

**STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES**

Rhode Island 2017 Annual Monitoring Network Plan



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Acronyms and Abbreviations

AIRS-AQS	Aerometric Information Retrieval System - Air Quality System
AQI	Air Quality Index
BAM	Beta Attenuation Monitor
CAA	Clean Air Act
CFR	Code of Federal Regulations
CO	Carbon Monoxide
DEM	Department of Environmental Management (RI)
DOH	Department of Health (RI)
EIS	Emissions Inventory System
EMP	Enhanced Monitoring Plan
EPA	Environmental Protection Agency
FEM	Federal equivalent method
FRM	Federal reference method
GC	Gas chromatograph
HAPs	Hazardous air pollutants
MADEP	Massachusetts Department of Environmental Protection
MDL	Method detection limit
MSA	Metropolitan statistical area
NAAQS	National Ambient Air Quality Standards
NAMS	National Air Monitoring Station
NATTS	National Air Toxics Trends Station
NCORE	National Core Multi-pollutant Monitoring Stations Networks
NO ₂	Nitrogen dioxide
NO _x	Nitrogen oxides
OAQPS	Office of Air Quality Planning and Standards
ORD	Office of Research and Development
OTR	Ozone Transport Region
PAMS	Photochemical Assessment Monitoring Stations
PAH	Polycyclic Aromatic Hydrocarbon
PM ₁₀	Particulate matter < 10 microns
PM _{2.5}	Particulate matter < 2.5 microns
QAPP	Quality assurance project plan
O ₃	Ozone
SIPs	State implementation plans
SLAMS	State and Local Air Monitoring Station
SOP	Standard operating procedure
SO ₂	Sulfur dioxide
STN	Speciation Trends Network
SVOC	Semi-Volatile Compound
TSA	Technical system audit
TSP	Total suspended particulate
VOC	Volatile organic compound

Introduction and Regulatory Background

This document will serve as Rhode Island's 2017 Annual Monitoring Network Plan, prepared by the Rhode Island Department of Environmental Management, in accordance with Section 58.10(a) of Title 40 of the Code of Federal Regulations (40 CFR 58.10(a)) requires states to submit a monitoring network plan to the United States Environmental Protection Agency (EPA) in July of each year. The plan provides a description of the state's current monitoring network, demonstrates that the network conforms to EPA requirements, and discusses any plans to remove or move a monitoring station in the 18 months following the plan submittal.

In addition, the recently revised monitoring rule (80 FR 65292; October 26, 2015) requires PAMS measurements June 1 through August 31 at NCore sites that are located in Core-Based Statistical Areas (CBSAs) with populations of 1,000,000 or more. The Providence, New Bedford, Fall River, RI-MA Statistical Area qualifies as one of those sites. RIDEM is required to develop an implementation plan for this monitoring rule. That implementation plan is detailed within this monitoring plan. The Annual Monitoring Network Plan must be posted for public comment 30 days prior to submittal to the EPA.

Rhode Island Monitoring Network

The Rhode Island Department of Environmental Management (RI DEM), in conjunction with the Rhode Island Department of Health (RI DOH), operates a network of air monitoring stations to measure ambient concentrations of pollutants for which the EPA has established a National Ambient Air Quality Standard (NAAQS). Those pollutants, which are known as criteria pollutants, include ozone (O₃), particulate matter smaller than 10 microns (PM₁₀), particulate matter smaller than 2.5 microns (PM_{2.5}), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), carbon monoxide (CO) and lead. The criteria pollutant monitoring sites are part of the EPA's State or Local Air Monitoring Stations network (SLAMS).

In addition, RI DEM and RI DOH monitor ambient levels of toxic air pollutants and of ozone precursors, which are substances that react in the atmosphere to form ground-level ozone. The State operates one monitoring site that is part of the National Air Toxics Trends Sites (NATTS) network, one that is part of the Photochemical Assessment Monitoring Stations (PAMS) network, one that is part of the PM_{2.5} Speciation Trends Network (STN) and one that is part of the network of core multipollutant monitoring stations (NCore).

Table 1 summarizes the NAAQS and Table 2 lists the locations of the eight air monitoring stations that operated in the State in 2016 or are currently operating, along with the parameters monitored and monitoring methods used at each of the sites. Table 3 lists the sites as well as the methods used. The locations of those sites are shown in Figures 1-4. All of these sites have been approved by EPA Region 1 as meeting applicable siting criteria, as specified in Subpart B of 40 CFR Part 58. All criteria pollutants are monitored, as required in the CFR, using Federal Reference Methods (FRMs) or Federal Equivalent Methods (FEMs) and monitors are operated according to the procedures specified in Quality Assurance Project Plans (QAPPs) that have been approved by EPA.¹ All sites are located in the Providence-New Bedford-Fall River, RI-MA

Metropolitan Statistical Area (MSA), which encompasses all of Rhode Island as well as Bristol County in Massachusetts.

¹RI DEM and RI DOH, “QAPP for Criteria Pollutants Including Particulates and NCore Parameters, Revision 10.0,” approved by EPA December 5, 2012 and “QAPP: Air Toxics and PAMS Monitoring Programs, Revision 4.1,” approved by EPA December 5, 2012.

Summary of Proposed Changes in the Rhode Island Monitoring Network

In summary, RI DEM plans to modify the current monitoring network as follows:

- When the Urban League building becomes unavailable, or sooner, RI DEM will move the PM2.5 FEM monitor and NATTS monitoring activities at that site to the proposed Community College of Rhode Island (CCRI) location.
- RIDEM will cease all monitoring at the Brown University site as of December 31, 2017.
- When necessitated by the progression of highway construction activity to the north side of I-95, RI DEM will discontinue monitoring at the Near-Road site and will ask EPA's approval of future Near-Road monitoring plans for Rhode Island. Work on the north side of the highway is currently scheduled to begin in spring of 2017 or later.
- At this time, we are requesting to modify the State's PM10 network and discontinue operation of the Alton Jones site as of December 31, 2017, due to budgetary constraints and will seek EPA approval.
- RIDEM proposes to terminate NO₂ monitoring at the Alton Jones site as of December 31, 2017.
- RIDEM will continue to operate the PM2.5 FRM along with the PM2.5 FEM at the Alton Jones, West Greenwich site for information purposes, but will no longer designate it as a collocated monitor. The FEM will be the primary monitor. As of December 31, 2017, Rhode Island is requesting to discontinue the PM2.5 FRM at the Alton Jones West Greenwich site.
- Due to logistical limitations at the proposed CCRI site, RI is requesting discontinuation of FRM PM2.5 sampling at the Urban League site or its replacement site at CCRI. The FEM PM2.5 monitoring will be maintained and would serve as the only PM2.5 monitor at this, or the new location.
- RI DEM has purchased a continuous GC and will employ that instrument at the East Providence site for measuring one-hour speciated VOCs and plans to begin monitoring June 2017. This monitor will be used for the PAMS program.
- RI DEM will implement the revised PAMS requirements as promulgated in the final ozone NAAQS, including the possible expansion of carbonyl monitoring.

RI DEM understands that all network modifications that involve discontinuation or moving of any sites are subject to EPA approval, even if the remaining network meets EPA's minimum requirements.

Table 1 National Ambient Air Quality Standards (NAAQS)

POLLUTANT (links to historical tables of NAAQS reviews)	AVERAGING TIME	PRIMARY STANDARD	SECONDARY STANDARD
Sulfur Dioxide (SO₂)	3-Hour ^A	None	0.5 ppm (1300 µg/m ³)
	1-Hour ^B	0.075 ppm (75 ppb)	None
Carbon Monoxide (CO)	8-Hour ^A	9 ppm	None
	1-Hour ^A	35 ppm	None
Ozone (O₃)	8-Hour ^C	0.070 ppm (70 ppb)	Same as Primary Standard
Nitrogen Dioxide (NO₂)	Annual Arithmetic Mean	0.053 ppm (53 ppb)	Same as Primary Standard
	1-Hour ^D	100 ppb	None
Particulate Matter < 10 micrometers (PM₁₀)	24-Hour ^E	150 µg/m ³	Same as Primary Standard
Particulate Matter < 2.5 micrometers (PM_{2.5})	Annual Arithmetic Mean ^F	12.0 µg/m ³	15.0 µg/m ³
	24-Hour ^G	35 µg/m ³	Same as Primary Standard
Lead (Pb)	Rolling 3-Month Average ^H	0.15 µg/m ³	Same as Primary Standard

Primary standards protect against adverse health effects. **Secondary standards** protect against welfare effects such as damage to crops, vegetation, and buildings.

^A Not to be exceeded more than once a year.

^B A rule revoking the annual and 24-hour SO₂ NAAQS and promulgating a new 1-hour SO₂ NAAQS was signed on June 2, 2010. To attain the 1-hour NAAQS, the 3-year average of the 99th percentile of the daily maximum 1-hour average SO₂ level at each monitor must not exceed 75 ppb.

^C The ozone NAAQS is violated when the average of the 4th highest daily eight-hour concentration measured in 3 consecutive years exceeds 0.070 ppm (70 ppb). The 0.070 ppm NAAQS became effective December 28, 2015.

^D To attain the 1-hour NO₂ NAAQS, effective January 22, 2010, the 3-year average of the 98th percentile of the daily maximum 1-hour average NO₂ concentration at each monitor must not exceed 100 ppb.

^E To attain the PM₁₀ standard, the 24-hour concentration at each site must not exceed 150 µg/m³ more than once per year, on average over 3 years.

^F The primary annual average PM_{2.5} NAAQS was revised on December 10, 2012. The secondary NAAQS was not changed. To attain the PM_{2.5} annual standard, the 3-year average of the weighted annual means of the 24-hour concentrations must not exceed the NAAQS value.

^G To attain the PM_{2.5} 24-hour standard, the 3-year average of the 98th percentile of 24-hour concentrations must not exceed 35 µg/m³.

^H On October 15, 2008, the Pb NAAQS was changed to 0.15 µg/m³ as a rolling 3-month average, not to be exceeded in a 3-year period.

µg/m³ = micrograms per cubic meter

mg/m³ = milligrams per cubic meter

ppb = parts per billion

ppm = parts per million

Monitoring Site Information

The ambient air monitoring sites currently operated by DEM are listed in the Table 2 below. Detailed information for each monitoring site is provided in a later section of this plan.

Table 2: Monitoring Network Summary

Town	Site	PM2.5 (FRM), 1:3 (Except AJ 1:6)	PM2.5 (FRM, Collocated), 1:6	PM2.5 (Continuous - FEM)	PM10/PM- (Hi Vol), 1:6	PM10/PM- (Hi Vol), Collocated, 1:6	PM10/PM-Coarse (lo-Vol), 1:3	Polycyclic aromatic hydrocarbons (PAH), 1:6	Speciation, PM2.5 super SASS (CSN), 1:3	PM2.5 Carbon (URG) (CSN), 1:3	Ozone	SO2	CO	Direct NO ₂	NO/NO ₂ /NOx	NO/NOy	VOCs 24 HR Canister (NATTS, State)	VOCs Hourly PAMS	Black Carbon	Black Carbon, Collocated	Carbonyls, 1:6	Carbonyls Collocated, 1:12	Particle Counter	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation	UV Radiation	Precipitation
Pawtucket	Vernon Street	X	X*		X												X														
Providence	Brown University											T			T																
Narragansett	USEPA Laboratory			X							S												X	X	X						
East Providence	Myron Francis School	X		X		X	X	X	X	X	X	X	X		X	X	X	S	X	X	X	X	X	X	X	X	X	X	S	S	S
Providence	Urban League	T	X+	X	X**	X++	X										X		X		X	X	X	X	X	X	X				
West Greenwich	Alton Jones Campus	T		X	T						S				T		X						X	X	X			S			
Providence	Near-Road Site			X									X		X				X				X								
Providence	Johnson & Wales				T																										

X = Exiting

P= Planning new 2015/16

T= Proposed to terminate in 2016/2017

S= Seasonal (June 1-August 30, except ozone and NOX March 1-Sep 30)

* Collocated PM2.5 FRM started 4/1/2016, 1:6

+ Collocated PM2.5 FRM terminated 3/31/2016 for site construction, 1:6

**High-Volume metals run 1:6

++High-Volume metals run 1:12

PM-10 Lead was terminated June 30, 2016 from EP due to rule change.

Table 3: Monitoring Sites

Site	AQS ID	Latitude Longitude	Parameter Measured	Method Of Sampling	EPA Method Designation
Vernon Trailer Vernon Street Pawtucket	440070026	41.874675 -71.379953	PM _{2.5}	Lo Vol	Reference
			PM ₁₀	Hi Vol	Reference
			VOC	Canisters, GC/FID/MS	Reference
Johnson & Wales # 111 Dorrance Street Providence # closed 9/30/2016	440070027	41.822686 -71.411089	PM ₁₀	Hi Vol	Reference
Brown University 10 Prospect Street Providence	440070012	41.825556 -71.405278	Oxides of Nitrogen	Chemiluminescence (low range)	Reference
			Nitrogen Dioxide		
			Sulfur dioxide	Pulsed Fluorescence (low range)	Equivalent
USEPA Laboratory 27 Tarzwell Drive Narragansett	440090007	41.4950779 -71.4236587	Ozone	U.V. Photometric	Reference
			PM _{2.5}	Beta Attenuation/Cont	Equivalent
			Wind Speed	Anemometer	N/A
			Wind Direction	Wind Vane	N/A
			Temperature	Spot Reading	N/A
Myron Francis School 64 Bourne Avenue E. Providence	440071010	41.840920 -71.36094	Oxides of Nitrogen	Chemiluminescence (low range)	Reference
			Nitrogen Dioxide		
			NO/NO _y	Chemiluminescence (low range)	Reference
			Carbon Monoxide	Gas Filter Correlation (low range)	Equivalent
			Sulfur dioxide	Pulsed Fluorescence (low range)	Equivalent
			Ozone	U.V. Photometric	Reference
			PM _{2.5}	Lo Vol	Reference
			PM _{2.5}	Beta Attenuation/Cont	Equivalent
			Speciated PM _{2.5}	Speciation Monitor	N/A
			Coarse PM (PM _{10-2.5})	Lo Vols (PM ₁₀ & PM _{2.5})	Reference
			Black Carbon	Aethalometer	N/A
			VOC	Canisters, GC/FID/MS	Reference
			VOC	Continuous GC	
			Carbonyls	HPLC Cartridges	Reference
			Wind Speed	Anemometer	N/A
			Wind Direction	Wind Vane	N/A
			Barometric Pressure	Barometer	N/A
			Temperature	Spot Reading	N/A
			Relative Humidity	Plastic Film	N/A
			Solar Radiation	Pyranometric	N/A
UV Radiation	UV Photometric	N/A			
Precipitation	Bucket/Continuous	N/A			

Site	AQS ID	Latitude Longitude	Parameter Measured	Method Of Sampling	EPA Method Designation
Urban League 212 Prairie Avenue Providence	440070022	41.807949 -71.415103	PM _{2.5}	Lo Vol	Reference
			PM _{2.5}	Beta Attenuation/Cont	Equivalent
			PM ₁₀ /Metals	Hi Vol	Reference
			VOC	Canisters, GC/FID/MS	Reference
			Carbonyls	HPLC Cartridges	Reference
			Black Carbon	Aethalometer	N/A
			Semi-volatiles	PUF/XAD, GC/MS	N/A
			Wind Speed	Anemometer	N/A
			Wind Direction	Wind Vane	N/A
			Temperature	Spot Reading	N/A
			Relative Humidity	Plastic Film	N/A
Alton Jones Campus Victory Highway West Greenwich	440030002	41.615600 -71.719900	Ozone	U.V. Photometric	Reference
			Nitrogen Dioxide	Chemiluminescence	Reference
			Oxides Of Nitrogen	Chemiluminescence	Reference
			VOC	Canisters, GC/FID/MS	Reference
			PM ₁₀	Hi Vol	Reference
			PM _{2.5}	Lo Vol	Reference
			PM _{2.5}	Beta Attenuation/Cont	Equivalent
			Wind Speed	Anemometer	N/A
			Wind Direction	Wind Vane	N/A
			Barometric Pressure	Barometer	N/A
			Temperature	Spot Reading	N/A
			Relative Humidity	Plastic Film	N/A
			Solar Radiation	Pyranometric	N/A
Near-Road Site Hayes and Park Sts. Providence	440070030	41.829495 -71.417457	Oxides of Nitrogen	Chemiluminescence (low range)	Reference
			Nitrogen Dioxide		
			Carbon Monoxide	Gas Filter Correlation (low range)	Equivalent
			PM _{2.5}	Beta Attenuation/Cont	Equivalent
			Black Carbon	Aethalometer	N/A

Network Evaluation

Following is a discussion, by pollutant, of:

- The current monitoring network,
- The NAAQS and a comparison of recent measurements with the NAAQS,
- Whether that network meets EPA's monitoring criteria,
- Whether new sites are needed,
- Whether any existing sites are no longer needed, and
- Plans for modification of the network in the next 18 months.

Ozone (O₃)

The sites in the current ozone monitoring network are listed in Table 4 and Figure 1:

Table 4: Rhode Island Ozone Monitoring Sites

SITE	MEASUREMENT SCALE	MONITORING OBJECTIVE	SCHEDULE
Alton Jones Campus Victory Highway West Greenwich	Regional	Upwind background Population exposure	Continuous Ozone Season March-September
USEPA Laboratory 27 Tarzwell Drive Narragansett	Regional	Population exposure	Continuous Ozone Season March-September
Myron Francis School 64 Bourne Avenue E. Providence	Neighborhood (PAMS, NCore)	Maximum precursor emissions impact Population exposure	Continuous Year-Round

The NAAQS for ozone is 70 ppb. A site is in violation of that NAAQS when the average of the 4th highest daily eight-hour ozone concentration measured in 3 consecutive years (the design value) at that site exceeds 70 ppb.

Ozone design values for all of the Rhode Island sites have decreased over time, but design values increased or remained constant in 2012 and 2013, as shown in Table 5. Based on 2009-2011 design values, EPA designated Rhode Island as unclassifiable/attainment for the 75 ppb NAAQS on April 30, 2012. Note, however, that the 2009-2011 design values were lower than normal, due to unusually cool temperatures in the summer of 2009. In the most recent three year period, 2014-2016, the design values for both the West Greenwich and Narragansett the sites met the 70 ppb NAAQS, while the design value for the E. Providence site was slightly lower than that standard.

Table 5: Ozone Design Values (ppb)

	W. Greenwich	Narragansett	E. Providence
2002 - 2004	87	90	84
2003 - 2005	84	89	82
2004 - 2006	83	85	81
2005 - 2007	86	84	84
2006 - 2008	80	81	82
2007 -2009	77	77	77
2008 - 2010	71	76	72
2009 –2011	73	73	71
2010 - 2012	74	78	75
2011 - 2013	74	78	76
2012 -2014	70	74	73
2013 - 2015	70	73	70
2014-2016	70	70	68

Since EPA’s rules require Rhode Island to operate at least two ozone monitors, the State has one more monitor than the minimum number required. Continued operation of all of the current monitors is important for the following reasons:

- Ground-level ozone levels have generally decreased in the past several years; however, ozone concentrations in the State continue to reach unhealthy levels on several days each summer. Note that 8-hour average ozone levels were above 70 ppb at one or more of the Rhode Island monitoring sites on 10 days in 2015 and 31 days with levels above 60 ppb. In 2016 there were 13 days above 70 ppb and 42 days with levels above 60 ppb.
- EPA has strengthened the ozone NAAQS to 70 ppb to protect public health effective December 28, 2015.
- The three sites represent three distinct geographical areas that are affected by different weather patterns and therefore experience very different ozone levels on some days.
- The availability of real-time ozone data from the three ozone sites enables RI DEM to issue area-specific health advisories as appropriate and to provide residents with real-time information about ozone concentrations and associated health risks in their neighborhoods.

The July 2009 Federal Register Notice also proposed an increase in the length of the ozone season in several states, including Massachusetts and Connecticut. EPA did not propose a change in Rhode Island’s ozone monitoring season, April – September. Although the final rule did not change Rhode Island’s ozone season, RI DEM has extended the period of operation of its ozone monitors to be consistent with monitoring in neighboring states. Beginning in 2011, the ozone monitors at the Narragansett and West Greenwich sites have been operated from March through October. In 2017 this will be changed to operate March –September to follow 40 CFR Part 58 Appendix D Table D-3 Ozone Season. Note also that, beginning in 2011, ozone is being measured year round at the East Providence site, consistent with NCore requirements.

No changes to the ozone monitoring network are planned for the next 18 months.

Carbon Monoxide (CO)

The current CO monitoring network is as shown in Table 6 and on Figure 1:

Table 6: Carbon Monoxide Monitoring Network

SITE	MEASUREMENT SCALE	MONITORING OBJECTIVE	SCHEDULE
Myron Francis School 64 Bourne Avenue E. Providence	Neighborhood	Maximum precursor emissions impact Population exposure	Continuous Year-Round
Near-Road Site Hayes and Park Sts. Providence	Microscale	Maximum emissions Near-road (began operation in April 2014)	Continuous Year-Round

The NAAQS for CO are:

- 35 ppm as a 1 hour average, not to be exceeded more than once per year (design value is the highest annual 2nd maximum 1-hour concentration) and
- 9 ppm as an 8 hour average, not to be exceeded more than once per year (design value is the highest annual 2nd maximum non-overlapping 8-hour concentration)

The 2016 CO design values for Rhode Island are:

Near Road:

- 3.0 ppm – 1 hour average, 8.6% of NAAQS
- 1.8 ppm – 8 hour average, 20% of NAAQS

Francis School:

- 1.3ppm – 1 hour average, 3.7% of NAAQS
- 0.9 ppm – 8 hour average, 10% of NAAQS

The CO NAAQS has not been exceeded in Rhode Island since 1984. Since 2001, all CO levels recorded in Rhode Island have been in the “Good” category of the EPA’s Air Quality Index (AQI).

EPA’s regulations do not specify a minimum number of CO monitors that must be operated in a state, except that CO monitoring is required at NCore sites (40 CFR 58, Appendix D 3(b)) and EPA regulations require a certain number of CO monitors to be operating near road based upon population.. Since the East Providence site is both a PAMS site and the State’s NCore site, carbon monoxide monitoring will continue at that site using a low range monitor, consistent with

NCore requirements.

On August 21, 2011, EPA issued a decision retaining the CO NAAQS at the current levels. The decision requires the operation of CO monitors at sites established to comply with the near-road monitoring requirements specified in the 2010 NO₂ NAAQS. Near-road sites are required in all urban areas which, like the Providence-New Bedford-Fall River, RI-MA MSA, have a population of 1,000,000 or more. Near-road CO monitoring is not required until January 1, 2017; however, Rhode Island began operating a low-range CO monitor at a site adjacent to Interstate Route 95 that meets the above near-road specifications in April 2014.

No changes to the CO monitoring network are planned in the next 18 months.

²US EPA, “Review of National Ambient Air Quality Standards of Carbon Monoxide: Final Rule,” Federal Register 76 (169):54294, August 31, 2011. <http://www.gpo.gov/fdsys/pkg/FR-2011-08-31/pdf/2011-21359.pdf>

Sulfur Dioxide (SO₂)

The current SO₂ monitoring network is as shown in Table 7 and on Figure 1:

Table 7: Sulfur Dioxide Monitoring Network

SITE	MEASUREMENT SCALE	MONITORING OBJECTIVE	SCHEDULE
Brown University 10 Prospect Street Providence	Neighborhood	Population exposure	Continuous Year-Round
Myron Francis School 64 Bourne Avenue E. Providence	Neighborhood	NCore	Continuous Year-Round

The NAAQS for SO₂ are:

- 75 ppb, 1-hour average (primary standard effective June 2, 2010). The design value is the average of the 99th percentile maximum daily hour measured in 3 consecutive years.
- 0.5 ppm (500 ppb), 3 hour average (secondary standard) not to be exceeded more than once per year.

The SO₂ design values recorded in the last three years (2014 – 2016) in Rhode Island are:

- 7.33 ppb - 1 hour average, 9.8% of primary NAAQS - Brown monitor
- 7 ppb – 1 hour average 9.3% of primary NAAQS – East Providence monitor

The SO₂ NAAQS has never been exceeded in the State. One-hour design values for SO₂ have been below 75 ppb, the one-hour NAAQS promulgated in 2010, since 1994. All measurements have been in the “Good” range of the AQI since 2007. SO₂ levels measured at the Brown University monitor in Providence declined dramatically in 2013, probably due to the increased use of natural gas rather than fuel oil by nearby sources.

EPA’s 2006 amended monitoring regulation requires SO₂ monitoring only at NCore sites. However, the 2010 SO₂ NAAQS rule requires at least one SO₂ monitor in the Providence-New Bedford-Fall River RI, MA MSA, which includes all of Rhode Island and Bristol County, Massachusetts. That SO₂ monitor must be sited to meet one or more of the following objectives: (1) characterizing concentrations around emissions sources, (2) measuring the highest concentrations in an area, (3) determining population exposure, (4) establishing general background levels and (5) evaluating regional transport.

³An EPA rule amending the SO₂ NAAQS was signed on June 2, 2010. The rule revokes the previous annual and 24-hour NAAQS and sets a new one-hour average NAAQS at 0.075 ppm (75 ppb). Revisions of monitoring networks consistent with the requirements in the rule must be in place by January 1, 2013.

Rhode Island operates a SO₂ monitor at Brown University in Providence and, to meet NCore requirements, began operating a low-range SO₂ monitor at the East Providence site in January 2011. The Brown University SO₂ monitor was updated to a low-range unit in January 2013. RI DEM believes that the Brown University and East Providence monitors appropriately characterize population exposure in the major urban areas in Rhode Island.

The State of Massachusetts also operates a SO₂ monitor in the Providence Warwick RI-MA MSA. Since that monitor is located in Fall River, MA, approximately two miles southeast of the Brayton Point coal-fired power plant, the SO₂ levels recorded at that site have historically been substantially higher than those at the Rhode Island sites; however, SO₂ levels recorded at that site dropped in 2014, probably due to the decreased operation of the power plant. The 2014 one-hour design value for SO₂ at the Fall River monitor was 47 ppb, 63% of the NAAQS and more than three times the highest Rhode Island design value. According to EPA's Emissions Inventory System (EIS), in 2011 the Brayton Point facility emitted 18,648 tons of SO₂, 50 times more than the highest emitting Rhode Island source, Central Landfill (352 tons). Therefore, the Fall River monitor is more appropriate than a Rhode Island location for characterizing maximum concentrations in the MSA. Given that the SO₂ Population Weighted Emissions Index (PWEI) monitor located in Fall River appears to be more representative, RI DEM will reevaluate the placement of the maximum concentration monitor subsequent to the closure of the Brayton Point plant, which is scheduled for the summer of 2017.

RI DEM plans to discontinue monitoring at the Brown University site at the end of 2017. Note that, since a low-range SO₂ monitor is now in use at the East Providence site, RI DEM does not plan to further update the technology used for measuring that pollutant at this time.

Nitrogen Dioxide (NO₂)

The current NO₂ monitoring network is shown in Table 8a and on Figure 1:

Table 8a: Nitrogen Dioxide Monitoring Network

SITE	MEASUREMENT SCALE	MONITORING OBJECTIVE	SCHEDULE
Brown University 10 Prospect Street Providence	Neighborhood	Population exposure	Continuous Year-Round
Myron Francis School 64 Bourne Avenue E. Providence	Neighborhood (PAMS)	Population exposure	Continuous Year-Round
Alton Jones Campus Victory Highway West Greenwich	Regional	Population exposure Upwind background	Continuous Ozone season
Near-Road Site Hayes and Park Sts. Providence	Microscale	Maximum emissions Near-road	Continuous Year-Round

In January 2013, NO₂ monitors at all sites were replaced with low-range units with the exception of Brown University.

The NO₂ NAAQS are:

- 100 ppb - 1 hour average (effective January 22, 2010). The design value is the average of the 98th percentile maximum daily hour measured in 3 consecutive years.
- 0.053 ppm (53 ppb) - annual average

The highest design values for 2016 are:

- 58 ppb - 1 hour average, 58% of NAAQS – Near Road
- 45 ppb - 1 hour average, 45% of NAAQS – Brown
-

The highest annual averages for 2016 are:

- 19.83 ppb annual average, 37.4% of NAAQS – Near Road
- 9.9 ppb annual average, 18.7% of NAAQS - Brown

The NO₂ NAAQS have never been exceeded in Rhode Island. Since there was no short-term NAAQS for NO₂ until the standard was amended in 2010, this pollutant was not used for the Air Quality Index (AQI) before that date. The amended NO₂ NAAQS rule, which was published on February 9, 2010, establishes hourly levels of 54 -100 ppb as the range for a “Moderate” AQI.

⁴USEPA, “Primary National Ambient Air Quality Standards for Nitrogen Dioxide: Final Rule, “FR 75(26):6474, 9 February 2010. <http://www.epa.gov/ttn/naaqs/standards/nox/fr/20100209.pdf>

In the 5 year period of 2011– 2015, there were a total of 4 days when NO₂ levels recorded in Rhode Island were in that range. No levels in the “Unhealthy for Sensitive Populations” or more serious AQI categories were recorded in that period.

The 2010 amended NO₂ NAAQS requires Rhode Island to operate two NO₂ monitoring sites, one at “a location of expected highest NO₂ concentrations representing the neighborhood or larger spatial scales” and a second monitor at a near-road location where maximum microscale- representative concentrations are expected, Rhode Island intends to use the current NO₂/NO_x site at Brown University in Providence to fulfill the requirement for a neighborhood scale site. NO₂/NO_x monitoring has been conducted at that site, which has been approved as neighborhood scale representative, since 1994; therefore, the data collected at that site can be used to track trends in NO₂/NO_x concentrations over time. Moreover, the site is in the area of the State with the largest NO₂/NO_x emitting sources and the highest density of NO₂/NO_x emissions. NO₂ concentrations measured at the Brown University site are substantially lower than the NAAQS for that pollutant, including the 1-hour average standard.

After an evaluation of meteorology, traffic counts, diesel traffic and congestion, RI DEM and EPA agreed to locate the Rhode Island near-road site on the east side of the Interstate Route 95 near downtown Providence. Monitoring for NO₂/NO_x, as well as CO, PM_{2.5} and black carbon, began at that site in April 2014. It should be noted that the Rhode Island Department of Transportation is currently engaged in a large scale highway reconstruction/bridge repair project on the southbound side of I-95, just southwest of the monitoring site, and emissions from construction equipment and activities may have a measureable impact on monitored levels at the near-road site. In addition, construction is due to shift to the northbound lanes in two or three years, at which time the monitoring site will need to be relocated.

To fulfill PAMS requirements, NO₂/NO_x is also monitored at the East Providence year-round. Although not required under the new regulations West Greenwich is monitored during the ozone season. To determine how NO₂/NO_x levels at the East Providence site compare to those measured at the Brown University site, Rhode Island has operated the East Providence monitor continuously since March 2012.

Table 8b: 2016 Nitrogen Dioxide Levels at Brown and East Providence Sites (ppb)

Site	Year	98 th Percentile One-Hour	Annual Average
Brown University, Providence	2016	39	9.19
Myron Francis School, E. Providence	2016	36	6.63

It does not appear that operation of the East Providence monitor year-round has affected Rhode Island’s NO₂ design values. However, NO₂ levels were higher at the East Providence site than at

the Brown University sites on some days. Given the above considerations, RI DEM will make changes in the State’s nitrogen dioxide monitoring network in the next 18 months. Since low-range NO₂ monitors are currently in use at the East Providence, and Near-Road sites, RI DEM does not plan to further update the technology used for measuring that pollutant at this time. A low-range monitor that measures NO and NO_y (total reactive nitrogen oxides) has also been operated at the East Providence site since January 2011, consistent with the NCore requirements. Under the circumstances RIDEM will terminate the site located at Brown University on December 31, 2017. In addition, Rhode Island plans to terminate NO₂ monitoring at the West Greenwich site as of December 31, 2017 as this site is no longer a PAMS site and therefore no longer required and will in cost savings. The East Providence site will take the place of the Brown site as the area wide NO₂ monitoring site.

Particulate Matter

Particles smaller than 10 microns (PM₁₀)

The current PM₁₀ monitoring network is as shown in Table 9 and Figure 2:

Table 9: PM₁₀ Monitoring Network

SITE	MEASUREMENT SCALE	MONITORING OBJECTIVE	SCHEDULE
Vernon Trailer Vernon Street Pawtucket	Middle	Population exposure	24-hour 1 in 6 day
Johnson & Wales 111 Dorrance Street Providence	Neighborhood	Population exposure	24-hour 1 in 6 day
Urban League 212 Prairie Avenue Providence	Neighborhood (NATTS)	Population exposure Highest concentration	24-hour 1 in 6 day Co-located 1 in 6 day
Alton Jones Campus Victory Highway West Greenwich	Regional	Upwind background	24-hour 1 in 6 day
Myron Francis School 64 Bourne Avenue E. Providence	Neighborhood (NCore)	Population exposure (Lead (discontinued 6/30/16) and PM _{10-2.5})	24-hour 1 in 6 day (Pb) 1 in 3 (PM _{10-2.5})

The PM₁₀ NAAQS is:

- 150 µg/m³ – 24-hour average, not to be exceeded more than once per year on average over 3 years (design value is 4th high value in a 3-year period)

The highest value for PM₁₀ recorded at a Rhode Island site for 2016 is:

- 52 µg/m³ – 24-hour average, 34.7% of NAAQS, recorded at Vernon St.

The PM₁₀ NAAQS has never been exceeded in Rhode Island. Since PM₁₀ is measured using a filter-based method, results are not immediately available and cannot be used for Air Quality Index calculations. Levels tend to be highest at the Vernon Street site, which is adjacent to I-95, and higher at the two Providence sites than at the rural West Greenwich site. PM₁₀ levels appear to have slightly decreased over the past decade.

Since late 2011, PM₁₀ has also been measured at the East Providence NCore site every sixth day using a lo-vol sampler. Those PM₁₀ measurements are used, in conjunction with PM_{2.5} measurements at that site, for calculating PM_{10-2.5} levels. The lo-vol PM₁₀ filters were also used for lead measurements.

EPA's monitoring regulations require areas like the Providence-New Bedford-Fall River, RI-MA Metropolitan Statistical Area (MSA), which has a population greater than 1,000,000 and measured PM₁₀ concentrations below 80% of the NAAQS, to operate a minimum of 2-4 PM₁₀ monitoring sites. Since Rhode Island is currently operating five sites and is not measuring levels close to the NAAQS at any of the sites, one or more sites could be discontinued without violating the minimum criteria.

As discussed above, PM₁₀ measurements at the East Providence site are used for calculating PM_{10-2.5} levels and, since this measurement is required at NCore sites, PM₁₀ sampling cannot be discontinued at that site. Similarly, PM₁₀ samples collected at the Urban League site in Providence are analyzed for metals to fulfill NATTS requirements, so PM₁₀ sampling at that location cannot be discontinued. The Vernon St., Pawtucket site, which is adjacent to I-95, tends to record the highest PM₁₀ concentrations in the State. The rural Alton Jones, West Greenwich site provides information about background concentrations of PM₁₀ in Rhode Island.

Since the Johnson & Wales site was approximately one mile from the Urban League location and the PM₁₀ levels at the Johnson & Wales site correlated well with those at the Urban League ($r^2 = 0.81$), RIDEM discontinued operation of the Johnson & Wales site as of September 30, 2016. Due to budgetary constraints RI DEM plans to discontinue operation of the PM₁₀ monitor at the Alton Jones site on December 31, 2017.

RI DEM is planning to modify the State's PM₁₀ network in the next 18 months. Since three of the four PM₁₀ monitors currently operating in the State are located in the Providence metropolitan area and one of those monitors is near a major roadway, the current PM₁₀ measurements adequately characterize exposure of the sensitive populations in urban areas to that pollutant. There are no immediate plans to use new technology for measuring PM₁₀ in Rhode Island. RIDEM is requesting to discontinue monitoring at the Alton Jones site as of December 31, 2017.

Fine Particulate Matter (Particulate Matter Smaller than 2.5 microns, or PM_{2.5})

The Federal Reference Method/Federal Equivalent Method (FRM/FEM) PM_{2.5} monitoring network is shown in Table 10 and in Figure 3:

Table 10: PM_{2.5} Monitoring Network

SITE	MEASUREMENT SCALE	MONITORING OBJECTIVE	SCHEDULE
Vernon Trailer Vernon Street Pawtucket	Middle	Population exposure	24-hour, 1 in 3 day FRM Co-located FRM began operation 4/1/17
Urban League 212 Prairie Avenue Providence	Neighborhood	Population exposure Highest concentration	24-hour, daily Continuous FEM 1 in 6 day co-located sampler FRM 2 nd FRM Terminated 4/1/17
Myron Francis School 64 Bourne Avenue E. Providence	Urban	Population exposure Highest concentration	24-hour, daily Continuous FEM 1 in 3 day FRM
Alton Jones Campus Victory Highway West Greenwich	Regional	Population exposure General/Background Regional Transport	Continuous FEM 1 in 6 day co-located sampler FRM
USEPA Laboratory 27 Tarzwell Drive Narragansett	Regional	Population exposure	Continuous FEM
Near Road Site Hayes and Park Sts. Providence	Microscale	Near-road	Continuous FEM

Filter-based FRM PM_{2.5} units are operated as the primary sampler at the Vernon and FEM continuous PM_{2.5} monitors are used as the primary samplers at the West Greenwich, Narragansett East Providence and, as of April 2014, the Near-Road site in Providence. Co-located filter-based FRM samplers are operated at the Vernon and East Providence sites for quality assurance purposes.

The PM_{2.5} NAAQS are:

- 35 µg/m³ – 24-hour average (design value is the 3-year average of the 98th percentile 24-hour concentration)
- 12 µg/m³- annual average (design value is calculated by averaging the daily concentrations from each quarter, averaging these quarterly averages to obtain an annual average, and then averaging the annual averages for three consecutive years)

⁵In December 2012, EPA revised the PM NAAQS, reducing the annual average PM_{2.5} NAAQS from 15 to 12 µg/m³. The rule left the PM₁₀ NAAQS and the 24-hour average PM_{2.5} NAAQS and the secondary annual average PM_{2.5} NAAQS unchanged.

The highest PM_{2.5} values for 2016 are:

- 24.5µg/m³ – 24-hour average, 70% of NAAQS, recorded at Near Road.
- 9.3µg/m³ – annual average, 77.5% of NAAQS, recorded at Near Road.

Annual average levels are consistently highest at the Vernon Street site, which is adjacent to I-95, and higher at the East Providence and the two Providence sites than at the rural West Greenwich site. PM_{2.5} levels have decreased over the past decade, although the additional data obtained from the New Road site is higher than other sites, no conclusion can be made as to whether the levels have decreased over the past decade.

EPA regulations require a minimum of two PM_{2.5} monitoring sites in Rhode Island. These sites must characterize the following:

- Community-wide air quality;
- Background PM_{2.5} levels in the State; and
- Regional transport of PM_{2.5}.

Although Rhode Island operates more PM_{2.5} sites than required, each site fulfills a specific information need or EPA requirement. The West Greenwich site fulfills EPA's requirements for measurement of background and regional transport concentrations of PM_{2.5}. The 24-hour and annual PM_{2.5} design values for the Vernon Street, Pawtucket site, which is immediately adjacent to Interstate Rte. 95, tend to be higher than those at the other sites, so that is a maximum impact site. The East Providence monitor cannot be removed because PM_{2.5} monitoring is required at NCore sites, and the Urban League and Narragansett monitors fulfill the need for air quality data for urban and coastal areas of the State, respectively.

As discussed above, PM_{2.5} monitoring at the Rhode Island near-road site began in April 2014 and will continue until such time that the site is no longer tenable, due to the progression of construction activity in the area. Note also that the long-term future of the Urban League building is questionable as the building is for sale, therefore arrangements are being made to move the site to an alternative location at the Community College of Rhode Island - Liston Campus (CCRI). RI DEM will request approval from the EPA for this location as soon as an agreement is reached with this facility. Since CCRI had difficulty accommodating all of the equipment from the Urban League site, the PM_{2.5} from that location was moved to Vernon Street for co-locating with the existing FRM on April 1, 2017.

RI DEM is changing the FEM at the E. Providence site to be the primary PM_{2.5} monitor and use the FEM and FRM data from that site to evaluate FEM-FRM comparability at Rhode Island sites. The advantages of using the East Providence, rather than the West Greenwich site for this purpose include:

- PM_{2.5} levels at the East. Providence site, although still substantially below the NAAQS, tend to be higher than those at the West Greenwich site.

- Since the East Providence FRM runs 1 in 3 day, it generates more comparison data than are generated at West Greenwich.
- Historical data has demonstrated that the E. Providence FEM and FRM measurements tend to be better correlated and have less bias than is observed at the W. Greenwich site.

Operation of the Near-Road site will be disrupted at some future date, due to the progression of construction activity in the area. RI DEM will notify EPA when it receives notice of that disruption to discuss future plans for near-road monitoring in the State. RIDEM changed the PM_{2.5} FRM sampling frequency from every day, to 1-in-3 at Francis School and Urban League beginning October 1, 2016. As of April 1, 2017 RIDEM moved the collocated FRM monitor from the Urban League site to Vernon Street.

Due to budgetary considerations RIDEM will discontinue using the FRM at Alton Jones as of December 31, 2017. When RIDEM moves the monitoring station from Urban League to its new NATTS location at CCRI it plans to discontinue the FRM at this new location. No other changes to the PM_{2.5} network are anticipated in the next 18 months.

Speciation Monitoring

The EPA's PM_{2.5} Speciation Trends Network (STN) is designed to characterize metal, ion and carbon constituents of PM_{2.5}. RI DEM began operating PM_{2.5} speciation monitors at the Urban League and East Providence sites as a part of that network on a one in six-day schedule in June 2002. Operation of the East Providence speciation equipment was discontinued in May 2004 and, at that time, the monitoring frequency at the Urban League speciation site was increased to one in three days. In November 2008, the speciation equipment at the Urban League was replaced by a SASS speciation unit and, in March 2009, an URG carbon sampler began operation at that location as part of the speciation program. To conform to NCore requirements, the speciation equipment, including the carbon sampler, was moved to the East Providence NCore site in January 2011 and is now being operated there on a one-in-three day schedule. Speciation filters are analyzed by an EPA contractor.

Lead (Pb)

On November 12, 2008, the EPA promulgated an amended NAAQS for lead (FR 73:66964). The new NAAQS is an order of magnitude more stringent than the previous standard. To determine whether an area is in compliance with the new standard, the rule requires two types of lead monitoring: source-specific monitoring in the vicinity of lead sources that emit 0.5 or more tons of lead per year and area-wide lead monitoring at urban NCore sites. Rhode Island has no sources emitting 0.5 tons or more of lead per year and, therefore, is not required to operate any source-specific monitors. To fulfill the requirement for area-wide monitoring, RI DEM and RI DOH began collecting lo-vol PM-10 samples to be analyzed for lead at the East Providence NCore site in June 2011. As specified in the lead NAAQS rule, sampling was conducted on a one-in-six day schedule.

The lead (Pb) monitoring network is as shown in Table 11 (discontinued 4/30/16):

Table 11: Lead Monitoring Network

SITE	MEASUREMENT SCALE	MONITORING OBJECTIVE	SCHEDULE
Myron Francis School 64 Bourne Avenue E. Providence	Neighborhood	Population exposure (area-wide) (NCore)	1 in 6 day Discontinued 6/30/2016

- The NAAQS for Pb is 0.15 $\mu\text{g}/\text{m}^3$, as a rolling three month average, measured in total suspended particulate matter (TSP)

Rhode Island measured Pb in PM_{10} , not in TSP. In the lead NAAQS rule, EPA allows states to use Pb- PM_{10} monitoring, without a scaling factor, as a surrogate for Pb-TSP NAAQS monitoring at area-wide monitoring sites, as long as the 3-month average Pb- PM_{10} concentrations at those sites remain below 0.10 $\mu\text{g}/\text{m}^3$. Note that the highest 3-month average PM_{10} concentration that had been measured at the East Providence site is approximately 7% of that trigger level.

Rhode Island's lead filters were analyzed by the State of Maine using EPA-approved XRF methodology. As specified in the lead NAAQS rule, sampling was conducted on a one-in-six day schedule. EPA deleted the requirement to monitor for non-source Pb at NCore sites from Appendix D of 40 CFR part 58.16 and to allow monitoring agencies to request permission to discontinue non-source monitoring following the collection of at least 3 years of data at urban NCore sites.

Since ambient lead monitoring was conducted in the State for more than 3 years and the lead levels were consistently considerably lower than the NAAQS since the inception of monitoring, RI DEM had asked for and received permission to discontinue monitoring as of June 30, 2016. Monitoring has been discontinued as of June 30, 2016.

Ozone Precursor and Air Toxics Measurements

Photochemical Assessment Monitoring Stations (PAMS)

The Clean Air Act Amendments of 1990 (CAAA) required serious, severe and extreme ozone nonattainment areas to establish enhanced monitoring networks to measure ozone and ozone precursors. In response to that mandate, the US EPA promulgated rules in 1993 that required the establishment of a network of Photochemical Assessment Monitoring Stations (PAMS) to measure ozone, NO_x, volatile organic compounds (VOCs), carbonyls, and meteorological parameters in serious and above nonattainment areas. This network was designed to provide comprehensive data on trends in ambient concentrations of ozone and ozone precursors and to evaluate the spatial and diurnal variability of those pollutants in order to track the formation and transport of ozone across large areas and to evaluate the effectiveness of strategies implemented to reduce levels of that pollutant.

The EPA rule identified four types of PAMS sites:

- Type 1 sites, located on the upwind side of the nonattainment area and used to characterize background and transported concentrations of ozone, NO_x and VOC;
- Type 2 sites, sited to measure the maximum impact of VOC and NO_x emitted in the area;
- Type 3 sites, sited to measure maximum ozone concentrations occurring downwind of the area, and
- Type 4 sites, sited to measure the concentration of ozone, NO_x and VOC exiting the area.

Two PAMS sites, including a Type 2 site, were required in each serious and above nonattainment area. Since Rhode Island was a serious nonattainment area for the one-hour average ozone NAAQS, the ozone standard that was in effect at the time the enhanced monitoring requirements were promulgated, a PAMS network was required in the State. The Alton Jones monitoring site in West Greenwich was designated as the State's Type 1 PAMS site and the East Providence site as the Type 2 PAMS site. In addition, the Massachusetts Department of Environmental Protection (MA DEP) operated a site at the Blue Hills Observatory in Milton, Massachusetts (Site ID 25-021-3003) that served as the Type 1 (upwind) site for the Boston area and as the Type 3 (downwind) site for the Providence area.

The following PAMS pollutants have been monitored in the Rhode Island network:

- 24-hour speciated VOC samples have been collected every sixth day year round at the Type 1 and Type 2 sites, VOC samples are collected daily during June, July and August at the Type 2 site. As of June, July and August of 2017, hourly VOC samples will be collected at the East Providence site using an Auto-GC.
- 24-hour carbonyl samples have been collected every sixth day year round at the East Providence Type 2 site. Eight 3-hour carbonyl samples per day were collected every third

day during June, July and August through 2011 at that site. Note that 3-hour carbonyl samples were required only in nonattainment areas classified as serious or above for the 8-hour ozone standard. Since Rhode Island has never had a nonattainment classification higher than “moderate” for that NAAQS, this requirement did not apply to the State.

- In 2016, NO_x was measured continuously March through October at the Type 1 site in West Greenwich and year round at the Type 2 site in E. Providence and the MA DEP Type 3 site in Milton, MA.
- Rhode Island has measured reactive nitrogen oxides (NO_y) at the Type 2 site since January 2011 to fulfill NCore requirements. EPA regulations require NO_y measurements at one Type 3 or Type 1 PAMS site during the ozone season. Rhode Island currently monitors NO_x, but not NO_y, at its Type 1 site. Similarly, NO_x, rather than NO_y, is monitored at the Type 3 site in Milton, MA, although MA DEP has measured NO_y at that site in the past. Rhode Island does not have any immediate plans to install NO_y equipment at the Type 1 site.
- CO is measured year round at the Type 2 site. In 2010, the conventional CO monitor at that site was replaced with a low-range (ppb) CO monitor, in fulfillment of both NCore and PAMS network requirements.
- Ozone is measured March through October at the West Greenwich and Narragansett sites, since 2011, and will be monitored March –September beginning in 2017, it has been measured year-round at the Type 2 site in East Providence to fulfill NCore requirements. Ozone has also been measured year-round at the Milton, MA site since February 2013.
- Surface meteorological parameters are measured at all three Rhode Island sites and at the Milton, MA site year-round.
- Rhode Island uses the upper air data collected at the Brookhaven, New York meteorological site to fulfill the PAMS requirements for those measurements.

PAMS recently revised monitoring rule (80 FR 65292; October 26, 2015) requirements

The recently revised monitoring rule (80 FR 65292; October 26, 2015) requires PAMS measurements June 1 through August 31 at NCore sites that are located in Core-Based Statistical Areas (CBSAs) with populations of 1,000,000 or more. The Providence, New Bedford, Fall River, RI-MA Statistical Area qualifies as one of those sites. RIDEM is required to develop an implementation plan for this monitoring rule.

PAMS Monitoring Implementation Network Plan

RIDEM formerly operated two Photochemical Assessment Monitoring Stations (PAMS) sites in the air monitoring network in 2015, at the West Greenwich and East Providence sites.

Network Decision

The NCore site located at Francis School in East Providence will serve as the location of the required PAMS site and will measure the following parameters described below. An inventory of equipment used at the site is provided in Table 13.

Auto GC Decision

Volatile organic compounds (VOCs) – A complete list of the targeted compounds are found in Table 12. We will measure hourly speciated VOC measurements with an auto-gas chromatograph (GC) using Chromatotec GC 866 airmo VOC.

Meteorology Measurements Decision

RIDEM will measure wind direction, wind speed, temperature, humidity, atmospheric pressure, precipitation, solar radiation, ultraviolet radiation, and mixing height. We have elected to use the following instrumentation to measure the parameters described above:

Wind speed- Met One 014A

Wind direction – MetOne 6929

Temperature and Humidity all in one – Met One 083D

Atmospheric pressure – Met One 091

Precipitation - Met One 370C

Solar radiation – LI-COR LI-200SZ pyranometer sensor

Ultraviolet radiation – EPLAB model TUVR

RIDEM will use a yet to be purchased ceilometer for determining mixing height and plans to purchase the Vaisala CL51

Other Required Measurements

Carbonyls - Carbonyl sampling at a frequency of three 8-hour samples on a one-in-three day basis (~90 samples per PAMS sampling season) will be accomplished using a yet to be purchased sampler however RIDEM plans on purchasing the ATEC 8000

A complete list of the target carbonyl compounds may be found in Table 12. The TO-11A test method, as used in the National Air Toxics Trends (NATTS) program¹ will be used.

Nitrogen Oxides – Will monitor for NO and NO_y (total oxides of nitrogen) in addition to true NO₂. The true NO₂ is required to be measured with a direct reading NO₂ analyzer, cavity attenuated phase shift (CAPS) spectroscopy or photolytic-converter NO_x analyzer. We have not yet purchased a monitor for the true NO₂ measurement but plan on purchasing the TAPI T500U (CAPS) NO and NO_y will be measured using a Thermo 42iY.

¹ See NATTS Technical Assistance Document for TO-11A method.

PAMS Implementation Plan Waiver Requests and Rationale

Meteorological Waiver Request

We request a waiver to allow meteorological measurements, in particular mixing height using the ceilometer. We hope to utilize the Vernon Street site which is approximately 2.5 miles from the NCORE site located at the Myron Francis School in East Providence.

Rationale for Waiver

This request is precautionary since there may be problems depending on siting criteria associated with this instrument. There may not be sufficient space and may be permitting issues with the City of East Providence when trying to place this instrument at the East Providence site. The site at Vernon Street has sufficient space, is 2.5 miles away, and located on the same side of the river. Every effort will be made to place this instrument at the NCORE site, but this waiver is requested to insure that the meteorological data can be obtained nearby.

Table 12: PAMS Target Compound List

Priority Compounds				Optional Compounds			
1	1,2,3-trimethylbenzene ^a	19	n-hexane ^b	1	1,3,5-trimethylbenzene	19	m-diethylbenzene
2	1,2,4-trimethylbenzene ^a	20	n-pentane	2	1-pentene	20	methylcyclohexane
3	1-butene	21	o-ethyltoluene ^a	3	2,2-dimethylbutane	21	methylcyclopentane
4	2,2,4-trimethylpentane ^b	22	o-xylene ^{a, b}	4	2,3,4-trimethylpentane	22	n-decane
5	acetaldehyde ^{b, c}	23	p-ethyltoluene ^a	5	2,3-dimethylbutane	23	n-heptane
6	acetone ^{c, d}	24	Propane	6	2,3-dimethylpentane	24	n-nonane
7	benzene ^{a, b}	25	propylene	7	2,4-dimethylpentane	25	n-octane
8	c-2-butene	26	styrene ^{a, b}	8	2-methylheptane	26	n-propylbenzene ^a
9	ethane ^d	27	toluene ^{a, b}	9	2-methylhexane	27	n-undecane
10	ethylbenzene ^{a, b}	28	t-2-butene	10	2-methylpentane	28	p-diethylbenzene
11	Ethylene			11	3-methylheptane	29	t-2-pentene
12	formaldehyde ^{b, c}			12	3-methylhexane	30	α/β -pinene
13	Isobutane			13	3-methylpentane	31	1,3 butadiene ^b
14	Isopentane			14	Acetylene	32	benzaldehyde ^c
15	Isoprene			15	c-2-pentene	33	carbon tetrachloride ^b
16	m&p-xylenes ^{a, b}			16	cyclohexane	34	Ethanol
17	m-ethyltoluene ^a			17	cyclopentane	35	Tetrachloroethylene ^b
18	n-butane			18	isopropylbenzene ^b		

Source: Revisions to the Photochemical Assessment Monitoring Stations Compound Target List. U.S. EPA, November 20, 2013

^a Important SOAP (Secondary Organic Aerosols Precursor) Compounds

^b HAP (Hazardous Air Pollutant) Compounds

^c Carbonyl compounds

^d Non-reactive compounds, not considered to be VOC for regulatory purposes

Table 13: Inventory at East Providence Site

NAME	Manufacturer	Model
Black Carbon-Aethalometer	Teldyne	M633
Black Carbon-Aethalometer	Magee	AE16-ER
Carbonyl sampler	Atec	2200
Carbonyl sampler	Atec	2200
Wind direction sensor	MetOne	590S (6929)
Pure air generator	aadco	737-R-12A
Chemiluminescence NO-NO2-NOx Analyzer	Thermo	42ITL
Sulphur Dioxide analyzer	Thermo	43ITL
Caron Monoxide analyzer	Thermo	TE48i
Data logger	Agilaire	8832
Hydrogen generator	Packard	H2PD-150NA
Translator module	MetOne	126
Translator module	MetOne	2270
Barometric pressure sensor	MetOne	091
Rain sensor	MetOne	370-8"
Relative Humidity/temp sensor	MetOne	083D-1-35
Met Station Tower	MetOne	
Ultraviolet radiation sensor	EPLAB	TUVR
Wind Speed sensor	MetOne	014A
Solar Radiation pyranometer sensor	LI-COR	LI-200SZ
Chemiluminescence NO-DIF-NOy Analyzer	Thermo	TE42iY
Ozone analyzer	Thermo	TE49i
PM2.5 Sampler	MetOne	1020
PM2.5 Speciation	MetOne	SASS
PM2.5 Partisol-Plus	R&P	2025
PM2.5 Partisol-Plus	R&P	2025
Standard Calibrator,	API	M700E
Standard Calibrator	Enviroics	6103
Standard-Zero Air	Teledyne	701
VOC sampler	Xontech	910A
VOC sampler	Xontech	910A
Compac II AC units	Marvair	
Compac II AC units	Marvair	
GC custom	Agilent	7890A
Mass Spec	Agilent	5973N
Auto GC	Chromtaotec	866
Ceilometer **	Vaisala	CL51
Carbonyl Sampler **	Atec	8000
True NO ₂ **	Teledyne	T500U

** To be purchased

The EPA promulgated a new NAAQS for ozone effective December 28, 2015. As a result, the following changes to the PAMS program have occurred as a result of the new regulations.

- The network design change involved EPA requiring PAMS measurements minimally during the PAMS (summer) sampling season, which is June 1 through August 31, at all NCore sites in Core-Based Statistical Areas (CBSAs) with a population of 1,000,000 people or more. Note that, since the Rhode Island Type 2 PAMS site is also the State's NCore site, this requirement would not necessitate a relocation of that site. The second part of the network design requires states with moderate or above non-attainment areas and states in the Ozone Transport Region (OTR) to develop and implement Enhanced Monitoring Plans (EMPs). These EMPs are intended to provide monitoring organizations with flexibility to implement additional monitoring to suit the needs of their area.
- Since it is strongly suggested that all required PAMS sites take hourly speciated VOC measurements with auto-gas chromatographs (GCs). RI DEM has purchased and will employ a continuous GC at the East Providence PAMS site for summer 2017.
- All required PAMS sites must monitor for NO and NO_y (total oxides of nitrogen) in addition to true NO₂, where the latter must be measured with a direct reading NO₂ analyzer, cavity attenuated phase shift (CAPS) spectroscopy analyzer, or photolytic-converter NO_x analyzer. Rhode Island installed a FRM low-range NO₂/NO_x analyzer at the East Providence site in 2013 and operates that analyzer year-round. EPA's preferences for a particular NO₂/NO_x monitoring technology will be considered when replacement of that equipment is necessary.
- All required PAMS sites must measure wind direction, wind speed, temperature, humidity, atmospheric pressure, precipitation, solar radiation, ultraviolet radiation and mixing height. Although EPA is suggesting the use of ceilometers for mixing height, other types of meteorological equipment that provide for an indication of mixing height can be proposed. A waiver to allow meteorological measurements to be obtained from other nearby sites, such as National Oceanic and Atmospheric Administration Automated Surface Observing System sites. The required parameters are measured at the E. Providence site, and the location of mixing height measurements will be considered prior to the required implantation date.

As discussed above, Rhode Island has purchased and will employ a continuous GC for measuring one-hour average speciated VOCs at the East Providence PAMS site summer 2017. RI DEM will develop an Enhanced Monitoring Plan (EMP) for implementing additional applicable PAMS requirements, including a possible expansion of the carbonyl monitoring program.

Air Toxics

Rhode Island operates one site that is part of the National Air Toxics Trends Stations (NATTS) network. The primary purposes of the NATTS network are to track trends in ambient air toxics levels, to characterize exposures, and to measure progress toward emission and risk reduction goals.

The Rhode Island NATTS site is located on the roof of the Urban League building in an urban residential neighborhood on the south side of Providence, approximately ½ mile west of I-95. This site was chosen as the State's NATTS site because it is not dominated by local sources and because levels of air toxics at this site appear to be representative of those in urban areas in the State. Note that, since the long-term future of the Urban League building is unknown at this time, RI DEM is working to identify nearby locations to which the NATTS site could be moved if necessary. RI DEM will request the EPA's approval of the new proposed location at CCRI if we succeed in obtaining the necessary agreements with CCRI

In keeping with EPA requirements, the following pollutants, at a minimum, are measured at the Rhode Island NATTS site:

Volatile Organic Compounds (VOC)

- Acrolein
- Perchloroethylene (tetrachloroethylene)
- Benzene
- Carbon tetrachloride
- Chloroform
- Trichloroethylene
- 1,3-butadiene
- Vinyl Chloride

Carbonyls

- Formaldehyde
- Acetaldehyde

Metals

- Nickel compounds (PM₁₀)
- Arsenic compounds (PM₁₀)
- Cadmium compounds (PM₁₀)
- Manganese compounds (PM₁₀)
- Beryllium (PM₁₀)
- Hexavalent chromium (TSP) – Discontinued as of the end of June 2013 in accordance with changing EPA priorities.
- Lead (Pb) – discontinued on 4/30/2016

Semi-Volatile Organic Compounds (SVOC)

- Benzo(a)pyrene
- Napthalene

VOC, carbonyls and PM₁₀ metal samples are analyzed by RI DOH. Semi-Volatile Organic Compounds (SVOC) samples are analyzed by an EPA contractor. Note that, due to the redirection of EPA resources, monitoring for hexavalent chromium in Rhode Island was discontinued at the end of June 2013. Sampling at the NATTS site is conducted for all of the above parameters for 24-hour periods every sixth day. 24-hour VOC samples are also collected every sixth day at the West Greenwich site, East Providence site, and at the Vernon Street site,

which is adjacent to I-95 in Pawtucket. 24-hour carbonyl samples are collected at the East Providence site on the same schedule.

In addition, RI DEM /RI DOH operates aethalometers, which measure black carbon, an indicator of diesel exhaust, at the Urban League NATTS site and the East Providence PAMS/NCORE site and, as of April 2014, at the near-road site in Providence.

RI DEM has discontinued its lead monitoring at the East Providence site as of 6/30/2016. In addition the Rhode Island NATTS site may be moved from the Urban League Building to the roof of the Community College of Rhode Island which is very close by as soon as negotiations are finalized. No other changes are planned for the ozone precursor or air toxics monitoring sites in the next 18 months.

National Core (NCORE) Multi-pollutant Monitoring Stations Network

As required in an October 17, 2006 Federal Register notice (FR 71:61236), Rhode Island began operating a site that is part of EPA's network of core multipollutant monitoring (NCORE) stations in January 2011. This network is designed to address the following monitoring objectives:

- Timely reporting of data to the public through AIRNow, air quality forecasting, and other public reporting mechanisms
- Supporting development of emission strategies through air quality model evaluation and other observational methods
- Assessing accountability of emission strategy progress through tracking long-term trends of criteria and non-criteria pollutants and their precursors
- Supporting long-term health assessments that contribute to ongoing reviews of the NAAQS
- Establishing nonattainment/attainment areas by comparison with the NAAQS
- Supporting multiple disciplines of scientific research, including; public health, atmospheric and ecological.

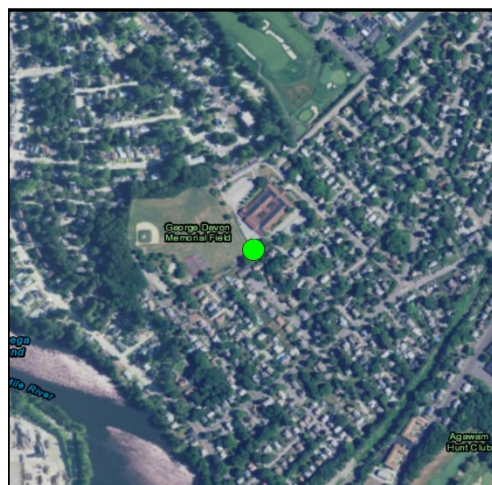
The East Providence site is operating as the State's NCORE site. Ozone, low-range NO₂/NO_x, reactive oxides of nitrogen (NO_y), low-range CO, low range SO₂, PM_{2.5} (FRM, continuous and speciated), coarse PM (PM_{10-2.5}), VOCs, carbonyls, black carbon, lo-vol PM₁₀ lead, and meteorological parameters are monitored at that site. PM_{10-2.5} is measured as the difference between lo-vol PM₁₀ and lo-vol PM_{2.5} concentrations. Note that the conventional NO₂/NO_x monitor at this site was replaced by a low-range NO₂/NO_x monitor in January 2013 and is being operated year-round. EPA deleted the requirement to monitor for non-source lead at NCORE sites from Appendix D of 40 CFR part 58.16 and to allow monitoring agencies to request permission to discontinue non-source monitoring following the collection of at least 3 years of data at urban NCORE sites. Since ambient lead monitoring was conducted in the State for more than 3 years and the lead levels were consistently considerably lower than the NAAQS since the inception of monitoring, RI DEM had asked for and received permission to discontinue monitoring as of June 30, 2016.

Detailed Site Information

The following section presents detailed information for each monitoring site, such as: identification code, location, history, monitored parameters, monitoring objectives, history and descriptive information.

Town – Site: **East Providence – Myron Francis School**
 County: **Providence** Latitude: **41.841039°**
 Address: **64 Bourne Street** Longitude: **-71.36097°**
 AQS Site ID: **440071010** Elevation: **62 ft.**
 Spatial Scale: **Neighborhood/Urban** Year Established: **1993**

Statistical Area: **Providence, New Bedford, Fall River, RI-MA Metropolitan Statistical Area**



PM2.5 (FRM), 1:3 (Except AJ 1:6)	X
PM2.5 (FRM, Collocated), 1:6	
PM2.5 (Continuous - FEM)	X
PM10/PM- (Hi Vol), 1:6	
PM10/PM- (Hi Vol), Collocated, 1:6	
PM10/PM-Coarse (lo-Vol), 1:3	X
Polycyclic aromatic hydrocarbons (PAH), 1:6	
Speciation, PM2.5 super SASS (CSN), 1:3	X
PM2.5 Carbon (URG) (CSN), 1:3	X
Ozone	X
SO2	X
CO	X
Direct NO2	
NO/NO2/NOx	X
NO/NOy	X
VOCs 24 HR Canister (NATTS, State)	X
VOCs Hourly PAMS	S
Black Carbon	X
Black Carbon, Collocated	X
Carbonyls, 1:6	X
Carbonyls Collocated, 1:12	X
Particle Counter	
Wind Speed	X
Wind Direction	X
Temperature	X
Dew Point / Rel. Humidity	X
Barometric Pressure	X
Solar Radiation	S
UV Radiation	S
Precipitation	S

x=Existing

P = Planned in 2015/16

T = Proposed to terminate in 2016/2017

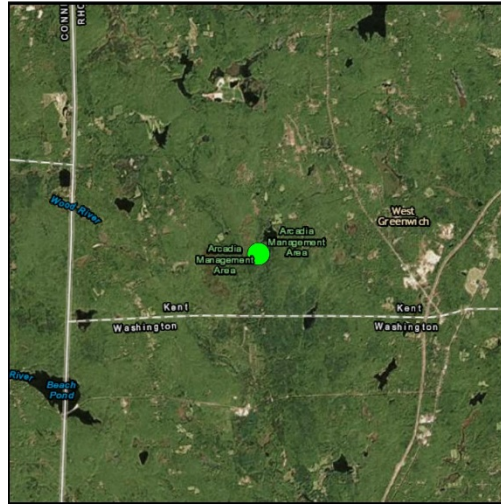
S = Seasonal 6/1-8/30: O₃ & NO_x 3/1-9/30

Site Description: The Myron Francis School site is a neighborhood scale site located in a suburban area in north-eastern Rhode Island in the City of East Providence. This site is operated by RIDEM as part of the NCORE and PAMS network. Land use type: Playground/sports fields/Residential/Elementary School. It is located near Interstate RT 195 approximately 2 miles south, Pawtucket Ave. <1/2 mile to the north, North Broadway <1/2 mile to the south / east. This site is located behind an elementary school, on the backside of the school playground; it sits on city property, recreational park. It abuts residential property to the south. The trailer is approximately 12 X 23 feet with an attached shed housing liquid nitrogen.

Monitoring Objectives: The Myron Francis School monitoring site objective is to collect air quality measurements to assess long-term trends as part of the national NCORE and PAMS network.

Planned changes for 2016-2017: None.

Town – Site: **West Greenwich –Alton Jones Campus**
 County: **Providence** Latitude: **41.61537°**
 Address: **401 Victory Highway** Longitude: **-71.72°**
 AQS Site ID: **440030002** Elevation: **253 ft.**
 Spatial Scale: **Regional** Year **1976**
 Established: **1976**
 Statistical Area: **Providence, New Bedford, Fall River, RI-MA Metropolitan Statistical Area**



PM2.5 (FRM), 1:3 (Except AJ 1:6)	T
PM2.5 (FRM, Collocated), 1:6	X
PM2.5 (Continuous - FEM)	T
PM10/PM- (Hi Vol), 1:6	
PM10/PM- (Hi Vol), Collocated), 1:6	
PM10/PM-Coarse (lo-Vol), 1:3	
Polycyclic aromatic hydrocarbons (PAH), 1:6	
Speciation, PM2.5 super SASS (CSN),	
PM2.5 Carbon (URG) (CSN), 1:3	S
Ozone	
SO2	
CO	
Direct NO ₂	
NO/NO ₂ /NOx	T
NO/NOy	
VOCs 24 HR Canister (NATTS, State)	X
VOCs Hourly PAMS	
Black Carbon	
Black Carbon, Collocated	
Carbonyls, 1:6	
Carbonyls Collocated, 1:12	
Particle Counter	
Wind Speed	X
Wind Direction	X
Temperature	X
Dew Point / Rel. Humidity	
Barometric Pressure	X
Solar Radiation	S
UV Radiation	
Precipitation	

x=Existing



= Planned in 2015/16



= Proposed to terminate in 2016/2017



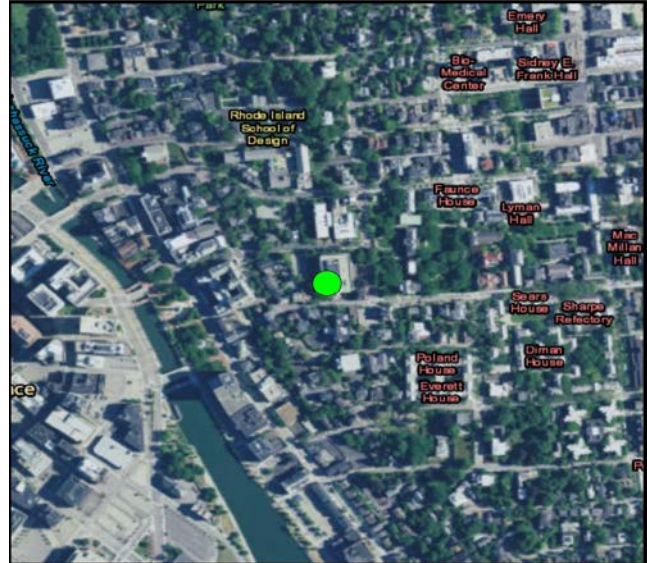
= Seasonal 6/1-8/30: O₃ & NO_x 3/1-9/30

Site Description: The Alton Jones site is a regional scale site located in a meadow surrounded by trees in Rhode Island in the town of West Greenwich. This site is operated by RIDEM as part of the SLAMS and PAMS network. Land use type: Forest and recreation field. It is located near RT 102 approximately 2.5 miles east, and Interstate I-95, 5 miles south. The trailer approximately 12' X 12', with a pressure treated deck off to the east side of the trailer. A meteorological tower sits on the west side of the trailer.

Monitoring Objectives: The Alton Jones monitoring site objective is to collect air quality measurements to assess long-term trends as part of the SLAMS network.

Planned changes for 2016-2017: We are terminating the PM_{2.5} FRM, the PM₁₀ FRM, and the NO/NO₂/NO_x monitors on the December 31, 2017.

Town – Site: **Providence – Rockefeller Library Brown Univ.**
 County: **Providence** Latitude: **41.82556°**
 Address: **10 Prospect Street** Longitude: **-71.40528°**
 AQS Site ID: **440070012** Elevation: **75 ft.**
 Spatial Scale: **Neighborhood** Year Established: **1975**
 Statistical Area: **Providence, New Bedford, Fall River, RI-MA Metropolitan Statistical Area**



PM2.5 (FRM), 1:3 (Except AJ 1:6)	
PM2.5 (FRM, Collocated), 1:6	
PM2.5 (Continuous - FEM)	
PM10/PM ₁₀ - (Hi Vol), 1:6	
PM10/PM ₁₀ - (Hi Vol), Collocated, 1:6	
PM10/PM ₁₀ -Coarse(Io-Vol), 1:3	
Polycyclic aromatic hydrocarbons (PAH), 1:6	
Speciation, PM2.5 super SASS (CSN), 1:3	
PM2.5 Carbon (URG) (CSN), 1:3	
Ozone	
SO ₂	T
CO	
Direct NO ₂	
NO/NO ₂ /NO _x	T
NO/NO _y	
VOCs 24 HR Canister (NATTS, State)	
VOCs Hourly PAMS	
Black Carbon	
Black Carbon, Collocated	
Carbonyls, 1:6	
Carbonyls Collocated, 1:12	
Particle Counter	
Wind Speed	
Wind Direction	
Temperature	
Dew Point / Rel. Humidity	
Barometric Pressure	
Solar Radiation	
UV Radiation	
Precipitation	

x=Existing **P** = Planned in 2015/16 **T** = Proposed to terminate in 2016/2017 **S** = Seasonal 6/1-8/30: O₃ & NO_x 3/1-9/30

Site Description: The Rockefeller Library site is an urban City Center commercial scale site located on the 5th floor of the Brown University Library; in a corner of the utility room in an urban area in the City of Providence. A glass manifold is extended about 1.5 meters out the side of (South East) of the building. This site is operated by RIDEM. Land use type: City It is located on the corner of Prospect and George St., Benefit Street is 344.5 ft. to the west, South Main St. is 652.6 ft. to the west, I-95 is 3,510.9 ft. to the south, I 95 is 3,676.9 ft. to the west. This site is located on 5th floor of the library overlooking the city. Street traffic is light to moderate.

Monitoring Objectives: The Brown University monitoring site objective is to collect air quality measurements within an urban city setting.

Planned changes for 2016-2017: Propose to terminate in 2017.

Town – Site: **Narragansett – US EPA Laboratory**
 County: **Washington** Latitude: **41.495511°**
 Address: **27 Tarzwell Drive** Longitude: **-71.423705°**
 AQS Site ID: **440090007** Elevation: **19.69 ft.**
 Spatial Scale: **Regional** Year Established: **1997**
 Statistical Area: **Providence, New Bedford, Fall River, RI-MA Metropolitan Statistical Area**



PM2.5 (FRM), 1:3 (Except AJ 1:6)	
PM2.5 (FRM, Collocated), 1:6	
PM2.5 (Continuous - FEM)	X
PM10/PM- (Hi Vol), 1:6	
PM10/PM- (Hi Vol), Collocated, 1:6	
PM10/PM-Coarse (lo-Vol), 1:3	
Polycyclic aromatic hydrocarbons (PAH), 1:6	
Speciation, PM2.5 super SASS (CSN),	
PM2.5 Carbon (URG) (CSN), 1:3	S
Ozone	
SO2	
CO	
Direct NO2	
NO/NO2/NOx	
NO/NOy	
VOCs 24 HR Canister (NATTS, State)	
VOCs Hourly PAMS	
Black Carbon	
Black Carbon, Collocated	
Carbonyls, 1:6	
Carbonyls Collocated, 1:12	
Particle Counter	
Wind Speed	X
Wind Direction	X
Temperature	X
Dew Point / Rel. Humidity	
Barometric Pressure	X
Solar Radiation	
UV Radiation	
Precipitation	

x=Existing



= Planned in 2015/16



= Proposed to terminate in 2016/2017



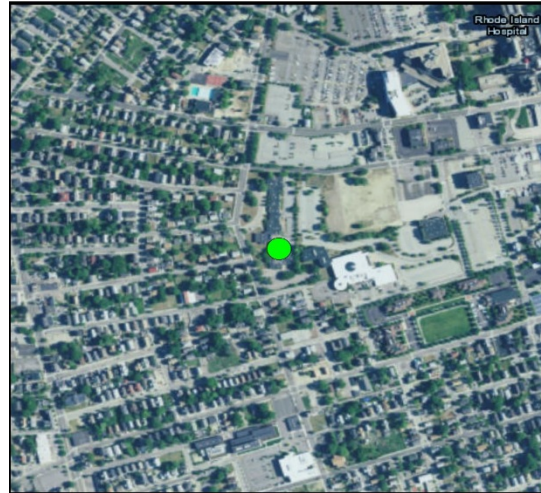
= Seasonal 6/1-8/30: O₃ & NO_x 3/1-9/30

Site Description: The Narragansett USEPA laboratory is a regional scale site located 425 feet from the bay in southern Rhode Island in the town of Narragansett. This site is operated by RIDEM as part of SLAMS network. Equipment is in a small office on the east side of the EPA building. A staircase in the back of the building leads to the roof where the continuous PM2.5 sampler is placed. A meteorological tower sits on the east side of the building. RT 1 is 1.7 miles south. Rhode Island sound is 425 ft. to the east and the building sits at the top of a hill.

Monitoring Objectives: The Narragansett USEPA monitoring site objective is to collect air quality measurements to assess long-term trends as part of the national SLAMS network.

Planned changes for 2016-2017: None.

Town – Site: **Providence – Urban League**
 County: **Providence** Latitude: **41.80776°**
 Address: **212 Prairie Avenue** Longitude: **-71.415105°**
 AQS Site ID: **440070022** Elevation: **75 ft.**
 Spatial Scale: **Neighborhood** Year Established: **1999**
 Statistical Area: **Providence, New Bedford, Fall River, RI-MA Metropolitan Statistical Area**



PM2.5 (FRM), 1:3 (Except AJ 1:6)	T
PM2.5 (FRM, Collocated), 1:6	X+
PM2.5 (Continuous - FEM)	X
PM10/PM- (Hi Vol), 1:6	X**
PM10/PM- (Hi Vol), Collocated), 1:6	X++
PM10/PM-Coarse(lo-Vol), 1:3	
Polycyclic aromatic hydrocarbons (PAH), 1:6	X
Speciation, PM2.5 super SASS (CSN),	
PM2.5 Carbon (URG) (CSN), 1:3	
Ozone	
SO2	
CO	
Direct NO ₂	
NO/NO ₂ /NOx	
NO/NOy	
VOCs 24 HR Canister (NATTS, State)	X
VOCs Hourly PAMS	
Black Carbon	X
Black Carbon, Collocated	
Carbonyls, 1:6	X
Carbonyls Collocated, 1:12	X
Particle Counter	X
Wind Speed	X
Wind Direction	X
Temperature	X
Dew Point / Rel. Humidity	
Barometric Pressure	
Solar Radiation	
UV Radiation	
Precipitation	

x=Existing P = Planned in 2015/16 T = Proposed to terminate in 2016/2017 S = Seasonal 6/1-8/30: O₃ & NO_x 3/1-9/30

X+ Collocated PM2.5 FRM terminated 3/31/2016 for site construction, 1:6

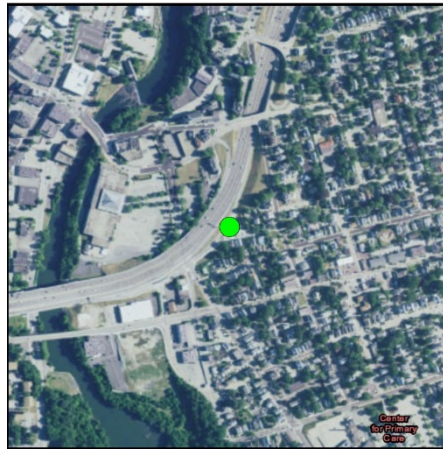
X** High-Volume metals run 1:6 X++ High-Volume metals run 1:12

Site Description: The Urban League site is a neighborhood scale site located in an urban area in north-eastern Rhode Island in the City of Providence. This site is operated by RIDEM as part of the SLAMS and toxics network. This site sits on the roof of a building approximately 18 feet off the ground. On the east side of this building is a 2 story school. There are some trees, residences and 2 story homes and buildings surrounding the location. It has street traffic from Prairie Ave, with Broad St. 2.8 miles west, and Elmwood Avenue 3.24 miles west. Interstate I-95 is 1.4 miles east with RI Hospital 2.23 miles away.

Monitoring Objectives: The Urban League monitoring site objective is to collect air quality measurements to assess long-term trends as part of the SLAMS and NATTS network.

Planned changes for 2016-2017: Site will be moved to an alternative location nearby at the Community College of RI as soon as an agreement is finalized.

Town – Site: **Pawtucket – Vernon Street**
 County: **Providence** Latitude: **41.874668°**
 Address: **Vernon Street** Longitude: **-71.379971°**
 AQS Site ID: **440070026** Elevation: **36 ft.**
 Spatial Scale: **Middle** Year: **2001**
 Established: **2001**
 Statistical Area: **Providence, New Bedford, Fall River, RI-MA Metropolitan Statistical Area**



	PM2.5 (FRM), 1:3 (Except AJ 1:6)	
X	PM2.5 (FRM, Collocated), 1:6	X*
	PM2.5 (Continuous - FEM)	
X	PM10/PM- (Hi Vol), 1:6	
	PM10/PM- (Hi Vol), Collocated, 1:6	
	PM10/PM-Coarse(lo-Vol), 1:3	
	Polycyclic aromatic hydrocarbons (PAH), 1:6	
	Speciation, PM2.5 super SASS (CSN),	
	PM2.5 Carbon (URG) (CSN), 1:3	
	Ozone	
	SO2	
	CO	
	Direct NO ₂	
	NO/NO ₂ /NOx	
	NO/NOy	
X	VOCs 24 HR Canister (NATTS, State)	
	VOCs Hourly PAMS	
	Black Carbon	
	Black Carbon, Collocated	
	Carbonyls, 1:6	
	Carbonyls Collocated, 1:12	
	Particle Counter	
	Wind Speed	
	Wind Direction	
	Temperature	
	Dew Point / Rel. Humidity	
	Barometric Pressure	
	Solar Radiation	
	UV Radiation	
	Precipitation	

x=Existing

P = Planned in 2015/16

T = Proposed to terminate in 2016/2017

S = Seasonal 6/1-8/30: O₃ & NO_x 3/1-9/30

X* collocated FRM started 4/1/2-16, 1:6

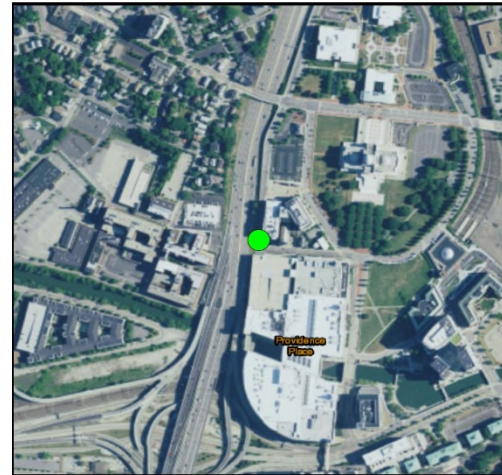
Site Description: The Vernon Street site is a middle scale site located in a suburban area in north-eastern Rhode Island in the City of Pawtucket. This site is operated by RIDEM as part of the SLAMS and Toxics network. Land use type: Highway/ Residential. It is located at grass level adjacent to Interstate RT I-95 and sits midway on a hill near the on-ramp with houses on the east-south sides.

This site is a small grassy median situated 22 meters from I-95 North and 7.6 meters to the ramp leading to the highway. The samplers are placed on a cement platform and pressure treated deck. The area is surrounded by a chain link fence.

Monitoring Objectives: The Vernon Street monitoring site objective is to collect air quality measurements to assess long-terms trends as part of the national SLAMS and Toxics network.

Planned changes for 2016-2017: None.

Town – Site: **Providence – Near Road, Park/Hayes Street**
 County: **Providence** Latitude: **41.829495°**
 Address: **Hayes and Park Street** Longitude: **-71.417457°**
 AQS Site ID: **440070030** Elevation: **75 ft.**
 Spatial Scale: **Microscale** Year Established: **2014**
 Statistical Area: **Providence, New Bedford, Fall River, RI-MA Metropolitan Statistical Area**



PM2.5 (FRM), 1:3 (Except AJ 1:6)	
PM2.5 (FRM, Collocated), 1:6	
PM2.5 (Continuous - FEM)	X
PM10/PM- (Hi Vol), 1:6	
PM10/PM- (Hi Vol), Collocated, 1:6	
PM10/PM-Coarse(lo-Vol), 1:3	
Polycyclic aromatic hydrocarbons (PAH), 1:6	
Speciation, PM2.5 super SASS (CSN), 1:3	
PM2.5 Carbon (URG) (CSN), 1:3	
Ozone	
SO2	
CO	X
Direct NO ₂	
NO/NO ₂ /NO _x	X
NO/NO _y	
VOCs 24 HR Canister (NATTS, State)	
VOCs Hourly PAMS	
Black Carbon	X
Black Carbon, Collocated	
Carbonyls, 1:6	
Carbonyls Collocated, 1:12	
Particle Counter	X
Wind Speed	
Wind Direction	
Temperature	
Dew Point / Rel. Humidity	
Barometric Pressure	
Solar Radiation	
UV Radiation	
Precipitation	

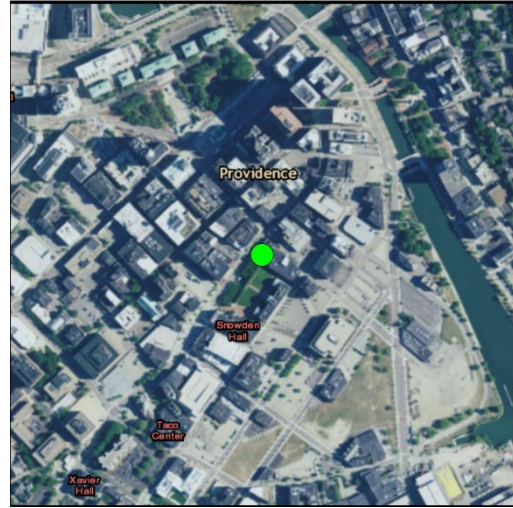
x=Existing **P** = Planned in 2015/16 **T** = Proposed to terminate in 2016/2017 **S** =Seasonal 6/1-8/30: O₃ & NO_x 3/1-9/30

Site Description: The Near Road site is a microscale scale site located in an urban, commercial area along the highway I-95 near the corner of Park/Hayes Street in the City of Providence. This site is operated by RIDEM as part of Near Road network. Land use type: Highway/City. It is located near Interstate RT I-95 North near the RT-10 and RT-146 connectors. This site is 4 meters off of RT I-95 North just after a parking garage and the on ramp from RT 6/10 connector. The trailer is 20' x 8", and 5 feet of it is storage area without heat. Access to the roof is by an attached ladder on the front side of the trailer. The trailer is surrounded by a chain link fence and a guard rail along the highway side. The trailer sits level with the highway and is midway on the hill on Park Street. A tall buildings is on the east side and on the west side is parking garage, south is the highway and the other side of the highway are tall buildings, and north is looking up the a hill.

Monitoring Objectives: The Near Road monitoring site objective is to collect air quality measurements to assess long-terms trends as part of the Near Road network.

Planned changes for 2016-2017: None.

Town – Site: **Providence – Johnson & Wales**
 County: **Providence** Latitude: **41.822499°**
 Address: **111 Dorrance Street** Longitude: **-71.410659°**
 AQS Site ID: **440070027** Elevation: **17 ft.**
 Spatial Scale: **Neighborhood** Year: **2004**
 Established: **2004**
 Statistical Area: **Providence, New Bedford, Fall River, RI-MA Metropolitan Statistical Area**



PM2.5 (FRM), 1:3 (Except AJ 1:6)	
PM2.5 (FRM, Collocated), 1:6	
PM2.5 (Continuous - FEM)	
PM10/PM- (Hi Vol), 1:6	T
PM10/PM- (Hi Vol), Collocated), 1:6	
PM10/PM-Coarse (lo-Vol), 1:3	
Polycyclic aromatic hydrocarbons (PAH), 1:6	
Speciation, PM2.5 super SASS (CSN),	
PM2.5 Carbon (URG) (CSN), 1:3	
Ozone	
SO2	
CO	
Direct NO ₂	
NO/NO ₂ /NOx	
NO/NOy	
VOCs 24 HR Canister (NATTS, State)	
VOCs Hourly PAMS	
Black Carbon	
Black Carbon, Collocated	
Carbonyls, 1:6	
Carbonyls Collocated, 1:12	
Particle Counter	
Wind Speed	
Wind Direction	
Temperature	
Dew Point / Rel. Humidity	
Barometric Pressure	
Solar Radiation	
UV Radiation	
Precipitation	

x=Existing **P** = Planned in 2015/16 **T** = Proposed to terminate in 2016/2017 **S** =Seasonal 6/1-8/30: O₃ & NO_x 3/1-9/30

Site Description: The Johnson & Wales site is a neighborhood scale site located in an urban area in downtown Providence, Rhode Island. This site is operated by RIDEM as part of the SLAMS network. Land use type: City. It is located on the roof of the Johnson & Wales University library in downtown Providence. It is four stories high and surrounded by buildings (many taller than the library). It is a busy traffic area of downtown with many tall building close together. RT–195 is 3,603 feet to the west and I-95 is 2,504 feet to the south.

Monitoring Objectives: The Johnson & Wales monitoring site objective is to collect air quality measurements to assess long-terms trends as part of the national SLAMS network.

This site was closed on: September 30, 2016

Figure 1
Air Quality Monitoring Network
Continous Gas Monitors
Site Locations



Figure 2
PM-10 Air Pollution Monitoring Network
Site Locations

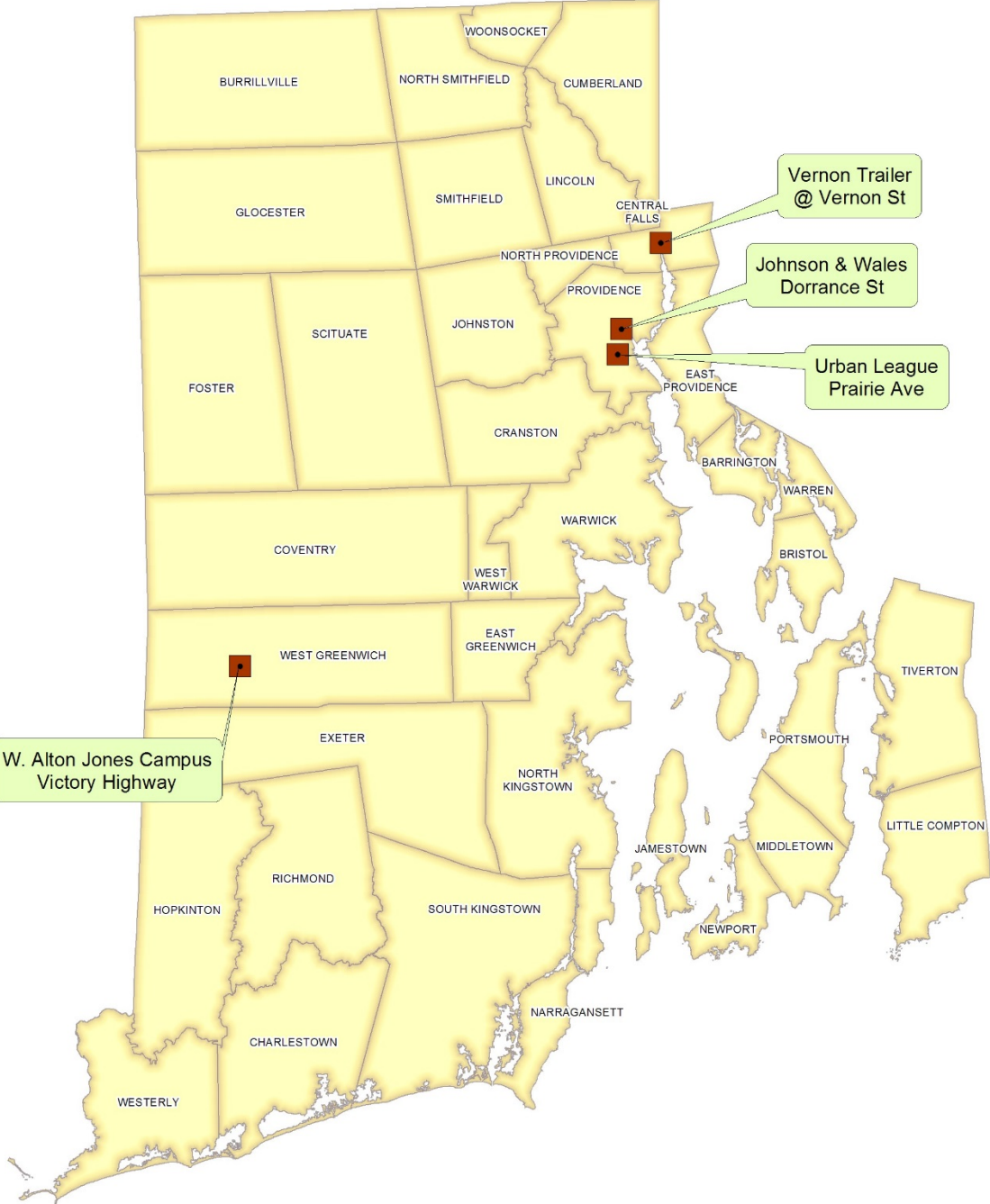


Figure 3
PM-2.5 Air Pollution Monitoring Network
Site Locations

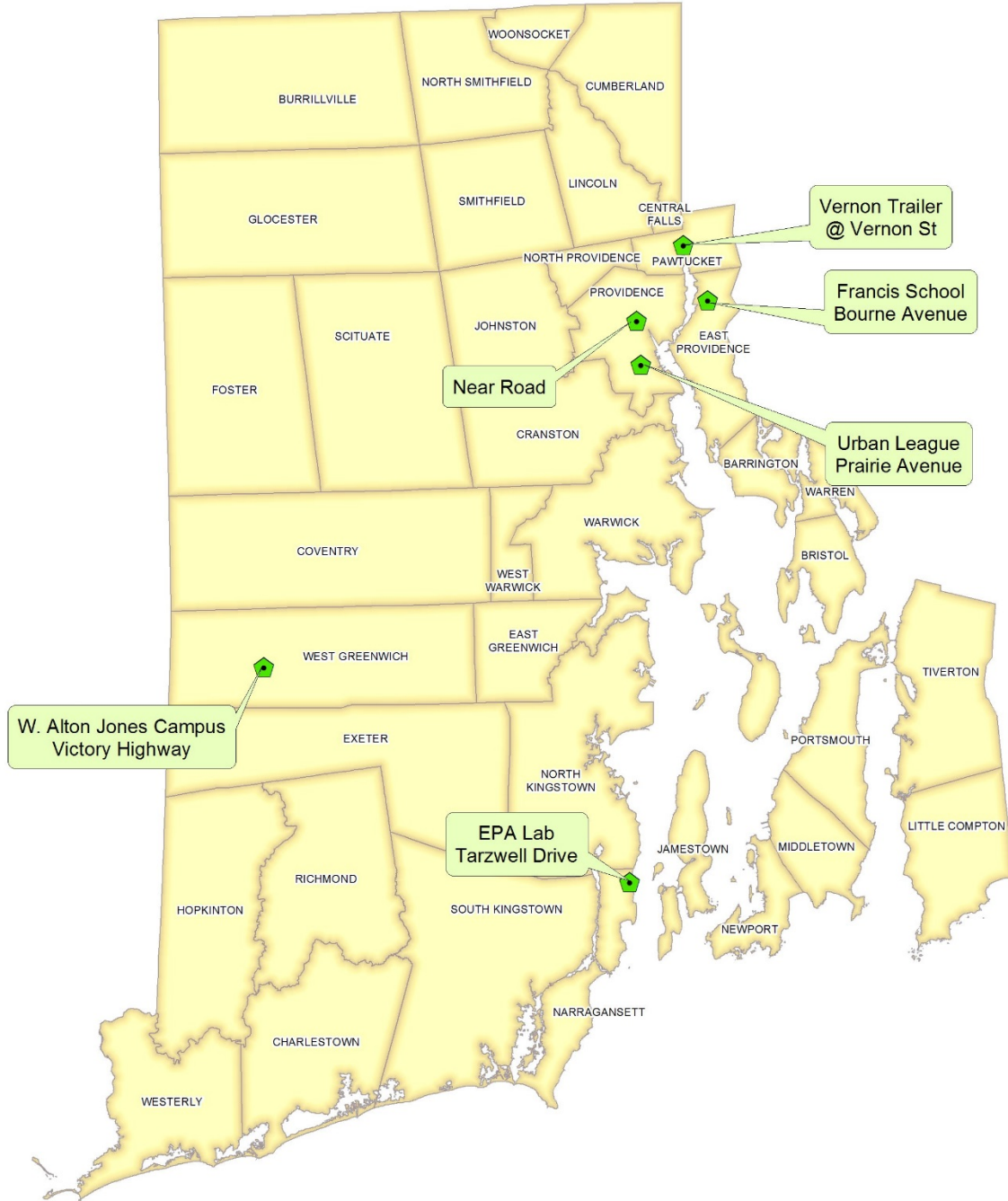


Figure 4
Air Toxics Monitoring Network
Site Locations



Figure 5
RI Air Quality Monitoring Network

