City of Hamilton
TRUCK ROUTE SUB-COMMITTEE
AGENDA

Meeting #:	25-001
Date:	January 10, 2025
Time:	11:00 a.m.
Location:	Room 264, 2nd Floor, City Hall (hybrid) (RM) 71 Main Street West

Matt Gauthier, Legislative Coordinator (905) 546-2424 ext. 6437

Pages

1. CALL TO ORDER

2. CEREMONIAL ACTIVITIES

3. APPROVAL OF THE AGENDA

   (Added Items, if applicable, will be noted with *)

4. DECLARATIONS OF INTEREST

5. APPROVAL OF MINUTES OF PREVIOUS MEETING

   5.1 September 13, 2022 — 3

6. DELEGATIONS

7. ITEMS FOR INFORMATION

   7.1 PED19073(e) — 9

   Truck Route Monitoring and Evaluation Framework (City Wide)
   (Outstanding Business List)

   This item will be preceded by a staff presentation.

8. ITEMS FOR CONSIDERATION

   8.1 Amendments to the Outstanding Business List

a. Items Considered Complete and Needing to be Removed:

a. Truck Route Network Monitoring and Evaluation Framework (PED19073(d)) (City Wide)

Added: September 13, 2022 - Truck Route Sub-Committee - Item (g)(i)
Addressed as Item 8.1 on today's agenda

b. Goods Movement Strategy (PED24049)

Added: May 15, 2024 – General Issues Committee - Item 1(c)
Addressed as Item 8.1 on today's agenda

9. MOTIONS

10. NOTICE OF MOTIONS

11. PRIVATE AND CONFIDENTIAL

12. ADJOURNMENT

Members of the public can contact the Clerk's Office to acquire the documents considered at this meeting, in an alternate format.

TRUCK ROUTE SUB-COMMITTEE
MINUTES 22-002

1:30 p.m.
September 13, 2022
Council Chambers
Hamilton City Hall

Present:	Councillors J. Farr (Chair), N. Nann (Vice-Chair), T. Jackson, B. Johnson, M. Pearson, and M. Wilson
Absent:	Councillor S. Merulla - Personal

THE FOLLOWING ITEMS WERE REFERRED TO THE PUBLIC WORKS COMMITTEE FOR CONSIDERATION:

1. Truck Route Network Monitoring and Evaluation Framework (PED19073(d)) (City Wide) (Outstanding Business List Item) (Item 8.1)

(Nann/Johnson)

(a) That the framework and associated criteria for the evaluation of approved truck route network described in this Report PED19073(d) be received and approved;

(b) That staff be directed to operationalize the truck route network evaluation framework including all required data collection, public and stakeholder engagement and analysis commencing in early 2023 and through 2023/2024 and report back to the Truck Route Sub-Committee by no later than Q4 2024;

(c) That the estimated upset limit cost of $20,000 associated with implementing and promoting a public opinion survey be funded from Project ID 4032155744 Transportation Master Plan (TMP) Modelling and Monitoring;

(d) That the estimated upset limit cost of $30,000 to conduct targeted data collection including truck volume and routing surveys, be funded from Project ID 4662115820 Traffic Count Program;

(e) That Outstanding Business List Item ACP, respecting Public Works Report 22-005, Item 5 (PED19073(c)), staff to develop a framework and associated criteria that can be used to evaluate changes to the approved Truck Route Network in order to inform future revisions to the truck route network and that the criteria be presented to the Truck Route Sub-Committee by Q3, 2022 with the results of the evaluation being completed

no later than 2024, be identified as completed and removed from the Public Works Committee Outstanding Business List.

Result: Motion CARRIED by a vote of 6 to 0, as follows:

YES - Ward 1 Councillor Maureen Wilson
YES - Ward 3 Councillor Nrinder Nann
NOT PRESENT - Ward 4 Councillor Sam Merulla
YES - Ward 6 Councillor Tom Jackson
YES - Chair - Ward 2 Councillor Jason Farr
YES - Ward 11 Councillor Brenda Johnson
YES - Ward 10 Councillor Maria Pearson

FOR INFORMATION:

(a) CHANGES TO THE AGENDA (Item 2)

The Committee Clerk advised of the following changes to the agenda:

6. DELEGATION REQUESTS (Item 6)

6.1 Sean Burak, respecting the TRMP implementation schedule (For today's meeting)

(Johnson/Wilson)
That the agenda for the September 13, 2022 Truck Route Sub-Committee meeting be approved, as amended.

Result: Motion CARRIED by a vote of 6 to 0, as follows:

YES - Ward 1 Councillor Maureen Wilson
YES - Ward 3 Councillor Nrinder Nann
NOT PRESENT - Ward 4 Councillor Sam Merulla
YES - Ward 6 Councillor Tom Jackson
YES - Chair - Ward 2 Councillor Jason Farr
YES - Ward 11 Councillor Brenda Johnson
YES - Ward 10 Councillor Maria Pearson

(b) DECLARATIONS OF INTEREST (Item 3)

There were no declarations of interest.

(c) APPROVAL OF MINUTES OF PREVIOUS MEETING (Item 4)

(i) March 28, 2022 (Item 4.1)

(Pearson/Wilson)
That the Minutes of the March 28, 2022 meeting of the Truck Route Sub-Committee be approved, as presented.

Result: Motion CARRIED by a vote of 6 to 0, as follows:

YES - Ward 1 Councillor Maureen Wilson
YES - Ward 3 Councillor Nrinder Nann
NOT PRESENT - Ward 4 Councillor Sam Merulla
YES - Ward 6 Councillor Tom Jackson
YES - Chair - Ward 2 Councillor Jason Farr
YES - Ward 11 Councillor Brenda Johnson
YES - Ward 10 Councillor Maria Pearson

(d) DELEGATION REQUESTS (Item 6)

(i) Sean Burak, respecting the TRMP implementation schedule (For today's meeting) (Added Item 6.1)

(Wilson/Jackson)
That the delegation request from Sean Burak, respecting the TRMP implementation schedule, be approved for today's meeting.

Result: Motion CARRIED by a vote of 6 to 0, as follows:

YES - Ward 1 Councillor Maureen Wilson
YES - Ward 3 Councillor Nrinder Nann
NOT PRESENT - Ward 4 Councillor Sam Merulla
YES - Ward 6 Councillor Tom Jackson
YES - Chair - Ward 2 Councillor Jason Farr
YES - Ward 11 Councillor Brenda Johnson
YES - Ward 10 Councillor Maria Pearson

(e) STAFF PRESENTATIONS (Item 8)

(i) Truck Route Network Monitoring and Evaluation Framework (PED19073(d)) (City Wide) (Outstanding Business List Item) (Item 8.1)

Steve Molloy, Manager of Transportation Planning, and Omar Shams, Project Manager, Transportation Planning - New Initiatives, addressed the Committee with a presentation respecting Report PED19073(d), Truck Route Network Monitoring and Evaluation Framework.

(Pearson/Jackson)
That the staff presentation respecting Report PED19073(d), Truck Route Network Monitoring and Evaluation Framework, be received.

Result: Motion CARRIED by a vote of 6 to 0, as follows:

YES - Ward 1 Councillor Maureen Wilson
YES - Ward 3 Councillor Nrinder Nann
NOT PRESENT - Ward 4 Councillor Sam Merulla
YES - Ward 6 Councillor Tom Jackson
YES - Chair - Ward 2 Councillor Jason Farr
YES - Ward 11 Councillor Brenda Johnson
YES - Ward 10 Councillor Maria Pearson

(Nann/Wilson)
That consideration of PED19073(d), Truck Route Network Monitoring and Evaluation Framework, be DEFERRED until after the delegates for this matter have been heard.

Result: Motion CARRIED by a vote of 6 to 0, as follows:

YES - Ward 1 Councillor Maureen Wilson
YES - Ward 3 Councillor Nrinder Nann
NOT PRESENT - Ward 4 Councillor Sam Merulla
YES - Ward 6 Councillor Tom Jackson
YES - Chair - Ward 2 Councillor Jason Farr
YES - Ward 11 Councillor Brenda Johnson
YES - Ward 10 Councillor Maria Pearson

For further disposition of this matter, refer to Item 1.

(f) PUBLIC HEARINGS / DELEGATIONS (Item 9)

(i) Sean Burak, respecting the TRMP implementation schedule (Added Item 9.1)

Sean Burak addressed the Committee respecting TRMP implementation schedule.

(Pearson/Jackson)
That the delegation from Sean Burak, respecting the TRMP implementation schedule, be received.

Result: Motion CARRIED by a vote of 6 to 0, as follows:

YES - Ward 1 Councillor Maureen Wilson
YES - Ward 3 Councillor Nrinder Nann
NOT PRESENT - Ward 4 Councillor Sam Merulla
YES - Ward 6 Councillor Tom Jackson
YES - Chair - Ward 2 Councillor Jason Farr
YES - Ward 11 Councillor Brenda Johnson
YES - Ward 10 Councillor Maria Pearson

For disposition of this matter, refer to Items 1 and (g)(i).

(g) STAFF PRESENTATIONS (Item 8) (Continued)

(i) Truck Route Network Monitoring and Evaluation Framework (PED19073(d)) (City Wide) (Outstanding Business List Item) (Item 8.1)

(Wilson/Nann)
That staff be directed to research options for engagement and enforcement for staff and citizens to identify real-time truck route violations

in consultation with Hamilton Police Service, Municipal Law Enforcement, and the City's Chief Digital Officer & Director of Innovation, and report back to the Truck Route Sub-Committee.
Result: Motion CARRIED by a vote of 6 to 0, as follows:

YES - Ward 1 Councillor Maureen Wilson
YES - Ward 3 Councillor Nrinder Nann
NOT PRESENT - Ward 4 Councillor Sam Merulla
YES - Ward 6 Councillor Tom Jackson
YES - Chair - Ward 2 Councillor Jason Farr
YES - Ward 11 Councillor Brenda Johnson
YES - Ward 10 Councillor Maria Pearson

(Johnson/Pearson)
That staff be directed to prepare an amendment to the City of Hamilton Traffic By-law 01-215 to identify sewage and water vehicles as "Authorized Emergency Vehicles" for an exemption from Section 56(2) of By-law 01-215, allowing these vehicles to travel on non-designated truck routes, within rural areas only.

Result: Motion CARRIED by a vote of 6 to 0, as follows:

YES - Ward 1 Councillor Maureen Wilson
YES - Ward 3 Councillor Nrinder Nann
NOT PRESENT - Ward 4 Councillor Sam Merulla
YES - Ward 6 Councillor Tom Jackson
YES - Chair - Ward 2 Councillor Jason Farr
YES - Ward 11 Councillor Brenda Johnson
YES - Ward 10 Councillor Maria Pearson

For disposition of this matter, refer to Item 1.

(h) ADJOURNMENT (Item 15)

(Nann/Pearson)
That, there being no further business, the Truck Route Sub-Committee, be adjourned at 3:02 p.m.

Result: Motion CARRIED by a vote of 6 to 0, as follows:

YES - Ward 1 Councillor Maureen Wilson
YES - Ward 3 Councillor Nrinder Nann
NOT PRESENT - Ward 4 Councillor Sam Merulla
YES - Ward 6 Councillor Tom Jackson
YES - Chair - Ward 2 Councillor Jason Farr
YES - Ward 11 Councillor Brenda Johnson
YES - Ward 10 Councillor Maria Pearson

Respectfully submitted,

Councillor Farr, Chair
Truck Route Sub-Committee

Angela McRae
Legislative Coordinator
Office of the City Clerk

Truck Route Network Monitoring & Evaluation Framework

Truck Route Sub-Committee
January 10, 2025

Hamilton

Planning and Economic Development Department
Transportation Planning and Parking

Truck Route Sub-Committee Recommendations, September 13, 2022

Truck Route Master Plan Update (PED19073(d)) (City Wide)

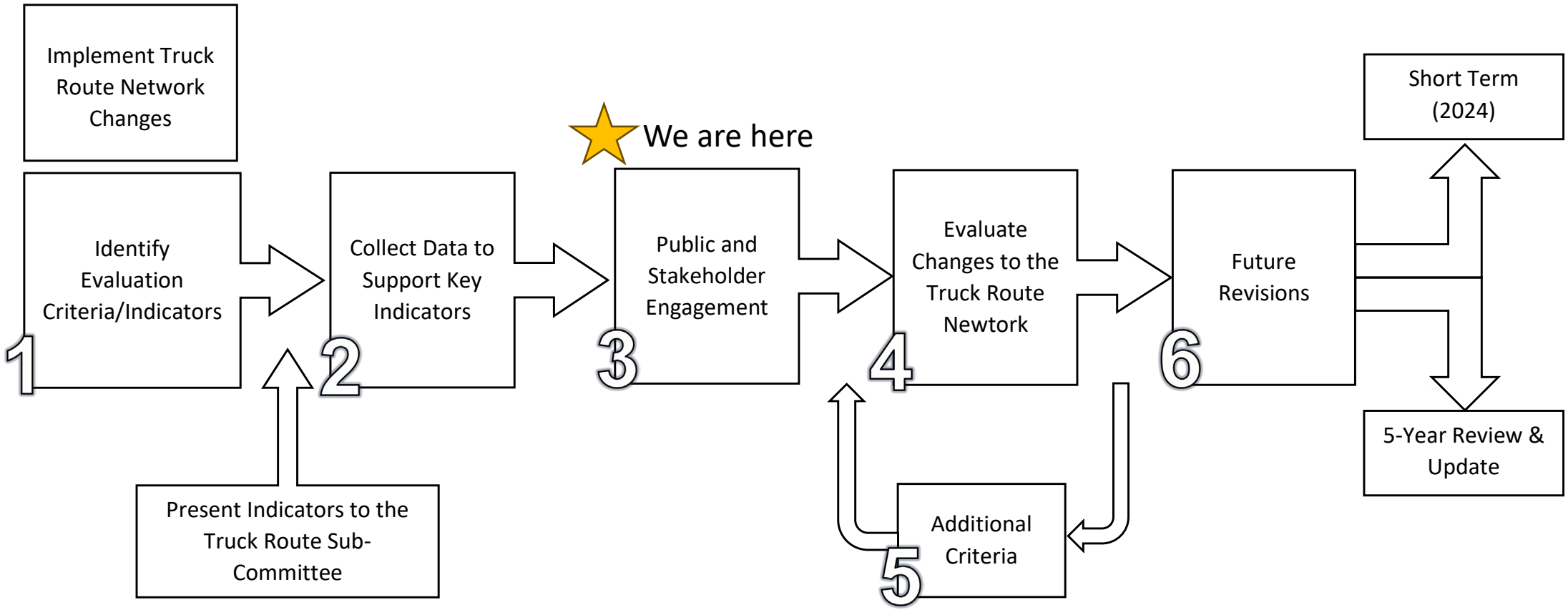
That staff be directed to operationalize the truck route network evaluation framework including all required data collection, public and stakeholder engagement and analysis commencing in early 2023 and through 2023/2024 and report back to the Truck Route Sub-Committee by no later than Q4 2024.

General Issues Committee Recommendations, May 15, 2024

Goods Movement Strategy (PED24049) (City Wide)

(c) That staff be directed, as part of the in-progress Truck Route Network Monitoring and Evaluation actioned by Report PED19073, to report back to the Truck Route Sub-Committee on potential updates and/or modifications to the 32 Actions identified in the Goods Movement Strategy in order to explicitly address concerns and opportunities related to term of council priorities, including equity, public health, roadway safety, impacts of continued road expansion; and urgency around the City's declared climate crisis.

Truck Route Network Monitoring and Evaluation Framework



Monitoring and Evaluation Framework

Community Liveability – Truck Volume Data

Location	Truck Type	Percentage Change**
Wellington Street***	Five axels or more* Four axels or less	- 86.0% - 44.2%
Victoria Avenue***	Five axels or more* Four axels or less	- 47.8% - 14.9%
Upper James Street	Five axels or more* Four axels or less	+ 4.0% - 2.1%
Centennial Parkway	Five axels or more* Four axels or less	- 15.4% - 17.4%
Rymal Road***	Five axels or more* Four axels or less	+ 17.3% + 13.0%
Lincoln Alexander Parkway	Five axels or more* Four axels or less	+ 68.6% + 16.6%
Red Hill Valley Parkway	Five axels or more* Four axels or less	+ 87.5% - 31.7%

* Includes articulated Hamilton Street Railway buses.
** Calculated based on truck volume not percent of total volume.
*** Count location is different but is representative of the expected volume change due to network modifications.

Community Liveability – Collision and Enforcement Data

Collisions

- Between 2019-2022 there was a total 148 collisions involving trucks, including three (3) with pedestrians and cyclists.
- No fatalities occurred during this period.
- Post-implementation collision data is not available until 2025.

Enforcement

- Approximately 300 charges relating to the Truck Route By-law (as of end of October).
- Approximately 597 Commercial Motor Vehicles, taken 179 (or 30 percent) out-of-service.
- Issued approximately 2,073 charges in relation to Commercial Motor Vehicles.

Public and Environmental Health – Air Quality

- There was an increase in the ambient Sulfur Dioxide levels recorded in Phase 2 when compared to Phase 1 across the entire route.

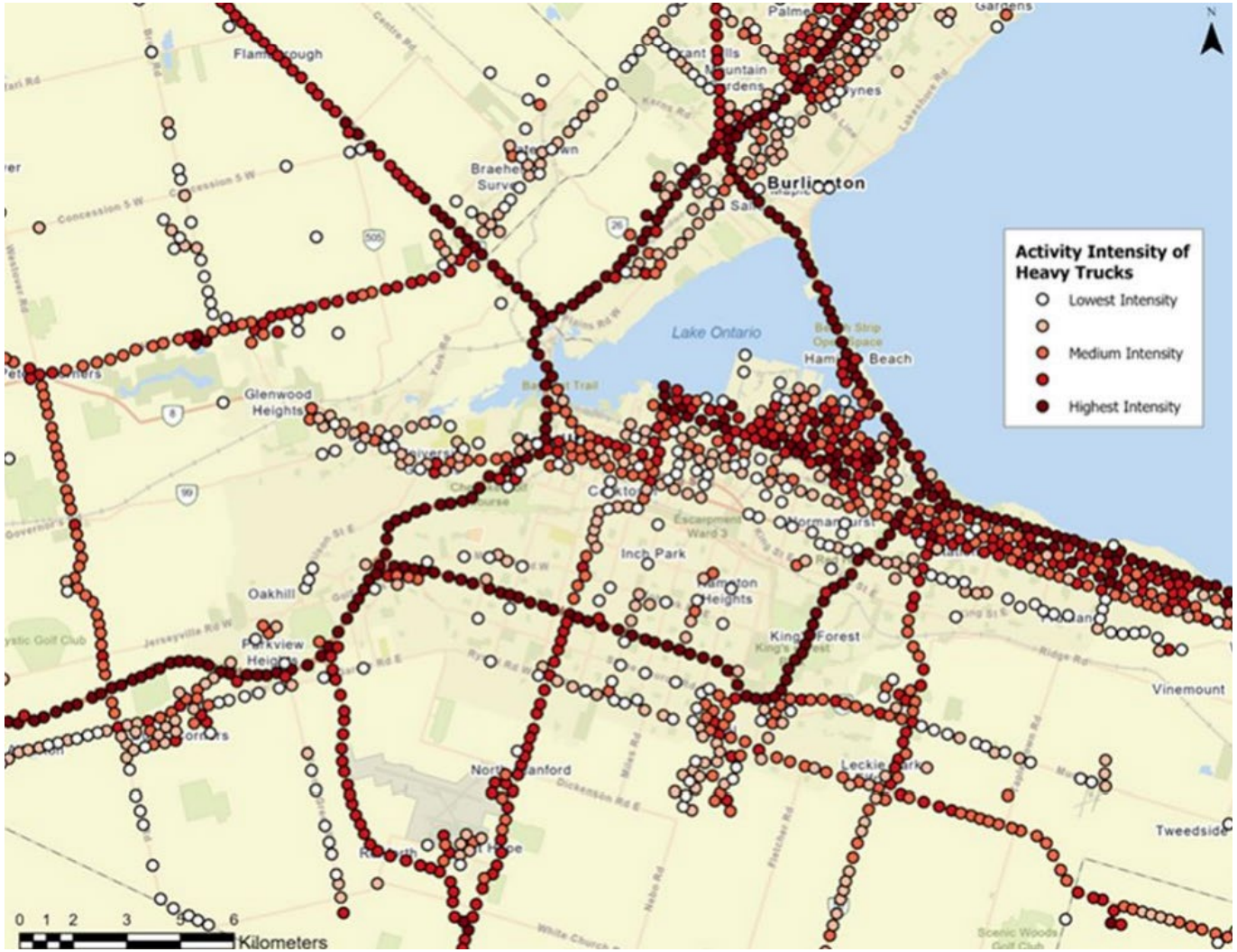
- Nitrogen Dioxide, Carbon Monoxide, Ozone, and Particulate Matter had relatively similar hourly average levels in both Phase 1 and Phase 2. There is a spatial shift in locations with higher concentration levels of Carbon Monoxide and Ozone towards the Red Hill Valley and Lincoln Alexander Parkways in Phase 2.

Public and Environmental Health – Noise Data

Location	Percent Change between January 2023 / January 2024
King Street	+7.8%
Main Street	+7.7%
Victoria Avenue	+9.7%
Centennial Parkway South	+11.1%
Upper James (Twenty Road)	+10.0%
Nikola Tesla Parkway/Burlington Street (Woodward Overpass)	+22.7%
Garner Road (Miller Drive)	+35.2%
Rymal Road East (Upper Ottawa)	+11.7%
Rymal Road East (Trinity Church Road)	+11.5%
Lincoln Alexander Parkway (Limeridge-Upper Gage)	+7.9%
Lincoln Alexander Parkway (Cranbrook-Upper Paradise)	+8.1%
Red Hill Valley Parkway (Barton Overpass)	+4.5%
Red Hill Valley Parkway (Hixon Road)	+7.7%
Red Hill Valley Parkway (Pritchard Road)	+9.2%

Economic Prosperity – Goods Movement Data

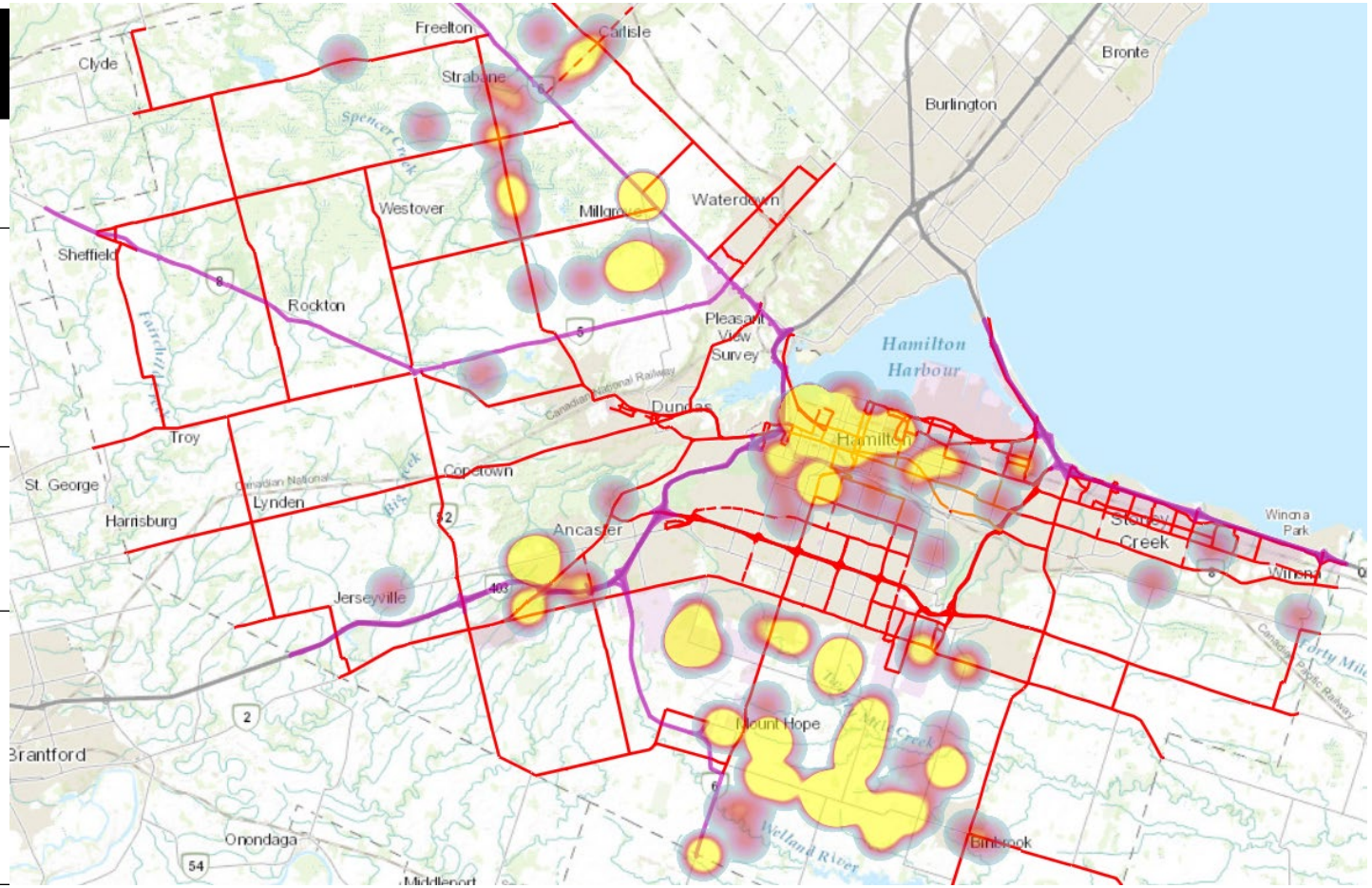
- Highest intensity of activity clusters occurring at designated employment areas, along Burlington Street, the parkways, and along Provincial Highway Network
- Vessel activity at the Hamilton-Oshawa Port Authority continues to grow, with a 9% increase between 2022 and 2023.
- More than half of the weekly truck flow volumes are to/from the Greater Toronto-Hamilton Area
- Potential Goods Movement Strategy Action Plan Modifications / Updates:
    - Inclusion of broader community partnerships aimed at continuously improving equity and sustainable goods movement practices through information sharing and opportunities for collaboration.



Public Engagement

Concern / Issue	Percent of comments*	Number
Trucks on non-designated routes	62%	935
Driver behaviour / road safety (includes speeding / rolling stop / ability to turn etc.)	29%	437
Trucks with five or more axels on a non-designated route	8%	116
Trucks not following time of day restrictions on designated route (includes non-designated routes)	1%	11

* As of end of October



Successes

Successes	
Impact	**Opportunity / Action:**
Decrease in trucks five axels or more along Wellington Street and Victoria Avenue	Continue to monitor and evaluate compliance of trucks that are greater than five axels
Increase in truck volumes on the Red Hill Valley and Lincoln Alexander Parkways, consistent with the adopted ring road network concept	Continue to advance planning for capacity improvements on the Lincoln Alexander Parkway and Red Hill Valley Parkway per previous Council Direction
Online reporting tool effective in visualizing community problem areas	Identification of some problem areas for further investigation and interventions
Enforcement has improved and tickets have been issued to improve compliance and overall road safety of commercial vehicles	Work with Hamilton Police Services to improve reporting information such as breakdown of locations where tickets have been issued

Challenges / Opportunities

Challenges	
Impact	**Opportunity / Action:**
On-line tools do not provide additional positive guidance based on Hamilton's truck route network	○ Investigate opportunities to integrate Hamilton's truck route network into the Ministry of Transportation's Ontario 511 application. ○ Continue to advocate for the integration of the truck route network into mapping platforms such as Google and Apple maps.
Construction Projects	○ Improve coordination, communications, as well as construction management and detour plans around road construction projects that occur on truck routes. ○ Improve the coordination of growth-related and development-specific construction projects.
Road Network Improvements	○ Continue to advance key road infrastructure projects as identified in the City-wide Transportation Master Plan and Airport Area Growth District Master Plan ○ Advance studies to provide network redundancy in the former Glanbrook area.
Enforcement	○ Identify capital projects to achieve enforcement through design. ○ Through advancing road infrastructure projects, enforcement resources may be allocated to other locations.

Thank you!

Hamilton

INFORMATION REPORT

TO:	Chair and Members Truck Route Sub-Committee
COMMITTEE DATE:	January 10, 2025
SUBJECT/REPORT NO:	Truck Route Monitoring and Evaluation Framework (PED19073(e)) (City Wide) **(Outstanding Business List Item)**
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Steve Molloy (905) 546-2424 Ext. 2975
SUBMITTED BY: **SIGNATURE:**	Brian Hollingworth Director, Transportation Planning and Parking Planning and Economic Development Department 

COUNCIL DIRECTION

On, September 2022, direction was provided by the Truck Route Sub-Committee to report back to the Sub-Committee on the evaluation of the approved Truck Route Network as identified below:

> That staff be directed to operationalize the truck route network evaluation framework including all required data collection, public and stakeholder engagement and analysis commencing in early 2023 and through 2023/2024 and report back to the Truck Route Sub-Committee by no later than Q4 2024.

Direction was also provided as part of the approval of the Goods Movement Strategy (PED24049) as identified below:

> That staff be directed, as part of the in-progress Truck Route Network Monitoring and Evaluation actioned by Report PED19073, to report back to the Truck Route Sub-Committee on potential updates and/or modifications to the 32 Actions identified in the Goods Movement Strategy in order to explicitly address concerns and opportunities related to term of council priorities, including equity, public

health, roadway safety, impacts of continued road expansion; and urgency around the City's declared climate crisis.

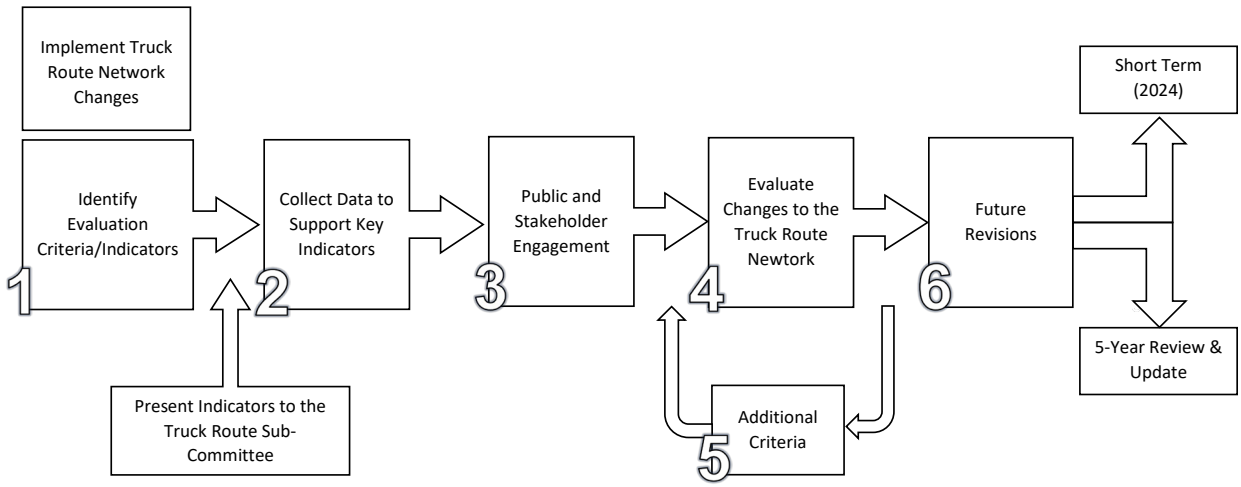
INFORMATION

The April 2022 Council Approved Truck Route Master Plan and network emphasizes the use of the ring road concept for heavy trucks via the Red Hill Valley and Lincoln Alexander Parkways, Highway 403 and QEW. This is intended to improve the quality of life for residents and vulnerable populations. Implementation of truck route signs occurred between May and September 2023 with follow-up adjustments based on community feedback.

The approved evaluation framework identified several criteria to measure the impacts of network changes. The objective of the evaluation is to measure the effectiveness of the changes from a community liveability, environmental and public health, and economic prosperity perspectives.

The evaluation framework is illustrated in Figure 1. The evaluation framework includes both the collection of data and public input through the truck route reporting tool. This data informs the evaluation of the truck route network and serves to contribute to future updates of the Truck Route Master Plan.

Figure 1: Truck Route Network Monitoring and Evaluation Framework



The purpose of this Report is to present the results of truck route monitoring work to date. The Report also identifies overall observed impacts of the changes and areas

where further refinement and improvements to be made to improve the effectiveness of the truck route network. It is noted that this is an interim report and continued data collection, and analysis is on-going to help to inform continuous improvements and network refinements.

Evaluation Criteria and Key Indicators

The approved evaluation framework identified several criteria to measure the impacts of the truck network changes. The selection of evaluation criteria/indicators was informed by the vision, goals, and guiding principles of the Truck Route Master Plan, and the City's Strategic Plan priorities. The high-level categories include Community Livability, Environment and Public Health, and Economic Prosperity. Each category and the monitoring results to date are discussed below.

Community Liveability

This set of criteria is intended to measure how the revisions to the truck route network support a safe multimodal transportation system that adheres to the Vision Zero policies and minimizes and distributes the impacts of the truck route network away from vulnerable communities therefore improving equity. Community livability is also measured and expressed by the volume of truck types travelling through neighbourhoods, collision, and compliance/enforcement data along designated truck routes.

- Volume Data

Truck Route data was collected at select corridors to measure the impacts of network changes, particularly, the removal of truck routes in the Lower City. The results, as shown in Table 1, indicate significant reductions in truck volumes on Wellington Street and Victoria Avenue, which would also be reflective of trucks travelling through the Downtown core.

Volume counts were also taken on King Street and Main Street; however, it was determined that data may have been affected by a construction project in the vicinity of the counts. Based on informal observations and spot counts, there is anecdotal evidence that truck volumes have decreased on these streets. Additional counts are being programmed to confirm the reductions.

Upper James Street observed relatively stable volumes, Rymal Road observed an increase in volumes, while Centennial Parkway observed a reduction in volumes. Each of these routes are full-time truck routes with five axle or more.

Table 1: Before and After Comparison of Truck Volumes on Select Truck Route Corridors (Daily trucks)

Location	2021/2022 Truck Volume (percent of total volume)	2023 Truck Volume (percent of total volume)	**Percent Increase / Decrease
Wellington Street*** Before (south of McAuley) After (south of Barton)	*Five Axels or more 293 (7.4%) Four Axels or less 224 (5.6%)	*Five Axels or more 41 (0.6%) Four Axels or less 125 (1.8%)	- 86.0% - 44.2%
Victoria Avenue*** (south of Barton)	*Five Axels or more 197 (2.0%) Four Axels or less 242 (2.5%)	*Five Axels or more 101 (1.2%) Four Axels or less 206 (2.5%)	- 47.8% - 14.9%
Upper James Street (south of Lincoln Alexander Parkway)	*Five Axels or more 1,179 (3.0%) Four Axels or less 1,189 (3.0%)	*Five Axels or more 1,226 (3.2%) Four Axels or less 1,164 (3.0%)	+ 4.0% - 2.1%
Centennial Parkway (south of Queenston)	*Five Axels or more 651 (2.4%) Four Axels or less 1,132 (4.2%)	*Five Axels or more 551 (2.2%) Four Axels or less 935 (3.7%)	- 15.4% - 17.4%
Rymal Road*** Before (east of Upper Ottawa) After (West of Upper Ottawa)	*Five Axels or more 300 (1.6%) Four Axels or less 754 (4.1%)	*Five Axels or more 352 (1.9%) Four Axels or less 852 (4.6%)	+ 17.3% + 13.0%

Notes:

* Includes articulated Hamilton Street Railway buses.

** Calculated based on truck volume not percent of total volume.

*** Count location is different but is representative of the expected volume change due to network modifications.

As Table 2 indicates, there has been a substantial increase in five axel or more trucks travelling along the Lincoln Alexander and Red Hill Valley Parkways, which demonstrates success in re-routing heavy trucks to these parkways. These increases are higher in scale than the changes in the Lower City, which suggests the changes may have also been influenced by other factors. This could include changes due to the recovery from the Pandemic as well as increased development activity in the Red Hill Valley Business Park.

Table 2: Before and After Comparison of Truck Volumes on the Lincoln Alexander and Red Hill Valley Parkways

Location	2019-2021-2022 Truck Volume (percent of total volume)	2023 Truck Volume (percent of total volume)	**Percent Increase / Decrease
Lincoln Alexander Parkway (east of Dartnall)	*Five Axels or more 2,917 (4.2%) Four Axels or less 2,699 (3.8%)	*Five Axels or more 4,917 (5.5%) Four Axels or less 3,147 (3.5%)	+68.6% +16.6%
Red Hill Valley Parkway (south of Barton)	*Five Axels or more 2,607 (3.2%) Four Axels or less 3,332 (4.1%)	*Five Axels or more 4,889 (6.0%) Four Axels or less 2,275 (3.4%)	+ 87.5% - 31.7%

Notes:

* Includes articulated Hamilton Street Railway buses.

** Calculated based on truck volume not percent of total volume.

*** Count location is different but is representative of the expected volume change due to network modifications.

- Collision Data

Four-year (2019 to 2022) collision data has been reviewed along selected corridors to establish a benchmark for comparisons as illustrated in Table 3. A total of 148 collisions involving trucks were recorded at these collective locations, with approximately 52% of these collisions occurring along the King Street and Main Street segments. There were three collisions involving pedestrians and cyclists. No fatalities were recorded.

Collision data for 2023 will not be available until early 2025. Once this data is available, it will be reviewed as a follow-up report to the Truck Route Sub-committee as well as being integrated into the Annual Collision Report prepared by the Transportation Division in Public Works. As a result, there is no current data to indicate if the Potential for Safety Improvement ranking has changed based on the truck route network modifications.

Table 3: Collision Summary Involving Trucks

Location	2019	2020	2021	2022	*Collisions Involving Pedestrians / Cyclist	Total
East-West Corridors						
Burlington Street (Gage to Ottawa)	0	1	1	2	0	4
Cannon Street (Wellington to Queen)	5	2	2	7	(2)	16
King Street (Dundurn to Wentworth)	6	3	4	12	(1)	25
Main Street (Dundurn to Wentworth)	12	12	16	12	0	52
Rymal Road (Upper Gage to Red Hill Valley Parkway)	3	0	2	4	0	9
North-South Corridors						
Centennial Parkway (King to Queenston)	0	3	8	1	0	12
Upper James Street (Lincoln Alexander Parkway to Stone Church	1	1	0	1	0	3
Wellington Street (Barton to Cannon)	1	0	1	1	0	3
Victoria Avenue (Barton to Cannon)	2	0	2	0	0	4
Parkways						
Red Hill Valley Parkway	3	4	3	0	0	10
Lincoln Alexander Parkway	0	0	5	5	0	10
Total						
All Locations	33	26	44	45	(3)	148

* Pedestrian and cyclist collisions are a subset of the total collisions recorded.

- Enforcement Data

Due to the timing of sign installation and education period, enforcement data is not representative of activities. However, based on data to the end of October 2024, Hamilton Police Services' Traffic Services Division has issued approximately 300 charges relating to the Truck Route By-law. This number could be higher as other Divisions within Hamilton Police Services carry out enforcement, however, these Divisions group all by-law infractions together for data collection and reporting. Therefore, the exact number is not available at this time.

Ensuring trucks are operating in a safe manner is also important to community safety. So far, in 2024, the Commercial Motor Vehicle Inspectors, within the Traffic Division, have inspected approximately 597 Commercial Motor Vehicles, taken 179 (or 30 percent) out-of-service, and have issued 2,073 charges in relation to Commercial Motor Vehicles. These charges have occurred on both truck and non-truck route roadways.

Environmental and Public Health

These criteria serve to measure how the revisions to the truck route network have succeeded in influencing environmental, climate change, and public health outcomes. The indicators are intended to measure the exposure level of truck volumes to sensitive land uses through the measurement of air quality and noise data.

- Air Quality Data

Collaborated through a Smart Cities initiative with Ecosystem Informatics Inc. to collect a snapshot of before and after air quality data to identify any pattern changes. Six total scans were collected in each phase: Phase 1 in Fall-Winter 2022; and Phase 2 in Spring 2023. Factors influencing the data set include seasonal weather changes, vegetation, human activities, industrial land use activities, and the change in travel patterns, such as the truck route changes.

The route driven by Ecosystem Informatics included Hamilton General Hospital (location one), the Industrial Sector (location two), Queen Street and King Street area (location three), the Red Hill Valley Parkway (location four), and the Lincoln Alexander Parkway via Upper James Street (location five). This route captures most neighbourhood development areas. An Air Quality report was prepared and is provided in Appendix "A" attached to Report PED19073(e). A summary of the findings of this Report is provided in Table 4.

Table 4: Summary of Air Quality Data Results

Pollutant	Summary
Sulfur Dioxide	There was an increase in the ambient Sulfur Dioxide levels recorded in Phase 2 when compared to Phase 1 across the entire route. In follow-up analysis undertaken, data spikes were identified that were consistent with findings from data observed from air quality monitoring stations. These spikes occur during the May and June months as compared with other months and requires further investigation into contributing factors and solutions.
Nitrogen Dioxide, Carbon Monoxide, and Ozone	Nitrogen Dioxide, Carbon Monoxide, Ozone, and Particulate Matter had relatively similar hourly average levels in both Phase 1 and Phase 2. There is a spatial shift in locations with higher concentration levels of Carbon Monoxide and Ozone towards the Red Hill Valley and Lincoln Alexander Parkways in Phase 2. This is an expected outcome, given the increase in the volume of trucks using these corridors (see table 2).
Particulate Matter 2.5 and Particulate Matter 10	Increase in measured levels of Particulate Matter 2.5 and Particulate Matter 10 in the Industrial Sector. The data also indicates some reductions along the Lincoln Alexander Parkway.

- Noise Data

In a collaborative effort to leverage a Smart Cities approach, noise sensors (via SmartLinx) were placed at various locations to monitor decibel levels near designated truck routes to evaluate the effectiveness of change. The location of the SmartLinx noise sensors is provided in Appendix “B” attached to Report PED19073(e).

A snapshot of the data was selected for a nine-day period between January 6 and 14, 2023, and between January 6 and 14, 2024, which is presented in Table 5. The data represents an average decibel level based on 15-minute intervals from approximately 720 data points collected during each period selected. This data does not represent peak agricultural activities but is representative of typical travel patterns.

Overall, the decibel levels have increased along all corridors measured during the selected time-periods. Based on the previous section, traffic volumes have been steadily increasing, which may account for differences, in addition to other factors such as nearby construction activities, road condition, and other activities. Of note, the Garner Road decibel level had the highest increase, which can be attributed to background noise relating to construction activities in the area.

Other notable increases, which demonstrates the effectiveness of the route changes is the increase in decibel levels near the Nickola Tesla Parkway and Woodward Avenue. Conversely, the decibel levels at the Red Hill Valley Parkway sensor near Barton Avenue is less than others, which is likely attributed to reduced speeds during the peak hour periods.

Table 5: Pre- and Post-Network Changes Impact on Decibel Levels

Location	Pre-Implementation (Jan 2023)	Post-Implementation (Jan 2024)	Percent Change
King Street	58.4	63.0	+7.8%
Main Street	60.8	65.5	+7.7%
Victoria Avenue	57.0	62.5	+9.7%
Centennial Parkway South	60.8	67.5	+11.1%
Upper James (Twenty Road)	61.7	67.9	+10.0%
Nikola Tesla Parkway/Burlington Street (Woodward Overpass)	58.9	72.1	+22.7%
Garner Road (Miller Drive)	49.8	67.4	+35.2%
Rymal Road East (Upper Ottawa)	58.5	65.4	+11.7%
Rymal Road East (Trinity Church Road)	60.3	67.2	+11.5%
Lincoln Alexander Parkway (Limeridge-Upper Gage)	66.3	71.6	+7.9%
Lincoln Alexander Parkway (Cranbrook-Upper Paradise)	67.0	72.4	+8.1%
Red Hill Valley Parkway (Barton Overpass)	66.4	69.3	+4.5%
Red Hill Valley Parkway (Hixon Road)	66.4	71.6	+7.7%
Red Hill Valley Parkway (Pritchard Road)	66.1	72.2	+9.2%

Economic Prosperity

A variety of indicators were identified to assess changes in economic prosperity including travel reliability, resiliency and connectivity among goods-generating land uses, access to employment centres, as well as economic uplift due to the removal of designated truck routes from the network. Given the more gradual change in economic

conditions as opposed to other indictors, the evaluation of economic prosperity should be considered on-going. For example, development activity in the corridors where truck routes were removed is an indictor which requires a longer period of time to evaluate.

Another indicator of economic activity is the overall volume of truck movements to and from Hamilton. Currently, there is only one time horizon for this data, which is presented in this Report as a baseline only. This dataset includes trucking volumes collected as part of the Commercial Vehicle Survey led by the Ministry of Transportation (which the City is a partner) and shows the general origin and destination of goods moved by trucks. The breakdown is provided in Table 6 and is discussed in more detail as part of the Council approved Goods Movement Strategy (Report PED24049).

A review of the action items in Report PED24049 for opportunities for modifications and updates that align with this term of Council priorities was undertaken and are provided in Appendix "C" attached to Report PED19073(e).

Table 6: Weekly Truck Flows based on the Commercial Vehicle Survey

Location	**Origin Hamilton (out) N = 19,512**		**Destination Hamilton (in) N = 19,208**	
	Weekly Volume	**Percent**	**Weekly Volume**	**Percent**
Central Ontario (GTA)	10,274	52.7%	10,274	53.5%
Southwest Ontario	5,235	26.8%	6,550	33.6%
Northern Ontario	248	1.3%	66	0.3%
Eastern Ontario	251	1.3%	344	1.8%
Canadian Provinces	852	4.4%	505	2.6%
United States	2,652	13.6%	1,469	7.6%

The Goods Movement Strategy also identifies trucking activity and intensity clusters, which generally aligns with designated Employment Areas and Economic Centres within the city. It also identifies mid-day travel speeds based on TomTom data (TomTom is a data collection company that uses GPS and cell-phone data). The data aligns with what would be expected. For example, higher speeds are generally experienced along the Ministry of Transportation Highway Network and the Red Hill Valley and Lincoln Alexander Parkways. Lower speeds are observed within activity cluster themselves as well as some first and last mile connections into the Highway and Parkway network (e.g. Dartnall Road connection and connections from the Parkways to the Highway network). These clusters and mid-day travel speeds are provided in Appendix "D" attached to Report PED19073(e) and are also available within the Goods Movement Strategy.

Additional information relating to the change in truck trip travel times using telemetric data to compare data used in the Truck Route Master Plan is in progress and was not available at the time of this Report.

A final source of economic prosperity data relates to activities in the Port Area. At the time of the truck route network review, concerns were raised about the impact of removing lower City routes on the viability of businesses in the Port. As noted on the Hamilton Oshawa Port Authority ports website, “Hamilton Oshawa Port Authority Ports has released results for the 2023 navigation season, reporting a combined total cargo of 11,293,179 metric tonnes (MT) through the ports of Hamilton and Oshawa. The 2023 total was a 9% increase from 2022, marking the second-highest volume in the past decade. The season saw a total of 665 vessels, with 603 in Hamilton and 62 in Oshawa, taking advantage of the longest ever Seaway shipping season.

This high-level statistic would suggest that to date, the Hamilton Port area continues to be a major and growing contributor to the economy.

Public Engagement

The online truck monitoring tool is a tool that allows residents to report any truck route violation they observe in their community and is a key source for public input. The tool was launched in August 2024 and communications to promote the tool occurred in September. As of the time of writing this Report, there was 1,499 data points (representing unique submissions) (220 in August, 299 in September, and 977 in October), which include comments, photographs, and completed survey. This data assists in identifying and highlighting problem areas for further engagement with residents and stakeholders to develop and implement solutions. Appendix “E” attached to Report PED19073(e) contains heat maps for each month as well as a combined map, where locations for further investigation, engagement, and action have been highlighted.

Based on collated survey results shown in Table 7, there are two distinct issues that stand out: Trucks on non-designated truck routes (62%); and Driver behaviour / road safety (29%).

Table 7: Distribution of Online Tool Survey Concerns

Concern / Issue	Percent of comments to date	Number
Trucks on non-designated routes	62%	935
Driver behaviour / road safety (includes speeding / rolling stop / ability to turn etc.)	29%	437
Trucks with five or more axels on a non-designated route	8%	116
Trucks not following time of day restrictions on designated route (includes non-designated routes)	1%	11

In terms of trucks on non-designated routes and as illustrated in the heat maps, there are two areas that stand out:

- Locke Street North, where it has been observed that trucks are travelling in violation of the designated truck route network. This is attributed to the road reconstruction project on York Boulevard and portions of Cannon Street. Overall, the issue, not limited to Locke Street, but is a broader issue to improve the integration of construction and transportation management communications during construction projects and concurrent projects.

- Glanbrook between the Airport Employment Growth District and the Red Hill Business Park, which are more complex issues and involves several factors. The lack of a designated truck route and network redundancy has created issues. Short and long-term solutions include the completion of the Rymal Road improvements between Dartnall Road and Upper James Street, review the timing of improvements to Upper James Street south of Rymal Road, and advancing the Red Hill Business Park to Highway 6 conceptual link study as described in Report PED23246.

As road projects move forward, there is need to improve construction and transportation management coordination and communications. Applying an array of strategies to reduce the impact on the broader community, not just those directly affected by these projects. This would also apply to development construction activities as well. Again, the example of Glanbrook, where previous complaints of trucks using Dickenson Road (which is not a designated truck route) have shifted to Miles Road and White Church Road as Dickenson Road has been closed due to construction.

Other issues reported by the community (e.g. Millgrove area) have been previously identified, such as the historical issue of trucks using Millgrove Sideroad as opposed to Concession 5 West. This issue requires further discussions with the Ministry of Transportation and the community for a suitable resolution. In addition, further review of data, investigation of noted issues, and the potential for interventions to address driver behaviour, will be undertaken based on the data set.

Summary of Successes, Challenges and Opportunities

There is a need for continued data collection and evaluation using consistent data sets. This data will help inform the need for further truck route network refinement. Notwithstanding the need for more data to inform decisions, there are actions that can have a positive impact on the community. Based on the data collected thus far, Table 8 summarizes the various successes, challenges, and opportunities.

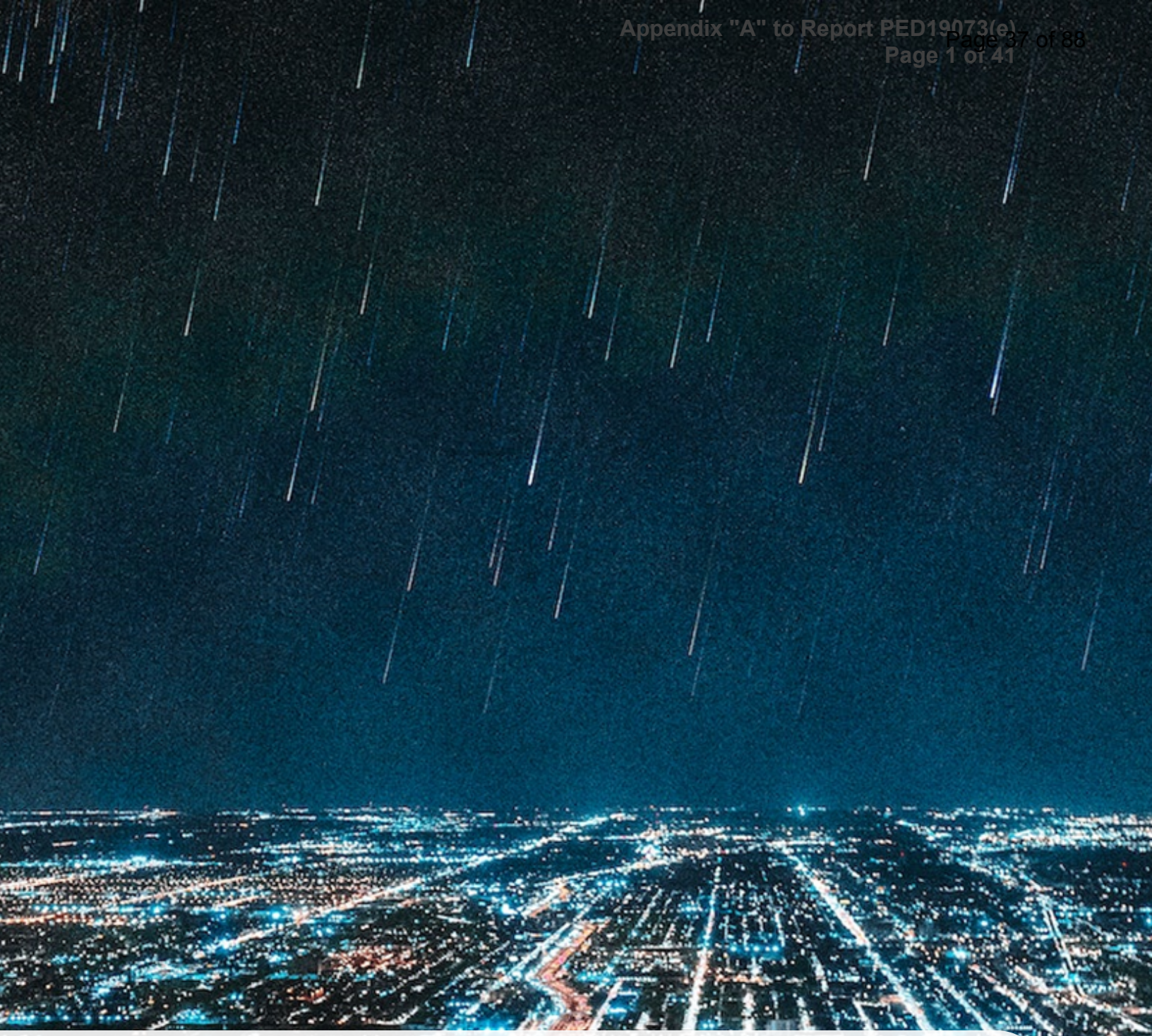
Table 8: Successes, Challenges and Opportunities

Successes	
Impact	**Opportunity / Action:**
Decrease in trucks five axels or more along Wellington Street and Victoria Avenue	Continue to monitor and evaluate compliance of trucks that are greater than five axels
Increase in truck volumes on the Red Hill Valley and Lincoln Alexander Parkways, consistent with the adopted ring road network concept	Continue to advance planning for capacity improvements on the Lincoln Alexander Parkway and Red Hill Valley Parkway per previous Council Direction
Online reporting tool effective in visualizing community problem areas	Identification of some problem areas for further investigation and interventions
Enforcement has improved and tickets have been issued to improve compliance and overall road safety of commercial vehicles	Work with Hamilton Police Services to improve reporting information such as breakdown of locations where tickets have been issued
Challenges	
Impact	**Opportunity / Action:**
On-line tools such as Google Maps do not provide additional positive guidance based on Hamilton's truck route network	Investigate opportunities to integrate Hamilton's truck route network into the Ministry of Transportation's Ontario 511 application. Continue to advocate for the integration of the truck route network into mapping platforms such as Google and Apple maps.
Construction Projects	Improve coordination, communications, as well as construction management and detour plans around road construction projects that occur on truck routes. Improve the coordination of growth-related and development-specific construction projects.
Road Network Improvements	Continue to advance key road infrastructure projects as identified in the City-wide Transportation Master Plan and Airport Area Growth District Master Plan Advance studies to provide network redundancy in the former Glanbrook area.

Enforcement	Identify capital projects to achieve enforcement through design. Through advancing road infrastructure projects, enforcement resources may be allocated to other locations.

APPENDICES AND SCHEDULES ATTACHED

Appendix “A” to Report PED19073(e) - Air Quality Report
Appendix “B” to Report PED19073(e) - SmartLinx Noise Sensor Locations
Appendix “C” to Report PED19073(e) - Potential Action Plan Modifications and Updates
Appendix “D” to Report PED19073(e) - Goods Movement Strategy Data
Appendix “E” to Report PED19073(e) - Online Reporting Tool Heatmaps



Air Quality Report

Linc. Pkwy, Red Hill Pkwy. & Downtown Core
City of Hamilton, 2022-23

SUBMITTED TO:
CITY OF HAMILTON, TRANSPORTATION PLANNING

BY:
ECOSYSTEM INFORMATICS INC.

CONTENTS

ABOUT THIS REPORT

The 2022-23 report for City of Hamilton – Extended study area measurement program conducted by Ecosystem Informatics (ESI) analyzes gas concentration data collected by ground-level monitoring devices, as aggregated through ESI's air quality platform. By comparing gas concentration levels across all the measurement days of the study, ESI strives to understand and highlight a wide variety of insights to help improve our understanding of air quality and its impacts.

INTRODUCTION

About Ecosystem Informatics Inc. (ESI)

Ecosystem Informatics Inc. (ESI) has developed a next-generation air quality monitoring and measurement technology. ESI's core competencies include wide-ranging environmental studies with active involvement in air quality and pollution monitoring, modeling, and assessments. ESI's comprehensive system includes low-footprint units that can measure, in real-time, a large set of pollutants, ambient air quality and meteorological factors. In addition to this, ESI's integrated AI based calibration and visualization software augments the data collection capabilities, for detailed analysis, predictive modeling, and customized reporting. ESI's team has extensive technical and project management experience in design, commissioning, and operation of fixed and mobile air monitoring stations; and modeling based on EPA tools like MOVES, AERMOD and CAL3HQC.

ESI's technology

ESI's hardware forms the base of the company's next-generation air quality measurement platform and the underlying technology stack. The measuring device, with its modular design, can house multiple different combinations of sensors that measure gas concentration levels in ambient air. The technology aims to achieve a leap-forward from existing air quality measurement stations (both Government owned and private sector competitors) with its dramatically reduced size and an ability to measure data accurately in both stationary and mobile modes.

The accuracy and reliability of the measured data is ensured with the help of Artificial Intelligence (AI) based calibration that sets the technology apart. ESI's devices and other devices (Government stations and competitor devices) work in a fundamentally similar way -they all have sensors that measure pollutant concentrations, air quality etc. However, sensors lose accuracy over time due to several factors but not limited to micro vibrations in mechanical moving parts, changes in operating environment etc. This must be negated regularly during a sensors' operation and is usually done by calibrating and re-calibrating the sensors. To Calibrate is to standardize (something, such as a measuring instrument) by determining the deviation from a standard to ascertain the proper correction factors to ensure measured data is accurate and reliable.

The major differentiating factor between the ESI device and other devices is the AI based calibration which allows the ESI device to be of a smaller footprint, stationary and mobile next-generation hardware. With non-ESI devices, sensors are routinely calibrated under laboratory conditions against a reference atmosphere. This process involves specialized hardware that is resource heavy. During the day-to-day operation of the conventional, non-ESI, equipment, the sensors are stabilized through hardware to keep the environment around the sensor synthetically stable, that is to keep the temperature and relative humidity at the levels in which the sensors were calibrated to in the lab. This "stabilizing" hardware adds to the size and the cost of the equipment, which in turn adds to the power needed to operate as well as makes these devices bulky needing large platforms to deploy them on.

The ESI device sensors on the other hand, are initially calibrated to an accurate source. This could be:

- An existing calibrated and accurate device like a government measurement station.
- A reference atmosphere using a controlled chamber like the method used by non-ESI devices.

The difference with ESI devices however is that the sensors are then continuously calibrated with software, i.e., the hardware used in non-ESI equipment that is used to stabilize the sensors is replaced by ESI's preparatory Artificial Intelligence (AI) algorithms. The underlying AI algorithms built by ESI can detect variations in the sensors over time, and operating environment factors like temperature, humidity, Atmospheric pressure etc. and negate the impact these variations have on the sensor readings, thereby ensuring accuracy. Sensors are recalibrated with an accurate source periodically to further ensure accuracy. This allows ESI's operation to be less demanding of resource-heavy and expensive calibration process that is required with other devices.

STUDY AREA & DATA COLLECTION

As outlined in our proposal, Ecosystem Informatics Inc. (ESI) has conducted 6 total scans; Phase 1 in Fall-Winter 2022 and Phase 2 in Spring 2023 within the agreed upon driving routes (as per image above).

Mobile monitoring units placed on ESI vehicles conducted scans along the determined route on 6 different days. The data was processed for calibration and accuracy to create charts, geographic maps, and other visualizations of emissions climate factors over the AOI. This report outlines the details of the environmental conditions, gas concentration data and other insights.

Note for Mobile scan data: The gas concentration metrics measured by ESI do not reflect the daily average numbers. The numbers are with respect to our scans which last a few hours during a single day. The numbers reflect the ambient air concentration of the respective gases for the hours during which the scan was conducted, and don't reflect the whole day. It is also to be noted that on each scan, there were differences in the weather conditions and the traffic conditions. With respect to placement of the measurement device, it was mounted onto the car and done so at a point on the roof rails with the best chances to pick up only ambient air and not that car emissions for measurement.

AMBIENT AIR QUALITY STANDARDS

Canada Ambient Air Quality Standards (CAAQS)

Source: https://ccme.ca/en/air-quality-report

Canadian Council of Ministers for Environment (CCME)-the primary minister-led intergovernmental forum for collective action on environmental issues of national and international concern-developed Canadian Ambient Air Quality Standards (CAAQS) for PM2.5, O3, SO2 and NO2.

All CAAQS consist of three interrelated elements:

- an averaging time period
- a numerical value
- the statistical form of the numerical standard.

CAAQS are supported by four color-coded management levels. Each management level is determined by the amount of a pollutant within an air zone and provides recommended air quality management actions. If the amount of a pollutant within an air zone increases, the management actions become more stringent. This helps ensure that CAAQS are not treated as polluted-up-to levels and actions will be taken to keep clean areas clean.
When determining the CAAQS management levels, provinces and territories can consider the influence of human activities originating outside of the province or territory and of exceptional events such as forest fires

Pollutant	Averaging Time	Numerical Value		Statistical Form
		2020	2025	
Sulphur Dioxide (SO2)	1-hour	70 ppb	65 ppb	The 3-year average of the annual 99th percentile of the SO2 daily maximum 1-hour average concentrations.
	Annual	5.0 ppb	4.0 ppb	The average over a single calendar year of all 1-hour average SO2 concentrations.
Nitrogen Dioxide (NO2)	1-hour	60 ppb	42 ppb	The 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations.
	Annual	17.0 ppb	12.0 ppb	The average over a single calendar year of all 1-hour average concentrations.

Air quality management levels	Management Levels for the Ozone CAAQS (parts per billion)		Management Levels for the 1-hour Sulphur Dioxide CAAQS (parts per billion)		Management Levels for the Annual Sulphur Dioxide CAAQS (parts per billion)		Management Levels for the 1-hour Nitrogen Dioxide CAAQS (parts per billion)		Management Levels for the Annual Nitrogen Dioxide CAAQS (parts per billion)	
	2020	2025	2020	2025	2020	2025	2020	2025	2020	2025
Red	>62	>60	>70	>65	>5.0	>4.0	>60	>42	>17.0	>12.0
Orange	57 to 62	57 to 60	51 to 70	51 to 65	3.1 to 5.0	3.1 to 4.0	32 to 60	32 to 42	7.1 to 17.0	7.1 to 12.0
Yellow	51 to 56		31 to 50		2.1 to 3.0		21 to 31		2.1 to 7.0	
Green	≤50		≤30		≤2.0		≤20		≤2.0	

Ontario Ambient Air Quality criteria

The below table shows the Ontario 1-hour Ambient Air Quality Criterion (AAQC) for the gases that were scanned.
From: https://www.ontario.ca/page/ontarios-ambient-air-quality-criteria
An AAQC is not a regulatory value. It is the concentration of a contaminant in air that is protective against adverse effects on health and/or the environment. AAQCs are used to assess general (ambient) air quality resulting from all sources of a contaminant to air. AAQCs are most used in environmental assessments, special studies using ambient air monitoring data, assessment of general air quality in a community and annual reporting on air quality across the province.
Since AAQCs are based on a review of scientific information about the effects of contaminants on health and the environment, they may be modified from time to time based on new or relevant scientific information

Gas	Averaging Time	AAQC criteria (PPB)
Carbon Monoxide (CO)	1-hour	30000
Nitrogen Dioxide (NO2)	1-hour	200
Ozone (O3)	1-hour	80
Sulphur Dioxide (SO2)	1-hour	40

FOR EASE OF HAVING A BENCHMARK TO COMPARE AGAINST AND TO HAVE A DIRECTIONAL SENSE OF THE TRENDS IN AMBIENT AIR MEASURED POLLUTANTS, IN THIS REPORT, WE HAVE USED THE COLOR SCALING ACCORDING TO THE SO2 (ANNUAL) AND NO2 (ANNUAL) SCALE AND THE O3(8 HOUR) SCALE. FOR CO, WE USED THE ONTARIO AMBIENT AIR QUALITY CRITERIA.

SCAN DATA AND INSIGHTS

INFLUENCING FACTORS

Given the nature of this project, below are some factors that can potentially influence changes in ambient air quality:

- **Seasonal Weather Changes:** Variations in temperature, wind patterns, and precipitation can influence pollutant dispersion and concentration.
- **Vegetation:** Spring growth can absorb pollutants but also release allergenic pollens.
- **Human Activities:** Increased construction, outdoor events, or agricultural activities in spring can affect air quality. Lower energy consumption for heating can also reduce overall emissions.
- **Change in Traffic Flow:** The planned diversion of trucks can decrease emissions in the city center but potentially increase them on the outskirts.
- **Change in Industrial Activities:** Variations in industrial activity can alter pollutant levels.

FINDINGS

- There was a significant increase in the ambient SO2 levels recorded in phase 2 when compared to phase 1 across the entire route. (This led to a different investigation on SO2 spikes in the city of Hamilton that was done by ESI and shared in a separate forum with relevant teams. The details of that report are out of scope in this report.)
- NO2, CO and O3 and PM had relatively similar hourly average levels in both phase 1 and phase 2.
- There is a noticeable spatial shift in locations with higher concentration levels of CO and O3 towards Red Hill Pkwy and Linc Pkwy in phase 2 when compared to phase 1.
- In both phase 1 and phase 2, NO2 concentration consistently measured above the CAAQS Green zone.
- There is spatial increase in the concentration of NO2 towards the west of the city from phase 1 to phase 2.
- Spatial locations closer to the Port and Bay Front Industrial Areas showed an increase in measured levels of PM 2.5 and PM10 in phase 2.

SCAN DATA AND INSIGHTS

RECOMMENDATIONS

- There is a noted spatial variation in the concentration of CO over phase 2 versus phase 1 (given that transportation is one of the major contributors of CO) suggesting that the change in truck routes is showing positive results.

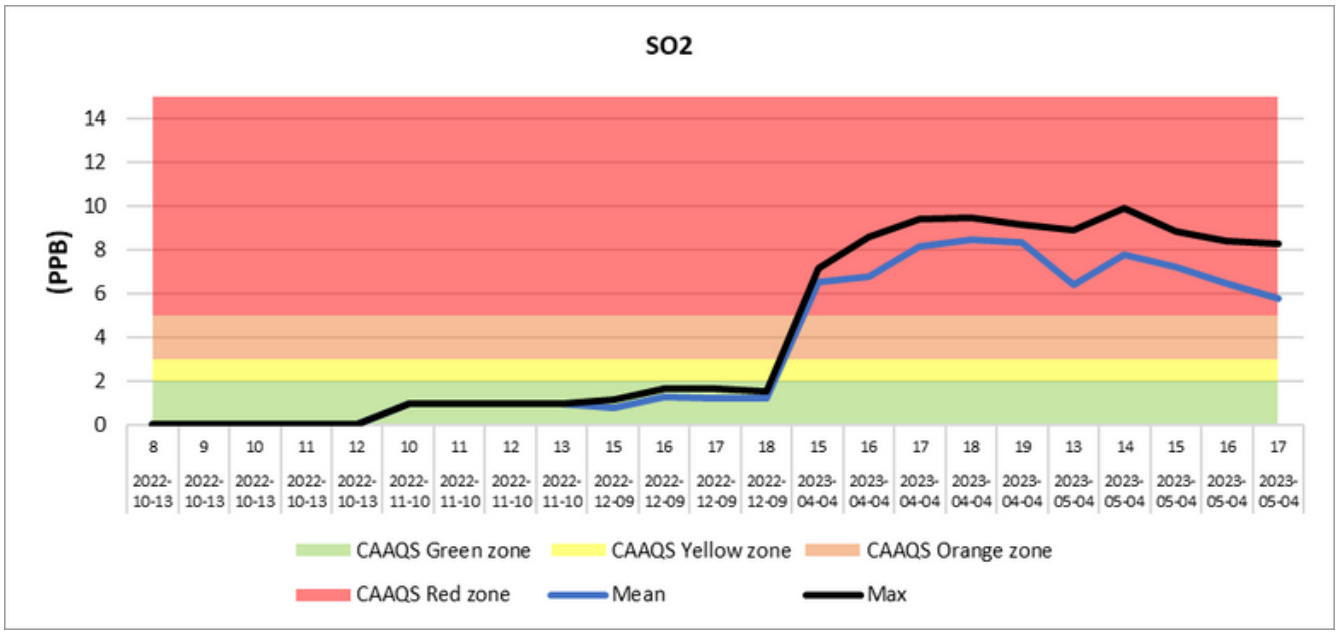
- The current results weigh towards being more directional, and more data is required to support the analytics further.

- Data needs to be collected at a higher frequency covering several scenarios to factor in the noise from influencing factors at a higher detail to gather more detailed results and insights.

THE FOLLOWING PAGES CONTAIN DETAILS AROUND BASIC STATISTICS AND VISUALIZATIONS ON THE GAS CONCENTRATIONS DURING THE MEASUREMENT SCANS ALONG THE FIXED ROUTES. THE SECTION DEALS WITH THE 6 MEASURED POLLUTANTS (SO2, CO, NO2 AND O3, PM2.5 AND PM10).

POLLUTANT: SULPHUR DIOXIDE (SO2)

TIME SERIES: HOURLY AVERAGE OF POLLUTANT OVER SCAN DAYS



TIME SERIES: HOURLY AVERAGE OF POLLUTANT OVER SCAN DAYS (TABULATED)

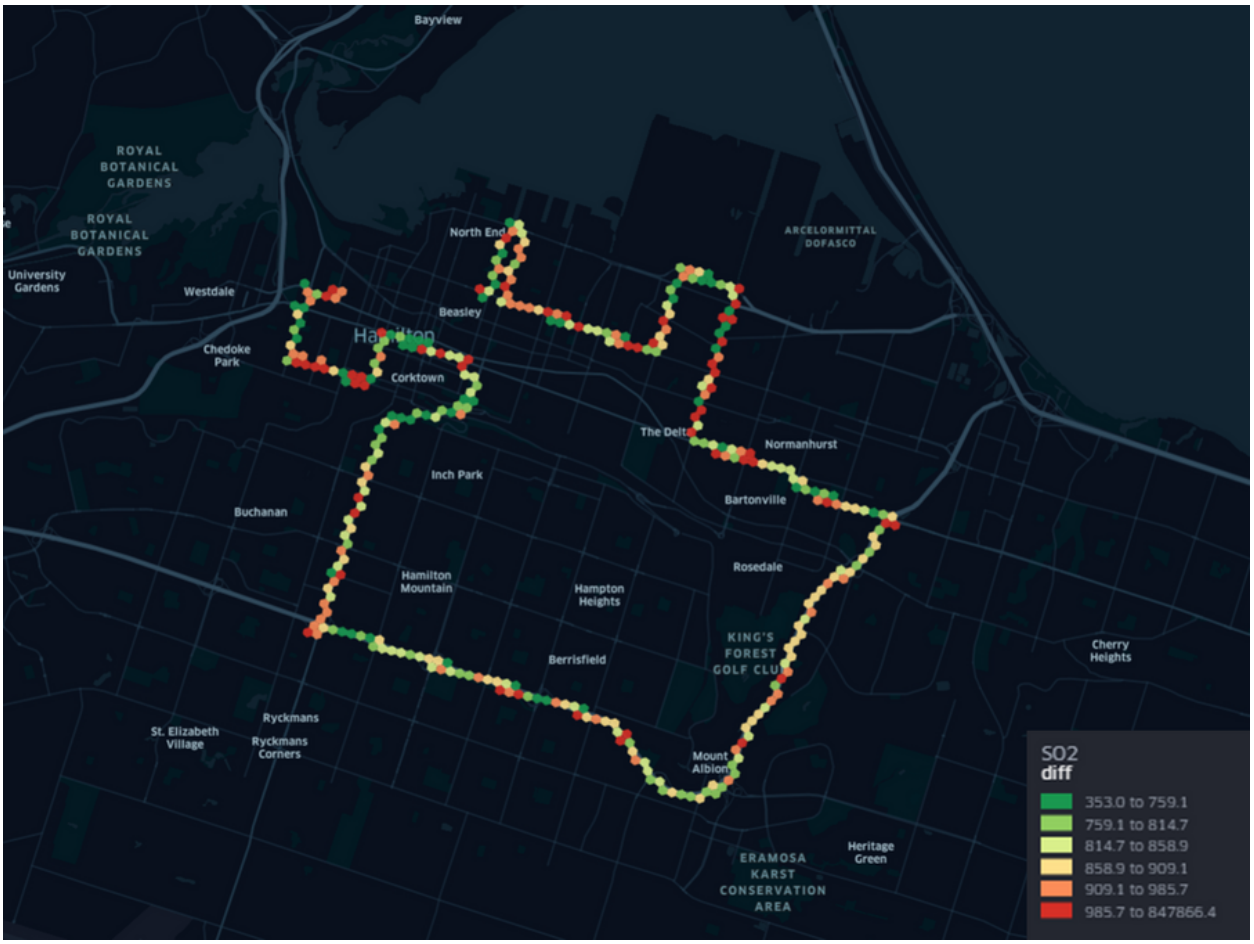
DATE	HOUR OF DAY	MEAN	MEDIAN	STD.DEV	MAX	MIN	CAAQS GREEN ZONE	CAAQS YELLOW ZONE	CAAQS ORANGE ZONE	CAAQS RED ZONE
2022-10-13	8	0.00	0.00	0.00	0.02	0.00	<=2	2.1-3	3.1-5	>5
2022-10-13	9	0.00	0.00	0.00	0.01	0.00	<=2	2.1-3	3.1-5	>5
2022-10-13	10	0.00	0.00	0.00	0.01	0.00	<=2	2.1-3	3.1-5	>5
2022-10-13	11	0.01	0.01	0.00	0.01	0.00	<=2	2.1-3	3.1-5	>5
2022-10-13	12	0.01	0.01	0.00	0.01	0.00	<=2	2.1-3	3.1-5	>5
2022-11-10	10	1.00	1.00	0.00	1.00	0.99	<=2	2.1-3	3.1-5	>5
2022-11-10	11	1.00	1.00	0.00	1.00	1.00	<=2	2.1-3	3.1-5	>5
2022-11-10	12	1.00	1.00	0.00	1.00	1.00	<=2	2.1-3	3.1-5	>5
2022-11-10	13	1.00	1.00	0.00	1.00	1.00	<=2	2.1-3	3.1-5	>5
2022-12-09	16	0.81	0.77	0.15	1.19	0.47	<=2	2.1-3	3.1-5	>5
2022-12-09	17	1.29	1.32	0.16	1.69	0.66	<=2	2.1-3	3.1-5	>5
2022-12-09	18	1.25	1.28	0.18	1.64	0.78	<=2	2.1-3	3.1-5	>5
2022-12-09	15	1.21	1.21	0.09	1.56	0.97	<=2	2.1-3	3.1-5	>5
2023-04-04	15	6.56	6.75	0.64	7.14	4.70	<=2	2.1-3	3.1-5	>5
2023-04-04	16	6.79	6.67	0.83	8.63	5.09	<=2	2.1-3	3.1-5	>5
2023-04-04	17	8.17	8.19	0.66	9.42	6.70	<=2	2.1-3	3.1-5	>5
2023-04-04	18	8.49	8.53	0.54	9.50	6.94	<=2	2.1-3	3.1-5	>5
2023-04-04	19	8.36	8.57	0.61	9.14	6.58	<=2	2.1-3	3.1-5	>5
2023-05-04	13	6.40	6.60	1.30	8.88	0.87	<=2	2.1-3	3.1-5	>5
2023-05-04	14	7.80	7.77	0.80	9.90	5.53	<=2	2.1-3	3.1-5	>5
2023-05-04	15	7.26	7.38	0.76	8.84	5.06	<=2	2.1-3	3.1-5	>5
2023-05-04	16	6.45	6.73	1.15	8.41	3.31	<=2	2.1-3	3.1-5	>5
2023-05-04	17	5.76	5.75	1.70	8.27	1.39	<=2	2.1-3	3.1-5	>5

POLLUTANT: SULPHUR DIOXIDE (SO2)

SPATIAL AVERAGE OF POLLUTANT OVER PHASES

PLEASE NOTE THAT COLORS ARE RELATIVE TO LIMITS.

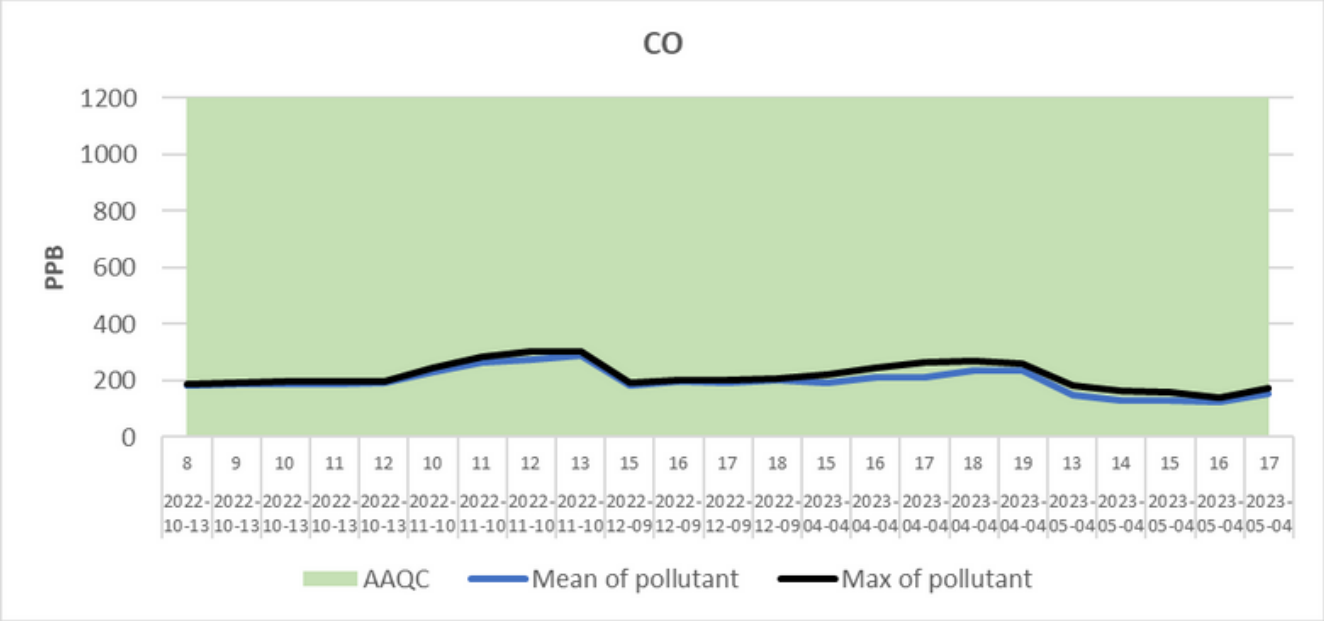
PERCENTAGE DIFFERENCE IN SPATIAL AVERAGE BETWEEN PHASES



PLEASE NOTE THAT COLORS ARE RELATIVE TO LIMITS.

POLLUTANT: CARBON MONOXIDE (CO)

TIME SERIES: HOURLY AVERAGE OF POLLUTANT OVER SCAN DAYS



TIME SERIES: HOURLY AVERAGE OF POLLUTANT OVER SCAN DAYS (TABULATED)

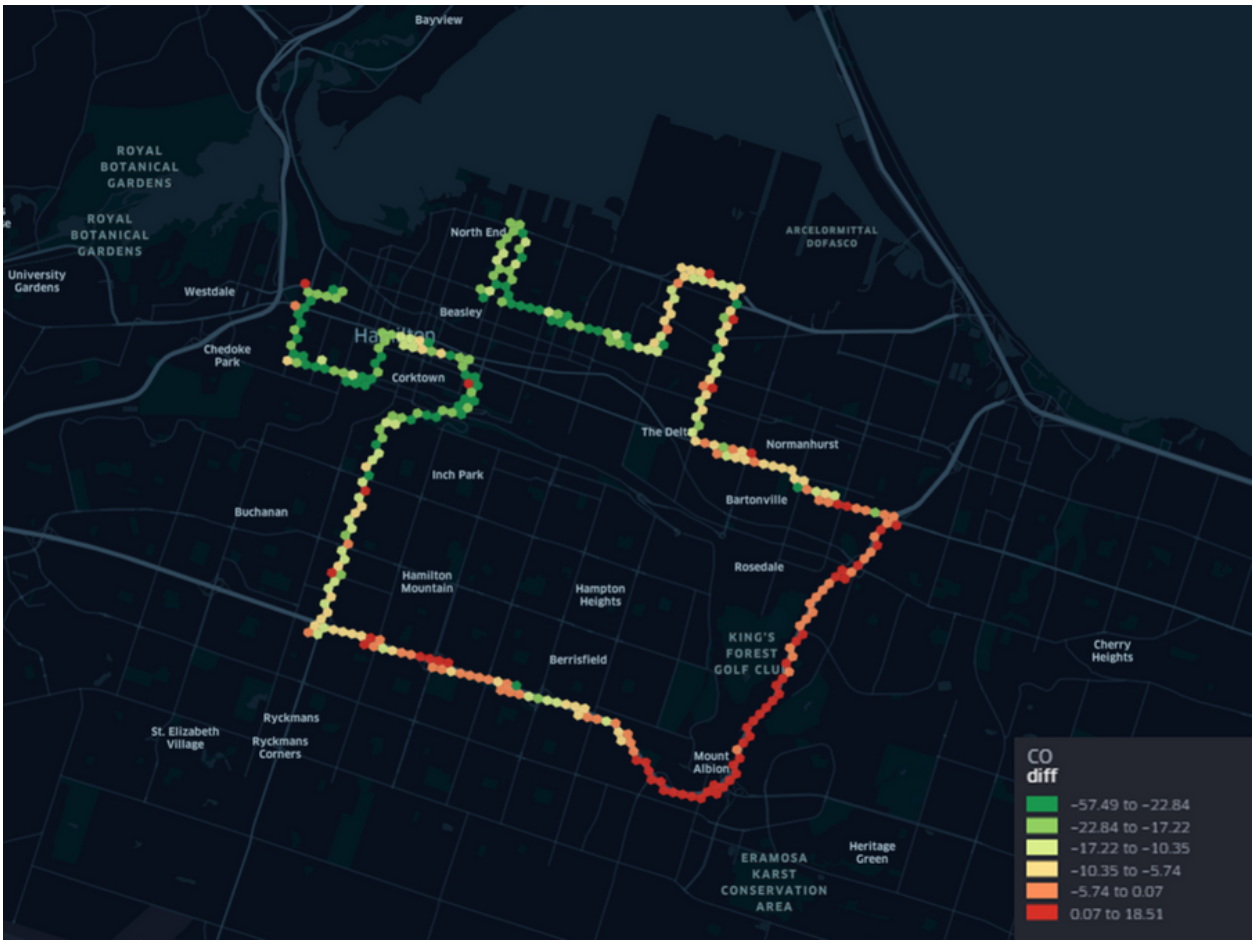
DATE	HOUR OF DAY	MEAN	MEDIAN	STD.DEV	MAX	MIN	AAQC GREEN ZONE
2022-10-13	8	182	183	3	186	176	30000
2022-10-13	9	186	186	4	193	177	30000
2022-10-13	10	187	187	4	195	179	30000
2022-10-13	11	187	188	4	195	178	30000
2022-10-13	12	194	195	2	199	190	30000
2022-11-10	10	231	232	7	245	216	30000
2022-11-10	11	264	265	14	286	235	30000
2022-11-10	12	275	275	15	301	240	30000
2022-11-10	13	290	293	11	305	264	30000
2022-12-09	15	182	181	5	194	170	30000
2022-12-09	16	197	199	4	204	180	30000
2022-12-09	17	194	195	7	203	180	30000
2022-12-09	18	200	200	3	205	192	30000
2023-04-04	15	193	196	11	222	176	30000
2023-04-04	16	212	215	20	246	163	30000
2023-04-04	17	214	212	15	265	188	30000
2023-04-04	18	236	236	13	272	215	30000
2023-04-04	19	237	236	11	258	218	30000
2023-05-04	13	148	147	18	182	100	30000
2023-05-04	14	129	127	16	164	100	30000
2023-05-04	15	128	128	15	158	102	30000
2023-05-04	16	125	128	10	140	101	30000
2023-05-04	17	152	160	17	174	120	30000

POLLUTANT: CARBON MONOXIDE (CO)

SPATIAL AVERAGE OF POLLUTANT OVER PHASES

PLEASE NOTE THAT COLORS ARE RELATIVE TO LIMITS.

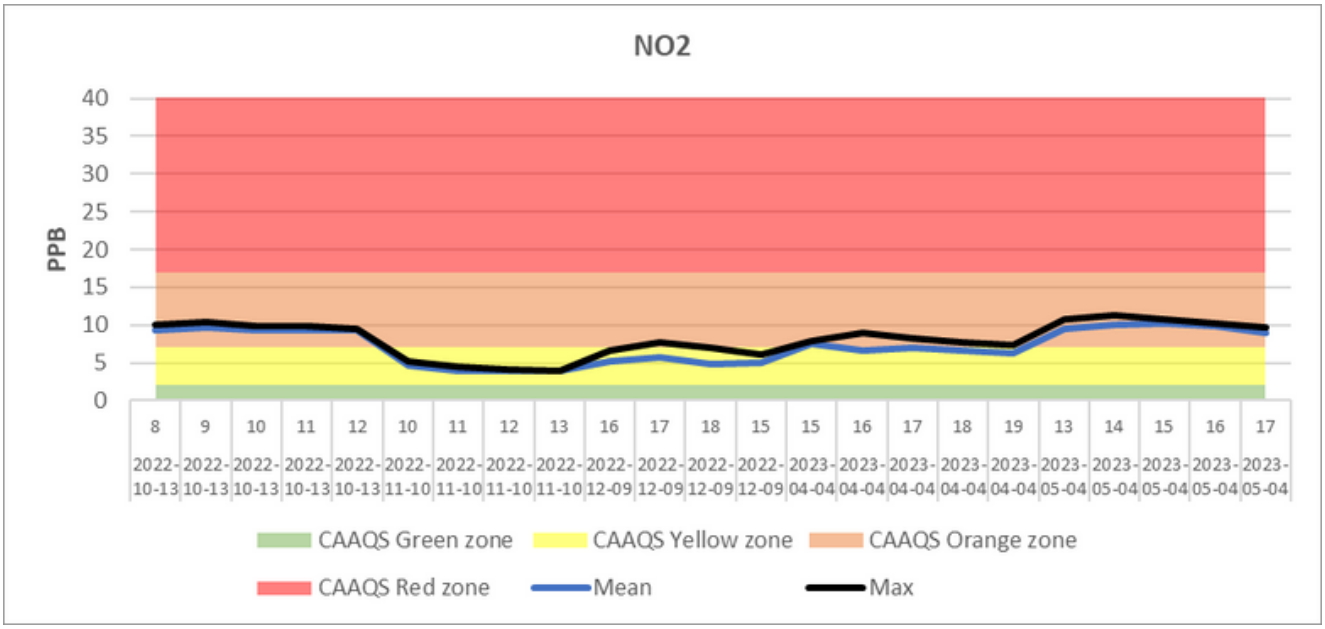
PERCENTAGE DIFFERENCE IN SPATIAL AVERAGE BETWEEN PHASES



PLEASE NOTE THAT COLORS ARE RELATIVE TO LIMITS.

POLLUTANT: NITROGEN DIOXIDE (NO2)

TIME SERIES: HOURLY AVERAGE OF POLLUTANT OVER SCAN DAYS

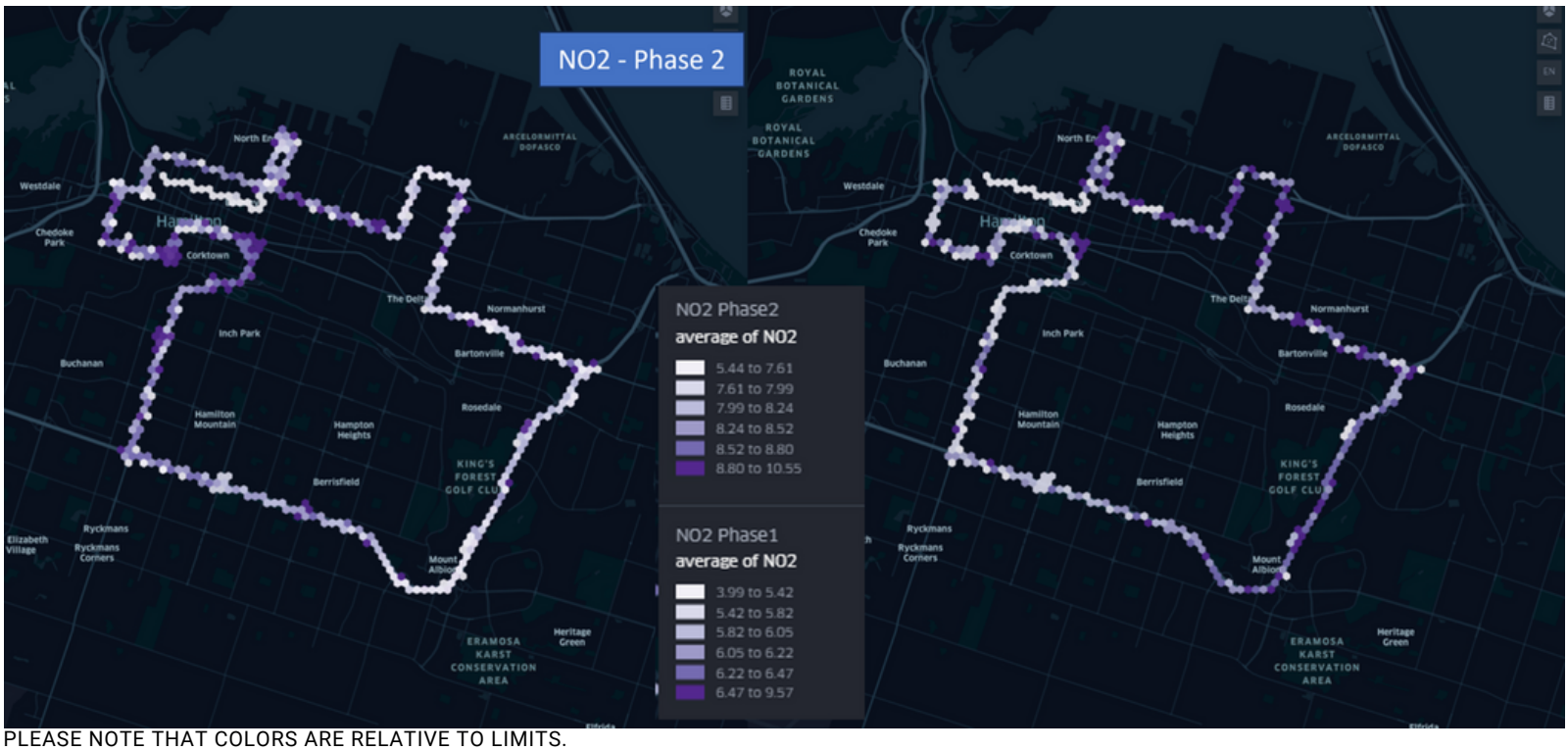


TIME SERIES: HOURLY AVERAGE OF POLLUTANT OVER SCAN DAYS (TABULATED)

DATE	HOUR OF DAY	MEAN	MEDIAN	STD.DEV	MAX	MIN	CAAQS GREEN ZONE	CAAQS YELLOW ZONE	CAAQS ORANGE ZONE	CAAQS RED ZONE
2022-10-13	8	9.3	9.2	0.3	10.1	8.9	<=2	2.1-7	7.1-17	>17
2022-10-13	9	9.6	9.6	0.3	10.3	8.9	<=2	2.1-7	7.1-17	>17
2022-10-13	10	9.3	9.4	0.2	9.8	8.5	<=2	2.1-7	7.1-17	>17
2022-10-13	11	9.4	9.5	0.3	9.8	8.6	<=2	2.1-7	7.1-17	>17
2022-10-13	12	9.3	9.3	0.2	9.6	8.9	<=2	2.1-7	7.1-17	>17
2022-11-10	10	4.7	4.6	0.2	5.1	4.1	<=2	2.1-7	7.1-17	>17
2022-11-10	11	4.0	4.0	0.1	4.4	4.0	<=2	2.1-7	7.1-17	>17
2022-11-10	12	4.0	4.0	0.0	4.2	4.0	<=2	2.1-7	7.1-17	>17
2022-11-10	13	4.0	4.0	0.0	4.0	4.0	<=2	2.1-7	7.1-17	>17
2022-12-09	16	5.1	5.1	0.4	6.6	4.2	<=2	2.1-7	7.1-17	>17
2022-12-09	17	5.8	5.8	0.8	7.6	4.2	<=2	2.1-7	7.1-17	>17
2022-12-09	18	4.8	5.0	0.6	7.0	4.2	<=2	2.1-7	7.1-17	>17
2022-12-09	15	4.9	5.0	0.6	6.1	4.2	<=2	2.1-7	7.1-17	>17
2023-04-04	15	7.5	7.5	0.3	7.8	6.5	<=2	2.1-7	7.1-17	>17
2023-04-04	16	6.7	6.7	1.0	8.9	4.7	<=2	2.1-7	7.1-17	>17
2023-04-04	17	7.1	7.0	0.4	8.2	6.3	<=2	2.1-7	7.1-17	>17
2023-04-04	18	6.7	6.6	0.5	7.8	5.4	<=2	2.1-7	7.1-17	>17
2023-04-04	19	6.4	6.3	0.5	7.4	5.1	<=2	2.1-7	7.1-17	>17
2023-05-04	13	9.5	9.5	0.4	10.8	8.0	<=2	2.1-7	7.1-17	>17
2023-05-04	14	10.1	10.0	0.4	11.3	9.5	<=2	2.1-7	7.1-17	>17
2023-05-04	15	10.2	10.1	0.3	10.8	9.4	<=2	2.1-7	7.1-17	>17
2023-05-04	16	9.9	9.9	0.2	10.3	9.4	<=2	2.1-7	7.1-17	>17
2023-05-04	17	9.0	9.0	0.3	9.6	8.5	<=2	2.1-7	7.1-17	>17

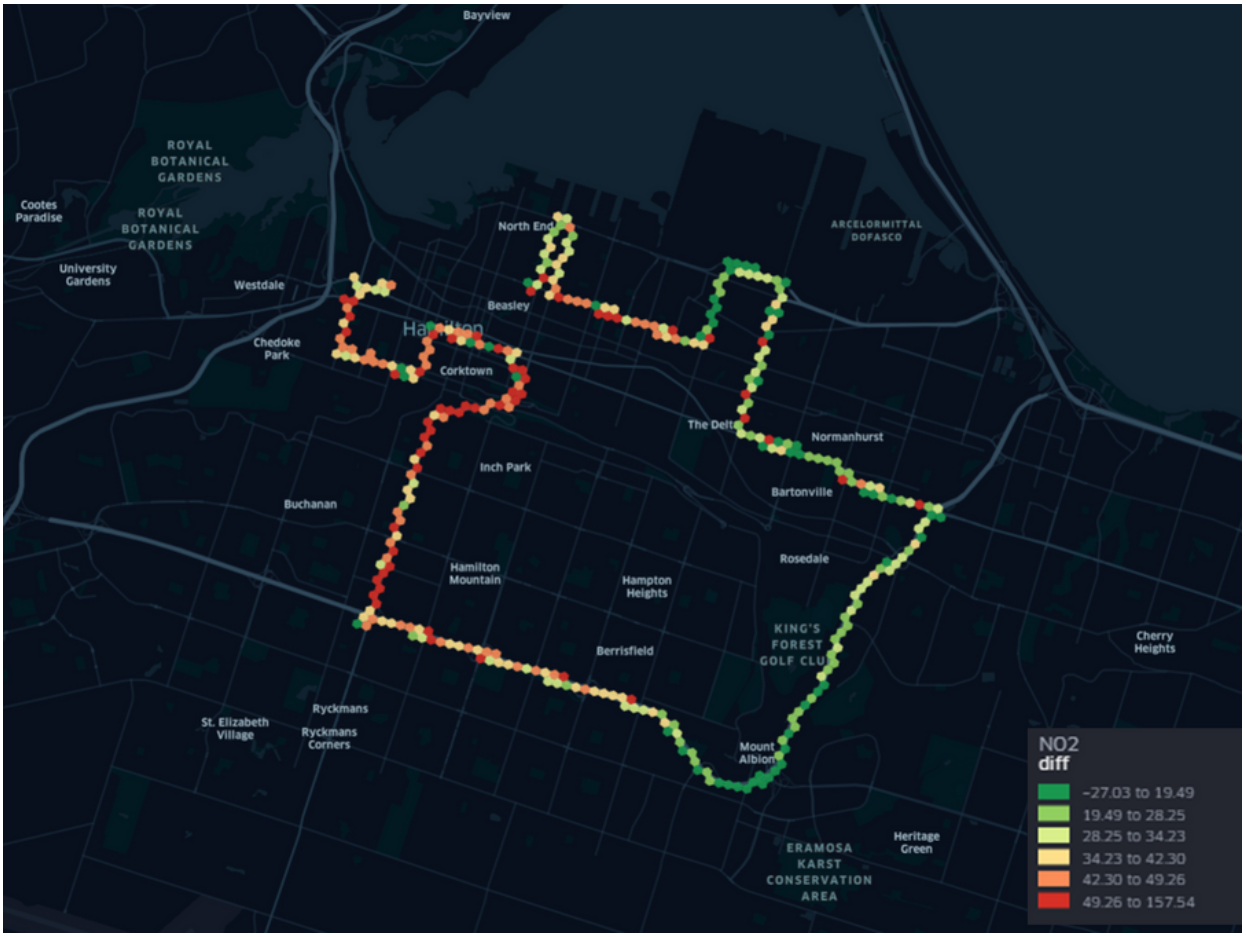
POLLUTANT: NITROGEN DIOXIDE (NO2)

SPATIAL AVERAGE OF POLLUTANT OVER PHASES



PLEASE NOTE THAT COLORS ARE RELATIVE TO LIMITS.

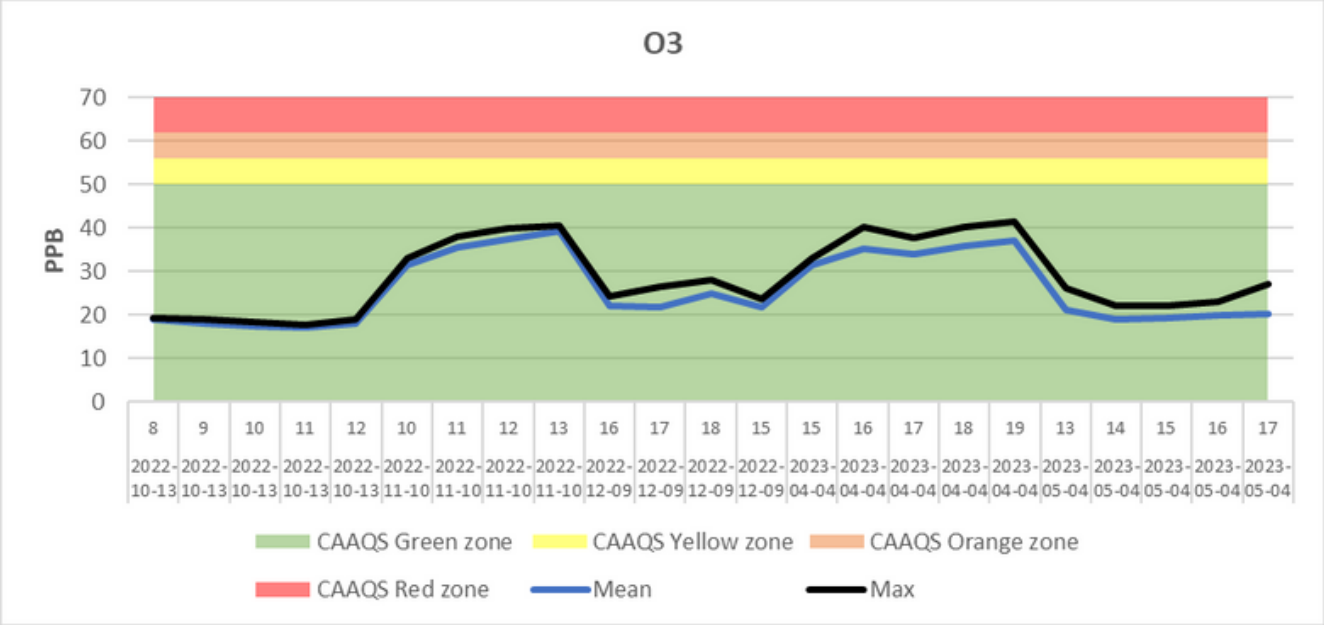
PERCENTAGE DIFFERENCE IN SPATIAL AVERAGE BETWEEN PHASES



PLEASE NOTE THAT COLORS ARE RELATIVE TO LIMITS.

POLLUTANT: OZONE (O3)

TIME SERIES: HOURLY AVERAGE OF POLLUTANT OVER SCAN DAYS



TIME SERIES: HOURLY AVERAGE OF POLLUTANT OVER SCAN DAYS (TABULATED)

DATE	HOUR OF DAY	MEAN	MEDIAN	STD.DEV	MAX	MIN	CAAQS GREEN ZONE	CAAQS YELLOW ZONE	CAAQS ORANGE ZONE	CAAQS RED ZONE
2022-10-13	8	19.1	19.1	0.1	19.3	18.7	<=50	50-56	57-62	>62
2022-10-13	9	18.1	18.1	0.4	19.1	17.4	<=50	50-56	57-62	>62
2022-10-13	10	17.3	17.1	0.4	18.4	17.1	<=50	50-56	57-62	>62
2022-10-13	11	17.2	17.1	0.2	17.8	17.1	<=50	50-56	57-62	>62
2022-10-13	12	17.9	17.9	0.2	18.9	17.6	<=50	50-56	57-62	>62
2022-11-10	10	31.5	31.4	0.6	32.9	30.2	<=50	50-56	57-62	>62
2022-11-10	11	35.5	35.8	1.3	37.9	32.1	<=50	50-56	57-62	>62
2022-11-10	12	37.5	37.5	1.1	39.8	34.0	<=50	50-56	57-62	>62
2022-11-10	13	39.4	39.6	0.7	40.6	37.8	<=50	50-56	57-62	>62
2022-12-09	16	22.0	22.1	0.8	24.2	20.2	<=50	50-56	57-62	>62
2022-12-09	17	21.8	21.5	1.1	26.4	20.1	<=50	50-56	57-62	>62
2022-12-09	18	25.0	25.0	0.8	27.9	23.1	<=50	50-56	57-62	>62
2022-12-09	15	21.7	21.6	0.8	23.6	20.7	<=50	50-56	57-62	>62
2023-04-04	15	31.4	31.6	1.1	33.0	26.5	<=50	50-56	57-62	>62
2023-04-04	16	35.1	35.9	3.6	40.4	28.0	<=50	50-56	57-62	>62
2023-04-04	17	34.1	34.2	1.7	37.8	29.9	<=50	50-56	57-62	>62
2023-04-04	18	35.8	36.3	2.0	40.3	32.4	<=50	50-56	57-62	>62
2023-04-04	19	37.1	37.5	1.7	41.5	33.6	<=50	50-56	57-62	>62
2023-05-04	13	21.1	21.0	2.3	26.1	17.1	<=50	50-56	57-62	>62
2023-05-04	14	19.1	19.2	1.2	22.0	16.2	<=50	50-56	57-62	>62
2023-05-04	15	19.3	19.6	1.0	22.1	16.9	<=50	50-56	57-62	>62
2023-05-04	16	20.0	19.1	1.5	23.2	17.5	<=50	50-56	57-62	>62
2023-05-04	17	20.3	19.9	3.6	27.2	13.9	<=50	50-56	57-62	>62

POLLUTANT: OZONE (O3)

SPATIAL AVERAGE OF POLLUTANT OVER PHASES

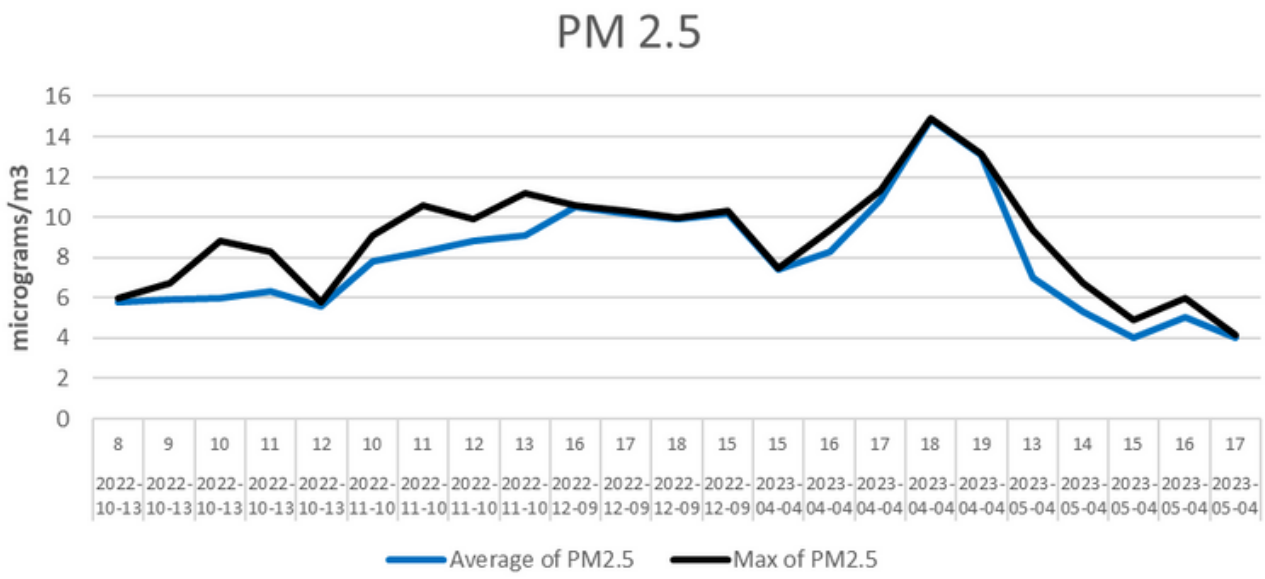
PLEASE NOTE THAT COLORS ARE RELATIVE TO LIMITS.

PERCENTAGE DIFFERENCE IN SPATIAL AVERAGE BETWEEN PHASES

PLEASE NOTE THAT COLORS ARE RELATIVE TO LIMITS.

POLLUTANT: PARTICULATE MATTER (PM 2.5)

TIME SERIES: HOURLY AVERAGE OF POLLUTANT OVER SCAN DAYS



TIME SERIES: HOURLY AVERAGE OF POLLUTANT OVER SCAN DAYS (TABULATED)

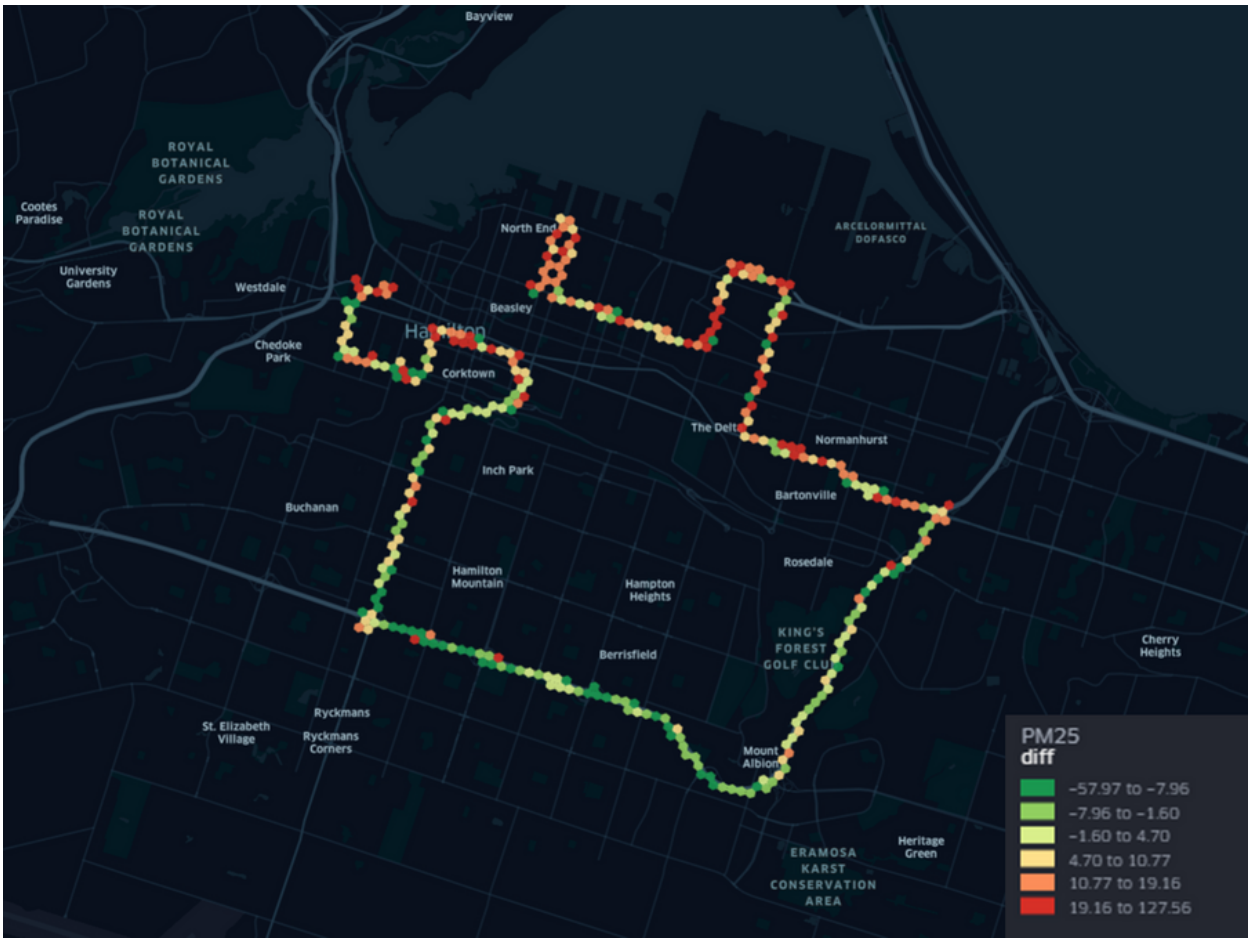
DATE	HOUR OF DAY	MEAN	MEDIAN	STD.DEV	MAX	MIN
2022-10-13	8	5.8	5.8	0.1	6.0	5.8
2022-10-13	9	5.9	5.9	0.3	6.7	5.4
2022-10-13	10	6.0	6.0	0.6	8.8	5.2
2022-10-13	11	6.3	6.3	0.5	8.3	5.4
2022-10-13	12	5.6	5.6	0.1	5.8	5.4
2022-11-10	10	7.8	7.8	0.2	9.1	7.6
2022-11-10	11	8.3	8.3	0.3	10.6	8.0
2022-11-10	12	8.8	8.8	0.2	9.9	8.4
2022-11-10	13	9.1	9.1	0.3	11.2	8.7
2022-12-09	16	10.5	10.5	0.1	10.6	10.3
2022-12-09	17	10.2	10.2	0.2	10.3	6.7
2022-12-09	18	9.9	9.9	0.1	10.0	9.7
2022-12-09	15	10.2	10.2	0.1	10.3	9.0
2023-04-04	15	7.4	7.4	0.0	7.5	7.4
2023-04-04	16	8.3	8.3	0.1	9.4	8.1
2023-04-04	17	10.8	10.8	0.1	11.3	10.7
2023-04-04	18	14.9	14.9	0.0	14.9	14.8
2023-04-04	19	13.1	13.1	0.0	13.1	13.1
2023-05-04	13	7.0	6.9	0.2	9.4	6.8
2023-05-04	14	5.3	5.2	0.2	6.7	5.0
2023-05-04	15	4.0	4.0	0.2	4.9	3.8
2023-05-04	16	5.0	5.0	0.2	6.0	4.9
2023-05-04	17	4.0	4.0	0.1	4.1	3.9

POLLUTANT: PARTICULATE MATTER (PM 2.5)

SPATIAL AVERAGE OF POLLUTANT OVER PHASES

PLEASE NOTE THAT COLORS ARE RELATIVE TO LIMITS.

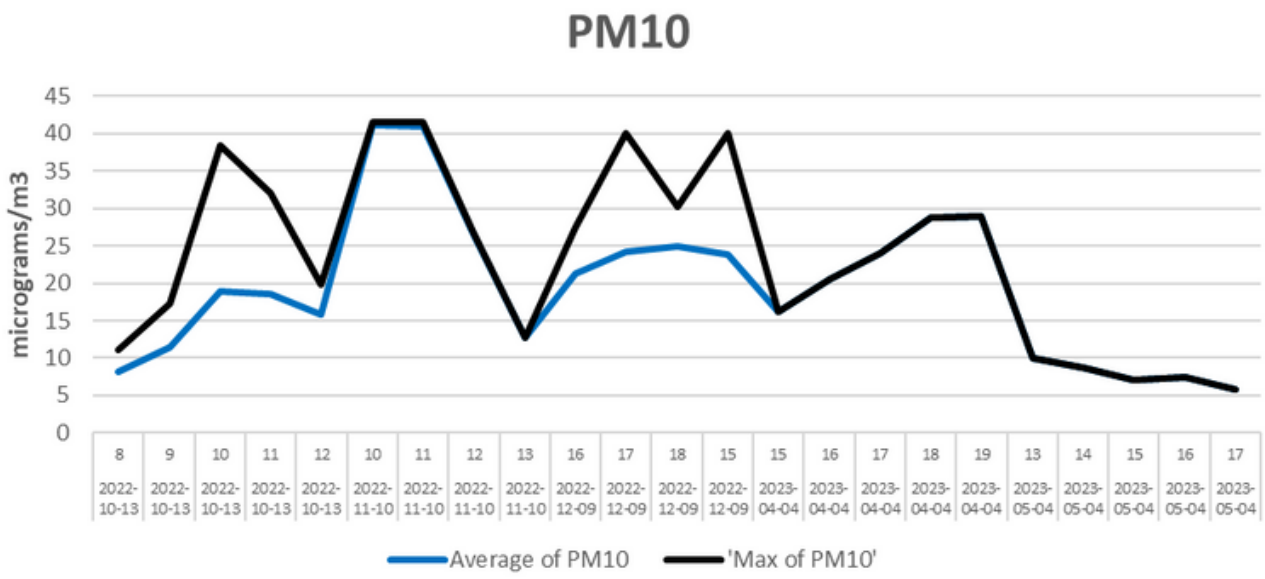
PERCENTAGE DIFFERENCE IN SPATIAL AVERAGE BETWEEN PHASES



PLEASE NOTE THAT COLORS ARE RELATIVE TO LIMITS.

POLLUTANT: PARTICULATE MATTER (PM 10)

TIME SERIES: HOURLY AVERAGE OF POLLUTANT OVER SCAN DAYS

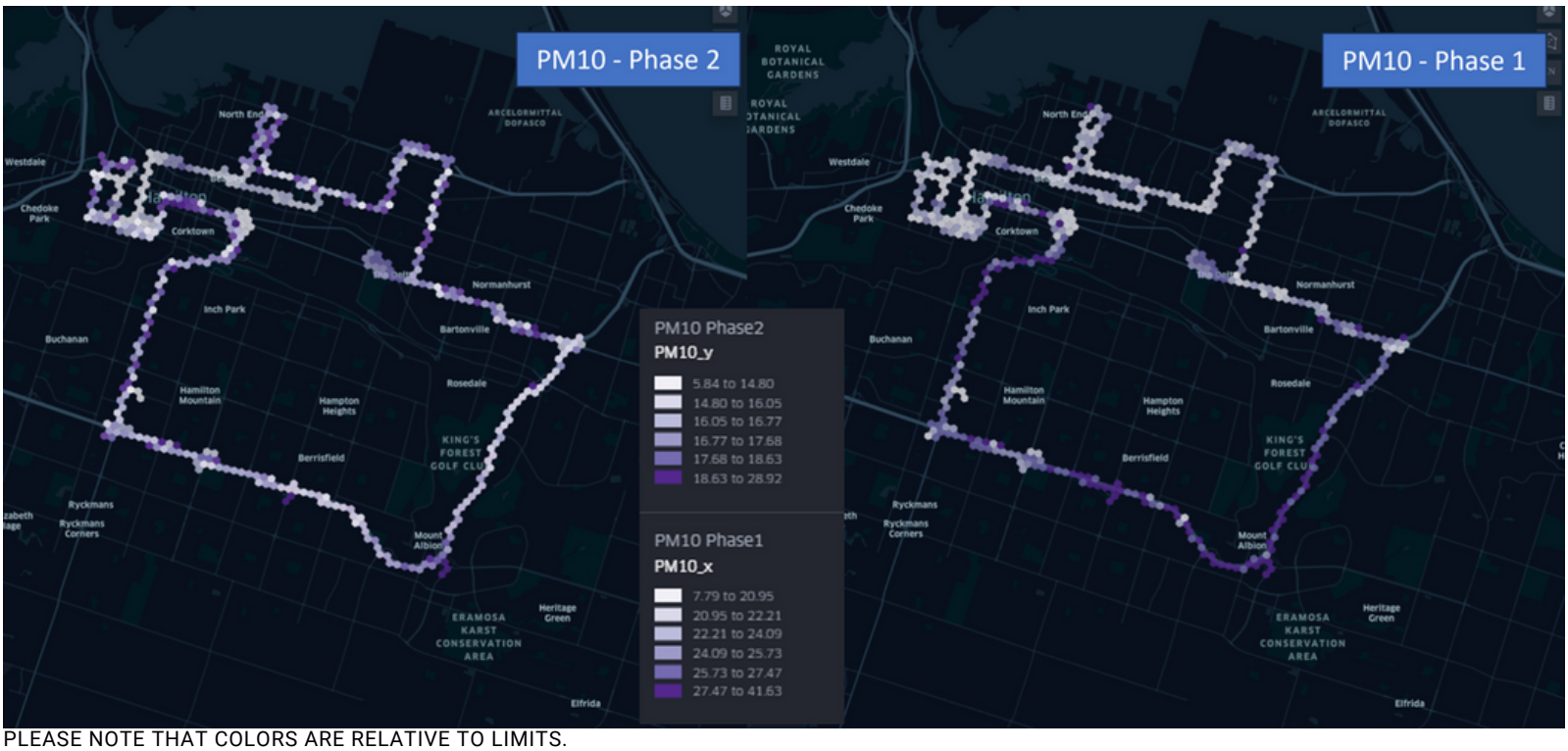


TIME SERIES: HOURLY AVERAGE OF POLLUTANT OVER SCAN DAYS (TABULATED)

DATE	HOUR OF DAY	MEAN	MEDIAN	STD.DEV	MAX	MIN
2022-10-13	8	8.1	8.1	0.9	11.1	6.8
2022-10-13	9	11.5	11.5	1.8	17.2	7.8
2022-10-13	10	19.0	19.0	4.4	38.4	13.3
2022-10-13	11	18.5	18.5	3.4	32.1	11.6
2022-10-13	12	15.8	15.8	1.7	19.9	12.7
2022-11-10	10	41.1	41.1	0.9	41.6	38.0
2022-11-10	11	41.0	41.0	1.1	41.6	37.3
2022-11-10	12	26.6	26.6	0.5	26.7	22.6
2022-11-10	13	12.7	12.7	0.2	12.8	11.3
2022-12-09	16	21.2	21.2	1.9	27.4	18.5
2022-12-09	17	24.2	24.2	3.7	40.1	21.0
2022-12-09	18	25.0	25.0	1.2	30.2	22.9
2022-12-09	15	23.8	23.8	3.5	40.0	20.3
2023-04-04	15	16.2	16.2	0.0	16.2	16.2
2023-04-04	16	20.6	20.6	0.0	20.6	20.6
2023-04-04	17	24.0	24.0	0.0	24.0	24.0
2023-04-04	18	28.7	28.7	0.0	28.7	28.7
2023-04-04	19	28.9	28.9	0.0	29.0	28.9
2023-05-04	13	9.9	9.9	0.0	9.9	9.9
2023-05-04	14	8.7	8.7	0.0	8.7	8.7
2023-05-04	15	7.1	7.1	0.0	7.1	7.1
2023-05-04	16	7.4	7.4	0.0	7.4	7.4
2023-05-04	17	5.8	5.8	0.0	5.8	5.8

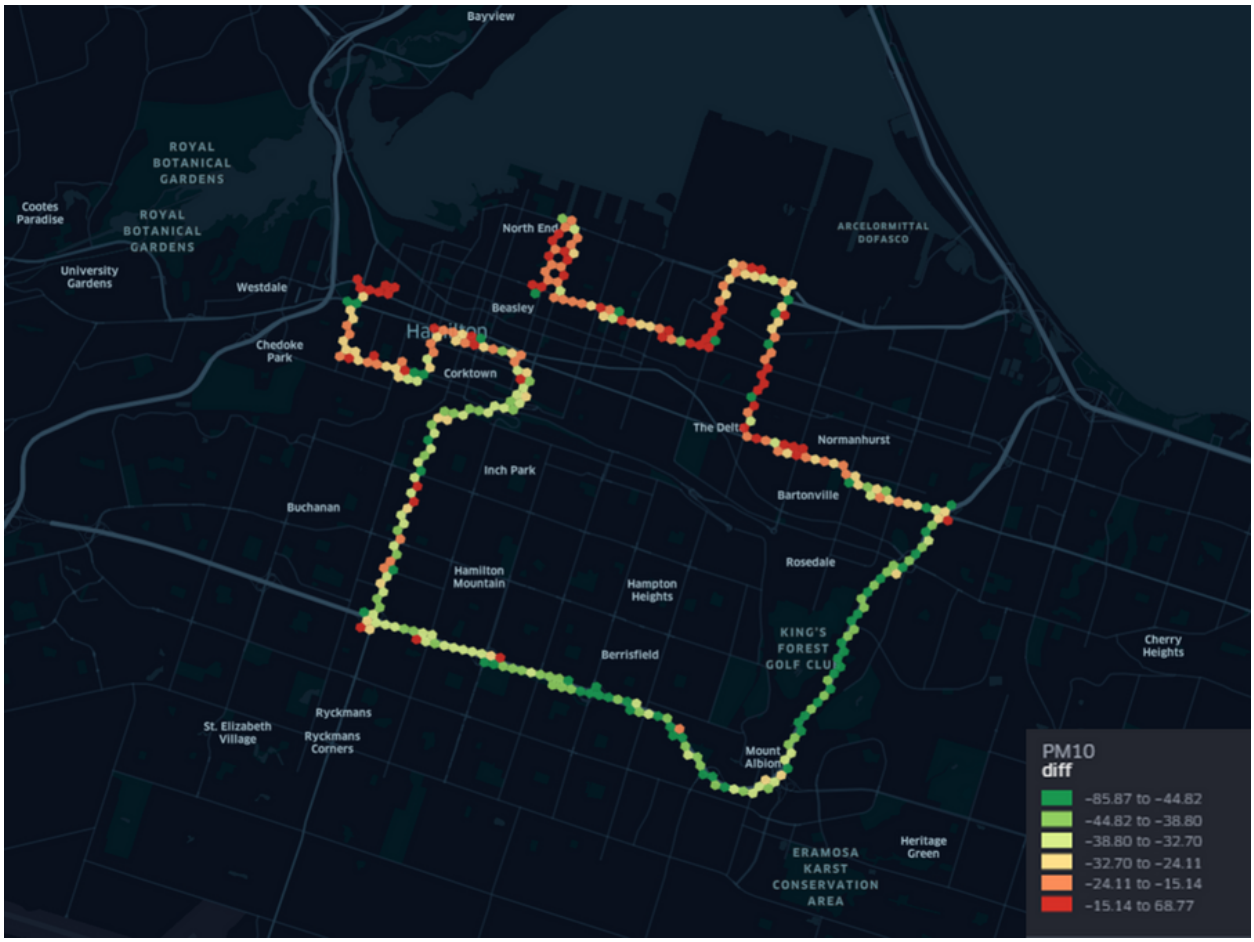
POLLUTANT: PARTICULATE MATTER (PM 10)

SPATIAL AVERAGE OF POLLUTANT OVER PHASES



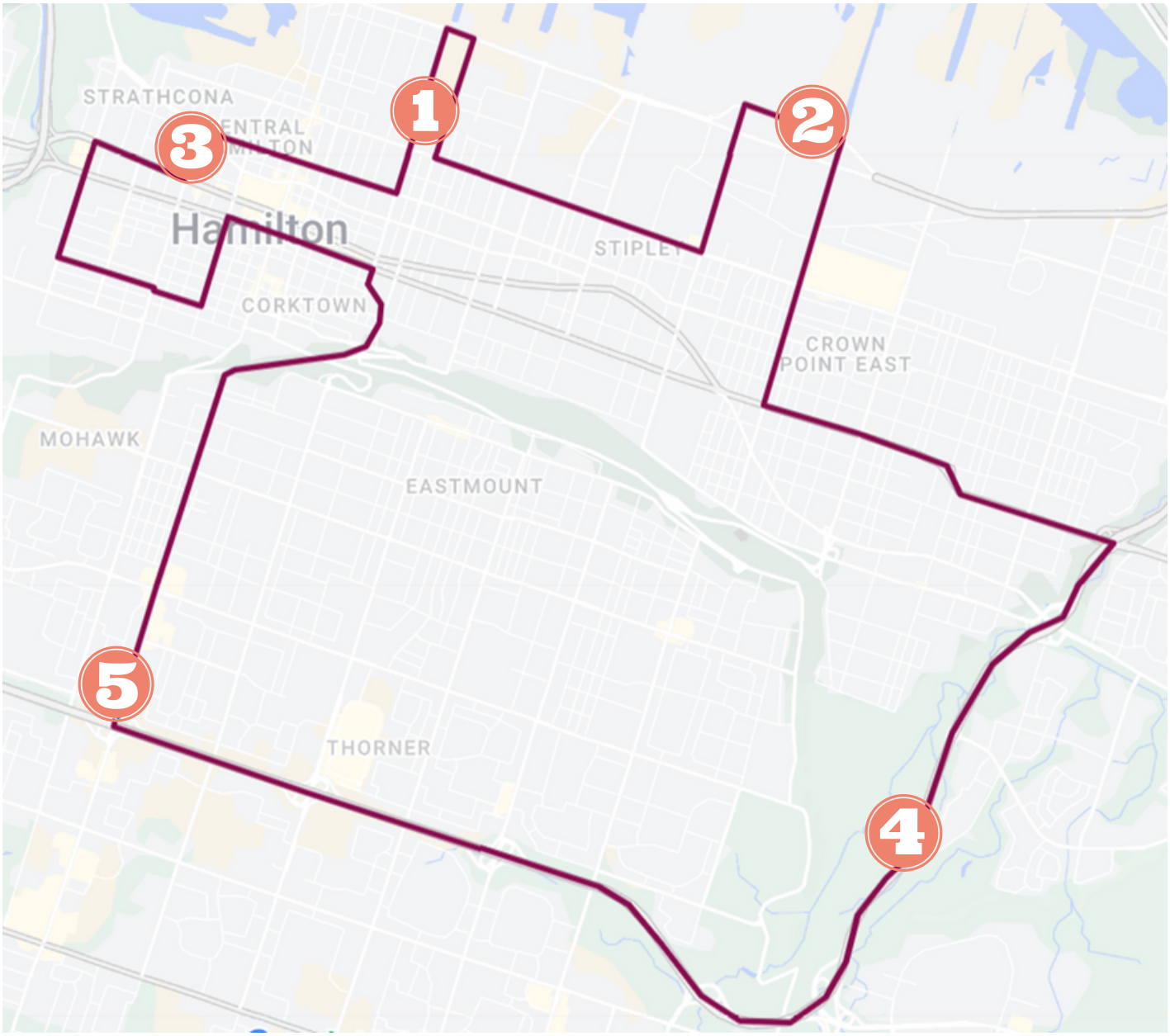
PLEASE NOTE THAT COLORS ARE RELATIVE TO LIMITS.

PERCENTAGE DIFFERENCE IN SPATIAL AVERAGE BETWEEN PHASES



PLEASE NOTE THAT COLORS ARE RELATIVE TO LIMITS.

INSIGHTS – POINTS OF INTEREST



INSIGHTS – POINTS OF INTEREST

This section details the mean gas concentration levels at 5 identified points of interest on each scan day compared with the mean gas concentration for the overall scan.

1.HAMILTON GENERAL HOSPITAL
Chosen as a point of interest due to nature of sensitivity to air quality. Hospitals having a higher concentration of individuals with health vulnerabilities, such as patients with respiratory conditions, weakened immune systems, and other illnesses.

2.INDUSTRIAL SECTOR (CLOSE TO ARCELORMITTAL DOFASCO)
Chosen due to the fact that the industrial sector is a major source of pollutants in the City of Hamilton.

3.KING ST. W & QUEEN ST. N
This location is the physcial intersection at which max restrictions of truck by size is implemented.

4.RED HILL VALLEY PKWY (NEAR GLEN CASTLE PARK)
This locations was chosen as it is expected to have increased volume of trucks in phase 2 and due to the physcial location on the point on an inclined road where there is higher emissions from heavy vehicles including trucks due to acceleration uphill and braking downhill.

5.UPPER JAMES ST. & LINC. PKWY
This locations was chosen as it is expected to have the most impact in terms of increased volume of trucks in phase 2. It is an existing major intersection that is expected to hangle signficantly higher number of vehicles on a daily basis in phase 2 comapred to phase 1.

INSIGHTS – POINTS OF INTEREST

POLLUTANT: SULPHUR DIOXIDE (SO2)

	Phase 1	Phase 2	% Change from Phase 1 to Phase 2
Hamilton General hospital	0.8	7.3	+857%
Industrial sector	0.7	6.7	+811%
King & Queen	0.8	8.0	+939%
Red Hill valley pkwy	0.8	7.7	+911%
Upper James & Linc. pkwy	0.7	8.3	+1074%
Overall Scan	**0.7**	**7.2**	**+899%**

POLLUTANT: CARBON MONOXIDE (CO)

Location	Phase 1	Phase 2	% Change from Phase 1 to Phase 2
Hamilton General hospital	222.8	172.6	-23%
Industrial sector	217.4	186.1	-14%
King & Queen	221.5	170.6	-23%
Red Hill valley pkwy	218.3	175.3	-20%
Upper James & Linc. pkwy	209.3	182.6	-13%
Overall Scan	**215.3**	**177.5**	**-18%**

POLLUTANT: NITROGEN DIOXIDE (NO2)

	Phase 1	Phase 2	% Change from Phase 1 to Phase 2
Hamilton General hospital	6.2	8.4	+36%
Industrial sector	6.1	7.8	+28%
King & Queen	6.1	8.5	+39%
Red Hill valley pkwy	6.2	8.4	+35%
Upper James & Linc. pkwy	6.3	8.7	+37%
Overall Scan	**6.2**	**8.3**	**+33%**

INSIGHTS – POINTS OF INTEREST

POLLUTANT: OZONE (O3)

	Phase 1	Phase 2	% Change from Phase 1 to Phase 2
Hamilton General hospital	26.0	27.7	+6%
Industrial sector	25.8	29.4	+14%
King & Queen	26.1	27.0	+4%
Red Hill valley pkwy	25.5	27.4	+7%
Upper James & Linc. pkwy	24.8	26.1	+5%
Overall Scan	**25.5**	**27.3**	**+7%**

POLLUTANT: PARTICULATE MATTER (PM 2.5)

Location	Phase 1	Phase 2	% Change from Phase 1 to Phase 2
Hamilton General hospital	8.3	8.7	+5%
Industrial sector	8.3	8.7	+5%
King & Queen	8.1	8.6	+7%
Red Hill valley pkwy	8.2	8.9	+8%
Upper James & Linc. pkwy	8.3	7.8	-6%
Overall Scan	**8.2**	**8.0**	**-3%**

POLLUTANT: PARTICULATE MATTER (PM 10)

Location	Phase 1	Phase 2	% Decrease from Phase 1 to Phase 2
Hamilton General hospital	21.6	17.4	-20%
Industrial sector	24.9	16.7	-33%
King & Queen	22.3	17.4	-22%
Red Hill valley pkwy	22.1	17.3	-22%
Upper James & Linc. pkwy	25.9	15.9	-38%
Overall Scan	**23.7**	**15.7**	**-34%**

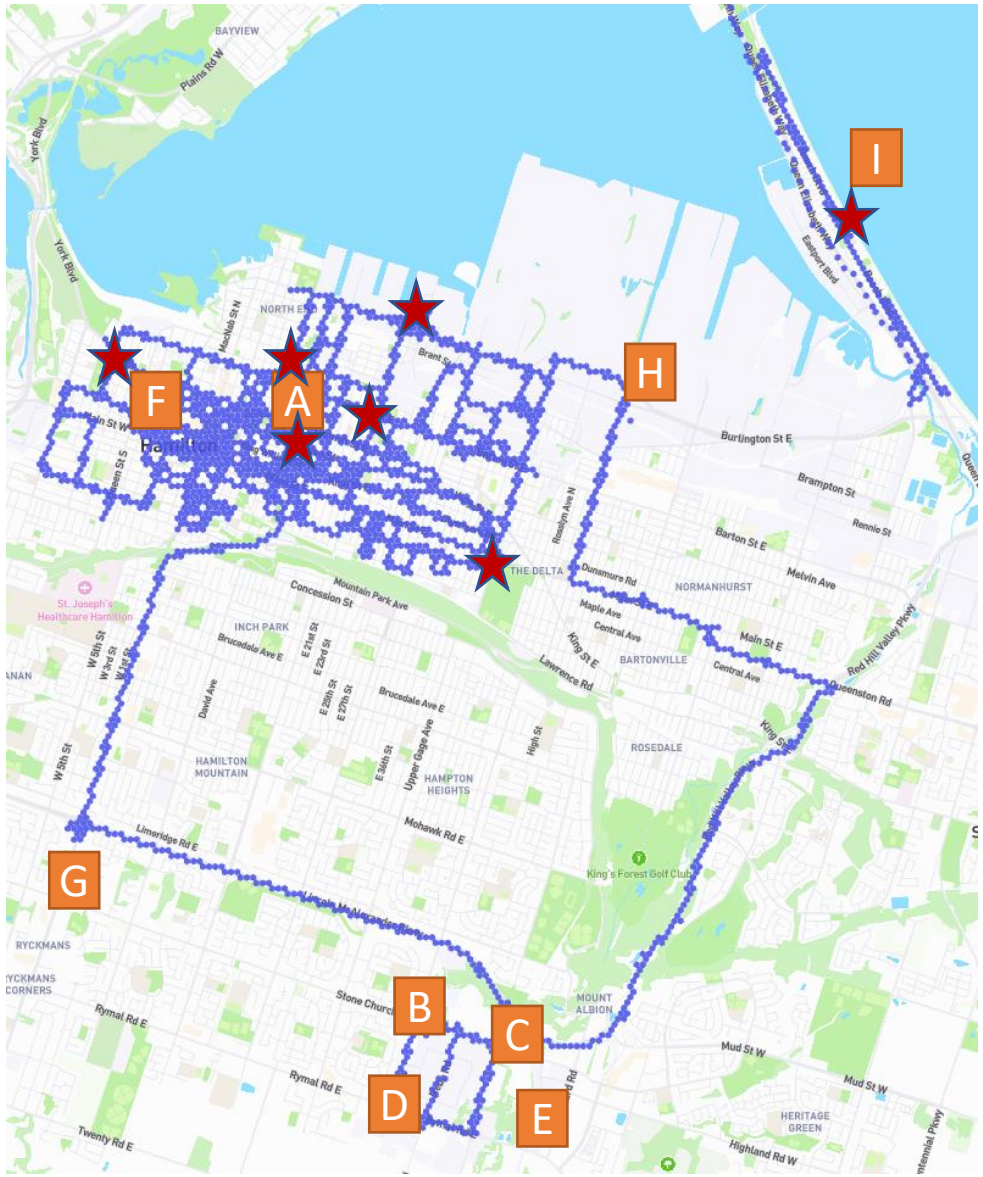
High level analysis for SO2 spikes in the City of Hamilton (2012-Present)

eco system informatics inc.

Background

- ESI is an AI-powered Air Quality monitoring company that has worked with several partners in the City of Hamilton from December 2021-Present.
- During this period, ESI has measured pollutant levels in ambient air in several different locations within the City of Hamilton and has also worked to analyze MECP data (as part of internal benchmarking and demonstration of ESI data accuracy).
- ESI's analysis showed noticeable spikes in Sulphur Dioxide(SO2) and Nitrogen Dioxide (NO2) over several different days during 2022.
- The readings were significantly outside the Ontario Ambient Air Quality guideline levels and such readings often continued for several hours at a time (and on consecutive days as well in a few instances).
- Post discussing these findings with clients from and closely connected to the City of Hamilton, the common understanding is that there is a need to understand this further, to look deeper into the findings and to understand the sources and the sinks of the pollutants.

The Next few slides present a bird's eye view of findings from ESIs data over the last year and analysis of historical MECP data going back to 2012.



Overview of ESI's presence in Hamilton

#	Type of Data	Location/Route	Timeline of availability
A	Continuous	Beasley Park	Dec2021-Dec2022
B,C,D	Continuous	Rymal Rd E & Upper Ottawa St. Upper Ottawa St. & Stone Church Rd E Rymal Rd E & Dartnall Rd	July2022-Nov2022
E	Mobile Scans	Rymal Rd East – CUBIC McMaster	July2022-Nov2022
F	Mobile Scans	Downtown core –Public Health	Dec2021-May2022
G	Mobile Scans	Extended Study Area – Transportation Planning	Oct2022-Dec2022
H	Mobile Scans	Truck Route-CITM	Feb2022-May2022
I	Mobile Scans	Beach Blvd-CITM	Oct2022-Nov2022

★ SO2 Hotspot

(Locations where ESI measured data found significantly high readings for SO2 levels. ESI measured data over timelines specified above)

Analysis includes

- Sulphur Dioxide MECP – Hamilton Downtown station data from 2012-2022.
  - Yearly number of hours with SO2 concentration >= 40 PPB (Parts Per Billion).
  - For 2021 and 2022, a monthly look at the number of hours with SO2 concentration >= 40 PPB.
- ESI data from May 2022
  - ESI mobile scan data from 2 scan-days in May 2022.
  - ESI fixed unit data (located in Beasley park) from May 2022.
- Benchmarked against Ontario Ambient Air Quality Criteria for SO2
  - 10 minutes AAQC Assesses protection against acute effects = 67 PPB
  - 1-hour AAQC Assesses protection against acute effects = 40 PPB
  - Annual AAQC Assesses protection against chronic effects = 4 PPB

Observations from MECP Station – Hamilton Downtown

11%

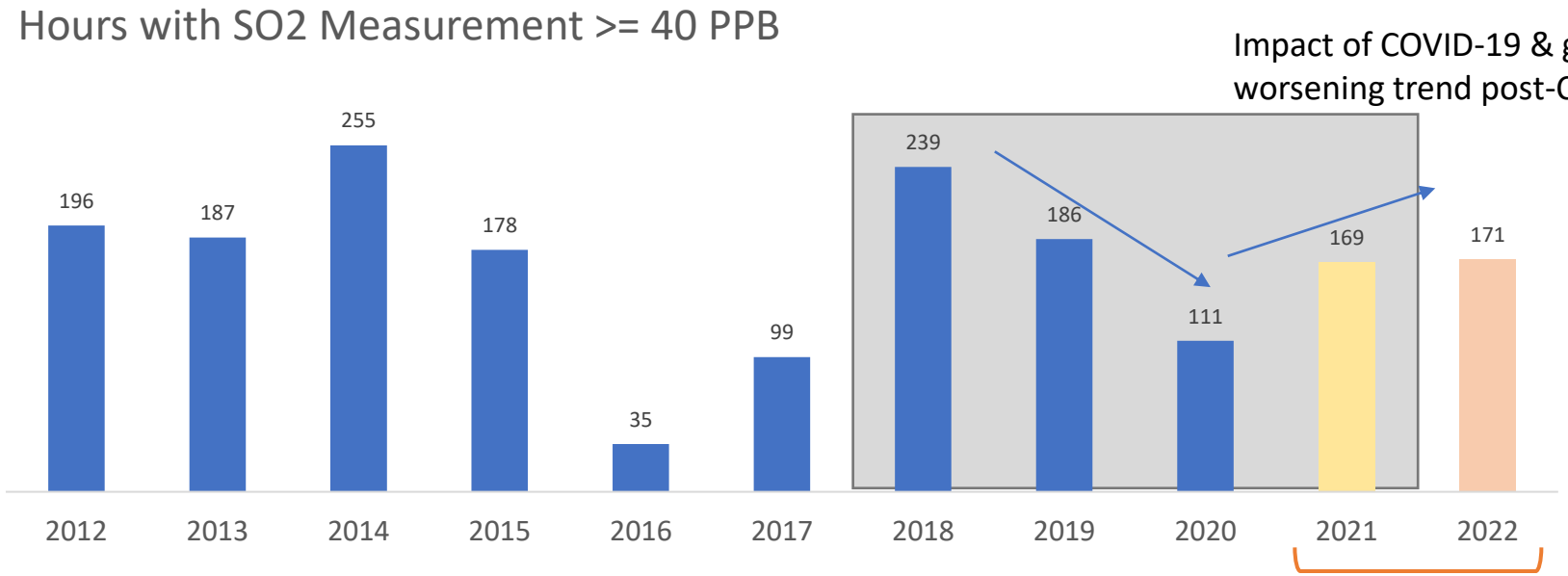
Percentage of time in May 2022 during which SO2 concentration in ambient air was >= 40 PPB.

This level of SO2 is so bad that even short-term exposure can cause severe human health effects.

Ontario's Ambient Air Quality Criteria for SO2

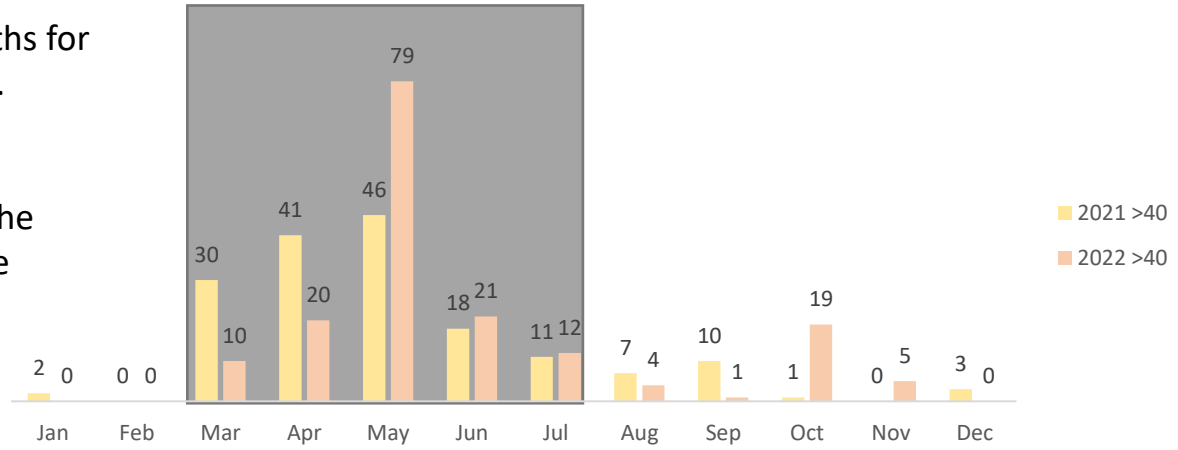
SO2
40 PPB

1-hour AAQC
Assesses protection against acute effect to human health



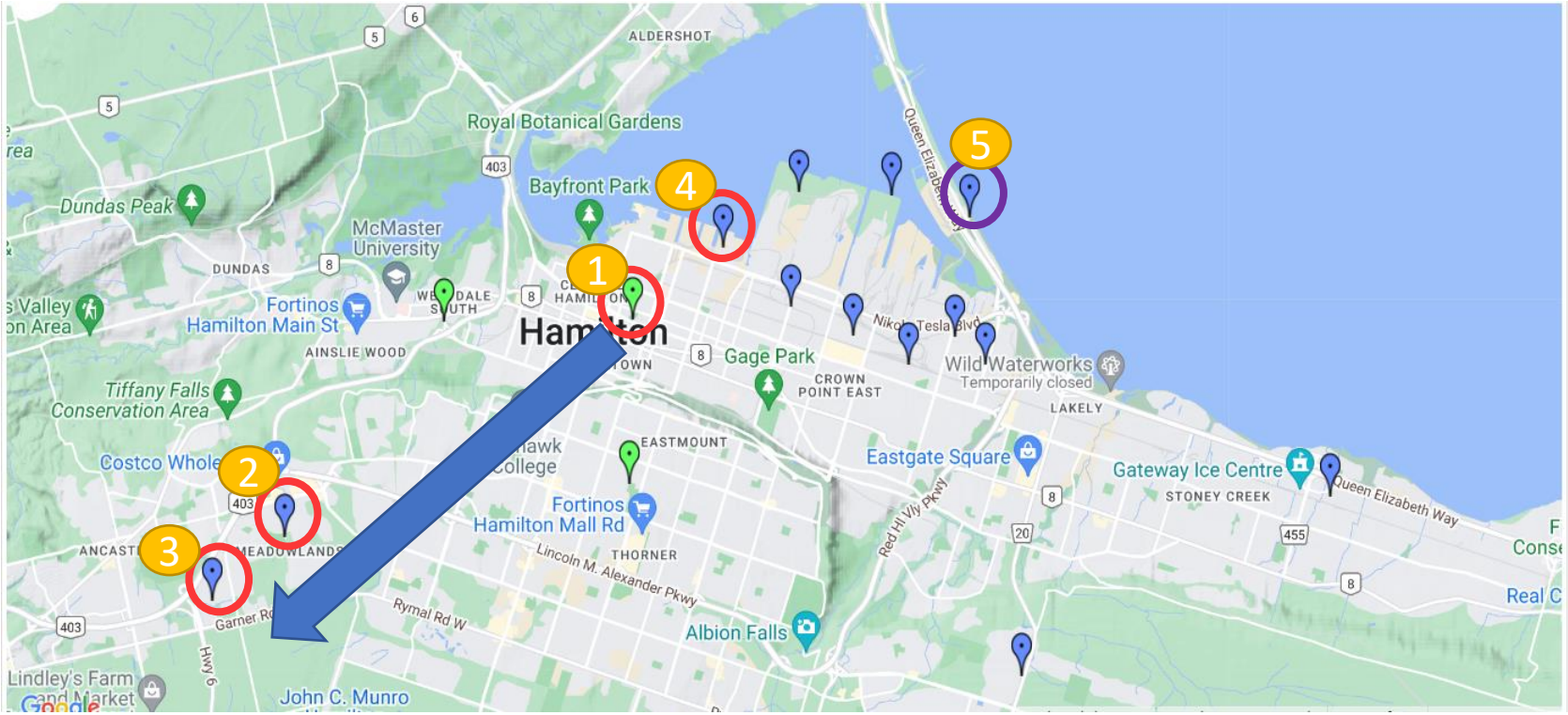
March to July are the worst months for SO2 concentration in ambient air.

In 2022, 83% of hours with concentration >=40PPB were in the months of May-June. In 2021, the number was 86%



Hamilton – Air Quality Stations – 2022 Daily Average SO2 Concentration

- Stations 1,2 and 3 showed similar daily average SO2 concentration trends and there is also a noticeable reduction in concentration level from station 1 to 3 showing a dispersion over distance. This is supported by the wind direction trend.
- Station 5 shows a substantially different trend than all the other stations and warrants further investigation.
- Station 4 shows a trend weakly similar to station 1,2 and 3.



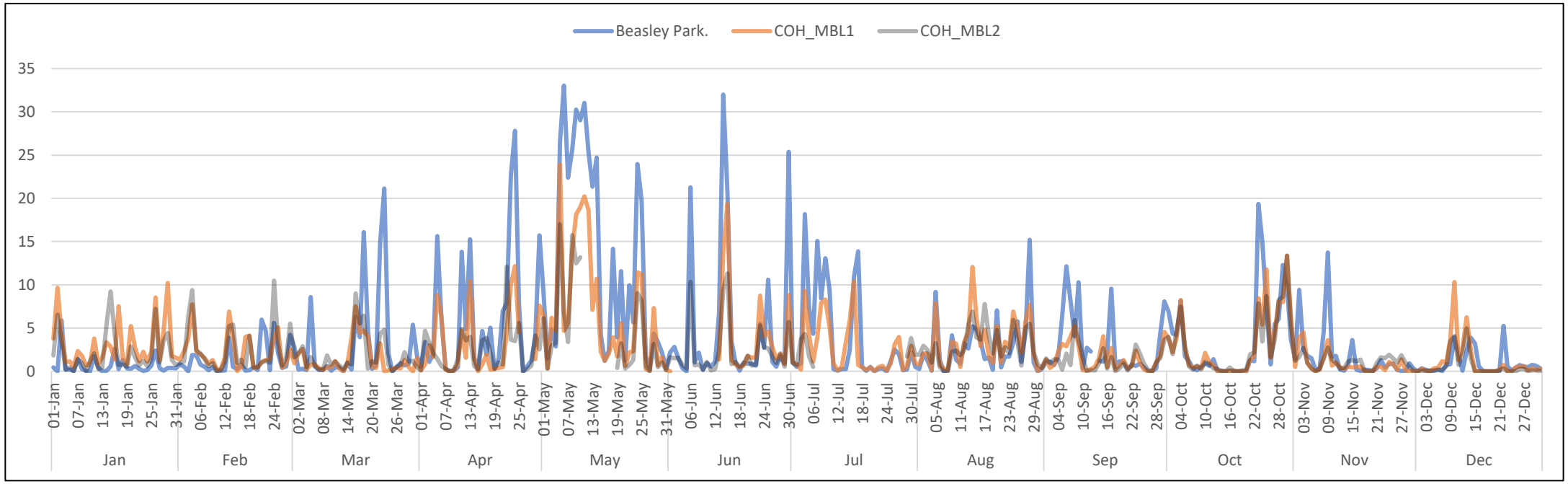
1	MECP Station – Beasley Park
2	COH_MBL1 (Meadowlands Park, Ancaster)
3	COH_MBL2 (Bookjans Park, Ancaster)
4	HAMN STN29567 – Niagara/Land St
5	HAMN STN2102 – Beach Blvd

2022 observations from Hamilton Air Quality Stations

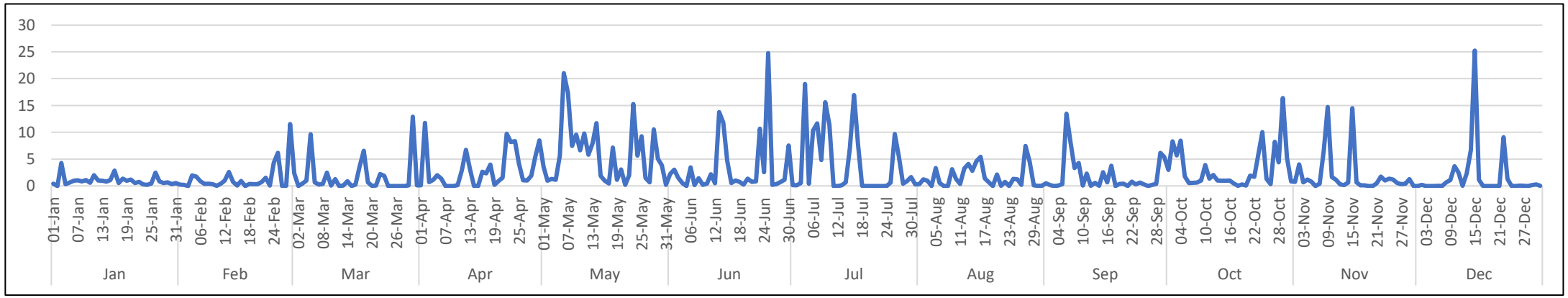
MECP Station – Beasley Park

COH- MBL1

COH-MBL2



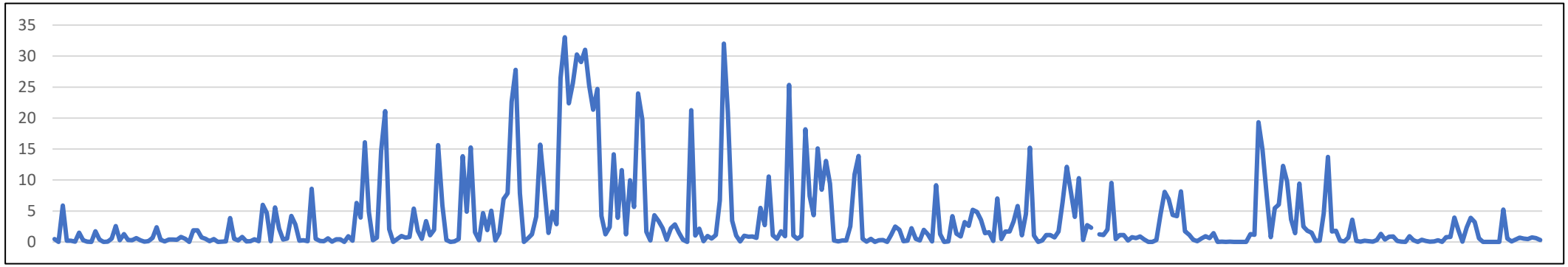
HAMN- Station Niagara/ Land St



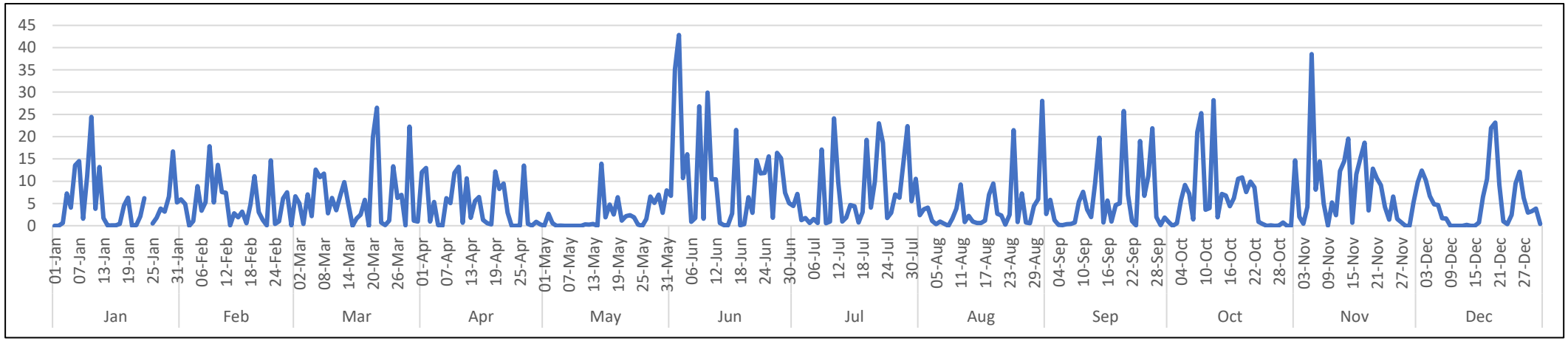
2022 observations from Hamilton Air Quality Stations

- 3 of the 5 stations that measure SO2 had very similar daily average SO2 concentration trend.
- The HAMN Station at Niagara St./Land St. had slightly different trend while…
- The **HAMN Station at Beach Blvd.** had significantly different daily average trend in SO2 concentration when compared to the other 4 stations.

MECP Station – Beasley Park

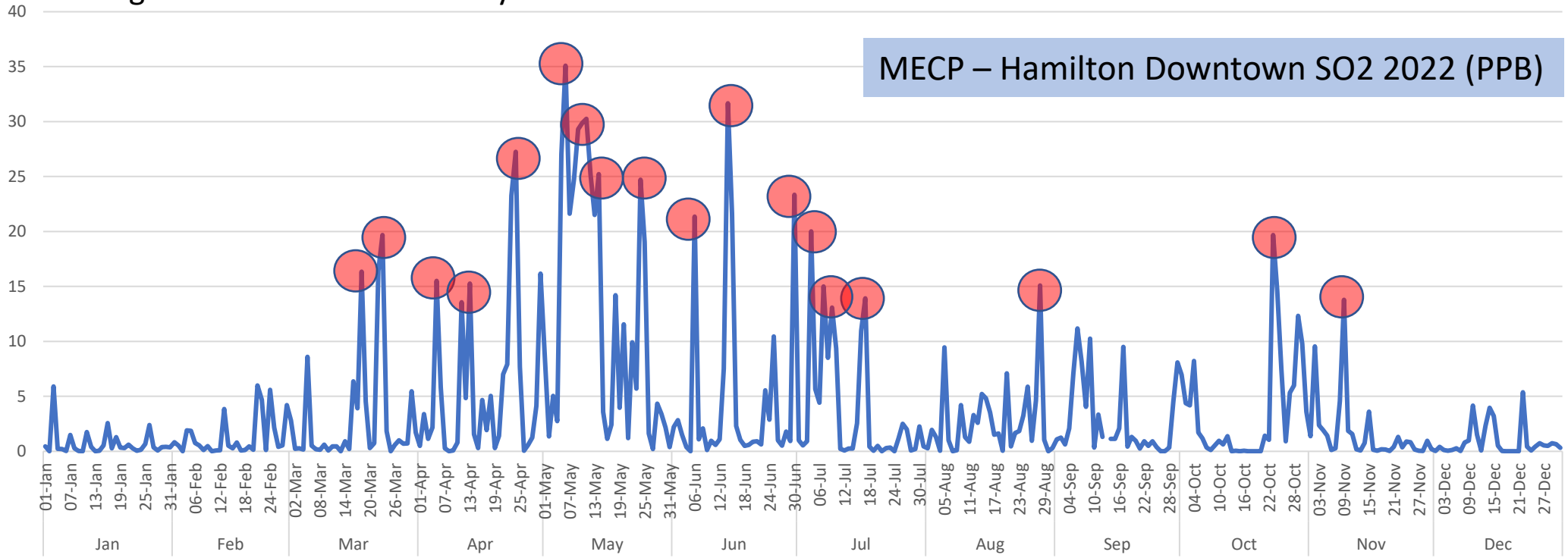


HAMN Station – Beach Blvd.



Observations of Year 2022 from MECP Station – Hamilton Downtown

- We can understand that there are days when SO2 concentration in ambient air shows a significantly high reading.
- There are several occurrences where the spikes are on consecutive days and not just restricted to a single one-off hour in the day.
- On analysis of other pollutants such as NO2, we notice similar trends of prolonged spikes being observed.
- For SO2, such days are not restricted to certain months. They occur throughout the year but occur more during the months of March-July.



Note: The above is monthly averaged data which smoothens out the extreme readings.

2022 observations from Hamilton Air Quality Stations

- From the concentration distribution below, we can observe that the HAMN STN2102- Beach Blvd is measuring higher levels of SO2 versus all other stations. This is a definite red flag on air quality around the Beach Blvd. area and needs to be investigated further.

SO2 Daily Average Concentration (PPB) distrubition over 2022					
SO2 (PPB)	**MECP Station – Beasley Park**	**COH_MBL1 (Meadowlands Park, Ancaster)**	**COH_MBL2 (Bookjans Park, Ancaster)**	**HAMN STN29567 – Niagara/Land St**	**HAMN STN2102 – Beach Blvd**
0-5	289	293	292	302	210
5-10	35	38	33	39	76
10-15	13	14	7	15	42
15-20	9	4	2	6	15
20-25	8	2		2	11
25-30	6			1	7
30-35	4				2
40-45					1
No Data	1	14	31	0	1
	365	365	365	365	365

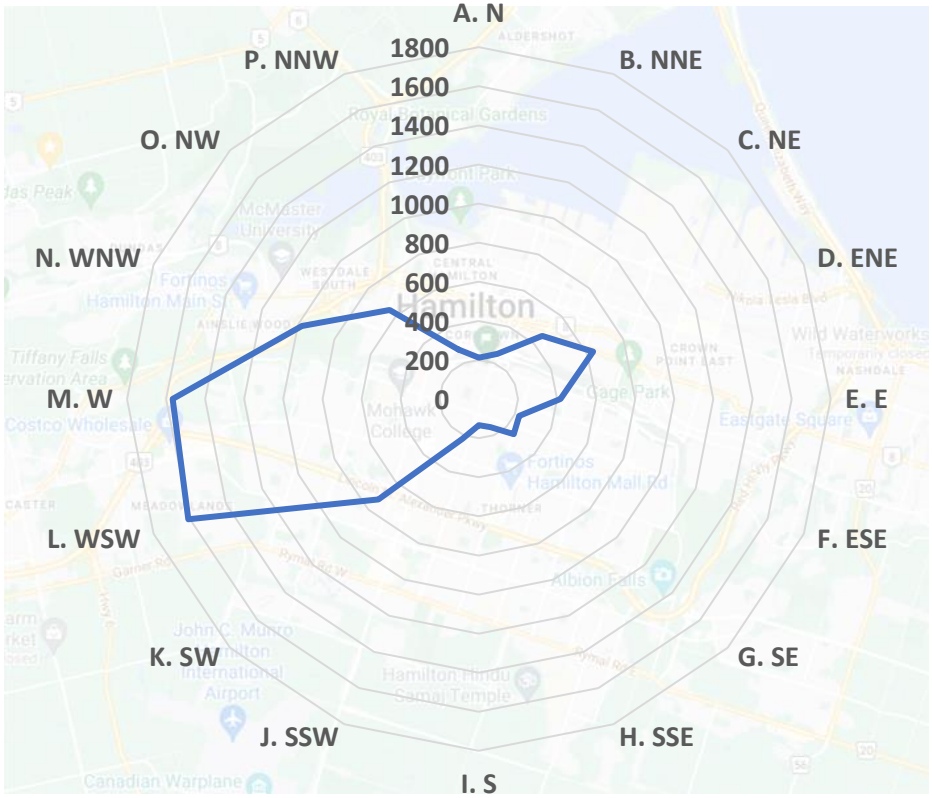
This table shows the numbers of days versus the average daily SO2 concentration measured in each of the 5 stations in 2022. For example, MECP Station – Beasley Park had a daily average SO2 concentration between 0-5 PPB on 289 days (out of 365) in 2022. Correspondingly, HAMN STN2102 – Beach Blvd. had only 210 days with daily average SO2 concentration between 0-5 PPB.

2022 observations on Wind direction in Hamilton

- Wind direction is largely westerly directional blowing in from the Lake Ontario towards the Niagara escarpment.
- This is leading to dispersion **(and only a slight reduction in concentration)** of SO2 pollution up the escarpment and towards Ancaster.

Wind Direction	Hours in 2022	Percentage of total hours
N	212	2%
NNE	250	3%
NE	458	5%
ENE	633	7%
E	417	5%
ESE	224	3%
SE	253	3%
SSE	155	2%
S	133	2%
SSW	220	3%
SW	726	8%
WSW	1608	18%
W	1566	18%
WNW	979	11%
NW	645	7%
NNW	276	3%

Wind direction is west-oriented 47% of the time



Observations from ESI data – May 2022

43%

Percentage of data points collected by ESI in May 2022 where measured SO2 in ambient air was >= 40 PPB. **This level of SO2 is so bad that even short-term exposure can cause severe human health effects.**

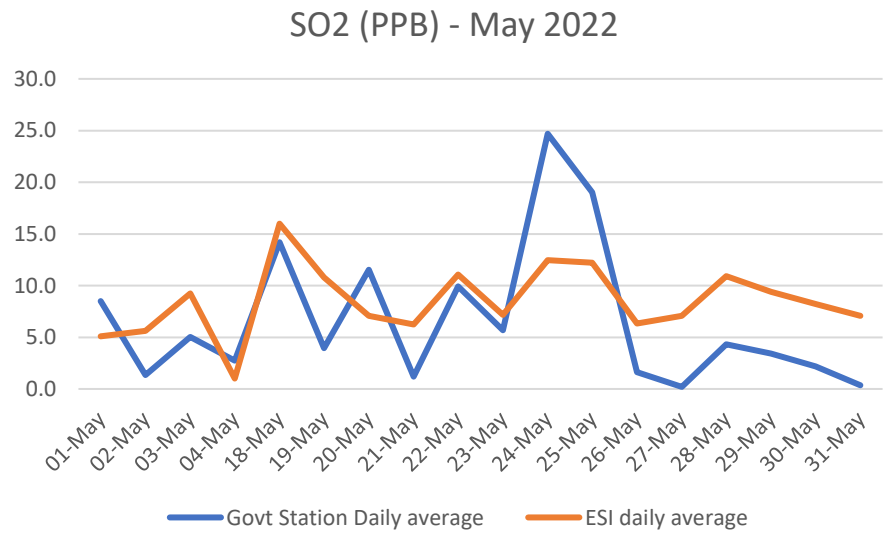
Ontario's Ambient Air Quality Criteria for SO2

SO2
40 PPB

1-hour AAQC
Assesses protection against acute effect to human health

ESI collected ~6000 data points over 2 mobile scans conducted in and around the downtown core.

ESI had a fixed device that continuously collected data. In the month of May 2022, the device was active was 18 days and shows a similar trend in average daily measurement to that of the MECP station.



Possible Contributing Factors

- Industry activities within the City of Hamilton and surroundings
- Leaks from natural (geological) sources
- Human activity within the City of Hamilton
- Meteorological factors contributing to buildup and dispersion/dissipation

What can be done?

- Identify source and sink for pollutants
- Understand impact of meteorological factors on pollutant levels throughout the year
- ESI can continue city-wide scans to see a hyperlocal picture of how the concentration of pollutant is dispersed over the city geography and identify trends, hotspots and correlations
- Continuously monitor at hotspot and highly sensitive locations (ex: Beach Blvd.)
- Dive deeper to understand the reason for days with significantly high measurements of gases
- Dive deeper into analyzing other pollutants to a granular level to understand the trends, patterns and outliers in pollutant concentration, what is causing them and how to mitigate the adverse effects
- Integrate all gathered data to draw conclusions and create comprehensive analyses, draw insights to help create mitigation and action plans

This report was prepared by Ecosystem Informatics Inc. for the City of Hamilton.

To go over the details, and for any further questions and clarifications, please feel free to reach out to:

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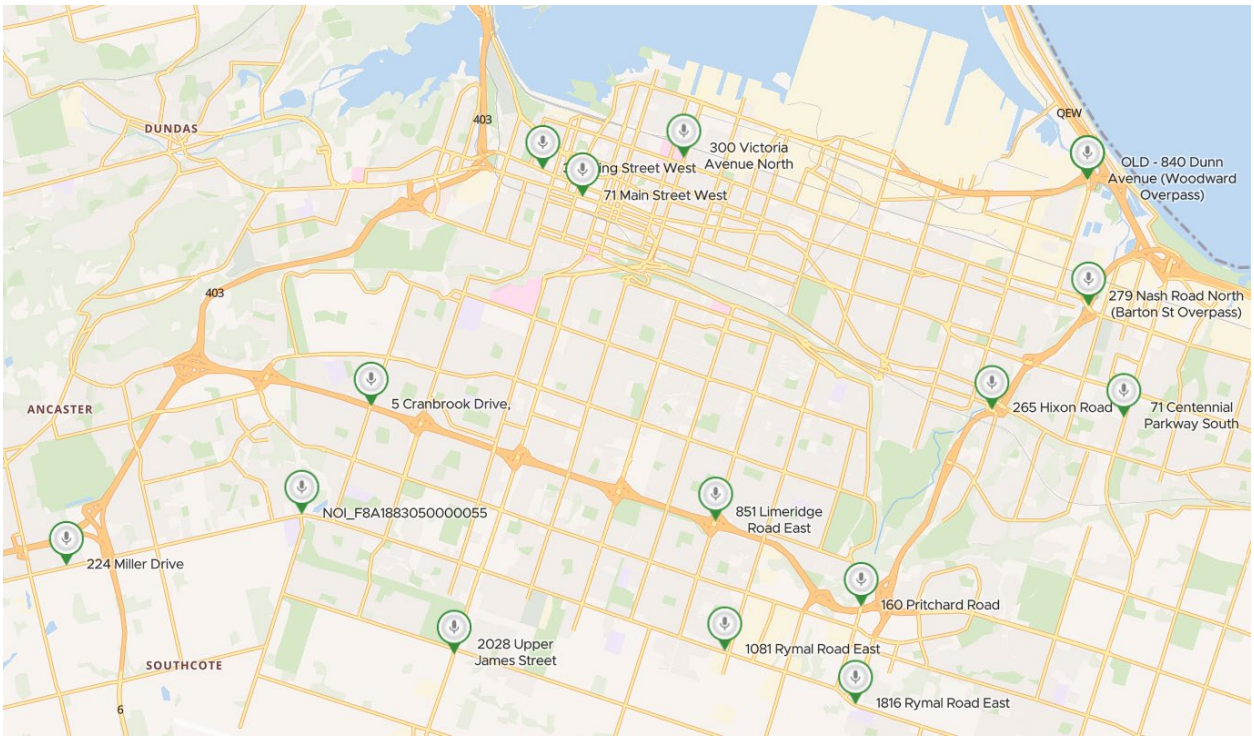
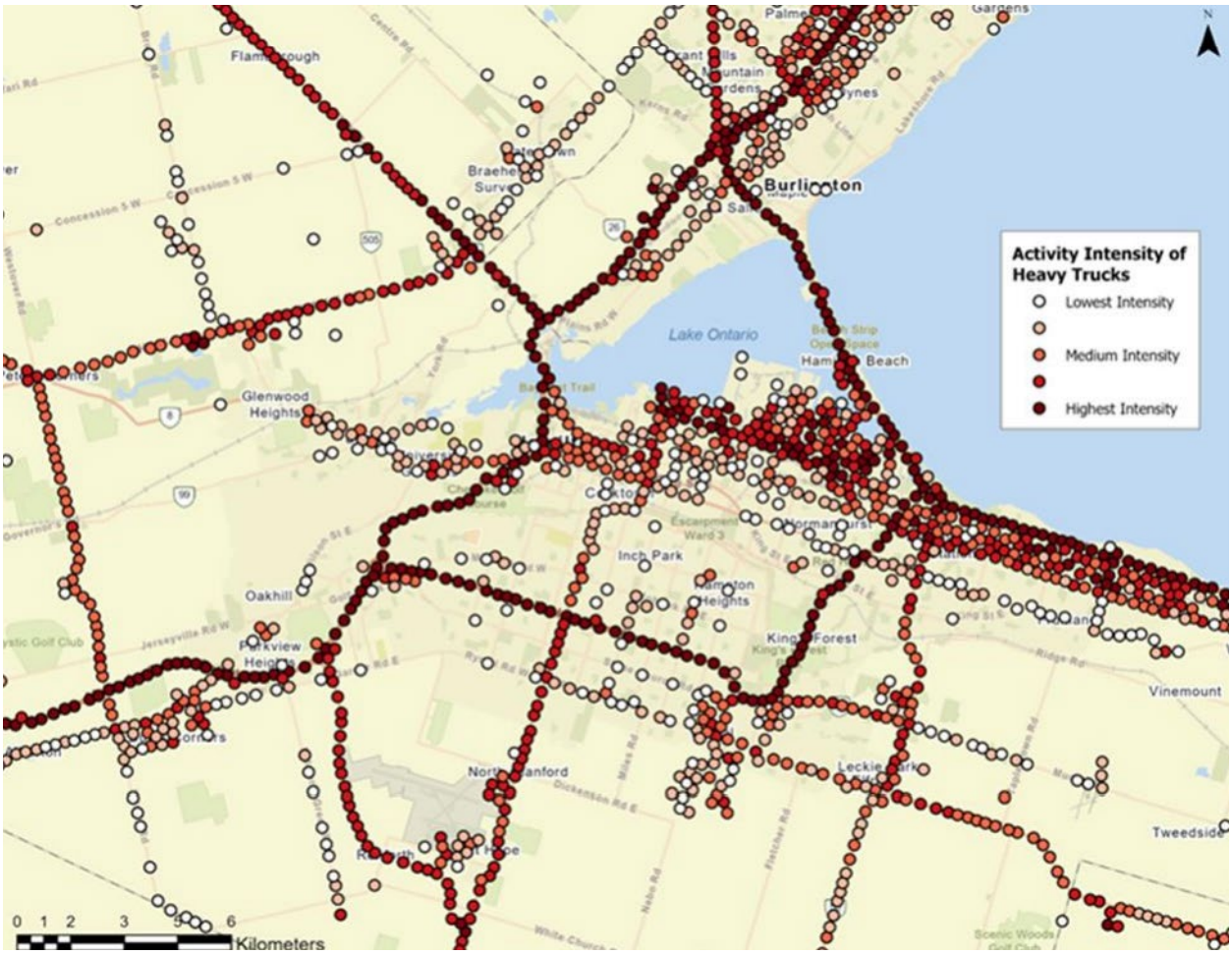
SmartLinx Noise Sensor Locations



Potential Modifications to Existing Actions						
Council Priority	Number	Category	Action	City of Hamilton (Economic Development Role)	Groups Involved	Timeline
Priority 2	9.1	Surface Transportation	Addition: Improve enforcement data collection to include all policing divisions in addition to the Traffic Services Section.	Support	Various groups at the City and Hamilton Police Services	Medium-term
Priority 1	9.2		Addition: Advocate for improved route mapping applications to facilitate improved route efficiencies and route compliance.	Support	Various groups at the City	Medium-term
Priority 3	9.3		~~Engage with client base on alternative "last mile" solutions (e.g. cargo bikes)~~ Engage industry and active transportation community stakeholders on last mile alternative solutions (e.g. cargo bikes and curbside management).	Support	Various groups at the City and industry partners	Short-term
Priority 1	10.1	Electrification / Decarbonization	Addition: Collect fleet inventory information to measure change within the Goods Movement Sector.	Support	Various groups at the City and industry partners	Short-term

Potential Updates – New Actions						
Council Priority	Number	Category	Action	City of Hamilton (Economic Development Role)	Groups Involved	Timeline
Priority 3	2.6	Marketing / Promotion	Host a community showcase event(s) that highlights innovation within the Goods Movement Sector and demonstrates alignment with Council Priorities.	Lead	Industry, community stakeholders, educational institutions, and other partners	Short-term
Priority 2	12.1	Community	Collaborate with CityLab to create a pilot program that supports businesses to use Cargo Bikes in their operations (e.g. feasibility plan template).	Support	Various groups at the City, educational institutions, and industry partners	Short-term
Priority 3	12.2		Collaborate with partners to provide social determinants of health data to provide holistic review information that supports both the community and the goods movement sector.	Support	Various groups at the City and community partners.	Short-term
Priority 3	12.3		Connect industry and community stakeholders to share information on truck route issues and create opportunities to provide feedback on evaluation criteria (e.g. Truck advisory Focus Group).	Support	Industry, community stakeholders, educational institutions, and other partners	Short-term to Long-term

Hamilton Activity Intensity of Heavy Trucks (Trucking Clusters)



Mid-Day Travel Speeds

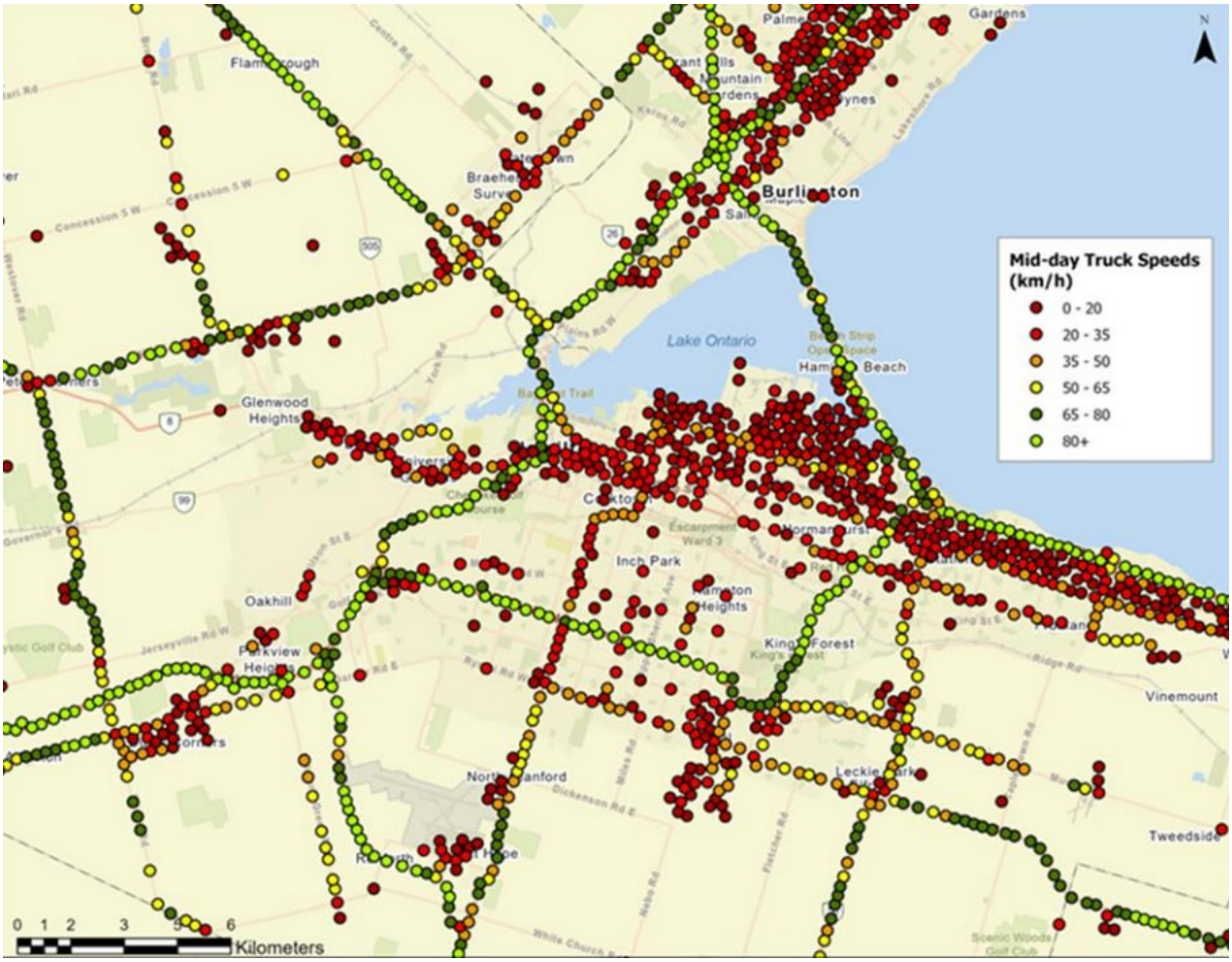


Figure 1: August Heat Map – Number of comments = 220

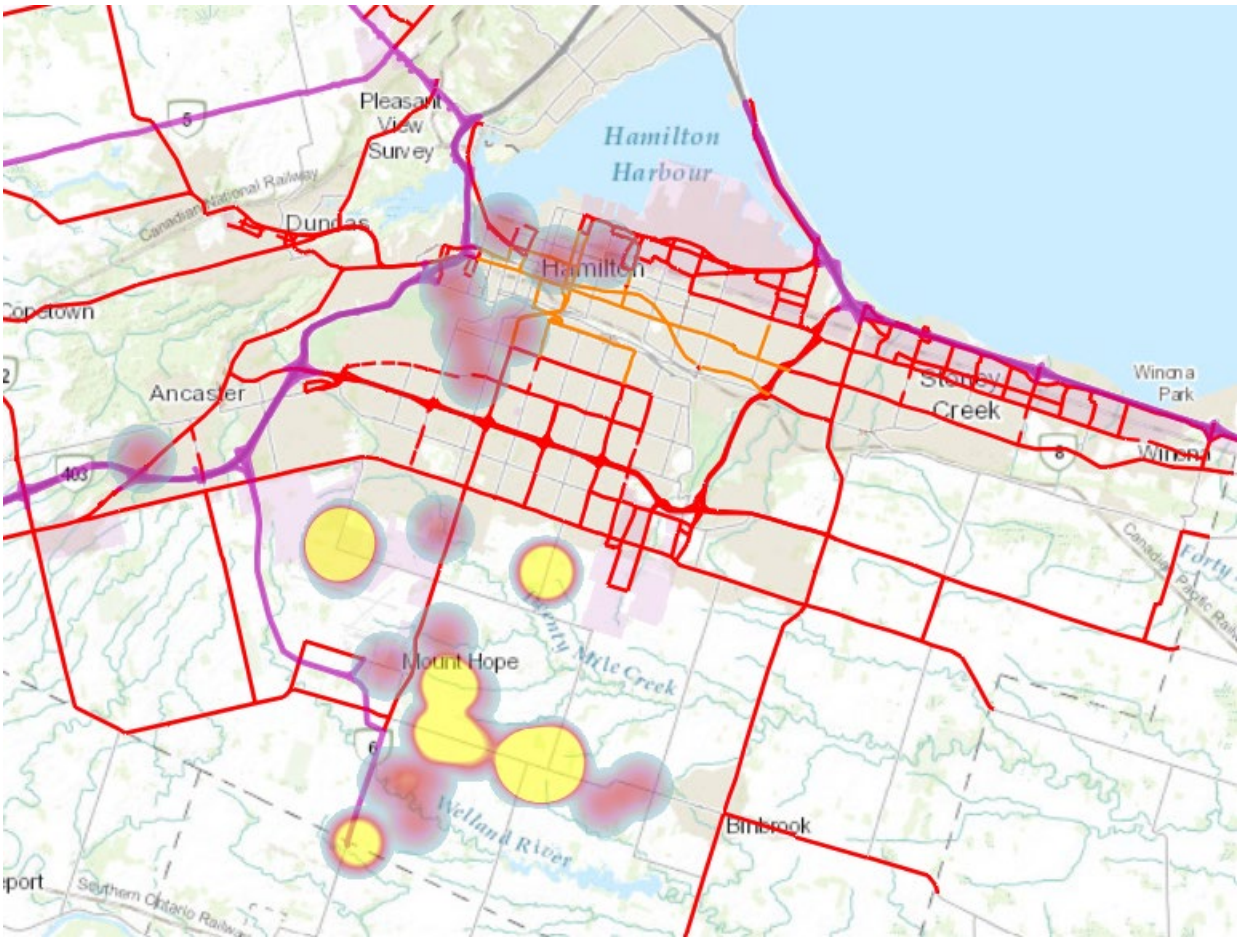


Figure 2: September Heat Map - Number of comments = 299

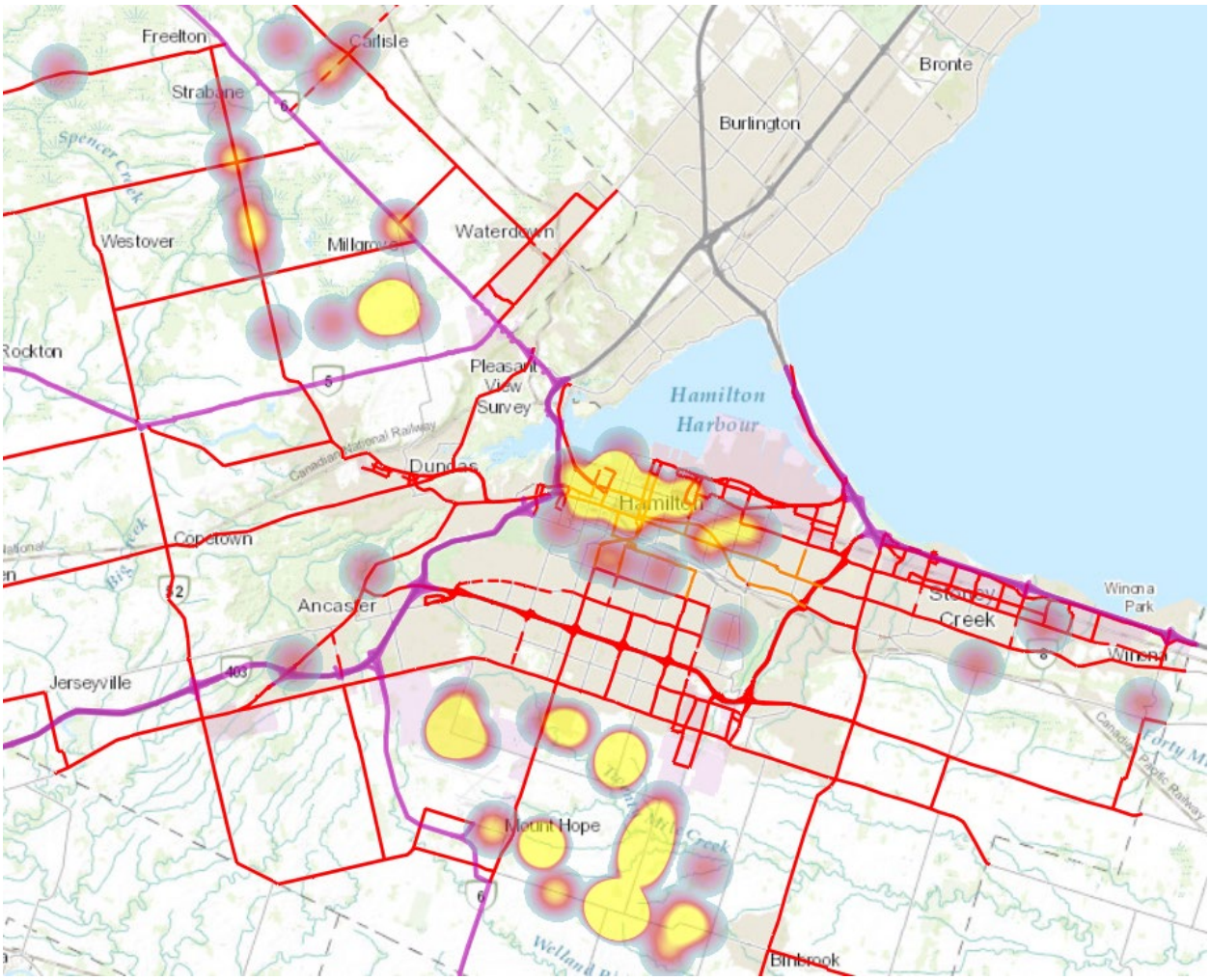


Figure 3: October Heat Map - Number of comments = 977

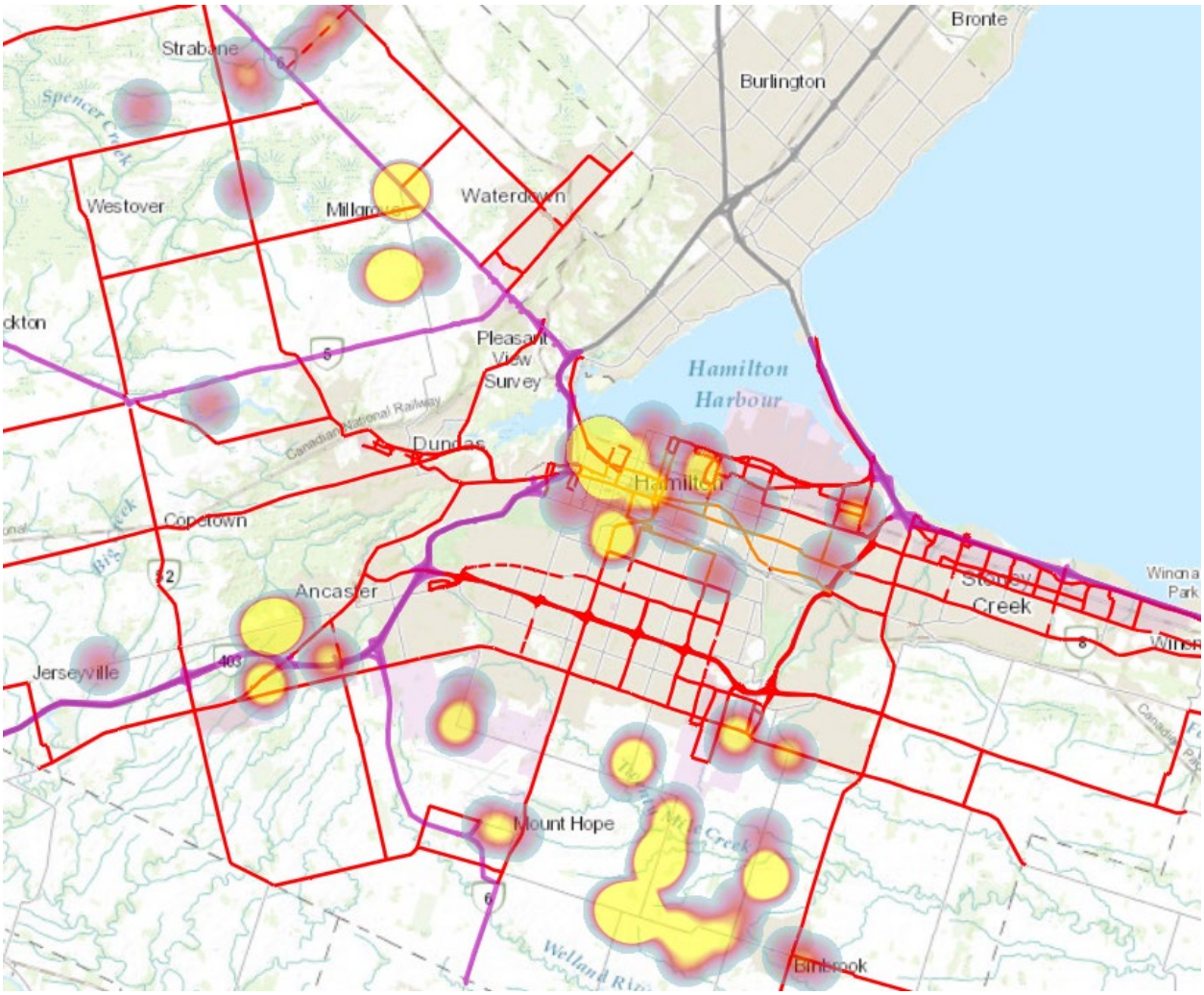


Figure 4: Combined Heat Map - N Number of comments = 1,499