Mobile Air Quality Mapping in the District

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MWAQC-TAC

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DEPARTMENT OF ENERGY & ENVIRONMENT

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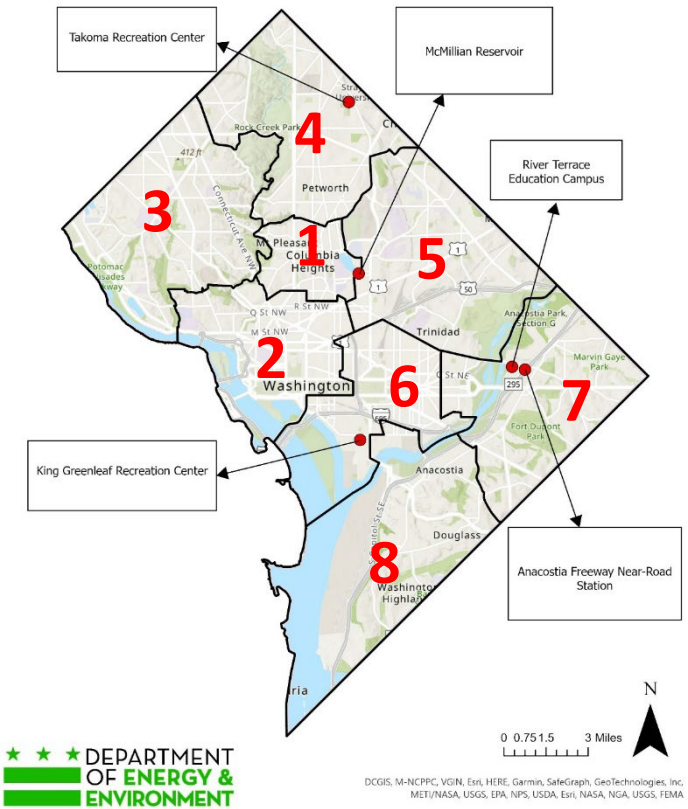
Washington DC's Ambient Air Monitoring Network



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DCGIS, M-NCPPC, VGIN, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS, FEMA

Site Location	Address	Location Setting*
Takoma Rec Center	301 Van Buren St NW	
McMillan Reservoir	2500 First St NW	
River Terrace Education Campus	405 Anacostia Ave NE	Historically overburdened community
Anacostia Freeway Near-Road Station	Benning Rd NE @ I-295 On-ramp	Historically overburdened community
King Greenleaf Rec Center	201 N St SW	Historically overburdened community
Ward 8 Site	TBD	Historically overburdened community

*All stations considered urban

What is DOEE doing to Assess Air Quality in Overburdened Communities?

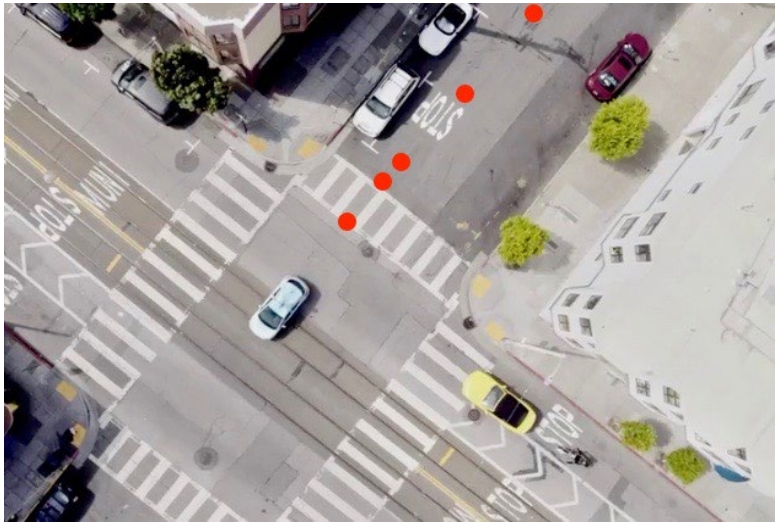
- Reorienting and expanding the regulatory network
  - Currently 3 (of 5) stations in overburdened communities
  - Another station in Ward 8 this fiscal year
- Community-scale hyper-local air monitoring to identify hot-spots
  - Mobile platform monitoring- Aclima Pilot Study
  - Emerging technology low-cost sensors
  - 3 park bench emerging technology air monitoring stations
- Community Involvement
  - Stakeholder engagement on Ward 8 location
  - Shared governance for 3 park-bench monitor
  - Training “Air Ambassadors” to understand local air quality issues
  - Examining Air Ambassadors as an avenue for low-cost-sensor network hosting

Introduction to Aclima Mobile Monitoring

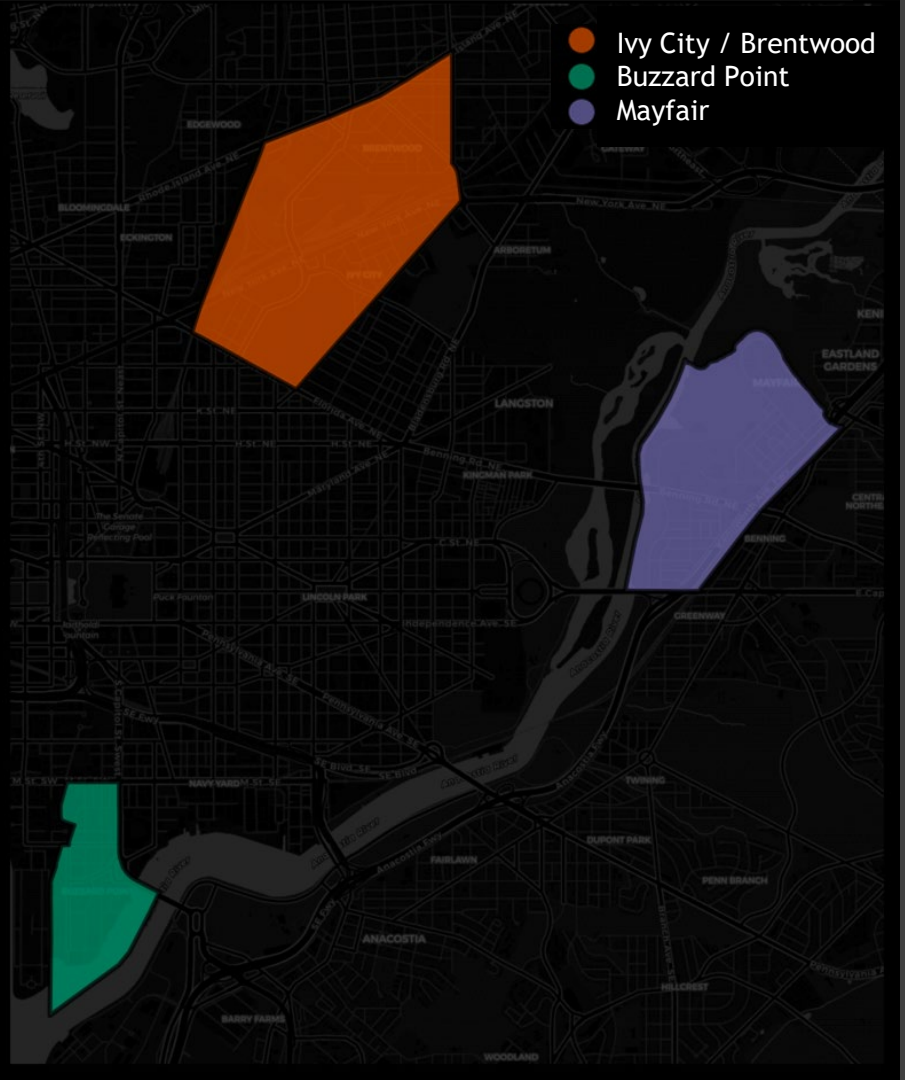
Aclima uses mobile mapping and analysis to generate maps that show typical pollution concentrations with high spatial resolution (**hyperlocal maps)**

These maps highlight typical concentrations over a defined measurement period, in this case two weeks for the DC Pilot, illustrating high and low pollution concentrations at the street level.

All 1-second measurements are assigned to a ~100m **road segment** based on the location (latitude and longitude) of the data point.



1 second data points as red dots aligned to the route of the car.



PILOT OVERVIEW

In June 2023, Aclima conducted two weeks of hyperlocal mobile air quality measurement across 3 neighborhoods specified by DC-DOEE:

Mayfair, Ivy City/Brentwood, and Buzzard Point (5 census tracts total).

Measurement included:
Carbon dioxide, fine particulate matter, nitrogen dioxide, carbon monoxide, ozone, black carbon, methane, and TVOCs.

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EPA's National Ambient Air Quality Standards (NAAQS)

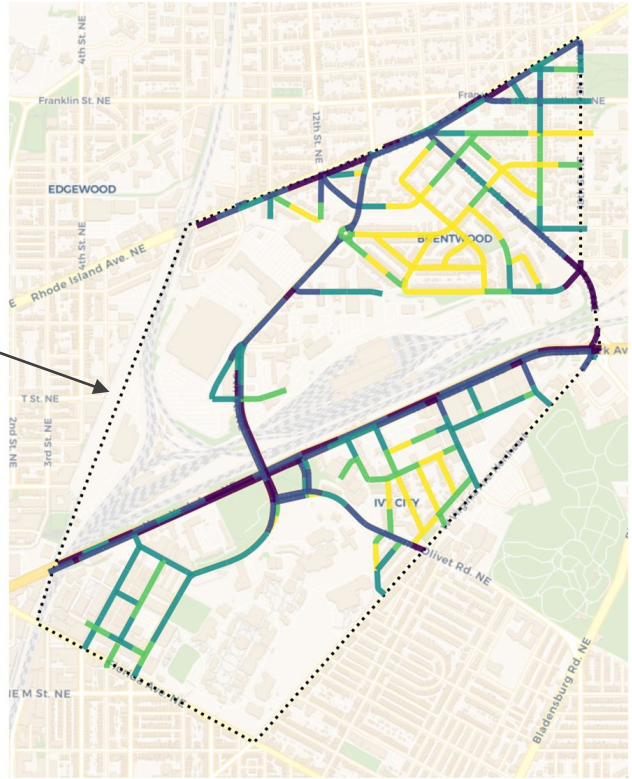
Criteria Air Pollutants (in **bold** are pollutants measured by Aclima)

- ☑ **Ozone (O_3)** – 70 ppb (8 hour)
- ☑ **Nitrogen dioxide (NO_2)** – 100 ppb (1 hour); 53 ppb (annual average)
- ☑ **Fine particulate matter ($PM_{2.5}$)** – 35 $\mu g/m^3$ (24 hour); 12 ug/m3 (annual average)*
- ☑ Coarse particulate matter (PM_{10}) – 150 $\mu g/m^3$ (24 hour)
- ☑ **Carbon monoxide (CO)** – 35 ppm (1 hour), 9 ppm (8 hour)
- ☑ Sulfur dioxide (SO_2) – 75 ppb (1 hour)
- ☑ Lead (Pb) – 0.15 $\mu g/m3$ (3 month average)

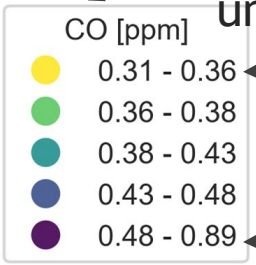
**Currently under review by EPA to strengthen NAAQS*

How to interpret the following maps:

Measurements collected June 15 – 28, 2023



Measurement area bounds



Pollutant and units

Bottom 20th percentile

Top 20th percentile

Median concentration color scale grouped by 20th percentile intervals

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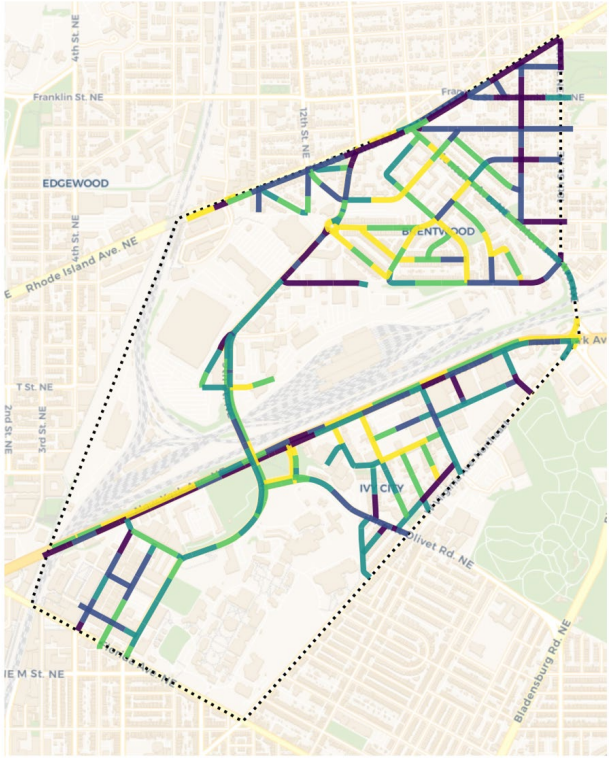
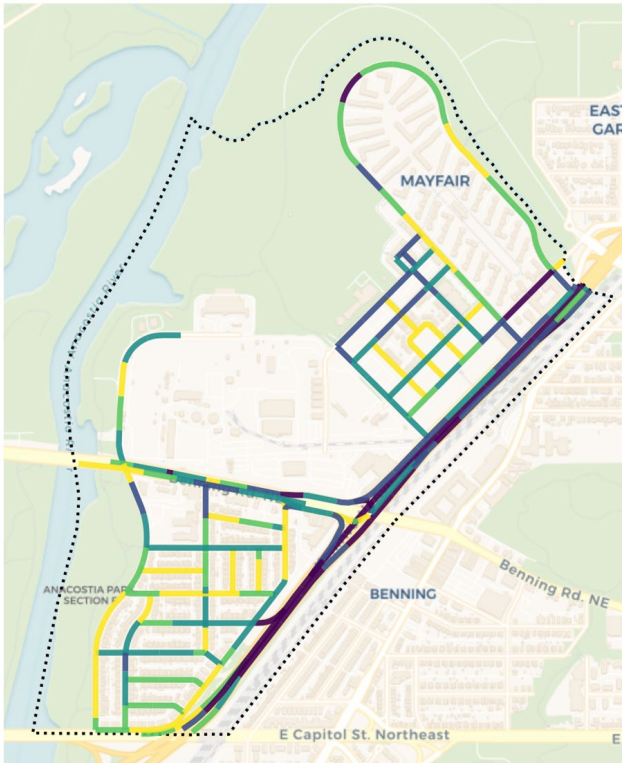
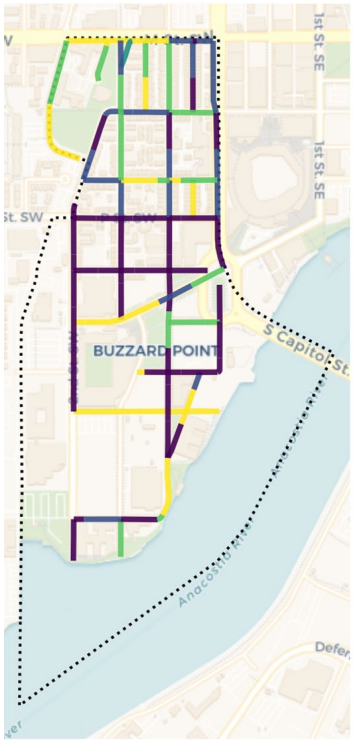
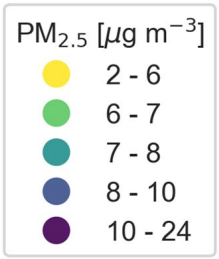
$PM_{2.5}$ (Fine particulate matter)

Standard: 35 $\mu g/m^3$ (24 hr); 12 $\mu g/m^3$ (annual)









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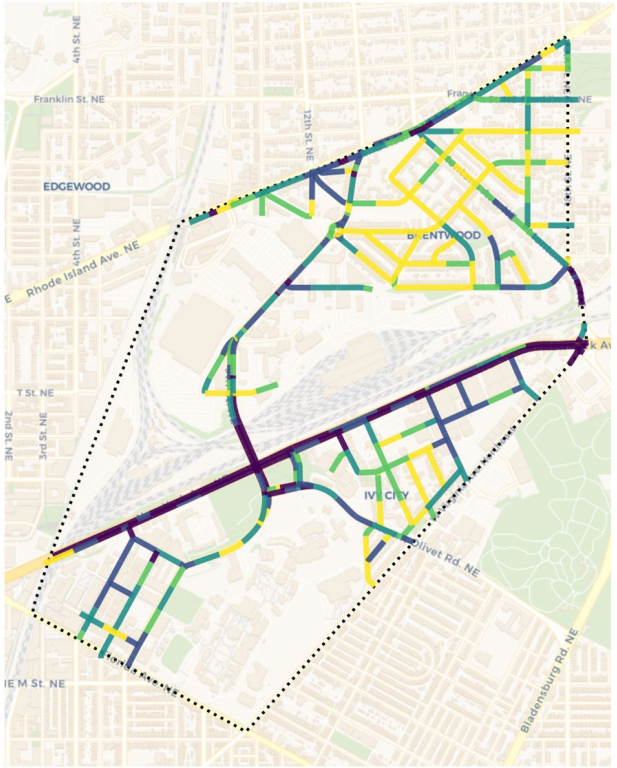
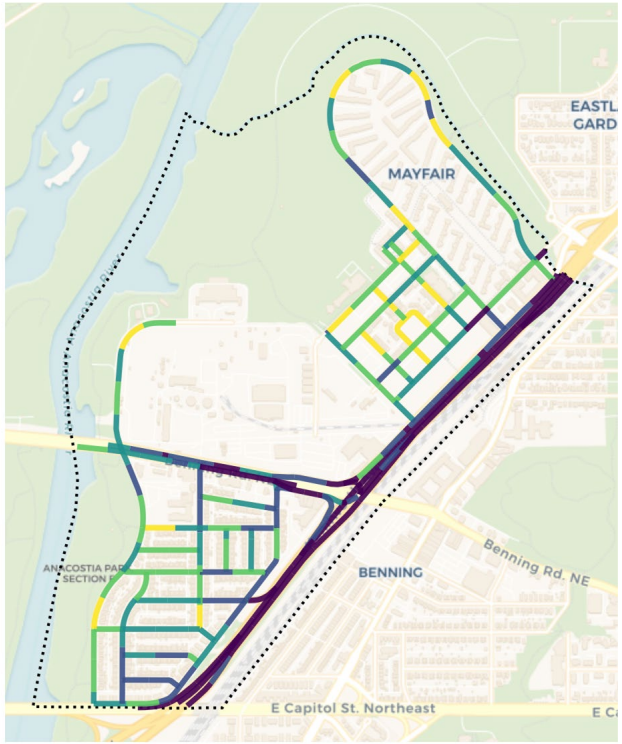
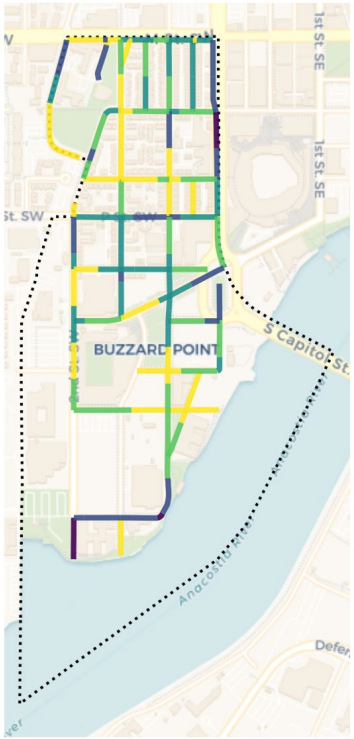
Black Carbon (BC)







BC [$\mu g\ m^{-3}$]
- -0.09 - 0.79
- 0.79 - 0.9
- 0.9 - 1.04
- 1.04 - 1.3
- 1.3 - 4.5

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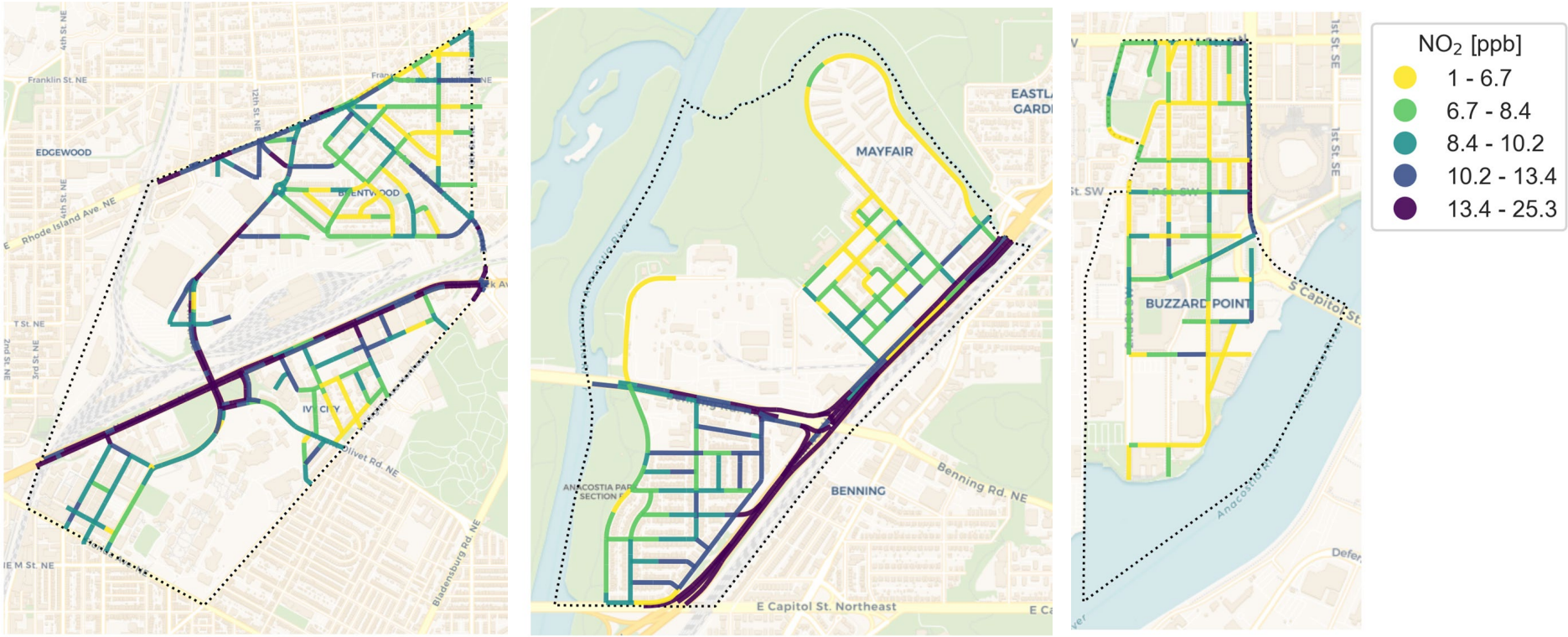
Nitrogen Dioxide (NO_2)

Standard: 100 ppb (1 hr); 53 ppb (annual)



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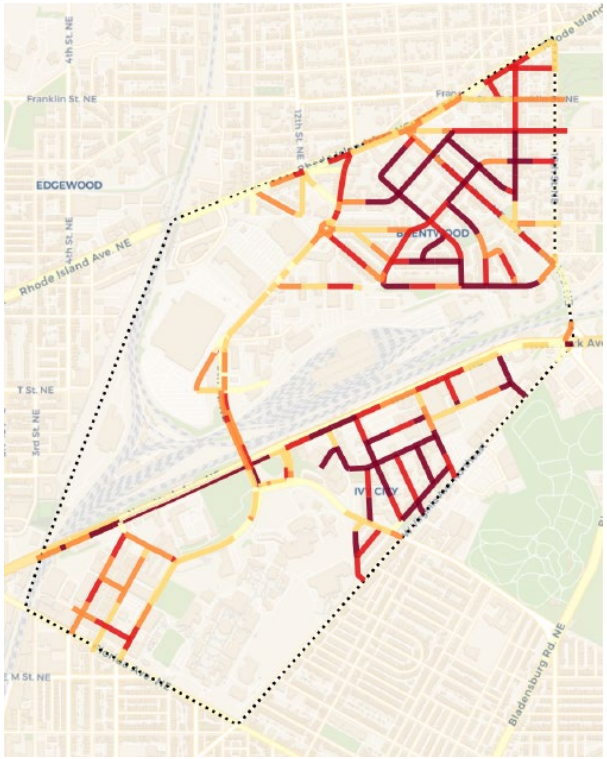
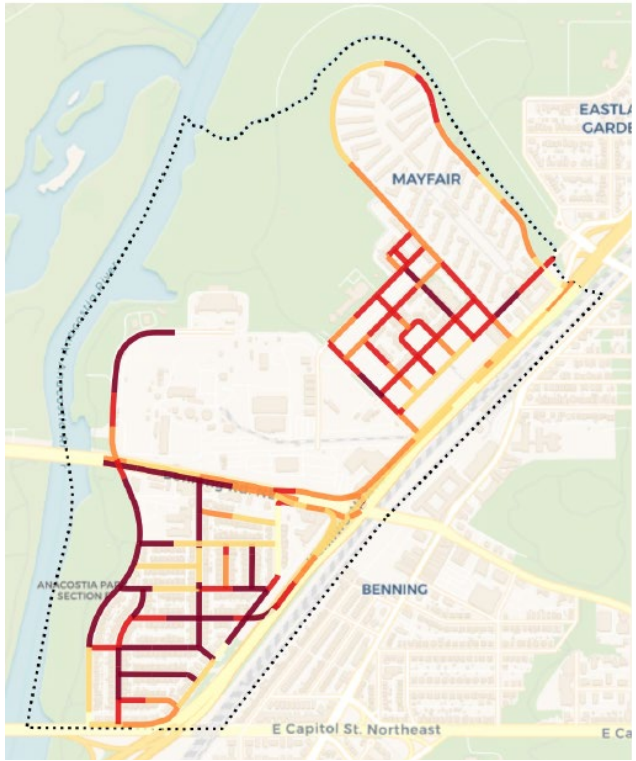
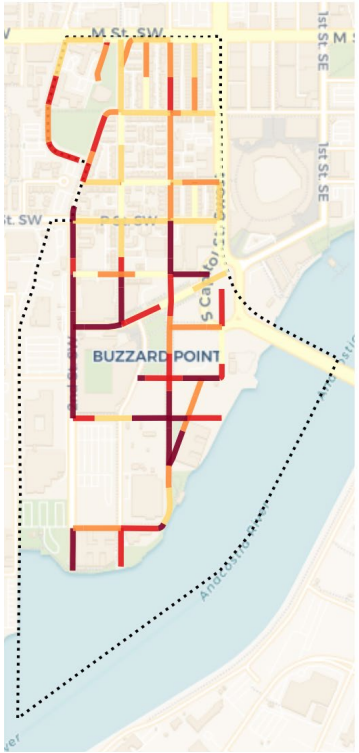
Ozone

Standard: 70 ppb







O_3 [ppb]
- 13 - 29
- 29 - 32
- 32 - 33
- 33 - 35
- 35 - 47

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Comparision Statistics

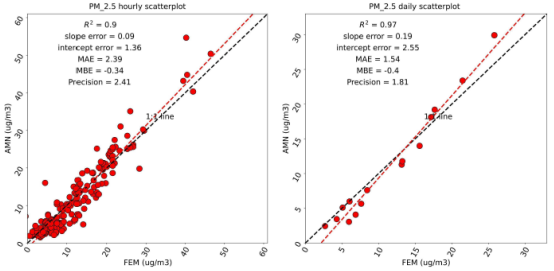


Figure A1: Comparison of hourly (left) and daily (right) mean Aclima mobile sensor measurements within a 250 m radius circle centered at all available stationary regulatory sites to the corresponding collocated data at those regulatory sites for $PM_{2.5}$ [µg/m3], including comparison metrics (including R2, slope error, intercept error, MAE, MBE, and precision) that represent Aclima AMN 1-hr or 24-hr device-level performance.

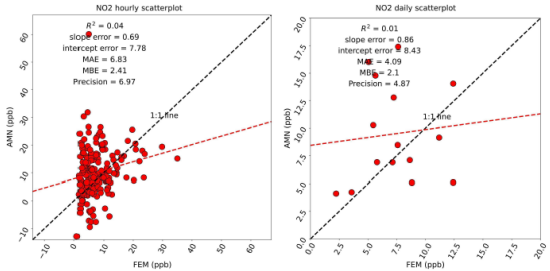


Figure A2: Comparison of hourly (left) and daily (right) mean Aclima mobile sensor measurements within a 250 m radius circle centered at all available stationary regulatory sites to the corresponding collocated data at those regulatory sites for NO_2 [ppb], including comparison metrics (including R2, slope error, intercept error, MAE, MBE, and precision) that represent Aclima AMN 1-hr or 24-hr device-level performance.

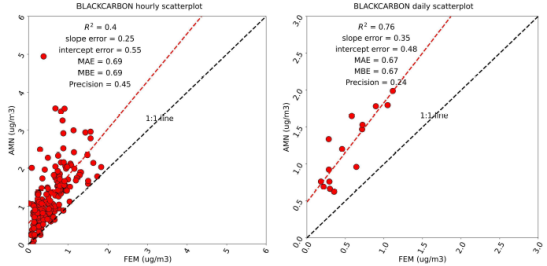


Figure A5: Comparison of hourly (left) and daily (right) mean Aclima mobile sensor measurements within a 250 m radius circle centered at all available stationary regulatory sites to the corresponding collocated data at those regulatory sites for Black Carbon [µg/m3], including comparison metrics (including R2, slope error, intercept error, MAE, MBE, and precision) that represent Aclima AMN 1-hr or 24-hr device-level performance.

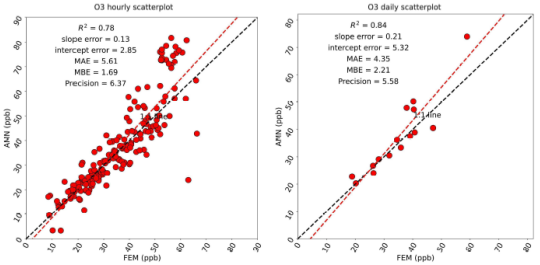
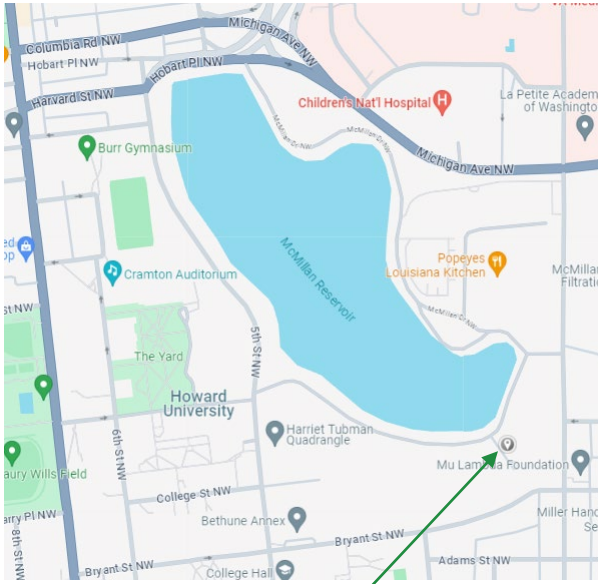


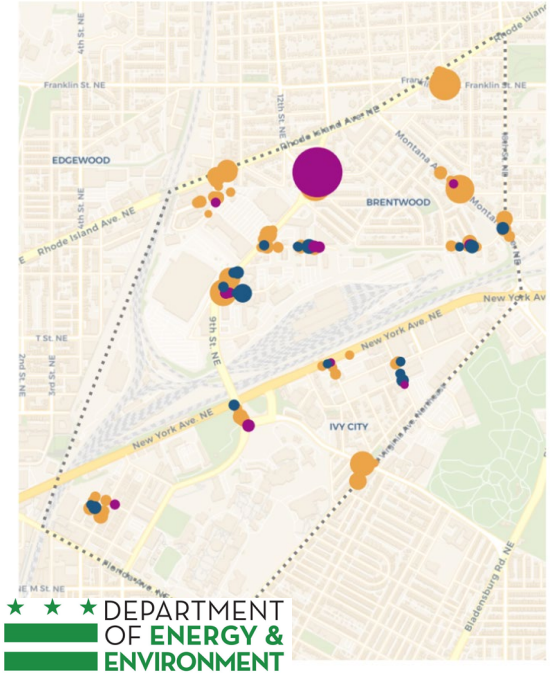
Figure A3: Comparison of hourly (left) and daily (right) mean Aclima mobile sensor measurements within a 250 m radius circle centered at all available stationary regulatory sites to the corresponding collocated data at those regulatory sites for O_3 [ppb], including comparison metrics (including R2, slope error, intercept error, MAE, MBE, and precision) that represent Aclima AMN 1-hr or 24-hr device-level performance.

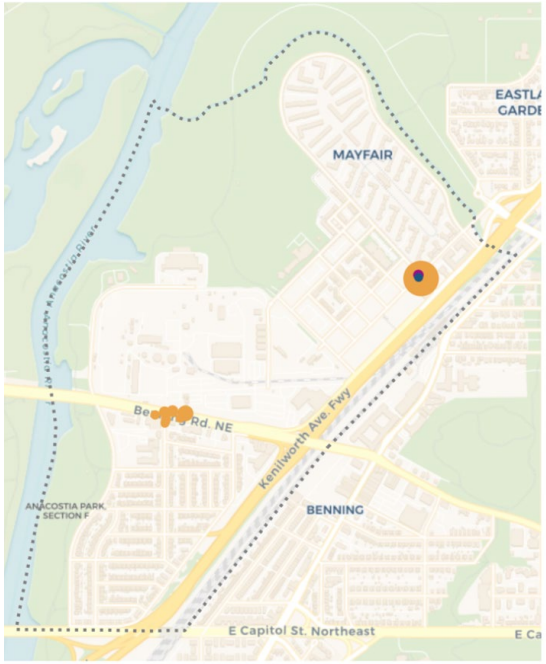


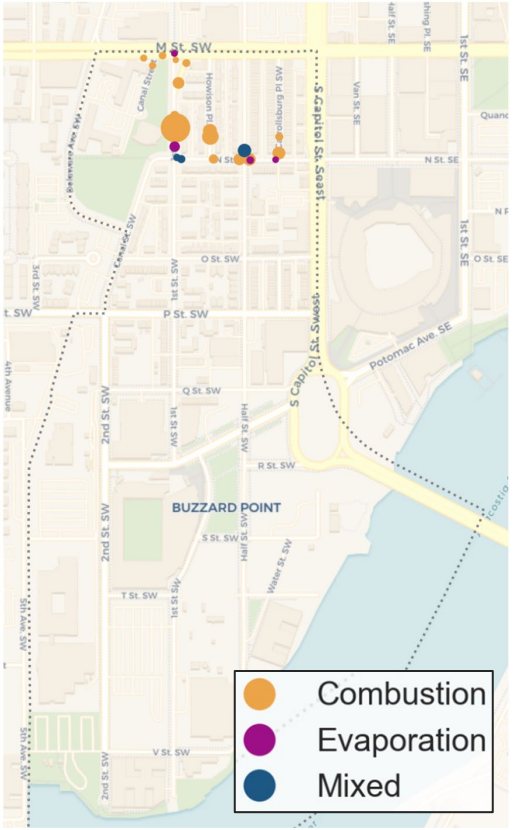
Total Volatile Organic Compounds (TVOC) measurements

Combustion-related (orange), off-gassing-related (purple), and a combination of the two (blue) TVOC enhancements

Size of the circle increases with concentration







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Questions

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