
APPENDIX E

FIELD NOISE MEASUREMENTS



February 4, 2010

Robert Hunton
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Mr. Hunton,

Re.: West Transitway Extension Project
Field Noise Measurements
GmE File # 09-004

1. Introduction

Gradient Microclimate Engineering Inc. (*GmE*) was retained by McCormick Rankin Corporation to conduct environmental noise, air quality and ground vibration studies as part of an environmental assessment (EA) for the proposed West Transitway expansion from Holly Acres Road to Moodie Drive. In addition to theoretically calculated noise levels that represent existing conditions, outdoor noise measurements have been performed at six locations to represent the outdoor living areas (OLA) of residences backing onto Highway 417. This letter summarizes the noise measurement procedure, recorded noise levels, and the applicable comparisons to theoretical data; and is intended to supplement the analysis of existing conditions presented in GME Report # 09-004-Existing dated February 3, 2010.

2. Field Noise Measurements

In accordance with supporting MOE documents, NPC-205¹, NPC-102² and NPC-103³, field measurements were undertaken under calm wind conditions (<15 km/h), in the absence of rain, and dry surfaces. The instrumentation used to perform the measurements consisted of two calibrated Brüel & Kjær Integrating Sound Level Meters, Models 2231 and 2236, equipped with Type 1 microphones (Model ZC 0020). These are Class 1 instruments that satisfy the requirements of the MOE noise measurement protocols described in NPC 103. The meters were fixed onto tripods at approximate heights of 1.5 meters (m) above the ground with each microphone protected by spherical wind screens to eliminate any spurious wind noise.

The measurement locations, described in Table 1 and illustrated in Figure 1, were selected to correspond with theoretical noise receptor locations initially used in the assessment of existing conditions. This relationship enables a direct comparison of calculated vs. measured noise levels. The measurement period at each location was initiated at 0700 Hours extending continuously through to 2300 Hours. During this time period the noise meters were not reset, ensuring that the final value recorded at 2300 Hours accurately represented the complete 16 hour equivalent noise level. This level corresponds to the same time period used for the calculated values according to the City of Ottawa Environmental Noise Control Guidelines enacted May 2006. The running average noise levels were recorded hourly and are presented in Table 1.

Since traffic counts were not performed during the measurement periods, the traffic volumes along Highway 417 are not known. Other relevant environmental factors, as recorded at the MacDonald Cartier International Airport, for each measurement period are provided in Appendix A.

¹ NPC-205 Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban)

² NPC-102 Noise Measurement Instrumentation

³ NPC-103 Noise Measurement Procedures

2. Noise Related Background Information and Criteria

Noise can be defined as any unwanted sound. It is created at a source, transmitted through a medium, such as air, and intercepted by a receiver. Noise may be characterized in terms of the power of the source or the sound pressure at a specific distance. While the power of a source is characteristic of that source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Its measurement is based on the decibel unit, dBA, which is a logarithmic ratio referenced to a standard noise level (2×10^{-5} Pascals). The 'A' suffix refers to a weighting scale, which represents the noise perceived by the human ear. With this scale, a doubling of power results in a 3 dBA increase in measured noise levels and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

For vehicle traffic the equivalent noise level, L_{EQ} , provides an averaged measure of the time varying noise levels. It is defined as the continuous sound level, which has the same energy as a time varying noise level over a selected period of time. The City of Ottawa⁴ and Ministry of The Environment⁵ (MOE) guidelines specify that the L_{EQ} must be based on a 16-hour daytime / 8-hour night time split to assess the impacts of roadway noise on residences.

The same documents also state that the 16 hour L_{EQ} within a noise sensitive area must be equal to or greater than 60 dBA to make that area eligible for noise impact mitigation. A 'noise sensitive area' is defined to be the outdoor living area of a dwelling usually at the rear yard of the building at ground level. Although some receptor locations from the existing conditions analysis experience noise levels that exceed 60 dBA (L_{EQ} 16 hour), the affected areas are not eligible for noise abatement under the City of Ottawa's Local Improvements policy, since the primary noise source is the provincial Highway 417⁶.

⁴ City of Ottawa Environmental Noise Control Guidelines, April 5 2006, Page B6.

⁵ MOE, LU-131 Noise Assessment In Land Use Planning, Tables 1 & 2, page 8

⁶ City of Ottawa Environmental Noise Control Guidelines, City of Ottawa, April 2006, Section 3.2.1.



3. Results and Comparison

Hourly recorded noise levels for each measurement location are summarized in Table 1.

TABLE 1: HOURLY RECORDED NOISE LEVELS (L_{EQ} dBA)

	43 Creeks End Lane	55 Creeks End Lane	33 Creekwood Crescent	70 Cleandon Drive	19 Aero Drive	48 Aero Drive
DD/MM/YY	24/08/09	24/08/09	25/08/09	25/08/09	27/08/09	28/08/09
Hour						
8:00	58.5	56.7	56.9	56.7	53.5	56.4
9:00	58.3	56.7	56.8	56.0	53.7	56.4
10:00	58.3	56.3	56.9	56.0	54.1	-
11:00	58.0	55.9	56.7	55.7	53.8	-
12:00	57.9	57.6	56.8	56.1	54.1	55.9
13:00	57.6	57.2	56.8	56.5	53.7	54.8
14:00	57.6	57.0	56.8	56.7	53.5	55.3
15:00	57.7	56.9	56.8	56.8	53.3	55.9
16:00	55.8	56.8	56.7	56.9	53.3	56.1
17:00	57.8	56.9	56.8	57.1	53.1	56.6
18:00	57.8	56.9	57.1	57.6	53.0	56.9
19:00	57.7	56.8	57.0	57.4	53.0	57.2
20:00	57.6	56.7	56.9	57.3	52.9	57.3
21:00	57.6	56.6	56.7	57.2	53.1	57.0
22:00	57.7	56.6	56.7	57.2	53.0	56.8
23:00, L _{EQ} 16	57.6	56.6	56.7	57.1	53.0	56.7

This data represents the hourly recorded running-average noise levels for each location. The gap in the data at 48 Aero Drive is a result of a pause in the measurement that was required during tree maintenance activities that occurred between 9 AM and 11 AM. The final value in each column represents the average noise level for the complete daytime period (L_{EQ} 16).



Table 2 provides a comparative summary of the measured L_{EQ16} against *GmE's* theoretically calculated values⁷.

TABLE 2: COMPARATIVE MEASURED VS. THEORETICAL NOISE LEVELS (L_{EQ} dBA)

Address	GME Receptor #	Measured 16 Hour LEQ	GmE Theoretical*
43 Creeks End Lane	25	57.6	62.5
55 Creeks End Lane	25	56.6	62.5
33 Creekwood Crescent	14	56.7	63.0
70 Cleandon Drive	20	57.1	58.8
19 Aero Drive	5	53.0	57.2
48 Aero Drive	10	56.7	58.1

* Theoretical noise levels are based on Highway 417 traffic data provided by McCormick Rankin Corporation⁸.

In all cases measured values are lower than theoretical values. The lower measured values may be attributed to the combined effects of several mitigating factors including atmospheric conditions, foliage, complex topographical attenuation, and actual traffic volumes that are lower than those used in the calculations. In a similar fashion, with optimal highway and atmospheric conditions, measured noise levels could approach the theoretical values. This situation demonstrates the benefits of using theoretical prediction models that are based on annually averaged data and conservative estimates of environmental effects; and demonstrates why limited field measured data cannot be exclusively relied upon to generate an accurate representation of existing conditions.

⁷ West Transitway Extension Project, Holly Acres Road to Moodie Drive, Environmental Noise, Air Quality & Ground Vibrations, Existing Conditions Report, GME Report # 09-004-Existing, February 4 2010.

⁸ Memo To File, McCormick Rankin Corporation File # 107499, January 28 2010.



4. SUMMARY

The results of the foregoing field noise measurements support theoretical prediction methods by illustrating that theoretical values are often significantly higher than actual conditions. Although the measured data cannot be used exclusively to define the local noise environment, it provides a valuable confirmation that the theoretical prediction model produces results that favourably represent the best interests of homeowners impacted by roadway noise. This concludes our summary of field measurements and their comparison to theoretical data.

Yours truly,

Gradient Microclimate Engineering Inc.

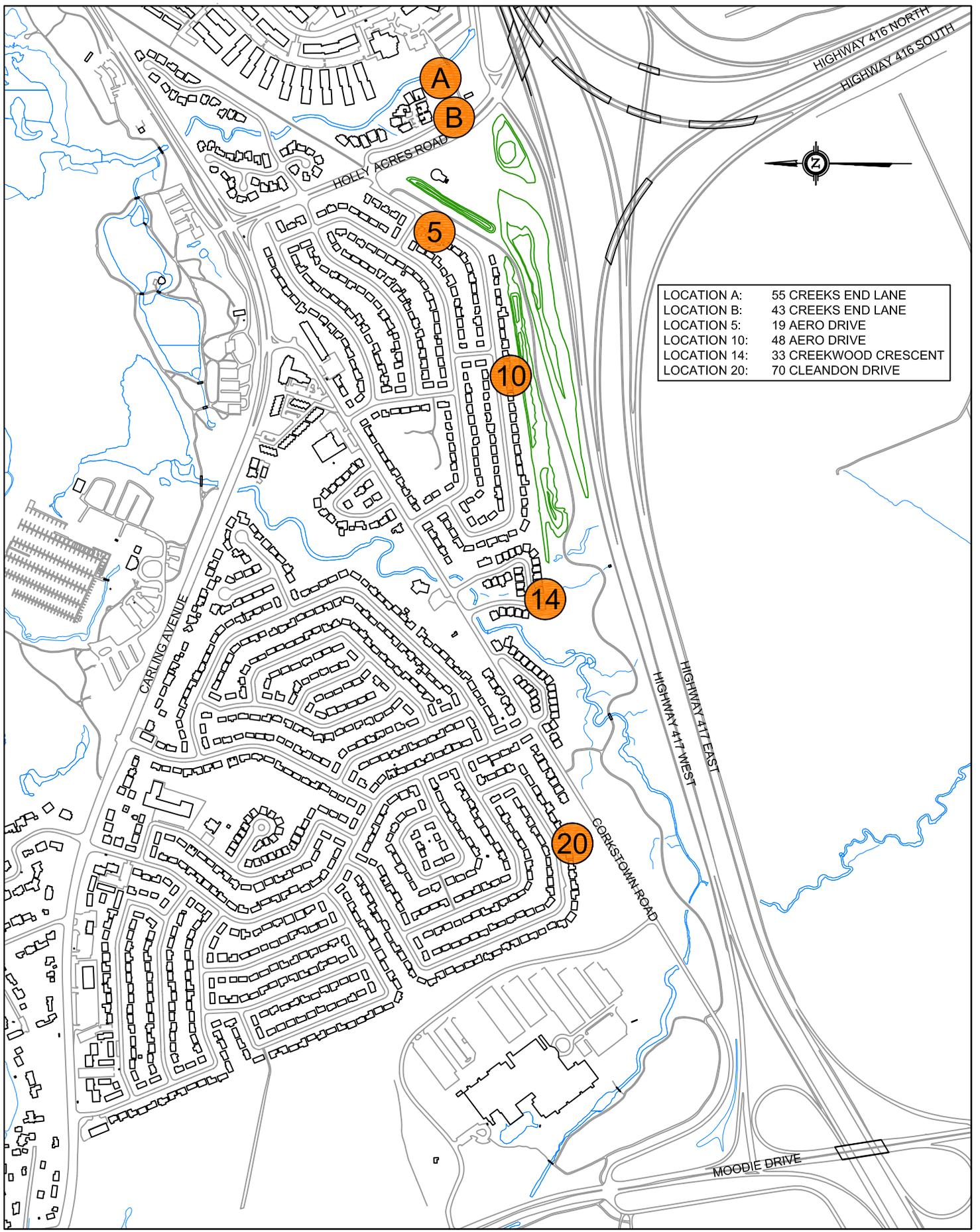
A handwritten signature in blue ink, appearing to read 'Vincent Ferraro', is written over the top portion of the professional engineer's seal.

Vincent Ferraro, M.Eng., P.Eng.



A handwritten signature in blue ink, appearing to read 'Adam Welburn', is written in a cursive style.

Adam Welburn, Project Technologist



LOCATION A:	55 CREEKS END LANE
LOCATION B:	43 CREEKS END LANE
LOCATION 5:	19 AERO DRIVE
LOCATION 10:	48 AERO DRIVE
LOCATION 14:	33 CREEKWOOD CRESCENT
LOCATION 20:	70 CLEANDON DRIVE



APPENDIX A

WEATHER DATA RECORDED AT THE MACDONALD CARTIER
INTERNATIONAL AIRPORT
DURING EACH MEASUREMENT PERIOD



August 24 2009								
Time	Temp	Dew Point	Rel Hum	Wind Dir	Wind Spd	Visibility	Stn Press	Weather
	°C	°C	%	10's deg	km/h	km	kPa	
7:00	18.2	15	82	29	4	24.1	100.43	Mostly Cloudy
8:00	19.5	15.2	76	35	6	24.1	100.44	Mostly Cloudy
9:00	20.9	15.3	70	32	13	24.1	100.46	Mostly Cloudy
10:00	20.9	15.5	71	28	9	24.1	100.49	Mostly Cloudy
11:00	22.5	14.8	62	29	4	24.1	100.51	Mainly Clear
12:00	23.1	14.2	57	29	15	24.1	100.55	Mainly Clear
13:00	23.3	15.1	60	27	22	24.1	100.55	Mostly Cloudy
14:00	23.1	14.3	58	29	19	24.1	100.52	Mainly Clear
15:00	23.4	14.4	57	27	15	24.1	100.51	Mainly Clear
16:00	23.3	12.3	50	28	17	24.1	100.51	Mainly Clear
17:00	23.1	11.7	49	28	15	24.1	100.48	Mainly Clear
18:00	21.8	11.7	53	29	9	24.1	100.47	Mainly Clear
19:00	18.6	10.2	58	30	11	24.1	100.5	Mainly Clear
20:00	19.1	10.7	58	27	6	25	100.59	Clear
21:00	18.1	10.9	63		0	25	100.61	Clear
22:00	17.1	11.1	68	32	4	25	100.62	Clear
23:00	16.8	12.1	74	27	4	25	100.6	Clear

August 25 2009								
Time	Temp	Dew Point	Rel Hum	Wind Dir	Wind Spd	Visibility	Stn Press	Weather
	°C	°C	%	10's deg	km/h	km	kPa	
7:00	16.6	13.5	82		0	24.1	100.65	Mainly Clear
8:00	18	13.9	77	19	6	24.1	100.61	Mainly Clear
9:00	20.5	14.5	68	22	7	24.1	100.57	Mainly Clear
10:00	22.5	14.6	61	22	20	24.1	100.52	Mainly Clear
11:00	23.3	14.7	58	24	22	24.1	100.46	Mostly Cloudy
12:00	24	15	57	23	19	24.1	100.41	Mostly Cloudy
13:00	24.2	15.2	57	23	15	24.1	100.34	Mostly Cloudy
14:00	25.6	15	52	22	20	24.1	100.24	Mainly Clear
15:00	25.2	16	57	20	20	24.1	100.16	Mostly Cloudy
16:00	25	15.8	57	20	24	24.1	100.04	Mostly Cloudy
17:00	23.6	15.7	61	21	22	24.1	100.04	Mostly Cloudy
18:00	22.7	16.2	67	20	17	24.1	100.02	Mostly Cloudy
19:00	21	15.8	72	21	19	24.1	100.05	Cloudy
20:00	20.1	15.3	74	20	17	25	99.97	Mainly Clear
21:00	19.3	15.3	78	21	15	25	99.95	Clear
22:00	18.8	15.5	81	22	15	25	99.92	Mainly Clear
23:00	18.9	16.1	84	21	13	25	99.84	Mostly Cloudy



August 27 2009								
Time	Temp	Dew Point	Rel Hum	Wind Dir	Wind Spd	Visibility	Stn Press	Weather
	°C	°C	%	10's deg	km/h	km	kPa	
7:00	11.1	8	81	1	11	24.1	100.88	Mainly Clear
8:00	12.5	6.1	65	2	7	24.1	100.92	Mainly Clear
9:00	13.4	5.6	59	33	7	24.1	100.91	Mainly Clear
10:00	14.6	6.5	58	28	7	24.1	100.88	Mostly Cloudy
11:00	15.3	6.2	55	31	15	24.1	100.89	Mostly Cloudy
12:00	17.1	6.3	49	32	11	24.1	100.87	Mostly Cloudy
13:00	17.5	6.6	49	30	7	24.1	100.81	Mostly Cloudy
14:00	17.8	6.1	46	27	13	24.1	100.78	Mostly Cloudy
15:00	18.6	4.8	40	34	15	24.1	100.77	Mostly Cloudy
16:00	18.3	5.4	43	36	15	24.1	100.77	Mostly Cloudy
17:00	17.6	5.6	45	34	9	24.1	100.76	Mostly Cloudy
18:00	16.4	6	50	3	7	24.1	100.76	Mostly Cloudy
19:00	15	5.5	53	6	7	24.1	100.79	Mostly Cloudy
20:00	13.3	6.1	62	16	4	25	100.85	Mostly Cloudy
21:00	13.5	5.8	60		0	25	100.9	Mostly Cloudy
22:00	13.4	5.4	58		0	25	100.89	Mostly Cloudy
23:00	12.2	5.1	62		0	25	100.87	Mostly Cloudy

August 28 2009								
Time	Temp	Dew Point	Rel Hum	Wind Dir	Wind Spd	Visibility	Stn Press	Weather
	°C	°C	%	10's deg	km/h	km	kPa	
7:00	10.7	7.1	78	7	11	24.1	101.04	Mostly Cloudy
8:00	12.4	7.3	71	8	13	24.1	101.03	Mostly Cloudy
9:00	14.4	7.8	65	9	13	24.1	100.99	Mainly Clear
10:00	16.2	7.8	57	7	11	24.1	100.99	Mainly Clear
11:00	17.4	6.7	49	6	15	24.1	100.94	Mostly Cloudy
12:00	18.5	7.5	49	13	9	24.1	100.9	Mostly Cloudy
13:00	18	7.3	50	10	9	24.1	100.83	Cloudy
14:00	17.8	7.4	51	9	11	24.1	100.84	Cloudy
15:00	18.3	7.8	50	9	13	24.1	100.79	Cloudy
16:00	17.2	7.8	54	7	15	24.1	100.71	Cloudy
17:00	16.7	8.1	57	7	17	24.1	100.68	Cloudy
18:00	16.1	8.6	61	7	15	24.1	100.61	Cloudy
19:00	15.3	8	62	7	19	25	100.55	Cloudy
20:00	14.6	8.2	65	7	15	25	100.58	Cloudy
21:00	14.5	8	65	7	17	25	100.53	Cloudy
22:00	14.1	8.6	69	7	19	25	100.46	Cloudy
23:00	13.9	8.1	68	7	20	25	100.37	Cloudy