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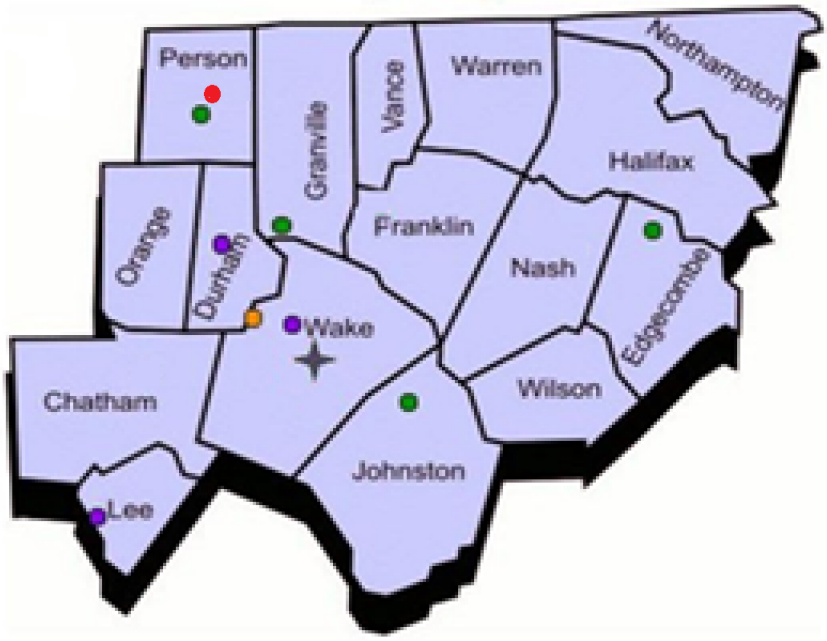
2017-2018 Annual Monitoring Network Plan for the North Carolina Division Of Air Quality

Volume 2

Site Descriptions by Division of Air Quality Regional Office and Metropolitan Statistical Area

D. The Raleigh Monitoring Region



June 30, 2017

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D. The Raleigh Monitoring Region

The Raleigh monitoring region of North Carolina, shown in Figure D1, consists of six sections: (1) the Durham-Chapel Hill metropolitan statistical area, MSA, - Chatham, Durham, Orange and Person counties, (2) the northeastern Piedmont - Granville, Halifax, Northampton, Vance and Warren counties, (3) the Raleigh MSA - Franklin, Johnston and Wake counties, (4) the Rocky Mount MSA - Edgecombe and Nash counties, (5) the Wilson micropolitan statistical area - Wilson County and (6) the Sanford micropolitan statistical area - Lee County.

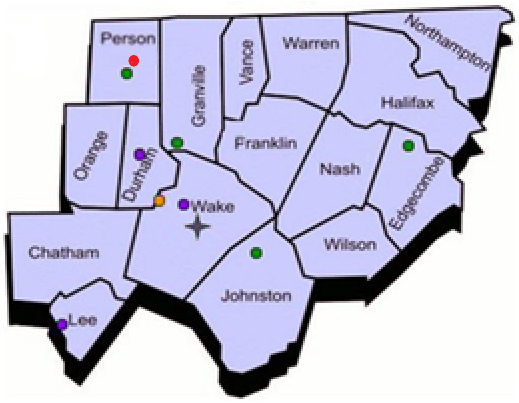


Figure D1. The Raleigh monitoring region
The dots show the approximate locations of most of the monitoring sites in this region.

(1) Durham-Chapel Hill MSA

The Durham-Chapel Hill MSA consists of four counties: Chatham, Durham, Orange and Person. The major metropolitan areas are the cities of Durham and Chapel Hill. The North Carolina Division of Air Quality, DAQ, currently operates two monitoring sites in the Durham-Chapel Hill MSA. These sites are located at the Durham Armory in the City of Durham in Durham County and Bushy Fork in Person County. Starting on Jan. 1, 2017, DAQ in cooperation with Duke Energy Progress started operating a third site in Semora (Person County). The locations of these monitors are shown in Figure D2. The seasonal ozone monitor in Pittsboro in Chatham County was shut down on Oct. 31, 2015, at the end of ozone season and the rotating sulfur dioxide monitor was shut down on Feb. 4, 2015.

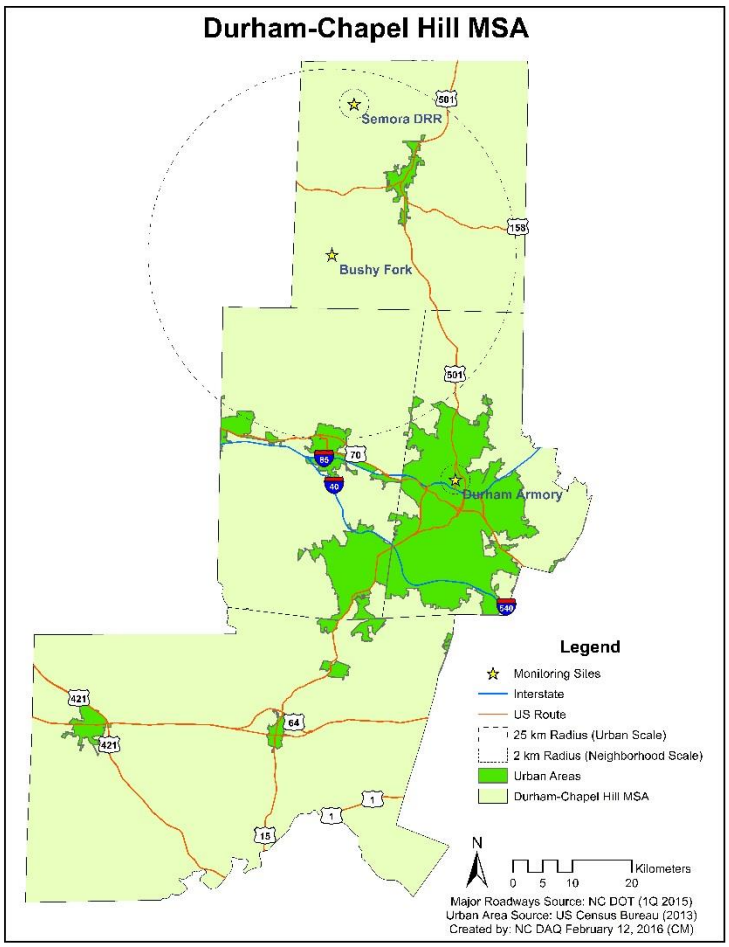


Figure D2. Location of monitors in the Durham-Chapel Hill MSA.

At the Durham Armory site the DAQ operates a seasonal ozone monitor, a one-in-three-day fine particle FRM monitor, a continuous low volume PM_{10} monitor and a continuous fine particle monitor. The site, as well as views looking north, northeast, east, southeast, south, southwest, west and northwest, is shown in Figure D3 through Figure D11. This fine-particle monitoring site is the design value site for the MSA. On Jan. 1, 2011, the DAQ started operating a low volume PM_{10} monitor at the site to meet minimum PM_{10} monitoring requirements in the Durham-Chapel Hill MSA and to provide $PM_{10-2.5}$ data. In May 2015, this monitor was changed to a continuous low volume PM_{10} monitor.

Figure D3. The Durham Armory ozone, sulfur dioxide and particle monitoring site

Figure D4. Looking north from the Durham Armory site

Figure D5. Looking east from the Durham Armory site

Figure D6. Durham Armory site looking northwest

Figure D7. Looking west from the Durham Armory site

Figure D8. Durham Armory site looking southwest

Figure D9. Durham Armory site looking northeast

Figure D10. Durham Armory site looking southeast

Figure D11 Looking south from the Durham Armory site

At the Bushy Fork site, the DAQ operates a seasonal ozone monitor. A special purpose sulfur dioxide monitor operated for 12 months from June 2014 through May 2015 to provide background sulfur dioxide concentrations for Person County to support modeling requirements for the sulfur dioxide national ambient air quality standard, NAAQS. A picture of the site as well as views looking north, east, south and west are provided in Figure D12 through Figure D16.

Figure D12. Bushy Fork ozone monitoring site

Figure D13. Bushy Fork site looking north

Figure D15. Bushy Fork site looking east

Figure D14. Bushy Fork site looking west

Figure D16. Bushy Fork site looking south

At the Semora DRR site, DAQ operates a source-oriented sulfur dioxide monitor to meet the requirements in the 2010 sulfur dioxide data requirements rule. The monitor will operate for a minimum of three years from 2017 to 2019 to ensure that ambient air in the proximity of the Duke Energy Progress Roxboro plant meets the national ambient air quality standards. An aerial view of the site in relationship to the Roxboro facility as well as views looking north, east, south and west from the location are provided in Figure D17 through Figure D21. Additional details on the site as well as on how the site location was chosen are provided in Appendix D-3. Duke Energy Roxboro Siting Analysis and Additional Site Information.

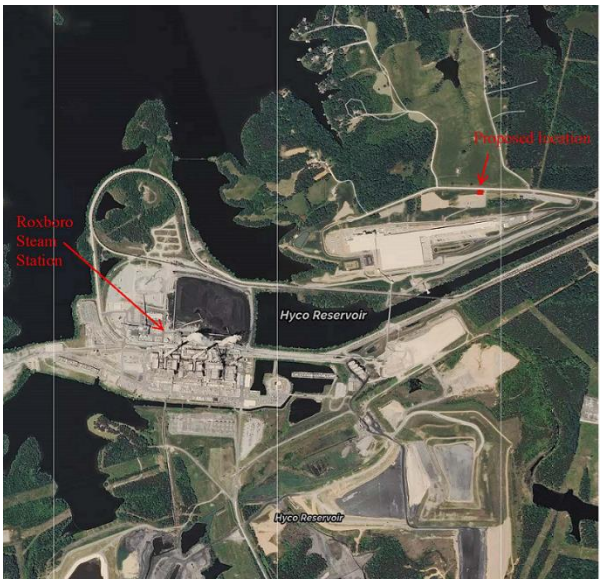


Figure D17. Aerial view showing the location of the Semora DRR monitoring station

Figure D18. Looking north from the Semora DRR monitoring station

Figure D19. Looking east from the Semora DRR site

Figure D20. Looking west from the Semora DRR site

Figure D21. Looking south from the Semora DRR site

In 2008 EPA expanded the **lead** monitoring network to support the lower lead NAAQS of 0.15 micrograms per cubic meter.[1] On Dec. 27, 2010, the EPA revised the monitoring requirements to focus on fence line monitoring located at facilities that emit 0.5 tons or more of lead per year and at National Core, NCore, monitoring sites.[2] On March 28, 2016, the EPA finalized changes to ambient monitoring quality assurance and other requirements, which removed the requirement for lead monitoring at NCore monitoring stations in urban areas with populations greater than 500,000.[3] These changes to the lead monitoring network requirements did not require any lead monitoring in the Durham-Chapel Hill MSA. The Duke Progress Energy Roxboro electricity generating facility emitted 91.1 pounds of lead in 2015,[4] well below the 0.5-ton threshold. In addition, modeling performed in 2009 indicated the concentrations of lead in ambient air around the facility are less than 0.01 micrograms per cubic meter, which is far enough below the NAAQS that no fence-line monitoring is required for this facility.

[1] National Ambient Air Quality Standards for Lead, Federal Register, Vol. 73, No. 219, \ Wednesday, Nov. 12, 2008, p. 66964, available on the worldwide web at https://www.gpo.gov/fdsys/pkg/FR-2008-11-12/pdf/E8-25654.pdf.

[2] Revisions to Lead Ambient Air Monitoring Requirements, Federal Register, Vol. 75, No. 247, Monday, Dec. 27, 2010, p. 81126, available on the worldwide web at https://www.gpo.gov/fdsys/pkg/FR-2010-12-27/pdf/2010-32153.pdf#page=1.

[3] Revisions to Ambient Monitoring Quality Assurance and Other Requirements, Federal Register, Vol. 81, No. 59, Monday, March 28, 2016, p. 17248, available on the worldwide web at https://www.gpo.gov/fdsys/pkg/FR-2016-03-28/pdf/2016-06226.pdf.

[4] North Carolina Criteria and Toxic Air Pollutant Point Source Emissions Report, available on the worldwide web at https://xapps.ncdenr.org/aq/ToxicsReport/ToxicsReportFacility.jsp?ibeam=true&year=2015&sorting=103&overridetype=All&pollutant=153&county_code=145, accessed April 25, 2017.

Currently, the MSA is required to operate two **ozone** monitors – one at the Durham Armory, 37-063-0015, and one at Bushy Fork, 37-145-0003. Beginning in 2017, seasonal ozone monitoring starts on March 1 instead of April 1. The 2010 **nitrogen dioxide** monitoring requirements,[5] as modified in 2016, [6] do not require the Durham-Chapel Hill MSA to monitor for nitrogen dioxide.

The 2010 **sulfur dioxide monitoring** requirements added additional monitoring in this MSA. Because of power generating facilities located in Person and Chatham counties and a large population base, a population-weighted emission index, PWEI, population exposure monitor was added at the Armory site. Figure D22 shows the location of the PWEI monitor relative to where people lived based on the 2000 census. Figure D23 shows the distribution of sulfur dioxide emissions among the counties in the MSA. The closest permitted source of sulfur dioxide to the Armory site is Carolina Sunrock, located 3.25 kilometers southeast of the site, as shown in Figure D24. Carolina Sunrock reported emitting 5.4 tons of sulfur dioxide in 2011.[7] As mentioned earlier an additional source-oriented sulfur dioxide monitor was added in this MSA on Jan. 1, 2017.

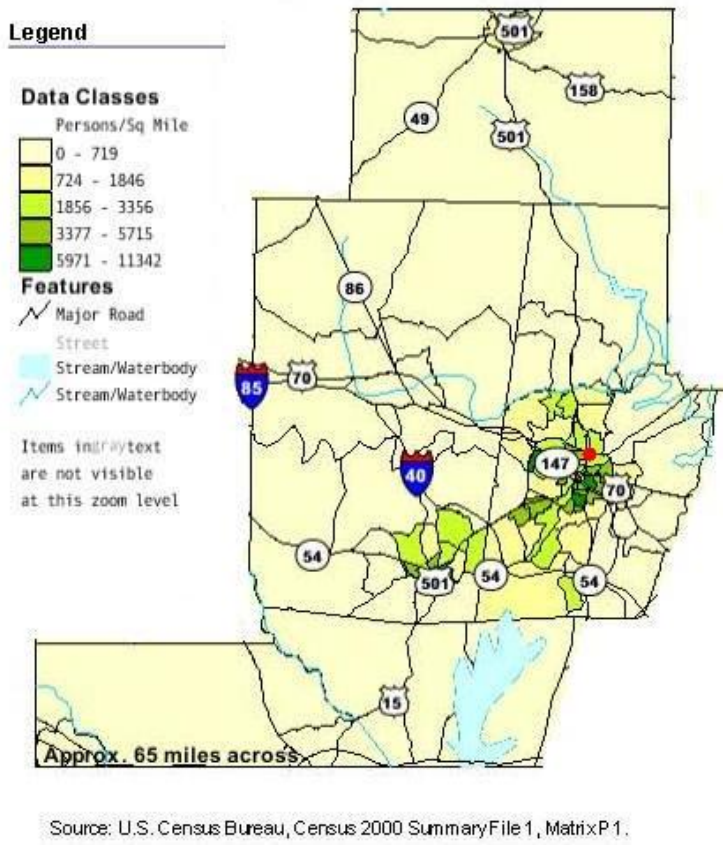


Figure D22. Location of Durham-Chapel Hill PWEI monitor in relationship to centers of population in 2000

[5] Primary National Ambient Air Quality Standards for Nitrogen Dioxide, Federal Register**,** Vol. 75, No. 26, Feb. 9, 2010, available on the worldwide web at https://www3.epa.gov/ttn/naaqs/standards/nox/fr/20100209.pdf.
[6] Revision to the Near-road NO2 Minimum Monitoring Requirements, Federal Register**,** Vol. 81, No. 251, Dec. 30, 2016, available on the worldwide web at https://www.gpo.gov/fdsys/pkg/FR-2016-12-30/pdf/2016-31645.pdf.
[7] North Carolina Criteria and Toxic Air Pollutant Point Source Emissions Report, available on the worldwide web at https://xapps.ncdenr.org/aq/ToxicsReport/ToxicsReportFacility.jsp?ibeam=true&year=2015&pollutant=264&county_code=063, accessed April 25, 2017.

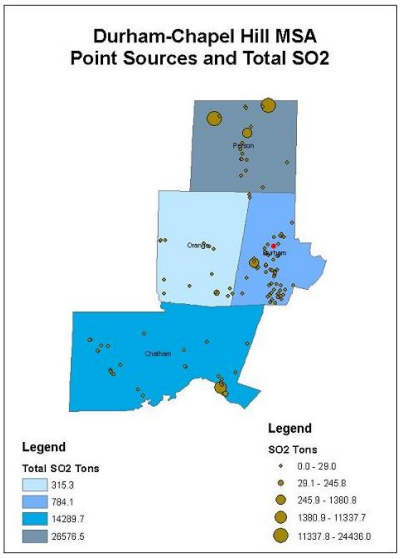


Figure D23. Location of the Durham-Chapel Hill PWEI sulfur dioxide monitor, red dot, in relationship to sulfur dioxide sources

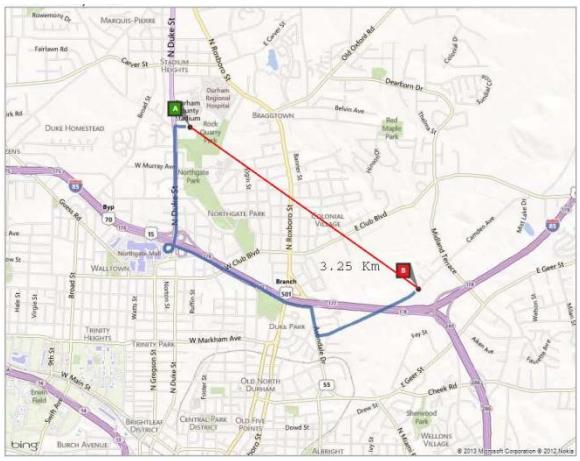


Figure D24. Location of the Armory monitoring site, A, in relationship to Carolina Sunrock, B

Changes to the **carbon monoxide monitoring** requirements did not add additional monitoring to this MSA because the population is less than one million.

(2) The Northeastern Piedmont

The northeastern Piedmont consists of five counties: Granville, Halifax, Northampton, Vance and Warren. There is not an MSA in these counties; however, Henderson micropolitan statistical area is in Vance County and the Roanoke Rapids micropolitan statistical area consists of Halifax and Northampton counties. The DAQ currently operates one monitoring site in the northeastern piedmont. This site is located at Butner (Granville County). The location of this monitoring site is shown in Figure D25.

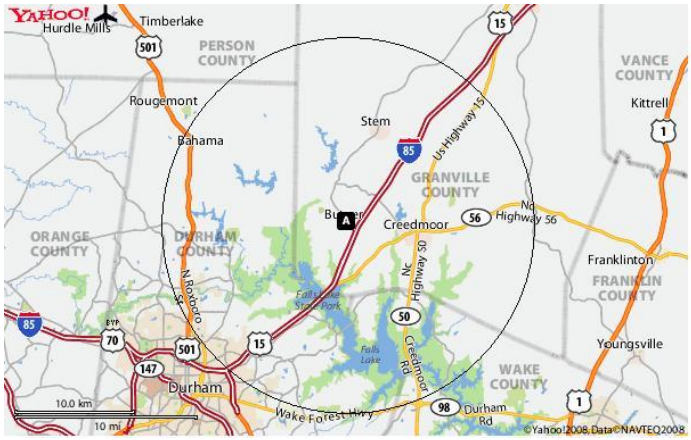


Figure D25. Location of the Butner monitoring site

A is the Butner ozone monitoring site. The circle around the site approximates the urban scale (4 to 50 Km).

At the **Butner** site, 37-077-0001, the DAQ operates a seasonal ozone monitor. A picture of the site as well as views looking north, east, south and west are provided in Figure D26 through Figure D34. The Butner site was established as the downwind site for the Durham-Chapel Hill MSA when the wind is from the primary direction during the season of highest ozone concentrations.

Figure D26. The Butner ozone monitoring site

Figure D27. Looking north from the Butner site

Figure D29. Looking northeast from the Butner site

Figure D28. Looking northwest from the Butner site

Figure D30. Looking east from the Butner site

Figure D31. Looking west from the Butner site

Figure D33. Looking southeast from the Butner site

Figure D32. Looking southwest from the Butner site

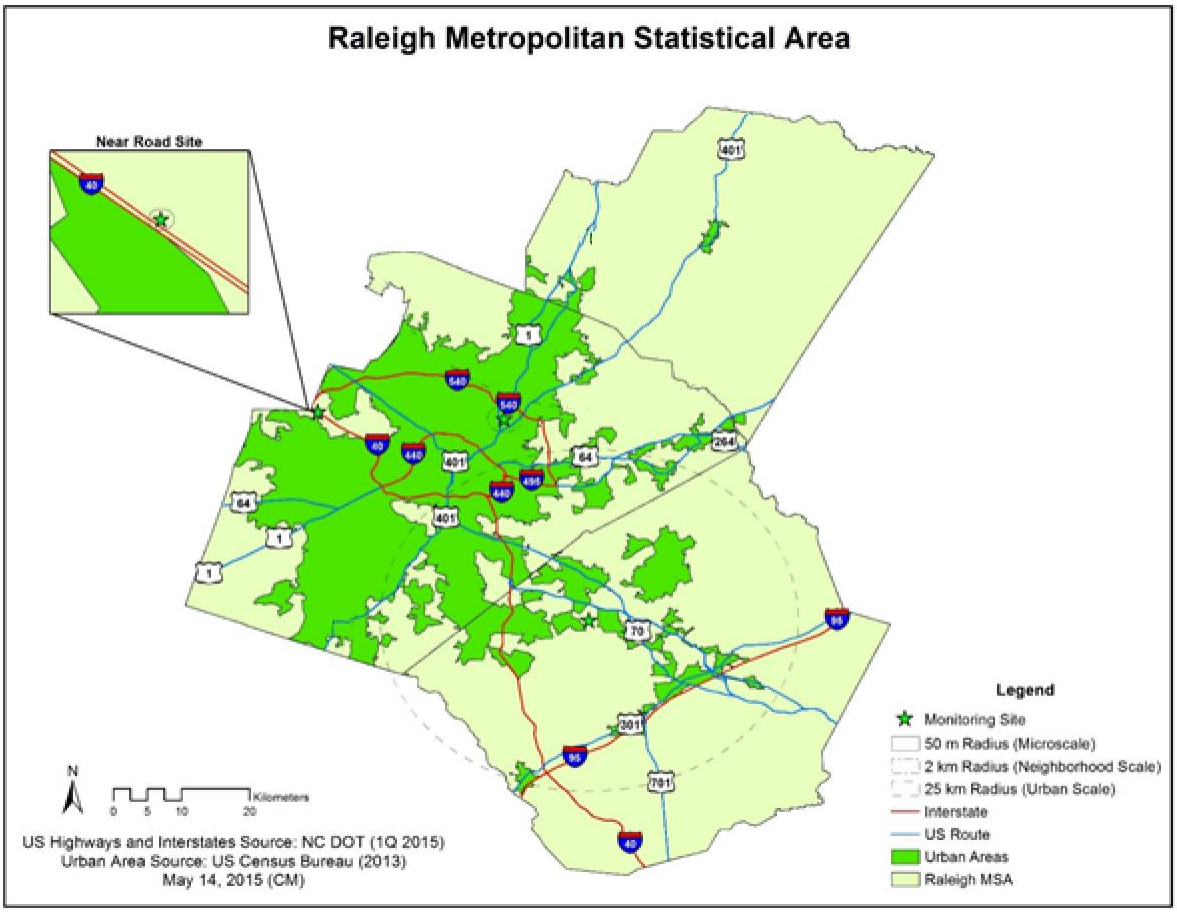
Figure D34. Looking south from the Butner site

This area was not required to add any lead monitors because of the 2010 changes made to the **lead monitoring** requirements. There are no facilities here that emit 0.5 ton or more of lead per year.

The 2015 **ozone monitoring** requirements did not require additional monitoring in the northeastern Piedmont. The area does not have any MSAs that are required by 40 CFR 58 Appendix D to conduct population exposure monitoring in urban areas. The northeastern Piedmont did not add monitors to comply with the 2010 **nitrogen dioxide** monitoring requirements because it does not have any roads exceeding the traffic threshold and does not have any MSAs that trigger nitrogen dioxide monitoring requirements. The northeastern piedmont also did not add sulfur dioxide monitors to comply with the 2010 **sulfur dioxide monitoring** requirements because there are no large sources of sulfur dioxide in this area. This area also does not need to do carbon monoxide monitoring to comply with the changes to the **carbon monoxide monitoring** requirements because the population is under one million.

(3) The Raleigh MSA

As shown in Figure D35, the Raleigh MSA consists of three counties: Franklin, Johnston and Wake. The major metropolitan areas include Raleigh and Cary. The DAQ currently operates three monitoring sites in the Raleigh MSA. These sites are located at West Johnston in Johnston County and Millbrook and Triple Oak in Wake County. The ozone monitors at Franklinton and Fuquay were shut down on Oct. 31, 2015.



Millbrook multipollutant site, center, neighborhood scale; Triple Oak near-road site, furthest west, micro scale; and West Johnston ozone and particle monitors, furthest east, urban scale.

Figure D35. Monitoring sites located in the Raleigh MSA.

At the **West Johnston** site, 37-101-0002, the DAQ operates a seasonal ozone monitor, a one-in-three-day fine particle FRM monitor and a continuous fine particle monitor. The West Johnston ozone site was established as the upwind site for the Raleigh MSA when the wind is from the secondary direction during the season of highest ozone concentrations. This site is one of two ozone-monitoring sites in the MSA. 40 Code of Federal Regulations, CFR, 58 Appendix D requires the Raleigh MSA to have two ozone monitoring sites. The West Johnston fine particle site is the second fine particle monitoring site in the MSA because the Raleigh MSA has a population over one million people and is currently required to have three fine particle monitors. The DAQ added a continuous fine particle monitor at the site in 2016 that will eventually replace the FRM monitor. A picture of the site and views looking north, east, south and west are provided in Figure D36 through Figure D40.

Figure D36. The West Johnston ozone and fine particle monitoring site

Figure D37. Looking North from the West Johnston Site

Figure D39. Looking east from the West Johnston site

Figure D38. Looking West from the West Johnston Site

Figure D40. Looking south from the West Johnston site

At the **Millbrook** site, 37-183-0014, the DAQ operates year-round ozone, one-in-three-day fine particle FRM, one-in-three-day manual SASS and URG fine particle speciation, continuous BAM fine particle, continuous PM_{10} and $PM_{10-2.5}$, nitrogen dioxide and trace-level sulfur dioxide, carbon monoxide and reactive oxide of nitrogen monitors. The manual 1-in-3-day PM_{10} and $PM_{10-2.5}$ monitors, as well as the collocated one-in-six day PM_{10} monitor, ended in 2017 after a continuous PM_{10} and $PM_{10-2.5}$ monitor was installed at the site. The DAQ also started evaluating a Teledyne D640X $PM_{10-2.5}$ monitor at Millbrook in April 2017. The DAQ also operates continuous fine particle monitors for sulfate, nitrate and black carbon and a meteorological station at this site. A picture of the site as well as views looking north, northeast, east, southeast, south, southwest, west and northwest are provided in Figure D41 through Figure D49. The Millbrook site is an NCORE, National Community Representative, site so the probe for the reactive oxide of nitrogen monitor at this site was installed on a 10-meter tower in late 2010. Dec. 27, 2011, the DAQ began analyzing the low volume PM_{10} filters for lead on a one-in-six-day schedule to meet the 2010 monitoring requirements for lead monitoring at NCore sites. This lead monitoring ended on April 30, 2016. In 2013 the DAQ added a carbonyl sampler to the site to support a shale gas development background monitoring study in Lee County. The DAQ has monitored for VOCs at Millbrook since July 14, 2004, on a 1-in-6-day schedule.

Figure D41. Millbrook NCore monitoring site

Figure D42. Looking north from the Millbrook site

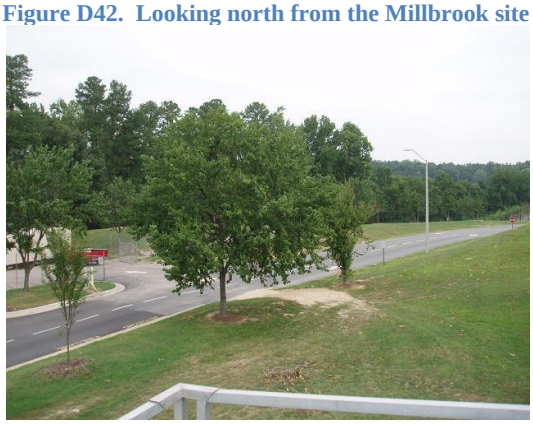


Figure D43. Looking northwest from the Millbrook site

Figure D44. Looking west from the Millbrook site

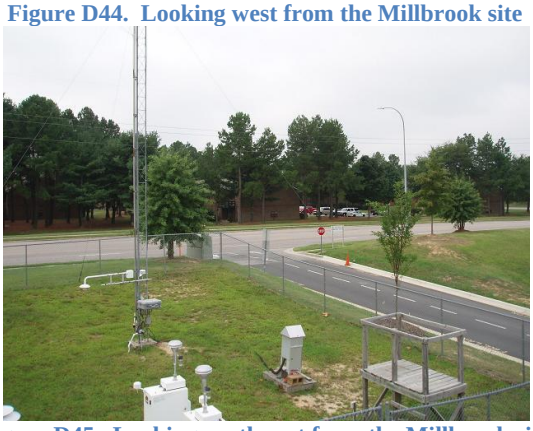


Figure D45. Looking southwest from the Millbrook site

Figure D46. Looking northeast from the Millbrook site

Figure D47. Looking east from the Millbrook site

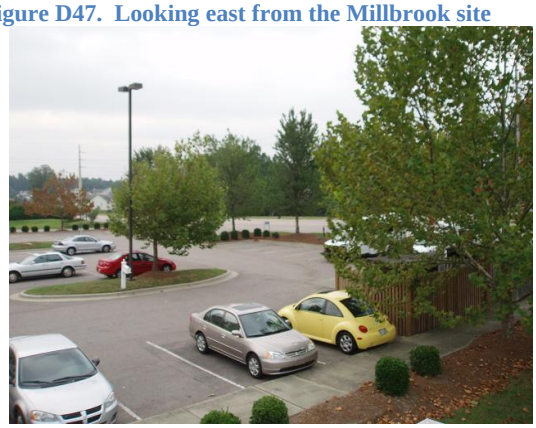


Figure D48. Looking southeast from the Millbrook site

Figure D49. Looking south from the Millbrook site

At the **Triple Oak** site, 37-183-0021, the DAQ operates a near road nitrogen dioxide monitor with a photolytic convertor, a trace-level carbon monoxide monitor and a continuous fine particle monitor. The nitrogen dioxide monitor started operating on Jan. 8, 2014. The carbon monoxide monitor started operating on Dec. 6, 2016, and the fine particle monitor started operating in 2017. A picture of the site as well as views looking north, east, south and west are provided in Figure D50 through Figure D54.

Figure D50. The Triple Oak near road nitrogen dioxide monitoring site, 37-183-0021

Figure D51. Looking north from the Triple Oak site

Figure D52. Looking east from the Triple Oak site

Figure D53. Looking west from the Triple Oak site

Figure D54. Looking south from the Triple Oak site

To comply with the December 2010 changes to the **lead monitoring** requirements,[8] the DAQ began lead monitoring at the Raleigh Millbrook NCore site on Dec. 27, 2011, using the low-volume PM_{10} monitor already at the site. This lead monitoring ended on April 30, 2016, when new monitoring regulations became effective.[9] The Raleigh MSA does not have any permitted facilities located within its bounds that emit 0.5 ton or more per year of lead so no other lead monitoring is required.

Changes to the **ozone monitoring** requirements in 2015 did not require additional monitoring in the Raleigh MSA. The MSA currently meets the minimum number of monitors required by 40 CFR 58 Appendix D for population exposure monitoring in urban areas. Seasonal ozone monitoring starts on March 1 instead of April 1 in 2017.

Due to the 2010 **nitrogen dioxide** monitoring requirements, DAQ added two nitrogen dioxide monitors to the Raleigh MSA. Because its population exceeds the 1,000,000 threshold, it was required to have a near road monitor starting Jan. 1, 2014. The near road monitoring station was placed on the west bound side of I-40 between Exit 283 and 284. This location was approved by the EPA in 2012. The Raleigh MSA has over one million people so it is also required to have a community or area-wide monitor. This monitor is located at the Raleigh Millbrook NCore monitoring site. The monitor was scheduled to start operating on Jan. 1, 2013. The DAQ asked for permission to delay installing the monitor so that a photolytic nitrogen dioxide monitor could be installed at the site. The photolytic nitrogen dioxide monitor is more selective for nitrogen dioxide but because it was approved as an equivalent method in 2012 the DAQ could not purchase it and have it up and operational by the Jan. 1, 2013, scheduled start date. The DAQ began monitoring for nitrogen dioxide at Millbrook on Dec. 10, 2013.

The 2010 **sulfur dioxide monitoring** requirements did not require additional sulfur dioxide monitors in the Raleigh MSA because there are no large sources of sulfur dioxide in the MSA. This MSA was required to add a carbon monoxide monitor to comply with the changes to the **carbon monoxide monitoring** requirements. Near road carbon dioxide monitoring is required in MSAs greater than one

[8] Revisions to the Lead Ambient Air Monitoring Requirements, Federal Register, Vol. 75, No. 247, Monday, Dec. 27, 2010, available on the worldwide web at https://www.gpo.gov/fdsys/pkg/FR-2010-12-27/pdf/2010-32153.pdf#page=1.

[9] Revisions to Ambient Monitoring Quality Assurance and Other Requirements, Federal Register, Vol. 81, No. 59, Monday, March 28, 2016, available on the worldwide web at https://www.gpo.gov/fdsys/pkg/FR-2016-03-28/pdf/2016-06226.pdf.

million people starting Jan. 1, 2017. On Jan. 1, 2017, the DAQ was also required to add a fine particle monitor at the Triple Oak near road monitoring site.

(4) Rocky Mount MSA

The Rocky Mount MSA consists of two counties: Edgecombe and Nash. The major metropolitan area is the City of Rocky Mount. The DAQ currently operates one monitoring site in the Rocky Mount MSA, located in Edgecombe County at Leggett as shown in Figure D55.

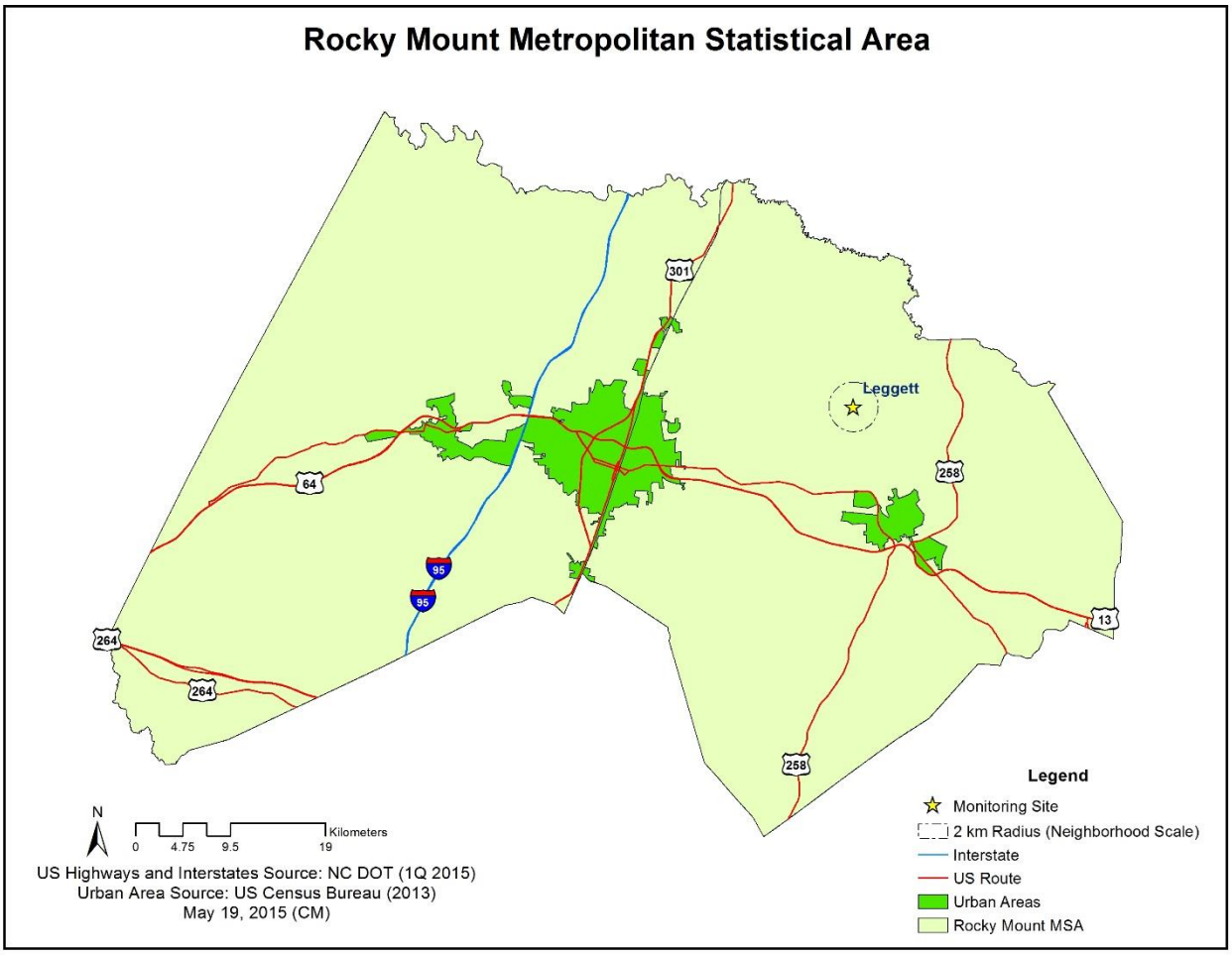


Figure D55. Monitoring site location in the Rocky Mount MSA

At the **Leggett** site, the DAQ operates a seasonal ozone monitor and a non-regulatory continuous fine particle monitor. The ozone monitor is required for the MSA. In April 2011, the DAQ added a continuous fine particle monitor to the site to enable real time fine particle air quality index reporting and fine particle forecasting. Figure D56 through Figure D64 show the site as well as views looking north, northeast, east, southeast, south, southwest, west and northwest.

Figure D56. Leggett seasonal ozone and air quality index fine particle monitoring site

Figure D57. Looking north from the Leggett site

Figure D58. Looking northeast from the Leggett site

Figure D59. Looking northwest from the Leggett site

Figure D62. Looking east from the Leggett site

Figure D60. Looking west from the Leggett site

Figure D63. Looking southeast from the Leggett site

Figure D61. Looking southwest from the Leggett site

Figure D64. Looking south from the Leggett site

Changes made to the **lead monitoring** requirements in December 2010 did not require additional monitoring in the Rocky Mount MSA. The MSA does not have any permitted facilities located within its bounds that emit 0.5 tons or more of lead per year. [10]

[10] Data obtained from the DAQ emission inventory database available on the worldwide web at https://xapps.ncdenr.org/aq/ToxicsReportServlet?ibeam=true&year=2015&physical=byCounty&overridetype=All&toxics=153&sortorder=103, accessed April 26, 2017.

2015 changes to the **ozone monitoring requirements** did not require additional monitoring in the Rocky Mount MSA. The MSA already has the minimum number of monitors required by 40 CFR 58 Appendix D for population exposure monitoring in urban areas. Starting in 2017, the seasonal ozone monitor begins a month earlier on March 1 instead of April 1.

The 2010 **nitrogen dioxide monitoring** requirements did not add any monitors to the Rocky Mount MSA because its population is less than 500,000. Additional monitors will also not be needed to meet the 2010 sulfur dioxide monitoring requirements because there are no large sources of sulfur dioxide in the MSA. This area will also not need any carbon monoxide monitors due to the changes to the **carbon monoxide monitoring** requirements because the population is under one million.

(5) The Wilson Micropolitan Statistical Area

The Wilson Micropolitan Statistical Area consists of Wilson County. There currently is no Metropolitan Statistical Area in Wilson County; however, the Wilson Micropolitan Statistical Area is located here. The Wilson area is growing. It is the 330th fastest growing municipality in North Carolina, growing at a rate of 0.39 percent.[11] It may someday, possibly around 2030, be large enough to become an MSA. The DAQ currently does not operate any monitoring sites in the Wilson Micropolitan Statistical Area.

The Wilson Micropolitan Statistical Area was impacted by changes made to the **lead monitoring** requirements in December 2010 because it had a permitted facility located within its bounds that emitted more than 0.5 tons per year of lead.[12] Saint-Gobain Containers, LLC, reported 2009 lead emissions of 0.84 tons. The DAQ requested and received a waiver for Saint-Gobain based on the results of modeling. Model results indicate the maximum ambient lead concentration in the ambient air at and beyond the fence line is 0.015 micrograms per cubic meter, well below the 0.075 micrograms per cubic meter or 50 percent of the NAAQS threshold for monitoring. The EPA renewed the waiver in 2015 based on 2011 National Emission Inventory emissions of 0.53 tons of lead. The waiver is good until 2020.[13] In 2015 Ardagh Glass, the former Saint Gobain Containers, reported 510.1 pounds of lead emissions.[14]

Changes to the **ozone monitoring** requirements in 2015 did not require additional monitoring in the Wilson Micropolitan Statistical Area. Until it becomes an MSA, it does not have to meet population exposure monitoring requirements for urban areas. The Wilson Micropolitan Statistical Area was not reclassified as an MSA in February 2013 when the MSA classifications were revised. The next scheduled revision for MSA classifications is in 2023; however, sometimes the Office of Management and Budget adjusts classifications between the scheduled revisions. Currently, the Wilson municipality is several hundred people short of being classified as a metropolitan statistical area.

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[11] North Carolina Office of State Budget and Management, Municipal Growth, April 1, 2010 to July 1, 2015, last updated Sep. 22, 2016, available on the worldwide web at https://ncosbm.s3.amazonaws.com/s3fs-public/demog/municipalfastgrowth_2015.html, accessed April 26, 2017.

[12] Data obtained from the DAQ emission inventory database available on the worldwide web at https://xapps.ncdenr.org/aq/ToxicsReport/ToxicsReportFacility.jsp?ibeam=true&county_code=195&year=2009&sorting=103&overridetype=All&pollutant=153.

[13] 2015 State of North Carolina Ambient Air Monitoring Network Plan, The U. S. EPA Region 4 Comments and Recommendations, p7, available at http://xapps.ncdenr.org/aq/documents/DocsSearch.do?dispatch=download&documentId=7440.

[14] Data obtained from the DAQ emission inventory database available on the worldwide web at https://xapps.ncdenr.org/aq/ToxicsReport/ToxicsReportFacility.jsp?ibeam=true&year=2015&pollutant=153&county_code=195, accessed on April 26, 2017

The Wilson Micropolitan Statistical Area was not required by the 2010 **nitrogen dioxide monitoring** rule to do any nitrogen dioxide monitoring. Its population is less than 500,000 and the annual average daily traffic measured on its roadways is below the threshold for monitoring. It also is not required to do sulfur dioxide monitoring by the 2010 **sulfur dioxide monitoring** rule because the population is too small and the sulfur dioxide emissions are too low to trigger PWEI monitoring. This area is also not required to do carbon monoxide monitoring by the changes to the **carbon monoxide monitoring** requirements because the population is under one million.

(6) The Sanford Micropolitan Statistical Area

The Sanford Micropolitan Statistical Area consists of Lee County. The DAQ started a monitoring site in the Sanford Micropolitan Statistical Area in November 2013. The location of the site is shown in Figure D65. The Blackstone monitoring station supports a special study to monitor baseline ambient air near potential shale gas development areas in Lee County.[15] Ozone monitoring started on Nov. 1, 2013 and a continuous fine particle monitor started Jan. 1, 2014. In December 2014, the DAQ added a sulfur dioxide monitor and nitrogen dioxide monitor. The site also monitors for volatile organic and carbonyl toxic compounds and hydrocarbons. Figure D66 through Figure D70 shows the site and views looking north, east, south and west.

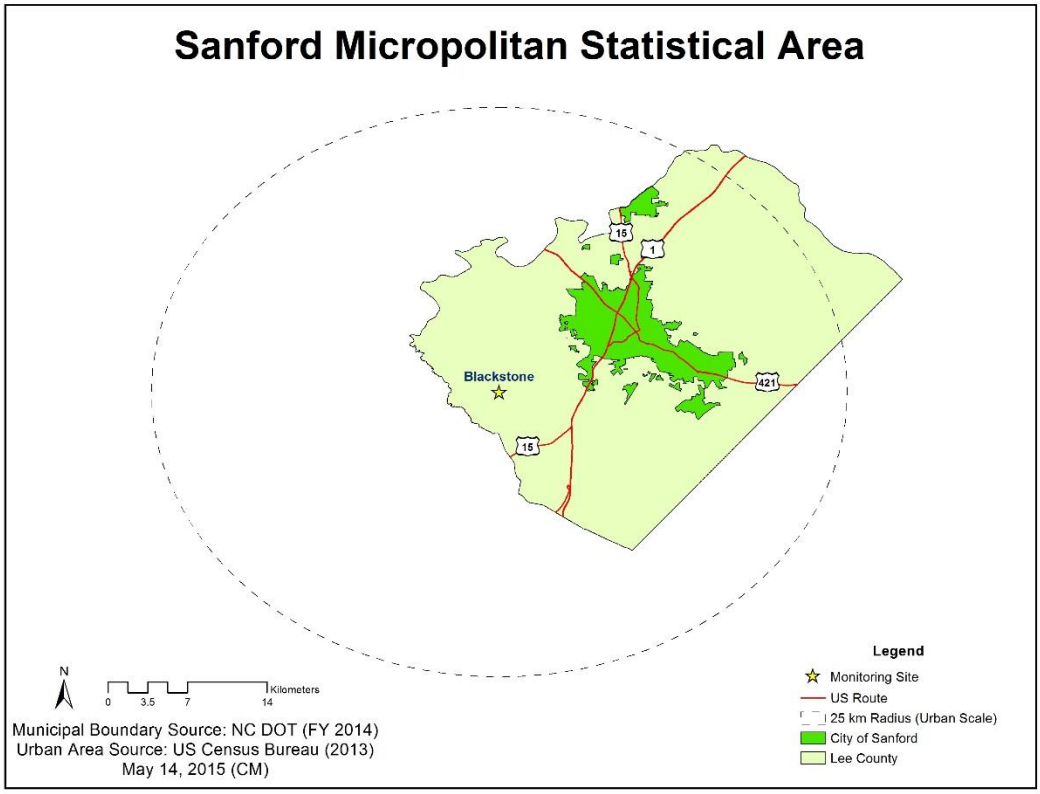


Figure D65. Monitoring site location in the Sanford micropolitan statistical area

[15] Department of Environment and Natural Resources, Division of Air Quality, Project Plan for Baseline Ambient Air Monitoring near Potential Shale Gas Development Zones in Lee County, NC, Feb. 19, 2013. Available on the world wide web at https://ncdenr.s3.amazonaws.com/s3fs-public/Air%20Quality/monitor/specialstudies/DAQ_Project_Plan.pdf, accessed on April 26, 2017.

Figure D66. Blackstone shale gas development monitoring site

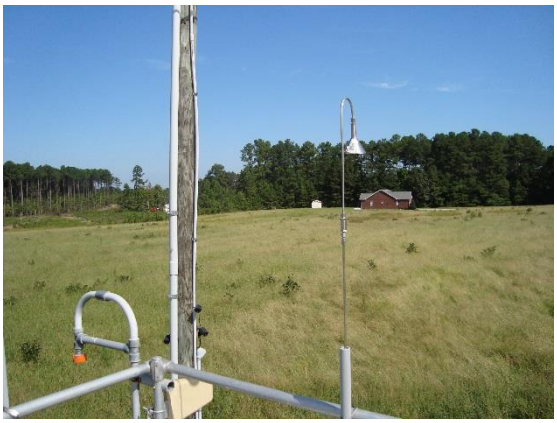


Figure D67. Looking north from the Blackstone site

Figure D69. Looking east from the Blackstone site

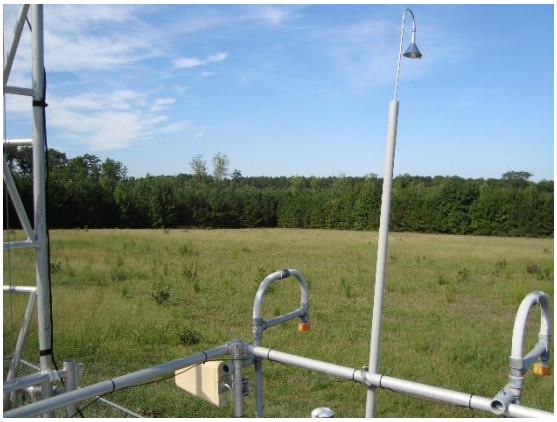


Figure D68. Looking west from the Blackstone site

Figure D70. Looking south from the Blackstone site

The Sanford micropolitan statistical area was not required to do any lead monitoring to comply with the changes made to the **lead monitoring** requirements in December 2010. There are no facilities located within its bounds that emit more than 0.5 tons per year of lead.[16]

Changes to the **ozone monitoring** requirements in 2015 did not require additional ozone monitoring in the Sanford micropolitan statistical area. Until the Sanford municipality grows larger to be classified as an MSA, it does not have to meet population exposure monitoring requirements for urban areas.

The Sanford micropolitan statistical area was not required by the 2010 **nitrogen dioxide monitoring** rule to do any nitrogen dioxide monitoring. Its population is less than 500,000 and the annual average daily traffic measured on its roadways is below the threshold for monitoring. It also is not required by the 2010 **sulfur dioxide monitoring** rule to do sulfur dioxide monitoring because the population is too small and the sulfur dioxide emissions are too low to trigger PWEI monitoring. This area is also not required to do carbon monoxide monitoring by the changes to the **carbon monoxide monitoring** requirements because the population is under one million.

[16] Data obtained from the DAQ emission inventory database, available on the worldwide web at https://xapps.ncdenr.org/aq/ToxicsReport/ToxicsReportFacility.jsp?ibeam=true&year=2015&pollutant=153&county_code=105, accessed April 26, 2017.

Appendix D.1 Annual Network Site Review Forms for 2016

Durham Armory in Durham

Bushy Fork

Semora DRR

Butner

West Johnston in Johnston County

Millbrook in Raleigh

Triple Oak Road in Cary

Leggett

Blackstone in Lee County

Site Review Form Calendar Year 2016

Site Information

Region RRO	**Site Name** Durham Armory	**AQS Site # 37-063-0015**
Street Address 801 Stadium Dr.		**City** Durham
Urban Area DURHAM	**Core-based Statistical Area** Durham, NC	
Enter Exact		**Method of Measuring**
Longitude -78.9040	**Latitude** 36.0329	
In Decimal Degrees	In Decimal Degrees	**Interpolation** / **Explanation: Google Maps**
Elevation Above/below Mean Sea Level (in meters)		**109**

Name of nearest road to inlet probe Stadium Drive ADT _____ Year Choose an item _____

Comments: Stadium Drive has no ADT counts avalable in 2016

Distance of site to nearest major road (m) 130.00 Direction from site to nearest major road W

Name of nearest major road Duke Street (US 501) ADT 35000 Year 2013

Comments: None

Site located near electrical substation/high voltage power lines? Yes ☐ No ☒

Distance of site to nearest railroad track (m) _____ Direction to RR ___ ☒NA

OPTIONAL Distance of site to nearest power pole w/transformer (m) ____ Direction ___

Distance between site and drip line of water tower (m) _____ Direction from site to water tower _____ ☒NA

Explain any sources of potential bias; include cultivated fields, loose bulk storage, stacks, vents, railroad tracks, construction activities, fast food restaurants, and swimming pools.

The Durham National Guard Armory, in 2015, has undergone a refurbishment. There is a presumed parking lot remodeling coming in the future.

ANSWER ALL APPLICABLE QUESTIONS:

Parameters	Monitoring Objective	Scale	Monitor Type
☐ NA ☒ SO_2 (NAAQS) ☐ SO_2 (trace-level) ☐ NO_2 (NAAQS) ☐ $HSNO_y$ ☒ O_3 ☐ NH_3 ☐ Hydrocarbon ☐ Air Toxics ☐ CO (trace-level)	☐ General/Background_____ ☐ Highest Concentration_____ ☐ Max O3 Concentration_____ ☒ Population Exposure SO2, O3 ☐ Source Oriented_____ ☐ Transport_____ ☐ Upwind Background_____ ☐ Welfare Related Impacts _____	☐ Micro_____ ☐ Middle_____ ☐ Neighborhood_____ ☒ Urban_____ ☐ Regional_____	☒ SLAMS _____ ☐ SPM_____ **Monitor Network Affiliation** ☐ NCORE_____ ☐ Unofficial PAMS_____

Probe inlet height (from ground) 2-15 m? Yes ☒ No ☐ Give actual measured height from ground (meters) 3.87

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (roof) supporting structure > 1 m? Yes ☐ No ☒

Actual measured distance from outer edge of probe to supporting structure (meters) _____

Distance of outer edge of probe inlet from other monitoring probe inlets > 1 m? Yes ☐ No ☐ NA ☒

Is probe > 20 m from the nearest tree drip line? Yes ☒ *No ☐ (answer *'d questions)

*Is probe > 10 m from the nearest tree drip line? Yes ☐ *No ☐

*Distance from probe to tree (m) _____ Direction from probe to tree ___ *Height of tree (m) _____

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒

*Identify obstacle _____ Distance from probe inlet (m) _____ Direction from probe inlet to obstacle ___

*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No ☐

Distance of probe to nearest traffic lane (m) 41 Direction from probe to nearest traffic lane N

Site Review Form Calendar Year 2016

Parameters	Monitoring Objective	Scale	Site Type
☐ NA Air flow < 200 L/min ☒ PM2.5 FRM ☐ PM10 FRM ☐ PM10 Cont. (BAM) ☐ PM10-2.5 FRM ☒ PM10-2.5 BAM ☐ PM10 Lead (PB) ☐ PM2.5 Cont. (BAM) ☐ PM2.5 Spec. (SASS) ☐ PM2.5 Spec. (URG) ☐ PM2.5 Cont. Spec.	☐ General/Background _____ ☐ Highest Concentration _____ ☒ Population Exposure PM 2.5 FRM, PM10-2.5 BAM ☐ Source Oriented _____ ☐ Transport _____ ☐ Welfare Related Impacts _____	☐ Micro _____ ☐ Middle _____ ☒ Neighborhood PM 2.5 FRM, PM10-2.5 BAM ☐ Urban _____ ☐ Regional _____	☒ SLAMS PM 2.5 FRM, PM10-2.5 BAM ☐ SPM_____ **Monitor Network Affiliation** ☐ NCORE _____ ☐ SUPPLEMENTAL SPECIATION_____ **Monitor NAAQS Exclusion** ☐ NONREGULATORY_____

Probe inlet height (from ground) ☐ < 2 m _____ ☒ 2-7m _____ ☐ 7-15 m _____ ☐ > 15 m _____
Actual measured distance from probe inlet to ground (meters) 2.7m

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (platform or roof) supporting structure > 2 m?
Actual measured distance from outer edge of probe inlet to supporting structure (meters) 3 Yes ☒ No ☐

Distance (Y) between outer edge of probe inlets of any low volume monitor and any other low volume monitor at the site = 1 m or greater? Yes ☒ No ☐ NA ☐

Distance (Y) between outer edge of all low volume monitor inlets and any Hi-Volume PM-10 or TSP inlet = 2 m or greater? Yes ☒ No ☐ NA ☐

Are collocated PM2.5 Monitors (Two FRMs, FRM & BAM, FRM & TEOM, BAM & TEOM) Located at Site? *Yes ☒ (answer *'d questions) No ☐ NA ☐

* Entire inlet opening of collocated PM 2.5 samplers (X) within 2 to 4 m of each other? Yes ☒ No ☐ Give actual (meters) _____

*Are collocated PM2.5 sampler inlets within 1 m vertically of each other? Yes ☒ No ☐ Give actual (meters) _____

Is an URG 3000 monitor collocated with a SASS monitor at the site? *Yes ☐ (answer *'d questions) No ☐ NA ☒

* Entire inlet opening of collocated speciation samplers inlets (X) within 2 to 4 m of each other? Yes ☐ No ☐
Give actual (meters) _____

* Are collocated speciation sampler inlets within 1 m vertically of each other? Yes ☐ No ☐ Give actual (meters) _____

Is a low-volume PM10 monitor collocated with a PM2.5 monitor at the site to measure PM10-2.5? *Yes ☒ (answer *'d questions) No ☐ NA ☐

* Entire inlet opening of collocated PM10 and PM2.5samplers for PM10-2.5 (X) within 2 to 4 m of each other? Yes ☒ No ☐

*Are collocated PM10 and PM2.5 sampler inlets within 1 m vertically of each other? Yes ☒ No ☐

Is probe > 20 m from the nearest tree drip line? Yes ☒ *No ☐ (answer *'d questions)

*Is probe > 10 m from the nearest tree drip line? Yes ☐ *No ☐
*Distance from probe to tree (m) _____ Direction from probe to tree ___ *Height of tree (m) _____

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒

*Identify obstacle ____ Distance from probe inlet (m) _____Direction from probe inlet to obstacle ___
*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No ☐

Distance of probe to nearest traffic lane (m) 40 Direction from probe to nearest traffic lane N

RECOMMENDATIONS:

1) Maintain current site status? Yes ☒ *No ☐ (answer *'d questions)

*2) Change monitoring objective? Yes ☐ (enter new objective _____) No ☐-

*3) Change scale of representativeness? Yes ☐ (enter new scale _) No ☐

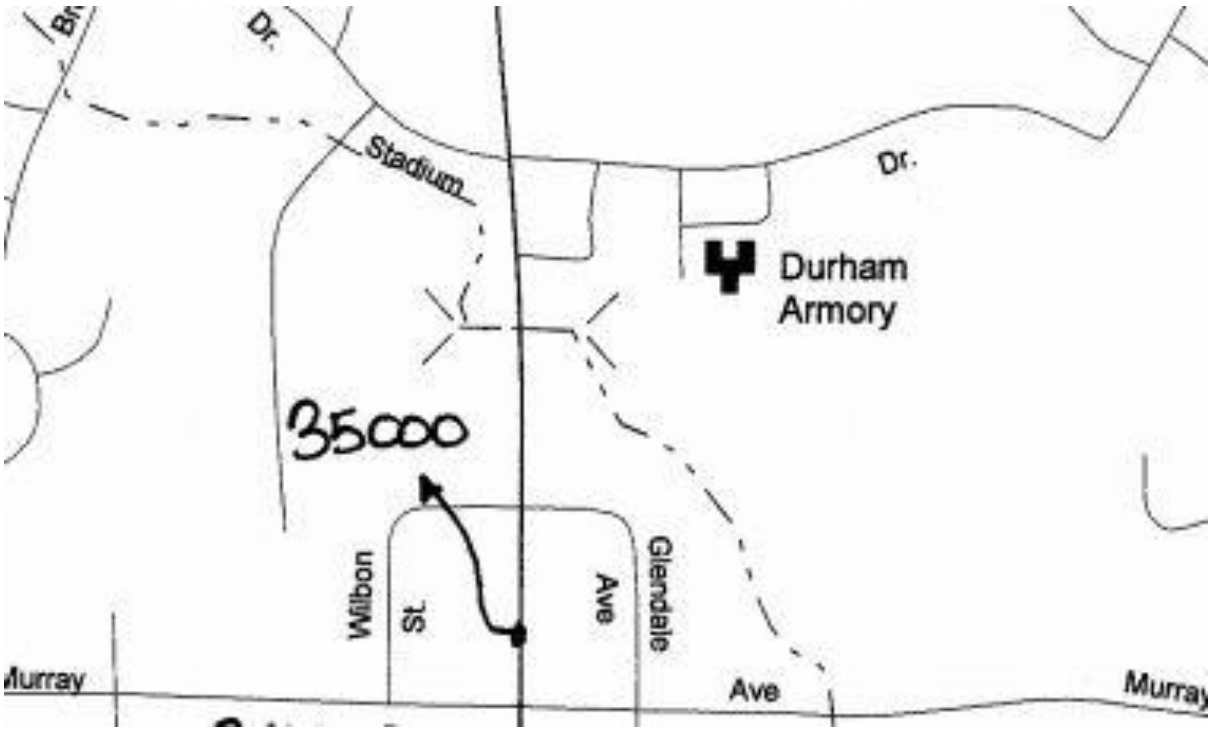
*4) Relocate site? Yes ☐ No ☒

Comments:

Date of Last Site Pictures ___2016__ New Pictures Submitted? Yes ☒ No ☐

Reviewer James H Reske Date September 23, 2016

Ambient Monitoring Coordinator Rik Tebeau DateSeptember 28, 2016



2013 Average Annual Daily Traffic for the Durham Armory in Durham, North Carolina
From the NC Department of Transportation Traffic Survey Unit

Site Review Form Calendar Year 2016

Site Information

Region RRO	**Site Name** Bushy Fork	**AQS Site # 37-145-0003**
Street Address-		**City**
Urban Area ROXBORO	**Core-based Statistical Area** Durham, NC	
Enter Exact		
Longitude -79.0922	**Latitude** 36.3069	**Method of Measuring**
In Decimal Degrees	In Decimal Degrees	**Explanation: Google Earth**
Elevation Above/below Mean Sea Level (in meters)		**200**

Name of nearest road to inlet probe NC Hwy49 ADT 3300 Year latest available 2014

Distance of ozone probe to nearest traffic lane (m) 180 Direction from ozone probe to nearest traffic lane SSE

Comments: N/A

Name of nearest major road NC Hwy.49 ADT 3300 Year latest available 2014

Distance of site to nearest major road (m) 180.00 Direction from site to nearest major road SSE

Comments:

Site located near electrical substation/high voltage power lines?	Yes ☐ No ☒
Distance of site to nearest railroad track (m)	Direction to RR ☒NA
OPTIONAL Distance of site to nearest power pole w/transformer (m)	Direction
Distance between site and drip line of water tower (m)	Direction from site to water tower ☒NA

Explain any sources of potential bias; include cultivated fields, loose bulk storage, stacks, vents, railroad tracks, construction activities, fast food restaurants, and swimming pools.

tt

ANSWER ALL APPLICABLE QUESTIONS:

Parameters	Monitoring Objective	Scale	Site Type
☒ O_3	☒General/Background ☐Highest Concentration ☐Max O3 Concentration ☐Population Exposure ☐Source Oriented ☐Transport ☐Upwind Background ☐Welfare Related Impacts	☐Micro ☐Middle ☐Neighborhood ☒Urban ☐Regional	☒SLAMS ☐SPM

Probe inlet height (from ground) 2-15 m? Yes ☒ No ☐

Give actual measured height from ground (meters) 4.00

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (roof) supporting structure > 1 m? Yes ☒ No ☐

Actual measured distance from outer edge of probe to supporting structure (meters) 1.50

Is probe > 20 m from the nearest tree drip line? Yes ☒ *No ☐ (answer *'d questions)

*Is probe > 10 m from the nearest tree drip line? Yes ☒ *No ☐

*Distance from probe to tree (m) Direction from probe to tree *Height of tree (m)

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒

*Identify obstacle Distance from probe inlet (m) Direction from probe inlet to obstacle

*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No ☐

Site Review Form Calendar Year 2016

RECOMMENDATIONS:

1) Maintain current site status? Yes ☒ *No ☐ (answer *'d questions)

*2) Change monitoring objective? Yes ☐ (enter new objective: _____) No ☒

*3) Change scale of representativeness? Yes ☐ (enter new scale:) No ☒

*4) Relocate site? Yes ☐ No ☒

Comments: _____

Date of Last Site Pictures: September 13, 2016 New Pictures Submitted? Yes ☒ No ☐

Reviewer _____ Date: _____

Ambient Monitoring Coordinator Rik Tebeau Date: September 28, 2016

Instructions:

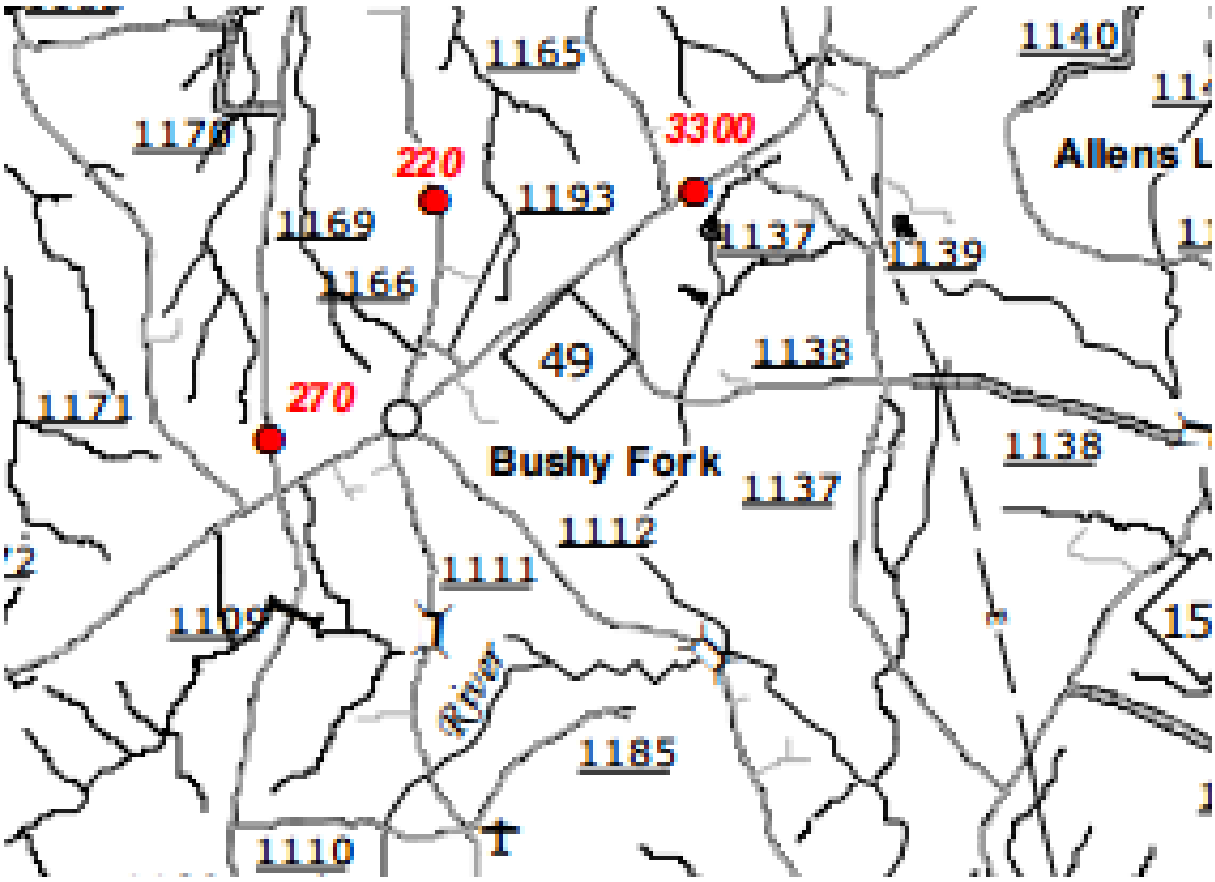
If the annual network review has indicated that the monitoring objectives and scale of representativeness for the site have not changed and the siting criteria still meets those monitoring objectives and that scale of representativeness and there are no other reasons to modify the site in any way, check "Yes" to the question "Maintain current site status?" and skip the rest of the recommendations section.

If the annual network review has indicated that the monitoring objectives, scale of representativeness, or siting criteria have changed for some reason or there is another reason to modify the site in some way, check "No" to the question "Maintain current site status?" and complete the rest of the recommendations section. If the monitoring objective or scale of representativeness needs to be changed, check the "Yes" box and write in the new monitoring objective or scale of representativeness on the line. Otherwise check the "No" box. If the site needs to be relocated, check the "Yes" box. If the site needs to be shut down, write "Shut down" in the comments line. Also use the comments line to explain any change requested.

Check the site picture archive to find out when the last set of site pictures were taken and write the date down on the line. If the pictures are more than five years old or if something at the site has changed in the past year, take new site pictures. Changes that require new site pictures include additions, removals, or movement of monitors at the site, growth or removal of trees and other shrubs at the site, and construction of roads or buildings at or in the vicinity of the site.

Pictures of the site should at a minimum include at least one picture showing the site itself and pictures standing at the probe or inlet or as close as possible to the probe or inlet looking in the four compass directions (north, east, south, and west). If meteorological data are collected at the site, pictures standing at the meteorological tower looking southwest and northeast should also be included. Sometimes pictures looking at the site from the four compass directions are also helpful.

Be sure to correctly identify the pictures as to which compass direction they show. This documentation may be achieved by using good notes when taking the pictures, holding a compass in front of the camera, or placing a sign with the appropriate direction indicated somewhere in the picture. Label the pictures with the name of the site using the two digit logger ID (HC, JW, *etc.*), the direction (N, NE, E, SE, S, SW, W, NW), and the date taken (YYYYMMDD) and transfer the pictures to the group drive in the appropriate Incoming/Regional Office directory.



2014 Average Annual Daily Traffic for Bushy Fork, North Carolina
From the NC Department of Transportation Traffic Survey Unit

Site Review Form Calendar Year 2016

Site Information

Region Duke Energy	**Site Name** Semora	**AQS Site # 37-** 145-0004
Street Address- 1063 Shore Rd	**City** Semora	
Urban Area Choose an item.	**Core-based Statistical Area** Choose an item.	
NAD	**Enter Exact**	**Method of Measuring**
Longitude -79.0589	**Latitude** 36.4898	Google Maps
In Decimal Degrees	In Decimal Degrees	Select one / **Explanation:**
Elevation Above/below Mean Sea Level (in meters) 158m		

Name of nearest road to inlet probe _____ ADT _____ Year Choose one _____

Comments: _____

Distance of site to nearest major road (m) _____ Direction from site to nearest major road ___

Name of nearest major road _____ ADT _____ Year Choose one _____

Comments: _____

Site located near electrical substation/high voltage power lines?		Yes ☐ No ☒
Distance of site to nearest railroad track	(m) _____ Direction to RR ___	☒ NA
OPTIONAL Distance of site to nearest power pole w/transformer	(m) _____	Direction ___
Distance between site and drip line of water tower (m) _____	Direction from site to water tower _____	☐ NA

Explain any sources of potential bias; include cultivated fields, loose bulk storage, stacks, vents, railroad tracks, construction activities, fast food restaurants, and swimming pools.

_____

ANSWER ALL APPLICABLE QUESTIONS:

Parameters	Monitoring Objective	Scale	Monitor Type
☐ SO_2 (NAAQS) ☐ SO_2 (trace-level) ✓SO2 DRR	☐ General/Background ☑ Highest Concentration ☐ Population Exposure ☑ Source Oriented ☐ Transport ☐ Upwind Background ☐ Welfare Related Impacts	☐ Micro ☐ Middle ☐ Neighborhood ☐ Urban ☐ Regional	☐ SLAMS ☐ SPM ✓Industrial

Probe inlet height (from ground) 2-15 m? Yes ☒ No ☐ Give actual measured height from ground (meters) 4m

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (roof) supporting structure > 1 m? Yes ☒ No ☐
Actual measured distance from outer edge of probe to supporting structure (meters) 2

Distance of outer edge of probe inlet from other gas monitoring probe inlets > 0.25 m? Yes ☐ No ☐ NA ☒

Is probe > 20 m from the nearest tree drip line? Yes ☒ *No ☐ (answer *'d questions)

*Is probe > 10 m from the nearest tree drip line? Yes ☐ *No ☐

*Distance from probe to tree (m) _____ Direction from probe to tree ___ *Height of tree (m) _____

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒

*Identify obstacle _____ Distance from probe inlet (m) _____ Direction from probe inlet to obstacle ___

*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No ☐

Distance of probe to nearest traffic lane (m) 35m Direction from probe to nearest traffic lane N

Site Review Form Calendar Year 2016

SULFUR DIOXIDE MONITOR RECOMMENDATIONS:

1) Maintain current monitor status? Yes ☑ *No ☐ (answer *'d questions)

*2) Change monitoring objective? Yes ☐ (enter new objective _____) No ☐

*3) Change scale of representativeness? Yes ☐ (enter new scale _____) No ☐

*4) Relocate monitor? Yes ☐ No ☐

Comments: _____

Date of Last Site Pictures 2/9/16 New Pictures Submitted? Yes ☐ No ☑

Reviewer Vincent Houston Date 12/9/2016

Ambient Monitoring Coordinator _____ Date _____

Revised 2016-10-14

Instructions:

If the annual network review has indicated that the monitoring objectives and scale of representativeness for the site have not changed and the siting criteria still meets those monitoring objectives and that scale of representativeness and there are no other reasons to modify the site in any way, check "Yes" to the question "Maintain current site status?" and skip the rest of the recommendations section.

If the annual network review has indicated that the monitoring objectives, scale of representativeness, or siting criteria have changed for some reason or there is another reason to modify the site in some way, check "No" to the question "Maintain current site status?" and complete the rest of the recommendations section. If the monitoring objective or scale of representativeness needs to be changed, check the "Yes" box and write in the new monitoring objective or scale of representativeness on the line. Otherwise check the "No" box. If the site needs to be relocated, check the "Yes" box. If the site needs to be shut down, write "Shut down" in the comments line. Also use the comments line to explain any change requested.

Check the site picture archive to find out when the last set of site pictures were taken and write the date down on the line. If the pictures are more than five years old or if something at the site has changed in the past year, take new site pictures. Changes that require new site pictures include additions, removals, or movement of monitors at the site, growth or removal of trees and other shrubs at the site, and construction of roads or buildings at or in the vicinity of the site.

Pictures of the site should at a minimum include at least one picture showing the site itself and pictures standing at the probe or inlet or as close as possible to the probe or inlet looking in the four compass directions (north, east, south, and west). If meteorological data are collected at the site, pictures standing at the meteorological tower looking southwest and northeast should also be included. Sometimes pictures looking at the site from the four compass directions are also helpful.

Be sure to correctly identify the pictures as to which compass direction they show. This documentation may be achieved by using good notes when taking the pictures, holding a compass in front of the camera, or placing a sign with the appropriate direction indicated somewhere in the picture. Label the pictures with the name of the site using the two digit logger ID (HC, JW, *etc.*), the direction (N, NE, E, SE, S, SW, W, NW), and the date taken (YYYYMMDD) and transfer the pictures to the group drive in the appropriate Incoming/Regional Office directory.

Site Review Form Calendar Year 2016

Site Information

Region RRO	**Site Name** Butner	**AQS Site # 37-077-0001**
Street Address-800 Central Avenue		**City Butner**
Urban Area BUTNER	**Core-based Statistical Area** None	
Enter Exact		**Method of Measuring**
Longitude -78.7681	**Latitude** 36.1412	
In Decimal Degrees	In Decimal Degrees	**Interpolation** | **Explanation: Google Maps**
Elevation Above/below Mean Sea Level (in meters)		121.00

Name of nearest road to inlet probe West G Street ADT _____ Year _____ ____

Distance of ozone probe to nearest traffic lane (m) 88 Direction from ozone probe to nearest traffic lane SE

Comments: Traffic data not available for West G Street

Name of nearest major road Central Ave (SR 1103) ADT 11000 Year latest available 2013

Distance of site to nearest major road (m) 184.00 Direction from site to nearest major road NE

Comments: _____

Site located near electrical substation/high voltage power lines?	Yes ☐ No ☒
Distance of site to nearest railroad track (m) 1790 Direction to RR SE	☐NA
OPTIONAL Distance of site to nearest power pole w/transformer (m) _____ Direction ___	
Distance between site and drip line of water tower (m) 250 Direction from site to water tower NE	☐NA

Explain any sources of potential bias; include cultivated fields, loose bulk storage, stacks, vents, railroad tracks, construction activities, fast food restaurants, and swimming pools.

The monitoring site is located at a waste water treatment plant.

ANSWER ALL APPLICABLE QUESTIONS:

Parameters	Monitoring Objective	Scale	Site Type
☒ O_3	☒General/Background ☐Highest Concentration ☒Max O3 Concentration ☐Population Exposure ☐Source Oriented ☐Transport ☐Upwind Background ☐Welfare Related Impacts	☐Micro ☐Middle ☐Neighborhood ☒Urban ☐Regional	☒SLAMS ☐SPM

Probe inlet height (from ground) 2-15 m? Yes ☒ No ☐

Give actual measured height from ground (meters) 4.00

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (roof) supporting structure > 1 m? Yes ☒ No ☐

Actual measured distance from outer edge of probe to supporting structure (meters) 1.10

Is probe > 20 m from the nearest tree drip line? Yes ☒ *No ☐ (answer *'d questions)

*Is probe > 10 m from the nearest tree drip line? Yes ☐ *No ☐

*Distance from probe to tree (m) _____ Direction from probe to tree ___ *Height of tree (m) _____

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒

*Identify obstacle _____ Distance from probe inlet (m) _____Direction from probe inlet to obstacle ___

*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No ☐

Site Review Form Calendar Year 2016

RECOMMENDATIONS:

1) Maintain current site status? Yes ☒ *No ☐ (answer *'d questions)

*2) Change monitoring objective? Yes ☐ (enter new objective: _____) No ☐

*3) Change scale of representativeness? Yes ☐ (enter new scale:) No ☐

*4) Relocate site? Yes ☐ No ☐

Comments: _____

Date of Last Site Pictures: September 7, 2016 New Pictures Submitted? Yes ☒ No ☐

Reviewer C. Marshall Cannon Date: September 27, 2016

Ambient Monitoring Coordinator Rik Tebeau Date: September 28, 2016

Instructions:

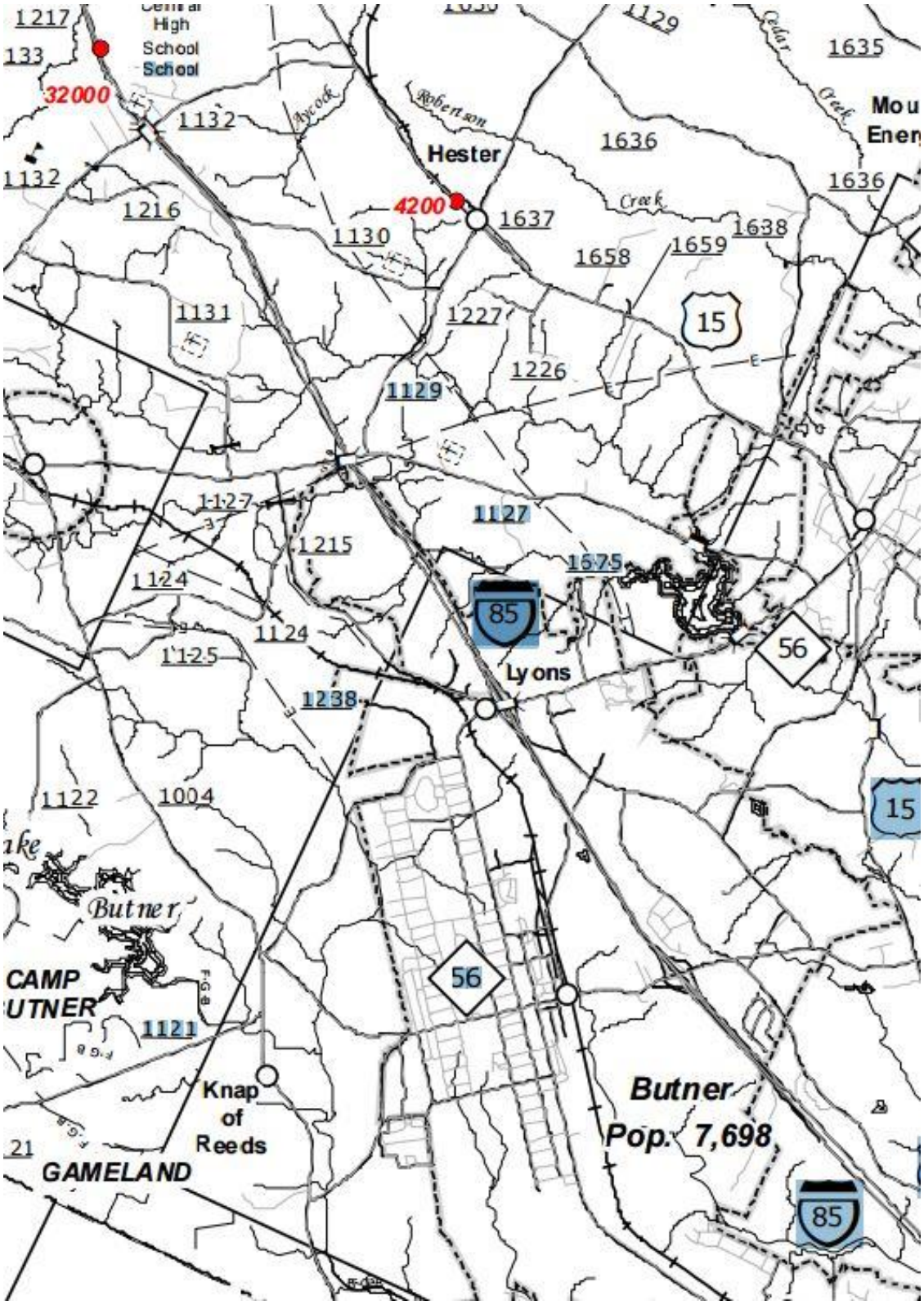
If the annual network review has indicated that the monitoring objectives and scale of representativeness for the site have not changed and the siting criteria still meets those monitoring objectives and that scale of representativeness and there are no other reasons to modify the site in any way, check "Yes" to the question "Maintain current site status?" and skip the rest of the recommendations section.

If the annual network review has indicated that the monitoring objectives, scale of representativeness, or siting criteria have changed for some reason or there is another reason to modify the site in some way, check "No" to the question "Maintain current site status?" and complete the rest of the recommendations section. If the monitoring objective or scale of representativeness needs to be changed, check the "Yes" box and write in the new monitoring objective or scale of representativeness on the line. Otherwise check the "No" box. If the site needs to be relocated, check the "Yes" box. If the site needs to be shut down, write "Shut down" in the comments line. Also use the comments line to explain any change requested.

Check the site picture archive to find out when the last set of site pictures were taken and write the date down on the line. If the pictures are more than five years old or if something at the site has changed in the past year, take new site pictures. Changes that require new site pictures include additions, removals, or movement of monitors at the site, growth or removal of trees and other shrubs at the site, and construction of roads or buildings at or in the vicinity of the site.

Pictures of the site should at a minimum include at least one picture showing the site itself and pictures standing at the probe or inlet or as close as possible to the probe or inlet looking in the four compass directions (north, east, south, and west). If meteorological data are collected at the site, pictures standing at the meteorological tower looking southwest and northeast should also be included. Sometimes pictures looking at the site from the four compass directions are also helpful.

Be sure to correctly identify the pictures as to which compass direction they show. This documentation may be achieved by using good notes when taking the pictures, holding a compass in front of the camera, or placing a sign with the appropriate direction indicated somewhere in the picture. Label the pictures with the name of the site using the two digit logger ID (HC, JW, *etc.*), the direction (N, NE, E, SE, S, SW, W, NW), and the date taken (YYYYMMDD) and transfer the pictures to the group drive in the appropriate Incoming/Regional Office directory.



2013 Average Annual Daily Traffic for Butner, North Carolina
From the NC Department of Transportation Traffic Survey Unit

Site Review Form Calendar Year 2016

Site Information

Region RRO	**Site Name** West Johnston	**AQS Site # 37-101-0002**
Street Address 1338 Jack Rd		**City** Clayton
Urban Area CLAYTON	**Core-based Statistical Area** Raleigh, NC	
Enter Exact		
Longitude -78.4622	**Latitude** 35.59095	**Method of Measuring**
In Decimal Degrees	In Decimal Degrees	**Interpolation** | **Explanation: Google Maps**
Elevation Above/below Mean Sea Level (in meters)		80

Name of nearest road to inlet probe Jack Rd (SR 1557) ADT 1700 Year latest available 2013

Comments: None

Distance of site to nearest major road (m) 2010.00 Direction from site to nearest major road NNE

Name of nearest major road US Hwy 70 Bypass ADT 25000 Year latest available 2014

Comments: None

Site located near electrical substation/high voltage power lines?	Yes ☐ No ☒
Distance of site to nearest railroad track	(m) _____ Direction to RR ___ ☒NA
OPTIONAL Distance of site to nearest power pole w/transformer	(m) ____ Direction ___
Distance between site and drip line of water tower (m) _____ Direction from site to water tower _____	☒NA

Explain any sources of potential bias; include cultivated fields, loose bulk storage, stacks, vents, railroad tracks, construction activities, fast food restaurants, and swimming pools.

____

ANSWER ALL APPLICABLE QUESTIONS:

Parameters	Monitoring Objective	Scale	Monitor Type
☐ NA ☐ SO_2 (NAAQS) ☐ SO_2 (trace-level) ☐ NO_x (NAAQS) ☐ $HSNO_y$ ☒ O_3 ☐ NH_3 ☐ Hydrocarbon ☐ Air Toxics ☐ CO (trace-level)	☒ General/Background_____ ☐ Highest Concentration_____ ☐ Max O3 Concentration_____ ☒ Population Exposure_____ ☐ Source Oriented_____ ☐ Transport_____ ☒ Upwind Background_____ ☐ Welfare Related Impacts _____	☐ Micro_____ ☐ Middle_____ ☐ Neighborhood_____ ☒ Urban_____ ☐ Regional_____	☒ SLAMS _____ ☐ SPM_____ **Monitor Network Affiliation** ☐ NCORE_____ ☐ Unofficial PAMS_____

Probe inlet height (from ground) 2-15 m? Yes ☒ No ☐ Give actual measured height from ground (meters) 3.61

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (roof) supporting structure > 1 m? Yes ☒ No ☐

Actual measured distance from outer edge of probe to supporting structure (meters) 1.02

Distance of outer edge of probe inlet from other monitoring probe inlets > 1 m? Yes ☒ No ☐ NA ☐

Is probe > 20 m from the nearest tree drip line? Yes ☒ *No ☐ (answer *'d questions)

*Is probe > 10 m from the nearest tree drip line? Yes ☐ *No ☐

*Distance from probe to tree (m) _____ Direction from probe to tree ___ *Height of tree (m) _____

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒

*Identify obstacle _____ Distance from probe inlet (m) _____ Direction from probe inlet to obstacle ___

*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No ☐

Distance of probe to nearest traffic lane (m) 19 Direction from probe to nearest traffic lane WSW

Site Review Form Calendar Year 2016

Parameters	Monitoring Objective	Scale	Site Type
☐ NA Air flow < 200 L/min ☒ PM2.5 FRM ☐ PM10 FRM ☐ PM10 Cont. (BAM) ☐ PM10-2.5 FRM ☐ PM10-2.5 BAM ☐ PM10 Lead (PB) ☒ PM2.5 Cont. (BAM) ☐ PM2.5 Spec. (SASS) ☐ PM2.5 Spec. (URG) ☐ PM2.5 Cont. Spec.	☒ General/Background _____ ☐ Highest Concentration _____ ☒ Population Exposure _____ ☐ Source Oriented _____ ☐ Transport _____ ☐ Welfare Related Impacts _____	☐ Micro _____ ☐ Middle _____ ☒ Neighborhood _____ ☐ Urban _____ ☐ Regional _____	☒ SLAMS _____ ☐ SPM_____ **Monitor Network Affiliation** ☐ NCORE _____ ☐ SUPPLEMENTAL SPECIATION_____ **Monitor NAAQS Exclusion** ☐ NONREGULATORY_____

Probe inlet height (from ground) ☐ < 2 m _____ ☒ 2-7m _____ ☐ 7-15 m _____ ☐ > 15 m _____
Actual measured distance from probe inlet to ground (meters) 2.2

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (platform or roof) supporting structure > 2 m?
Actual measured distance from outer edge of probe inlet to supporting structure (meters) 2.1 Yes ☒ No ☐

Distance (Y) between outer edge of probe inlets of any low volume monitor and any other low volume monitor at the site = 1 m or greater? Yes ☒ No ☐ NA ☐

Distance (Y) between outer edge of all low volume monitor inlets and any Hi-Volume PM-10 or TSP inlet = 2 m or greater? Yes ☐ No ☐ NA ☒

Are collocated PM2.5 Monitors (Two FRMs, FRM & BAM, FRM & TEOM, BAM & TEOM) Located at Site? *Yes ☒ (answer *'d questions) No ☐ NA ☐

* Entire inlet opening of collocated PM 2.5 samplers (X) within 2 to 4 m of each other? Yes ☒ No ☐ Give actual (meters) 1.87

*Are collocated PM2.5 sampler inlets within 1 m vertically of each other? Yes ☒ No ☐ Give actual (meters) 0.20

Is an URG 3000 monitor collocated with a SASS monitor at the site? *Yes ☐ (answer *'d questions) No ☒ NA ☐

* Entire inlet opening of collocated speciation samplers inlets (X) within 2 to 4 m of each other? Yes ☐ No ☐
Give actual (meters) _____

* Are collocated speciation sampler inlets within 1 m vertically of each other? Yes ☐ No ☐ Give actual (meters) _____

Is a low-volume PM10 monitor collocated with a PM2.5 monitor at the site to measure PM10-2.5? *Yes ☐ (answer *'d questions) No ☒ NA ☐

* Entire inlet opening of collocated PM10 and PM2.5samplers for PM10-2.5 (X) within 2 to 4 m of each other? Yes ☐ No ☐

*Are collocated PM10 and PM2.5 sampler inlets within 1 m vertically of each other? Yes ☐ No ☐

Is probe > 20 m from the nearest tree drip line? Yes ☒ *No ☐ (answer *'d questions)

*Is probe > 10 m from the nearest tree drip line? Yes ☐ *No ☐
*Distance from probe to tree (m) _____ Direction from probe to tree ___ *Height of tree (m) _____

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒

*Identify obstacle ____ Distance from probe inlet (m) _____Direction from probe inlet to obstacle ___
*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No ☐

Distance of probe to nearest traffic lane (m) 19 Direction from probe to nearest traffic lane WSW

RECOMMENDATIONS:

1) Maintain current site status? Yes ☒ *No ☐ (answer *'d questions)

*2) Change monitoring objective? Yes ☐ (enter new objective _____) No ☐-

*3) Change scale of representativeness? Yes ☐ (enter new scale _) No ☐

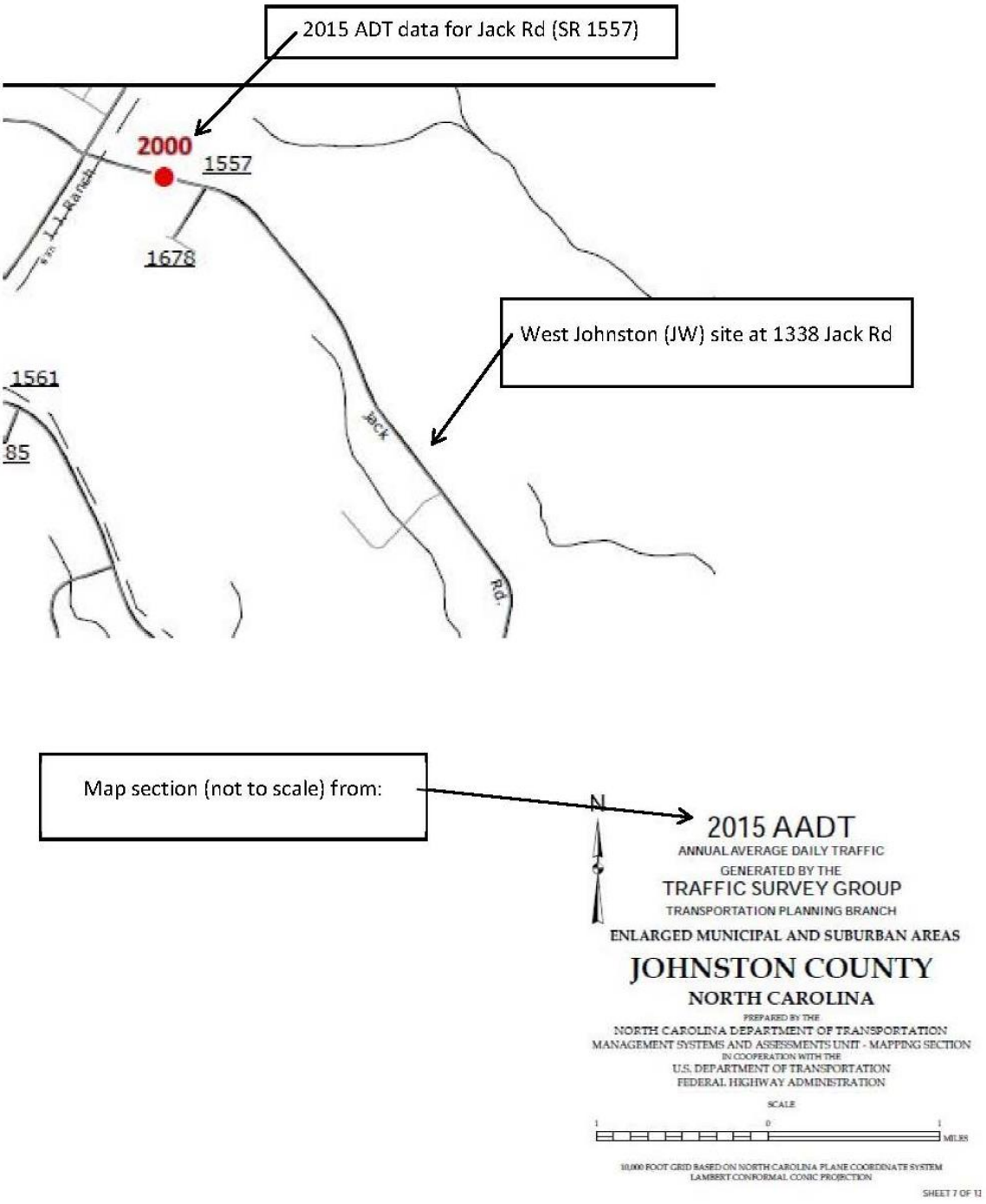
*4) Relocate site? Yes ☐ No ☐

Comments:

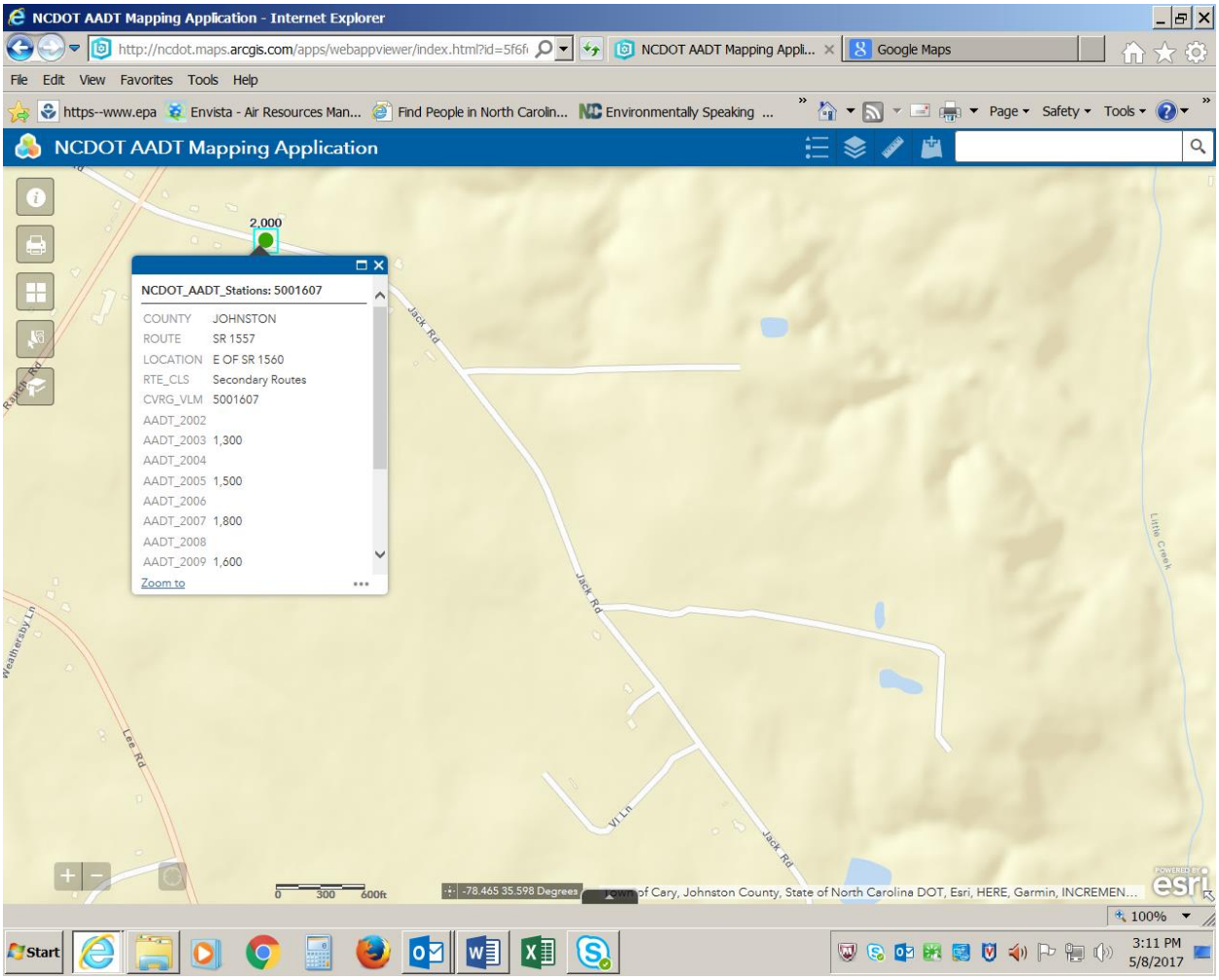
Date of Last Site Pictures 9/12/16 New Pictures Submitted? Yes ☒ No ☐

Reviewer C. Marshall Cannon Date September 27, 2016

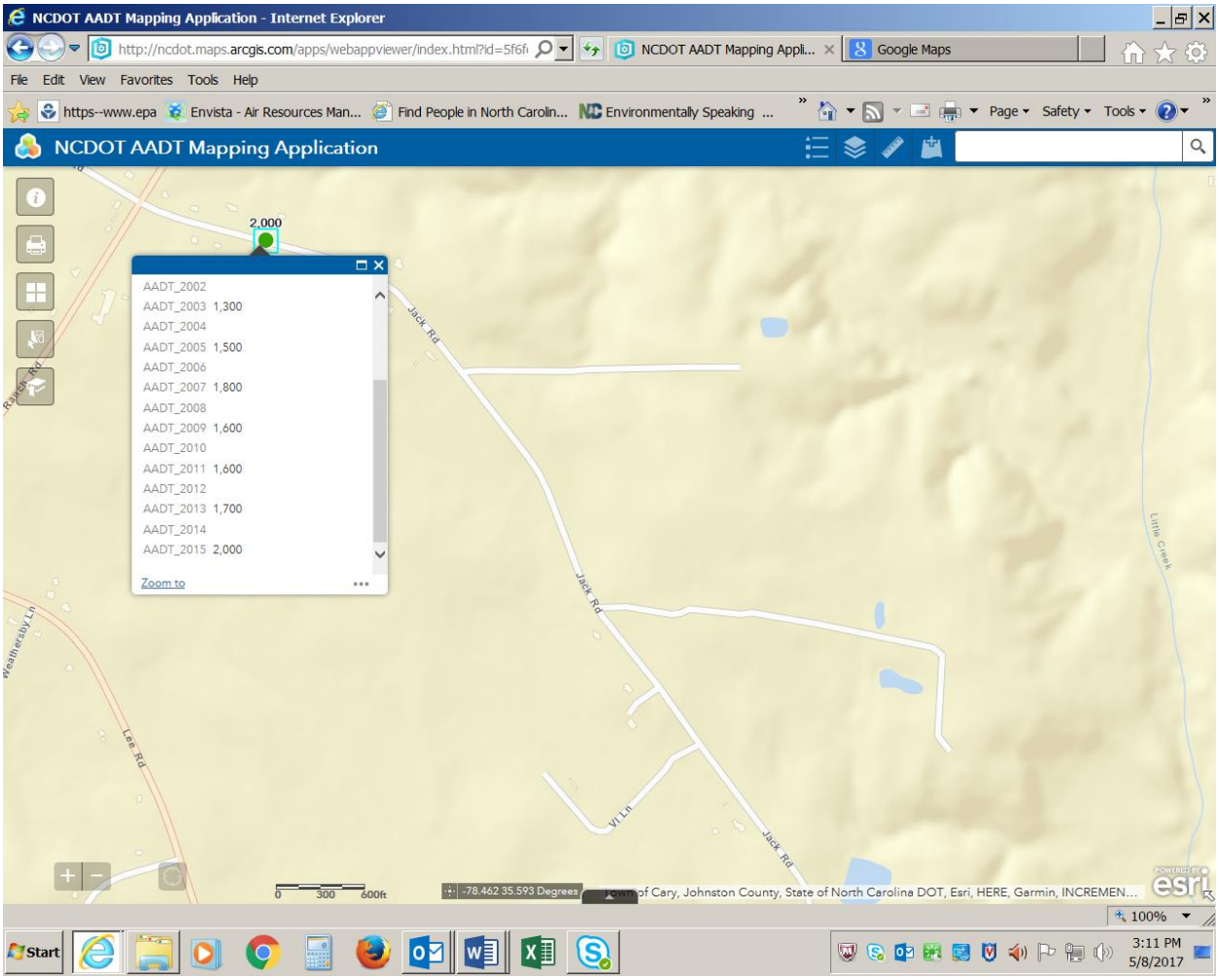
Ambient Monitoring Coordinator Rik Tebeau DateSeptember 28, 2016



2015 Average Annual Daily Traffic for West Johnston in Clayton, North Carolina
From the NC Department of Transportation Traffic Survey Unit



2003-2009, 2015 Average Annual Daily Traffic for West Johnston in Clayton, North Carolina
From the NC Department of Transportation Traffic Survey Unit



2003 - 2015 Average Annual Daily Traffic for West Johnston in Clayton, North Carolina
From the NC Department of Transportation Traffic Survey Unit

Site Review Form Calendar Year 2016

Site Information

Region RRO	**Site Name** Millbrook	**AQS Site # 37-183-0014**
Street Address-3801 Spring Forest Road		**City** Raleigh
Urban Area RALEIGH	**Core-based Statistical Area** Raleigh, NC	
Enter Exact		**Method of Measuring**
Longitude -78.574167	**Latitude** 35.85611	
In Decimal Degrees	In Decimal Degrees	**GPS** **Explanation: GPS**
Elevation Above/below Mean Sea Level (in meters)		**90**

Name of nearest road to inlet probe Spring Forest Road ADT 18000 Year latest available 2013

Comments: Site is 40m North of Spring Forest Road

Distance of site to nearest major road (m) 614.00 Direction from site to nearest major road W

Name of nearest major road Capital Blvd/ Hwy1 ADT 49000 Year 2014 Comments: _____

Site located near electrical substation/high voltage power lines? Yes ☐ No ☒

Distance of site to nearest railroad track (m) _____ Direction to RR ___ ☒NA

Distance between site and drip line of water tower (m) _____ Direction from site to water tower _____ ☒NA

Explain any sources of potential bias; include cultivated fields, loose bulk storage, stacks, vents, railroad tracks, construction activities, fast food restaurants, and swimming pools.

____

ANSWER ALL APPLICABLE QUESTIONS:

Parameters	Monitoring Objective	Scale	Monitor Type
☐ NA ☐ SO_2 (NAAQS) ☒ SO_2 (trace-level) ☒ NO_2 (NAAQS) ☒ O_3 ☐ NH_3 ☒ Hydrocarbon ☒ Air Toxics ☐ HSCO (Not Micro) ☒ CO (trace-level)	☒General/Background CO ☒Highest Concentration NO2 ☒Max O3 Concentration CO,O3 ☒Population Exposure CO,SO2,O3,NO2 ☐Source Oriented_____ ☐Transport_____ ☐Upwind Background_____ ☐Welfare Related Impacts _____	☒MicroNO2 ☒Middle CO ☒Neighborhood SO2,NO2,O3 ☐Urban_____ ☐Regional_____	☒SLAMS CO,SO2,NO2,O3 ☒SPM NO2 **Monitor Network Affiliation** ☒NCORE CO, SO2,NO2,O3 ☐Unofficial PAMS_____

Probe inlet height (from ground) 2-15 m? Yes ☒ No ☐ Give actual measured height from ground (meters) SO2(4.9),NO2 (5.14),O3(4.9),Hydrocarbons(4.7), Air Toxics-Aldehyde(3.08), CO(4.9)

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (roof) supporting structure > 1 m? Yes ☒ No☐
Actual measured distance from outer edge of probe to supporting structure (meters) SO2(1.3),NO2 (1.35),O3(1.3),Hydrocarbons(1.3),Air Toxics-Aldehyde(.95), CO(1.3)

Distance of outer edge of probe inlet from other monitoring probe inlets > 1 m? Yes ☒ No ☐ NA ☐

Is probe > 20 m from the nearest tree drip line? Yes ☐ *No ☒ (answer *'d questions)
*Is probe > 10 m from the nearest tree drip line? Yes ☒ *No ☐
*Distance from probe to tree (m) SO2 (10.1),NO2 (13.70),O3 (10),Hydrocarbons (12.1),Air Toxics-Aldehyde(12.5), CO (10) Direction from probe to tree ENE *Height of tree (m) 33.00

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒

*Identify obstacle tree (as described above) Distance from probe inlet (m) 0 Direction from probe inlet to obstacle ENE
*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No ☒

Distance of probe to nearest traffic lane (m) Air Toxics-Aldehyde (39) is the nearest probe to Spring Forest Road
Direction from probe to nearest traffic lane S

Site Review Form Calendar Year 2016

Parameters	Monitoring Objective	Scale	Site Type
☐ NA Air flow < 200 L/min ☒ PM2.5 FRM ☒ PM10 FRM ☒ PM10 Cont. (BAM) ☒ PM10-2.5 FRM ☒ PM10-2.5 BAM ☐ PM10 Lead (PB) ☒ PM2.5 Cont. (BAM) ☒ PM2.5 Spec. (SASS) ☒ PM2.5 Spec. (URG) ☒ PM2.5 Cont. Nitrate ☒ PM2.5 Cont. Sulfate ☒ PM2.5 Aethalometer	☐ General/Background _____ ☒ Highest Concentration All of the selected PM parameters ☒ Population Exposure All of the selected PM parameters ☐ Source Oriented _____ ☐ Transport _____ ☐ Welfare Related Impacts _____	☒ Micro PM2.5 Cont. NO3, SO4, Aeth ☐ Middle _____ ☒ Neighborhood PM2.5/10 FRM, PM10 Cont. (BAM), PM10-2.5 FRM, PM10-2.5 BAM, PM2.5 Cont. (BAM), PM2.5 Spec. (SASS), PM2.5 Spec. (URG), PM2.5 Cont. ☐ Urban _____ ☐ Regional _____	☒ SLAMS PM 2.5/PM10 FRM, BAM PM2.5/PM10 ☒ SPM _PM2.5 Spec. (SASS), PM2.5 Spec. (URG)PM2.5 Cont. NO3, SO4, Aeth **Monitor Network Affiliation** ☒ NCORE PM 2.5/PM10 FRM, BAM PM2.5/PM10 ☒ SUPPLEMENTAL SPECIATION _PM2.5 Spec. (SASS), PM2.5 Spec. (URG),PM2.5 Cont. NO3, SO4, Aeth **Monitor NAAQS Exclusion** ☒ NONREGULATORY PM2.5 Cont. NO3, SO4, Aeth

Probe inlet height (from ground) ☐ < 2 m _____ ☒ 2-7m _____ ☐ 7-15 m _____ ☐ > 15 m _____
Actual measured distance from probe inlet to ground (meters) PM10 FRM (2.7), PM2.5 FRM (2.4),BAM (2.62),PM2.5 SASS(2.1), PM2.5 URG (2.3),PM2.5 Cont. (Aeth (5.47),SO4 (4.74),NO3 (4.65))

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (platform or roof) supporting structure > 2 m?
Actual measured distance from outer edge of probe inlet to supporting structure (meters) PM10 FRM (2.1), PM2.5 FRM (2.1),PM2.5 SASS(2.1), PM2.5 URG (2.07), PM2.5 Cont. (Aeth 1.15,SO4 0.85,NO3 0.85) Yes ☒ No ☐

Distance (Y) between outer edge of probe inlets of any low volume monitor and any other low volume monitor at the site = 1 m or greater? Yes ☒ No ☐ NA ☐
Distance (Y) between outer edge of all low volume monitor inlets and any Hi-Volume PM-10 or TSP inlet = 2 m or greater? Yes ☐ No ☐ NA ☒

Are collocated PM2.5 Monitors (Two FRMs, FRM & BAM, BAM & BAM) Located at Site? *Yes ☒ (answer *'d questions) No ☐ NA ☐
* Entire inlet opening of collocated PM 2.5 samplers (X) within 2 to 4 m of each other? Yes ☒ No ☐ Give actual (meters) 4
*Are collocated PM2.5 sampler inlets within 1 m vertically of each other? Yes ☒ No ☐ Give actual (meters) 3

Is an URG 3000 monitor collocated with a SASS monitor at the site? *Yes ☒ (answer *'d questions) No ☐ NA ☐
* Entire inlet opening of collocated speciation samplers inlets (X) within 2 to 4 m of each other? Yes ☒ No ☐
Give actual (meters) 2.2
* Are collocated speciation sampler inlets within 1 m vertically of each other? Yes ☒ No ☐ Give actual (meters)_____

Is a low-volume PM10 monitor collocated with a PM2.5 monitor at the site to measure PM10-2.5? *Yes ☒ (answer *'d questions) No ☐ NA ☐
* Entire inlet opening of collocated PM10 and PM2.5samplers for PM10-2.5 (X) within 2 to 4 m of each other? Yes ☒ No ☐
*Are collocated PM10 and PM2.5 sampler inlets within 1 m vertically of each other? Yes ☒ No ☐

Is probe > 20 m from the nearest tree drip line? Yes ☒ *No ☐ (answer *'d questions)
*Is probe > 10 m from the nearest tree drip line? Yes ☒ *No ☐
*Distance from probe to tree (m) PM10 FRM (28.0),PM2.5 FRM (27),PM2.5FRM (COL)(26),PM2.5 FRM(27) URG (28),URG COL(30), SASS (26),BAM (28) Direction from probe to tree ENE *Height of tree (m) 33.00

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒
*Identify obstacle ____ Distance from probe inlet (m) _____Direction from probe inlet to obstacle ___
*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No☐

Distance of probe to nearest traffic lane (m) -2 Direction from probe to nearest traffic lane S

Site Review Form Calendar Year 2016

Parameters	Monitoring Objective	Scale	Monitor Type
☐ NA ☒ NO_y (trace-level)	☐ General/Background_____ ☐ Highest Concentration_____ ☐ Max O3 Concentration_____ ☒ Population ExposureNOy ☐ Source Oriented_____ ☐ Transport_____ ☐ Upwind Background_____ ☐ Welfare Related Impacts _____	☐ Micro_____ ☐ Middle_____ ☒ Neighborhood NOy ☐ Urban_____ ☐ Regional_____	☒ SLAMS NOy_____ ☐ SPM _____ **Monitor Network Affiliation** ☒ NCORE NOy

Probe inlet height (from ground) 10-15 m? Yes ☒ No ☐
Actual measured distance from probe inlet to ground (meters) 10.70

Distance of outer edge of probe inlet from horizontal and/or vertical supporting structure > 1 m? Yes ☒ No ☐
Actual measured distance from outer edge of probe inlet to supporting structure (meters) 7.40

Distance of outer edge of probe inlet from other monitoring probe inlets > 1 m? Yes ☒ No ☐ NA ☐

Is probe > 20 m from the nearest tree drip line? Yes ☐ *No ☒ (answer *'d questions)

*Is probe > 10 m from the nearest tree drip line? Yes ☒ *No ☐

*Distance from probe to tree (m) 11.40 Direction from probe to tree ENE *Height of tree (m) 33.00

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒

*Identify obstacle tree (as described above) Distance from probe inlet (m) 11 Direction from probe inlet to obstacle ENE

*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☒ No ☐

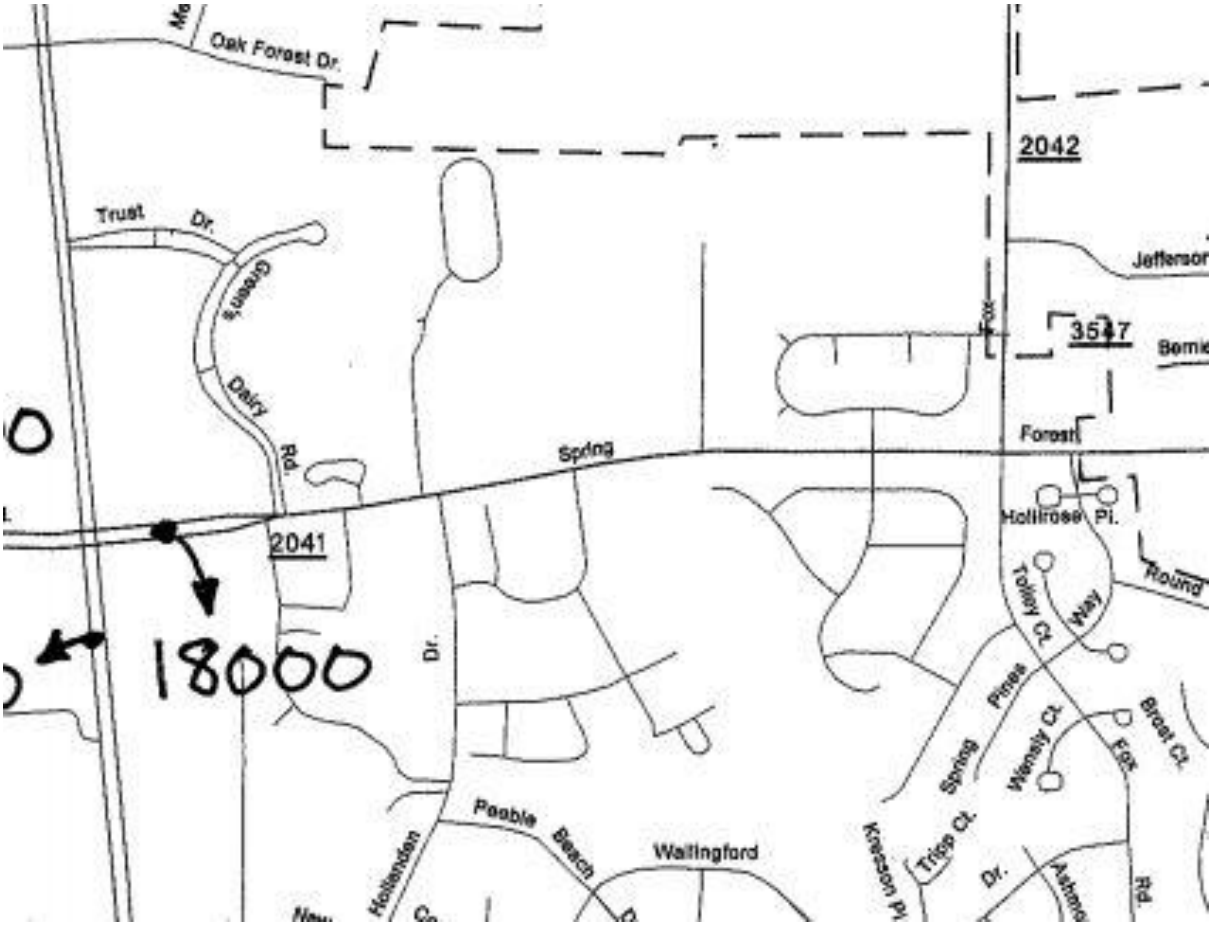
Distance of probe to nearest traffic lane (m) 40 Direction from probe to nearest traffic lane S

RECOMMENDATIONS:

1) Maintain current site status? Yes ☒ *No ☐ (answer *'d questions)
*2) Change monitoring objective? Yes ☐ (enter new objective _____) No ☒-
*3) Change scale of representativeness? Yes ☐ (enter new scale _) No ☒
*4) Relocate site? Yes ☐ No ☒

Comments:

Date of Last Site Pictures 9/26/16 New Pictures Submitted? Yes ☒ No ☐
Reviewer Travis Funderburk Date 9/23/16
Ambient Monitoring Coordinator Rik Tebeau Date October 4, 2016



2013 Average Annual Daily Traffic for Millbrook in Raleigh, North Carolina
From the NC Department of Transportation Traffic Survey Unit

Site Review Form Calendar Year 2016

Site Information

Region RRO	**Site Name** Triple Oak	**AQS Site # 37**-183-0021
Street Address-2826 Triple Oak Road,		**City Cary-ETJ (Morrisville)**
Urban Area RALEIGH	**Core-based Statistical Area** Raleigh, NC	

Enter Exact		
Longitude -78.819654	**Latitude** 35.865106	**Method of Measuring**
In Decimal Degrees	In Decimal Degrees	**Interpolation** | **Explanation: orthophoto**

Elevation Above/below Mean Sea Level (in meters) 96

Name of nearest road to inlet probe Interstate 40 ADT 140000 Year 2013
Comments: Nearest road and nearest MAJOR road are the same
Distance of site to nearest major road (m) 19.30 Direction from site to nearest major road SW
Name of nearest major road I-40 ADT 140000 Year 2013
Comments: EPA maintains a continuous traffic counting camera/radar at the site.

Site located near electrical substation/high voltage power lines? Yes ☐ No ☒

Distance of site to nearest railroad track (m) _____ Direction to RR ___ ☒NA

Distance between site and drip line of water tower (m) _____ Direction from site to water tower ___ ☒NA

Explain any sources of potential bias; include cultivated fields, loose bulk storage, stacks, vents, railroad tracks, construction activities, fast food restaurants, and swimming pools.

1.9 km to NE-RDU airport runway. 320m to S-Triangle Factory Shops mall. 650m to N-multiple distribution warehouses. 620m to SE-I40 exit #284 (Airport Blvd) multiple hotels and restauraunts. 1.3km to NW-I40 exit #283 (I-540).

Parameters	Monitoring Objective	Scale	Monitor Type
☒NO_2 (Near Road only) ☒CO (Near Road only)	☐Highest Concentration____ ☒Population Exposure____ ☒Source Oriented____ ☐Transport_____ ☐Welfare Related Impacts____	☒Micro____	☒SLAMS _____ ☐SPM_____

Probe inlet height (from ground) 2-7 m? Yes ☒ No ☐ Give actual measured height from ground (meters) 4.20
Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (roof) supporting structure > 1 m? Yes ☒ No ☐
Actual measured distance from outer edge of probe inlet to supporting structure (meters) 1.00
Distance of outer edge of probe inlet from other monitoring probe inlets > 0.25 m? Yes ☒ No ☐ NA ☐

Is probe > 20 m from the nearest tree drip line? Yes ☐ *No ☒ (answer *'d questions)
*Is probe > 10 m from the nearest tree drip line? Yes ☐ *No ☒
*Distance from probe to tree (m) 8.00 Direction from probe to tree N *Height of tree (m) 35.00

Are there any obstacles to air flow? *Yes ☒ (answer *'d questions) No ☐
*Identify obstacle tree line running parallel to interstate Distance from probe inlet (m) 8 Direction from probe inlet to obstacle N
*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No ☒

Distance of probe to nearest traffic lane (m) 20 Direction from probe to nearest traffic lane SW

NO_2 and CO RECOMMENDATIONS:

1) Maintain current site status? Yes ☒ *No ☐ (answer *'d questions)
*2) Change monitoring objective? Yes ☐ (enter new objective _____) No ☐-
*3) Change scale of representativeness? Yes ☐ (enter new scale _____) No ☐
*4) Relocate site? Yes ☐ No ☐

Comments:

Date of Last Site Pictures 12/9/2016New Pictures Submitted? Yes ☒ No ☐
Reviewer Tim Skelding Date April 28, 2017
Ambient Monitoring Coordinator RAT - CO added December 2016 DateApril 28, 2017

Site Review Form Calendar Year 2016

Parameters	Monitoring Objective	Scale	Site Type
☒ NA Air flow < 200 L/min ☐ PM2.5 FRM ☐ PM10 FRM ☐ PM10 Cont. (BAM) ☐ PM10-2.5 FRM ☐ PM10-2.5 BAM ☐ PM10 Lead (PB) ☐ PM2.5 Cont. (TEOM) ☐ PM2.5 Cont. (BAM) ☐ PM2.5 Spec. (SASS) ☐ PM2.5 Spec. (URG) ☐ PM2.5 Cont. Spec.	☐ General/Background _____ ☐ Highest Concentration _____ ☐ Population Exposure _____ ☐ Source Oriented _____ ☐ Transport _____ ☐ Welfare Related Impacts _____	☐ Micro _____	☐ SLAMS _____ ☐ SPM_____ **Monitor Network Affiliation** ☐ SUPPLEMENTAL SPECIATION _____ **Monitor NAAQS Exclusion** ☐ NONREGULATORY_____

Probe inlet height (from ground) ☐ < 2 m _____ ☐ 2-7m _____ ☐ 7-15 m _____ ☐ > 15 m _____
Actual measured distance from probe inlet to ground (meters) _____

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (platform or roof) supporting structure > 2 m?
Actual measured distance from outer edge of probe inlet to supporting structure (meters) _____ Yes ☐ No ☐

Distance (Y) between outer edge of probe inlets of any low volume monitor and any other low volume monitor at the site = 1 m or greater? Yes ☐ No ☐ NA ☐

Distance (Y) between outer edge of all low volume monitor inlets and any Hi-Volume PM-10 or TSP inlet = 2 m or greater? Yes ☐ No ☐ NA ☐

Are collocated PM2.5 Monitors (Two FRMs, FRM & BAM, FRM & TEOM, BAM & TEOM) Located at Site? *Yes ☐ (answer *'d questions) No ☐ NA ☐

* Entire inlet opening of collocated PM 2.5 samplers (X) within 2 to 4 m of each other? Yes ☐ No ☐ Give actual (meters) _____

*Are collocated PM2.5 sampler inlets within 1 m vertically of each other? Yes ☐ No ☐ Give actual (meters) _____

Is an URG 3000 monitor collocated with a SASS monitor at the site? *Yes ☐ (answer *'d questions) No ☐ NA ☐

* Entire inlet opening of collocated speciation samplers inlets (X) within 2 to 4 m of each other? Yes ☐ No ☐
Give actual (meters) _____

* Are collocated speciation sampler inlets within 1 m vertically of each other? Yes ☐ No ☐ Give actual (meters) _____

Is a low-volume PM10 monitor collocated with a PM2.5 monitor at the site to measure PM10-2.5? *Yes ☐ (answer *'d questions) No ☐ NA ☐

* Entire inlet opening of collocated PM10 and PM2.5samplers for PM10-2.5 (X) within 2 to 4 m of each other? Yes ☐ No ☐

*Are collocated PM10 and PM2.5 sampler inlets within 1 m vertically of each other? Yes ☐ No ☐

Is probe > 20 m from the nearest tree drip line? Yes ☐ *No ☐ (answer *'d questions)

*Is probe > 10 m from the nearest tree drip line? Yes ☐ *No ☐
*Distance from probe to tree (m) _____ Direction from probe to tree ___ *Height of tree (m) _____

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☐

*Identify obstacle ____ Distance from probe inlet (m) _____Direction from probe inlet to obstacle ___
*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No ☐

Distance of probe to nearest traffic lane (m) _____ Direction from probe to nearest traffic lane ___

PM RECOMMENDATIONS:

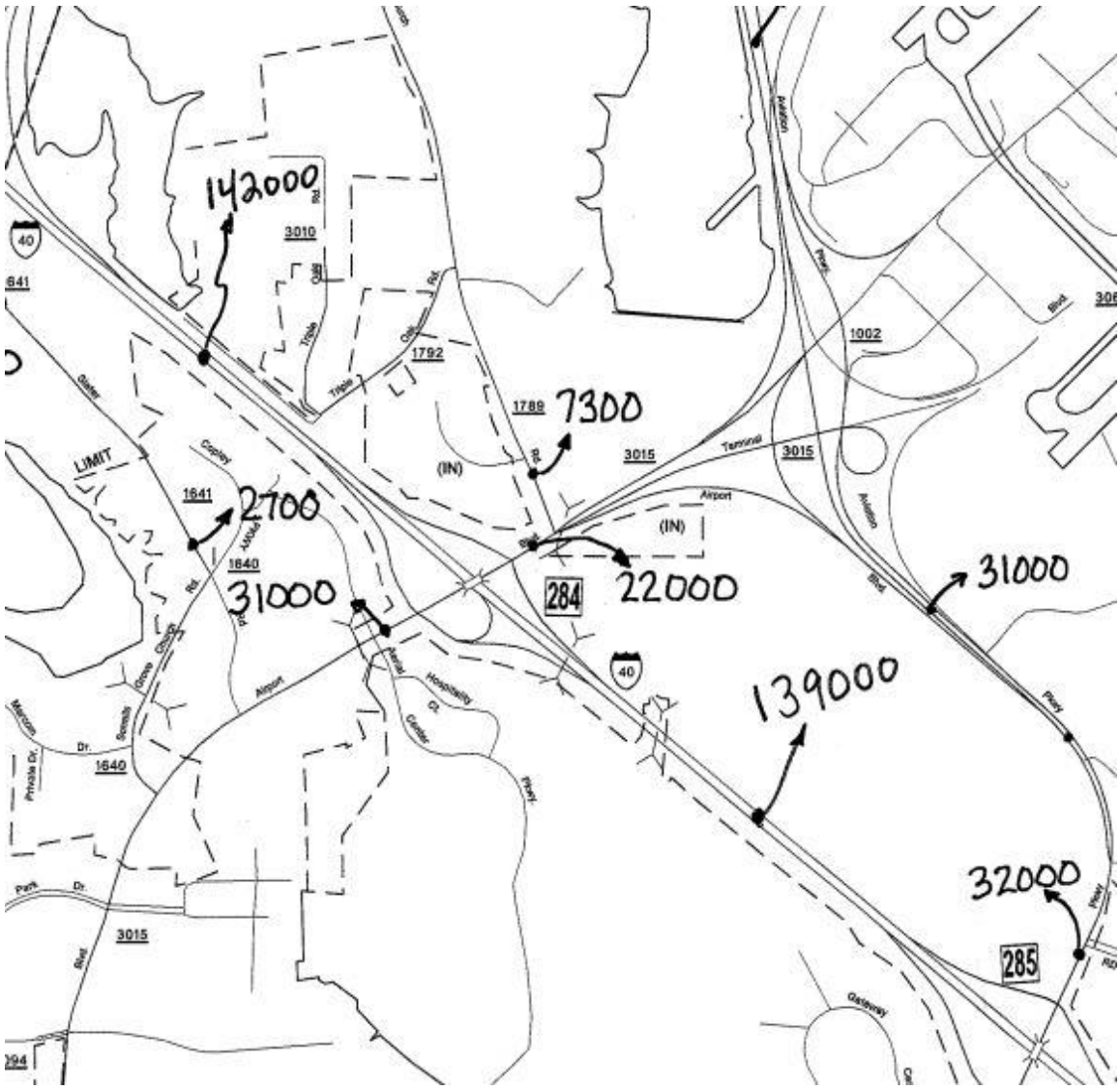
1) Maintain current site status? Yes ☐ *No ☒ (answer *'d questions)

*2) Change monitoring objective? Yes ☐ (enter new objective _____) No ☒
*3) Change scale of representativeness? Yes ☐ (enter new scale _) No ☒
*4) Relocate site? Yes ☐ No ☒

Comments:

Reviewer Tim Skelding Date April 28, 2017

Ambient Monitoring Coordinator RAT -Add BAM 1022 and COT in 2017 DateApril 28, 2017



2013 Average Annual Daily Traffic for Triple Oak in Cary, North Carolina
From the NC Department of Transportation Traffic Survey Unit

Site Review Form Calendar Year 2016

Site Information

Region RRO	**Site Name** Leggett	**AQS Site # 37-065-0099**
Street Address 7589 NC 33 NW		**City** Tarboro
Urban Area TARBORO	**Core-based Statistical Area**	Rocky Mount, NC

Enter Exact		
Longitude -77.5843	**Latitude** 35.988278	**Method of Measuring**
In Decimal Degrees	In Decimal Degrees	**Interpolation** / **Explanation: Google Maps**
Elevation Above/below Mean Sea Level (in meters)		**20.00**

Name of nearest road to inlet probe NC 97 ADT 2500 Year Choose an item 2014

Comments: _____

Distance of site to nearest major road (m) 92.00 Direction from site to nearest major road ENE

Name of nearest major road NC 33 ADT 2200 Year 2013

Comments: NC 33 is the closest road, other than NC97. The closest 'major' road is US258 is greater than 8KM miles away

Site located near electrical substation/high voltage power lines?	Yes ☐ No ☒
Distance of site to nearest railroad track	(m) _____ Direction to RR ___ ☒NA
OPTIONAL Distance of site to nearest power pole w/transformer	(m) ____ Direction ___
Distance between site and drip line of water tower (m) _____ Direction from site to water tower _____	☒NA

Explain any sources of potential bias; include cultivated fields, loose bulk storage, stacks, vents, railroad tracks, construction activities, fast food restaurants, and swimming pools.

_____

ANSWER ALL APPLICABLE QUESTIONS:

Parameters	Monitoring Objective	Scale	Monitor Type
☐ NA ☐ SO_2 (NAAQS) ☐ SO_2 (trace-level) ☐ NO_2 (NAAQS) ☐ $HSNO_y$ ☒ O_3 ☐ NH_3 ☐ Hydrocarbon ☐ Air Toxics ☐ CO (trace-level)	☒General/Background_____ ☐Highest Concentration_____ ☐Max O3 Concentration_____ ☒Population Exposure O3 ☐Source Oriented_____ ☐Transport_____ ☐Upwind Background_____ ☐Welfare Related Impacts _____	☐Micro_____ ☐Middle_____ ☒ Neighborhood_____ ☐Urban_____ ☐Regional_____	☒SLAMS _____ ☐SPM_____ **Monitor Network Affiliation** ☐NCORE_____ ☐Unofficial PAMS_____

Probe inlet height (from ground) 2-15 m? Yes ☒ No ☐ Give actual measured height from ground (meters) 3.00

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (roof) supporting structure > 1 m? Yes ☒No ☐

Actual measured distance from outer edge of probe to supporting structure (meters) 0.80

Distance of outer edge of probe inlet from other monitoring probe inlets > 1 m? Yes ☒ No ☐ NA ☐

Is probe > 20 m from the nearest tree drip line? Yes ☒ *No ☐ (answer *'d questions)

*Is probe > 10 m from the nearest tree drip line? Yes ☐ *No ☐

*Distance from probe to tree (m) _____ Direction from probe to tree ___ *Height of tree (m) _____

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒

*Identify obstacle _____ Distance from probe inlet (m) _____Direction from probe inlet to obstacle ___

*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No ☐

Distance of probe to nearest traffic lane (m) 96 Direction from probe to nearest traffic lane ESE

Site Review Form Calendar Year 2016

Parameters	Monitoring Objective	Scale	Site Type
☐ NA Air flow < 200 L/min ☐ PM2.5 FRM ☐ PM10 FRM ☐ PM10 Cont. (BAM) ☐ PM10-2.5 FRM ☐ PM10-2.5 BAM ☐ PM10 Lead (PB) ☒ PM2.5 Cont. (BAM) ☐ PM2.5 Spec. (SASS) ☐ PM2.5 Spec. (URG) ☐ PM2.5 Cont. Spec.	☒ General/Background _____ ☐ Highest Concentration _____ ☒ Population Exposure _____ ☐ Source Oriented _____ ☐ Transport _____ ☐ Welfare Related Impacts _____	☐ Micro _____ ☐ Middle _____ ☒ Neighborhood _____ ☐ Urban _____ ☐ Regional _____	☒ SLAMS _____ ☐ SPM_____ **Monitor Network Affiliation** ☐ NCORE _____ ☐ SUPPLEMENTAL SPECIATION_____ **Monitor NAAQS Exclusion** ☐ NONREGULATORY_____

Probe inlet height (from ground) ☐ < 2 m _____ ☒ 2-7m _____ ☐ 7-15 m _____ ☐ > 15 m _____
Actual measured distance from probe inlet to ground (meters) 2.5

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (platform or roof) supporting structure > 2 m?
Actual measured distance from outer edge of probe inlet to supporting structure (meters) 4.0 Yes ☒ No ☐

Distance (Y) between outer edge of probe inlets of any low volume monitor and any other low volume monitor at the site = 1 m or greater? Yes ☐ No ☐ NA ☒

Distance (Y) between outer edge of all low volume monitor inlets and any Hi-Volume PM-10 or TSP inlet = 2 m or greater? Yes ☐ No ☐ NA ☒

Are collocated PM2.5 Monitors (Two FRMs, FRM & BAM, FRM & TEOM, BAM & TEOM) Located at Site? *Yes ☐ (answer *'d questions) No ☒ NA ☐

* Entire inlet opening of collocated PM 2.5 samplers (X) within 2 to 4 m of each other? Yes ☐ No ☐ Give actual (meters) _____
*Are collocated PM2.5 sampler inlets within 1 m vertically of each other? Yes ☐ No ☐ Give actual (meters) _____

Is an URG 3000 monitor collocated with a SASS monitor at the site? *Yes ☐ (answer *'d questions) No ☒ NA ☐
* Entire inlet opening of collocated speciation samplers inlets (X) within 2 to 4 m of each other? Yes ☐ No ☐
Give actual (meters) _____
* Are collocated speciation sampler inlets within 1 m vertically of each other? Yes ☐ No ☐ Give actual (meters) _____

Is a low-volume PM10 monitor collocated with a PM2.5 monitor at the site to measure PM10-2.5? *Yes ☐ (answer *'d questions) No ☒ NA ☐

* Entire inlet opening of collocated PM10 and PM2.5samplers for PM10-2.5 (X) within 2 to 4 m of each other? Yes ☒ No ☐
*Are collocated PM10 and PM2.5 sampler inlets within 1 m vertically of each other? Yes ☒ No ☐

Is probe > 20 m from the nearest tree drip line? Yes ☒ *No ☐ (answer *'d questions)

*Is probe > 10 m from the nearest tree drip line? Yes ☐ *No ☐
*Distance from probe to tree (m) _____ Direction from probe to tree ___ *Height of tree (m) _____

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒

*Identify obstacle ____ Distance from probe inlet (m) _____Direction from probe inlet to obstacle ___
*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☒No ☐

Distance of probe to nearest traffic lane (m) 40 Direction from probe to nearest traffic lane N

RECOMMENDATIONS:

1) Maintain current site status? Yes ☒ *No ☐ (answer *'d questions)

*2) Change monitoring objective? Yes ☐ (enter new objective _____) No ☒-

*3) Change scale of representativeness? Yes ☐ (enter new scale _) No ☒

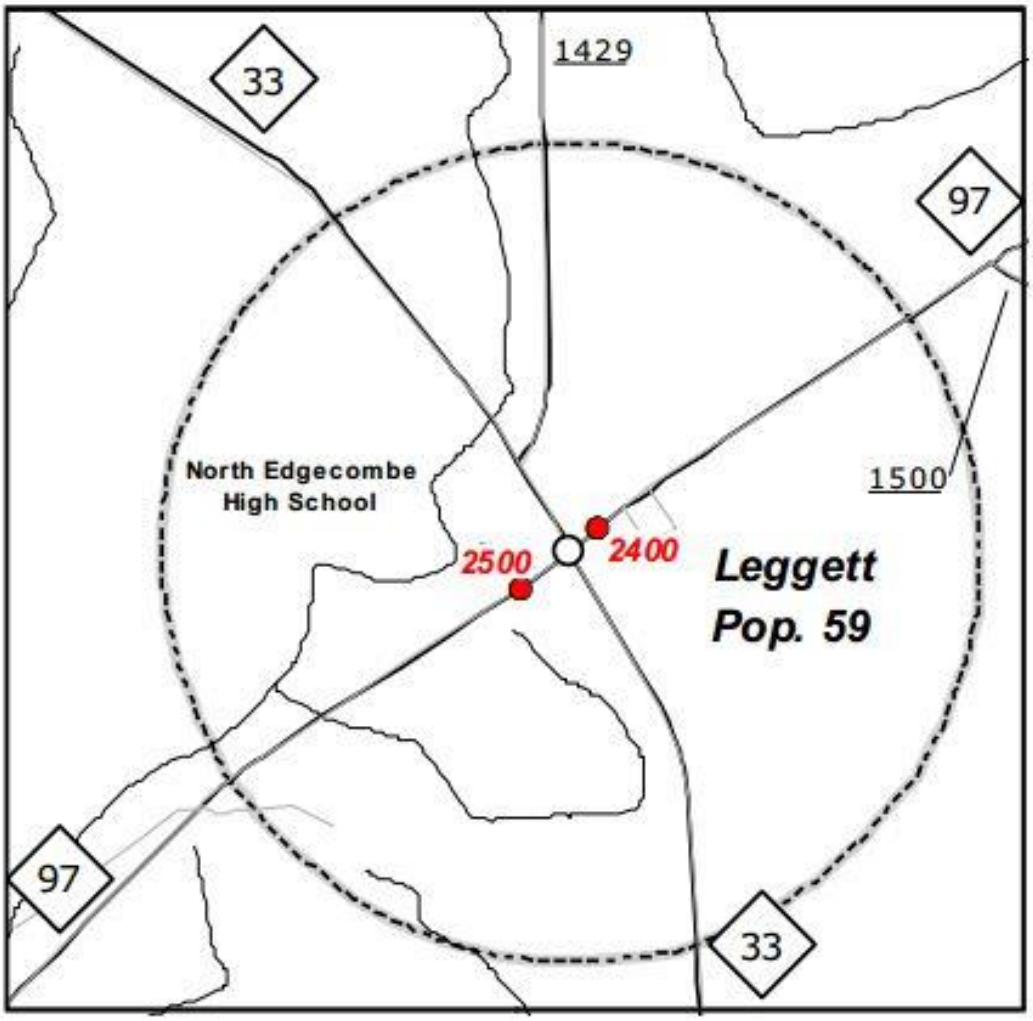
*4) Relocate site? Yes ☐ No ☒

Comments:

Date of Last Site Pictures ___2016__ New Pictures Submitted? Yes ☒ No ☐

Reviewer James H Reske Date May 1, 2017

Ambient Monitoring Coordinator RAT - Revised to include the BAM 1022 DateMay 2, 2017



Leggett

2014 Average Annual Daily Traffic for Leggett, North Carolina
From the NC Department of Transportation Traffic Survey Unit

Site Review Form Calendar Year 2016

Site Information

Region RRO	**Site Name** Blackstone	**AQS Site # 37-105-0002**
Street Address 4110 Blackstone Road		**City** SANFORD
Urban Area Not in an Urban Area	**Core-based Statistical Area** Sanford, NC	

Enter Exact		
Longitude -79.28879	**Latitude** 35.43248	**Method of Measuring**
In Decimal Degrees	In Decimal Degrees	**Interpolation** | **Explanation: Orthophoto**
Elevation Above/below Mean Sea Level (in meters)		**117**

Name of nearest road to inlet probe Blackstone Road ADT 390 Year latest available 2014

Comments: _____

Distance of site to nearest major road (m) 50.00 Direction from site to nearest major road E

Name of nearest major road Blackstone Road ADT 390 Year 2014

Comments: _____

Site located near electrical substation/high voltage power lines?	Yes ☐ No ☒
Distance of site to nearest railroad track	(m) _____ Direction to RR ___ ☒NA
OPTIONAL Distance of site to nearest power pole w/transformer	(m) 35 Direction SE
Distance between site and drip line of water tower (m) _____ Direction from site to water tower _____	☒NA

Explain any sources of potential bias; include cultivated fields, loose bulk storage, stacks, vents, railroad tracks, construction activities, fast food restaurants, and swimming pools.

_____

ANSWER ALL APPLICABLE QUESTIONS:

Parameters	Monitoring Objective	Scale	Monitor Type
☐ NA ☒ SO_2 (NAAQS) ☐ SO_2 (trace-level) ☒ NO_2 (NAAQS) ☐ $HSNO_y$ ☒ O_3 ☐ NH_3 ☒ Hydrocarbon ☒ Air Toxics ☐ CO (trace-level)	☒General/Background SO2 NO2 O3 ☐Highest Concentration_____ ☐Max O3 Concentration_____ ☐Population Exposure_____ ☐Source Oriented_____ ☐Transport_____ ☐Upwind Background_____ ☐Welfare Related Impacts _____	☐Micro_____ ☐Middle_____ ☐Neighborhood_____ ☒Urban SO2 NO2 O3 ☐Regional_____	☐SLAMS _____ ☒SPM SO2 NO2 O3 **Monitor Network Affiliation** ☐NCORE_____ ☐Unofficial PAMS_____

Probe inlet height (from ground) 2-15 m? Yes ☒ No ☐ Give actual measured height from ground (meters) 3.68

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (roof) supporting structure > 1 m? Yes ☒ No ☐
Actual measured distance from outer edge of probe to supporting structure (meters) 1.02

Distance of outer edge of probe inlet from other monitoring probe inlets > 1 m? Yes ☒ No ☐ NA ☐

Is probe > 20 m from the nearest tree drip line? Yes ☒ *No ☐ (answer *'d questions)

*Is probe > 10 m from the nearest tree drip line? Yes ☐ *No ☐

*Distance from probe to tree (m) _____ Direction from probe to tree ___ *Height of tree (m) _____

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒

*Identify obstacle _____ Distance from probe inlet (m) _____ Direction from probe inlet to obstacle ___

*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No ☐

Distance of probe to nearest traffic lane (m) 50 Direction from probe to nearest traffic lane E

Site Review Form Calendar Year 2016

Parameters	Monitoring Objective	Scale	Site Type
☐ NA Air flow < 200 L/min ☐ PM2.5 FRM ☐ PM10 FRM ☐ PM10 Cont. (BAM) ☐ PM10-2.5 FRM ☐ PM10-2.5 BAM ☐ PM10 Lead (PB) ☒ PM2.5 Cont. (BAM) ☐ PM2.5 Spec. (SASS) ☐ PM2.5 Spec. (URG) ☐ PM2.5 Cont. Spec.	☐ General/Background _____ ☐ Highest Concentration _____ ☐ Population Exposure _____ ☐ Source Oriented _____ ☐ Transport _____ ☐ Welfare Related Impacts _____	☐ Micro _____ ☐ Middle _____ ☐ Neighborhood _____ ☐ Urban _____ ☐ Regional _____	☐ SLAMS _____ ☐ SPM_____ **Monitor Network Affiliation** ☐ NCORE _____ ☐ SUPPLEMENTAL SPECIATION_____ **Monitor NAAQS Exclusion** ☐ NONREGULATORY_____

Probe inlet height (from ground) ☐ < 2 m _____ ☒ 2-7m _____ ☐ 7-15 m _____ ☐ > 15 m _____
Actual measured distance from probe inlet to ground (meters) 2.5

Distance of outer edge of probe inlet from horizontal (wall) and/or vertical (platform or roof) supporting structure > 2 m?
Actual measured distance from outer edge of probe inlet to supporting structure (meters) 0.8 Yes ☒ No ☐

Distance (Y) between outer edge of probe inlets of any low volume monitor and any other low volume monitor at the site = 1 m or greater? Yes ☒ No ☐ NA ☐
Distance (Y) between outer edge of all low volume monitor inlets and any Hi-Volume PM-10 or TSP inlet = 2 m or greater? Yes ☒ No ☐ NA ☐

Are collocated PM2.5 Monitors (Two FRMs, FRM & BAM, FRM & TEOM, BAM & TEOM) Located at Site? *Yes ☐ (answer *'d questions) No ☒ NA ☐
* Entire inlet opening of collocated PM 2.5 samplers (X) within 2 to 4 m of each other? Yes ☐ No ☐ Give actual (meters) _____
*Are collocated PM2.5 sampler inlets within 1 m vertically of each other? Yes ☐ No ☐ Give actual (meters) _____

Is an URG 3000 monitor collocated with a SASS monitor at the site? *Yes ☐ (answer *'d questions) No ☒ NA ☐
* Entire inlet opening of collocated speciation samplers inlets (X) within 2 to 4 m of each other? Yes ☐ No ☐
Give actual (meters) _____
* Are collocated speciation sampler inlets within 1 m vertically of each other? Yes ☐ No ☐ Give actual (meters) _____

Is a low-volume PM10 monitor collocated with a PM2.5 monitor at the site to measure PM10-2.5? *Yes ☐ (answer *'d questions) No ☒ NA ☐
* Entire inlet opening of collocated PM10 and PM2.5samplers for PM10-2.5 (X) within 2 to 4 m of each other? Yes ☐ No ☐
*Are collocated PM10 and PM2.5 sampler inlets within 1 m vertically of each other? Yes ☐ No ☐

Is probe > 20 m from the nearest tree drip line? Yes ☒ *No ☐ (answer *'d questions)
*Is probe > 10 m from the nearest tree drip line? Yes ☐ *No ☐
*Distance from probe to tree (m) _____ Direction from probe to tree ___ *Height of tree (m) _____

Are there any obstacles to air flow? *Yes ☐ (answer *'d questions) No ☒
*Identify obstacle ____ Distance from probe inlet (m) _____Direction from probe inlet to obstacle ___
*Is distance from inlet probe to obstacle at least twice the height that the obstacle protrudes above the probe? Yes ☐ No ☐

Distance of probe to nearest traffic lane (m) 50 Direction from probe to nearest traffic lane E

RECOMMENDATIONS:

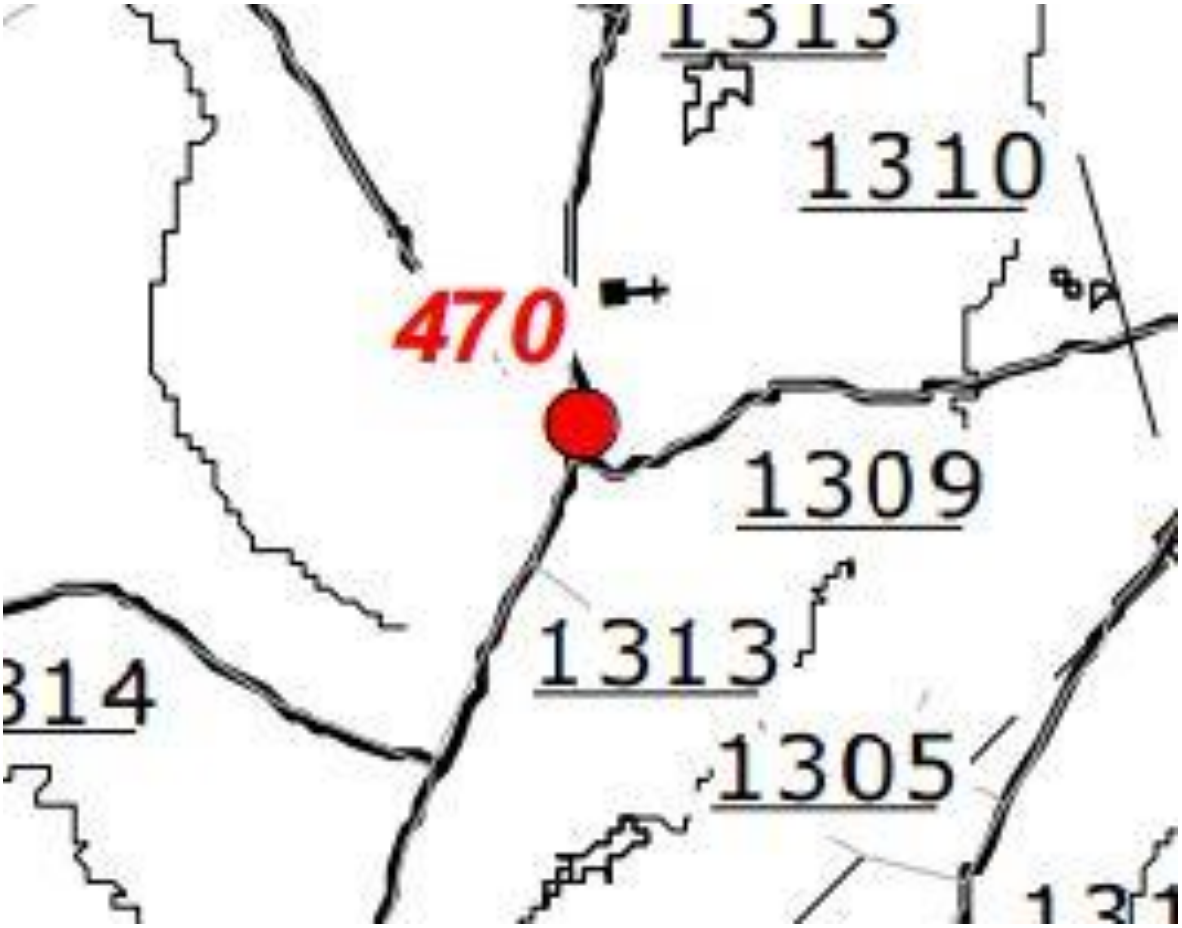
1) Maintain current site status? Yes ☒ *No ☐ (answer *'d questions)
*2) Change monitoring objective? Yes ☐ (enter new objective _____) No ☐-
*3) Change scale of representativeness? Yes ☐ (enter new scale _) No ☐
*4) Relocate site? Yes ☐ No ☐

Comments:

Date of Last Site Pictures September 14, 2016 New Pictures Submitted? Yes ☒ No ☐

Reviewer Stephen Helms Date September 28, 2016

Ambient Monitoring Coordinator Rik Tebeau DateOctober 4, 2016



2014 Average Annual Daily Traffic for Blackstone in Sanford, North Carolina
From the NC Department of Transportation Traffic Survey Unit

Appendix D-2. Scale of Representativeness

Each station in the monitoring network must be described in terms of the physical dimensions of the air parcel nearest the monitoring station throughout which actual pollutant concentrations are reasonably similar. Area dimensions or scales of representativeness used in the network description are:

a) Microscale - defines the concentration in air volumes associated with area dimensions ranging from several meters up to about 100 meters.

b) Middle scale - defines the concentration typical of areas up to several city blocks in size with dimensions ranging from about 100 meters to 0.5 kilometers.

c) Neighborhood scale – defines concentrations within an extended area of a city that has relatively uniform land use with dimensions ranging from about 0.5 to 4.0 kilometers.

d) Urban scale - defines an overall citywide condition with dimensions on the order of 4 to 50 kilometers.

e) Regional Scale - defines air quality levels over areas having dimensions of 50 to hundreds of kilometers.

Closely associated with the area around the monitoring station where pollutant concentrations are reasonably similar are the basic monitoring exposures of the station.

There are six basic exposures:

a) Sites located to determine the highest concentrations expected to occur in the area covered by the network.

b) Sites located to determine representative concentrations in areas of high population density.

c) Sites located to determine the impact on ambient pollution levels of significant sources or source categories.

d) Sites located to determine general background concentration levels.

e) Sites located to determine the extent of regional pollutant transport among populated areas.

f) Sites located to measure air pollution impacts on visibility, vegetation damage or other welfare-based impacts and in support of secondary standards.

The design intent in siting stations is to correctly match the area dimensions represented by the sample of monitored air with the area dimensions most appropriate for the monitoring objective of the station. The following relationship of the six basic objectives and the scales of representativeness are appropriate when siting monitoring stations:

Table D-1. Site Type Appropriate Siting Scales

1. Highest concentration	Micro, middle, neighborhood, sometimes urban or regional for secondarily formed pollutants
2. Population oriented	Neighborhood, urban
3. Source impact	Micro, middle, neighborhood
4. General/background & regional transport	Urban, regional
5. Welfare-related impacts	Urban, regional

Appendix D-3. Duke Energy Roxboro Siting Analysis and Additional Site Information

(1) Duke Energy Roxboro SO_2 Modeling for Monitor Placement

Introduction

On June 22, 2010, the EPA revised the primary sulfur dioxide, SO_2, national ambient air quality standard, NAAQS (75 FR 35520). The EPA promulgated a new 1-hour daily maximum primary SO_2 standard at a level of 75 parts per billion, ppb, based on the 3-year average of the annual 99th percentile f 1-hour daily maximum concentrations.

On May 13, 2014, the EPA proposed the Data Requirements Rule (DRR) for the 1-Hour SO_2 NAAQS (79 FR 27445). The final DRR was promulgated on Aug. 21, 2015 (80 FR 51051) and requires states to gather and submit to the EPA additional information characterizing SO_2 air quality in areas with larger sources of SO_2 emissions. In the DRR, air agencies have the choice to use either monitoring or modeling to characterize SO_2 air quality near priority SO_2 sources and submit the modeling and/or monitoring to the EPA on a schedule specified by the rule.

This analysis was conducted to identify a suitable 1-hour SO_2 source-oriented monitoring site location for the 2017-2019 monitoring period intended to satisfy the DRR for Duke Energy Roxboro. In 2016 when the analysis was performed, the closest SO_2 monitor with a design value was about 80 kilometers southwest of Duke Energy Roxboro, located at 3801 Spring Forest Road, Raleigh, NC. The 1-hour background monitored air concentration for the area based on 2012-2014 data from that monitor is 9 ppb (23.58 µg/m^3).

Duke Energy Roxboro

Duke Energy's Roxboro Plant is a coal-fired electric generating facility located at 1700 Dunnaway Road outside of Roxboro, Person County, NC. The facility produces steam in four coal-fired combustion units (Units 1-4) and the steam is routed to steam turbines that produce electricity to sell to residential or industrial consumers. The facility is a significant source of SO_2 emissions, emitting over the 2,000 tons per year threshold specified in the DRR for determining which sources need to be evaluated in determining area NAAQS compliance designations.

A part of the requirements for the DRR is the consideration of other sources of SO_2 near the facility. In an initial analysis, the impact of SO_2 emissions from the Mayo Generating Facility also in Person County were examined. The analysis determined that the cumulative impacts of the two facilities were insignificant compared to the impact from the Duke Energy Roxboro facility alone.

AERMOD Modeling

As described in the EPA SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, or the Monitoring TAD,[17] the North Carolina Division of Air Quality's, DAQ's, modeling

[17] U.S. EPA, Office of Air and Radiation, Office of Air Quality Planning and Standards, Air Quality Assessment Division, *SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document*, Draft, February

followed the recommendations of the SO_2 NAAQS Designations Modeling Technical Assistance Document (Modeling TAD).[18] According to the Modeling TAD, given the source-oriented nature of SO_2, dispersion models are appropriate air quality modeling tools to predict the near-field concentrations. The AMS/EPA Regulatory Model (AERMOD) was used, as suggested in the Monitoring TAD. AERMOD is the preferred air dispersion model because it is capable of handling rural and urban areas, flat and complex terrain, surface and elevated releases and multiple sources (including, point, area and volume sources) to address ambient impacts for the designations process.

Three years of hourly SO_2 Continuous Emissions Monitor (CEM) data for each of the four stacks at the Duke Energy Roxboro facility was used in the modeling. Following the example in Appendix A of the Monitoring TAD, normalized emission rates were used as input to the model. Because of the linear scalability of emissions to modeled concentrations, the relative model results using normalized emissions can be used to predict the location of maximum concentration gradients. The CEM emissions rates were normalized by dividing each hour's rate by the highest overall rate over all stacks throughout the period. Building locations, sizes and orientations relative to stacks were input into BPIP-PRIME to calculate building parameters for AERMOD. Table D-2 provides the stack parameters used in the modeling analysis.

Table D-2. Parameters for Duke Energy Roxboro SO2 Modeling for Monitor Placement

Source ID	Stack Height (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
UNIT1	121.92	325.37	14.22	6.71
UNIT2	121.92	325.93	15.32	8.69
UNIT3	121.92	326.48	14.32	9.3
UNIT4	121.92	325.91	14.32	9.3

Receptors were spaced 100 meters apart along the fence line. A set of nested Cartesian grid receptors were generated extending outward from the fence line. The receptors were spaced 100 meters apart out to 3 km from the facility center, 500 meters apart from 3 to 5 km out and 1000 meters apart from 5 to 10 km out. Receptors were removed from the model if they were within the fence line of the facility or in areas not suitable for the placement of a permanent monitor such as open water. The following figures are included to show the facility and modeling inputs. Figure D71 is an aerial photo of the facility, Figure D72 shows the emissions point and building locations and Figure D73 shows the receptor placement.

2016, available on the worldwide web at https://www.epa.gov/sites/production/files/2016-06/documents/so2monitoringtad.pdf, accessed on May 3, 2017

[18] U.S. EPA, Office of Air and Radiation, Office of Air Quality Planning and Standards, Air Quality Assessment Division, *SO_2 NAAQS Designations Modeling Technical Assistance Document*, Draft, August 2016, available on the worldwide web at https://www.epa.gov/sites/production/files/2016-06/documents/so2modelingtad.pdf, accessed on May 3, 2017

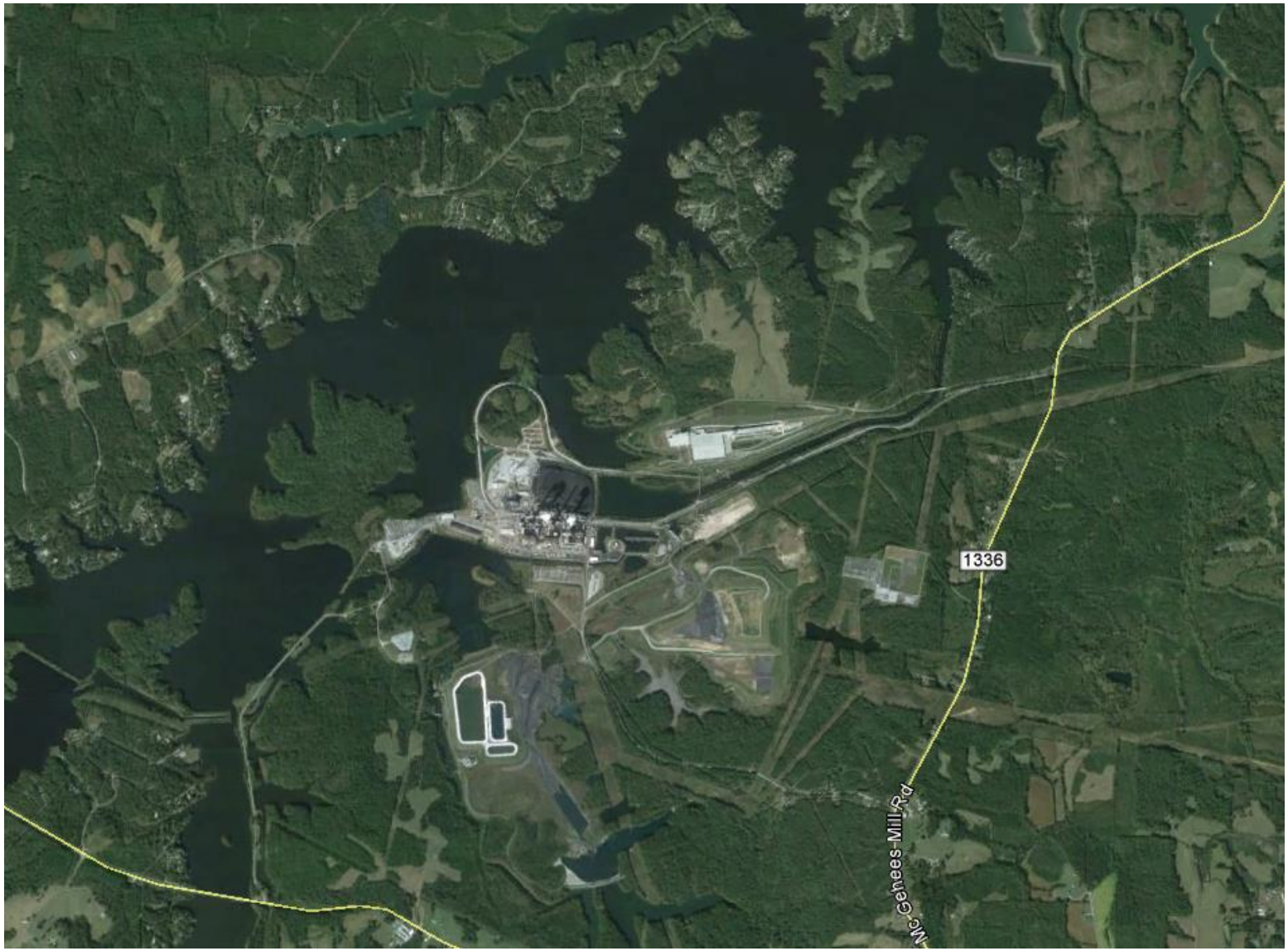


Figure D71. Aerial View of Duke Energy Roxboro and Surrounding Areas

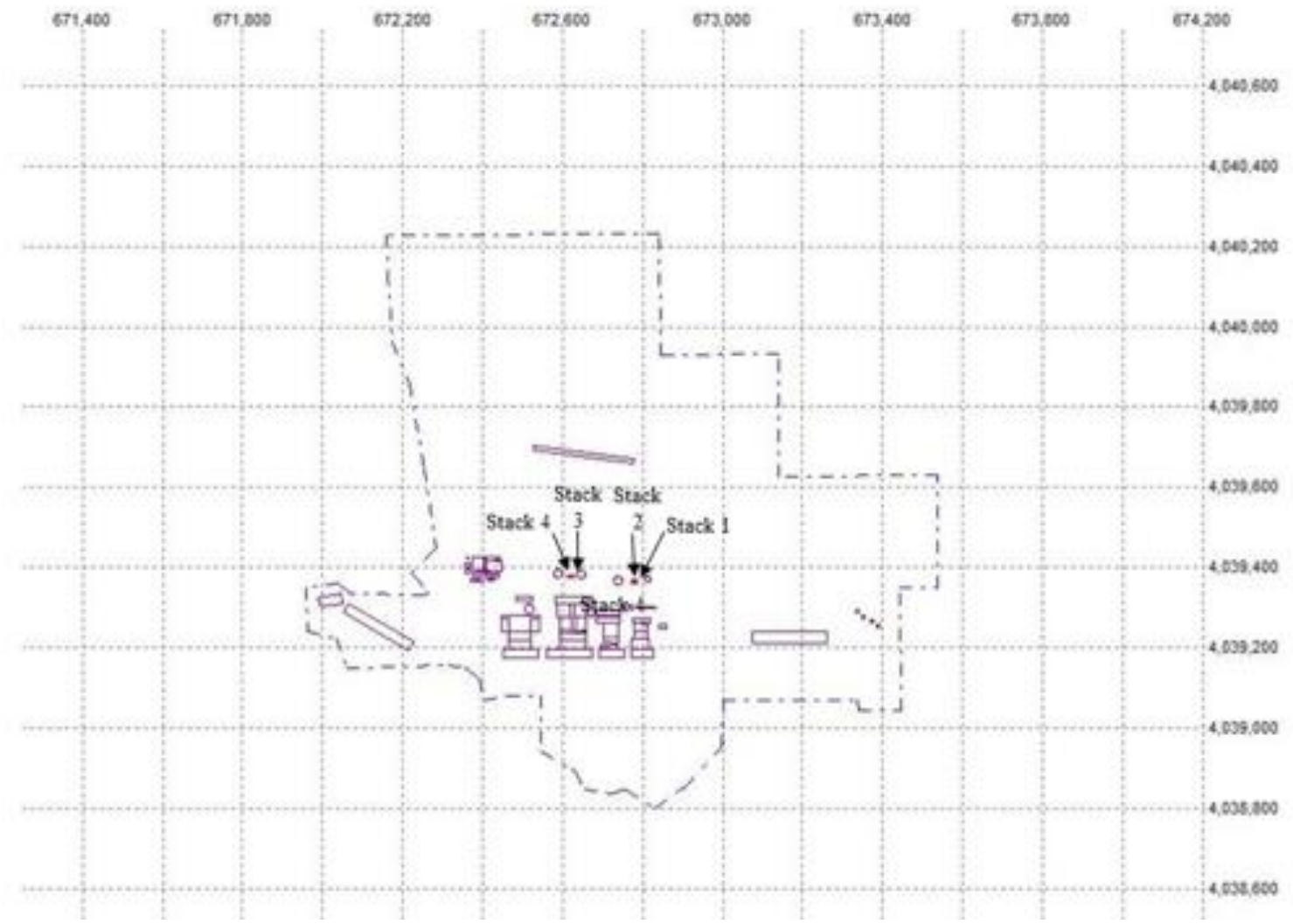


Figure D72. Locations in Duke Energy Roxboro SO2 Modeling for Monitor Placement (UTM NAD 83 Coordinates in Meters, Zone 17)

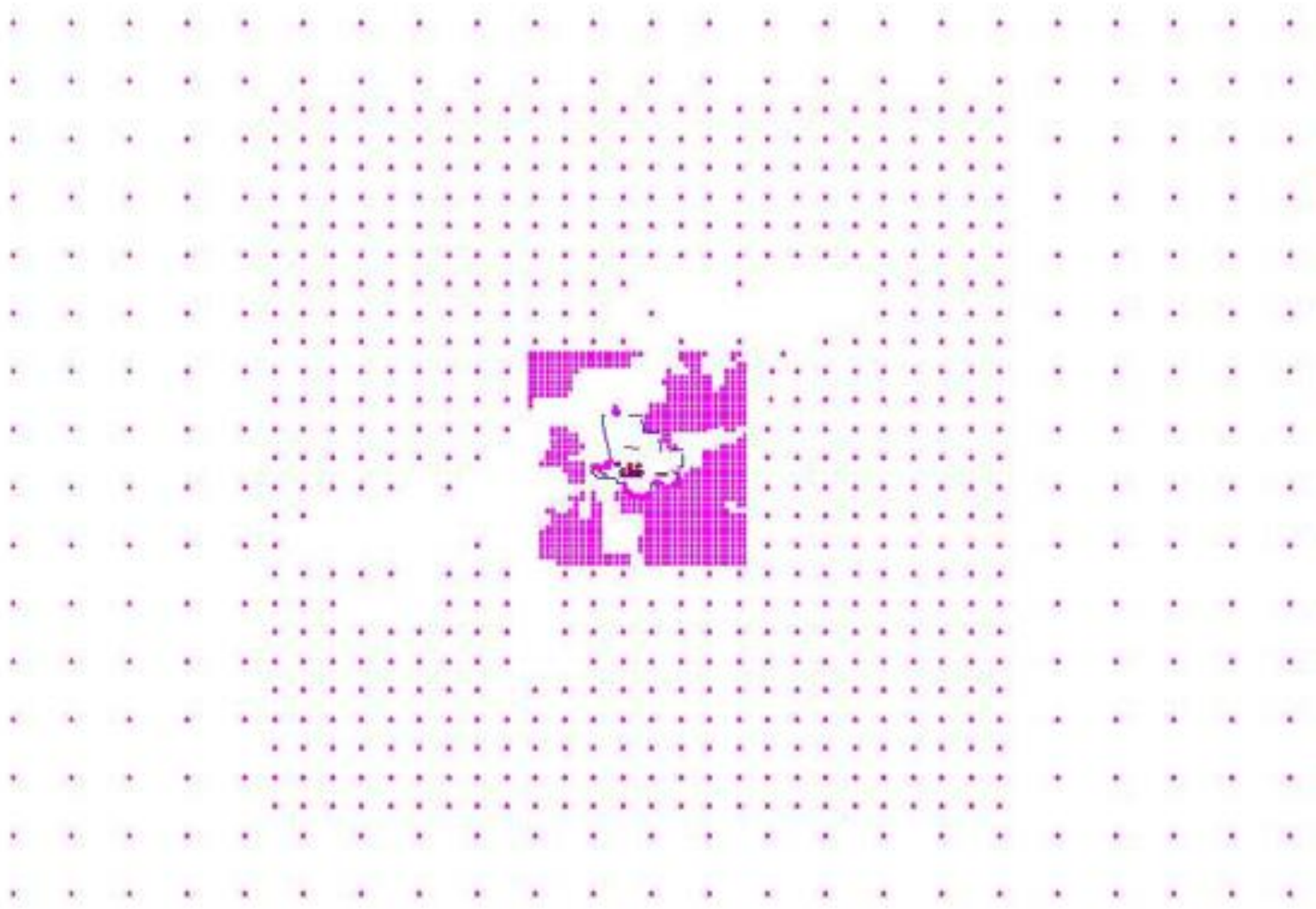


Figure D73. Receptor Grids in Duke Energy Roxboro SO2 Modeling for Monitor Placement Receptor

Terrain data used in the analysis was obtained from the USGS Seamless Data Server at http://viewer.nationalmap.gov/viewer/. The 1 arc-second NED data was obtained in the GeoTIFF format and used in determining receptor elevations and hill heights using AERMAP.

National Weather Service (NWS) Automated Surface Observation Station (ASOS) data for 2012 to 2014 for the station located at Danville, VA was processed using AERMET together with upper air data for the same period from Greensboro, NC. AERMinute was also used in processing the data to incorporate additional wind data.

Modeling Results and Ranking Methodology

Following the guidance outlined in Appendix A of the Monitoring TAD, normalized modeled impacts were used to determine suitable locations for installing an SO_2 monitor near Duke Energy Roxboro. The three-year average of each year's 4th daily highest 1-hour maximum concentration (99th percentile of daily 1-hour maximum concentrations) was calculated for each receptor. This value is commonly referred to as the design value (DV). Because normalized emissions were used to calculate these values, the results are referred to as normalized design values (NDVs) in this analysis.

Figure D74 shows the NDVs for the receptors near Duke Energy Roxboro. To better understand the relative difference between the NDVs, Figure D75 shows the ratio of the NDV at each receptor to that of the overall maximum NDV. In the figures, the receptors with the highest values are in the black area surrounded by the darker purple, just northeast of the facility. From the NDV ratio results, 200 receptors with the highest values were selected for further analysis. The receptors having the top 200 and top 50 NDVs, are shown in Figure D76 and Figure D77, respectively. The highest NDVs in the figures are shown in purple.

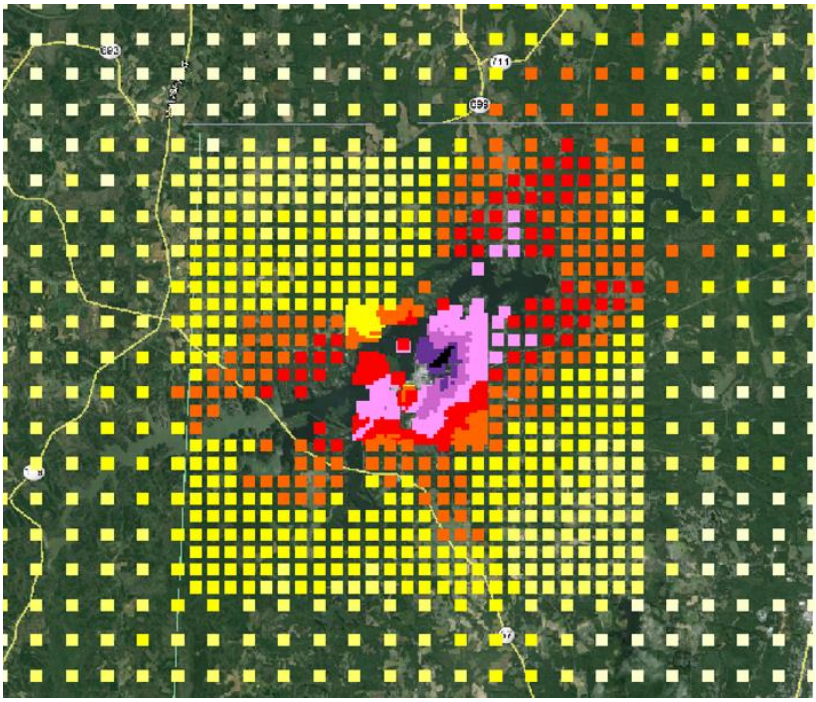


Figure D74. Modeled NDVs for Each Receptor at Duke Energy Roxboro: Values increase as colors go from yellow through red and purple

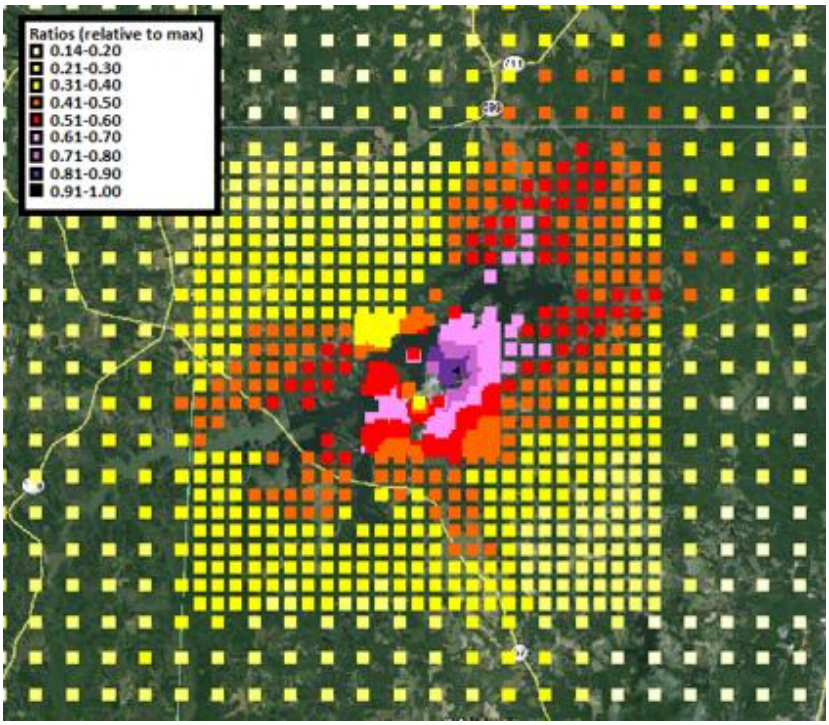


Figure D75. Ratios of Individual Receptor's NDV to the Overall Maximum NDV at Duke Energy Roxboro: Values increase as colors go from yellow through red and purple

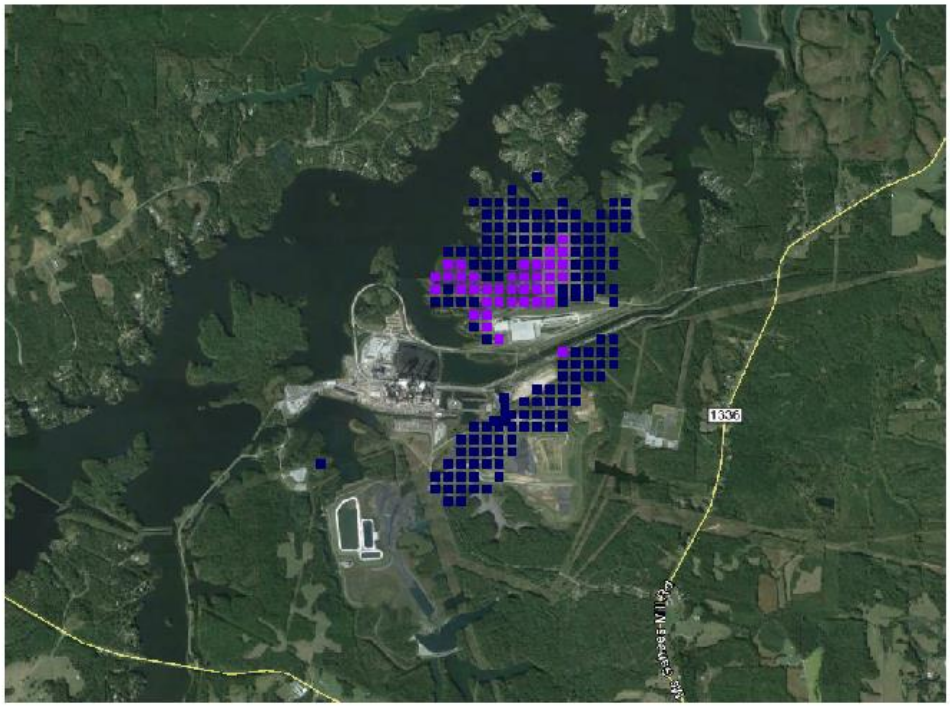


Figure D76. Locations of Top 200 NDVs for Duke Energy Roxboro: Highest Values are in Purple

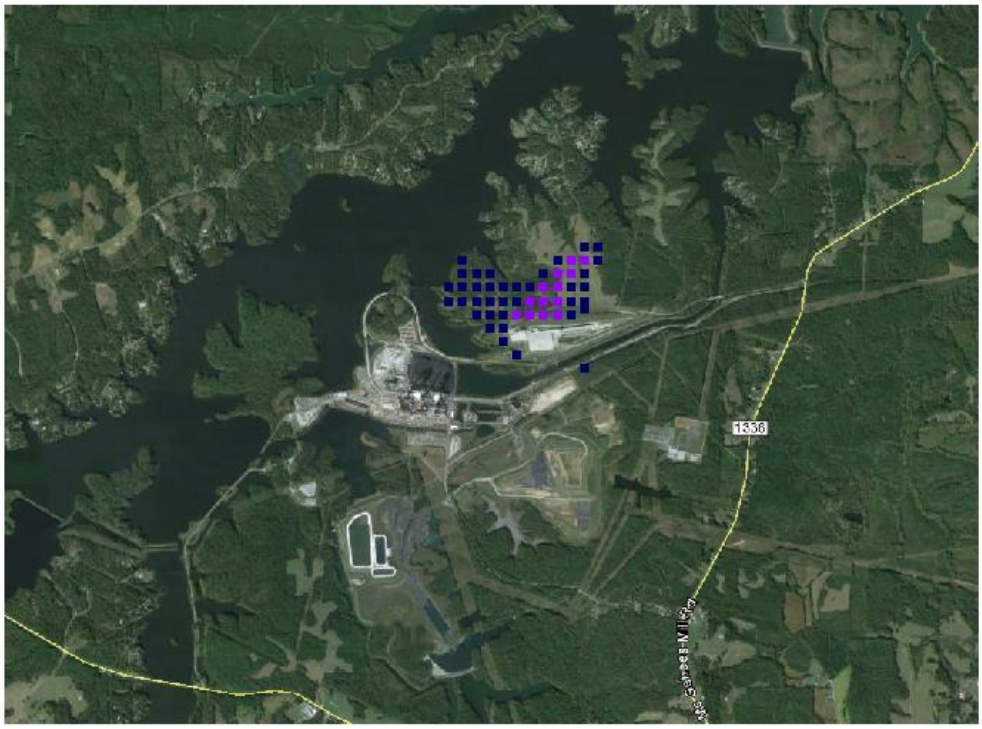


Figure D77. Locations of Top 50 NDVs for Duke Energy Roxboro: Highest Values are in Purple

Figure D76 and Figure D77 show the prioritized locations that were first evaluated to select a monitor location. The primary objective of this analysis was to find sufficient feasible locations with predicted peak and/or relatively high SO_2 concentrations where a permanent monitoring site could be located. However; Appendix A of the Monitoring TAD requires the site selection process to also account for the frequency in which a receptor has the daily maximum concentrations. The frequency is the number of times each receptor was estimated to have the maximum daily 1-hour concentration. Figure D78 shows the results of the frequency analysis.

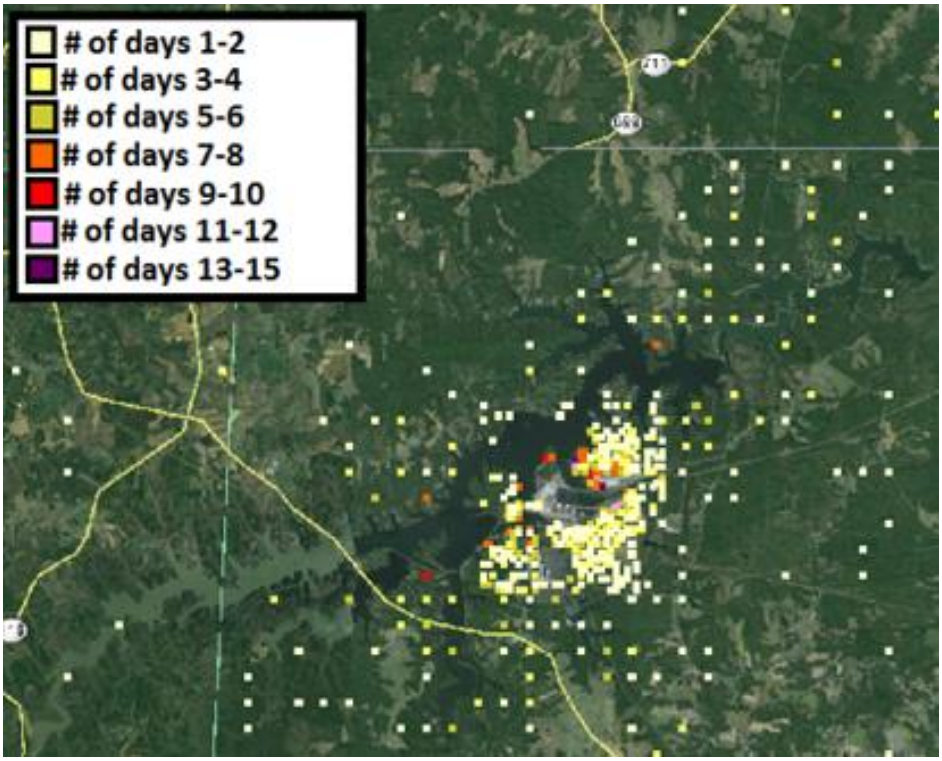


Figure D78. Frequency of Daily Maximum Concentrations for Duke Energy Roxboro

Each receptor's frequency value was used with its NDV to create a relative prioritized list of receptor locations. This process is referred to in Appendix A of the Monitoring TAD as a scoring strategy. The list of receptors was developed through the following steps:

1. The NDVs were ranked from highest to lowest. Rank 1 means the highest NDV.
2. The frequencies for the 200 receptors were ranked from the highest to lowest. Rank 1 means the highest number of days having the daily maximum value.
3. The NDV rank and the frequency rank were added together to obtain a score.
4. The scores were ranked from lowest to highest. The receptors with the lowest scores were identified as the most favorable locations for the monitor.

Ranking Results and Discussion of Chosen Monitor Site

Table 2 shows a summary of the ranking results for the top 64 receptors and the selected monitor location. Figure D79 shows the receptor locations that ranked in the top 100. The selected monitor location resulted from a site visit conducted using information from the scoring strategy.

Figure D79. Locations of Top 100 NDVs for Duke Energy Roxboro with Ranked Values

DAQ staff, in conjunction with Duke Energy staff and a representative from EPA Region 4, conducted an in-situ survey near the Duke Energy Roxboro facility to select a suitable location for SO_2 monitor placement. Focusing on the area to the northeast of the Roxboro facility where most of the maximum NDVs occurred, the on-site visit confirmed that a majority of the area is heavily wooded and currently undeveloped as indicated from Google Earth satellite imagery. When selecting adequate locations for the monitor, considerations were made regarding the availability of electrical power, security of the monitor, accessibility, proper instrument exposure and assurance of long-term use of the site. This last point was especially important, given the tight timelines in the rule. Most of the nearby clear area is privately-owned and there was no guarantee that we could keep the monitor there for at least three years to get a design value.

During the site visit, numerous receptor locations, including the highest-ranking ones, were deemed to not meet monitor siting criteria. The primary reasons being the terrain placing them in a deep depressed area (not apparent from Google imagery) or the location having no clear path between the facility and the monitor (tree lines). The chosen site has a clear, unobstructed path, as seen in the photo shown in Figure D80.

Figure D80. View of Duke Energy Roxboro from the Monitor Location

A location was selected northeast of the facility along Shore Road and approximately 550 meters from the property line of the Roxboro facility. This location is adjacent to a paved roadway, in an open location free of trees or other vegetation and the property is owned by the CertainTeed Corporation which agreed to allow DAQ to place and operate a monitor there. The selected location has a score ranking of #64 as indicated in Table D-3. The location is within the area of highest ranked receptors, approximately 300 meters to the east of the #1 receptor. Based on this information, DAQ believes that the selected location is highly suitable for operating an SO_2 monitor.

Table D-3. Selected Ranking Results from the Duke Energy Roxboro SO2 Modeling for Monitor Placement

Easting (m)	Northing (m)	Normalized Design Value (NDV)	NDV Rank	Freq. Count	Freq. Rank	Score	Score Rank	Comments on Location
673,600	4,040,000	0.5724	2	12	3	5	1	Trees/ in hole
673,700	4,040,200	0.5592	7	7	10	17	2	Ownership
673,300	4,039,900	0.5335	14	11	4	18	3	Trees
673,600	4,040,100	0.5645	6	5	15	21	4	Ownership
673,700	4,040,000	0.5455	11	7	11	22	5	Access
673,400	4,040,000	0.5467	9	5	16	25	6	Ownership
672,900	4,040,200	0.5128	24	13	2	26	7	Ownership
673,500	4,040,000	0.5813	1	4	25	26	8	Ownership
673,700	4,040,100	0.5456	10	5	17	27	9	Ownership

Table D-3. Selected Ranking Results from the Duke Energy Roxboro SO2 Modeling for Monitor Placement

Easting (m)	Northing (m)	Normalized Design Value (NDV)	NDV Rank	Freq. Count	Freq. Rank	Score	Score Rank	Comments on Location
673,000	4,040,200	0.5155	22	8	8	30	10	Ownership
673,600	4,040,200	0.5687	5	4	26	31	11	Ownership
673,300	4,040,000	0.5161	21	6	13	34	12	Ownership
673,900	4,040,300	0.5254	16	5	18	34	13	Ownership
673,400	4,039,700	0.5027	34	15	1	35	14	Trees
673,200	4,039,900	0.5057	30	9	7	37	15	Trees
672,900	4,040,100	0.5043	33	11	5	38	16	Ownership
673,800	4,040,100	0.5191	19	5	19	38	17	Ownership
673,000	4,040,300	0.5118	25	6	14	39	18	Ownership
673,800	4,040,300	0.5532	8	3	35	43	19	Ownership
673,800	4,040,000	0.5236	18	4	27	45	20	Access
673,900	4,039,600	0.5019	35	7	12	47	21	Access
673,100	4,040,200	0.5068	28	5	20	48	22	Ownership
673,800	4,040,400	0.5435	12	3	36	48	23	Ownership
673,200	4,040,200	0.5074	27	4	28	55	24	Ownership
673,300	4,039,800	0.5016	36	5	21	57	25	Trees
673,900	4,040,400	0.5369	13	2	44	57	26	Ownership
673,800	4,040,200	0.5295	15	2	45	60	27	Ownership
673,300	4,040,100	0.5117	26	3	37	63	28	Ownership
673,500	4,040,200	0.5250	17	2	46	63	29	Ownership
673,500	4,040,100	0.5712	3	1	60	63	30	Ownership
673,700	4,040,300	0.5697	4	1	61	65	31	Ownership
673,000	4,040,400	0.4942	44	5	22	66	32	Ownership
673,700	4,039,300	0.4779	62	11	6	68	33	Railroad
673,100	4,040,000	0.4981	39	4	29	68	34	Ownership
673,000	4,040,000	0.4762	66	8	9	75	35	Ownership
673,100	4,040,400	0.4856	53	5	23	76	36	Ownership
673,300	4,039,700	0.4830	55	5	24	79	37	Access
673,900	4,040,200	0.5051	32	2	47	79	38	Ownership
673,100	4,040,100	0.5014	37	2	48	85	39	Ownership
673,400	4,040,100	0.5138	23	1	62	85	40	Ownership
673,700	4,040,400	0.4927	48	3	38	86	41	Ownership
673,000	4,040,100	0.4973	41	2	49	90	42	Ownership
673,400	4,040,200	0.4971	42	2	50	92	43	Ownership
673,900	4,040,500	0.5058	29	1	63	92	44	Ownership

Table D-3. Selected Ranking Results from the Duke Energy Roxboro SO2 Modeling for Monitor Placement

Easting (m)	Northing (m)	Normalized Design Value (NDV)	NDV Rank	Freq. Count	Freq. Rank	Score	Score Rank	Comments on Location
673,400	4,040,300	0.4776	63	4	30	93	45	Ownership
673,900	4,040,100	0.4966	43	2	51	94	46	Ownership
673,300	4,040,400	0.4822	56	3	39	95	47	Ownership
673,200	4,039,800	0.4816	57	3	40	97	48	Trees
673,200	4,040,100	0.5167	20	0	78	98	49	Ownership
673,900	4,039,400	0.4725	69	4	31	100	50	Railroad
674,000	4,040,400	0.4900	50	2	52	102	51	Ownership
673,900	4,040,000	0.4862	51	2	53	104	52	Trees
673,600	4,039,200	0.4766	65	3	41	106	53	Access
674,000	4,039,600	0.4859	52	2	54	106	54	Trees
673,300	4,040,300	0.4833	54	2	55	109	55	Ownership
673,600	4,040,300	0.5056	31	0	79	110	56	Ownership
672,900	4,040,000	0.4641	79	4	32	111	57	Ownership
673,200	4,040,300	0.4933	47	1	64	111	58	Ownership
673,300	4,040,600	0.4626	82	4	33	115	59	Ownership
673,100	4,040,300	0.5000	38	0	80	118	60	Ownership
673,700	4,039,200	0.4618	85	4	34	119	61	Access
674,000	4,040,500	0.4974	40	0	81	121	62	Ownership
673,500	4,040,300	0.4799	59	1	65	124	63	Ownership
Chosen Monitor Location								
673,897	**4,040,042**	**0.4940**	**45**	**0**	**82**	**127**	**64**	**Optimal**

Note to Table 2: Comments show reasons higher ranked locations were not selected. Ownership means that the landowners were identified as private individuals where it was less likely a three-year dataset could be obtained. In Figure D79, all locations north of the road north of the chosen location were not selected because of ownership.

(2) Region 4 Requested Information for Sites (Duke Energy Progress – Roxboro)

In 2015, the DAQ began working with Duke Energy Progress to establish a sulfur dioxide monitoring station in Semora, North Carolina, to characterize the ambient sulfur dioxide concentrations near the Roxboro steam station as required by the data requirements rule for sulfur dioxide.[19] The area chosen for placement of the monitor was selected using the results of modeling done as described in the

[19] Data Requirements Rule for the 2010 1-Hour Sulfur Dioxide Primary National Ambient Air Quality Standard, Federal Register of Aug. 21, 2015, (80 FR 51052) (FRL-9928-18-OAR), 2015-20367.

technical assistance document[20] as reported earlier. An aerial view of the monitoring location identified based on the considerations reported earlier is shown in Figure D81.

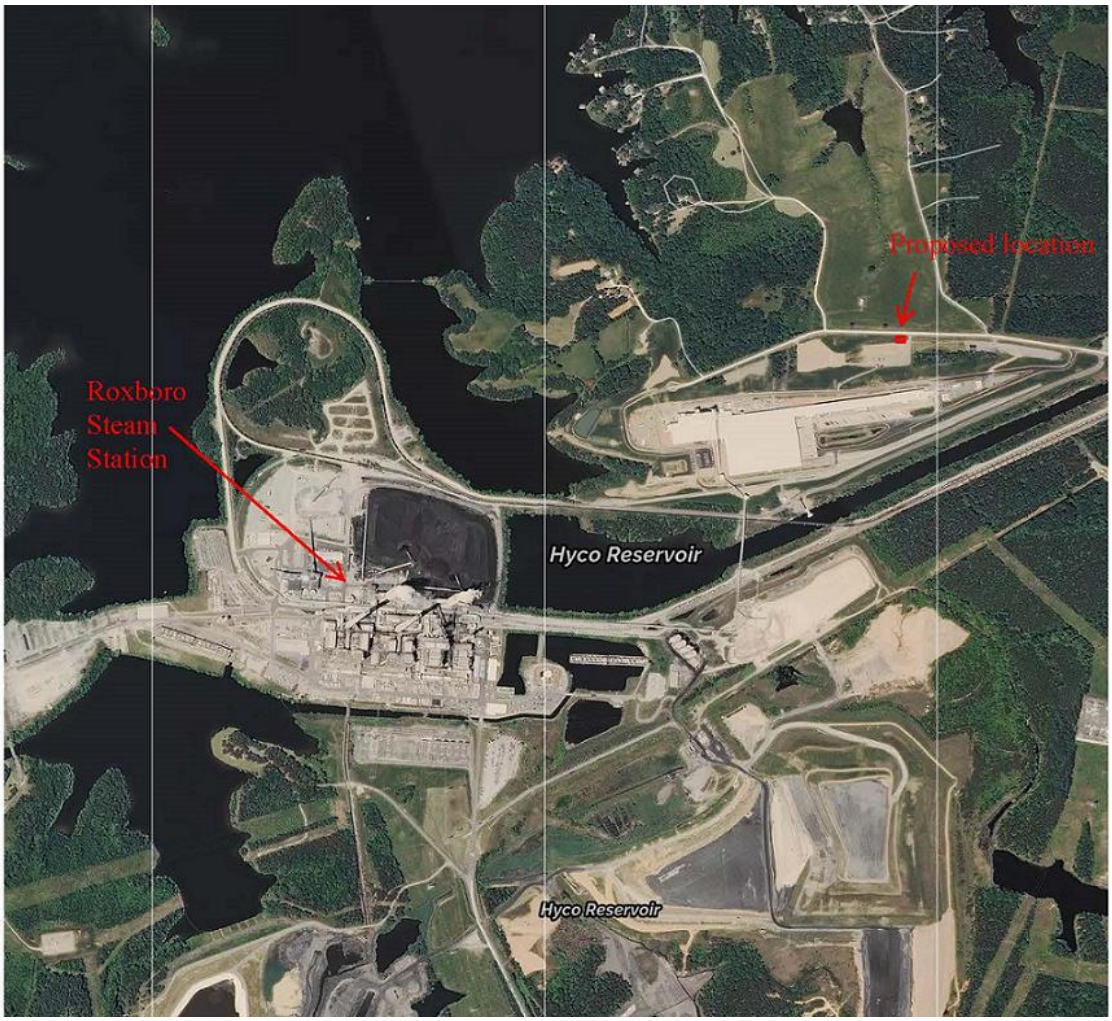


Figure D81. Aerial view showing the location of the Semora DRR monitoring station

The Air Quality System, AQS, identification number for this monitor is 37-145-0004-42401-1. DAQ operates this monitor in collaboration with Duke Energy Progress to ensure the air in the Semora area complies with the national ambient air quality standards for sulfur dioxide. Duke Energy Progress operates the monitor following the DAQ quality assurance project plan and the monitor is part of the DAQ primary quality assurance organization. Figure D82 through Figure D85 show views from the site looking north, east, south and west.

[20] SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, U.S. EPA, Office of Air and Radiation, Office of Air Quality Planning and Standards, Air Quality Assessment Division, December 2013, Draft.

Figure D82. Looking north from the Semora DRR location

Figure D84. Looking east from the Semora DRR location

Figure D83. Looking west from the Semora DRR location

Figure D85. Looking south from the Semora DRR location

The monitoring site is located 27 meters from the trees to the southeast. The tallest trees are estimated to be 15 meters in height. The nearest road is Shore Road located approximately 27 meters to the north. This road does not have traffic count data; however, as shown in Figure D86, secondary road

number 1336, Ceffo Road, had an average annual daily traffic count of 2,500 north of Ceffo in 2014. The probe height is approximately 3.6 meters.

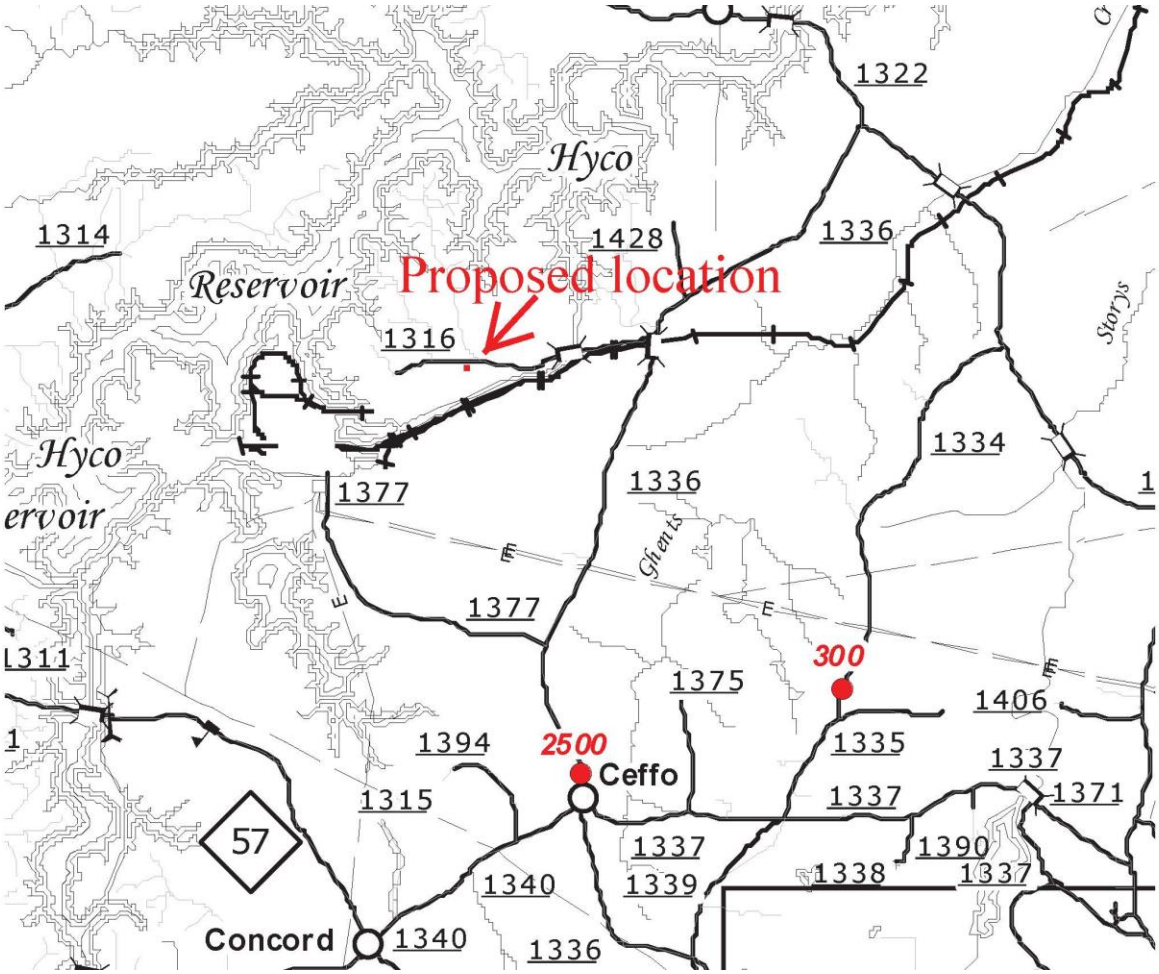


Figure D86. 2014 Traffic count map for the Semora area (from NC DOT)

The AQS identification number and street address for the site is: 37-145-0004 and Shore Drive Air Monitor, Roxboro Plant, Semora, North Carolina. The latitude and longitude is 36.489943 and -79.058523. The sampling and analysis method is AQS code 560, Thermo Electron 43i TLE pulsed fluorescent instrument, EQSA-0486-060, and the operating schedule is hourly. The monitoring objective is source oriented. Figure D87 shows the location of the monitoring station relative to the population center of Person County in the Semora area.

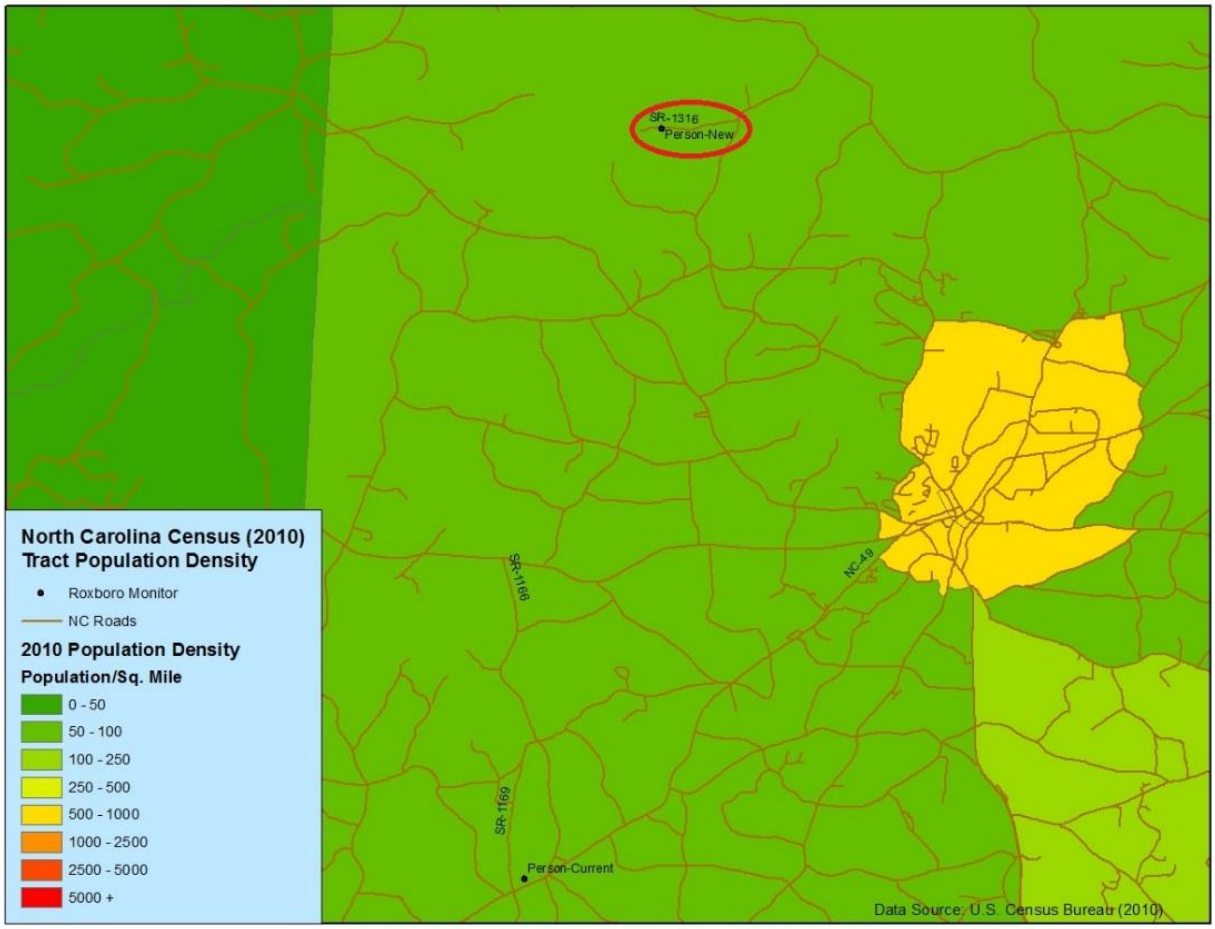


Figure D87. Location of the monitoring station relative to the population of the Semora area in Person County

Based on the wind roses in Figure D88 and Figure D89, the monitoring station is located downwind of the Roxboro plant. Figure D88 is a wind rose representing the 3-year period (2012 to 2014) for Danville, VA, surface meteorological data and for comparative purposes, Figure D89 is a second wind rose for RDU (Raleigh Durham NWS Airport) surface met data that represents wind speed and direction frequency for the same 3-year period. The second RDU wind rose identifies similarities between the Danville, VA, and RDU met data for the 3-year period between 2012 and 2014. As expected, the greatest frequency of occurrence or tendency of wind speed and direction occurred within the southwest quadrant for both met stations. This high frequency of wind speed and direction from the southwest is consistent with the direction of prevailing wind flow patterns for this part of the country. Note both stations also show a secondary high frequency of winds from the northeast direction which likely coincides with colder ridge air masses to the north/northeast and coastal low pressure systems off the coast during winter and early spring.

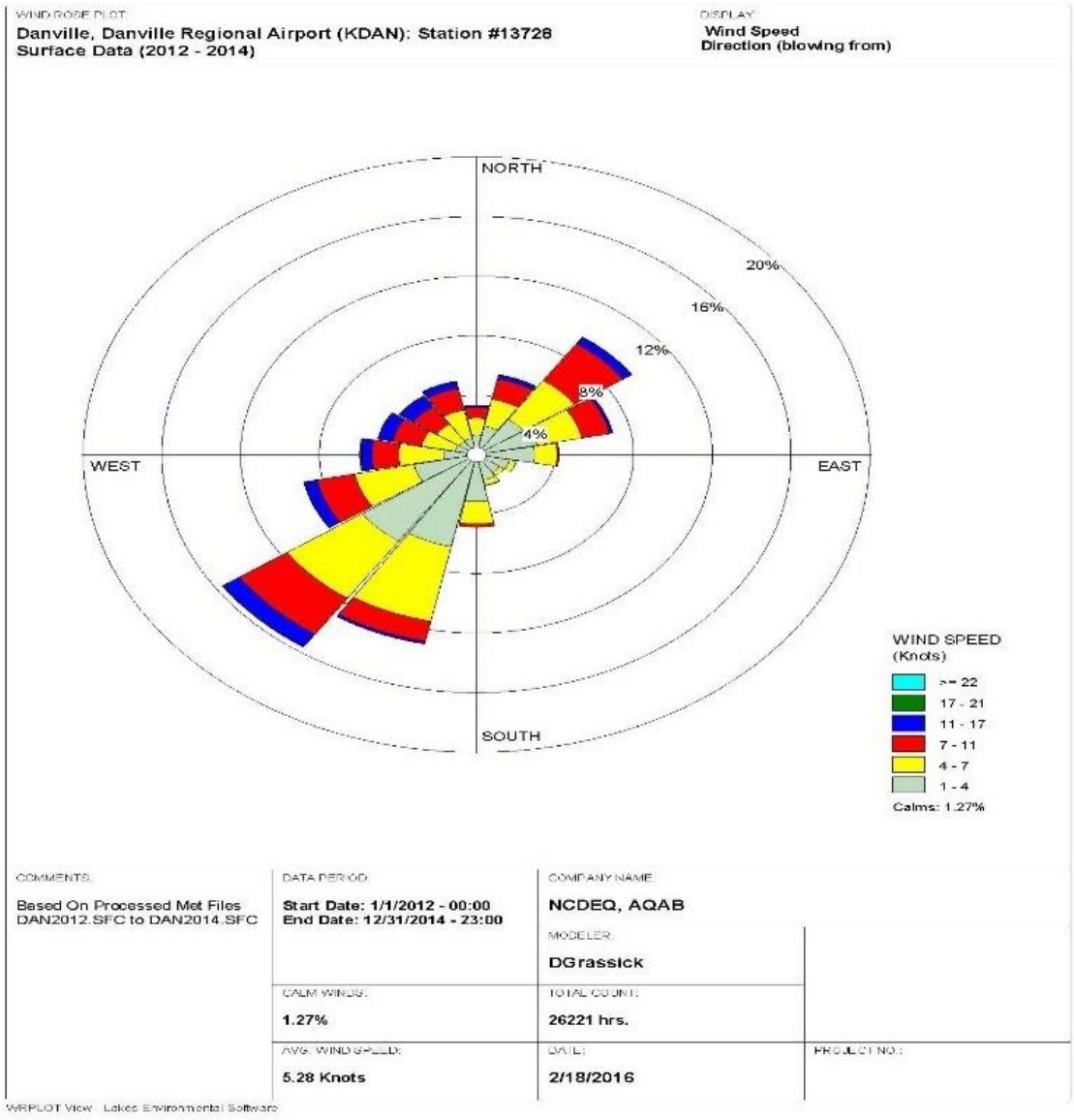


Figure D88. Wind rose from the Danville Regional Airport for 2012 to 2014

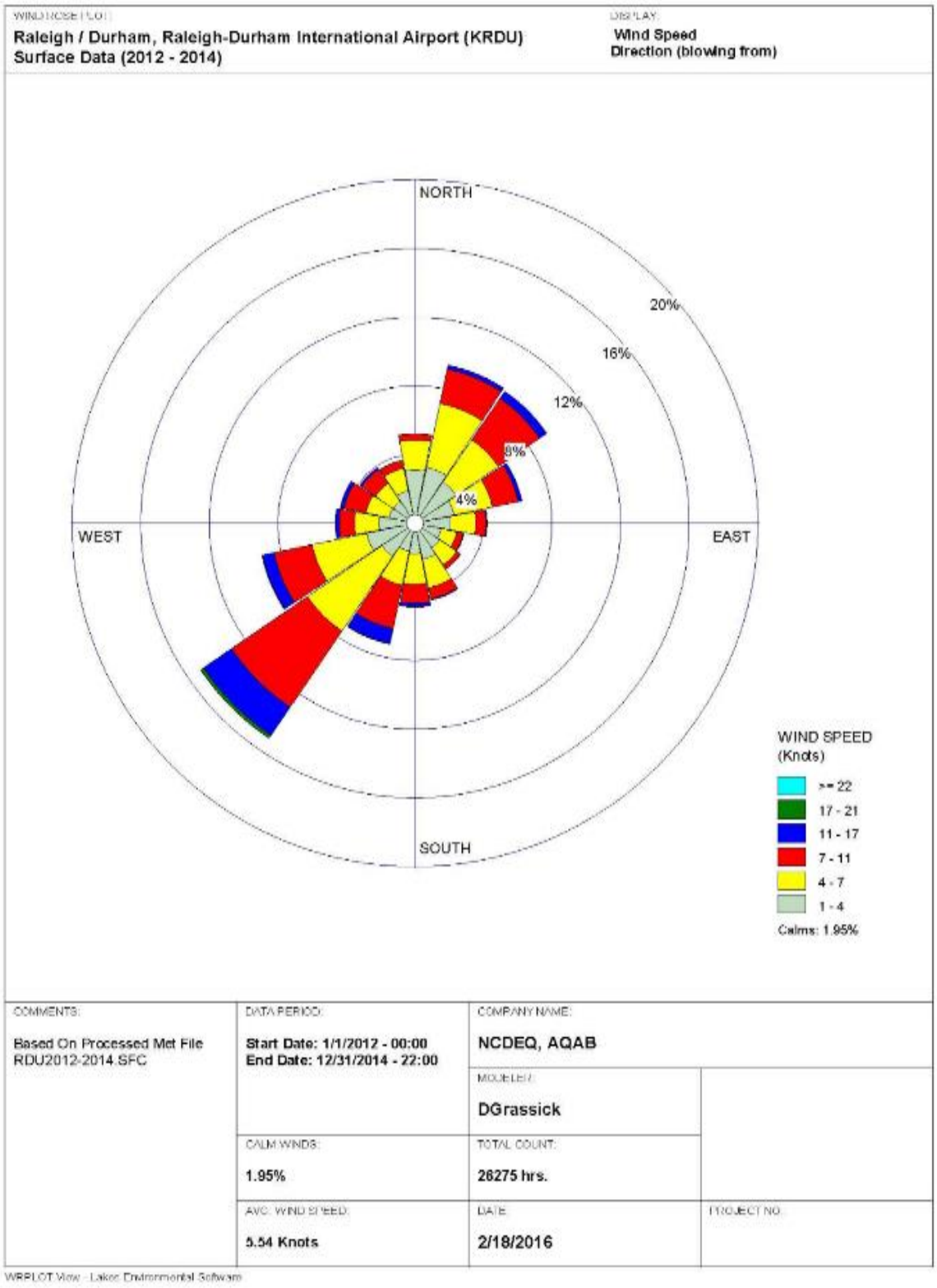


Figure D89. Raleigh Durham Airport wind rose for 2012 to 2014

The spatial scale of representativeness for the monitor is neighborhood based on the distance of the monitor from the source. The monitor is located approximately 550 meters northeast from the

property line of the facility. This monitor is in the Durham-Chapel Hill metropolitan statistical area and is representative of the air quality downwind from the fence line of the Roxboro Steam Station.

Table D-4 summarizes other factors DAQ evaluated when choosing the location for the monitoring station.

Table D-4. Other considerations selection of the Semora DRR site

Factor	Evaluation
Long-term Site Commitment	CertainTeed was willing to provide Duke with a long-term lease agreement and has no plans to develop the current area any time in the next three years
Sufficient Operating Space	100 meter by 150-meter open area free of trees and buildings
Access and Security	The building is inside a fenced area within the fenced area of the CertainTeed property so it is secured from possible vandalism. The building is located by a driveway and gate into the CertainTeed property so it has easy access.
Safety	Appropriate electrical permits were obtained.
Power	Overhead powerlines are located 27 meters north of the site.
Environmental Control	The monitoring shelter was placed with the door to the north so that sunlight does not shine in through the window and warm up the building.
Exposure	The monitoring station is at least 20 meters from the driplines of trees and is not near any trees or buildings that could be an obstacle to air flow.
Distance from Nearby Emitters	There are two permitted facilities within 0.5 miles of the location: **CertainTeed Roxboro Wallboard Facility**, located at 921 Shore Road, 100 meters south of the monitoring station, emitted 0.4 tons of SO2, 97.5 tons of NOx, 3.4 tons of VOC and 47.4 tons of TSP in 2014. **Dawkins Concrete**, also located at 921 Shore Road, 100 meters south of the monitoring station, has not reported emitting any pollutants.
Proximity to Other Measurements	The monitoring station is located about 22 kilometers northwest of the Person County Airport and 21 kilometers north of the Bushy Fork ozone monitoring station.