Clark County Department of Air Quality

Exceptional Event Documentation for the May 10, 2012, PM_{10} Transported Dust Exceedance Event

December 6, 2013

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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

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

1.0 INTRODUCTION

1.1 DOCUMENTATION OBJECTIVES

The Clark County Department of Air Quality (DAQ) hereby submits this exceptional event documentation package to the U.S. Environmental Protection Agency (EPA) for review. DAQ prepared this document for two purposes:

1. To obtain EPA concurrence that the 24-hour concentration of particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) recorded on May 10, 2012, was an exceptional event caused by dust transported from a macro-weather event in northwestern Arizona.

2. To eliminate consideration of the May 10, 2012, PM_{10} readings from future assessments of historical fluctuations of PM_{10} concentrations.

1.2 DOCUMENT OVERVIEW

This document presents the justifications for classifying the transported-dust event that occurred in the Eldorado and Las Vegas Valleys of Clark County, Nevada, on May 10, 2012, as an exceptional event. Section 1.3 reviews the conceptual model explaining the event, and Section 1.4 describes DAQ's notification and data-flagging processes. Section 1.5 summarizes the two 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 the 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, Section 2.4.1 provides demonstration that the event satisfies the criteria set forth in 40 CFR §50.1(j); Section 2.4.1.1 describes how the event affected air quality; Section 2.4.1.2 explains why the event was not reasonably controllable or preventable; Section 2.4.2 describes the clear causal connection between the exceedances and the exceptional event; Section 2.4.3 explains how the event is associated with a measured concentration in excess of normal historical fluctuations, including background; and Section 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. Section 3.1.1 summarizes weather associated with the event. Section 3.1.2 outlines the weather data resources used with the documentation package. Sections 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 the document. Section 3.1.3 contains the monitoring network measurement background and a description of how the system works and how data is obtained. Section 3.1.4 provides an explanation using data charts and maps of weather prior to the event of May 10, 2012. Section 3.1.5 presents weather data during the event using weather charts, data tables, graphs, and maps. Section 3.1.6 presents weather data tables and conditions experienced after the event. Section 3.1.7 contains National Oceanic and Atmospheric Administration (NOAA) Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) modeling results and graphical illustrations of the event. Subsection 3.2 contains media coverage of the transported dust event. (Appendix A contains copies of the news releases from local newspapers.)

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. It describes the activities DAQ took regarding transported dust prior to, during, and after the forecasted 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 2011 and 2012 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" (full report 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 May 10, 2012, exceedance as a transported dust exceptional event.

1.3 EXCEPTIONAL EVENT CONCEPTUAL MODEL

On May 10, 2012, an exceedance of the 24-hour National Ambient Air Quality Standard (NAAQS) for PM_{10} occurred in the Eldorado Valley (Boulder City) and the Las Vegas Valley. DAQ has conceptually characterized this as a regionally transported dust event. Monitored values were elevated throughout the Las Vegas Valley, where four of seven sites registered exceedances: Joe Neal (CAMS 0075) at 182 micrograms per cubic meter ($\mu g/m^3$), Jerome Mack (CAMS 0540) at 228 $\mu g/m^3$, Sunrise Acres (CAMS 0561) at 211 $\mu g/m^3$, and J.D. Smith (CAMS 2002) at 203 $\mu g/m^3$. The remaining Las Vegas Valley sites, which recorded high concentrations of PM_{10} but did not exceed, were Paul Meyer (CAMS 0043) at 147 $\mu g/m^3$, Palo Verde (CAMS 0073) at 138 $\mu g/m^3$, and Green Valley (CAMS 0298) at 145 $\mu g/m^3$.

The monitoring site in Boulder City (CAMS 0601), in the Eldorado Valley, experienced the highest concentration in Clark County on the event day, at 314 $\mu g/m^3$. The only network PM_{10} site that did not exceed was at Jean, Nevada (CAMS 1019), 35 miles southwest of the Las Vegas Valley. The 24-hour PM_{10} concentration measured at Jean that day was 27 $\mu g/m^3$.

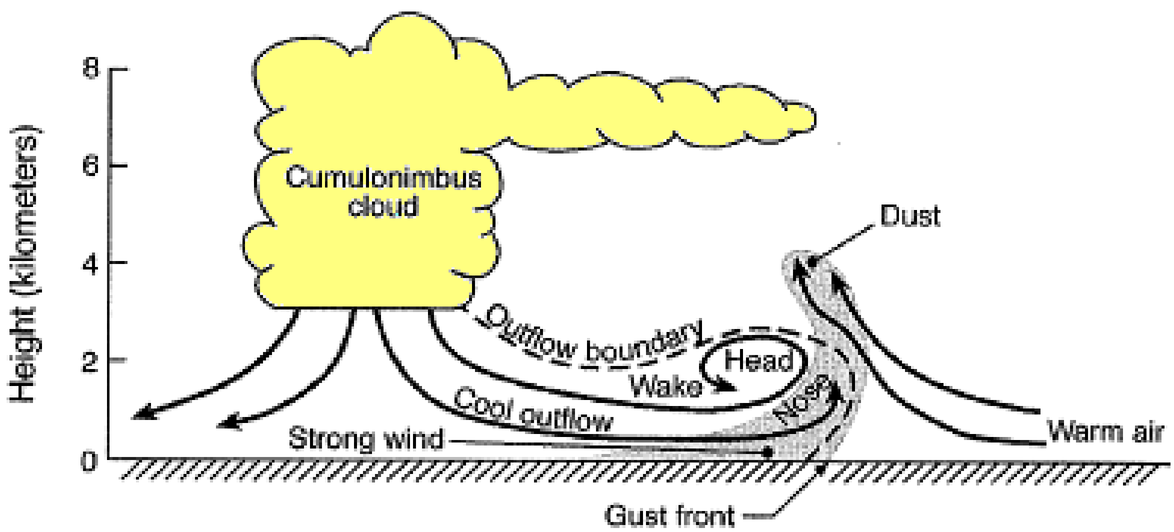
The regionally transported dust was caused by thunderstorms in Phoenix, Arizona, which caused an "outflow boundary" separating thunderstorm-cooled air from the surrounding air. This outflow traveled hundreds of miles from its origin, picking up dust that reduced visibility in northwest Arizona and parts of southern Nevada (Figure 1). The Ivanpah Valley (Jean, Nevada) monitoring site was not affected by the dust transported from northwestern Arizona.

It is unlikely that anthropogenic sources near the monitoring sites played a role in elevated PM_{10} levels. Wind speeds during the majority of the day were far below Clark County's established thresholds for dust re-entrainment, with an hourly average of 6 mph and wind gusts up to 15 mph throughout the valleys. However, these low wind speeds and the predominant wind direction (from the southeast) spread the transported dust throughout the Eldorado and Las Vegas Valleys during the first half of the day through the early afternoon. At approximately 2:00 PM, wind speeds increased slightly and began "washing out" the high PM concentrations in a northwest direction. PM concentrations began dropping throughout the PM_{10} network around 4:00 PM. Not all PM_{10} sites exceeded, only the ones affected by the predominant wind direction and dust flows (Figure 2).

DAQ has stringent controls in place to reduce dust from local anthropogenic sources, including BACM required by the PM_{10} maintenance plan and the Clark County Air Quality Regulations (AQRs). However, this event was not a wind-generated dust storm, but an "outflow boundary" that caused the transported dust to overwhelm both BACM and natural desert conditions, resulting in PM_{10} exceedances in both valleys.

Section 5 documents how Dust Advisory notices were issued for this event. DAQ Compliance and Enforcement Division staff conducted visual inspections throughout both valleys to assure AQR compliance and check that sources generated no additional dust. Photos from these inspections document the implementation of BACM on all relevant emission sources (Appendix C).

Severe weather in the desert



Cross-section schematic of a haboob caused by the cool outflow from a thunderstorm, with the leading edge that is propagating ahead of the storm called an outflow boundary. The strong, gusty winds that prevail at the boundary are defined as a gust front. The leading edge of the cool air is called the nose, and the upward-protruding part of the feature is referred to as the head. Behind the roll in the windfield at the leading edge is a turbulent wake. The rapidly moving cool air and the gustiness at the gust front raise dust (shaded) high into the atmosphere.

Source: T. T. Warner, *Desert Meteorology* (2004).

Figure 1. Cross Section of a Thunderstorm Creating an Outflow Boundary and Haboob.

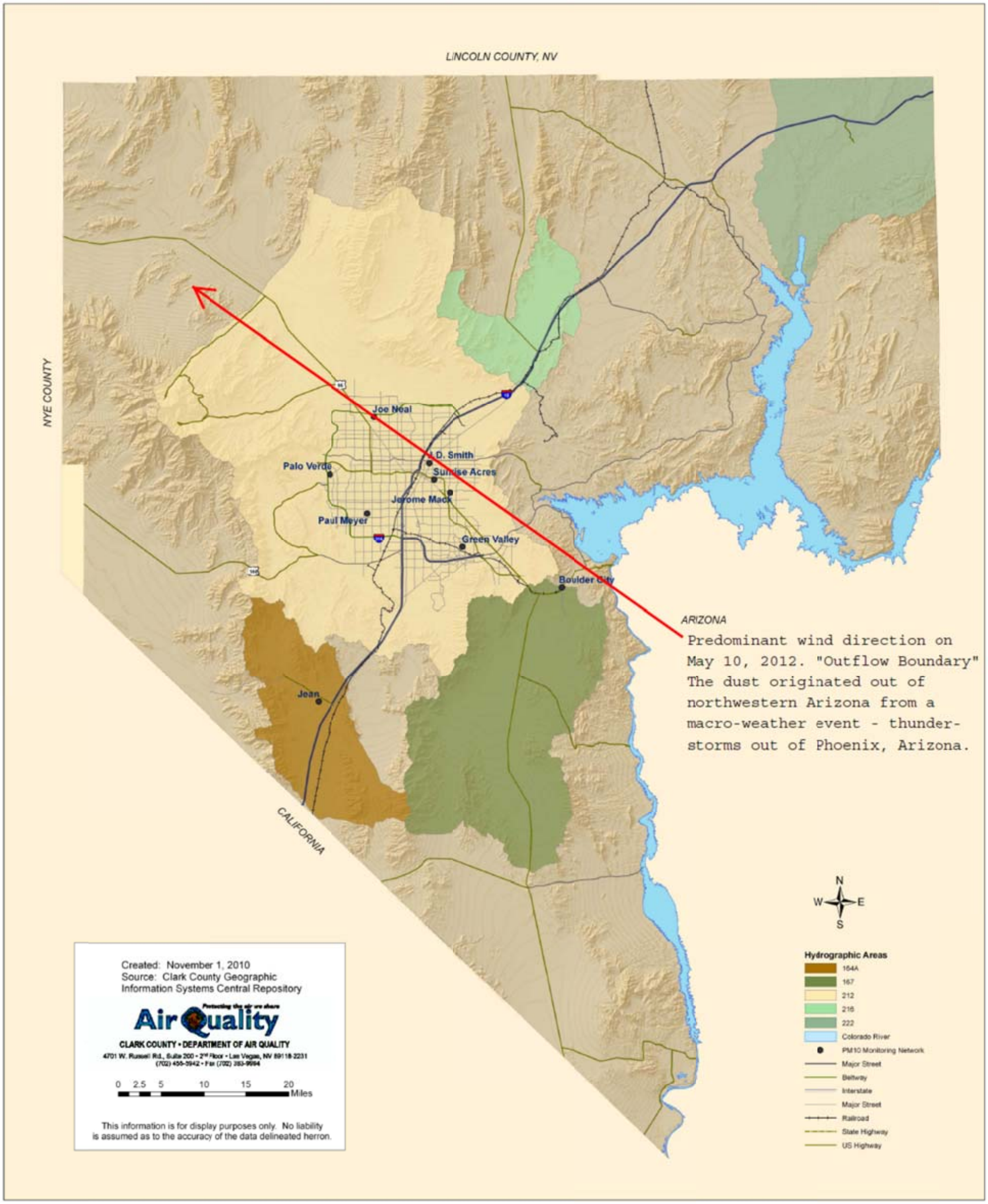


Figure 2. Predominant Wind Direction on May 10, 2012.

1.4 EXCEPTIONAL EVENT PROCESS

Clark County's *Natural Events Action Plan* 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 it was indicated by monitoring site instrument readings in the hours before sunrise (1:00–2:00 AM Pacific Daylight Time (PDT)).

Meteorological models and weather software can track desert storm conditions that can lead to dust transport, sometimes 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 low. DAQ broadcast an Air Quality Advisory during the early morning hours of the event day because of concentrations measured only hours earlier, DAQ then broadcast an updated Air Quality Alert. This update was necessary because PM_{10} concentrations and mass accumulations indicated that the PM_{10} monitoring network would experience 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 transported dust event occurred during the early hours, 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 specific or permitted sources (Appendix C).

Following the event, the DAQ Planning and Engineering Division conduct a preliminary assessment to determine what may have caused the exceedance and whether an initial data flag in the EPA Air Quality System (AQS) is appropriate. If a data flag for high dust conditions as a result of a 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 Engineering and Compliance Divisions, documents that timely advisories were issued; that there is a clear causal relationship between the 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 the 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 2012.[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.

Beyond formal climatic data publications, there is very little material containing summaries of extreme weather events relevant to this exceptional event submittal. 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 move into southern Clark County during 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.

The spring and fall seasons are generally considered ideal. Although sharp temperature changes can occur, outdoor activities are seldom hampered. However, winter and spring wind events of-

[1] *Clark County, Nevada, 2012 Population Estimates*, Clark County Department of Comprehensive Planning.

ten 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 May 10, 2012 PM_{10} Transported Dust Exceedance Event document and the supporting Appendices on the Clark County DAQ Web site for a 30-day public comment period effective Monday October 28, 2013 through November 29, 2013 at 5:00 PM. Clark County received no comments on the document or the appendices by close of business on November 29, 2013. Appendix E contains the official postings from the DAQ Web page.

2.0 EXCEPTIONAL EVENT DOCUMENTATION

2.1 SUMMARY OF EVENT DAY

Sustained low-velocity wind speeds throughout the Eldorado Valley into the Las Vegas Valley in the early morning of May 10, 2012, transported dust from a desert storm in northwestern Arizona into southern Nevada, causing PM_{10} exceedances at five sites in the Clark County monitoring network (Figures 3–4). The monitoring site in Boulder City recorded the first NAAQS exceedance on the event day, recording very high PM_{10} masses at approximately 0000 (midnight) PDT and high PM_{10} hourly concentrations through 8:00 PM. Anthropogenic sources near the monitoring site did not play a role in the elevated PM_{10} levels at the site (Figures 28–32).

2.2 NATURAL EVENTS ACTION PLAN FOR HIGH-WIND EVENTS

The Clark County Board of County Commissioners adopted the *Natural Events Action Plan for High-Wind Events* (NEAP) in April 2005. Protection of the public health is the foundation of the NEAP and its replacement, the TDAP. The NEAP protects public health by 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 TDAP. One example 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, which helps DAQ reduce the health and environmental effects of PM_{10}.

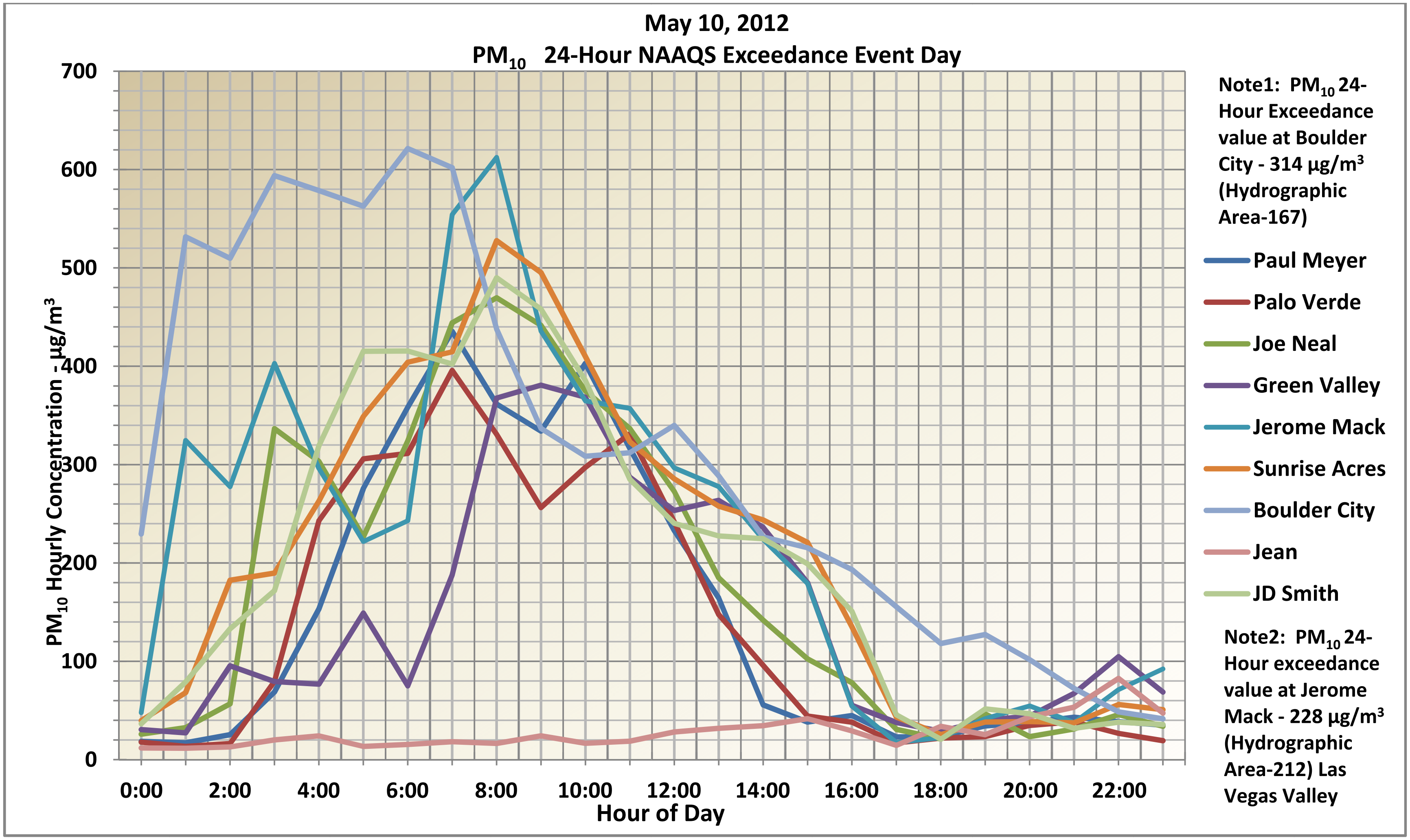


Figure 3. PM_{10} 24-Hour NAAQS Exceedance Event Day.

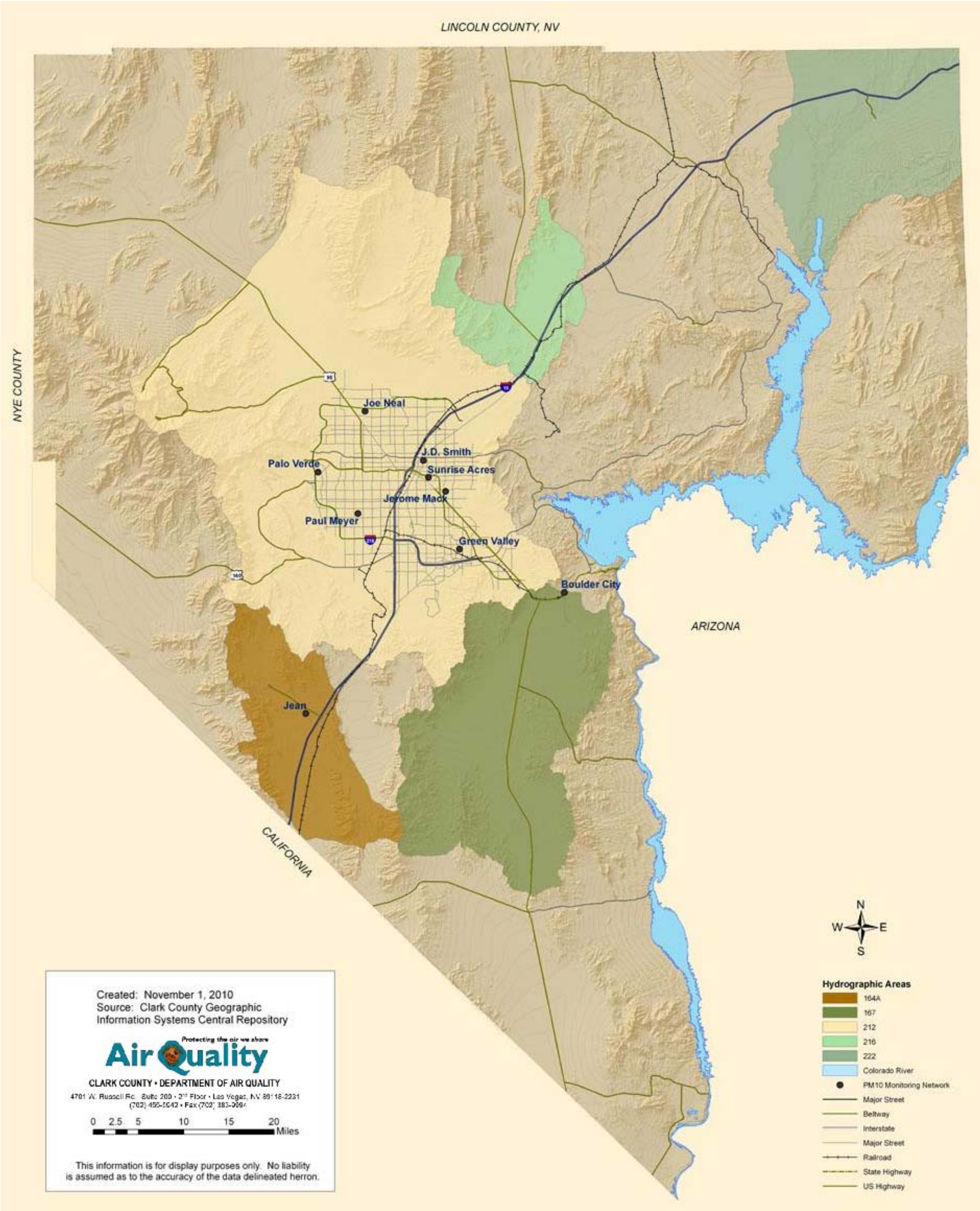


Figure 4. PM_{10} Transport Dust Event Monitoring Sites, Clark County, Nevada.

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 EPA's Air Quality System (AQS) so it would not count toward an area's attainment status if it could 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. Clark County is developing a new process for transported dust events, the Transported Dust Action Plan (TDAP). Until the BCC adopts the new plan, Clark County will use the existing NEAP processes.

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). It 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 Code of Federal Regulations (40 CFR 50.1(j)), 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 relating to source noncompliance.

Section 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. Section 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), and Joe Neal (CAMS 0075) monitoring sites on May 10, 2012, satisfied the following exceptional event criteria.

I. The event satisfies the criteria set forth in 40 CFR 50.1(j).

The event affected air quality. Tables 1–2 show that hourly PM_{10} concentrations at the Boulder City monitoring site were low on the days before and after the transported dust event. Table 3 and Figure 5 show that hourly PM_{10} concentrations increased rapidly with the arrival of the transported dust, most significantly between the hours of 0000 and 1700 Pacific Standard Time (PST).[2] Figure 5a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the low 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 increased by early afternoon, blowing the bulk of the dust out of the Eldorado Valley into the Las Vegas Valley. This trend continued to "wash out" the dusty mass of air pollution to the northwest of the Las Vegas Valley, causing exceedance-level concentrations at four other monitoring sites within the predominant northwesterly air flow (Figure 2). By 10:00 PM, the Boulder City monitoring site had begun to exhibit normal background concentrations.

Tables 4–5 show that hourly PM_{10} concentrations at the Jerome Mack (NCore) monitoring site were low on the days before and after the transported dust event. Table 6 and Figure 6 show that hourly PM_{10} concentrations increased rapidly with the arrival of the transported dust, most significantly between 1:00 AM – 3:00 PM PDT. Figure 6a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the low 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 by early afternoon, blowing the transported dust toward the next monitoring site in the network (Sunrise Acres). Increasing winds continued to "wash out" the dusty mass of air pollution to the northwest of the valley, and by 3:00 PM the Jerome Mack site had begun to exhibit normal background concentrations.

Tables 7–8 show that hourly PM_{10} concentrations at the Sunrise Acres monitoring site were low on the days before and after the transported dust event. Table 9 and Figure 7 show that hourly PM_{10} concentrations increased rapidly with the arrival of the transported dust, most significantly between 2:00 AM – 4:00 PM PDT. Figure 7a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the low 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 by early afternoon, blowing the transported dust toward the next monitoring site in the network (J. D. Smith). No significant local dust was coming from PM sources in the area. Increasing winds continued to "wash out" the dusty mass of air pollution to the northwest of the valley, and by 5:00 PM the Sunrise Acres site had begun to exhibit normal background concentrations.

Tables 10–11 show that hourly PM_{10} concentrations at the J. D. Smith monitoring site were low on the days before and after the transported dust event. Table 12 and Figure 8 show that hourly PM_{10} concentrations increased rapidly with the arrival of the transported dust, most significantly between 2:00 AM – 4:00 PM PDT. Figure 8a shows the speeds of hourly sustained winds and the

[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.

hourly average of maximum wind gusts on the event day; note that the low 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 by early afternoon, blowing the transported dust toward the next monitoring site in the network (Joe Neal). No local dust was coming from particulate matter sources in the area. Increasing winds continued to "wash out" the dusty mass of air pollution to the northwest of the valley, and y 5:00 PM the J. D. Smith monitoring site had begun to exhibit normal background concentrations.

Tables 13–14 show that hourly PM_{10} concentrations at the Joe Neal monitoring site were low on the days before and after the transported dust event. Table 15 and Figure 9 show that hourly PM_{10} concentrations increased rapidly with the arrival of the transported dust, most significantly between 3:00 AM – 4:00 PM PDT. Figure 9a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the low 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 by early afternoon, blowing the transported dust northwest and out of the valley. By 5:00 PM, the Joe Neal monitoring site had begun to exhibit normal background concentrations.

Tables 16–17 show that hourly PM_{10} concentrations at the Green Valley monitoring site were low on the days before and after the transported dust event. Table 18 and Figure 10 show that hourly PM_{10} concentrations increased slowly with the arrival of the transported dust from the direction of the Jerome Mack site, most significantly between 7:00 AM –3:00 PM PDT.

Figure 8a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the low wind speeds coincide with the high hourly PM_{10} concentrations seen later in the morning from deposition. Source-generated dust was not a factor. Hourly sustained winds and hourly peak wind gusts had increased by midafternoon, blowing the transported dust out of the Green Valley monitoring site area. Increasing winds continued to "wash out" the dusty mass of air pollution to the northwest of the valley, and by 4:00 PM the Green Valley site had begun to exhibit normal background concentrations. The Green Valley site experienced above-normal PM_{10} concentrations for nine hours this day, but the site did not record a NAAQS exceedance.

Tables 19–20 show that PM_{10} hourly concentrations at the Paul Meyer monitoring site were low on the days before and after the transported dust event. Table 21 and Figure 11 show that hourly PM_{10} concentrations increased slowly with the arrival of the transported dust from the general direction of the Jerome Mack and Green Valley monitoring sites, most significantly between 7:00 AM –3:00 PM PDT. Figure 8a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the low wind speeds coincide with the high hourly PM_{10} concentrations experienced later in the morning and into the afternoon. Source-generated dust was not a factor. Hourly sustained winds and hourly peak wind gusts had increased by late morning, blowing the transported dust out of the Paul Meyer monitoring site area. Increasing winds continued to "wash out" the dusty mass of air pollution to the northwest of the valley, and by 1:00 PM the Paul Meyer site had begun to exhibit normal background concentrations. Paul Meyer experienced above-normal PM_{10} concentrations for ten hours that day, but the site did not record a NAAQS exceedance.

Tables 22–23 show that PM_{10} hourly concentrations at the Palo Verde monitoring site were low on the days before and after the transported dust event. Table 24 and Figure 12 show that hourly PM_{10} concentrations increased slowly with the arrival of the transported dust from the general direction of the Paul Meyer monitoring site, most significantly between 4:00 AM and 1:00 PM PDT. Figure 12a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day; note that the low wind speeds coincide with the high hourly PM_{10} concentrations experienced later in the morning and into the afternoon. 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 northwest of the valley, and by 4:00 PM the Palo Verde site began to exhibit normal background concentrations. Palo Verde experienced above-normal PM_{10} concentrations for ten hours this day, but the site did not record a NAAQS exceedance.

Tables 25–26 show that hourly PM_{10} concentrations at the Jean monitoring site were low on the days before and after the transported dust event. Table 27 and Figure 13 show that hourly PM_{10} concentrations were not affected by the event from any wind flows in or near the Jean monitoring site (Ivanpah Valley), roughly 35 miles southwest of the Las Vegas Valley. There were air flows out of California, but none significant enough to produce elevated readings at the Jean site, which recorded a 24-hour PM_{10} concentration of 27 $\mu g/m^3$.

The event was not reasonably controllable or preventable. As described in Section 5 (“Compliance and Enforcement Activity”), there were no unusual emission activities on the event day. No local sources within a mile and half radius of any of the monitoring sites in the PM_{10} network were contributing measurable dust to the mix of air pollution from the event.

Table 1. Boulder City Monitoring Data for May 9, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2012	5	9	0000	3	275	5	18.60	17.80
2012	5	9	0100	2	300	4	19.40	13.10
2012	5	9	0200	3	312	7	21.90	33.90
2012	5	9	0300	4	6	8	17.90	51.10
2012	5	9	0400	2	344	6	20.10	69.80
2012	5	9	0500	2	288	6	18.50	86.50
2012	5	9	0600	3	94	9	32.50	118.50
2012	5	9	0700	6	42	12	35.80	150.80
2012	5	9	0800	8	46	14	22.90	173.10
2012	5	9	0900	9	46	17	19.20	189.00
2012	5	9	1000	7	41	14	ND	ND
2012	5	9	1100	5	36	15	ND	ND
2012	5	9	1200	6	16	20	ND	ND
2012	5	9	1300	8	13	20	14.40	470.10
2012	5	9	1400	9	24	19	19.10	486.70
2012	5	9	1500	7	34	18	15.30	501.20
2012	5	9	1600	6	27	15	15.50	515.00
2012	5	9	1700	6	30	15	13.80	529.00
2012	5	9	1800	3	33	8	21.70	547.80
2012	5	9	1900	2	291	4	11.10	559.30
2012	5	9	2000	3	209	5	24.50	580.40
2012	5	9	2100	4	249	7	22.60	601.40
2012	5	9	2200	5	243	9	19.00	618.60
2012	5	9	2300	6	214	17	19.10	640.50

Table 2. Boulder City Monitoring Data for May 11, 2012

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)
2012	5	11	0000	6	220	15	42.10	62.20
2012	5	11	0100	4	243	12	33.50	57.90
2012	5	11	0200	5	241	11	42.80	97.30
2012	5	11	0300	4	229	8	31.50	125.20
2012	5	11	0400	4	243	8	26.70	150.50
2012	5	11	0500	5	338	13	24.00	174.70
2012	5	11	0600	9	342	21	39.40	210.20
2012	5	11	0700	10	19	27	38.50	247.00
2012	5	11	0800	10	41	16	41.60	285.00
2012	5	11	0900	7	34	15	35.50	318.40
2012	5	11	1000	5	25	16	31.20	346.40
2012	5	11	1100	5	98	14	38.20	383.00
2012	5	11	1200	6	137	21	31.40	410.20
2012	5	11	1300	6	89	18	30.70	437.90
2012	5	11	1400	6	240	18	24.70	460.30
2012	5	11	1500	5	307	14	25.30	484.10
2012	5	11	1600	6	278	14	39.30	520.00
2012	5	11	1700	4	198	12	27.10	543.60
2012	5	11	1800	4	168	8	35.30	575.90
2012	5	11	1900	4	184	8	46.00	617.90
2012	5	11	2000	5	230	9	30.10	646.00
2012	5	11	2100	5	248	11	30.70	674.00
2012	5	11	2200	4	252	10	31.70	701.70
2012	5	11	2300	3	240	7	22.80	723.50

Table 3. Boulder City Monitoring Data for May 10, 2012

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)
2012	5	10	0000	6	193	18	229.40	232.00
2012	5	10	0100	8	203	17	531.60	696.60
2012	5	10	0200	5	207	12	509.70	1176.10
2012	5	10	0300	7	206	12	593.90	362.70
2012	5	10	0400	5	211	10	578.60	751.80
2012	5	10	0500	5	210	10	562.80	1116.00
2012	5	10	0600	6	199	11	621.40	362.70
2012	5	10	0700	8	166	17	602.00	916.80
2012	5	10	0800	9	147	18	437.80	1321.80
2012	5	10	0900	10	135	22	336.90	177.30
2012	5	10	1000	10	131	19	308.50	413.70
2012	5	10	1100	10	153	19	312.00	699.40
2012	5	10	1200	11	133	28	339.90	1005.90
2012	5	10	1300	12	145	26	288.60	1264.60
2012	5	10	1400	13	146	31	226.50	865.60
2012	5	10	1500	14	156	33	215.40	180.20
2012	5	10	1600	15	163	36	193.30	353.20
2012	5	10	1700	13	167	28	155.40	491.20
2012	5	10	1800	10	161	22	118.10	599.00
2012	5	10	1900	10	167	25	127.20	714.10
2012	5	10	2000	7	181	15	101.60	805.00
2012	5	10	2100	5	211	10	72.40	871.30
2012	5	10	2200	5	210	11	48.50	914.90
2012	5	10	2300	8	217	15	41.60	953.90

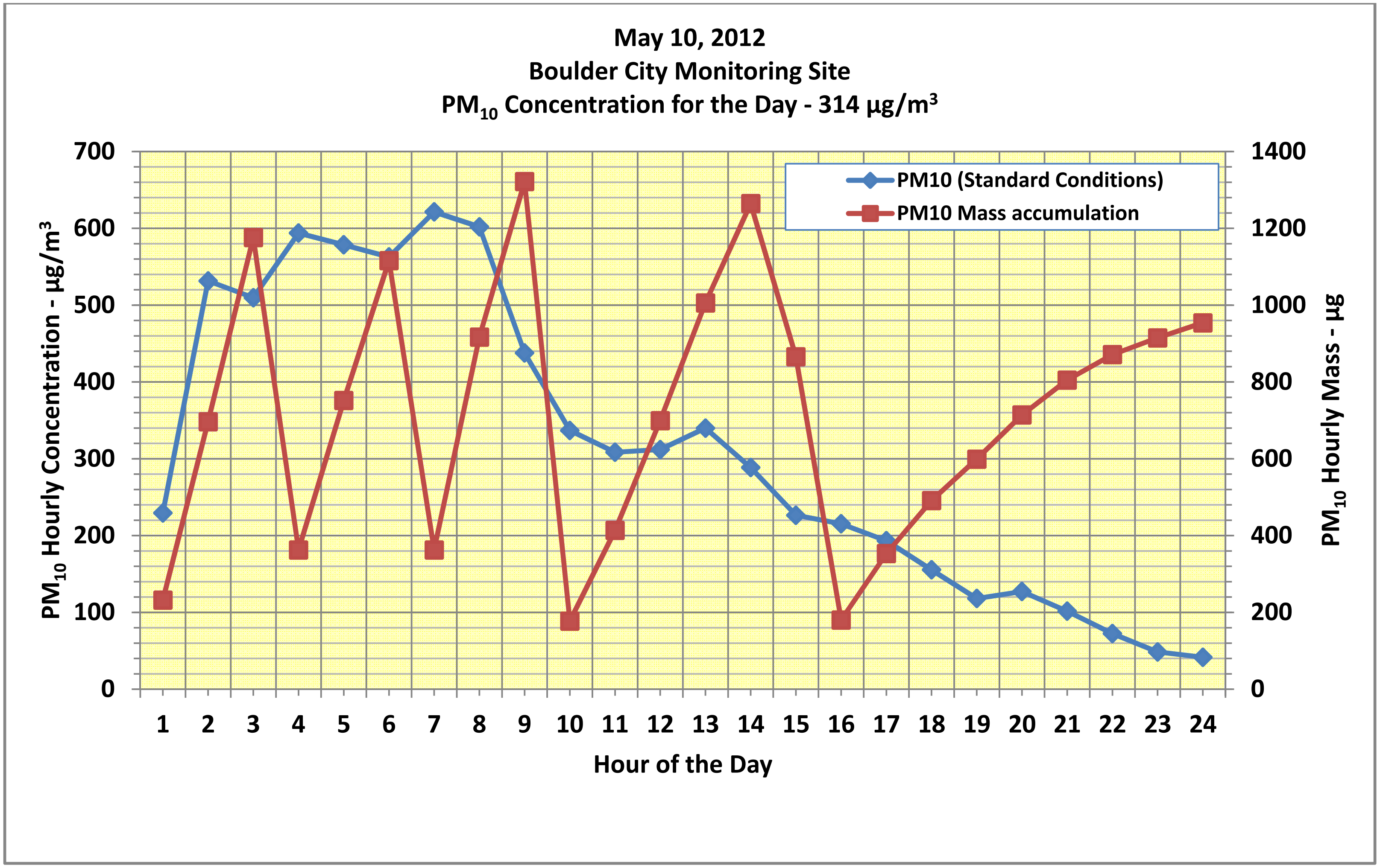


Figure 5. PM_{10} Concentrations at Boulder City Monitoring Site, May 10, 2012.

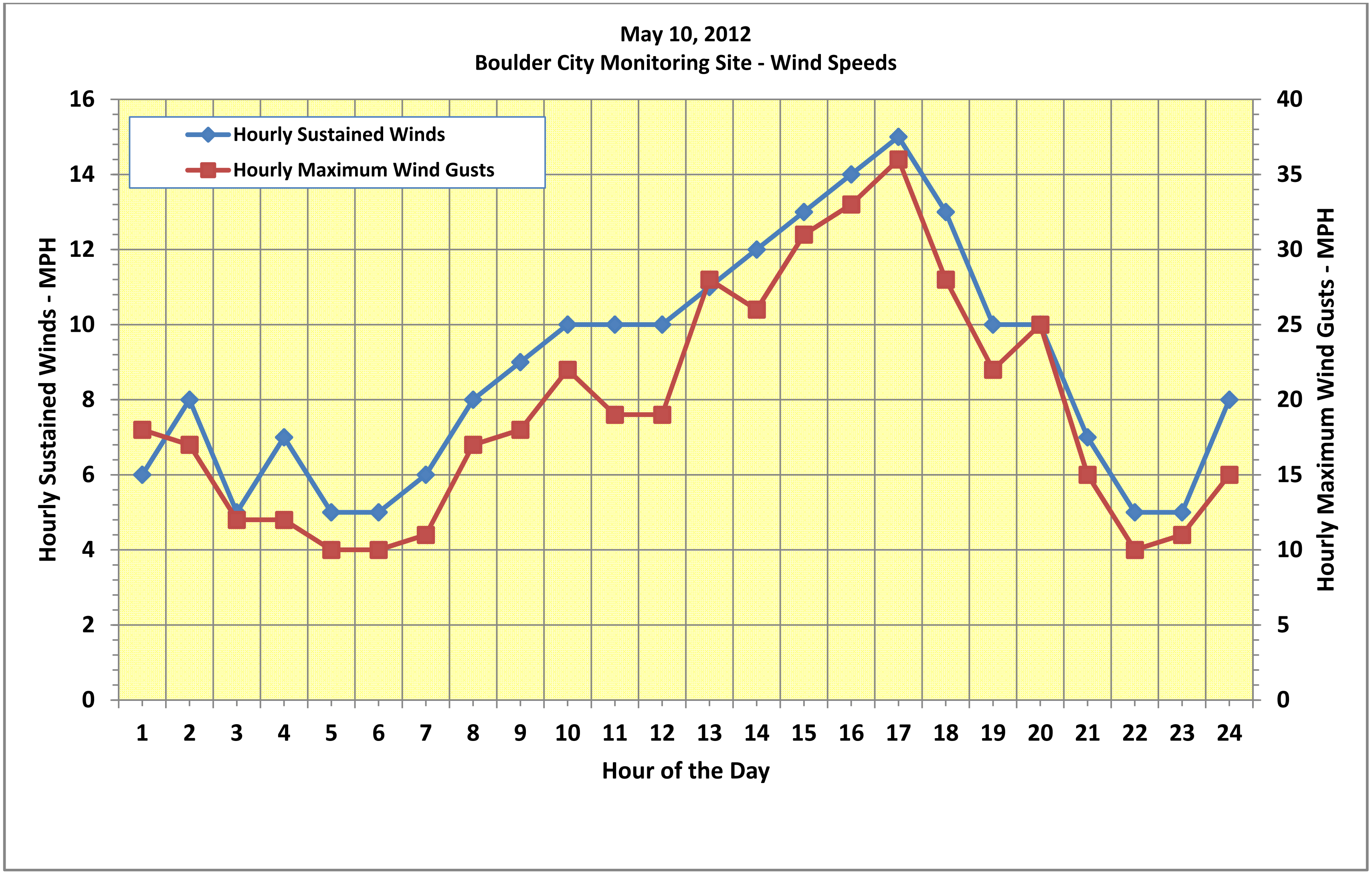


Figure 5a. Wind Speeds at Boulder City Monitoring Site, May 21, 2008.

Table 4. Jerome Mack Monitoring Data for May 9, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (μg/m^3)	PM_{10} Mass Accumulation (μg)
2012	5	9	0000	2	311	6	55.60	ND
2012	5	9	0100	2	266	6	37.90	ND
2012	5	9	0200	1	289	3	32.00	ND
2012	5	9	0300	3	283	6	38.20	ND
2012	5	9	0400	2	239	4	33.80	ND
2012	5	9	0500	2	197	5	57.80	ND
2012	5	9	0600	2	308	4	72.00	ND
2012	5	9	0700	2	31	9	45.60	ND
2012	5	9	0800	2	314	9	33.10	ND
2012	5	9	0900	3	91	11	18.90	ND
2012	5	9	1000	4	96	10	12.60	ND
2012	5	9	1100	4	172	14	16.90	ND
2012	5	9	1200	5	178	14	13.30	ND
2012	5	9	1300	5	93	15	17.20	ND
2012	5	9	1400	5	121	17	10.70	ND
2012	5	9	1500	4	129	12	11.80	ND
2012	5	9	1600	4	158	15	12.70	ND
2012	5	9	1700	2	314	9	12.40	ND
2012	5	9	1800	3	157	5	21.10	ND
2012	5	9	1900	2	207	4	28.10	ND
2012	5	9	2000	2	156	7	51.80	ND
2012	5	9	2100	2	272	5	45.40	ND
2012	5	9	2200	3	16	6	45.70	ND
2012	5	9	2300	2	271	6	47.50	ND

Table 5. Jerome Mack Monitoring Data for May 11, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2012	5	11	0000	6	168	14	64.80	ND
2012	5	11	0100	5	166	11	30.20	ND
2012	5	11	0200	5	231	13	27.20	ND
2012	5	11	0300	6	256	13	30.80	ND
2012	5	11	0400	5	321	12	47.50	ND
2012	5	11	0500	3	17	14	84.20	ND
2012	5	11	0600	7	351	21	74.60	ND
2012	5	11	0700	6	339	16	58.90	ND
2012	5	11	0800	8	32	16	68.40	ND
2012	5	11	0900	6	48	14	48.70	ND
2012	5	11	1000	6	54	17	44.30	ND
2012	5	11	1100	5	19	14	40.50	ND
2012	5	11	1200	5	60	14	38.90	ND
2012	5	11	1300	5	103	13	34.60	ND
2012	5	11	1400	5	143	13	26.40	ND
2012	5	11	1500	6	203	16	37.20	ND
2012	5	11	1600	7	200	15	33.70	ND
2012	5	11	1700	6	192	16	29.60	ND
2012	5	11	1800	4	179	8	36.20	ND
2012	5	11	1900	4	181	9	44.70	ND
2012	5	11	2000	3	126	6	40.50	ND
2012	5	11	2100	2	7	7	59.00	ND
2012	5	11	2200	3	286	6	58.00	ND
2012	5	11	2300	3	272	8	46.20	ND

Table 6. Jerome Mack Monitoring Data for May 10, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2012	5	10	0000	4	139	13	47.80	ND
2012	5	10	0100	4	146	9	324.70	ND
2012	5	10	0200	2	337	6	277.50	ND
2012	5	10	0300	3	129	6	402.90	ND
2012	5	10	0400	3	209	6	296.10	ND
2012	5	10	0500	3	179	7	221.80	ND
2012	5	10	0600	2	138	5	242.90	ND
2012	5	10	0700	5	114	11	554.30	ND
2012	5	10	0800	8	83	17	612.40	ND
2012	5	10	0900	8	86	19	435.70	ND
2012	5	10	1000	10	77	21	364.80	ND
2012	5	10	1100	10	83	20	357.20	ND
2012	5	10	1200	10	92	20	296.70	ND
2012	5	10	1300	9	93	20	277.70	ND
2012	5	10	1400	11	110	22	224.00	ND
2012	5	10	1500	11	116	22	179.20	ND
2012	5	10	1600	10	205	28	54.40	ND
2012	5	10	1700	8	211	18	17.50	ND
2012	5	10	1800	4	206	12	22.40	ND
2012	5	10	1900	8	213	20	41.70	ND
2012	5	10	2000	12	210	22	54.60	ND
2012	5	10	2100	9	204	18	37.70	ND
2012	5	10	2200	7	190	17	71.20	ND
2012	5	10	2300	5	142	13	92.20	ND

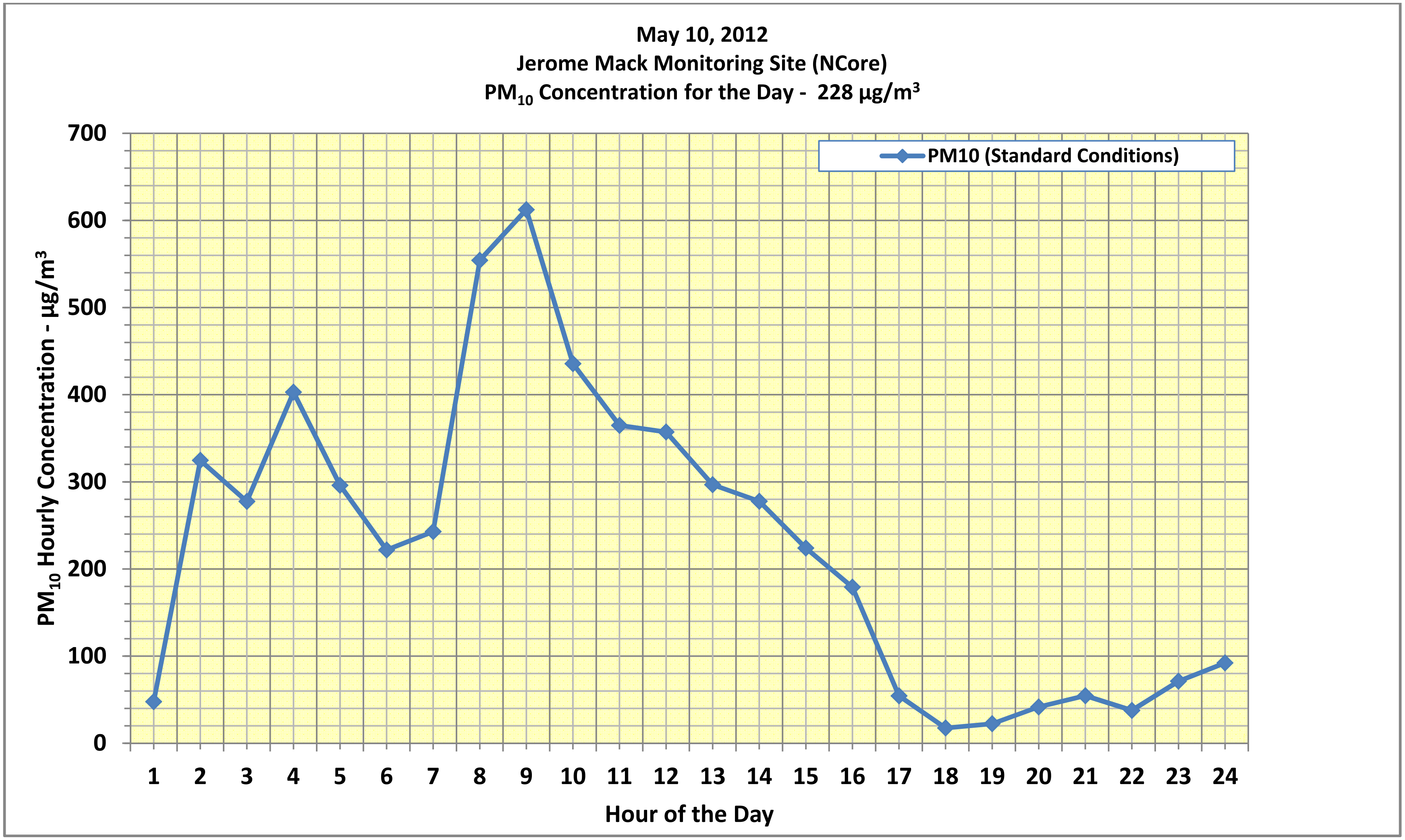


Figure 6. PM_{10} Concentrations at Jerome Mack Monitoring Site, May 10, 2012.

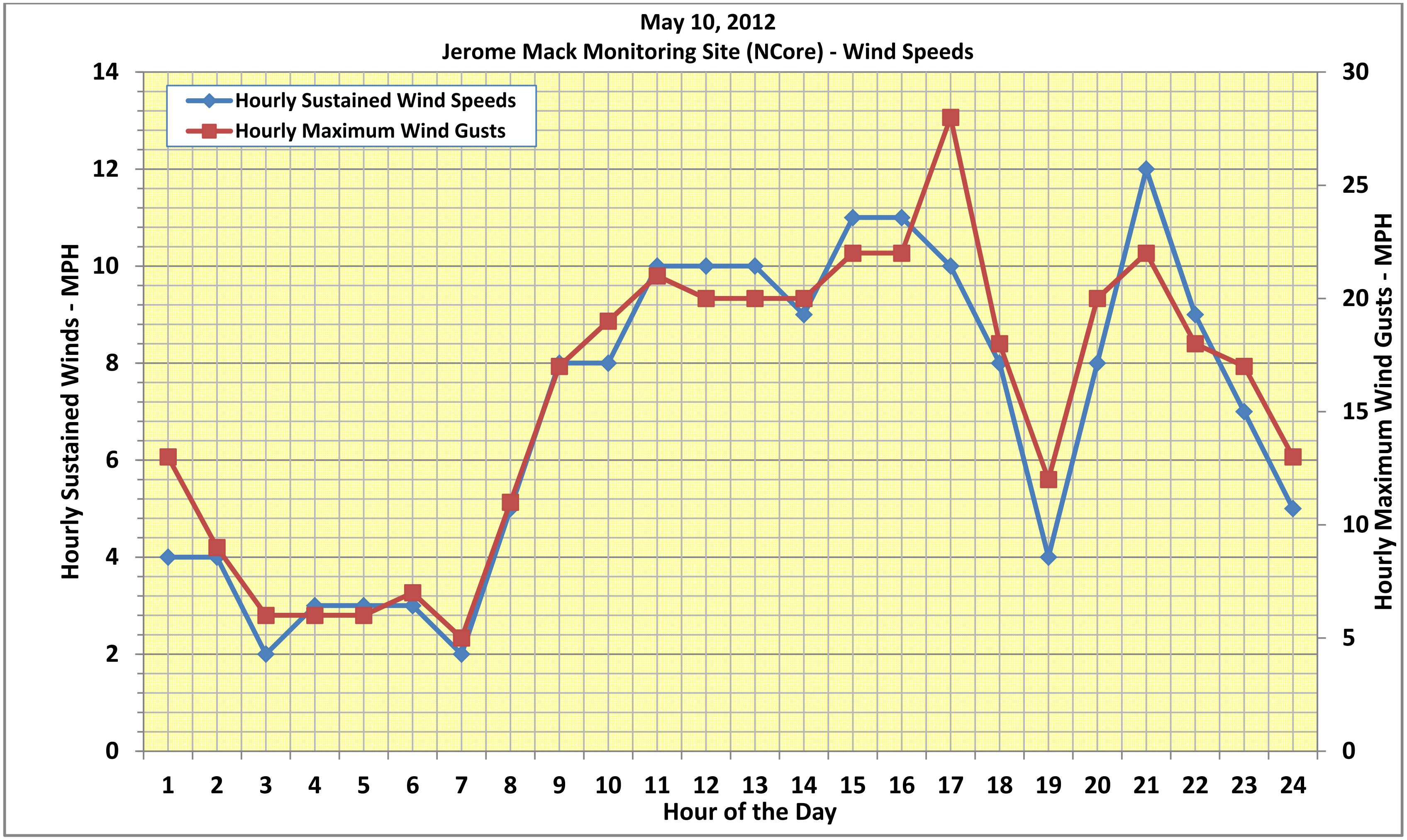


Figure 6a. Wind Speeds at Jerome Mack Monitoring Site, May 10, 2012.

Table 7. Sunrise Acres Monitoring Data for May 9, 2012

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)
2012	5	9	0000	2	110	8	51.40	48.80
2012	5	9	0100	2	274	4	39.10	68.60
2012	5	9	0200	2	251	5	36.70	102.50
2012	5	9	0300	1	261	4	38.10	140.10
2012	5	9	0400	1	295	3	39.70	180.10
2012	5	9	0500	2	138	5	58.90	238.00
2012	5	9	0600	2	29	7	53.70	288.80
2012	5	9	0700	4	350	10	47.20	329.50
2012	5	9	0800	4	43	12	ND	ND
2012	5	9	0900	5	51	14	ND	ND
2012	5	9	1000	4	32	21	21.00	28.10
2012	5	9	1100	4	150	12	16.30	44.50
2012	5	9	1200	5	228	15	21.20	63.80
2012	5	9	1300	6	146	18	19.30	80.80
2012	5	9	1400	5	135	17	18.80	98.10
2012	5	9	1500	4	242	14	11.00	109.70
2012	5	9	1600	4	75	17	16.40	123.80
2012	5	9	1700	3	113	9	15.00	139.10
2012	5	9	1800	2	157	5	22.30	159.20
2012	5	9	1900	3	201	5	38.50	194.60
2012	5	9	2000	2	201	6	34.10	228.20
2012	5	9	2100	3	268	6	44.30	269.00
2012	5	9	2200	2	43	6	26.40	295.90
2012	5	9	2300	2	324	4	59.60	348.70

Table 8. Sunrise Acres Monitoring Data for May 11, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2012	5	11	0000	9	187	20	41.30	31.40
2012	5	11	0100	3	212	15	41.50	62.50
2012	5	11	0200	3	246	15	42.00	101.70
2012	5	11	0300	3	301	8	32.80	133.10
2012	5	11	0400	4	0	17	39.20	168.10
2012	5	11	0500	4	359	11	34.40	201.40
2012	5	11	0600	5	19	14	36.60	237.70
2012	5	11	0700	6	354	16	37.90	274.40
2012	5	11	0800	6	27	19	50.00	320.10
2012	5	11	0900	5	59	17	39.60	357.50
2012	5	11	1000	4	43	19	40.10	395.50
2012	5	11	1100	5	79	16	38.60	429.90
2012	5	11	1200	4	145	14	39.60	466.70
2012	5	11	1300	3	254	14	38.50	502.40
2012	5	11	1400	3	206	12	34.80	535.30
2012	5	11	1500	6	217	16	37.90	569.60
2012	5	11	1600	6	199	17	37.90	605.40
2012	5	11	1700	6	189	16	37.60	639.40
2012	5	11	1800	5	185	14	40.30	677.10
2012	5	11	1900	4	174	14	42.10	716.00
2012	5	11	2000	4	120	12	40.60	754.30
2012	5	11	2100	4	329	7	51.10	801.40
2012	5	11	2200	3	318	8	42.30	841.70
2012	5	11	2300	1	242	6	38.00	876.50

Table 9. Sunrise Acres Monitoring Data for May 10, 2012

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)
2012	5	10	0000	3	151	13	39.70	26.60
2012	5	10	0100	3	178	9	68.10	83.80
2012	5	10	0200	2	330	6	182.40	256.00
2012	5	10	0300	2	302	3	189.70	439.40
2012	5	10	0400	2	286	4	262.90	696.70
2012	5	10	0500	2	206	7	348.80	1032.00
2012	5	10	0600	2	141	8	404.10	968.40
2012	5	10	0700	4	130	11	414.60	313.90
2012	5	10	0800	6	110	15	527.80	810.50
2012	5	10	0900	6	81	14	495.40	1272.40
2012	5	10	1000	6	92	18	409.90	278.90
2012	5	10	1100	5	105	16	323.10	431.20
2012	5	10	1200	7	110	19	285.60	693.60
2012	5	10	1300	8	110	20	257.80	930.30
2012	5	10	1400	9	119	21	243.80	1151.50
2012	5	10	1500	10	124	23	220.90	1351.60
2012	5	10	1600	9	186	23	135.10	1317.20
2012	5	10	1700	7	195	19	43.20	26.30
2012	5	10	1800	4	201	12	25.50	50.50
2012	5	10	1900	8	210	19	38.20	84.70
2012	5	10	2000	9	201	21	38.80	122.20
2012	5	10	2100	7	207	20	37.40	155.60
2012	5	10	2200	4	170	11	56.10	208.70
2012	5	10	2300	8	188	19	50.80	255.30

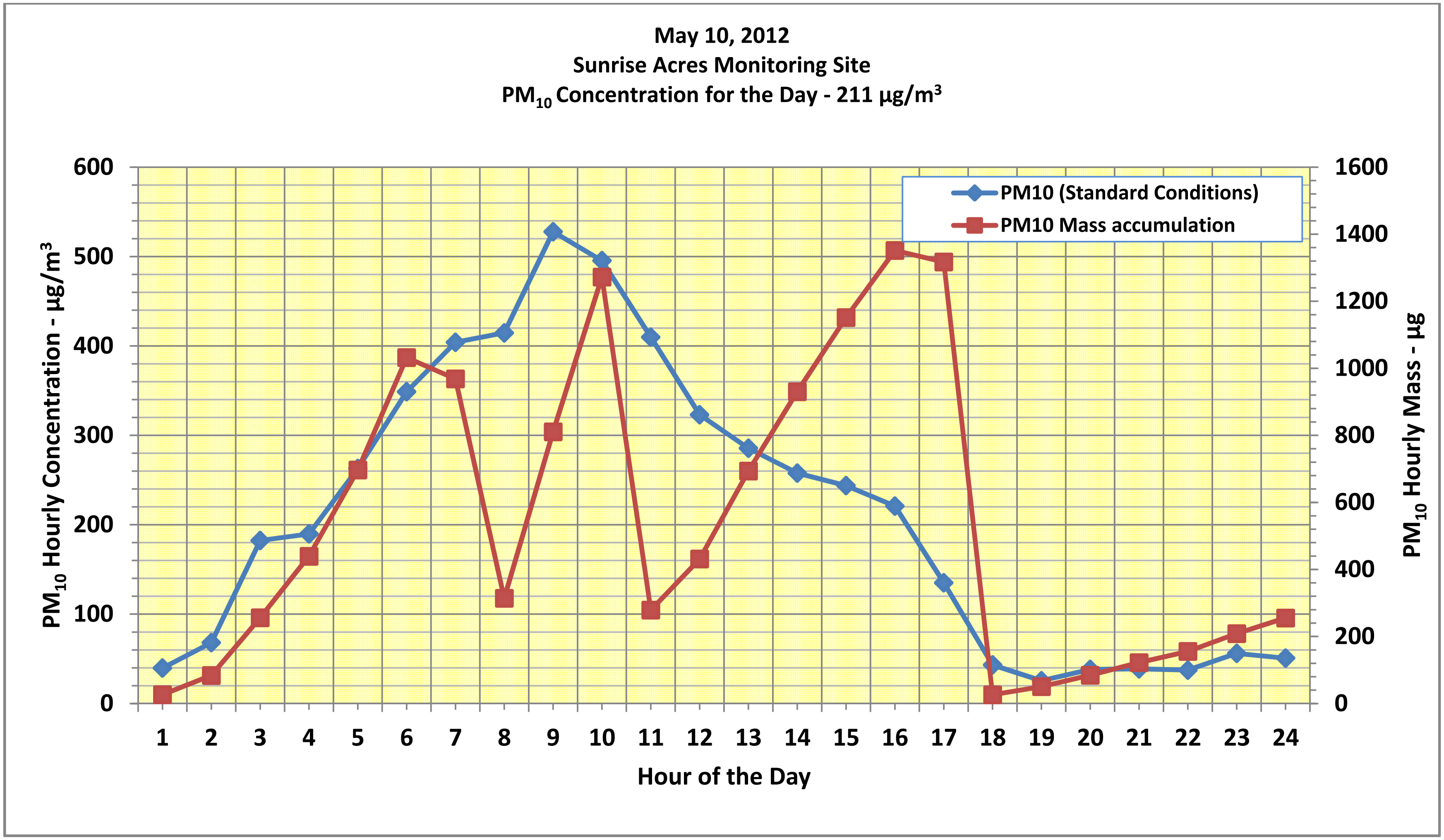


Figure 7. PM_{10} Concentrations at Sunrise Acres Monitoring Site, May 10, 2012.

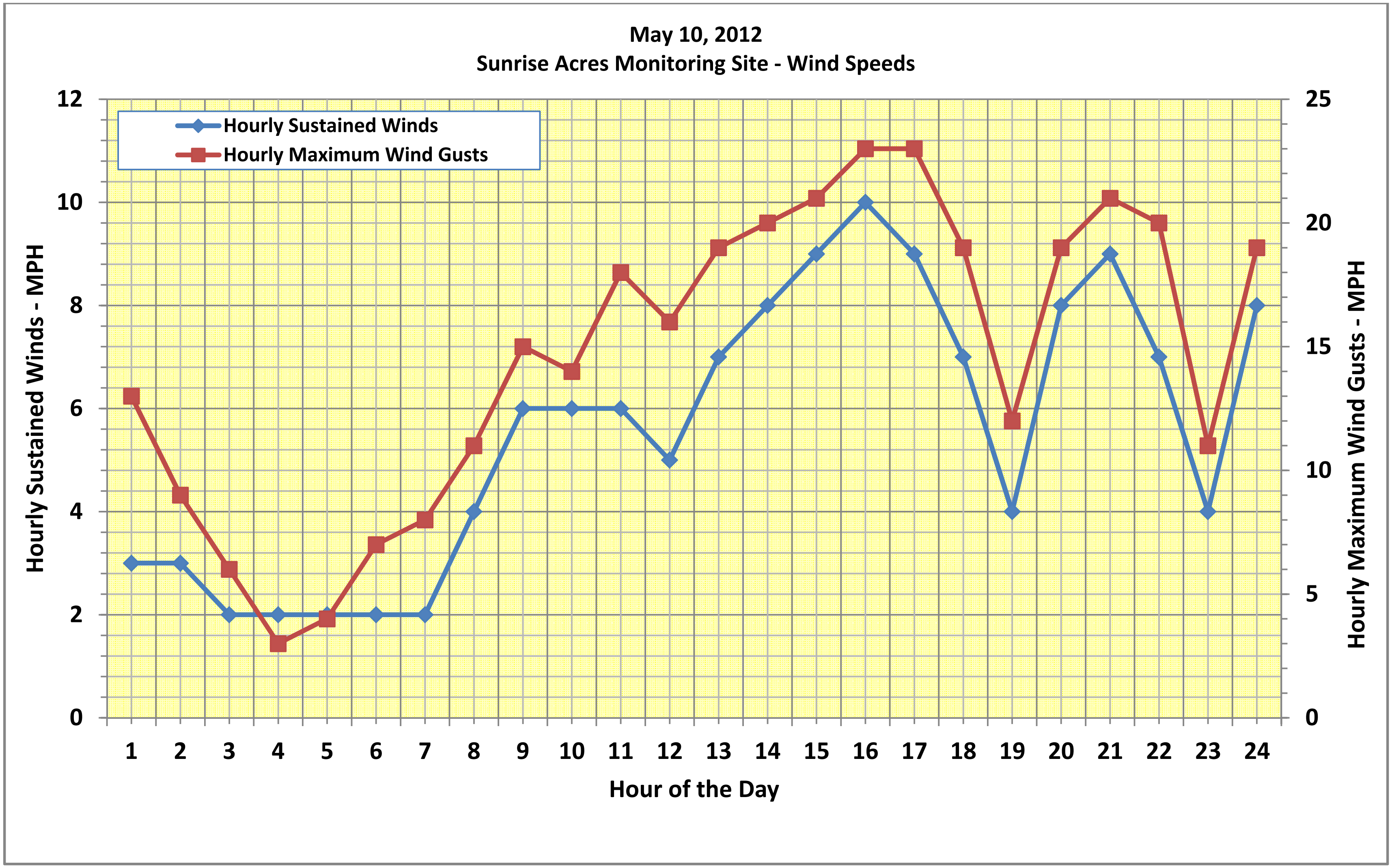


Figure 7a. Wind Speeds at Sunrise Acres Monitoring Site, May 10, 2012.

Table 10. J. D. Smith Monitoring Data for May 9, 2012

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)
2012	5	9	0000	3	113	7	35.60	35.30
2012	5	9	0100	2	293	4	33.00	51.60
2012	5	9	0200	2	238	5	38.30	87.40
2012	5	9	0300	2	252	4	38.00	125.20
2012	5	9	0400	2	310	5	34.40	159.20
2012	5	9	0500	2	153	5	42.90	200.60
2012	5	9	0600	2	118	5	45.70	243.20
2012	5	9	0700	3	352	6	33.40	276.20
2012	5	9	0800	4	51	9	36.10	310.80
2012	5	9	0900	5	74	16	24.20	333.00
2012	5	9	1000	4	78	13	16.20	347.80
2012	5	9	1100	3	256	9	14.20	361.10
2012	5	9	1200	6	157	14	15.20	375.10
2012	5	9	1300	4	169	14	16.00	392.20
2012	5	9	1400	4	133	15	18.00	406.60
2012	5	9	1500	4	174	10	20.70	426.20
2012	5	9	1600	4	143	10	21.80	446.60
2012	5	9	1700	3	65	8	17.70	463.70
2012	5	9	1800	2	154	4	27.90	489.50
2012	5	9	1900	2	199	4	41.20	527.50
2012	5	9	2000	2	229	5	40.50	564.60
2012	5	9	2100	3	299	7	44.50	608.00
2012	5	9	2200	2	324	6	47.00	650.30
2012	5	9	2300	2	314	4	23.90	675.20

Table 11. J. D. Smith Monitoring Data for May 11, 2012

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)
2012	5	11	0000	7	185	15	40.90	30.00
2012	5	11	0100	3	253	12	47.40	71.30
2012	5	11	0200	3	238	9	38.10	107.30
2012	5	11	0300	5	309	14	30.80	135.50
2012	5	11	0400	5	342	18	22.80	158.30
2012	5	11	0500	5	338	15	26.10	183.60
2012	5	11	0600	4	45	10	39.60	219.90
2012	5	11	0700	5	343	14	35.20	252.90
2012	5	11	0800	7	48	14	38.90	290.40
2012	5	11	0900	6	52	16	43.90	332.10
2012	5	11	1000	5	67	16	43.10	371.60
2012	5	11	1100	5	189	12	36.50	404.70
2012	5	11	1200	4	207	13	39.50	440.60
2012	5	11	1300	4	218	13	34.80	473.40
2012	5	11	1400	4	198	13	24.90	497.60
2012	5	11	1500	6	206	18	42.40	534.30
2012	5	11	1600	5	204	12	30.90	564.50
2012	5	11	1700	6	185	12	29.50	590.60
2012	5	11	1800	4	184	12	32.10	621.30
2012	5	11	1900	3	190	8	39.60	657.50
2012	5	11	2000	3	47	6	48.20	702.60
2012	5	11	2100	3	335	8	48.80	747.40
2012	5	11	2200	3	273	6	30.40	777.00
2012	5	11	2300	2	245	5	24.40	803.50

Table 12. J. D. Smith Monitoring Data for May 10, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2012	5	10	0000	3	145	15	36.50	35.60
2012	5	10	0100	3	185	11	79.00	98.40
2012	5	10	0200	3	345	6	133.10	225.30
2012	5	10	0300	3	321	7	171.90	393.10
2012	5	10	0400	2	319	5	319.20	703.00
2012	5	10	0500	2	310	5	415.20	1098.60
2012	5	10	0600	3	105	8	415.40	771.80
2012	5	10	0700	5	115	9	402.20	353.70
2012	5	10	0800	5	80	13	490.00	812.90
2012	5	10	0900	4	70	12	458.20	1239.70
2012	5	10	1000	5	93	13	385.40	408.80
2012	5	10	1100	4	106	13	285.20	342.10
2012	5	10	1200	5	122	13	240.30	563.40
2012	5	10	1300	7	125	16	227.40	772.20
2012	5	10	1400	9	127	19	224.70	975.30
2012	5	10	1500	10	125	21	199.20	1158.40
2012	5	10	1600	8	198	21	150.80	1291.50
2012	5	10	1700	8	188	17	45.50	1332.40
2012	5	10	1800	4	185	12	20.70	1353.70
2012	5	10	1900	8	211	22	51.60	1400.90
2012	5	10	2000	7	211	21	46.70	1441.40
2012	5	10	2100	6	215	14	31.90	888.30
2012	5	10	2200	4	174	10	38.10	33.80
2012	5	10	2300	6	170	13	35.70	66.30

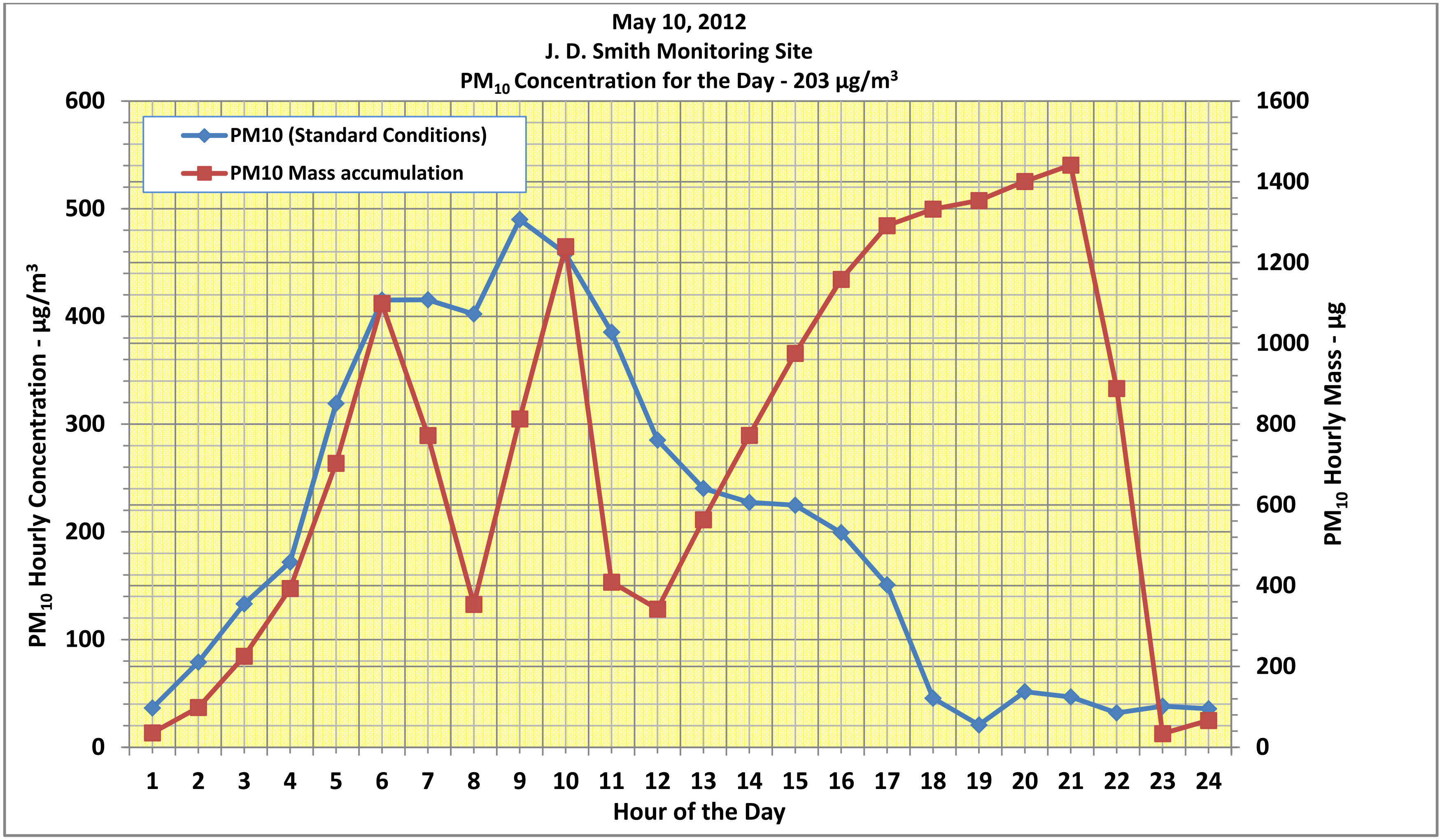


Figure 8. PM_{10} Concentrations at J. D. Smith Monitoring Site, May 10, 2012.

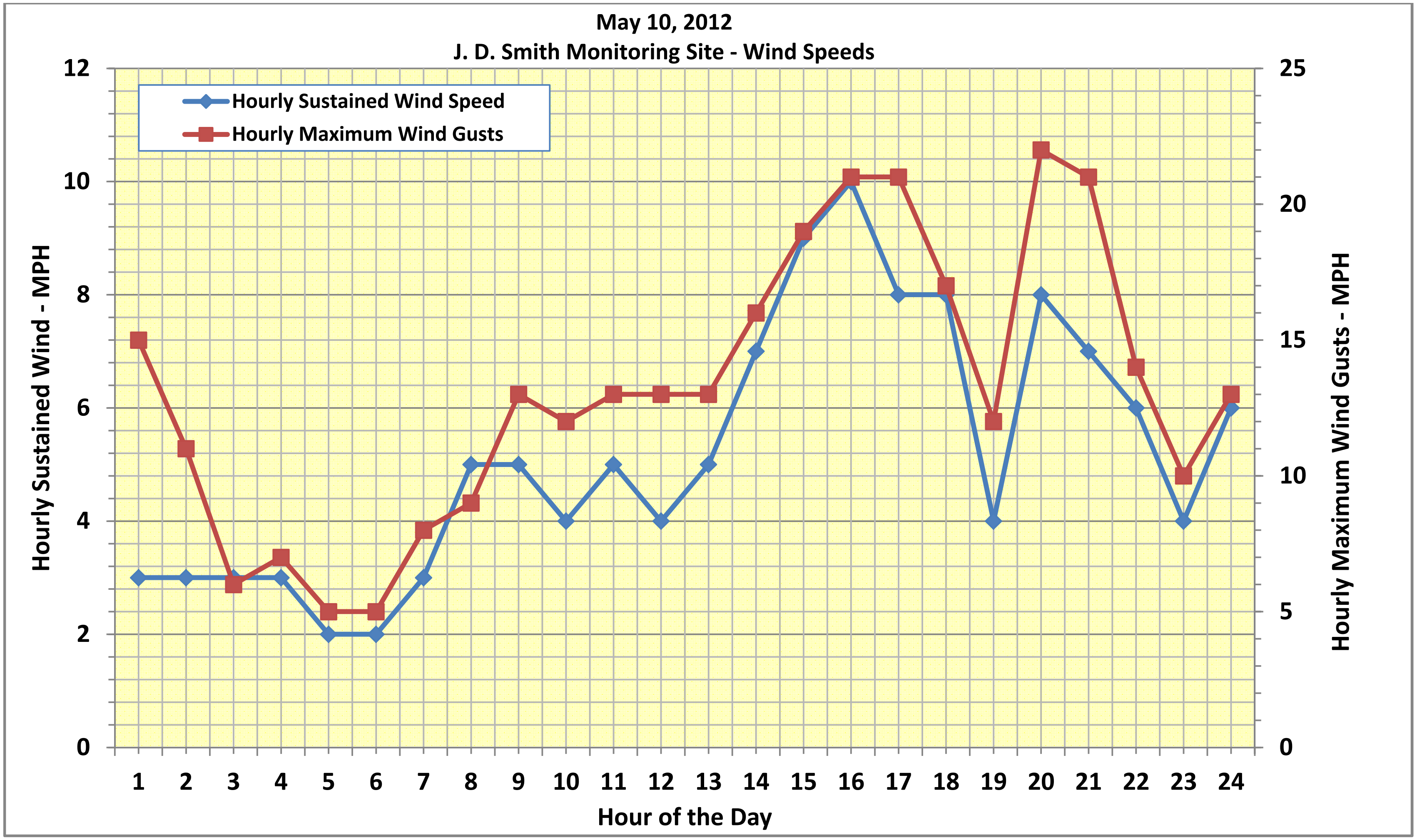


Figure 8a. Wind Speeds at J. D. Smith Monitoring Site, May 10, 2012.

Table 13. Joe Neal Monitoring Data for May 9, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2012	5	9	0000	10	312	19	5.10	12.80
2012	5	9	0100	4	336	15	11.70	23.10
2012	5	9	0200	5	313	11	15.50	39.00
2012	5	9	0300	7	318	15	15.70	53.70
2012	5	9	0400	5	319	12	18.80	71.10
2012	5	9	0500	7	318	16	24.10	94.30
2012	5	9	0600	7	323	15	28.00	119.80
2012	5	9	0700	5	342	12	29.20	148.40
2012	5	9	0800	3	138	9	27.40	173.80
2012	5	9	0900	5	144	14	26.90	197.90
2012	5	9	1000	5	132	14	18.40	215.30
2012	5	9	1100	5	132	17	17.30	231.80
2012	5	9	1200	5	133	17	15.60	246.40
2012	5	9	1300	5	88	18	15.30	260.80
2012	5	9	1400	5	167	14	13.60	274.00
2012	5	9	1500	4	209	14	22.00	293.20
2012	5	9	1600	5	130	14	17.10	309.50
2012	5	9	1700	4	128	12	16.90	325.30
2012	5	9	1800	4	142	9	20.60	344.80
2012	5	9	1900	3	184	6	45.00	384.50
2012	5	9	2000	2	227	6	32.40	417.90
2012	5	9	2100	3	328	6	50.90	465.00
2012	5	9	2200	2	349	6	45.50	507.50
2012	5	9	2300	3	342	7	34.10	531.00

Table 14. Joe Neal Monitoring Data for May 11, 2012

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)
2012	5	11	0000	5	317	10	25.40	16.50
2012	5	11	0100	6	334	12	29.20	42.60
2012	5	11	0200	4	48	11	22.70	64.90
2012	5	11	0300	6	9	20	25.30	88.70
2012	5	11	0400	6	14	16	21.40	109.50
2012	5	11	0500	9	329	21	31.40	138.00
2012	5	11	0600	9	333	21	38.40	175.60
2012	5	11	0700	10	335	24	46.50	217.40
2012	5	11	0800	8	322	20	39.00	254.80
2012	5	11	0900	4	337	17	33.00	286.50
2012	5	11	1000	4	56	20	41.60	323.90
2012	5	11	1100	6	128	16	37.90	359.40
2012	5	11	1200	5	120	15	35.10	392.50
2012	5	11	1300	6	136	16	47.00	434.20
2012	5	11	1400	5	175	17	37.10	468.40
2012	5	11	1500	6	190	18	36.30	501.70
2012	5	11	1600	5	214	18	38.60	535.80
2012	5	11	1700	5	218	12	36.00	568.60
2012	5	11	1800	4	234	10	37.00	602.40
2012	5	11	1900	2	278	9	57.80	656.60
2012	5	11	2000	4	338	8	56.30	710.20
2012	5	11	2100	5	339	12	44.30	750.10
2012	5	11	2200	5	319	10	23.00	774.00
2012	5	11	2300	4	271	10	28.30	789.50

Table 15. Joe Neal Monitoring Data for May 10, 2012

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)
2012	5	10	0000	2	328	7	25.91	12.10
2012	5	10	0100	5	346	10	32.58	41.30
2012	5	10	0200	3	55	10	56.80	104.40
2012	5	10	0300	5	21	9	336.53	418.80
2012	5	10	0400	4	346	7	303.19	703.80
2012	5	10	0500	4	341	7	226.56	922.70
2012	5	10	0600	5	40	18	324.17	1233.00
2012	5	10	0700	9	101	19	444.25	449.20
2012	5	10	0800	8	101	18	469.63	547.70
2012	5	10	0900	8	106	18	441.71	954.90
2012	5	10	1000	8	112	17	375.02	1298.90
2012	5	10	1100	7	108	23	336.70	312.40
2012	5	10	1200	7	125	25	272.72	328.60
2012	5	10	1300	8	142	20	184.98	496.00
2012	5	10	1400	10	126	23	141.87	622.10
2012	5	10	1500	9	135	23	102.43	716.20
2012	5	10	1600	9	186	21	78.26	784.50
2012	5	10	1700	9	198	22	30.87	812.30
2012	5	10	1800	5	194	14	21.00	831.70
2012	5	10	1900	3	186	11	46.43	873.70
2012	5	10	2000	7	222	20	23.43	897.80
2012	5	10	2100	7	50	22	31.26	925.30
2012	5	10	2200	5	54	15	45.83	967.40
2012	5	10	2300	4	41	10	33.85	986.90

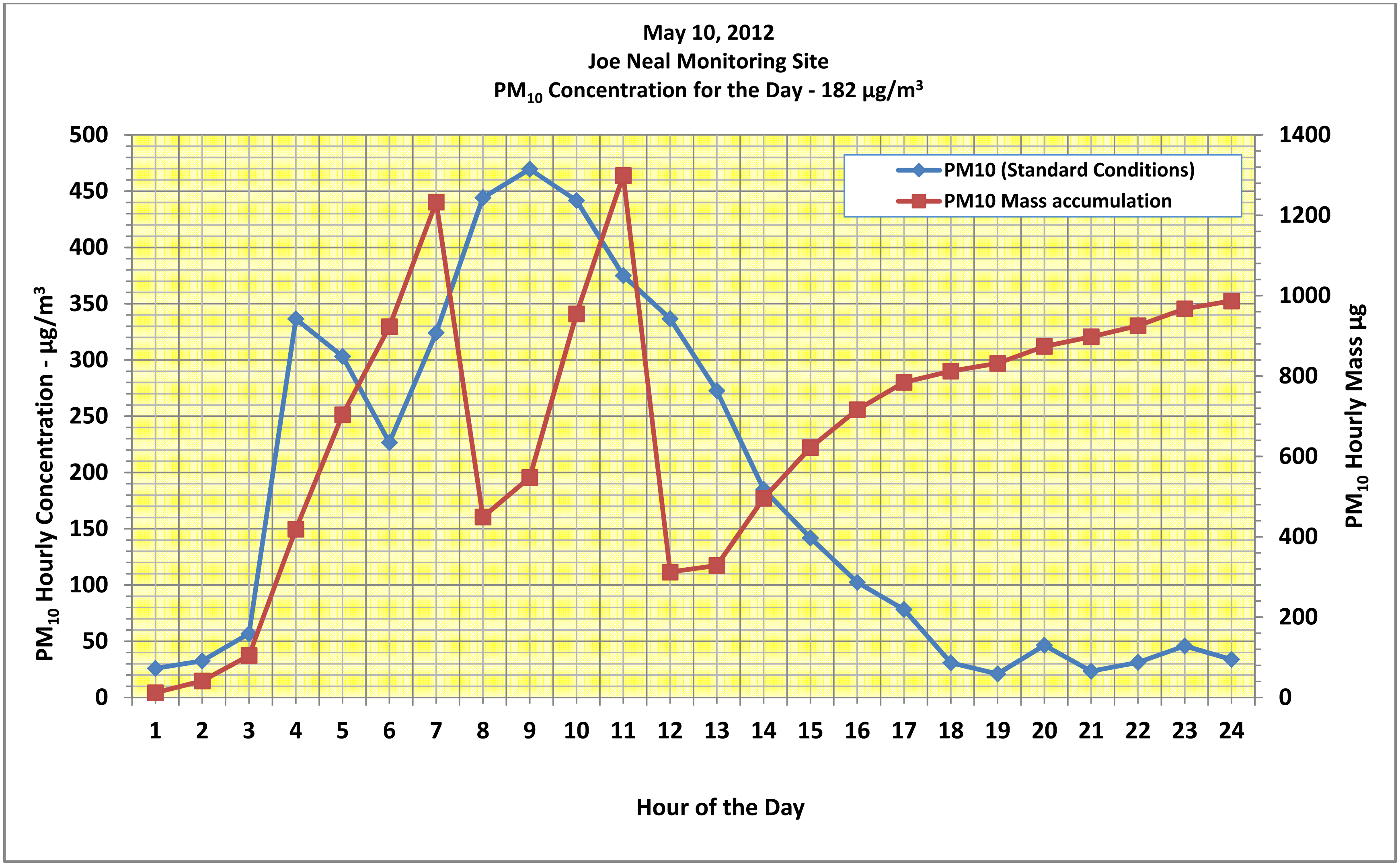


Figure 9. PM_{10} Concentrations at Joe Neal Monitoring Site, May 10, 2012.

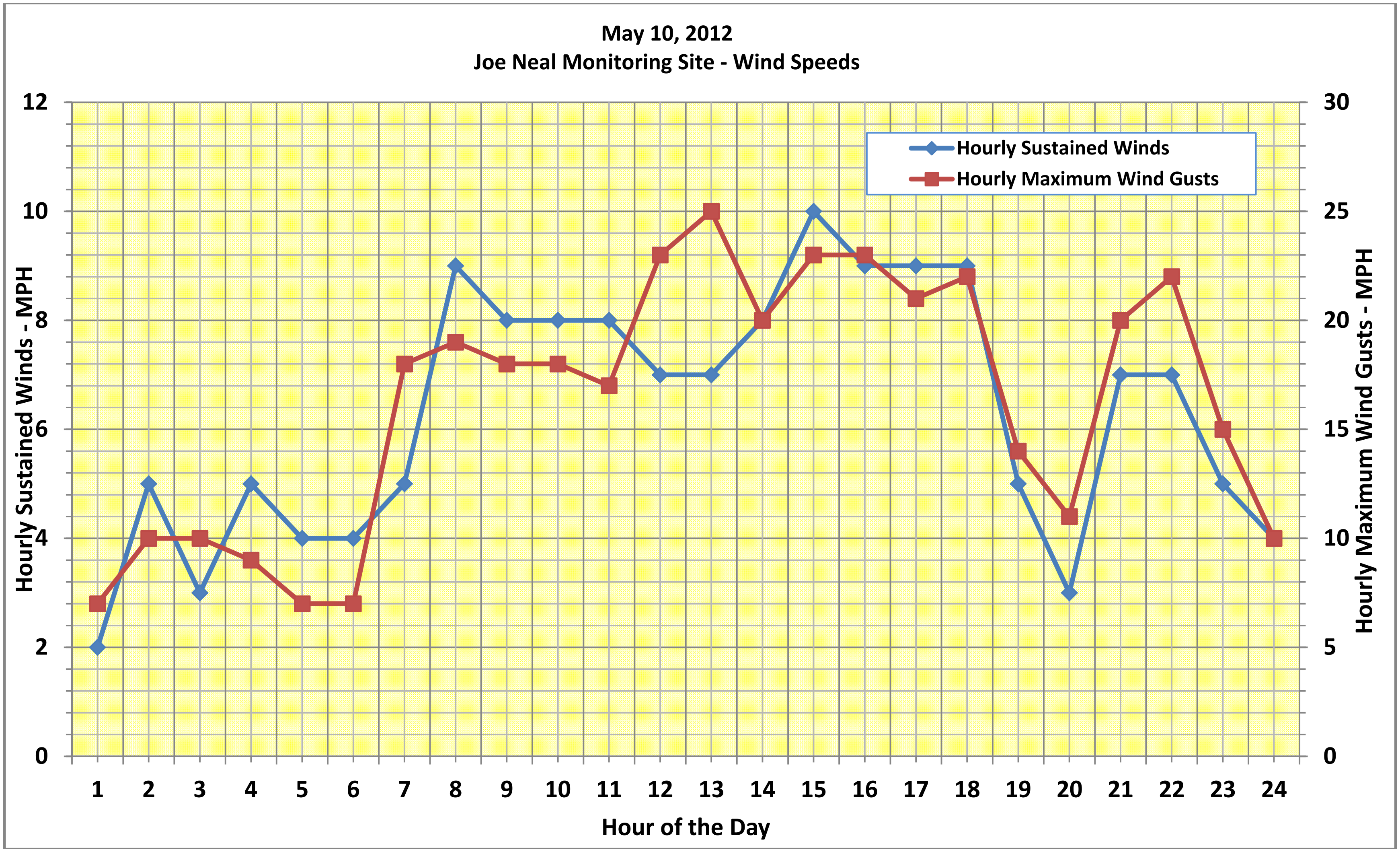


Figure 9a. Wind Speeds at Joe Neal Monitoring Site, May 10, 2012.

Table 16. Green Valley Monitoring Data for May 9, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2012	5	9	0000	2	228	6	27.8	29.2
2012	5	9	0100	3	235	6	24.7	37.4
2012	5	9	0200	4	240	11	24.6	60.5
2012	5	9	0300	3	229	6	21.4	81.6
2012	5	9	0400	3	236	6	19.9	10 0.9
2012	5	9	0500	2	231	5	24.2	125.5
2012	5	9	0600	2	242	8	29.6	153.8
2012	5	9	0700	1	257	4	29.5	181.2
2012	5	9	0800	2	3	7	19.6	200.0
2012	5	9	0900	3	32	10	21.1	219.5
2012	5	9	1000	3	341	9	16.4	235.3
2012	5	9	1100	3	344	11	15.8	249.4
2012	5	9	1200	3	214	11	19 .5	267.7
2012	5	9	1300	5	101	21	14.1	280.5
2012	5	9	1400	5	71	17	13.4	292.3
2012	5	9	1500	6	76	18	11.2	303.5
2012	5	9	1600	3	43	9	10.5	313.7
2012	5	9	1700	3	6	9	18.2	330.4
2012	5	9	1800	2	225	4	26.3	354.8
2012	5	9	1900	3	231	5	39.6	392.1
2012	5	9	2000	3	223	7	41.1	429.4
2012	5	9	2100	6	257	12	22.4	449.8
2012	5	9	2200	5	243	12	24.0	473.5
2012	5	9	2300	2	248	6	21.1	493.0

Table 17. Green Valley Monitoring Data for May 11, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2012	5	11	0000	4	232	16	47.7	23.6
2012	5	11	0100	8	205	24	41.5	52.9
2012	5	11	0200	11	201	28	39.3	89.6
2012	5	11	0300	8	225	22	35.4	122.1
2012	5	11	0400	6	256	32	24.5	146.1
2012	5	11	0500	1	241	6	26.2	172.4
2012	5	11	0600	5	334	13	41.6	210.3
2012	5	11	0700	7	7	20	39.5	248.8
2012	5	11	0800	7	22	17	39.6	285.3
2012	5	11	0900	5	58	15	ND	ND
2012	5	11	1000	5	59	14	ND	ND
2012	5	11	1100	4	86	13	ND	ND
2012	5	11	1200	4	349	13	32.9	1046.8
2012	5	11	1300	4	55	11	40.3	1084.1
2012	5	11	1400	4	307	13	33.0	1115.2
2012	5	11	1500	4	268	14	36.6	1148.0
2012	5	11	1600	4	51	9	35.8	1181.0
2012	5	11	1700	2	330	8	32.7	1210.6
2012	5	11	1800	2	30	6	37.1	1245.7
2012	5	11	1900	4	187	9	43.4	1285.4
2012	5	11	2000	2	218	7	35.9	1317.6
2012	5	11	2100	3	216	10	26.5	1341.3
2012	5	11	2200	5	247	9	21.9	1363.2
2012	5	11	2300	5	246	9	26.2	1387.7

Table 18. Green Valley Monitoring Data for May 10, 2012

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)
2012	5	10	0000	3	259	7	30.5	23.6
2012	5	10	0100	4	226	11	27.2	35.5
2012	5	10	0200	4	289	11	95.4	123.8
2012	5	10	0300	2	281	9	79.5	202.3
2012	5	10	0400	3	208	6	76.8	281.0
2012	5	10	0500	3	232	7	149.0	417.8
2012	5	10	0600	2	333	5	75.0	495.2
2012	5	10	0700	3	325	7	187.8	676.7
2012	5	10	0800	2	129	11	367.7	1018.5
2012	5	10	0900	5	77	25	380.7	1134.5
2012	5	10	1000	6	60	14	368.5	215.7
2012	5	10	1100	5	46	15	287.1	478.8
2012	5	10	1200	6	121	30	253.3	709.3
2012	5	10	1300	9	125	29	263.7	949.9
2012	5	10	1400	12	141	27	236.3	1164.6
2012	5	10	1500	7	167	35	180.1	1322.5
2012	5	10	1600	8	226	22	55.2	1375.3
2012	5	10	1700	6	217	14	37.9	1408.2
2012	5	10	1800	4	206	28	28.8	1435.7
2012	5	10	1900	6	215	19	40.1	1236.1
2012	5	10	2000	8	220	18	44.4	31.9
2012	5	10	2100	8	214	18	67.4	96.4
2012	5	10	2200	12	205	28	104.8	191.9
2012	5	10	2300	8	220	24	68.7	253.2

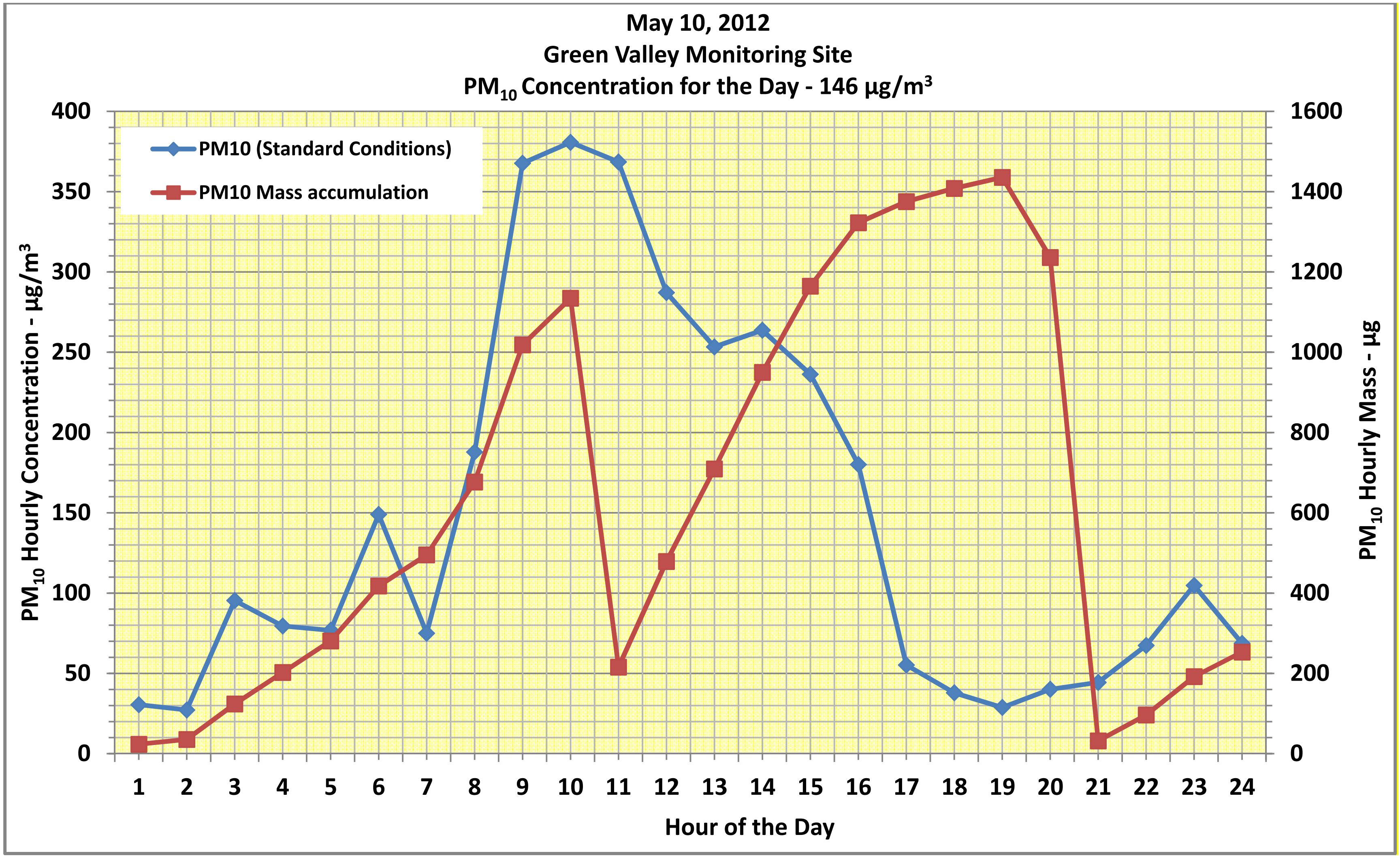


Figure 10. PM_{10} Concentrations at Green Valley Monitoring Site, May 10, 2012.

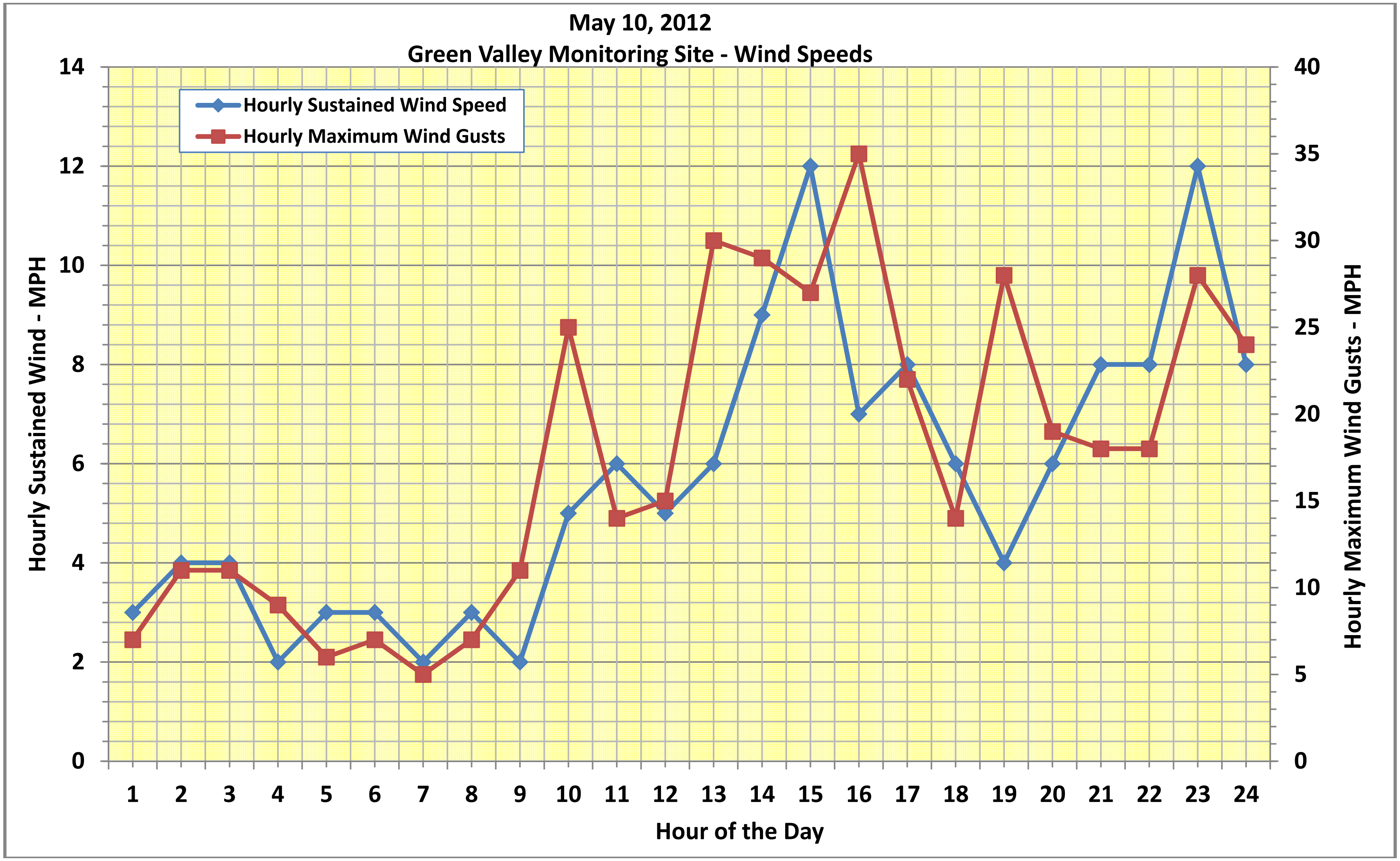


Figure 10a. Wind Speeds at Green Valley Monitoring Site, May 10, 2012.

Table 19. Paul Meyer Monitoring Data for May 9, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2012	5	9	0000	3	198	7	29.9	28.6
2012	5	9	0100	4	271	8	44.2	57.9
2012	5	9	0200	4	258	9	43.7	99.1
2012	5	9	0300	4	245	8	26.3	124.0
2012	5	9	0400	2	267	5	17.1	141.5
2012	5	9	0500	3	273	6	18.9	159.1
2012	5	9	0600	2	183	8	32.3	187.7
2012	5	9	0700	2	87	10	23.3	210.6
2012	5	9	0800	3	65	12	19.9	228.6
2012	5	9	0900	4	69	16	ND	ND
2012	5	9	1000	4	17	12	ND	ND
2012	5	9	1100	4	97	17	ND	ND
2012	5	9	1200	5	75	17	16.0	24.0
2012	5	9	1300	5	86	19	22.8	41.4
2012	5	9	1400	5	128	19	16.7	57.8
2012	5	9	1500	4	117	16	10.7	68.7
2012	5	9	1600	4	161	11	19.4	84.2
2012	5	9	1700	3	172	12	14.3	97.0
2012	5	9	1800	2	175	5	19.6	115.6
2012	5	9	1900	2	225	4	24.2	137.6
2012	5	9	2000	4	253	7	30.8	166.0
2012	5	9	2100	3	253	5	24.9	189.1
2012	5	9	2200	4	259	6	26.2	212.7
2012	5	9	2300	5	241	8	18.6	230.9

Table 20. Paul Meyer Monitoring Data for May 11, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2012	5	11	0000	4	192	9	34.4	23.3
2012	5	11	0100	4	202	8	39.8	53.1
2012	5	11	0200	2	130	5	31.5	82.8
2012	5	11	0300	3	190	9	35.2	115.5
2012	5	11	0400	3	249	7	28.9	143.1
2012	5	11	0500	2	224	7	32.4	173.3
2012	5	11	0600	2	244	11	38.4	210.1
2012	5	11	0700	6	342	25	42.2	251.9
2012	5	11	0800	9	9	25	69.6	313.5
2012	5	11	0900	6	34	20	38.0	348.2
2012	5	11	1000	6	38	16	41.9	387.2
2012	5	11	1100	5	85	17	32.4	416.8
2012	5	11	1200	5	78	13	37.9	450.7
2012	5	11	1300	4	84	17	33.6	482.0
2012	5	11	1400	4	161	14	39.6	516.2
2012	5	11	1500	3	178	10	36.7	549.9
2012	5	11	1600	4	138	14	34.7	580.4
2012	5	11	1700	2	107	12	32.4	611.5
2012	5	11	1800	2	117	7	36.4	644.8
2012	5	11	1900	3	239	9	38.3	679.0
2012	5	11	2000	5	273	14	24.4	700.9
2012	5	11	2100	5	303	10	24.6	724.6
2012	5	11	2200	4	265	8	29.1	750.3
2012	5	11	2300	3	269	7	31.9	781.4

Table 21. Paul Meyer Monitoring Data for May 10, 2012

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)
2012	5	10	0000	4	230	9	18.6	11.3
2012	5	10	0100	3	130	9	17.2	19.8
2012	5	10	0200	4	344	10	25.3	45.2
2012	5	10	0300	3	289	6	68.8	110.6
2012	5	10	0400	4	279	8	153.2	259.6
2012	5	10	0500	3	266	6	275.7	521.8
2012	5	10	0600	3	353	8	358.3	864.9
2012	5	10	0700	5	1	9	435.5	1267.0
2012	5	10	0800	4	36	10	361.6	450.1
2012	5	10	0900	4	45	14	334.1	372.8
2012	5	10	1000	5	65	16	403.0	737.4
2012	5	10	1100	5	63	16	316.6	1025.6
2012	5	10	1200	6	74	21	233.0	1233.8
2012	5	10	1300	6	92	19	164.4	1380.3
2012	5	10	1400	7	159	22	58.8	1430.7
2012	5	10	1500	8	196	25	38.3	1456.5
2012	5	10	1600	9	205	21	44.8	15.6
2012	5	10	1700	7	216	20	23.1	33.9
2012	5	10	1800	5	208	17	23.2	55.2
2012	5	10	1900	10	216	24	34.25	85.6
2012	5	10	2000	10	236	25	37.8	120.7
2012	5	10	2100	7	243	21	43.1	159.3
2012	5	10	2200	6	239	18	38.6	194.7
2012	5	10	2300	4	177	8	35.1	227.8

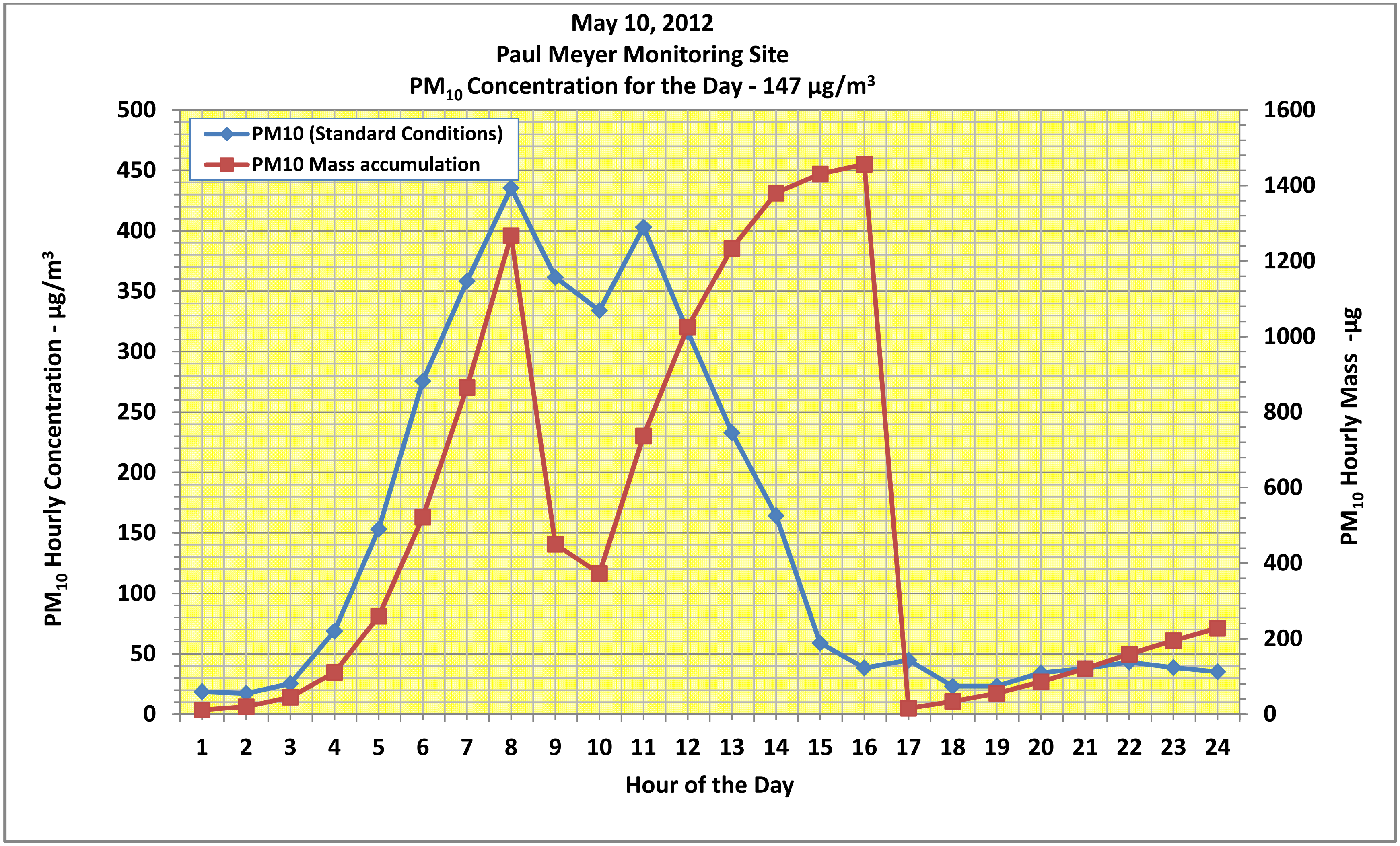


Figure 11. PM_{10} Concentrations at Paul Meyer Monitoring Site, May 10, 2012.

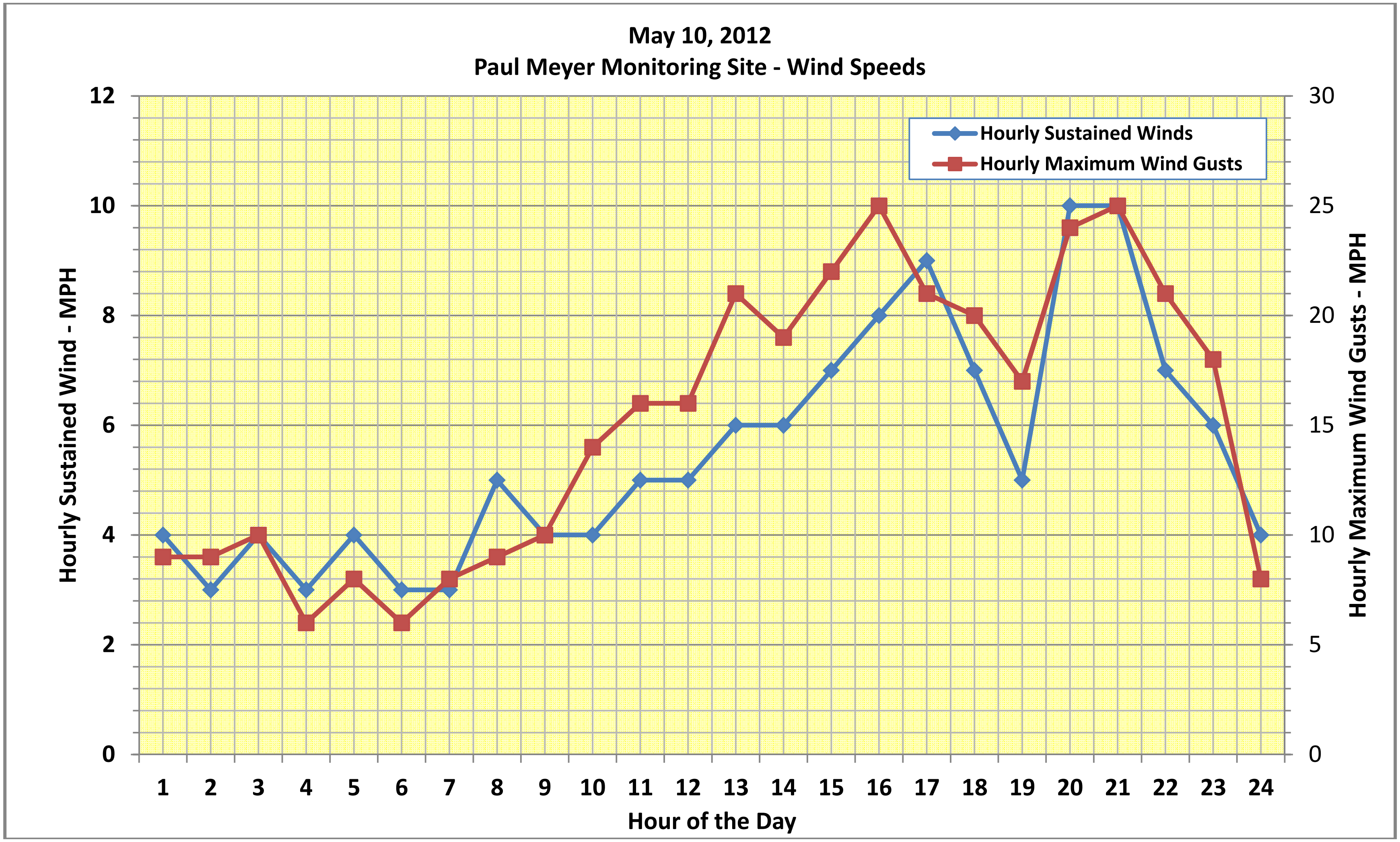


Figure 11a. Wind Speeds at Paul Meyer Monitoring Site, May 10, 2012.

Table 22. Palo Verde Monitoring Data for May 9, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2012	5	9	0000	4	249	8	11.5	21.4
2012	5	9	0100	3	242	12	16.8	26.8
2012	5	9	0200	4	269	9	21.6	46.9
2012	5	9	0300	5	252	10	16.4	62.1
2012	5	9	0400	5	255	9	13.7	76.1
2012	5	9	0500	5	255	9	12.8	88.6
2012	5	9	0600	5	237	10	18.2	105.8
2012	5	9	0700	3	137	8	12.1	119.9
2012	5	9	0800	4	117	9	24.9	142.1
2012	5	9	0900	4	121	12	19.6	160.4
2012	5	9	1000	4	113	11	17.5	176.9
2012	5	9	1100	5	102	15	11.9	188.9
2012	5	9	1200	5	102	15	13.6	201.4
2012	5	9	1300	5	113	15	14.7	214.6
2012	5	9	1400	4	112	13	15.3	229.8
2012	5	9	1500	4	116	12	11.6	240.7
2012	5	9	1600	3	124	10	19.0	257.8
2012	5	9	1700	3	159	10	15.0	273.1
2012	5	9	1800	4	201	8	21.5	291.9
2012	5	9	1900	4	246	8	16.0	307.5
2012	5	9	2000	5	245	13	18.3	325.0
2012	5	9	2100	7	247	12	13.9	338.7
2012	5	9	2200	7	248	17	14.4	353.0
2012	5	9	2300	6	247	12	11.8	364.8

Table 23. Palo Verde Monitoring Data for May 11, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2012	5	11	0000	6	277	19	20.5	14.3
2012	5	11	0100	4	230	13	29.0	38.0
2012	5	11	0200	4	285	13	16.9	56.2
2012	5	11	0300	6	353	21	23.9	78.0
2012	5	11	0400	4	261	9	20.7	97.4
2012	5	11	0500	6	284	14	23.0	119.2
2012	5	11	0600	4	207	9	19.0	138.2
2012	5	11	0700	5	85	19	26.7	164.1
2012	5	11	0800	9	41	20	38.9	198.5
2012	5	11	0900	7	41	19	28.8	226.4
2012	5	11	1000	6	51	18	29.1	253.1
2012	5	11	1100	5	86	17	34.4	284.1
2012	5	11	1200	5	121	18	32.6	314.2
2012	5	11	1300	4	120	13	31.2	344.0
2012	5	11	1400	4	125	13	34.4	374.4
2012	5	11	1500	3	142	11	34.1	404.8
2012	5	11	1600	4	143	13	33.2	435.6
2012	5	11	1700	4	156	9	32.4	464.5
2012	5	11	1800	4	189	9	32.4	493.5
2012	5	11	1900	4	270	11	30.7	522.6
2012	5	11	2000	5	283	9	27.6	547.1
2012	5	11	2100	3	249	6	16.7	564.1
2012	5	11	2200	5	257	9	21.2	584.1
2012	5	11	2300	5	253	10	18.5	601.7

Table 24. Palo Verde Monitoring Data for May 10, 2012

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)
2012	5	10	0000	7	245	14	17.8	14.2
2012	5	10	0100	5	260	9	13.4	15.7
2012	5	10	0200	4	359	9	16.4	31.2
2012	5	10	0300	5	13	11	79.6	111.7
2012	5	10	0400	4	15	12	242.9	337.1
2012	5	10	0500	3	325	7	305.8	613.0
2012	5	10	0600	4	28	11	311.4	904.4
2012	5	10	0700	6	46	13	395.8	1263.4
2012	5	10	0800	5	55	12	330.7	462.5
2012	5	10	0900	4	100	11	256.3	268.3
2012	5	10	1000	4	102	11	297.2	539.0
2012	5	10	1100	4	117	14	331.2	832.2
2012	5	10	1200	6	121	19	241.8	1045.4
2012	5	10	1300	8	139	19	147.6	1178.4
2012	5	10	1400	8	131	22	95.9	1259.0
2012	5	10	1500	10	221	23	44.3	1299.8
2012	5	10	1600	9	206	25	38.1	1333.5
2012	5	10	1700	8	219	22	17.1	1349.3
2012	5	10	1800	6	226	16	21.9	1369.5
2012	5	10	1900	9	226	24	23.4	1392.3
2012	5	10	2000	13	244	29	34.8	1423.3
2012	5	10	2100	17	265	42	38.5	1458.1
2012	5	10	2200	11	256	30	26.7	1189.7
2012	5	10	2300	8	256	18	19.3	11.5

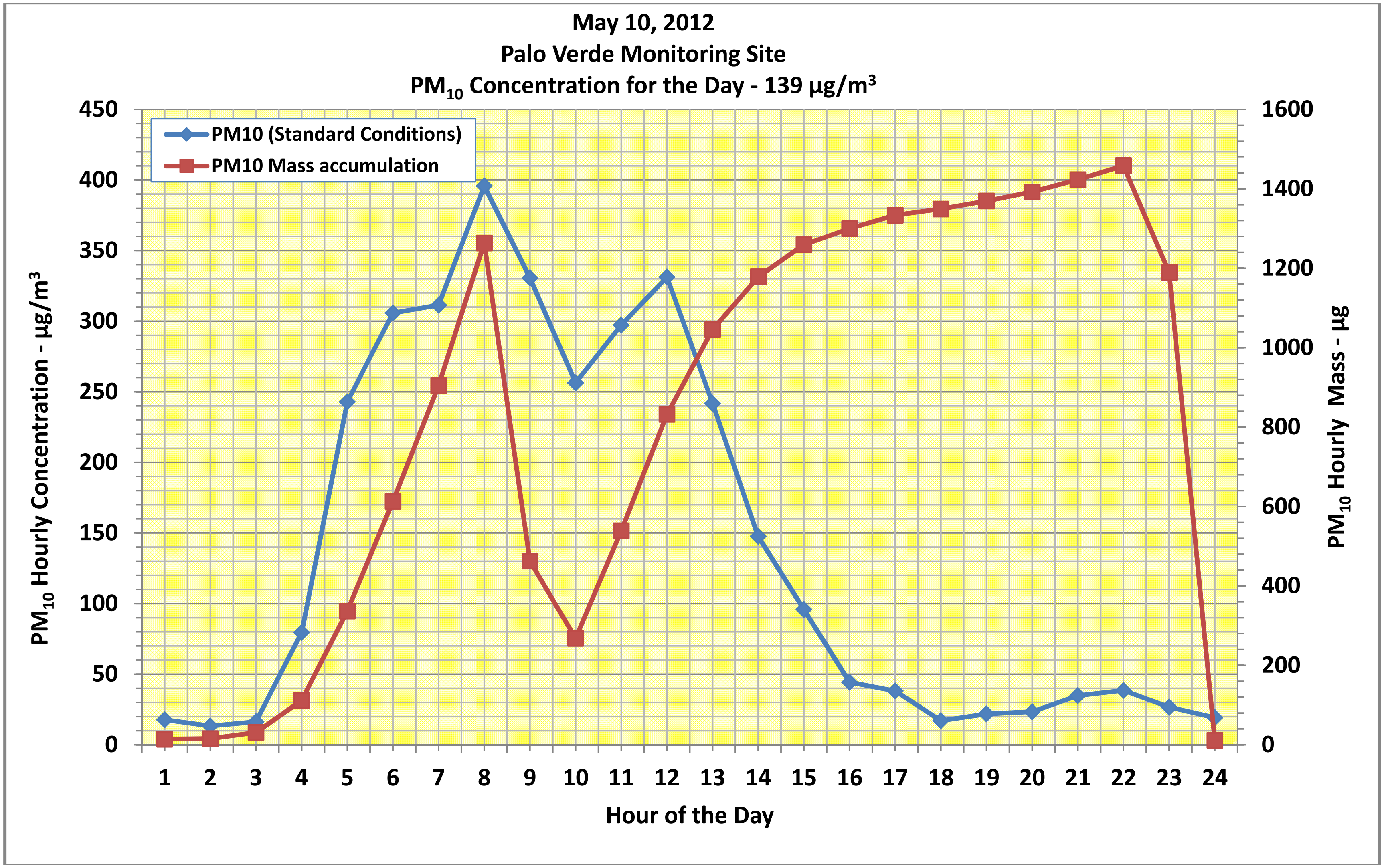


Figure 12. PM_{10} Concentrations at Palo Verde Monitoring Site, May 10, 2012.

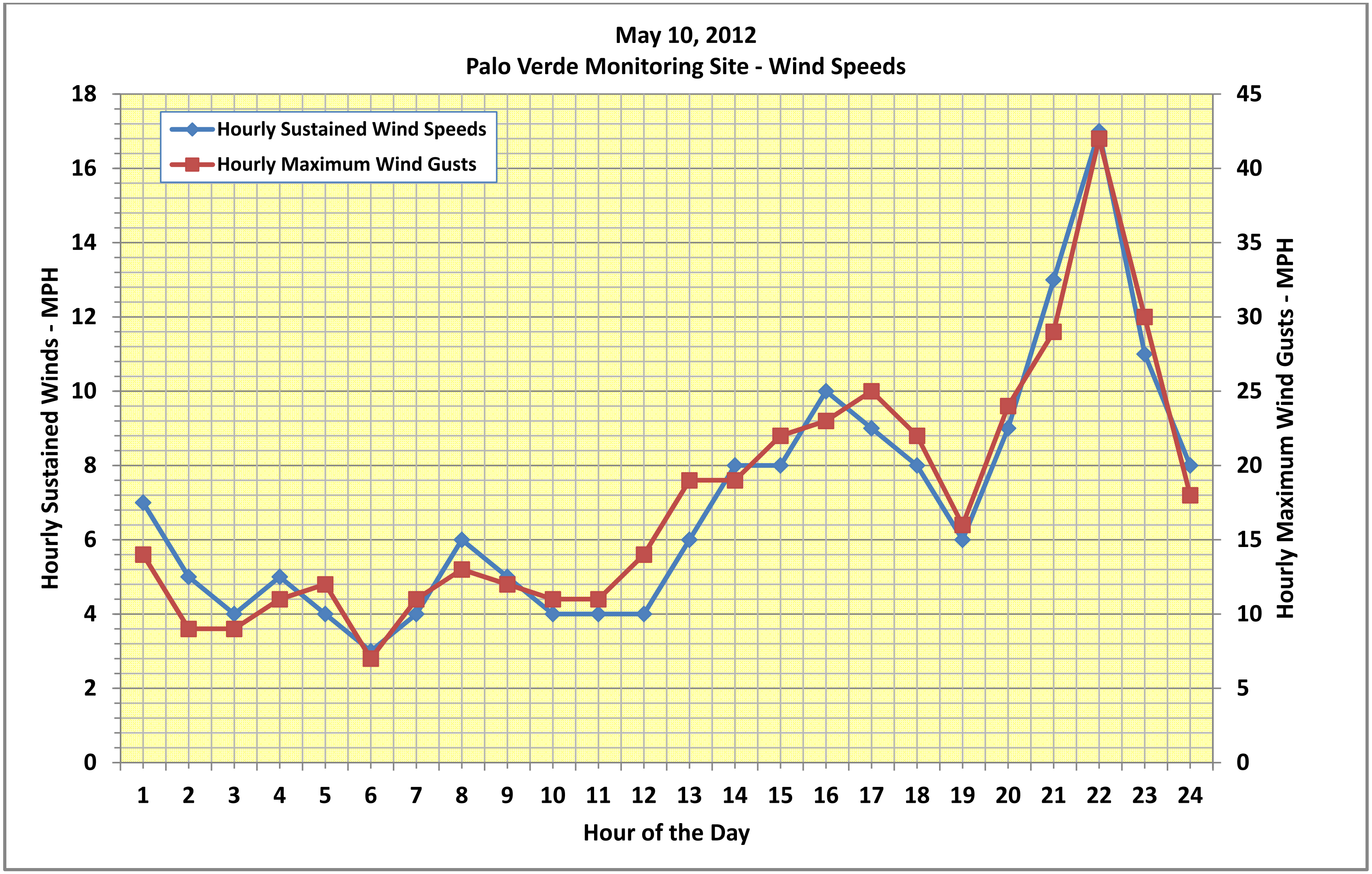


Figure 12a. Wind Speeds at Palo Verde Monitoring Site, May 10, 2012.

Table 25. Jean Monitoring Data for May 9, 2012

Year	Month	Day	Time	Wind Speed (mph)	Wind Direction (degrees)	Maximum Gust (mph)	PM_{10} Concentration (µg/m^3)	PM_{10} Mass Accumulation (µg)
2012	5	9	0000	9	ND	16	18.8	17.8
2012	5	9	0100	9	ND	13	14.7	17.9
2012	5	9	0200	8	ND	12	17.8	33.7
2012	5	9	0300	11	ND	15	10.1	44.5
2012	5	9	0400	6	ND	15	17.0	59.8
2012	5	9	0500	5	ND	9	16.9	75.9
2012	5	9	0600	3	ND	8	13.3	88.1
2012	5	9	0700	3	ND	8	19.5	105.5
2012	5	9	0800	5	ND	15	15.4	120.1
2012	5	9	0900	8	ND	17	14.1	133.3
2012	5	9	1000	8	ND	17	19.5	149.5
2012	5	9	1100	6	ND	18	12.7	160.5
2012	5	9	1200	8	ND	22	11.3	171.7
2012	5	9	1300	8	ND	19	10.0	180.6
2012	5	9	1400	8	ND	20	13.0	191.6
2012	5	9	1500	6	ND	14	8.3	199.1
2012	5	9	1600	4	ND	10	11.8	208.8
2012	5	9	1700	3	ND	9	10.8	219.2
2012	5	9	1800	4	ND	7	15.3	233.1
2012	5	9	1900	5	ND	10	19.2	250.5
2012	5	9	2000	10	ND	14	16.4	265.1
2012	5	9	2100	11	ND	13	19.6	283.1
2012	5	9	2200	11	ND	15	12.7	294.5
2012	5	9	2300	9	ND	15	12.3	305.4

Table 26. Jean Monitoring Data for May 11, 2012

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)
2012	5	11	0000	9	ND	16	41.4	31.8
2012	5	11	0100	10	ND	19	35.6	49.4
2012	5	11	0200	8	ND	19	31.7	77.7
2012	5	11	0300	8	ND	14	31.9	107.0
2012	5	11	0400	8	ND	12	27.5	132.7
2012	5	11	0500	8	ND	12	23.8	154.6
2012	5	11	0600	5	ND	8	20.9	174.8
2012	5	11	0700	6	ND	10	31.2	202.2
2012	5	11	0800	5	ND	10	28.2	229.0
2012	5	11	0900	4	ND	11	25.6	252.0
2012	5	11	1000	7	ND	19	28.6	278.3
2012	5	11	1100	9	ND	20	44.5	316.4
2012	5	11	1200	6	ND	18	37.9	350.5
2012	5	11	1300	6	ND	19	32.0	379.3
2012	5	11	1400	7	ND	20	35.6	411.0
2012	5	11	1500	8	ND	22	17.4	425.6
2012	5	11	1600	10	ND	23	20.7	444.5
2012	5	11	1700	10	ND	20	22.6	464.4
2012	5	11	1800	9	ND	16	20.7	482.4
2012	5	11	1900	9	ND	12	20.8	501.3
2012	5	11	2000	9	ND	13	19.8	518.2
2012	5	11	2100	10	ND	14	13.1	529.9
2012	5	11	2200	8	ND	12	15.9	545.8
2012	5	11	2300	5	ND	11	20.0	563.3

Table 27. Jean Monitoring Data for May 10, 2012

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)
2012	5	10	0000	8	ND	14	11.8	13.7
2012	5	10	0100	6	ND	10	11.7	14.2
2012	5	10	0200	7	ND	11	13.0	27.4
2012	5	10	0300	9	ND	12	20.1	45.0
2012	5	10	0400	8	ND	11	24.2	67.5
2012	5	10	0500	7	ND	14	13.4	80.2
2012	5	10	0600	7	ND	13	15.5	94.4
2012	5	10	0700	9	ND	14	18.3	110.9
2012	5	10	0800	10	ND	18	16.5	124.8
2012	5	10	0900	10	ND	18	24.2	147.2
2012	5	10	1000	10	ND	20	16.7	161.7
2012	5	10	1100	9	ND	19	18.8	178.7
2012	5	10	1200	7	ND	17	28.2	203.6
2012	5	10	1300	8	ND	21	31.9	230.7
2012	5	10	1400	10	ND	20	34.5	261.7
2012	5	10	1500	12	ND	23	41.7	298.3
2012	5	10	1600	10	ND	21	29.2	323.5
2012	5	10	1700	14	ND	30	14.5	337.3
2012	5	10	1800	17	ND	27	33.9	366.0
2012	5	10	1900	18	ND	31	25.4	389.9
2012	5	10	2000	17	ND	31	43.6	427.7
2012	5	10	2100	11	ND	28	53.3	478.8
2012	5	10	2200	10	ND	18	82.6	550.1
2012	5	10	2300	11	ND	24	47.4	592.5

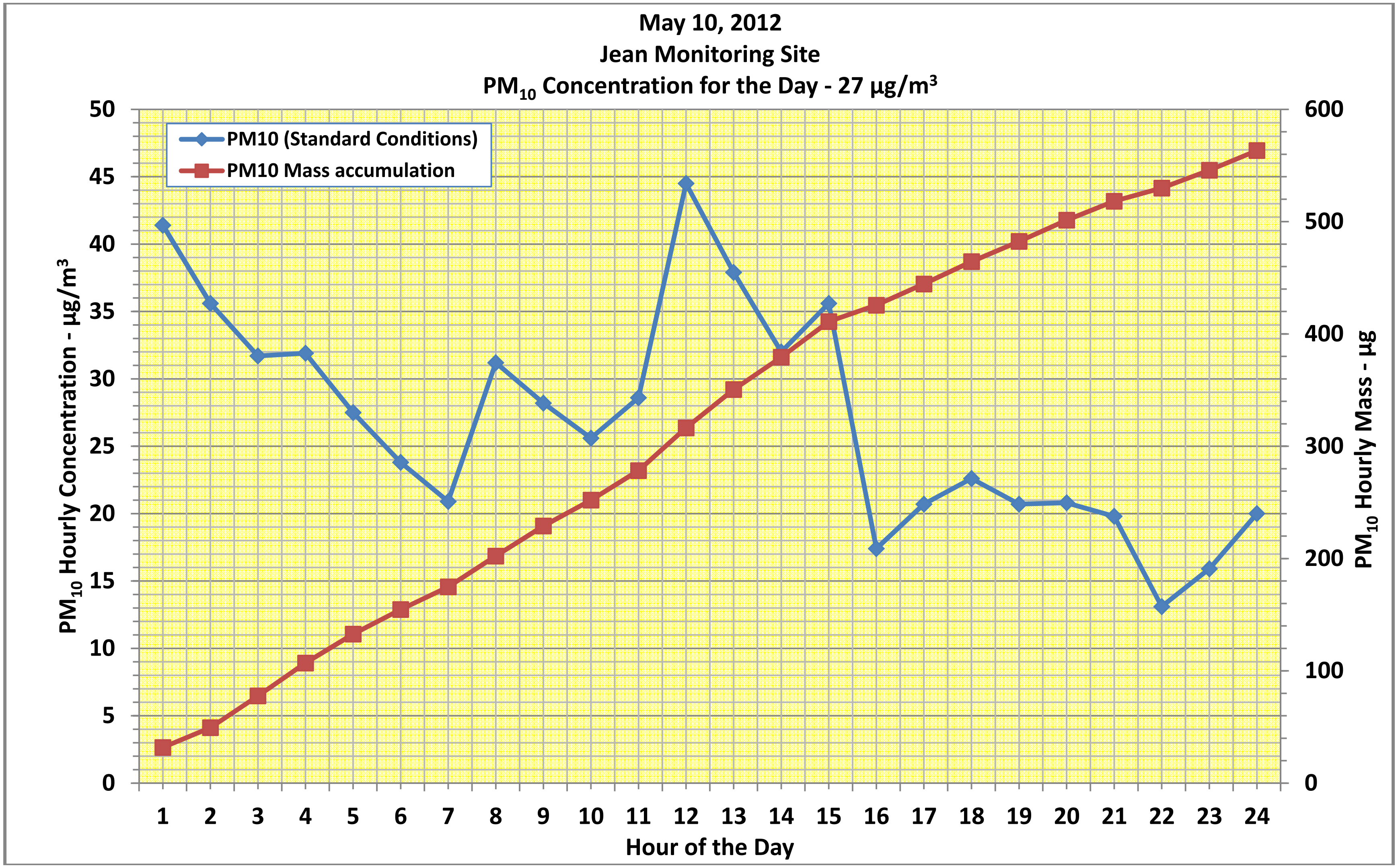


Figure 13. PM_{10} Concentrations at Jean Monitoring Site, May 10, 2012.

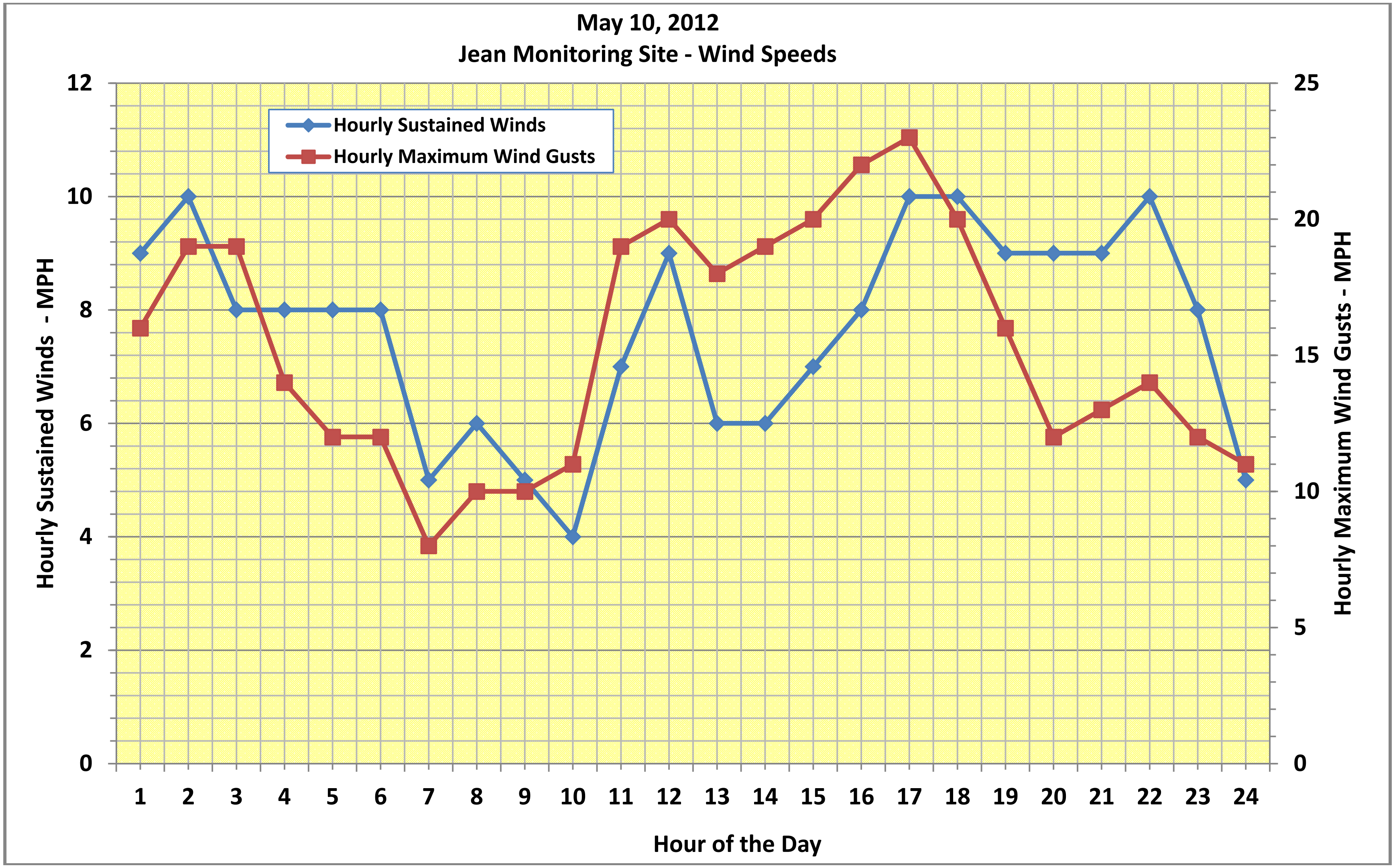


Figure 13a. Wind Speeds at Jean Monitoring Site, May 10, 2012.

II. There is a clear causal connection between the exceedances and the exceptional event.

The causal connection is demonstrated by the dramatic increase in hourly PM_{10} concentrations that coincided with the dust transported from the desert storm in Arizona into the Eldorado and Las Vegas Valleys.

III. The event is associated with a measured concentration in excess of normal historical fluctuations, including background.

The 24-hour average PM_{10} concentration of 314 $\mu g/m^3$ at the Boulder City monitoring site in Eldorado Valley on May 10, 2012, was the highest recorded in the Clark County PM_{10} monitoring network, and at this specific site, between 2006 and 2012. The reading indicates an excess of normal historical fluctuation, including background (Figure 14).

The 24-hour average PM_{10} concentration of 228 $\mu g/m^3$ at the Jerome Mack (NCore) monitoring site on May 10, 2012, was the second highest recorded in Clark County and the highest recorded in the Las Vegas Valley during 2012. The Jerome Mack site only began operating January 1, 2012, and the data in this document are the only data available in AQS. The reading indicates an excess of normal historical fluctuation, including background, for 2012 (Figure 15).

The 24-hour average PM_{10} concentration of 211 $\mu g/m^3$ at the Sunrise Acres monitoring site on May 10, 2012, was the third highest recorded in Clark County between 2006 and 2012. It was also the highest concentration recorded at the site in over six years. The reading indicates an excess of normal historical fluctuation, including background (Figure 16).

The 24-hour average PM_{10} concentration of 203 $\mu g/m^3$ at the J. D. Smith monitoring site on May 10, 2012, was the fourth highest recorded in Clark County between 2006 and 2012. It was also the highest concentration recorded at the site in over six years. The reading indicates an excess of normal historical fluctuation, including background (Figure 17).

The 24-hour average PM_{10} concentration of 182 $\mu g/m^3$ at the Joe Neal monitoring site on May 10, 2012, was the fifth highest recorded in Clark County between 2006 and 2012. It was also the highest concentration recorded at the site in over six years. The reading indicates an excess of normal historical fluctuation, including background (Figure 18).

The 24-hour average PM_{10} concentration of 147 $\mu g/m^3$ at the Paul Meyer monitoring site on May 10, 2012, was the sixth highest recorded in Clark County between 2006 and 2012. It was also the highest concentration recorded at the site in over six years. This site did not exceed the NAAQS on the event day, but it exhibited a trend similar the exceeding sites discussed in this document. Since this was the sixth highest 24-hour average PM_{10} concentration recorded at this site in a six-year period, the reading indicates an excess of normal historical fluctuation, including background (Figure 19).

The 24-hour average PM_{10} concentration of 145 $\mu g/m^3$ at the Green Valley monitoring site on May 10, 2012, was the seventh highest recorded in Clark County between 2006 and 2012. It was also the highest concentration recorded at the site in over six years. This site did not exceed the 24-hour PM_{10} NAAQS on the event day, but it exhibited a trend similar to the exceeding sites discussed in this document. Since this was the seventh highest 24-hour average PM_{10} concentration recorded in a six-year period at this site, the reading indicates an excess of normal historical fluctuation, including background (Figure 20).

The 24-hour average PM_{10} concentration of 138 µg/m^3 at the Palo Verde monitoring site on May 10, 2012, was the eighth highest recorded in Clark County between 2006 and 2012. It was also the highest concentration recorded at the site in over six years. This site did not exceed the 24-hour PM_{10} NAAQS on the event day, but it exhibited a trend similar to the exceeding sites discussed in this document. Since this was the eighth 24-hour average PM_{10} concentration recorded in a six-year period at this site, the reading indicates an excess of normal historical fluctuation, including background (Figure 21).

The 24-hour average PM_{10} concentration of 27 µg/m^3 at the Jean monitoring site on May 10, 2012, was the lowest value sampled on the event day; in fact, it was the lowest 24-hour value sampled at any of the network PM_{10} sites that day. This site did not exceed the 24-hour PM_{10} NAAQS on the event day and did not exhibit trends similar to any of the sites described above.

IV. There would have been no exceedance or violation *but for* the event.

There are several indications that the PM_{10} NAAQS would not have been exceeded on May 10, 2012, but for the presence of transported dust from the desert storm in northwestern Arizona. DAQ's exceptional event data shows that PM_{10} concentrations in Clark County were low until the arrival of the dust. Wind speeds were low and constant, and the dust flowed into both the Eldorado and Las Vegas Valleys. Increasing wind speeds in the early afternoon pushed the dust out of both valleys, and concentrations at all affected PM_{10} sites decreased 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 additional dust from the transport event had not been present.

The meteorological analysis, established scientific bases for transported particulate entrainment, and implementation of BACM on particulate emissions sources detailed in the following sections of this document demonstrate that during this transported dust event, PM_{10} emissions were not reasonably controllable, and the exceedance was not reasonably preventable. Therefore, the May 10, 2012, exceedance would not have occurred *but for* the regionally transported dust event.

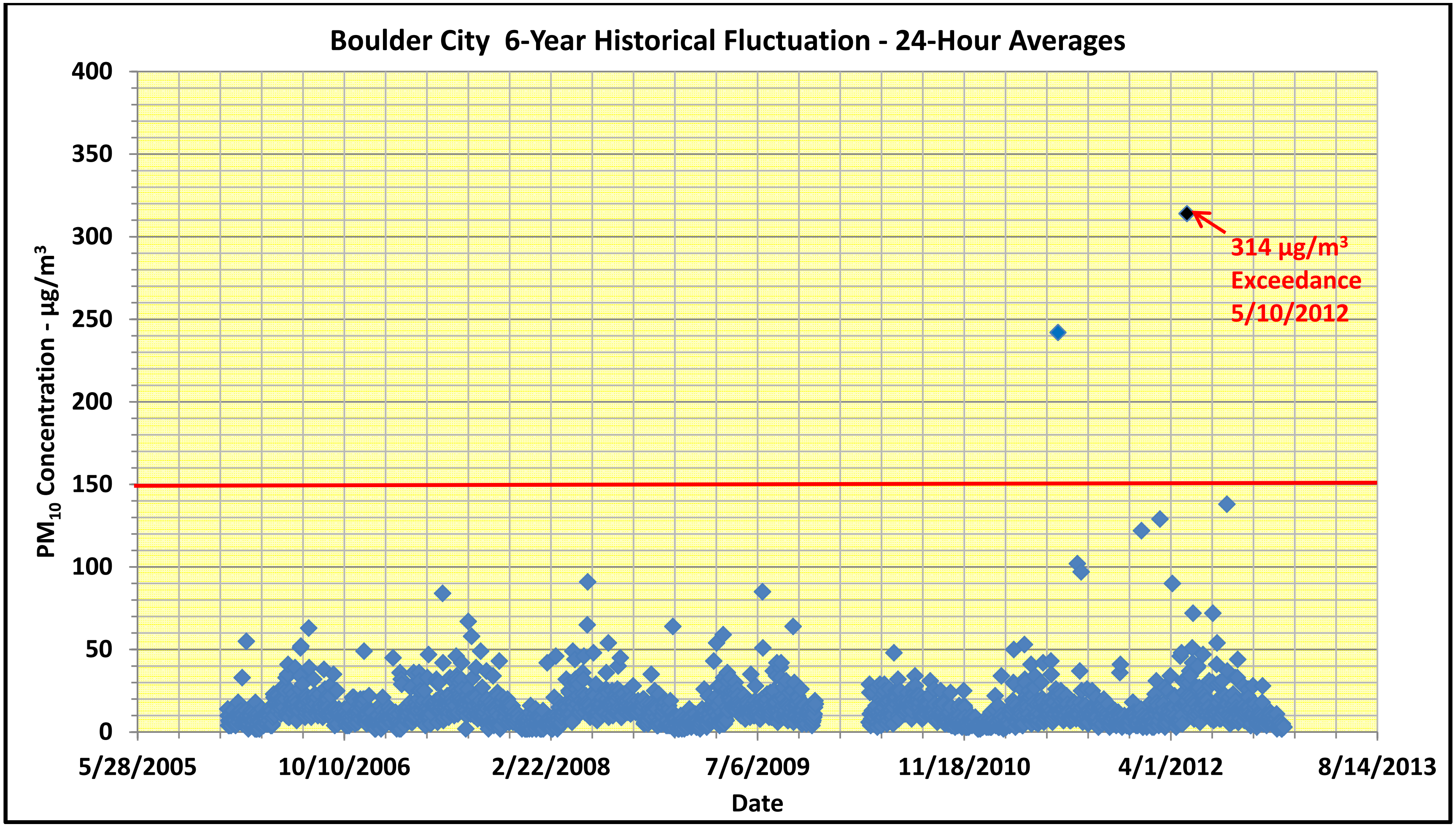


Figure 14. Boulder City Monitoring Site 6-Year Historical Trends in 24-Hour PM_{10} Concentrations.

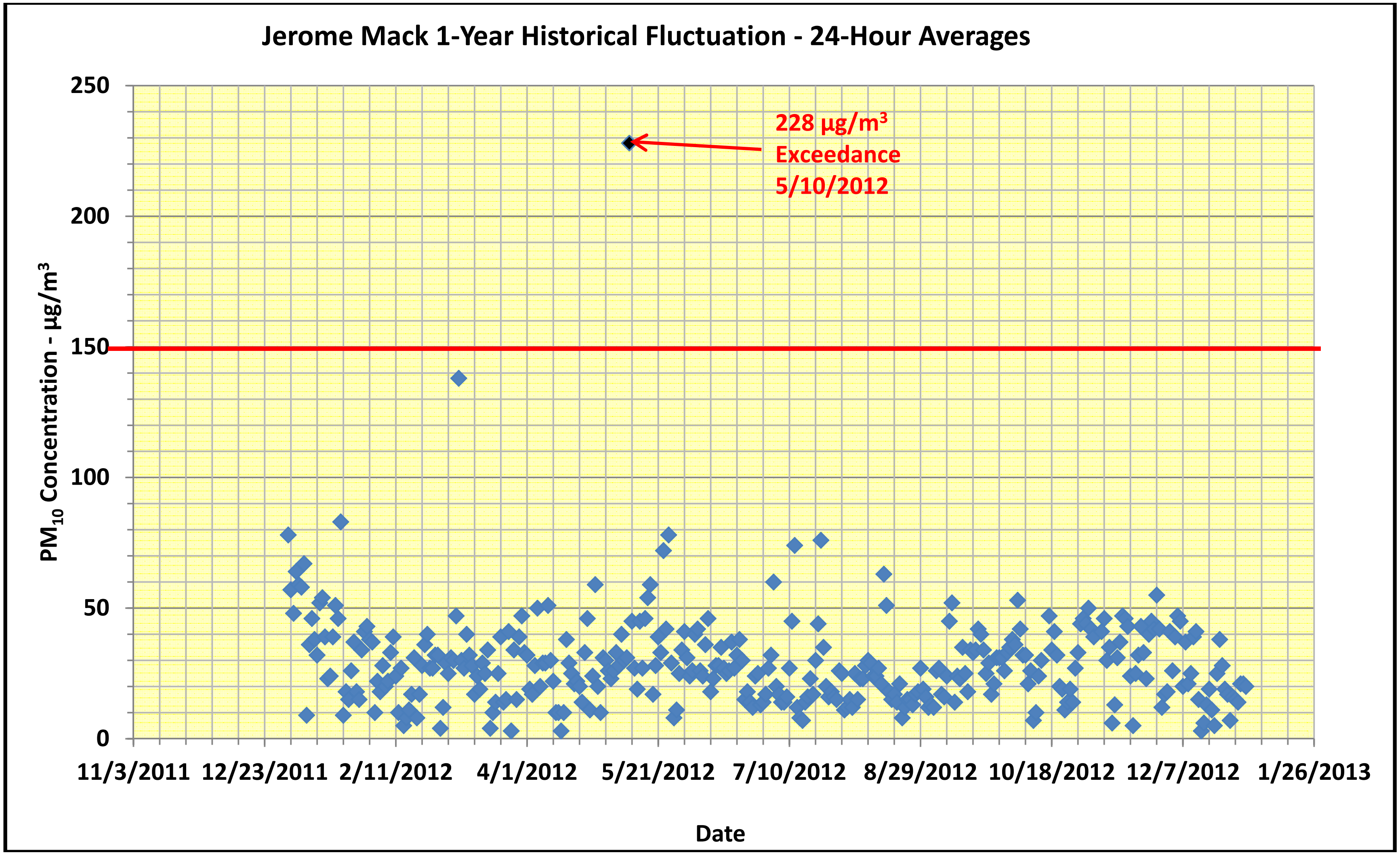


Figure 15. Jerome Mack Monitoring Site 1-Year Historical Trends in 24-Hour PM_{10} Concentrations.

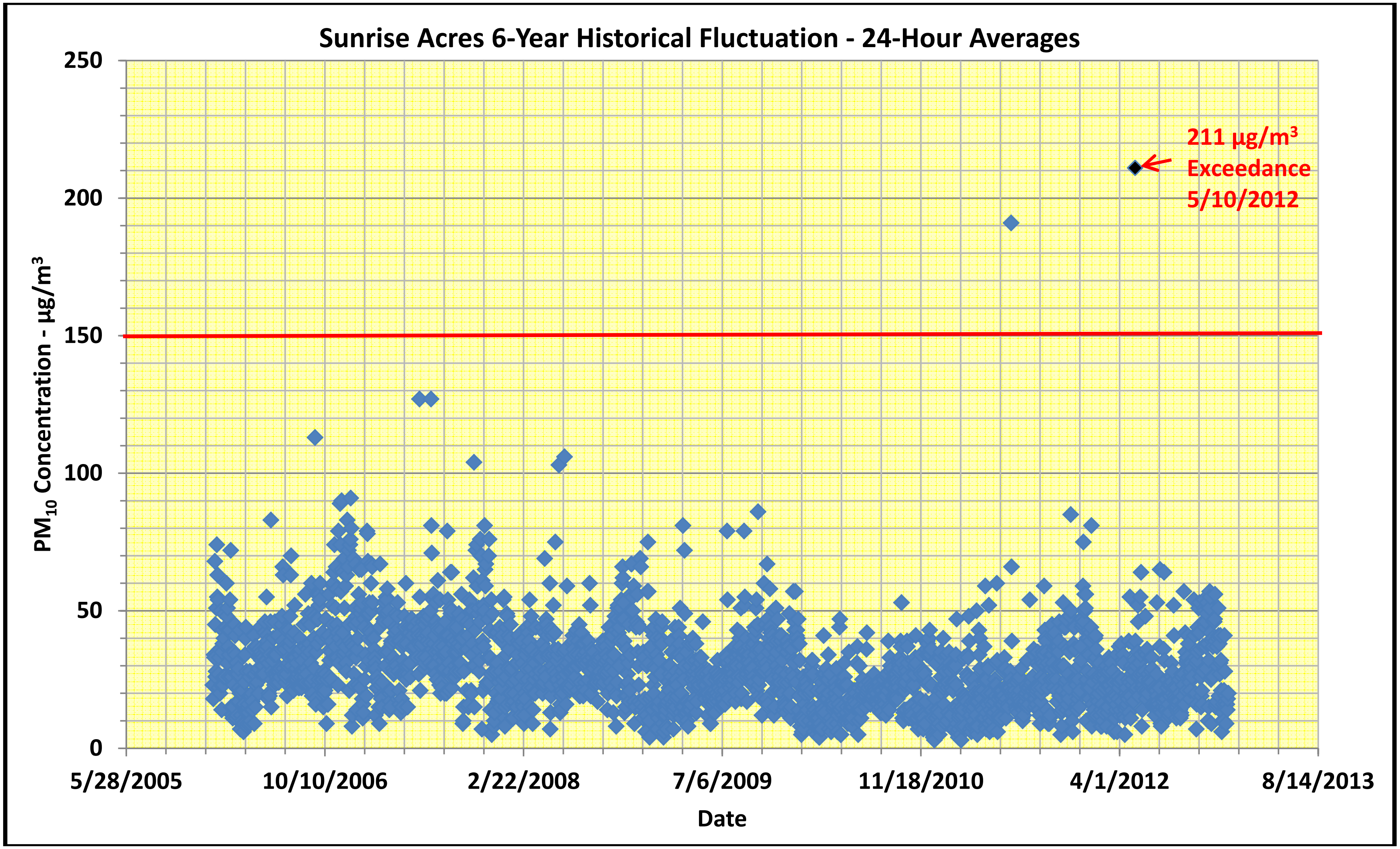


Figure 16. Sunrise Acres Monitoring Site 6-Year Historical Trends in 24-Hour PM_{10} Concentrations.

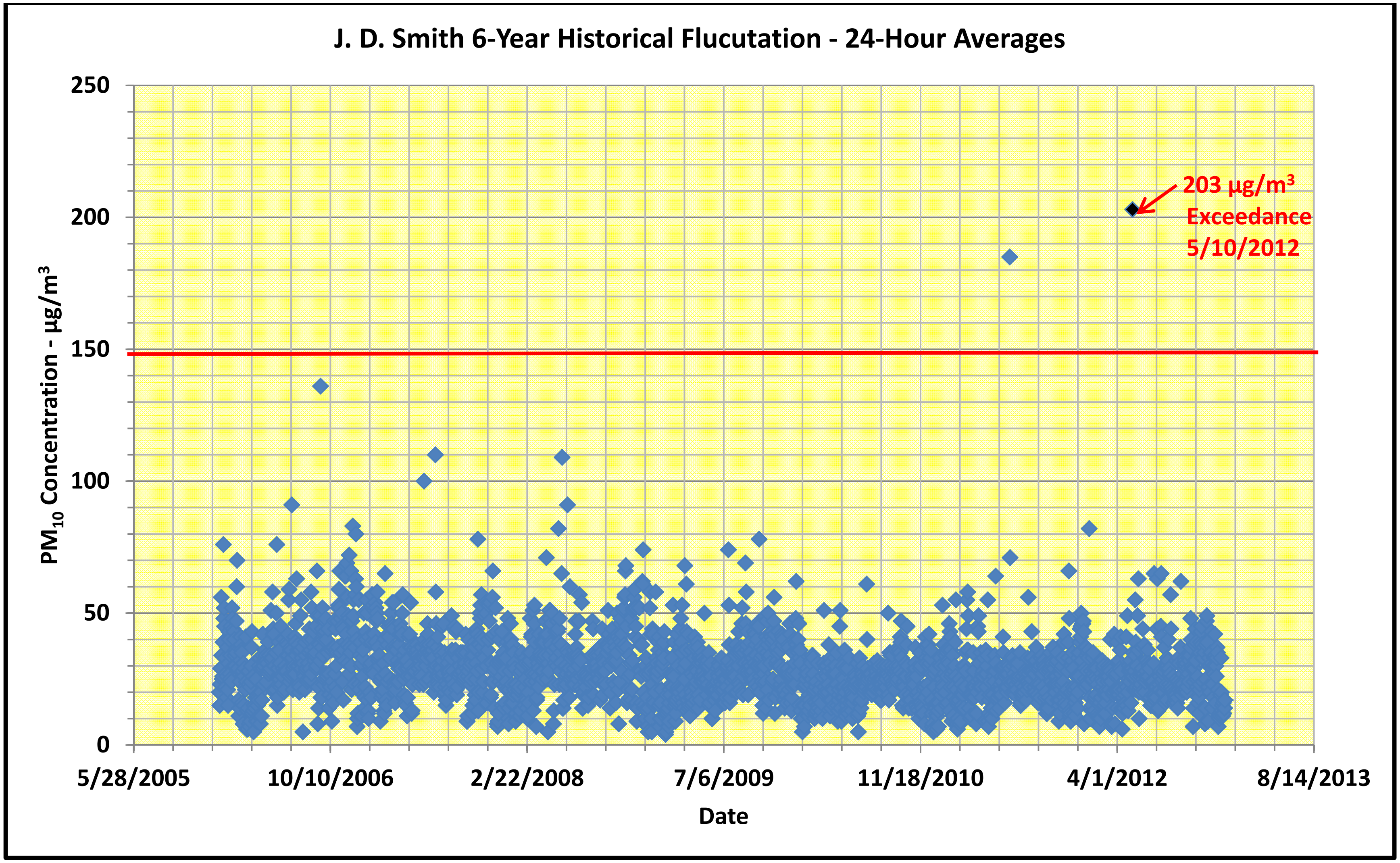


Figure 17. J. D. Smith Monitoring Site 6-Year Historical Trends in 24-Hour PM_{10} Concentrations.

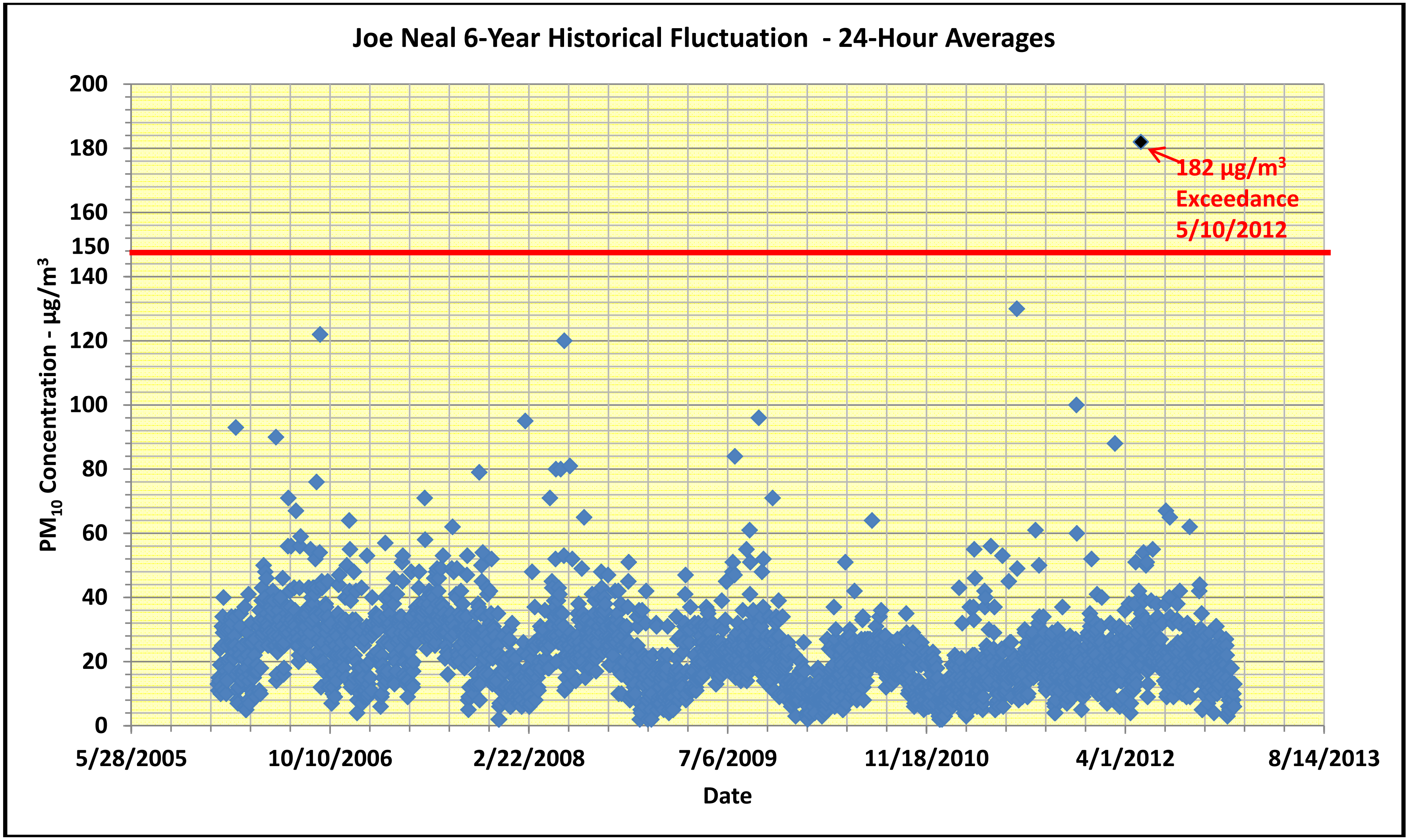


Figure 18. Joe Neal Monitoring Site 6-Year Historical Trends in 24-Hour PM_{10} Concentrations.

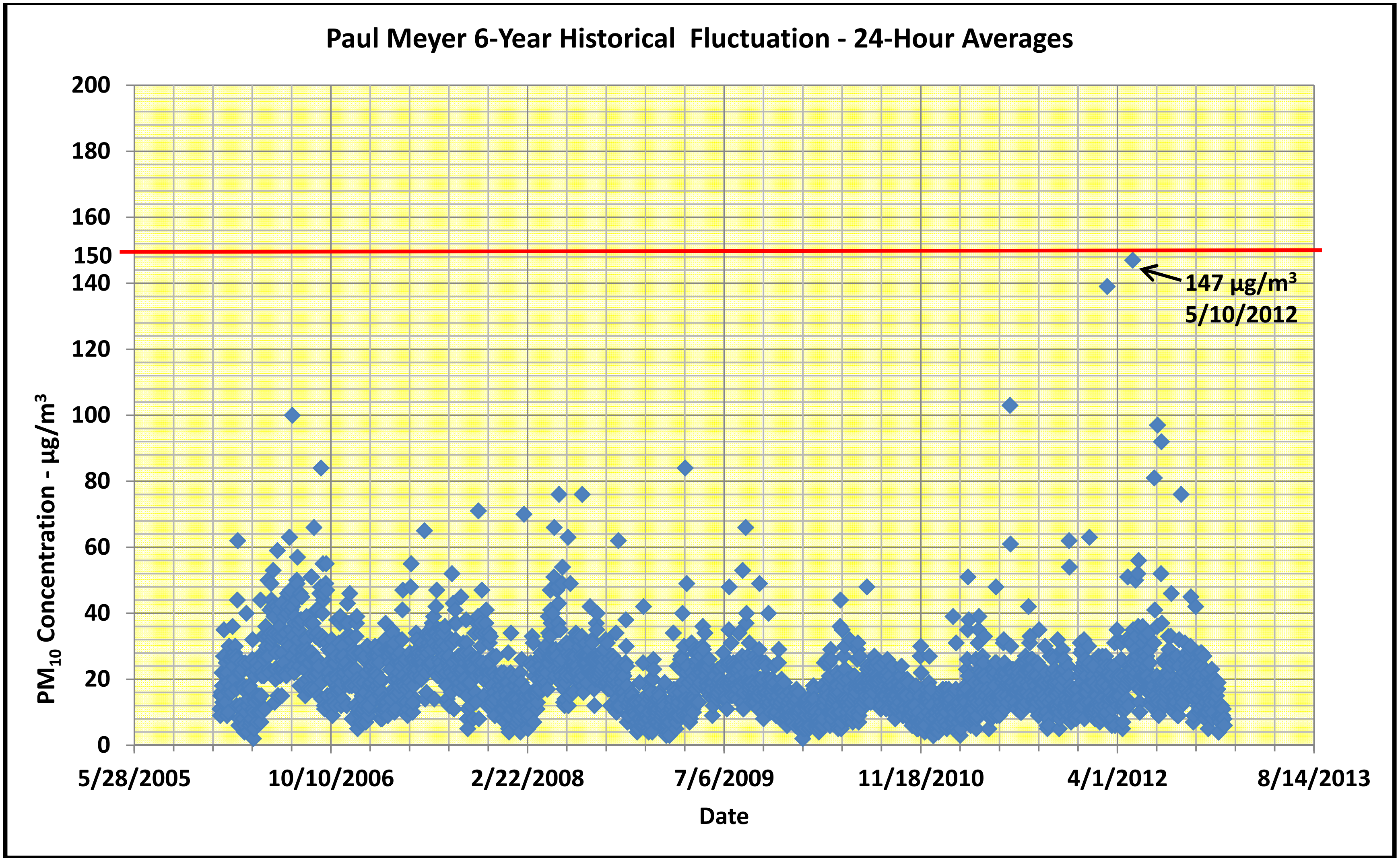


Figure 19. Paul Meyer Monitoring Site 6-Year Historical Trends in 24-Hour PM_{10} Concentrations.

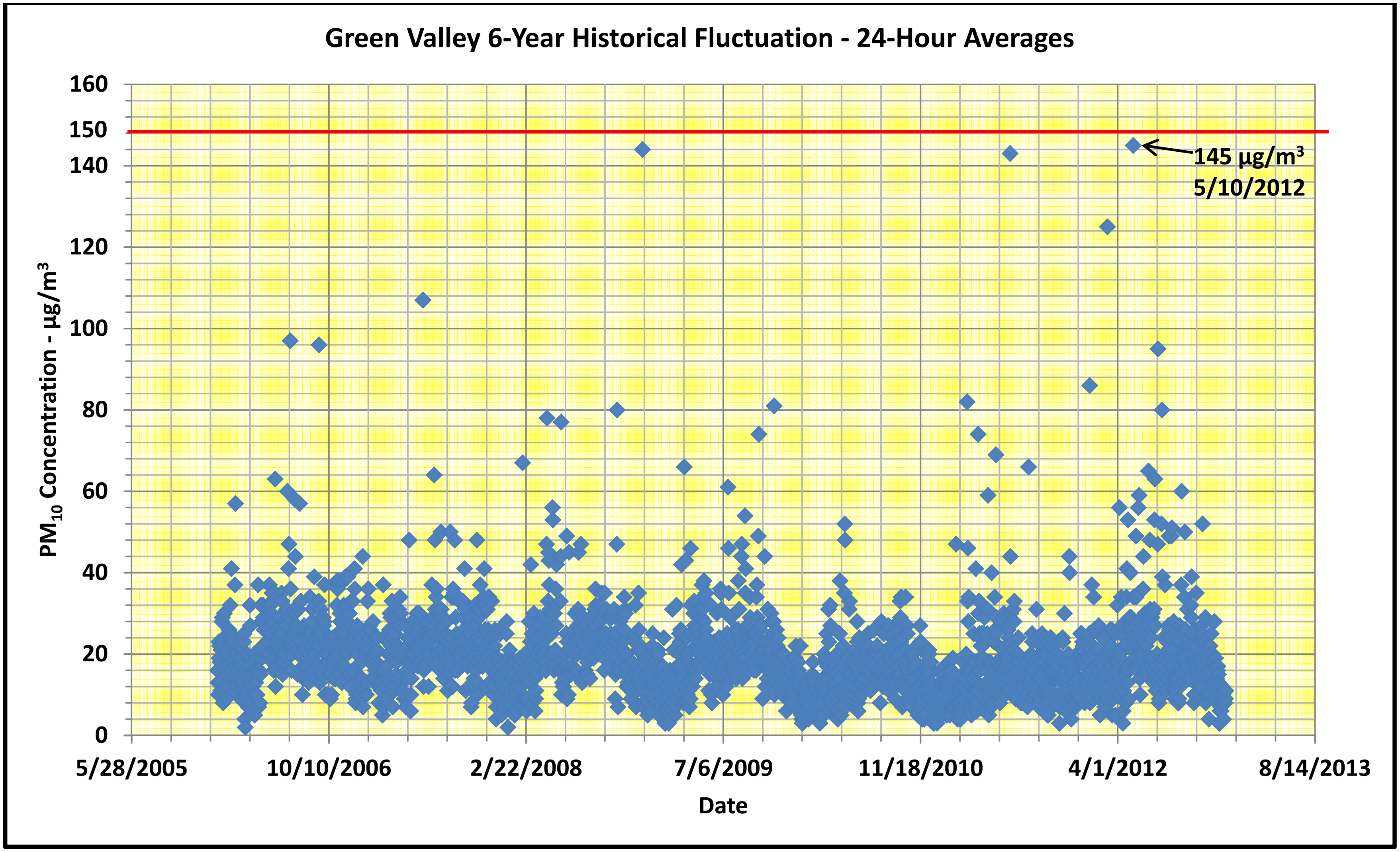


Figure 20. Green Valley Monitoring Site 6-Year Historical Trends in 24-Hour PM_{10} Concentrations.

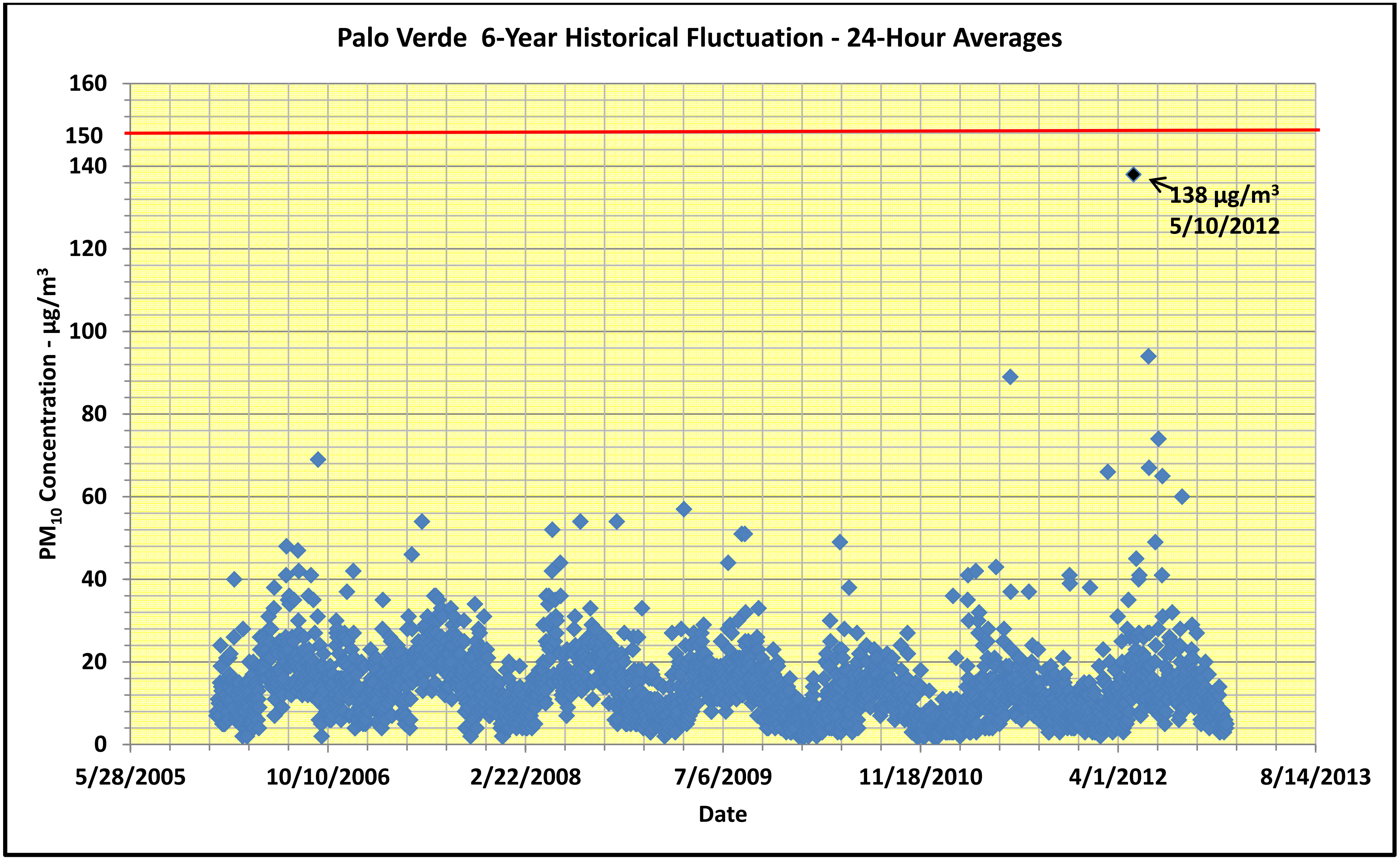


Figure 21. Palo Verde Monitoring Site 6-Year Historical Trends in 24-Hour PM_{10} Concentrations.

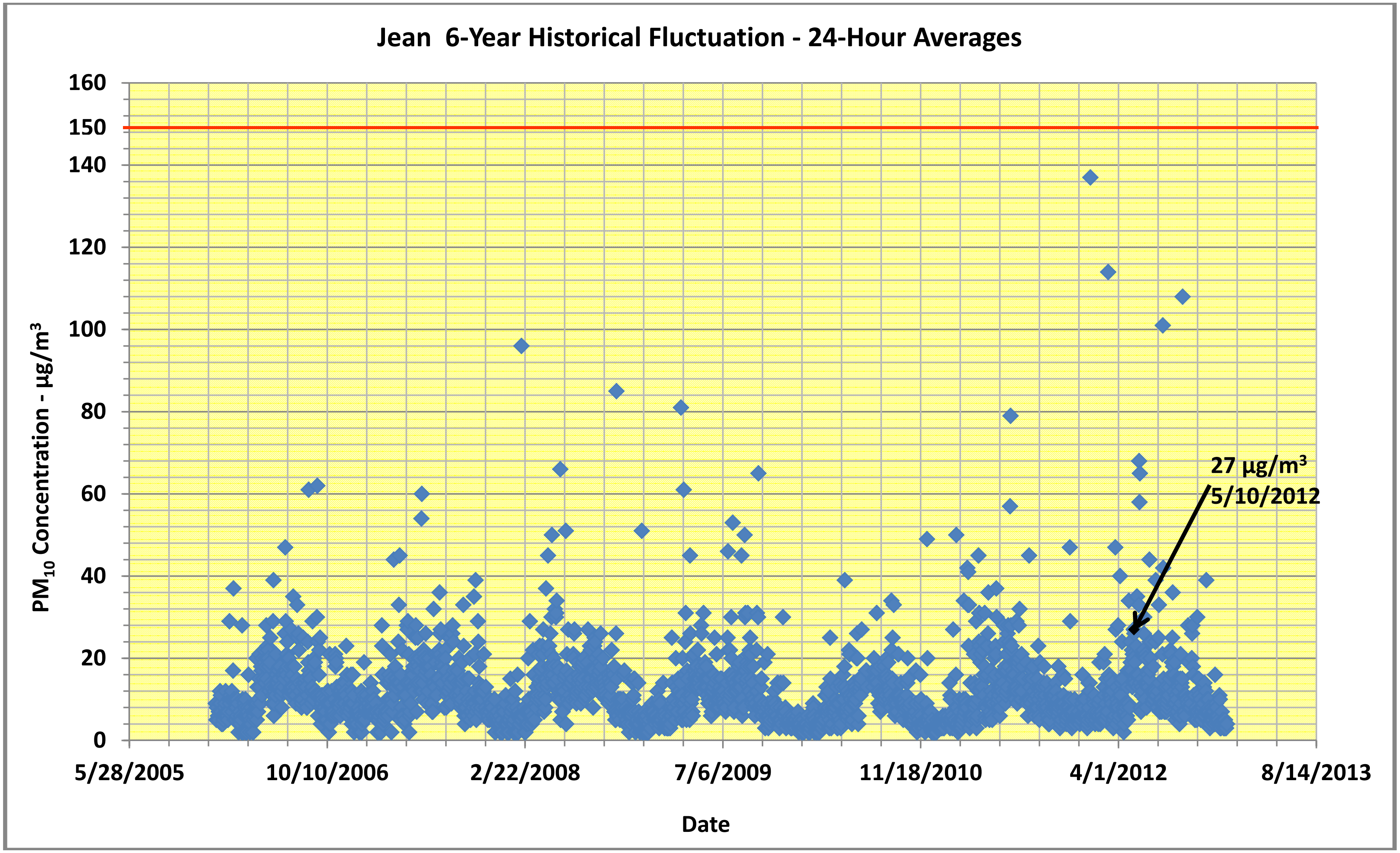


Figure 22. Jean Monitoring Site 6-Year Historical Trends in 24-Hour PM_{10} Concentrations.

Figure 23 illustrates the highest concentrations for PM_{10} recorded by an active air quality monitoring station in Clark County between 2006 and 2012; Table 28 contains the calculated 95th and 99th percentiles for PM_{10}, which are the values that exceed all but the highest 5 percent and 1 percent of the values, respectively. Maximum PM_{10} concentrations in Clark County have risen as high as 101–203 percent of the NAAQS. Like the number of exceedances (Figure 23), maximum concentrations vary from year to year, depending on meteorological conditions. Therefore, they 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 24–25 show a 46 percent change in the 95th-percentile data in Las Vegas over the last six years for all exceedance events/days; Figures 26 and 27 shows a less than 1 percent change in the 99th-percentile data during the same period for all exceedance events/days. Figure 28 shows what the combined 95th and 99th percentiles, with the corresponding concentration levels, were for applicable exceedance events in all hydrographic areas involved. Figure 29 shows the 95th and 99th percentiles for 2012, and where the exceedance fell that year at the Boulder City site. Figure 30 shows the 95th and 99th percentiles for 2012, and where the exceedance fell that year at the Jerome Mack site. Figure 31 shows the 95th and 99th percentiles for 2012, and where the exceedance fell that year at the Sunrise Acres site. Figure 32 shows the 95th and 99th percentiles for 2012, and where the exceedance fell that year at the J. D. Smith site. Figure 33 shows the 95th and 99th percentiles for 2012, and where the exceedance fell that year at the Joe Neal site. Figure 34 shows the 95th and 99th percentiles for 2012, and where the exceedance fell that year at the Green Valley site. Figure 35 shows the 95th and 99th percentiles for 2012, and where the exceedance fell that year at the Paul Meyer site. Figure 36 shows the 95th and 99th percentiles for 2012, and where the exceedance fell that year at the Palo Verde site. Figure 37 shows the 95th and 99th percentiles for 2012, and where the exceedance fell that year at the Jean site.

Figure 38 shows sustained wind speeds and maximum wind gusts in 2012, and contrasts the transported dust event on May 10, 2012, with other wind speed values (sustained winds of 9.7 mph and maximum wind gusts of 28 mph) measured during the year. The measured wind values on May 10, 2012, are close to the mean values for the Las Vegas Valley. (The mean sustained wind and maximum wind gust values in 2012 were 8.9 mph and 25 mph, respectively.) Wind speed values provide little or no causal link to the increase of fugitive dust in the area of influence around any of the monitoring sites. In fact, hourly wind speed increases in the early to late afternoon helped clear dust out of the Eldorado and Las Vegas Valleys. The exceedance concentration values for PM_{10} for May 10, 2012, have occurred less than 1 percent of the time over the last six years, and fall outside normal seasonal variations.

Figures 39– 44 show the sustained and maximum wind gusts for 2011–2006 for comparison with 2012 winds. Both sustained winds and maximum wind gusts for the represented years are average for the Las Vegas Valley: sustained winds of 8 mph or more, with wind gusts of 25 mph or more.

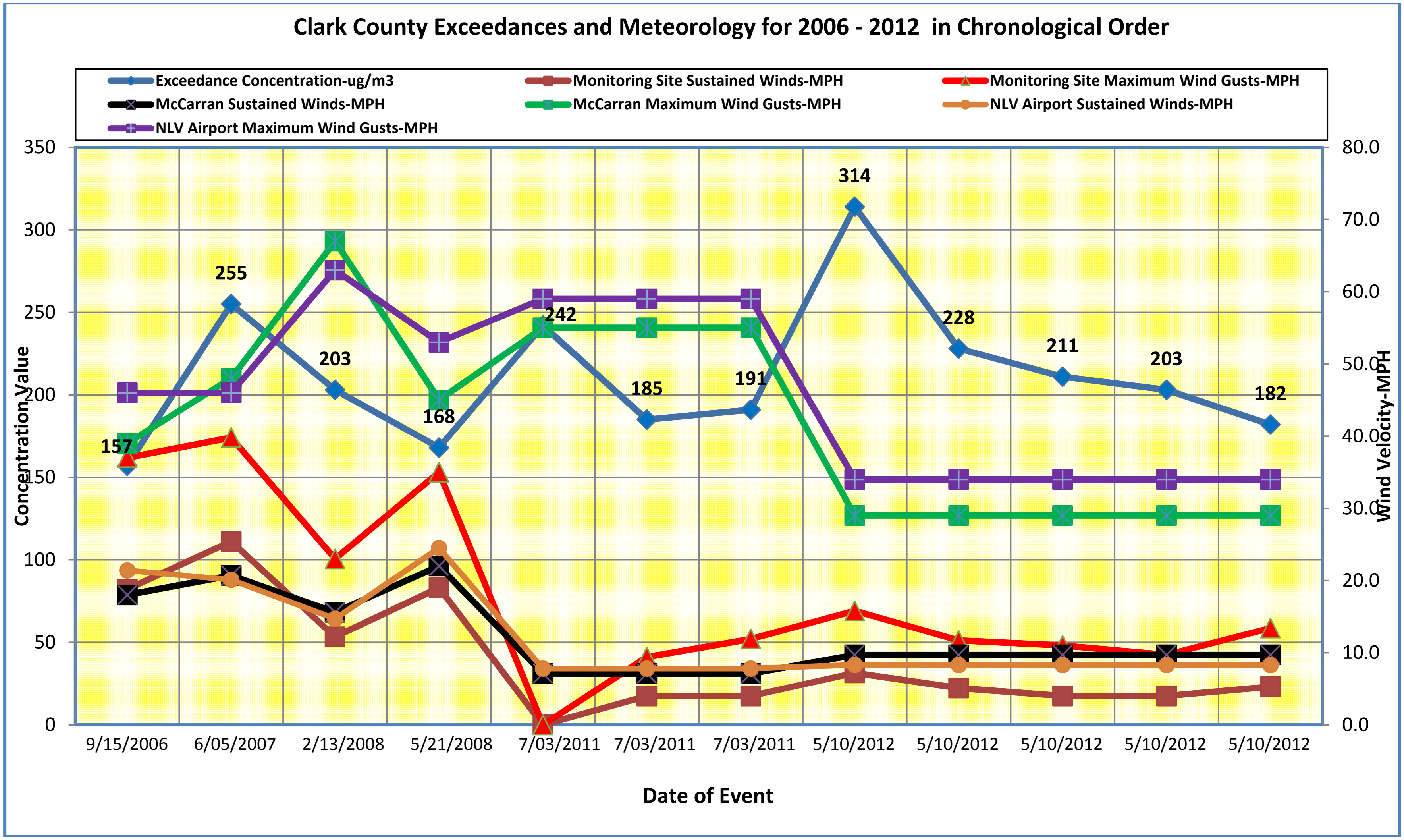


Figure 23. Clark County Exceedance Days in Chronological Order, 2006-2012.

Table 28. PM_{10} Concentration Percentages of NAAQS and 95th/99th Percentiles Data, 2006-2012.

Exceedance Value ($\mu g/m^3$)	% of 155 $\mu g/m^3$ NAAQS	Month & Year	$\mu g/m^3$ 95th Percentile	$\mu g/m^3$ 99th Percentile
314	203	05/2012	37	122
255	165	06/2007	75	111
242	156	07/2011	30	53
228	147	05/2012	54	78
211	136	05/2012	53	65
203	131	05/2008	67	124
203	131	05/2012	46	65
191	123	07/2011	47	60
185	119	07/2011	44	64
182	117	05/2012	39	65
168	108	02/2008	67	124
157	101	09/2006	77	79

Table 29 provides the 2006–2012 exceedance histories for the hydrographic areas affected by the transported dust event. Only one previous event—on September 15, 2006—would have been submitted under EPA's 1996 natural event policy (the Mary Nichols memorandum), and only if it had resulted from non-anthropogenic activity. Exceedances caused by anthropogenic activity were not submitted for EPA review.

The table indicates EPA pending action where applicable. Two prior events (on February 13 and May 21, 2008) have been submitted under the new Exceptional Event Rule, but EPA has not yet taken action on them.

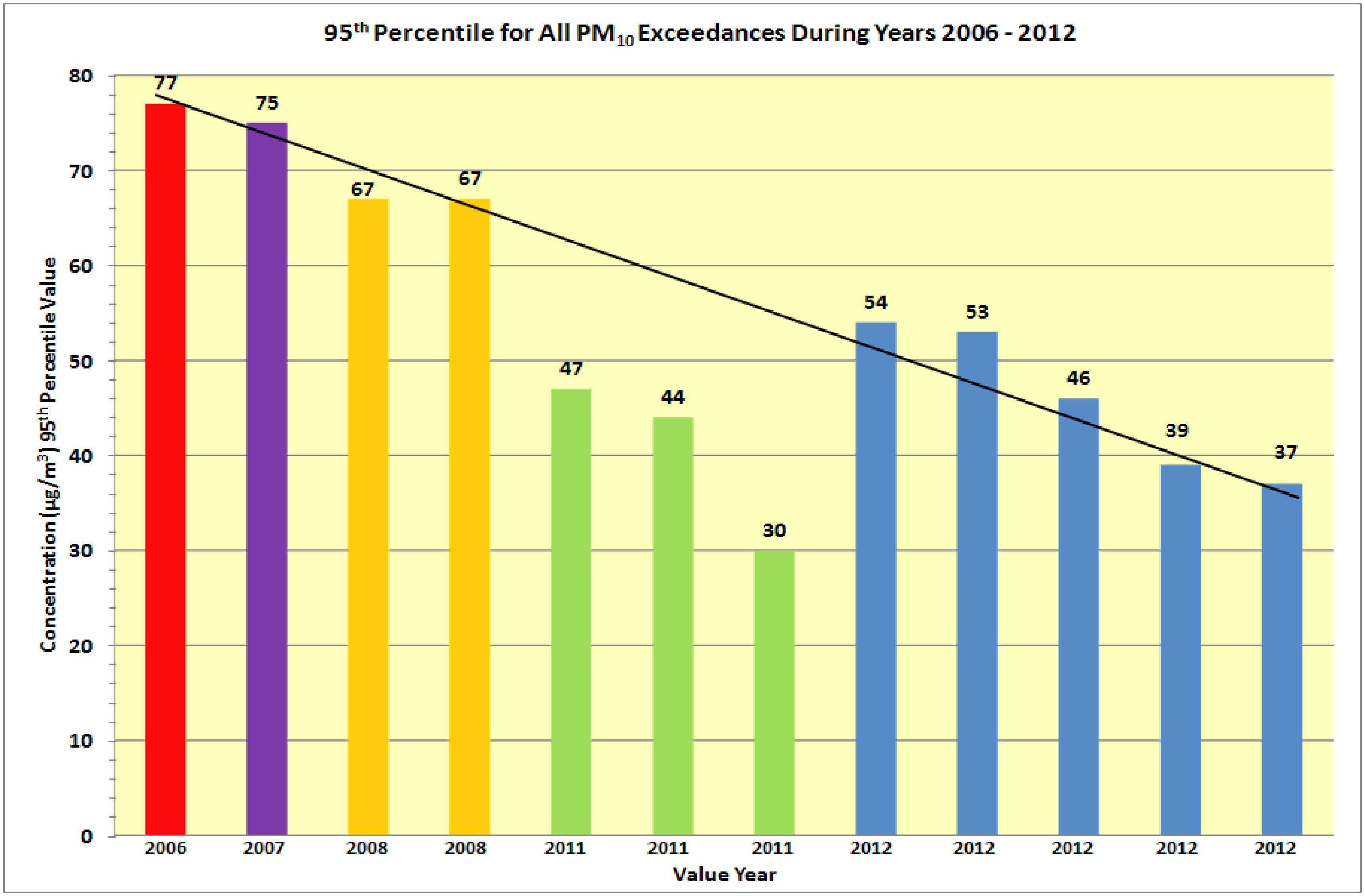


Figure 24. 95th Percentile for all PM_{10} Exceedances, 2006–2012.

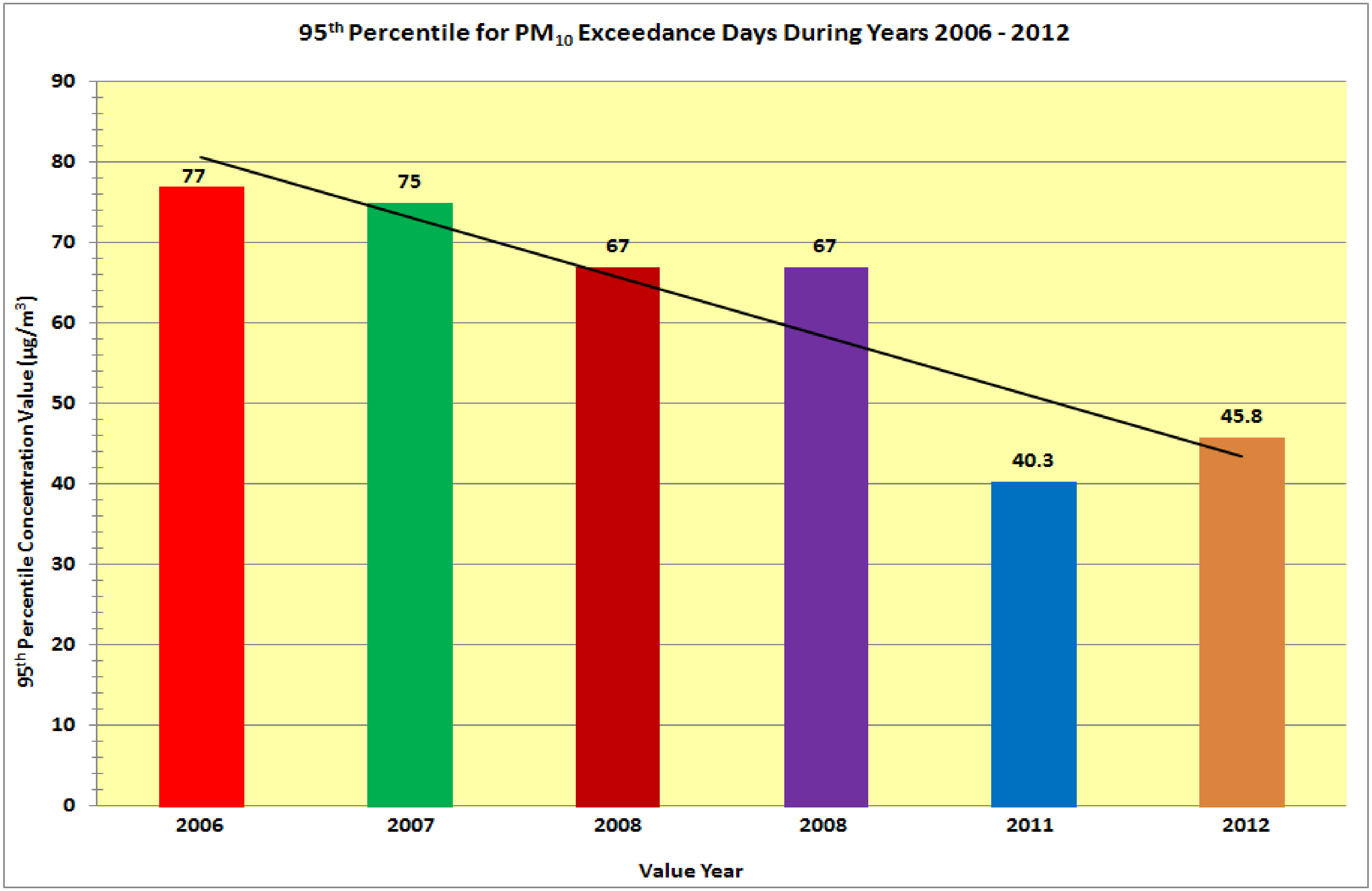


Figure 25. 95th Percentile for PM_{10} Exceedance Days, 2006–2012.

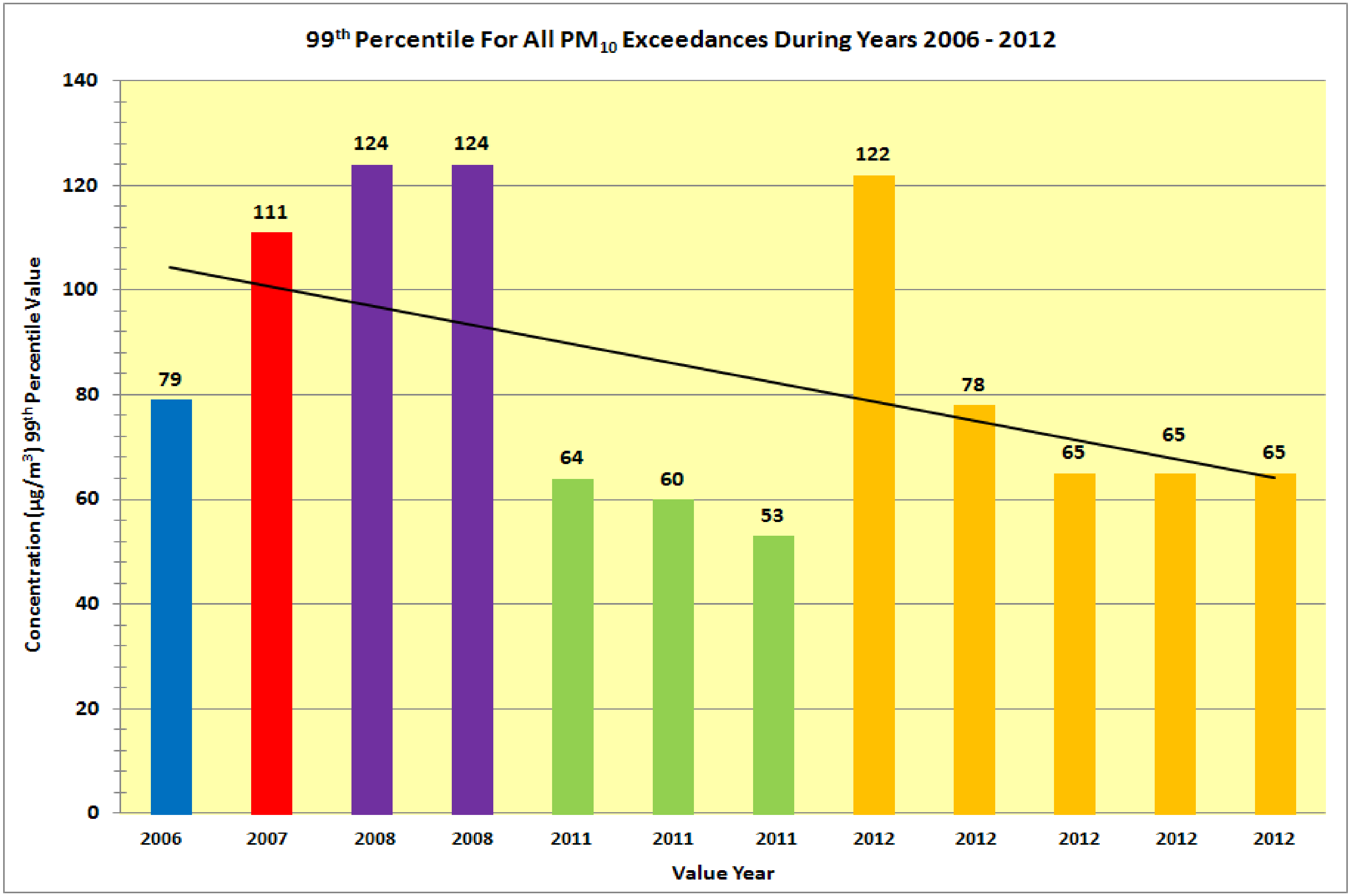


Figure 26. 99th Percentile for all PM_{10} Exceedances, 2006–2012.

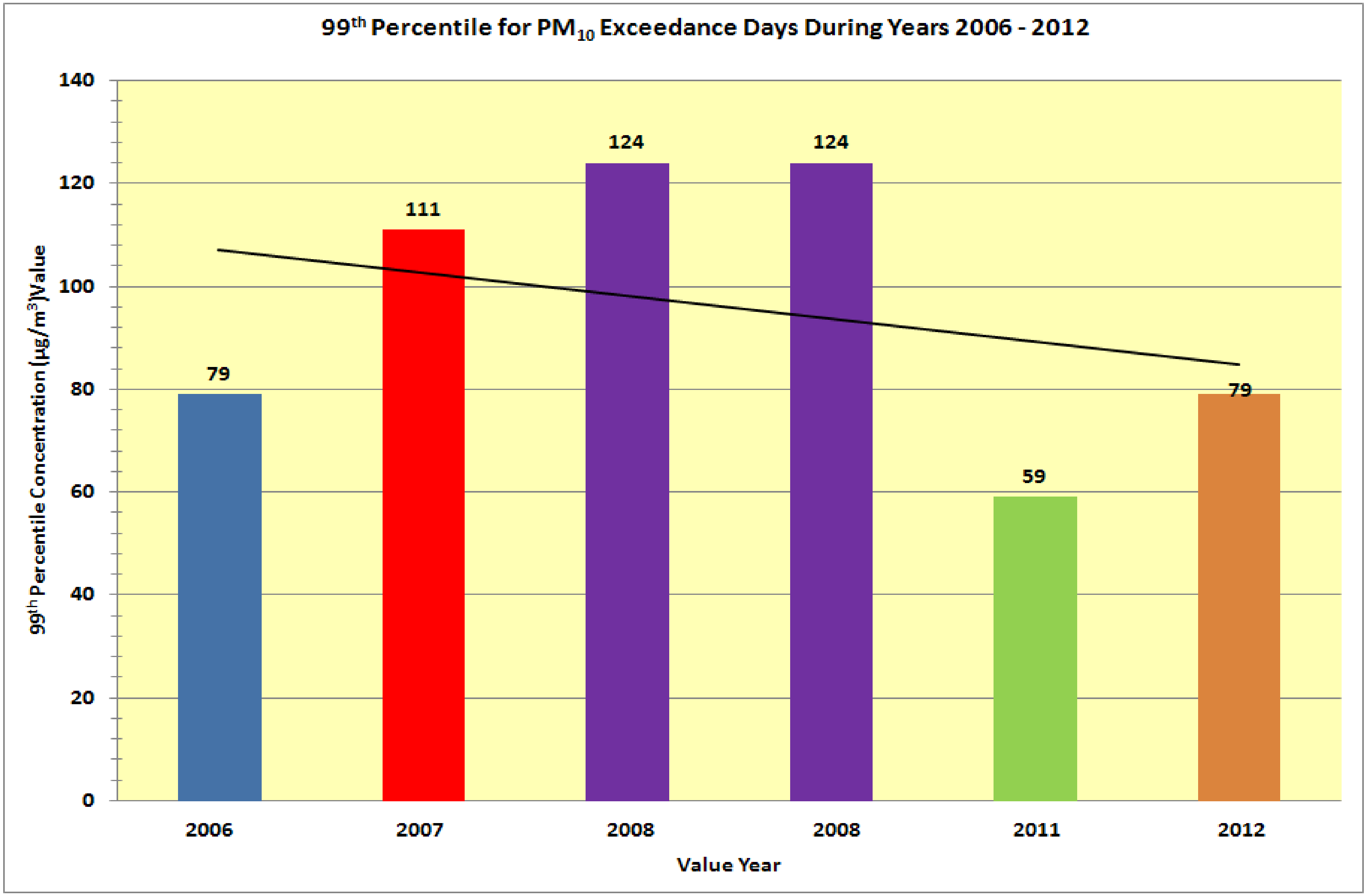


Figure 27. 99th Percentile for PM_{10} Exceedance Days, 2006–2012.

Table 29. Exceedance History of Applicable Hydrographic Areas, 2006–2012

Date	µg/m³	Site ID	Site Name	Active	Non-attainment Area?	EPA Concur-rence	Event Type	MSSW[1]	MSMWG[2]	MCSWS[3]	MCMWG[4]	NLVSWS[5]	NLVMWG[6]
20060915[7]	157	32-003-0020	East Craig Rd.	No	Yes/212	Not submitted: Anthropogenic	High wind	18.8	37.0	18	39	21.4	46
20070605	255	32-003-0022	Apex	No	No/216	Not submitted: Anthropogenic	High wind	25.4	39.8	20.7	48	20.1	46
20080213	203	32-003-0020	East Craig Rd.	No	Yes/212	Pending	High wind	12.2	23	15.6	67	14.7	63
20080521	168	32-003-0020	East Craig Rd.	No	Yes/212	Pending	High wind	19.0	35.0	22	45	24.5	53
20110703	242	32-003-0601	Boulder City	Yes	No/167	Not yet submitted	Unknown dust origin	N/A	N/A	7.1	55	7.8	59
20110703	185	32-003-2002	J.D. Smith	Yes	Yes/212	Not yet submitted	Unknown dust origin	4.0	9.4	7.1	55	7.8	59
20110703	191	32-003-0561	Sunrise Acres	Yes	Yes/212	Not yet submitted	Unknown dust origin	4.0	11.9	7.1	55	7.8	59
20120510	314	32-003-0601	Boulder City	Yes	No/167	Pending	Transported dust event	7.2	15.8	9.7	29	8.3	34
20120510	228	32-003-0540	Jerome Mack	Yes	Yes/212	Pending	Transported dust event	5.1	11.7	9.7	29	8.3	34
20120510	211	32-003-0561	Sunrise Acres	Yes	Yes/212	Pending	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	Transported dust event	4.0	9.7	9.7	29	8.3	34
20120510	182	32-003-0075	Joe Neal	Yes	Yes/212	Pending	Transported dust event	5.3	13.4	9.7	29	8.3	34

[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).
[7] Indicates case would have been submitted under Natural Events Policy of 1996 if event had not been caused by anthropogenic activity.

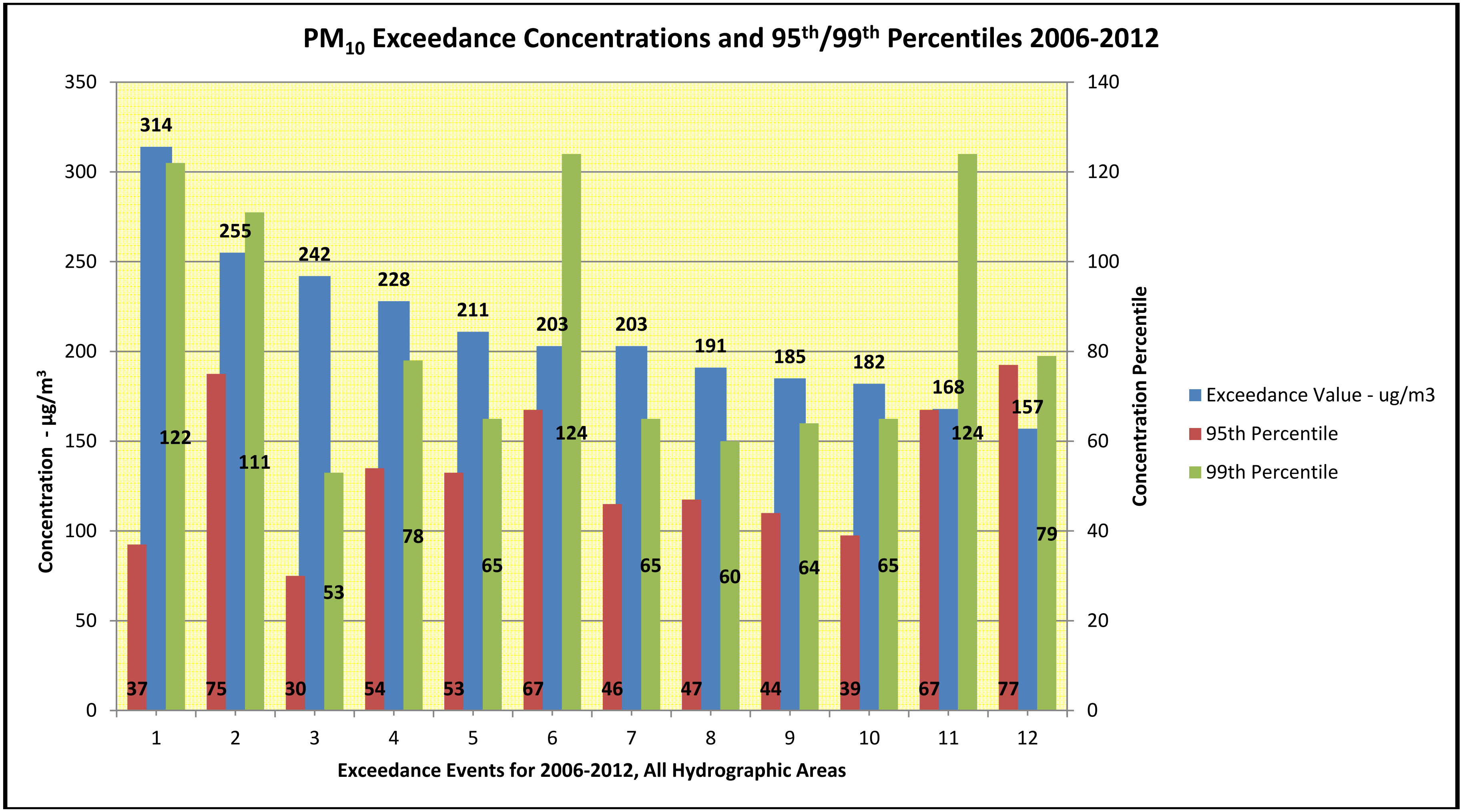


Figure 28. PM_{10} Exceedance Concentrations and 95th & 99th Percentiles, 2006–2012.

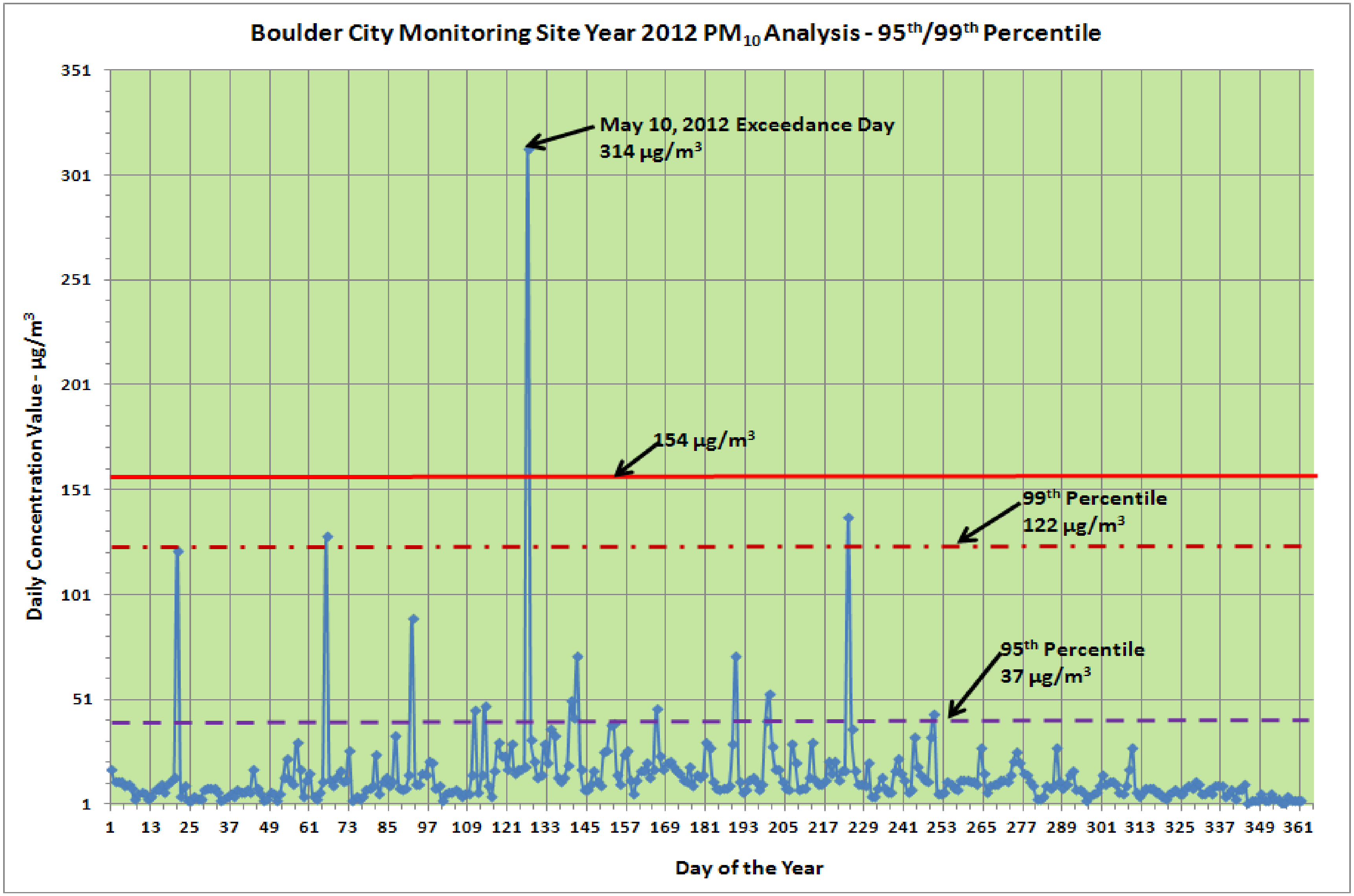


Figure 29. PM_{10} Analysis for 95th & 99th Percentiles, Boulder City Site, 2012.

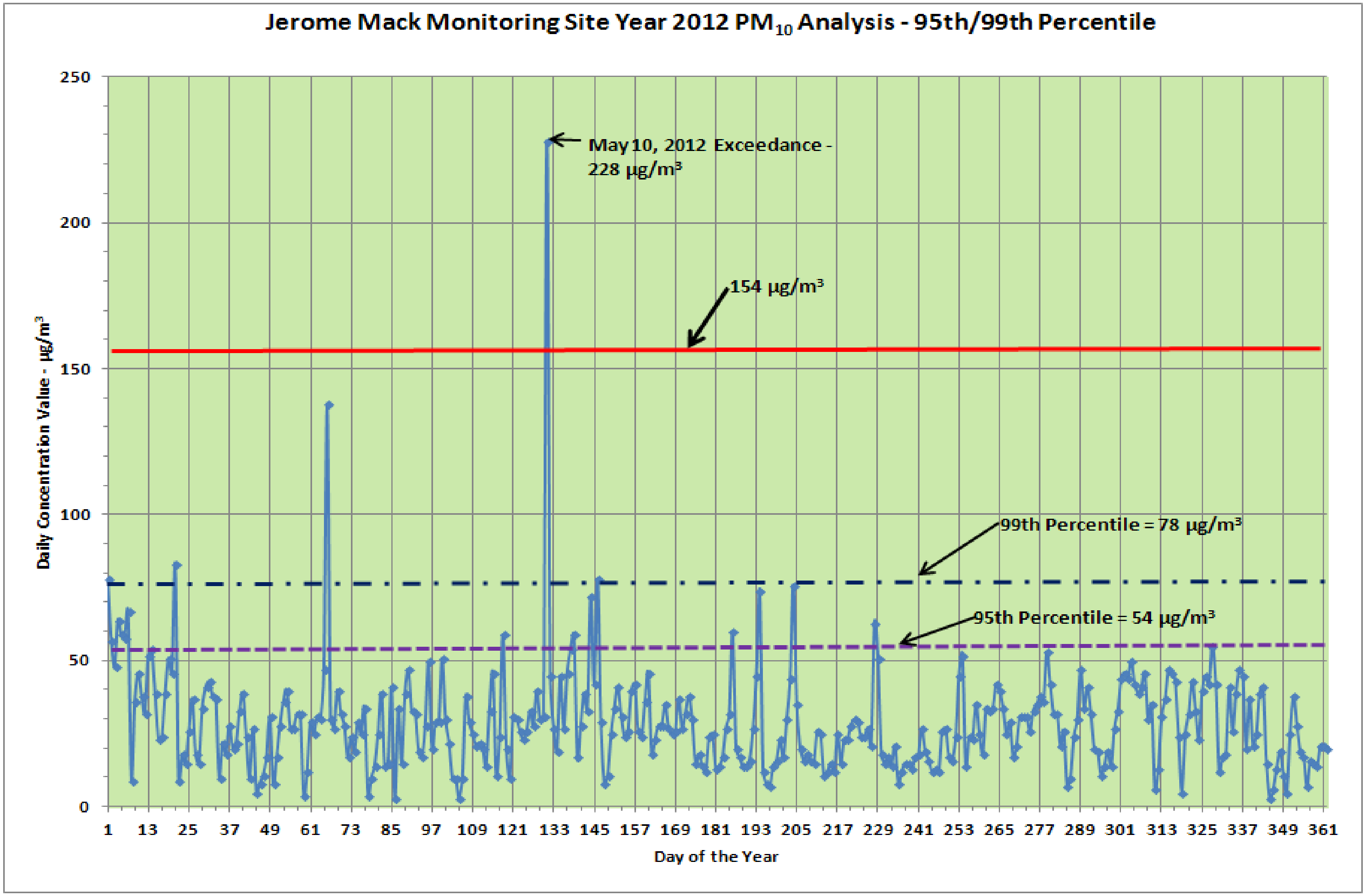


Figure 30. PM_{10} Analysis for 95th & 99th Percentiles, Jerome Mack Site, 2012.

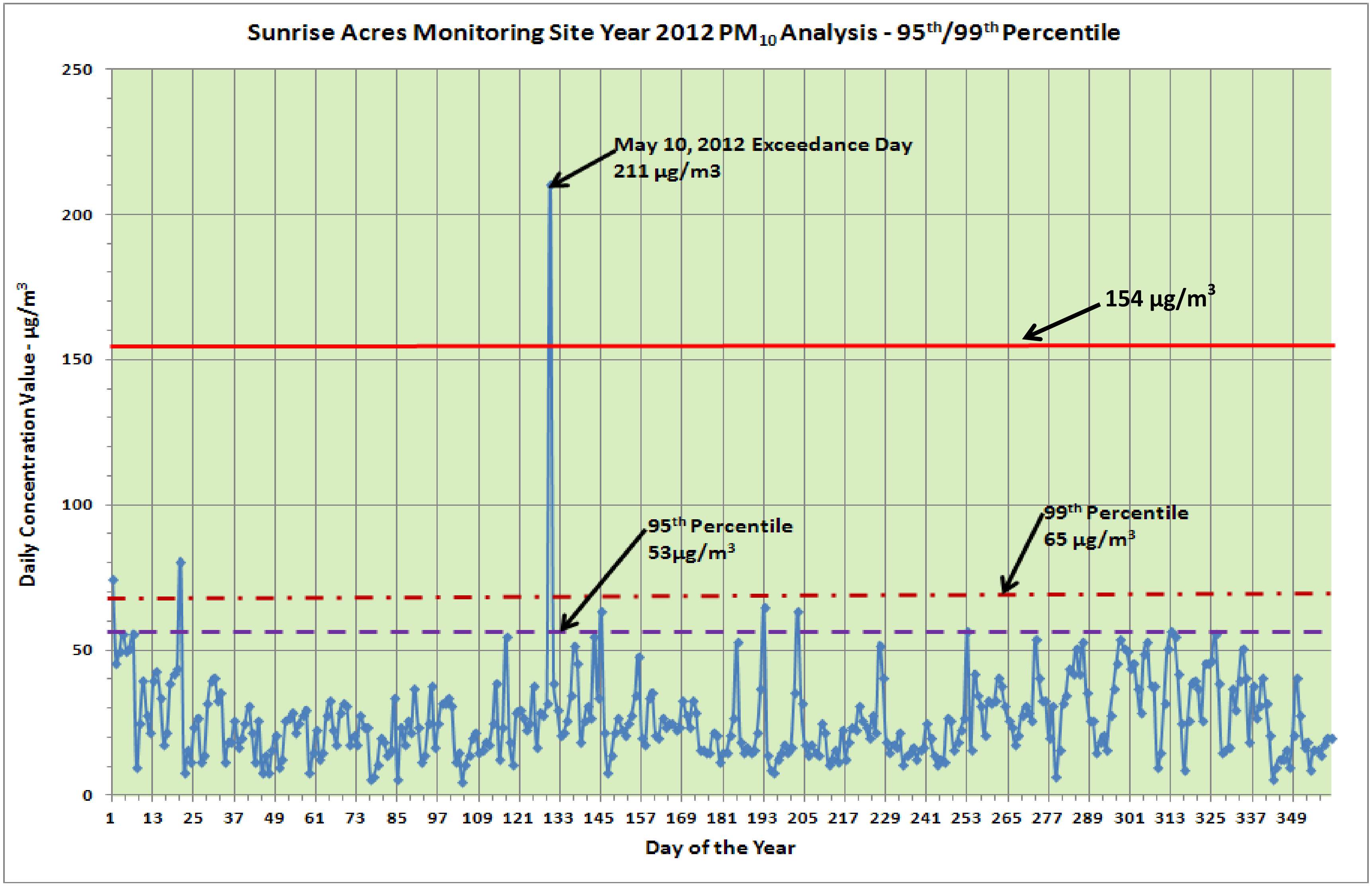


Figure 31. PM_{10} Analysis for 95th & 99th Percentiles, Sunrise Acres Site, 2012.

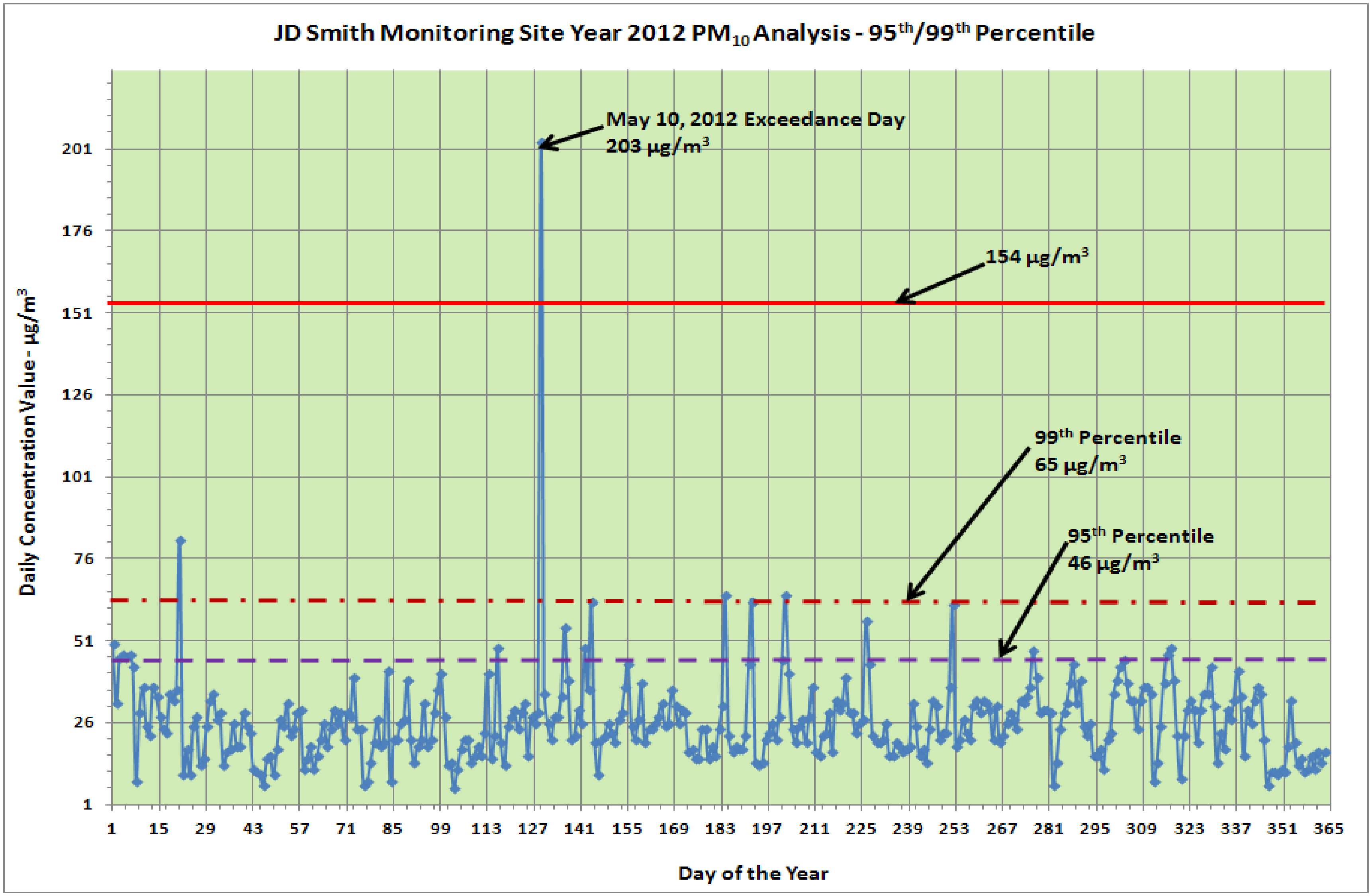


Figure 32. PM_{10} Analysis for 95th & 99th Percentiles, J.D. Smith Site, 2012.

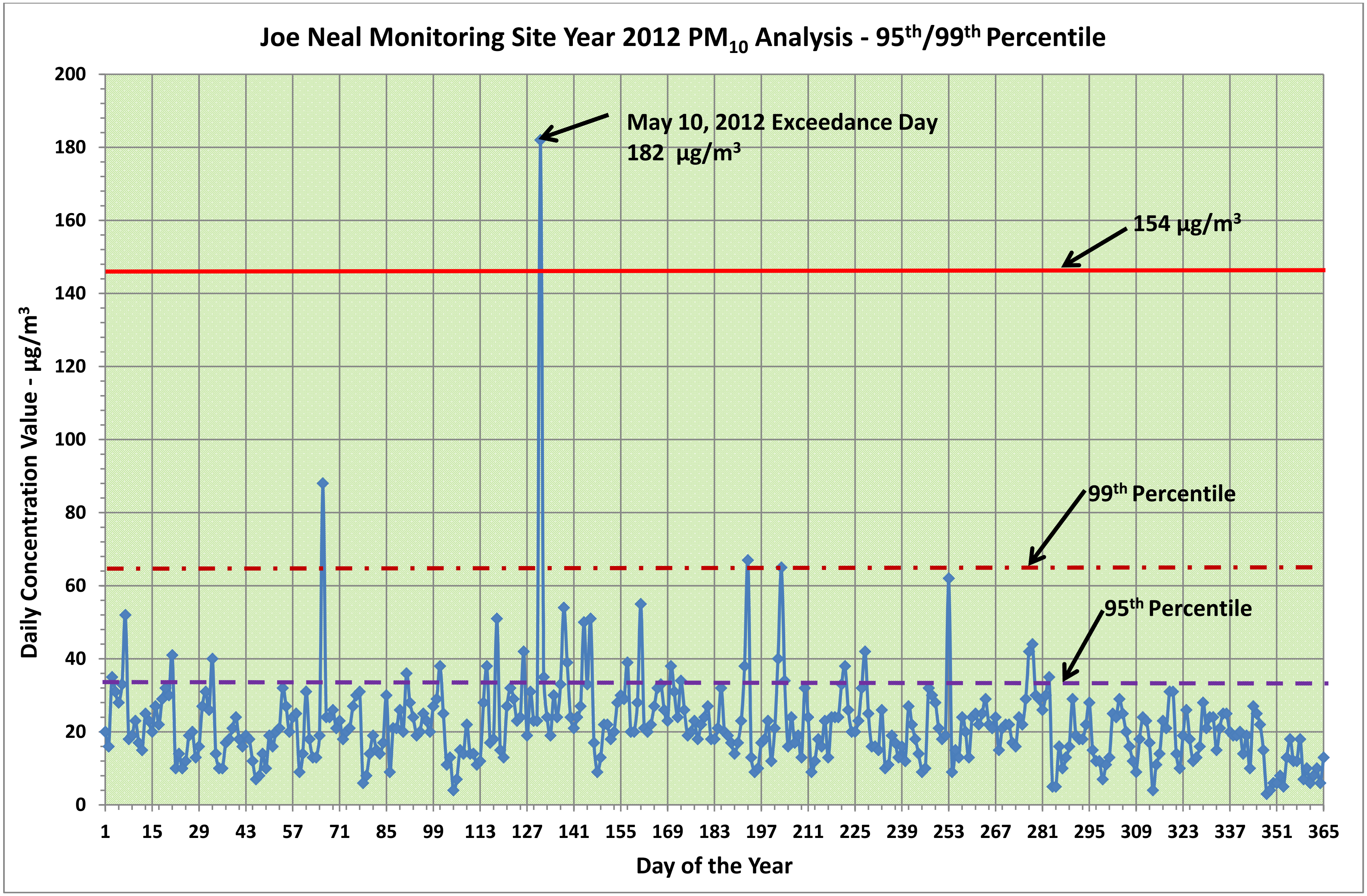


Figure 33. PM_{10} Analysis for 95^{th}& 99^{th} Percentiles, Joe Neal Site, 2012.

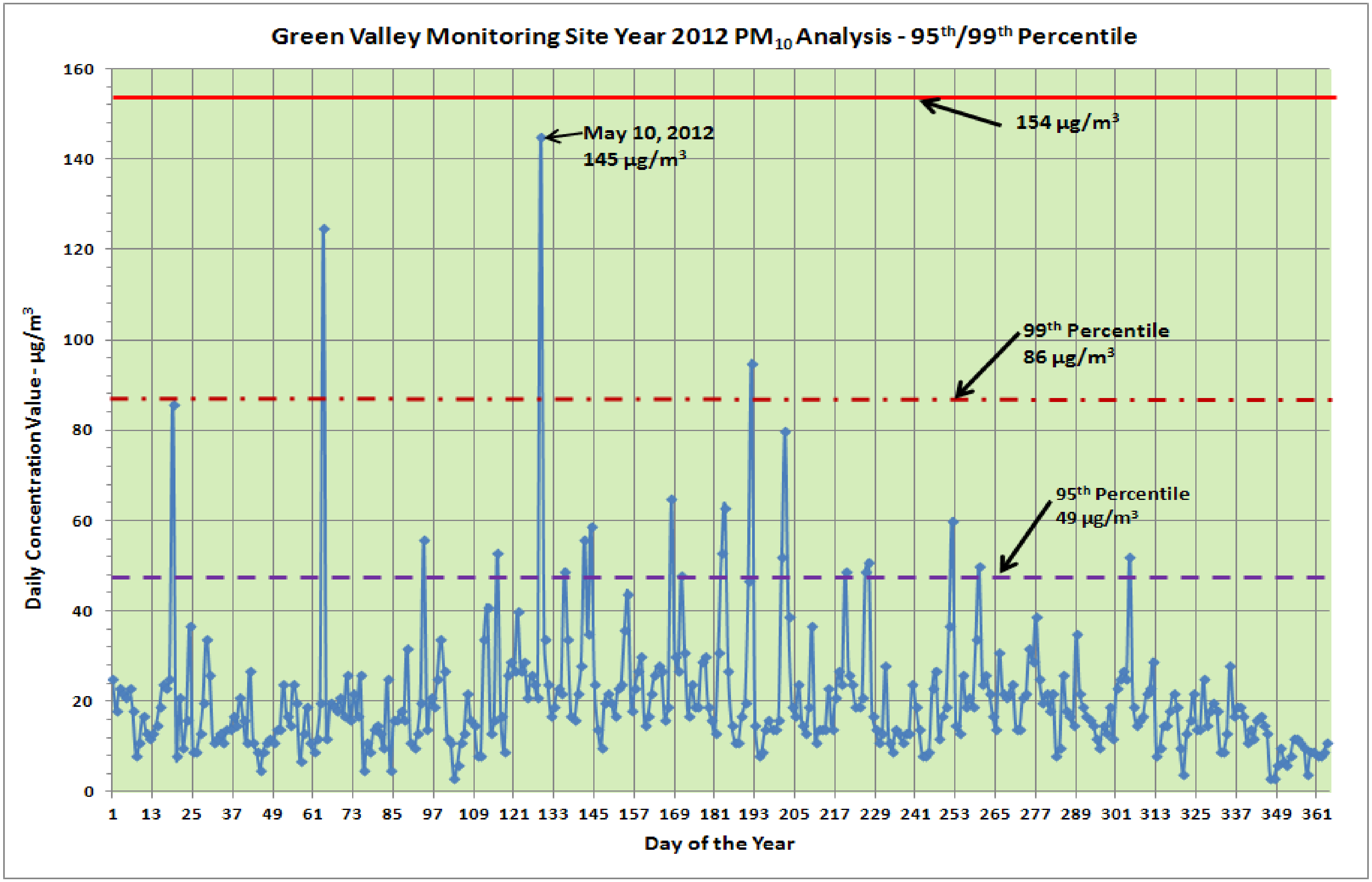


Figure 34. PM_{10} Analysis for 95th& 99th Percentiles, Green ValleySite, 2012.

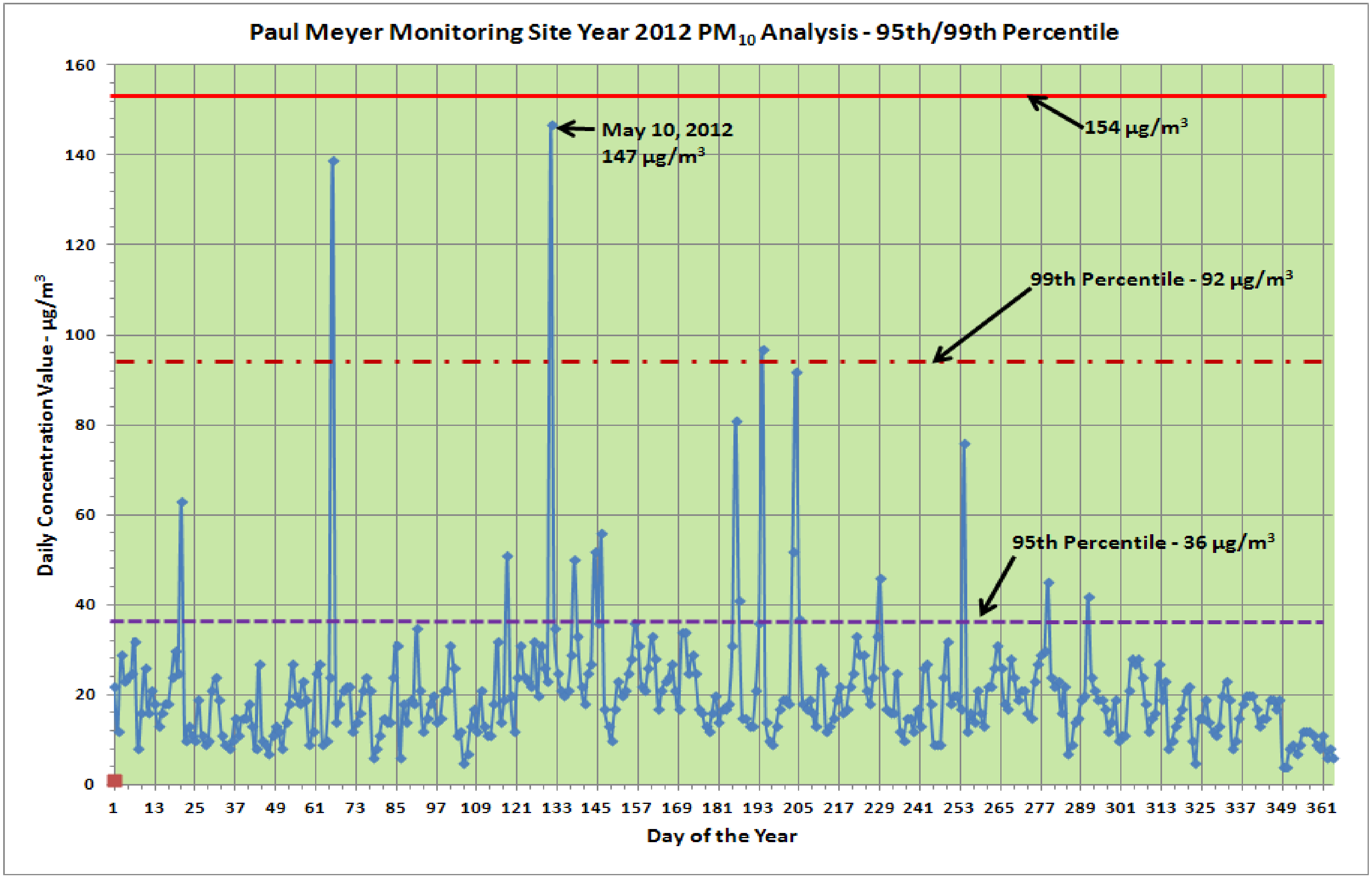


Figure 35. PM_{10} Analysis for 95^{th} & 99^{th} Percentiles, Paul Meyer Site, 2012.

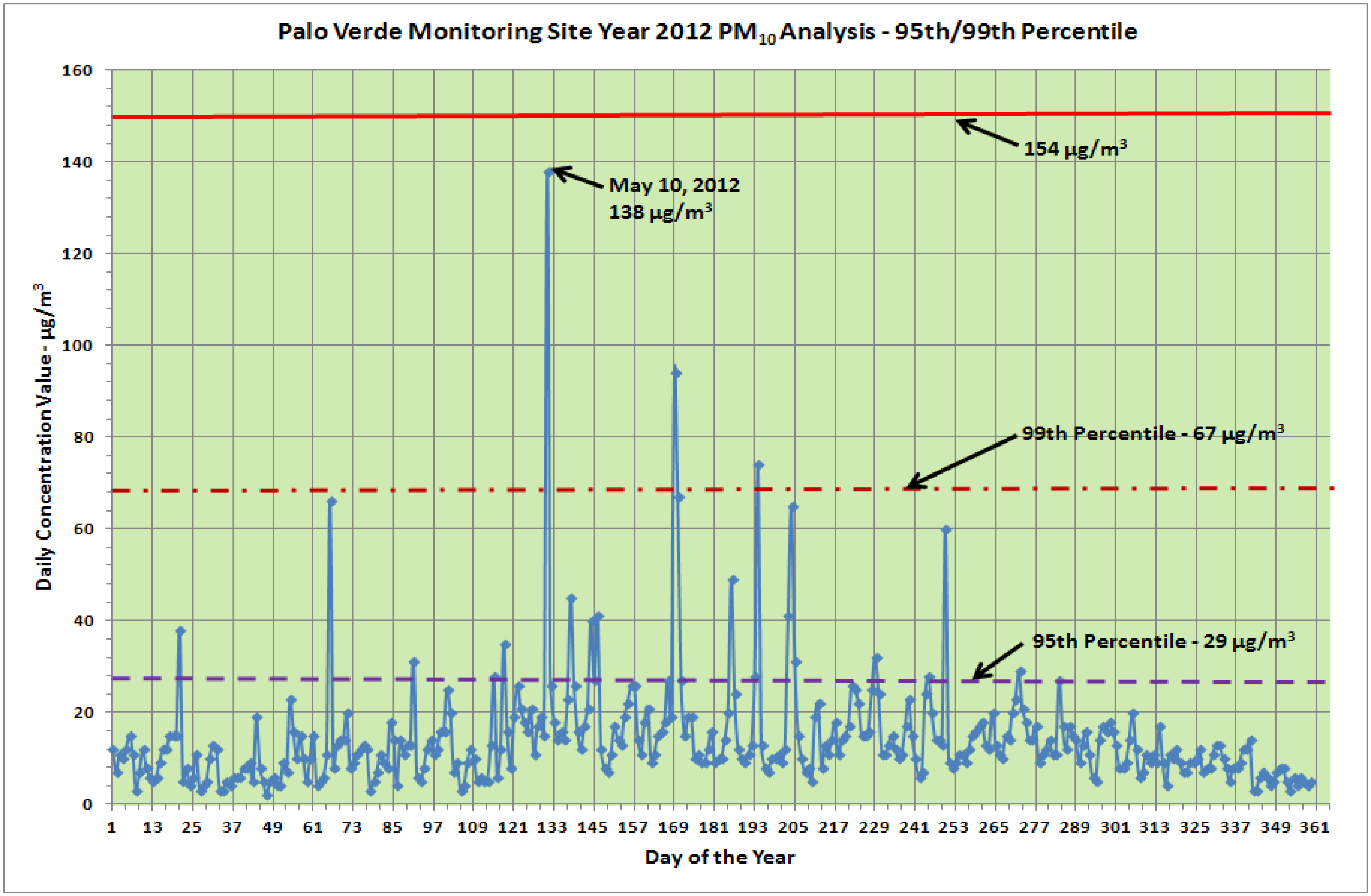


Figure 36. PM_{10} Analysis for 95^{th} & 99^{th} Percentiles, Palo Verde Site, 2012.

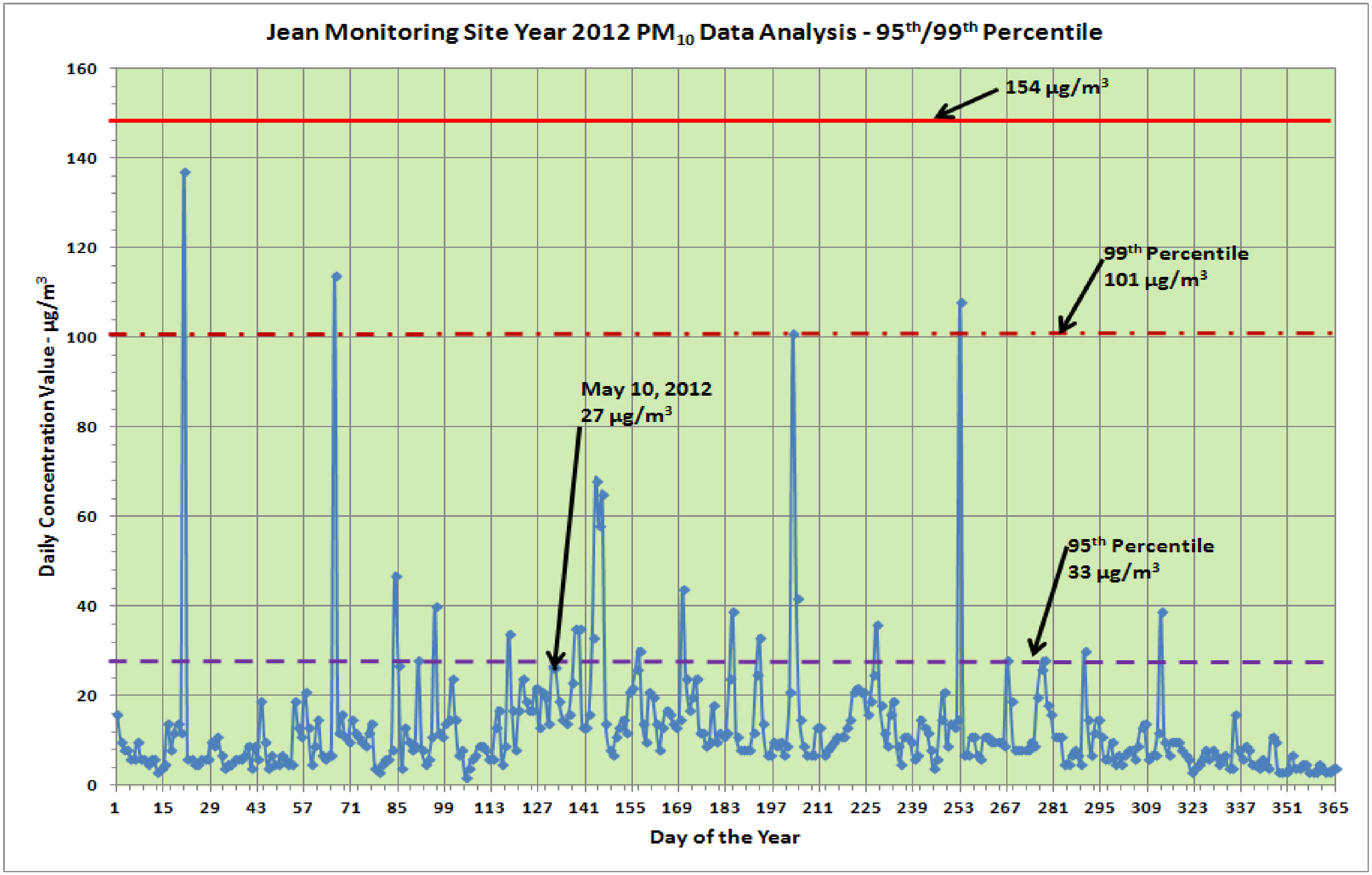


Figure 37. PM_{10} Analysis for 95th& 99th Percentiles, Jean, 2012.

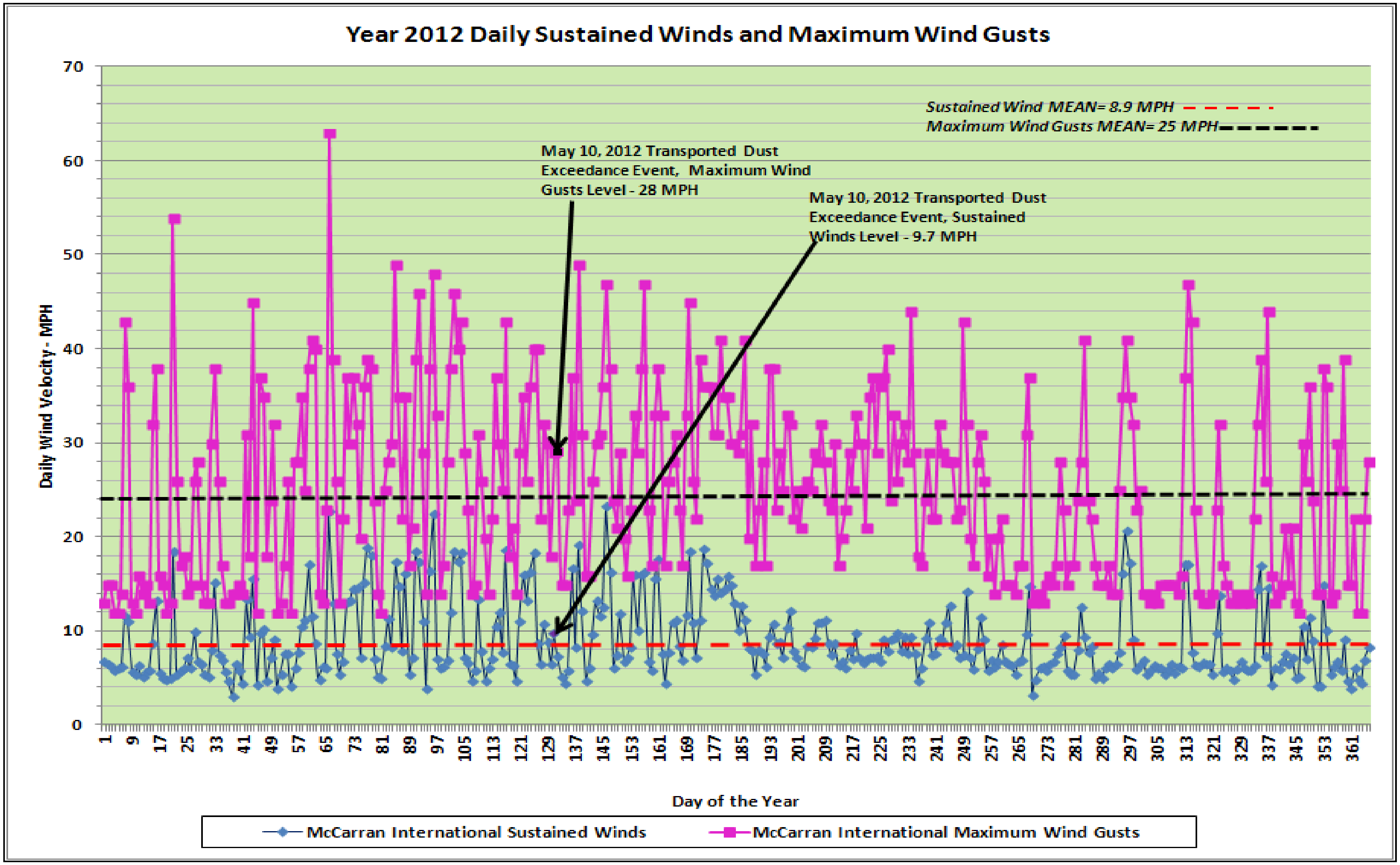


Figure 38. Sustained Winds and Maximum Wind Gusts at McCarran International Airport, 2012.

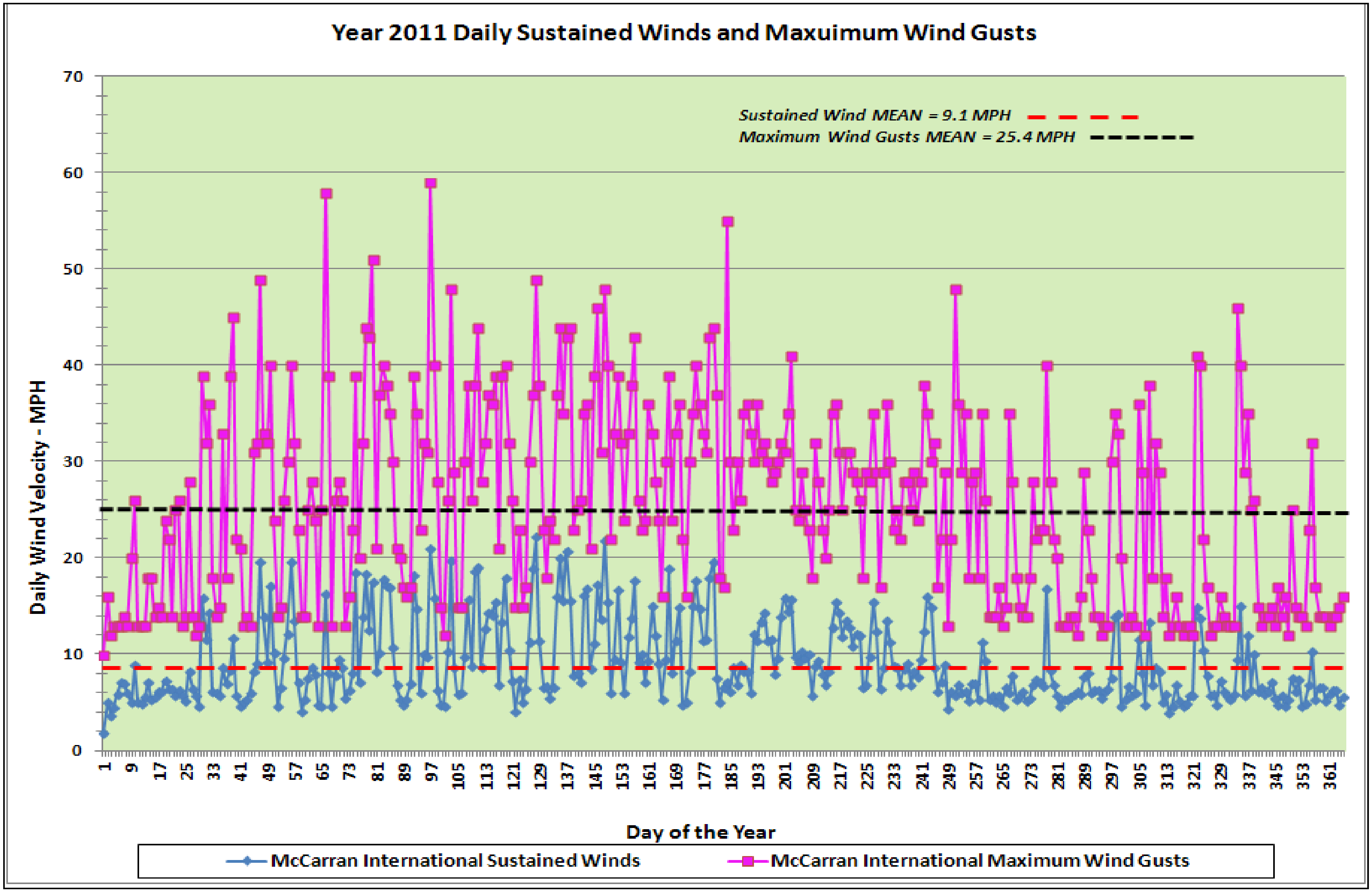


Figure 39. Sustained Winds and Maximum Wind Gusts at McCarran International Airport, 2011.

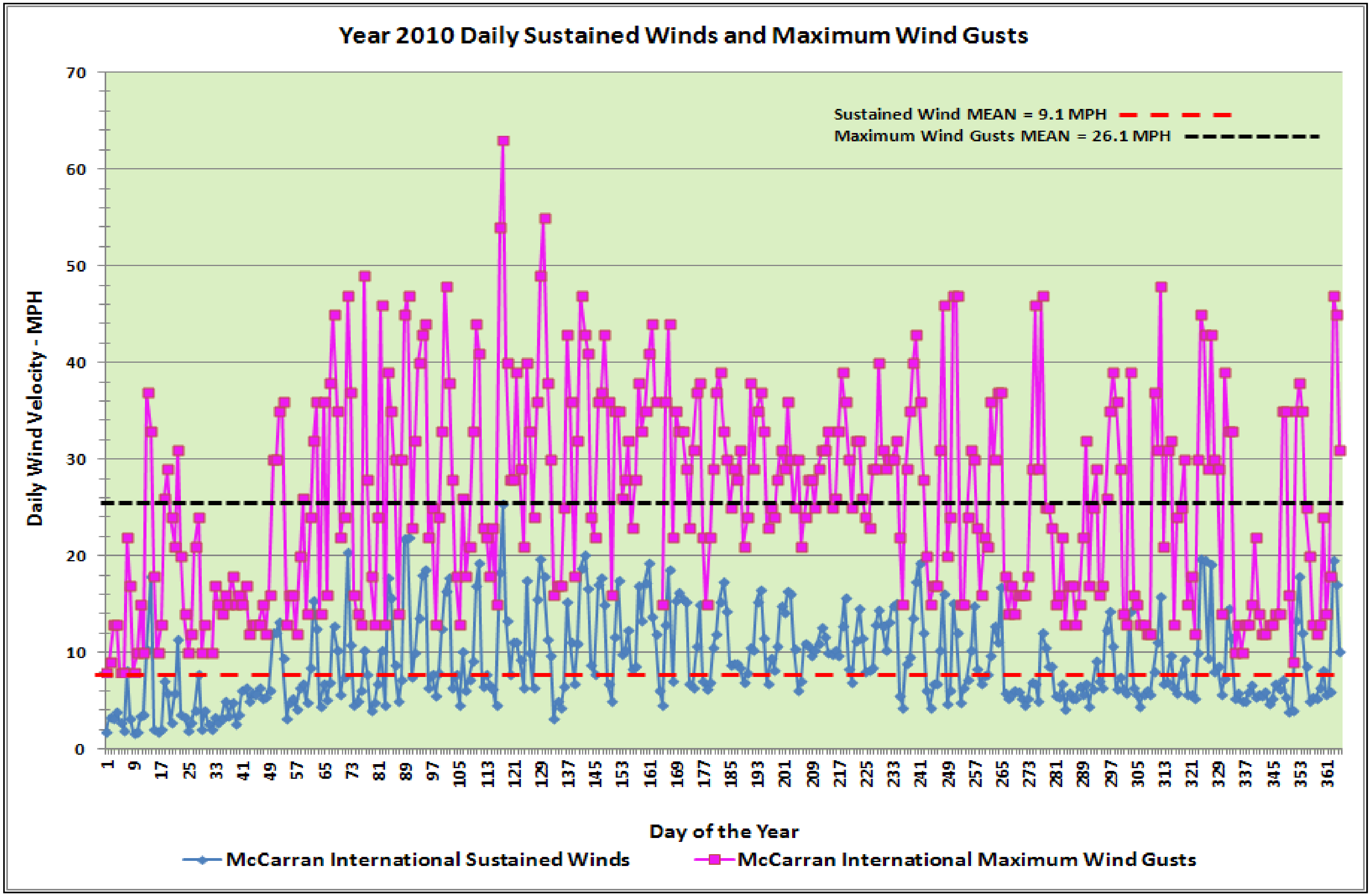


Figure 40. Sustained Winds and Maximum Wind Gusts at McCarran International Airport, 2010.

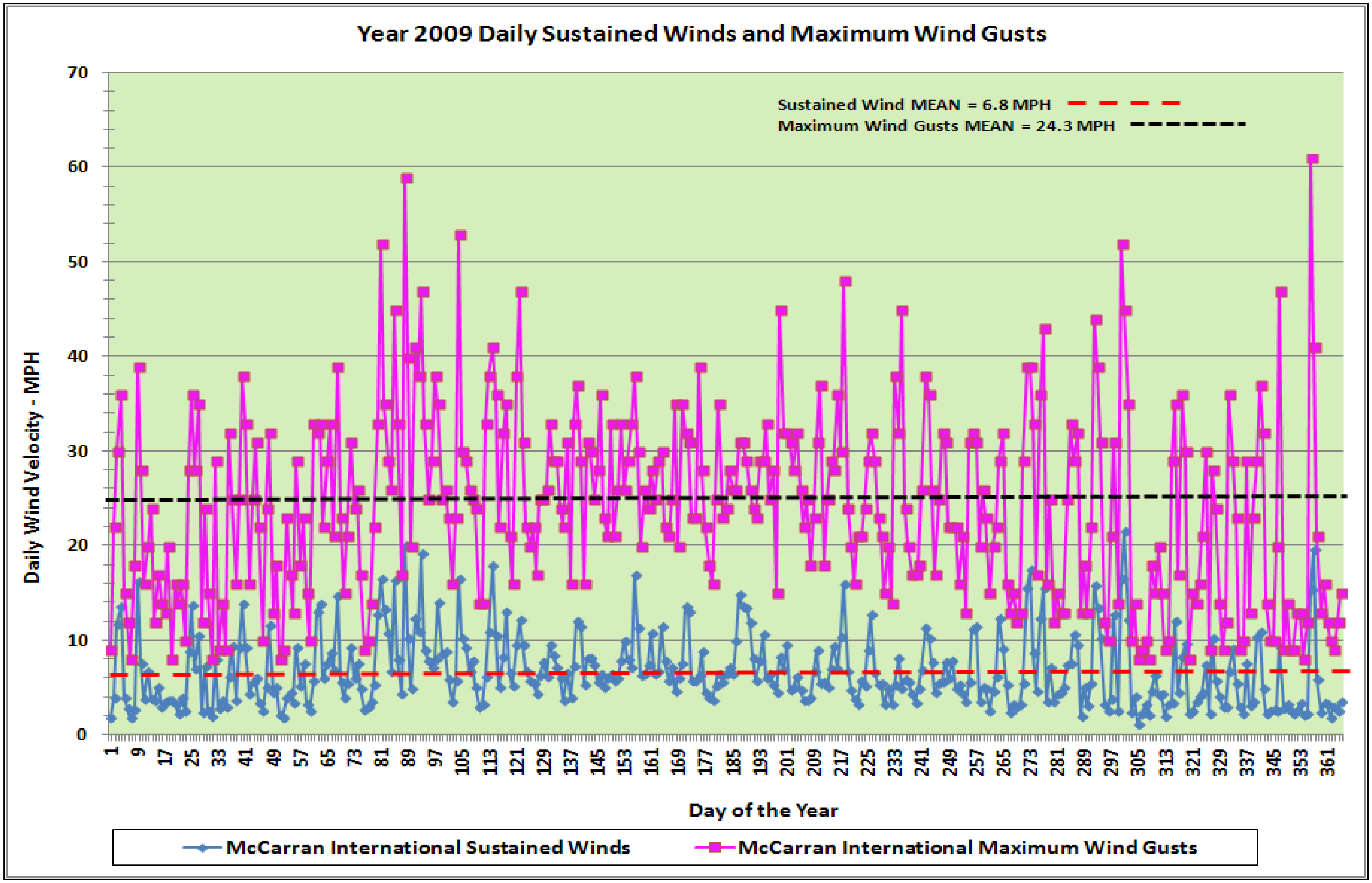


Figure 41. Sustained Winds and Maximum Wind Gusts at McCarran International Airport, 2009.

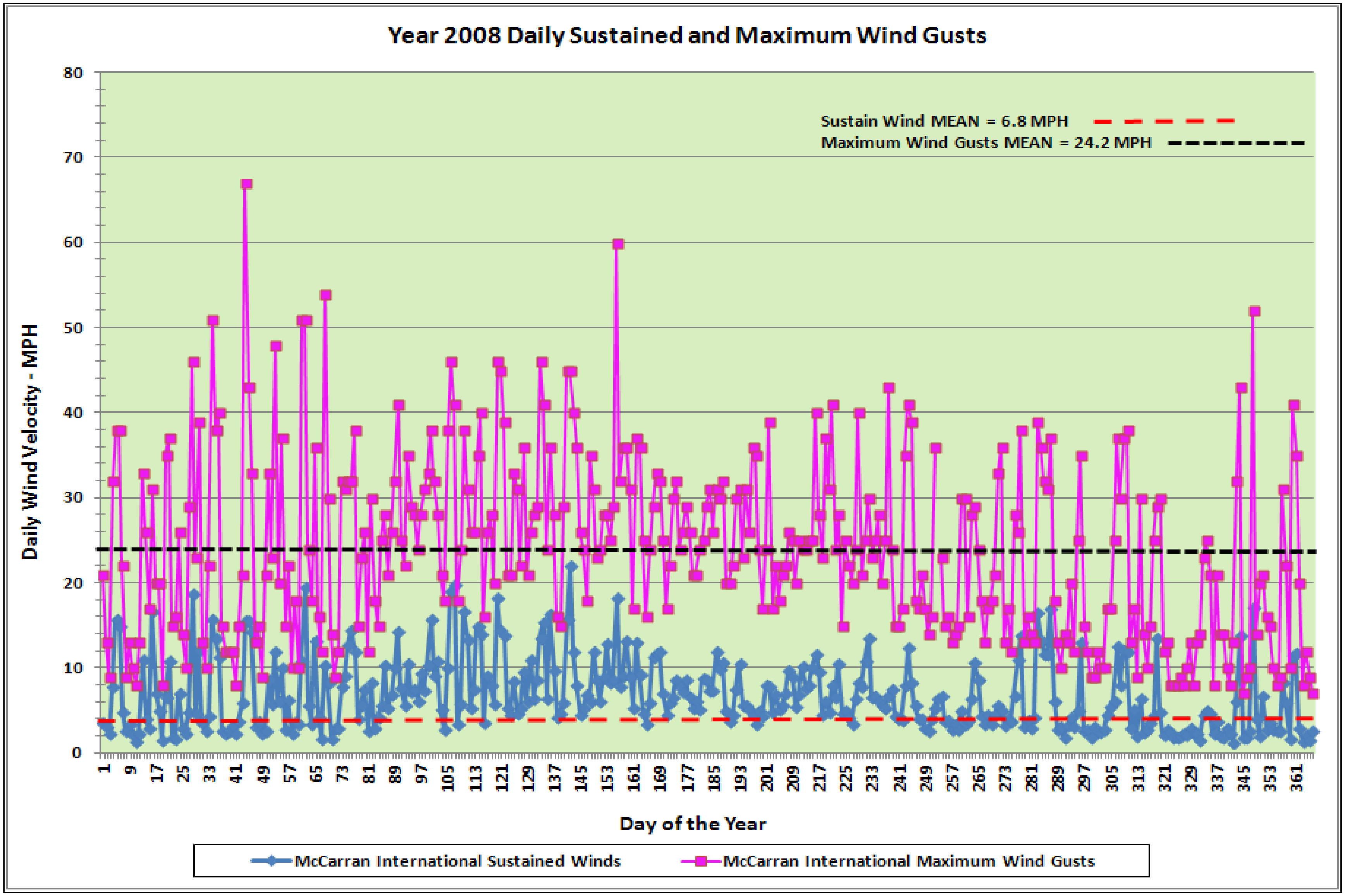


Figure 42. Sustained Winds and Maximum Wind Gusts at McCarran International Airport, 2008.

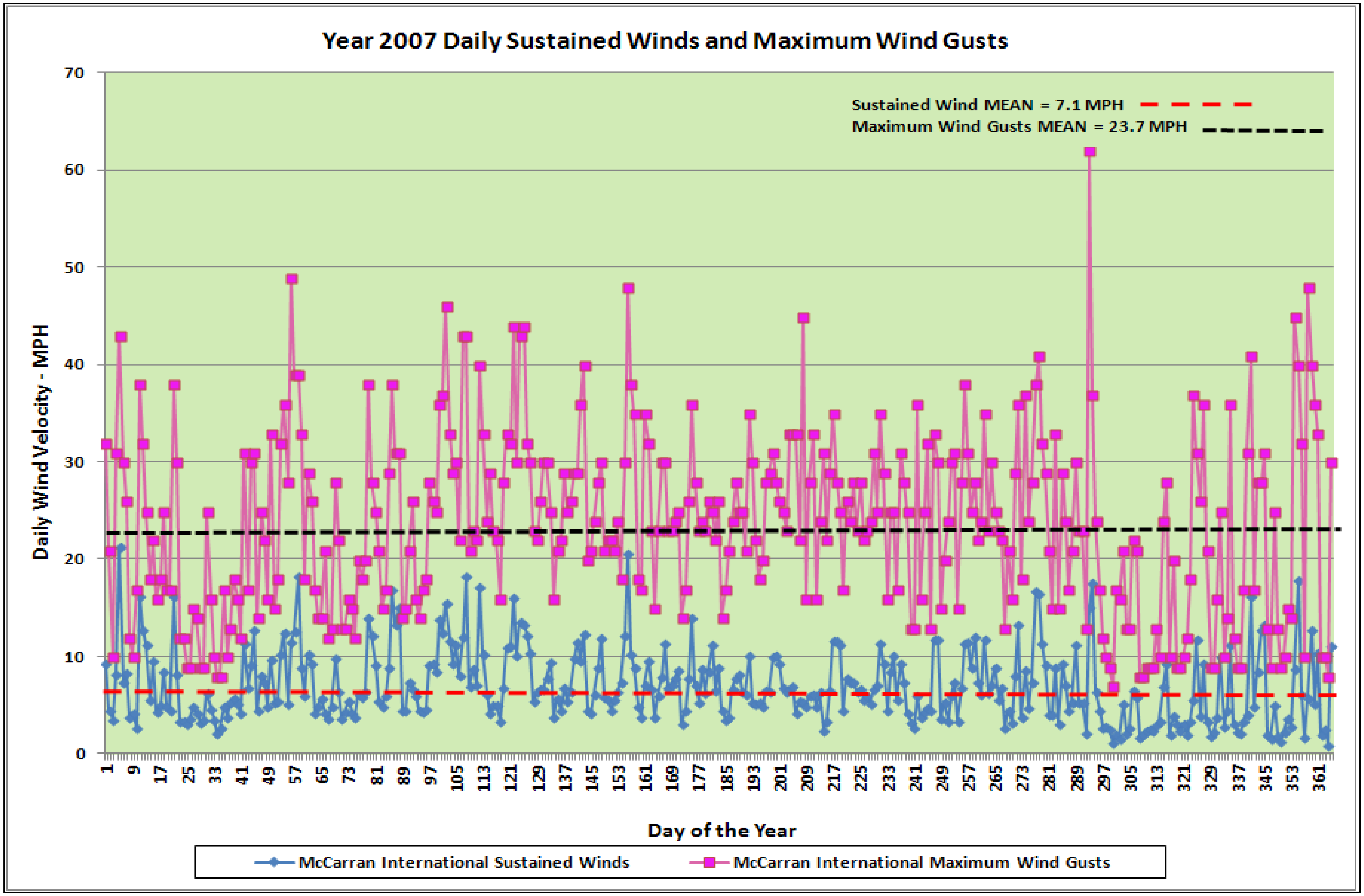


Figure 43. Sustained Winds and Maximum Wind Gusts at McCarran International Airport, 2007.

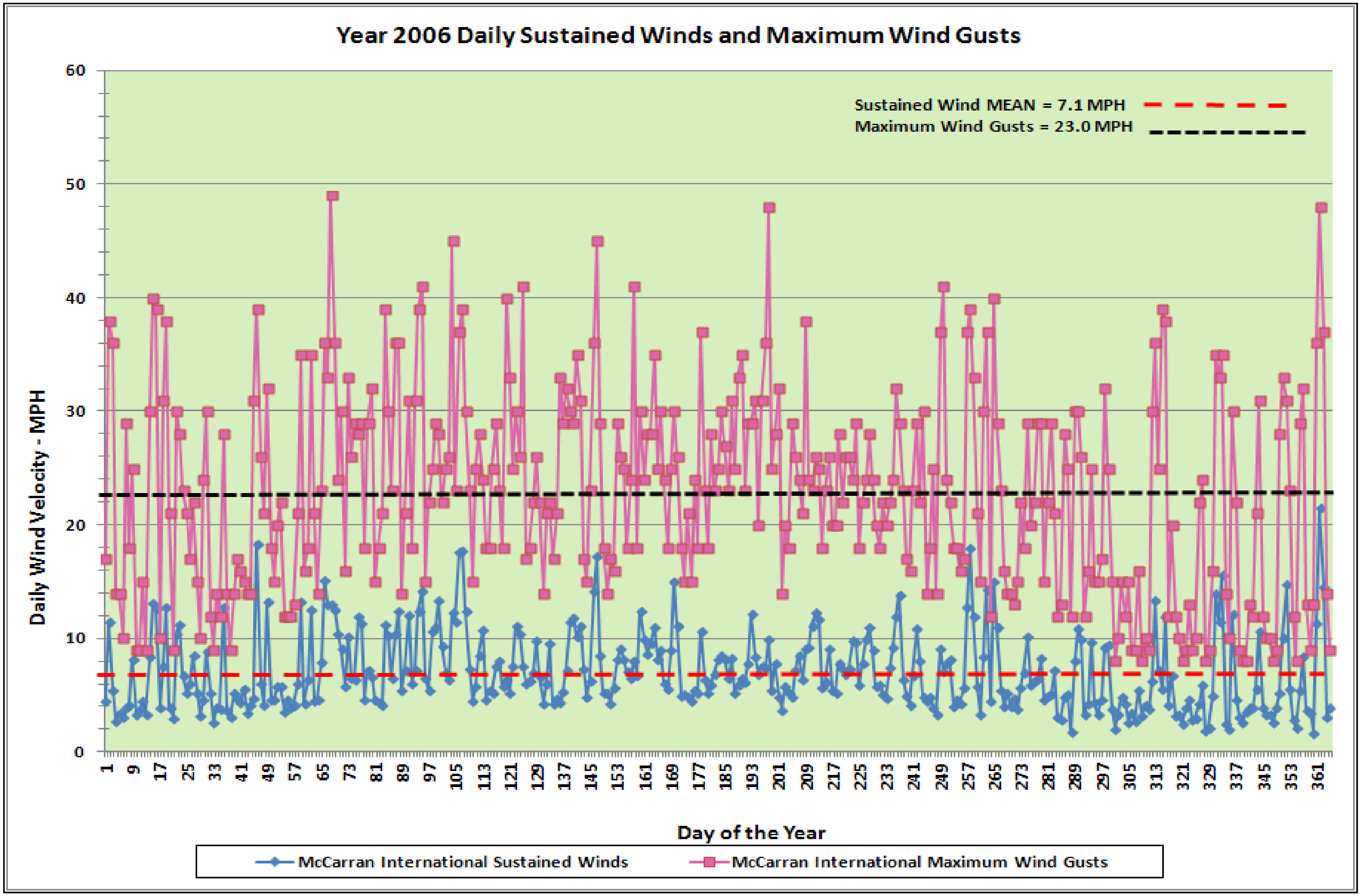


Figure 44. Sustained Winds and Maximum Wind Gusts at McCarran International Airport, 2006.

Table 30 lists the measured mean average values for sustained winds and maximum wind gusts at McCarran International Airport from 2006–2012. Although the Las Vegas Valley often experiences elevated winds in May, the sustained winds and wind gusts on May 10, 2012, were average and did not contribute to the exceedances.

Table 30. Annual Mean Wind Velocities for Sustained Winds and Maximum Wind Gusts at McCarran International Airport, 2006–2012

Year[1]	MCWS[2] (mph)	MCMWG[3] (mph)
2006	7.1	23.0
2007	7.1	23.7
2008	6.8	24.2
2009	6.8	24.3
2010	9.1	26.1
2011	9.1	25.4
2012	**8.9**	**25.0**
Six-year Average:	***7.8***	***24.5***

[1] Annual local climatological data for 2006–2012 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 listed readings for the days before, during, and after the exceptional event at all Clark County PM_{10} network sites. These data clearly show that the event occurred on May 10, 2012, between 0000 and 1700 PST. The wind direction was predominantly from the southeast to the northwest, and the monitoring sites measured peak gusts of 15 mph and sustained two-minute winds of 6 mph.

Other supporting documentation includes meteorological data and analysis (e.g., wind speed and wind direction); Hybrid Single-Particle Lagrangian Integrated Trajectory (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 local news accounts of the event published by the *Las Vegas Sun* and *Las Vegas Review-Journal*.

If the dust sources contributing to a transported dust event are anthropogenic, the state must document the application of reasonable control measures to those sources. Section 5.0, "Compliance and Enforcement Activity," describes the application of BACM to these sources and DAQ's enforcement activities during and after the event, including follow-up enforcement activity.

This section demonstrates that the exceptional event on May 10, 2012, 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 transported dust.

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

3.1 METEOROLOGICAL ASSESSMENT

3.1.1 Weather Summary

The following sections discuss the meteorological conditions associated with the May 10, 2012, exceedance of the PM_{10} NAAQS at the Boulder City (CAMS 0601), J. D. Smith (CAMS 2002), Sunrise Acres (CAMS 0561), Jerome Mack (CAMS 0540), and Joe Neal (CAMS 0075) monitoring stations. The applicable part of the Exceptional Event Rule (40 CFR 50.14) addresses PM_{10} exceedances that affect ambient particulate matter concentrations through the raising of dust or re-entrainment of deposited material (72 FR 13565, IV.E.5.c).

Several factors contributed to the significant ambient PM_{10} concentrations on the event day. A large thunderstorm over northwestern Arizona produced an outflow boundary, which raised a large amount of dust over southern Mohave County, Arizona, extreme southern Clark County, Nevada, and extreme southeastern San Bernardino County, California. A narrow ridge over most of Clark County trapped dust there until a frontal system from the north moved through in the afternoon, dispersing the PM concentrations. Wind flow in the Las Vegas and Eldorado Valleys came from the outflow boundary created by the Arizona thunderstorm, while flow in the Ivanpah

Valley came from southern California. This explains why the Jean monitoring site did not experience elevated PM_{10} readings, but the other two valleys did, including all PM_{10} sites within the Las Vegas Valley. The dynamitic interaction between a cold front in central Nevada merging with a low-pressure system and troughing over most of Clark County formed a stronger low-pressure system; also, a high-pressure system over the extreme eastern portion of Clark County pushed south in the afternoon and evening to quickly disperse PM_{10} levels at the Palo Verde, Paul Meyer, and Green Valley sites. Although these sites did not exceed, they experienced near-exceedance PM_{10} levels. The 24-hour averages for these sites were:

- Palo Verde: 139 µg/m^3
- Green Valley: 146 µg/m^3
- Paul Meyer: 147 µg/m^3

There is a clear causal relationship between the exceptionally high concentrations of dust raised by the thunderstorm outflow boundary and the PM_{10} exceedances 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. The data come from observations made during a few minutes at the end of an hour; gusts are noted when they exceed 10 knots above average wind speed during the observation period. The National Climatic Data Center (NCDC) of the National Oceanic and Atmospheric Administration (NOAA) provides the quality-controlled data for these local reports.

3.1.2.2 Clark County Monitoring Stations

While NCDC airport data comes from observations made over a few minutes once an hour, DAQ stations collect weather data continually over each hour. 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 transported dust event, which are showcased in the remainder of Section 3. The upper air pressure charts illustrate systems at the 200-mb, 500-mb, and 850-mb levels.

The tracks of the jet stream can clearly be seen in the 200-mb upper air charts, which show the area near the level of the jet stream's core. The jet stream indicates wind flow direction, which is generally from west to east throughout most of the subtropics, mid-latitudes, and high latitudes. Its momentum carves trough ridge patterns: if winds are greater on the left side of a trough, the trough becomes more amplified and moves further south; if winds are greater on the right side of a trough, the trough becomes less amplified over time and moves further north.

3.1.2.3.1 Surface Charts

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

- Areas of high or low pressure are marked with an H or an L.
- White, wavy lines show equal pressure reduced to sea level ("isobars"), with pressure values labeled in millibar (mb). Closely spaced isobars typically indicate areas of stronger wind.
- Cold fronts are shown in blue as triangular wedges; warm fronts are shown in red as semicircular 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 illustrate an occluded front, which is a mixture of cold and warm fronts overlapping in the vertical direction.
- An orange dashed line indicates an area of low pressure ("trough").

3.1.2.3.2 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 charts altitude is near the level of the core of the jet stream, so the tracks of the jet streams can be seen clearly on this chart. The jet stream indicates the directional wind flow, which is generally from west to east throughout most of the subtropics, mid-latitudes, and high latitudes. 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 over time and move further north. The pressure level in the 200-mb charts occurs approximately 12,000 m (40,000 ft.) above mean sea level.

The pressure level in the 500-mb charts occurs approximately 5,600 m (18,000 ft.) above mean sea level, and is approximately half of average sea-level pressure.

The pressure level in the 850-mb charts occurs approximately 1,500 m (5,000 ft.) above mean sea level. Each chart includes the following illustrations:

- Notations of low and high-pressure areas. A circular pattern of height lines around a low-pressure area is called a "closed low," and indicates a very strong system. A trough of low pressure typically appears as a V-shaped pattern of height lines; a ridge of high pressure typically appears as an inverted V-shaped pattern of height lines.

- Wind data indications. Most charts indicate wind data at the upper air station as arrow-shaped line figures. The shaft of the arrow shows the direction the wind blows from, with the station as the reference point. The "feathers" on the back of the arrow shaft indicate speed: a solid line is 10 knots, a triangle is 50 knots. These charts provide a colored scale for wind speeds at the bottom.

Trajectory plots were created using the NOAA HYSPLIT model run in the EPA AIRNow-Tech system. Section 3.1.7 discusses these plots in detail.

3.1.3 Monitoring Network Measurement Background

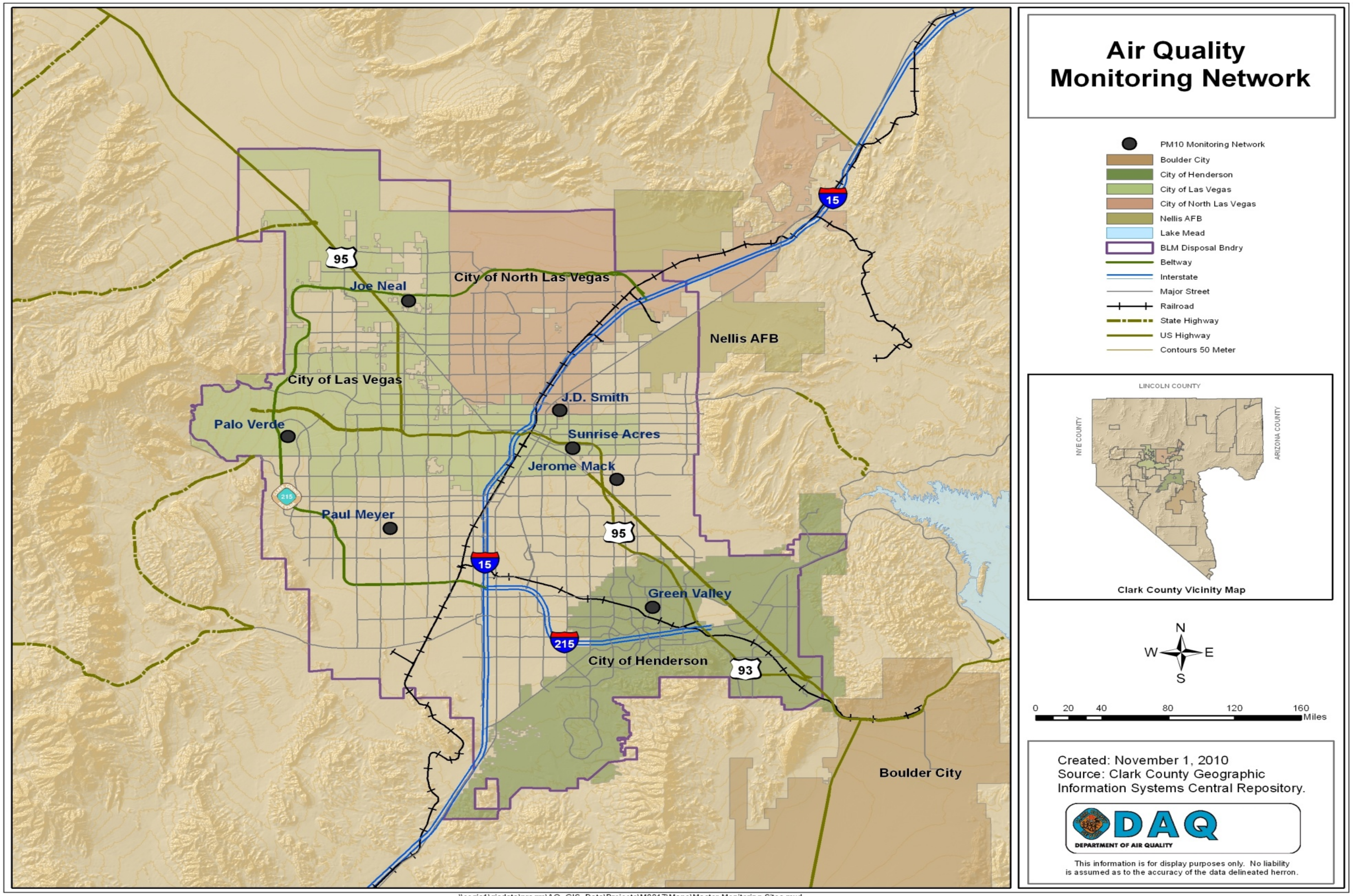
Figure 45 is a map of the Las Vegas Valley showing the monitoring stations referenced in the analysis. Figure 46 is a map of the overall Clark County PM_{10} monitoring network. Figure 47 is a map of the Boulder City (Eldorado Valley) monitoring site; Figures 48–51 are maps of the J. D. Smith, Sunrise Acres, Joe Neal, and Jerome Mack (Las Vegas Valley) monitoring sites with wind/pollution roses. All sites in the analysis were selected to show representative conditions across Clark County.

DAQ operates all its Thermo Scientific FH62C14 PM_{10} samplers are operated to in compliance with the EPA Federal Equivalent Method (FEM) designation mode. FEM is an automated method (analyzer) that uses a measurement principle based on sample collection by filtration, then analysis by beta-ray attenuation. As a designated equivalent method, FEM is acceptable for use by states and other air monitoring agencies under the requirements of 40 CFR 58.

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 1 m^3/hr. The samplers have two analog voltage output channels, which are sampled by the data system once every minute. The concentration channel signal is proportional to the running 60-minute average value, which is scaled from 0–1,500 $\mu g/m^3$. The mass accumulation channel signal passes through a digital filter with a two-minute time constant, and is scaled to an accumulated mass from 0–1,500 µg.

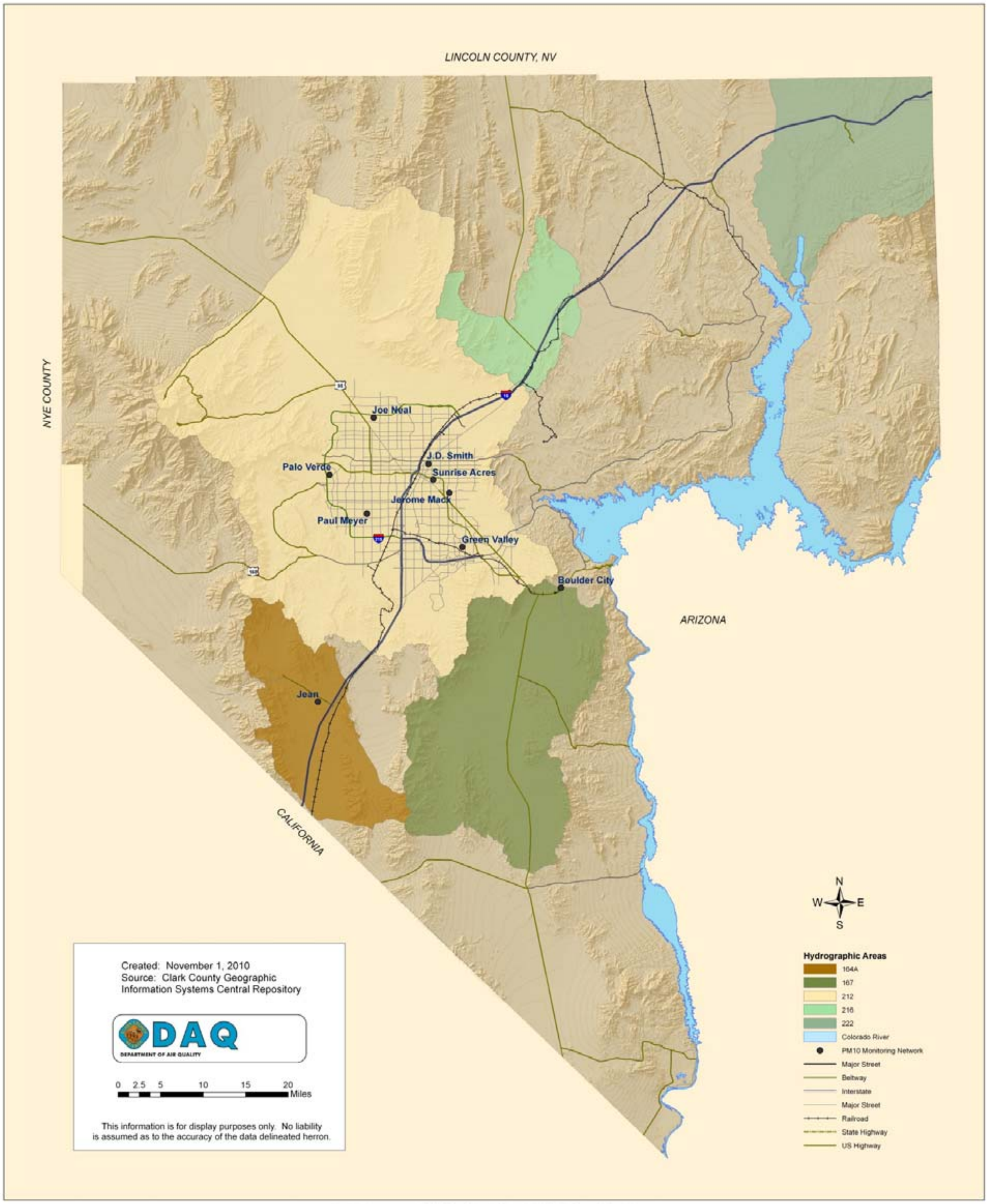
The data system calculates and records five-minute averages of the concentration and accumulated mass channels, then calculates hourly values by averaging the five-minute readings. Since the concentration channel has a 60-minute running average, its hourly concentrations are calculated from a two-hour period. Because the volume of air sampled in one hour is 1 m^3, 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 values are 1,500 $\mu g/m^3$ for the concentration channel and 1,500 $\mu g/m^3$ for the mass channel. When the sampler registers a mass value of 1,500 µg, 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, however, the reset process can produce erroneous values without corrections for short time periods. On May 10, 2012, the official reported 24-hour values calculated for standard conditions were 314 $\mu g/m^3$ at Boulder City (Eldorado Valley, Hydrographic Area 167) and 228 $\mu g/m^3$ at Jerome Mack (Las Vegas Valley, Hydrographic Area 212).



\\ccgis1\gisdata\praqm\AO_GIS_Data\Projects\M0017\Maps\Master Monitoring Sites.mxd

Figure 45. PM_{10} Federal Equivalent Method Monitoring Sites in the Las Vegas Valley.



\\ccgis1\gisdata\praqm\AQ_GIS_Data\Projects\Monitoring\M0017\Map\CurrentOverall_sites.mxd

Figure 46. PM_{10} FEM Monitoring Sites in Clark County.

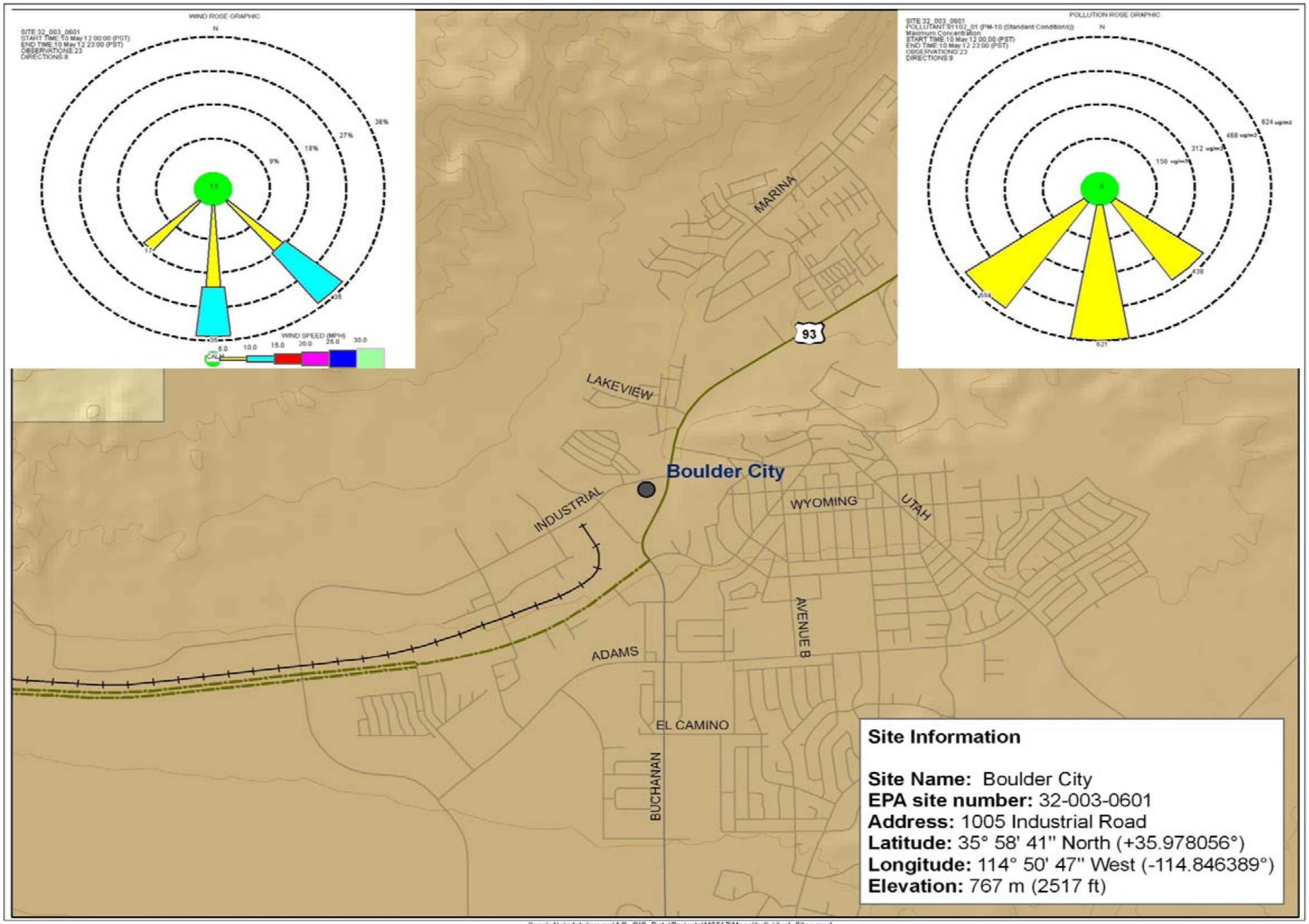


Figure 47. Wind/Pollution Rose, Boulder City PM_{10} Monitoring Site.

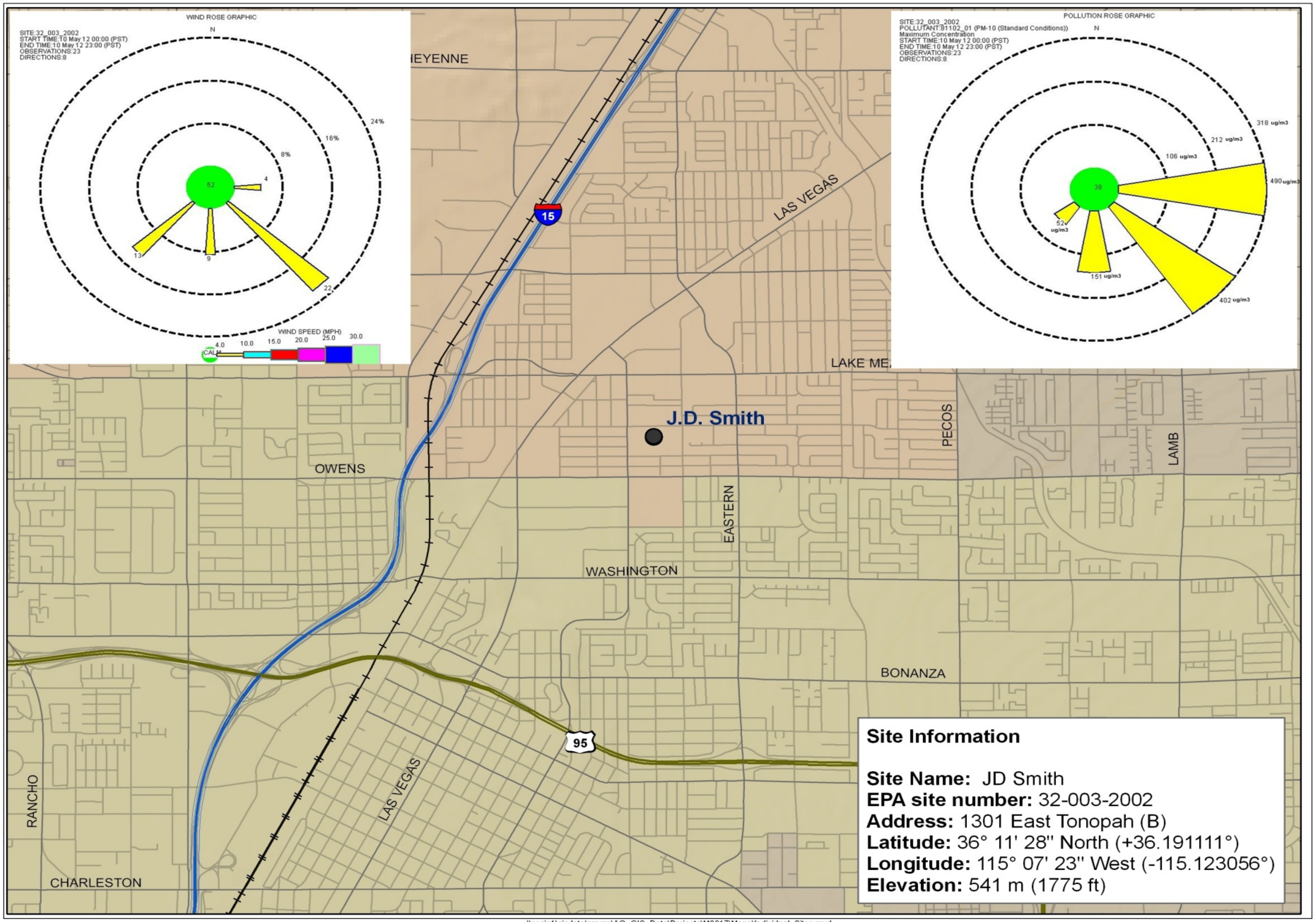


Figure 48. Wind/Pollution Rose, J.D. Smith PM_{10} Monitoring Site.

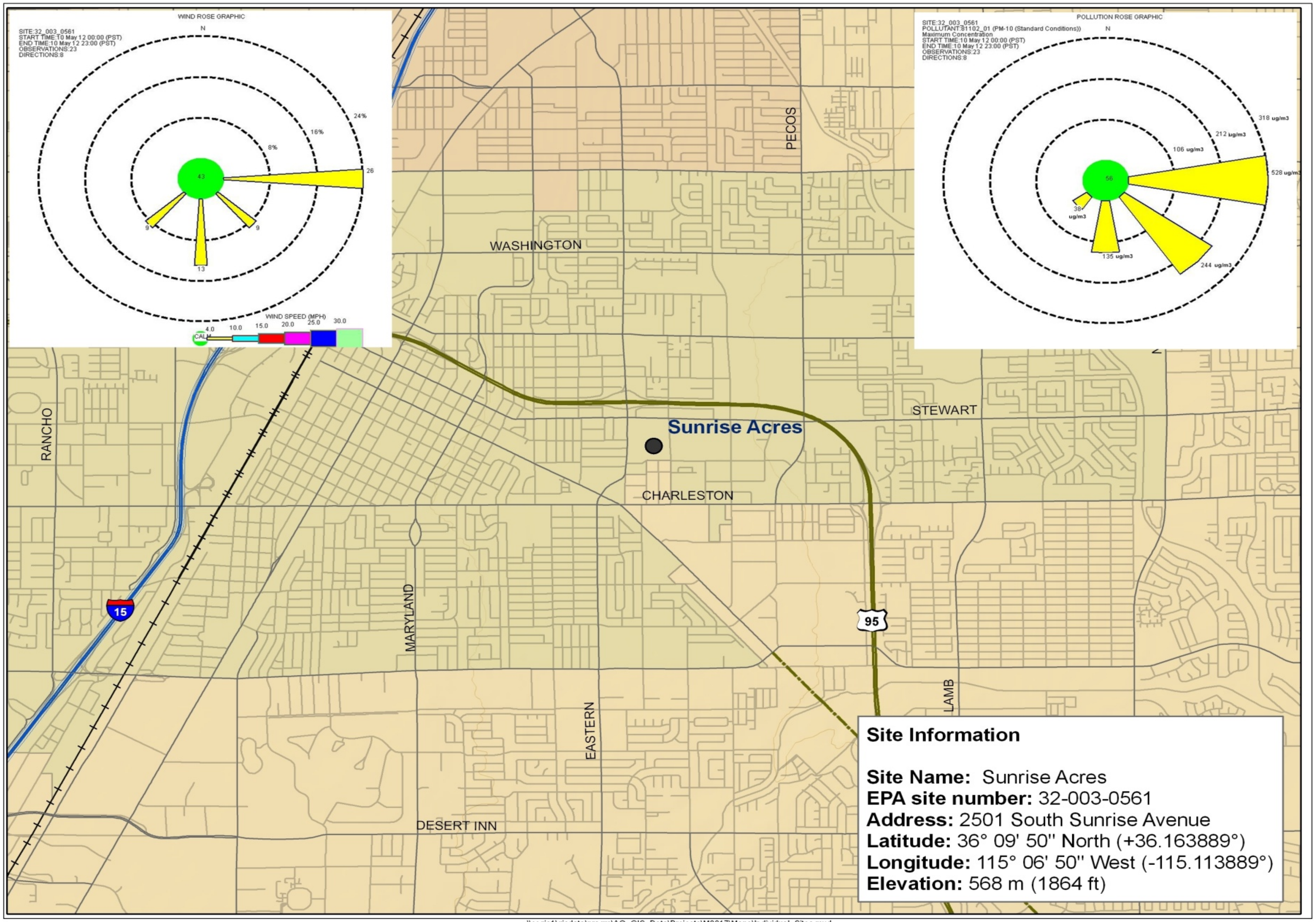


Figure 49. Wind/Pollution Rose, Sunrise Acres PM_{10} Monitoring Site.

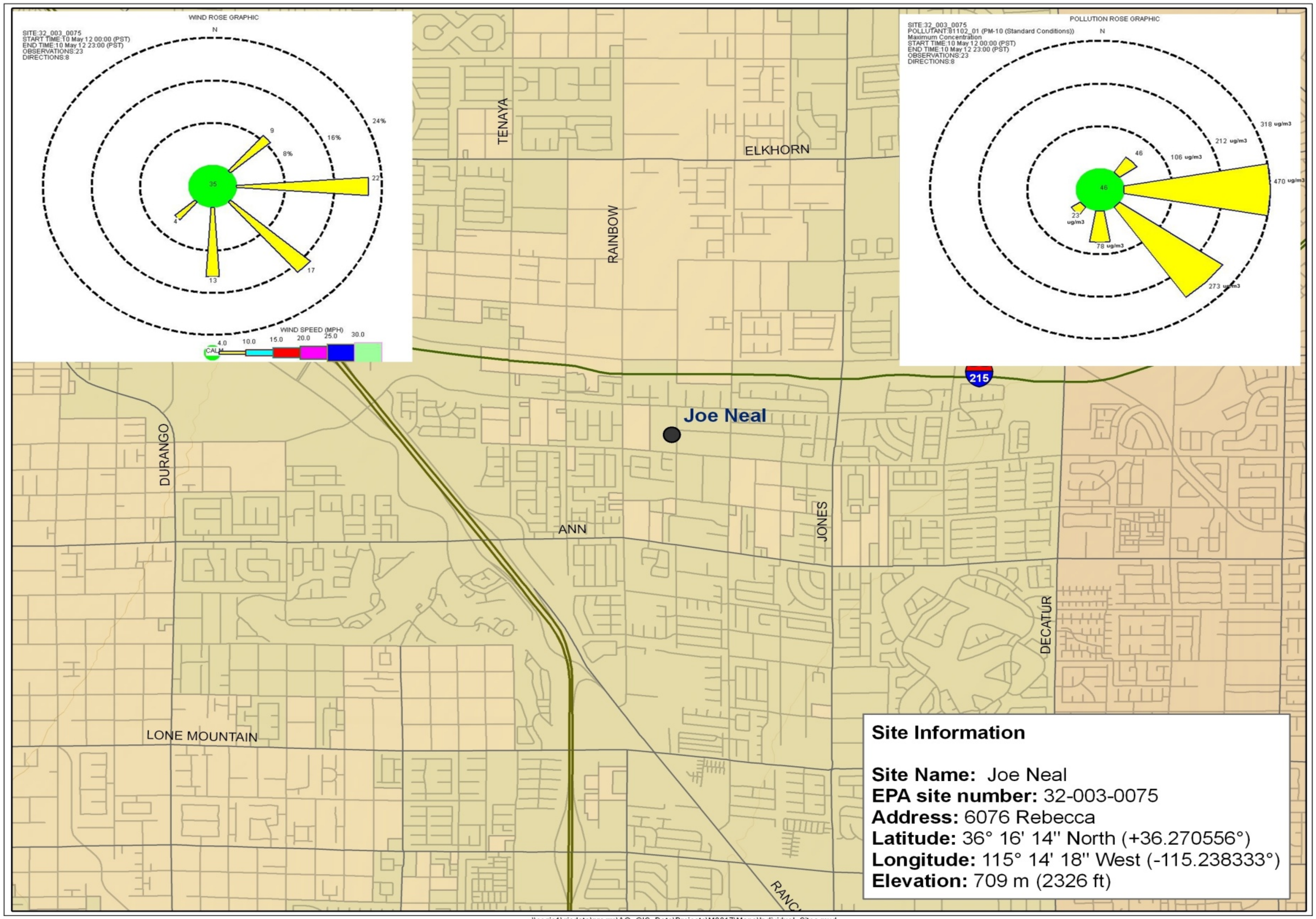


Figure 50. Wind/Pollution Rose, Joe Neal PM_{10} Monitoring Site.

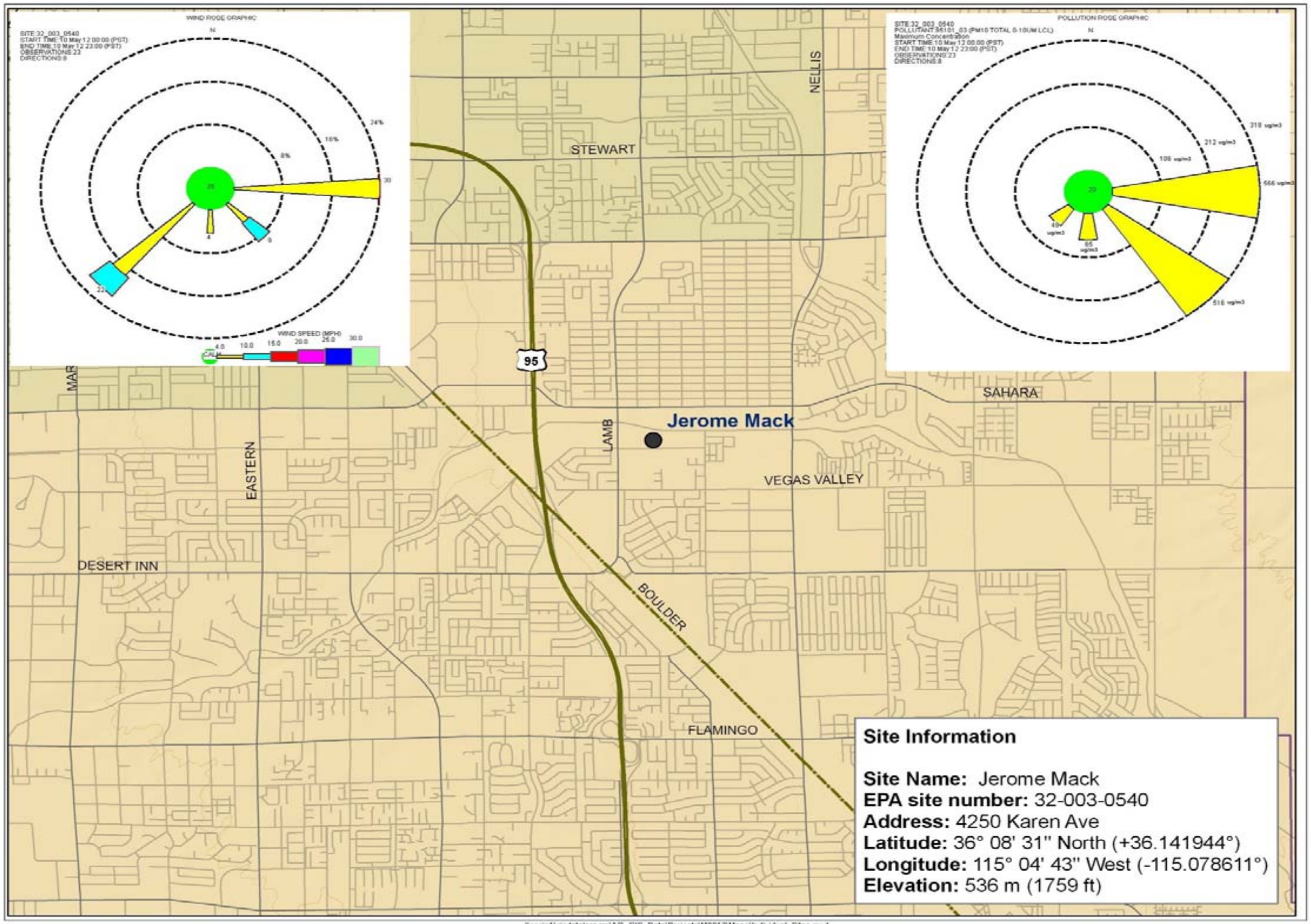


Figure 51. Wind/Pollution Rose, Jerome Mack PM_{10} Monitoring Site.

3.1.4 Weather Before Event

Weather in Clark County for the period preceding the exceptional event on May 10, 2012, was dominated by a low pressure system over southern Nevada that slowly migrated south. Table 31 contains the monthly summary local climatological data for North Las Vegas Airport, and Table 32 contains the monthly summary local climatological data for McCarran International Airport. Unstable atmospheric winds were not high enough to cause dust entrainment in Clark County.

In Clark County, dry conditions and low wind speeds are conducive to building up a reservoir of loose dust on the surface; this dust can readily become airborne when wind speeds exceed 15–20 mph. Wind speeds during most of the event day were lower than the Clark County wind event threshold, but strong enough to spread the dust from the transport event from early afternoon through the evening. These speeds were measured during field studies in the Las Vegas area **(**Appendix D**).**

3.1.4.1 Surface Charts

Figures 52–55 show a low-pressure system over southern Nevada, with an inverted trough extending through central Nevada (brown dashed line).

3.1.4.2 Upper Air Charts

The 250-mb charts (Figures 56–58) show a cutoff low on the southeastern edge of Clark County with ridging over the rest of the county.

The 500-mb charts (Figures 59–61) show a closed low over southern Nevada, Arizona, and Mexico slowly migrating south.

The 850-mb charts (Figures 62–64) show a low-pressure system over southern Nevada, Arizona, and Mexico slowly migrating south.

Table 31. Monthly Summary Climatological Data for North Las Vegas Airport, May 2012

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)

NOAA, National Climatic Data Center

Month: 05/2012

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	max 5-second Dir	max 2-minute Speed	max 2-minute 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	91	69	80	M	34	56	0	15	-	-		0	M	0.0	0.00	27.37	29.65	10.3	20	11.7	32	220	23	210	01
02	86	67	77	M	31	54	0	12	-	-		0	M	0.0	0.00	27.45	29.73	7.6	16	9.1	29	140	24	150	02
03	88	65	77	M	27	53	0	12	-	-		0	M	0.0	0.00	27.50	29.79	11.7	19	14.2	31	210	24	240	03
04	87	67	77	M	18	51	0	12	-	-		0	M	0.0	0.00	27.53	29.83	9.3	21	12.9	35	200	26	150	04
05	83	67	75	M	12	48	0	10	-	-		0	M	0.0	0.00	27.62	29.92	12.9	33	13.5	43	330	35	330	05
06	83	65	74	M	8	47	0	9	-	-		0	M	0.0	0.00	27.65	29.96	7.8	35	9.6	29	340	22	340	06
07	81	64	73	M	9	47	0	8	-	-		0	M	0.0	0.00	27.65	29.95	12.4	35	14.1	37	330	30	330	07
08	89	71	80	M	18	51	0	15	-	-		0	M	0.0	0.00	27.60	29.90	5.6	03	9.6	29	040	23	330	08
09	92	66	79	M	17	52	0	14	-	-		0	M	0.0	0.00	27.56	29.85	0.4	05	3.7	17	330	13	340	09
10	96	66	81	M	24	54	0	16	-	-	HZ	0	M	0.0	0.00	27.44	29.71	3.8	19	8.3	24	270	18	150	10
11	92	72	82	M	18	53	0	17	-	-		0	M	0.0	0.00	27.51	29.78	3.2	35	6.6	26	350	20	350	11
12	97	69	83	M	14	52	0	18	-	-		0	M	0.0	0.00	27.65	29.93	1.7	33	4.2	18	350	14	350	12
13	97	73	85	M	7	52	0	20	-	-		0	M	0.0	0.00	27.68	29.97	2.6	05	7.6	24	020	20	010	13
14	96	67	82	M	10	52	0	17	-	-		0	M	0.0	0.00	27.62	29.90	3.4	16	6.1	20	130	14	120	14
15	95	72	84	M	7	52	0	19	-	-		0	M	0.0	0.00	27.48	29.75	7.2	23	11.4	33	230	25	270	15
16	99	67	83	M	17	54	0	18	-	-		0	M	0.0	0.00	27.49	29.76	3.0	22	6.4	21	260	17	190	16
17	101	70	86	M	20	55	0	21	-	-		0	M	0.0	0.00	27.35	29.60	12.8	23	14.9	47	240	35	240	17
18	88	73	81	M	18	52	0	16	-	-		0	M	0.0	0.00	27.40	29.66	13.4	33	14.8	45	250	31	330	18
19	89	65	77	M	21	52	0	12	-	-		0	M	0.0	0.00	27.59	29.88	1.9	36	4.9	17	170	12	140	19
20	96	66	81	M	21	54	0	16	-	-		0	M	0.0	0.00	27.62	29.91	0.7	23	4.0	14	150	12	180	20
21	103*	69	86	M	22	56	0	21	-	-		0	M	0.0	0.00	27.55	29.84	3.7	20	8.4	24	210	18	240	21
22	102	77	90*	M	26	58	0	25	-	-		0	M	0.0	0.00	27.42	29.68	4.3	22	9.1	29	240	24	250	22
23	96	80	88	M	13	54	0	23	-	-		0	M	0.0	0.00	27.29	29.54	13.6	34	15.1	35	350	29	330	23
24	93	71	82	M	15	51	0	17	-	-		0	M	0.0	0.00	27.26	29.52	5.6	22	12.9	40	210	32	220	24
25	81	60	71	M	26	50	0	6	-	-		0	M	0.0	0.00	27.18	29.45	21.5	23	23.3	49	220	40	220	25
26	74	53*	64*	M	25	46	1	0	-	-		0	M	0.0	0.00	27.46	29.78	11.1	23	14.8	35	320	25	340	26
27	80	58	69	M	25	49	0	4	-	-		0	M	0.0	0.00	27.65	29.97	3.1	34	7.9	26	330	21	350	27
28	88	62	75	M	20	51	0	10	-	-		0	M	0.0	0.00	27.60	29.91	2.0	13	5.5	20	150	16	150	28
29	95	63	79	M	16	52	0	14	-	-		0	M	0.0	0.00	27.57	29.86	4.2	21	7.8	26	210	21	180	29
30	96	66	81	M	19	54	0	16	-	-		0	M	0.0	0.00	27.59	29.88	1.1	25	4.4	16	170	12	160	30
31	102	76	89	M	22	57	0	24	-	-		0	M	0.0	0.00	27.55	29.81	2.4	36	6.0	23	090	15	360	31
	91.5	67.6	79.6		18.7	52.2	0.0	14.7	<-----Monthly Averages | Totals----->				M	M	0.00	27.51	29.80	2.6	25	9.8	<Monthly Average				
	M	M	M	<-----------Departure From Normal----------->									M												

Table 32. Monthly Summary Climatological Data for McCarran International Airport, May 2012

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)

NOAA, National Climatic Data Center

Month: 05/2012

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

Lat. 36.071 Lon. -115.163

Elevation(Ground): 2131 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	91	73	82	11	28	54	0	17	0448	1827		0	M	0.0	0.00	27.38	29.57	15.3	20	16.0	35	190	26	200	01
02	88	68	78	7	25	52	0	13	0447	1828		0	M	0.0	0.00	27.44	29.65	12.6	19	13.2	26	190	22	190	02
03	88	67	78	7	22	52	0	13	0446	1829		0	M	0.0	0.00	27.50	29.71	15.8	20	16.3	36	210	25	220	03
04	86	68	77	5	10	49	0	12	0445	1830		0	M	0.0	0.00	27.55	29.75	17.6	21	18.3	40	200	29	230	04
05	84	63	74	2	9	48	0	9	0444	1830		0	M	0.0	0.00	27.62	29.84	3.0	29	8.6	40	350	28	350	05
06	84	66	75	2	3	47	0	10	0443	1831		0	M	0.0	0.00	27.65	29.88	2.8	36	6.4	22	070	16	340	06
07	81	64	73	0	3	47	0	8	0442	1832	TS	0	M	0.0	0.00	27.64	29.87	7.6	35	10.7	32	310	23	030	07
08	90	71	81	8	13	51	0	16	0441	1833		0	M	0.0	0.00	27.60	29.82	3.2	03	8.8	30	020	21	020	08
09	93	66	80	7	11	51	0	15	0440	1834		0	M	0.0	0.00	27.55	29.76	6.0	19	6.4	18	150	13	220	09
10	97	69	83	10	16	53	0	18	0439	1835	HZ	0	M	0.0	0.00	27.43	29.63	7.5	20	9.7	29	220	21	220	10
11	93	72	83	9	15	53	0	18	0438	1835		0	M	0.0	0.00	27.50	29.70	4.5	21	7.3	29	230	22	220	11
12	96	71	84	10	9	52	0	19	0438	1836		0	M	0.0	0.00	27.64	29.85	3.2	18	5.1	15	210	14	210	12
13	97	71	84	9	2	52	0	19	0437	1837		0	M	0.0	0.00	27.68	29.88	1.9	16	4.4	15	160	12	180	13
14	97	71	84	8	1	52	0	19	0436	1838		0	M	0.0	0.00	27.60	29.81	4.2	18	5.8	23	170	17	180	14
15	94	75	85	9	3	52	0	20	0435	1839		0	M	0.0	0.00	27.48	29.67	15.7	21	16.6	37	230	29	230	15
16	100	73	87	11	15	55	0	22	0434	1840		0	M	0.0	0.00	27.48	29.67	7.1	20	8.2	24	210	17	210	16
17	101	78	90	14	14	55	0	25	0433	1840	VCBLDU	0	M	0.0	0.00	27.35	29.52	18.5	21	19.1	49	210	37	220	17
18	89	71	80	4	14	52	0	15	0433	1841		0	M	0.0	0.00	27.40	29.58	5.8	29	12.1	31	300	24	220	18
19	91	68	80	4	17	52	0	15	0432	1842		0	M	0.0	0.00	27.58	29.79	2.9	18	4.6	16	090	9	220	19
20	97	69	83	7	11	53	0	18	0431	1843		0	M	0.0	0.00	27.61	29.82	5.4	19	6.0	16	150	13	230	20
21	104*	72	88	11	15	55	0	23	0431	1844		0	M	0.0	0.00	27.55	29.74	8.7	21	9.6	26	230	20	230	21
22	103	79	91*	14	20	57	0	26	0430	1844		0	M	0.0	0.00	27.42	29.61	12.1	20	13.2	30	190	24	200	22
23	99	78	89	12	10	54	0	24	0429	1845		0	M	0.0	0.00	27.29	29.46	6.8	27	11.6	31	310	22	240	23
24	94	72	83	5	10	51	0	18	0429	1846	VCBLDU	0	M	0.0	0.00	27.26	29.44	5.7	19	12.5	36	190	28	230	24
25	80	59	70	-8	22	49	0	5	0428	1847	VCBLDU	0	M	0.0	0.00	27.19	29.38	23.1	22	23.2	47	230	37	230	25
26	75	52*	64*	-14	21	45	1	0	0428	1847		0	M	0.0	0.00	27.47	29.70	15.6	21	16.2	38	220	29	220	26
27	82	58	70	-8	19	49	0	5	0427	1848		0	M	0.0	0.00	27.65	29.88	3.9	20	6.0	24	190	15	190	27
28	90	63	77	-1	13	50	0	12	0427	1849		0	M	0.0	0.00	27.60	29.83	5.3	18	7.4	21	090	14	190	28
29	95	69	82	3	9	52	0	17	0426	1849		0	M	0.0	0.00	27.57	29.77	11.2	20	11.9	29	200	22	230	29
30	97	71	84	4	13	54	0	19	0426	1850		0	M	0.0	0.00	27.58	29.79	6.0	19	6.8	20	200	16	190	30
31	103	75	89	9	15	56	0	24	0426	1851		0	M	0.0	0.00	27.55	29.73	6.0	19	7.2	16	090	14	200	31
	92.2	69.1	80.7		13.2	51.7	0.0	15.9	<-----Monthly Averages | Totals----->				M	0.0	0.00	27.51	29.71	7.2	21	10.6	<Monthly Average				
	3.3	3.3	3.4	<-----------Departure From Normal---------->									-0.12												

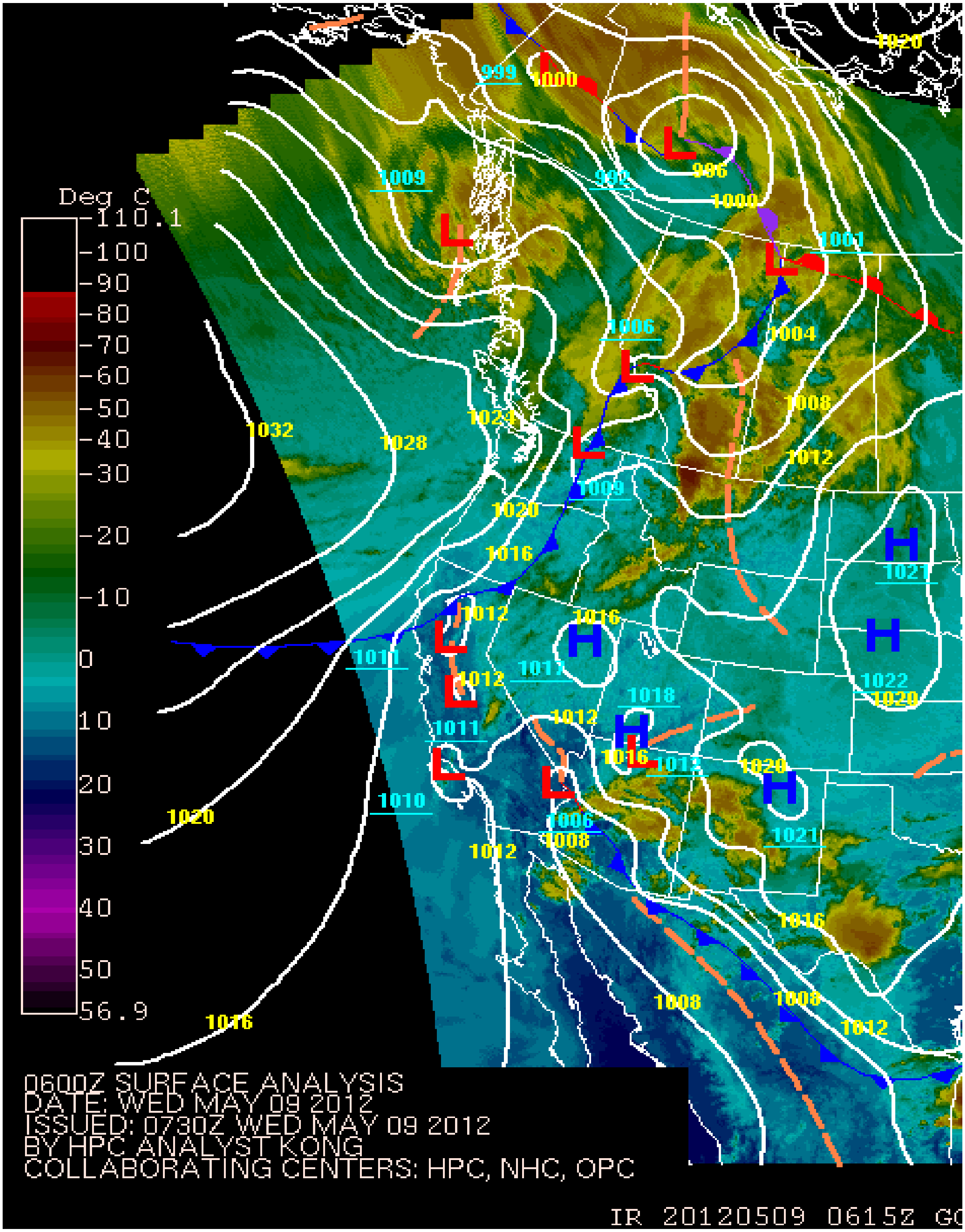


Figure 52. Weather Chart with Infrared Overlay Showing Surface Before Event, May 9, 2012—0600Z.

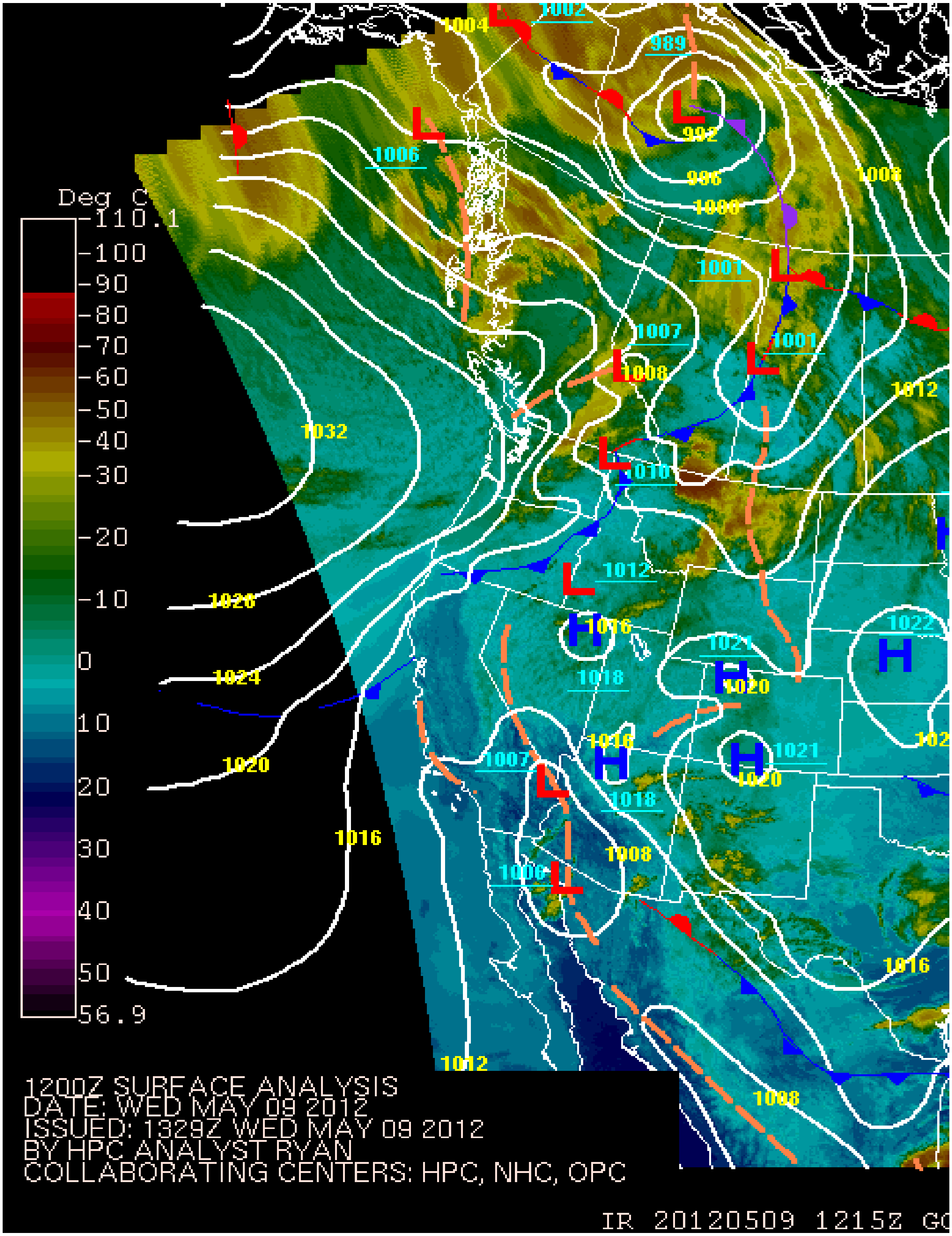


Figure 53. Weather Chart with Infrared Overlay Showing Surface Before Event, May 9, 2012—1200Z.

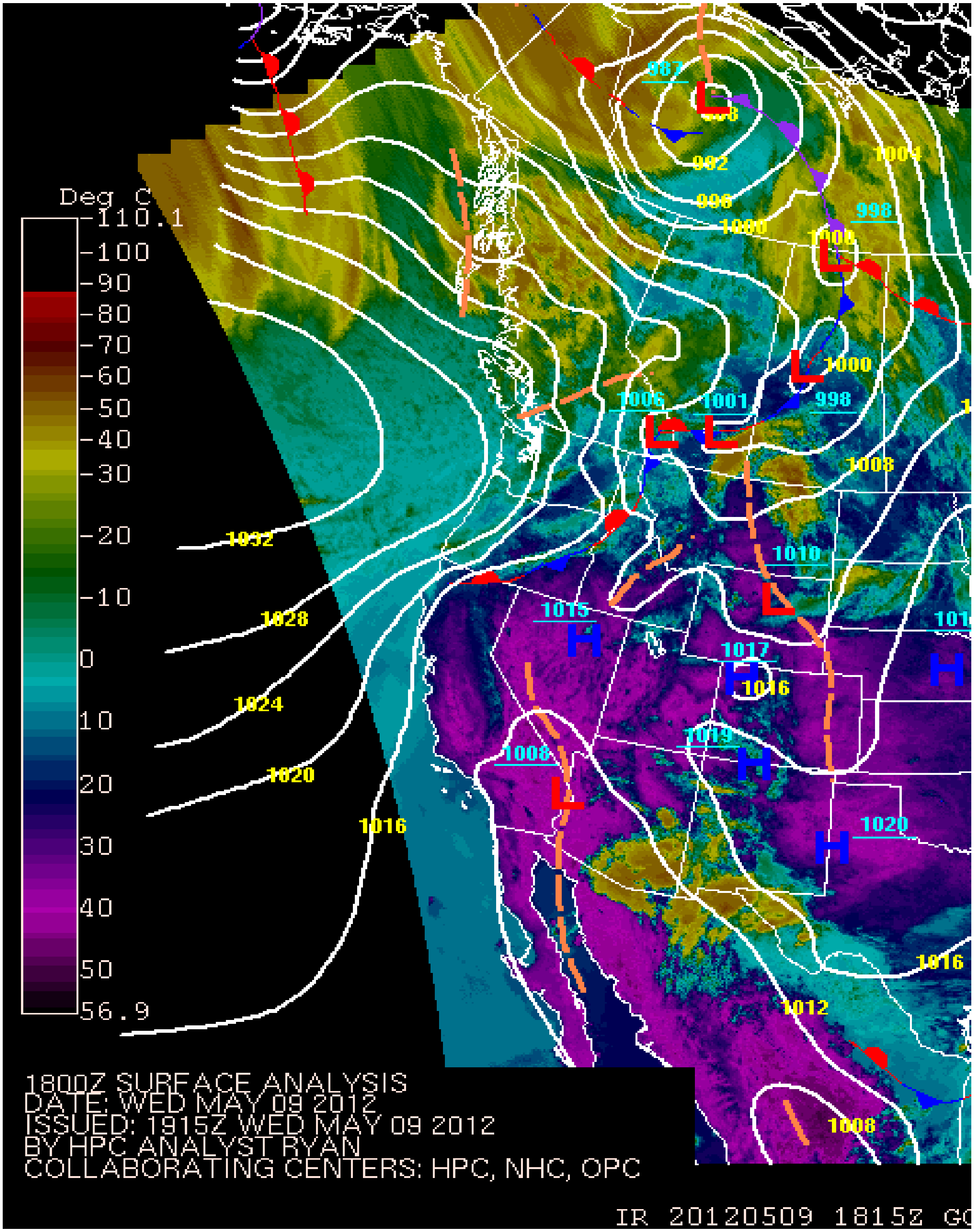


Figure 54. Weather Chart with Infrared Overlay Showing Surface Before Event, May 9, 2012—1800Z.

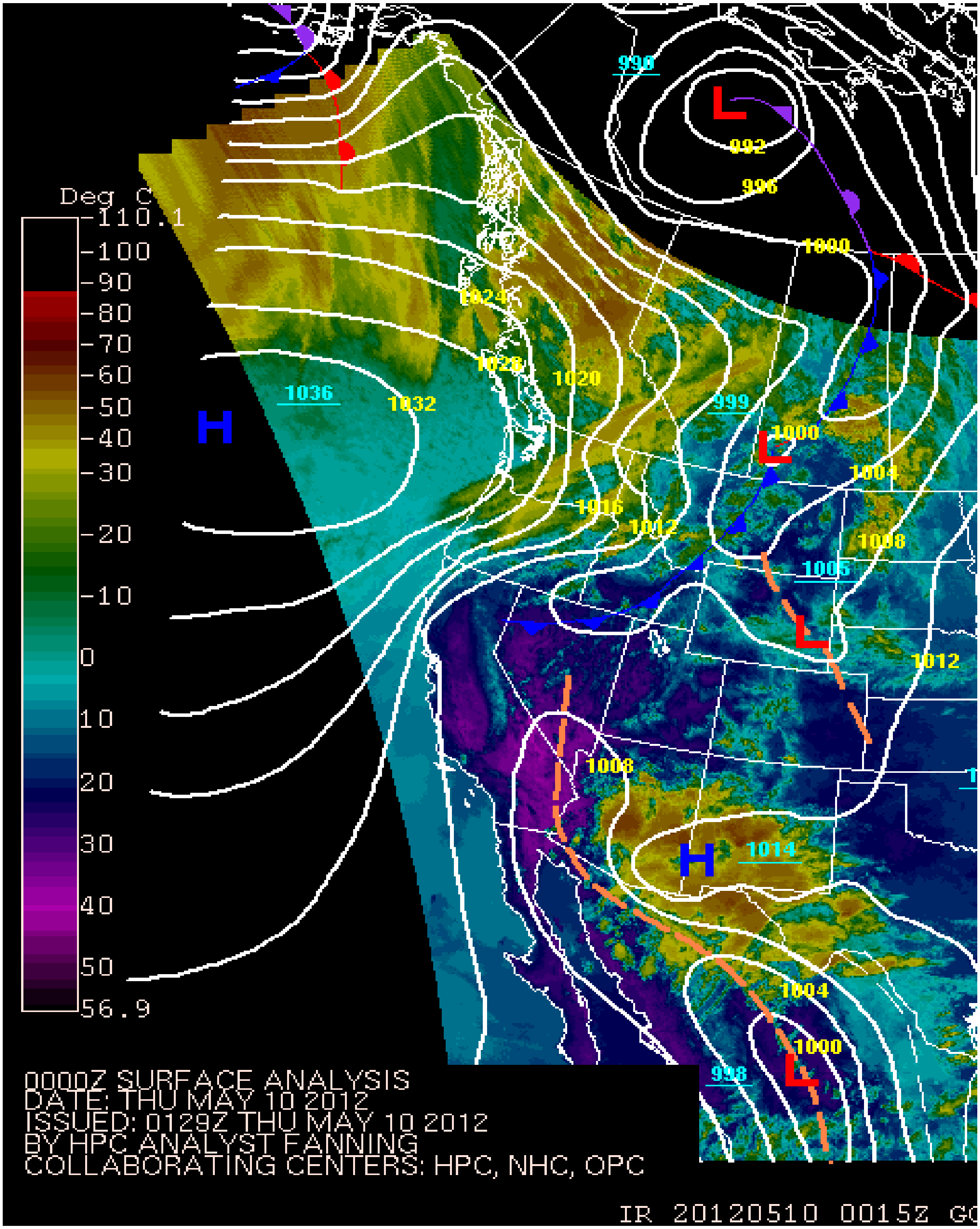


Figure 55. Weather Chart with Infrared Overlay Showing Surface Before Event, May 10, 2012—0000Z.

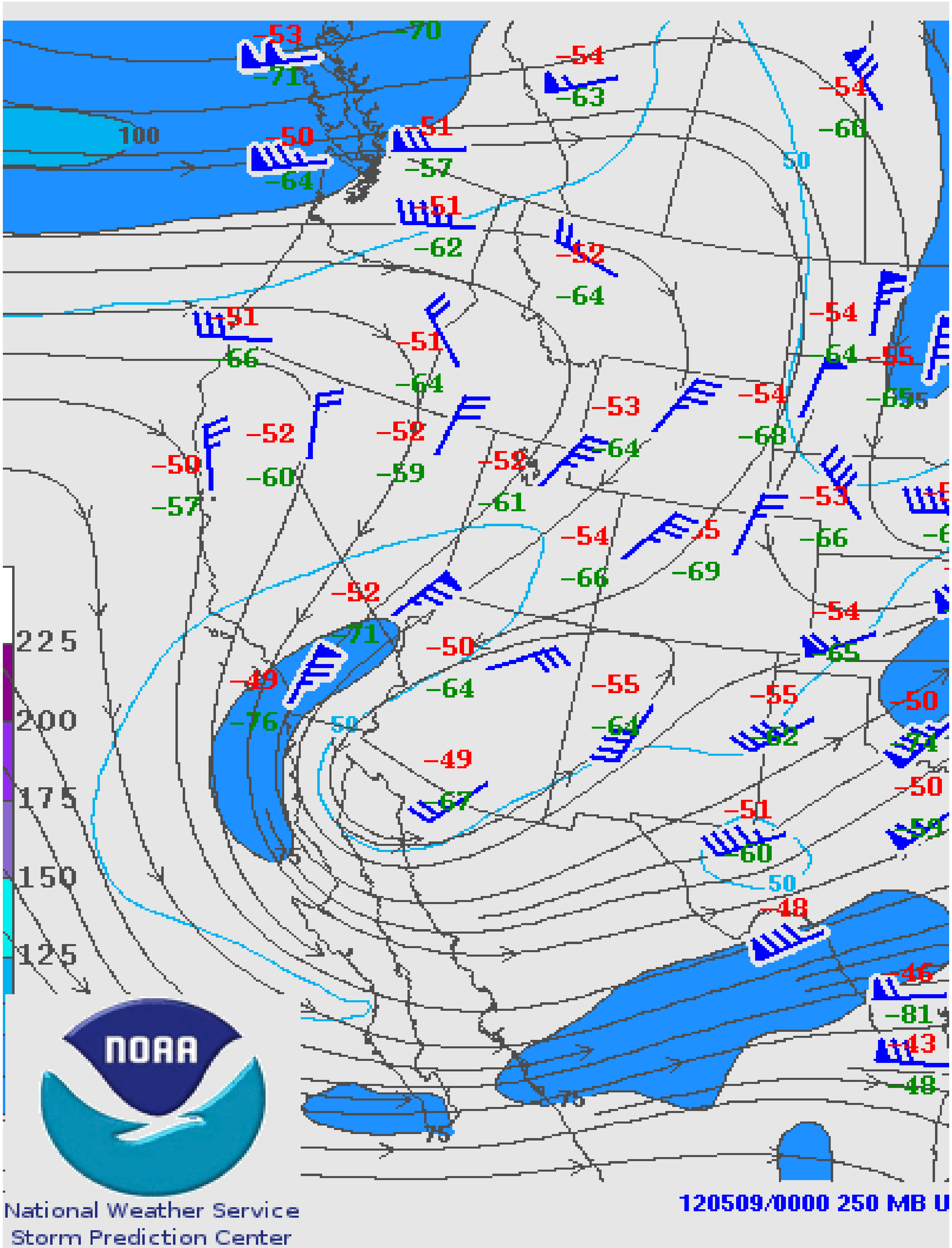


Figure 56. 250-mb Weather Chart Before Event, May 9, 2012—0000Z.

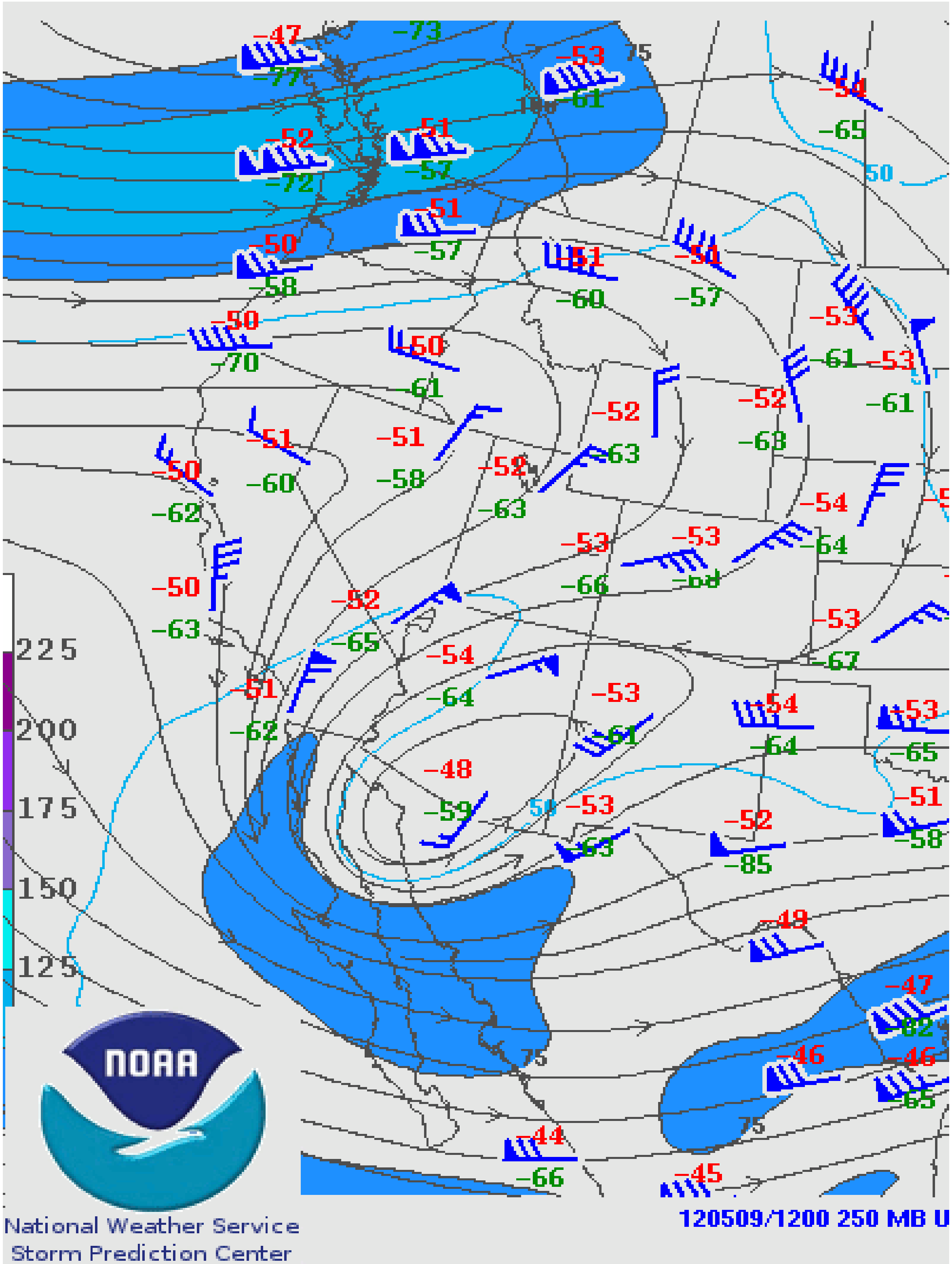


Figure 57. 250-mb Weather Chart Before Event, May 9, 2012—1200Z.

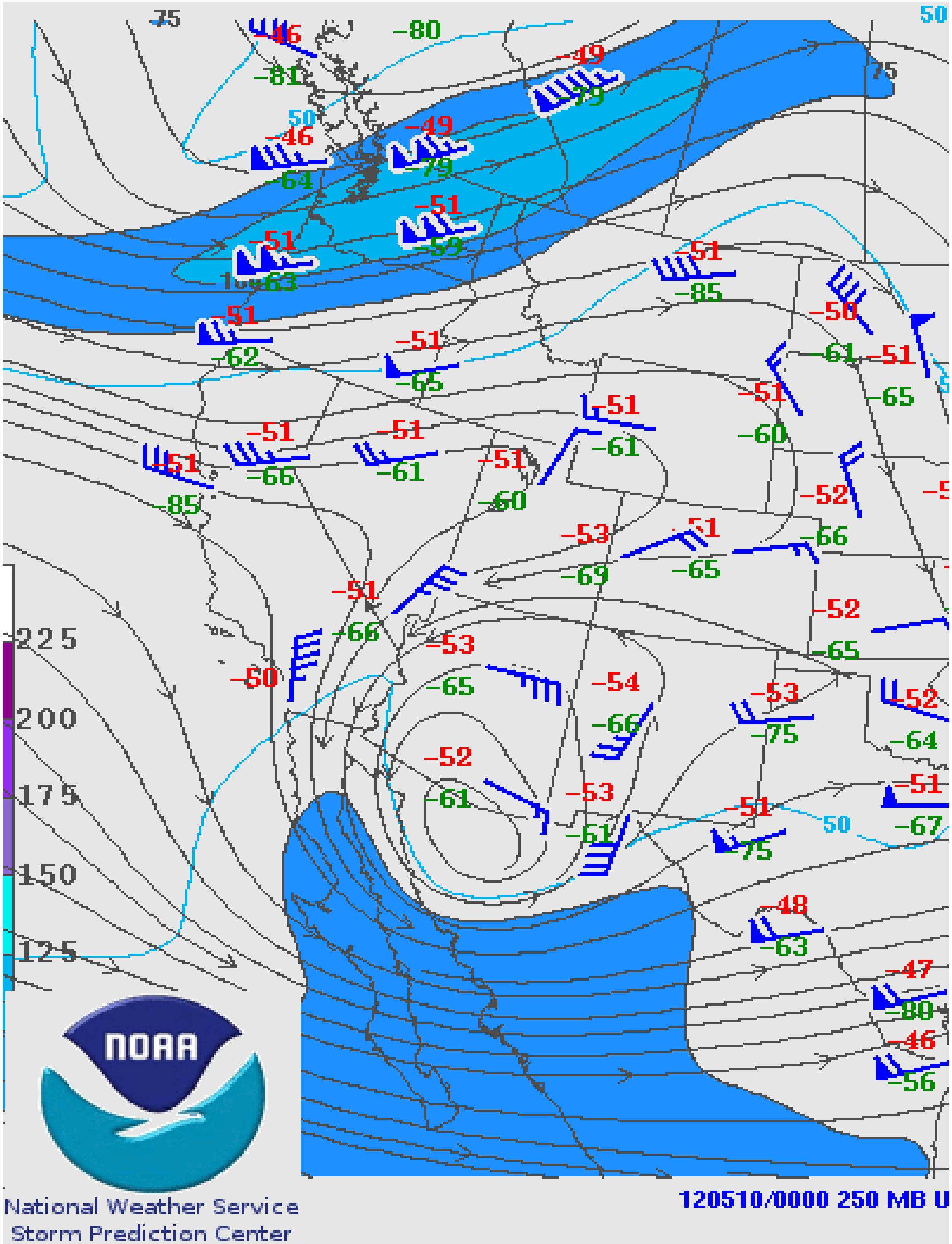


Figure 58. 250-mb Weather Chart Before Event, May 10, 2012—0000Z.

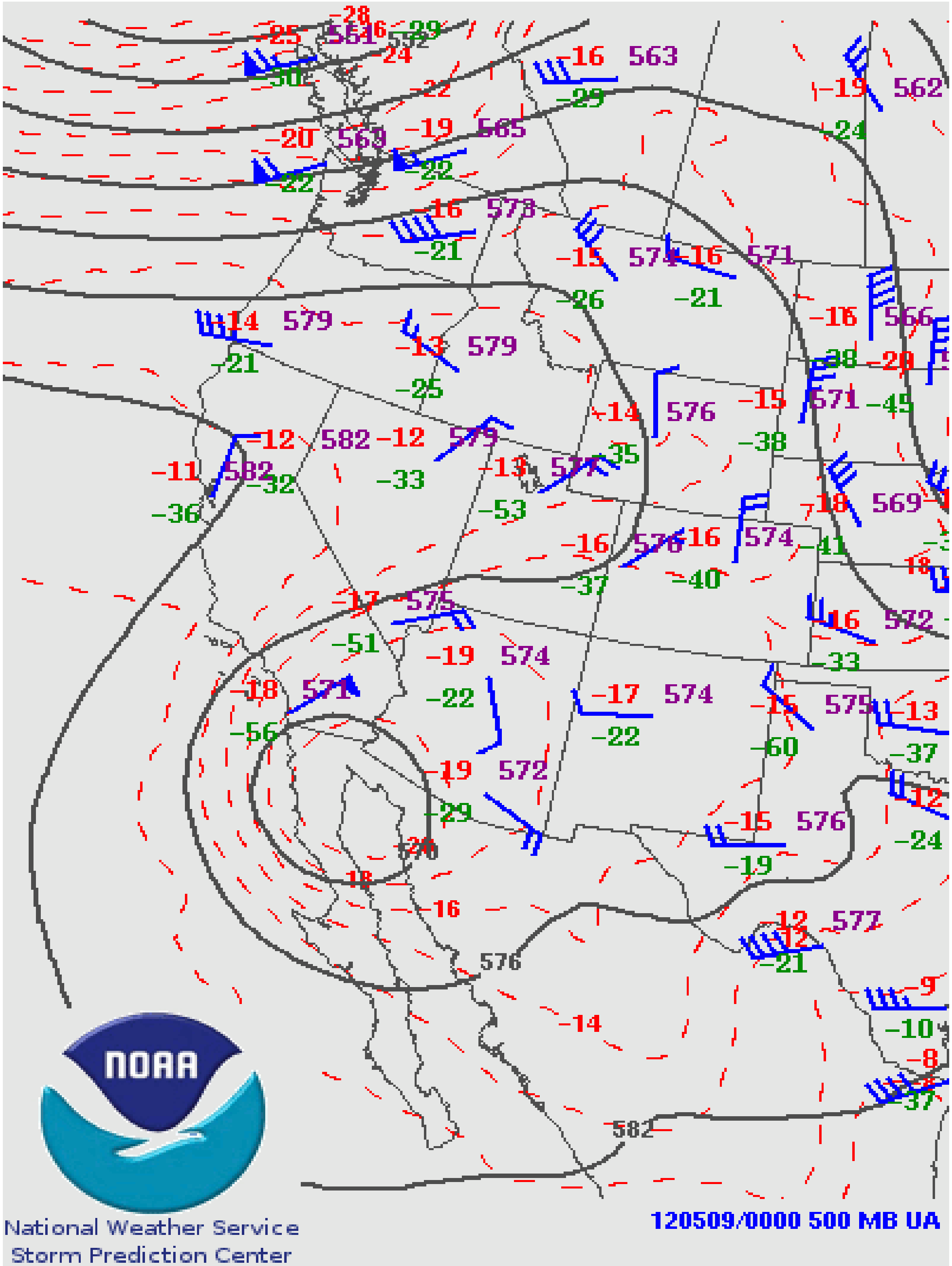


Figure 59. 500-mb Weather Chart Before Event, May 9, 2012—0000Z.

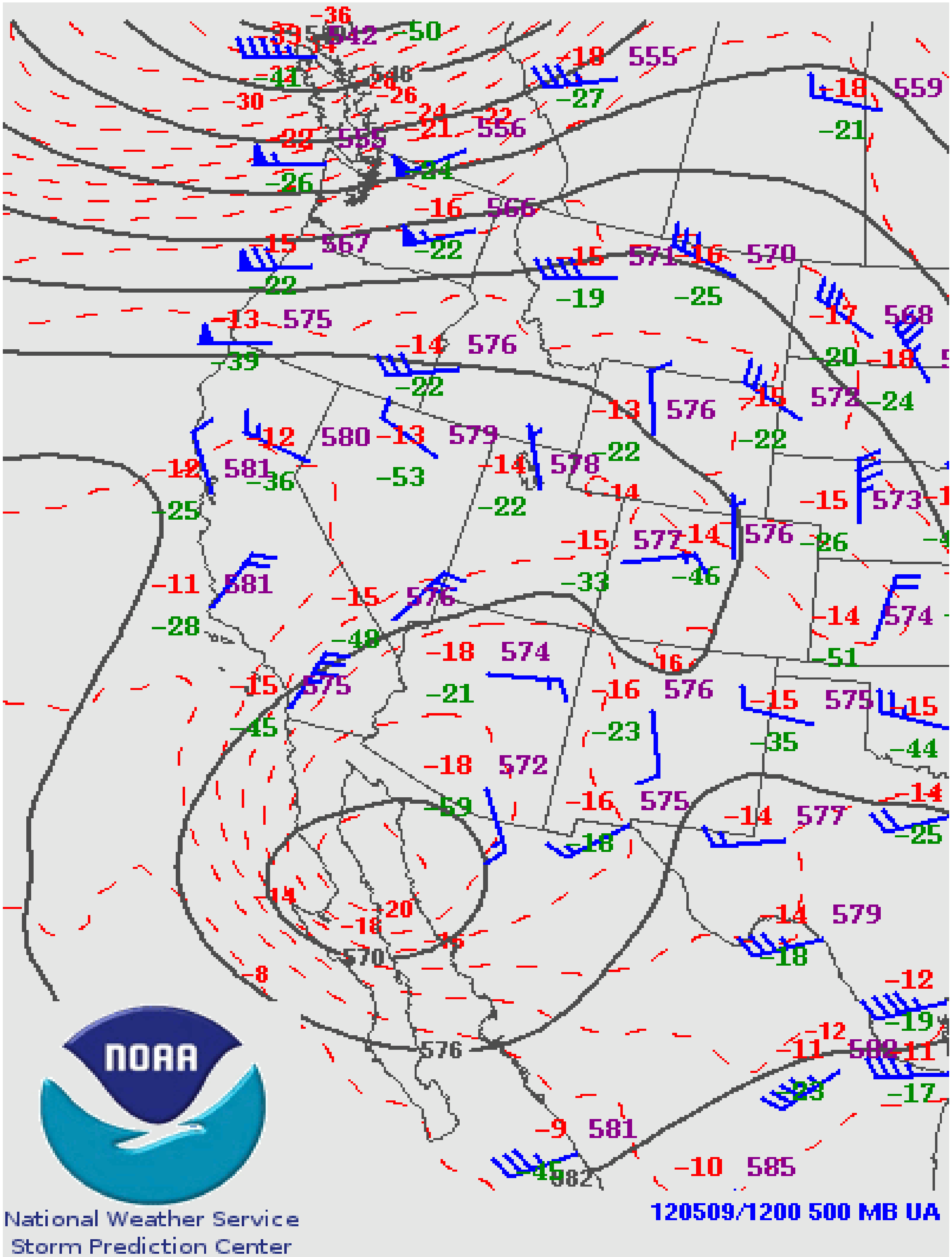


Figure 60. 500-mb Weather Chart Before Event, May 9, 2012—1200Z.

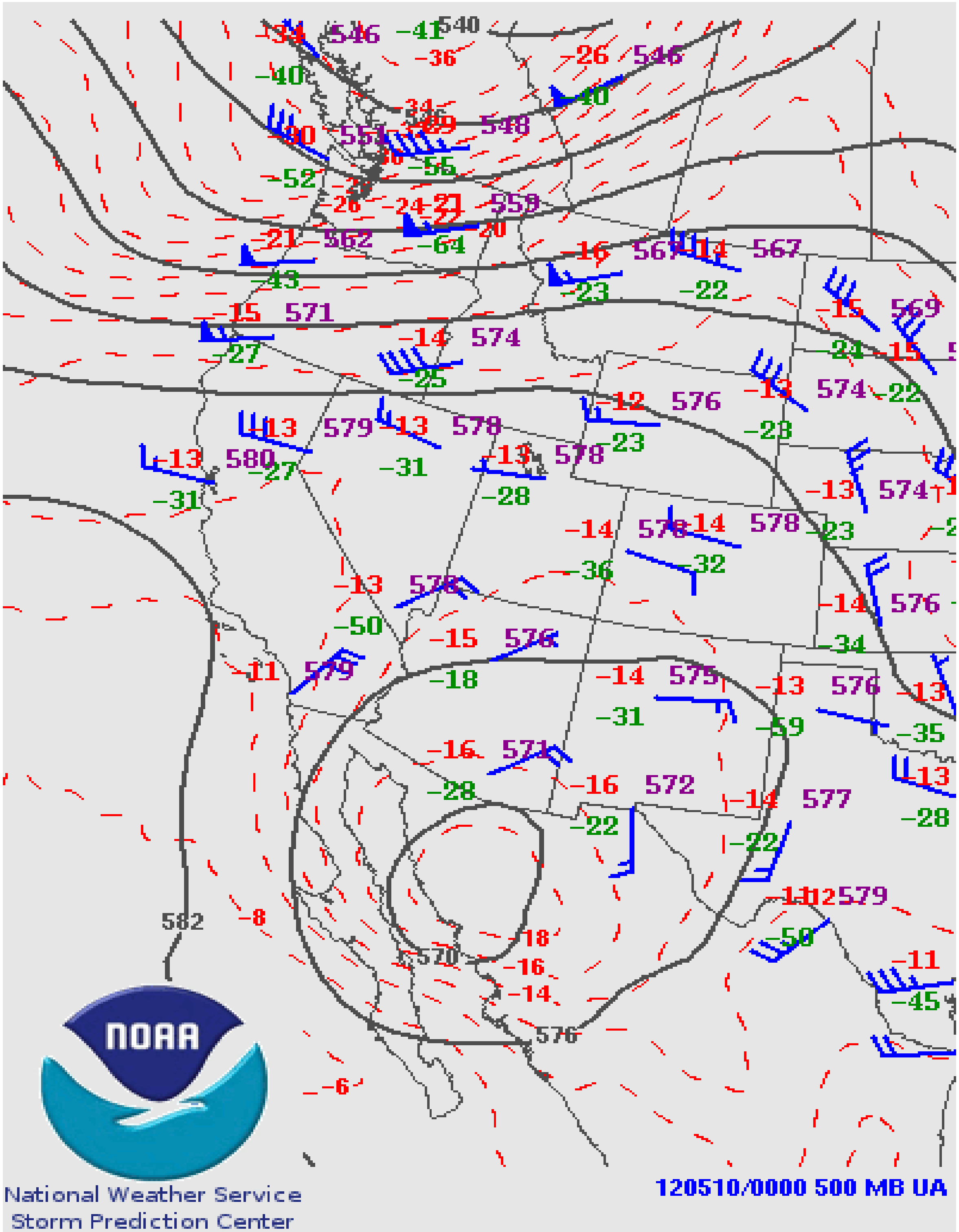


Figure 61. 500-mb Weather Chart Before Event, May 10, 2012—0000Z.

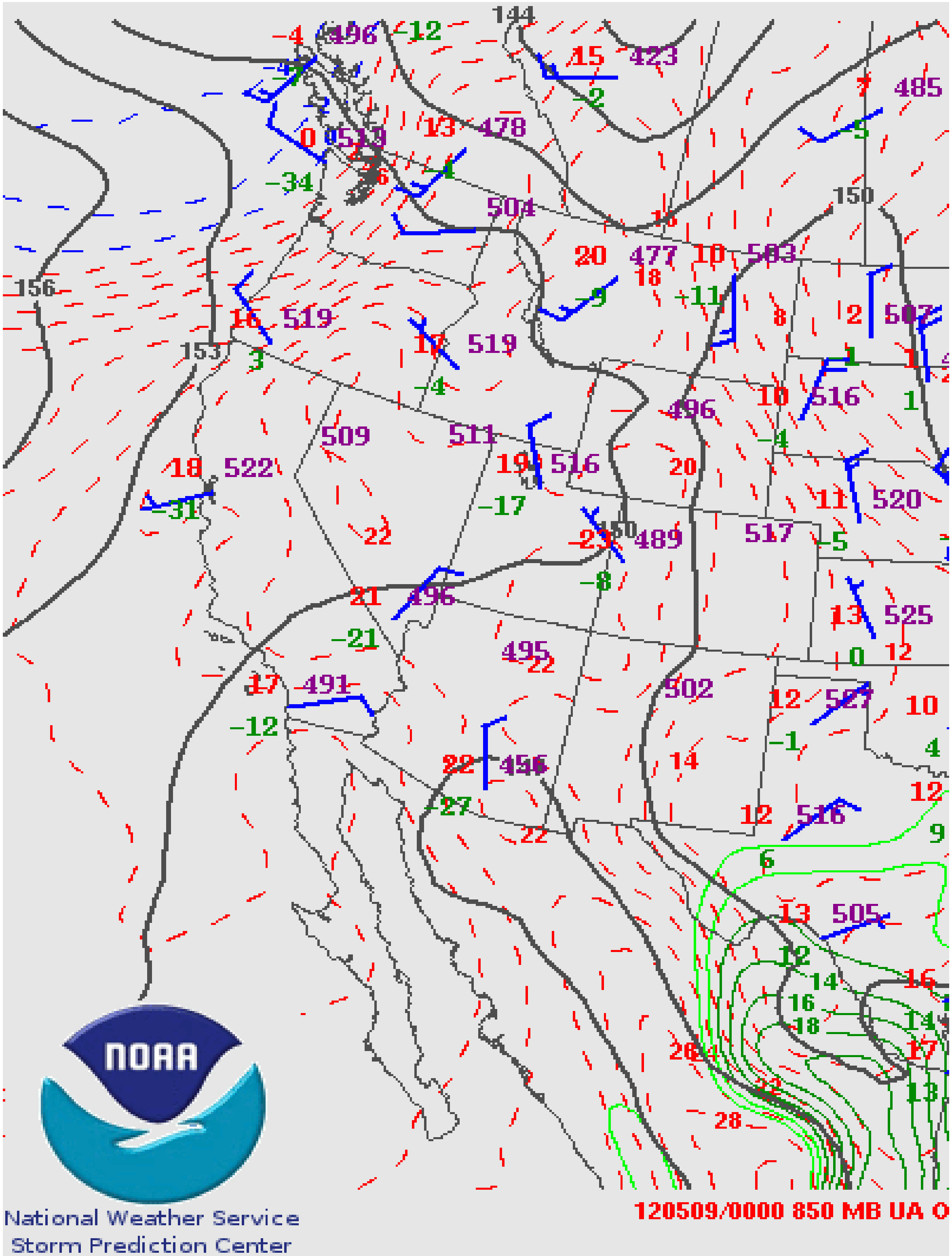


Figure 62. 850-mb Weather Chart Before Event, May 9, 2012—0000Z.

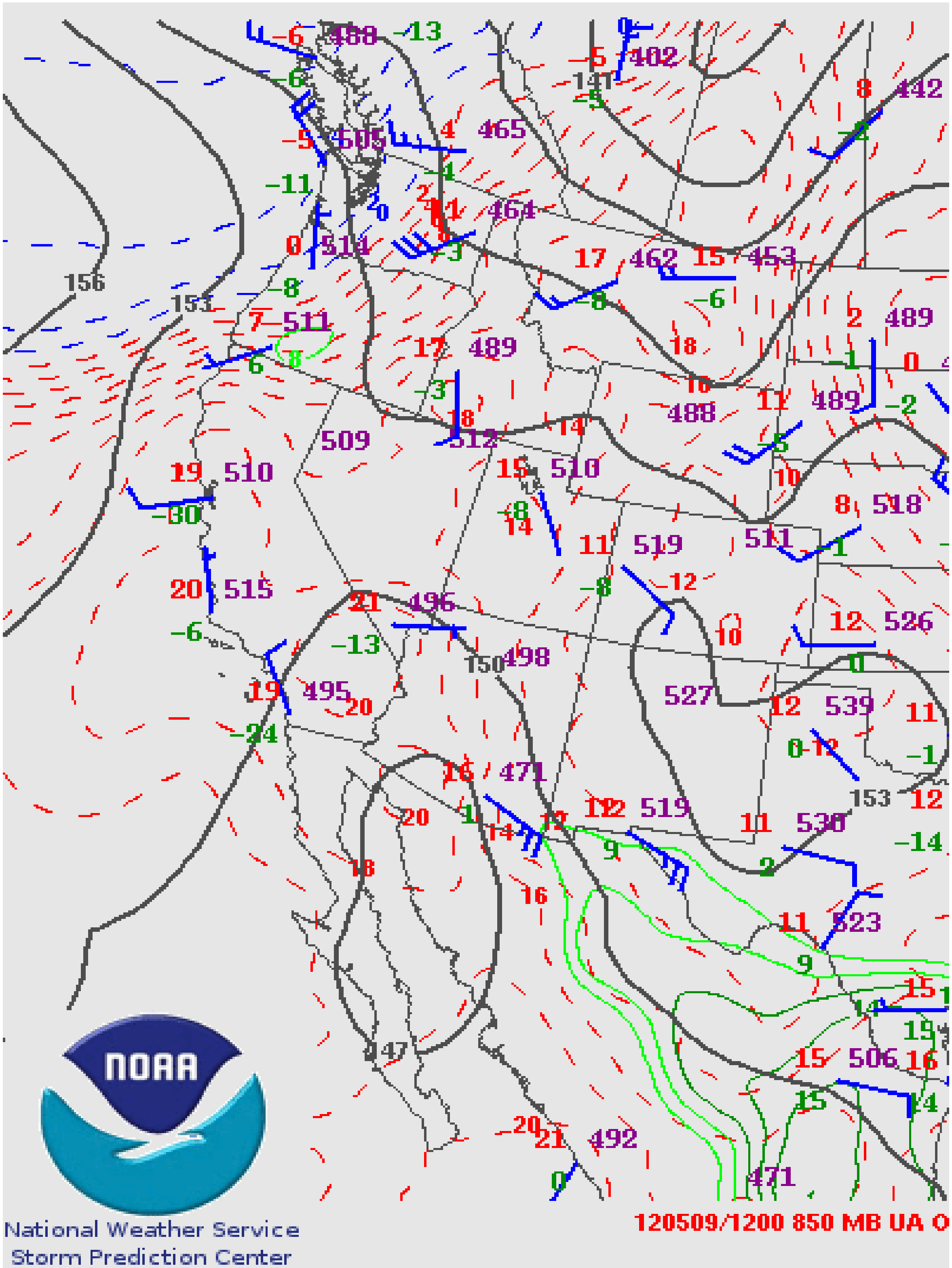


Figure 63. 850-mb Weather Chart Before Event, May 9, 2012—1200Z.

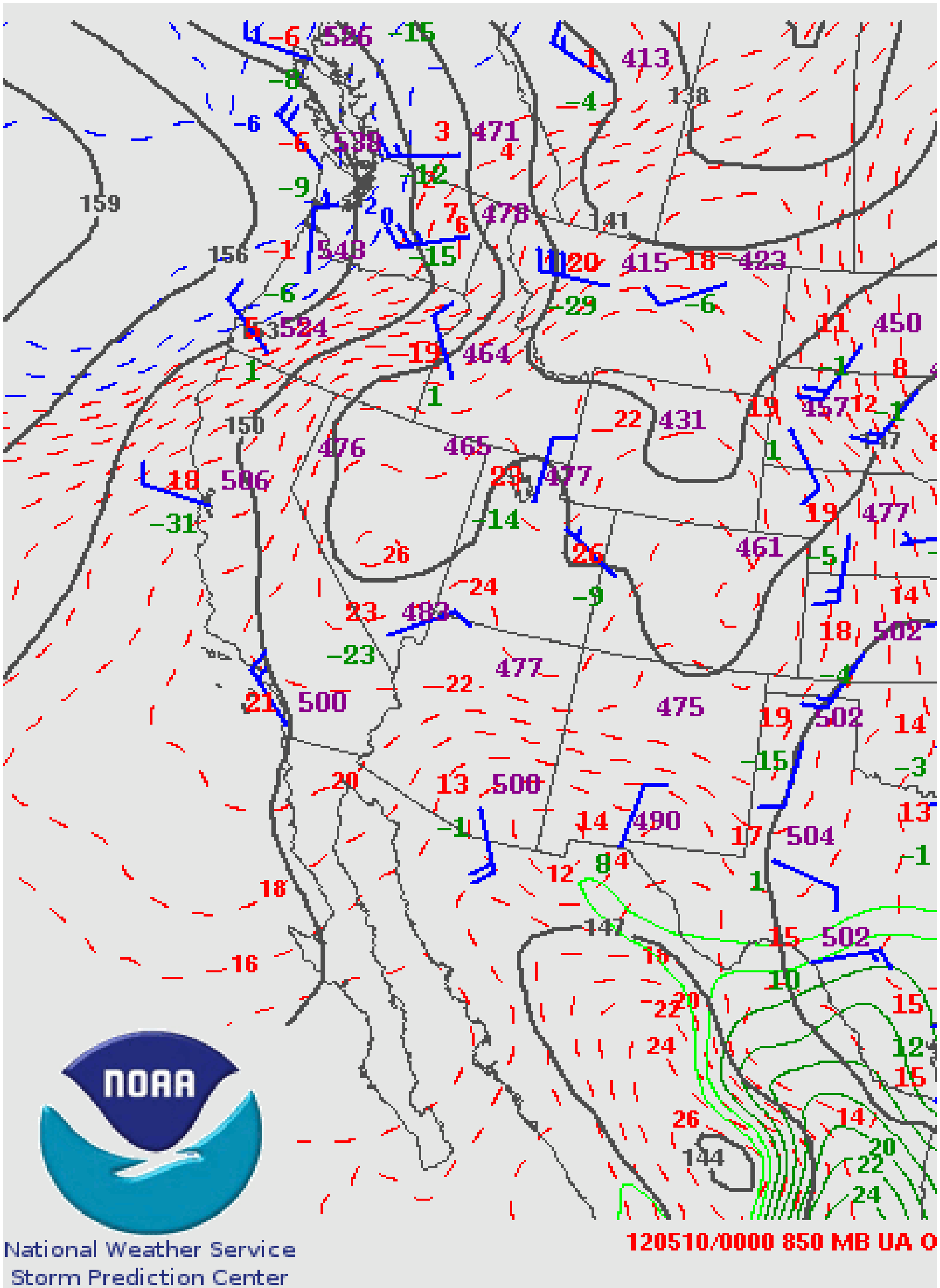


Figure 64. 850-mb Weather Chart Before Event, May 10, 2012—0000Z.

3.1.5 Weather During Event

Figures 54–55 show the surface weather charts with infrared overlays (850-mb, 500-mb, and 250-mb) covering 11:00 PM on May 9 through 5:00 AM on May 11 in 12-hour increments. Tables 33–35 show the hourly winds at North Las Vegas Airport, McCarran International Airport, and DAQ monitoring stations throughout the Las Vegas Valley.

3.1.5.1 Surface Charts

Figures 65–68 show a cold front in central Nevada merging with a low-pressure system and troughing over most of Clark County to form a stronger low-pressure system. The high-pressure system over the extreme eastern portion of Clark County was pushed south in the afternoon and evening hours.

3.1.5.2 Upper Air Charts

The 250-mb charts (Figures 69–71) and 500-mb charts (Figures 72–74) show the low-pressure system moving east, and ridging building in.

The 850-mb charts (Figures 75–77) show troughing over central Nevada moving into southern Nevada and then becoming a closed low centered just north of Clark County.

3.1.5.3 Wind Data

Tables 33–34 provide the local climatological data reports from North Las Vegas Airport and McCarran International Airport on May 10, 2012. Table 35 lists hourly wind speeds, directions, and gusts at DAQ monitoring sites in the Las Vegas Valley.

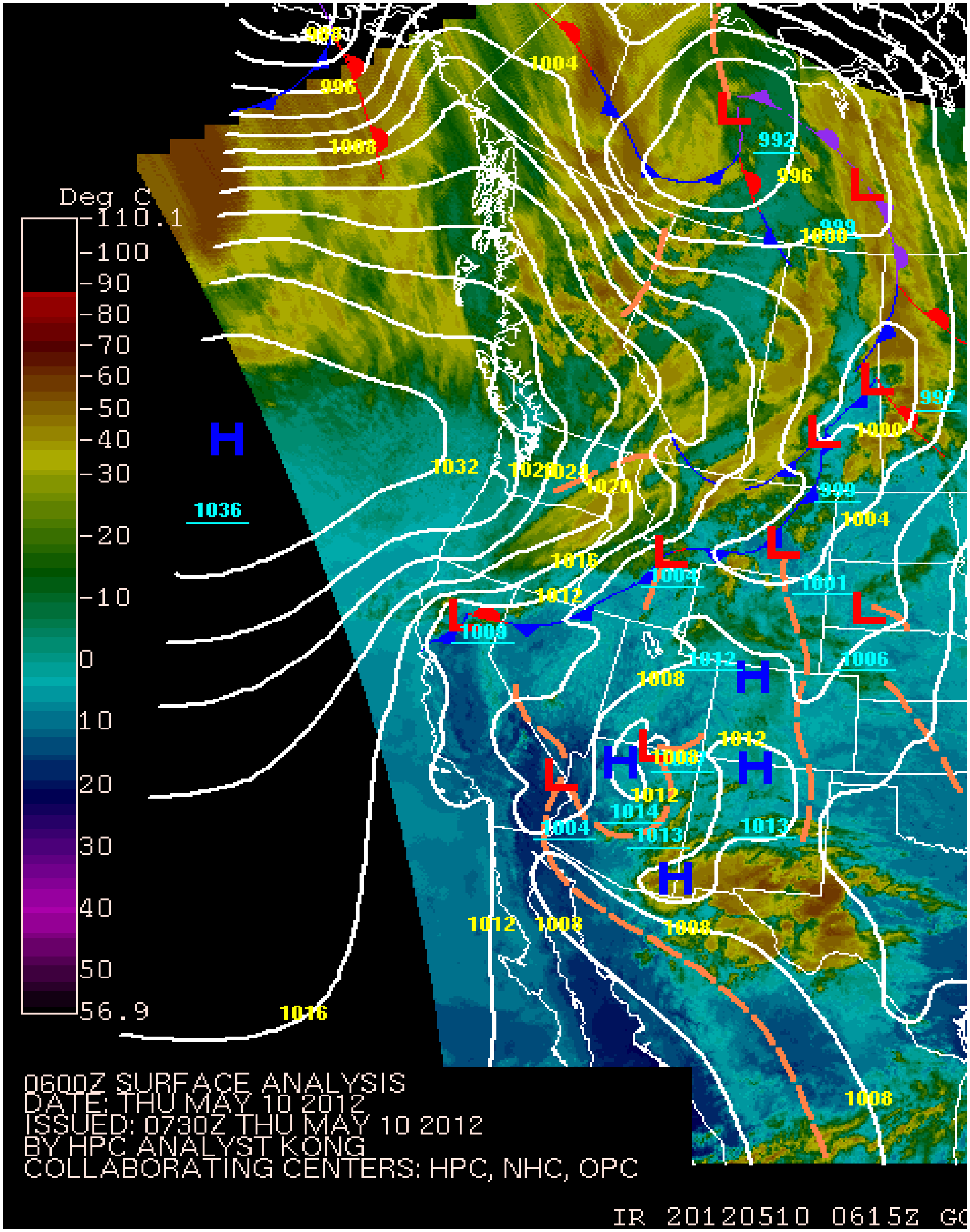


Figure 65. Weather Chart with Infrared Overlay Showing Surface During Event, May 10, 2012—0600Z.

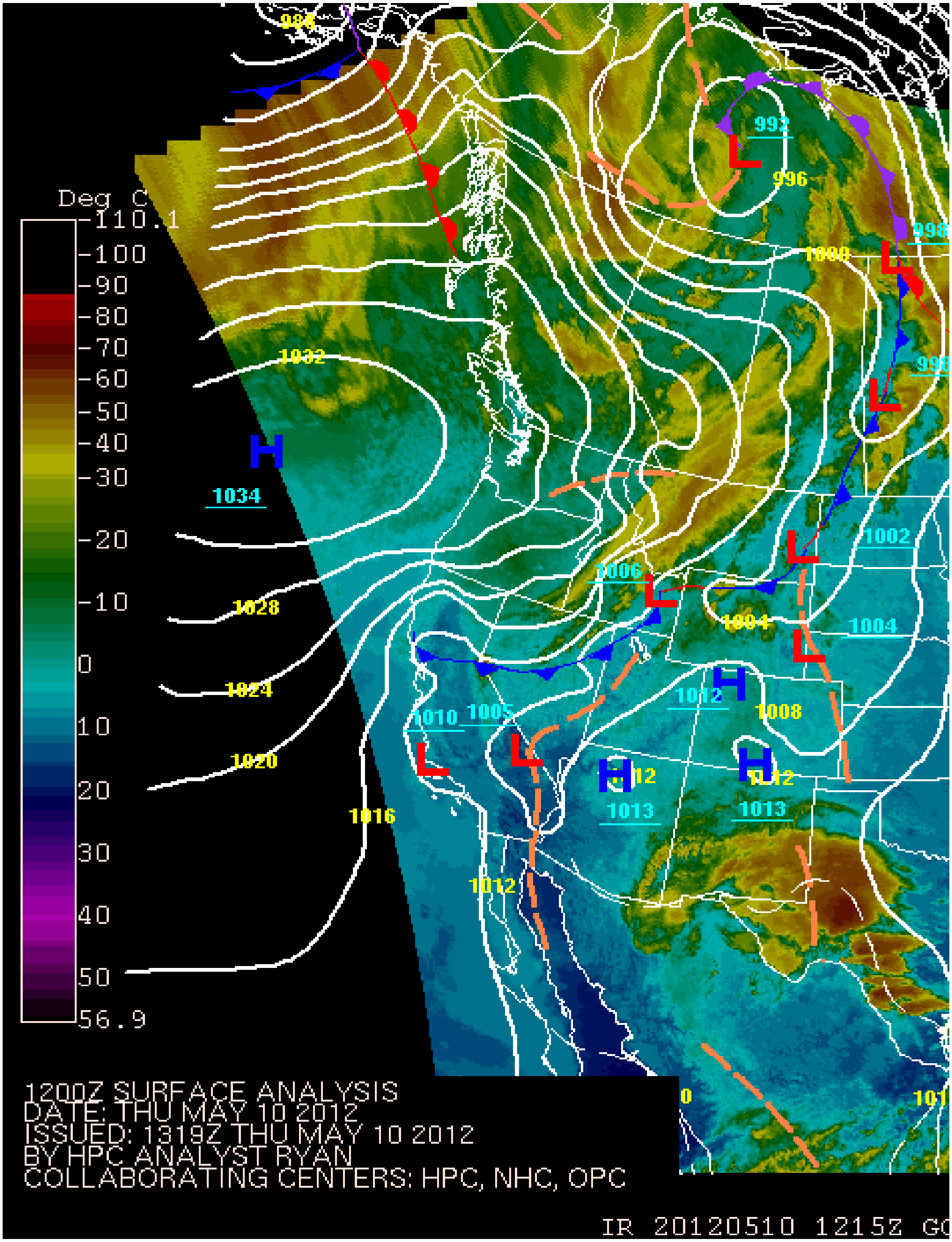


Figure 66. Weather Chart with Infrared Overlay Showing Surface During Event, May 10, 2012—1200Z.

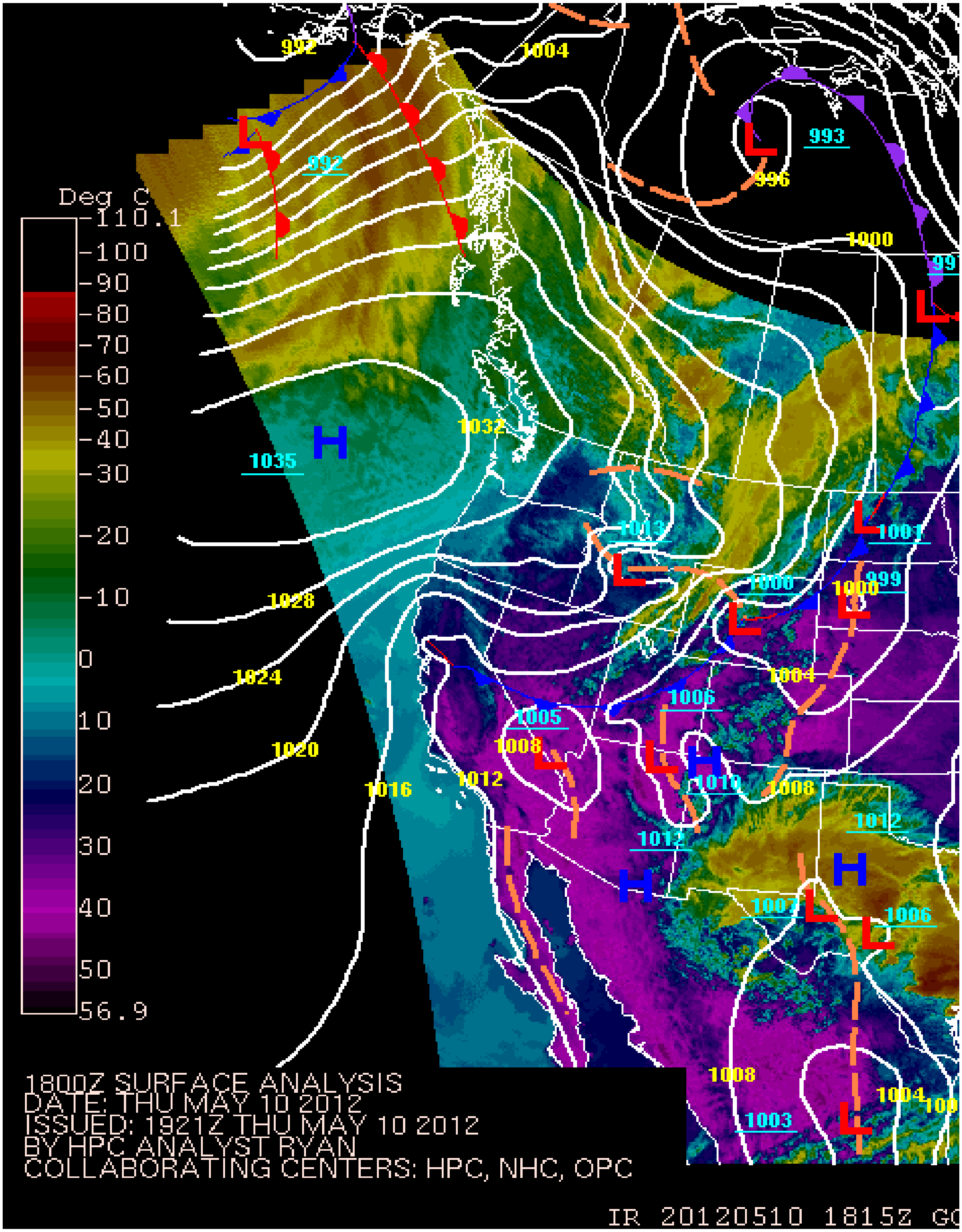


Figure 67. Weather Chart with Infrared Overlay Showing Surface During Event, May 10, 2012—1800Z.

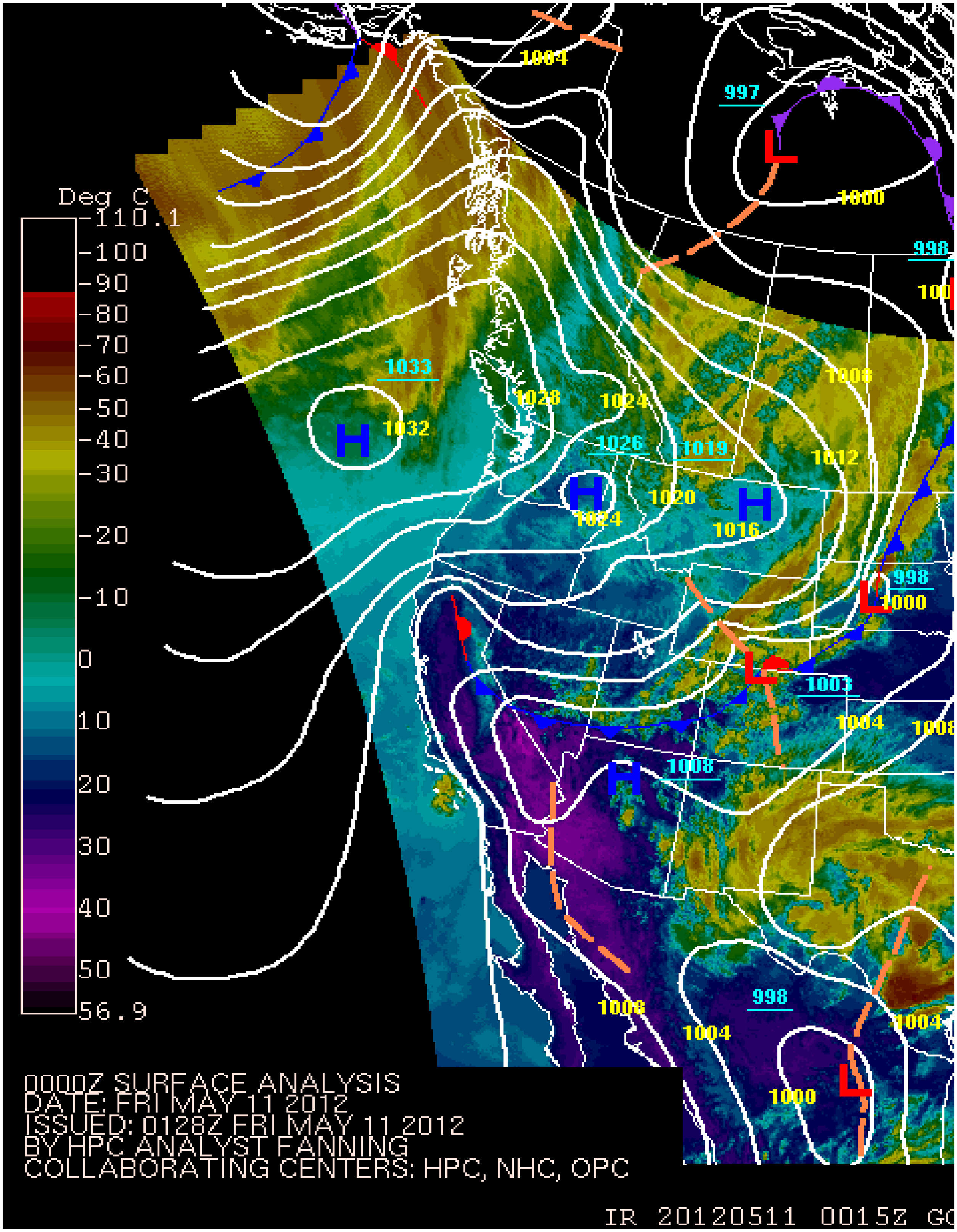


Figure 68. Weather Chart with IR Overlay Showing Surface During Event, May 11, 2012—0000Z.

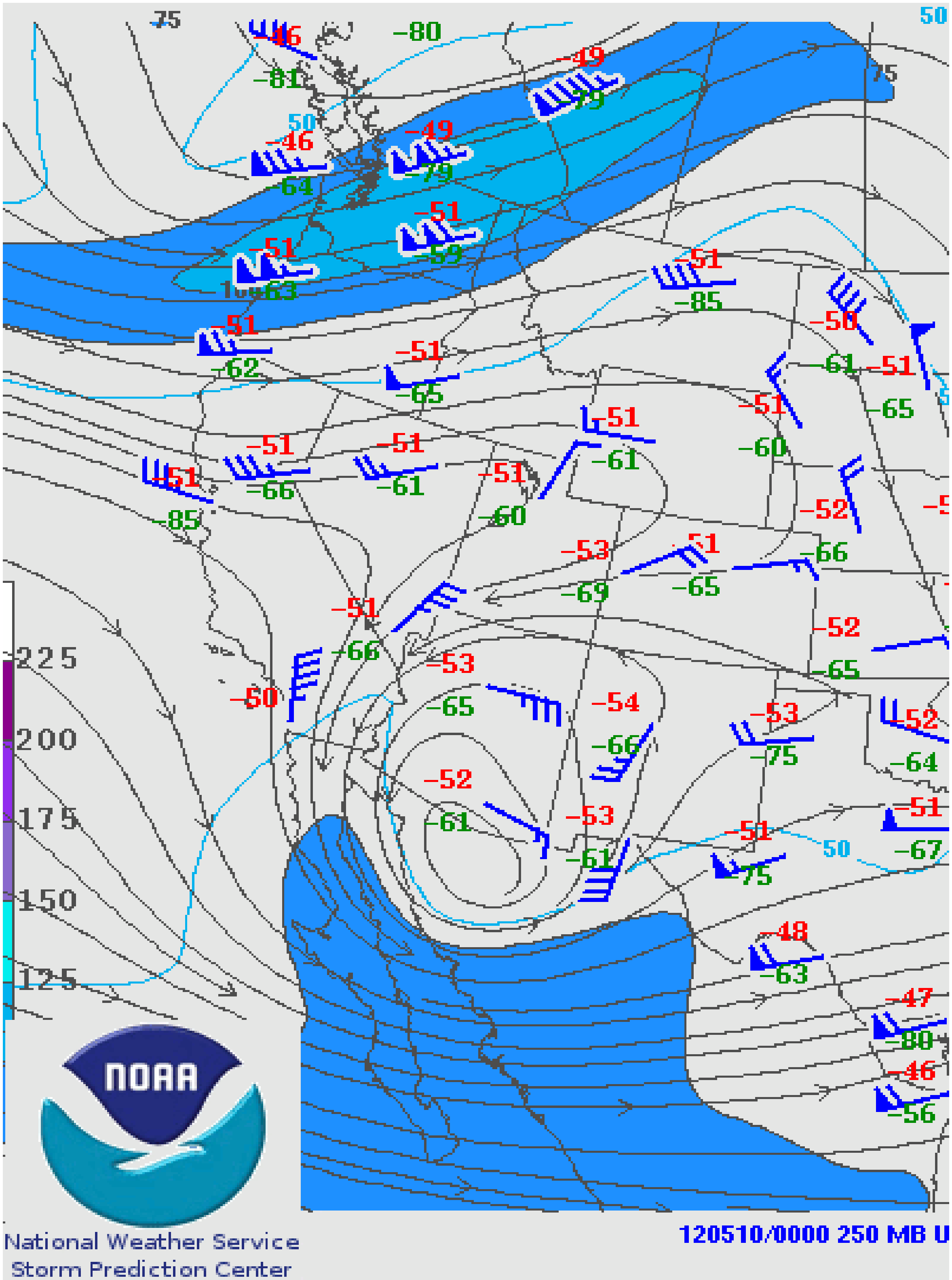


Figure 69. 250-mb Weather Chart During Event, May 10, 2012—0000Z.

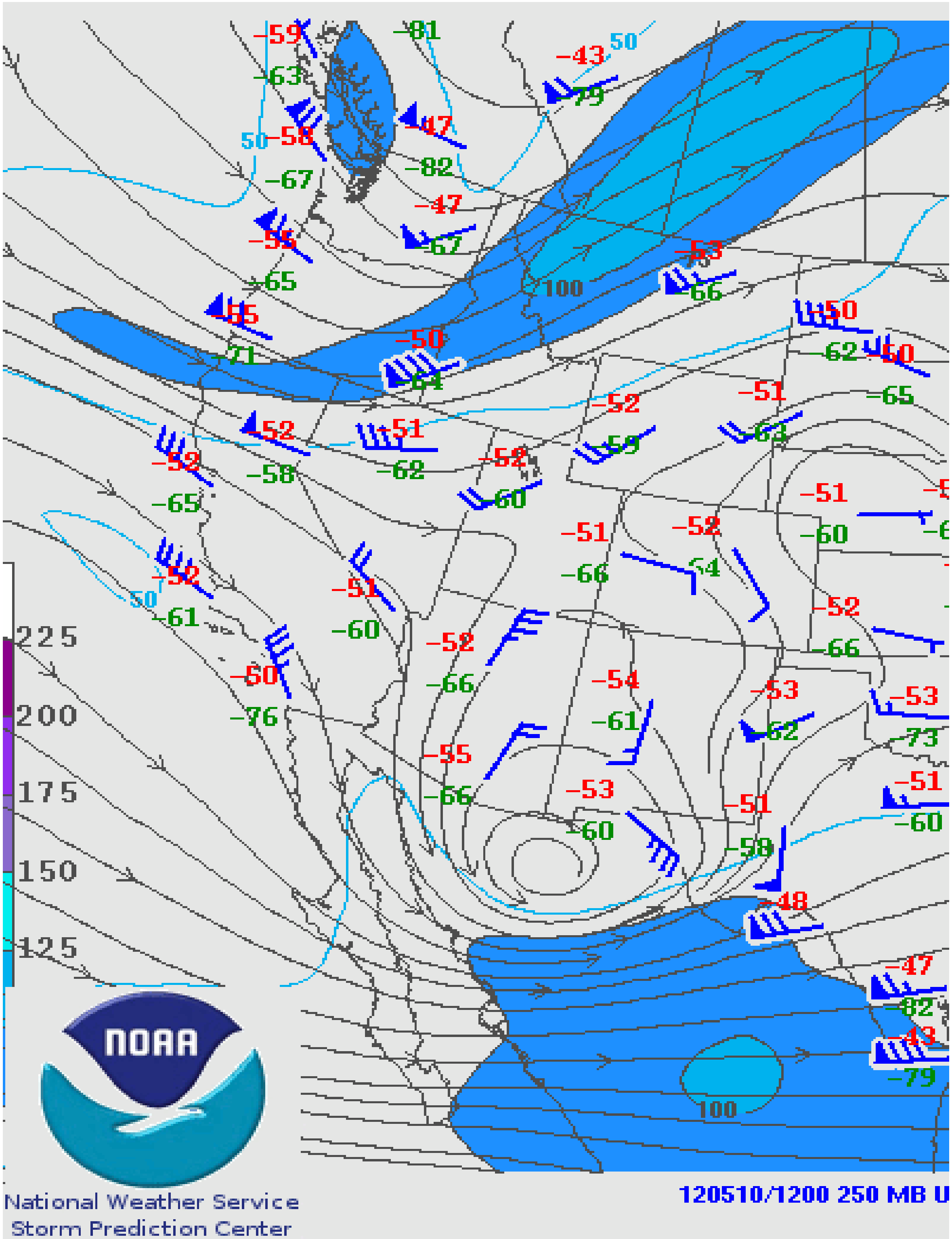


Figure 70. 250-mb Weather Chart During Event, May 10, 2012—1200Z.

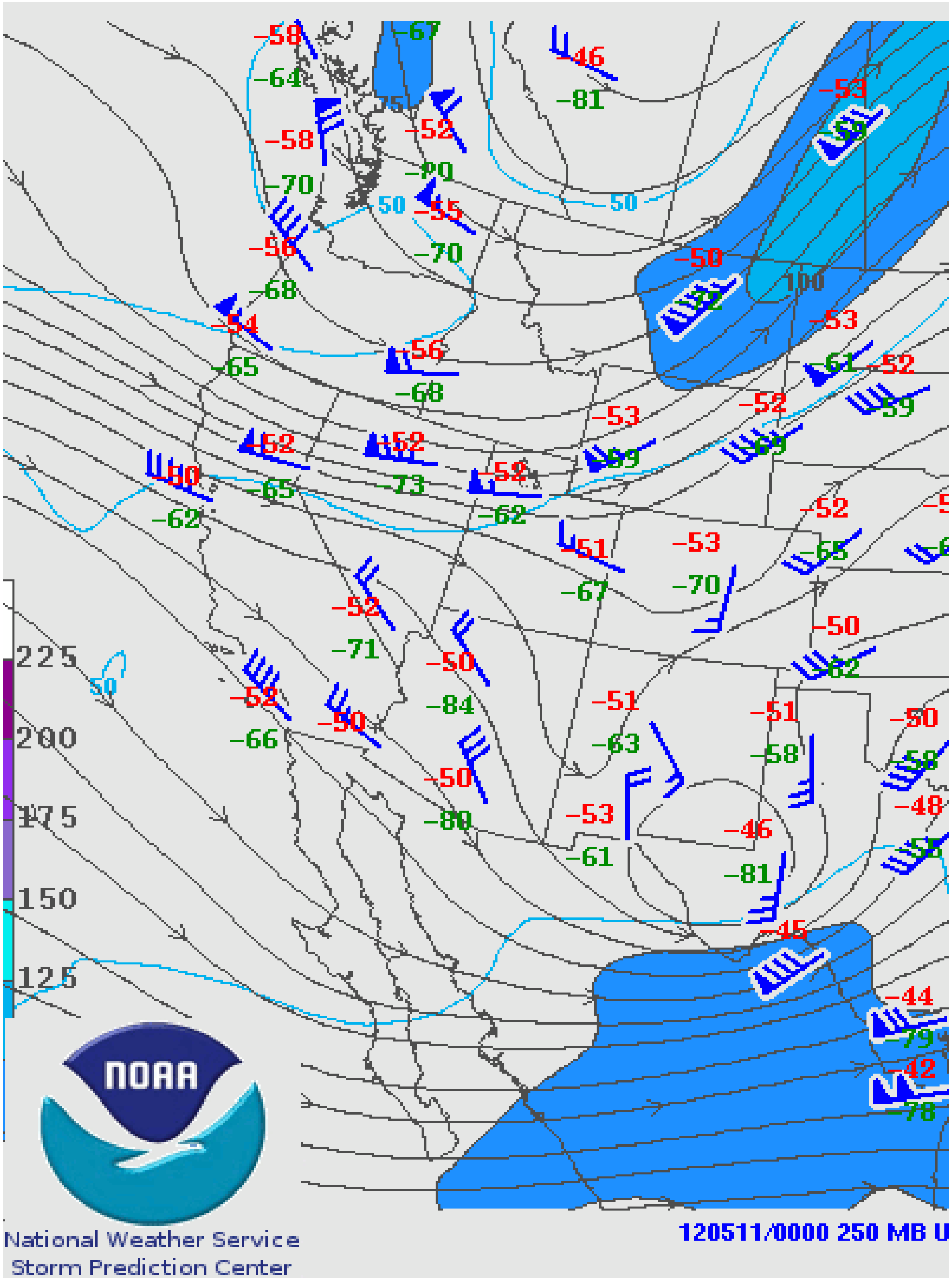


Figure 71. 250-mb Weather Chart During Event, May 11, 2012—0000Z.

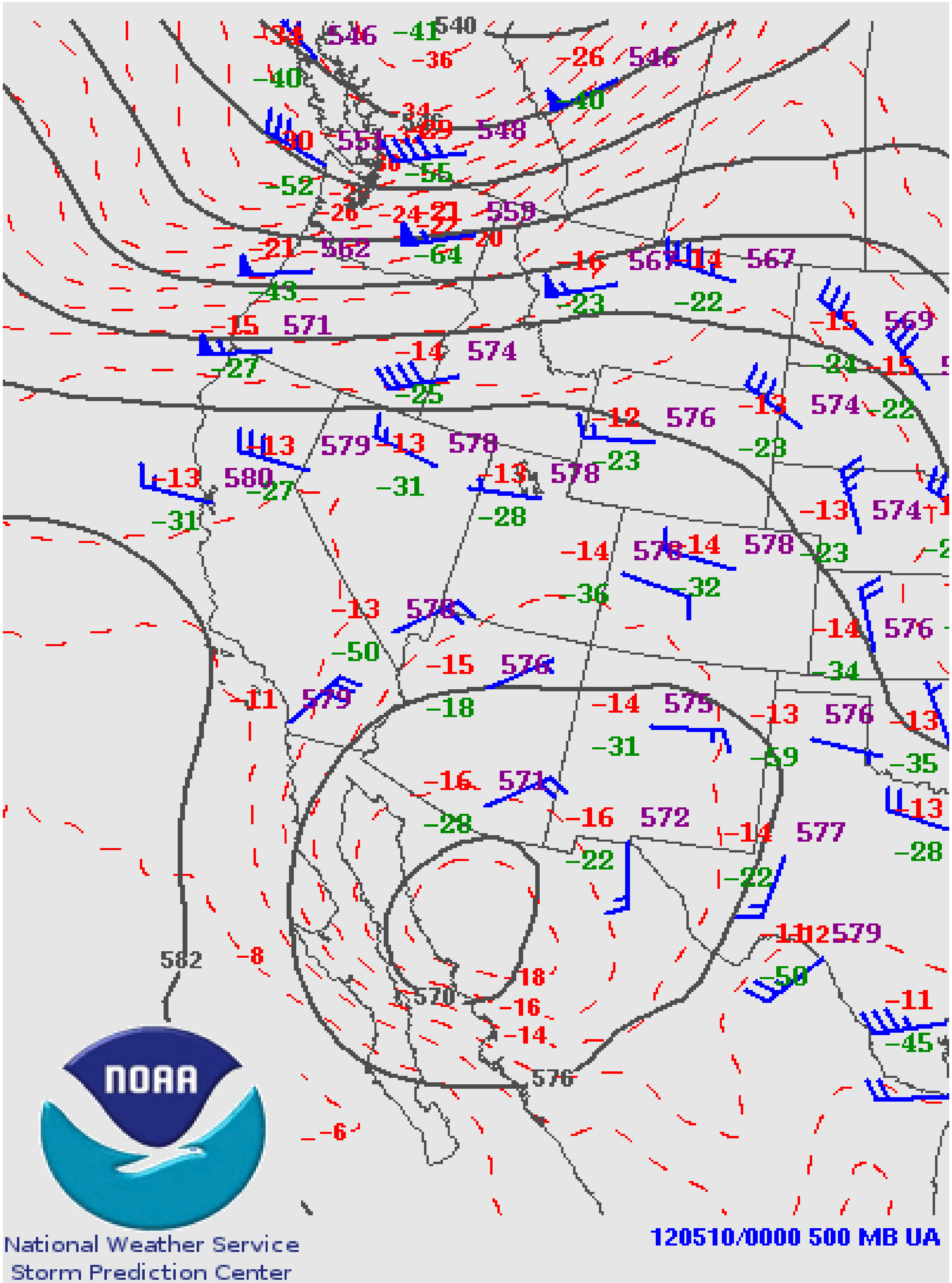


Figure 72. 500-mb Weather Chart During Event, May 10, 2012—0000Z.

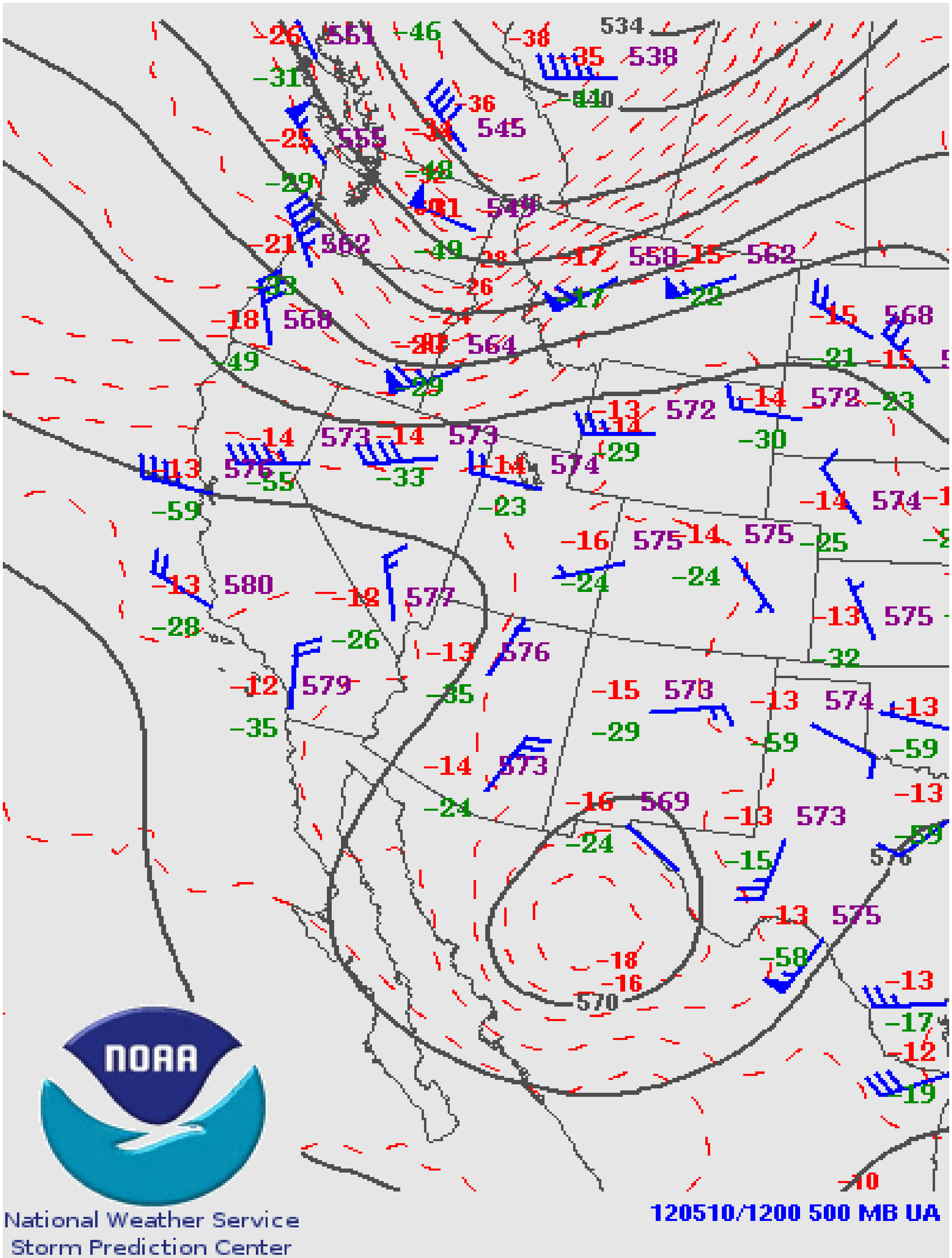


Figure 73. 500-mb Weather Chart During Event, May 10, 2012—1200Z.

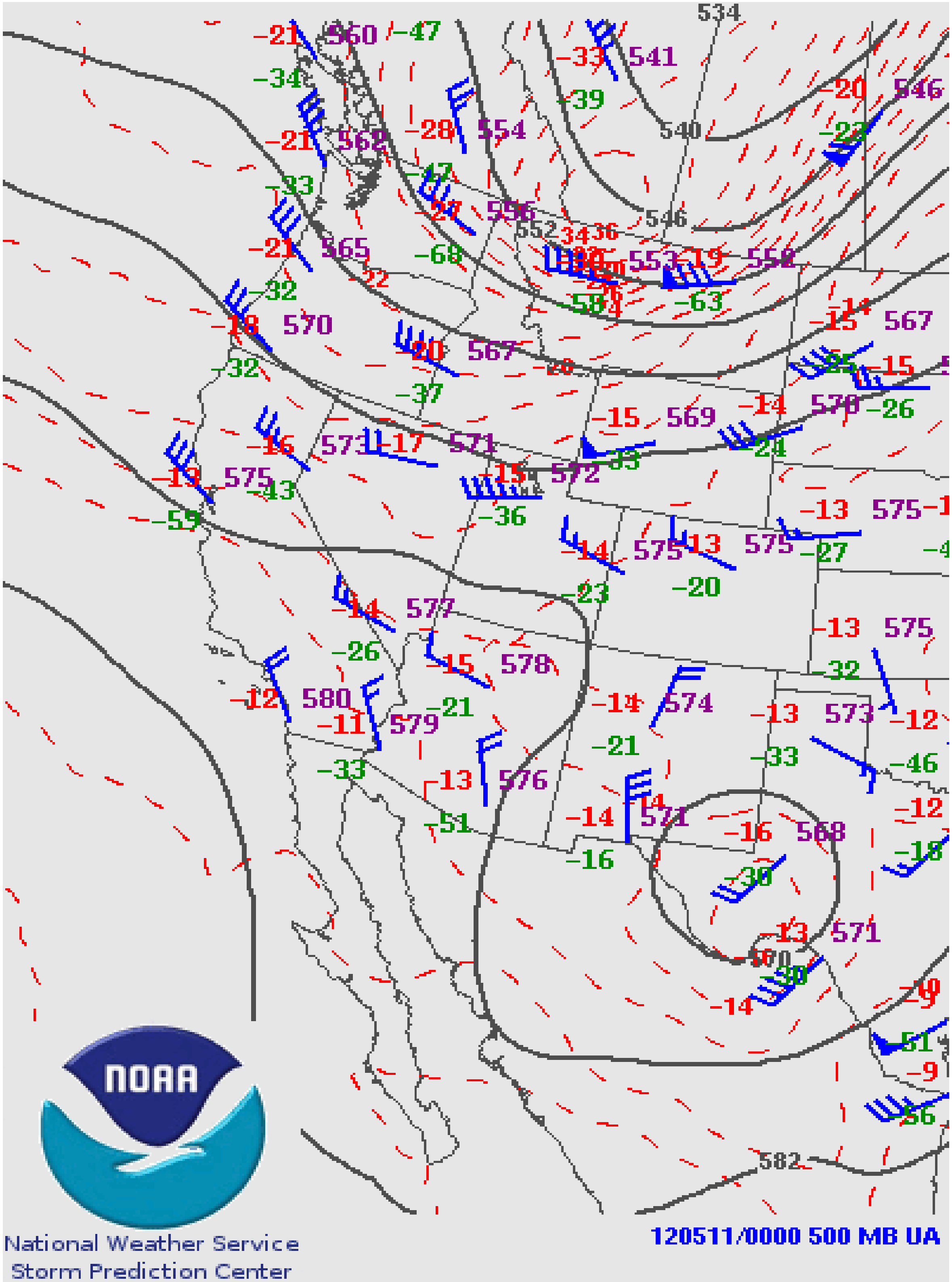


Figure 74. 500-mb Weather Chart During Event, May 11, 2012—0000Z.

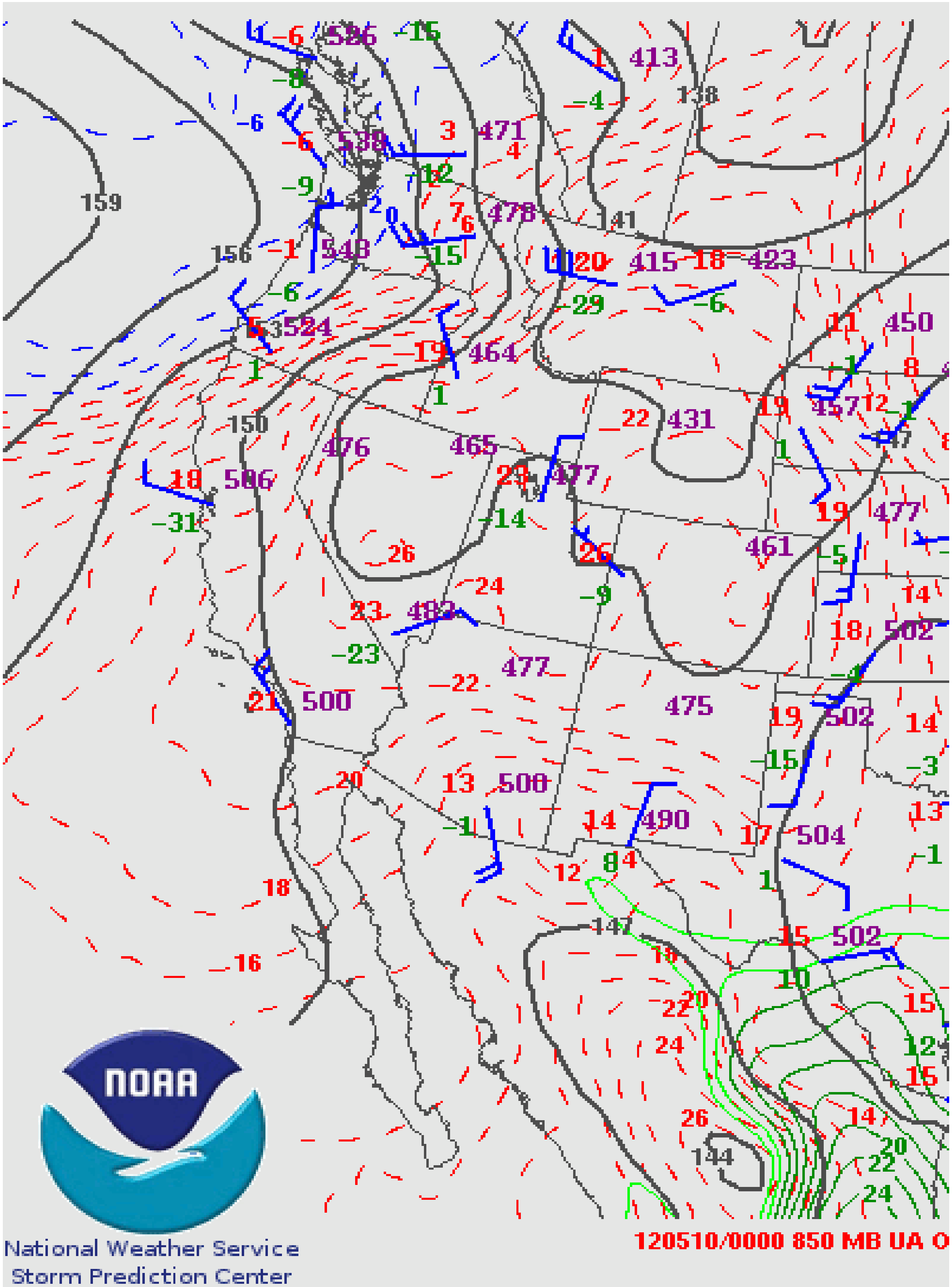


Figure 75. 850-mb Weather Chart During Event, May 10, 2012—0000Z.

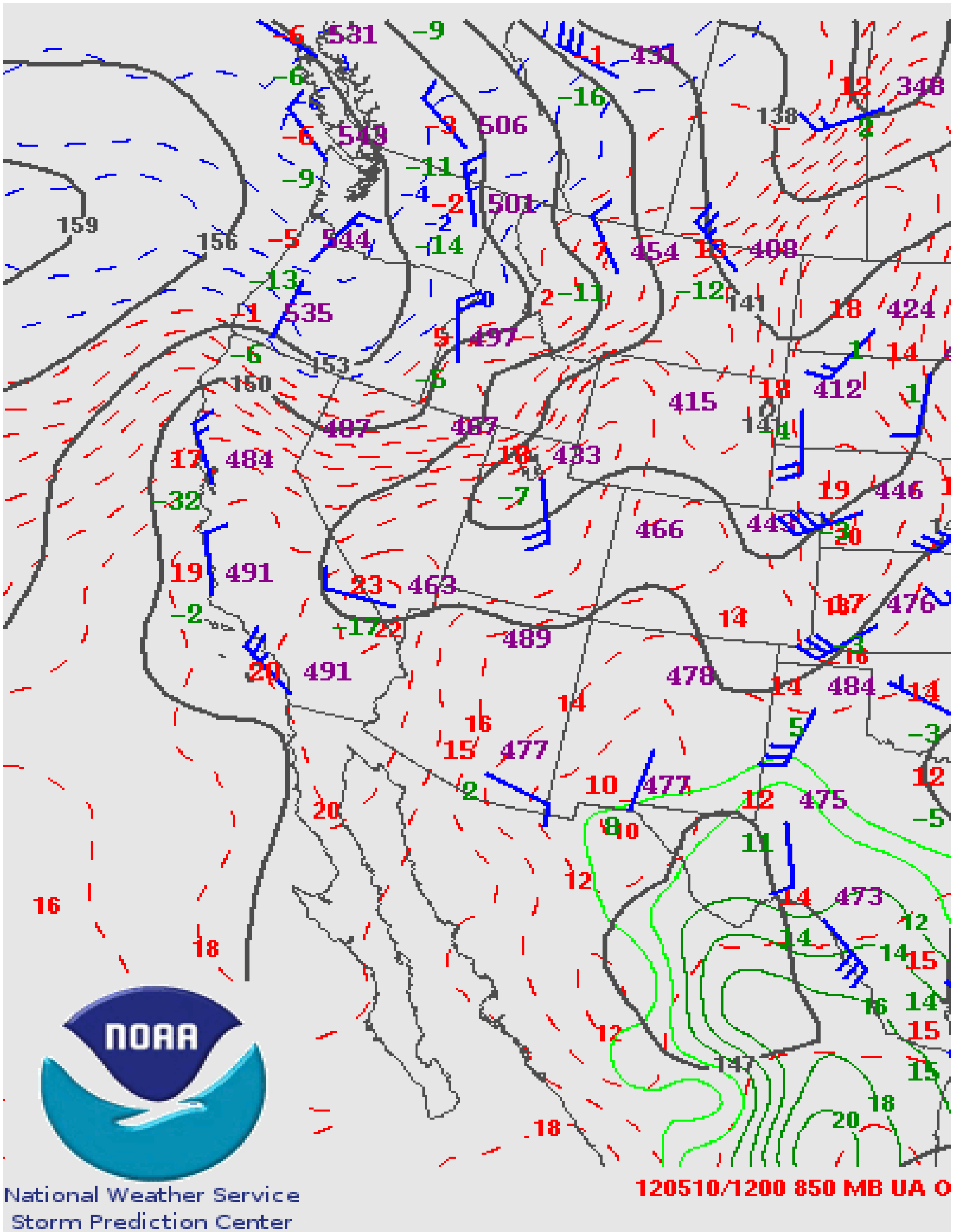


Figure 76. 850-mb Weather Chart During Event, May 10, 2012—1200Z.

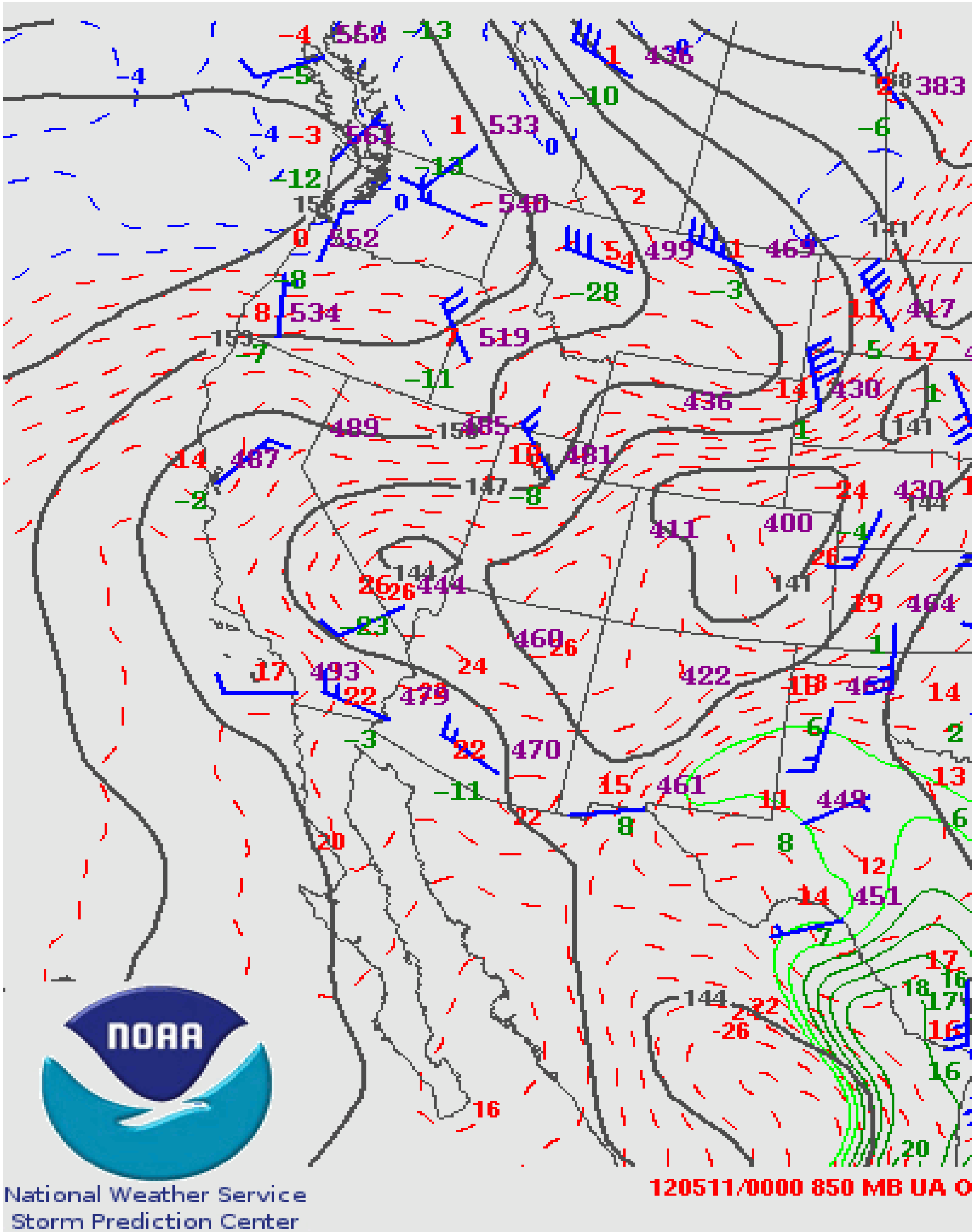


Figure 77. 850-mb Weather Chart During Event, May 11, 2012—0000Z.

Table 33. Hourly Observations Climatological Data for North Las Vegas Airport, May 10, 2012

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

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)

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

HOURLY OBSERVATIONS TABLE
NORTH LAS VEGAS AIRPORT (53123)
LAS VEGAS, NV
(05/2012)

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 (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
10	0053	12	CLR	10.00		71	21.7	49	9.2	22	-5.6	16	7	140		27.49	5	005	29.77	AA		29.79
10	0153	12	CLR	10.00		69	20.6	48	8.9	23	-5.0	18	7	340		27.48			29.76	AA		29.78
10	0253	12	CLR	10.00		68	20.0	48	9.1	26	-3.3	21	7	010		27.48			29.76	AA		29.78
10	0353	12	CLR	8.00		66	18.9	49	9.6	32	0.0	28	3	360		27.49	3	001	29.77	AA		29.79
10	0453	12	CLR	6.00	HZ	66	18.9	50	9.8	33	0.6	29	7	360		27.50			29.78	AA		29.80
10	0553	12	CLR	6.00	HZ	68	20.0	51	10.5	34	1.1	29	3	360		27.52			29.80	AA		29.82
10	0653	12	CLR	7.00		74	23.3	53	11.4	31	-0.6	21	6	100		27.52	2	014	29.81	AA		29.83
10	0753	12	CLR	7.00		76	24.4	53	11.6	30	-1.1	18	9	120		27.52			29.81	AA		29.83
10	0839	12	BKN017	5.00	HZ	79	26.0	55	13.0	34	1.0	20	6	130		27.52			M	SP		29.83
10	0853	12	OVC019	6.00	HZ	79	26.1	55	12.5	31	-0.6	17	5	160		27.52			29.81	AA		29.83
10	0953	12	OVC023	6.00	HZ	83	28.3	56	13.5	32	0.0	16	6	VR		27.51	8	006	29.79	AA		29.81
10	1000	12	SCT023	6.00	HZ	84	29.0	57	13.7	32	0.0	15	7	090		27.51			M	SP		29.81
10	1053	12	SCT023	8.00		86	30.0	58	14.3	33	0.6	15	6	VR		27.49			29.77	AA		29.79
10	1100	12	OVC025	8.00		88	31.0	59	14.9	34	1.0	15	9	110		27.49			M	SP		29.79
10	1111	12	CLR	8.00		88	31.0	58	14.5	32	0.0	13	5	180		27.48			M	SP		29.78
10	1153	12	CLR	10.00		89	31.7	58	14.4	30	-1.1	12	5	150		27.46			29.74	AA		29.76
10	1253	12	CLR	10.00		91	32.8	58	14.3	26	-3.3	9	3	160		27.43	8	027	29.71	AA		29.73
10	1353	12	CLR	10.00		94	34.4	59	14.8	25	-3.9	8	14	130	20	27.40			29.68	AA		29.70
10	1453	12	CLR	10.00		95	35.0	58	14.3	19	-7.2	6	11	170	22	27.38			29.64	AA		29.67
10	1553	12	CLR	10.00		96	35.6	58	14.5	19	-7.2	6	15	220	21	27.36	6	024	29.63	AA		29.65
10	1653	12	CLR	10.00		94	34.4	57	13.9	17	-8.3	6	11	190	21	27.35			29.62	AA		29.64
10	1753	12	CLR	10.00		93	33.9	56	13.4	14	-10.0	5	11	200		27.35			29.61	AA		29.64
10	1853	12	CLR	10.00		91	32.8	56	13.2	17	-8.3	6	5	200		27.35	5	004	29.61	AA		29.64
10	1953	12	CLR	10.00		89	31.7	56	13.3	22	-5.6	9	11	240		27.36			29.62	AA		29.65
10	2053	12	CLR	10.00		87	30.6	56	13.0	23	-5.0	10	16	260	24	27.37			29.64	AA		29.66
10	2153	12	CLR	10.00		84	28.9	54	12.1	21	-6.1	10	6	160		27.39	3	012	29.65	AA		29.68
10	2253	12	CLR	10.00		83	28.3	52	10.9	11	-11.7	6	10	190		27.39			29.65	AA		29.68
10	2353	12	CLR	10.00		80	26.7	51	10.6	16	-8.9	9	14	200		27.39			29.65	AA		29.68

Table 34. Hourly Observations Climatological Data for McCarran International Airport, May 10, 2012

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 (05/2012)

Elevation: 2131 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
10	0056	11	CLR	10.00		76	24.4	49	9.3	12	-11.1	9	10	180		27.48	6	006	29.67	AA		29.75
10	0156	11	CLR	10.00		75	23.9	48	8.8	9	-12.8	8	14	200		27.46			29.65	AA		29.73
10	0256	11	CLR	10.00		75	23.9	48	8.9	10	-12.2	8	9	190		27.48			29.67	AA		29.75
10	0356	11	CLR	10.00		69	20.6	47	8.3	19	-7.2	15	8	250		27.48	3	001	29.68	AA		29.75
10	0456	11	CLR	8.00		69	20.6	48	8.9	23	-5.0	18	6	240		27.50			29.70	AA		29.77
10	0556	11	CLR	6.00	HZ	72	22.2	50	10.2	27	-2.8	19	6	230		27.52			29.71	AA		29.79
10	0656	11	CLR	6.00	HZ	74	23.3	52	10.8	28	-2.2	18	0	000		27.52	1	015	29.72	AA		29.80
10	0756	11	CLR	6.00	HZ	78	25.6	52	11.3	25	-3.9	14	0	000		27.52			29.72	AA		29.80
10	0856	11	CLR	5.00	HZ	83	28.3	55	12.6	26	-3.3	12	3	VR		27.52			29.71	AA		29.79
10	0956	11	CLR	4.00	HZ	87	30.6	56	13.2	24	-4.4	10	9	110		27.50	8	008	29.70	AA		29.77
10	1056	11	CLR	4.00	HZ	89	31.7	57	14.0	27	-2.8	11	10	080		27.48			29.67	AA		29.75
10	1156	11	CLR	8.00		92	33.3	58	14.2	24	-4.4	8	3	VR		27.45			29.64	AA		29.72
10	1256	11	FEW140	8.00		96	35.6	59	14.7	21	-6.1	7	10	100		27.43	8	025	29.61	AA		29.70
10	1343	11	FEW140	10.00		95	35.0	56	13.4	7	-14.0	4	7	140		27.41			M	SP		29.68
10	1356	11	FEW140	10.00		95	35.0	56	13.4	7	-13.9	4	6	190	17	27.40			29.59	AA		29.67
10	1456	11	FEW140	10.00		95	35.0	56	13.4	6	-14.4	3	7	200	22	27.37			29.56	AA		29.64
10	1556	11	FEW140	10.00		96	35.6	57	13.8	10	-12.2	4	14	200		27.37	6	021	29.55	AA		29.63
10	1656	11	FEW140	10.00		95	35.0	56	13.5	8	-13.3	4	13	210	22	27.36			29.54	AA		29.62
10	1756	11	FEW140	10.00		94	34.4	56	13.2	8	-13.3	4	11	220		27.35			29.53	AA		29.61
10	1856	11	FEW140	10.00		92	33.3	56	13.2	14	-10.0	5	15	210		27.36	5	004	29.54	AA		29.62
10	1956	11	CLR	10.00		89	31.7	55	12.8	17	-8.3	7	17	200	25	27.37			29.55	AA		29.63
10	2056	11	CLR	10.00		87	30.6	55	12.5	18	-7.8	8	17	200		27.38			29.57	AA		29.65
10	2156	11	CLR	10.00		85	29.4	52	11.1	8	-13.3	5	14	220		27.39	1	013	29.57	AA		29.66
10	2256	11	CLR	10.00		83	28.3	51	10.4	4	-15.6	5	14	210		27.40			29.58	AA		29.67
10	2356	11	CLR	10.00		82	27.8	52	10.8	13	-10.6	7	15	220	22	27.40			29.59	AA		29.67

Dynamically generated Fri Aug 17 13:47:11 EDT 2012 via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

Table 35. Hourly Observations Monitoring Site Data for May 10, 2012

PST	Joe Neal			J.D. Smith			Jerome Mack			Sunrise Acres		
	Speed (mph)	Direction (degrees)	Gust (mph)	Speed (mph)	Direction (degrees)	Gust (mph)	Speed (mph)	Direction (degrees)	Gust (mph)	Speed (mph)	Direction (degrees)	Gust (mph)
1:00		328	7	1	145	15	2	146	13	2	151	13
2:00	2	346	10	1	185	11	3	146	9	2	178	9
3:00	3	55	10	2	345	6	1	337	6	2	330	6
4:00	4	21	9	2	321	7	2	129	6	1	302	3
5:00	4	346	7	2	319	5	2	209	6	1	286	4
6:00	4	341	7	1	310	5	3	179	7	2	206	7
7:00	3	40	18	3	105	8	2	138	5	2	141	8
8:00	9	101	19	5	115	9	5	114	11	4	130	11
9:00	8	101	18	4	80	13	7	83	17	6	110	15
10:00	7	106	18	4	70	12	8	86	19	5	81	14
11:00	7	112	17	3	93	13	10	77	21	5	92	18
12:00	6	108	23	2	106	13	10	83	20	5	105	16
13:00	6	125	25	4	122	13	10	92	20	6	110	19
14:00	8	142	20	6	125	16	8	93	20	7	110	20
15:00	9	126	23	8	127	19	10	110	22	9	119	21
16:00	9	135	23	9	125	21	10	116	22	9	124	23
17:00	7	186	21	6	198	21	8	205	28	8	186	23
18:00	8	198	22	7	188	17	7	211	18	7	195	19
19:00	4	194	14	4	185	12	4	206	12	4	201	12
20:00	3	186	11	8	211	22	8	213	20	8	210	19
21:06	7	222	20	7	211	21	12	210	22	9	201	21
22:00	5	50	22	6	215	14	9	204	18	7	207	20
23:00	5	54	15	3	174	10	7	190	17	3	170	11
24:00	3	41	10	5	170	13	4	142	13	8	187	19

Figures 78–81 are plots of the hourly average wind speed and maximum gust speed recorded at select DAQ monitoring stations on May 10, 2012. The stations were chosen to represent conditions throughout the Las Vegas Valley PM_{10} network. Each plot also shows the wind speed observed at the routine hourly time at North Las Vegas Airport (VGT) to facilitate comparisons between the stations. DAQ data consist of averages and maximum values recorded throughout the hour; VGT data come from a short observation period occurring a few minutes before the time listed. The similarity between the monitoring sites and North Las Vegas Airport indicates the regional-scale influence of the weather system affecting the area.

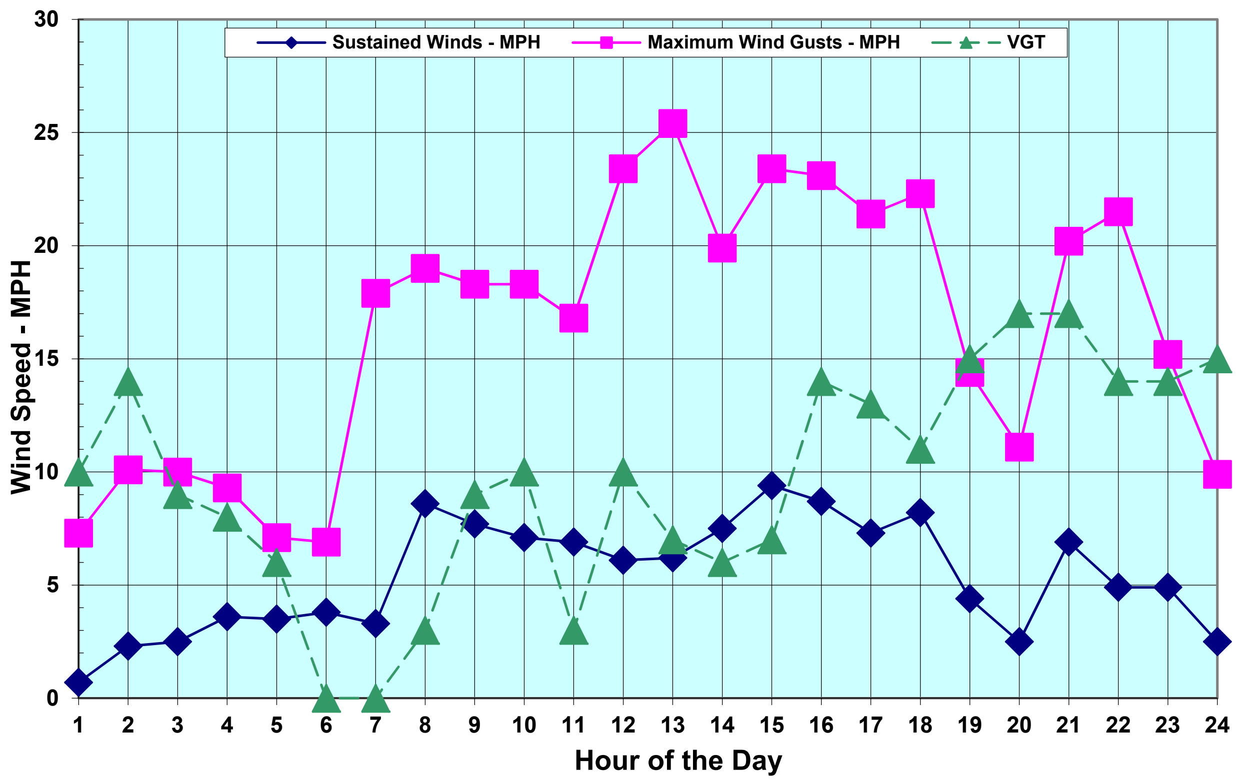


Figure 78. Joe Neal Wind Speeds Compared to North Las Vegas Airport.

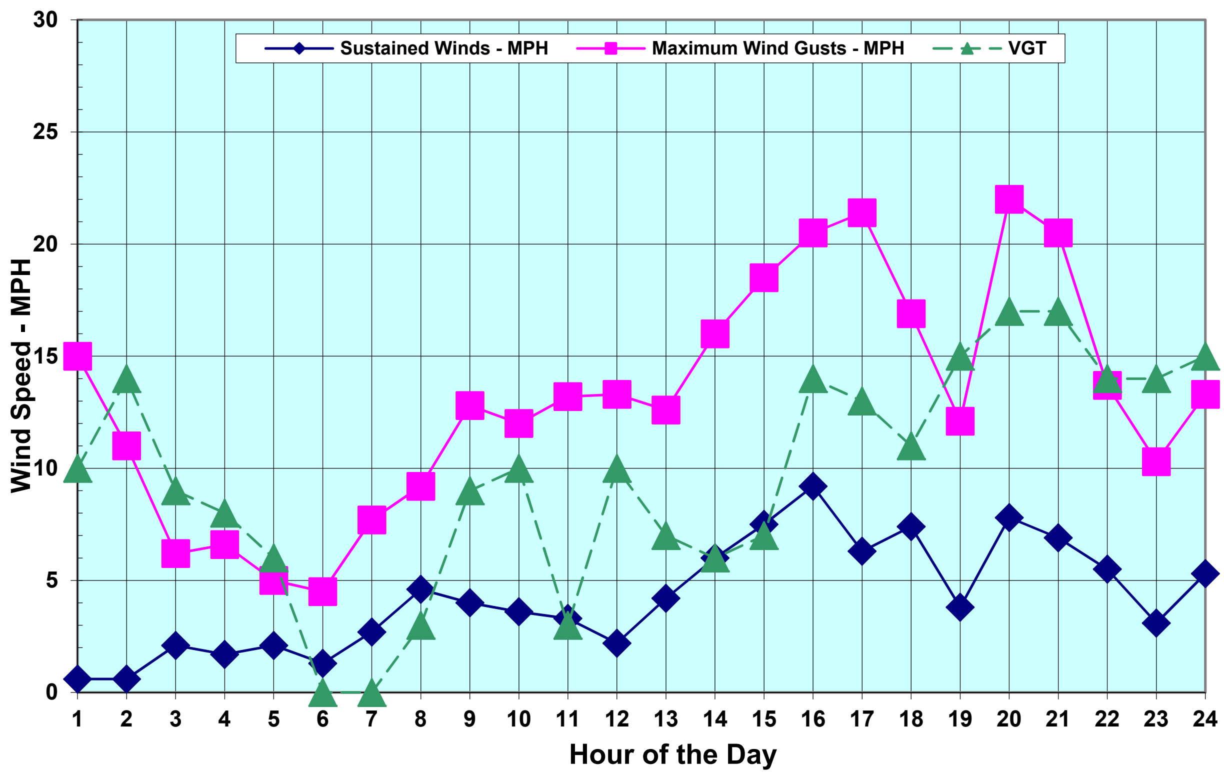


Figure 79. J. D. Smith Wind Speeds Compared to North Las Vegas Airport.

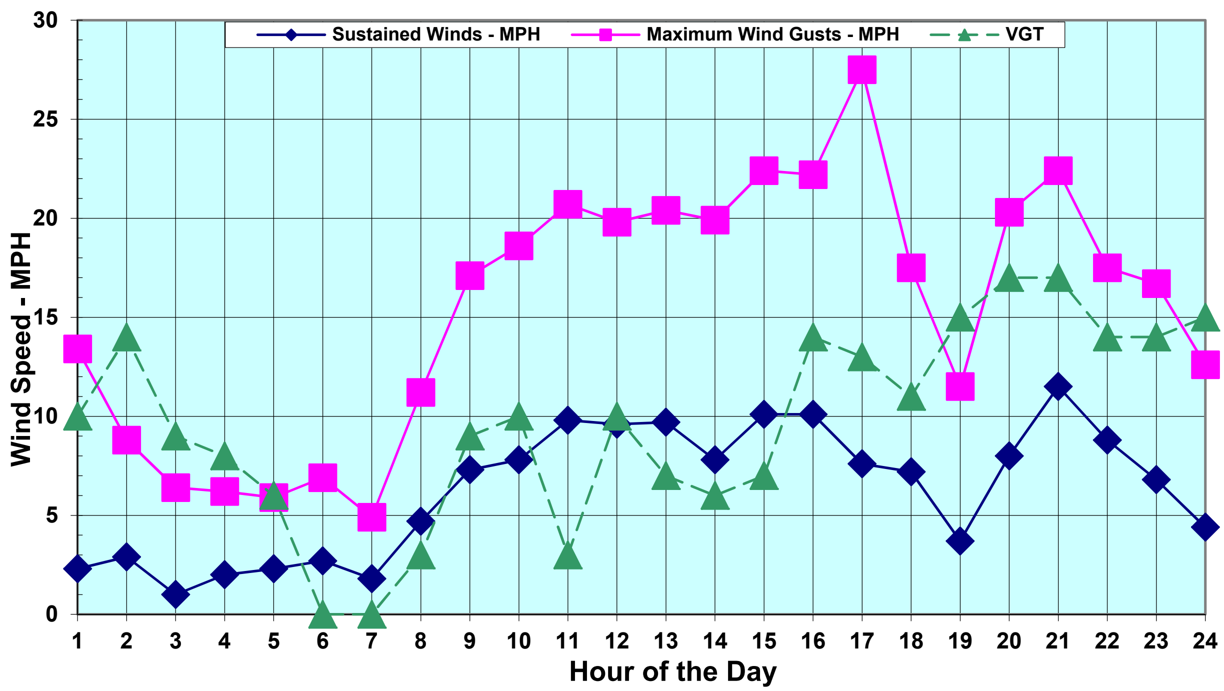


Figure 80. Jerome Mack Wind Speeds Compared to North Las Vegas Airport.

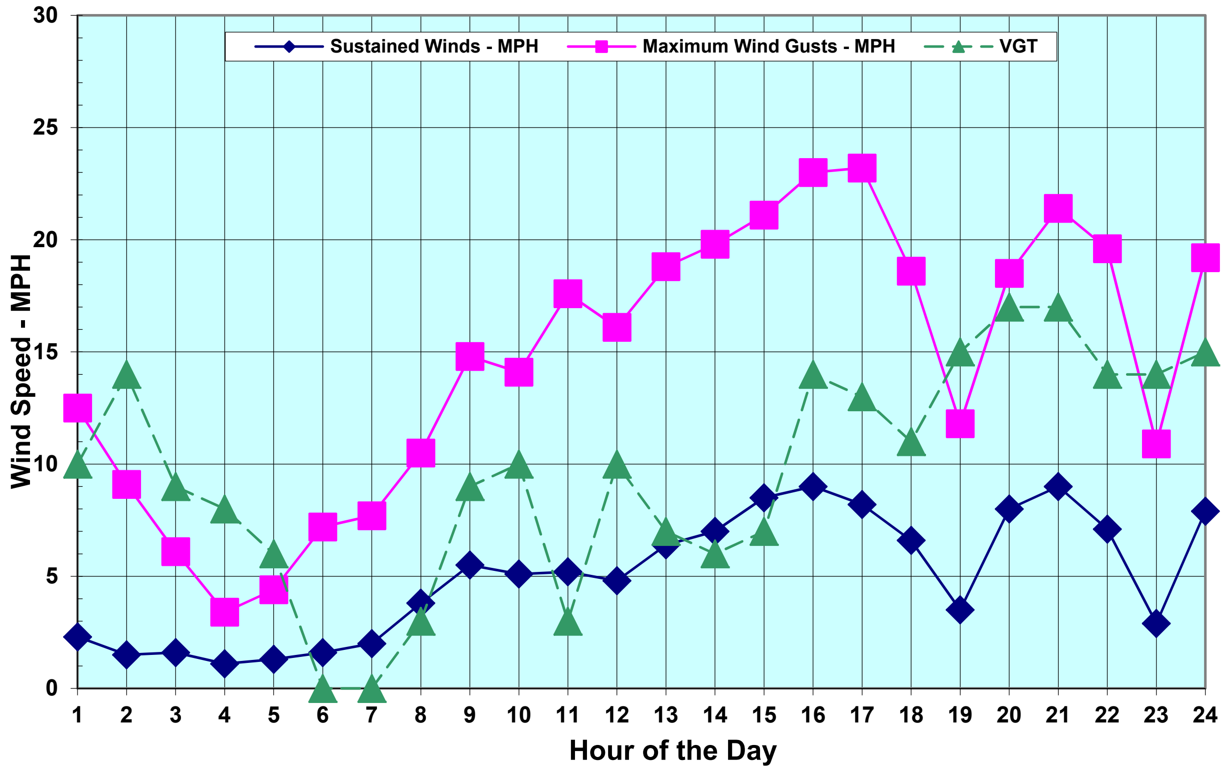


Figure 81. Sunrise Acres Wind Speeds Compared to North Las Vegas Airport.

Table 36 shows wind data from McCarran International Airport and PM_{10} concentration data from Jerome Mack for May 10, 2012. All DAQ wind data from Jerome Mack (except maximum wind gust) consist of averages for the one-hour period beginning at the time shown. McCarran International Airport data came from observations made a few minutes before the time shown.

Table 36. Jerome Mack Wind and PM_{10} Concentration Data and McCarran Wind Data, May 10, 2012.

Jerome Mack (Station 540) (hourly averages except extreme speed gusts)					McCarran International Airport (observations a few minutes before time shown)		
Time (PST)	PM_{10} (µg/m^3)	Wind Speed (mph)	Wind Direction (degrees)	Wind Gust (mph)	Wind Speed (mph)	Wind Direction (degrees)	Wind Gust (mph)
1:00	47.80	2	146	13	10	10	10
2:00	324.7	3	146	9	14	14	14
3:00	277.5	1	337	6	9	9	9
4:00	402.9	2	129	6	8	8	8
5:00	296.1	2	209	6	6	6	6
6:00	221.8	3	179	7	6	6	6
7:00	242.9	2	138	5	0	0	0
8:00	554.3	5	114	11	0	0	0
9:00	612.4	7	83	17	3	3	3
10:00	435.7	8	86	19	9	9	9
11:00	364.8	10	77	21	10	10	10
12:00	357.2	10	83	20	3	3	3
13:00	296.7	10	92	20	10	10	10
14:00	277.7	8	93	20	7	7	7
15:00	224	10	110	22	6	6	6
16:00	179.2	10	116	22	7	7	7
17:00	54.4	8	205	28	14	14	14
18:00	17.5	7	211	18	13	13	13
19:00	22.4	4	206	12	11	11	11
20:00	41.7	8	213	20	15	15	15
21:00	54.6	12	210	22	17	17	17
22:00	37.7	9	204	18	17	17	17
23:00	92.2	4	142	13	14	14	14

3.1.5.4 National Weather Service Forecast

The National Weather Service (NWS) forecast discussed surface observations and a radar loop that shows a cloud of dust over southern Clark County caused by a thunderstorm outflow boundary:

```
FXUS65 KVEF 224 AM PDT THU MAY 10 2012

.SHORT TERM...SATELLITE LOOP SHOWED MOSTLY CLEAR SKIES AREAWIDE
EARLY THIS MORNING. HOWEVER...SURFACE OBS AND RADAR LOOP SHOWED A
CLOUD OF DUST SUSPENDED OVER SOUTHERN MOHAVE...EXTREME SOUTHERN
CLARK...AND FAR SOUTHEAST SAN BERNARDINO COUNTIES COURTESY OF AN
OUTFLOW BOUNDARY WHICH CAME OUT OF THUNDERSTORMS OVER SOUTHERN
ARIZONA WEDNESDAY EVENING. VISIBILITY HAD IMPROVED UNDER THE DUST
CLOUD SINCE LATE EVENING...AND BASED ON THE PREMISE THAT THE DUST
WILL CONTINUE TO SETTLE AND/OR DISPERSE AS THE MORNING WEARS
ON...CHOSE NOT TO MENTION IT IN THE WEATHER GRIDS. IN THE LARGER
SCALE VIEW...THERE ARE THREE PLAYERS IN THE SHORT TERM. ONE IS THE
SHORTWAVE TROUGH ENTERING FAR NORTHERN CALIFORNIA EARLY THIS
MORNING. THIS FEATURE WILL BRUSH BY OUR NORTHERN BORDER DURING THE
DAY...KICKING OFF SOME CLOUDS AND PERHAPS EVEN A STRAY THUNDERSTORM
OVER NORTHERN LINCOLN COUNTY. AFTER IT GOES BY...A RIDGE STARTS TO
BUILD IN FROM THE WEST...BUT BY SATURDAY THE RIDGE IS PINCHED FROM
THE EAST AND THE WEST BY PLAYERS TWO AND THREE. TWO IS A TIGHTLY
WOUND CIRCULATION NEAR 48N 150W THIS MORNING WHICH IS FORECAST TO
RIDE OVER THE TOP OF THE RIDGE AND THEN AMPLIFY ON THE DOWNSTREAM
SIDE...DIVING ALMOST STRAIGHT SOUTH INTO THE GREAT BASIN BY SATURDAY
NIGHT AND ERODING THE RIDGE FROM THE EAST. THREE IS A WEAK LOW
PRESSURE SYSTEM NEAR 30N 150W THIS MORNING WHICH IS EXPECTED TO
STRENGTHEN AND MOVE TO 35N 130W BY SATURDAY NIGHT...IMPINGING ON THE
RIDGE FROM THE WEST. THESE TWO FORCES WILL FORCE THE RIDGE INTO A
TALL SKINNY OMEGA CONFIGURATION BY THE END OF THE SHORT TERM...WITH
MORE INTERESTING EFFECTS STILL TO COME. FEATURE TWO IS OF MORE
CONCERN IN THE SHORT TERM...WITH AT LEAST AN OUTSIDE CHANCE OF
THUNDERSTORMS OVER THE EASTERN ZONES SATURDAY AND SATURDAY NIGHT AS
IT DIGS SOUTH. CONFIDENCE IN THE PLACEMENT OF THIS FEATURE IS QUITE
LOW DUE TO THE UNSTABLE NATURE OF THE OVERALL PATTERN...SO CHOSE TO
STICK WITH SILENT POPS FOR THE TIME BEING. TEMPERATURES WILL REMAIN
ABOVE NORMAL THROUGH SATURDAY...WITH TODAY LIKELY TO BE THE WARMEST
DAY OF THE THREE IN MOST AREAS.
```

3.1.5.5 Radar Images

Still images of the radar loop described in the NWS forecast (Figures 83–91) show the timing and persistence of the dust cloud.

3.1.5.6 HYSPLIT Trajectory Modeling

The NOAA HYSPLIT model (Figure 82) shows two different source regions, one in California and the other in northwestern Arizona.

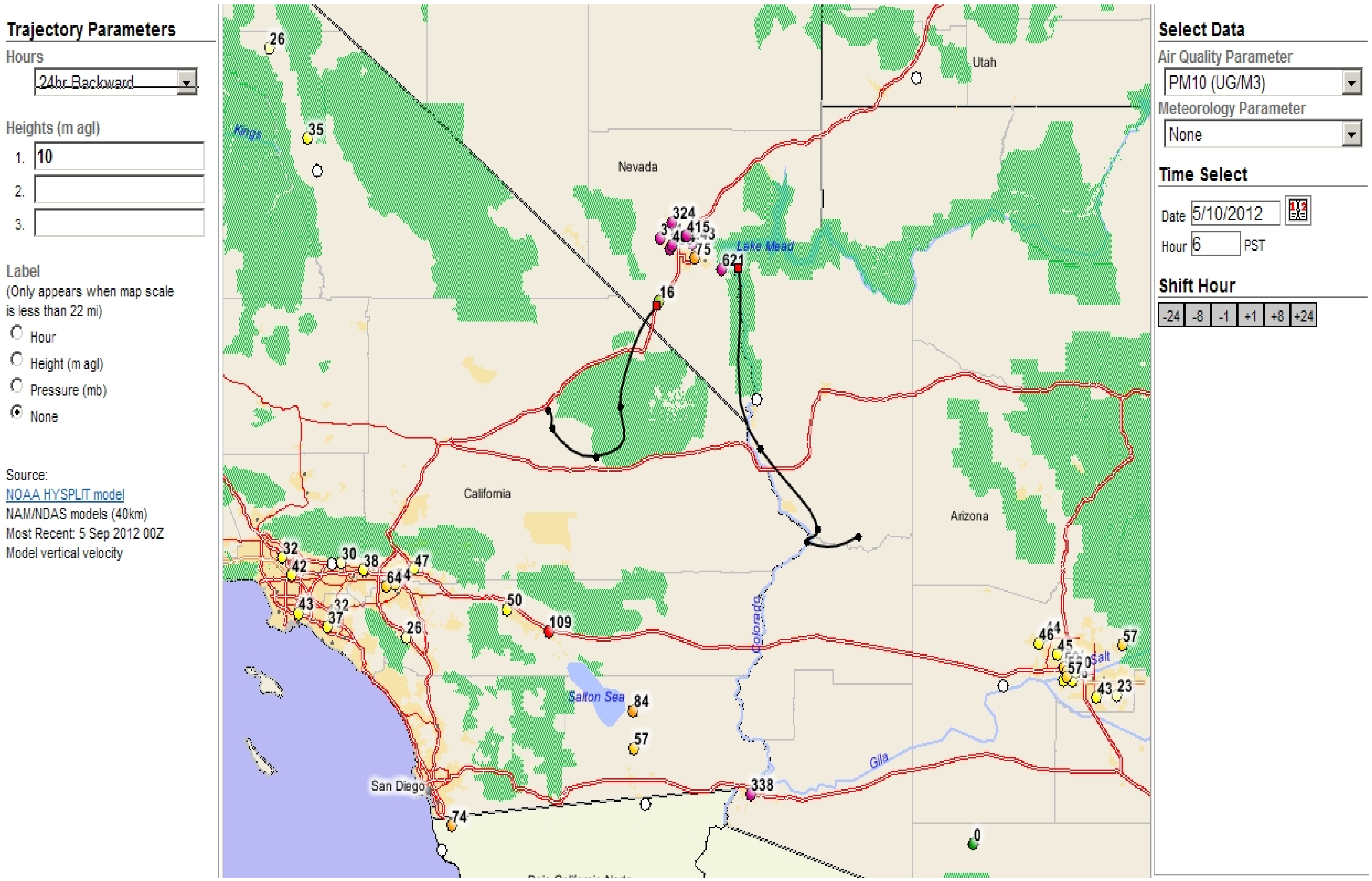


Figure 82. HYSPLIT 10 m Above Ground Level at Boulder City and Jean Stations.

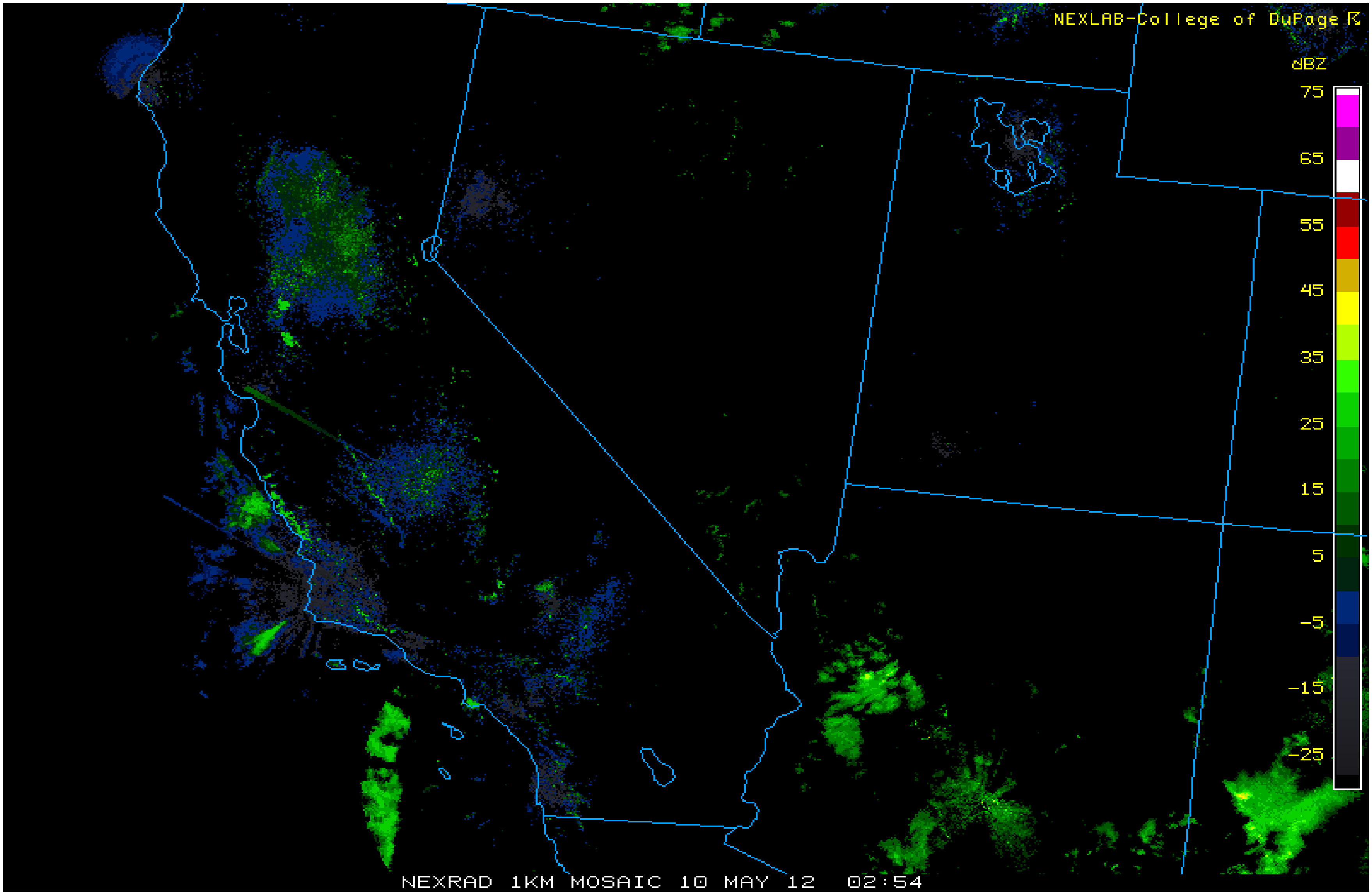


Figure 83. Southwest Region Radar Image, May 10, 2012—0300Z.

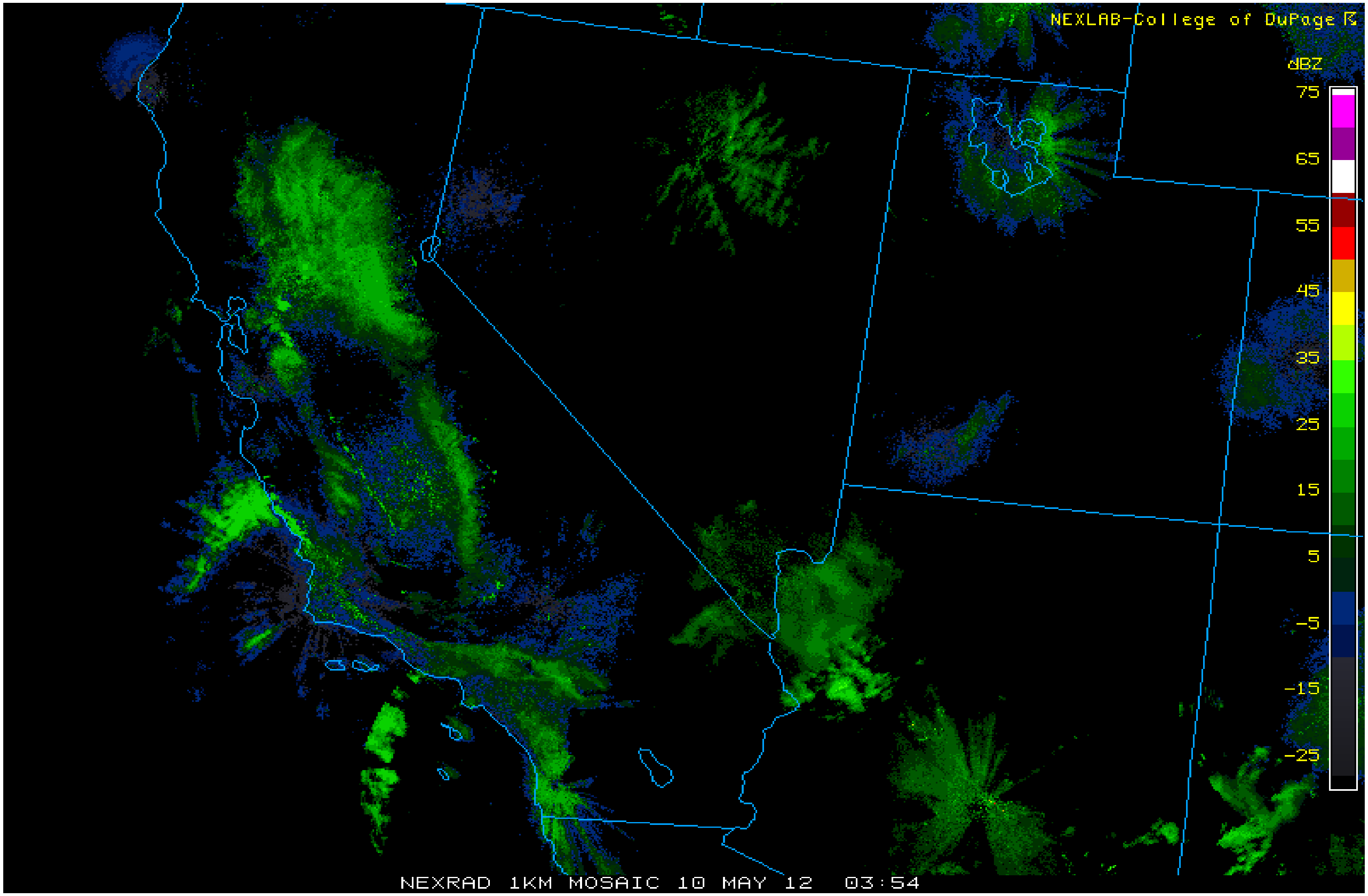


Figure 84. Southwest Region Radar Image, May 10, 2012—0400Z.

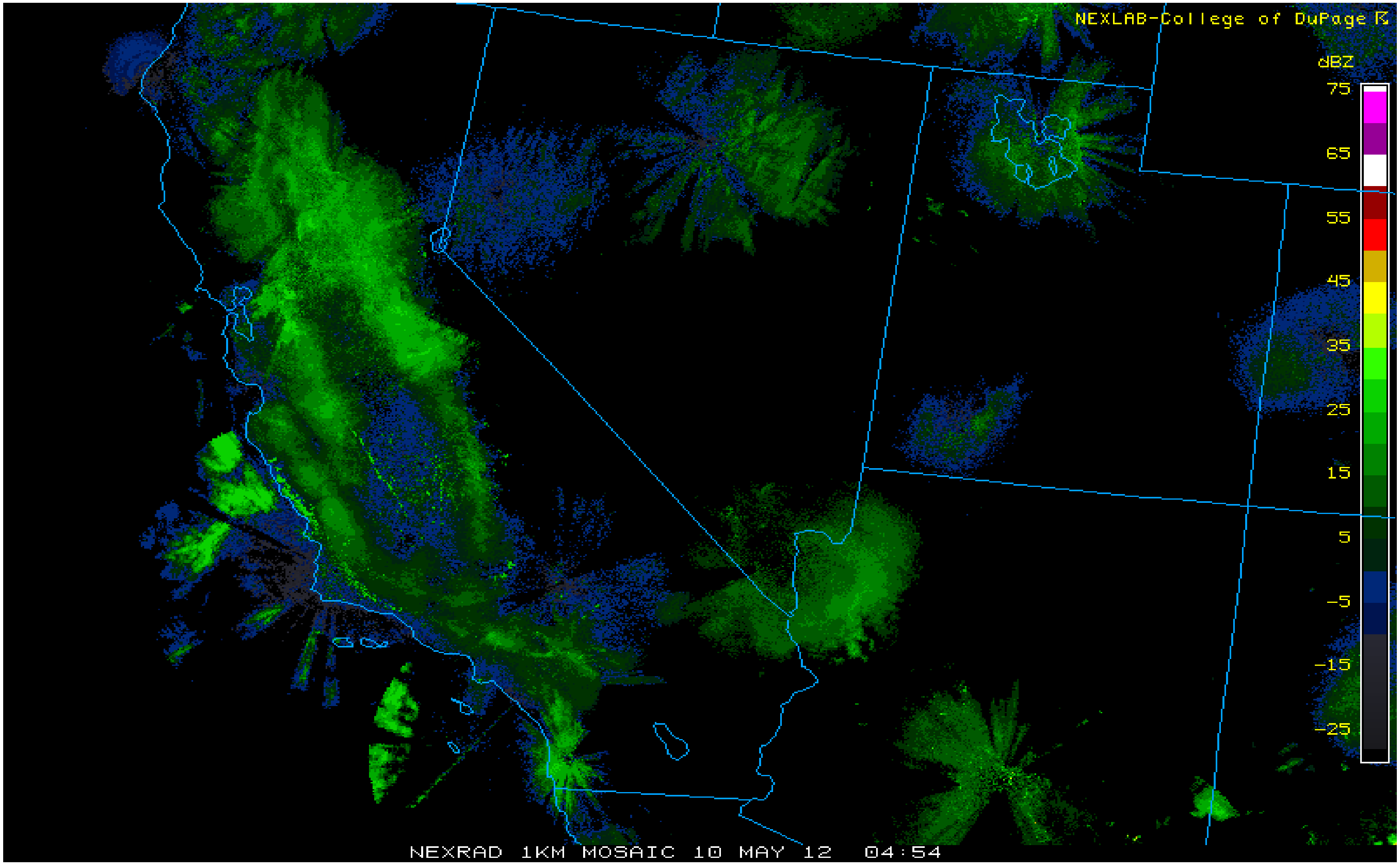


Figure 85. Southwest Region Radar Image, May 10, 2012—0500Z.

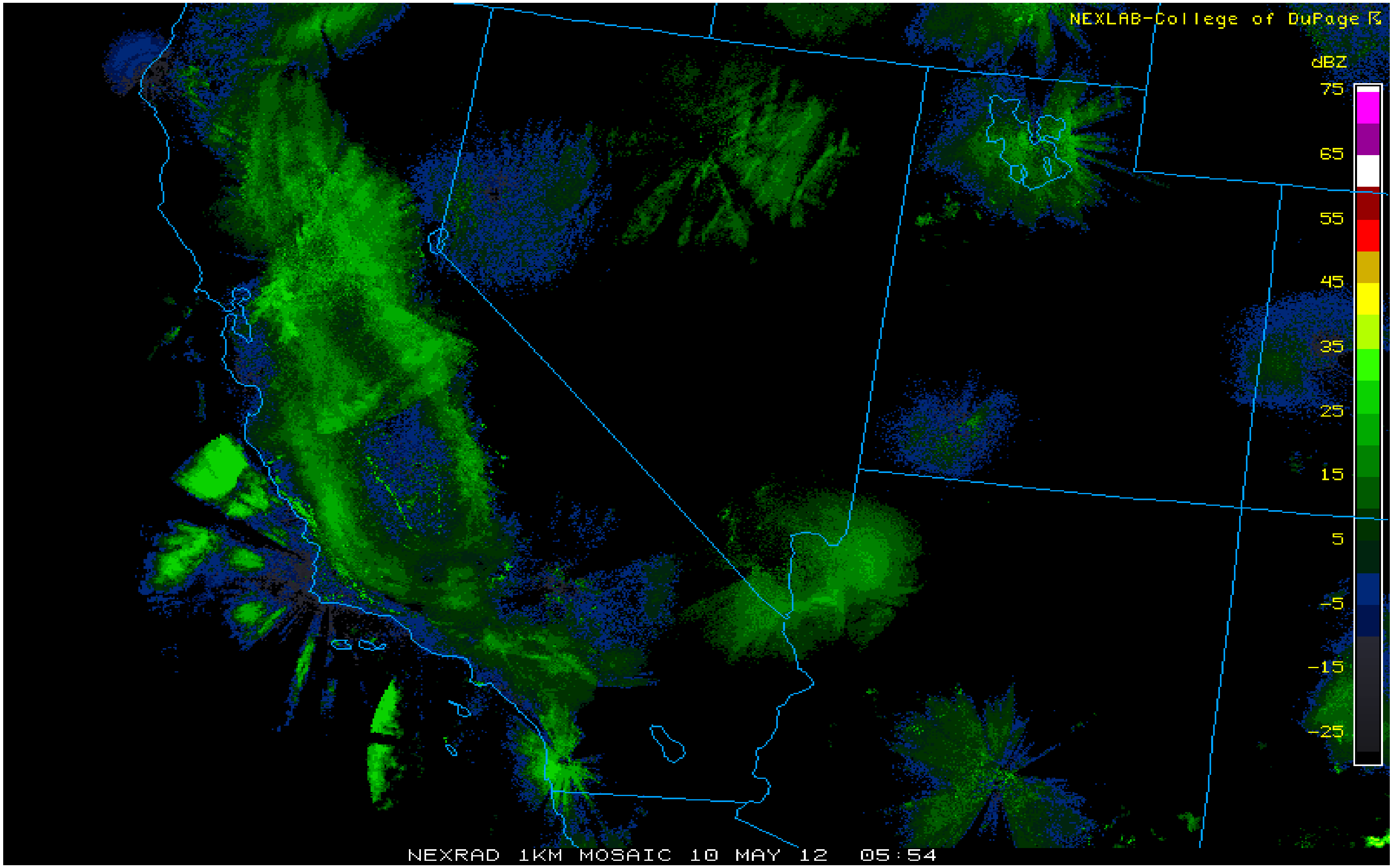


Figure 86. Southwest Region Radar Image, May 10, 2012—0600Z.

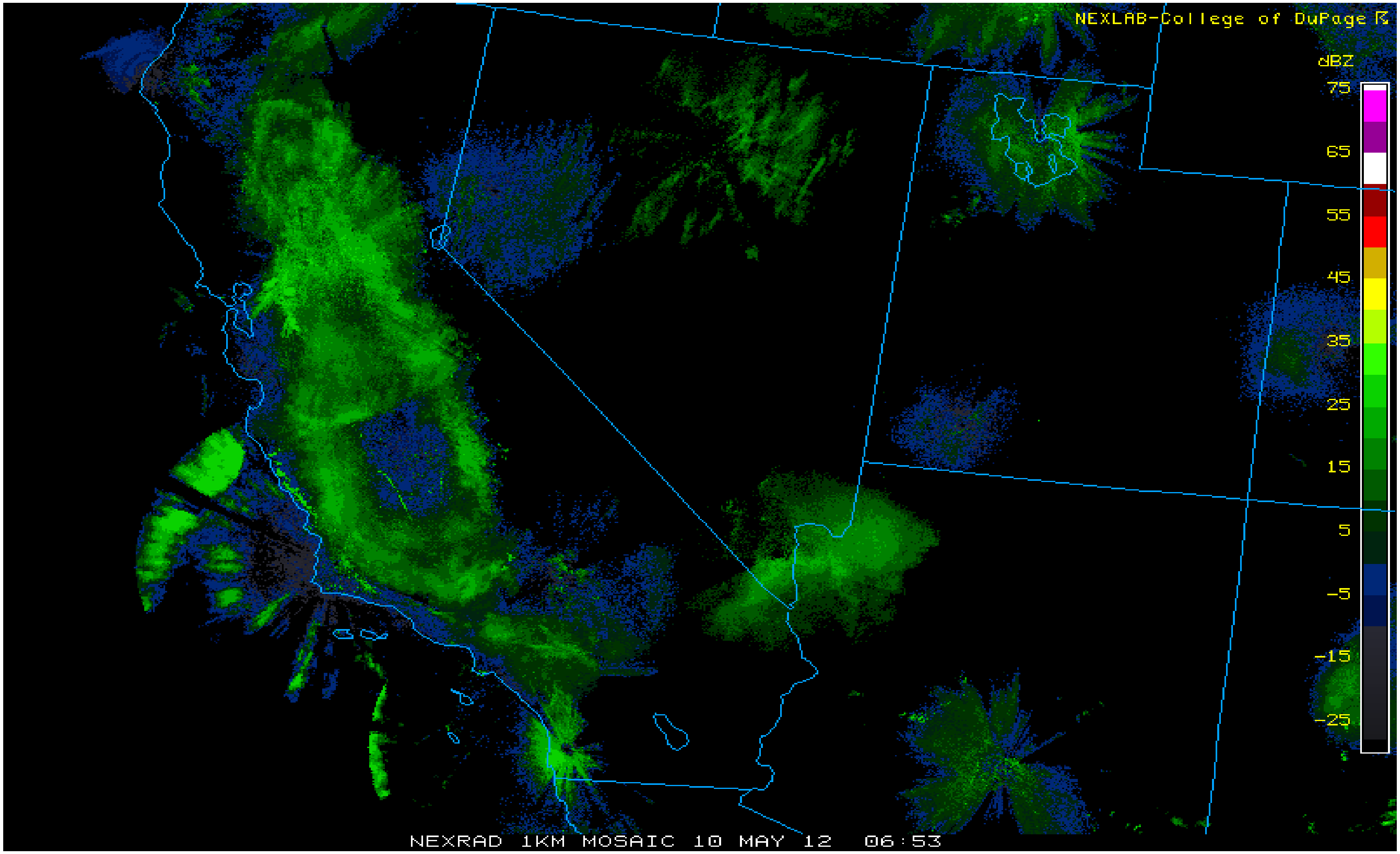


Figure 87. Southwest Region Radar Image, May 10, 2012—0700Z.

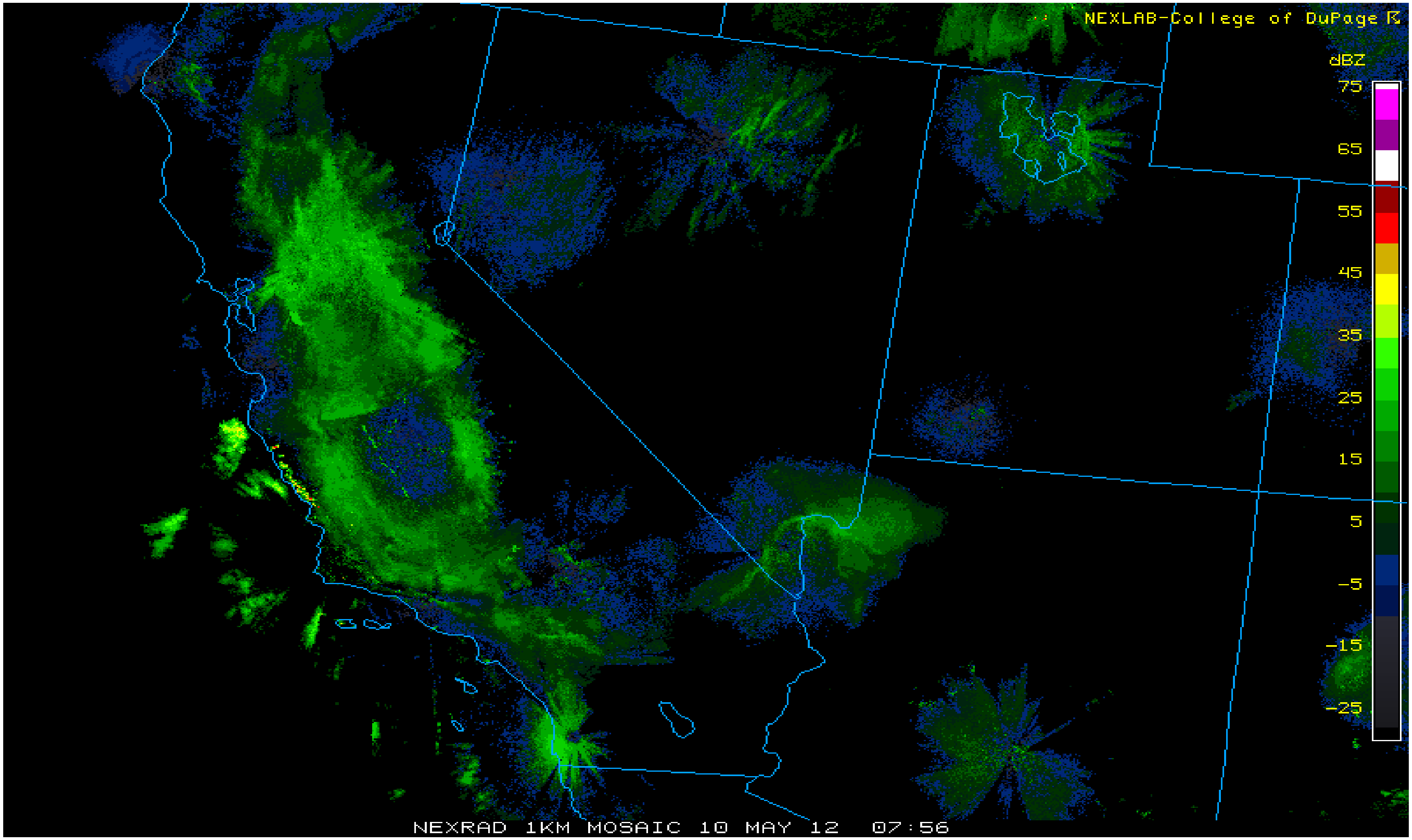


Figure 88. Southwest Region Radar Image, May 10, 2012—0800Z.

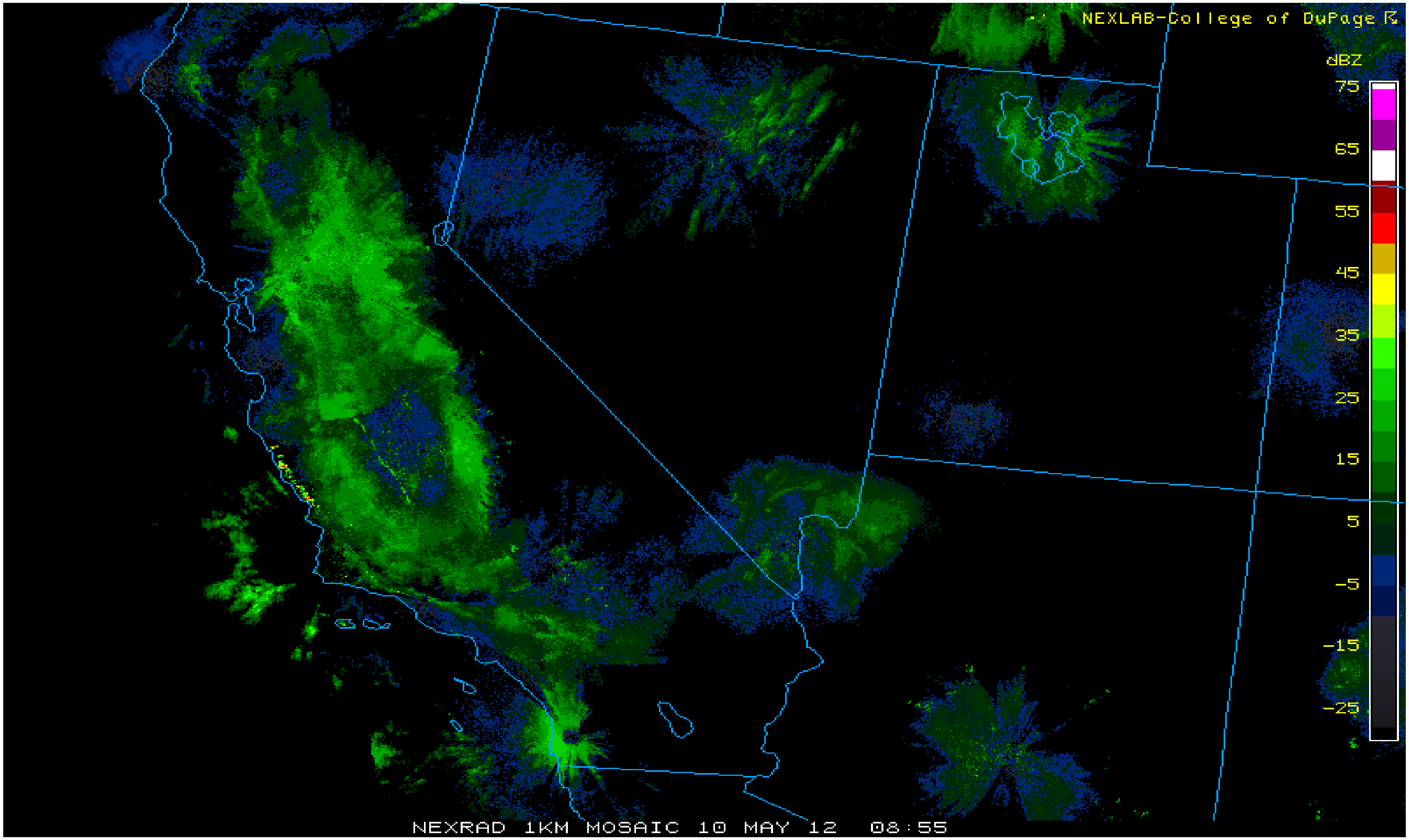


Figure 89. Southwest Region Radar Image, May 10, 2012—0900Z.

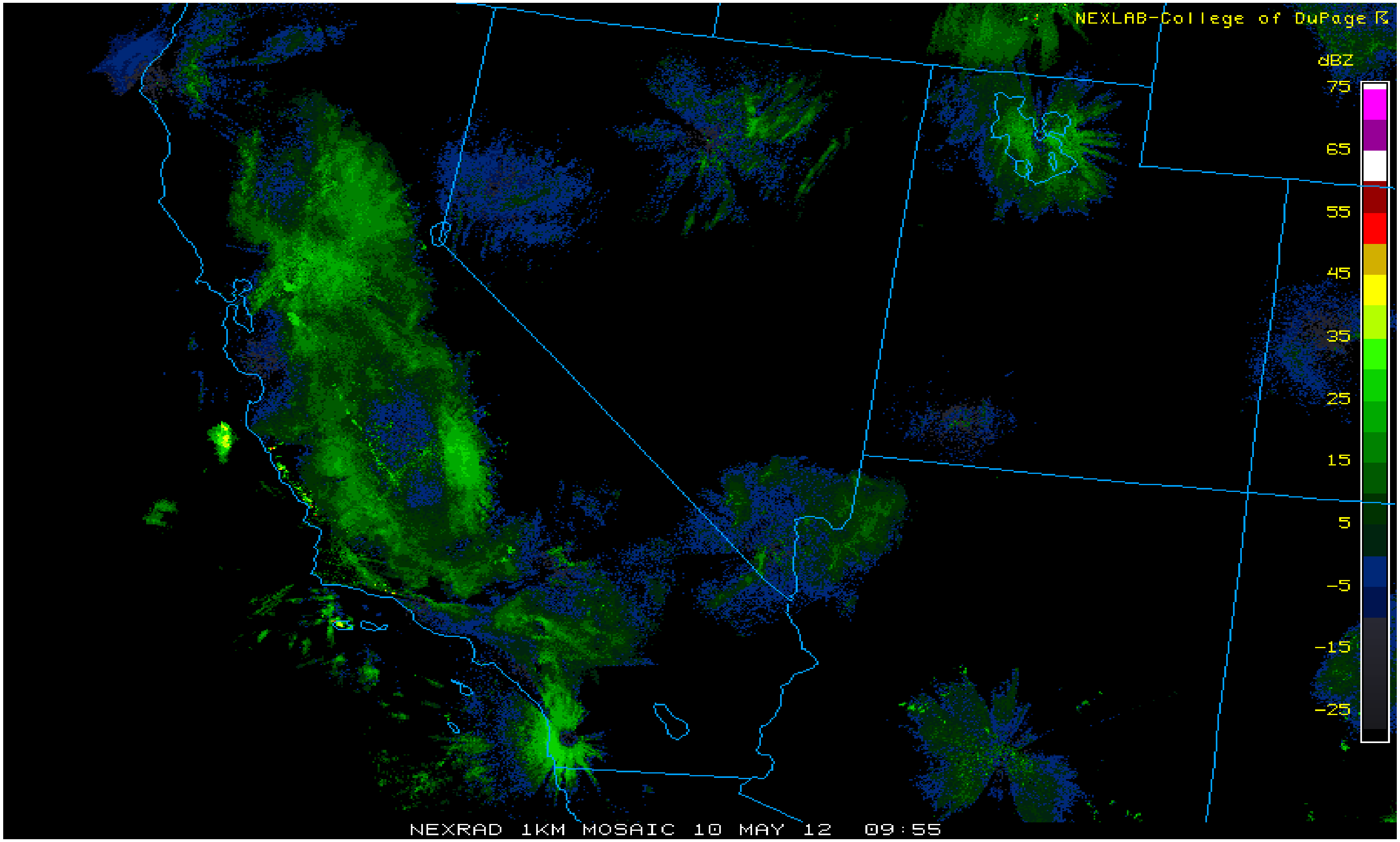


Figure 90. Southwest Region Radar Image, May 10, 2012—1000Z.

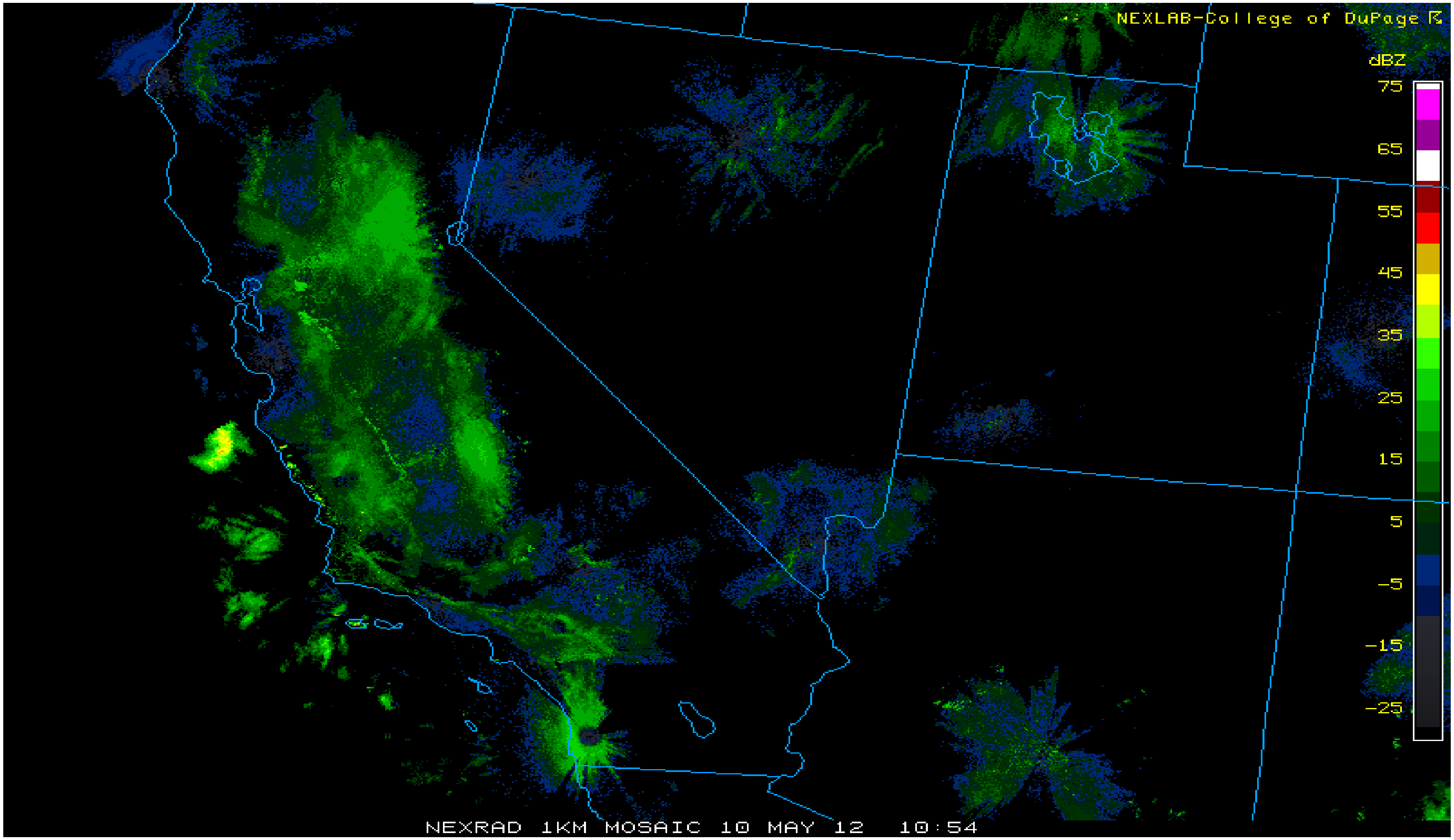


Figure 91. Southwest Region Radar Image, May 10, 2012—1100Z.

3.1.6 Weather After Event

Table 37 lists wind and PM_{10} data from the Jerome Mack station on May 11, 2012. The surface weather charts in Figures 92–95 show a cold front moving through Clark County, and the upper-air weather charts in Figures 96–104 show the low-pressure system over Arizona moving east and ridging over Nevada building in.

Table 37. Jerome Mack PM_{10} Concentration and Wind Data and McCarran Wind Data on May 11, 2012

Jerome Mack (Station 540) (hourly averages except for extreme speed gust)					McCarran International Airport (observations a few minutes before time shown)		
Time (PST)	PM_{10} ($\mu g/m^3$)	Wind Speed (mph)	Wind Direction (degrees)	Wind Gusts (mph)	Wind Speed (mph)	Wind Direction (degrees)	Wind Gust (mph)
1:00	64.8	5.2	168	13.5	20	220	29
2:00	30.2	3.9	166	11.4	14	190	
3:00	27.2	4.6	231	13.1	16	200	
4:00	30.8	5	256	13.2	10	220	
5:00	47.5	4	321	11.5	8	170	
6:00	84.2	2.8	17	13.6	6	210	
7:00	74.6	6.4	351	21.4	9	40	
8:00	58.9	5.1	339	15.7	10	360	
9:00	68.4	7.4	32	15.6	5	VR	
10:00	48.7	5.5	48	14.4	5	VR	
11:00	44.3	4.3	53	17.4	0	0	
12:00	40.5	2	19	13.7	5	VR	
13:00	38.9	0.5	60	14.1	0	0	
14:00	34.6	1.8	103	12.5	5	200	
15:00	26.4	2.7	143	13.4	5	VR	
16:00	37.2	3.9	203	16.2	10	180	
17:00	33.7	6.2	200	15	3	190	
18:00	29.6	4.9	192	16	3	VR	
19:00	36.2	3.4	179	8.4	7	190	
20:00	44.7	3.6	180	9	9	220	
21:00	40.5	2.4	126	6.2	7	250	
22:00	59	1.4	7	6.5	9	250	
23:00	58	2.5	286	6.3	0	0	

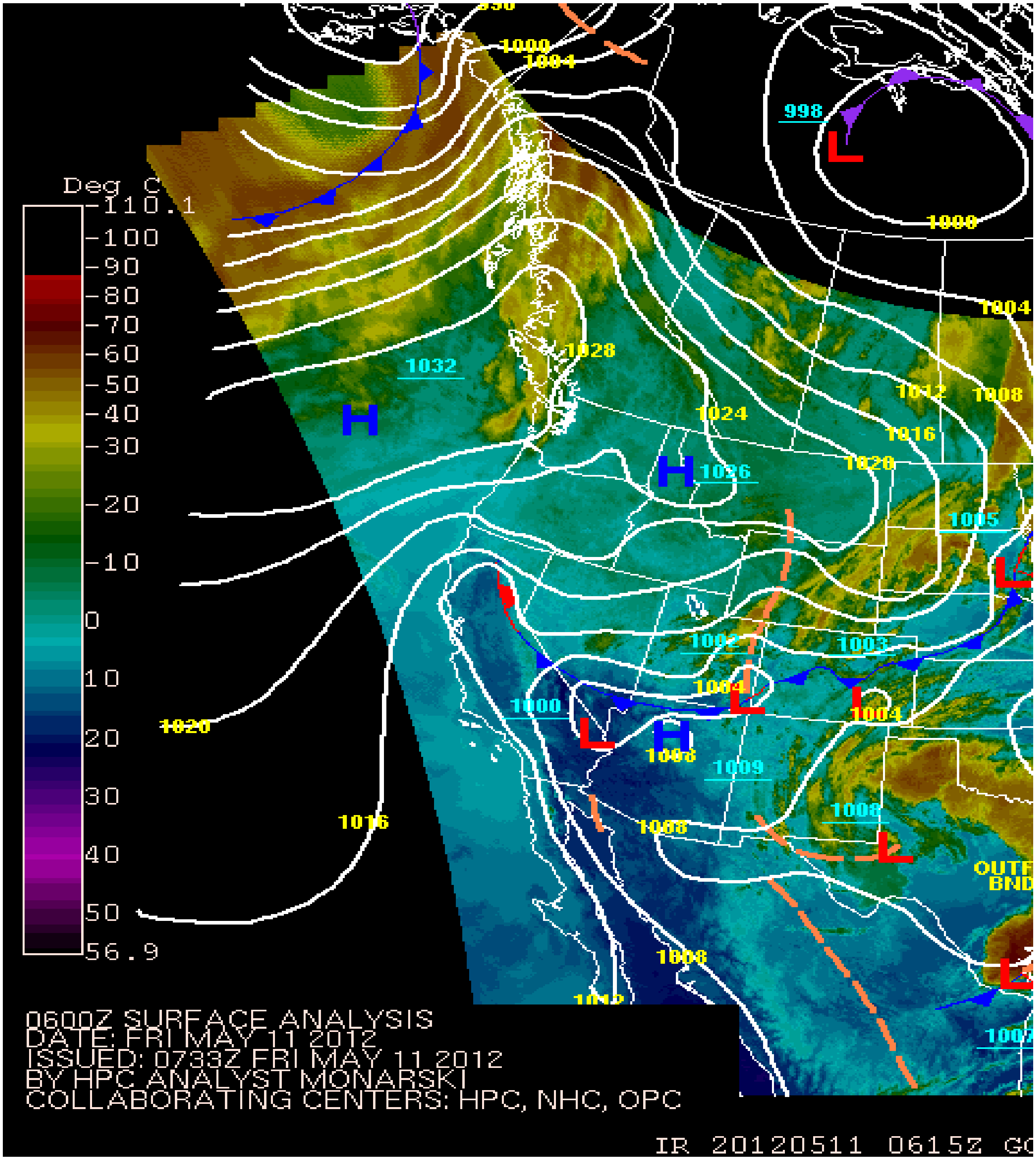


Figure 92. Surface Weather Charts After Event, May 11, 2012—0600Z.

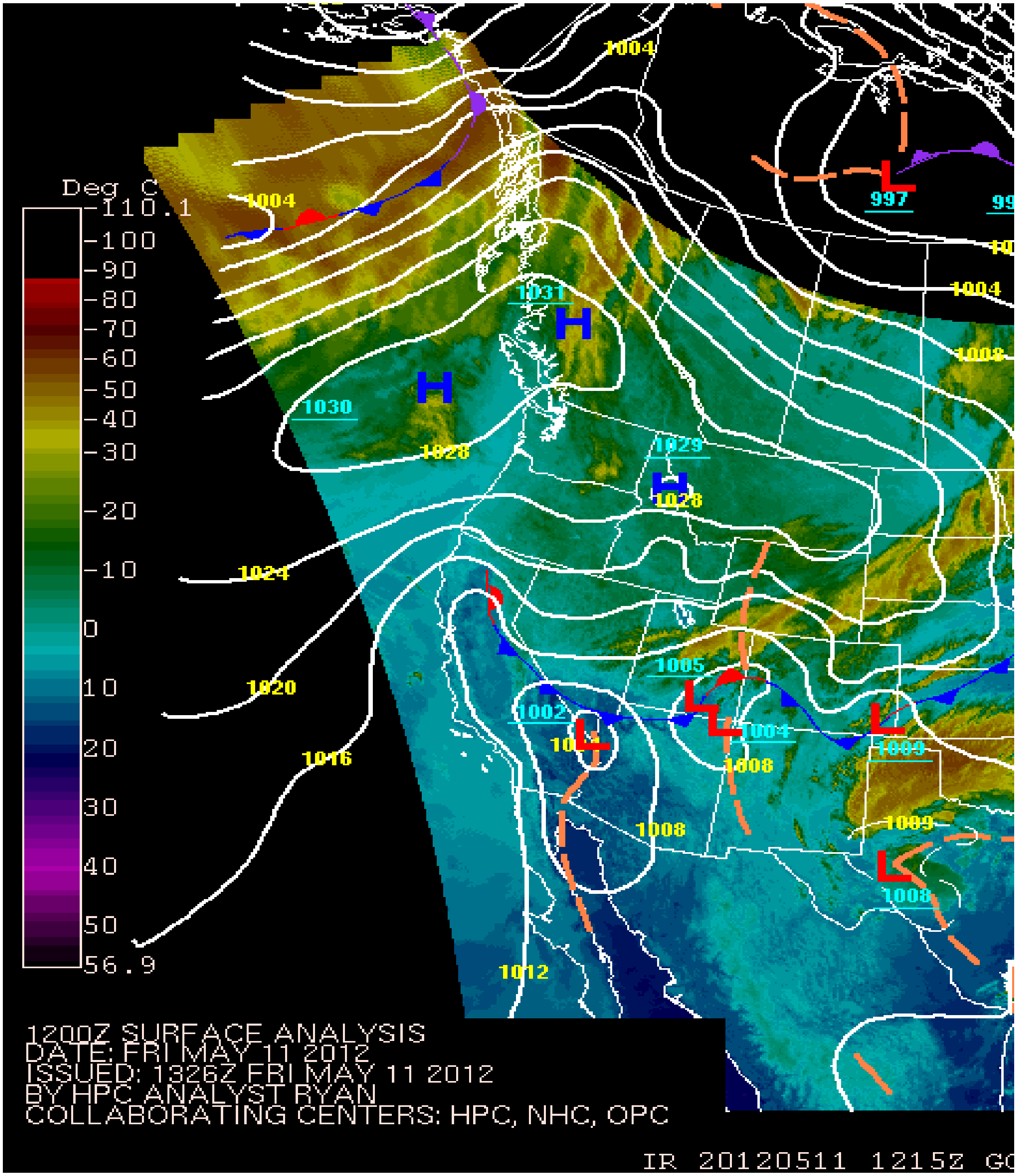


Figure 93. Surface Weather Charts After Event, May 11, 2012—1200Z.

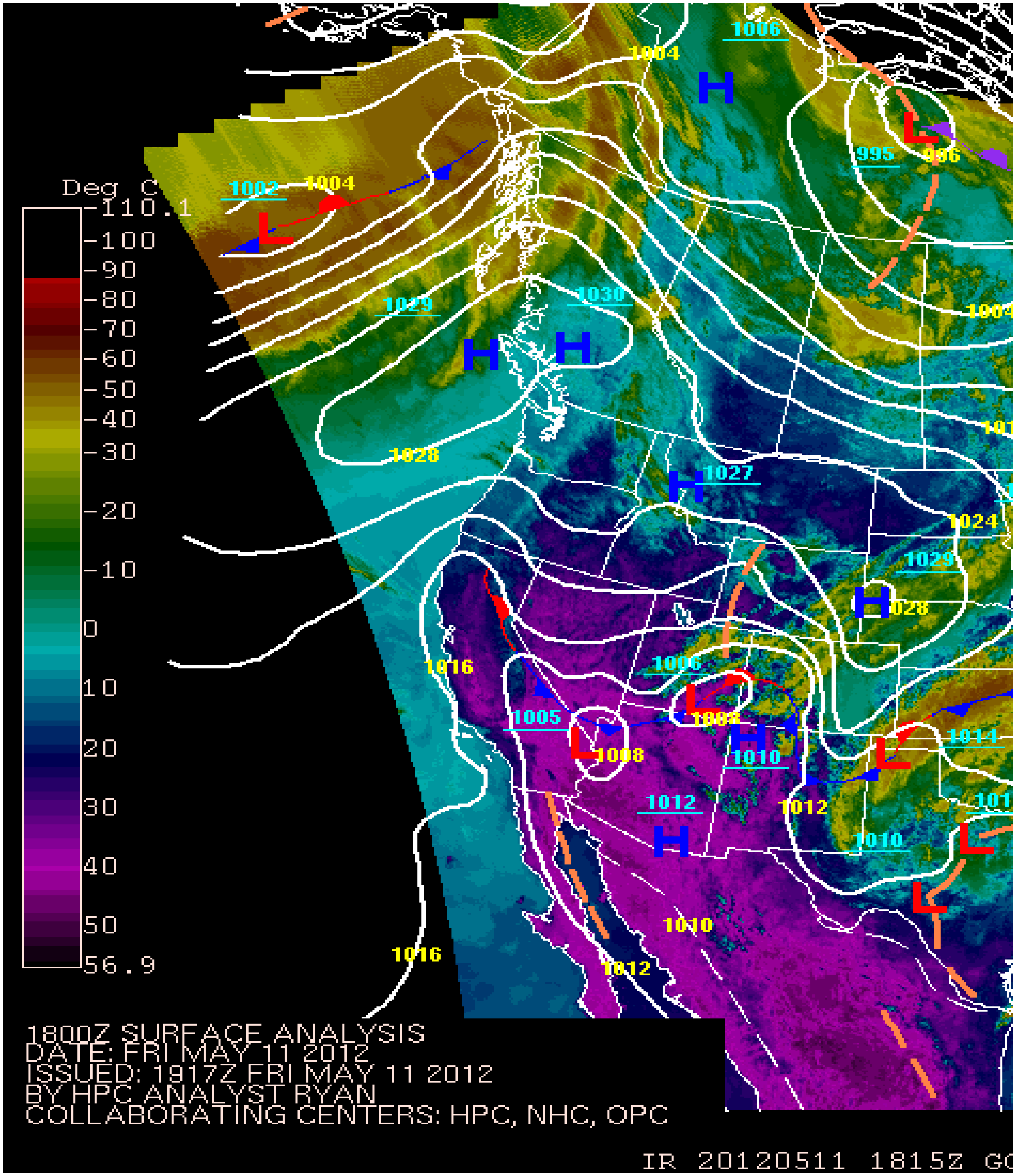


Figure 94. Surface Weather Charts After Event, May 11, 2012—1800Z.

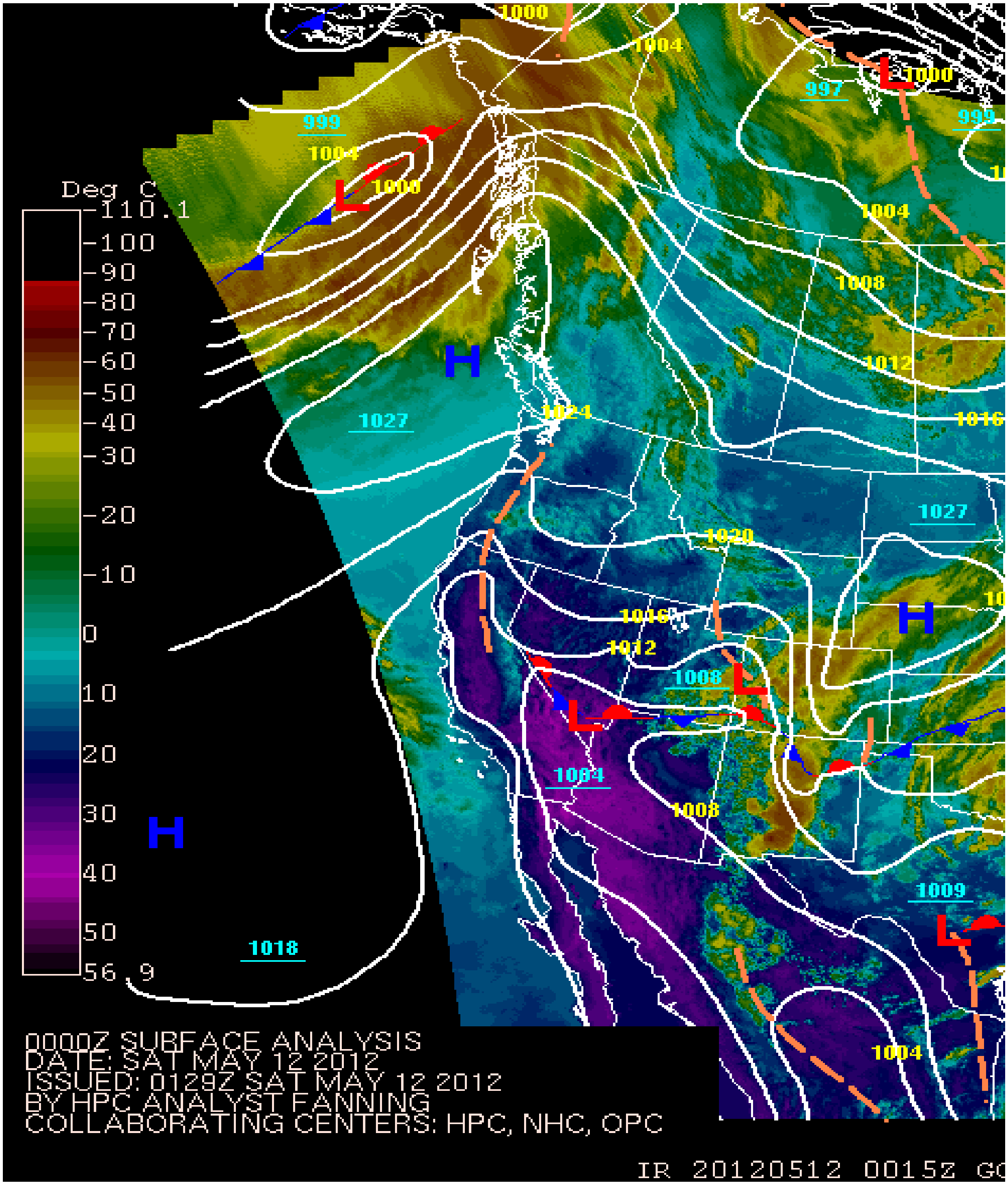


Figure 95. Surface Weather Charts After Event, May 12, 2012—0000Z.

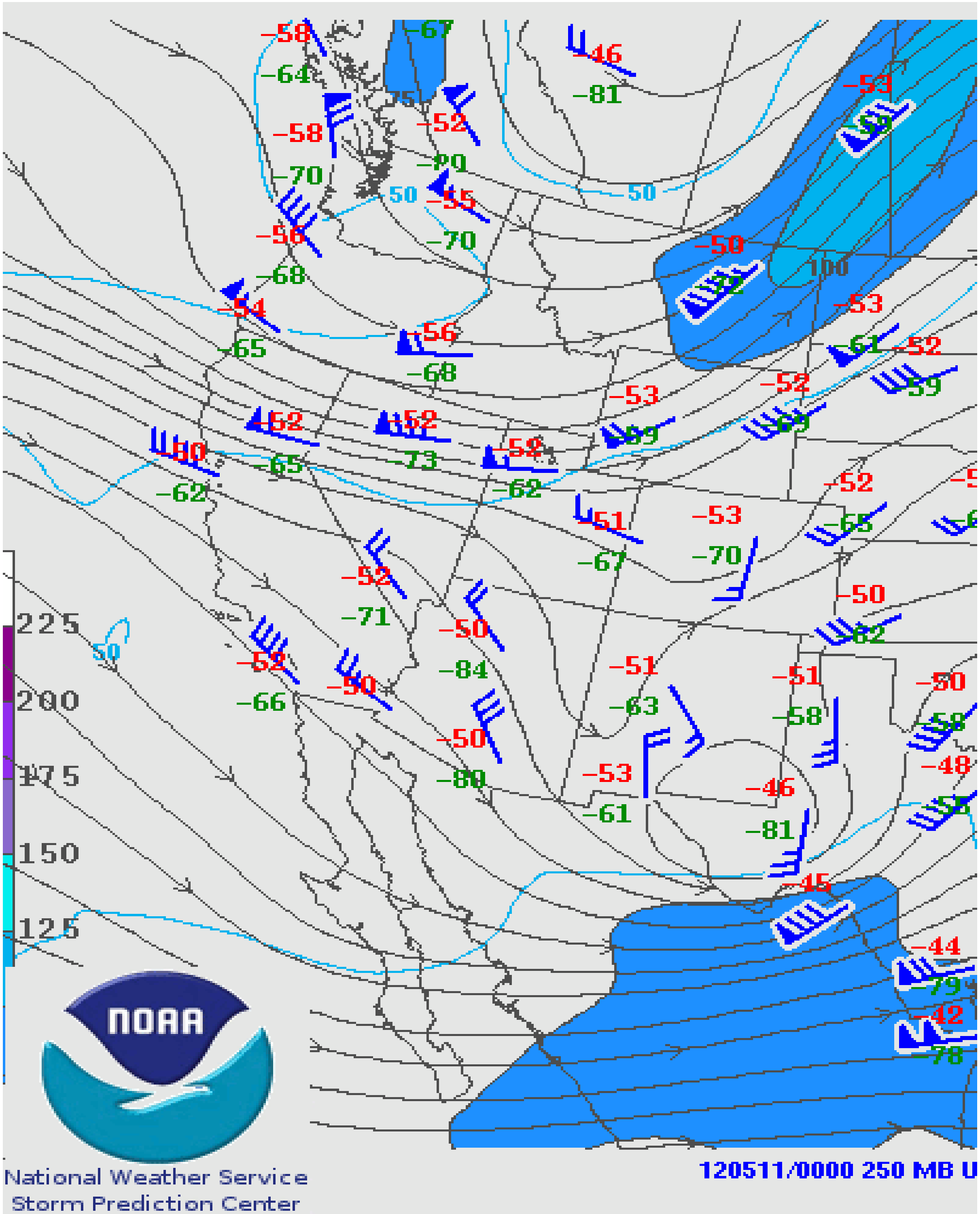


Figure 96. 250-mb Weather Chart After Event, May 11, 2012—0000Z.

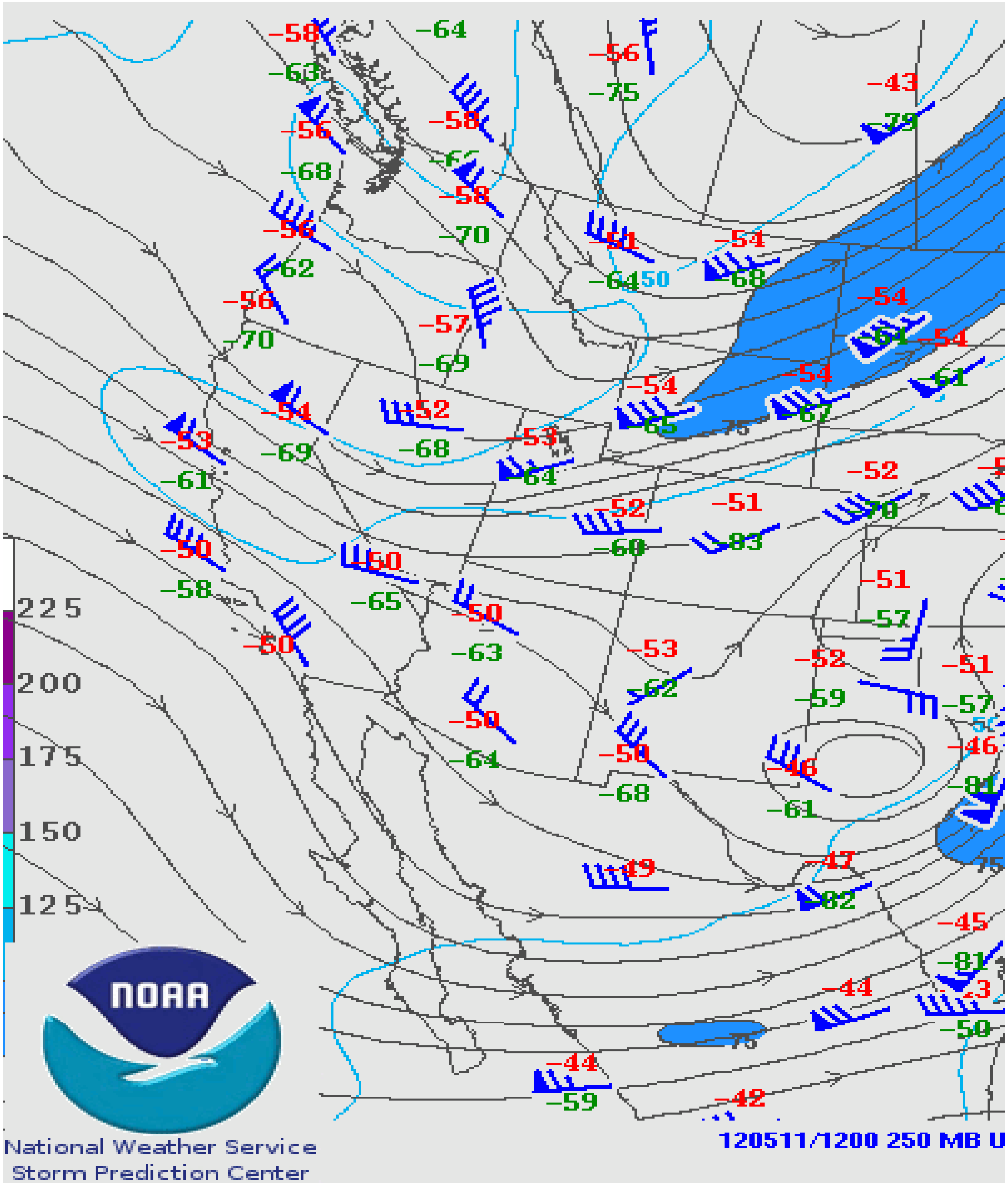


Figure 97. 250-mb Weather Chart After Event, May 11, 2012—1200Z.

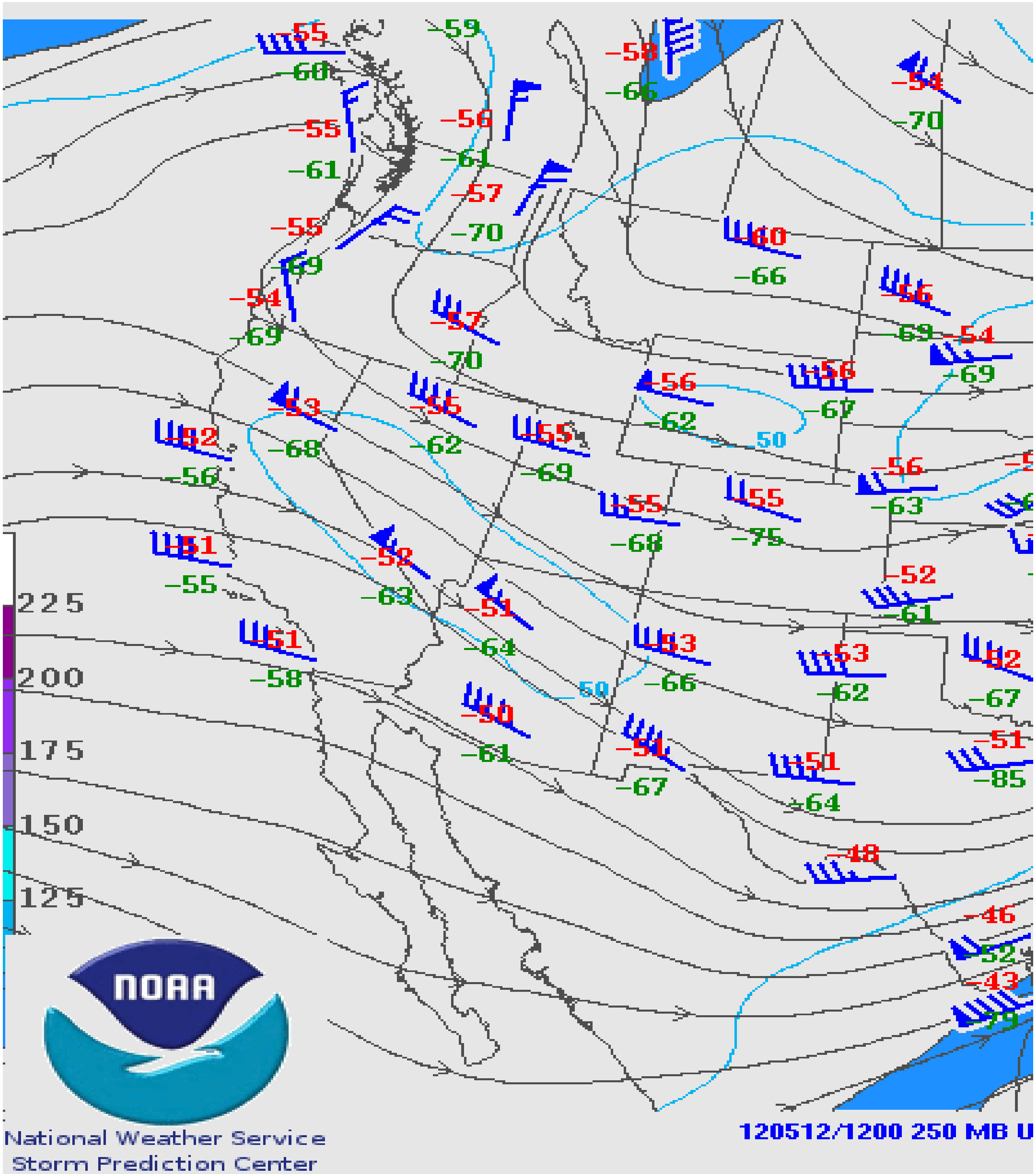


Figure 98. 250-mb Weather Chart After Event, May 12, 2012—1200Z.

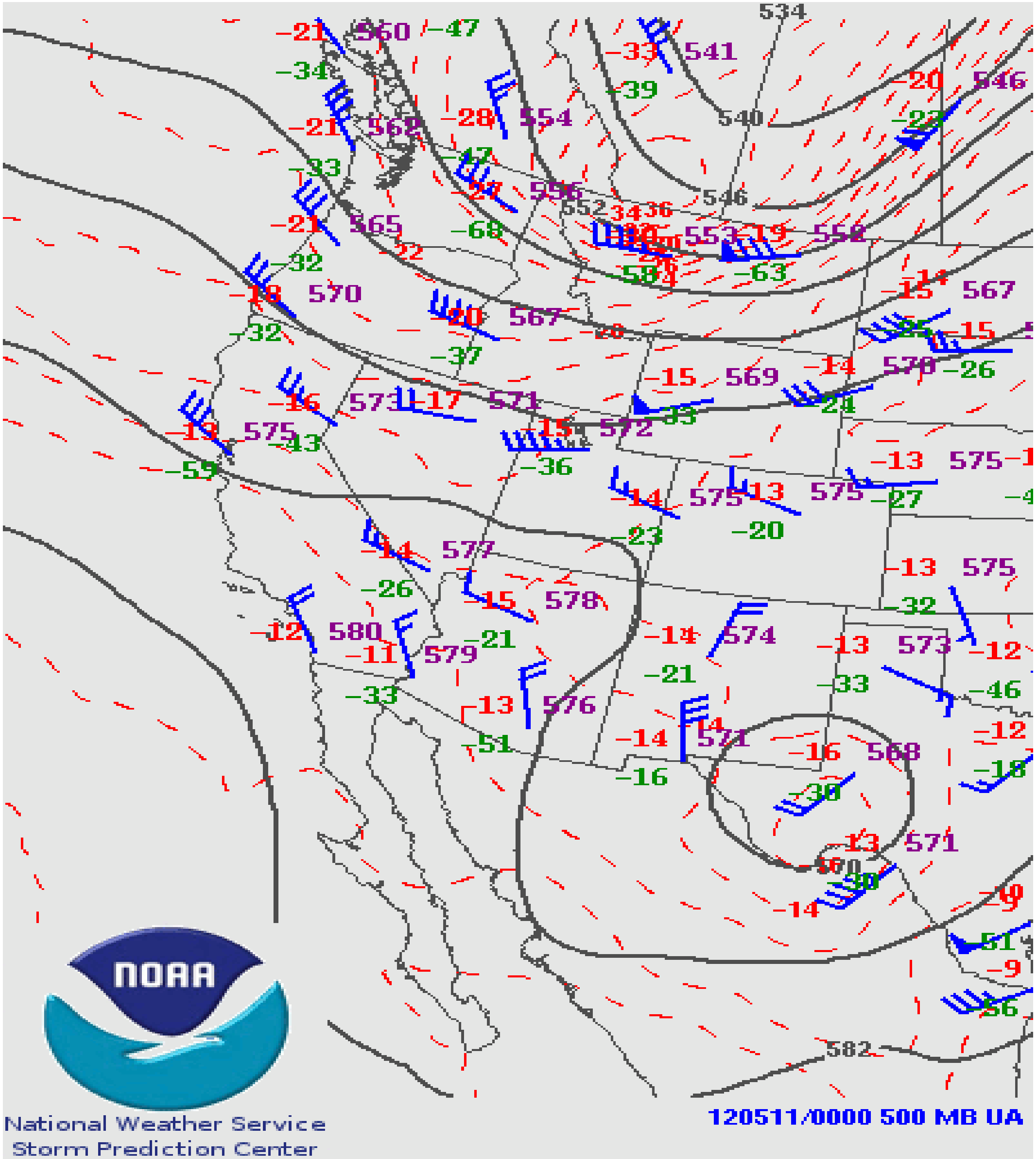


Figure 99. 500-mb Weather Chart After Event, May 11, 2012—0000Z.

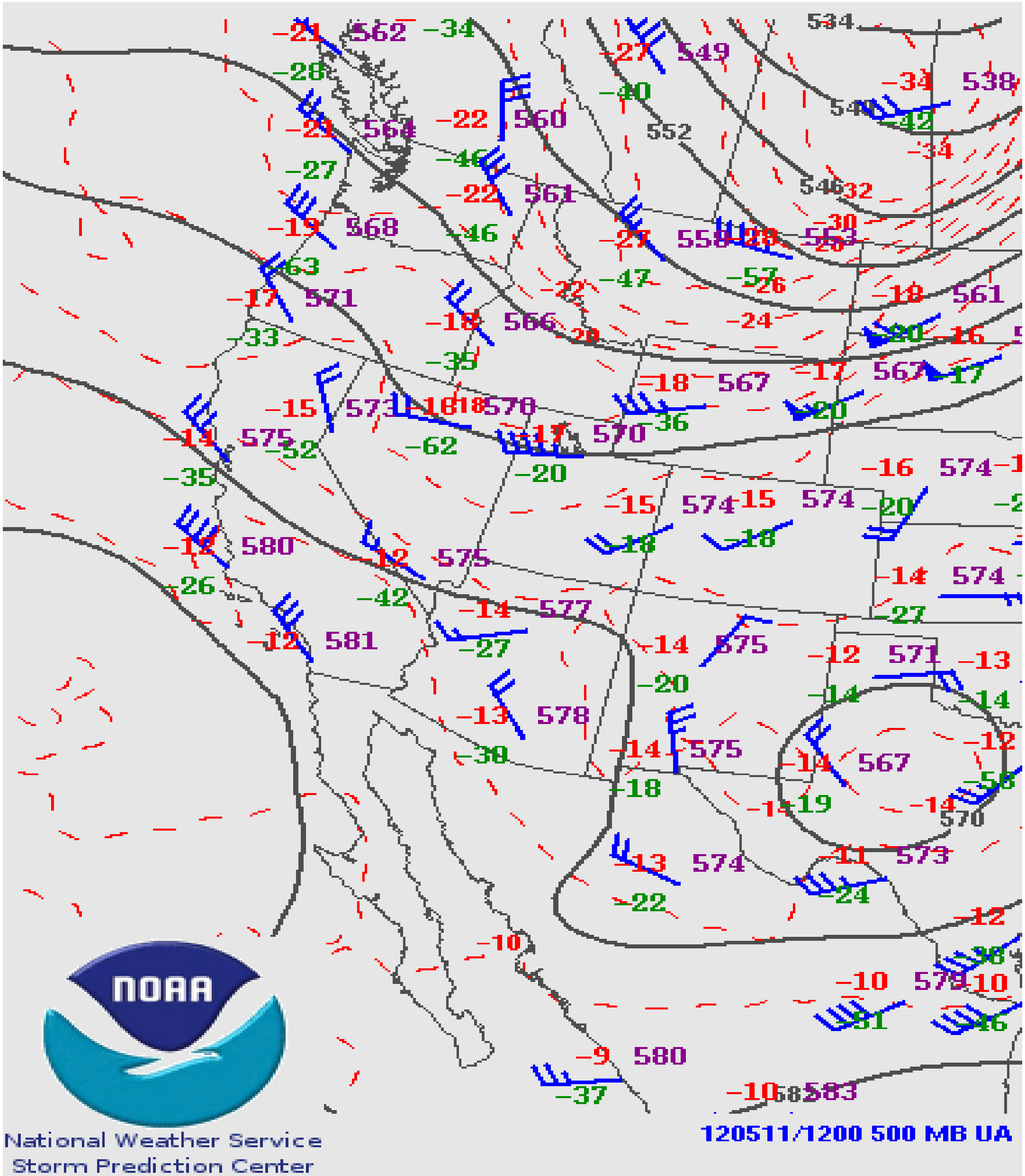


Figure 100. 500-mb Weather Chart After Event, May 11, 2012—1200Z.

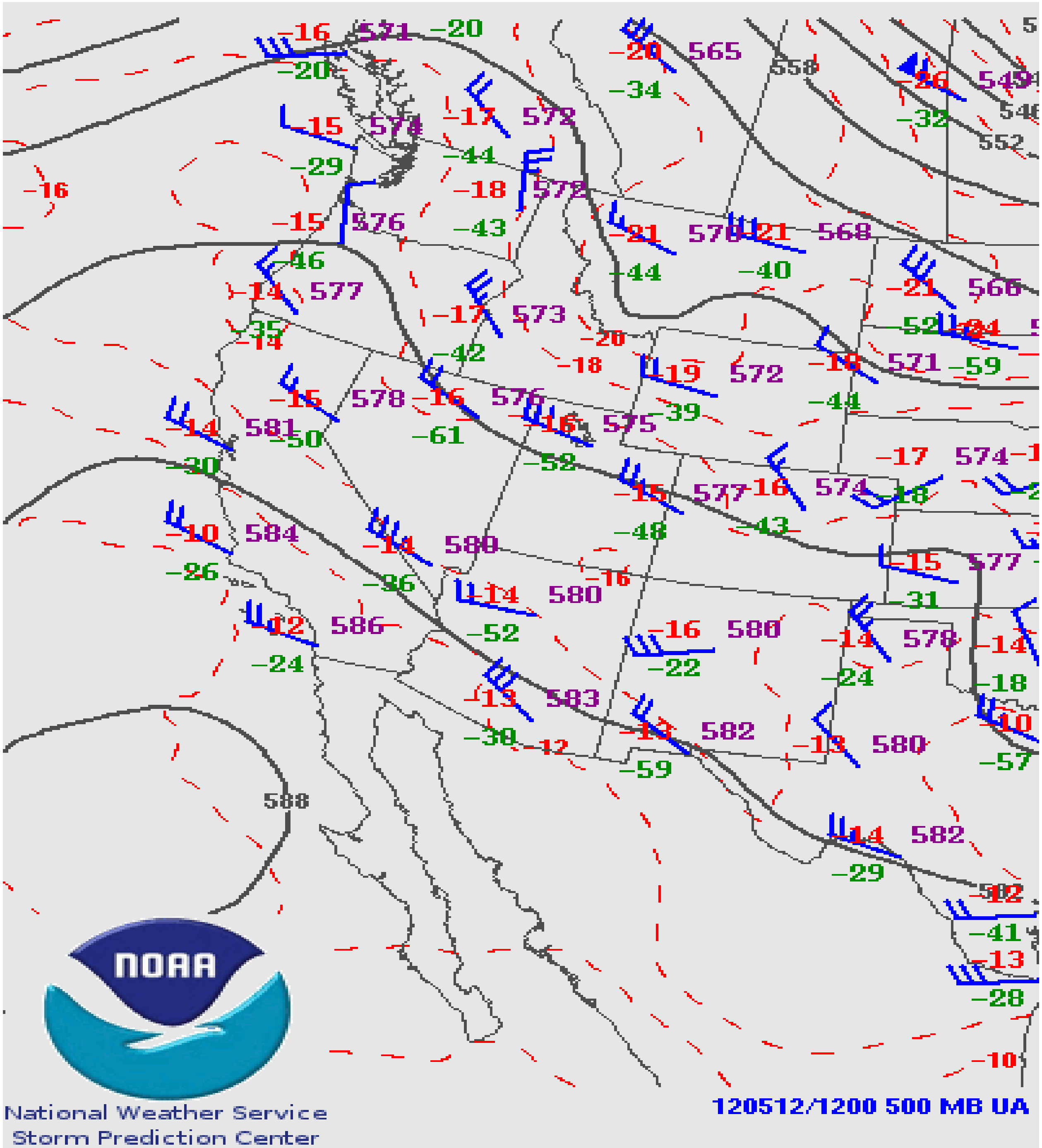


Figure 101. 500-mb Weather Chart After Event, May 12, 2012—1200Z.

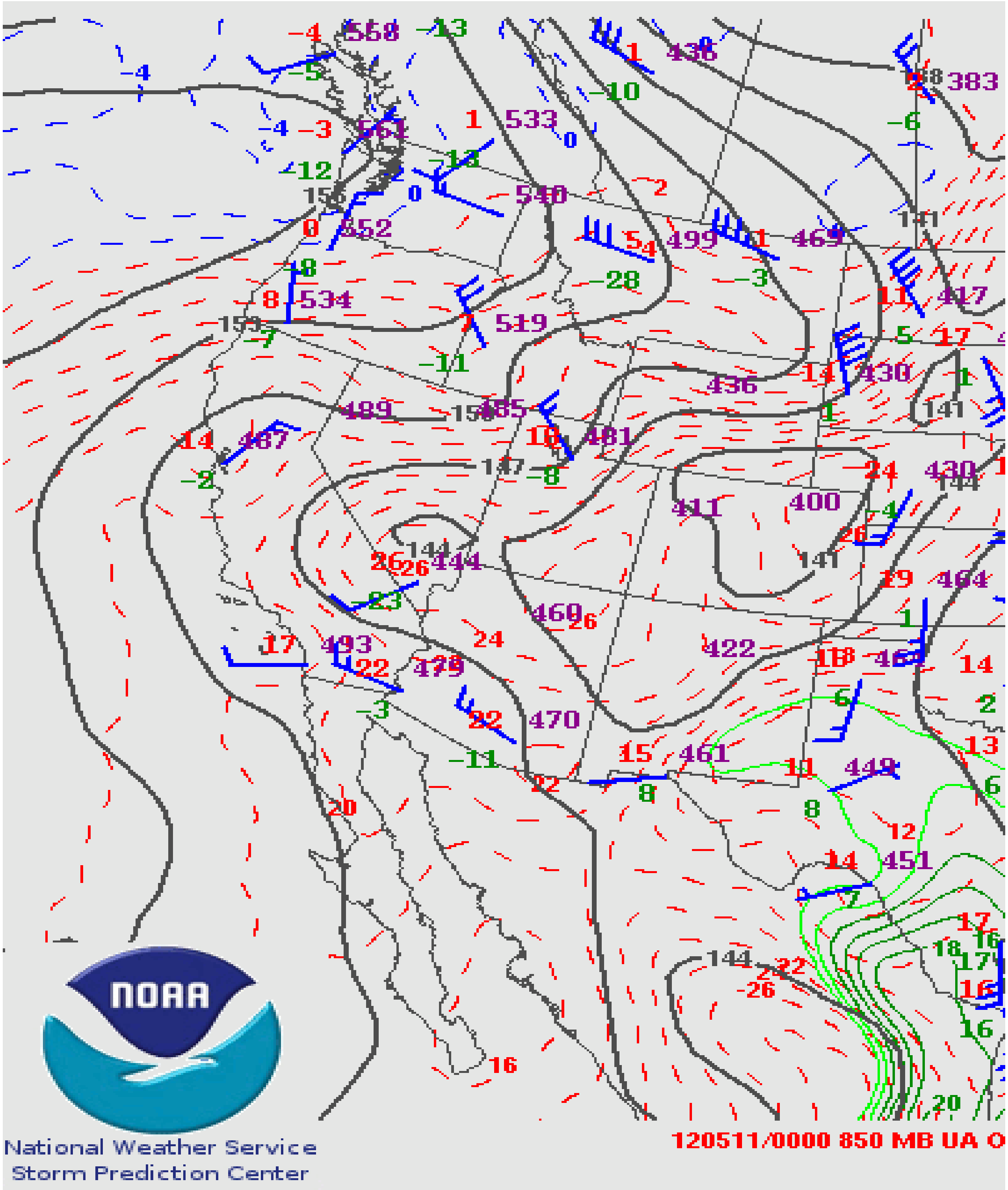


Figure 102. 850-mb Weather Chart After Event, May 11, 2012—0000Z.

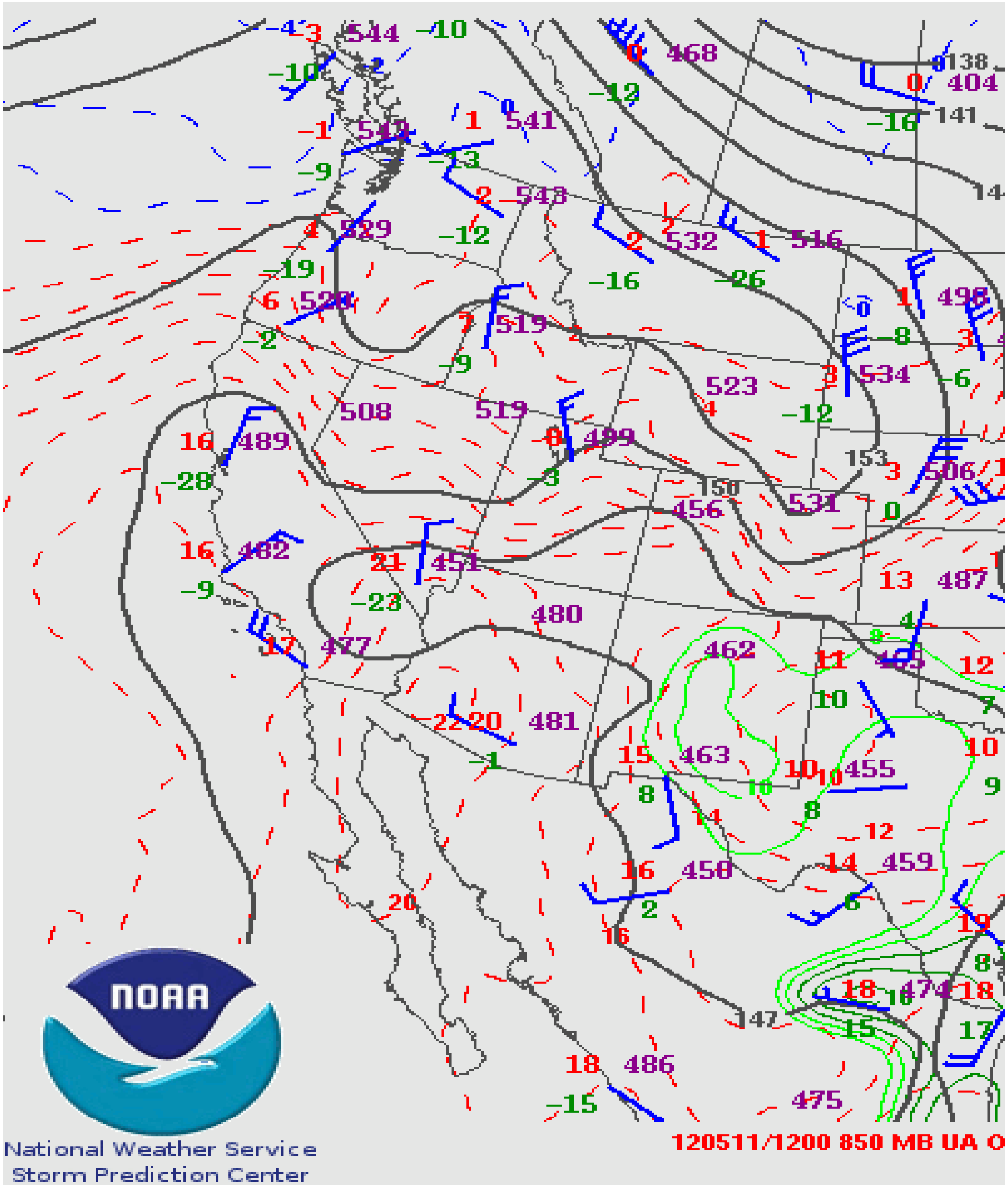


Figure 103. 850-mb Weather Chart After Event, May 11, 2012—1200Z.

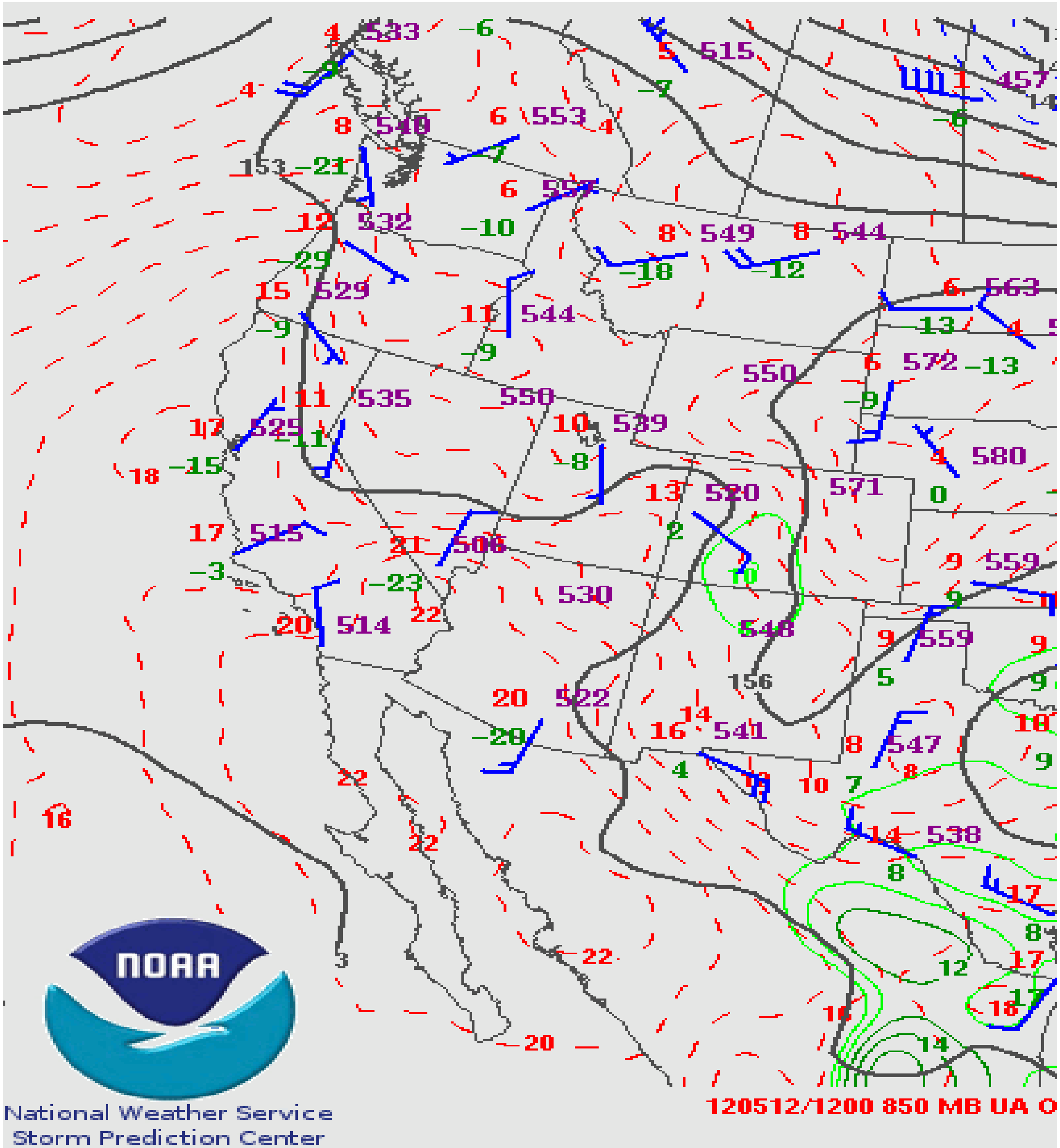


Figure 104. 850-mb Weather Chart After Event, May 12, 2012—1200Z.

3.2 MEDIA COVERAGE

The Clark County media is diligent about informing the public at large of air quality forecasts and giving advice to residents without direct access to the Internet. The *Las Vegas Sun* ran an article on May 10, 2012, at 11:00 AM PDT (updated at 2:11 PM PDT) titled "Hazy Skies over Vegas Valley Prompt Health Warning" that reiterated the air quality warnings published by DAQ (Appendices A and C). The *Las Vegas Review-Journal* ran an article during the event titled "Hazy Skies Prompt Alert in Valley," which gave the cause of the transported dust storm as desert storm conditions from Arizona that transported dust and haze to the Las Vegas and Eldorado Valleys. The local paper in Kingman, Arizona, the *Daily Miner,* ran an article on May 10 titled "Dust Caused by Storms in Phoenix," which ascribed the dust in Kingman, Arizona, and Las Vegas, Nevada to the thunderstorms in Arizona. The Web site of Fox 5 Television in Las Vegas (KVVU) posted an article on May 10, 2012, at 3:50 PM titled "Air Quality Alert Remains in Effect" that discussed particulate matter and possible sources of the area's haze and dust.

Appendix A contains a news release sent out by the Clark County Public Information Office during the transported dust event. DAQ published both dust advisories and an updated air quality alert on May 10, 2012. A video titled "Air Advisory for Dust, Wildfire Smoke Revised to Alert Status" is provided on DVD as Appendix D. It describes the conditions causing the transported dust in Las Vegas as a result of a desert storm in northwestern Arizona.

4.0 EMISSIONS SOURCES AND ACTIVITY

4.1 BOULDER CITY

The Boulder City monitoring site (CAMS 0601, EPA 32-003-0601) (Figure 105) is located in the northwest part of the Eldorado Valley at the southeast entrance to the Las Vegas Valley (Figure 4), in a predominantly industrial business area with commercial amenities. Figures 106–109 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 m south of the site and a lightly traveled road (Industrial Road) approximately 50 m 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 site's area of influence, which has blocked accesses and is stabilized. 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 predominant wind direction is normally 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 highest exceedance concentration values in the entire PM_{10} network, recording a 24-hour PM_{10} value of 314 $\mu g/m^3$ on May 10.

Figure 105. Boulder City Monitoring Site (EPA 32-003-0601)—Street View.

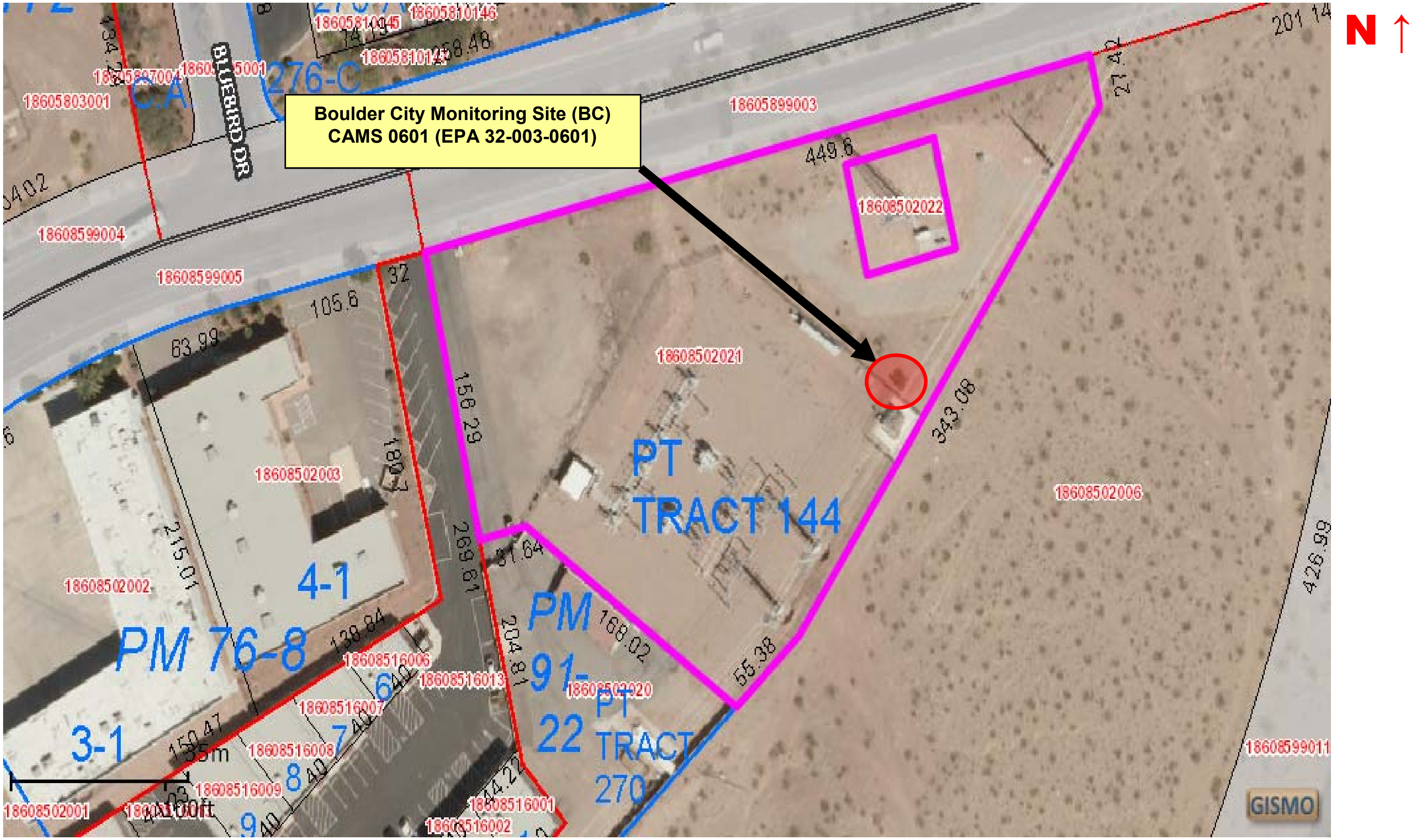


Figure 106. Boulder City Monitoring Site—Aerial View #1.

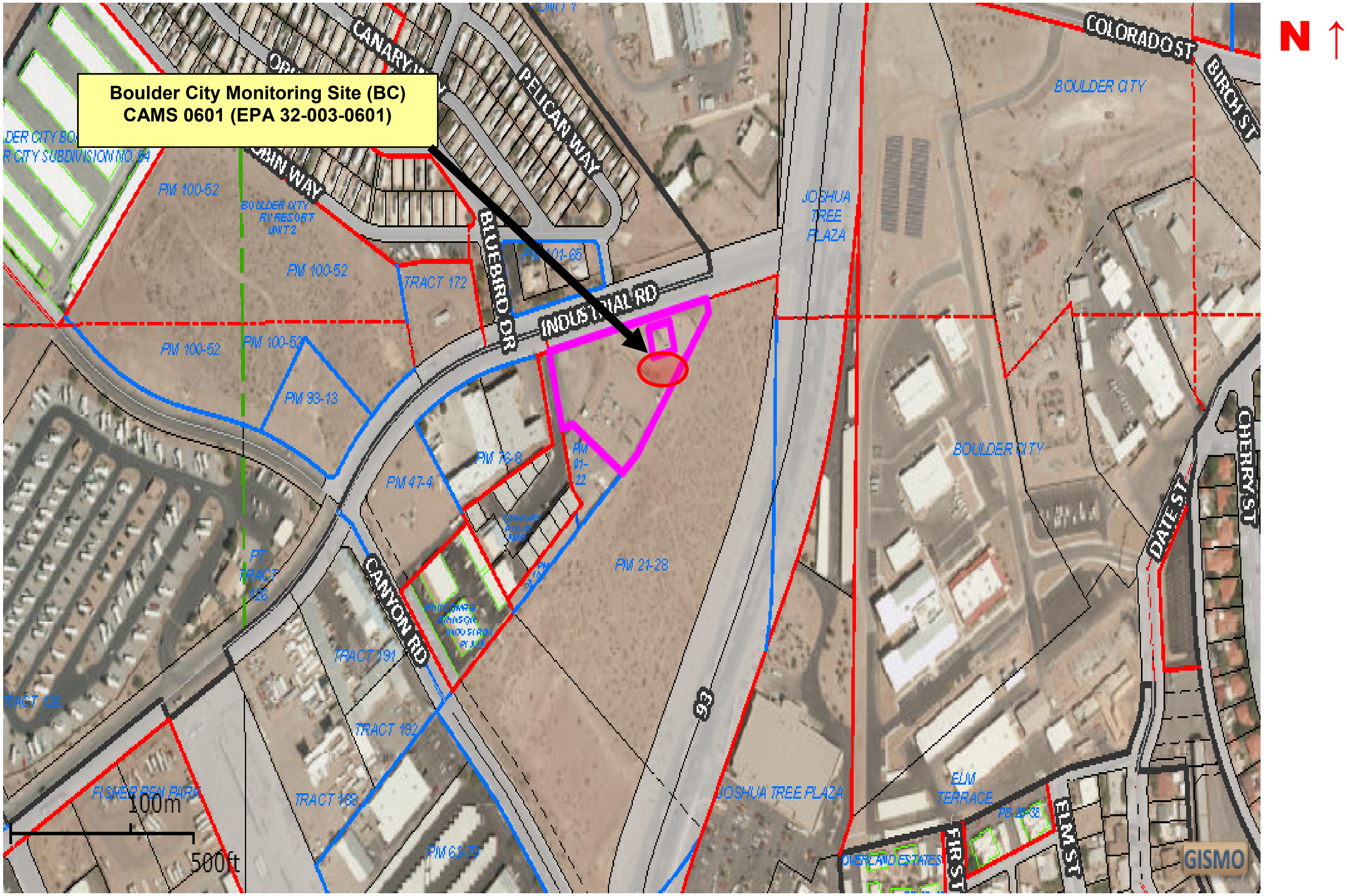


Figure 107. Boulder City Monitoring Site—Aerial View #2.

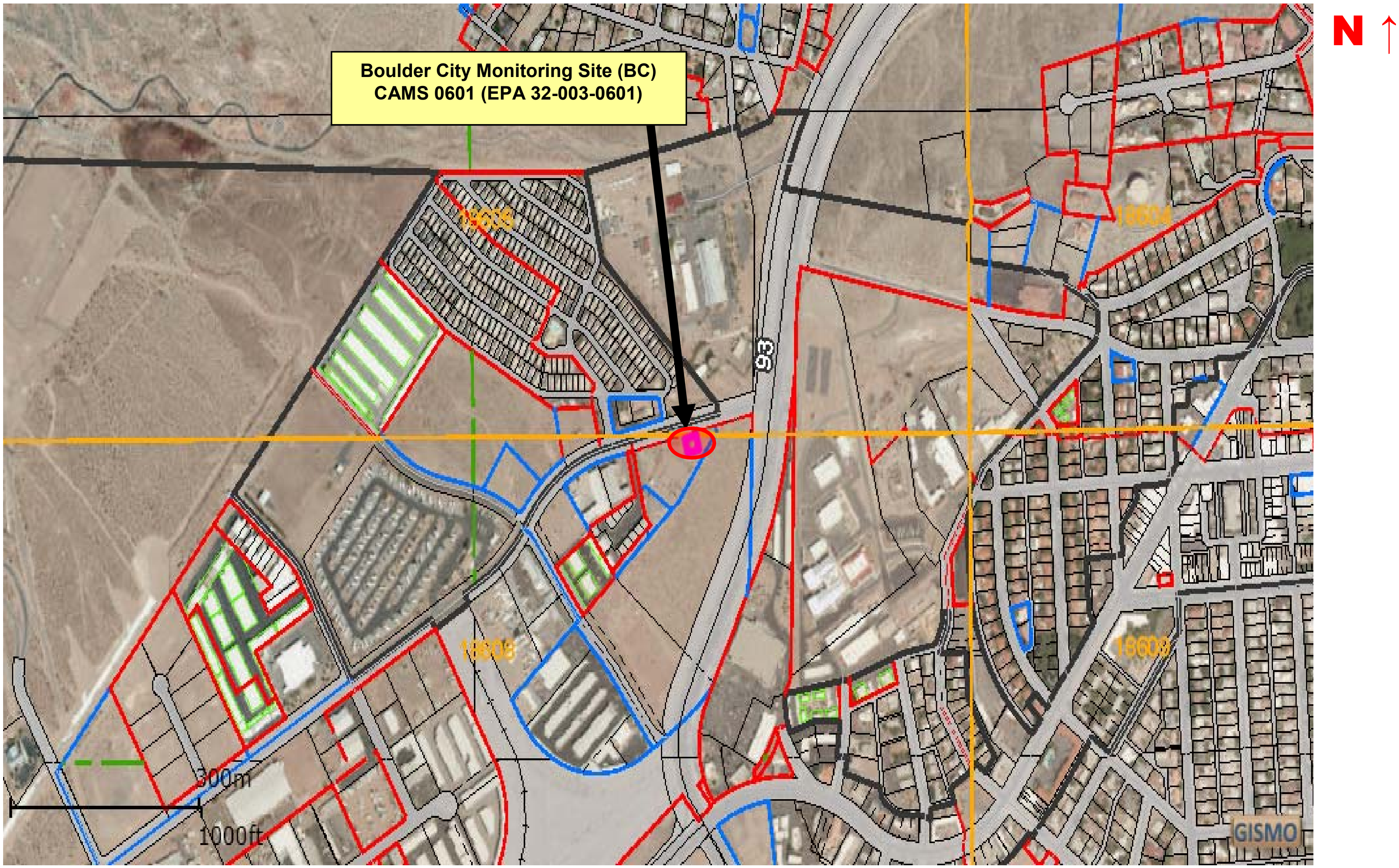


Figure 108. Boulder City Monitoring Site—Aerial View #3.

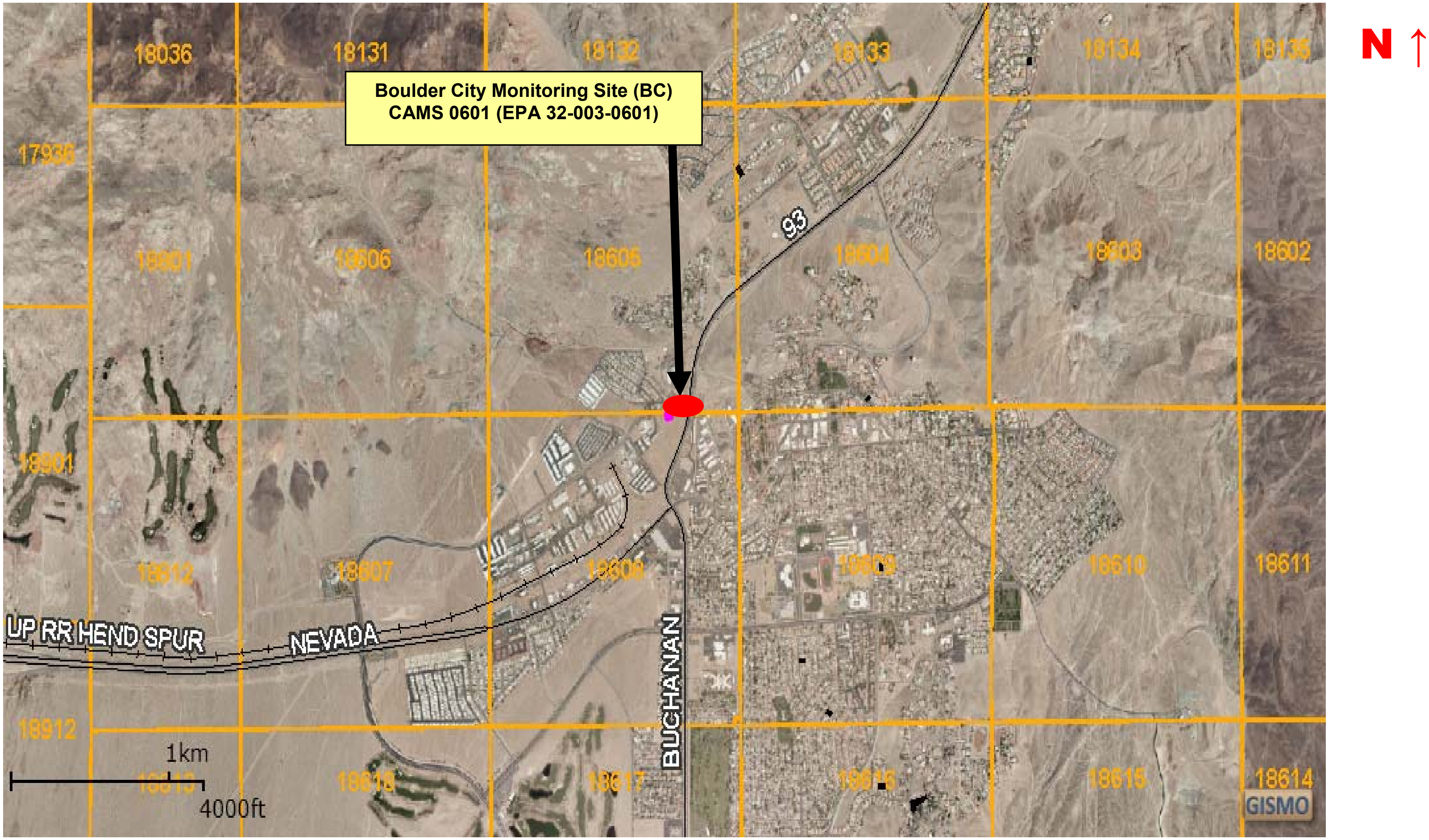


Figure 109. Boulder City Monitoring Site—Aerial View #4.

4.2 JEROME MACK (NCORE)

The Jerome Mack monitoring site (CAMS 0540, EPA 32-003-0540) (Figure 110) is located in the southeastern part of the Las Vegas Valley (Figure 4), in a predominantly older urban development area. Most of the apartments and single-family housing units were built in the 1970s to early 2000s. Figures 111–114 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 ft. north of the site. Both roads are heavily traveled most of the day. Since there are many wood-burning fireplaces within a three-mile radius of the site, $PM_{2.5}$ concentrations run from high to moderate at various times of the early day and late night during the winter months.

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 Arizona through the Eldorado Valley. Dust from the transported event affected the Jerome Mack monitoring site; the measured 24-hour PM_{10} value was 229 $\mu g/m^3$ on May 10.

Figure 110. Jerome Mack Monitoring Site (EPA 32-003-0540)—Street View.

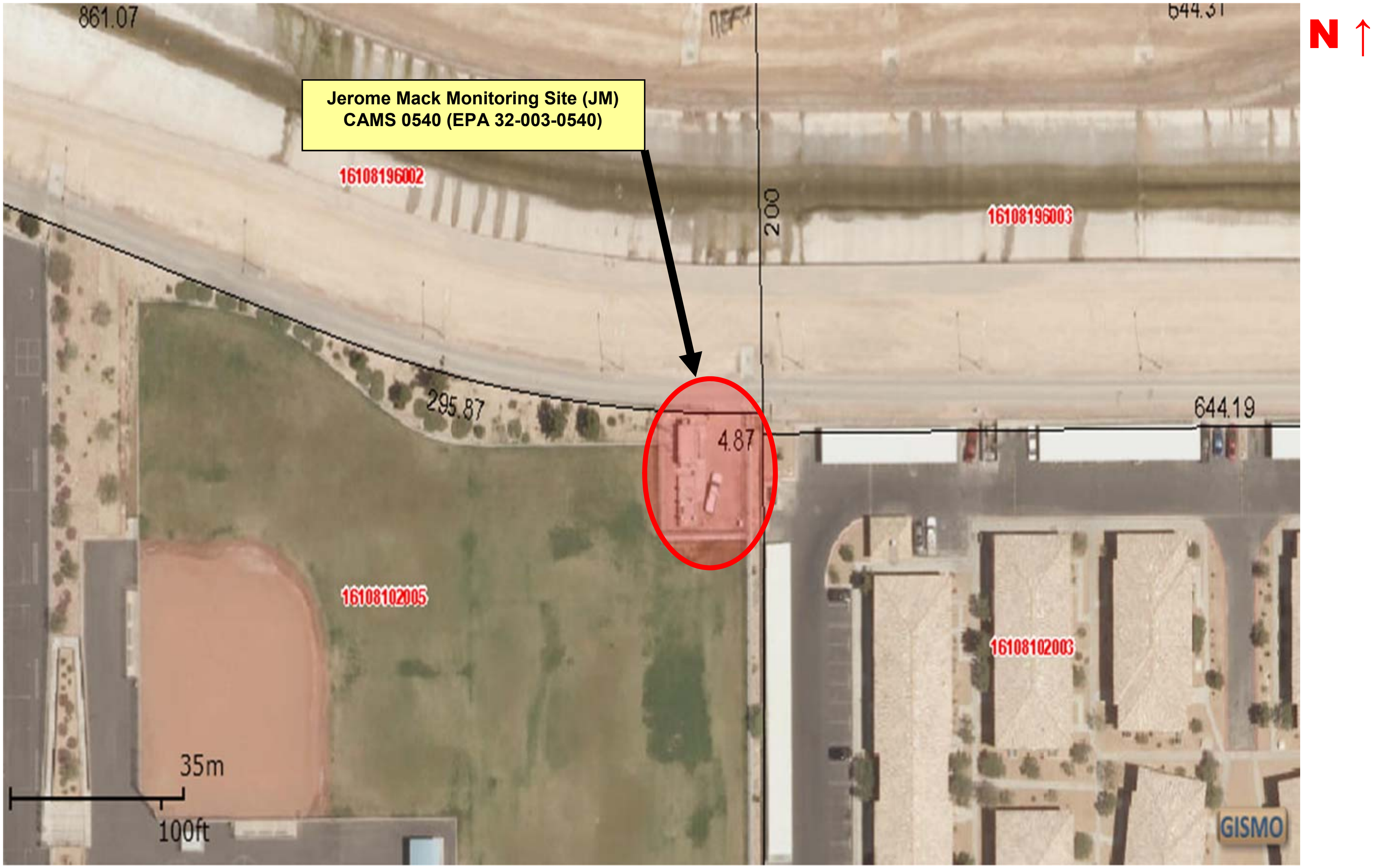


Figure 111. Jerome Mack Monitoring Site—Aerial View #1.

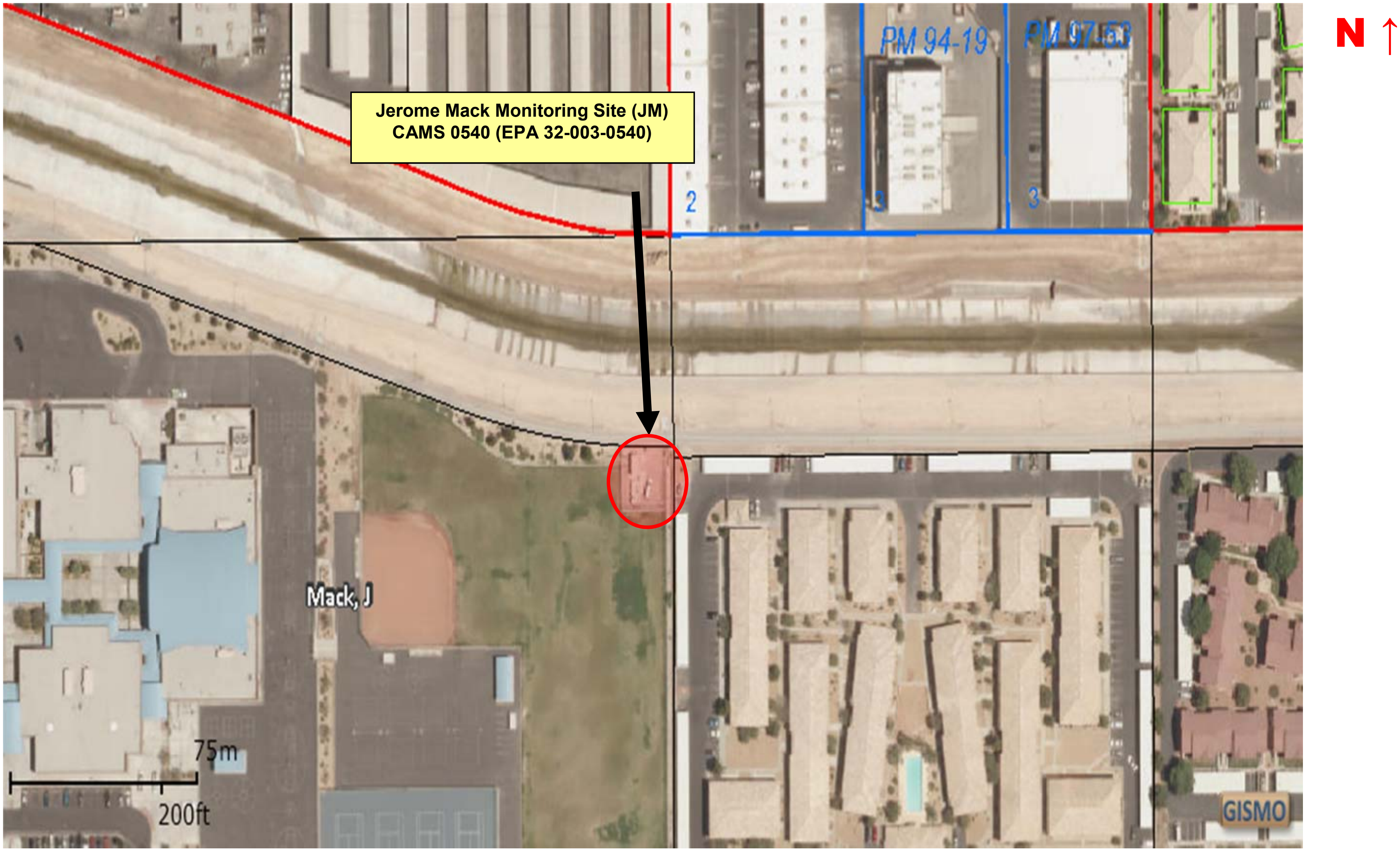


Figure 112. Jerome Mack Monitoring Site—Aerial View #2.

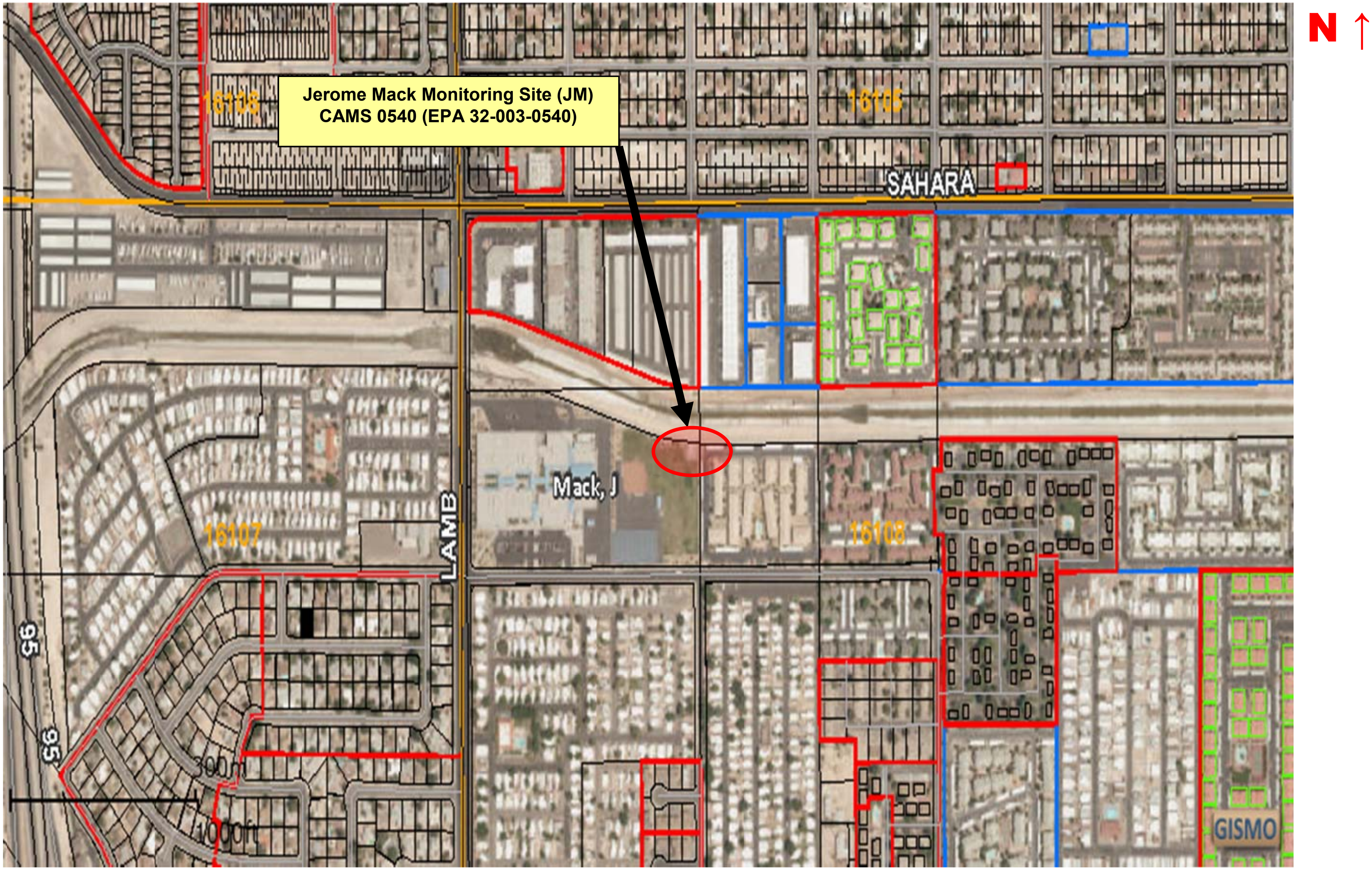


Figure 113. Jerome Mack Monitoring Site—Aerial View #3.

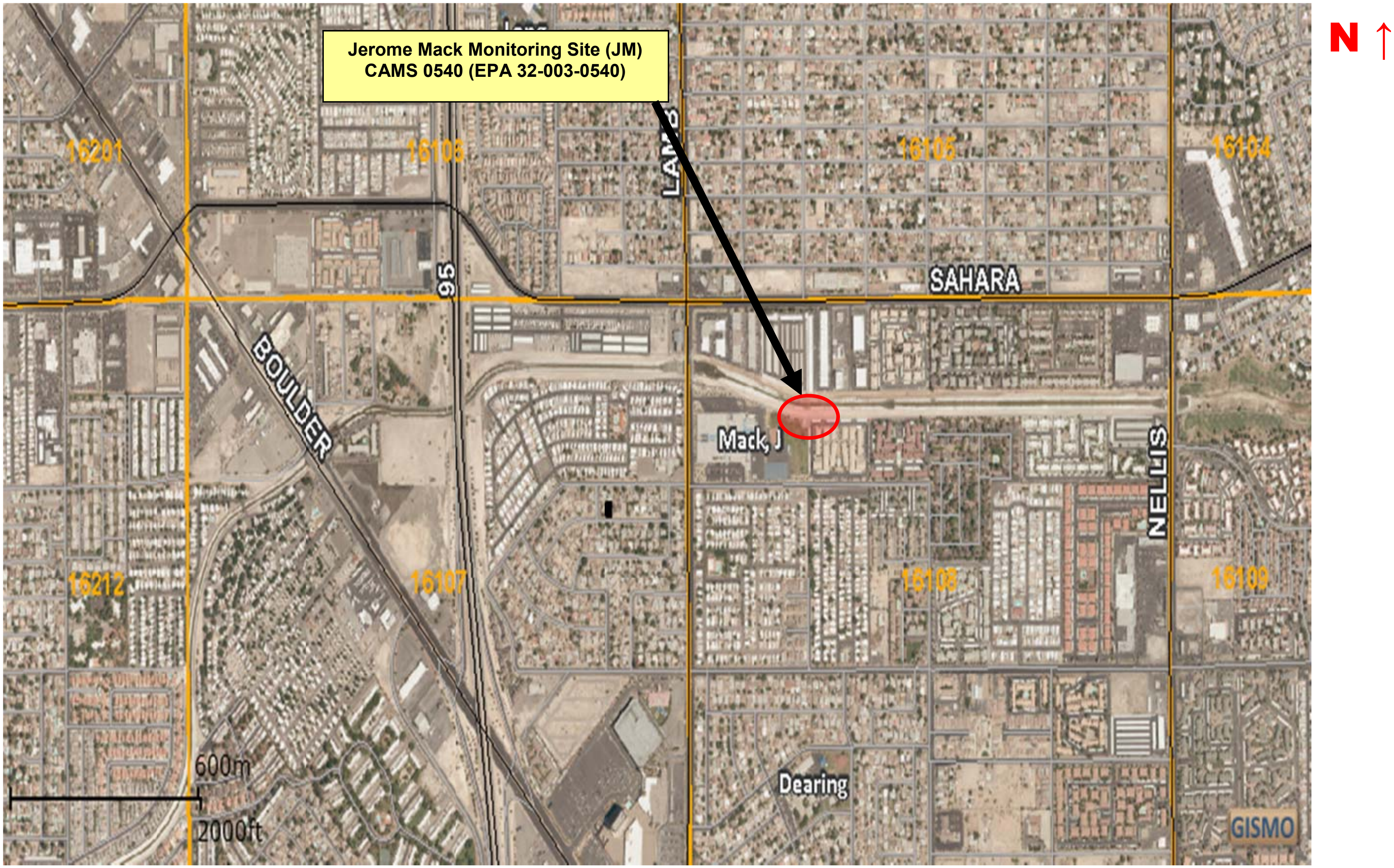


Figure 114. Jerome Mack Monitoring Site —Aerial View #4.

4.3 SUNRISE ACRES

The Sunrise Acres monitoring site (CAMS 0561, EPA 32-003-0561) (Figure 115) is located in the central part of the Las Vegas Valley (Figure 4), in a predominantly older urban development area. Most of the apartments and single-family housing units were built in the 1940s to early 1980s. Figures 116–119 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 ft. to the west and U.S. Highway 95 is located approximately 1,400 ft. to the north. Both roads are heavily traveled most of the day. Since there are many wood-burning fireplaces and wood boilers within a three-mile radius of the site, $PM_{2.5}$ concentrations run from high to moderate at various times during the winter months.

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. 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 Arizona through the Eldorado Valley. Dust from the transported event affected the Sunrise Acres monitoring site; the measured 24-hour PM_{10} value was 212 $\mu g/m^3$ on May 10.

Figure 115. Sunrise Acres Monitoring Site (EPA 32-003-0561)—Street View.

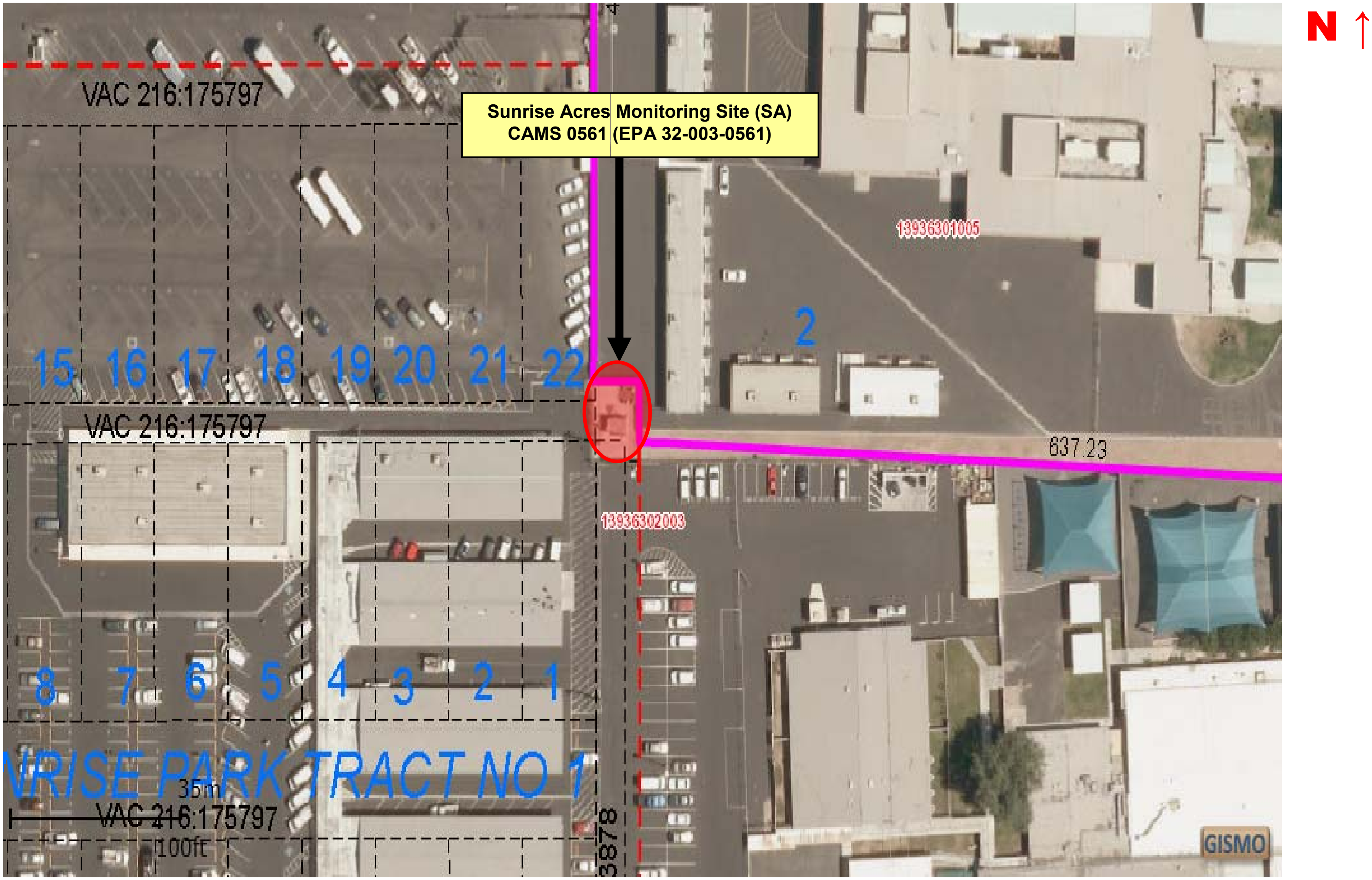


Figure 116. Sunrise Acres Monitoring Site—Aerial View #1.

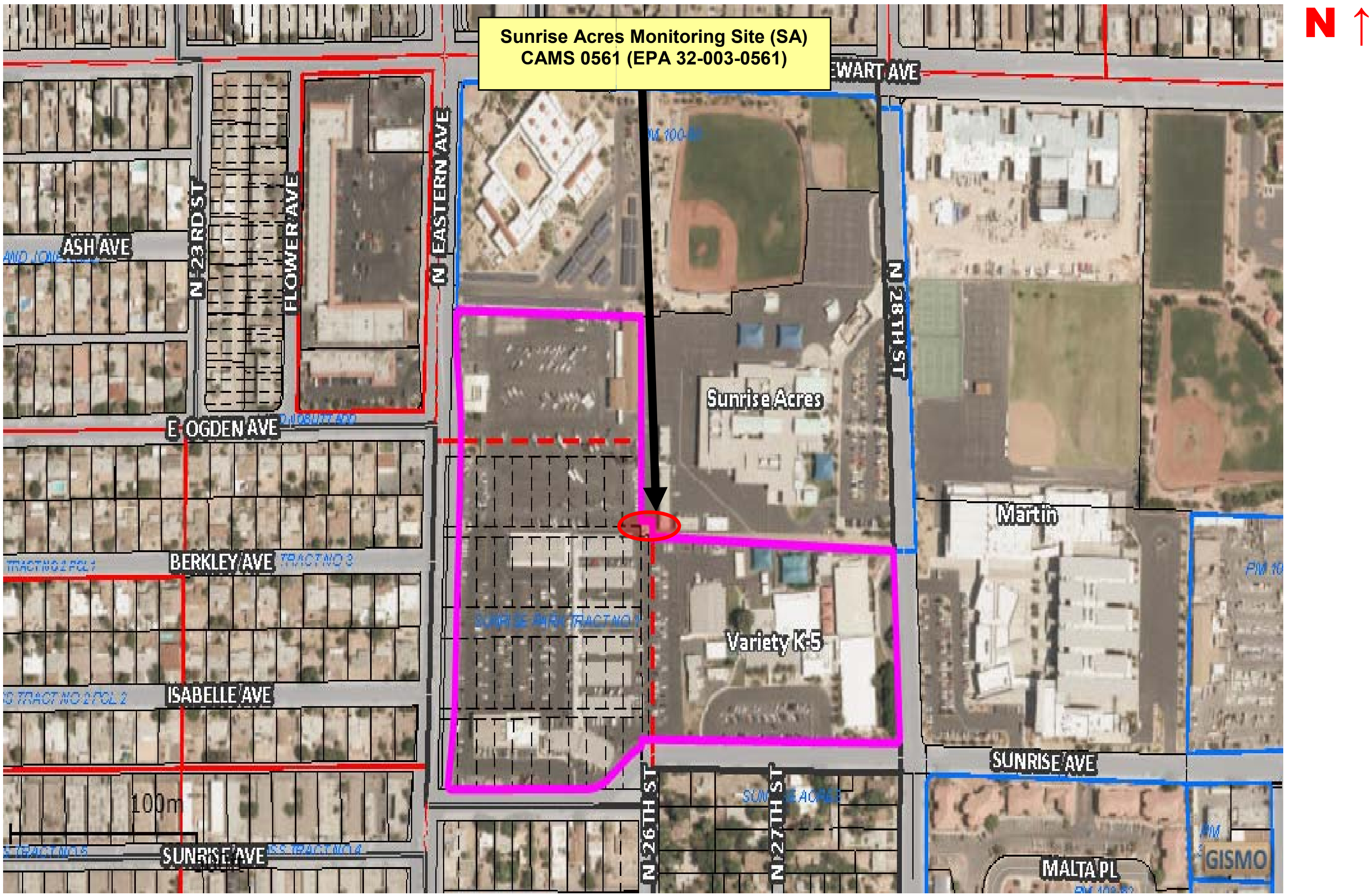


Figure 117. Sunrise Acres Monitoring Site—Aerial View #2.

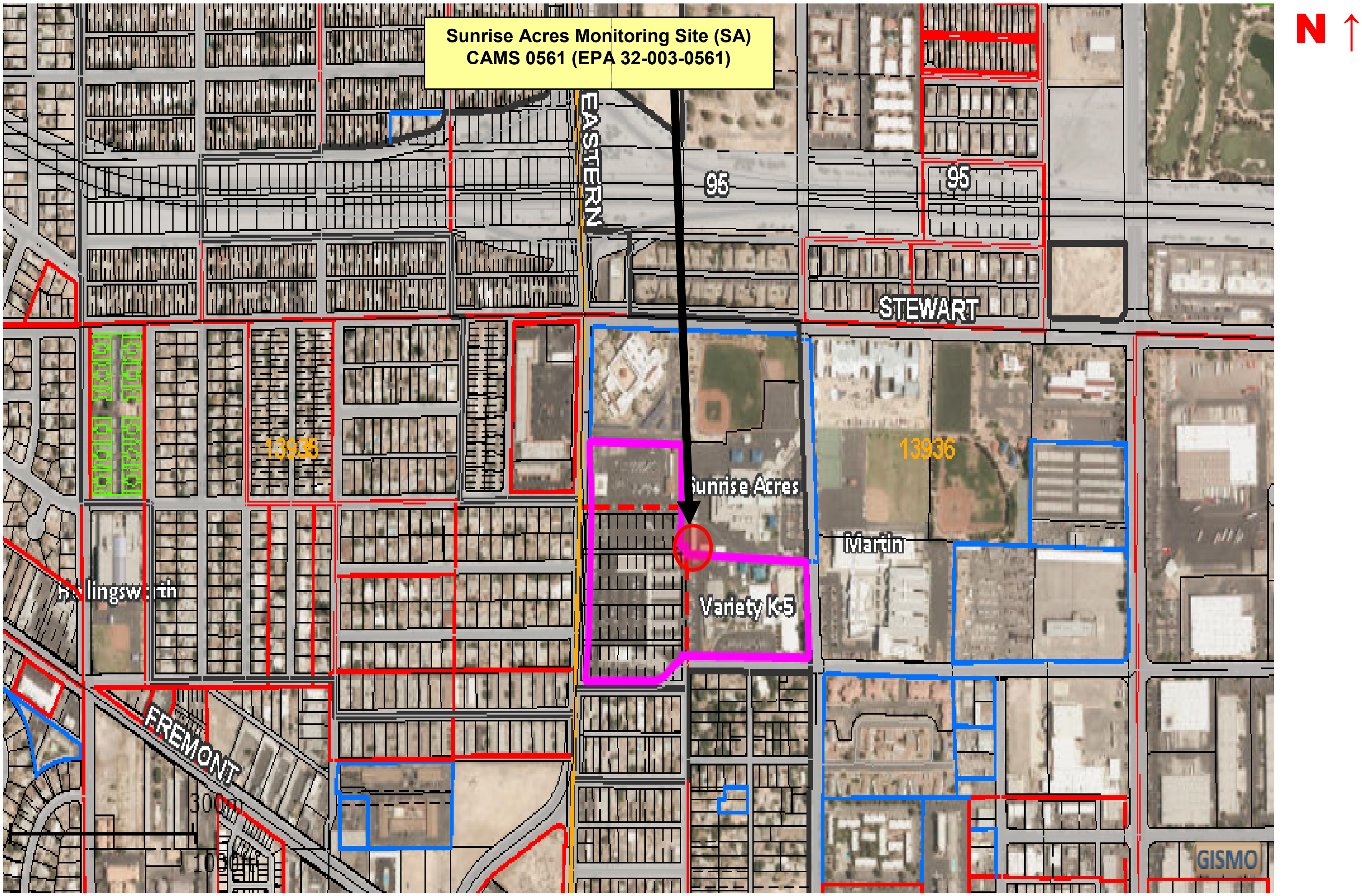


Figure 118. Sunrise Acres Monitoring Site—Aerial View #3.

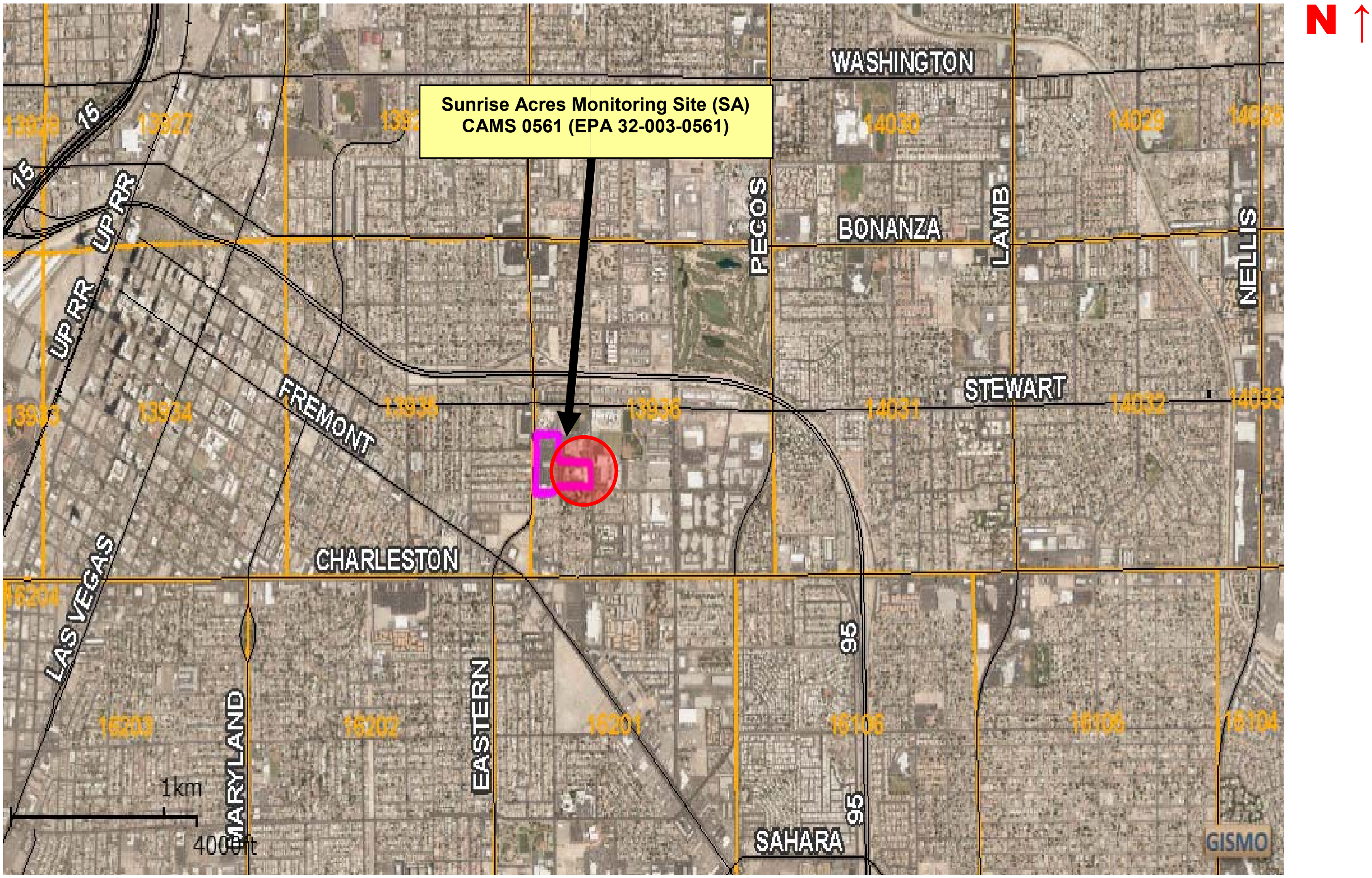


Figure 119. Sunrise Acres Monitoring Site—Aerial View #4.

4.4 J. D. SMITH

The J. D. Smith monitoring site (CAMS 2002, EPA 32-003-2002) (Figure 120) is located in the northeast part of the Las Vegas Valley (Figure 4), in a predominantly residential area. Figures 121–124 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. On May 10, however, there were low wind speeds, and the transported dust traveled with the prevailing wind currents that brought copious amounts of dust directly through the monitoring site on its way out of the valley to the northwest. The site exceeded with a 24-hour PM_{10} concentration of 204 $\mu g/m^3$.

Figure 120. J. D. Smith Monitoring Station (EPA 32-003-2002)—Street View.

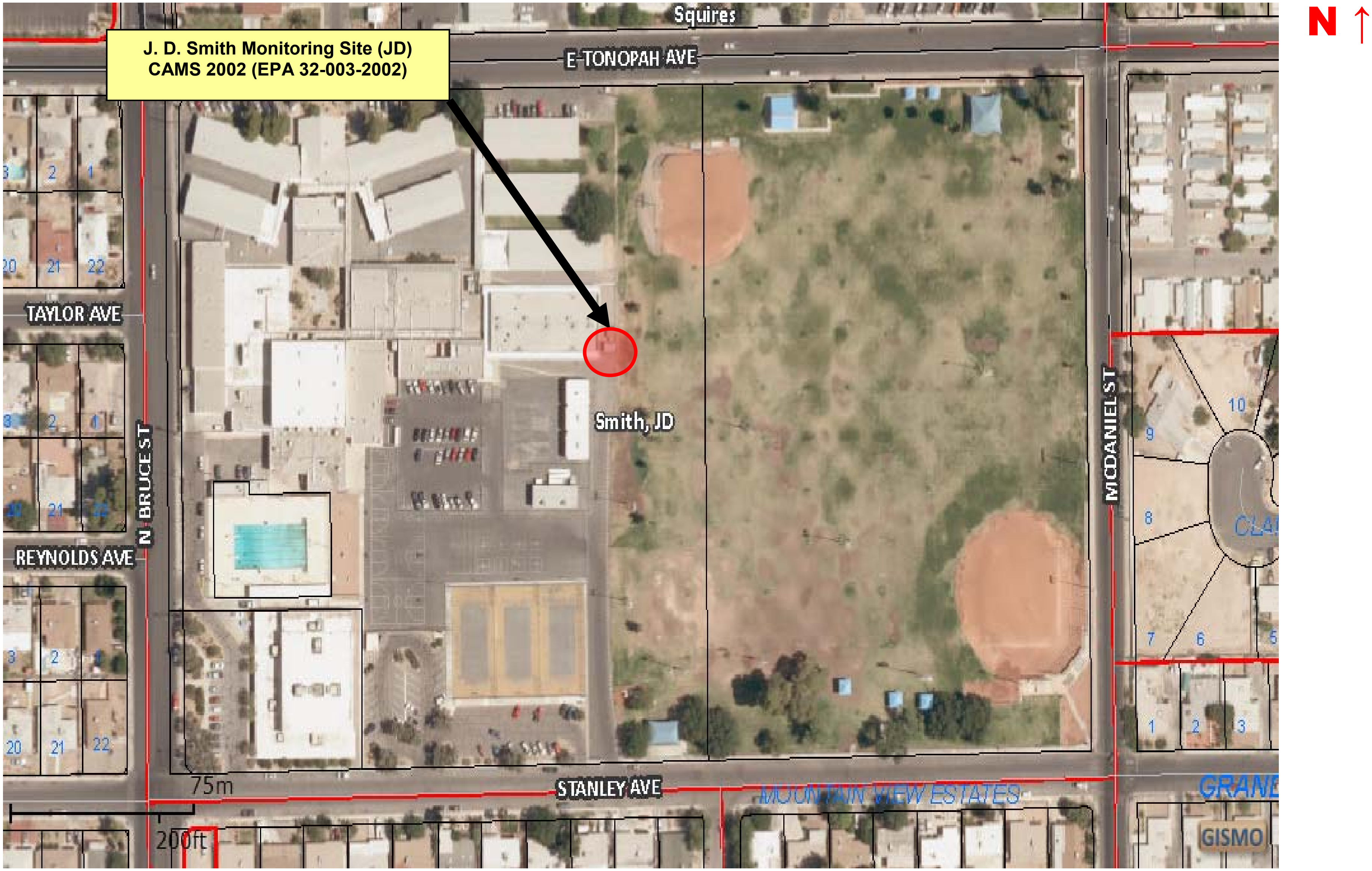


Figure 121. J. D. Smith Monitoring Site—Aerial View #1.

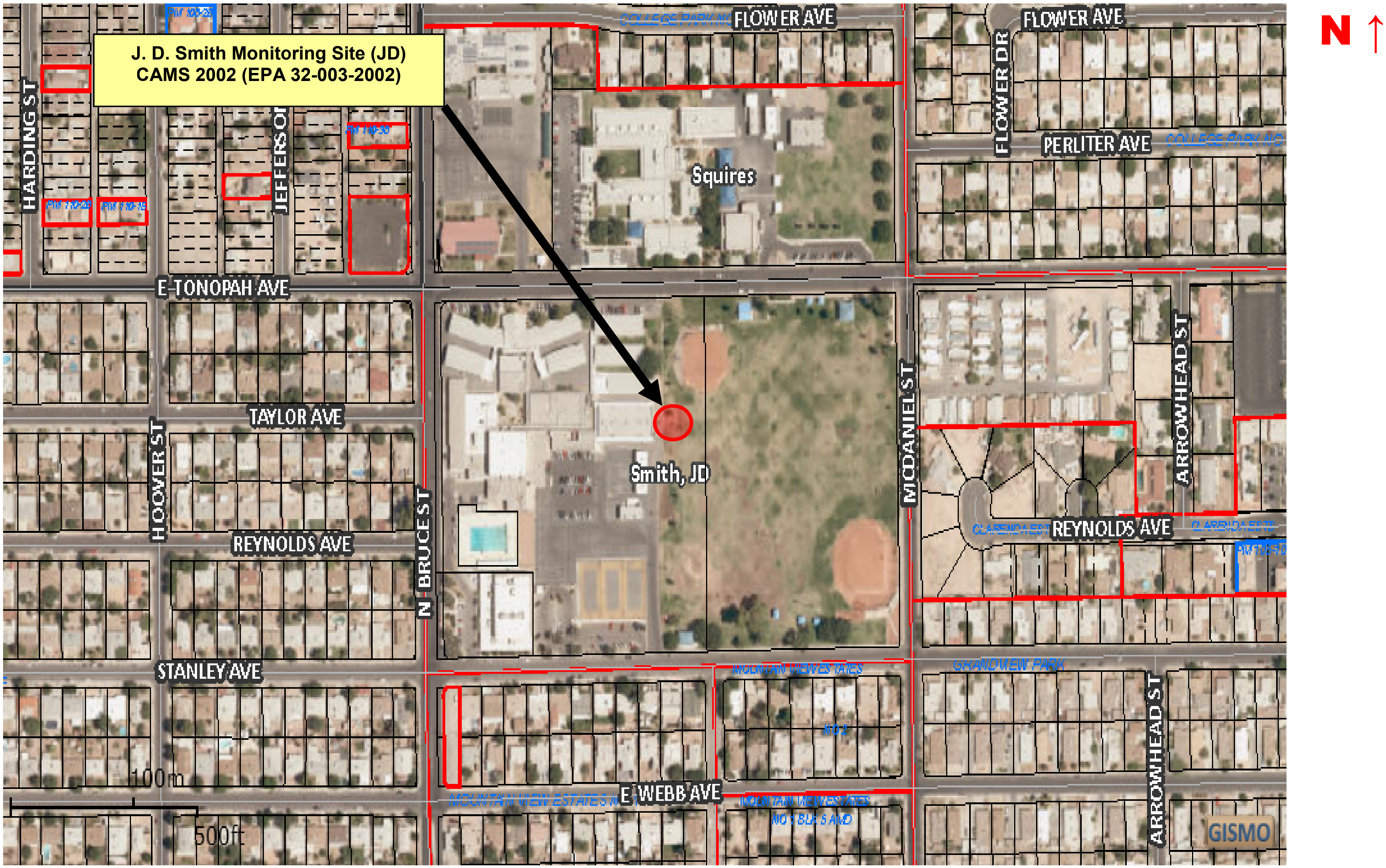


Figure 122. J. D. Smith Monitoring Site—Aerial View #2.

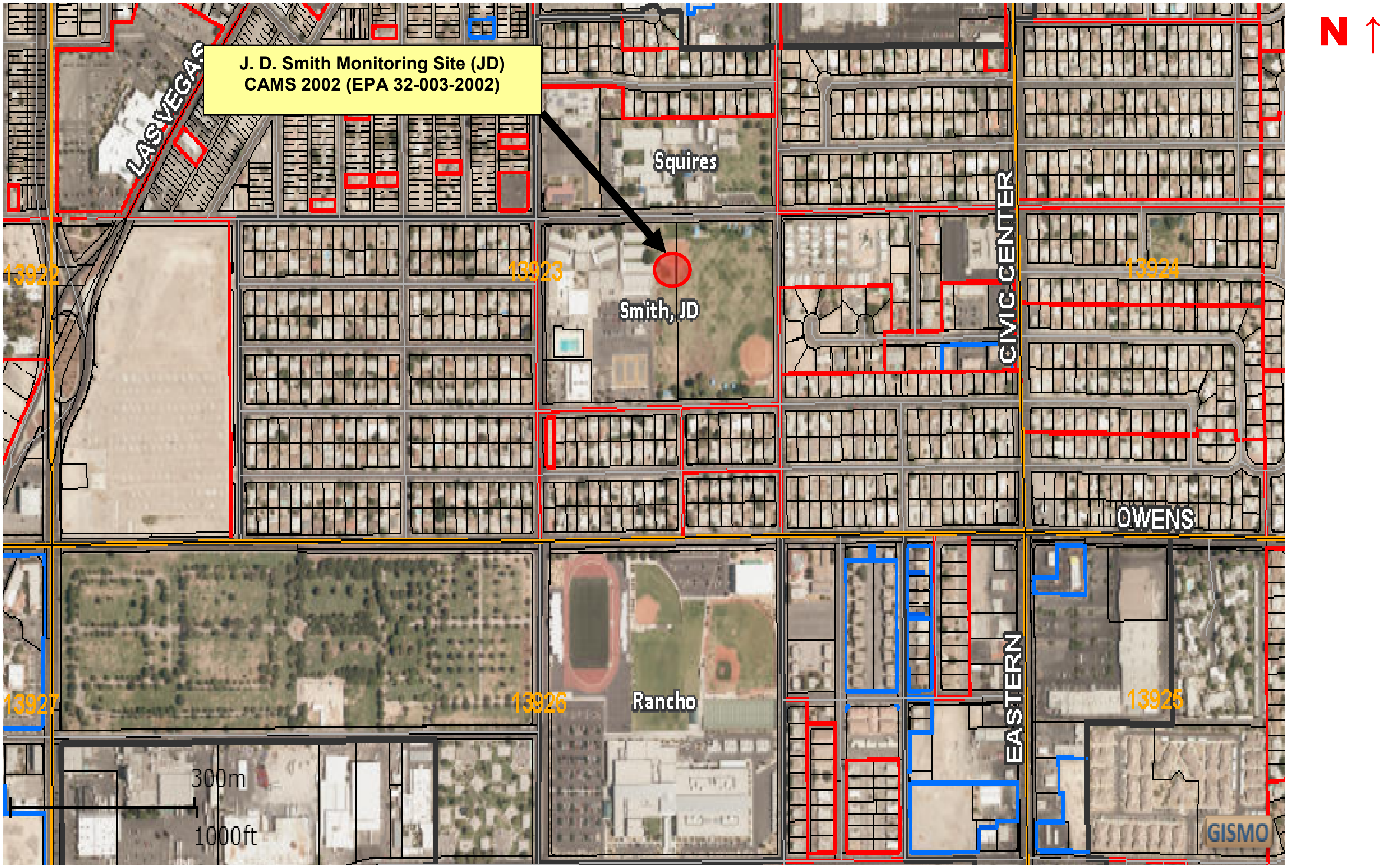


Figure 123. J. D. Smith Monitoring Site—Aerial View #3.

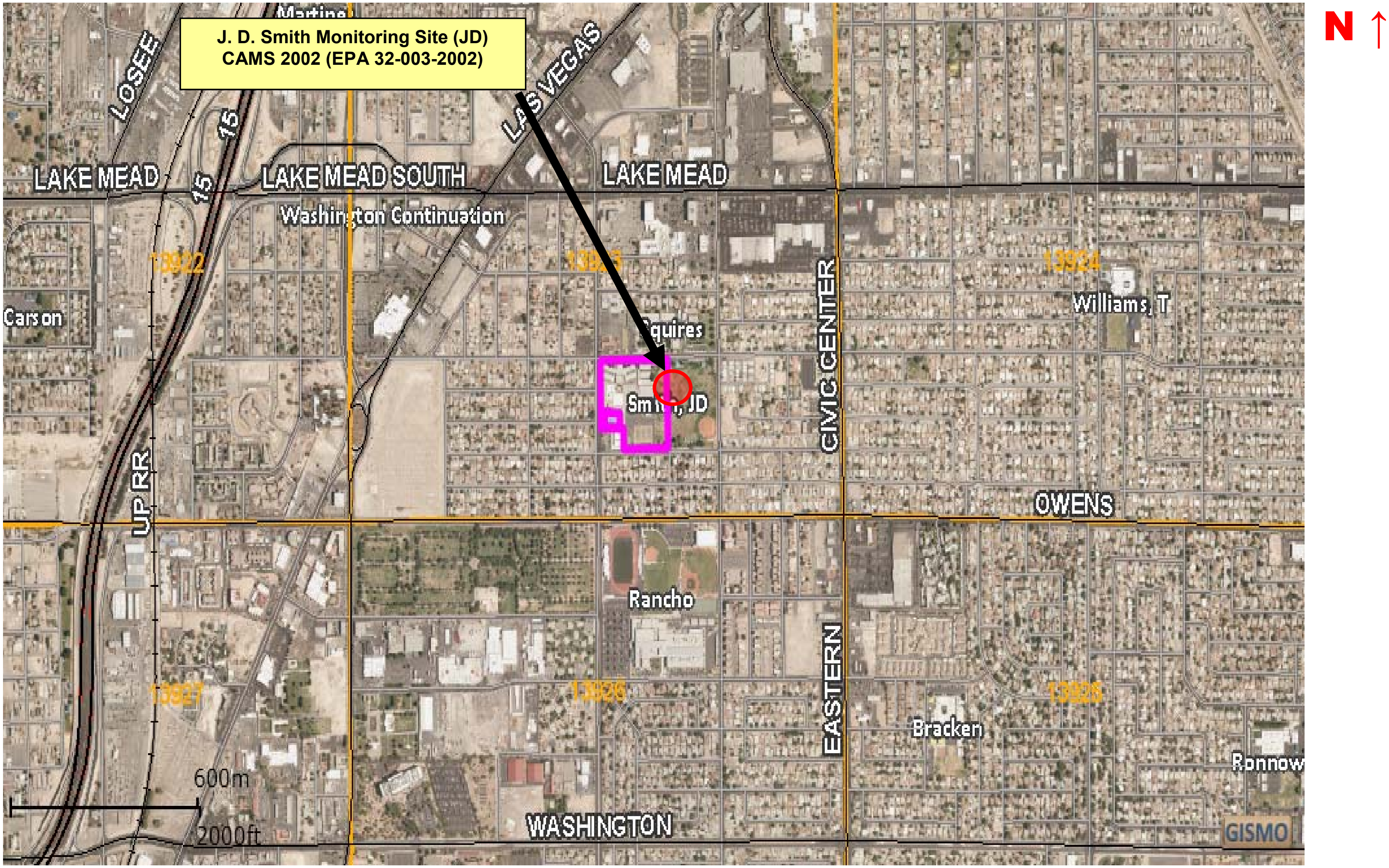


Figure 124. J. D. Smith Monitoring Site—Aerial View #4.

4.5 JOE NEAL

The Joe Neal monitoring site (CAMS 0075, EPA 32-003-0075) (Figure 125) is located in the northwest part of the Las Vegas Valley (Figure 4), in a city park next to a middle school. The area is predominantly residential, with commercial amenities nearby. Figures 126–129 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 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 m 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 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, so lower levels of dust arrived at this site compared to other sites. Due to earlier disposition of dust at sites southeast of its location, Joe Neal experienced the lowest exceedance concentration in the monitoring network. The site measured a 24-hour PM_{10} value of 182 μg/m^3 on May 10.

Figure 125. Joe Neal Monitoring Station (EPA 32-003-0075)—Street View.

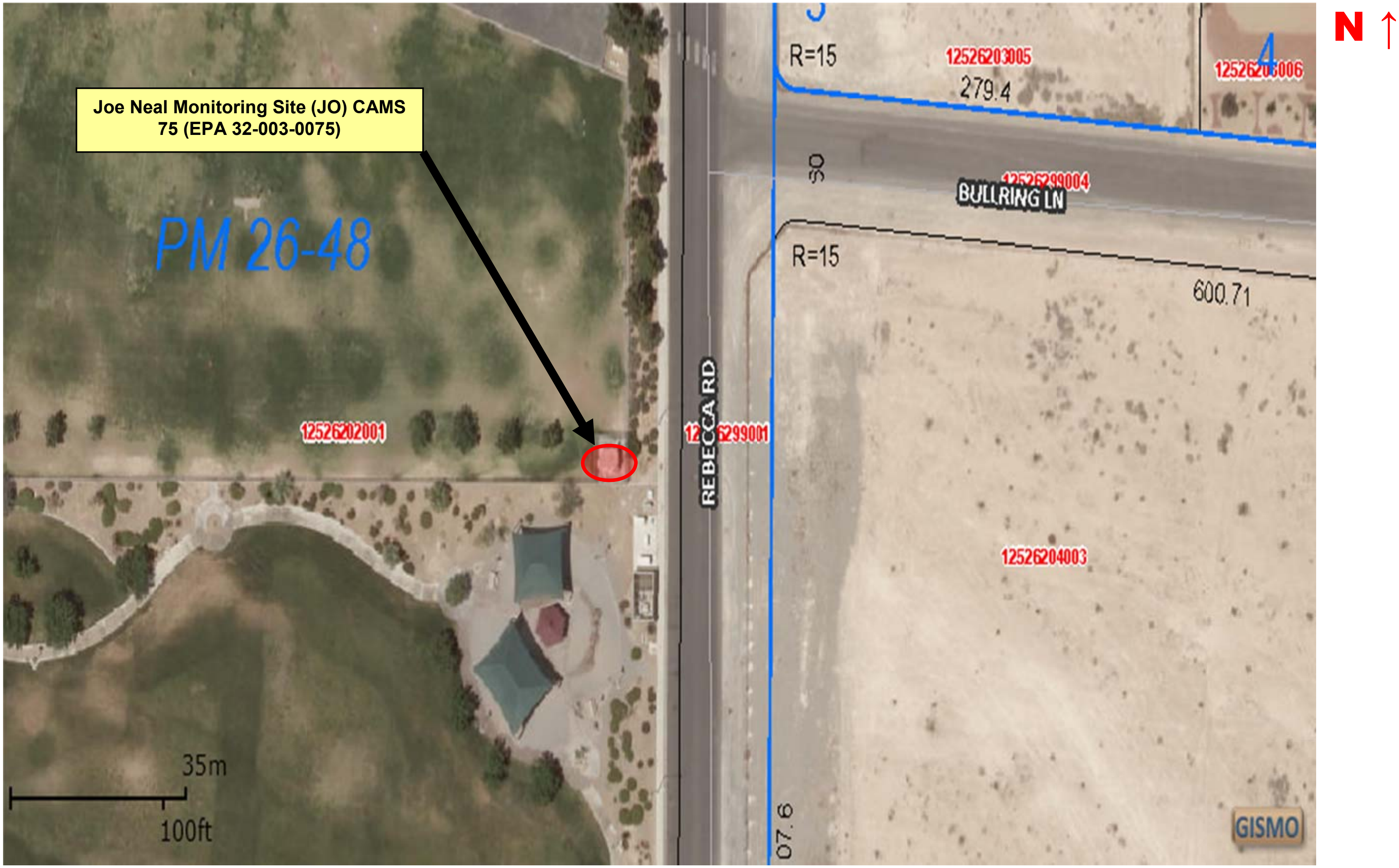


Figure 126. Joe Neal Monitoring Site—Aerial View #1.

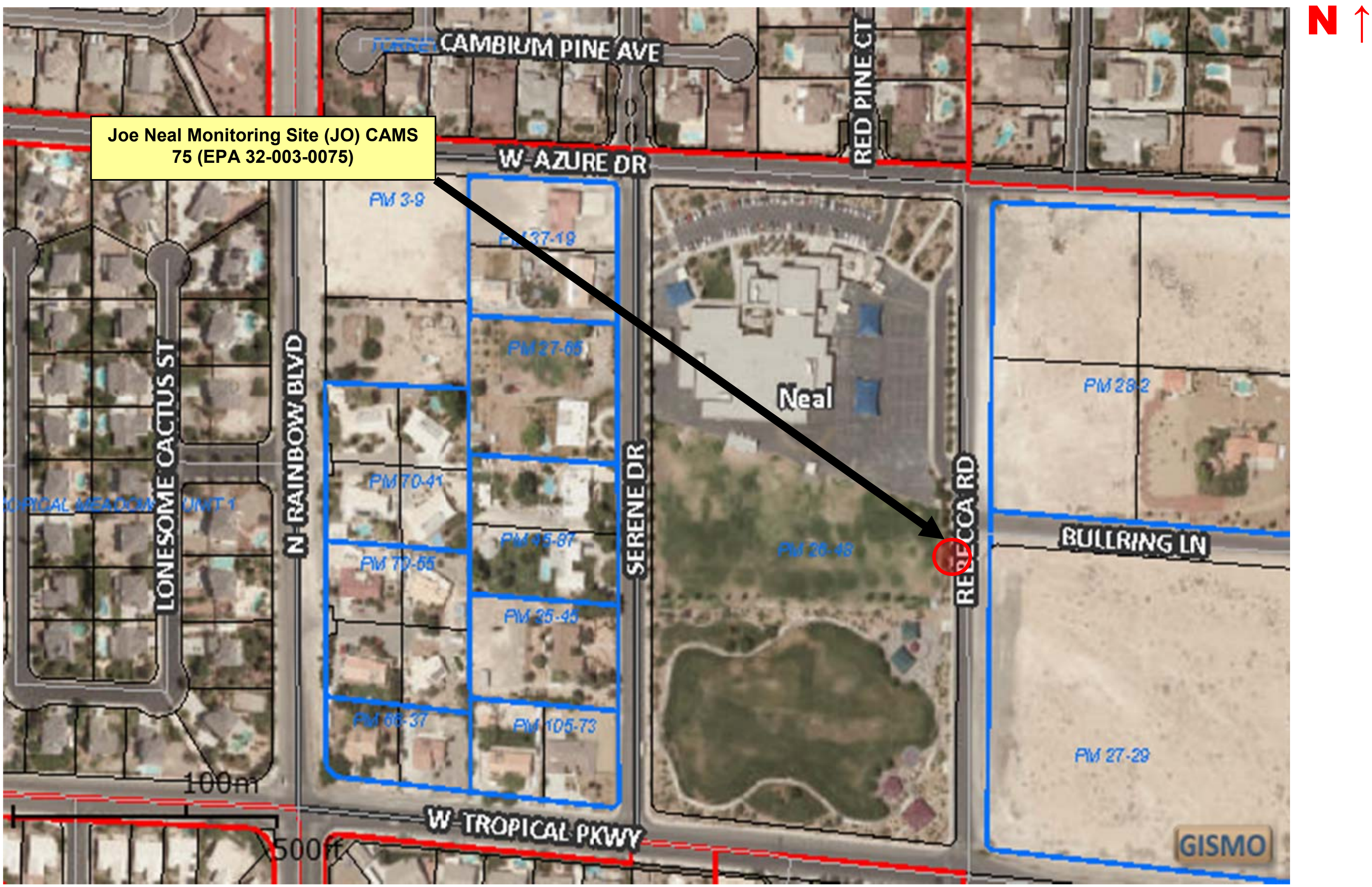


Figure 127. Joe Neal Monitoring Site—Aerial View #2.

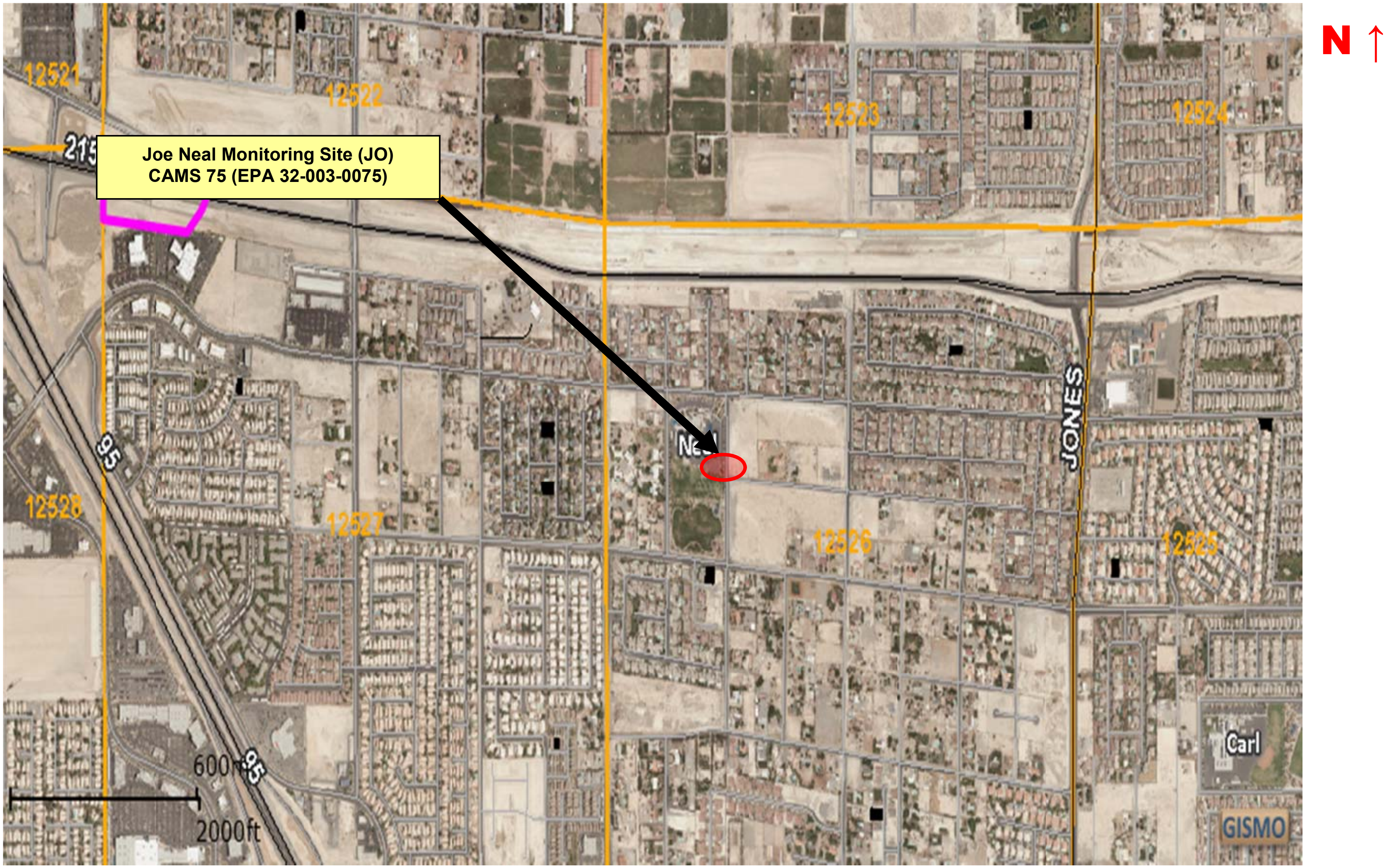


Figure 128. Joe Neal Monitoring Site—Aerial View #3.

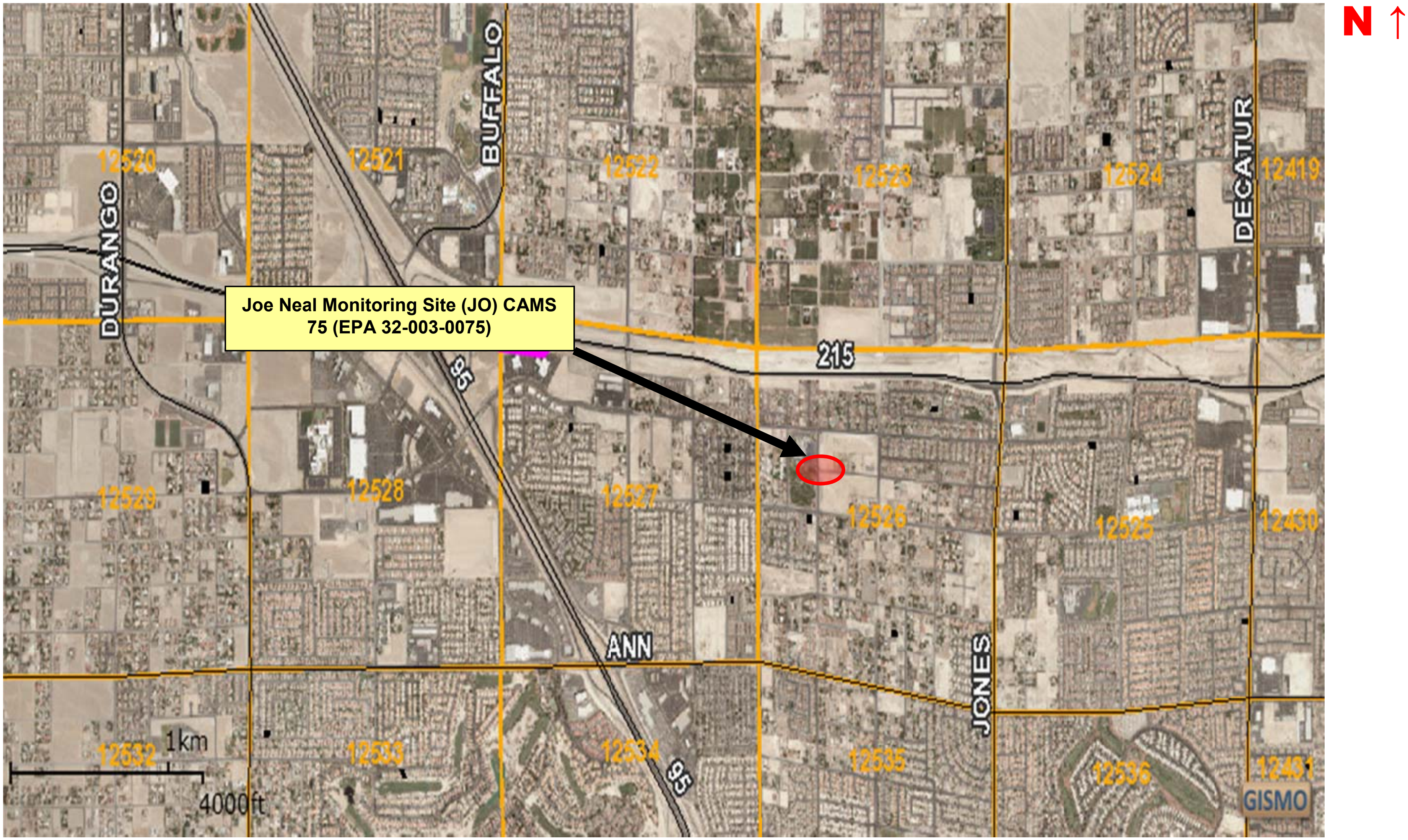


Figure 129. Joe Neal Monitoring Site—Aerial View #4.

4.6 GREEN VALLEY

The Green Valley monitoring site (CAMS 0298, EPA 32-003-0298) (Figure 130) is located in the southern part of the Las Vegas Valley (Figure 4), in a predominantly residential area with commercial amenities. Figures 131–134 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 did not dip down and bring a significant amount of the transported dust through or close to this site, so although it recorded elevated concentrations from the periphery of the dust storm, it did not have a measured PM_{10} exceedance on May 10.

Figure 130. Green Valley Monitoring Station (EPA 32-003-0298)—Street View.

Figure 131. Green Valley Monitoring Site—Aerial View #1.

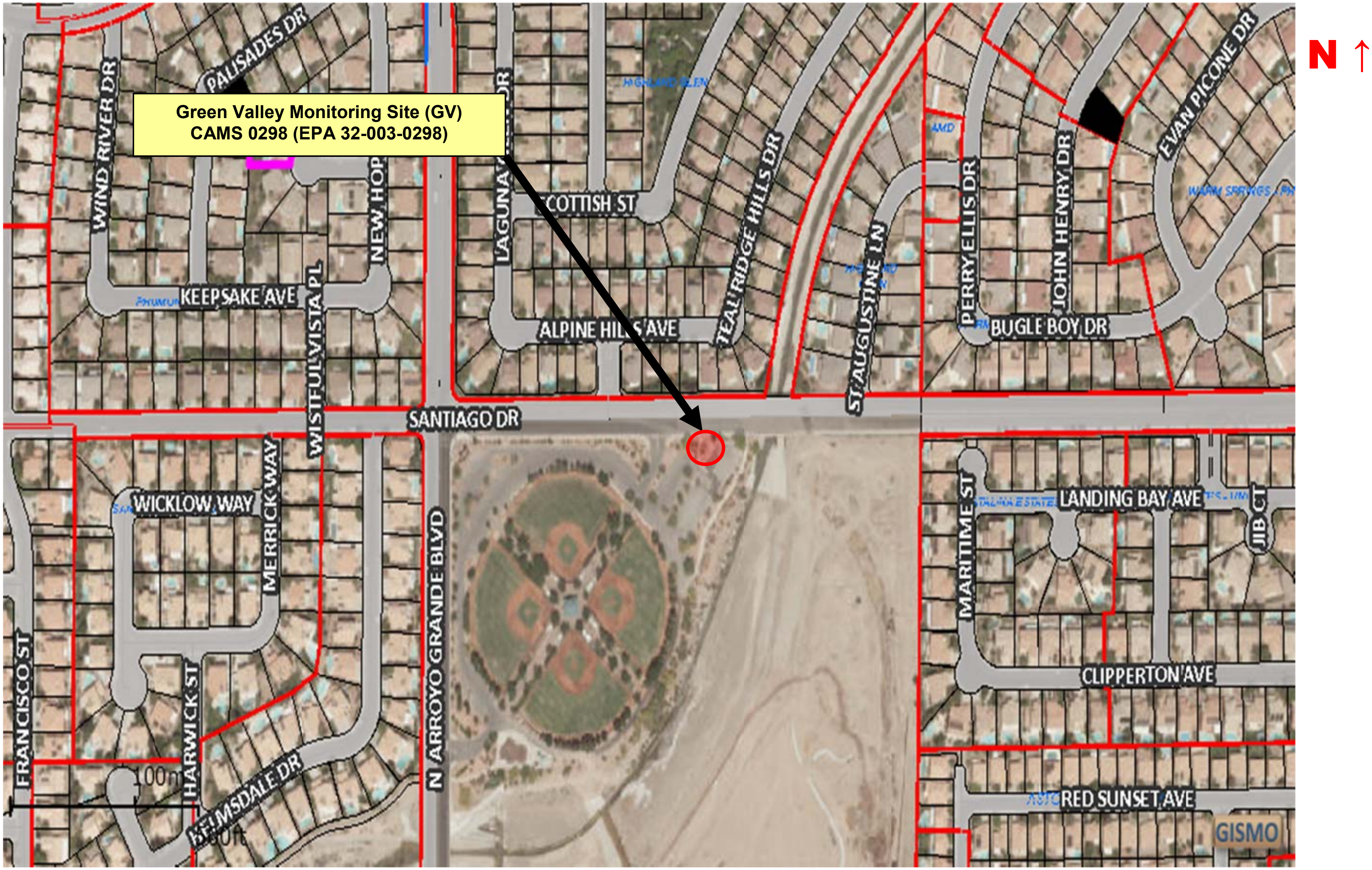


Figure 132. Green Valley Monitoring Site—Aerial View #2.

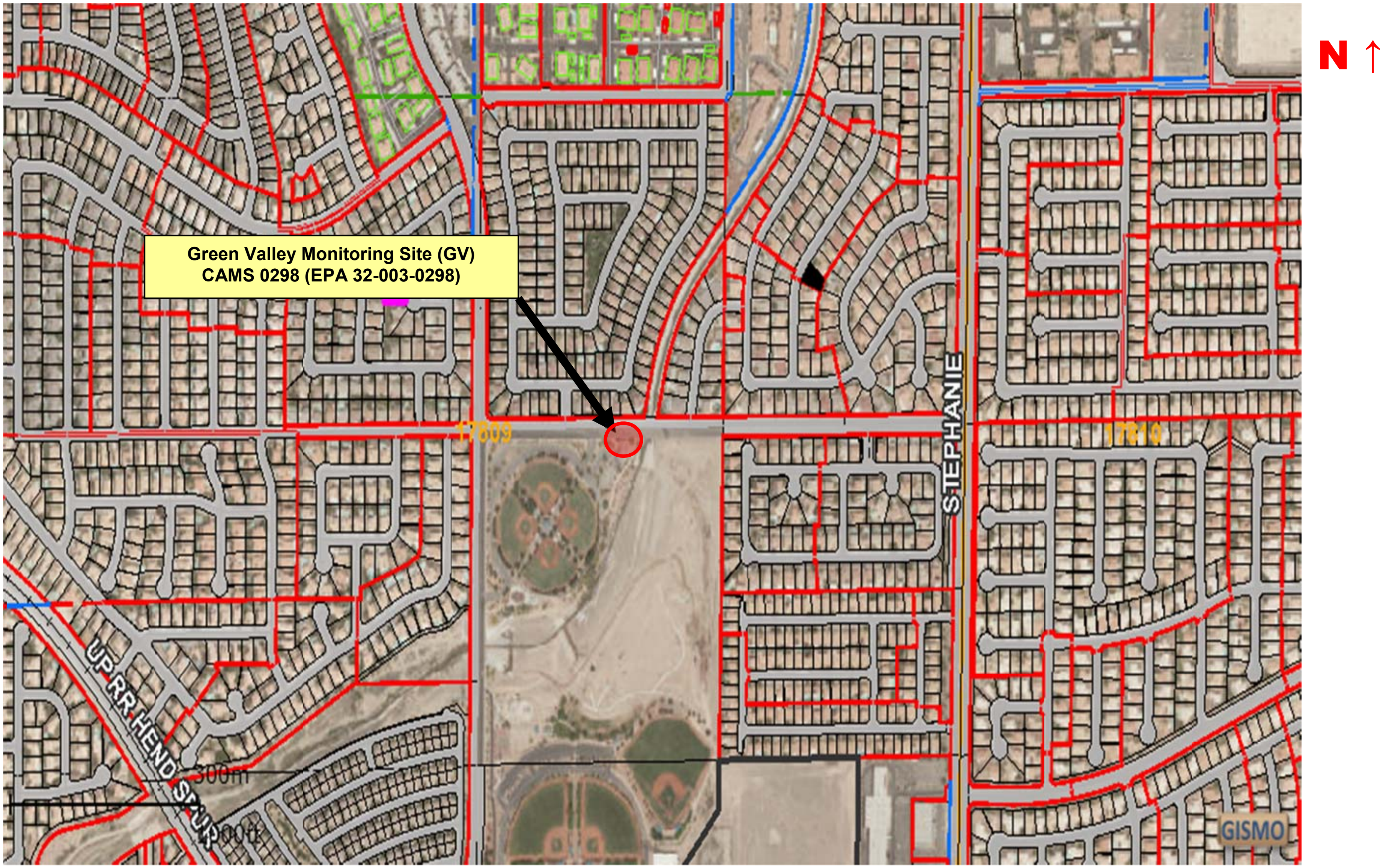


Figure 133. Green Valley Monitoring Site—Aerial View #3.

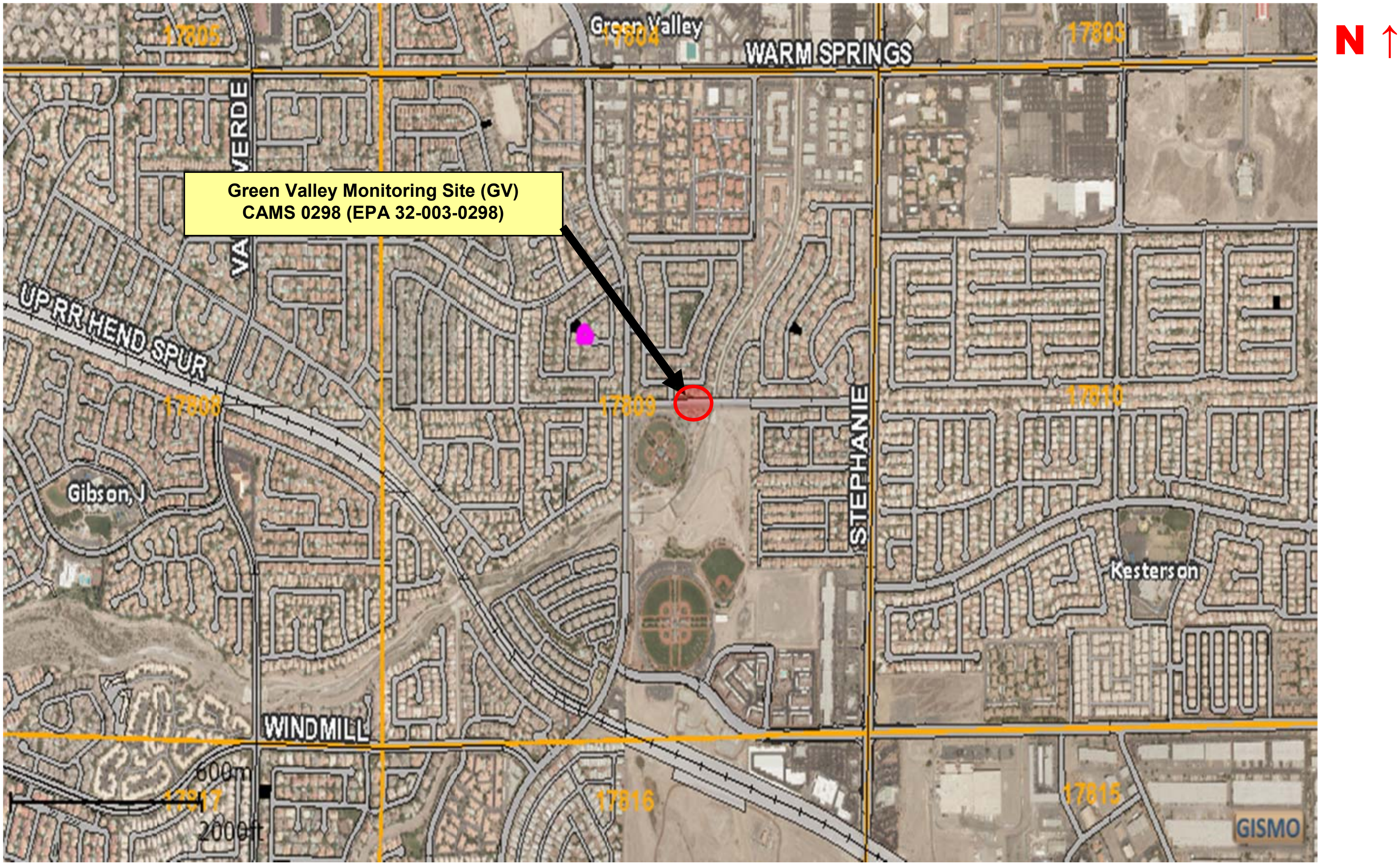


Figure 134. Green Valley Monitoring Site—Aerial View #4.

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 4), 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 transported dust event was from the southeast to the northwest. The wind did not dip down and bring a significant amount of the transported dust through or close to this site, so although it recorded elevated concentrations from the periphery of the dust storm, it did not have a measured PM_{10} exceedance on May 10.

Figure 135. Paul Meyer Monitoring Station (EPA 32-003-0043)—Street View.

Figure 136. Paul Meyer Monitoring Site—Aerial View #1.

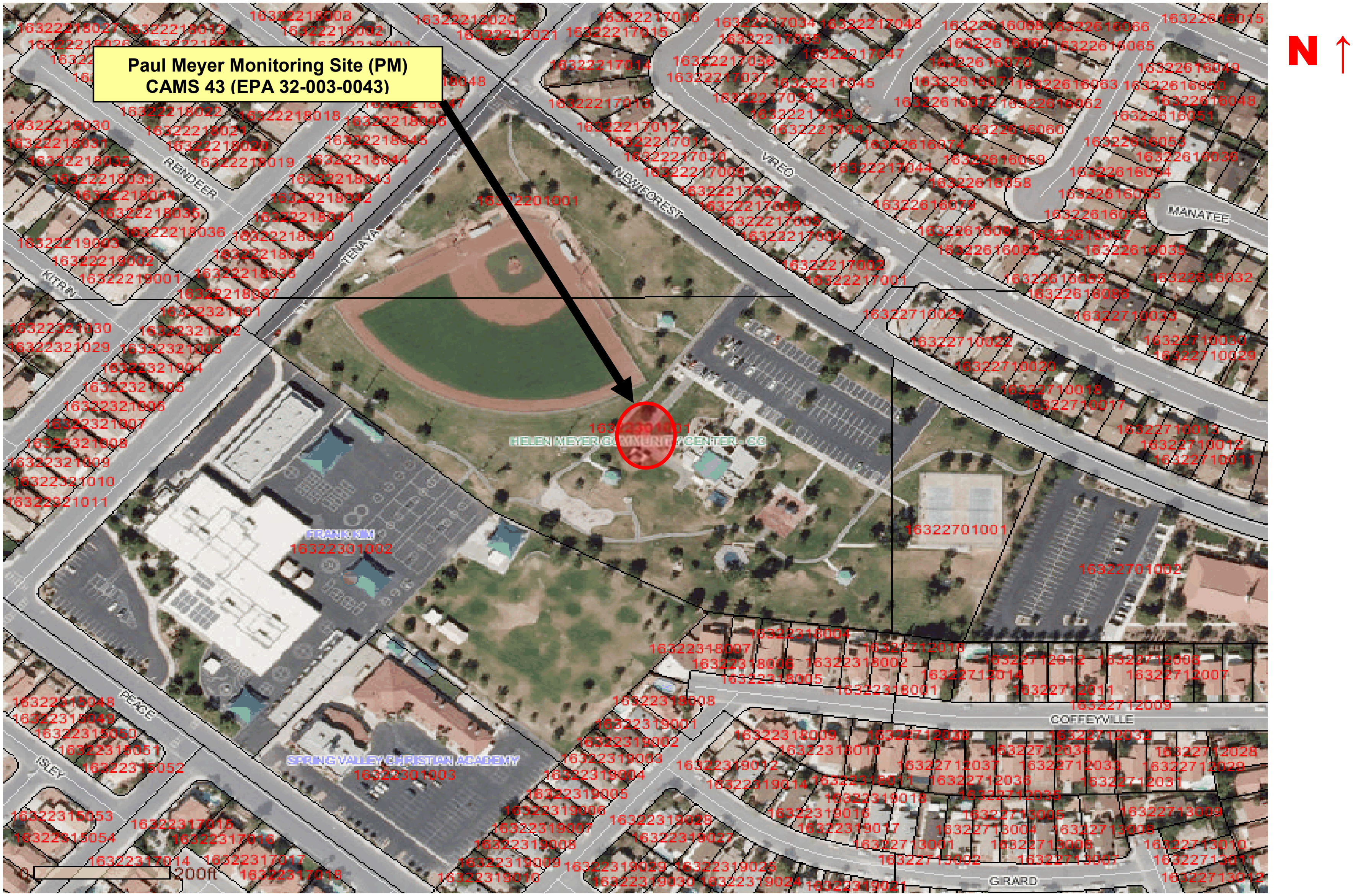


Figure 137. Paul Meyer Monitoring Site—Aerial View #2.

Figure 138. Paul Meyer Monitoring Site—Aerial View #3.

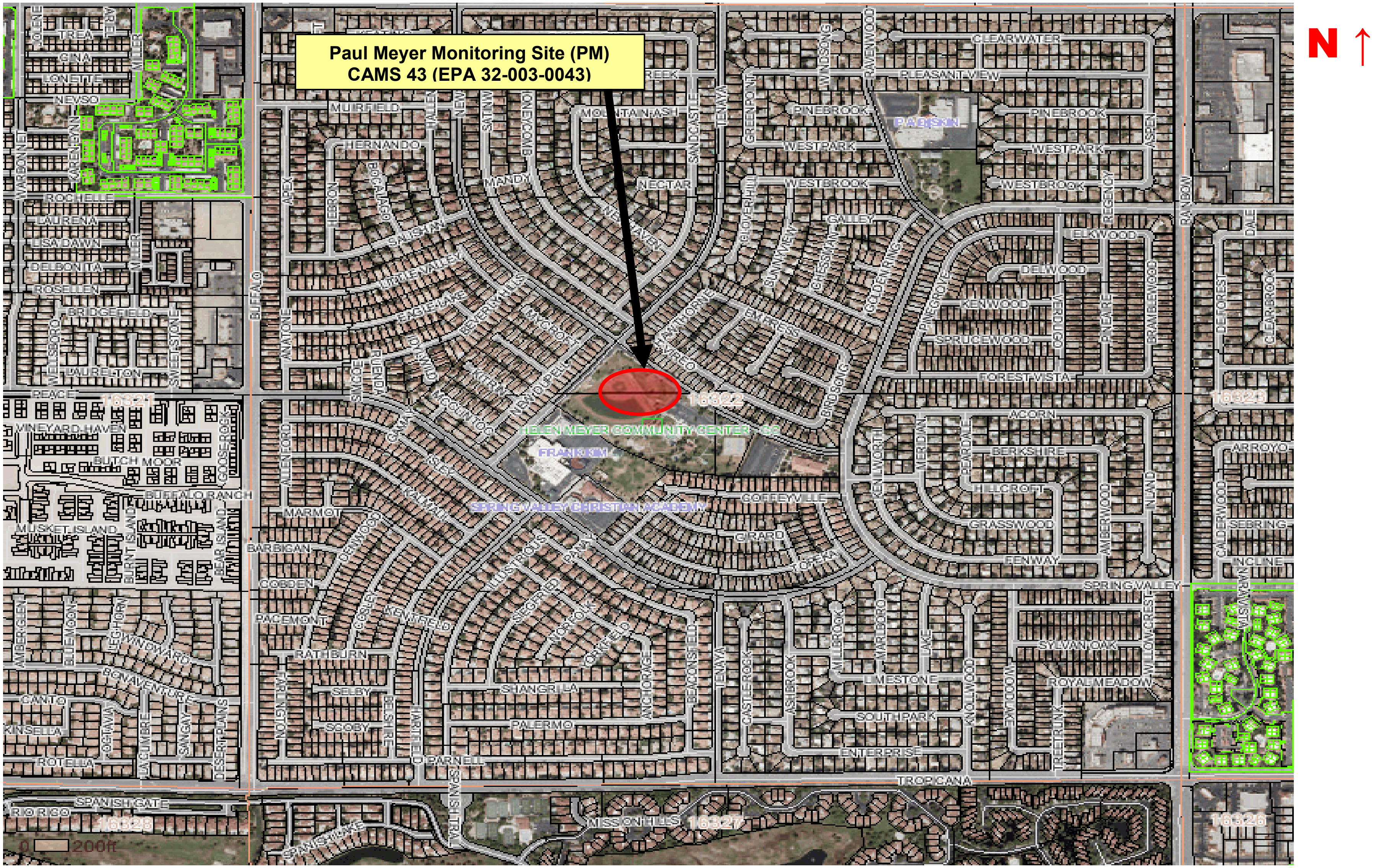


Figure 139. Paul Meyer Monitoring Site—Aerial View #4.

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 4), 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 m 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, so no significant amount of transported dust came through or close to this site. It recorded elevated concentrations from the periphery of the dust storm, but did not have a measured PM_{10} exceedance on May 10.

Figure 140. Palo Verde Monitoring Site (EPA 32-003-0073)—Street View.

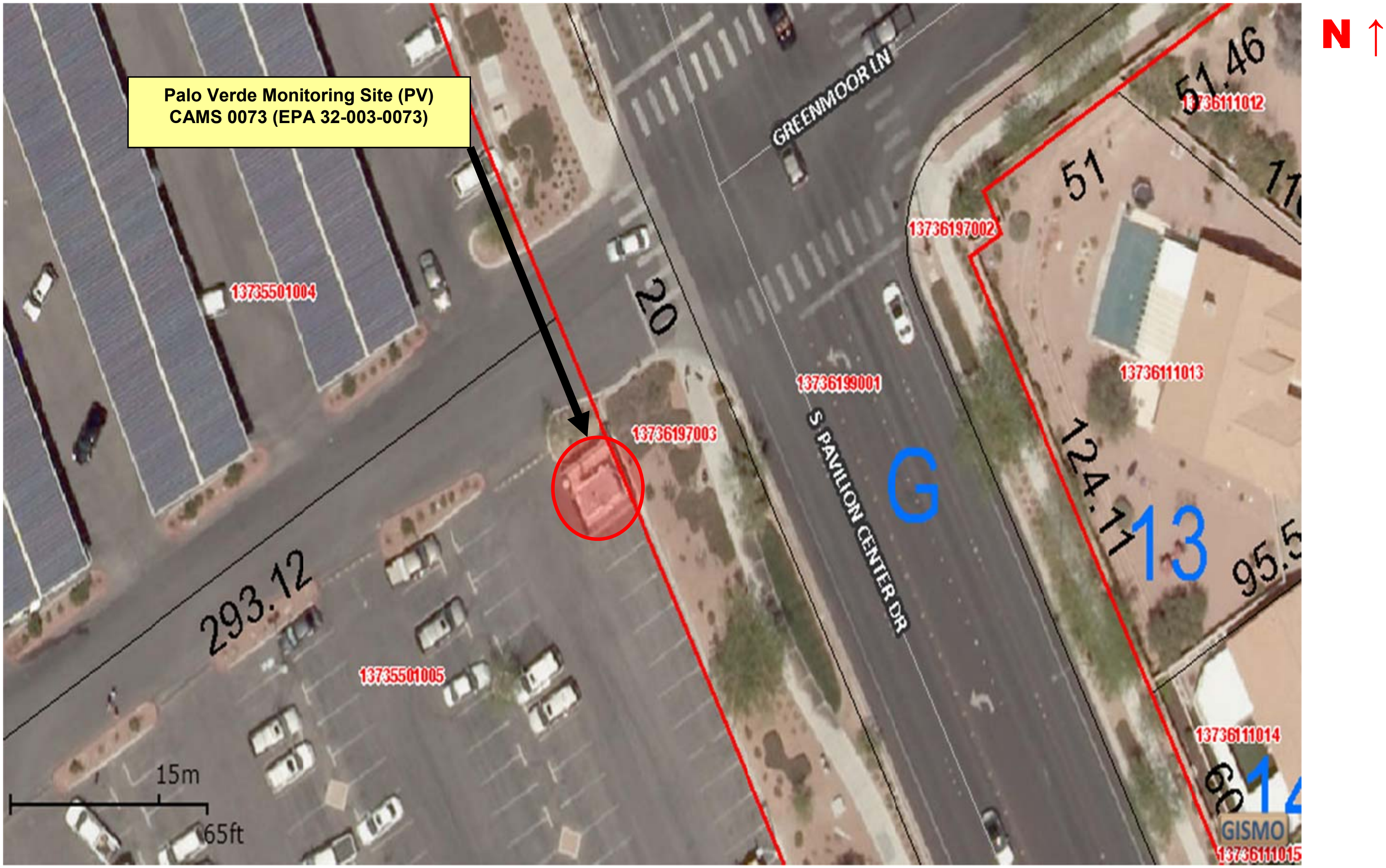


Figure 141. Palo Verde Monitoring Site—Aerial View #1.

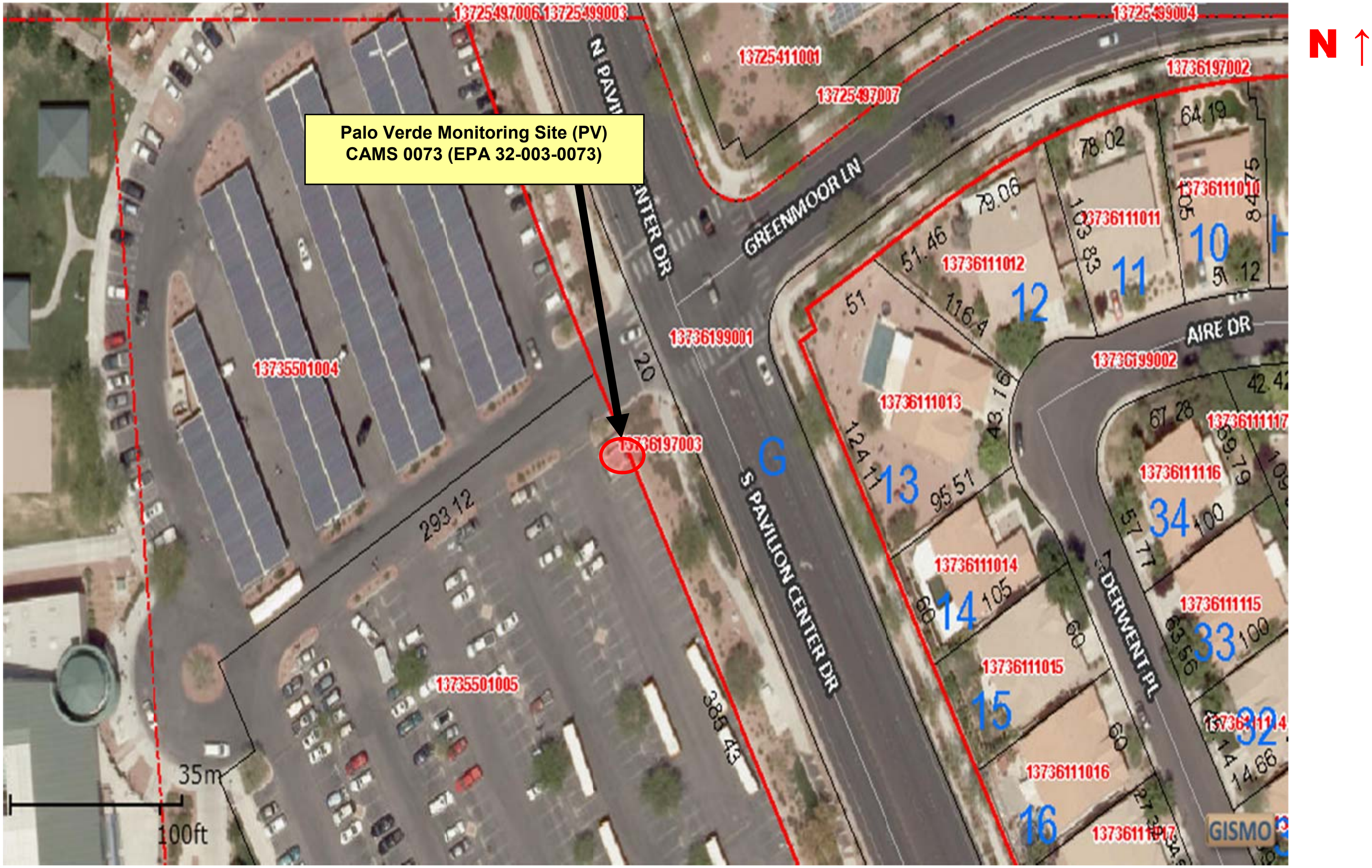


Figure 142. Palo Verde Monitoring Site—Aerial View #2.

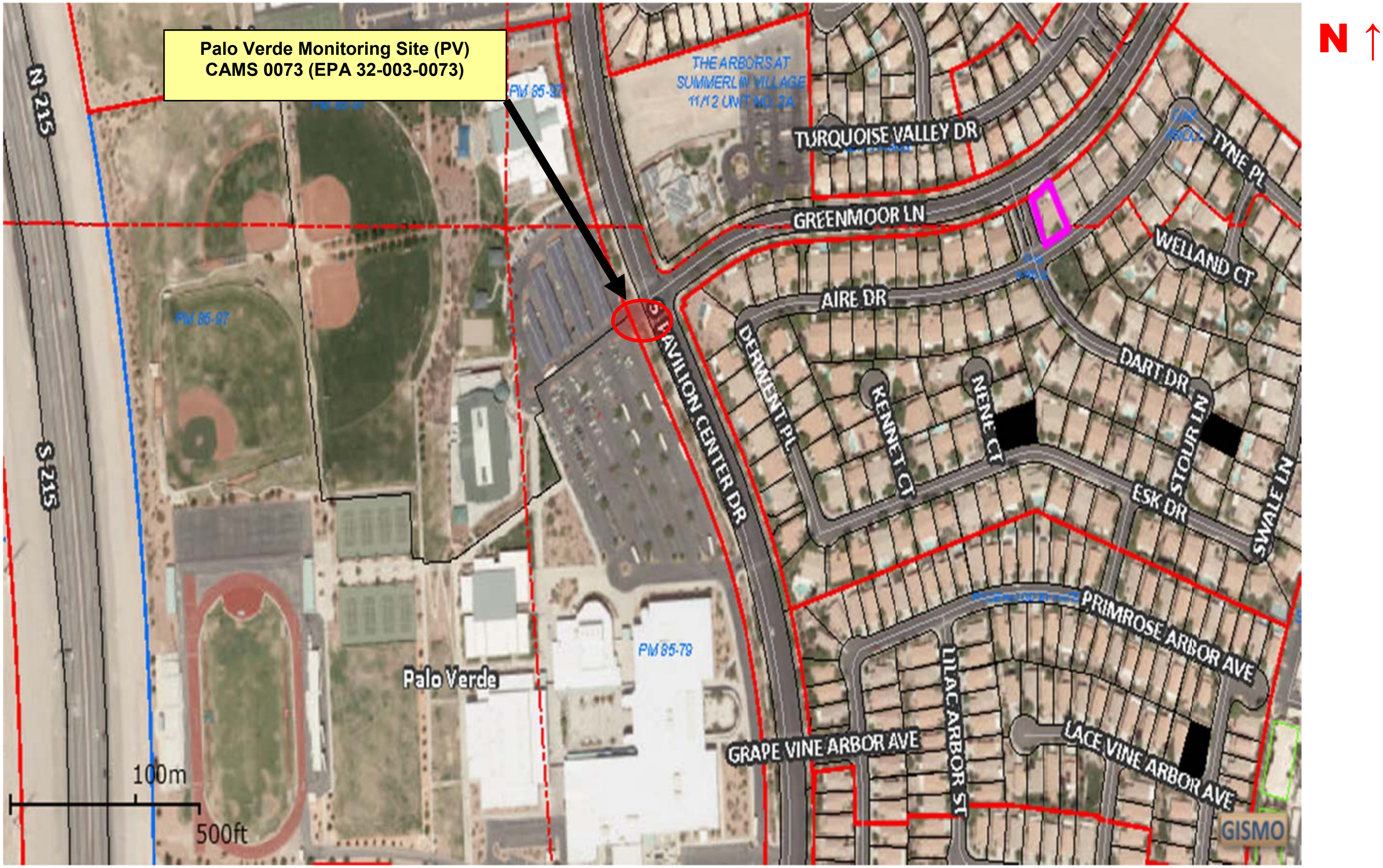


Figure 143. Palo Verde Monitoring Site—Aerial View #3.

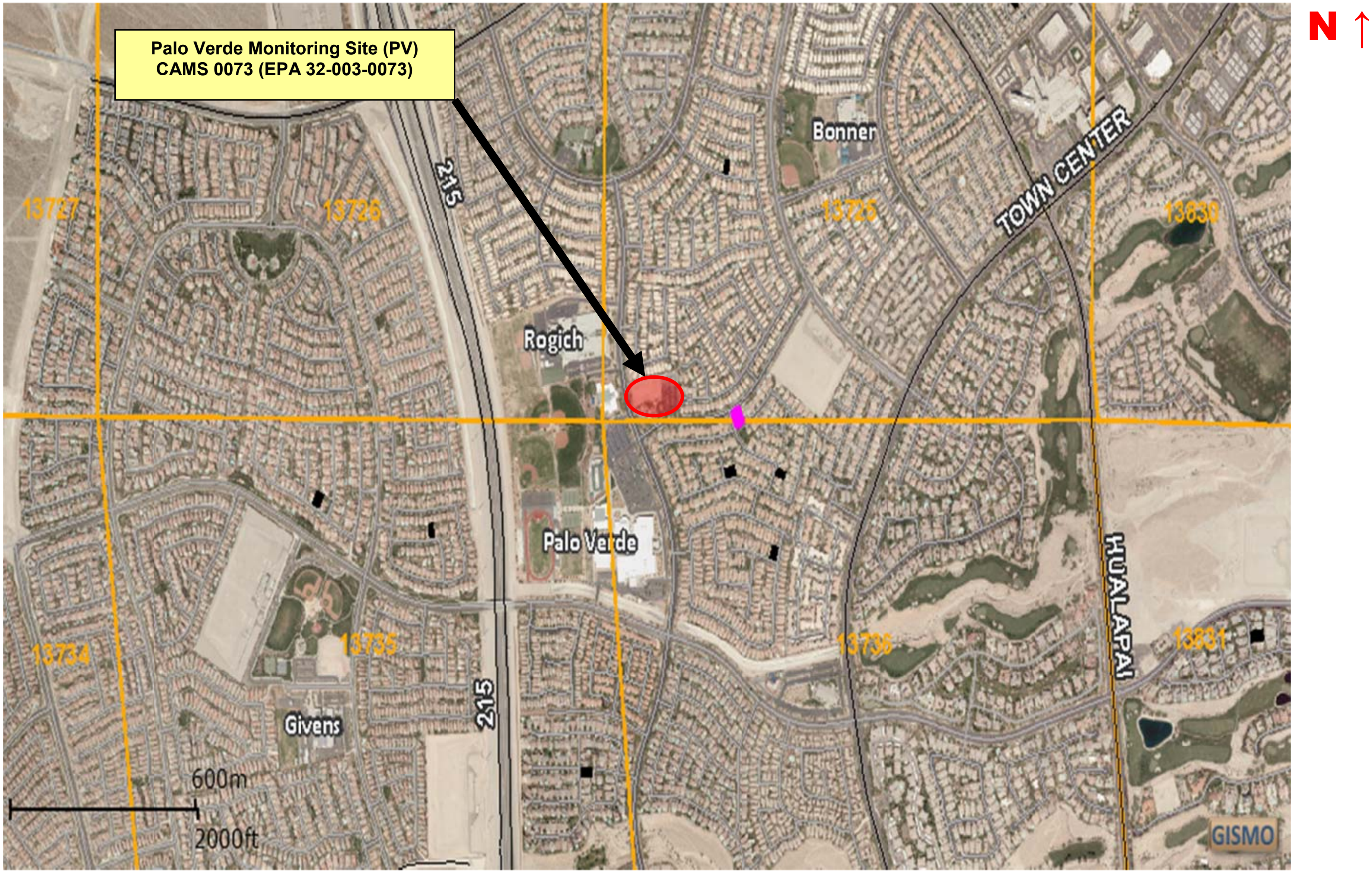


Figure 144. Palo Verde Monitoring Site—Aerial View #4.

4.9 JEAN

The Jean monitoring site (CAMS 1019, EPA 32-003-1019) (Figure 145) is located in the southwestern part of the Ivanpah Valley, in a predominantly rural area approximately 35 miles from the Las Vegas Valley (Figure 4). 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 m north of the monitoring site, and heavily traveled I-15 is approximately 3,100 m 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 gravel. The predominant wind direction for this site is normally southeast. The predominant wind direction during the transported dust event was from the southeast to the northwest, i.e., from Arizona through the Eldorado Valley, and no dust from the transported event affected the Jean monitoring site. The site experienced the lowest concentration values of the entire PM_{10} monitoring network: the measured 24-hour PM_{10} value was 27 µg/m^3 on May 10.

Figure 145. Jean Monitoring Site (EPA 32-003-1019)—Street View.

Figure 146. Jean Monitoring Site —Aerial View #1.

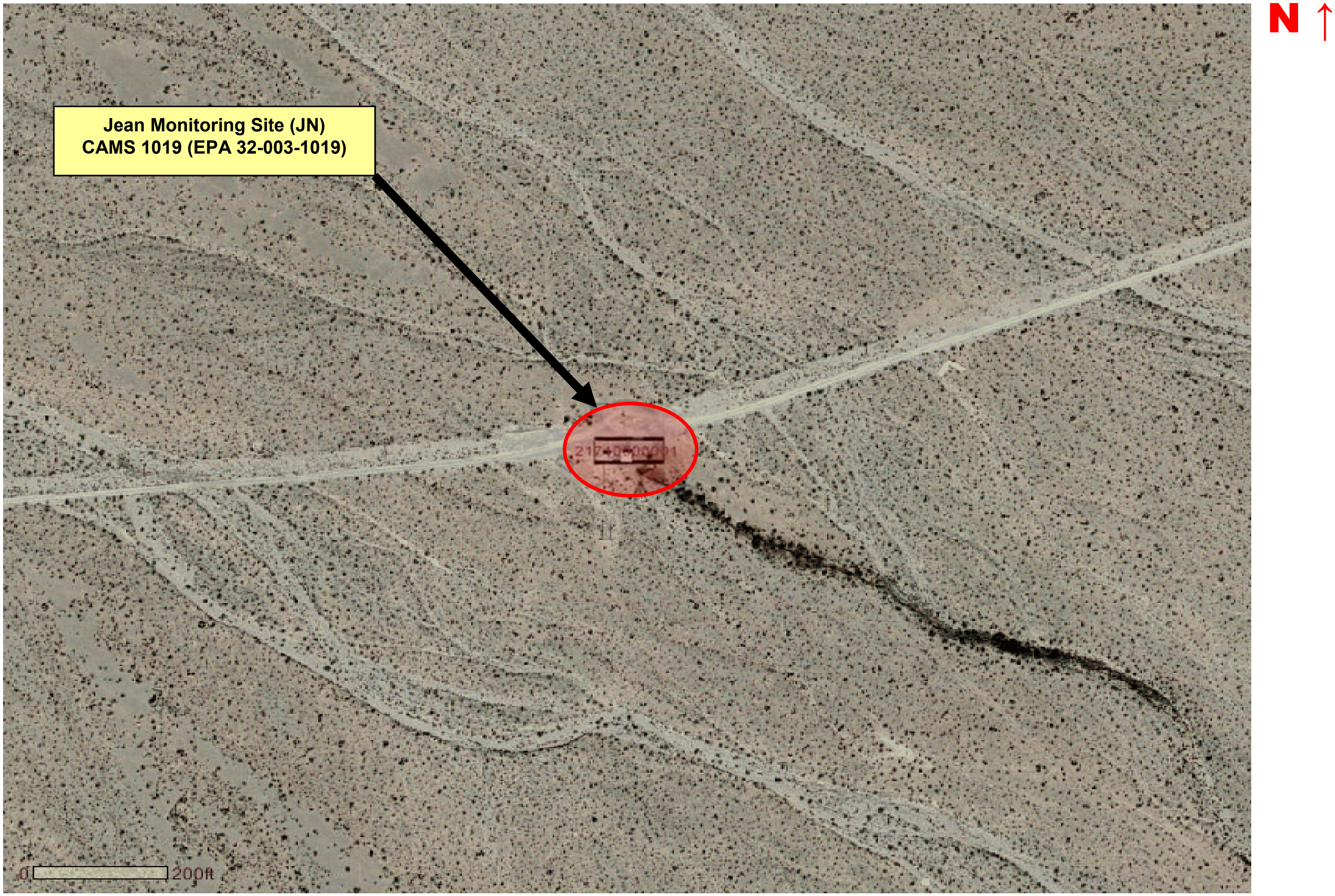


Figure 147. Jean Monitoring Site—Aerial View #2.

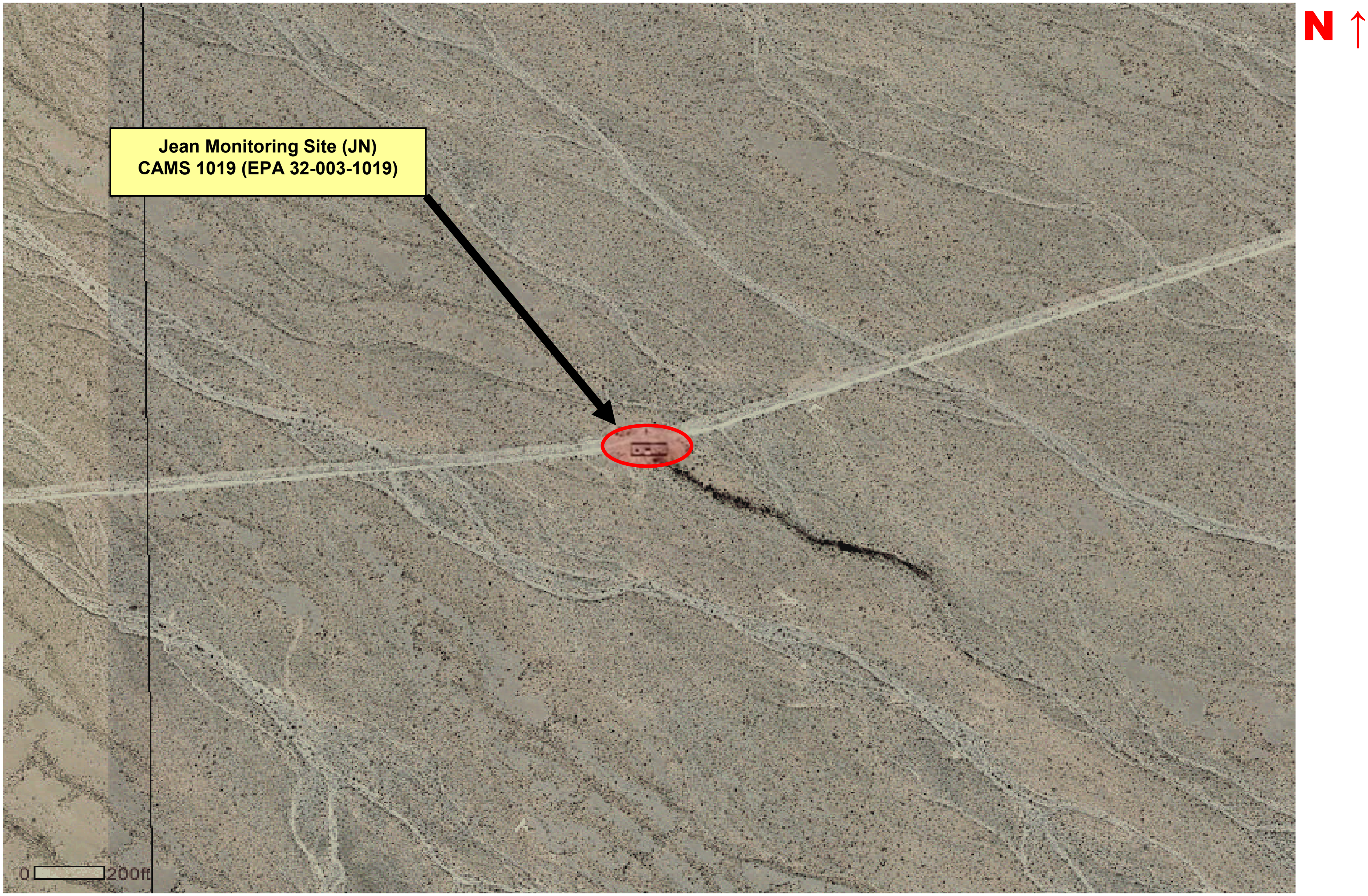


Figure 148. Jean Monitoring Site—Aerial View #3.

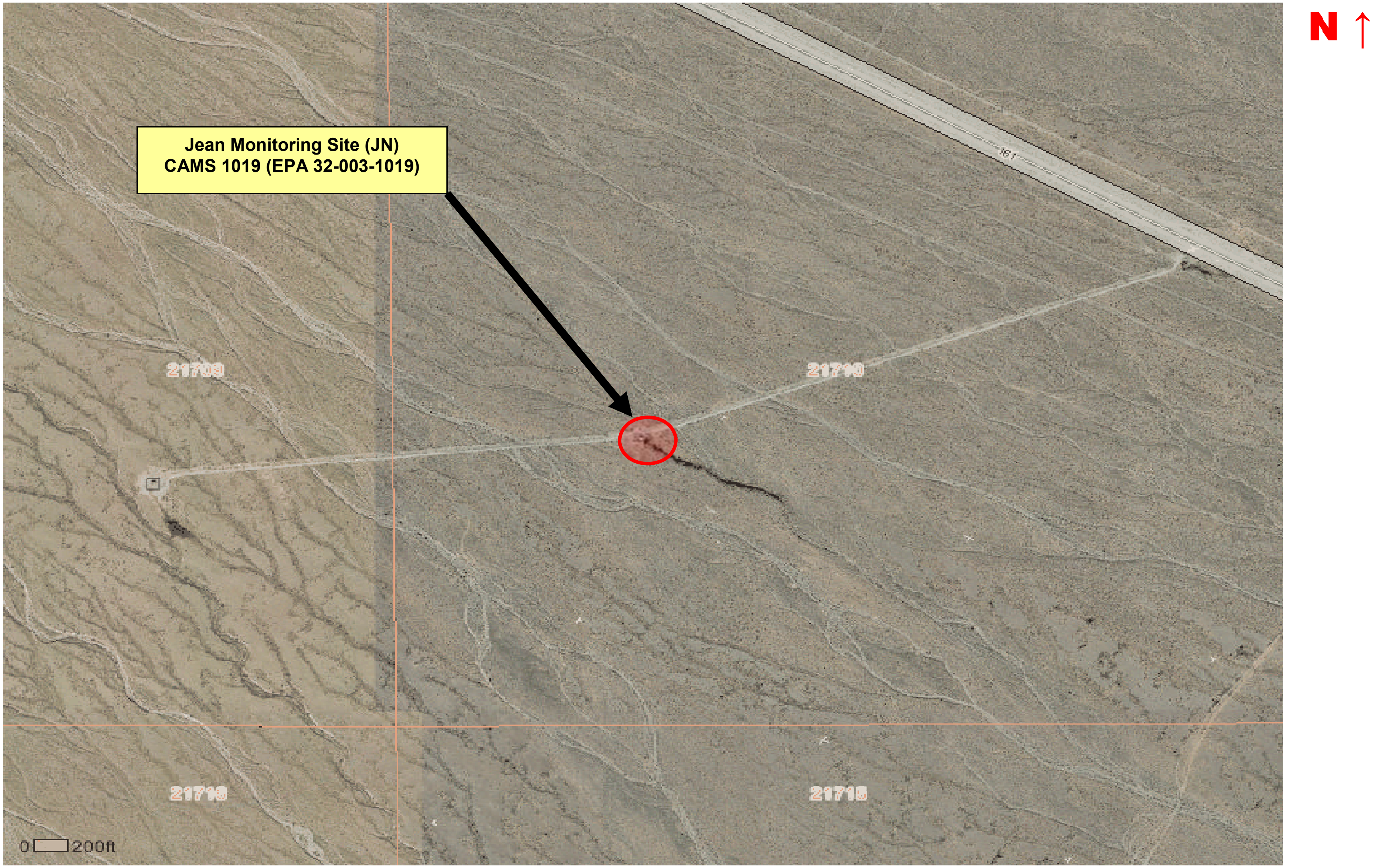


Figure 149. Jean Monitoring Site—Aerial View #4.

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 five exceedance sites. These regulations require stabilization of open areas and disturbed vacant lands, unpaved roads, unpaved parking lots, and 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 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.

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 normal work day. When staff arrived at work that morning, they took immediate action and deployed to the field. DAQ faxed out a "Dust Advisory" to approximately 530 construction sites and selected stationary sources. In addition, 225 valid e-mails were sent to construction sites from the alternative contact list.

Around 30 of the faxes DAQ sent out were not successfully received. The procedure for unsuccessful batch faxes is to review the failed fax confirmation list provided by DAQ's Information Technology section. If a fax does not transmit to any company with three or more active dust control permits, staff makes a follow-up call to verify the fax number and try a manual resend. If this is unsuccessful, a staff member calls the company's landline and, at a minimum, reads the Dust Advisory aloud over the phone.

On May 10, 2012, nine enforcement officers were active in the field on 10-hour shifts. Additionally, one Senior Air Quality Specialist and one Air Quality Compliance Supervisor were on duty during the same time frame to supervise enforcement efforts. Four management and administrative staff supported field enforcement efforts. All eleven officers continued enforcement activities until approximately 1730 PDT. Inspectors contacted 40 construction sites that day, and by 1730 PDT, few were still active. One standby officer was on duty from 1700 to 2200 PDT, but no dust complaints were called in. Attachment 2 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 event day.

Many permitted construction sites prepared for transported dust and possible high winds during the afternoon of May 10 based on DAQ's faxed upgrade from "Dust Advisory" to "Dust Alert" (Appendix C, Attachment 3 and 4). Most contractors were aware of the advisories and responded appropriately, using the training from their DAQ dust classes. All sites were in compliance.

On May 11, the day after the event, DAQ enforcement officers conducted their normal daily site inspections. Eleven enforcement officers were active in the field on 9-hour shifts, with four management and administrative staff supporting field efforts. All eleven officers continued enforcement activities until approximately 1800 PDT. Inspectors contacted 59 permitted construction sites that day: three were not in compliance, and were given verbal warnings. One site was given a warning for not having a dust permit; the other two were given verbal warnings for not keeping dust down and not having a water truck available. One standby officer was on duty from 1700 to 2200 PDT, but no dust complaints were called in after hours.

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 and Las Vegas Valleys. Attachment 2 in Appendix C provides a full list of site inspections, along with the project name and enforcement officer assigned.

Attachment 5 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.

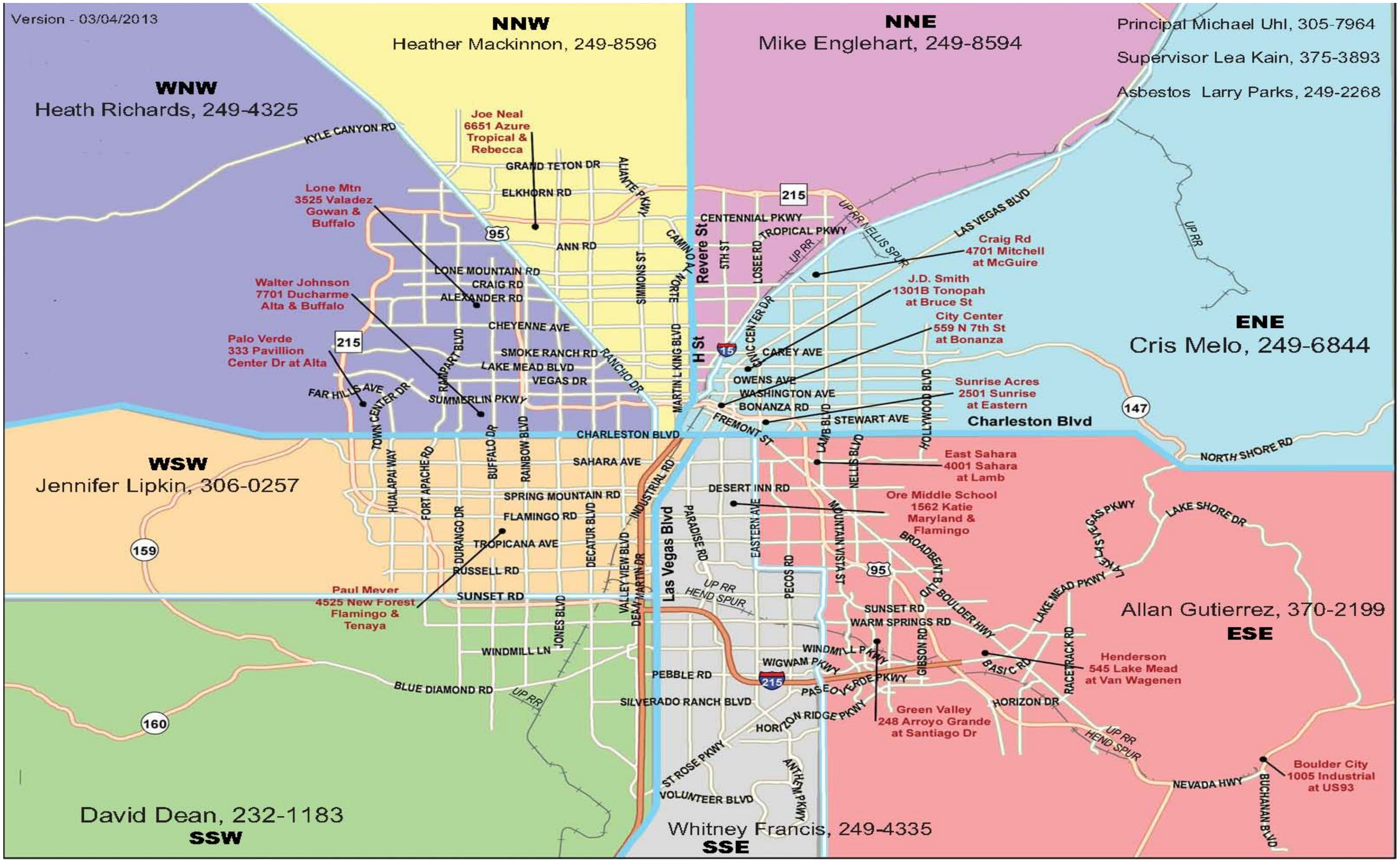


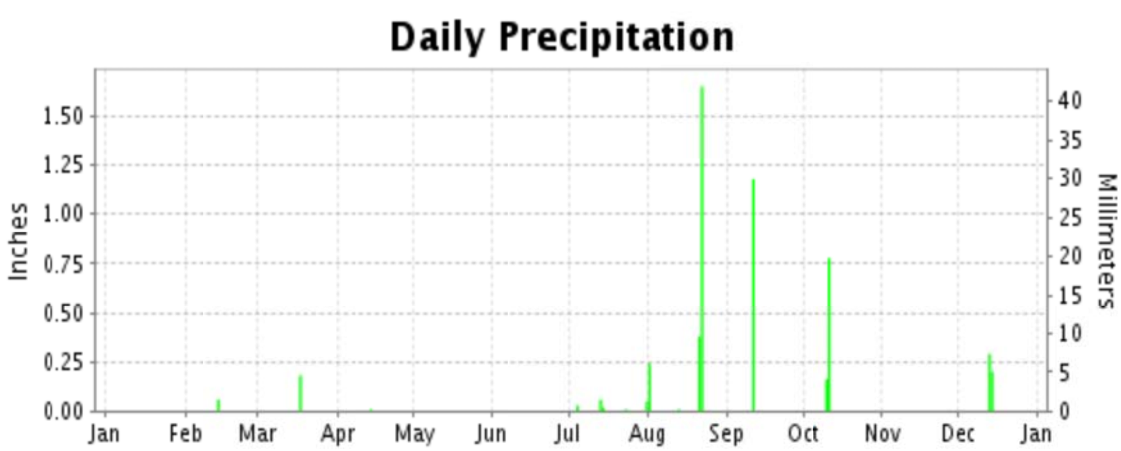
Figure 150. Enforcement/Compliance Exceptional Event Response Sector Map.

5.2 PRECIPITATION IN POTENTIAL FUGITIVE DUST SOURCE REGION

Figure 151 illustrates the small amount of rain Las Vegas had received by the end of May 2012. According to NWS records, the Las Vegas Valley had received only 0.30 inches of measurable precipitation as of May 10, 2012 (Table 14). During May 2012, the Las Vegas Valley and surrounding areas received no measurable precipitation (Figure 152).

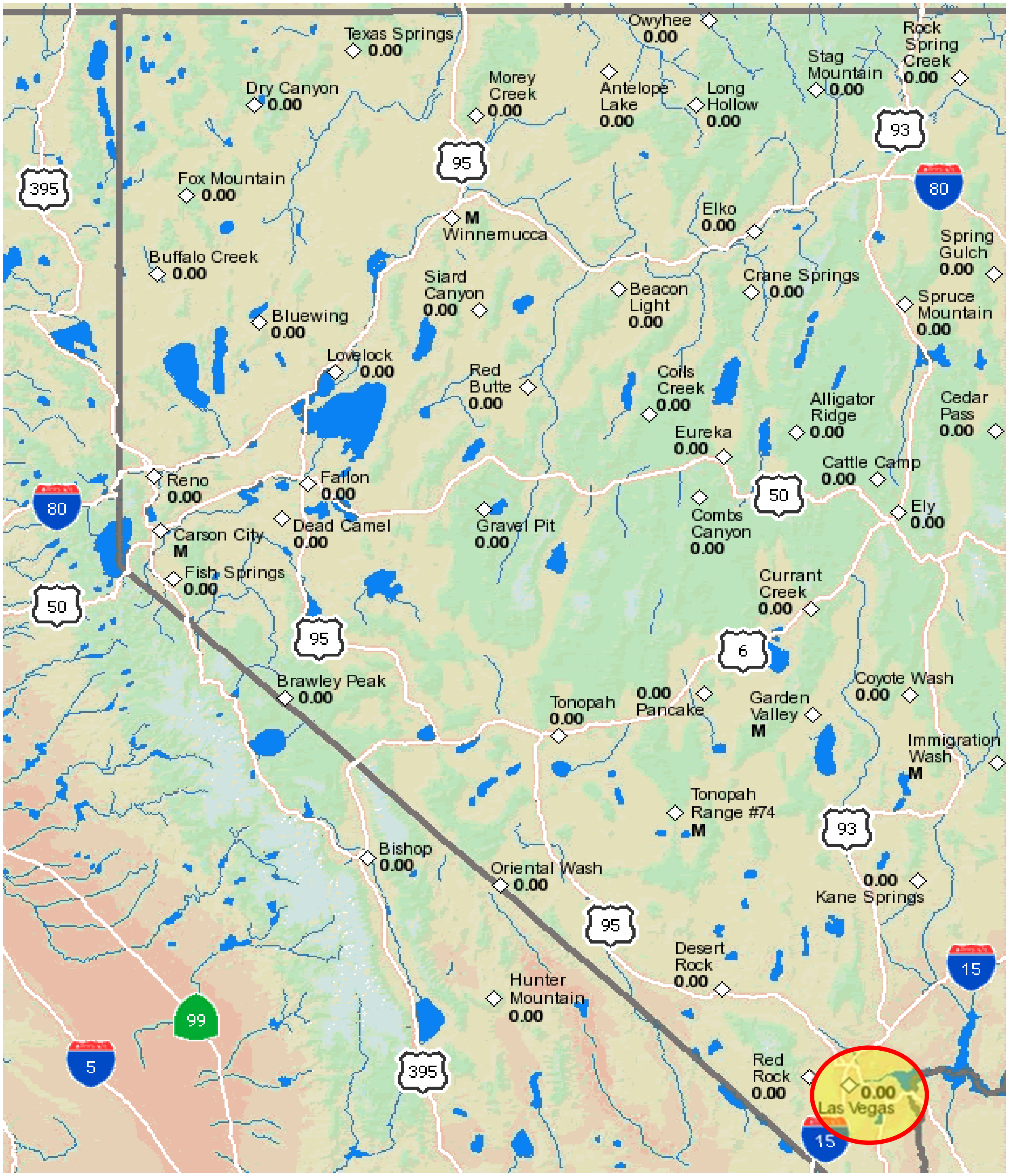
Moisture content of soils is a significant factor in a high-wind or transported dust event. Figures 153–154 show Clark County's departure from normal precipitation levels during 2011 and 2012. Table 38, provides precipitation data for the water years (WY) of 2011 – 2012. NOAA/NWS for California and Nevada River Forecast Center measures precipitation data from October the previous year through September of the present year. Therefore, Table 38 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 May 10 was in April 2012, when 0.02 inches were recorded. Figure 152 shows that no measurable precipitation occurred on May 10, 2012, 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 transported dust event; however, due to generally low sustained wind speeds—and considering the low-velocity wind gusts experienced in the late afternoon of the exceedance day—the additional amount of fugitive dust would not have added to the mix of pollution experienced on May 10, 2012.



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

Figure 151. Daily Precipitation in Las Vegas Valley, 2012.



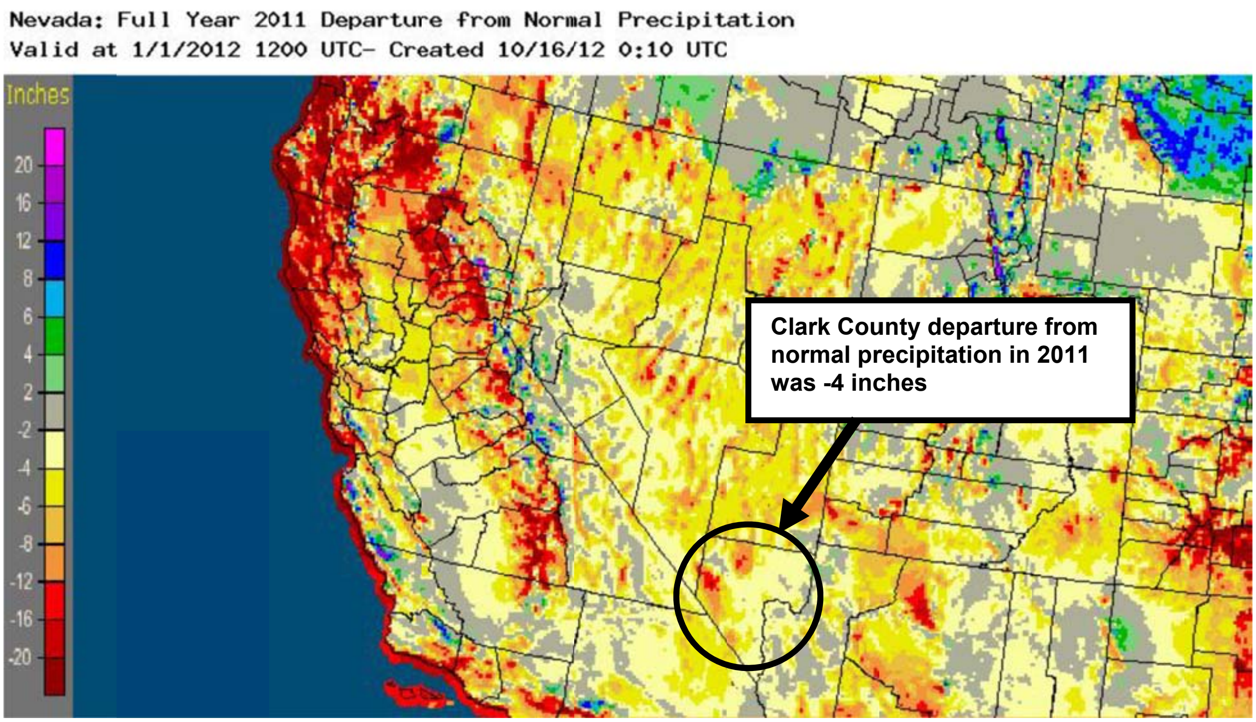
24 Hour Synoptic Precipitation (Inches) Ending Thu May 10 2012 at 12 UTC
NOAA / NWS / California Nevada River Forecast Center

Figure 152. Precipitation at McCarran International Airport and Surrounding Area, May 10, 2012.

Table 38. Cumulative Totals of Precipitation for October 2011–September 2012 Water Year

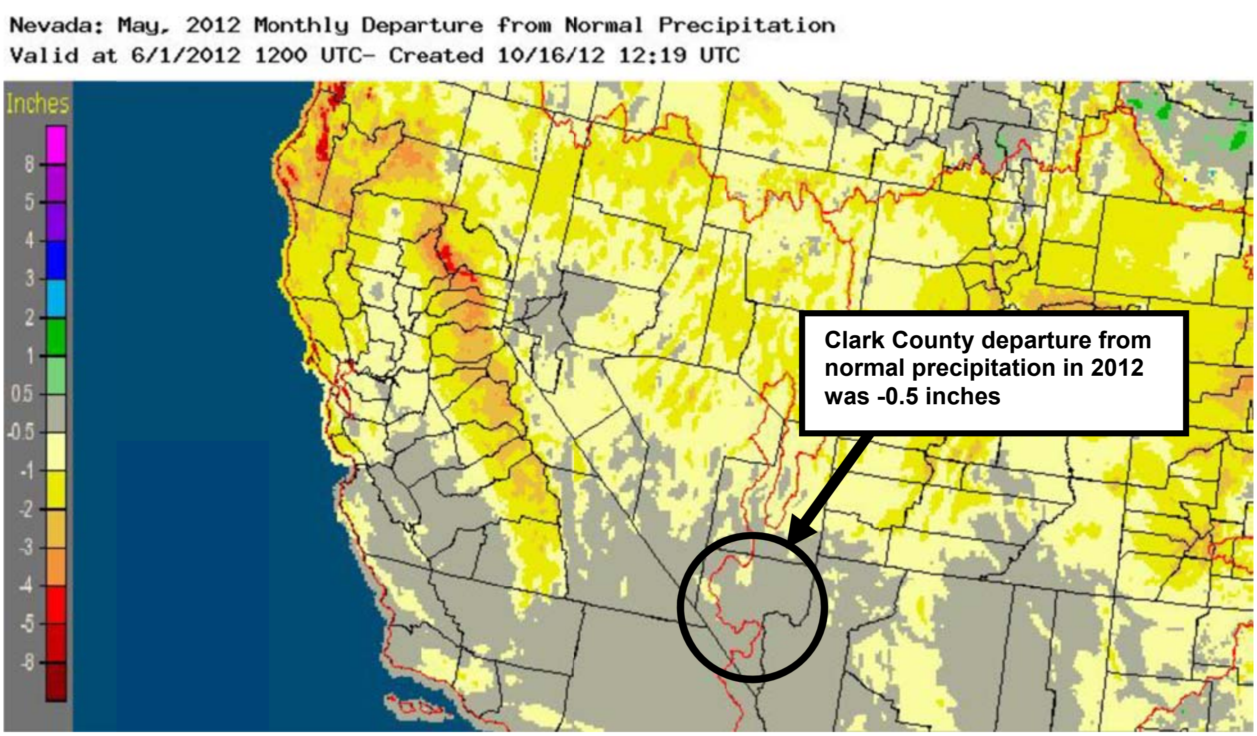
LOWER COLORADO															
ID	Location	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	WY to Date	Pct. Avg to Date	Pct. Tot WY
BLH	BLYTHE	0.12	0.29	0.62	0.00	0.01	0.19	0.14	0.00	0.00	1.88	1.05	0.07	4.37	109	109
BULA3	BULLHEAD CITY	0.00	M	0.17	0.00	0.02	0.20	1.22	0.00	0.00	2.01	0.64	0.00	M		
CALN2	CALIENTE	2.08	0.41	0.06	0.63	0.95	1.25	0.45	0.00	0.00	2.48	2.75	0.36	11.42	115	115
DNWN2	DESERT NTL WILDLIFE REF	0.08	0.00	0.15	M	M	0.24	0.33	0.00	M	0.12	1.16	0.05	M		
EED	NEEDLES	0.39	0.31	0.29	0.00	0.09	0.11	0.42	0.00	0.00	1.37	0.32	0.21	3.51	69	69
EGNN2	ELGIN	2.21	0.61	0.40	M	M	0.78	0.58	0.00	M	M	M	M	M		
GUNU1	GUNLOCK PH	1.82	0.69	0.21	0.69	1.56	0.79	0.93	0.00	0.00	1.99	2.14	2.52	13.34	98	98
HIKN2	HIKO	0.58	0.07	0.25	0.56	0.31	0.78	0.77	0.00	0.00	1.27	1.17	0.35	6.11	106	106
LAUN2	LAUGHLIN	0.51	0.35	0.29	0.00	0.06	0.43	0.96	0.00	0.00	0.55	1.76	0.03	4.94	117	117
LAVU1	LA VERKIN	1.44	0.64	0.34	0.89	1.29	0.62	0.83	0.00	0.00	2.56	1.52	0.95	11.08	92	92
LHCA3	LAKE HAVASU CITY	0.11	0.56	0.66	0.11	0.27	0.14	0.32	0.00	0.00	2.48	1.21	0.19	6.05	NA	NA
LUNN2	LUND	1.93	0.20	0.02	0.73	0.69	0.58	0.17	0.03	0.01	2.13	1.37	0.93	8.79	80	80
PWMN2	PAHRANAGAT WILDLIFE REF	1.12	0.16	0.00	0.22	0.31	0.57	0.66	0.00	0.00	0.80	1.21	0.56	5.61	85	85
SGUU1	ST. GEORGE	0.72	0.17	0.27	0.46	1.70	0.08	0.45	0.00	0.00	1.13	1.76	1.00	7.74	88	88
SPVN2	SPRING VALLEY STATE PA	2.69	0.41	0.20	0.60	1.01	1.02	0.45	0.26	0.00	0.40	1.68	1.60	10.32	84	84
SRCN2	SEARCHLIGHT	0.18	0.20	0.56	0.08	0.12	0.19	0.38	0.00	0.00	1.82	2.01	1.67	7.21	87	87
SUNN2	SUNNYSIDE	M	M	0.16	0.30	0.66	1.13	0.60	0.09	0.00	0.83	0.64	0.73	M		
VEF	LAS VEGAS	0.32	0.13	0.23	0.01	0.06	0.21	0.02	0.00	0.00	0.34	2.63	1.20	5.15	112	112
VEYU1	VEYO POWER HOUSE	1.63	0.55	0.22	0.50	1.29	0.75	1.31	0.00	0.00	2.63	1.99	1.48	12.35	82	82
VOFN2	VALLEY OF FIRE SP	1.46	0.30	0.26	0.03	0.36	0.71	0.70	0.00	0.00	0.14	1.61	0.47	6.04	93	93
WUPA3	WIKIEUP	0.42	0.45	1.48	0.05	0.38	0.78	0.61	0.00	0.00	1.00	1.58	0.92	7.67	78	78
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, 2011.



Source: National Weather Service
California-Nevada River Forecast Center

Figure 154. Departure from Normal Precipitation in Nevada, 2012.

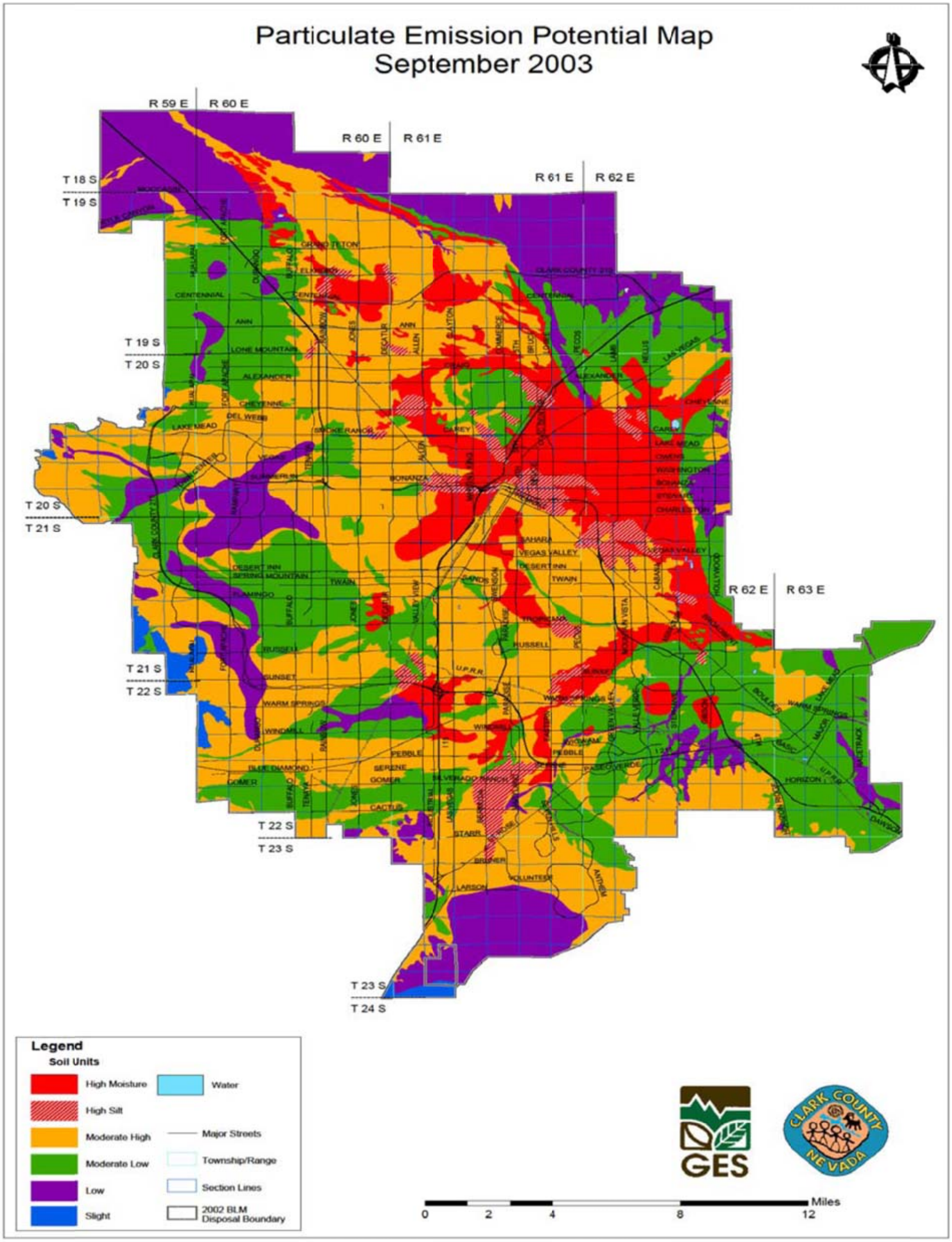


Figure 155. Particulate Emissions Potential Map of Las Vegas Valley, September 2003.

6.0 CONCLUSION

DAQ investigated emission-generating activities during and after the 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 would have significantly impacted the particulate concentrations measured at DAQ's monitoring sites. Low sustained wind speeds and wind gusts helped dilute the dust, then blew the bulk of it out of the Eldorado and Las Vegas Valleys. DAQ, therefore, concludes that the PM_{10} exceedance would not have occurred *but for* the transported dust from the Arizona haboob. Based on the evidence of a transported dust event set forth in this report, Clark County requests that EPA support the flagging of the PM_{10} exceedance at the Boulder City, Jerome Mack, Sunrise Acres, J. D. Smith, and Joe Neal monitoring sites on May 10, 2012, in the EPA AQS.