Staff Report

CARB Review of the Ozone Attainment Plan for Western Nevada County

Release Date: October 12, 2018

Hearing Date: November 15, 2018

CALIFORNIA
AIR RESOURCES BOARD

Electronic copies of this report are online at **https://www.arb.ca.gov/planning/sip/planarea/vensip.htm**. Alternatively, paper copies may be obtained from the Visitors and Environmental Services Center of the Air Resources Board, located at 1001 I Street, Sacramento, California 95814, or by contacting CARB's Office of Communications at (916) 322-2990.

For individuals with sensory disabilities, this document is available in Braille, large print, audiocassette, or compact disc. Please contact CARB's Disability Coordinator at (916) 323-4916 by voice or through the California Relay Services at 711 to place your request for disability services. If you are a person with limited English and would like to request interpreter services, please contact CARB's Bilingual Manager at (916) 323-7053.

For questions, contact:

Earl Withycombe, Air Resources Engineer
Central Valley Air Quality Planning Section
Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

Phone: (916) 322-8487
Email: earl.withycombe@arb.ca.gov

Or

Webster Tasat, Manager
Central Valley Air Quality Planning Section
Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

Phone: (916) 323-4950
Email: webster.tasat@arb.ca.gov

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

I. BACKGROUND 1

II. NATURE OF THE OZONE PROBLEM IN WESTERN NEVADA COUNTY 2

III. DEMONSTRATING ATTAINMENT 5

IV. CONTROL STRATEGY 7

V. CLEAN AIR ACT REQUIREMENTS 8

VI. ENVIRONMENTAL IMPACTS 12

VII. STAFF RECOMMENDATION 13

APPENDICES

A. WEIGHT OF EVIDENCE 15

EXECUTIVE SUMMARY

This report presents the California Air Resources Board (CARB or Board) staff's assessment of the Ozone Attainment Plan for Western Nevada County (Ozone Plan) developed by the Northern Sierra Air Quality Management District (Northern Sierra or the District). CARB staff has concluded that the Ozone Plan meets the SIP planning requirements of the federal Clean Air Act (Act), including attainment demonstration, reasonably available control measure demonstration, reasonable further progress demonstration, contingency measures for progress and attainment, and transportation conformity budgets. The Board is scheduled to consider the Ozone Plan on November 15, 2018. If approved, CARB will submit the Ozone Plan to the U.S. Environmental Protection Agency (U.S. EPA) as a revision to the California State Implementation Plan (SIP).

The Ozone Plan addresses the 2008 federal 8-hour ozone standard of 75 parts per billion (ppb), representing the next building block in planning efforts to meet increasingly health protective air quality standards. Ozone concentrations in Western Nevada County are overwhelmingly impacted by the transport of ozone and ozone precursors from upwind nonattainment areas. Over the past decade, ozone levels in these upwind nonattainment areas have shown significant improvement in response to reductions in emissions of oxides of nitrogen (NOx) and reactive organic gases (ROG) from current federal, state, and local air pollution control programs. Most of these reductions come from on-road mobile sources that fall under CARB's control authority. CARB's comprehensive strategy to reduce emissions from mobile sources consists of emission standards for new vehicles, in-use programs to reduce emissions from existing vehicles and equipment fleets, cleaner fuels, and incentive programs to accelerate market penetration of the cleanest vehicles beyond what is achieved by regulations alone. These existing control programs will provide 48 percent reduction of NOx and 24 percent reduction of ROG emission reductions between 2011 and 2021 in the upwind areas that will in turn provide for attainment of the 75 ppb ozone standard in Western Nevada County by the area's attainment deadline of 2021.

I. BACKGROUND

The Act requires U.S. EPA to set ambient air quality standards and periodically review the latest health research to ensure that these standards remain protective of public health. Based on research demonstrating adverse health effects at lower exposure levels, U.S. EPA has set a series of increasingly health protective ozone standards, beginning with a 1-hour ozone standard in 1979. Subsequent health studies demonstrated the greater effects of exposure to ozone over longer time periods, resulting in U.S. EPA establishing an 8-hour ozone standard of 80 ppb in 1997, the 75 ppb standard in 2008 and more recently, the 70 ppb standard in 2015.

Effective on July 20, 2012, U.S. EPA designated Western Nevada County as a nonattainment area with a Marginal classification and a July 20, 2015 attainment date for the 75 ppb 8-hour ozone standard.[1] On May 4, 2016, U.S. EPA determined that Western Nevada County did not attain the 75 ppb 8-hour standard by its July 20, 2015 attainment deadline, and reclassified the nonattainment area as a Moderate area with a new attainment deadline of July 20, 2018.[2] To address the 75 ppb 8-hour ozone standard, the District prepared and has scheduled the Ozone Plan for adoption by their Board on October 22, 2018. Because Western Nevada County did not attain the 75 ppb 8-hour standard by July 20, 2018, the Ozone Plan requests U.S. EPA to reclassify the nonattainment area as a Serious area with an attainment deadline of July 20, 2021. The Ozone Plan addresses Act requirements applicable to a Serious 8-hour ozone nonattainment area, consistent with U.S. EPA's 2015 Implementation Rule for the 75 ppb 8-hour ozone standard (Implementation Rule).[3]

II. NATURE OF THE OZONE PROBLEM IN WESTERN NEVADA COUNTY

Nevada County straddles the northern crest of the Sierra Nevada Mountains and is bounded by Yuba County on the west, the Nevada State line on the east, Sierra County on the north, and Placer County on the south. Since the County straddles the crest of the Sierra Nevada Mountains, 33 percent of the County is owned by the federal government and administered for multi-purpose use by the U.S. Forest Service. The 2010 Census recorded the population of Western Nevada County as 82,107. Only the western portion of Nevada County is designated nonattainment for the 75 ppb 8-hour ozone standard as transported ozone and ozone precursors from upwind ozone nonattainment areas – when passing over the Sierra Nevada crest - are lofted and mixed into a residual layer of the atmosphere that does not mix with the surface boundary layer in the eastern portion of the County. The eastern boundary of the nonattainment area is a north-south line near the physical crest of the Sierra Nevada Mountains in Nevada County. Maps of air basin boundaries and 8-hour ozone nonattainment areas in the southern portion of the Sacramento Valley are shown in Figure 1. The Western Nevada County ozone nonattainment area is designated as "WNNA" (Western Nevada Nonattainment Area) and the Sacramento Region ozone nonattainment area is designated as "SFNA" (Sacramento Federal Nonattainment Area) in the right portion of Figure 1.

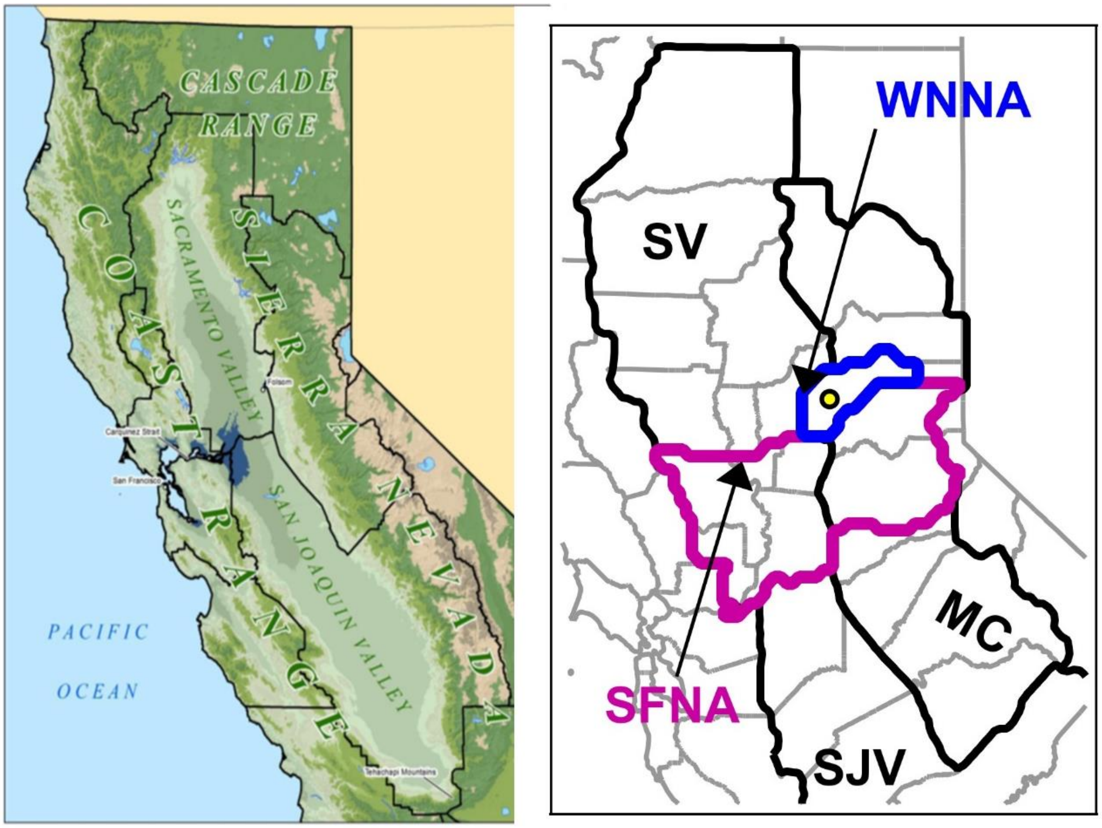
---

[1] 77 FR 30088, Published on May 21, 2012 and effective on July 20, 2012, "Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards", https://www.gpo.gov/fdsys/pkg/FR-2012-05-21/pdf/2012-11618.pdf

[2] 81 FR 26697, Published on May 4, 2016 and effective on June 3, 2016, "Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Several Area for the 2008 Ozone National Ambient Air Quality Standards", https://www.gpo.gov/fdsys/pkg/FR-2016-05-04/pdf/2016-09729.pdf

[3] 80 FR 12264 http://www.gpo.gov/fdsys/pkg/FR-2015-03-06/pdf/2015-04012.pdf

Figure 1. Air Basins and 8-Hour Ozone Nonattainment Areas Values In Northern California

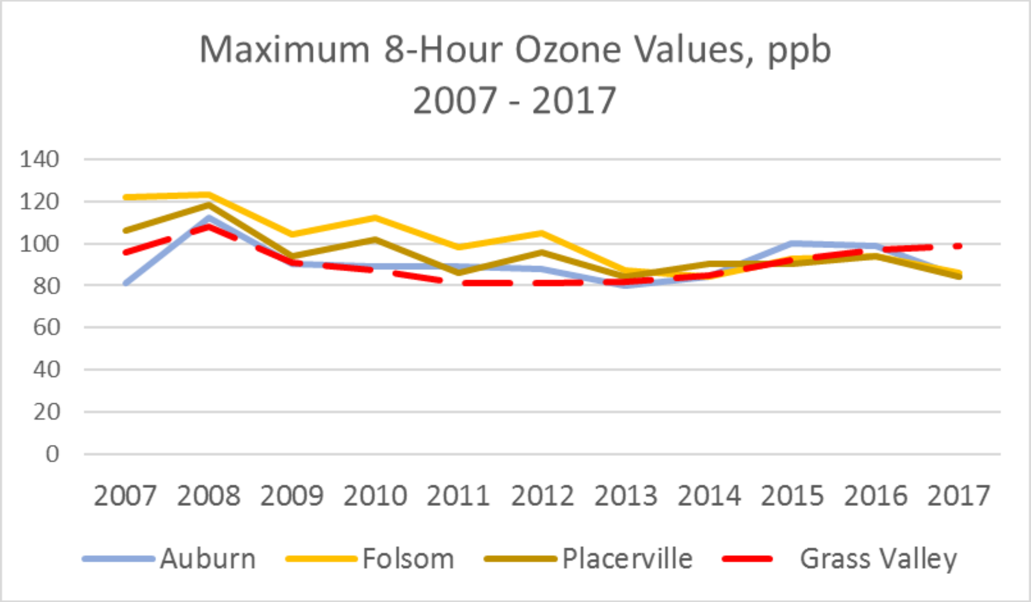


Elevated ozone concentrations occur in Western Nevada County during the late spring through early fall, when high temperatures and stable atmospheric conditions favor ozone formation. Ozone during this season generally reaches peak levels by early evening and remains elevated through the night, both of which are evidence of the transported nature of ozone recorded in Western Nevada County.

Long-term trends in ozone levels in Western Nevada County and the closest upwind ozone nonattainment area in the Sacramento region suggest the contribution of transported ozone and ozone precursors from one area to the other. Emission inventories for these areas significantly underscore the impacts that emissions from upwind regions contribute to Western Nevada County ozone concentrations.

The sole site in Western Nevada County at which ozone has been monitored continuously over the past decade is in eastern Grass Valley at the headquarter offices of the District. The relationship of annual ozone trends recorded at Grass Valley and at the sites of highest ozone concentration in the SFNA are presented in Figure 2. Ozone values in this plot represent the highest 8-hour average ozone concentration recorded at each site annually between 2007 and 2017, the most recent years for which data are complete. As the plot shows, between 2007 and 2013, sites in the SFNA recorded higher concentrations than were recorded at Grass Valley. During this period, maximum ozone concentrations declined with some annual variability due to differences in seasonal weather patterns. Since 2014, however, maximum ozone levels at SFNA sites have remained somewhat constant and levels at Grass Valley have slowly increased. In 2017, levels at Grass Valley were discernibly higher than at any site in the SFNA.

Figure 2. Maximum 8-Hour Ozone Values at Western Nevada County and Select Upwind Monitoring Sites



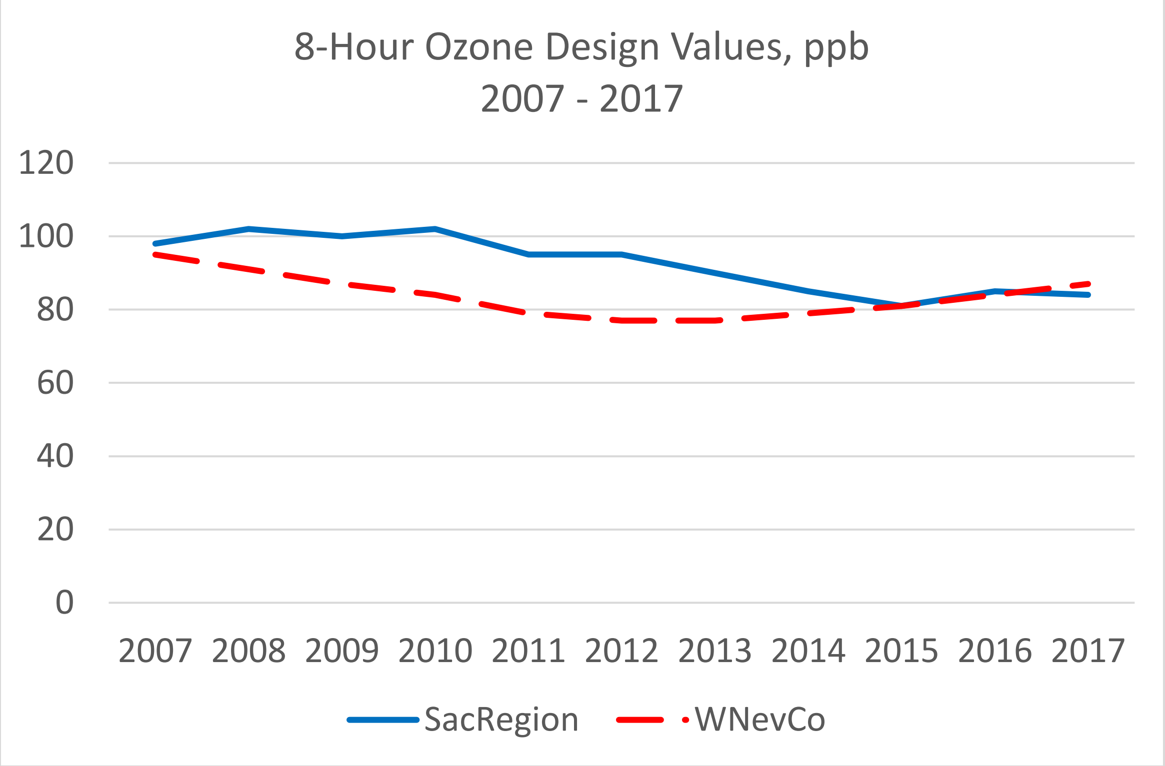
Source: iADAM, Air Quality Data Statistics, CARB, *https://www.arb.ca.gov/adam/*

The determination of whether an area attains an 8-hour ozone standard is based on the current ozone design value for that area. The design value is calculated as the average of the 4th highest 8-hour ozone value recorded in each of three consecutive years. Figure 3 shows the design value concentrations at Grass Valley and at the highest SFNA site between 2007 and 2017.

Between 2007 and 2012, the Grass Valley design value declined by 19 percent from 95 ppb to 77 ppb, but between 2013 and 2017, the design value increased by 13 percent from 77 ppb to 87 ppb. Also, between 2013 and 2017, the number of days per year when the 8-hour ozone concentration exceeded the 75 ppb standard increased from 4 to 58.

In 2018, ozone levels have remained similar to those recorded in 2017, with the exceptions that the number of days when the 8-hour ozone concentration exceeded the 75 ppb standard have been lower at 17 (as of October 1, 2018), and that the design value to date has increased to 90 ppb from 87 ppb in 2017. It should be noted that many of the exceedance days occurred while heavy smoke from large regional windfires, which is known to contribute to ozone formation, inundated the Western Nevada County area.

Figure 3. Ozone Design Values at Western Nevada Monitoring Sites



Source: iADAM, Air Quality Data Statistics, CARB, *https://www.arb.ca.gov/adam/*

III. DEMONSTRATING ATTAINMENT

SIPs must identify both the magnitude of emission reductions needed and the actions necessary to achieve those reductions as part of demonstrating attainment of the relevant ambient air quality standard. The District and CARB have prepared an attainment demonstration that provides for expeditious attainment of the 75 ppb 8-hour ozone standard. The attainment demonstration takes into account: (1) the emissions reductions within Western Nevada County, (2) the influence of transport from upwind ozone nonattainment areas, and (3) recent monitoring measurements. Given these inputs, the attainment demonstration includes an assessment of achieving the standard by the mandated Serious attainment deadline and concludes that attaining the standard by July 20, 2021 is achievable.

The Act requires the use of air quality modeling to relate ozone levels to emissions in a region and simulate future air quality based on changes in emissions. The modeled attainment demonstration in this plan was prepared using photochemical dispersion and meteorological modeling tools developed in response to U.S. EPA modeling guidelines, and recommendations from air quality modeling experts. The modeling uses emission inventories, with measurements of meteorology and air quality, to establish the relationship between emissions and air quality. Additional information and a detailed description of the procedures employed in this modeling are available in Appendices E through H of the District Ozone Plan.

The Western Nevada County ozone nonattainment area is located within the Mountain Counties Air Basin, but is subject to transport from the SFNA and Bay Area ozone nonattainment areas. The photochemical modeling domain used in the Ozone Plan covers all of California, with a smaller Northern California nested domain of 4 kilometer grids which includes the Western Nevada County ozone nonattainment area in its entirety.

The modeled attainment demonstration in this plan was prepared using photochemical dispersion and meteorological modeling tools developed in response to U.S. EPA modeling guidelines, and recommendations from air quality modeling experts. The model uses emission inventories, with measurements of meteorology and air quality, to establish the relationship between emissions and air quality. The modeling is used to identify the benefits of controlling ozone precursors and the most expeditious attainment date.

The year 2012 was chosen as the modeling base (or reference) year. The future year modeled was 2020 because it is the year attainment must be demonstrated for a Serious ozone nonattainment area. The attainment demonstration modeling includes the benefits of CARB's mobile source control program and District regulations for stationary sources submitted through November 2016. These measures provide the necessary control strategy, demonstrating that the Western Nevada County nonattainment area will meet the 75 ppb 8-hour ozone standard by 2020. Table 1 summarizes the 2012 and 2020 emissions modeled in the attainment demonstration. By 2020, emissions of NOx are predicted to decline by 23 percent and ROG by 16 percent, with the largest reductions coming from on-road mobile sources.

Table 1. Western Nevada County Base Year and Attainment Year Emissions

(tpd, summer planning inventory)

	NOx		ROG	
Source Category	**2012**	**2020**	**2012**	**2020**
Stationary and Area-wide	0.23	0.23	2.10	2.17
On-Road Motor Vehicles	3.98	2.16	1.79	1.00
Off-Road Vehicles and Equipment	0.97	0.86	1.32	0.96
TOTAL	5.18	3.25	5.21	4.13

Source: CARB CEPAM v.1.03. Numbers may not add up due to rounding

Results of the attainment demonstration modeling are shown on Table 2. The 2020 design value is predicted to be 67 ppb at the Grass Valley site, which will be below the 75 ppb standard.

Further information on the modeled attainment demonstration is included in Chapter XII and Appendices E, F, G, and H of the Ozone Plan.

Table 2. Modeled 8-hour Ozone Design Values Demonstrating Attainment

Site	2012 Base Year Design Value (ppb)	2020 Future Year Design Value (ppb)
Grass Valley	79	67

Source: Ozone Plan, Table 12: *Baseline Design Value, Modeled RRF, and projected future year (2020) 8-hour ozone Design Values (DV at the Grass Valley ozone monitoring site in WNNA)*.

U.S. EPA modeling guidance requires that modeled attainment demonstrations be accompanied by a weight of evidence analysis (WOE) to provide a set of complementary analyses. Examining an air quality problem in a variety of ways provides a more informed basis for the attainment strategy as well as better understanding of the overall problem and the level and mix of emissions controls needed for attainment. CARB staff prepared the WOE, which is presented in Appendix A of this Staff Report. WOE analyses include assessment of trends in ozone air quality, ozone precursor emission trends, meteorology impacts on ozone air quality trends, and summary of corroborating analyses. The WOE indicates that Western Nevada County is on track to attain the 75 ppb 8-hour ozone standard by 2020, which is consistent with design value projections derived from the regional photochemical modeling assessment.

IV. CONTROL STRATEGY

The ongoing emission reductions from continued implementation of CARB and District control strategies developed to meet prior standards provide the attainment control strategy for the Ozone Plan. The following sections highlight ongoing CARB control programs and District measures that provide the emission reductions included in the attainment demonstration.

A. CARB Control Program

Given the severity of California’s air quality challenges, CARB has implemented the most stringent mobile source emissions control program in the nation. CARB’s comprehensive strategy to reduce emissions from mobile sources consists of emissions standards for new vehicles, in-use programs to reduce emissions from existing vehicle and equipment fleets, cleaner fuels, and incentive programs to accelerate the penetration of the cleanest vehicles beyond that achieved by regulations alone. A detailed description of the mobile source control programs and a comprehensive list of CARB regulations are included in Appendices B and C of the Ozone Plan.

B. District Control Program

Consistent with its regulatory authority, the District has adopted rules for reducing emissions from a broad scope of stationary and area sources. The District's stationary source NOx and ROG prohibitory rules were fully addressed in the "*Reasonably Available Control Technology (RACT) State Implementation Plan (SIP) Revision for Western Nevada County 8-Hour Ozone Nonattainment Area*" adopted by the District Board on March 26, 2018. The RACT SIP analysis followed RACT requirements for major sources with a potential to emit (PTE) of 50 tons per year (TPY) or greater of ROG or NOx, the threshold for Serious attainment areas.

The District's Rule 428, New and Modified Stationary Source Review, references the Code of Federal Regulations (CFR) with respect to the definition of major stationary source as based on the ozone designation of Western Nevada County. Because the CFR reference includes the publication date of July 2, 2015, CARB has alerted the District that this reference will need to be updated when U.S. EPA approves the District's request for reclassification to Serious nonattainment for the 75 ppb 8-hour ozone standard. With such change, Rule 428 will reference the 50 ton per year emission threshold in CFR that defines a major stationary source in Serious ozone nonattainment areas.

V. CLEAN AIR ACT REQUIREMENTS

In addition to the elements related to the attainment demonstration, the Act also requires SIPs for Serious ozone nonattainment areas to address the following elements:

- Base year emission inventories and future year forecasts for manmade sources of ozone precursors;
- Demonstration that control measures meet reasonably available control measures (RACM) level;
- Provisions that demonstrate reasonable further progress (RFP);
- Provisions for sufficient contingency measures for RFP and attainment; and
- Transportation conformity emission budgets to ensure transportation projects are consistent with the SIP.

A. Emission Inventory

An emissions inventory is a critical tool used to evaluate, control, and mitigate air pollution. At its core, an emissions inventory is a systematic listing of the sources of air pollutants along with the amount of pollutants emitted from each source or category over a given time period. The planning emissions inventory is divided into three major categories: stationary, area-wide, and mobile sources. The summer season inventory is used for ozone planning because it reflects the source activity levels and meteorological conditions presented when higher ozone levels occur in California ozone nonattainment areas.

2012 is the emission base year for air quality modeling, and uses backcasting and forecasting methods to construct emission inventories for other milestone years. For RFP purposes, the starting baseline year is 2011 which is consistent with the 2012 base year inventory. The inventories in the Ozone Plan reflect the benefits of District rules submitted to CARB through November 2016. The Ozone Plan in Chapters IV and V, and in Appendix A, presents a summary of the emission data sources, along with revisions and improvements made to the emission inventory.

On-road motor vehicle emissions estimates were generated using CARB's mobile source emissions model, EMFAC2014. On-road motor vehicle activity data reflect projections provided by the Nevada County Transportation Commission in September 2018. Off-road mobile source emissions estimates were generated using CARB's OFFROAD model. Both models were developed for use in CARB's 2016 SIP revisions, and represent significant improvements over models used in prior SIP updates.

Mobile sources are responsible for the majority of Western Nevada County's NOx emissions inventory, with on-road mobile vehicles as the largest source category (Table 3). Both mobile and areawide sources are currently significant contributors to the ROG inventory; however, as ROG emissions from mobile sources are projected to decline, areawide sources are becoming a relatively more significant portion of the ROG inventory (Table 3).

Table 3. Western Nevada County NOx and ROG Emissions
(tpd, summer planning inventory)

	NOx			ROG		
Source Category	**2011**	**2012**	**2020**	**2011**	**2012**	**2020**
Stationary (Point)	0.10	0.10	0.09	0.76	0.70	0.78
Areawide	0.15	0.13	0.14	1.41	1.39	1.51
On-Road Motor Vehicles	4.48	3.98	2.16	1.94	1.79	1.01
Off-Road Vehicles and Equipment	0.96	0.94	0.73	1.39	1.32	0.95
TOTAL	5.69	5.15	3.12	5.50	5.21	4.26

Source: Ozone Plan, Appendix A: *Emission Inventories for 2011, 2012, 2014, 2017, 2020 & 2021.*
Numbers may not add due to rounding.

The Act requires ozone nonattainment areas to have an Emissions Statement program that mandates stationary sources with emissions over 25 tons per year of NOx or ROG report and certify the accuracy of NOx and ROG emissions estimates annually. District Rule 513, *Emissions Statements and Recordkeeping*, addresses this requirement as stated in Chapter VII of the Ozone Plan.

B. Reasonably Available Control Measures Demonstration

As specified in the Act, the SIP shall provide for the implementation of RACM as expeditiously as practicable to provide for attainment of the ozone standard. RACM must also include emission reductions from existing sources that may be obtained through the adoption, at a minimum, of reasonably available control technology (RACT). The U.S. EPA has interpreted RACM as those emission control measures that are technologically and economically feasible and when considered in aggregate, would advance the attainment date by at least one year. The Ozone Plan contains a RACM analysis that demonstrates no new measures were identified that would advance attainment from 2020 to 2019. These analyses are further described in Chapter X, Appendix B, Appendix C, and Appendix D of the Ozone Plan. The District submitted the required RACT SIP to U.S. EPA in 2018 as discussed in Chapter 3 of the Ozone Plan.

C. Reasonable Further Progress Demonstration

The Act and the Implementation Rule specify that each ozone nonattainment area must demonstrate ongoing emission reductions relative to the baseline year (2011). The Act requires a three percent per year reduction in ROG emissions. Where both ROG and NOx emissions have been shown to contribute to high ozone levels, the Act allows NOx emission reductions to augment ROG emission reductions in order to demonstrate RFP.

The Ozone Plan includes an RFP demonstration that meets the Act’s requirements. The analysis indicates that the adopted measures from CARB’s mobile source program will provide emissions reductions beyond those needed for Western Nevada County’s RFP demonstration. Further information on the RFP demonstration can be found in Chapter XI of the Ozone Plan.

D. Contingency Measures

Contingency measures provide additional emission reductions in the event a nonattainment area fails to achieve RFP targets or attain the ozone standard by the attainment date. These reductions are considered to be additional since they are reductions not accounted for in the attainment demonstration. U.S. EPA has interpreted this requirement to represent one year’s worth of RFP, which amounts to three percent reductions from measures that are already in place or that would take effect without further rulemaking action.

U.S. EPA staff has interpreted the recent decision in *Bahr v. U.S. EPA* (*Bahr*) to mean that contingency measures must include a future action triggered by a failure to attain or failure to make RFP. The *2018 Updates to the California State Implementation Plan* (released September 21, 2018), includes a triggered Statewide Contingency measure that, together with district contingency measures and the inventory analysis presented below, fully address the contingency measure requirements of the Act as interpreted by U.S. EPA in response to *Bahr*. The tables below document the amount of emission reductions needed for contingency and the excess emission reduction benefits from implementing California’s Mobile Source Program that can be used towards meeting RFP and attainment contingency.

Since progress must first be shown with ROG prior to using NOx substitution, Table 4 includes the estimated one year of progress for 2011 and 2020.

Table 4. Western Nevada County Contingency Calculation
(tpd, reductions calculated on summer planning inventory)

	2011	2020
3 Percent ROG Emissions	0.2	0.1

An inventory analysis serves the purpose of demonstrating that there are emission reductions in the baseline inventory beyond what is needed for RFP of approximately one year of progress due to future implementation of the Mobile Source Program. Included in Table 5 are calculations demonstrating that there are enough emission reductions from mobile sources in the baseline inventory for Western Nevada County sufficient to meet contingency measure requirements in the milestone years.

Table 5. Western Nevada County RFP Contingency Reductions
(tpd, reductions calculated on summer planning inventory)

	2017	2020
ROG Reductions Used for RFP	0.8	1.2
NOx Reductions Used for RFP	0.0	0.1
Total NOx Reductions since 2011	2.0	2.6
Surplus NOx Reductions Available for RFP Contingency	2.0	2.5

Note: numbers may not add up due to rounding

Table 6 documents the emission reductions that occur after the attainment year due to implementation of California’s Mobile Source Program.

Table 6. Western Nevada County Attainment Contingency Reductions
(tpd, reductions calculated on summer planning inventory)

	2020 Emissions	2021 Emissions	2020 to 2021 Emission Reductions
Mobile Source ROG	2.0	1.9	0.1
Mobile Source NOx	2.9	2.7	0.2
Reduction in Post-Attainment Year Available for Attainment Contingency	--	--	0.3

Note: numbers may not add up due to rounding

E. Transportation Conformity Budgets

Under section 176(c) of the Act, transportation plans, programs, and projects that receive federal funding or approval must be fully consistent with the SIP before being approved by a Metropolitan Planning Organization (MPO) or county transportation commission. U.S. EPA's transportation conformity rule details requirements for establishing motor vehicle emission budgets (budgets) in SIPs for the purpose of ensuring the conformity of transportation plans and programs with the SIP.[4]

The Ozone Plan establishes county-level on-road motor vehicle emission budgets for each RFP milestone year, as well as for the attainment year. Table 7 summarizes the motor vehicle emissions budget for transportation conformity purposes under a Serious area 8-hour ozone classification. The emission budgets will apply to all subsequent transportation conformity years per the federal transportation conformity regulation. Emission budgets for NOx and ROG were calculated using EMFAC2014 and reflect summer average emissions. Once U.S. EPA approves the emission budgets established in the Ozone Plan, these will serve as the conformity emissions budgets for future transportation conformity determinations in Western Nevada County. Additional details on the on-road motor vehicle emission budgets can be found in Chapter VI of the Ozone Plan.

Table 7. On-Road Motor Vehicle Emission Budgets

(tpd, summer planning inventory)

Western Nevada Ozone Nonattainment Area	2020	
	ROG	NOx
Baseline Emissions	0.75	1.61
Total	0.75	1.61
Conformity Budget	0.8	1.7

Source: Ozone Plan, Table 7: *Transportation Conformity Budgets for the 2008 8-hour Ozone standard in the Western Nevada County Ozone Nonattainment Area, tons per average summer day*.

VI. ENVIRONMENTAL IMPACTS

The California Environmental Quality Act (CEQA) requires that State and local agency projects be assessed for potential environmental impacts. An air quality plan is a "project" that is potentially subject to CEQA requirements. The District found that the Ozone Plan will not result in any potentially significant adverse effects on the environment and is exempt from CEQA under the provisions of section 15061 (b)(3) (the general rule that CEQA only applies to projects which have the potential for causing

---

[4] Federal transportation conformity regulations are found in 40 CFR Part 51, subpart T – Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Developed, Funded or Approved Under Title 23 U.S.C. of the Federal Transit Laws. Part 93, subpart A of this chapter was revised by the EPA in the August 15, 1997 Federal Register.

a significant effect on the environment) and section 15308 (actions taken by a regulatory agency for protection of the environment) of the CEQA Guidelines.

CARB has determined that its review and approval of the Ozone Plan submitted by the District for inclusion in the California State Implementation Plan (SIP) is a ministerial activity by CARB for purposes of CEQA (14 CCR § 15268). A "ministerial" decision is one that involves fixed standards or objective measurements, and the agency has no discretion to shape the activity in response to environmental concerns.
(14 CCR § 15369; *San Diego Navy Broadway Complex Coalition v. City of San Diego* (2010) 185 Cal.App.4th 924, 934.)

CARB's review of the Ozone Plan is limited to determining if it meets all the requirements of the Act. CARB is prohibited from approving it or changing it unless CARB finds that it does not comply with the Act (Health and Safety Code § 41650 and 41652). Since CARB lacks authority to not adopt the plan, or modify it, in response to environmental concerns raised through the CEQA process, CARB's action on the plan is ministerial for purposes of CEQA.

VII. STAFF RECOMMENDATION

CARB staff recommends that the Board:

1. Approve the Ozone Plan, including the emission inventories, attainment demonstration, RACM demonstration, RFP demonstration, contingency measures, and transportation conformity budgets, and the CARB Staff Report WOE and supplemental information on contingency measures as a revision to the California SIP;

2. Approve the District's request that Western Nevada County be classified as a Serious ozone nonattainment area;

3. Direct the Executive Officer to submit the Ozone Plan to U.S. EPA as a revision to the California SIP;

4. Direct the Executive Officer to work with the District and U.S. EPA and take appropriate action to resolve any completeness or approvability issues that may arise regarding the SIP submission; and

5. Authorize the Executive Officer to include in the SIP submittal any technical corrections, clarifications, or additions that may be necessary to secure U.S. EPA approval.

Appendix A

Weight of Evidence Analysis

Western Nevada Weight of Evidence

Introduction

The Western Nevada nonattainment area comprises the portion of Nevada County from the western boundary with Yuba and Placer counties up to the crest of the Sierra Nevada Mountains.

Western Nevada County was designated as a moderate non-attainment area for the federal 2008 8-hour ozone standard of 0.075 parts per million (ppm). Ozone concentrations have decreased significantly over the past two decades, and 8-hour ozone design values were 0.077 ppm in 2012 and 2013, within 3 percent of the ozone standard. However, in recent years, a slight increase in ozone concentrations has been observed in the Grass Valley region of Western Nevada County.

To address the uncertainties inherent to modeling assessment, the U.S. Environmental Protection Agency (U.S. EPA) has released guidance, *Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$ and Regional Haze*. This guidance recommends that supplemental analyses accompany all modeled attainment demonstrations. The weight of evidence (WOE) analyses presented in this report complement the regional photochemical modeling analyses included in the Western Nevada State Implementation Plan (SIP).

Currently, Nevada County has an ozone monitoring site in Grass Valley that operates year-round. Through 2015, the nonattainment area also had a seasonal site at White Cloud Mountain, operated by California Air Resources Board (CARB) staff. These two sites are at elevations of 2,600 and 3,500 feet, respectively as shown in Figure 1. Locations for these and other ozone monitoring sites are indicated in Figure 1 and identified in Table 1, together with information about the county and air district in which these monitors are located.

The following WOE demonstration includes a conceptual model of conditions that contribute to the exceedances of the 0.075 ppm federal ozone standard in Western Nevada, together with detailed analysis of ambient ozone levels and trends, regional ozone transport using back trajectories, ozone weekday and weekend analyses, and precursor emissions trends.

Area Description

Nevada County is drained by the Middle and South Yuba rivers. The western part of the county is defined by the course of several rivers and the irregular boundaries of adjoining counties.

The city of Grass Valley is the largest city in the western region of Nevada County. Situated at roughly 2,500 feet elevation in the western foothills of the Sierra Nevada mountain range, this historic Gold Country city is located about 60 miles north-northwest from the State capitol in Sacramento. As of the 2010 United States Census, the population of Grass Valley was 12,860. Grass Valley has a hot summer Mediterranean climate with warm to hot, dry summers and wet, cool, winters. Summer is very dry and the winter rains contribute to a heavy fuel-loading of brush and grass, which dry out during the summer, posing a wildfire hazard. In 2018, air quality at Grass Valley was heavily impacted by forest fires in the region during the summer ozone season. High fine particulate matter (PM2.5) and ozone concentrations were observed in the region during these forest fire days.

Figure 1. Ozone monitoring sites in Western Nevada County

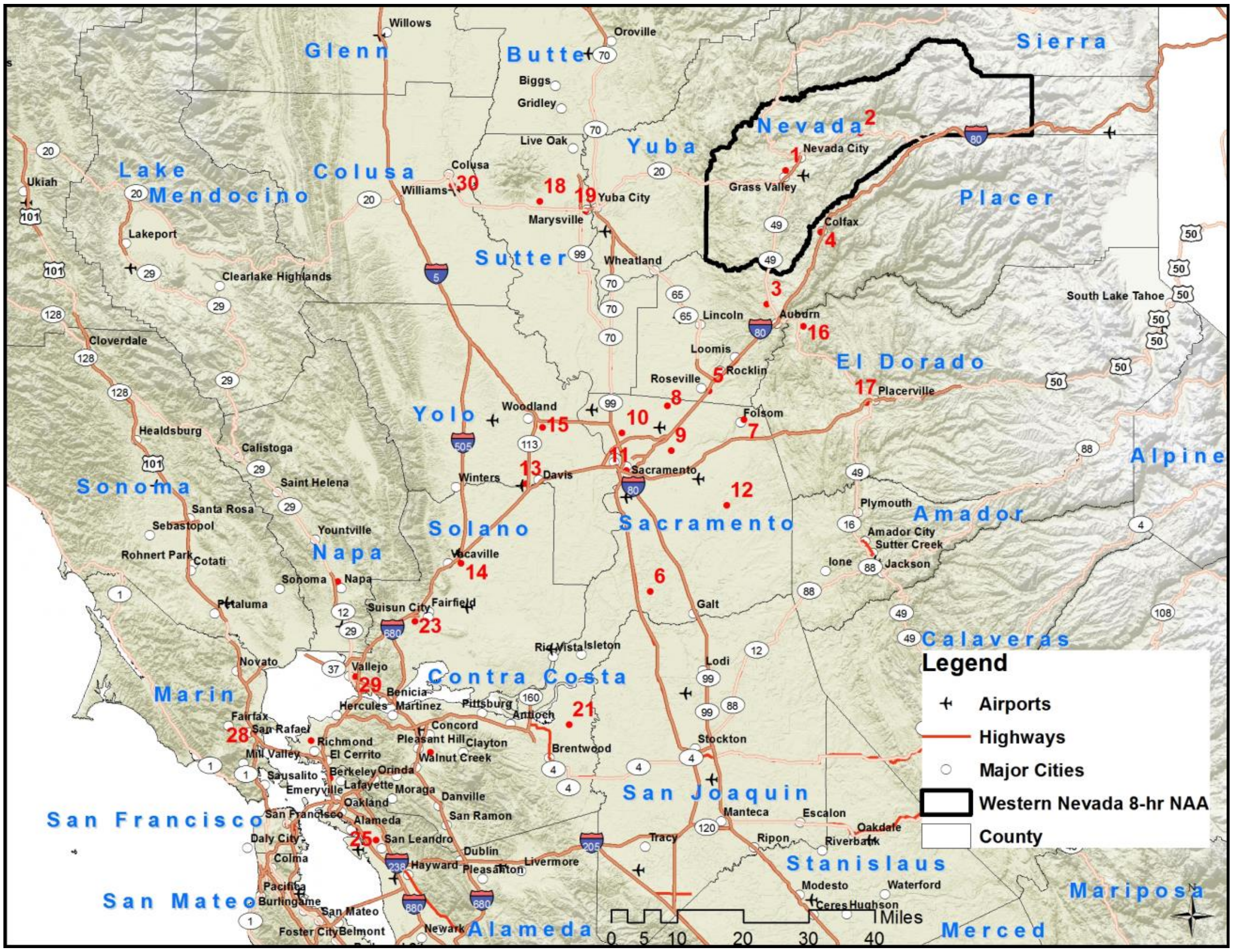


Table 1. List of ozone monitoring sites in Figure 1

Site Number	Site Name	County	Air District
1	Grass Valley-Litton Building	Nevada	Northern Sierra AQMD
2	White Cloud Mountain	Nevada	Northern Sierra AQMD
3	Auburn-Dewitt-C Avenue	Placer	Placer County APCD
4	Colfax-City Hall	Placer	Placer County APCD
5	Roseville-N Sunrise Blvd	Placer	Placer County APCD
6	Elk Grove-Bruceville Road	Sacramento	Sacramento Metropolitan AQMD
7	Folsom-Natoma Street	Sacramento	Sacramento Metropolitan AQMD
8	North Highlands-Blackfoot Way	Sacramento	Sacramento Metropolitan AQMD
9	Sacramento-Del Paso Manor	Sacramento	Sacramento Metropolitan AQMD
10	Sacramento-Goldenland Court	Sacramento	Sacramento Metropolitan AQMD
11	Sacramento-T Street	Sacramento	Sacramento Metropolitan AQMD
12	Sloughhouse	Sacramento	Sacramento Metropolitan AQMD
13	Davis-UCD Campus	Yolo	Yolo-Solano County AQMD
14	Vacaville-Ulatis Drive	Solano	Yolo-Solano County AQMD
15	Woodland-Gibson Road	Yolo	Yolo-Solano County AQMD
16	Cool-Highway 193	El Dorado	El Dorado County AQMD
17	Placerville-Gold Nugget Way	El Dorado	El Dorado County AQMD
18	Sutter Buttes-S Butte	Sutter	Feather River AQMD
19	Yuba City-Almond Street	Sutter	Feather River AQMD
20	Berkeley-6th Street	Alameda	Bay Area AQMD
21	Bethel Island Road	Contra Costa	Bay Area AQMD
22	Concord-2975 Treat Blvd	Contra Costa	Bay Area AQMD
23	Fairfield-Chadbourne Road	Solano	Bay Area AQMD
24	Napa-Jefferson Avenue	Napa	Bay Area AQMD
25	Oakland-9925 International Blvd	Alameda	Bay Area AQMD
26	San Francisco-Arkansas Street	San Francisco	Bay Area AQMD
27	San Pablo-Rumrill Blvd	Contra Costa	Bay Area AQMD
28	San Rafael	Marin	Bay Area AQMD
29	Vallejo-304 Tuolumne Street	Solano	Bay Area AQMD
30	Colusa-Sunrise Blvd	Colusa	Colusa County APCD

APCD: Air Pollution Control District; AQMD: Air Quality Management District

Conceptual Model

Transport of ozone and ozone precursors from the upwind urban regions including Sacramento and the San Francisco Bay Area, local anthropogenic emissions, varied terrain, and meteorological conditions favorable for the formation and buildup of ozone all contribute to the ozone air quality challenges in the Western Nevada Region.

Ozone concentrations within the Western Nevada nonattainment area are directly the result of emissions and pollutant formation within metropolitan areas to the southwest, flowing up into the foothills most summer evenings with the onset of moderate to strong onshore winds, known locally as the Delta Breeze. In addition, the formation of an atmospheric inversion nearly every night, combined with the mountainous terrain of the Western Nevada County region, has the potential to trap air for extended periods of time.

Terrain and Meteorology

Nevada County is in the foothills and mountains of the Sierra Nevada mountain range and is located entirely within the Mountain Counties Air Basin (MCAB). The MCAB consists of gradual foothills rising out of California's Central Valley on the western side of the basin that transition to steeper, more complex terrain with high mountain peaks and a broad range of valleys spanning the full north-south extent of the air basin on the eastern side. Elevations within Nevada County increase from roughly 300 feet above mean sea level in the west to over 9,000 feet in the east (the eastern edge of the proposed nonattainment area is some 20 miles from the Sierra Nevada crest).

Nevada County is characterized by river valleys running roughly east-northeast to west-southwest, separated by mountain ridges. This tends to inhibit north-south air flow, but to allow east-west upslope and downslope flow. The western portion of the County, which makes up the Western Nevada ozone nonattainment area, is defined as the portion of the County that lies to the west of the crest of the Sierra Nevada mountain range. This ridgeline also represents the hydrographic boundary between the Lake Tahoe watershed and the watersheds to the west. The eastern portion of the County would not be expected to be influenced regularly by conditions in or transport from the Sacramento Valley or even the western portion of Nevada County itself, since it is on the other side of the crest of the Sierra Nevada mountain range, which is up to 9,000 feet in elevation.

The foothills of the Sierra Nevada allow air to flow easily into the basin from the west under normal summertime Delta Breeze conditions, but the rugged terrain on the eastern side of the MCAB requires much stronger winds, associated with large-scale low pressure systems, to transport air over the crest of the Sierras. As a result, Western Nevada County experiences the daily recirculation of air up the slope during the day and back down the slope at night, especially between the Central Valley floor and Highway 49, which travels along the foothills from north to south at an elevation of about 1,000-2,000 feet. Days with a moderate to strong Delta Breeze see the valley air reach up into Grass Valley and Nevada City.

As is the case elsewhere in the Mountain Counties Air Basin, during the summer ozone can be transported up into the Western Nevada region and become trapped in mountain valleys. With nothing to break down ozone in the atmosphere, ozone concentrations have the potential to remain high for as long as 24-48 hours straight until a weather system with strong winds is able to vent the valleys.

Another weather pattern that is mostly limited to the eastern half of California and frequently impacts the MCAB is monsoonal flow from the south in the summer time. Upper-level high pressure over the four corner states (Arizona, Utah, Colorado, and New Mexico) is a common feature during the summer and the clockwise flow of air around it pulls moisture from the Gulf of Mexico into the western U.S. On occasion, the moisture moves far enough to the west that thunderstorms will form over the Sierra Nevada Mountains. Residual clouds from thunderstorms formed the previous day in southern California will also flow into the MCAB. In both cases, the clouds block sunlight and limit ozone formation. Wind and rain showers associated with some of the storms will also help to prevent the formation and buildup of pollutant concentrations. However, in cases where the storms only produce dry lightning, the chance for wildfires is greatly increased, leading to a higher potential for smoke and both particulate matter and ozone impacts in the MCAB and neighboring air basins, depending on winds and drainage flows.

Regional Transport

As the area is located downwind of the populated urban areas of Sacramento and the San Francisco Bay Area, ozone in the Western Nevada is mostly impacted by regional transport of ozone and ozone precursors.

Diurnal ozone patterns

Ozone forms as a result of photochemical reactions by precursor emissions under certain meteorological conditions. Measured ozone can be due to local precursor emissions and/or due to regional transported ozone and ozone precursors. In general, within large urban areas, ozone concentrations increase after sunrise and continue to peak after noon, then start decreasing in the evening and declining to minimum concentrations during the night. Areas impacted by transport generally show ozone concentrations peaking in the late afternoon or evening. In developing this report, diurnal patterns of median hourly ozone concentrations were analyzed. For this analysis, hourly ozone concentrations for the months of May to October were considered because the number of hours of daylight during these months is similar, ranging from 13 to 14 hours each day. Median hourly concentration were considered because the median provides a generally more robust metric than the mean, which can be influenced by outliers. All data collected during the month for the year of interest were included in the analysis to provide a more robust sample size.

Figure 2 shows the median hourly ozone concentrations for the years 2010 onwards, at the Grass Valley-Litton Building and White Cloud Mountain sites. The diurnal patterns for Grass Valley show maximum daily values occurring in the late afternoon/evening. This is unlike typical patterns for photochemical production of ozone from local sources which have a bell curve-shaped peak in the early afternoon. The flat diurnal ozone pattern is more prominent at the White Cloud Mountain site than the Grass Valley-Litton Building site, as the White Cloud Mountain site has fewer local emissions. Lower concentrations occurring at White Cloud Mountain are consistent with that site's higher elevation and greater distance from contributing urban areas. In general, both sites have a typical diurnal ozone pattern for sites located in remote areas and/or national parks.

As mentioned above, a factor leading to persistently elevated ozone concentrations at the Grass Valley and White Cloud Mountain monitors is the lack of widespread combustion emissions, which would otherwise tend to break down ozone during the nighttime hours when sunlight is not available to drive ozone formation process. Without the continuous influx of fresh emissions that are emitted in metropolitan areas, ozone concentrations remain high overnight, requiring fewer hours to reach higher concentrations the following day.

Because locally generated emissions in Western Nevada County are lower than in upwind metropolitan areas, late morning and early afternoon ozone concentrations at the Western Nevada monitors are lower than they would be in the upwind Sacramento metropolitan area.

Ozone diurnal patterns are similar at the Grass Valley – Litton Building site in all these years. However, median hourly ozone in 2017 was significantly higher than the rest of the years at Grass Valley at all hours, highlighting the unusual levels of ozone observations at this site in that year.

Wind flow on high ozone days

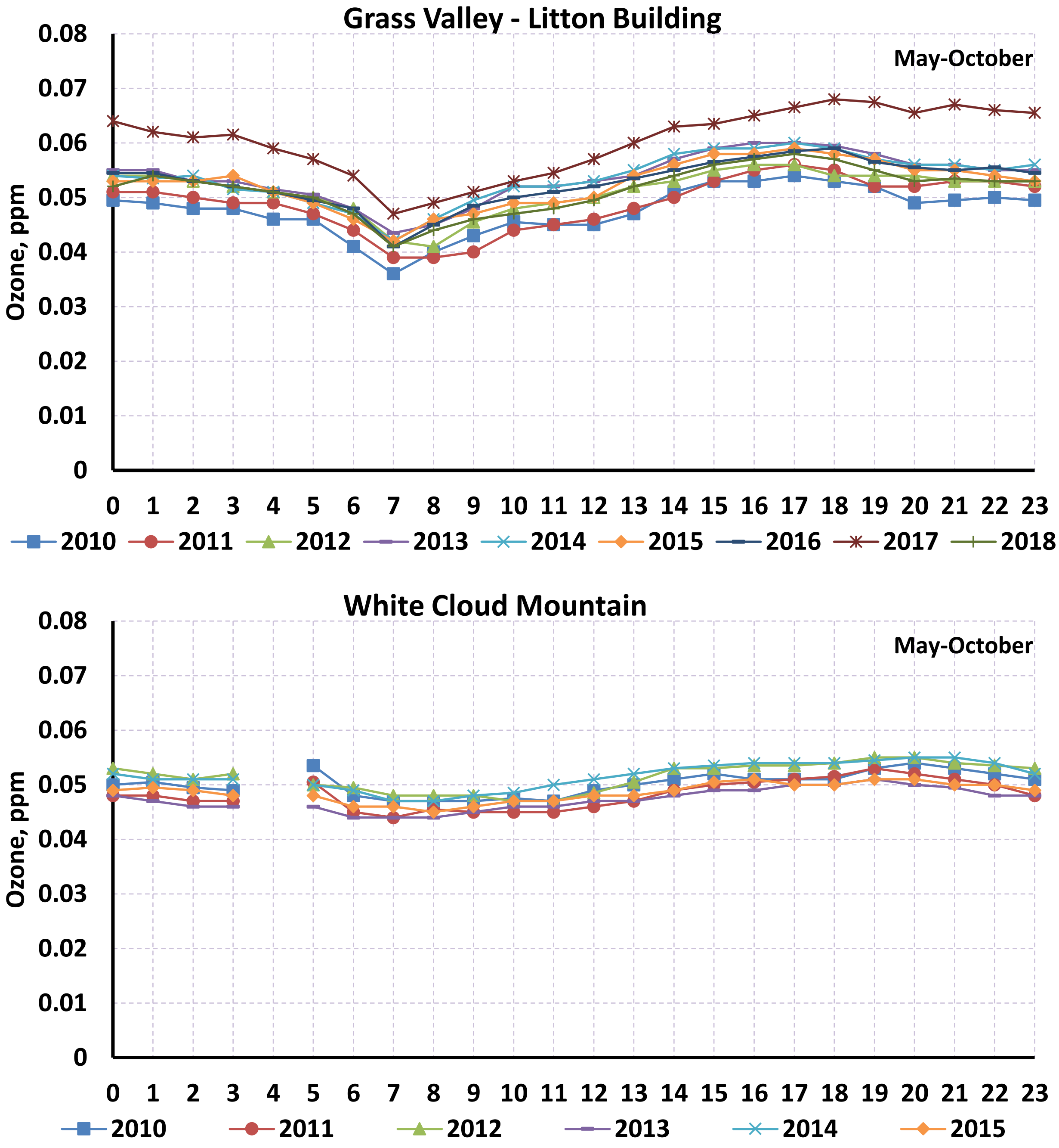
Evaluation of meteorological data helps to assess the fate and transport of emissions contributing to ozone concentrations and to identify areas potentially contributing to the monitored violations.

CARB staff used the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model to calculate 24-hour back trajectories using North American Mesoscale Forecast System 12 km-grid meteorological data. This analysis shed light on how meteorological conditions, including, but not limited to, weather, transport patterns, and stagnation conditions, could affect the fate and transport of ozone and precursor emissions from sources in the region.

In Western Nevada County, carryover ozone is of prime concern. As discussed in the previous section, ozone concentrations are higher during the night hours resulting in higher ozone levels available to contribute to pollution levels the following day. CARB staff developed back trajectories for the Grass Valley-Litton Building and White Cloud Mountain sites at the heights of 3 and 300 meters above ground level and at 6 p.m. local time.

Back trajectory analysis for days exceeding the 0.075 ppm standard points to transport mostly from the Sacramento and San Francisco Bay Area regions, with comparatively little transport from within Nevada County and almost no transport from the eastern half of Nevada County. As shown in Figure 3, 9 of the 11 exceedance days in 2015 featured an air parcel coming from the San Francisco Bay Area and passing through the Sacramento area. On the remaining two exceedance days, the air parcel came from the surrounding area of the site, consistent with a stagnation period.

Figure 2. Hourly median pattern of ozone concentrations at the Grass Valley-Litton Building and White Cloud Mountain sites



Back-trajectories were consistent for all years studied as shown in Appendix A3. There was no significant difference between trajectories at 3 and 300 meter heights indicating an almost uniform wind pattern in the lower and upper atmosphere. The few trajectories coming from the surounding area indicate stable amospheric conditions, and air circulation and stagnation within the Grass Valley area. This is consistent with downslope flow in the evening preceding the exceedances, followed by upslope flow on the day of the exceedance, and may indicate recirculation of pollutants, possibly transported to Nevada County on the preceding day.

Results of HYSPLIT analysis may inform the determination of nonattainment area boundaries. In support of area designations for the 0.070 ppm ozone standard, U.S. EPA evaluated 2014-2016 HYSPLIT trajectories at 100, 500, and 1000 meters above ground level, and arrived at similar conclusions to those described above.

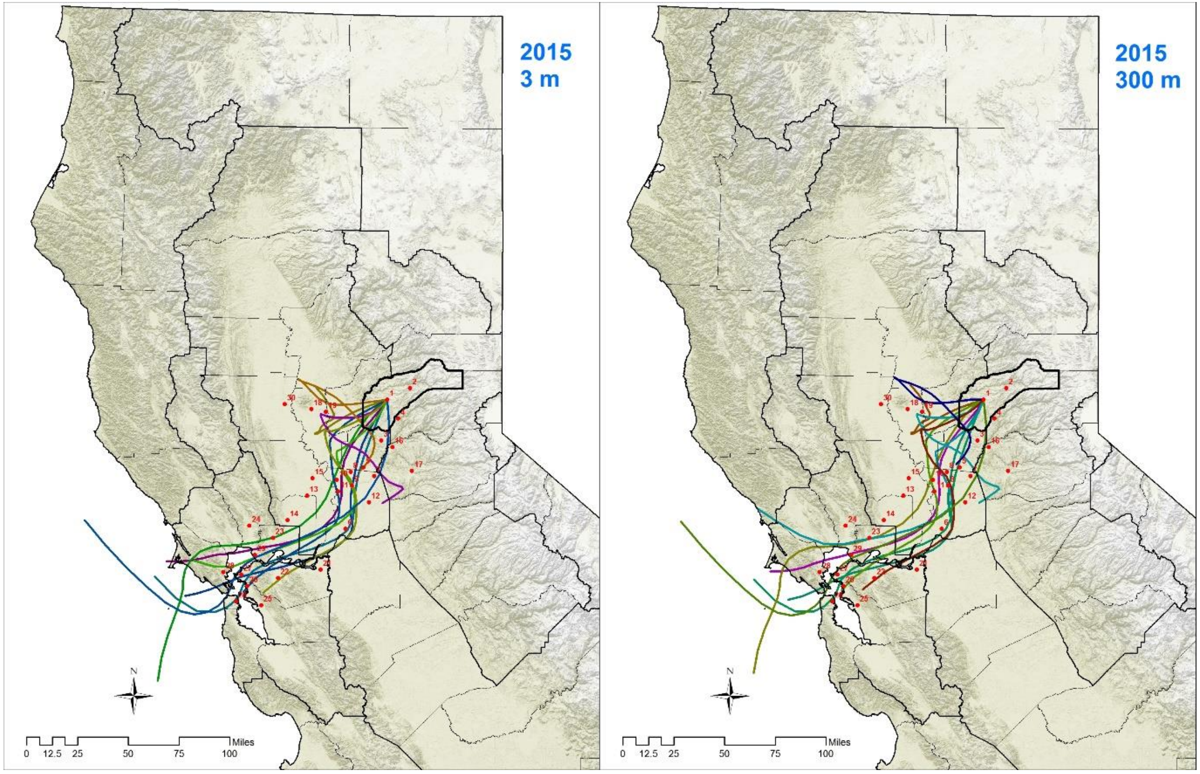
Regional Distribution of Precursor Emissions

Precursor emissions generated in the upwind Sacramento and Bay Area nonattainment areas overshadow those from Western Nevada County. The emissions inventory, summarized in Figure 4, indicates that the emissions of oxides of nitrogen (NOx) and reactive organic gases (ROG) in Western Nevada County are a fraction of emissions generated in the two large upwind metropolitan nonattainment areas. Western Nevada's NOx and ROG emissions amounted to only 5 percent of Sacramento nonattainment area emissions in 2015. Similarly, Western Nevada's 2015 NOx and ROG emissions are less than 2 percent of those from the Bay Area. The difference in emissions between these upwind, contributing areas and Western Nevada County helps explain the important role of transport in Western Nevada's ozone air quality.

The connection between ozone, a secondary pollutant, and emissions of ozone precursor compounds is characterized by considerable temporal and spatial variability. In general, as air masses travel downwind, entrainment of fresh emissions, atmospheric reactions, depositional processes, and dilution increase the VOC/NOx ratio. As a result, ozone formation in suburban and rural areas downwind of major urban areas is generally regarded as NOx limited (cf. Finlayson-Pitts and Pitts, 1993; Finlayson-Pitts and Pitts, 2000). Given Western Nevada's location, downwind of two large metropolitan nonattainment areas, ozone formation would be expected to be limited by available NOx. The demonstrated role of transport indicates that a substantial portion of ozone measured in Western Nevada is derived from precursor emissions in upwind areas. Thus, attainment in Western Nevada is directly linked to emission reduction strategies upwind in the Sacramento and San Francisco Bay Area nonattainment areas.

Figure 3. 24-hour back trajectories at 3 m and 300 m height for high ozone days (>0.075 ppm) at Western Nevada sites for the year 2015

Grass Valley



White Cloud Mountain

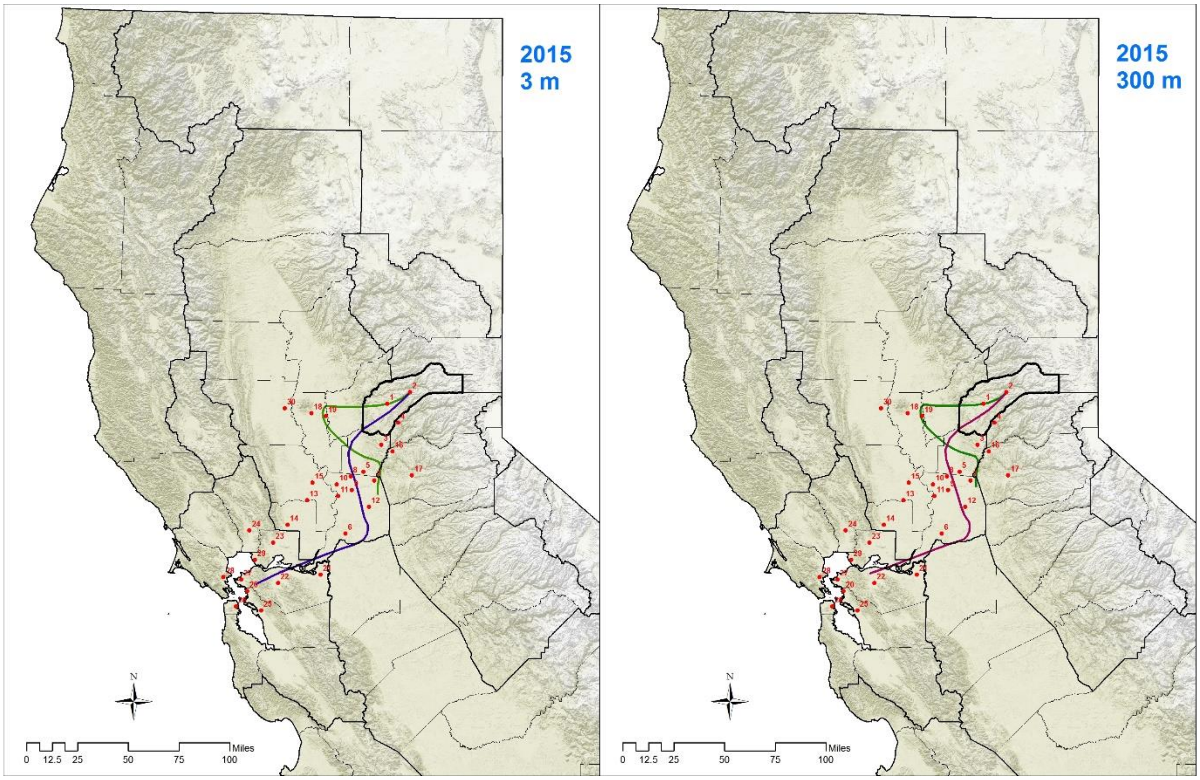
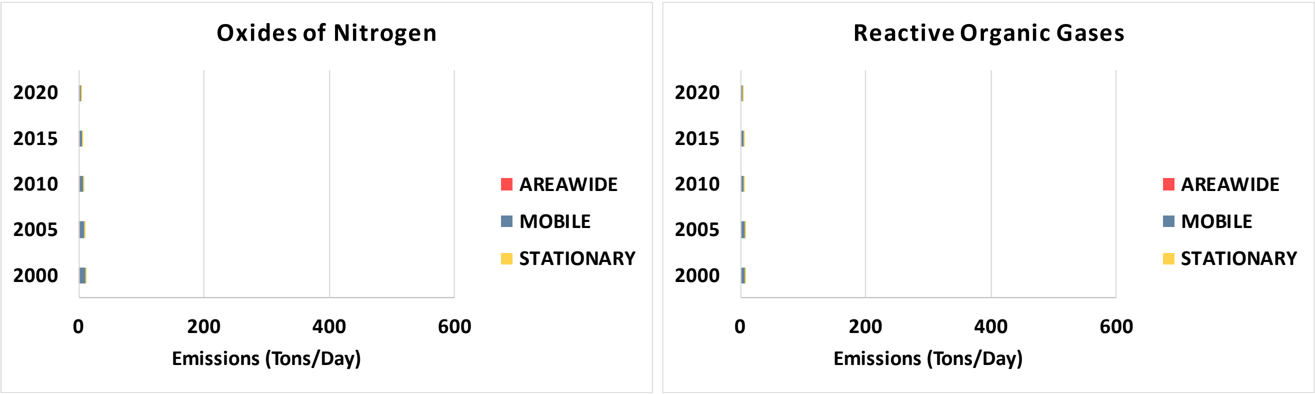
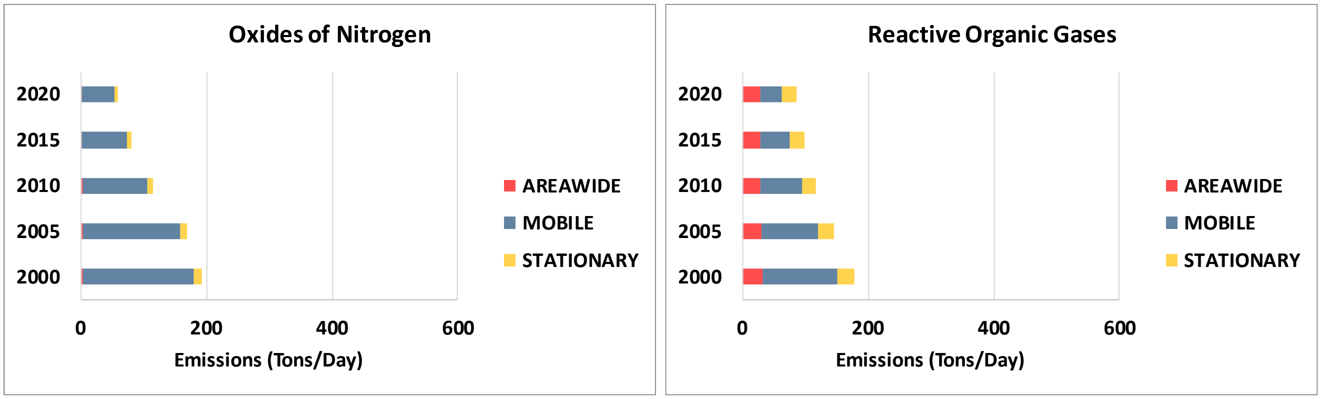


Figure 4. Emission Inventories for Western Nevada, Sacramento, and San Francisco Bay Area by Source Category

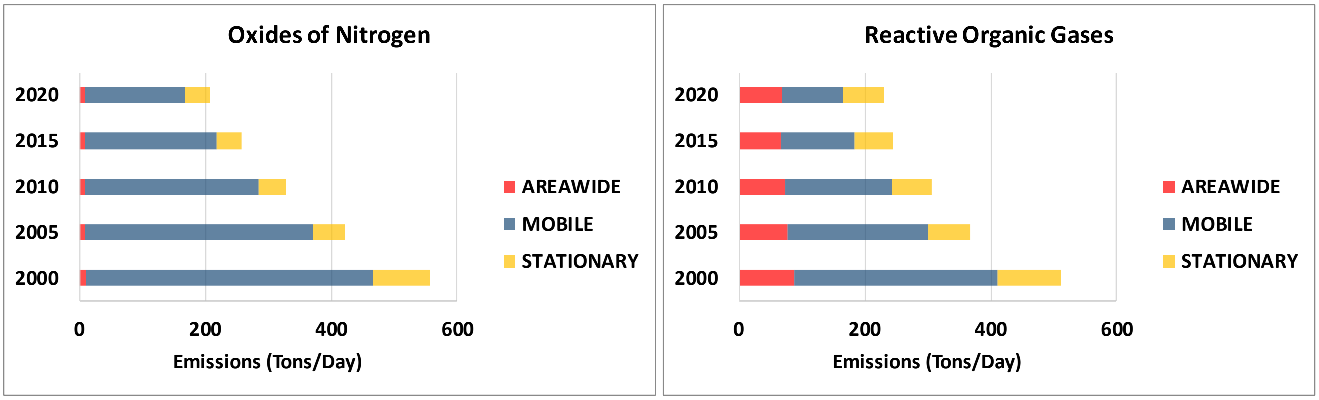
Western Nevada



Sacramento



San Francisco Bay Area



Conceptual Model Summary

Meeting the 0.075 ppm ozone standard is a complex challenge in the Western Nevada nonattainment area. A diverse suite of precursor emissions, largely from upwind nonattainment areas, results from upwind urban areas surrounded by heavily-traveled highways and major agricultural activities. The area is characterized by varied terrain, which limits dispersion and effectively traps emissions in the region. Furthermore, meteorological conditions are dominated by a semi-permanent high pressure system, which enhances the trapping effect of the local terrain. A thermally driven afternoon Delta Breeze wind and a nighttime, downslope drainage flow recirculation pattern complete the picture. Together, they serve to routinely transport emissions from upwind areas into the foothills of Western Nevada during the day, and then back down toward the valley floor overnight. State of the art photochemical modeling, supported by extensive monitoring and research efforts, indicates that the path towards attainment of the 0.075 ppm standard is with a NOx-focused control strategy. This strategy is already in place in the upwind contributing areas.

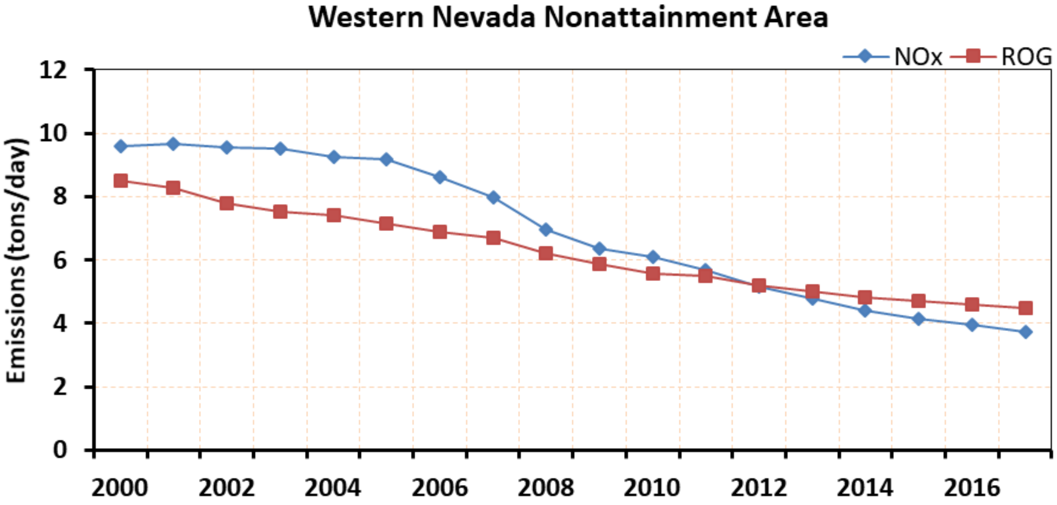
Anthropogenic Emission Trends

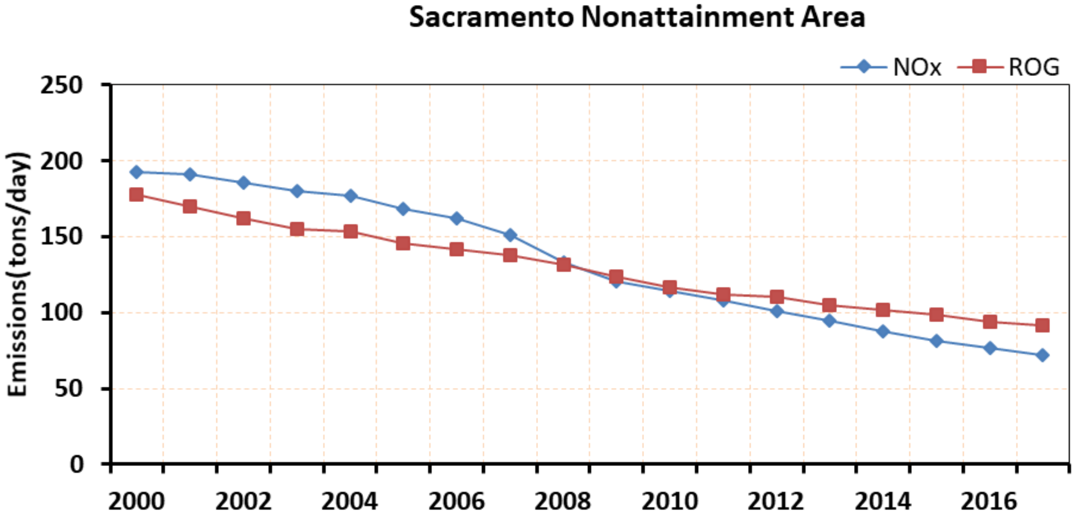
Tropospheric ozone is a secondary pollutant that is formed by NOx and VOCs (also referred to as reactive organic gases, or ROG) through complex non-linear photochemical reactions. Anthropogenic emissions from mobile sources, industrial facilities and electric utilities, gasoline vapors, and chemical solvents are some of the major sources of NOx and ROG. Vegetation is also a major source of ROG emissions.

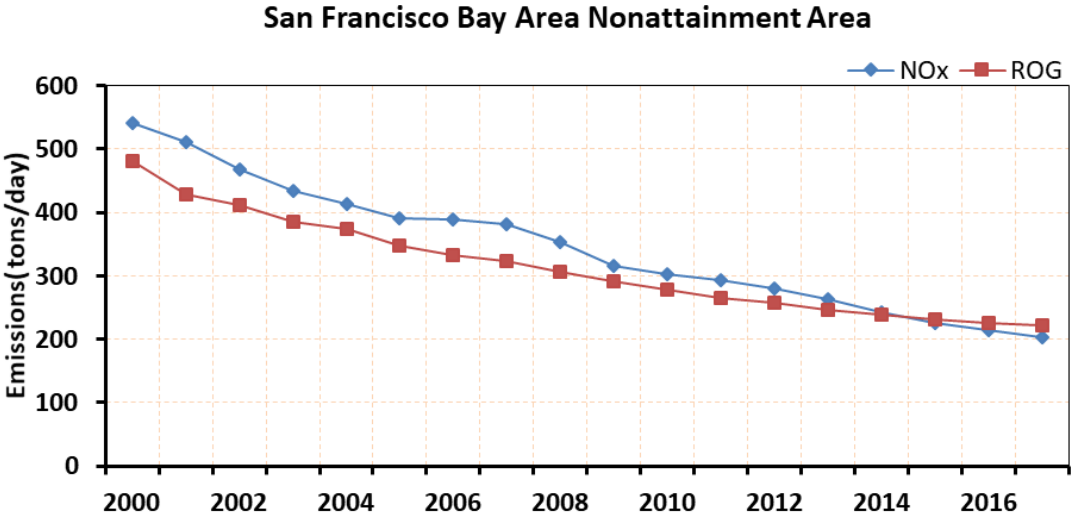
Emissions control programs have substantially reduced the amounts of both NOx and ROG emitted by various sources throughout the Western Nevada nonattainment area. Emissions trends, excluding emissions from natural sources, for NOx and ROG in the Western Nevada, Sacramento, and San Francisco Bay Area nonattainment areas are shown in Figure 5. All emission inventory values are based on CARB’s California Emission Projection Analysis Model (CEPAM) for the 2016 Ozone SIP, version 1.05 with external adjustments, which uses 2012 as the inventory base year. The figure shows that from 2000-2016, anthropogenic NOx emissions decreased by 59 percent and ROG emissions decreased by 46 percent in Western Nevada.

As Western Nevada is progressing towards attainment, the quantity and composition of ozone precursors have changed. In recent years, NOx has been the primary focus of control efforts. State of the art photochemical modeling assessments are necessary to understand the current and future mechanisms that will control ozone concentrations in the Western Nevada NNA. The most recent modeling indicates that the dominant precursor controlling ozone production is NOx, and that by means of a NOx-focused control strategy the Western Nevada nonattainment area will be able to achieve the 0.075 ppm standard.

Figure 5. Trends of ozone precursor emissions in Western Nevada, Sacramento, and San Francisco Bay Area Nonattainment Areas







Aggregated source category trends for anthropogenic emissions are shown in Figures 6 and 7 for NOx and ROG, respectively. Mobile source emissions are the largest category of NOx in Western Nevada. A significant decrease in NOx emissions due to CARB's emissions reduction strategies is evident. A similar but less pronounced trend for ROG emissions is shown in Figure 7, with a significant decrease in mobile ROG. However, the areawide ROG emissions category has seen a minimal decrease in emissions and over time has become the leading source category.

Figure 6. NOx emissions inventory categories for Western Nevada

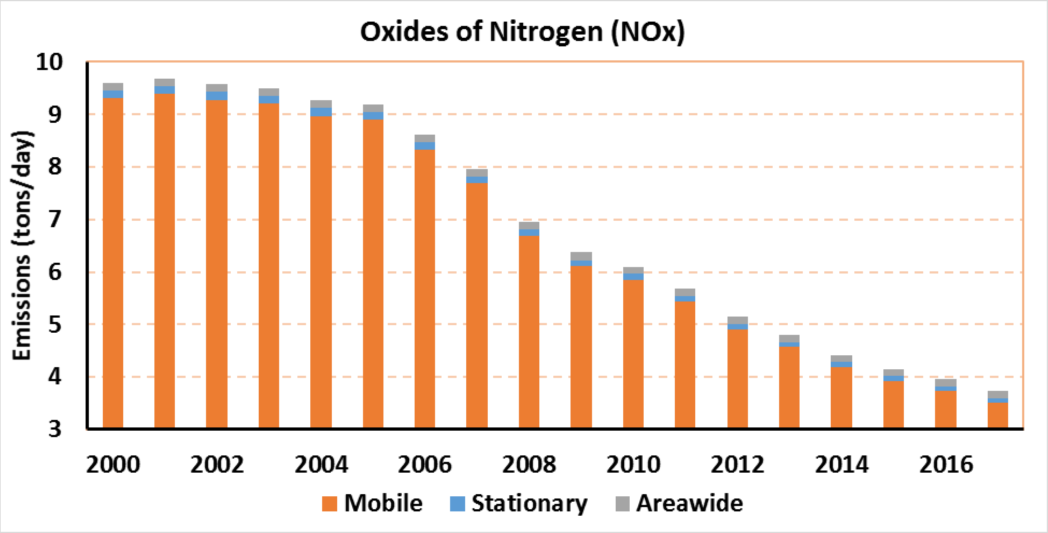
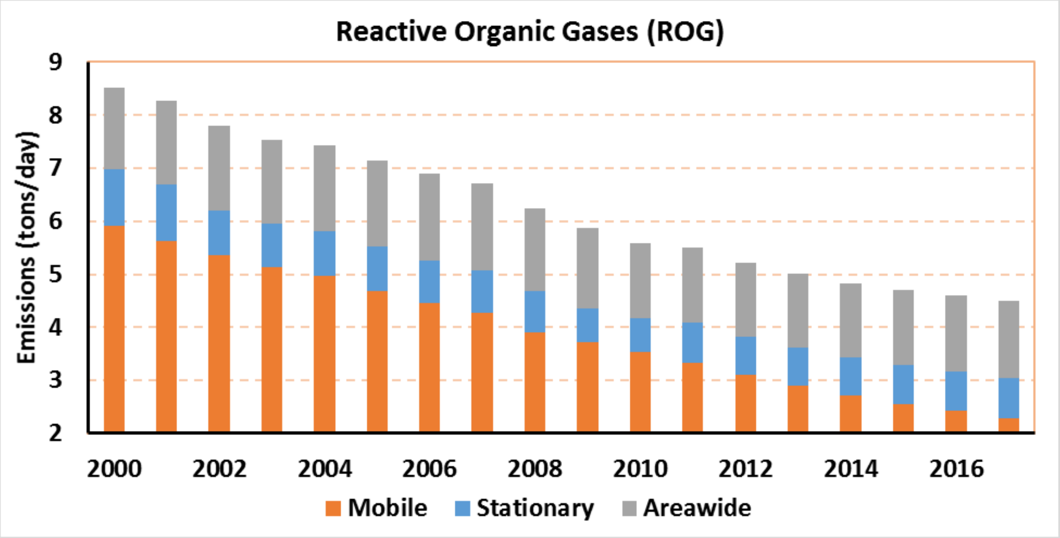


Figure 7. ROG emissions inventory categories for Western Nevada



Ozone Air Quality

As a consequence of implementing an emission control program for decades, ozone monitors throughout Northern California have recorded long-term improvement in ozone air quality. These improvements can be tracked using a variety of metrics, including design value trends, number and timing of exceedance days, magnitude of concentrations on weekday and weekend exceedance days, and ozone trends in neighboring nonattainment areas. As with all areas, inter-annual variability of ozone levels due to meteorology and wildfires must be recognized in such analyses.

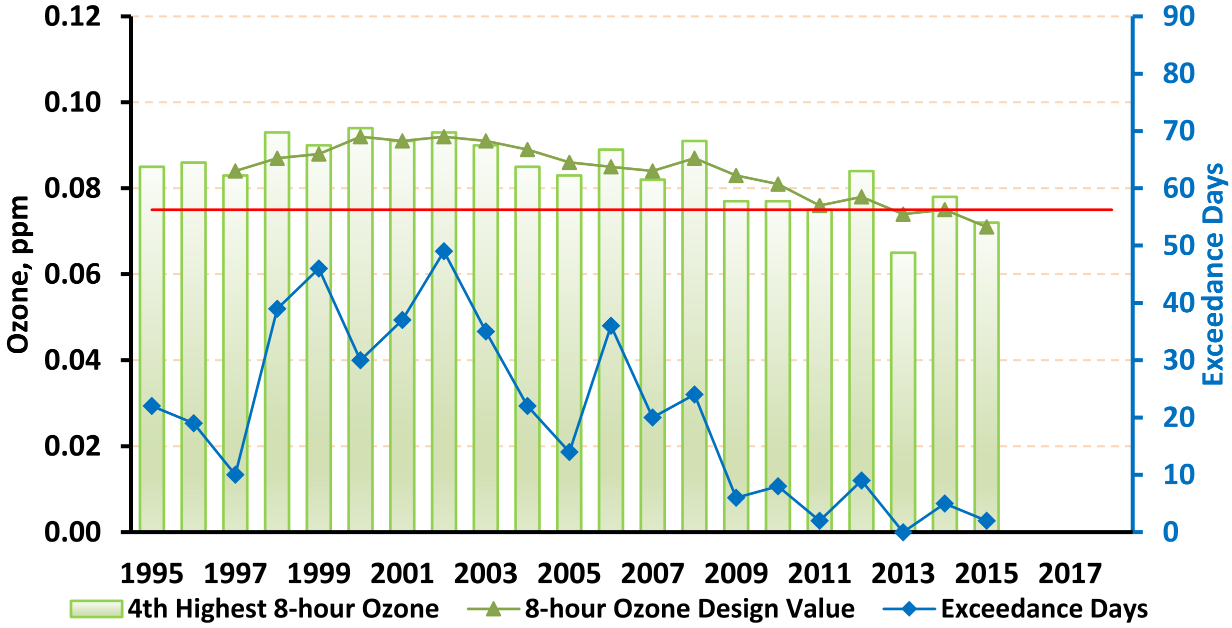
Design Value Trends

The design value is the key metric for assessing the state of ozone air quality in a region, and is compared to the federal 8-hour ozone standard for the purpose of determining attainment status. The design value is computed as the three-year average of the fourth highest 8-hour ozone concentration from each year, and is determined for each monitoring site in the region. For any area, design value is calculated across all sites within the area, and then maximum of the design values across all sites is the area-wide design value. The 8-hour ozone design values based on calculation procedures for the 0.075 ppm standard are shown in Figure 8 starting with 1995 values.

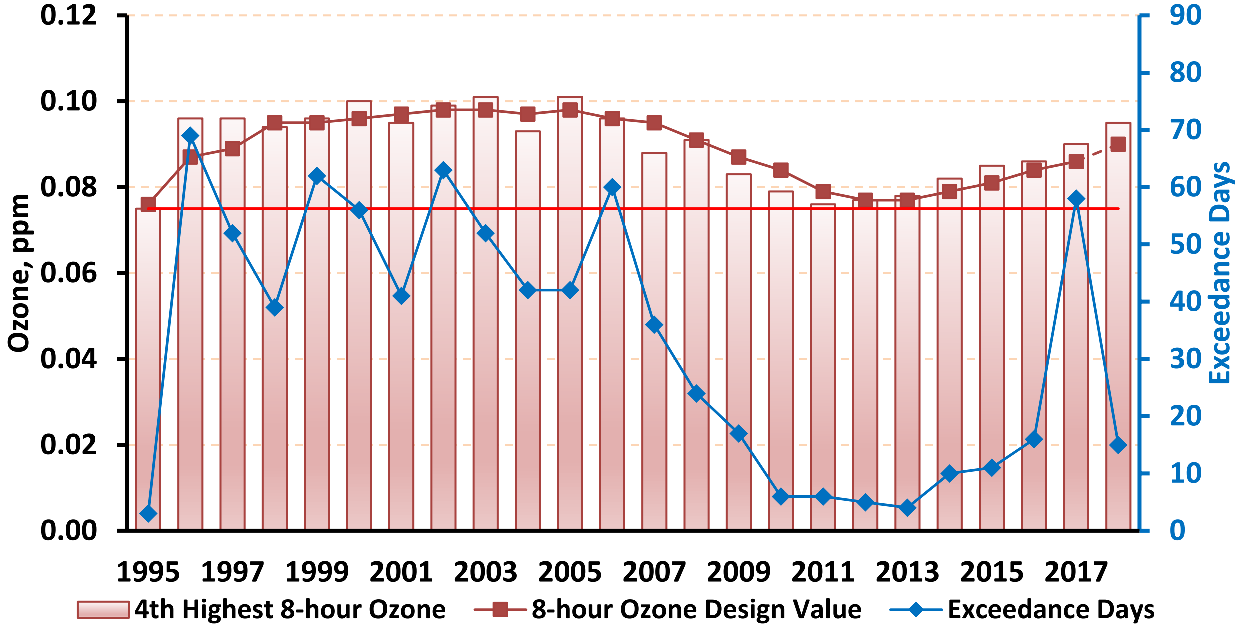
The White Cloud Mountain site has shown declining trends in design values and exceedances since 2008 and 2002, respectively. The site needed to relocate and has not operated since the end of 2015, when it met the 0.075 ppm standard in 2015. This site is projected to re-open at a nearby location in 2019.

Figure 8. 8-hour ozone design values (including preliminary 2018 design values with and without fire days) at Western Nevada sites

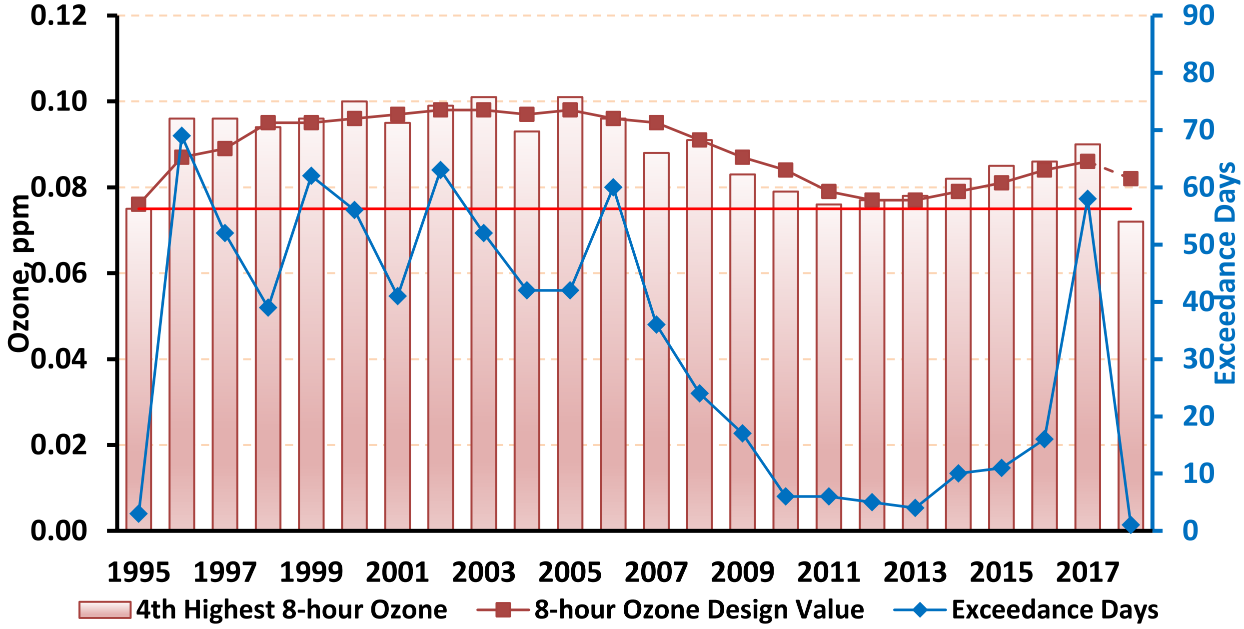
White Cloud Mountain



Grass Valley: Including 2018 Fire Days



Grass Valley: Excluding 2018 Fire Days

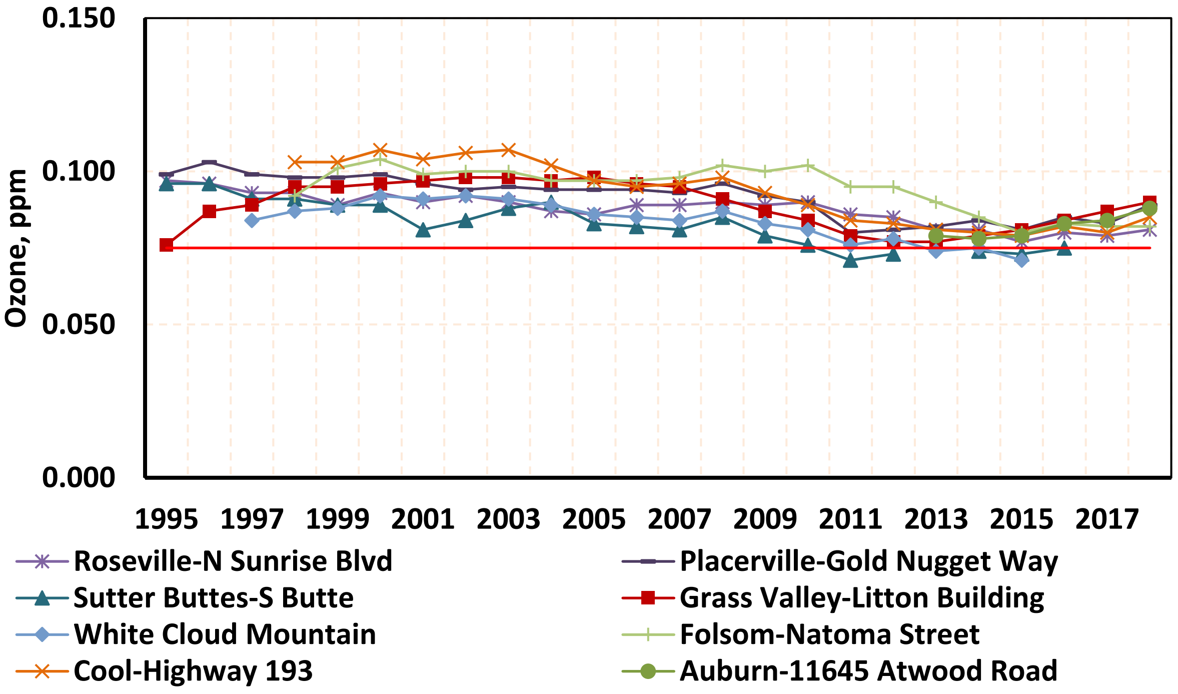


Design values for 2018 are preliminary as they rely on recent data yet to be certified. Two sets are calculated for 2018, by either including or excluding high ozone days likely impacted by forest fires. While the Grass Valley-Litton Building site has also shown a declining trend from 2005 to 2012, an upward trend after 2013 and through 2017 was observed. However, this site has shown a significant decline in design value for 2018 when excluding the high ozone days impacted by forest fires.

Figure 9 shows 8-hour ozone design values of sites close to Grass Valley, and Figure 10 shows the regional design value trends in Sacramento, San Francisco Bay area and Western Nevada. The design values of nearby sites are very close to each other and following a declining trend. In general, ozone concentrations have decreased significantly in this region until recent years when ozone trends were mostly flat or slightly increased. This increase is likely due to variations in large-scale meteorological patterns during the summer months. Some of the variability in the design values during the past five years can be attributed to two of the cleanest years ever for ozone in the Sacramento Region in 2013 and 2015, when large-scale weather patterns for both years favored moderate to strong Delta Breezes, cooler temperatures, and increased dispersion of emissions.

Figure 9. 8-hour ozone design values of select regional sites (including preliminary 2018 design values with and without fire days)

Including 2018 Fire Days



Excluding 2018 Fire Days

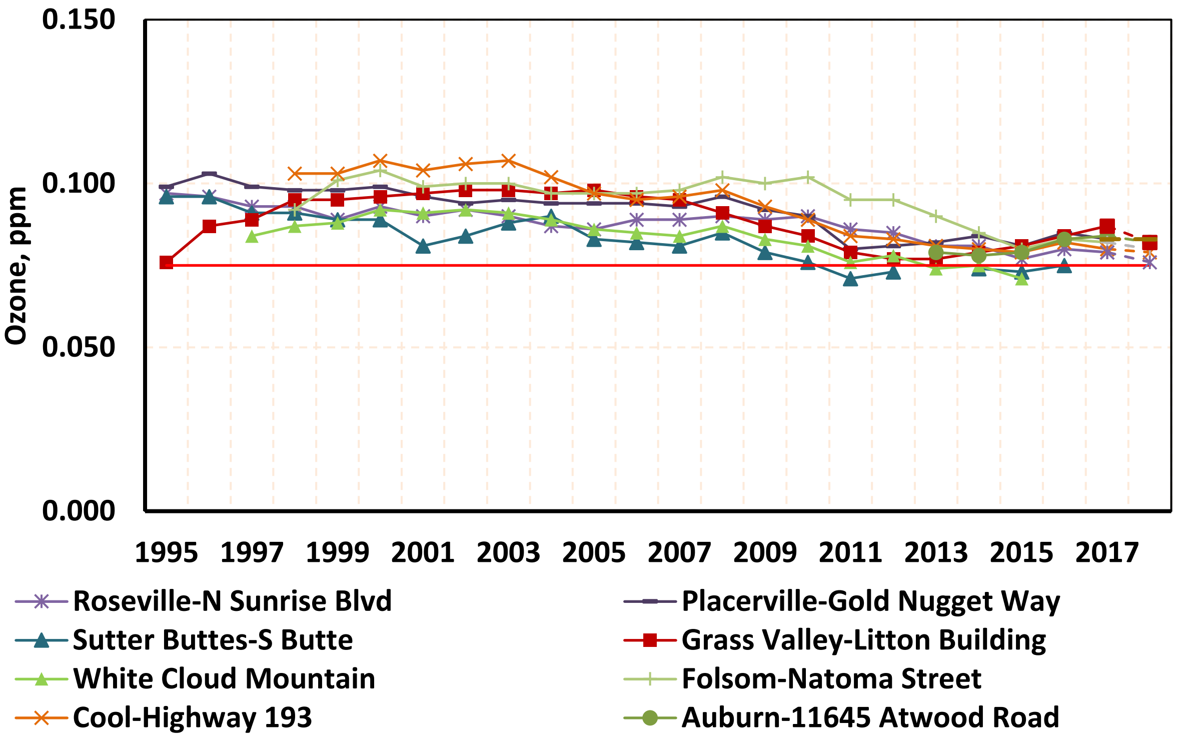
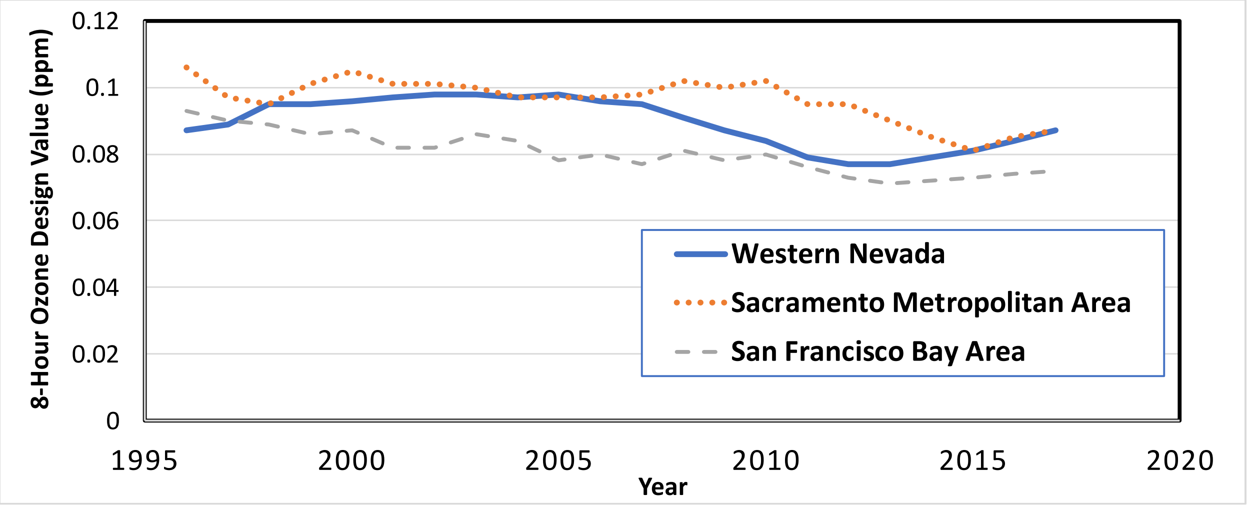


Figure 10. Trends of 8-hour Ozone Design Values in Sacramento, San Francisco Bay Area, and Western Nevada



Exceedance Day Trends

The number of days exceeding the 8-hour ozone standard for the two Nevada County sites are shown in Figure 11. After a significant decrease in the number of exceedance days from the late 1990s, the number of exceedances has shown an increasing trend beginning in 2014 at the Grass Valley - Litton Building site, from four days in 2013 to 16 days in 2016 and to 58 days in 2017. The 58 exceedance in 2017 were the highest number of exceedance days in the region since 1993, which is very unusual for this site. The number of exceedance days with preliminary data in 2018 excluding high ozone days thought to be impacted by forest fire emission impacts has dropped down to two. Monthly exceedance days from 2012 to 2017 and preliminary data excluding high ozone days likely impacted by forest fire emissions in 2018 are shown in Table 2 for selected ozone monitoring sites.

The values in Table 2 indicate that in 2017, the Grass Valley - Litton Building site observed exceedance days in every month from May to October (including three exceedance days in May and seven in October). This was very different than what Grass Valley experienced in other years, and also differed from what other sites in nearby locations recorded in 2017. The anomalous ozone data observed in 2017 at the Grass Valley - Litton Building site is discussed in more detail later in this document.

Figure 11. Number of 8-hour exceedance days (2008 Std.) (Preliminary data of 2018 excluding fire days)

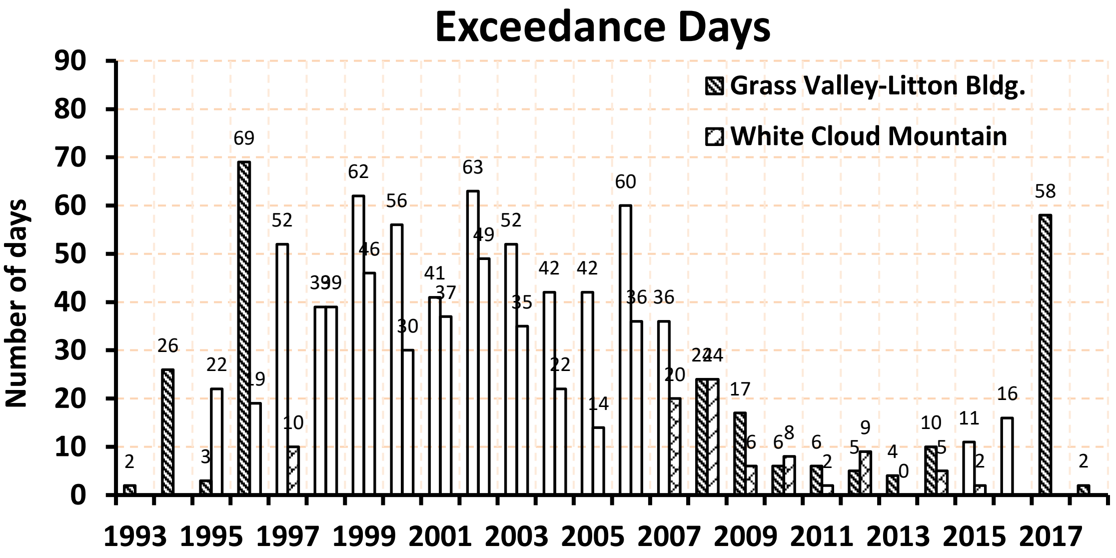


Table 2. Number of 8-hour exceedance days in Grass Valley-Litton Building (Preliminary data of 2018 without fire days)

	Grass Valley-Litton Building	White Cloud Mountain	Placerville	Sutter Buttes	Folsom	Cool	Auburn	Roseville
2010								
April	0	0	0	0	0	0	-	0
May	0	0	0	0	0	0	-	0
June	0	2	1	0	1	0	-	1
July	3	0	0	0	6	1	-	6
August	1	2	2	0	6	2	-	4
September	2	3	5	0	6	3	-	4
October	0	1	0	0	0	0	-	0
Total	**6**	**8**	**8**	**0**	**19**	**6**	**-**	**15**
2011								
April	0	0	0	0	0	0	-	0
May	0	1	0	0	1	1	-	1
June	1	0	0	0	1	2	0	2
July	0	0	1	0	8	6	1	4
August	5	1	1	0	14	9	10	4
September	0	0	3	3	9	6	4	4
October	0	0	0	0	0	0	0	0
Total	**6**	**2**	**5**	**3**	**33**	**24**	**15**	**15**
2012								
April	0	0	0	0	0	0	0	0
May	0	1	2	0	2	1	1	1
June	0	2	3	0	3	2	1	1
July	2	2	4	4	4	1	2	2
August	3	2	8	2	12	4	6	7
September	0	2	3	1	13	0	1	1
October	0	0	0	0	4	0	2	1
Total	**5**	**9**	**20**	**7**	**38**	**8**	**13**	**13**
2013								
April	0	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0	0
June	0	0	2	1	0	1	0	0
July	3	0	5	0	4	2	0	1
August	1	0	3	0	1	1	1	1
September	0	0	1	0	1	0	0	0
October	0	0	0	0	0	0	0	0
Total	**4**	**0**	**11**	**1**	**6**	**4**	**1**	**2**

	Grass Valley-Litton Building	White Cloud Mountain	Placerville	Sutter Buttes	Folsom	Cool	Auburn	Roseville
2014								
April	0	0	0	0	0	0	0	0
May	1	0	2	0	1	0	0	0
June	2	2	4	0	2	2	2	2
July	4	2	3	2	3	2	3	7
August	2	1	2	0	2	3	1	1
September	1	0	1	0	4	3	0	0
October	0	0	0	1	2	0	0	0
Total	**10**	**5**	**12**	**3**	**14**	**10**	**6**	**10**
2015								
April	0	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0	0
June	7	0	3	1	4	4	5	3
July	2	0	3	0	0	2	3	0
August	2	1	1	0	1	0	2	0
September	0	1	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0
Total	**11**	**2**	**7**	**1**	**5**	**6**	**10**	**3**
2016								
April	0	-	0	0	0	0	0	0
May	0	-	0	1	0	0	0	0
June	2	-	2	2	2	1	1	2
July	6	-	7	4	5	7	6	2
August	8	-	14	4	2	7	8	2
September	0	-	5	3	4	0	0	2
October	0	-	0	1	0	0	0	0
Total	**16**	**-**	**28**	**15**	**13**	**15**	**15**	**8**
2017								
April	0	-	0	0	0	0	0	0
May	3	-	0	0	1	0	0	0
June	11	-	1	1	0	4	2	1
July	20	-	0	0	1	1	2	1
August	12	-	2	2	2	3	6	1
September	5	-	3	4	3	1	3	1
October	7	-	1	0	0	0	0	0
Total	**58**	**-**	**7**	**7**	**7**	**9**	**13**	**4**

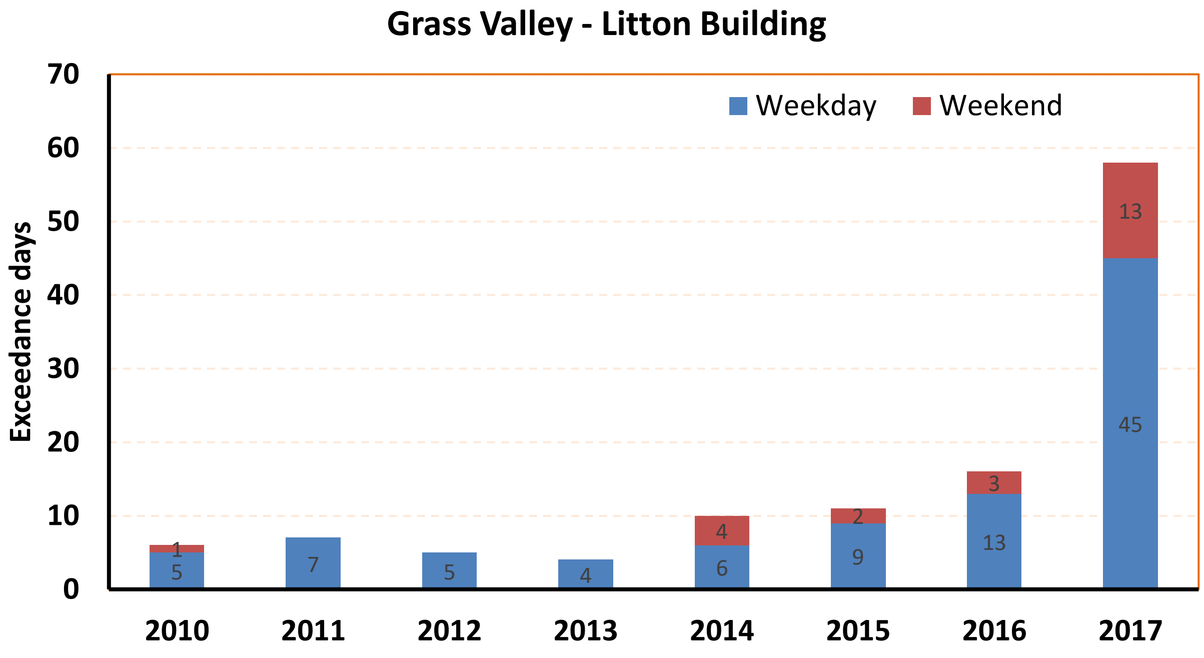
	Grass Valley-Litton Building	White Cloud Mountain	Placerville	Sutter Buttes	Folsom	Cool	Auburn	Roseville
2018*								
April	0	-	0	0	0	0	0	0
May	0	-	0	0	0	0	0	0
June	0	-	0	0	0	1	2	0
July	1	-	2	0	2	1	3	0
August	0	-	0	0	0	0	1	0
September	1	-	2	0	0	0	0	0
October	0	-	0	0	0	0	0	0
Total	**2**	**-**	**4**	**0**	**2**	**2**	**6**	**0**

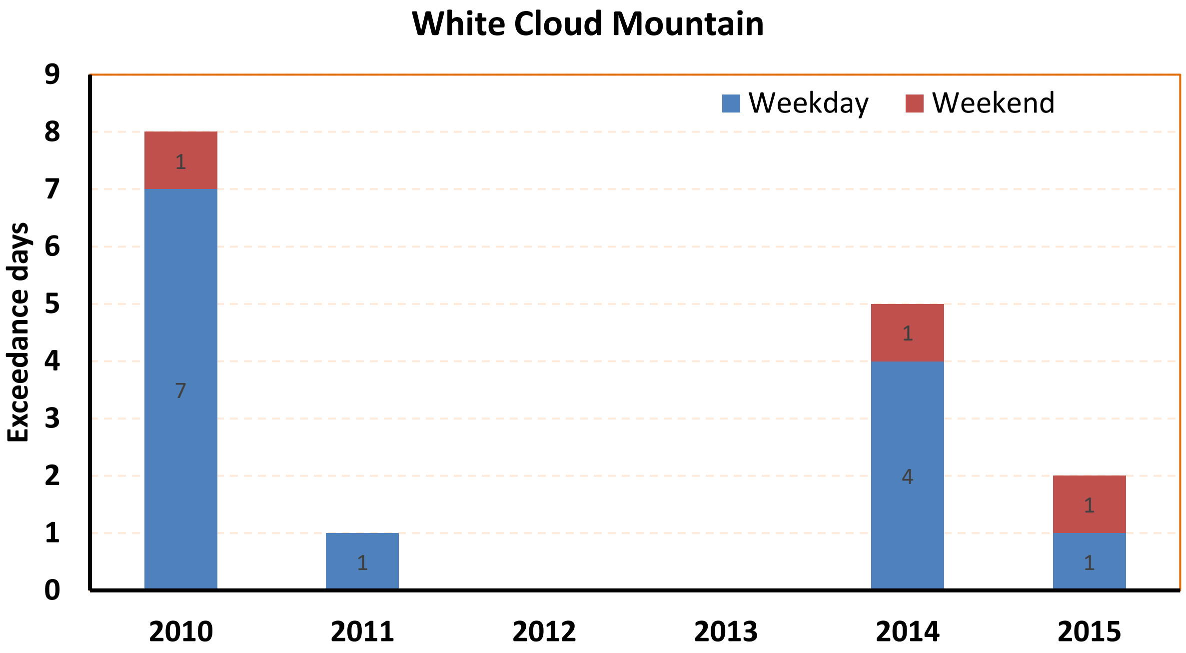
*Preliminary data excluding forest fire impacted days (as of October 8, 2018)

Weekday/Weekend Trends

Exceedance days during weekends and weekdays were also analyzed at the two Western Nevada monitoring sites with results shown in Figure 12.

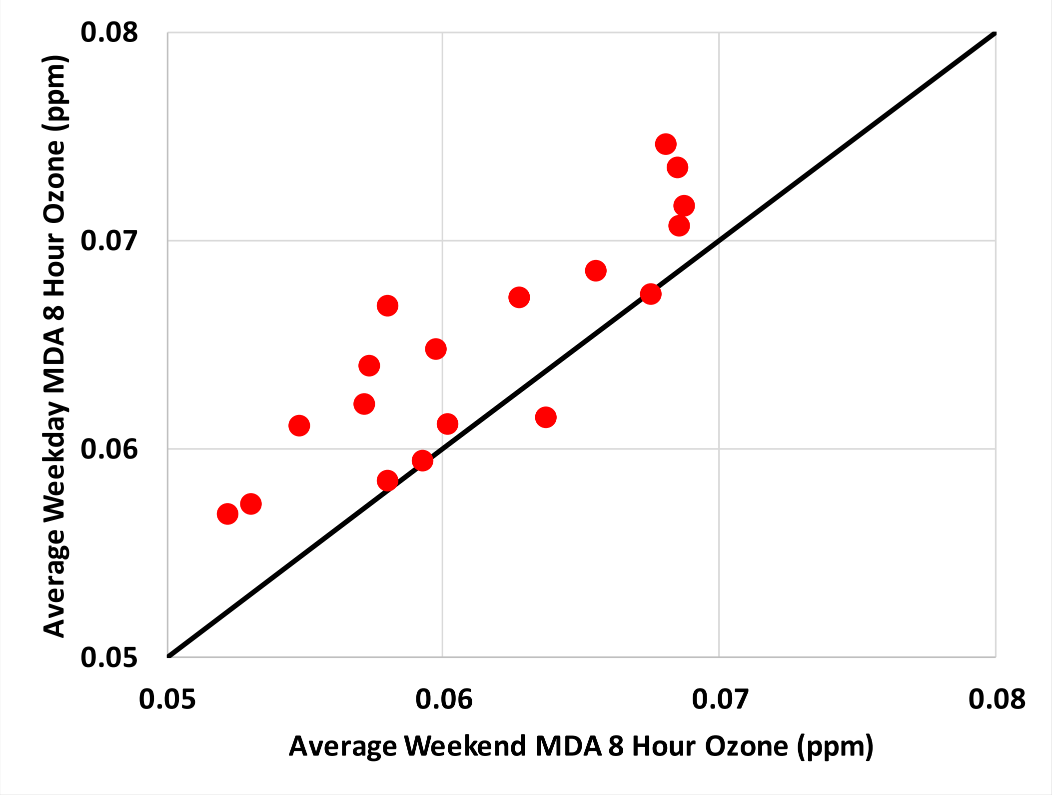
Figure 12. Number of 8-hour exceedance days during weekdays and weekends at Grass Valley-Litton Building and White Cloud Mountain





While it is challenging to determine if the number of exceedance days were correlated with weekdays and/or weekends, the day-of-week dependence of ozone in the Western Nevada was also investigated using the average weekday (Wednesday and Thursday) and weekend (Sunday) maximum daily average (MDA) 8-hr ozone values observed in the ozone season (May through September) from 2000-2017. Results of this analysis are shown in Figure 13, which indicates that the Western Nevada region has generally been in a NOx limited regime, with peak ozone occurring on weekdays than on weekends (with 2008 as the only exception). As discussed above, this region is in close proximity to biogenic VOC emission sources and further away from large anthropogenic NOx sources in the Sacramento and San Francisco Bay Area. The occasional shift in weekday/weekend ozone levels closer to the 1:1 line, and crossing over the line in 2008, is likely due to inter-annual variability in meteorological conditions and its impact on the regional transport patterns and local biogenic VOC emissions.

Figure 13. Average weekday (Wednesday and Thursday) and weekend (Sunday) maximum daily average (MDA) 8-hour ozone for each year from 2000 to 2017 for the Grass Valley – Litton Building Site. Points falling above the 1:1 solid line represent a NOx-limited regime, those on the 1:1 line represent a transitional regime, and those below the 1:1 line represent a VOC-limited regime.



2017 Anomalous Ozone Data

As discussed above, unusually high ozone concentrations were observed at the Grass Valley-Litton Building site in 2017. Monitored readings at Grass Valley in 2017 outpaced other sites in the region in terms of ozone concentrations and in particular, number of exceedance days for the 0.075 ppm federal 8-hour ozone standard. There were 58 exceedance days recorded at the Grass Valley-Litton Building site in 2017, which is the highest number of ozone exceedance days at any one site within both the Western Nevada and Sacramento nonattainment areas during the last 10 years. The Grass Valley site has been averaging between 10-20 exceedances annually in other recent years.

CARB staff evaluated the recent high ozone concentrations recorded by the Grass Valley monitor. Staff found that multiple factors likely played a role:

- Ozone levels at air quality monitors across the Sierra Nevada foothills increased slightly from 2015 to 2016 and 2017. Staff found this to be a function of synoptic meteorological patterns that were conducive to ozone formation and buildup. While the meteorology-related elevated ozone levels throughout northern California contributed to some of the exceedance days at Grass Valley in 2017, large increases in exceedance days occurring at Grass Valley were not shared by other regional monitors that experienced the same synoptic meteorological patterns. Therefore, the meteorological conditions could not have caused the four-fold increase in exceedance days at Grass Valley.

- The summer of 2017 was not marked with much wildfire activity that impacted ozone levels in the region.
- The upwind Sacramento metropolitan area, including the I-80 corridor through Roseville, has seen population growth in recent years. However, other downwind air quality monitors track each other but not the Grass Valley monitor; and did not show the same uptick in ozone design values or exceedances as the Grass Valley monitor.
- There is no evidence of significant increase in locally formed ozone at Grass Valley due to changes in anthropogenic emissions. There were no new large industrial sources of pollution. Traffic counts were not appreciably different than in past years.
- It is possible that the changes in biogenic VOC emissions, including increased VOCs as a result of bark beetle infestations, could have played a role. However, Grass Valley is a NOx-limited area with an abundance of VOC emissions, and ozone formation in this area would be limited by the amount of NOx emissions available. Additional biogenic VOC emissions would not be expected to increase ozone at Grass Valley to the extent recorded in 2017. Also, other regional sites have not seen a sharp increase in ozone levels, and they too would be NOx-limited and would be subject to bark beetle infestations.
- Ozone concentrations at Grass Valley during the late 2016 and 2017 time frame, when compared against ozone levels at other nearby monitoring sites, departed sharply from historical patterns that have since resumed in 2018. As shown in Figure A9, daily maximum 8-hour ozone levels in 2017 at Grass Valley continued to follow the same peaks and dips as at other neighboring sites; but the concentrations at Grass Valley were much higher than all the neighboring sites, and were also higher than they were in recent years and in 2018. This suggests a potential positive bias in the monitoring at Grass Valley.

While ozone observations at the Grass Valley-Litton Building site in 2017 are certainly unusual, the WOE analysis suggests that the Grass Valley ozone monitor, had it recorded more typical numbers of exceedances and concentrations in 2017, would still have resulted in a 2017 ozone design value above the 0.075 ppm standard. This expectation is based on the relationship of Grass Valley design values in other years to other regional high ozone monitors. Those monitors experienced a slight uptick in ozone levels due to meteorological conditions conducive to hozone formation and buildup. Therefore, the Western Nevada ozone nonattainment area would still have missed its moderate classification attainment date, and the area would need to be reclassified serious. As a serious area, Western Nevada will need to have air quality meeting the ozone standard by 2020. CARB will work with the Northern Sierra AQMD to further investigate the causes of high ozone concentrations recorded by the Grass Valley monitor, and will support the District in ensuring the quality of ozone and meteorological data collected.

Ozone Air Quality Summary

As a downwind, transport-impacted area, Western Nevada's future progress towards the federal 8-hour ozone standard is linked to the upwind metropolitan nonattainment areas and their progress in making significant reductions.

Due to effectively designed and implemented emission reduction control programs, both ozone precursor trends and ozone trends in the upwind areas have progressed steadily toward levels supporting attainment. The ozone precursor control strategy focuses on NOx emission reductions. Since Western Nevada is a NOx-limited area, this strategy is effective in reducing ozone levels in Western Nevada as well as upwind areas.

Consistent with ozone trends for these upwind areas, the Western Nevada nonattainment area's ozone air quality trends show, despite inter-annual variability, ongoing and measurable progress towards meeting the federal 8-hour ozone standard.

Attainment Projections

The Northern Sierra AQMD is requesting as a part of its SIP that U.S. EPA reclassify the Western Nevada nonattainment area to a serous classification with a 2020 attainment deadline. Photochemical modeling performed by CARB staff projects a 2020 design value at Grass Valley (the area's design site) at 0.069 ppm, a level in attainment of the standard.

CARB staff's analysis of ozone air quality data concurs that attainment by 2020 is feasible. The recent (and therefore preliminary) design value for 2018 at Grass Valley is promising. When factoring for days that were likely impacted by wildfire emissions, there were only two exceedance days at Grass Valley in 2018. The fourth-high value for 2018 is 0.072 ppm, which is 4 percent below the standard. While this preliminary design value for 2018 (with likely wildfire impacted data removed) is over 9 percent above the standard at 0.082 ppm, that design value is the average of fourth-high values from 2016, 2017 and 2018. Those earlier years will drop out of the design value calculation in time for Western Nevada to meet the ozone standard in 2020, based on air quality data from 2018-2020. The fact that the first of the three years on which Western Nevada's serious area attainment date will be based is well below the standard is supportive of attainment by 2020.

Summary

Western Nevada is currently classified as a moderate ozone nonattainment area for the 2008 8-hour ozone standard of 0.075 ppm. This WOE evaluated ambient air quality and emission trends to complement the regional photochemical modeling analyses conducted to assess the Western Nevada's progress toward meeting the 2020 attainment deadline as a serious nonattainment area.

Photochemical modeling analyses indicate that the Western Nevada will be able to meet a 2020 attainment deadline with the currently adopted control measures, which will continue to yield additional emission reductions in future years. No new emission control measures are required for attainment. This WOE supports attainment by a 2020 deadline. Below is the summary of WOE findings:

- Western Nevada County comprises the portion of Nevada County from the western boundary with Yuba and Placer counties up to the crest of the Sierra Nevada Mountains. Thermally driven afternoon Delta Breeze wind and a nighttime, downslope drainage flow recirculation pattern serves to routinely transport ozone and ozone precursors from southwestern part of the region and keep the ozone trapped in the area.
- Long term trends show that ozone levels have declined in the past 13 years with the exception of few recent years. However, air quality progress has not been sufficient for Western Nevada to meet its moderate area attainment date. Therefore, the Northern Sierra AQMD is requesting that U.S. EPA reclassify the Western Nevada nonattainment area to a serous classification with a 2020 attainment deadline.
- Levels of locally generated emissions of ozone precursor emissions are much lower than those released in upwind nonattainment areas. Mobile source emissions form the largest source of locally generated NOx, with significant contributions from Interstate and State highway traffic.
- Carryover of ozone is of prime concern. Ozone concentrations remain elevated during the night hours, resulting in higher levels at the start of the following day. Due to lack of local NOx emissions, scavenging of ozone is minimal. Back-trajectory analysis, replicating the Delta Breeze, shows the transit of air parcels from the San Francisco Bay Area via Sacramento and nearby areas on the majority of exceedance days.
- Western Nevada is a NOx-limited area with an abundance of VOC emissions; ozone formation in this area would be limited by reducing the availability of NOx emissions. The NOx emission reduction-focused control strategy deployed in the upwind areas are effective in reducing ozone levels in Western Nevada.
- Consistent with ozone trends for these upwind areas, the Western Nevada nonattainment area's ozone air quality trends show, despite inter-annual

variability, ongoing and measurable progress towards meeting the ozone standard.

- Atypical high ozone concentrations were observed at the Grass Valley-Litton Building site in 2017. There were 58 exceedance days recorded at the Grass Valley-Litton Building site in 2017, which is the highest number of ozone exceedance days at any one site within both the Western Nevada and Sacramento nonattainment areas during the last 10 years. CARB staff analysis does not point to specific anthropogenic or biogenic emission increases or meteorology as likely causes for the unusual number of exceedances.
- In 2018, ozone levels were much lower once again, with the exception of days likely influenced by wildfire emissions. The projected design value of 2018 at Grass Valley-Litton site, excluding forest fire impacted days high ozone days, is lower than design values in 2016 and 2017.
- Photochemical modeling performed by CARB staff projects a 2020 design value at Grass Valley (the area's design site) at 0.069 ppm, a level in attainment of the standard. CARB staff's analysis of ozone air quality data concurs that attainment by 2020 is feasible.

Collectively, the air quality analyses included in this WOE indicate that substantial progress has been accomplished in the Western Nevada; and that the current control measures implemented in the Western Nevada County and in the upwind urban areas should lead the region to attain the ozone standard of 0.075 ppm by the serious attainment deadline of 2020.

Appendix A1. Ozone Execeedance Days

Table A1. Days exceeding the 8-hour ozone standard (in ppm), shaded in orange, for the Grass Valley-Litton Building site; 2018 forest fire days (preliminary data) are shaded in pink.

	Grass Valley-Litton Building															
	2011		2012		2013		2014		2015		2016		2017		2018*	
Rank	Date	8hrO3	Date	8hrO3	Date	8hrO3	Date	8hrO3	Date	8hrO3	Date	8hrO3	Date	8hrO3	Date	8hrO3
1	8/24	0.081	7/12	0.081	7/30	0.082	7/26	0.085	8/18	0.092	6/29	0.097	7/14	0.099	8/2	0.101
2	8/11	0.078	7/13	0.079	7/2	0.081	6/1	0.083	6/26	0.089	7/1	0.093	6/23	0.098	7/31	0.1
3	8/31	0.078	8/30	0.078	7/8	0.079	7/27	0.082	6/17	0.085	7/28	0.093	8/29	0.092	8/1	0.098
4	6/22	0.076	8/3	0.077	8/20	0.078	8/27	0.082	8/19	0.085	8/16	0.086	6/24	0.09	8/8	0.095
5	8/10	0.076	8/31	0.076	8/14	0.075	7/14	0.081	6/20	0.082	8/20	0.086	10/18	0.09	8/9	0.093
6	8/26	0.076	8/16	0.075	6/5	0.074	8/28	0.081	7/1	0.081	8/18	0.084	6/30	0.089	8/10	0.086
7	7/6	0.074	9/2	0.075	7/23	0.074	9/10	0.081	6/8	0.079	6/30	0.082	7/2	0.088	8/7	0.084
8	6/24	0.073	9/4	0.075	7/29	0.074	6/5	0.079	6/16	0.078	7/29	0.082	7/19	0.088	7/26	0.083
9	6/25	0.073	5/9	0.074	7/11	0.073	7/7	0.077	6/27	0.078	7/15	0.081	8/18	0.088	7/27	0.082
10	8/29	0.073	6/18	0.074	7/21	0.073	5/31	0.076	6/9	0.076	8/19	0.081	9/2	0.088	8/25	0.082
11	9/4	0.073	8/2	0.074	7/25	0.073	5/15	0.075	7/29	0.076	7/27	0.08	5/22	0.087	8/24	0.079
12	8/19	0.072	8/24	0.074	7/26	0.073	7/1	0.075	4/17	0.075	8/12	0.078	5/23	0.087	7/28	0.078
13	8/27	0.072	9/5	0.074	5/13	0.072	9/5	0.075	6/15	0.075	7/2	0.077	6/20	0.087	7/29	0.078
14	9/3	0.072	8/23	0.073	7/3	0.072	9/22	0.075	6/24	0.075	8/2	0.077	7/13	0.087	7/19	0.077
15	9/5	0.072	6/19	0.072	7/6	0.072	6/19	0.074	8/20	0.075	8/28	0.076	7/23	0.087	9/21	0.077
16	5/5	0.071	7/9	0.072	7/19	0.072	8/8	0.074	6/6	0.074	8/29	0.076	8/1	0.087	7/30	0.076
17	7/8	0.071	8/14	0.072	7/24	0.072	8/29	0.074	5/2	0.073	6/22	0.075	9/1	0.087	8/4	0.075
18	7/29	0.071	8/20	0.072	5/3	0.071	9/2	0.074	6/19	0.073	7/3	0.075	7/22	0.086	8/11	0.075
19	9/10	0.071	8/22	0.072	7/7	0.071	9/11	0.074	7/17	0.073	8/13	0.075	7/15	0.085	9/20	0.075
20	8/23	0.07	8/28	0.071	8/15	0.071	10/3	0.074	5/1	0.072	9/19	0.075	8/2	0.085	6/26	0.072
21	9/14	0.07	9/3	0.071	6/3	0.07	5/16	0.073	5/29	0.072	7/25	0.074	9/4	0.085	9/28	0.072
22	6/21	0.069	5/21	0.07	7/13	0.07	6/2	0.072	6/18	0.072	8/14	0.074	9/3	0.084	8/19	0.071
23	6/26	0.068	8/11	0.07	7/20	0.07	6/3	0.072	6/25	0.072	8/17	0.074	10/17	0.084	8/26	0.071
24	7/2	0.068	8/17	0.07	8/6	0.07	7/8	0.072	8/8	0.072	8/21	0.074	7/20	0.083	9/4	0.071
25	8/30	0.068	8/25	0.07	8/18	0.07	9/3	0.072	9/1	0.072	8/24	0.074	6/19	0.082	8/6	0.07
26	7/21	0.067	10/18	0.07	9/14	0.07	9/6	0.072	6/5	0.071	9/28	0.074	7/1	0.082	8/15	0.07
27	7/22	0.067	8/21	0.069	6/15	0.069	9/23	0.072	6/13	0.071	10/9	0.074	7/3	0.082	8/20	0.07
28	8/12	0.067	9/6	0.069	7/10	0.069	5/1	0.071	7/2	0.071	7/4	0.073	7/5	0.082	9/22	0.07
29	8/13	0.066	10/1	0.069	7/14	0.069	5/2	0.071	7/16	0.071	7/6	0.073	7/21	0.082	8/13	0.068
30	9/28	0.066	5/8	0.068	7/22	0.069	7/30	0.071	8/2	0.071	9/27	0.073	6/6	0.081	8/14	0.068
31	9/1	0.065	8/12	0.068	8/4	0.069	10/6	0.071	6/12	0.07	6/6	0.072	7/4	0.081	8/5	0.067

	Grass Valley-Litton Building															
	2011		2012		2013		2014		2015		2016		2017		2018*	
Rank	Date	8hrO3	Date	8hrO3	Date	8hrO3	Date	8hrO3	Date	8hrO3	Date	8hrO3	Date	8hrO3	Date	8hrO3
32	5/6	0.064	4/8	0.067	9/7	0.069	5/13	0.07	4/18	0.069	7/7	0.072	7/9	0.081	9/2	0.067
33	7/5	0.064	7/10	0.067	5/12	0.068	5/14	0.07	6/14	0.069	8/3	0.072	7/25	0.081	7/2	0.066
34	7/23	0.064	7/23	0.067	10/18	0.068	6/6	0.07	8/3	0.069	9/9	0.072	8/9	0.081	8/3	0.066
35	8/2	0.064	7/31	0.067	7/15	0.067	6/28	0.07	8/17	0.069	9/26	0.072	6/3	0.08	9/5	0.066
36	8/8	0.064	4/9	0.066	9/10	0.067	7/6	0.07	6/11	0.068	4/18	0.071	7/24	0.08	9/27	0.066
37	8/9	0.064	7/15	0.066	9/13	0.067	8/18	0.07	7/18	0.068	4/19	0.071	6/21	0.079	6/24	0.065
38	8/25	0.064	8/1	0.066	9/19	0.067	9/7	0.07	8/21	0.068	7/14	0.071	6/27	0.079	8/23	0.065
39	9/2	0.064	8/10	0.066	10/19	0.067	9/14	0.07	10/10	0.068	7/16	0.071	7/12	0.079	9/3	0.065
40	9/9	0.064	9/14	0.066	10/23	0.067	10/13	0.07	5/30	0.067	7/26	0.071	7/26	0.079	8/16	0.064
41	7/30	0.063	6/1	0.065	5/2	0.066	7/15	0.069	7/14	0.067	8/11	0.071	8/19	0.079	8/21	0.064
42	7/31	0.063	6/12	0.065	5/20	0.066	7/28	0.069	7/30	0.067	8/15	0.071	10/24	0.079	6/13	0.063
43	8/1	0.063	7/4	0.065	7/12	0.066	8/9	0.069	9/20	0.067	8/26	0.071	5/24	0.078	6/27	0.063
44	8/17	0.063	7/30	0.065	7/27	0.066	8/30	0.069	6/22	0.066	9/10	0.071	6/4	0.078	7/20	0.063
45	8/28	0.063	8/13	0.065	8/5	0.066	9/4	0.069	7/24	0.066	9/29	0.071	8/3	0.078	8/22	0.063
46	9/8	0.063	6/20	0.064	8/21	0.066	10/2	0.069	10/6	0.066	4/20	0.07	10/10	0.078	9/10	0.063
47	5/2	0.062	7/25	0.064	8/22	0.066	10/4	0.069	10/14	0.066	8/6	0.07	10/16	0.078	9/26	0.063
48	6/17	0.062	7/26	0.064	9/8	0.066	6/9	0.068	10/16	0.066	7/24	0.069	10/25	0.078	6/5	0.062
49	6/18	0.062	7/28	0.064	4/30	0.065	6/20	0.068	4/10	0.065	8/10	0.069	7/10	0.077	7/8	0.062
50	9/11	0.062	8/4	0.064	5/11	0.065	6/29	0.068	5/3	0.065	6/20	0.068	8/4	0.077	5/8	0.061
51	9/13	0.062	8/18	0.064	5/14	0.065	6/30	0.068	6/7	0.065	8/5	0.068	8/31	0.077	6/15	0.061
52	9/23	0.062	8/29	0.064	6/16	0.065	8/7	0.068	8/9	0.065	9/15	0.068	9/17	0.077	8/12	0.061
53	9/24	0.062	9/7	0.064	7/5	0.065	8/16	0.068	8/16	0.065	5/12	0.067	10/15	0.077	8/17	0.061
54	6/23	0.061	5/31	0.063	8/3	0.065	9/24	0.068	8/22	0.065	8/4	0.067	6/28	0.076	9/11	0.061
55	6/27	0.061	7/11	0.063	8/12	0.065	10/7	0.068	8/25	0.065	8/8	0.067	7/11	0.076	9/17	0.061
56	7/25	0.061	7/27	0.063	8/17	0.065	4/19	0.067	9/21	0.065	8/25	0.067	8/12	0.076	9/18	0.061
57	8/3	0.061	8/27	0.063	8/23	0.065	4/30	0.067	10/15	0.065	8/27	0.067	8/17	0.076	6/2	0.06
58	8/5	0.061	9/27	0.063	8/28	0.065	6/4	0.067	5/5	0.064	9/8	0.067	8/24	0.076	6/6	0.06

*Preliminary data, forest fire impact days

Table A2. Days exceeding the 8-hour ozone standard (in ppm) at White Cloud Mountain

	2010		2011		2012		2013		2014		2015	
Rank	**Date**	**8hrO3**	**Date**	**8hrO3**	**Date**	**8hrO3**	**Date**	**8hrO3**	**Date**	**8hrO3**	**Date**	**8hrO3**
1	9/2	0.084	8/24	0.087	7/12	0.091	8/20	0.069	6/5	0.08	8/18	0.078
2	8/25	0.082	5/5	0.081	9/6	0.088	7/8	0.067	6/19	0.076	9/13	0.076
3	8/26	0.079	6/22	0.075	7/13	0.084	7/25	0.065	7/14	0.078	6/17	0.074
4	9/3	0.077	8/25	0.075	9/7	0.084	7/30	0.065	7/26	0.08	7/16	0.072
5	10/1	0.077	6/25	0.074	8/30	0.08	8/14	0.065	8/27	0.078	6/26	0.071
6	6/23	0.076	8/26	0.072	6/18	0.078	5/20	0.064	7/27	0.075	6/20	0.07
7	6/29	0.076	8/31	0.072	5/9	0.076	6/15	0.064	5/15	0.075	9/1	0.07
8	9/4	0.076	9/4	0.072	6/19	0.076	7/6	0.064	8/28	0.074	6/16	0.069
9	8/4	0.073	5/6	0.071	8/31	0.076	7/7	0.064	6/1	0.074	8/19	0.069

Apendix A2. Wildfire Emission Impacted Days and Ozone

Unusually high daily average $PM_{2.5}$ days at the Grass Valley-Litton Building were used as a surrogate for days impacted by wildfires near and around Grass Valley in July and August 2018. Figure A1 and Table A3 show daily average $PM_{2.5}$ and daily maximum 8-hour ozone concentrations from April 1 to early October, 2018. Unusual high daily average $PM_{2.5}$ days are shaded in a peach color to identify days on which wildfire emissions likely impacted the Grass Valley ozone monitor. From Figure A1 it is evident that many of the 8-hour ozone exceedace days in 2018 were likely impacted by wildfire emissions.

Figure A1. Grass Valley and surrounding regional daily $PM_{2.5}$ and maximum 8-hour ozone concentrations in 2018 (preliminary data as of October 8, 2018)

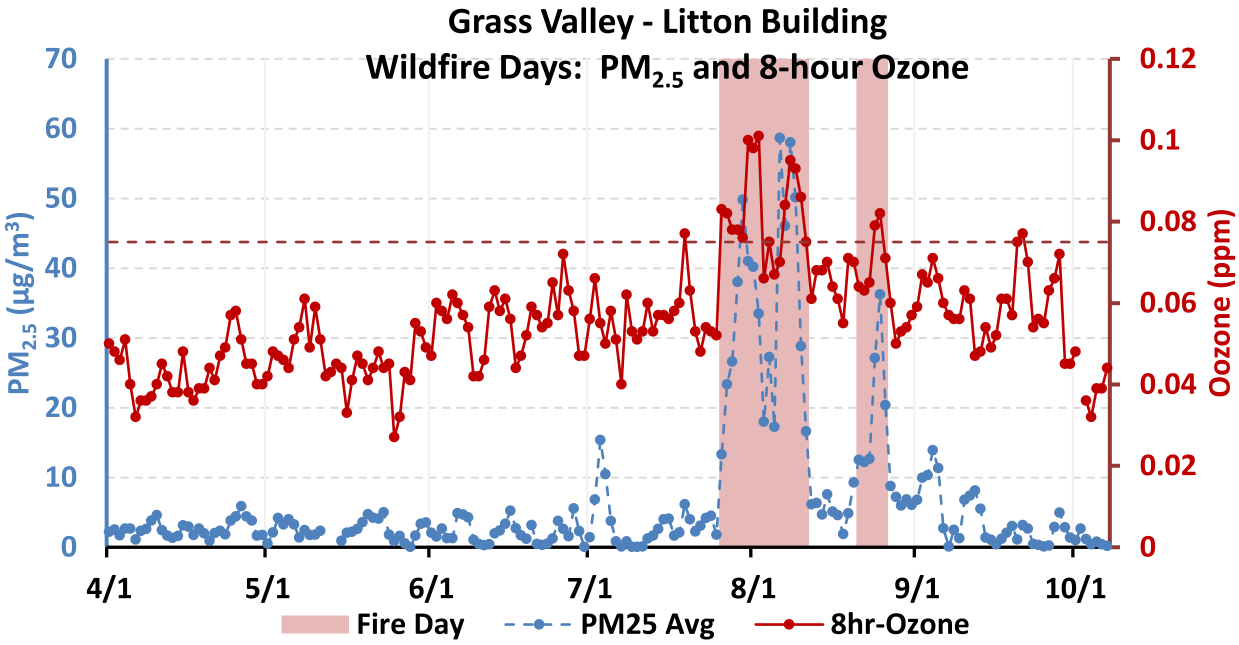


Table A3. Daily maximum and average $PM_{2.5}$ and daily maximum 8-hour ozone at Grass Valley – Litton Building. (Preliminary data as of October 8, 2018. Days likely impacted by wild fires are shaded in pink; ozone exceedance days excluding the fire impacted days are shaded in orange.)

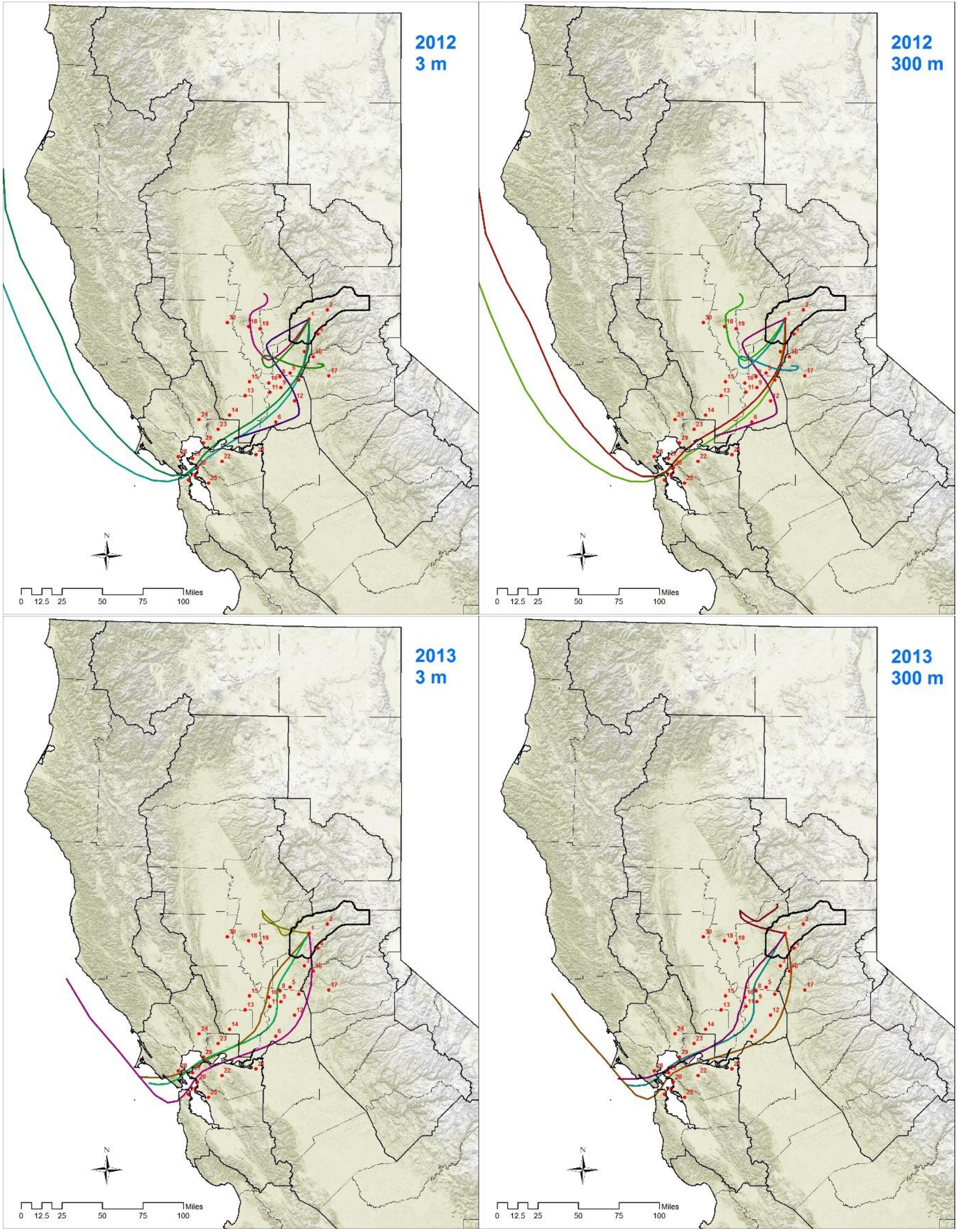
	PM2.5 Max, µg/m^3	PM2.5 Avg, µg/m^3	8hr-Ozone, ppm
7/19/2018	10	6.1	0.077
7/20/2018	8	4.0	0.063
7/21/2018	5	2.3	0.053
7/22/2018	6	3.0	0.048
7/23/2018	6	4.2	0.054
7/24/2018	9	4.5	0.053
7/25/2018	7	1.8	0.052
7/26/2018	20	13.3	0.083
7/27/2018	37	23.3	0.082
7/28/2018	46	26.6	0.078
7/29/2018	47	38.0	0.078
7/30/2018	74	49.8	0.076
7/31/2018	50	41.0	0.1
8/1/2018	49	40.2	0.098
8/2/2018	96	33.5	0.101
8/3/2018	41	18.0	0.066
8/4/2018	72	27.2	0.075
8/5/2018	110	17.2	0.067
8/6/2018	196	58.7	0.07
8/7/2018	67	46.0	0.084
8/8/2018	83	58.0	0.095
8/9/2018	71	50.1	0.093
8/10/2018	42	28.8	0.086
8/11/2018	36	16.6	0.075
8/12/2018	29	6.1	0.061
8/13/2018	15	6.3	0.068
8/14/2018	11	4.7	0.068

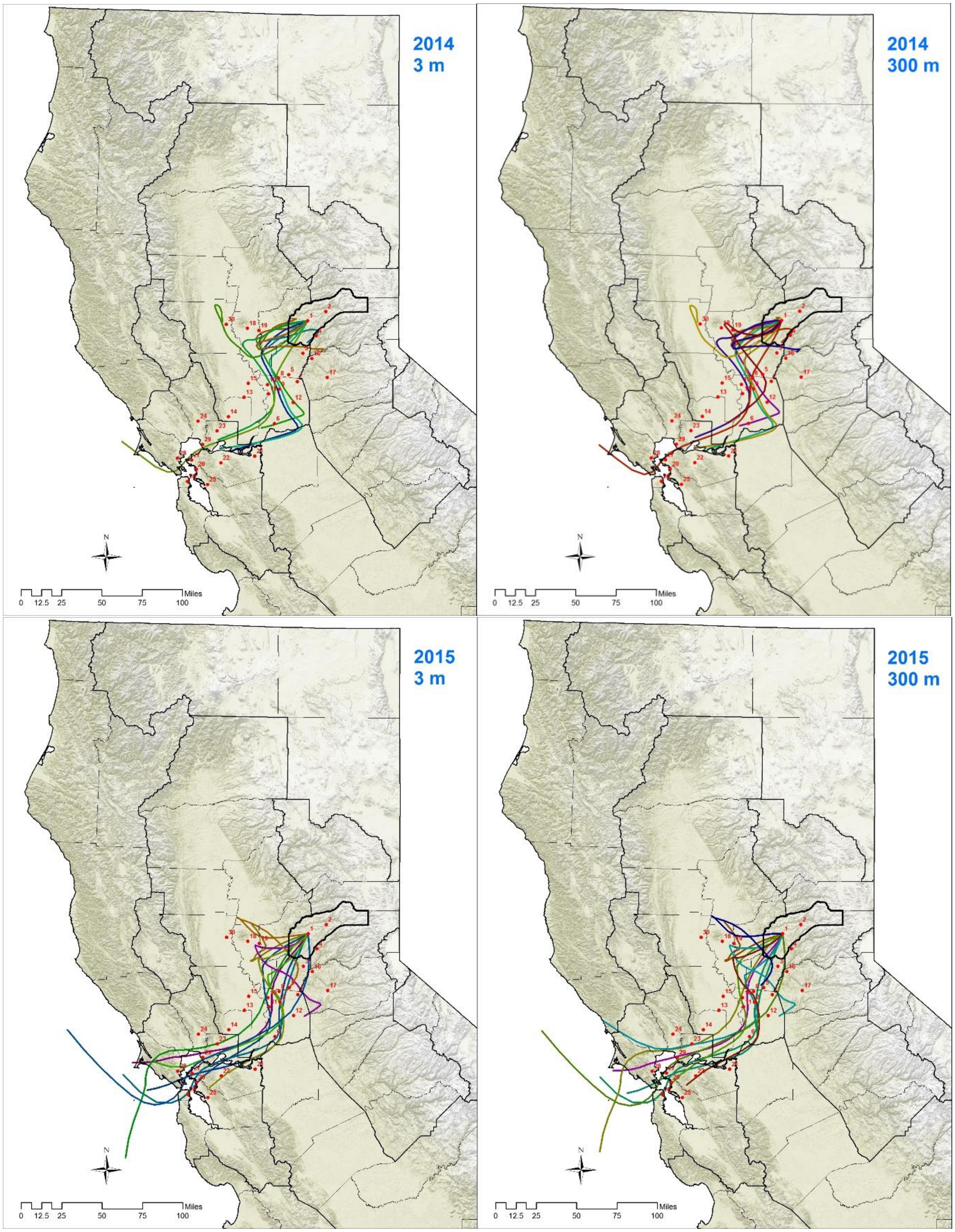
	PM2.5 Max, µg/m^3	PM2.5 Avg, µg/m^3	8hr-Ozone, ppm
8/15/2018	13	7.5	0.07
8/16/2018	10	5.1	0.064
8/17/2018	7	4.6	0.061
8/18/2018	6	1.9	0.055
8/19/2018	16	4.8	0.071
8/20/2018	15	9.3	0.07
8/21/2018	23	12.5	0.064
8/22/2018	17	12.2	0.063
8/23/2018	19	12.6	0.065
8/24/2018	39	27.1	0.079
8/25/2018	43	36.2	0.082
8/26/2018	33	20.3	0.071
8/27/2018	17	8.8	0.06
8/28/2018	13	7.2	0.05
8/29/2018	10	6.0	0.053
8/30/2018	12	6.8	0.054
8/31/2018	14	6.0	0.057
9/1/2018	12	6.8	0.059
9/2/2018	16	9.9	0.067
9/3/2018	18	10.3	0.065
9/4/2018	19	13.9	0.071
9/5/2018	22	11.3	0.066
9/6/2018	10	2.7	0.06
9/7/2018	2	0.1	0.057
9/8/2018	7	2.5	0.056
9/9/2018	7	1.3	0.056
9/10/2018	20	6.8	0.063
9/11/2018	19	7.4	0.061
9/12/2018	20	8.1	0.047
9/13/2018	21	5.5	0.048

	PM2.5 Max, µg/m³	PM2.5 Avg, µg/m³	8hr-Ozone, ppm
9/14/2018	6	1.4	0.054
9/15/2018	4	1.0	0.049
9/16/2018	2	0.4	0.052
9/17/2018	6	1.2	0.061
9/18/2018	8	2.0	0.061
9/19/2018	10	3.0	0.057
9/20/2018	6	1.1	0.075
9/21/2018	7	3.2	0.077
9/22/2018	7	2.7	0.07
9/23/2018	4	0.5	0.054
9/24/2018	2	0.3	0.056
9/25/2018	1	0.1	0.055
9/26/2018	2	0.2	0.063
9/27/2018	12	2.9	0.066
9/28/2018	10	5.0	0.072
9/29/2018	7	2.8	0.045
9/30/2018	4	1.4	0.045
10/1/2018	4	1.0	0.048
10/2/2018	11	2.6	--
10/3/2018	5	1.1	0.036
10/4/2018	3	0.4	0.032
10/5/2018	3	0.8	0.039
10/6/2018	1	0.4	0.039
10/7/2018	2	0.2	0.044

Appendix A3. Ozone Transport

Figure A2. 24-hour back trajectories at 3 m (left) and 300 m (right) height for high ozone days (>0.075 ppm) at the Grass Valley-Litton Building site for 2012-2017




2014
3 m
2014
300 m
2015
3 m
2015
300 m
N
0 12.5 25 50 75 100 Miles
1
2
6
12
13
14
15
16
17
18
19
20
22
23
24
25
29
30

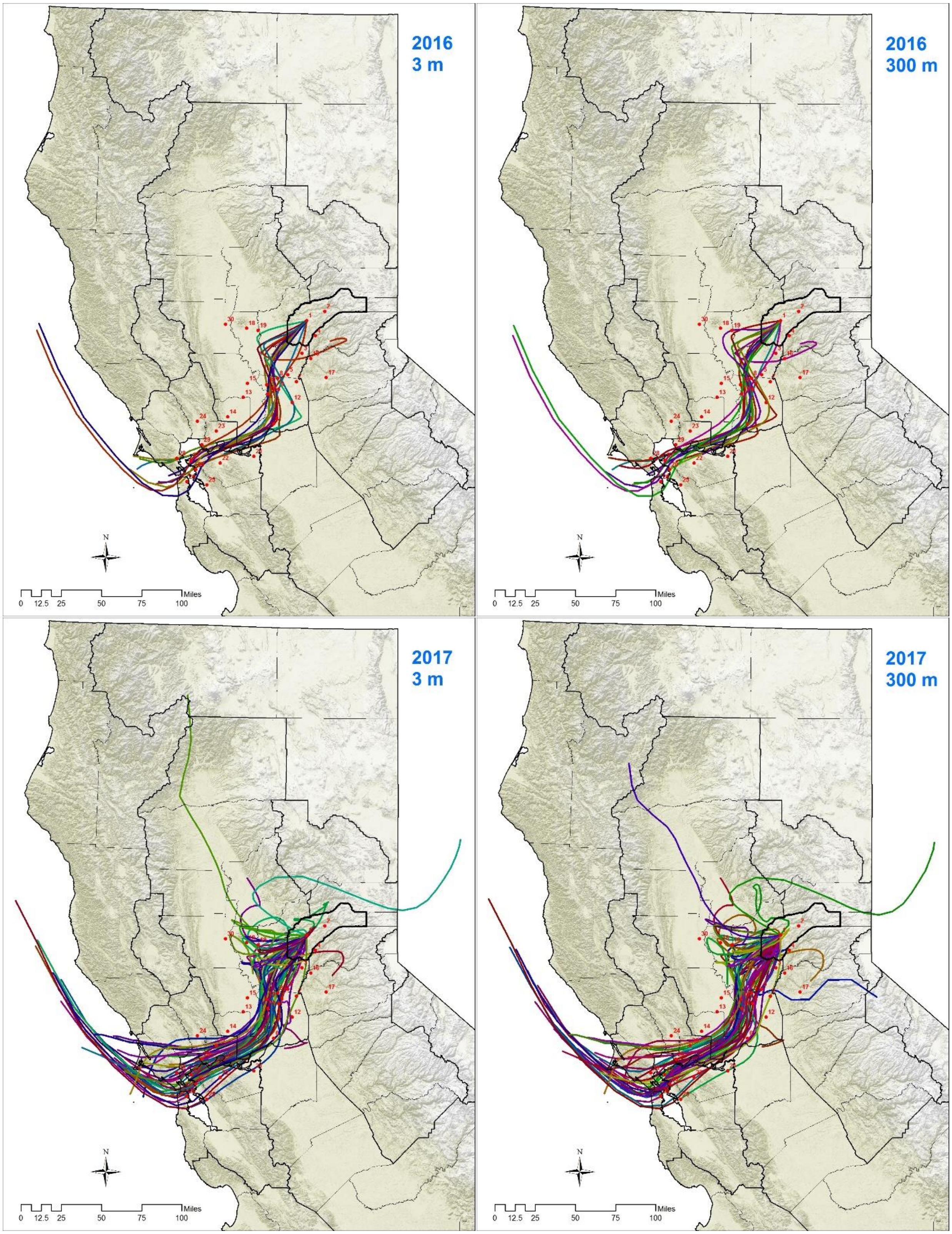
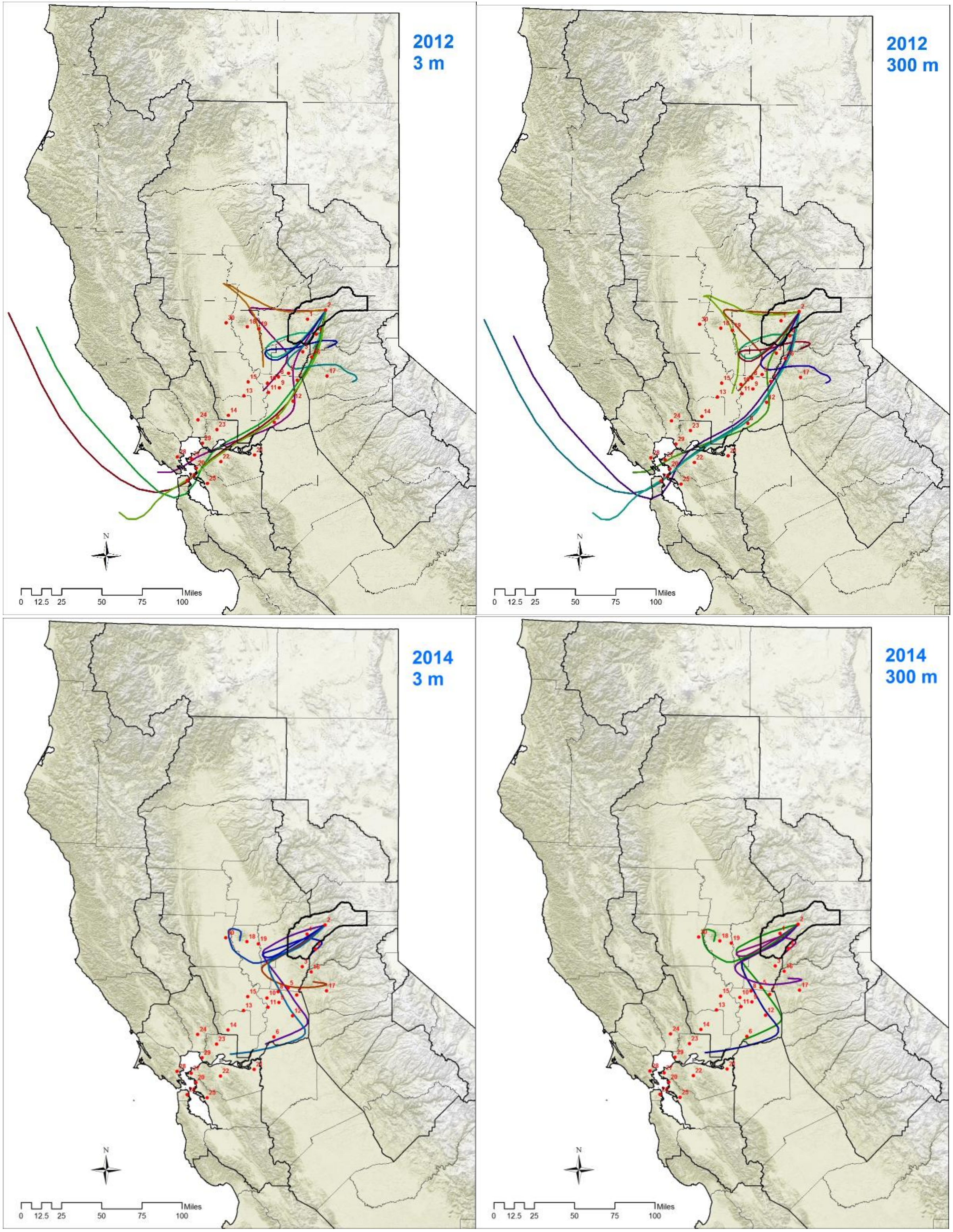
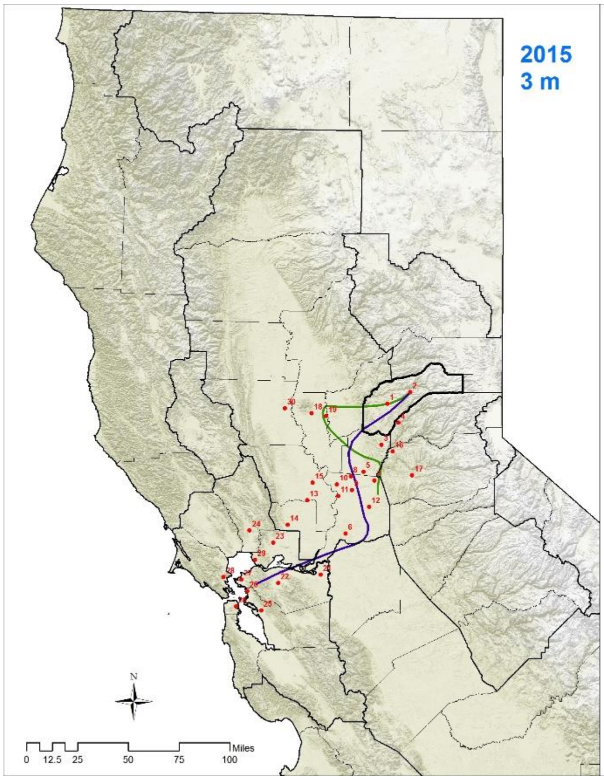
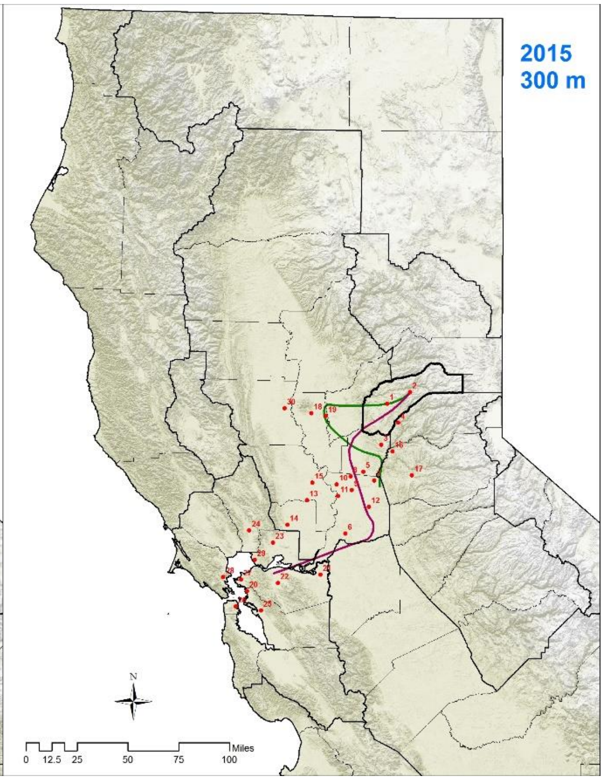

2016
3 m
2016
300 m
2017
3 m
2017
300 m
N
0
12.5
25
50
75
100
Miles
30
18
19
15
13
12
14
24
23
17

Figure A3. 24-hour back trajectories at 3 m (left) and 300 m (right) height for high ozone days (>0.075 ppm) at the White Cloud Mountain site for 2012-2015



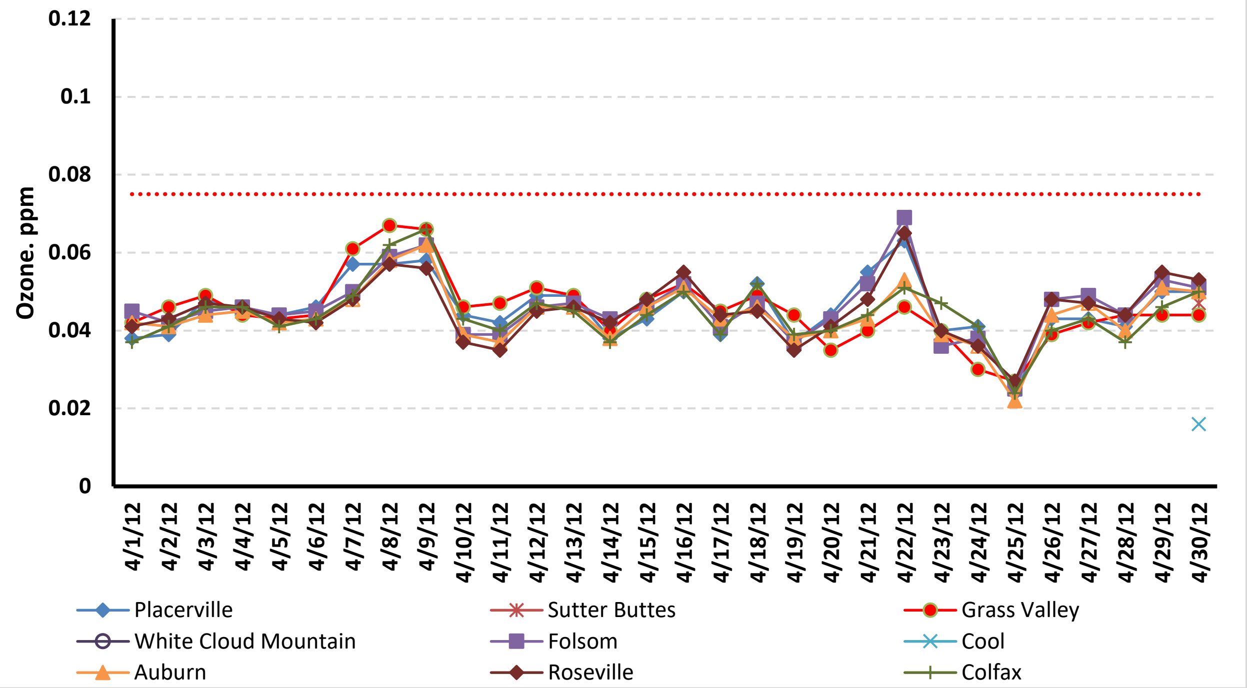

2015
3 m
30
18
19
1
2
4
3
16
5
8
17
15
10
11
13
12
14
6
24
23
29
28
27
21
22
26
25
N
0
12.5
25
50
75
100
Miles

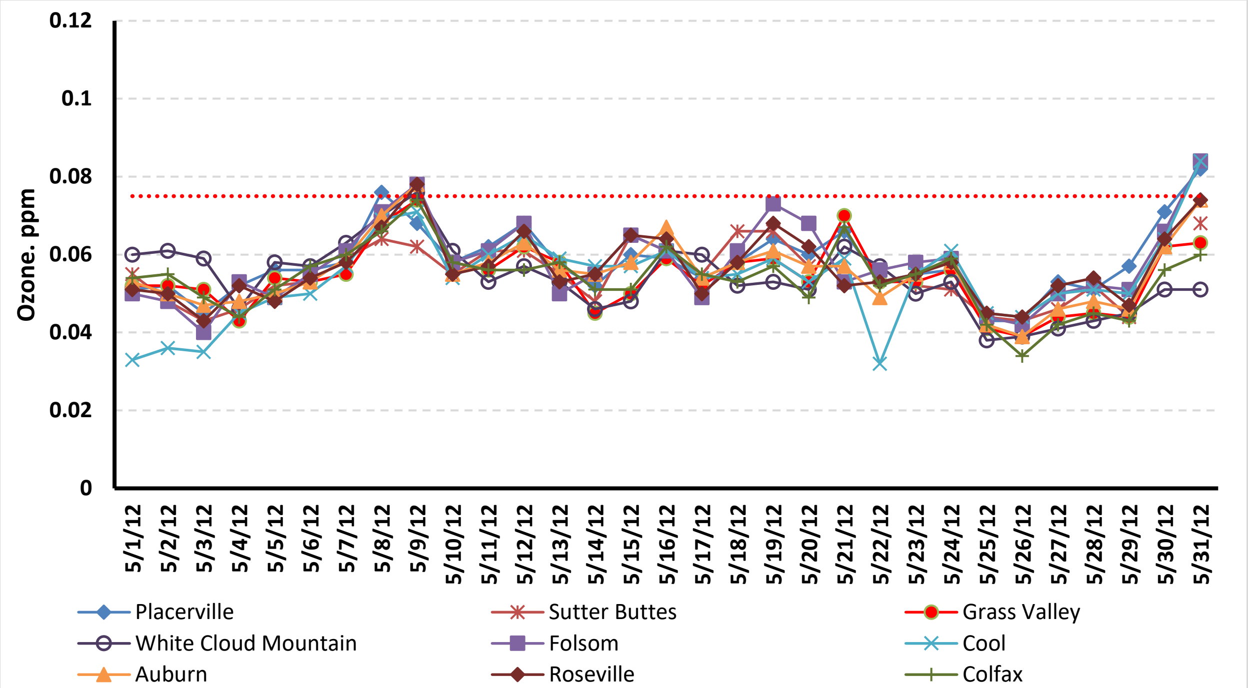

2015
300 m
30
18
19
1
2
4
3
16
5
8
17
15
10
11
13
12
14
6
24
23
29
28
27
21
22
20
25
N
0
12.5
25
50
75
100
Miles

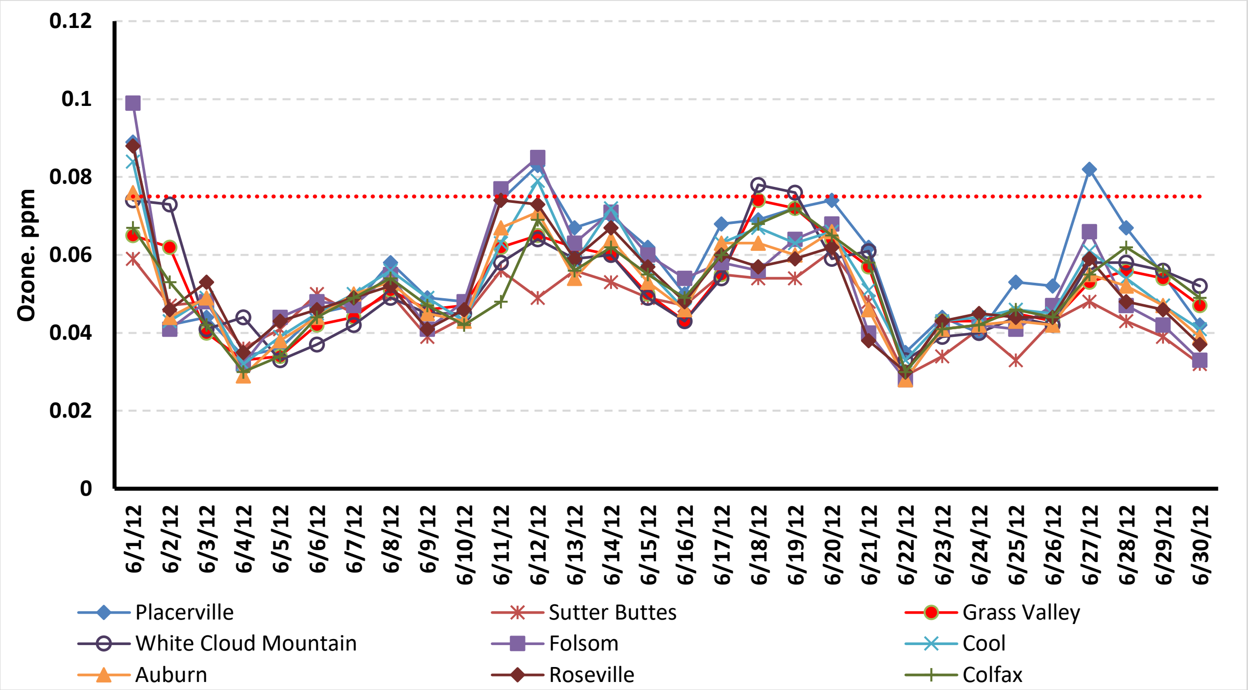
Appendix A4: Regional Ozone Concentrations

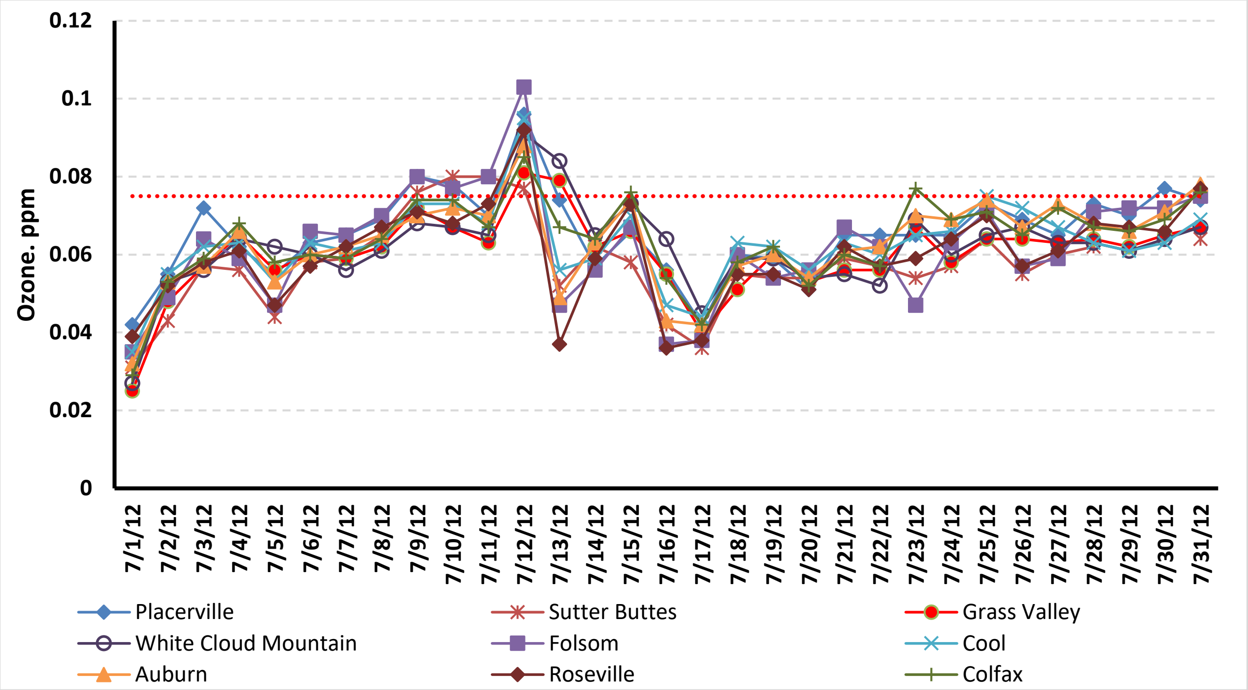
Daily maximum 8-hour ozone concentrations in Grass Valley and the surrounding area including Placerville, Sutter Buttes, Folsom, and Auburn for the years 2012 - 2017 are shown in Figures A4 - A9. In 2016, ozone concentrations in Grass Valley were similar to those in the surrounding area, except for few days in July when ozone concentrations were higher in Grass Valley than in the surrounding area. In 2017, for most of the days, the 8-hour ozone concentration was higher in Grass Valley than surrounding area monitors.

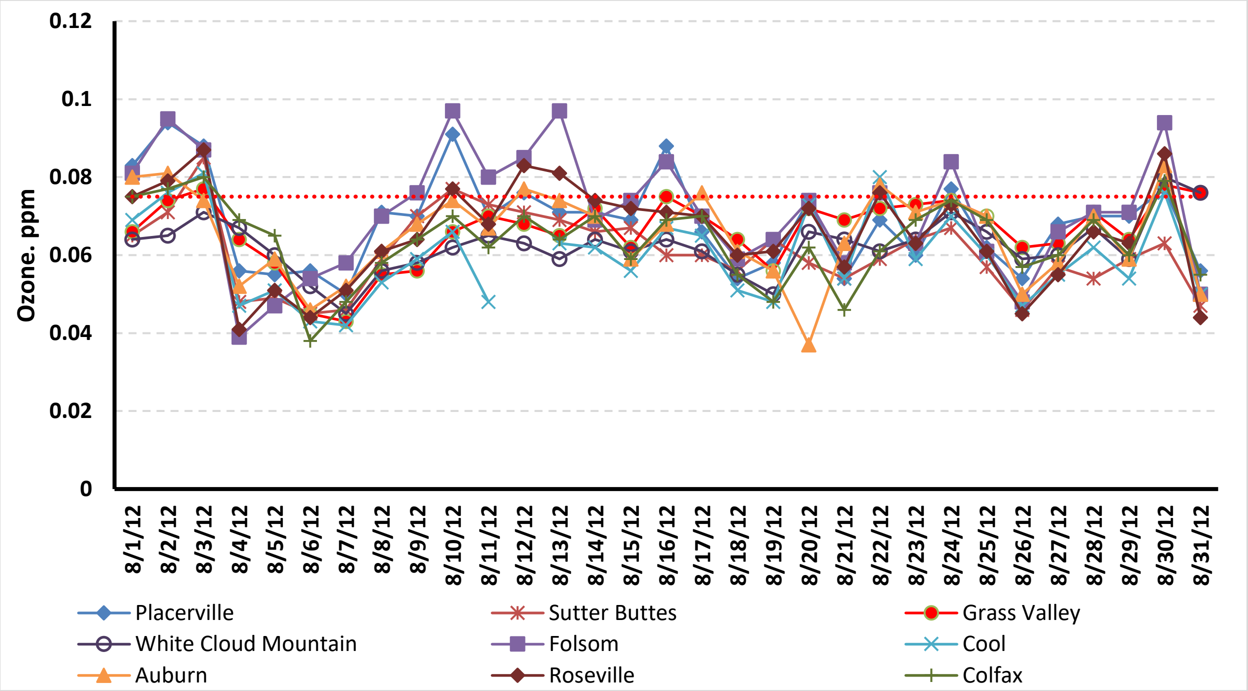
Figure A4. Grass Valley and surrounding regional daily maximum 8-hour ozone concentrations in 2012

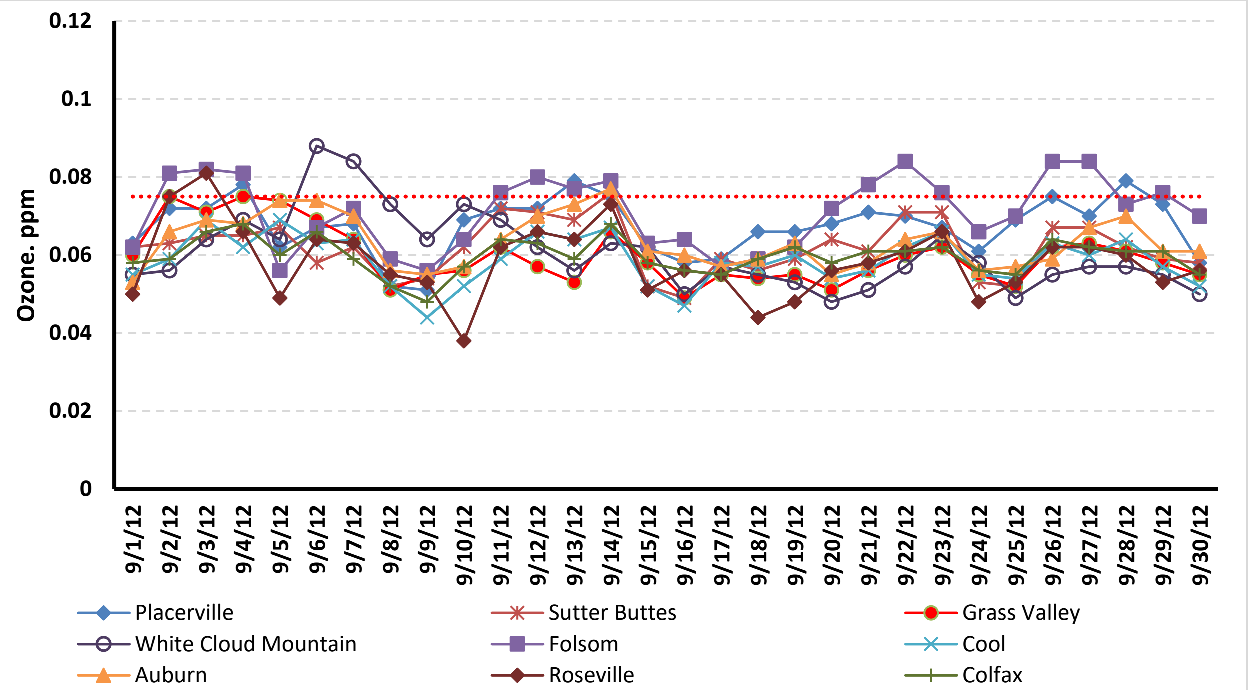



Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
5/1/12
5/2/12
5/3/12
5/4/12
5/5/12
5/6/12
5/7/12
5/8/12
5/9/12
5/10/12
5/11/12
5/12/12
5/13/12
5/14/12
5/15/12
5/16/12
5/17/12
5/18/12
5/19/12
5/20/12
5/21/12
5/22/12
5/23/12
5/24/12
5/25/12
5/26/12
5/27/12
5/28/12
5/29/12
5/30/12
5/31/12
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax


Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
6/1/12
6/2/12
6/3/12
6/4/12
6/5/12
6/6/12
6/7/12
6/8/12
6/9/12
6/10/12
6/11/12
6/12/12
6/13/12
6/14/12
6/15/12
6/16/12
6/17/12
6/18/12
6/19/12
6/20/12
6/21/12
6/22/12
6/23/12
6/24/12
6/25/12
6/26/12
6/27/12
6/28/12
6/29/12
6/30/12
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax


0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
7/1/12
7/2/12
7/3/12
7/4/12
7/5/12
7/6/12
7/7/12
7/8/12
7/9/12
7/10/12
7/11/12
7/12/12
7/13/12
7/14/12
7/15/12
7/16/12
7/17/12
7/18/12
7/19/12
7/20/12
7/21/12
7/22/12
7/23/12
7/24/12
7/25/12
7/26/12
7/27/12
7/28/12
7/29/12
7/30/12
7/31/12
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax


0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
8/1/12
8/2/12
8/3/12
8/4/12
8/5/12
8/6/12
8/7/12
8/8/12
8/9/12
8/10/12
8/11/12
8/12/12
8/13/12
8/14/12
8/15/12
8/16/12
8/17/12
8/18/12
8/19/12
8/20/12
8/21/12
8/22/12
8/23/12
8/24/12
8/25/12
8/26/12
8/27/12
8/28/12
8/29/12
8/30/12
8/31/12
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax


0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
9/1/12
9/2/12
9/3/12
9/4/12
9/5/12
9/6/12
9/7/12
9/8/12
9/9/12
9/10/12
9/11/12
9/12/12
9/13/12
9/14/12
9/15/12
9/16/12
9/17/12
9/18/12
9/19/12
9/20/12
9/21/12
9/22/12
9/23/12
9/24/12
9/25/12
9/26/12
9/27/12
9/28/12
9/29/12
9/30/12
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax

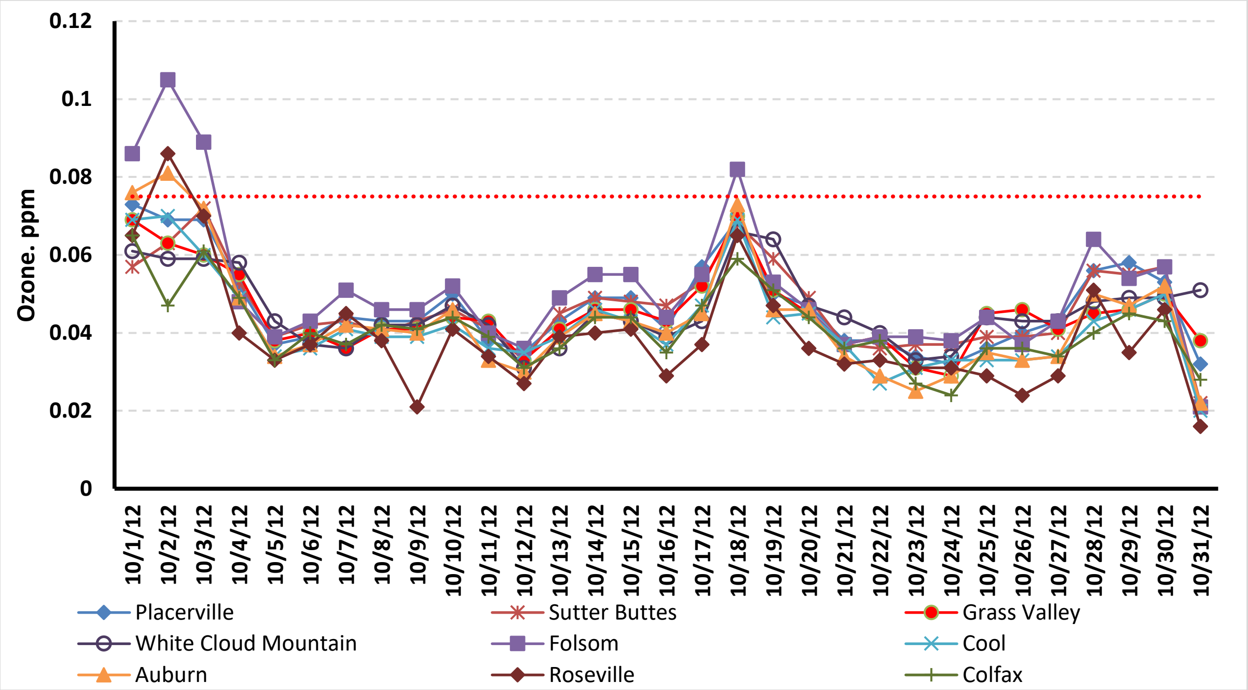
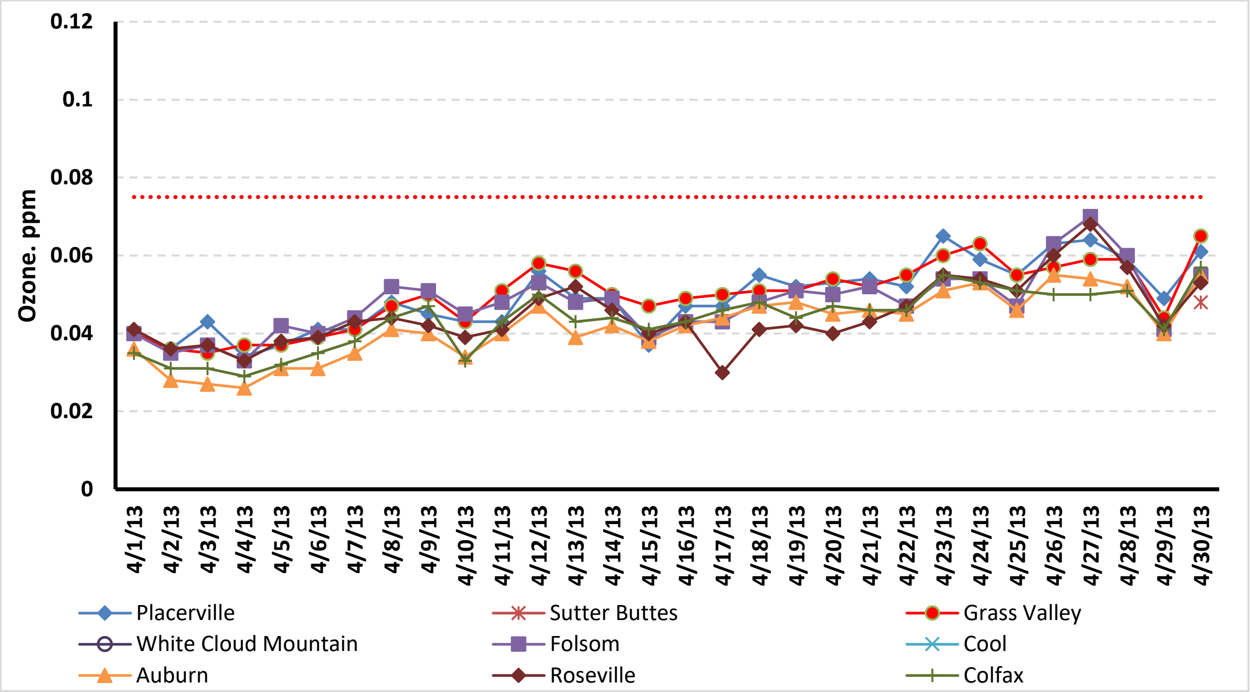
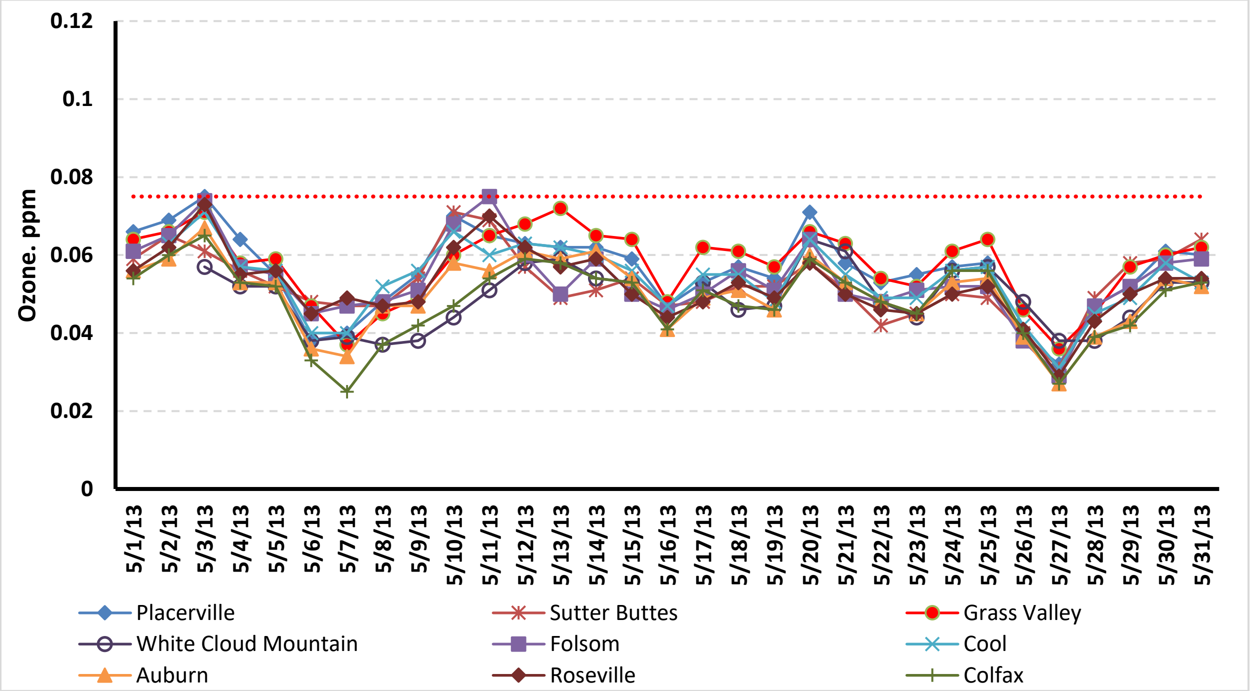
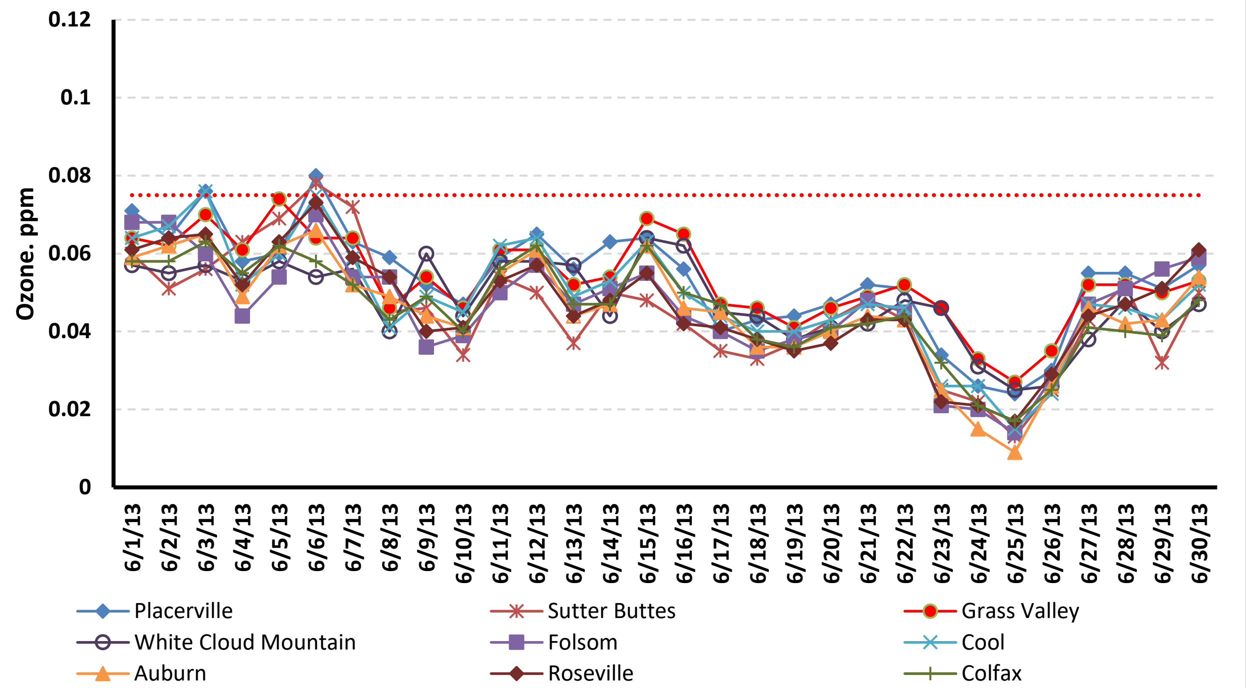

0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
10/1/12
10/2/12
10/3/12
10/4/12
10/5/12
10/6/12
10/7/12
10/8/12
10/9/12
10/10/12
10/11/12
10/12/12
10/13/12
10/14/12
10/15/12
10/16/12
10/17/12
10/18/12
10/19/12
10/20/12
10/21/12
10/22/12
10/23/12
10/24/12
10/25/12
10/26/12
10/27/12
10/28/12
10/29/12
10/30/12
10/31/12
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax

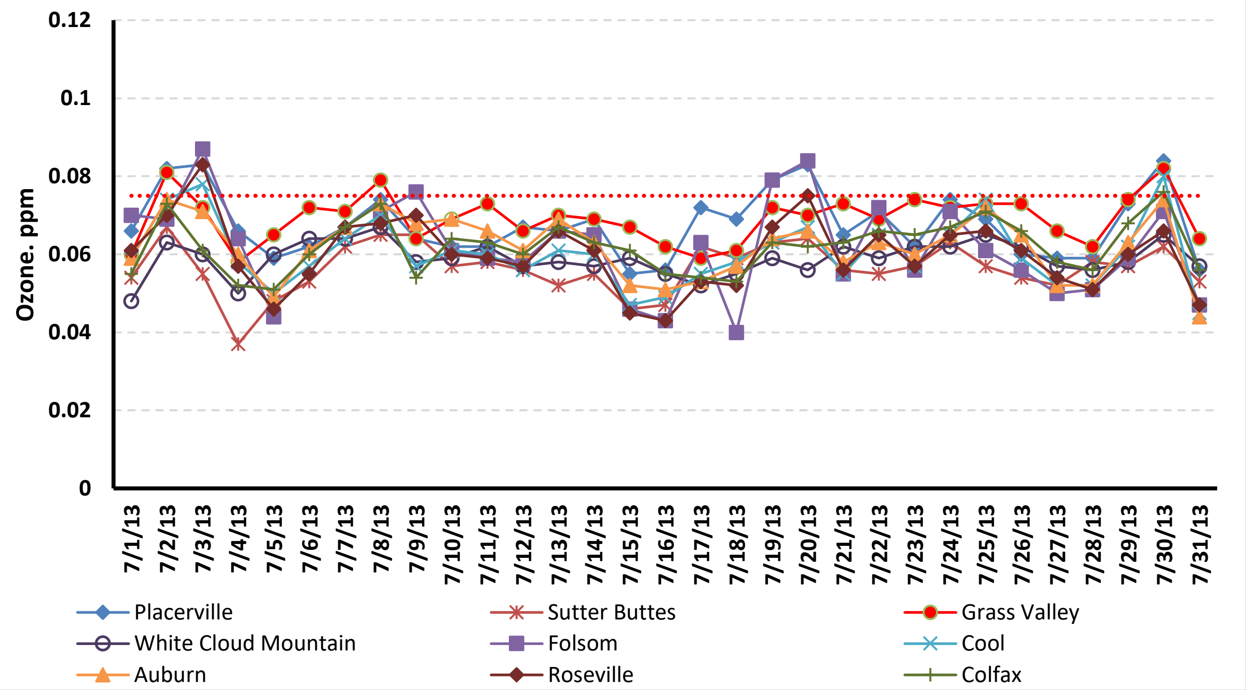
Figure A5. Grass Valley and surrounding regional daily maximum 8-hour ozone concentrations in 2013



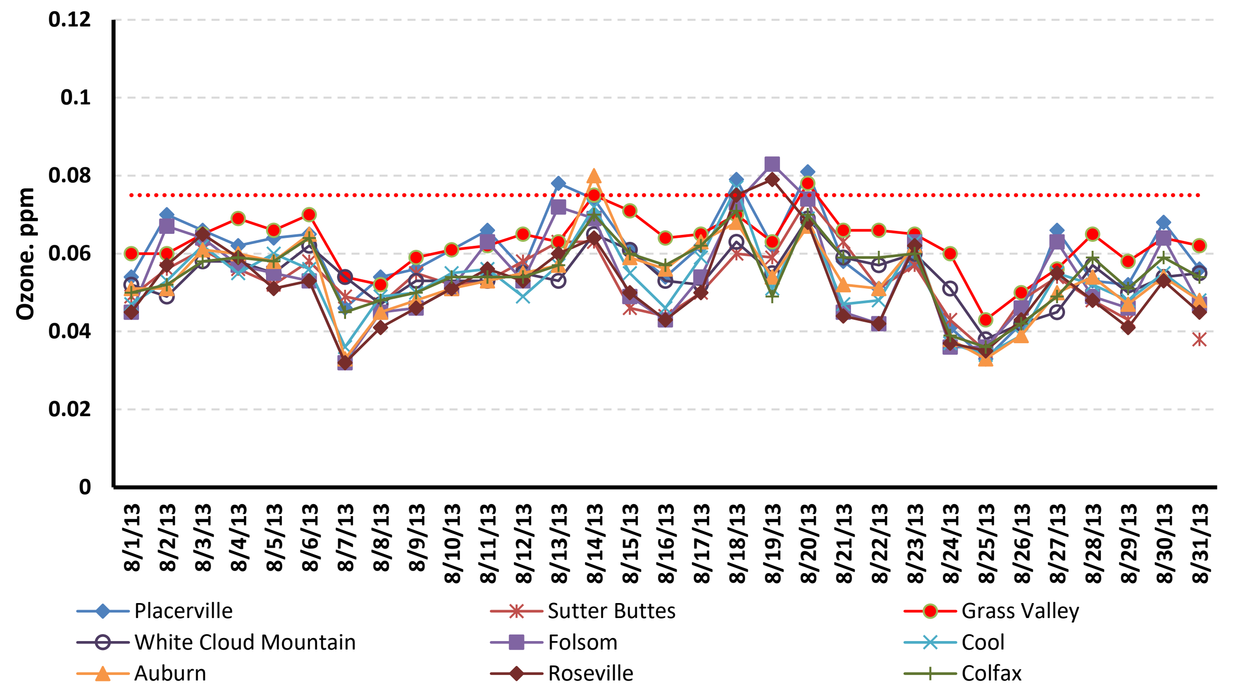




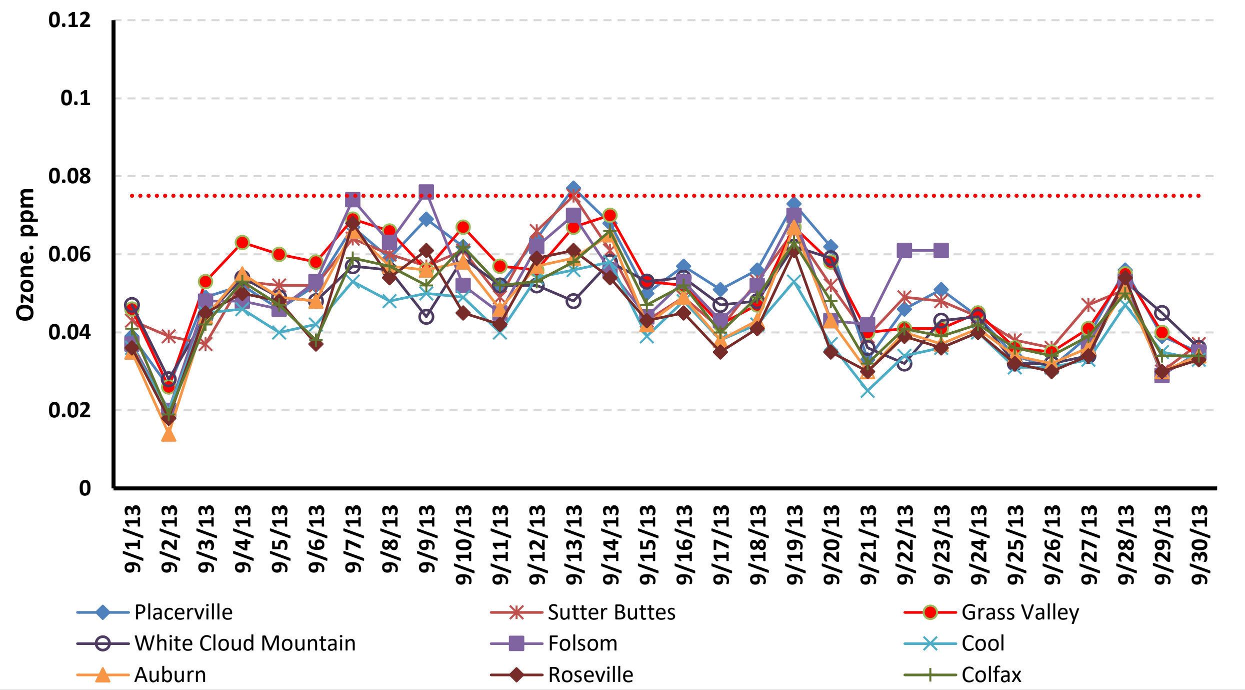
0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
6/1/13
6/2/13
6/3/13
6/4/13
6/5/13
6/6/13
6/7/13
6/8/13
6/9/13
6/10/13
6/11/13
6/12/13
6/13/13
6/14/13
6/15/13
6/16/13
6/17/13
6/18/13
6/19/13
6/20/13
6/21/13
6/22/13
6/23/13
6/24/13
6/25/13
6/26/13
6/27/13
6/28/13
6/29/13
6/30/13
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax



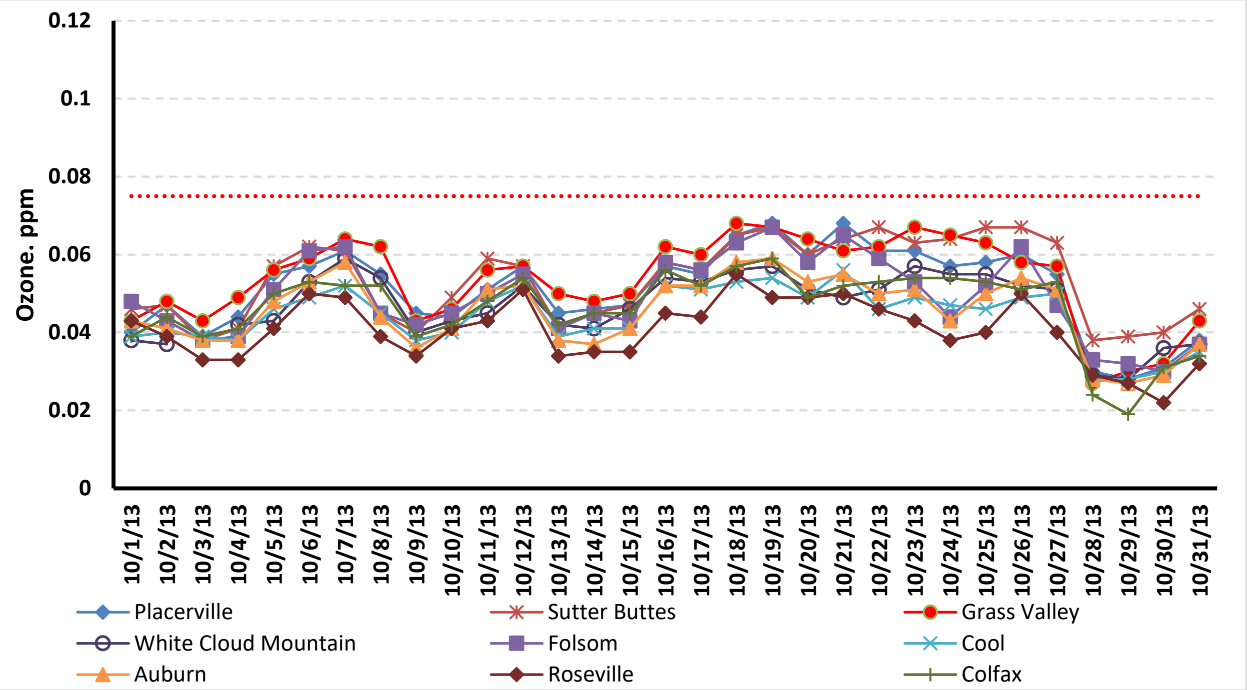
0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
7/1/13
7/2/13
7/3/13
7/4/13
7/5/13
7/6/13
7/7/13
7/8/13
7/9/13
7/10/13
7/11/13
7/12/13
7/13/13
7/14/13
7/15/13
7/16/13
7/17/13
7/18/13
7/19/13
7/20/13
7/21/13
7/22/13
7/23/13
7/24/13
7/25/13
7/26/13
7/27/13
7/28/13
7/29/13
7/30/13
7/31/13
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax



Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
8/1/13
8/2/13
8/3/13
8/4/13
8/5/13
8/6/13
8/7/13
8/8/13
8/9/13
8/10/13
8/11/13
8/12/13
8/13/13
8/14/13
8/15/13
8/16/13
8/17/13
8/18/13
8/19/13
8/20/13
8/21/13
8/22/13
8/23/13
8/24/13
8/25/13
8/26/13
8/27/13
8/28/13
8/29/13
8/30/13
8/31/13
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax

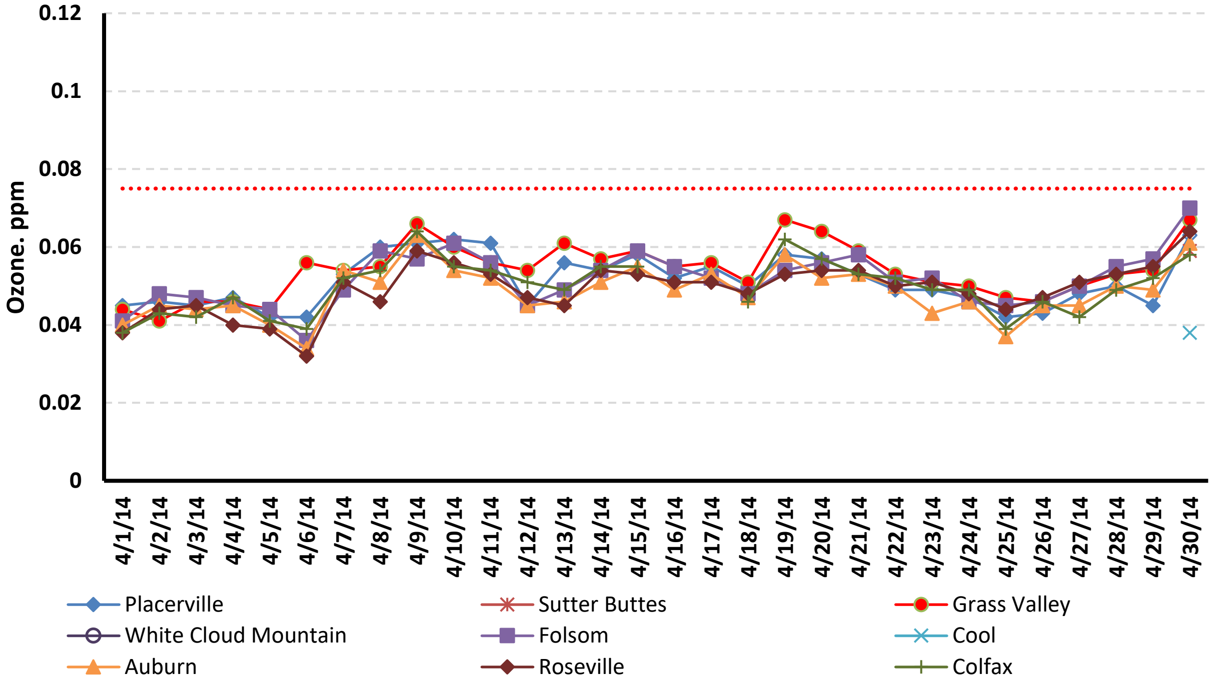


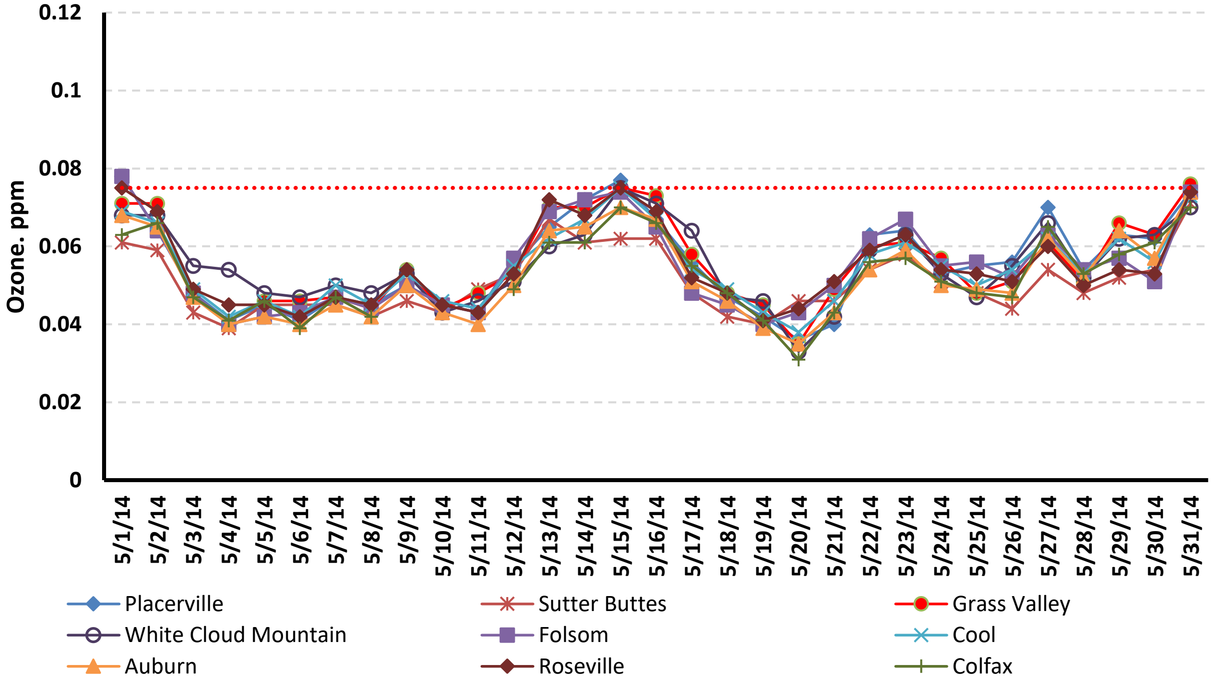
Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
9/1/13
9/2/13
9/3/13
9/4/13
9/5/13
9/6/13
9/7/13
9/8/13
9/9/13
9/10/13
9/11/13
9/12/13
9/13/13
9/14/13
9/15/13
9/16/13
9/17/13
9/18/13
9/19/13
9/20/13
9/21/13
9/22/13
9/23/13
9/24/13
9/25/13
9/26/13
9/27/13
9/28/13
9/29/13
9/30/13
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax

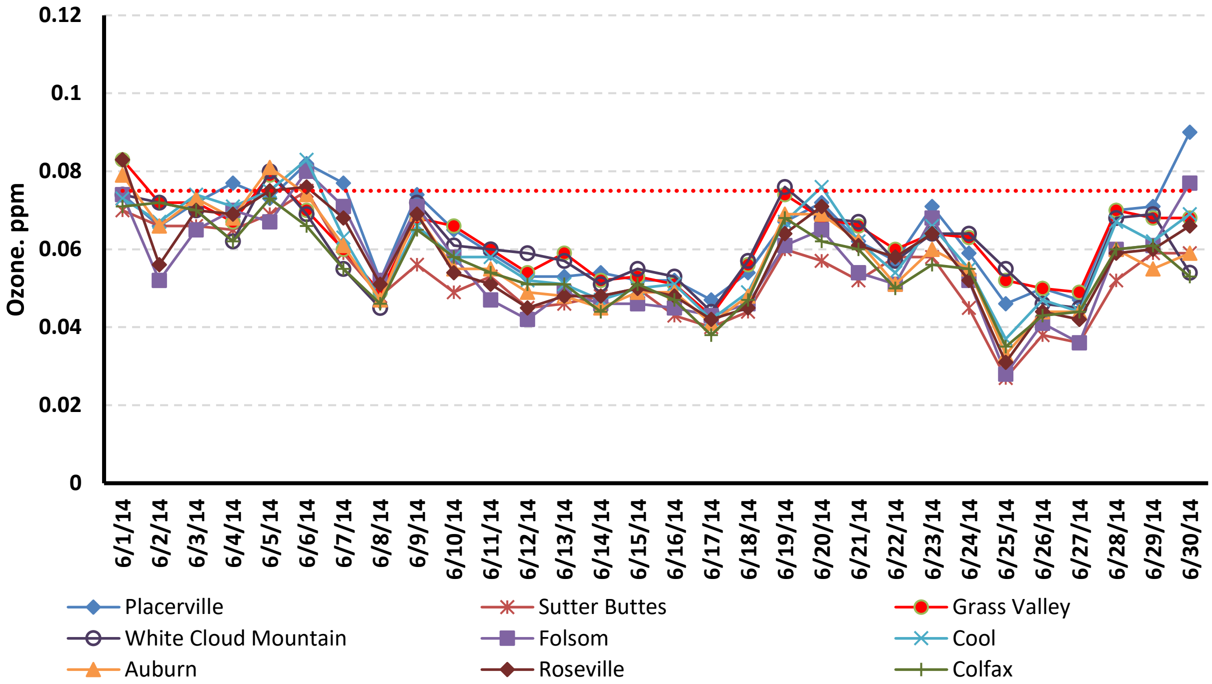


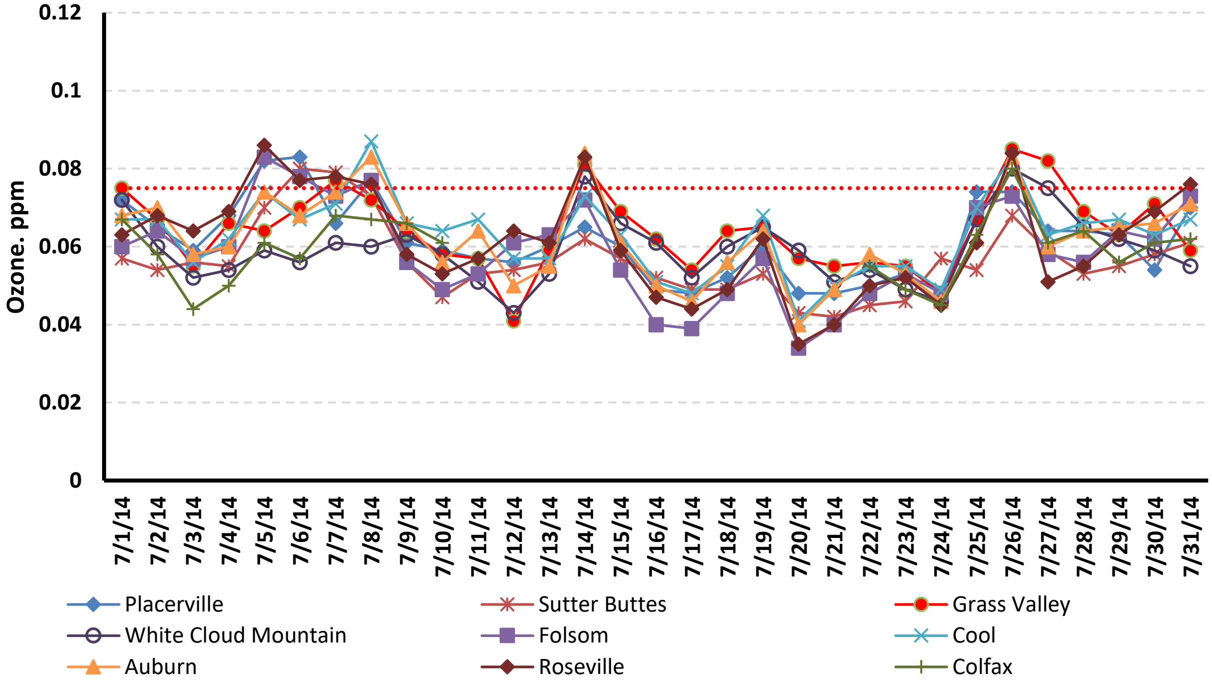
Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
10/1/13
10/2/13
10/3/13
10/4/13
10/5/13
10/6/13
10/7/13
10/8/13
10/9/13
10/10/13
10/11/13
10/12/13
10/13/13
10/14/13
10/15/13
10/16/13
10/17/13
10/18/13
10/19/13
10/20/13
10/21/13
10/22/13
10/23/13
10/24/13
10/25/13
10/26/13
10/27/13
10/28/13
10/29/13
10/30/13
10/31/13
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax

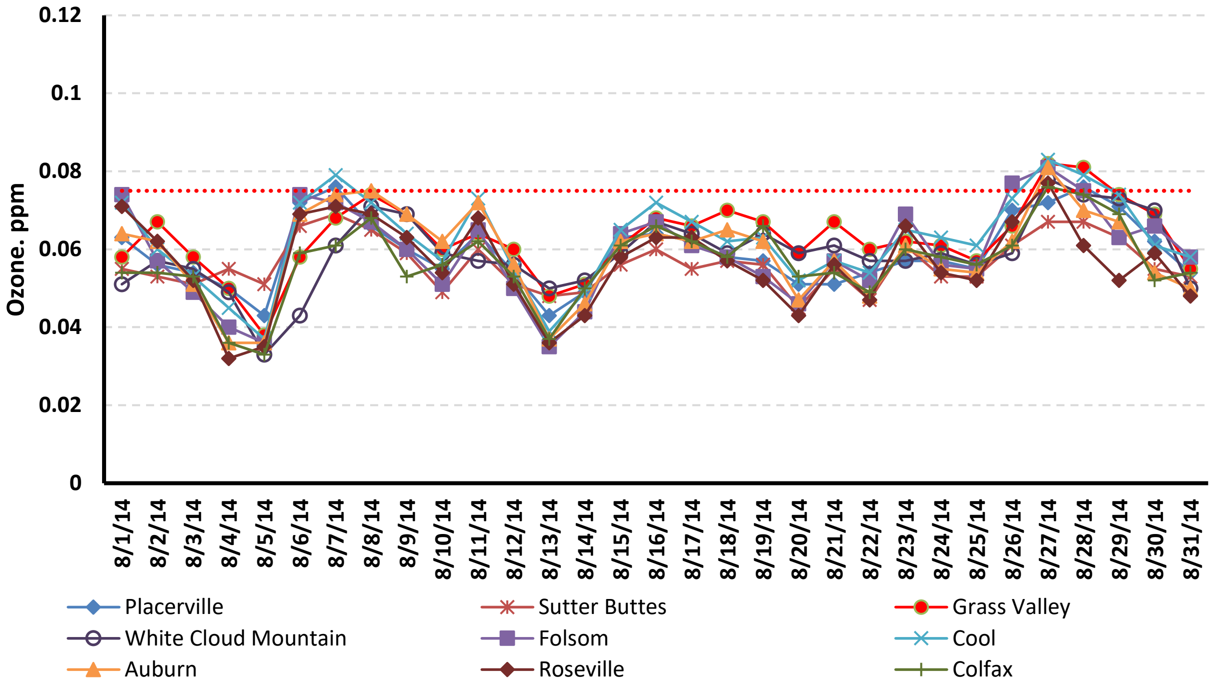
Figure A6. Grass Valley and surrounding regional daily maximum 8-hour ozone concentrations in 2014

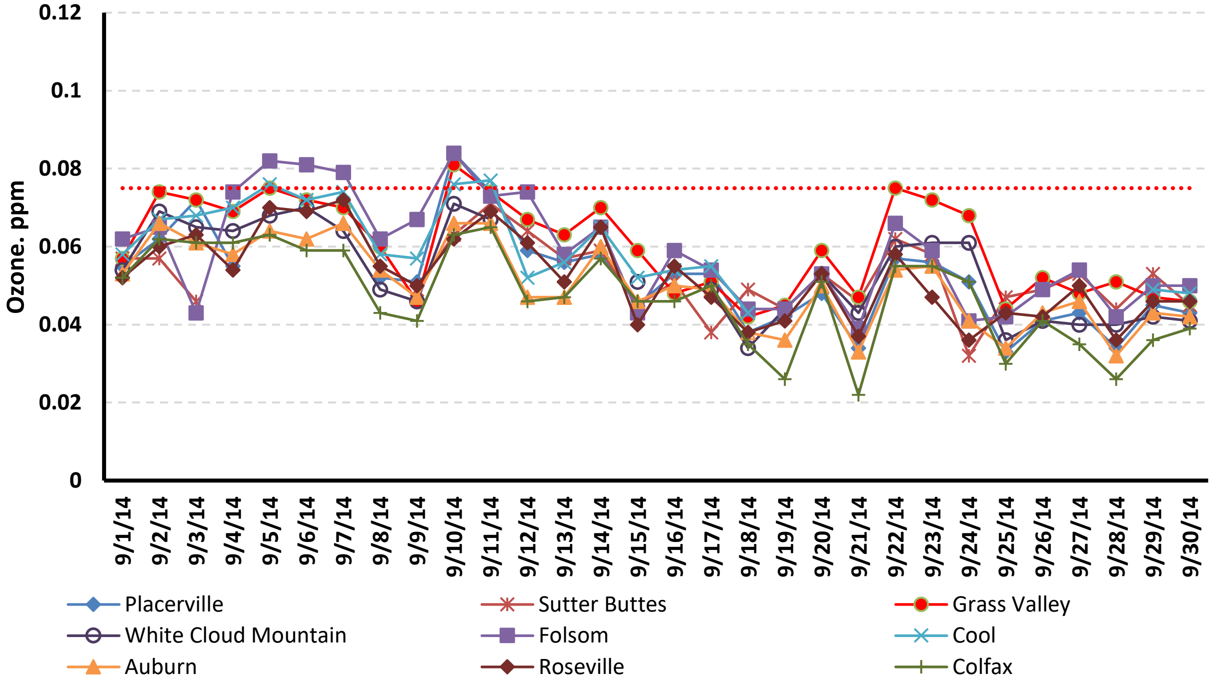





Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
6/1/14
6/2/14
6/3/14
6/4/14
6/5/14
6/6/14
6/7/14
6/8/14
6/9/14
6/10/14
6/11/14
6/12/14
6/13/14
6/14/14
6/15/14
6/16/14
6/17/14
6/18/14
6/19/14
6/20/14
6/21/14
6/22/14
6/23/14
6/24/14
6/25/14
6/26/14
6/27/14
6/28/14
6/29/14
6/30/14
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax


Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
7/1/14
7/2/14
7/3/14
7/4/14
7/5/14
7/6/14
7/7/14
7/8/14
7/9/14
7/10/14
7/11/14
7/12/14
7/13/14
7/14/14
7/15/14
7/16/14
7/17/14
7/18/14
7/19/14
7/20/14
7/21/14
7/22/14
7/23/14
7/24/14
7/25/14
7/26/14
7/27/14
7/28/14
7/29/14
7/30/14
7/31/14
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax


Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
8/1/14
8/2/14
8/3/14
8/4/14
8/5/14
8/6/14
8/7/14
8/8/14
8/9/14
8/10/14
8/11/14
8/12/14
8/13/14
8/14/14
8/15/14
8/16/14
8/17/14
8/18/14
8/19/14
8/20/14
8/21/14
8/22/14
8/23/14
8/24/14
8/25/14
8/26/14
8/27/14
8/28/14
8/29/14
8/30/14
8/31/14
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax


Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
9/1/14
9/2/14
9/3/14
9/4/14
9/5/14
9/6/14
9/7/14
9/8/14
9/9/14
9/10/14
9/11/14
9/12/14
9/13/14
9/14/14
9/15/14
9/16/14
9/17/14
9/18/14
9/19/14
9/20/14
9/21/14
9/22/14
9/23/14
9/24/14
9/25/14
9/26/14
9/27/14
9/28/14
9/29/14
9/30/14
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax

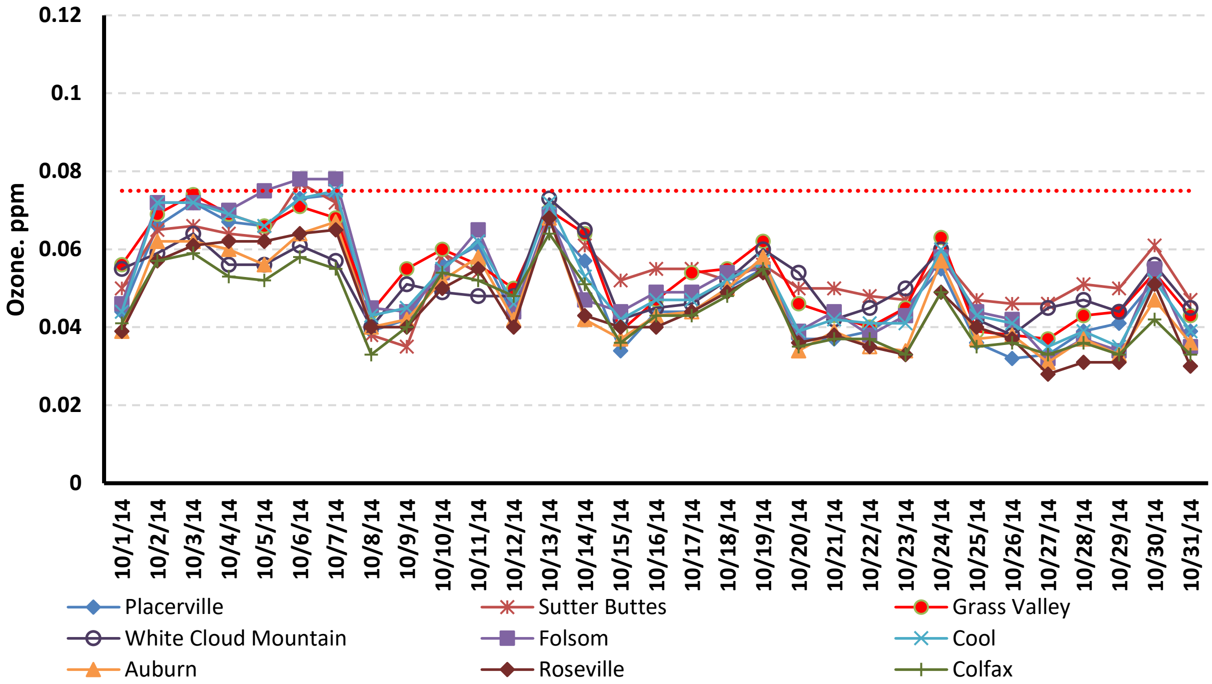
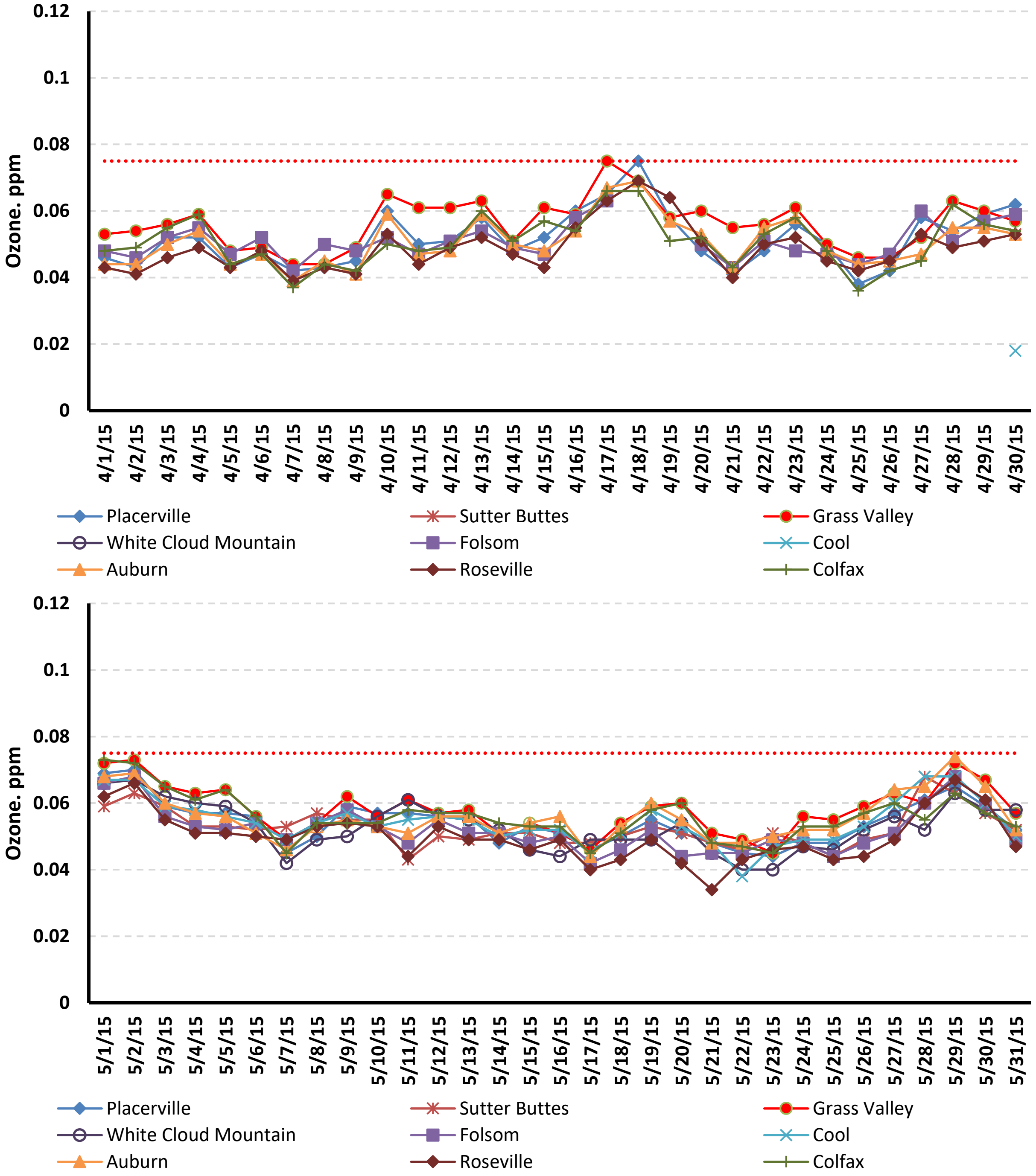
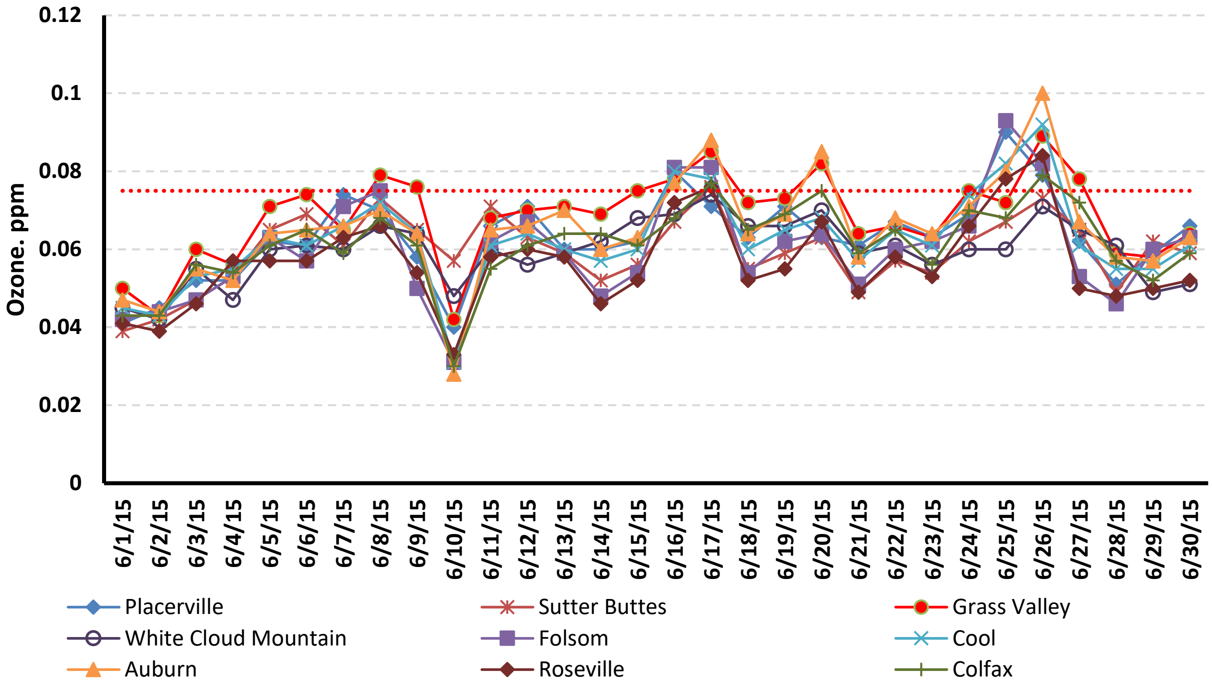
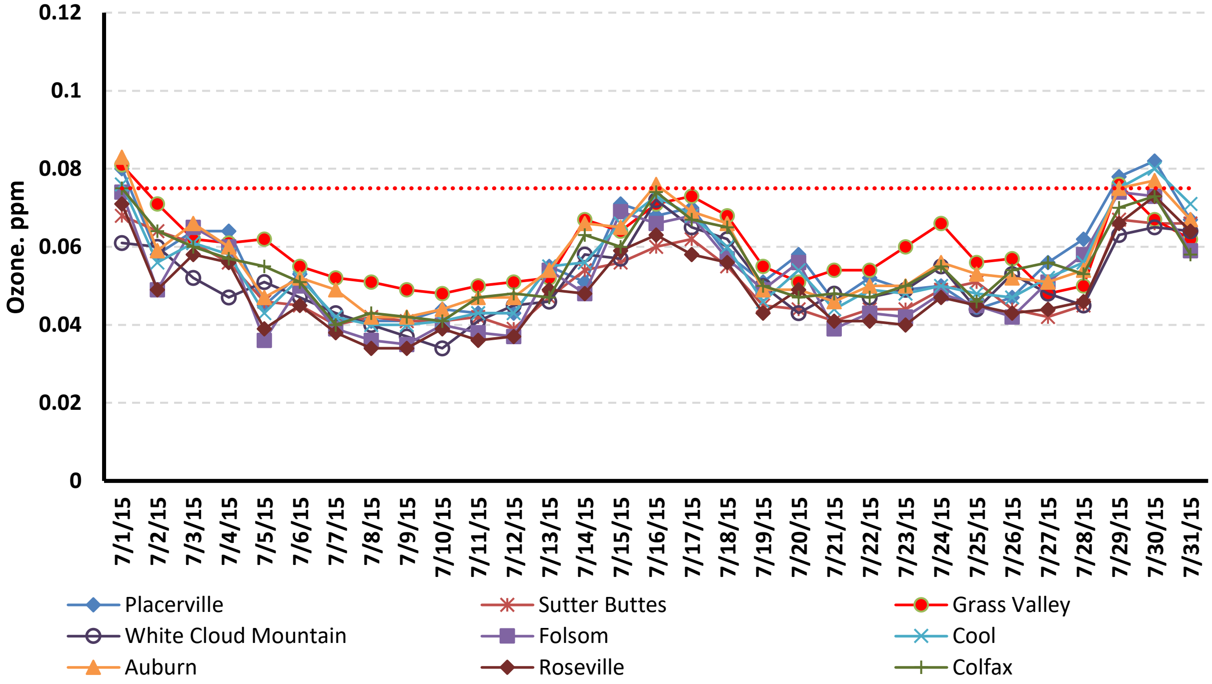
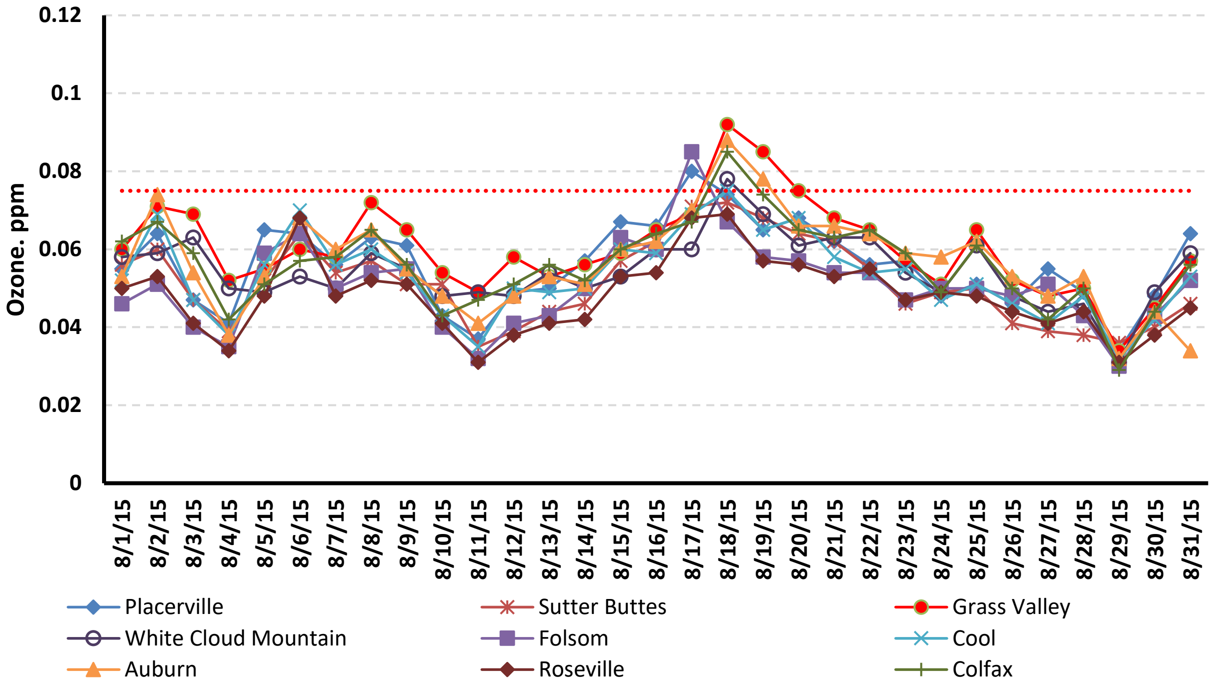

Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
10/1/14
10/2/14
10/3/14
10/4/14
10/5/14
10/6/14
10/7/14
10/8/14
10/9/14
10/10/14
10/11/14
10/12/14
10/13/14
10/14/14
10/15/14
10/16/14
10/17/14
10/18/14
10/19/14
10/20/14
10/21/14
10/22/14
10/23/14
10/24/14
10/25/14
10/26/14
10/27/14
10/28/14
10/29/14
10/30/14
10/31/14
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax

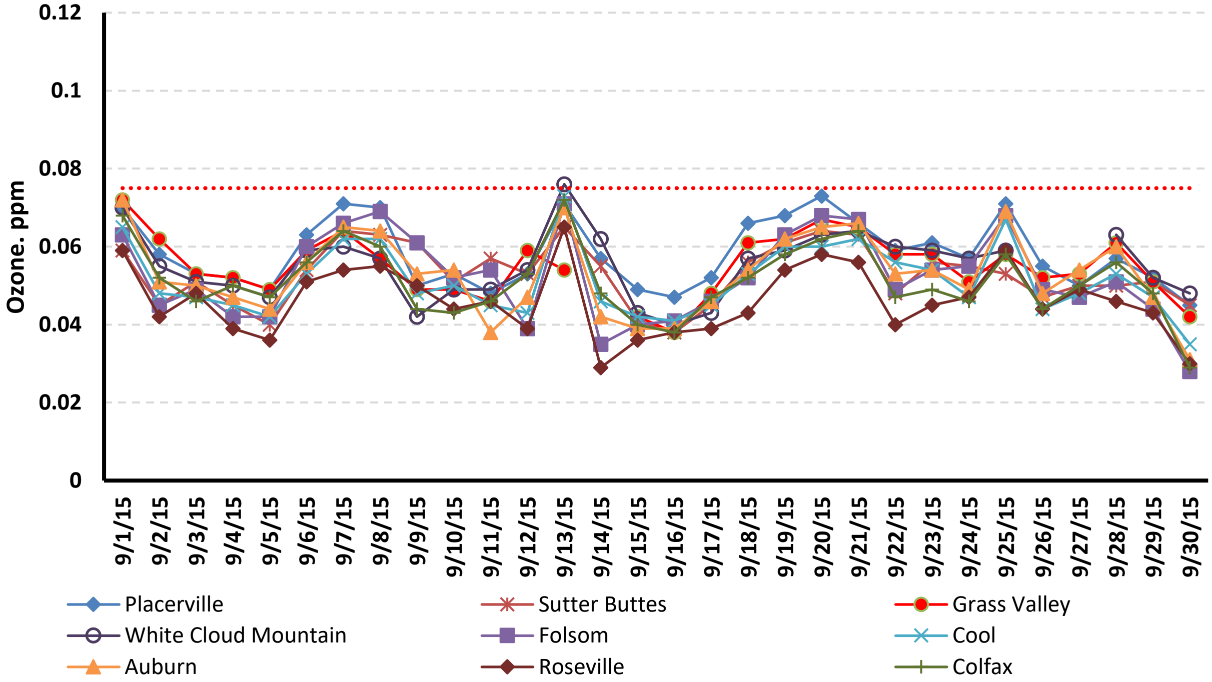
Figure A7. Grass Valley and surrounding regional daily maximum 8-hour ozone concentrations in 2015




0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
6/1/15
6/2/15
6/3/15
6/4/15
6/5/15
6/6/15
6/7/15
6/8/15
6/9/15
6/10/15
6/11/15
6/12/15
6/13/15
6/14/15
6/15/15
6/16/15
6/17/15
6/18/15
6/19/15
6/20/15
6/21/15
6/22/15
6/23/15
6/24/15
6/25/15
6/26/15
6/27/15
6/28/15
6/29/15
6/30/15
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax


0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
7/1/15
7/2/15
7/3/15
7/4/15
7/5/15
7/6/15
7/7/15
7/8/15
7/9/15
7/10/15
7/11/15
7/12/15
7/13/15
7/14/15
7/15/15
7/16/15
7/17/15
7/18/15
7/19/15
7/20/15
7/21/15
7/22/15
7/23/15
7/24/15
7/25/15
7/26/15
7/27/15
7/28/15
7/29/15
7/30/15
7/31/15
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax


0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
8/1/15
8/2/15
8/3/15
8/4/15
8/5/15
8/6/15
8/7/15
8/8/15
8/9/15
8/10/15
8/11/15
8/12/15
8/13/15
8/14/15
8/15/15
8/16/15
8/17/15
8/18/15
8/19/15
8/20/15
8/21/15
8/22/15
8/23/15
8/24/15
8/25/15
8/26/15
8/27/15
8/28/15
8/29/15
8/30/15
8/31/15
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax


0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
9/1/15
9/2/15
9/3/15
9/4/15
9/5/15
9/6/15
9/7/15
9/8/15
9/9/15
9/10/15
9/11/15
9/12/15
9/13/15
9/14/15
9/15/15
9/16/15
9/17/15
9/18/15
9/19/15
9/20/15
9/21/15
9/22/15
9/23/15
9/24/15
9/25/15
9/26/15
9/27/15
9/28/15
9/29/15
9/30/15
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax

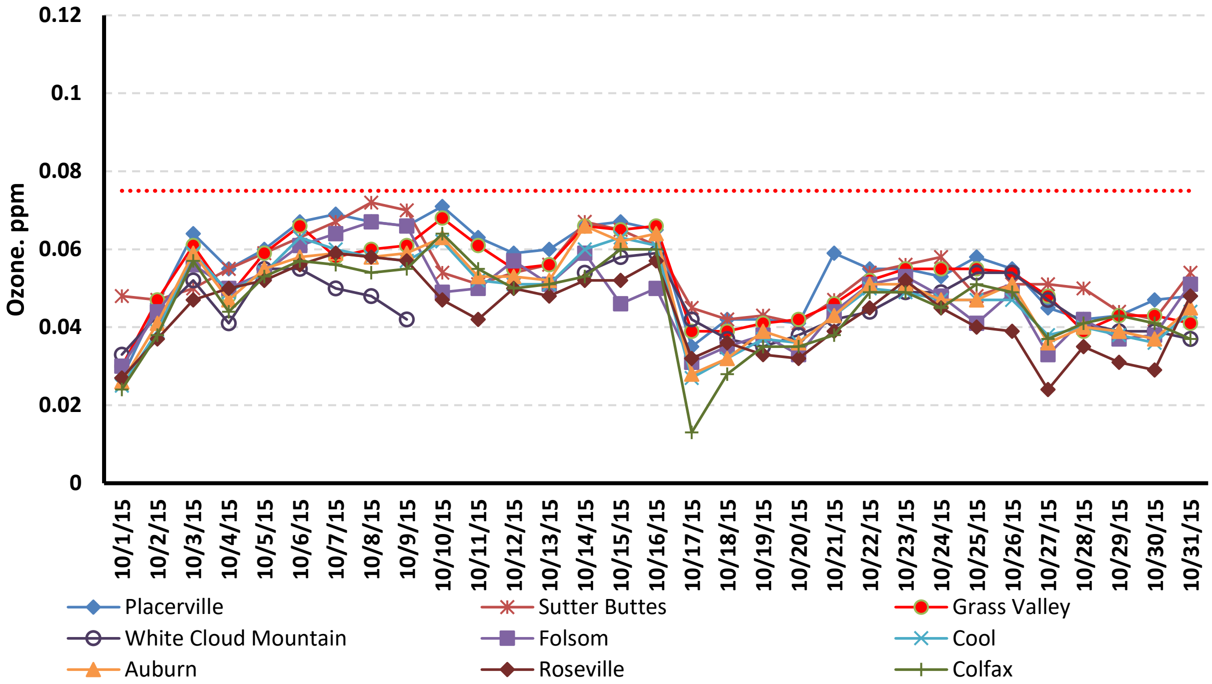
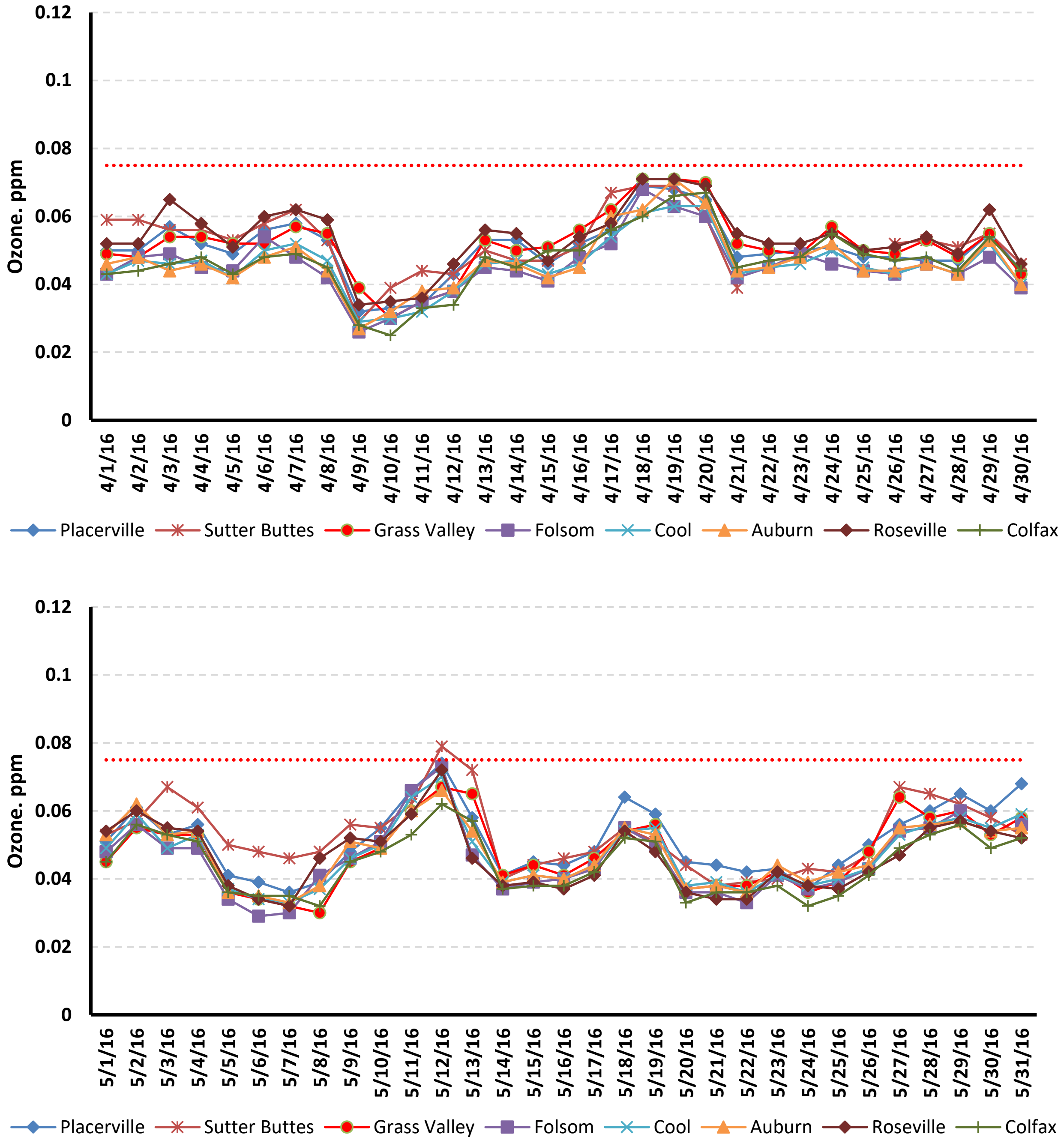
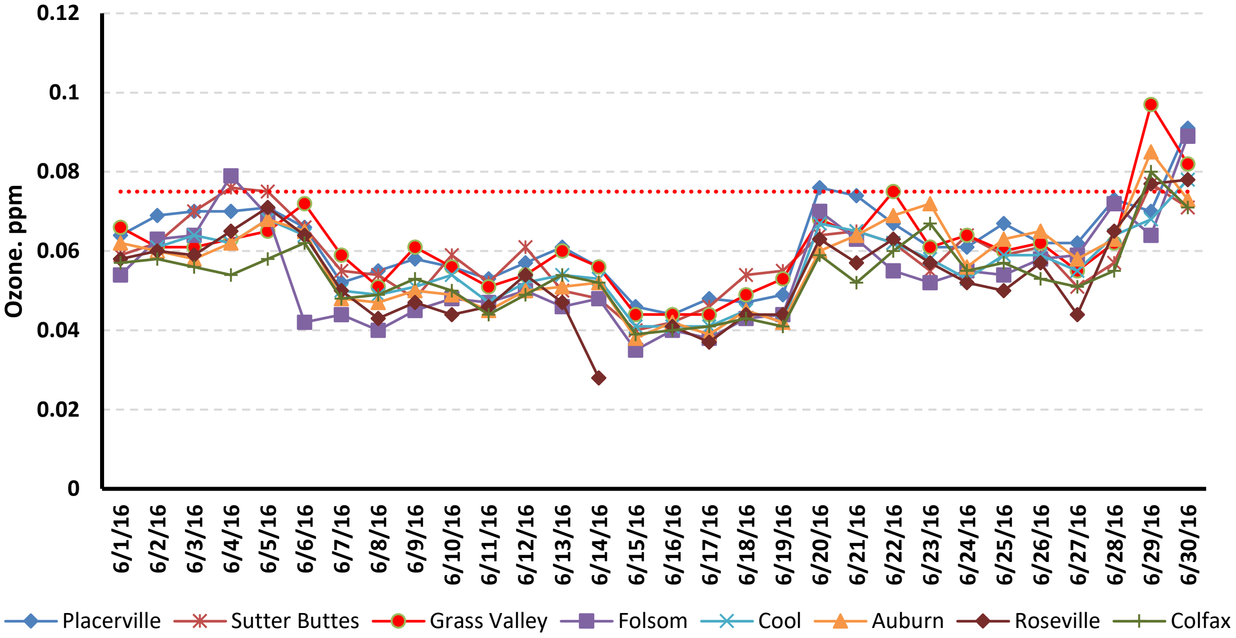
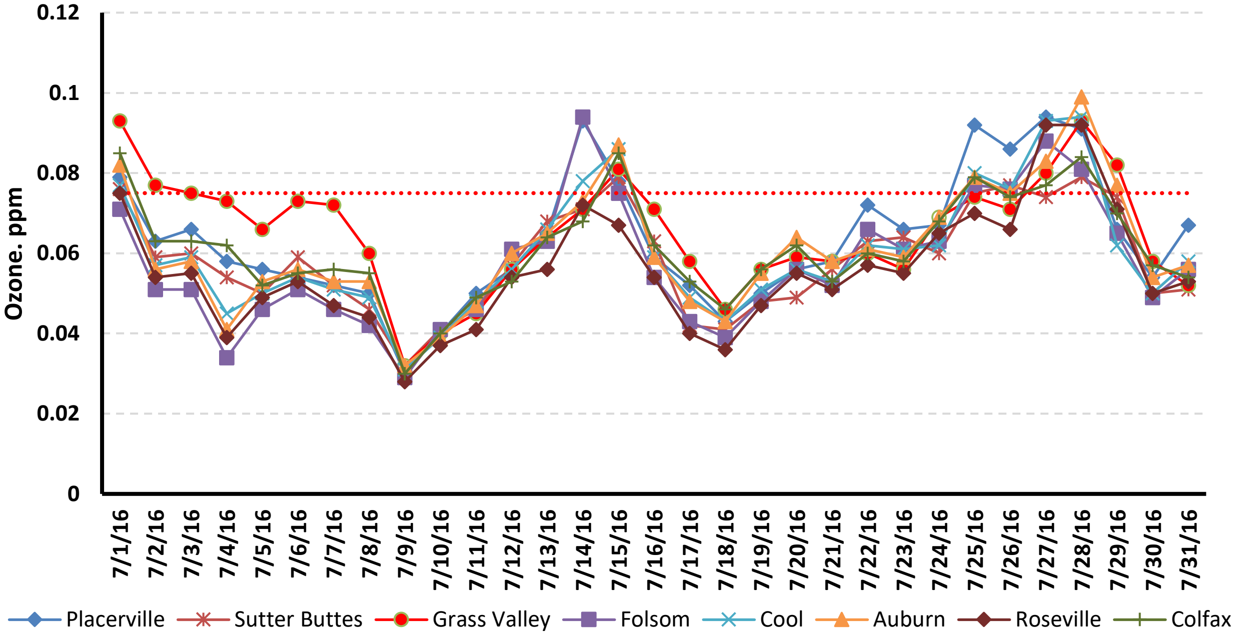

0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
10/1/15
10/2/15
10/3/15
10/4/15
10/5/15
10/6/15
10/7/15
10/8/15
10/9/15
10/10/15
10/11/15
10/12/15
10/13/15
10/14/15
10/15/15
10/16/15
10/17/15
10/18/15
10/19/15
10/20/15
10/21/15
10/22/15
10/23/15
10/24/15
10/25/15
10/26/15
10/27/15
10/28/15
10/29/15
10/30/15
10/31/15
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax

Figure A8. Grass Valley and surrounding regional daily maximum 8-hour ozone concentrations in 2016

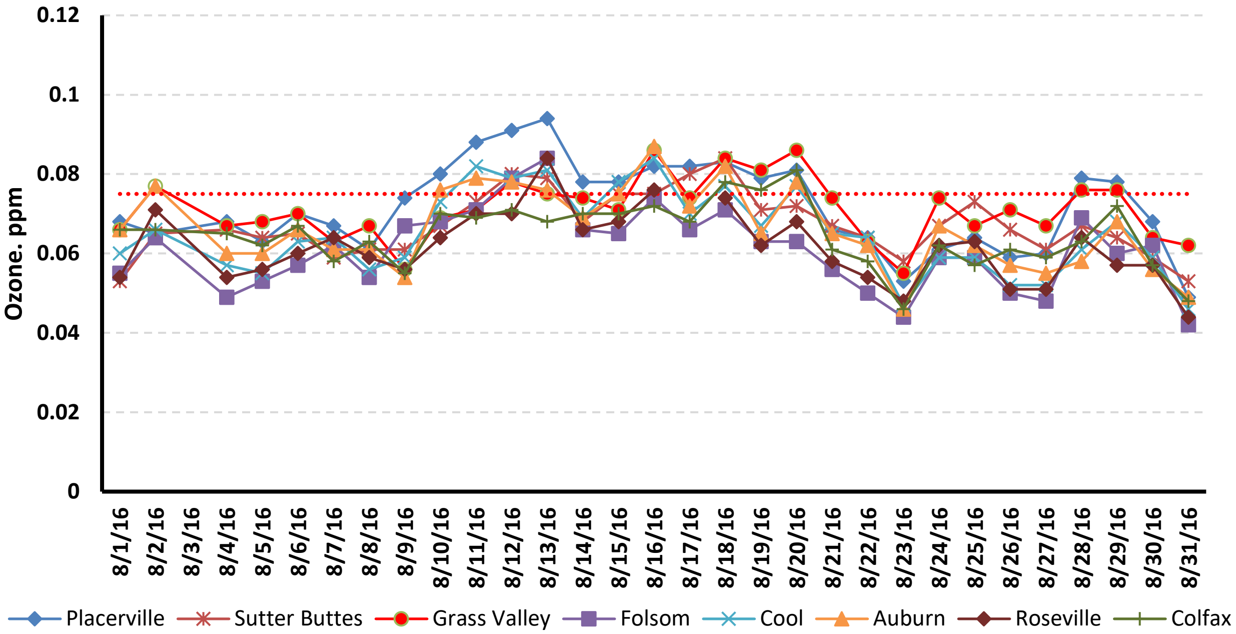




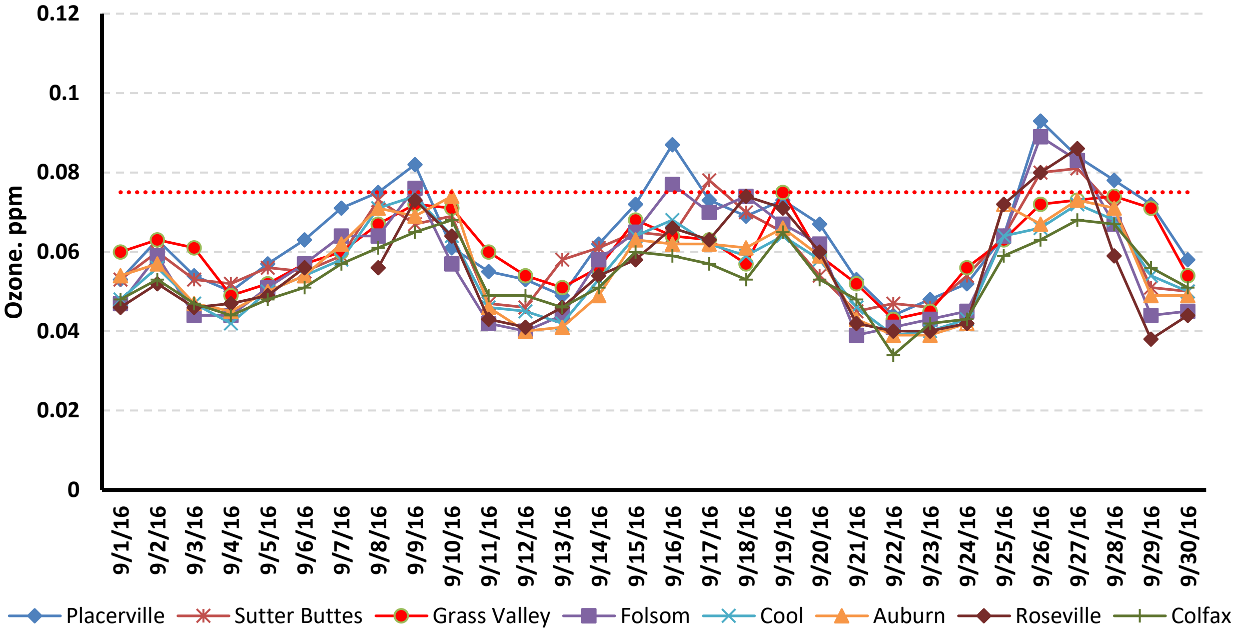
0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
6/1/16
6/2/16
6/3/16
6/4/16
6/5/16
6/6/16
6/7/16
6/8/16
6/9/16
6/10/16
6/11/16
6/12/16
6/13/16
6/14/16
6/15/16
6/16/16
6/17/16
6/18/16
6/19/16
6/20/16
6/21/16
6/22/16
6/23/16
6/24/16
6/25/16
6/26/16
6/27/16
6/28/16
6/29/16
6/30/16
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax



0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
7/1/16
7/2/16
7/3/16
7/4/16
7/5/16
7/6/16
7/7/16
7/8/16
7/9/16
7/10/16
7/11/16
7/12/16
7/13/16
7/14/16
7/15/16
7/16/16
7/17/16
7/18/16
7/19/16
7/20/16
7/21/16
7/22/16
7/23/16
7/24/16
7/25/16
7/26/16
7/27/16
7/28/16
7/29/16
7/30/16
7/31/16
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax



Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
8/1/16
8/2/16
8/3/16
8/4/16
8/5/16
8/6/16
8/7/16
8/8/16
8/9/16
8/10/16
8/11/16
8/12/16
8/13/16
8/14/16
8/15/16
8/16/16
8/17/16
8/18/16
8/19/16
8/20/16
8/21/16
8/22/16
8/23/16
8/24/16
8/25/16
8/26/16
8/27/16
8/28/16
8/29/16
8/30/16
8/31/16
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax



Ozone. ppm
0.12
0.1
0.08
0.06
0.04
0.02
0
9/1/16
9/2/16
9/3/16
9/4/16
9/5/16
9/6/16
9/7/16
9/8/16
9/9/16
9/10/16
9/11/16
9/12/16
9/13/16
9/14/16
9/15/16
9/16/16
9/17/16
9/18/16
9/19/16
9/20/16
9/21/16
9/22/16
9/23/16
9/24/16
9/25/16
9/26/16
9/27/16
9/28/16
9/29/16
9/30/16
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax

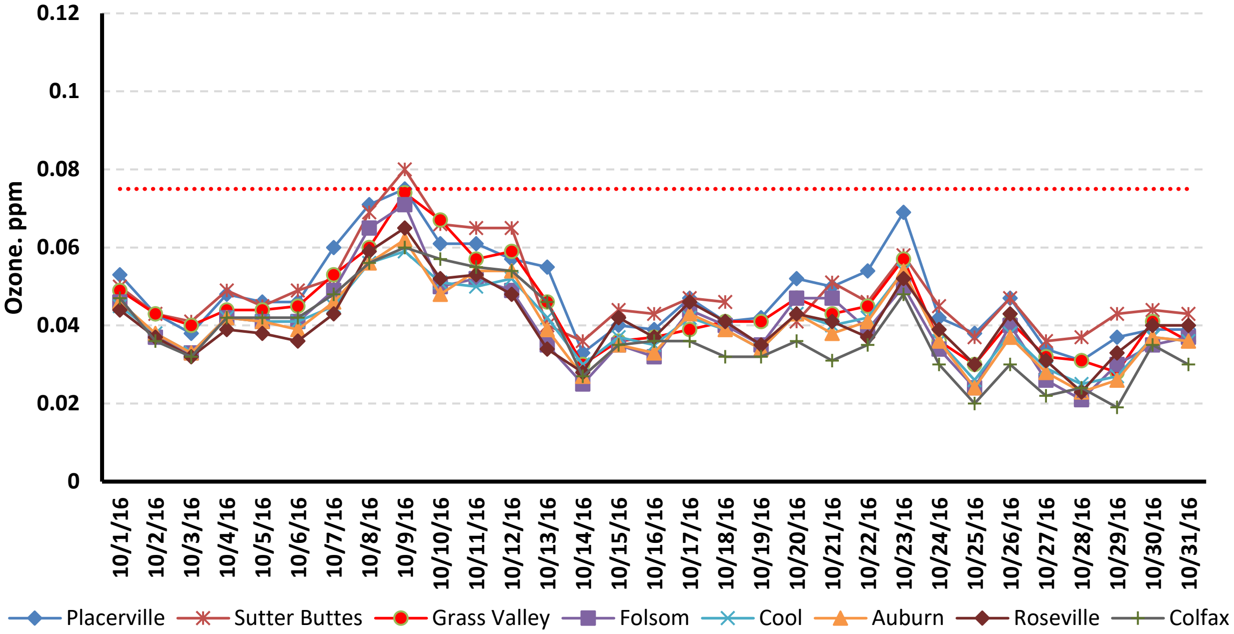
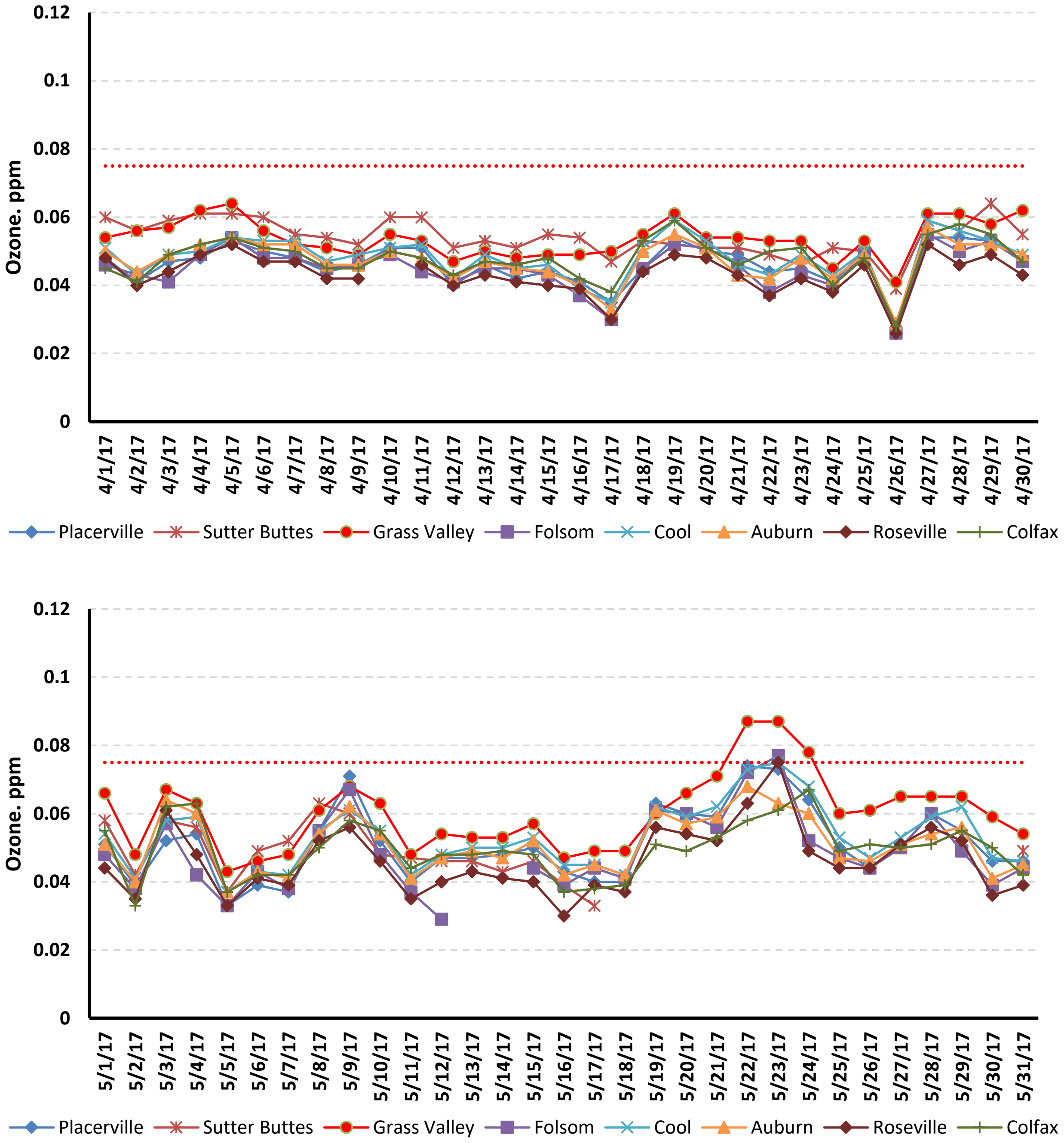
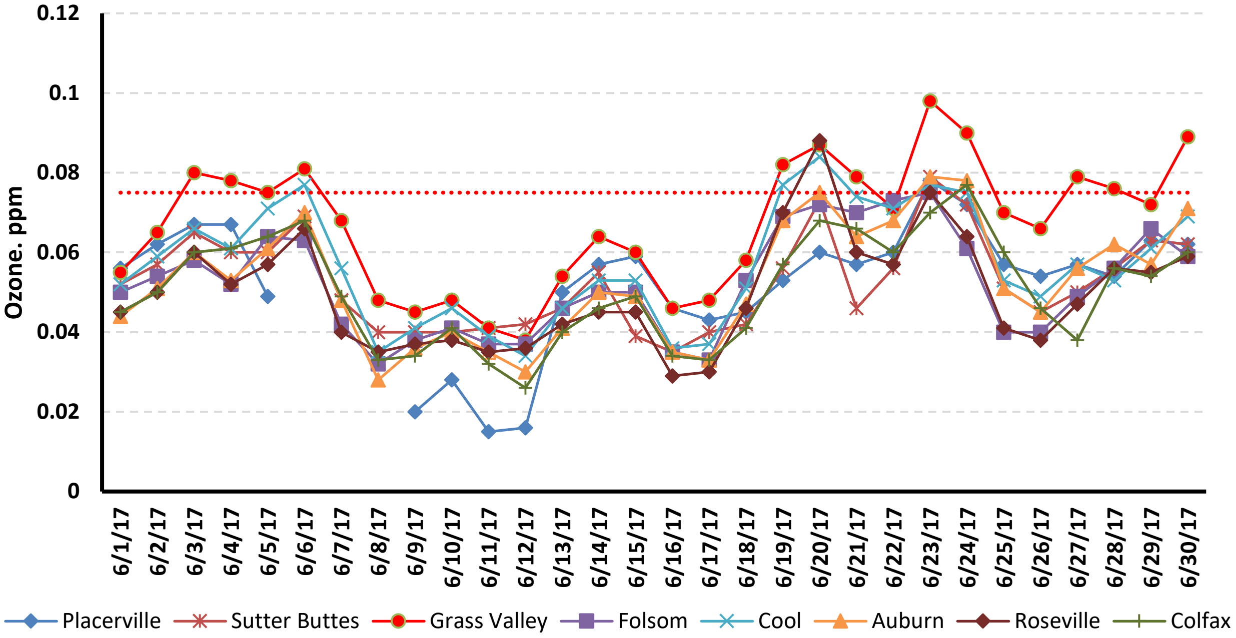
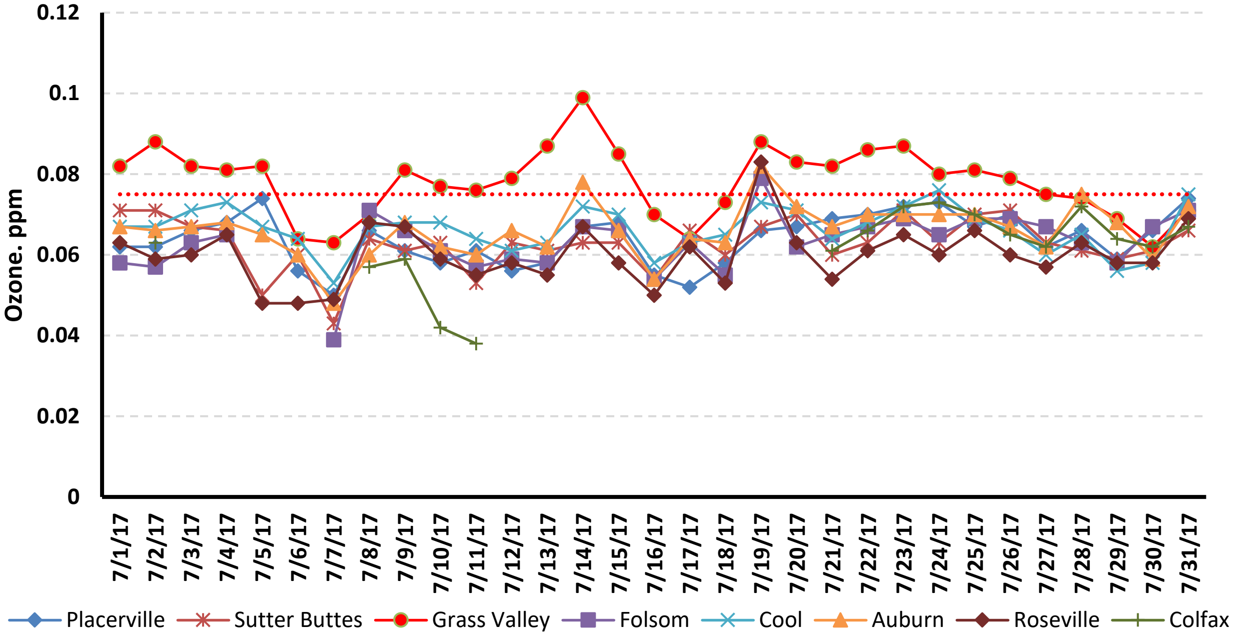
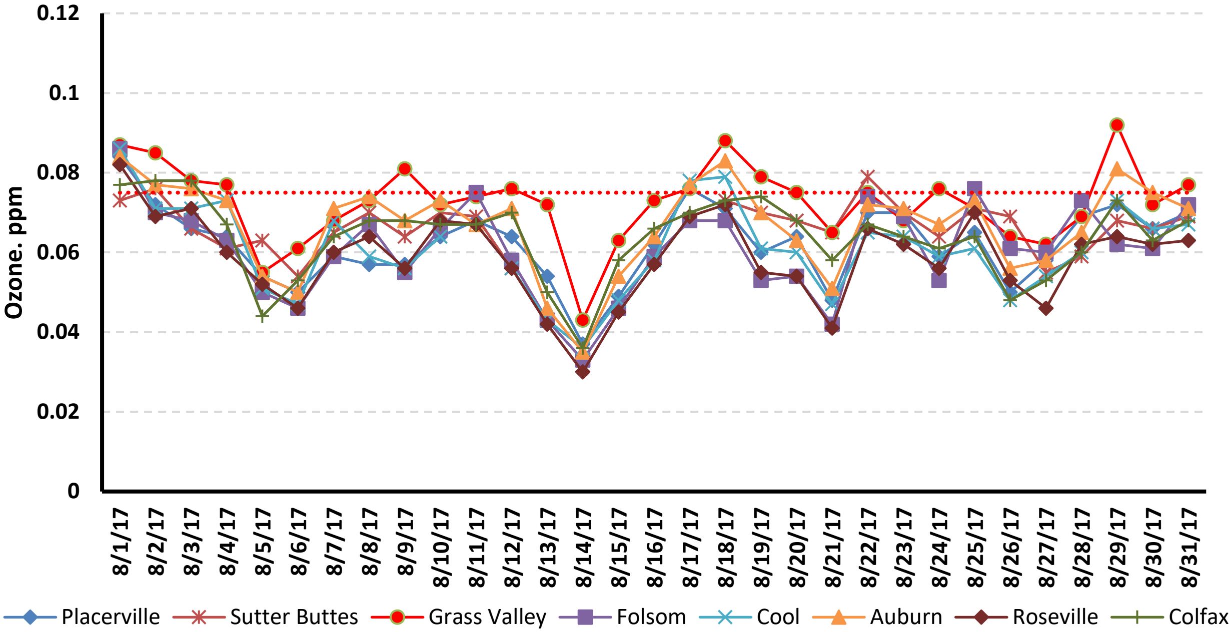

0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
10/1/16
10/2/16
10/3/16
10/4/16
10/5/16
10/6/16
10/7/16
10/8/16
10/9/16
10/10/16
10/11/16
10/12/16
10/13/16
10/14/16
10/15/16
10/16/16
10/17/16
10/18/16
10/19/16
10/20/16
10/21/16
10/22/16
10/23/16
10/24/16
10/25/16
10/26/16
10/27/16
10/28/16
10/29/16
10/30/16
10/31/16
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax

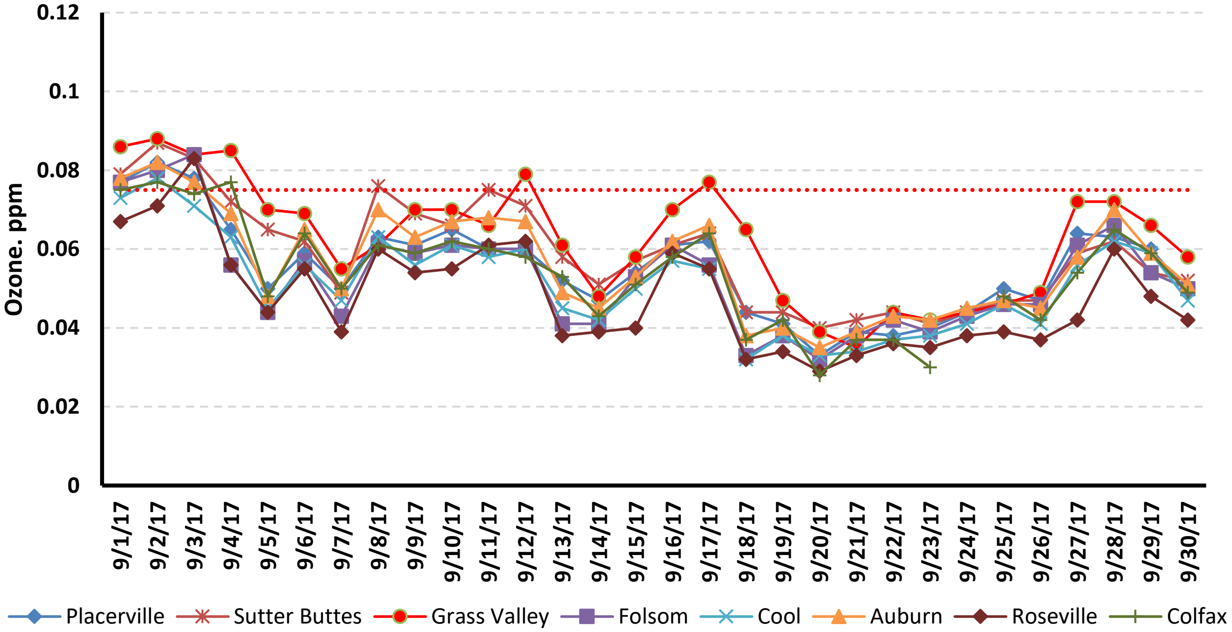
Figure A9. Grass Valley and surrounding regional daily maximum 8-hour ozone concentrations in 2017

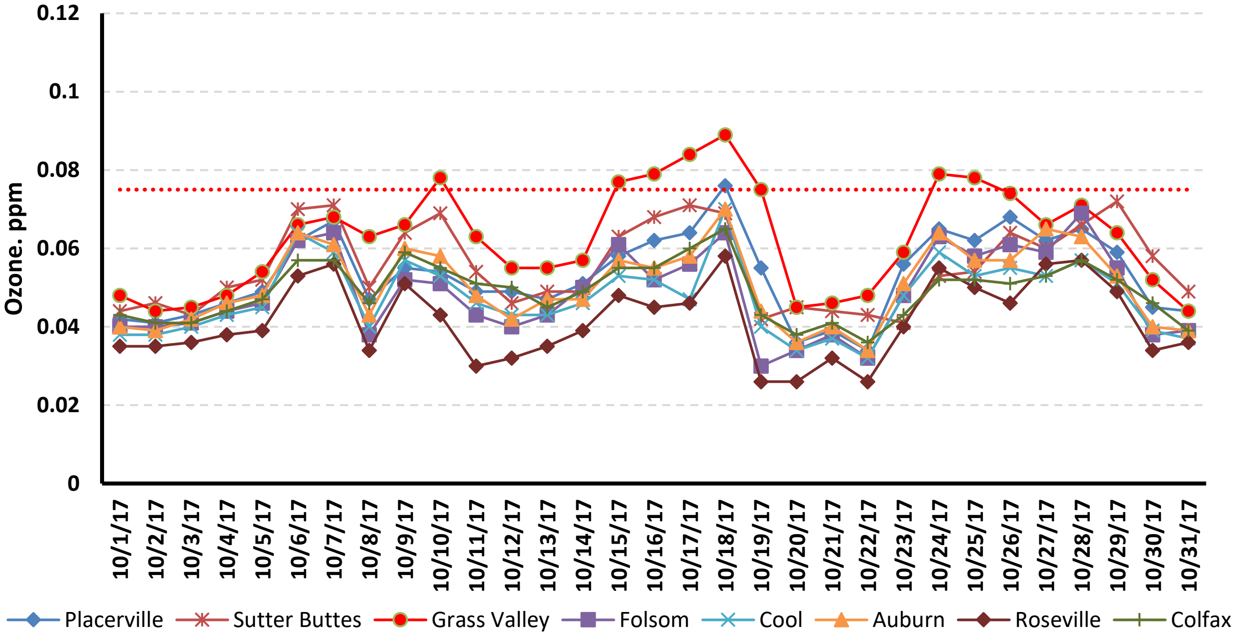



0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
6/1/17
6/2/17
6/3/17
6/4/17
6/5/17
6/6/17
6/7/17
6/8/17
6/9/17
6/10/17
6/11/17
6/12/17
6/13/17
6/14/17
6/15/17
6/16/17
6/17/17
6/18/17
6/19/17
6/20/17
6/21/17
6/22/17
6/23/17
6/24/17
6/25/17
6/26/17
6/27/17
6/28/17
6/29/17
6/30/17
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax


0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
7/1/17
7/2/17
7/3/17
7/4/17
7/5/17
7/6/17
7/7/17
7/8/17
7/9/17
7/10/17
7/11/17
7/12/17
7/13/17
7/14/17
7/15/17
7/16/17
7/17/17
7/18/17
7/19/17
7/20/17
7/21/17
7/22/17
7/23/17
7/24/17
7/25/17
7/26/17
7/27/17
7/28/17
7/29/17
7/30/17
7/31/17
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax

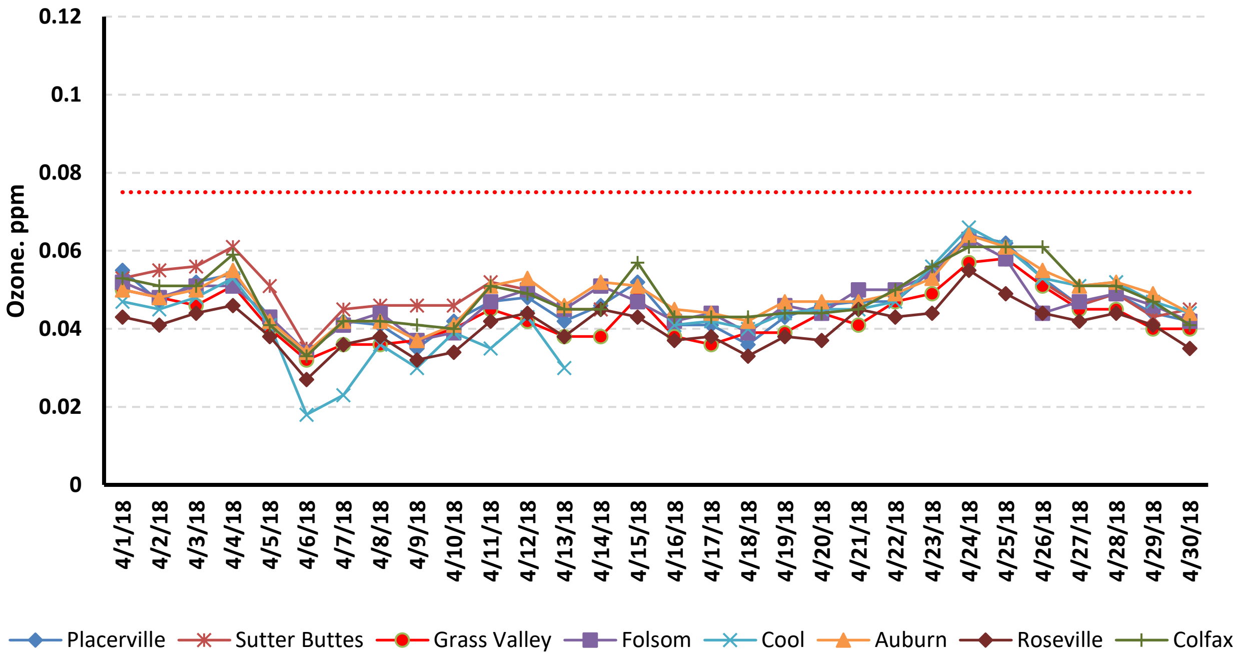

0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
8/1/17
8/2/17
8/3/17
8/4/17
8/5/17
8/6/17
8/7/17
8/8/17
8/9/17
8/10/17
8/11/17
8/12/17
8/13/17
8/14/17
8/15/17
8/16/17
8/17/17
8/18/17
8/19/17
8/20/17
8/21/17
8/22/17
8/23/17
8/24/17
8/25/17
8/26/17
8/27/17
8/28/17
8/29/17
8/30/17
8/31/17
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax

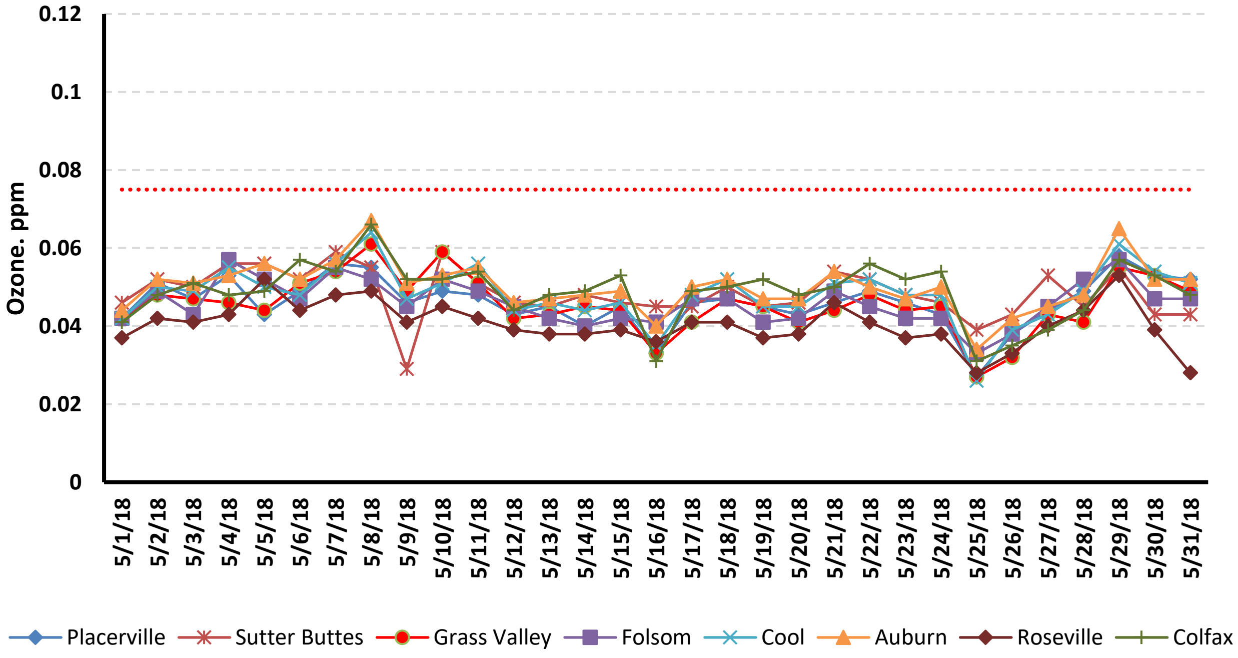

0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
9/1/17
9/2/17
9/3/17
9/4/17
9/5/17
9/6/17
9/7/17
9/8/17
9/9/17
9/10/17
9/11/17
9/12/17
9/13/17
9/14/17
9/15/17
9/16/17
9/17/17
9/18/17
9/19/17
9/20/17
9/21/17
9/22/17
9/23/17
9/24/17
9/25/17
9/26/17
9/27/17
9/28/17
9/29/17
9/30/17
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax

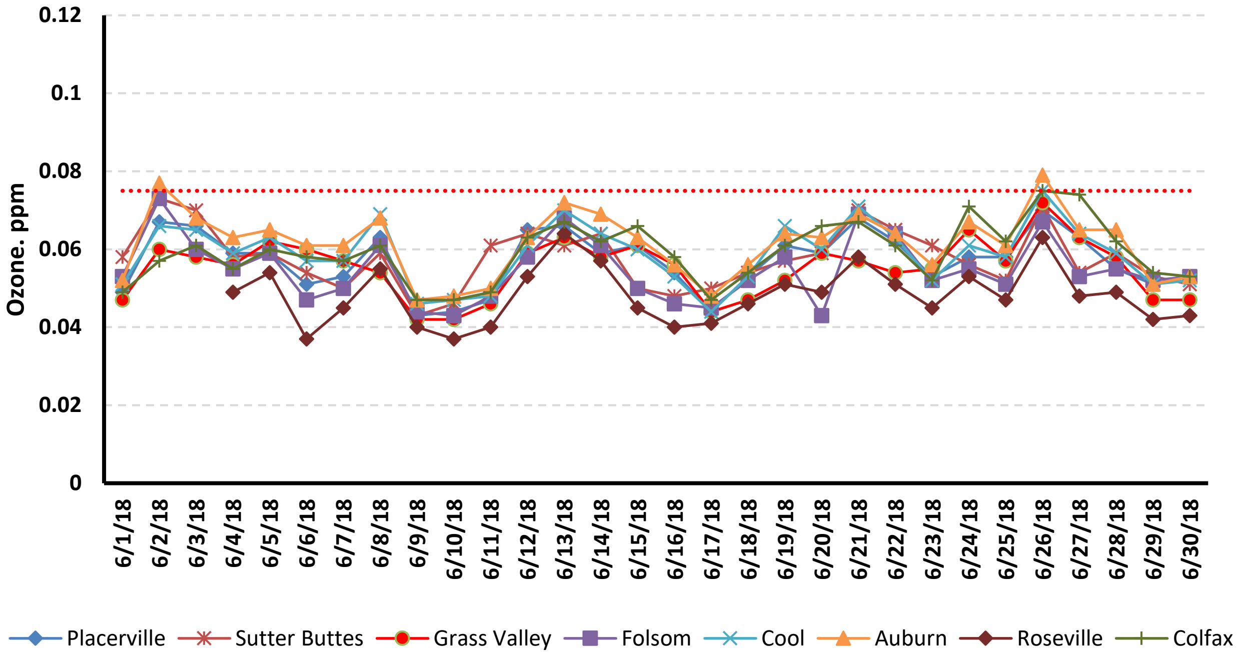


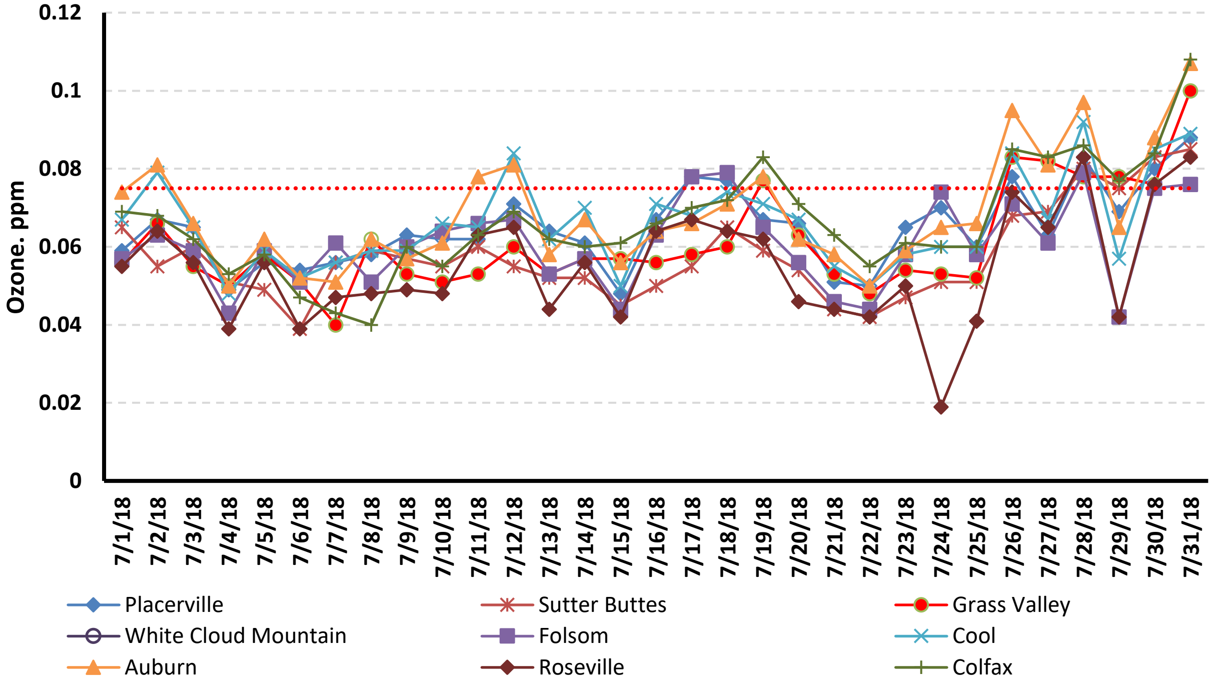
0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
10/1/17
10/2/17
10/3/17
10/4/17
10/5/17
10/6/17
10/7/17
10/8/17
10/9/17
10/10/17
10/11/17
10/12/17
10/13/17
10/14/17
10/15/17
10/16/17
10/17/17
10/18/17
10/19/17
10/20/17
10/21/17
10/22/17
10/23/17
10/24/17
10/25/17
10/26/17
10/27/17
10/28/17
10/29/17
10/30/17
10/31/17
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax

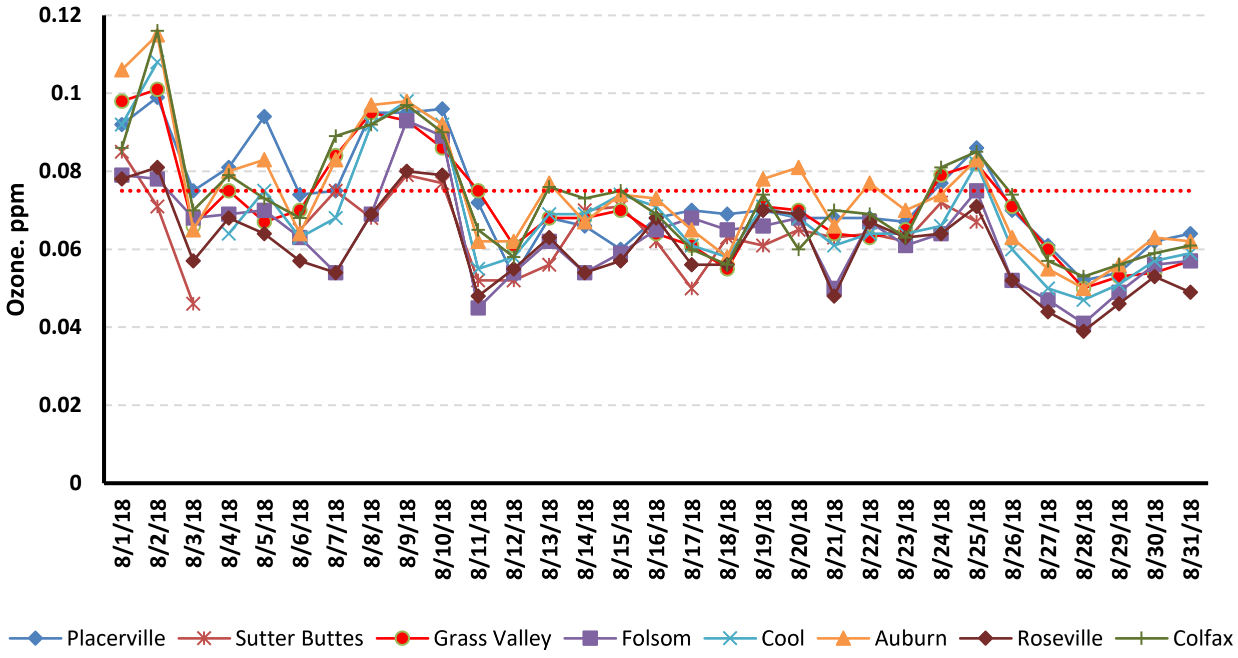
Figure A10. Grass Valley and surrounding regional daily maximum 8-hour ozone concentrations in 2018



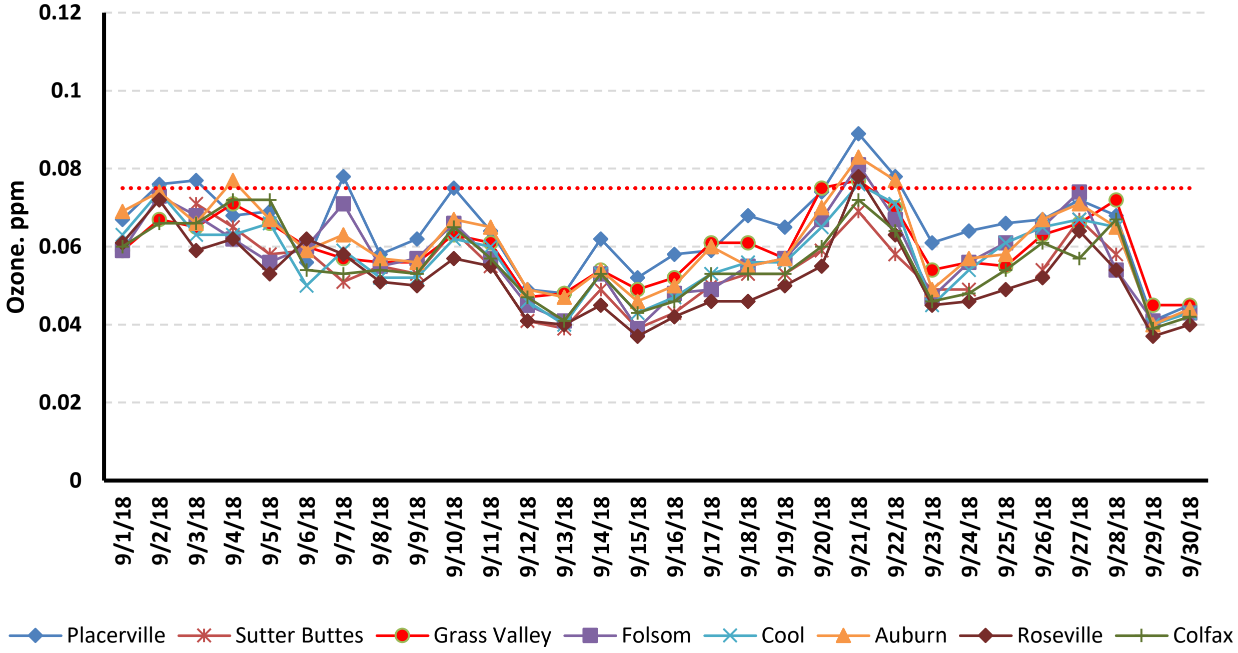



0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
6/1/18
6/2/18
6/3/18
6/4/18
6/5/18
6/6/18
6/7/18
6/8/18
6/9/18
6/10/18
6/11/18
6/12/18
6/13/18
6/14/18
6/15/18
6/16/18
6/17/18
6/18/18
6/19/18
6/20/18
6/21/18
6/22/18
6/23/18
6/24/18
6/25/18
6/26/18
6/27/18
6/28/18
6/29/18
6/30/18
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax


0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
7/1/18
7/2/18
7/3/18
7/4/18
7/5/18
7/6/18
7/7/18
7/8/18
7/9/18
7/10/18
7/11/18
7/12/18
7/13/18
7/14/18
7/15/18
7/16/18
7/17/18
7/18/18
7/19/18
7/20/18
7/21/18
7/22/18
7/23/18
7/24/18
7/25/18
7/26/18
7/27/18
7/28/18
7/29/18
7/30/18
7/31/18
Placerville
Sutter Buttes
Grass Valley
White Cloud Mountain
Folsom
Cool
Auburn
Roseville
Colfax



0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
8/1/18
8/2/18
8/3/18
8/4/18
8/5/18
8/6/18
8/7/18
8/8/18
8/9/18
8/10/18
8/11/18
8/12/18
8/13/18
8/14/18
8/15/18
8/16/18
8/17/18
8/18/18
8/19/18
8/20/18
8/21/18
8/22/18
8/23/18
8/24/18
8/25/18
8/26/18
8/27/18
8/28/18
8/29/18
8/30/18
8/31/18
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax



0.12
0.1
0.08
0.06
0.04
0.02
0
Ozone. ppm
9/1/18
9/2/18
9/3/18
9/4/18
9/5/18
9/6/18
9/7/18
9/8/18
9/9/18
9/10/18
9/11/18
9/12/18
9/13/18
9/14/18
9/15/18
9/16/18
9/17/18
9/18/18
9/19/18
9/20/18
9/21/18
9/22/18
9/23/18
9/24/18
9/25/18
9/26/18
9/27/18
9/28/18
9/29/18
9/30/18
Placerville
Sutter Buttes
Grass Valley
Folsom
Cool
Auburn
Roseville
Colfax

CALIFORNIA
AIR RESOURCES BOARD

1001 I Street
P.O. Box 2815
Sacramento, CA 95812
www.arb.ca.gov