Geofirma Engineering Ltd
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October 30, 2018 Ref. No.: 18-201-1

City of Ottawa
Planning, Infrastructure and Economic Development Department
City Of Ottawa - 100 Constellation Crescent, 6th Floor West
Ottawa, Ontario, K2G 6J8

Attn: Mr. Steve Courtland – Program Manager CSST

RE: Air Quality Monitoring – Stanley Park near Residences (July 11 to 23, 2018)

Dear Mr. Courtland:

Geofirma Engineering Ltd. (Geofirma) was retained by the City of Ottawa to complete ambient air quality monitoring along the north edge of Stanley Park near residences that face Stanley Avenue. This monitoring was requested primarily to address ongoing concerns from adjacent residents regarding the migration of exhaust fumes from diesel powered equipment from the combined storm sewer tunnel (CSST) Site 5A (Stanley Park) construction project. Work was initiated following a request by telephone from the City on June 11, 2018 and subsequent discussions. All work was completed in accordance with City of Ottawa Standing Offer Agreement RFSO 30717-92500-S01.

1 BACKGROUND, OBJECTIVES AND SCOPE OF WORK

Previously, Geofirma provided similar services, including continuous ambient air quality monitoring and air sampling for the City of Ottawa at the CSST Stanley Park work site (Site 5A) during construction activities between June-September 2017 (Geofirma Engineering Ltd, 2017) as well as spot checking ambient air quality around the site using a hand-held unit during March-April, 2018 (Geofirma Engineering Ltd, 2018).

The objective of this ambient air quality monitoring program near residences was to address ongoing concerns from adjacent residents and park users regarding potential off-site migration of airborne contaminants, notably diesel exhaust. This monitoring was intended to supplement the recent spot checking around the Stanley Park area and focus specifically on the nearby residences.

Health Canada (2016) studies the potential adverse health effects associated with diesel fuel use in Canada, and identifies fine particulate matter ($PM_{2.5}$) and NOx (primarily NO_2 along with NO that converts to NO_2 through oxidation) emissions as the main concerns associated with diesel engines. Additionally, diesel emissions contain other gaseous and particulate compounds, including carbon monoxide (CO), polycyclic aromatic hydrocarbons (PAHs), semi-volatile organic compounds (SVOCs) and volatile organic compounds (VOCs).

$PM_{2.5}$ and NO_2 are considered to be common field screening parameters used to evaluate diesel emission impact and for the purpose of this study were selected as target parameters to assess the air quality in Stanley Park near the residences because they can both be monitored in real time using

portable equipment.

The agreed upon scope of work was developed to address these concerns and included continuous collection of air quality data at one static station along the north edge Stanley over a two week period.

2 DATA COLLECTION

A single static air quality monitoring station was established along the north edge Stanley Park near the back property boundary of the residence addressed as 155 Stanley Avenue. The monitoring station consisted of the following equipment:

- a tripod with a weatherproof case;
- a DustTRAK DRK Aerosol Monitor 8533;
- two VRae gas monitors; and,
- telemetry hardware and software to provide real-time, continuous records of particulate matter and chemical concentrations.

All equipment was housed within a 3-panel security fence that was locked for the duration of the 2 week monitoring period. The telemetry unit was powered via electrical extension cord plugged into the exterior receptacle on the rear wall of the residence at 155 Stanley Avenue.

The DustTRAK DRK aerosol monitor (Model 8533) recorded the total mass concentration of particulate (mg/m^3) in the air along with the mass concentrations below select particulate sizes, including 1 μm, 2.5 μm, 4 μm, and 10 μm. As discussed in Section 1, $PM_{2.5}$ concentrations are considered to be a target parameters to assess diesel emission impact and are therefore tabulated and reported in this memo. In addition, continuous particulate in air monitoring focusing on inhalable particulate (PM_{10}) with particle sizes of less than 10 μm is most appropriate particle size for assessing potential human health effects from soils handling, dust and construction activities and are therefore also tabulated and reported.

The VRae instruments were calibrated prior to use were used to measure the concentration of several parameters in ambient air, including nitrogen dioxide (NO_2), carbon monoxide (CO), and oxygen (O_2).

Data was recorded at one minute intervals and reviewed by Geofirma staff daily to ensure optimal operation of the real-time sampling units. Weekly data downloads were completed. The monitoring location is shown on Figure A.1, Attachment A.

3 ONTARIO'S AMBIENT AIR QUALITY CRITERIA

The Ontario Ministry of the Environment (MOE, 2012) published ambient air quality criteria (AAQC) considered to be desirable concentration level for contaminants in air based on protection against adverse effects on health or the environment. Table 1 summarizes the AAQC values for the parameters of interest for this study as well as the detection limit (resolution) of the particular equipment used.

Table 1 Summary of Applicable Ambient Air Quality Criteria Relevant to this Study

Contaminant	AAQC (μg/m^3)	Equipment Detection Limit[1]	Averaging Time	Limiting Effect
Nitrogen Dioxide (NO_2)	200 (0.1 ppm)	0.1 ppm (200 μg/m^3)	24 Hour	Health
	400 (0.2 ppm)		1 Hour	Health
Carbon monoxide (CO)	15,700 (13 ppm)	1 ppm (1164 μg/m^3)	8 hour	Health
	36,200 (30 ppm)		1 hour	Health
Particulate Matter ($PM_{2.5}$)[2]	25 (30)	1 μg/m^3	24 Hour	Guide for Decision Making Only
Particulate Matter (PM_{10})[3]	50	1 μg/m^3	24 Hour	Guide for Decision Making Only

[1] The equipment used for this study included a DusTRAK DRK aerosol monitor Model 8533 and a VRae handheld five gas surveyor.

[2] The value for $PM_{2.5}$ (24-hour average) is not an AAQC but rather 30 μg/m^3 is the Canada-wide Standard (CWS) developed jointly by Federal and Provincial governments with 25 μg/m^3 being the maximum target emission level from a single facility.

[3] The value for PM_{10} (24-hour average) is an interim AAQC and provided as part of AAQC as a guide for decision making.

4 RESULTS AND DISCUSSION

A summary of the air monitoring data is included as Attachment B as raw (one-minute interval data) presented in tabular form. Figures A.2 through A.3 show the one-hour reading raw data along with the 24-hour time-weighted average concentrations for CO (Figure A.2) and $PM_{2.5}$ and PM_{10} (Figure A.3). Based on the air quality results presented in Attachment B, the following observations can be made:

- Instantaneous NO_2 concentrations recorded on one-minute intervals was not reported above equipment detection limits (0.1 ppm) at anytime throughout the monitoring period and therefore did not exceed the AAQC value for either the 24 hour average (0.1 ppm) or 1 hour average (0.2 ppm) concentration.
- Instantaneous CO concentrations recorded on one-minute intervals were occasionally reported above the equipment detection limit (1 ppm) with a maximum concentration of 1.3 ppm, therefore the time-weighted average CO concentrations were always well below the 1-hour average (30 ppm) and 8-hour average (13 ppm) AAQC values.
- Time-weighted $PM_{2.5}$ concentrations (24-hour average) were not reported above the recommended maximum target emission level from a single facility (25 μg/m^3) at anytime throughout the monitoring period.
- Time-weighted PM_{10} concentrations (24-hour average) were not reported above the interim AAQC 24-hour average value of 50 μg/m^3 at anytime throughout the monitoring period.

Overall, the absence of detections of NO_2 and low $PM_{2.5}$ concentrations measured at the sampling location suggests that there is negligible impact to air quality near the residences along the northern Boundary of Stanley Park due to diesel exhaust.

5 REFERENCES

Geofirma Engineering Ltd., 2018. Supplemental Air Quality Monitoring, Lands Surrounding CSST Site 5A (March-April, 2018). Letter Report prepared for the City of Ottawa, April 18.

Geofirma Engineering Ltd., 2017. Ambient Air Quality Monitoring, Summary Report CSST Project, Stanley Park Construction Area, Ottawa. Final Report (Revision 0) prepared for the City of Ottawa, November 21.

Health Canada, 2016. Human Health Risk Assessment for Diesel Exhaust. Prepared by the Fuels Assessment Section, Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch. March.

MOE, Ontario Ministry of the Environment, 2012. Ontario's Ambient Air Quality Criteria, Standards Development Branch, PIBS # 6570e01, April.

6 LIMITATIONS

The data collected represent the air quality at a specific location over the monitoring period. It is recognized that these concentrations may vary from the location where the air monitoring equipment was established.

Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Respectfully submitted,

Geofirma Engineering Ltd.

Sean Sterling, M.Sc., P.Eng., P.Geo.
Principal

Steve Gaines, M.A.Sc., P.Eng.
Geo-Environmental Engineer

Attach.
Attachment A – Figures
Attachment B – Air Quality Data

Doc. ID:	18-201-1_StanleyPark_Aug11-23_Air Monitoring_Memo_R2.docx	
Revision Number:	2	Date: October 30, 2018
Prepared By:	Sean Sterling	
Reviewed By:	Tim Galt	

ATTACHMENT A

Figures

LEGEND

- Existing Pathway
- Approximate Construction Zone
- Air Monitoring Station

Figure 1
Site Layout

Scale1:2,000

0 20 40 80

Metres

N

Projection: NAD 1983 MTM 9
Source: NCC
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

PROJECT No. 18-201-1

PROJECT

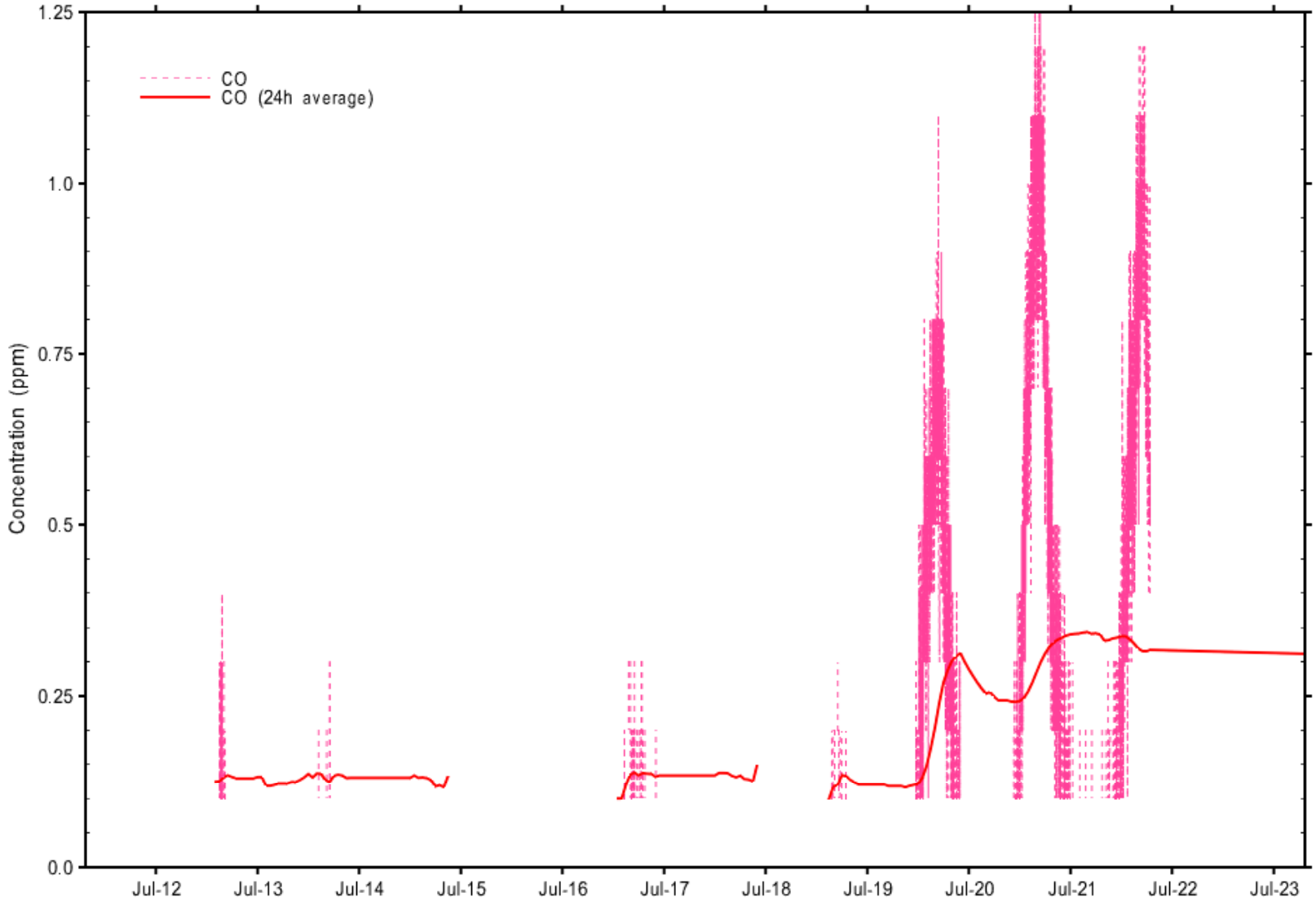
Supplemental Air Quality Monitoring,
159 Stanley Avenue, Ottawa

DESIGN: ADG
CAD/GIS: NMP
CHECK: SNG
REV: 0

DATE: 16/08/2018

Geofirma Engineering Ltd

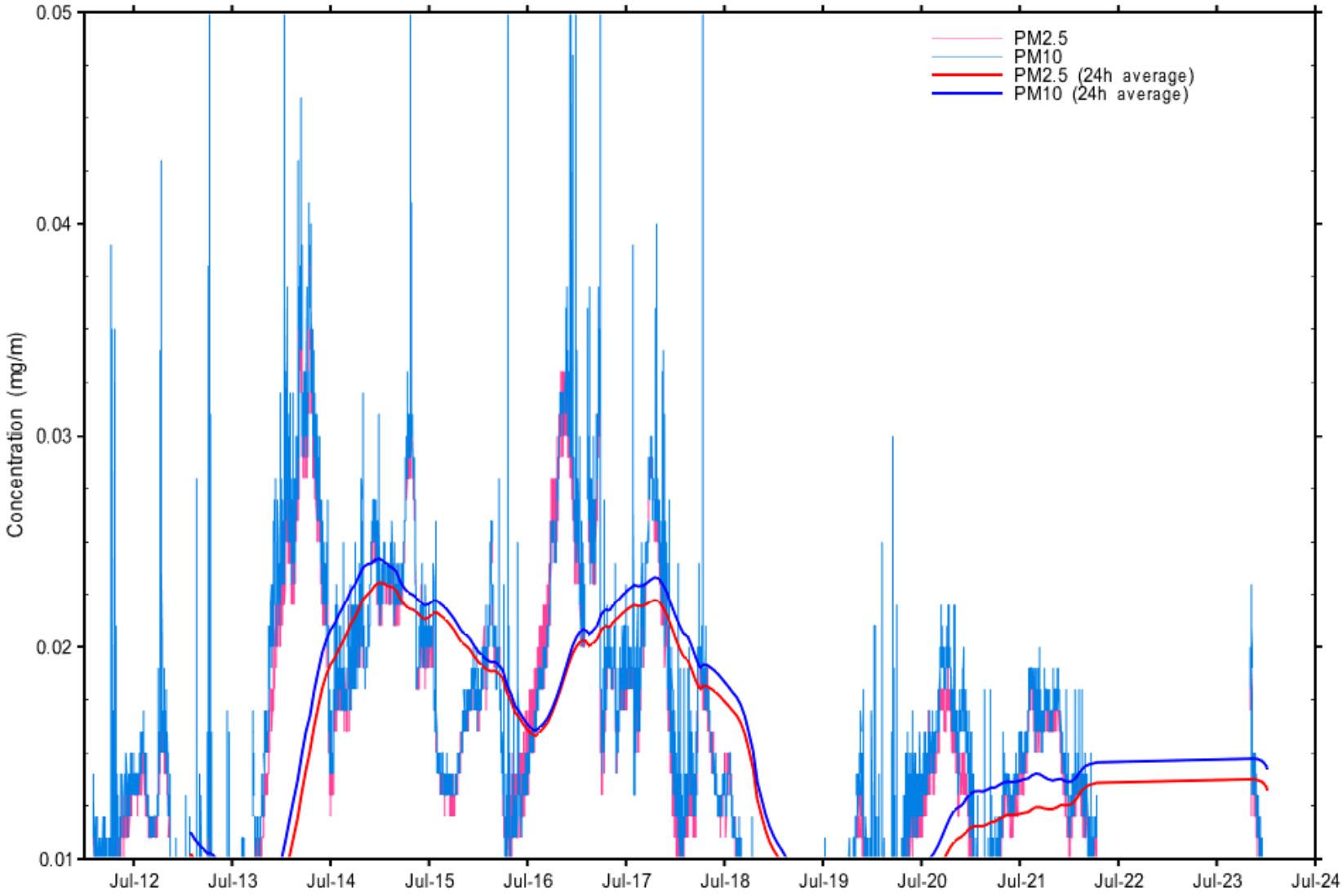
G:\Data\Project\StanleyPark\Maps\18-201-1_StanleyPark\15-201-11_2018August_SiteLayout.mxd



Hourly and 24-Hour Time Weighted Average Carbon Monoxide (CO) Concentration - Stanley Park, CSST Site 5A

Figure A.2	Doc. No.: 18-201-1_Data_Figures_R0	Prepared by: NS Reviewed by: SNS Date: 24-Sep-18

Geofirma Engineering Ltd



Hourly and 24-Hour Time Weighted Average Concentration Particulate Matter ($PM_{2.5}$ and PM_{10}) - Stanley Park, CSST Site 5A

Figure A.3	Doc. No.: 18-201-1_Data_Figures_R0	Prepared by: NS Reviewed by: SNS Date: 23-Aug-18

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ATTACHMENT B

Air Quality Data

Table B.1 Summary of 24-Hour Time Weighted Average Concentrations (Reported Each Hour)

Date and Time	CO	NO_2	PM_1	$PM_{2.5}$	PM_4	PM_{10}	Total Particulate Mass
	ppm	ppm	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)
12 July 14:00	0.12	< 0.1	10.03	10.23	10.48	11.22	11.28
12 July 15:00	0.13	< 0.1	9.70	9.91	10.16	10.90	10.96
12 July 16:00	0.13	< 0.1	9.44	9.65	9.91	10.67	10.73
12 July 17:00	0.13	< 0.1	9.22	9.43	9.68	10.47	10.53
12 July 18:00	0.13	< 0.1	9.01	9.22	9.48	10.27	10.34
12 July 19:00	0.13	< 0.1	8.77	9.01	9.34	10.28	10.35
12 July 20:00	0.13	< 0.1	8.53	8.77	9.10	10.03	10.10
12 July 21:00	0.13	< 0.1	8.31	8.55	8.89	9.81	9.88
12 July 22:00	0.13	< 0.1	7.99	8.24	8.58	9.50	9.57
12 July 23:00	0.13	< 0.1	7.79	8.04	8.40	9.31	9.39
13 July 0:00	0.13	< 0.1	7.56	7.79	8.17	9.10	9.17
13 July 1:00	0.13	< 0.1	7.33	7.55	7.96	8.89	8.96
13 July 2:00	0.12	< 0.1	7.09	7.31	7.73	8.65	8.72
13 July 3:00	0.12	< 0.1	6.89	7.11	7.53	8.44	8.51
13 July 4:00	0.12	< 0.1	6.70	6.94	7.36	8.26	8.34
13 July 5:00	0.12	< 0.1	6.54	6.79	7.23	8.12	8.19
13 July 6:00	0.12	< 0.1	6.55	6.80	7.24	8.13	8.20
13 July 7:00	0.12	< 0.1	6.30	6.54	6.96	7.81	7.88
13 July 8:00	0.12	< 0.1	6.15	6.40	6.82	7.69	7.76
13 July 9:00	0.12	< 0.1	6.22	6.48	6.93	7.82	7.89
13 July 10:00	0.13	< 0.1	6.68	6.97	7.46	8.42	8.49
13 July 11:00	0.13	< 0.1	7.26	7.57	8.10	9.13	9.21
13 July 12:00	0.14	< 0.1	8.02	8.34	8.88	9.95	10.03
13 July 13:00	0.13	< 0.1	8.83	9.16	9.72	10.83	10.92
13 July 14:00	0.14	< 0.1	9.78	10.11	10.68	11.82	11.91
13 July 15:00	0.14	< 0.1	10.69	11.03	11.61	12.78	12.87
13 July 16:00	0.13	< 0.1	11.59	11.93	12.52	13.70	13.78
13 July 17:00	0.12	< 0.1	12.77	13.11	13.72	14.92	15.01

Prepared by: SNS
Reviewed by: TKG
30/10/2018
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Table B.1 Summary of 24-Hour Time Weighted Average Concentrations (Reported Each Hour)

Date and Time	CO	NO_2	PM_1	$PM_{2.5}$	PM_4	PM_{10}	Total Particulate Mass
	ppm	ppm	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)
13 July 18:00	0.13	< 0.1	13.83	14.17	14.78	16.00	16.09
13 July 19:00	0.14	< 0.1	14.78	15.10	15.65	16.74	16.83
13 July 20:00	0.13	< 0.1	15.90	16.23	16.79	17.91	17.99
13 July 21:00	0.13	< 0.1	16.84	17.17	17.73	18.85	18.94
13 July 22:00	0.13	< 0.1	17.73	18.06	18.61	19.74	19.82
13 July 23:00	0.13	< 0.1	18.36	18.70	19.23	20.34	20.43
14 July 0:00	0.13	< 0.1	18.83	19.16	19.68	20.79	20.88
14 July 1:00	0.13	< 0.1	19.14	19.46	19.97	21.09	21.17
14 July 2:00	0.13	< 0.1	19.56	19.89	20.39	21.52	21.60
14 July 3:00	0.13	< 0.1	19.93	20.24	20.74	21.87	21.95
14 July 4:00	0.13	< 0.1	20.32	20.64	21.14	22.26	22.34
14 July 5:00	0.13	< 0.1	20.78	21.10	21.60	22.72	22.81
14 July 6:00	0.13	< 0.1	21.08	21.41	21.89	23.00	23.09
14 July 7:00	0.13	< 0.1	21.52	21.85	22.33	23.43	23.51
14 July 8:00	0.13	< 0.1	21.98	22.29	22.76	23.82	23.90
14 July 9:00	0.13	< 0.1	22.21	22.51	22.94	23.95	24.03
14 July 10:00	0.13	< 0.1	22.43	22.71	23.09	24.01	24.08
14 July 11:00	0.13	< 0.1	22.73	23.00	23.34	24.17	24.24
14 July 12:00	0.13	< 0.1	22.81	23.07	23.40	24.20	24.27
14 July 13:00	0.13	< 0.1	22.78	23.04	23.36	24.09	24.15
14 July 14:00	0.13	< 0.1	22.66	22.92	23.22	23.90	23.95
14 July 15:00	0.13	< 0.1	22.62	22.87	23.16	23.80	23.85
14 July 16:00	0.13	< 0.1	22.49	22.75	23.03	23.63	23.68
14 July 17:00	0.13	< 0.1	22.05	22.30	22.57	23.13	23.18
14 July 18:00	0.12	< 0.1	21.78	22.02	22.28	22.82	22.85
14 July 19:00	0.12	< 0.1	21.59	21.82	22.08	22.60	22.64
14 July 20:00	0.12	< 0.1	21.53	21.77	22.02	22.50	22.54
14 July 21:00	0.13	< 0.1	21.42	21.66	21.89	22.36	22.40

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30/10/2018
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Table B.1 Summary of 24-Hour Time Weighted Average Concentrations (Reported Each Hour)

Date and Time	CO	NO_2	PM_1	$PM_{2.5}$	PM_4	PM_{10}	Total Particulate Mass
	ppm	ppm	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)
14 July 22:00	NA	< 0.1	21.18	21.41	21.63	22.09	22.13
14 July 23:00	NA	< 0.1	21.09	21.32	21.54	21.99	22.02
15 July 0:00	NA	< 0.1	21.15	21.38	21.60	22.02	22.07
15 July 1:00	NA	< 0.1	21.37	21.61	21.81	22.22	22.27
15 July 2:00	NA	< 0.1	21.37	21.61	21.79	22.19	22.25
15 July 3:00	NA	< 0.1	21.22	21.45	21.63	22.02	22.07
15 July 4:00	NA	< 0.1	21.08	21.30	21.47	21.86	21.91
15 July 5:00	NA	< 0.1	20.85	21.07	21.23	21.61	21.67
15 July 6:00	NA	< 0.1	20.60	20.82	20.97	21.35	21.41
15 July 7:00	NA	< 0.1	20.29	20.51	20.66	21.04	21.09
15 July 8:00	NA	< 0.1	19.99	20.20	20.34	20.72	20.77
15 July 9:00	NA	< 0.1	19.87	20.08	20.21	20.59	20.65
15 July 10:00	NA	< 0.1	19.67	19.86	19.99	20.38	20.44
15 July 11:00	NA	< 0.1	19.37	19.56	19.67	20.06	20.11
15 July 12:00	NA	< 0.1	19.13	19.30	19.40	19.79	19.84
15 July 13:00	NA	< 0.1	18.93	19.10	19.19	19.57	19.62
15 July 14:00	NA	< 0.1	18.78	18.95	19.02	19.41	19.46
15 July 15:00	NA	< 0.1	18.69	18.85	18.91	19.29	19.34
15 July 16:00	NA	< 0.1	18.71	18.87	18.91	19.29	19.35
15 July 17:00	NA	< 0.1	18.61	18.76	18.79	19.17	19.22
15 July 18:00	NA	< 0.1	18.35	18.51	18.53	18.89	18.95
15 July 19:00	NA	< 0.1	17.70	17.85	17.86	18.20	18.26
15 July 20:00	NA	< 0.1	17.31	17.45	17.43	17.77	17.83
15 July 21:00	NA	< 0.1	16.76	16.90	16.86	17.20	17.26
15 July 22:00	NA	< 0.1	16.52	16.66	16.60	16.94	17.00
15 July 23:00	NA	< 0.1	16.20	16.35	16.26	16.62	16.67
16 July 0:00	NA	< 0.1	15.94	16.10	15.99	16.35	16.38
16 July 1:00	NA	< 0.1	15.73	15.88	15.77	16.13	16.16

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Reviewed by: TKG
30/10/2018
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Table B.1 Summary of 24-Hour Time Weighted Average Concentrations (Reported Each Hour)

Date and Time	CO	NO_2	PM_1	$PM_{2.5}$	PM_4	PM_{10}	Total Particulate Mass
	ppm	ppm	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)
16 July 2:00	NA	< 0.1	15.65	15.81	15.69	16.04	16.07
16 July 3:00	NA	< 0.1	15.80	15.97	15.82	16.19	16.22
16 July 4:00	NA	< 0.1	16.03	16.20	16.03	16.40	16.42
16 July 5:00	NA	< 0.1	16.32	16.46	16.30	16.67	16.69
16 July 6:00	NA	< 0.1	16.75	16.89	16.70	17.09	17.10
16 July 7:00	NA	< 0.1	17.25	17.40	17.19	17.58	17.59
16 July 8:00	NA	< 0.1	17.80	17.95	17.74	18.15	18.16
16 July 9:00	NA	< 0.1	18.40	18.57	18.35	18.78	18.79
16 July 10:00	NA	< 0.1	18.98	19.16	18.96	19.43	19.45
16 July 11:00	NA	< 0.1	19.50	19.68	19.52	20.06	20.09
16 July 12:00	NA	< 0.1	19.85	20.04	19.91	20.48	20.51
16 July 13:00	0.10	< 0.1	20.10	20.30	20.17	20.76	20.80
16 July 14:00	0.10	< 0.1	20.13	20.32	20.22	20.84	20.87
16 July 15:00	0.12	< 0.1	19.87	20.06	19.97	20.60	20.64
16 July 16:00	0.14	< 0.1	19.97	20.16	20.08	20.75	20.79
16 July 17:00	0.14	< 0.1	20.19	20.38	20.32	21.01	21.06
16 July 18:00	0.13	< 0.1	20.58	20.79	20.76	21.54	21.59
16 July 19:00	0.14	< 0.1	20.78	20.99	20.97	21.77	21.82
16 July 20:00	0.14	< 0.1	20.69	20.91	20.91	21.71	21.77
16 July 21:00	0.14	< 0.1	20.98	21.20	21.22	22.02	22.08
16 July 22:00	0.13	< 0.1	21.14	21.36	21.41	22.22	22.28
16 July 23:00	0.13	< 0.1	21.34	21.55	21.63	22.44	22.51
17 July 0:00	0.13	< 0.1	21.53	21.73	21.83	22.65	22.73
17 July 1:00	0.13	< 0.1	21.67	21.87	22.00	22.80	22.89
17 July 2:00	0.13	< 0.1	21.79	21.99	22.14	22.96	23.04
17 July 3:00	0.13	< 0.1	21.74	21.94	22.11	22.91	23.00
17 July 4:00	0.13	< 0.1	21.73	21.94	22.13	22.93	23.03
17 July 5:00	0.13	< 0.1	21.79	22.03	22.24	23.05	23.16

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data_24h_R2.xlsx

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Table B.1 Summary of 24-Hour Time Weighted Average Concentrations (Reported Each Hour)

Date and Time	CO	NO_2	PM_1	$PM_{2.5}$	PM_4	PM_{10}	Total Particulate Mass
	ppm	ppm	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)
17 July 6:00	0.13	< 0.1	21.92	22.16	22.39	23.21	23.32
17 July 7:00	0.13	< 0.1	22.02	22.24	22.52	23.33	23.45
17 July 8:00	0.13	< 0.1	21.94	22.19	22.48	23.28	23.40
17 July 9:00	0.13	< 0.1	21.62	21.87	22.19	22.99	23.11
17 July 10:00	0.13	< 0.1	21.26	21.51	21.83	22.62	22.73
17 July 11:00	0.13	< 0.1	20.72	20.98	21.29	22.02	22.13
17 July 12:00	0.13	< 0.1	20.19	20.46	20.76	21.50	21.63
17 July 13:00	0.14	< 0.1	19.69	19.96	20.28	21.04	21.16
17 July 14:00	0.14	< 0.1	19.28	19.54	19.86	20.62	20.75
17 July 15:00	0.14	< 0.1	19.15	19.42	19.74	20.52	20.64
17 July 16:00	0.13	< 0.1	18.67	18.94	19.27	20.05	20.17
17 July 17:00	0.13	< 0.1	18.13	18.40	18.73	19.51	19.62
17 July 18:00	0.13	< 0.1	17.72	17.99	18.30	19.01	19.12
17 July 19:00	0.13	< 0.1	17.90	18.17	18.47	19.17	19.28
17 July 20:00	0.13	< 0.1	17.84	18.11	18.41	19.11	19.21
17 July 21:00	0.13	< 0.1	17.71	17.99	18.29	18.97	19.07
17 July 22:00	0.15	< 0.1	17.57	17.84	18.13	18.81	18.91
17 July 23:00	NA	< 0.1	17.38	17.65	17.92	18.59	18.68
18 July 0:00	NA	< 0.1	17.17	17.43	17.70	18.35	18.44
18 July 1:00	NA	< 0.1	16.95	17.21	17.47	18.11	18.20
18 July 2:00	NA	< 0.1	16.73	16.99	17.23	17.85	17.93
18 July 3:00	NA	< 0.1	16.51	16.76	16.99	17.62	17.69
18 July 4:00	NA	< 0.1	16.17	16.41	16.63	17.26	17.32
18 July 5:00	NA	< 0.1	15.65	15.88	16.10	16.71	16.76
18 July 6:00	NA	< 0.1	14.87	15.10	15.31	15.92	15.97
18 July 7:00	NA	< 0.1	14.02	14.25	14.46	15.07	15.11
18 July 8:00	NA	< 0.1	12.60	12.81	13.02	13.63	13.66
18 July 9:00	NA	< 0.1	11.87	12.07	12.26	12.87	12.90

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Table B.1 Summary of 24-Hour Time Weighted Average Concentrations (Reported Each Hour)

Date and Time	CO	NO_2	PM_1	$PM_{2.5}$	PM_4	PM_{10}	Total Particulate Mass
	ppm	ppm	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)
18 July 10:00	NA	< 0.1	11.17	11.36	11.54	12.12	12.15
18 July 11:00	NA	< 0.1	10.63	10.81	10.97	11.52	11.55
18 July 12:00	NA	< 0.1	10.26	10.42	10.57	11.08	11.09
18 July 13:00	NA	< 0.1	9.96	10.11	10.25	10.72	10.73
18 July 14:00	NA	< 0.1	9.71	9.86	9.99	10.42	10.43
18 July 15:00	0.10	< 0.1	9.39	9.54	9.66	10.08	10.09
18 July 16:00	0.12	< 0.1	9.00	9.13	9.26	9.64	9.65
18 July 17:00	0.12	< 0.1	8.64	8.78	8.89	9.26	9.27
18 July 18:00	0.13	< 0.1	8.10	8.23	8.36	8.69	8.71
18 July 19:00	0.13	< 0.1	7.42	7.55	7.66	8.00	8.02
18 July 20:00	0.13	< 0.1	6.89	7.01	7.13	7.46	7.47
18 July 21:00	0.12	< 0.1	6.46	6.56	6.68	7.02	7.03
18 July 22:00	0.12	< 0.1	6.11	6.22	6.36	6.69	6.71
18 July 23:00	0.12	< 0.1	5.87	5.98	6.14	6.48	6.50
19 July 0:00	0.12	< 0.1	5.66	5.77	5.95	6.30	6.32
19 July 1:00	0.12	< 0.1	5.48	5.60	5.79	6.15	6.17
19 July 2:00	0.12	< 0.1	5.26	5.38	5.59	5.96	5.99
19 July 3:00	0.12	< 0.1	5.14	5.26	5.49	5.86	5.89
19 July 4:00	0.12	< 0.1	5.00	5.12	5.35	5.73	5.76
19 July 5:00	0.12	< 0.1	4.92	5.05	5.30	5.67	5.70
19 July 6:00	0.12	< 0.1	4.92	5.07	5.31	5.68	5.71
19 July 7:00	0.12	< 0.1	4.99	5.14	5.39	5.75	5.78
19 July 8:00	0.12	< 0.1	5.69	5.86	6.11	6.47	6.51
19 July 9:00	0.12	< 0.1	5.91	6.10	6.37	6.75	6.79
19 July 10:00	0.12	< 0.1	6.15	6.36	6.65	7.10	7.15
19 July 11:00	0.12	< 0.1	6.31	6.53	6.84	7.31	7.36
19 July 12:00	0.12	< 0.1	6.45	6.67	6.98	7.48	7.54
19 July 13:00	0.13	< 0.1	6.57	6.80	7.12	7.65	7.70

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Geofirma Engineering Ltd

Table B.1 Summary of 24-Hour Time Weighted Average Concentrations (Reported Each Hour)

Date and Time	CO	NO_2	PM_1	$PM_{2.5}$	PM_4	PM_{10}	Total Particulate Mass
	ppm	ppm	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)
19 July 14:00	0.15	< 0.1	6.66	6.89	7.24	7.78	7.84
19 July 15:00	0.17	< 0.1	6.75	6.98	7.33	7.91	7.97
19 July 16:00	0.20	< 0.1	6.82	7.05	7.39	7.99	8.05
19 July 17:00	0.24	< 0.1	6.91	7.14	7.49	8.12	8.18
19 July 18:00	0.27	< 0.1	7.07	7.29	7.64	8.33	8.39
19 July 19:00	0.29	< 0.1	7.18	7.41	7.77	8.46	8.51
19 July 20:00	0.30	< 0.1	7.34	7.57	7.93	8.64	8.70
19 July 21:00	0.31	< 0.1	7.56	7.80	8.19	8.93	8.99
19 July 22:00	0.31	< 0.1	7.83	8.07	8.46	9.22	9.29
19 July 23:00	0.30	< 0.1	8.04	8.28	8.67	9.44	9.50
20 July 0:00	0.29	< 0.1	8.22	8.46	8.84	9.61	9.68
20 July 1:00	0.28	< 0.1	8.38	8.61	8.99	9.77	9.83
20 July 2:00	0.27	< 0.1	8.62	8.85	9.23	10.01	10.07
20 July 3:00	0.26	< 0.1	8.87	9.11	9.48	10.26	10.33
20 July 4:00	0.25	< 0.1	9.17	9.42	9.80	10.60	10.67
20 July 5:00	0.26	< 0.1	9.54	9.79	10.20	11.04	11.10
20 July 6:00	0.25	< 0.1	9.91	10.18	10.63	11.51	11.57
20 July 7:00	0.24	< 0.1	10.25	10.54	11.03	11.94	12.01
20 July 8:00	0.24	< 0.1	10.54	10.81	11.34	12.28	12.34
20 July 9:00	0.24	< 0.1	10.69	10.96	11.48	12.42	12.48
20 July 10:00	0.24	< 0.1	10.79	11.06	11.59	12.54	12.59
20 July 11:00	0.24	< 0.1	11.02	11.29	11.84	12.85	12.90
20 July 12:00	0.24	< 0.1	11.18	11.46	12.02	13.06	13.11
20 July 13:00	0.25	< 0.1	11.25	11.54	12.11	13.17	13.22
20 July 14:00	0.26	< 0.1	11.25	11.55	12.12	13.18	13.23
20 July 15:00	0.27	< 0.1	11.25	11.54	12.11	13.16	13.22
20 July 16:00	0.29	< 0.1	11.33	11.62	12.19	13.24	13.30
20 July 17:00	0.30	< 0.1	11.44	11.73	12.30	13.35	13.40

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Table B.1 Summary of 24-Hour Time Weighted Average Concentrations (Reported Each Hour)

Date and Time	CO	NO_2	PM_1	$PM_{2.5}$	PM_4	PM_{10}	Total Particulate Mass
	ppm	ppm	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)
20 July 18:00	0.31	< 0.1	11.48	11.77	12.34	13.35	13.41
20 July 19:00	0.32	< 0.1	11.58	11.88	12.45	13.48	13.53
20 July 20:00	0.33	< 0.1	11.68	11.99	12.56	13.58	13.63
20 July 21:00	0.33	< 0.1	11.78	12.08	12.64	13.63	13.68
20 July 22:00	0.34	< 0.1	11.77	12.07	12.62	13.61	13.66
20 July 23:00	0.34	< 0.1	11.77	12.08	12.63	13.63	13.67
21 July 0:00	0.34	< 0.1	11.79	12.11	12.67	13.67	13.72
21 July 1:00	0.34	< 0.1	11.83	12.16	12.73	13.74	13.78
21 July 2:00	0.34	< 0.1	11.86	12.19	12.76	13.78	13.83
21 July 3:00	0.34	< 0.1	12.00	12.33	12.90	13.93	13.97
21 July 4:00	0.34	< 0.1	12.10	12.43	13.00	14.01	14.06
21 July 5:00	0.34	< 0.1	12.12	12.43	12.96	13.96	14.00
21 July 6:00	0.34	< 0.1	12.08	12.37	12.87	13.84	13.88
21 July 7:00	0.34	< 0.1	12.08	12.34	12.81	13.73	13.78
21 July 8:00	0.33	< 0.1	12.09	12.34	12.79	13.69	13.73
21 July 9:00	0.33	< 0.1	12.18	12.42	12.85	13.73	13.77
21 July 10:00	0.33	< 0.1	12.31	12.53	12.94	13.76	13.81
21 July 11:00	0.34	< 0.1	12.31	12.52	12.89	13.65	13.69
21 July 12:00	0.34	< 0.1	12.33	12.53	12.90	13.62	13.66
21 July 13:00	0.34	< 0.1	12.42	12.62	12.98	13.66	13.70
21 July 14:00	0.33	< 0.1	12.67	12.88	13.23	13.90	13.94
21 July 15:00	0.33	< 0.1	12.98	13.18	13.53	14.19	14.23
21 July 16:00	0.32	< 0.1	13.18	13.38	13.74	14.38	14.42
21 July 17:00	0.32	< 0.1	13.28	13.48	13.83	14.46	14.51
21 July 18:00	0.32	< 0.1	13.32	13.53	13.88	14.51	14.56
21 July 18:49	0.32	< 0.1	13.36	13.57	13.92	14.55	14.60
23 July 9:00	0.31	< 0.1	13.51	13.74	14.09	14.73	14.78
23 July 10:00	0.31	< 0.1	13.46	13.70	14.06	14.71	14.76

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Table B.1 Summary of 24-Hour Time Weighted Average Concentrations (Reported Each Hour)

Date and Time	CO	NO_2	PM_1	$PM_{2.5}$	PM_4	PM_{10}	Total Particulate Mass
	ppm	ppm	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)
23 July 11:00	0.32	< 0.1	13.37	13.62	13.98	14.62	14.67
23 July 12:00	0.32	< 0.1	13.21	13.44	13.81	14.43	14.49
23 July 12:18	0.33	< 0.1	12.98	13.21	13.58	14.20	14.25