event weather chart for April 14, 2013 00Z.

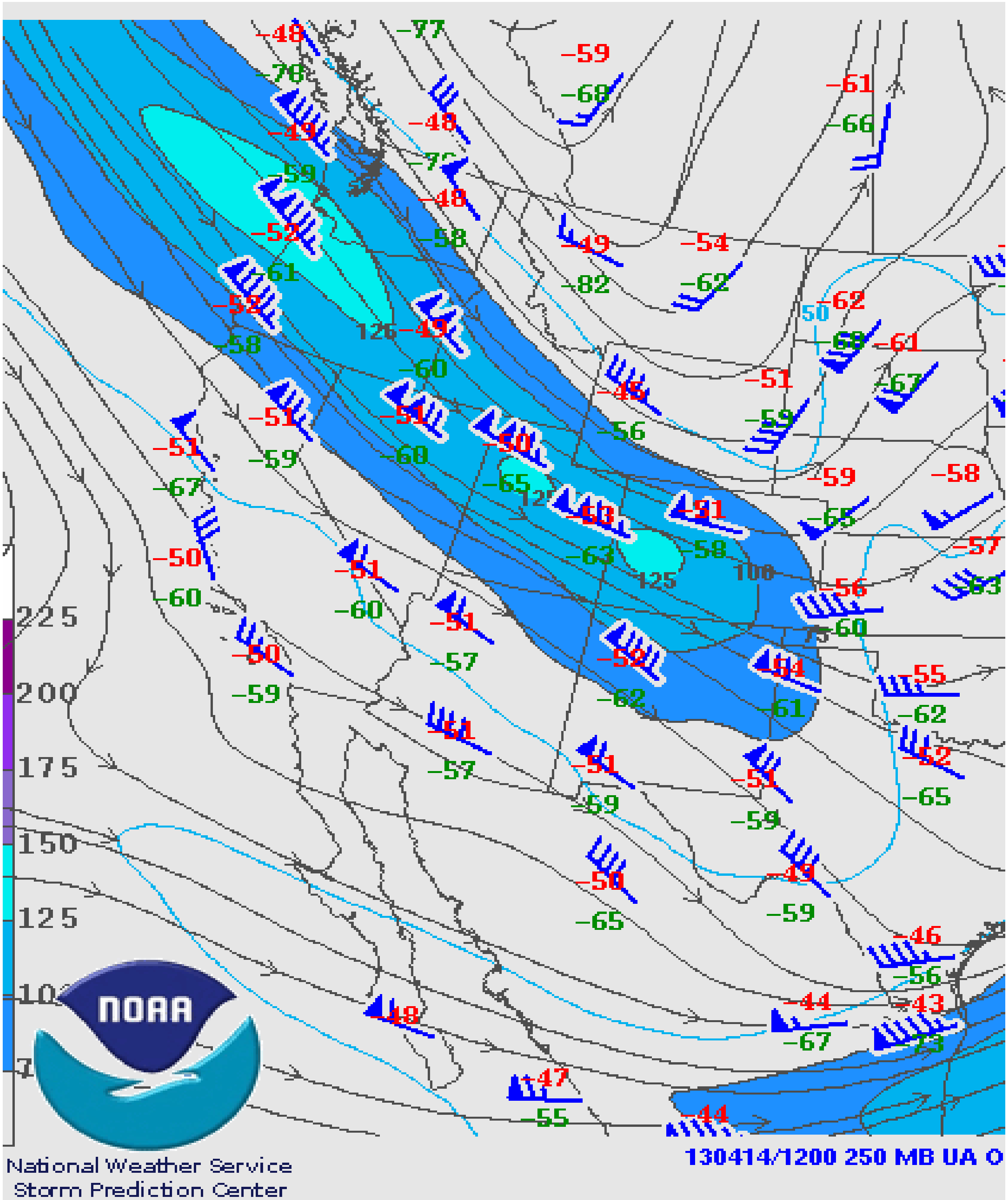


Figure 61. 250 mb prior to event weather chart for April 14, 2013 12Z.

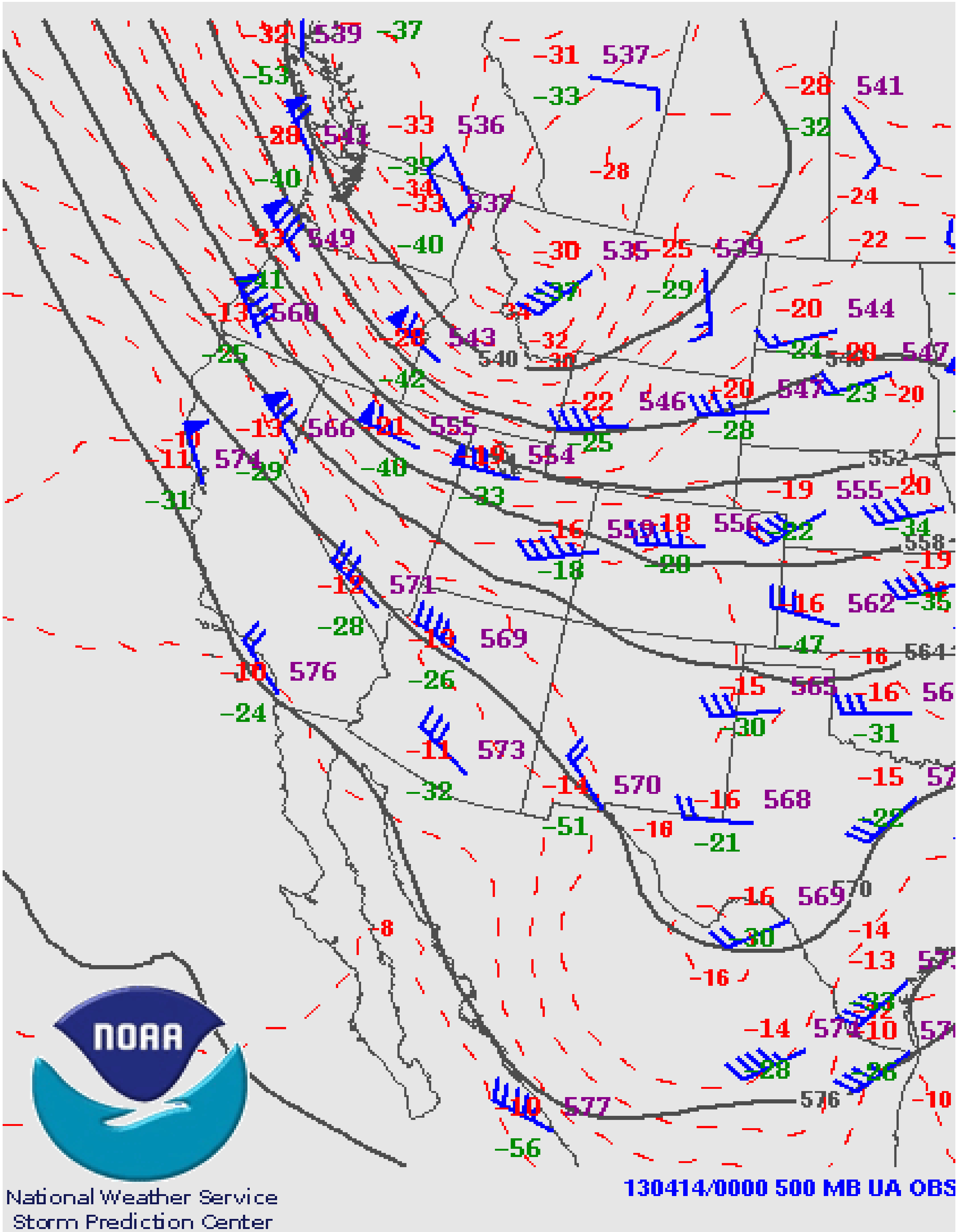


Figure 62. 500 mb prior to event weather chart for April 14, 2013 00Z.

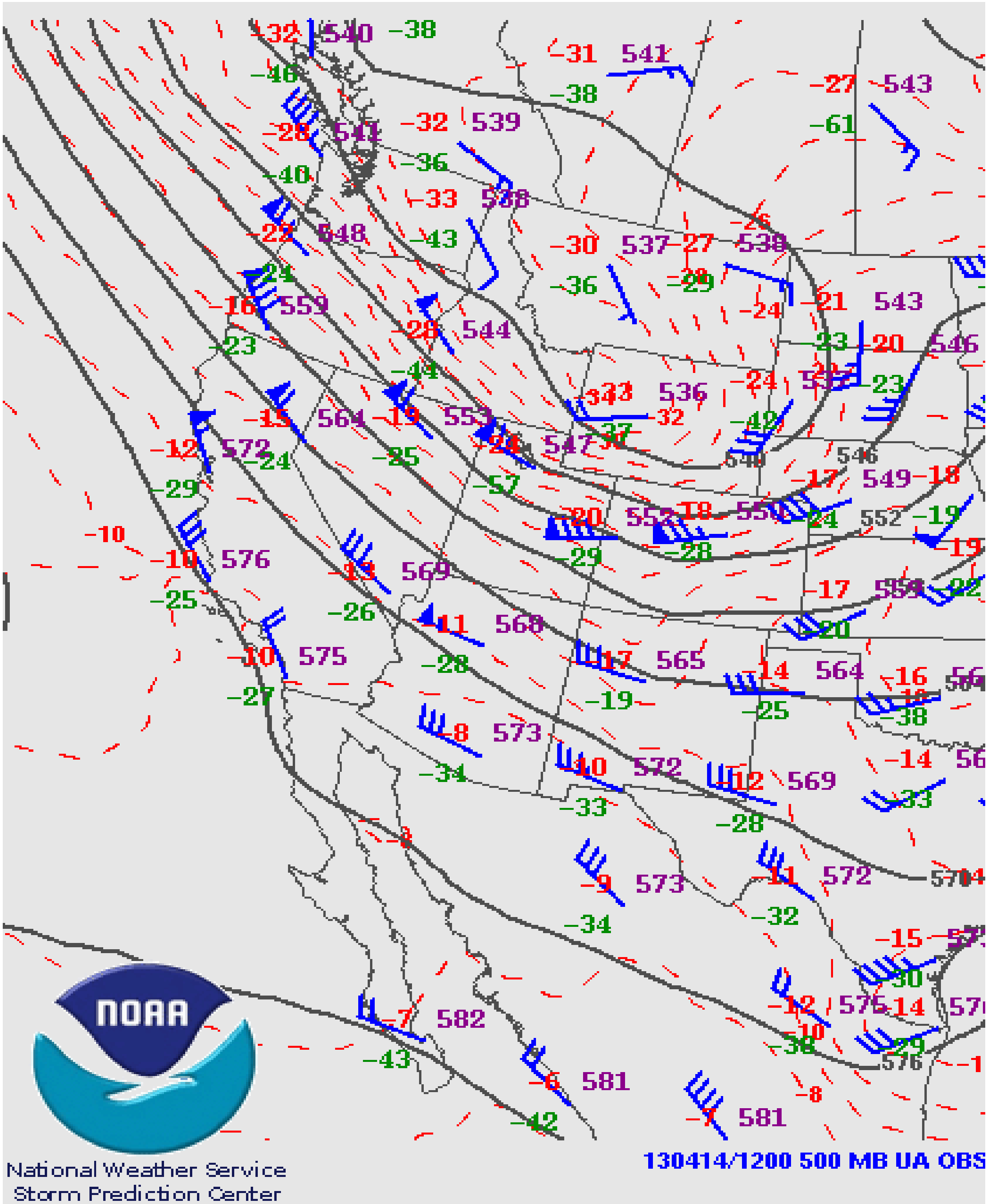


Figure 63. 500 mb prior to event weather chart for April 14, 2013 12Z.

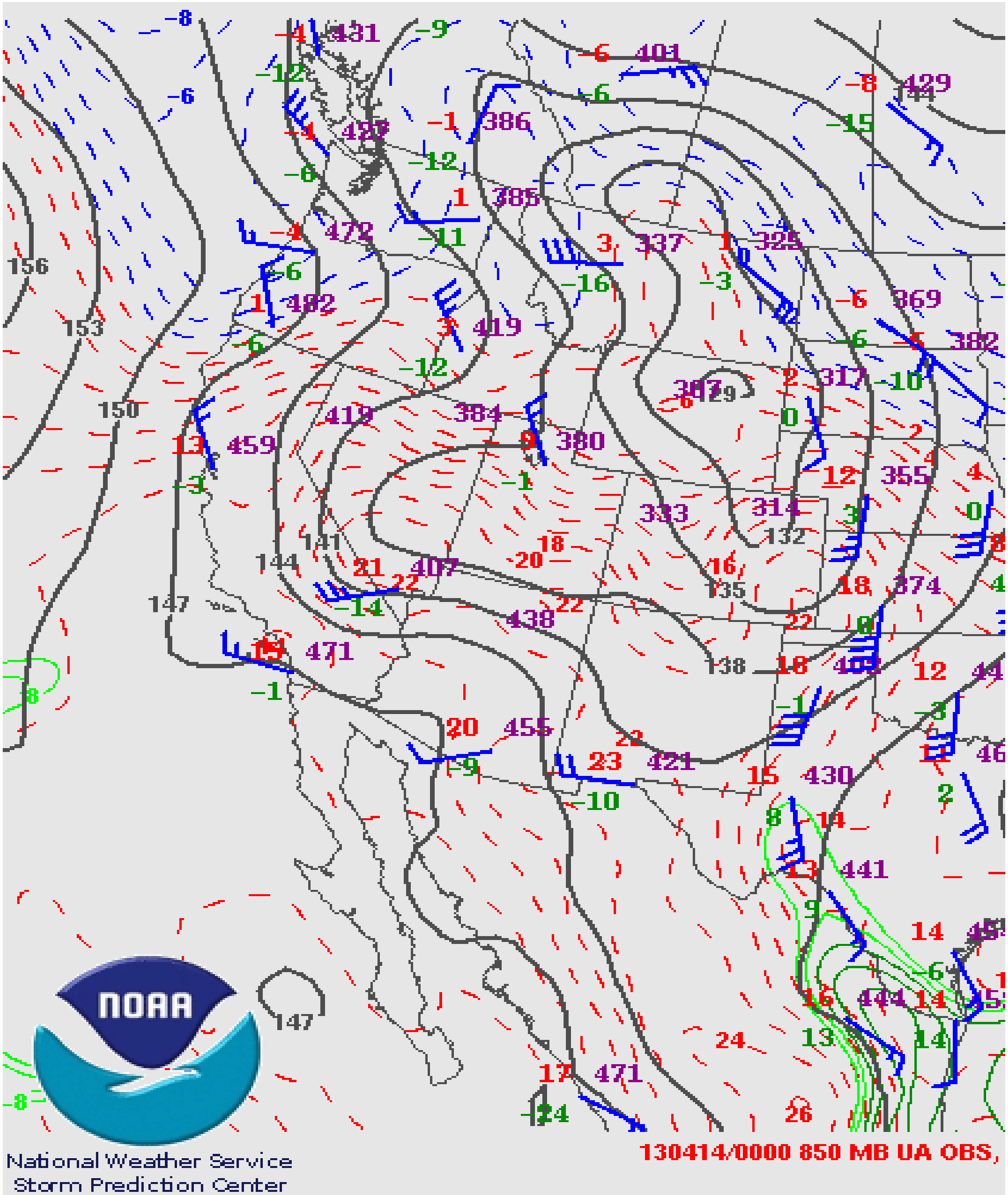


Figure 64. 850 mb prior to event weather chart for April 14, 2013 00Z.

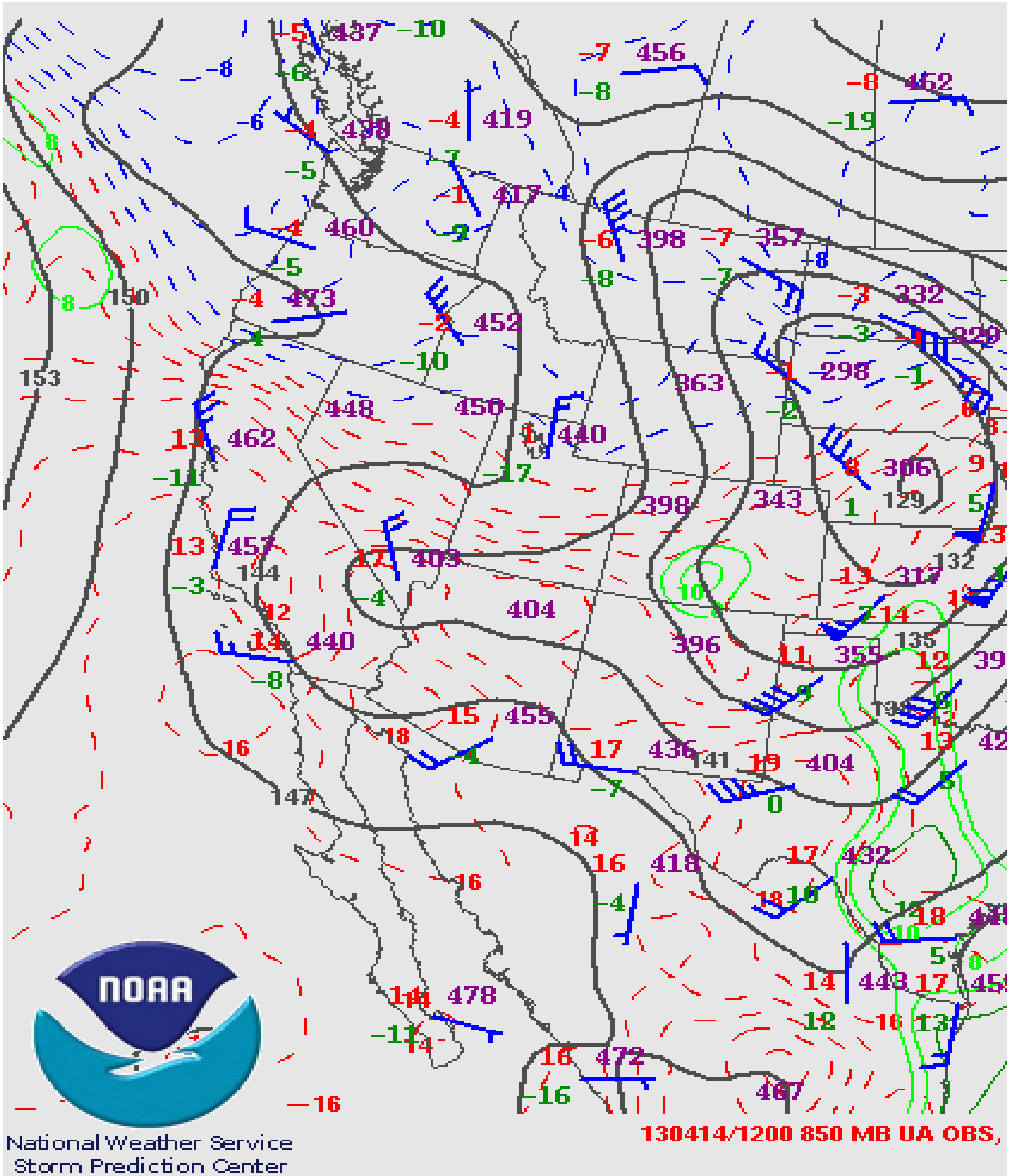


Figure 65. 850 mb prior to event weather chart for April 14, 2013 12Z.

3.2.2 Weather During the Event

Figures 66 through 69 show the surface weather charts with infrared overlays for April 14, 2013, 11:00 pm (PST) through April 16, 2013, 5:00 am (PST) in six-hour increments. Figures 70 through 78 show the 200, 500, and 850 mb pressure charts for April 14, 2013, 11:00 pm through April 16, 2013, 5:00 am in 12-hour increments. Tables 33 through 35 show the hourly winds from the North Las Vegas Airport, McCarran International Airport, and the DAQ monitoring stations. Table 36 shows the PM_{10} concentration and wind data from the Sunrise Acres and the McCarran International Airport.

Surface Charts (Figures 66–69)

These charts show a low-pressure system dropping down directly over Clark County. The low-pressure system has an associated cold front and pre-frontal trough.

Upper Air Charts (Figures 70–78)

200 mb Charts
The 200 mb charts show toughing deepening and digging down.

500 mb Charts
The 500 mb charts show toughing deepening and digging down.

850 mb Charts
The 850 mb charts show a low-pressure system over southern Nevada with several associated troughs.

Wind Data

Climatological Data for the North Las Vegas and McCarran Airports
Wind from the Local Climatological Data source for North Las Vegas Airport and McCarran International Airport for April 15 are shown in Tables 33 and 34.

Monitoring Site Wind Data
Table 35 lists the hourly wind speeds, direction and gusts for the monitoring sites within the Las Vegas Valley.

Wind Graphs (Figures 79–87)
Plots of the hourly average wind speed and maximum gust speed recorded at selected DAQ monitoring stations compared with the McCarran International Airport wind data for April 15, 2013.

Monitoring Site PM Data
Table 36 lists the hourly average PM_{10} concentration data from Sunrise Acres, for April 15, 2013, and wind data from McCarran International Airport

NWS Forecast Discussion (Illustration 1)
Note the following exert.

SHORT TERM...TODAY THROUGH WEDNESDAY NIGHT...WINDS REALLY KICKED UP ACROSS THE WESTERN MOJAVE DESERT LAST EVENING CLOSING I-40 FOR A TIME EAST OF BARSTOW DUE TO BLOWING DUST. THAT SUSPENDED DUST HAS WORKED NORTH AND EAST INTO PARTS OF SOUTHERN NEVADA AND NORTHWEST ARIZONA PRODUCING SOME RESTRICTION IN THE VISIBILITY.

Tables 37 and 38:
List the NWS Weather Observations for Barstow, California for April 14, 2013, and April 15, 2013.

Tables 39 and 40:
List the NWS Weather Observations for Baker, California for April 14, 2013, and April 15, 2013.

Tables 41 and 42:
List the NWS Weather Observations for McCarran Airport for April 14, 2013, and April 15, 2013.

HYSPLIT Trajectory modeling (Figures 88–90)
NOAA HYSPLIT models that show Barstow and Baker, California, are the source regions throughout the day, as can be seen in the Barstow and Baker NWS observations.

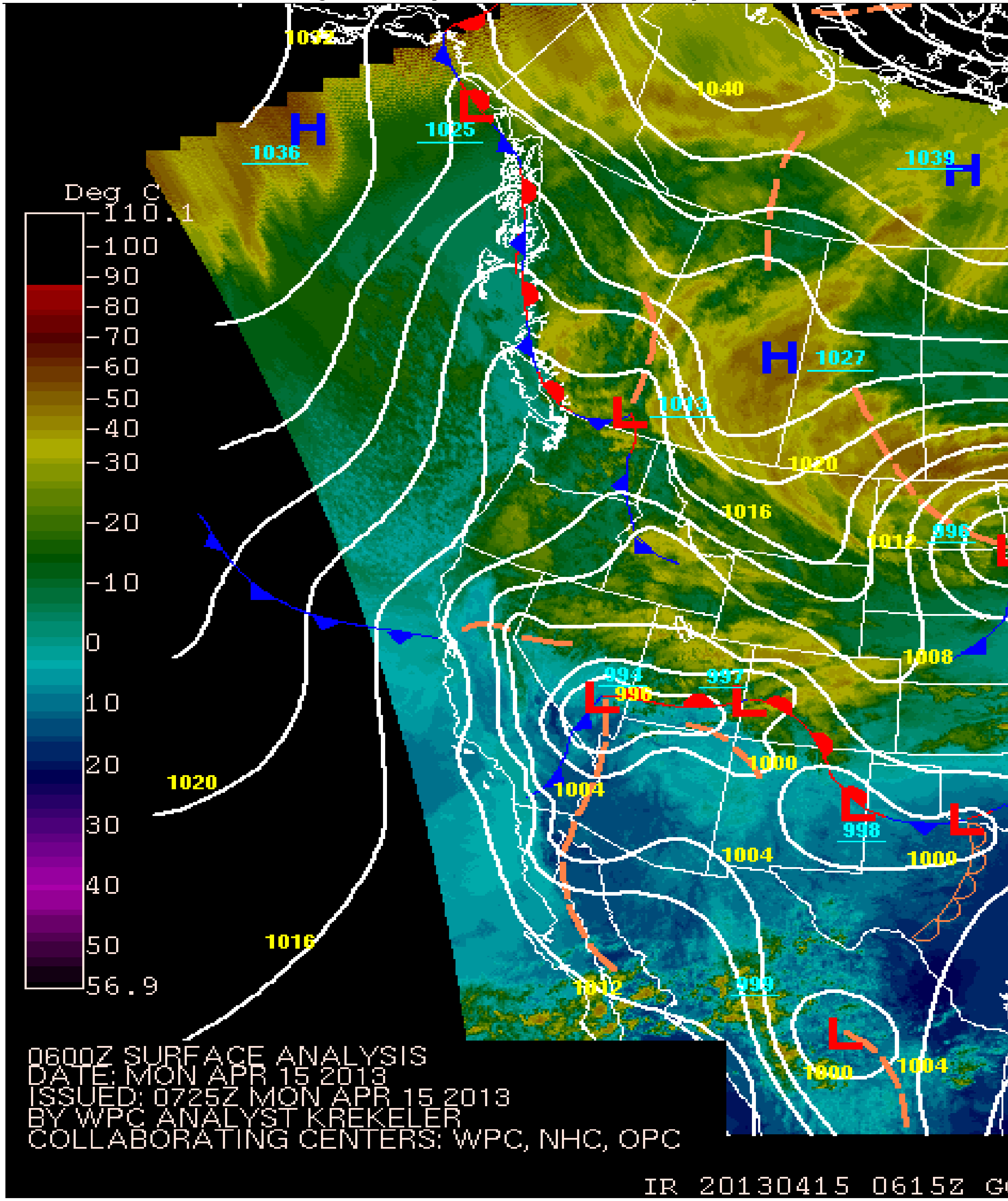


Figure 66. Surface during the event weather chart with infrared overlays for April 15, 2013 06Z.

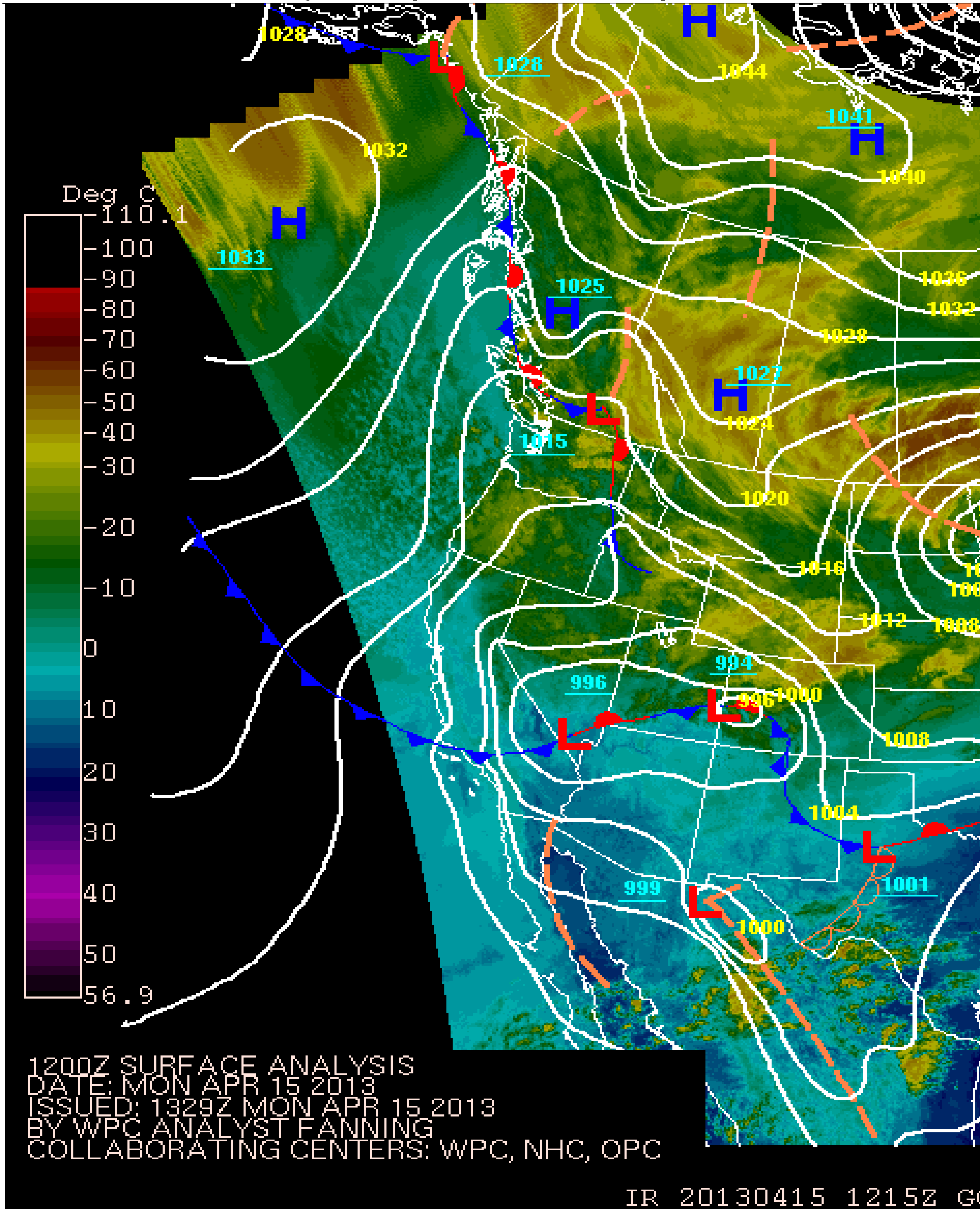


Figure 67. Surface during the event weather chart with infrared overlays for April 15, 2013 12Z.

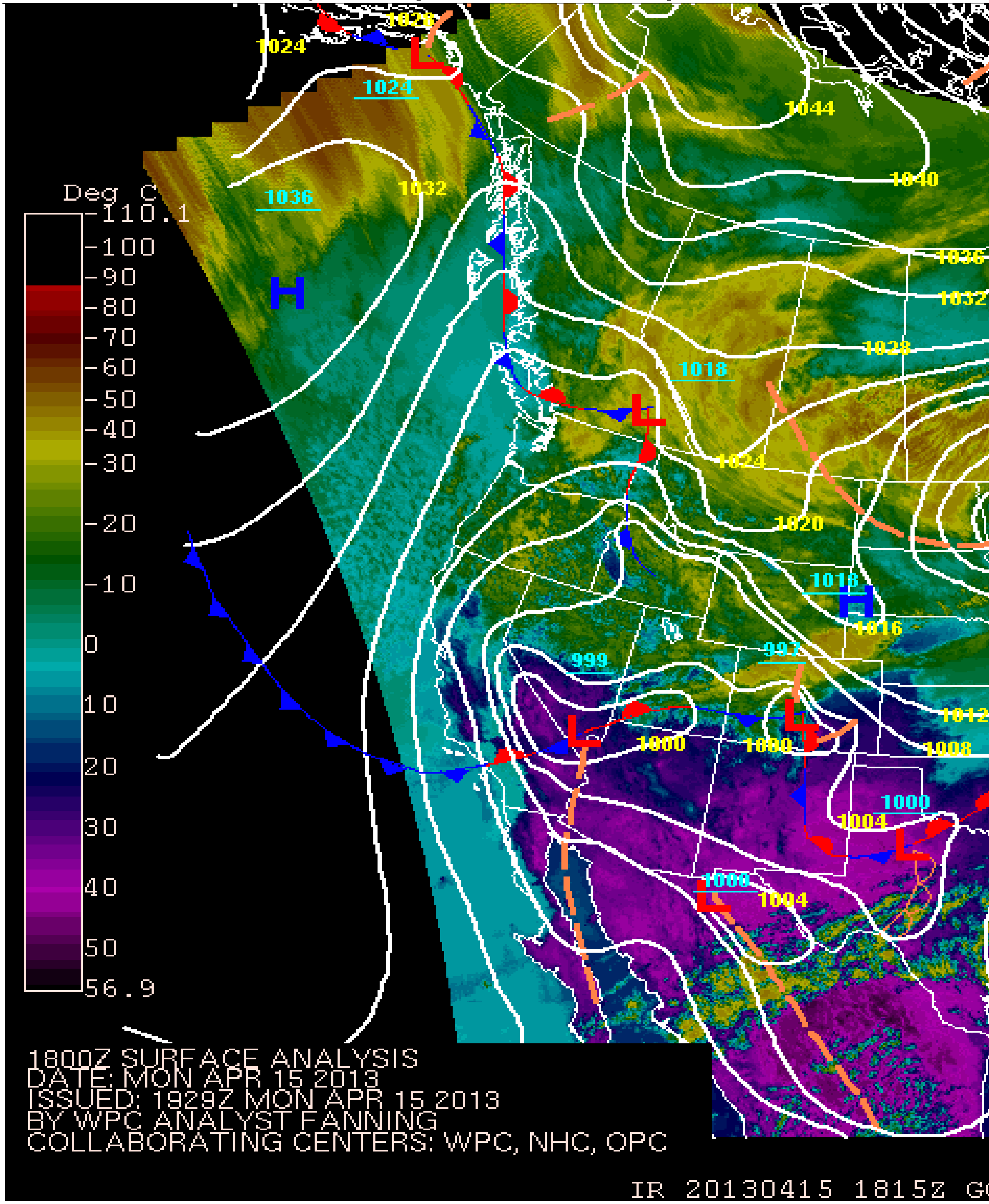


Figure 68. Surface during the event weather chart with infrared overlays for April 15, 2013 18Z.

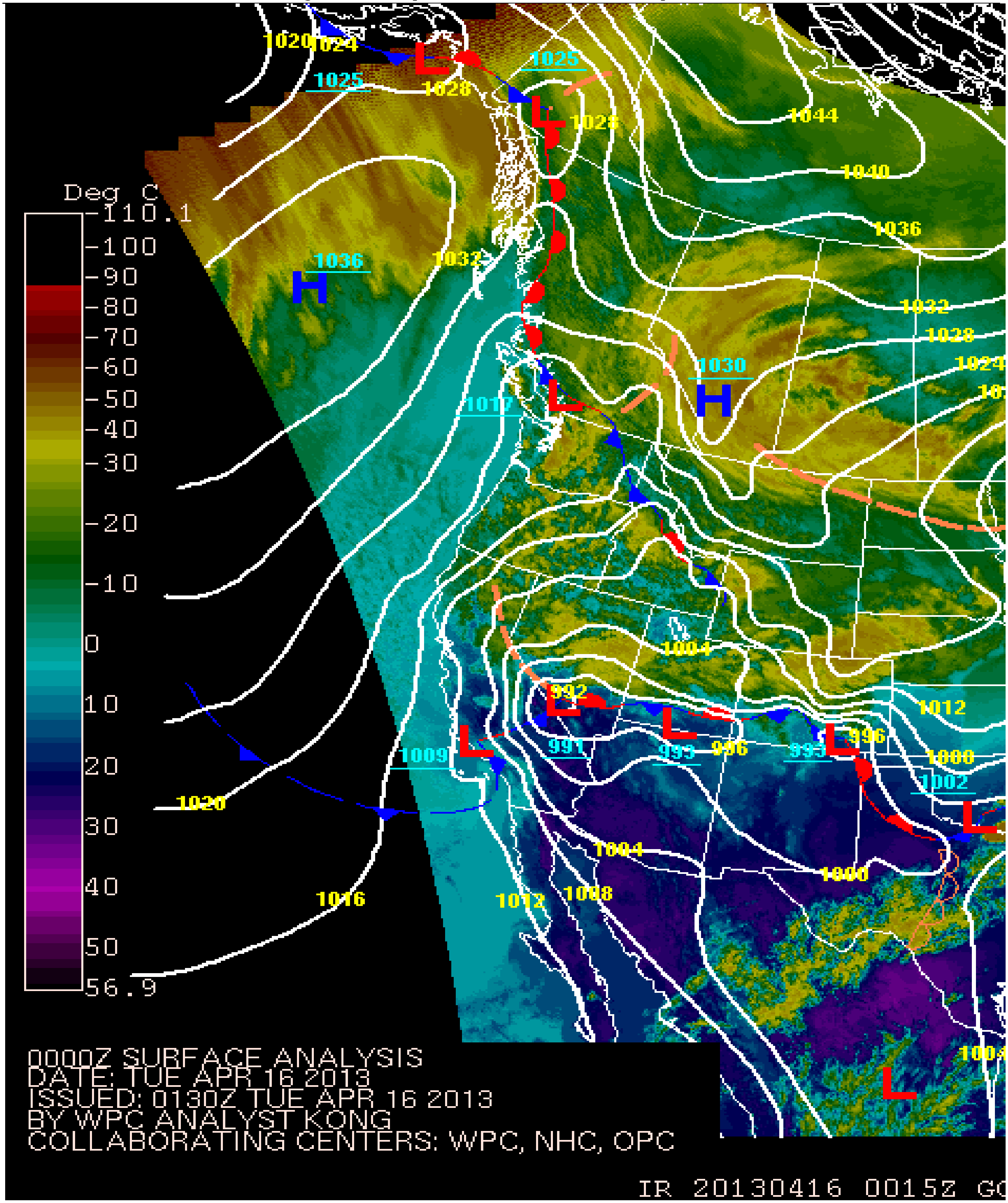


Figure 69. **Surface during the event weather chart with infrared overlays for April 16, 2013 00Z.**

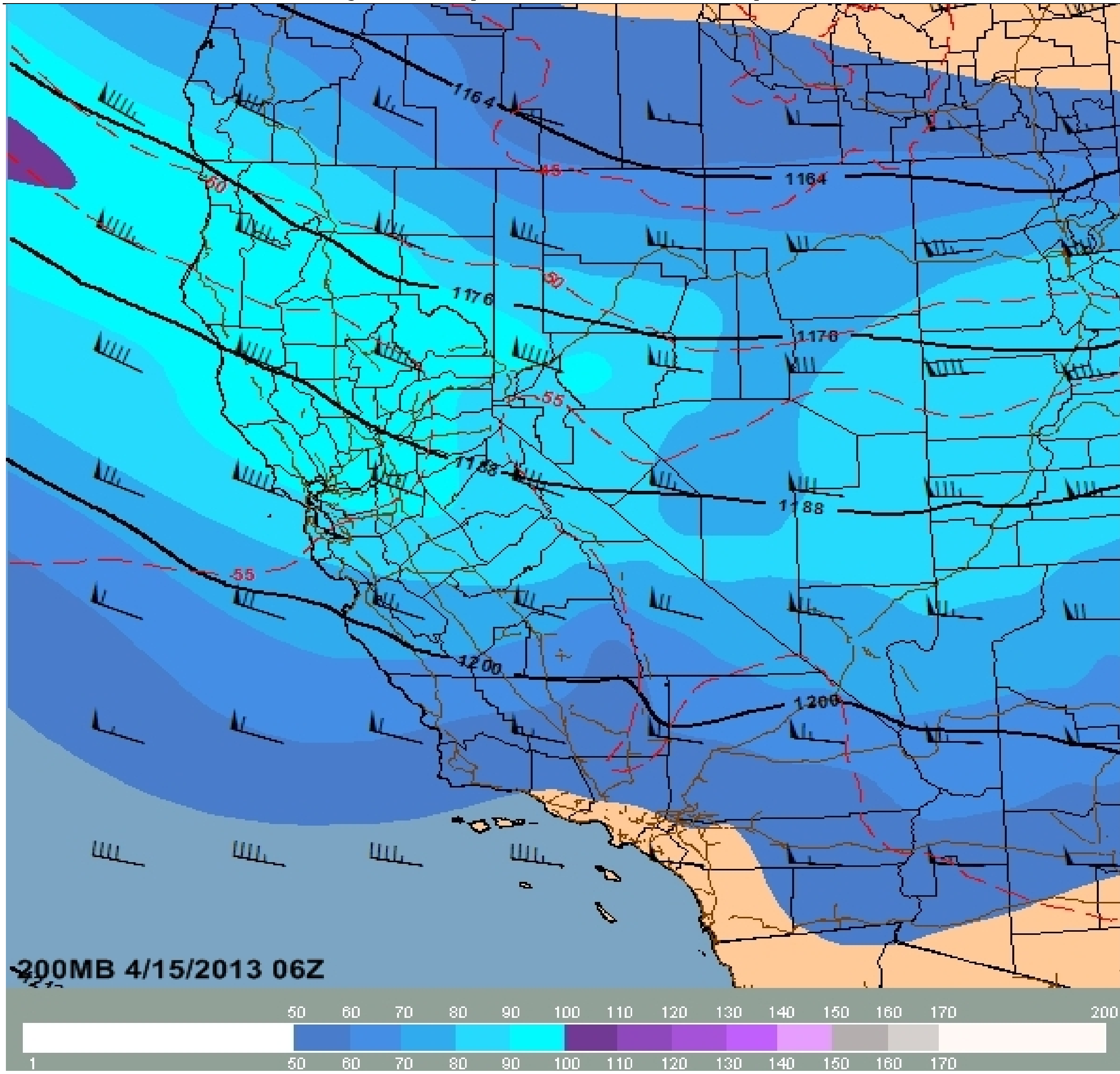


Figure 70. 200 mb during the event weather chart for April 15, 2013 06Z.

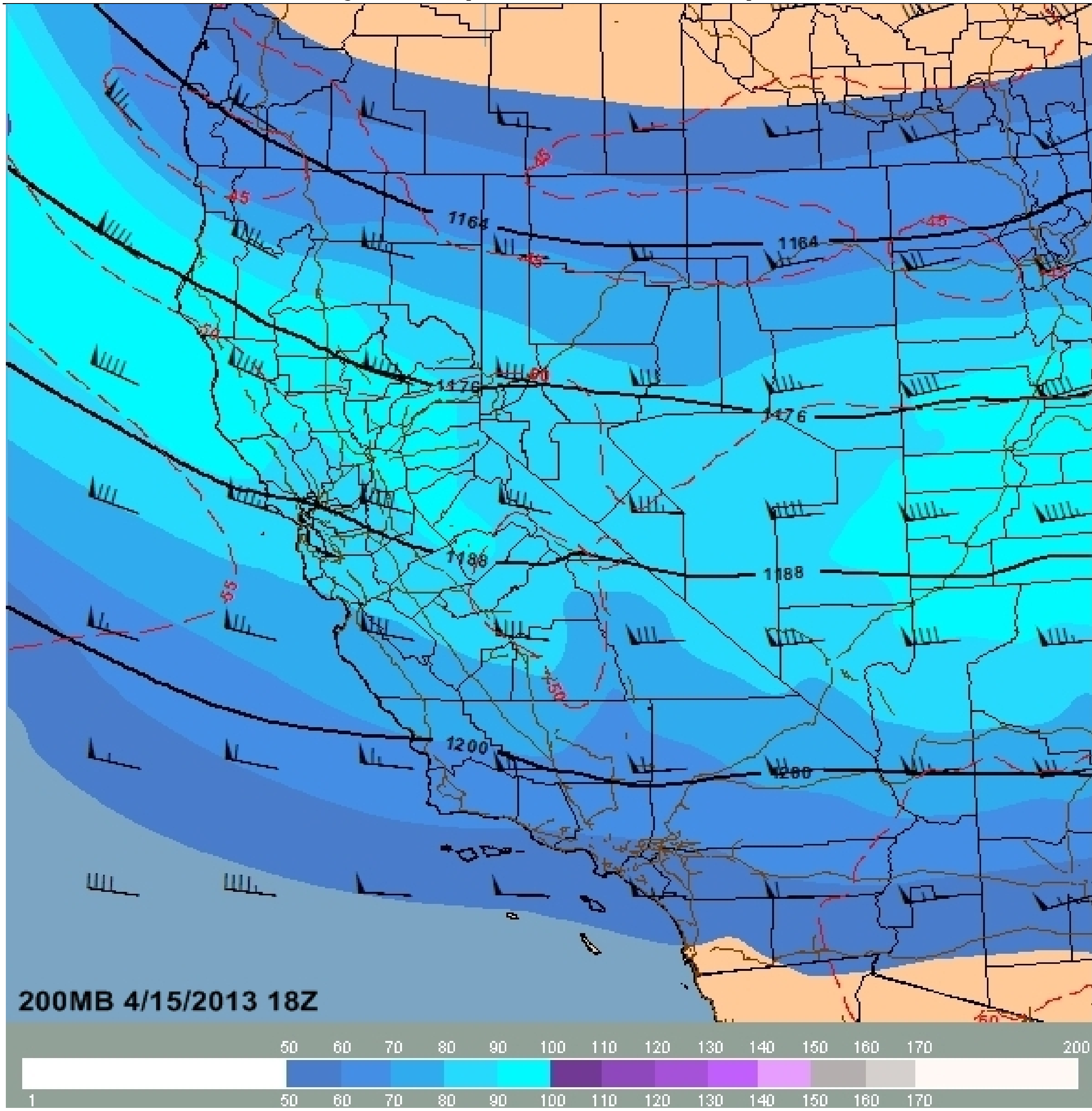


Figure 71. 200 mb during the event weather chart for April 15, 2013 18Z.

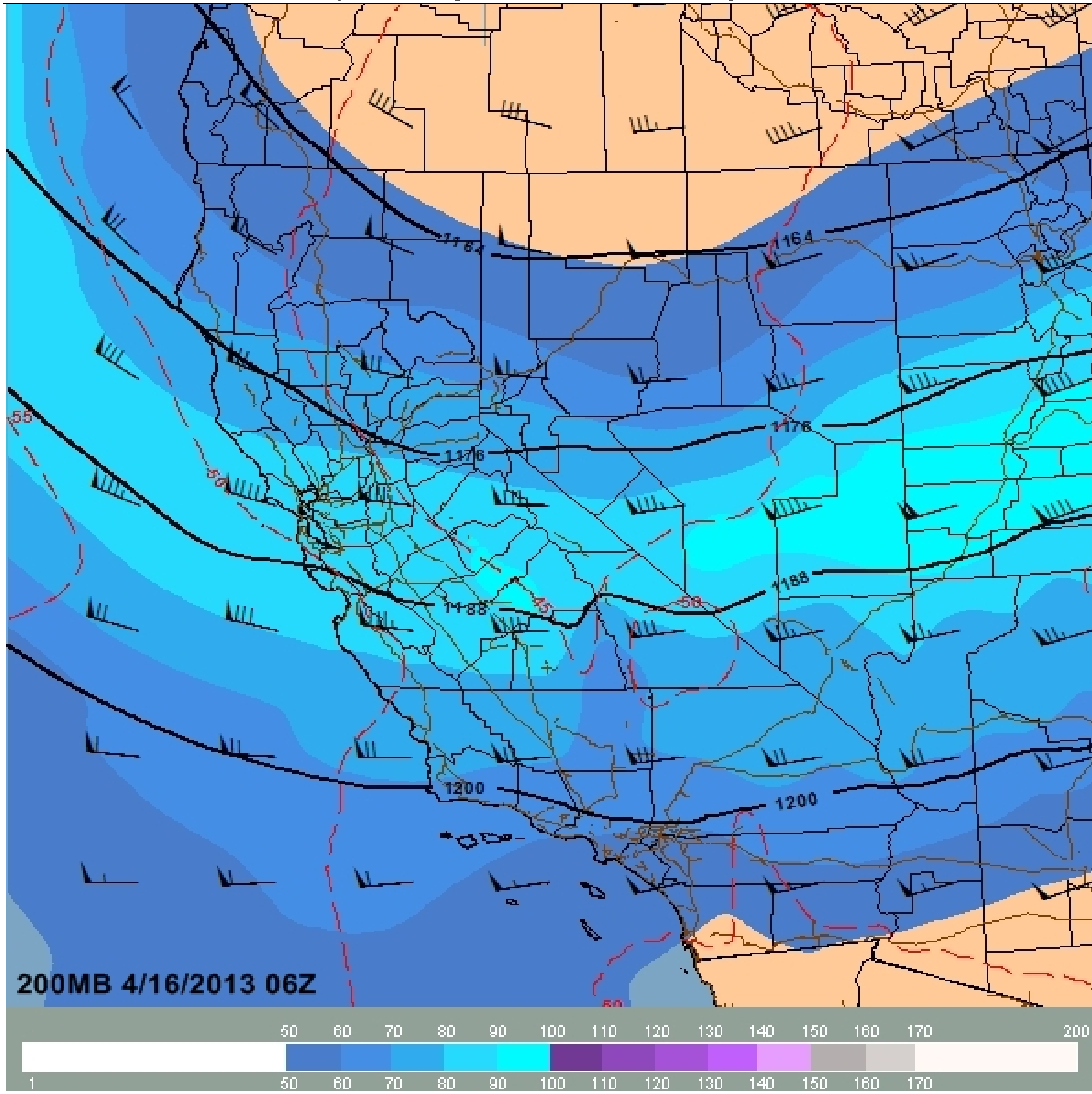


Figure 72. 200 mb during the event weather chart for April 16, 2013 06Z.

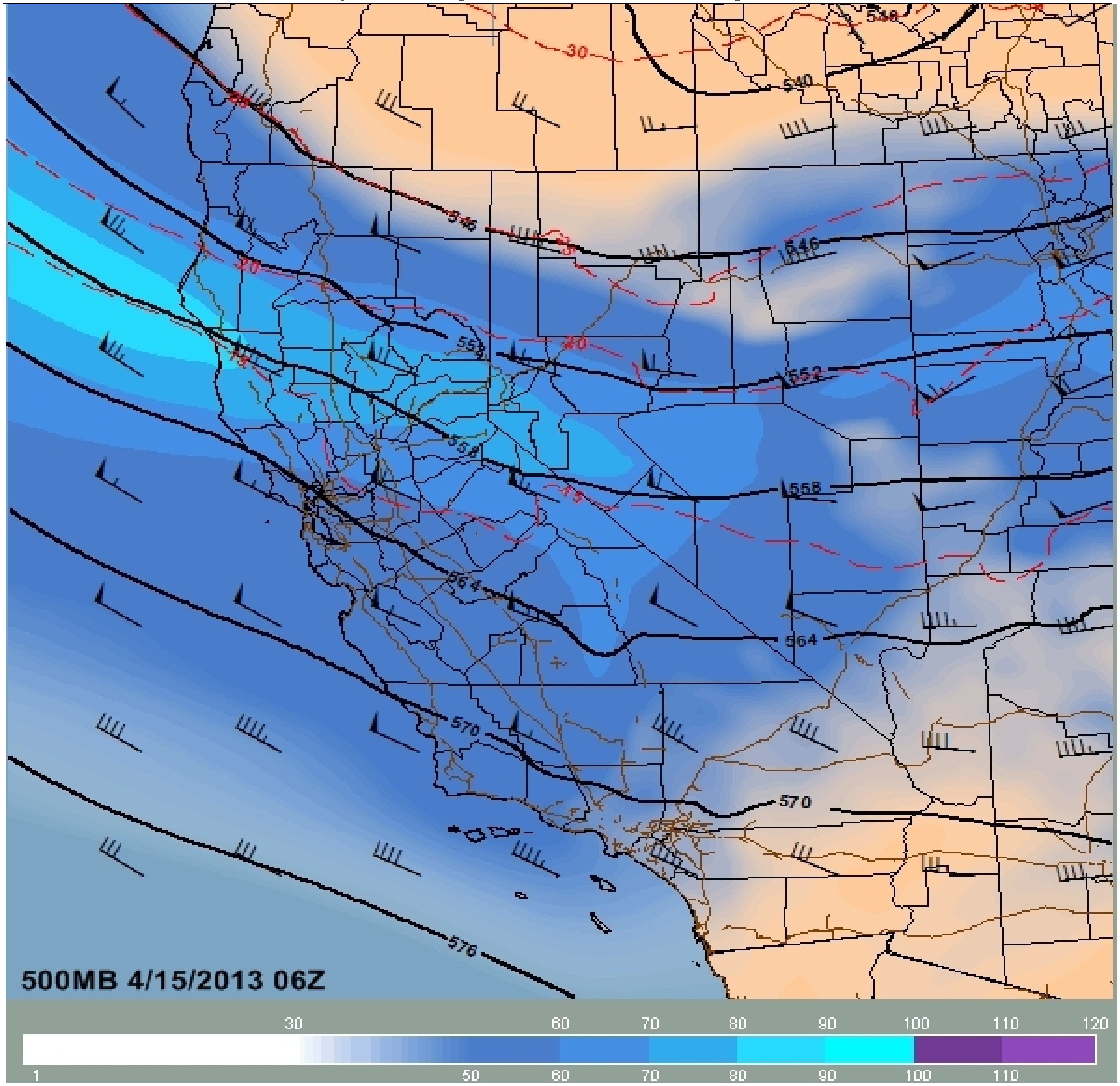


Figure 73. 500 mb during the event weather chart for April 15, 2013 06Z.

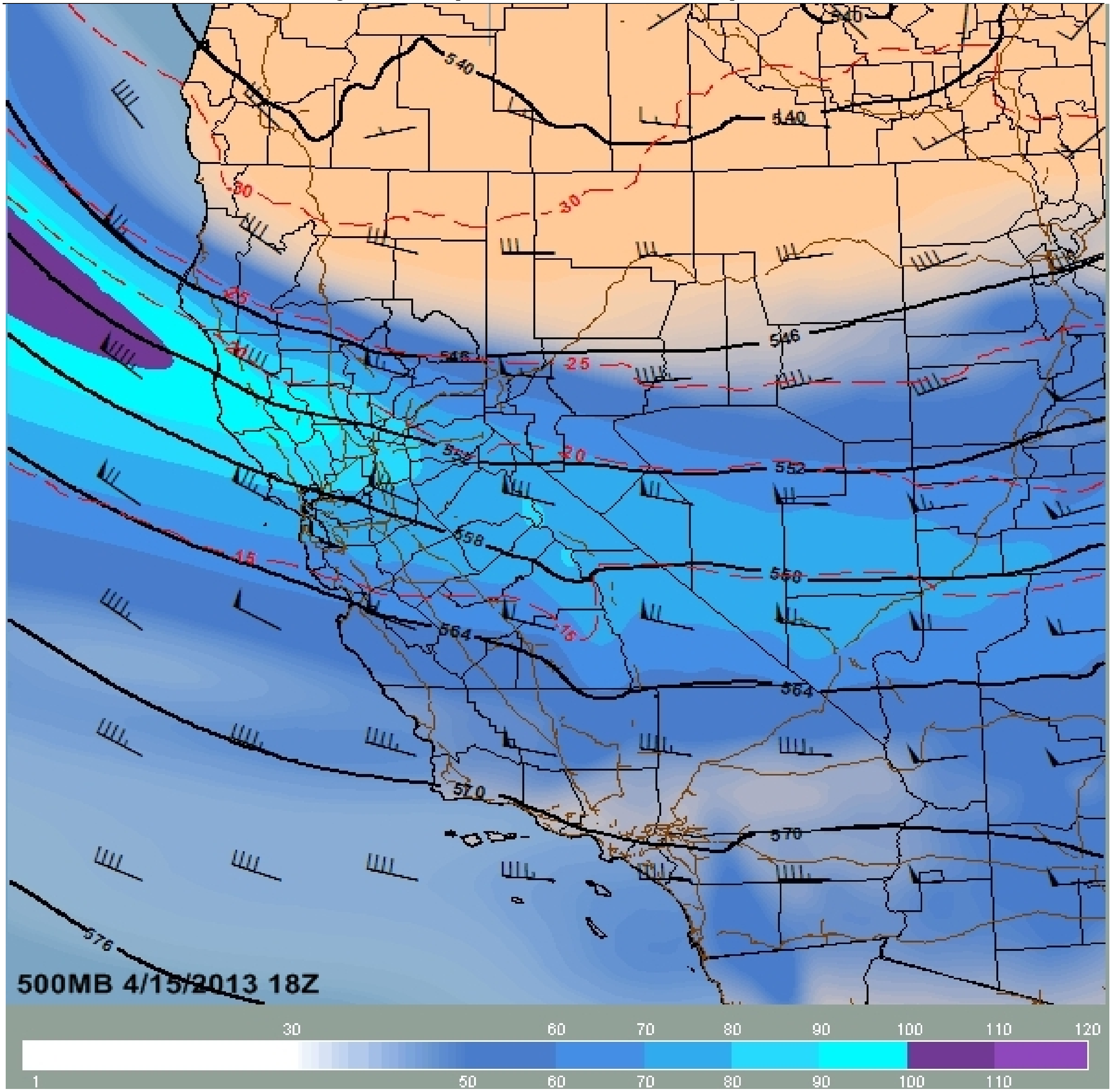


Figure 74. 500 mb during the event weather chart for April 15, 2013 18Z.

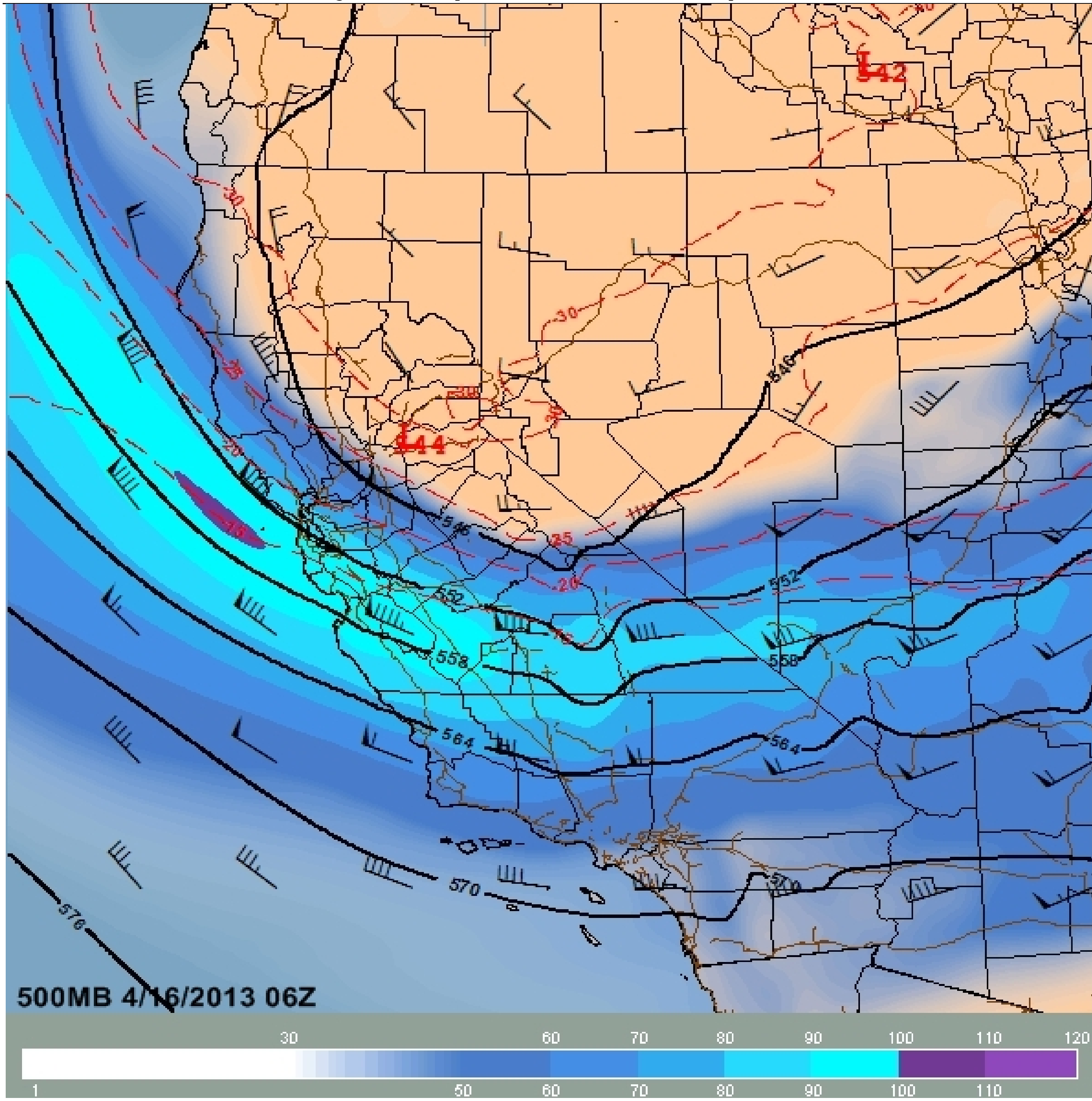


Figure 75. **500 mb during the event weather chart for April 16, 2013 06Z.**

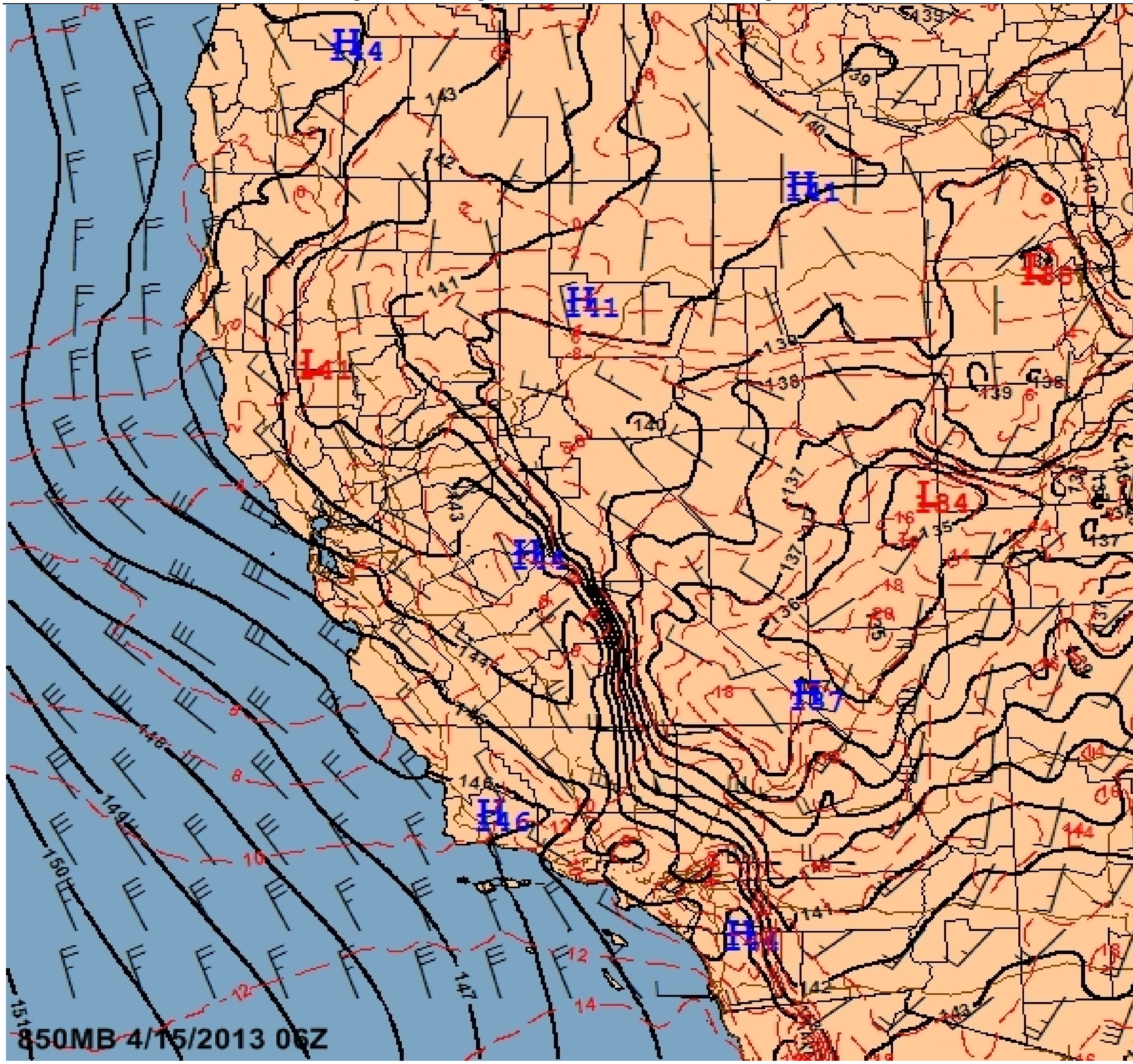


Figure 76. 850 mb during the event weather chart for April 15, 2013 06Z.

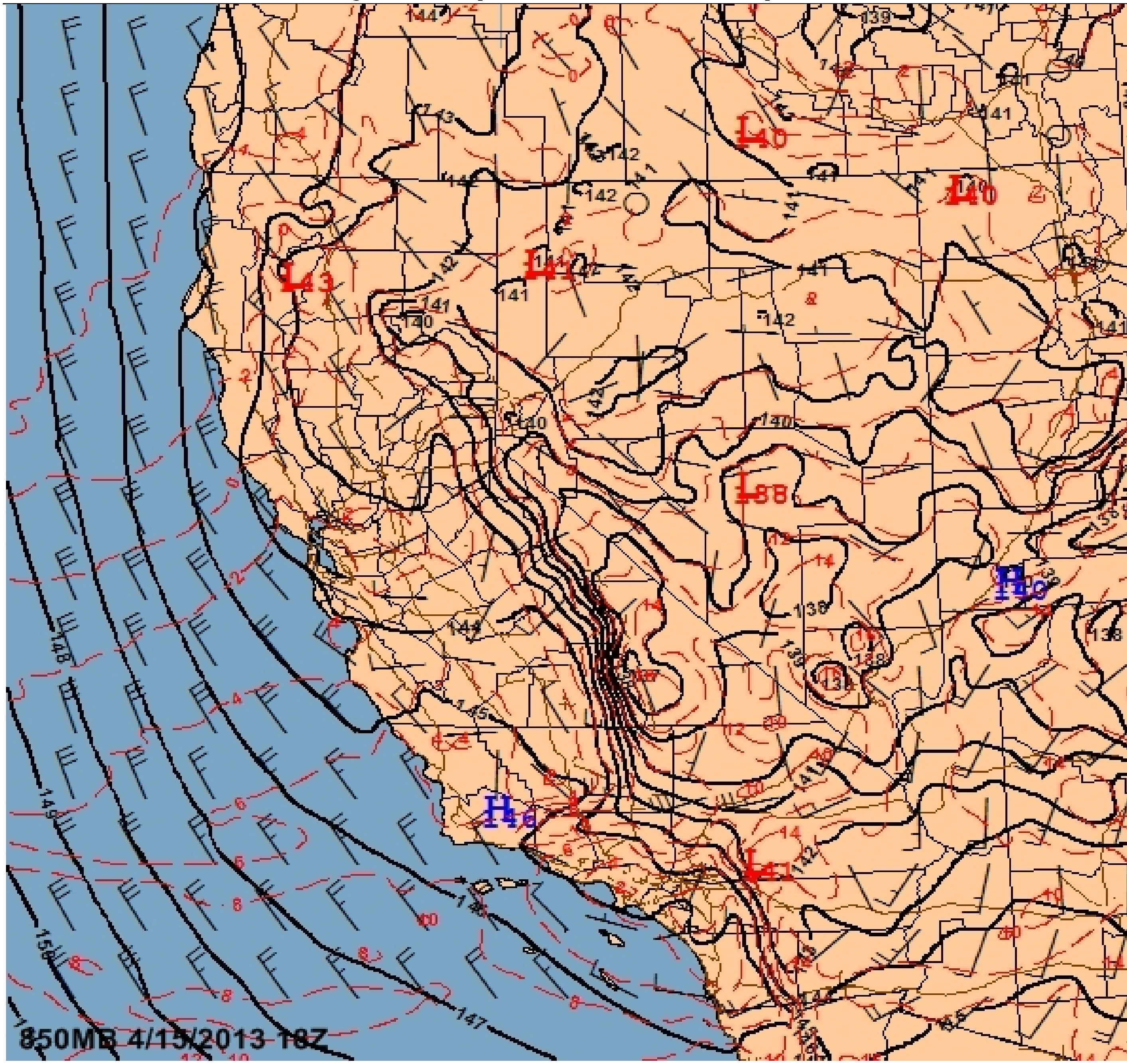


Figure 77. 850 mb during the event weather chart for April 15, 2013 18Z.

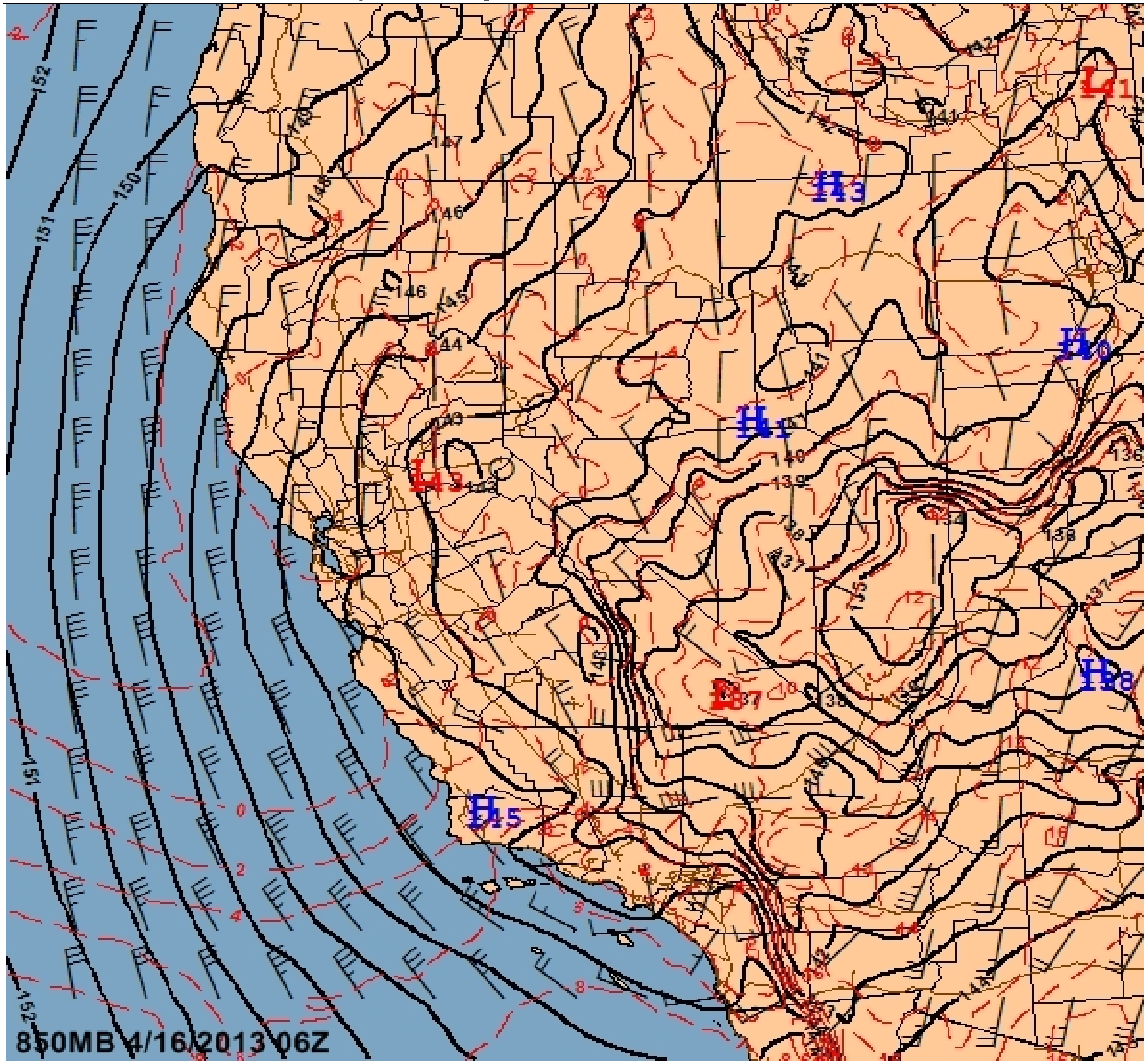


Figure 78. 850 mb during the event weather chart for April 16, 2013 06Z.

Table 33. Quality controlled hourly observations climatological data for the North Las Vegas Airport for April 2013.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
(final)
HOURLY OBSERVATIONS TABLE
NORTH LAS VEGAS AIRPORT (53123)
LAS VEGAS, NV
(04/2013)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 2203 ft above sea level
Latitude: 36.211
Longitude: -115.195
Data Version: VER2

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
15	0053	12	CLR	9.00		66	18.9	49	9.4	31	-0.6	27	9	200		27.18			29.45	AA		29.46
15	0153	12	CLR	9.00		65	18.3	49	9.2	31	-0.6	28	7	230		27.20			29.47	AA		29.48
15	0253	12	CLR	9.00		63	17.2	48	8.9	32	0.0	31	0	000		27.22			29.49	AA		29.50
15	0353	12	CLR	7.00		61	16.1	47	8.4	32	0.0	34	7	330		27.23			29.50	AA		29.51
15	0453	12	CLR	7.00		60	15.6	47	8.1	32	0.0	35	6	310		27.24			29.51	AA		29.52
15	0553	12	CLR	7.00	VCBLDUs	60	15.6	46	7.9	31	-0.6	34	0s	000		27.27			29.54	AA		29.55
15	0653	12	CLR	7.00	VCBLDUs	62	16.7	48	8.6	32	0.0	32	3s	310		27.27			29.56	AA		29.56
15	0753	12	CLR	10.00		66	18.9	49	9.4	31	-0.6	27	0	000		27.29			29.57	AA		29.58
15	0853	12	CLR	10.00		68	20.0	50	9.7	30	-1.1	24	0	000		27.31			29.59	AA		29.60
15	0953	12	CLR	7.00	VCBLDUs	69	20.6	50	10.0	30	-1.1	23	3s	230		27.31			29.59	AA		29.60
15	1053	12	CLR	10.00	VCBLDU	74	23.3	52	11.0	29	-1.7	19	15	160	20	27.29			29.57	AA		29.58
15	1153	12	CLR	10.00		77	25.0	53	11.5	28	-2.2	16	18	210	25	27.25			29.53	AA		29.54
15	1253	12	CLR	9.00		78	25.6	53	11.6	27	-2.8	15	26	200	46	27.23			29.50	AA		29.51
15	1353	12	CLR	10.00		78	25.6	52	11.1	24	-4.4	13	21	230	29	27.22			29.49	AA		29.50
15	1453	12	CLR	10.00		78	25.6	52	10.8	22	-5.6	12	23	250	32	27.19			29.46	AA		29.47
15	1553	12	CLR	10.00		78	25.6	51	10.5	19	-7.2	11	21	220	29	27.16			29.43	AA		29.44
15	1653	12	CLR	10.00		76	24.4	50	10.0	19	-7.2	12	22	220	31	27.14			29.42	AA		29.42
15	1753	12	SCT036	9.00		73	22.8	49	9.6	22	-5.6	15	18	220	31	27.14			29.42	AA		29.42
15	1853	12	CLR	10.00		69	20.6	48	8.7	22	-5.6	17	28	200	33	27.13			29.42	AA		29.41
15	1953	12	CLR	10.00		66	18.9	47	8.4	25	-3.9	21	22	220	33	27.16			29.44	AA		29.44
15	2053	12	CLR	10.00		64	17.8	47	8.5	29	-1.7	27	33	230	44	27.13			29.42	AA		29.41
15	2153	12	CLR	10.00		63	17.2	45	7.4	24	-4.4	23	23	230	34	27.18			29.47	AA		29.46
15	2253	12	CLR	10.00		61	16.1	45	7.4	27	-2.8	27	25	250	38	27.24			29.52	AA		29.52
15	2353	12	CLR	10.00		60	15.6	45	7.2	27	-2.8	28	23	260	36	27.27			29.54	AA		29.55

Table 34. Quality controlled hourly observations climatological data for the McCarran International Airport for April 15, 2013.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final) HOURLY OBSERVATIONS TABLE MCCARRAN INTERNATIONAL AIRPORT (23169) LAS VEGAS, NV (04/2013)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 2180 ft above sea level
Latitude: 36.071
Longitude: -115.163
Data Version: VER3

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp (F)	Dry Bulb Temp (C)	Wet Bulb Temp (F)	Wet Bulb Temp (C)	Dew Point Temp (F)	Dew Point Temp (C)	Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
15	0056	11	CLR	7.00	VCBLDU	65	18.3	49	9.2	31	-0.6	28	21	200	34	27.20			29.38	AA		29.45
15	0156	11	CLR	7.00	VCBLDU	65	18.3	49	9.2	31	-0.6	28	16	190	30	27.20			29.39	AA		29.45
15	0256	11	CLR	7.00	VCBLDU	64	17.8	48	8.7	30	-1.1	28	15	200		27.21			29.41	AA		29.47
15	0356	11	CLR	9.00	VCBLDU	63	17.2	47	8.5	30	-1.1	29	16	200	24	27.22			29.41	AA		29.48
15	0456	11	CLR	10.00		62	16.7	47	8.0	29	-1.7	29	14	200		27.24			29.43	AA		29.50
15	0556	11	CLR	10.00		61	16.1	46	7.8	29	-1.7	30	15	190		27.26			29.46	AA		29.52
15	0656	11	CLR	10.00		63	17.2	47	8.5	30	-1.1	29	17	200	24	27.27			29.47	AA		29.53
15	0756	11	CLR	10.00		65	18.3	49	9.2	31	-0.6	28	18	200	25	27.29			29.50	AA		29.55
15	0856	11	CLR	10.00		68	20.0	50	10.1	32	0.0	26	20	180	26	27.31			29.51	AA		29.57
15	0956	11	CLR	10.00		71	21.7	51	10.4	30	-1.1	22	18	190	25	27.31			29.52	AA		29.57
15	1056	11	CLR	10.00		73	22.8	52	10.9	30	-1.1	20	21	190	26	27.29			29.49	AA		29.55
15	1156	11	CLR	10.00	VCBLDU	74	23.3	52	11.1	30	-1.1	20	22	200	29	27.27			29.47	AA		29.53
15	1256	11	CLR	10.00	VCBLDU	76	24.4	52	11.3	28	-2.2	17	17	200	31	27.25			29.46	AA		29.51
15	1356	11	CLR	10.00	VCBLDU	77	25.0	52	11.2	26	-3.3	15	26	210	36	27.22			29.42	AA		29.48
15	1456	11	CLR	10.00	VCBLDU	78	25.6	53	11.4	26	-3.3	15	25	200	33	27.21			29.40	AA		29.46
15	1556	11	FEW036	10.00	VCBLDU	78	25.6	52	10.8	22	-5.6	12	25	210	37	27.18			29.37	AA		29.43
15	1626	11	CLR	1.50	HZ BLDU	75	24.0	50	10.0	21	-6.0	13	23	210	40	27.17			M	SP		29.42
15	1654	11	CLR	2.00	HZ BLDU	75	24.0	50	10.0	21	-6.0	13	18	210	37	27.16			M	SP		29.41
15	1656	11	CLR	2.00	HZ BLDU	75	23.9	50	10.0	21	-6.1	13	20	210	33	27.16			29.36	AA		29.41
15	1710	11	CLR	3.00	HZ BLDU	73	23.0	49	9.5	21	-6.0	14	22	200	38	27.16			M	SP		29.41
15	1754	11	CLR	2.50	HZ BLDU	72	22.0	49	9.3	21	-6.0	14	20	230	33	27.16			M	SP		29.41
15	1756	11	CLR	3.00	HZ BLDU	72	22.2	49	9.3	21	-6.1	14	17	220	33	27.16			29.36	AA		29.41
15	1819	11	CLR	5.00	HZ BLDU	72	22.0	49	9.3	21	-6.0	14	18	190	25	27.16			M	SP		29.41
15	1856	11	CLR	8.00	VCBLDU	69	20.6	48	8.7	22	-5.6	17	15	210	28	27.17			29.37	AA		29.42
15	1956	11	CLR	9.00	VCBLDU	66	18.9	47	8.4	25	-3.9	21	20	190	34	27.21			29.41	AA		29.46
15	2056	11	CLR	8.00	VCBLDU	63	17.2	47	8.5	30	-1.1	29	20	200	31	27.23			29.44	AA		29.49
15	2156	11	CLR	9.00	VCBLDU	61	16.1	46	8.0	30	-1.1	31	20	210	37	27.23			29.44	AA		29.49
15	2256	11	CLR	9.00	VCBLDU	60	15.6	46	7.9	31	-0.6	34	26	220	38	27.24			29.45	AA		29.50
15	2356	11	CLR	9.00	VCBLDU	58	14.4	45	7.4	31	-0.6	36	20	210	32	27.29			29.50	AA		29.55

Table 35. Hourly observation monitoring site data for April 15, 2013.

PST	Joe Neal			Palo Verde			Paul Meyer			Sunrise Acres			Jerome Mack		
	Speed (mph)	Direction (degrees)	Gust (mph)	Speed (mph)	Direction (degrees)	Gust (mph)	Speed (mph)	Direction (degrees)	Gust (mph)	Speed (mph)	Direction (degrees)	Gust (mph)	Speed (mph)	Direction (degrees)	Gust (mph)
0:00	7	73	17	4	60	12	9	180	21	15	154	30	15	194	29
1:00	7	49	13	3	VAR	9	9	192	19	13	150	32	12	193	27
2:00	5	9	10	5	9	18	3	VAR	15	12	213	19	9	185	20
3:00	5	19	9	5	22	16	2	258	4	13	170	21	11	201	21
4:00	4	355	8	3	VAR	8	3	224	7	10	115	16	8	206	16
5:00	5	35	10	2	VAR	4	1	175	4	11	120	16	7	210	14
6:00	3	VAR	8	2	VAR	6	2	194	5	11	134	18	10	207	21
7:00	5	78	12	5	51	11	4	150	11	12	144	19	10	196	23
8:00	4	95	11	5	62	15	5	350	15	13	164	21	13	197	25
9:00	4	88	12	6	82	16	8	132	19	13	188	21	11	190	23
10:00	6	108	19	5	114	14	9	165	23	12	191	22	10	189	23
11:00	10	106	29	4	148	14	12	173	31	14	190	29	13	194	28
12:00	13	164	34	16	257	45	13	196	40	16	175	32	ND	ND	ND
13:00	14	193	32	20	248	47	12	215	28	16	164	33	16	204	27
14:00	13	184	32	18	241	46	15	209	39	14	167	35	16	219	29
15:00	13	201	39	14	199	32	16	208	36	16	182	36	21	221	37
16:00	17	206	38	10	218	24	15	194	34	18	164	37	17	208	35
17:00	15	194	43	10	208	34	14	192	31	14	155	30	12	206	26
18:00	18	189	45	14	229	38	15	187	38	15	158	43	13	206	29
19:00	20	197	55	19	245	52	12	202	32	22	170	47	16	219	33
20:06	21	202	49	17	246	54	12	207	32	21	174	47	21	226	39
21:00	17	218	40	16	241	42	15	234	42	20	174	47	21	219	45
22:00	15	228	36	21	250	52	20	237	48	14	171	36	17	219	35
23:00	7	226	17	19	272	51	13	226	36	10	160	32	16	228	29

VAR=Variable wind/calm winds with no specific wind direction

Table 35. Hourly observation monitoring site data for April 15, 2013 (continued).

PST	Boulder City			Green Valley			JD Smith			Jean		
	Speed (mph)	Direction (degrees)	Gust (mph)	Speed (mph)	Direction (degrees)	Gust (mph)	Speed (mph)	Direction (degrees)	Gust (mph)	Speed (mph)	Direction (degrees)	Gust (mph)
0:00	6	199	12	10	226	31	9	180	24	13	206	25
1:00	8	191	14	10	239	29	8	176	21	14	201	24
2:00	8	201	16	9	254	30	6	147	16	9	213	18
3:00	8	196	14	7	266	22	5	182	15	10	194	22
4:00	8	202	15	8	259	24	4	221	8	12	213	20
5:00	6	207	12	9	259	23	3	VAR	9	13	209	19
6:00	8	196	16	9	263	31	6	177	14	15	197	25
7:00	12	182	26	11	219	33	8	173	14	16	187	30
8:00	12	168	23	11	250	31	9	176	19	12	242	22
9:00	10	190	41	10	261	28	7	168	16	13	240	22
10:00	10	194	24	10	247	29	8	166	19	13	239	32
11:00	13	216	27	10	257	35	11	160	24	17	237	29
12:00	13	217	27	10	279	32	14	184	30	20	245	35
13:00	14	209	30	11	283	30	16	194	32	20	240	36
14:00	17	215	46	12	281	34	15	205	39	21	238	36
15:00	19	217	38	14	282	37	18	215	44	24	235	39
16:00	17	205	38	11	292	28	17	194	45	30	239	48
17:00	22	204	39	12	280	34	14	198	31	26	238	44
18:00	25	204	47	11	276	34	17	202	40	24	242	42
19:00	20	194	39	12	288	27	20	204	50	23	231	38
20:06	15	207	30	15	262	36	22	204	45	28	229	53
21:00	11	221	27	12	247	43	18	194	46	32	224	52
22:00	17	223	40	17	242	45	16	227	39	26	230	46
23:00	17	221	34	14	265	41	14	234	31	22	237	40

VAR=Variable wind/calm winds with no specific wind direction

Figures 79–87 are plots of the hourly average wind speed and maximum gust speed recorded at selected DAQ monitoring stations for April 15, 2013. The stations were chosen to represent conditions throughout the Las Vegas Valley PM_{10} sites. One important observation in these data is the speed of the winds. DAQ monitoring site speed wind data and McCarran International Airport wind speed data is shown on each chart to facilitate comparisons between stations. Keep in mind that DAQ's data are averages and maximum values recorded throughout the hour, while the McCarran International Airport data are from a short observation period occurring a few minutes ahead of the time listed. The similarity between the monitoring sites and the McCarran International Airport indicates the regional-scale influence of the weather system affecting the area.

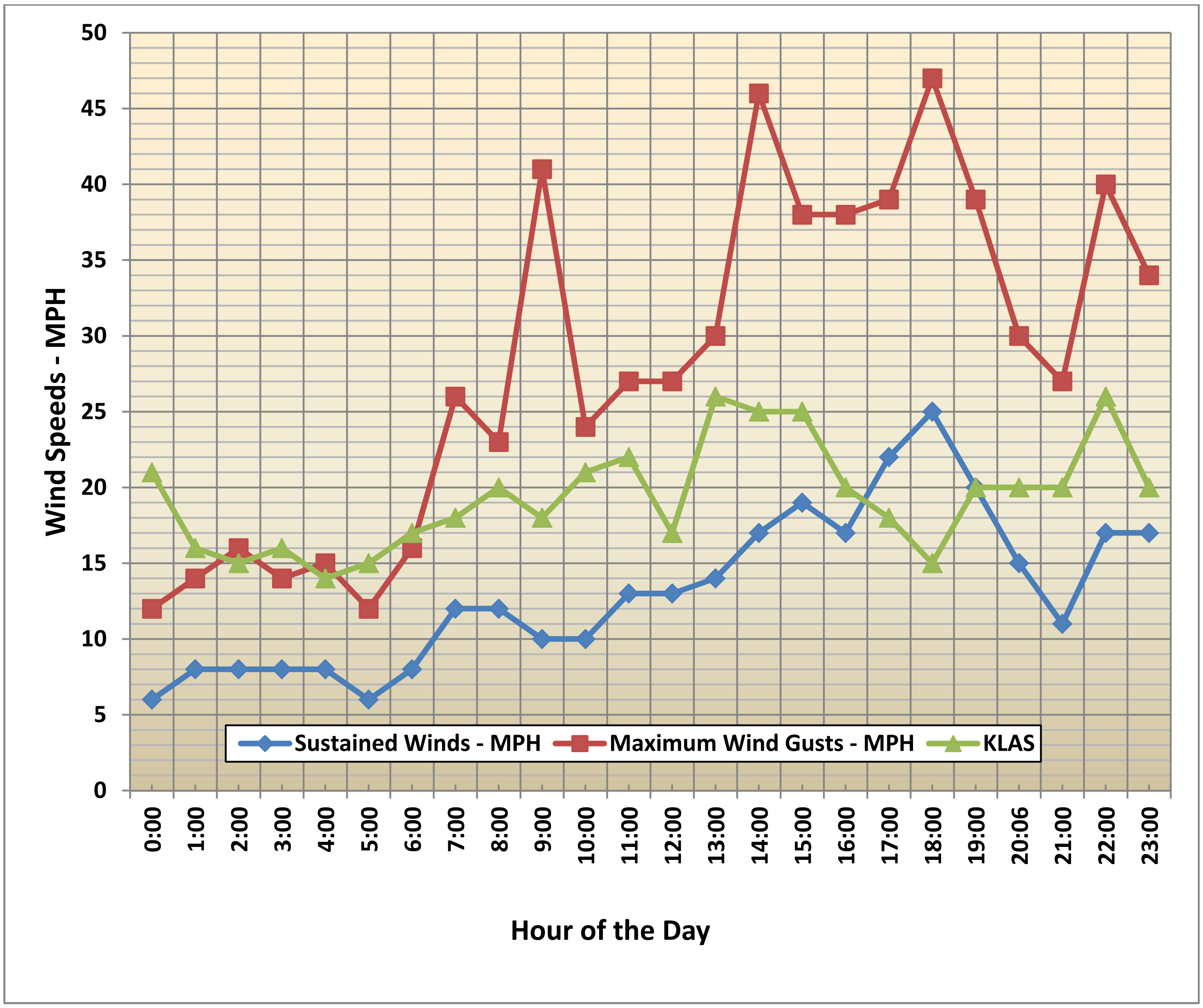


Figure 79. Boulder City and McCarran International Airport wind speeds.

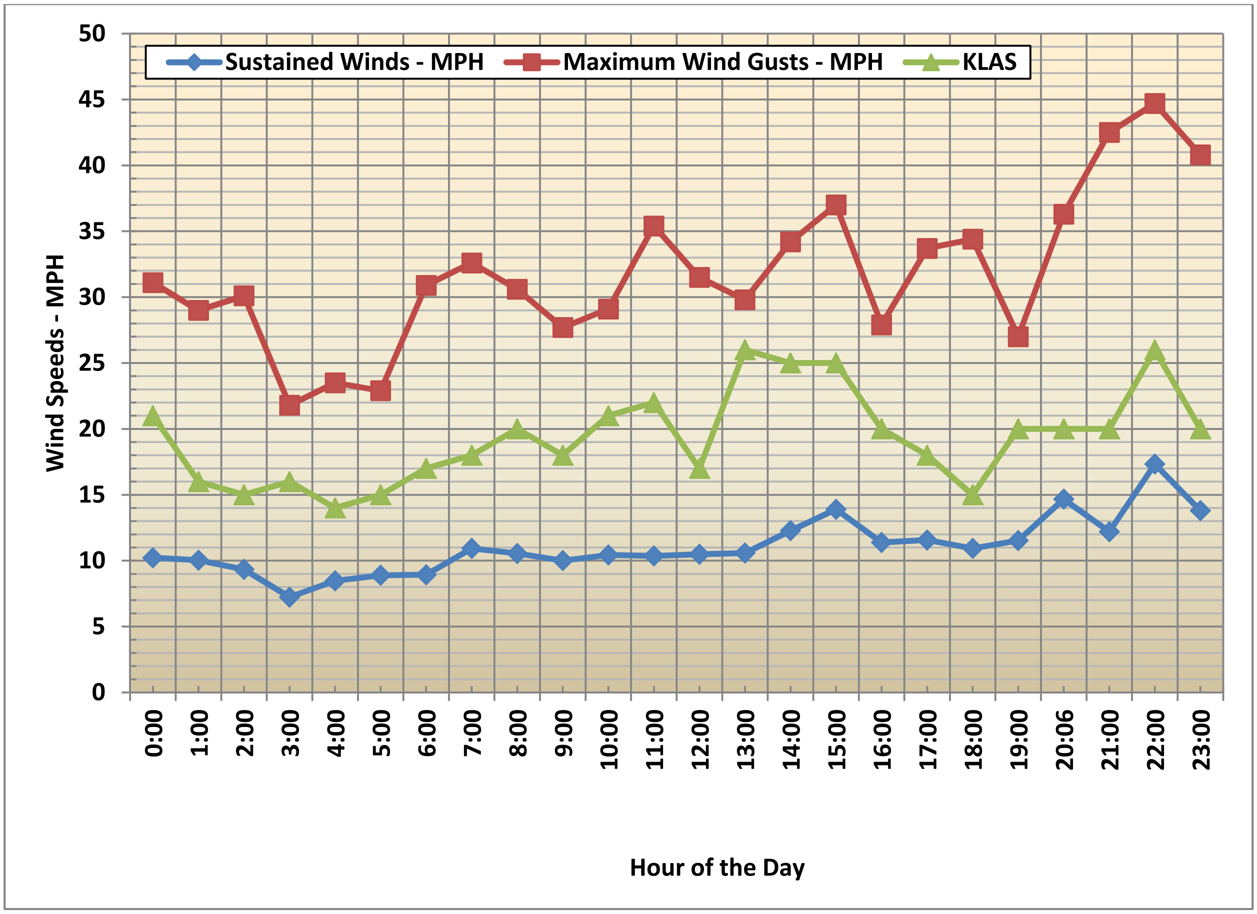


Figure 80. Green Valley and McCarran International Airport wind speeds.

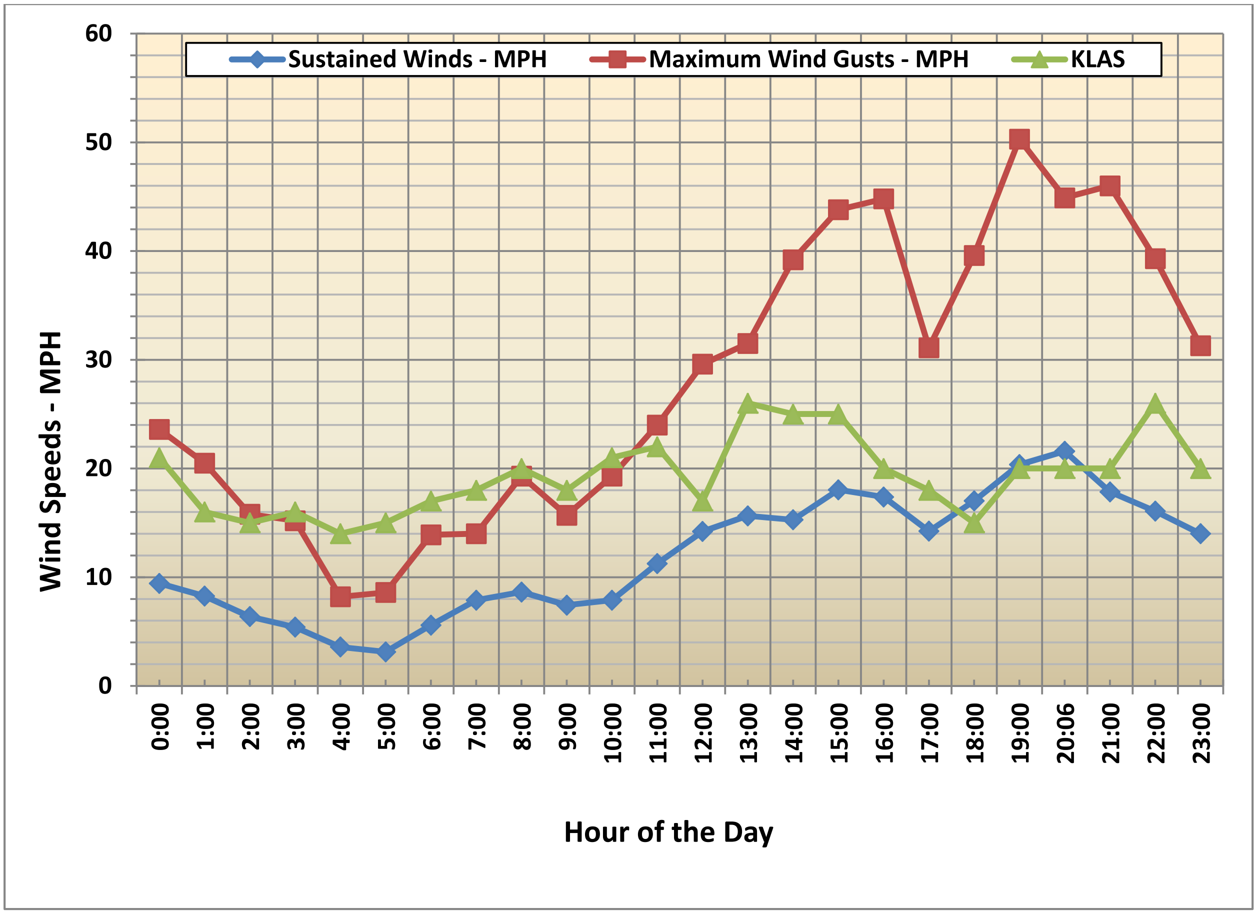


Figure 81. J. D. Smith and McCarran International Airport wind speeds.

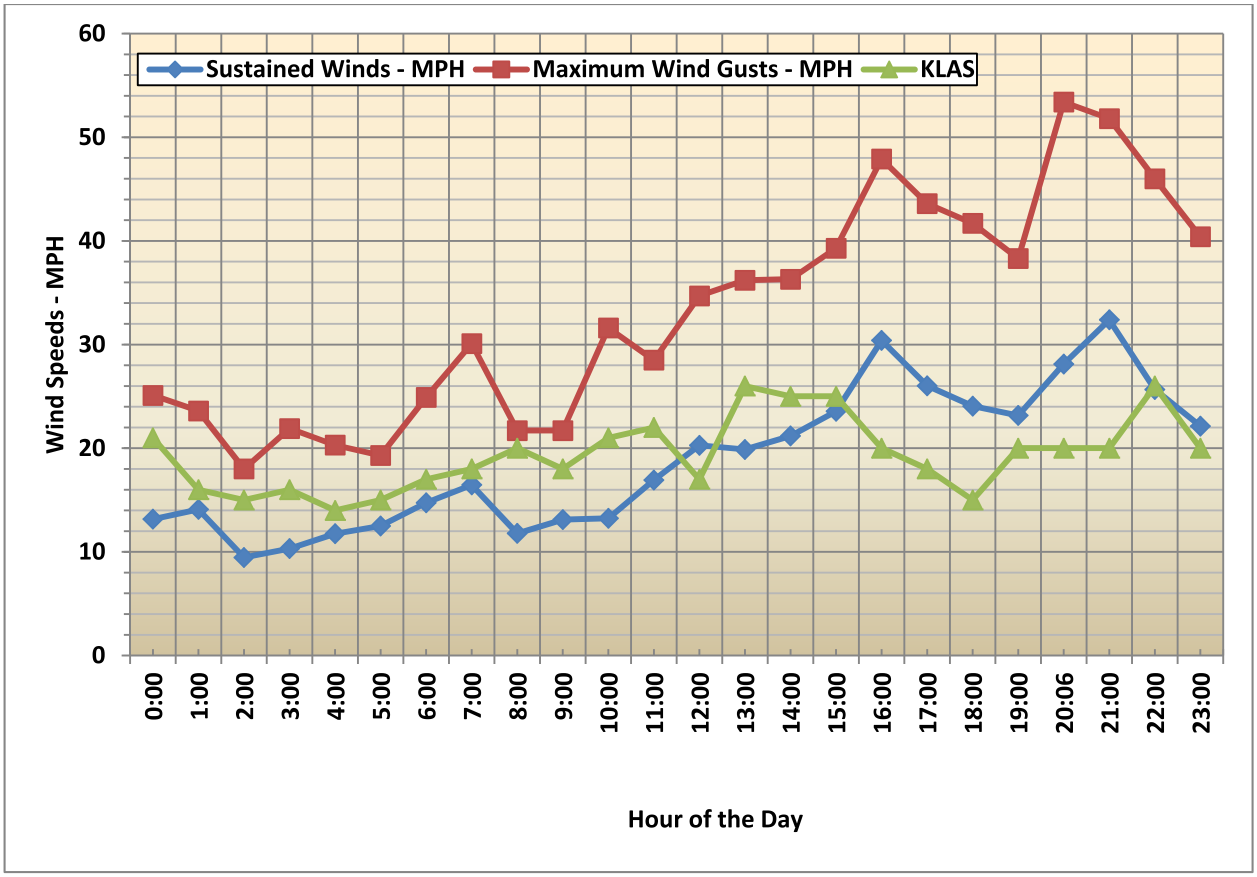


Figure 82. Jean, Nevada and McCarran International Airport wind speeds.

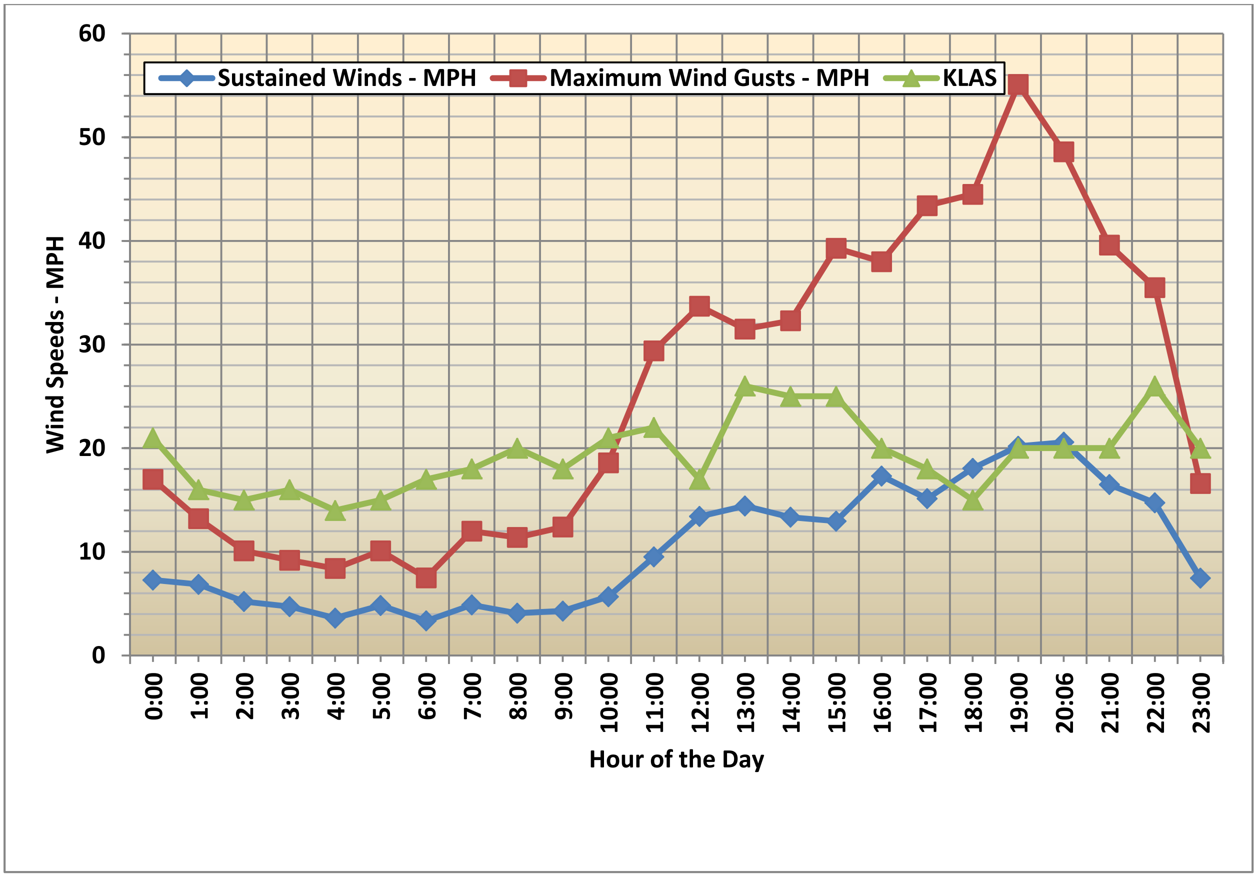


Figure 83. Joe Neal and McCarran International Airport wind speeds.

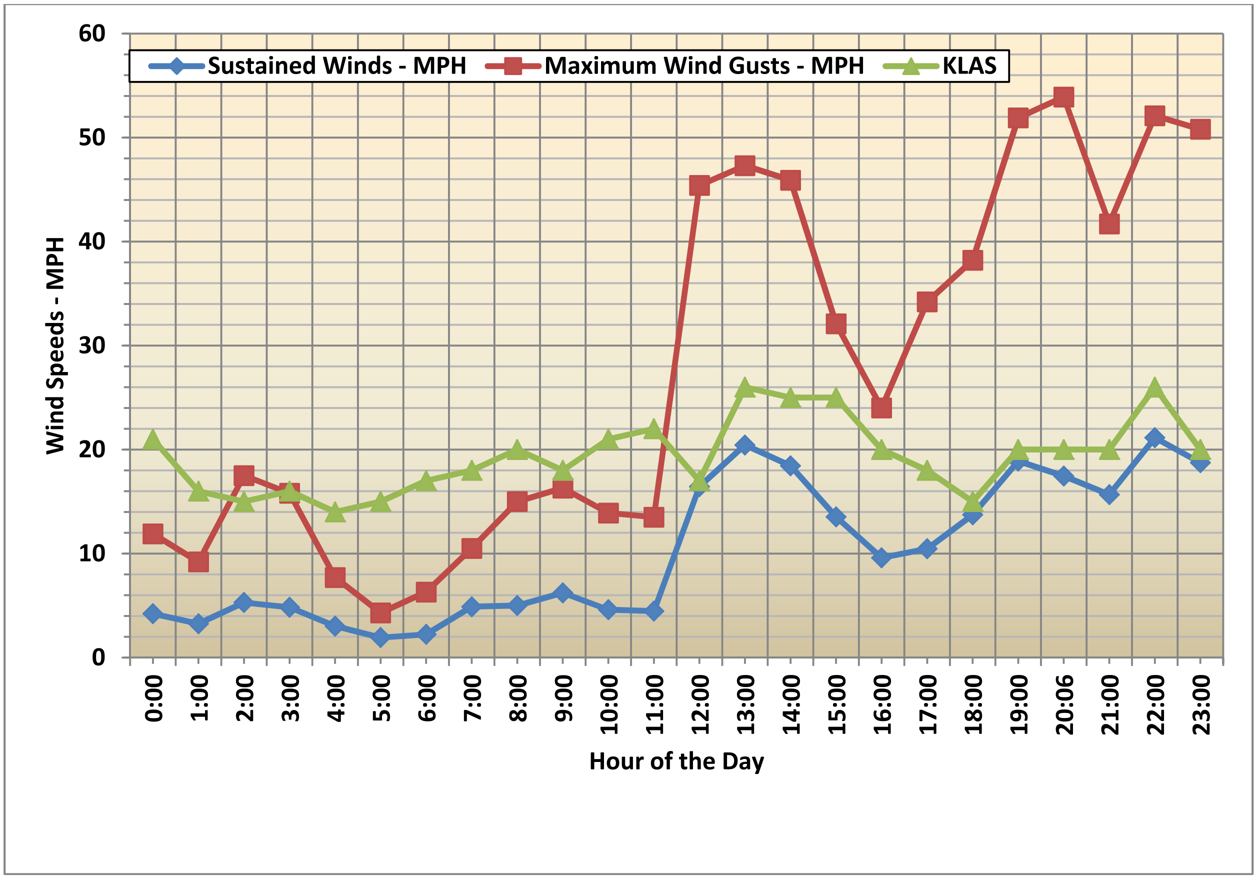


Figure 84. Palo Verde and McCarran International Airport wind speeds.

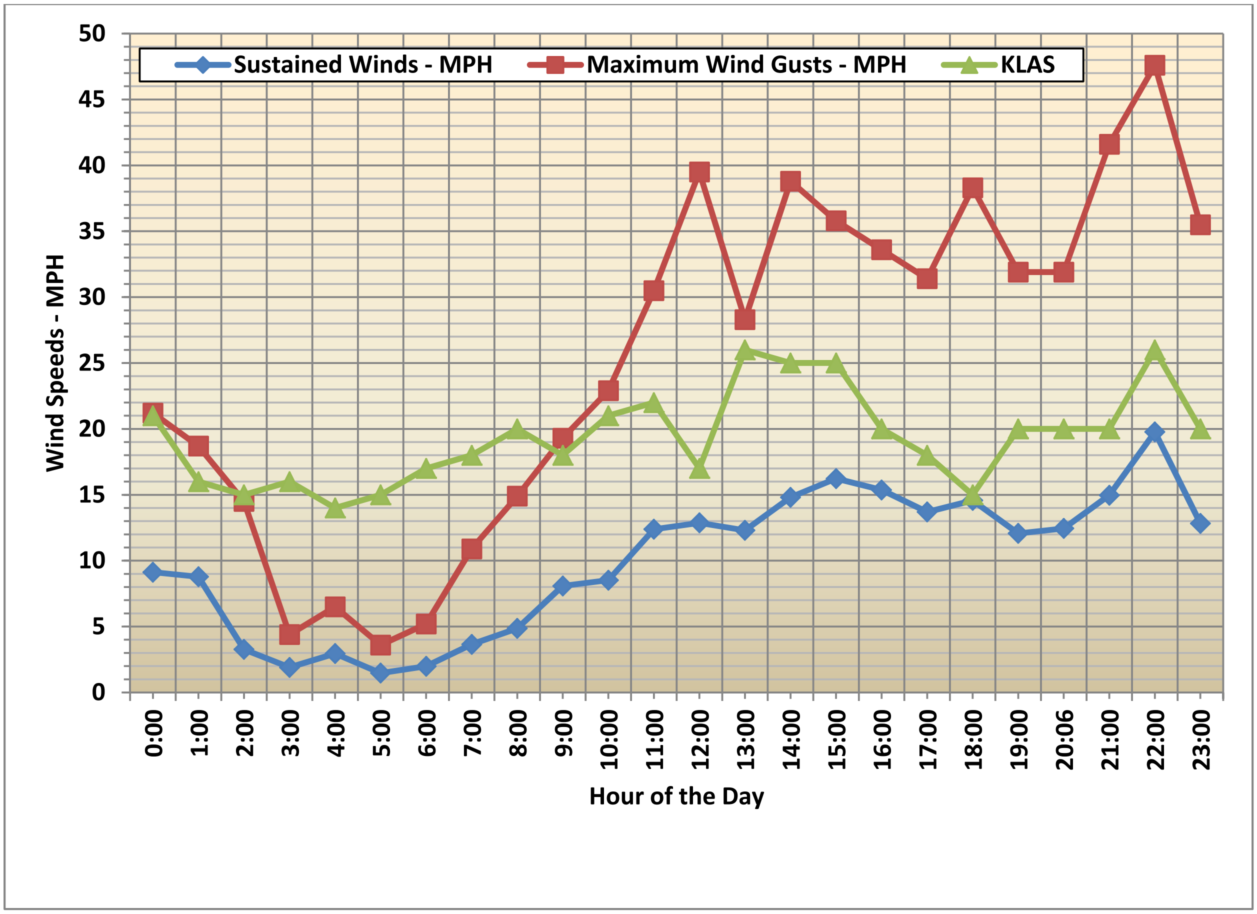


Figure 85. Paul Meyer and McCarran International Airport wind speeds.

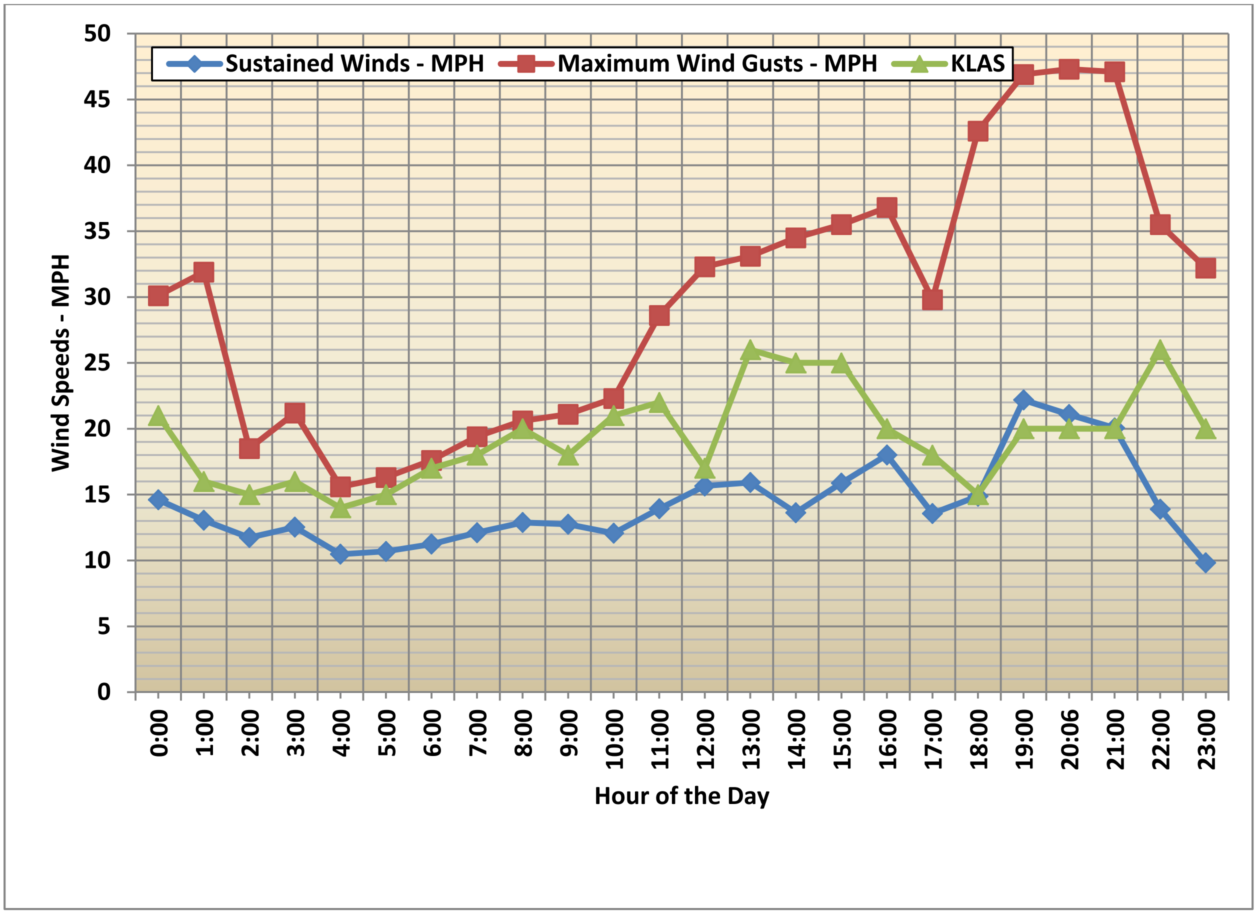


Figure 86. Sunrise Acres and McCarran International Airport wind speeds.

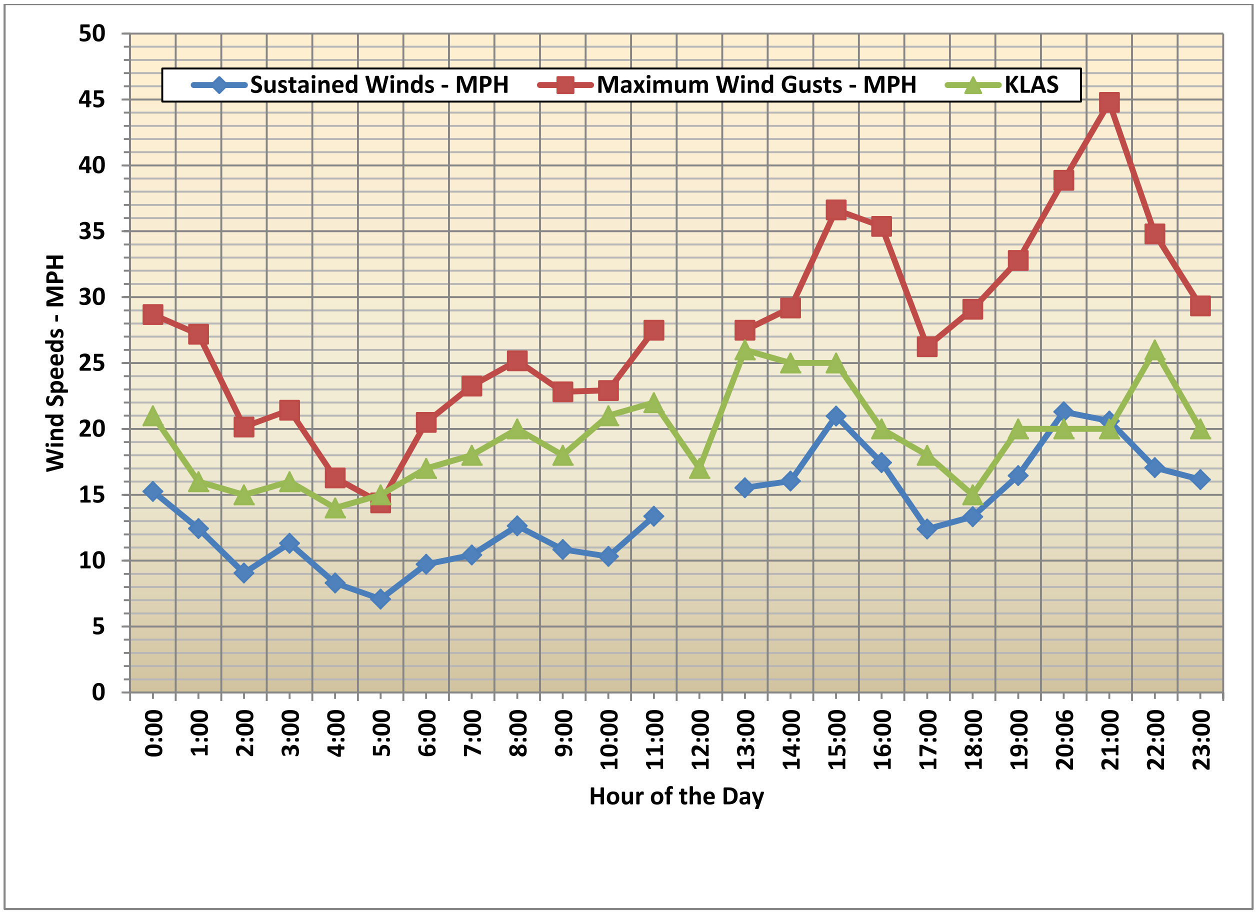


Figure 87. Jerome Mack (NCore) and McCarran International wind speeds.

Table 36. PM_{10} Concentration and wind data from the Sunrise Acres DAQ Station and McCarran International Airport wind data on April 15, 2013.

Sunrise Acres (DAQ Station 0561) (hourly averages, except for extreme speed gust)					McCarran International Airport (observations during a few minutes prior to time shown)		
Time (PST)	PM_{10} ($\mu g/m^3$)	Wind Speed (mph)	Wind Direction (degrees)	Wind Gust (mph)	Wind Speed (mph)	Wind Direction (degrees)	Wind Gust (mph)
0:00	435.79	15	154	30	21	200	34
1:00	393.11	13	150	32	16	190	30
2:00	393.19	12	213	19	15	200	ND
3:00	460.04	13	170	21	16	200	24
4:00	322.82	10	115	16	14	200	ND
5:00	304.65	11	120	16	15	190	ND
6:00	143.82	11	134	18	17	200	24
7:00	115.21	12	144	19	18	200	25
8:00	132.05	13	164	21	20	180	26
9:00	151.01	13	188	21	18	190	25
10:00	126.08	12	191	22	21	190	26
11:00	114.02	14	190	29	22	200	29
12:00	90.83	16	175	32	17	200	31
13:00	85.67	16	164	33	26	210	36
14:00	124.7	14	167	35	25	200	33
15:00	208.24	16	182	36	25	210	37
16:00	358.21	18	164	37	20	210	37
17:00	814.6	14	155	30	20	217	35
18:00	367.77	15	158	43	17	200	27
19:00	420.01	22	170	47	20	190	34
20:00	390.81	21	174	47	20	200	31
21:00	228.38	20	174	47	20	210	37
22:00	145.64	14	171	36	26	220	38
23:00	113.45	10	160	32	20	210	32

Illustration 2. NWS Forecast Discussion.

FXUS65 KVEF 151037
AFDVEF

AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE LAS VEGAS NV337 AM PDT MON APR 15 2013

.SYNOPSIS...A STORM SYSTEM WILL BRING STRONG WINDS AND COOLERTEMPERATURES AREAWIDE TODAY THROUGH WEDNESDAY...ALONG WITH CHANCESFOR SHOWERS FROM GENERALLY LAS VEGAS NORTH WITH THE SNOW ABOVE 5000FEET. DRY AND WARMER WEATHER WILL RETURN LATE IN THE WEEK.
&&

.SHORT TERM...TODAY THROUGH WEDNESDAY NIGHT...WINDS REALLY KICKED UPACROSS THE WESTERN MOJAVE DESERT LAST EVENING CLOSING I-40 FOR ATIME EAST OF BARSTOW DUE TO **BLOWING** DUST. THAT SUSPENDED DUST HASWORKED NORTH AND EAST INTO PARTS OF SOUTHERN NEVADA AND NORTHWESTARIZONA PRODUCING SOMERESTRICTION IN THE **VISIBILITY**.

THERE MAY BE A BRIEF REPRIEVE IN WIND SPEEDS LATER THISMORNING...BUT WINDS WILL RETURN THIS AFTERNOON AND TONIGHT AS**SHORTWAVE** ENERGY FROM THE GULF OF ALASKA DIGS SOUTH INTO NORTHERNCALIFORNIA. POTENTIALLY DAMAGING WINDS INEXCESS OF 60 MPH AREEXPECTED ACROSS NORTHWEST SAN BERNARDINO COUNTY. MADE NO CHANGE TOEXISTING WIND HEADLINES. AN E-W BAND OF RAIN/SNOW SHOWERS WILL GENERALLY STAY ALONG AND NORTH OF HIGHWAY 50 THROUGH TONIGHT. DIDTRIM BACK **POPS**/**WX** FROM OUR NORTHERN ZONES TODAY AND TONIGHT. NEAR**NORMAL** TEMPERATURES EXPECTED TODAY.

A DEEP **TROUGH** WILL BE CARVED OUT ACROSS THE GREAT **BASIN** TUESDAY AS**SHORTWAVE** DIVES SOUTHEAST ACROSS THE SOUTHERN GREAT **BASIN** AND MOJAVEDESERT TUESDAY AND TUESDAY NIGHT. THIS WILL BRING A SHIFT IN WINDSFROM THE NORTHWEST. A WIND ADVISORY MAY BE NEEDED FOR THE OWENSVALLEY AND ESMERALDA/CENTRAL NYE COUNTY. THIS CAN BE ADDRESSEDLATER. **TROUGH** WILL HAVE LIMITED **MOISTURE** TO WORK WITH...HOWEVER AIRMASS WILL DESTABILIZE UNDER **COLD POOL** ALOFT TUESDAY AFTERNOON ANDNIGHT LEADING TO THE DEVELOPMENT OF **ISOLD**-**SCT** SHOWERS. DID INCLUDETHE MENTION OF THUNDERSTORMS TUESDAY AFTERNOON FOR LINCOLN COUNTY.
AREA WILL LIES UNDER A COOL NORTHERLY **FLOW** WEDNESDAY AS **TROUGH**SLOWLY SHIFTS EAST INTO THE FOUR CORNERS. DID EXPAND OUR **POPS** SOMEACROSS EASTERN LINCOLN AND NORTHERN MOHAVE COUNTIES WEDNESDAY DUE TOSLOWER EXIT OF **TROUGH**. OTHER ISSUE WILL BE NORTH WINDS DOWN THECOLORADO RIVER VALLEY WITH THE POTENTIAL OF A LAKE WIND ADVISORY ORWIND ADVISORY BEING NEEDED. BELOW **NORMAL**TEMPERATURES TUESDAY ANDWEDNESDAY.

.LONG TERM...MODELS CONTINUE TO TREND A LITTLE SLOWER WITH EJECTINGOUT THE AFOREMENTIONED SYSTEM FROM THE SOUTHWEST...WHICH WILL RESULTIN STRONGER AND COLDER NORTHERLY **FLOW** ALOFT OVER OUR AREA ONTHURSDAY. AS A RESULT I ADJUSTED HIGHS DOWN A FEW DEGREES WHICH WILLSTILL KEEP READINGS ABOUT 6-10 DEGREES BELOW **NORMAL**. NORTH-SOUTHSURFACE PRESSURE GRADIENTS AND **UPPER LEVEL** SUPPORT ARE NOT AS GREATAS ON WEDNESDAY...BUT STILL UP ENOUGH TO GENERATE NORTH WINDS OF20-35 MPH IN THE COLORADO RIVER VALLEY ESPECIALLY IN THELAUGHLIN-BULLHEAD CITY AREA. BY FRIDAY A **RIDGE** ALOFT OFF THE COASTOF CALIFORNIA TRIES TO NUDGE INLAND AND RAISE HEIGHTS WHICH SHOULDPUSH HIGH TEMPS BACK CLOSER TO **NORMAL**. GRADIENTS AND UPPER SUPPORTSHOULD FINALLY WEAKEN ENOUGH TO LOWERWINDS IN THE COLORADO RIVERVALLEY.
&&

Table 37. National Weather Service weather observations for Barstow, California, for April 14, 2013.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
(final)
HOURLY OBSERVATIONS TABLE
BARSTOW-DAGGETT AIRPORT (23161)
DAGGETT, CA
(04/2013)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 1917 ft. above sea level
Latitude: 34.853
Longitude: -116.785
Data Version: VER3

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp (F)	Dry Bulb Temp (C)	Wet Bulb Temp (F)	Wet Bulb Temp (C)	Dew Point Temp (F)	Dew Point Temp (C)	Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
14	0050	12	CLR	10.00		68	20.0	53	11.6	39	3.9	35	22	220	33	27.67			29.61	AA		29.69
14	0150	12	CLR	10.00		67	19.4	52	11.3	39	3.9	36	32	250	40	27.64			29.57	AA		29.65
14	0250	12	CLR	10.00		67	19.4	52	11.1	38	3.3	35	28	210	36	27.64			29.57	AA		29.65
14	0350	12	CLR	10.00		66	18.9	52	10.9	38	3.3	36	21	230	34	27.65			29.59	AA		29.66
14	0450	12	CLR	10.00		60	15.6	50	9.9	40	4.4	48	16	290		27.67			29.63	AA		29.69
14	0550	12	CLR	10.00		61	16.1	51	10.3	41	5.0	48	22	270		27.69			29.65	AA		29.71
14	0650	12	CLR	10.00		63	17.2	52	11.1	42	5.6	46	17	290		27.70			29.67	AA		29.72
14	0750	12	CLR	10.00		68	20.0	54	12.0	41	5.0	38	21	280	26	27.71			29.66	AA		29.73
14	0850	12	CLR	10.00		71	21.7	55	12.7	41	5.0	34	21	270		27.71			29.67	AA		29.73
14	0950	12	CLR	10.00		77	25.0	57	13.8	40	4.4	27	20	270	28	27.70			29.65	AA		29.72
14	1050	12	CLR	10.00		79	26.1	57	13.8	38	3.3	23	15	270	25	27.68			29.63	AA		29.70
14	1150	12	CLR	10.00		82	27.8	58	14.2	37	2.8	20	18	270	29	27.65			29.59	AA		29.66
14	1250	12	CLR	10.00		84	28.9	58	14.3	35	1.7	17	20	270	33	27.63			29.57	AA		29.64
14	1350	12	CLR	10.00		86	30.0	58	14.3	33	0.6	15	32	250	41	27.59			29.53	AA		29.60
14	1450	12	BKN034	10.00		85	29.4	57	13.8	31	-0.6	14	36	260	45	27.56			29.49	AA		29.57
14	1531	12	OVC028	6.00	HZ	84	29.0	57	14.1	34	1.0	17	45	250	53	27.53			M	SP		29.54
14	1536	12	OVC028	1.25	HZ	82	28.0	57	13.6	34	1.0	18	41	250	55	27.54			M	SP		29.55
14	1546	12	OVC028	8.00		82	28.0	57	13.6	34	1.0	18	39	260	49	27.54			M	SP		29.55
14	1550	12	OVC028	9.00		83	28.3	57	13.7	33	0.6	16	36	260	48	27.54			29.48	AA		29.55
14	1604	12	BKN030	9.00		82	28.0	57	13.6	34	1.0	18	40	260	48	27.53			M	SP		29.54
14	1641	12	OVC028	2.50	HZ	81	27.0	56	13.1	32	0.0	17	46	260	56	27.52			M	SP		29.53
14	1650	12	OVC024	1.75	HZ	80	26.7	55	12.7	31	-0.6	17	34	260	54	27.55			29.49	AA		29.56
14	1653	12	BKN024	3.00	HZ	81	27.0	55	12.8	30	-1.0	16	36	260	53	27.55			M	SP		29.56
14	1704	12	SCT022	10.00		79	26.0	54	12.3	30	-1.0	17	44	250	54	27.54			M	SP		29.55
14	1720	12	FEW012	1.50	HZ	79	26.0	54	12.0	28	-2.0	15	45	260	56	27.51			M	SP		29.52
14	1731	12	BKN021	0.75	HZ	75	24.0	53	11.4	30	-1.0	19	45	260	58	27.52			M	SP		29.53
14	1748	12	OVC023	1.50	HZ	75	24.0	53	11.4	30	-1.0	19	41	250	55	27.53			M	SP		29.54
14	1750	12	OVC023	2.00	HZ	75	23.9	52	11.2	29	-1.7	18	41	250	55	27.53			29.48	AA		29.54
14	1757	12	OVC023	4.00	HZ	73	23.0	51	10.6	28	-2.0	19	47	250	55	27.54			M	SP		29.55
14	1816	12	SCT025	9.00		73	23.0	52	10.9	30	-1.0	20	40	260	49	27.53			M	SP		29.54
14	1824	12	SCT022	1.75	HZ	72	22.0	51	10.7	30	-1.0	21	43	260	58	27.53			M	SP		29.54
14	1831	12	VV016	1.00	HZ	72	22.0	51	10.7	30	-1.0	21	45	260	58	27.53			M	SP		29.54
14	1840	12	VV014	0.75	HZ	72	22.0	52	11.1	32	0.0	23	52	260	60	27.53			M	SP		29.54

National Weather Service weather observations for Barstow, California, for April 14, 2013. (continued)

14	1850	12	VV013	0.75	HZ	71	21.7	52	11.0	33	0.6	25	47	250	61	27.54			29.49	AA		29.55
14	1855	12	OVC013	1.50	HZ	72	22.0	53	11.4	34	1.0	25	47	250	59	27.54			M	SP		29.55
14	1901	12	VV010	0.50	HZ	72	22.0	52	11.1	32	0.0	23	51	250	66	27.54			M	SP		29.55
14	1906	12	VV009	0.50	-RA HZ	70	21.0	52	11.0	34	1.0	27	51	250	66	27.55			M	SP		29.56
14	1916	12	OVC009	1.50	-RA	70	21.0	52	11.0	34	1.0	27	48	250	60	27.55			M	SP		29.56
14	1926	12	BKN007	2.00	HZ	70	21.0	52	11.0	34	1.0	27	47	250	60	27.56			M	SP		29.57
14	1933	12	BKN009	3.00	HZ	70	21.0	52	11.0	34	1.0	27	45	250	59	27.56			M	SP		29.57
14	1939	12	BKN011	2.50	HZ	70	21.0	52	11.0	34	1.0	27	48	250	61	27.56			M	SP		29.57
14	1942	12	BKN009	3.00	HZ	70	21.0	52	11.0	34	1.0	27	47	250	61	27.57			M	SP		29.58
14	1950	12	SCT009	4.00	HZ	69	20.6	51	10.7	34	1.1	28	47	250	60	27.58			29.53	AA	T	29.59
14	2050	12	CLR	9.00		68	20.0	51	10.5	34	1.1	29	45	240	56	27.59			29.54	AA	T	29.60
14	2056	12	FEW003	4.00	-RA	68	20.0	51	10.5	34	1.0	29	46	240	60	27.59			M	SP		29.60
14	2150	12	CLR	10.00		66	18.9	50	10.0	34	1.1	31	43	240	53	27.60			29.54	AA	T	29.61
14	2250	12	CLR	10.00		65	18.3	49	9.4	32	0.0	29	37	250	46	27.63			29.57	AA		29.64
14	2350	12	CLR	10.00		65	18.3	48	9.0	30	-1.1	27	38	250	47	27.62			29.56	AA		29.63

Table 38. National Weather Service weather observations for Barstow, California, for April 15, 2013.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
(final)
HOURLY OBSERVATIONS TABLE
BARSTOW-DAGGETT AIRPORT (23161)
DAGGETT, CA
(04/2013)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 1917 ft. above sea level
Latitude: 34.853
Longitude: -116.785
Data Version: VER3

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp (F)	Dry Bulb Temp (C)	Wet Bulb Temp (F)	Wet Bulb Temp (C)	Dew Point Temp (F)	Dew Point Temp (C)	Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
15	0050	12	CLR	9.00		63	17.2	48	8.7	31	-0.6	30	39	240	56	27.60			29.54	AA		29.61
15	0150	12	CLR	10.00		61	16.1	47	8.4	32	0.0	34	36	250	49	27.62			29.56	AA		29.63
15	0250	12	CLR	10.00		59	15.0	47	8.5	35	1.7	41	38	250	51	27.63			29.58	AA		29.64
15	0350	12	CLR	10.00		57	13.9	47	8.2	36	2.2	46	33	250	44	27.64			29.59	AA		29.65
15	0450	12	CLR	10.00		56	13.3	47	8.4	38	3.3	51	33	250	40	27.65			29.62	AA		29.67
15	0550	12	CLR	10.00		56	13.3	47	8.4	38	3.3	51	39	250	49	27.66			29.62	AA		29.68
15	0650	12	CLR	10.00		58	14.4	48	8.7	37	2.8	46	33	250	47	27.68			29.64	AA		29.70
15	0750	12	CLR	10.00		61	16.1	49	9.4	37	2.8	41	29	250	39	27.70			29.67	AA		29.72
15	0850	12	CLR	10.00		65	18.3	51	10.4	37	2.8	36	36	260	45	27.67			29.64	AA		29.69
15	0950	12	CLR	10.00		68	20.0	52	10.9	36	2.2	31	34	250	44	27.68			29.65	AA		29.70
15	1050	12	CLR	10.00		72	22.2	52	10.9	31	-0.6	22	31	260	46	27.66			29.62	AA		29.68
15	1150	12	CLR	10.00		75	23.9	54	12.1	34	1.1	22	36	240	44	27.65			29.61	AA		29.67
15	1250	12	CLR	10.00		76	24.4	53	11.7	30	-1.1	18	34	250	48	27.65			29.60	AA		29.66
15	1350	12	CLR	10.00		76	24.4	52	11.0	26	-3.3	16	37	270	51	27.63			29.58	AA		29.64
15	1450	12	CLR	10.00		75	23.9	54	12.3	35	1.7	23	38	250	48	27.61			29.56	AA		29.62
15	1550	12	CLR	10.00		72	22.2	53	11.6	35	1.7	26	36	250	52	27.60			29.56	AA		29.61
15	1650	12	CLR	10.00		69	20.6	51	10.8	34	1.1	28	32	250	46	27.61			29.57	AA		29.62
15	1750	12	CLR	10.00		65	18.3	51	10.4	37	2.8	36	34	240	41	27.60			29.57	AA		29.61
15	1850	12	CLR	10.00		62	16.7	49	9.5	36	2.2	38	29	240	40	27.60			29.57	AA		29.61
15	1950	12	CLR	10.00		60	15.6	49	9.6	39	3.9	46	31	240	40	27.63			29.59	AA		29.64
15	2050	12	CLR	10.00		59	15.0	49	9.2	38	3.3	46	31	250	44	27.65			29.62	AA		29.66
15	2150	12	CLR	10.00		57	13.9	47	8.4	37	2.8	47	34	250	41	27.65			29.62	AA		29.67
15	2250	12	CLR	10.00		55	12.8	47	8.1	38	3.3	53	21	230	31	27.68			29.65	AA		29.70
15	2350	12	CLR	10.00		54	12.2	46	7.9	38	3.3	55	25	250	34	27.70			29.67	AA		29.72

Table 39. National Weather Service weather observations for Baker, California, for April 14, 2013.

MDHC1—Baker, California Airport					
Date and Time	[1]WS	[2]WG	[3]WD	Winds From	Visibility Type
4/14/2013 00:51:AM	21	34	272	W	ND
4/14/2013 01:51 AM	18	30	277	W	ND
4/14/2013 02:51 AM	17	29	266	WSW	ND
4/14/2013 03:51 AM	13	26	269	WSW	ND
4/14/2013 04:51 AM	13	23	268	WSW	ND
4/14/2013 05:51 AM	10	24	265	WSW	ND
4/14/2013 06:51 AM	1	14	VAR	VAR	ND
4/14/2013 07:51 AM	8	11	294	WNW	ND
4/14/2013 08:51 AM	1	11	VAR	VAR	ND
4/14/2013 09:51 AM	3	9	VAR	VAR	ND
4/14/2013 10:51 AM	6	14	146	SE	ND
4/14/2013 11:51 AM	9	15	162	SSE	ND
4/14/2013 12:51 PM	9	16	142	SE	ND
4/14/2013 1:51 PM	9	19	125	ESE	ND
4/14/2013 2:51 PM	10	21	180	S	ND
4/14/2013 3:51 PM	11	21	241	SW	ND
4/14/2013 4:51 PM	13	26	249	SW	ND
4/14/2013 5:51 PM	15	28	222	SSW	ND
4/14/2013 6:51 PM	14	28	221	SSW	ND
4/14/2013 7:51 PM	16	29	246	SW	ND
4/14/2013 8:51 PM	15	26	250	WSW	ND
4/14/2013 9:51 PM	19	32	267	WSW	ND
4/14/2013 10:51 PM	21	38	261	WSW	ND
4/14/2013 11:51 PM	22	36	267	WSW	ND

[1]Hourly sustained wind speed (mph)
[2]Hourly maximum wind gusts (mph)
[3]Wind direction (degrees)
VAR=Variable wind/calm winds with no specific wind direction

Table 40. National Weather Service weather observations for Baker, California, for April 15, 2013.

MDHC1—Baker, California Airport					
Date and Time	[1]WS	[2]WG	[3]WD	Winds From	Visibility Type
4/15/2013 00:51:AM	23	36	274	W	ND
4/15/2013 01:51 AM	20	34	261	WSW	ND
4/15/2013 02:51 AM	21	35	290	W	ND
4/15/2013 03:51 AM	21	38	270	W	ND
4/15/2013 04:51 AM	17	32	285	W	ND
4/15/2013 05:51 AM	22	35	257	WSW	ND
4/15/2013 06:51 AM	22	35	269	WSW	ND
4/15/2013 07:51 AM	20	33	259	WSW	ND
4/15/2013 08:51 AM	22	33	250	WSW	ND
4/15/2013 09:51 AM	19	36	261	WSW	ND
4/15/2013 10:51 AM	16	33	294	WNW	ND
4/15/2013 11:51 AM	15	27	248	SW	ND
4/15/2013 12:51 PM	13	25	222	SSW	ND
4/15/2013 1:51 PM	17	29	250	WSW	ND
4/15/2013 2:51 PM	16	29	240	SW	ND
4/15/2013 3:51 PM	17	28	256	WSW	ND
4/15/2013 4:51 PM	17	28	232	SW	ND
4/15/2013 5:51 PM	18	30	254	WSW	ND
4/15/2013 6:51 PM	23	35	259	WSW	ND
4/15/2013 7:51 PM	16	33	257	WSW	ND
4/15/2013 8:51 PM	28	40	254	WSW	ND
4/15/2013 9:51 PM	19	41	258	WSW	ND
4/15/2013 10:51 PM	22	44	279	W	ND
4/15/2013 11:51 PM	19	35	272	W	ND

[1]Hourly sustained wind speed (mph)
[2]Hourly maximum wind gusts (mph)
[3]Wind direction (degrees)

Table 41. National Weather Service weather observations for McCarran International Airport for April 14, 2013.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
MCCARRAN INTERNATIONAL AIRPORT (23169)
LAS VEGAS, NV
(04/2013)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 2180 ft. above sea level
Latitude: 36.071
Longitude: -115.163
Data Version: VER3

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
14	0056	11	SCT250	10.00		70	21.1	51	10.6	32	0.0	25	11	210		27.30			29.49	AA		29.56
14	0156	11	BKN250	10.00		69	20.6	51	10.3	32	0.0	25	15	180		27.30			29.49	AA		29.56
14	0256	11	BKN250	10.00		68	20.0	50	10.1	32	0.0	26	9	190		27.31			29.50	AA		29.57
14	0356	11	BKN250	10.00		68	20.0	51	10.3	33	0.6	27	11	210		27.33			29.52	AA		29.59
14	0456	11	BKN250	10.00		66	18.9	50	9.8	33	0.6	29	7	180		27.35			29.54	AA		29.61
14	0556	11	SCT250	10.00		67	19.4	50	9.9	32	0.0	27	3	050		27.37			29.57	AA		29.63
14	0656	11	SCT250	10.00		69	20.6	49	9.5	27	-2.8	21	8	040		27.38			29.59	AA		29.65
14	0756	11	SCT250	10.00		71	21.7	49	9.6	25	-3.9	18	11	070		27.39			29.60	AA		29.66
14	0856	11	FEW250	10.00		73	22.8	50	10.1	25	-3.9	17	3	VR		27.40			29.61	AA		29.67
14	0956	11	FEW250	10.00		74	23.3	50	10.2	24	-4.4	15	5	200		27.40			29.61	SY-MT		29.67
14	1056	11	SCT250	10.00		76	24.4	52	10.8	25	-3.9	15	6	190		27.38			29.58	AA		29.65
14	1156	11	FEW250	10.00		79	26.1	53	11.5	25	-3.9	14	0	000		27.35			29.55	AA		29.61
14	1256	11	FEW250	10.00		81	27.2	55	12.6	29	-1.7	15	10	170		27.32			29.51	AA		29.58
14	1356	11	FEW250	10.00		82	27.8	55	12.9	30	-1.1	15	7	150		27.27			29.46	AA		29.53
14	1456	11	FEW140	10.00		86	30.0	57	13.9	31	-0.6	14	13	200		27.22			29.41	AA		29.48
14	1556	11	FEW140	10.00		86	30.0	58	14.4	34	1.1	16	14	190	24	27.20			29.38	AA		29.45
14	1656	11	FEW130	10.00		84	28.9	57	13.8	33	0.6	16	22	230	33	27.19			29.37	AA		29.44
14	1756	11	CLR	10.00		82	27.8	56	13.2	32	0.0	16	17	220	25	27.17			29.36	AA		29.42
14	1856	11	CLR	10.00		80	26.7	54	12.3	29	-1.7	15	14	200	28	27.16			29.35	AA		29.41
14	1956	11	CLR	10.00	VCBLDU	77	25.0	53	11.8	30	-1.1	18	22	220	33	27.18			29.37	AA		29.43
14	2056	11	CLR	10.00	VCBLDU	74	23.3	52	11.0	29	-1.7	19	22	190	29	27.20			29.39	AA		29.45
14	2130	11	CLR	7.00	VCBLDU	72	22.0	51	10.7	30	-1.0	21	20	190	32	27.20			M	SP		29.45
14	2156	11	CLR	6.00	BLDU	71	21.7	51	10.4	30	-1.1	22	24	190	32	27.20			29.39	AA		29.45
14	2256	11	CLR	7.00	VCBLDU	69	20.6	50	10.1	31	-0.6	24	20	190	31	27.18			29.37	AA		29.43
14	2356	11	CLR	7.00	VCBLDU	67	19.4	49	9.7	31	-0.6	26	28	190	36	27.19			29.38	AA		29.44

Table 42. National Weather Service weather observations for McCarran International Airport for April 15, 2013.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
MCCARRAN INTERNATIONAL AIRPORT (23169)
LAS VEGAS, NV
(04/2013)

Elevation: 2180 ft. above sea level
Latitude: 36.071
Longitude: -115.163
Data Version: VER3

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp (F)	Dry Bulb Temp (C)	Wet Bulb Temp (F)	Wet Bulb Temp (C)	Dew Point Temp (F)	Dew Point Temp (C)	Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
15	0056	11	CLR	7.00	VCBLDU	65	18.3	49	9.2	31	-0.6	28	21	200	34	27.20			29.38	AA		29.45
15	0156	11	CLR	7.00	VCBLDU	65	18.3	49	9.2	31	-0.6	28	16	190	30	27.20			29.39	AA		29.45
15	0256	11	CLR	7.00	VCBLDU	64	17.8	48	8.7	30	-1.1	28	15	200		27.21			29.41	AA		29.47
15	0356	11	CLR	9.00	VCBLDU	63	17.2	47	8.5	30	-1.1	29	16	200	24	27.22			29.41	AA		29.48
15	0456	11	CLR	10.00		62	16.7	47	8.0	29	-1.7	29	14	200		27.24			29.43	AA		29.50
15	0556	11	CLR	10.00		61	16.1	46	7.8	29	-1.7	30	15	190		27.26			29.46	AA		29.52
15	0656	11	CLR	10.00		63	17.2	47	8.5	30	-1.1	29	17	200	24	27.27			29.47	AA		29.53
15	0756	11	CLR	10.00		65	18.3	49	9.2	31	-0.6	28	18	200	25	27.29			29.50	AA		29.55
15	0856	11	CLR	10.00		68	20.0	50	10.1	32	0.0	26	20	180	26	27.31			29.51	AA		29.57
15	0956	11	CLR	10.00		71	21.7	51	10.4	30	-1.1	22	18	190	25	27.31			29.52	AA		29.57
15	1056	11	CLR	10.00		73	22.8	52	10.9	30	-1.1	20	21	190	26	27.29			29.49	AA		29.55
15	1156	11	CLR	10.00	VCBLDU	74	23.3	52	11.1	30	-1.1	20	22	200	29	27.27			29.47	AA		29.53
15	1256	11	CLR	10.00	VCBLDU	76	24.4	52	11.3	28	-2.2	17	17	200	31	27.25			29.46	AA		29.51
15	1356	11	CLR	10.00	VCBLDU	77	25.0	52	11.2	26	-3.3	15	26	210	36	27.22			29.42	AA		29.48
15	1456	11	CLR	10.00	VCBLDU	78	25.6	53	11.4	26	-3.3	15	25	200	33	27.21			29.40	AA		29.46
15	1556	11	FEW036	10.00	VCBLDU	78	25.6	52	10.8	22	-5.6	12	25	210	37	27.18			29.37	AA		29.43
15	1626	11	CLR	1.50	HZ BLDU	75	24.0	50	10.0	21	-6.0	13	23	210	40	27.17			M	SP		29.42
15	1654	11	CLR	2.00	HZ BLDU	75	24.0	50	10.0	21	-6.0	13	18	210	37	27.16			M	SP		29.41
15	1656	11	CLR	2.00	HZ BLDU	75	23.9	50	10.0	21	-6.1	13	20	210	33	27.16			29.36	AA		29.41
15	1710	11	CLR	3.00	HZ BLDU	73	23.0	49	9.5	21	-6.0	14	22	200	38	27.16			M	SP		29.41
15	1754	11	CLR	2.50	HZ BLDU	72	22.0	49	9.3	21	-6.0	14	20	230	33	27.16			M	SP		29.41
15	1756	11	CLR	3.00	HZ BLDU	72	22.2	49	9.3	21	-6.1	14	17	220	33	27.16			29.36	AA		29.41
15	1819	11	CLR	5.00	HZ BLDU	72	22.0	49	9.3	21	-6.0	14	18	190	25	27.16			M	SP		29.41
15	1856	11	CLR	8.00	VCBLDU	69	20.6	48	8.7	22	-5.6	17	15	210	28	27.17			29.37	AA		29.42
15	1956	11	CLR	9.00	VCBLDU	66	18.9	47	8.4	25	-3.9	21	20	190	34	27.21			29.41	AA		29.46
15	2056	11	CLR	8.00	VCBLDU	63	17.2	47	8.5	30	-1.1	29	20	200	31	27.23			29.44	AA		29.49
15	2156	11	CLR	9.00	VCBLDU	61	16.1	46	8.0	30	-1.1	31	20	210	37	27.23			29.44	AA		29.49
15	2256	11	CLR	9.00	VCBLDU	60	15.6	46	7.9	31	-0.6	34	26	220	38	27.24			29.45	AA		29.50
15	2356	11	CLR	9.00	VCBLDU	58	14.4	45	7.4	31	-0.6	36	20	210	32	27.29			29.50	AA		29.55

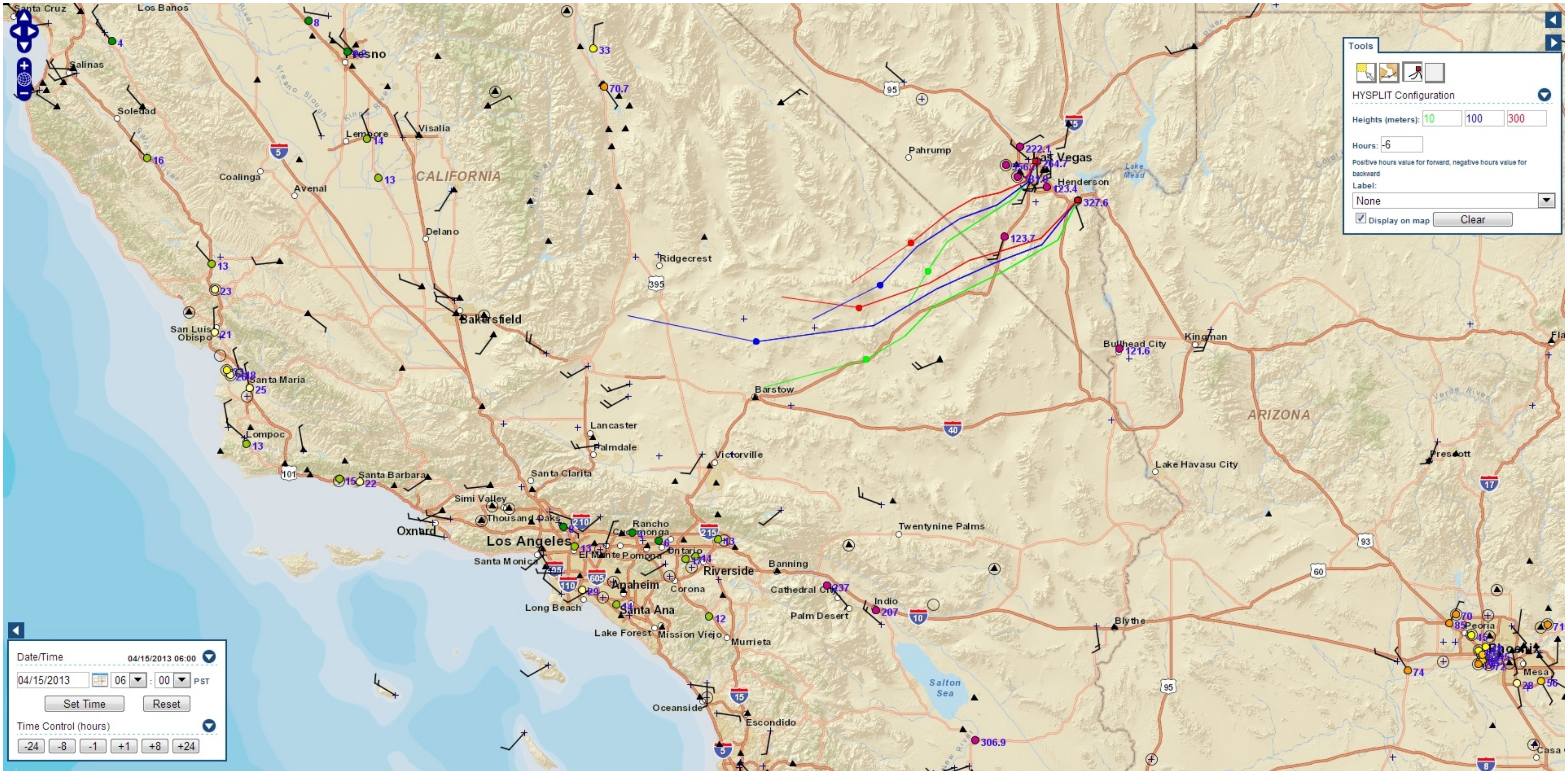


Figure 88. **Six-hour backward trajectory HYSPLIT for Boulder City and Sunrise Acres DAQ stations April 15, 2013 06:00 PST.**

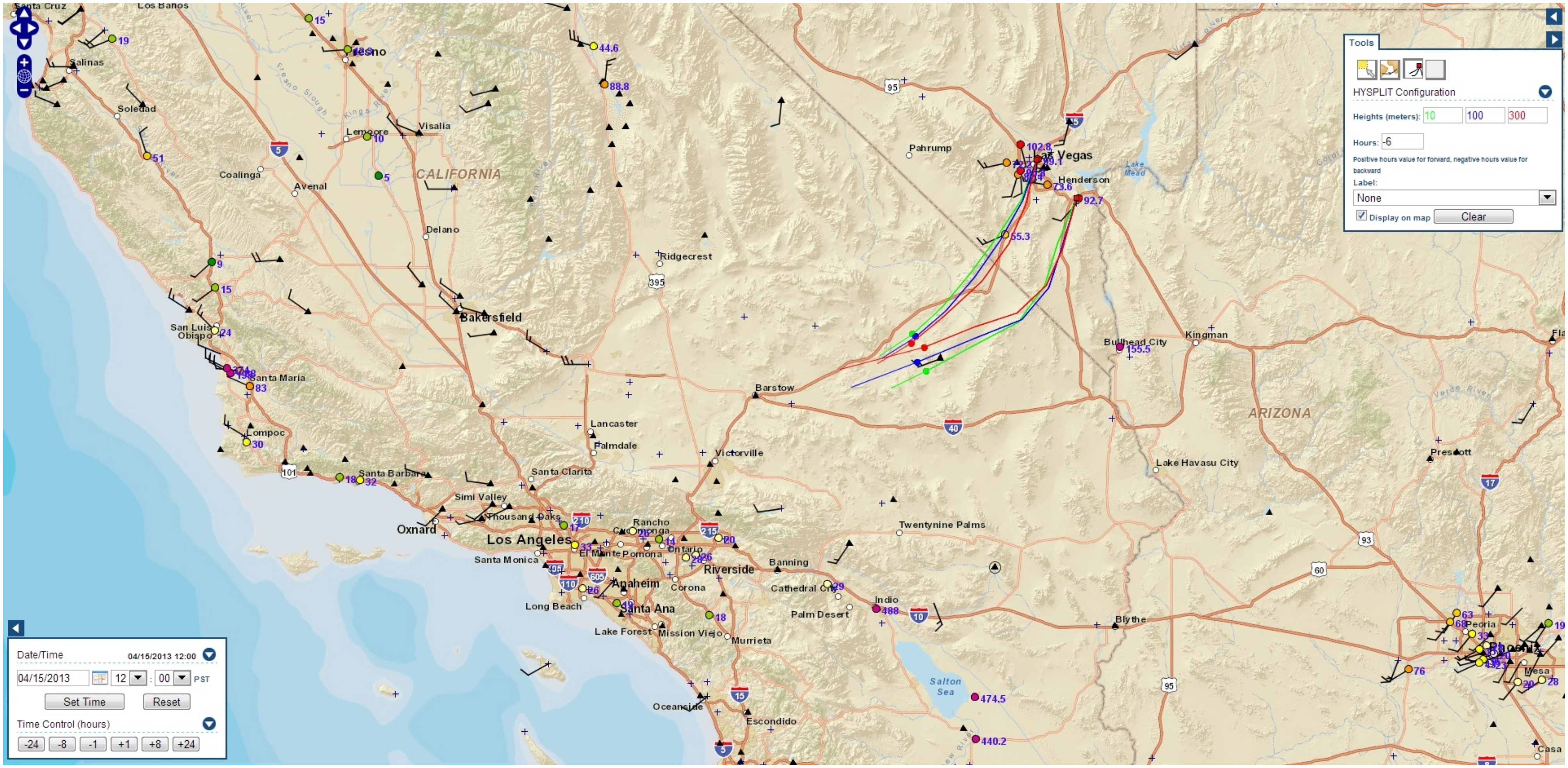


Figure 89. Six-hour backward trajectory HYSPLIT for Boulder City and Sunrise Acres DAQ stations April 15, 2013 12:00 PST.

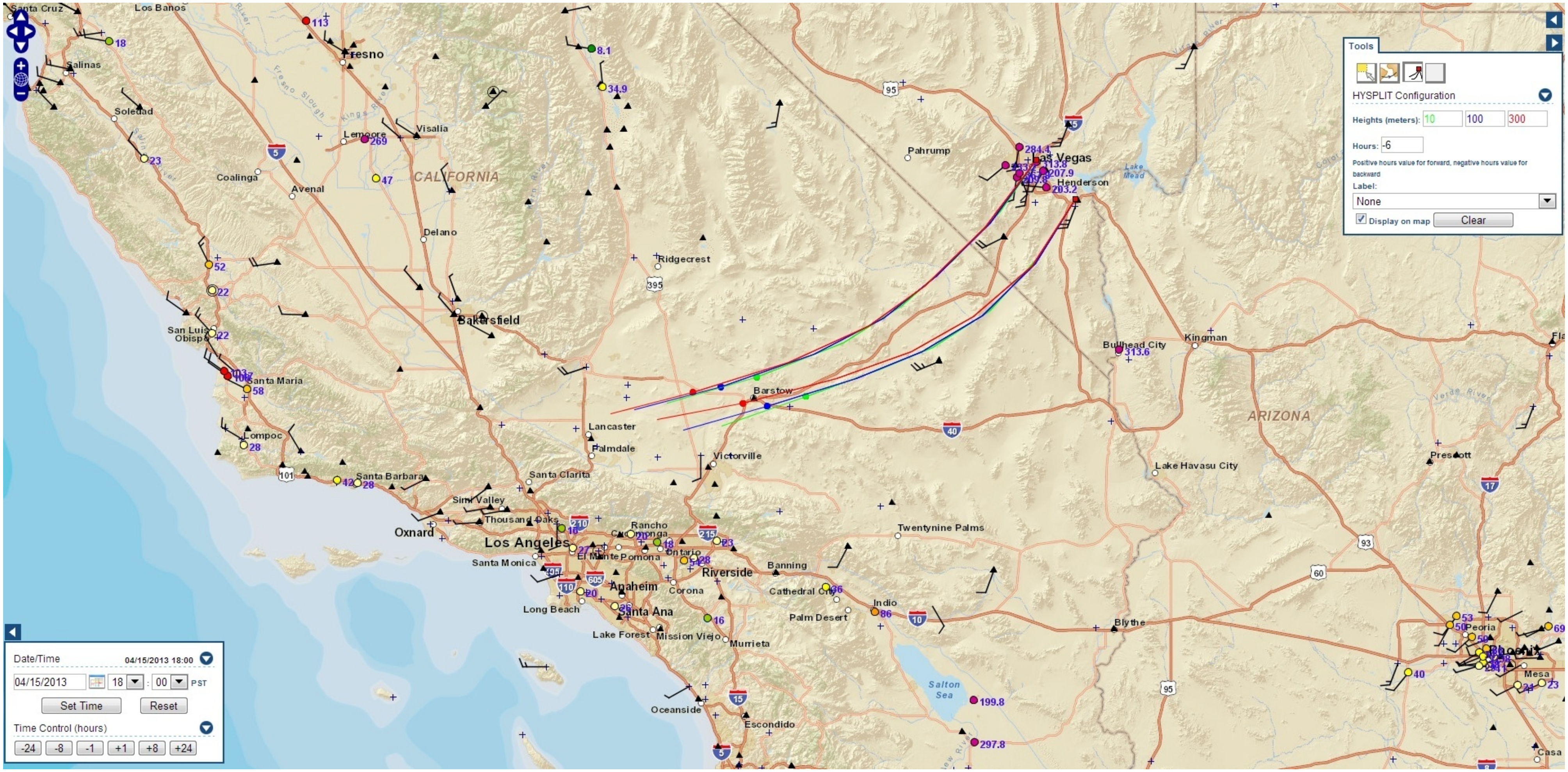


Figure 90. Six-hour backward trajectory HYSPLIT for Boulder City and Sunrise Acres DAQ stations April 15, 2013 18:00 PST.

3.2.3 Weather After the Event

Surface Charts (Figures 91–92)

These charts show the low-pressure system that was over Clark County moving east. The gradients are widening causing a decrease in wind speeds as the existing suspended dust is transported east of Clark County.

Upper Air Charts (Figures 93–98)

250 mb Charts
The 250 mb charts show the low-pressure system that was over Clark County moving east.

500 mb Charts
The 500 mb charts show the low-pressure system that was over Clark County moving east.

850 mb Charts
The 850 mb charts show the low-pressure system that was over Clark County moving east.

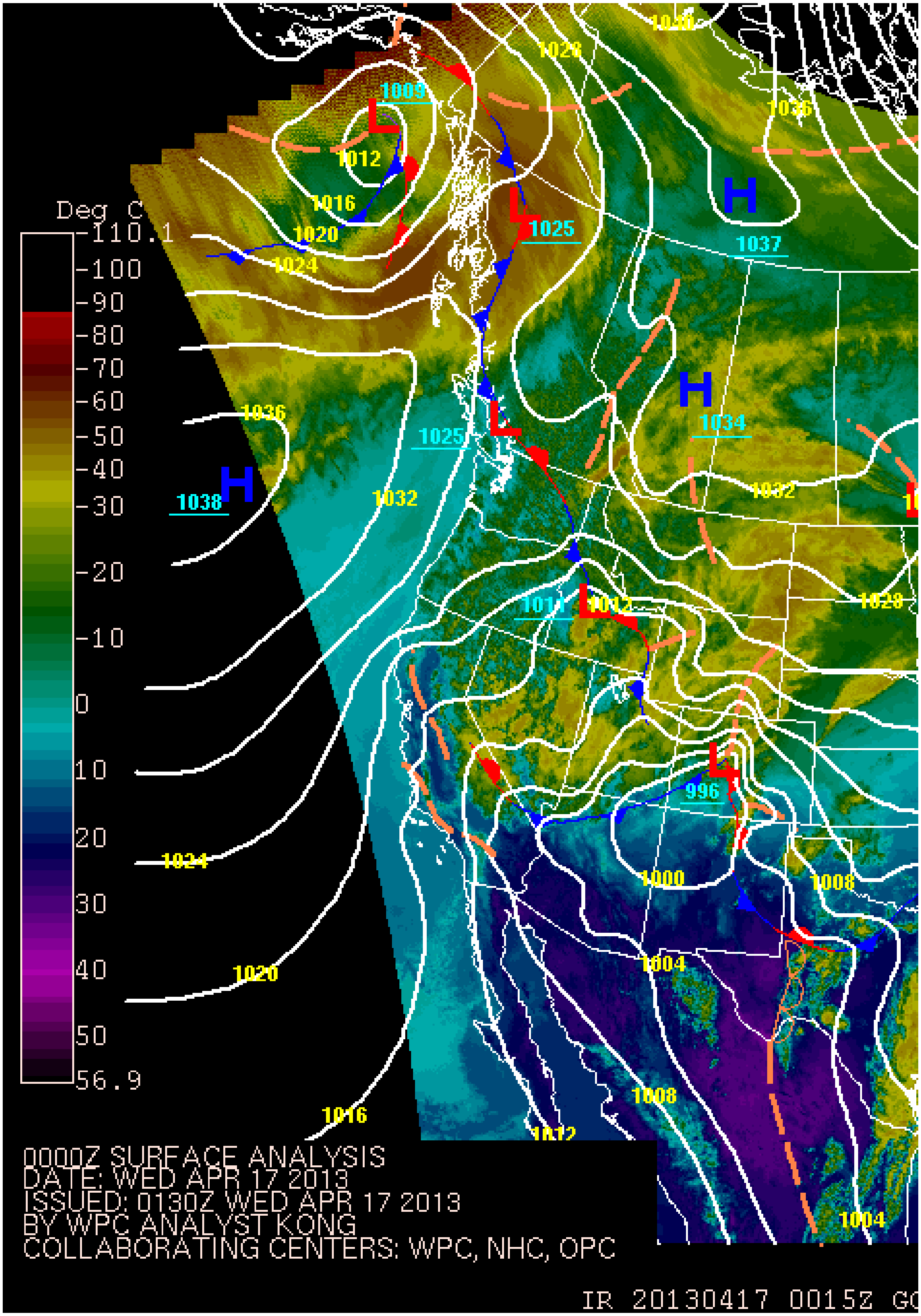


Figure 91. Surface weather charts after the event April 16, 2013 18Z.

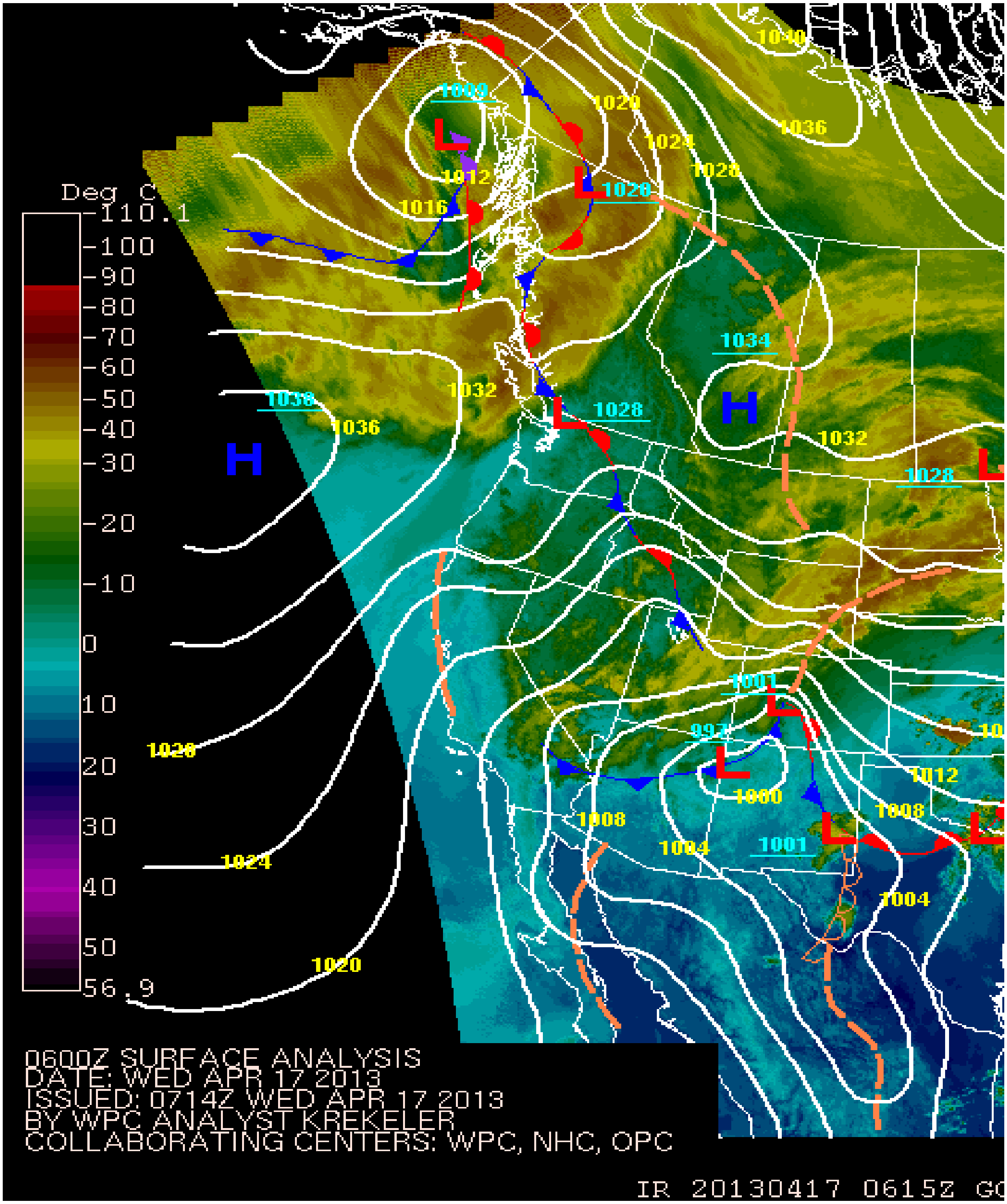


Figure 92. Surface weather charts after the event April 17, 2013 06Z.

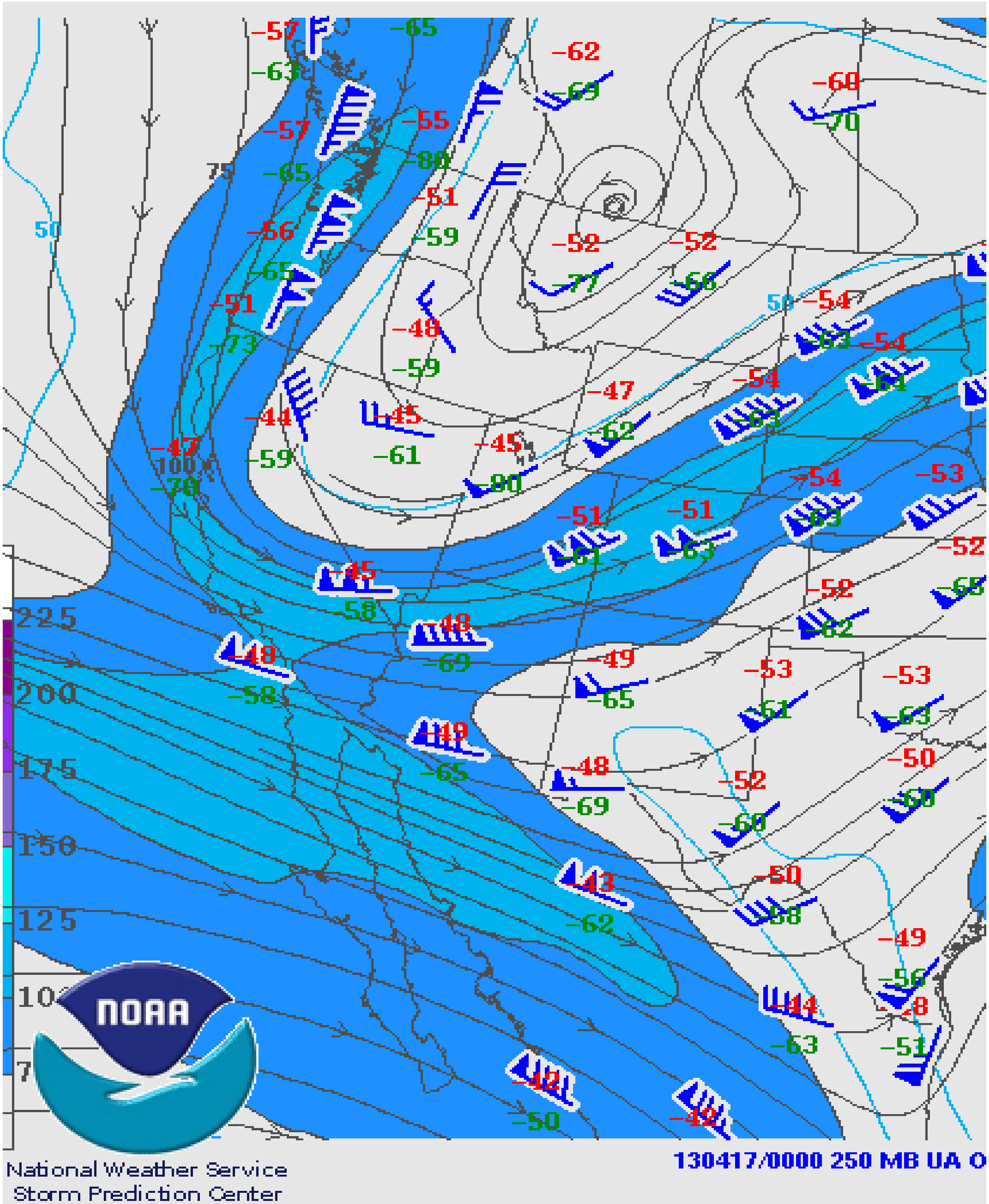


Figure 93. 250 mb after the event weather chart for April 17, 2013 00Z.

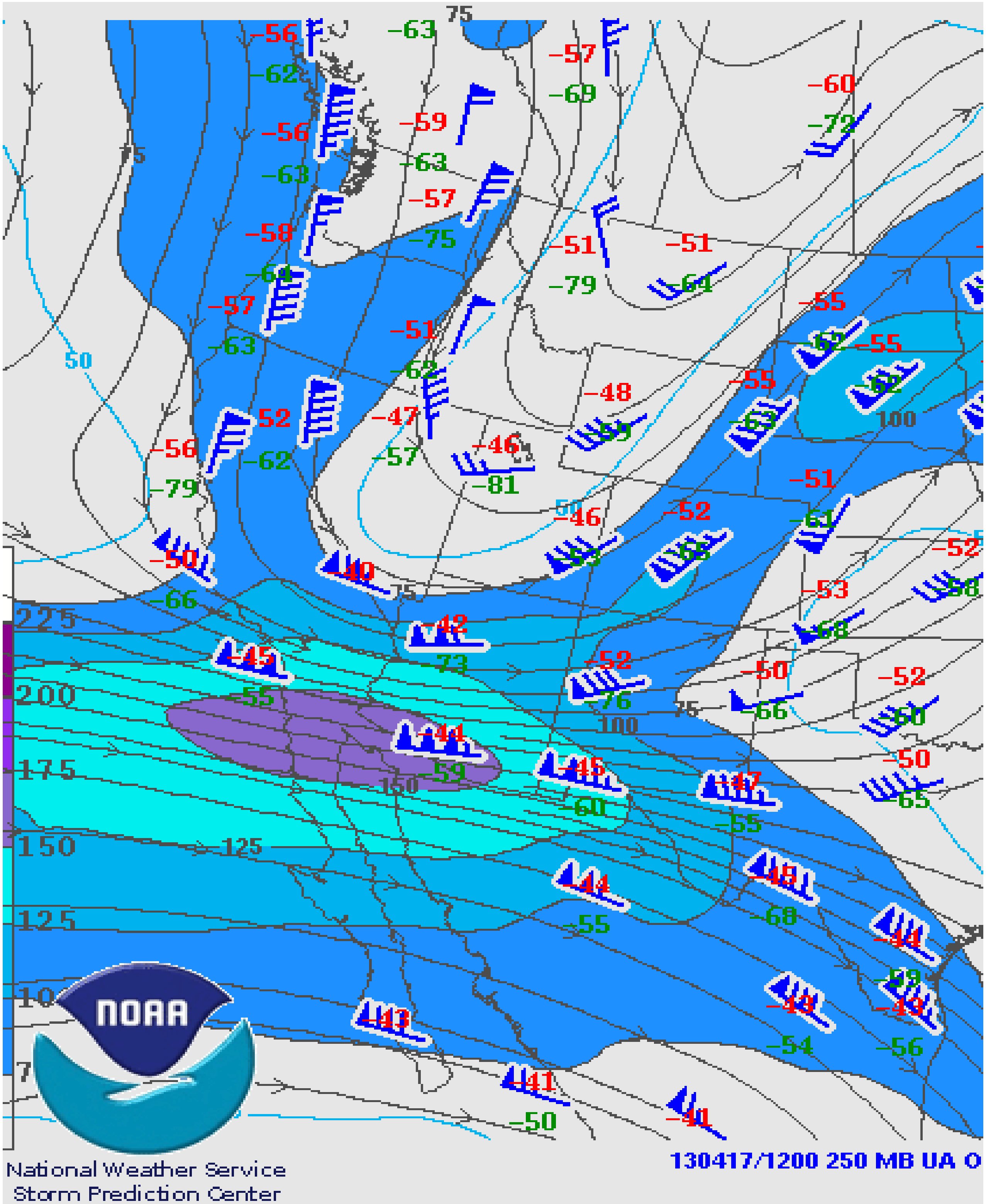


Figure 94. 250 mb after the event weather chart for April 17, 2013 12Z.

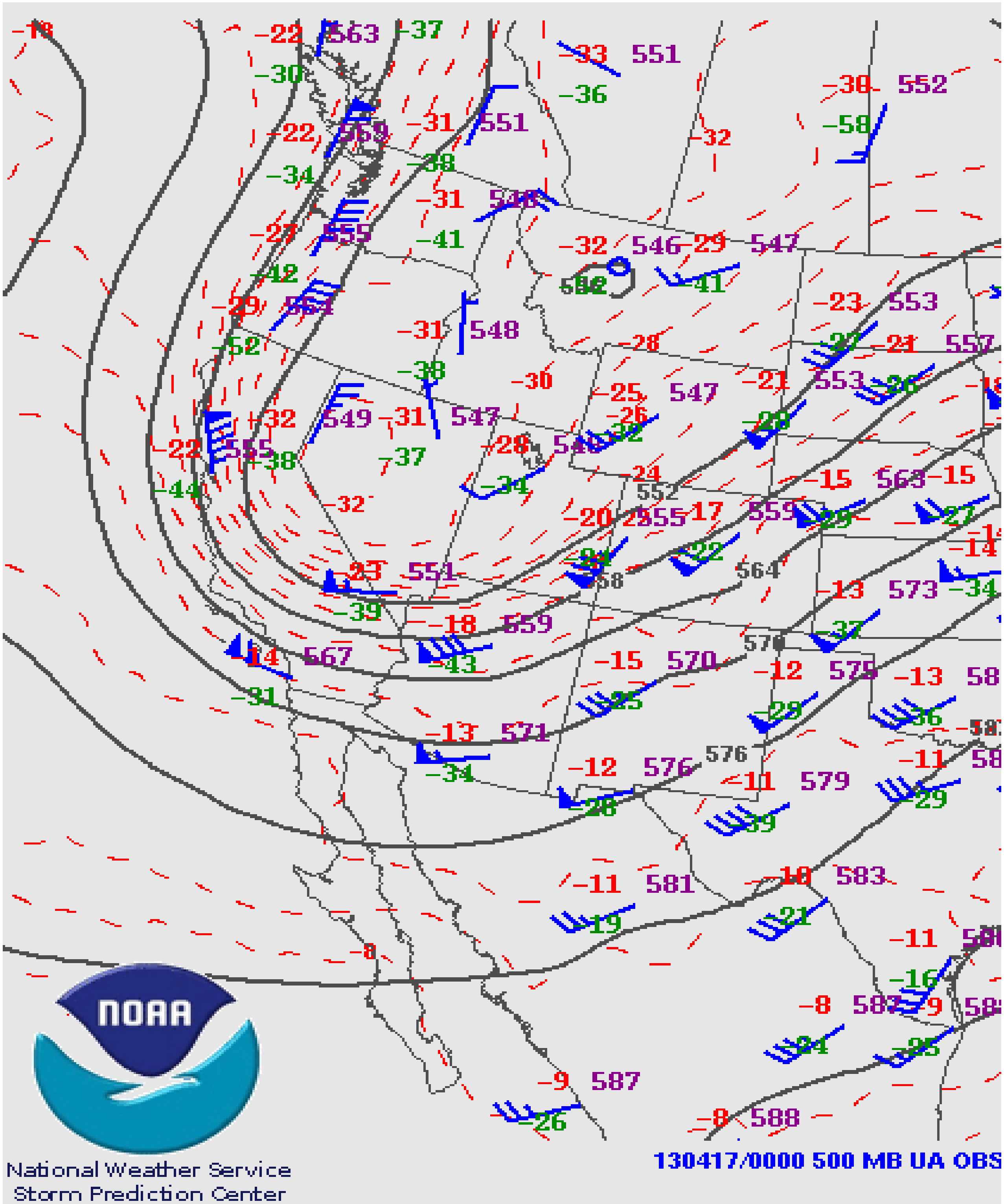


Figure 95. **500 mb after the event weather chart for April 17, 2013 00Z.**

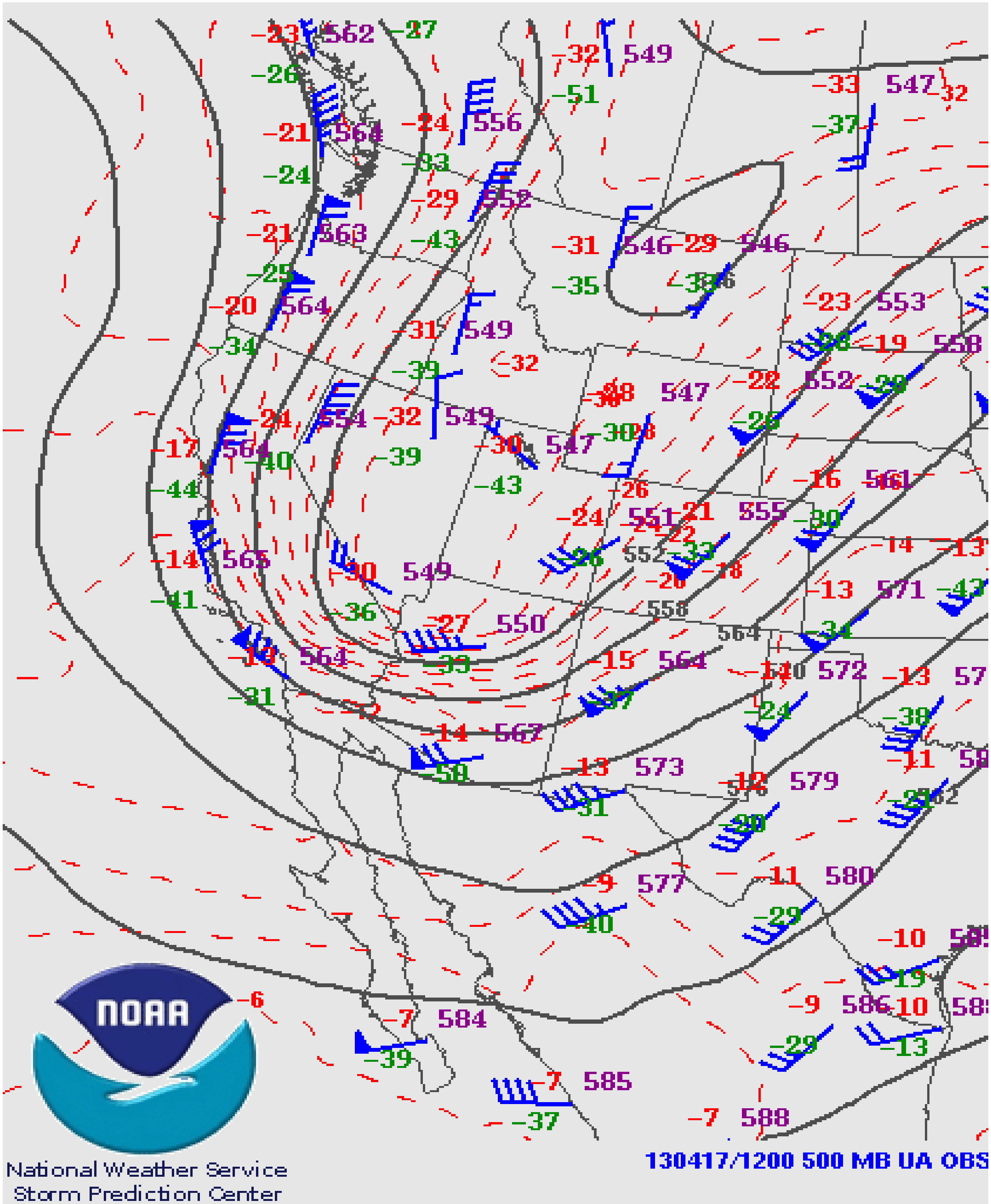


Figure 96. 500 mb after the event weather chart for April 17, 2013 12Z.

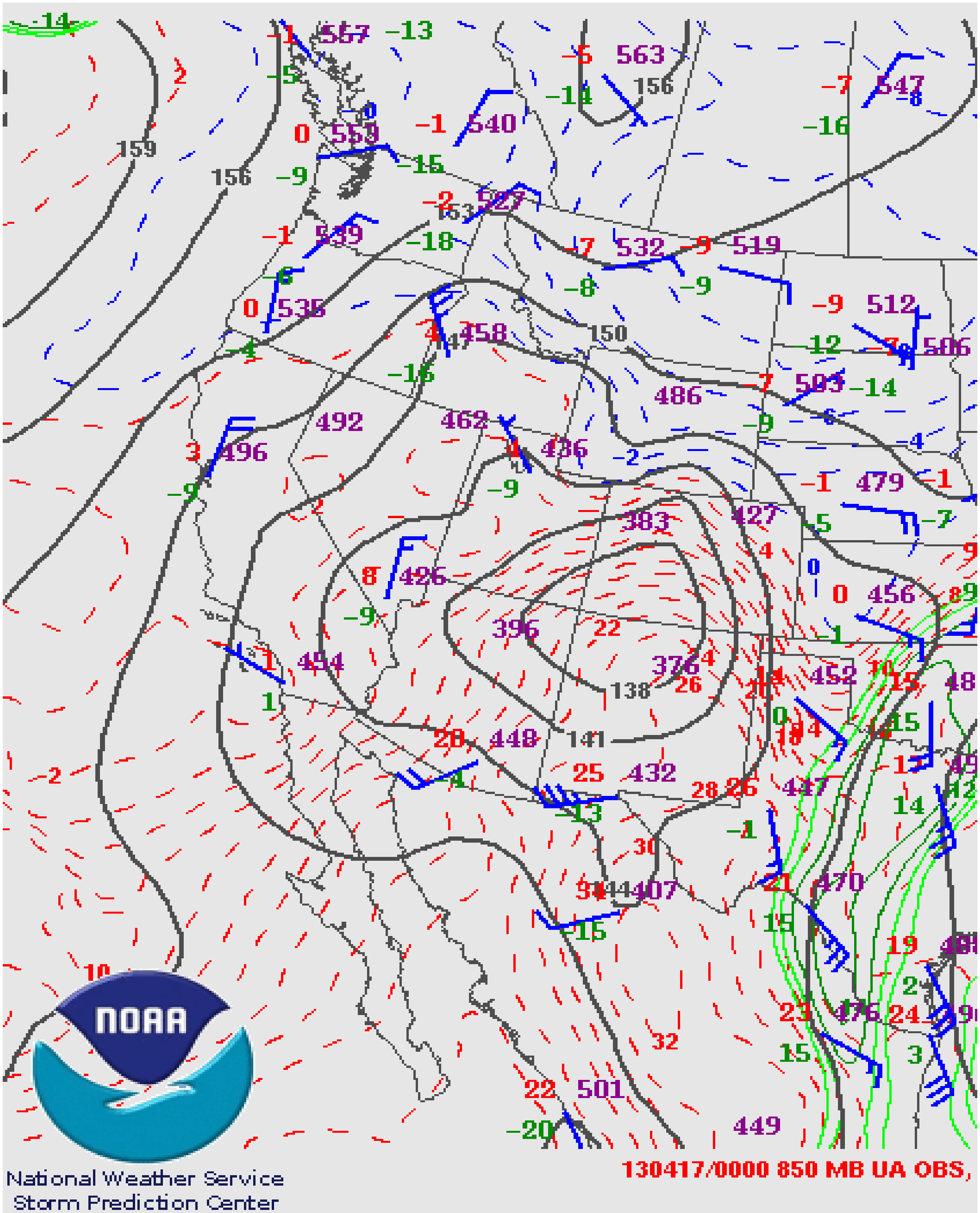


Figure 97. 850 mb after the event weather chart for April 17, 2013 00Z.

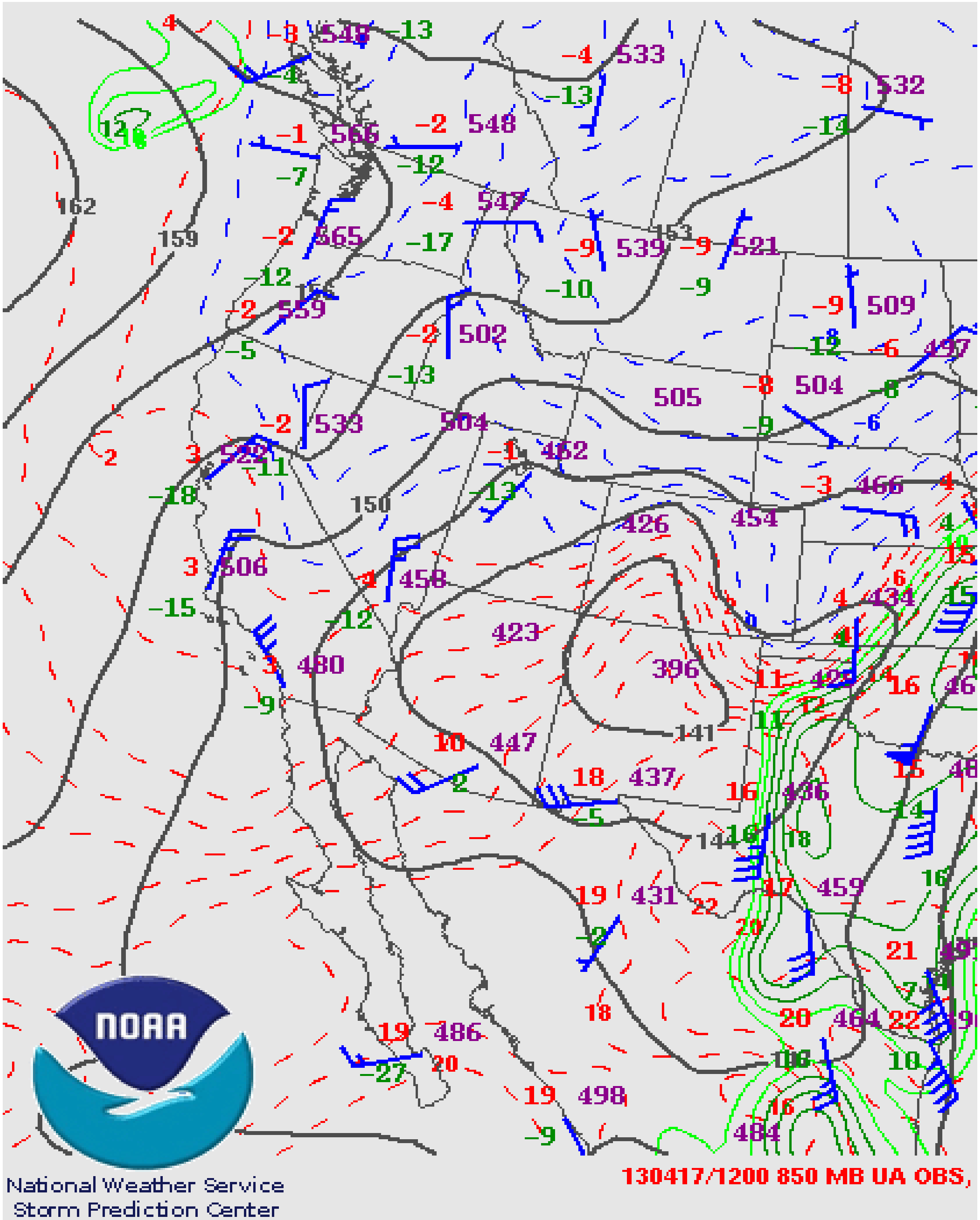


Figure 98. 850 mb after the event weather chart for April 17, 2013 12Z.

3.3 MEDIA COVERAGE OF THE HIGH-WIND TRANSPORT DUST EVENT

The Clark County media is diligent about informing the public at large of air quality forecasts and also giving advice to residents who don't have direct access to the Internet. The *Las Vegas Review Journal* ran an article on April 15, 2012, at 9:38 am Pacific Daylight Time (PDT) (updated April 16, 2013, 2:06 am) titled *"It's a windy, dusty Monday"* that reiterated the air quality warnings published by DAQ (Appendices A and C). *Goggle Public Alerts* ran an article during the event titled "*High Wind Warning for the Mojave Desert, California,"* which gave the cause of the high-wind transported dust storm as desert storm conditions from Barstow, Daggett, and Fort Irwin, California. This is the wind and dust storm that transported dust and haze to the Las Vegas, Ivanpah, and Eldorado Valleys.

Appendix A contains a news release sent out by the Clark County Public Information Office during the high-wind transported dust event. DAQ published construction notices, dust advisories, and an updated air quality alert on April 15, 2013 (Appendix C). Videos titled "Dusty Day" from channel 8@Now news discussed the dust storm and reviewed health precautions of exposure to dust from the storm *My News 3* published a video, *"Dust Alert,"* that discussed wind and dust conditions in the Las Vegas Valley, and with Pulmonologists reporting on the health impacts of high dust conditions. A short briefing on the conditions surrounding the dust storm was given by DAQ staff meteorologist Phillip Wiker in the video segment. *My News 3* published an update video at 4:00 pm local time by Channel 3 Meteorologist Kevin Janison on "Wind Advisories" and discussed multiple water-smart sites reporting wind speeds and gusts throughout the Las Vegas Valley. *My News 3* published an updated video at 11:00 pm local time by Meteorologist Kevin Janison on "Wind Advisories" throughout the Las Vegas Valley and how the advisories will continue through 3:00 am on April 16, 2013.

The Clark County visibility camera network images show the storm as it progressed through the Las Vegas Valley. These cameras are located at the North Las Vegas Airport and are focused on the valley from a north vantage to southwest and southeast. The complete day animation is available in Appendix D (NLV Visibility Camera Network) of this document on CD. The following images are from key times of the high-wind transport dust event on April 15, 2013. Figure 99 is a still image from 8:00:04 am on April 15, 2013. Note that the mountains to the south are nearly obscured and few buildings are visible due to dust entering the valley. Figures 100 and 101 from 10:00:04 am and 1:00:04 pm on April 15, 2013 show most of the mountains obscured and the buildings are less visible. Figure 102, taken at 7:15:04 pm on April 15, 2013, shows the second wave of transported dust in the early evening obscuring most of the city of Las Vegas and the mountains as the high-wind dust transport event moves to the north by northwest.

Figure 99. North Las Vegas Airport network visibility camera capture at 8:00:04 am on April 15, 2013.

Figure 100. North Las Vegas Airport network visibility camera capture at 10:00:04 am on April 15, 2013.

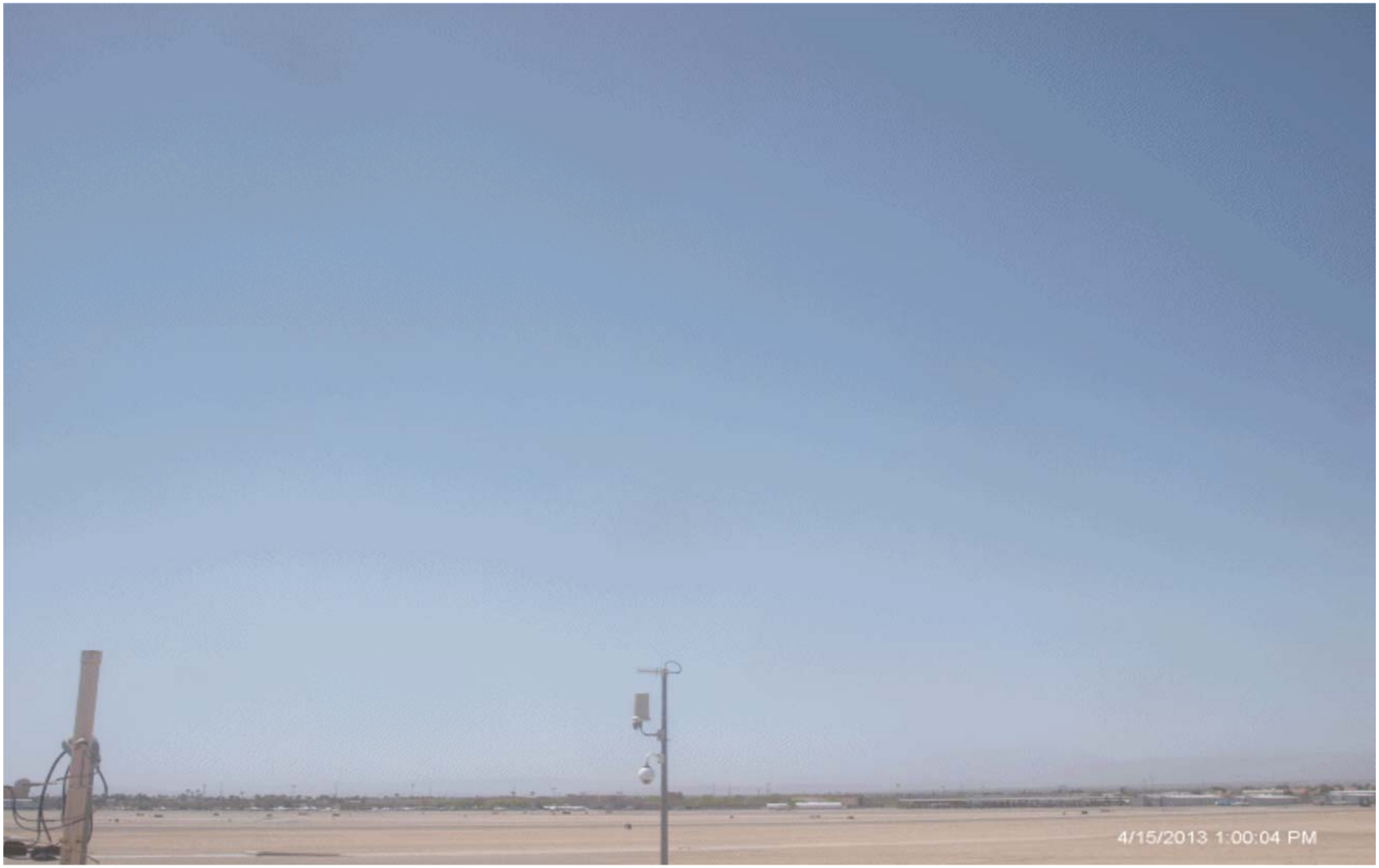


Figure 101. North Las Vegas Airport network visibility camera capture at 1:00:04 pm on April 15, 2013.

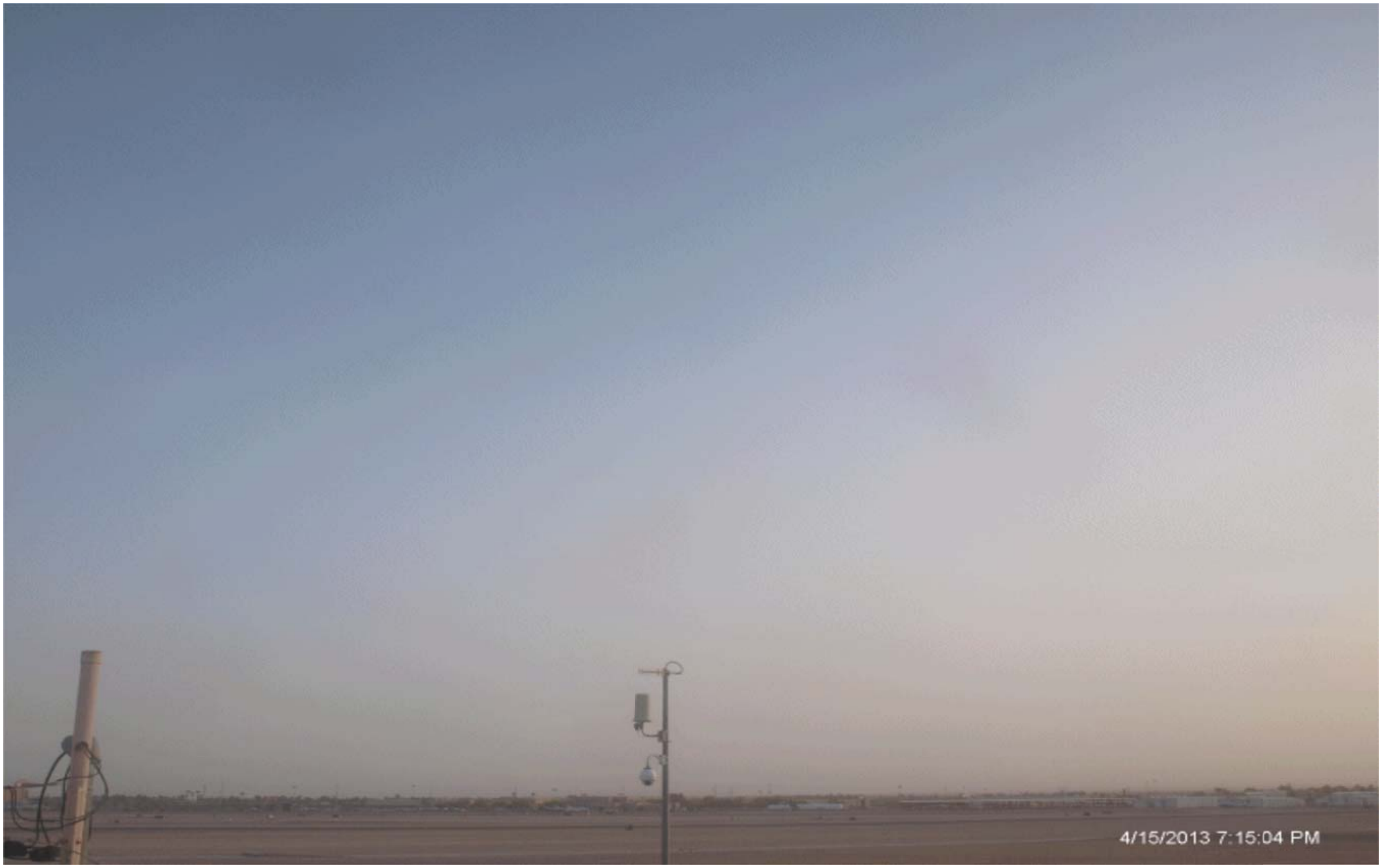


Figure 102. North Las Vegas Airport network visibility camera capture at 7:15:04 pm on April 15, 2013.

4.0 EMISSIONS SOURCES AND ACTIVITIES

4.1 BOULDER CITY

The Boulder City monitoring site (CAMS 0601, EPA 32-003-0601) (Figure 103) is located in the northwest part of the Eldorado Valley at the southeast entrance to the Las Vegas Valley (Figure 6), in a predominantly industrial business area with commercial amenities. Figures 104–107 provide aerial views of the site, whose purpose is to monitor neighborhood-scale spatial emissions of PM_{10} from individual sources in the area. The site's monitoring objective is classified as population exposure, and it provides a good insight into predominant air quality trends for the citizens of the city. There is a major transportation route (U.S. Highway 93) 100 meters south of the site and a lightly traveled road (Industrial Road) approximately 50 meters north of the site.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a moderate contributor to PM emissions at the site, which has blocked accesses and is stabilized. There is native desert and vacant, undeveloped land in the site's area of influence. The lack of current land development in the immediate vicinity has resulted in a decrease of PM emissions in the area. The monitoring station is located inside a fenced compound; the adjacent parking area is predominantly native desert and gravel. The usual, predominant wind direction is southwest. The predominant wind direction during the transported dust event was from the southeast to the northwest, which brought the bulk of the storm's dust through or close to this site. It experienced the second highest exceedance concentration value in the entire PM_{10} network, recording a 24-hour PM_{10} value of 245 μg/m^3 on April 15.

Figure 103. Boulder City monitoring site (street view).

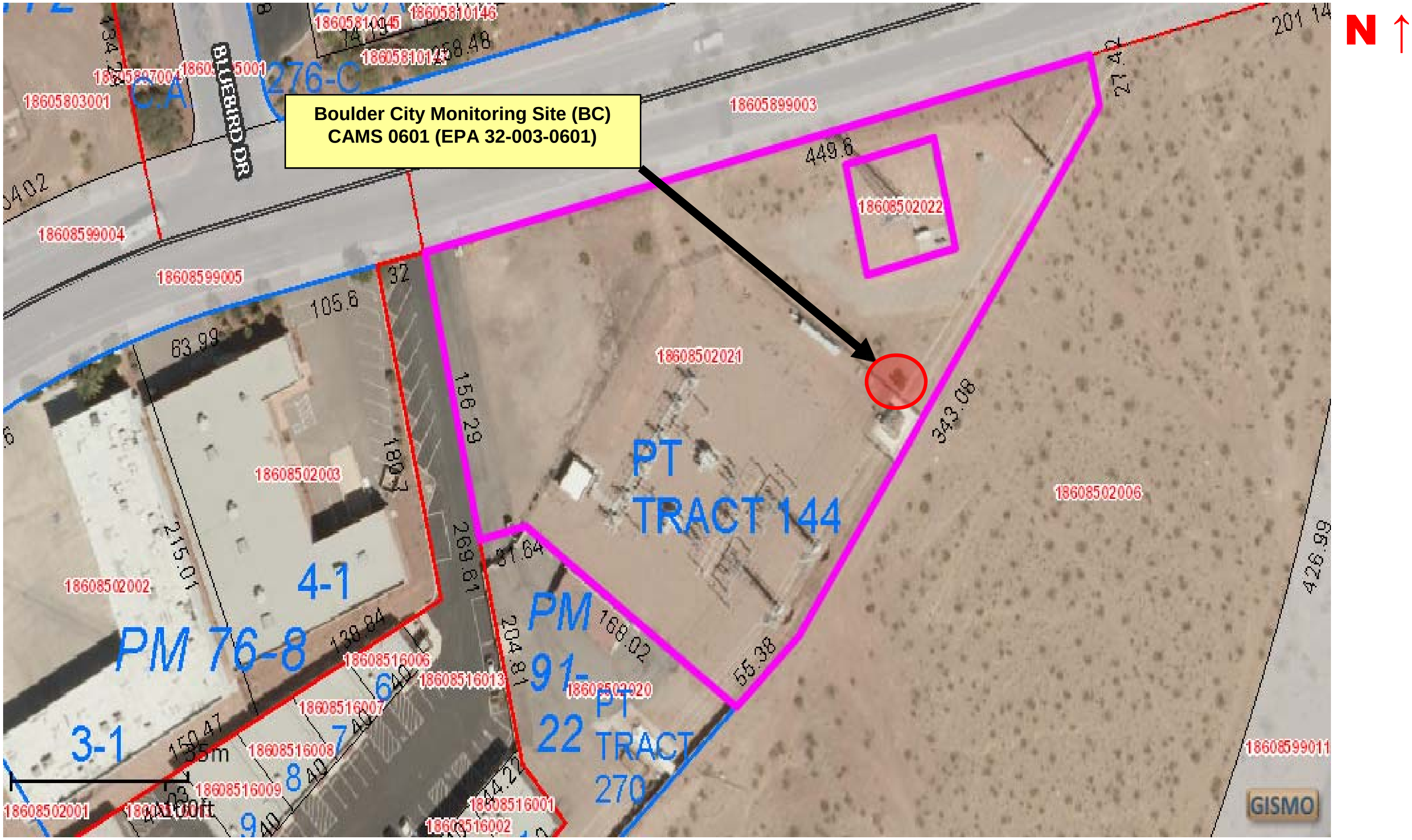


Figure 104. Boulder City monitoring site (aerial view 1).

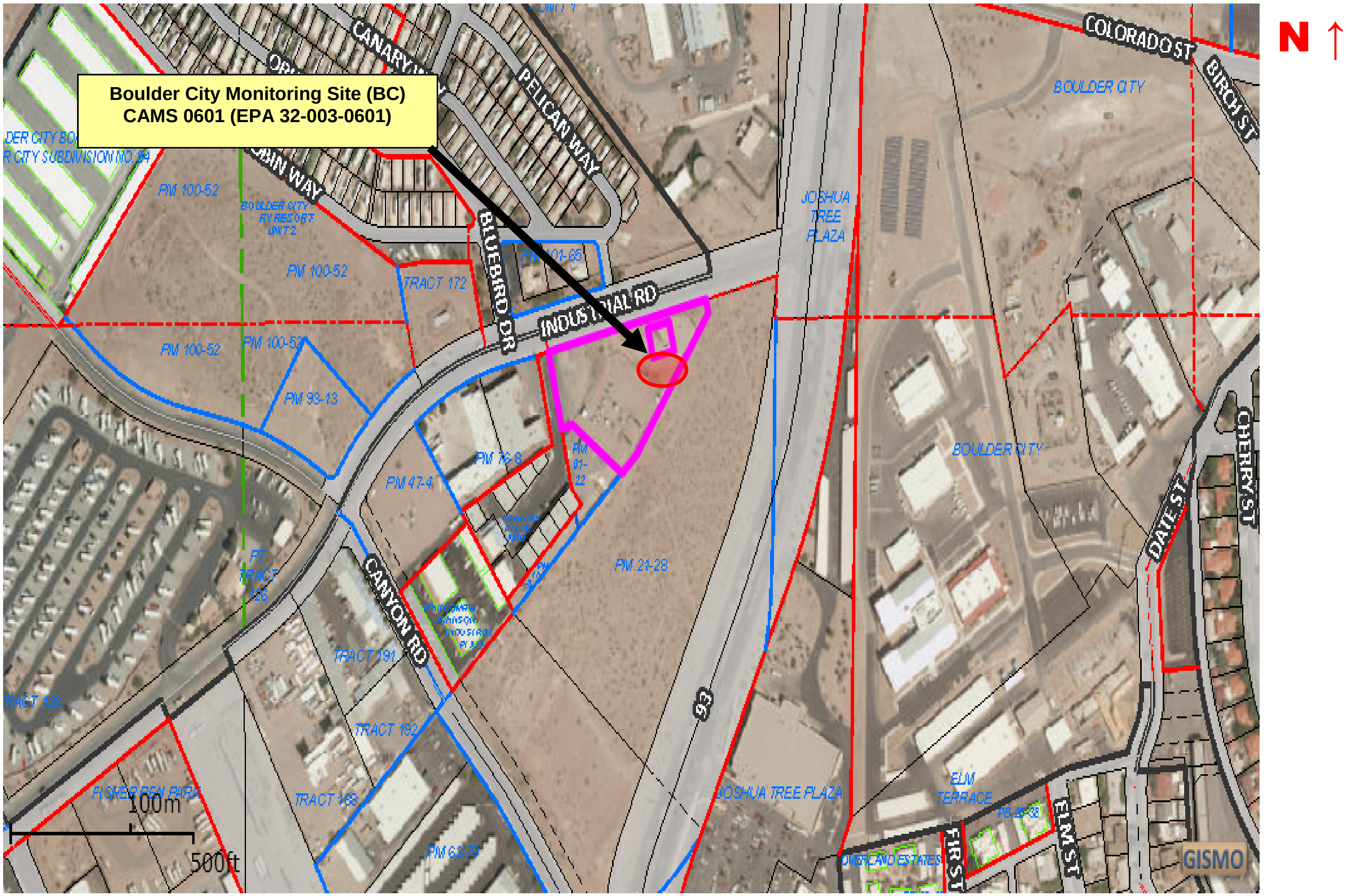


Figure 105. Boulder City monitoring site (aerial view 2).

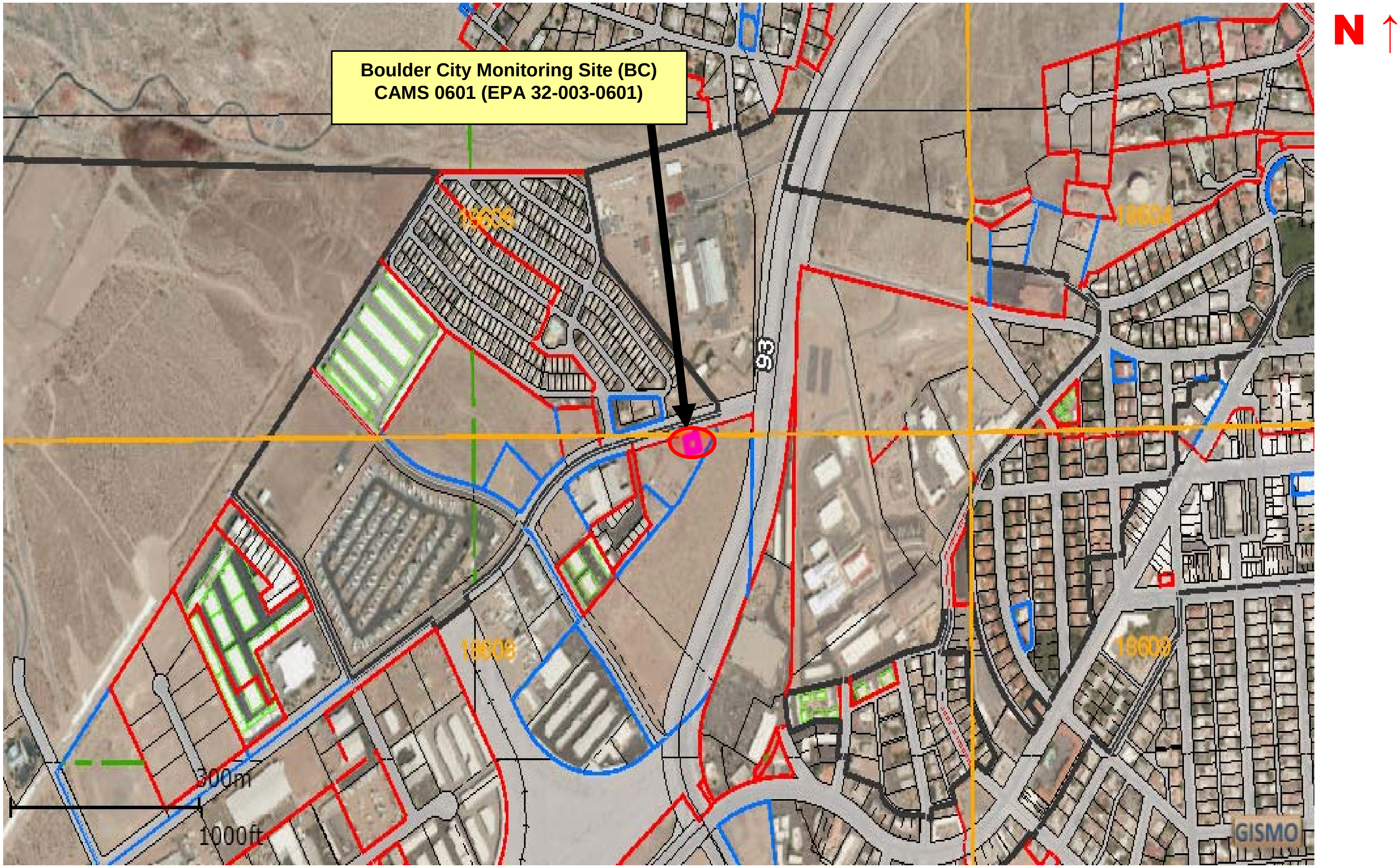


Figure 106. Boulder City monitoring site (aerial view 3).

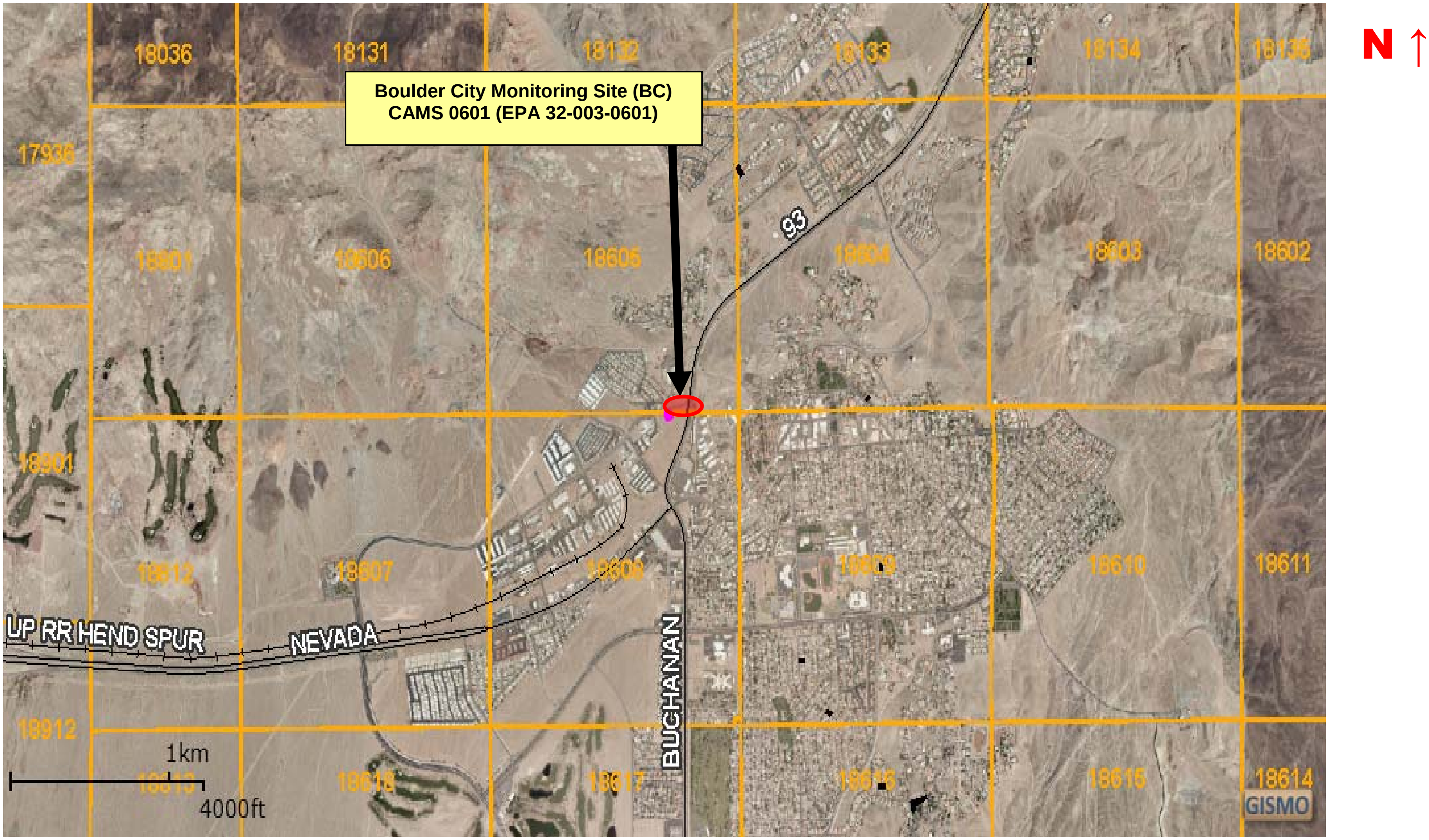


Figure 107. **Boulder City monitoring site (aerial view 4).**

4.2 JEROME MACK (NCORE)

The Jerome Mack monitoring site (CAMS 0540, EPA 32-003-0540) (Figure 108) is located in the southeastern part of the Las Vegas Valley (Figure 6), in a predominantly older urban development area. Most of the apartments and single-family housing units were built from the 1970s to early 2000s. Figures 109–112 provide aerial views of the site, whose purpose is to monitor neighborhood-scale spatial emissions of PM_{10} from sources in the area. The site's monitoring objective is classified as population exposure, and it provides a good insight into predominant air quality trends. It is classified as NCore for the monitoring network, so it samples a vast array of pollutants, including the speciation network. There are no major transportation routes (freeways/interstates) within the vicinity of the monitoring site. South Nellis Boulevard, an arterial, is located less than a mile to the east, and Sahara Avenue is located approximately 1,000 feet north of the site. Both roads are heavily traveled most of the day.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a moderate contributor to PM emissions at the site. The lack of current land development in the immediate vicinity after a major drainage easement project was completed has resulted in an overall decrease of PM emissions in the area. The monitoring station is located inside a fenced compound, and the adjacent area is predominantly grass and gravel. The predominant wind direction for this site is normally southwest. The predominant wind direction during the transported dust event was from the southeast to the northwest, i.e., from northwest Arizona and southeast California through the Eldorado Valley and southern portions of California through Jean, Nevada. From Jean, the transported dust blew into the Las Vegas Valley from the south to the southeast, toward this site. Dust from the high-wind transported event affected the Jerome Mack monitoring site; the measured 24-hour PM_{10} value was 243 $\mu g/m^3$ on April 15.

Figure 108. Jerome Mack monitoring site (street view).

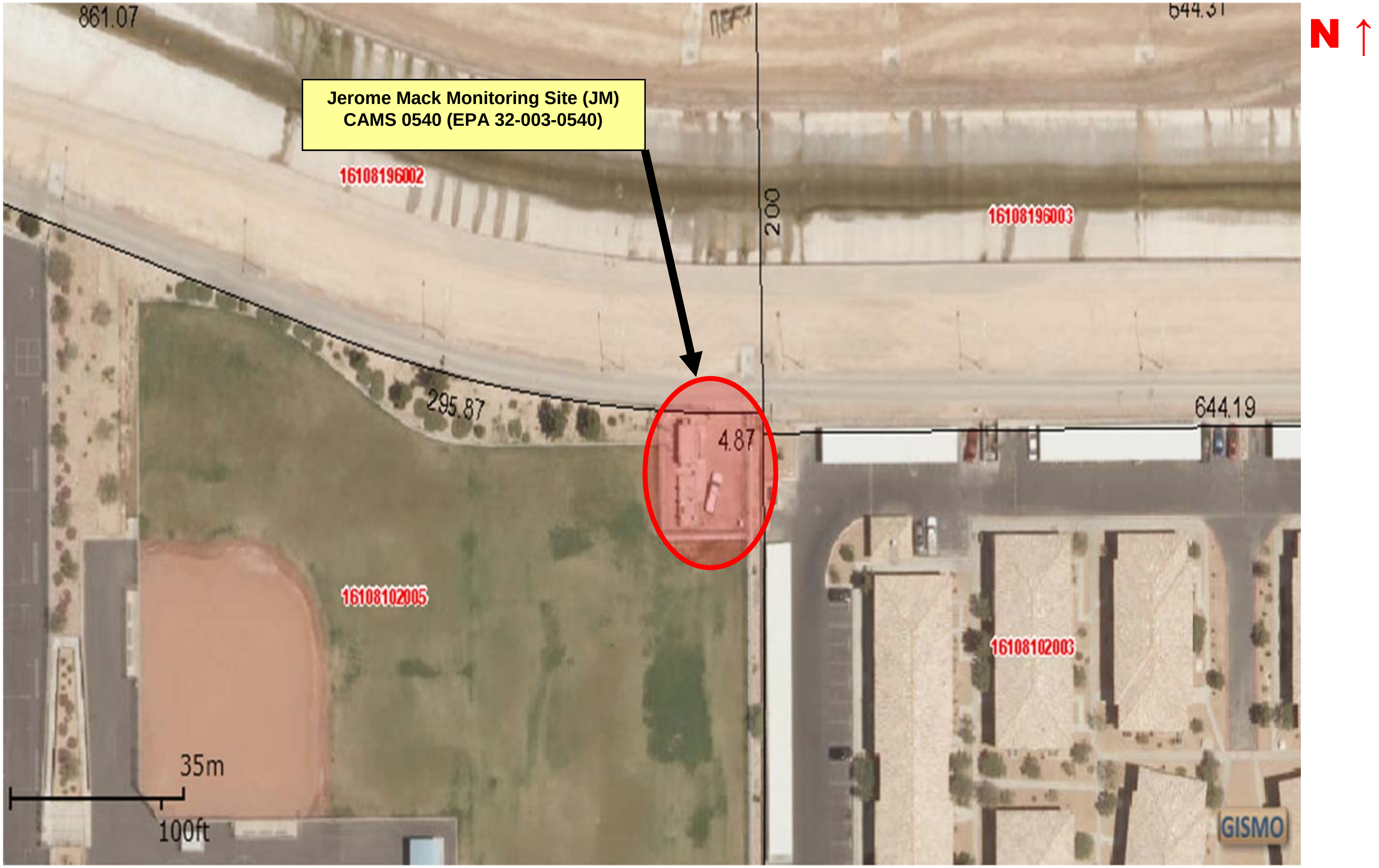


Figure 109. Jerome Mack monitoring site (aerial view 1).

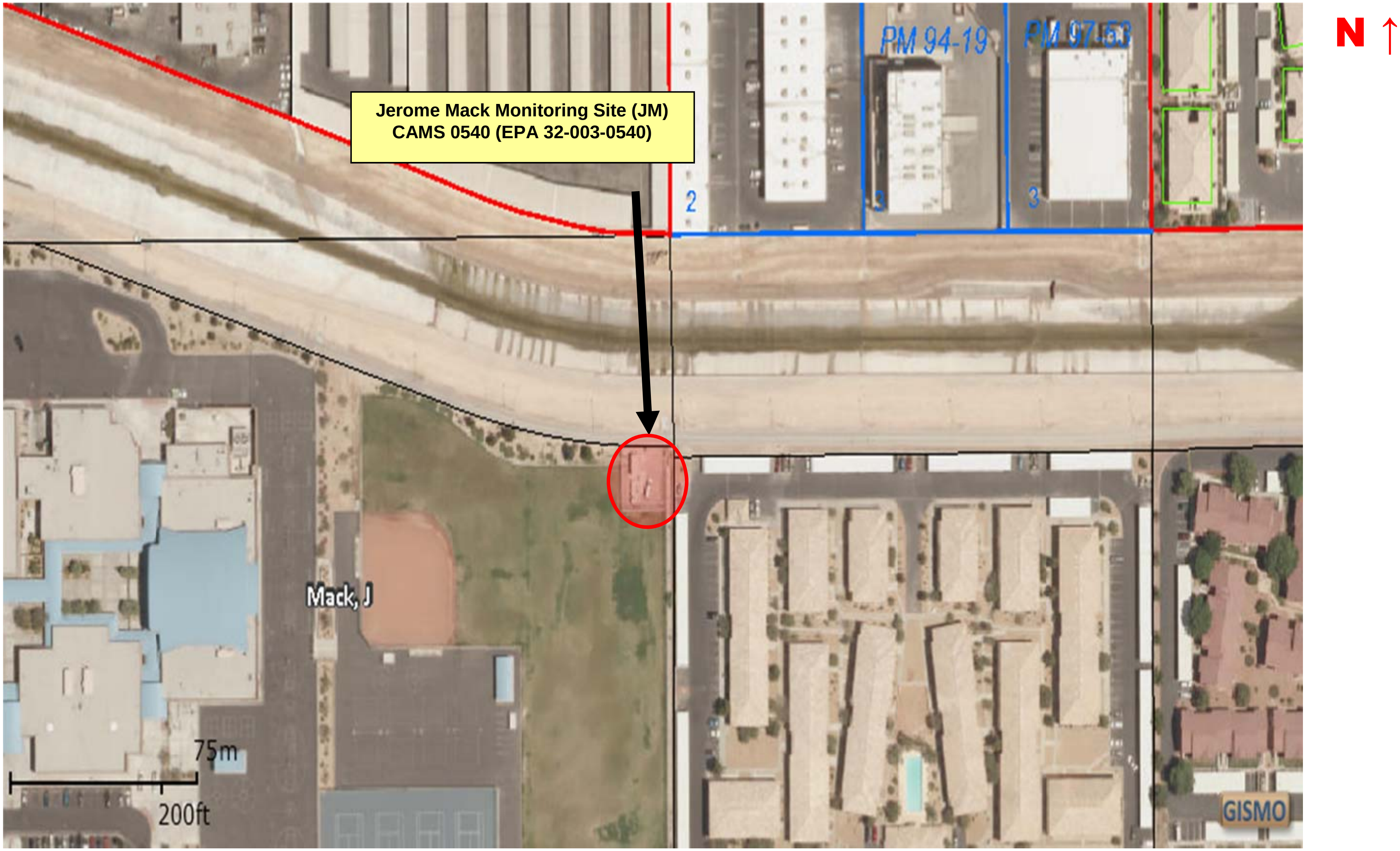


Figure 110. Jerome Mack monitoring site (aerial view 2).

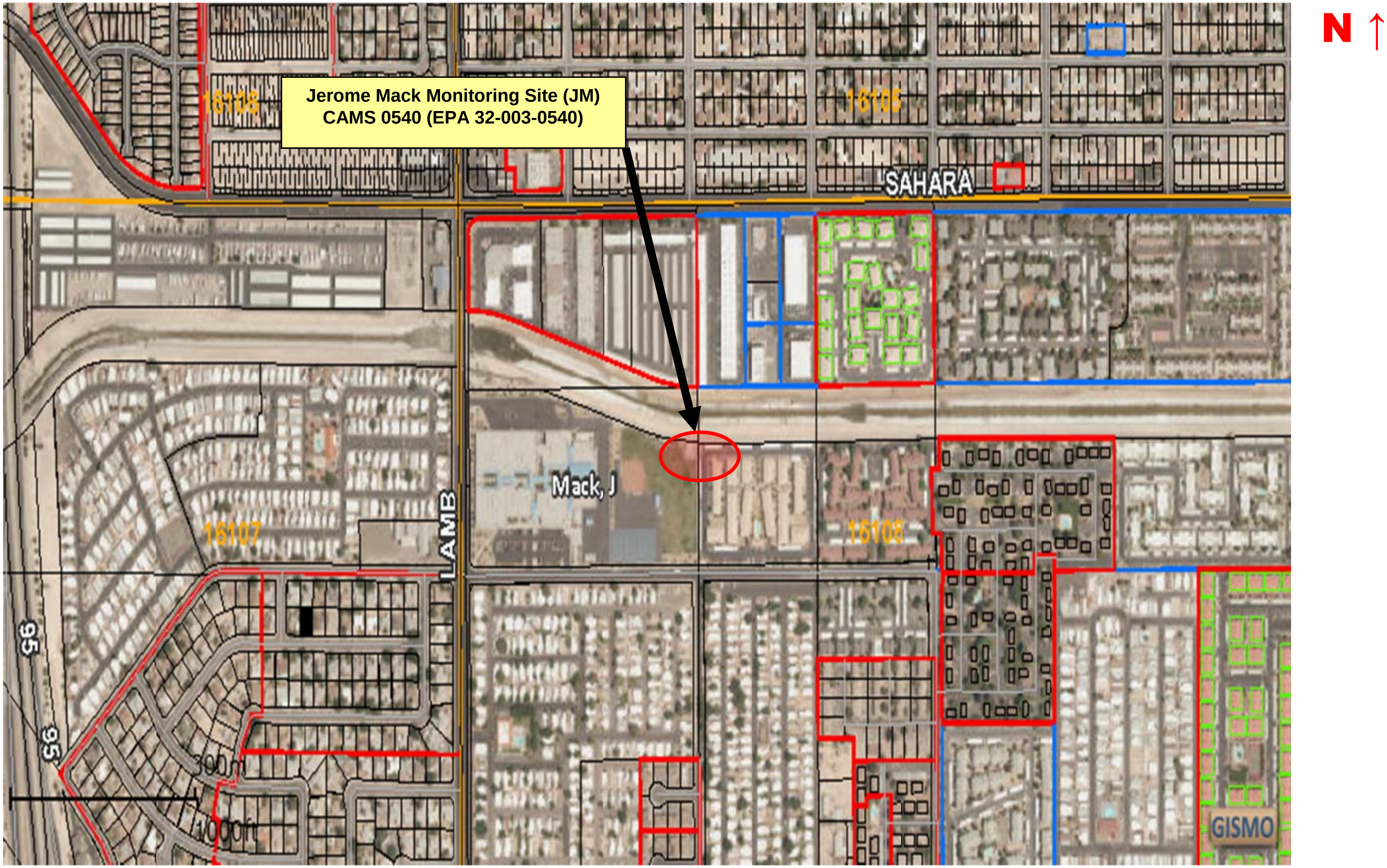


Figure 111. Jerome Mack monitoring site (aerial view 3).

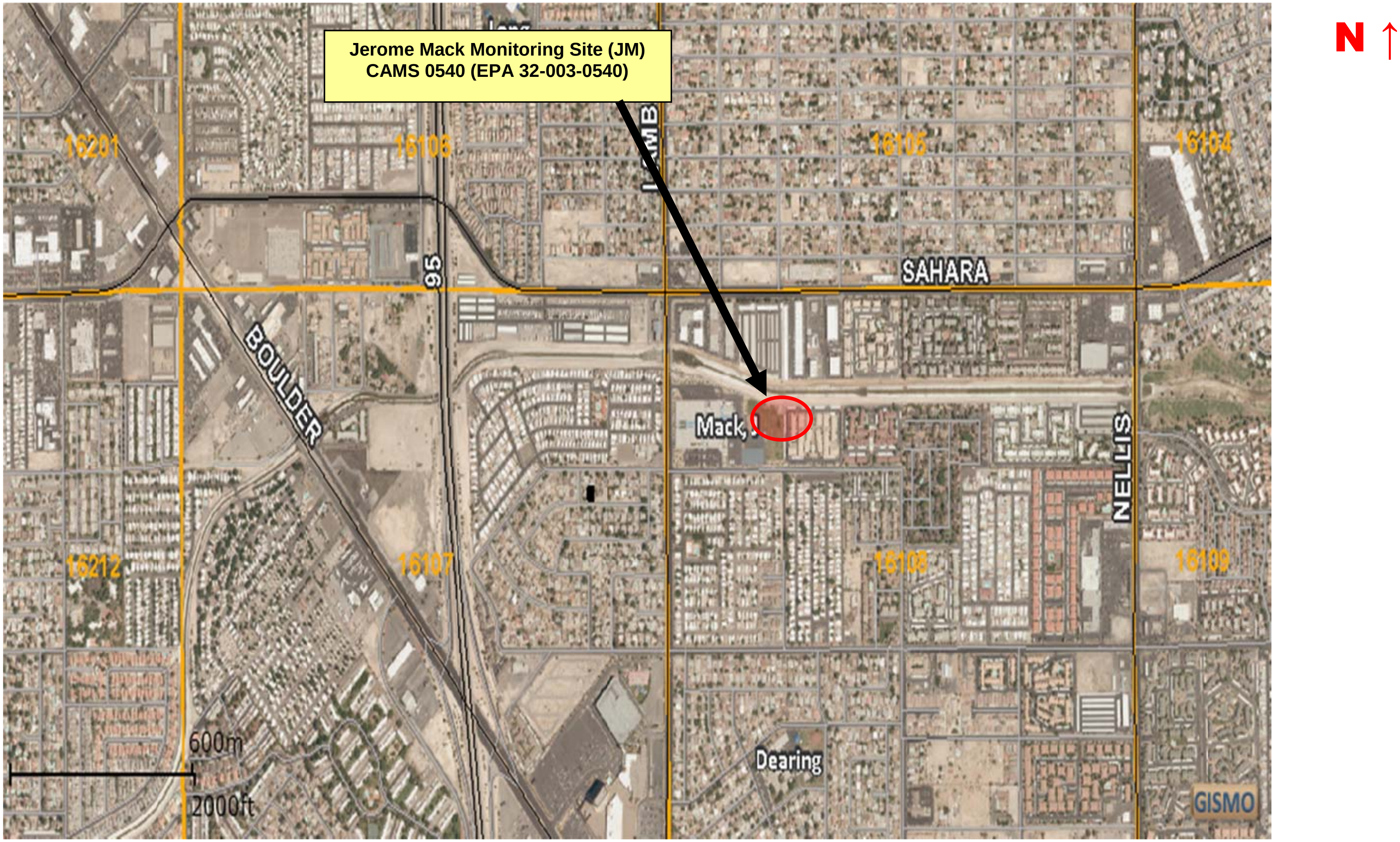


Figure 112. Jerome Mack monitoring site (aerial view 4).

4.3 SUNRISE ACRES

The Sunrise Acres monitoring site (CAMS 0561, EPA 32-003-0561) (Figure 113) is located in the east-central part of the Las Vegas Valley (Figure 6), in a predominantly older urban development area. Most of the apartments and single-family housing units were built from the 1940s to early 1980s. Figures 114–117 provide aerial views of the site, whose purpose is to monitor neighborhood-scale spatial emissions of PM_{10} from sources in the area. The site's monitoring objective is classified as population exposure, and it provides a good insight into predominant air quality trends. There are major transportation routes within the vicinity of the monitoring site: Eastern Boulevard, a major arterial, is located less than 576 feet to the west, and U.S. Highway 95 is located approximately 1,400 feet to the north. Both roads are heavily traveled most of the day.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a moderate contributor to PM emissions at the site. A Clark County School District automotive maintenance yard sits immediately to the north. The lack of current new land development or redevelopment in the immediate vicinity has resulted in a decrease of PM emissions in the area. The monitoring station is located inside a fenced compound, and the adjacent area is primarily comprised of paved parking lots and fenced stabilized vacant land. The predominant wind direction is normally southwest. The predominant wind direction during the transported dust event was from the southeast to the northwest, i.e., from northwest Arizona and southeast California through the Eldorado Valley and southern portions of California through Jean, Nevada. From Jean, the transported dust blew into the Las Vegas Valley from the south to the southeast, toward this site. Dust from the transported event affected the site with a measured 24-hour PM_{10} value of 267 $\mu g/m^3$ on April 15 (the highest exceedance concentration for the day).

Figure 113. Sunrise Acres monitoring site (street view).

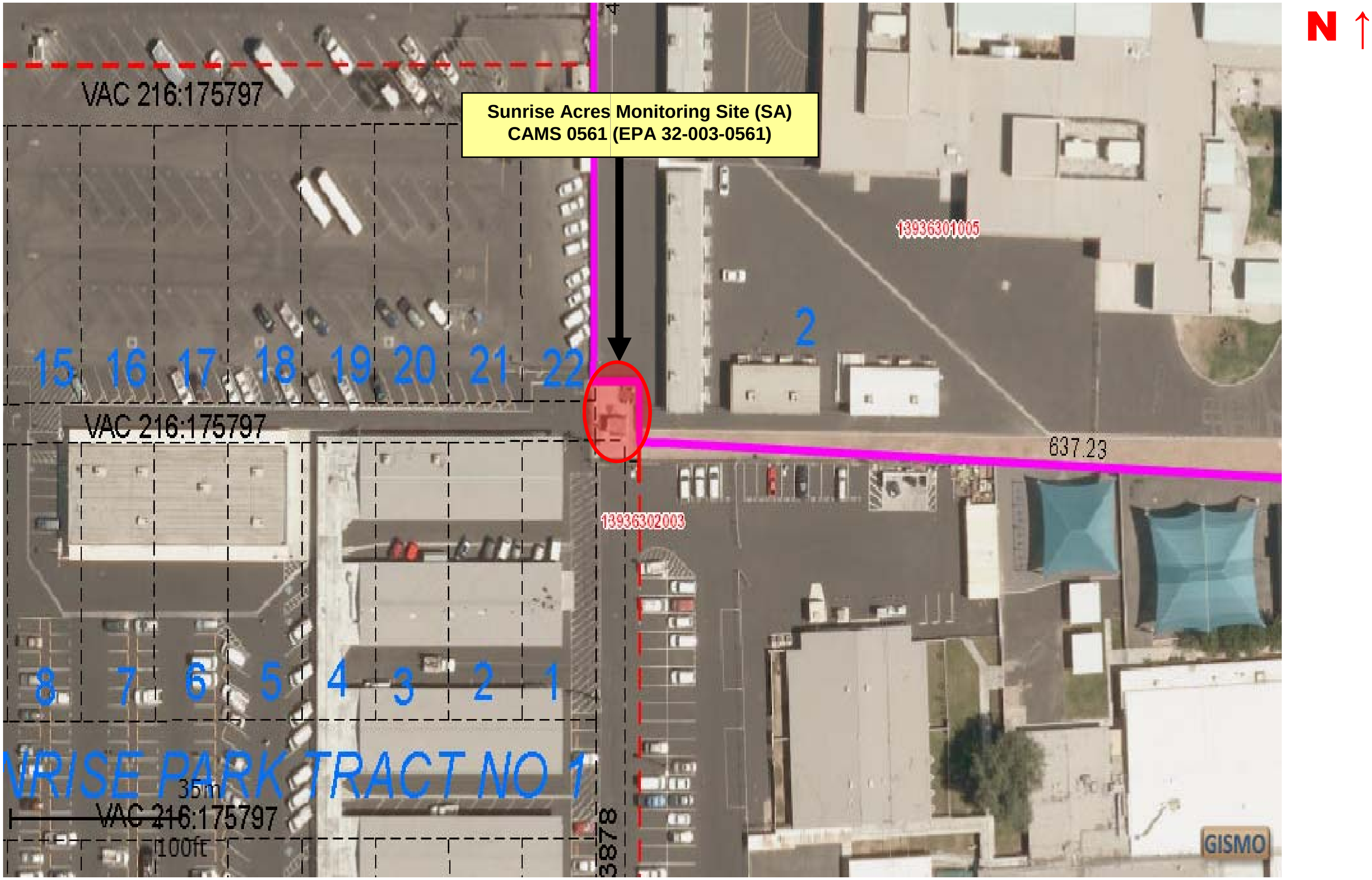


Figure 114. Sunrise Acres monitoring site (aerial view 1).

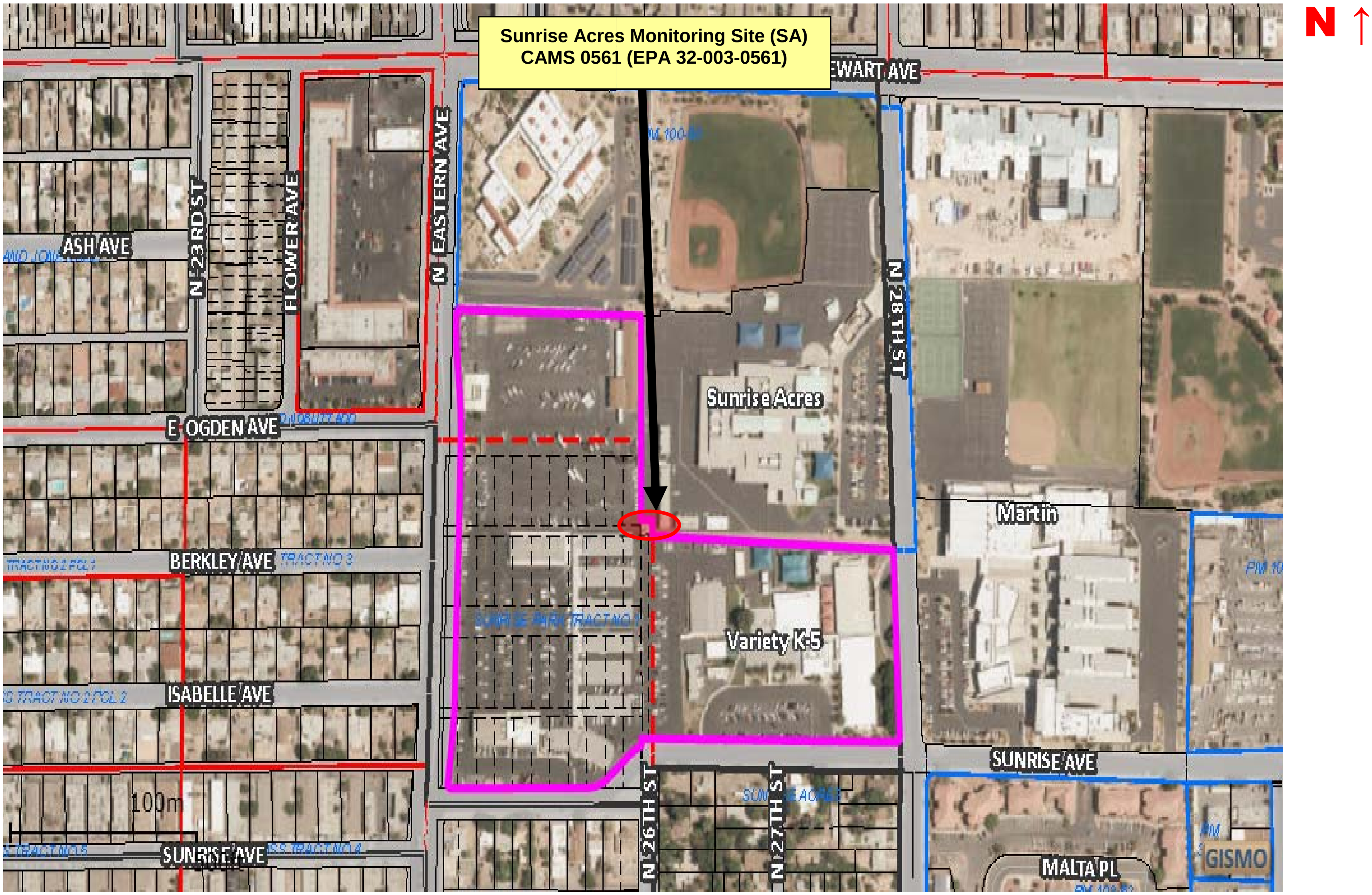


Figure 115. Sunrise Acres monitoring site (aerial view 2).

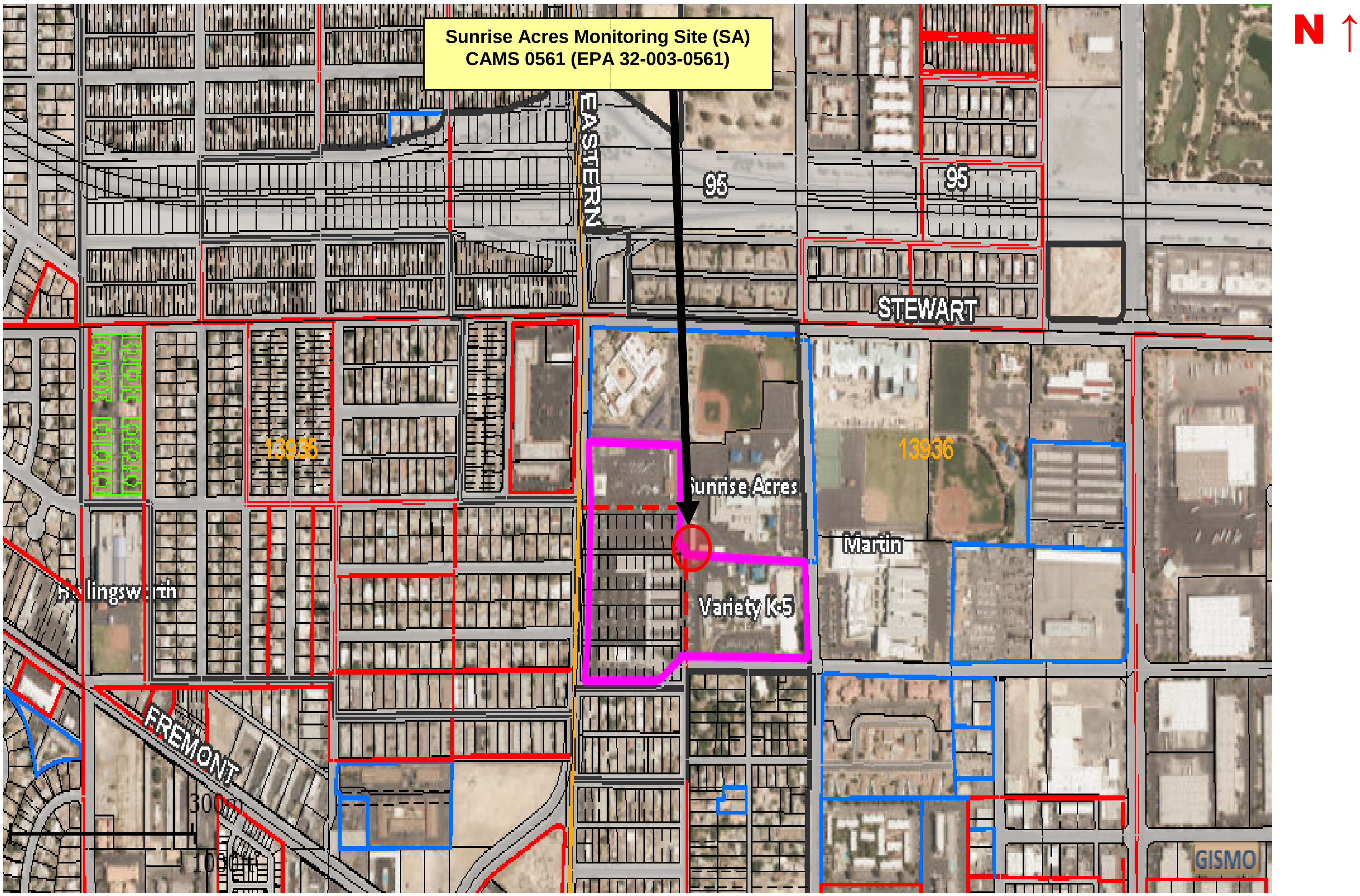


Figure 116. Sunrise Acres monitoring site (aerial view 3).

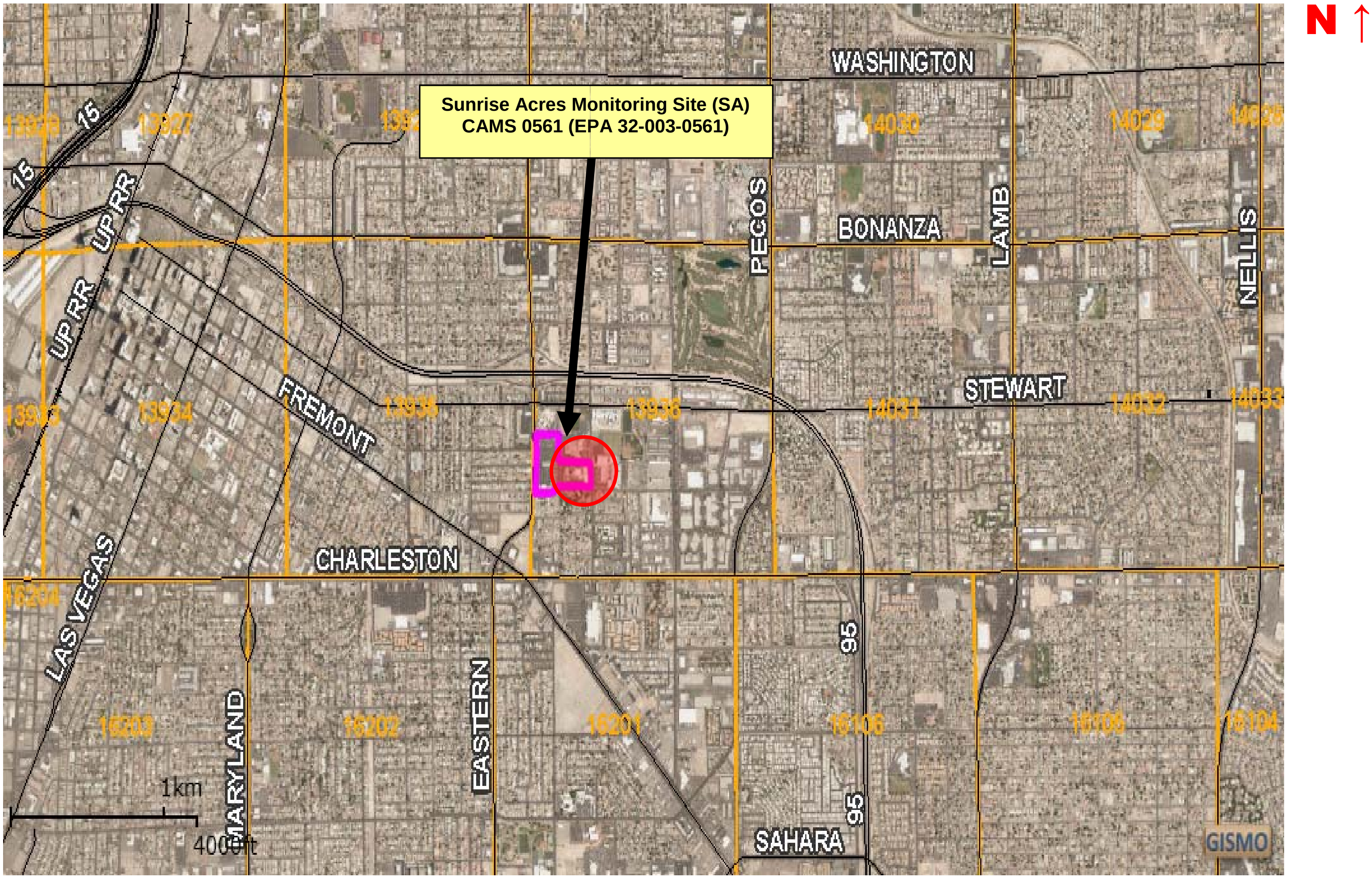


Figure 117. **Sunrise Acres monitoring site (aerial view 4).**

4.4 J. D. SMITH

The J. D. Smith monitoring site (CAMS 2002, EPA 32-003-2002) (Figure 118) is located in the northeast part of the Las Vegas Valley (Figure 6), in a predominantly residential area. Figures 121–122 provide aerial views of the site, whose purpose is to monitor spatial-scale neighborhood emissions of PM_{10} from individual sources in the area. The nearest cross streets are Tonopah and Bruce, which get their traffic influences primarily from personal vehicles and small trucks delivering to the three schools in the area.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a small contributor to PM emissions at the site, whose monitoring objective is classified as population exposure. The lack of current new land development or redevelopment in the immediate vicinity has resulted in a decrease of PM emissions in the area. DAQ checked nearby sources to ensure they are fenced and stabilized. Some sources and land uses to the north, east, southeast, and west, even though well stabilized, may cause elevated dust conditions when high-wind thresholds occur. The predominant wind direction is normally southwest. The predominant wind direction during the transported dust event was from the southeast to the northwest, i.e., from northwest Arizona and southeast California through the Eldorado Valley and southern portions of California, through Jean, Nevada. From Jean, the transported dust blew into the Las Vegas Valley from the south to the southeast, toward this site. The site exceeded with a 24-hour PM_{10} concentration of 237 $\mu g/m^3$.

Figure 118. J. D. Smith monitoring site (street view).

N ↑

Figure 119. J. D. Smith monitoring site (aerial view 1).

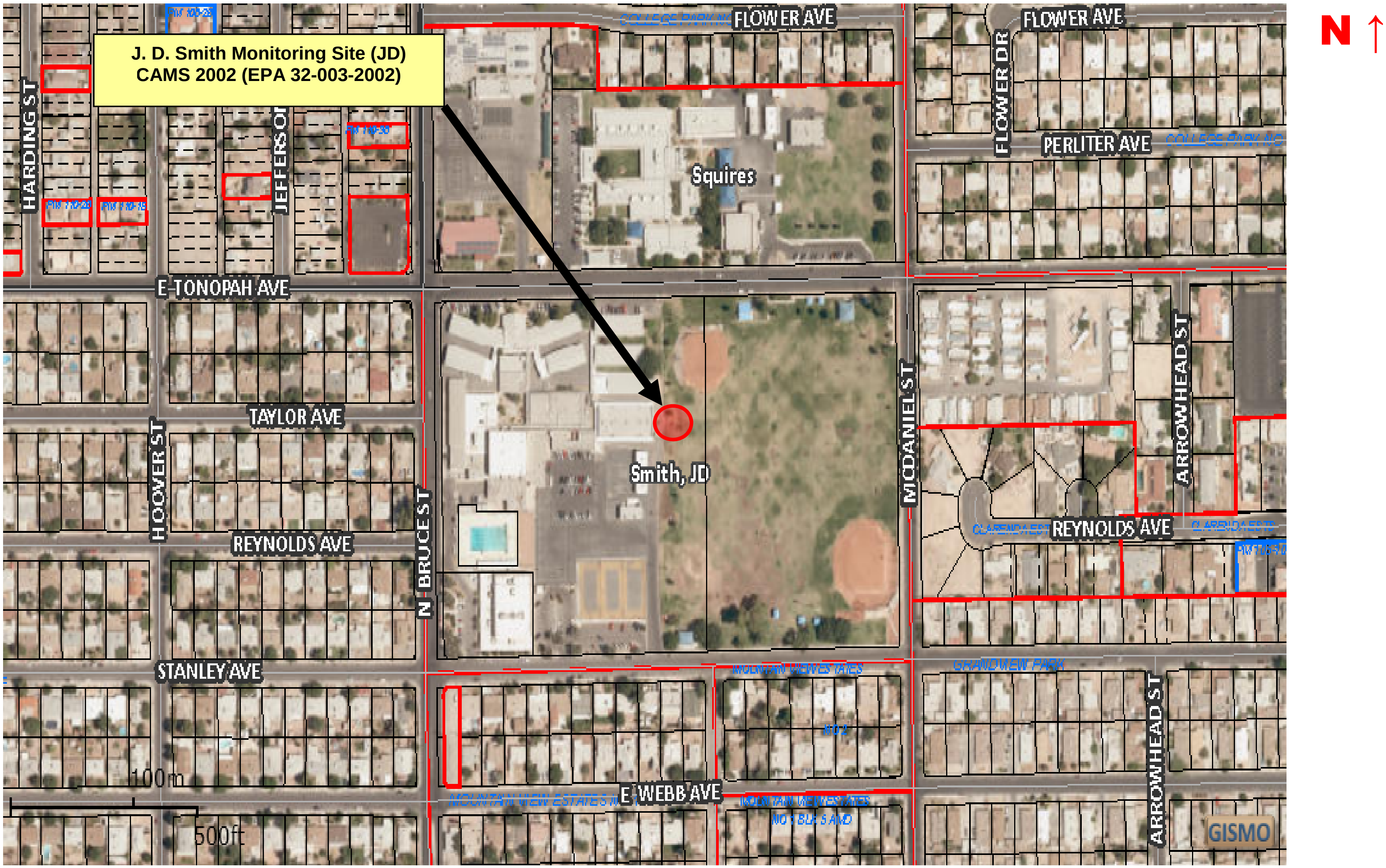


Figure 120. **J. D. Smith monitoring site (aerial view 2).**

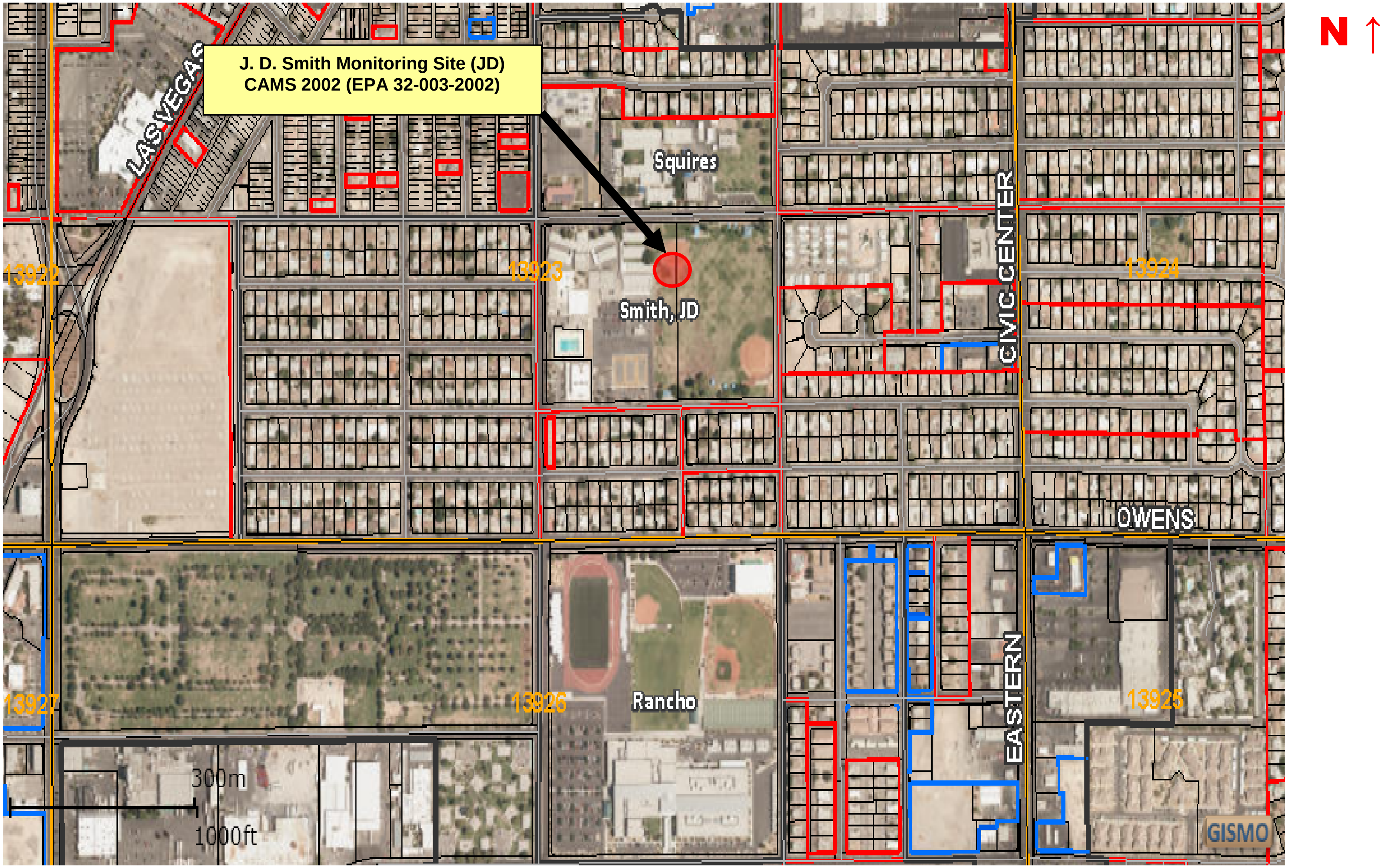


Figure 121. **J. D. Smith monitoring site (aerial view 3).**

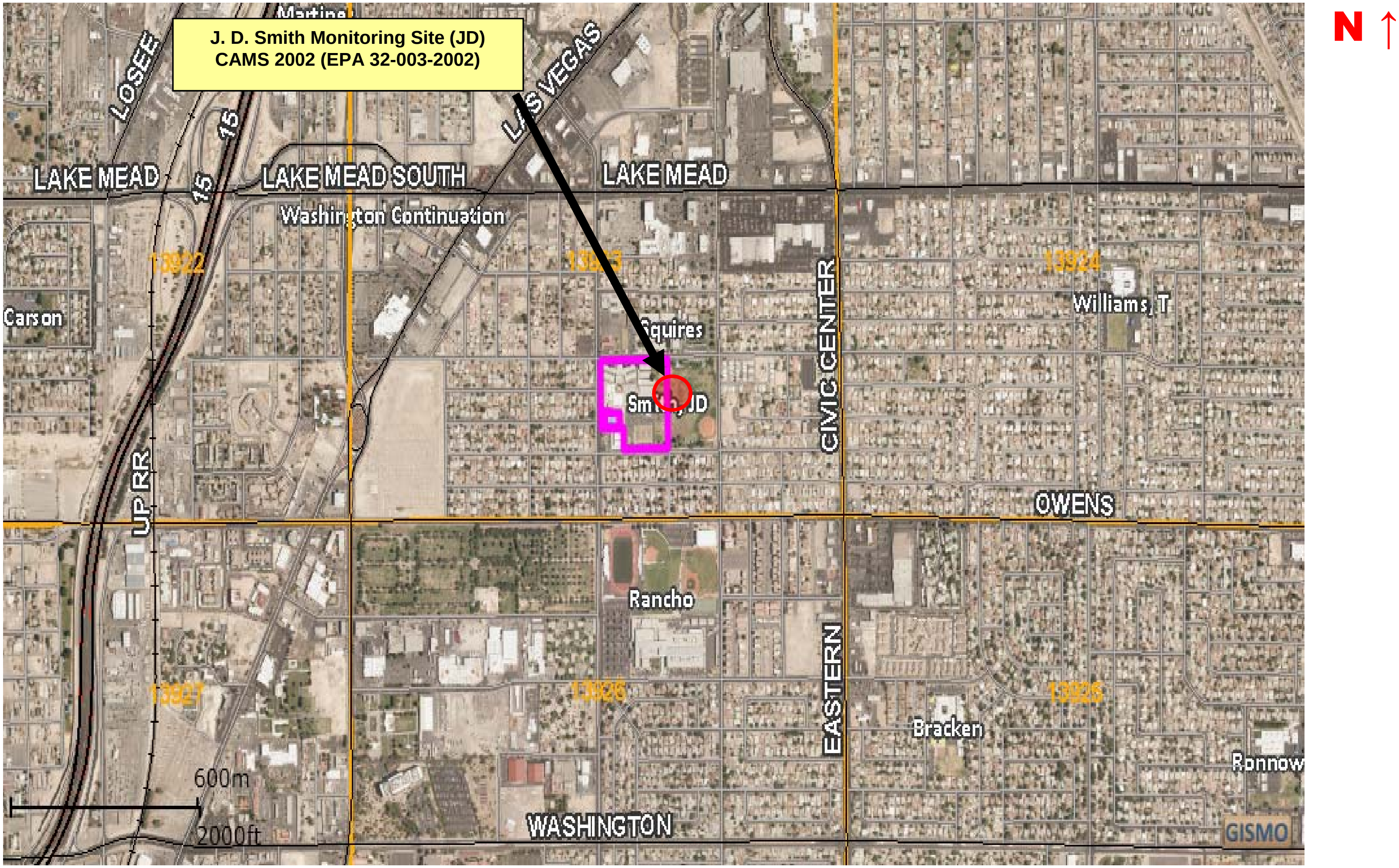


Figure 122. J. D. Smith monitoring site (aerial view 4).

4.5 JOE NEAL

The Joe Neal monitoring site (CAMS 0075, EPA 32-003-0075) (Figure 123) is located in the northwest and central part of the Las Vegas Valley (Figure 6), in a city park next to a middle school. The area is predominantly residential, with commercial amenities nearby. Figures 124–127 provide aerial views of the site, whose purpose is to monitor neighborhood-scale spatial emissions of PM_{10} from individual sources in the area. The site's monitoring objective is classified as population exposure, and it provides a good insight into predominant air quality trends for the citizens northwest and central of the city of Las Vegas. There is a major transportation route (U.S. Highway 95) approximately 1.3 miles northwest of the monitoring site and a heavily traveled beltway (I-215) approximately 423 meters due north of the site.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a moderate contributor to PM emissions at the site. There is native desert and vacant, undeveloped land in the area of influence around the site, which has blocked accesses, is fenced, and is stabilized. The lack of current new land development or redevelopment in the immediate vicinity has resulted in an area-wide decrease of PM emissions. DAQ checked nearby sources to ensure they are fenced and stabilized. The monitoring station is located inside a fenced compound surrounded by a city park and a large, grass play area at the middle school. The predominant wind direction is normally northwest. The predominant wind direction during the transported dust event was from the southeast to the northwest, i.e., from northwest Arizona and southeast California through the Eldorado Valley and southern portions of California, through Jean, Nevada. From Jean, the transported dust blew into the Las Vegas Valley from the south to the southeast, toward the northwest, on its way out of the valley. Lower levels of dust arrived at this site compared to other sites located on the east side of the Las Vegas Valley due to earlier deposition of dust at sites southeast of its location. The site measured a 24-hour PM_{10} value of 226 $\mu g/m^3$ on April 15.

Figure 123. Joe Neal monitoring site (street view).

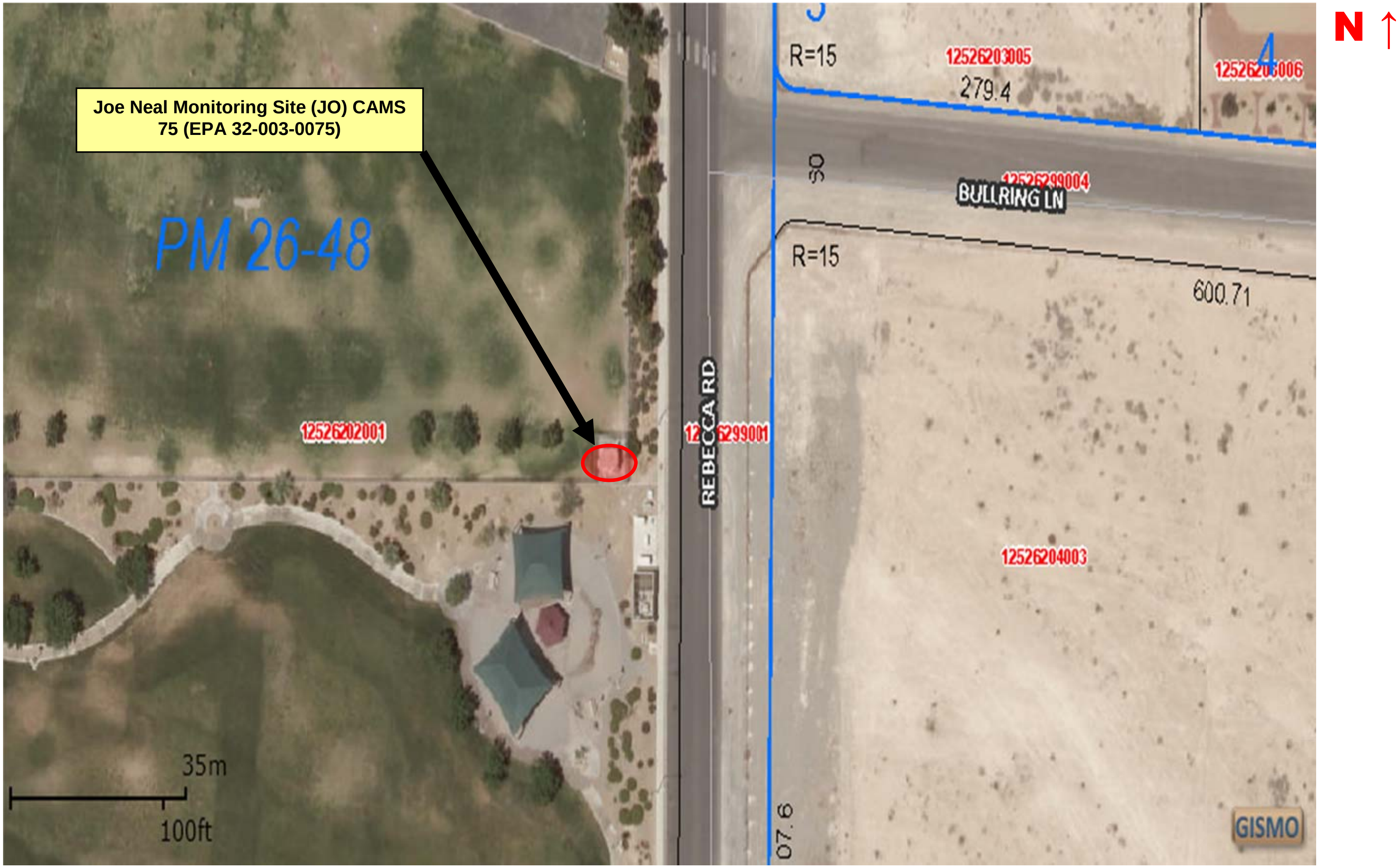


Figure 124. **Joe Neal monitoring site (aerial view 1).**

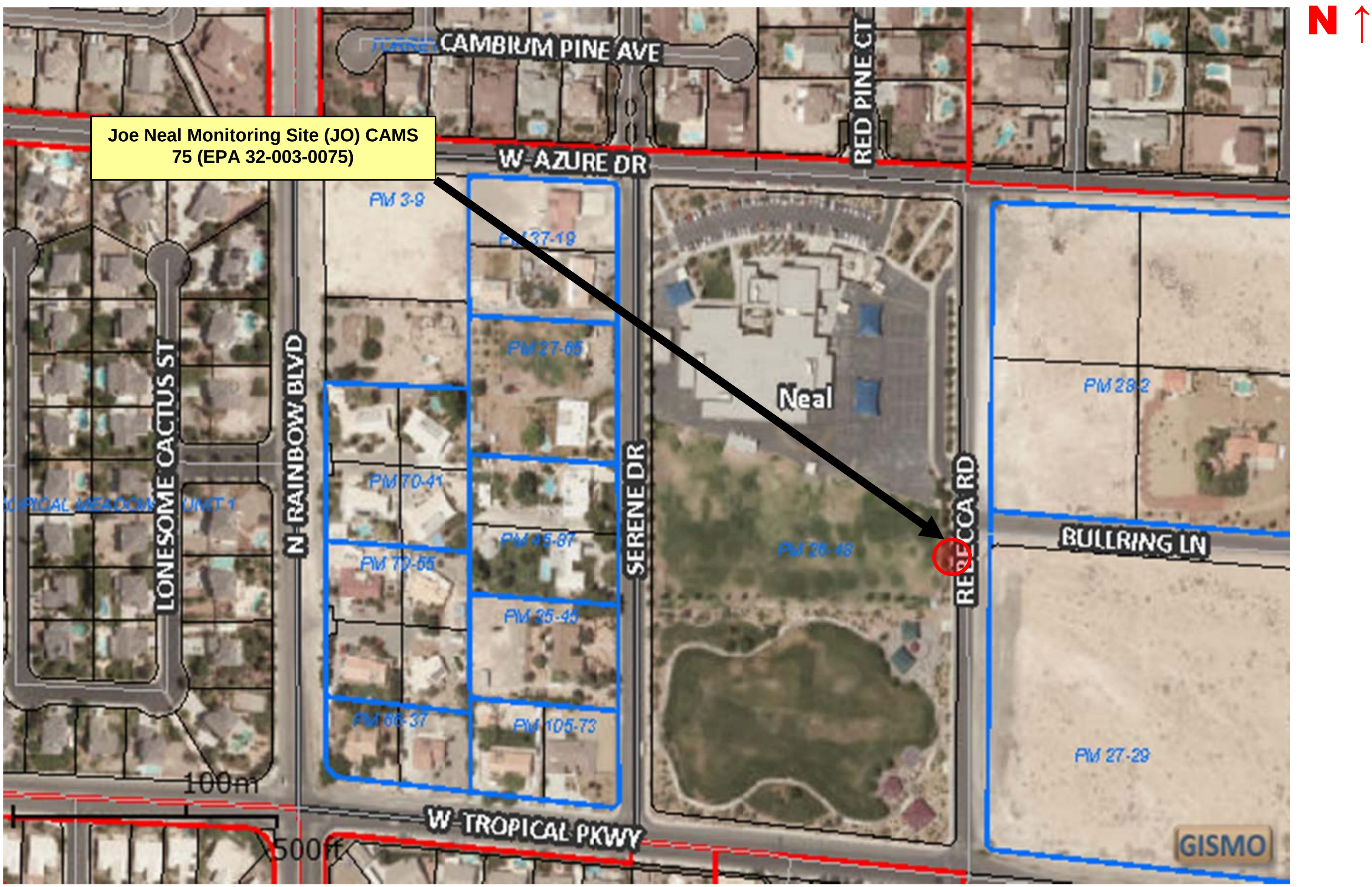


Figure 125. **Joe Neal monitoring site (aerial view 2).**

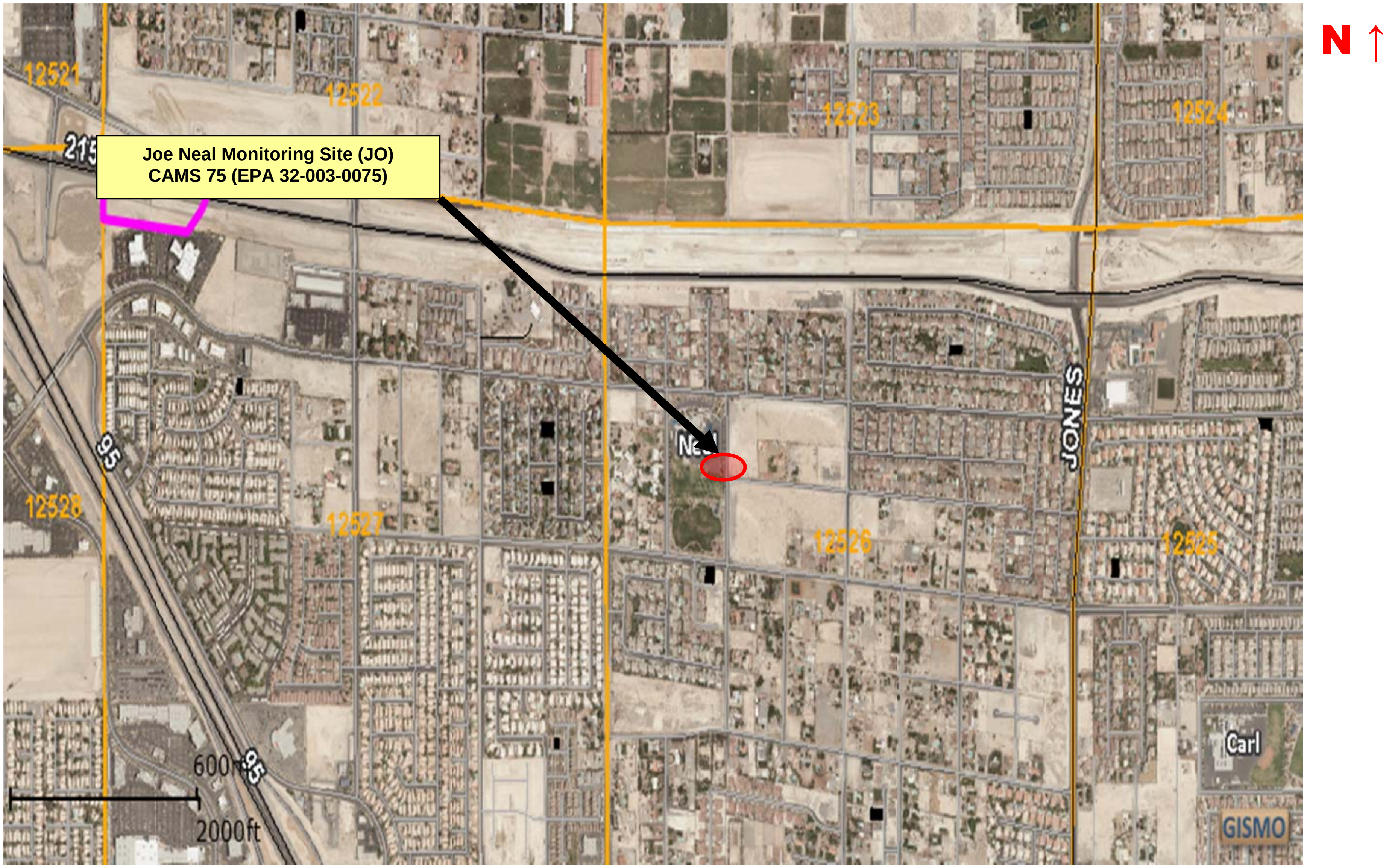


Figure 126. Joe Neal monitoring site (aerial view 3).

N ↑

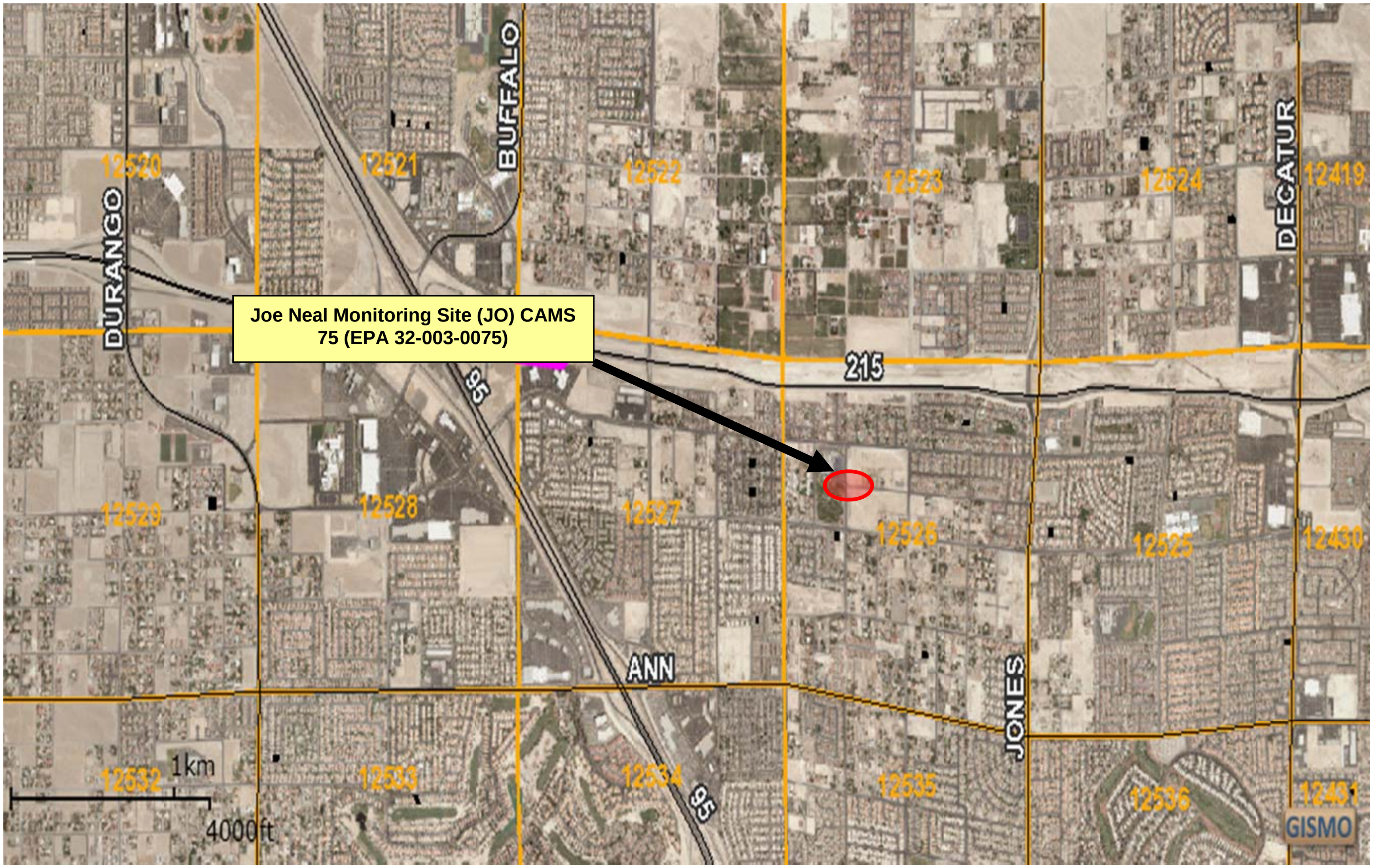


Figure 127. Joe Neal monitoring site (aerial view 4).

4.6 GREEN VALLEY

The Green Valley monitoring site (CAMS 0298, EPA 32-003-0298) (Figure 128) is located in the southern part of the Las Vegas Valley (Figure 6), in a predominantly residential area with commercial amenities. Figures 129–132 provide aerial views of the site, whose purpose is to monitor middle-scale spatial emissions of PM_{10} from individual sources in the area. A large sports complex/city park and community center surround the site, whose monitoring objective is classified as population exposure. There is no major transportation route in the area.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a small contributor to PM emissions at the site. There is vacant and undeveloped land in the area of influence around the site, which has blocked access and is stabilized. A major drainage easement/flood basin area nearby also has blocked access and is stabilized. The lack of current new land development or redevelopment in the immediate vicinity has resulted in a decrease of PM emissions in the area. DAQ checked nearby sources to ensure they are fenced and stabilized. The sports park has the required soils to keep dust levels down during events, and shows signs of appropriate upkeep. The monitoring station is located inside a fenced compound, and the adjacent parking area is paved. The predominant wind direction is normally southwest. The predominant wind direction during the transported dust event was from the southeast to the northwest. The winds flowed down from around a small mountain range (McCullough Range at 3,332 feet) directly south of the site, and brought the transported dust through this site (Figures 133 and 134.). Due to earlier deposition of dust at sites southeast of its location, the site measured lower concentrations on April 15 than did other sites, with a 24-hour PM_{10} value of 196 $\mu g/m^3$.

Figure 128. Green Valley monitoring site (street view).

Figure 129. **Green Valley monitoring site (aerial view 1).**

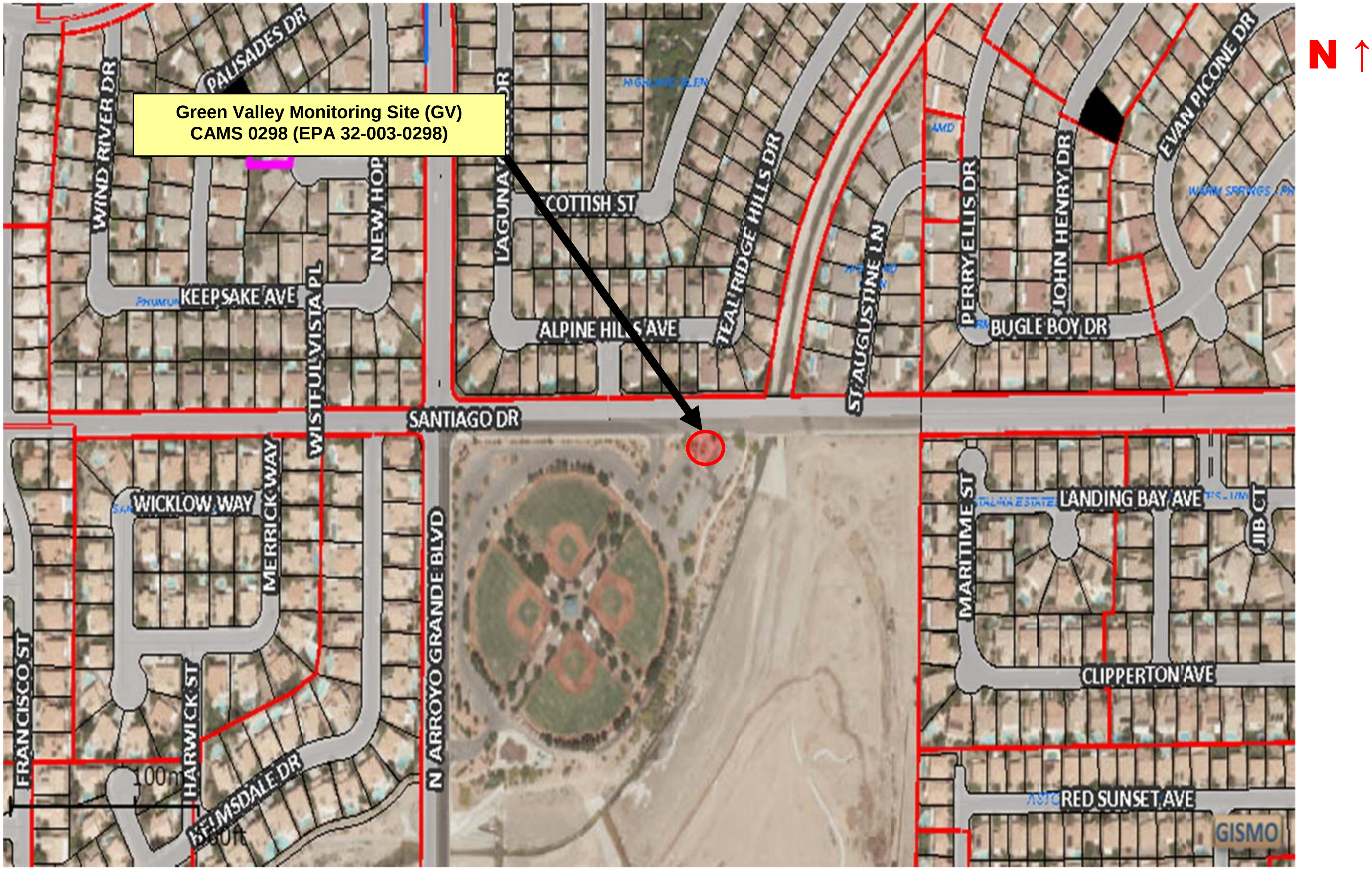


Figure 130. **Green Valley monitoring site (aerial view 2).**

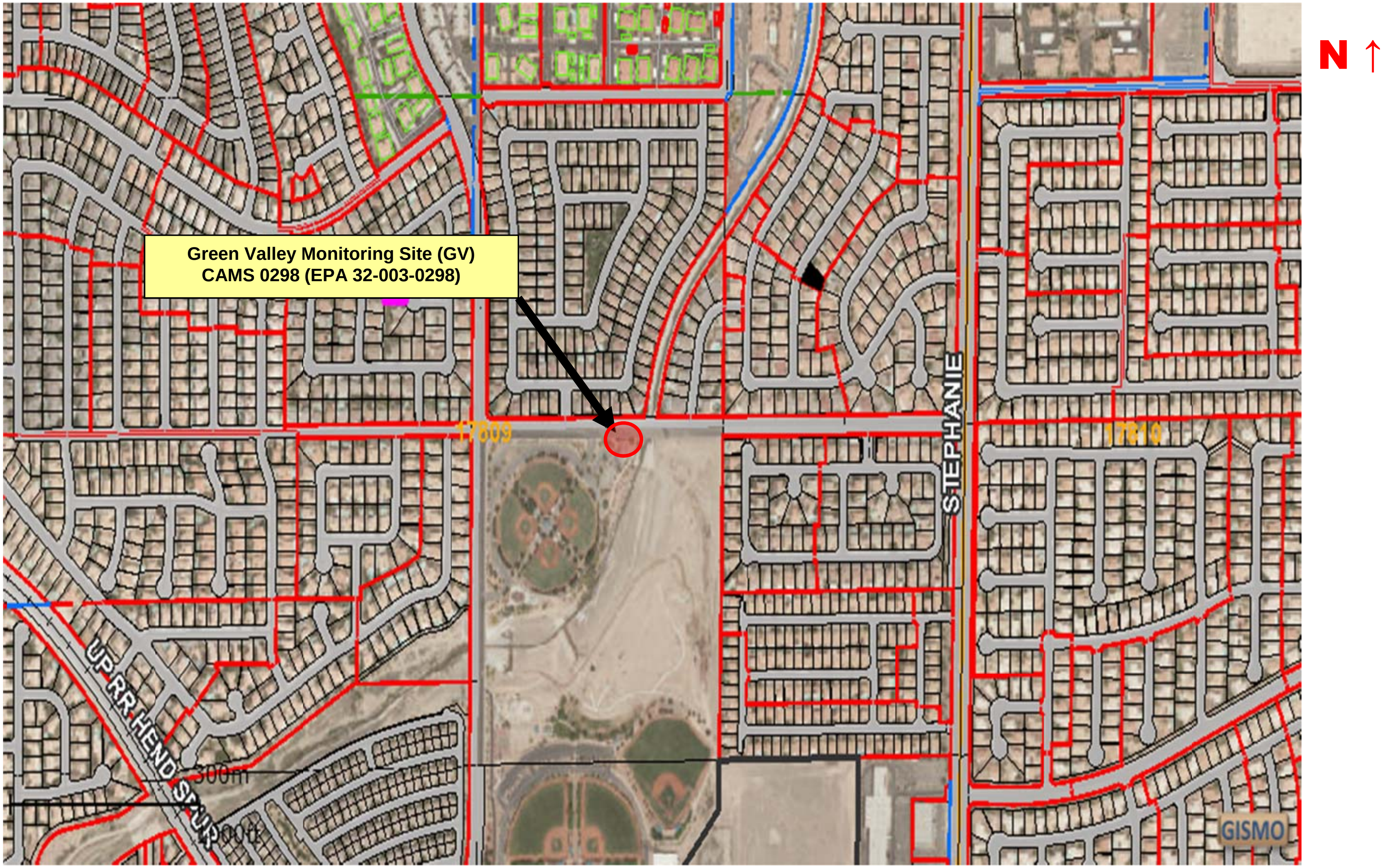


Figure 131. Green Valley monitoring site (aerial view 3).

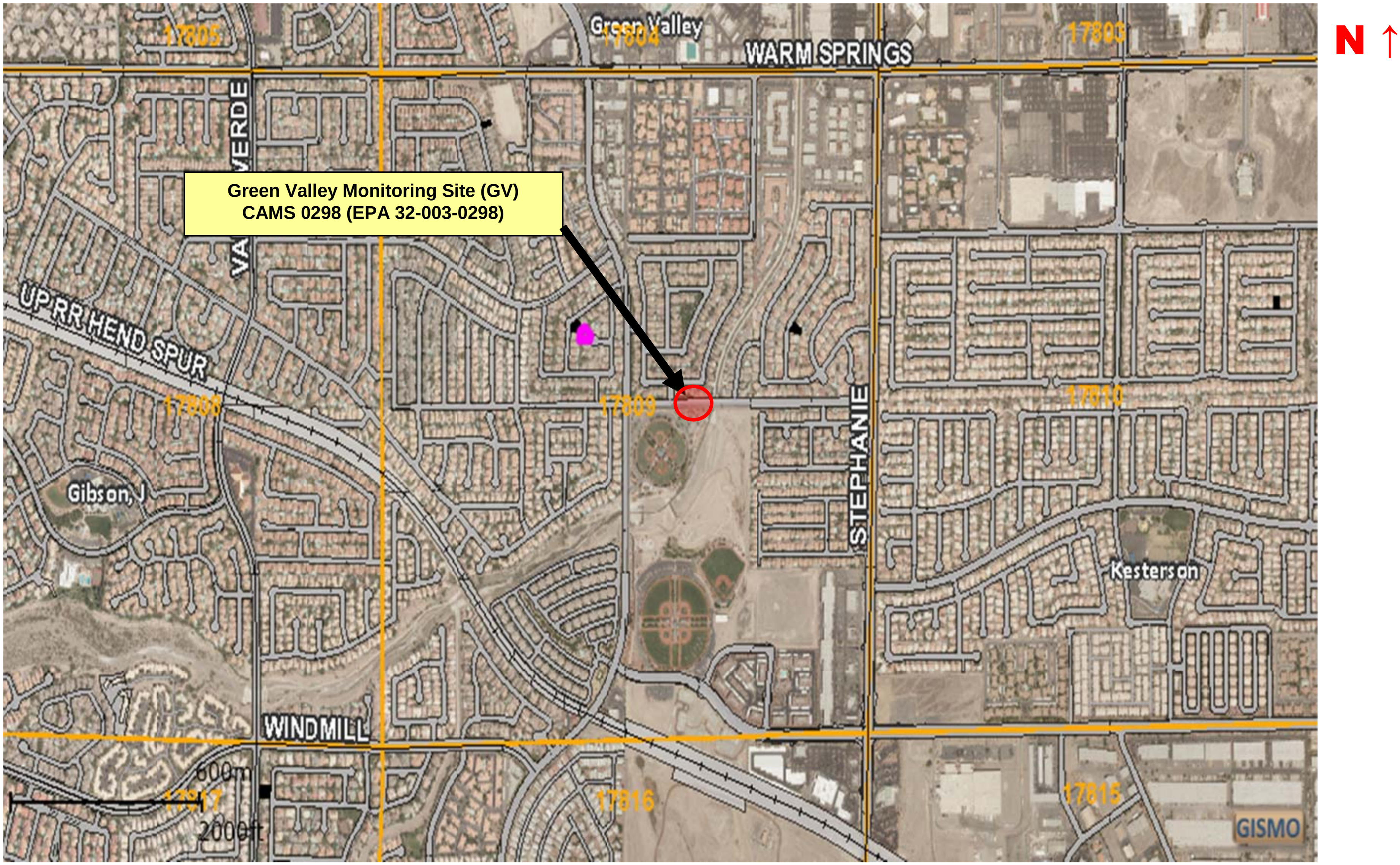


Figure 132. Green Valley monitoring site (aerial view 4).

Figure 133. Outside the Las Vegas Valley, view of high-wind dust flows affecting the Green Valley monitoring site on April 15, 2013.

Figure 134. Inside the Las Vegas Valley, view of Green Valley monitoring site with high-wind dust flows on April 15, 2013.

4.7 PAUL MEYER

The Paul Meyer monitoring site (CAMS 43, EPA 32-003-0043) (Figure 135) is located in the western part of the Las Vegas Valley (Figure 6), in a predominantly residential area with commercial amenities, a sports/city park, a community center, and a school. Figures 136–139 provide aerial views of the site, whose purpose is to monitor spatial-scale neighborhood emissions of PM_{10} from individual sources in the area. The park and community center surround the site, whose objective is classified as population exposure, with a Christian academy and school nearby. There is no major transportation route in the area.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a small contributor to PM emissions at the site. There is no vacant or undeveloped land in the area of influence around the site; the lack of current land development in the immediate vicinity has resulted in a decrease of PM emissions in the area. The sports park is maintained with the required soils to keep dust levels down during events, and shows signs of appropriate upkeep. The school and academy grounds are paved with asphalt. The monitoring station is located within a fenced compound inside the park, and the adjacent parking area is paved. The predominant wind direction is normally southwest. The predominant wind direction during the high-wind transported dust event was from the southeast to the northwest. The wind had dipped down later in the morning than at the other sites and brought a smaller amount of the high-wind transported dust through the site. The site recorded a 24-hour PM_{10} exceedance concentration of 164 µg/m^3 due to the site's location, which was on the periphery of the dust storm.

Figure 135. Paul Meyer monitoring site (street view).

Figure 136. **Paul Meyer monitoring site (aerial view 1).**

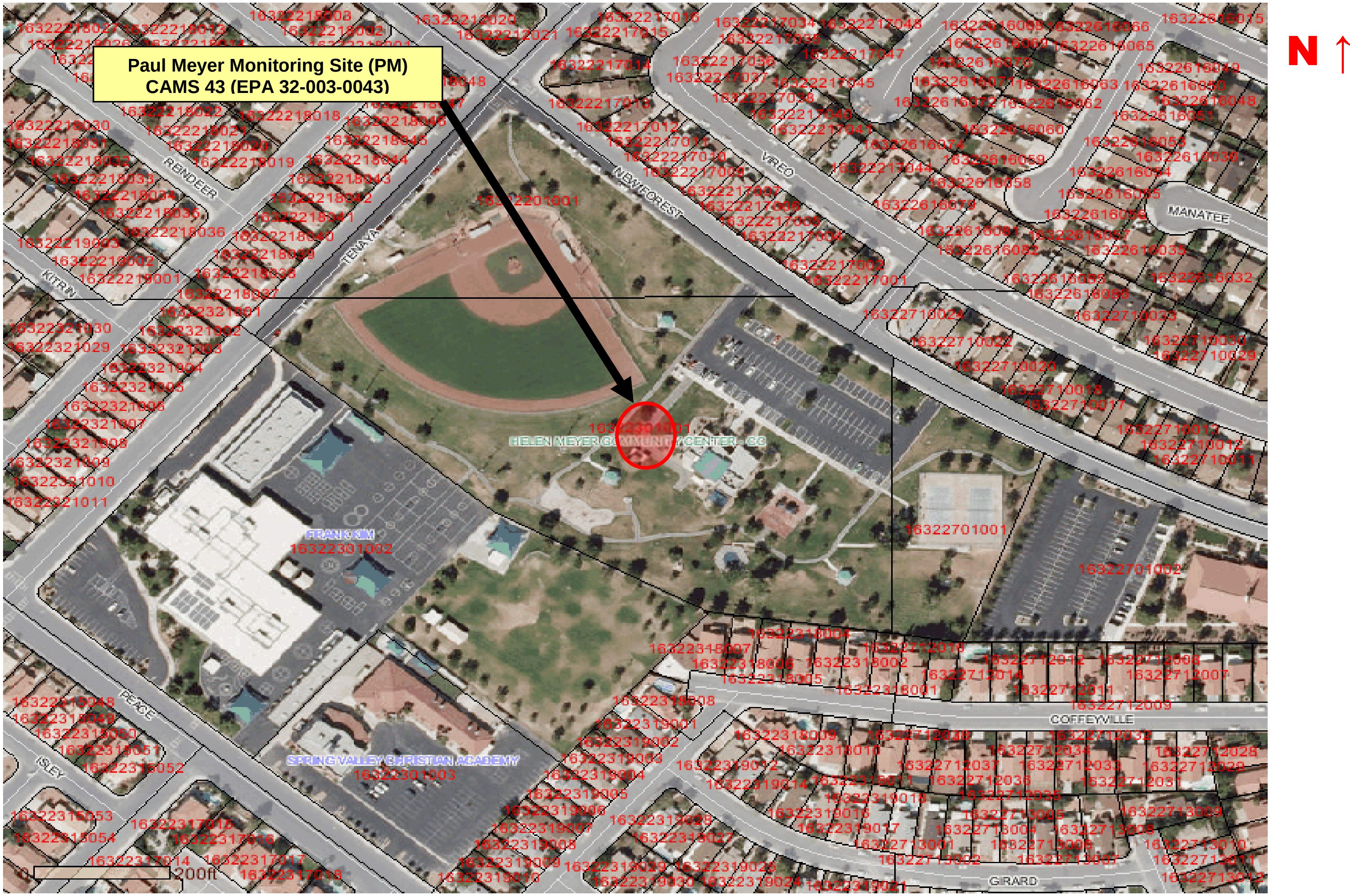


Figure 137. Paul Meyer monitoring site (aerial view 2).

Figure 138 Paul Meyer monitoring site (aerial view 3).

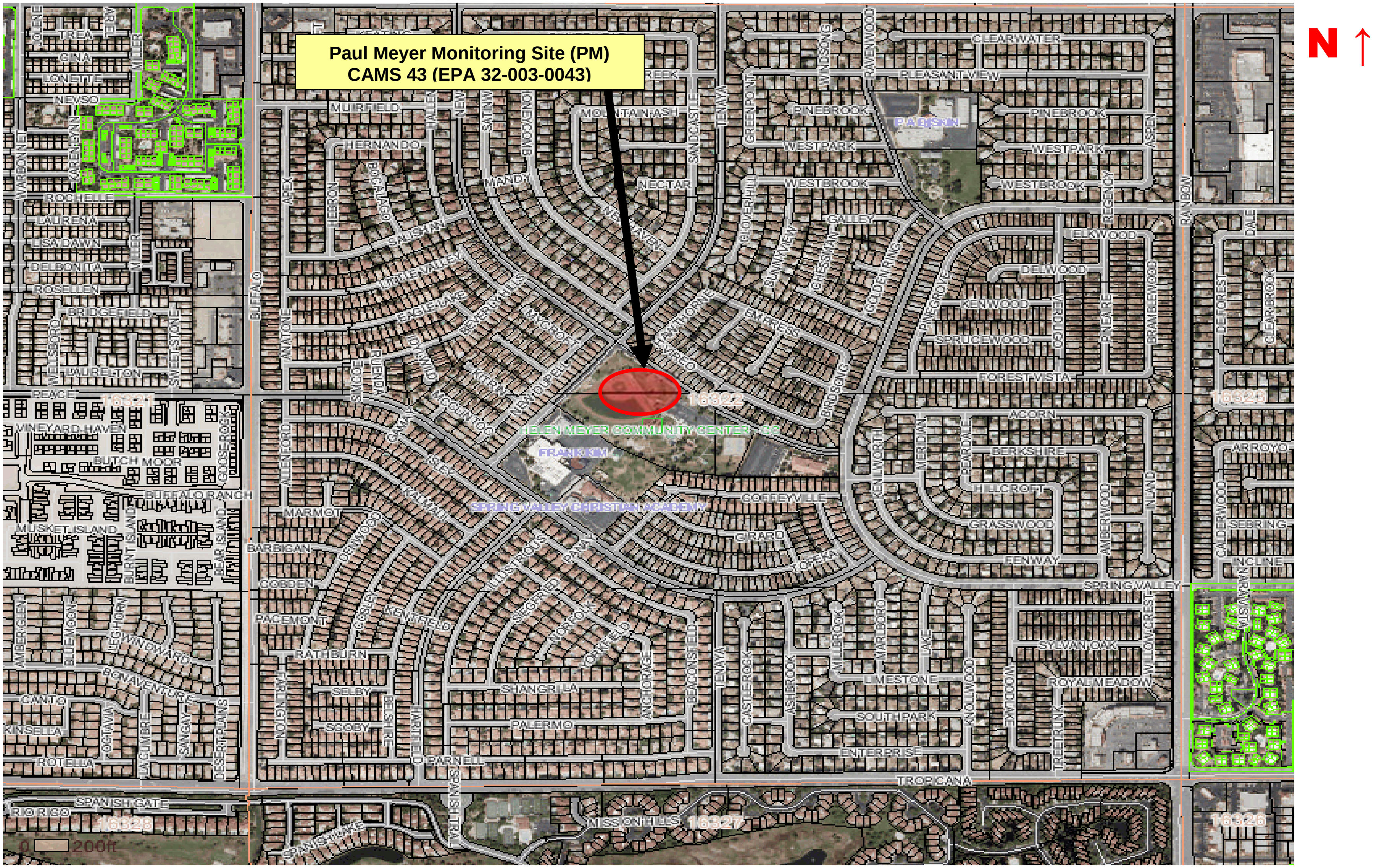


Figure 139. **Paul Meyer monitoring site (aerial view 4).**

4.8 PALO VERDE

The Palo Verde monitoring site (CAMS 73, EPA 32-003-0073) (Figure 140) is located on the western edge of the monitoring network in the Las Vegas Valley (Figure 6), in a predominantly residential area with commercial amenities, a major sports park, a community center, a city library, and a high school. Figures 141–144 provide aerial views of the site, whose purpose is to monitor middle spatial-scale neighborhood emissions of PM_{10} from individual sources in the area. The sports park and community center are immediately west of the site, whose objective is classified as population exposure, with a high school directly south of the site. A heavily traveled beltway (I-215) is 415 meters directly west of the site, and a major arterial (North/South Pavilion Center Drive) runs parallel to the site.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a moderate contributor to PM emissions at the site. There is no vacant or undeveloped land in the area of influence around the site, and the lack of current land development in the immediate vicinity has resulted in a decrease of PM emissions in the area. The sports park is maintained with the required soils to keep dust levels down during events, and shows signs of appropriate upkeep. The school grounds are paved with asphalt. The monitoring station is located within a fenced compound inside the main student parking area, and all adjacent parking areas are paved. The predominant wind direction for the site is normally southwest. The predominant wind direction during the transported dust event was from the southeast to the northwest. A small amount of high-wind transported dust came through this site on its direction northwest and out of the valley. It recorded a PM_{10} exceedance concentration of 212 $\mu g/m^3$ from the periphery of the dust storm.

Figure 140. Palo Verde monitoring site (street view).

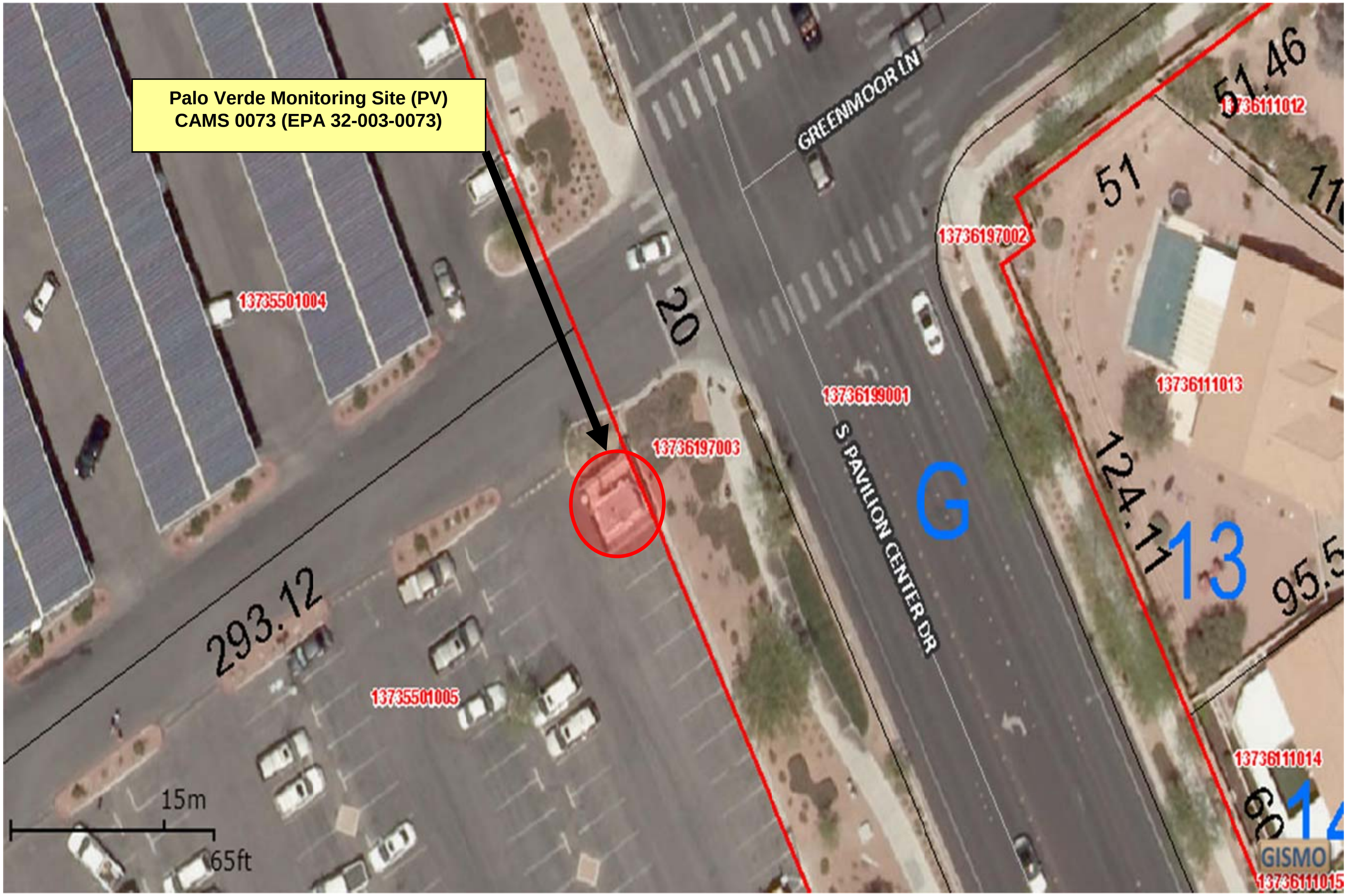


Figure 141. Palo Verde monitoring site (aerial view 1).

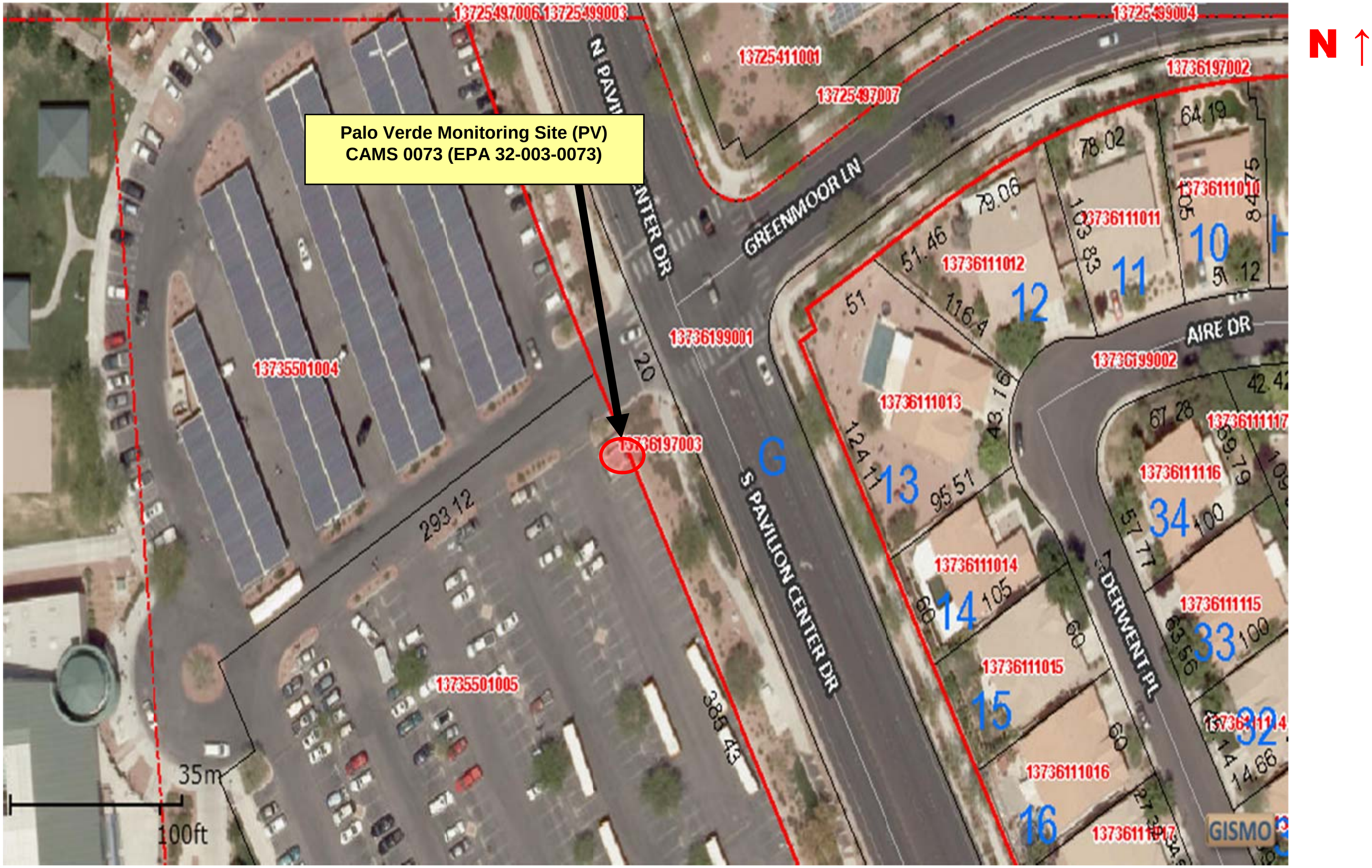


Figure 142. Palo Verde monitoring site (aerial view 2).

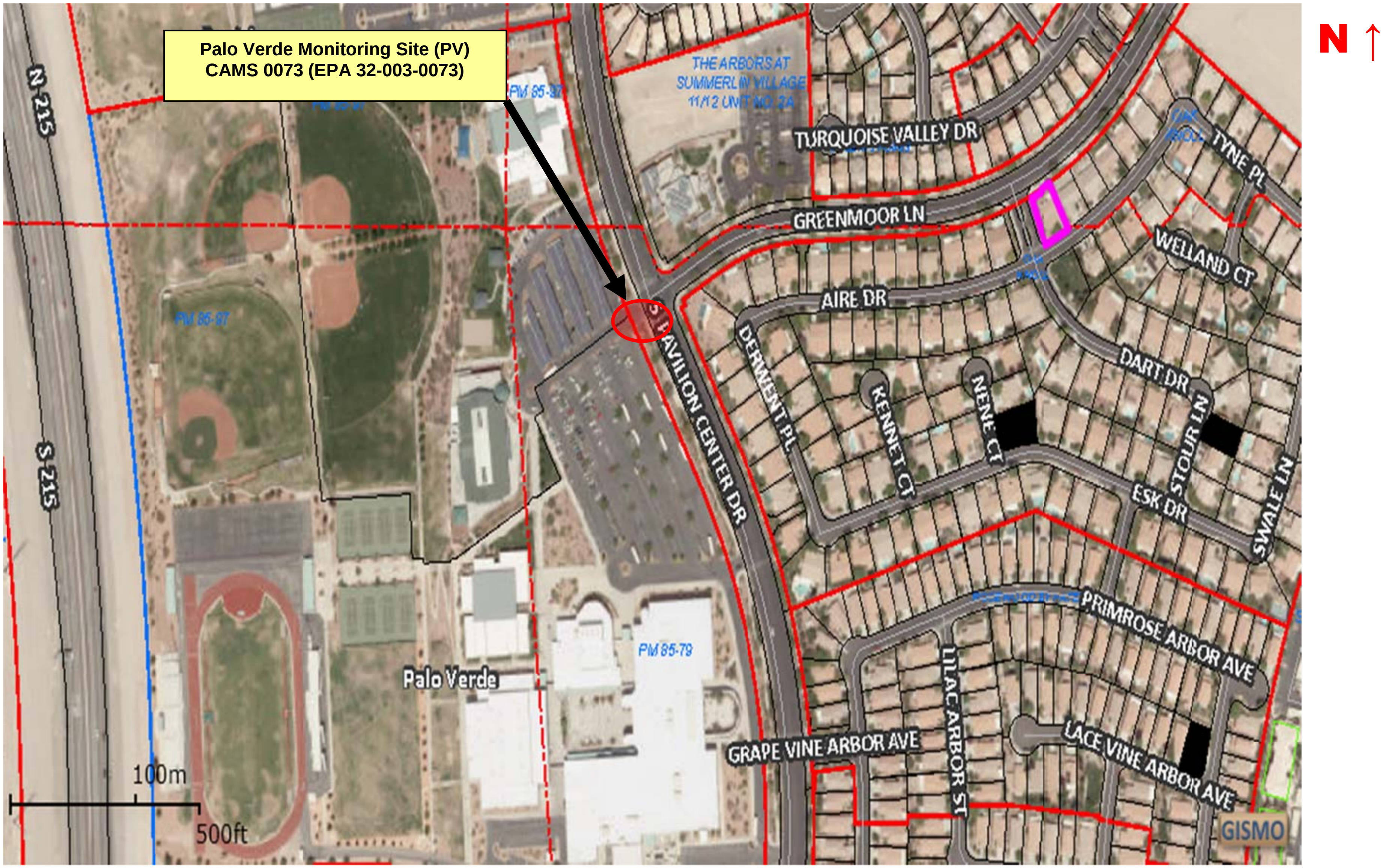


Figure 143. Palo Verde monitoring site (aerial view 3).

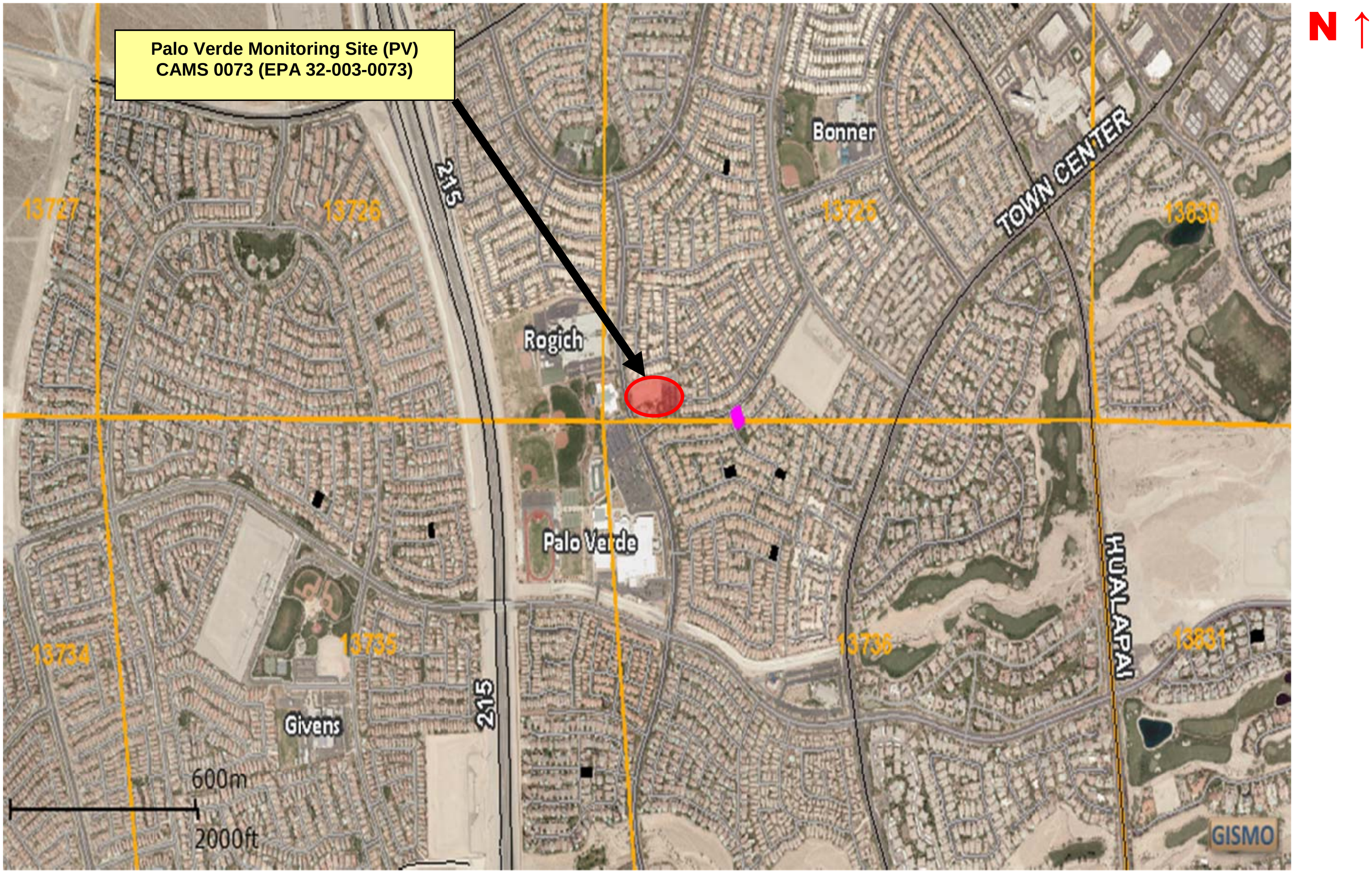


Figure 144. **Palo Verde monitoring site (aerial view 4).**

4.9 JEAN

The Jean monitoring site (CAMS 1019, EPA 32-003-1019) (Figure 145) is located in the south-western part of the Ivanpah Valley, in a predominantly rural area approximately 35 miles from the Las Vegas Valley (Figure 6). Figures 146–149 provide aerial views of the site, whose purpose is to monitor regional-scale spatial emissions of PM_{10} from sources in the area. The site's monitoring objective is classified as background, and it provides a good insight into predominant air quality trends and background. There is a major transportation route (State Route 161) 1,287 meters north of the monitoring site, and heavily traveled I-15 is approximately 3,100 meters to the east.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a moderate contributor to PM emissions at the site. There is native desert and vacant, undeveloped land in the area of influence around the site, which has blocked access and is stabilized. The lack of land development or redevelopment in the immediate vicinity, or any disturbed native desert sources, has resulted in a decrease of PM emissions in the area. The monitoring station is located inside a fenced compound, and the adjacent parking area is predominantly native desert and stabilized with gravel. The predominant wind direction for this site is normally southeast. The predominant wind direction during the high-wind transported dust event was from the southeast to the northwest, from northwest Arizona and southeast California through the southern portions of California to Jean, Nevada. From Jean, the high-wind transported dust blew into the Las Vegas Valley from the south to the southeast. The measured 24-hour PM_{10} exceedance concentration value at this site was 165 $\mu g/m^3$ on April 15.

Figure 145. Jean Monitoring site (street view).

Figure 146. Jean monitoring site (aerial view 1).

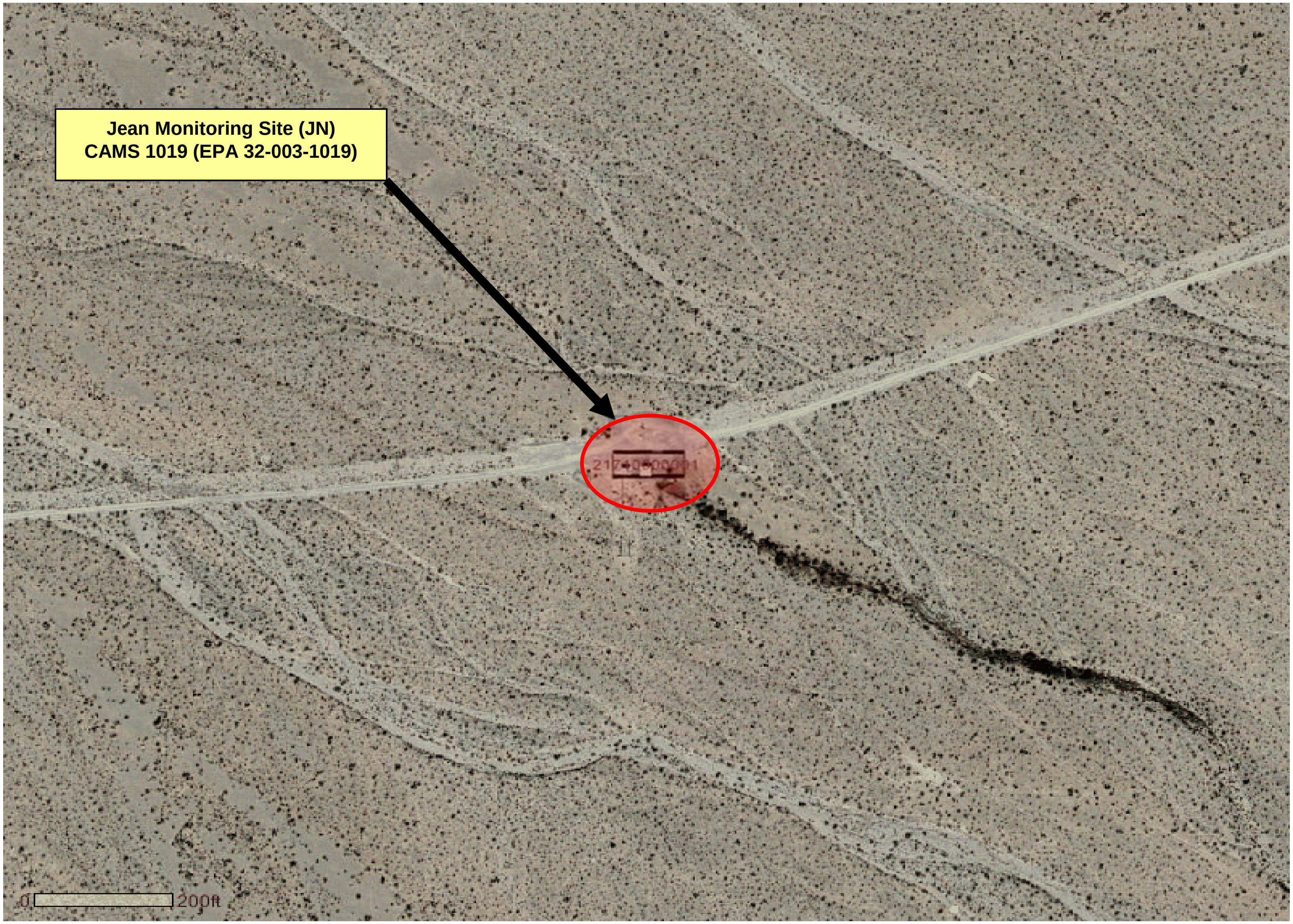


Figure 147. Jean monitoring site (aerial view 2).

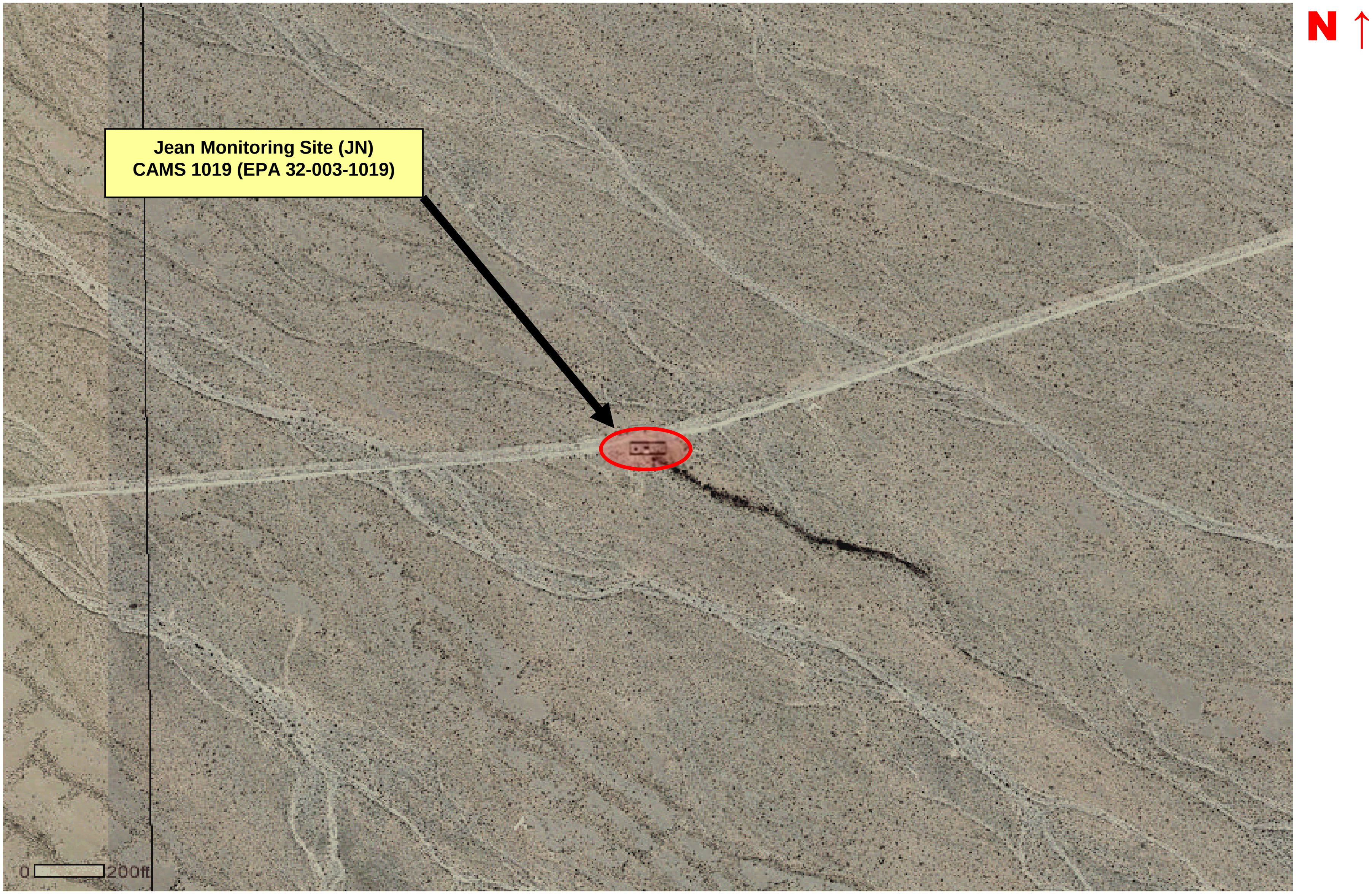


Figure 148. Jean monitoring site (aerial view 3).

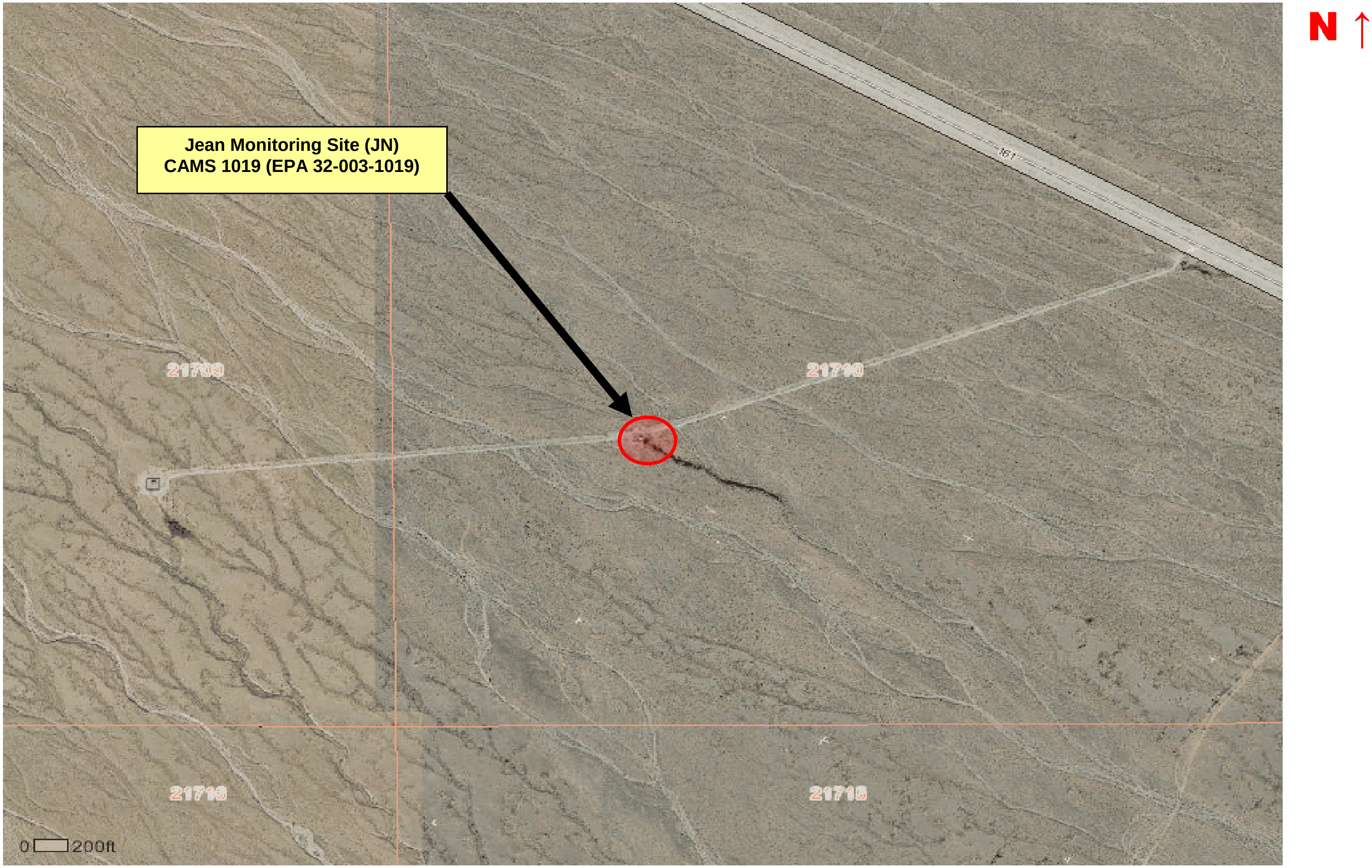


Figure 149. Jean monitoring site (aerial view 4).

5.0 COMPLIANCE AND ENFORCEMENT ACTIVITY

5.1 BEST AVAILABLE CONTROL MEASURES

AQR Sections 90, 91, 92, 93, and 94 cover the BACM applicable to the seven exceedance sites. Only Section 94 (Construction Rule) applies to the Boulder City and Jean, Nevada, sites. The 90-series regulations require stabilization of open areas and disturbed vacant lands, unpaved roads, unpaved parking lots, unpaved shoulders on paved roads, and the use of soil-specific best management practices for construction activities.

DAQ follows a proven standard procedure, detailed in its existing NEAP, for handling potential transported dust events and wind events. This procedure requires maximum enforcement activity, to the extent possible, a day before the potential dust event, with a major focus on areas where dust violations have previously occurred. Figure 150 shows a map of the Las Vegas, Ivanpah, and Eldorado Valleys with sectors and name assignments for exceptional event inspection and compliance responses. Since this event was unforeseen, there were no pre-event enforcement/compliance activities; however, a Construction Notice was sent out on Friday, April 12, 2013, because forecasting models predicted moderate winds for the weekend through Monday morning.

DAQ normally faxes a Construction Notice to construction firms with permits and selected stationary sources 12–24 hours before the expected arrival of high-dust conditions from a high-wind or transported-dust event. DAQ did not send out notices for this event because it was already in progress by the beginning of the Monday workday. When staff arrived at work that morning, they took immediate action and deployed field inspectors. DAQ faxed a Dust Advisory to construction sites, selected stationary sources, news media groups, and other entities such as schools. In addition, approximately 185 e-mails were sent to construction sites from the notification list.

Many permitted construction sites prepared for transported dust and possible high winds during the afternoon of April 15, 2013, based on DAQ's faxed upgrade from Dust Advisory to Dust Alert (Appendix C, Attachment x and x). Most contractors were aware of the advisories and responded appropriately, using the training from their DAQ dust classes. All but one site (discussed below) was in substantial compliance with the Clark County AQR.

On April 15, 2013, six enforcement officers were active in the field on nine-hour shifts. Additionally, one Senior Air Quality Specialist and one Air Quality Compliance Supervisor were on duty during the same timeframe to supervise enforcement efforts. One full-time-equivalent support staff consisting of a manager and administrative staffer supported field enforcement efforts. All six officers continued enforcement activities until approximately 1600 PDT. Inspectors inspected 42 construction sites that day. Attachment x in Appendix C provides a full list of site inspections, along with the project name and enforcement officer assigned. No Notices of Noncompliance or Notices of Violation were issued on the day of the event. Three verbal warnings were issued, two of which were for sites with small areas of unstable soil that were corrected immediately while the inspector was on site. The third site had larger areas of disturbed soil, but no blowing dust, and the operator did not correct the issue during the inspection. This construction site is located approximately nine miles away from the nearest air quality monitoring site and did not directly impact any part of DAQ's monitoring network.

On April 16, the day after the event, DAQ enforcement officers conducted their normal daily site inspections. Seven enforcement officers were active in the field on nine-hour shifts, with one manager and one administrative staff supporting field efforts. All seven officers continued enforcement activities until approximately 1600 PDT. Inspectors contacted 39 inspections on permitted construction sites that day. One site had unstable soils but no blowing dust, and that site was given a verbal warning.

All enforcement activity occurred during the hours of the transported dust event, and all follow-up activity occurred the day after the event. This enhanced enforcement activity reduced the potential for multiple exceedances of the 24-hour PM_{10} NAAQS in the Eldorado, Ivanpah, and Las Vegas Valleys.

Attachment 4 of Appendix C provides pictures of the event taken by DAQ compliance officers from many areas around Clark County as they performed their enforcement duties.

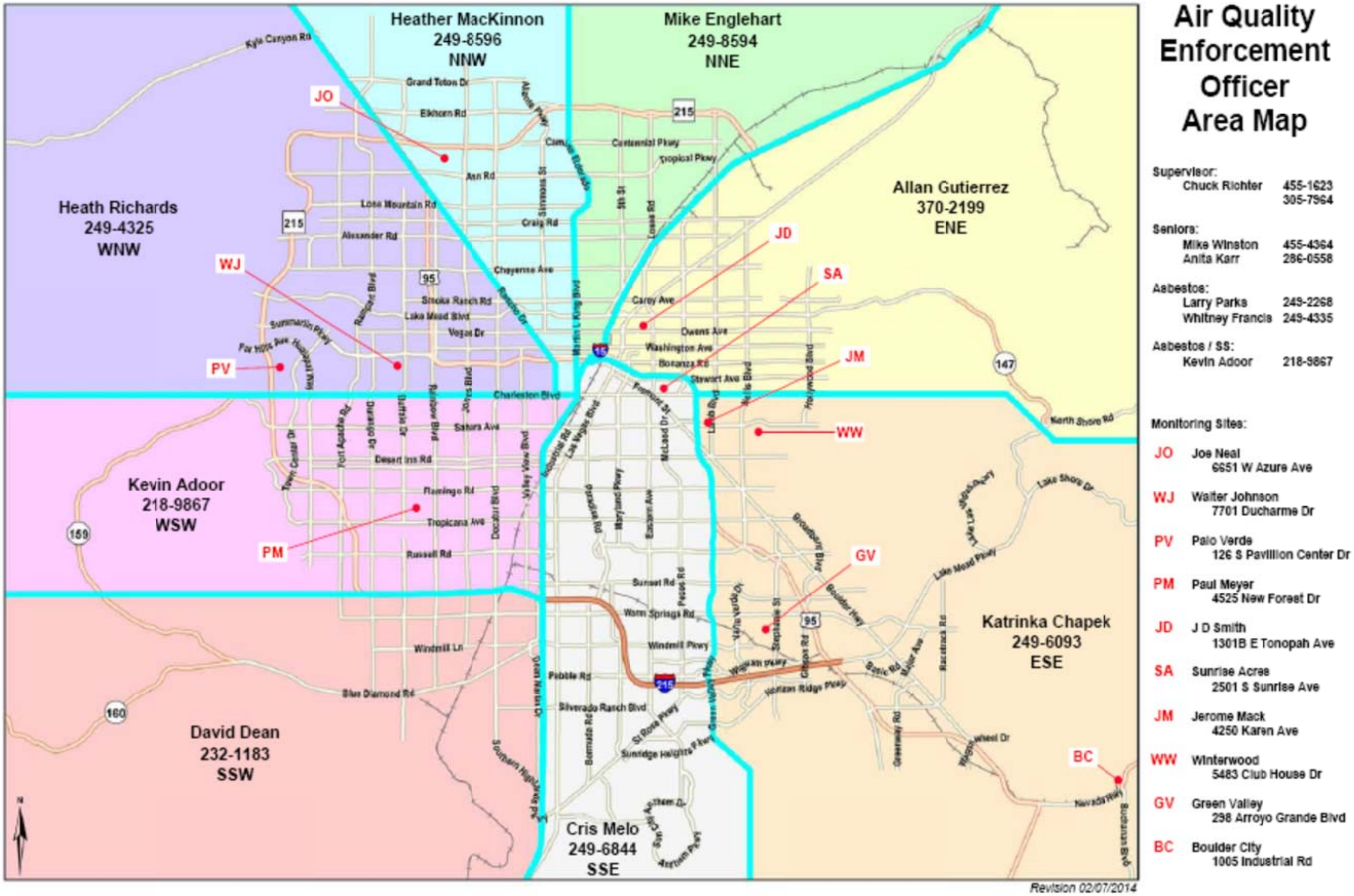


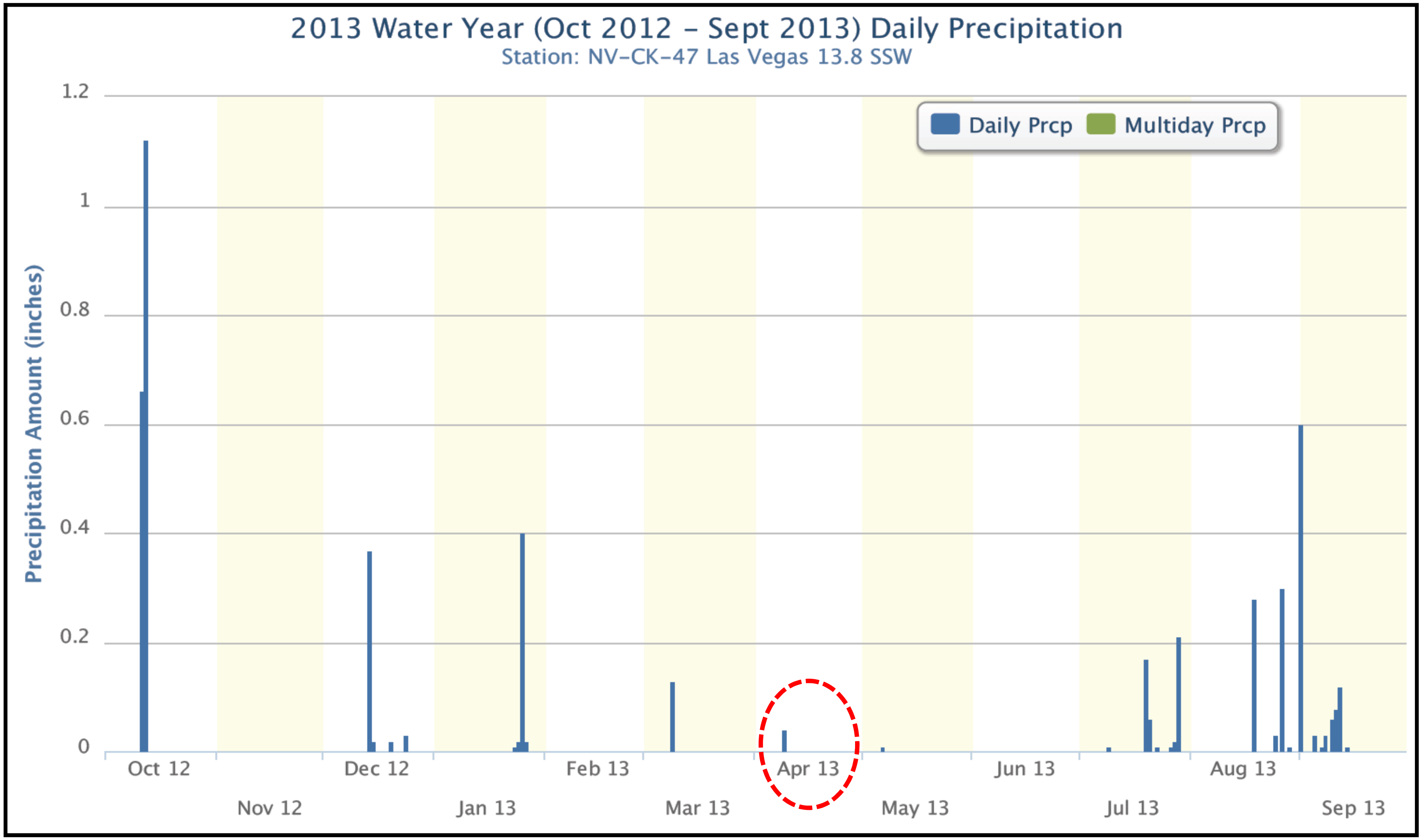
Figure 150. Enforcement/Compliance exceptional event response sector map.

5.2 PRECIPITATION IN POTENTIAL FUGITIVE DUST SOURCE REGION

Figure 151 illustrates the small amount of rain (0.06 inches) Las Vegas had received during April 2013. According to NWS records, the Las Vegas Valley received only 0.73 inches of measurable precipitation from January 2013 through April 15, 2013 (Table 43). On April 15, 2013, the event day, the Las Vegas Valley and surrounding areas received no measurable precipitation (Figure 152).

Moisture content of soils is a significant factor in a high-wind or transported dust event. Figures 153–154 show Clark County's departure from normal precipitation levels during 2012 and 2013. Table 43 provides precipitation data for the water years of 2012–2013. NOAA/NWS for California and the Nevada River Forecast Center measures precipitation from October the previous year through September of the present year. Therefore, once again, Table 43 demonstrates that soils during the period preceding the transported dust event were not damp enough to limit blowing dust where the soil crust had been disturbed. The last rain event before April 15 was in March 2013, when 0.16 inches were recorded. Figure 152 shows that no measurable precipitation occurred on April 15, 2013, the exceedance day. During a 2003 survey conducted to develop a Particulate Emission Potential map (Figure 155), the predominant soils in the area around the majority of the exceeding monitoring sites were classified as "moderate high" in silt and/or "high" in hydrophobic properties. The "high" soils have a relatively high percent clay content that resists rapid moisture absorption and is very emissive under dry conditions, but can absorb a high percentage of moisture by weight over an extended period. Soils with low moisture content are more easily entrained by winds during the driest time of the year; even with 100 percent BACM in place, stabilized native desert areas may emit dust.

This absence of local measurable precipitation increased the susceptibility of fugitive dust generation from native desert soil during the high-wind transported dust event; however, due to generally moderate-high sustained wind speeds—and considering the medium- to high-velocity wind gusts exceeding Clark County wind thresholds in the late afternoon of the exceedance day—the additional amount of fugitive dust would have added to the mix of pollution experienced on April 15, 2013.



Source: NOAA/NCDC, 151 Patton Avenue, Asheville, NC 28801-5001

Figure 151. Daily precipitation in Las Vegas Valley, 2013.

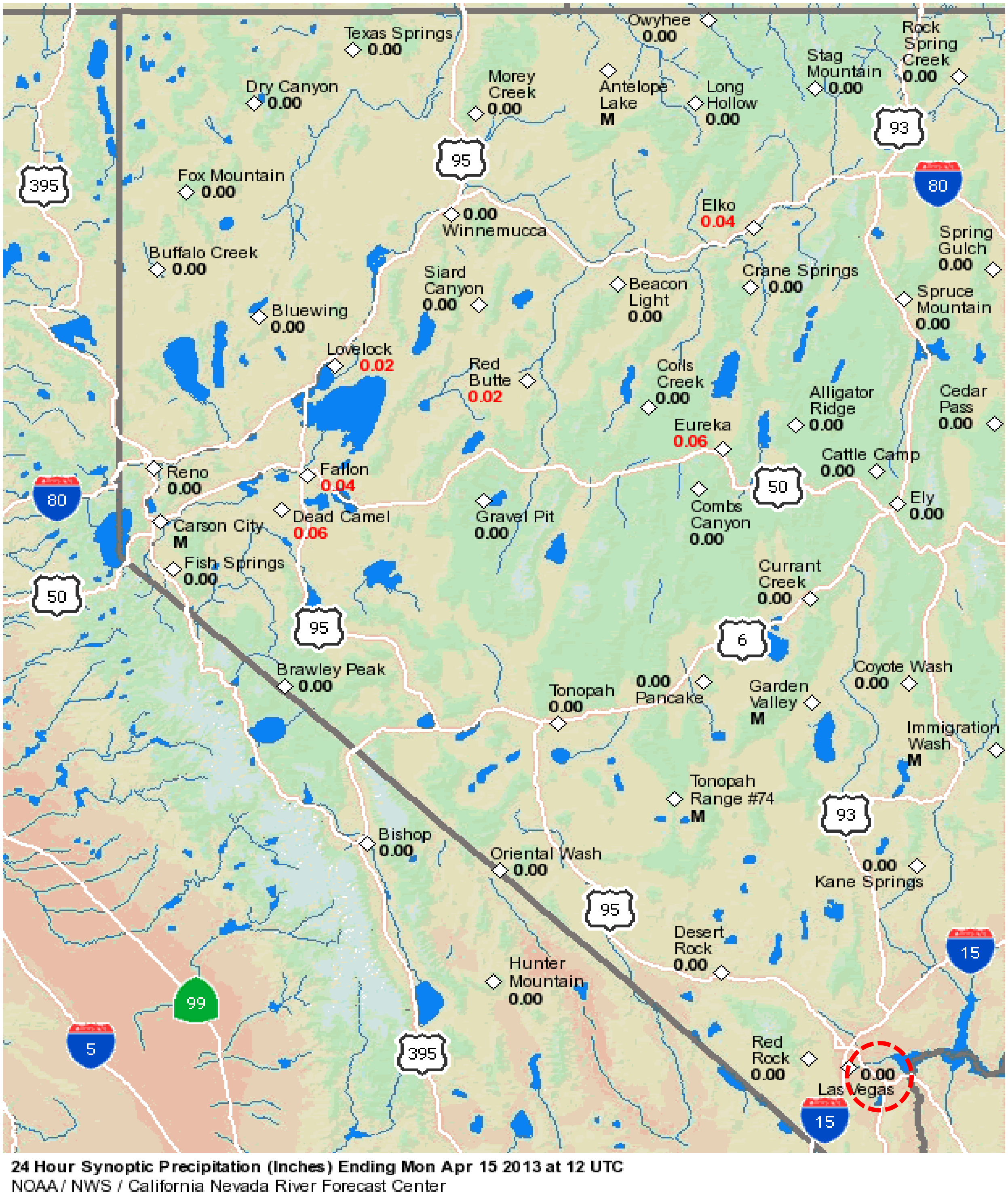
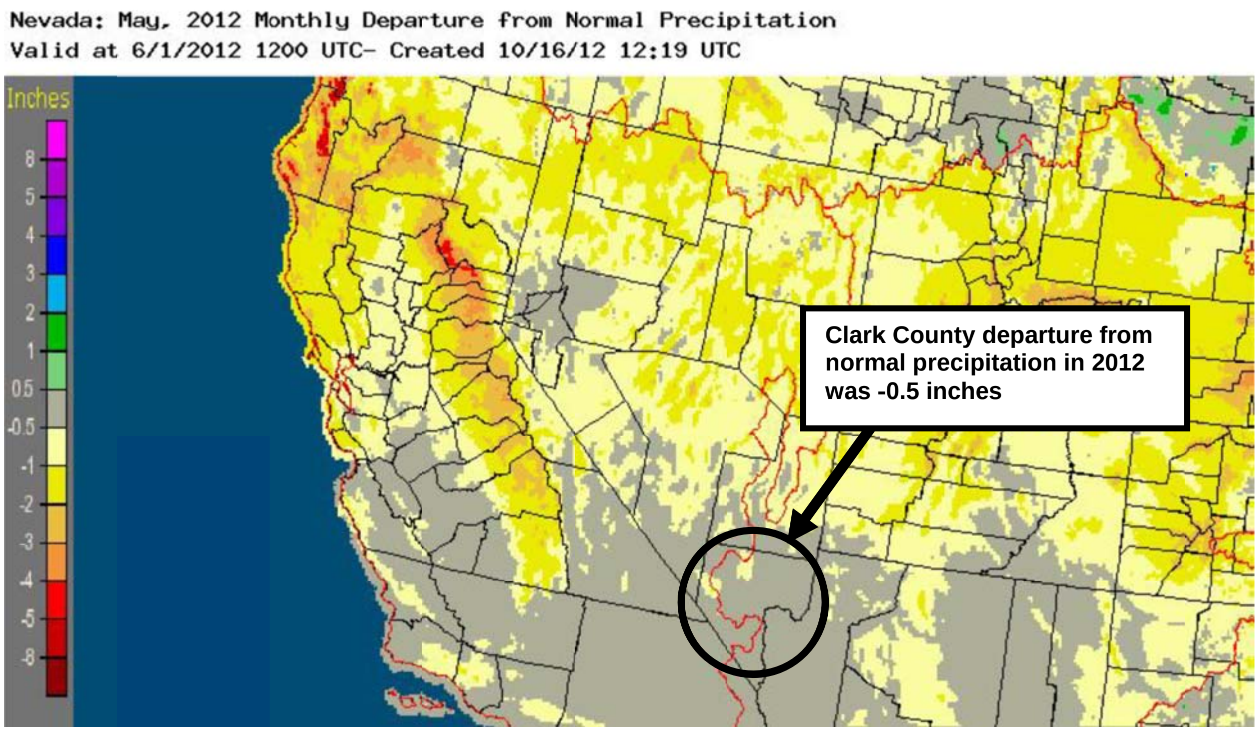


Figure 152. Precipitation at McCarran International Airport and surrounding areas on April 15, 2013.

Table 43. Cumulative totals of precipitation for October 2012–September 2013 water year (WY).

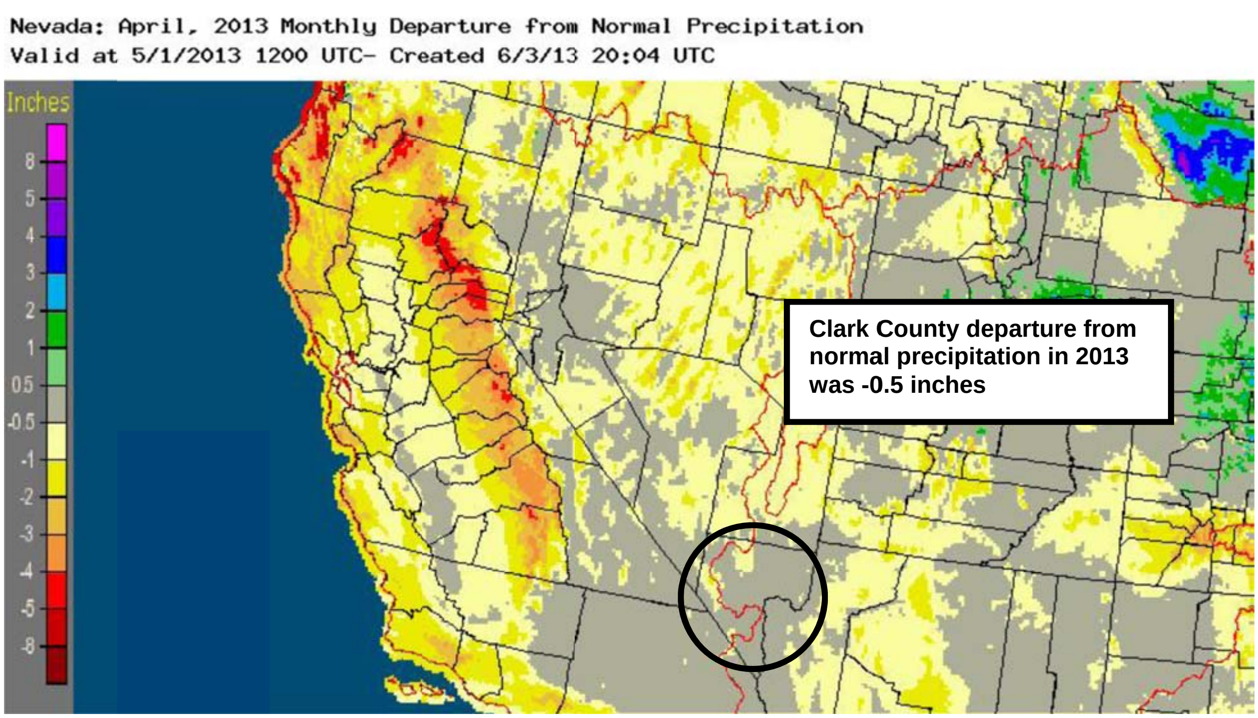
LOWER COLORADO															
ID	**Location**	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**WY to Date**	**Pct Avg to Date**	**Pct Tot WY**
BLH	BLYTHE	0.27	0.00	0.86	0.80	0.01	0.03	0.00	0.00	0.00	0.54	0.66	0.57	3.74	93	93
BULA3	BULLHEAD CITY	1.37	0.00	1.11	0.45	0.29	0.38	0.00	0.00	0.00	0.11	1.67	0.87	6.25	107	107
CALN2	CALIENTE	0.83	0.02	1.41	0.82	0.94	0.65	0.29	0.97	0.00	1.90	0.40	2.57	10.80	109	109
DNWN2	DESERT NTL WILDLIFE REF	1.88	0.02	0.46	0.37	0.00	0.52	0.10	0.16	0.00	1.16	0.93	0.15	5.75	119	119
EED	NEEDLES	0.72	0.00	0.99	0.46	0.08	0.25	0.00	0.00	0.00	0.17	2.84	0.26	5.77	113	113
GUNU1	GUNLOCK PH	1.10	0.00	1.29	0.52	0.43	0.98	M	M	M	M	M	M	M		
HIKN2	HIKO	0.71	0.04	0.70	0.36	0.03	0.66	0.03	0.49	0.00	0.92	0.32	2.89	7.15	124	124
LAUN2	LAUGHLIN	1.03	0.00	1.25	0.50	0.00	0.32	0.00	0.00	0.00	0.05	1.36	0.71	5.22	124	124
LAVU1	LA VERKIN	0.80	0.17	1.16	0.85	0.00	0.67	0.24	0.35	0.00	1.15	1.92	3.93	11.24	94	94
LHCA3	LAKE HAVASU CITY	0.88	0.00	1.83	0.81	0.16	0.26	0.00	0.00	0.00	0.14	1.07	0.57	5.72	NA	NA
LUNN2	LUND	0.62	0.21	1.45	0.68	0.49	0.19	0.18	0.14	0.00	0.24	0.15	2.93	7.28	66	66
PWMN2	PAHRANAGAT WILDLIFE REF	1.08	0.00	1.20	0.00	M	M	M	M	M	M	M	M	M		
SGUU1	ST. GEORGE	1.79	0.00	0.93	0.53	0.36	0.20	0.23	0.68	0.00	0.24	M	M	M		
SPVN2	SPRING VALLEY STATE PA	1.40	0.20	M	M	M	M	0.22	0.06	0.00	2.07	1.27	2.10	M		
SRCN2	SEARCHLIGHT	0.36	0.00	0.14	0.43	0.25	0.20	0.00	0.10	0.00	0.85	4.66	1.00	7.99	96	96
SUNN2	SUNNYSIDE	0.64	0.28	0.91	0.32	0.40	0.61	0.00	0.54	0.00	M	1.23	1.20	M		
VEF	LAS VEGAS	1.09	0.00	0.59	0.48	0.03	0.16	0.06	0.00	0.00	0.34	0.62	0.41	3.78	82	82
VEYU1	VEYO POWER HOUSE	1.16	0.32	1.48	0.55	0.66	0.93	0.93	0.00	M	M	M	M	M		
VOFN2	VALLEY FO FIRE SP	0.64	0.00	1.23	0.36	0.05	0.48	0.00	0.00	0.00	0.00	0.61	0.33	3.70	57	57
WUPA3	WIKIEUP	0.25	0.00	1.65	1.46	0.35	0.25	0.00	0.05	0.00	1.16	1.72	3.02	9.91	100	100
YUM	YUMA	M	M	M	M	M	M	M	M	M	M	M	M	M		

Source: NOAA/NWS California Nevada River Forecast Center.



Source: National Weather Service
California-Nevada River Forecast Center

Figure 153. Departure from normal precipitation in Nevada for 2012.



Source: National Weather Service
California-Nevada River Forecast Center

Figure 154. Departure from normal precipitation in Nevada for 2013.

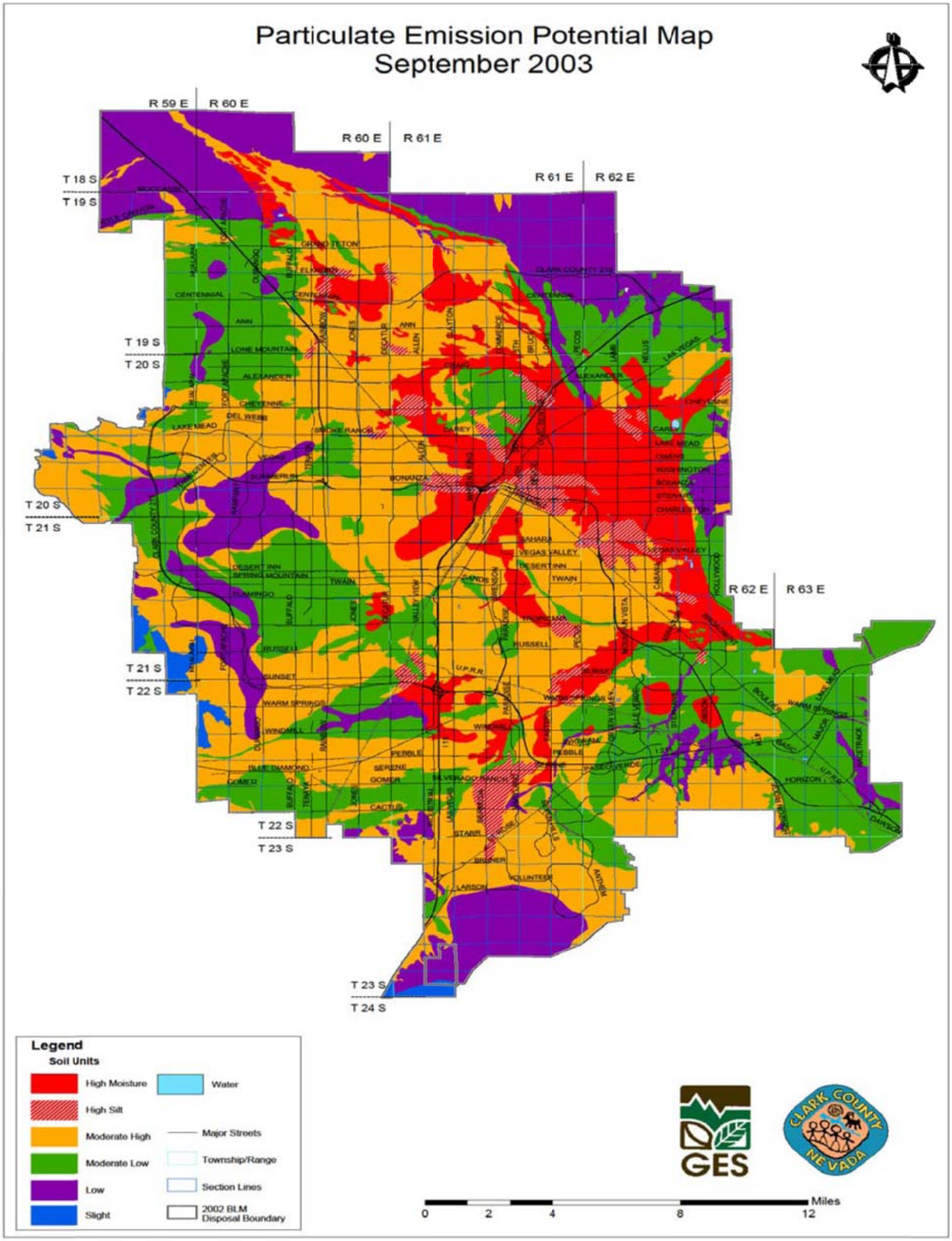


Figure 155. Particulate emissions potential map, Las Vegas Valley, Sept. 2003.

6.0 CONCLUSION

DAQ investigated emission-generating activities during and after the high-wind transported dust event and found that PM_{10} emissions for BACM sources were well controlled. Native desert areas experienced some dust entrainment when wind speeds increased in late afternoon; however, BACM controls limiting disturbance of developed areas prevented large-scale emissions that may have significantly impacted the particulate concentrations measured at DAQ's monitoring sites. Moderately high sustained wind speeds and moderate to high wind gusts helped dilute the dust, blowing the bulk of it out of the Ivanpah, Eldorado, and Las Vegas Valleys. DAQ, therefore, concludes that the PM_{10} exceedance would not have occurred ***but for*** the high-wind transported dust from the eastern California and northwestern Arizona desert storms. Based on the evidence of a high-wind transported dust event set forth in this report, Clark County requests that EPA support the flagging of the PM_{10} exceedance at the Jean, Boulder City, Jerome Mack, Sunrise Acres, J. D. Smith, Paul Meyer, Palo Verde, Green Valley, and Joe Neal monitoring sites on April 15, 2013, in the EPA AQS and grant concurrence of the exceptional event.