Connecticut 2022 Annual Air Monitoring Network Plan

Connecticut Department of Energy and Environmental Protection
Bureau of Air Management

Final
July 2022

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Acronyms and Abbreviations

AQI – Air Quality Index
AQS – Air Quality System
BAM – Beta Attenuation Monitor
BC – Black Carbon (Aethalometer)
CAA – Clean Air Act
CBSA – Core-Based Statistical area
CFR – Code of Federal Regulations
CO – carbon monoxide
CSA – combined statistical area
CSN – Chemical Speciation Network
DEEP – Connecticut Department of Energy and Environmental Protection
DAS – data acquisition system
EC/OC – Elemental Carbon/Organic Carbon
EMP – Enhanced Monitoring Plan for ozone
EPA – Environmental Protection Agency
FEM – Federal Equivalent Method
FRM – Federal Reference Method
GC – gas chromatography
GC/MS – gas chromatography/mass spectrometry
HAP – hazardous air pollutant
IMPROVE – Interagency Monitoring of Protected Visual Environments
LC – local conditions of temperature and pressure
LISTOS – Long Island Sound Tropospheric Ozone Study
LMP – limited maintenance plan
MPA – monitoring planning area
MSA – metropolitan statistical area
NAAQS – National Ambient Air Quality Standards
NCore – National Core Monitoring Stations
NOAA – National Oceanic and Atmospheric Administration
NOx – nitrogen oxides
NOy – reactive oxides of nitrogen
OAQPS – Office of Air Quality Planning and Standards
OTR – Ozone Transport Region
PAMS – Photochemical Assessment Monitoring Stations
$PM_{2.5}$ – fine particulate matter (<2.5 microns)
PM_{10} – respirable particulate matter (<10 microns)
$PM_{10-2.5}$ – coarse particulate matter (PM_{10} – $PM_{2.5}$)
QA – quality assurance
QA/QC – quality assurance/quality control
QAPP – quality assurance project plan
QMP – quality management plan
RH – relative humidity
SIP – State Implementation Plan
SLAMS – state and local monitoring stations
SO_2 – sulfur dioxide
SOP – standard operating procedure
STP – standard conditions of temperature and pressure (40 CFR 50.3: 25°C and 760 mm Hg)
TSA – technical system audit
TSP – total suspended particulate
UVC – Ultra-violet carbon (aethalometer)
VOC – volatile organic compound

Introduction

The Connecticut 2022 Air Monitoring Network Plan (Plan) is prepared by the Connecticut Department of Energy and Environmental Protection (DEEP) in accordance with 40 CFR 58.10. This plan meets the requirement to develop and submit to the Environmental Protection Agency (EPA) an annual air quality monitoring network plan to describe the air monitoring network and propose any planned changes to air quality monitoring sites and monitored air pollutants to occur within 18 months following submittal.

The draft Network Plan was posted on DEEP's website at DEEP: Air Monitoring Network from May 17, 2022 to June 17, 2022. Public comments were submitted to:

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Background

The Clean Air Act of 1970 (CAA) established the EPA as the principal administrative body to enact regulations to meet the requirements of the CAA and subsequent amendments thereto. One such requirement directed EPA to set primary and secondary air quality standards, known as the National Ambient Air Quality Standards (NAAQS) for the six "criteria pollutants" that Congress determined presented serious negative impacts to human health and welfare. For areas within Connecticut that do not meet a NAAQS, DEEP develops State Implementation Plans (SIPs) to detail the steps to be taken to bring air quality into attainment. Ambient air quality monitoring is essential to track progress towards meeting clean air goals and demonstrate attainment.

While DEEP monitors ambient air quality in Connecticut primarily for comparison with the NAAQS, there are other important objectives to ambient air quality monitoring. This monitoring provides local air quality data to the public, supports air quality forecasting and the Air Quality Index (AQI), supports long-term health assessments and other scientific research, assists with air permitting and identifying long-term air quality trends to gauge effectiveness of air pollution control strategies and serves as an accuracy check on computer-based air quality models. Additionally, emerging air monitoring technology such as small sensors and mobile monitoring platforms can be strategically deployed in historically overburdened communities or other areas of concern to determine localized air quality impacts too granular to be observed by the DEEP's static network.

DEEP's ability to manage the air quality monitoring network greatly depends on federal grant support from EPA. DEEP matches a portion of the federal grant by covering personnel costs from its general fund allocation. As potential state budget challenges related to the COVID-19 pandemic begin to impact DEEP, there may need to be a greater reliance on federal funds. Indications are that future federal funding levels for air monitoring programs will be stable or slightly increased during the time period covered by this plan. In addition, as with state governmental operations everywhere, it will be a challenge to maintain personnel resources allocated to ambient air quality monitoring given the pace of anticipated staff attrition. DEEP will strive to provide an acceptable level of service within these constraints by continually improving operations and focusing its efforts to ensure the completion of the most critical ambient air quality monitoring. As operating costs and federal monitoring requirements increase, DEEP must operate within its means by either improving operational efficiencies or reducing other aspects of the air monitoring network. Efficiencies being employed and expanded include improving data acquisition software and hardware, streamlining access to the public thorough DEEP's website, and reducing the number of monitoring sites or parameters measured by increasing multi-pollutant monitoring or terminating duplicative or unnecessary monitors.

Network Overview

DEEP currently operates 14 stations in its air-monitoring network (Figure 1) as part of the national State and Local Air Monitoring Stations (SLAMS) network, established under the CAA. In October 2006, EPA instituted a network of core multi-pollutant sites. These sites are known as the National Core (NCore) network, the primary purpose of which is to consolidate monitoring of multiple pollutants at fewer sites for efficiency and cost savings. In addition, the NCore sites provide a comprehensive suite of high-resolution pollutant data for NAAQS compliance assessment, research studies and long-term trends analysis. There are two NCore sites located in Connecticut: Criscuolo Park in New Haven, and Mohawk Mountain in Cornwall. The NCore network is part of the SLAMS network.

Figure 1: Connecticut DEEP Air Monitoring Network

Proposed Network Changes

Details of the proposed monitoring network configuration are described in the following site information pages. In addition to infrastructure maintenance and improvements, DEEP proposes the following additions to the monitoring network during the period 2022-2023:

- Assess continuous formaldehyde (HCHO) methods for potential future deployment to one or more coastal ozone sites.
- Support Long Island Sound coastal ozone studies proposed by EPA for 2023.
- No monitors are planned to be discontinued during 2022 – 2023.

Monitoring Site Information

The ambient air monitoring sites currently operated by DEEP are listed in the Table 1 below. Detailed information for each monitoring site is provided in a later section of this plan.

Table 1: Monitoring Network Summary

Town	Site	PM2.5 (FRM)	PM2.5 (FRM, collocated)	PM2.5 (continuous FEM)	PM2.5 (continuous FEM, secondary)	PM10/PM10-2.5 (FRM)	PM10/PM10-2.5 (FRM, collocated)	PM10/PM-10.2.5 (continuous FEM)	PM10/PM10-2.5 (cont. FEM, secondary)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, continuous)	Ozone	SO2	CO	NO_2	NO/NOy	HCHO (continuous)	Total Column NO_2/HCHO	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation	Mixing Height
Bridgeport	Roosevelt School		1/6	X				X						X									X				
Cornwall	Mohawk Mountain	1/3		X				X			1/3	X	X	X	X		X		X		X	X	X	X	X	X	
Danbury	Western Connecticut State University	1/6		X				X				X	X								X	X	X		X		
East Hartford	McAuliffe Park			X				X				X	X			X					X	X	X	X	X		
Greenwich	Point Park												X								X	X	X				
Groton	Fort Griswold			X				X					X										X				
Hartford	Huntley Place	1/6		X				X				X			X	X				X	X	X	X		X		
Madison	Hammonasset State Park												X						X		X	X	X				
Middletown	Connecticut Valley Hospital												X								X	X	X		X		
New Haven	Criscuolo Park	1/3	1/6	X	X	1/3	1/6	X	X	1/3		X	X	X	X	X	X		X		X	X	X	X	X	X	X
Stafford	Shenipsit State Forest												X								X	X	X				
Stratford	Stratford Lighthouse												X										X				
Waterbury	Bank Street			X				X													X	X	X				
Westport	Sherwood Island State Park												X			X		P*	X		X	X	X		X		X

X=Existing P = Planned in 2022/2023 T = Terminated in 2022/2023

* Deployment in 2023 contingent on availability of continuous HCHO method that meets acceptable QA/QC criteria; additionally, monitor may be located at an alternative site if warranted (e.g., LISTOS activities focused at alternative coastal site).

National Ambient Air Quality Standards (NAAQS)

The EPA's Office of Air Quality Planning and Standards (OAQPS) has set NAAQS for six principal pollutants, known as the criteria pollutants. Table 2, reprinted here from EPA's website[1], summarizes the current NAAQS compliance requirements for the criteria pollutants.

Table 2: National Ambient Air Quality Standards

Pollutant [links to historical tables of NAAQS reviews]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		primary and secondary	Rolling 3 month average	0.15 µg/m^3 [(a)]	Not to be exceeded
Nitrogen Dioxide (NO_2)		primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	1 year	53 ppb [(b)]	Annual Mean
Ozone (O_3)		primary and secondary	8 hours	0.070 ppm [(c)]	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	primary	1 year	12.0 µg/m^3	annual mean, averaged over 3 years
		secondary	1 year	15.0 µg/m^3	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		primary	1 hour	75 ppb [(d)]	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Notes for Table 2:

[a] In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m3 as a calendar quarter average) also remain in effect.

[b] The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

[c] Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

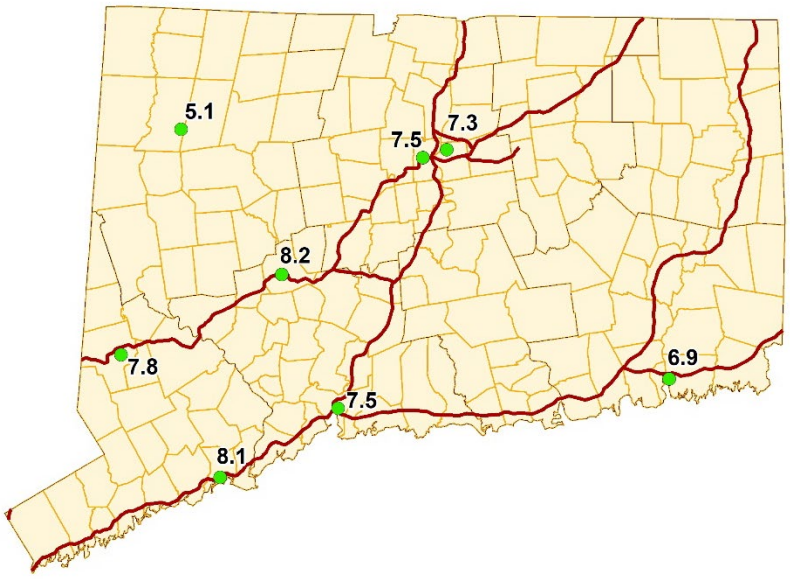
[d] The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR 50.4(3)), A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

[1] https://www.epa.gov/criteria-air-pollutants/naaqs-table

$PM_{2.5}$ Annual Design Values (2021)

The 2021 annual design values for $PM_{2.5}$, based on 2019 through 2021 data, are presented in the table and figure below. $PM_{2.5}$ annual design values are calculated using the 3-year average of the respective annual weighted averages, based on daily average $PM_{2.5}$ values[2]. The current annual $PM_{2.5}$ NAAQS is 12.0 μg/m^3. All Connecticut monitors demonstrate compliance with the design value for the annual $PM_{2.5}$ NAAQS. The design values presented below have been reconciled with EPA's reported 2021 design values[3].

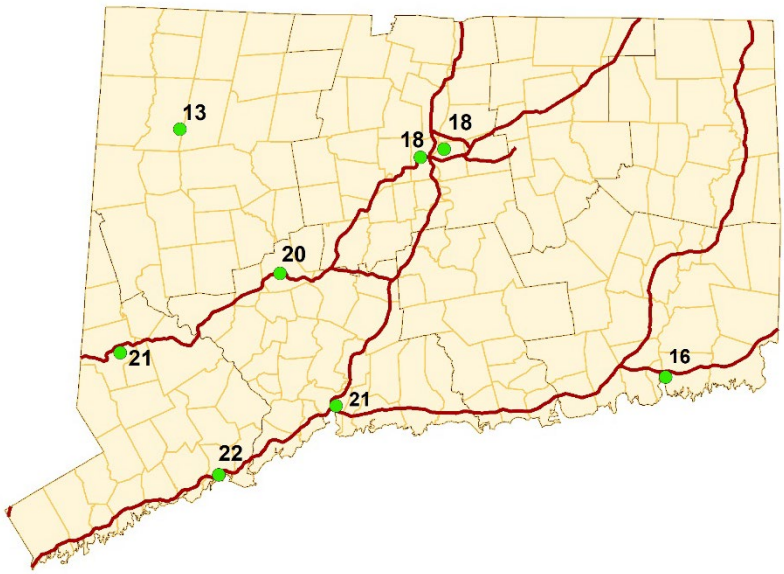
Site	Design Value (μg/m^3)
Bridgeport	8.1
Cornwall	5.1
Danbury	7.8
East Hartford	7.3
Groton	6.9
Hartford	7.5
New Haven	7.5
Waterbury	8.2
NAAQS	**12.0**



$PM_{2.5}$ Daily Design Values (2021)

Daily design values for $PM_{2.5}$ using 2019 through 2021 data are given below. $PM_{2.5}$ daily design values are calculated using the 3-year average of the annual 98th percentile of daily average values[2]. The daily $PM_{2.5}$ NAAQS is 35 μg/m^3. All Connecticut monitors demonstrate compliance with the design value for the 24-hour $PM_{2.5}$ NAAQS. The design values presented below have been reconciled with EPA's reported design values[3].

Site	Design Value (μg/m^3)
Bridgeport	22
Cornwall	13
Danbury	21
East Hartford	18
Groton	16
Hartford	18
New Haven	21
Waterbury	20
NAAQS	**35**



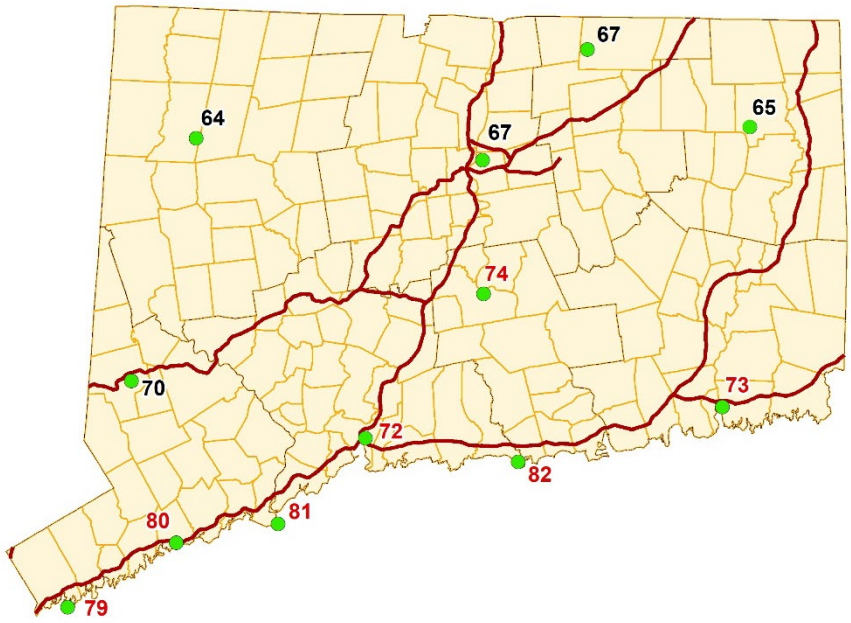
[2] 40 CFR 50.18 -- National primary ambient air quality standards for PM2.5.

[3] Air Quality Design Values | US EPA

Ozone Design Values (2021)

The draft 2021 ozone 8-hour design values for the 2015 NAAQS are given in the table below. Ozone design values are derived by averaging three consecutive annual fourth highest daily maximum 8-hour ozone values[4]. Based on both the 2008 ozone standard of 0.075 ppm (75 ppb) and the October 2015 revised ozone standard of 0.070 ppm (70 ppb), 8 out of 12 sites indicate nonattainment, shown in red font below. Starting in 2017, the ozone monitoring season in Connecticut is extended by a month, beginning March 1 and ending September 30. The design values presented below are reconciled with EPA's reported design values.

Site	Design Value (ppb)
Abington	**65**
Cornwall	**64**
Danbury	**70**
East Hartford	**67**
Greenwich	**79**
Groton	**73**
Madison	**82**
Middletown	**74**
New Haven	**72**
Stafford	**67**
Stratford	**81**
Westport	**80**
NAAQS	**70**



CO, SO_2, NO_2, PM_{10} and Pb NAAQS Comparisons (2021)

Comparisons of ambient levels of CO, SO_2, NO_2, PM_{10} and Pb to the primary NAAQS are provided in the tables below. The draft design values for each pollutant were derived in accordance with 40 CFR 50. The design values presented will be reconciled with EPA's reported design values before this plan is finalized. For PM_{10}, the 3-year fourth-high value, rounded to the tens place, is given to indicate the ambient level relative to the standard, as the actual design value is the expected number of annual exceedances of the standard, averaged over a 3-year period, which is in attainment with a value of less than or equal to one.

CO NAAQS Comparison*

Site	1-Hr Design Value (ppm)	8-Hr Design Value (ppm)
Cornwall	2.8	0.7
Hartford	2.0	1.3
New Haven	1.9	1.3
NAAQS	**35**	**9**

*Design values represent the higher of 2020 and 2021 2nd high values

[4] 40 CFR 50.15 -- National primary and secondary ambient air quality standards for ozone.

SO_2 NAAQS Comparison

Site	1-Hr Design Value (ppb)
Bridgeport	3
Cornwall	1
New Haven	2
NAAQS	**75**

NO_2 NAAQS Comparison

Site	1-Hr Design Value (ppb)	Annual Design Value (ppb)
East Hartford	38	7
Hartford	41	12
New Haven	46	12
Westport	40*	8
NAAQS	**100**	**53**

* DV based on incomplete 2019 data

PM_{10} NAAQS Comparison

Site	Daily "Design Value"* (µg/m^3 STP)
Bridgeport	45
Cornwall	38
East Hartford	44
Hartford	57
New Haven	36
NAAQS	**150**

*Daily "design values" given are the fourth high daily concentrations over three years (2019-2021), presented here for comparison to the standard. The actual PM10 design value form is the expected number of exceedance days per year, averaged over three years, which should be less than or equal to one.

Overview of Network Operation

DEEP operates a network of 14 State and Local Air Monitoring Stations (SLAMS) sites throughout Connecticut used for monitoring air pollutants and meteorological parameters. This section contains information about monitoring methods and sampling frequencies, as well as monitoring network maps for each pollutant parameter. Network changes planned before the end of 2022 are discussed as are any anticipated network changes beyond that period.

$PM_{2.5}$ Monitoring

Network Design The DEEP $PM_{2.5}$ network consists of Thermo Partisol®-Plus 2025i sequential FRM air samplers with BGI VSCC (RFPS-0498-118/EQPM-020-145) and Teledyne API T640X continuous air samplers (EQPM-0516-238) for NAAQS compliance at eight air monitoring stations. The distribution of $PM_{2.5}$ monitors in the network and their applicability to NAAQS attainment are shown in Table 3. All valid data from designated primary monitors is used in the derivation of NAAQS design values. Additionally, valid data from collocated and supplemental monitors are used to fill in any missing or invalidated scheduled or nonscheduled days for the primary monitor data used for computing the design values.

The filter-based FRM monitors operate at a 1-in-6 day frequency, except at the two NCore sites, New Haven and Cornwall, which run on 1-in-3 day schedules. As shown in Table 3, there are three primary $PM_{2.5}$ FRM monitors, so the collocated monitor in New Haven meets the collocation requirement of 15 percent of the network[5]. The FEM monitor in Bridgeport is designated as primary, collocated with FRM monitor, to meet collocation requirements for the FEM network[6] and provide precision data. The FEM monitors in East Hartford McAuliffe Park, Groton Fort Griswold, Hartford Huntley Place, and Waterbury Bank Street are designated as primary monitors. The two Continuous FEM monitors in New Haven are used to for direct comparison of the Teledyne T640X analyzers.

There are no changes planned for the $PM_{2.5}$ monitoring network during 2022-2023.

[5] 40 CFR 58 Appendix A 3.2.3

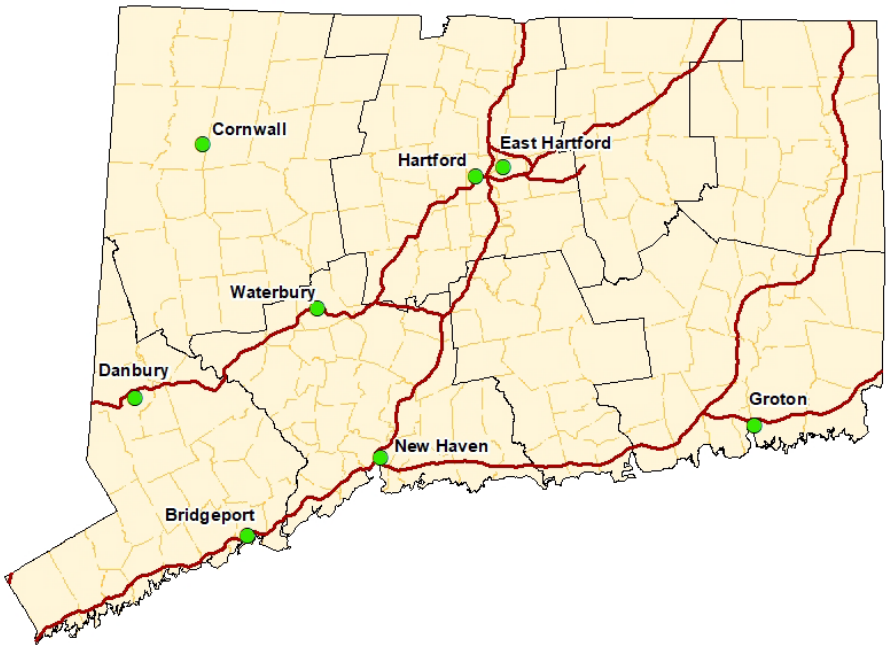
[6] Ibid.

Table 3: DEEP $PM_{2.5}$ FRM/FEM Network Summary

Site	Primary	Collocated	Supplemental
Bridgeport-Roosevelt Sch.	Continuous FEM	1-in-6 FRM	
Cornwall-Mohawk Mt.	1-in-3 FRM		Continuous FEM
Danbury-WCSU	1-in-6 FRM		Continuous FEM
East Hartford-McAuliffe Pk.	Continuous FEM		
Groton-Ft. Griswold	Continuous FEM		
Hartford-Huntley Pl.	1-in-6 FRM		Continuous FEM
New Haven-Criscuolo Pk.	1-in-3 FRM	1-in-6 FRM	2 Continuous FEMs
Waterbury-Bank St.	Continuous FEM		

$PM_{10}/PM_{10\text{-}2.5}$ Monitoring

DEEP operates one $PM_{10}/PM_{10\text{-}2.5}$ FRM sites in the air monitoring network using Thermo Partisol®-Plus 2025i sequential air samplers (RFPS-1298-127). The New Haven NCore site operates on a 1-in-3 day sample schedule. The New Haven site has a collocated PM_{10} FRM sampler operating on a 1-in-6 day sample schedule. All primary and collocated PM_{10} FRM samplers are paired with $PM_{2.5}$ FRM samplers for coarse PM ($PM_{10\text{-}2.5}$). The New Haven site has $PM_{10\text{-}2.5}$ collocated FRM monitors, as requested by EPA as part of a national network of FRM $PM_{10\text{-}2.5}$ collocated sites for data quality assessment.



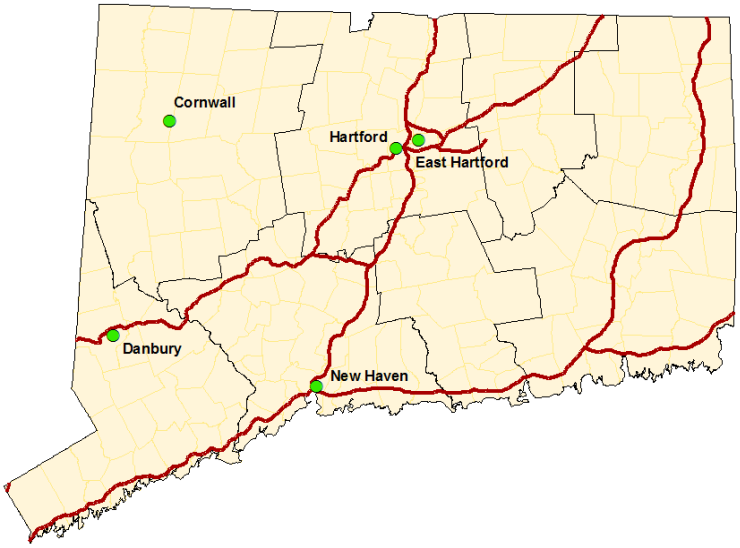
In addition to the FRM PM_{10} monitors, 8 sites have FEM Teledyne API T640 continuous PM mass monitors with 640X option for FEM PM_{10} (EQPM-0516-239). The current PM_{10} network configuration is shown in Table 4. The T640X analyzers produce 1-minute and 60-minute average $PM_{2.5}$, PM_{10} (at local (LC) and standard (STP) conditions of temperature and pressure) and $PM_{10\text{-}2.5}$ (coarse PM). Coarse PM is defined as thoracic PM having particle aerodynamic diameters between 2.5 and 10 microns, operationally defined as the difference PM_{10} minus $PM_{2.5}$. No changes are planned for the $PM_{10}/PM_{10\text{-}2.5}$ monitoring network during 2022 -2023.

Table 4: DEEP PM10 Network Configuration

Site	Primary	Collocated	Supplemental
Bridgeport-Roosevelt Sch.	Continuous FEM		
Cornwall-Mohawk Mt.	Continuous FEM		
Danbury-WCSU	Continuous FEM		
East Hartford-McAuliffe Pk.	Continuous FEM		
Groton-Ft. Griswold	Continuous FEM		
Hartford-Huntley Pl.	Continuous FEM		
New Haven-Criscuolo Pk.	1-in-3 FRM	1-in-6 FRM	2 Continuous FEMs
Waterbury-Bank St.	Continuous FEM		

PM Speciation Monitoring

$PM_{2.5}$ chemical speciation measurements are obtained at five sites in the DEEP air monitoring network. These include filter-based daily composite 1-in-3 day samples at the 2 NCore sites, and continuous hourly black carbon at five sites.

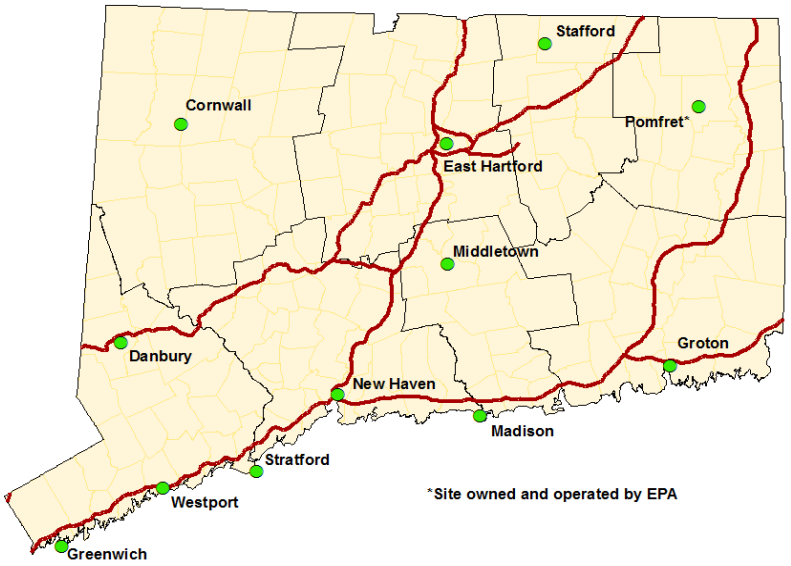


The Interagency Monitoring of Protected Visual Environments (IMPROVE) monitor is located at the Cornwall site and the Chemical Speciation Network (CSN) monitor is at the New Haven Criscuolo Park site. Both sites are operated on the standard EPA 1-in-3 day PM sample schedule and provide 24-hour integrated filter-base measurements.

Black carbon (BC) and ultra-violet channel carbon (UVC), a wood smoke PM surrogate, are monitored at the Criscuolo Park, Cornwall, Hartford, East Hartford McAuliffe Park and Danbury WCSU sites using 7-channel TAPI Model 633 aethalometers. No changes are proposed to the PM speciation network during 2022-2023.

Ozone Monitoring

DEEP operates eleven ozone sites in its air monitoring network for NAAQS compliance. The ozone analyzers at the Cornwall Mohawk Mountain, East Hartford McAuliffe Park and New Haven Criscuolo Park sites are operated year-round, while the remaining sites are operated during the EPA-defined ozone season, which for Connecticut is from March 1 to September 30. In addition to the DEEP's ozone monitoring network, EPA operates an ozone monitor in Abington (Pomfret) during the ozone season as part of its Clean Air Status and Trends (CASTNET) network.



NAAQS compliance ozone monitoring in the DEEP network is conducted using Teledyne-API Model T400 UV photometric ozone analyzers (method EQOA-992-087). Ozone measurements are sent to the EPA AIRNow website for AQI purposes on an hourly basis. DEEP is planning to replace the current network of ozone monitors with new monitors within the next year or two, as the current units have been in service for approximately ten years. Additionally, DEEP plans to purchase addition new calibrators to comply with EPA's proposed directive that ozone transfer standards must have internal photometers to improve and/or ensure data quality control.

Ozone Enhanced Monitoring Plan

This section consists of the Enhanced Monitoring Plan (EMP) for Connecticut pursuant to 40 CFR sections 58.10 (a) (11) and 58 App D 5(h). These federal regulations, revised under the 2015 National Ambient Air Quality Standards (NAAQS) for ozone[7], require that any state with any area designated moderate nonattainment or above, or any state within the Ozone Transport Region (OTR), submit an Enhanced Monitoring Plan for ozone (EMP) to the regional office of the Environmental Protection Agency (EPA) no later than October 1, 2019.

Background

Recent ozone (O_3) levels in Connecticut are generally the highest in the eastern U.S, placing some regions of the state in serious nonattainment for the 2008 ozone National Ambient Air Quality Standards (NAAQS). The southwestern three counties of the state (Connecticut portion of the New York-N. New Jersey-Long Island, NY-NJ-CT non-attainment area) have been designated moderate for the 2015 ozone NAAQS, while the remainder of the state is designated marginal, under the 2015 NAAQS. These levels largely result from transport of ozone and ozone precursors into Connecticut from the south-west direction along the northeast urban corridor. Modeling and other analyses have shown significant contributions to ozone levels in Connecticut from sources both inside and outside of the greater New York and greater Connecticut nonattainment areas[8].

[7] FR 80 65292, October 26, 2015

[8] FR 82 1733, January 6, 2017

DEEP has documented through numerous public comment submissions, communications and even litigation, that EPA[9] must fully implement in a timely manner the Clean Air Act "good neighbor" provisions designed to address interstate air pollution transport before Connecticut can reasonably expect to attain either the 2008 or 2015 ozone NAAQS in the Connecticut portion of the Northern New Jersey – New York – Connecticut nonattainment area. DEEP will continue to develop and implement monitoring activities under this EMP to increase the scientific knowledge and understanding of the fate and transport mechanisms of ozone and related ozone precursor pollutants in this region, with specific attention to impacts of the water-land boundary. DEEP expects the data from these enhanced monitoring activities will further clarify the critical role that interstate air pollution transport plays in the Northern New Jersey-New York-Connecticut and Greater Connecticut nonattainment areas and further inform the development and implementation of meaningful national programs that will protect public health and the environment.

The 2015 O_3 NAAQS amended monitoring requirements for the Photochemical Air Monitoring Stations (PAMS) network. Previously, Connecticut operated PAMS volatile organic compounds (VOC) monitors at three sites: East Hartford McAuliffe Park, New Haven Criscuolo Park and Westport Sherwood Island State Park. The revised rule now requires VOC monitoring at all National Core (NCore) monitoring sites in Core-Based Statistical Areas (CBSAs) having populations greater than 1 million. In addition, areas with moderate or higher levels of O_3 nonattainment, as well as all areas within the Ozone Transport Region (OTR), are required to develop Enhanced Monitoring Plans (EMPs). EMPs are required to provide for any additional monitoring beyond the minimum requirements for State and Local Air Monitoring Stations (SLAMS) that would be beneficial in identifying pollutant levels, sources, transport and progress towards attainment. The EMP mandate is intended to provide state and local environmental agencies an opportunity to implement additional monitoring beyond SLAMS that addresses the particular needs of nonattainment areas not explicitly covered under the revised PAMS network.

Strategic Approach and Objectives

State and local environmental agencies have conducted considerable surface monitoring of O_3, O_3 precursors [e.g.: nitrogen oxides (NO, NO_2, NO_X, NO_Y), volatile organic compounds (VOCs)] and meteorological parameters for many years as part SLAMS and PAMS networks. Current strategies for analyzing O_3 production and transport are typically based on computer modeling with source emissions and meteorological inputs, where high resolution speciated VOC data have limited usefulness in model development or validation.

PAMS monitoring programs also include, in addition to VOCs, three carbonyls that are more typically abundant: formaldehyde, acetaldehyde and acetone. The most significant of these, formaldehyde (HCHO), has been used extensively as a proxy for VOC free radical formation in research and analyses on tropospheric ozone[10]. Given the understanding that O_3 formation may be sensitive to changes in either VOCs (VOC limited regime) or NO_X (NO_X limited regime), as demonstrated with photochemical numeric computer models, the ratio of HCHO to NO_2 from ambient air monitoring during high O_3 events can be key in the validation of computer modeling approaches.

In addition to monitoring strategies aimed at understanding aspects of the regional O_3 chemistry, collecting data that clearly show the spatial variability of surface O_3 concentrations is critical to developing approaches to address non-attainment in Connecticut. DEEP maintains an extensive network of O_3 monitoring sites, particularly along its prevailing upwind (south-southwestern) border to effectively track ozone plumes transported into the state, and these sites consistently show the highest ozone concentrations in Connecticut.

Enhanced Monitoring Activities

DEEP proposed the following activities and resource commitments to meet the objectives for enhanced monitoring under this EMP. DEEP believes these proposed actions meet the requirements of the EMP and will assist DEEP's ongoing efforts toward assessing and understanding ozone nonattainment issues in Connecticut:

[9] Greater CT Ozone Attainment Demonstration for the 2008 NAAQS

[10] Jin, X et. al, 2017,Evaluating a Space-Based Indicator of Surface Ozone-NOx-VOC Sensitivity Over Midlatitude Source Regions and Application to Decadal Trends, J. of Geophysical Research, 122 (19) 10,439-10,461

- Continued operation of two additional O_3 monitors beyond those minimally required for the State and Local Air Monitoring Station (SLAMS) in the Bridgeport-Stamford-Norwalk Core-Based Statistical Area (CBSA).
- Continued operation of one additional ozone monitor beyond those minimally required in the Hartford-West Hartford-East Hartford CBSA.
- Continued operation of one additional NO_2 monitor, located at the Westport Sherwood Island State Park site.
- Assessment of continuous HCHO methods. Contingent upon the availability of an instrument that DEEP can operate within demonstrable acceptable quality assurance criteria, DEEP would procure and potentially deploy to a coastal ozone site.
- Continued operation of two ceilometers, at Westport and New Haven, for atmospheric mixing height (boundary layer depth).
- Provision of site access and on-site technical support for EPA's Pandora spectrophotometers, which continuously monitor total column NO_2 and HCHO, at four sites (Westport Sherwood Island, New Haven Criscuolo Park, Cornwall Mohawk Mountain and Madison Hammonasset State Park).
- Provision of field and data support as needed for EPA's proposed study of ozone fate and transport in the Long Island Sound/coastal Connecticut region proposed for 2023.

DEEP has participated as a joint effort with multiple state and federal agencies, academic researchers, non-governmental organizations and private businesses in the development, planning and implementation of these activities. Figure 2 shows the proposed DEEP monitoring network with EMP activities included.

SLAMS Ozone Monitoring

The ozone monitoring requirements in 40 CFR 58 for state and local air monitoring stations (SLAMS) set minimum numbers of monitors based on ozone NAAQS design values and population for each core-based statistical area (CBSA). In addition, the months of the ozone season are determined for each location, which for Connecticut is March through September. Ozone monitors at National Core (NCore) multipollutant sites operate year-round, using Teledyne API 400E analyzers (reference method ID EQOA-0992-087).

Minimum SLAMS ozone monitoring requirements are provided in Table D-2 of Appendix D, 40 CFR 58. An assessment for the Connecticut network, shown in Table 1 below, gives populations and design values for each CBSA. For both the Bridgeport-Stamford-Norwalk and Hartford-West Hartford-East Hartford CBSAs, a minimum of 2 monitors are required, while there are 4 and 3 monitors in each CBSA, respectively. DEEP proposes to consider these 3 additional monitors as part of this EMP.

Table 5: Summary of Connecticut Ozone Monitoring Network Design Compliance

CBSA	2019 Population (estimated)	Maximum 2020 design value	No. of required SLAMS monitors	Current no. of SLAMS monitors
Bridgeport-Stamford-Norwalk, CT	943,332	82	2	4
Hartford-West Hartford-East Hartford, CT	1,204,877	74	2	3
New Haven-Milford, CT	854,757	80	2	2
Norwich-New London, CT	265,206	73	1	1
Worcester, MA-CT	947,404	69	2	3
Torrington, CT	180,333	65	1	1

Figure 2: Map of EMP-Related Monitoring Locations

SLAMS NO_2 Monitoring

Connecticut meets its regulatory NO_2 monitoring requirements for near road and area-wide monitors with two monitors in the Hartford CBSA. An additional NO_2 monitor required by the Regional Administrators for the protection of sensitive and vulnerable populations is located at the New Haven NCore site. A fourth monitor, located in Westport as part of the enhanced monitoring plan, is intended to provide further data

to assist in understanding ozone precursor transport into Connecticut. All NO_2 monitors are Teledyne API T500U cavity attenuated phase shift spectroscopy (CAPS) (reference method ID EQNA-0514-212).

Formaldehyde Monitoring

DEEP intends to continue to assess automated formaldehyde (HCHO) methods for potential procurement and deployment to one or more coastal ozone sites. HCHO measurements would be a complement to NO_2 measurements, as the ratio is an important indicator to assess whether the ozone production regime is VOC or NO_X limited. Acquisition of a continuous HCHO monitor is contingent on the determination of reliable and practical quality assurance and control methodology.

Upper Air Measurements

The planetary boundary layer (PBL) is the near-surface portion of the troposphere that is generally considered to be well mixed, such that pollutants emitted or created are more or less mixed but confined within the PBL. As such, lower boundary layer heights are associated with higher pollutant concentrations. The different radiative and absorptive capacities of land and water can affect the PBL height, also known as the mixing height (MH). Thus, coastal areas downwind of large water bodies may have higher concentrations than inland levels where the mixing heights are increased. DEEP is operating two ceilometers, at New Haven and Westport, for automated mixing height measurements. The ceilometers are model CL51, manufactured by Vaisala, Oyj, that operate based on optical backscattering by fine particulate aerosols that tend to concentrate just below the mixing height. The New Haven ceilometer has been in operation since November 2015, and the Westport ceilometer was installed in May 2021. DEEP's ceilometer data is available on the University of Maryland Baltimore County's Unified Ceilometer Network (UMBC UCN) at https://alg.umbc.edu/ucn/.

Long Island Sound Tropospheric Ozone Study

Starting in 2017, and continuing through 2018, DEEP partnered with EPA, the National Aeronautics and Space Administration (NASA), the Northeast States for Coordinated Air Use Management (NESCAUM), other states and academic institutions to conduct field studies of O_3 atmospheric chemistry and transport in the greater New York – Long Island Sound – Connecticut area, with a particular focus on the mechanisms that result in the high O_3 levels observed along the Connecticut coastline. This study, named the Long Island Tropospheric Ozone Study (LISTOS)[11], has utilized, in addition to the enhanced monitoring conducted by DEEP as described above (fixed site and ferry O_3, NO_2 HCHO, MH), ground-based upper air monitoring, investigations into coastal meteorology, intensive upper air chemical and meteorological monitoring during high O_3 events, aircraft-based high resolution remote sensing of trace gases for source identification during high O_3 events, and ground-based episode monitoring of trace NO_2 and VOCs using a mobile laboratory. EPA has indicated interest in a follow-up study of coastal Connecticut ozone to take place during the summer of 2023, for which DEEP would provide support as personnel resources allow.

[11] http://www.nescaum.org/documents/listos/

NO_2 and NO/NO_Y Monitoring

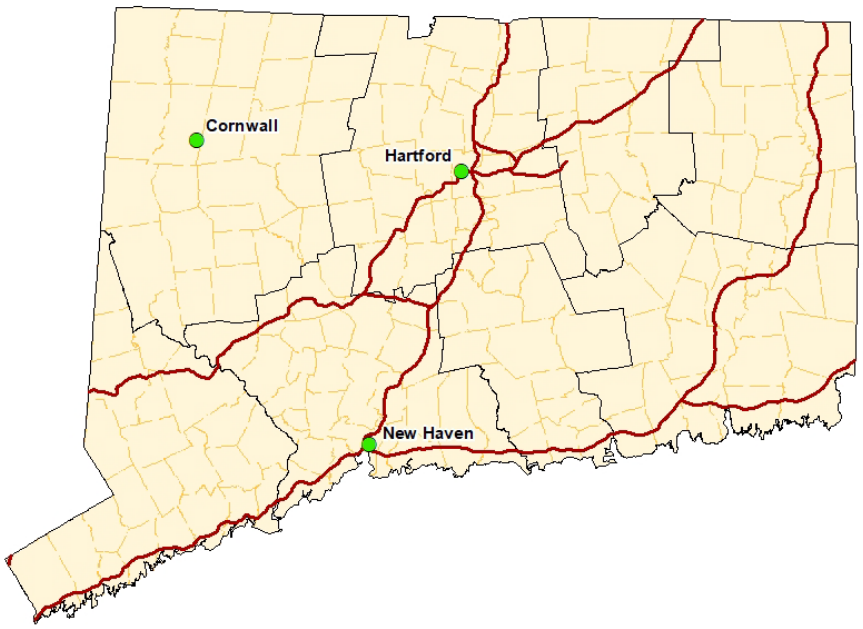
DEEP monitors nitrogen dioxide (NO_2) at four sites in the monitoring network using Teledyne-API Model T500U (EQNA-0514-212), which are capable of directly measuring NO_2 using cavity attenuated phase shift (CAPS) spectroscopy methodology. The NO_2 monitors are maintained at Hartford Huntley Place, East Hartford McAuliffe Park, New Haven Criscuolo Park and Westport Sherwood Island State Park for regulatory compliance.

DEEP also operates two nitrogen oxide/total reactive oxides of nitrogen (NO/NO_Y) TAPI model T200U/501 monitors, at Cornwall Mohawk Mountain and New Haven Criscuolo Park, to comply with NCore requirements. NO_Y is defined as $NO+NO_2+NO_Z$, where NO_Z represents higher oxides of nitrogen. The major components of NO_Z include nitrous acids [nitric acid (HNO_3), and nitrous acid (HONO)], organic nitrates [peroxyl acetyl nitrate (PAN), methyl peroxyl acetyl nitrate (MPAN), and peroxyl propionyl nitrate, (PPN)], and particulate nitrates.

The NO_2 and NO/NO_Y networks fulfill requirements for NCore and SLAMS monitoring of these parameters. These requirements include: near road and area wide NO_2 monitoring in a core-based statistical area (CBSA) with a population greater than 1,000,000 (Hartford and East Hartford sites, respectively); nationwide NO_2 monitoring for susceptible and vulnerable populations at site selected by EPA (New Haven) and NCore NO/NO_Y monitoring (Cornwall and New Haven). The Westport NO_Z monitor is operated in fulfillment of Connecticut's enhanced monitoring plan.

CO Monitoring

DEEP operates three carbon monoxide (CO) sites in the air monitoring network, as shown on the map at right. All CO samplers are operated year-round and employ TEI 48iQ-TL analyzers (RFCA-0981-054). Of the 3 sites, New Haven and Cornwall satisfy the requirement for CO monitoring at NCore sites and Hartford fulfills requirements for co-location with an NO_2 near road monitor in a CBSA having a population greater than 1 million.[12] The EPA Regional Administrator has not indicated any locations in the state for additional CO monitoring aimed at susceptible and vulnerable populations.



SO_2 Monitoring

DEEP currently operates three sulfur dioxide (SO_2) sites in the air monitoring network

All samplers are TEI 43iQ-TL SO_2 analyzers (EQSA-0486-060) and are operated year-round. Both 1-hour average and 5-minute block average SO_2 data are validated and reported to EPA.

The network requirements for SO_2 monitoring include NCore, population-weighted emissions index (PWEI) and Regional Administrator-required monitoring.[13] The Cornwall and New Haven sites satisfy the NCore SO_2 requirement.

Table 6 shows the PWEI values for CBSAs that are within or intersecting Connecticut, based on the 2017 National Emissions Inventory and US Census Bureau 2019 county population estimates. The SO_2 NAAQS monitoring requirements based on PWEI values state that a monitor is required in areas having PWEI values greater than or equal to 5,000 MMperson-tons/yr. Therefore, no PWEI SO_2 monitors are currently required in the

[12] 76 FR 54294; August 31, 2011

[13] 75 FR 35520; June 22, 2010

state. In addition, the EPA has not indicated a requirement for any additional SO_2 monitors in areas having the potential to violate the NAAQS, areas where vulnerable or sensitive populations may be impacted, or near large sources not conducive to modeling. We also note that the SO_2 primary design values, as provided in an earlier section of this Network Plan, range from 2 to 4 ppb, and are well below the 1-hour NAAQS of 75 ppb.

Although not covered by PWEI requirements, DEEP intends to continue SO_2 monitoring at Bridgeport Roosevelt School at this time, given that it is located in an area of relatively higher concentrations and vulnerable and sensitive populations. The Bridgeport Harbor Unit 3 410MW dual fuel (coal/oil) electric generating unit, a significant source of SO_2 emissions, was recently decommissioned.

Table 6: Population Weighted Emissions Index (PWEI) Values for Connecticut CBSAs

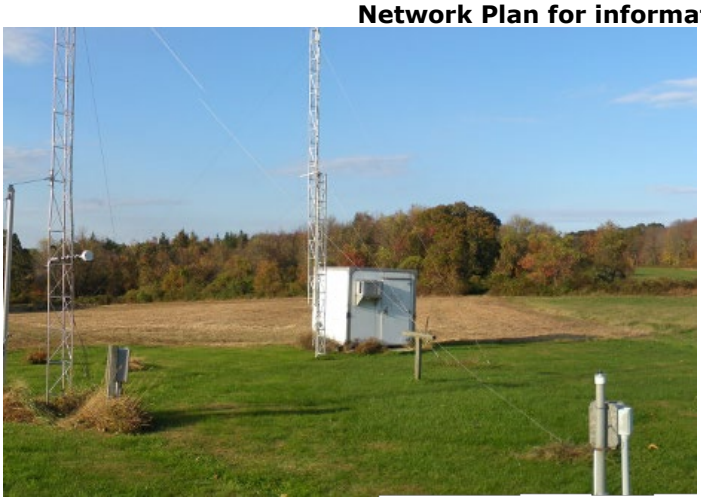
Core-Based Statistical Area (CBSA)	SO_2 (tons/yr)	Population (2019 estim.)	PWEI (MMperson-tons/yr)
Bridgeport-Stamford-Norwalk	359	943332	339
Hartford-East Hartford-Middletown	284	1204877	342
Torrington	1	180333	0
New Haven-Milford	90	854757	77
Norwich-New London	109	265206	29
Worcester	273	947404	259

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:	**Pomfret – Abington**		
County:	**Windham**	Latitude:	**41.84046°**
Address:	**80 Ayers Road**	Longitude:	**-72.010368°**
AQS Site ID:	**09-015-9991**	Elevation:	**209 m (686 ft)**
Spatial Scale:	**Regional**	Year Established:	**1993**
Statistical Area:	**CBSA Willimantic, CT**		

This site is not under the operational control or purview of DEEP and is included in this Network Plan for informational purposes only



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	$NO/NO_2/NO_x$	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
											X													

X=Existing P = Planned in 2022/23 T = Proposed to terminate in 2022/2023

Site Description: The Abington site is a regional-scale site located in a rural/agricultural area in northeast Connecticut in the town of Pomfret. This site is operated by the National Park Service under the direction of EPA as part of their Clean Air Status and Trends Network (CASTNET). It is located on a hilltop approximately 2.3 km south of State Route (SR) 44 and 0.6 km east of SR 97. The site includes a portable shed located in the center of an agricultural field that is surrounded by forest. DEEP tracks ambient air quality and quality assurance data from the site but is not responsible for site operations and planning.

Monitoring Objectives: The Abington monitoring site objective is to collect ozone measurements to assess long-terms trends as part of the national CASTNET network. The site will also be used to determine compliance with the ozone NAAQS in Windham County.

Planned changes for 2022-2023: This site is not under the operational control or purview of DEEP and is included in this Network Plan for informational purposes only.

Town – Site:	**Bridgeport – Roosevelt School**		
County:	**Fairfield**	Latitude:	**41.17086°**
Address:	**Park Avenue**	Longitude:	**-73.19476°**
AQS Site ID:	**09-001-0010**	Elevation:	**7 m (23 ft)**
Spatial Scale:	**Neighborhood**	Year Established:	**1982**
Statistical Area:	**CSA (New York-Newark-Bridgeport)**		

PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	$NO/NO_2/NO_x$	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
	1/6	X			X							X									X			

X=Existing P = Planned in 2022/23 T = Proposed to terminate in 20222023

Site Description: The Roosevelt School site is a neighborhood-scale site located in southwestern Connecticut in the city of Bridgeport. This site is located 50 m to the north of I-95 and 200 m to the west of the I-95 and Route 8 interchange. This coastal site is located in a schoolyard and residential neighborhoods are present in every direction of the site. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I.

Monitoring Objectives: The Bridgeport Roosevelt School monitoring site objectives include collecting continuous FEM $PM_{2.5}$ measurements for compliance purposes and for AQI and forecasting purposes. The $PM_{2.5}$ FEM is designated as the primary sampler to for NAAQS.

Planned changes for 2022-2023: None.

Town – Site:	**Cornwall – Mohawk Mountain**		
County:	**Litchfield**	Latitude:	**41.82140°**
Address:	**Mohawk Mountain**	Longitude:	**-73.29733°**
AQS Site ID:	**09-005-0005**	Elevation:	**505 m (1656 ft)**
Spatial Scale:	**Regional**	Year Established:	**1988**
Statistical Area:	**CSA (New York-Newark-Bridgeport)**		

PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	$NO/NO_2/NO_x$	NO/NOy	VOCs (PAMS)	Total Column NO2/HCHO	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
1/3		X			X				1/3	X	X	X	X			X		X	X	X	X	X	X	X

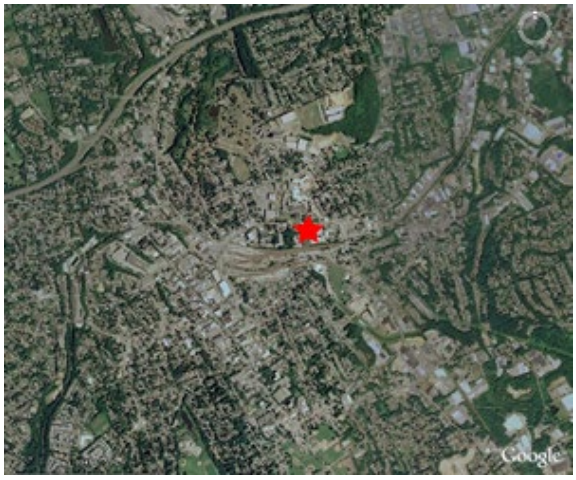
X=Existing P = Planned in 2022/23 T = Proposed to terminate in 2022/2023

Site Description: The Mohawk Mountain site is a rural regional-scale site located in northwestern Connecticut in the town of Cornwall. The site is located at the summit of Mohawk Mountain with an elevation of 505 m (1656 ft), and is approximately 17 km to the east of the New York border and 25 km to the south of the Massachusetts border. This site meets all siting requirements and criteria and has been approved by EPA as an NCore site.

Monitoring Objectives: The primary monitoring objectives are to meet NCore requirements for O_3, CO, SO_2, NO, NOy, $PM_{2.5}$ FRM, PM_{10} FRM, $PM_{10\text{-}2.5}$ FRM, $PM_{2.5}$ speciation, continuous $PM_{2.5}$ and surface meteorology. $PM_{2.5}$ chemical speciation measurements are collected through the IMPROVE network as 1-in-3 day 24-hour samples and by continuous analyzers for fine particulate carbon parameters (BC/UVC). EPA operates a Pandora analyzer for total column NO_2 and HCHO.

Planned changes for 2022-2023: None.

Town – Site:	**Danbury – Western Connecticut State University**		
County:	**Fairfield**	Latitude:	**41.398692°**
Address:	**White Street**	Longitude:	**-73.443148°**
AQS Site ID:	**09-001-1123**	Elevation:	**116 m (380 ft)**
Spatial Scale:	**Neighborhood**	Year Established:	**1974**
Statistical Area:	**CSA (New York-Newark-Bridgeport)**		



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	$NO/NO_2/NOx$	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
1/6		X			X					X	X								X	X	X		X	

X=Existing P = Planned in 2022/23 T = Proposed to terminate in 2022/2023

Site Description: The Western Connecticut State University (WCSU) site is a neighborhood-scale site for $PM_{2.5}$ and an urban-scale site for O_3, located in western Connecticut in the city of Danbury. This site is located on the top level of a parking garage on the WCSU campus. This site is located approximately 140 m to the southeast of I-84 on White Street. Residential neighborhoods are located in all directions of the site. This site meets all siting requirements and criteria and has been approved by EPA Region I. The downtown area of Danbury has a generally bowl-shaped topography, and therefore is subject to occasional high $PM_{2.5}$ events during the winter.

Monitoring Objectives: The Danbury WCSU monitoring site objectives include collecting $PM_{2.5}$ and $PM_{10}/PM_{10\text{-}2.5}$ measurements for NAAQS compliance and for AQI forecasting purposes. Ozone is measured at the Danbury site for compliance assessment and AQI forecast reporting. Black carbon (BC/UVC) aethalometer monitoring is included to track the wood smoke contribution to PM pollution.

Planned changes for 2022-2023: None.

Town – Site:	**East Hartford – McAuliffe Park**		
County:	**Hartford**	Latitude:	**41.78471°**
Address:	**McAuliffe Park**	Longitude:	**-72.63158°**
AQS Site ID:	**09-003-1003**	Elevation:	**15 m (50 ft)**
Spatial Scale:	**Neighborhood**	Year Established:	**1981**
Statistical Area:	**CSA (Hartford-West Hartford-Willimantic)**		

PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	$NO/NO_2/NOx$	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
		X			X					X	X			X					X	X	X	X	X	

X=Existing P = Planned in 2022/23 T = Proposed to terminate in 2022/2023

Site Description: The McAuliffe Park site is neighborhood-scale site located in central Connecticut in the town of East Hartford. The site is located approximately 120 m to the east of Route 5, 2.0 km to the east of I-91 and 2.5 km to the south of I-291. This site is located 3.7 km to the northeast of the city of Hartford. Residential neighborhoods are located in all directions of this site. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I.

Monitoring Objectives: The East Hartford McAuliffe Park monitoring site objectives include collecting $PM_{2.5}$ and $PM_{10}/PM_{10\text{-}2.5}$ measurements for NAAQS compliance and AQI forecasting purposes using continuous FEM samplers. Ozone is measured at the McAuliffe Park site for compliance assessment and AQI and forecast reporting. The NO_2 monitor meets the requirement for area-wide monitoring in the Hartford-West Hartford-East Hartford CBSA.

Planned changes for 2022-2023: None.

Town – Site: **Greenwich – Point Park**

County:	**Fairfield**	Latitude:	**41.005047°**
Address:	**Point Park**	Longitude:	**-73.58382°**
AQS Site ID:	**09-001-0017**	Elevation:	**3 m (10 ft)**
Spatial Scale:	**Urban**	Year Established:	**1978**
Statistical Area:	**CSA (New York-Newark-Bridgeport)**		

PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	$NO/NO_2/NOx$	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
											X								X	X	X			

X=Existing P = Planned in 2022/23 T = Proposed to terminate in 2022/2023

Site Description: The Greenwich Point Park site is an urban-scale site located is southwestern Connecticut on the Long Island Sound in the town of Greenwich. This is a coastal site located approximately 3.0 km to the southeast and 5.0 km to the northeast of the New York border. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I

.

Monitoring Objectives: The Greenwich Point Park monitoring site objectives include collecting ozone measurements for compliance assessment and AQI and forecast reporting.

Planned changes for 2022-2023: None.

Town – Site:	**Groton – Fort Griswold**		
County:	**New London**	Latitude:	**41.35362°**
Address:	**141 Smith Street**	Longitude:	**-72.07882°**
AQS Site ID:	**09-011-0124**	Elevation:	**37 m (120 ft)**
Spatial Scale:	**Neighborhood**	Year Established:	**2007**
Statistical Area:	**MSA (Norwich-New London)**		

PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	$NO/NO_2/NOx$	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
		X			X						X										X			

X=Existing P = Planned in 2022/23 T = Proposed to terminate in 2022/2023

Site Description: The Fort Griswold site is a neighborhood-scale site located in southeastern Connecticut in the town of Groton. This site is located approximately 1.1 km to the south of I-95 and 0.5 km to the east of the New London Harbor. Residential neighborhoods are located in all directions of this site. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I.

Monitoring Objectives: The Groton Fort Griswold monitoring site objectives include monitoring of the two key pollutants, ozone and $PM_{2.5}$, for the southeastern part of Connecticut. Ozone and $PM_{2.5}$ are measured at the Fort Griswold site for compliance assessment and AQI and forecast reporting.

Planned changes for 2022-2023: None.

Town – Site:	**Hartford – Huntley Place**		
County:	**Hartford**	Latitude:	**41.771444°**
Address:	**10 Huntley Place**	Longitude:	**-72.679923°**
AQS Site ID:	**09-003-0025**	Elevation:	**57.2 m (187.7 ft)**
Spatial Scale:	**Near Road**	Year Established:	**2013**
Statistical Area:	**CSA (Hartford-West Hartford-Willimantic)**		

PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	$NO/NO_2/NOx$	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
1/6		X			X					X			X	X				X	X	X	X		X	

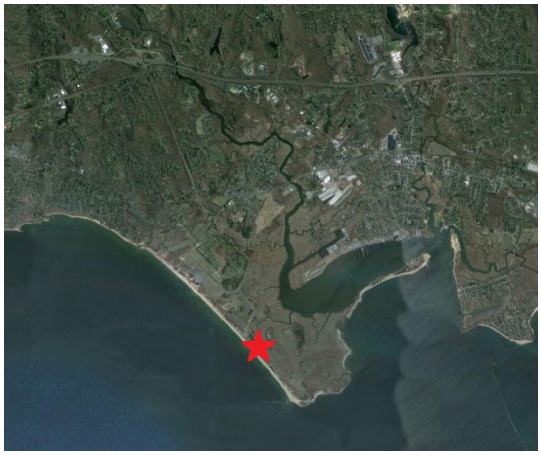
X=Existing P = Planned in 2022/23 T = Proposed to terminate in 2022/2023

Site Description: The Huntley Place site is a near-road site located in north central Hartford. The site, located on the north west side of US I-84, is approximately 0.25 km to the west of the US I-91 corridor and the Founders and Bulkeley Bridges over the Connecticut River. Residential neighborhoods are located to the north, east and west of the site. This site meets siting requirements for a near-road NO_2 site, and has been approved by EPA.

Monitoring Objectives: The primary monitoring objectives for the site are to capture NO_2 concentrations near heavily trafficked roads, to assess area-wide NO_2 concentrations, and to assess NO_2 concentrations for vulnerable and susceptible populations in adjacent neighborhoods. The data will also be used to help determine compliance with the 1-hour NO_2 NAAQS as established by EPA in 2010. This site also collects CO, FRM $PM_{2.5}$, continuous FEM $PM_{2.5}$ & PM_{10}, BC/UVC and traffic counts.

Planned changes for 2022-2023: None.

Town – Site:	**Madison – Hammonasset State Park**		
County:	**New Haven**	Latitude:	**41.25984°**
Address:	**Hammonasset SP**	Longitude:	**-72.55018°**
AQS Site ID:	**09-009-9002**	Elevation:	**3 m (10 ft)**
Spatial Scale:	**Regional**	Year Established:	**1981**
Statistical Area:	**CSA (New York-Newark-Bridgeport)**		



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	NO/NOy	VOCs (PAMS)	Total Column NO_2/HCHO	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
											X						X	X	X	X			

X=Existing P = Planned in 2022/23 T = Proposed to terminate in 2022/2023

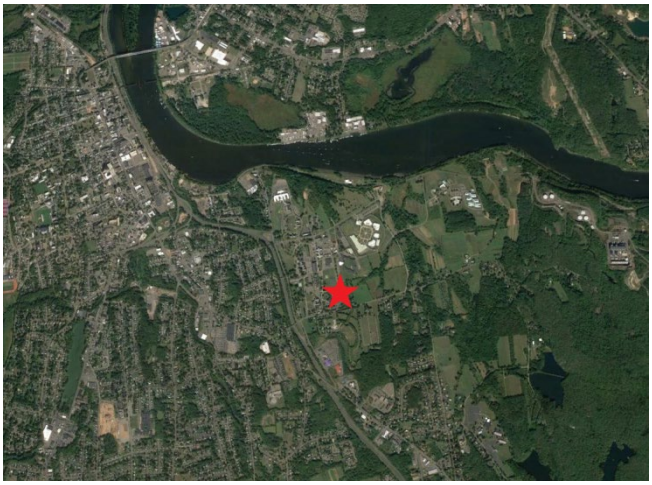
Site Description: The Hammonasset State Park site is a regional-scale site located in central coastal Connecticut in the town of Madison. This site is located approximately 1.5 km to the south of Route 1 and 3.0 km to the south of I-95 on the Long Island Sound. Residential neighborhoods are located primarily to the northeast, north and northwest of the site. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I.

Monitoring Objectives: The Madison Hammonasset State Park monitoring site objective is to collect ozone measurements for compliance assessment and AQI forecast reporting. A second objective is to collect data in support of the Enhanced Monitoring Plan (Appendix B of this Network Plan) for research on regional ozone transport.

Planned changes for 2022-2023: None.

Middletown – Connecticut Valley Hospital

Town – Site:			
County:	**Middlesex**	Latitude:	**41.55224°**
Address:	**Shew Hall**	Longitude:	**-72.63004°**
AQS Site ID:	**09-007-9007**	Elevation:	**58 m (190 ft)**
Spatial Scale:	**Neighborhood**	Year Established:	**1980**
Statistical Area:	**CSA (Hartford-West Hartford-Willimantic)**		



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	$NO/NO_2/NOx$	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
											X								X	X	X		X	

X=Existing P = Planned in 2022/23 T = Proposed to terminate in 2022/2023

Site Description: The Middletown Connecticut Valley Hospital (CVH) site is an urban-scale ozone site located in central Connecticut. This site is located approximately 0.2 km to the east of Route 9. Residential neighborhoods are located to the west, north and south of this site. This site meets all siting requirements. DEEP relocated the site within the CVH campus to a shed near Battelle Hall in 2017.

Monitoring Objectives: The CVH monitoring site objective is to collect ozone measurements for compliance assessment and AQI forecast reporting.

Planned changes for 2022-2023: None.

Town – Site:	**New Haven – Criscuolo Park**		
County:	**New Haven**	Latitude:	**41.30117°**
Address:	**1 James Street**	Longitude:	**-72.90288°**
AQS Site ID:	**09-009-0027**	Elevation:	**3 m (10 ft)**
Spatial Scale:	**Neighborhood**	Year Established:	**2004**
Statistical Area:	**CSA (New York-Newark-Bridgeport)**		

PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (FEM, Continuous)	PM2.5 (Cont. FEM, secondary)	PM10/PM-Coarse (Cont. FEM, secondary)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	NO/NOy	VOCs (PAMS)	Total Column NO_2/HCOC	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation	Mixing Height
1/3	1/6	X	1/3	1/6	X	X	X	1/3		X	X	X	X	X	X		X	X	X	X	X	X	X	X

X=Existing P = Planned in 2022/23 T = Proposed to terminate in 2022/2023

Site Description: The Criscuolo Park site is a neighborhood-scale site located on the western side of the city of New Haven. The site is approximately 0.25 km to the north of the I-95 Quinnipiac River Bridge. The site is approximately 1.0 km to the east of the I-91 and I-95 interchange. Bulk petroleum transfer stations are located 0.3 to 2.0 km to the south of the site. Residential neighborhoods are located to the west, north and east of the site.

Monitoring Objectives: The primary monitoring objectives are to meet NCore requirements for O_3, CO, SO_2, $PM_{2.5}$, PM_{10}, $PM_{10-2.5}$, $PM_{2.5}$ speciation, NO/NO_Y and surface meteorology. NO_2 monitoring is conducted in fulfillment of the requirement for NO_2 monitoring of vulnerable and sensitive populations at 40 nationwide sites selected by the Regional Administrators. $PM_{2.5}$ chemical speciation measurements are collected through the Chemical Speciation Network (CSN) as 1-in-3 day 24-hour samples and by continuous analyzers for fine particulate carbon parameters (BC/UVC).

Planned changes for 2022-2023: None.

Town – Site:	**Stafford – Shenipsit State Forest**		
County:	**Tolland**	Latitude:	**41.97568°**
Address:	**Route 190**	Longitude:	**-72.38674°**
AQS Site ID:	**09-013-1001**	Elevation:	**265 m (869 ft)**
Spatial Scale:	**Regional**	Year Established:	**1980**
Statistical Area:	**CBSA (Hartford-West Hartford-Willimantic)**		

PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	$NO/NO_2/NOx$	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
											X								X	X	X			

X=Existing P = Planned in 2022/23 T = Proposed to terminate in 2022/2023

Site Description: The Shenipsit State Forest site is a regional-scale site that is located in northern Connecticut in the town of Stafford. The site is approximately 100 m to the south of Rte 190, 17 km to the east of I-91 and 12 km to the northwest of I-84. This site is located 34 km to the northeast of the city of Hartford. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I.

Monitoring Objectives: The Stafford Shenipsit State Forest monitoring site objective is to collect ozone measurements for compliance assessment and AQI forecasting purposes.

Planned changes for 2022-2023: None.

Town – Site:	**Stratford – Lighthouse**		
County:	**Fairfield**	Latitude:	**41.15181°**
Address:	**Prospect Drive**	Longitude:	**-73.10334°**
AQS Site ID:	**09-001-3007**	Elevation:	**3 m (10 ft)**
Spatial Scale:	**Regional**	Year Established:	**1980**
Statistical Area:	**CSA (New York-Newark-Bridgeport)**		

PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	$NO/NO_2/NOx$	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
											X										X			

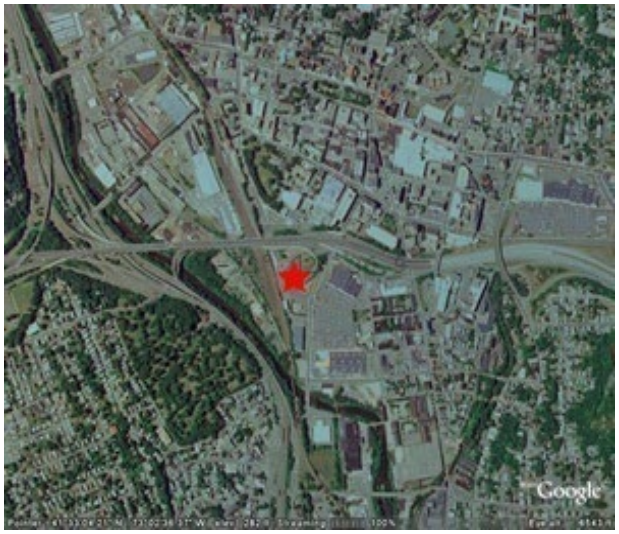
X=Existing P = Planned in 2022/23 T = Proposed to terminate in 2022/2023

Site Description: The Stratford Lighthouse site is a regional-scale site located in southwestern Connecticut in the town of Stratford. This is a coastal site that is located 4.5 km to the southeast of I-95 and is directly on the Long Island Sound. This site is approximately 45 km to the northeast of the New York State border. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I.

Monitoring Objectives: The Stratford Lighthouse monitoring site objective is to collect ozone measurements for compliance assessment and AQI forecasting purposes.

Planned changes for 2022-2023: None.

Town – Site:	**Waterbury – Bank Street**		
County:	**New Haven**	Latitude:	**41.55046°**
Address:	**Meadow & Bank**	Longitude:	**-73.04365°**
AQS Site ID:	**09-009-2123**	Elevation:	**80 m (269 ft)**
Spatial Scale:	**Neighborhood**	Year Established:	**1975**
Statistical Area:	**CSA (New York-Newark-Bridgeport)**		



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO_2	NO/NO_2/NOx	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
		X			X														X	X	X			

X=Existing P = Planned in 2022/23 T = Proposed to terminate in 2022/2023

Site Description: The Waterbury site is a neighborhood-scale site located in western Connecticut at Meadow Street and Bank Street in the Naugatuck River Valley. This site is approximately 170 m to the south of I-84, 300 m to the east of Route 8 and 0.75 km to the east of the I-84 and Route 8 interchange. Residential neighborhoods are located in all directions of the site. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region 1.

Monitoring Objectives: The Waterbury Bank Street site monitoring objectives include collecting $PM_{2.5}$/PM_{10} FEM measurements for compliance purposes and AQI forecast reporting.

Planned changes for 2022-2023: None.

Town – Site:	**Westport – Sherwood Island State Park**		
County:	**Fairfield**	Latitude:	**41.11822°**
Address:	**Sherwood Island SP**	Longitude:	**-73.33681°**
AQS Site ID:	**09-001-9003**	Elevation:	**3 m (10 ft)**
Spatial Scale:	**Regional**	Year Established:	**1996**
Statistical Area:	**CSA (New York-Newark-Bridgeport)**		

PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	NO_2	NO/NOy	HCHO (Continuous)	Total Column NO_2/HCOC	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation	Mixing Height
											X			X		P*	X	X	X	X				X

X=Existing | P = Planned in 22/23 | T = Proposed to terminate in 2022/2023 | *

* Deployment of HCHO in 2023 contingent on availability of continuous HCHO method that meets acceptable QA/QC criteria; additionally, monitor may be located at an alternative site if warranted (e.g., LISTOS activities focused at alternative coastal site).

Site Description: The Westport Sherwood Island State Park site is a regional-scale site located in southwestern Connecticut. This is a coastal site that is approximately 0.5 km to the south of I-95 on the Long Island Sound. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region 1.

Monitoring Objectives: Ozone is measured at the Westport site for compliance assessment and AQI forecast reporting. Surface level and total column NO_2 and HCHO will be monitored as part of the Enhanced Monitoring Plan. A total column NO_2 (and other trace gas) Pandora analyzer, operated by EPA, was installed in May 2018 to support studies of ozone fate and transport in the Long Island Sound/Coastal Connecticut region.

Planned changes for 2022-2023: None.

Appendix A: Network Plan Public Comments and Responses

Comments received in response to the public notification of this plan and DEEP's responses are presented in this section. Written comments were received from EPA-New England (Region 1) and Sierra Club Connecticut.

Comments received from EPA-New England

1. We acknowledge the following overall changes to your network, on page 5:

***Proposed Network Changes**:*
In addition to infrastructure maintenance and improvements, DEEP proposes the following additions to the monitoring network during the period 2022-2023:
• Assess continuous formaldehyde (HCHO) methods for potential future deployment to one or more coastal ozone sites.*
• Support Long Island Sound coastal ozone studies proposed by EPA for 2023.*
• No monitors are planned to be discontinued during 2022 – 2023.

** Note: These two proposed changes were initially included in the 2018 Network Plan as part of the Enhanced Monitoring Plan, which was submitted one year in advance as requested by EPA.*

2. Pages 8-10. EPA released design values for all criteria pollutants in May of 2022 which includes 2021 data for the entire country. All design values represented here are generally consistent with those values. (We also note that for PM_{10} the standard is based on exceedances.) https://www.epa.gov/air-trends/air-quality-design-values#report As discussed in the narrative, the design values in final plan will be updated as appropriate.

3. Pages 11-14 notes that CT DEEP is utilizing all its continuous $PM_{2.5}$ monitors for NAAQS compliance purposes and coded as 88101. This was effective the beginning of 2016. We acknowledge that you have availed yourself of many of the resource saving opportunities we suggested in the $PM_{2.5}$ network. Still, utilizing continuous $PM_{2.5}$ monitors at Danbury and Hartford- Huntley Place as "primary" could offer resource savings opportunities relative to the FRM network.

DEEP Response: DEEP has elected to retain the two additional FRM PM2.5 monitors at Danbury and Hartford beyond the minimum required for the network to provide a more robust data set for assessment of FEM (TAPI T640x) performance relative to the FRM monitors. DEEP will likely designate these FEM monitors primary in the near future based on this assessment.

4. Page 14. We note and support plans to replace your aging ozone monitors currently used in the network.

5. On pages 15-16, we note, acknowledge, and support implementation of CT's EMP as approved by EPA on October 25, 2018, as described below:

Enhanced Monitoring Activities
DEEP proposed the following activities and resource commitments to meet the objectives for enhanced monitoring under this EMP. DEEP believes these proposed actions meet the requirements of the EMP and will assist DEEP's ongoing efforts toward assessing and understanding ozone nonattainment issues in Connecticut:

- *Continued operation of two additional O_3 monitors beyond those minimally required for the State and Local Air Monitoring Station (SLAMS) in the Bridgeport-Stamford-Norwalk Core-Based Statistical Area (CBSA).*
- *Continued operation of one additional ozone monitor beyond those minimally required in the Hartford-West Hartford-East Hartford CBSA.*
- *Continued operation of one additional NO_2 monitor, located at the Westport Sherwood Island State Park site.*
- *Targeted deployment of a compact O_3 monitor on one of the Bridgeport, CT – Port Jefferson, NY ferries crossing the Long Island Sound to assist scientific research of ozone fate and transport mechanisms in the greater New York-Long Island Sound region.* (Note this language is slightly revised from CT DEEP's approved EMP)
- *Installation of one HCHO continuous monitor at the Westport site.*
- *Continued operation of two ceilometers, at Westport and New Haven, for atmospheric mixing height (boundary layer depth).*
- *Provision of site access and on-site technical support for EPA's Pandora spectrophotometers, which continuously monitor total column NO_2 and HCHO, at four sites (Westport Sherwood Island, New Haven Criscuolo Park, Cornwall Mohawk Mountain and Madison Hammonasset State Park).*

DEEP has participated as a joint effort with multiple state and federal agencies, academic researchers, non-governmental organizations and private businesses in the development, planning and implementation of these activities.

We note that the 2022 ANP does not include the deployment of a compact O_3 monitor on one of the Bridgeport, CT – Port Jefferson, NY ferries. We hope that this monitor will once again be deployed in support of the proposed 2023 Long Island Sound/coastal Connecticut study. We are also hopeful that the installation and operation of one HCHO continuous monitor at the Westport site as described in the EMP will begin in 2022.

DEEP Response: DEEP notes that there have been difficulties obtaining continuing approval, as well as limitation with personnel resources, for monitoring on the Bridgeport-Port Jefferson ferries in the recent ozone seasons since deployment during the 2018 LISTOS study. Additionally, recent discussions among the LISTOS research group have indicated that a Long Island Sound mobile marine O_3 monitoring platform should ideally include mixing height monitoring, which was not feasible on the commercial ferry. As such, the group is pursuing alternate marine monitoring platforms. If resources and approvals allow, DEEP will deploy the mobile O_3 monitors on the ferry, or otherwise considering deployment at inland locations downwind of coastal monitors during selected episodes to investigate the possible effects of the increase of mixing height over land versus over the Sound.

As you are aware, EPA- New England has developed a GIS tool which can be helpful to identify valley locations across the region which may be impacted by wood smoke. Given the recent changes to your network and associated resource savings, we think there might be additional opportunities to conduct PM monitoring in CT, and we urge you to consider the results of that tool as it relates to some areas in Connecticut that may be impacted by wood smoke.

DEEP Response: DEEP performed an analysis of valley terrain in Connecticut using EPA-New England's GIS tool as part of the 2020 five-year network assessment[14], where several areas with the potential for impact by wood smoke were identified. DEEP is currently developing a network of portable $PM_{2.5}$ sensors (PurpleAir) for community monitoring and performance evaluation. DEEP

[14] Connecticut 2020 5-Year Network Assessment

will consider deploying one or more monitors in an area or areas with the potential for high wood smoke concentrations.

Comments received from Sierra Club

Connecticut has the dirtiest air in New England and has been called the "tailpipe" of the northeastern United States. In New England, Connecticut had the highest number of unhealthy air days recorded in 2021. The American Lung Association's 2022 State of the Air report found that 4 counties in Connecticut learn failing grades for ozone pollution; the other 4 counties receiving Ds and Cs. Connecticut should do more comprehensive monitoring at all of its monitoring stations, should monitor all the major health damaging air pollutants at each station, should expand its monitoring base, should report elevated findings to the public in a timely way, and should craft policy to limit human health destroying air pollutants from all sectors including transportation and the industrial and energy sectors.

Comments Specific to the Plan

Monitoring Site Information: Table1 - Regardless of EPA regulations, for the benefit of Connecticut residents, it seems reasonable that each monitor should measure every metric, or a fulsome explanation be provided why monitoring is different by area of the state. Perhaps the explanation is that certain pollutants are prevalent in some parts of the state and not others. This should be clarified. Moreover, more monitors are needed, optimally located to provide maximum coverage and potentially making use of non-reference grade sensors now available online throughout the state. Lastly, it should be explained why state monitors are not run continuously (or nearly so) and not 1-in-3 or 1-in-6 days.

DEEP Response: The Connecticut 2020 Ambient Air Monitoring 5-Year Network Assessment[15] provides a more detailed description of Connecticut's monitoring network, and how it meets the objectives of the Clean Air Act regulations, specifically 40 CFR 58 (58.10 and Appendix D). DEEP believes the current network configuration provides representation of generalized worst-case population exposure to the criteria pollutants. For example, the Bridgeport Roosevelt School particulate monitor characterizes concentrations in densely populated urban/industrial areas near high-traffic roads in Fairfield County. As such, any mitigation measures, if needed, would be applicable to that County (or Core-based Statistical Area). Having $PM_{2.5}$ monitors at all locations in the county would not likely produce any further benefit, but would add significantly to the cost of operating the network. Similarly, analysis of data from the ozone monitor network[15] indicates the network has sufficient spatial density to capture exceedances from the many regional variations seen during events.

[15] Connecticut 2020 5-Year Network Assessment

Regarding the intermittent (one-in-three day, one-in six day) PM monitors versus continuous monitors, EPA and the state/local/tribal agencies have moved toward utilizing continuous monitors for assessing compliance with the National Ambient Air Quality Standards (NAAQS) in recent years as EPA has certified many continuous monitors as Federal Equivalent Methods (FEMs). However, a minimum number of Federal Reference Method (FRM) (intermittent) monitors are required to provide quality assurances of the FEM data; as such, Connecticut has several sites with paired FRM-FEM monitors. In accordance with regulations, all FEM data is used to supplement any missing or unscheduled primary FRM data for comparison to the NAAQS. As the FRM monitoring method is very labor-intensive, utilizing FEMs for daily data provides a significant cost benefit for the program. Additionally, FEMs provide concentrations at lower time intervals (hour, minute), which may benefit future research on PM health impacts.

National Ambient Air Quality Standards (NAAQS): Table 2 - In addition to compliance with NAAQS, Connecticut residents would benefit from publicly available real-time data, not just averages or averages of averages, which tend to dampen air quality spikes most harmful to human health.

DEEP Response: DEEP is considering the feasibility of providing real-time web based ambient air data. DEEP provides ambient air data to the public on request, and notes that real-time air quality index (AQI) values are readily available[16].

$PM_{2.5}$ Annual & Daily Design Values (2021): The concept of the National Ambient Air Quality Standards "design values" needs to be further explained / clarified for the public benefit. It appears daily values are the *average* 98th percentiles of *average* daily values over 3 years. It would be beneficial for readers to understand what actions are taken when daily values surpass the 98th percentile, and why the 98th percentile was chosen instead of the 25th or 10th. One could conclude that if the 3-year average is increasing and the 98th percentile is increasing (i.e., the statistical distribution is widening over time), then the daily "tolerance" level *would also increase*. It is concerning that when designing target values for air pollutants, DEEP takes these 98 percentile of values. High levels of air pollution should not be treated as normal, or literally normalized by referring to high values as "averages".

DEEP Response: The description of the PM design values has been edited with additional detail on the computation of the design values, including references to the source regulations. Explanations regarding EPA's determination of the form of specific design values or DEEP's actions relative to forecasts or occurrences of NAAQS exceedances are beyond the scope of this Plan. Use of the word "average" with reference to $PM_{2.5}$ design values is solely intended to accurately convey the mathematical operations that are part of the design value metrics.

[16] https://www.airnow.gov/

$PM_{2.5}$ Monitoring: it seems odd that 1-in-6 and 1-in-3 day frequency monitors (FRM) are used as *primary* monitors and not continuous (FEM) monitors; perhaps this is budgetary limitation, but from the document it appears arbitrary. It would be preferable to have *supplemental* continuous monitors be designated as primary instead. DEEP refers to budgetary constraints which limit the number of monitoring stations, and it is worrisome that DEEP might consider closing any stations, as air pollution is worsening. Sierra Club Connecticut's Air Quality Research Team is a group of citizen scientists engaged in monitoring air quality with low cost sensors in Connecticut. Low cost sensors such as the PurpleAir monitor show a high level of correlation with (i.e., can be calibrated to) DEEP/EPA monitors, and are offline much less frequently. They require very little maintenance, unlike DEEP sensors that may go offline many times per day, leaving large gaps in air monitoring data. DEEP should consider increasing the number of monitoring stations, and using PurpleAir sensors to limit expense, broaden air quality monitoring reach, and potentially increase accuracy. For example, The Waterbury - Bank Street $PM_{2.5}$ monitor could be supplemented with nearby private PurpleAir monitors to more comprehensively gauge air quality particulate matter in the area. Figure 1 below is a screenshot of open source, online low-cost monitors (chiefly PurpleAir) throughout Connecticut by location obtained from Open AQ (www.openaq.org), each one of which produces real-time PM2.5 data available to be harvested, compiled and used to refine air quality monitoring.

DEEP Response: The Federal Reference Method (FRM) for $PM_{2.5}$ is considered by EPA as a benchmark for the continuous FEM methods, since the FRM data is derived by directly measuring the particulate mass, while DEEP's FEM analyzers use an indirect method of determining PM based on estimates of particle density applied to the various size fractions indicated by light scattering. As such, DEEP operates $PM_{2.5}$ FRM samplers as primary monitors at three sites (Cornwall, Danbury and Hartford), as well as the required two at New Haven, which are used to meet minimum network specifications for FRMs. The Bridgeport Roosevelt School FEM is designated as primary to comply with FEM network co-location requirements. As indicated in this Plan, where FRM monitors are designated as primary, data from co-located FEM monitors is used to fill in the days between scheduled FRM sampling for assessment of NAAQS compliance. Overall, the data completeness for daily $PM_{2.5}$ samples over the three years covering the 2021 design values was high, with Cornwall at 93% and the remaining sites at 98%-99%.

In addition to maintaining and operating the statewide monitoring efforts, over the past several months, DEEP has worked to invest existing and limited resources to support community-based air monitoring efforts. DEEP has obtained and is installing PurpleAir sensors at each monitoring station and has partnered with schools and community groups to deploy sensors at schools and neighborhoods beyond those areas covered by the DEEP network. DEEP intends to advance several goals as part of this outreach effort, including: assessing air quality information at more spatially refined scales, with a focus on areas with sensitive and vulnerable populations; evaluating low-cost sensor performance relative to that of reference monitors; and educating

students and the general public about air quality issues and promoting interest in science and technology.