MARYLAND

DEPARTMENT OF THE ENVIRONMENT

AMBIENT AIR MONITORING NETWORK PLAN
for CALENDAR YEAR 2027

Prepared for: U.S. Environmental Protection Agency
Prepared by:
Ambient Air Monitoring Program
Air and Radiation Administration
Maryland Department of the Environment

April 14, 2026

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard | Baltimore, MD 21230 | www.mde.maryland.gov
410-537-3000 | 800-633-6101 | TTY Users: 800-735-2258

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On the cover: HCNR air monitoring station
Photo credit – Kenna Ingham, Field Operator
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ACRONYMS AND DEFINITIONS

AADT	Annual Average Daily Traffic
AQS	Air Quality System
AQS ID	9-digit site identification number in AQS database
ARA	MDE's Air and Radiation Administration
BAM	Beta Attenuation [Mass] Monitor-for measuring continuous particulate matter
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAPS	Cavity Attenuated Phase Shift (Direct NO_2 method)
CASTNET	Clean Air Status and Trends Network
CBSA	Core Based Statistical Area
CFR	Code of Federal Regulations
CSN	Chemical Speciation Network
CO	Carbon Monoxide
DPW	Department of Public Works (Baltimore City)
EGU	Electrical Generating Unit
EMP	Enhanced Monitoring Plan
EPA	United States Environmental Protection Agency
FE-AADT	Fleet Equivalent Annual Average Daily Traffic
FEM	Federal Equivalent Method-EPA approved method designated as equivalent to the Federal Reference Method (FRM) for a specific pollutant to compared to the applicable NAAQS
FID	Flame Ionization Detector
FRM	Federal Reference Method-EPA approved reference method necessary for a specific pollutant to be compared to the applicable NAAQS
GC	Gas Chromatograph
HAPS	Hazardous Air Pollutants
IMPROVE	Interagency Monitoring of PROtected Visual Environments
IR	Infrared (radiation)
MDE	Maryland Department of the Environment
MSA	Metropolitan Statistical Area
NAA	Non-Attainment Area
NAAQS	National Ambient Air Quality Standards-used for determining attainment status
NCore	National Core multi-pollutant monitoring stations
NEI	National Emissions Inventory
µm	Micrometer, measure of length; 1 µm equals 10^{-6} meter
NO	Nitrogen Oxide
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen (O_3 precursor)
NO_y	Total Reactive Nitrogen Species (O_3 precursor)
O_3	Ozone
PAMS	Photochemical Assessment Monitoring Station
Pb	Lead
$PM_{2.5}$	Particulate matter with an aerodynamic diameter less than or equal to 2.5 µm
PM_{10}	Particulate matter with an aerodynamic diameter less than or equal to 10 µm

$PM_{10-2.5}$	Pronounced "PM coarse" - Particulate matter with an aerodynamic diameter less than or equal to 10 µm minus particulate matter with an aerodynamic diameter less than or equal to 2.5 µm
PQAO	Primary Quality Assurance Organization
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
SLAMS	State or Local Air Monitoring Stations
SO_2	Sulfur Dioxide
SOP	Standard Operating Procedure
UV	Ultraviolet
VOCs	Volatile Organic Compounds

1. INTRODUCTION

In 1970, Congress passed the Clean Air Act (CAA) that authorized the Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) for pollutants shown to threaten human health and welfare. Primary standards were set according to criteria designed to protect public health, including an adequate margin of safety to protect sensitive populations such as children and asthmatics. Secondary standards were set according to criteria designed to protect public welfare (decreased visibility, damage to crops, vegetation, buildings, etc.). As part of the CAA, both local and state air quality agencies are required to maintain and operate ambient air quality monitoring networks.

The six pollutants that currently have NAAQS are: Ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$ and PM_{10}), and lead (Pb). They are commonly called the "criteria" pollutants. When air quality does not meet the NAAQS for one of the criteria pollutants, the area is said to be in “non-attainment” with the NAAQS for that pollutant. Since 1970, EPA has promulgated additional rules and regulations to strengthen the oversight of criteria pollutants. The timeline of recent progress in Maryland is discussed below.

On December 16, 2014, EPA approved Maryland's request to re-designate the Baltimore Non-attainment Area to “Attainment” for the 1997 annual $PM_{2.5}$ NAAQS. This Area also attains the 2008 $PM_{2.5}$ annual standard and continues to attain that standard. The Baltimore Attainment Area includes the following: Anne Arundel, Baltimore, Carroll, Harford, and Howard Counties, and Baltimore City.

On October 26, 2015, EPA promulgated a rule (80 Fed. Reg. 65292) strengthening the primary and secondary NAAQS for ground-level O_3 to 70 parts per billion (ppb), based on extensive scientific evidence about O_3’s effects on public health and welfare. The updated standards will improve public health protection, particularly for at-risk groups including children, older adults, people of all ages who have lung diseases such as asthma, and people who are active outdoors, especially outdoor workers. They also will improve the health of trees, plants, and ecosystems.

On June 30, 2016, the EPA designated portions of Maryland’s Anne Arundel County and Baltimore County as non-attainment for the 2010 1-hour SO_2 NAAQS. The NAA extends approximately 26.8 kilometers (16.6 miles) from the Herbert A. Wagner’s Unit 3 stack, which is located at 39.17765N latitude and 76.52752W longitude (see Maryland 2018 Monitoring Network Plan.) This designation was based on modeled, not monitored, SO_2 concentrations.

On June 4, 2018, EPA promulgated a rule (83 Fed. Reg. 25776) establishing attainment designations for the strengthened 2015 primary and secondary NAAQS for O_3. The following Maryland counties have been designated Marginal Nonattainment: Anne Arundel, Carroll, Harford, Howard, Cecil, Calvert, Charles, Frederick, Montgomery, Prince George’s, Baltimore County, and the City of Baltimore. All other Maryland counties have been designated Attainment/Unclassifiable.

On February 7, 2024, EPA strengthened the National Ambient Air Quality Standards for Particulate Matter by setting the level of the primary (health-based) annual $PM_{2.5}$ standard at 9.0 micrograms per cubic meter (down from 12 $\mu g/m^3$) to provide increased public health protection, consistent with the available health science. More information about that decision can be found at https://www.epa.gov/pm-pollution/national-ambient-air-quality-standards-naaqs-pm.

On January 23, 2026, the Environmental Protection Agency (EPA) proposed, via the Federal Register, to determine that the Baltimore, Maryland nonattainment area (the Baltimore Area or the Area) has clean data for the 2015 8-hour O_3 national ambient air quality standards (2015 O_3 NAAQS or standard). This proposed clean data determination (CDD) under the EPA's Clean Data Policy is based on quality-assured, quality-controlled, and certified ambient air quality monitoring data showing that the Baltimore Area has attained the 2015 O_3 NAAQS based on 2022-2024 data available in the EPA Air Quality System (AQS) database. If finalized, this proposed CDD would suspend the obligations of the State of Maryland to submit certain attainment area planning requirements for as long as the Baltimore Area continues to attain the 2015 O_3 NAAQS. As part of this rulemaking, the EPA also proposes to take final agency action on portions of exceptional events requests submitted by MD on February 2, 2024 and concurred on by the EPA on November 12, 2025. The proposed CDD is based upon the EPA's concurrence on portions of the exceptional events demonstrations. This action is being taken under the Clean Air Act (CAA).

A Core Based Statistical Area (CBSA) is a U.S. geographic area defined by the Office of Management and Budget (OMB) that centers on an urban center of at least 10,000 people and adjacent areas that are socioeconomically tied to the urban center by commuting. The term "CBSA" refers collectively to both metropolitan statistical areas (MSAs) and micropolitan statistical areas. The OMB released new standards based on the 2010 Census on February 28, 2013. For the purposes of the Maryland Air Monitoring Network, the terms CBSA and MSA are interchangeable. The names and boundaries of the MSAs in Maryland are shown in Table 1-1 and Figure 1-2. Counties outside of Maryland are included in the map because they are part of the MSA; however, this document will only address monitors located in Maryland.

Table 1-1 Maryland's population by MSA. Based on tables available at **https://www.census.gov/data/tables/time-series/demo/popest/2020s-total-metro-and-micro-statistical-areas.html**.

MSA Name	Population	Maryland Counties in the MSA
Baltimore-Towson, MD	2,859,024	Carroll, Baltimore County, Baltimore City, Harford, Howard, Anne Arundel, Queen Anne's
Hagerstown-Martinsburg, MD-WV	311,295	Washington
Washington-Arlington-Alexandria, DC-VA-MD-WV	6,436,489	Frederick, Montgomery, Prince George's, Charles, Calvert
Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD	6,330,422	Cecil
Salisbury, MD-DE	131,570	Somerset, Wicomico, Worchester

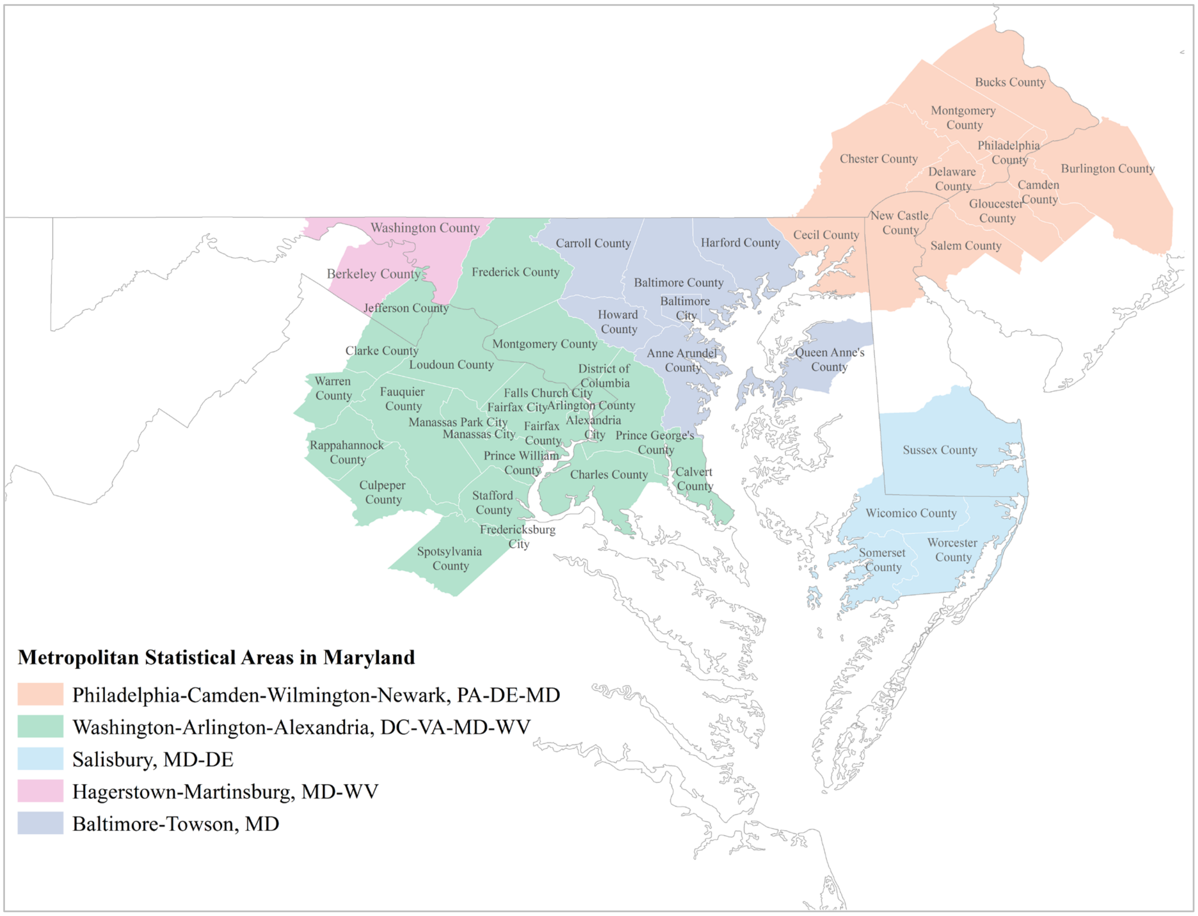

Figure 1-1 Map showing MSAs in Maryland.

The original EPA O_3 precursor revisions to the air monitoring regulations (40 CFR Part 58) required by Title 1, Section 182 of the 1990 Clean Air Act Amendments (CAAA) were promulgated on February 12, 1993. The CAAA requires that the States incorporate enhanced monitoring for O_3, speciated volatile organic compounds (VOC's), NO_x, carbonyls, and surface meteorology as well as upper air meteorological parameters (MET) into their State Implementation Plan (SIP). The Part 58 regulations refer to these enhanced monitoring stations as photochemical assessment monitoring stations (PAMS). The PAMS monitoring rules were revised along with the new 2015 O_3 NAAQS in 2015. The final rule streamlines and modernizes the PAMS network to use monitoring resources most efficiently. States were required to comply with revised PAMS monitoring by June 1, 2021. There are no ambient standards for any of the VOC's.

Section 112 of the CAA currently identifies 188 hazardous air pollutants (HAPS), also referred to as air toxics, and requires EPA to regulate facilities that emit one or more of these air toxics. EPA Region III has developed a Cooperative Air Toxics Monitoring Program, and MDE operates several air toxics sites as part of the program. MDE also provides analytical support for other sampling sites in EPA Region III.

As part of the CAA, states are required to submit an annual network plan to the U.S. EPA for review and approval. Since 2007, EPA has required State and Local Air Pollution Control Agencies to make this plan available for public inspection at least thirty days prior to formal submission to EPA. The 2026 Network Plan receive many comments to which we must respond. That has caused a delay in submitting the 2026 Plan to EPA, and thus delayed approval. This 2027 plan was posted to MDE's website from **[placeholder for dates]**

MDE is also required to certify the air quality monitoring data by May 1 for the previous calendar year's data. MDE's 2025 O_3 data were certified on January 14, 2026. All other 2025 air monitoring data were certified on April 14, 2026.

2. REQUIREMENTS FOR MONITORING NETWORK DESCRIPTIONS

In October 2006, the U.S. EPA issued final regulations concerning state and local agency ambient air monitoring networks. These regulations require an annual monitoring network plan that includes the information described below. The annual monitoring network plan as described in §58.10 must contain the following information for existing and proposed sites:

- The Air Quality System (AQS) site identification number
- The location, including street address and geographical coordinates
- The sampling and analysis method(s) for each measured parameter
- The operating schedules for each monitor
- Any proposals to remove or move a monitoring station within a period of 18 months following plan submittal
- The identification of sites that are suitable and sites that are non-suitable for comparison against the annual $PM_{2.5}$ NAAQS as described in §58.30
- The monitoring objective and spatial representative scale for each monitor
- The Metropolitan Statistical Area (MSA), Core Based Statistical Area (CBSA), Combined Statistical Area (CSA) or other area represented by the monitor

3. MARYLAND AIR MONITORING NETWORK

Maryland currently operates 23 air monitoring sites around the state that measure ground-level concentrations of criteria pollutants, air toxics, meteorological parameters, and research-oriented parameters (Tables 3-1 and 3-2). This total includes two “Haze Cams”, cameras exclusively used to monitor visibility, and one Interagency Monitoring of Protected Visual Environments (IMPROVE) network monitor. The IMPROVE network monitor is operated near the Piney Run monitoring station (Figure 3-1). The IMPROVE network monitors measure $PM_{2.5}$, PM_{10}, $PM_{10-2.5}$, and speciated $PM_{2.5}$.

Although monitoring takes place statewide, most of the stations are concentrated in the urban/industrial areas that have the highest population and number of pollutant sources. A comprehensive air monitoring network map is shown in Fig 3-1. Pollutant-specific network maps are included in each section. Design Value maps by MSA for each pollutant are also included. Additional topographic and area maps and site descriptions are provided in Appendix A.

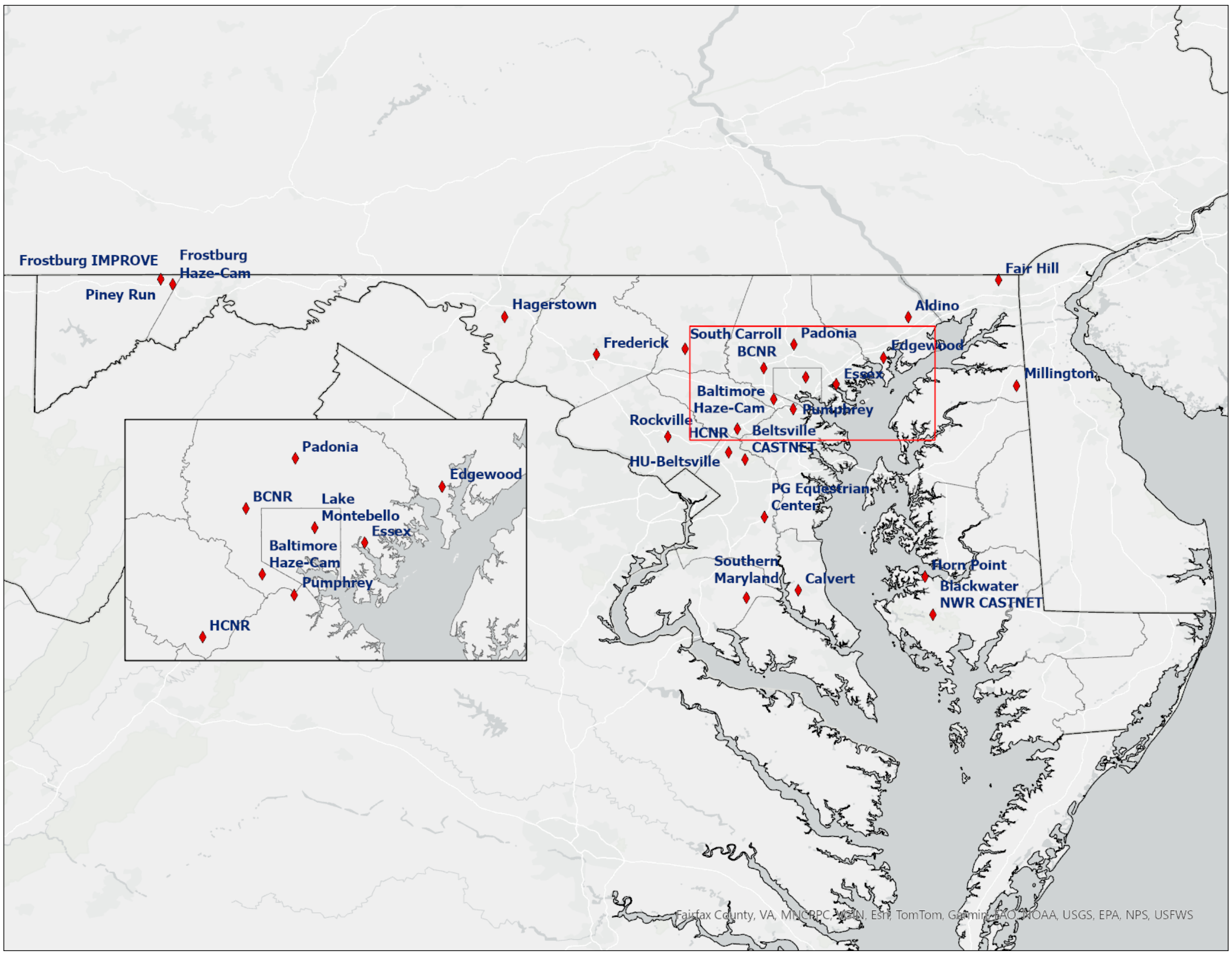

Figure 3-1 Maryland's current air monitoring network map

In addition to the ambient air monitoring stations operated and quality assured by MDE, two Clean Air Status and Trends Network (CASTNET) sites are located in Maryland: Blackwater National Wildlife Refuge and Beltsville (Figure 3-1). CASTNET is a long-term environmental monitoring network with 90 sites located throughout the US and Canada. The sites are managed and operated by EPA's Clean Air Markets Division (CAMD) in cooperation with the National Parks Service (NPS) and other federal, state, and local partners. The network was established under the 1991 CAAA to assess trends in acidic deposition due to emission reduction programs, such as the Acid Rain Program, NO_x Budget Trading Program, and the Clean Air Interstate Rule. CASTNET measures ambient rural O_3 concentrations. Results from CASTNET are used to report on geographic patterns and temporal trends in acidic pollutants, deposition, and regional O_3 concentrations.

Maryland's 2026 Annual Network Plan received 30 comments during the public comment period, which took extra time to process, and the report was delivered to EPA on March 11, 2026.

Several changes to MDE's regulatory air monitoring network are being made in this 2027 Annual Network Plan. These changes are due to public comment, EPA suggestions, or the result of recommendations from the 2025 Network Assessment. These changes have been approved by EPA and are listed below:

- In response to neighborhood concerns, the Brooklyn Park monitoring site was renamed "Pumphrey" to better reflect its location.
- The location of the Lake Montebello $PM_{2.5}$ monitors (FEM and FRM) serve the population of Baltimore City, and so the measurement scale has been changed from Middle scale to Neighborhood, reflecting wider coverage.
- The location of the Millington $PM_{2.5}$ monitor serves the growing population of Queen Anne's County, and so the measurement scale has been changed from Neighborhood to Urban, reflecting a more regional coverage.
- The sampling frequency on the Padonia $PM_{2.5}$ FRM was increased to a 1-in-6 day sampling schedule

Additional changes were recommended in the 2025 Network Assessment due to increasing populations in both Queen Anne's County and Frederick County. Both areas have $PM_{2.5}$ monitors in close proximity, however may benefit from having one within the county boundaries given the recent population growth. Should resources become available in the future, these recommended changes will be considered.

3.1 General Network Information

The following tables include information required as part of the monitoring network description. General information (e.g. site name, AQS identification number, latitude, longitude, etc.) can be found in Table 3-1. Specific information related to each parameter measured at air monitoring sites is given in Tables 3-2 and 3-3. Meteorological parameters measured are included in Table 3-4. Monitoring method descriptions can be found in Table 3-5. Parameters measured as part of the air toxics, PAMS, IMPROVE, and speciated $PM_{2.5}$ mass are listed in Table 3-6.

Table 3-1 General Information for Current Maryland Ambient Air Monitoring Sites

Site Name, AQS ID	Street Address	City, County	Zip Code	Latitude, Longitude (NAD83)	Location Setting	Nearest Road	Traffic Count (2017)	Distance from Nearest Road (m)	CBSA/MSA
Aldino, 240259001	3538 Aldino Rd.	Churchville, Harford	21028	39.563333, -76.203889	Suburban	Aldino Rd.	1,411	156	Baltimore-Towson
Baltimore County Near Road 240050009	4380 Old Court Rd.	Pikesville, Baltimore County	21208	39.371679, -76.746814	Suburban	I-695/I-795	190,812	20	Baltimore-Towson
Baltimore Haze Cam	1000 Hilltop Circle UMBC Campus	Arbutus, Baltimore County	21250	39.254619 -76.709436	Urban	NA	NA	NA	NA
Beltsville CASTNET, 240339991	Powder Mill Rd.	Laurel, Prince George's	20708	39.0284, -76.8171	Rural	*	*	*	Wash-Arlington-Alexandria
Blackwater NWR CASTNET, 240199991	Blackwater National Wildlife Refuge	Cambridge, Dorchester	21613	38.445, -76.1114	Rural	*	*	*	Cambridge (Micro)
Calvert, 240090011	350 Stafford Rd.	Barstow, Calvert	20610	38.536722, -76.617194	Rural	Hallowing Pt. Rd. – Rt. 231	20,690	789	Wash-Arlington-Alexandria
Edgewood, 240251001	Edgewood Chemical Biological Center (APG), Waehli Rd.	Edgewood, Harford	21010	39.410191, -76.296946	Rural	Wise Rd.	4,532	210	Baltimore-Towson
Essex, 240053001	600 Dorsey Ave.	Essex, Baltimore County	21221	39.310833, -76.474444	Suburban	Woodward Dr.	2,190	16	Baltimore-Towson
Fair Hill, 240150003	Fair Hill Natural Resource Mgmt. Area 4493 Telegraph Rd.	Elkton, Cecil	21921	39.702982, -75.864771	Rural	Telegraph Rd. (RT 273)	8,173	24	Philadelphia-Camden-Wilmington
Frederick Airport, 240210037	180 E. Treatment Plant Rd.	Frederick, Frederick	21701	39.422760, -77.375190	Suburban	Monocacy Blvd.	11,923	809	Wash-Arlington-Alexandria
Frostburg Haze-Cam	E. Garrett Co. Vol. Fire Dept. 401 Finzel Rd.	Finzel, Garrett	21532	39.686467, -78.966917	Rural	NA	NA	NA	NA
Frostburg IMPROVE	Frostburg Reservoir	Finzel, Garrett	21532	39.705896, -79.012117	Rural	Rt. 40 National Pike	2,054	2,064	NA
Hagerstown, 240430009	18530 Roxbury Rd.	Hagerstown, Washington	21740	39.564178, -77.720244	Rural	Sharpsburg Pike	9,161	910	Hagerstown-Martinsburg
Horn Point, 240190004	UMd Horn Point Lab 2020 Horns Point Rd	Cambridge, Dorchester	21613	38.587525, -76.141006	Rural	Hudson Road	3,990	1,185	Cambridge (Micro)

Site Name, AQS ID	Street Address	City, County	Zip Code	Latitude, Longitude (NAD83)	Location Setting	Nearest Road	Traffic Count (2017)	Distance from Nearest Road (m)	CBSA/MSA
Howard Co. Near Rd, 240270006	I-95 S Welcome Center	Laurel, Howard	20723	39.143130 -76.846110	Suburban	I-95	203,912	16	Baltimore-Towson
HU-Beltsville, 240330030	Howard Univ., Beltsville Lab., 7501 Muirkirk Rd.	Beltsville, Prince George's	20705	39.055277, -76.878333	Suburban	Muirkirk Road	10,820	397	Wash-Arlington-Alexandria
Lake Montebello, 245105253	Baltimore City DPW 3900 Hillen Road	Baltimore City	21218	39.33746, -76.58905	Urban	Hillen Road	26,450	46	Baltimore-Towson
Millington, 240290002	Millington WMA- 33626 Massey-MD Line Rd.	Massey, Kent	21650	39.305021, -75.797317	Rural	RT 330, Massey-DE Line Rd.	1,065	121	NA
Padonia, 240051007	103 Galloway Ave	Cockeysville, Baltimore County	21030	39.460478 -76.633534	Suburban	York Road	36401	94	Baltimore-Towson
PG Equestrian Ctr, 240338003	14900 Pennsylvania Ave.	Upper Marlboro, Prince George's	20772	38.811940, -76.744170	Rural	Pennsylvania Ave.	54,981	170	Wash-Arlington-Alexandria
Piney Run, 240230002	Frostburg Reservoir, Finzel	Finzel, Garrett	21532	39.705950, -79.012000	Rural	Rt. 40 National Pike	2,054	2,064	NA
Pumphrey, 240031004	5757 Belle Grove Road	Pumphrey, Anne Arundel	21225	39.2177194, -76.6360972	Suburban	Belle Grove Road	13,710	800	Baltimore-Towson
Rockville, 240313001	LE Smith Env Educ Ctr, 5110 Meadowside Ln.	Rockville, Montgomery	20855	39.114313, -77.106876	Rural	Muncaster Mill Road	17,572	499	Wash-Arlington-Alexandria
South Carroll, 240130001	South Carroll H.S. 1300 W Old Liberty Rd.	Sykesville, Carroll	21784	39.444294, -77.042252	Rural	W. Liberty Rd.	10,561	227	Baltimore-Towson
Southern Maryland, 240170010	14320 Oaks Rd.	Charlotte Hall, Charles	20622	38.508547, -76.811864	Rural	Burnt Store Rd.	2,841	2,167	Wash-Arlington-Alexandria

Note: Blank cells indicate no data available. NA means not applicable. Traffic count data are AADT 2013, MD State Hwy Administration.

* See EPA CASTNET Annual Network Plan https://www.epa.gov/castnet/O3

Table 3-2 Monitor Information for Current Maryland Ambient Air Monitoring Sites

Site Name & AQS ID	Parameter	Start Date	Method Code	Probe Height (m)	Measurement Scale	Monitor Objective	Monitor Network/Type	Schedule
Aldino, 240259001	O_3	04/20/1990	047	4.4	Urban	Highest Concentration	SLAMS	H, S
Baltimore County Near Road 240050009	Direct NO_2 (CAPS)	01/01/2019	212	4.4	Microscale	Source Oriented/Highest Conc	SLAMS	H
Baltimore Haze Cam	Visibility	04/01/2007	NA	NA	NA	Public Notification	NA	NA
Beltsville CASTNET, 240339991	O_3	04/01/2011	047	10	Regional	Regional Transport	CASTNET	H
Blackwater NWR CASTNET, 240199991	O_3	01/01/2011	047	10	Regional	Regional Transport	CASTNET	H
Calvert, 240090011	O_3	04/01/2005	087	4.6	Urban	Population Exposure	SLAMS	H, S
Edgewood, 240251001	O_3	03/10/1980	047	4.5	Urban	Highest Concentration	SLAMS	H, S
	$PM_{2.5}$ - Hourly	09/01/2011	170	5.1	Neighborhood	Population Exposure	SLAMS	H
Essex, 240053001	Air Toxics	01/01/1990	150	4	Neighborhood	Population Exposure	Other	6
	CO	02/15/2006	593	4.4	Middle	Highest Concentration	SLAMS	H
	Ceilometer	10/27/2020	NA	2	NA	NA	PAMS	H
	Direct NO_2 (CAPS)	08/10/2017	212	4.4	Neighborhood	Population Exposure	SLAMS	H
	NO	11/16/2017	699	10	Neighborhood	Maximum Precursor	PAMS	H
	NO_Y	11/16/2017	699	10	Neighborhood	Maximum Precursor	PAMS	H
	NO_Y – NO	11/16/2017	699	4.4	Neighborhood	Maximum Precursor	PAMS	H
	O_3	01/01/1972	087	4.4	Neighborhood	Highest Conc, Pop. Expos	SLAMS	H
	$PM_{2.5}$ – continuous	04/01/2025	638	5.1	Neighborhood	Population Exposure	SLAMS	H, M
	PM_{10} – continuous	04/01/2025	639	5.1	Neighborhood	Population Exposure	SLAMS	H, M
	$PM_{2.5}$ - Local Conditions	01/01/1999	145	5.1	Neighborhood	Population Exposure	SLAMS	3
	$PM_{2.5}$ - Speciation	07/08/2004	812	5.0	Neighborhood	Population Exposure	Trends Speciation	3
	SO_2	07/01/2003	600	4.4	Neighborhood	Highest Concentration	SLAMS	R
	PAMS VOCS	01/01/1992	126, 142, 228, 102*	4	Neighborhood	Max Precursor, Highest Conc	PAMS / SLAMS	6; S:H,3
Fair Hill, 240150003	O_3	01/01/1992	087	4.5	Urban	Regional Transport	SLAMS	H, S

Site Name & AQS ID	Parameter	Start Date	Method Code	Probe Height (m)	Measurement Scale	Monitor Objective	Monitor Network/Type	Schedule
	$PM_{2.5}$ - Hourly	07/01/2010	170	4.7	Neighborhood	Population Exposure	SLAMS	H
Frederick Airport, 240210037	O_3	07/09/1998	087	4.6	Urban	Population Exposure	SLAMS	H, S
Frostburg IMPROVE, 240239000	IMPROVE Parameters	03/01/2004	NA	4.0	Regional	Public Notification	NA	3
Frostburg Haze Cam	Visibility	10/01/2005	NA	NA	NA	Public Notification	NA	NA
Hagerstown, 240430009	O_3	04/01/1999	087	4.6	Urban	Highest Conc/ Population Exposure	SLAMS	H, S
	$PM_{2.5}$ - Hourly	07/01/2010	170	5.1	Urban	Highest Conc	SLAMS	H
Horn Point, 240190004	O_3	04/01/2012	087	4	Regional	General/Background	SLAMS	H
	$PM_{2.5}$ - Hourly	04/01/2012	170	4	Regional	General/Background	SLAMS	H
	SO_2	04/01/2012	600	4	Regional	General/ Background	SLAMS	R
Howard County Near Road, 240270006	Air Toxics	04/01/2014	150	4	Microscale	Source Oriented/Highest Conc	SLAMS	6
	Black Carbon	08/01/2015	894	4	Microscale	Source Oriented/Highest Conc	SPM	H
	Ultrafine Particle Counter	01/01/2017	173	4	Microscale	Source Oriented/Highest Conc	SPM	H
	CO	04/01/2014	593	4	Middle Scale	Source Oriented/Highest Conc	SLAMS	H
	NO	04/01/2014	599	4	Microscale	Source Oriented/Highest Conc	SLAMS	H
	NO_2	04/01/2014	599	4	Microscale	Source Oriented/Highest Conc	SLAMS	H
	NO_X	04/01/2014	599	4	Microscale	Source Oriented/Highest Conc	SLAMS	H
	$PM_{2.5}$ - Hourly	04/01/2014	170	4.5	Microscale	Source Oriented/Highest Conc	SLAMS	H
HU-Beltsville, 240330030	CO	01/01/2007	593	4.6	Urban	General/Background	SLAMS/NCore	H
	Air Toxics	05/05/2005	150	4	Neighborhood	Population Exposure	Other	6

Site Name & AQS ID	Parameter	Start Date	Method Code	Probe Height (m)	Measurement Scale	Monitor Objective	Monitor Network/Type	Schedule
	Direct NO_2 (CAPS)	11/1/2019	212	4.6	Urban	General/Background	SLAMS/NCore	H
	O_3	05/01/2005	087	4.6	Urban	Highest Conc./ Population Exposure	SLAMS/NCore	H
	$PM_{2.5}$ Speciation	12/05/2004	812	4.6	Urban	Population Exposure General/Background	SLAMS/NCore	3
	PM_{10} – STP	07/25/2010	127	4.6	Neighborhood	Population Exposure	SLAMS/NCore	3
	$PM_{10-2.5}$ - Local Conditions	07/25/2010	176	4.6	Neighborhood	Population Exposure	SLAMS/NCore	3
	$PM_{2.5}$ - Local Conditions	07/10/2004	145	4.6	Urban	Population Exposure	SLAMS/NCore	3
	$PM_{2.5}$ - Local Conditions	07/31/2010	145	4.6	Urban	Population Exposure	QA-Collocated	12
	$PM_{2.5}$ – Hourly	07/01/2010	170	4.5	Urban	Population Exposure	SLAMS/NCore	H
	Black Carbon	12/01/2007	894	4	NA	NA	SPM	H
	SO_2	09/29/2006	600	4.6	Urban	General/Background	SLAMS/NCore	R
	VOCS	05/05/2005	126	4	Urban	Upwind/Background	Old PAMS/EMP	6; S: 3
Lake Montebello, 245105253	O_3	1/20/2022	087	4.5	Neighborhood	Population Exposure	SLAMS	H, S
	Air Toxics	1/20/2022	150	4.5	Neighborhood	Population Exposure	Other	6
	Direct NO_2 (CAPS)	7/1/2023	212	4.5	Middle	Highest Concentration	SLAMS	H
	PM_{10} – STP	1/20/2022	127	4.5	Middle	Population Exposure	SLAMS	6
	$PM_{2.5}$ - Local Conditions	1/20/2022	145	4.5	Neighborhood	Highest Concentration	SLAMS	3
	$PM_{2.5}$ - Hourly	1/20/2022	170	4.5	Neighborhood	Highest Concentration	SLAMS	H
Millington, 240290002	O_3	06/19/1989	087	4.5	Urban	Population Exposure	SLAMS	H, S
	$PM_{2.5}$ - Hourly	07/01/2010	170	5	Urban	Population Exposure	SLAMS	H
Padonia, 240051007	O_3	01/01/1979	087	4.4	Neighborhood	Population Exposure	SLAMS	H, S
	$PM_{2.5}$ - Hourly	01/01/2016	170	4.8	Neighborhood	Population Exposure	SLAMS	H
	$PM_{2.5}$ - Local Conditions	01/01/1999	145	4.8	Neighborhood	Population Exposure	SLAMS	6
PG Equestrian Center, 240338003	O_3	04/01/2002	087	4.4	Urban	Population Exposure	SLAMS	H, S
Piney Run,	CO	09/01/2007	593	4.4	Regional	Regional Transport	SLAMS/NCore	H

Site Name & AQS ID	Parameter	Start Date	Method Code	Probe Height (m)	Measurement Scale	Monitor Objective	Monitor Network/Type	Schedule
240230002	Direct NO_2 (CAPS)	07/12/2019	212	4.6	Regional	Regional Transport	SLAMS/NCore	H
	NO	05/01/2004	699	10	Regional	Regional Transport	SLAMS/NCore	H
	NO_Y – NO	05/01/2004	699	10	Regional	Regional Transport	SLAMS/NCore	H
	NO_Y	05/01/2004	699	10	Regional	Regional Transport	SLAMS/NCore	H
	O_3	04/01/2004	087	4.4	Regional	Regional Transport	SLAMS/NCore	H
	$PM_{2.5}$ – Hourly	07/01/2010	170	4.9	Regional	Regional Transport	SLAMS/NCore	H
	SO_2	04/01/2004	600	4.6	Regional	Population Exposure	SLAMS/NCore	R
Pumphrey, 240031004	O_3	04/01/2024	087	5	Neighborhood	Population Exposure	SLAMS	H, S
	PM_{10} – STP	04/01/2024	127	4.7	Neighborhood	Population Exposure	SLAMS	6
	PM_{10} – STP	04/01/2024	127	4.7	Neighborhood	Population Exposure	QA-Collocated	6
Rockville, 240313001	O_3	01/01/1980	087	4.6	Urban	Population Exposure	SLAMS	H, S
	$PM_{2.5}$ - Hourly	07/01/2010	170	5.3	Neighborhood	Population Exposure	SLAMS	H
South Carroll, 240130001	O_3	07/14/1983	087	4.5	Urban	Population Exposure	SLAMS	H, S
Southern Maryland, 240170010	O_3	10/02/1984	087	4.6	Regional	General Background	SLAMS	H, S

Sampling Schedule is coded as follows: 1 – every day, 2 – every 2 hours, 3 – every 3rd day, 6 - every 6th day, 12 – every 12th day, H – every hour, every day, R – both every hour and every five minutes every day, S – seasonally measured only. M means 1-minute data. F means passive filter collected every 2 weeks. NA means not applicable for the cell.
*Method Code 102 refers to carbonyl analyses performed by ERG.

Table 3-3 Monitor Counts by Site (Cross-reference to Table 3-2)

Site Name	O_3	CO	SO_2	CAPS Direct NO2	NOx	NOy	PM2.5 – Continuous FEM	PM10 – Hourly FEM	PM10 STP (24-hr FRM)	PM10-2.5 LC 24-hr FRM)	PM2.5 LC (24-hr FRM)	PM2.5 Speciation	PAMS VOCS	HAPS / Air Toxics	IMPROVE Parameters	Ultrafine Particle Count	Aethalometer	Ceilometer	Camera	Total
Aldino	1																			1
Baltimore Co. Near Rd				1																1
Baltimore Haze Cam																			1	1
Beltsville CASTNET	1																			1
Blackwater NWR CASTNET	1																			1
Calvert	1																			1
Edgewood	1						1													2
Essex	1	1	1	1		1	1	1			1	1	2	1				1		13
Fair Hill	1						1													2
Frederick Airport	1																			1
Frostburg Haze Cam																			1	1
Frostburg Improve															1					1
Hagerstown	1						1													2
Horn Point	1		1				1													3
Howard County Near Rd		1			1		1							1		1	1			6
HU-Beltsville	1	1	1	1			1		1	1	2	1	1	1			1			13
Lake Montebello	1			1			1		1		1			1						6
Millington	1						1													2
Padonia	1						1				1									3
PG Equestrian Center	1																			1
Piney Run	1	1	1	1		1	1													6
Pumphrey	1								2											3
Rockville	1						1													2
South Carroll	1																			1
Southern Maryland	1																			1
Total	20	4	4	5	1	2	12	1	4	1	5	2	3	4	1	1	2	1	2	**75**

Table 3-4 Count of Meteorological Parameters Measured in the Maryland Network

AQS State County Site	Local Site Name	Barometric Pressure-64101	Temp-62101	Rain-65102	Relative Humidity-62201	Solar Radiation-63301	Ultraviolet Radiation-63302	Wind Direction-61104	Wind Speed-61103	Radar Wind Profiler	Total
240259001	Aldino	1	1	1	1			1	1		6
240050009	Baltimore County Near Rd	1	1	1	1			1	1		6
240251001	Edgewood	1	1	1	1			1	1		6
240053001	Essex	1	1	1	1	1	1	1	1		8
240150003	Fair Hill	1	1	1	1			1	1		6
240430009	Hagerstown	1	1	1	1			1	1		6
240190004	Horn Point	1	1	1	1			1	1	1	7
240270006	Howard County Near Rd	1	1	1	1			1	1		6
240330030	HU-Beltsville	1	1	1	1	1		1	1	1	8
240290002	Millington	1	1	1	1			1	1		6
240051007	Padonia	1	1	1	1			1	1		6
240338003	PG Equestrian Center	1	1	1	1			1	1		6
240230002	Piney Run	1	1	1	1	1		1	1	1	8
240031004	Pumphrey	1	1	1	1			1	1		6
240313001	Rockville	1	1	1	1			1	1		6
240130001	South Carroll	1	1	1	1			1	1		6
Total		16	16	16	16	3	1	16	16	3	**103**

Table 3-5 Monitoring Methods and AQS Codes used in the Maryland Ambient Air Monitoring Network

Parameter	Parameter Code	Method Code	Sample Analysis Description
HAPS / Air Toxics*	NA	150	Cryogenic Pre-concentration: GC/MS
Black Carbon $PM_{2.5}$ @ 880 nm and UV Carbon $PM_{2.5}$ @370 nm	88313 and 88314	894	Magee Scientific AE33 Aethalometer
CO, trace	42101	593	Gas Filter Correlation Teledyne API T300U
Ceilometer	61301	NA	Vaisala CL 51 Ceilometer via backscatter
Direct NO_2	42602-4	212	API T500U - CAPS (Cavity Attenuated Phase Shift)
NO and NOx	42601-2, 42602, 42603	599	Gas Phase Chemiluminescence, Teledyne API T200U
NO and NOy	42601, 42612, 42600	699	Chemiluminescence, Teledyne API T200U NOy
PAMS VOCS*	NA	102	DNHP followed by HPLC (ERG Lab)
	NA	126	Cryogenic Pre-concentration Trap GC/FID
	NA	142	Pre-concentration Trap/Thermal, Auto GC (Markes-Agilent)
O_3	44201	047	Ultraviolet Photometry (Thermo 49C)
	44201	087	Ultraviolet Radiation Absorption (API T400)
PM_{10}	81102	127	Gravimetric Partisol Model 2025i (Thermo)
$PM_{2.5}$	88101	145	Gravimetric, Partisol Plus 2025i
$PM_{2.5}$ continuous	88101-3	170	FEM, Beta Attenuation (BAM) MetOne 1020
$PM_{2.5}$ continuous	88101	638	Teledyne T640x PM Mass Monitor w/ Data Alignment Enabled
PM_{10} continuous	81102	639	Teledyne T640x PM Mass Monitor w/ Data Alignment Enabled
$PM_{10-2.5}$ (PM Coarse)	86101	176	PAIRED Gravimetric Difference, Partisol Plus 2025i
$PM_{2.5}$ Species* Constituents: Trace elements	NA	811	Energy Dispersive XRF using Teflon filter
$PM_{2.5}$ Species* Constituents: Ions	NA	812	Ion Chromatography using Nylon filter
$PM_{2.5}$ Species* Constituents: Organics	NA	813	Thermo-Optical Transmittance using Quartz filter
$PM_{2.5}$ Speciation mass	88502-5	810	Gravimetric, Met One SASS using Teflon
IMPROVE Parameters*	NA	NA	Four module, Improve Protocol analysis
SO_2, trace	42401	560	Pulsed Fluorescence, 43C-TLE/43I-TLE
	42401	600	Ultraviolet Fluorescence API T100U
Ultrafine Particle Counter	87101	173	Ultrafine Particle Counter
Visibility	NA	NA	Camera (Haze Cam)

*See Table 3-6 for constituents belonging to these groups. NA means not applicable for the cell. Parameter occurrence code (POC) 1 unless otherwise noted.

Table 3-6 Constituent Compounds and Species Measured in Maryland

CONSTITUENT GROUP	COMPOUNDS IN THE CONSTITUENT GROUP
HAPS / Air Toxics	Dichlorodifluoromethane, Chloromethane, 1,2-Dichloro-1,1,2,2,tetrafluorolethane, Chloroethene, 1,3-Butadiene, Trichlorofluoromethane, Acrolein, Acetone, Methylene Chloride, 1,1,2-Trichloro-1,2,2-trifluoroethane, 2-methoxy-2-methyl-Propane, Hexane, Chloroform, Tetrahydrofuran, 1,2-Dichloroethane, 1,1,1-Trichloroethane, Benzene, Carbon tetrachloride, Cyclohexane, 1,2-Dichloropropane, Trichloroethene, Heptane, Cis-1,3-Dichloro-1-Propene, Trans-1,3-Dichloro-1-Propene, Toluene, 1,2-Dibromoethane, Tetrachloroethylene, Chlorobenzene, Ethylbenzene, m & p- Xylene, Styrene, 1,1,2,2-Tetrachloroethane, o-Xylene, 1-Ethyl-4-Methylbenzene, 1,3,5-Trimethylbenzene, 1,2,4-Trimethylbenzene, 1,4-Dichlorobenzene, Ethylene Oxide
IMPROVE Parameters	Air temperature, Aluminum, Ammonium ion, Ammonium Nitrate, Ammonium sulfate, Arsenic, Bromine, Calcium, Chloride, Chlorine, Chromium, Copper, Elemental carbon, Humidity, Hydrogen, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Nitrate, Nitrite, Organic carbon, Phosphorus, PM_{10}, $PM_{2.5}$, Potassium, Relative Humidity, Rubidium, Selenium, Silicon, Sodium, Strontium, Sulfate, Sulfur Dioxide, Sulfur, Titanium, Vanadium, Zinc, and Zirconium
PAMS VOC's	Acetaldehyde, Acetone, Acrolein, Formaldehyde, Methyl Ethyl Ketone, Methyl Isobutyle Ketone, Propionaldehyde, Ethene, Ethyne, Ethane, Propene, Propane, Isobutane, 1-Butene, Butane, T-2-Butene, C-2-Butene, Isopentane, 1-Pentene, Pentane, Isoprene, T-2-Pentene, C-2-Pentene, 2,2-Dimethylbutane, Cyclopentane, 2,3-Dimethylbutane, 2-Methylpentane, 3-Methylpentane, 1-Hexene, Hexane, Methylcyclopentane, 2,4dimethylpentane, Benzene, Cyclohexane, 2-Methylhexane, 2,3dimethylpentane, 3-Methylhexane, 2,2,4tmpentane, Heptane, Methylcyclohexane, 2,3,4-Tmpentane, Toluene, 2-Methylheptane, 3-Methylheptane, Octane, Ethylbenzene, M&P-Xylene, Styrene, O-Xylene, Nonane, Isopropylbenzene, Propylbenzene, 1-Ethyl-3-Mbenzene, 1-Ethyl-4-Mbenzene, 135tmbenzene, 1-Ethyl-2-Mbenzene, 124tmbenzene, Decane, 1,2,3-Trimbenzene, M-Diethylbenzene, P-Diethylbenzene, Undecane, Dodecane, Total HC, PAMSHC, 1,3-Butadiene, Alpha-pinene, Beta-pinene
$PM_{2.5}$ Chemical Species	Aluminum, Ammonium Ion, Antimony, Arsenic, Barium, Bromine, Cadmium, Calcium, Cerium, Cesium, Chloride, Chlorine, Chromium, Cobalt, Copper, Elemental Carbon, Indium, Iron, Lead, Magnesium, Manganese, Nickel, Organic Carbon, Phosphorus, Potassium, Potassium Ion, Rubidium, Selenium, Silicon, Silver, Sodium, Sodium Ion, Strontium, Sulfate, Sulfur, Tin, Titanium, Total Nitrate, Vanadium, Zinc, Zirconium

4. SPECIFIC POLLUTANT NETWORK DESCRIPTIONS AND REQUIREMENTS

4.1 Carbon Monoxide (CO) – General Description and Sampling Method

CO is measured by infrared absorption photometry. Air is drawn continuously through a sample cell where infrared light passes through it. CO molecules in the air absorb part of the infrared light, reducing the intensity of the light reaching a light sensor. The light is converted into an electrical signal related to the concentration of CO in the sample cell. The Maryland CO monitoring network is shown in Figure 4.1.

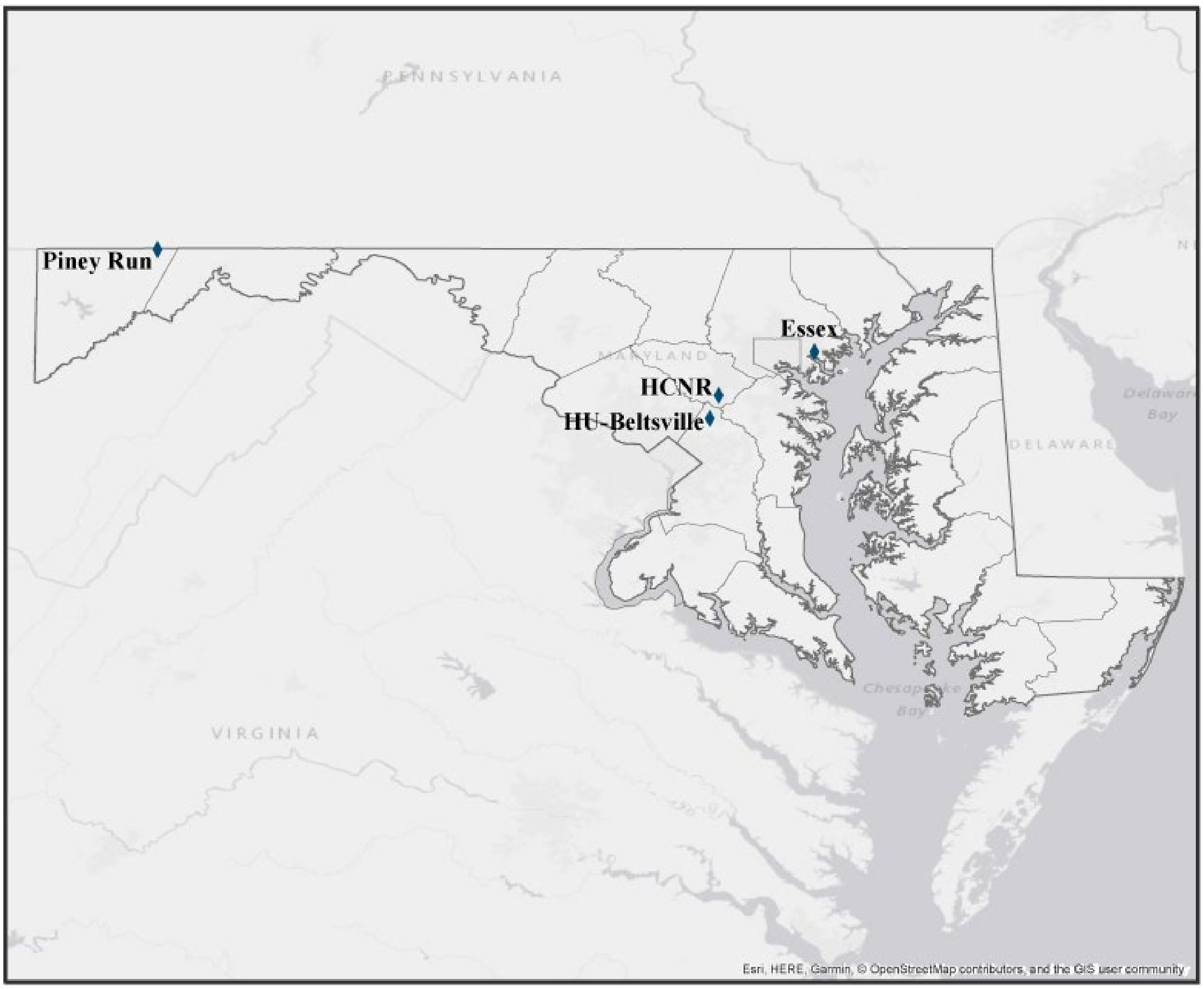

Figure 4-1 Maryland's CO monitoring network.

4.1.1 Monitoring Requirements

EPA revised the minimum monitoring requirements for CO on August 12, 2011. One CO monitor is required to be collocated with Near Road NO_2 in urban areas having a population of 1 million or more. MDE added a CO monitor to the Near Road NO_2 monitoring site at the Interstate 95 South (I-95S) rest area between MD-32 and MD-216. This monitor began collecting data April 1, 2014. Operation of the existing CO sites in Maryland is required until MDE requests discontinuation of a site in the Annual Network Plan and the EPA Regional Administrator approves the request.

Table 4-1 CO Monitoring Requirements

Requirement	Appendix D 40 CFR Part 58	Required in Maryland	Number of monitors active in Maryland
One CO monitor collocated with a Near Road NO_2 monitor in an urban area with a population > 1 million	4.2.1	1	1
One CO monitor at each NCore site	3(b)	2	2

In addition to the three CO monitors referenced in the table above, Maryland operates a CO monitor at Essex, as part of the PAMS monitoring requirements.

4.1.2 Sources

CO is formed when carbon in fuel is not completely burned. The EPA estimates that approximately 60% of all CO emissions are from motor vehicle exhaust. Other sources include waste incinerators, wood stoves, furnaces, and some industrial processes. Concentrations are highest along heavily traveled highways and decrease significantly the further away the monitor is from traffic. Therefore, CO monitors are usually located close to roadways or in urban areas.

4.1.3 Changes Planned for 2026-2027

No changes planned.

4.2 Lead (Pb) – General Description and Sampling Method

Pb is collected by gravimetric PM_{10} samplers as described in Section 4.5; then the filters are sent to a lab to be analyzed for lead by the x-ray fluorescence method. If a Pb - PM_{10} monitor measures three-month average levels greater than or equal to 0.10 µg/m^3, then MDE must install and operate a lead-TSP monitor within six months.

4.2.1 Monitoring Requirements

The latest revision to the Pb NAAQS was finalized on October 15, 2008, lowering the primary and secondary standards from 1.5 µg/m^3 to 0.15 µg/m^3. Revisions to the lead monitoring regulations were finalized on December 27, 2010 as follows:

Table 4-2 Lead Monitoring Requirements

Requirement	Appendix D 40 CFR Part 58	Required in MD	Number in MD
One source-oriented SLAMS site located to measure the maximum Pb concentration resulting from each non-airport Pb source which emits 0.50 or more tons per year (tpy)	4.5(a)	0	0
One source-oriented SLAMS site located to measure the maximum Pb concentration resulting from airport which emits 1.0 or more tpy	4.5(a)	0	0

On March 28, 2016, EPA published 40 CFR Part 58 Revisions to Ambient Monitoring Quality Assurance and Other Requirements; Final Rule. This rule revision eliminated the requirement in section 3 of appendix D to measure Pb at urban NCore sites either as Pb in Total Suspended Particles (Pb-TSP) or as Pb PM_{10}. In order to discontinue Pb measurements at urban NCore sites, Part II.I Network Design Requirements of the publication states:

"With specific regard to Pb monitoring at urban NCore sites, monitoring agencies should request permission from the EPA Regional Administrator to discontinue non-source-oriented monitoring following the collection of at least 3 years of complete data at each affected site."

MDE terminated the Pb monitor at HU-Beltsville due to low concentrations (see the 2018 Monitoring Network Plan.)

4.2.2 Sources

Pb is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions have historically been motor vehicles and industrial sources. As a result of EPA's regulatory efforts to remove lead from gasoline, emissions of lead from the transportation sector dramatically declined by 95 percent between 1980 and 1999, and levels of lead in the air decreased by 94 percent between 1980 and 1999. Today, the highest levels of lead in the air are usually found near lead smelters. Other stationary sources are waste incinerators, utilities, lead-acid battery manufacturers and general aviation airports. Soil can pick up lead from exterior paint, or other sources such as past use of leaded gas in cars. There are no sources in Maryland that emit more than ½ ton (1,000 pounds) of lead per year.

4.2.3 Changes Planned for 2026-2027

No changes planned.

4.3 Nitrogen Dioxide (NO_2) – General Description and Sampling Method

NO_2 is produced during high temperature burning of fuels. Sources include motor vehicles and stationary sources that burn fossil fuels such as power plants and industrial boilers. Until recently, it has only been possible to measure NO_2 indirectly. First, NO is measured using the chemiluminescence reaction of nitric oxide (NO) with O_3 (O_3). Air is drawn into a reaction chamber where it is mixed with a high concentration of O_3 from an internal O_3 generator. Any NO in the air reacts with the O_3 to produce NO_2. Light emitted from this reaction is detected with a photomultiplier tube and converted to an electrical signal proportional to the NO concentration.

NO_x are measured by passing the air through a converter where any NO_2 in the air is reduced to NO before the air is passed to the reaction chamber. By alternately passing the air directly to the reaction chamber, and through the converter before the reaction chamber, the analyzer alternately measures NO and NO_x. The NO_2 concentration is equal to the difference between NO_x and NO. NO_y are measured in a similar manner to NO_x, except that NO is measured by bypassing the converter. The combination of NO_2 and NO_z can be then determined by difference. This procedure is similar to the current methodology used to measure NO_x; however, the converter temperature is higher in order to more completely convert NO_z species, and the converter has been moved to very near the sample inlet to avoid line losses of "sticky" NO_y species such as nitric acid (HNO_3).

Direct NO_2 monitoring using cavity-attenuated phase shift (CAPS) technology has been deployed to the Baltimore County Near Road, Essex, HU-Beltsville, Lake Montebello, and Piney Run sites. CAPS NO_2 monitors provide a direct absorption measurement of NO_2. Unlike standard chemiluminescence-based monitors, these instruments require no conversion of NO_2 to another species and thus are not sensitive to other nitrogen-containing species.

4.3.1 Monitoring Requirements

The last revision to the NO_2 NAAQS was finalized on January 22, 2010, setting a new 1-hour NAAQS at 100 ppb, and retaining the previous annual average NAAQS at 53 ppb. On December 30, 2016, EPA published 40 CFR Part 50 Revision to the Near-Road NO_2 Minimum Monitoring Requirements, which eliminated the requirement for a near-road monitoring station in CBSA's having populations between 500,000 and 1,000,000 persons.

Table 4-3 NO_2 Monitoring Requirements

Requirement	Appendix D 40 CFR Part 58	Required in Maryland	Number of monitors active in Maryland
Near Road NO_2 monitoring in CBSA with a population > 2,500,000	4.3.2(a)	2	2
Area-wide NO_2 monitoring in CBSA with a population > 1,000,000	4.3.3	1	2
Regional Administrator required monitoring	4.3.4	Variable	0

The Maryland NO_2 monitoring network is shown in Figure 4-2.

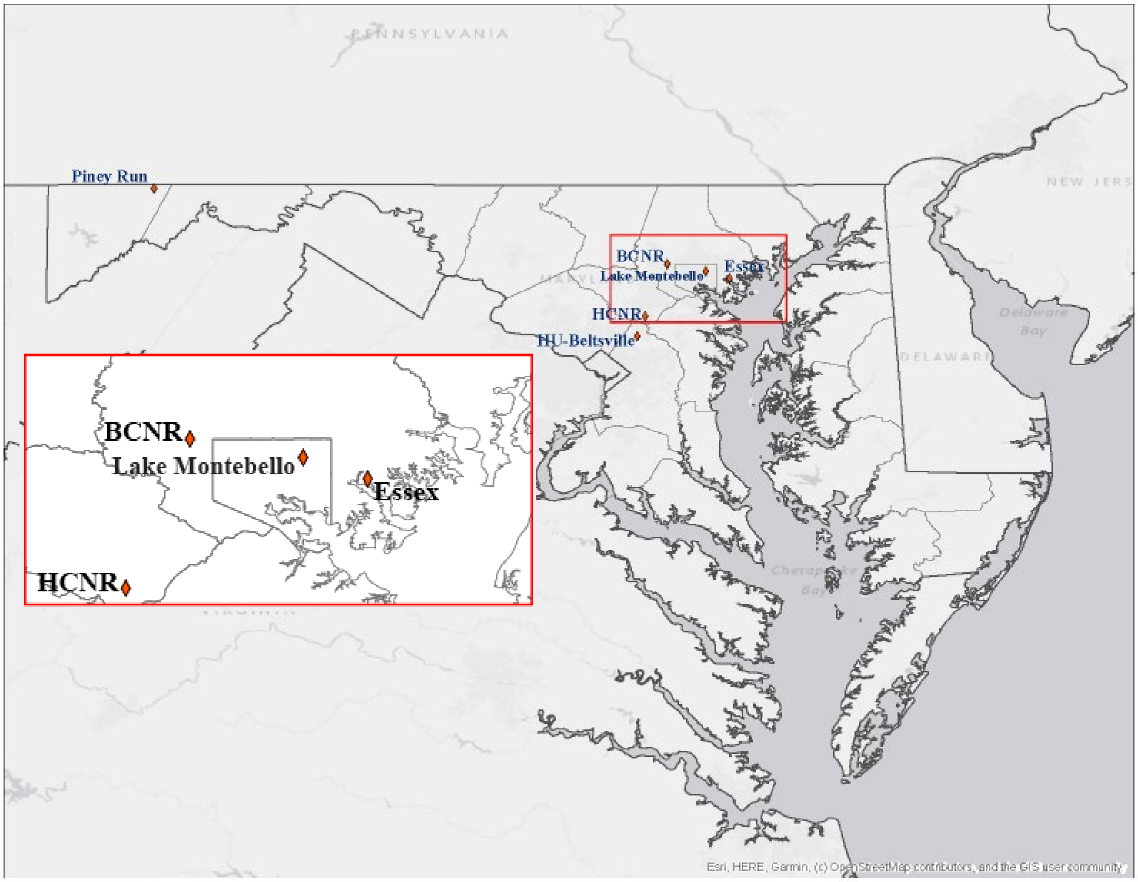

Figure 4-2 Maryland's NO_2 monitoring network.

Near Road Monitoring

There are three MSAs with populations greater than 2,500,000 that are either wholly in Maryland, or that Maryland is a part of, that each qualify for two near road NO_2 monitors (Table 1-1). For the Baltimore-Towson, MD MSA, MDE is currently operating two near road NO_2 monitoring stations: the Howard County Near Road site, located on I-95 S between Routes 32 and 216, and the Baltimore County Near Road site, located at the Maryland Transit Administration maintenance facility at the interchange of I-695 and I-795.

For the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA, the requirements will be met by monitors installed in Washington, DC by the District of Columbia Department of the Environment (DOEE) and in Virginia by the Virginia Department of Environmental Quality (VADEQ). For the Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD MSA, the requirements are being met by monitors installed by the Philadelphia Air Management Service (AMS).

Area Wide Monitoring

There are three MSAs with populations greater than 1,000,000 that are either wholly in Maryland, or that Maryland is a part of, that each qualify for one community wide NO_2 monitor (Table 1-1). MDE's NO_2 monitors at the Essex and Lake Montebello sites fulfill this requirement for the Baltimore-Towson, MD MSA.

For the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA, the requirements are met by monitors installed in Washington, DC by the District of Columbia Department of the Environment (DOEE) and in Virginia by VADEQ. For the Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD MSA, the requirements are met by monitors installed by Philadelphia AMS.

Sensitive and Vulnerable Populations

EPA Region III has not required MDE to install any additional monitors to meet this requirement.

Additional NO_2 Monitoring Requirements

Each State is required to operate one NCore site. This is discussed in more detail in Section 4.10. Maryland runs two NCore stations, Piney Run and HU-Beltsville, both of which monitor NO_2.

4.3.2 Sources

NO_x are produced during high temperature burning of fuels. Sources of NO_x include motor vehicles and stationary sources that burn fossil fuels such as power plants and industrial boilers.

4.3.3 Changes Planned for 2026-2027

No changes planned.

4.4 Ozone (O_3) – General Description and Sampling Method

O_3 is measured by ultraviolet absorption photometry. Air is drawn continuously through a sample cell where ultraviolet light passes through it. O_3 molecules in the air absorb part of the ultraviolet light, reducing the intensity of the light reaching a light sensor. The light is converted into an electrical signal related to the concentration of O_3 in the sample cell.

On October 1, 2015, EPA strengthened the NAAQS for ground-level O_3 to 70 parts per billion (ppb), based on extensive scientific evidence about O_3's effects on public health and welfare. The updated standard improves public health protection, particularly for at-risk groups including children, older adults, people of all ages who have lung diseases such as asthma, and people who are active outdoors, especially outdoor workers. They also will improve the health of trees, plants, and ecosystems. The implementation of the 2015 O_3 NAAQS included expanding the O_3 season in Maryland from March 1 through October 31, beginning March 1, 2017.

4.4.1 Monitoring Requirements

O_3 monitoring requirements are determined by the MSA population and design value, as specified in Table D-2 of 40 CFR Part 58 Appendix D. Table 4-4 shows that the MDE monitoring network meets or exceeds the minimum requirements. Since O_3 levels decrease significantly in the colder periods of the year in many areas, O_3 is only required to be monitored during the designated "O_3 season".

Table 4-4 Number of O_3 SLAMS Sites Required

MSA Name	Population	Monitors Deployed by State[A]						Total Monitors	Required ≥ 85% NAAQS
		DE	DC	MD	VA	WV	PA		
Baltimore-Towson, MD	2,859,024	--	--	7	--	--	--	7	4
Hagerstown-Martinsburg, MD-WV	311,295	--	--	1	--	1	--	2	1
Washington-Arlington-Alexandria, DC-VA-MD-WV	6,436,489	--	3	7	6	0	--	16	3
Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD	6,330,422	4	--	1	--	--	7	12	3
Salisbury, MD-DE	131,570	2	--	0	--	--	--	2	2
Total		6	3	16	6	1	7	39	13

A - Based on tables available at https://www.epa.gov/air-trends/air-quality-design-values. All areas had their maximum site >= 85% O_3 NAAQS; -- indicates that no part of that State exists in that MSA.

The Maryland O_3 monitoring network is shown in Figure 4-3.

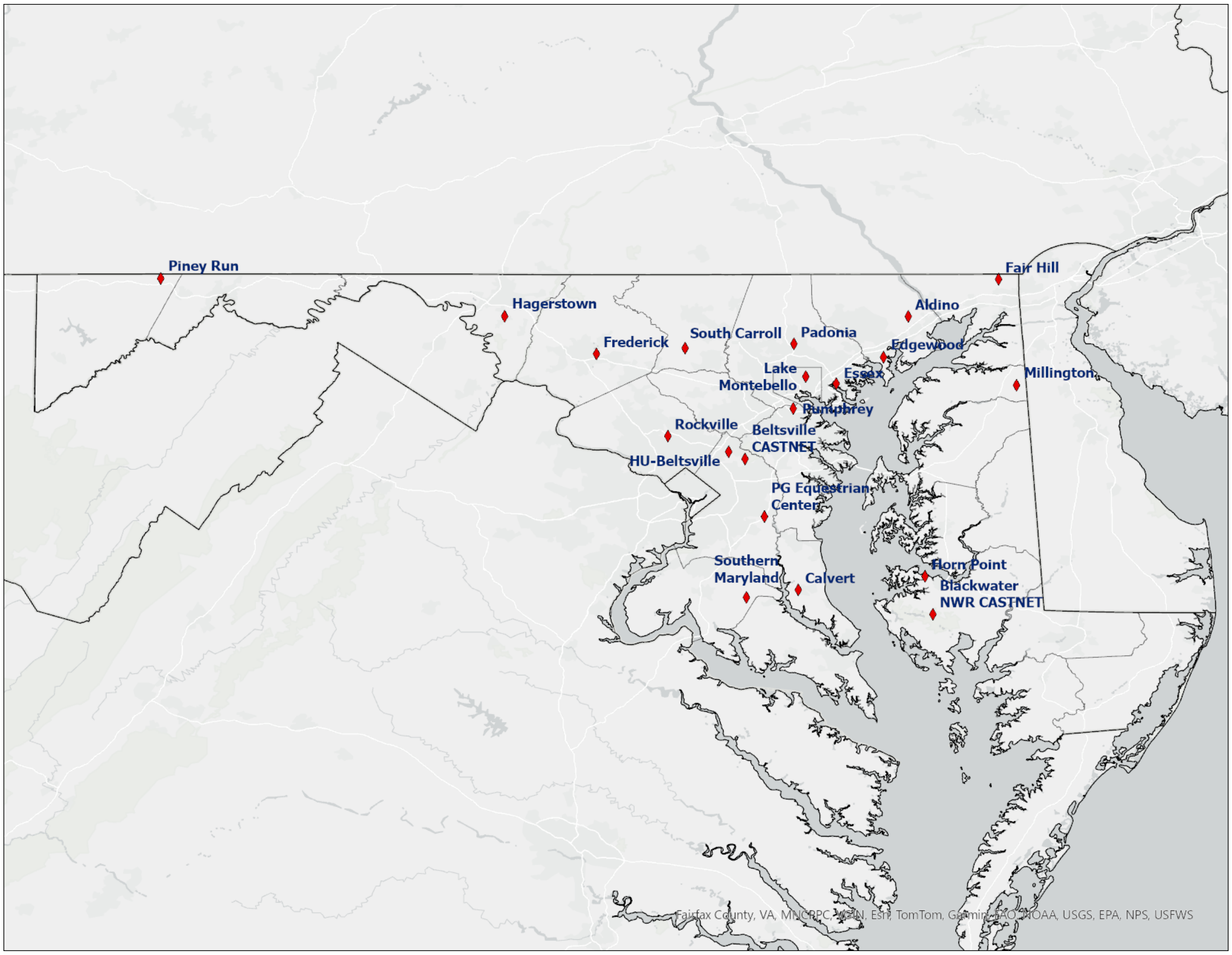

Figure 4-3 Maryland's O_3 monitoring network.

Within an O_3 network, at least one O_3 site for each MSA must be designed to record the maximum concentration for that particular metropolitan area. More than one maximum concentration site may be necessary in some areas. Since O_3 requires appreciable formation time, the mixing of reactants and products occurs over large volumes of air, and this reduces the importance of monitoring small-scale spatial variability. The appropriate spatial scales for O_3 sites are neighborhood, urban, and regional.

The prospective maximum concentration monitor site should be selected in a direction from the city that is most likely to observe the highest O_3 concentrations, more specifically, downwind during periods of photochemical activity. For the Baltimore-Towson, MD MSA, Essex, Edgewood, and Aldino are assigned this designation. For the Washington-Arlington-Alexandria, DC-MD-VA-WV MSA, HU-Beltsville, Beltsville-CASTNET and PG Equestrian Center are assigned this designation for the Maryland portion of the MSA. For the Martinsburg-Hagerstown, MD-WV MSA, Hagerstown is assigned this designation.

Additional O_3 Monitoring Requirements

Additional O_3 monitoring stations are located throughout Maryland to characterize population exposure to O_3. For the Baltimore-Towson, MD MSA, Padonia, Brooklyn Park, Lake Montebello, and South Carroll are assigned this designation. For the Washington-Arlington-Alexandria, DC-MD-VA-WV MSA, Rockville, Frederick, and Calvert are assigned this designation, while the Southern Maryland site is in place to characterize the general background concentration. Piney Run, the rural NCore site, helps characterize regional O_3 transport. On the Eastern Shore, Horn Point is in place to characterize the general background concentration and help notify the public about poor AQI conditions; Blackwater CASTNET is designated as a highest concentration monitor; and the Millington O_3 monitor is not required at all but serves as an important tool in notifying the public of AQI forecasts.

4.4.2 Sources

O_3 is not emitted directly from a pollution source but is formed in the lower atmosphere by the reaction of NO_x and VOC's in the presence of sunlight and warm temperatures. Sources of NO_x include automobiles, power plants and other combustion activities. VOC's can come from automobiles, gasoline vapors, and a variety of large and small commercial and industrial sources that use chemical solvents, paint thinners, and other chemical compounds. NO_x and VOC's or "precursors of O_3" can travel for many miles before chemical reactions in the atmosphere form O_3.

4.4.3 Changes Planned for 2026-2027

At the request of the residents near our Anne Arundel air monitoring site, we have changed the name of Brooklyn Park to **Pumphrey**.

4.5 Particulate Matter (PM_{10}) – General Description and Sampling Method

MDE uses manual gravimetric monitors and one continuous sampler to measure PM_{10} mass concentrations. Gravimetric samplers draw air through a specially designed inlet that excludes particles larger than 10 microns in diameter for a period of 24 hours. The particles are collected on a Teflon filter that is weighed to determine the particulate mass. These samplers report the air volume measured during the sampling period allowing the concentration (mass/volume) to be calculated.

The Model T640x is a continuous sampler capable of collecting PM_{10} and $PM_{2.5}$ mass concentration data at 1-minute and 1-hour intervals. It is an optical aerosol spectrometer that converts optical measurements to mass measurements with sharp accuracy by determining sampled particle size via scattered light at the single particle level according to Lorenz-Mie Theory. The sampling head draws in ambient air with different sized particles, which are dried with the Aerosol Sample Conditioner (ASC) and moved into the optical particle sensor where scattered light intensity is measured to determine particle size diameter. The particles move separately into the T-aperture through an optically differentiated measurement volume that is homogeneously illuminated with polychromatic light. The polychromatic light source, an LED, combined with a 90° scattered light detection achieves a precise and unambiguous calibration curve in the Mie range, resulting in a large size resolution. Each particle generates a scattered light impulse that is detected at an 85° to 95° angle where amplitude and signal length are measured; the amplitude (height) of the scattered light impulse is directly related to the particle size diameter.

4.5.1 Monitoring Requirements

The number of required PM_{10} monitors in each CBSA is determined by the CBSA population and design value, as specified in Table D-5 of Appendix D to 40 CFR Part 58. Table 4-5 shows that the MDE monitoring network meets or exceeds the minimum requirements.

Table 4-5 Number of PM_{10} SLAMS Sites

MSA Name	Population	Monitors Required[A] in each MSA	Active Monitors in MD/Total[B]
Baltimore-Towson, MD	2,859,024	2-4	4/4
Hagerstown-Martinsburg, MD-WV	311,295	0-1	0/0
Washington-Arlington-Alexandria, DC-VA-MD-WV	6,436,489	2-4	1/5
Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD	6,330,422	2-4	0/2
Salisbury, MD-DE	131,570	0-1	0/0

A – All of the listed MSAs have PM_{10} ambient concentrations well below 80% of the PM_{10} NAAQS.
B – Based on tables available at https://www.epa.gov/air-trends/air-quality-design-values. All areas had their maximum site >= 85% O_3 NAAQS; -- indicates that no part of that State exists in that MSA.

Minimum Requirements for Collocated PM_{10}

A minimum of 15% (round up), or at least one of the PM_{10} monitors must be collocated as specified in 40 CFR Part 58 Appendix A 3.3.4. MDE has 4 PM_{10} monitors and two are collocated at Brooklyn Park (previously Glen Burnie) thereby meeting this requirement. The third gravimetric PM_{10} monitor is located at Lake Montebello. The fourth PM_{10} monitor is a T640x located in Essex collecting continuous $PM_{2.5}$ and PM_{10} data. The PM_{10} part of the unit will be collocated to the primary PM_{10} FRM sampler there. The Maryland PM_{10} monitoring network is shown in Figure 4-4.

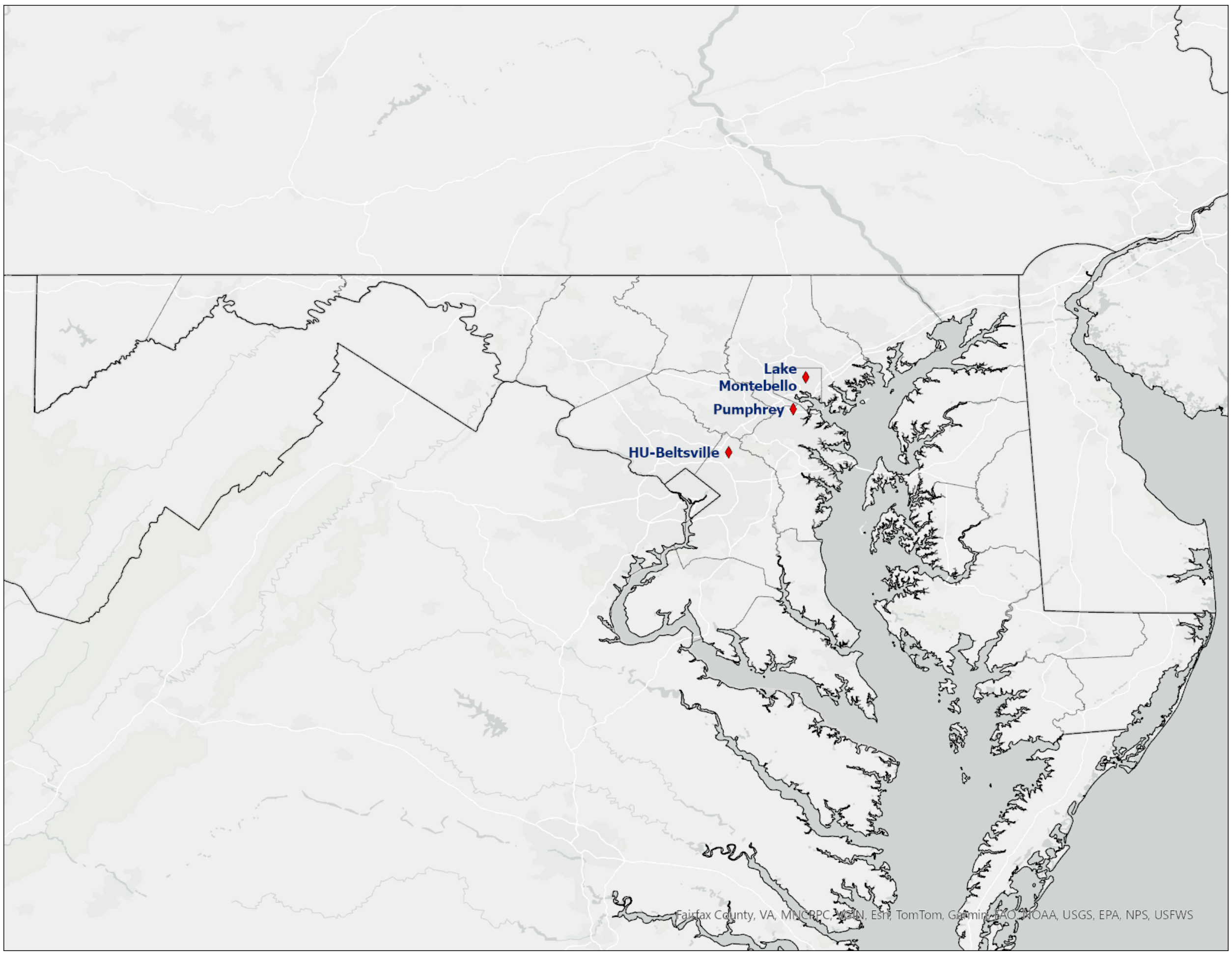

Figure 4-4 Maryland's PM_{10} monitoring network.

4.5.2 Sources

Major sources of PM_{10} include steel mills, power plants, motor vehicles, industrial plants, unpaved roads, and agricultural tilling. The wide variety of PM_{10} sources means that the chemical and physical composition of coarse particles is highly variable.

4.5.3 Changes Planned for 2026-2027

At the request of the residents near our Anne Arundel air monitoring site, we have changed the name of Brooklyn Park to **Pumphrey**. The PM10s will be **PUMX** and **PUMY**, to correspond with the old BRPX and BRPY, respectively.

4.6 Fine Particulate Matter ($PM_{2.5}$) – General Description and Sampling Method

MDE uses both FRM manual gravimetric and FEM automated monitors to measure $PM_{2.5}$ mass concentrations. For the FRM manual gravimetric sampling, a very sharp cut cyclone (VSSC) is attached to the inlets of these monitors to exclude particles having diameters greater than 2.5 microns. Otherwise, the monitors work as described for PM_{10} gravimetric monitoring. Some of the gravimetric monitors are specially equipped to collect $PM_{2.5}$ samples, which are later analyzed into concentrations of the samples' chemical constituents or species. See Table 3-6 for list of speciated $PM_{2.5}$ mass. MetOne Super SAAS samplers, URG 3000N, and IMPROVE samplers are used for the collection of samples for the chemical speciation of $PM_{2.5}$. The samplers collect 3 to 4 filter samples simultaneously every third day for a period of 24 hours. These samples are then sent to an EPA contract laboratory for chemical analyses. There are over 50 species consisting of ions, metals, and carbon species quantified by the analyses (Table 3-6).

For the FEM continuous monitoring, the $PM_{2.5}$ Beta Attenuation Monitor (BAM) automatically measures and records dust concentrations with built-in data logging. The principle of beta ray attenuation is used to provide a simple determination of mass concentration. An external pump pulls a measured amount of air through a filter tape for a one-hour period. The filter tape, impregnated with ambient dust, is placed between the source and the detector thereby causing the attenuation of the measured beta-particle signal. The degree of attenuation of the beta-particle signal is used to determine the mass concentration of particulate matter on the filter tape and hence the hourly volumetric concentration of particulate matter in the ambient air.

The T640x continuous sampler is described in the previous section.

4.6.1 Monitoring Requirements

The number of required $PM_{2.5}$ monitors in each MSA is determined by the MSA population and design value, as specified in Table D-5 of Appendix D to 40 CFR Part 58. Table 4-6 shows that the MDE monitoring network meets or exceeds the minimum requirements.

Table 4-6 Number of $PM_{2.5}$ SLAMS Sites Required

MSA Name	Population	2024 Annual Design Value ($\mu g/m^3$)	2024 Daily Design Value ($\mu g/m^3$)	Required SLAMS Monitors	Monitors Active in MD/Total[A,B]	Required ≥ 85% NAAQS
Baltimore-Towson, MD	2,859,024	8.2	21	3	5/5	3
Hagerstown-Martinsburg, MD-WV	311,295	8.7*	24*	1	1/2	1
Washington-Arlington-Alexandria, DC-VA-MD-WV	6,436,489	8.1*	21*	2	2/11	3
Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD	6,330,422	10.3*	27*	3	1/21	2
Salisbury, MD-DE**	131,570	7.0*	19*	0	0/1	0

A- Based on tables available at https://www.epa.gov/air-trends/air-quality-design-values.
-- indicates that no part of that State exists in that MSA.
B- Total number of monitors includes those located in other States.
* Highest values not observed in Maryland. **Data do not meet validity requirements.

The Maryland $PM_{2.5}$ monitoring network is shown in Figure 4-5.

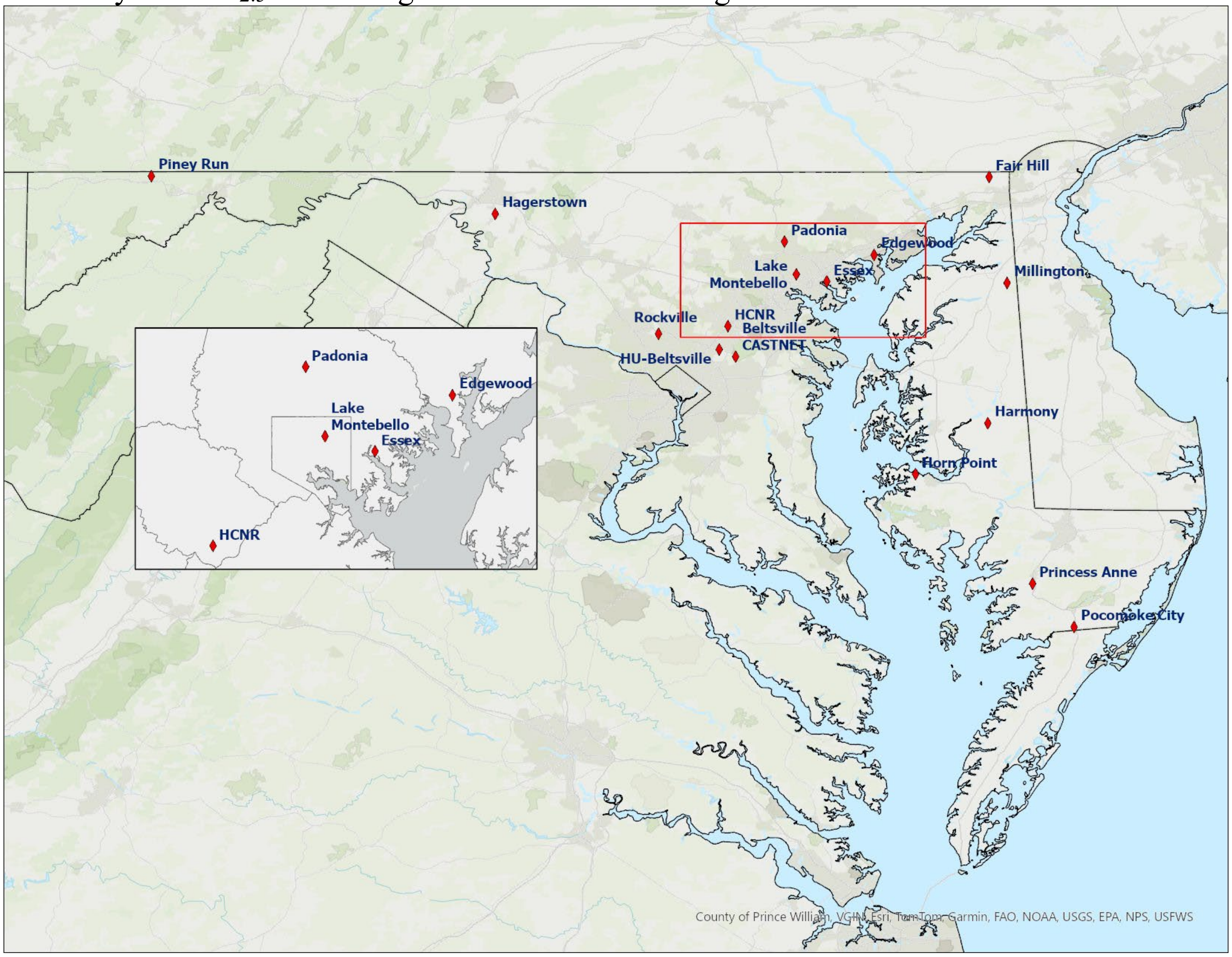

Figure 4-5 Maryland's $PM_{2.5}$ monitoring network.

Minimum Requirements for Collocated $PM_{2.5}$

Collocation requirements for $PM_{2.5}$ are based on the number of $PM_{2.5}$ monitors within a Primary Quality Assurance Organization (PQAO) and by measurement method (FRM or FEM) as specified in 40 CFR Part 58 Appendix A 3.2.5 and Appendix D 4.7.2. MDE is its own PQAO so all monitors in Maryland are counted in the collocation requirements. A minimum of 15% (round up) of the monitors must be collocated. MDE has 12 $PM_{2.5}$ monitoring stations; therefore 2 must be collocated. MDE currently operates three collocated $PM_{2.5}$ monitors, one FRM-FRM (Howard U), one FRM-FEM, where the FRM is primary, (Lake Montebello), and one FEM-FRM, where the FEM is primary, (Padonia). The new T640x will be collocated with the primary FRM monitor at Essex.

On the Lower Eastern Shore, Princess Anne, Pocomoke City, and sites monitor NH_3, $PM_{2.5}$, PM_{10}, and surface meteorology as part of a special air monitoring project to learn more about how air quality near poultry houses compares to other areas of Maryland. These stations are not part of Maryland's regulatory monitoring network, as they are operated by the University of Maryland Eastern Shore.

Requirements for Continuous $PM_{2.5}$ Monitoring

At least one-half (round up) of the minimum number of sites per MSA must operate continuous $PM_{2.5}$ monitors. MDE operates 12 continuous $PM_{2.5}$ monitors, five in the Baltimore-Towson, MD MSA; two in the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA; one in the Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD MSA; and one in the Hagerstown-Martinsburg, MD-WV MSA. The other three are in areas not designated as MSAs (Figure 3-1; Tables 3-1 and 3-2).

Requirements for Near Road $PM_{2.5}$ Monitoring

For MSAs with a population of one million or greater, at least one $PM_{2.5}$ monitor is to be located at a Near Road NO_2 station. The Howard County near road site fulfills this requirement for the Baltimore-Towson, MD MSA. MDE does not operate near road NO_2 stations in any other MSA (Section 4.3.1).

Requirements for $PM_{2.5}$ Chemical Speciation

Each state shall continue to conduct chemical speciation monitoring and analyses at sites designated to be part of the $PM_{2.5}$ Chemical Speciation Network (CSN) consisting of $PM_{2.5}$ sites and supplemental sites. MDE conducts chemical speciation monitoring at Essex and HU-Beltsville, but only HU-Beltsville is designated as part of the CSN.

Other Requirements for $PM_{2.5}$ Monitoring

Table D-5 of Appendix D to Part 58 lays out several monitoring requirements for $PM_{2.5}$. The required monitoring sites must be located to represent area-wide air quality. These will typically be either neighborhood or urban scale, although micro or middle scale may be appropriate in some urban areas. At least one monitoring site must be neighborhood scale or greater in an area of expected maximum concentration and one site must be sited in an area of poor air quality. Each State shall have at least one $PM_{2.5}$ site to monitor the regional background and at least one $PM_{2.5}$ site to monitor regional transport. Each NCore station must operate a $PM_{2.5}$ monitor. Table 4-7 shows that MDE meets all of these additional requirements.

Additionally, for areas with additional required SLAMS, a monitoring station is to be sited in an at-risk community with poor air quality, particularly where there are anticipated effects from sources in the area. This requirement is met at Edgewood and Padonia.

4.6.2 Sources

$PM_{2.5}$ pollution is emitted from combustion activities, such as industrial and residential fuel burning and motor vehicles. $PM_{2.5}$ can also form in the atmosphere from precursor compounds through various physical and chemical processes.

Table 4-7 Monitor Objective Types and Scales Assigned to $PM_{2.5}$ Monitors in Maryland (FEM BAMs, unless otherwise noted.)

Site Name	Measurement Scale	Monitor Objective	MSA
Lake Montebello (FRM & BAM FEM)	Neighborhood	Highest Concentration	Baltimore-Towson, MD
Howard Co. Near Rd	Microscale	Highest Concentration/ Source Oriented	Baltimore-Towson, MD
Padonia (FRM & FEM)	Neighborhood	Population Exposure	Baltimore-Towson, MD
Essex (FRM & T640x FEM)	Neighborhood	Population Exposure	Baltimore-Towson, MD
Edgewood	Neighborhood	Population Exposure	Baltimore-Towson, MD
Hagerstown	Urban Scale	Population Exposure/ Highest Concentration	Hagerstown-Martinsburg, MD-WV
Fair Hill	Regional Scale	Population Exposure	Philadelphia-Camden-Wilmington, PA-DE-MD
Rockville	Neighborhood	Population Exposure	Washington-Arlington-Alexandria, DC-VA-MD-WV
HU-Beltsville (FRM & BAM FEM)	Urban Scale	Population Exposure	Washington-Arlington-Alexandria, DC-VA-MD-WV
Horn Point	Regional Scale	Population Exposure	NA
Millington	Urban	Population Exposure	NA
Piney Run	Regional Scale	Regional Transport	NA

4.6.3 Applicability of FEM Data for Comparison to the NAAQS and Reporting the AQI

MDE operates both FRM and FEM $PM_{2.5}$ monitors (Table 3-2). Pursuant to the January 15, 2013, revisions to $PM_{2.5}$ monitoring requirements, MDE recommends that all of the FEM monitors currently operating in the MDE monitoring network remain eligible for comparison to the $PM_{2.5}$ NAAQS and for reporting the AQI. This recommendation applies retrospectively to FEM data collected since the first quarter of 2015, and prospectively for data collected in 2024 and 2025. MDE will re-evaluate this recommendation for FEM data collected in the 36 months prior to January 1, 2024 and 2025 in next year's Annual Network Plan.

4.6.4 Changes Planned for 2026-2027

Changes to the $PM_{2.5}$ network are listed below:

- Lake Montebello $PM_{2.5}$ – Changed measurement scale from Middle to Neighborhood.
- Millington $PM_{2.5}$ – Changed measurement scale from Neighborhood to Urban.
- Padonia $PM_{2.5}$ FRM – sampling frequency increased to a 1-in-6 day sampling schedule.

4.7 Sulfur Dioxide (SO_2) – General Description and Sampling Method

SO_2 is measured with a fluorescence analyzer. Air is drawn through a sample cell where it is subjected to high intensity ultraviolet light. This causes the SO_2 molecules in the air to fluoresce and release light. The fluorescence is detected with a photo multiplier tube and converted to an electrical signal proportional to the SO_2 concentration. The Maryland SO_2 monitoring network is shown in figure 4-6.

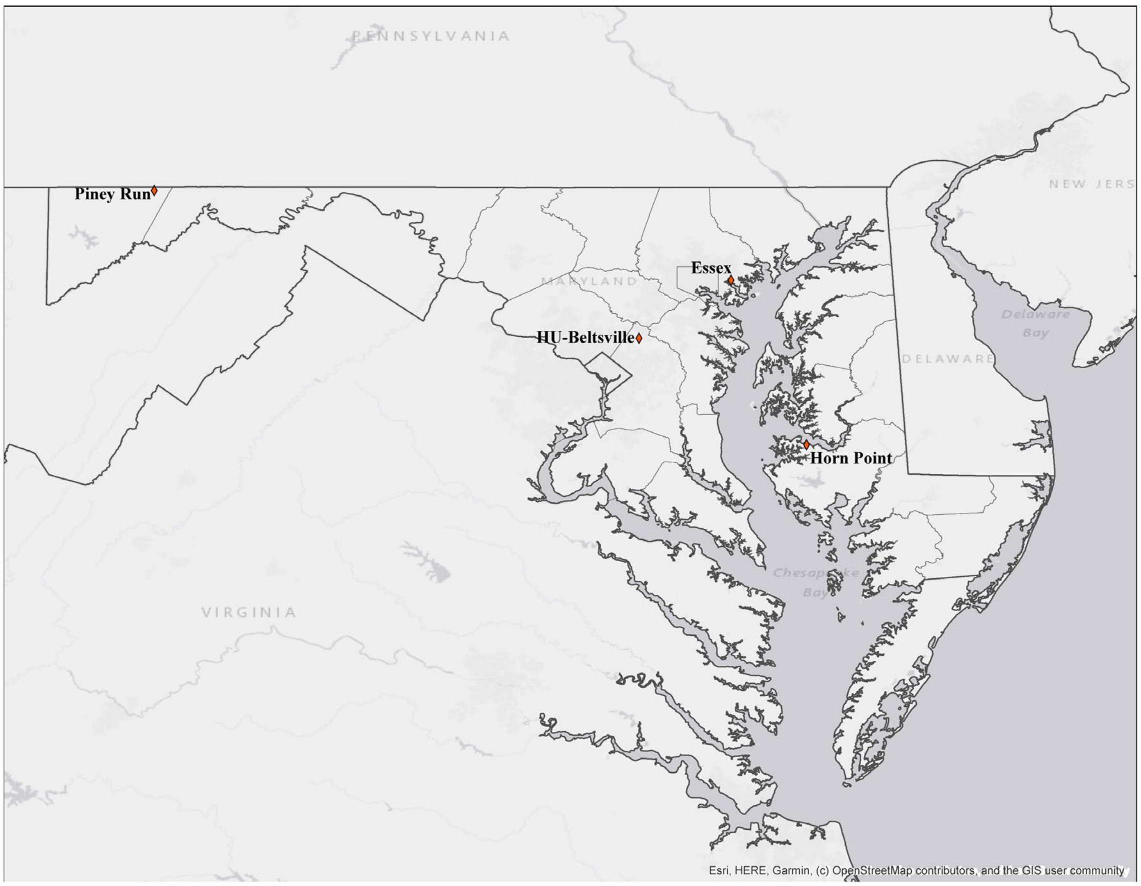

Figure 4-6 Maryland's SO_2 monitoring network

4.7.1 Monitoring Requirements

The minimum number of required SO_2 monitors in each MSA is proportional to the product of the total amount of SO_2 emissions in the MSA and its population, as specified in 40 CFR Part 58, Appendix D, Section 4.4. The resulting value is defined as the Population Weighted Emissions Index (PWEI). SO_2 emissions shown in Table 4-8 are from the 2022 National Emissions Inventory (NEI).

Table 4-8 Minimum SO_2 Monitoring Requirements

MSA Name	2024 Population Estimate	2024 NEI SO_2 (tons/year)[A]	PWEI (millions of people-tons per year)	Monitors Required	Monitors Active in MD/Total[B]
Baltimore-Towson, MD	2,859,024	1,693	4,840	1	1/1
Hagerstown-Martinsburg, MD-WV	311,295	317	99	0	0/0
Washington-Arlington-Alexandria, DC-VA-MD-WV	6,436,489	120	772	1	1/5
Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD	6,330,422	14	89	0	0/1
Salisbury, MD-DE	131,570	14	2	1	0/7

[A]NEI from 2024 summaries in MDE database, based on reported emissions.
[B]Total monitors in an MSA is based on tables available at https://www.epa.gov/air-trends/air-quality-design-values

Other SO_2 Monitoring Requirements

The Regional Administrator may require additional SO_2 monitoring stations above the minimum in areas where the minimum requirements are not deemed sufficient to meet monitoring objectives. There are no additional monitors required in Maryland by the Regional Administrator.

Each NCore station must operate an SO_2 monitor. This requirement is met at both the HU-Beltsville and Piney Run monitoring stations.

4.7.2 Sources

The main sources of SO_2 are combustion of coal and oil (mostly from electrical generating units (EGUs), refineries, smelters, and industrial boilers). Nationally, two-thirds of all SO_2 emissions are from EGUs. Coal operated EGUs account for 95% of these emissions.

4.7.3 Changes Planned for 2026-2027

No changes planned.

4.8 Photochemical Assessment Monitoring Stations (PAMS) – General Description and Sampling Method

The purpose of the PAMS program is to provide an air quality database that will assist in evaluating and modifying control strategies for attaining the O_3 NAAQS. The selection of parameters to be measured at a PAMS site varies with the site's O_3 nonattainment designation (moderate, serious, severe, or extreme) and whether the site is upwind or downwind of O_3 precursor source areas. The parameters are O_3, NO, NO_x, NO_2, NO_y, and speciated VOC's. The Maryland PAMS monitoring network is shown in Figure 4-7.

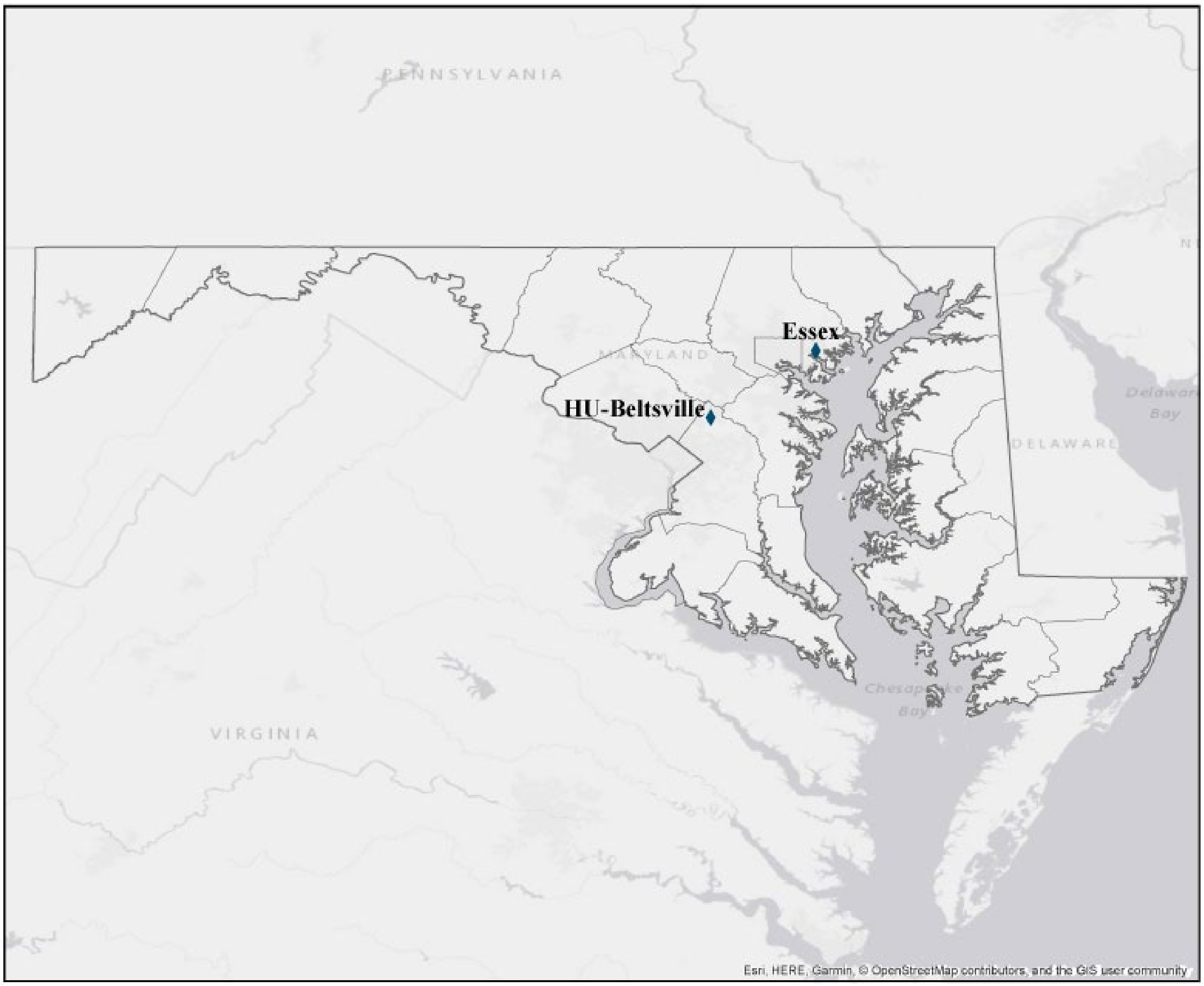

Figure 4-7 Maryland's PAMS monitoring network.

On October 1, 2015, the PAMS monitoring rule (40 CFR Part 58, Appendix D, Section 5) was revised in conjunction with the strengthening of the O_3 NAAQS. States had until June 1, 2021, to meet these new requirements. MDE's PAMS Quality Assurance Project Plan was approved by the EPA on February 3, 2021.

Based on 40 CFR part 58, Appendix D, State air monitoring agencies were required to begin making the revised PAMS measurements at their NCore location(s) by June 1, 2019. EPA proposed a two-year extension to this deadline on May 31, 2019 because many states had not yet received the equipment and training needed to implement the new requirements. A final rule extending the start date from June 1, 2019 to June 1, 2021 was signed on December 20, 2019 and published in the Federal Register on January 8, 2020. MDE has all the necessary equipment and began collecting the required PAMS measurements on June 1, 2020. A CL51 ceilometer was relocated to the Essex site on October 27, 2020.

MDE was granted a waiver (Appendix D to the 2018 Monitoring Network Plan) to terminate the collection of PAMS data at HU-Beltsville in support of enhanced PAMS monitoring at Essex. This change, which included relocating the NO_y monitor from Howard U to Essex, was approved on May 31, 2017.

Methods used to sample and analyze VOC's and NO_y follow (NO/NO_x and O_3 have already been described in Sections 4.3 and 4.4, respectively):

- Ambient air is collected in three 8-hour canister samples every 3rd day during PAMS season (June – August) using a XonTech Model 910A Canister Sampler with a Model 912 multi-canister sampling adapter. The canisters are returned to the laboratory for analysis on an EnTech/Agilent GC/FID system.
- Ambient air is collected year-round in 24-hour canister samples every sixth day using a XonTech Model 910A/Atec Model 2200 Canister Sampler. The canisters are returned to the laboratory for analysis on an EnTech/Agilent GC/FID system. These are the same canister samples listed in section 4.9 below but analyzed for the PAMS list of compounds.
- Ambient air is collected and analyzed on-site every hour (June – August) using a Markes-Agilent auto GC.
- Ambient air is sampled hourly for NO_y using an API T200U NOy low level NO_x analyzer.

4.8.1 Monitoring Requirements and Locations for Revised PAMS Monitoring Rule

Under the October 1, 2015 revisions to the PAMS monitoring rule, state and local monitoring agencies are required to collect and report PAMS measurements at each NCore site with a population of 1,000,000 or more beginning June 1, 2021. PAMS measurements include:

(1) Hourly averaged speciated VOCs;
(2) Three 8-hour averaged carbonyl samples per day on a 1-in-3 day schedule, or hourly averaged formaldehyde;
(3) Hourly averaged O_3;
(4) Hourly averaged NO, true NO_2, and NO_y;
(5) Hourly averaged ambient temperature;
(6) Hourly vector-averaged wind direction;
(7) Hourly vector-averaged wind speed;
(8) Hourly averaged atmospheric pressure;
(9) Hourly averaged relative humidity;
(10) Hourly precipitation;
(11) Hourly averaged mixing-height;
(12) Hourly averaged solar radiation; and
(13) Hourly averaged ultraviolet radiation.

MDE has been granted a waiver from the EPA Region III Administrator to collect the required PAMS measurements at the Essex site in lieu of the HU-Beltsville site in order to maintain the 25-year historical record of O_3 precursor trends collected at the Essex site, located in the Baltimore-Towson, MD CBSA.

MDE adopted the national PAMS Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOP's), with minor modifications. EPA approval was granted on Feb 3, 2021.

With respect to PAMS instrumentation at the Essex site, MDE utilizes the following:

Hourly Speciated VOC's
Hourly averaged speciated VOC's are measured, at a minimum, from June through August with a Markes-Agilent Auto GC.

Carbonyls
Carbonyl sampling is made at a frequency of three 8-hour on a one-in-three day basis from June through August annually using an ATEC Model 8000-2 Eight Channel Automated Carbonyl sampler with co-located independent channel. Samples are analyzed by ERG laboratory services (RTP, NC) using EPA Method TO-11A, as used in the National Air Toxics Trends (NATTS) program.

NO_x
Hourly averaged NO, NO_y and true NO_2 are measured, at a minimum, from June through August. True NO_2 is measured with a Teledyne API Model T500U CAPS NO_2 analyzer. NO and NOy are measured using an API T200U NOy analyzer.

Meteorological Parameters
Hourly averaged temperature, vector-averaged wind speed, vector-averaged wind direction, atmospheric pressure, relative humidity, and precipitation are measured with a Vaisala Model WXT536.

Hourly averaged solar radiation is measured with a Kipp and Zonen SMP3 instrument. Hourly averaged ultraviolet radiation is measured with a Kipp and Zonen SUV-5 instrument. Hourly averaged mixing height is measured with a Viasala Model CL51 ceilometer.

4.8.2 Sources

PAMS VOCs can come from automobiles, gasoline vapors, and a vast variety of large and small commercial, and industrial sources that use chemical solvents, paint thinners and other chemical compounds.

4.8.3 Changes Planned for 2026-2027

No changes planned.

4.8.4 MDE Enhanced Monitoring Plan

EPA developed a Technical Note "Guidance for Photochemical Assessment Monitoring Stations (PAMS) Required Network Implementation Plans and Enhanced Monitoring Plans (EMP's)" that recommended monitoring organizations submit the EMP by July 1, 2018 along with the annual network plan. In addition to the requirements listed in Section 4.8.1, the October 1, 2015 revisions to the PAMS monitoring rule also require states with moderate and above 8-hour O_3 nonattainment areas and states in the O_3 Transport Region to develop and implement an Enhanced Monitoring Plan (EMP) detailing enhanced O_3 and O_3 precursor monitoring activities to be performed. The regulatory requirement for EMP contained in 50CFR58, Appendix D.5(h) states that "the EMP shall be submitted to the EPA Regional Administrator no later than October 1, 2019" for states in the O_3 Transport Region.

MDE has implemented the following measurements as basic elements of the required EMP:

- Year-round O_3 monitoring at Piney Run, Essex, HU-Beltsville, and Horn Point as of 2020.
- Additional VOC measurements at HU-Beltsville, as of June 2019, consisting of eight 3-hour canister samples collected every third day June through August.
- PAMS analysis performed on air toxics canisters collected at HU-Beltsville, Essex, Lake Montebello, and Howard County Near Road.
- Operation of radar wind profilers at Piney Run, HU-Beltsville, and Horn Point as of 2020.

Collection and reporting of these measurements will be contingent on receipt of sufficient additional EPA funding directed specifically towards these EMP activities.

In addition to the activities listed above, MDE is considering the use of low cost sensors to measure O_3 at higher spatial resolution as a means to investigate concentration gradients and spatial variability. MDE is also exploring the possibility of pooling future EMP funding with other states within the OTR. The goal in mind is to develop an OTR-wide approach to special intensive studies possibly utilizing aircraft, Ozonesondes, LIDAR, unmanned aerial vehicles (UAVs), low-cost sensors, and other research measurement platforms.

4.9 Air Toxics – General Description and Sampling Method

Air toxics, or hazardous air pollutants (HAPS), are those pollutants which are known or suspected to cause cancer or other serious health effects, such as reproductive or birth defects, or adverse environmental effects. MDE's air toxics network measures the toxic VOCs listed in Table 3-6. Air toxics samples are collected for 24 hours in canisters with a XonTech 910A or Atec 2200 canister sampler on an every-sixth-day schedule. The canisters are returned to the MDE laboratory for analysis on an Entech/Agilent gas chromatograph mass spectrometer system. Maryland's air toxics monitoring network is shown in Figure 4-8.

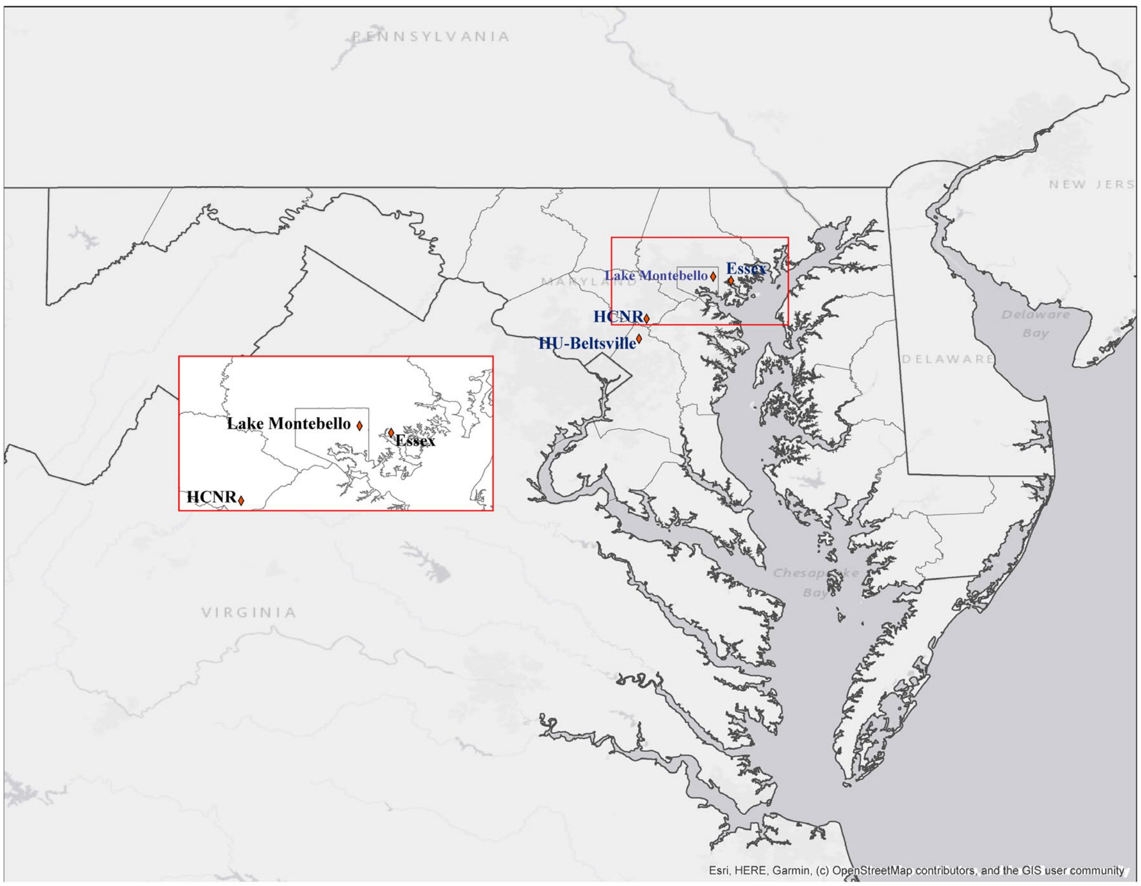

Figure 4-8 Maryland's Air Toxics monitoring network.

4.9.1 Monitoring Requirements

As part of the EPA Region III Cooperative Toxic Monitoring Program, MDE operates four air toxic monitoring stations to assess general urban levels. Toxics are sampled every sixth day year-round.

4.9.2 Monitoring Locations

There are four monitors measuring air toxics in Maryland: Essex, Baltimore County; Lake Montebello, Baltimore City; Howard County Near Road, Howard County; and HU-Beltsville, Prince George's County. Refer to Table 3-2 Monitor Information for Current Maryland Ambient Air Monitoring Sites, for parameter information and monitoring objective at each monitoring site. For a map of monitoring locations in Maryland refer to Figure 3-1.

4.9.3 Sources

Toxics can come from automobiles, gasoline vapors, and a large variety of large and small commercial and industrial sources that use chemical solvents, paint thinners and other chemical compounds.

4.9.4 Changes Planned for 2026-2027

No changes planned.

4.10 NCore – General Description and Sampling Method

NCore, or National Core multi-pollutant monitoring stations, is the National monitoring network required in the October 17, 2006 revisions to the air monitoring regulations (40 CFR, Part 58). NCore sites are required to measure, at a minimum, $PM_{2.5}$ particle mass using continuous and integrated/filter-based samplers, $PM_{10-2.5}$ particle mass, O_3, SO_2, CO, NO/NO_y, wind speed, wind direction, barometric pressure, rain, relative humidity, and ambient temperature.

Sampling methods for $PM_{2.5}$, O_3, SO_2, NO_2, and NO/ NO_y are described under the individual pollutant sections throughout this document. Trace level measurement of CO and SO_2 is performed at NCore sites. $PM_{10-2.5}$ is determined by the difference between collocated PM_{10} and $PM_{2.5}$ FRM samplers. The meteorological parameters (Table 3-4) are measured as follows:

- The Vaisala WXT536 PTU module contains separate sensors for pressure, temperature, and humidity measurements. The measurement principle of the pressure, temperature and humidity sensors is based on an advanced RC oscillator and two reference capacitors against which the capacitance of the sensors is continuously measured. The microprocessor of the transmitter performs compensation for the temperature dependency of the pressure and humidity sensors.
- The Vaisala WXT536 uses RAINCAP Sensor 2- technology in precipitation measurement. The precipitation sensor comprises a steel cover and a piezoelectrical sensor mounted on the bottom surface of the cover. The precipitation sensor detects the impact of individual raindrops. Hence, the signal of each drop can be converted directly to accumulated rainfall. An advanced noise filtering technique is used to filter out signals originating from other sources and not raindrops.
- The Vaisala WXT536 uses WINDCAP sensor technology in wind measurement. The wind sensor has an array of three equally spaced ultrasonic transducers on a horizontal plane. Wind speed and wind directions are determined by measuring the time it takes the ultrasound to travel from each transducer to the other two. The wind sensor measures the transit time (in both directions) along the three paths established by the array of transducers. This transit time depends on the wind speed along the ultrasonic path. For zero wind speed, both the forward and reverse transit times are the same. With wind along the sound path, the up-wind direction transit time increases, and the down-wind transit time decreases.

MDE operates other meteorological parameters not required by the NCore network, and they are measured as follows:

- The Kipp and Zonen SMP3 instrument is used to measure solar radiation at the Piney Run and HU-Beltsville NCore sites, as well as at Essex. It uses a photodiode detector, which creates a voltage output that is proportional to the incoming radiation. Ultraviolet (UV) radiation is measured at Essex using a Kipp and Zonen SUV-5 instrument.

4.10.1 Monitoring Requirements

Each State is required to operate one NCore site. Urban NCore stations are to be located at the urban or neighborhood scale to provide representative concentrations of exposure expected throughout the metropolitan area. Rural NCore stations are to be located to the maximum extent practicable at a regional or larger scale away from any large local emission source so that they represent ambient concentrations over an extensive area.

4.10.2 Monitoring Locations

MDE operates two NCore stations, at HU-Beltsville and Piney Run. The HU-Beltsville site is considered an Urban NCore site and Piney Run, a Rural NCore site. Refer to Table 3-2 for parameter information and monitoring objective at each site. For a map of monitoring locations in Maryland, refer to Figure 4-9.

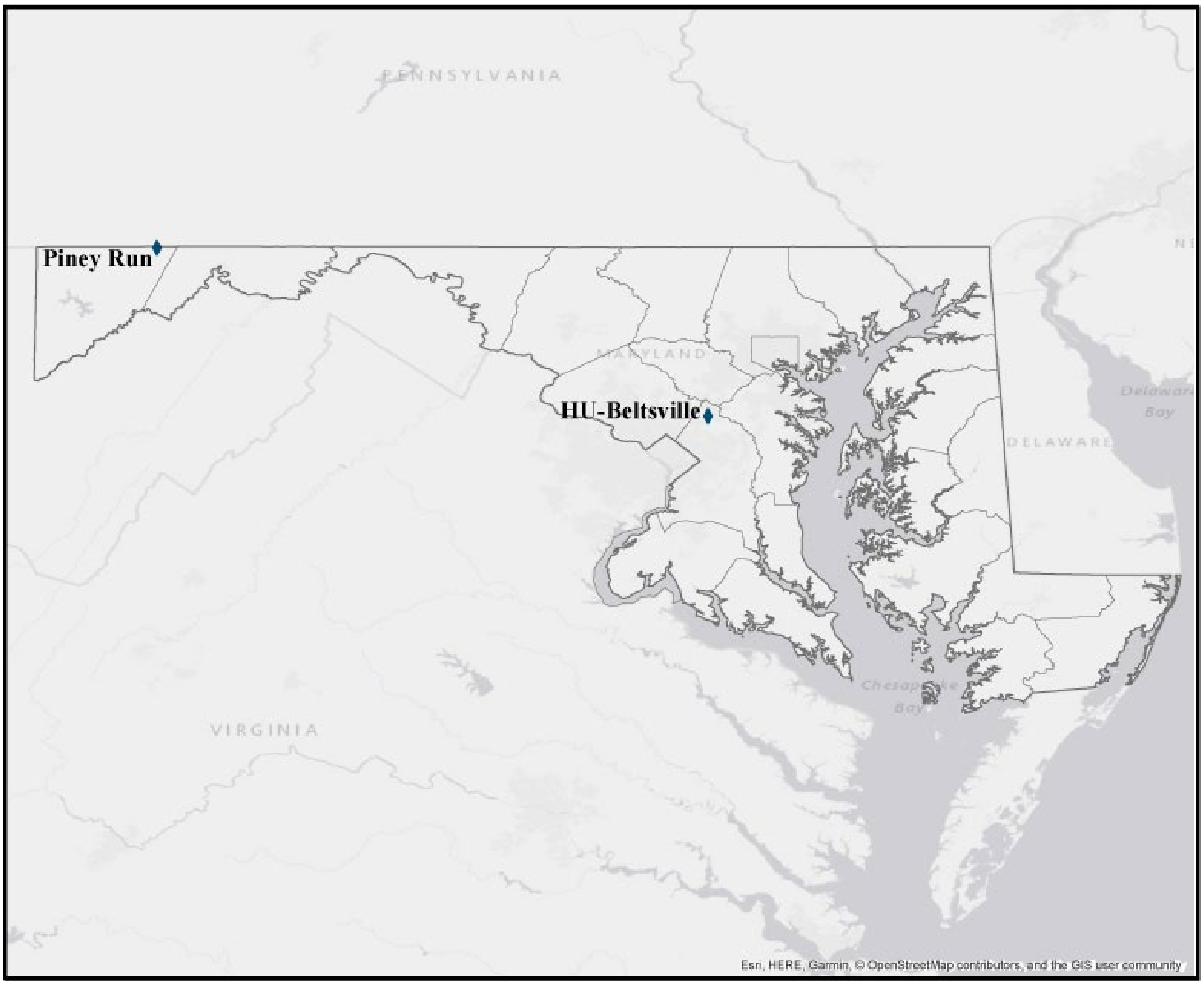

Figure 4-9 Maryland's NCore monitoring network.

4.10.3 Sources

Sources have already been addressed under the individual pollutant sections throughout this document.

4.10.4 Changes Planned for 2026-2027

No changes planned.

APPENDIX A
to the Maryland 2027 Air Monitoring Network Plan

Topographic Map and Areal Maps
with Site Descriptions of Air Monitoring Stations in Maryland

April 14, 2026

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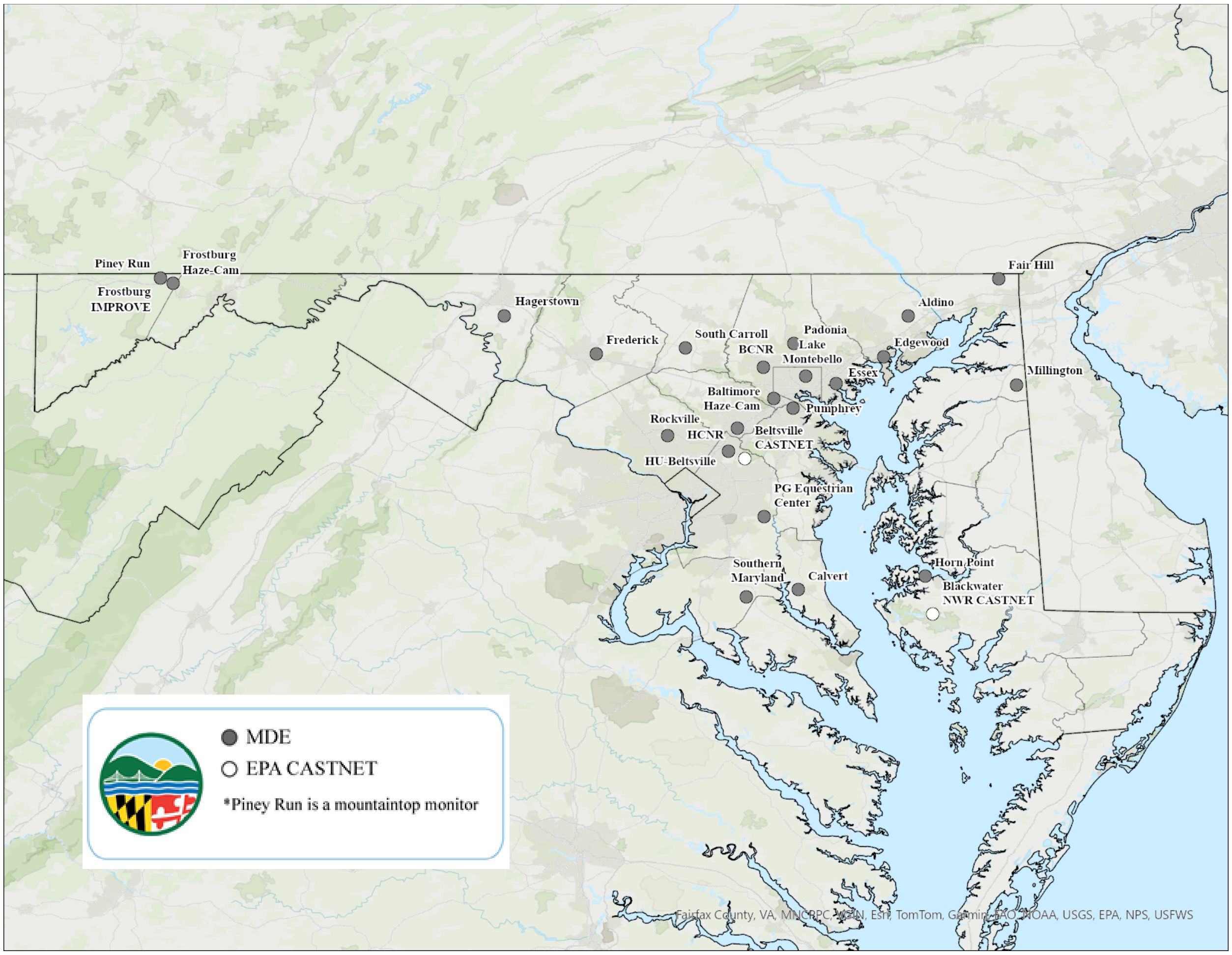

Figure A- 1. Topographic map of air monitoring sites in Maryland.

Figure A- 2. Areal map of Aldino air monitoring site in Harford County, MD.

Aldino was chosen as a seasonal ozone monitoring site because of the potential to measure the highest concentration of ozone at an urban measurement scale in a suburban setting. As a result of construction activities at the airport, the Aldino station needed to be moved a short distance from its original location. Due to a runway reconfiguration, the station was moved approximately 237 meters to the northeast, away from the roadway into a field on the property. There are several small airplanes and several hangars behind the office building. To the south is a large flat grassy field containing a grass/dirt runway and another small hangar. To the west is the end of the runway, a house just past the runway, and the continuation of Aldino Road and the sod farm.

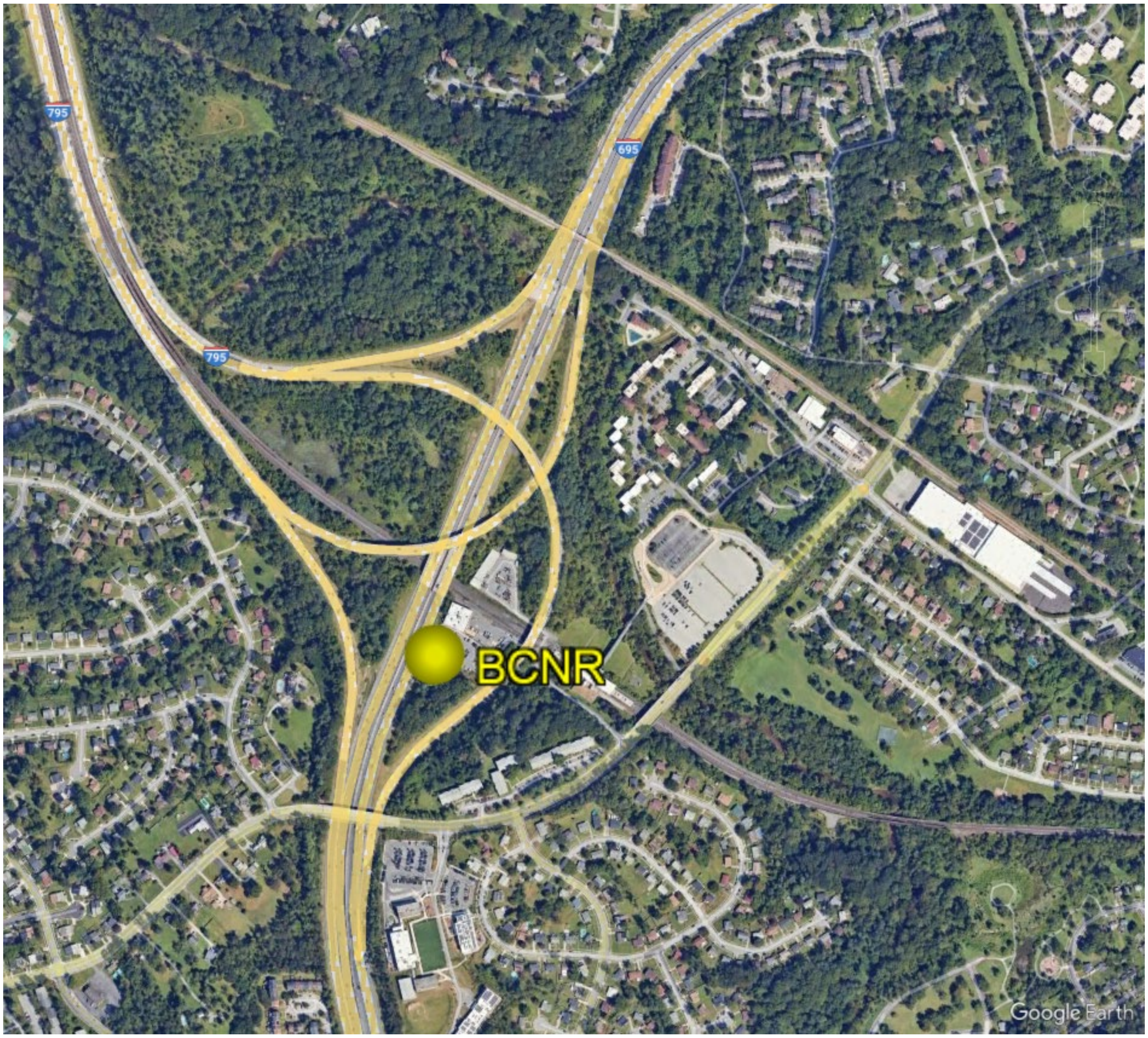

Figure A- 3. Areal map of the Baltimore County Near Road air monitoring site in Baltimore County, MD.

BCNR, located in a suburban setting, was chosen as a site for monitoring air quality near roads, including NO, NO2, and NOx, source-oriented/highest concentration at the microscale. The BCNR site is in the back left corner of a Metro Station parking lot next to a gazebo that is to the left of the site.

Figure A- 4. Areal map of Baltimore Haze Cam site on the University of Maryland Baltimore County (UMBC) campus.

The Baltimore Haze Camera site provides the public notification of visibility in an urban setting. The location provides an excellent vista of downtown Baltimore City.

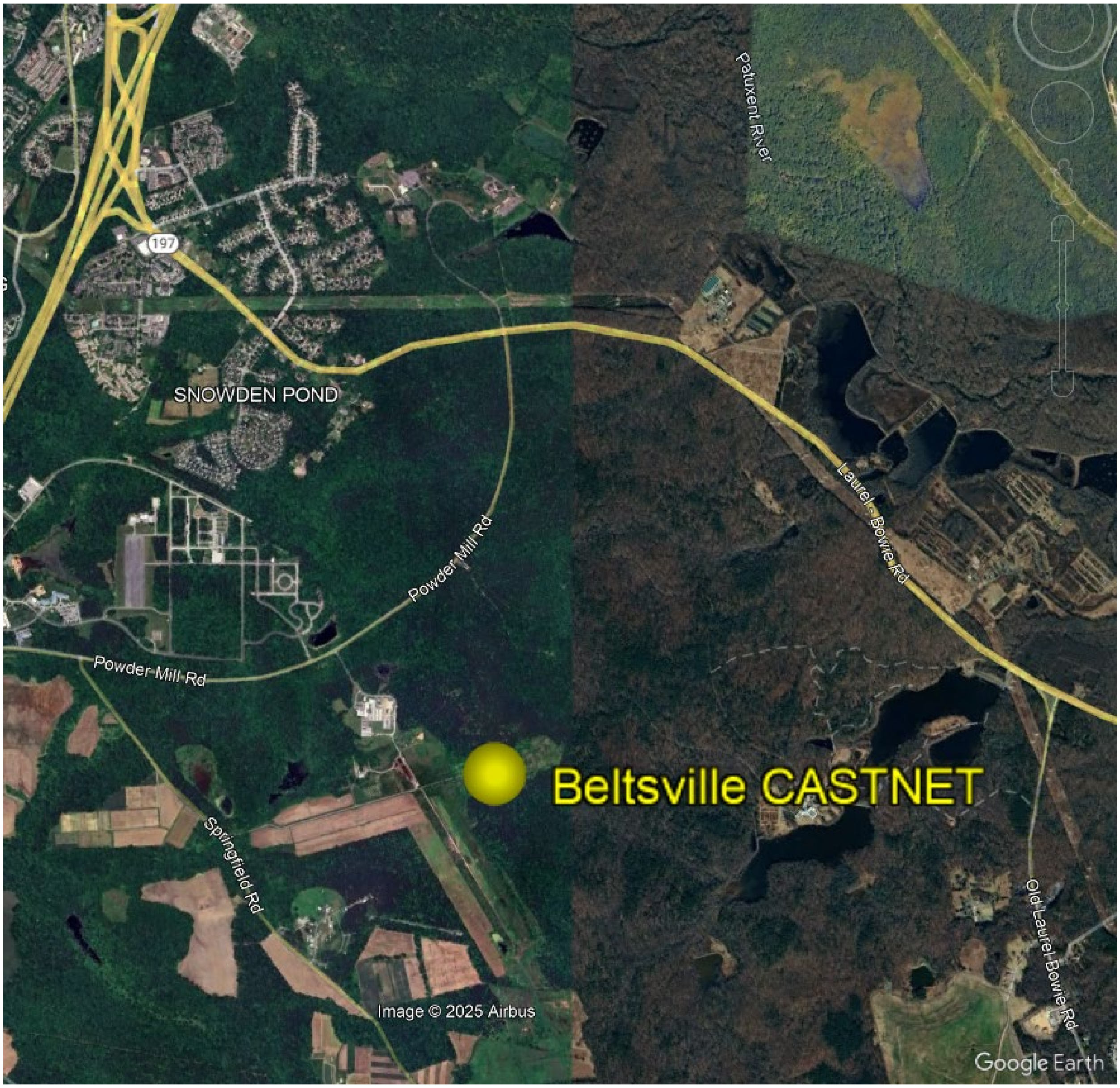

Figure A- 5. Areal map of Beltsville CASTNET air monitoring site in Prince George's County, MD.

Beltsville was chosen as an ozone monitoring site in the CASTNET network because of the potential to measure the highest concentration of ozone at a regional measurement scale.

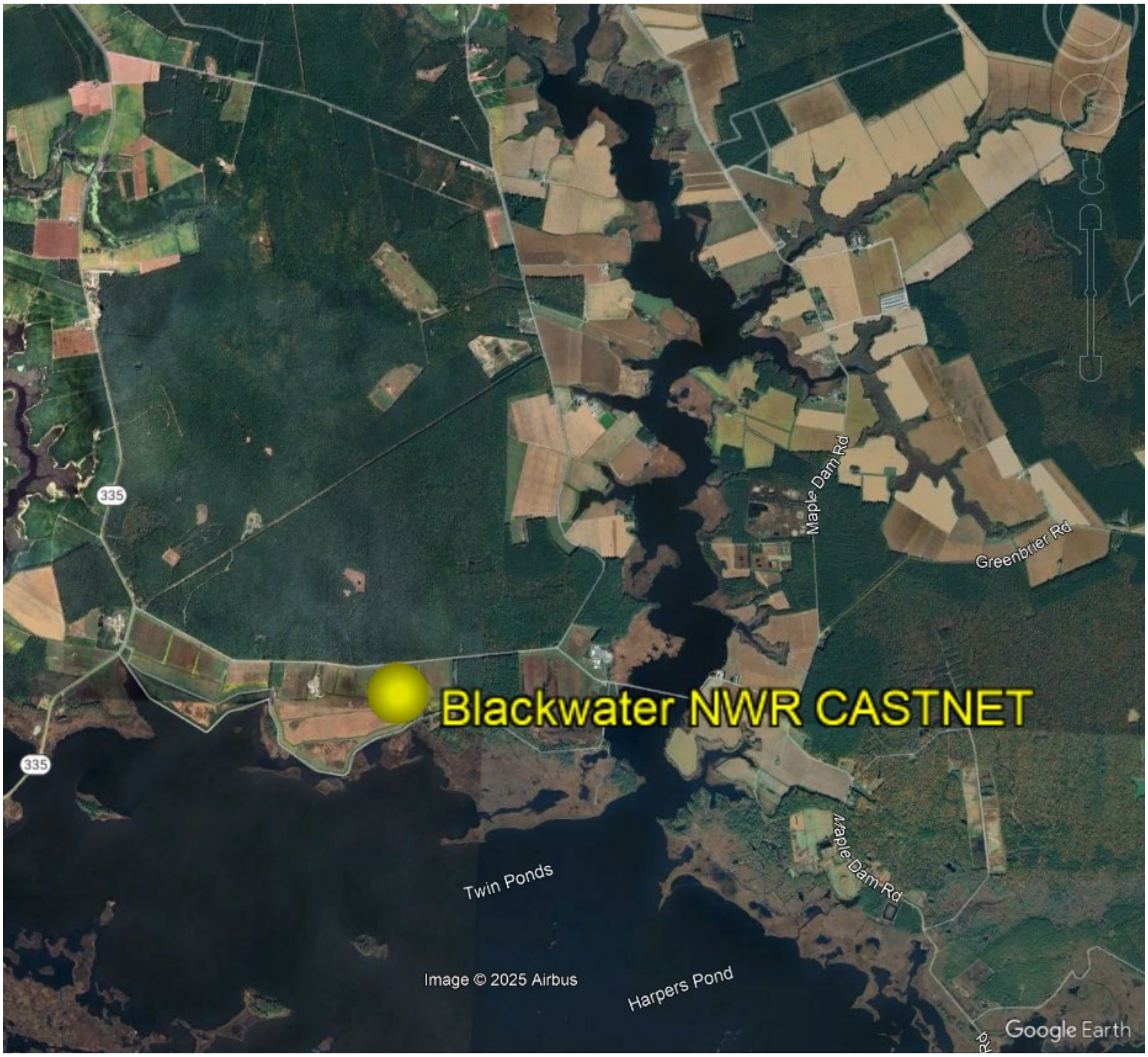

Figure A- 6. Areal map of Blackwater NWR CASTNET air monitoring site in Dorchester County, MD.

Blackwater was chosen as an ozone monitoring site in the CASTNET network because of the potential to measure the highest concentration of ozone at a regional measurement scale.

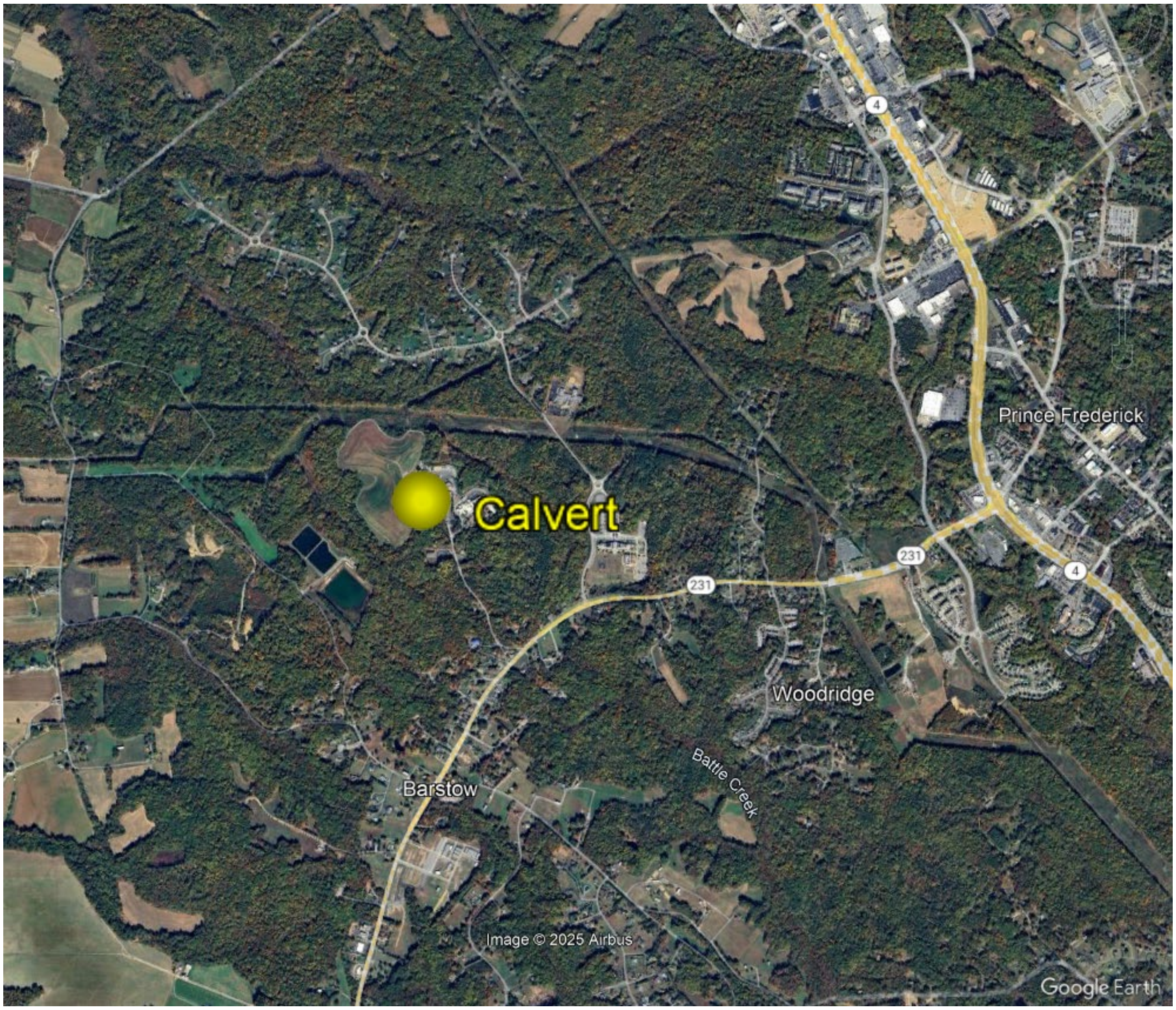

Figure A- 7. Areal map of Calvert air monitoring site in Calvert County, MD.

Calvert was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at the urban measurement scale in a rural setting. The site is located at a recycling facility on a paved parking lot adjacent to a large radio tower that is several hundred feet high.

Figure A- 8. Areal map of Edgewood air monitoring site in Harford County, MD.

Edgewood was chosen as a seasonal ozone monitoring site because of the potential to measure the highest concentration of ozone at the urban measurement scale. It was chosen as a PM2.5 monitoring site because it has the potential to measure population exposure to PM at the neighborhood scale. It is located in a rural setting. The site is located within the Aberdeen Proving Grounds. Adjacent to the site are woods, a few small buildings, and mobile units that the Army uses as storage for their own ambient air monitoring equipment. The site is several miles west of the Chesapeake Bay.

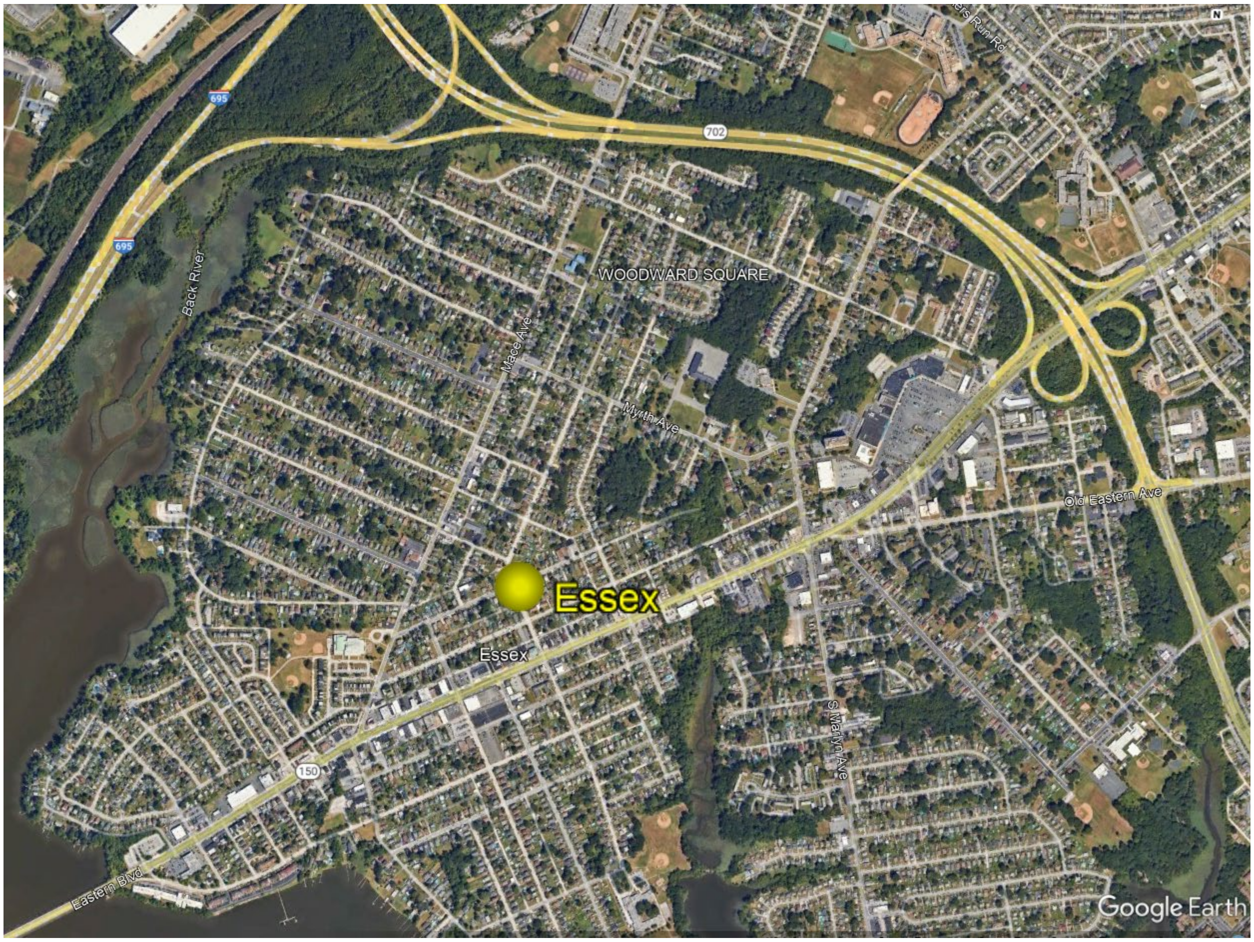

Figure A- 9. Areal map of the Essex air monitoring site in Baltimore County, MD.

Essex, located in a suburban setting, was chosen as a site for monitoring air toxics population exposure at the neighborhood scale; CO highest concentration at the middle scale; NO population exposure and maximum precursor at the neighborhood scale; NOx and NO2 maximum precursor at the neighborhood scale; year-round ozone highest concentration and population exposure at the neighborhood scale; PM2.5 (local conditions and hourly) population exposure at the neighborhood scale; SO2 highest concentration at the neighborhood scale; and Type 2 PAMS VOC's maximum precursor and highest concentration at the neighborhood scale. Essex is located in the parking lot of the Essex Senior Center, two blocks from a four-lane road going through the town. To the north of the monitoring station is a small patch of grass, a sidewalk, and Woodward Road, a two-lane road. To the south and west of the monitoring shelter is parking lot for the senior center, which can hold about 50 cars. The senior center is located just beyond the parking lot. The surrounding area is a neighborhood with one or two-story houses on less than quarter acre lots, power lines, and sparse trees.

Figure A- 10. Areal map of Fair Hill air monitoring site location in Cecil County, MD.

The Fair Hill air monitoring station is approximately 440 meters to the west of the original location, and situated about 24 meters north of Rt. 273, Telegraph Road. The station will continue to be used to measure regional transport of ozone at the urban measurement scale, and general/background $PM_{2.5}$ at the regional scale, in a rural setting.

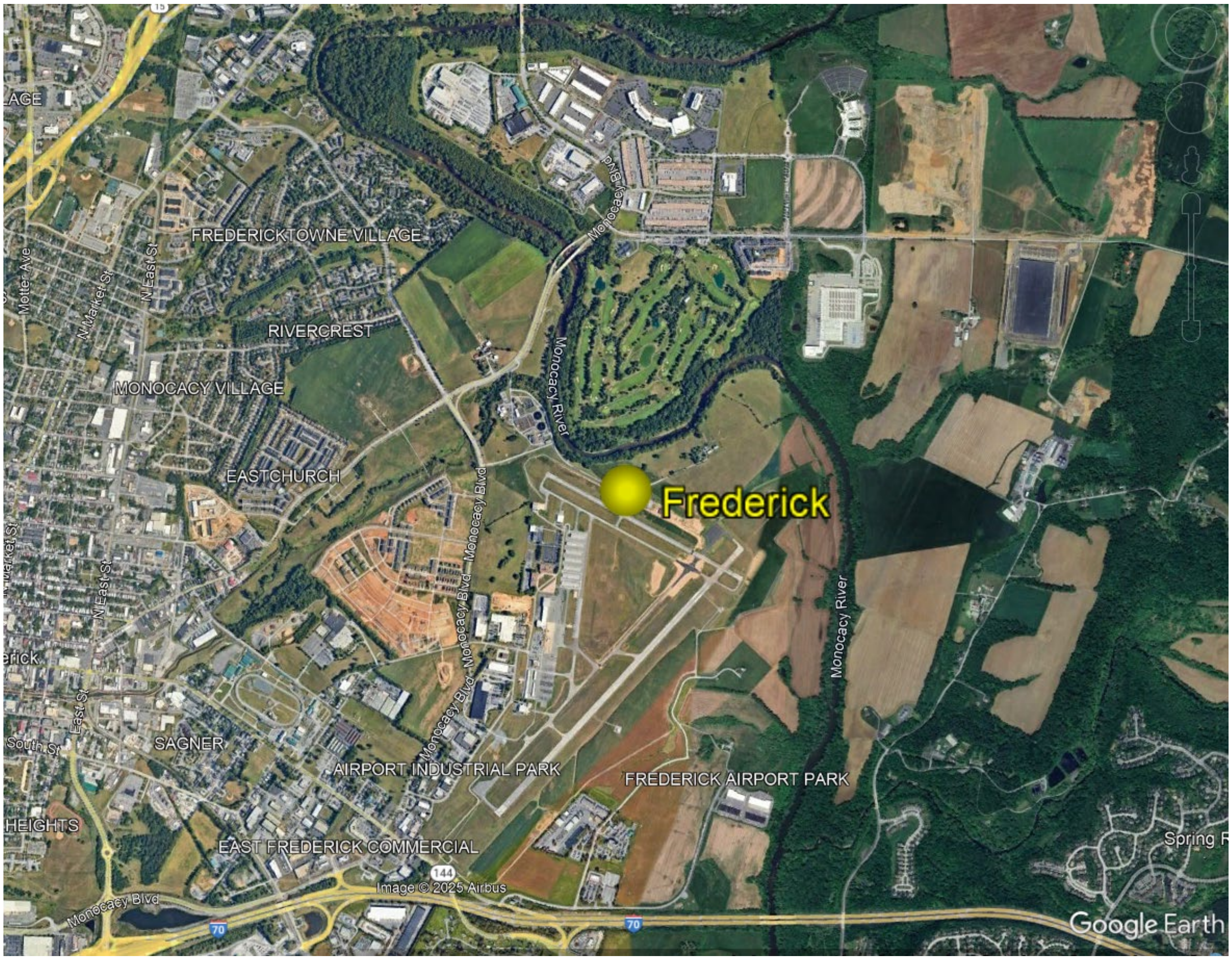

Figure A- 11. Areal map of Frederick Airport air monitoring site in Frederick County, MD.

Frederick was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at an urban measurement scale in a suburban setting. The Frederick trailer sits off to the side of a road that passes through a Wastewater Treatment Facility. The trailer sits a few feet from a building and airplanes can frequently be observed taking off from the airport in the distance.

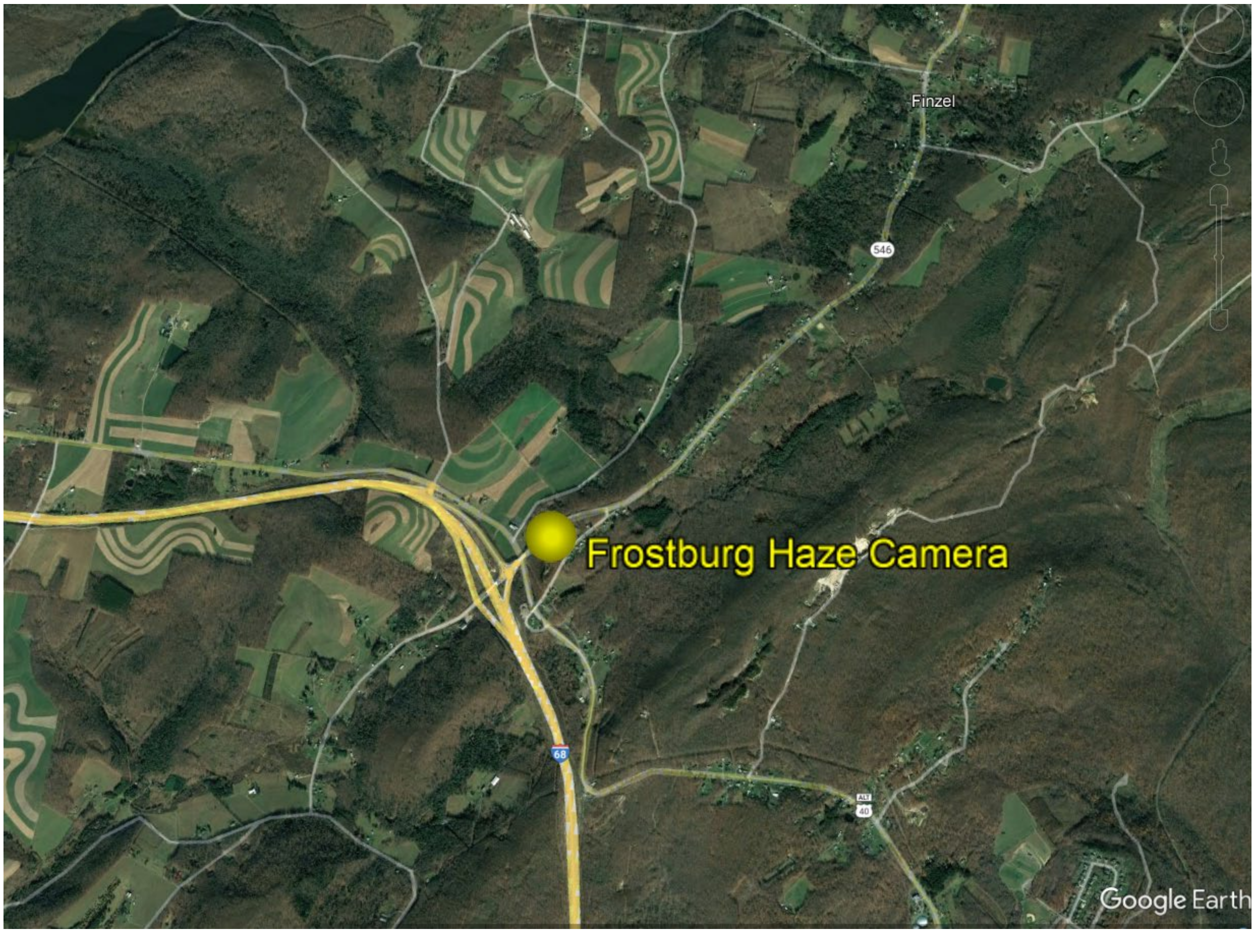

Figure A- 12. Areal map of Frostburg Haze Cam site in Garrett County, MD.

Frostburg was chosen as a Haze Cam site for the purpose of providing public notification of visibility in a rural setting. The location provides a view of the Piney Run air monitoring station.

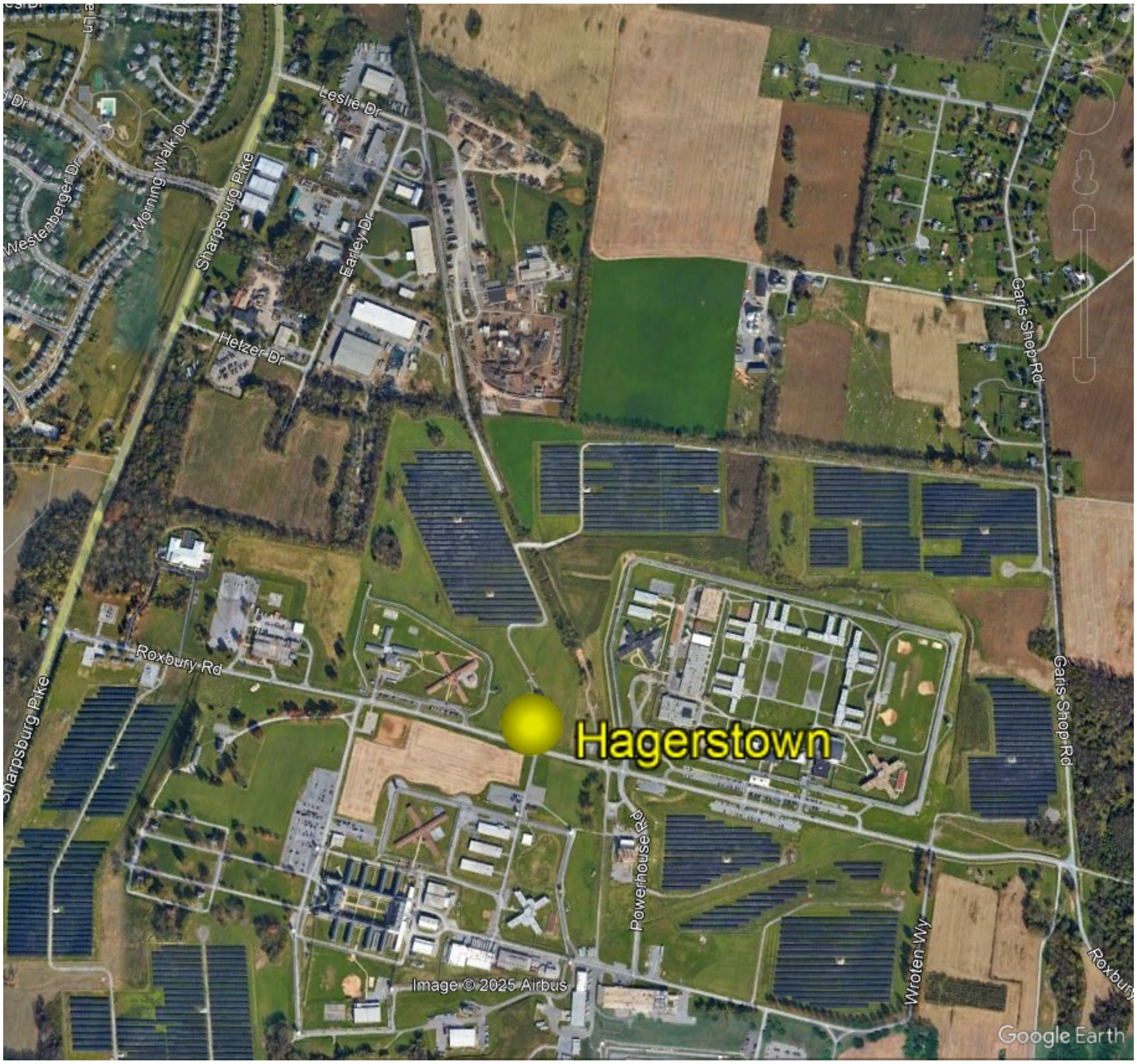

Figure A- 13. Areal map of Hagerstown air monitoring site in Washington County, MD.

Hagerstown was chosen as a seasonal ozone monitoring site because of the potential to measure the highest concentration and population exposure of ozone at the urban scale. It was chosen as a PM2.5 monitoring site because of the potential to measure population exposure to PM2.5 at the urban scale. It is located in a rural setting. The Hagerstown trailer sits right by a blue water tower on rolling hills a few hundred feet from a correctional facility. You can see two parking lots - one lot that is passed to get to the trailer and one lot that is across the road from the trailer.

Figure A- 14. Areal map of the Horn Point air monitoring site in Dorchester County, MD.

Horn Point, located in a rural setting, was chosen as a site for monitoring CO population exposure at the regional scale; NO population exposure at the regional scale; NOy-NO population exposure at the regional scale; year-round ozone population exposure at the regional scale; PM2.5 (hourly) population exposure at the regional scale; Reactive oxides of Nitrogen (NOy) population exposure at the regional scale; and SO2 population exposure at the regional scale. The site is located on the lower eastern shore and sits in an open field with pine trees in the distance surrounding the site. The University of Maryland Center for Environmental and Estuarine Studies is next door to the site.

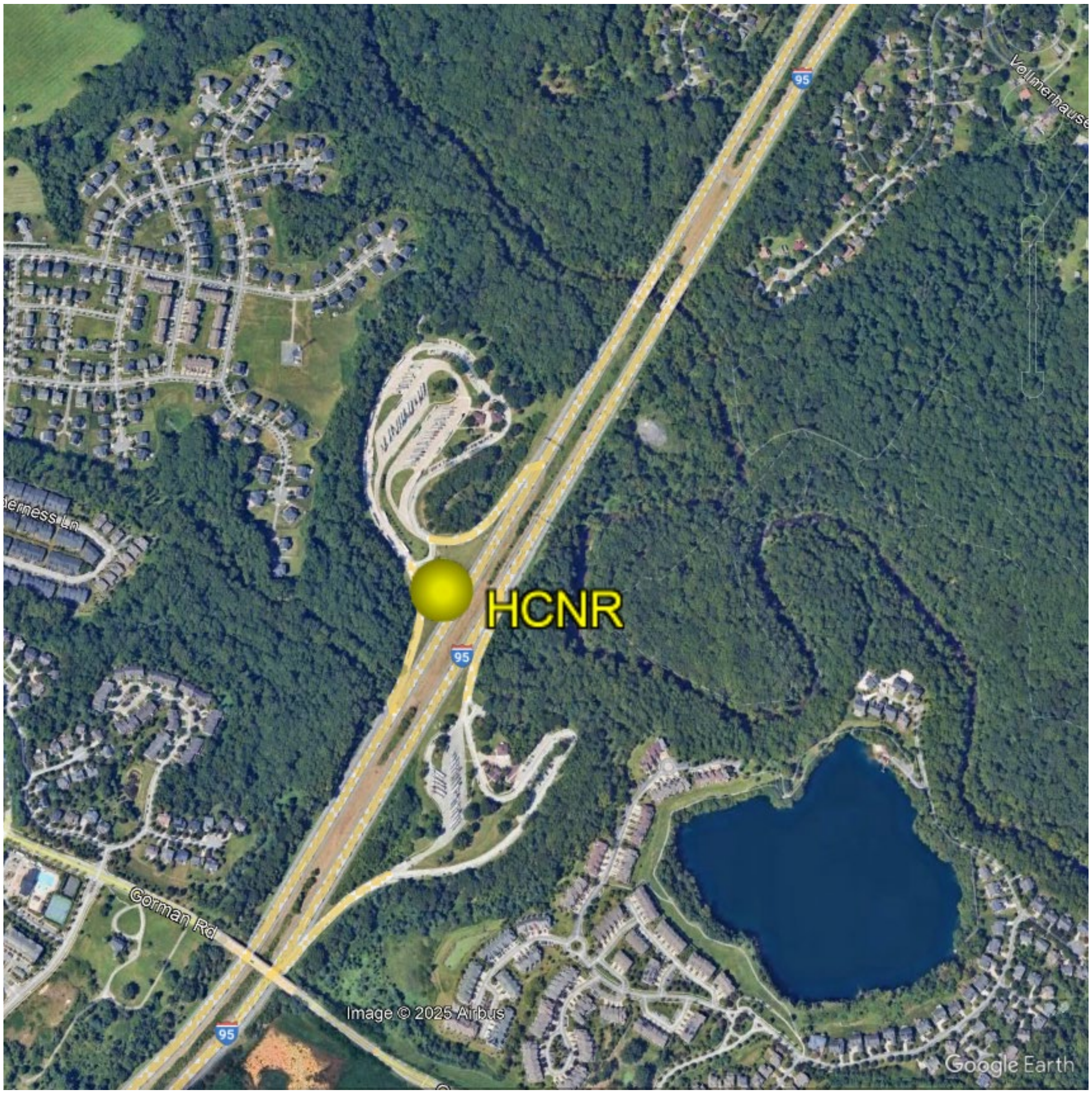

Figure A- 15. Areal map of the Howard County Near Road air monitoring site in Howard County, MD.

HCNR, located in a suburban setting, was chosen as a site for monitoring air quality near roads, including air toxics, CO, NO, NO2, NOx, and $PM_{2.5}$ source-oriented/highest concentration at the microscale. To the north of the Howard County Near Road monitoring site is a small grassy area with a few trees along with a gravel access road and the Rest Stop just beyond. The Rest Stop accommodates many tractor trailers and cars. To the east the grassy patch continues and acts as storm water management for the parking area and just beyond is the on-ramp to access the parking area. To the south just behind the trailer is interstate 95 spanning 8 lanes with a good size grass median. On the far side of the road is the rest stop for north bound traffic. To the west the interstate continues and is joined by the exit ramp from the rest area. There are trees and woods on the far side of the exit ramp.

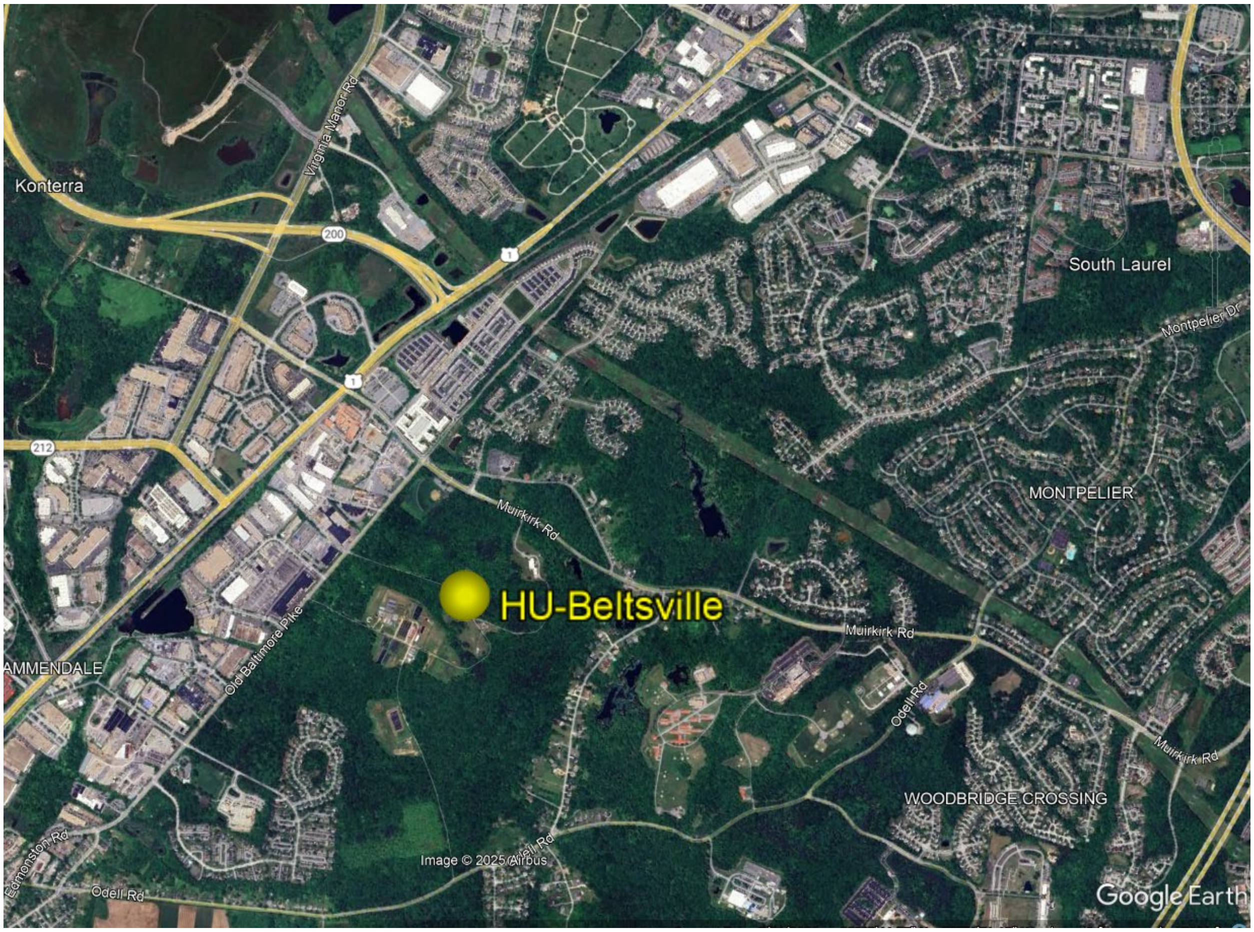

Figure A- 16. Areal map of HU-Beltsville air monitoring site in Prince George's County, MD.

HU-Beltsville, an NCore station located in a suburban setting, was chosen as a site for monitoring air toxics population exposure at the neighborhood scale; CO, NO, NO2, NOy-NO, NOx, and NOy general/background at the urban scale; year-round ozone highest concentration and population exposure at the urban scale; PM population exposure at the urban scale for PM2.5 and neighborhood scale for PM10; SO2 general/background at the urban scale; and Type 3 PAMS VOC's upwind/background at the urban scale. The site is in an open yard surrounded by trees.

Figure A- 17. Areal map of Lake Montebello air monitoring site in Baltimore City, MD.

Lake Montebello, located in an urban setting, was chosen as a site for monitoring O_3 and air toxics population exposure at the neighborhood scale, and CO, NO, NO_2, NO_x, and $PM_{2.5}$ highest concentration at the Neighborhood scale. The Lake Montebello trailer sits on property owned and used by Baltimore City Department of Public Works, at the Lake Montebello Water Treatment facility. This new site combines the monitoring objectives of the now-closed Furley and Oldtown sites.

Figure A- 18. Areal map of Millington air monitoring site in Kent County, MD.

Millington was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at the urban scale. It was chosen as a PM2.5 monitoring site because it has the potential to measure population exposure to PM2.5 at the Urban scale. It is located in a rural setting. The site is located on the upper eastern shore in a wildlife management area and is adjacent to fields and woods. A few hundred yards away is a small-use airport.

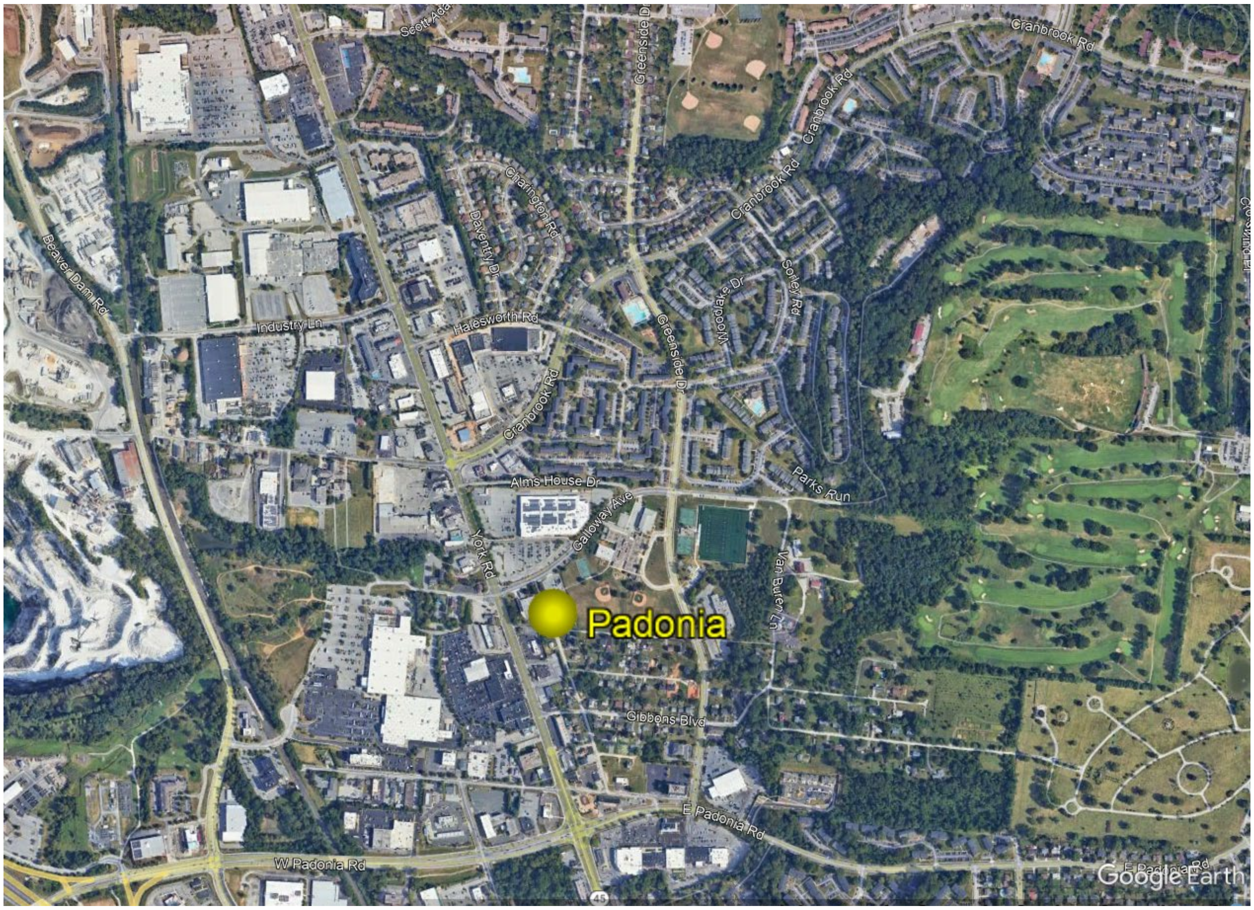

Figure A- 19. Areal map of Padonia air monitoring site in Baltimore County, MD.

Padonia was chosen as a seasonal ozone and PM2.5 monitoring site because of the potential to measure the population exposure of ozone and PM2.5 at the neighborhood scale. It is located in a suburban setting. The Padonia trailer was on an elementary school grounds near a small parking lot until March 1, 2017, when MDE was forced by the school to remove it due to construction activities. The station was restarted at the new location on December 15, 2017. There is a gravel pit, a landfill, and a spice company all off Beaver Dam Road, to the west and slightly north of the site.

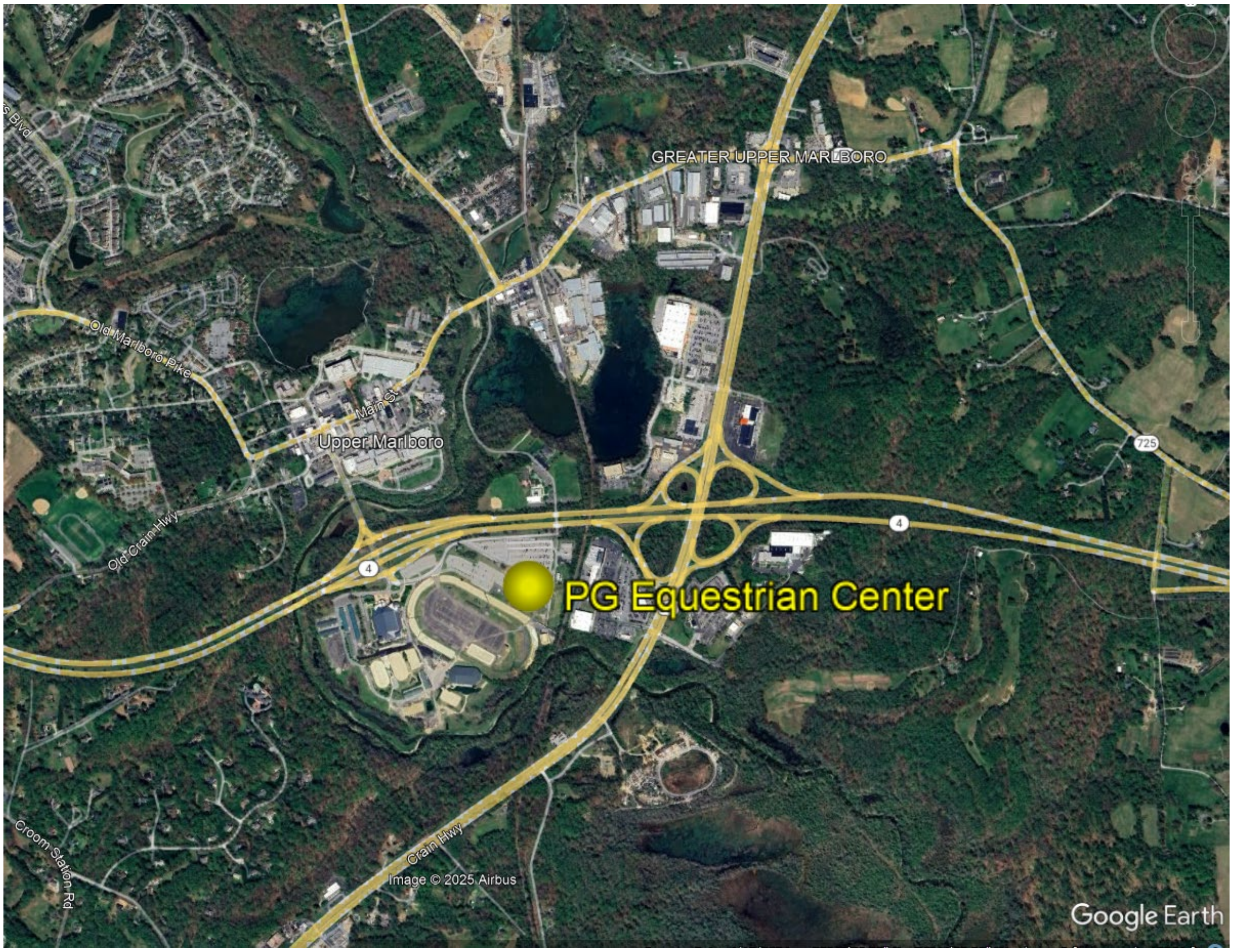

Figure A- 20. Areal map of PG Equestrian Center air monitoring site in Prince George's County, MD.

PG Equestrian Center was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at the urban scale. It was chosen as a PM2.5 monitoring site because it has the potential to measure population exposure to PM2.5 at the neighborhood scale. It is located in a rural setting. The site sits in the parking lot of the Ranger office. Surrounding the site are parking lots and a horse track.

Figure A- 21. Areal map of Piney Run air monitoring site in Garrett County, MD.

Piney Run, an NCore station located in a rural setting, is located on a mountain top at an elevation of 777 meters (2,548 feet). It was chosen as a site for monitoring year-round ozone, CO, NO, NO2, NOy-NO, NOx, NOy, SO2, and PM2.5 regional transport at the regional scale.

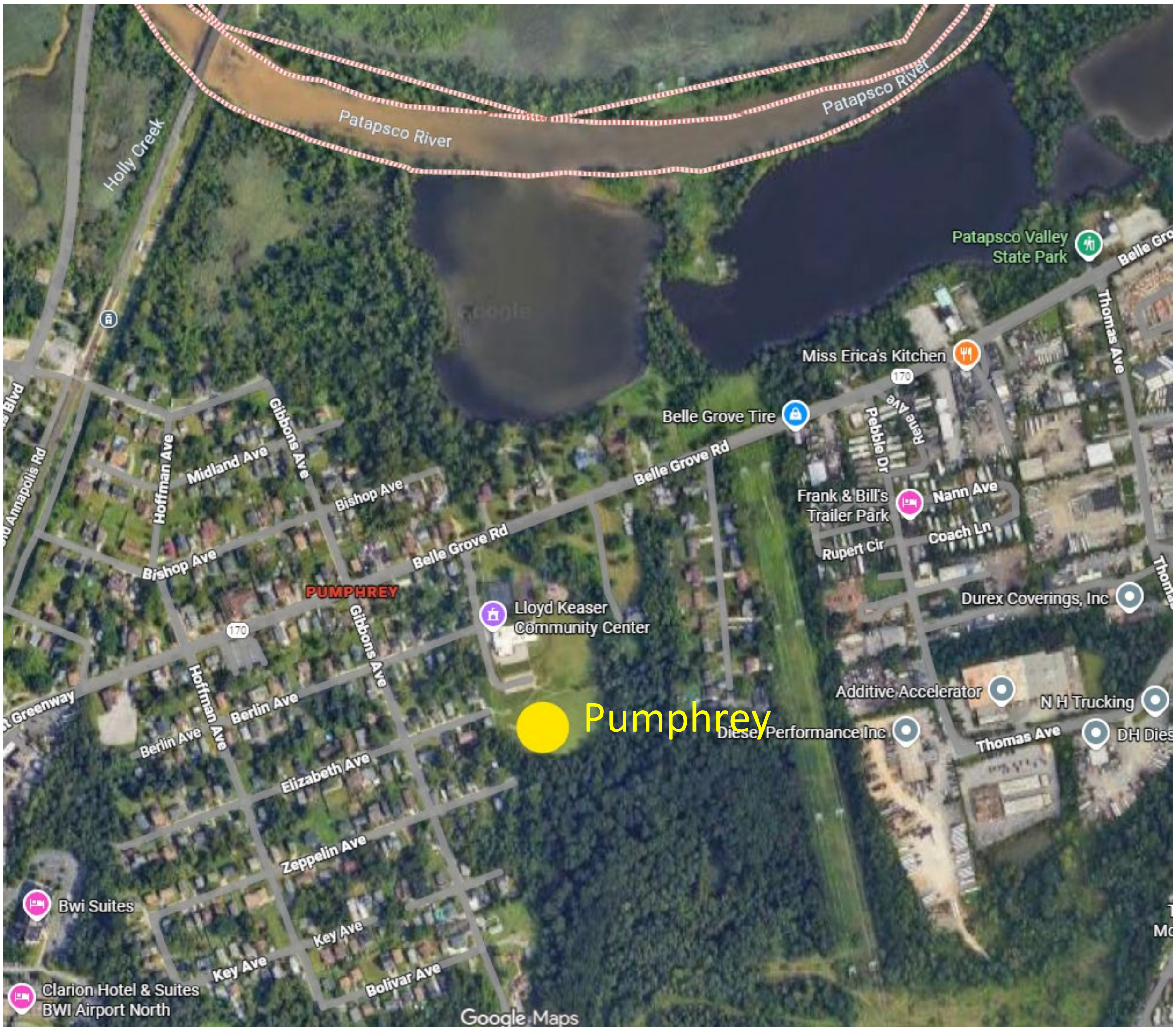

Figure A- 22 Areal map of Pumphrey air monitoring site in Anne Arundel County, MD.

Pumphrey is the new name given to Brooklyn Park, which recently replaced Glen Burnie. This site was established April 1, 2021. Seasonal ozone and PM_{10} are measured to characterize Population Exposure at the Neighborhood scale in a Suburban setting.

Figure A- 23. Areal map of Rockville air monitoring site in Montgomery County, MD.

Rockville was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at the urban measurement scale. It was chosen as a PM2.5 monitoring site because it has the potential to measure population exposure to PM at the neighborhood scale. It is located in a rural setting. The station will be moved about 37 feet (11 meters) to the south by the end of June. Five trees were removed to prevent any obstruction of the inlet prior to the beginning of the 2018 Ozone Season, in accordance with 40 CFR Part 58, Appendix E siting criteria.

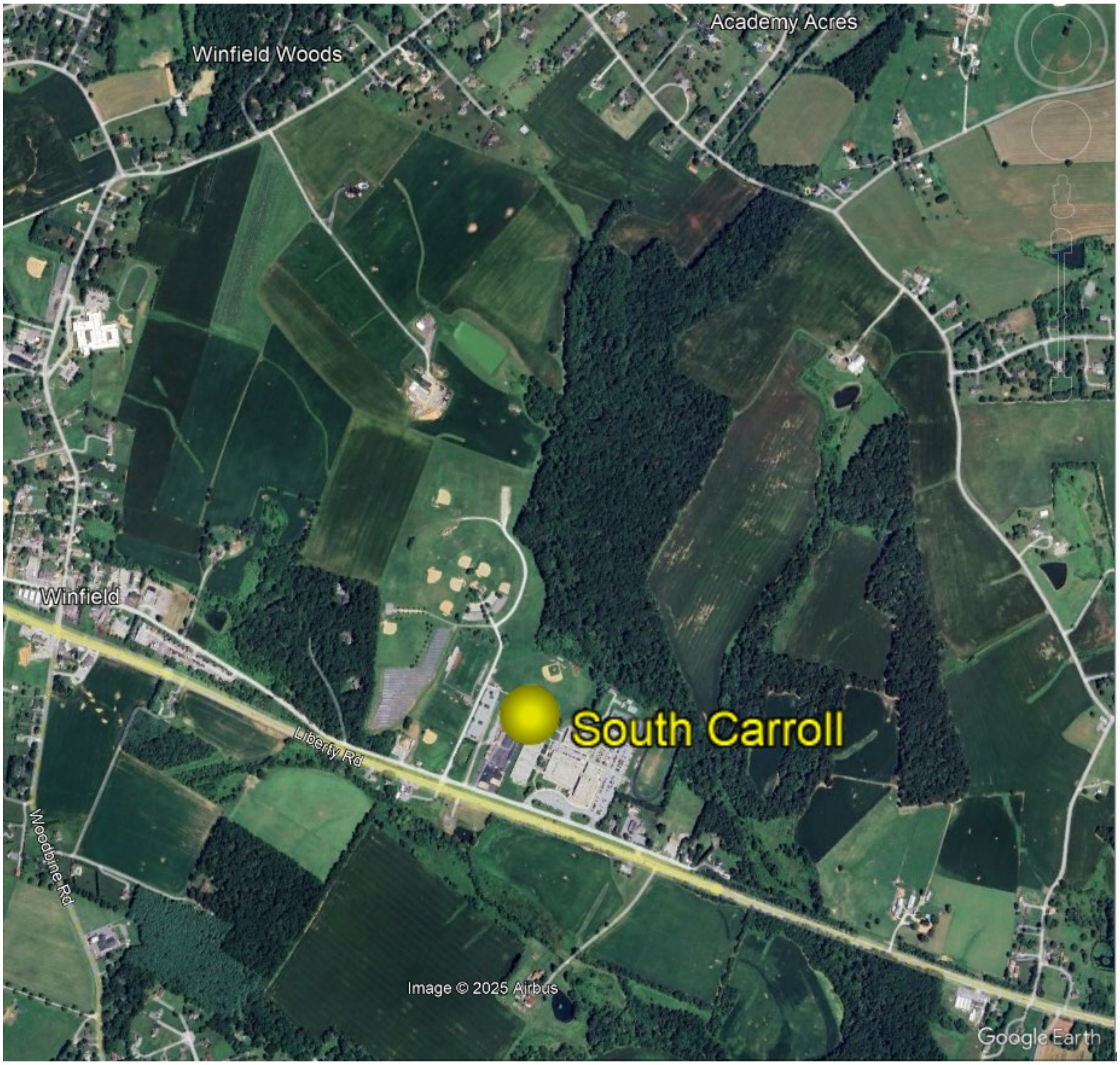

Figure A- 24. Areal map of South Carroll air monitoring site in Carroll County, MD.

South Carroll was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at the urban measurement scale. It is located in a rural setting. The South Carroll trailer sits a few yards from South Carroll High School on the grounds of the school. There is a fence right alongside the trailer as well as ball playing fields within sight of the trailer.

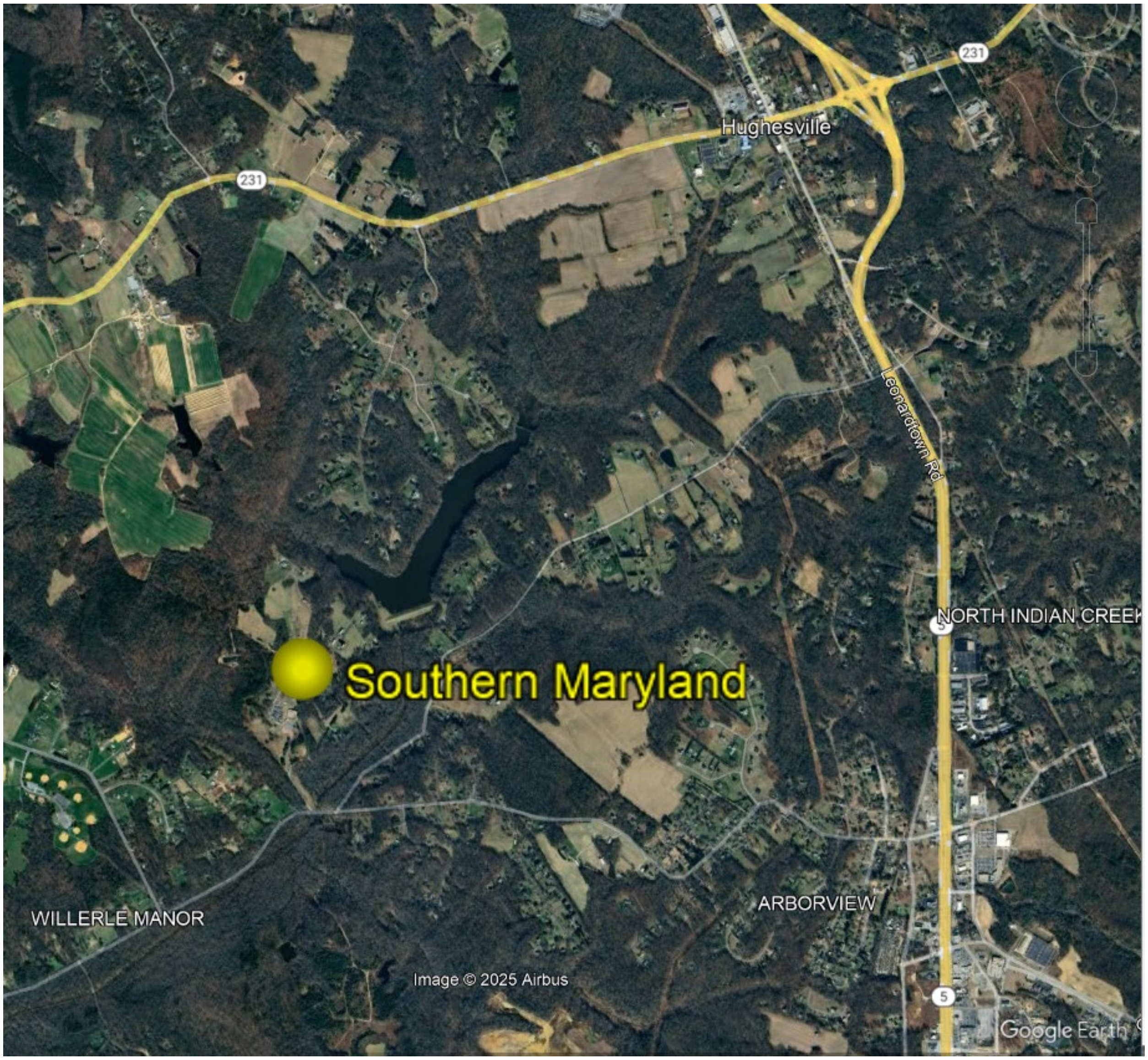

Figure A- 25. Areal map of Southern Maryland air monitoring site in Charles County, MD.

Southern Maryland was chosen as a seasonal ozone monitoring site because of the potential to measure the general background ozone at the regional measurement scale. It is located in a rural setting. This site is our most southern site and is located in the yard of a pre-release prison surrounded by fields and woods.