Michigan's 2021
Annual Ambient Air Monitoring
Network Review

July 1, 2020

Department of Environment, Great Lakes, and Energy
Air Quality Division
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INTRODUCTION

The purpose of this document is to examine Michigan's ambient air monitoring network and recommend changes based on monitor history, population distribution, and modifications to federal monitoring requirements under the Clean Air Act (CAA), Title 40 of the Code of Federal Regulations (CFR) Part 58. Recommended changes to this network will be implemented during the 2021 calendar year, contingent upon adequate levels of funding.

Network Review Goals

The Michigan Ambient Air Monitoring Network Review will describe the ambient air monitoring network, show how the network meets the United States Environmental Protection Agency's (USEPA) monitoring regulations, discuss the public comment procedure, summarize recent changes to the network, and address potential impacts of other actions in greater detail. All discussions of air monitors reference a unique nine-digit site identification code to remove all ambiguity regarding the monitor location.

Federal Changes

Historically, there have been a number of changes at the federal level that have impacted the design of Michigan's monitoring network. These changes include revisions to the National Ambient Air Quality Standards (NAAQS) for Lead (Pb), Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), secondary NAAQS for NO_2 and SO_2, Particulate Matter (PM), and Ozone. Changes or revisions in the ambient air monitoring rules made by the USEPA can be found in 40 CFR Part 58, which contains the ambient air monitoring requirements for all criteria pollutants. [1]

Historic Changes

Lead: On November 12, 2008, the USEPA modified, strengthened and reduced the primary health-based lead NAAQS from a maximum quarterly average of 1.5 µg/m^3 to a 3-month rolling average of 0.15 µg/m^3.

Sulfur Dioxide: On November 16, 2009, the USEPA proposed to modify the SO_2 NAAQS and proposed the creation of a two-tier monitoring network based on SO_2 emissions, requiring a total of 12 SO_2 stations in Michigan. The SO_2 NAAQS became final on August 23, 2010. The network design was modified to a single tier requiring a total of five SO_2 monitors in Michigan. Changes to the SO_2 monitoring network are discussed in this Network Review and were required to be implemented before January 1, 2013.

[1] https://www.federalregister.gov/documents/2020/01/08/2019-28219/extension-of-start-date-for-revised-photochemical-assessment-monitoring-stations

On February 12, 2010, a secondary NAAQS for SO_2 was proposed and the final rule was effective June 4, 2012. The USEPA chose to retain the standards while adding additional monitoring requirements.

Nitrogen Dioxide: On February 9, 2010, the USEPA changed the NO_2 NAAQS and required deployment of a two-tiered NO_2 monitoring network consisting of near-roadway and community monitors. Design of the new NO_2 monitoring network is discussed in this Network Review. These NO_2 monitors had a deployment deadline of January 1, 2013.

On February 12, 2010, a secondary NAAQS for NO_2 was proposed, and the final rule was effective June 4, 2012. The USEPA chose to retain the standards while adding additional monitoring requirements.

On December 22, 2016, the USEPA finalized the rule to remove the requirement of tier III near-road NO_2 monitors.

Carbon Monoxide: On August 13, 2011, the USEPA proposed to retain the CO NAAQS level while adding additional monitoring requirements. The USEPA proposed that CO monitors be added to the near-roadway sites. These CO monitors had a deployment deadline of January 1, 2014.

Particulate Matter: The USEPA revised and lowered the $PM_{2.5}$ annual average NAAQS to 12.0 $\mu g/m^3$ which was effective March 18, 2013.

Ozone: Effective October 26, 2015, the USEPA revised and strengthened the 8-hour ozone NAAQS to 0.070 parts per million (ppm).

Recent Changes

Ozone: Effective December 20, 2019, the USEPA extended the start date for the required Photochemical Assessment Monitoring Station (PAMS) sites from June 1, 2019, to June 1, 2021. This extension was made to give states more time to acquire the necessary equipment and expertise needed to successfully make the required PAMS measurements. The PAMS network is designed to evaluate precursor compounds that contribute to the formation of ozone.

Changes and Recommendations for Michigan's Air Monitoring Network in 2020-2021

The following changes will be made to Michigan's ambient air monitoring network during 2020-2021. If funding cuts occur, additional changes to the network may need to be implemented.

Lead and Metals: Lead sampling at National Core (NCore) sites is no longer required. The Michigan Department of Environment, Great Lakes, and Energy (EGLE) shut down the metal samplers at Allen Park (26163001) and Grand Rapids (260810020) on January 1, 2020.

$PM_{2.5}$ Continuous FEM: In 2020-2021 EGLE intends to continue to install Federal Equivalent Method (FEM) continuous $PM_{2.5}$ monitors to transition from a filter-based network, which provides real-time data, and reduces laboratory and labor costs. EGLE will add MetOne Beta Attenuation Monitor (BAMs), Teledyne T640/T640X at the following sites to replace either a High vol PM_{10} $PM_{2.5}$ Federal Reference Method (FRM), $PM_{2.5}$ continuous TEOM (tapered element oscillating microbalance) or a Thermo BAM () in 2020-2021:

- Lansing (260650018) T640 will replace a TEOM
- Kalamazoo (260770008) T640 will replace FRM(s) and TEOM
- Grand Rapids (260810020) (**NCore**) **T640X** will replace low vol PM10 (PMc), TEOM, and high vol PM_{10}
- Grand Rapids (new near-road site to be set up in 2020) will have a new MetOne BAM
- New Haven (260990009) T640 will replace FRM
- Jenison (261390005) **T640X** will replace FRM and High Vol PM_{10}
- Port Huron (261470005) T640 will replace FRM and TEOM
- Seney (261530001) MetOne BAM replaced the Thermo BAM in March 2020
- Allen Park (261630001) (**NCore**) **T640X** will replace low vol PM10 (PMcoarse), TEOM, and high vol PM_{10})
- Southwest High School (261630015) T640 will replace Thermo BAM
- Detroit Police 4th Precinct (261630098) T640 will replace Thermo BAM
- Trinity St. Marks (261630099) T640 will replace Thermo BAM, and
- Military Park (261630100) T640 will replace Thermo BAM

Continuous $PM_{2.5}$ TEOMs: Tapered Element Oscillating Microbalance Monitors (TEOMs) are used to display data for public notification. These are not regulatory monitors. Sites listed below will be shut down and replaced with the FEM continuous $PM_{2.5}$ Teledyne T640/T640X:

- Lansing (260650018) will be replaced with T640
- Kalamazoo (260770008) will be replaced withT640
- Grand Rapids (260810020) will be replaced withT640X
- Port Huron (261470005) will be replaced withT640
- Allen Park (261630001) will be replaced withT640X

$PM_{2.5}$ FRM: In 2021 EGLE intends to run the following $PM_{2.5}$ filter-based FRM samplers at the following sites, some will be co-located:

- Flint (260490021) method co-location for MetOne BAM
- Lansing (260650018) method co-location for T640
- Grand Rapids (26081020) (NCore, required for speciation) could qualify as a method co-location for T640X
- Manistee (261010922) Tribal site
- Oak Park (261250001)
- Ypsilanti (261610008) method co-location for Thermo BAM

- Allen Park (261630001) (NCore, required for speciation) could qualify as a method co-location for T640**X**
- SWHS (261630015) design value close to the NAAQS standard
- Dearborn (261630033) design value close to the NAAQS standard and the co-located FRM site

In accordance with 40 CFR Part 58, Appendix A, the number of required co-located sites is 15 percent of the network. Reduction in the filter-based samplers reduces the required number of co-located monitors. With this reduction, only one co-located site is required and EGLE proposes to keep the co-located FRM monitor at the Dearborn (261630033) site.

PAMS Sites: Based on 40 CFR Part 58, Appendix D, EGLE is required to begin making Photochemical Assessment Monitoring Station (PAMS) measurements June 1 through August 31, at NCore sites located in Core-based Statistical Areas (CBSAs) with populations of one million or more. The purpose of the PAMS network is to evaluate ozone precursor compounds. Based on communications with the USEPA, equipment necessary to begin making PAMS measurements were to be purchased and delivered prior to the start of the PAMS season in 2019. Due to contract delays, the necessary equipment was not delivered in time to begin making PAMS measurements on June 1, 2019. The USEPA has extended the start date to June 1, 2021.

EGLE will have two NCore sites begin making PAMS measurements June 1, 2021 contingent on receiving adequate federal funding and equipment provided through the national purchasing contract.

The parameters for PAMS include ozone, volatile organic compounds (VOCs) by auto-gas chromatograph (GC), direct-NO_2, reactive oxides of nitrogen (NO_Y), carbonyls (3-8 hour samples every three days), mixing height using ceilometer, solar radiation, ultraviolet (UV) radiation, precipitation, wind speed, wind direction, relative humidity, barometric pressure, and temperature.

EGLE has two NCore sites; Grand Rapids (260810020) and Allen Park (261630001). As requested during the previous network review process, the Detroit PAMS station will be operated at the E 7 Mile (261630019) site rather than the NCore station at Allen Park (261630001). The USEPA approved the waiver for an alternate location on October 4, 2018.

In January 2019, EGLE added an NO_2 monitor at the Jenison site (261390005) to fulfil the population-based NO_2 area-wide requirement in the Grand Rapids area. When the direct NO_2 measurement is added to the Grand Rapids NCore site for PAMS, the Jenison monitor may be discontinued.

Other: Contingent upon approval from the USEPA in 2020-2021 EGLE plans to shut down the following two sites:

- Sterling State Park (261150006) SO_2 monitor
- West Olive (261390011) SO_2 monitor

EGLE is in the process of setting up two new near-road sites to begin operating in 2020-2021. Parameters to be sampled will be carbon monoxide (CO), reactive oxides of nitrogen (NO_x), $PM_{2.5}$ BAM (Grand Rapids only), wind speed, wind direction, relative humidity, barometric pressure, and temperature.

- Livonia Near-road 2 (261630101) new relocated site to the east side of I-275
- Grand Rapids Near-road (260810023) new site.

Public Comment Process

The USEPA requires that EGLE document the process for obtaining public comments and include any comments received through the public notification process. On May 5, 2020, it was announced through the AQD list serve that this Network Review document was placed on the Air Quality Division (AQD) section of EGLE's Internet home page to solicit comments from the general public and stakeholders. In addition, the public comment period will be announced in a press release. Reviewers are given 30 calendar days from the date the draft network review report is posted to provide written comments. Written comments are accepted until close of business June 4, 2020, either by e-mail or by postal service (verbal comments are not accepted) and should be sent to:

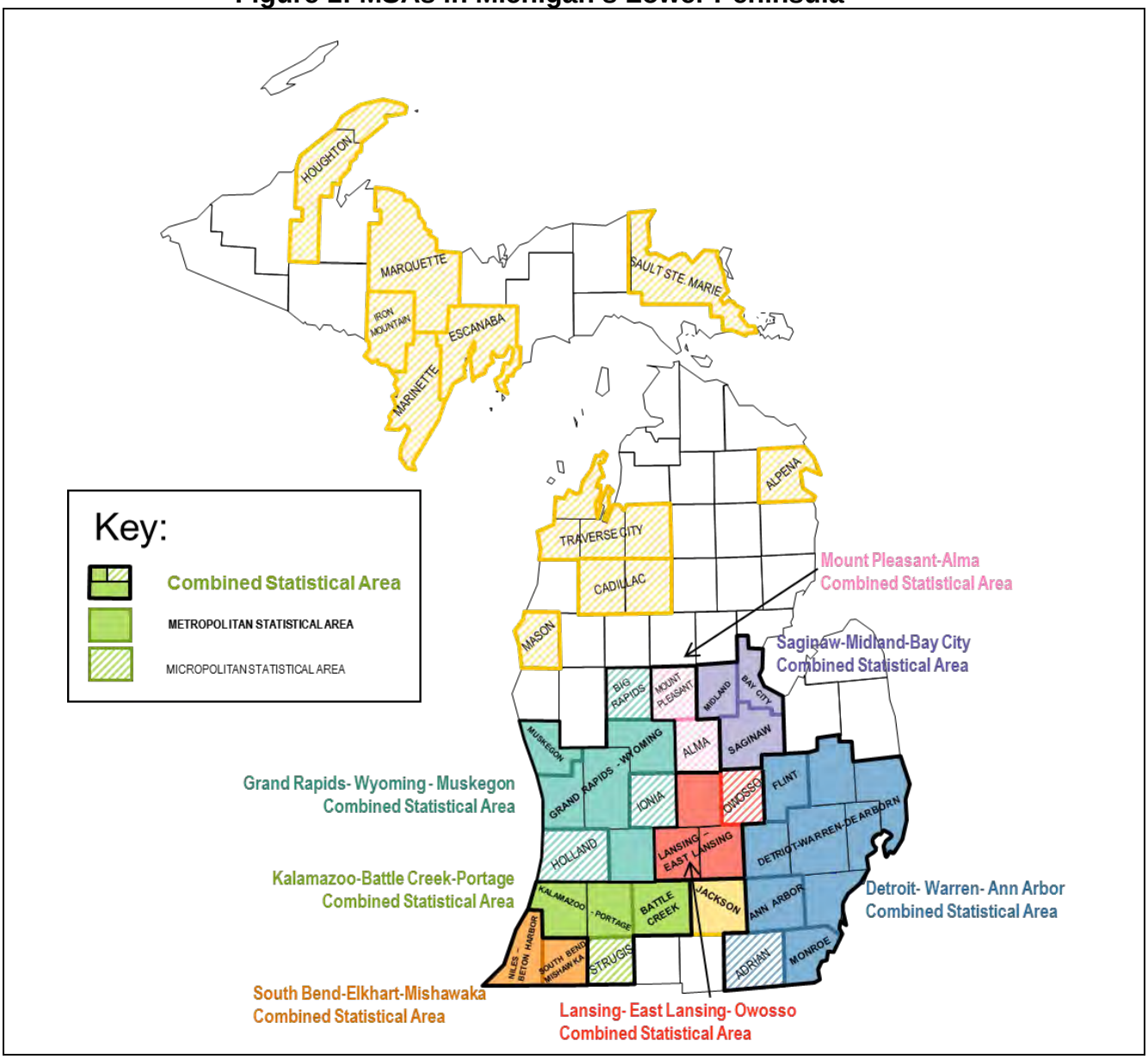
Navnit K. Ghuman
EGLE – Air Quality Division
3058 West Grand Blvd. Suite 2-300
Detroit, MI 48202
GhumanN@michigan.gov

All written comments that are received will be organized by topic, summarized, and addressed in the final version of the Michigan Ambient Air Monitoring Network Review. The final document will be placed on the AQD section of EGLE's Internet home page and sent to the USEPA Region 5 office for approval. Hard copies of the final version will be available for inspection free of charge at the AQD offices located in Lansing (525 West Allegan Street) or Detroit (3058 West Grand Boulevard, Suite 2-300). Requests for hard copies of the plan may incur a nominal fee to cover copying and/or mailing costs. These requests should be directed to Ms. Navnit K. Ghuman, AQD, 313-456-4695, GhumanN@michigan.gov.

AMBIENT AIR MONITORING NETWORK REQUIREMENTS

The minimum network design criteria for ozone, $PM_{2.5}$ (particulate matter with an aerodynamic diameter less than or equal to [≤] 2.5 micrometers) and PM_{10} (≤ 10 micrometers) are based on the 2010 Metropolitan Statistical Area (MSA) geographical borders, population totals, and historical concentrations. The MSA outlines for Michigan are shown in **Figure 1** [2].

Figure 1: MSAs in Michigan's Lower Peninsula



To be classified as an MSA, an area must have an urban core population totaling at least 50,000 people in the most recent decennial census. Micropolitan statistical areas

[2] https://www2.census.gov/geo/maps/metroarea/stcbsa_pg/Feb2013/cbsa2013_MI.pdf

contain an urban core of at least 10,000 (but less than 50,000). MSAs that consist of one or more counties have a sizeable urban cluster or a high level of commuting to or from an urban cluster. MSAs and/or micropolitan areas are grouped to form consolidated statistical areas (CSAs), also shown in **Figure 1**. A CBSA is defined as an entity consisting of the county or counties associated with at least one urbanized area/ urban cluster of at least 10,000 in population, plus adjacent counties having a high degree of social and economic integration. Changes to the metropolitan and micropolitan areas as a result of the 2010 Census were released in 2013. The areas affected include Midland, Hillsdale, Three Rivers, Ludington, and Whitehall. However, the remainder of MSAs in the state were unaffected by the 2010 Census.

Specific counties that make up each MSA or micropolitan area in Michigan are listed in **Table 1 and Table 2**.[3] These geographical areas, coupled with their population totals and historical ambient monitoring data, were used to develop the minimum monitoring network design for ozone, $PM_{2.5}$, and PM_{10}. **Table 1** shows the adjusted 2018 population totals.

Some proposed monitoring requirements are based on micropolitan statistical areas with an urban cluster of at least 10,000 but less than 50,000 people. **Table 2** shows 2018 population estimates for micropolitan areas in Michigan.

[3] Metropolitan and Micropolitan Statistical Areas: April 1, 2010 to July 1, 2018 (CBSA-EST2009-1). Source: U.S. Census Bureau, Population Release Date March 2018. https://www.census.gov/data/tables/time-series/demo/popest/2010s-total-metro-and-micro-statistical-areas.html

Table 1: Composition of Core-based Statistical Areas in Michigan

Combined Statistical Areas	Population Estimates 2019	Core-based Statistical Areas	Population Estimates 2019	County
Detroit-Warren-Ann Arbor CSA	5,341,994	Detroit-Warren-Dearborn MSA	4,319,629	Wayne
				Oakland
				Macomb
				Livingston
				St. Clair
				Lapeer
		Flint MSA	405,813	Genessee
		Ann Arbor MSA	367,601	Washtenaw
		Monroe MSA	150,500	Monroe
		Adrian Micropolitan	98,451	Lenawee
Grand Rapids-Wyoming-Muskegon CSA	1,476,680	Grand Rapids-Wyoming MSA	1,077,370	Kent
				Ottawa
				Montcalm
				Barry
		Muskegon MSA	173,566	Muskegon
		Holland Micropolitan	118,081	Allegan
		Ionia Micropolitan	64210 *	Ionia
		Big Rapids Micropolitan	43,453	Mecosta
Lansing-East Lansing-Owosso CSA	618,583	Lansing-East Lansing MSA	550,391	Ingham
				Eaton
				Clinton
		Owosso Micropolitan	68192 *	Shiawassee
Kalamazoo-Battle Creek-Portage CSA	460,189	Kalamazoo-Portage MSA	265,066	Kalamazoo
				Van Buren
		Battle Creek MSA	134,159	Calhoun
		Sturgis Micropolitan	60,964	St. Joseph
Saginaw-Midland-Bay City CSA	376,821	Saginaw MSA	190,539	Saginaw
		Bay City MSA	103,126	Bay
		Midland MSA	83,156	Midland
South Bend-Elkhart-Mishawaka, IN-MI CSA	729,613	South Bend-Mishawaka, IN-MI MSA	323,613	St. Joseph, IN
				Cass
		Elkhart-Goshen, IN MSA	206,341	Elkhart, IN
		Niles-Benton Harbor MSA	153,401	Berrien
		Plymouth, IN Micropolitan	46,258	Marshall, IN
Mount Pleasant-Alma CSA	110,583	Mount Pleasant Micropolitan	69,872	Isabella
		Alma Micropolitan	40,711	Gratiot
none		Jackson MSA	158,510	Jackson

Table 2: Composition of Micropolitan Statistical Areas in Michigan

Micropolitan Area	Principal Cities	Counties	Population Estimates 2019
Adrian	Adrian	Lenawee	98,451
Alma	Alma	Gratiot	40,711
Alpena	Alpena	Alpena	28,405
Big Rapids	Big Rapids	Mecosta	43,453
Cadillac	Cadillac	Missaukee,Wexford	48,749
Coldwater	Coldwater	Branch	43,517
Escanaba	Escanaba	Delta	35,784
Hilsdale	Hillsdale	Hillsdale	45,605
Holland	Holland(pt.)	Allegan	118,081
Houghton	Houghton	Houghton,Keweenaw	37,800
Ionia	Ionoa	Ionia	64210 *
Iron Mountain	Iron Mountain,MI	Dickinson,MI:Florence,WI	29,534
Ludington	Ludington	Mason	29,144
Marinette	Marinette,WI	Menominee,MI:Marinette,WI	63,130
Marquette	Marquette	Marquette	66,699
Mount Pleasant	Mount Pleasant	Isabelle	69,872
Owosso	Owosso	Shiawassee	68192 *
Sault Ste.Marie	Sault St. Marie	Chippewa	37,349
Sturgis	Sturgis	St.Joseph	60,964
Traverse City	Traverse City	Benzie, Grand Traverse, Kalkaska, Leelanau	150,653

Other Monitoring Network Requirements

NCore sites provide a full suite of measurements at one location. NCore stations collect the following measurements: ozone, SO_2 (trace), CO (trace), NO_Y, $PM_{2.5}$ FRM, continuous $PM_{2.5}$, speciated $PM_{2.5}$, wind speed, wind direction, relative humidity, and ambient temperature. In addition, filter-based measurements are required for PM coarse ($PM_{10-2.5}$) on a once every three-day sampling frequency. Previously, a minimum of 10 NCore sites nationwide measure lead; however, this requirement was removed in 2016. NCore stations in Michigan located at Grand Rapids–Monroe St. (260810020) and Allen Park (261630001) became operational January 1, 2010; one full year ahead of schedule.

The 2015 Ozone Standard added an additional requirement to the NCore sites by requiring PAMS monitors to be located at certain NCore sites. Two NCore sites in Michigan were initially required to implement PAMS monitoring on June 1, 2019, but due to a delay in federal funding, this deadline has been extended to June 1, 2021. The Detroit E 7 Mile site will host the PAMS monitoring instead of the Allen Park NCore site. Both sites will conduct the PAMS suite of measurements when full funding is received.

State and Local Air Monitoring Stations (SLAMS) monitors will supplement the network and improve spatial coverage. Specific network design criteria are contained in the

monitoring regulations that describe the SLAMS monitoring networks for criteria pollutants. These requirements are discussed in detail in the remainder of this Review.

Network Review Requirements

According to 40 CFR Part 58.10, an air monitoring network review should:

- Be conducted at least once a year;
- Determine if the system meets the monitoring objectives stated in Appendix D of 40 CFR Part 58 "Network Design Criteria for Ambient Air Quality Monitoring" [4]
- Determine if the system meets the appropriate spatial scales and monitoring objectives, population-driven requirements, and the minimum number of stations that are required based on the likelihood of exceeding the NAAQS;
- Identify needed modifications to the network including termination and relocation of unnecessary stations;
- Identify any new stations that are necessary;
- Correct any inadequacies previously identified; and
- Be used as a starting point for five-year regional assessments.

Elements that must be included in the Network Review are:

- The USEPA's Air Quality System (AQS) site identification number;
- Site locations including coordinates and street address;
- Sampling and analysis methods, including parameter codes;
- Operating schedule;
- Monitoring objective and spatial scales;
- Identification of those sites that are suitable and not suitable for comparison to the NAAQS (for $PM_{2.5}$ only);
- The MSA, CBSA, or CSA represented by each monitor; and
- Evidence that the siting and operation of the monitor meets 40 CFR Part 58, Appendices A (quality assurance requirements), C (ambient air quality monitoring), D (network design criteria), and E (probe and monitoring path siting criteria).

For Michigan, the site-specific data is summarized in various tables throughout the review.

Modifications to the network should address:

- New census data;
- Changes in air quality levels; and
- Changes in emission patterns.

The time frame for implementation of modifications is one year from the time of the previous network review. Changes will be made on a calendar year basis whenever possible.

[4] "Environmental Protection Agency Ambient Air Quality Surveillance Regulations." 40 CFR Part 58, Appendix D; April 27, 2016.

Monitor Deployment by Location

Table 3 summarizes the distribution of ambient air monitors by pollutant operating in Michigan during 2020-2021. The distinction is made between building and trailer to indicate differences in floor space and temperature control, information useful in planning deployment of new monitors.

Table 3: Monitor Distribution of the 2020-2021 Network in Michigan

Site Name	AQS ID	O_3	$PM_{2.5}$ FRM	Continuous $PM_{2.5}$	Speciation	PM_{10}	PM Coarse	CO	NO_2	NOy	SO_2	Metals (TSP)	Black Carbon	VOCs	Carbonyls	PAHs	Meteorological	Building/Trailer
Holland	260050003	x		MB													x	T
Bay City	260170014			MB													x	T
Benzonia (Frankfort)	260190003	x																T
Coloma	260210014	x															x	T
Cassopolis	260270003	x															x	B
Rose Lake 2	260370002	x																B
Flint	260490021	x	6d	MB													x	T
Otisville	260492001	x															x	T
Harbor Beach	260630007	x															x	T
Belding - Merrick St.	260670003											Pb & 4						
Lansing Filley	260650018	x	3d	T					x		x						x	T
Kalamazoo	260770008	x		T													x	T
Gr.Rapids-Monroe St.	260810020	x	3d	TX	x	TX	TX	Tr	P	Tr	Tr			P	P		x	T
Gr.Rapids-Near-road	260810023			MB				x	x								x	
Evans	260810022	x															x	T
Tecumseh	260910007	x		TB													x	T
New Haven	260990009	x		T													x	T
Sterling Hts/Freedom Hill	260990021																x	
Warren	260991003	x																T
Manistee (Tribal)	261010922	x	3d														x	B
Scottville	261050007	x															x	T
Houghton Lake	261130001	x		TB					x								x	T
Sterling State Park	261150006										psd						x	T
Muskegon-Green Crk. Rd.	261210039	x															x	T
Oak Park	261250001	x	3d														x	T
Pontiac	261250011																x	
Rochester	261250012																x	
Jenison	261390005	x		TX		TX											x	T
West Olive	261390011										psd						x	T
Port Huron	261470005	x		T							x						x	T
Port Huron-Rural St.	261470031											Pb & 4						
Seney	261530001	x		MB													x	T
Ypsilanti	261610008	x	6d	TB													x	T
Allen Park	261630001	x	3d	TX	x	TX	TX	Tr		Tr	Tr		x				x	T
River Rouge	261630005											Pb & 4			x		x	T
Fort St. (SWHS) - Detroit	261630015		3d	T	x	x			x		x	Pb & 4	x	x	x		x	B
E. 7 Mile - Detroit	261630019	x	3d						P	Tr				P	P		x	B
Joy Rd. - Detroit	261630026																x	
S Delray / Jefferson	261630027											Pb & 4						T
Dearborn	261630033		3d&6d	Te	x	x&Te						x	x	x	x	x	x	B
Eliza Howell	261630093			MB				x	x								x	T
Livonia Near-road 2	261630101							x	x								x	T
NMH 48217	261630097			Te							x	Pb & 4						T
DP4th	261630098			T				x	x		x	Pb & 4	x					T
Trinity	261630099			T				x	x		x	Pb & 4	x				x	T
Military	261630100			T					x		x	Pb & 4	x					T
	Total	26	10	22	4	5	2	7	11	3	11	10	6	4	5	1	37	39

3d	a run every three days	Te	TEOM	P	PAMS	psd	pending shut down
6d	a run every six days	T	T640	Tr	Trace	B/T/S	Building/Trailer/Shelter
		TX	T640X			Pb & 4	Lead &Metals suite: Mn, As, Cd, Ni,
		MB	MetOne BAM				
		TB	ThermoBAM				

Quality Assurance (QA)

EGLE has an approved Quality Management Plan (QMP). In turn, the Air Monitoring Unit (AMU) has a Quality Assurance Project Plan (QAPP), which covers operation of the ambient air network. The QAPP addresses criteria pollutants, air toxics, metals, and particulates including the USEPA $PM_{2.5}$ Speciation Trends Network (STN). Separate QAPPs exist for the National Air Toxics Trend Site (NATTS) and NCore. Special purpose monitoring projects also have dedicated QAPPs. The AMU has approved standard operating procedures, standardized forms and documentation policies, and a robust audit and assessment program to ensure high data quality.

As part of the network review process, it is important to ensure that each monitor meets the specific requirements in 40 CFR Part 58, Appendix A, governing proper calibration and operation, proper probe height, and monitor path length. In addition, the site itself must meet specific criteria governing distances from large trees and buildings, exhaust vents, highways, etc. To address the adequacy of these operational parameters, various types of audits are performed.

The USEPA finalized revisions to the ambient air monitoring requirements for criteria pollutants, which were published in the Federal Register on March 27, 2016, and became effective on April 27, 2016. EGLE has implemented most of these changes and has procured the equipment to fully implement the requirement for conducting lower level annual audit points for the gaseous monitors.

Audits are conducted by the AMU's Quality Assurance (QA) Team, which has a separate reporting line of supervision. The audits are conducted on the particulate-based monitors every six months ($PM_{2.5}$ FRM, continuous $PM_{2.5}$ TEOM, BAM, $PM_{2.5}$ Speciation, High Volume TSP [total suspended particulate], and PM_{10}) and the gaseous monitors (CO, SO_2, ozone, NO_Y, and NO_2) at least once a year. All audit results are reported to AQS quarterly. The toxics monitors (volatile organic compounds [VOCs], carbonyl compounds, and poly-aromatic hydrocarbons [PAH]) are also audited once a year and the aethalometers are audited every six months by the QA Team. These audits are conducted with independent equipment and gases, which are only used for quality assurance. The AMU's QA Coordinator reviews the results from all audits.

External audits are conducted annually by the USEPA. The USEPA conducts Performance Evaluation Program (PEP) audits for $PM_{2.5}$ samplers, eight sites per year, and National Performance Audit Program (NPAP) for the gaseous monitors, 20 percent of the sites, per year using a Thru-The-Probe (TTP) audit system. The USEPA also conducts program-wide Technical Systems Audits (TSA) every three years to evaluate overall program operations and assess adequacy of documentation and records retention. External audits are also conducted on the laboratory operations for air toxics (VOCs and carbonyls) and metals through the use of performance evaluation samples. The concentrations of audit samples are unknown to both the AQD staff and EGLE Environmental Laboratory staff.

LEAD MONITORING NETWORK

Background

On December 14, 2010, the USEPA revised the ambient monitoring requirements to better address possible exposures to lead.[5] On January 5, 2015, the USEPA proposed to retain the current standard. Monitoring is required for point sources that emit 0.5 tons of lead per year or more, if modeling indicates that the maximum concentration is more than half of the level of the air quality standard. If modeling indicates that there is little likelihood of violating the NAAQS, a waiver from monitoring may be obtained from the regional administrator.

The final component of the 2010 revisions to the monitoring regulations includes the addition of population-oriented lead monitors at NCore stations that are located in CBSAs with populations greater than 500,000. In the final monitoring regulations of 2016, the USEPA has removed lead monitoring requirement at NCore sites, provided the sites are attaining the standard.

To place these new monitoring requirements into context, the 2008 lead NAAQS is reviewed below, as are changes already implemented in the lead network.

The 2008 Lead NAAQS

The 2008 lead NAAQS reduced the level of the standard from a maximum quarterly average of 1.5 µg/m^3 to 0.15 µg/m^3 as a rolling three-month average. To determine if the primary NAAQS is met, the maximum three-month average within a three-year period is compared to the level of 0.15 µg/m^3.

In addition to changing the level and form of the standard, the 2008 NAAQS also changed monitoring requirements. The USEPA required that ambient monitoring be performed downwind of point sources emitting one ton or more per year of lead, unless modeling proved that the sources didn't pose a health risk. In 2010, the new per-ton threshold was reduced to 0.5 ton/year.

The NAAQS retained the Total Suspended Particle (TSP) size fraction of lead, but acknowledged that agencies may, under certain conditions, measure lead as PM_{10} if low volume sampling devices are used. EGLE is currently using high volume TSP samplers to measure lead and will continue to do so for compliance with the NAAQS and consistency with historical data. The NAAQS requires that lead sampling be conducted on a once every six-day schedule. Filters are analyzed by EGLE laboratory using ICP/MS. EGLE follows the USEPA sampling schedule published yearly on the USEPA web site at: https://www3.USEPA.gov/ttnamti1/calendar.html.

[5] "Environmental Protection Agency National Ambient Air Quality Standards for Lead; Final Rule." 40 CFR Parts 50, 51, 53 and 58, November 12, 2008.

Point Source-oriented Monitoring

In 2018 EGLE added three new lead monitoring sites near the Gordie Howe International Bridge (GHIB). Additional site details are in the Special Purpose Monitoring section.

For 2021, there are no new facilities that need to be investigated with regard to the lead NAAQS requirements. The Merrick St. site (260670003) and the Port Huron Rural St. site (261470031) are still operating.

Non-source-oriented/NCore Monitoring Network Design

According to the November 12, 2008, lead NAAQS, each CBSA with a population equaling or exceeding 500,000 people shall have a lead monitoring station to measure neighborhood scale lead in the urban area. The revised 2016 USEPA regulations stated removal of lead monitoring requirement at NCore sites, provided they are attaining the standard. As a result, EGLE discontinued lead sampling at the two NCore sites at Grand Rapids (260810020) and Allen Park (261630001) in 2020.

Lead Co-location Requirements

If a primary quality assurance organization (PQAO) has a mixture of source and non-source-oriented lead sites, the number of co-located lead sites is equal to 15 percent of the total number of these lead sites. According to the *Federal Register,* the co-located site should be at the location with the highest lead concentrations. **Table 4** describes the deployment schedule for various components of the EGLE lead network and total number of co-located lead sites that are required.

EGLE prefers to retain one co-located lead site at the NATTS site at Dearborn (261630033), which is located close to many industrial sources including a steel mill, automotive manufacturing plant, and a rail yard. The station is sited at Salina Elementary School. Typically, NATTS sites determine lead as PM_{10} using a high volume sampler and thus do not meet the monitoring requirements, which specify the use of a high volume TSP sampler or a low volume PM_{10} sampler under certain instances. However, EGLE opted to collect co-located lead measurements as both TSP and PM_{10} at the Dearborn site to continue generating trend data, promote comparability with other NATTS sites in the nation, and to determine precision for both size fractions. In addition, a MetOne SASS monitor supports the measurement of lead as $PM_{2.5}$, rounding out the suite of various particle sizes.

As shown in **Table 4,** the total number of lead sites in Michigan was expanded in 2018 when the new GHIB sites were installed. A second co-located site for lead was established to meet the 15 percent requirement. A second co-located monitor was added to the Port Huron–Rural Street site (261470031) in August 2018.

Table 5 summarizes the lead monitoring site information for the Michigan lead network. **Figure 2** shows monitoring site locations in the 2018 and 2019 network.

Table 4: Deployment Schedule of Lead Sites and Calculation of the Total Number of Co-located Lead Sites

Site Name and ID	Site Purpose	2014	2015	2016	2017	2018	2019	2020	2021
Belding-Reed St (260670002)	Source -oriented	operational	operational	operational	operational	operational			
Belding (260670003)	Source -oriented	operational	operational	operational	operational	operational	operational	operational	operational
Grand Rapids-Monroe St. (260810020)	NCore Non-Source -oriented	operational	operational	operational	operational	operational	operational		
Port Huron-Rural St. (261470031)	Source -oriented *co-located site*	operational	operational	operational	operational	operational	operational	operational	operational
Allen Park (261630001)	NCore Non-Source -oriented	operational	operational	operational	operational	operational	operational		
River Rouge (261630005)	Non-Source -oriented					operational	operational	operational	operational
SWHS (261630015)	Non-Source -oriented					operational	operational	operational	operational
S.Delray (261630027)	Non-Source -oriented					operational	operational	operational	operational
Dearborn (261630033)	NATTS *co-located site*	operational	operational	operational	operational	operational	operational	operational	operational
NMH48217 (261630097)	SLAMS			operational	operational	operational	operational	operational	operational
Trinity (261630098)	Source -oriented					operational	operational	operational	operational
DP4TH (261630099)	Source -oriented					operational	operational	operational	operational
Military (261630100)	Source -oriented					operational	operational	operational	operational
	Total No of sites	6	6	7	7	13	12	10	10
	No. Co-located sites Required	1	1	1	1	2	2	2	2

Table 5: Michigan's Lead Monitoring Network

Operating Schedule: 1:6 days

Method: High Volume Sampler & ICAP Spectra, Method Code 108

Point Source Oriented Sites

Monitoring Sites														
Site Name	AQS Site ID	Address	Part. Size	Latitude	Longitude	Sampling Frequency	Purpose/ Type	Parameter Code	POC	Scale	County	Date Estab.	Facility Name	Est Emissions Tons/yr
Belding - Merrick St.	260670003	509 Merrick St.	TSP	43.09984	-85.22163	1:6	max conc	14129	1	Micro	Ionia	1/1/10	Mueller Industries	0.9 - 1.0
Port Huron	261470031	324 Rural St.	TSP	42.98209	-82.449233	1:6	max conc	14129	1	Micro	St. Clair	1/1/13	Mueller Industries	0.75
Port Huron	261470031	324 Rural St.	TSP	42.98209	-82.449233	1:12,co-loc	max conc	14129	2	Micro	St. Clair	8/1/08	Mueller Industries	0.75

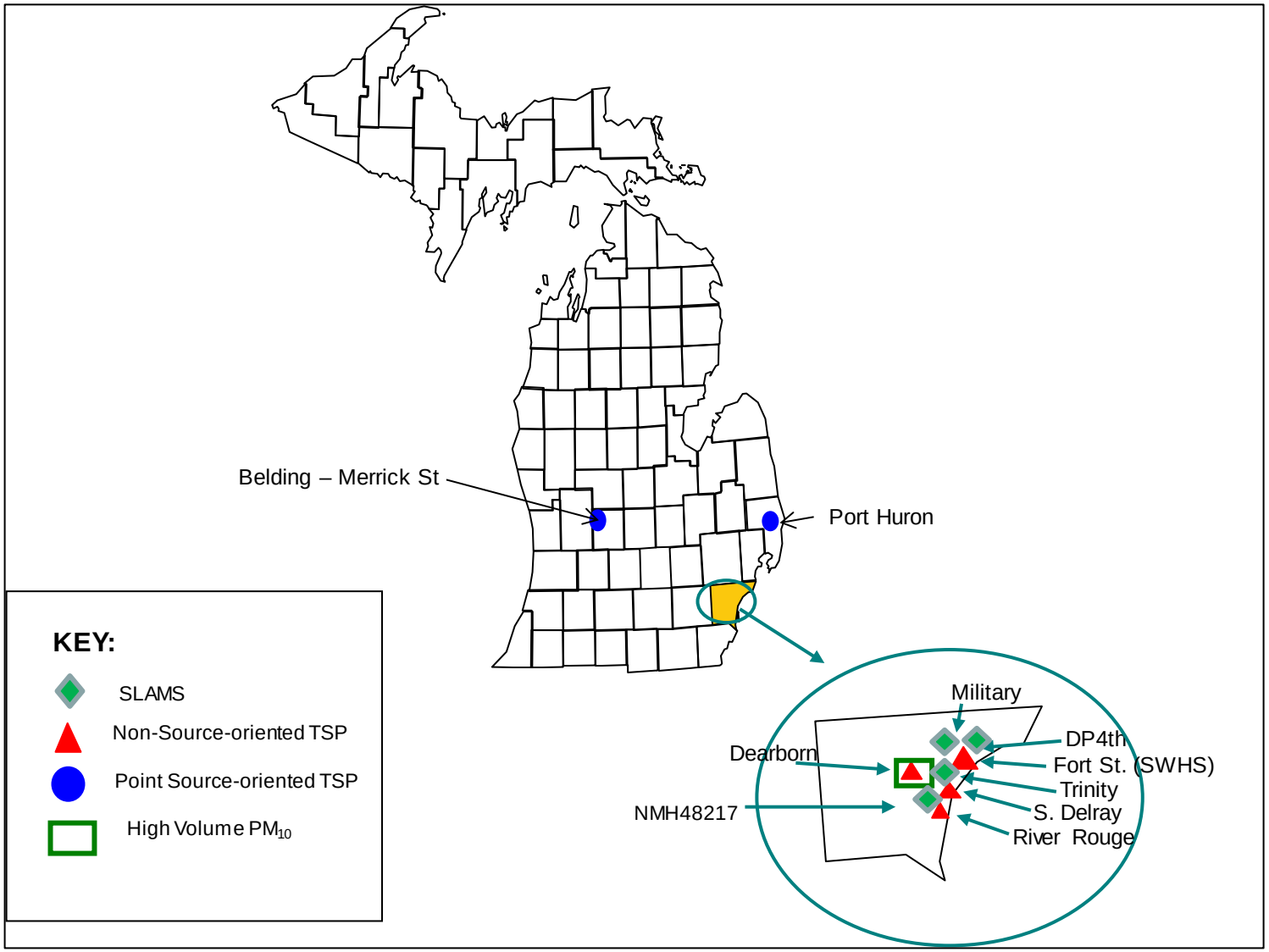
Non Source Oriented Sites

Monitoring Sites														
Site Name	AQS Site ID	Address	Part. Size	Latitude	Longitude	Sampling Frequency	Purpose/ Type	Parameter Code	POC	Scale	County	Date Estab.	CBSA [1]	Pop (2019 Estimate)
Grand Rapids - Monroe St.	260810020	1179 Monroe St. NW	TSP	42.984167	-85.671389	1:6	pop. exp.	14129	1	Neighborhood	Kent	1/8/10	GW	1,077,370
Allen Park	261630001	14700 Goddard	TSP	42.228611	-83.208333	1:6	pop. exp.	14129	1	Neighborhood	Wayne	1/2/10	DWL	4,319,629
River Rouge	261630005	315 Genesee	TSP	42.267222	-83.13222	1:6	pop. exp.	14129	1	Neighborhood	Wayne	1/1/18	DWL	4,319,629
Fort St. (SWHS)	261630015	150 Waterman	TSP	42.302778	-83.106667	1:6	pop. exp.	14129	1	Neighborhood	Wayne	1/1/18	DWL	4,319,629
S. Delray	261630027	7701 W. Jefferson	TSP	42.292222	-83.106944	1:6	pop. exp.	14129	1	Neighborhood	Wayne	1/1/18	DWL	4,319,629
Dearborn	261630033	2842 Wyoming	TSP	42.306666	-83.148889	1:6	max conc	14129	1	Neighborhood	Wayne	6/1/90	DWL	4,319,629
Dearborn	261630033	2842 Wyoming	TSP	42.306666	-83.148889	1:12, co-loc	max conc	14129	2	Neighborhood	Wayne	6/1/90	DWL	4,319,629
Dearborn	261630033	2842 Wyoming	PM_{10}	42.306666	-83.148889	1:6	max conc	14129	1	Neighborhood	Wayne	6/1/90	DWL	4,319,629
Dearborn	261630033	2842 Wyoming	PM_{10}	42.306666	-83.148889	1:12, co-loc	max conc	14129	2	Neighborhood	Wayne	6/1/90	DWL	4,319,629
NMH 48217	261630097	3225 Deacon St	TSP	42.2616692	-85.157893	1:6	pop.exp	14129	1	Neighborhood	Wayne	9/1/18	DWL	4,319,629
DP4th	261630098	4700 W Fort St	TSP	42.312158	-83.091943	1:6	max conc	14129	1	Neighborhood	Wayne	7/17/18	DWL	4,319,629
Trinity	261630099	9191W Fort St	TSP	42.295824	-83.129431	1:6	max conc	14129	1	Neighborhood	Wayne	10/17/18	DWL	4,319,629
Military	261630100	1238 Military Park	TSP	42.30934	-83.115722	1:6	max conc	14129	1	Neighborhood	Wayne	11/1/18	DWL	4,319,629

[1] **CBSA Key:**

DWL = Detroit-Warren-Livonia Core Based Statistical Area
GW = Grand Rapids-Wyoming Core Based Statistical Area

Figure 2: Michigan's Lead Monitoring Network



Waiver(s) From Lead Monitoring

In the 2010 Network Review, waivers from monitoring were sought for point sources where modeling indicated there was little likelihood to violate the NAAQS. These waivers were renewed again in July 2014. According to the waiver process, new waivers from monitoring for these sources need to be applied for five years after the first waiver was obtained. The current emission inventory data indicates that the previous sources are below the threshold that previously required a waiver. Likewise, there are no new sources of lead over this threshold value.

Lead Quality Assurance

The site operator conducts a flow rate verification each month. The flow check values are sent to the QA Coordinator each quarter. An independent audit is conducted by a member of the AMU's QA Team every six months. The auditor is in a separate line of reporting authority from the site operator and uses independent, dedicated equipment to perform the flow rate audit. The auditor also assesses the condition of the monitor and siting criteria. The QA Coordinator reviews all audit results and hard copies are retained in the QA files. The audit results are uploaded to the USEPA's AQS database each quarter. External lead PEP audits are conducted annually by the USEPA. The USEPA uses a separate sampler at the monitoring station to collect a filter on the same day as an EGLE sample. The USEPA's PEP filter is analyzed by a USEPA laboratory. Once EGLE enters the filter results in the AQS database, the USEPA enters the result from the co-located PEP filter for comparison.

EGLE's Laboratory participates in an external performance testing program that is administered by the USEPA. The laboratory analyzes spiked filter strips each month which are reported to the USEPA AQS database. Once a quarter, EGLE sends a co-located lead filter to the USEPA Region 9 laboratory. The results from the primary filter, analyzed by EGLE laboratory, are compared to the co-located filter that was analyzed by the USEPA Region 9 laboratory.

Plans for the 2021 Lead Monitoring Network

In 2021, EGLE will continue to collect high volume TSP and PM_{10} lead measurements at the NATTS site:

- Dearborn NATTS site (261630033); and
- Co-located Dearborn NATTS (261630033).

In 2021, EGLE will continue TSP lead source-oriented measurements at:

- Port Huron (261470031);
- Co-located Port Huron (261470031); and
- Belding–Merrick St. (260670003).

In 2021, EGLE will continue TSP lead measurements at the three new sites set up in 2018 around the Gordie Howe International Bridge area.

- DP4th (261630098);
- Trinity (261630099); and
- Military (261630100).

In 2018, EGLE also added high volume TSP lead non-source-oriented measurements at existing three sites:

- River Rouge (261630005);
- Southwest High School (SWHS) (261630015);
- S. Delray (261630027); and
- NMH 48217 (261630097).

Lead sampling at NCore sites is no longer required, thus in 2020, EGLE discontinued collecting lead measurements using high volume TSP samplers at the NCore sites at:

- Grand Rapids–Monroe St. (260810020); and
- Allen Park (261630001).

NCORE MONITORING NETWORK

The purpose of the NCore stations is to collect a variety of air quality measurements that can be used to provide an integrated approach to air quality management. Collection of a suite of measurements at a single site improves our understanding of how concentrations of various pollutants are inter-related and can evaluate the effectiveness of control programs. Data from NCore sites is also used for the determination of air quality trends, for model evaluation, and for attainment purposes. Reference or equivalent methods must be used.

Network Design

Neighborhood and urban scale measurements are to be made at one NCore site per state. Some states, including Michigan, have more than one major population center or multiple airsheds with unique characteristics. Sampling at NCore sites should use a spatial scale of neighborhood (up to 4 km) or urban (4 km to 50 km).

There are a limited number of rural NCore stations. These NCore sites are located away from the influences of major sources, are sited in areas of relatively homogeneous geography, and should sample on a regional scale or larger. There are no rural NCore sites in Michigan.

Whether urban or rural, the *Federal Register*[6] specifies the minimum parameters that each NCore site must measure:

- Continuous $PM_{2.5}$
- 24-hour $PM_{2.5}$
- Speciated $PM_{2.5}$
- $PM_{10–2.5}$
- Ozone
- Trace SO_2
- Trace CO
- NO/NO_Y
- Wind speed
- Wind direction
- Relative humidity
- Outdoor temperature
- Lead (2016 ruling not required, discontinued in 2020)

Michigan NCore Sites

EGLE's NCore sites are located at Grand Rapids-Monroe St. (260810020) in the Grand Rapids-Wyoming CBSA and at Allen Park (261630001) in the Detroit-Warren-Livonia CBSA. Details were provided in the 2010 Network Review. The 2015 ozone NAAQS has a requirement for PAMS measurements of specific ozone precursor compounds at some

[6] "Environmental Protection Agency National Ambient Air Quality Standards for Lead; Final Rule." 40 CFR Parts 50, 51, 53 and 58, November 12, 2008.

NCore sites across the nation. These requirements for EGLE are discussed in the PAMS chapter later in this Review.

Tables 6 and **7** list the parameters currently measured at Grand Rapids-Monroe St. (260810020) and Allen Park (261630001), respectively. Start dates are also shown.

Speciation samplers at EGLE NCore stations sample on a once every three-day schedule (USEPA schedule) to meet the NCore monitoring requirements.

Lead was added to both sites in January 2010 and discontinued in 2020 since the measured levels were low and no longer mandated. Relative humidity was added to the Grand Rapids–Monroe St. (260810020) NCore station on March 3, 2010.

In 2021 the low volume PM_{10}, $PM_{2.5}$ TEOM, and high volume PM_{10} instrumentation at both NCore sites will be replaced by a continuous FEM T640X instrument. The T640X will measure for 2.5 micron, 10 micron, and coarse particulate matter ($PM_{10-2.5}$).

Site specific data for Michigan's NCore network is summarized in **Table 8**. A map showing the locations of NCore sites is displayed in **Figure 3**.

NCore Quality Assurance

EGLE's NCore stations contain a variety of monitors that are required to meet the federal requirements for NCore stations. Quality assurance is discussed for each type of monitor in the appropriate section of the Network Review.

Plans for 2021 NCore Monitoring Network

In 2021 EGLE is planning to continue to collect the measurements required for the NCore program at the following sites:

- Grand Rapids–Monroe St. (260810020); and
- Allen Park (261630001).

In 2021, seasonal PAMS measurements will be collected at the Grand Rapids NCore site and the Detroit-E 7 Mile site as an alternative to the Allen Park site, as approved by USEPA Region 5.

Table 6: Measurements Collected at the Grand Rapids-Monroe St. (260810020) NCore Site

Parameter	Designation	Spatial Scale	Sampling Frequency	Instrument Type	Method	Existing Monitor Start-Up Date	Comments
$PM_{2.5}$ continuous	***NCore/AQI***	***Neighborhood***	***Continuous***	***R & P TEOM 1400 a***	***Tapered element oscillating microbalance***	***11/4/1999***	***Shutdown in in 2020 ,replaced with the T640***
$PM_{2.5}$ continuous	NCore/AQI	Neighborhood	Continuous	Teledyne API Model T640X	FEM	1/1/2020	It will replace the $PM_{2.5}$ TEOM ,low vol PM_{10} and high vol PM_{10}(used to calculate PMc)
$PM_{2.5}$ FRM mass	NCore	Neighborhood	1:3 days	R & P Partisol plus 2025	Manual collection, gravimetric analysis	10/23/1998	---
$PM_{2.5}$ Speciation	NCore	Neighborhood	1:3 days	Met One Super SASS + URG 3000N	Manual collection, laboratory analysis*	6/1/02 at 1:6 sampling frequency	Freq. changed to 1:3 on 1/1/2011
Trace CO	NCore/AQI	Neighborhood	Continuous	API 300 eu/ TECO 48 i	Non-dispersive infrared	4/25/2007	probe height 5 m
Trace SO_2	NCore/AQI	Neighborhood	Continuous	API 100 eu/ TECO 43i	UV fluorescence	4/1/2008	probe height 5 m
NO_Y	NCore/AQI	Neighborhood	Continuous	TECO 42C	Chemiluminescence	4/1/2008	external converter installed at 10 m
Ozone	NCore/AQI was NAMS	Neighborhood	Continuous	API 400 A1E	UV absorption	4/24/1980	Year round
Lead	***Non-source***	***Neighborhood***	***1:6 days***	***General Metal Works Hi-Vol filter based***	***Manual collection, ICP/MS analysis***	***1/8/2010***	***Shut down 2020***
$PM_{10-2.5}$ mass	NCore	Neighborhood	1:3 days	R & P Partisol plus 2025	Manual collection, gravimetric analysis	7/16/2010	-----
WS	NCore	---	Continuous	R. M. Young Prop. Anemom. & vane	Vector summation	1/1/1988	At 10 m
WD	NCore	---	Continuous	R. M. Young Prop. Anemom. & vane	Vector summation	1/1/1988	At 10 m
Relative Humidity	NCore	---	Continuous	R. M. Young	Resistance hygrometer	3/3/2010	> 4 m
Outdoor Temperature	NCore	---	Continuous	R. M. Young	Thermometer	7/15/1993	> 4 m
Sigma Theta	SLAMS	---	Continuous	R. M. Young Prop. Anemom. & vane	Calculation	1/16/2001	Optional
Barometric Pressure	SLAMS	---	Continuous	R. M. Young	Electronic pressure sensor	7/15/1993	Optional
PM_{10} Hi-Vol	***SLAMS***	***Neighborhood***	***1:6 days***	***Hi-Vol***	***Manual collection, gravimetric analysis***	***1/1/1985***	***Shutdown in in 2020 ,replaced with the T640***

* Laboratory analysis consists of ion chromatography, X-Ray Fluorescence (XRF) and thermal optical analysis for ions, trace metals and forms of carbon, respectively.

Table 7: Measurements Collected at the Allen Park (261630001) NCore Site

Parameter	Designation	Spatial Scale	Sampling Frequency	Instrument Type	Method	Existing Monitor Start-Up Date	Comments
$PM_{2.5}$ continuous	***NCore/AQI***	***Neighborhood***	***Continuous***	***R & P TEOM 1400 a***	***Tapered element oscillating microbalance (TEOM)***	***2/1/2001***	***Shutdown in in 2020 ,replaced with the T640***
$PM_{2.5}$ PM_{10} and PM_c continuous	NCore/AQI	Neighborhood	Continuous	Teledyne API Model T640X	FEM	8/1/2020	It will replace the $PM_{2.5}$ TEOM ,low vol PM_{10} and high vol PM_{10}(used to calculate PMc)
$PM_{2.5}$ FRM mass	***NCore***	***Neighborhood***	***1:1 day***	***R & P Partisol plus 2025***	***Manual collection, gravimetric analysis***	***5/12/1999***	***Shutdown in in 2020 ,replaced with the T640***
$PM_{2.5}$ Speciation	NCore	Neighborhood	1:3 day	Met One Super SASS + URG 3000N + IMPROVE carbon channel	Manual collection, laboratory analysis*	12/1/2000	---
Trace CO	NCore/AQI	Neighborhood	Continuous	API 300 eu/ TECO 48 i	Non-dispersive infrared	6/1/2007	probe height 4m
Trace SO_2	NCore/AQI	Neighborhood	Continuous	API 100 eu / TECO 43 i as	UV fluorescence	4/1/2008	probe height 4 m
NO_Y	NCore/AQI	Neighborhood	Continuous	TECO 42C	Chemiluminescence	4/1/2008	external converter installed at 10 m
Ozone	NCore/AQI was NAMS	Neighborhood	Continuous	API 400 E	UV absorption	1/1/1980	Year round probe height 4 m
Lead	***Non-source***	***Neighborhood***	***1:6 days***	***General Metal Works Hi-Vol filter-based***	***Manual collection, ICP/MS analysis***	***3/2/01 to 3/31/07; 1/2/10***	***Shutdown in 2020***
$PM_{10-2.5}$ mass	NCore	Neighborhood	1:3 days	R & P Partisol plus 2025	Manual collection, gravimetric analysis	7/16/2010	-------
WS	NCore	---	Continuous	R. M. Young Prop. Anemom. & vane	Vector summation	10/18/1981	At 10 m
WD	NCore	---	Continuous	R. M. Young Prop. Anemom. & vane	Vector summation	10/18/1981	At 10 m
Relative Humidity	NCore	---	Continuous	R. M. Young	Resistance hygrometer	1/1/2000	> 4 m
Outdoor Temperature	NCore	---	Continuous	R. M. Young	Thermometer	1/1/2000	> 4 m
Sigma Theta	SLAMS	---	Continuous	R. M. Young Prop. Anemom. & vane	Calculation	9/1/2001	Optional
Barometric Pressure	SLAMS	---	Continuous	R. M. Young	Electronic pressure sensor	1/5/1971	Optional
Black Carbon	SLAMS	---	Continuous	Magee large spot AE21	Optical absorption	12/19/2003	Not Req NCore
PM_{10} Hi-Vol	***Was NAMS***	***Neighborhood***	***1:6 days***	***Hi-Vol***	***Manual collection, gravimetric analysis***	***9/12/1987***	***Shutdown in in 2020 ,replaced with the T640***

* Laboratory analysis consists of ion chromatography, X-Ray Fluorescence (XRF) and thermal optical analysis for ions, trace metals and forms of carbon, respectively.

Table 8: Michigan's NCore Monitoring Network

Monitoring Sites										
Site Name	AQS Site ID	Address	Latitude	Longitude	Purpose/ Type	Scale	County	Date Estab.	CBSA[1]	Pop (2019 Estimate)
Grand Rapids	260810020	1179 Monroe St., NW,	42.98417	-85.6714	Pop. Exp.	Neighborhood	Kent	1/1/10	GW	1,077,370
Allen Park	261630001	14700 Goddard	42.22861	-83.2083	Pop. Exp.	Neighborhood	Wayne	1/1/10	DWL	4,319,629

[1] **CBSA Key:**

DWL = Detroit-Warren-Livonia Core Based Statistical Area

GW = Grand Rapids-Wyoming Core Based Statistical Area

Figure 3: Michigan's NCore Monitoring Network

OZONE MONITORING NETWORK

On October 26, 2015, the USEPA revised the ozone NAAQS, lowering the standard to 0.070 ppm and extending the ozone season in many areas, including Michigan, from March 1 through October 31. EGLE began the expanded season in 2017.

As a result of the October 17, 2006, monitoring regulations, the minimum number of required ozone sites in an MSA were changed. In addition, due to the 2010 Census, MSA boundaries were modified and population totals tied to measurements of ambient air quality were increased. A monitor with a design value (using the most recent three years of data) that is ≥ 85 percent of the ozone NAAQS has a higher probability of violating the standard. Therefore, the USEPA requires more monitors in these MSAs. In other instances, the number of monitors may be reduced if the design value is greater than 115 percent of the NAAQS.[7] Note: background and transport ozone monitors are still required but are not shown in **Table 9**.

Table 9: SLAMS Minimum Ozone Monitoring Requirements

MSA Population[1,2]	Most Recent 3-year Design Value Concentrations ≥ 85% of any Ozone NAAQS[3]	Most Recent 3-year Design Value Concentrations < 85% of any Ozone NAAQS[3,4]
> 10 million	4	2
4 - 10 million	3	1
350,000 - < 4 million	2	1
50,000 - < 350,000[5]	1	0

[1] Minimum monitoring requirements apply to the MSA.
[2] Population based on the latest available census figures.
[3] The ozone NAAQS levels and forms are defined in 40 CFR Part 50.
[4] These minimum monitoring requirements apply in the absence of a design value.
[5] MSA must contain an urbanized area of 50,000 or more population.

Applying the requirements described in **Table 9** to Michigan's MSAs, population totals and the most recent 3-year design values results in a minimum ozone network design summarized in **Table 10**. All monitors in Michigan are above 85 percent of the ozone NAAQS of 0.070 ppm.

Figure 4 illustrates changes in the 3-year averages of the fourth highest ozone values, called design values, from 2015 to 2019. When contemplating changes to the ozone network, it is important to consider changes in design values in nonattainment areas. In 2015 the USEPA lowered the ozone NAAQS to 0.070 ppm. The USEPA's nonattainment designations were based on the ozone design values for 2014-2016.

[7] Table D-2 of Appendix D to Part 58.

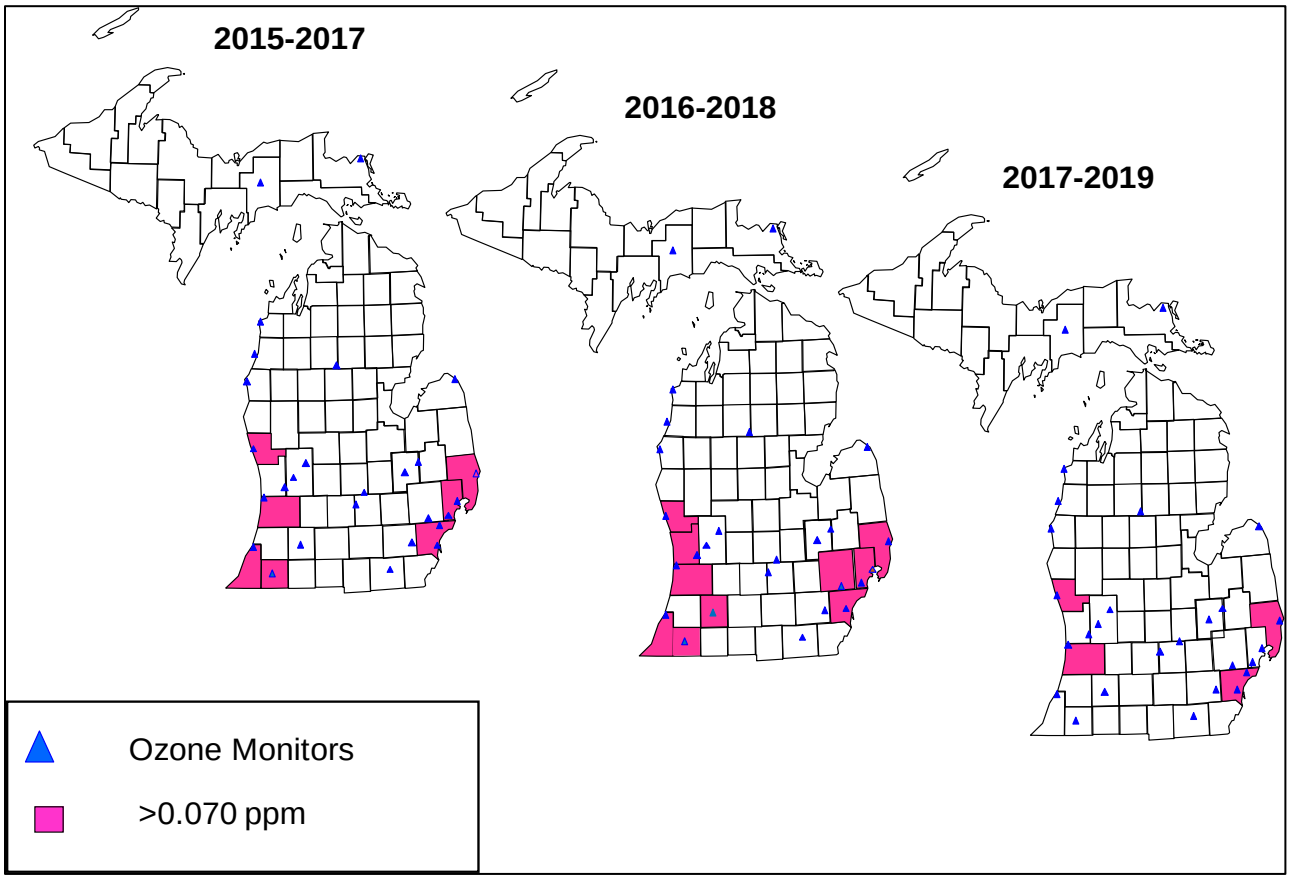
Table 10: Application of Minimum Ozone Requirements in the October 17, 2006 - Final Revision to the Monitoring Regulation to Michigan's Ozone Network

NAAQS: 0.070 ppm
85% NAAQS: 0.059 ppm
Decimals to the right of the third decimal place are truncated.
The 3-year O3 average at the MSA Design Value site is shown in bold.
Values for sites ≥ 85% NAAQS are in red.

MSA	2019 Population Estimate	Counties	Existing Monitors	2017-2019 3-year O_3 design value	Min. No. Monitors Required
		Macomb	New Haven	0.068	**3**
			Warren	0.066	
		Oakland	Oak Park	0.070	
Detroit-Warren-Livonia MSA	4,319,629	Wayne	Allen Park	0.066	
			Detroit - E 7 Mile	**0.072**	
		Lapeer	---		
		St. Clair	Port Huron	0.071	
		Livingston	---		
Flint MSA	405,813	Genesee	Flint	**0.064**	2
			Otisville	0.063	
Monroe MSA	150,500	Monroe	---		
Ann Arbor MSA	367,601	Washtenaw	Ypsilanti	**0.066**	2
Grand Rapids-Wyoming MSA		Kent	Grand Rapids - Monroe St.	0.066	2
	1,077,370		Evans	0.064	
		Barry	---		
		Ottawa	Jenison	**0.067**	1
		Montcalm	---		
Muskegon-Norton Shores MSA	173,566	Muskegon	Muskegon - Green Creek Rd.	**0.074**	1
		Clinton	Rose Lake	0.062	2
Lansing-East Lansing MSA	550,391	Ingham	Lansing	**0.063**	
		Eaton	---		
Bay City MSA	103,126	Bay	---		
Saginaw MSA	190,539	Saginaw	---		
Kalamazoo-Portage MSA	265,066	Kalamazoo	Kalamazoo	**0.066**	1
		Van Buren	---		
Niles-Benton Harbor MSA	153,401	Berrien	Coloma	**0.069**	1
Jackson MSA	158,510	Jackson	---		
Battle Creek MSA	134,159	Calhoun	---		
South Bend Mishawaka MSA	323,613	Cass	Cassopolis	**0.070**	1

Other areas:	Comments			
	transport site	Lenawee	Tecumseh	0.065
		Benzie	Frankfort	0.063
		Huron	Harbor Beach	0.064
		Allegan	Holland	0.072
	background site	Missaukee	Houghton Lake	0.062
		Mason	Scottville	0.063
		Schoolcraft	Seney	0.059
	tribal site	Manistee	Manistee	0.064

Figure 4: Comparison of 4th Highest 8-Hour Ozone Values Averaged Over Three Years 2015-2017, 2016-2018 and 2017-2019



In southeast Michigan, New Haven (260990009) has been the design value site for many years, measuring maximum ozone concentrations downwind from Detroit. However, in 2015, the Port Huron (2611470005) monitoring site became the new design value site for the Detroit-Warren-Livonia MSA. The location of the maximum ozone concentration has moved in recent years, possibly due to changes in the amount, type, and location of ozone precursor emissions. The E 7 Mile (261630019) site is the new design value site. Allen Park (261630001) is upwind of the central business district and is an NCore site for the Detroit-Warren-Livonia MSA. Both NCore sites are required by EGLE to measure ozone over the entire year. Although three ozone sites are required for the Detroit-Warren-Livonia MSA, USEPA Region 5 staff have indicated that E 7 Mile (2601630019) will be the new design value site for that area. The Oak Park (261250001) and Port Huron (261470005) monitors are the only ozone sites in Oakland and St. Clair Counties, respectively. Based on the 2017-2019 data, Allen Park (261630001), Warren (261631003) and New Haven (260990009) are below the 0.070 ppm design values. Whereas Oak Park (261250001) is at the design value, and E 7 Mile (261630019) and Port Huron (261470005), are over the design value.

Two monitors are required in the Ann Arbor MSA and consist of the Ypsilanti monitor (261610008) and the downwind monitor in Oak Park (261250001). The urban center city location coupled with a downwind maximum concentration site is a carry-over from

the defunct NAMS network. Oakland County houses the downwind site, although it is outside of the boundary of the Ann Arbor MSA. The upwind/downwind configuration will be retained wherever possible to preserve historical trend data.

Two monitors are required in the Flint MSA; they consist of the urban center city site in Flint (260490021) and the downwind site at Otisville (260492001).

Three ozone monitors are also required in the Grand Rapids-Wyoming MSA. They consist of the urban center city site in Grand Rapids on Monroe St. (260810020), the downwind site at Evans (260810022), and the Jenison (26139005) site.

Two monitors are required in the Lansing-East Lansing MSA consisting of the urban center city site in Lansing (260650018) and the downwind Rose Lake 2 (260370002) location. Due to the Lansing School District's property redevelopment project, EGLE was required to move the monitoring site from Lansing Eastern High School (260650012) in April 2018 to 815 Filley Street in Lansing. The new Lansing site began operation in May 2018.

A single ozone monitor is required in each of the MSAs of Holland-Grand Haven, Muskegon-Norton Shores, Kalamazoo-Portage, Niles-Benton Harbor, and South Bend-Mishawaka. The Holland (260050003), Muskegon–Green Creek Rd. (261210039), Kalamazoo (260770008), Coloma (260210014), and Cassopolis (260270003) monitors fulfill these requirements, respectively. Nonattainment designations on the west side of the state were based on the 2014-2016 design values at the Holland, Muskegon, and Coloma sites.

Tecumseh (260910007) measures ozone transport into southeast Michigan and is required by Michigan's maintenance plan. Harbor Beach (260630007) measures transport out of southeast Michigan under southwesterly winds. Scottville (261050007) and Frankfort / Benzonia (260190003) are sited to measure transport of ozone along Lake Michigan and have been in operation for 20 and 26 years, respectively. These two sites are also an important part of Michigan's maintenance plan. Houghton Lake (261130001) and Seney (261530001) measure background ozone levels in the upper region of the Lower Peninsula and Upper Peninsula, respectively.

The Tribal ozone site in Manistee (261010922) had to be relocated in 2020 and missed sampling a part of the ozone season.

Created by the Lake Michigan Air Directors Consortium (LADCO), **Figure 5** (map) compares ozone concentrations across the region.

Figure 5: Ozone Design Values 2014 – 2016[8]

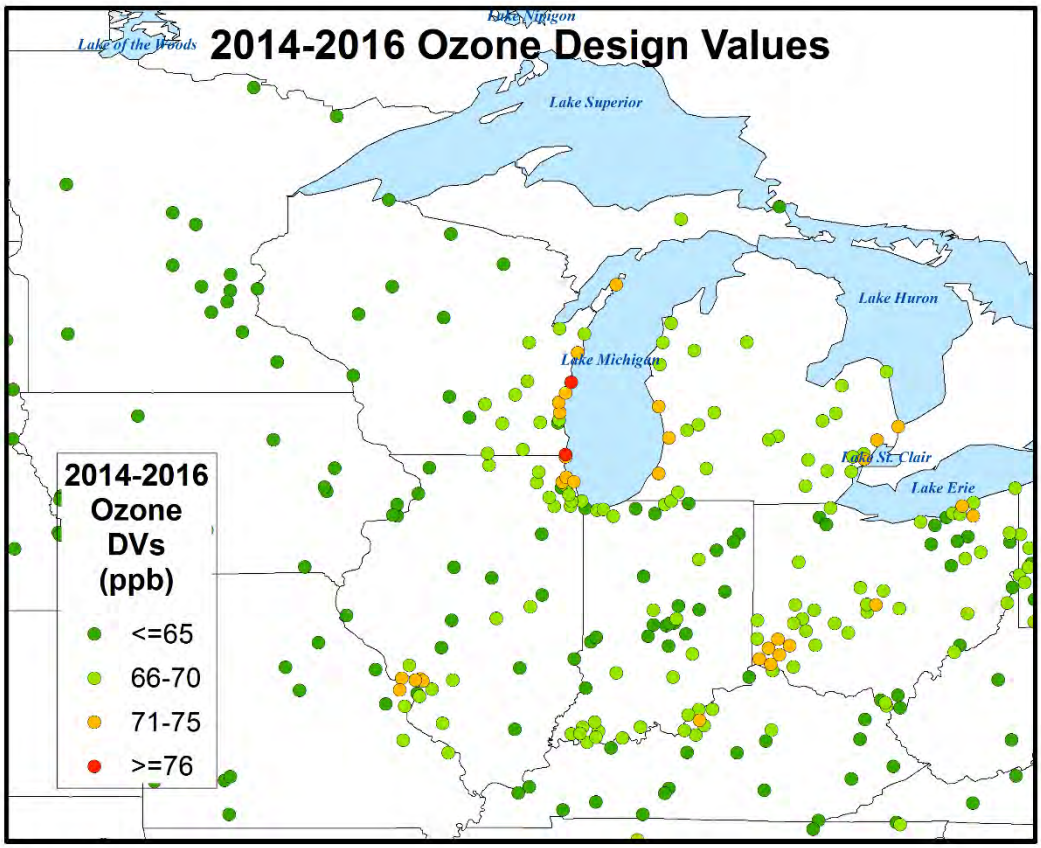


Table 11 summarizes the ozone monitoring site information for sites that were operational in 2020 and are planned to be operational in 2021. **Figure 6** illustrates the geographical distribution of this network.

[8] Map provided by D. Kenski, Lake Michigan Air Directors Consortium (LADCO).

Table 11: Michigan's Ozone Monitoring Network 2020-2021

Operating Schedule: Hourly, March 1 to Octover 31; *NCore operate hourly all year*
Houghton Lake and Lansing operate hourly all year
Method: Ultra Violet Absorption Continuous Monitor, Method Code 087

SLAMS Stations

Monitoring Sites												
Site Name	AQS Site ID	Address	Latitude	Longitude	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	MSA[1]	2019 Population Estimate
Holland	260050003	966 W 32nd St	42.7678	-86.1486	max conc	44201	1	urban	Allegan	8/25/92	A	118,081
Frankfort / Benzonia	260190003	West St., Benzonia Twp.	44.61694	-86.10944	max conc	44201	1	regional	Benzie	7/28/92	Not in MSA	N/A
Coloma	260210014	Paw Paw WWTP, 4689 Defield Rd.,Coloma	42.1978	-86.3097	max conc	44201	1	regional	Berrien	8/3/92	NBH	153,401
Cassopolis	260270003	Ross Beatty High School, 22721 Diamond	41.8956	-86.0017	pop exp	44201	2	urban	Cass	5/16/91	SBM	323,613
Rose Lake 2	260370002	9870 Stoll Rd,Lansing	42.7983	-84.3939	max conc	44201	1	urban	Clinton	9/30/16	LEL	550,391
Flint	**260490021**	**Whaley Park, 3610 Iowa**	**43.0472**	**-83.6703**	**pop exp**	**44201**	**1**	**nghbrhd**	**Genesee**	**6/16/92**	**F**	**405,813**
Otisville	**260492001**	**G11107 Washburn Rd**	**43.1683**	**-83.4617**	**max conc**	**44201**	**1**	**urban**	**Genesee**	**5/13/80**	**F**	**405,813**
Harbor Beach	260630007	1172 S. M 25, Sand Beach Twp.	43.8364	-82.6431	backgrd	44201	1	regional	Huron	4/1/94	Not in MSA	N/A
Lansing Filley	260650018	815 Filley St., Lansing	42.7614	-84.5629	pop exp	44201	2	nghbrhd	Ingham	4/1/18	LEL	550,391
Kalamazoo	260770008	Fairgrounds, 2500 Lake St	42.2781	-85.5419	pop exp	44201	1	nghbrhd	Kalamazoo	6/1/92	KP	265,066
GR - Monroe St	***260810020***	***1179 Monroe NW***	***42.984***	***-85.6714***	***pop exp***	***44201***	***1***	***nghbrhd***	***Kent***	***4/24/80***	***GW***	***1,077,370***
Evans	260810022	10300 14 Mile Road, NE	43.1767	-85.4167	max conc	44201	1	urban	Kent	4/1/99	GW	1,077,370
Tecumseh	260910007	6792 Raisin Center Highway	41.9956	-83.9467	up wind backgrd	44201	1	regional	Lenawee	7/6/93	AL	98,451
New Haven	260990009	57700 Gratiott	42.7314	-82.7936	max conc	44201	1	urban	Macomb	7/14/80	DWL	4,319,629
Warren	**260991003**	**29900 Hoover**	**42.5133**	**-83.0061**	**max conc**	**44201**	**1**	**urban**	**Macomb**	**1/1/77**	**DWL**	**4,319,629**
Scottville	261050007	525 W US 10	43.9533	-86.2944	max conc	44201	1	regional	Mason	4/1/98	Not in MSA	N/A
Houghton Lake	261130001	1769 S Jeffs Road	44.3106	-84.8919	background	44201	1	regional	Missaukee	4/1/98	Not in MSA	N/A
Muskegon - Green Ck	261210039	1340 Green Creek Road	43.2781	-86.3111	pop exp	44201	1	regional	Muskegon	5/1/91	MNS	173,566
Oak Park	261250001	13701 Oak Park Blvd.	42.4631	-83.1833	pop exp	44201	2	urban	Oakland	1/9/81	DWL	4,319,629
Jenison	261390005	6981 28Th Ave. Georgetown Twp.	42.8944	-85.8528	pop exp	44201	1	urban	Ottawa	4/1/89	GW	1,077,370
Port Huron	261470005	2525 Dove Rd	42.9533	-82.4564	pop exp	44201	1	urban	Saint Clair	2/28/81	DWL	4,319,629
Seney	261530001	Seney Wildlife Refuge, HCR 2 Box 1	46.2889	-85.9503	bkgrd	44201	1	regional	Schoolcraft	1/15/02	Not in MSA	N/A
Ypsilanti	261610008	555 Towner Ave	42.2406	-83.5997	pop exp	44201	1	nghbrhd	Washtenaw	4/1/00	AA	367,601
Allen Park	*261630001*	*14700 Goddard*	*42.229*	*-83.2083*	*pop exp*	*44201*	*2*	*nghbrhd*	*Wayne*	*1/1/80*	*DWL*	*4,319,629*
Detroit - E 7 Mile	261630019	11600 East Seven Mile Road	42.4308	-83.0003	max conc	44201	2	urban	Wayne	4/11/77	DWL	4,319,629

Tribal Stations

Monitoring Sites												
Site Name	AIRS Site ID	Address	Latitude	Longitude	Purpose	Parameter Code	POC	Scale	County	Start Date	MSA [1]	2019 Population Estimate
Manistee	261010922	3031 Domres Rd	44.307	-86.2427	transport	44,201	1	regional	Manistee	4/1/06	Not in MSA	N/A

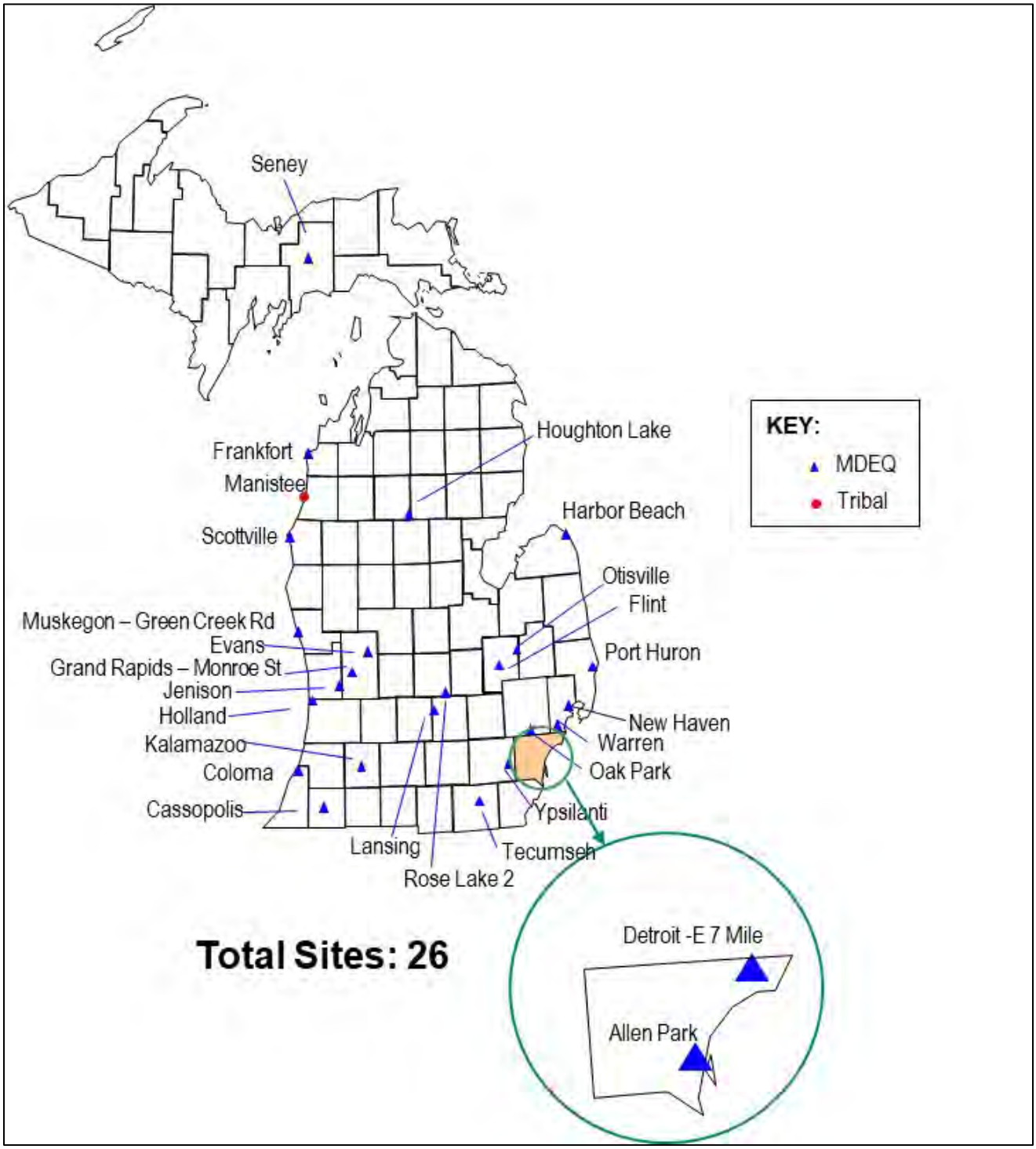
[1] **MSA Key:**

A	Allegan Micropolitan Area	HGH	Holland-Grand Haven MSA
AA	Ann Arbor MSA	KP	Kalamazoo-Portage MSA
AL	Adrian Micropolitan Area	LEL	Lansing-E. Lansing MSA
DWL	Detroit-Warren-Livonia MSA	MNS	Muskegon-Norton Shores MSA
F	Flint MSA	NBH	Niles-Benton Harbor MSA
GW	Grand Rapids-Wyoming MSA	SBM	South Bend-Mishawaka MSA (IN/MI)

[2] **Former NAMS sites** are shown in **bold**.Old Lansing and Roselake have been moved

[3] **NCore sites** are shown in *italics* .

Figure 6: Michigan's Ozone Network in 2020-2021



Ozone Season and Modeling

The length of the ozone season was modified with the enactment of the 0.070 ppm 8-hour primary NAAQS. The new ozone NAAQS final rule extends the ozone season in Michigan from March 1 through October 31. This new season started with the 2017 ozone season.

With the new 1-hour NO_2 NAAQS, modeling conducted as part of the permitting process for new source review (NSR) has indicated that many facilities in Michigan could violate the standard. More refined modeling is an option using the Ozone Limiting Method or Plume Volume Molar Ratio Method (PVMRM), but more site-specific 1-hour NO_2 background levels, as well as year-round ozone values, are necessary. Specifically, modeling staff need five years of ozone and NO_2 data collected in small cities, urban, and rural areas. While Allen Park (261630001) and Grand Rapids–Monroe St. (260810020) measure ozone values in urban areas throughout the year, levels in smaller cities and rural areas were not available. Therefore, beginning October 1, 2010, EGLE began to monitor for ozone throughout the year at the Lansing (260650012) and Houghton Lake (261130001) stations. The new Lansing site (260650018) operates the same parameters as the previous Lansing site. The collection of additional NO_2 data to support NSR modeling is discussed in the NO_2 section.

Ozone Quality Assurance

Site operators conduct 1-point quality assurance checks on the monitors every two weeks. The results of the precision checks are sent to the QA Coordinator for review each quarter. Each ozone monitor is also audited annually by the AMU's QA Team. The audit utilizes a dedicated ozone photometer to assess the accuracy of the station monitor. The auditor also assesses the monitoring system (inspecting the sample line, filters, and the inlet probe), siting, and documentation of precision checks. Results of the ozone audits and quality assurance checks indicate whether the monitor is meeting measurement quality objectives. The AMU uploads the results of the precision checks and audits to the USEPA's AQS database each quarter. The QA Coordinator reviews all audits and hard copies are retained in the QA files.

The USEPA conducts thru-the-probe audits of 20 percent of EGLE's ozone monitors each year. The audit consists of delivering four levels of ozone to the station monitor through the probe. The percent difference that is measured by the auditor's monitor is compared to the station monitor. The auditor also assesses station and monitoring siting criteria. The USEPA auditor provides the AMU with a copy of the audit results and uploads the audit data to AQS.

Ozone Area Designations

On April 30, 2018, the USEPA made their final ozone nonattainment designations. On the west side of the state, part of Allegan County, all of Berrien County, and part of Muskegon County were reclassified for nonattainment for ozone . In 2019 EGLE submitted a request to USEPA to re-designate Berrien County as in attainment for ozone The request is under review . On the east side of the state, a seven-county area

was reclassified as nonattainment for ozone, which includes Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne Counties. The remaining counties were designated attainment or unclassifiable.

In accordance with the CAA section 107(d), the USEPA must designate as nonattainment any area that violates the NAAQS and any nearby areas that contribute to the violation in the violating area. Based on the five factors below, the USEPA has determined that Livingston, Monroe, Oakland, and Washtenaw Counties contribute to the violating area.

1. Air Quality Data (including the design value calculated for each FRM or FEM monitor;
2. Emissions and Emissions-related Data (including locations of sources, population, amount of emissions, and urban growth patterns);
3. Meteorology (weather / transport patterns);
4. Geography/Topography (including mountain ranges or other physical features that may influence the fate and transport of emissions and ozone concentrations); and
5. Jurisdictional Boundaries (e.g., counties, air districts, existing nonattainment areas, areas of Indian country, Metropolitan Planning Organizations (MPOs)).

The nonattainment areas in western Michigan, with violating ozone monitors, are areas impacted by the unique air flow and meteorology of Lake Michigan and the resulting subregional transport of ozone and ozone-forming emissions from major urban areas in the Lake Michigan area (e.g., Chicago, Gary, and Milwaukee). At shoreline locations, the contribution of ozone-forming emissions from sources in Michigan is negligible.

Area	Michigan's Recommended Nonattainment Counties	EPA's Designated Nonattainment Counties
Detroit, MI	Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw and Wayne Counties	Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw and Wayne Counties
Muskegon, MI	Muskegon Partial County	Muskegon Partial County
Allegan, MI	Allegan Partial County	Allegan Partial County
Berrien, MI	Berrien County	Berrien County

Plans for the 2021 Ozone Monitoring Network

Beginning October 1, 2009, EGLE began collecting ozone measurements all year at the NCore sites and plans to continue through 2021:

- Grand Rapids–Monroe St. (260810020); and
- Allen Park (261630001).

To support NSR modeling projects, EGLE will continue to collect all year ozone measurements in 2021 at the following sites:

- Lansing (260650018); and
- Houghton Lake (261130001).

The current ozone network meets the minimum design specifications in 40 CFR Part 58. No ozone site reductions are planned at this time. The following monitors are planned to be retained as part of the 2021 ozone network, operating March 1 through October 31:

- Holland (260050003)
- Frankfort / Benzonia (260190003)
- Coloma (260210014)
- Cassopolis (260270003)
- Rose Lake 2 (260370002)
- Flint (260490021)
- Otisville (260492001)
- Harbor Beach (260630007) (downwind monitor)
- Kalamazoo (260770008)
- Evans (260810022)
- Tecumseh (260910007) (background monitor)
- New Haven (260990009)
- Warren (260991003)
- Scottville (261050007)
- Muskegon–Green Creek Rd. (261210039)
- Oak Park (261250001)
- Jenison (261390005)
- Port Huron (261470005)
- Seney (261530001)
- Ypsilanti (261610008)
- Detroit-E 7 Mile (261630019)

The Manistee (261050922) Tribal monitor will continue to operate in 2021.

$PM_{2.5}$ FRM MONITORING NETWORK

The January 15, 2013, revision to the PM NAAQS lowered the $PM_{2.5}$ annual average from 15.0 µg/m^3 to 12.0 µg/m^3. All counties in Michigan are currently meeting this standard.

The October 17, 2006, changes to the monitoring regulations impacted the minimum number of $PM_{2.5}$ sites in an MSA, as shown in **Table 13**.[9] Background and transport monitors are required, in addition to these minimum requirements.

Although speciation monitoring is required, details specifying the exact number of sites and their sampling frequency were not stated in the October 17, 2006, regulations. However, the continued operation of the speciation trends site Allen Park (261630001) on a once every three-day sampling schedule is required.

Michigan does not spatially average $PM_{2.5}$ values from multiple sites to determine attainment with the annual $PM_{2.5}$ NAAQS. Therefore, if a $PM_{2.5}$ monitor that is violating the NAAQS must be removed due to loss of access or funding, a replacement site need not be found, if the annual and/or 24-hour design value site(s) in that MSA are still operational. The attainment status of the area is dependent upon the design value sites.

Table 12: $PM_{2.5}$ Minimum Monitoring Requirements

MSA Population[1,2]	Most Recent 3-year Design Value Concentrations ≥ 85% of any $PM_{2.5}$ NAAQS[3]	Most Recent 3-year Design Value Concentrations < 85% of any $PM_{2.5}$ NAAQS[3,4]
> 1,000,000	3	2
500,000 – < 1,000,000	2	1
50,000 - ≤ 500,000[5]	1	0

[1] Minimum monitoring requirements apply to the MSA.
[2] Population based on the latest available census figures.
[3] The $PM_{2.5}$ NAAQS levels and forms are defined in 40 CFR Part 50.
[4] These minimum monitoring requirements apply in the absence of a design value.
[5] MSA must contain an urbanized area of 50,000 or more.

The regulations also state that any FRM monitors that are within ± 5 percent of the level of the 24-hour NAAQS must sample on a daily sampling frequency. The monitoring regulations also state that organizations co-locate 15 percent of sites for each primary method with a secondary $PM_{2.5}$ measurement to estimate precision at a reporting organization level.

In 2016, EGLE changed all FRM monitors to very sharp cut cyclones. The changes were made in April and May 2016. This changed the method code from 118 to 145. The dates of each instrument conversion can be determined by the data in the USEPA AQS database.

[9] Table D-5 of Appendix D to Part 58.

Applying **Table 12** to Michigan's MSAs, population totals and most recent three-year design values results in **Table 13**. Design values shown in bold print represent the controlling site in each MSA, which is also called the design value site.

Table 13: Application of the Minimum $PM_{2.5}$ Monitoring Requirements in the October 17, 2006, Final Revision to the Monitoring Regulation to Michigan's $PM_{2.5}$ FRM Network

The annual avg & 24-hr avg are rounded to 1 and 0 decimal points respectively.

annual	24-hr	**5% of the 24-Hr NAAQS**
85% of 12 ug/m3	85% of 35 ug/m3	33-37 = 5% NAAQS
10.2	30	

The 3-year PM2.5 average at MSA Design Value site is shown in bold.

MSA	2019 Population Est.	Counties	Existing Monitors	2017-2019 3-year PM2.5 design value (annual)	2017-2019 3-year PM2.5 design value (24-Hr)	Min. No. monitors Required	Comments
		Macomb	New Haven	7.5	18	3	
		Oakland	Oak Park	8.0	19		
		Wayne	Allen Park	8.8	22		daily
			Detroit-SW HS	**11.6**	**30**		
			Detroit - Linwood (closed)	---	---		
			Detroit - E 7 Mile	8.0	19		
			DP4th	**10.8**	27		
			Trinity	**11.6**	28		
			Military	**11.6**	29		
Detroit-Warren-Livonia MSA	4,319,629		Livonia (closed)	---	---		
			Dearborn	**10.4**	25		
			Wyandotte (closed)	---	---		
			Livonia Near Road (relocated)	8.6	24.0		
		Lapeer	---				
		St Clair	Port Huron	7.9	20		
		Livingston	---				
Flint MSA	405,813	Genesee	Flint	***7.3***	19	0	
Monroe MSA	150,500	Monroe	Sterling State Park (closed)	---	---	0	
Ann Arbor MSA	367,601	Washtenaw	Ypsilanti	8.3	21	0	
		Kent	GR - Monroe St.	8.2	22	2	
			GR - Wealthy St.	---	--		
Grand Rapids-Wyoming MSA	1,077,370	Barry	---				
		Ottawa	Jenison	8.3	23		
		Montcalm	---				
Muskegon-Norton Shores MSA	173,566	Muskegon	Muskegon - Apple St. (closed)			0	
		Clinton	---				
Lansing-East Lansing MSA	550,391	Ingham	Lansing Filley	**7.5**	26	0	
		Eaton	---				
Bay City MSA	103,126	Bay	Bay City	6.9	19	0	
Kalamazoo-Portage MSA	265,066	Kalamazoo	Kalamazoo	7.9	20	0	
		Van Buren	---				
Niles-Benton Harbor MSA	153,401	Berrien	Coloma (closed)	---	---	0	
Jackson MSA	158,510	Jackson	---				
Battle Creek MSA	134,159	Calhoun	---				
South Bend-Mishawaka MSA	323,613	Cass	---				
		St. Joseph, IN				0	
Other areas							
		Allegan	Holland	7.4	21		*micropolitan area*
		Missaukee	Houghton Lake	5.4	15		
		Manistee	Manistee	5.6	17		
		Lenawee	Tecumseh	8.1	21		
		Schoolcraft	Seney	4.2	17		

The reduced concentrations of $PM_{2.5}$ measured since 2010 have caused the 2017-2019 design values to drop markedly in many MSAs. The minimum number of monitoring sites in Monroe, Ann Arbor, Holland-Grand Haven, Muskegon-Norton Shores, Lansing-East Lansing, Bay City, Kalamazoo-Portage, Flint, and Niles-Benton Harbor has fallen

from one site to zero. Due to an increase in population, two monitors are again required in the Grand Rapids-Wyoming MSA.

The $PM_{2.5}$ monitor in Holland (260050003) in Allegan County is a micropolitan area. The monitor's design values were no longer within 85 percent of the NAAQS. As the agency works to transition to real-time monitoring, EGLE replaced the filter-based FRM sampler with a continuous FEM, MetOne BAM on January 6, 2020.

The Saginaw MSA is required to have a $PM_{2.5}$ FRM site. The USEPA Regional Administrator granted a waiver allowing for the Bay City site (260170014) to fulfill this requirement. The 24-hour $PM_{2.5}$ design value of the monitor in Bay City was less than 85 percent of the NAAQS, indicating that monitoring was no longer required. EGLE will continue to measure $PM_{2.5}$ and replaced the filter-based FRM and TEOM with a continuous FEM, MetOne BAM on October 24, 2019.

As shown in **Table 13**, using the most recent three years of data, the Flint monitor (260490021) had an annual and a 24-hour design value equaling 7.3 and 19 $\mu g/m^3$, respectively, which are less than 85 percent of their respective NAAQS. EGLE will continue to operate a filter-based FRM $PM_{2.5}$ monitor as a secondary sampler to the MetOne BAM in the Flint MSA in 2021. The continuous MetOne BAM replaced the TEOM on September 6, 2018.

The annual and 24-hour $PM_{2.5}$ design values at the Lansing monitor (260650018) are no longer greater than 85 percent of the NAAQS, indicating that monitoring is no longer required. However, EGLE will continue to measure $PM_{2.5}$, but will transition to a continuous FEM T640 in 2021 along with a co-located FRM filter-based sampler.

The Kalamazoo monitor (260770008) fulfilled the requirement that the Kalamazoo-Portage MSA have one FRM sampler. Both the 24-hour and annual design values are now less than 85 percent of the respective NAAQS, indicating that a site is no longer necessary in this MSA. EGLE intends to discontinue operation in 2020-2021of both the primary and secondary, filter-based FRM $PM_{2.5}$ samplers and the $PM_{2.5}$ TEOM. A new continuous $PM_{2.5}$ FEM (T640) monitor will operate at this site in 2020-2021.

In the past, two monitors were required in the Grand Rapids-Wyoming MSA; the site at Monroe St. (260810020) and at Wealthy St. in Wyoming (260810007). Grand Rapids-Monroe St. (260810020) is an NCore site and is therefore required to retain the $PM_{2.5}$ FRM monitor. Due to difficulties with accessing the Wealthy St. (260810007) site, EGLE had to relocate the $PM_{2.5}$ monitor to the Jenison (261390005) site January 14, 2018. The 24-hour and annual design values at both sites are now less than 85 percent of the respective NAAQS. EGLE will replace monitors at both sites with new continuous $PM_{2.5}$ FEM (T640X) monitors in 2020-2021.The T640X has FEM status for $PM_{2.5}$, PM_{10}, and $PM_{10-2.5}$.

The Tecumseh site (260910007) is the upwind background site near the Detroit-Warren-Livonia MSA, EGLE added a continuous FEM Thermo BAM on January 1, 2019, replacing the continuous $PM_{2.5}$ TEOM and filter-based FRM sampler.

The sites at New Haven (260990009) and Oak Park (261250001) are the only sites in Macomb and Oakland Counties, respectively. EGLE will continue to operate the Oak Park FRM monitor. However, the New Haven monitor will be replaced with a continuous $PM_{2.5}$ FEM (T640) monitor at this site in 2020-2021.

Houghton Lake (261130001) is the background $PM_{2.5}$ FRM site in Michigan. EGLE replaced the filter-based sampler with a continuous $PM_{2.5}$ BAM on January 1, 2019.

The Port Huron (261470005) site design value has also dropped, EGLE will replace the FRM $PM_{2.5}$ monitor with a new continuous $PM_{2.5}$ FEM (T640) monitor in 2020-2021.

Fine particulate concentrations have dropped below 85 percent of the level of the NAAQS in the Ann Arbor MSA, so a monitor is no longer required. However, EGLE will continue to operate a $PM_{2.5}$ FRM as a secondary monitor to the continuous $PM_{2.5}$ Thermo BAM at the Ypsilanti site (261610008) in 2021.

A total of three $PM_{2.5}$ FRM monitors are required in the Detroit-Warren-Livonia MSA. Dearborn (261630033) has historically been the highest annual design value site with a primary and a secondary monitor. EGLE will continue the operation of both FRM monitors at Dearborn. Allen Park (261630001) is the population-oriented trend site, an NCore site, and as such, is also required to collect speciated $PM_{2.5}$ samples on a once every three-day schedule. EGLE will continue to operate the FRM at the Allen Park site. The Detroit-SWHS site (261630015) is the second highest site in the MSA. With construction of the Gordie Howe International Bridge near this site, EGLE will continue operating the primary $PM_{2.5}$ along with a continuous FEM sampler. EGLE will replace the Thermo BAM with a T640 in 2021. The E 7 Mile (261630019) site $PM_{2.5}$ FRM will continue operation in 2021.

The Livonia site (261630025) in western Wayne County was shut down on January 1, 2019. The Livonia Near-road site (261630095) fulfilled the requirement for $PM_{2.5}$ monitoring at a near-road site. However, the near-roadway site was shut down due to accessibility issues in July 2019. Due to closure of this site, the MetOne BAM was moved to the Eliza Howell Near-roadway site (261630093) to satisfy the near-roadway requirement in the Detroit MSA for $PM_{2.5}$ monitoring. A replacement site in Livonia along I-275 was re-established in the spring of 2020; however, the near-roadway monitoring for $PM_{2.5}$ will remain at the Eliza Howell site.

A Tribal $PM_{2.5}$ FRM monitoring site located in Manistee (261010922) is operated by the Little River Band of Ottawa Indians. This monitor will continue to operate in 2021.

The above changes in the network will reduce the required number of FRM co-located sites. The reduction to 10 sites equates to a 15 percent co-location requirement of one site. EGLE proposes to keep Dearborn (261630033) as the co-located sites and shut down the secondary sampler at Kalamazoo (260770008).

Table 14 summarizes the $PM_{2.5}$ FRM monitoring site information for sites that were operating in 2020 and are planned to be operational in 2021. **Figure 7** illustrates the geographical distribution of $PM_{2.5}$ FRM monitors for 2019 and 2021.

Table 14: Michigan's $PM_{2.5}$ FRM Network

Operating Schedule: Once every 6 days, once every 3 days or daily see below.
Method: Partisol 2025 Rupprecht & Patashnick Samplers, Method Code 142

SLAMS Network

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	MSA [1]	2019 Population Estimate
Flint	260490021	Whaley Park, 3610 Iowa St., Flint	43.04722	-83.670278	1:3	Pop. Exp.	88101	1	Neighborhood	Genesee	12/16/98	F	405,813
Lansing Filley	260650018	815 Filley St Lansing	42.76138	-84.562867	1:3	Pop. Exp.	88101	1	Neighborhood	Ingham	05/16//2018	LEL	550,391
Grand Rapids - Monroe St.	260810020	1179 Monroe St., NW,	42.984167	-85.671389	1:3	Pop. Exp.	88101	1	Neighborhood	Kent	10/23/98	GW	1,077,370
Oak Park	261250001	13701 Oak Park Blvd.	42.463056	-83.183333	1:3	Pop. Exp.	88101	1	Neighborhood	Oakland	12/25/98	DWL	4,319,629
Ypsilanti	261610008	555 Towner Ave.	42.240556	-83.599722	1:3	Pop. Exp.	88101	1	Neighborhood	Washtenaw	8/4/99	AA	367,601
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	1:3	Pop. Exp.	88101	1	Neighborhood	Wayne	5/12/99	DWL	4,319,629
Detroit - SWHS	261630015	150 Waterman	42.302778	-83.106667	1:3	Pop. Exp. Max. Conc.	88101	1	Neighborhood	Wayne	2/26/99	DWL	4,319,629
Detroit - E 7 Mile	261630019	11600 E. 7 Mile, Osborne School	42.430833	-83.000278	1:3	Pop. Exp.	88101	1	Neighborhood	Wayne	4/30/00	DWL	4,319,629
Dearborn	261630033	2842 Wyoming, Salina School	42.306666	-83.148889	1:3	Pop. Exp. Max. Conc.	88101	1	Neighborhood	Wayne	2/5/99	DWL	4,319,629
Dearborn	261630033	2842 Wyoming, Salina School	42.306666	-83.148889	1:6, co-loc	Pop. Exp. Max. Conc.	88101	2	Neighborhood	Wayne	2/5/99	DWL	4,319,629

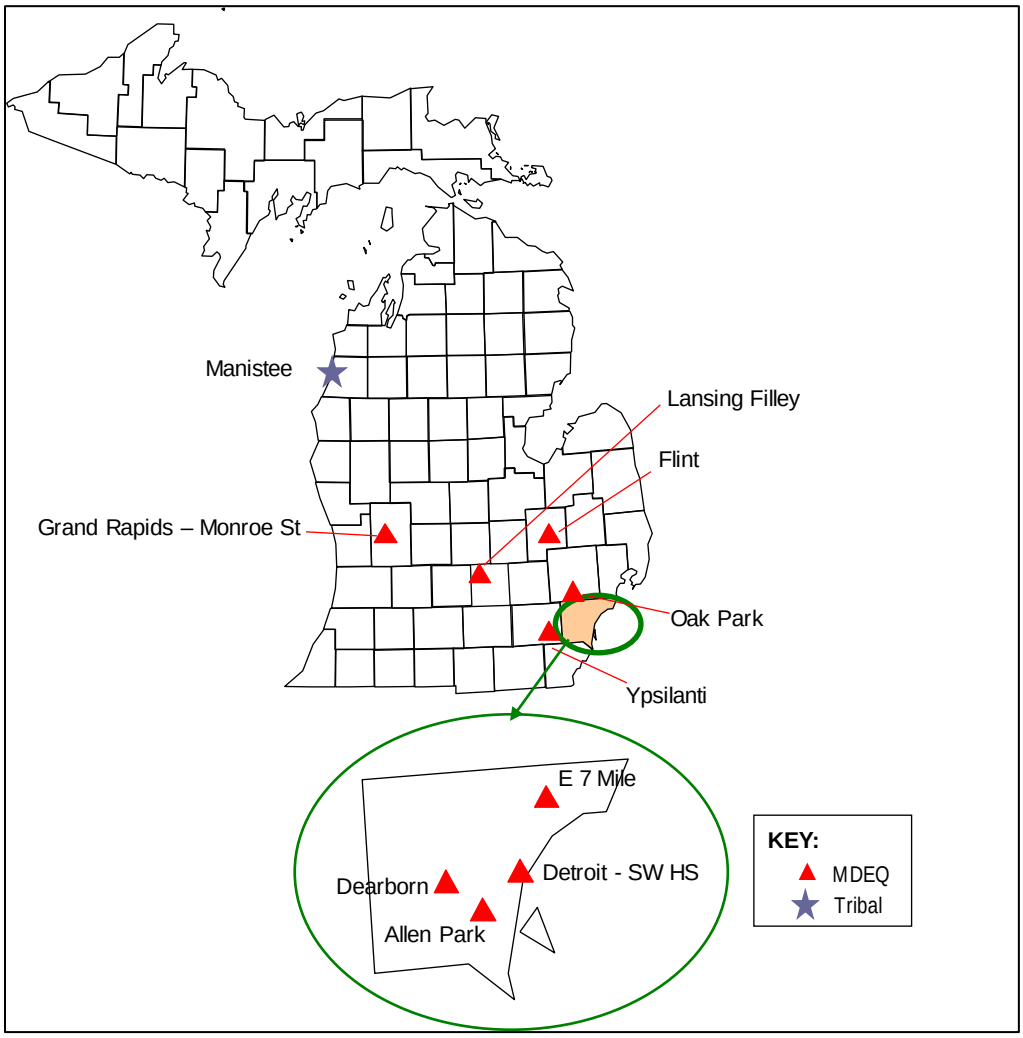
Special Purpose and Tribal $PM_{2.5}$ Monitors in Michigan

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	MSA [1]	2019 Population Estimate
Manistee	261010922	3031 Domres Rd.	44.307	-86.24268	1:3	Tribal	88101	1	Regional	Manistee	4/2/06	Not in CBSA	N/A

[1] **MSA Key:**

AA = Ann Arbor MSA
DWL = Detroit-Warren-Livonia MSA
F = Flint MSA
GW = Grand Rapids-Wyoming MSA
LEL = Lansing-E. Lansing MSA

Figure 7: Michigan's $PM_{2.5}$ FRM Monitoring Network



$PM_{2.5}$ Quality Assurance

The $PM_{2.5}$ sampling is addressed in the Air Monitoring Unit program QAPP. EGLE plans to operate one co-located $PM_{2.5}$ FRM sampler, meeting the precision monitoring requirement of 15 percent. The sampling frequency of the co-located precision sampler at Dearborn (261630033) is once every six days. Each continuous method must have a co-located FRM sampler. A FRM sampler will operate at Flint (260490021) to co-locate with the MetOne BAM, Ypsilanti (261610008) to co-locate with the Thermo BAM, Lansing (260650018) to co-locate with the T640, and both Grand Rapids (260410020) and Allen Park (261630001) NCore sites will operate FRM samplers with the T640X samplers.

EGLE's station operators conduct flow rate verifications every four weeks to ensure the flow rate is meeting the measurement quality objectives. Results from these flow checks are submitted to the Quality Assurance Team each month for review and are uploaded to the USEPA's AQS database each quarter. Every six months, each $PM_{2.5}$ sampler is audited by a member of the AMU's QA Team. The auditor has a separate line of supervision from the site operator and uses dedicated equipment for audits. The audit assesses the accuracy of the flow as well as the monitor sampling and siting criteria. Every flow audit is reviewed by the QA Coordinator, copies are retained in the QA files, and the audits are uploaded to the USEPA's AQS database. The AMU's auditor also performs a systems audit for each sampler. The systems audit evaluates the siting criteria, condition of the sampling site/station, and other parameters. Copies of the systems audit forms are reviewed by the QA Coordinator and are retained in the QA central files.

EGLE participates in the USEPA's PEP audits at eight sites each year. The USEPA auditor sets up a $PM_{2.5}$ monitor to run side-by-side with the station $PM_{2.5}$ sampler on a run day. The filter from the PEP audit is sent to a USEPA laboratory for analysis. Once the EGLE filter weight is entered into the USEPA's AQS database, the audit filter weight is entered by the USEPA whereby the concentrations are compared between the PEP audit filter and the station filter. The USEPA auditor also assesses the station and monitor siting criteria to evaluate adequacy of the location, including distances from trees, exhaust vents, and large buildings. Probe heights and separation distances are also assessed.

Plans for the 2020-2021 $PM_{2.5}$ FRM Monitoring Network

The following filter-based $PM_{2.5}$ FRM monitors and sampling frequencies will be retained as part of the 2021 network:

- Flint (260490021) one in three-day
- Lansing (260650018) one in three-day
- Grand Rapids-Monroe St. (260810020) one in three-day
- Manistee (261010922) tribal site, one in three-day
- Oak Park (261250001) one in three-day
- Ypsilanti (261610008) one in three-day
- Allen Park (261630001) one in three-day
- Detroit-SWHS (261630015) one in three-day
- E 7 Mile (261630019) one in three-day

- Dearborn (261630033) one in three-day
- Dearborn (261630033) one in six-day

The following FRM $PM_{2.5}$ monitors will be replaced in 2020-2021 with a continuous $PM_{2.5}$ FEM T640 monitor:

- Kalamazoo (260770008) one in three-day
- Kalamazoo (260770008) one in six-day (co-located)
- Jenison (261390005) one in three-day
- New Haven (260990009) one in three-day
- Port Huron (261470005) one in three-day

CONTINUOUS $PM_{2.5}$ MONITORING NETWORK

According to the October 17, 2006, changes to the monitoring regulations, 50 percent of the minimum number of required FRM sites must be co-located with a continuous $PM_{2.5}$ monitor. The current number of continuous monitors operational in the state exceed the minimum number that are required. State agencies are encouraged by the USEPA to convert the existing filter-based FRM $PM_{2.5}$ samplers to FEM continuous instruments. This change in technology allows for real-time measurements for both public notification and regulatory comparison to the NAAQS. The change in technology also reduces filter costs, laboratory analysis costs, and staff time to conduct filter installation and recovery. Both filter-based and continuous instruments still require the monthly flow rate verifications and semi-annual audits.

The Dearborn (261630033) monitor measures the highest concentrations of $PM_{2.5}$ in Michigan and is needed for the development of attainment strategies, AIRNOW reporting, diurnal profiling, and estimation of risk. The Allen Park (261630001) monitor is needed to provide a counterpoint to the measurements taken at Dearborn. Allen Park is a population-oriented site designated as the trend site for Michigan. Dearborn is the maximum concentration site, so comparisons between these sites are important to characterize point source impacts on ambient air quality. The $PM_{2.5}$ TEOMs at Grand Rapids-Monroe St. (260810020) and Allen Park (261630001) will both be replaced with continuous FEM T640x to meet the NCore requirement for continuous fine particulate measurements.

In 2021 EGLE will operate two Rupprecht & Patashnick TEOM, non-FEM samplers for public notification purposes, six FEM MetOne BAM monitors, three Thermo BAMs and eight FEM Teledyne T640 monitors, and three Teledyne T640X to supply continuous fine particulate data at 21 monitoring sites, as shown in **Table 15**. **Figure 8** illustrates the geographical distribution of the continuous monitoring network.

With the ongoing construction of the Gordie Howe International Bridge, EGLE in 2020-2021 will install $PM_{2.5}$ FEM T640 samplers at Fort St. (SWHS) (261630015), DP4th (261630098), Trinity (261630099) and Military Park (2616300100), which will replace the Thermo BAMs operational since the summer and fall of 2018.

EGLE operates the TEOMs from March through October with an inlet temperature of 50°C. Once the ozone season is over, starting November 1, EGLE reduces the inlet temperature to 30°C in the winter months to minimize loss of nitrates. Operating the TEOMs in this way maximizes comparability with the FRMs. The $PM_{2.5}$ TEOM sites operate to support AIRNOW real time data reporting and to provide adequate spatial coverage. In 2020-2021 with adequate funding, EGLE will transition these instruments out of service in favor of the real-time FEM T640 continuous samplers and existing Thermo BAM's and MetOne BAMs.

Table 15: Michigan's Continuous $PM_{2.5}$ Monitoring Network

Operating Schedule: continuous

Method: Rupprecht & Patashnick Tapered Element Oscilating Microbalance (TEOMS) Samplers Method Codes 701/703

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Purpose	Scale	County	Start Date	CBSA [1]	Estimated Population 2019
Dearborn	261630033	2842 Wyoming, Salina School	42.306666	-83.148889	Pop. Exp. Max. Conc.	Neighborhood	Wayne	9/26/03	DWL	4,319,629
NMH48217	261630097	3225 S Deacon St.	42.261669	-83.157893	Pop. Exp.	Neighborhood	Wayne	8/18/16	DWL	4,319,629

Method: MetOne Beta Attenuation Monitor (BAM) Method Code 170

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Purpose	Scale	County	Start Date	CBSA [1]	Estimated Population 2019
Holland	260050003	966 W 32nd	42.767778	-86.148611	Pop. Exp.	urban	Allegan	8/1/19	A	118,081
Bay City	260170014	1001 Jennison St.	43.571389	-83.890833	Pop. Exp.	Neighborhood	Bay	8/1/19	BC	103,126
Flint	260490021	Whaley Park , 3610 Iowa St., Flint	43.047220	-83.670278	Pop. Exp.	Neighborhood	Genesee	9/11/18	F	405,813
Grand Rapids Near-Road	260810023	4365 Louisiana Ave. SW	42.885368	-85.679765	Pop. Exp.	Neighborhood	Kent	11/4/99	GW	1,077,370
Seney	261530001	Seney Wildlife Refuge, HCR 2 Box 1	46.288880	-85.950270	Background	Regional	Schoolcraft	1/1/21	Not in CBSA	N/A
Eliza Howell Near- Road	26016100101	23751 Fenkell St,	42.984167	-85.671389	Pop. Exp.	Neighborhood	Wayne	11/1/19	DWL	4,319,629

Method: Thermo Beta Attenuation Monitor (BAM) Method Code 183

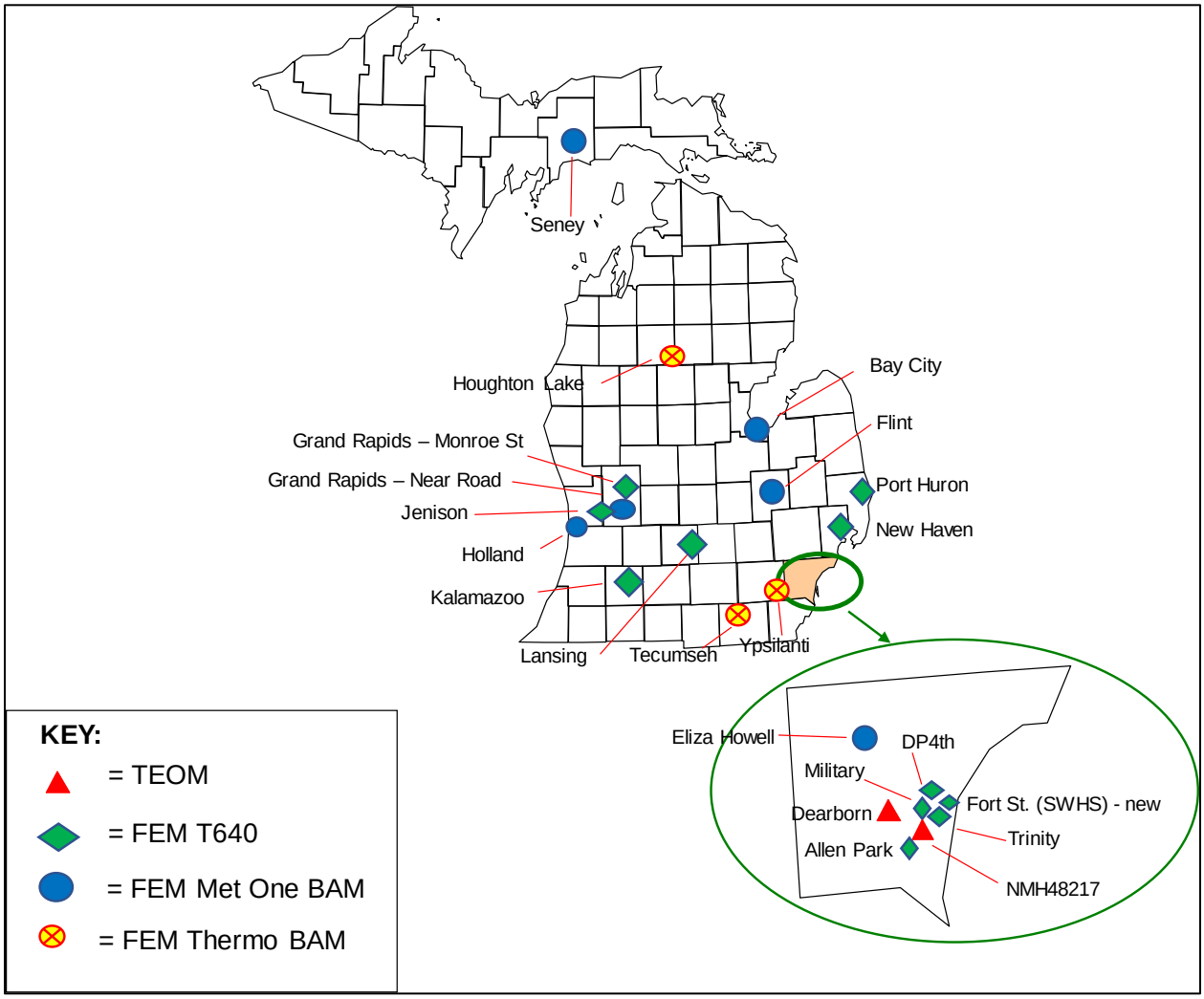
Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Purpose	Scale	County	Start Date	CBSA [1]	Estimated Population 2019
Tecumseh	260910007	6792 Raisin Center Highway	41.995556	-83.946667	up wind backgrd	regional	Lenawee	11/27/18	AL	98,451
Houghton Lake	261130001	1769 S Jeffs Rd.	44.310556	-84.891944	Background	Regional	Missaukee	11/28/18	Not in CBSA	N/A
Ypsilanti	261610008	555 Towner Ave.	42.240556	-83.599722	Pop. Exp.	Neighborhood	Washtenaw	2/24/00	AA	367,601

Method: Teledyne API T640 / T640X Method Code 236 / 238

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Purpose	Scale	County	Start Date	CBSA [1]	Estimated Population 2019
Lansing	260650012	220 N. Pennsylvania	42.738611	-84.534722	Pop. Exp.	Neighborhood	Ingham	1/1/21	LEL	550,391
Kalamazoo	260770008	Fairgrounds,1400 Olmstead Rd.	42.278056	-85.541944	Pop. Exp.	Neighborhood	Kalamazoo	1/1/21	KP	265,066
Grand Rapids - Monroe St.	260810020	1179 Monroe St., NW,	42.984167	-85.671389	Pop. Exp.	Neighborhood	Kent	1/1/21	GW	1,059,113
New Haven	2610990009	57700 Gratiot	42.731389	-82.793611	Pop. Exp.	Neighborhood	Macomb	1/1/21	DWL	4,319,629
Jenison	261390005	6981 29th Ave	42.894444	-85.852778	Background	Neighborhood	Ottawa	1/1/21	GW	1,077,370
Port Huron	261470005	2525 Dove Rd.	42.953333	-82.456389	Pop. Exp.	Urban	St. Clair	1/1/21	DWL	4,319,629
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	Pop. Exp.	Neighborhood	Wayne	1/1/21	DWL	4,319,629
Detroit-SWHS	261630015	150 Waterman	42.302778	-83.106667	Background	Neighborhood	Wayne	1/1/21	DWL	4,319,629
DP4th	161630098	4700 W Fort St	42.312158	-83.091943	Background	Neighborhood	Wayne	1/1/21	DWL	4,319,629
Trinity	261630099	9191 W Fort St	42.295824	-83.129431	Background	Neighborhood	Wayne	1/1/21	DWL	4,319,629
Military	261630100	1238 Military St	42.312078	-83.103469	Background	Neighborhood	Wayne	1/1/21	DWL	4,319,629

AL = Adrian Micropolitan Area
AA = Ann Arbor Metro. Area
BC = Bay City Metro. Area
DWL = Detroit-Warren-Livonia MSA
F = Flint Metro Area
GW = Grand Rapids-Wyoming MSA
KP = Kalamazoo-Portage Metro. Area
LEL = Lansing-E. Lansing Metro. Area

Figure 8: Michigan's Continuous $PM_{2.5}$ Network



$PM_{2.5}$ Continuous Quality Assurance

The AMU site operator conducts flow rate verifications once a month. Results from the flow checks are sent to the QA Team for review each month and reported to the USEPA's AQS database each quarter. An independent flow rate audit is conducted by a member of the AMU's QA Team every six months. During the flow rate audit, the auditor assesses the condition of the station, sample probe, and siting criteria. The QA Coordinator reviews all audit results and hard copies of the results are retained in the QA files. Each quarter the flow audits are uploaded to the USEPA's AQS database.

Plans for the 2021 $PM_{2.5}$ TEOM and $PM_{2.5}$ BAM Network

During 2021, Michigan will continue to operate $PM_{2.5}$ TEOM (non-FEM) monitors at:

- Dearborn (261630033)
- New Mount Hermon (261630095)

During 2021, EGLE plans to continue to operate $PM_{2.5}$ MetOne BAM monitors at:

- Holland (260050003) Method 170
- Bay City (260170014) Method 170
- Flint (260490021) Method 170
- Grand Rapids Near-road (260810023) Method 170
- Seney (261530001) Method 170
- Eliza Howell Near-road (261600101) Method 170

During 2021, EGLE plans to continue to operate $PM_{2.5}$ Thermo BAM monitors at:

- Tecumseh (260910007) Method 183
- Houghton Lake (261130001) Method 183
- Ypsilanti (261610008) Method 183

During 2021, EGLE plans to install and operate new $PM_{2.5}$ Teledyne T640/T640X BAM monitors at:

- Lansing (260650018) Method 236
- Kalamazoo (260770008) Method 236
- Grand Rapids–Monroe St. (260810020) Method 238
- New Haven (260990009) Method 236
- Jenison (261390005) Method 238
- Port Huron (261470005) Method 236
- Allen Park (261630001) Method 238
- Fort St. (SWHS) (261630015) Method 236
- DP4th (261630098) Method 236
- Trinity (261630099) Method 236
- Military (261630100) Method 236

SPECIATED $PM_{2.5}$ MONITORING NETWORK

Continued operation of the speciation trend site network is required on a national level and these sites sample on frequency of once every three days, following the USEPA sampling schedule. The speciated trend site in Michigan is located at Allen Park (261630001). All remaining supplemental speciation sites operate on a once every six-day schedule, except for the NCore site at Grand Rapids–Monroe St. (260810020), which also has a sampling frequency of once every three days. The speciation network is described in **Table 16**. **Figure 9** illustrates the current coverage across Michigan.

Note that Allen Park (261630001) contains a suite of carbon channel samplers: an IMPROVE, a MetOne SUPER SASS, and an URG 3000 N. EGLE will continue to operate the three different carbon samplers to support USEPA OAQPS inter-sampler comparability studies.

Continuous Speciation Measurements

In addition to the speciated measurements integrated over a 24-hour time period described above, EGLE operates continuous monitors for black carbon using aethalometry. Large spot aethalometers from Magee Scientific operate at Dearborn (261630033) and Allen Park (261630001). These units measure carbon black, which is very similar to and correlates well with elemental carbon. As part of the Community Scale Air Toxics monitoring grant in 2015, three new aethalometers were purchased from Magee Scientific. These were installed in 2016 as Special Purpose Monitors at Eliza Howell Near-road (261630093), Eliza Howell Downwind (261630094), and Livonia Near-road (261630095) for the Air Toxics Near-roadway study. When that study ended in 2017, these instruments were relocated to the three new GHIB monitoring locations and another at Detroit-SWHS in 2018.

Speciation Quality Assurance

The site operator conducts flow rate verifications every four weeks. Results from the flow checks are sent to the QA Team for review each month and uploaded to the USEPA's AQS database each quarter. The QA team conducts semi-annual flow rate audits on the $PM_{2.5}$ speciation monitors. The auditor also assesses the monitoring station and siting criteria to ensure it continues to meet the measurement quality objectives. Audit results are reviewed by the AMU's QA Coordinator. Audit data is also uploaded to the USEPA's AQS database each quarter. The USEPA periodically conducts technical systems audits and instrument audits for the speciation network. The USEPA also conducts audits of the national contract laboratory, which supplies speciation analysis services for the entire nation.

Table 16: Michigan's $PM_{2.5}$ Speciation Network

Current Speciation Sites

Operating Schedule: Once Every 3 days (Allen Park and Grand Rapids), once every 6 days all others. Follows USEPA sampling schedule.

Method: Met One SASS and URG 3000 N units to collect organic & elemental carbon, Method Code 811 (SASS) Method Code 839/840 (URG)

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose/ Type	POC	Scale	County	Start Date	MSA [1]	Pop 2017 Estimate
Grand Rapids - Monroe St	260810020	1179 Monroe St., NW,	42.984	-85.67139	1:3	Pop. Exp.	5	Neighborhood	Kent	11/4/99	GW	1,059,113
Allen Park	261630001	14700 Goddard	42.229	-83.20833	1:3	Pop. Exp.	5	Neighborhood	Wayne	12/1/00	DWL	4,313,002
Fort St. (SWHS)	261630015	150 Waterman St	42.303	-83.10667	1:6	Pop. Exp. Max. Conc.	5	Neighborhood	Wayne	11/2/08	DWL	4,313,002
Dearborn	261630033	2842 Wyoming, Salina School	42.307	-83.14889	1:6	Pop. Exp. Max. Conc.	5	Neighborhood	Wayne	9/26/03	DWL	4,313,002

Continuous Speciation Measurements

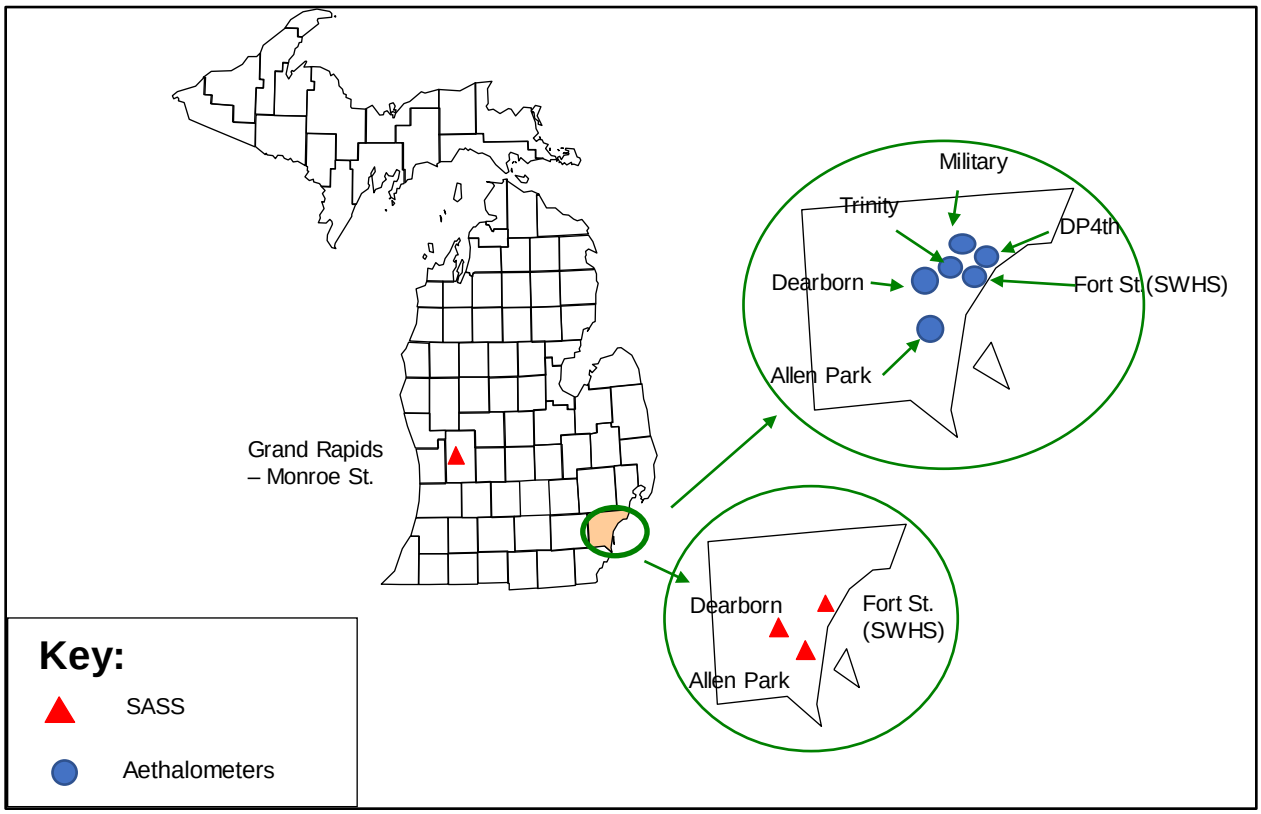
Method: Magee Aethalometer: Method Code 861

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Method	Purpose	POC	Scale	County	Start Date	MSA [1]	Pop 2017 Estimate
Allen Park	261630001	14700 Goddard	42.229	-83.20833	McGee large spot Aethalometer (carbon black)	Pop. Exp.	1	Neighborhood	Wayne	1/1/04	DWL	4,313,002
Fort St. (SWHS)	261630015	150 Waterman St	42.303	-83.10667	McGee large spot Aethalometer (carbon black)	SPM		Neighborhood	Wayne	8/20/18	DWL	4,313,002
Dearborn	261630033	2842 Wyoming, Salina School	42.307	-83.14889	McGee large spot Aethalometer (carbon black)	Pop. Exp. Max. Conc.	1	Neighborhood	Wayne	12/19/03	DWL	4,313,002
DP4th	161630098	4700 W Fort St	42.312	-83.09194	McGee large spot Aethalometer (carbon black)	SPM	1	Neighborhood	Wayne	7/30/18	DWL	4,313,002
Trinity	261630099	9191 W Fort St	42.296	-83.12943	McGee large spot Aethalometer (carbon black)	SPM	1	Neighborhood	Lenawee	10/23/18	DWL	4,313,002
Military	261630100	1238 Military St	12.312	-83.10347	McGee large spot Aethalometer (carbon black)	SPM	1	Neighborhood	Wayne	11/17/18	DWL	4,313,002

[1] MSA Key:

AL = Adrian Micropolitan Area
DWL = Detroit-Warren-Livonia MSA
GW = Grand Rapids-Wyoming MSA
SPM = Special Purpose Monitor

Figure 9: Michigan's $PM_{2.5}$ Speciation (SASS) Network



Plans for the 2021 $PM_{2.5}$ Speciation Monitoring Network

MetOne SASS and URG 3000N:

During 2021, contingent upon adequate levels of funding, EGLE will continue to operate 24-hour $PM_{2.5}$ speciation monitors at:

- Grand Rapids-Monroe St. (260810020) operating once every three days;
- Allen Park (261630001) operating once every three days;
- Dearborn (261630033) operating once every six days; and
- SWHS (261630015) operating once every six days.

Black Carbon - Aethalometer:

During 2021, EGLE will continue to operate hourly Magee aethalometer monitors at:

- Dearborn (261630033);
- Allen Park (261630001);
- Fort St. SWHS (261630015);
- DP4th 261630098);
- Trinity (261630099); and
- Military Park (261630100).

PM_{10} MONITORING NETWORK

The October 17, 2006, monitoring regulations modified the minimum number of PM_{10} samplers required in MSAs. Since then, further revisions have occurred, relaxing the numbers of sites required in high population areas with low concentrations of PM_{10}, as shown in **Table 17**.[10]

Table 17: PM_{10} Minimum Monitoring Requirements (Number of Stations per MSA)[1]

Population Category	High Concentration[2]	Medium Concentration[3]	Low Concentration[4, 5]
> 1,000,000	6-10	4-8	2-4
500,000 – 1,000,000	4-8	2-4	1-2
250,000 – 500,000	3-4	1-2	0-1
100,000 – 250,000	1-2	0-1	0

[1] Selection of urban areas and actual numbers of stations per area within the ranges shown in this table will be jointly determined by USEPA and the state agency.
[2] High concentration areas are those for which ambient PM_{10} data show ambient concentrations exceeding the PM_{10} NAAQS by 20% or more.
[3] Medium concentration areas are those for which ambient PM_{10} data show ambient concentrations exceeding 80% of the PM_{10} NAAQS.
[4] Low concentration areas are those for which ambient PM_{10} data show ambient concentrations < 80% of the PM_{10} NAAQS.
[5] These minimum monitoring requirements apply in the absence of a design value.

Applying **Table 17** to Michigan's urban areas, population totals, and historical PM_{10} data results in the design requirements that are shown in **Table 18**.

According to the tables, two to four PM_{10} sites are required in the Detroit-Warren-Livonia Metropolitan Area. Currently, there are three sites in operation; one at Allen Park (261630001), one at Detroit-SWHS (261630015), and a co-located pair at the design value site at Dearborn (261630033). The one at Allen Park (261630001) will be shut down in 2020-2021 to be replaced by the FEM continuous T640X.

The PM_{10} monitoring requirements specify that two to four PM_{10} sites are required in the Grand Rapids-Wyoming MSA. There are currently two sites in operation, one at Grand Rapids-Monroe St. (260810020) and the second at Jenison (261390005). In 2020-2021 EGLE will shut down both monitors at each site to be replaced by the FEM continuous T640X monitors.

According to the requirements, either zero or one PM_{10} monitor is required in the Flint MSA. In 2006 EGLE operated a PM_{10} sampler in Flint (260490021) but as a result of budget cuts, PM_{10} sampling was discontinued on April 1, 2007.

As part of a special study investigating the concentrations of manganese (Mn) in the Detroit urban area, PM_{10} filters at Allen Park (261630001), River Rouge (26163005), Detroit-SWHS (261630015) and Dearborn (261630033) were analyzed for Mn and compared with the concentrations of Mn on the TSP filters. The manganese data was

[10] Table D-4 of Appendix D to Part 58.

reviewed and determined to be equivalent to the TSP values. Therefore, the PM_{10} manganese analysis was discontinued in March 2009.

PM coarse measurements are required at NCore sites. One acceptable technology is to use two R & P Partisol Plus 2025 low volume samplers; one equipped with a $PM_{2.5}$ head and a very sharp cut cyclone, and the second with a PM_{10} head and a down tube. PM coarse value is determined by subtracting the fine particulate from the PM_{10} size fraction. These paired samplers operating at both NCore sites; Grand Rapids–Monroe St. (260810020) and Allen Park (261630001) will cease operation and will be replaced by the FEM, continuous T640X.

Table 19 summarizes the PM_{10} monitoring site information for sites in operation in 2020-2021. **Figure 10** shows the PM_{10} monitoring locations for 2020-2021.

Table 18: Application of the Minimum PM_{10} Monitoring Regulations in the April 30, 2007, Correction to the October 17, 2006, Final Revision to the Monitoring Regulation to Michigan's PM_{10} Network

Design value sites are in bold

MSA	2019 Estimated Population	Counties	Existing Monitors	2017-2019 most recent 3-year PM10 design value (24-Hr)	Conc. Class.	Min No monitors Required
Detroit-Warren-Livonia MSA	4,319,629	Macomb	---	**---**		2-4
		Oakland	---	**---**		
		Wayne	Allen Park	34	low	
			Detroit -SW HS	67	low	
			Dearborn	**48**	low	
		Lapeer	---	**---**		
		St Clair	---	**---**		
		Livingston	---	---		
Flint MSA	405,813	Genesee	---	---		
Monroe MSA	150,500	Monroe	---	**---**		
Ann Arbor MSA	367,601	Washtenaw	---	**---**		0-1
Grand Rapids-Wyoming MSA	1,077,370	Kent	GR - Monroe St	35		2
		Barry	---	---		
		Ottawa	Jenison started 2018	28		
		Montcalm	---	---		
Muskegon-Norton Shores MSA	173,566	Muskegon	---	---		
Lansing-East Lansing MSA	550,391	Clinton	---	---		0-1
		Ingham	---	---		
		Eaton	---	---		
Bay City MSA	103,126	Bay	---	---		
Saginaw-Saginaw Twp N MSA	190,539	Saginaw	---	---		
Kalamazoo-Portage MSA	265,066	Kalamazoo	---	---		0-1
		Van Buren	---	---		
Niles-Benton Harbor MSA	153,401	Berrien	---	---		
Jackson MSA	158,510	Jackson	---	---		
Battle Creek MSA	134,159	Calhoun	---	---		
South Bend-Mishawaka MSA	323,613	Cass	---	---		0-1
		St. Joseph, IN	---	---		

MSAs with populations greater than 500,000 require at least 1 PM 10 monitor.

Table 19: Michigan's PM_{10} Monitoring Network

Manual High Volume PM_{10} Sites

Method: Manual High Volume Sampler Tisch Environmental, Inc. Model TE-6070D-B

Monitoring Sites														
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Monitor Type	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	CBSA [1]	2019 Population Estimate
Detroit - SWHS	261630015	150 Waterman	42.302778	-83.106667	1:6	High Vol	max conc	81102	1	nghbrhd	Wayne	3/27/87	DWL	4,319,629
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:6	High Vol	max conc	81102	1	nghbrhd	Wayne	6/12/90	DWL	4,319,629
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:12	High Vol for precision	max conc	81102	9	nghbrhd	Wayne	6/12/90	DWL	4,319,629

Continous PM_{10} Sites

Method: Continous Particulate Mass Monitor Ruppecht and Patashnick TEOM® 1400 series

Monitoring Sites														
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Monitor Type	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	CBSA [1]	2019 Population Estimate
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	continuous	R&P PM10 TEOM	max conc	81102	3	nghbrhd	Wayne	4/1/00	DWL	4,319,629

Continous Low Volume PM_{10} Sites

Method: Continous Particulate Mass Monitor Teledyne T640x PM_{10}

Monitoring Sites														
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Monitor Type	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	CBSA [1]	2019 Population Estimate
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.984167	-85.671389	continuous	T640x	pop exp	81102	1	nghbrhd	Kent	1/1/21	GW	1,077,370
Jenison	261390005	6981 28Th Ave. Georgetown Twp.	42.894444	-85.852778	continuous	T640x	pop exp	81102	1	nghbrhd	Ottawa	1/1/21	GW	1,077,370
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	continuous	T640x	pop exp	81102	1	nghbrhd	Wayne	1/1/21	DWL	4,319,629

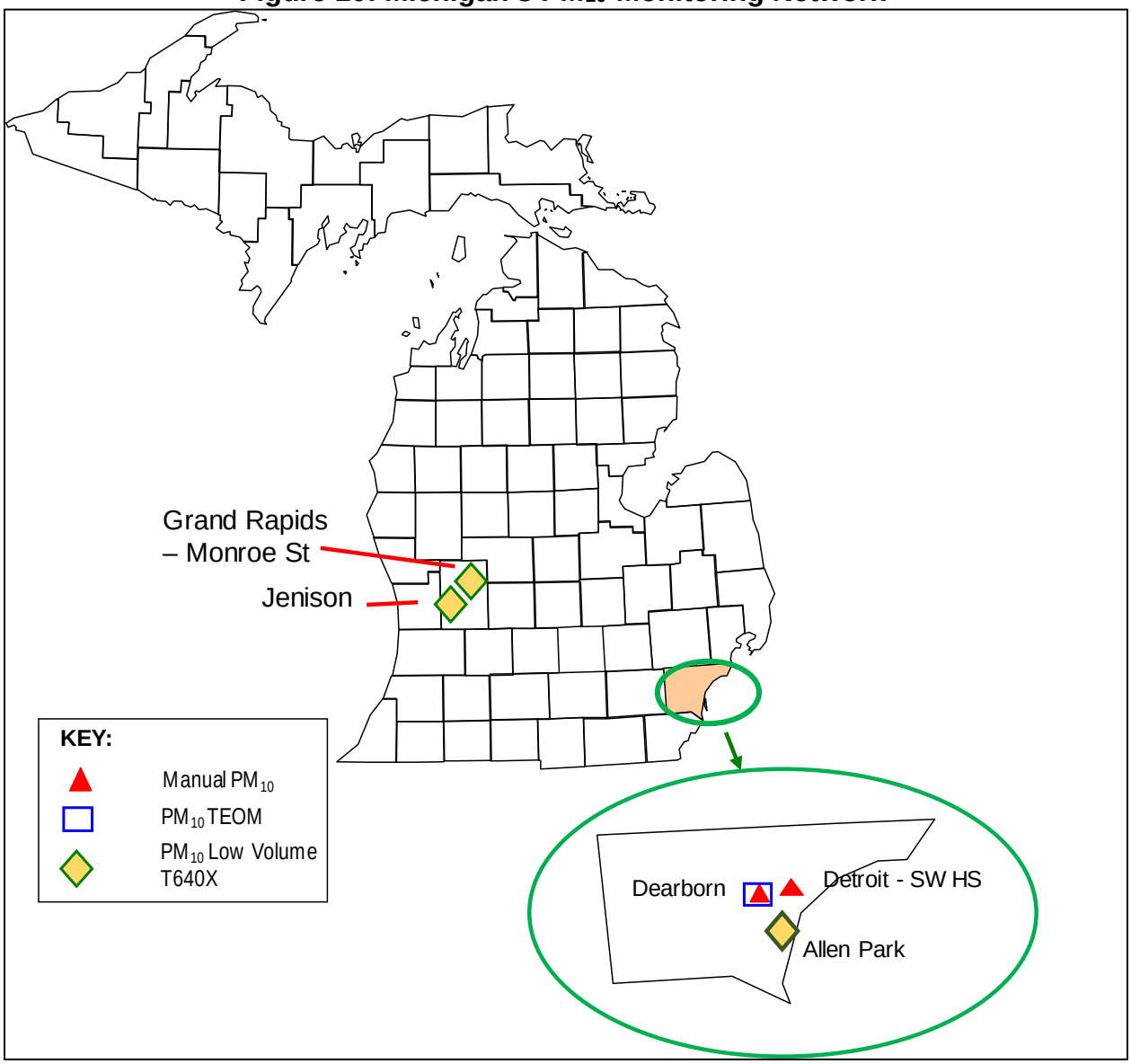
NCore Continous Low Volume PM Coarse Sites

Method: Continous Particulate Mass Monitor Teledyne T640x $PM_{10-2.5}$

Monitoring Sites														
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Monitor Type	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	CBSA [1]	2019 Population Estimate
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.984167	-85.671389	continuous	T640X	pop exp	81102	1	nghbrhd	Kent	1/1/21	GW	1,077,370
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	continuous	T640X	pop exp	81102	1	nghbrhd	Wayne	1/1/21	DWL	4,319,629

[1] **CBSA Key:** DWL= Detroit-Warren-Livonia Metro. Area
GW=Grand Rapids-Wyoming Metro. Area

Figure 10: Michigan's PM_{10} Monitoring Network



PM_{10} Quality Assurance

The AMU site operator conducts a flow rate verification once a month. Flow check values are sent to the QA Team for review and are reported to the USEPA's AQS database each quarter. An independent flow rate audit is conducted by a member of the AMU's QA Team every six months. The auditor is in a separate line of reporting authority from the site operator and uses independent dedicated equipment to perform the flow rate audit. The auditor also assesses the condition of the monitor and siting criteria. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files. Audit results are uploaded to the USEPA's AQS database each quarter.

Plans for the 2021 PM_{10} Monitoring Network

During 2021, contingent upon adequate levels of funding, EGLE is planning to operate:

1. **High volume PM_{10} monitors sampling over 24-hours at:**

   - Detroit–SWHS (261630015) - once every six-day
   - Dearborn (261630033) - once every six-day
   - Dearborn (261630033) - once every 12-day

2. **Low volume PM_{10} continuous T640X monitors** measure both PM_{10} and $PM_{10-2.5}$ (PM_c) at the following NCore sites:

   - Grand Rapids (260810020), PM_{10} and PM_c
   - Jenison (261390005), PM_{10}
   - Allen Park (261630001), PM_{10} and PM_c

3. **Continuous PM_{10} TEOM** at Dearborn (261630033) - hourly schedule.

CARBON MONOXIDE (CO) MONITORING NETWORK

Prior to the latest CO NAAQS review, EGLE operated trace CO monitors at Grand Rapids–Monroe St. (260810020) and Allen Park (261630001) as part of NCore.

On August 31, 2011,[11] the USEPA finalized the new CO NAAQS and retained the level and form of the CO NAAQS but revised the design of the ambient monitoring network for CO to be more focused on heavily traveled urban roads. In the rule, CBSAs with population totals equal to or greater than one million people would be required to add CO monitors to near-road monitoring stations that are required in the NO_2 network design. EGLE had CO monitor at two sites; Eliza Howell Near-road (261630093) and the Livonia Near-road (261630095) site. Due to site access issues the Livonia Near-road site had to be shut down and relocated to the Livonia Near-road 2 (261630101) site in the spring of 2020. Due to an increase in population, the Grand Rapids MSA is required to have a near-roadway monitoring station. EGLE will establish a near-roadway monitoring site in Grand Rapids in 2020-2021.

Table 20 summarizes the CO monitoring site information for sites that will operate in 2021. **Figure 11** shows the distribution of CO monitors across the state of Michigan.

CO Quality Assurance

The AMU site operator performs a 1-point quality assurance check of the analyzer every two weeks. Results of checks are sent to the QA Coordinator each quarter. Each monitor is audited annually by the AMU's QA Team. The auditor has a separate reporting line of authority from the site operator. The auditor utilizes a dedicated gas calibrator and calibration gases that are only for audits. The independent audit challenges the accuracy of the station monitor at several concentrations using a certified gas standard. The auditor also assesses the monitoring system (inspecting the sample line, filters, and inlet probe), siting, and documentation of the 1-point checks. Results of the 1-point checks and annual audits indicate whether the monitor is meeting the measurement quality objectives. The AMU uploads the results of the checks and audits to the USEPA's AQS database each quarter. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files.

External audits are conducted by the USEPA's thru-the-probe audit procedure for regular and trace level CO monitors. The USEPA reports the results to AQS.

Plans for the 2021 CO Monitoring Network

Contingent upon adequate levels of funding, EGLE plans to continue to operate trace level CO monitors to support NCore operations:

- Grand Rapids-Monroe St. (26810020); and
- Allen Park (261630001).

[11] Environmental Protection Agency, "National Ambient Air Quality Standards for Carbon Monoxide," 40 CFR Parts 50, 53 and 58, proposed rule, January 28, 2011.

Contingent upon adequate levels of funding, EGLE plans to operate CO monitors at the near-roadway monitoring sites:

- Grand Rapids Near-road (26810023)
- Eliza Howell (roadway) (261630093)
- Livonia Near-road 2 (261630101)

Contingent on adequate funding, EGLE will operate the CO monitors around the Gordie Howe International Bridge project:

- DP4th (261630098)
- Trinity (261630099)

Table 20: Michigan's CO Monitoring Network

Operating Schedule: Continuous
Method: Gas Filter Correlation Analyzer- CO: Method 054 and Trace CO: Method Code 093

Ncore Sites (Trace)

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	MSA [1]	2019 Population Estimate
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.984167	-85.671389	trace CO	pop exp	42101	1	nghbrhd	Kent	1/1/08	GW	1,077,370
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	trace CO	pop exp	42101	1	nghbrhd	Wayne	1/1/08	DWL	4,319,629

Near Roadway Sites

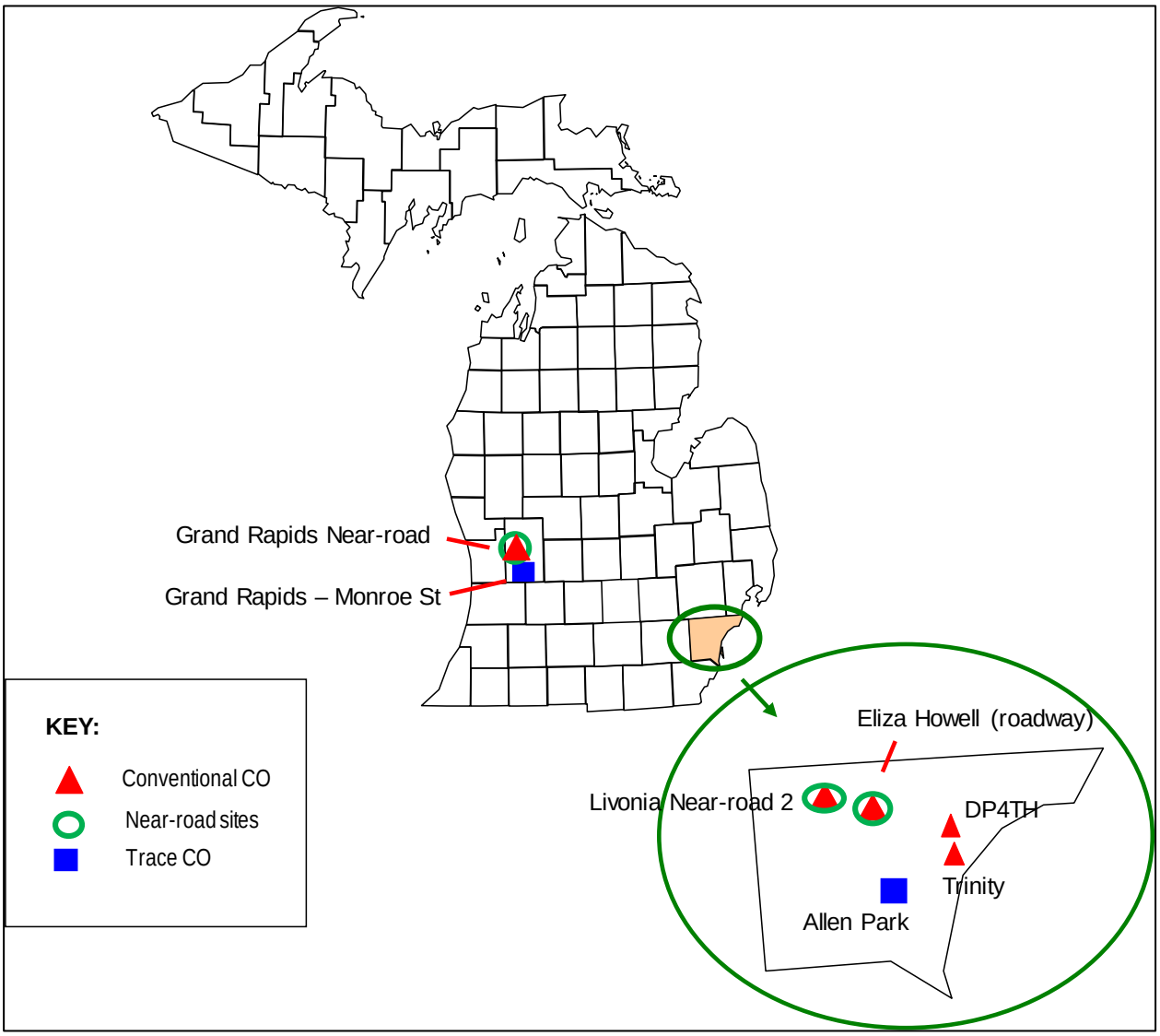
Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose	Parameter Code	POC	Scale	County	Start Date	MSA [1]	2019 Population Estimate
Grand Rapids Near - road	260810023	4365 Louisiana Ave. SW	42.885368	-85.679765	CO	Near Road	42101	1	micro	Kent	8/1/20	GW	1,077,370
Eliza Howell (Roadway)	261630093	Service Road I-96 & Telegraph	42.38599	-83.26632	CO	Near Road	42101	1	micro	Wayne	9/1/11	DWL	4,319,629
Livonia Near Road 2	261630101	14975 Eckels Rd	42.393574	-83.431948	CO	Near Road	42101	1	micro	Wayne	8/1/20	DWL	4,319,629

Special Purpose Monitors

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose	Parameter Code	POC	Scale	County	Start Date	MSA [1]	2019 Population Estimate
DP4th	261630098	4700 W Fort St	42.312158	-83.091943	CO	SPM	42101	1	nghbrhd	Wayne	7/27/18	DWL	4,319,629
Trinity	261630099	9191 W Fort St	42.295824	-83.129431	CO	SPM	42101	1	nghbrhd	Wayne	10/25/18	DWL	4,319,629

[1] **MSA Key:**
DWL = Detroit-Warren-Livonia MSA GW = Grand Rapids-Wyoming MSA

Figure 11: Michigan's CO Monitoring Network



NITROGEN DIOXIDE (NO_2) and NO_Y MONITORING NETWORK

On February 9, 2010, the USEPA modified the NO_2 NAAQS from an ***annual*** average concentration of 53 ppb to an ***hourly*** average of 100 ppb.

Along with modifications to the standard, changes to the design of the ambient monitoring network also occurred. A three-tiered monitoring network for NO_2 focuses on near-roadway monitoring as well as monitoring at urban locations. The minimally required components of the network are:

Tier 1: Near-road Monitors

1. Every CBSA with a population greater than or equal to 1,000,000 people must have a microscale NO_2 monitor located within 50 meters of a major roadway.

2. An additional near-roadway site is required in CBSAs with populations of 2,500,000 or more.

3. An additional near-roadway site is required for any roadway segment with 250,000 or more annual average daily traffic (AADT) totals.

Tier 2: Area-wide Monitors

One NO_2 monitor in every CBSA with a population equal to or greater than 1,000,000 people. This monitor should be located in an area with an expected high concentration of NO_2 and should use a neighborhood or larger scale. Emission inventory data should be used to make this selection.

Tier 3: Regional Administrator Required Monitors

The USEPA Administrator must require a minimum of 40 NO_2 monitors nationwide in locations with "susceptible and vulnerable" populations.

The network design described above uses the latest available Census figures. The new monitoring stations were to be deployed and operational by January 1, 2013.[12] Due to budgetary constraints, the USEPA developed a build-and-hold system for implementing the new monitoring locations. Two Detroit near-road monitoring sites have been deployed. In addition, EGLE operated the community scale NO_2 monitor at its Detroit-E 7 Mile (261630019) site.

The USEPA has finalized a new rule, which eliminates Tier 3 of the near-road sites. This would have removed the requirement for a near-road site in Grand Rapids; however, the Grand Rapids CBSA exceeded the one million population threshold, which is now subject to the Tier 1 requirements. Funding for a near-road site in the Grand Rapids CBSA per CFR

[12] "Primary National Ambient Air Quality Standards for Nitrogen Dioxide," USEPA, 40 CFR Parts 50 and 58. February 9, 2010.

requirements was approved. EGLE will start operating the Grand Rapids Near-road monitoring station in summer of 2020. The existing NO_Y monitor at the NCore site did not meet the CFR requirements for the near-roadway site.

The one million population in Grand Rapids requires both a near-road site (Tier 1) and a population-based area monitor (Tier 2). EGLE planned to install a 'true NO_2' for PAMS, which would meet both the population requirement and the PAMS requirement. However, since USEPA funding for the PAMS direct NO_2 has been delayed, in 2019 EGLE installed a traditional NO_X analyzer at Jenison (261390005). EGLE will shut down the NO_X at Jenison once the PAMS funding is available for the direct NO_2 sampler at Grand Rapids.

Table 21 summarizes the monitoring requirements for NO_2 according to the various tiers for all CBSAs in Michigan. As shown by this table, one monitor is required in Grand Rapids-Wyoming MSA and three monitors are required in the Detroit-Warren-Livonia MSA.

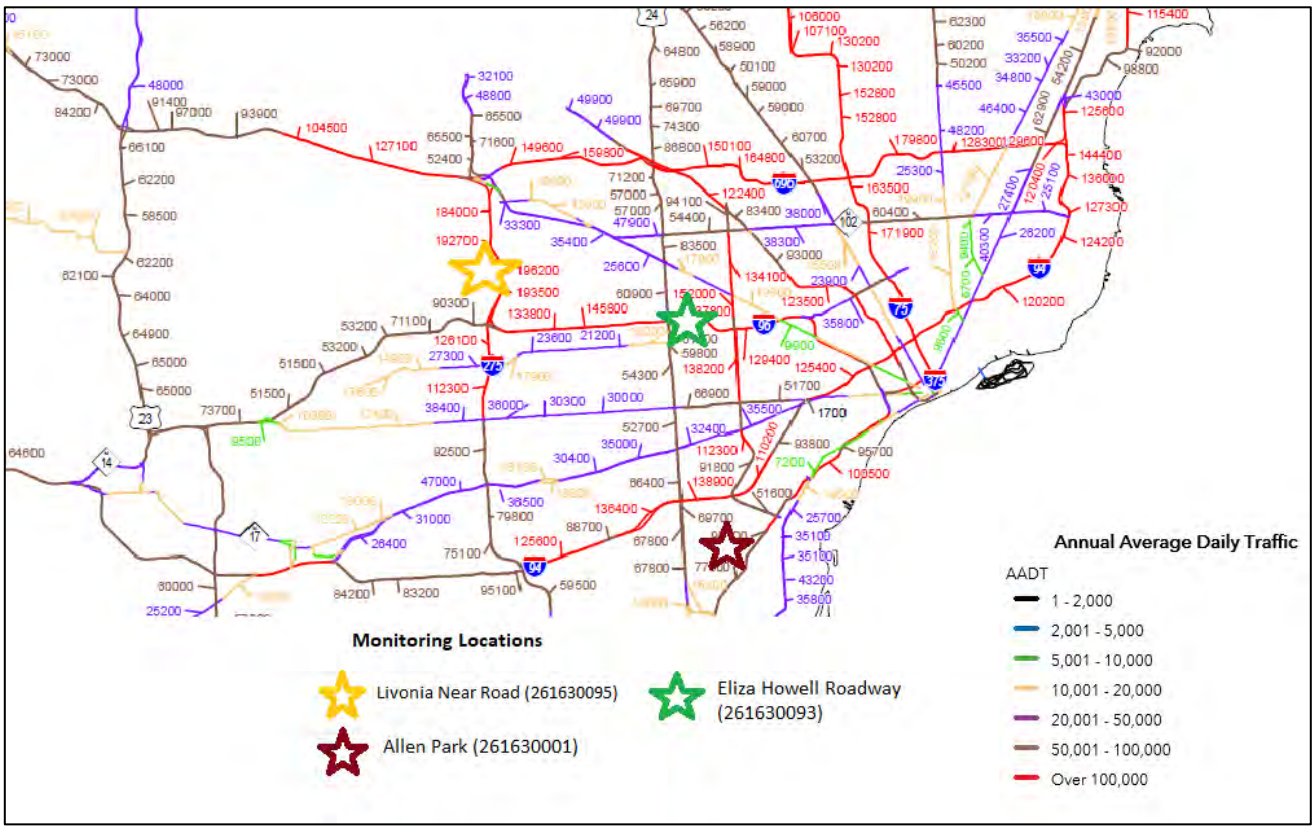
Table 21: NO_2 Network Design

MSA	Counties	2019 Estimated Population	Near Roadway Monitors Req'd	Additional Near Roadway Site	250,000 AADT	Community Wide Monitor	EJ Monitor
Detroit-Warren-Livonia MSA	Macomb Oakland Wayne Lapeer St Clair Livingston	4,319,629	1	1		1	
Flint MSA	Genesee	405,813					
Monroe MSA	Monroe	150,500					
Ann Arbor MSA	Washtenaw	367,601					
Grand Rapids-Wyoming MSA	Kent Barry Ottawa Montcalm	1,077,370	1			1	
Muskegon-Norton Shores MSA	Muskegon	173,566					
Lansing-East Lansing MSA	Clinton Ingham Eaton	550,391					
Bay City MSA	Bay	103,126					
Saginaw MSA	Saginaw	190,539					
Kalamazoo-Portage MSA	Kalamazoo Van Buren	265,066					
Niles-Benton Harbor MSA	Berrien	153,401					
Jackson MSA	Jackson	158,510					
Battle Creek MSA	Calhoun	134,159					
South Bend Mishawaka MSA IN/MI	Cass St. Joseph, IN	323,613					

Tier 1: Near-roadway NO_2 Monitors – Phase 2

The second near-road site for the Detroit-Warren-Livonia MSA was due by January 1, 2015. The Livonia Near-road site (261630095) was established in December 2014 and was operational by January 1, 2015. This is the heaviest traveled traffic segment in the Detroit-Warren-Livonia MSA, see yellow star on **Figure 12**. Due to site access issues the site had to be shut down. It has been relocated in the same traffic area segment and will be operational summer of 2020.
(https://www.michigan.gov/mdot/0,4616,7-151-11151-22141--,00.html)

Figure 12: Comparison of Eliza Howell Park Location with other Air Monitoring Stations and Roadway Segments with High Traffic Counts



Tier 2: Area-wide NO_2 Monitors

Area-wide monitoring is required in every CBSA with 1,000,000 or more people. The Detroit-Warren-Livonia MSA and the Grand Rapids-Wyoming MSA both meet this requirement in Michigan. In Detroit, EGLE is currently operating NO_2 monitors at the sites identified as Detroit-SWHS (261630015), DP4 (261630098), Trinity (261630099), and Military Park (261630100).

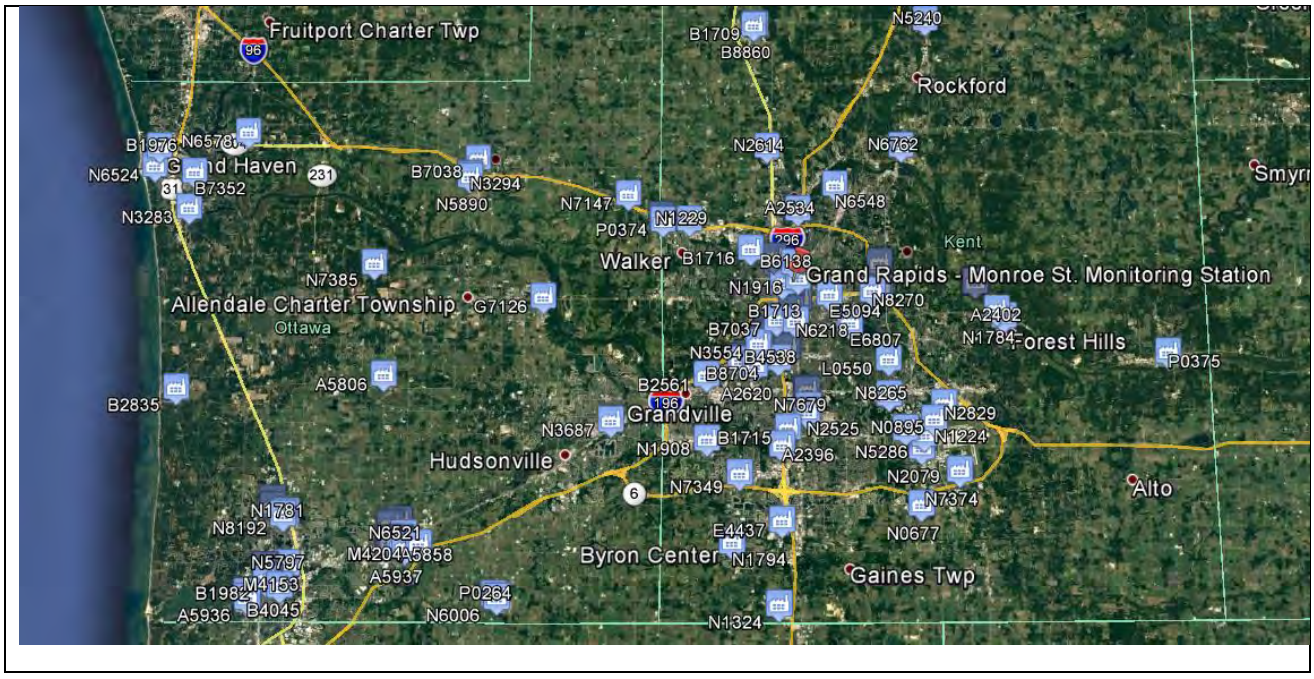
The NO_X monitor at the Detroit-E 7 Mile site (261630019) in northeast Detroit was shut down August 15, 2018 to prepare the site for the PAMS work, which includes the operation

of direct NO_2 and NO_Y monitors. The NO_Y monitor was operational May 15, 2019, and the direct NO_2 will depending upon funding be installed before the 2021 PAMS season.

The Grand Rapids MSA area is required to have an area-wide NO_2 monitor as the population requirement. The NO_Y monitor at the NCore site does not satisfy this requirement. EGLE planned to install a direct NO_2 for PAMS, which would meet both the population requirement and the PAMS requirement. However, since the USEPA funding for the PAMS direct NO_2 was delayed, on January 10, 2019, EGLE installed a traditional NO_X analyzer at Jenison (261390005). EGLE will shut down in 2021 the NO_X monitor at Jenison once PAMS funding is available for the direct NO_2 sampler at Grand Rapids. EGLE will continue to operate an NO_Y monitor in 2021, which meets the NCore and PAMS requirements.

Figure 13 shows the NO_2 emission points for Kent and Ottawa Counties, as well as the location of the Grand Rapids-Monroe Street site.

Figure 13: NO_2 Emission in Kent and Ottawa Counties



NO_2 Monitoring for GHIB Study

In 2018, to monitor NO_2 before, during, and after construction of the Gordie Howe International Bridge, EGLE added three new sites; DP4th (261630098), Trinity (261630099) and Military Park (261630100), in addition to the existing Detroit-SWHS (2616300015).

NO_2 Monitoring for NSR

Recent modeling projects for NSR (New Source Review) have shown that there is a possibility that the new 1-hour NO_2 NAAQS could be violated using current modeling techniques. More refined modeling that would provide a more accurate picture of the impact from new sources could be performed; however, EGLE lacked ambient data required for use in the models. At least five years of NO_2 data are required in both urban and rural locations. Therefore, on July 1, 2010, EGLE began collecting NO_2 measurements at Houghton Lake (261130001) and at Lansing (260650012).

NO_Y Monitoring

Trace NO_Y monitors for the NCore sites at Grand Rapids–Monroe St. (260810020) and Allen Park (261630001) have been operational since December 2007.

Table 22 summarizes the NO_2 and NO_Y monitoring site information for sites that are in existence in 2020 and 2021. **Figure 14** shows the NO_2 and NO_Y monitoring network operated by EGLE in 2020 and 2021.

NO_2 and NO_Y Quality Assurance

The AMU site operator performs a 1-point quality assurance check of the analyzer every two weeks. The checks are sent to the QA Coordinator each month. Each monitor is audited annually by the AMU's QA Team, which has a separate reporting line of authority from the site operator. The auditor utilizes dedicated gas calibrator and calibration gases that are only for audits. The independent audit challenges the accuracy of the station monitor at several concentrations using a certified gas standard. The auditor also assesses the monitoring system (inspecting the sample line, filters, and inlet probe), siting, and documentation of precision checks. The results of the audits and precision checks indicate whether the monitor is meeting the measurement quality objectives. The AMU uploads the precision check results and audit results to the USEPA's AQS database each quarter. The QA Coordinator reviews all audit results and hard copies are retained in the QA files.

For conventional (non-trace level) NO_2 monitors, the USEPA conducts thru-the-probe audits at 20 percent of the monitors each year. The audit consists of delivering four levels of calibration gas to the station monitor through the probe. At this time, the USEPA is not conducting thru-the-probe audits for the NO_Y monitors.

Plans for the 2021 NO_2 and NO_Y Monitoring Network

During 2021, contingent upon adequate levels of funding, EGLE is planning to operate NO_2, NO_X at the following sites:

- Grand Rapids Near-road (260810023) Tier 1
- Eliza Howell Near-road site (261630093) Tier 1
- Livonia Near-road (261630095) Tier 1
- Lansing (260650018) Tier 2
- Houghton Lake (261130001) Tier 2

- SWHS (261630015) Tier 2
- DP4 (261630098) Tier 2
- Trinity (261630099) Tier 2
- Military (261630100) Tier 2

Also contingent upon adequate funding, EGLE will continue to operate trace level NO_Y monitors at the NCore and PAMS sites:

- Grand Rapids–Monroe St. (26810020) NCore and PAMS
- Allen Park (261630001) NCore
- Detroit-E 7 Mile (261630019) PAMS

Also contingent upon adequate funding, in 2021 EGLE will operate direct NO_2 monitors during the PAMS season at the following sites:

- Grand Rapids (260810020)
- Detroit-E 7 Mile (261630019)

Upon installation of a direct NO_2 monitor in Grand Rapids (260810020), the Jenison (261390005) NOx/NO_2 monitor will be shut down.

Table 22: Michigan's NO_2 and NO_Y Monitoring Network

Operating Schedule: Continuous
Method: Chemiluminescense, Method Code 074 (NOx) and Method Code 075 (NO_y)

NCore Sites

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	CBSA [1]	2019 Population Estimate
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.984167	-85.671389	NOy	pop exp	42612	1	nghbrhd	Kent	1/1/08	GW	1,077,370
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	NOy	pop exp	42612	1	nghbrhd	Wayne	1/1/08	DWL	4,319,629

Tier 1: Near Roadway Sites

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	CBSA [1]	2019 Population Estimate
Grand Rapids Near-road	260810020	4365 Louisiana Ave. SW	42.885368	-85.679765	NOy	pop exp	42602	1	nghbrhd	Kent	1/1/20	GW	1,077,370
Eliza Howell	261630093	Service Road I-96 & Telegraph	42.38599	-83.26632	NO2	Near Road	42602	1	micro	Wayne	9/1/11	DWL	4,319,629
Livonia Near Road 2	261630101	14975 Eckels Rd.	42.393574	-83.431948	NO2	Near Road	42602	1	micro	Wayne	1/1/15	DWL	4,319,629

Tier 2: Community Sites

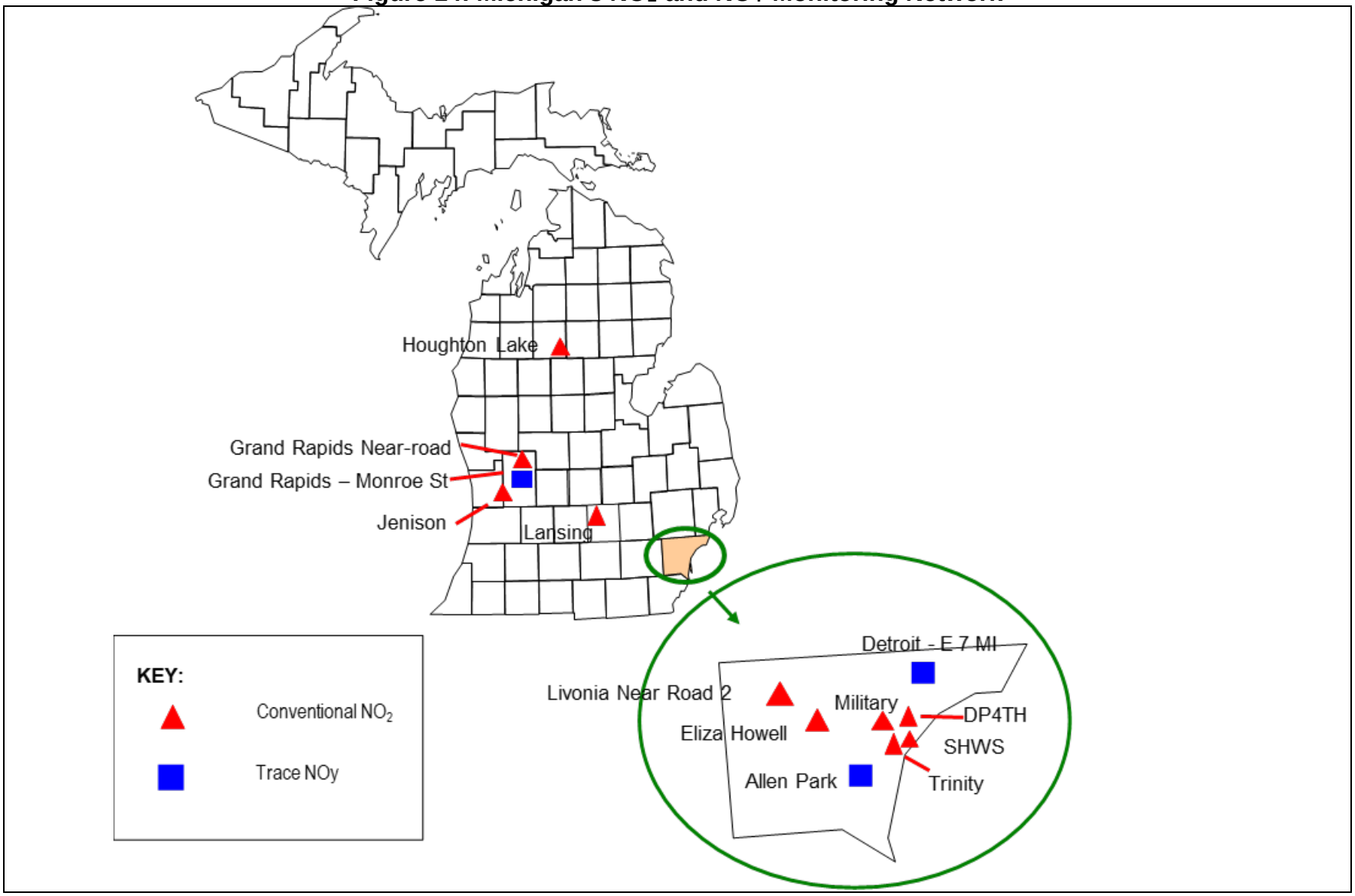
Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	CBSA [1]	2019 Population Estimate
Lansing	260650012	220 N Pennsylvania	42.738611	-84.534722	NO2	pop exp	42602	1	nghbrhd	Ingham	9/5/80	LEL	550,391
Houghton Lake	261130001	1769 S Jeffs Road	44.310556	-84.891944	NO2	background	42602	1	regional	Missaukee	4/1/98	Not in CBSA	N/A
Jenison	261390005	6981 28th Ave	42.894444	-85.852778	NO2	pop exp	42602	1	nghbrhd	Ottawa	1/8/19	GW	1,077,370
Detroit-SWHS	261630015	150 Waterman	42.302778	-83.106667	NO2	SPM	42602	1	nghbrhd	Wayne	6/11/18	DWL	4,319,629
Detroit - E 7 Mile	261630019	11600 East Seven Mile Road	42.430833	-83.000278	NOy	pop exp	42602	1	urban	Wayne	12/1/90	DWL	4,319,629
DP4th	261630098	4700 W Fort St	42.312158	-83.091943	NO2	SPM	42602	1	nghbrhd	Wayne	7/17/18	DWL	4,319,629
Trinity	261630099	9191 W Fort St	42.295824	-83.129431	NO2	SPM	42602	1	nghbrhd	Wayne	10/17/18	DWL	4,319,629
Military	261630100	1238 Military St	42.312078	-83.103469	NO2	SPM	42602	1	nghbrhd	Wayne	11/1/18	DWL	4,319,629

PAMS

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parameter Code	POC	Scale	County	Start Date	CBSA [1]	2019 Population Estimate
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.984167	-85.671389	NO2	pop exp	42602	1	nghbrhd	Kent	1/1/08	GW	1,077,370
Detroit - E 7 Mile	261630019	11600 East Seven Mile Road	42.430833	-83.000278	NO2	pop exp	42602	1	urban	Wayne	12/1/90	DWL	4,319,629

[1] **CBSA Key:**
DWL= Detroit-Warren-Livonia MSA
GW = Grand Rapids-Wyoming MSA
LEL= Lansing-East Lansing MSA

Figure 14: Michigan's NO_2 and NO_Y Monitoring Network



SULFUR DIOXIDE (SO_2) MONITORING NETWORK

On June 2, 2010, the USEPA made the SO_2 NAAQS more stringent by revoking the 24-hour and annual average standards and creating an hourly standard that cannot exceed 75 ppb. The form of the standard is the 99th percentile averaged over three years. The secondary standard has not been changed.[13]

To design a monitoring network, the USEPA created the Population Weighted Emissions Index (PWEI) that is calculated by:

(CBSA population)[14] (total SO_2 emissions in that CBSA in tpy) / 1,0000,000 = PWEI

The PWEI value for each CBSA is compared to the threshold values shown in **Table 23** to determine the number of monitoring sites that are required:

Table 23: Population Weighted Emission Index-based Monitoring Requirements

Population Weighted Emissions Index Value	Number of Sites
Greater than or equal to 1,000,000	3
Greater than 100,000 but less than 1,000,000	2
Greater than 5,000	1

The PWEI monitors serve a variety of purposes including assessing population exposure, determining trends and transport as well as ascertaining background levels.

The USEPA allows agencies to count the NCore SO_2 monitors as part of these new requirements. Also, because the new SO_2 monitors are not single source-oriented, existing infrastructure can be used to select locations for expansion of the SO_2 network.

If **Table 23** is applied to the PWEI calculations for the CBSAs in Michigan, the number of monitors that are required is shown in **Table 24**. The data in the table uses the 2010 Census data and the 2014 version of the National Emissions Inventory data.

[13] Primary National Ambient Air Quality Standards for Sulfur Dioxide; Final Rule, 75 *Federal Register* 35520 (June 22, 2010).
[14] According to the latest Census Bureau estimates.

Table 24: Population Weighted Emissions Index Totals for CBSAs in Michigan

MSA	Counties	2014 NEI Download: Total County SO_2 Emissions, tpy	2014 NEI SO_2 Total Emissions, tpy	2010 Population	2014/2010 NEI PWEI	Monitors Required 2008 EI & 2010 Census
Detroit-Warren-Livonia Metro Area	Macomb	1,640.40	148,810	4,296,250	639,325	2
	Oakland	1,785.67				
	Wayne	53,783.79				
	Lapeer	339.64				
	St Clair	91,003.09				
	Livingston	257.45				
Flint Metro Area	Genesee	736.16	736	425,790	313	0
Monroe Metro Area	Monroe	17,728.75	17,729	152,021	2,695	0
Ann Arbor Metro Area	Washtenaw	596.75	597	344,791	206	0
Grand Rapids-Wyoming Metro Area	Kent	1,650.61	1,991	774,160	1,542	0
	Barry	152.05				
	Newaygo	79.70				
	Ionia	108.91				
Holland-Grand Haven Metro Area	Ottawa	40,353.25	40,353	263,801	10,645	1
Muskegon-Norton Shores Metro Area	Muskegon	12,313.94	12,314	172,188	2,120	0
Lansing-East Lansing Metro Area	Clinton	238.56	11,729	464,036	5,442	1
	Ingham	5,069.91				
	Eaton	6,420.12				
Bay City Metro Area	Bay	15,356.59	15,357	107,771	1,655	0
Saginaw-Saginaw Twp N Metro Area	Saginaw	500.99	501	200,169	100	0
Kalamazoo-Portage Metro Area	Kalamazoo	1,397.61	1,533	326,589	500	0
	Van Buren	134.89				
Niles-Benton Harbor Metro Area	Berrien	349.72	350	156,813	55	0
Jackson Metro Area	Jackson	444.89	445	160,248	71	0
Battle Creek Metro Area	Calhoun	388.72	389	136,146	53	0
South Bend Mishawaka Metro Area IN/MI	Cass	76.76	77	52,293	4	0

Based on the 2014 emissions data and 2010 population estimates, the Detroit-Warren-Livonia CBSA needs two SO_2 monitoring sites, while the Holland-Grand Haven Metropolitan Area and Lansing-East Lansing Metropolitan Area each need a single SO_2 monitoring site.

The NCore trace level SO_2 monitor at Allen Park (261630001) fulfills the requirement for one of the SO_2 monitors required in the Detroit-Warren-Livonia CBSA. EGLE also monitors at Detroit–SWHS (261630015) and Port Huron (261470005).

EGLE deployed the Sterling State Park (261150006) site on January 1, 2013, to fulfill the requirement for the Monroe Metropolitan Area. If USEPA approves EGLE will discontinue operation in 2021.

EGLE deployed SO_2 monitors in the Holland-Grand Haven Metropolitan Area at the West Olive site (261390011) in Ottawa County, on January 1, 2015, and in the Lansing-East Lansing Metropolitan Area at the Lansing site (260650012) in Ingham County, on January 1, 2012. In 2021 if the USEPA approves, EGLE will discontinue operations at West Olive in 2021.

In 2019, SO_2 monitors were added to the three new GHIB sites; DP4th (261630098), Trinity (261630099), and Military Park (261630100).

Table 25 summarizes the SO_2 monitoring site information for 2020 and 2021. **Figure 16** shows the geographical distribution of SO_2 sites across Michigan.

SO_2 Monitoring and Modeling Requirements

With the revision to the SO_2 NAAQS in 2010, federal regulations also changed for both monitoring and modeling SO_2 emissions. The USEPA established a three-tiered process for assessing the attainment status of the ambient air near large sources emitting SO_2.

States were required in Tier 1 to establish monitoring stations in areas with high population levels and high emission levels. Existing monitors in Detroit and Lansing, and new monitors in West Olive and Monroe met this obligation for assessment. Of these four areas, a portion of Wayne County was found to have levels of SO_2 exceeding the health-based standard. This area was designated by the USEPA as nonattainment. EGLE completed an attainment plan that included rulemaking, which would bring the area into compliance with the NAAQS. EGLE was sued by an affected company, lost the lawsuit, and now the USEPA has developed a Federal Implementation Plan for the nonattainment area.

The second tier requires States to conduct either monitoring or modeling for sources emitting over 16,000 tons per year. EGLE identified six areas meeting this criterion. Modeling has been completed for sources in St. Clair, Eaton, Ingham, Marquette, Ottawa, Bay, and Monroe Counties. The USEPA reviewed the modeling and designated a small portion of St. Clair County as nonattainment and the other areas were designated attainment/unclassifiable, in September 2016. Control strategies will be developed for the sources in St. Clair County and the attainment plan will be incorporated into the Michigan State Implementation Plan (SIP). DTE Energy has informed EGLE that it will be installing two SO_2 special purpose monitoring stations in St. Clair County to provide additional SO_2 and meteorological data to aid future SIP development. These monitors are not part of a Data Requirements Rule network.

The third tier involves modeling of SO_2 source emissions greater than 2,000 tons per year. This modeling project involved two sources in Delta County and Alpena County, and was submitted to the USEPA on January 11, 2017. The modeling demonstrated that the two sources did not have an impact on the NAAQS. The USEPA designated the two counties as attainment/unclassifiable on April 9, 2018.

The necessity of taking a combination monitoring/modeling approach to assessment for SO_2 was borne out of the fact that monitoring could not cover every wind scenario at each large emission source nationwide. States could not bear the large associated expenses of establishing enough new monitoring sites to adequately characterize the SO_2 pollutant levels in ambient air. Assessment is enhanced with additional modeling, a less expensive methodology, which helps to inform planners about the degree of the problem to solve and also the effectiveness of different proposed control measures.

EGLE continues to identify strategies to reduce SO_2 pollutant levels through collaboration with Michigan industry, as well as local and federal partners.

SO_2 Quality Assurance

The AMU site operator performs a 1-point quality assurance check of the analyzer every two weeks. The checks are sent to the QA Coordinator each quarter. Each monitor is audited annually by the AMU's QA Team, which has a separate reporting line of authority from the site operator. The auditor utilizes a dedicated gas calibrator and calibration gases that are only for audits. The independent audit challenges the accuracy of the station monitor at several concentrations using a certified gas standard. The auditor also assesses the monitoring system (inspecting the sample line, filters, and inlet probe), siting, and documentation of precision checks. Results of the checks and audits indicate whether the monitor is meeting the measurement quality objectives. The AMU uploads 1-point checks and audit results to the USEPA's AQS database each quarter. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files.

The USEPA conducts thru-the-probe audits on 20 percent of the SO_2 monitors each year. The audit consists of delivering four levels of calibration gas to the station monitor through the probe. The USEPA reports the audit results to AQS.

Plans for the 2021 SO_2 Monitoring Network

During 2021, contingent upon adequate levels of funding, EGLE is planning to continue to operate SO_2 monitors at:

- Lansing (260650018)
- Grand Rapids–Monroe St. (260810020) (NCore trace SO_2)
- Sterling State Park (261150006); if USEPA approves, will shut down site in 2021
- West Olive (261390011); if USEPA approves, will shut down site in 2021
- Port Huron (261470005)
- Allen Park (261630001) (NCore trace SO_2)
- Detroit-SWHS (261630015)
- NMH 48217 (261630097)
- DP4 (261630098)
- Trinity (261630099)
- Military Park (2161630100)

Table 25: Michigan's SO_2 Monitoring Network

Operating Schedule: Continuous

Method: Ultra Violet Stimulated Fluorescence; Method Code 060 (SO_2) and Method Code 600 (Trace SO_2)

NCore Sites, Trace

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parmeter Code	POC	Scale	County	Start Date	MSA [1]	2019 population Estimate
Grand Rapids - Monroe St.	260810020	1179 Monroe NW	42.9842	-85.671389	trace	pop exp	42401	2	nghbrhd	Kent	1/1/08	GW	1,077,370
Allen Park	261630001	14700 Goddard	42.2286	-83.208333	trace	pop exp	42401	1	nghbrhd	Wayne	1/1/08	DWL	4,319,629

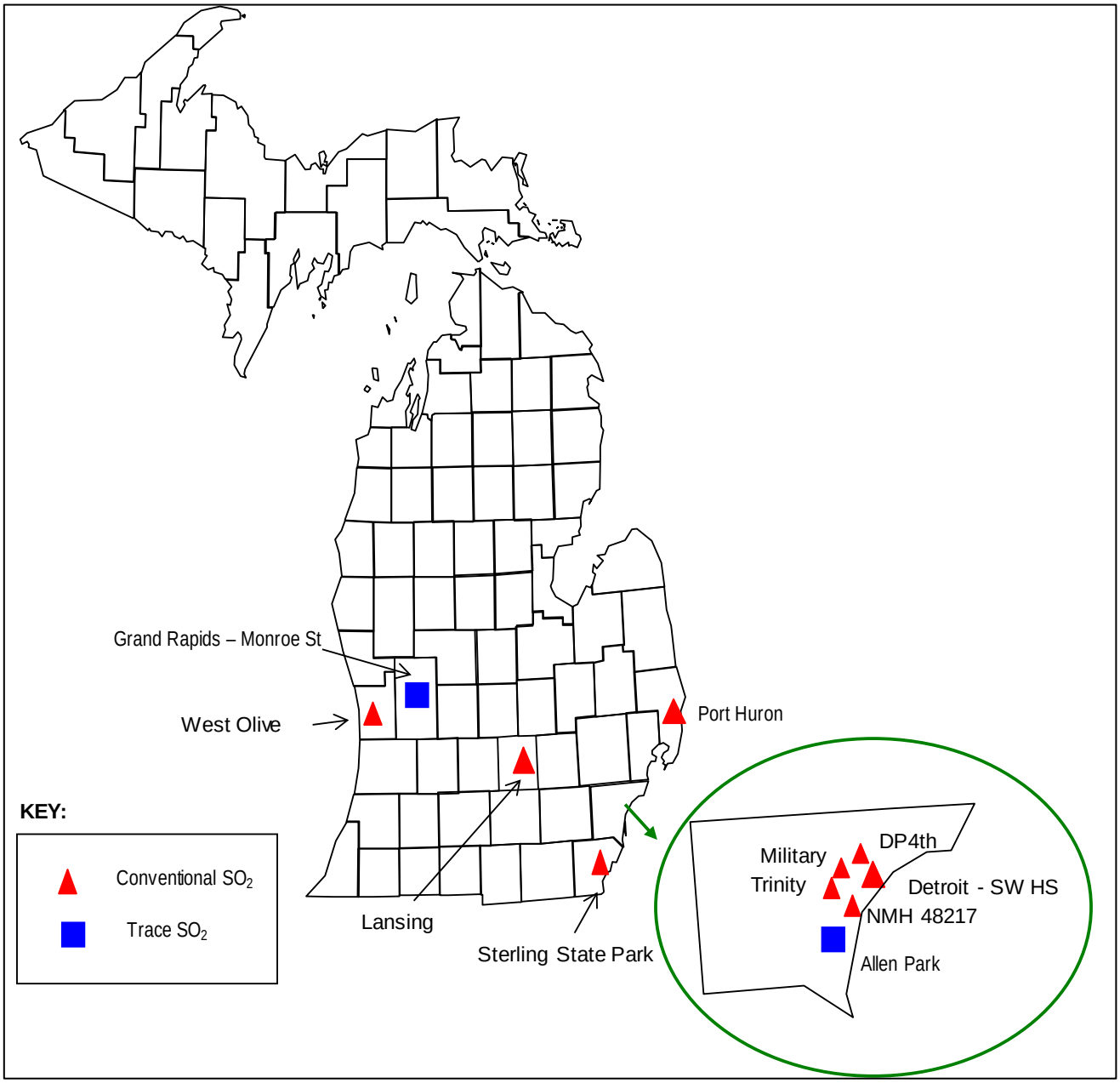
Source-Oriented and Community Sites

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose/ Type	Parmeter Code	POC	Scale	County	Start Date	MSA [1]	2019 population Estimate
Lansing	260650012	220 N Pennsylvania	42.7386	-84.534722	SO2	Max Conc	42401	1	nghbrhd	Ingham	1/1/12	LEL	550,391
Sterling Sate Park	261150006	2800 State Park Road	41.9236	-83.345858	SO2	Max Conc	42401	1	nghbrhd	Monroe	1/1/13	Monroe	150,500
West Olive	261390011	8578 Hiawatha Dr.	42.9231	-86.194604	SO2	Max Conc	42401	1	nghbrhd	Ottawa	1/1/15	GW	1,077,370
Port Huron	261470005	2525 Dove Rd	42.9533	-82.456389	SO2	Max Conc	42401	1	urban	St. Clair	2/28/81*	DWL	4,319,629
Detroit - SW HS	261630015	150 Waterman	42.3028	-83.106667	SO2	Max Conc	42401	1	nghbrhd	Wayne	1/1/71	DWL	4,319,629
DP4th	261630098	4700 W Fort St	42.3122	-83.091943	SO2	Max Conc	42401	1	SPM	Wayne	8/3/18	DWL	4,319,629
Trinity	261630099	9191 W Fort St	42.2958	-83.129431	SO2	Max Conc	42401	1	SPM	Wayne	10/23/18	DWL	4,319,629
Military	261630100	1238 Military	42.3121	-83.103469	SO2	Max Conc	42401	1	SPM	Wayne	11/2/18	DWL	4,319,629

[1] **MSA Key:**
DWL = Detroit-Warren-Livonia MSA
GW = Grand Rapids-Wyoming MSA
LEL = Lansing-East Lansing MSA
Monroe = Monroe MSA

* Monitor shutdown in 2007 restarted in January 2012

Figure 15: Michigan's SO_2 Monitoring Network



TRACE METAL MONITORING NETWORK

Since 1981, monitoring for trace metals as TSP (Total Suspended Particles) has been conducted as part of the Michigan Toxics Air Monitoring Program (MITAMP). Over the years, the program gradually expanded to ten sites that collect TSP samples on a once every six or 12-day schedule. Sample collection follows the schedule developed by the USEPA. The TSP filters are analyzed by the EGLE laboratory for lead, manganese, arsenic, cadmium, and nickel. Further discussion of lead is detailed in another chapter.

The Dearborn (261630033) NATTS site measures a suite of 14 metals for the TSP size fractions. The list of metals includes lead, beryllium, vanadium, chromium, manganese, nickel, cobalt, copper, zinc, arsenic, molybdenum, cadmium, barium, and iron.

In 2021, the following sites will measure TSP metals and PM_{10} as indicated below:

- Belding-Merrick St. (260670003)
- Port Huron (261470031); co-located
- River Rouge (261630005)
- Detroit-SWHS (261630015)
- S. Delray-Jefferson (261630027)
- Dearborn (261630033) **TSP**; NATTS - 14 metals list and co-located
- Dearborn (261630033) **PM_{10}**; NATTS - 14 metals list and co-located
- NMH 48217 (261630097)
- DP4 (261630098)
- Trinity (261630099)
- Military Park (261630100)

Table 26 summarizes the trace metals monitoring site information for 2021. **Figure 16** shows the geographical distribution of trace metal sites across Michigan.

Table 26: Michigan's Trace Metal Monitoring Network

Operating Schedule: 1:6, follows EPA published calendar

Method: TSP: High Volume sampler using glass fiber filter ; Emission Spectra ICAP for lead; ICP MS for remaining metals

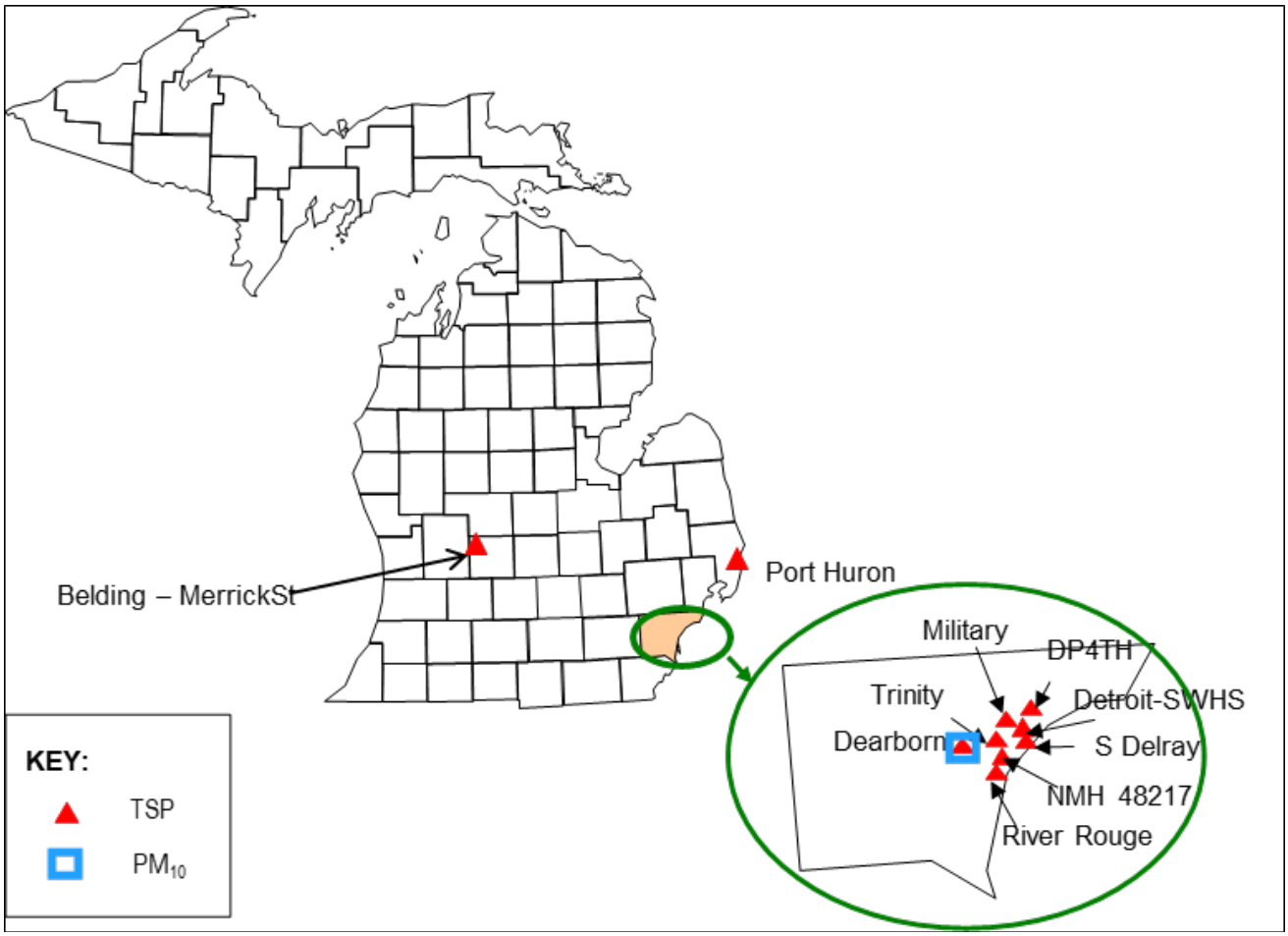
PM10: High Volume sampler using quartz filter; Emission Spectra ICAP for lead; ICP MS for remaining metals

Monitoring Sites														2019
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Elements	Size	Purpose/ Type	POC	Scale	County	Date Estab.	MSA [1]	Population Estimated
Belding - Merrick St	260670003	509 Merrick	43.09984	-85.22163	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	1	micro	Ionia	1/1/10	I	* 64210
Port Huron	261470031	324 Rural St	42.98209	-82.449233	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	1	micro	Saint Clair	1/1/13	DWL	4,319,629
Port Huron (colocated)	261470031	324 Rural St	42.98209	-82.449233	1:12	Pb, Mn, As, Cd, Ni	TSP	max conc	1	micro	Saint Clair	1/1/13	DWL	4,319,629
River Rouge	261630005	315 Genesee	42.267222	-83.132222	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	1	nghbrhd	Wayne	1/1/94	DWL	4,319,629
Fort St. (SWHS)	261630015	150 Waterman	42.302778	-83.106667	1:6	Pb, Mn, As, Cd, Ni	TSP	pop exp	1	nghbrhd	Wayne	2/26/99	DWL	4,319,629
S Delray	261630027	7701 W Jefferson	42.292222	-83.106944	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	1	nghbrhd	Wayne	10/6/04	DWL	43,196,629
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:6	Be, V, Cr, Mn, Co, Ni, Cu, Zn, As, Mo, Cd, Ba, Pb, Fe	TSP	max conc	1	nghbrhd	Wayne	6/1/90	DWL	4,319,629
Dearborn (colocated)	261630033	2842 Wyoming	42.306666	-83.148889	1:12	Be, V, Cr, Mn, Co, Ni, Cu, Zn, As, Mo, Cd, Ba, Pb, Fe	TSP	max conc	9	nghbrhd	Wayne	6/1/90	DWL	4,319,629
NMH 48217 [2]	261630097)				1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	1	SPM	Wayne		DWL	4,319,629
DP4th [2]	261630098	4700 W Fort St	42.312158	-83.091943	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	1	SPM	Wayne	1/25/09	DWL	4,319,629
Trinity [2]	261630099	9191 W Fort St	42.295824	-83.129431	1:6	Pb, Mn, As, Cd, Ni	TSP	pop exp	1	SPM	Wayne	1/25/09	DWL	4,319,629
Military [2]	261630100	1238 Military St	42.312078	-83.103469	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	1	SPM	Wayne	6/1/90	DWL	4,319,629
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:6	Be, V, Cr, Mn, Co, Ni, Cu, Zn, As, Mo, Cd, Ba, Pb, Fe	PM 10	max conc	1	nghbrhd	Wayne	6/1/90	DWL	4,319,629
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:12	Be, V, Cr, Mn, Co, Ni, Cu, Zn, As, Mo, Cd, Ba, Pb, Fe	PM 10	max conc	3	nghbrhd	Wayne	6/1/90	DWL	4,319,629

[1] **MSA Key:** DWL Detroit-Warren-Livonia MSA
I Ionia Micropolitan * population estimate from 2018,2019 not available
GW Grand Rapids- Wyoming MSA

[2] SPM Special Purpose Monitor

Figure 16: Michigan's Trace Metal Monitoring Network



Trace Metal Quality Assurance

The site operator conducts a flow rate verification once a month. Flow check values are sent to the QA Coordinator each quarter. An independent audit is conducted by a member of the AMU's QA Team every six months. The auditor is in a separate line of reporting authority from the site operator and uses independent, dedicated equipment to perform the flow rate audit. The auditor also assesses the condition of the monitor and siting criteria. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files.

EGLE Laboratory participates in two types of external performance testing programs. A nationally-based audit program sends a sample that has a known concentration of metals spiked onto a filter. The lab analyzes the filter in the same fashion as the routine samples. Results are compared to a "true" value and tabulated for all participants in the program. EGLE Laboratory also receives regional round robin audits. The regional audit sample is collected by running an ambient air monitor for 24 hours. The filter is cut into strips and sent to several laboratories. Results for the participating laboratories are compared to each other since a "true" value is not known.

Co-located samples for precision are collected for both PM_{10} and TSP-sized trace metals at Dearborn (261630033) and Port Huron (261470031) TSP-size on a once every 12-day frequency.

VOLATILE ORGANIC COMPOUND (VOC) MONITORING NETWORK

The collection and analysis of more than 50 VOC compounds per sample began at various sites in 1990 as part of the MITAMP. Either a once every six-day or once every 12-day sampling frequency has been used depending on the site and budget status. The VOC network follows the sampling calendar published by the USEPA. The Detroit-SWHS (261630015) site in Detroit has been the trend site and has collected VOC samples every year since 1993. The determination of VOC samples on a once every six-day sampling frequency using Method TO-15 is required for the NATTS site at Dearborn (261630033). A minimum of six precision (duplicate) samples per year are also collected at Dearborn (261630033) as part of the NATTS program. NATTS samples go to a national contract lab and the trend site samples are analyzed by the EGLE lab.

VOC sampling with an Auto-GC is also a requirement of the PAMS (photochemical assessment monitoring station) network which is anticipated to be operational in 2021. The PAMS section of this document provides more details.

Table 27 summarizes the VOC monitoring site information. **Figure 17** illustrates the geographical distribution of VOC monitors in Michigan.

VOC Quality Assurance

Once a year, the QA Team conducts a thru-the-probe audit using a known concentration of specialized calibration gas. The gas is sent through the station sample probe and collected into a clean, evacuated 6-liter Summa canister over a 24-hour period, and analyzed using USEPA Method TO-15. The results are compared to the auditor's target concentration. Once a year, the QA Team also conducts a zero-air check on the sampler by running VOC-free air through the probe and into an air canister for 24 hours. The auditor assesses the sampling configuration, including the condition and height of probe and siting criteria.

The EGLE laboratory also participates in regional performance test programs. The regional performance test audit is produced by a multi-sampling unit that collects actual ambient air. The results from the participating laboratories are compared to each other since a "true" value is not known. The QA Coordinator receives, reviews, and retains copies of all performance test audit samples. The EGLE laboratory also participates in regional round robin samples.

Plans for the 2021 VOC Monitoring Network

During 2021, contingent upon adequate levels of funding, EGLE plans to continue collecting VOCs using Summa cans at:

- Detroit-SWHS (261630015) **Air Toxics Trend site**; once every 12 days
- Dearborn (261630033) **NATTS site**; once every six days and precision samples once every two months

In June 2021, contingent upon funding, EGLE plans to start operating the continuous Auto-GC for VOC analysis at the following **PAMS sites**:

- Detroit-E 7 Mile (261630019)
- Grand Rapids (260810020)

Figure 17: Michigan's VOC Monitoring Network

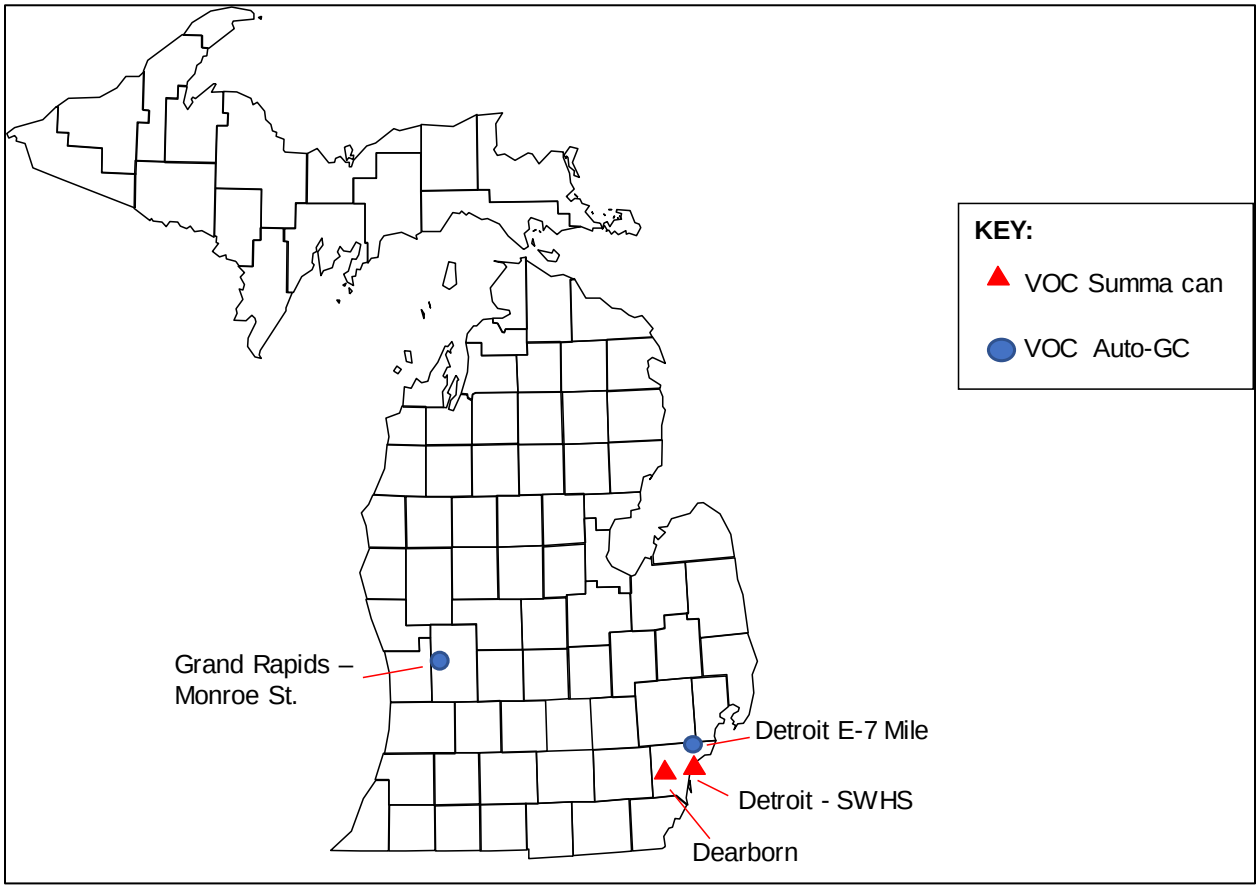


Table 27: Michigan's VOC Monitoring Network

Operating Schedule: 1:6 and 1:12, Follows EPA Published Schedule
Method: Stainless Steel Pressurized Canister Sampler; Gas Chromatograph/ Mass Spectrometer (24-hr samples); Method Code 110

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose/ Type	POC	Scale	County	Date Estab.	MSA [1]	2019 Population Estimate
Detroit - SWHS	261630015	150 Waterman	42.302778	-83.106667	1:12	pop exp	1	nghbrhd	Wayne	2/26/99	DWL	4,319,629
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:6	max conc	1	nghbrhd	Wayne	6/1/90	DWL	4,319,629

Operating Schedule: Semi continous ; 1 hour composite
Method: CAS Auto-GC

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose/ Type	POC	Scale	County	Date Estab.	MSA [1]	2019 Population Estimate
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.984167	-85.671389	1-hr composite	pop exp	1	nghbrhd	Kent	6/1/21	GW	1,077,370
Detroit - E 7 Mile	261630019	11600 East Seven Mile Road	42.430833	-83.000278	1-hr composite	pop exp	1	nghbrhd	Wayne	6/1/21	DWL	4,319,629

[1] **MSA Key:** DWL= Detroit-Warren-Livonia
GW=Grand Rapids-Wyoming Metro

CARBONYL MONITORING NETWORK

The collection of carbonyl compounds, including formaldehyde and acetaldehyde as part of MITAMP, began at various sites in 1995. Either a once every six-day or once every 12-day sampling frequency has been used depending on the site and budget status. The carbonyl network follows the sampling calendar published by the USEPA. The Detroit-SWHS (261630015) site in Detroit has been the trend site and has collected carbonyl samples every year since 1995.

Levels of formaldehyde in southeast Michigan are very heterogeneous, unlike other areas of the United States. Historical concentrations at River Rouge (261630005) are elevated, so the continuation of this monitor is important for the characterization of risk and for the determination of trends, this runs on a once every 12-day schedule. Detroit-SWHS (261630015) is EGLE's air toxic trend site, so monitoring has continued on a once every 12-day schedule. Monitoring for carbonyl compounds on a one in six-day frequency using Method TO-11A is required at the Dearborn NATTS site (261630033). Also, as a part of NATTS, six precision samples for carbonyls are collected every year.

Carbonyl sampling is also a requirement of the PAMS (photochemical assessment monitoring station) network, which is anticipated to be operational in 2021. The PAMS section of this document provides more details.

Table 28 summarizes the carbonyl monitoring site information for sites that were in existence in 2020 and will be added in 2021. **Figure 18** shows the distribution of carbonyl samplers across Michigan.

Carbonyl Quality Assurance

Once a year, the QA Team conducts a thru-the-probe audit using a known concentration of specialized calibration gas. The gas is sent through the station sample probe and collected on a dinitrophenyl hydrazine (DNPH) cartridge over a 24-hour period and analyzed using USEPA Method TO-11A. The laboratory result is compared to the auditor's target concentration. The QA Team also conducts a zero-air check of the sampler once a year by sending carbonyl-free air through the probe and into the sampler for 24 hours. The auditor assesses the sampling configuration, including the condition and height of probe and siting criteria.

The carbonyl samples are sent to two different labs. NATTS samples go to a national contract lab. The national lab participates in a national performance test program. The Detroit-SWHS and River Rouge samples go to a lab that is also required to participate in the NATTS performance test program. The national contractor sends a spiked sample of known compounds and concentrations to the laboratory. The results are compared to the "true" value. The regional performance test audit is produced by a multi-sampling unit that collects actual ambient air. The results from the participating laboratories are compared to each other since a "true" value is not known. The QA Coordinator receives, reviews, and retains copies of all performance test audit samples.

Plans for the 2021 Carbonyl Monitoring Network

During 2021, contingent upon adequate levels of funding, Michigan plans to continue collecting carbonyls at:

- River Rouge (261630005) – once every 12 days
- Detroit-SWHS (261630015) – **Air Toxics Trend site**; once every 12 days
- Dearborn (261630033) – **NATTS** site; once every six days and precision sample once every two months

In June 2021, contingent upon funding, EGLE plans to start collecting *three 8-hour carbonyl samples on a one-in-three day basis* at the following **PAMS sites:**

- Detroit-E 7 Mile (261630019)
- Grand Rapids (260810020)

Figure 18: Michigan's Carbonyl Monitoring Network

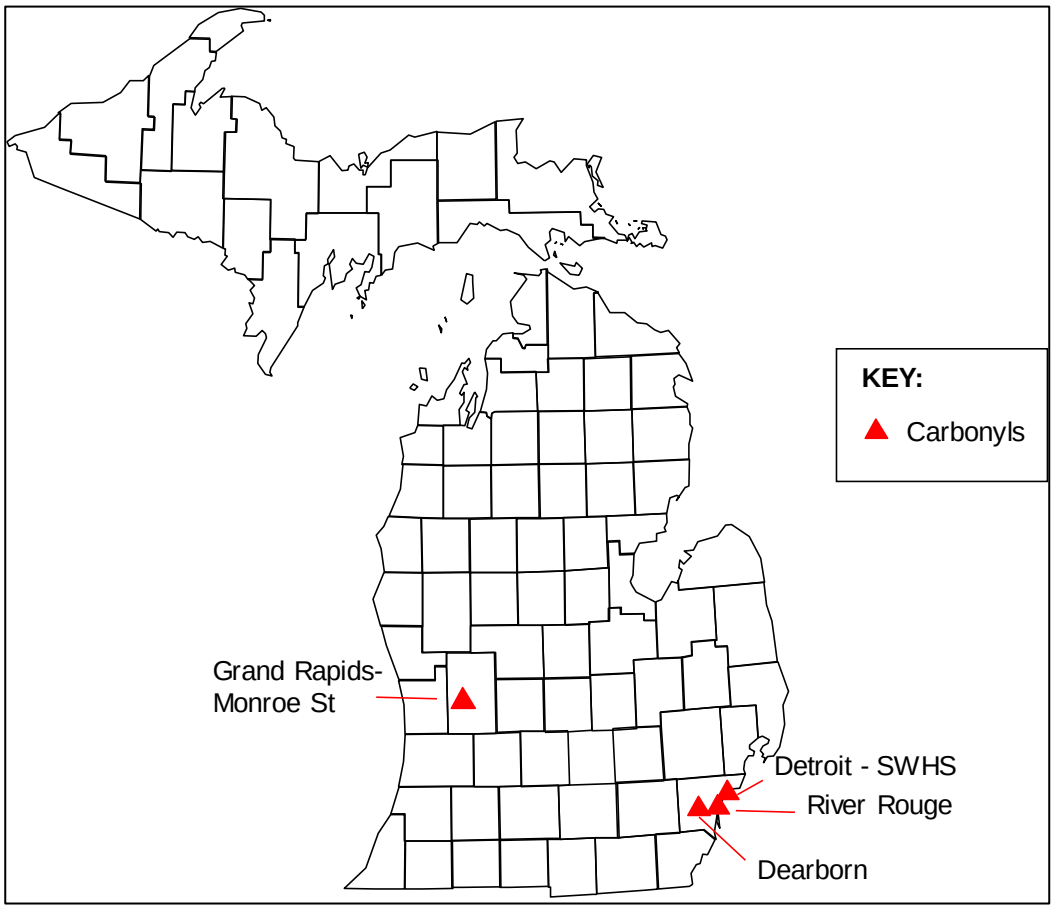


Table 28: Michigan's Carbonyl Monitoring Network

Operating Schedule: 1:6 and 1:12, Follows EPA published schedule
Method: TO-11A ; 2,4 dinitrophenyl hydrazine treated silica gel cartridges; HPLC with ultraviolet absorption; Method Code 202

Monitoring Sites												
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose/ Type	POC	Scale	County	Date Estab.	MSA [1]	2019 Population Estimate
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:6	max conc	1	nghbrhd	Wayne	6/1/90	DWL	4,319,629
River Rouge	261630005	315 Genesee	42.267222	-83.132222	1:12	max conc	1	nghbrhd	Wayne	1/1/94	DWL	4,319,629
Detroit - SWHS	261630015	150 Waterman	42.302778	-83.106667	1:12	pop exp	2	nghbrhd	Wayne	2/26/99	DWL	4,319,629
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.984167	-85.671389	3 8-hr samples 1:3 day	pop exp	1	nghbrhd	Kent	6/1/21	GW	1,077,370
Detroit - E 7 Mile	261630019	11600 East Seven Mile Road	42.430833	-83.000278	3 8-hr samples 1:3 day	pop exp	1	nghbrhd	Wayne	6/1/21	DWL	4,319,629

[1] **MSA Key:** DWL= Detroit-Warren-Livonia
GW=Grand Rapids-Wyoming Metro

POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) MONITORING NETWORK

As part of the USEPA's desire to augment the NATTS, PAHs were added to the Dearborn site on April 6, 2008. Samples are collected on a once every six-day sampling schedule using an Anderson PS-1 sampler. The PAH network follows the sampling calendar published by the USEPA. The sampler contains a glass thimble filled with prepared polyurethane foam plugs that surround XAD-2 resin. Volatile PAHs are absorbed into the foam and XAD-2 resin. Particle bound PAHs are trapped on a filter that precedes the thimble. A second sampler was deployed to the Dearborn site so that six precision samples can be collected each year, conforming to the USEPA's co-location criteria.

The sample media is sent to the national contract laboratory, Eastern Research Group (ERG), where it is extracted and analyzed according to ASTM test method D 6209, which is equivalent to USEPA method TO-13A.

Table 29 shows the site information for PAH sites that will be in operation in 2021 **Figure 19** shows the locations of the PAH monitoring sites.

PAH Quality Assurance

The site operator conducts a flow rate verification once a month. The flow check values are sent to the QA Coordinator each quarter. An independent audit is conducted by a member of the AMU's QA Team once a year. The auditor is in a separate line of reporting authority from the site operator and uses independent, dedicated equipment to perform the flow rate audit. The auditor also assesses the condition of the monitor and siting criteria. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files.

Plans for the 2021 PAHs Monitoring Network

During 2021, contingent upon adequate levels of funding, Michigan plans to continue collecting PAHs at:

- Dearborn (261630033) – once every six days and precision once every two months.

Table 29: Michigan's PAHs Monitoring Network

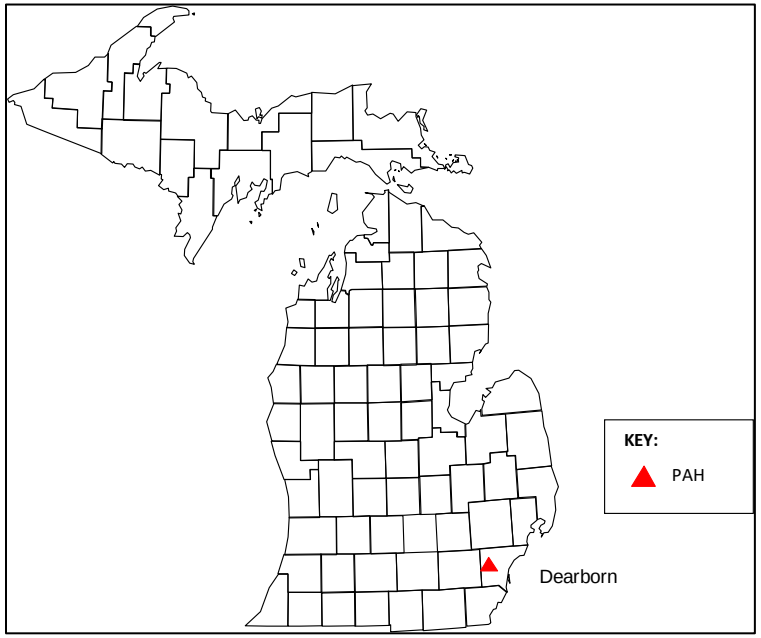
Operating Schedule: 1:6 , Follows EPA published schedule

Method: Polyurethane foam plugs and XAD-2 resin with gas chromatography mass spectrometry; Method Code 202

Monitoring Sites														
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Parameter Code	POC	Purpose/ Type	POC	Scale	County	Date Estab.	MSA [1]	Pop (2015 Estimated)
Dearborn	261630033	2842 Wyoming	42.30667	-83.1489	1:6	various	1	max conc	1	nghbrhd	Wayne	6/1/90	DWL	4,319,629

[1] **MSA Key:** DWL= Detroit-Warren-Livonia MSA

Figure 19: Michigan's PAHs Monitoring Network



PAMS NETWORK

EGLE has not operated a Photochemical Assessment Monitoring Station (PAMS) site since before 2001. However, the recently revised monitoring rule (80 FR 65292; October 26, 2015) requires PAMS measurements June 1 through August 31 at NCore sites that are located in CBSAs with populations of one million or more. As long as federal funding is made available for Michigan to fully fund two PAMS sites, EGLE will implement the following changes to its network starting June 2021.

Network Decision

EGLE has two NCore sites located at Allen Park (261630001) and Grand Rapids-Monroe St. (260810020). The Grand Rapids-Monroe St. (260810020) will serve as one of the locations and the second Detroit PAMS site will be operated at E 7 Mile (261630019) due to its higher ozone design values. This alternate site for the Detroit area PAMS station was approved by the USEPA in October 2018. The required PAMS sites will measure the parameters described below. Due to federal issues for funding, the purchasing process has been delayed. Equipment likely to be installed at the sites will be; ceilometers for determining mixing height, CAS Auto-GCs for VOCs, true NO_2 using a direct reading NO_2 analyzer, and three 8-hour samples for carbonyls every three days. National purchasing contract will be used to obtain as much of the instrumentation as possible.

Auto GC Decision

A complete list of the targeted compounds is presented in **Table 30.**

EGLE intends to participate in the national contract purchasing program to obtain the CAS auto-gas chromatograph (GC) system for the hourly speciated VOC measurements.

Meteorology Measurements Decision

EGLE will measure wind direction, wind speed, temperature, humidity, atmospheric pressure, precipitation, solar radiation, ultraviolet radiation, and mixing height using Ceilometer. The USEPA has committed to providing the states with specific funding for the purchase of the Ceilometers instruments.

Other Required Measurements

Carbonyl sampling at a frequency of three 8-hour samples on a one-in-three-day basis (90 samples per PAMS sampling season) is required. EGLE intends to use the national contract laboratory for the analysis of the PAMS carbonyl samples. A complete list of the target carbonyl compounds may be found in **Table 30**. The TO-11A test method, as used in the National Air Toxics Trends (NATTS) program will be used.

EGLE will monitor for NO and NO_Y (total oxides of nitrogen) in addition to true NO_2. The USEPA has committed to providing the states specific funding for the purchase of the true NO_2 analyzers.

Table 30: PAMS Target Compound List

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

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

[a] Important SOAP (Secondary Organic Aerosols Precursor) Compounds
[b] HAP (Hazardous Air Pollutant) Compounds
[c] Carbonyl compounds
[d] Non-reactive compounds, not considered to be VOC for regulatory purposes

METEOROLOGICAL MEASUREMENTS

Various meteorological measurements have been added to supplement the ambient monitoring network and enhance data analysis activities. A description of the types of meteorological measurements that are made at each site is provided in **Table 31**. EGLE is not planning any changes to the meteorological measurements, except as required for PAMS.

Meteorological Equipment Quality Assurance

On an annual basis, an Equipment Technician conducts a multi-speed and directional certification of the propeller anemometer and vane systems. The QA Team staff or Senior Environmental Technician performs a "sun shot" to check the true north orientation of the anemometer and vane system at the station.

An independent audit is conducted by the QA Team to assess the accuracy of the indoor and outdoor temperature, barometric pressure, and relative humidity measurements at the site. The comparison is done between the station's measurements and the auditor's certified thermometer, barometer, and hygrometer to ensure quality objectives are being met. The QA Coordinator reviews the results of both the wind speed and wind direction certifications as well as the independent audits. Hard copies of all assessments are retained in the QA file system.

Plans for the 2021 Meteorological Monitoring Network

During 2021, contingent upon adequate levels of funding, Michigan plans to continue collecting hourly meteorological measurements at:

- Holland (26005003)
- Bay City (260170014)
- Coloma (260210014)
- Cassopolis (260270003)
- Flint (260490021)
- Otisville (260492001)
- Harbor Beach (260630007)
- Lansing (260650018)
- Kalamazoo (260770008)
- Grand Rapids–Monroe St. (260810020)
- Grand Rapids Near-road (260810023); *new site*
- Evans (280810022)
- Tecumseh (260910007)
- New Haven (260990009)
- Sterling Heights / Freedom Hill (260990021)
- Manistee (261010922) Tribal
- Scottville (261050007)
- Houghton Lake (261130001)
- Muskegon–Green Creek Rd. (261210039)

- Oak Park (261250001)
- Pontiac (261250011)
- Rochester (261250012)
- Jenison (261390005)
- Port Huron (261470005)
- Seney (261530001)
- Ypsilanti (261610008)
- Allen Park (261630001)
- River Rouge (261630005)
- Detroit–SWHS (261630015)
- Detroit–E 7 Mile (261630019)
- Livonia Near-road 2 (261630101); *relocated site*
- Detroit–Joy Rd. (261630026)
- Dearborn (261630033)
- Eliza Howell (261630093)
- Trinity (261630099)

Table 31: Meteorological Measurements in Michigan

Site Name	AQS ID	Wind Speed 61103	Wind Direction 61104	Temperature 62101	Relative Humidity 62201	Barometric Pressure 64101	Solar Radiation 63301	Sigma Theta 61106
Holland	260050003	x	x	x	x	x	x	x
Bay City	260170014	x	x	x				x
Coloma	260210014	x	x	x				x
Cassopolis	260270003	x	x	x				x
Flint	260490021	x	x	x		x		x
Otisville	260492001	x	x	x		X		x
Harbor Beach	260630007	x	x	x				x
Belding- Reed St	260670002	x	x	x		x		x
Lansing	260650012	x	x	x		x		x
Kalamazoo	260770008	x	x	x				x
Grand Rapids - Monroe St	260810020	x	x	x	x	x		x
Grand Rapids Near-road	260810023	x	x	x				x
Evans	260810022	x	x	x				x
Tecumseh	260910007	x	x	x		x		x
New Haven	260990009	x	x	x	x		x	x
Sterling Hts/ Freedom Hill	260990021	x	x	x				x
Manistee	261010922	x	x	x		x		x
Scottville	261050007	x	x	x				x
Houghton Lake	261130001	x	x	x		x		x
Sterling St Park - Monroe	261150006	x	x	x				x
Muskegon, Green Ck Rd	261210039	x	x	x				x
Oak Park	261250001	x	x	x		x		x
Pontiac	261250011	x	x	x				x
Rochester	261250012	x	x	x				x
Jenison	261390005	x	x	x				x
West Olive	261390011	x	x	x				x
Port Huron	261470005	x	x	x		X		x
Seney	261530001	x	x	x	x	x		x
Ypsilanti	261610008	x	x	x		x		x
Allen Park	261630001	x	x	x	x	x		x
River Rouge	261630005	x	x	x				x
Detroit - SW HS	261630015	x	x	x	x	x		x
Detroit - E 7 Mile	261630019	x	x	x	x	x		x
Livonia Near Road 2	261630101	x	x	x				x
Detroit - Joy Rd	261630026	x	x	x				x
Dearborn	261630033	x	x	x	x	x		x
Eliza Howell	261630093	x	x	x				x
	Total	37	37	37	8	17	2	37

All Parameters at all sites use POC 1, expect River Rouge WS and WD which is POC 2

SPECIAL PURPOSE MONITORS

Near-roadway:

The USEPA has approved funding for the required near-road monitoring station in the Grand Rapids area. This site is required since Grand Rapids CBSA hit the one-million population threshold. EGLE has a location for this new site and plans to start monitoring in summer 2020.

In 2021, contingent upon funding, EGLE will monitor at the following near-roadway sites:

- Grand Rapids Near-road (260810023); CO, NO_x, $PM_{2.5}$ BAM and meteorological parameters
- Eliza Howell Near-road (261630093); CO, NO_x, $PM_{2.5}$ BAM and meteorological parameters
- Livonia Near-road 2 (261630101); CO, NO_x and meteorological parameters

GHIB Study:

In a joint Canadian-American venture, the Gordie Howe International Bridge will be built linking Windsor, Ontario and Detroit, Michigan. Demolition, construction, and vehicular traffic using the bridge all have the potential to cause an increase in the level of air pollution in nearby communities. In 2018, EGLE established three new air monitoring sites in SW Detroit and placed additional monitors in the existing Fort St. (SWHS) (261630015) site. The new sites are DP4th (261630098), Trinity (261630099), and Military Park (261630100). The three new sites are measuring NOx, SO_2, CO, continuous $PM_{2.5}$, black carbon, and five trace metals including lead. There is no CO monitor at the Military Park (26163100) site. NOx, continuous $PM_{2.5}$, and black carbon were added to the SWHS (261630015) site. The new sites and additional parameters at the SWHS site became operational in the summer and fall of 2018. In 2020-2021, EGLE will contingent on funding replace the existing BAMs at all four sites with newer continuous $PM_{2.5}$ Teledyne T640 instruments. **Table 32** identifies the instruments that were deployed for the project.

Table 32: Instruments and Sites Added for the Gordie Howe International Bridge Study

Site	Instrument	Sampling Frequency
SWHS (261630015)	MET	Hourly
	SO_2	Hourly
	NOx	Hourly
	TSP-Pb	24-hr every 6 day
	Continuous $PM_{2.5}$ T640	Hourly
	Black Carbon-Aethalometer	Hourly
DP4th (261630098)	SO_2	Hourly
	CO	Hourly
	NOx	Hourly
	TSP-Pb	24-hr every 6 day
	Continuous $PM_{2.5}$ T640	Hourly
	Black Carbon-Aethalometer	Hourly
Trinity (261630099)	MET	Hourly
	SO_2	Hourly
	CO	Hourly
	NOx	Hourly
	TSP-Pb	24-hr every 6 day
	Continuous $PM_{2.5}$ T640	Hourly
	Black Carbon-Aethalometer	Hourly
Military (261630100)	SO_2	Hourly
	NOx	Hourly
	TSP-Pb	24-hr every 6 day
	Continuous PM2.5 T640	Hourly
	Black Carbon-Aethalometer	Hourly

ADEQUACY OF MICHIGAN'S MONITORING SITES

The suitability of monitoring site locations is frequently assessed by the AMU's QA Team and the USEPA. The USEPA assesses the adequacy of the stations during $PM_{2.5}$ PEP audits, gaseous NPAP audits, and technical systems audits. The results indicate that the stations are properly sited, which includes distances away from obstructions, large trees, and set-backs from roadways. Suitability of probe heights and separation distances are assessed both by EGLE and USEPA auditors. If any issues are found during the audits, EGLE works with USEPA Region 5 to correct them during the audit follow-up process.

The Dearborn NATTS Site (261630033) had an issue with a tree dripline being too close to some of the monitors located on the sampler deck. The tree was located on private property, and therefore EGLE had no authority to remove the tree. EGLE was able to construct a new deck on the west side of the bunker, so that the tree drip line would no longer be an issue.

Table 33 summarizes the various monitoring waivers EGLE has requested.

Table 33: Summary of Waivers for Michigan's Monitoring Network

Type of Wavier	Explanation
Ozone Monitor	The Ann Arbor MSA is represented by a monitor in Oakland County.
Lead Co-location	There is not a large enough footprint at the Belding monitoring sites to co-locate a lead monitor. Therefore, EGLE requested to leave the lead co-location at Dearborn. Originally requested in 2010. A second co-located monitor is located in Port Huron.
Lead Monitoring	Request to waive lead monitoring at Consumer's JH Campbell plant. Modeling shows low impact. Originally requested in 2009 and resubmitted in 2014. Current emission data is below the required monitoring threshold.
Lead Monitoring	Request to waive lead monitoring at St. Mary's Cement plant. Modeling shows low impact. Originally requested in 2009 and resubmitted in 2014. Current emission data is below the required monitoring threshold.
Lead Monitoring	Request to waive lead monitoring at Consumer's Karn-Weadock plant. Modeling shows low impact. Originally requested in 2011 and resubmitted in 2016. Current emission data is below the required monitoring threshold.
PAMS Monitoring	The USEPA approved the request to locate the Detroit area PAMS station at the E 7 Mile site (261630019) in lieu of the NCore site in Allen Park (261630001).

Appendix A: Acronyms and Their Definitions

Acronym	Definition
>	Greater than
<	Less than
≥	Greater than or equal to
≤	Less than or equal to
%	Percent
$\mu g/m^3$	Micrograms per cubic meter
AERMOD	AMS/USEPA Regulatory Model
AMU	Air Monitoring Unit
AQD	Air Quality Division
AQS	Air Quality System (USEPA air monitoring data archive)
ARM	Approved regional method
BAM	Beta Attenuation Monitor (hourly $PM_{2.5}$ measurement monitor)
CAA	Clean Air Act
CASTNET	Clean Air Status and Trends Network
CBSA	Core-Based Statistical Area
CFR	Code of Federal Regulations
CO	Carbon monoxide
CSA	Consolidated Statistical Area
DNPH	2,4-dinitrophenyl hydrazine – this is the derivatizing agent on cartridges used to collect carbonyl samples
DPW	Department of Public Works
EC	Elemental carbon
EGLE	Environment Great Lakes and Energy
USEPA	United States Environmental Protection Agency
FDMS	Filter Dynamic Measurement System
FEM	Federal Equivalent Method
FIA	Family Independence Agency
FRM	Federal Reference Method
GC	Gas chromatograph (instrument providing VOC measurements)
GFIs	Ground fault circuit interrupters
GHIB	Gordie Howe International Bridge
hr	Hour
IN-MI	Indiana-Michigan
LADCO	Lake Michigan Air Directors Consortium
EGLE	Michigan Department of Environment, Great Lakes, and Energy
MITAMP	Michigan Toxics Air Monitoring Program
MSA	Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standard

Acronym	Definition
NAMS	National Air Monitoring Station
NATTS	National Air Toxics Trend Sites
NCore	National Core Monitoring Sites
NEI	National Emission Inventory
NO_2	Nitrogen dioxide
NO_X	Oxides of Nitrogen
NO_Y	Oxides of nitrogen + nitric acid + organic and inorganic nitrates
NPAP	National Performance Audit Program
NSR	New Source Review
OAQPS	Office of Air Quality and Planning and Standards (USEPA)
OC	Organic carbon
OTAQ	Office of Transportation and Air Quality (USEPA)
PAH	Polynuclear Aromatic Hydrocarbon
PAMS	Photochemical Assessment Monitoring Station
PEP	Performance Evaluation Program
PM	Particulate matter
PMc	Particulate Matter coarse
$PM_{2.5}$	Particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10}	Particulate matter with a diameter of 10 microns or less
$PM_{10-2.5}$	Coarse PM equal to the concentration difference between PM_{10} and $PM_{2.5}$
ppb	parts per billion
ppm	parts per million = mg/kg, mg/L, µg/g (1 ppm = 1,000 ppb)
PQAO	Primary Quality Assurance Organization
PWEI	Population Weighted Emissions Index
QA	Quality assurance
QAPP	Quality Assurance Project Plan
RTI	Research Triangle Institute (national contract laboratory for speciated $PM_{2.5}$)
SASS	Source Assessment Sampling System
SLAMS	State and Local Air Monitoring Station
SO_2	Sulfur dioxide
STAG	State Air Grant (federal)
STN	Speciation Trend Network ($PM_{2.5}$)
TEOM	Tapered element oscillating microbalance (hourly $PM_{2.5}$ measurement monitor)
tpy	ton per year
TRI	Toxic Release Inventory
TSA	Technical Systems Audits
TSP	Total Suspended Particulate
TTP	Through the probe audit
U of M	University of Michigan
U.S.	United States

Acronym	Definition
VOC	Volatile organic compounds

Appendix B: Summary of Comments Received and Replies

As part of the network review process, the USEPA requires that EGLE solicit public comments. EGLE made the draft 2021 Network Review available for public comment by posting the document on its Air Quality Division web page. To ensure that the public was aware the document was open for comment, the 30-day public comment period was announced through the Air Quality Listserv and via a press release mid-May 2020.

EGLE received comments to the network review.