SACRAMENTO METROPOLITAN

AIR QUALITY
MANAGEMENT DISTRICT

2025 5-YEAR AIR MONITORING

NETWORK ASSESSMENT

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Executive Summary

In accordance with 40 CFR Part 58.10(d), the Sacramento Metropolitan Air Quality Management District (District) is required to submit to the United States Environmental Protection Agency (EPA) an assessment of the air quality surveillance system. A network assessment was performed using five years of data between 2020 to 2024 to determine if the monitoring network is meeting the required monitoring objectives of 40 CFR Part 58, which are:

1. Provide air pollution data to the general public in a timely manner.
2. Support compliance with ambient air quality standards and emissions strategy development.
3. Support for air pollution research studies.

This assessment follows a spectrum methodology, emphasizing cross-sectional comparisons, to evaluate whether the existing ambient air monitoring network meets the needs of the residents of Sacramento County and District's monitoring objectives, as well as the EPA statutory requirements outlined in the Clean Air Act. The District is the local air quality regulatory and monitoring organization with jurisdiction over Sacramento County, California. Sacramento County has a population of approximately 1.6 million persons[1] and is located in the southern portion of the Sacramento Valley air basin[2] (Figure 1).

Sacramento County is included in the Sacramento Federal Ozone Nonattainment Area (SFNA; 56 FR 56728), and the SFNA is a nonattainment area for the federal 8-hr ozone (O_3) standard (83 FR 25776). The Sacramento region was also designated as nonattainment for the 2006 24-hour fine particulate matter ($PM_{2.5}$) standard. The region met the 2006 24-hour $PM_{2.5}$ standard in 2015 (82 FR 21711), but the Sacramento Federal $PM_{2.5}$ Nonattainment Area (74 FR 58688) has not yet been redesignated to attainment. See Figure 1 for boundaries of these two areas. Sacramento County has met the coarse particulate matter (PM_{10}) air quality standard since 2002[3]. Sacramento County is designated as attainment for the most recent federal health standards for carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2). EPA has designated Sacramento County as unclassifiable/attainment for the 2008 federal lead (Pb) standard (70 FR 72097).

[1] United States Census Bureau: https://www.census.gov/quickfacts/sacramentocountycalifornia

[2] California air basins as defined by the California Air Resources Board (CARB): https://www.arb.ca.gov/ei/maps/2017statemap/zabmap.htm

[3] The 2018 Camp Fire caused PM_{10} exceedances, and the District has submitted to EPA an exceptional event demonstration to exclude the data from air quality standard comparison. More information can be found in the PM_{10} section of this assessment.

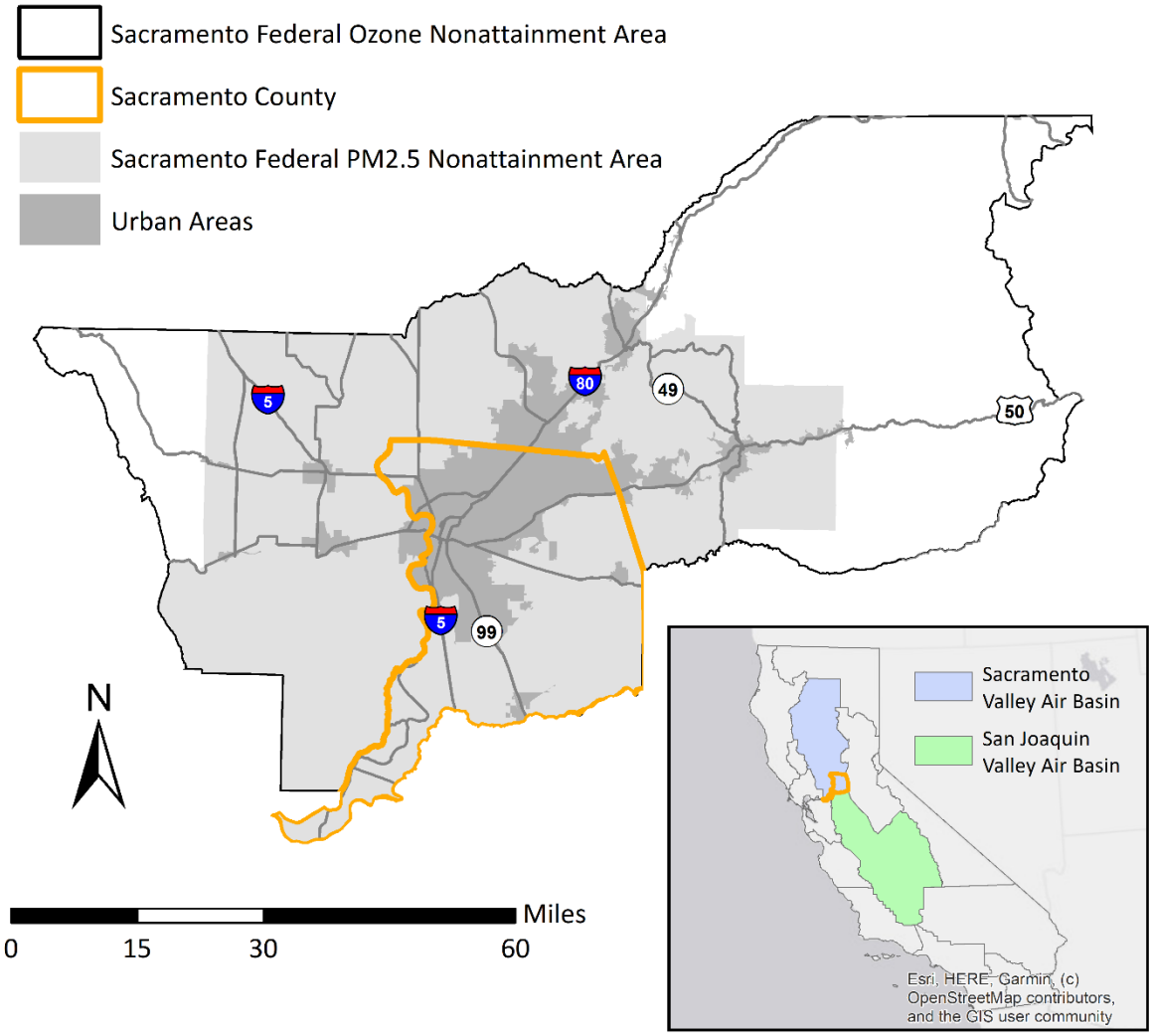

Figure 1 – Map of Sacramento County, the urban areas within and close to Sacramento County, the Sacramento Federal Ozone Nonattainment Area, the Sacramento Federal $PM_{2.5}$ Nonattainment Area, and the Sacramento and San Joaquin Valley air basins.

The air monitoring network is fundamentally designed to fulfill federal regulatory requirements, making every component of the network essential. It supports evaluating compliance with health-based standards aimed to protect public health and welfare. As such, the network is necessary to meet specific regulatory objectives, including the implementation of State Implementation Plans (SIPs), assessment of pollutant trends, and identification of areas of nonattainment with federal health standards. Routine evaluation ensures that the network continues to satisfy these regulatory requirements in consideration of evolving air quality conditions and distribution of emissions over time, thereby maintaining the integrity and regulatory relevance of the network.

Each monitoring site plays a distinct role in the District network, based on a number of factors critical in defining air quality for the region. This assessment investigates how the network can be improved upon based on criteria set forth in 40 CFR part 58.10(d) and the EPA Ambient Air Monitoring Network

Assessment Guidance[4]. However, as this assessment investigates whether the current network adequately meets the monitoring objectives defined in 40 CFR Appendix D to Part 58, it is important to assess whether updates to the monitoring network are needed.

The methodology used in this assessment is based on a subset of the analysis methods prescribed in EPA's Network Assessment Guidance document[5]. The Clean Air Act requires the EPA to set health standards for six criteria air pollutants: O_3, particulate matter, CO, Pb, SO_2, and NO_2. These pollutants are called criteria pollutants as the health standards are set based on the characterizations of the latest scientific information regarding their effects on health or welfare[6]. Each criteria pollutant monitor was analyzed and ranked for importance based on the following analysis techniques.

- **Area-Served** – Monitors with the largest areas of influence were ranked highest.
- **Population-Served** – Monitors serving the largest total population were ranked highest.
- **Measured Concentration** – Monitors with higher design values were ranked highest.
- **Deviation from NAAQS** – Monitors closest to the NAAQS were ranked highest.
- **Trend Impact** – Monitoring sites with the longest active historical record were ranked highest.
- **Monitor-to-Monitor Correlation** – Monitors were ranked by considering correlation based on Pearson coefficients, distance between sites, and mean difference in concentrations. Monitors with low correlation, large proximities, and high absolute differences are ranked highest.
- **Removal Bias** – Monitors having the highest change in concentration when removed from the network were ranked highest.

An additional analysis was performed for the District network as a whole using the Number of Parameters technique, which ranks the total number of parameters measured at each site. Sites measuring multiple parameters ranked highest. Analyses listed above were performed for each pollutant, and individual monitors were ranked based on each of the analysis techniques. Each monitor was ranked based on the specific analysis technique. An overall score was then calculated for each monitor. The results of the analyses were evaluated in context of the overall monitoring objectives for each pollutant. Recommendations for the network were made based on the aggregated results of the analysis identified above. Below are the major recommendations from this assessment.

- Installation of a replacement air monitoring station near the discontinued North Highlands-Blackfoot location to measure continuous PM_{10} concentrations to improve long term resource efficiency, if resources are available to replace the station.
- Discontinuation of the Sacramento-Branch Center #2 PM_{10} filter-based monitor and the Sacramento-Branch Center #2 air monitoring station, if a replacement air monitoring station has been installed for the North Highlands-Blackfoot location.
- Installation of the Photochemical Assessment Monitoring Stations (PAMS) equipment required in 40 CFR Appendix D to Part 58 after the Sacramento-Del Paso Manor station expansion project is completed. The existing PAMS VOC canister sampling will be replaced with an automated gas chromatograph (autoGC).

[4] US EPA, Ambient Air Monitoring Network Assessment Guidance Documents; https://www.epa.gov/amtic/ambient-air-monitoring-network-assessment-guidance-documents

[5] US EPA Ambient Air Monitoring Network Assessment Guidance, Analytical Techniques for Technical Assessments of Ambient Air Monitoring Networks, EPA-454/D-07-001, February 2007.

[6] US EPA, Criteria Air Pollutants; https://www.epa.gov/criteria-air-pollutants

- The Sacramento area has surpassed the threshold for a second near-road monitoring site to measure NO_2 and CO. The District is working with EPA and CARB to determine the appropriate timing, location, and funding for this site.

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List of Definitions

µg m^{-3}	micrograms per cubic meter
AADT	annual averaged daily traffic
AB 617	Assembly Bill 617
AQI	Air Quality Index
AQS	Air Quality System
autoGC	automated gas chromatograph
CAL FIRE	California Department of Forestry and Fire Protection
CARB	California Air Resources Board
CBSA	Core Based Statistical Areas
CFR	Code of Federal Regulations
CNRA	California Natural Resources Agency
CO	carbon monoxide
CSN	Chemical Speciation Network
District	Sacramento Metropolitan Air Quality Management District
DV	design value
EE	Exceptional Event Rule
EMP	Enhanced Monitoring Plan
EPA	United States Environmental Protection Agency
FEAADT	Fleet Equivalent Annual Average Daily Traffic
FEM	federal equivalent method
FR	Federal Register
FRM	federal reference method
ID	identification
IMPROVE	Interagency Monitoring of Protected Visual Environments
km	kilometers

MODIS	Moderate Resolution Imaging Spectroradiometer
MSA	Metropolitan Statistical Areas
NAAMS	National Ambient Air Monitoring Strategy
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NCore	National Core Multi-Pollutant Monitoring Stations
NEI	National Emission Inventory
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
NO_y	Reactive nitrogen compounds
O_3	ozone
OAQPS	EPA Office of Air Quality Planning and Standards
PAMS	Photochemical Assessment Monitoring Stations
Pb	lead
PM_{10}	coarse particulate matter (diameter less than or equal to 10 micrometers)
$PM_{10-2.5}$	particulate matter with diameter between 10 and 2.5 micrometers
$PM_{2.5}$	fine particulate matter (diameter less than or equal to 2.5 micrometers)
ppb	parts per billion
ppm	parts per million
PQAO	Primary Quality Assurance Organizations
PWEI	population weighted emission index
R	Pearson correlation coefficient
SACOG	Sacramento Area Council of Governments
SFAD	Sacramento Federal $PM_{2.5}$ Area Designation
SFNA	Sacramento Federal Ozone Nonattainment Area
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Stations

SO_2	sulfur dioxide
SPM	Special Purpose Monitoring
USCB	United States Census Bureau
VOC	volatile organic compound

Station Abbreviations

BC	Sacramento-Branch Center #2
BER	Sacramento-Bercut Drive
BRU	Elk Grove-Bruceville Rd.
DPM	Sacramento-Del Paso Manor
FOL	Folsom-Natoma St.
NH	North Highlands-Blackfoot
SLU	Sloughhouse
TST	Sacramento-1309 T Street

Introduction

In October 2006[7], the U.S. Environmental Protection Agency (EPA) finalized amendments to the ambient air monitoring regulations. The goal of the amendments was to enhance ambient air monitoring networks to better serve current and future air quality management and research needs. As part of the amendments, EPA required that states or local air monitoring agencies conduct a network assessment once every five years to determine, at a minimum, if the air monitoring network meets the air monitoring objectives as defined in Title 40 Code of Federal Regulations (CFR) Part 58, Appendix D. This requirement is an outcome of implementing the 2005 National Ambient Air Monitoring Strategy (NAAMS). The purpose of the NAAMS is to optimize air monitoring networks to achieve the best possible scientific value and protection of public and environmental health and welfare utilizing limited resources. Per 40 CFR 58.10(e):

> *"(e) The State, or where applicable local, agency shall perform and submit to the EPA Regional Administrator an assessment of the air quality surveillance system every 5 years to determine, at a minimum, if the network meets the monitoring objectives defined in appendix D to this part, whether new sites are needed, whether existing sites are no longer needed and can be terminated, and whether new technologies are appropriate for incorporation into the ambient air monitoring network. The network assessment must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby States and Tribes or health effects studies. For $PM_{2.5}$, the assessment also must identify needed changes to population-oriented sites. The State, or where applicable local, agency must submit a copy of this 5-year assessment, along with a revised annual network plan, to the Regional Administrator. The first assessment is due July 1, 2010."*

To satisfy the requirements of 40 CFR Part 58.10(e), the Sacramento Metropolitan Air Quality Management District (District) performed this assessment of the District air and meteorological monitoring networks for the five-year period from 2020-2024. This assessment revisits the findings of and builds upon the District's 2020 Air Monitoring Network Assessment[8]. The methodology and techniques used in the assessment are a subset of the analysis methods prescribed in EPA's network assessment guidance document[9].

[7] US EPA Revisions to Ambient Air Monitoring Regulations; Final Rule, FR Vol. 71, No. 200, October 17, 2006.
[8] Sacramento Metropolitan Air Quality Management District, 2020 Air Monitoring Network Assessment, https://www.airquality.org/ProgramCoordination/Documents/2020%205%20Year%20Network%20Assessment.pdf
[9] US EPA Ambient Air Monitoring Network Assessment Guidance, Analytical Techniques for Technical Assessments of Ambient Air Monitoring Networks, EPA-454/D-07-001, February 2007.

Background

Since ambient monitoring objectives, regulatory requirements, and demographics change over time, air agencies need to reevaluate and potentially reconfigure their monitoring networks to best meet the needs of these changes. There are several factors to consider when assessing the network, including the following:

- Changes in air quality monitoring requirements;
- Improvements in air quality;
- Changes in population and behaviors; and
- Advances in scientific understanding of air quality.

This assessment reviews the adequacy of the air monitoring network, if it meets monitoring objectives and requirements, and helps to determine how the network can be improved upon and the efficiency of the network increased holistically. Changes to the National Ambient Air Quality Standards (NAAQS) motivate air agencies to examine their monitoring activities and to prioritize monitoring resources on pollutants of interest, such as ozone (O_3) and its precursors and fine particulate matter (diameter less than or equal to 2.5 microns in size; $PM_{2.5}$).

Agencies intentionally design networks that protect the public and the environment while maintaining the ability to understand long-term historical air quality trends. A comprehensive network provides the appropriate information to help support State Implementation Plan (SIP) development requirements and to track the effectiveness of control measures. Air quality trends are integral in understanding the efficacy of pollutant reduction strategies as well as identifying long-term factors impacting air quality. Air monitoring agencies can also take advantage of improved scientific understanding of air quality issues as well as implement new air monitoring technologies into their monitoring networks.

Monitoring networks should be designed to address multiple, interrelated air quality issues and to support other types of air quality assessments, such as emission inventory assessments or photochemical modeling. Agencies need to effectively utilize extremely limited federal and state resources to maximize the outputs of the air monitoring networks to meet the needs of current air quality issues. Ongoing research will further strengthen the value of these networks in protecting the public, stakeholders, and the scientific community.

Network Objectives

Sacramento County is located within the southern portion of the Sacramento Valley (Figure 2). The objectives of the District's air monitoring stations are to collect ambient air quality and meteorological data to be used for several purposes as outlined in 40 CFR Appendix D to Part 58:

- To provide the public with air quality information that includes air quality forecasts, notices of air quality episodes that affect public health, and current air quality conditions.
- To establish regulatory compliance with ambient air quality standards.
- To develop a scientific understanding of air quality, including spatial and temporal distribution of emissions, historical trends in air quality, identification and quantification of emission source contributions, input to and evaluation of air quality models, population exposure to poor air quality, and design and evaluation of the effectiveness of control strategies.

The goal of the District's monitoring network is to effectively characterize air quality and meteorology in the county and continues to meet its monitoring objectives.

Figure 2 – Map of Sacramento County.

The District is the public agency responsible for development, implementation, monitoring, and enforcement of various air pollution control strategies in Sacramento County, including its incorporated cities. This includes meeting monitoring objectives as set forth by federal air monitoring standards for ozone (O_3) and fine particulate matter ($PM_{2.5}$). The District is part of larger federal non-attainment areas (see Figure 3), which includes Sacramento County and portions of El Dorado, Placer, Solano, Sutter, and Yolo counties[10]. The Sacramento Federal Ozone Nonattainment Area (SFNA) is designated by the EPA as severe non-attainment for the 1997 (0.08 ppm) and 2008 (0.075 ppm) 8-hour O_3 standards, and serious for the 2015 8-hour O_3 standard (0.070 ppm) (86 FR 59648). For the 1997 O_3 standard, the District requested in December 2023 to EPA to make a Clean Data Determination. EPA has not yet made a determination. However, for the 2008 O_3 Standard, a more stringent standard than the 1997 O_3 Standard, EPA published the preliminary Determination of Attainment by the Attainment Date (DAAD)

[10] The southern portion of Sutter County is included as part of the Sacramento Federal Ozone Nonattainment Area.

on March 21, 2025[11]. Although the concentrations remain above the 2015 federal standard of 0.070 ppm at several monitoring stations, ozone concentrations continue to steadily decrease in the nonattainment area. In 2022, the District submitted a bump-up request to severe nonattainment designation[12] for the 2015 standard. The District prepared an Attainment and Reasonable Further Progress Plan[13] and submitted it for EPA review in November 2023 assuming this designation. The plan outlines how the region will continue to reduce concentrations through implementation of programs and strategies.

The Sacramento region was also designated as nonattainment for the 2006 24-hour and in attainment for the annual fine particulate matter ($PM_{2.5}$) standards, even as the annual $PM_{2.5}$ standard was lowered from 12.0 μgm^{-3} to 9.0 μgm^{-3} in February 2024[14]. The region, as shown in Figure 3, met the 2006 24-hour $PM_{2.5}$ standard in 2015 (82 FR 21711) and continues to reduce $PM_{2.5}$ levels through various programs and strategies. Sacramento County has met the particulate matter with size of 10 microns or smaller (PM_{10}) air quality standard since 2002[15]. The District has prepared a Second 10-year Maintenance Plan for Sacramento County that shows maintenance of the 24-hour PM_{10} NAAQS from 2024 through 2033[16]. Sacramento County is in attainment for the federal carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2) standards. The EPA designated Sacramento County as unclassified/attainment for the 2008 federal lead (Pb) standard[17].

[11] U.S. EPA (2025) Determination of Attainment by the Attainment Date. 21 March 2025. https://www.airquality.org/Businesses/Air-Quality-Plans

[12] Peter, Ellen (2022) CARB to EPA Bump-Up Letter https://www.airquality.org/ProgramCoordination/Documents/2022-09-06%20CARB%20to%20EPA%20Bump%20Up%20Ltr%20EMP%20Signed.pdf

[13] Sacramento Metropolitan Air Quality Management District (2023), Sacramento Regional 2015 NAAQS 8-Hour Ozone Attainment & Reasonable Further Progress Plan. 17 October 2023. https://www.airquality.org/Businesses/Air-Quality-Plans

[14] U.S. EPA (2024) Reconsideration of the National Ambient Air Quality Standards for Particulate Matter. 7 February 2024. https://www.epa.gov/system/files/documents/2024-04/2024-pm-naaqs-fr-published.pdf

[15] The 2018 Camp Fire caused PM_{10} exceedances, and the District has submitted to EPA an Exceptional Event Demonstration to exclude the data from air quality standard comparison. More information can be found in the PM_{10} section of this assessment.

[16] Second 10-Year PM_{10} Maintenance Plan for Sacramento County; https://www.airquality.org/air-quality-health/air-quality-plans/federal-planning

[17] US EPA, Region 9 (2011), Letter to California Governor Brown and CARB. 14 June 2011. Print.

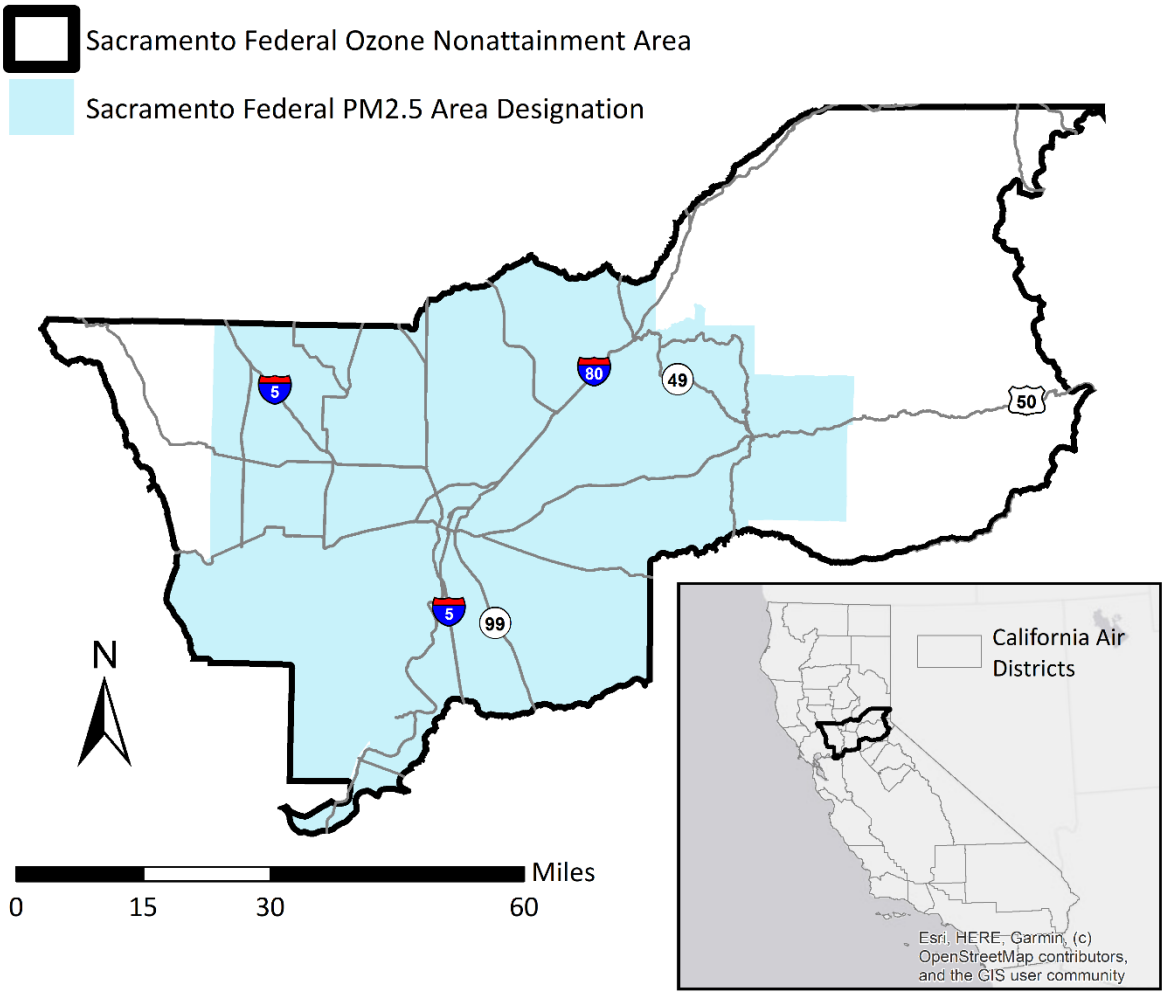


Figure 3 – Sacramento Federal Ozone Nonattainment Area (SFNA) and the Sacramento Federal $PM_{2.5}$ Area Designation. Inset shows all California Air District boundaries with the SFNA overlaid in black.

There are six (6) air monitoring sites currently operated by the District. A seventh monitoring site in Sacramento County, Sacramento-1309 T Street, is currently operated by the California Air Resources Board (CARB). Figure 4 presents the locations of the stations within the County and the population density by census tract from 2020 Census data[18]. Table 2 also provides site network affiliation and station start dates. Table 3 presents, by station, the air quality and meteorological parameters measured at each site. Throughout this assessment, monitoring types are listed (e.g. background, population oriented, high concentration) consistent with 40 CFR Appendix D to Part 58. Each District monitoring site has monitors that belong to one or more of the following national monitoring networks:

- SLAMS – State and Local Air Monitoring Stations
- NCore – National Core Multi-Pollutant Monitoring Stations
- CSN – Chemical Speciation Network

[18] Data found at: https://www.census.gov/en.html

- PAMS – Photochemical Assessment Monitoring Stations
- SPM – Special Purpose Monitoring

State and Local Air Monitoring Stations (SLAMS) are used for supplying general monitoring data for criteria pollutants and determining compliance with the NAAQS. The SLAMS are long-term stations that must meet and follow specific quality assurance, monitoring methodology, sampling objectives and siting requirements. The District SLAMS stations have been established with the purpose of determining compliance with NAAQS and for the protection of public health. Due to the proximity of ambient air pollutant concentrations to the NAAQS in Sacramento County, a primary focus of the current ambient air monitoring network is the collection of particulate matter, O_3, and photochemical pollutant precursors such as oxides of nitrogen (NO_X) and volatile organic compounds (VOC). These data are used to ensure improvement to air quality and public health by supporting state implementation plan (SIP) development, attainment/non-attainment decisions, air quality modeling efforts, and public notification.

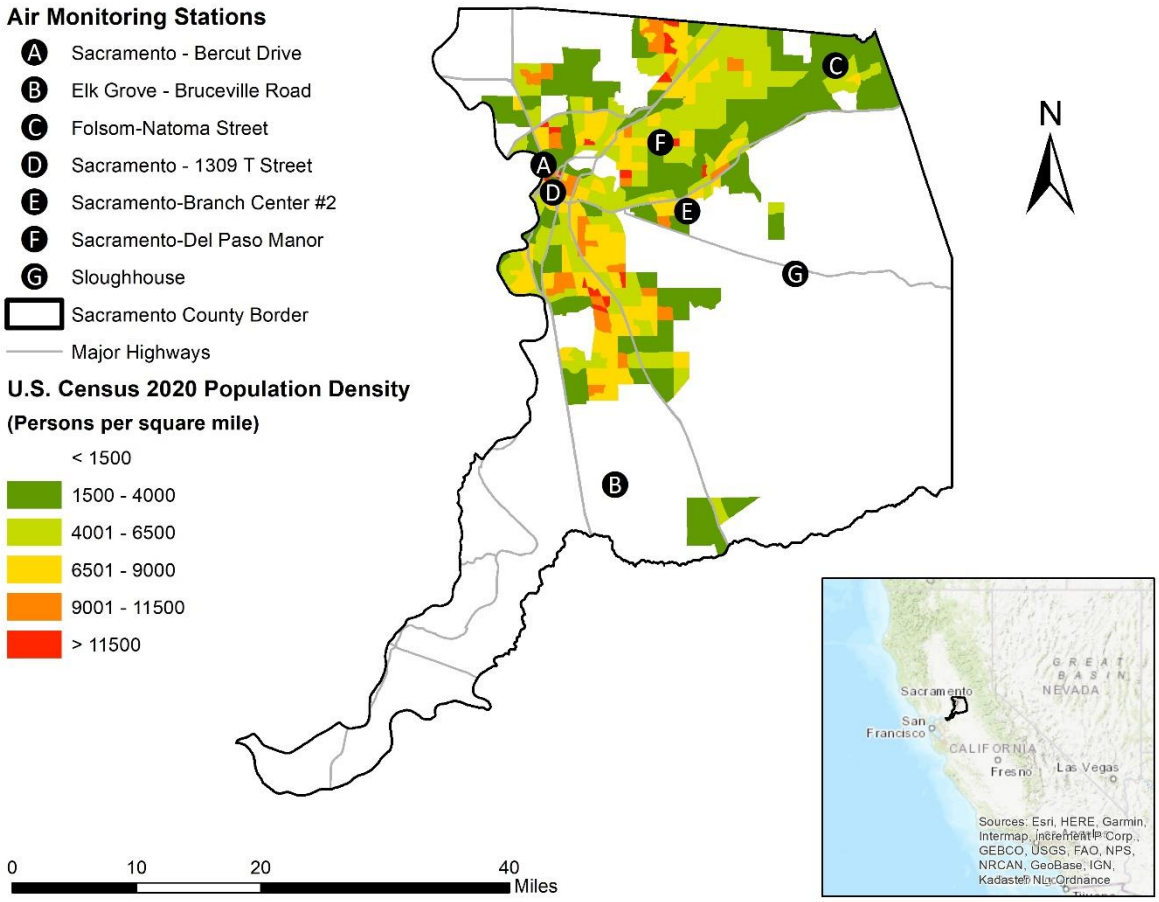


Figure 4 – Locations of District air monitoring stations and 2020 US Census population density. Note that the Sacramento-1309 T Street air monitoring station is operated by the California Air Resources Board.

In 1997, EPA completed a review of the $PM_{2.5}$ NAAQS and established a $PM_{2.5}$ Chemical Speciation Network (CSN) whose goal is to provide supplemental speciation information used for multiple objectives. EPA[19] outlines these objectives as:

- The assessment of trends;
- The development of effective State Implementation Plans (SIPs) and determination of regulatory compliance;
- The development of emission control strategies and tracking progress of control programs;
- Aiding in the interpretation of health studies by linking effects to $PM_{2.5}$ constituents;
- Characterizing annual and seasonal spatial variation of aerosols; and
- Comparison to chemical speciation data collected from the Interagency Monitoring of Protected Visual Environments (IMPROVE) network.

The District operates one of the 82 National Core Multi-Pollutant Monitoring Stations (NCore) and one of 150 nation-wide $PM_{2.5}$ Chemical Speciation Network (CSN) monitors. 40 CFR Part 58, Appendix D defines NCore criteria as the following: "The NCore multipollutant sites are sites that measure multiple pollutants in order to provide support to integrated air quality management data needs. NCore sites include both neighborhood and urban scale measurements in general, in a selection of metropolitan areas and a limited number of more rural locations."

In addition to the criteria pollutants, the District operates three (3) Photochemical Assessment Monitoring Stations (PAMS) due to the region's ozone non-attainment classification. As part of the 2015 Ozone National Ambient Air Quality Standard review[20], significant changes were made to the PAMS requirements[21] including calling for ozone precursor measurements to be made at existing NCore sites in Core Based Statistical Areas (CBSA) of over 1 million population. Sacramento County is required to have its NCore site be the primary PAMS monitoring station. The Sacramento-Del Paso Manor station is the core PAMS station with Elk Grove-Bruceville Rd. and Folsom-Natoma St. serving as enhanced ozone monitoring sites. More information on this can be found in the PAMS section of this assessment.

Special Purpose Monitoring (SPM) stations are also part of the District's monitoring network. SPM stations provide additional information needed by state and local air quality agencies to support air program activities and fulfill the objectives of the air monitoring network. The District operates a SPM black carbon monitor at the Sacramento-Del Paso Manor station and a SPM station with meteorology instruments at the Sloughhouse station.

Station abbreviations are used throughout this assessment are outlined in Table 1.

[19] EPA Chemical Speciation Network (CSN); https://www.epa.gov/amtic/chemical-speciation-network-csn.
[20] EPA, Ozone Air Quality Standards; https://www.epa.gov/naaqs/ozone-o3-air-quality-standards
[21] Code of Federal Regulations; https://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&mc=true&r=PART&n=pt40.6.58#ap40.6.58.0000_0nbspnbspnbsp.d

Table 1 – Abbreviation used in this document for District monitoring stations.

Site Name	Abbreviation
Sacramento-Branch Center #2	BC
Sacramento-Bercut Drive	BER
Elk Grove-Bruceville Rd.	BRU
Sacramento-Del Paso Manor	DPM
Folsom-Natoma St.	FOL
Sloughhouse	SLU
Sacramento-1309 T Street	TST

Monitoring Requirements

The number of monitoring sites required for each pollutant is based on one or more applicable factors, as described in 40 CFR Part 58, Appendix D. These factors include: MSA population, CBSA population, pollutant design value, pollutant maximum concentration, attainment status, annual averaged daily traffic (AADT), SIP, maintenance plan, population weighted emission index (PWEI), and EPA's national emission inventory (NEI) data.

Federal monitoring requirements (40 CFR, Part 58, Appendix D) were evaluated for the Sacramento–Roseville–Arden-Arcade MSA, which, according to the 2020 United States decennial census[22], has a population of approximately 2.4 million persons. The District's jurisdiction is Sacramento County, which is part of the Sacramento MSA, with an estimated population in 2020 of approximately 1.6 million persons[22]. It is the responsibility of the District to meet the monitoring requirements. Once sites are established, site discontinuation is in most cases are subject to EPA discontinuation requirements and concurrence under 40 CFR §58.14(c).

Recent Notable Modifications to the Network

In December 2020, the Folsom-Natoma St. air monitoring station footprint reconstruction was completed. The District resumed operations of all instrumentation with some exceptions for PAMS monitoring. More details on these exceptions can be found in the PAMS section of this assessment.

On April 20, 2020, EPA approved the District's request to discontinue operation of the carbon monoxide (CO) monitor at North Highlands-Blackfoot and the lead (Pb) monitor at Sacramento-Del Paso Manor. The District discontinued the CO monitor on May 20, 2020, and the Pb monitor on May 31, 2020.

In late July 2022, the District was given a notice to promptly vacate the area where the North Highlands-Blackfoot air monitoring station was located and remove the station from the premises. The District notified EPA of the discontinuation of all remaining monitors at this location (ozone, coarse particulate matter, and nitrogen dioxide). The last day of monitoring operation was July 31, 2022. This assessment will discuss further on whether a replacement station is recommended.

[22] United States Census Bureau, 2020 Census Redistricting Data (Public Law 94-171)

Per the recommendation of the 2020 5-Year Network Assessment[23], a PM_{10} monitor was installed at the Sacramento-Bruceville station in February 2025 and began operations March 2025.

[23] Sacramento Metropolitan Air Quality Management District, 2020 5-Year Air Monitoring Network Assessment https://www.airquality.org/ProgramCoordination/Documents/2020%205%20Year%20Network%20Assessment.pdf

Table 2 – List of District air monitoring stations, site network affiliation, and established date.

Site Name	AQS ID	Latitude (°)	Longitude (°)	Site Network Affiliation						Date Established
				SLAMS	PAMS	CSN	NCore	NR	SPM	
Sacramento-Branch Center #2	06-067-0284	38.55351	-121.33714	X						04/01/2006
Sacramento-Bercut Drive	06-067-0015	38.59333	-121.50373	X				X		11/08/2015
Elk Grove-Bruceville Rd.	06-067-0011	38.30263	-121.42085	X	X*					07/01/1992
Sacramento-Del Paso Manor	06-067-0006	38.61380	-121.36801	X	X	X	X		X	01/01/1980
Folsom-Natoma St.	06-067-0012	38.68330	-121.16446	X	X*					06/01/1996
Sloughhouse	06-067-5003	38.49448	-121.21113	X					X	07/01/1997
Sacramento-1309 T Street	06-067-0010	38.56844	-121.49311	X		X				12/01/1988

SLAMS – State/Local Air Monitoring Stations
PAMS – Photochemical Assessment Monitoring Station
CSN – Chemical Speciation Network
NCore – National Core Multi-Pollutant Network
NR – Near-Road
SPM – Special Purpose Monitor

* As of the 2015 review of National Ambient Air Quality Standards for Ozone (80 FR 65292), this station is not required to report PAMS measurements.

Table 3 – Parameters measured at District monitoring stations.

Site Name	Parameters
Sacramento-Branch Center #2	24-hr PM_{10}
Sacramento-Bercut Drive	CO, NO_2, hourly $PM_{2.5}$, Black Carbon, Outdoor Temperature, Wind Direction, Wind Speed
Elk Grove-Bruceville Rd.	O_3, NO_2, Total NMHC, hourly $PM_{2.5}$, hourly PM_{10}, Outdoor Temperature, Relative Humidity, Wind Direction, Wind Speed, Solar Radiation, Ultraviolet Radiation, Barometric Pressure, Precipitation, UA Profiler
Sacramento-Del Paso Manor	O_3, CO, NO_2, SO_2, Total NMHC, Hourly $PM_{2.5}$, 24-hr $PM_{2.5}$, 24-hr PM_{10}, speciated $PM_{2.5}$, $PM_{10-2.5}$, Black Carbon, NOy, VOC, Carbonyl, Outdoor Temperature, Relative Humidity, Wind Direction, Wind Speed, Solar Radiation
Folsom-Natoma St.	O_3, NO_2, , Total NMHC, Hourly $PM_{2.5}$, Outdoor Temperature, Relative Humidity, Wind Direction, Wind Speed, Solar Radiation
Sloughhouse	O_3, Hourly $PM_{2.5}$, Wind Direction, Wind Speed
Sacramento-1309 T Street	O_3, NO_2, Hourly PM_{10}, Hourly $PM_{2.5}$, 24-hr $PM_{2.5}$, speciated $PM_{2.5}$, Outdoor Temperature, Relative Humidity, Wind Direction, Wind Speed

Technical Approach

The overall technical approach for the network assessment was centered on two types of measurements:

- Ambient air monitoring of criteria pollutants
- Meteorological and PAMS networks.

For each of these two types of measurements, several analyses were performed to determine the contribution to the overall network's effectiveness. The results of the analyses were reviewed and evaluated by each station and for their contributions to the network in its entirety. Recommendations for adjustments to the overall network are presented in the Summary and Recommendations section of this assessment. PAMS network recommendations follow EPA guidance as found in Appendix D to 40 CFR Part 58.

A list of network assessment analyses utilized is presented below. The analysis methods are described in detail in EPA's Ambient Air Monitoring Network Assessment Guidance[24] (Network Assessment Guidance). The number of parameters monitored analysis was first performed for the District's entire network, then the rest of the analyses were performed on a pollutant-specific basis. The results of the number of parameters monitored analysis are incorporated into the pollutant specific conclusions in the

[24] EPA, "Ambient Air Monitoring Network Assessment Guidance, Analytical Techniques for Technical Assessments of Ambient Air Monitoring Networks": https://www.epa.gov/amtic/ambient-air-monitoring-network-assessment-guidance-documents

Summary and Recommendations section of this assessment. The analysis techniques were applied to criteria pollutants only.

Below is a list of the pollutant-specific analyses included in the site-to-site assessment. The Number of Parameters technique is not included in this list as it is calculated for the District network as a whole and is included in its own section. Each of these analyses will be discussed in further detail in the Analyses section.

- Area-Served
- Population-Served
- Measured Concentration
- Deviation from NAAQS
- Trend Impact
- Monitor-to-Monitor Correlation
- Removal Bias

The analyses were performed for each pollutant, and individual monitors among those sampling each pollutant were ranked based on each of the analysis techniques. Each monitor was ranked as high, medium, or low based on the analysis technique. An overall ranking was calculated for each site for each pollutant by assigning a value to each rank (1 – low, 2 – medium, 3 – high) and summed over all analyses to provide a score. The results of the analyses were evaluated and viewed with consideration to the overall monitoring objectives for each pollutant. Recommendations for the network were made based on the aggregated results and are found in the Summary and Recommendations section of this document.

Sources of Data

Ambient air monitoring, meteorological, emissions, and population data were obtained from several sources including, but not limited to:

- the District database,
- National Oceanic and Atmospheric Administration (NOAA),
- United States Census Bureau (USCB), and
- EPA.

The primary data source for air monitoring stations within the District's air monitoring network was EPA's Air Quality System (AQS) database, which was accessed through the EPA web application[25], or the EPA's Network Assessment application tool (NetAssess2025 v1.1). EPA's Office of Air Quality Planning and Standards (OAQPS) developed NetAssess2025 v1.1 and has made it available to all agencies. It is available for use at: https://rconnect-public.epa.gov/NetAssess2025/ . The tool includes data from AQS as well as other EPA resources to calculate many analyses described in the following section. Raw data for criteria pollutants for each District monitoring station that were not available through NetAssess2025 v1.1 were downloaded from AQS.

[25] EPA Air Quality System (AQS): https://aqs.epa.gov/aqs/

To evaluate population characteristics within Sacramento County, unless otherwise specified, spatially resolved population data were obtained from NetAssess2025 v1.1 or directly from the USCB[26].

Analyses of Ambient Monitoring Data

A comprehensive statistical analysis of the monitoring data was performed to determine the adequacy of the existing monitoring sites.

Many of the analyses applied in this assessment require the calculation of pollutant design values. A design value is the mathematically determined pollutant concentration at a particular site that must be reduced to, or maintained at or below, the NAAQS to assume attainment. Calculation methods for each pollutant and averaging period are found in 40 CFR Part 50, Appendices A through U. The period that was evaluated for this assessment was the five-year period from 2020 through 2024. Data may be presented for dates earlier than this range, but those are contextual only. For each pollutant in this assessment, tables are included, which provide the design value(s) obtained from AQS. A list of the current, most stringent NAAQS[27] is summarized in Table 4.

Data analysis methods follow the Network Assessment Guidance[24] and are outlined below. The Network Assessment Guidance is designed to be flexible and expandable to meet the needs of air quality planning agencies. Therefore, in some analyses where specific thresholds for monitor importance were not provided by the Network Assessment Guidance, the District developed and applied thresholds suitable to Sacramento County.

[26] Data found at https://www.census.gov/data/data-tools.html
[27] EPA NAAQS table: https://www.epa.gov/criteria-air-pollutants/naaqs-table

Table 4 – EPA National Ambient Air Quality Standards (NAAQS).

Criteria Pollutant	Averaging Period	NAAQS	Form
Carbon Monoxide (CO)	1 hour	35 ppm	Not to be exceeded more than once per year
	8 hours	9 ppm	
Lead (Pb)	Rolling 3-month Average	0.15 µg/m^3	Not to be exceeded
Nitrogen Dioxide (NO_2)	1 hour	100 ppb	98th percentile of 1-hr daily maximum concentration averaged over 3 years
	1 year	53 ppb	Annual mean
Ozone (O_3)	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hr concentration averaged over 3 years
Particulate Matter ($PM_{2.5}$)	24 hours	35 µg/m^3	98th percentile averaged over 3 years
	1 year (Primary)	9.0 µg/m^3	Annual mean averaged over 3 years
	1 year (Secondary)	15 µg/m^3	
Particulate Matter (PM_{10})	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)	1 hour	75 ppb	99th percentile of 1-hr daily maximum concentration averaged over 3 years
	3 hours (Secondary)	0.5 ppm	Not to be exceeded more than once per year

Number of Parameters Monitored

According to the Network Assessment Guidance, "air monitoring sites hosting monitors collocated with other measurements are likely more valuable than sites where fewer parameters are measured." This analysis addresses two aspects of site value. First, collocated measurements of several pollutants are valuable for many air quality analyses, such as source apportionment, model evaluation, and emission inventory reconciliation. Second, a single site with multiple measurements is more cost-effective to operate than monitors located at several sites. Sites were analyzed by the number of parameters (or instruments) collected. Sites at which many parameters are measured are ranked highest.

Measured Concentrations

The objective of the measured concentration analysis is to identify individual monitors by pollutant that sample the highest concentrations for that pollutant. Design values for each monitor were calculated utilizing air monitoring data from 2020 through 2024. Per the Network Assessment Guidance, "[m]onitors that measure high concentrations or design values are ranked higher than monitors that measure low concentrations. … If more than one standard exists for a pollutant (e.g., annual and 24-hr average), monitors can be scored for each standard." For this analysis, the average concentrations used to determine the design value (DV_{ave}) for the assessment period (2020-2024) were used to determine monitor rank. Highest ranked monitors exceed the NAAQS, sites within 10% less than the NAAQS are ranked as medium. These criteria are outlined below.

Monitor Rank	Criteria*
High	DV_{ave} > NAAQS
Medium	NAAQS ≥ DV_{ave} ≥ NAAQS – 10% * NAAQS
Low	DV_{ave} < NAAQS – 10% * NAAQS

* For pollutants with multiple NAAQS, the most stringent federal standard or the federal standard closest to exceedance was used in this analysis.

Deviation from NAAQS

The deviation from NAAQS analysis provides an indication of which sites were important for monitoring NAAQS compliance. Per the Network Assessment Guidance, "[s]ites measuring concentrations (design values) that are very close to the NAAQS exceedance threshold are ranked highest in this analysis. … Sites measuring concentrations well above or below the threshold do not provide as much information in terms of NAAQS compliance." For pollutants with multiple NAAQS averaging times, sites were ranked by each standard.

The design values for each pollutant were calculated and monitors were analyzed for each standard using the absolute value of the difference between the measured design value and the NAAQS. Monitors with the smallest absolute difference were deemed the most important in this test regardless of the design value being higher or lower than the standard following the criteria below.

Monitor Rank	Criteria*
High	|Deviation| < 10% of NAAQS
Medium	10% of NAAQS ≥ |Deviation| ≥ 20% of NAAQS
Low	|Deviation| > 20% of NAAQS

* For pollutants with multiple NAAQS, the most stringent federal standard was used in this analysis.

Trend Analyses

The trend analysis assesses the historical record of monitors located within the network. Monitors with a long historical record of data are valuable to the network for tracking pollutant trends and control strategy effectiveness. In this analysis, monitoring sites within the District's network were analyzed based on the number of years of measurements specific to each pollutant. The ranking of monitors for this analysis follows the criteria below where the maximum number of years refers to the maximum number of years for all sites.

Monitor Rank	Criteria
High	Trend ≥ 75% of the maximum number of years
Medium	Trend is within 25% - 75% of the maximum number of years
Low	Trend < 25% of the maximum number of years

Exceedance Probability

As part of the ozone and $PM_{2.5}$ assessments, each monitoring site was evaluated using the NetAssess2025 v1.1 tool to determine if there was a less than 10% probability that the monitor would exceed 80% of the applicable NAAQS during the next three years based on concentrations, trends, and variability observed during the data period. This probability was only calculated by the NetAssess2025 v1.1 tool for ozone and $PM_{2.5}$. Exceedance probability was calculated by the tool by applying a bootstrap analysis to the concentration outputs of 2019-2021 source data from the EPA Downscaler Model.[28]

Monitor-to-Monitor Correlation

The monitor-to-monitor correlation technique determines the temporal correlation between monitors through a regression analysis. In other words, this analysis evaluates whether monitors statistically collect similar information. Data from 2019 through 2021 for each monitor were compared in the NetAssess2025 v1.1 tool using the square of the Pearson correlation coefficient[29], R^2, to other monitoring sites within the network. Per the Network Assessment Guidance, "[m]onitor pairs with correlation coefficient values near one are highly correlated and should be ranked lower than those with correlation coefficient values near zero. Monitors that do not correlate well with other monitors exhibit unique temporal concentration variation relative to other monitors and are likely to be important for assessing local emissions, transport, and spatial coverage. Monitors with concentrations that correlate well (e.g., $R^2 > 0.75$) with concentrations at another monitor may be redundant."

Similar sites would show fairly high correlations consistently across all of their pairings, however, due to the homogeneity of the terrain relative to the area of Sacramento County, two other factors were included in this analysis in addition to Pearson correlations. As the Pearson correlation itself does not indicate if one site consistently measures pollutant concentrations at levels substantially higher or lower than the other, similar sites would also have low average relative difference despite the distance. Therefore, the average relative difference and linear distance are calculated between sites and are indicators of the overall measurement similarity between the two sites. Site pairs with a lower average relative difference are more like each other than pairs with a larger difference, and in general, correlation between sites will decrease as distance increases.

In this analysis, the following three criteria were used as thresholds to rank each monitor.

Monitor Rank	Criteria
High (meets 1 or less of the criteria)	Highest pairwise $R^2 > 0.75$
Medium (meets 2 of the criteria)	Distance between sites < 25% of the Maximum Distance between any two sites
Low (meets 3 of the criteria)	Mean Difference < 25% of the Maximum Mean Difference between any two sites

[28] https://rconnect-public.epa.gov/NetAssess2025/

[29] EPA, Guidance for Data Quality Assessment, Practical Methods for Data Analysis. "The Pearson correlation coefficient measures a linear relationship between two variables. A linear association implies that as one variable increases so does the other linearly, or as one variable decreases the other increases linearly. Values of the correlation coefficient close to +1 (positive correlation) imply that as one variable increases so does the other…" https://www.epa.gov/sites/default/files/2015-06/documents/g9-final.pdf

Area-Served Analysis

The purpose of the area-served analysis is to estimate the spatial coverage of each monitoring site to identify potential spatial gaps or similarities in the network. Thiessen polygons were applied as a standard technique to assign a zone of influence surrounding a given point (monitoring sites for this analysis). The polygons are a simple quantitative method to determine the areas closest to each monitoring site, of which the nearest site may be a monitor not operated by the District. Thiessen Polygons were generated using the NetAssess2025 v1.1 tool. Thiessen polygon boundaries in this assessment were limited to the boundaries of the jurisdiction of the District.

Thiessen polygons do not consider terrain within the area of influence. Air quality measured by a monitor may not represent air quality at a location at a much higher elevation within the monitor's area of influence. However, there were no areas within Sacramento County excluded as being represented by a monitor due to complex terrain.

Using the Thiessen polygon technique, some monitors outside of District's network were found to be representative of a portion of Sacramento County. The District does not have control over the continued operation of these monitors, therefore regulatory monitors located outside of Sacramento County were not included as part of the assessment. Figure 5 presents an example of Thiessen polygons developed for the monitoring network by the NetAssess2025 v1.1 tool.

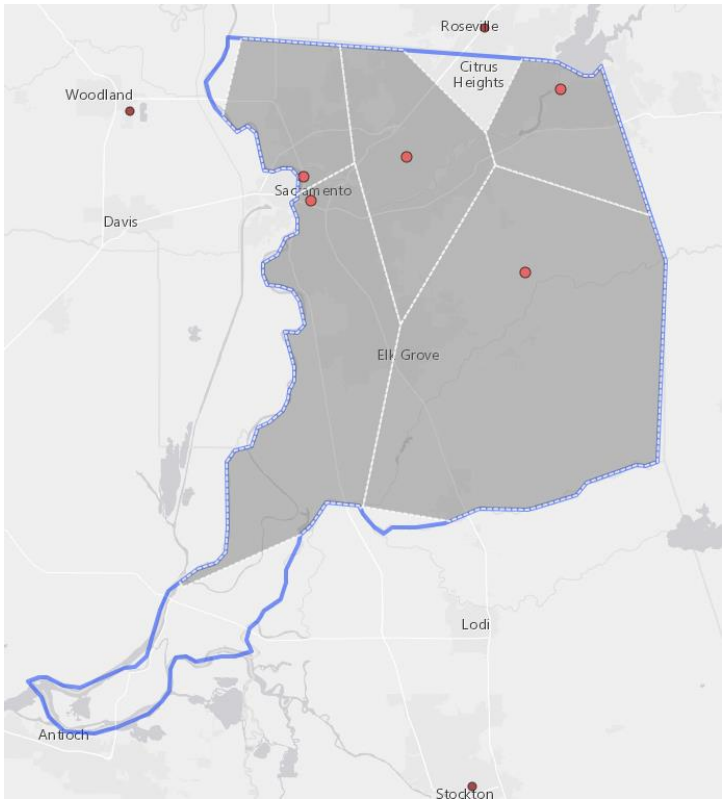


Figure 5 – Example of Thiessen polygons calculated by the EPA NetAssess2025 v1.1 tool for the area-served analysis.

Per the Network Assessment Guidance, "[s]ites are ranked based on their area of coverage. Sites that are used to represent a large area score high in this analysis." Therefore, for this analysis, the ranking thresholds were set at 20% and 10% of the total county area. The approximate area of Sacramento County is 2574 km^2, therefore 20% and 10% of the total area equate to approximately 500 km^2 and 250 km^2, respectively. The ranking of monitors for this analysis follows the criteria below.

Monitor Rank	Criteria
High	Area-Served > 500 km^2
Medium	250 km^2 < Area-Served < 500 km^2
Low	Area-Served < 250 km^2

Population-Served Analysis

The purpose of the population-served analysis is to determine the population coverage represented by each monitoring site and to identify the sites surrounded by high population densities. Large populations can be associated with high emissions; therefore, it is important in this analysis to investigate the impact of these possible emission sources on populated areas by assessing the number of persons served by each monitor. The population served by each site was calculated using the NetAssess2025 v1.1 tool where Thiessen polygons were created for each site (same polygons as the area-served analysis) and the population enclosed within that polygon was calculated from 2020 Census data.

Per the Network Assessment Guidance, "[s]ites are ranked based on the number of people they represent." In this analysis, a similar method to the Area-Served analysis was used with 20% and 10% thresholds. The total population of Sacramento County as of the 2020 US Census[30] was approximately 1.585 million persons. Therefore, 20% and 10% of the total population equate to approximately 317,000 and 159,000 persons, respectively. The ranking of monitors for this analysis follows the criteria below.

Monitor Rank	Criteria
High	Population-Served > 317,000 persons
Medium	159,000 persons < Population-Served < 317,000 persons
Low	Population-Served < 159,000 persons

Removal Bias

Removal bias sensitivity analysis determines monitor importance by the change in concentrations across the District monitors if a monitor is removed. The NetAssess2025 v1.1 tool was used to perform this analysis. Per the Network Assessment Guidance, "[g]reater bias or uncertainty indicates a more important site for developing interpolations to represent concentrations across a domain. Those sites with low bias may be providing redundant information." This analysis follows similar methodology to the Trends analysis where 75% and 25% thresholds were used for the maximum mean relative bias to

[30] United States Census Bureau: https://www.census.gov/quickfacts/fact/table/sacramentocountycalifornia/POP010220#POP010220

determine monitor rank. The ranking of monitors for this analysis follows the criteria below where MRB is the mean relative bias.

Monitor Rank	Criteria
High	|MRB| ≥ 75% of the maximum MRB of all monitors
Medium	|MRB| is within 25% - 75% of the maximum MRB of all monitors
Low	|MRB| < 25% of the maximum MRB of all monitors

Meteorology Network Assessment

Meteorological measurements are required based on the specifics of the air monitoring network associations, such as NCore, PAMS, and Near Road. The District meteorological network was assessed to determine if the network meets the requirements of 40 CFR Appendix D to Part 58, and if the network meets District monitoring objectives.

PAMS Network Assessment

The PAMS program originated to meet the requirements of Section 182(c)(1) of the Clean Air Act. The PAMS network was developed specifically to characterize upwind, new emissions, and downwind pollutant concentrations within a region for the purpose of understanding ozone precursor emissions, chemical transformation, geospatial ozone patterns, and transport. The objective of a PAMS network is to obtain measurements, which will assist air quality agencies to support ozone model development and track the trends of important ozone precursor concentrations.

A PAMS site typically monitors hydrocarbons and carbonyl compounds, ozone, oxides of nitrogen (NO_X and/or NO_Y), and meteorological measurements. Lists of the specific pollutants and measurements required for the PAMS network and associated technical documents can be found on the EPA PAMS website[31]. The District has three active PAMS monitoring sites, which are included in Table 2.

In October 2015, the EPA Administrator signed the final rule for the revised NAAQS for ground-level ozone at 0.070 ppm (80 FR 65291). As part of the new standard, EPA revised the PAMS network requirements and recommends five main areas of assessment. These areas are summarized as follows:

- Moving PAMS measurements to existing NCore sites.
- Preparing an Enhanced Monitoring Plan (EMP)[32] to be included in the annual monitoring network plan to improve monitoring of O_3, NO_X/NO_Y, VOC, and meteorology.
- Using an automatic gas chromatograph (autoGC) for the determination of hourly averaged speciated VOCs.
- Enhancing meteorological stations to collect wind speed, wind direction, temperature, relative humidity, barometric pressure, precipitation, solar and ultraviolet radiation data.
- Measuring mixing height at the required PAMS monitoring site.

[31] EPA PAMS: https://www.epa.gov/amtic/photochemical-assessment-monitoring-stations-pams

[32] CARB is responsible for submitting the EMP for the entire state, including all Primary Quality Assurance Organizations (PQAO) and all air districts within the CARB PQAO that submit their own annual network plans and/or 5-year monitoring network assessments.

The approach of this assessment was to analyze the sites to ensure that the District met the PAMS requirements and that the District PAMS network also met the needs of the District and the intentions of the EPA network.

Data Uses Other Than Comparing to the NAAQS

As defined in 40 CFR Part 58 Appendix D, the network is designed to meet three basic monitoring objectives as discussed in the Network Objectives section of this document. The District monitoring network is designed to meet the first objective, provide air pollution data to the public in a timely manner through many different methods and programs. Some examples of where air pollution data can be accessed by the public include EPA's AirNow (https://www.airnow.gov/), CARB's Air Quality and Meteorological Information System (AQMIS; https://www.arb.ca.gov/aqmis2/aqmis2.php), and the District website (http://www.airquality.org/). More information on these uses of the data which directly inform the residents of Sacramento County of air quality conditions are discussed below.

Air Quality Forecasting

As the District is responsible for meeting state and federal health standards to improve the air quality for all residents of Sacramento County, a significant part of meeting these objectives is to provide the public with accurate forecasts and current conditions. The area's two biggest air pollutants are ground-level ozone and particulate matter. In Sacramento County, the majority of air pollution during the summer comes from mobile sources, which are cars, trucks, buses, agriculture, and construction equipment that are used every day. In the winter, the majority of air pollution comes from wood burning in residential fireplaces and wood stoves. As Sacramento County sits in a valley between the Coast and Sierra Nevada ranges, the topography is such that air pollution can at times be trapped at ground-level within the county. The addition of cars and trucks, high temperatures, no wind in the summer, residential wood burning in the winter, and wildfire smoke is a recipe for high ozone or particulate matter pollution. Therefore, air quality forecasting serves to both provide public information to inform residents so they can make healthy choices for themselves and their families as well as prevent unnecessary or harmful concentrations of air pollutants on days which are conducive to pollutant buildup.

Public Notification

The District has established a website (Spare The Air; https://sparetheair.com) from which the public can access real-time and historical air quality and meteorological data. The District has also developed a Sacramento Region Air Quality mobile application, which provides the daily forecast, current conditions, Spare The Air alerts, plus the daily burn status for Sacramento County from November through February (Check Before You Burn; https://www.airquality.org/Residents/Fireplaces-Wood-Stoves/Check-Before-You-Burn). The Sacramento Regional Air Quality Index (AQI) and AQI forecast are available on the District's Spare The Air website, mobile application, and email air alerts as well as EPA's AirNow website. Historical air quality and meteorological data collected by the network can also be accessed by the public through EPA's AirData website (www.epa.gov/airdata). CARB also provides a portal to access District data through the CARB Air Quality and Meteorological Information System (AQMIS) website (https://www.arb.ca.gov/aqmis2/aqdselect.php).

Air Quality Federal and State Planning

The second objective of the District ambient air monitoring network is to support compliance with ambient quality standards and emissions strategy development. This objective is met through the development of air quality plans such as State Implementation Plans (SIP). Air quality plans are

comprehensive strategies designed to meet or maintain compliance with federal and state air quality standards. The two most common types of plans are attainment plans and maintenance plans.

- Attainment plans show how the region will attain the air quality standard for a specific pollutant by a certain date, known as the attainment date.
- Maintenance plans are prepared after a region has attained an air quality standard and can demonstrate continued compliance with the standard.

Development of these plans requires extensive collaboration and cooperation with other agencies within the region, and includes businesses, industry, and the public. Included in the development of these plans are the use of meteorological and air quality models. These models are used to simulate air quality conditions, as compared to measured air quality data throughout the region. For the models to simulate air quality accurately, the models require a relatively dense monitoring network of pollutants and precursors for model validation.

Understanding background air pollutant concentrations is another vital component of plan development as background concentration measurements can improve the interpretation of the air monitoring data. For example, background concentrations can provide a point of reference for other measurements near emission sources. If the data collected near an emission source were elevated with respect to the determined background concentrations, the obvious initial assumption would be that the elevated concentrations sampled near the source are a result of emissions from that specific source. Another example could be using concentrations collected from a background site far from known emission point sources to provide evidence of regionally elevated concentrations such as wildfire smoke. Essentially, background concentrations will ideally indicate the measured pollutant concentrations that are equal to the concentrations measured at a location if local emission sources did not occur.

The District or CARB has submitted, or is in the process of developing, several planning efforts during the period of 2020 to the submission of this document, including the following:

- Submission of a Second 10-year PM_{10} Maintenance Plan, which was approved by CARB and submitted to EPA in October 2021
- CARB submitted a Statewide (included Sacramento) Regional 8-Hour Ozone Milestone Compliance Demonstration Report to EPA in March 2021
- Submission of an Attainment and Reasonable Further Progress Plan for the 2015 Ozone Standard to CARB in October 2023. CARB submitted the plan to the EPA on November 7, 2023
- Requested a Clean Data Determination for the 1997 Ozone Standard in 2023
- Certified 2024 ozone data early, January 15, 2025, to receive a Determination of Attainment by the Attainment Date (DAAD). EPA released the DAAD[11] and an Interim Final Designation[33] for the 2008 Ozone Standard on March 21, 2025
- Developing a Redesignation Request and Maintenance Plan for the 1979 1-hour and 1997 8-hour NAAQS

[33] https://www.airquality.org/ProgramCoordination/Documents/IFD%20SacMetro.pdf

Regional Air Quality Data and Trends

The third objective of the District ambient air monitoring network is to support air pollution research studies. Publicly-available air pollution data collected by the District can be used to supplement data collected by researchers working on various aspects of the air quality field. Some examples of these projects are health effects assessments and atmospheric processes, or for monitoring methods development work. As discussed throughout this assessment, the District provides air quality data for many pollutants, many of which are required for attainment purposes. However, the District also samples many other pollutants which are vital to air pollution research studies. Examples would be speciated particulate matter, VOCs, black carbon, and meteorological parameters.

There are two pollutants of most concern in Sacramento County – particulate matter and ozone. The trends in concentrations of both pollutants are improving from a public health aspect. These trends are discussed in more detail within the respective pollutant sections of this assessment below. This trend is also consistent for regional concentrations, where regional is defined as the respective nonattainment areas as shown in Figure 3.

The following sections provide overviews of how the air monitoring data collected by the District network is able to support air quality programs at the District, which in turn have direct impacts on pollutant trends. This highlights the strong link between the monitoring network and the successes in reducing pollutant concentrations in Sacramento County and ultimately improvements to quality of life for Sacramento residents.

Ozone Concentrations

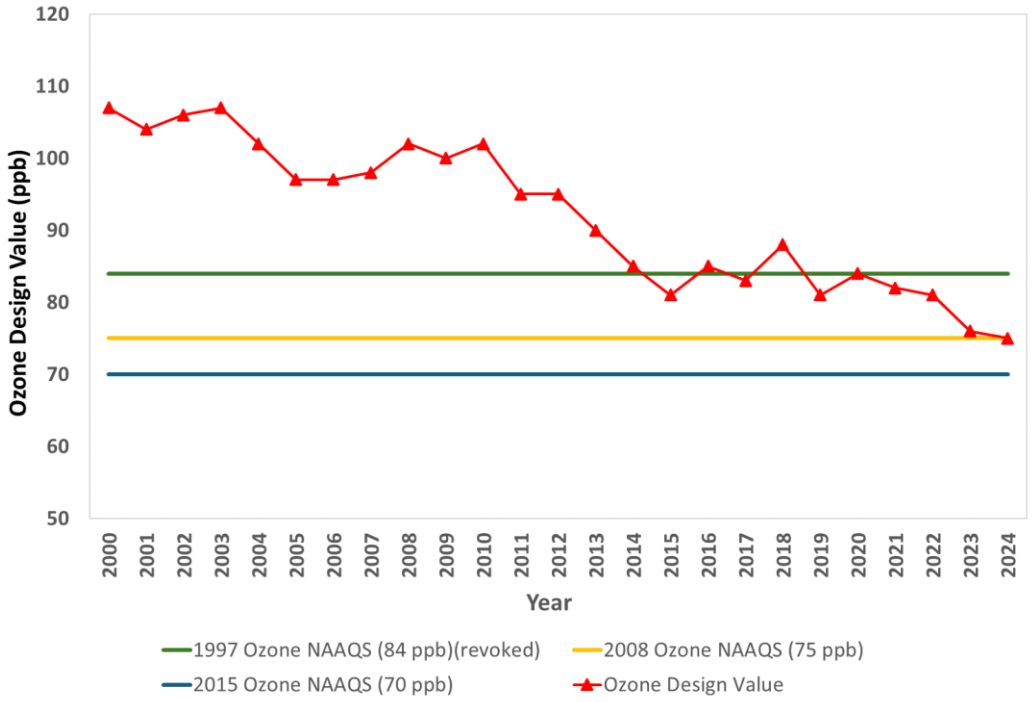
Ozone concentrations peak in the summer when there are calm winds, high temperatures, and maximum insolation, conditions necessary for the photochemical production of ozone from ozone precursors. In Sacramento, ozone precursor emission trends show significant declines in emissions over the past decades, despite increasing population, vehicle activity, and economic development[34]. Historically, the eastern portion of the SFNA typically measures the highest 8-hr ozone concentrations in the SFNA due to meteorology, topography, and photochemical processes. The 8-hr ozone NAAQS is described in detail in the ozone section of this assessment. There is year-to-year variability in the site within the SFNA which measures the maximum concentration. This is due in part to meteorological variability, wildfire impacts, and changes in precursor emissions. Figure 6 shows the peak 8-hour ozone design value concentrations for the SFNA during the period 2000-2024, excluding outlier concentrations in 2018, 2020, 2021, and 2022 which were suspected to be impacted by wildfire smoke. The drop in ozone design value concentrations corresponds to a dedicated decrease in ozone precursors, despite increases in temperature and other meteorological variables. Detailed in the Sacramento Regional 2015 NAAQS 8-Hour Ozone Attainment and Reasonable Further Progress Plan[35], the SFNA air districts are implementing existing regional and local control measures (including stationary source measures) and are assisting the Sacramento Area Council of Governments (SACOG) in implementing existing transportation control measures. The agencies track the implementation of the control measures and

[34] CEPAM: 2019 SIP Baseline Emission Projections, Version 1.04. https://ww2.arb.ca.gov/applications/cepam2019v1-04-standard-emission-tool

[35] Sacramento Metropolitan Air Quality Management District, Sacramento Regional 2015 NAAQS 8-Hour Ozone Attainment and Reasonable Further Progress Plan, 17 October 2023. Print.

monitor the success of the measures and transportation control measures committed to in the 1994 SIP[36] and 2013 SIP[37]. CARB also tracks the implementation and success of mobile sources emissions control programs.

Since 1990, the SFNA has shown a declining trend in exceedances of the 2015 8-hour ozone NAAQS and ozone design value concentrations. Historically, the most frequent and highest violations occurred at the easternmost monitoring sites; however, the peak site shifted to sites in the central region of the SFNA in recent years. VOC and NO_X emissions inventory forecasts show significant declines in mobile source emissions, despite increasing population, vehicle activity, and economic development in the Sacramento region. Photochemical modeling results also show declines in ozone concentrations due to combined reductions from existing local strategies, regional, state, and federal control measures.



Source: EPA AQS (https://www.epa.gov/aqs).
*Design value is calculated as the annual fourth-highest daily maximum 8-hour ozone concentration averaged over three years.
Note: The SFNA was impacted by wildfires in 2018, 2020, and 2021. The peak design value calculation in this chart includes suspected days impacted by wildfires.

Figure 6 – 8-hour ozone design values for the Sacramento Federal Ozone Nonattainment Area for 2000-2024 (source: EPA AQS).

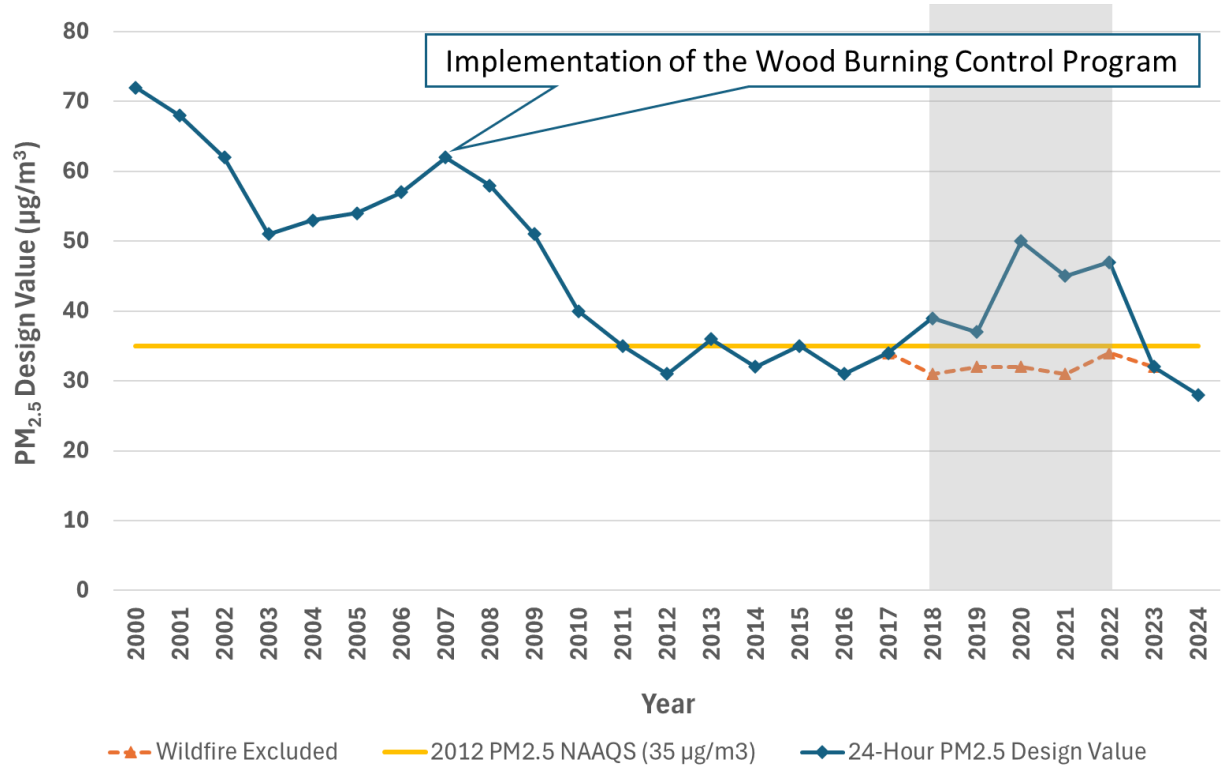
[36] Sacramento Metropolitan Air Quality Management District, Sacramento Area Regional Ozone Attainment Plan, 15 November 1994. Print.
[37] Sacramento Metropolitan Air Quality Management District, Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan (2013 SIP Revision), 26 September 2013. Print.

Fine Particulate Matter ($PM_{2.5}$) Concentrations

Fine particulate matter can be emitted directly into the atmosphere or formed through chemical reactions of precursors such as NO_X, sulfur dioxide (SO_2), VOCs, and ammonia (NH_3). Precursor emissions have decreased since 2005 and based on projections are expected to continue to decrease in the future despite an increase in population and economic growth[38]. Figure 7 shows $PM_{2.5}$ design value concentrations from 2000 to 2024 and similar to ozone above,excludes exceptionally high concentration s due to wildfires in 2018, 2020, 2021, and 2022. The $PM_{2.5}$ design values are described in detail in the $PM_{2.5}$ section of this assessment. Figure 7 shows $PM_{2.5}$ design value concentrations from 2000 to 2024 and similar to ozone above, excludes exceptionally high concentrations due to wildfires in 2018, 2020, 2021, and 2022.

The majority of directly emitted $PM_{2.5}$ in the nonattainment area is the result of fuel combustion, including wood burning. The District and the local air districts of the nonattainment area, have rules to control directly emitted $PM_{2.5}$ and $PM_{2.5}$ precursors. The District has made significant progress in reducing ambient $PM_{2.5}$ concentrations since 2007, after implementation of a wood burning regulation, Rule 421 Mandatory Episodic Curtailment Of Wood And Other Solid Fuel Burning[39], which restricts or prohibits the use of all fireplaces, woodstoves, inserts and pellet stoves when $PM_{2.5}$ concentrations are forecasted to be high. When excluding wildfire events, exceedances of the standard most often occur in Sacramento County during the winter months. Higher $PM_{2.5}$ concentrations in winter are driven by meteorological conditions that favor pollutant accumulation, along with emissions from key sources of $PM_{2.5}$ including residential wood burning and mobile sources. With the removal of wildfire smoke impacted data, concentrations have remained relatively stable and below the 24-hour $PM_{2.5}$ standard since 2012.

[38] CEPAM: NORCAL 2012 $PM_{2.5}$ SIP Baseline Emission Projections, Section a1 – Emission Projections With External Adjustments, Sacramento Nonattainment Area 2012 $PM_{2.5}$ SIP Version 1.01.
[39] Sacramento Metropolitan Air Quality Management District: http://www.airquality.org/ProgramCoordination/Documents/rule421.pdf



*The 24-hour $PM_{2.5}$ design value is calculated as the 98th percentile concentrations, averaged over 3 years.
Note: The SFNA was impacted by wildfires in 2018, 2020, 2021, and 2022 which caused exceptionally high $PM_{2.5}$ concentrations. The peak design value calculation in this chart includes suspected days impacted by wildfires (blue line), the design value with wildfire impacted data removed (orange dashed line), and the time period of wildfire years (shaded gray).

Figure 7 – 24-hour $PM_{2.5}$ design values for the Sacramento Federal $PM_{2.5}$ Area Designation for 2000-2024 and the approximate implementation of wood burning controls in the form of Rule 421 (source: EPA AQS, District).

Natural Event Impacts on the Monitoring Network

Natural events can have drastic impacts on air quality in very short periods of time; therefore, ambient air monitoring networks need to be prepared as best as possible for these situations. Monitoring networks also play a vital role in measuring concentrations. This section details natural events that specifically impact the District network. The impacts of these events are incorporated throughout the assessment on a pollutant-specific basis. The natural events in this section are unusual or naturally occurring events that are not reasonably controlled by air quality agencies. In general, this means that the techniques that agencies implement to control air quality to maintain the NAAQS are ineffective or limited during these events. General examples of natural events include wildfires, high wind dust, prescribed fires, stratospheric ozone intrusions, and volcanic and seismic activities. EPA provides a mechanism for determining if air quality monitoring data has been influenced by one of these natural events. This is outlined in the Treatment of Data Influenced by Exceptional Events (81 FR 68216). This rule provides criteria and procedures for excluding a natural event impacted data from regulatory decisions, such as attainment status. However, as mentioned above, at the time of an event it is important that air monitoring networks are robust enough to provide timely air quality data to the public and collect enough data for subsequent evaluation of the event. In Sacramento County, the most common natural events that impact the District air monitoring network are wildfires and high wind dust events.

Wildfire Impacts

Table 5 shows the total number of fires in California from 2020-2024 and the total number of acres burned. Due to the topography and climate of California, months of active burning continuously emitted smoke from wildfires located in the heavily forested mountainous regions and caused pollutants to settle in the valleys, including the Sacramento metropolitan area. As shown in Figure 8, the meteorological conditions in the Sacramento region are conducive to wildfire activity, that is warm temperatures and low precipitation totals during the summer months. Figure 9 shows Sacramento County's location in reference to the topography of California as well as the area burned by wildfires during the assessment period from 2020-2024. Sacramento lies within a long northwest-southeast valley between the Sierra Nevada Mountains and the Coastal Mountains, a region that fills with smoke during periods of heavy wildfire activity.

Table 5 – Total number of wildfires, total acres burned and selected major fire names from 2020-2024 (source: CalFire).

Year	Number of Fires	Total Acres Burned	Select Major Fire Names
2020	8,648	4,304,379	August Complex, SCU Lightning Complex, LNU Lightning Complex
2021	7,396	2,569,386	Dixie Fire, Caldor Fire
2022	7,477	331,358	
2023	7,386	332,822	
2024	8,024	1,050,012	Park Fire

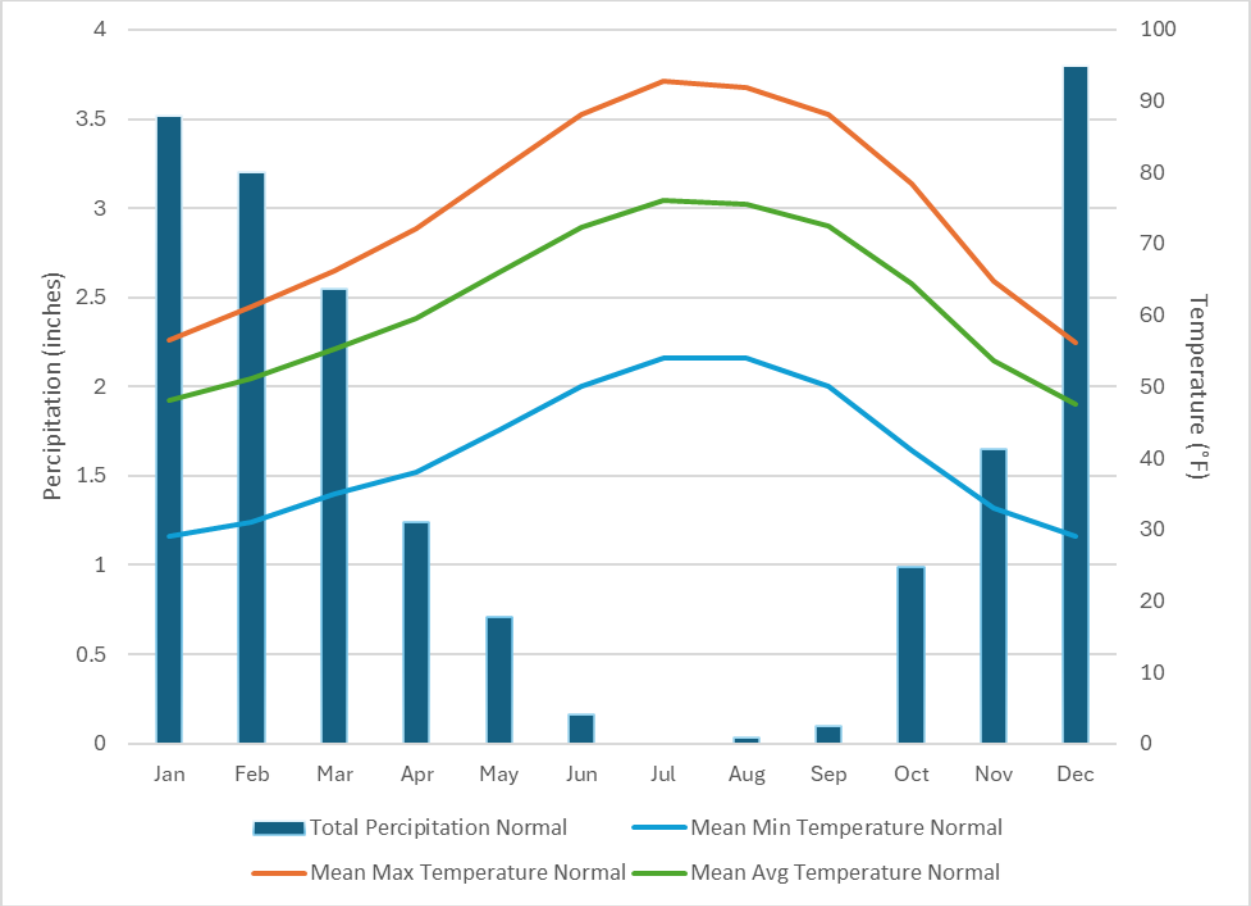


Figure 8 – Monthly temperature and precipitation normal for the Sacramento area for the period 1994-2024 (source: NOAA NWS[40]).

[40] National Oceanic and Atmospheric Administration, National Weather Service, NOWData data for Sacramento, CA; https://www.weather.gov/wrh/climate?wfo=sto

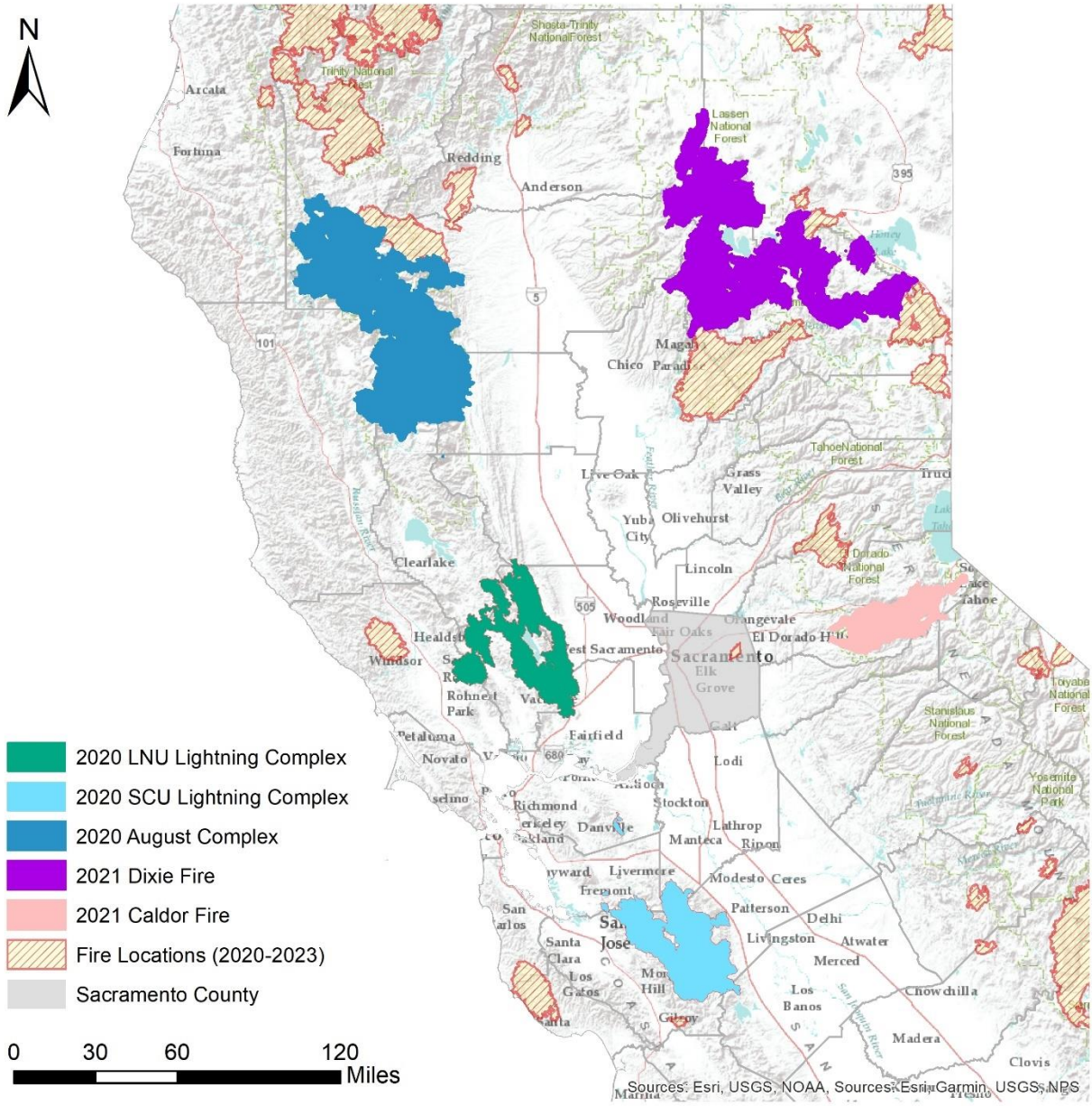


Figure 9 – Perimeters of Sacramento County and wildfires for the period 2020-2023. The 2020 LNU Lightning Complex, SCU Lightning Complex, and August Complex wildfires and the 2021 Dixie and Caldor fires, which directly impacted air quality in Sacramento County are highlighted in green, light blue, blue, purple, and pink respectively (Source: CalFire; California Department of Technology).

Wildfire activity in California during 2020 reached unprecedented levels, with approximately 4.2 million acres burned across 500 fires—two to three times more than in previous high-activity years like 2008, 2017, and 2018 [41]. Notably, the August Complex became the largest recorded wildfire event in California's history. The plumes from the August Complex Fires were clearly visible Figure 10. In 2021,

[41] California Air Resources Board, Wildfire Emission Estimates for 2020;https://ww2.arb.ca.gov/sites/default/files/2021-07/Wildfire%20Emission%20Estimates%20for%202020%20_Final.pdf

the state reported 372 wildfires that burned approximately 2.5 million acres. Over half of the total acreage in 2021 was attributed to three major fires: Dixie, Monument, and Caldor, with the Dixie Fire becoming the second-largest fire event in state history, burning 963,405 acres[42]. In both years, high fuel loads in forested lands combined with dry conditions led to extensive fuel consumption and significant emissions.

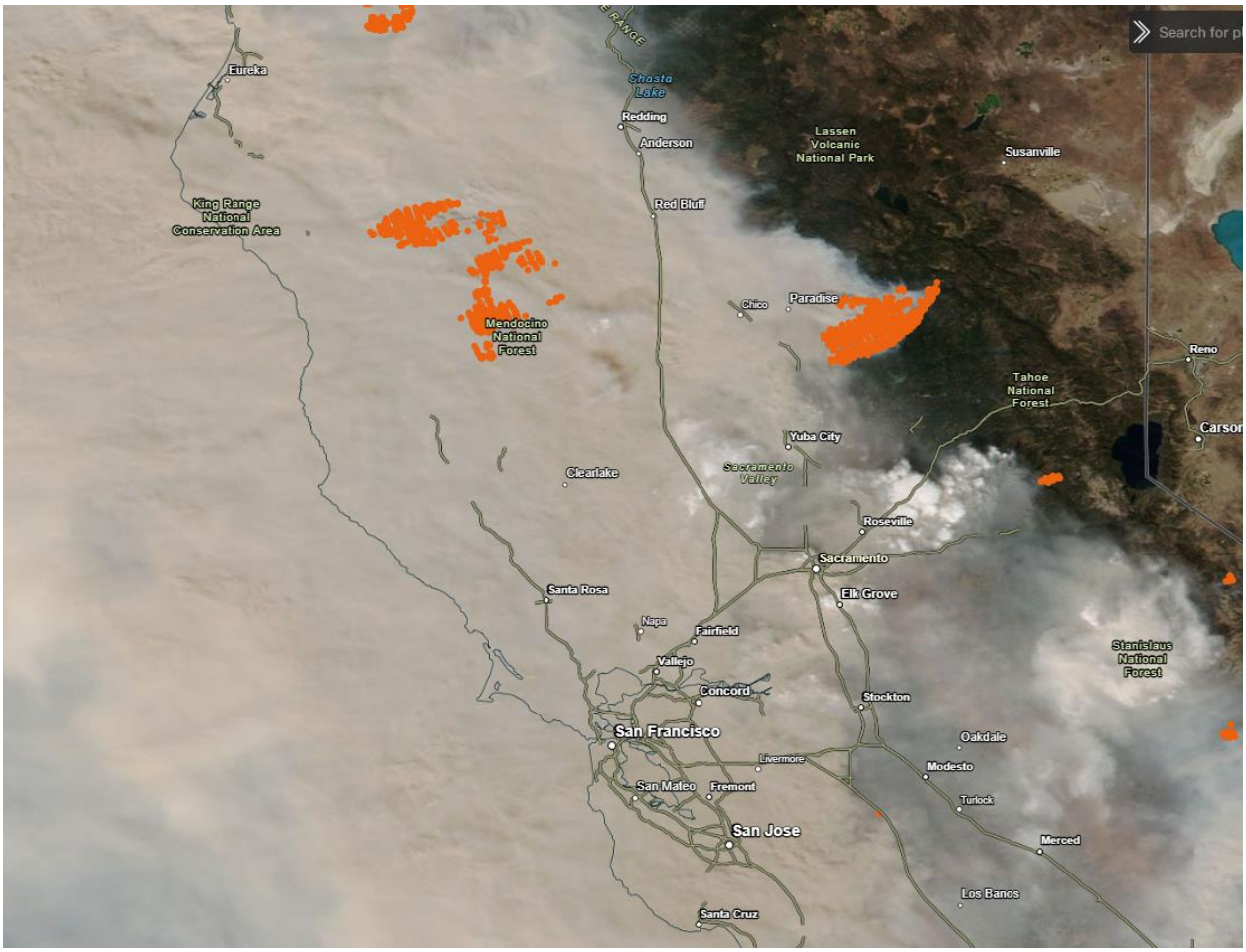


Figure 10 – Thick smoke and dense plumes blanketed the Bay Area and much of Northern California during the August Complex wildfire, as captured by the MODIS satellite on September 9, 2020. (source: NASA; https://worldview.earthdata.nasa.gov/). Red dots indicate satellite derived hotspots, the Western cluster represents the August Complex wildfire while the eastern cluster represents the Potters Fire.

Wildfires are an increasingly prevalent burden on Sacramento County residents and the District network, impacting multiple pollutants. Evidence of increased wildfire activity throughout the western United States is shown in the change in annual burned acreage between 1984-2002 and 2003-2021[43] (Figure 11). The extent of burned land in California increased by 4.16 acres per square mile of land area

[42] California Air Resources Board, Wildfire Emission Estimates for 2021; https://ww2.arb.ca.gov/sites/default/files/classic/cc/inventory/Wildfire%20Emission%20Estimates%202000-2021.pdf

[43] EPA Climate Indicators: Wildfires. https://www.epa.gov/climate-indicators/

in 1984-2002 as compared to 2003-2021. This is the highest value in the United States.

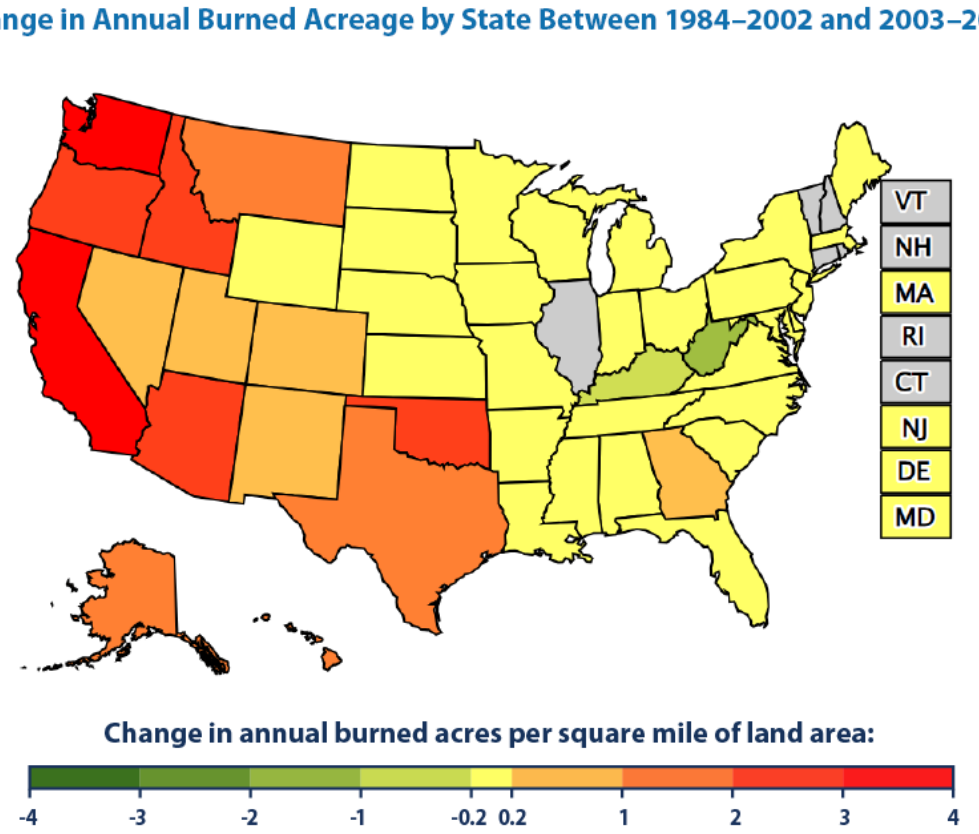


Figure 11 – Change in annual burned acreage by state between 1984-2002 and 2003-2021 (source: EPA, 2024).

Within California specifically, a time series of the total annual burned acreage due to wildfires shows the increase in wildfire activity throughout the last decade[43] (source: EPA, Figure 12).

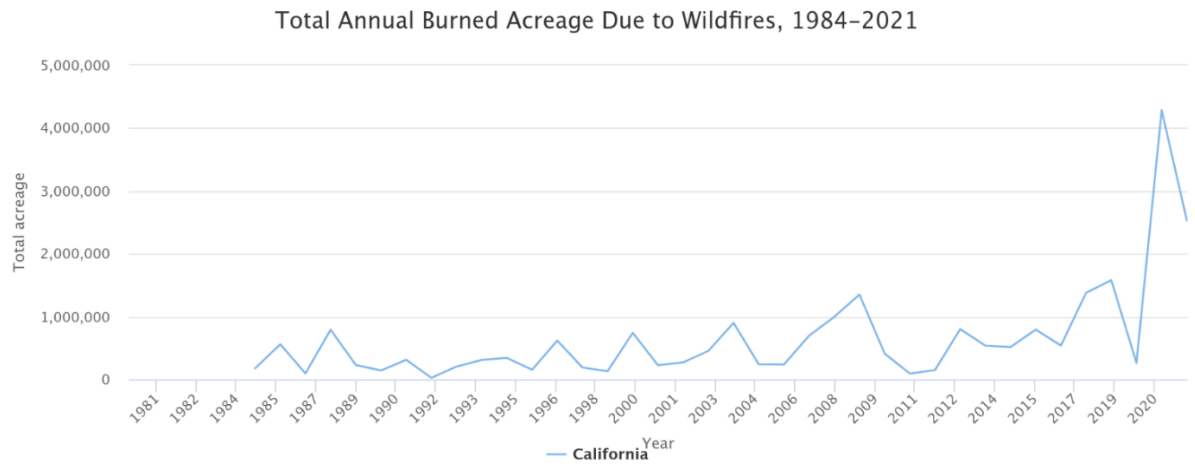


Figure 12 – Total annual burned acreage due to wildfires (source: EPA).

As Figure 11 and Figure 12 highlight, the frequency of total fire activity has increased in the last decade throughout the western United States. However, not to be lost in this is that the severity and magnitude of individual major wildfires during the last five years in California has been catastrophic. At the time of publication, fires from 2018, 2020, 2021, and 2024 combined to burn more than 3.5 million acres and make up the six largest wildfires in California history[44] (source: CalFire, Table 6).

Table 6 – Top 6 largest wildfires by acreage in California history (source: CalFire).

	Fire Name	Date	County	Acres	Structures	Deaths
1	August Complex	August 2020	Mendocino, Humboldt, Trinity, Tehama, Glenn, Lake, & Colusa	1,032,648	935	1
2	Dixie	July 2021	Butte, Plumas, Lassen, Shasta & Tehama	963,309	1,311	1
3	Mendocino Complex	July 2018	Colusa, Lake, Mendocino & Glenn	459,123	280	1
4	Park Fire	July 2024	Butte, Plumas, Shasta & Tehama	429,603	709	0
5	SCU Lightning Complex	August 2020	Stanislaus, Santa Clara, Alameda, Contra Costa, & San Joaquin	396,625	225	0
6	Creek	September 2020	Fresno & Madera	379,895	858	0

Wildfire data also indicates that wildfire activity has increased recently in the shoulder seasons historically not conducive to wildfire conditions[43]. Figure 13 shows that the total burned acreage in the western United States has increased in nearly every month of the year (source: EPA). This is yet another

[44] California Department of Forestry and Fire Protection (CalFire), Top 20 Largest California Wildfires. https://www.fire.ca.gov/our-impact/statistics. Data valid October 2024.

factor that ultimately increases the frequency of elevated ground-level pollutant concentrations from wildfires and directly impacts public health.

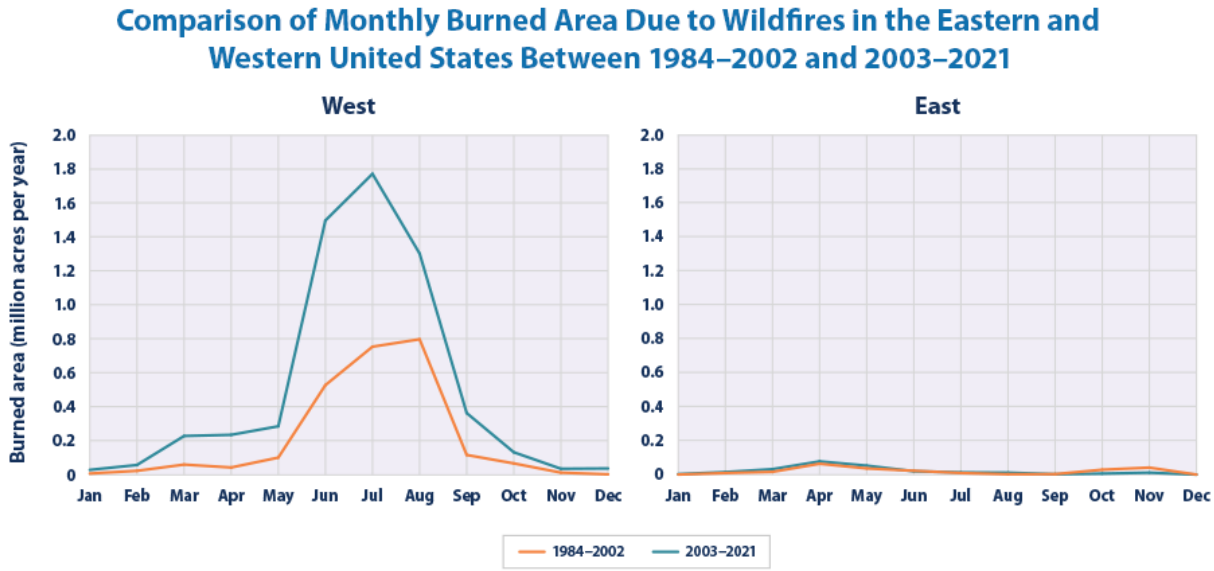


Figure 13 – Comparison of monthly burned area due to wildfires in the Eastern and Western United States between 1984–2002 and 2003–2021 (source: EPA).

Increases in the severity and frequency of wildfires have significantly elevated air pollutant concentrations during these episodes throughout much of California. As shown in Figure 9, Sacramento County lies in a large valley extending throughout the interior of California. During large wildfire events located anywhere from the city of Bakersfield north to Washington State and beyond, depending on wind direction, smoke can commonly be transported throughout the entire interior of California, thus increasing pollutant concentrations in Sacramento County. These pollutants can include fine particulate matter, ozone, carbon monoxide, and others, and can have drastic impacts on public health. The wildfire impacts on pollutant concentrations are factored into this assessment and addressed specific to each pollutant in the appropriate sections.

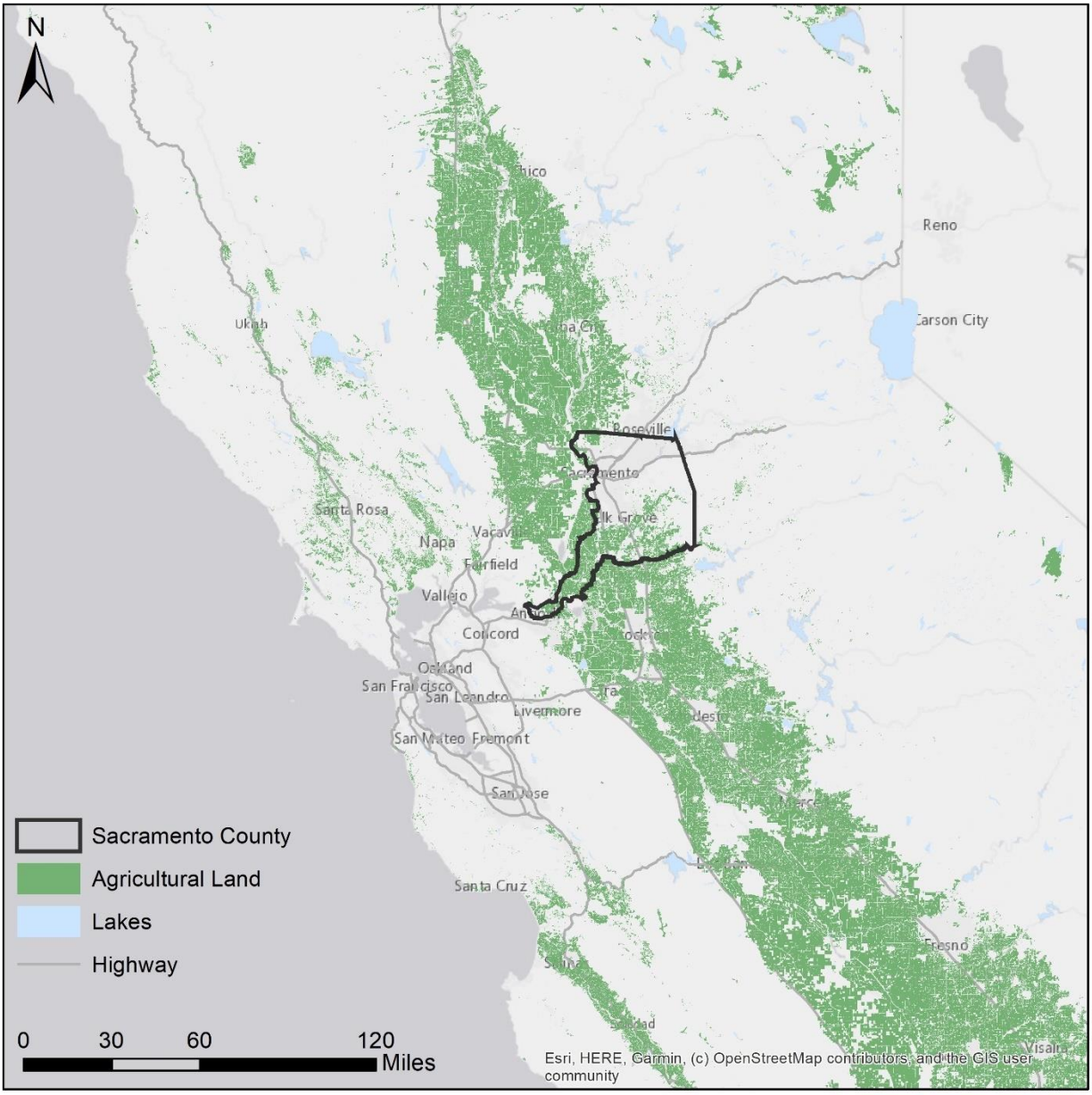


Figure 14 – Map of agricultural land and Sacramento County (source: CNRA)

High Wind Dust Impacts

In Sacramento County, high wind dust events can occur when high-speed wind entrains and transports dust. These events can cause drastic and at times sudden increases in particulate matter concentrations. It is possible for these events to impact Sacramento County due to the proximity of the county to agricultural activities as well as frequent construction sites throughout the county. shows the large amount of agricultural land surrounding Sacramento County[45] as of 2023 (source: CNRA). Warmer and drier atmospheric conditions can lead to increased high wind dust events. Drought conditions can cause fields to be extremely dry or left fallow exposing dry, loose soil for wind to entrain. The high wind dust impacts on pollutant concentrations are factored into this assessment and addressed specifically for each pollutant in the appropriate sections.

[45] California Natural Resources Agency, California Department of Water Resources, Land IQ. 2018 Statewide Crop Mapping. https://data.cnra.ca.gov/dataset/statewide-crop-mapping

Network-Wide Analyses (Pollutant Non-specific)

An evaluation of the District's ambient air monitoring network was evaluated by the number of parameters (O_3, $PM_{2.5}$, PM_{10}, NO_2, CO, SO_2, Pb, meteorological, and PAMS measurements). Each section below provides explanations pertaining to monitoring objectives and spatial scales as well as recommendations based on the analyses outlined above. As mentioned in the Technical Approach section, the number of parameters monitored analysis is performed on the network as a whole, whereas each of the other analyses are applied and concluded upon a pollutant-specific basis.

Number of Parameters Monitored Analysis

There is a total of seven (7) ambient air monitoring sites located within Sacramento County. Each station is categorized as SLAMS, PAMS, CSN, NCore, and/or SPM. Table 7 lists the number of parameters, categorized by pollutant type and meteorology, measured at each site. The total number of parameters sampled are summed for each station. The total score is shaded red, with the highest overall score darkest. Sites at which a larger number of parameters are measured are ranked highest.

Table 7 – Number of parameters monitored at each District air monitoring station. The overall score is shaded red, with highest overall score darkest.

Parameter	BER	BC	BRU	DPM	FOL	SLU	TST
O_3			1	1	1	1	1
$PM_{2.5}$	1		1	3	2	1	2
Speciated $PM_{2.5}$				1			1
PM_{10}		1	1	2			1
NO_2	1		1	1	1		1
CO	1			1			
SO_2				1			
Pb				1**			
NOy				1	1***		
NMHC			1	1	1		
VOC*			1***	1	1***		
Carbonyl*				1			
$PM_{10\text{-}2.5}$				1			
BC	1			1			
Temperature	1		1	1	1		1
Wind Direction	1		1	1	1	1	1
Wind Speed	1		1	1	1	1	1
Relative Humidity			1	1	1		1
Barometric Pressure			1				
Precipitation			1				
Solar Radiation			1	1	1		
UV			1				
Mixing Height			1				
Total Score	**7**	**1**	**14**	**21**	**10**	**4**	**10**

* For this analysis, VOCs and carbonyls are each counted as one parameter instead of summing each specific species included in the laboratory analyzed VOC and carbonyl samples.
** Monitor discontinued as approved by EPA via letter on April 20, 2020.
***These sites are no longer required to collect VOC data. DPM is the primary PAMS monitoring station.

Based on this assessment, Sacramento-Branch Center #2 ranked lowest; therefore, this site is evaluated in further detail in the Coarse Particulate Matter (PM10) Network Analysis section.

Ozone (O_3) Network Analysis

Monitoring Objectives

Sacramento County has a total of five (5) active SLAMS ozone monitoring stations as shown in Figure 15. The North Highlands-Blackfoot station as discussed in the Recent Notable Modifications to the Network section was discontinued in 2022. Based on the characteristics of the sites, including the population served and the area served, each site can be designated as background, population oriented, or high concentration monitoring locations as listed in Table 8.

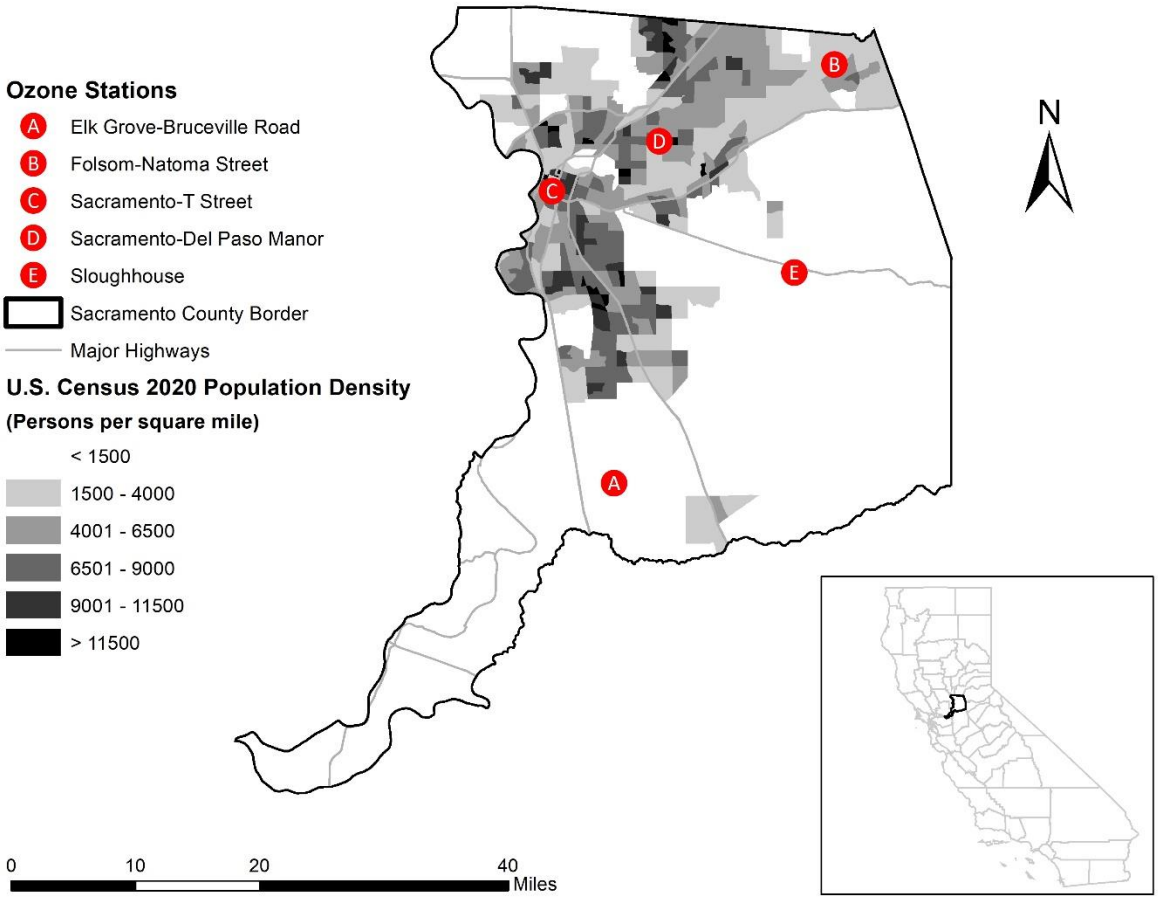


Figure 15 – Ozone network in Sacramento County. Darker shades indicate higher population density (source: 2020 US Census). Red markers indicate active monitors.

Table 8 – EPA network affiliation and monitoring objective for ozone monitors serving Sacramento County.

Site	EPA Network Affiliation*	Monitoring Type**
Elk Grove-Bruceville Rd.	PAMS	Background
Folsom-Natoma St.	PAMS	Population Oriented / High Concentration
Sacramento-1309 T Street		Background/ Population Oriented***
Sacramento-Del Paso Manor	NCORE, PAMS	Population Oriented / High Concentration****
Sloughhouse	SPM	High Concentration

Note: All monitors are SLAMS (State and Local Air Monitoring Stations) monitor type unless otherwise noted.
* NCORE (National Core Multi-pollutant Monitoring Stations), PAMS (Photochemical Assessment Monitoring Station), SPM (Special Purpose Monitor not part of SLAMS).
** Consistent with EPA monitoring types as listed in 40 CFR Part 58, Appendix D.
*** Sacramento-1309 T Street is officially classified as upwind/background for ozone, but for the purposes of this assessment, it is classified as background and population oriented due to the large number of people in the downtown core of Sacramento at any given time.
**** Sacramento-Del Paso Manor is officially classified as a population oriented site, but for the purposes of this assessment, it is also classified as a high concentration site due to being the design value site for the SFNA the past few years.

As discussed in the Background section, the District is part of a larger area, the Sacramento Federal Ozone Nonattainment Area (SFNA; Figure 16). The Sacramento Federal Ozone Nonattainment Area (SFNA) is designated by the EPA as severe non-attainment for the 1997 (0.08 ppm) and 2008 (0.075 ppm) 8-hour O_3 standards, and serious for the 2015 (0.070 ppm) 8-hour O_3 standard (86 FR 59648). In addition to the District, the SFNA includes all or parts of four other regional air districts: El Dorado County Air Quality Management District, Feather River Air Quality Management District, Placer County Air Pollution Control District, and Yolo-Solano Air Quality Management District.

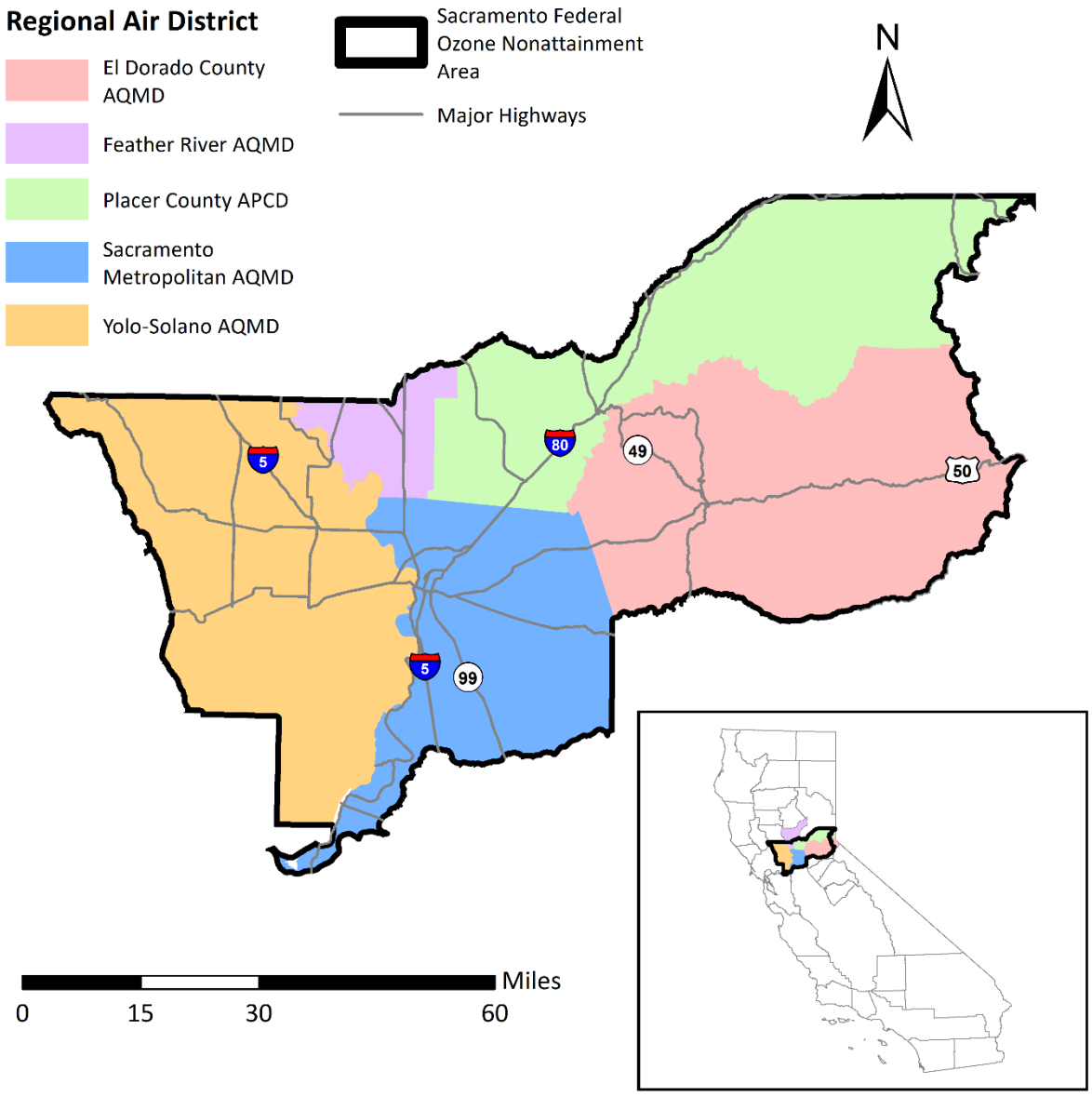


Figure 16 – Sacramento Federal Ozone Non-Attainment Area (SFNA).

In this assessment, the 2015 federal 8-hr ozone standard of 0.070 ppm will be used for comparisons. For 2020-2024, the number of daily maximum 8-hour exceedance days exceeding the 2015 Federal ozone standard (greater than 0.070 ppm) was calculated for each site and shown in Table 9. The exceedances were counted as number of station days that exceeded the 8-hour ozone standard, so multiple exceedances within a single day at a station were not counted.

Table 9 – Number of daily maximum 8-hour ozone exceedance days above the 2015 Federal standard (NAAQS; greater than 0.070 ppm) for 2020-2024. Totals include days that could potentially be considered exceptional under the Exceptional Events Rule.

Site	2020	2021	2022	2023	2024	Total
Elk Grove-Bruceville Road	2	5	1	0	0	8
Folsom-Natoma Street*	-	29	3	5	0	37
Sacramento-Del Paso Manor	10	17	3	9	14	53
Sacramento-1309 T Street	3	1	3	1	3	11
Sloughhouse**	5	13	5	0	2	25
Total	20	65	15	15	19	134
Total without Folsom	20	36	12	10	19	97
Total without Sloughhouse	15	52	10	15	17	109

*Folsom-Natoma St. site was offline due to construction beginning late January 2020 through December 2020.
** Sloughhouse had poor quality assurance issues from July 2023 through April 2024.

The background sites consistently had the fewest number of exceedance days. The sites that recorded two of the highest frequencies of exceedances from 2020-2024 are the sites designated as population oriented, Sacramento-Del Paso Manor and Folsom-Natoma St., with a total of 53 and 37 exceedances, respectively. As noted in Table 8, of this document, Sacramento-1309 T Street is officially classified as upwind/background for ozone, but for the purposes of this assessment, it is classified as population oriented. The three high concentration sites are located in the urban core (1 site) and downwind[46] of the urban core (2) of the Sacramento metropolitan area as shown in Figure 1. Historically, the highest ozone concentrations were observed at the downwind sites, consistent with the ozone formation process as ozone forms through photochemical reactions in the presence of precursor pollutants and sunlight. These photochemical reactions take time, and the air masses typically get transported away from emission sources before ozone forms. However, recent data in 2023 and 2024, indicate a shift of the peak ozone levels toward the urban core. This trend may be attributed to changes in the prevailing wind patterns, variations in boundary layer dynamics, elevated urban temperatures, and/or increased frequency of atmospheric stagnation events that limit atmospheric mixing. The total number of exceedances by year fluctuates, with 2022 and 2023 being the lowest years in the previous 5 years. Note that the Folsom-Natoma St. site was offline due to construction throughout the majority of 2020 through December 2020 (covered the entire ozone season), which could introduce a low bias to the totals for 2020. Additionally, Sloughhouse had poor quality assurance issues from July 2023 through April 2024 (encompassing 53% of ozone season of 2023). Sections with Folsom-Natoma St. and Sloughhouse site data removed were added to the chart to highlight this possible bias. On average from 2020-2024, the Folsom-Natoma St. site contributed 24% of the ozone exceedances, while Sloughhouse contributed 17%. If this average was projected for 2024, there would have been a total of 23 exceedances in 2024 as indicated with the orange point in Figure 17. The number of 8-hour exceedance days by year for each site in Sacramento County is broken down in Figure 18.

[46] Summertime wind direction in Sacramento County during days with the highest ozone concentrations is predominantly westerly, consistent with upslope terrain flow.

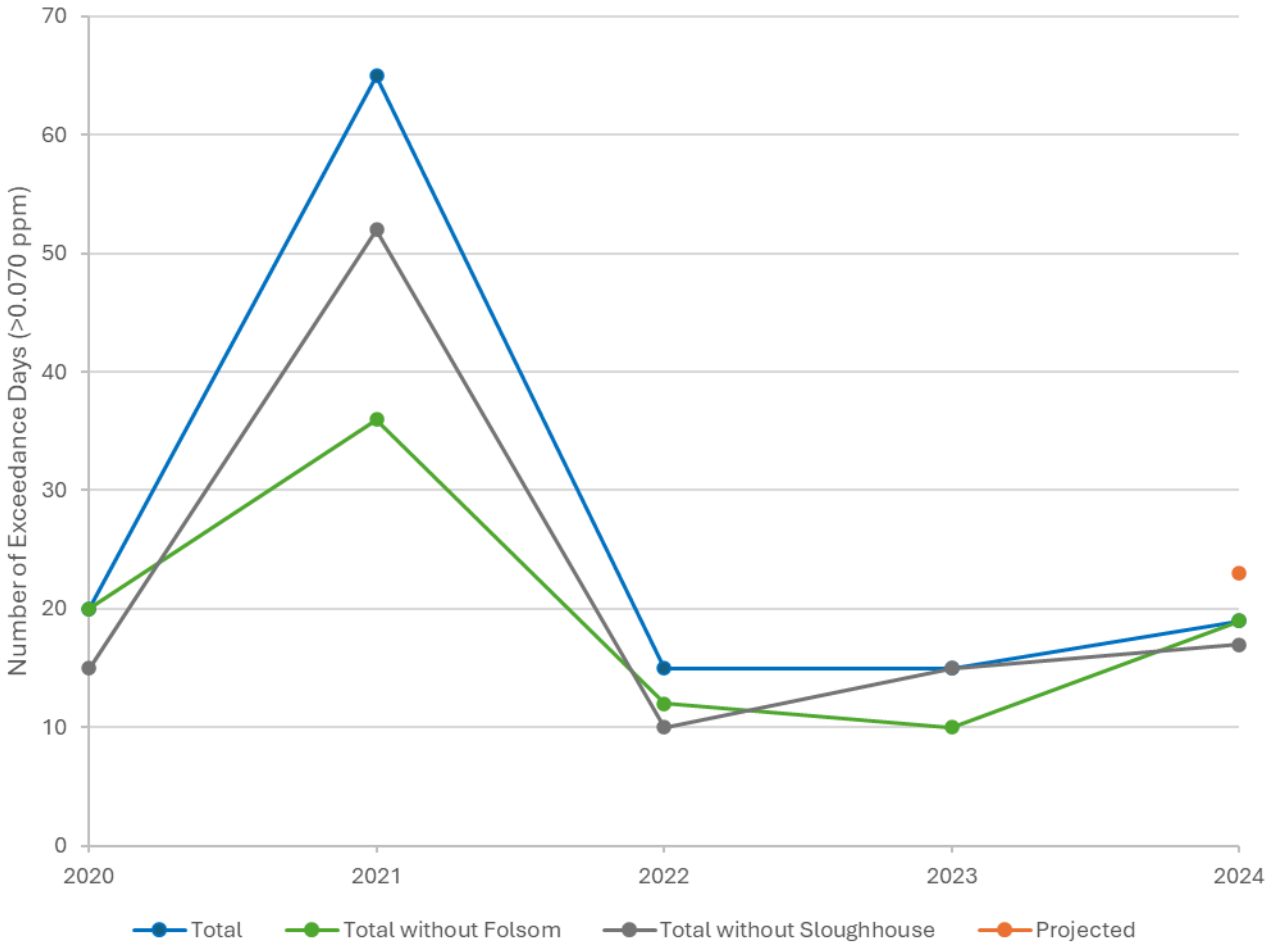
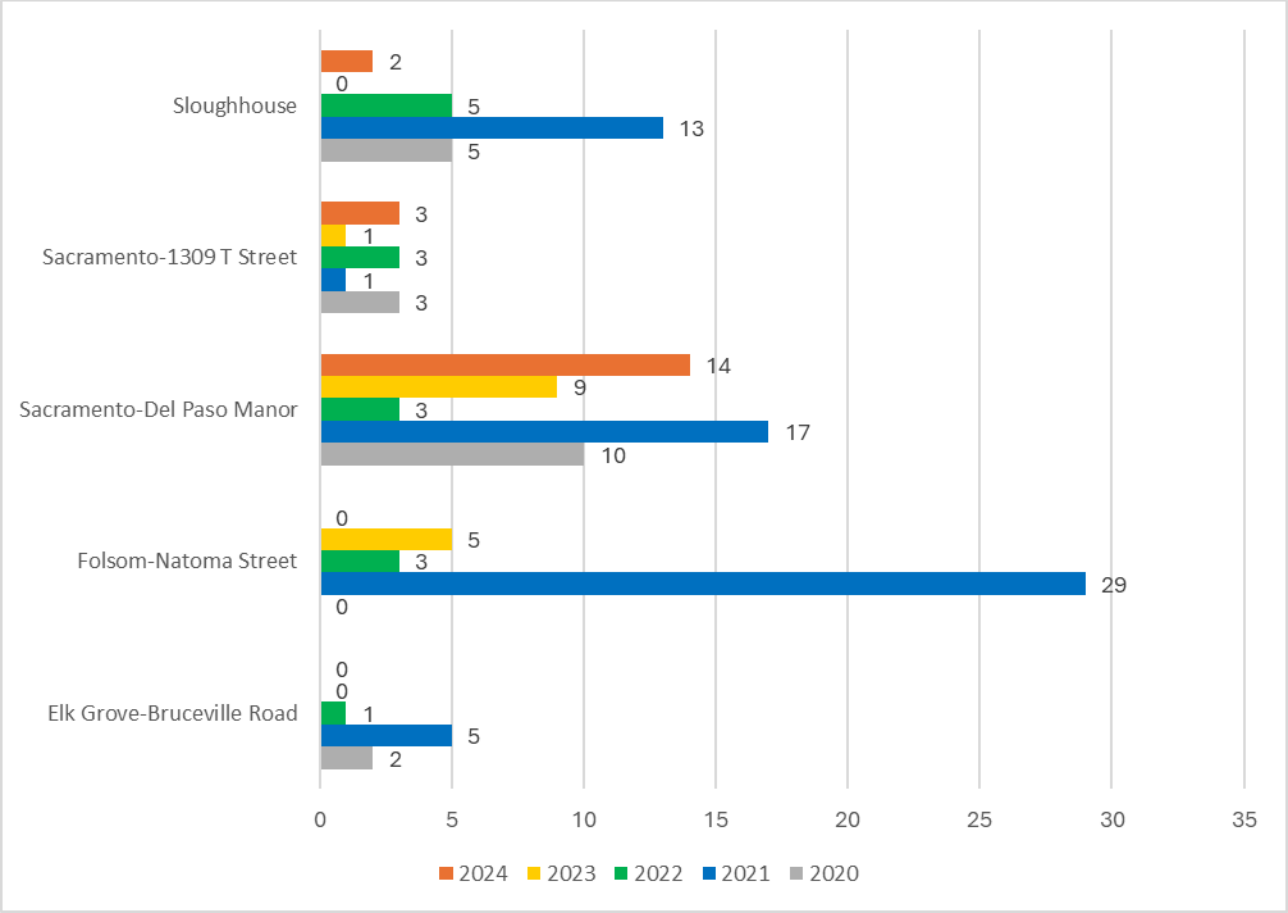


Figure 17 – Total number of 8-hour exceedances (2015 NAAQS of 0.070 ppm) in Sacramento County.

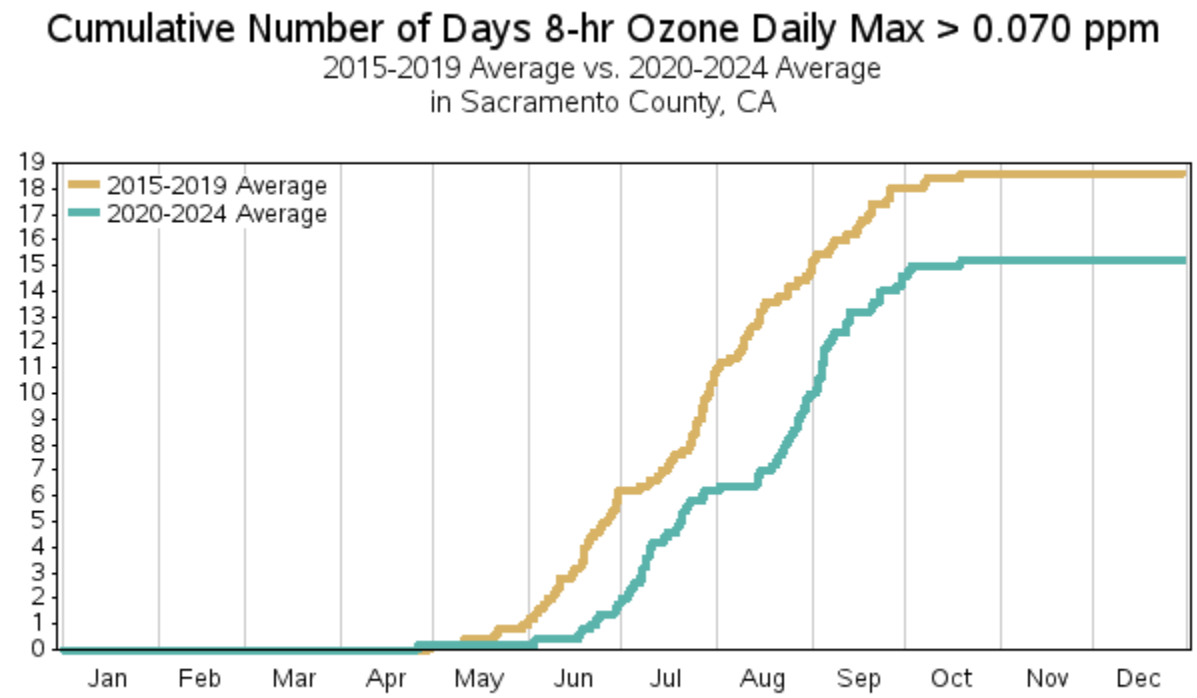


* Folsom-Natoma St. site was offline due to construction From January 2020 through early December 2020. Sloughhouse was offline due to poor quality assurance from July 2023 through April 2024.

Figure 18 – Number of 8-hour exceedance days (2015 NAAQS of 0.070 ppm) by year for each site in Sacramento County for 2020-2024.

Throughout this analysis, days which may have been impacted by wildfire were included. This could introduce bias to the totals in years when wildfires heavily impacted Sacramento County. However, wildfire smoke has a nonlinear effect on ozone concentrations as light smoke can enhance ozone formation when VOC-rich wildfire smoke mixes into NO_X-rich urban plumes[47], but heavy or thick smoke can inhibit incoming solar radiation (which also has the effect of decreasing daytime maximum temperatures) and therefore, decrease ozone formation. The average number of 8-hr ozone exceedances for the period 2020-2024 has decreased from the average between 2015-2019 from the previous 5-year Network Assessment. Figure 19 shows the cumulative number of days over the 0.070 ppm standard for the two periods in Sacramento County. This decrease in exceedance days could be a result of meteorological or climatological changes, fluctuations in wildfire impacts, consistent enforcement of regulations and rules, or a product of land use or mobile source changes within Sacramento County.

[47] Lu Xu et al, Ozone chemistry in western U.S. wildfire plumes, Science Advances (2021). DOI: 10.1126/sciadv.abl3648



Note: Based on ALL sites
Source: U.S. EPA AirData <https://www.epa.gov/air-data>

Figure 19 – Cumulative number of days exceeding 2015 8-hr NAAQS (0.070 ppm) for the periods 2015-2019 and 2020-2024.

Ozone Network Area- and Population-Served Analyses

Spatial analysis techniques were evaluated to determine whether the current ozone stations meet the objectives of the monitoring network. Thiessen polygons, as described in the previous section, were generated to determine the spatial representation of each of the five (5) ozone monitoring stations located in Sacramento County. The following sections present the findings for area- and population-served analyses for the ozone network. Note that as seen in Table 8, some ozone monitoring stations are affiliated with EPA networks and are therefore required regardless of these analyses.

The population within Sacramento County represented by each monitoring site was counted within the Thiessen polygons by NetAssess2025 v1.1 using 2020 US Census data. Area- and population-served analyses are presented in Table 10. Figure 20 presents a map showing the location and area of influence for each ozone monitor.

In the area-served analysis, sites are ranked based on their area of coverage. Sites that are used to represent a large area score high in this analysis. In the population-served analysis, larger populations are associated with higher emissions, and thus, sites are ranked based on the number of people they represent.

Following the methods outlined in the EPA network assessment guidance and the thresholds described in the Introduction to this document, the ozone station rankings are summarized in Table 10.

Table 10 – Area and population served by ozone monitors serving Sacramento County. Darker red indicates the highest values of population and area served.

Station Name	Population Estimate (persons)*	Area (km^2)*	Population Served Ranking	Area Served Ranking
Elk Grove-Bruceville Rd.	204,530	641	Medium	High
Folsom-Natoma St.	122,084	171	Low	Low
Sacramento-1309 T Street	565,221	355	High	Medium
Sacramento-Del Paso Manor	492,349	351	High	Medium
Sloughhouse	59,411	797	Low	High

* Population and area estimates based on monitor's area of influence and an approximate boundary of Sacramento County as extracted from the NetAssess2025 v1.1 tool. Population estimated with some overlapping census tracts.

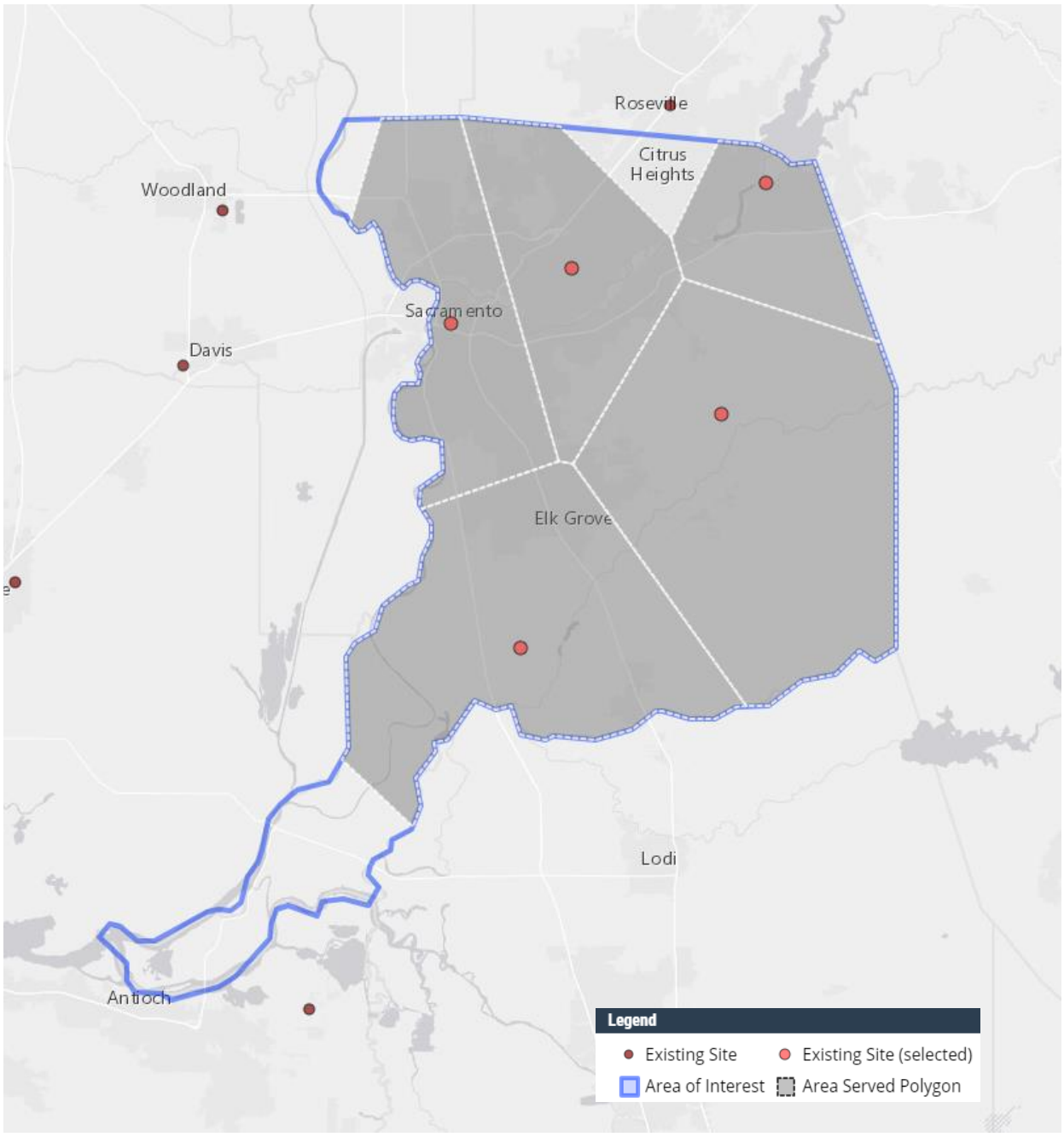


Figure 20 – Ozone Network Area-Served analysis.

Ozone Data Analyses

The ozone data analysis was conducted based on the following methods:

- measured concentrations and exceedance probability,
- deviation from NAAQS,
- monitor-to-monitor correlation,
- trend impact, and
- removal bias.

Measured Concentration and Exceedance Probability

The eight-hour ozone NAAQS of 0.070 ppm, as revised on October 1, 2015, was utilized for the exceedance probability calculations. Monitors within the District's ambient air monitoring network shown to have high levels of ozone, design values close to the standard, and with long historical record were considered to be of high value for characterizing pollution in an area. Table 11 presents 8-hour ozone design value concentrations for 2015 through 2024 (2015-2024 data included for historical context), deviation from the NAAQS using 2024 8-hr design value[48], and the exceedance probability for 2019-2021 in percent calculated using the NetAssess2025 v1.1 tool. The deviation from the NAAQS analysis will be discussed in the next section.

Table 11 – Concentration Analysis for Ozone Monitors Serving Sacramento County.

Station Name	Three-Year Calculated 8-hr Ozone Design Value (ppm)										Deviation from NAAQS (ppm)[a]	Exceedance Probability[b]
	2015	2016	2017	2018[c]	2019	2020[c]	2021[c]	2022[c]	2023	2024		
DPM	0.076	0.077	0.077	0.075	0.071	0.072	-*	-*	-*	0.075	0.005	>90%
TST	0.068	0.069	0.069	0.067	0.067	0.065	0.066	0.066	0.067	0.067	0.003	>90%
BRU	0.066	0.068	0.068	0.067	0.068	0.068	0.070	0.066	0.059	0.052	0.018	>90%
FOL	0.080	0.083	0.082	0.082	-*	-*	-*	-*	0.075	0.068	0.002	>90%
SLU	0.076	0.079	0.078	0.075	0.070	0.070	0.071	0.073	-*	-*	0.003	>90%

DPM – Sacramento-Del Paso Manor
TST – Sacramento-1309 T Street
BRU – Elk Grove-Bruceville Rd.
FOL – Folsom-Natoma St.
SLU – Sloughhouse

[a] Based on 2024 design values.
[b] Calculated by the NetAssess2025 v1.1 tool as described in the Sources of Data section.
[c] Wildfire smoke in 2018, 2020, 2021, and 2022 impacted multiple air monitoring stations; the District will work with other monitoring organizations in the Sacramento Federal Non-attainment Area, CARB, and EPA in addressing some impacts under the Exceptional Event Rule (81 FR 68216) if necessary.
*The design value was invalid due to failure to achieve data completeness of 75% or greater for each year in the calculation.

[48] The design value is calculated as the annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years, EPA, https://www.epa.gov/ground-level-ozone-pollution/table-historical-ozone-national-ambient-air-quality-standards-naaqs

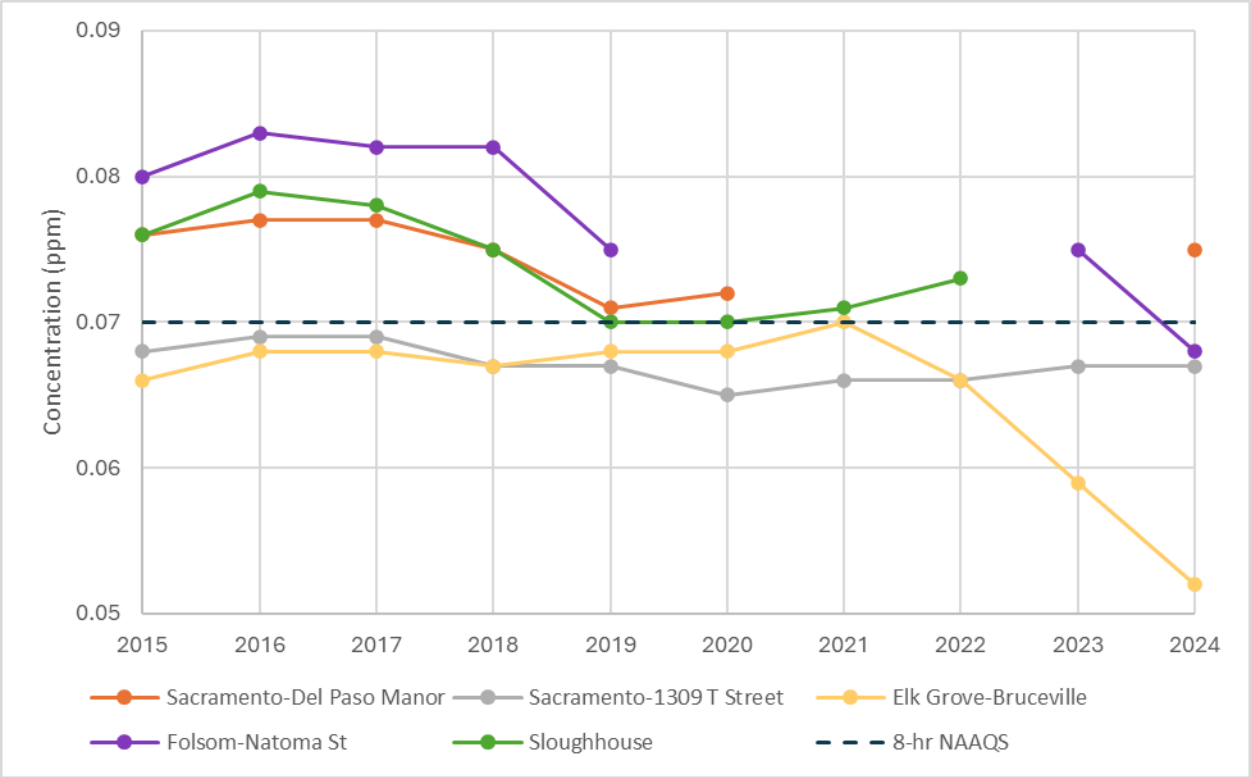


Figure 21 – 2015 through 2024 3-year design values for ozone monitors serving Sacramento County. Impacted design values mentioned in Table 11 were not included in this graphical representation.

Figure 21 presents the 2015 through 2024 3-year design values for ozone monitors serving Sacramento County. As described in the introduction to this document, sites were ranked based on the average concentrations used to determine the design value (DV_{ave}) for the assessment period (2020-2024). The thresholds for this analysis are as follows:

Monitor Rank	Criteria
High	$DV_{ave} > 0.070$ ppm
Medium	$0.070 \text{ ppm} \geq DV_{ave} \geq 0.063$ ppm
Low	$DV_{ave} < 0.063$ ppm

Table 12 summarizes the rankings of the monitoring stations for this analysis. It is important to note that although the Elk-Grove Bruceville station ranked lowest, it serves an essential role as a background monitor to establish a baseline reference level of regional air quality, and is also important for SIP planning and development.

As previously mentioned, ozone forms through photochemical reactions in the presence of precursor pollutants and sunlight. These photochemical reactions take time, and the air masses typically get transported away from emission sources before ozone forms. Folsom-Natoma and Sloughhouse are located outside the urban core of the county where many of the ozone precursors are emitted.

However, Del Paso Manor is located in the urban core, indicating potential meteorological factors that may have caused this shift. Ozone pollution roses are shown in Figure 22. This figure shows that on days with the highest 1-hr ozone concentrations, the wind direction is generally from the west or the south. These wind patterns transport precursors, from urban areas where the ozone process begins, eastward towards the Folsom-Natoma and Sloughhouse sites, which have historically recorded the highest ozone concentrations. The data also suggest potential wind patterns that lead to higher concentrations at the Del Paso Manor site. The measured concentration rankings are compiled in Table 12.

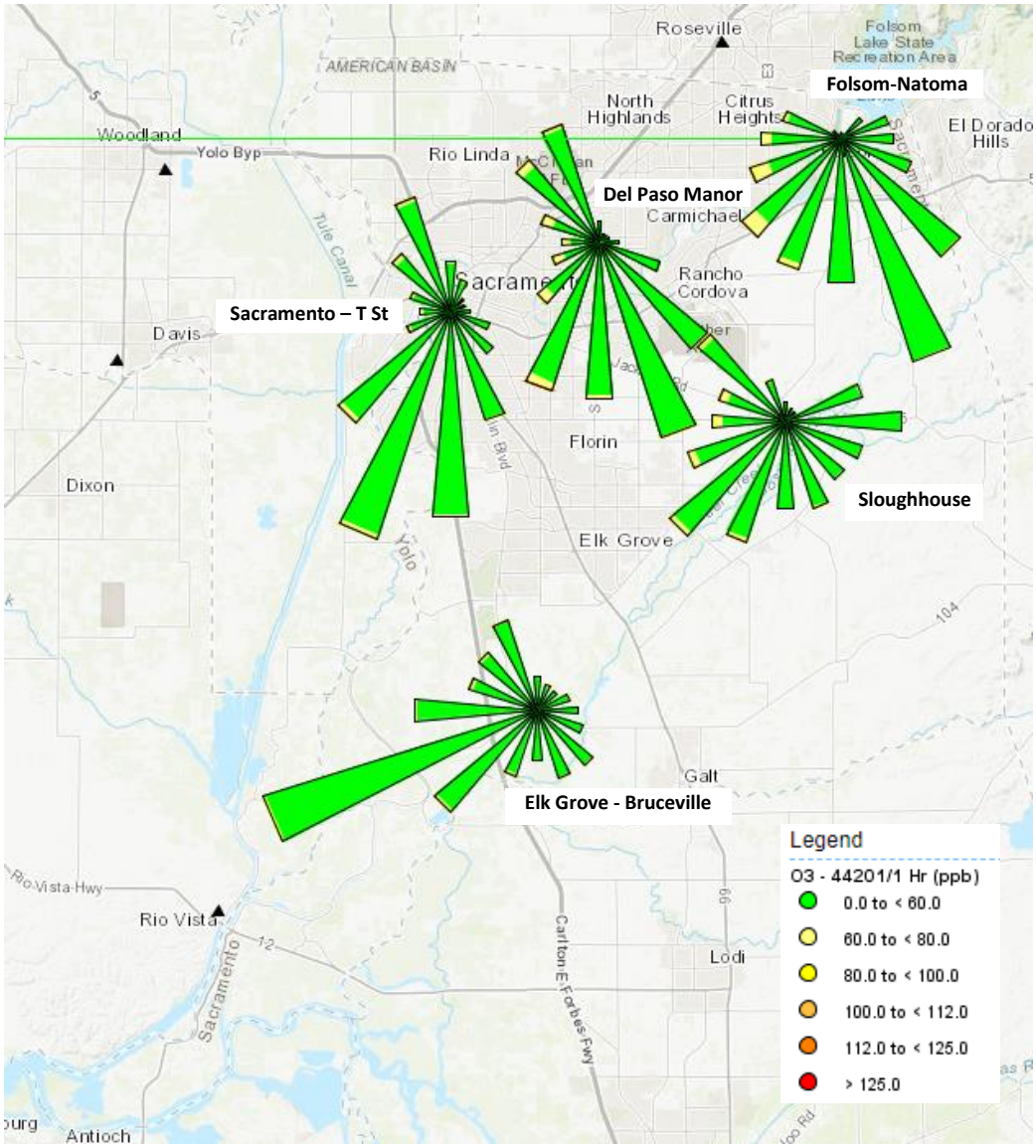


Figure 22 – Ozone pollution roses at Sacramento County air monitoring stations for January 2020 – October 2024 (source: AirNow-Tech; https://www.airnowtech.org/ downloaded on 4/14/2025. November and December 2024 data not yet available). The colors indicate hourly ozone concentrations in ppb.

As mentioned previously, the exceedance probability was calculated by applying a bootstrap analysis to the concentration outputs of 2019-2021 source data from the EPA Downscaler Model. Figure 23 shows the ozone monitoring stations overlaid on the calculated ozone exceedance probability. Each site in Sacramento County is determined to have a greater than 90% chance of exceeding the NAAQS. The exceedance probability presented in Table 11 is calculated for the Thiessen polygon which represents each site, not necessarily the exact geographical location of the monitor. Therefore, each site is ranked high for the exceedance probability analysis Table 12.

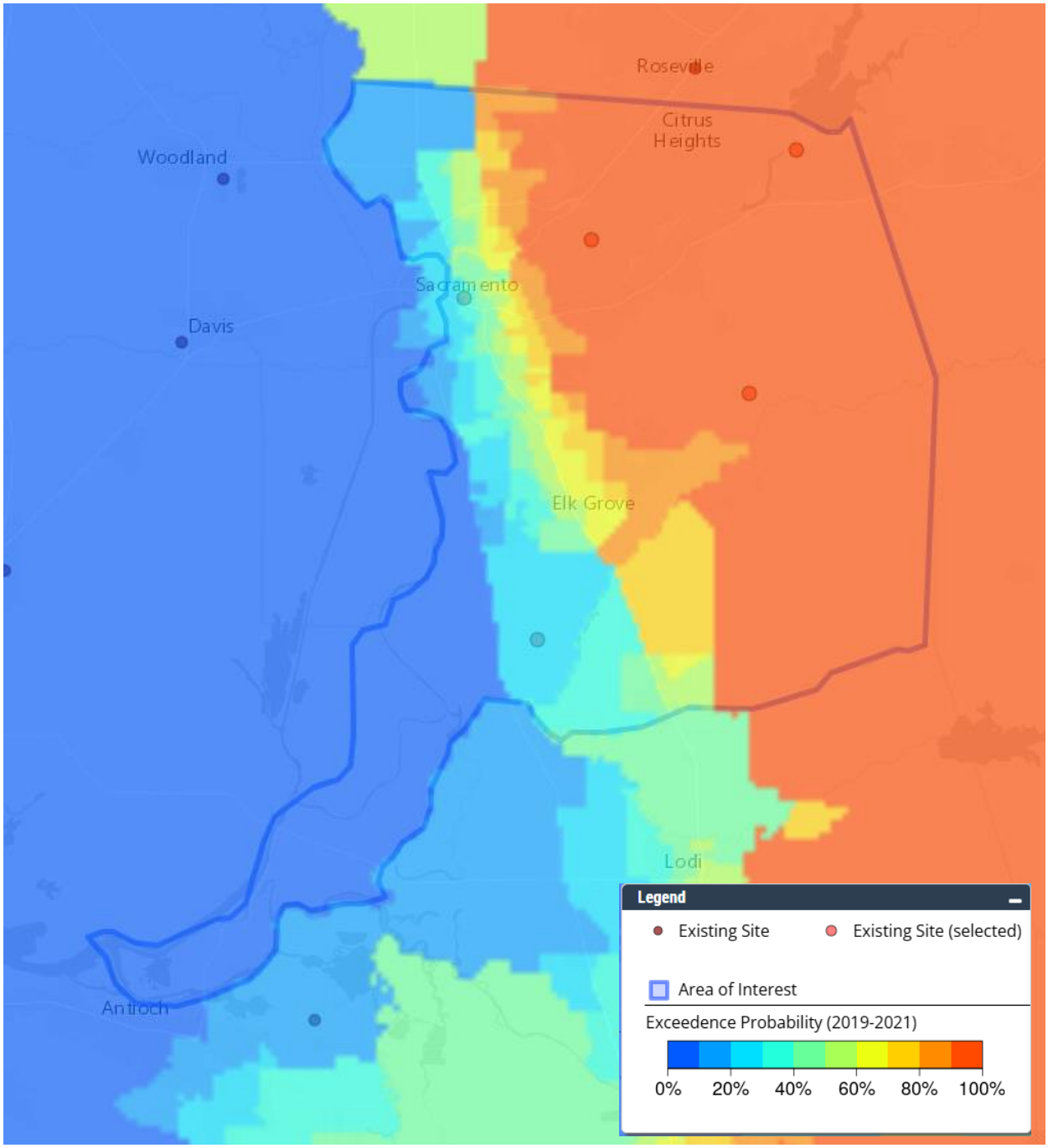


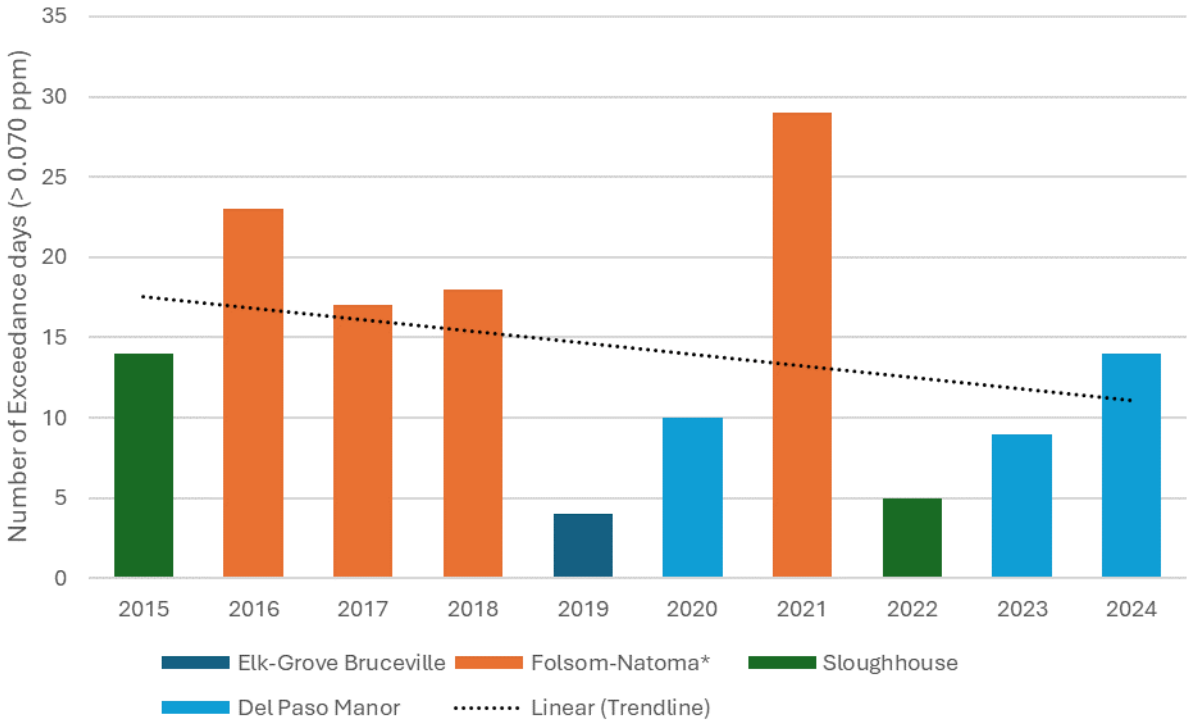
Figure 23 – Ozone monitoring stations overlaid on the calculated ozone exceedance probability (source: NetAssess2025 v1.1).

Table 12 – Measured concentration and exceedance probability ranking.

Station Name	Measured Concentrations	Exceedance Probability[a]
Sacramento-Del Paso Manor	High	High
Sacramento-1309 T Street	Medium	High
Elk Grove-Bruceville Rd.	Low	High
Folsom-Natoma St.	Medium	High
Sloughhouse	High	High

[a] Calculated by the NetAssess2025 v1.1 tool as described in the Sources of Data section.

As mentioned previously, the highest ozone concentration sites in Sacramento County have historically been located downwind (to the east) of the urban core of the Sacramento metropolitan area, but this has recently shifted to the urban core. For the previous 10-year period (2015-2024) as seen in Figure 24 the design value site has typically been the Folsom station, but most recently has shifted to Del Paso Manor located in the central region of the Ozone Nonattainment area.



*Folsom-Natoma St. site was offline due to construction through mid-December 2020.
Note: Wildfire impacted data were not removed

Figure 24 – Number of ozone exceedance days of the 0.070 ppm 2015 ozone NAAQS by year of the maximum station within Sacramento County. A linear trend of the maximum number of exceedances is shown as the black dotted line.

Deviation from NAAQS

The deviation from NAAQS analysis when using the threshold outlined in the Introduction to this document (|Deviation| < 10% of NAAQS or 0.007 ppm) are summarized in Table 13.

Table 13 – 2014 ozone design value and deviation from NAAQS analysis.

Station Name	2024 O_3 Design Value (ppm)*	Deviation from NAAQS (ppm)**	Ranking***
Sacramento-Del Paso Manor	0.075	0.005	High
Sacramento-1309 T Street	0.067	0.003	High
Elk Grove-Bruceville Rd.	0.052	0.018	Low
Folsom-Natoma St.	0.068	0.002	High
Sloughhouse	0.073****	0.003	High

* Wildfire smoke in 2020 and 2021 impacted multiple air monitoring stations; the District is working with other monitoring organizations in the Sacramento Federal Non-attainment Area, CARB, and EPA in addressing possible impacts under the Exceptional Event Rule (81 FR 68216).
** Based on 2024 design values.
*** Ranking based on the most stringent 8-hour ozone NAAQS, which is the 2015 standard of 0.070 ppm.
**** The 2024 design value for Sloughhouse is considered invalid due to data completeness falling below 75%. The design value from 2022 was used.

The interpolation of the ozone design values was performed to further investigate geographically the behavior of ozone concentrations. Ozone design values were interpolated for the region with the most recent available design values from 2023 which do not include the North Highlands station. Figure 25 displays the ozone concentration contour lines, showing that higher concentrations from the most current available data traverse through part of the urban core of Sacramento.

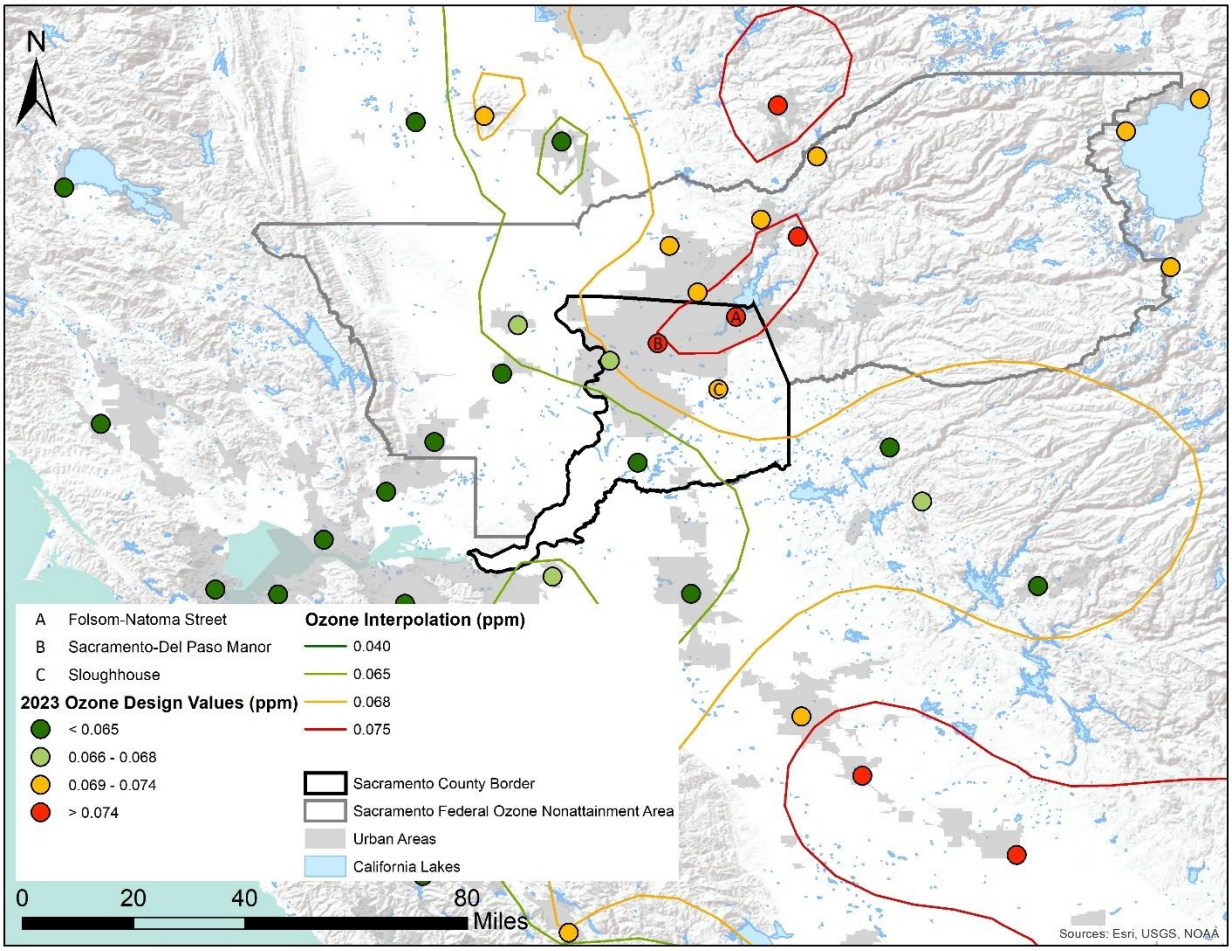


Figure 25 – Interpolated ozone design value isoconcentrations. Folsom-Natoma Street, Sacramento-Del Paso Manor, and Sloughhouse sites are labeled with letters. All active sites are colored by 2023 ozone design value concentration.

Ozone Monitor-to-Monitor Correlation Analysis

Ozone concentrations were compared to examine their relationships using a correlation matrix analysis. Figure 26 shows a correlation matrix for all ozone monitors in Sacramento County provided by the NetAssess2025 v1.1 tool. The raw values from the correlation matrix are shown in Table 14 of the Monitor-to-monitor correlation data. **Red and bold** represent high correlation ($R^2 > 0.75$, distance between sites < 25% of maximum distance between any two sites, mean difference < 25% of maximum mean difference between any two sites). Included in the matrix are Pearson correlations, mean absolute differences, number of observations used in the correlation, distance in kilometers between the sites, and the 2023 design values. The correlation matrix helps to identify similarities between sites within the network. Sites with high correlation, low absolute difference, and close proximities are closely related.

Monitor-to-monitor correlation analysis found that based on the square of the Pearson coefficients (R^2), all five of the monitors within Sacramento County were highly correlated ($R^2 > 0.85$) with at least one other monitor based on the highest pairwise R^2. As can be expected, monitors closer in proximity

correlated better than those that were further apart. The mean absolute difference tended to increase as the east-west distance between the stations increased. This is due to the sites furthest west in the county sampling nearer the source of ozone precursor emissions and hence measuring lower ozone concentrations, and the sites further east into the foothills, where ambient air has had time and distance for the photochemical production of ozone to occur, measuring elevated ozone concentrations.

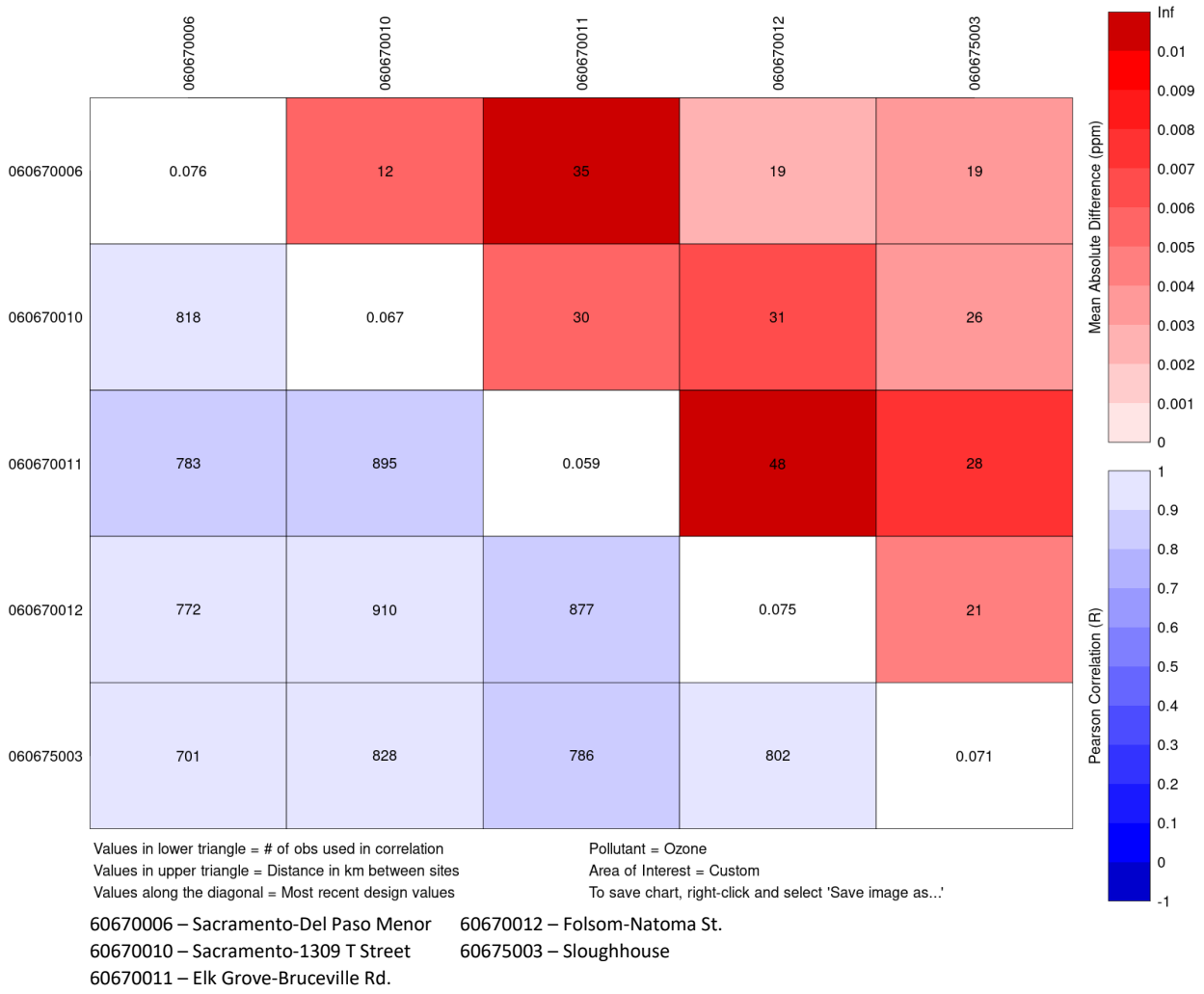


Figure 26 – Correlation matrix for ozone monitors serving Sacramento County (source: NetAssess2025 v1.1). The lower triangle refers to the blue shaded boxes and the upper triangle refers to the red shaded boxes. Most recent design values are for the 2023 design value year.

Based on thresholds outlined in the Introduction of this document, the criteria for this analysis are as follows:

Monitor Rank	Criteria
High (meets 1 or less of the criteria)	Highest pairwise $R^2 > 0.75$
Medium (meets 2 of the criteria)	Distance between sites < 12 km
Low (meets 3 of the criteria)	Mean Difference < 0.0020 ppm

Table 14 – Monitor-to-monitor correlation data. **Red and bold** represent high correlation (R2 > 0.75, distance between sites < 25% of maximum distance between any two sites, mean difference < 25% of maximum mean difference between any two sites).

Site #1	Site #2	Distance Between Sites (km)	Number of Observations	Pearson Correlation	Mean Difference (ppm)
DPM	TST	**12**	818	**0.9653**	0.0052
DPM	BRU	35	783	**0.8849**	0.0103
DPM	FOL	19	772	**0.9703**	**0.0027**
DPM	SLU	19	701	**0.9538**	0.0034
TST	BRU	30	895	**0.8817**	0.0055
TST	FOL	31	910	**0.9288**	0.0066
TST	SLU	26	828	**0.9474**	0.0039
BRU	FOL	48	877	**0.8684**	0.0111
BRU	SLU	28	786	**0.8527**	0.0078
FOL	SLU	21	802	**0.9386**	0.0045

DPM – Sacramento-Del Paso Manor
FOL – Folsom-Natoma St.
TST – Sacramento-1309 T Street
BRU – Elk Grove-Bruceville Rd.
SLU – Sloughhouse

This correlation analysis shows that the ozone sites in Sacramento County generate comparable data. This result is expected for ozone given the regional nature of ozone, the topography of Sacramento County, and the density of the ozone network. Even if the sites in the network measure comparable ozone levels (high correlation), the District follows the requirements of Appendix D to 40 CFR Part 58 to protect public health through public reporting for health alerts and AQI levels. This necessitates a dense ozone network to capture spatial variability. This may lead to a network of sites with high correlation, but it will provide valuable data for the residents of Sacramento County to make healthy choices for themselves and their families. Based on this analysis alone, no sites meet all three criteria. Although ranked lower than the other sites in the network, Sacramento-Del Paso Manor is the NCore[49] site for Sacramento County and Sacramento-1309 T Street functions as a background monitoring station – both of which are vital to meeting the requirements outlined in 40 CFR Part 58 and supporting SIP work, respectively. The ranking of the sites is summarized in Table 15.

[49] https://www3.epa.gov/ttnamti1/ncore.html

Table 15 – Monitor-to-monitor correlation ranking.

Station Name	Monitor-to-Monitor Correlation Rank
Sacramento-Del Paso Manor	Medium
Sacramento-1309 T Street	Medium
Elk Grove-Bruceville Rd.	High
Folsom-Natoma St.	High
Sloughhouse	High

Trend Analysis

Monitors that have a long historical record are valuable for tracking long-term trends. This helps with the modeling and planning of pollutant concentrations as well as scientific research. In this analysis, sites are ranked based on the duration of the continuous measurement record as described in the Introduction to this document. The thresholds for this analysis are as follows:

Monitor Rank	Criteria
High	Trend ≥ 30 years
Medium	30 years > Trend ≥ 10 years
Low	Trend < 10 years

Table 16 shows the year that ozone measurements began at each of the stations serving Sacramento County, as well as the resulting rank based on this analysis.

Table 16 – Date of operation for each $PM_{2.5}$ station serving Sacramento County.

Station Name	Begin Year of Ozone Operation	Trend Rank
Sacramento-Del Paso Manor	1981	High
Sacramento-1309 T Street	1981	High
Elk Grove-Bruceville Rd.	1992	High
Folsom-Natoma St.	1996	Medium
Sloughhouse	1997	Medium

Ozone Monitor Removal Bias Analysis

Each monitor was analyzed to determine the change in spatial concentrations interpolated across Sacramento County if the monitor were removed. That is, the difference between a measured concentration from a particular site and what the concentration would be if it were removed and predicted by interpolation calculations. Table 17 and Figure 27 present the results of the removal bias analysis and the maximum change in ozone concentrations in Sacramento County if each ozone monitor in the District's network were individually removed as calculated by the NetAssess2025 v1.1 tool.

The change in concentration at a site indicates the bias which may be observed if the individual monitor were removed. Per the Network Assessment Guidance, "[t]he greater the bias, the more important the site is for interpolation." Based on the thresholds outlined in the Introduction to this document, the thresholds for this analysis are as follows, where MRB is the mean relative bias:

Monitor Rank	Criteria
High	|MRB| ≥ 0.0045 ppm
Medium	0.0045 ppm > |MRB| ≥ 0.0015 ppm
Low	|MRB| < 0.0015 ppm

Table 17 below summarizes the mean removal bias for each monitor, while Table 18 indicates the monitor ranking.

Table 17 – Ozone monitoring network removal bias results.

Station Name	Mean Removal Bias (ppm)
Sacramento-Del Paso Manor	-0.0029
Sacramento-1309 T Street	0.0028
Elk Grove-Bruceville Rd.	0.006
Folsom-Natoma St.	-0.0024
Sloughhouse	0.0004

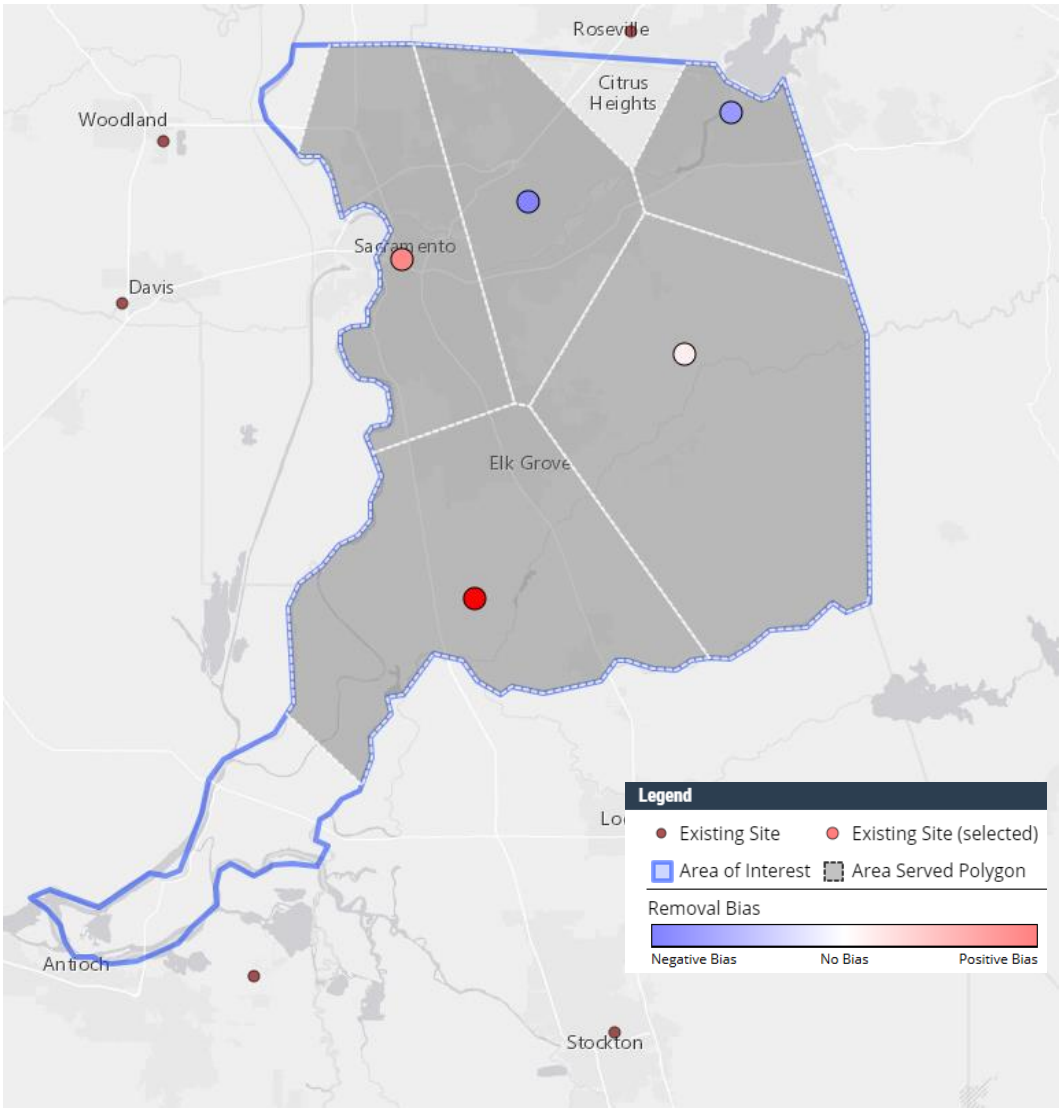


Figure 27 – Ozone removal bias analysis in Sacramento County (source: NetAssess2025 v1.1).

Table 18 – Ozone monitoring removal bias results.

Station Name	Removal Bias Rank
Sacramento-Del Paso Manor	Medium
Sacramento-1309 T Street	Medium
Elk Grove-Bruceville Rd.	High
Folsom-Natoma St.	Medium
Sloughhouse	Low

Ozone Monitoring Sites

The number of sites in the Sacramento MSA are listed in Table 19. At least one ozone site within the MSA must be designed to record the maximum concentration for that particular area. There are

currently five (5) ozone monitors within Sacramento County (BRU, DPM, FOL, SLU, TST) as shown in Figure 15.

Table 19 – Ozone Monitoring Sites within Sacramento MSA

Sites in Sacramento MSA	Additional Sites Needed	2024 Design Value and Site ID
15	0	(1) 0.075 ppm at Sacramento-Del Paso Manor (06-067-0006)

Conclusions

Table 20 is a summary of the District's ozone monitor rankings from the analyses performed in this section. An overall ranking was calculated for each site by assigning a value to each rank (1 – low, 2 – medium, 3 – high) and summing over all analyses. Overall, all sites are ranked very closely with each other for this assessment. The similarity of the overall scores demonstrates that all sites are imperative to the District network. Therefore, small differences in overall scores must not be misrepresented as large deviations in ranking.

Table 20 – Ozone monitor ranking summary. Overall score is shaded red, with highest overall score darkest.

Station Name	Population-Served	Area-Served	Measured Concentrations	Exceedance Probability[a]	Deviation from NAAQS	Monitor-to-Monitor	Trend	Removal Bias	Overall
BRU	Medium	High	Low	High	Low	High	High	High	**19**
FOL	Low	Low	Medium	High	High	High	Medium	Medium	**17**
TST	High	Medium	Medium	High	High	Medium	High	Medium	**20**
DPM	High	Medium	High	High	High	Medium	High	Medium	**20**
SLU	Low	High	High	High	High	High	Medium	Low	**19**

According to Table 20, Folsom currently has the lowest overall score, which may be attributed to missin g data for a portion of the assessment period. Historically, however, Folsom has exhibited higher ozone concentrations and has been the peak concentration site for multiple years in the SFNA within the past 10 years and is therefore unsuitable for removal. It is also inconclusive whether the recent trend toward the urban core will persist or shift back eastward, depending on future meteorological conditions. Based on the scoring system of Table 20 all sites score within three points of the highest rank indicating the significance of all ozone sites within Sacramento County.

As mentioned in this section, the design value for Sacramento is close to the NAAQS for the 8-hour standard. The highest concentrations occur during the warm summer months, when photochemical production of ozone is at its most efficient. Some of the sites are located close to the ozone precursor emission sources, some are located in rural areas representing background conditions, and some are located downwind of sources and therefore capture the highest concentrations. As can be seen from

Table 20, all these sites have served essential roles within the ozone network in Sacramento County. Whether that is for public notification within urban areas, to assist with modeling and research purposes by sampling background conditions, or to determine the maximum concentrations within the county, all sites provide important information and value to the overall network to meet regulatory requirements. Maintaining all monitoring sites is essential to fulfilling requirements under the Clean Air Act and supporting the ozone State Implementation Plans (SIP). SIPs rely heavily on accurate, continuous, and representative air quality data to demonstrate attainment or progress toward the reaching attainment of the NAAQS.

An important aspect of the District ozone network is that all sites have long historical records, which is vital to understanding the changes to not only ozone in Sacramento County, but the Sacramento Federal Nonattainment Area and throughout the interior of California. These records reflect multi-scale fluctuations to multiple earth systems and provide important long-term information to aid research studies and possibly emission reduction strategies. Also, as some of the sites are included in various EPA monitoring programs (e.g. NCore and PAMS), the network meets all EPA monitoring requirements and each monitor covers various ozone monitoring purposes consistent with monitoring objectives outlined in the Appendix D to 40 CFR Part 58, reinforcing the need to maintain all monitoring locations within the network. There are no sites in Sacramento County recommended for removal or addition of an ozone monitoring station.

Fine Particulate Matter ($PM_{2.5}$) Network Analysis

Monitoring Objectives

Sacramento County has a total of six (6) active SLAMS $PM_{2.5}$ monitoring stations as shown in Figure 28. Based on the characteristics of the sites, including the population served and the area served, each site can be designated as background, population oriented, source oriented, or high concentration monitoring locations as listed in Table 21. Table 21 also includes the EPA network affiliation for each site. The Elk Grove-Bruceville Rd. site operates a non-FEM $PM_{2.5}$ monitor, suitable for public information and forecasting, and is therefore not included in design value calculations for comparison to the NAAQS.

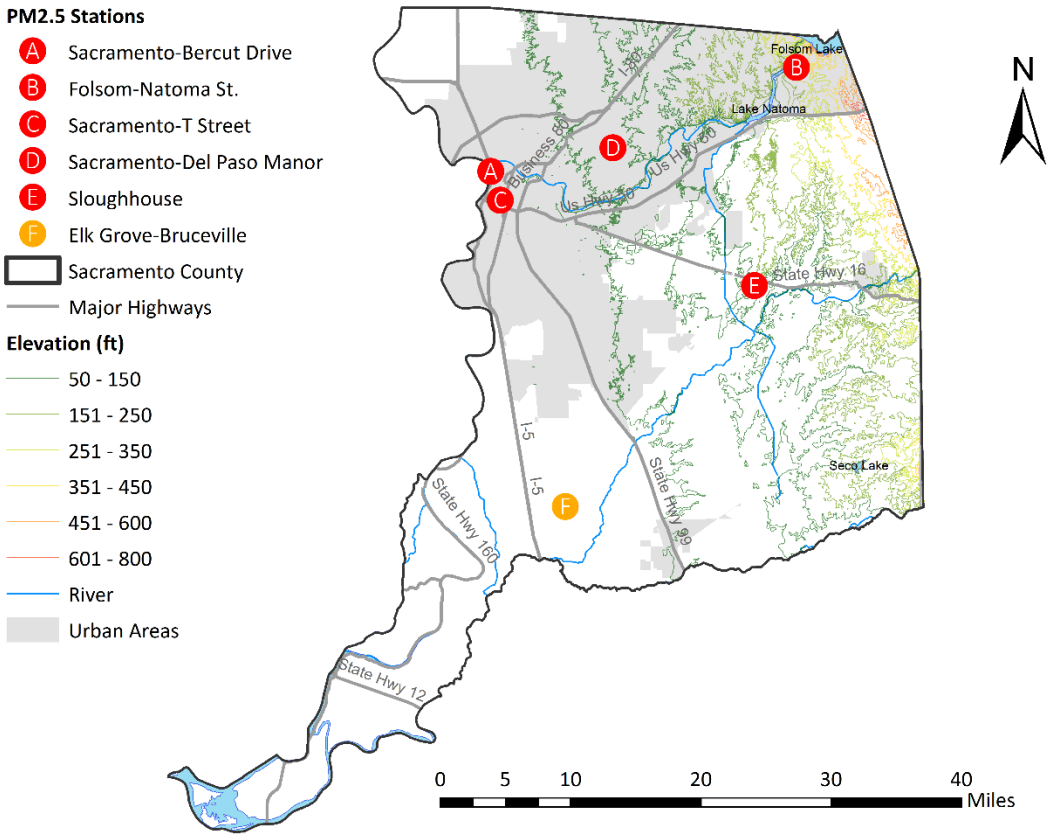


Figure 28 – $PM_{2.5}$ Network in Sacramento County. Red dots mark FEM/FRM monitors, and the orange dot mark non-FEM monitors. Colored lines show elevation above sea level in feet.

Table 21 – EPA network affiliation and monitoring objective for $PM_{2.5}$ monitors serving Sacramento County.

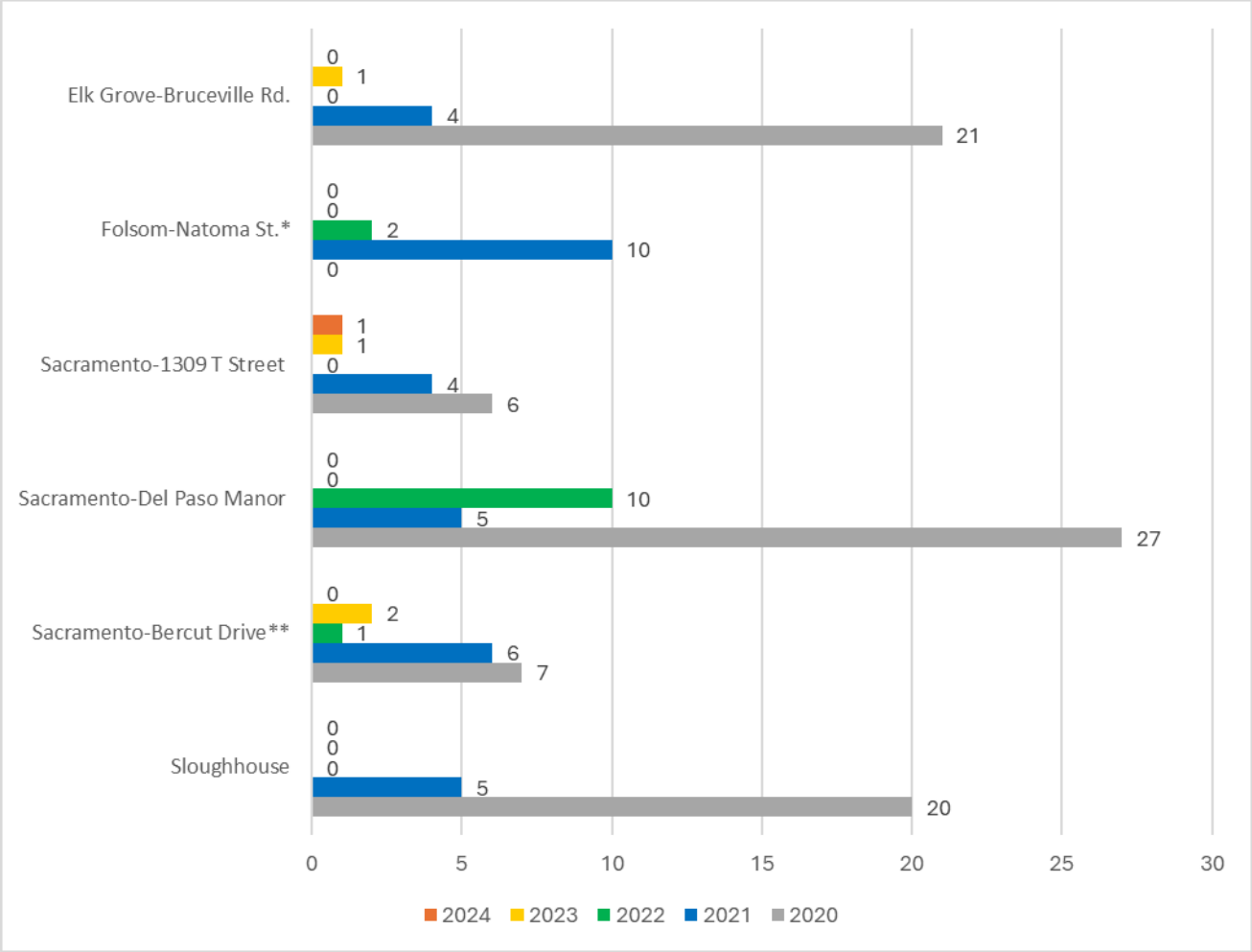
Site	EPA Network Affiliation*	Monitoring Type**
Sacramento-Del Paso Manor	NCORE, CSN	Population Oriented / High Concentration
Sacramento-1309 T Street	CSN	Population Oriented
Folsom-Natoma St.		Population Oriented
Sloughhouse		Background
Sacramento-Bercut Drive	Near Road	Source Oriented
Elk Grove-Bruceville Rd.		Background

Note: All monitors are SLAMS (State and Local Air Monitoring Stations) monitor type unless otherwise noted.
* NCORE (National Core Multi-pollutant Monitoring Stations), CSN (Chemical Speciation Network).
** Consistent with EPA monitoring types as listed in 40 CFR Part 58, Appendix D.

The District operates a single CSN site at the Sacramento-Del Paso Manor station. The District network meets all federal CSN requirements and District monitoring objectives.

In Sacramento County, ambient $PM_{2.5}$ concentrations are typically elevated during the winter months. Meteorological conditions in Sacramento County during these months are conducive to particulate matter buildup, with factors such as relatively higher humidity than in the summer months, lower mixing heights as the temperature is lowered and hours of sunlight are decreased, increased fog formation especially near water sources with minimal change in elevation, and frequent temperature inversions near the surface. The cooler winters also cause an increase in the amount of residential wood burning, which is a major source of $PM_{2.5}$ in the winter months. As seen in Figure 28, the urban areas within Sacramento County are generally at low elevation with very little terrain difference and close proximity to water sources. This provides ideal land surface conditions for particulate matter to settle just above the ground under inversion conditions. These factors combined can lead to elevated $PM_{2.5}$ concentrations near the surface.

For 2020-2024, the number of daily average 24-hour exceedance days exceeding the federal standard (greater than 35 $\mu g\ m^{-3}$) were calculated for each site and shown in Figure 29. The exceedances were counted as number of station days that exceeded the 24-hour $PM_{2.5}$ standard, so multiple exceedances from collocated monitors at a single station were not counted.



* Due to construction at Folsom-Natoma St. site, data offline Jan 2020 – December 2020

** Sacramento-Bercut Drive Site had an FRM monitor until December 2020. A FEM monitor was installed January 2021.

Figure 29 – Number of days exceeding the 24-hour NAAQS (35 µg m^{-3}) by year for each site in Sacramento County (source: EPA AQS)

Solely analyzing the number of exceedance days in Sacramento County can provide a misleading assessment of the importance of each site. The totals fluctuate from year to year due to exceptional events (conditions outside human control that impact air quality), most notably wildfires. As mentioned in the Natural Event Impacts on the Monitoring Network section, 2020 and 2021 were highly impacted years for wildfire smoke. As seen in Figure 30, there were periods of unhealthy and very unhealthy AQI values in 2020 and 2021. The late summer of 2020 was impacted by the August Complex fire west of Sacramento. The summer of 2021 was impacted by the Dixie fire north of Sacramento.

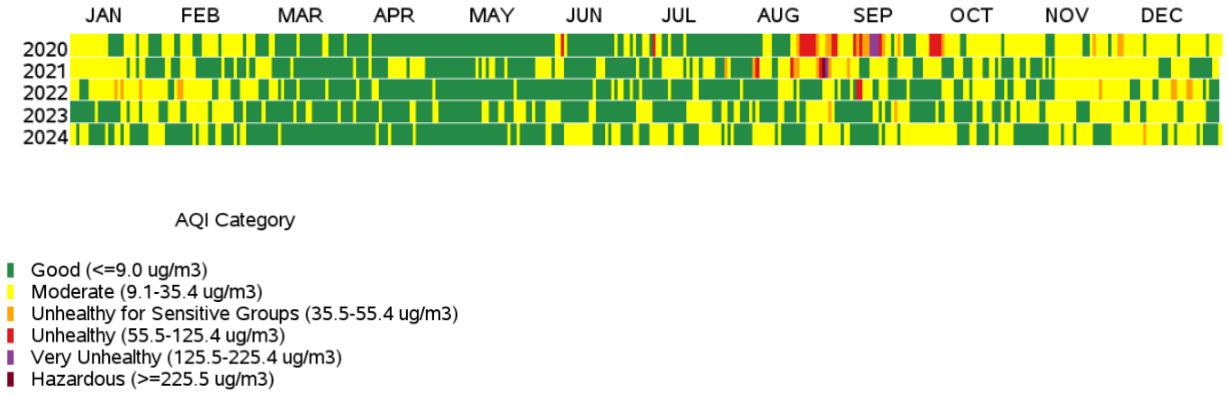


Figure 30 – $PM_{2.5}$ daily AQI data for Sacramento County (Source: EPA AirData).

In years without significant wildfire impacts, the Sacramento-Del Paso Manor site measures the most exceedances on average. This is mainly due to its residential location where in the winter months, residential wood burning in Sacramento County becomes a prominent source of ground-level $PM_{2.5}$ pollution, averaging more than 61% of the total winter average $PM_{2.5}$ over 2020-2024[50] as seen in Figure 31. Therefore, under normal wintertime conditions, the sites located within residential communities tend to measure the most exceedances.

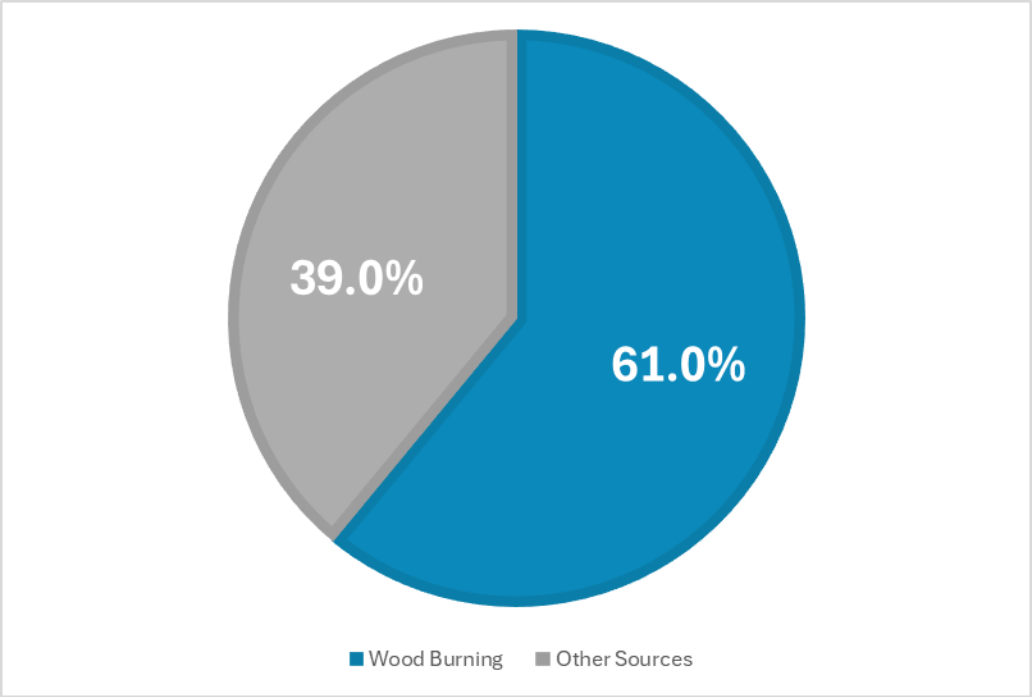


Figure 31 – Percentage of wood burning $PM_{2.5}$ to the total winter average $PM_{2.5}$ emissions for Sacramento County averaged over 2020-2024 (Source: ARB CEPAM).

[50] CEPAM2019v1.04 - Standard Emission Tool | California Air Resources Board

$PM_{2.5}$ Network Area- and Population-Served Analyses

Spatial analysis techniques were evaluated to determine whether the current $PM_{2.5}$ stations meet the objectives of the monitoring network. Thiessen polygons, as described previously, were generated by the NetAssess2025 v1.1 tool to determine the spatial representation of each of the six (6) $PM_{2.5}$ monitoring stations located in Sacramento County. The following sections present the findings for area- and population-served analyses for the $PM_{2.5}$ network. Note that as seen in Table 21, some of the $PM_{2.5}$ stations are affiliated with EPA networks and are, therefore, required regardless of these analyses.

The population within Sacramento County represented by each monitoring site was counted within the Thiessen polygons by NetAssess2025 v1.1 using 2020 US Census data. Area- and population-served analyses are presented in Table 22. Figure 32 presents a map showing the location and area of influence for each $PM_{2.5}$ monitor.

Following the methods outlined in the Network Assessment Guidance and the thresholds described in the Introduction of this document, site rankings are summarized in Table 22.

Table 22 – Area and population served by $PM_{2.5}$ monitors serving Sacramento County. Darker red indicates the highest values of population and area served.

Station Name	Population Estimate (persons)*	Area (km^2)*	Population-Served Ranking	Area-Served Ranking
Sacramento-Del Paso Manor	479,737	341	High	Medium
Sacramento-1309 T Street	398,372	170	High	Low
Folsom-Natoma St.	129,148	177	Low	Low
Sloughhouse	59,411	797	Low	High
Sacramento-Bercut Drive	176,123	194	Low	Low
Elk Grove-Bruceville Rd.	204,530	641	Medium	High

* Population and area estimates based on monitor's area of influence and an approximate boundary of Sacramento County as extracted from the NetAssess2025 v1.1 tool. Population estimated with some overlapping census tracts.

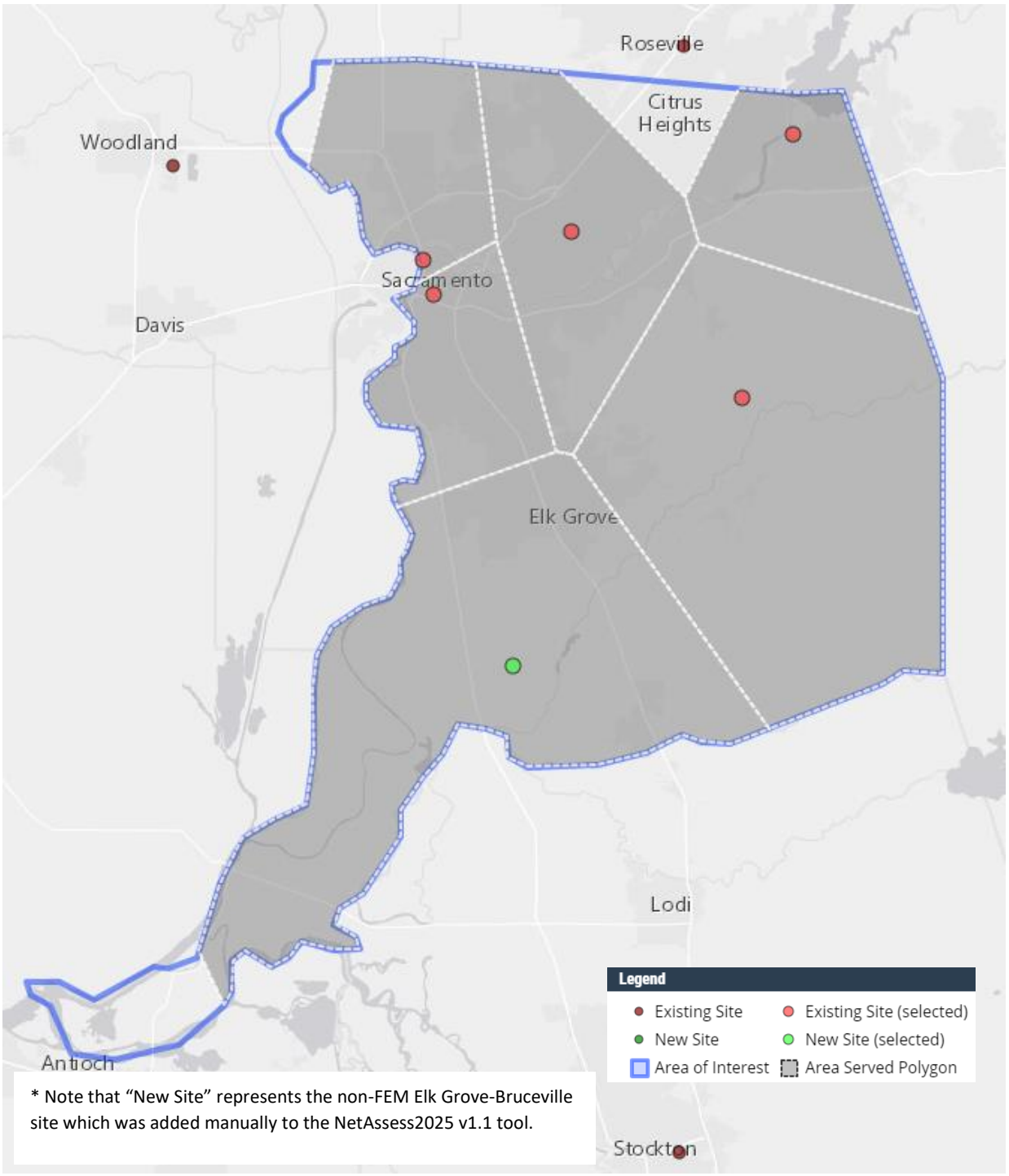


Figure 32 – $PM_{2.5}$ Network Area-Served. The green dot represents the non-FEM site of Elk Grove-Bruceville Rd.

$PM_{2.5}$ Data Analyses

The $PM_{2.5}$ data analysis was conducted based on the following methods:

- measured concentrations and exceedance probability,
- deviation from NAAQS,
- monitor-to-monitor correlation,
- trend impact, and
- removal bias.

Measured Concentration and Exceedance Probability Analysis

The 2006 24-hour $PM_{2.5}$ NAAQS[51] of 35 µg m^{-3} was utilized for the exceedance probability calculations. The 2024 annual $PM_{2.5}$ NAAQS[52] is 9.0 µg m^{-3}. Monitors within the District's ambient air monitoring network shown to have high levels of $PM_{2.5}$, design values close to the standard, and with a long historical record were considered to be of high value for characterizing pollution in an area. Table 23 presents 24-hour and annual $PM_{2.5}$ design value concentrations for 2015 through 2024 (2015-2019 data included for historical context), deviation from the NAAQS for the 2022 through 2024 24-hour and annual design values, and the 24-hour exceedance probability for 2019-2021 in percent calculated using the NetAssess2025 v1.1 tool. It is important to note that the NetAssess2025 v1.1 tool calculates exceedance based on data from the years 2019 to 2021, which includes the influence of wildfire events. As a result, the inclusion of these high-impact events may potentially introduce a positive bias in the estimated exceedance probabilities. The deviation from the NAAQS analysis will be discussed in the next section.

[51] The 24-hour design value is calculated as the 3-year average of annual 98th percentile 24-hour average values recorded at each monitoring site and the annual design value is calculated as the annual arithmetic mean averaged over 3 years at each monitoring site, EPA, https://www.epa.gov/air-trends/air-quality-design-values .
[52] The annual design value is calculated as the annual arithmetic mean concentrations, averaged over 3 years.

Table 23 – Concentration analysis for $PM_{2.5}$ monitors serving Sacramento County. **Bold and underlined** numbers exceed the NAAQS[51,52] (source: EPA AQS).

Station Name	2015	2016	2017	2018[c]	2019	2020[c]	2021[c]	2022	2023	2024	Deviation from NAAQS (µg m^{-3})[a]	Exceedance Probability[b]
	Three-Year Calculated 24-hr $PM_{2.5}$ Design Value (µg m^{-3})											
DPM	35	31	34	**37**	**37**	**50**	**44**	**47**	32	31	4	> 90%
FOL[d]	NA	20	21	29	NA	NA	NA	NA	26	18	17	> 90%
BER[e]	NA	NA	NA	NA	30	**40**	**41**	**43**	31	27	8	> 90%
SLU[f]	NA	NA	NA	NA	NA	**45**	**47**	24	17	17	18	> 90%
TST	30	27	30	34	34	**43**	**40**	**41**	28	25	10	> 90%
BRU[g]	28	25	27	27	27	35	31	27	22	21	14	N/A
	Three-Year Calculated Annual $PM_{2.5}$ Design Value (µg m^{-3})											
DPM	**10.2**	**9.3**	**9.6**	**10.4**	**10.2**	**11.9**	**11.1**	**11.7**	**9.6**	8.6	0.4	
FOL[d]	NA	7.3	7.4	8	NA	NA	NA	NA	7.8	6.3	2.7	
BER[e]	NA	NA	NA	NA	**9.9**	**11.6**	**11.2**	**11.6**	**9.9**	8.9	0.1	
SLU[f]	NA	NA	NA	NA	NA	**9.6**	8.5	8.8	6.9	5.5	3.5	
TST	**9.5**	8.7	8.9	**9.4**	**9.4**	**10.7**	**10.1**	**10.4**	8.3	7.5	1.5	
BRU[g]	**10.4**	**10.7**	**10.2**	9	7.9	**10.9**	**10.8**	**10**	8.9	7.7	1.3	

DPM – Sacramento-Del Paso Manor
FOL – Folsom-Natoma St.
BER – Sacramento-Bercut Dr.
SLU – Sloughhouse
TST – Sacramento-1309 T Street
BRU – Elk Grove-Bruceville Rd.

[a] Based on 2024 design values.
[b] Calculated by the NetAssess2025 v1.1 tool as described in the Sources of Data section, independent of design value calculations.
[c] Wildfire smoke in 2020 and 2021 impacted multiple air monitoring stations; the District is working with other monitoring organizations in the Sacramento Federal Non-attainment Area, CARB, and EPA in addressing possible impacts under the Exceptional Event Rule (81 FR 68216).
[d] Folsom-Natoma St. site was offline due to construction from late July 2019- December 2020, therefore it did not meet data completeness requirements for a valid design value from 2019-2022.
[e] Sacramento-Bercut Drive came online October 2015, due to instrument malfunctions and data completeness requirements, with the first valid 3-year design value in 2019.
[f] Sloughhouse monitor came online May 2017, with the first valid 3-year design value in 2020 for the assessment period.
[g] Elk Grove-Bruceville Rd. monitor is non-FEM, therefore design values are not valid, only an estimate for comparison purposes.

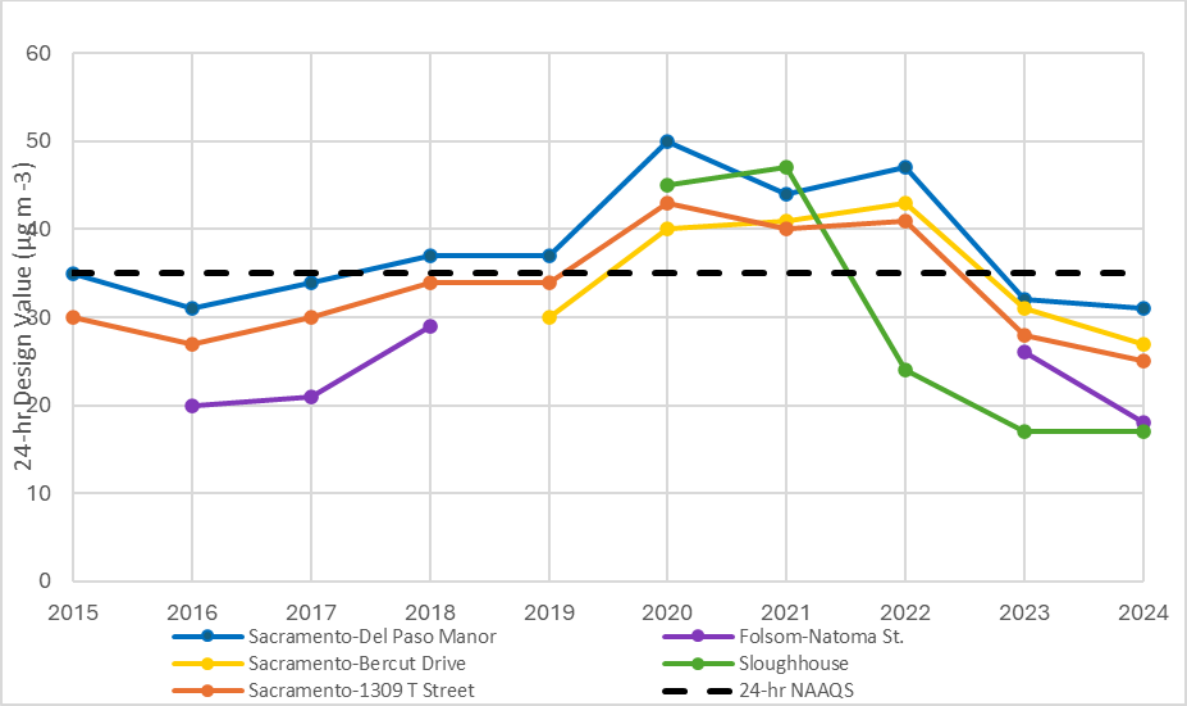


Figure 33 – 24-hr $PM_{2.5}$ design value trend (Source: EPA AQS).

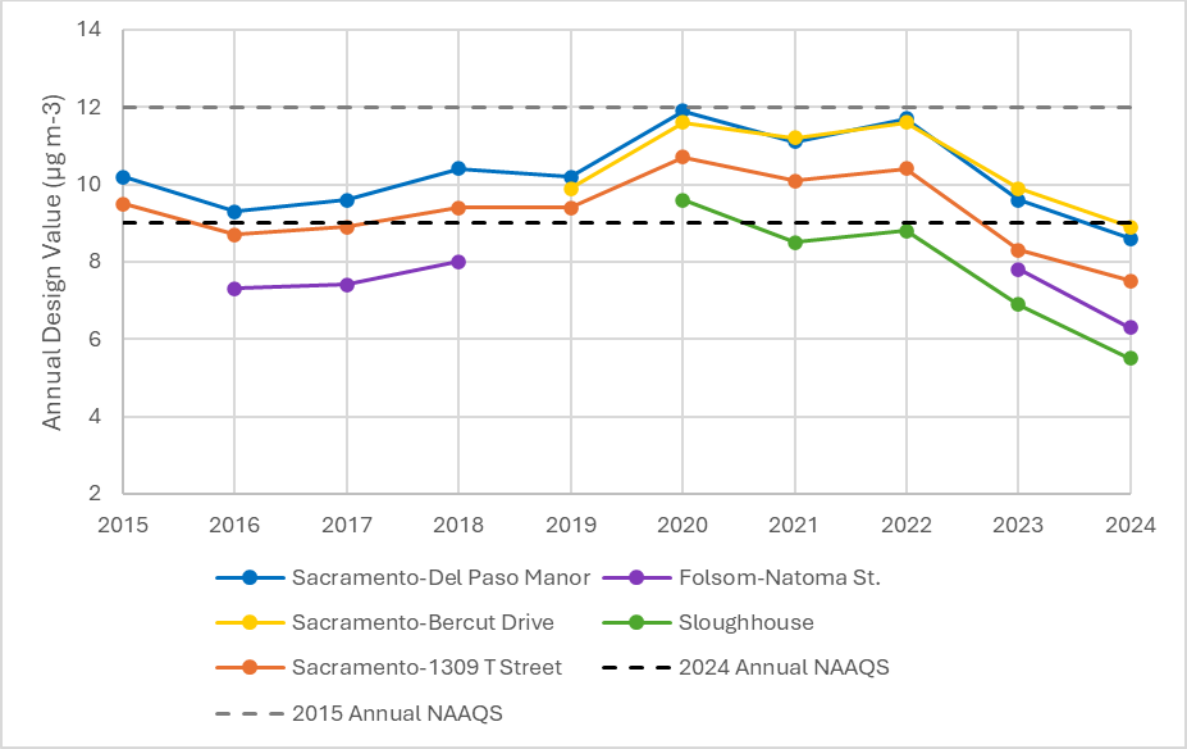


Figure 34 – Annual $PM_{2.5}$ design value trend (Source: EPA AQS).

Figure 33 and Figure 34 present the 2015 through 2024 3-year 24-hour and annual design values for $PM_{2.5}$ monitors serving Sacramento County. The NAAQS for the primary annual $PM_{2.5}$ concentration were revised from 12.0 µg/m³ to 9.0 µg/m³, with the final ruling issued on May 6, 2024[53]. It is important to note that the EPA is currently reconsidering the ruling of the Annual $PM_{2.5}$ NAAQS. For the purposes of this analysis, all annual design values are evaluated against the 2024 revised standard. Note that exceptional event determinations in previous years were based on the applicable NAAQS in effect at the time. Although some historical design values may appear to exceed the current standard, they were not evaluated against the 2024 revision at the time of their determination.

Of the monitoring stations located within Sacramento County, Sacramento-Del Paso Manor has historically been the peak site. However, within the past five years, it has alternated with Sacramento-Bercut Drive as the highest concentration site. As seen in Figure 31, residential wood burning is a significant source of ground-level $PM_{2.5}$ in Sacramento County. In October 2007, the District adopted the Check Before You Burn rule (Rule 421 Mandatory Episodic Curtailment Of Wood And Other Solid Fuel Burning[54]), which restricts or prohibits the use of all fireplaces, woodstoves, inserts and pellet stoves when $PM_{2.5}$ is forecast to be high. This rule has helped to decrease wintertime $PM_{2.5}$ concentrations throughout the county and bring the 24-hour $PM_{2.5}$ design values closer to attainment of the NAAQS.

However, as previously mentioned, wildfire smoke has become an increasingly frequent source of summer and fall $PM_{2.5}$. During these large-scale events, it is typical that all monitors within the county ar e impacted by regional wildfire smoke. National Aeronautics and Space Administration (NASA) satellite i mages show the scale of the smoke from October 2020 (Figure 35). The impact of the smoke can vary thr oughout the county depending on wind direction and speed, terrain, ground cover, and boundary layer height or vertical mixing. Therefore, it is difficult to rank any site within Sacramento County as low importance.

[53] https://www.epa.gov/system/files/documents/2024-04/2024-pm-naaqs-fr-published.pdf
[54] https://www.airquality.org/ProgramCoordination/Documents/rule421.pdf

Figure 35 – Satellite imagery from October 2, 2020, showing wildfire smoke throughout California (Source: NASA; https://worldview.earthdata.nasa.gov/). Image from the Terra/MODIS satellites in corrected reflectance (true color), satellite derived fires and thermal anomalies are shown as red dots.

Wildfire smoke in 2020 and 2021 impacted multiple air monitoring stations throughout California. The District works with other monitoring organizations in the Sacramento Federal Non-attainment Area, CARB, and EPA in addressing possible impacts under the Exceptional Event Rule (EE, 81 FR 68216). However, no dates were concluded to have regulatory significance to the 24-hour design value or annual design values from 2020-2024.

As mentioned previously, the exceedance probability was calculated by applying a bootstrap analysis to the concentration outputs of 2019-2021 source data from the EPA Downscaler Model. Figure 36 shows the $PM_{2.5}$ monitoring stations overlaid on the calculated $PM_{2.5}$ exceedance probability. According to this estimation all stations show exceedance probabilities greater than 90%. As aforementioned, the tool includes the influence of wildfire events. The exceedance probability presented in Table 23 is calculated for the Thiessen polygon which represents each site. It is unclear whether this analysis takes local seasonal sources of $PM_{2.5}$ such as residential wood burning or wildfire smoke into account or how the

interpolation of the probability is distributed throughout the county. Based on local knowledge, violations, and historical conditions, the Sacramento-Del Paso Manor and Sacramento-Bercut Drive sites tend to have the greatest chance at exceeding the 24-hour $PM_{2.5}$ NAAQS.

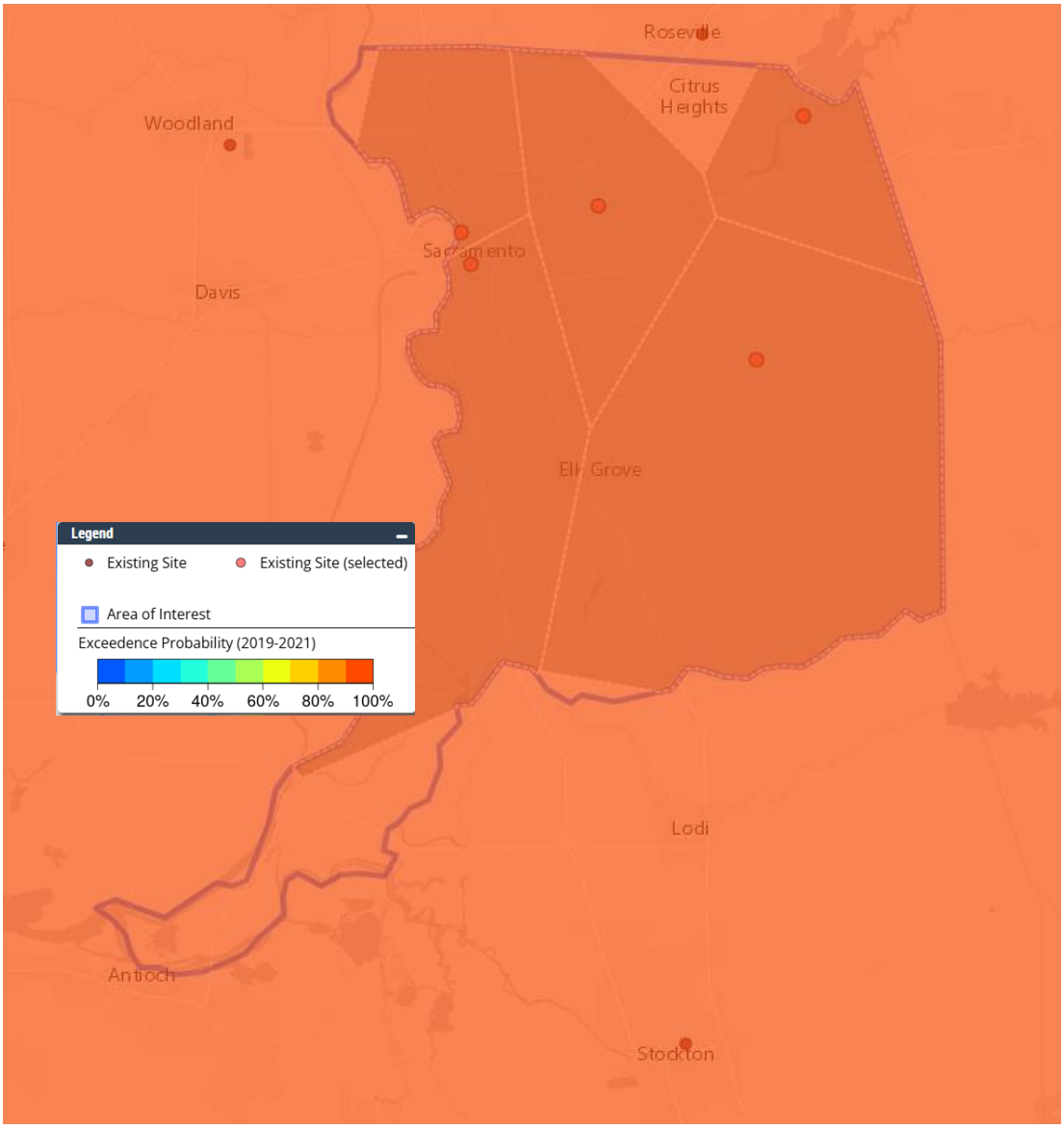


Figure 36 – $PM_{2.5}$ monitoring stations overlaid on the calculated $PM_{2.5}$ exceedance probability (source: NetAssess2025 v1.1).

Table 24 compiles the ranking for the measured concentrations and exceedance probability analyses. As described in the introduction to this document, sites were ranked based on the average concentrations used to determine the design value (DV_{ave}) for the assessment period (2020-2024). The thresholds for this analysis used the 24-hour NAAQS and are as follows:

Monitor Rank	Criteria
High	$DV_{ave} > 35\ \mu g\ m^{-3}$
Medium	$35\ \mu g\ m^{-3} \geq DV_{ave} \geq 31.5\ \mu g\ m^{-3}$
Low	$DV_{ave} < 31.5\ \mu g\ m^{-3}$

Based on the measured concentrations analysis for $PM_{2.5}$ following these, Sacramento-Del Paso Manor, Sacramento-Bercut Drive, and Sacramento-1309 T Street are ranked the highest with all other sites ranking low. For the exceedance probability analysis, based on the NetAssess2025 v1.1 estimation alone, all stations exceed a probability of greater than 90% and are ranked as high. It can be inferred from Figure 36 that the non-FEM Elk Grove-Bruceville Rd. site would also exceed 90% probability.

Table 24 - Measured concentrations and exceedance probability ranking.

Station Name	Measured Concentrations	Exceedance Probability*
Sacramento-Del Paso Manor	High	High
Folsom-Natoma St.***	Low	High
Sacramento-Bercut Drive	High	High
Sloughhouse	Low	High
Sacramento-1309 T Street	High	High
Elk Grove-Bruceville Rd.**	Low	High

* Based on estimations from the NetAssess2025 v1.1 tool as described in the Sources of Data section.
** Elk Grove-Bruceville Rd. monitor is non-FEM and not included in the NetAssess2020 v1.1 tool. Rankings are only an estimate for comparison purposes.
*** Design Value average was calculated based off 2023 and 2024 design values. There are no prior valid design values for this assessment period.

Deviation from NAAQS

The thresholds for this analysis, as outlined in the Introduction to this document, use the 24-hour and annual NAAQS and are as follows:

Monitor Rank	Criteria (24-hour)	Criteria (annual)
High	$\lvert Deviation \rvert < 3.5\ \mu g\ m^{-3}$	$\lvert Deviation \rvert < 0.9\ \mu g\ m^{-3}$
Medium	$3.5\ \mu g\ m^{-3} \geq \lvert Deviation \rvert \geq 7\ \mu g\ m^{-3}$	$0.9\ \mu g\ m^{-3} \geq \lvert Deviation \rvert \geq 1.8\ \mu g\ m^{-3}$
Low	$\lvert Deviation \rvert > 7\ \mu g\ m^{-3}$	$\lvert Deviation \rvert > 1.8\ \mu g\ m^{-3}$

Table 25 summarizes the deviation from NAAQS for each site for the 24-hour standard as well as the rankings for each site.

Table 25 – 2024 24-hr and annual $PM_{2.5}$ design value and deviation from NAAQS analysis.

Station Name	2024 24-hr $PM_{2.5}$ Design Value ($\mu g\ m^{-3}$)[a]	Deviation from NAAQS ($\mu g\ m^{-3}$)[b]	Ranking
Sacramento-Del Paso Manor	31	4	Medium
Folsom-Natoma St.	18	17	Low
Sacramento-Bercut Drive	27	8	Low
Sloughhouse	17	18	Low
Sacramento-1309 T Street	25	10	Low
Elk Grove-Bruceville Rd.*	21	14	Low
	2024 Annual $PM_{2.5}$ Design Value ($\mu g\ m^{-3}$)[a]	**Deviation from NAAQS ($\mu g\ m^{-3}$)[b]**	**Ranking**
Sacramento-Del Paso Manor	8.6	0.4	High
Folsom-Natoma St.	6.3	2.7	Low
Sacramento-Bercut Drive	8.9	0.1	High
Sloughhouse	5.5	3.5	Low
Sacramento-1309 T Street	7.5	1.5	Medium
Elk Grove-Bruceville Rd.*	7.7	1.3	Medium

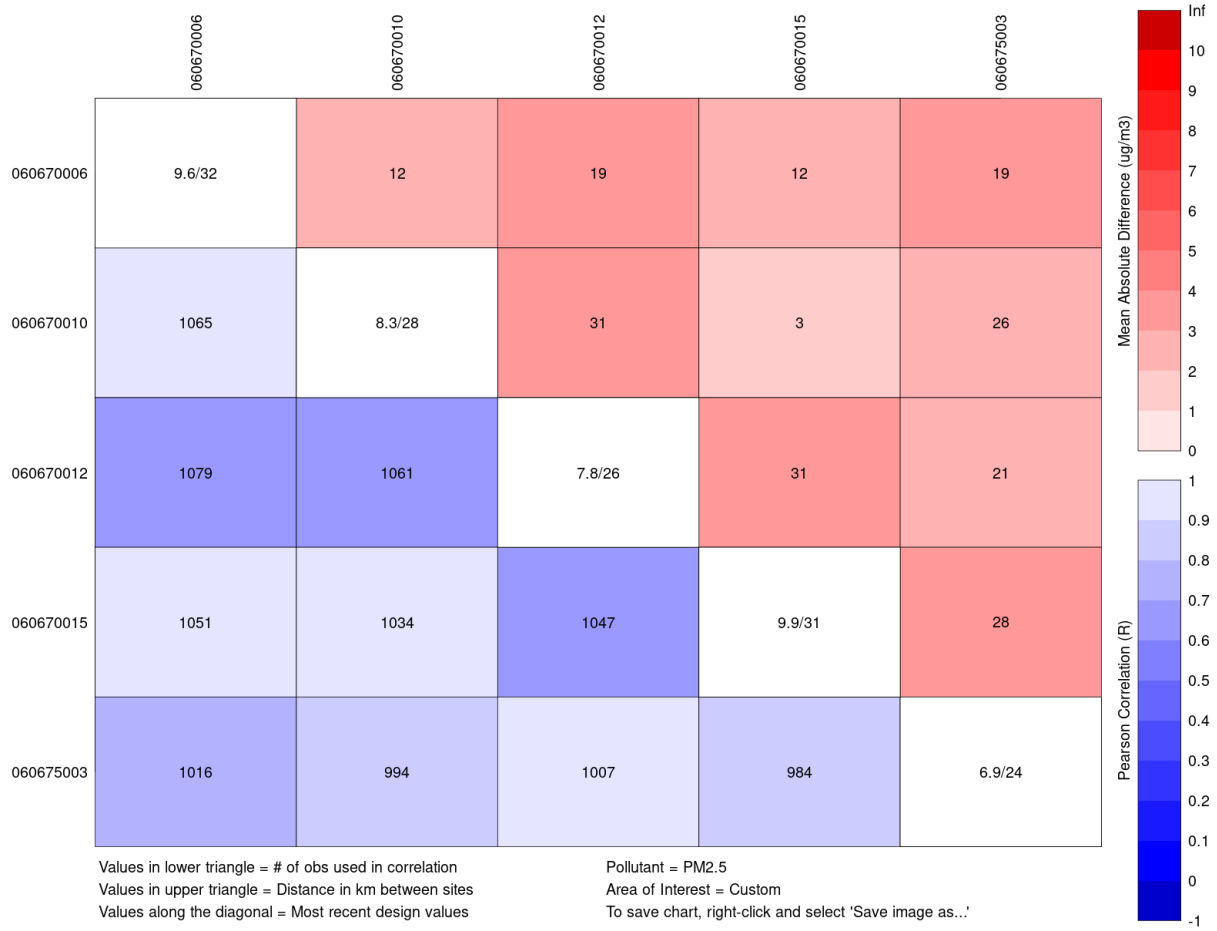
[a] Wildfire smoke in 2020 and 2021 impacted multiple air monitoring stations; the District is working with other monitoring organizations in the Sacramento Federal Non-attainment Area, CARB, and EPA in addressing possible impacts under the Exceptional Event Rule (81 FR 68216).
[b] Based on 2024 design values.
* Elk Grove-Bruceville Rd. monitor is non-FEM, therefore design values are not valid, only an estimate for comparison purposes.

$PM_{2.5}$ Monitor-to-Monitor Correlation Analysis

$PM_{2.5}$ concentrations were compared to examine their relationships using a correlation matrix analysis. Figure 37 shows a correlation matrix for all $PM_{2.5}$ monitors in Sacramento County provided by the NetAssess2025 v1.1 tool. The raw values from the correlation matrix are shown in Table 26. Included in the matrix are Pearson correlations, mean absolute differences, number of observations used in the correlation, distance in kilometers between the sites, and the 2023 design values. The correlation matrix helps to determine similarities between sites within the network. Sites with high correlation, low absolute difference, and close proximities are closely related in this analysis.

Monitor-to-monitor correlation analysis found that based on the square of the Pearson coefficients (R^2), all five of the FEM monitors within Sacramento County were highly correlated with at least one other monitor based on the Network Assessment Guidance ($R^2 > 0.75$). Elk-Grove Bruceville site is not presented in the NetAssess2025 v1.1 tool as it operates a non-FEM monitor and thus is not included in this analysis. The high correlation between the sites could be in part due to seasonal and regional-scale factors such as the relatively homogenous terrain throughout the county, widespread wildfire impacts, and consistent meteorological conditions (e.g. wintertime temperature inversions). These high correlations indicate that concentrations tend to fluctuate in unison at each of these sites, however when investigating the mean difference in concentrations, the subtleties of each site become prevalent. For example, Sacramento-Del Paso Manor as mentioned before, is an urban residential site with historically high $PM_{2.5}$ concentrations possibly due to wintertime residential wood burning sources. This site has the largest mean difference (near 3.6 $\mu g\ m^{-3}$) with Sloughhouse, which is a rural site with a much lower population density. Therefore, even though the $PM_{2.5}$ concentrations are highly correlated, the

magnitude of the measured concentrations can vary. This highlights not only the general trends, but localized variability of $PM_{2.5}$ pollution throughout the county. The last factor to include in this analysis is the proximity of the stations to each other. The Sacramento-1309 T Street and Sacramento-Bercut Drive sites are the closest in proximity at only 3 km. Every other site in the network is at least 10 km apart.



60670006 – Sacramento-Del Paso Manor
60670010 – Sacramento-1309 T Street
60670012 – Folsom-Natoma St.
60670015 – Sacramento-Bercut Drive
60675003 – Sloughhouse

Figure 37 – Correlation matrix for $PM_{2.5}$ monitors serving Sacramento County (source: NetAssess2025 v1.1). The lower triangle refers to the blue shaded boxes and the upper triangle refers to the red shaded boxes. Most recent design values are for the 2023 design value year (annual/24-hour).

Based on thresholds outlined in the Introduction of this document, the criteria for this analysis are as follows:

Monitor Rank	Criteria
High (meets 1 or less of the criteria)	Highest pairwise $R^2 > 0.75$
Medium (meets 2 of the criteria)	Distance between sites < 8 km
Low (meets 3 of the criteria)	Mean Difference < 1.24 µg m^{-3}

Table 26 – Monitor to monitor correlation data. **Red and bold** represent high correlation ($R^2 > 0.75$, distance between sites < 25% of maximum distance between any two sites, mean difference < 25% of maximum mean difference between any two sites).

Site #1	Site #2	Distance Between Sites (km)	Number of Observations	Pearson Correlation	R^2	Mean Difference (µg m^{-3})
DPM	TST	12	1065	0.9177	**0.842**	2.4605
DPM	FOL	19	1079	0.6581	0.433	3.6438
DPM	BER	12	1051	0.923	**0.852**	2.0959
DPM	SLU	19	1016	0.7852	0.617	3.6514
TST	FOL	31	1061	0.6854	0.470	3.0441
TST	BER	**3**	1034	0.9565	**0.915**	1.9855
TST	SLU	26	994	0.8129	0.661	2.5579
FOL	BER	31	1047	0.6833	0.467	3.2347
FOL	SLU	21	1007	0.9264	**0.858**	2.0849
BER	SLU	28	984	0.8075	0.652	3.3784

DPM – Sacramento-Del Paso Manor FOL – Folsom-Natoma St SLU – Sloughhouse
TST – Sacramento-1309 T Street BER – Sacramento-Bercut Drive

Based on this monitor-to-monitor correlation analysis, rankings for each site are summarized in Table 27. The Elk-Grove Bruceville site is not included in the NetAssess2025 v1.1 tool and thus not included in this analysis as it operates a non-FEM monitor.

Table 27 – Monitor-to-monitor correlation ranking.

Station Name	Monitor-to-Monitor Rank
Sacramento-Del Paso Manor	High
Folsom-Natoma St.	High
Sacramento-Bercut Drive	Medium
Sloughhouse	High
Sacramento-1309 T Street	Medium

Trend Analysis

Monitors that have a long historical record are valuable for tracking trends. In this analysis, sites are ranked based on the duration of the continuous measurement record as described in the Introduction to this document. The thresholds for this analysis are as follows:

Monitor Rank	Criteria
High	Trend ≥ 23 years
Medium	23 years > Trend ≥ 8 years
Low	Trend < 8 years

Table 28 shows the year that $PM_{2.5}$ measurements began at each of the stations serving Sacramento County as well as the rankings based on this analysis.

Table 28 – Date of operation for each $PM_{2.5}$ station serving Sacramento County.

Station Name	Begin Year of $PM_{2.5}$ Operation	Trend Rank
Sacramento-Del Paso Manor	1990	High
Folsom-Natoma St.	2013	Medium
Sacramento-Bercut Drive	2016	Medium
Sloughhouse	2017	Low
Sacramento-1309 T Street	1998	High
Elk Grove-Bruceville Rd.*	2003	Medium

* This $PM_{2.5}$ monitor is not comparable to NAAQS because it does not meet reference method or equivalent method designation requirements.

$PM_{2.5}$ Monitor Removal Bias Analysis

Each monitor was analyzed to determine the change in spatial concentrations interpolated across Sacramento County if the monitor was removed. Table 29 and Figure 38 present the results of the removal bias analysis and the maximum change in $PM_{2.5}$ concentrations in Sacramento County if each $PM_{2.5}$ monitor in the District's network was individually removed as calculated by the NetAssess2025 v1.1 tool. Again, Elk-Grove Bruceville site was not included in this analysis as it operates a non-FEM monitor and was not included in the NetAssess2025v1.1 tool.

The change in concentration at a site indicates the bias which may be observed if the individual monitor were removed. Per the Network Assessment Guidance, "[t]he greater the bias, the more important the site is for interpolation." Based on the thresholds outlined in the Introduction to this document, the thresholds for this analysis are as follows, where MRB is the mean relative bias:

Monitor Rank	Criteria
High	$\lvert MRB \rvert \geq 1.64\ \mu g\ m^{-3}$
Medium	$1.64\ \mu g\ m^{-3} > \lvert MRB \rvert \geq 0.55\ \mu g\ m^{-3}$
Low	$\lvert MRB \rvert < 0.55\ \mu g\ m^{-3}$

Table 29 below indicates the mean removal bias for each of the monitor. Table 30 summarizes the ranking of each of the monitors based on the mean removal bias.

Table 29 – $PM_{2.5}$ monitoring network removal bias results.

Station Name	Mean Removal Bias ($\mu g\ m^{-3}$)
Sacramento-Del Paso Manor	-1.44
Folsom-Natoma St.	0.32
Sacramento-Bercut Drive	-1.27
Sloughhouse	2.19
Sacramento-1309 T Street	1.3

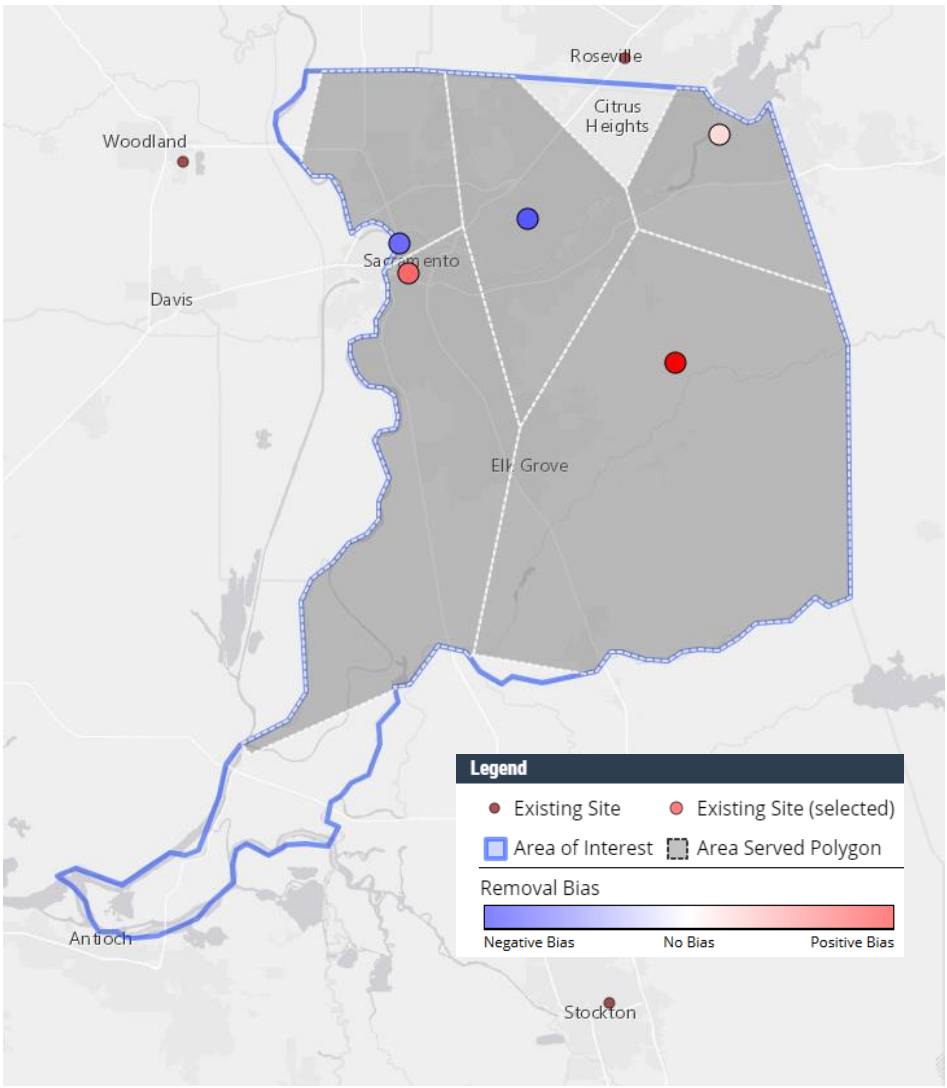


Figure 38 – $PM_{2.5}$ Removal bias analysis in Sacramento County.

Table 30 – Removal bias rank.

Station Name	Removal Bias Rank
Sacramento-Del Paso Manor	Medium
Folsom-Natoma St.	Low
Sacramento-Bercut Drive	Medium
Sloughhouse	High
Sacramento-1309 T Street	Medium

$PM_{2.5}$ Monitoring Sites

The number of sites in the Sacramento MSA are listed in Table 31. Note that there are six (6) sites in Sacramento County as shown in Figure 28, and eight (8) sites within Sacramento MSA (BER, BRU, DPM, FOL, SLU, TST) (Table 31). Two of the stations have active $PM_{2.5}$ FRM monitors (DPM & TST), three stations have FEM-designated continuous $PM_{2.5}$ monitors (BER, FOL, SLU), and three stations have non-FEM-designated continuous $PM_{2.5}$ monitors (BRU, DPM, TST). Non-FEM-designated data plays a valuable role in enhancing the coverage and resolution of the monitoring network. For example, the Elk Grove– Bruceville Rd. station extends the spatial representation and increases the population coverage within the network. Although not designated as FEM, these monitors operate in close alignment with FEM instruments, thereby minimizing measurement bias. Their deployment supports network objectives and aligns with the intent of 40 CFR Part 58, Appendix D.

Table 31 – $PM_{2.5}$ Monitoring Sites within Sacramento MSA.

Monitor Type	Sites in Sacramento MSA	Additional Sites Needed	2024 Design Value and Site ID*
FEM/FRM	8	0	**24-hr standard:** 31 µg m^{-3} at Sacramento-Del Paso Manor (06-067-0006) **Annual standard:** 8.9 µg m^{-3} at Sacramento-Bercut Drive (06-067-0015)
Continuous	13	0	

* The Sacramento Valley was impacted by wildfires in 2022 that may have impacted the 2024 design value.

Conclusions

Table 32 is a summary of the District's $PM_{2.5}$ monitor rankings from the analyses performed in this section. An overall ranking was calculated for each site by assigning a value to each rank (1 – low, 2 – medium, 3 – high) and summing over all analyses.

Table 32 – $PM_{2.5}$ monitor ranking summary. Overall score is shaded red, with highest overall score darkest.

Station Name	Population-Served	Area-Served	Measured Concentrations	Exceedance Probability[a]	Deviation from NAAQS 24-hour	Deviation from NAAQS Annual	Monitor-to-Monitor	Trend	Removal Bias	Overall
DPM	High	Medium	High	High	Medium	High	High	High	Medium	24
FOL	Low	Low	Low	High	Low	Low	Medium	Medium	Low	13
BER	Low	Low	High	High	Low	High	Medium	Medium	Medium	18
SLU	Low	High	Low	High	Low	Low	High	Low	High	17
TST	High	Low	High	High	Low	Medium	Medium	High	Medium	20
BRU*	Medium	High	Low	High	Low	Medium	N/A	Medium	N/A	14

[a] Based on estimations from the NetAssess2025 v1.1 tool as described in the Sources of Data section.
* Note that Elk Grove-Bruceville Rd. is operating a non-FEM monitor, and this site is not included in some of the analyses, therefore impacting its possible total.

As mentioned in this section, the design value for Sacramento is close to the NAAQS for the 24-hour standard. Additionally, following the revision of the annual NAAQS, higher concentration monitoring sites, such as Sacramento–Del Paso Manor and Sacramento–Bercut Drive, are now trending close to the updated standard. Wintertime and summertime concentrations can both be elevated due to different particulate matter sources (e.g. residential wood burning and wildfire smoke). The District is required by the Clean Air Act to monitor for air quality to protect public health. The District's commitment to meet these requirements is demonstrated through the District's various programs including the Wildfire Smoke Air Pollution Emergency Plan, residential woodsmoke curtailment program, and dedication to providing materials and education to aid communities in making healthy decisions. The District continues to evaluate data provided from these programs to help meet the needs of the residents of Sacramento County as well as District priorities.

Accurate, continuous, and representative air quality data are essential to demonstrating attainment or progress toward the NAAQS. This data underpins several critical planning and regulatory efforts for the Sacramento region, including all future implementation, maintenance, and redesignation request plans for the Sacramento $PM_{2.5}$ Nonattainment Area. In addition, it is fundamental to the 2023 Wildfire Mitigation Plan for the Sacramento Federal Nonattainment Area for $PM_{2.5}$, which addresses the growing impact of wildfire smoke on regional air quality[55]. The Federal Clean Air Act (CAA), Section 319(a), establishes comprehensive requirements for air quality monitoring across the United States. It sets uniform criteria and methodologies, mandates adequate network coverage in major urban areas, and requires that state and local monitoring efforts supplement national systems. The statute also calls for daily analysis, thorough data recordkeeping, and the timely reporting of air quality data to the public.

To fulfill these federal mandates and ensure the effectiveness of current and future air quality plans, it is vital that all existing air monitoring sites remain fully operational, regardless of rank as each monitor provides critical data that supports trend analysis, public health protection, and informed policy

[55] Wildfire Mitigation Plan for the Sacramento Federal Nonattainment Area for $PM_{2.5}$, 01 December 2023. Print.

decisions within the Sacramento region and beyond. Some of the current air monitoring sites are included in various EPA monitoring programs (e.g. Near Road and NCore) and are not suitable for removal. Currently, the District network meets all EPA monitoring requirements and each monitor covers various particulate matter monitoring purposes consistent with District monitoring goals and objectives.

In conclusion, the current $PM_{2.5}$ network for Sacramento County meets all federal requirements and District monitoring objectives. There are no sites in Sacramento County suitable for removal nor any site is recommended for an addition of a $PM_{2.5}$ monitoring station.

Coarse Particulate Matter (PM_{10}) Network Analysis

Monitoring Objectives

Sacramento County has a total of four (4) active SLAMS PM_{10} monitoring stations as shown in Figure 39. The North Highlands-Blackfoot station as discussed in the Recent Notable Modifications to the Network section was discontinued July 2022. For the purposes of this analysis, the North Highlands–Blackfoot station will be evaluated to determine whether it is recommended for reentry into the network as a PM_{10} monitoring site in the Conclusions section of this PM_{10} network analysis. It is important to note that the analysis will be limited, as it will rely on data collected from January 2020 through July 2022 for comparison with the current assessment period.

Based on the characteristics of the sites, including the population served and the area served, each site can be designated as background, population oriented, or high concentration monitoring locations as depicted in Table 33. The Sacramento-1309 T Street site operates an hourly PM_{10} monitor, all other sites operate 24-hour monitors. Three PM_{10} monitors are operated at the Sacramento-Del Paso Manor monitoring site; the primary monitor for NAAQS comparison and its collocated (audit) monitor (AQS[56] parameter code 88102), and a PM_{10} monitor used in the calculation of particulate matter with diameter between 10 and 2.5 micrometers ($PM_{10\text{-}2.5}$; AQS parameter code 85101). The primary and $PM_{10\text{-}2.5}$ monitors are requirements of the NCore monitoring network as outlined in 40 CFR Appendix D to Part 58. Appendix A to 40 CFR 58 details requirements for the collocated monitor within the CARB primary quality assurance organization (PQAO). This assessment will use data from the primary monitor.

The 2020 5-Year Network Assessment[23] provided detailed justification for the addition of a PM_{10} monitor at the Elk Grove–Bruceville Rd. station. Based on the findings and recommendations outlined in that assessment, a unit was installed in March 2025. However, due to the limited data currently available and the installation occurring following the assessment period, further analysis and findings will be presented in future documentation.

[56] EPA Air Quality System; https://www.epa.gov/aqs

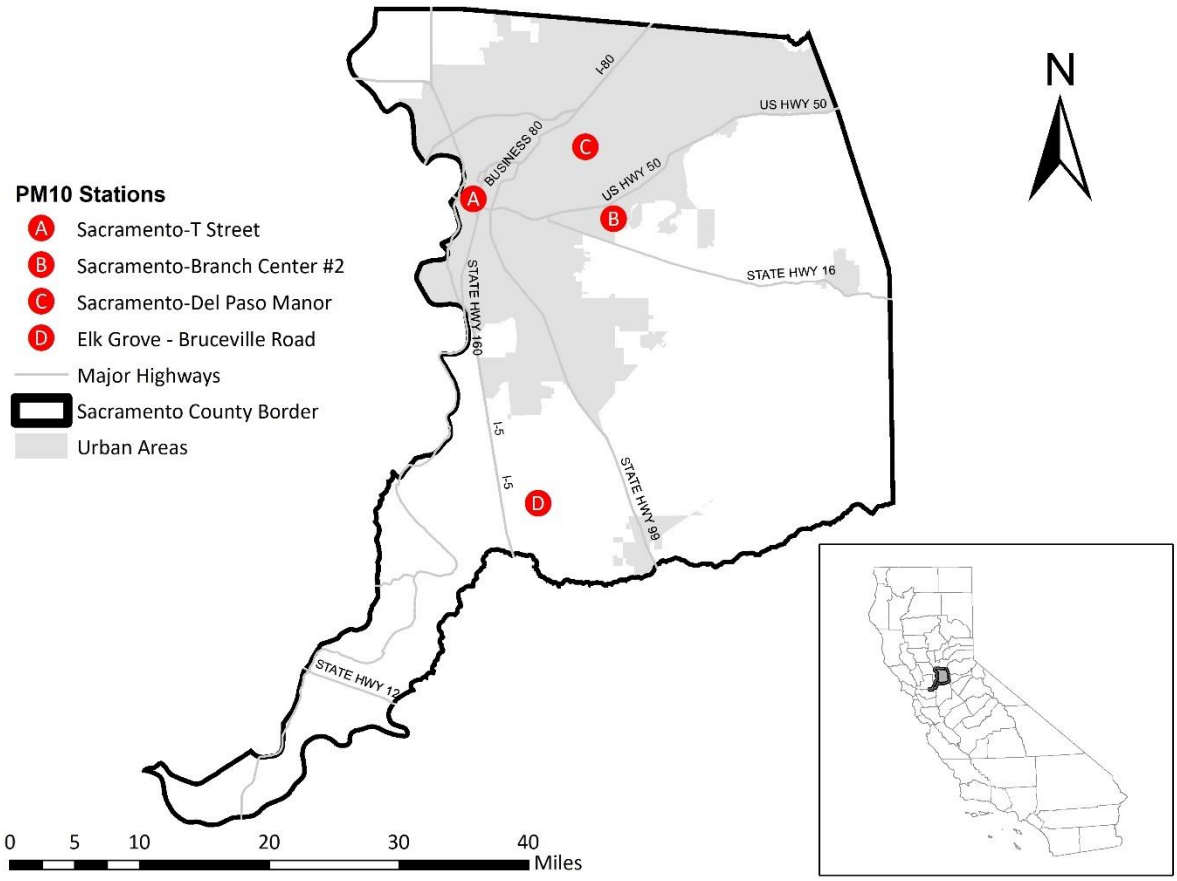


Figure 39 – PM_{10} Network in Sacramento County.

Table 33 – Monitoring type for PM_{10} monitors serving Sacramento County.

Site	EPA Network Affiliation*	Monitoring Type**
Sacramento-Del Paso Manor	NCore	Population Oriented
Sacramento-1309 T Street		Population Oriented
Sacramento-Branch Center #2		High Concentration
Elk Grove – Bruceville Rd.		Background

Note: All monitors are SLAMS (State and Local Air Monitoring Stations) monitor type unless otherwise noted.
* NCORE (National Core Multi-pollutant Monitoring Stations), SPM (Special Purpose Monitor not part of SLAMS).
** Consistent with EPA monitoring types as listed in 40 CFR Part 58, Appendix D.

In 1987, EPA set the NAAQS for coarse particulate matter (PM_{10}) at a level of 150 µg m^{-3}. The design value is the 24-hour average not to be exceeded more than 1.0 per year on average over 3 years. On September 26, 2013, Sacramento County was classified as attainment for the 24-hour PM_{10} NAAQS (78 FR 59261). The District has prepared a Second 10-year Maintenance Plan for Sacramento County that

shows maintenance of the 24-hour PM_{10} NAAQS from 2024 through 2033[57]. The plan includes updated emission inventories, demonstrates maintenance of the PM_{10} standard, provides an updated control measure evaluation, and establishes new motor vehicle emissions budgets.

Sacramento County has seen comparable or decreases in PM_{10} concentrations since the previous assessment, which is a result of implemented control measures. However, in 2020 and 2021, the county recorded peak PM_{10} concentrations near or above the standard of 150 µg m^{-3}. These peak concentrations were all impacted by wildfires and/or high wind dust events. Table 34 shows the maximum concentrations by site and the number of days exceeding the 24-hour NAAQS.

Table 34 – PM_{10} maximum 24-hour average concentrations (µg m^{-3}) and number of exceedance days for the 24-hour NAAQS for Sacramento County monitoring sites. (source: EPA AQS).

	Maximum 24-hour PM_{10} Concentration (µg m^{-3})			
Year	**DPM**	**TST**	**BC**	**Maximum**
2020	**186**	**298**	**201**	298
2021	59	132	57	132
2022	41	59	55	59
2023	46	62	48	62
2024	36	49	58	58
	Days Exceeding the 24-hour NAAQS of 150 (µg m^{-3})			
Year	**DPM**	**TST***	**BC**	**All Sites**
2020	1	4	1	6
2021	0	0	0	0
2022	0	0	0	0
2023	0	0	0	0
2024	0	0	0	0

* T Street operates a FEM continuous PM_{10} sampler, all other sites operate FRM filter-based 1 in 6-day samplers.
** North Highlands is included to assess its potential reinstatement as a PM_{10} monitoring site
NH – North Highlands-Blackfoot
DPM – Sacramento-Del Paso Manor, POC 1
TST – Sacramento-1309 T Street
BC – Sacramento-Branch Center #2

In 2020 and 2021, Sacramento County observed outlier spike concentrations in the peak 24-hour PM_{10} concentrations, which were influenced by wildfires and/or high wind dust events. The peak 24-hour PM_{10} concentration in 2020 was 298 µg m^{-3} on September 8 at the Sacramento T-Street monitoring station. Sacramento County experienced many days in 2020 and 2021 where the PM_{10} concentrations were impacted and elevated by wildfire smoke. Notably, high concentrations recorded during September 2020 were largely impacted by smoke from the August Complex Wildfires (see $PM_{2.5}$ section of this assessment for additional details).Table 35 presents the top fourteen PM_{10} concentrations sampled in 2020 and 2021. Four of these peak PM_{10} concentration days occurred

[57] Second 10-Year PM_{10} Maintenance Plan for Sacramento County; https://www.airquality.org/air-quality-health/air-quality-plans/federal-planning

consecutively with sampling data of September 12, 2020, impacting all stations, coinciding with the August Complex Wildfire. These exceptional concentrations are valuable in understanding the PM_{10} pollution that impacted Sacramento County during the assessment period. These exceedances in 2020 and 2021 due to wildfire smoke were addressed in the Second 10-Year PM_{10} Maintenance plan and do not impact the County's attainment designation of the standard. All analyses, including measured concentrations and deviations from the NAAQS, are presented with the inclusion of these exceedances. Site rankings incorporate data from the relevant dates.

Table 35 – Top PM_{10} 24-hour average concentrations between 2020-2024, sorted from highest to lowest concentration. **Bold and underlined** exceed the 24-hour PM_{10} NAAQS (source: EPA AQS).

Date	24-hour Concentration ($\mu g\ m^{-3}$)	Monitoring Station	Notes
9/8/2020	**298**	TST	Most likely impacted by LNU Lightning Complex, August Complex, Dixie, and Caldor wildfires.
9/11/2020	**231**	TST	
9/12/2020	**201**	BC	
9/12/2020	**188**	TST	
9/12/2020	**186**	DPM	
9/12/2020	**186**	TST	
9/13/2020	**169**	TST	
10/2/2020	137	TST	
9/27/2020	132	TST	
8/18/2021	132	TST	
10/11/2021	124	TST	
10/1/2020	123	TST	
9/30/2020	122	DPM	
10/3/2020	122	TST	
9/9/2020	121	TST	
9/14/2020	121	TST	

DPM – Sacramento-Del Paso Manor, POC 1
TST – Sacramento-1309 T Street
BC – Sacramento-Branch Center #2

As mentioned in the $PM_{2.5}$ section of this assessment, there has been increased frequency, duration, and magnitude of wildfires throughout the western United States thus impacting particulate matter concentrations in Sacramento County. The magnitude of wildfires as well as severe weather events, including high wind events and drought conditions that are particularly impactful to Sacramento County due to the proximity to agricultural operations. All these factors in one combination or another are common impacts during PM_{10} exceedances.

PM_{10} Network Area- and Population-Served Analyses

Spatial analysis techniques were evaluated to determine whether the current PM_{10} stations meet the objectives of the monitoring network. Thiessen polygons, as described in the Sources of Data section, were generated by the NetAssess2025 v1.1 tool to determine the spatial representation of each of the four (4) PM_{10} monitoring stations located in Sacramento County. The following sections present the findings for area- and population-served analyses for the PM_{10} network. Note that as seen in Table 33, some of the PM_{10} stations are affiliated with EPA networks and therefore, are required regardless of these analyses.

The population within Sacramento County represented by each monitoring site was counted within the Thiessen polygons by NetAssess2025 v1.1 using 2020 US Census data. Area- and population-served analyses are presented in Table 36. Figure 40 presents a map showing the location and area of influence for each PM_{10} monitor.

Following the methods outlined in the Introduction of this document, the PM_{10} rankings are summarized in Table 36.

Table 36 – Area and population served by PM_{10} monitors serving Sacramento County. Darker red indicates the highest values for population and area-served.

Station Name	Population Estimate (persons)*	Area (km^2)*	Population-Served Ranking	Area-Served Ranking
Sacramento-Del Paso Manor	358,853	215	High	Low
Sacramento-1309 T Street	389,371	188	High	Low
Sacramento-Branch Center #2	292,761	882	Medium	High
Elk Grove-Bruceville Rd.	172,975	780	Medium	High

* Population and area estimates based on monitor's area of influence and an approximate boundary of Sacramento County as extracted from the NetAssess2025 v1.1 tool. Population estimated with some overlapping census tracts.

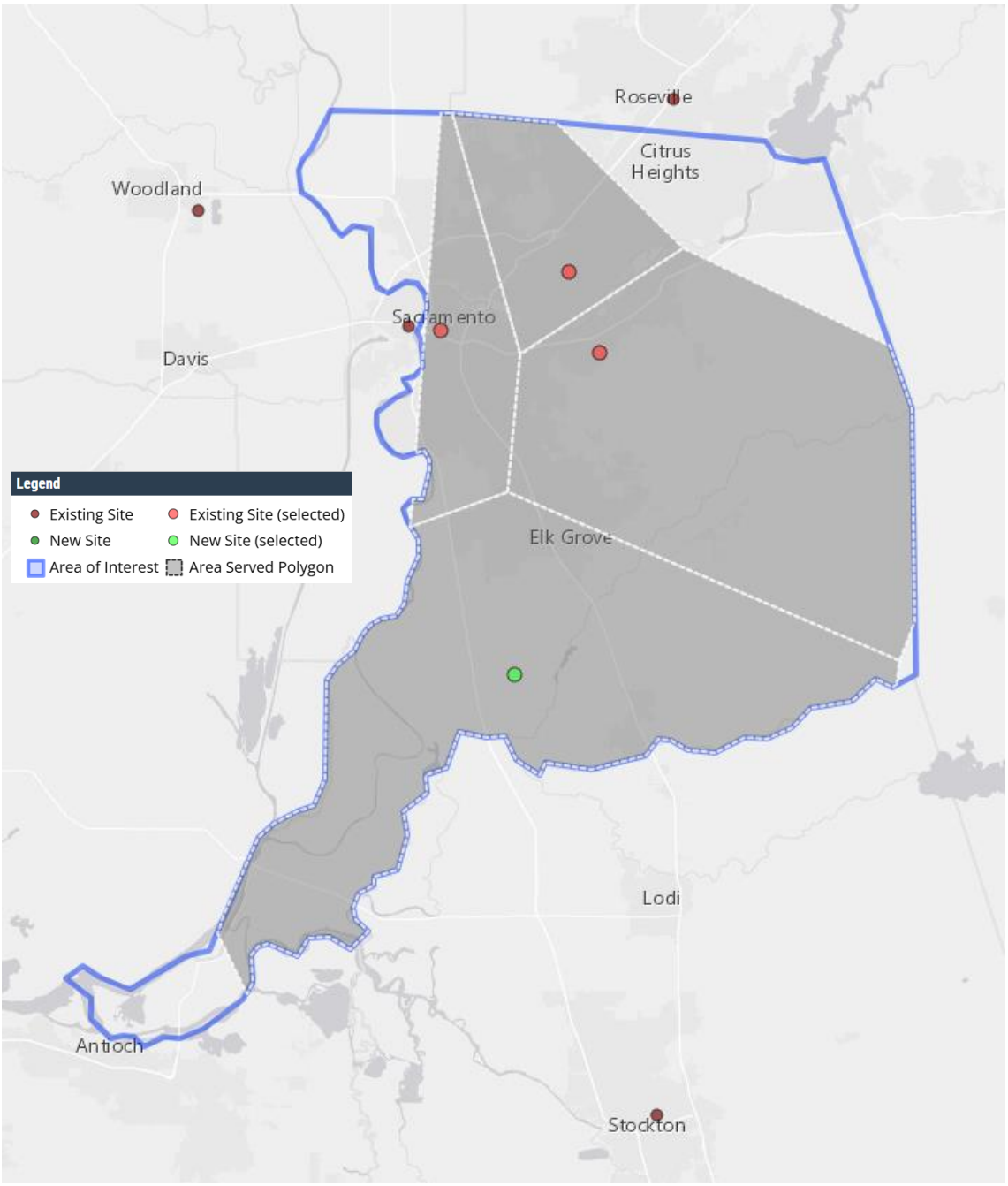


Figure 40 – PM_{10} Network Area-Served analysis. Bruceville is displayed as an added site in green since it began operations March 2025, after the 2020-2024 assessment period.

PM_{10} Data Analyses

The PM_{10} data analysis was conducted based on the following methods:

- measured concentrations and exceedance probability,
- deviation from NAAQS,
- monitor-to-monitor correlation,
- trend impact, and
- removal bias.

Measured Concentration and Exceedance Probability

Monitors within the District's ambient air monitoring network shown to have high levels of PM_{10} design values close to the standard, and with long historical record were considered to be of high value for characterizing pollution in an area. Table 37 presents 24-hour PM_{10} design value for 2020 through 2024 Estimated exceedances used in the design value calculations are adjusted for 1-in-6 day sampling as per 40 CFR Appendix K to Part 50. The estimated number of exceedances for the year is the sum of the estimates for each calendar quarter rounded to one decimal. The exceedance probability was not calculated in the NetAssess2025 v1.1 tool and is, therefore, not included in this analysis. There is no data from the recently added Elk Grove-Bruceville Rd. station during the assessment period, so it is also not included in this analysis.

Table 37 – Exceedance analysis for PM_{10} monitors serving Sacramento County. **Bold and underlined** numbers exceed the NAAQS[58]. Units are estimated number of exceedances (ene) (source: EPA AQS).

Station Name	Annual Estimated Exceedances					Three-Year Calculated 24-hr PM_{10} Design Value (ene)				
	2020*	2021	2022	2023	2024	2020	2021	2022	2023	2024
DPM	1	0	0	0	0	**4.7**	**3.3**	**1.9**	0.0	0.0
TST	4	0	0	0	0	**2.8**	**2.1**	**1.3**	0.0	0.0
BC	1	0	0	0	0	**3.9**	**3.2**	**2.6**	0.0	0.0

DPM – Sacramento-Del Paso Manor
TST – Sacramento-1309 T Street
BC – Sacramento-Branch Center #2

* Wildfire smoke in 2020 impacted multiple air monitoring stations; the District is working with other monitoring organizations in the Sacramento Federal Non-attainment Area, CARB, and EPA in addressing possible impacts under the Exceptional Event Rule (81 FR 68216).

[58] The 24-hour design value of 150 µg m^{-3} is not to be exceeded more than once per year on average over a 3-year period, EPA, https://www.epa.gov/pm-pollution/timeline-particulate-matter-pm-national-ambient-air-quality-standards-naaqs

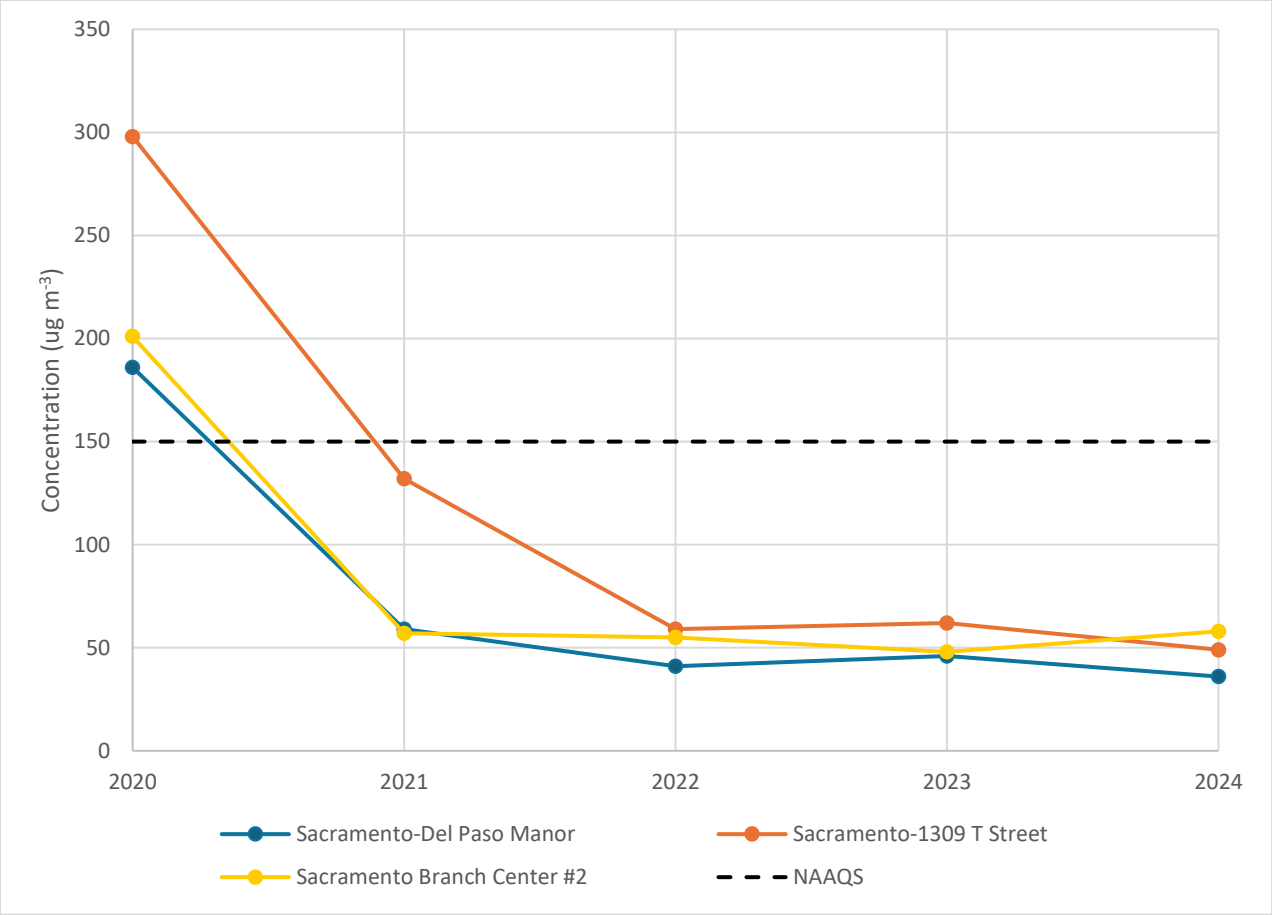


Figure 41 – Maximum 24-hour PM_{10} concentration trend (Source: EPA AQS).

Figure 41 presents the 2020 through 2024 maximum 24-hour concentrations for PM_{10} monitors serving Sacramento County. As described in the EPA network assessment guidance (EPA, 2007), "[m]onitors that measure high concentrations or design values are ranked higher than monitors that measure low concentrations." Therefore, for PM_{10}, sites that exceed the 150 µg m^{-3} 24-hour standard are ranked high, sites that are within 10 µg m^{-3} of the standard are ranked in the middle, and other sites are ranked low. Based on the data shown in Figure 41 and Table 37, all of the sites sampled higher than the standard during the assessment period. These exceedances took place mainly during wildfire or high dust events, which are occurring more and more frequently in the western United States as described earlier in the Natural Event Impacts on the Monitoring Network section. Therefore, providing accurate and timely particulate matter measurements to the residents of Sacramento County is of the highest priority to the District. Data collected during the assessment period shows that Sacramento County meet the PM_{10} standard of 150 µg m^{-3} except for exceedances that occurred in 2020, caused by either uncontrollable natural events or exceptional events.

In this analysis, each site exceeded the 150 µg m^{-3} threshold if the wildfire impacted dates are included. Based on this strict threshold, each site would be ranked high. However, without discounting the severe impact of these events, they are still exceptional in nature. The District has incorporated other methods for public notification during wildfire events in addition to the PM_{10} network. Therefore, it would be appropriate to assess the PM_{10} network in the absence of these events.

With the major 2020 wildfire events excluded from the analysis, it can be seen that the Sacramento -1309 T Street site measured the highest concentrations in the network (Table 38 and Figure 41). As sources of PM_{10} are mainly due to anthropogenic activities such as fuel combustion, road dust, and emissions from construction and farming activities, it is possible that the Sacramento-1309 T Street samples the highest concentrations due to close proximity of these sources. As described in the introduction to this document, sites were ranked based on the average concentrations used to determine the design value (DV_{ave}) for the assessment period (2020-2024). The thresholds for this analysis used the 24-hour NAAQS and are as follows:

Monitor Rank	Criteria
High	$DV_{ave} > 150$ µg m^{-3}
Medium	150 µg $m^{-3} \geq DV_{ave} \geq 135$ µg m^{-3}
Low	$DV_{ave} < 135$ µg m^{-3}

Consistent with the thresholds described in the Introduction to this document, results of this analysis are presented in Table 38.

Table 38 – Measured concentrations ranking based on 2024 data.

Station Name	Measured Concentrations
Sacramento-Del Paso Manor	Low
Sacramento-1309 T Street	Low
Sacramento-Branch Center #2	Low

Deviation from NAAQS

In this analysis, the maximum 24-hour concentration was averaged over the three-year period from 2022 to 2024 to provide a more accurate representation comparison to the NAAQS (24-hour average not to be exceeded more than once per year on average over 3 years). The thresholds for this analysis, as outlined in the Introduction to this document, are as follows:

Monitor Rank	Criteria
High	|Deviation| < 15 µg m^{-3}
Medium	15 µg $m^{-3} \geq$ |Deviation| $\geq$ 30 µg m^{-3}
Low	|Deviation| > 30 µg m^{-3}

Table 39 shows the deviation from NAAQS analysis for the 24-hour standard.

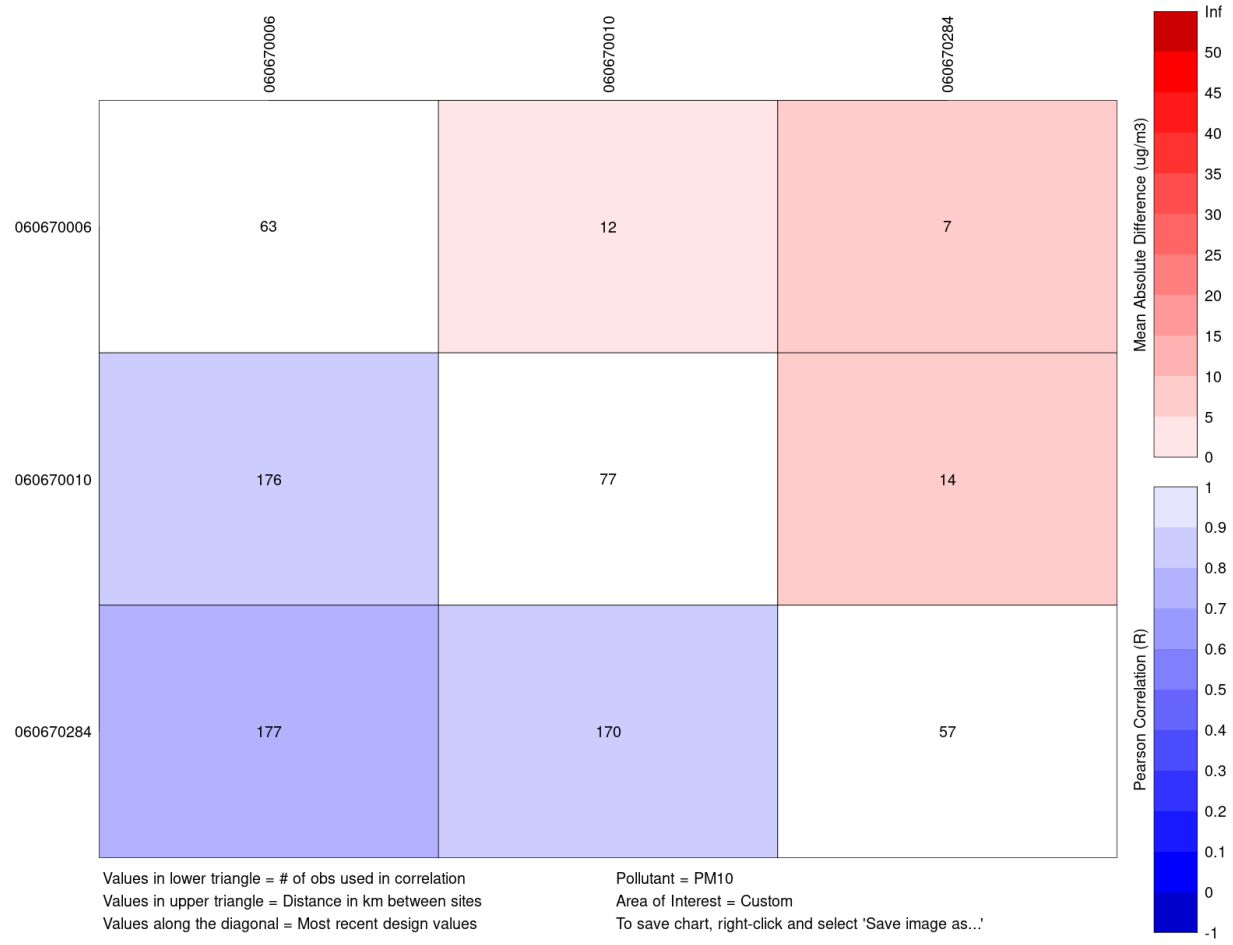
Table 39 – 2022-2024 average maximum 24-hr PM_{10} concentration and deviation from NAAQS analysis.

Station Name	2022-2024 Average Maximum 24-hr PM_{10} Concentration* ($\mu g\ m^{-3}$)	Deviation from NAAQS ($\mu g\ m^{-3}$)	Ranking
Sacramento-Del Paso Manor	42	108	Low
Sacramento-1309 T Street	57	93	Low
Sacramento-Branch Center #2	54	96	Low

PM_{10} Monitor-to-Monitor Correlation Analysis

PM_{10} concentrations were compared to examine their relationships using a correlation matrix analysis. Figure 42 shows a correlation matrix for all PM_{10} monitors in Sacramento County provided by the NetAssess2025 v1.1 tool. Elk Grove–Bruceville Rd. was also not included as it was added into the network in 2025, after the assessment period of 2020-2024 covered by the NetAssess2025 v1.1 tool. The raw values from the correlation matrix are shown in Table 40. Included in the matrix are Pearson correlations, mean absolute differences, number of observations used in the correlation, distance in kilometers between the sites, and the 2023 design values. The correlation matrix helps to determine sites within the network that have similarities. Sites with high correlation, low absolute difference, and close proximities are closely related in this analysis.

Monitor-to-monitor correlation analysis found that based on the square of the Pearson coefficients (R^2), all three of the monitors within Sacramento County were moderately correlated ($R^2 > 0.70$) with at least one other monitor. The highest correlations were between the Sacramento-Del Paso Manor site and the Sacramento-1309 T Street site. The moderate correlation between the sites could be in part due to seasonal and regional-scale factors such as the relatively homogenous terrain throughout the county, widespread wildfire impacts, and consistent meteorological conditions (e.g. wintertime temperature inversions and wind events). These correlations indicate that concentrations tend to fluctuate in unison at each of these sites; however, even though the PM_{10} concentrations are correlated, the magnitude of the measured concentrations can vary. Wildfire smoke can often remain elevated at 10s to 100s of feet above the surface, but when the smoke plume reaches the surface, the concentrations can easily exceed the NAAQS. Alerting the public of this rapid increase in PM_{10} concentrations is of utmost importance and the highest priority of the District. Also, during high wind events, not all monitors are necessarily impacted by blowing dust to the same magnitude. Often, the sites closer to open fields, construction sites, or other sources of loose particles can sample much higher than other sites. This highlights not only the general trends, but localized variability of PM_{10} pollution throughout the county. The last factor to include in this analysis is the proximity of the stations to each other. The Sacramento-Del Paso Manor and Sacramento-Branch Center #2 sites are the closest in proximity at 7 km, however, do not meet the criteria for the lowest rank at less than 25% of the maximum distance between any two PM_{10} monitors.



060670010 – Sacramento-1309 T Street
060670006 – Sacramento-Del Paso Manor 060670284 – Sacramento-Branch Center #2

Figure 42 – Correlation matrix for PM_{10} monitors serving Sacramento County (source: NetAssess2025 v1.1). The lower triangle refers to the blue shaded boxes and the upper triangle refers to the red shaded boxes. Most recent design values are for the 2023 design value year. Based on thresholds outlined in the Introduction of this document, the criteria for this analysis are as follows:

Monitor Rank	Criteria
High (meets 1 or less of the criteria)	Highest pairwise $R^2 > 0.75$
Medium (meets 2 of the criteria)	Distance between sites < 5 km
Low (meets 3 of the criteria)	Mean Difference < 1.38 µg m^{-3}

Table 40 – Monitor to monitor correlation data. **Red and bold** represent high correlation ($R^2 > 0.75$, distance between sites < 25% of maximum distance between any two sites, mean difference < 25% of maximum mean difference between any two sites).

Site #1	Site #2	Distance Between Sites (km)	Number of Observations	Pearson Correlation	R^2	Mean Difference ($\mu g\ m^{-3}$)
DPM	TST	12	176	0.8747	**0.765**	2.9261
DPM	BC	7	177	0.7985	0.638	5.5367
TST	BC	14	170	0.8567	0.734	5.1176

TST – Sacramento-1309 T Street
DPM – Sacramento-Del Paso Manor
BC – Sacramento-Branch Center #2

This monitor-to-monitor correlation analysis shows that all sites meet only one or less of the three criteria. Therefore, all sites are ranked as high due to their perceived uniqueness in this analysis. The rankings for this analysis are summarized in Table 41.

Table 41 – Monitor-to-monitor correlation ranking.

Station Name	Monitor-to-Monitor Rank
Sacramento-Del Paso Manor	High
Sacramento-1309 T Street	High
Sacramento-Branch Center #2	High

Trend Analysis

Monitors that have a long historical record are valuable for tracking trends. In this analysis, sites are ranked based on the duration of the continuous measurement record as described in the Introduction to this document. The thresholds for this analysis are as follows:

Monitor Rank	Criteria
High	Trend ≥ 30 years
Medium	30 years > Trend ≥ 10 years
Low	Trend < 10 years

Table 42 shows the year that PM_{10} measurements began at each of the stations serving Sacramento County, as well as the resulting rank based on this analysis.

Table 42 – Date of operation for each PM_{10} station serving Sacramento County.

Station Name	Begin Year of PM_{10} Operation	Trend Rank
Sacramento-Del Paso Manor	1980	High
Sacramento-1309 T Street	1990	High
Sacramento-Branch Center #2	1989	High
Elk Grove-Bruceville Rd.	2025	Low

*North Highlands-Blackfoot operated a PM_{10} monitor from 1989-2022.

PM_{10} Monitor Removal Bias Analysis

Each monitor was analyzed to determine the change in spatial concentrations interpolated across Sacramento County if the monitor was removed. Table 43 and Figure 43 present the results of the removal bias analysis and the maximum change in PM_{10} concentrations in Sacramento County if each PM_{10} monitor in the District's network was individually removed as calculated by the NetAssess2025 v1.1 tool. The tool does not account for added sites; therefore, Elk Grove–Bruceville Rd. was not included in this analysis.

The change in concentration at a site indicates the bias which may be observed if the individual monitor were removed. Per the Network Assessment Guidance, "[t]he greater the bias, the more important the site is for interpolation." Based on the thresholds outlined in the Introduction to this document, the thresholds for this analysis are as follows, where MRB is the mean relative bias:

Monitor Rank	Criteria
High	$\|MRB\| \geq 3.2$ µg m^{-3}
Medium	3.2 µg $m^{-3} > \|MRB\| \geq 1.1$ µg m^{-3}
Low	$\|MRB\| < 1.1$ µg m^{-3}

Table 43 below indicates that removal bias for each monitor.

As mentioned previously, the Sacramento nonattainment area will be able to continue to demonstrate maintenance for the 24-hour PM_{10} standard through 2033. All exceedances of the 24-hour standard of 150 µg m^{-3} in the assessment period have been due to events which can be deemed exceptional, such as wildfire smoke and high winds. Therefore, in relation to the 24-hour PM_{10} NAAQS of 150 µg m^{-3}, these biases would have little impact on maintenance or attainment statuses. The rankings are summarized in Table 44.

Table 43 – PM_{10} monitoring network removal bias results.

Station Name	Mean Removal Bias (µg m^{-3})
Sacramento-Del Paso Manor	1.1
Sacramento-1309 T Street	4.2
Sacramento-Branch Center #2	-3.2

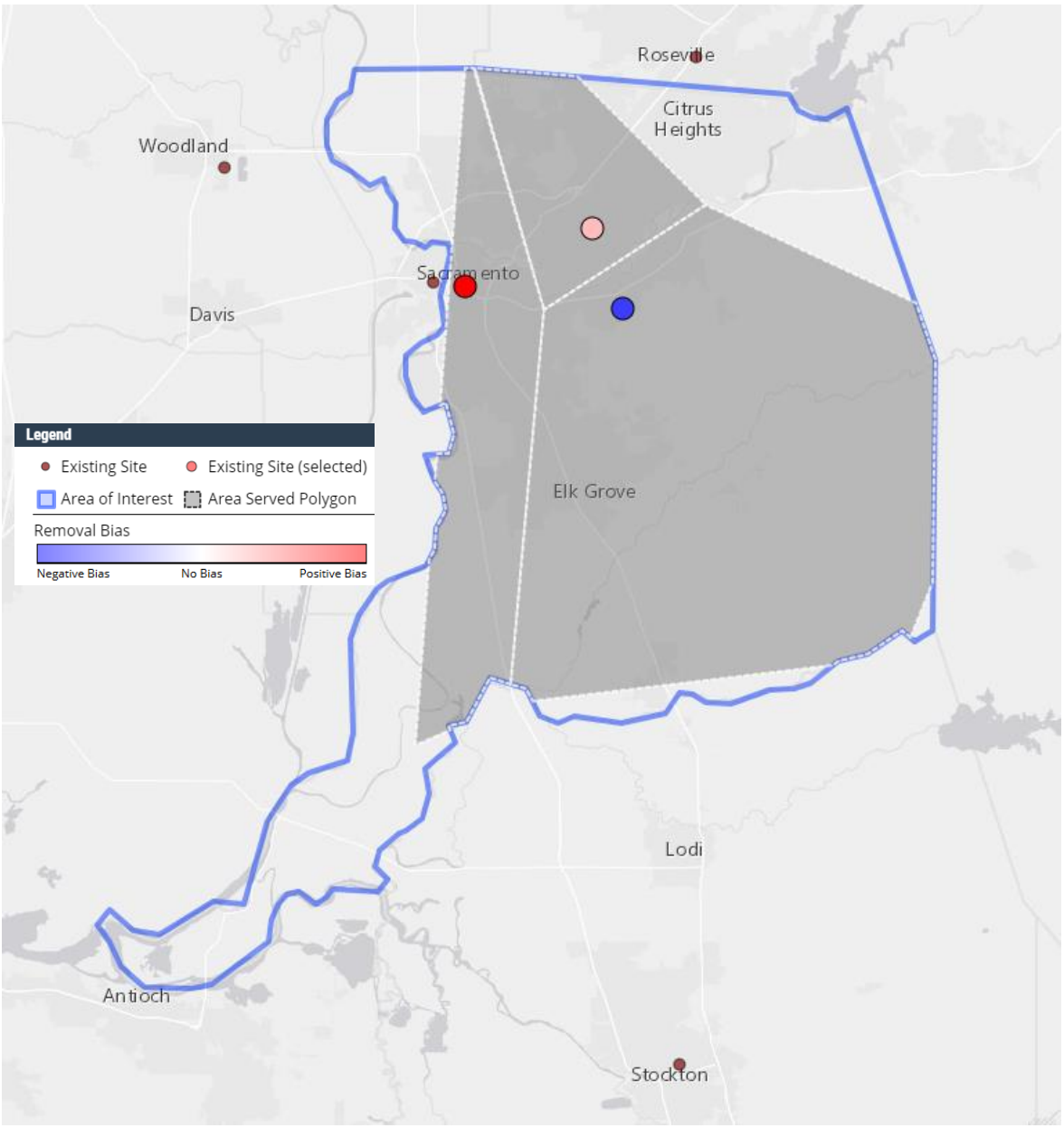


Figure 43 – PM_{10} removal bias analysis in Sacramento County.

Table 44 – Removal bias rank.

Station Name	Removal Bias Rank
Sacramento-Del Paso Manor	Medium
Sacramento-1309 T Street	High
Sacramento-Branch Center #2	High

PM_{10} Monitoring Sites

The number of sites in the Sacramento MSA are listed in Table 45. There are currently four (4) active PM_{10} monitors located in the District's network (BC, DPM, TST, BRU (as of March 2025)) as shown in Figure 39.

Table 45 – PM_{10} Monitoring Sites within Sacramento MSA.

Active Sites in Sacramento MSA*	Additional Sites Needed	2024 Design Value and Site ID
8	0	Expected number of exceedances (3-yr average): 0.0 days

* Wildfire smoke in 2020 impacted multiple air monitoring stations. Without any smoke impacts, historical data from 2015 through 2023 shows the maximum PM_{10} ambient concentration in Sacramento MSA is 70% of the NAAQS. Therefore, existing monitors meet the monitoring requirements in 40 CFR 58, Appendix D, as well as the needs of communities in local air districts. The District is committed to working with U.S. EPA, CARB, and other local air districts to ensure that monitoring levels continue to protect public health and safety.

Conclusions

Table 46 is a summary of the District's PM_{10} monitor rankings from the analyses performed in this section. An overall ranking was calculated for each site by assigning a value to each rank (1 – low, 2 – medium, 3 – high) and summing over all analyses.

Table 46 – PM_{10} monitor ranking summary. Overall score is shaded red, with highest overall score darkest.

Station Name	Population-Served	Area-Served	Measured Concentrations	Deviation from 24-hour NAAQS	Monitor-to-Monitor	Trend	Removal Bias	Overall
Sacramento-Del Paso Manor	High	Low	Low	Low	High	High	Medium	**14**
Sacramento-1309 T Street	High	Low	Low	Low	High	High	High	**15**
Sacramento-Branch Center #2	Medium	High	Low	Low	High	High	High	**16**
Elk Grove-Bruceville Rd.**	Medium	High	NA	NA	NA	NA	NA	NA

** Elk Grove-Bruceville Rd. has limited analysis since data are not available for the assessment period. An overall total was not determined for the station.

Sacramento-Del Paso Manor was ranked the lowest of the sites in the previous 5-year network assessment. As the Sacramento-Del Paso Manor site is the NCore site for Sacramento County, the station is a required site and not suitable for removal.

As mentioned in this section, the Sacramento attainment area will be able to continue to demonstrate maintenance for the 24-hour PM_{10} standard[57]. However, the frequency of elevated particulate matter concentrations has increased due to the growing prevalence of wildfires and high wind events across California. These events contribute to episodic spikes in PM_{10} levels throughout the year, underscoring the need for accurate, spatially resolved air quality data to support timely public health notifications across Sacramento County. The District's commitment to protecting public health through real-time air quality information is evident in the various programs discussed in the $PM_{2.5}$ section of this assessment. To meet the monitoring objective of providing timely public health notifications, the District is currently evaluating the replacement of filter-based PM_{10} methods with continuous monitoring at the Sacramento–Del Paso Manor and Sacramento–Branch Center #2 sites. To ensure continued compliance with the Clean Air Act and to maintain the ability to detect and respond to localized air quality impacts, it is vital to retain all current PM_{10} monitoring sites and update to continuous monitoring.

In the 2020 5-Year Network Assessment[23], it was recommended to discontinue the Sacramento-Branch Center #2 PM_{10} filter-based monitor and the Sacramento-Branch Center #2 monitoring station if a replacement air monitoring station was installed near the discontinued North Highlands-Blackfoot location to measure PM_{10}. Previously, in the Number of Parameters Monitored Analysis section, the Sacramento-Branch Center #2 site was shown to operate only a single parameter, PM_{10}, and is therefore considered as operating at the least possible efficiency from an operational and scientific standpoint. An assessment of the station’s role within the monitoring network was conducted to evaluate any potential similarities. Additionally, since the North Highlands–Blackfoot site was abruptly discontinued, it is recommended that the station be evaluated for reinstatement with a PM_{10} monitor. This analysis is presented in the following section of the PM_{10} conclusions to evaluate whether the recommendation from the previous assessment continues to be supported from this analysis.

Evaluation for Relocating Sacramento-Branch Center #2 Monitor to North Highlands-Blackfoot

As shown in Table 46, the Sacramento-Branch Center #2 monitor is the highest ranked of the four monitors in Sacramento County. Therefore, for the monitor to be considered suitable for removal or relocation, each of the high rankings must be justified that if the monitor was removed or relocated, it would not result in negatively impacting the network. In fact, the relocation of the monitor should be shown to increase the operational and scientific value of the network. Each of the high-ranking analyses for the Sacramento-Branch Center #2 site will be investigated below with consideration of the scenario in which the North Highlands-Blackfoot site remained to act as a surrogate for a station within the network.

Population-Served and Area-Served Analysis

As a result of a recommendation from the District’s 2020 5-Year Air Monitoring Network Assessment[23], a PM_{10} monitor has been installed at the Elk Grove-Bruceville Rd. air monitoring site. The Sacramento-Branch Center #2 monitor will be evaluated with the currently installed PM_{10} monitors. A map of all PM_{10} stations in this analysis are shown in Figure 44.

As previously noted, the implementation of a PM_{10} monitor at the North Highlands–Blackfoot station will serve as a surrogate for the Sacramento–Branch Center #2 station, if discontinued. This analysis will compare this scenario in terms of population-served and area-served. In this analysis, it was shown that

the area of influence for the current PM_{10} monitoring stations extend from the northernmost to the southernmost boundary of Sacramento County (Figure 40).

As shown in Figure 45, replacing the Sacramento–Branch Center #2 monitor with the North Highlands–Blackfoot monitor results in a balanced and effective monitoring network. The area served by the Sacramento–Del Paso Manor monitor increases from 10% to 31%, and the Elk Grove–Bruceville Rd. monitor expands its coverage from 38% to 53% of the area of influence[59]. In terms of population served, this adjustment leads to a 3–4% increase for the Elk Grove–Bruceville Rd., Sacramento–1309 T Street, and Sacramento–Del Paso Manor monitors, while maintaining a consistent mean population distribution across the network. These changes are largely due to division of the northern region between the North Highlands–Blackfoot and Sacramento–Del Paso Manor monitors. This balances the responsibility of the PM_{10} monitors in the District network, as demonstrated in Table 47. It aligns with the core objectives of the District's air monitoring network, including support for emissions strategy development and air pollution research. By improving the spatial uniformity of monitor placement, this change enhances the network's ability to provide meaningful data for air quality modeling and supports efforts such as State Implementation Plan development.

[59] The total area of influence is calculated as the sum of all Thiessen polygons as estimated by the NetAssess2025 v1.1 tool.

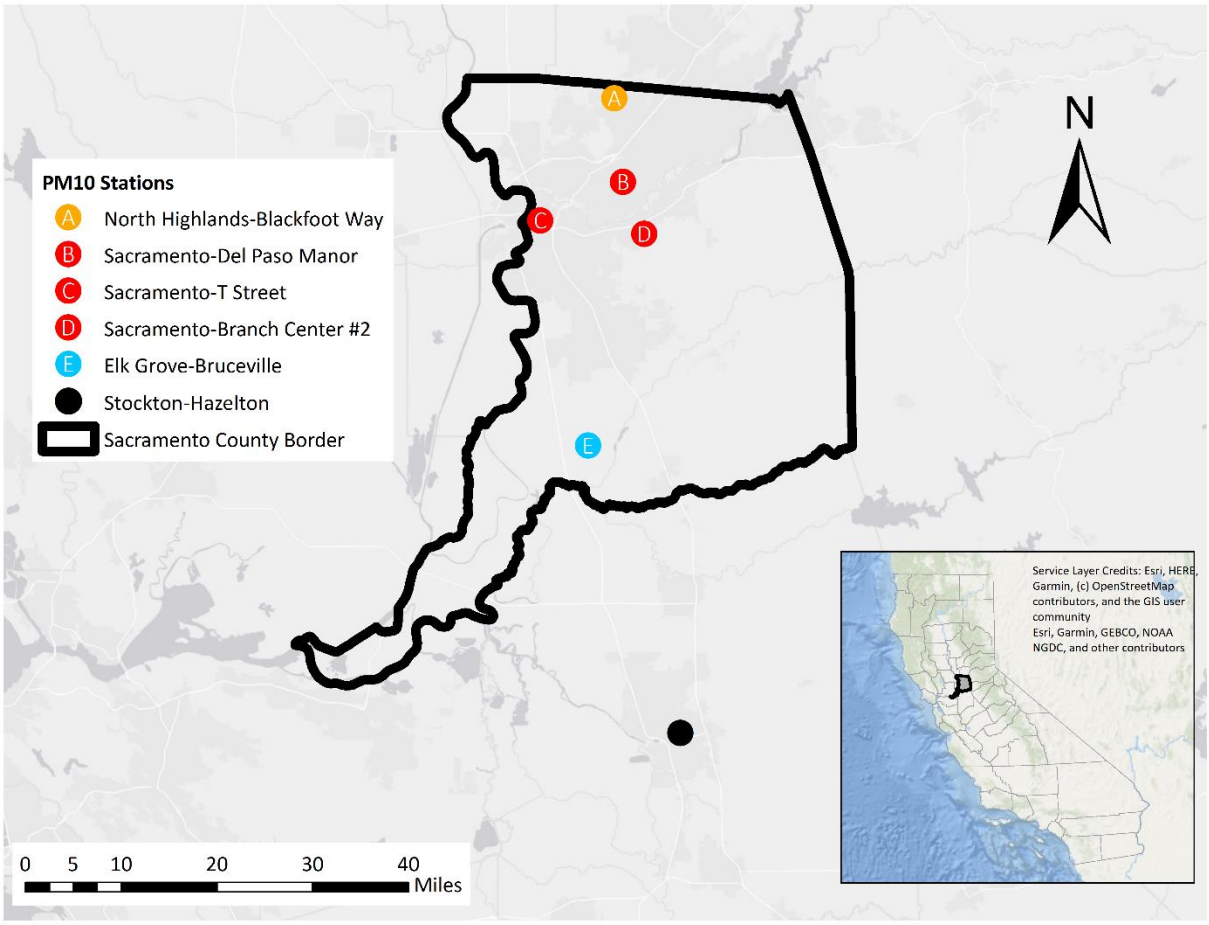


Figure 44 – District PM_{10} monitor network active sites (red dots), location of the recently added Elk-Grove Bruceville station (blue dot), location of removed North Highlands-Blackfoot station (orange dot), and the Stockton-Hazelton air monitoring station (black dot)

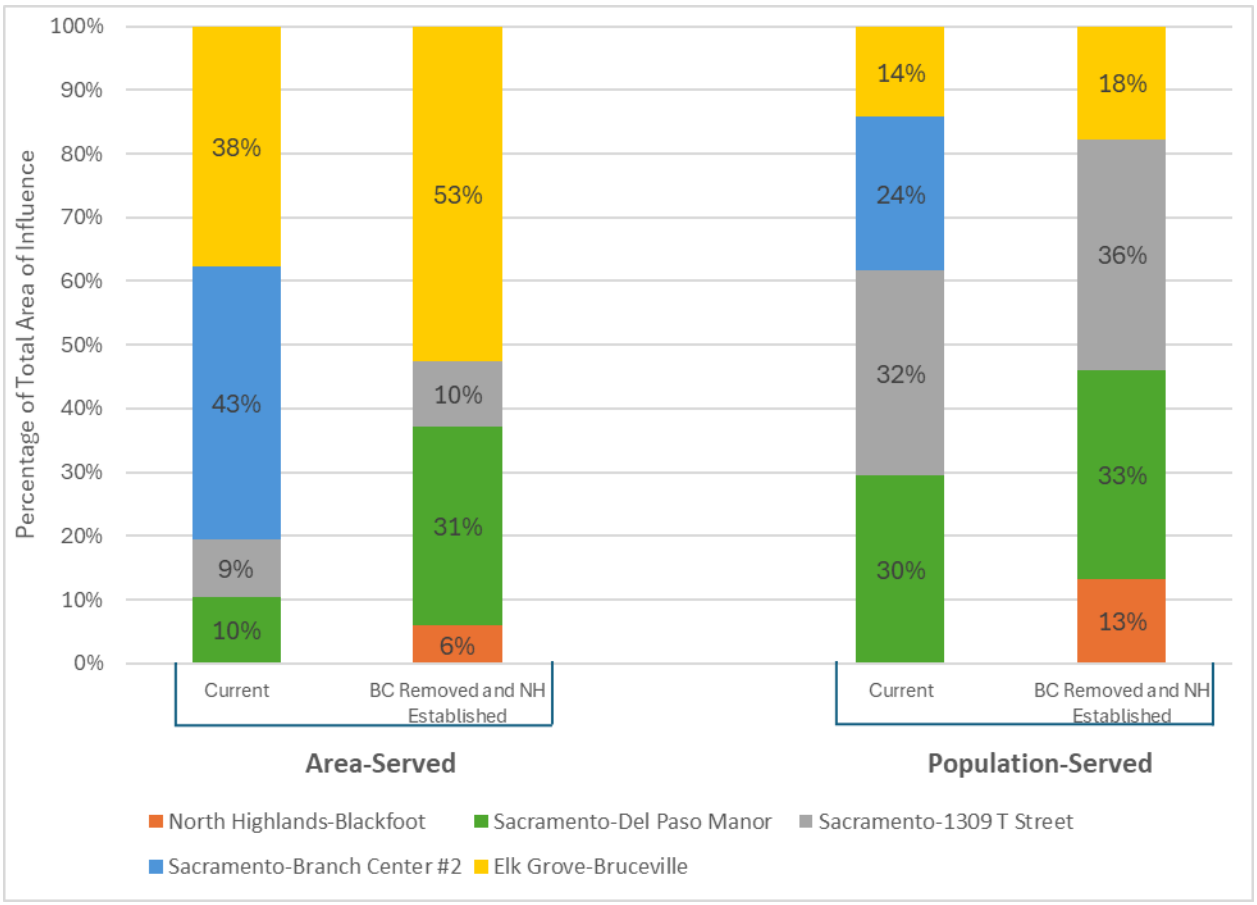


Figure 45 – Percentage of the total area of influence for area- and population-served as estimated by the NetAssess2025 v1.1 tool for two PM_{10} station scenarios (1) The current PM_{10} network with the newly added Elk Grove-Bruceville Rd. monitor, (2) BC Removed and NH Established – removing the Sacramento-Branch Center #2 station from analysis and replacing it with a monitor at the North Highlands-Blackfoot station.

Table 47 – Changes to the area and population served by PM_{10} monitors in Sacramento County if the Sacramento-Branch Center #2 monitor was relocated to North Highlands-Blackfoot.

Site	Area Served		Population Served	
	Current	BC Removed and NH Established	Current	BC Removed and NH Established
NH*		118		163,775
DPM	215	618	358,853	403,339
TST	188	202	389,371	445,067
BC	882		292,761	
BRU	780	1043	172975	219,035

NH – North Highlands-Blackfoot TST – Sacramento-1309 T Street BRU – Elk Grove-Bruceville Rd.
DPM – Sacramento-Del Paso Manor BC – Sacramento-Branch Center #2
* The exact location of the removed North Highlands-Blackfoot station is used as a surrogate for a replacement station within the community.

Trend Analysis

As seen in Table 42, the Sacramento-Branch Center #2 monitor has a long historical trend (operation began in 1989) and ranks high for the PM_{10} trend analysis. The Sacramento-1309 T Street monitor has a functionally equivalent history (operation began in 1990), and as seen in Table 40, is highly correlated with the Sacramento-Branch Center #2 PM_{10} monitor ($R^2 > 0.75$). Therefore, if the Sacramento-Branch Center #2 monitor has high correlation with the Sacramento-1309 T Street monitor based on the monitor-to-monitor correlation analysis, then the long historical trend is acceptable to terminate as the Sacramento-Del Paso Manor monitor has been proven to provide highly correlated data for a longer historical period.

Monitor-to-Monitor Correlation Analysis

In the monitor-to-monitor correlation analysis, three criteria were used to determine whether sites were deemed as redundant: (1) the square of the Pearson coefficient (R^2), (2) the distance between the stations, and (3) the mean difference in absolute units between sites. The usefulness of these three criteria is that the analysis investigates different aspects of uniqueness of the sites. However, in the case of the PM_{10} monitor-to-monitor correlation analysis, the ranking can be investigated in further detail. First, the Network Assessment Guidance clearly specifies that "[m]onitors with concentrations that correlate well (e.g., $R^2 > 0.75$) with concentrations at another monitor may be redundant." The Sacramento-Branch Center #2 site exceeds this threshold as shown in Table 40, and therefore based on the guidance alone can be considered redundant. When investigating the distance between sites, sites are in general more highly correlated the closer they are to each other. This is true in this case as well, as the Sacramento-Branch Center #2 and the Sacramento-Del Paso Manor sites are only 7 km apart, the shortest distance between any two PM_{10} monitors in the network. As for the mean difference between sites, even though none of the monitor pairs met the criteria for low ranking, or possible similarities (mean difference < 25% of the maximum mean difference between any two sites), the maximum mean difference between any site was only a fraction of the 150 µg m^{-3} 24-hour PM_{10} NAAQS at 5.5 µg m^{-3}. As described previously, the PM_{10} monitors in the Sacramento nonattainment area will be able to continue

to demonstrate maintenance for the 24-hour PM_{10} standard through 2033, and all exceedances of the standard throughout the assessment period have been due to events, which can be deemed exceptional, such as wildfire smoke and high winds. In relation to the 24-hour PM_{10} NAAQS of 150 µg m^{-3}, these biases would have little impact on maintenance or attainment statuses. Therefore, based on further investigation of the monitor-to-monitor correlation analysis, the Sacramento-Branch Center #2 monitor can be considered highly correlated with the Sacramento-1309 T Street monitor.

Additional Justification for Monitor and Station Relocation

While this document provides a detailed assessment of the District's air monitoring network, it is also important to consider the added value of shifting the existing PM_{10} monitoring capabilities from Sacramento–Branch Center #2 to the North Highlands–Blackfoot site. Although Sacramento–Branch Center #2 currently monitors only PM_{10} using a 24-hour sampling method, relocating this function to North Highlands would not only preserve this monitoring capability, but enhance it. Included in this recommendation is upgrading to a continuous PM_{10} monitor, which aligns with District priorities of increasing public awareness and providing localized information in a timely manner. Currently, the Branch Center station is equipped with a filter-based monitor located on the station's roof. The site lacks an indoor facility and is therefore not suitable for housing a continuous monitor, which requires a controlled environment for proper operation. The North Highlands–Blackfoot monitor would employ a continuous monitor with an hourly sampling method, enabling near real-time data reporting and providing the public with more timely and actionable air quality information. This move would increase long term efficiency, modernize the monitoring network, improve spatial distribution, and reallocate resources to a location better suited for future monitoring needs and community engagement. Additionally, the shift to continuous monitoring would strengthen the SIPs and track control measure effectiveness by providing higher-resolution data, enabling improved identification of pollution trends, responsive regulatory oversight, and enhanced public health protection; all of which support continued compliance with the Clean Air Act.

Overall Conclusions and Recommendations

The current and proposed network adequately meets all EPA monitoring requirements and covers various particulate matter monitoring purposes consistent with District monitoring goals and objectives. The following change is recommended to improve the efficiency and efficacy of the network:

- Discontinue the Sacramento-Branch Center #2 PM_{10} monitor and Sacramento-Branch Center #2 air monitoring station, if a replacement air monitoring station for the North Highland-Blackfoot location is installed.

Nitrogen Dioxide (NO_2) Network Analysis

Monitoring Objectives

Nitrogen dioxide (NO_2) is a component of highly reactive oxides of nitrogen and is emitted into the atmosphere largely through burning of fuel. NO_2 forms primarily from emissions from cars, trucks and buses, power plants, and off-road equipment[60].

Sacramento County has a total of five (5) active SLAMS NO_2 monitoring stations as shown in Figure 46. The North Highlands-Blackfoot station as discussed in the Recent Notable Modifications to the Network section was discontinued in July 2022. Based on the characteristics of the sites, including the population served and the area served, each site can be designated as background, population oriented, source oriented, or high concentration monitoring locations as depicted in Table 48.

[60] https://www.epa.gov/no2-pollution/basic-information-about-no2#What%20is%20NO2

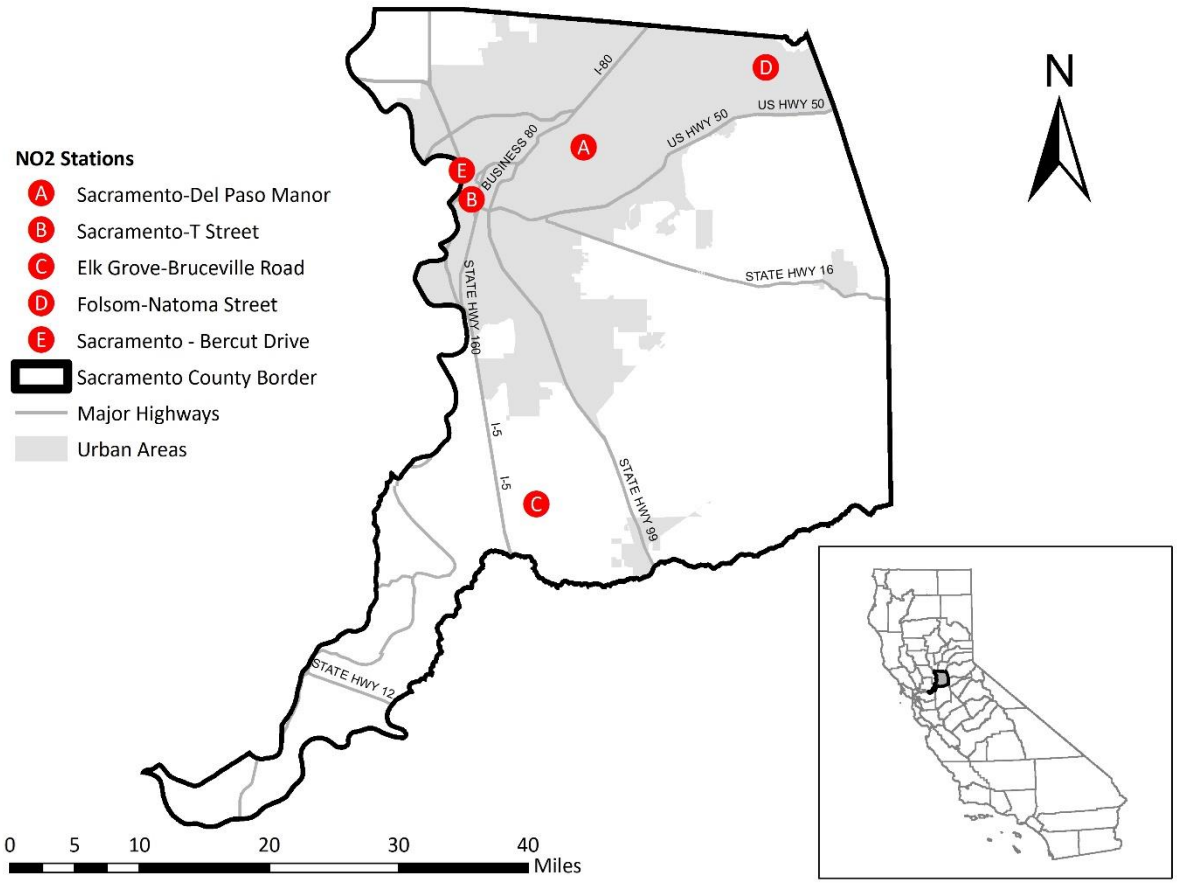


Figure 46 – NO_2 Network in Sacramento County. Red markers indicate active monitors.

Table 48 – Monitoring type for NO_2 monitors serving Sacramento County.

Site	EPA Network Affiliation*	Monitoring Type**
Sacramento-Del Paso Manor	NCORE,PAMS	Population Oriented
Sacramento-1309 T Street		Population Oriented
Elk Grove-Bruceville Rd.	PAMS	Background
Folsom-Natoma St.	PAMS	High Concentration
Sacramento-Bercut Drive	Near Road	Source Oriented

Note: All monitors are SLAMS (State and Local Air Monitoring Stations) monitor type unless otherwise noted.
* NCORE (National Core Multi-pollutant Monitoring Stations), SPM (Special Purpose Monitor not part of SLAMS), PAMS (Photochemical Assessment Monitoring Station).
** These objectives are consistent with EPA monitoring types as listed in 40 CFR Part 58, Appendix D.

In 2010, EPA revised the NO_2 annual NAAQS by establishing a 1-hour standard at the level of 100 ppb. The design value is the annual 98th percentile of the daily maximum 1-hour concentration values,

averaged over three consecutive years. In 2010, EPA also retained the existing annual NO_2 NAAQS at the level of 53 ppb. EPA has designated all areas of the United States as unclassifiable/attainment.

Sacramento County has one site, Sacramento-Bercut Drive, that began operation in October 2015 and operates as part of the EPA Near Road monitoring network. The Near Road monitoring network was initiated as part of the EPA 2010 NO_2 NAAQS review. The Sacramento-Bercut Drive station satisfies part of the near-road monitoring requirement[61]. Sacramento-Del Paso Manor satisfies the PAMS and area-wide monitoring requirements.

NO_2 Network Area- and Population-Served Analyses

Spatial analysis techniques were evaluated to determine whether the current NO_2 stations meet the objectives of the monitoring network. Thiessen polygons, as described previously, were generated by the NetAssess2025 v1.1 tool to determine the spatial representation of each of the five (5) NO_2 monitoring stations located in Sacramento County. The following sections present the findings for area- and population-served analyses for the NO_2 network. Note that as seen in Table 48, some of the NO_2 stations are affiliated with EPA networks and are, therefore, required regardless of these analyses.

The population within Sacramento County represented by each monitoring site was counted within the Thiessen polygons by NetAssess2025 v1.1 using 2020 US Census data. Area- and population-served analyses are presented in Table 49. Figure 47 presents a map showing the location and area of influence for each NO_2 monitor.

Following the methods outlined in the EPA network assessment guidance, site rankings are summarized in Table 49. Elk Grove-Bruceville Rd. and Folsom-Natoma St. monitors both have an area of influence at over 500 km^2. The Sacramento-Del Paso Manor monitor exceeded the 250 km^2 threshold. All other sites serve areas less than the 250 km^2. Sacramento-1309 T Street and Sacramento-Del Paso Manor serve the most populous portions of Sacramento County at exceeding the 317,000 persons threshold while the Elk Grove-Bruceville Rd. monitor exceeds the 159,000 persons threshold.

[61] Sacramento MSA has surpassed the 250,000 vehicles threshold for a second near-road monitoring site per 40 CFR Part 58 Appendix D, 4.3.2(a) using 2022 traffic volumes from the California Department of Transportation. From the most recent 2022 traffic volumes, Sacramento MSA exceeds this threshold with a maximum vehicle AADT of 257,000 on Interstate Route 80 near Greenback Lane . The District is working with EPA and CARB to determine the appropriate timing, location, and funding for a second near-road monitoring site if necessary.

Table 49 – Area and population served by NO2 monitors serving Sacramento County. Darker red indicates higher values.

Station Name	Population Estimate (persons)	Area (km^2)*	Population-Served Ranking	Area-Served Ranking
Sacramento-Del Paso Manor	514,178	401	High	Medium
Sacramento-1309 T Street	401,710	172	High	Low
Elk Grove-Bruceville Rd.	219,035	1043	Medium	High
Folsom-Natoma St.**	139,613	511	Low	High
Sacramento-Bercut Drive	176,123	194	Low	Low

* Population and area estimates based on monitor's area of influence and an approximate boundary of Sacramento County as extracted from the NetAssess2025 v1.1 tool. Population estimated with some overlapping census tracts.
** Folsom-Natoma St. site was offline due to construction until December 2020.

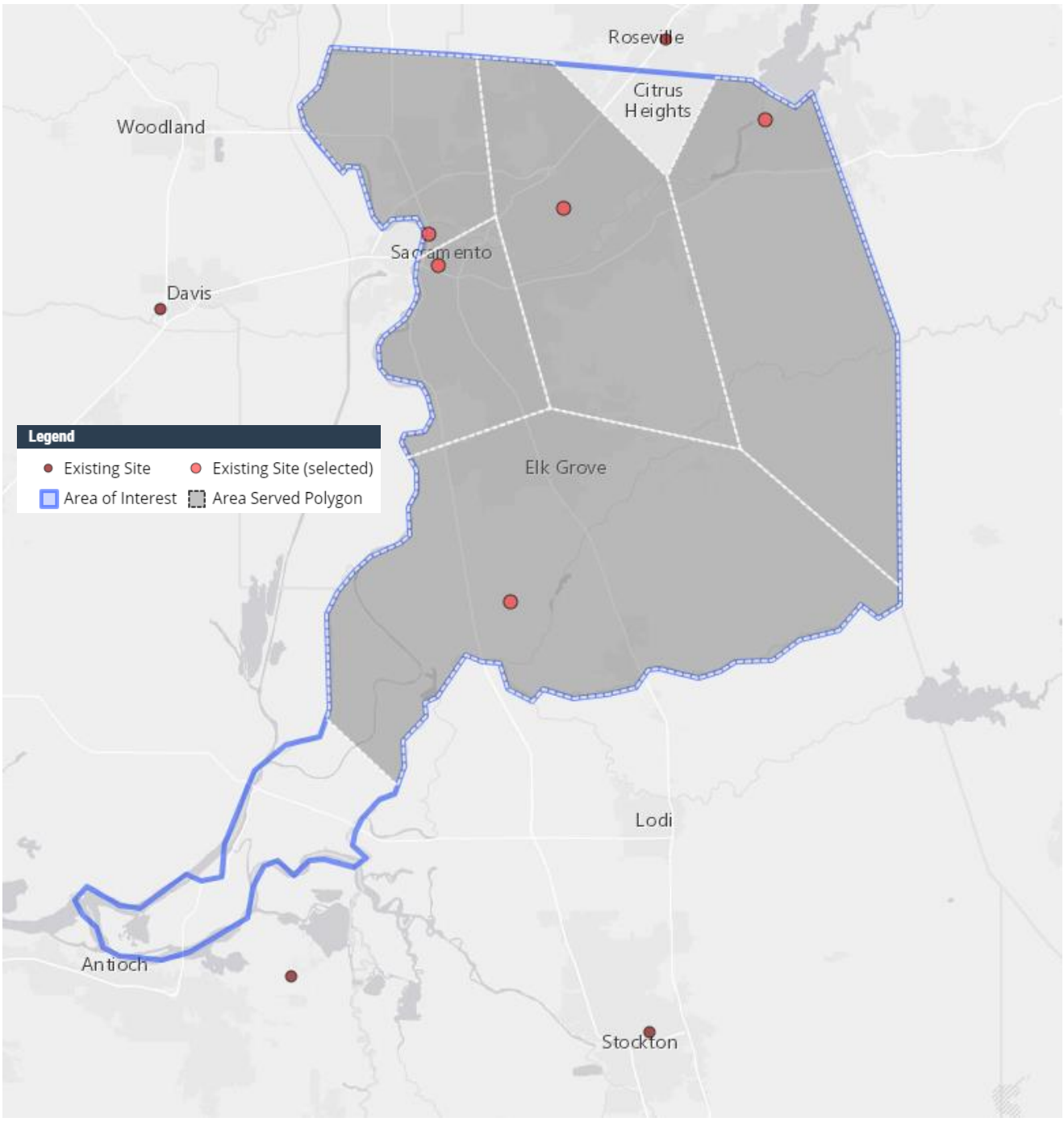


Figure 47 – NO_2 Network Area-Served analysis.

NO_2 Data Analyses

The NO_2 data analysis was conducted based on the following methods:

- measured concentrations and exceedance probability,
- deviation from NAAQS,
- monitor-to-monitor correlation,
- trend impact, and
- removal bias.

Measured Concentration and Exceedance Probability

Monitors within the District's ambient air monitoring network shown to have high levels of NO_2, design values close to the standard, and with long historical record ranked the highest for characterizing pollution in an area. Table 50 presents 1-hour and annual NO_2 design value concentrations for 2015 through 2024 (2015-2019 data included for historical context). The exceedance probability was not calculated in the NetAssess2025 v1.1 tool and is therefore not included in this analysis.

Table 50 – Concentration analysis for NO_2 monitors serving Sacramento County (source: EPA AQS).

Station Name	Valid Three-Year Calculated 1-hr NO_2 Design Value (ppb)*									
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
DPM		39	37	33	33					28
TST	51	48	47	51	54	54	48	45	41	41
BRU	29	25	22	23	23	22				
FOL**		22	20	20						
BER***										

Station Name	Valid Annual NO_2 Design Value (ppb)*									
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
DPM	7	6	6	6	6			6	4	5
TST	11	10	10	9	9		7	8	7	7
BRU	5	3	3	4	3	3		3	3	3
FOL**	3	3	2	3						
BER***		13		12	12	11			9	10

TST – Sacramento-1309 T Street FOL – Folsom-Natoma St.
DPM – Sacramento-Del Paso Manor BRU – Elk Grove-Bruceville Rd. BER – Sacramento-Bercut Drive
* Unless otherwise noted, invalid design values are the result of sampler malfunctions and unmet annual completeness requirements per 40 CFR Part 58 Appendix D (source: station logs and data certification letters). Blank cells indicate invalid design values.
** Folsom-Natoma St. site was offline due to site construction until December 2020.
*** Sacramento-Bercut Drive came online October 2015.

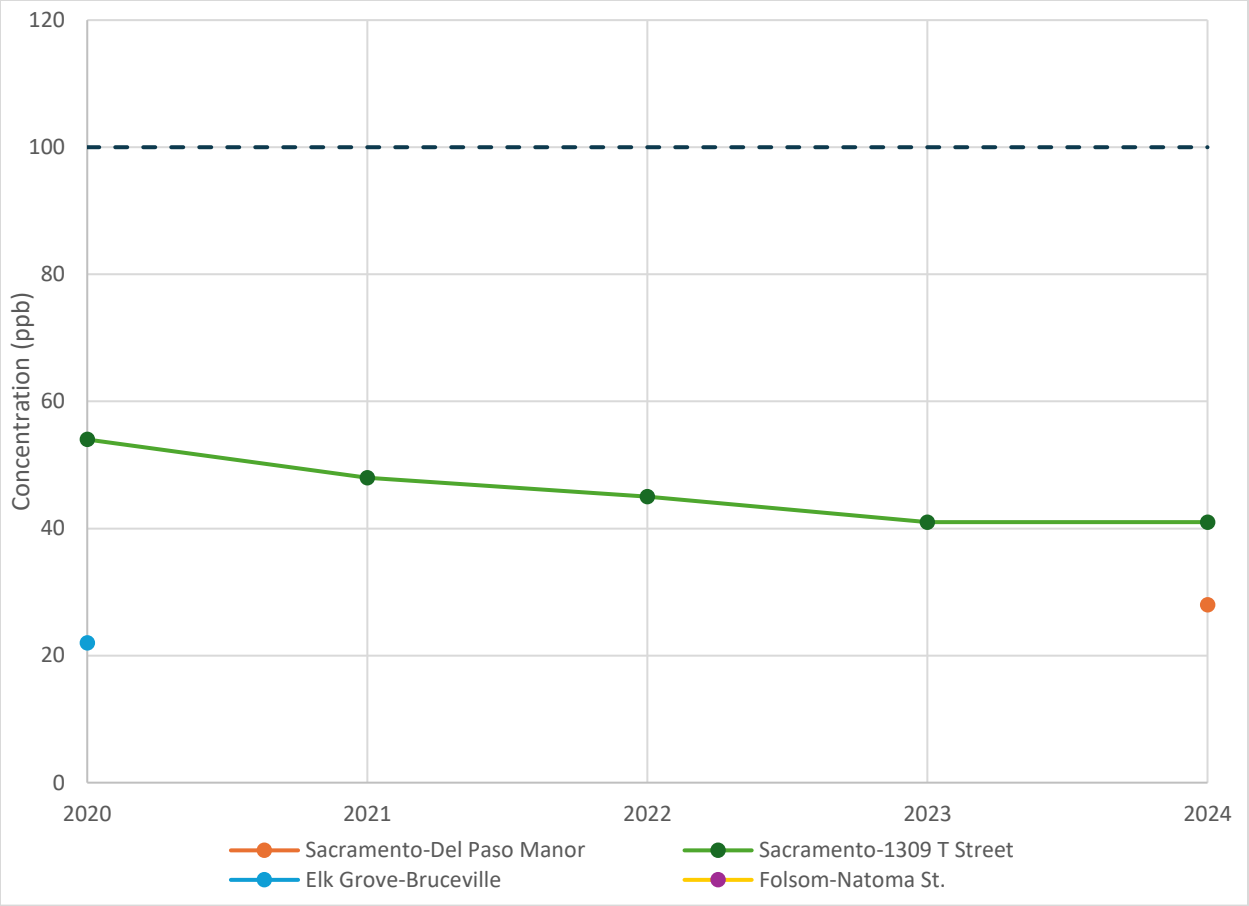


Figure 48 – 1-hr NO_2 concentration trend (Source: EPA AQS).

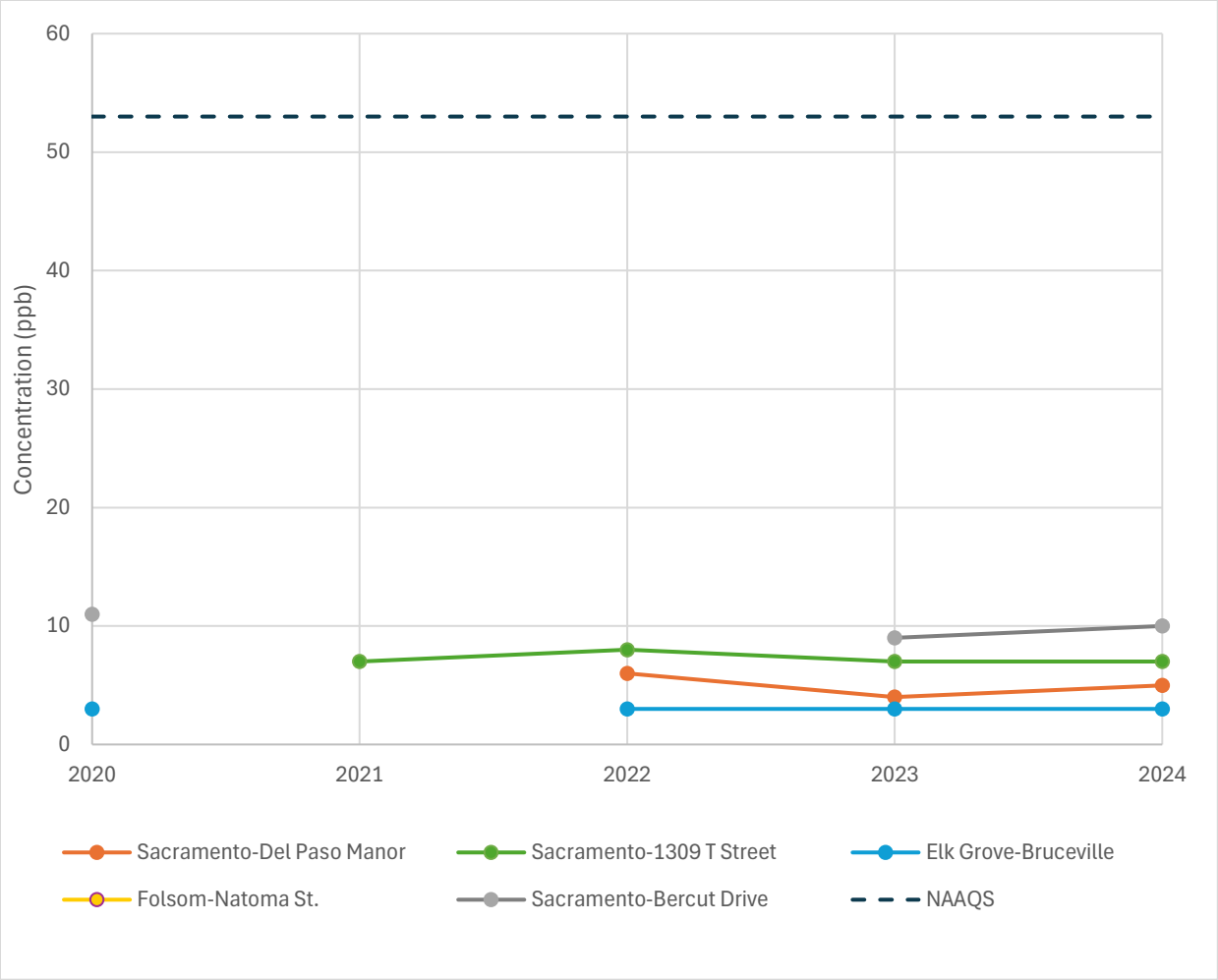


Figure 49 – Annual NO_2 concentration trend (Source: EPA AQS).

Figure 48 and Figure 49 present the 2020 through 2024 valid design values for NO_2 monitors serving Sacramento County. As described in the Network Assessment Guidance, "[m]onitors that measure high concentrations or design values are ranked higher than monitors that measure low concentrations." Per the introduction to this document, sites were ranked based on the average concentrations used to determine the design value (DV_{ave}) for the assessment period (2020-2024). The thresholds for this analysis used the 24-hour NAAQS and are as follows:

Monitor Rank	Criteria
High	$DV_{ave} > 100$ ppb
Medium	100 ppb $\geq DV_{ave} \geq 90$ ppb
Low	$DV_{ave} < 90$ ppb

Table 51 summarizes the ranking for each of the monitoring sites. Although all sites ranked low for measured concentrations and exceedance probability, continued monitoring at all existing locations remains critical for SIP implementation and progress tracking. It is important to note that aside from the

NAAQS for NO_2, NO_2 also serves as a precursor in ozone formation – an important consideration given the ozone nonattainment designation for SFNA for the ozone NAAQS.

Table 51 – Measured concentrations ranking.

Station Name	Measured Concentrations
Sacramento-Del Paso Manor	Low
Sacramento-1309 T Street	Low
Elk Grove-Bruceville Rd.	Low
Folsom-Natoma St.	Low
Sacramento-Bercut Drive	Low

Deviation from NAAQS

The thresholds for this analysis, as outlined in the Introduction to this document, use the 1-hour and annual NAAQS and are as follows:

Monitor Rank	Criteria (1-hour)	Criteria (annual)
High	|Deviation| < 10 ppb	|Deviation| < 5.3 ppb
Medium	10 ppb ≥ |Deviation| ≥ 20 ppb	5.3 ppb ≥ |Deviation| ≥ 10.6 ppb
Low	|Deviation| > 20 ppb	|Deviation| > 10.6 ppb

As shown in Table 52, the deviation from NAAQS analysis shows for both the 1-hr and the annual NAAQS, all sites having values exceeding 20% of the NAAQS (20 ppb and 10 ppb respectively). This corresponds to the lowest ranking based on the Network Assessment Guidance that "[s]ites measuring concentrations (design values) that are very close to the NAAQS exceedance threshold are ranked highest in this analysis." As design values for both averaging times are much lower than the NAAQS and to avoid low bias being applied to monitors without valid design values, for the NO_2 analysis only, the two standards were combined to provide a single ranking for sites with valid design values.

Table 52 – 2024 1-hr and annual NO_2 design value and deviation from NAAQS analysis.

Station Name	2024 1-hr NO_2 Design Value (ppb)	Deviation from 1-hr NAAQS (ppb)	2024 Annual NO_2 Design Value (ppb)	Deviation from Annual NAAQS (ppb)	Ranking
Sacramento-Del Paso Manor	28	72	5	48	Low
Sacramento-1309 T Street	41	59	7	46	Low
Elk Grove-Bruceville Rd.			3	50	Low
Folsom-Natoma St.					
Sacramento-Bercut Drive			10	43	Low

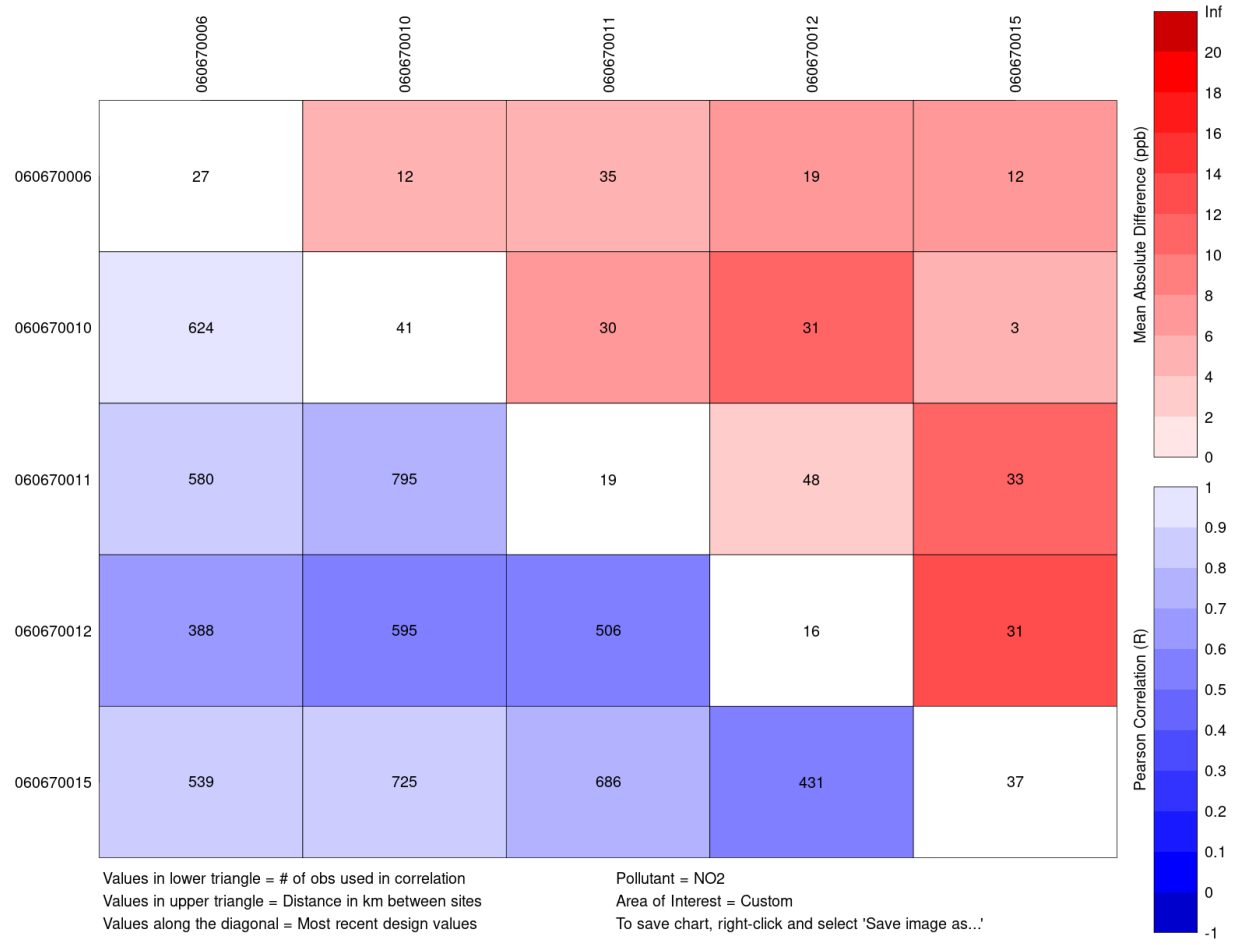
NO_2 Monitor-to-Monitor Correlation Analysis

NO_2 concentrations were compared to examine their relationships using a correlation matrix analysis. Figure 50 shows a correlation matrix for all NO_2 monitors in Sacramento County generated by the NetAssess2025 v1.1 tool. The raw values from the correlation matrix are shown in Table 53. Included in the matrix are the square of the Pearson correlations (R^2), mean absolute differences, number of observations used in the correlation, distance in kilometers between the sites, and the 2023 design values. The correlation matrix helps to determine sites within the network that exhibit similar measurement patterns. Sites with high correlation, low absolute difference, and close proximities are considered to provide comparable information.

Based on thresholds outlined in the Introduction of this document, the criteria for this analysis are as follows:

Monitor Rank	Criteria
High (meets 1 or less of the criteria)	Highest pairwise $R^2 > 0.75$
Medium (meets 2 of the criteria)	Distance between sites < 12 km
Low (meets 3 of the criteria)	Mean Difference < 3.19 ppb

Monitor-to-monitor correlation analysis found that based on R^2 values, only Sacramento-Del Paso Manor and Sacramento-1309 T Street were moderately correlated with each other ($R^2 > 0.75$). All other sites had R^2 values less than 0.75. This lack of correlation between sites not only highlights the difference in characteristics of the station locations with respect to NO_2 sources (e.g. near-road, background), but also the variability in NO_2 concentrations throughout the county. No monitors met the criteria for mean difference, further reinforcing the low correlation between sites. The last factor to include in this analysis is the proximity of the stations to each other. In general, sites are more correlated the closer they are together. There are three pairs of sites which meet the criteria for distance between sites. These are Sacramento-Del Paso Manor and Sacramento-1309 T Street, Sacramento-Del Paso Manor and Sacramento-Bercut Drive, and Sacramento-1309 T Street and Sacramento-Bercut Drive. Every other site in the network is at least 17 km from each other.



060670010 – Sacramento-1309 T Street 060670012 – Folsom-Natoma St.
060670006 – Sacramento-Del Paso Manor 060670011 – Elk Grove-Bruceville Rd. 060670015 – Sacramento-Bercut Drive

Figure 50 – Correlation matrix for NO_2 monitors serving Sacramento County (source: NetAssess2025 v1.1). The lower triangle refers to the blue shaded boxes and the upper triangle refers to the red shaded boxes. Most recent design values are for the 2023 design value year.

Table 53 – Monitor to monitor correlation data. **Red and bold** represent high correlation ($R^2 > 0.75$, distance between sites < 25% of maximum distance between any two sites, mean difference < 25% of maximum mean difference between any two sites).

Site #1	Site #2	Distance Between Sites (km)	Number of Observations	Pearson Correlation	R^2	Mean Difference (µg m^{-3})
DPM	TST	**12**	624	0.9098	**0.828**	5.1995
DPM	BRU	35	580	0.8159	0.666	4.3293
DPM	FOL	19	388	0.6167	0.380	7.5825
DPM	BER	**12**	539	0.8589	0.738	6.8293
TST	BRU	30	795	0.7782	0.606	7.9748
TST	FOL	31	595	0.5991	0.359	11.2343
TST	BER	**3**	725	0.8561	0.733	5.3113
BRU	FOL	48	506	0.5441	0.296	3.5375
BRU	BER	33	686	0.7382	0.545	10.2638
FOL	BER	31	431	0.5413	0.293	12.7749

TST – Sacramento-1309 T Street FOL – Folsom-Natoma St.
DPM – Sacramento-Del Paso Manor BRU – Elk Grove-Bruceville Rd. BER – Sacramento-Bercut Drive

This monitor-to-monitor correlation analysis shows that no sites in Sacramento County meet all three of the thresholds to being considered similar (rank low). The rankings for this analysis are summarized in Table 54.

Table 54 – Monitor-to-monitor correlation ranking.

Station Name	Monitor-to-Monitor Rank
Sacramento-Del Paso Manor	Medium
Sacramento-1309 T Street	Medium
Elk Grove-Bruceville Rd.	High
Folsom-Natoma St.	High
Sacramento-Bercut Drive	High

Trend Analysis

Monitors that have a long historical record are valuable for tracking trends. In this analysis, sites are ranked based on the duration of the continuous measurement record as described in the Introduction to this document. The thresholds for this analysis are as follows:

Monitor Rank	Criteria
High	Trend ≥ 30 years
Medium	30 years > Trend ≥ 10 years
Low	Trend < 10 years

Table 55 shows the year that NO_2 measurements began at each of the stations serving Sacramento County. Based on this analysis, Elk Grove-Bruceville Rd. and Sacramento-Del Paso Manor have record lengths, which meets the threshold outlined in the Introduction to this document to rank as high. Sacramento-1309 T Street and Folsom-Natoma all rank as medium. Sacramento-Bercut Drive is the only site that ranks as low in this analysis but is a required Near Road site under 40 CFR Part 58.

Table 55 – Date of operation for each NO_2 station serving Sacramento County.

Station Name	Begin Year of NO_2 Operation	Trend Rank
Sacramento-Del Paso Manor	1980	High
Sacramento-1309 T Street	1995	Medium
Elk Grove-Bruceville Rd.	1992	High
Folsom-Natoma St.*	1996	Medium
Sacramento-Bercut Drive	2015	Low

* Folsom-Natoma St. site was offline due to construction in late July 2019.

NO_2 Monitor Removal Bias Analysis

Each monitor was analyzed to determine the change in spatial concentrations interpolated across Sacramento County if the monitor was removed. Table 56 and Figure 51 present the results of the removal bias analysis and the maximum change in NO_2 concentrations in Sacramento County if each NO_2 monitor in the District's network was individually removed as calculated by the NetAssess2025 v1.1 tool.

The change in concentration at a site indicates the bias which may be observed if the individual monitor were removed. Per the Network Assessment Guidance, "[t]he greater the bias, the more important the site is for interpolation." Based on the thresholds outlined in the Introduction to this document, the thresholds for this analysis are as follows, where MRB is the mean relative bias:

Monitor Rank	Criteria	Criteria (NH Removed)
High	|MRB| ≥ 6.2 ppb	|MRB| ≥ 6.2 ppb
Medium	6.2 ppb > |MRB| ≥ 2.0 ppb	6.2 ppb > |MRB| ≥ 2.0 ppb
Low	|MRB| < 2.0 ppb	|MRB| < 2.0 ppb

Folsom-Natoma is the only monitor which ranked high. The Sacramento-Del Paso Manor, Elk Grove-Bruceville Rd., and Sacramento-Bercut Drive monitors rank as medium, and the Sacramento-1309 T Street monitor is the only site that ranks low in this analysis. Results are tabulated in Table 56 and Table 57.

Table 56 – NO_2 monitoring network removal bias results.

Station Name	Mean Removal Bias (ppb)
Sacramento-Del Paso Manor	3.1
Sacramento-1309 T Street	-0.8
Elk Grove-Bruceville Rd.	4.0
Folsom-Natoma St.	8.2
Sacramento-Bercut Drive	-3.2

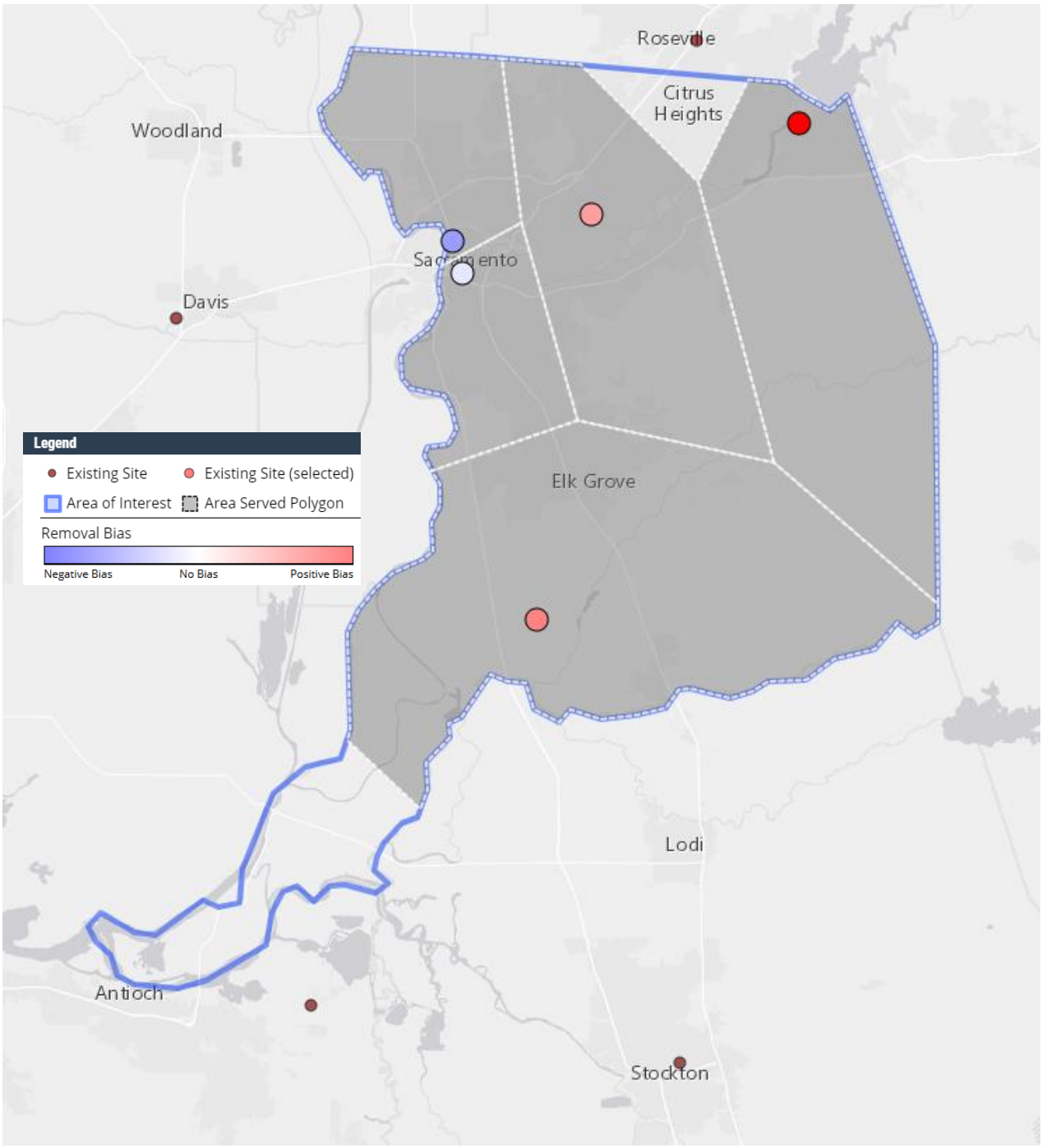


Figure 51 – NO_2 Removal bias analysis in Sacramento County.

Table 57 – Removal bias rank.

Station Name	Removal Bias Rank
Sacramento-Del Paso Manor	Medium
Sacramento-1309 T Street	Low
Elk Grove-Bruceville Rd.	Medium
Folsom-Natoma St.	High
Sacramento-Bercut Drive	Medium

NO_2 Monitoring Sites

The number of sites in the Sacramento MSA are listed in Table 58. Federal regulations require that a minimum of one monitor be placed in any urban area with a population greater than 1,000,000 people to assess area-wide NO_2 concentrations. There are five (5) NO_2 monitoring sites currently operational in the District's network to characterize area-wide NO_2 (BER, BRU, DPM, FOL, TST) as shown in Figure 46.

According to 40 CFR Part 58, CBSAs with a population above 1,000,000 are required to place a monitor near a major roadway where maximum concentrations are expected to occur. Additional near-road NO_2 monitoring stations are required for any CBSA with a population of 2,500,000 persons or more, or in a CBSA with a population of 1,000,000 or more persons that has one or more roadway segments with an AADT count of 250,000 or greater. Sacramento-Bercut Drive became operational in November 2015 and has been sited to meet the population-based microscale near-road NO_2 monitoring requirement in 40 CFR 58, Appendix D, Section 4.3.2.

AADT data for Sacramento County were obtained from the California Department of Transportation[62]. The most recent available AADT data is from 2022. In 2022, the highest AADT count of 309,000 were registered along U.S. Route 50 near the Yolo/Sacramento County line and along U.S. Route 50 near the Junction or Routes 51 and 99. This traffic count shows AADT values are greater than the 250,000 AADT threshold presented in 40 CFR 58, Appendix D, Section 4.3.2(a), requiring a second near-road monitoring site to be located within the Sacramento CBSA. From 2015-2022, 2020 was the only year below the 250,000 threshold. The trend in maximum AADT values from 2015 to 2022 is shown in Figure 52. From 2015 to 2020, the maximum AADT counts in Figure 52 are located along State Route 50 near Junction Route 160 between 15th and 16th Street. In 2021, the maximum count location changed to Route 99 near the Junction with Routes 50, 51, and 5. In 2022, the maximum count location moved to U.S. Route 50 near the Yolo/Sacramento County line and along U.S. Route 50 near the Junction or Routes 51 and 99. Traffic volumes in 2021 increased from 2020, potentially reflecting effects of post-pandemic recovery and a return to in-person activities following the easing of public health orders related to the COVID-19 pandemic. Traffic volumes are expected to remain above the 250,000 threshold. Evaluation of 2023 and 2024 data, once available, will help confirm the location for a second near-road monitor.

[62] California Department of Transportation. https://dot.ca.gov/programs/traffic-operations/census

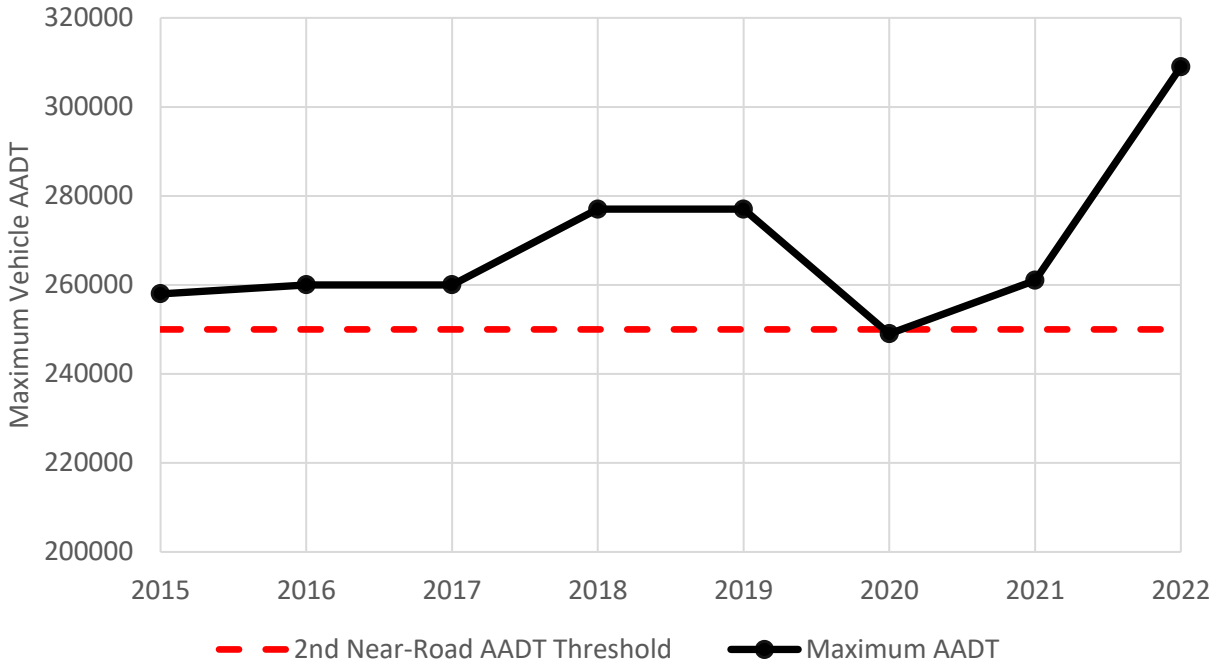


Figure 52 – Maximum annual average daily traffic (AADT) in Sacramento County for the years 2015 to 2022 and the 250,000 vehicles threshold for a second near-road monitoring site per 40 CFR Part 58 Appendix D, 4.3.2(a) (source: California Department of Transportation, CalTrans). 2015-2020 values are located along State Route 50 near Junction Route 160 between 15th and 16th Street.

The District analyzed AADT as well as Fleet Equivalent Annual Average Daily Traffic (FEAADT) in Sacramento County to determine the most appropriate location for near-road monitoring. The location of the highest FEAADT in 2021 was along Interstate Route 5 near I street and in 2022 was along Route 99 near the Junction of Routes 50, 51, and 5. These locations are illustrated in Figure 53. Included in Figure 53 are the locations of the current NO_2 monitoring stations (black), including the current District near-road monitoring site, Sacramento-Bercut Drive (green). The Sacramento-Bercut Drive station was established and located as near as possible to the location of the historically highest calculated FEAADT in Sacramento County, along Interstate 5 near I Street (blue square). The highest truck AADT counts fro m the most recent 2022 data are located along the I-5 corridor through Sacramento (greater than the 95^{th} percentile, red dots). This data indicates that the Sacramento-Bercut Drive station is measuring NO_2 concentrations corresponding to the highest truck traffic in Sacramento County. This is important as

heavy-duty trucks comprise nearly a third of California statewide NO_X emissions, whereas light-duty and medium-duty vehicles combined make up just over a tenth of those same emissions[63].

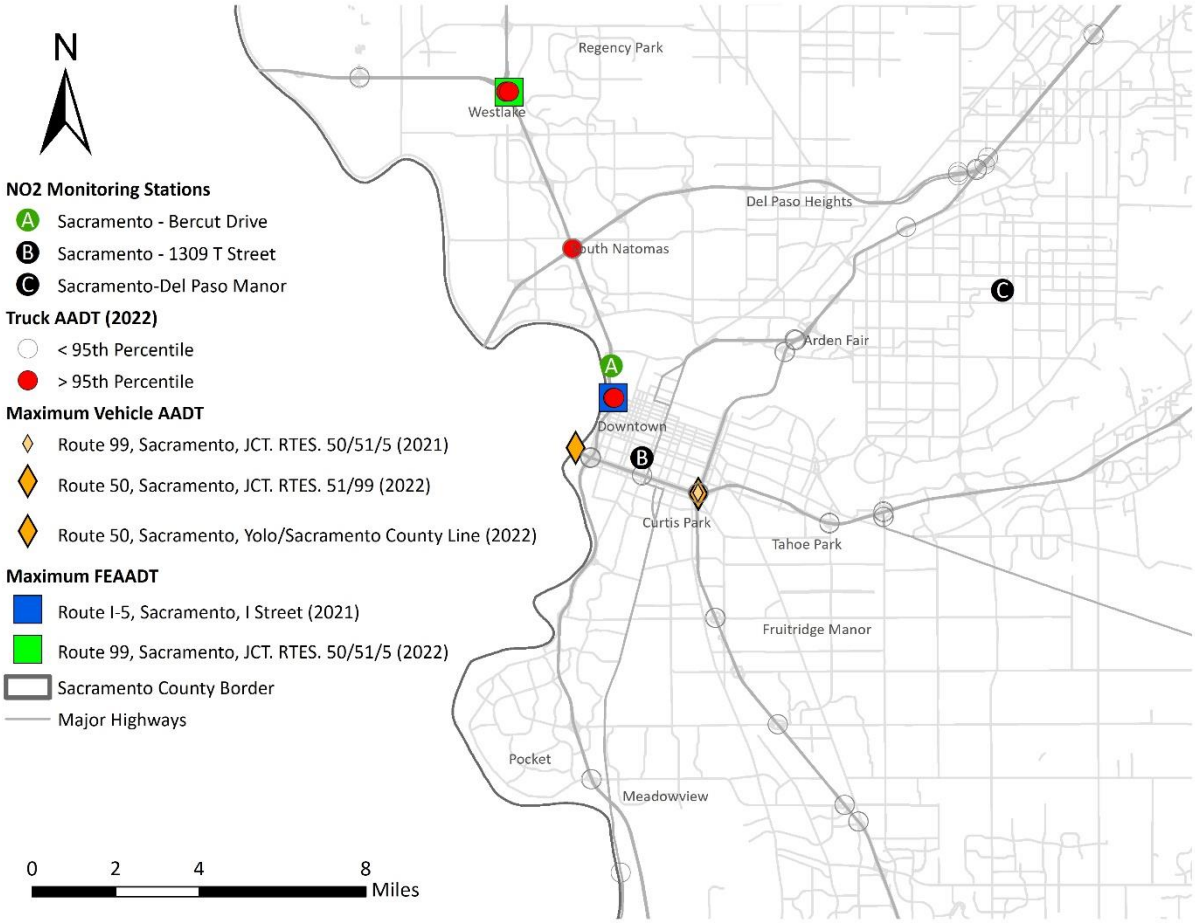


Figure 53 – Locations of greater than the 95th percentile of 2022 truck annual average daily traffic (AADT) (red dots), maximum vehicle AADT (orange diamonds), maximum fleet equivalent AADT (FEAADT; blue square – 2021, green square – 2022), the District near-road site (green dot), and the major highways within Sacramento County (AADT source: California Department of Transportation, CalTrans).

The highest total vehicle traffic volume in 2022 were measured along U.S. Route 50 (orange diamond) at the Yolo and Sacramento County line as well as southeast of the downtown core of Sacramento near the junction of Routes 51 and 99. According to the CalTrans AADT data, the highest vehicle volume measured where truck volumes were also measured were along Interstate 80 near Greenback Lane at 257,000 (not indicated in Figure 53); therefore, the AADT total vehicle count from Interstate 80 near Greenback Lane was used for comparisons between truck and total vehicle volumes. As shown in Figure

[63] California Air Resources Board, 2020. https://ww2.arb.ca.gov/news/california-adopts-strong-new-regulation-further-reduce-smog-forming-pollution-heavy-duty

54, truck traffic makes up 4.6% of the total vehicle traffic at the I-80 Greenback Lane location as opposed to 9.3% of the total vehicle traffic at the I-5 location. This difference in traffic composition could lead to lower measured NO_2 concentrations at the I-80 location than from the I-5 location even with the increased total vehicle AADT. The Sacramento-Bercut site (site A in Figure 53) is a near-road monitor located about 7 miles south from the highest 2022 truck volume location along State Route 99 (green square) and around 2.5 miles north and 3.8 miles northwest of the two sites with the highest vehicle volume in 2022 (dark orange diamonds). These sites may help to provide preliminary information on population impacts and NO_2 concentrations from the highest AADT counts in the county.

As discussed in the Measured Concentration and Exceedance Probability section of this section, NO_2 design values in Sacramento County, including the near-road Sacramento-Bercut Drive site, all fall well below the NAAQS. As the high vehicular and truck traffic sites changed from every year after 2020, it suggests that evaluating 2023 and 2024 data, once available, would be insightful in confirming the locations of the highest AADT count areas in Sacramento County before undertaking the heavy investment in resources and funding required to locate, install, and operate a second near-road station. The District will continue to monitor traffic count data and will continue to work with EPA and CARB to determine the appropriate timing, location, and funding for a second near-road monitoring site, if necessary.

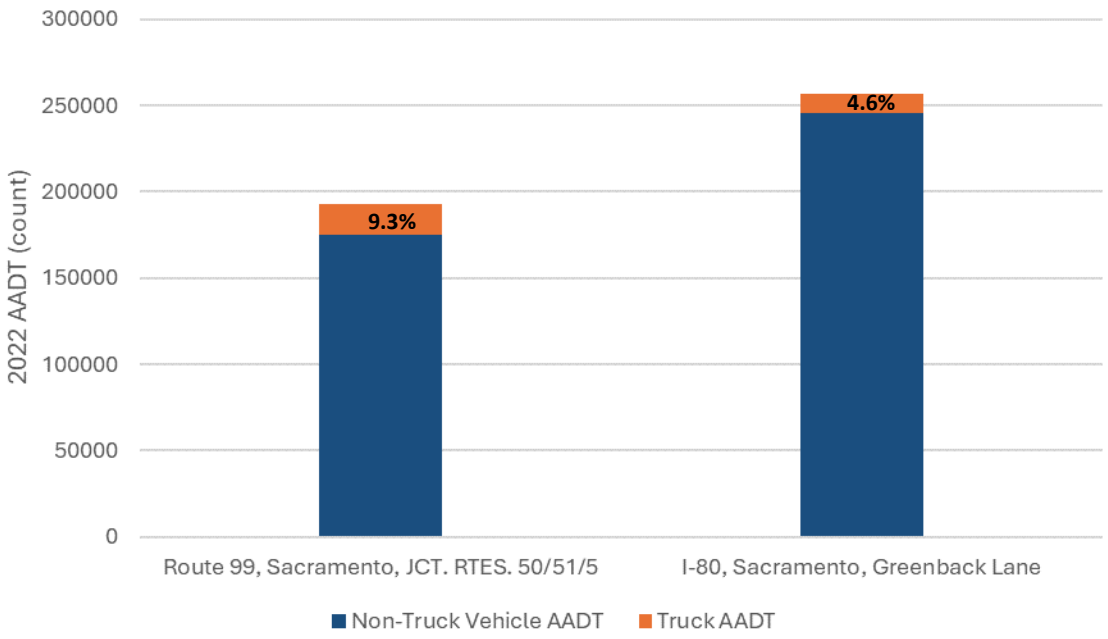


Figure 54 – 2022 vehicle and truck annual average daily traffic along State Route 99 near Junction Routes 50, 51, and 5 and along Interstate 80 near Greenback Lane in Sacramento (source: California Department of Transportation, CalTrans).

Table 58 – NO_2 Monitoring Sites within Sacramento MSA.

Type	Sites in Sacramento MSA	Additional Sites Needed
Area-wide	6	0
Near-road	1	1*

* Sacramento MSA has surpassed the 250,000 vehicles threshold for a second near-road monitoring site per 40 CFR Part 58 Appendix D, 4.3.2(a) using 2022 traffic volumes from the California Department of Transportation. The District is working with EPA and CARB to determine the appropriate timing, location, and funding for a second near-road monitoring site, if necessary.

Conclusions

Table 59 is a summary of the District's NO_2 monitor rankings from the analyses performed in this section. An overall ranking was calculated for each site by assigning a value to each rank (1 – low, 2 – medium, 3 – high) and summing over all analyses.

Table 59 – NO_2 monitor ranking summary. Overall score is shaded red, with highest overall score darkest.

Station Name	Population-Served	Area-Served	Measured Concentrations	Deviation from NAAQS*	Monitor-to-Monitor	Trend	Removal Bias	Overall
Sacramento-Del Paso Manor	High	Medium	Low	Low	Medium	High	Medium	14
Sacramento-1309 T Street	High	Low	Low	Low	Medium	Medium	Low	11
Elk Grove-Bruceville Rd.	Medium	High	Low	Low	High	High	Medium	15
Folsom-Natoma St.	Low	High	Low	NA	High	Medium	High	13
Sacramento-Bercut Drive	Low	Low	Low	Low	High	Low	Medium	10

* For the NO_2 analysis, the 1-hr and annual standards were combined to minimize bias in the overall score due to limited valid design value calculations.

Based on Table 59, Sacramento-Bercut Drive is ranked lowest of the monitors from this analysis; however, these analyses do not take into account that the Sacramento-Bercut Drive site is part of the Near Road network and is specifically designed to sample the highest concentrations of NO_2, which involves sampling very close to a highly trafficked roadway. The highest calculated FEAADT in Sacramento County in 2022 is located at Route 99 near the Junction of Routes 50, 51, and 5, 7 miles north of the Sacramento-Bercut Drive station[64]. Therefore, as this site was installed after many of the other long-term stations in the District network were already established, it has a data-driven specific location to sample. The location next to a busy freeway is reflected in the measured concentrations at the site, as it indeed has the highest annual design values and samples the highest hourly concentrations

[64] Estimated FEAADT is 588,557 vehicles at Sacramento-I Street using 2022 annual average daily truck traffic (source: California Department of Transportation) and EMFAC2017 v1.0.2 emission inventories.

in the county[65]. However, the design values are still below the federal standards and thus the ranking of this site is low in the deviation from NAAQS analysis as well. As the location of this site was specifically chosen to sample near the highest FEAADT in the county from the last 5-year Network Assessment, an important characteristic of the site is that it provides important and timely public information and data for research purposes. Given the reasoning above as well as being required as part of the near road monitoring network per 40 CFR Part 50, the Sacramento-Bercut Drive location is not suitable for removal or relocation. As the design values are far from exceeding the standard in Sacramento County, it is not recommended that new sites be included in the District network. However, due to Sacramento MSA exceeding the threshold for a second near-road monitoring site according to 40 CFR Part 58 (with the exception of 2020 traffic volume as described earlier), the District is working with EPA and CARB to determine the appropriate timing, location, and funding for a second near-road monitoring site if necessary.

In conclusion, the current NO_2 network for Sacramento County meets all federal requirements except for the requirement to add a second near-road station according to 40 CFR Part 58. There are no sites in Sacramento County recommended for removal.

[65] The Sacramento-Bercut Drive site had monitor malfunctions leading to unmet annual completeness requirements per 40 CFR Part 58 Appendix D (source: station logs and data certification letters). As the hourly design value is a three year average, there was no valid hourly design value for the assessment period.

Carbon Monoxide (CO) Network Analysis

Monitoring Objectives

The largest ambient atmospheric sources of carbon monoxide (CO) are cars, trucks and other vehicles or machinery that burn fossil fuels. Indoor sources can include unvented kerosene and gas space heaters, leaking chimneys and furnaces, and gas stoves[66]. Most emissions of CO in Sacramento County according to the 2022 EPA National Emissions Inventory[67] are from mobile sources as seen in Figure 55.

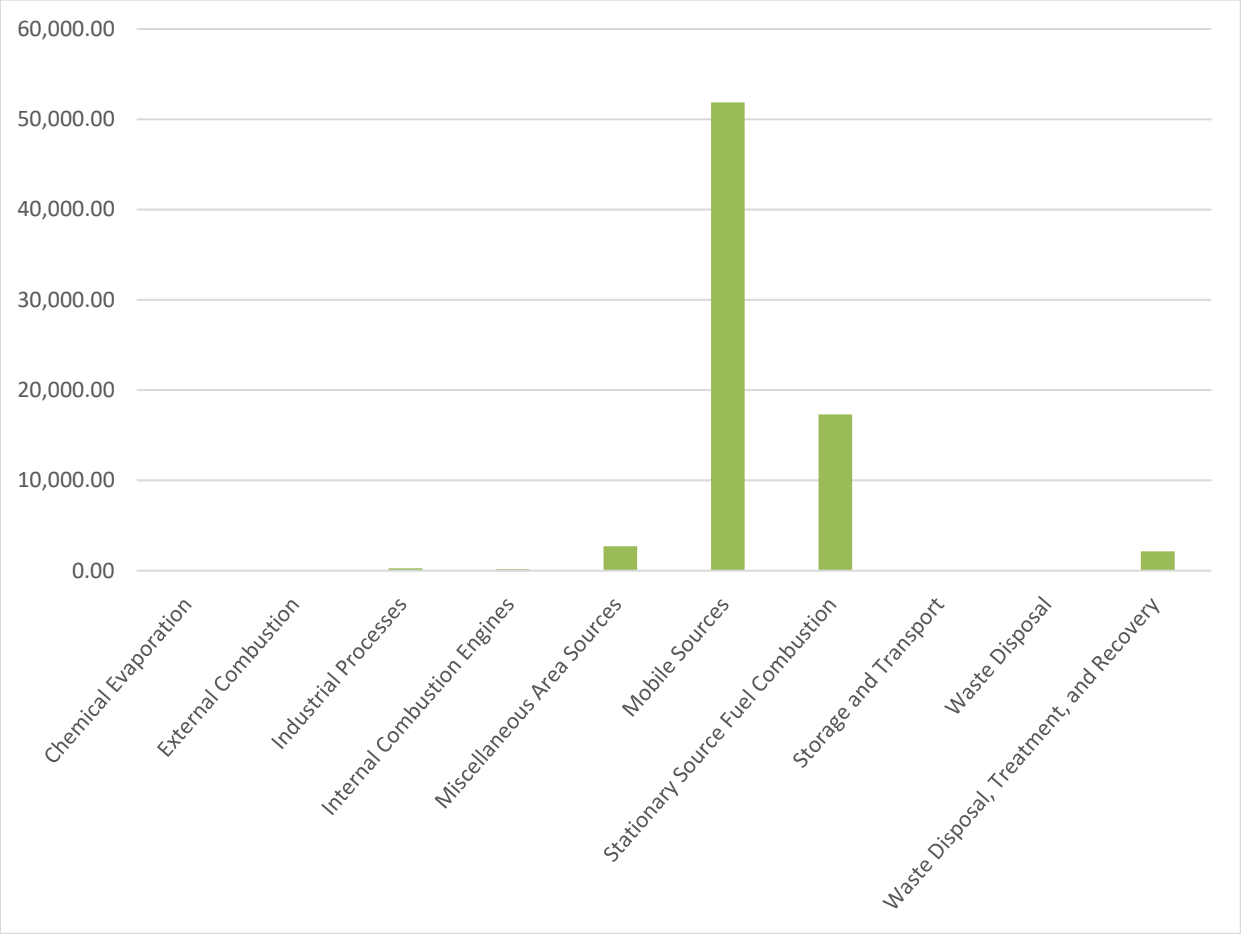


Figure 55 – Total CO emissions in tons by process in Sacramento County as per the 2022 EPA National Emissions Inventory (source: EPA NEI).

Sacramento County has a total of two (2) active SLAMS CO monitoring stations as shown in Figure 56. The North Highlands-Blackfoot station as discussed in the Recent Notable Modifications to the

[66] https://www.epa.gov/indoor-air-quality-iaq/carbon-monoxides-impact-indoor-air-quality
[67] https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform

Network section was discontinued in July 2022. Based on the characteristics of the sites, including the population served and the area served, each site can be designated as background, population oriented, source oriented, or high concentration monitoring locations as listed in Table 60.

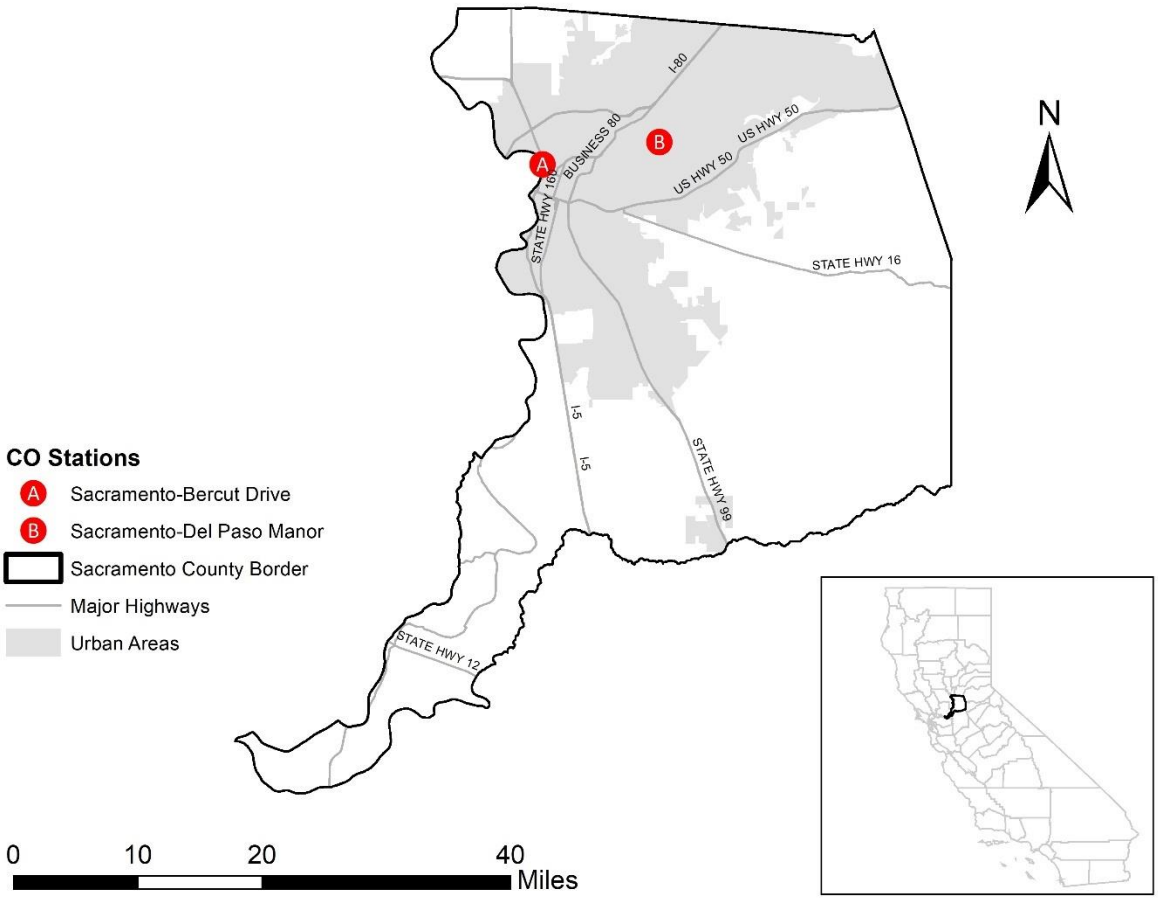


Figure 56 – CO Network in Sacramento County.

Table 60 – Monitoring objective for CO monitors serving Sacramento County.

Site	EPA Network Affiliation*	Monitoring Objective**
Sacramento-Del Paso Manor	NCORE	Population Oriented
Sacramento-Bercut Drive	Near Road	Source Oriented

Note: All monitors are SLAMS (State and Local Air Monitoring Stations) monitor type unless otherwise noted.
* NCORE (National Core Multi-pollutant Monitoring Stations), SPM (Special Purpose Monitor not part of SLAMS), .
** These objectives are consistent with EPA monitoring types as listed in 40 CFR Part 58, Appendix D.

In 2011, EPA retained the existing CO 1-hr NAAQS at a level of 35 parts per million (ppm) measured over 1 hour and retained the CO 8-hr NAAQS at a level of 9 ppm measured over 8 hours. The design value for the 1-hr and the 8-hr NAAQS are not to be exceeded more than once per year. In 2016, the Sacramento region completed the 20-year maintenance period as required by the Clean Air Act and fully reached the attainment classification for CO standard (70 FR 71776).

The District submitted a letter to EPA for the discontinuation of the CO monitor at North Highlands-Blackfoot, and it was approved by EPA on April 20, 2020. The District discontinued the CO monitor on May 20, 2020.

CO Network Area- and Population-Served Analyses

Spatial analysis techniques were evaluated to determine whether the current CO stations meet the objectives of the monitoring network. Thiessen polygons, as described previously, were generated by the NetAssess2025 v1.1 tool to determine the spatial representation of each of the two (2) CO monitoring stations located in Sacramento County. The following sections present the findings for area- and population-served analyses for the CO network. Note that as seen in Table 60, some of the CO stations are affiliated with EPA networks and are therefore required regardless of these analyses.

The population within Sacramento County represented by each monitoring site was counted within the Thiessen polygons by NetAssess2025 v1.1 using 2020 US Census data. Area- and population-served analyses are presented in Table 61. Figure 57 presents a map showing the location and area of influence for each CO monitor.

Following the methods outlined in the Network Assessment Guidance and the thresholds described in the Introduction to this document, the Sacramento-Del Paso Manor site has an area of influence exceeding 500 km^2 while Sacramento-Bercut Drive's area of influence is just under 500 km^2. Sacramento-Del Paso Manor and Sacramento-Bercut Drive serve the most populous portions of Sacramento County and both exceed the threshold of 317,000 persons in this analysis.

Table 61 – Area and population served by CO monitors serving Sacramento County. Darker red in dicates the highest values of population and area served.

Station Name	Population Estimate (persons)	Area (km^2)*	Population-Served Ranking	Area-Served Ranking
Sacramento-Del Paso Manor	924,421	1375	High	High
Sacramento-Bercut Drive	616,465	487	High	Medium

* Population and area estimates based on monitor's area of influence and an approximate boundary of Sacramento County as extracted from the NetAssess2025 v1.1 tool. Population estimated with some overlapping census tracts.

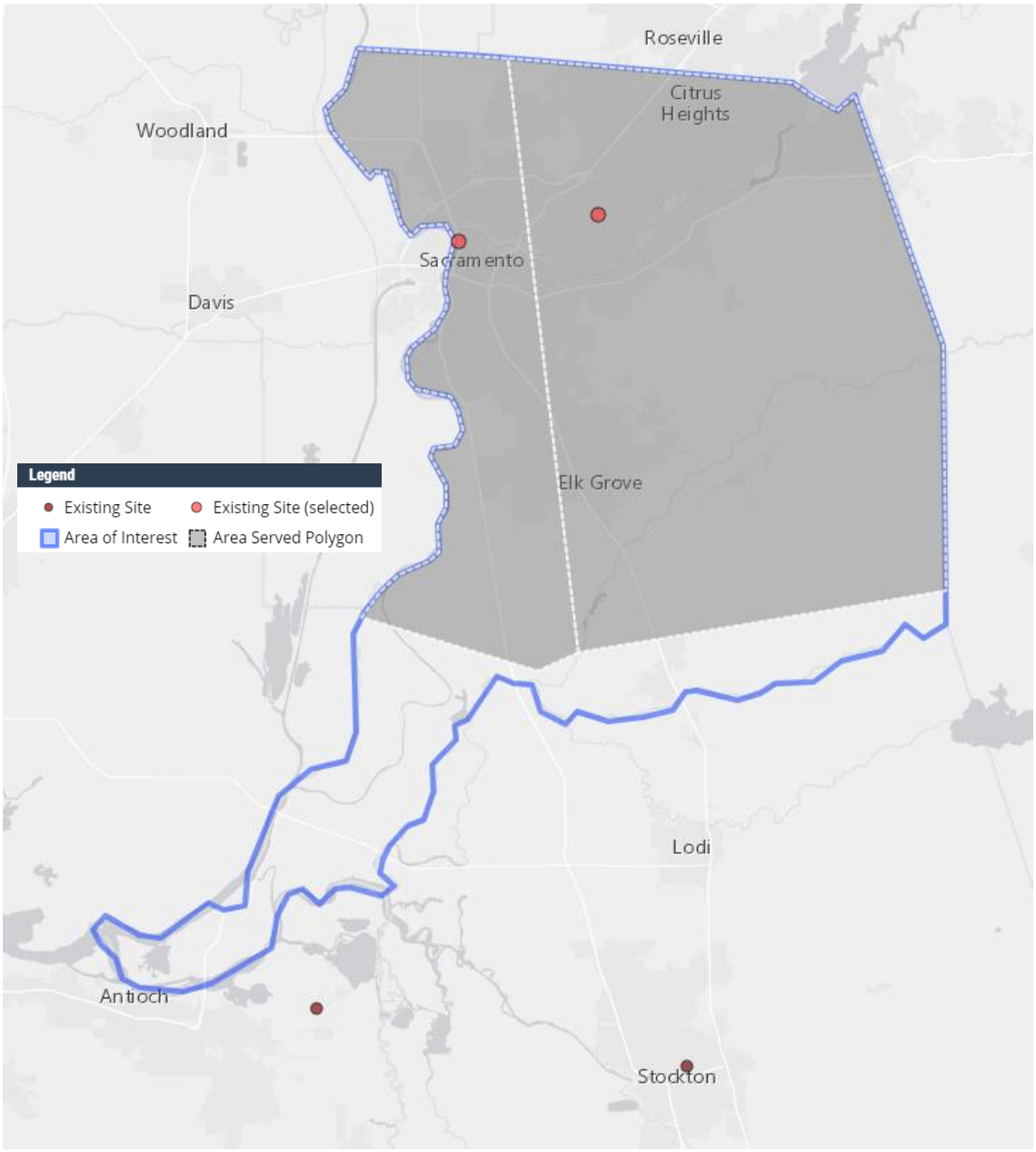


Figure 57 – CO network area-served.

CO Data Analyses

The CO data analysis was conducted based on the following methods:

- measured concentrations and exceedance probability,
- deviation from NAAQS,
- monitor-to-monitor correlation,
- trend impact, and
- removal bias.

Measured Concentration and Exceedance Probability

Monitors within the District's ambient air monitoring network shown to have high levels of CO, design values close to the standard, and with long historical record were considered to have the highest ranking for characterizing pollution in an area. Table 62 presents 1-hour and 8-hour CO design value concentrations for 2015 through 2024 (2015-2019 data included for historical context). The exceedance probability was not calculated in the NetAssess2025 v1.1 tool and is therefore not included in this analysis.

Table 62 – Concentration analysis for CO monitors serving Sacramento County (source: EPA AQS).

	Valid 1-hr CO Design Value (ppb)									
Station Name	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
DPM	2.2	2.4	2.4	3.9	3.9	2.2	2.2	1.3	NA	NA
BER*	NA	1.6	1.6	3.1	3.1	2.3	2.3	2.1	NA	2.1
	Valid 8-hour CO Design Value (ppb)									
Station Name	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
DPM	1.9	1.9	1.7	3.3	3.3	2.0	2.0	1.1	NA	NA
BER*	0.9	1.3	1.3	2.4	2.4	1.6	1.6	1.5	NA	1.5

DPM – Sacramento-Del Paso Manor
BER – Sacramento-Bercut Drive
* Sacramento-Bercut Drive came online October 2015.
** Unless otherwise noted, sections marked as 'not applicable' did not meet data completeness requirements for determining a valid design value.

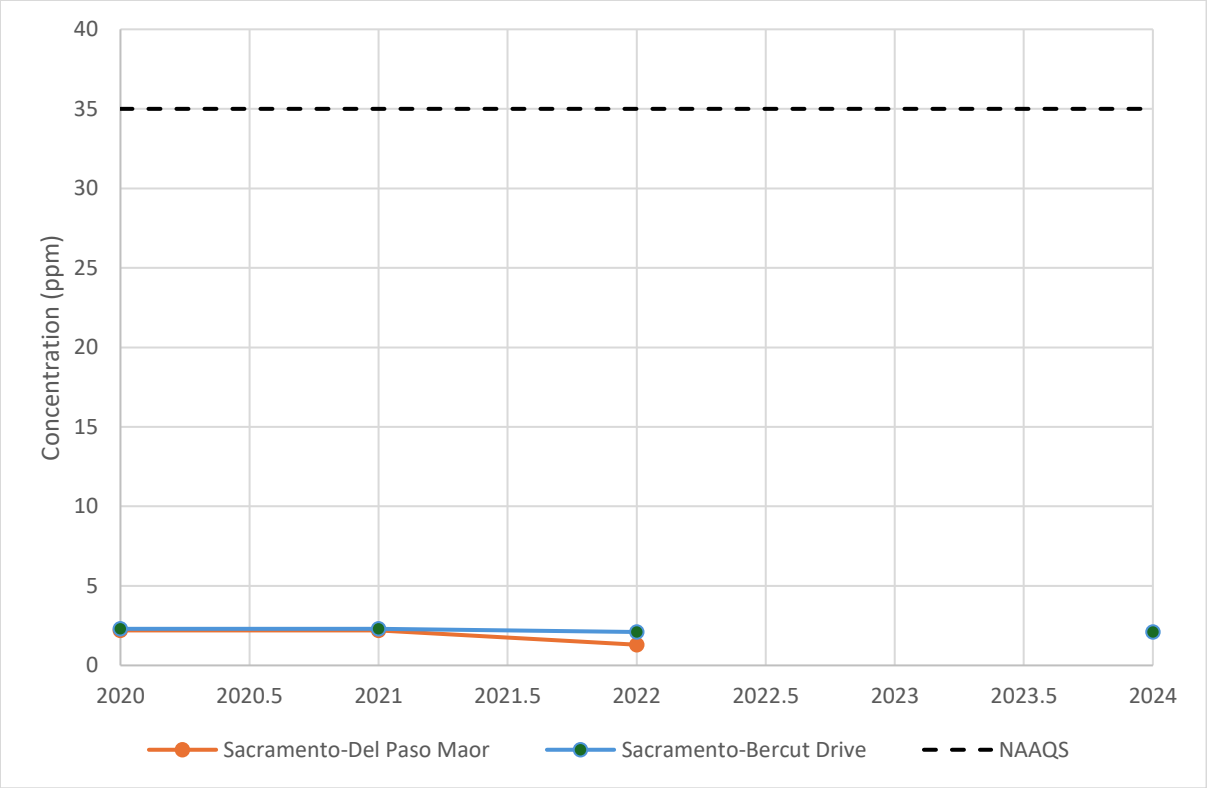


Figure 58 – 1-hr CO concentration trend (Source: EPA AQS).

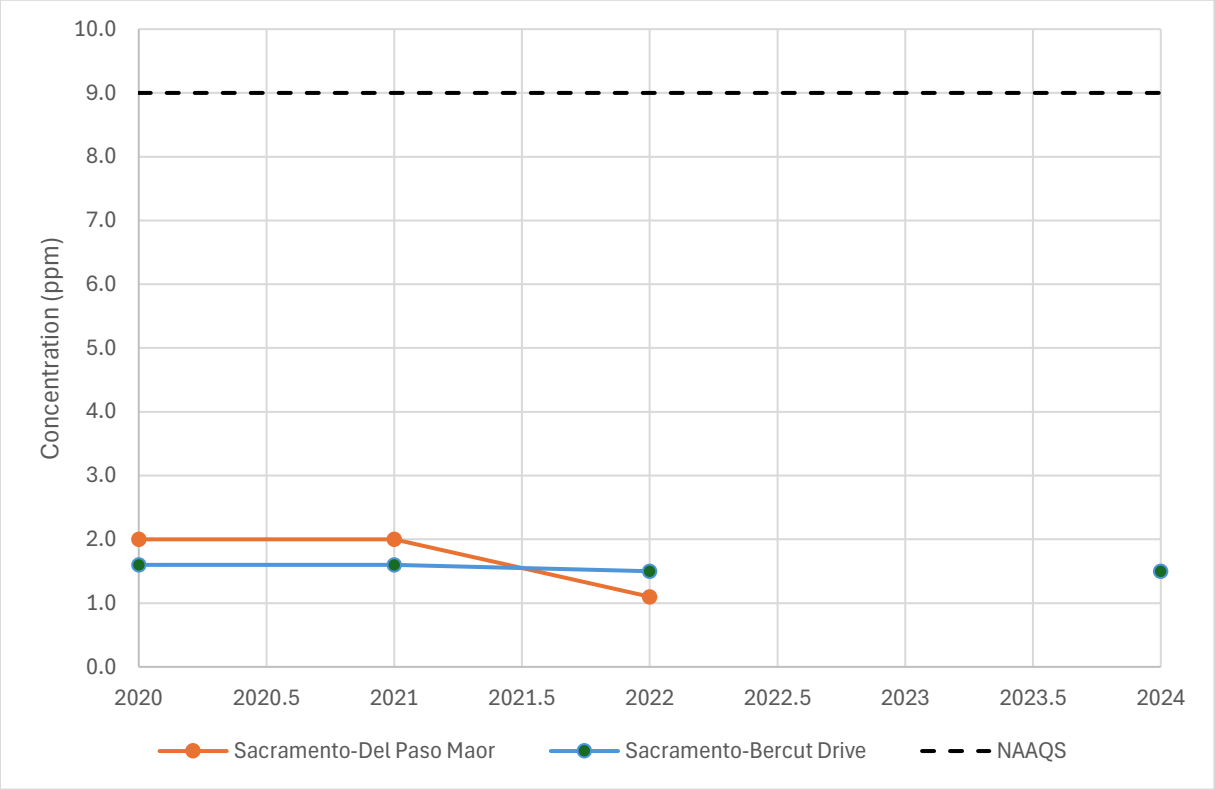


Figure 59 – 8-hr CO concentration trend (Source: EPA AQS).

Figure 58 and Figure 59 present the 2020 through 2024 valid design values for CO monitors serving Sacramento County. Per the introduction to this document, sites were ranked based on the average concentrations used to determine the design value (DV_{ave}) for the assessment period (2020-2024). The thresholds for this analysis used the 24-hour NAAQS and are as follows:

Monitor Rank	Criteria
High	$DV_{ave} > 35$ ppm
Medium	35 ppm ≥ DV_{ave} ≥ 31.5 ppm
Low	$DV_{ave} < 31.5$ ppm

The rankings from this analysis are tabulated in Table 63.

Table 63 – Measured concentrations ranking.

Station Name	Measured Concentrations
Sacramento-Del Paso Manor	Low
Sacramento-Bercut Drive	Low

Deviation from NAAQS

The thresholds for this analysis, as outlined in the Introduction to this document, use the 1-hour and 8-hour NAAQS and are as follows:

Monitor Rank	Criteria (1-hour)	Criteria (8-hour)
High	|Deviation| < 3.5 ppm	|Deviation| < 0.9 ppm
Medium	3.5 ppm ≥ |Deviation| ≥ 7 ppm	0.9 ppm ≥ |Deviation| ≥ 1.8 ppm
Low	|Deviation| > 7 ppm	|Deviation| > 1.8 ppm

As shown in Table 64, the deviation from NAAQS analysis shows for both the 1-hr and the 8-hour NAAQS, all sites having values exceeding 20% of the NAAQS (7 ppm and 1.8 ppm respectively). This corresponds to the lowest ranking based on the Network Assessment Guidance that "[s]ites measuring concentrations (design values) that are very close to the NAAQS exceedance threshold are ranked highest in this analysis."

Table 64 – 2024 1-hr and annual CO design value and deviation from NAAQS analysis.

Station Name	2024 1-hr CO Design Value (ppm)	Deviation from 1-hr NAAQS (ppm)	Ranking	2024 8-hr CO Design Value (ppm)	Deviation from Annual NAAQS (ppm)	Ranking
Sacramento-Del Paso Manor*	1.3	33.7	Low	1.1	7.9	Low
Sacramento-Bercut Drive	2.1	32.9	Low	1.5	7.5	Low

*Sacramento–Del Paso Manor does not have a valid design value for 2023 or 2024; the 2022 design value was used for ranking purposes. Historically, this site has consistently ranked low, supporting the assumption that its 2024 ranking would remain similarly low

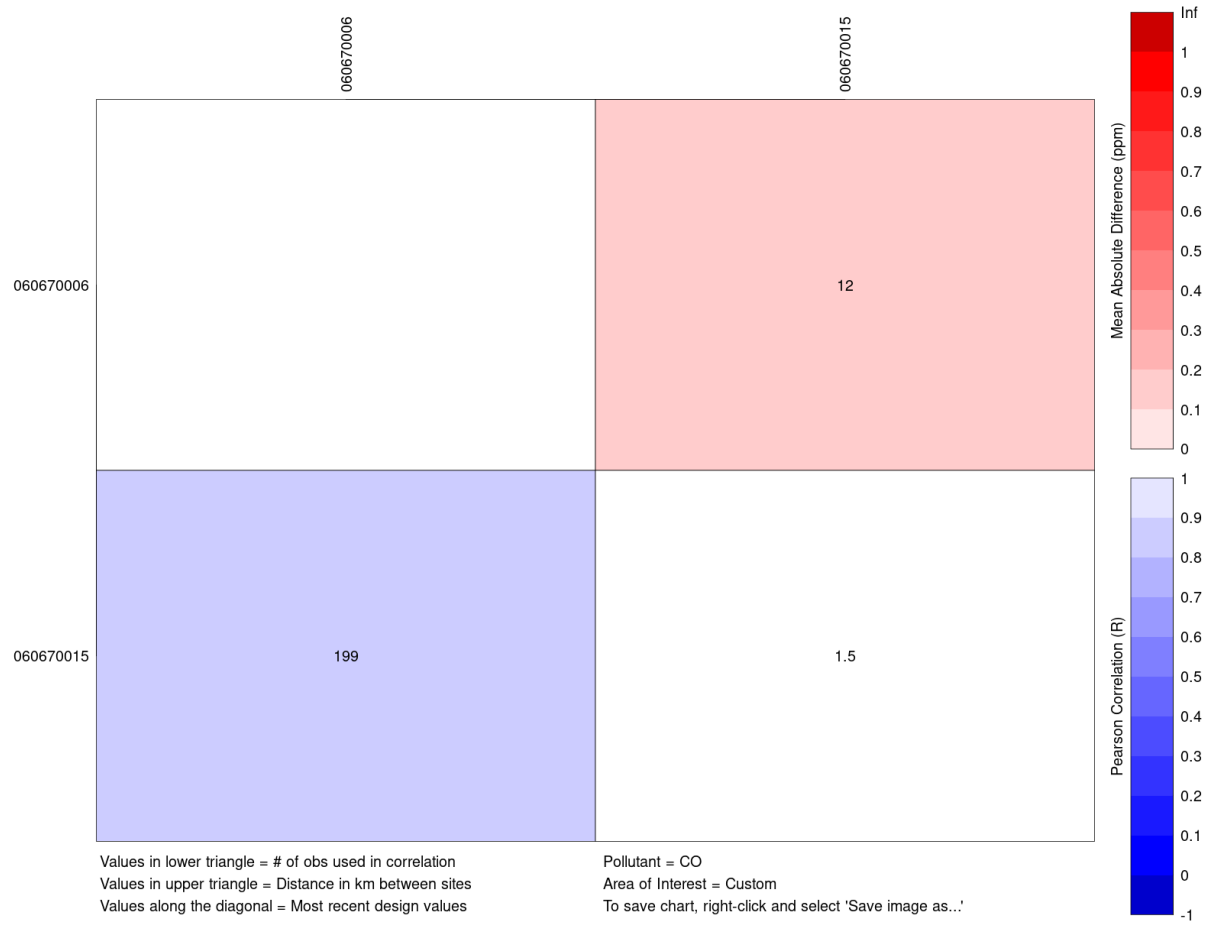
CO Monitor-to-Monitor Correlation Analysis

CO concentrations were compared to examine their relationships using a correlation matrix analysis. Figure 60 shows a correlation matrix for all CO monitors in Sacramento County provided by the NetAssess2025 v1.1 tool. The raw values from the correlation matrix are shown in Figure 60 and Table 65. Included in the matrix are the square of the Pearson correlations (R^2), mean absolute differences, number of observations used in the correlation, distance in kilometers between the sites, and the 2023 design values. The correlation matrix helps to determine sites within the network that has similar data patterns. Sites with high correlation, low absolute difference, and close proximities are closely related in this analysis.

Based on thresholds outlined in the Introduction of this document, the criteria for this analysis are as follows:

Monitor Rank	Criteria
High (meets 1 or less of the criteria)	Highest pairwise $R^2 > 0.75$
Medium (meets 2 of the criteria)	Distance between sites < 4 km
Low (meets 3 of the criteria)	Mean Difference < 0.032 ppm

Monitor-to-monitor correlation analysis found that based on R^2 values Sacramento-Del Paso Manor and Sacramento-Bercut Drive were moderately correlated with each other (R^2 >70%). The lack of correlation in CO values is possibly due to small fluctuations in low numbers as can be seen by the low mean differences. The monitor pair did not meet the criteria for the mean difference nor proximity to each other.



060670006 – Sacramento-Del Paso Manor
060670015 – Sacramento-Bercut Drive

Figure 60 – Correlation matrix for CO monitors serving Sacramento County (source: NetAssess2025 v1.1). The lower triangle refers to the blue shaded boxes and the upper triangle refers to the red shaded boxes. Most recent design values are for the 2023 design value year.

Table 65 – Monitor to monitor correlation data. **Red and bold** represent high correlation ($R^2 > 0.75$, distance between sites < 25% of maximum distance between any two sites, mean difference < 25% of maximum mean difference between any two sites).

Site #1	Site #2	Distance Between Sites (km)	Number of Observations	Pearson Correlation	R^2	Mean Difference (ppm)
DPM	BER	12	199	0.8411	0.707	0.1302

DPM – Sacramento-Del Paso Manor
BER – Sacramento-Bercut Drive

This monitor-to-monitor correlation analysis shows that both sites ranked high for this analysis. It can be noted that a level of uniqueness is to be expected with only two monitors. The Sacramento-Del Paso Manor is required as part of the NCore monitoring network based on Appendix D 40 CFR Part 58. The rankings for this analysis are summarized in Table 66.

Table 66 – Monitor-to-monitor correlation ranking.

Station Name	Monitor-to-Monitor Rank
Sacramento-Del Paso Manor	High
Sacramento-Bercut Drive	High

Trend Analysis

Monitors that have a long historical record are valuable for tracking trends. In this analysis, sites are ranked based on the duration of the continuous measurement record as described in the Introduction to this document. The thresholds for this analysis are as follows:

Monitor Rank	Criteria
High	Trend ≥ 30 years
Medium	30 years > Trend ≥ 10 years
Low	Trend < 10 years

Table 67 shows the year that CO measurements began at each of the stations serving Sacramento County and the site rankings based on this analysis.

Table 67 – Date of operation for each CO station serving Sacramento County.

Station Name	Begin Year of CO Operation	Trend Rank
Sacramento-Del Paso Manor	1981	High
Sacramento-Bercut Drive	2015	Low

CO Monitor Removal Bias Analysis

Each monitor was analyzed to determine the change in spatial concentrations interpolated across Sacramento County if the monitor was removed. Table 68 and Table 69 present the results of the remo val bias analysis and the maximum change in CO concentrations in Sacramento County if each CO monit or in the District's network was individually removed as calculated by the NetAssess2025 v1.1 tool.

The change in concentration at a site indicates the bias which may be observed if the individual monitor were removed. Per the Network Assessment Guidance, "[t]he greater the bias, the more important the site is for interpolation." Based on the thresholds outlined in the Introduction to this document, the thresholds for this analysis are as follows, where MRB is the mean relative bias:

Monitor Rank	Criteria
High	|MRB| ≥ 0.09 ppm
Medium	0.09 ppm > |MRB| ≥ 0.03 ppm
Low	|MRB| < 0.03 ppm

Rankings for this analysis follow the thresholds outlined above and mean removal biases as shown in Table 68. Both Sacramento-Del Paso Manor and Sacramento-Bercut Drive monitors rank as high import ance. Since there are only two monitors within the network, removing one of could reduce resolution. Results are tabulated in Table 69.

Table 68 – CO monitoring network removal bias results.

Station Name	Mean Removal Bias (ppm)
Sacramento-Del Paso Manor	0.1
Sacramento-Bercut Drive	-0.12

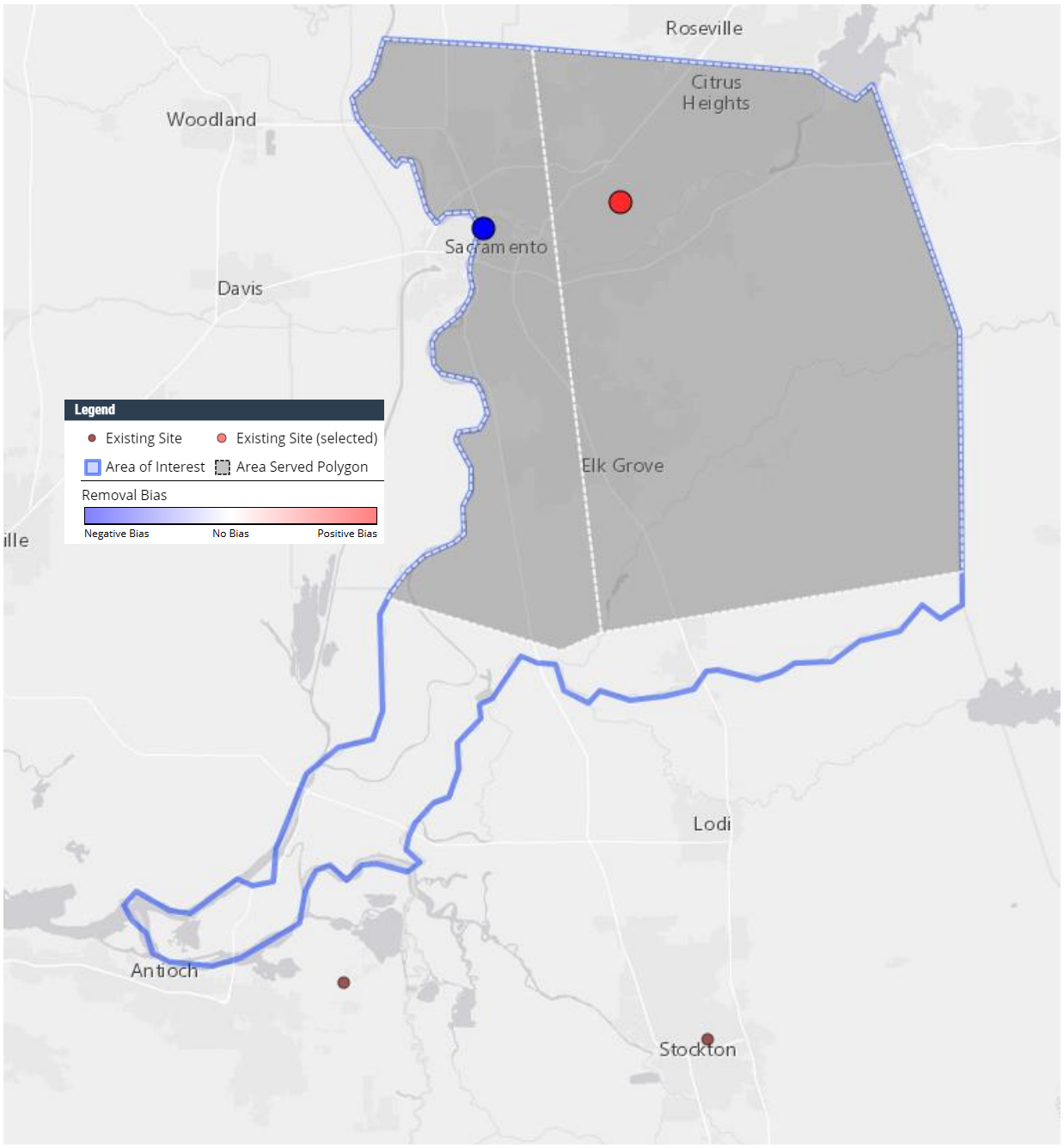


Figure 61 – CO Removal bias analysis in Sacramento County.

Table 69 – Removal bias rank.

Station Name	Removal Bias Rank
Sacramento-Del Paso Manor	High
Sacramento-Bercut Drive	High

CO Monitoring Sites

The number of sites in the Sacramento MSA are listed in Table 70. Note that there are two (2) sites in Sacramento County as shown in Figure 56. One CO monitor is required to operate co-located with a required near-road NO_2 monitor in CBSAs having populations greater than 1,000,000. In addition, NCore sites are required to monitor CO. During this assessment period, the District operated two (2) CO monitoring locations (DPM, BER). As discussed in the NO_2 analyses, the District is required to have a second near-road monitor that includes operation of a CO monitor.

Table 70 – CO Monitoring Sites within Sacramento MSA.

Type	Sites in Sacramento MSA	Additional Sites Needed
Non-near-road	1	0
Near-road	1	1*

* 40 CFR Part 58 requires state or local air monitoring organizations to operate a second near-road monitoring site if any traffic count in the metropolitan area surpasses 250,000 in annual average daily traffic. Sacramento MSA has surpassed the threshold and triggered the requirement. The location of the area that surpassed the traffic count threshold is on State Route 99 near the Junction of Routes 50, 51, and 5. The District is working with U.S. EPA and CARB to determine the appropriate timing, location, and funding for a second near-road monitoring site.

Conclusions

Table 71 is a summary of the District's CO monitor rankings from the analyses performed in this section. An overall ranking was calculated for each site by assigning a value to each rank (1 – low, 2 – medium, 3 – high) and summing over all analyses.

Table 71 – CO monitor ranking summary. Overall score is shaded red, with highest overall score darkest.

Station Name	Population-Served	Area-Served	Measured Concentrations	Deviation from 1-hour NAAQS	Deviation from 8-hour NAAQS	Monitor-to-Monitor	Trend	Removal Bias	Overall
Sacramento-Del Paso Manor	High	High	Low	Low	Low	High	High	High	**18**
Sacramento-Bercut Drive	High	Medium	Low	Low	Low	High	Low	High	**15**

Based on Table 71, the Sacramento-Del Paso Manor site is the highest overall ranked and therefore a key site for CO. Sacramento-Bercut Drive is ranked lowest. The Sacramento-Del Paso Manor and Sacramento-Bercut Drive monitors are required as part of the NCORE and Near Road networks, respectively, according to 40 CFR Part 58 and therefore, are unsuitable for removal.

In conclusion, the current CO network for Sacramento County meets all federal requirements except for the addition of a near-road CO monitor at the required second Near Road station as outlined in more detail in the NO2 section. The network adequately meets District monitoring objectives. There are no sites in Sacramento County suitable for removal nor recommended for addition.

Lead (Pb) Network Analysis

Sources of lead emissions vary from one area to another. In general, in the United States, major sources of atmospheric lead are ore and metals processing and piston-engine aircraft operating on leaded aviation fuel. Other sources include waste incinerators, utilities, and lead-acid battery manufacturers. The highest air concentrations of lead are usually found near lead smelters. As a result of EPA's regulatory efforts to remove lead from motor vehicle gasoline, levels of lead in the air decreased by 89 percent between 1980 and 2010[68].

Sacramento County had one (1) SLAMS lead (Pb) monitoring station, Sacramento-Del Paso Manor, during a small portion of this assessment period in 2020 as it operated from 2012-2020. Rankings are not included in this analysis as there is no longer a Pb monitoring site.

In 2008, EPA strengthened the NAAQS for Pb to a level of 0.15 µg m^{-3}. The design value is the maximum rolling 3-month lead-TSP average over a 3-year period not to be exceeded by any 3-month average. EPA has designated Sacramento County as unclassifiable/attainment for the 2008 federal Pb standard[69].

In Revisions to Ambient Monitoring Quality Assurance and Other Requirements promulgated on March 28, 2016 (81 FR 17248), EPA removed the Pb monitoring requirement at urban NCore sites, provided that the sampler has collected sufficient data to calculate a design value. Sacramento-Del Paso is an NCore site, and the Pb sampler at this site had met the condition to discontinue. Thus, with EPA approval, the District discontinued the lead monitor on May 31, 2020, and no analyses were conducted for lead in this assessment.

[68] https://www.epa.gov/lead/lead-outdoor-air
[69] https://www.federalregister.gov/d/C1-2011-29460; 70 FR 72097.

Sulfur Dioxide (SO_2) Network Analysis

Monitoring Objectives

Sulfur dioxide (SO_2) is a component of sulfur oxides and is emitted into the atmosphere largely through the burning of fossil fuels by power plants and other industrial facilities. Smaller sources of SO_2 include industrial processes, natural sources such as volcanoes, and locomotives, ships and other vehicles and heavy equipment that burn fuel with high sulfur content.

Sacramento County has one (1) SLAMS SO_2 monitoring station, Sacramento-Del Paso Manor, as shown in Figure 62. Based on the characteristics of this site, it is designated as population oriented (see Table 72). Rankings are not included in this analysis as there is only a single SO_2 monitoring site.

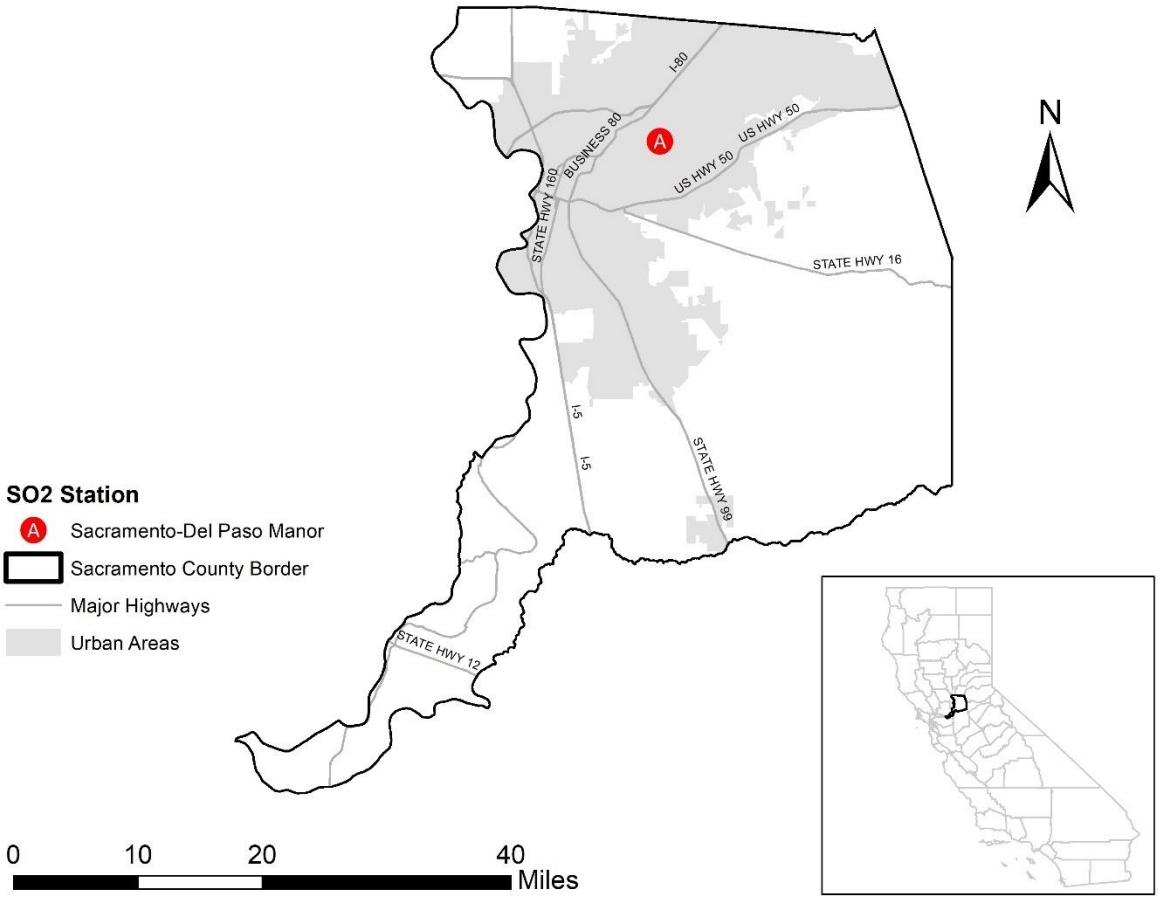


Figure 62 – SO_2 Network in Sacramento County.

Table 72 – Monitoring objective for SO_2 monitors serving Sacramento County.

Site	EPA Network Affiliation*	Monitoring Type**
Sacramento-Del Paso Manor	NCORE	Population Oriented

Note: All monitors are SLAMS (State and Local Air Monitoring Stations) monitor type unless otherwise noted.
* NCORE (National Core Multi-pollutant Monitoring Stations.
** Consistent with EPA monitoring types as listed in 40 CFR Part 58, Appendix D.

In 2010, EPA revised the SO_2 NAAQS by establishing a 1-hour standard at a level of 75 parts per billion (ppb). The design value is the 99th percentile of the annual distribution of daily maximum 1-hour averages, averaged over three years. EPA has designated Sacramento County as attainment for the federal SO_2 standard[70].

SO_2 Network Area- and Population-Served Analyses

As the only monitor representing Sacramento County, population and demographic statistics for the Sacramento-Del Paso Manor monitor represent Sacramento County as a whole. The population within Sacramento County represented by the monitor was provided courtesy of Sacramento County. Area- and population-served data are presented in Table 73.

Table 73 – Area and population served by SO_2 monitors serving Sacramento County.

Station Name	Population Estimate (persons)*	Area (km^2)*
Sacramento-Del Paso Manor	1,585,055	2,574

* Population and area estimates based on 2020 population (source: U.S. 2020 Census[71]

SO_2 Data Analyses

The SO_2 data analysis conducted was used to determine the importance of a site based on the following methods:

- measured concentrations and exceedance probability,
- deviation from NAAQS,
- monitor-to-monitor correlation,
- trend impact, and
- removal bias.

Measured Concentration and Exceedance Probability

Monitors within the District's ambient air monitoring network shown to have high levels of SO_2, design values close to the standard, and with long historical record were considered to be of high value for characterizing pollution in an area. Table 74 presents 1-hour design value concentrations for 2015

[70] https://www.epa.gov/sulfur-dioxide-designations
[71] https://www.census.gov/programs-surveys/decennial-census/decade/2020/2020-census-results.html

through 2024. The exceedance probability was not calculated in the NetAssess2025 v1.1 tool and is therefore not included in this analysis.

Table 74 – Concentration analysis for SO_2 monitors serving Sacramento County (source: EPA AQS).

Station Name	Valid 1-hour SO_2 Design Value (ppb)									
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
DPM	5	7	NA	NA	NA	2	2	NA	NA	NA

DPM – Sacramento-Del Paso Manor
* Values marked as 'NA' did not meet the completeness criteria; therefore, the design values are considered invalid.

Figure 63 presents the 2015 through 2024 valid design values for SO_2 monitors serving Sacramento County. As described in the EPA network assessment guidance (EPA, 2007), "[m]onitors that measure high concentrations or design values are ranked higher than monitors that measure low concentrations." Based on the data shown in Figure 63, the Sacramento-Del Paso Manor site sampled much lower than the 1-hour standard for valid design values during the assessment period of 2020-2024.

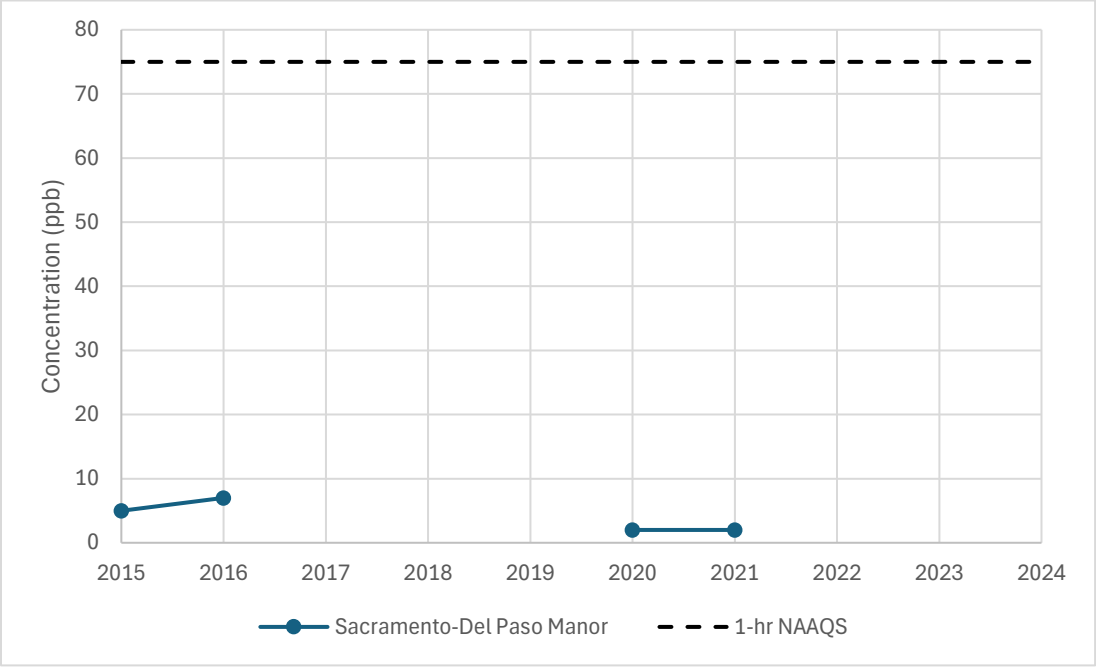


Figure 63 – 1-hour SO_2 concentration trend (Source: EPA AQS).

Deviation from NAAQS

As shown in Table 75, the deviation from NAAQS analysis shows for the 1-hour standard that the Sacramento-Del Paso Manor site has deviation values much greater than 20% of the NAAQS (15 ppb). This corresponds to the low ranking based on the EPA definition that "[s]ites measuring concentrations (design values) that are very close to the NAAQS exceedance threshold are ranked highest in this analysis" (EPA, 2007). The 20% value has been used as a threshold in this assessment for most other pollutants.

Table 75 – 2021 1-hour SO_2 design value and deviation from NAAQS analysis.

Station Name	2021 SO_2 Design Value (ppb)*	Deviation from NAAQS (ppb)
Sacramento-Del Paso Manor	2	72

* 2024 had an incomplete design value calculation, therefore the last valid year was used instead (2021).

SO_2 Monitor-to-Monitor Correlation Analysis

With Sacramento-Del Paso Manor being the only SO_2 monitor characterizing SO_2 concentrations in Sacramento County, monitor-to-monitor correlation was not evaluated.

Trend Analysis

Monitors that have a long historical record are valuable for tracking trends. In this analysis, site ranking is based on the duration of the continuous measurement record. Table 76 shows the year that SO_2 measurements began at the Sacramento-Del Paso Manor station. This site has a long historical sampling trend of over 40 years. However, as it is the only site in Sacramento County, no recommendation is available for this analysis.

Table 76 – Date of operation for the SO_2 station serving Sacramento County.

Station Name	Begin Year of SO_2 Operation
Sacramento-Del Paso Manor	1980

SO_2 Monitor Removal Bias Analysis

With Sacramento-Del Paso Manor being the only monitor within the District network, removal bias was not evaluated.

SO_2 Monitoring Sites

The number of sites in the Sacramento MSA are listed in Table 76. SO_2 monitoring requirements are de termined based on a combination of population and emissions. The Population Weighted Emissions Index (PWEI) is calculated by multiplying the population of each CBSA by the total amount of SO_2 (in tons per year) emitted within the CBSA area, then dividing the resulting product by one million. CBSAs with a calculated PWEI (in million persons-ton per year) greater than 1,000,000 require three (3) SO_2 monitoring sites. A PWEI between 100,000 and 1,000,000 requires a minimum of two (2) SO_2 monitoring sites, and CBSAs with a PWEI between 5,000 and 100,000 require a minimum of one (1) SO_2 monitoring site. Based on data from the 2020 National Emissions Inventory (NEI; updated March 2025)[72] of 1,104 tons of SO_2 emissions and an estimated population of the Sacramento MSA of 2.45 million persons, the PWEI for the Sacramento MSA is calculated to be 2,716 million persons-tons per year. However, per 40 CFR Part 58 3(b), NCore sites are required to monitor SO_2. Therefore, the District operates one SO_2 monitor at the Sacramento-Del Paso Manor site to satisfy NCore requirements.

[72] https://www.epa.gov/air-emissions-inventories/2020-national-emissions-inventory-nei-data

Table 77 – SO_2 Monitoring Sites within Sacramento MSA.

Sites in Sacramento MSA	Additional Sites Needed
1*	0

* Required as part of NCore monitoring station. Total SO_2: 1,104 tons (2020 National Emission Inventory, updated May 2025); Population Weighted Emission Index: 2,716 million persons-tons per year (Per 40 CFR Part 58, Appendix D, $PWEI = \frac{Total\ SO_2 \times MSA\ Population}{1{,}000{,}000}$).

Conclusions

The Sacramento-Del Paso Manor site is the single site in Sacramento County to sample SO_2. EPA has designated Sacramento County as attainment for the federal SO_2 standard as calculated design values at this site are well below the 1-hour NAAQS. Low monitored concentrations and calculated population weighted emissions index in accordance with 40 CFR Part 58 Appendix D suggest no additional monitors are required to be added to the network and that the single site is sufficient, and necessary, to meet monitoring requirements. In summary, the current SO_2 monitoring network meets all federal requirements and supports District monitoring objectives.

Meteorological Network Analysis

Monitoring Objectives

Surface meteorological measurements are currently being collected at six (6) monitoring sites within the District's network as seen in Figure 64. National Oceanic and Atmospheric Administration (NOAA) Surface weather observation stations[73] within Sacramento County are also included in Figure 64. Table 78 presents the meteorological parameters currently being measured at each District monitoring site.

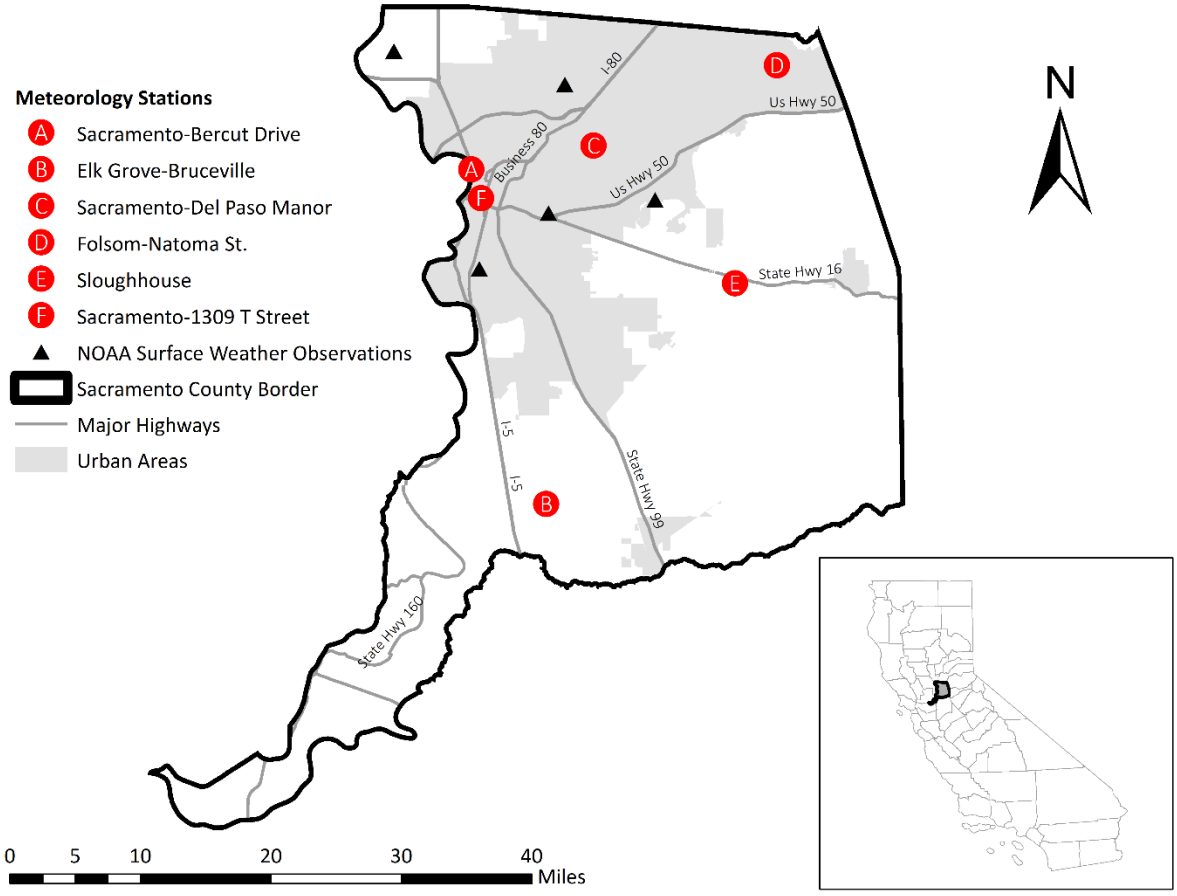


Figure 64 – Meteorological Network in Sacramento County and National Oceanic and Atmospheric Administration (NOAA) surface weather observations (source: NOAA).

[73] NOAA National Centers for Environmental Information (2001): Integrated Global Surface Hourly Dataset. NOAA National Centers for Environmental Information. https://data.noaa.gov/onestop/collections/details/da357c46-5107-417f-bc50-3130599a836d?f=dataFormats:ARCGIS

Table 78 – Meteorological parameters measured by station in Sacramento County.

	Outdoor Temperature	Relative Humidity	Solar Radiation	Ultraviolet Radiation	Barometric Pressure	Precipitation	Wind Direction & Speed	Ceilometer
Sacramento-Bercut Dr.	✓						✓	
Elk Grove-Bruceville Rd.	✓	✓	✓	✓	✓	✓	✓	✓
Sacramento-Del Paso Manor	✓	✓	✓				✓	
Folsom-Natoma St.	✓	✓	✓				✓	
Sloughhouse							✓	
Sacramento-1309 T Street	✓	✓					✓	

The District meteorological network satisfies the federal requirements as outlined in 40 CFR Appendix D to Part 58. There are specific requirements for monitoring programs, these are outlined in Table 79.

Table 79 – Meteorological requirements in 40 CFR Part 58.

Parameter	NCore	PAMS*	Near Road**
Wind Direction	✓	✓	✓
Wind Speed	✓	✓	✓
Relative Humidity	✓	✓	
Ambient Temperature	✓	✓	
Atmospheric Pressure		✓	
Hourly Precipitation		✓	
Hourly Averaged Mixing Height		✓	
Hourly Averaged Solar Radiation		✓	
Hourly Averaged Ultraviolet Radiation		✓	

✓ Installed
Not Required
Recommended

* See the PAMS section for more information.
**Meteorological parameters are recommended by EPA at near-road sites whenever possible[74].

The meteorological network supports meeting the District's objectives in multiple ways. Some examples of this are as follows. Surface wind speed and direction are integral in determining ground-level pollution transport throughout the county, especially important for public notification. These measurements are vital in accurately forecasting $PM_{2.5}$ conditions in the wintertime as part of the District's Check Before You Burn program as well as forecasting for possible high wind and dust events (PM_{10}). Relative humidity, solar radiation, and ultraviolet radiation help to understand chemical processes within the atmosphere in the particle, gas, and aerosol phases. These measurements are all used as part of the Spare the Air summertime O_3 forecasting. Upper atmosphere information from the ceilometer provides valuable data to forecast wintertime particulate matter concentrations, aid in model assimilation and verification, identify pollution plumes which may be elevated above the surface (e.g. wildfire smoke for Exceptional Event demonstrations), and to help characterize dispersion, fumigation and source contribution of pollutants. All of these measurements are also used in State Implementation Plans, providing the integral information to help determine and project attainment of federal standards. Where available, the District provides meteorological data in real time for public information, which is displayed on the National Weather Service (NWS) Weather & Hazards Data Viewer[75]. This data combined with NOAA NWS stations, which also provide real time meteorological data as seen in Figure 64, provide an accurate representation of meteorological measurements within Sacramento County.

The District meteorological network satisfies all federal requirements as well as District objectives. There are no sites in Sacramento County recommended for removal.

[74] As per the EPA Near-road NO_2 Monitoring Technical Assistance Document, "Although meteorological measurements were originally proposed in the [Notice of Proposed Rulemaking] for NO_2 to be required at near-road NO_2 monitoring sites, the EPA did not ultimately require them within 40 CFR Part 58. However, the EPA strongly encourages states to measure meteorological parameters at near-road sites whenever possible."; https://www.epa.gov/sites/default/files/2020-09/documents/nearroadtad.pdf.

[75] https://www.wrh.noaa.gov/map/

Photochemical Assessment Monitoring Station (PAMS) Network Analysis

Monitoring Objectives

The PAMS legacy network ran from 1994 through 2020 as an ozone precursor monitoring network to meet the requirements of Section 182(c)(1) of the Clean Air Act (CAA). As part of the 2015 Ozone National Ambient Air Quality Standard review[76], significant changes were made to the PAMS requirements[77] including calling for ozone precursor measurements to be made at existing NCore sites in Core Based Statistical Areas of over 1 million population. Sacramento County qualifies for this requirement, and therefore, the NCore Sacramento-Del Paso Manor site is determined to be the primary PAMS monitoring station.

Ground-level ozone photochemically forms in the atmosphere through chemical reactions in the presence of precursor pollutants and sunlight. Time is required for the reactions to occur and while ozone is being chemically formed, air masses are generally transported out of the area where precursor pollutants were emitted. In Sacramento County, prevailing ozone season winds transport ozone precursors to higher elevations in the easternmost portion of the county (topography is included in Figure 65). As seen in Figure 65, there are three (3) ambient air monitoring sites (Sacramento-Del Paso Manor, Elk Grove-Bruceville Rd., and Folsom-Natoma), which were part of the legacy PAMS monitoring network within Sacramento County to sample PAMS species. Since the start of PAMS monitoring in Sacramento County, the District had designated Elk Grove-Bruceville Rd., Sacramento-Del Paso Manor, and Folsom-Natoma St. as type I, II, and III PAMS sites, respectively. The types of PAMS sites are as follows:

1. Type I – upwind sites
2. Type II – maximum ozone precursor sites
3. Type III – maximum ozone concentrations sites
4. Type IV – downwind sites

[76] https://www.epa.gov/ground-level-ozone-pollution/2015-revision-2008-ozone-national-ambient-air-quality-standards-naaqs
[77] https://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&mc=true&r=PART&n=pt40.6.58#ap40.6.58.0000_0nbspnbspnbsp.d

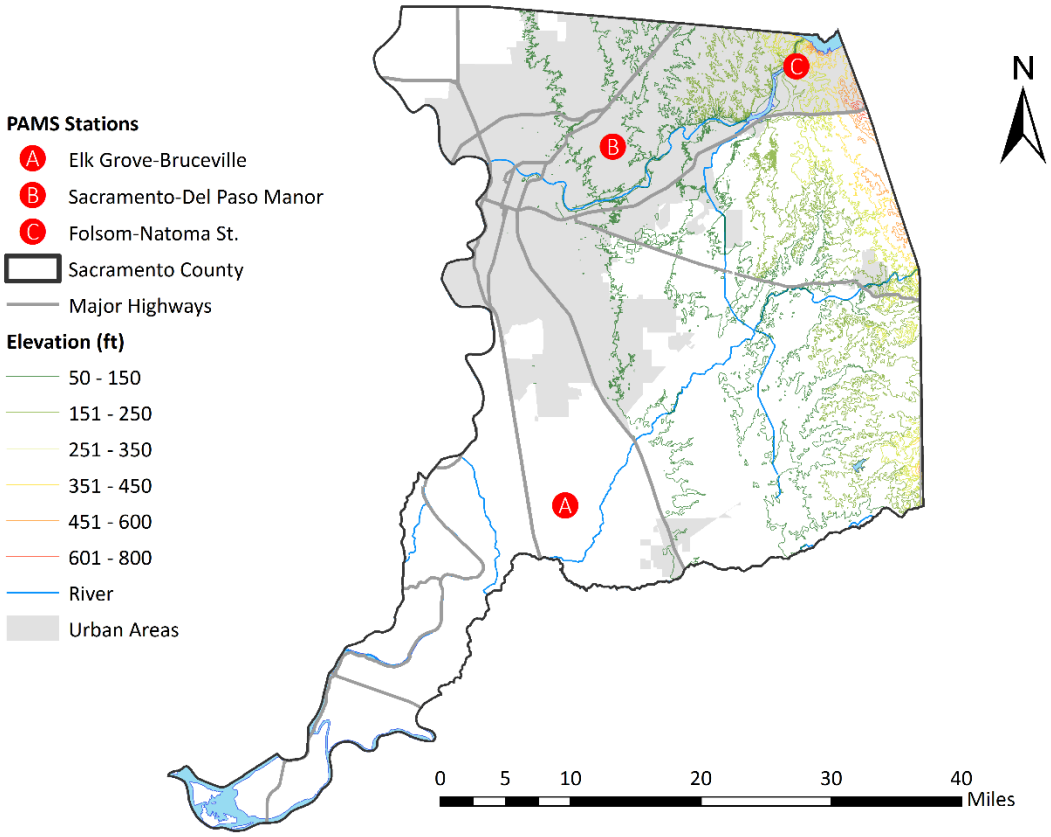


Figure 65 – PAMS Network and terrain in Sacramento County.

PAMS Monitoring Sites

According to 40 CFR Part 58 Appendix D, Section 5, state and local monitoring agencies are required to collect and report PAMS measurements at each NCore site in a CBSA with a population of 1,000,000 or more. The 2015 review of National Ambient Air Quality Standards for Ozone (80 FR 65292) required the State to develop an Enhanced Monitoring Plan (EMP) for enhanced ozone monitoring activities. The District, CARB, and neighboring air districts worked together to determine the appropriate monitoring plan. CARB is responsible for submitting the EMP for the entire state, including all Primary Quality Assurance Organizations (PQAO) and all air districts within the CARB PQAO that submit their own annual network plans and/or 5-year monitoring network assessments. Details on the Sacramento nonattainment area EMP are provided in the EMP portion of the 2020 Monitoring Network Assessment developed by CARB[78].

[78] Document referenced in CARB Annual Network Plan here: https://ww2.arb.ca.gov/our-work/programs/ambient-air-monitoring-regulatory/annual-monitoring-network-report

Other requirements of the revised PAMS network are the deployment and operation of a continuous hourly-averaged speciated volatile organic compound (VOC) sampler[79], specifically an automated gas chromatograph (autoGC) system, and a ceilometer to measure the mixing layer height.

In 2006, EPA eliminated the requirement to measure speciated carbonyls at PAMS sites with the exception of sites in areas designated as severe or extreme non-attainment for the 8-hour ozone standard. EPA has since begun revision of Compendium Method TO-11A for measuring carbonyl concentrations based on work performed to optimize and modernize the method.

Currently, as the transition to the revised PAMS requirements is in progress, the District has three (3) active PAMS monitoring sites (DPM, BRU, FOL) that meet the previous PAMS monitoring requirements and one site (DPM; NCore site) that is scheduled to meet current PAMS requirements as outlined in 40 CFR Part 58, Appendix D following station renovations (see PAMS section for more details).

In summary, in accordance with 40 CFR Appendix D to Part 58 each required PAMS site is expected to measure:

- Hourly averaged speciated volatile organic compounds (VOCs),
- Three 8-hour averaged carbonyl samples per day on a 1 in 3 day schedule, or hourly averaged formaldehyde,
- Hourly averaged O_3,
- Hourly averaged nitrogen oxide (NO), true nitrogen dioxide (NO_2), and total reactive nitrogen (NOy),
- Hourly averaged ambient temperature,
- Hourly vector-averaged wind direction,
- Hourly vector-averaged wind speed,
- Hourly average atmospheric pressure,
- Hourly averaged relative humidity,
- Hourly precipitation,
- Hourly averaged mixing-height,
- Hourly averaged solar radiation, and
- Hourly averaged ultraviolet radiation.

[79] EPA PAMS VOC target list can be found here: https://www.epa.gov/amtic/photochemical-assessment-monitoring-stations-pams-volatile-organic-compound-target-list

PAMS Monitoring and Revisions

In alignment with the revised PAMS requirements, the Sacramento-Del Paso Manor site will be the core PAMS station and the Elk Grove-Bruceville Rd. and Folsom-Natoma St. sites will both serve as enhanced ozone monitoring sites. The following modifications to the District PAMS network are currently planned to meet these requirements:

- To offset the added demands at the NCore site and save staff time and resources, the District has received approval from EPA and discontinued the following PAMS parameters that are identified in CARB's Enhanced Monitoring Plan:
    1. speciated volatile organic compounds (VOCs) at Elk Grove-Bruceville Rd.
    2. speciated VOCs at Folsom-Natoma St.
    3. reactive oxides of nitrogen (NO_X) at Folsom-Natoma St.
- To accommodate the autoGC and accompanying support equipment, the District will be rebuilding the PAMS station at the Sacramento-Del Paso Manor site. Construction work is scheduled to be completed prior to the 2026 PAMS season; however, completion may be delayed due to construction challenges.
- The District has been approved to operate some of the required meteorological instruments (ultraviolet radiation, precipitation, mixing height, and barometric pressure) at Elk-Bruceville Rd. instead of Sacramento-Del Paso Manor.

Adjacent to the Elk Grove-Bruceville Rd. site are the Franklin Field radar wind profiler (RWP) and radio acoustic sounding system (RASS). These instruments measure wind and temperature in the upper meteorological levels and are operated year-round. They have historically been included as required upper air measurements in the PAMS network. However, the RWP and RASS instruments malfunctioned in October 2016. Pursuant to the 2015 revisions to the PAMS requirements for upper air measurements, the District installed and began operation of a ceilometer at Elk Grove-Bruceville Rd. in January 2018 after receiving EPA approval of a waiver to allow measurements to be made at an alternative location than the NCore site.

Table 80 lists the parameters that the District plans to operate at each of the PAMS and enhanced monitoring sites in Sacramento County.

Table 80 – Enhanced PAMS monitoring parameters planned for each station.

Site Name	O_3	NO_2	autoGC	Carbonyl	NMHC*	Meteorology**	Ceilometer
Elk Grove-Bruceville Rd.	✓	✓			✓	✓	✓
Sacramento-Del Paso Manor	✓	✓	✓	✓		✓	
Folsom-Natoma St.	✓	✓			✓	✓	

* Non-methane hydrocarbon, a precursor for O_3; the NMHC analyzers are on a temporary shutdown due to instrument malfunction and are being replaced

** Surface meteorology at Elk Grove-Bruceville Rd. includes: temperature, relative humidity, wind direction and speed, solar radiation, ultraviolet radiation, precipitation, and barometric pressure. Surface meteorology at Sacramento-Del Paso Manor and Folsom-Natoma St. include: temperature, relative humidity, wind direction and speed, and solar radiation

In accordance with PAMS requirements, the District will continue to sample speciated carbonyl compounds[80] on the required schedule.

PAMS Conclusions and Recommendations

As seen in the ozone section of this assessment, ozone concentrations continue to improve in Sacramento County. This is due in part to the implementation of District and State programs designed to reduce local and statewide ozone precursor emissions and ultimately ozone formation. The PAMS monitoring network will meet all federal requirements and continue to support the District's monitoring objectives once the updates outlined in the PAMS Monitoring and Revisions section are fully implemented. Therefore, as also outlined in the CARB EMP, no additional ozone or ozone precursor monitoring as part of the PAMS network is recommended for Sacramento County.

[80] PAMS compound lists are updated in a 2017 EPA memorandum: https://www.epa.gov/sites/default/files/2019-11/documents/targetlist_0.pdf

Summary and Recommendations

As defined in 40 CFR Part 58 Appendix D, the network is designed to meet three basic monitoring objectives: (1) provide air pollution data to the general public in a timely manner; (2) support compliance with ambient quality standards and emissions strategy development; and (3) support air pollution research studies. The following sections highlight how the District ambient air monitoring network meets these three objectives.

In this assessment, the analytical results were synthesized to evaluate the entire network. Each analysis has its own value but does not stand alone in providing recommendations to the network. Whenever changes are recommended to the ambient air monitoring network, there are many aspects of the network that must be considered by the District, CARB, and EPA; many of which are unquantifiable. Incorporated into these decisions is that they are all subject to funding and resource availability as well as EPA approval.

Pollutant-specific analyses were performed in this assessment and associated ranking of monitors were calculated. Table 81 summarizes the overall rankings of each station by pollutant (for pollutants with 2 or more sites).

Table 81 – Summary of overall rankings of each station by pollutant from pollutant-specific analyses. Sites ranked highest are shaded green.

Site Name	O_3	$PM_{2.5}$	PM_{10}	NO_2	CO	SO_2
Sacramento-Branch Center #2			1			
Sacramento-Bercut Drive		3		5	2	
Elk Grove-Bruceville Rd.	2	5	✓	1		
Sacramento-Del Paso Manor	1	1	3	2	1	✓
Folsom-Natoma St.	3	6		3		
Sloughhouse	2	4				
Sacramento-1309 T Street	1	2	2	4		

More detailed information on the conclusions for each pollutant can be found within the specific sections of this assessment. As shown in Table 81, Sacramento-Del Paso Manor ranked the highest from the five pollutants with more than one site. The monitors with the lowest total scores for each pollutant were examined carefully to identify network redundancies or possible relocation. The results of each of the analyses were evaluated in context of the overall monitoring objectives specific to each pollutant. Recommendations for the network were made based on the aggregated results of the analyses identified in the Technical Approach section. Below are the major recommendations from this assessment.

- Installation of a continuous PM_{10} monitor near the discontinued North Highlands monitoring station, if resources are available.
- Installation of the Photochemical Assessment Monitoring Stations (PAMS) equipment required in 40 CFR Appendix D to Part 58 after the Sacramento-Del Paso Manor station expansion project

is completed. The existing PAMS VOC canister sampling will be replaced with an automated gas chromatograph (autoGC).

- 40 CFR Part 58 requires state or local air monitoring organization to operate a second near-road monitoring site if any traffic count in the metropolitan area surpasses 250,000 in annual average daily traffic. The Sacramento area has surpassed the threshold for 2020-2024 data (2020 traffic volume fell below the threshold). The District is working with EPA and CARB to determine the appropriate timing, location, and funding for a second near-road monitoring site.

The recommendations for addition and removal of sites are described in the following sections.

Recommendations for Removal of Existing Site(s)

Based on the assessment of the District ambient air monitoring network, there is a single site that is recommended for removal or discontinuation. The recommendation for this site is concurrent with a replacement air monitoring station for the discontinued North Highlands-Blackfoot station and are as follows:

- Discontinue the Sacramento-Branch Center #2 PM_{10} monitor and the Sacramento-Branch Center #2 air monitoring station, if a PM_{10} monitor is installed near the discontinued North Highlands station.

More detailed information on this recommendation can be found in the PM_{10} section of this assessment. No other sites are recommended for removal.

Recommendations for Addition of Site(s)

Based on the assessment of the District ambient air monitoring network, there are two recommendations.

1. The Sacramento MSA exceeded the traffic volume threshold for a second near-road monitoring site according to 40 CFR Part 58 (Most recent available data from 2021 and 2022 indicate traffic volume data exceeded threshold). The District is working with EPA and CARB to determine the appropriate timing, location, and funding for a second near-road monitoring site.
2. Installation of a replacement air monitoring station near the discontinued North Highlands-Blackfoot location to measure PM_{10} concentrations.

More detailed information on these recommendations can be found in the PM_{10}, and NO_2 sections of this assessment. There are no other recommendations for additional sites to the network.

Overall Satisfaction of Federal Air Monitoring Requirements

This assessment finds that most criteria pollutants meet or exceed federal air monitoring requirements as per 40 CFR Part 58. The only requirement not met is that the Sacramento MSA has surpassed the threshold for a second Near Road station. The District currently operates one Near Road station and exceeds the threshold levels for installing a second Near Road station that would include two monitors, one to monitor nitrogen dioxide (NO_2) and the other carbon monoxide (CO). The District is working with EPA and CARB to determine the appropriate timing, location, and funding for a second Near Road monitoring site. The District currently meets all requirements for PAMS and meteorological measurements.

Future Priorities and Technologies

EPA is continuously working with state, local, and tribal agencies to improve ambient air monitoring networks through improved technologies. The ability of the District network to support air quality measurements and characterize pollution within Sacramento County is enhanced with incorporating new technologies. The following is a description of some upgrades in technology the District has incorporated into the network.

The District has migrated the database system from an older SQL 2019 server to a newer SQL 2022 server dedicated to the District air resources manager software. The new server (virtual machine) runs on windows server 2022 as opposed to 2019.

The District has upgraded the primary $PM_{2.5}$ samplers at the Folsom-Natoma St., Sacramento-Del Paso Manor, and Sloughhouse monitoring sites to a newer sampler. The filter-based sampler at the Sacramento-Bercut Drive site was upgraded to an EPA approved FEM continuous $PM_{2.5}$ monitoring system. A continuous PM_{10} at Elk Grove-Bruceville Rd. was added, and continuous monitors are being considered for other PM_{10} monitoring sites to improve public information and network efficiency. As previously discussed, a continuous PM_{10} sampler is proposed for installation at the replacement North Highlands-Blackfoot station.

The PAMS network has also been infused with new technologies concurrent with the revised PAMS requirements in 40 CFR Part 58. A ceilometer was installed at the Elk Grove-Bruceville Rd. site to provide much improved measurements of atmospheric mixing heights. Upon the completed construction of the Sacramento-Del Paso Manor station, an automated gas chromatograph (autoGC) system will be installed to sample continuous hourly-averaged speciated VOCs. The District is also considering improving the current nonmethane hydrocarbon samplers to newer technologies.