PGA 582-16-60851-01, Amendment 3
Task 5.2, Deliverable 5.2.3

2019-2023 Ozone Monitoring Network Review Report

Prepared by the Capital Area Council of Governments

May 31, 2018

PREPARED UNDER A GRANT FROM THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

The preparation of this report was financed through grants from the State of Texas through the Texas Commission on Environmental Quality (TCEQ). The content, findings, opinions, and conclusions are the work of the author(s) and do not necessarily represent findings, opinions, or conclusions of the TCEQ.

This report was also financed through funding from the City of Austin. The content, findings, and conclusions are the work of the author(s) and do not necessarily represent the findings, opinions, or conclusions of the City of Austin.

Executive Summary

The Capital Area Council of Governments (CAPCOG) is 10-county regional planning commission in Central Texas that includes Bastrop, Blanco, Burnet, Caldwell, Fayette, Hays, Lee, Llano, Travis, and Williamson Counties. Five of these counties – Bastrop, Caldwell, Hays, Travis, and Williamson Counties – make up the Austin-Round Rock Metropolitan Statistical Area (MSA) and participate in CAPCOG's Central Texas Clean Air Coalition (CAC). The purpose of this report is to explain the technical basis and analyses conducted by CAPCOG staff in support of the 2019-2023 Monitoring Plan approved by the CAC on May 9, 2018. This plan calls for continuing to conduct ozone (O_3) monitoring at eight continuous air monitoring stations (CAMS) between 2019-2023, but moving three of the locations as follows:

- Discontinue O_3 monitoring at CAMS 601 (Fayetteville), CAMS 684 (McKinney Roughs), and CAMS 1603 (Gorzycki Middle School).
- Initiate O_3 monitoring in Bastrop, Elgin, and East Austin.

The figure below shows the proposed moves.

Figure ES-0-1. Approved Changes to CAPCOG's O_3 Monitoring Network for 2019-2023

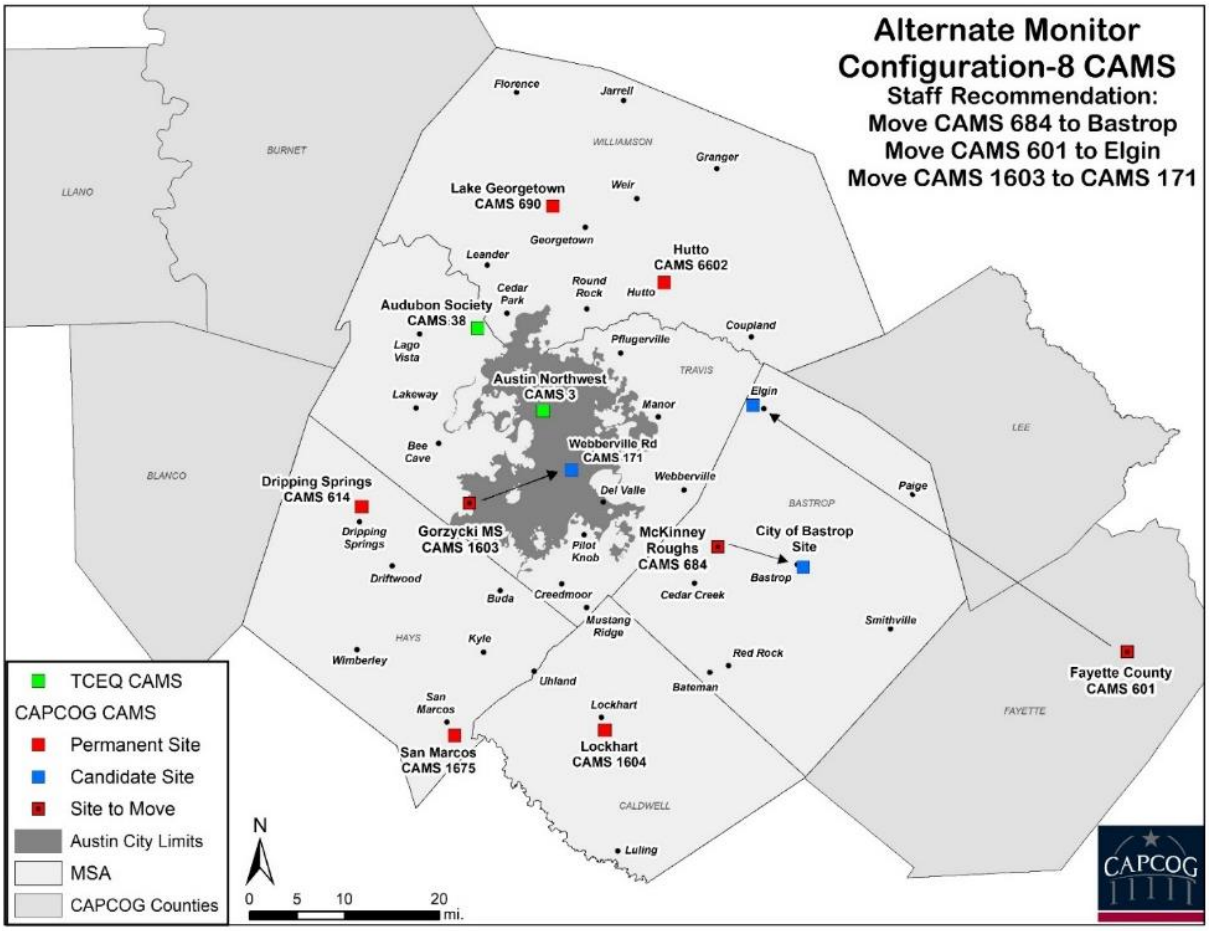


Table of Contents

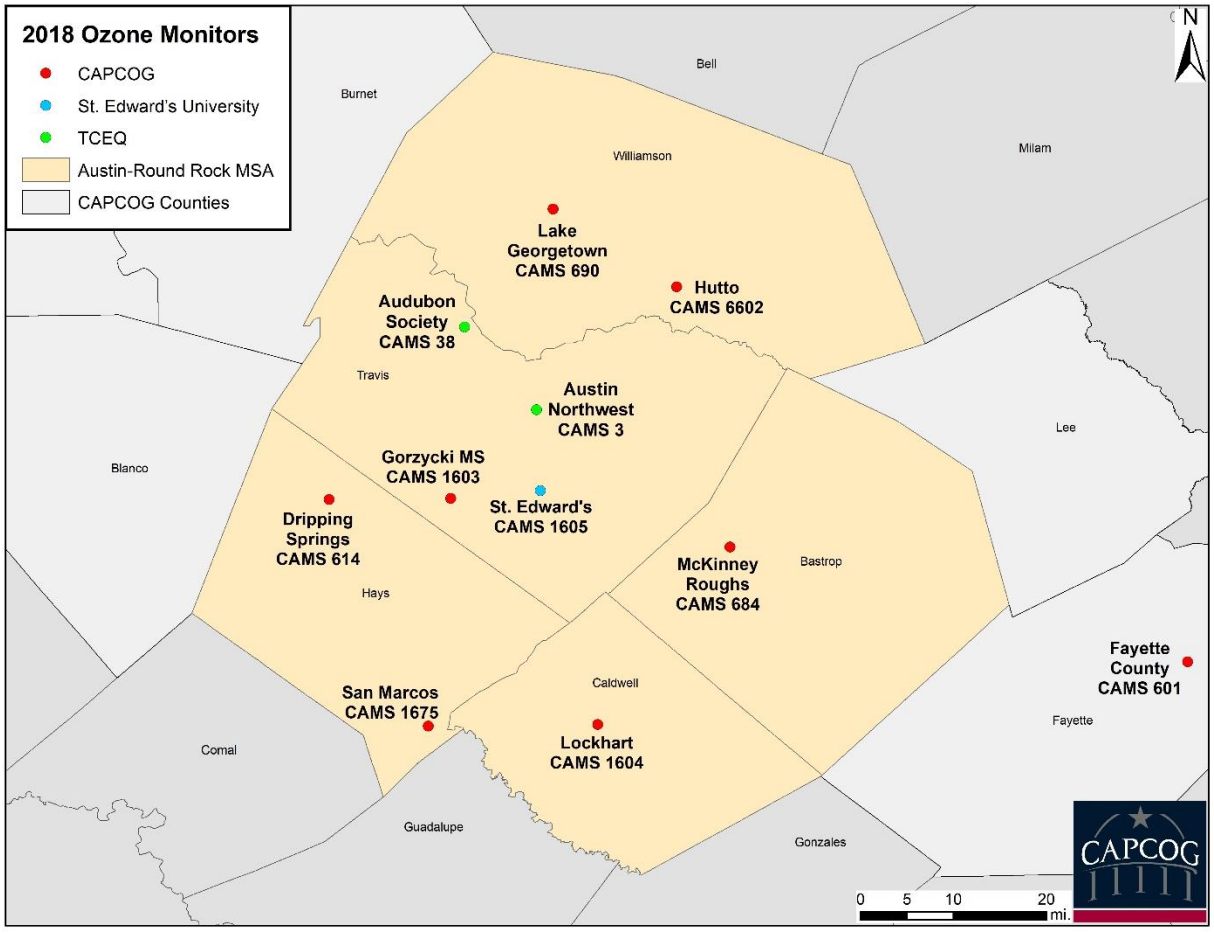
1 Introduction

The goal of this project is to formulate a plan for CAPCOG to conduct O_3 monitoring for 2019-2023, including the number of CAMS to operate and where within the region they should be deployed. This plan will be incorporated into a new regional air quality plan and will form the basis of any funding requests CAPCOG will make to support its monitoring activities during this timeframe.

1.1 Ozone Monitors in the CAPCOG Region

The following map shows the location and owners of all of the O_3 CAMS located in the CAPCOG region in 2018.

Figure 1-1. 2018 Ozone Monitors in the CAPCOG Region



While the goal of this project is to analyze CAPCOG's ozone monitoring stations within the region, TCEQ's two ozone monitoring stations are also included in this analysis as a point of reference. CAPCOG

is assuming, based on TCEQ's *2015 Five-Year Ambient Air Monitoring Assessment*[1] and its draft *2018 Annual Monitoring Network Plan*[2] that CAMS 3 and CAMS 38 will continue to collect ozone data to meet regulatory purposes, so understanding the value of CAPCOG's monitoring stations requires a comparison to the value of the data collected at these two TCEQ stations.

Since CAPCOG is unsure of the future operation of CAMS 1605 at St. Edwards' University, CAPCOG did not include CAMS 1605 in this assessment. For this analysis, CAPCOG focused on the value of each given monitoring station to the Austin-Round Rock MSA, rather than the COG region as a whole, since the CAC only covers the MSA (Bastrop, Caldwell, Hays, Travis, and Williamson Counties).

1.2 Consideration of Goals, Objectives, and Constraints for the 2019-2023 Monitoring Plan

For this project, CAPCOG used a subset of the monitoring objectives that were identified in CAPCOG's analysis of its monitoring network for 2018 monitoring activities.[3] In 2017, CAPCOG conducted a stakeholder survey for that report that provided CAPCOG with average scores for each objective (0-10). The objectives CAPCOG used for this project included:

1. Locating monitors where people live, work, and play (based on population and land area coverage) (avg. score = 8.8)
2. Locating monitors in environmental justice areas that have low-income and/or minority populations (based on comparisons of sub-population coverage) (avg. score = 8.3)
3. Tracking trends in ozone concentration over time (based on years of consecutive data-collection) (avg. score = 8.4)
4. Monitoring the area of maximum pollutant concentration (based on modeled 2020 ozone levels) (avg. score = 8.8)
5. Characterize ozone transport (based on proximity to MSA boundaries) (avg. score = 8.0)
6. Locating monitors where they will be of maximum value with assisting with air quality forecasting (based on location upwind of urbanized area on high ozone days) (avg. score = 9.3)
7. Measuring ozone in Bastrop County (avg. score = 7.8)
8. Measuring ozone in Blanco County (avg. score = 5.3)
9. Measuring ozone in Burnet County (avg. score = 5.5)
10. Measuring ozone in Caldwell County (avg. score = 7.0)
11. Measuring ozone in Fayette County (avg. score = 6.8)
12. Measuring ozone in Hays County (avg. score = 7.7)
13. Measuring ozone in Lee County (avg. score = 5.5)
14. Measuring ozone in Llano County (avg. score = 5.2)

[1] TCEQ. *2015 Five-Year Ambient Monitoring Network Assessment.* Available online at: https://www.tceq.texas.gov/assets/public/compliance/monops/air/annual_review/historical/2015-5yrAAMNA.pdf.
[2] TCEQ. *2018 Annual Monitoring Network Plan*. Available online at: https://www.tceq.texas.gov/airquality/monops/network_review.html.
[3] CAPCOG. *CAPCOG Ozone Monitoring Network Review for 2018 Monitoring Activities*. August 11, 2017. Available online at: http://www.capcog.org/documents/airquality/reports/2017/Deliverable_5.2.2_O3_Monitoring_Network_Review_for_2018.pdf

15. Measuring ozone in Travis County (avg. score = 8.3)
16. Measuring ozone in Williamson County (avg. score = 8.1)
17. Measuring ozone in all five counties of the Austin-Round Rock MSA (avg. score = 8.5)
18. Maintaining the same level of data quality in 2019-2023 as achieved in 2016 and 2017 (avg. score = 8.4)

For the 2019-2023 regional air quality plan that this analysis will be supporting, the CAC has approved the following goals:

- Primary: maximize the probability of compliance with the NAAQS region-wide (defined as the Austin-Round Rock MSA)
- Secondary: minimize the health and environmental impacts of regional air pollution

Based on the average scores in the 2017 monitoring survey responses in 2017 and the goals approved for the 2019-2023 air quality plan, CAPCOG used the following constraints and guidelines for the 2019-2023 monitoring plan:

- CAPCOG would need to continue to operate at least one O_3 monitor each in Bastrop, Caldwell, Hays, and Williamson Counties in order to ensure that there was at least one O_3 monitor in each of the five counties in the MSA (i.e., a minimum of four total).
- CAPCOG would plan to continue operating all O_3 monitors based on the same data quality objectives as were used in 2018.
- Since CAPCOG's funding request letter for FY 2019 indicated that CAPCOG was going to operate six to eight O_3 monitors, unless there were compelling logistical reasons or technical reason for moving an existing monitor, the top six-ranked monitors from the analysis for the 2018 network (CAMS 614, 684, 690, 1604, 1675, and 6602) would remain in place.
- In analyzing population and land area coverage, CAPCOG would limit the analysis to the MSA's population and land area covered by O_3 monitors.

2 Analysis of Overall Level of Monitoring

In order to assess the appropriate level of monitoring, CAPCOG compared the O_3 design value, population coverage (defined as monitors per million people), and land area coverage (defined as monitors per 1,000 square miles) of the Austin-Round Rock MSA to metro areas across the country and within Texas. CAPCOG and its Clean Air Coalition previously made comments on TCEQ's 2014 Annual Monitoring Network Plan (AMNP) and TCEQ's 2015 Five-Year Monitoring Network Assessment.

In TCEQ's 2014 AMNP, it responded to TCEQ's request that it support additional O_3 monitoring within the region as follows: "The TCEQ considers more than regulatory monitors in evaluating the area's air quality and determining the best surveillance and pollution reduction strategies…the use of both regulatory and non-regulatory data from the area's current O_3 monitoring network provides the TCEQ a sufficient dataset upon which to base decisions that will help continue to keep the Austin-Round Rock MSA in attainment."

2.1 National-Level Comparison

CAPCOG first conducted a comparison of the level of monitoring in the Austin-Round Rock MSA to similarly-sized metro areas across the country. CAPCOG used the five metro areas ranked immediately higher and five metro areas ranked immediately lower than the Austin-Round Rock MSA in terms of population as points of comparison for this analysis.

Table D-2 in Appendix D to 40 CFR Part 58 identifies the minimum number of regulatory O_3 monitors required for metro areas based on population and most recent 3-year design value. For metro areas of between 350,000 and 4 million, which all of these metros fall into, EPA requires two O_3 monitors if the most recent 3-year design value is at least 85% of any O_3 NAAQS, and one O_3 monitor if the most recent 3-year design value is less than 85% of all O_3 NAAQS.

CAPCOG used each state's 2017 monitoring plan in order to determine the number of O_3 monitors in each metro areas. CAPCOG used each metro area's 2016 design value for this analysis as well, since this would have informed the 2017 monitoring plan.[4] CAPCOG used the 2012-2016 five-year American Community Survey (ACS) population estimates for each metro area for this analysis.

Table 2-1. Total Ozone Monitors, Population, and Land Area for Similarly Sized National MSAs to the Austin-Round Rock MSA, 2017

MSA Rank	MSA	2016 O_3 Design Value (ppb)	% of 2015 O_3 NAAQS	2012-2016 Population [5]	Number of Regulatory Ozone Monitors	Required Number of Regulatory Ozone Monitors	Extra Regulatory Ozone Monitors
31	Kansas City, MO-KS[6]	67	95.71%	2,104,509	8	2	6
32	Cleveland-Elyria, OH[7]	75	107.14%	2,055,612	9	2	7
33	Columbus, OH[6]	71	101.43%	2,041,520	6	2	4
34	Indianapolis-Carmel-Anderson, IN[8]	69	98.57%	2,004,230	12	2	10

[4] https://www.epa.gov/sites/production/files/2017-10/ozone_designvalues_20142016_final_10_02_17_0.xlsx
[5] https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_16_5YR_DP05&prodType=table
[6] http://www.marc.org/Environment/Air-Quality/pdf/Ozone-Summaries/2017-O3-season-summary.aspx
[7] http://www.epa.state.oh.us/Portals/27/ams/sites/2017/Air%20Monitoring%20Network%20Plan%202017-2018.pdf
[8] https://www.in.gov/idem/airquality/files/monitoring_network_review_2017.pdf

MSA Rank	MSA	2016 O_3 Design Value (ppb)	% of 2015 O_3 NAAQS	2012-2016 Population [5]	Number of Regulatory Ozone Monitors	Required Number of Regulatory Ozone Monitors	Extra Regulatory Ozone Monitors
35	San Jose-Sunnyvale-Santa Clara, CA[9]	70	100.00%	1,943,107	6	2	4
36	**Austin-Round Rock, TX[10]**	**66**	**94.29%**	**1,942,615**	**2**	**2**	**0**
37	Nashville-Davidson-Murfreesboro-Franklin, TN[11]	67	95.71%	1,794,570	3	2	1
38	Virginia Beach-Norfolk-Newport News, VA-NC[12]	64	91.43%	1,714,428	3	2	1
39	Providence-Warwick, RI-MA[13]	69	98.57%	1,609,359	3	2	1
40	Milwaukee-Waukesha-West Allis, WI[14]	73	104.29%	1,571,730	6	2	4
41	Jacksonville, FL[15]	59	84.29%	1,424,097	4	1	3

As the table above indicates, the Austin area is the only metro area among the 11 analyzed that has fewer than three regulatory O_3 monitors, with other areas having between 3 and 12 regulatory O_3 monitors, and averaging 6.

The following three figures show a comparison of the Austin-Round Rock MSA to these other metro areas in terms of 2016 O_3 design value, population, and land area.

[9] https://www.epa.gov/sites/production/files/2017-10/documents/caplan2017-bayarea_0.pdf
[10] https://www.tceq.texas.gov/assets/public/compliance/monops/air/annual_review/historical/2017-AMNP.pdf
[11] https://www.epa.gov/sites/production/files/2017-12/documents/tnplan2017.pdf
[12] https://www.epa.gov/sites/production/files/2017-11/documents/vaplan2017.pdf
[13] http://www.dem.ri.gov/programs/air/documents/airnet17.pdf
[14] http://dnr.wi.gov/topic/AirQuality/documents/2017NetworkPlanFinal.pdf
[15] https://floridadep.gov/sites/default/files/APPROVED-2016-2017-Florida-Annual-Air-Monitoring-Network-Plan.pdf

Figure 2-1. Number of Regulatory Ozone Monitors v. 2016 O_3 Design Value for Similarly-Sized MSAs Nationwide, 2017

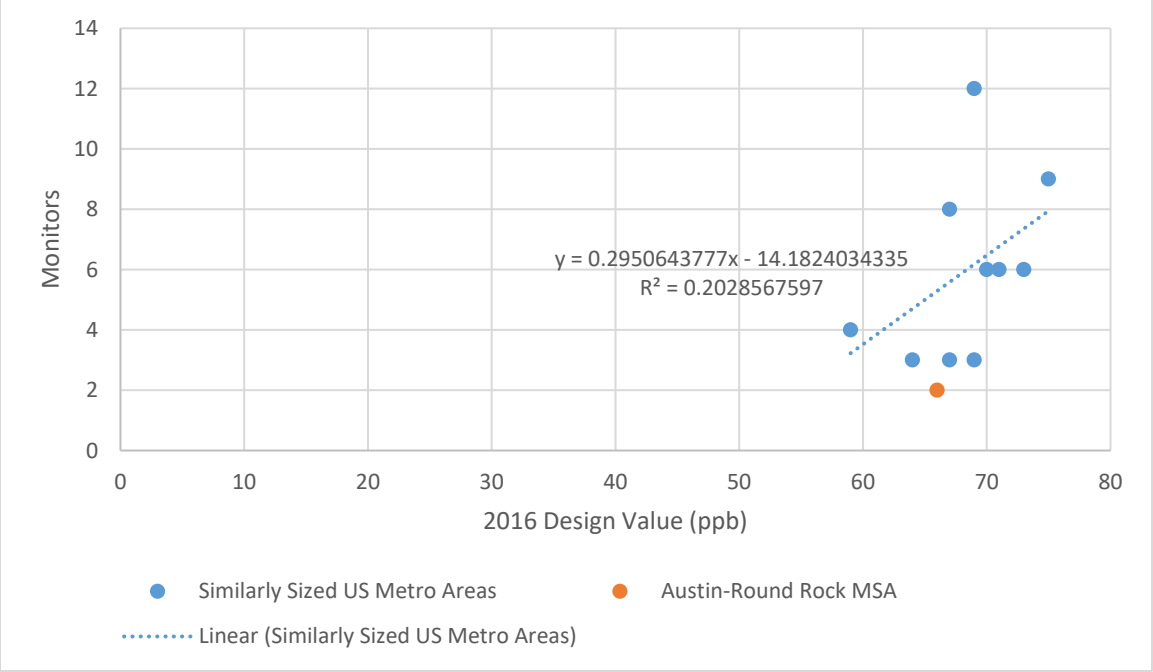


Figure 2-2. Number of Regulatory Ozone Monitors v. Population for Similarly-Sized MSAs Nationwide, 2017

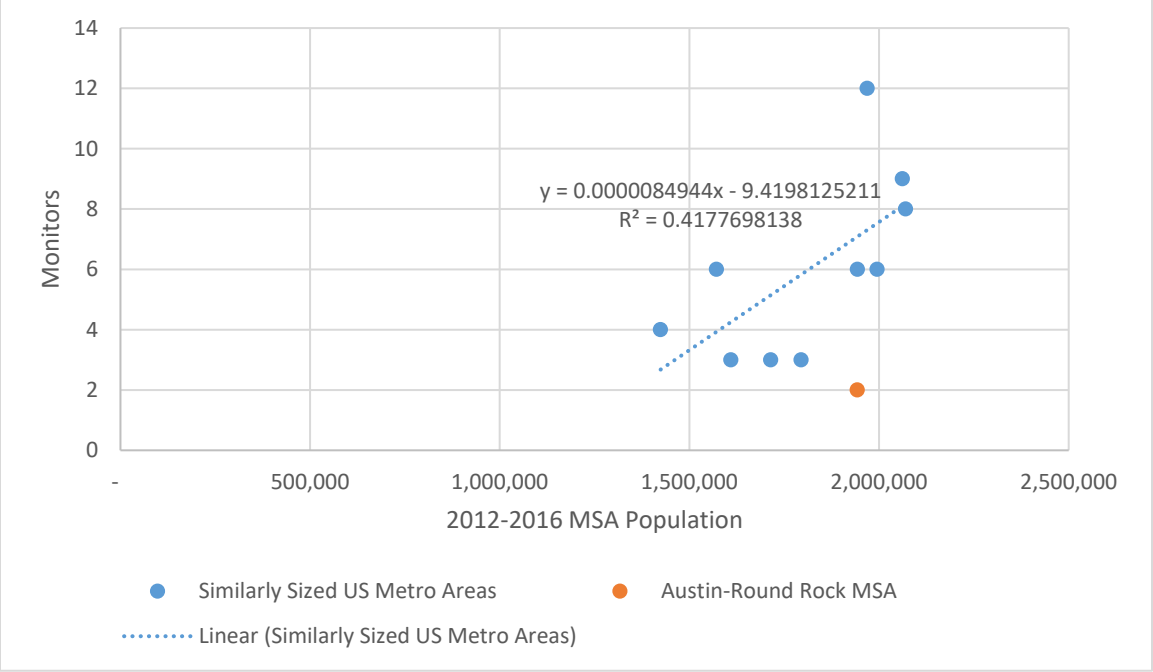
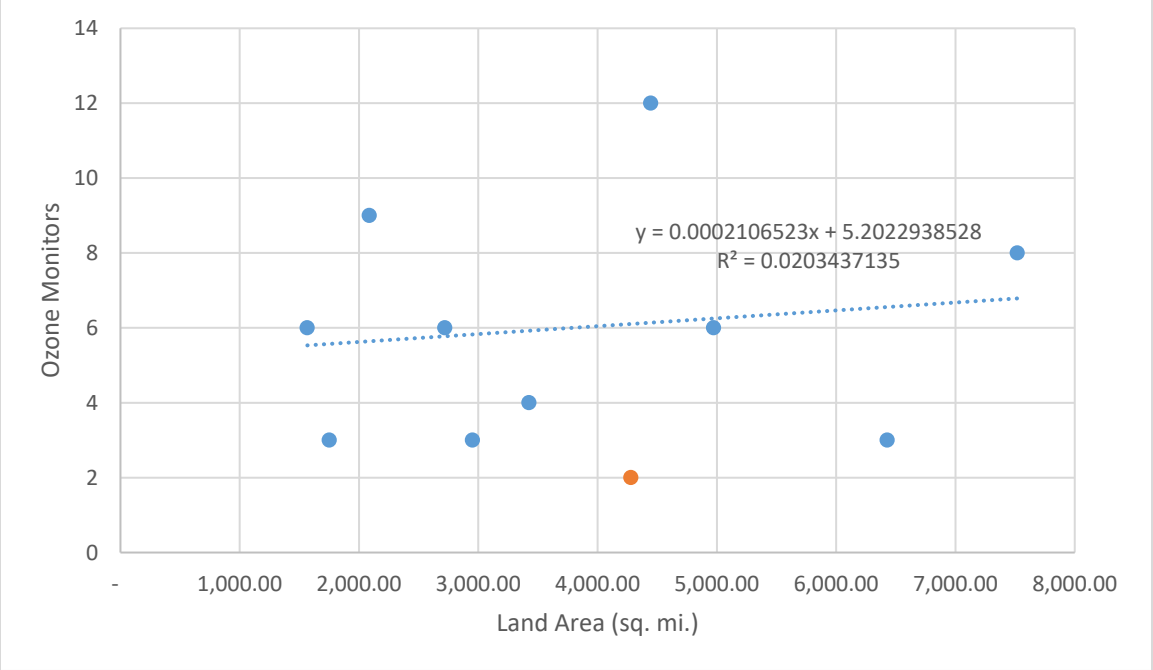


Figure 2-3. Number of Regulatory Ozone Monitors v. Land Area for Similarly-Sized MSAs Nationwide, 2017



In order for the Austin-Round Rock MSA to have comparable coverage in terms of 2016 O_3 design value, population, and land area, the MSA would need:

- 5.29 regulatory monitors in terms of O_3 design value
- 7.08 regulatory monitors in terms of population
- 6.10 regulatory monitors in terms of land area

This means that the MSA would need an additional three to five regulatory monitors in order to have coverage comparable to these other MSAs.

2.2 Texas Comparison

Since TCEQ is not proposing to add any regulatory monitors to Austin-Round Rock MSA and CAPCOG does not intend to operate regulatory monitors within the region, CAPCOG is comparing the O_3 monitoring coverage to other Texas metro areas in terms of both regulatory and non-regulatory monitors. CAPCOG identified all O_3 monitors in operation for the 2018 O_3 season reporting to TCEQ's LEADS system, and used each metro area's 2017 population and 2017 design value, both of which are used in TCEQ's 2018 Annual Monitoring Network Plan, for this analysis. CAPCOG excluded CAMS 1605, which is not certain to be continued in 2019, and CAMS 601, which is outside of the MSA for this analysis, and compared the Austin-Round Rock MSA to all Texas metro areas with O_3 monitoring. The following table and graphs show these comparisons.

Table 2-2. Total Ozone Monitors, Population, and Land Area for MSAs in Texas, 2017

MSA	Total Current Ozone Monitors[16]	2017 O_3 Design Value	2017 Population [17]	Monitors per Million People	Land Area (mi^2)[18]	Monitors per 1,000 Square Miles
Austin-Round Rock	9	69	2,018,916	4.46	4,221	2.13
Beaumont-Port Arthur	9	67	405,975	22.17	3,034	2.97
Brownsville-Harlingen	2	57	425,194	4.70	891	2.24
Corpus Christi	5	62	452,975	11.04	1,784	2.80
Dallas-Fort Worth	19	79	7,153,300	2.66	9,280	2.05
El Paso	6	72	844,001	7.11	5,584	1.07
Houston-The Woodlands-Sugar Land	40	81	6,728,844	5.94	8,261	4.84
Killeen-Temple	2	69	435,060	4.60	2,816	0.71
Laredo	1	53	275,291	3.63	3,361	0.30
Longview	1	65	220,778	4.53	1,780	0.56
McAllen-Edinburg-Mission	1	55	848,037	1.18	1,571	0.64
San Antonio-New Braunfels	11	74	2,412,219	4.56	7,313	1.50
Tyler	1	64	222,702	4.49	922	1.09
Victoria	1	65	100,408	9.96	1,734	0.58
Waco	1	65	269,846	3.71	1,803	0.55

The following graphs shows the number of monitors versus population and land area for Texas MSAs.

[16] https://www.tceq.texas.gov/assets/public/compliance/monops/air/annual_review/historical/2017-AMNP.pdf
https://www.tceq.texas.gov/cgi-bin/compliance/monops/8hr_monthly.pl
[17] http://txsdc.utsa.edu/Data/TPEPP/Estimates/
[18] http://txsdc.utsa.edu/geography/reference/CBSA/TX/201501

Figure 2-4. Number of Ozone Monitors v. 2017 O_3 Design Value by MSA in Texas, 2017

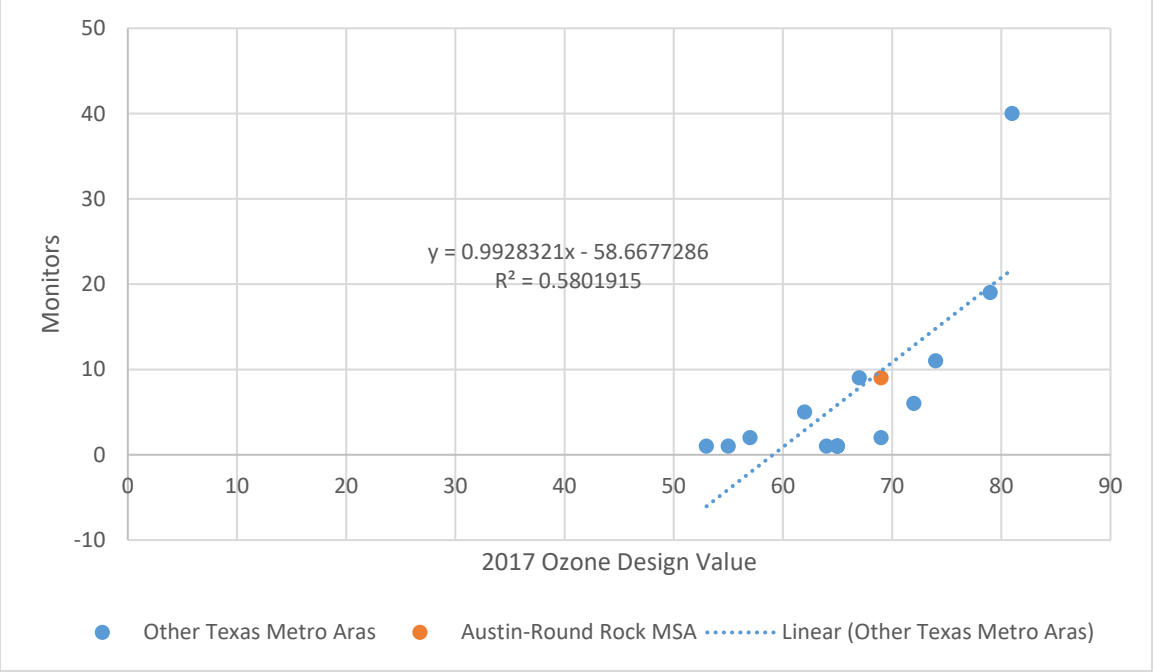


Figure 2-5. Number of Ozone Monitors v. Population by MSA in Texas, 2017

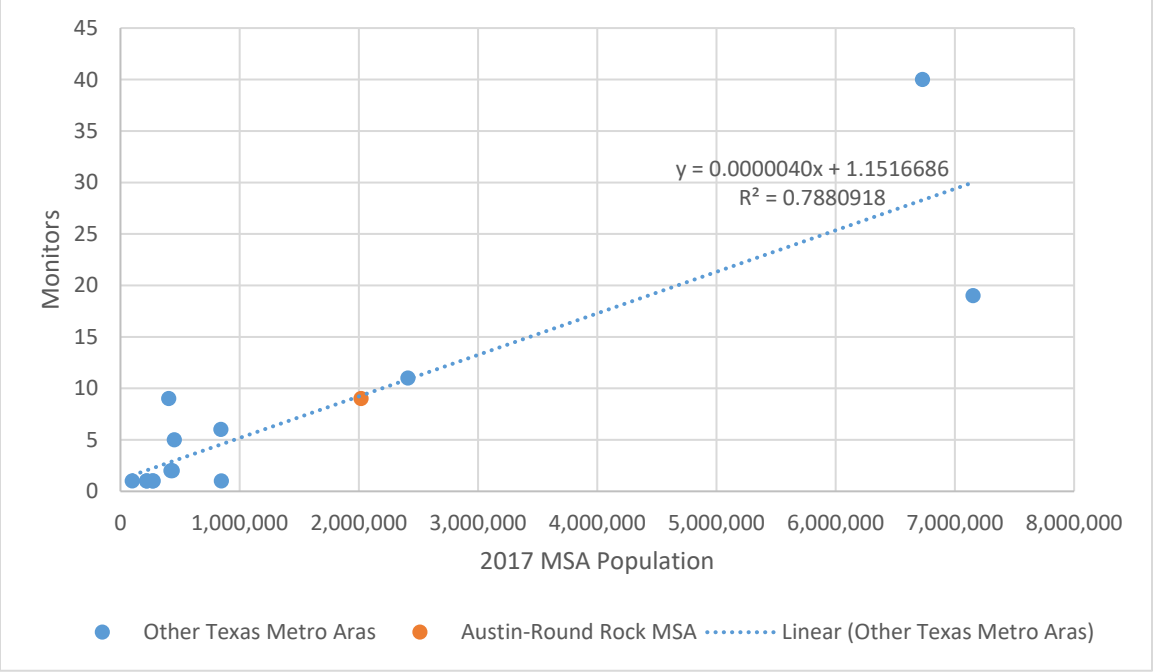
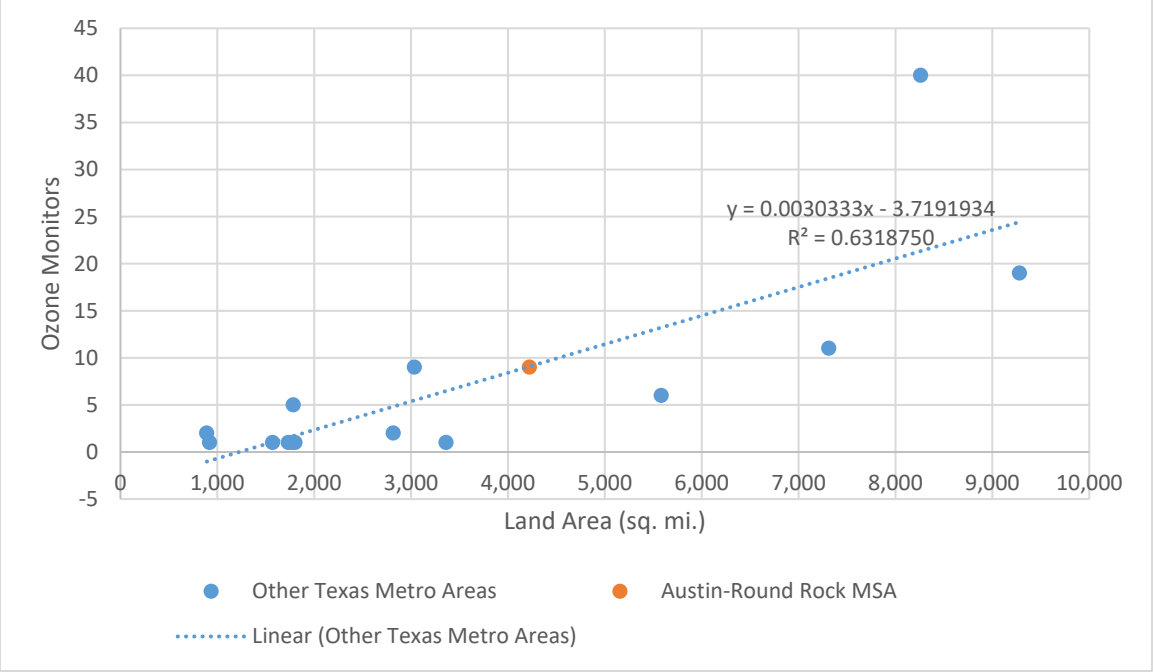


Figure 2-6. Number of Ozone Monitors v. Land Area by MSA in Texas, 2017



In order for the Austin-Round Rock MSA to have coverage comparable to other metro areas in the state, it would need:

- 9.84 monitors in terms of 2017 O_3 design value
- 9.23 monitors in terms of 2017 population coverage
- 9.09 monitors in terms of land area coverage

This means that CAPCOG would need to operate 7-8 non-regulatory monitors to supplement TCEQ's two regulatory ozone monitors in order to ensure that overall coverage in the Austin-Round Rock MSA was comparable to other metro areas in the state.

2.3 Conclusion Regarding Overall Level of Monitoring

Based on CAPCOG's need to ensure monitoring in all five counties, our comparison of regulatory O_3 monitoring in the Austin-Round Rock MSA compared to similar MSAs nationwide and our comparison of overall O_3 monitoring in the Austin-Round Rock MSA to other metro areas in the state, CAPCOG identified six to eight CAMS as appropriate levels of monitoring to consider for further analysis. Six monitoring stations would be below what would be considered comparable to other MSAs in the state, but would be above what would be necessary comparable to the number of additional regulatory monitors that would be needed for the MSA to have comparable levels of coverage to similarly sized MSAs nationwide.

3 Monitoring Network Deployment Analysis

Once CAPCOG staff identified six to eight monitoring stations as an appropriate number of monitors for CAPCOG to operate for 2019-2023, CAPCOG staff then identified a number of different potential monitoring network configurations at each of these resource levels and identified recommended

monitoring network configurations if CAPCOG operated six, seven, or eight stations between 2019 and 2023.

3.1 Process for Identifying and Selecting Options

The selection of the final approved network configuration for 2019-2023 first went through several steps:

1. CAPCOG staff first constrained its analysis based on the need for there to be at least one O_3 monitor in each county in the Austin-Round Rock MSA.
2. CAPCOG decided to discontinue O_3 monitoring at CAMS 601 Fayetteville site in any scenario since moving O_3 monitoring into any location within the MSA would better serve CAPCOG's monitoring objectives compared to continuing O_3 monitoring in Fayetteville.
3. For the six-monitor analysis, CAPCOG removed the two lowest-ranking monitors identified in CAPCOG's 2017 monitoring network analysis (CAMS 601 and CAMS 1603), and then considered whether any of the other existing monitoring stations should be moved for logistical reasons. Based on this analysis, CAPCOG staff recommended discontinuing monitoring at CAMS 684 and establishing a new CAMS in City of Bastrop.
4. For the seven-monitor analysis, CAPCOG removed the lowest-ranking monitor in the 2017 analysis (CAMS 601), and then assumed that the recommended change in the six-monitor configuration would be implemented. CAPCOG then considered three options for a Travis County monitoring station: a) keeping CAMS 1603 in place, b) shutting down CAMS 1603 and establishing a new CAMS in the Bee Cave/Lakeway area, and c) shutting down CAMS 1603 and initiating O_3 monitoring at or near CAMS 171. Based on its analysis, CAPCOG staff recommended option C.
5. For the eight-monitor analysis, CAPCOG assumed that the recommended change in Travis County monitoring identified in the seven-monitor configuration CAMS 1603 was moved to CAMS 171, and that both CAMS 601 and 684 were shut down and two new Bastrop County monitoring stations were established. CAPCOG considered two options: a) Elgin and Bastrop, and b) Elgin and Smithville. Based on its analysis, CAPCOG staff recommended option A.
6. CAPCOG presented the recommended options for six, seven, and eight O_3 monitoring stations and information on financial considerations at an April 26, 2018, Clean Air Coalition Advisory Committee (CACAC) meeting. The CACAC recommended that the CAC approve a plan for eight monitoring stations with CAPCOG's recommended configuration (discontinue O_3 monitoring at CAMS 601, 684, and 1603, and initiate O_3 monitoring in Bastrop, Elgin, and East Austin at or near CAMS 171).
7. On May 9, 2018, the Clean Air Coalition approved the 2019-2023 monitoring plan recommended by the CACAC. Several members of the CAC indicated concern about any reduction in the number of O_3 monitors being operated.

3.2 2017 Ozone Monitoring Ranking

On August 9, 2017, the Clean Air Coalition (CAC) endorsed a ranking of CAPCOG's O_3 monitors. Each monitor within the CAPCOG region was assigned a score, and then each of CAPCOG's monitors were

evaluated based on the number of points per $1,000 spent to operate the monitor[19]. This ranking was intended to provide CAPCOG with direction on which O_3 monitors to prioritize for operation in 2018.

Table 3-1. CAC-Approved Ranking of O_3 Monitors in the CAPCOG Region

Station	Composite Score	Network Rank	Incremental Cost for 2018	Points per $1,000	Rank (CAPCOG stations)
3	49.09	1	n/a	n/a	n/a
38	29.48	3	n/a	n/a	n/a
601	19.79	10	$14,340.34	1.38	8
614	28.27	5	$13,581.75	2.08	3
684	27.15	7	$13,337.97	2.04	5
690	26.93	8	$13,199.38	2.04	6
1603	24.31	9	$16,844.70	1.44	7
1604	30.06	2	$13,632.21	2.20	1
1675	29.19	4	$14,340.34	2.08	2
6602	27.26	6	$13,581.75	2.12	4

If CAPCOG had not conducted any further analysis, the default option would be to simply continue operating all of its current monitors, prioritizing the operation of the highest-ranking stations. Under the seven-monitor scenario, this would mean that CAPCOG would discontinue operation of CAMS 601. Under the six-monitor scenario, this would mean that CAPCOG would discontinue operation of CAMS 601 and CAMS 1603.

3.3 Initial Review of O_3 Modeling Data

Beyond the 2017 ranking, CAPCOG started its analysis of whether any potential changes to the monitoring network should be considered based on O_3 levels by using photochemical modeling data produced by the Alamo Area Council of Governments (AACOG). AACOG had modeled 2017, 2020, and 2023 O_3 levels using TCEQ's May 1 – September 30, 2012, photochemical modeling platform.

AACOG provided copies of spreadsheets showing the MDA8 O_3 concentrations modeled for each grid cell on TCEQ's East Texas 4 km x 4 km grid for days with high O_3 concentrations in the San Antonio area in the 2012 base case. This included a total of 15 days: 5/17, 5/21, 6/8, 6/9, 6/25, 6/26, 6/27, 8/22, 8/23, 8/30, 9/11, 9/12, 9/18, 9/22, and 9/23. CAPCOG staff decided to focus on the 2020 modeling data since it would likely to be most representative of the O_3 levels that would be expected to be measured over the entire five-year period covered by this plan, and the 2020 O_3 levels would be important to area designations if EPA were to complete its next review of the O_3 NAAQS in 2020 as required under the Clean Air Act. CAPCOG focused on the 4th-highest MDA8 O_3 concentration modeled among the days included in AACOG's data since this would most closely correspond to the area's 2020 O_3 design value.

CAPCOG's first analysis involved comparing the 4th-highest modeled MDA8 O_3 levels to EPA's Air Quality Index (AQI) for each grid cell within the entire 4 km modeling domain. This map and a zoom-in of the CAPCOG region are shown below. As the maps indicates, there is no area within the CAPCOG region with

[19] http://www.capcog.org/documents/airquality/reports/2017/Deliverable_5.2.2_O3_Monitoring_Network_Review_for_2018.pdf

a 4th-highest modeled MDA8 O_3 level of 71 ppb or above, with the entire region except a small part of Llano County within the "Moderate" O_3 range of 55-70 ppb.

Figure 3-1. 4th Highest MDA8 O_3 Modeled Compared to AQI for the Entire East Texas Modeling Domain, 2020

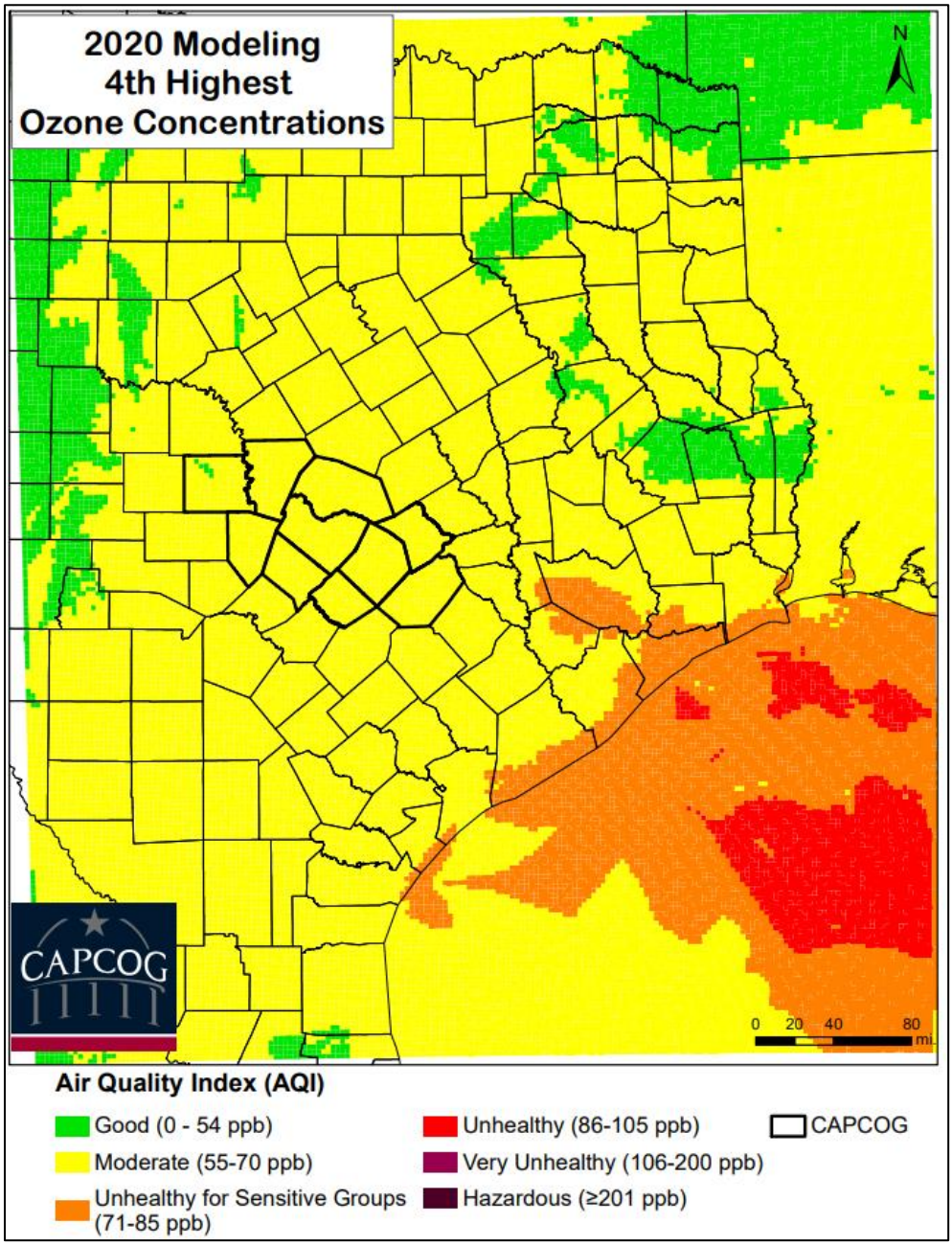
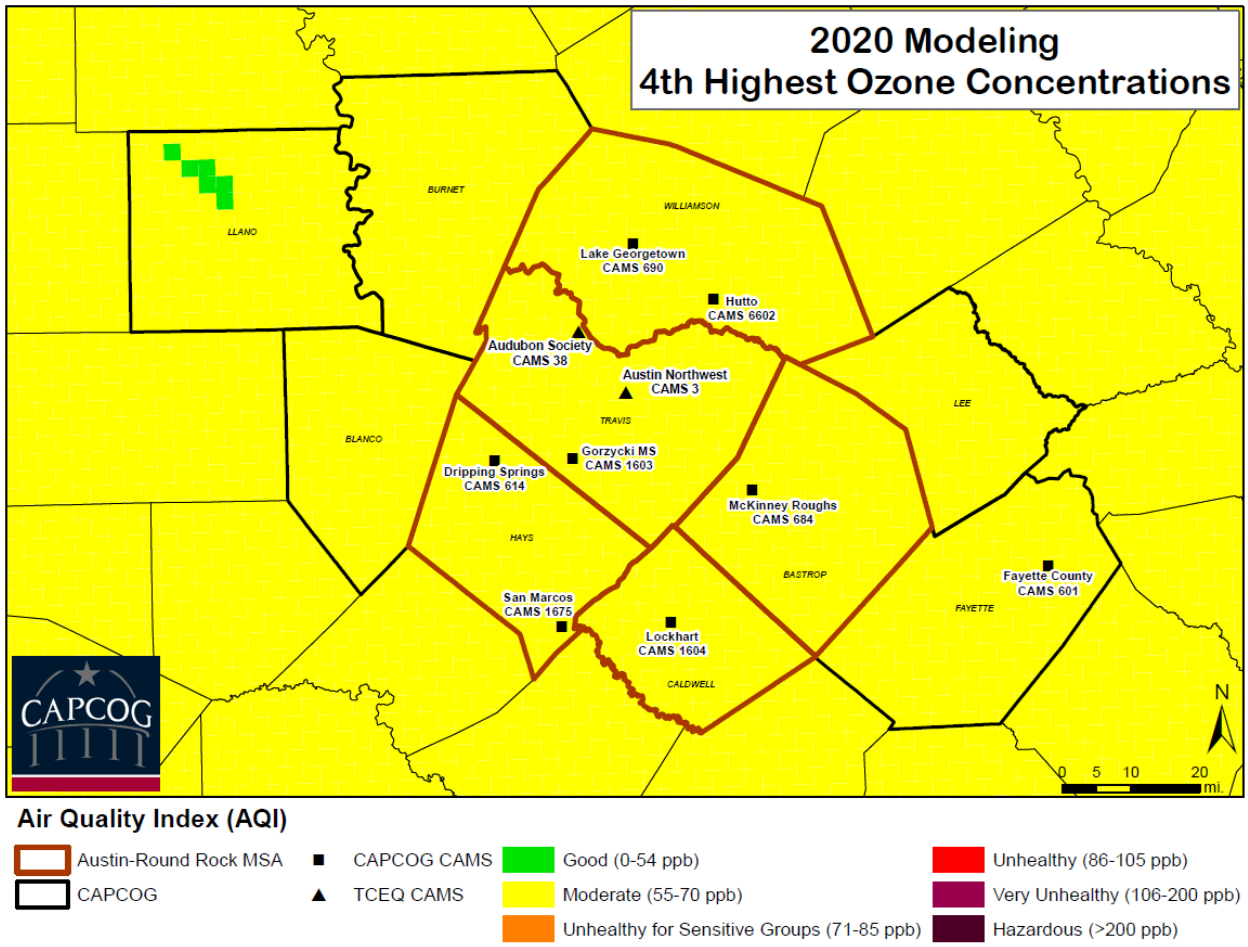
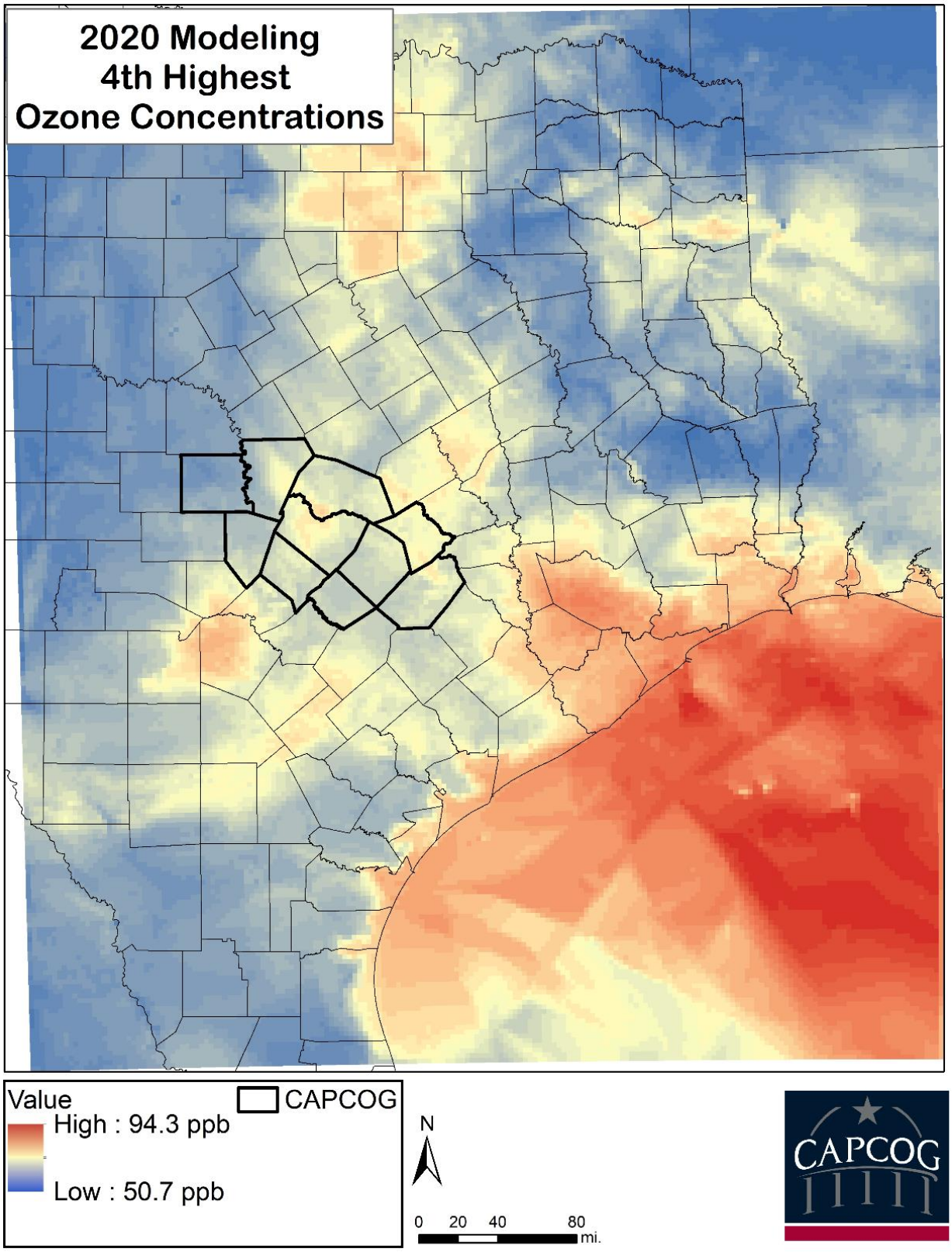


Figure 3-2. 4th Highest Ozone Concentrations expressed in the EPA Air Quality Index for the CAPCOG Region, 2020 Modeling



CAPCOG staff then generated maps showing the MDA8 O_3 levels on a more detailed level, with higher O_3 concentrations shown as red and lower O_3 concentrations shown as blue with yellow as an intermediate level. The following map show the modeling data across the entire 4 km grid.

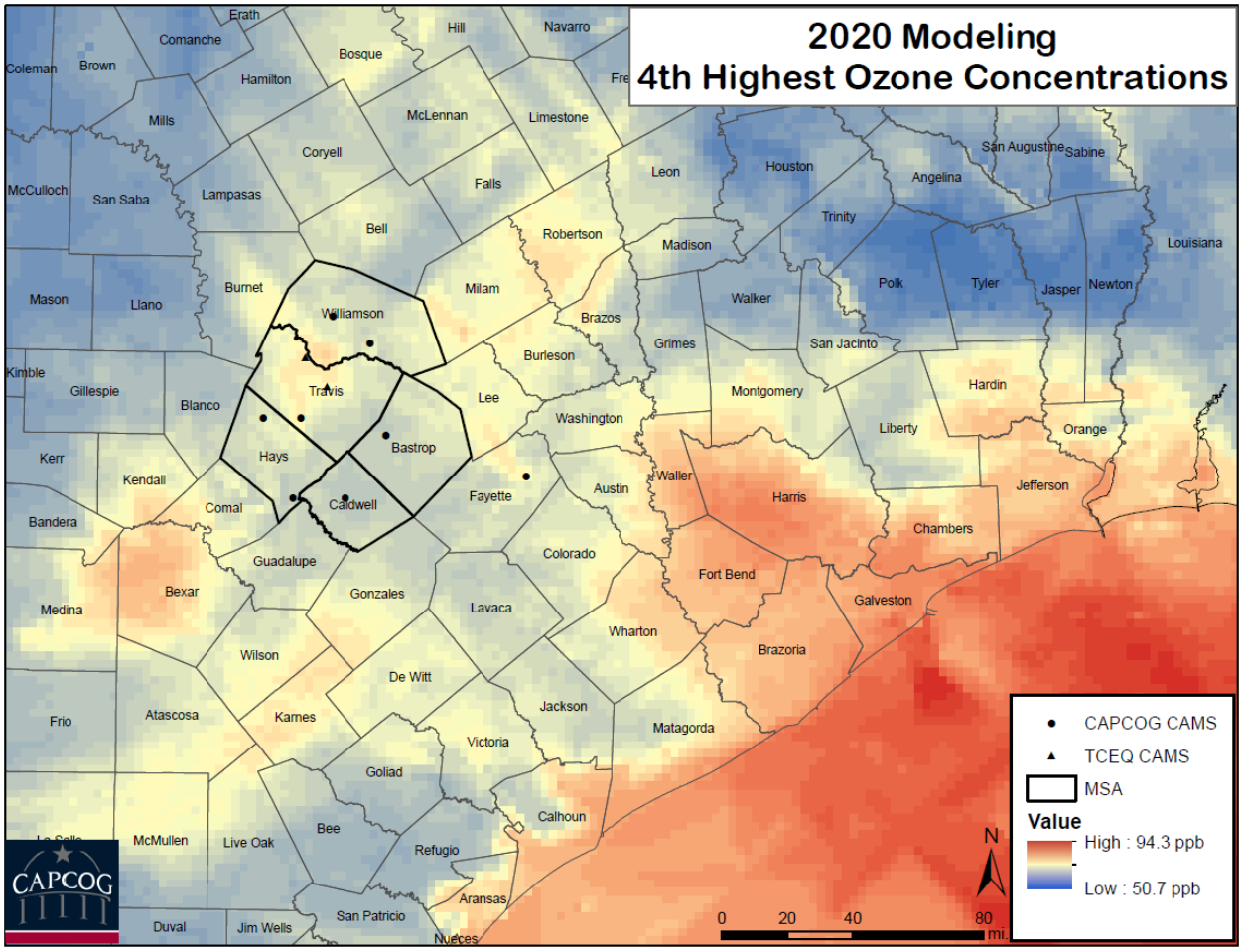
Figure 3-3. 4th Highest MDA8 O_3 for the Entire 4 km Grid from Selected Days, 2020



The figure above shows elevated O_3 concentrations over the industrial areas and metro areas of Austin, Beaumont-Port Arthur, Dallas-Fort Worth, East Texas, Houston, and San Antonio, as well as elevated O_3 levels in the section of the Eagle Ford Shale southeast of San Antonio and within a group of counties to the East and Northeast of the Austin-Round Rock metro area that includes Fayette, Lee, Milam, Burleson, Brazos, and Robertson Counties.

The following figure displays the same data as the map above, but shows a closer look at the central and southeast area of Texas with the Austin-Round Rock MSA boundaries outlined and CAPCOG's current monitoring stations identified. This view shows that the O_3 plume from the Austin urbanized area appears to reach into Burnet County, and also shows what appear to be power plant plumes from large coal-fired plants in Fayette, Milam, and Robertson counties. This modeling does not account for the closure of the Sandow power plant in Milam County at the beginning of 2018.

Figure 3-4. 4th Highest MDA8 O_3 in Central and Southeast Texas from Selected Days, 2020



For the counties in the CAPCOG region, the highest and lowest 4th-high MDA8 O_3 concentrations modeled for each county and the range of values are shown in the table below.

Table 3-2. CAPCOG Region Maximum and Minimum 4th High MDA8 O_3 Modeled for 2020 by County (ppb)

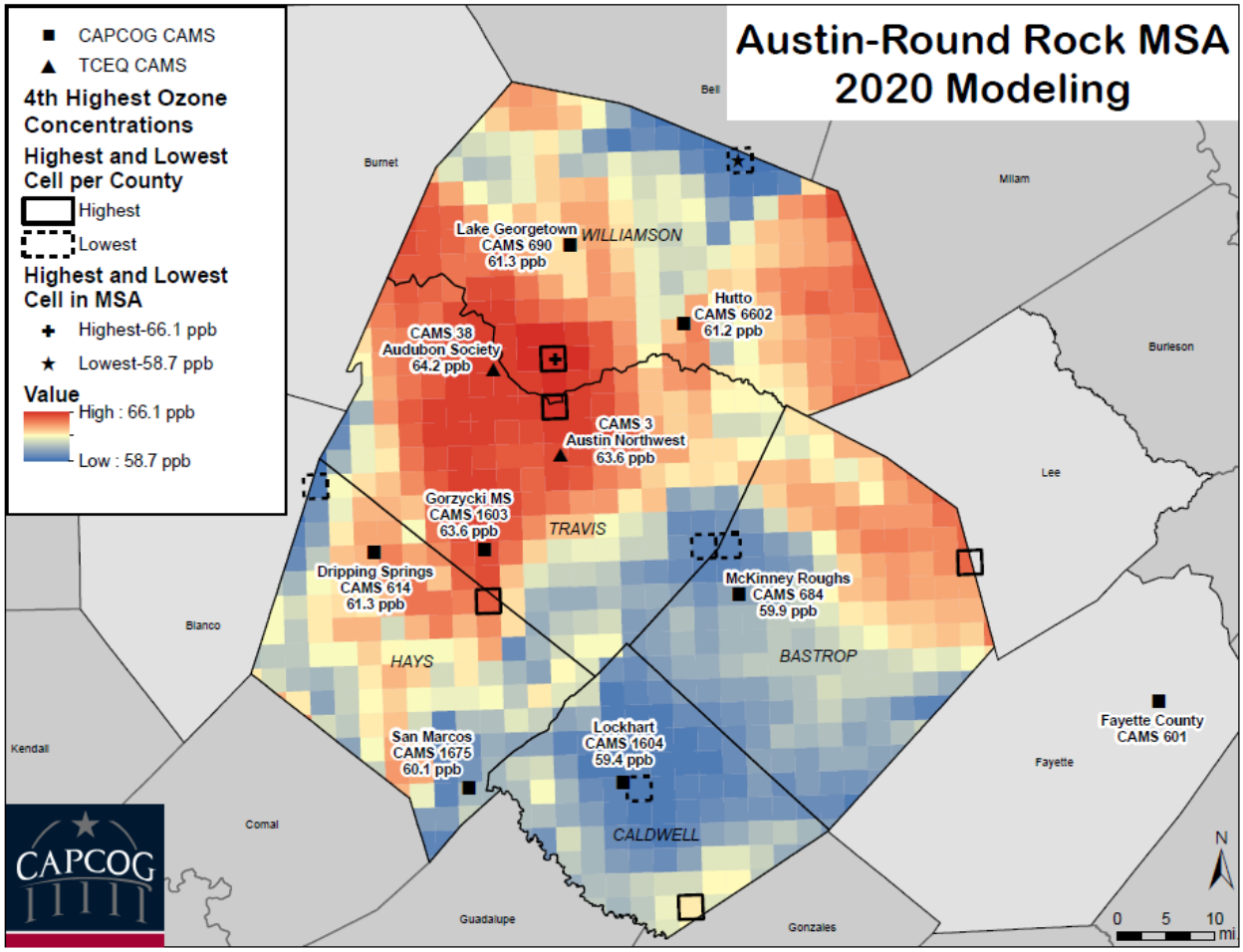
County	Min. (ppb)	Min. (rank)	Max. (ppb)	Max (rank)	Range (ppb)	Range (rank)
Bastrop	59.4	8	62.6	7	3.2	9
Blanco	57.4	3	61.6	8	4.2	5
Burnet	56.9	2	63.6	5	6.7	2
Caldwell	59.1	5	60.9	9	1.8	10
Fayette	59.2	6	64.8	3	5.7	3
Hays	59.2	7	62.9	6	3.7	8
Lee	61.0	10	65.0	2	4.0	7
Llano	54.2	1	58.4	10	4.2	6
Travis	59.4	8	64.6	4	5.2	4
Williamson	58.7	4	66.1	1	7.4	1
MSA	58.7	n/a	66.1	n/a	7.4	n/a
CAPCOG	54.2	n/a	66.1	n/a	11.9	n/a

CAPCOG noted the following interesting facts based on this analysis:

- Parts of all counties in the CAPCOG region, other than Llano, would be expected to have O_3 levels above the maximum allowable under a 60 ppb O_3 NAAQS, and other parts of the region would be very close to or exceeding the maximum allowable under a 65 ppb O_3 NAAQS (not accounting for any modeling bias, which would tend to result in modeled O_3 levels below monitored levels).
- Williamson County is modeled to have both the highest maximum and lowest minimum 4th-high MDA8 O_3 levels within the Austin-Round Rock MSA, and the maximum modeled O_3 levels would exceed an O_3 NAAQS set at 65 ppb.
- Travis County and Williamson County are the only counties in the MSA with a range of 4th-high MDA8 O_3 values of more than 5.0 ppb, with Caldwell County having the smallest range of just 1.8 ppb
- Lee County had the 2nd-highest county-wide maximum 4th-high MDA8 O_3 modeled (65.0 ppb), the highest county-wide minimum 4th-high MDA8 O_3 modeled (61.0 ppb), and is the only county in the CAPCOG region that 4th-highest MDA8 O_3 levels would exceed a 60 ppb NAAQS level throughout the entire county.
- Burnet and Fayette Counties have areas with higher modeled maximum 4th-highest O_3 concentrations (63.6 ppb and 64.8 ppb) than three of the five MSA counties: Bastrop (62.6 ppb), Caldwell (60.9 ppb), and Hays County (62.9 ppb).
- Caldwell County and Llano County are the only two counties in the CAPCOG region that have modeled maximum 4th-highest O_3 concentrations that would be in compliance with a 60 ppb NAAQS.

The color scale on map above is significantly skewed by the high O_3 concentrations over the Gulf of Mexico, so a closer-in view of just the Austin-Round Rock MSA is shown below, with the highest and lowest 4th high MDA8 O_3 concentrations for each county and the MSA as a whole indicated. Within the MSA, the 4th high MSDA8 O_3 concentrations ranged from 58.7 ppb to 66.1 ppb.

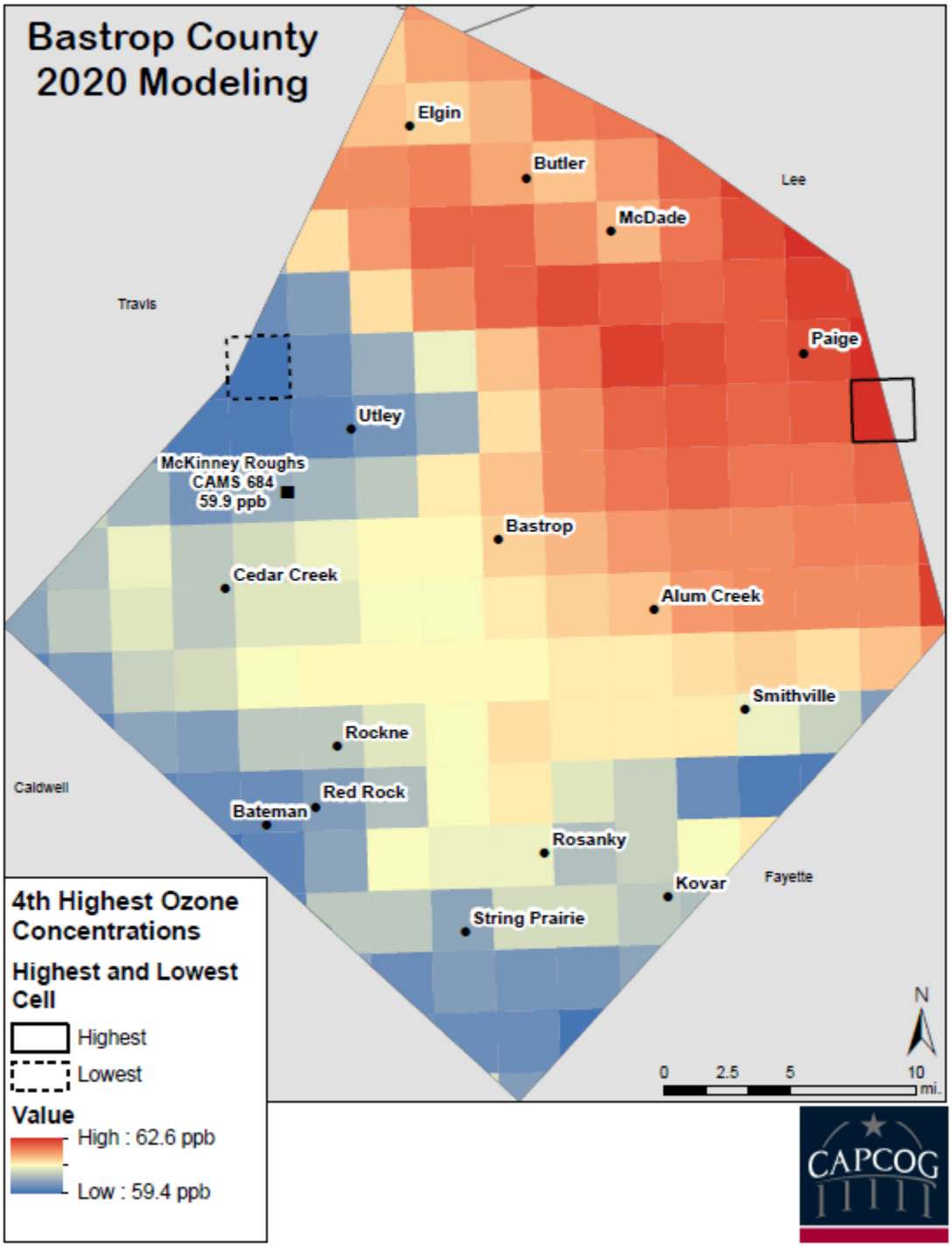
Figure 3-5. 4th Highest MDA8 O_3 in Austin-Round Rock MSA on Selected Days, 2020



3.3.1 Bastrop County Analysis

Within Bastrop County, the variation between maximum and minimum 4th-high MDA8 O_3 was only 3.2 ppb, with the highest modeled levels along the north-eastern edge of the County. This appears to be attributable to the influence of the Fayette Power Plant. CAPCOG's analysis suggested that CAMS 684 could be better positioned to capture the high concentrations in the county. The county-level map is shown below. The difference between CAMS 684's 4th-high MDA8 and the county's highest value was 2.7 ppb.

Figure 3-6. Bastrop County 2020 Modeling

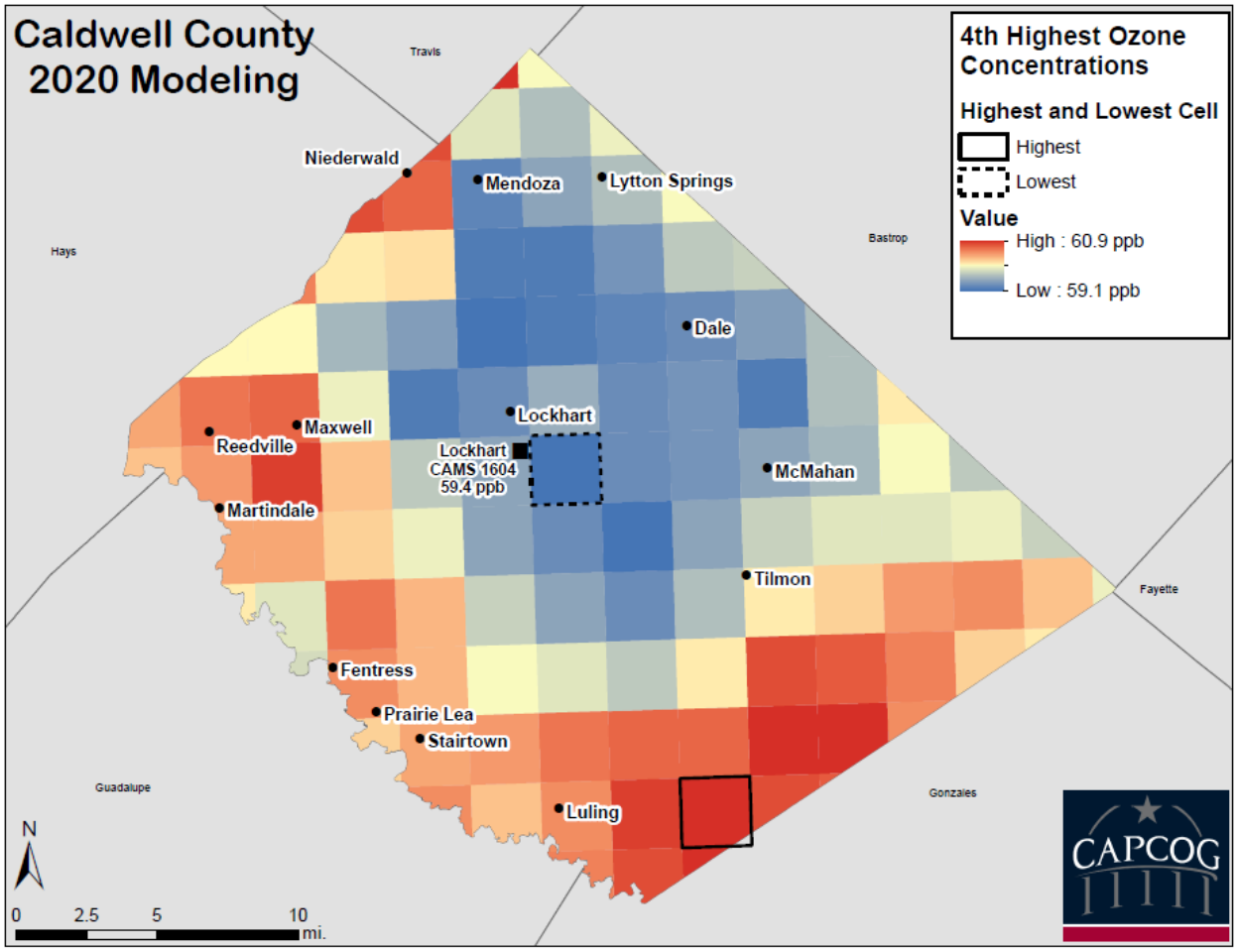


3.3.2 Caldwell County Analysis

In Caldwell County, variation between the maximum and minimum was only 1.8 ppb, with the highest levels along the southeastern border closer to the Eagle Ford Shale, and the lowest concentrations

immediately to the east of the grid cell where CAMS 1604 is located. Based on the high value of CAMS 1604 in the scoring conducted by CAPCOG in 2017 and the low level of variation in high and low O_3 in Caldwell County, CAPCOG decided that moving CAMS 1604 would not be warranted to capture the County's highest O_3 levels. The difference between CAMS 1604's 4th-high MDA8 and the county's highest value was only 1.3 ppb.

Figure 3-7. Caldwell County 2020 Modeling

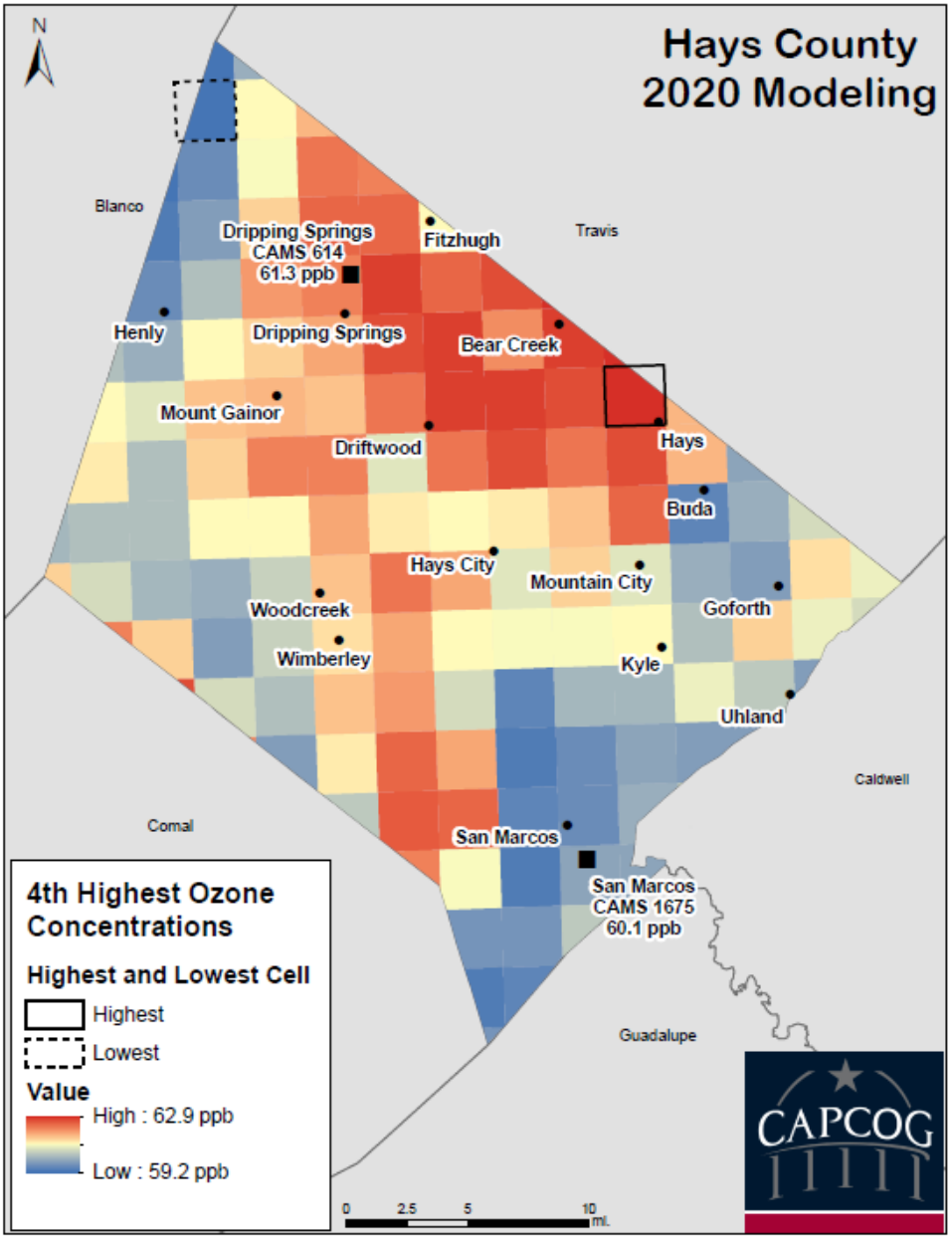


3.3.3 Hays County Analysis

In Hays County, the variation between maximum and minimum 4th-highest MDA8 O_3 concentration modeled was 3.7 ppb, with the highest modeled levels of along the County's border with Travis County at the extent of the City of Austin's jurisdiction, and the lowest concentrations at the northern most extreme of the county. CAMS 614 is intended to serve as a downwind monitor for the urbanized area when winds come out of the northeast, and it's 4th-high MDA8 O_3 was only 1.6 ppb below the county maximum. CAMS 1675 is more an ozone transport and population-centered monitor, and although it is located at the opposite end of the county from where the minimum is, the difference was only 0.9 ppb. Based on this review, while there might be justification for locating a monitor close to the IH-35 corridor where the highest modeled levels in the county are identified below, there isn't enough of a difference

in O_3 levels from CAMS 614 to justify such a move. Therefore, CAPCOG did not consider any changes to the Hays County monitoring network.

Figure 3-8. Hays County 2020 Modeling

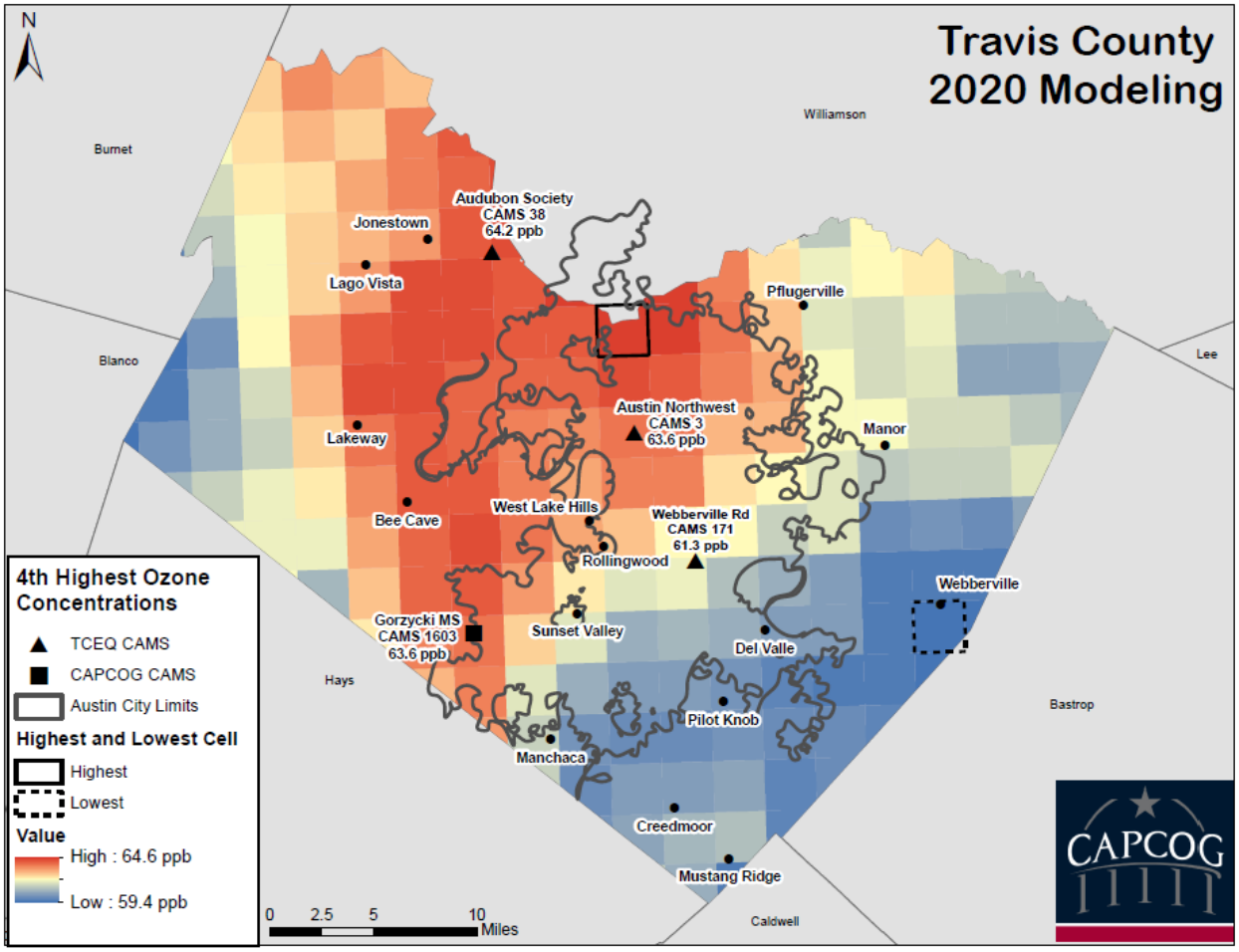


3.3.4 Travis County Analysis

Travis County has one of the highest variations between maximum and minimum 4th-highest MDA8 O_3 within a county in the MSA at 5.2 ppb. CAPCOG operates one non-regulatory O_3 monitor, CAMS 1603, in southwest Austin, and the TCEQ operates two regulatory O_3 monitors – CAMS 3 in central/northwest Austin, and CAMS 38, which is adjacent to the Travis County-Williamson County border near Cedar Park. The Clean Air Coalition has previously requested that TCEQ consider adding an O_3 sampler at CAMS 171, so it is also shown on the map below. The map below indicates that the TCEQ monitors are already

located within the area of modeled high concentrations for Travis County, and the 4th-highest MDA8 O_3 levels at CAMS 3 (63.6 ppb) and CAMS 38 (64.2 ppb) are very close to the highest value within the county (64.6 ppb), deviating by only 1.0 ppb and 0.4 ppb, respectively, and are also located physically close to this location along the Travis County/Williamson County border just north of CAMS 3.

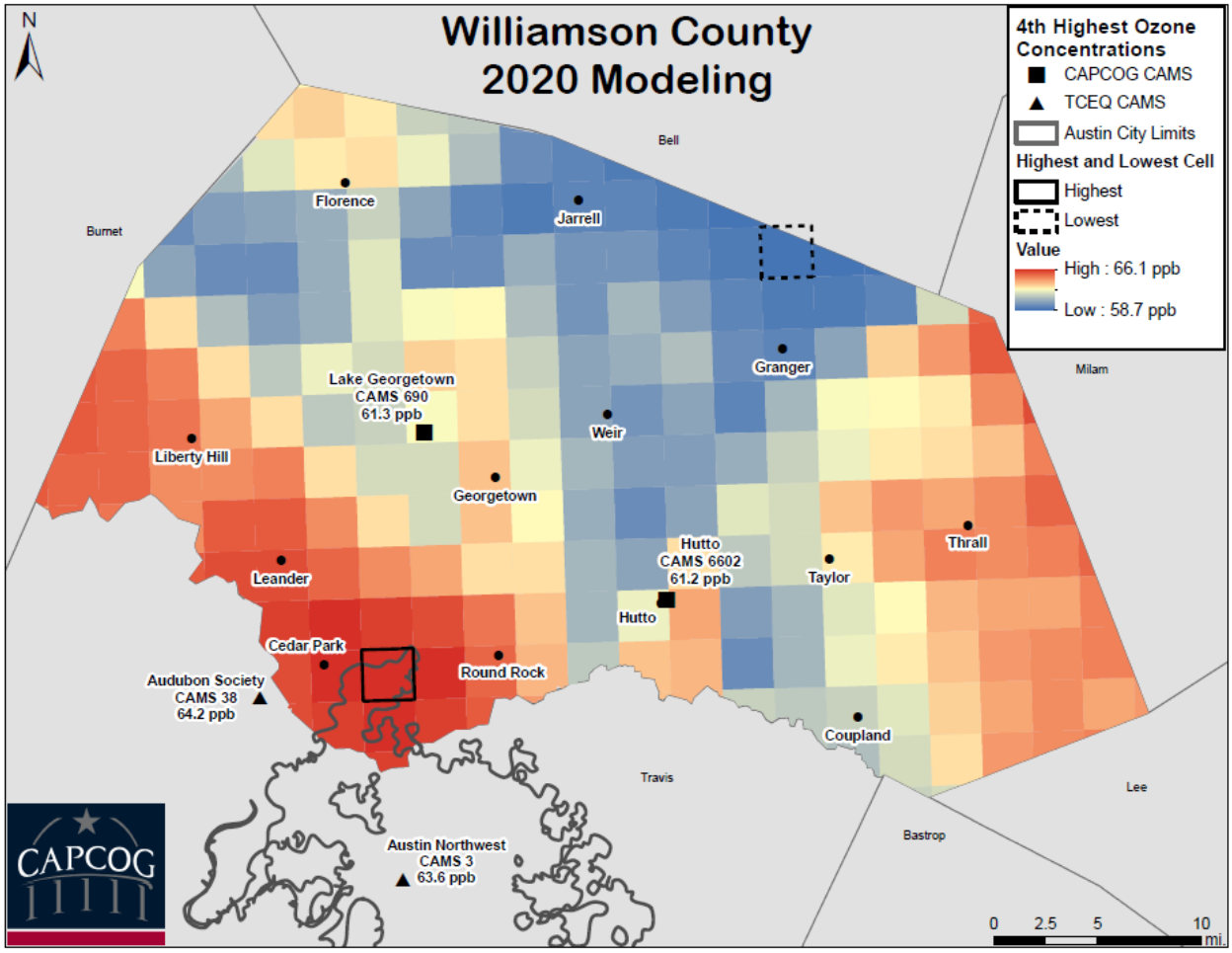
Figure 3-9. Travis County 2020 Modeling



3.3.5 Williamson County Analysis

Williamson County has the highest variation in concentration between the maximum and minimum 4th-highest modeled MDA8 O_3 concentrations of all five counties in the MSA at 7.4 ppb, and also contains both the maximum and minimum 4th-highest MDA8 O_3 for the entire MSA. The maximum value in the county is actually the northernmost extent of the city limits of Austin that extend into Williamson County. The 4th-highest MDA8 O_3 modeled for this grid cell (66.1 ppb) is 1.9 ppb higher than the value at CAMS 38, which is just two grid cells to the west. Due to the proximity of CAMS 38 and the high O_3 levels traditionally measured at CAMS 690 (often higher than what's measured at CAMS 3 or 38), and CAMS 1604's role as the primary upwind monitor for the region, CAPCOG determined that no modifications to the monitoring network in Williamson County was needed to measure the highest or lowest O_3 concentration within the county.

Figure 3-10. Williamson County 2020 Modeling



3.4 Back-Trajectories from 2010-2015 Conceptual Model

One of the other key factors in CAPCOG's current monitoring network configuration is the desire to measure O_3 levels upwind of the core of the Austin urbanized area and TCEQ's two regulatory O_3 monitors on days when MDA8 O_3 levels are high. CAPCOG's 2010-2015 Conceptual Model included a series of back-trajectory analyses for days when MDA8 O_3 levels exceeded 70 ppb at CAMS 3 and CAMS 38. CAPCOG used the HYSPLIT Trajectory Model to retrieve the back-trajectory data. Model Maps of the back-trajectory analyses for a 100 m elevation are shown below.

Figure 3-11. 24-Hour Back Trajectories at 100 m from CAMS 3 when MDA8 > 70 ppb, 2010-2015

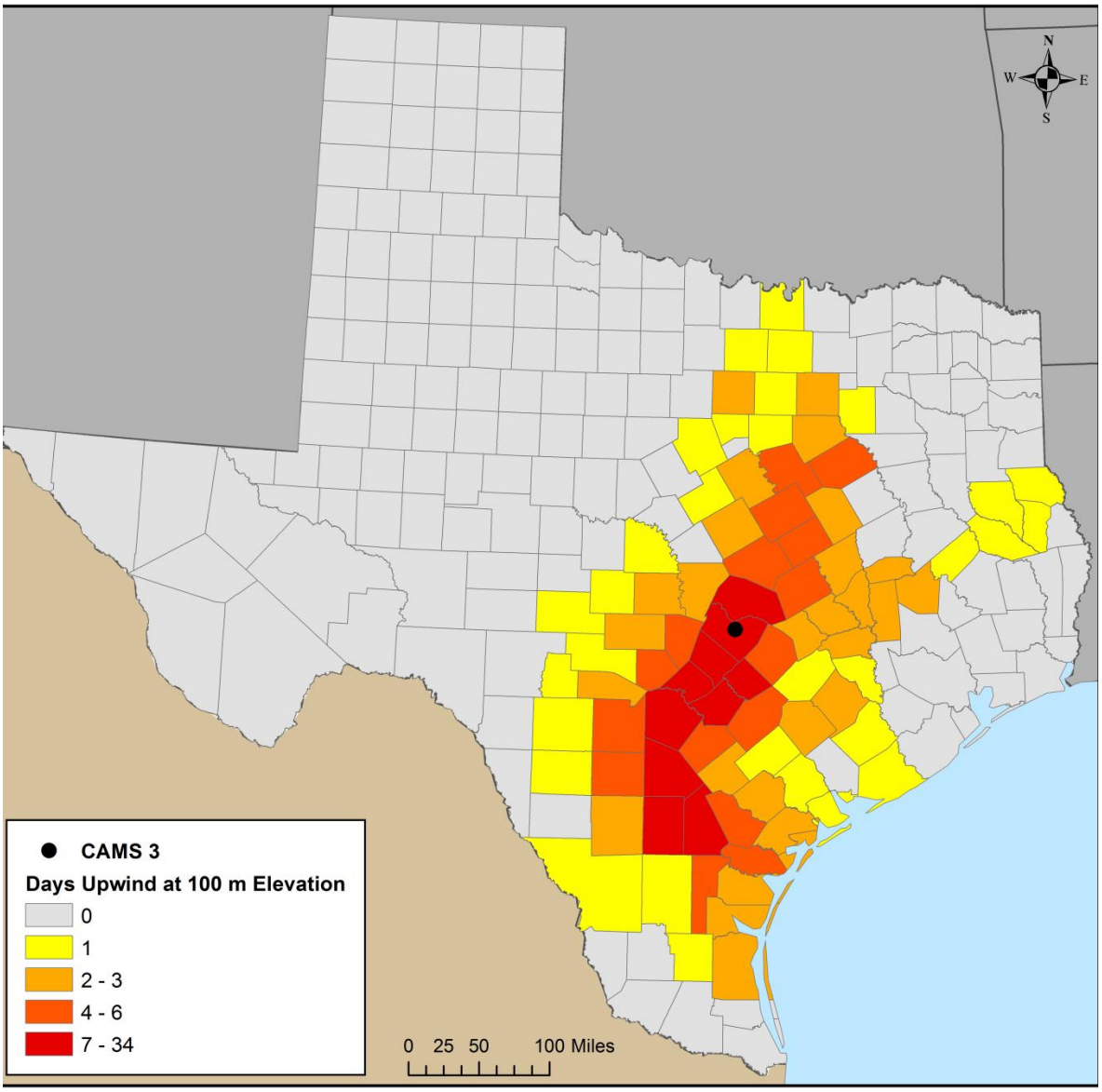
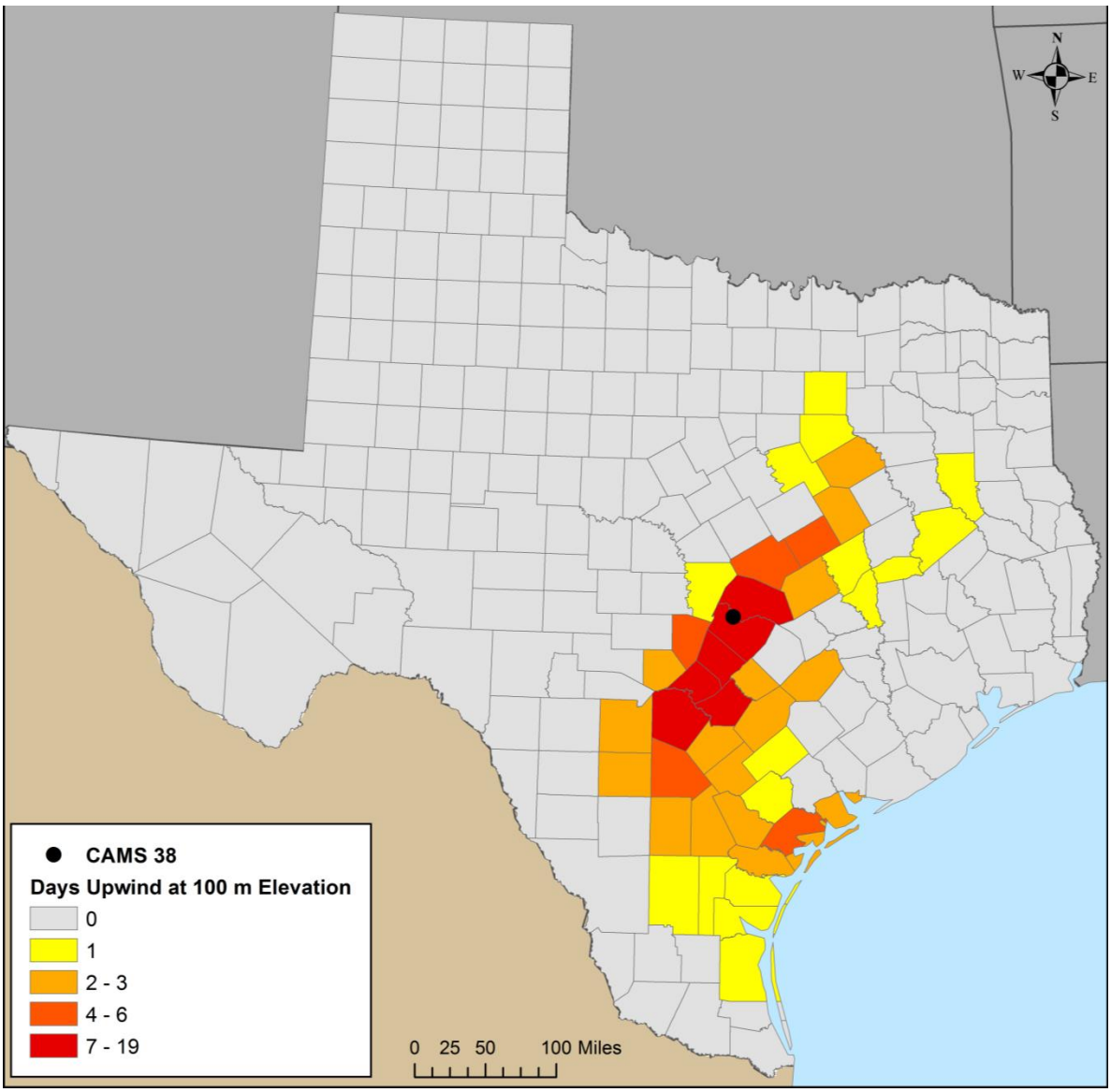


Figure 3-12. 24-Hour Back Trajectories at 100 m from CAMS 38 when MDA8 > 70 ppb, 2010-2015



These maps demonstrate the need for upwind monitors in each direction starting north and headed clockwise to the southwest. In 2010/2011 when CAPCOG shut down CAMS 674 in Round Rock and set up a new site in Hutto (CAMS 6602), this siting was intentionally done in order to better capture upwind O_3 concentrations when winds come out of the northeast, which can sometimes produce the highest O_3 levels the region experiences throughout an O_3 season. Likewise, CAMS 1604 was set up in 2013 on a temporary basis and then set up in 2014 on a permanent basis in order to better measure upwind O_3 levels for the entire MSA on high O_3 days, since the predominant wind direction is from the south/southeast. Interestingly, these maps suggest that CAMS 614, 690, 1603, 1675, and 6602 could all be upwind or downwind of the Austin urbanized area, depending on whether the wind was blowing from the southwest (which was more common than had previously been understood to be the case) or the north/northeast. Interestingly, while CAMS 684 is also positioned to be an upwind monitor when

winds would be blowing in from Houston, these back-trajectories did not seem to show that CAMS 684 was frequently serving as an upwind monitor to CAMS 3 or 38 at this elevation from 2010-2015.

4 Analysis of Alternative Network Configurations

CAPCOG used spatial analyses to analyze the MSA's current monitor ozone configuration and hypothetical configurations with 6, 7, and 8 CAPCOG monitors. Thiessen polygons are the primary tool employed for the spatial analysis. Each Thiessen polygon defines an area of influence around its sample point, so that any location inside the polygon is closer to that point than any of the other sample points.

4.1 Current Monitor Configuration

Within the CAPCOG region, there are currently 10 ozone monitors operating. Eight are CAPCOG monitors, with seven of those eight located within the MSA. The other two are operated by the TCEQ are located within the MSA. There is also an ozone monitor currently operating at St. Edward's University, CAMS 1605, in Austin. However, CAPCOG is unsure of the future operation of CAMS 1605 at St. Edwards' University, so CAPCOG did not include CAMS 1605 in this assessment. The following map displays the Thiessen polygons in the MSA for each CAPCOG and TCEQ monitor. While, the table displays the population and land area that lies within each polygon.

Figure 4-1. Current 2018 CAPCOG Monitor Configuration and Thiessen Polygons

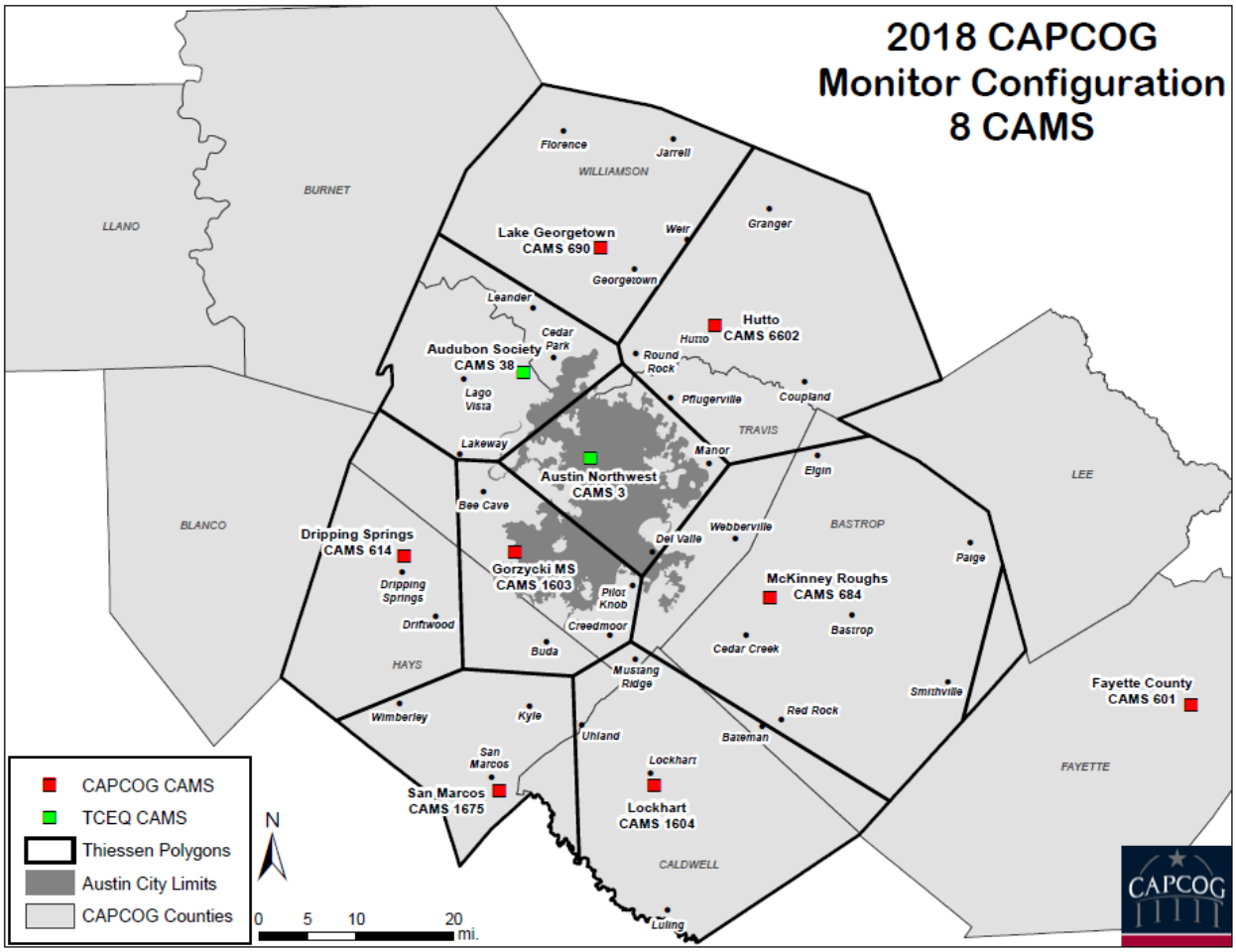


Table 4-1. Population and Land Area Coverage for the Current 2018 Monitoring Configuration

CAMS	Name	Population	Area (mi^2)
3	Austin Northwest	649,969	258.00
38	Audubon Society	264,753	339.19
601	Fayette County	4,484	37.26
614	Dripping Springs	44,367	391.92
684	McKinney Roughs	113,326	931.73
690	Lake Georgetown	132,731	489.02
1603	Gorzycki Middle School	352,671	300.69
1604	Lockhart	41,834	587.46
1675	San Marcos	120,174	286.94
6602	Hutto	242,351	659.62
Max.	n/a	649,969	931.73
Min.	n/a	4,484	37.26

Using the monitoring ranking and the analysis from the current ozone monitor configuration, CAPCOG analyzed monitor configurations with 6, 7, and 8 CAPCOG monitors.

4.2 Six-Monitor Configuration Options

For the first set of analyses, CAPCOG analyzed a monitor configuration with six CAPCOG-operated O_3 monitors. In order to reduce CAPCOG's monitoring network from eight to six stations, CAPCOG first removed the two lowest-ranking current stations: Fayette County (CAMS 601) and Gorzycki Middle School (CAMS 1603). Then, CAPCOG reviewed the remaining six remaining stations and assessed whether there was a compelling logistical or technical reason to move them.

While, as discussed above, it might be possible to reposition some of the monitors to better capture a county's highest or lowest O_3 levels, the value of having a continuous dataset at these locations outweighed the potential for being able to record somewhat higher O_3 measurements in each county, particularly since the range of 4^{th}-high MDA8 O_3 concentrations within the region and individual counties was quite small. For Bastrop, Caldwell, and Hays Counties, the current monitors are all within 5% of each county's maximum and minimum modeled 4^{th}-highest MDA8 O_3 concentration in 2020.

In Travis County, CAMS 38's 4^{th}-highest MDA8 O_3 modeled was within 1% of the modeled maximum 4^{th}-highest MDA8 O_3 concentration modeled for the county and within 3% of the maximum 4^{th}-high MDA8 O_3 modeled for the entire MSA (in Williamson County), and both CAMS 3 and 38 are deployed by TCEQ specifically to measure the highest MDA8 O_3 concentrations within the MSA. However, this also means that CAMS 3 has a modeled 4^{th}-high MDA8 O_3 that is more than 7% higher than the minimum 4^{th}-highest MDA8 O_3 level within the county, which is beyond the deviation that would fall within the +/-7% instrument bias allowed by EPA for ambient monitoring. This suggests that there might be a value to having an upwind monitor into Travis County to better represent the full range of O_3 values within the county.

Williamson County poses a different set of challenges because the modeling showed it containing grid cells with both the maximum and minimum 4th-highest MDA8 O_3 within the MSA, and neither of CAPCOG's two O_3 monitors are particularly close to those locations, either physically or in terms of their modeled 4th-highest MDA8 O_3 level. CAPCOG's Williamson County monitor with the lowest 4th high MDA8 O_3 modeled in 2020 was CAMS 6602 at 61.2 ppb, which was 2.5 ppb above the minimum 4th-highest MDA8 O_3 level in the County (4% higher), while CAMS 690 had a modeled 4th-high MDA8 O_3 of 61.3 ppb, which was 4.8 ppb lower than the maximum value of 66.1 ppb, which is more than 7% lower. However, CAMS 690 regularly measures MDA8 O_3 concentrations that are the highest among all of the 11 current O_3 monitors in the region. The following table compares the 4th-highest MDA8 O_3 concentrations at CAMS 3, CAMS 38, and CAMS 690 for 2014 – 2017. CAMS 690 has either the 1st-highest or 2nd-highest three-year average of 4th-highest MDA8 O_3 concentrations among these three stations in each of the three-year periods reviewed below.

Table 4-2. 4th-High MDA8 O_3 at CAMS 3, 38, and 690, 2015-2017

CAMS	2013	2014	2015	2016	2017	2013-2015 Avg.	2014-2016 Avg.	2015-2017 Avg.
3	69	62	73	64	70	68.0	66.3	69.0
38	70	63	73	62	67	68.7	66.0	67.3
690	75	66	75	61	70	72.0	67.3	68.7

Furthermore, CAMS 38 is located quite close (just two grid cells to the west) of the location within Williamson County where the maximum 4th-highest MDA8 O_3 was modeled, and the modeled 4th-high MDA8 O_3 at CAMS 3 is only 1.9 ppb below the MSA-wide maximum modeled in Williamson County. Finally, since it is ultimately TCEQ's responsibility to monitor O_3 levels where they are supposed to be highest within the region, and not CAPCOG's, CAPCOG decided that CAMS 690 and 6602 should remain in place, but will continue to assess whether any additional changes in monitoring in Williamson County would be warranted.

CAPCOG's conclusion of the review of the remaining six stations indicated that there was no compelling technical need to move any of them, but that there were logistical problems at CAMS 684 that warranted consideration of whether it should be moved. CAPCOG's contractors have experienced logistical problems at this site due to the physical location of the equipment at the McKinney Roughs Nature Preserve and the property lacks other options for moving the monitoring to a trailer on-site. Therefore, CAPCOG analyzed some key datapoints for moving CAMS 684 into another location within Bastrop County. CAPCOG considered four scenarios for the McKinney Roughs monitor:

1. CAMS 684 stays in location
2. CAMS 684 moved to the City of Bastrop (latitude: 30.106458, longitude: -97.309896)
3. CAMS 684 moved to the City of Elgin (latitude: 30.354704, longitude: -97.390340)
4. CAMS 684 moved to the City of Smithville (latitude: 29.999595, longitude: -97.144421)

4.2.1 Maps of Alternative Configurations

The following maps display the four configurations with Thiessen polygons that show the areas within the MSA closer to each monitor than any other monitor.

Figure 4-2. Six-Monitor Configuration 1 – Keep CAMS 684

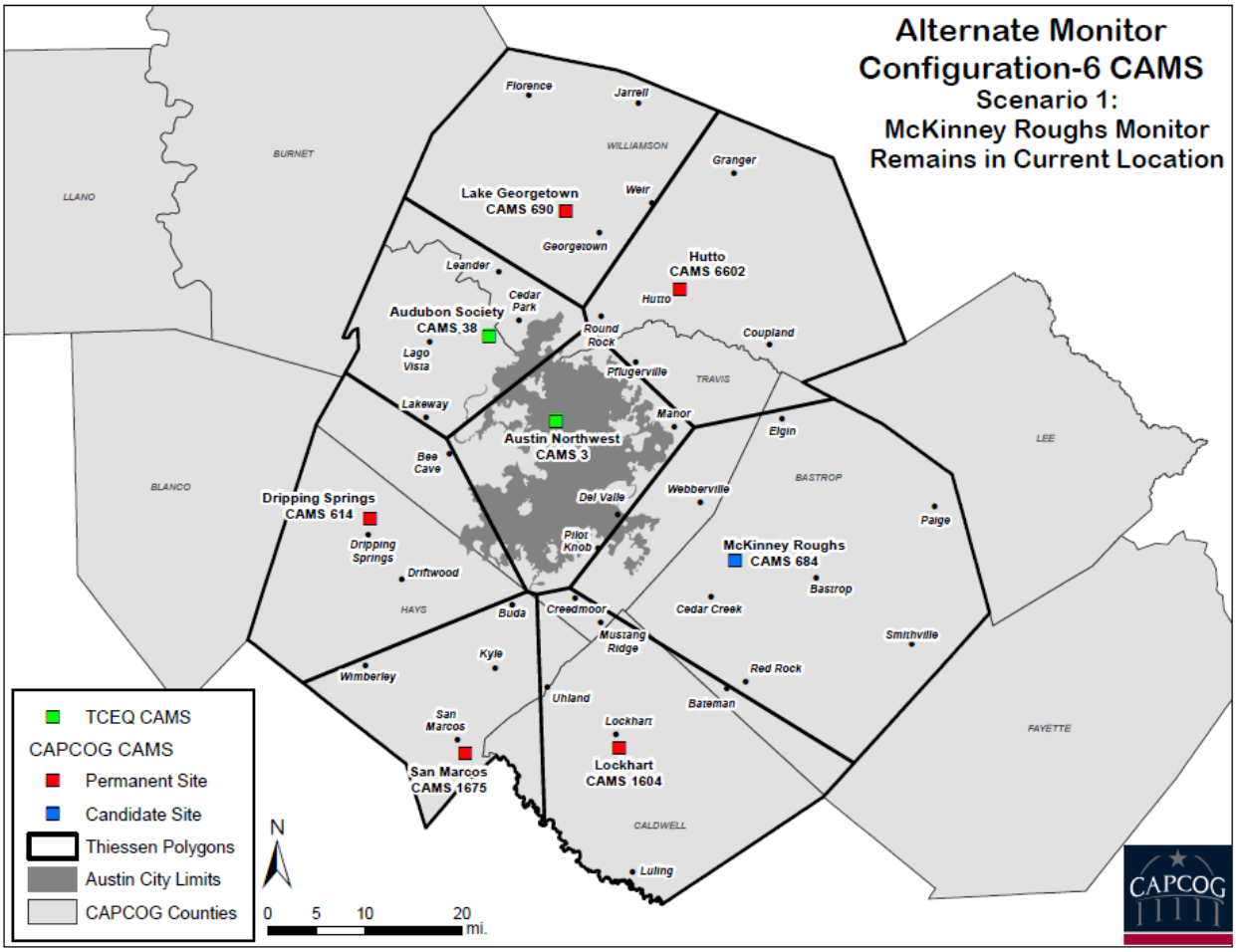


Figure 4-3. Six-Monitors Configuration 2 – Move CAMS 684 to Bastrop

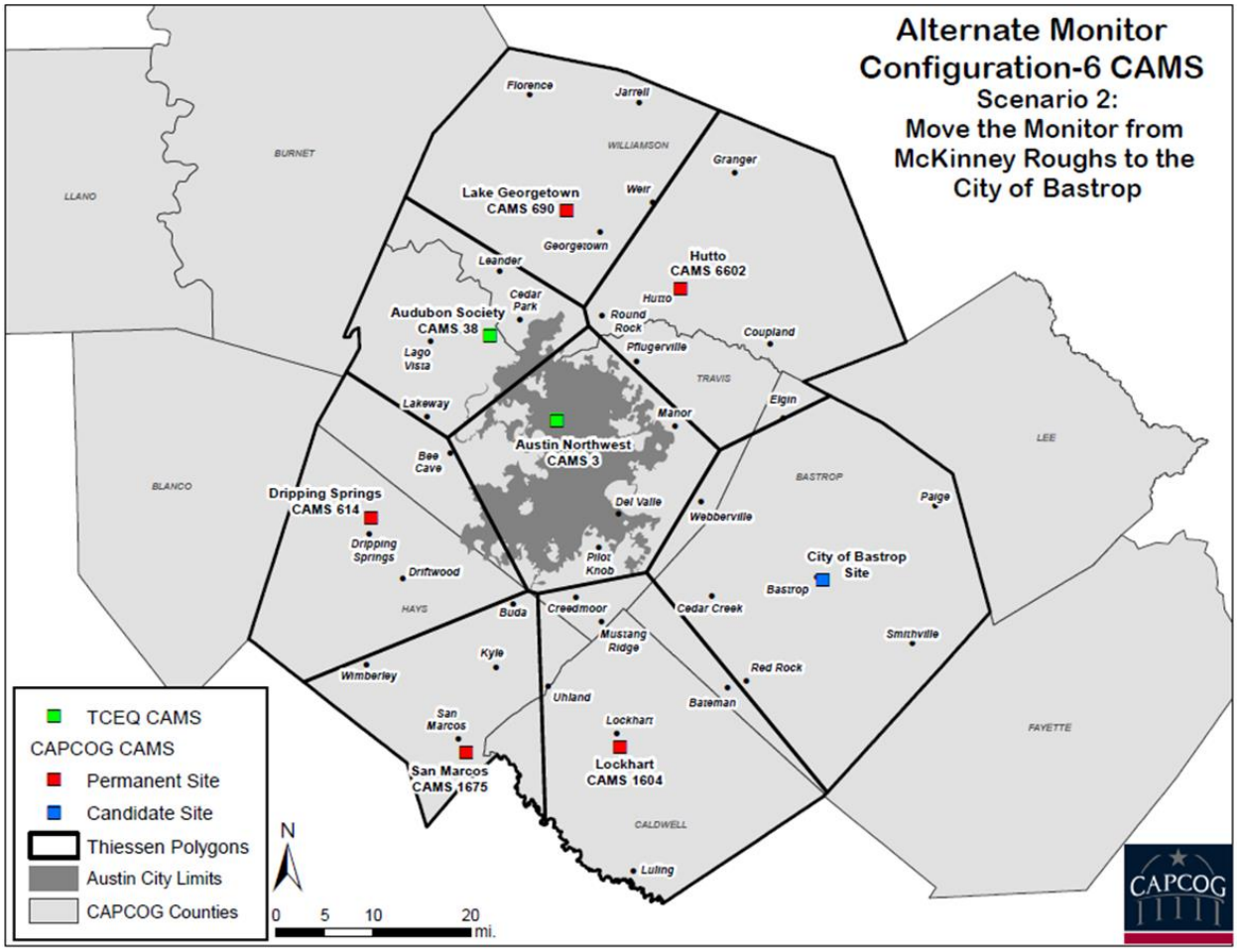


Figure 4-4. Six-Monitors Configuration 3 – Move CAMS 684 to Elgin

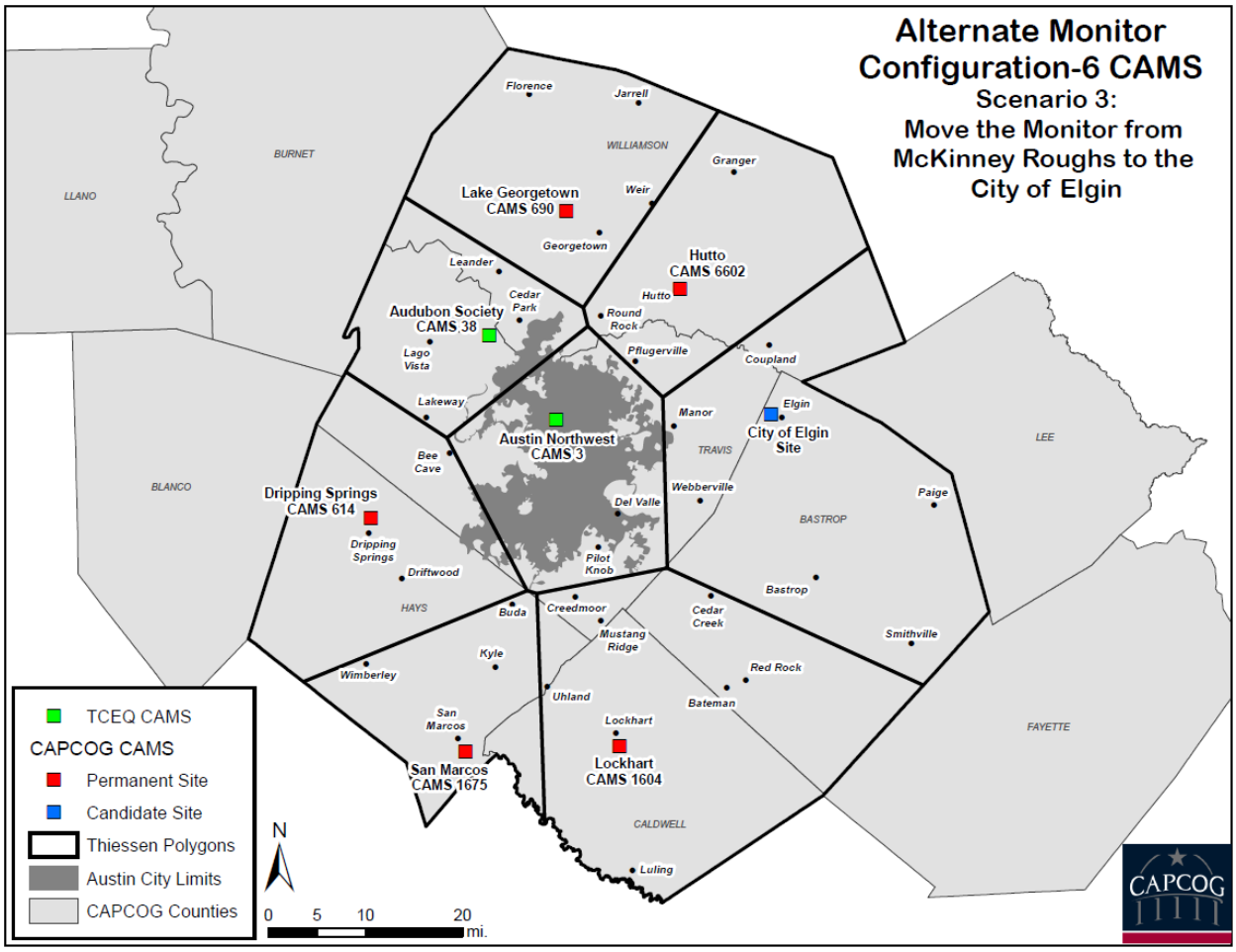
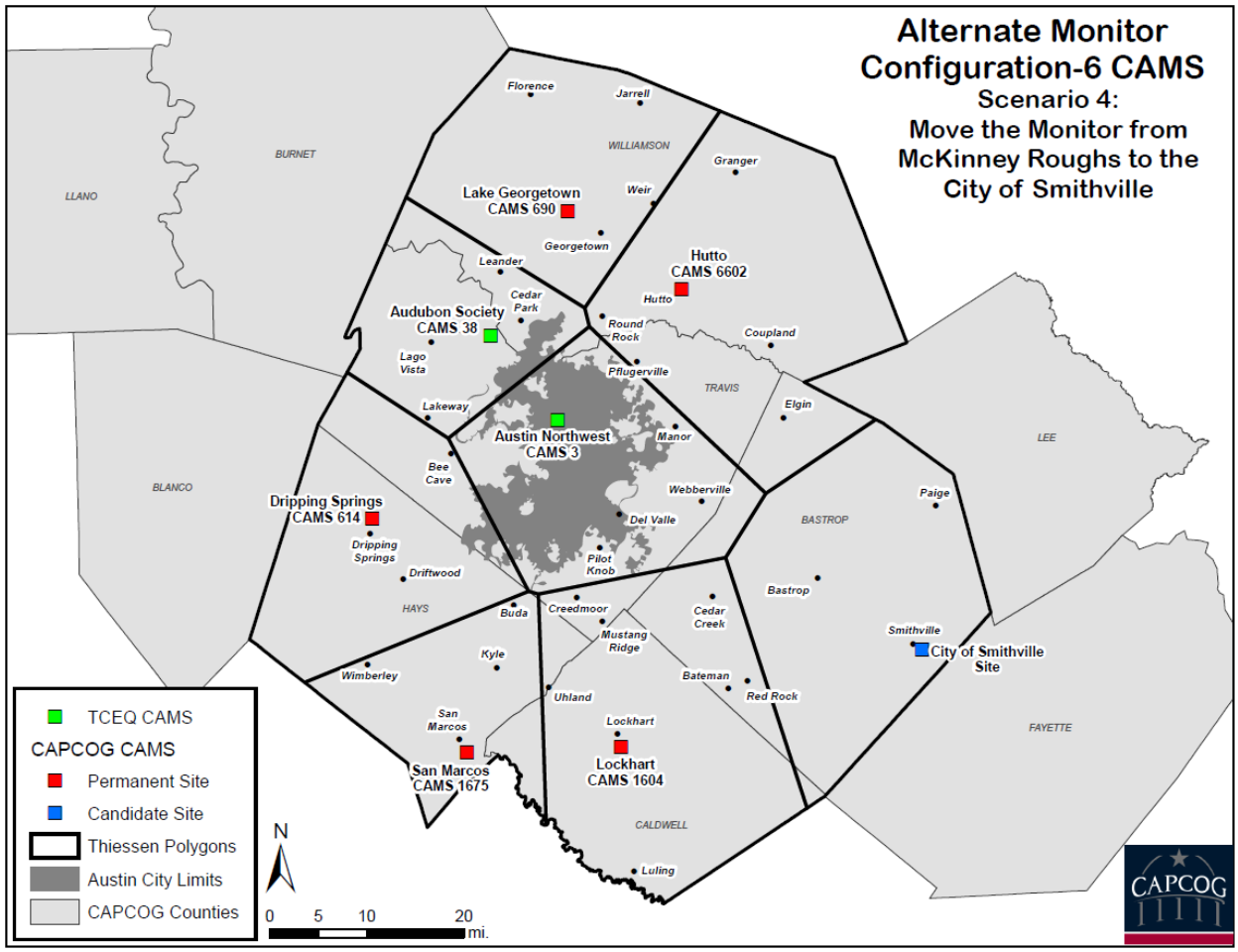


Figure 4-5. Six-Monitors Configuration 3 – Move CAMS 684 to Smithville



4.2.2 Staff Recommendation

Out of the four configurations for six monitors, CAPCOG staff recommended that the McKinney Roughs Monitor be moved to the City of Bastrop (configuration 2).

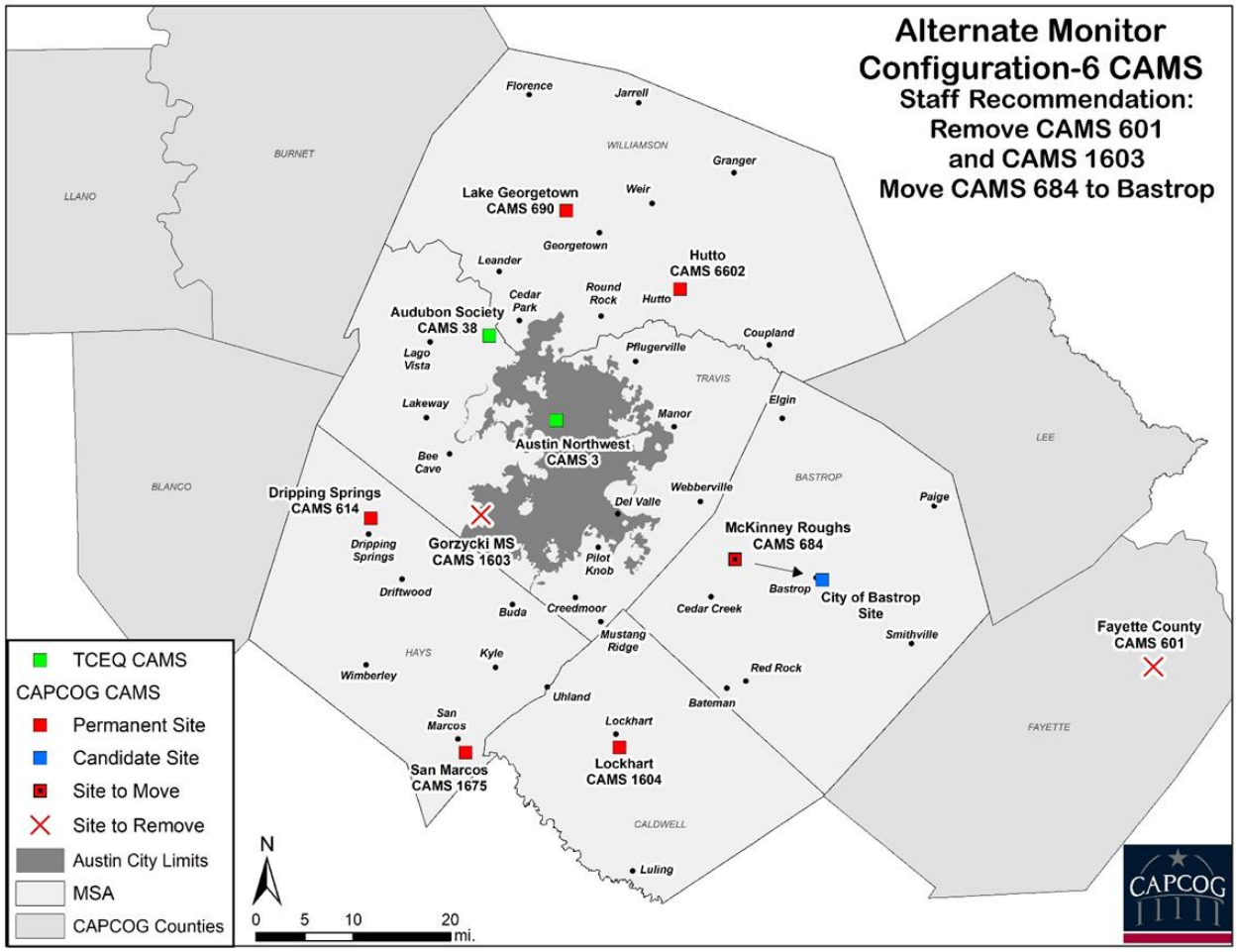
- Based on the small degree of variation in modeled 2020 O_3 levels within Bastrop County, the fact that the City of Bastrop is centrally located within the County, the fact that Bastrop is the largest city in the County, and the fact that there are not any major sources of emissions located between the Bastrop County/Fayette County border, CAPCOG staff recommended the City of Bastrop for the location of the single Bastrop County CAMS in a six-monitor configuration.
- The main advantage of locating a monitoring station in Elgin relative to Bastrop would be that an Elgin monitor would be better positioned to monitor the O_3 levels directly upwind of the Austin urbanized area on high O_3 days when wind is blowing in from the northeast. An Elgin location would also be situated very close to the boundaries of the MSA as a whole, and close the boundaries of four separate counties: Bastrop, Lee, Travis, and Williamson.

- The main advantage of a locating a monitoring station located in Smithville would be that it would be located right at the edge of the Austin-Round Rock MSA and would be able to measure the "background" O_3 levels for the MSA when winds were coming from the east/southeast.

If there is only one O_3 monitoring station in Bastrop County, locating it in either Elgin or Smithville would leave coverage of Bastrop County fragmented, with significant portions of the county closer to CAMS 1604 in Lockhart, CAMS 6602 in Hutto, or CAMS 3 in Austin. The centrality of Bastrop within the county makes it the most desirable option among the four considered.

The following map illustrates CAPCOG's staff recommendation for the 2019-2023 monitoring plan, if CAPCOG were only going to operate six monitoring stations.

Figure 4-6. CAPCOG Staff Recommendation for 2019-2023 Monitoring Plan If Operating Six CAMS



4.3 Seven-Monitor Configuration Options

For the second set of analyses, CAPCOG analyzed a MSA monitor configuration of 9 monitors total, 7 CAPCOG monitors and 2 TCEQ monitors. In order to drop from 8 to 7 CAPCOG monitors, CAPCOG removed the monitor in Fayette County, the lowest ranked monitor. From the six monitor configuration, it was determined that the McKinney Roughs monitor would move to the City of Bastrop. CAPCOG analyzed whether the Gorzycki Middle School monitor, CAMS 1603, could have a better location within

Travis County. CAMS 1603 is ranked second to last and is the most expensive monitor to maintain due to high insurance costs because the monitor is located in a school.

CAPCOG considered three scenarios for the Gorzycki Middle School monitor:

1. CAMS 1603 stays in location
2. CAMS 1603 moved to Bee Cave/Lakeway area (latitude: 30.353083, longitude: -97.93267)
3. CAMS 1603 moved at or near TCEQ's Webberville Road site (CAMS 171) in East Austin

4.3.1 Review of Prior Comments on Additional Travis County Monitoring

As noted earlier, CAPCOG and the CAC have consistently encouraged TCEQ to consider operating a third O_3 monitor in Travis County beyond CAMS 3 and CAMS 38. CAPCOG and the CAC encouraged TCEQ to consider adding O_3 sampling at CAMS 171 in comments on the agency's 2016[20] and 2017[21] AMNPs and in TCEQ's 2015 Five-Year Ambient Monitoring Network Assessment.[22] CAPCOG provided a detailed rationale for the value of TCEQ considering conducting O_3 monitoring at CAMS 171 in its comments on the 2016 AMNP, among which were:

- Benefits of co-pollutant monitoring of PM and VOC at CAMS 171
- Low marginal cost of adding an O_3 analyzer to an existing site rather than establishing a new site just for O_3 monitoring
- TCEQ's five-year assessment indicating that CAMS 3 and 38 are "highly correlated"
- O_3 monitoring should provide substantially different data because of its position east of the urban core, whereas both CAMS 3 and 38 are located northwest of the urban core
- The value of enabling residents of East Austin to have data that is more representative of neighborhood-level O_3 conditions for AQI reporting than the O_3 data for CAMS 3 and 38 provide.

The TCEQ declined to move forward with this recommendation, stating the following: "the TCEQ evaluated likely sources of precursor emissions and area topographical and meteorological information in order to select both an upwind location (to evaluate transport into the urban core) and a downwind location that was most likely to observe the highest O_3 concentrations in the Austin-Round Rock metropolitan statistical area (MSA). The TCEQ agrees with CAPCOG's assertion that East Austin is upwind of the urban core on virtually all days when the region traditionally sees high O_3 measurements, and therefore does not agree that there is regulatory benefit for monitor placement in East Austin at this time." CAPCOG remains unclear about how to interpret this response ("select both an upwind location…and a downwind location," but then indicating that it did not want an upwind monitor). However, CAPCOG staff have previously had conversations with TCEQ about the possibility of CAPCOG operating a non-regulatory O_3 monitor at CAMS 171, and TCEQ staff had seemed receptive to this possibility, indicating that there are such arrangements at other TCEQ regulatory monitoring stations

[20] https://www.tceq.texas.gov/assets/public/compliance/monops/air/annual_review/historical/2016-AMNP.pdf
[21] https://www.tceq.texas.gov/assets/public/compliance/monops/air/annual_review/historical/2017-AMNP.pdf
[22] https://www.tceq.texas.gov/assets/public/compliance/monops/air/annual_review/historical/2015-5yrAAMNA.pdf

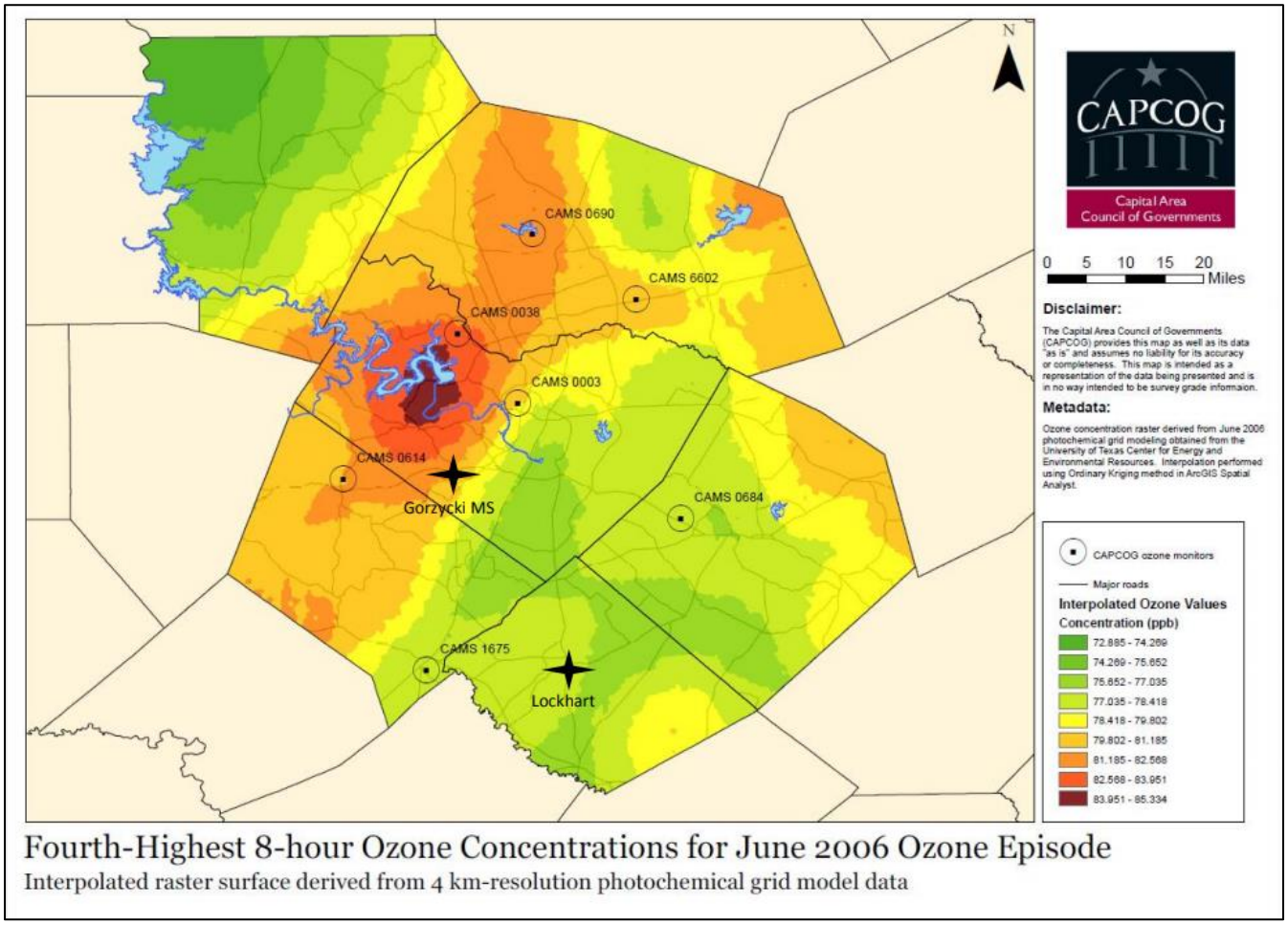
elsewhere. Therefore, CAPCOG identified the option of the 7th monitor in its network being located at or near CAMS 171.

CAPCOG also commented on TCEQ's 2014 AMNP requesting that TCEQ consider operating a regulatory O_3 monitor in Southwest Austin in order to measure peak O_3 levels when winds are out of the northeast. At the time, CAPCOG had just recently started collecting data at CAMS 1603 in Southwest Austin and this comment had been partially intended to encourage TCEQ to operate monitor nearby instead of CAPCOG operating CAMS 1603. TCEQ's response was a follows:

"The TCEQ evaluated meteorological data for the Austin-Round Rock MSA from 2010-2013 and determined that winds from the northeast occur less than 10% of the time during O_3 season (April through October). As a result, an O_3 monitor in southwest Austin would be ill-placed to measure elevated O_3 concentrations coming from the urban core during the periods of highest O_3 formation."

CAPCOG's 2014 monitoring network analyses, which also involved modeling data had also shown that there were high MDA8 O_3 concentrations just west of the City of Austin in the Bee Cave/Lakeway area, and that indeed – these might be the highest in the entire region. A map of the 4th-highest MDA8 O_3 concentration modeled for the June 2006 O_3 episode from that review highlights this.

Figure 4-7. 4th-Highest Daily 8-Hour O_3 Concentration in Central Texas, 2006 Episode



Based on the elevated O_3 concentrations in this vicinity, this became the 2nd candidate location for a CAPCOG Travis County monitor.

Despite the logistical challenges of operating the monitoring station at CAMS 1603, CAPCOG's decision to establish that site was based on a gap in the monitoring network that was best illustrated by the following two maps in CAPCOG's 2014 monitoring network analysis.

Figure 4-8. MDA8 O_3 June 3, 2006, from CAPCOG's 2014 Monitoring Network Analysis

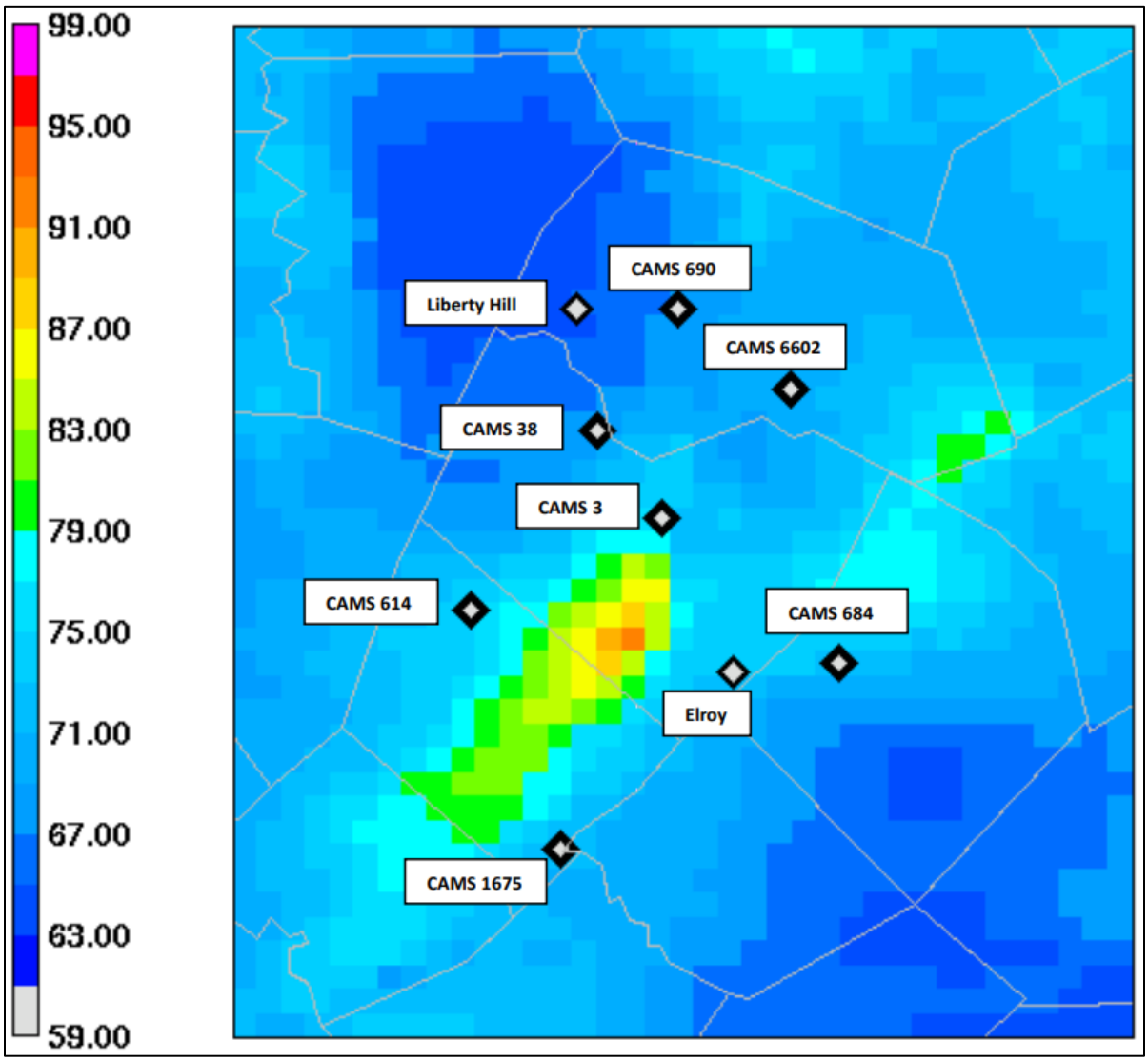
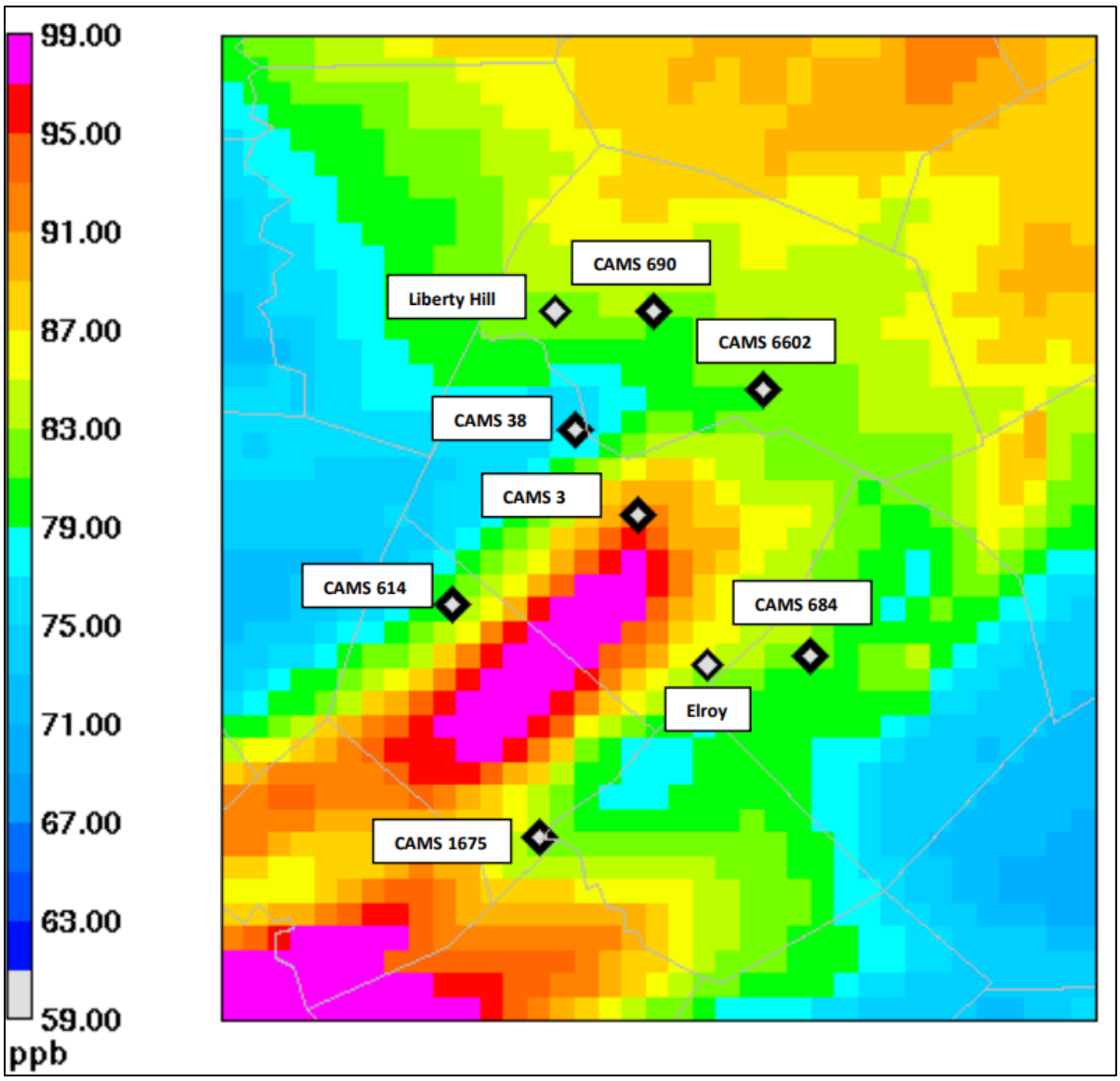


Figure 4-9. MDA8 O_3, June 13, 2006, from CAPCOG's 2014 Monitoring Network Analysis



These maps show a significant gap in the existing monitoring network's ability to capture the peak MDA8 O_3 within the region on each of these days. CAMS 1603 is located right along the edge of the core of the plumes shown above, and – while CAPCOG is uncertain about the future of CAMS 1605 at St. Edward's University, if this monitor is continued, it could potentially fulfill the same objective.

4.3.2 Maps of Alternative Configurations

The following sections display the three configurations with Thiessen polygons that show the areas within the MSA closer to each monitor than any other monitor.

Figure 4-10. Seven-Monitor Configuration 1 – Keep CAMS 1603

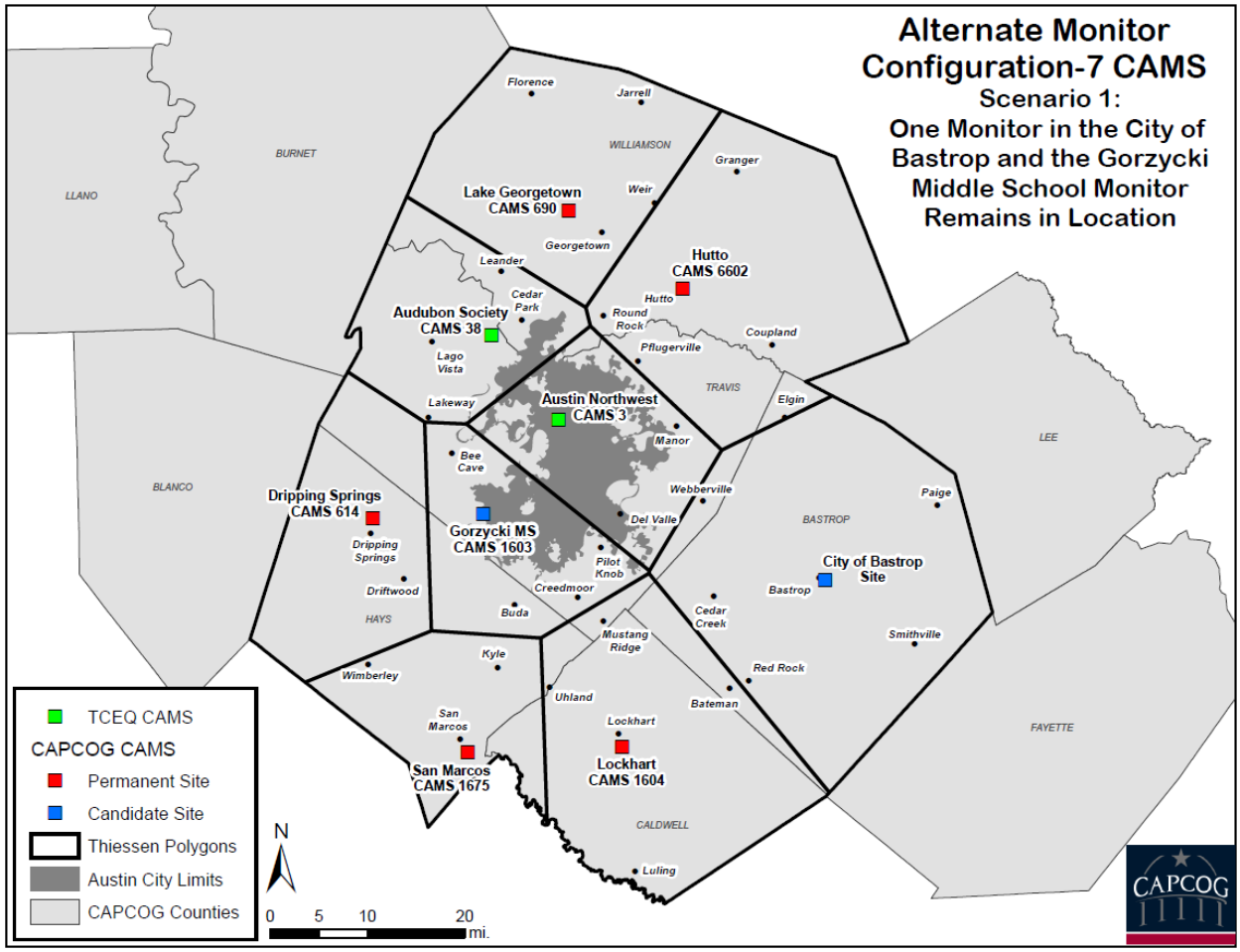


Figure 4-11. Seven-Monitor Configuration 2 –Move CAMS 1603 to Lake Travis Area

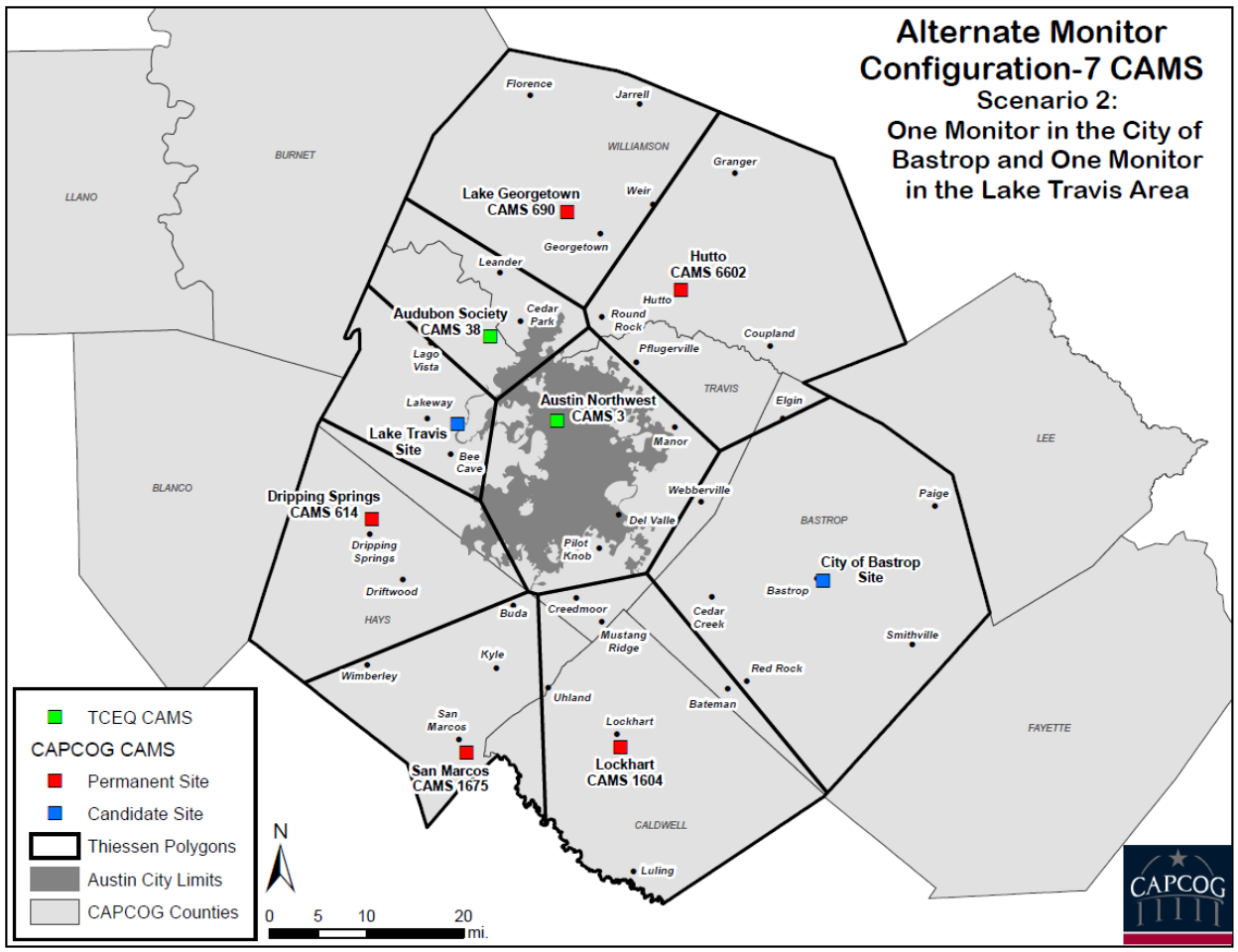
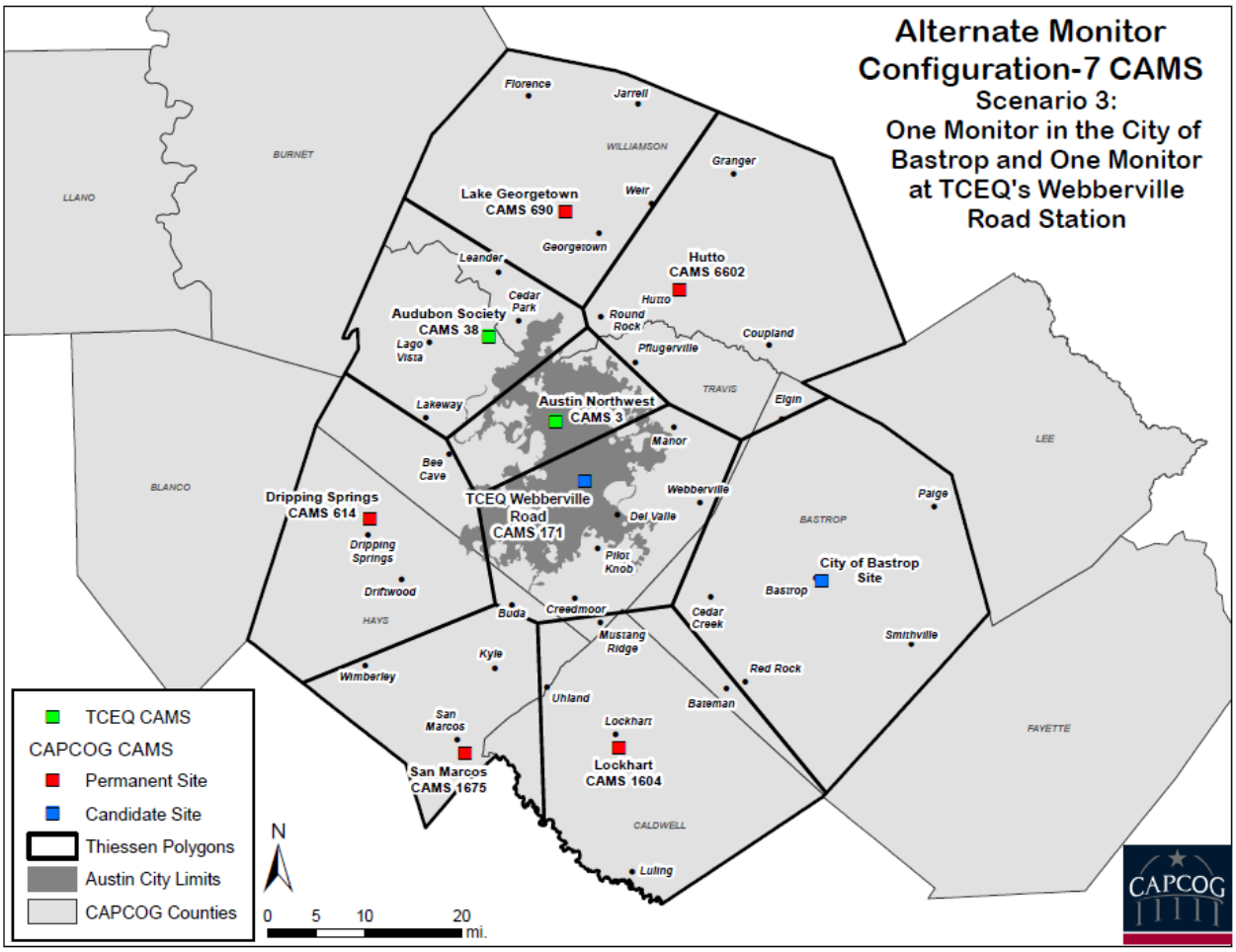


Figure 4-12. Seven-Monitor Configuration 3 –Move CAMS 1603 to East Austin



4.3.3 Comparison of Population and Land Area Coverage

The following figures show comparisons of the land area and populations coverages under the seven-monitor configurations analyzed.

Figure 4-13. Population and Land Area Coverage of CAPCOG Network Under Different Seven-Monitor Scenarios

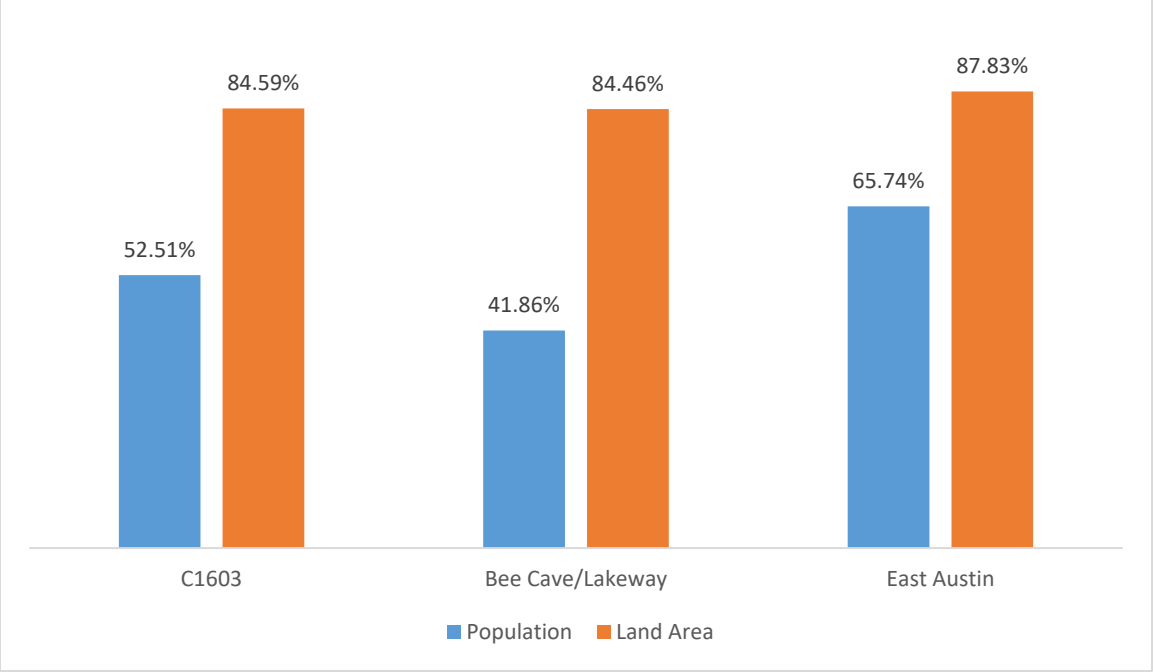
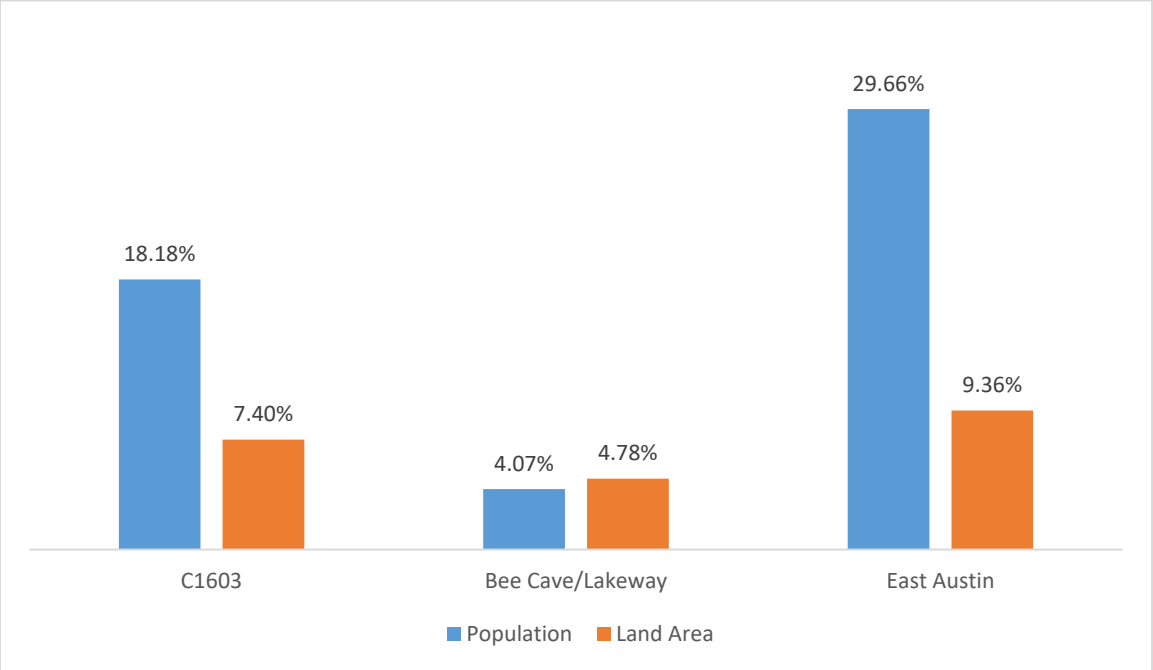


Figure 4-14. Population and Land Area Coverage of Travis County Site Under Different Seven-Monitor Scenarios



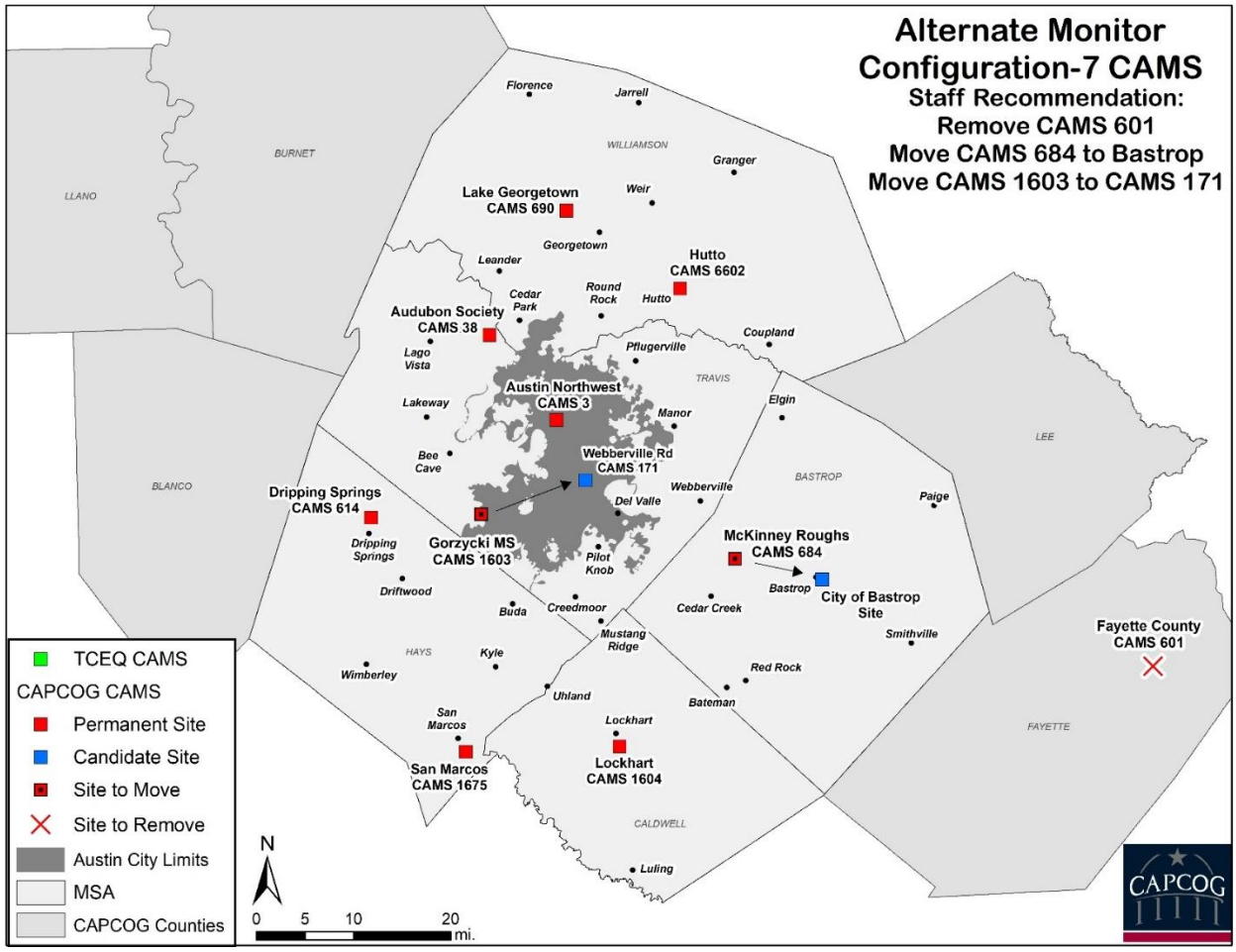
4.3.4 Staff Recommendation

Out of the three configurations for seven monitors, CAPCOG recommended that the Gorzycki Middle School monitor be moved to (or near) CAMS 171 in East Austin (configuration 3).

- Based on the improved population coverage at CAMS 171, the co-location of other air pollution and meteorological monitoring equipment at CAMS 171 (a canister sampler, a federal reference method PM_{10} sampler, a federal reference method $PM_{2.5}$ sampler, a continuous $PM_{2.5}$ sampler, outdoor temperature, and wind speed/wind direction), it's location between CAMS 1604 and CAMS 3, and TCEQ's prior receptivity to the possibility of CAPCOG operating an O_3 analyzer at CAMS 171, CAPCOG staff recommended moving CAMS 1603 to CAMS 171 or a location nearby.
- While CAMS 1603 has occasionally measured the highest O_3 levels within the region on high O_3 days and currently has the 2nd-largest population coverage among all of the O_3 monitors within the MSA, it is located quite close to CAMS 614, and has a number of logistical issues, including the need for added insurance coverage to operate this monitoring station due to Austin Independent School District's (AISD's) contractual requirements and issues with gaining access to the monitoring equipment at certain times.
- Locating a monitoring station in the Bee Cave/Lakeway area would be expected to measure higher MDA8 O_3 levels than either CAMS 1603 or CAMS 171, it would substantially reduce the percentage of the MSA's population and land area covered by CAPCOG's monitoring network compared to either keeping CAMS 1603 in-place or moving it to CAMS 171.

The following map shows CAPCOG staff's recommended 2019-2023 network plan under a seven-monitor scenario.

Figure 4-15. CAPCOG Staff Recommendation for 2019-2023 Monitoring Plan If Operating Seven CAMS



4.4 Eight Monitor Configuration Options

For the last set of analyses, CAPCOG analyzed a scenario in which it continued to operate eight O_3 monitors. From the previous analyses, it was determined that the CAPOCG should move CAMS 1603 to East Austin at or near CAMS 171. For the eight-monitor scenario, CAPCOG analyzed two options for fielding two O_3 monitors in Bastrop County by relocating both CAMS 684 and 601:

1. Elgin and Bastrop
2. Elgin and Smithville

Since, under this scenario, Bastrop County would now have two monitors, rather than just one as would be the case in the recommended six-monitor and seven-monitor configurations, CAPCOG decided that an Elgin/Smithville deployment would be worth evaluating since it is possible that that combination would better support CAPCOG's monitoring objectives to a configuration that just added an Elgin station to the seven-monitor configuration as option 1 provides for. CAPCOG decided not to evaluate a scenario in which it operated both a Bastrop and Smithville monitor because there are no major sources of emissions between these two locations, and it would therefore not add much in the way of scientific information to what the seven-monitor configuration would provide for, whereas an Elgin/Bastrop

configuration would help close an upwind "gap" between CAMS 6602 and a new Bastrop monitoring station.

The following sections display the two configurations.

4.4.1 Maps of Alternative Configurations

The following maps shows the two alternative configurations considered by CAPCOG for an eight-monitor scenario.

Figure 4-16. Eight-Monitor Configuration 1 –Elgin and Bastrop

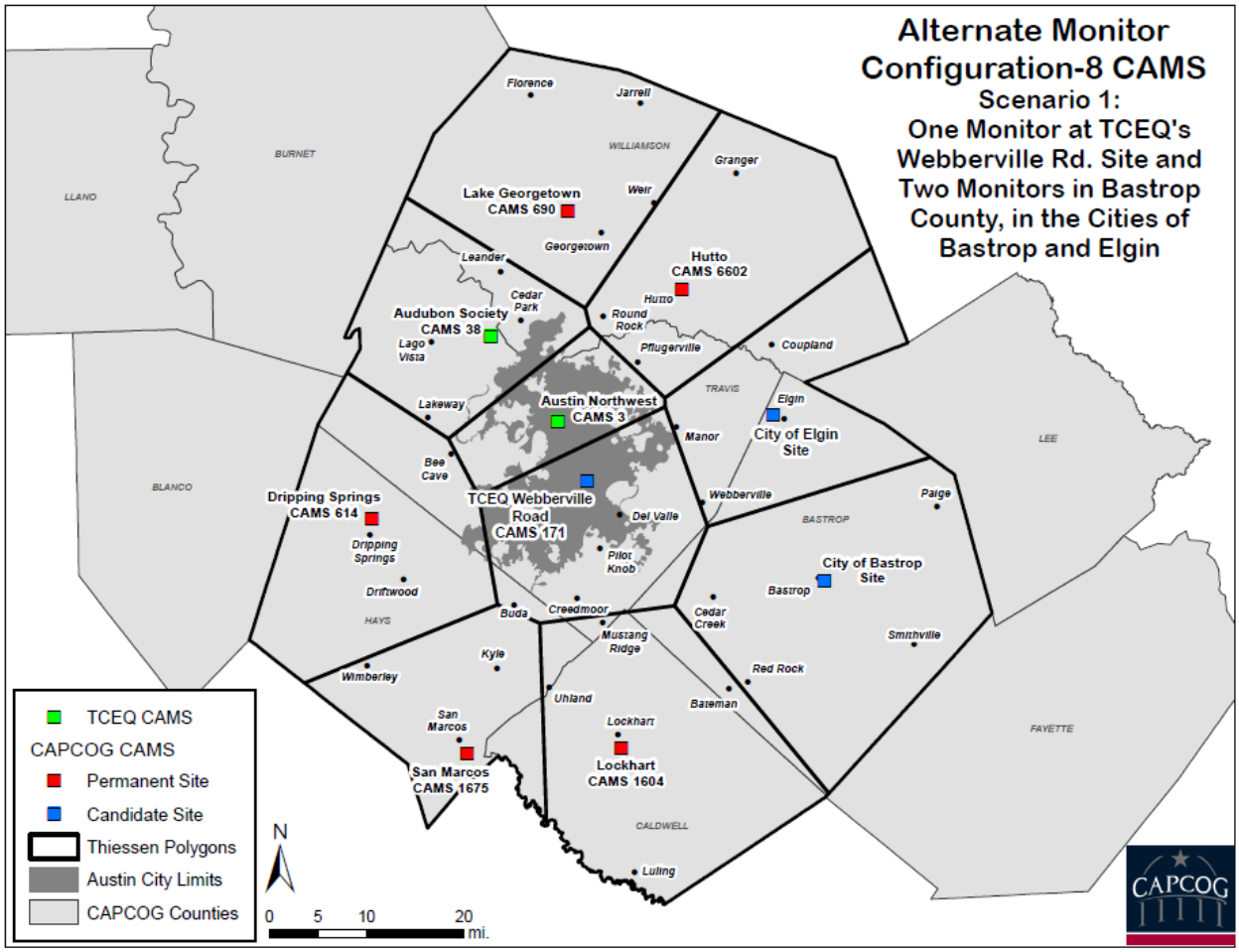
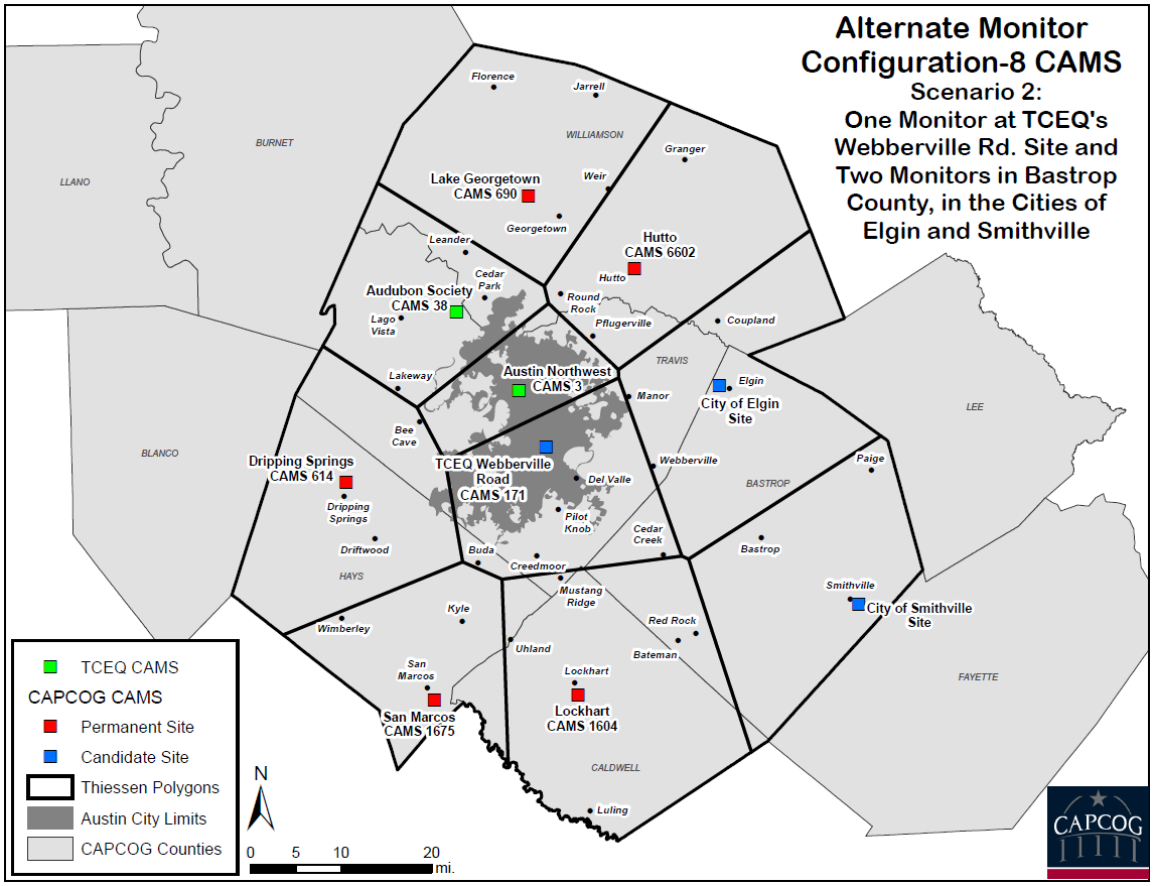


Figure 4-17. Eight-Monitor Configuration 1 –Elgin and Bastrop



4.4.2 Staff Recommendation

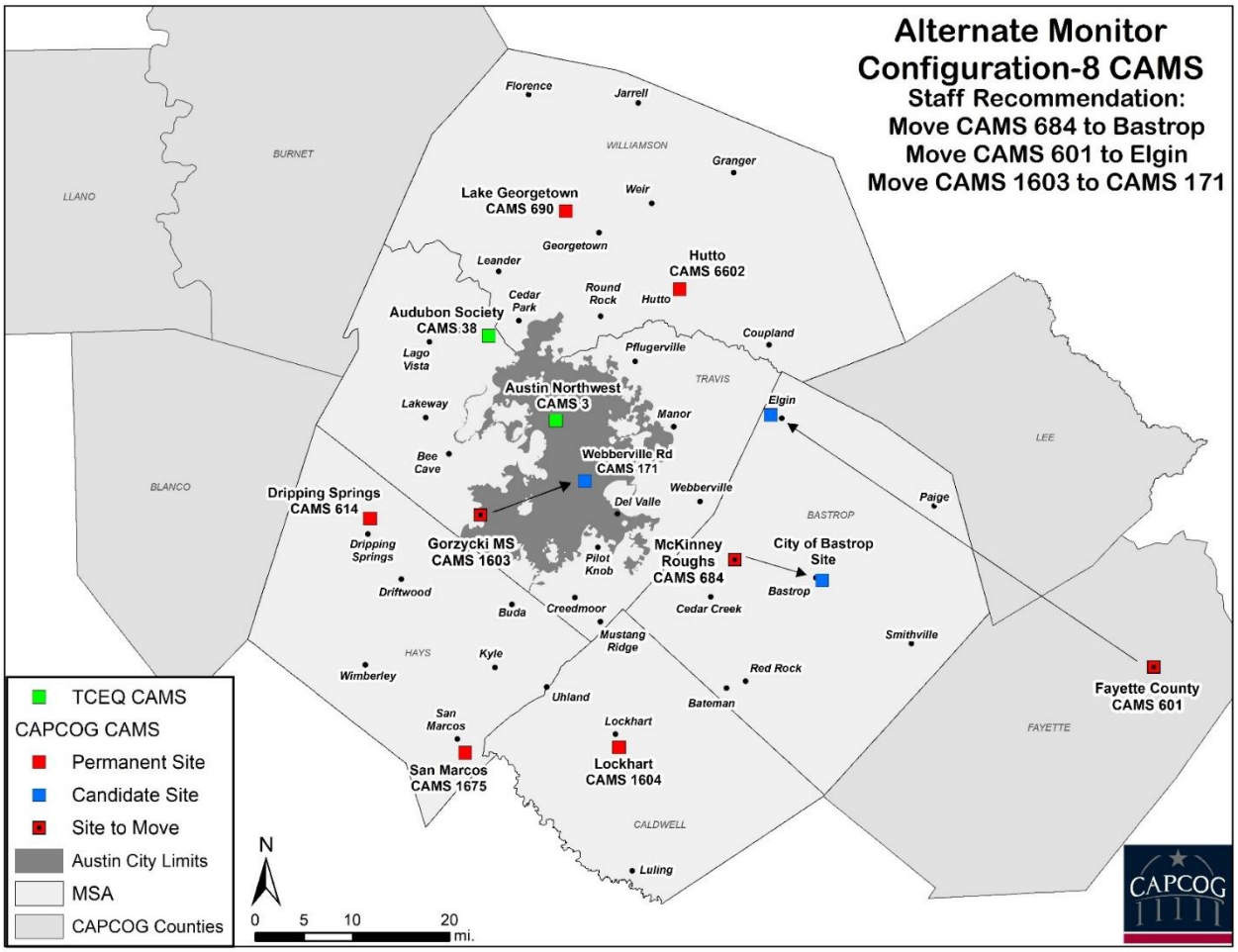
Out of the two configurations for eight monitors, CAPCOG recommends configuration 1, CAMS 601 moves to the City of Elgin and CAMS 684 moves to the City of Bastrop. With this configuration, monitors are located in the two most populated cities in county. Additionally, this scenario places monitors on two major roadways into the region, US-290 and SH 71. The following map displays CAPCOG's recommended eight monitor configuration.

- The recommended six-county monitoring configuration calls for a monitoring station in Bastrop based on the assumption that Bastrop County would have only one monitoring station, but the ability to locate two monitors in Bastrop County makes it possible that locating monitors in Elgin and Smithville would better serve CAPCOG's monitoring objectives than Bastrop and Elgin or Bastrop and Smithville.
- CAPCOG did not consider an option for locating a monitor in both Bastrop and Smithville due to the lack of any significant emission sources between these two cities and the likelihood of the monitors collecting redundant air quality data.
- Between the two options considered, CAPCOG determined that locating monitors in Elgin and Bastrop was preferable to locating monitors in Elgin and Smithville primarily based on the improved spacing between monitors for the Elgin/Bastrop scenario: the furthest distance to a

monitoring station in an adjacent Thiessen polygon is 22.10 miles and 27.02 miles, respectively, whereas for the Elgin/Smithville scenario, these distances are 37.33 miles and 32.58 miles, respectively.

The following map summarizes CAPCOG staff's recommended 2019-2023 configuration under an eight-monitor scenario.

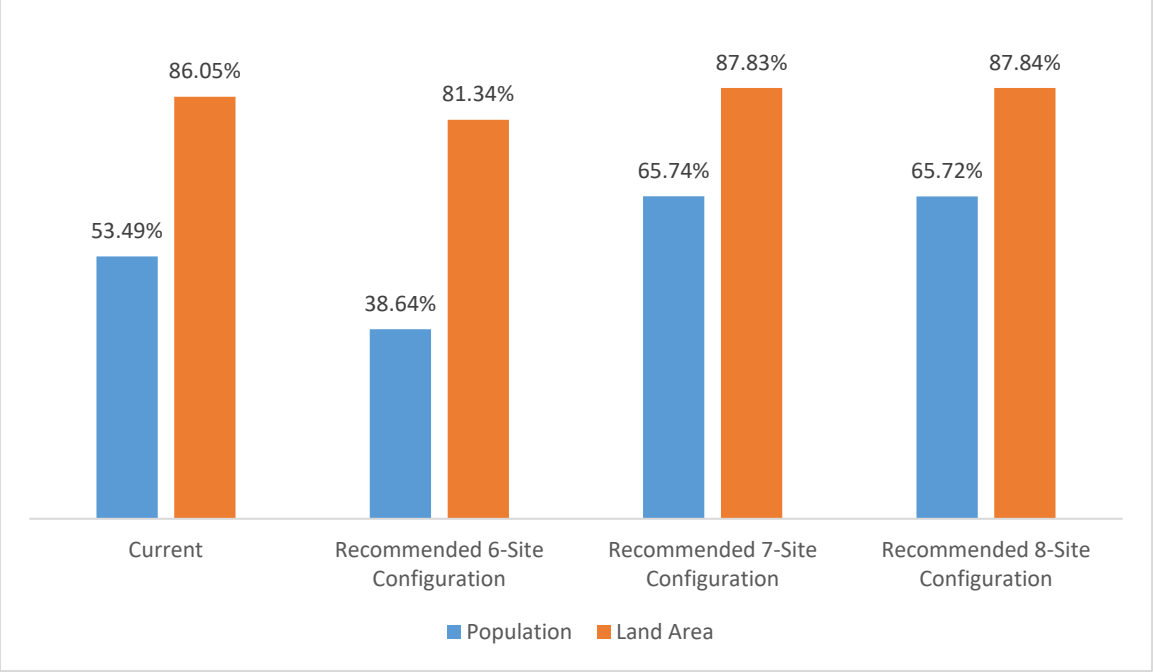
Figure 4-18. CAPCOG Staff Recommendation for 2019-2023 Monitoring Plan If Operating Eight CAMS



4.5 Comparison of Population and Land Area of Recommended Options

The following figure compares the population and land area of recommended options for six, seven, and eight monitors.

Figure 4-19. Population and Land Area Coverage of CAPCOG Network Under Different Scenarios



5 Clean Air Coalition Review of Options

On April 26, 2018, CAPCOG presented a summary of the information provided above to the Clean Air Coalition Advisory Committee, seeking a recommendation to the Clean Air Coalition. The CACAC unanimously approved the eight-monitor site configuration recommended by CAPCOG staff. On May 9, 2018, CAPCOG presented this information and the CACAC's recommendation to the CAC, along with an analysis of financial considerations.

CAPCOG reviewed its current contract for monitoring services and costs for equipment and site installation services in order to estimate the marginal costs associated with:

1. Continuing all eight current O_3 monitors for the next five years
2. Shutting down all eight current O_3 monitors at the end of 2018
3. Operating the six-monitor configuration recommended by CAPCOG staff
4. Operating the seven-monitor configuration recommended by CAPCOG staff
5. Operating the eight-monitor configuration recommended by CAPCOG staff

Elements of the cost analysis included:

- Site start-up costs each year
- Routine maintenance between March 1 and November 30
- Monthly calibrations
- Data validation
- End-of-season site shut-down costs
- Permanent site shut-downs for any sites that would be discontinued after 2018

- New equipment needed for any new sites (trailers)
- Other labor and material costs for establishing any new sites
- Inflation adjustments

CAPCOG did not include the costs for utilities, renewals of LEADS licenses, or monthly reports in this analysis, since these costs would be different enough between the options that involve continued monitoring to have been useful for the analysis. The following table summarizes the total five-year costs of each option considered as presented to the Clean Air Coalition.

Table 5-1. Estimated Five-Year Marginal Costs of Options for 2019-2023 Monitoring Presented to the CAC On May 9, 2018[23]

Activity	Option 1: Continue Same	Option 2: Shut All Monitors Down	Option 3: Recommended Six-Monitor Configuration	Option 4: Recommended Seven-Monitor Configuration	Option 5: Recommended Eight-Monitor Configuration
Ongoing Costs	$556,000	$0	$402,000	$470,000	$537,000
Decommissioning	$0	$22,000	$9,000	$9,000	$9,000
Trailers	$0	$0	$16,000	$16,000	$32,000
New Site Set-Up	$0	$0	$5,000	$10,000	$15,000
TOTAL	**$556,000**	**$22,000**	**$432,000**	**$504,000**	**$593,000**

CAPCOG staff requested that the CAC adopt the recommendation of the CACAC, but also provided options for the recommended six-monitor configuration, seven-monitor configuration, or another configuration as determined by the CAC. The CAC unanimously approved the eight-monitor site configuration that had been recommended by CAPCOG staff. Therefore, CAPCOG is going to plan on:

- Extending site lease agreements for CAMS 614, 1604, 1675, and 6602, all of which expire at the end of 2018 (a new five-year site lease for CAMS 690 was executed in early 2018)
- Request that TCEQ enter into an agreement to allow CAPCOG to operate an O_3 monitor at CAMS 171
- Scout sites for potential O_3 monitoring stations in Bastrop and Elgin and enter into site lease agreements for 2019-2023 by November 30, 2018
- End O_3 monitoring at CAMS 601, 684, and 1603 after the end of the 2018 O_3 season
- Purchase two new trailers for the new locations in Bastrop and Elgin

[23] Note that in a subsequent phone conservation between Andrew Hoekzema of CAPCOG and Cory Chism of TCEQ, on May 11, 2018, CAPCOG learned that the use of CAMS 171 would actually require a trailer if CAPCOG and TCEQ did come to an agreement to conduct O_3 monitoring at this location. This means that the costs for the seven-monitor configuration and eight-monitor configuration would both be expected to be about $16,000 higher - $520,000 and $609,000, respectively.

6 Additional Analyses

This appendix includes additional quantitative analysis of the monitoring network and the various options considered. These analyses were not necessarily directly used by CAPCOG staff or the CAC leading up to the CAC's May 9, 2018, meeting, but should provide an opportunity to prioritize these monitoring stations moving into the 2019-2023 time frame, and providing an improved understanding of the implications of each of the network configurations analyzed in this report.

6.1 Methods for Quantifying Value of Individual Monitors and the Network

Unlike the process CAPCOG used for prioritizing the current eight monitoring stations for 2018, which involved assigning scores, for this project, CAPCOG used quantitative data at each step of the process, but did not "score" each option in the same way. However, in the future, CAPCOG intends to score and rank the final configuration adopted for 2019-2023 based on the methodology laid out below

- Locating monitors where people live, work, and play
    - Percentage of people and land area within the Austin-Round Rock MSA within a 4 km radius of an O_3 monitor (including TCEQ) – corresponding to the "neighborhood-scale" of monitoring as defined in Appendix D to Part 58 of 40 CFR: *Network Design Criteria for Ambient Air Quality Monitoring*.
    - Percentage of people and land area within the Austin-Round Rock MSA within a 4 – 50 km radius of an O_3 monitor (including TCEQ) – corresponding to the "urban scale" of monitoring as defined in Appendix D to Part 58 of 40 CFR: *Network Design Criteria for Ambient Air Quality Monitoring*.
    - Percentage of people and land area within the Austin-Round Rock MSA closer to a CAPCOG monitoring station than to a TCEQ monitor for the entire CAPCOG network and for particular monitors.
    - Distance from centroid of county.
- Locating monitors in environmental justice areas that have low-income and/or minority populations
    - Percentage of sub-groups within the Austin-Round Rock MSA within a 4 km radius of an O_3 monitor (including TCEQ) – corresponding to the "neighborhood-scale" of monitoring as defined in Appendix D to Part 58 of 40 CFR: *Network Design Criteria for Ambient Air Quality Monitoring*.
    - Percentage of subgroups within the Austin-Round Rock MSA within a 4 – 50 km radius of an O_3 monitor (including TCEQ) – corresponding to the "urban scale" of monitoring as defined in Appendix D to Part 58 of 40 CFR: *Network Design Criteria for Ambient Air Quality Monitoring*.
- Monitoring the area of maximum pollutant concentration
    - Difference between each county's maximum 4^{th}-highest maximum daily 8-hour O_3 average (MDA8) and a monitoring station's 4^{th}-highest MDA8
    - Distance between each county's maximum MDA8 and the nearest monitoring location
- Characterize ozone transport
    - Proximity to MSA boundary

  - Location relative to urbanized or industrialized areas
  - Assessing the distances between monitoring stations
  - Locating monitors where O_3 levels are expected to be the lowest within the region and within counties
- Locating monitors where they will be of maximum value with assisting with air quality forecasting
  - Location upwind of the Austin urbanized area on high ozone days

6.1.1 Correlation Analysis

While not used directly in the presentations to the CACAC and CAC, CAPCOG did perform an analysis of the correlations between modeled MDA8 O_3 at the current monitoring locations within the Austin-Round Rock MSA and for the 15 days modeled by AACOG, in order to determine the extent to which any of CAPCOG's monitors might be collecting data that is redundant with TCEQ's O_3 data or another CAPCOG monitoring station. Correlations of 0.95 or higher are marked in red text, and correlations between 0.90 and 0.95 are marked in orange.

Table 6-1. Correlation of Modeled MDA8 O_3 at Current and Potential Monitoring (red: ≥ 0.95, orange: 0.95 > x ≥ 0.90)

	C3	C38	C614	C684	C690	C1603	C1604	C1675	C6602
C3	1.000	0.890	0.747	0.755	0.548	0.904	0.731	0.911	0.824
C38	0.890	1.000	0.906	0.879	0.632	0.908	0.849	0.933	0.856
C614	0.747	0.906	1.000	0.717	0.602	0.906	0.797	0.920	0.740
C684	0.755	0.879	0.717	1.000	0.460	0.724	0.807	0.770	0.889
C690	0.548	0.632	0.602	0.460	1.000	0.637	0.822	0.651	0.655
C1603	0.904	0.908	0.906	0.724	0.637	1.000	0.758	0.959	0.783
C1604	0.731	0.849	0.797	0.807	0.822	0.758	1.000	0.843	0.904
C1675	0.911	0.933	0.920	0.770	0.651	0.959	0.843	1.000	0.840
C6602	0.824	0.856	0.740	0.889	0.655	0.783	0.904	0.840	1.000
Pairs ≥ 0.95	0	1	1	0	0	2	0	2	0
Pairs ≥ 0.90	2	4	4	0	0	5	2	5	2
Max.	0.911	0.933	0.920	0.889	0.822	0.959	0.904	0.959	0.904
Min.	0.548	0.632	0.602	0.460	0.460	0.637	0.731	0.651	0.655
Avg.	0.789	0.857	0.792	0.750	0.626	0.822	0.814	0.853	0.811

Table 6-2. Correlation Analysis for Bastrop County Monitoring Station Options

Data	CAMS 684	Bastrop	Elgin	Smithville
Monitor Pair with Highest Correlation	CAMS 6602	CAMS 1604	CAMS 1604	CAMS 1675
Highest Correlation	0.889	0.900	0.945	0.828
Monitor Pair with Lowest Correlation	CAMS 690	CAMS 614	CAMS 614	CAMS 614
Lowest Correlation	0.460	0.746	0.699	0.735

Data	CAMS 684	Bastrop	Elgin	Smithville
Average Correlation with All Other Monitors	0.750	0.826	0.811	0.792
# of Pairs ≥ 0.95	0	0	0	0
# of Pairs ≥ 0.90	0	0	2	0

Table 6-3. Correlation Analysis for Travis County Monitoring Station Options

Data	CAMS 1603	Bee Cave / Lakeway	CAMS 171
Monitor Pair with Highest Correlation	CAMS 1675	CAMS 38	CAMS 3
Highest Correlation	0.959	0.975	0.828
Monitor Pair with Lowest Correlation	CAMS 690	CAMS 38	CAMS 690
Lowest Correlation	0.637	0.639	0.409
Average Correlation with All Other Monitors	0.836	0.853	0.647
# of Pairs ≥ 0.95	1	3	0
# of Pairs ≥ 0.90	4	3	0

Table 6-4. Correlation of Modeled MDA8 O_3 at Current and Potential Monitoring (red: ≥ 0.95, orange: 0.95 > x ≥ 0.90)

	C3	C38	C614	C690	C1604	C1675	C6602	C171	Bastrop	Elgin
C3	1.000	0.890	0.747	0.548	0.731	0.911	0.824	0.828	0.802	0.740
C38	0.890	1.000	0.906	0.632	0.849	0.933	0.856	0.617	0.770	0.778
C614	0.747	0.906	1.000	0.602	0.797	0.920	0.740	0.520	0.746	0.699
C690	0.548	0.632	0.602	1.000	0.822	0.651	0.655	0.409	0.842	0.855
C1604	0.731	0.849	0.797	0.822	1.000	0.843	0.904	0.638	0.900	0.945
C1675	0.911	0.933	0.920	0.651	0.843	1.000	0.840	0.754	0.861	0.796
C6602	0.824	0.856	0.740	0.655	0.904	0.840	1.000	0.662	0.852	0.922
C171	0.828	0.617	0.520	0.409	0.638	0.754	0.662	1.000	0.745	0.641
Bastrop	0.802	0.770	0.746	0.842	0.900	0.861	0.852	0.745	1.000	0.947
Elgin	0.740	0.778	0.699	0.855	0.945	0.796	0.922	0.641	0.947	1.000
Pairs ≥ 0.95	0	0	0	0	0	0	0	0	0	0
Pairs ≥ 0.90	1	2	2	0	2	3	2	0	1	3
Max.	0.911	0.933	0.920	0.855	0.945	0.933	0.922	0.828	0.947	0.947
Min.	0.548	0.617	0.520	0.409	0.638	0.651	0.655	0.409	0.745	0.641
Avg.	0.780	0.803	0.742	0.668	0.826	0.834	0.806	0.646	0.829	0.814

Table 6-5. Comparison of Correlation Statistics for Current and Recommended MSA O_3 Monitors

Statistic	2013-2018 Configuration	Approved 2019-2023 Configuration
Total Monitors in MSA	9	10
Total Monitor Pairs with Correlation of ≥ 0.95	1	0

Statistic	2013-2018 Configuration	Approved 2019-2023 Configuration
Total Monitor Pairs with Correlation of ≥ 0.90	9	8
Maximum Correlation	0.959	0.947
Minimum Correlation	0.460	0.409
Average Network Correlation	0.790	0.775
Monitor Pair with Highest Maximum Correlation	C1603-C1675	Bastrop-Elgin
Monitor Pair with Lowest Maximum Correlation	C684-C690	C171-C690
Monitor with the Highest Average Correlation	C38 (0.857)	C1675 (0.834)
Monitor with the Lowest Average Correlation	C690 (0.626)	C171 (0.646)

6.1.2 Proximity to Center of County, MSA Borders, and Other Monitors

Another factor that was considered by CAPCOG staff, but wasn't scored per se, were certain spatial dynamics for options under consideration, including:

- Distance to County Centroid: the closer to a county's center, the more representative a monitor could be of air pollution levels across the entire spatial extent of the county
- Distance to MSA boundary: the closer a monitor is to the MSA boundary, the better it is representing "background" conditions before emissions from within the MSA generate added air pollution levels within the region
- Spacing between monitors: finding the right balance between locating monitors to close to one another such that they are not being duplicative, while also not leaving major gaps in coverage that could result in misrepresentation of O_3 levels upwind or downwind of the core urban area

In CAPCOG's 2017 analysis of the current monitors, the distance to MSA boundary was one of the factors that was scored, and a new scoring of the proposed network could incorporate this variable for scoring, as well as these other factors as well. The following tables provide data on the various locations considered for monitors for each level of monitoring considered.

Table 6-6. Monitoring Distance Analysis for 6-Monitor Configuration (mi.)

Location	Distance to County Centroid	Distance to MSA Boundary	Shortest Distance to Monitor in Adjacent Thiessen Polygon	Furthest Distance to Monitor in Adjacent Thiessen Polygon
C684	9.16	19.37	22.67	28.32
Bastrop	0.27	15.02	27.02	38.28
Elgin	17.93	4.70	15.96	37.53
Smithville	12.33	2.78	32.58	44.75

These data show that:

- A Bastrop station would be nearly in the center of the county, and closer the MSA boundary than CAMS 684.
- An Elgin station would have the smallest gaps in the network among all three options for moving CAMS 684, as measured by the maximum distance to monitors in adjacent Thiessen polygons, but would have a larger gap than what currently exists. An Elgin location would also be the furthest from the center of the County, but quite close the border of the MSA.
- A Smithville station would be closest to the MSA boundary among the four options considered, but would leave the largest gap in coverage among all four options.

CAPCOG prepared the same data for the options for the seven-monitor configuration. These are shown below.

Table 6-7. Monitoring Distance Analysis for Bastrop and Elgin Option for 7-Monitor Configuration (mi.)

Location	Distance to County Centroid	Distance to MSA Boundary	Shortest Distance to Monitor in Adjacent Thiessen Polygon	Furthest Distance to Monitor in Adjacent Thiessen Polygon
C1603	10.52	18.91	11.34	35.76
Bee Cave/Lakeway	9.10	12.49	9.66	13.12
East Austin	6.40	25.47	6.89	30.50

For this analysis, CAPCOG was less concerned about the idea of a gap in coverage because the monitors in Bastrop, Caldwell, Hays, and Williamson Counties would each be "covering" the upwind side of the urban area. CAMS 171 would be physically closer to the center of the county than either of the other two options, but would be far enough away from CAMS 3 (6.89 miles) so as not to be duplicative.

Table 6-8. Monitoring Distance Analysis for Bastrop and Elgin Option for 8-Monitor Configuration (mi.)

Location	Distance to County Centroid	Distance to MSA Boundary	Shortest Distance to Monitor in Adjacent Thiessen Polygon	Furthest Distance to Monitor in Adjacent Thiessen Polygon
Bastrop	0.27	15.02	17.76	27.02
Elgin	17.93	4.70	15.96	22.10

Table 6-9. Monitoring Distance Analysis for Elgin and Smithville Option for 8-Monitor Configuration (mi.)

Location	Distance to County Centroid	Distance to MSA Boundary	Shortest Distance to Monitor in Adjacent Thiessen Polygon	Furthest Distance to Monitor in Adjacent Thiessen Polygon
Elgin	17.93	4.70	15.96	37.33
Smithville	12.33	2.78	28.55	32.58

Between these two options, the Bastrop/Elgin option provides a tighter network with smaller gaps between the monitoring stations along the eastern side of the MSA.

6.2 Detailed Cost Analysis

This section provides a more detailed break-down of the cost analysis than what was presented to the CAC and explains the basis for the estimates, with an adjustment to account for the need for a trailer at the new East Austin site. This section also includes an analysis of the additional costs for utilities, LEADS licenses, and monthly reports for 2019-2023, which can be used for CAPCOG's budgeting and planning.

6.2.1 Detailed Break-Down of Cost Analysis Presented to CAC

For the cost analysis presented to the CAC, CAPCOG assumed:

- Option 1: Continuation of costs in CAPCOG's 2018 monitoring contract with a 3% inflation factor each year
- Option 2: The cost for full decommissioning of all eight O_3 stations at the end of 2018 as detailed in CAPCOG's 2018 monitoring contract
- Option 3:
    - Continuation of costs in CAPCOG's 2018 monitoring contract with a 3% inflation factor each year for CAMS 614, 690, 1604, 1675, and 6602
    - Decommissioning of O_3 monitoring at CAMS 601 and the entire CAMS 684 and CAMS 1603 stations after the end of the 2018 O_3 season
    - The purchase of one trailer, based on costs being about $1,000 higher than the last trailer CAPCOG purchased for CAMS 6602
    - The installation costs for one new site in Bastrop, based on the most recent costs for establishing the new location for CAMS 6602 in 2015
- Option 4:
    - Continuation of costs in CAPCOG's 2018 monitoring contract with a 3% inflation factor each year for CAMS 614, 690, 1604, 1675, and 6602
    - Decommissioning of O_3 monitoring at CAMS 601 and the entire CAMS 684 and CAMS 1603 stations after the end of the 2018 O_3 season
    - The purchase of one trailer, based on costs being about $1,000 higher than the last trailer CAPCOG purchased for CAMS 6602
    - The installation costs for one new site in Bastrop, based on the most recent costs for establishing the new location for CAMS 6602 in 2015
    - Ongoing operating costs at three new stations based on the average annual cost for all eight of CAPCOG's current monitoring stations except for CAMS 1603 (due to the high set-up costs for that station that would not be expected elsewhere), with a 3% inflation factor each year
- Option 5:
    - Continuation of costs in CAPCOG's 2018 monitoring contract with a 3% inflation factor each year for CAMS 614, 690, 1604, 1675, and 6602
    - Decommissioning of O_3 monitoring at CAMS 601 and the entire CAMS 684 and CAMS 1603 stations after the end of the 2018 O_3 season

- The purchase of three trailers, based on costs being about $1,000 higher than the last trailer CAPCOG purchased for CAMS 6602
- The installation costs for three new sites in Bastrop, Elgin, and East Austin, based on the most recent costs for establishing the new location for CAMS 6602 in 2015
- Ongoing operating costs at three new stations based on the average annual cost for all eight of CAPCOG's current monitoring stations except for CAMS 1603 (due to the high set-up costs for that station that would not be expected elsewhere), with a 3% inflation factor each year

The following tables provide a detailed accounting of the costs by activity and year, except that costs for equipment in 2019 for options 4 and 5 have been adjusted to account for the likely need for a trailer in East Austin based on information CAPCOG received following the CAC meeting from TCEQ.

Table 6-10. 2019 Detailed Cost Estimate for CAC Presentation

Activity	Option 1	Option 2	Option 3	Option 4	Option 5
Set-Up	$13,149.46	$0.00	$7,111.67	$8,323.78	$9,535.90
Maintenance	$45,276.50	$0.00	$33,895.71	$39,583.67	$45,271.63
Calibrations	$26,118.49	$0.00	$19,580.23	$22,861.99	$26,143.74
Data Validations	$16,249.28	$0.00	$12,186.96	$14,218.12	$16,249.28
Shut-Downs	$3,965.21	$0.00	$2,972.83	$3,470.60	$3,968.37
Decommission	$0	$21,669.72	$8,566.75	$8,566.75	$8,566.75
Trailer	$0	$0.00	$16,000.00	$32,000.00	$48,000.00
Installation	$0	$0.00	$5,000.00	$10,000.00	$15,000.00
TOTAL	**$104,758.95**	**$21,669.72**	**$105,314.15**	**$139,024.91**	**$172,735.67**

Table 6-11. 2020 Detailed Cost Estimate for CAC Presentation

Activity	Option 1	Option 2	Option 3	Option 4	Option 5
Set-Up	$13,543.95	$0.00	$7,325.02	$8,573.50	$9,821.97
Maintenance	$46,634.80	$0.00	$34,912.58	$40,771.18	$46,629.78
Calibrations	$26,902.05	$0.00	$20,167.64	$23,547.85	$26,928.05
Data Validations	$16,736.76	$0.00	$12,552.57	$14,644.66	$16,736.76
Shut-Downs	$4,084.17	$0.00	$3,062.01	$3,574.72	$4,087.42
Decommission	$0	$0.00	$0.00	$0.00	$0.00
Trailer	$0	$0.00	$0.00	$0.00	$0.00
Installation	$0	$0.00	$0.00	$0.00	$0.00
TOTAL	**$107,901.72**	**$0.00**	**$78,019.82**	**$91,111.90**	**$104,203.99**

Table 6-12. 2021 Detailed Cost Estimate for CAC Presentation

Activity	Option 1	Option 2	Option 3	Option 4	Option 5
Set-Up	$13,950.27	$0.00	$7,544.77	$8,830.70	$10,116.63
Maintenance	$48,033.84	$0.00	$35,959.96	$41,994.32	$48,028.68
Calibrations	$27,709.11	$0.00	$20,772.67	$24,254.28	$27,735.90
Data Validations	$17,238.86	$0.00	$12,929.15	$15,084.00	$17,238.86
Shut-Downs	$4,206.69	$0.00	$3,153.87	$3,681.96	$4,210.04

Activity	Option 1	Option 2	Option 3	Option 4	Option 5
Decommission	$0	$0.00	$0.00	$0.00	$0.00
Trailer	$0	$0.00	$0.00	$0.00	$0.00
Installation	$0	$0.00	$0.00	$0.00	$0.00
TOTAL	**$111,138.77**	**$0.00**	**$80,360.42**	**$93,845.26**	**$107,330.11**

Table 6-13. 2022 Detailed Cost Estimate for CAC Presentation

Activity	Option 1	Option 2	Option 3	Option 4	Option 5
Set-Up	$14,368.77	$0.00	$7,771.12	$9,095.62	$10,420.13
Maintenance	$49,474.86	$0.00	$37,038.76	$43,254.15	$49,469.54
Calibrations	$28,540.38	$0.00	$21,395.85	$24,981.91	$28,567.97
Data Validations	$17,756.03	$0.00	$13,317.02	$15,536.52	$17,756.03
Shut-Downs	$4,332.89	$0.00	$3,248.49	$3,792.42	$4,336.34
Decommission	$0	$0.00	$0.00	$0.00	$0.00
Trailer	$0	$0.00	$0.00	$0.00	$0.00
Installation	$0	$0.00	$0.00	$0.00	$0.00
TOTAL	**$114,472.93**	**$0.00**	**$82,771.23**	**$96,660.62**	**$110,550.01**

Table 6-14. 2023 Detailed Cost Estimate for CAC Presentation

Activity	Option 1	Option 2	Option 3	Option 4	Option 5
Set-Up	$14,799.84	$0.00	$8,004.25	$9,368.49	$10,732.73
Maintenance	$50,959.10	$0.00	$38,149.92	$44,551.77	$50,953.62
Calibrations	$29,396.59	$0.00	$22,037.72	$25,731.37	$29,425.01
Data Validations	$18,288.71	$0.00	$13,716.53	$16,002.62	$18,288.71
Shut-Downs	$4,462.88	$0.00	$3,345.94	$3,906.19	$4,466.43
Decommission	$0	$0.00	$0.00	$0.00	$0.00
Trailer	$0	$0.00	$0.00	$0.00	$0.00
Installation	$0	$0.00	$0.00	$0.00	$0.00
TOTAL	**$117,907.12**	**$0.00**	**$85,254.37**	**$99,560.44**	**$113,866.51**

Table 6-15. 2019-2023 Detailed Cost Estimate for CAC Presentation by Year

Year	Option 1	Option 2	Option 3	Option 4	Option 5
2019	$104,758.95	$21,669.72	$105,314.15	$139,024.91	$172,735.67
2020	$107,901.72	$0.00	$78,019.82	$91,111.90	$104,203.99
2021	$111,138.77	$0.00	$80,360.42	$93,845.26	$107,330.11
2022	$114,472.93	$0.00	$82,771.23	$96,660.62	$110,550.01
2023	$117,907.12	$0.00	$85,254.37	$99,560.44	$113,866.51
TOTAL	**$556,179.50**	**$21,669.72**	**$431,719.98**	**$520,203.13**	**$608,686.29**

6.2.2 Break-Down of Additional Costs

Additional costs associated with monitoring that were not presented to the CAC are summarized below, including utilities, LEADS collateral licenses, and monthly reports. As the tables show, while these costs do collectively constitute a non-negligible portion of the cost of conducting monitoring over the next five years, there is less than a $7,000 difference between the highest-cost and lowest-cost options that involve continuing to conduct monitoring.

Table 6-16. 2019-2023 Additional Cost Estimates by Object of Expense

Year	Option 1	Option 2	Option 3	Option 4	Option 5
Utilities	$27,700.12	$0.00	$20,775.09	$24,237.61	$27,700.12
LEADS Licenses	$16,405.23	$0.00	$16,405.23	$16,405.23	$16,405.23
Monthly Reports	$7,108.93	$0.00	$7,108.93	$7,108.93	$7,108.93
TOTAL	**$51,214.28**	**$0.00**	**$44,289.25**	**$47,751.77**	**$51,214.28**

Table 6-17. 2019-2023 Additional Cost Estimates by Year

Year	Option 1	Option 2	Option 3	Option 4	Option 5
2019	$9,646.44	$0.00	$8,342.08	$8,994.26	$9,646.44
2020	$9,935.84	$0.00	$8,592.35	$9,264.09	$9,935.84
2021	$10,233.91	$0.00	$8,850.12	$9,542.01	$10,233.91
2022	$10,540.93	$0.00	$9,115.62	$9,828.27	$10,540.93
2023	$10,857.16	$0.00	$9,389.09	$10,123.12	$10,857.16
TOTAL	**$51,214.28**	**$0.00**	**$44,289.25**	**$47,751.77**	**$51,214.28**

6.2.3 Combined Costs by Year

For planning purposes, the following table represents the marginal costs of each of the five options for which cost analyses were conducted, including both sets of information above.

Table 6-18. 2019-2023 Total Cost Estimates by Year

Year	Option 1	Option 2	Option 3	Option 4	Option 5
2019	$114,405	$21,670	$113,656	$148,019	$182,382
2020	$117,838	$0	$86,612	$100,376	$114,140
2021	$121,373	$0	$89,211	$103,387	$117,564
2022	$125,014	$0	$91,887	$106,489	$121,091
2023	$128,764	$0	$94,643	$109,684	$124,724
TOTAL	**$607,394**	**$21,670**	**$476,009**	**$567,955**	**$659,901**

6.3 National-Level Comparison with 2017 Population Estimates

In Section 2.1, CAPCOG used the 2012-2016 American Community Survey (ACS) data to determine which metro areas in the country were used for the comparison of the level of monitoring in the Austin-Round Rock MSA to similarly-sized metro areas across the country. Upon comparison of the 2012-2016 ACS and the 2017 Current Population Estimates, CAPCOG noted that different MSAs were listed as the five metro areas ranked immediately higher and five metro areas ranked immediately lower than the Austin-Round

Rock MSA. Therefore, CAPCOG analyzed the level of monitoring for the similarly-sized metro areas using the 2017 Population Estimate data.

Table 6-19. National-Level MSA Coverage Comparison

MSA Rank	MSA	2016 O_3 Design Value (ppb)	% of 2015 O_3 NAAQS	2017 Population [24]	Number of Regulatory Ozone Monitors	Required Number of Regulatory Ozone Monitors	Extra Regulatory Ozone Monitors
26	Pittsburgh, PA[25]	70	100%	2,333,367	10	2	8
27	Sacramento--Roseville--Arden-Arcade, CA[26]	85	121%	2,324,884	15	2	13
28	Las Vegas-Henderson-Paradise, NV[27]	74	106%	2,204,079	12	2	10
29	Cincinnati, OH-KY-IN[28]	72	103%	2,179,082	7	2	5
30	Kansas City, MO-KS	67	96%	2,128,912	8	2	6
31	**Austin-Round Rock, TX**	**66**	**94%**	**2,115,827**	**2**	**2**	**0**
32	Columbus, OH	71	101%	2,078,725	6	2	4
33	Cleveland-Elyria, OH	75	107%	2,058,844	9	2	7
34	Indianapolis-Carmel-Anderson, IN	69	99%	2,028,614	12	2	10

[24] https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=PEP_2017_PEPANNRES&prodType=table

[25] https://www.epa.gov/sites/production/files/2017-11/documents/paplan2017.pdf and https://www.epa.gov/sites/production/files/2017-11/documents/paplan2017_-_achd.pdf

[26] http://www.airquality.org/ProgramCoordination/Documents/2017%20Annual%20Network%20Plan.pdf

[27] https://www.epa.gov/sites/production/files/2017-10/documents/clarkplan2017.pdf

[28] http://www.epa.state.oh.us/Portals/27/ams/sites/2017/Air%20Monitoring%20Network%20Plan%202017-2018.pdf

MSA Rank	MSA	2016 O_3 Design Value (ppb)	% of 2015 O_3 NAAQS	2017 Population [24]	Number of Regulatory Ozone Monitors	Required Number of Regulatory Ozone Monitors	Extra Regulatory Ozone Monitors
35	San Jose-Sunnyvale-Santa Clara, CA	70	100%	1,998,463	6	2	4
36	Nashville-Davidson--Murfreesboro--Franklin, TN	67	96%	1,903,045	3	2	1

As the table above indicates, the Austin area is the only metro area among the 11 analyzed that has fewer than three regulatory O_3 monitors, with other areas having between 3 and 15 regulatory O_3 monitors, and averaging 8.

The following three figures show a comparison of the Austin-Round Rock MSA to these other metro areas in terms of 2016 O_3 design value, 2017 population, and land area.

Figure 6-1. Number of Regulatory Ozone Monitors v. 2016 O3 Design Value for Similarly-Sized MSAs Nationwide, 2017

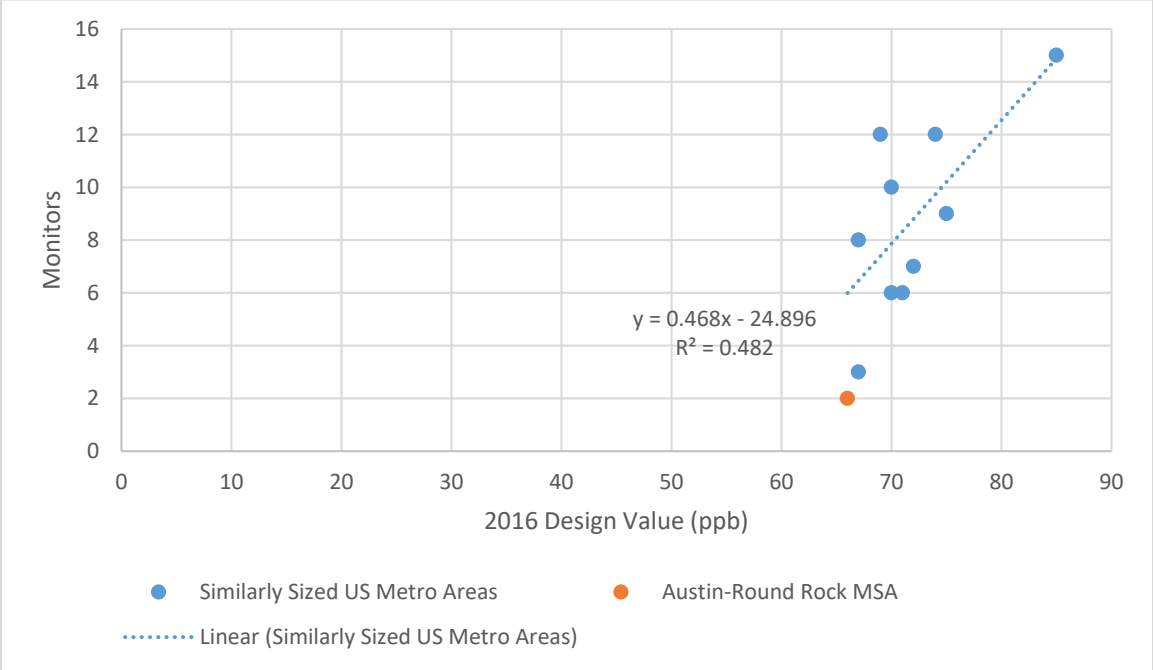


Figure 6-2. Number of Regulatory Ozone Monitors v. Population for Similarly-Sized MSAs Nationwide, 2017

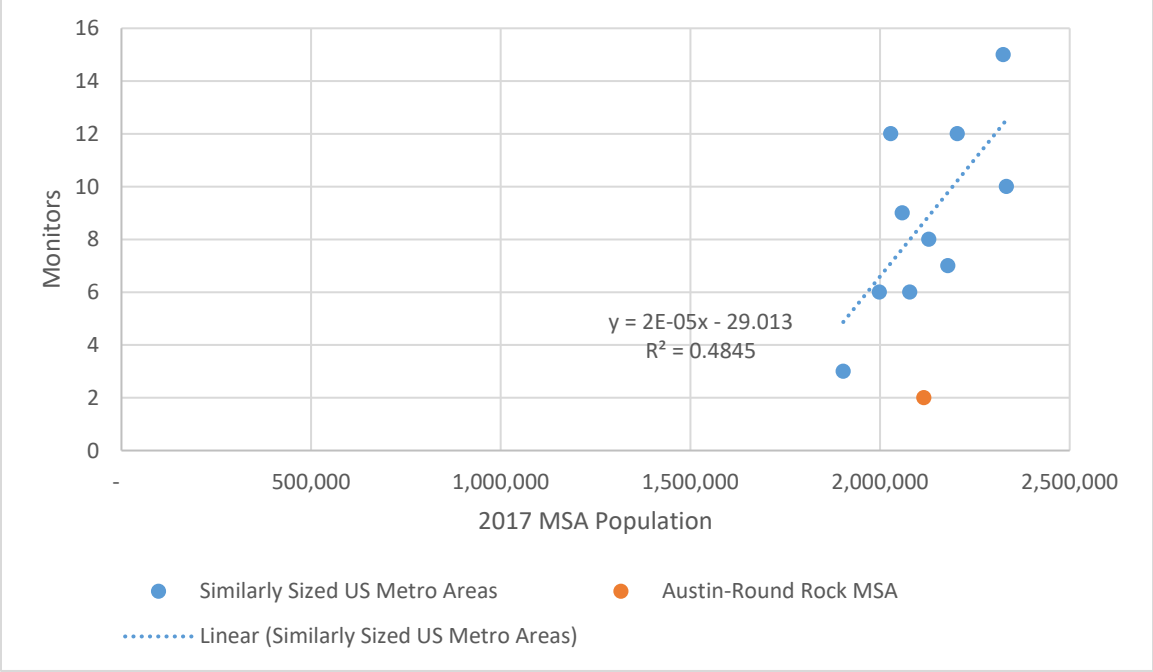
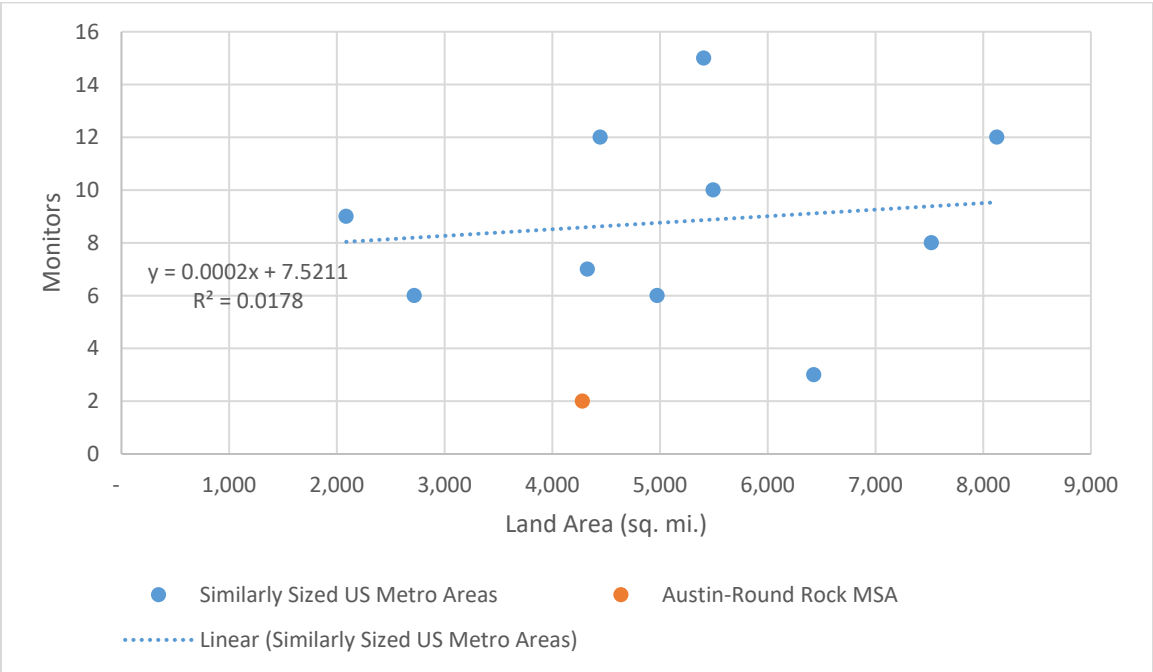


Figure 6-3. Number of Regulatory Ozone Monitors v. Land Area for Similarly-Sized MSAs Nationwide, 2017



In order for the Austin-Round Rock MSA to have comparable coverage in terms of 2016 O_3 design value, 2017 population, and land area, the MSA would need:

- 5.99 regulatory monitors in terms of O_3 design value
- 13.03 regulatory monitors in terms of population

- 8.38 regulatory monitors in terms of land area

With the 2017 population estimate analysis, the MSA would need an additional three to eleven regulatory monitors in order to have coverage comparable to these other MSAs.

6.4 Population within a Four Kilometer Radii of O_3 Monitors

In order to understand the "neighborhood-scale" of monitoring, CAPCOG analyzed the total population and the environmental justice (EJ) populations within the Austin-Round Rock MSA from the 2012-2016 American Community Survey that resided within a 4 kilometer radius of an O_3 monitoring location considered in this analysis. The population metric is designed to represent the "public reporting of the AQI" purpose in EPA's monitoring network assessment, which is described as follows:

"Monitors located where people live, work, and play are important for addressing exposure and protecting public health."

It also corresponds to the "Population Served" site-by-site analysis technique described in Table 2-2 of EPA's guidance document[29]. Additionally, CAPCOG included the EJ population in this analysis to include the environmental justice purpose stated in EPA's monitoring network assessment guidance, which is described as follows:

"Monitoring in areas that have large low-income and/or minority populations may be of particular value for assessing environmental justice issues."

Since EPA's monitoring network guidance only referenced low-income and minority populations, CAPCOG only used these two factors in calculating the EJ population. For this analysis, "Minority" means Hispanic/Latino or non-white, and "Low-Income" means population in households with less than or equal to twice the federal "poverty level," corresponding to the definitions used by EPA for their "EJ Screen" tool.[30] CAPCOG created 4 kilometer buffers around each monitor and used the latest Census Bureau data for block-group populations[31] within the Austin-Round Rock MSA to calculate the number of MSA residents living closest to an ozone monitor for all of the alternative network configurations.

The following represent the relevant 2012-2016 populations within the MSA:

- Total population (Table B01003): 1,942,615
- Minority population (Table B03002): 906,243
- Low-income population (Table C17002): 557,075

[29] https://www3.epa.gov/ttnamti1/files/ambient/pm25/datamang/network-assessment-guidance.pdf
[30] https://www.epa.gov/ejscreen/overview-demographic-indicators-ejscreen
[31] https://factfinder.census.gov/bkmk/table/1.0/en/ACS/16_5YR/B01003/0500000US48021.15000|0500000US48055.15000|0500000US48149.15000|0500000US48209.15000|0500000US48453.15000|0500000US48491.15000

6.4.1 Current Monitor Configuration

The following table summarizes the total population, minority population, and low-income population in the Austin-Round Rock MSA within 4 km of each monitoring station, along with the total for the entire network.

Table 6-20. Total 2012-2016 MSA Populations and MSA EJ Population within 4 km of a Monitoring Location, Current 2018 Configuration

Monitor	Total Population	Minority Population	Low Income Population
CAMS 3	64,176	17,338	11,756
CAMS 38	21,923	6,323	2,235
CAMS 601	0	0	0
CAMS 614	3,870	802	614
CAMS 684	4,145	2,056	1,432
CAMS 690	10,021	1,511	1,628
CAMS 1603	40,495	12,769	4,050
CAMS 1604	10,093	6,482	3,040
CAMS 1675	33,623	19,402	16,298
CAMS 6602	17,124	8,564	3,377
Sum	**205,470**	**75,247**	**44,430**

Of the CAPCOG monitors, CAMS 1603 has the largest total population, whereas CAMS 1675 has the highest minority and low-income EJ populations within a 4 km radius of the monitoring site. Overall:

- 10.58% of the MSA's total population lives within 4 km of an O_3 monitoring station
- 8.30% of the MSA's minority population lives within 4 km of an O_3 monitoring station
- 7.98% of the MSA's low-income population lives within 4 km an O_3 monitoring station

This means that minority populations in the MSA are 21.50% less likely to live within 4 km of an O_3 monitor than the population at large, and are low-income populations in the MSA are 24.59% less likely to live within 4 km of an O_3 monitor than the population at large.

6.4.2 Six-Monitor Configuration

The following table shows the population and EJ analysis for the three configurations analyzed for a six-monitor configuration.

Table 6-21. Total MSA Population and MSA EJ Populations within 4 km of an O_3 Monitor for Six-Monitor Configuration 1

Monitor	Population	Minority Population	Low Income Population
CAMS 0003	64,176	17,338	11,756
CAMS 0038	21,923	6,323	2,235
CAMS 0614	3,870	802	614
CAMS 0684	4,145	2,056	1,432
CAMS 0690	10,021	1,511	1,628
CAMS 1604	10,093	6,482	3,040

Monitor	Population	Minority Population	Low Income Population
CAMS 1675	33,623	19,402	16,298
CAMS 6602	17,124	8,564	3,377
Sum	**164,976**	**62,479**	**40,382**

Table 6-22. Total MSA Population and MSA EJ Populations within 4 km of an O_3 Monitor for Six-Monitor Configuration 2

Monitor	Population	Minority Population	Low Income Population
CAMS 0003	64,176	17,338	11,756
CAMS 0038	21,923	6,323	2,235
CAMS 0614	3,870	802	614
CAMS 0690	10,021	1,511	1,628
CAMS 1604	10,093	6,482	3,040
CAMS 1675	33,623	19,402	16,298
CAMS 6602	17,124	8,564	3,377
City of Bastrop	7,746	2,606	2,195
Sum	**168,577**	**63,029**	**41,144**

Table 6-23. Total MSA Population and MSA EJ Populations within 4 km of an O_3 Monitor for Six-Monitor Configuration 3

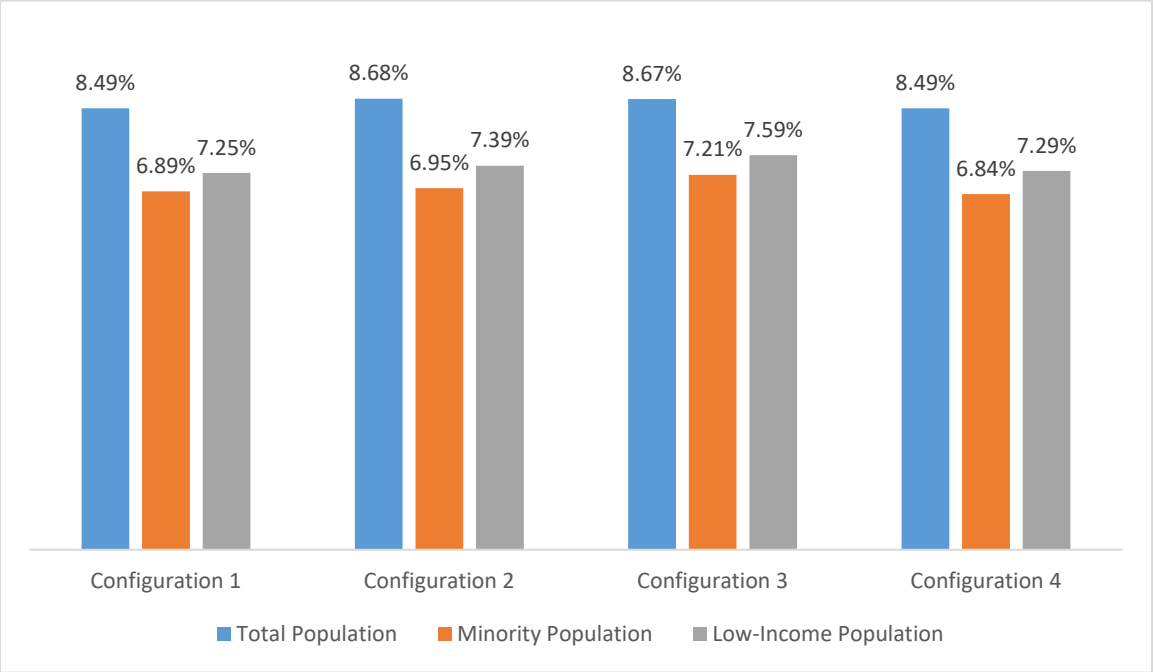
Monitor	Population	Minority Population	Low Income Population
CAMS 0003	64,176	17,338	11,756
CAMS 0038	21,923	6,323	2,235
CAMS 0614	3,870	802	614
CAMS 0690	10,021	1,511	1,628
CAMS 1604	10,093	6,482	3,040
CAMS 1675	33,623	19,402	16,298
CAMS 6602	17,124	8,564	3,377
City of Elgin	7,581	4,933	3,330
Sum	**168,412**	**65,355**	**42,279**

Table 6-24. Total MSA Population and MSA EJ Populations within 4 km of an O3 Monitor for Six-Monitor Configuration 4

Monitor	Population	Minority Population	Low Income Population
CAMS 1604	10,093	6,482	3,040
CAMS 1675	33,623	19,402	16,298
CAMS 3	64,176	17,338	11,756
CAMS 38	21,923	6,323	2,235
CAMS 614	3,870	802	614
CAMS 6602	17,124	8,564	3,377
CAMS 690	10,021	1,511	1,628
City of Smithville	4,112	1,591	1,652

Monitor	Population	Minority Population	Low Income Population
Sum	**164,943**	**62,014**	**40,602**

Figure 6-4. Comparison of Total MSA Population and EJ Populations within 4 km in 6-Monitor Configurations Evaluated



Of all the configurations, Configuration 2, City of Bastrop, has the largest total population within the buffer. However, Configuration 2 is second to Configuration 3, City of Elgin, in terms of the EJ population. Both configurations are an improvement over leaving CAMS 684 in place.

6.4.3 Seven-Monitor Configuration

The following tables show the population and EJ populations within 4 km of an O_3 monitor within the MSA.

Table 6-25. Total MSA Population and MSA EJ Populations within 4 km of an O_3 Monitor for Seven-Monitor Configuration 1

Monitor	Population	Minority Population	Low Income Population
CAMS 0003	64,176	17,338	11,756
CAMS 0038	21,923	6,323	2,235
CAMS 0614	3,870	802	614
CAMS 0690	10,021	1,511	1,628
CAMS 1603	40,495	12,769	4,050
CAMS 1604	10,093	6,482	3,040
CAMS 1675	33,623	19,402	16,298
CAMS 6602	17,124	8,564	3,377
City of Bastrop	7,746	2,606	2,195

Monitor	Population	Minority Population	Low Income Population
Sum	**209,071**	**75,798**	**45,194**

Table 6-26. Total MSA Population and MSA EJ Populations within 4 km of an O_3 Monitor for Seven-Monitor Configuration 2

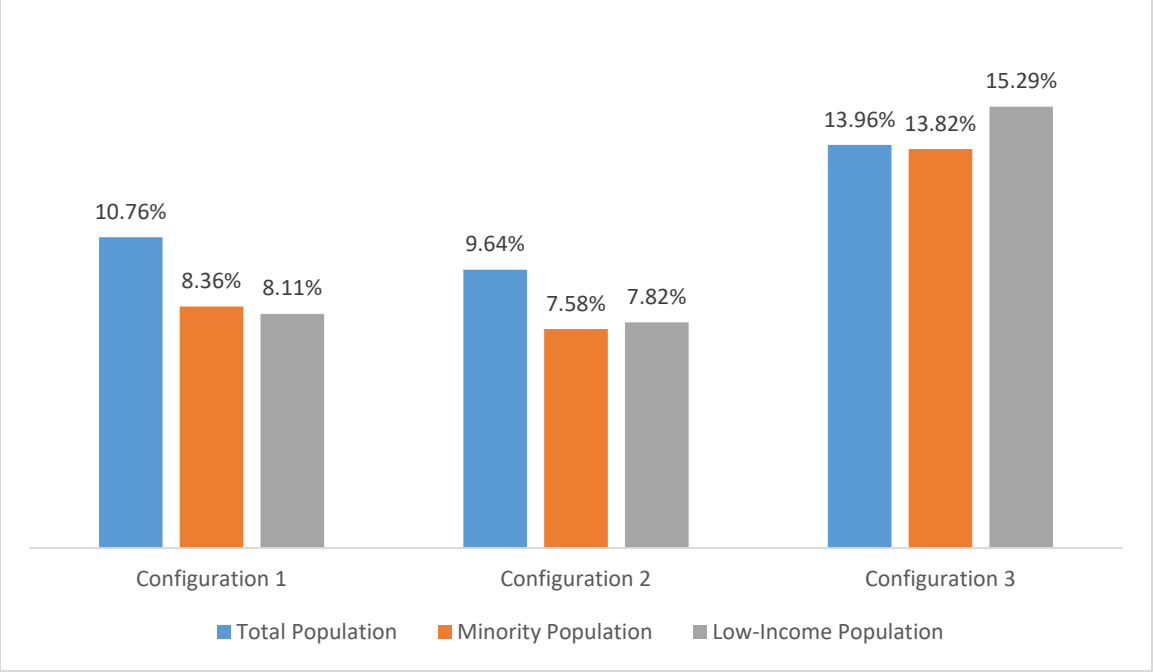
Monitor	Population	Minority Population	Low Income Population
CAMS 0003	64,176	17,338	11,756
CAMS 0038	21,923	6,323	2,235
CAMS 0614	3,870	802	614
CAMS 0690	10,021	1,511	1,628
CAMS 1604	10,093	6,482	3,040
CAMS 1675	33,623	19,402	16,298
CAMS 6602	17,124	8,564	3,377
City of Bastrop	7,746	2,606	2,195
Bee Cave/Lakeway	18,709	5,692	2,410
Sum	**187,285**	**68,721**	**43,555**

Table 6-27. Total MSA Population and MSA EJ Populations within 4 km of an O_3 Monitor for Seven-Monitor Configuration 3

Monitor	Population	Minority Population	Low Income Population
CAMS 0003	64,176	17,338	11,756
CAMS 0038	21,923	6,323	2,235
CAMS 0614	3,870	802	614
CAMS 0690	10,021	1,511	1,628
CAMS 1604	10,093	6,482	3,040
CAMS 1675	33,623	19,402	16,298
CAMS 6602	17,124	8,564	3,377
City of Bastrop	7,746	2,606	2,195
East Austin	102,659	62,214	44,022
Sum	**271,235**	**125,243**	**85,166**

A comparison of these three configurations is shown below.

Figure 6-5. Comparison of Total MSA Population and EJ Populations within 4 km in 7-Monitor Configurations Evaluated



As the comparison shows, configuration 3 (East Austin) significantly increases the share of the MSA's total population, minority population, and low-income population within 4 km of an O_3 monitor, whereas configuration 2 (Bee Cave/Lakeway) decreases all of those metrics compared to configuration 1 (SW Austin). Importantly, configuration 3 also dramatically improves the *relative* share of EJ populations close to a monitor compared to the population as a whole compared to configurations 1 and 2, bringing near-parity for minority populations and a better coverage for low-income populations than the population at large.

6.4.4 Eight-Monitor Configuration

The following tables show the population and EJ populations within 4 km of an O_3 monitor within the MSA.

Table 6-28. Total MSA Population and MSA EJ Populations within 4 km of an O_3 Monitor for Eight-Monitor Configuration 1

Monitor	Population	Minority Population	Low Income Population
CAMS 1604	10,093	6,482	3,040
CAMS 1675	33,623	19,402	16,298
CAMS 3	64,176	17,338	11,756
CAMS 38	21,923	6,323	2,235
CAMS 614	3,870	802	614
CAMS 6602	17,124	8,564	3,377
CAMS 690	10,021	1,511	1,628
City of Bastrop	7,746	2,606	2,195
City of Elgin	7,581	4,933	3,330

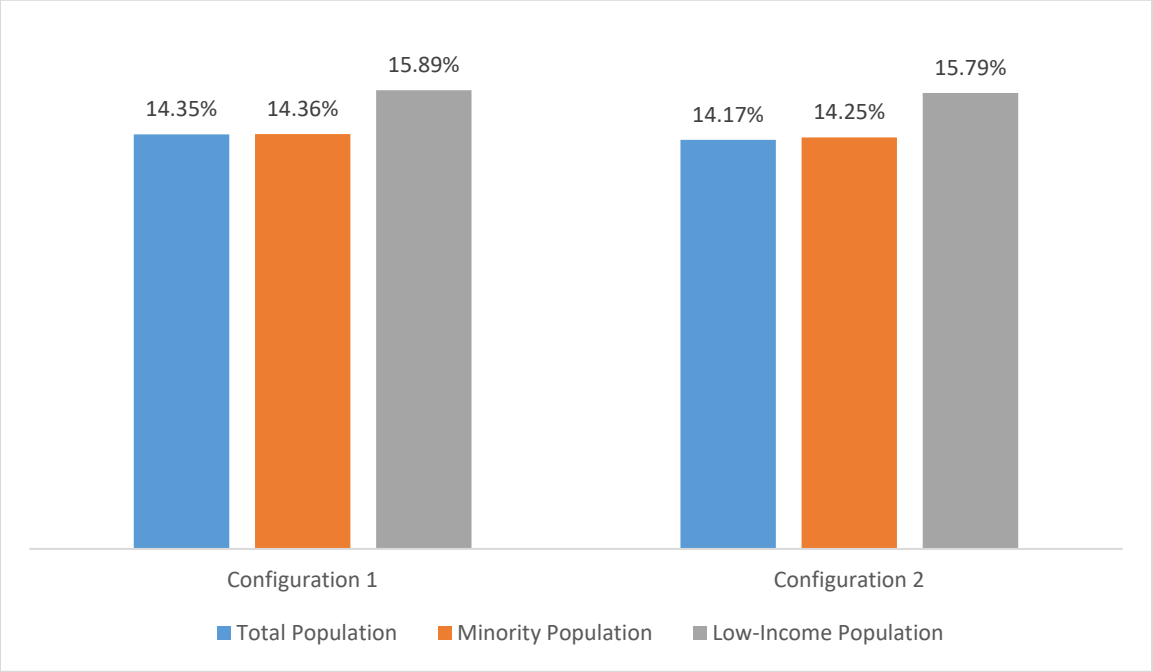
Monitor	Population	Minority Population	Low Income Population
East Austin	102,659	62,214	44,022
Sum	**278,816**	**130,176**	**88,496**

Table 6-29. Total MSA Population and MSA EJ Populations within 4 km of an O_3 Monitor for Eight-Monitor Configuration 2

Monitor	Population	Minority Population	Low Income Population
CAMS 1604	10,093	6,482	3,040
CAMS 1675	33,623	19,402	16,298
CAMS 3	64,176	17,338	11,756
CAMS 38	21,923	6,323	2,235
CAMS 614	3,870	802	614
CAMS 6602	17,124	8,564	3,377
CAMS 690	10,021	1,511	1,628
City of Elgin	7,581	4,933	3,330
City of Smithville	4,112	1,591	1,652
East Austin	102,659	62,214	44,022
Sum	**275,182**	**129,160**	**87,953**

Between these two options, Configuration 1, Bastrop/Elgin, has the largest total population and environmental justice population within a 4 kilometer radius of the monitors. The figure below shows the comparison.

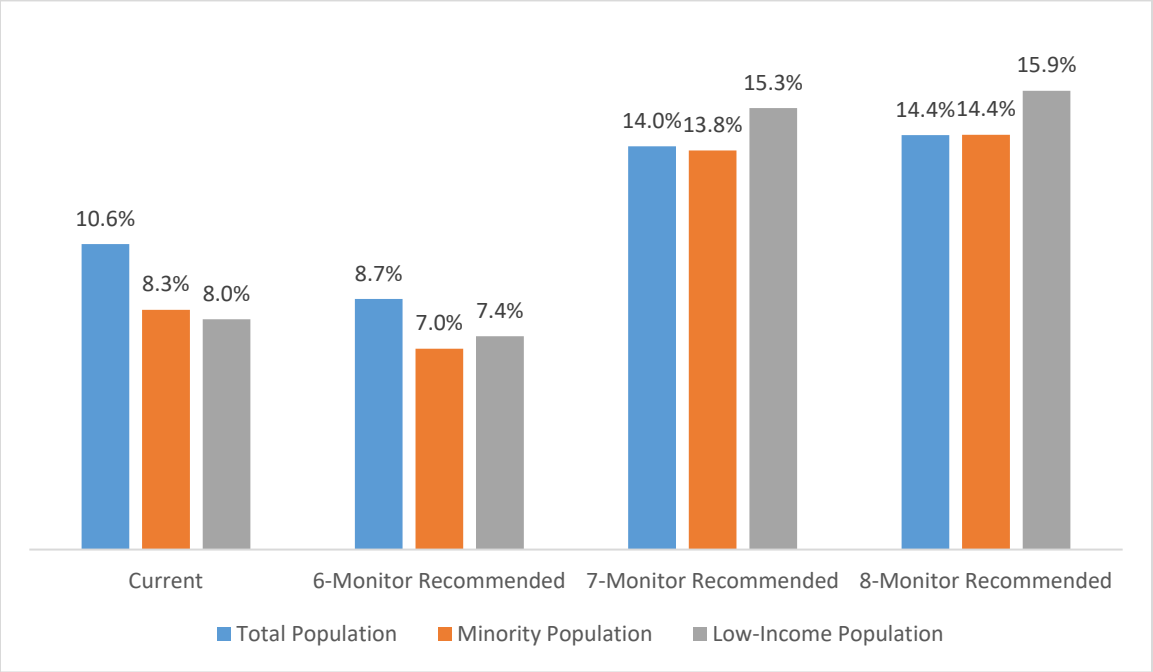
Figure 6-6. Comparison of Total MSA Population and EJ Populations within 4 km in 8-Monitor Configurations Evaluated



6.4.5 Comparison Across Scenarios

The following figure compares the current configurations to the recommended configurations for six, seven, and eight monitors.

Figure 6-7. Comparison of Total MSA Population and EJ Populations within 4 km Across All Scenarios



As the figure shows, the recommended seven-monitor and eight monitor configurations would increase the share of the MSA's population and EJ populations within 4 km of an O_3 monitor compared to the current configuration, and would also substantially increase the parity between EJ communities relative to the general population in terms of the share of population within 4 km of a station.