REPORT

Traffic Noise Monitoring Program 2020

City of Grande Prairie

Submitted to:

Jennifer Dalziel

Engineering Services
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Submitted by:

Golder Associates Ltd.
2800, 700 - 2nd Street SW, Calgary, Alberta, T2P 2W2, Canada

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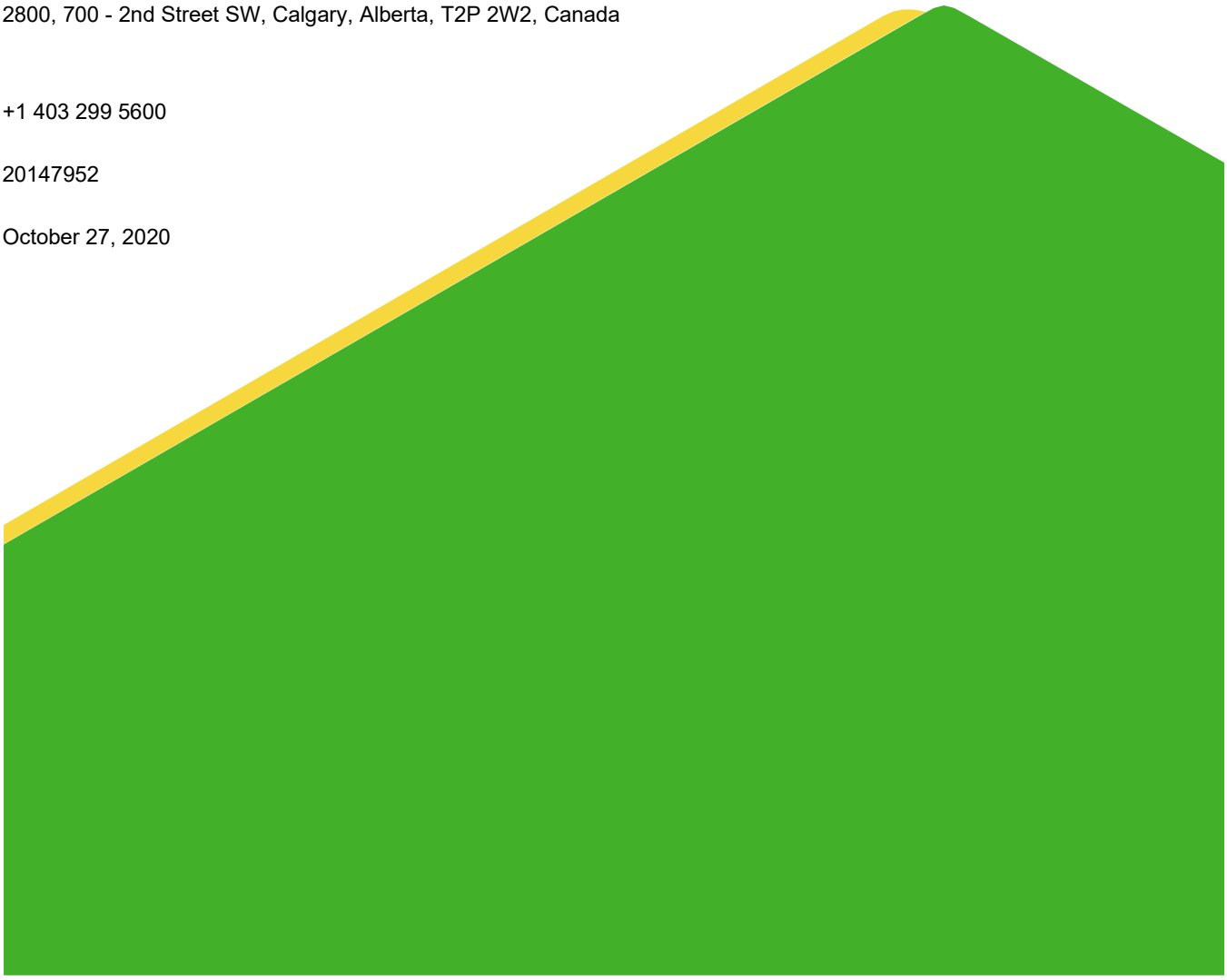
20147952

October 27, 2020



Distribution List

1 electronic copy - City of Grande Prairie

1 electronic copy - Golder Associates Ltd.

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1.0 INTRODUCTION

Since 2002, the City of Grande Prairie (the City) has been collecting sound level measurements to characterize traffic noise in residential neighbourhoods. Golder Associates Ltd. (Golder) was retained by the City to carry out the 2020 traffic noise monitoring program.

Golder executed the 2020 traffic noise monitoring program during the period September 15 to 17, 2020. During the 2020 traffic noise monitoring program, sound level measurements were collected at 14 residential receptors located throughout Grande Prairie. The results of the 2020 traffic noise monitoring program are presented in this report.

2.0 METHODS

Sound level measurements were collected using Bruel and Kjaer Model 2250 integrating sound level meters. A total of seven different sound level meters were used to collect measurements at the 14 residential receptors targeted during the 2020 traffic noise monitoring program. Each sound level meter was deployed sequentially at two different receptors. Table 1 provides the serial number of the sound level meter that was used to collect measurements at each receptor.

Table 1: Sound Level Meters

Make	Model	Serial Number	Residential Receptors
Bruel and Kjaer	2250	3007710	R01; R21
Bruel and Kjaer	2250	3024162	R02; R09
Bruel and Kjaer	2250	3007557	R03; R04
Bruel and Kjaer	2250	3004114	R05; R11
Bruel and Kjaer	2250	3009811	R06; R08
Bruel and Kjaer	2250	3011887	R07; R16
Bruel and Kjaer	2250	2717770	R15; R19

Each sound level meter used for the 2020 traffic noise monitoring program undergoes regular calibration at a certified laboratory. Copies of the most recent calibration certificate for each sound level meter are presented in Appendix A of this report. In addition, the sound level meters were field-calibrated before and after each monitoring period using a Bruel and Kjaer Model 4231 calibrator unit (serial no. 229623). The calibrator used in the 2020 traffic noise monitoring program also undergoes regular laboratory calibration and a copy of the most recent calibration certificate is presented in Appendix A of this report.

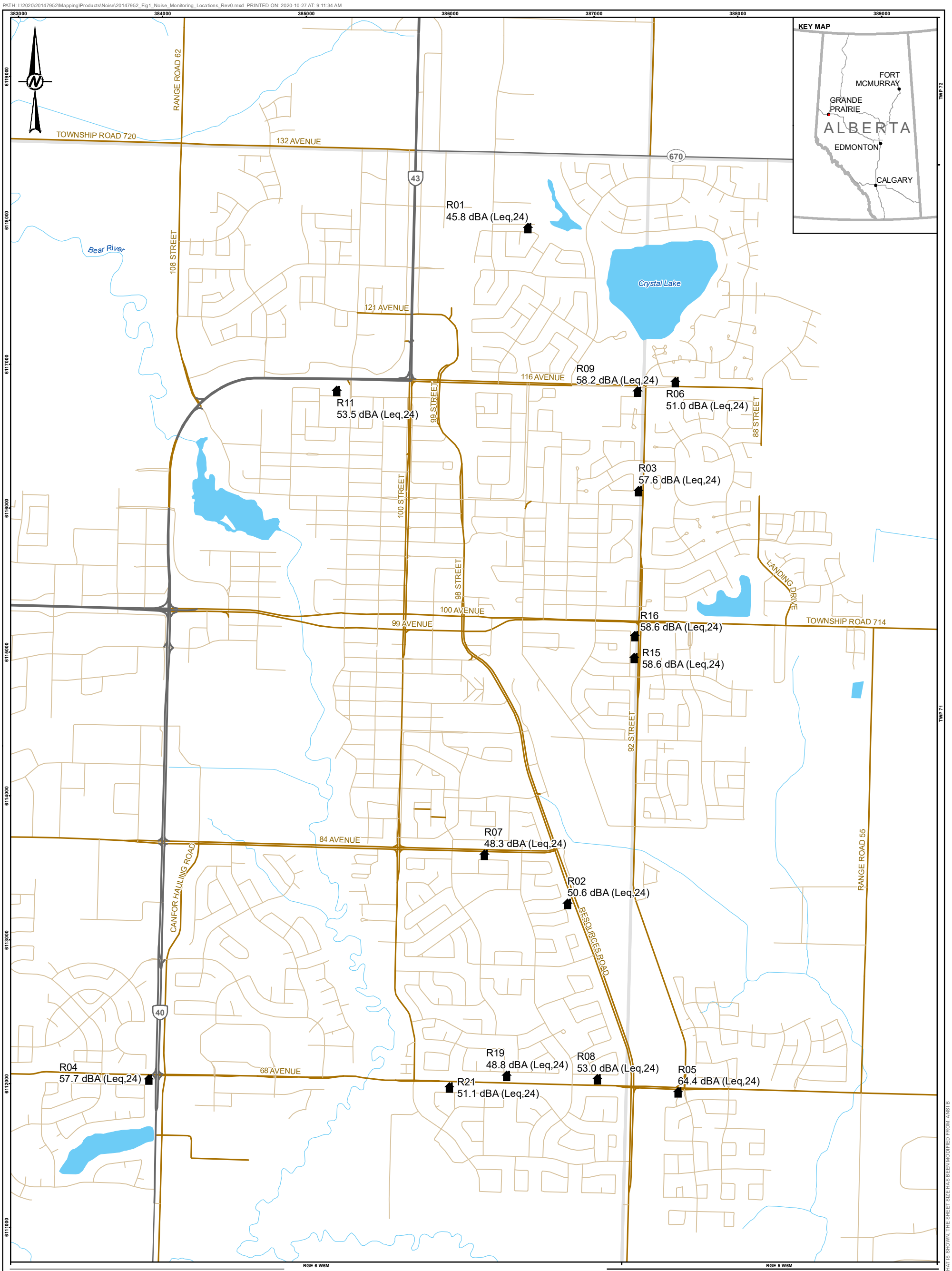
Table 2 presents the receptor identification code and street address for each of the 14 residential locations used for the 2020 traffic noise monitoring program. The location of the 14 residential receptors is also shown in Figure 1. At each receptor, the sound level meter was deployed a minimum of three metres from the rear wall of the dwelling. The sound level meter's microphone was deployed at a height of approximately 1.5 metres above ground, to match the height at which noise exposure typically occurs. Each of the sound level meters was configured to record energy equivalent sound levels over a one-minute averaging period ($L_{eq,1min}$). At each receptor, $L_{eq,1min}$ sound levels were logged for a minimum of 24 hours.

Table 2: Residential Receptors

Receptor Identification Code[(a)]	Street Address
R01	9628 126 AVENUE
R02	7923 94 STREET
R03	10901 92A STREET
R04	6705 109 STREET
R05	6713 90A STREET
R06	9113 117 AVENUE
R07	9654 83 AVENUE
R08	6337 69 AVENUE
R09	9214 115 AVENUE
R11	10218 114A AVENUE
R15	9709 92A STREET
R16	9813 92A STREET
R19	9617 69 AVENUE
R21	9854 67 AVENUE

(a) The City originally planned to use 21 residential receptors for the 2020 traffic noise monitoring program. Because 14 receptors were ultimately selected for the program, receptor identification codes are not continuous.

PATH: I:\2020\20147952\Mapping\Products\Noise\20147952_Fig1_Noise_Monitoring_Locations_Rev0.mxd PRINTED ON: 2020-10-27 AT: 9:11:34 AM



LEGEND

- NOISE MONITORING LOCATION
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- LOCAL STREET
- WATERCOURSE
- WATERBODY

0 500 1,000
1:25,000 METRES

REFERENCE(S)

ALBERTA DIGITAL BASE DATA MAY BE OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED, ALTALIS LTD.© GOVERNMENT OF ALBERTA 2016. ALL RIGHTS RESERVED. OR IHS MARKIT CANADA ULC.
PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
CITY OF GRANDE PRAIRIE

PROJECT
GRANDE PRAIRIE TRAFFIC NOISE MONITORING (2020)

TITLE
NOISE MONITORING LOCATIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2020-10-27
DESIGNED	VY
PREPARED	LB
REVIEWED	VY
APPROVED	AF

PROJECT NO.	CONTROL	REV.	FIGURE
20147952	1000	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25mm

At the conclusion of the 2020 traffic noise monitoring program, Golder eliminated $L_{eq,1min}$ data samples that were unduly influenced by Golder's technician during deployment and recovery of the sound level meter. Golder also eliminated $L_{eq,1min}$ data samples that were logged during periods of high wind speed (i.e., wind speed greater than 20 kilometres per hour), since high wind can unduly influence measured sound levels. Note that wind speed data were taken from Environment Canada's "Grande Prairie A" weather station.

For each receptor, Golder used the remaining $L_{eq,1min}$ data samples to calculate the:

- 24-hour average sound level ($L_{eq,24}$)
- 16-hour average daytime sound level ($L_{eq,day}$)
- eight-hour average nighttime sound level ($L_{eq,night}$)
- average sound level for the two-hour morning traffic peak ($L_{eq,morn}$)
- average sound level for the two-hour afternoon traffic peak ($L_{eq,aft}$)
- maximum sound level for a one-hour period ($L_{eq,1hr[max]}$)

Note that the 16-hour daytime corresponds to the period between 7 am and 11 pm, the eight-hour nighttime corresponds to the period between 11 pm and 7 am, the two-hour morning traffic peak corresponds to the period between 7 am and 9 am, and the two-hour afternoon traffic peak corresponds to the period between 4 pm and 6 pm.

3.0 ASSESSMENT CRITERIA

The City's 2002 Transportation Master Plan indicates that measured $L_{eq,24}$ sound levels should be evaluated against the following limits for traffic noise.

- For new residential areas, noise reduction be provided for traffic noise over 60 A-weighted decibels (dBA) for an existing or new road, within 1 year of completion of development in the area of the roadway, at the developer's responsibility.
- For existing residential areas, noise reduction for noise levels over 65 dBA for a new or modified roadway, within 10 years of construction, at the City's responsibility.

Subsequent versions of the City's Transportation Master Plan (e.g., the 2009 and 2020 versions) do not provide alternative limits for traffic noise. As such, noise limits from the 2002 Transportation Master Plan have been used to evaluate $L_{eq,24}$ sound levels measured in previous years of the traffic noise monitoring program, and these limits were used again in the 2020 traffic noise monitoring program.

Golder understands that the 14 residential receptors used for the 2020 traffic noise monitoring program are all within "existing residential areas" (as per the 2002 Transportation Master Plan). Therefore, a noise limit of 65 dBA was considered applicable to $L_{eq,24}$ sound levels measured at each of the 14 receptors.

4.0 RESULTS

Table 3 presents measured sound levels for each of the 14 residential receptors used for the 2020 traffic noise monitoring program. For each receptor, $L_{eq,24}$ sound levels are also shown in Figure 1 (see Section 3.0 of this report). Table 4 presents a qualitative description of the noise sources that were observed at each receptor. Graphs showing individual $L_{eq,1min}$ sound levels measured at each receptor are presented in Appendix B of this report. Appendix C of this report presents $L_{eq,24}$ sound levels from the 2020 traffic noise monitoring program in the context of historical sound level measurements dating back to 2002.

Table 3: Measured Sound Levels

Receptor Identification Code	Street Address	Measured Sound Level [dBA]					
		24-Hour Average [$L_{eq,24}$]	16-Hour Daytime Average [$L_{eq,day}$]	8-Hour Nighttime Average [$L_{eq,night}$]	2-Hour Morning Peak [$L_{eq,morn}$]	2-Hour Afternoon Peak [$L_{eq,aft}$]	1-Hour Maximum [$L_{eq,1hr[max]}$]
R01	9628 126 AVE	45.8	46.7	43.0	49.0	50.3	51.0
R02	7923 94 ST	50.6	51.5	48.5	52.0	52.9	54.8
R03	10901 92A ST	57.6	58.8	52.9	59.6	59.4	60.3
R04	6705 109 ST	57.7	58.9	53.9	57.9	59.6	62.4
R05	6713 90A ST	64.4	65.8	59.7	64.9	66.8	68.8
R06	9113 117 AVE	51.0	52.1	47.1	54.9	51.8	57.1
R07	9654 83 AVE	48.3	49.7	43.2	52.7	47.6	54.4
R08	6337 69 AVE	53.0	54.1	49.9	54.9	54.4	56.2
R09	9214 115 AVE	58.2	59.5	53.0	61.4	61.3	62.8
R11	10218 114A AVE	53.5	54.3	51.2	56.1	56.3	57.2
R15	9709 92A ST	58.6	59.9	53.2	60.3	60.3	64.0
R16	9813 92A ST	58.6	59.8	54.8	60.8	60.2	61.9
R19	9617 69 AVE	48.8	49.9	45.7	50.5	50.8	51.7
R21	9854 67 AVE	51.1	52.5	46.0	52.5	52.6	55.7

Table 4: Observed Noise Sources

Receptor Identification Code	Street Address	Observed Noise Sources
R01	9628 126 AVE	road noise; back-up beepers from distant construction site; birds
R02	7923 94 ST	traffic on Resources Road is dominant noise source; back-up beepers from distant construction site; birds
R03	10901 92A ST	traffic on 92 Street is dominant noise source
R04	6705 109 ST	traffic on 68 Avenue and Highway 40 is dominant noise source
R05	6713 90A ST	traffic on 68 Avenue and 92 Street; train whistles and bells from level crossing; birds
R06	9113 117 AVE	traffic on 116 Avenue; birds; barking from distant dogs; children playing in nearby park
R07	9654 83 AVE	traffic on 84 Avenue is dominant noise source; barking from distant dogs
R08	6337 69 AVE	traffic on 68 Avenue is dominant noise source
R09	9214 115 AVE	traffic on 116 Avenue and 92 Street is dominant noise source; children playing in nearby yards
R11	10218 114A AVE	traffic on 116 Avenue is dominant noise source; fountain within backyard; birds; barking from distant dogs
R15	9709 92A ST	traffic on 92 Street is dominant noise source; birds
R16	9813 92A ST	traffic on 92 Street is dominant noise source; birds
R19	9617 69 AVE	traffic on 68 Avenue is dominant noise source; several small fountains within backyard; birds
R21	9854 67 AVE	traffic on 68 Avenue is dominant noise source

5.0 DISCUSSION

At residential receptor R05 (6713 90A STREET), the $L_{eq,24}$ sound level was measured at 64.4 dBA, which is less than 1 dBA below the 65 dBA noise limit set out in the 2002 Transportation Master Plan. Measurements collected at this same receptor in 2016 and 2018 found $L_{eq,24}$ sound levels of 64.5 dBA and 64.6 dBA, respectively, which suggests traffic noise at R05 has remained relatively constant over the past four years (see Appendix C of this report). Because existing sound levels are very close to the applicable limit, Golder recommends that residential receptor R05 continue to be targeted during future traffic noise monitoring programs, and that the City consider noise mitigation if $L_{eq,24}$ sound levels are found to exceed 65 dBA.

At all other residential receptors targeted during the 2020 traffic noise monitoring program, $L_{eq,24}$ sound levels were found to be less than 60 dBA, which is more than 5 dBA below the 65 dBA noise limit set out in the 2002 Transportation Master Plan. Furthermore, none of the residential receptors showed major increases relative to historical data (see Appendix C of this report).

In summary, $L_{eq,24}$ sound levels measured at each of the residential receptors targeted during the 2020 traffic noise monitoring program were found to be compliant with the 65 dBA traffic noise limit set out in the City's 2002 Transportation Master Plan.

Signature Page

Golder Associates Ltd.

Victor Young, MSc
Acoustic Scientist

Andrew Faszer, BSc, INCE, PEng
Senior Engineer

VY/AF/rd/al

https://golderassociates.sharepoint.com/sites/130959/project files/6 deliverables/gp traffic noise 2020 - 27 oct 2020.docx

APPENDIX A

Calibration Certificates

This appendix presents laboratory calibration certificates for the seven sound level meters and one field calibrator unit used during the 2020 traffic noise monitoring program. In accordance with standard industry practice, the sound level meters are laboratory calibrated on a biannual basis (i.e. once every two years) and the field calibrator unit is laboratory calibrated on an annual basis (i.e., once every year).

Brüel & Kjær
North America Inc.

The Brüel & Kjær Calibration Laboratory
3079 Premiere Parkway Suite 120
Duluth, GA 30097
Telephone: 770/209-6907
Fax: 770/447-4033
Web site address: http://www.bkhome.com

ACCREDITED
Calibration Certificate Number 1568.01

CERTIFICATE OF CALIBRATION

Certificate No: CAS-411406-G1F0Z2-301 Page 1 of 9

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	Serial No: 3007710
Microphone:	Brüel & Kjær	4189	Serial No: 2680261
Preamplifier:	Brüel & Kjær	ZC-0032	Serial No: 15717
Software version:	BZ7222 Version 4.7.5		

CLIENT:

XSCALA Rental Instruments Inc.
234-5149 Country Hills Blvd. NW
Calgary, AB T3A 5K8

CALIBRATION CONDITIONS:

Preconditioning:	4 hours at 23 ± 3 °C
Environment conditions	See actual values in Environmental Condition sections

SPECIFICATIONS:

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Brüel and Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

Brüel and Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 8.0 - DB: 8.00 Test Collection 2250-4189.

RESULTS:

As Received Condition	As Received Data	Final Data
_X_ Received in good condition	_X_ Within acceptance criteria	_X_ Within acceptance criteria
___ Damaged - See attached report	___ Outside acceptance criteria	___ Limited test - See attached details
	___ Inoperative	
	___ Data not taken	

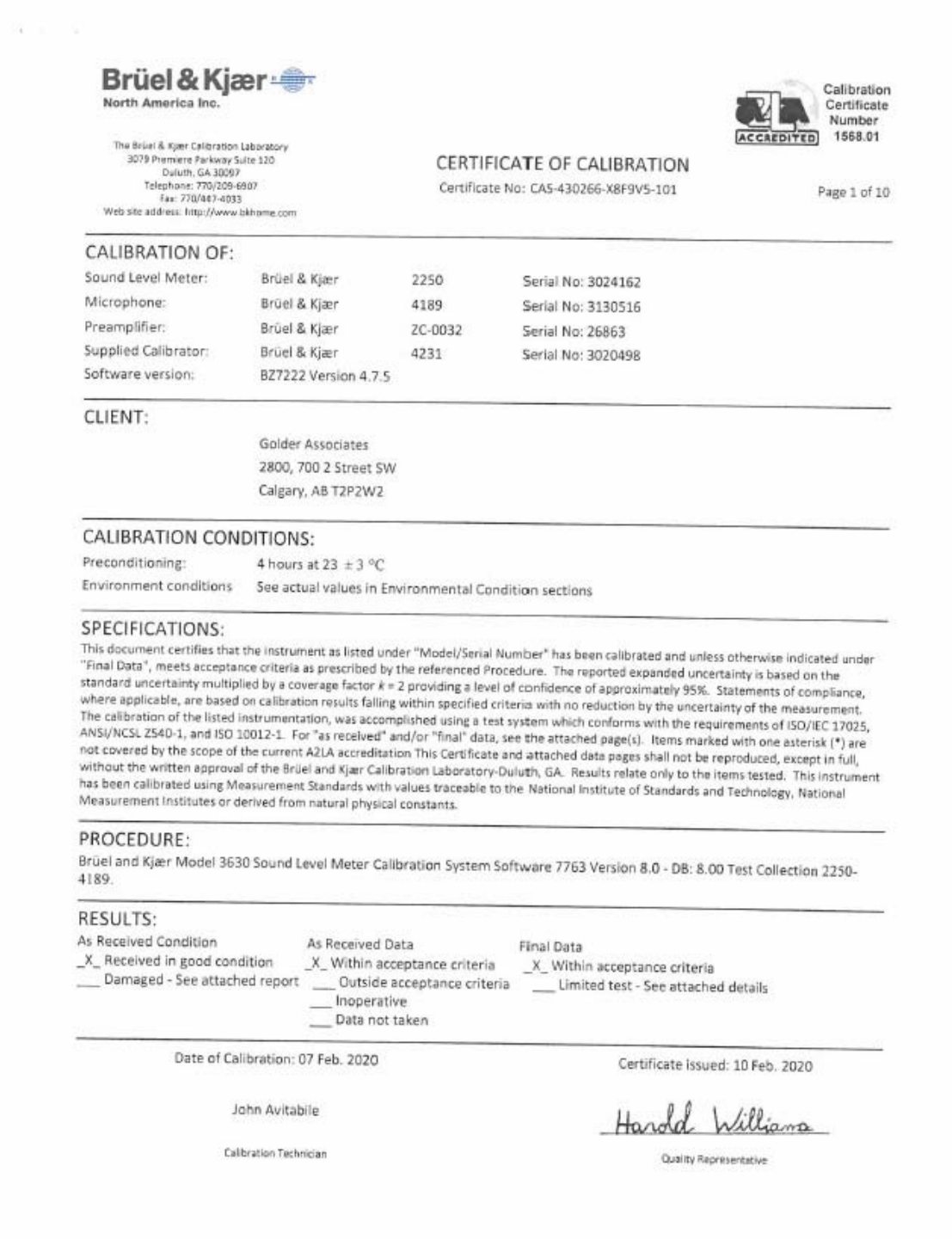
Date of Calibration: 18 Oct. 2019

Certificate issued: 21 Oct. 2019

Kyle Chancey
Calibration Technician

John Atilla
Quality Representative

Figure A-1 - Calibration Certificate for 2250 Sound Level Meter Serial No. 3007710



Brüel & Kjær
North America Inc.

The Brüel & Kjær Calibration Laboratory
3079 Premiere Parkway Suite 120
Duluth, GA 30097
Telephone: 770/209-6907
Fax: 770/447-4033
Web site address: http://www.bkhome.com

Calibration Certificate Number 1568.01

CERTIFICATE OF CALIBRATION

Certificate No: CAS-430266-X8F9V5-101

Page 1 of 10

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	Serial No: 3024162
Microphone:	Brüel & Kjær	4189	Serial No: 3130516
Preamplifier:	Brüel & Kjær	ZC-0032	Serial No: 26863
Supplied Calibrator:	Brüel & Kjær	4231	Serial No: 3020498
Software version:	BZ7222 Version 4.7.5		

CLIENT:

Golder Associates
2800, 700 2 Street SW
Calgary, AB T2P2W2

CALIBRATION CONDITIONS:

Preconditioning: 4 hours at 23 ± 3 °C
Environment conditions See actual values in Environmental Condition sections

SPECIFICATIONS:

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Brüel and Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

Brüel and Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 8.0 - DB: 8.00 Test Collection 2250-4189.

RESULTS:

As Received Condition	As Received Data	Final Data
_X_ Received in good condition	_X_ Within acceptance criteria	_X_ Within acceptance criteria
___ Damaged - See attached report	___ Outside acceptance criteria	___ Limited test - See attached details
	___ Inoperative	
	___ Data not taken	

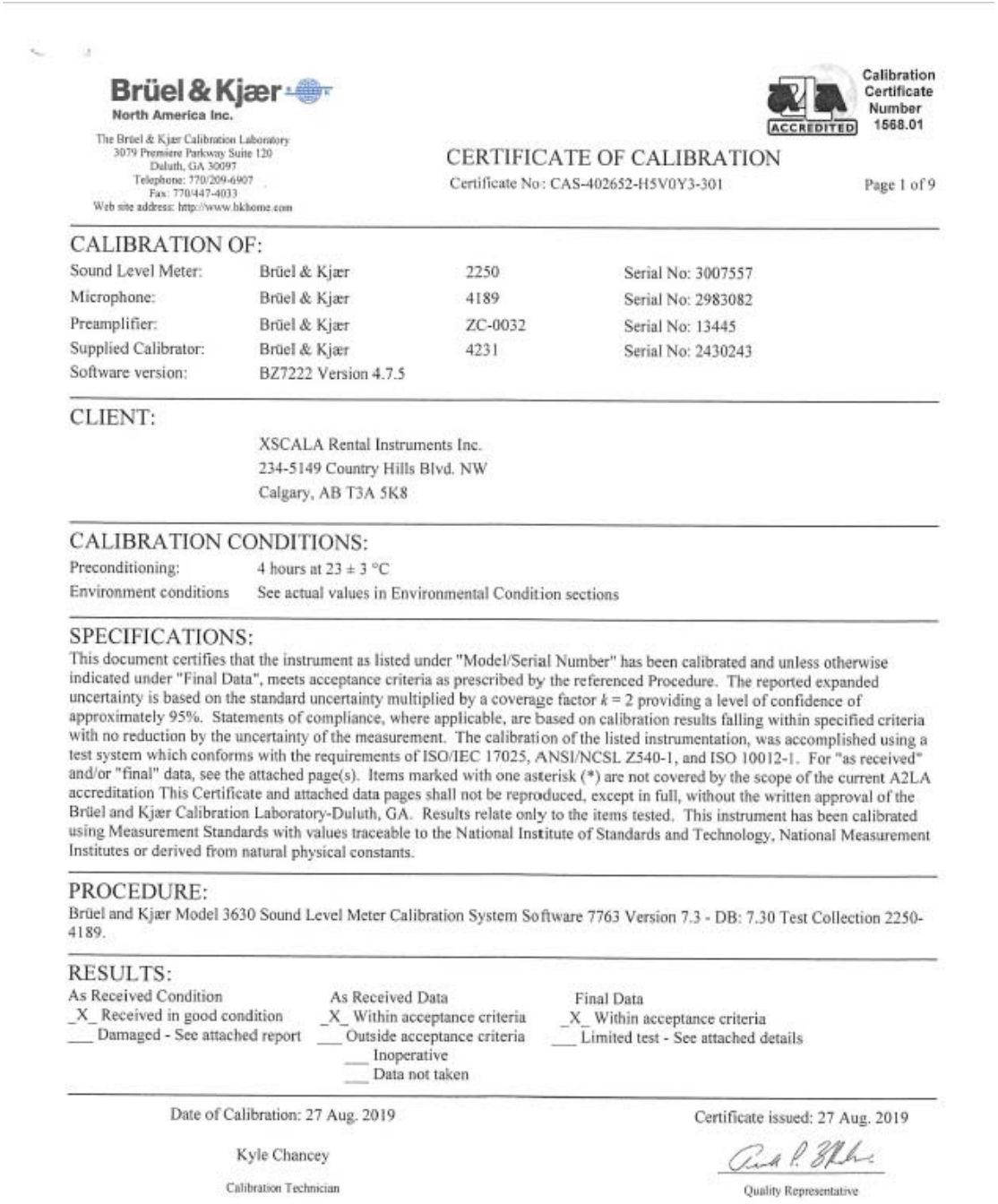
Date of Calibration: 07 Feb. 2020

Certificate issued: 10 Feb. 2020

John Avitabile
Calibration Technician

Harold Williams
Quality Representative

Figure A-2 - Calibration Certificate for 2250 Sound Level Meter Serial No. 3024162



Brüel & Kjær
North America Inc.

The Brüel & Kjær Calibration Laboratory
3079 Premiere Parkway Suite 120
Duluth, GA 30097
Telephone: 770/209-6907
Fax: 770/447-4033
Web site address: http://www.bkhome.com

ACCREDITED
Calibration Certificate Number 1568.01

CERTIFICATE OF CALIBRATION

Certificate No: CAS-402652-H5V0Y3-301 Page 1 of 9

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	Serial No: 3007557
Microphone:	Brüel & Kjær	4189	Serial No: 2983082
Preamplifier:	Brüel & Kjær	ZC-0032	Serial No: 13445
Supplied Calibrator:	Brüel & Kjær	4231	Serial No: 2430243
Software version:	BZ7222 Version 4.7.5		

CLIENT:

XSCALA Rental Instruments Inc.
234-5149 Country Hills Blvd. NW
Calgary, AB T3A 5K8

CALIBRATION CONDITIONS:

Preconditioning:	4 hours at 23 ± 3 °C
Environment conditions	See actual values in Environmental Condition sections

SPECIFICATIONS:

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Brüel and Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

Brüel and Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 7.3 - DB: 7.30 Test Collection 2250-4189.

RESULTS:

As Received Condition	As Received Data	Final Data
_X_ Received in good condition	_X_ Within acceptance criteria	_X_ Within acceptance criteria
___ Damaged - See attached report	___ Outside acceptance criteria	___ Limited test - See attached details
	___ Inoperative	
	___ Data not taken	

Date of Calibration: 27 Aug. 2019

Kyle Chancey
Calibration Technician

Certificate issued: 27 Aug. 2019

Quality Representative

Figure A-3 - Calibration Certificate for 2250 Sound Level Meter Serial No. 3007557

Brüel & Kjær
North America Inc.

The Brüel & Kjær Calibration Laboratory
3079 Premiere Parkway Suite 120
Duluth, GA 30097
Telephone: 770/209-6907
Fax: 770/447-4033
Web site address: http://www.bkhome.com

Calibration Certificate Number 1568.01
ACCREDITED

CERTIFICATE OF CALIBRATION

Certificate No: CAS-428360-H0R5F9-302

Page 1 of 9

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	Serial No: 3004114
Microphone:	Brüel & Kjær	4189	Serial No: 2877058
Preamplifier:	Brüel & Kjær	ZC-0032	Serial No: 19390
Software version:	BZ7222 Version 4.7.5		

CLIENT:

XSCALA Rental Instruments Inc.
234-5149 Country Hills Blvd. NW
Calgary, AB T3A 5K8

CALIBRATION CONDITIONS:

Preconditioning:	4 hours at 23 ± 3 °C
Environment conditions	See actual values in Environmental Condition sections

SPECIFICATIONS:

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Brüel and Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

Brüel and Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 8.0 - DB: 8.00 Test Collection 2250-4189.

RESULTS:

As Received Condition	As Received Data	Final Data
_X_ Received in good condition	_X_ Within acceptance criteria	_X_ Within acceptance criteria
___ Damaged - See attached report	___ Outside acceptance criteria	___ Limited test - See attached details
	___ Inoperative	
	___ Data not taken	

Date of Calibration: 13 Jan. 2020

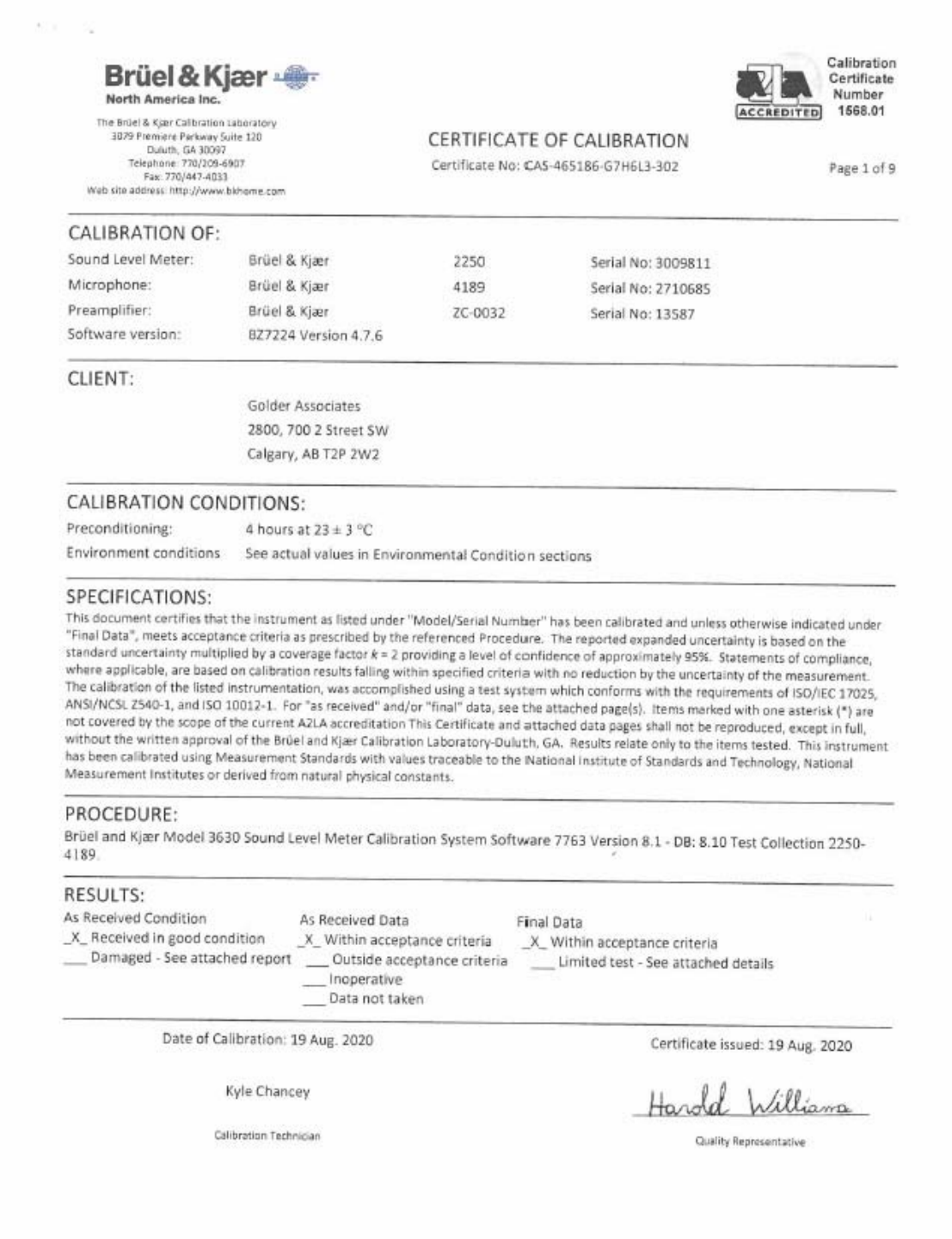
Certificate issued: 13 Jan. 2020

Kyle Chancey

Calibration Technician

Quality Representative

Figure A-4 - Calibration Certificate for 2250 Sound Level Meter 3004114



Brüel & Kjær
North America Inc.

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3079 Premiere Parkway Suite 120
Duluth, GA 30097
Telephone: 770/209-6907
Fax: 770/447-4033
Web site address: http://www.bkhome.com

ACCREDITED
Calibration Certificate Number 1568.01

CERTIFICATE OF CALIBRATION

Certificate No: CAS-465186-G7H6L3-302

Page 1 of 9

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	Serial No: 3009811
Microphone:	Brüel & Kjær	4189	Serial No: 2710685
Preamplifier:	Brüel & Kjær	ZC-0032	Serial No: 13587
Software version:	BZ7224 Version 4.7.6		

CLIENT:

Golder Associates
2800, 700 2 Street SW
Calgary, AB T2P 2W2

CALIBRATION CONDITIONS:

Preconditioning: 4 hours at 23 ± 3 °C
Environment conditions See actual values in Environmental Condition sections

SPECIFICATIONS:

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Brüel and Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

Brüel and Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 8.1 - DB: 8.10 Test Collection 2250-4189.

RESULTS:

As Received Condition	As Received Data	Final Data
_X_ Received in good condition	_X_ Within acceptance criteria	_X_ Within acceptance criteria
___ Damaged - See attached report	___ Outside acceptance criteria	___ Limited test - See attached details
	___ Inoperative	
	___ Data not taken	

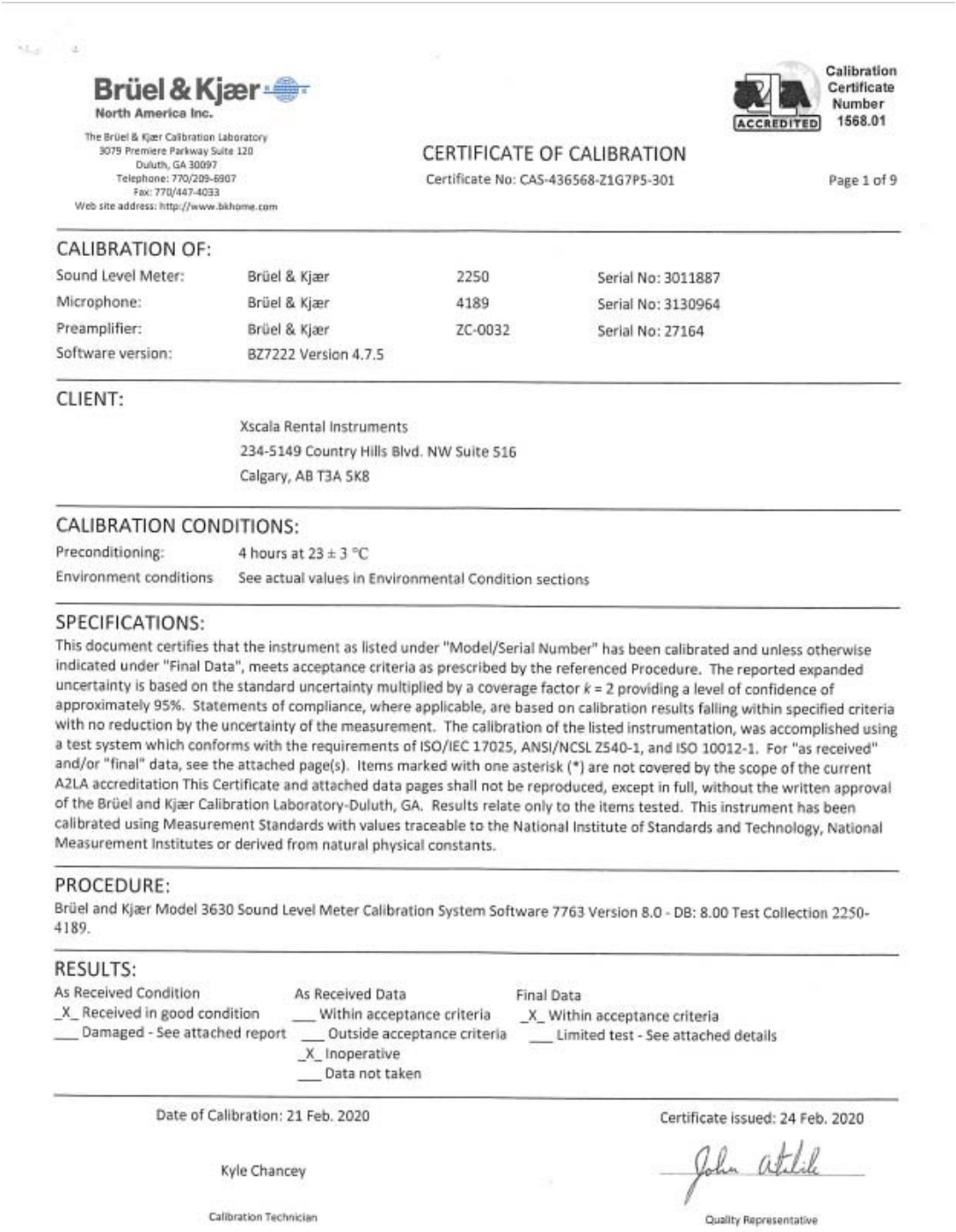
Date of Calibration: 19 Aug. 2020

Certificate issued: 19 Aug. 2020

Kyle Chancey
Calibration Technician

Harold Williams
Quality Representative

Figure A-5 - Calibration Certificate for 2250 Sound Level Meter Serial No. 3009811



Brüel & Kjær
North America Inc.

The Brüel & Kjær Calibration Laboratory
3079 Premiere Parkway Suite 120
Duluth, GA 30097
Telephone: 770/209-6907
Fax: 770/447-4033
Web site address: http://www.bkhome.com

ACCREDITED
Calibration Certificate Number 1568.01

CERTIFICATE OF CALIBRATION

Certificate No: CAS-436568-Z1G7P5-301

Page 1 of 9

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	Serial No: 3011887
Microphone:	Brüel & Kjær	4189	Serial No: 3130964
Preamplifier:	Brüel & Kjær	ZC-0032	Serial No: 27164
Software version:	BZ7222 Version 4.7.5		

CLIENT:

Xscala Rental Instruments
234-5149 Country Hills Blvd. NW Suite 516
Calgary, AB T3A 5K8

CALIBRATION CONDITIONS:

Preconditioning:	4 hours at 23 ± 3 °C
Environment conditions	See actual values in Environmental Condition sections

SPECIFICATIONS:

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Brüel and Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

Brüel and Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 8.0 - DB: 8.00 Test Collection 2250-4189.

RESULTS:

As Received Condition	As Received Data	Final Data
_X_ Received in good condition	___ Within acceptance criteria	_X_ Within acceptance criteria
___ Damaged - See attached report	___ Outside acceptance criteria	___ Limited test - See attached details
	_X_ Inoperative	
	___ Data not taken	

Date of Calibration: 21 Feb. 2020

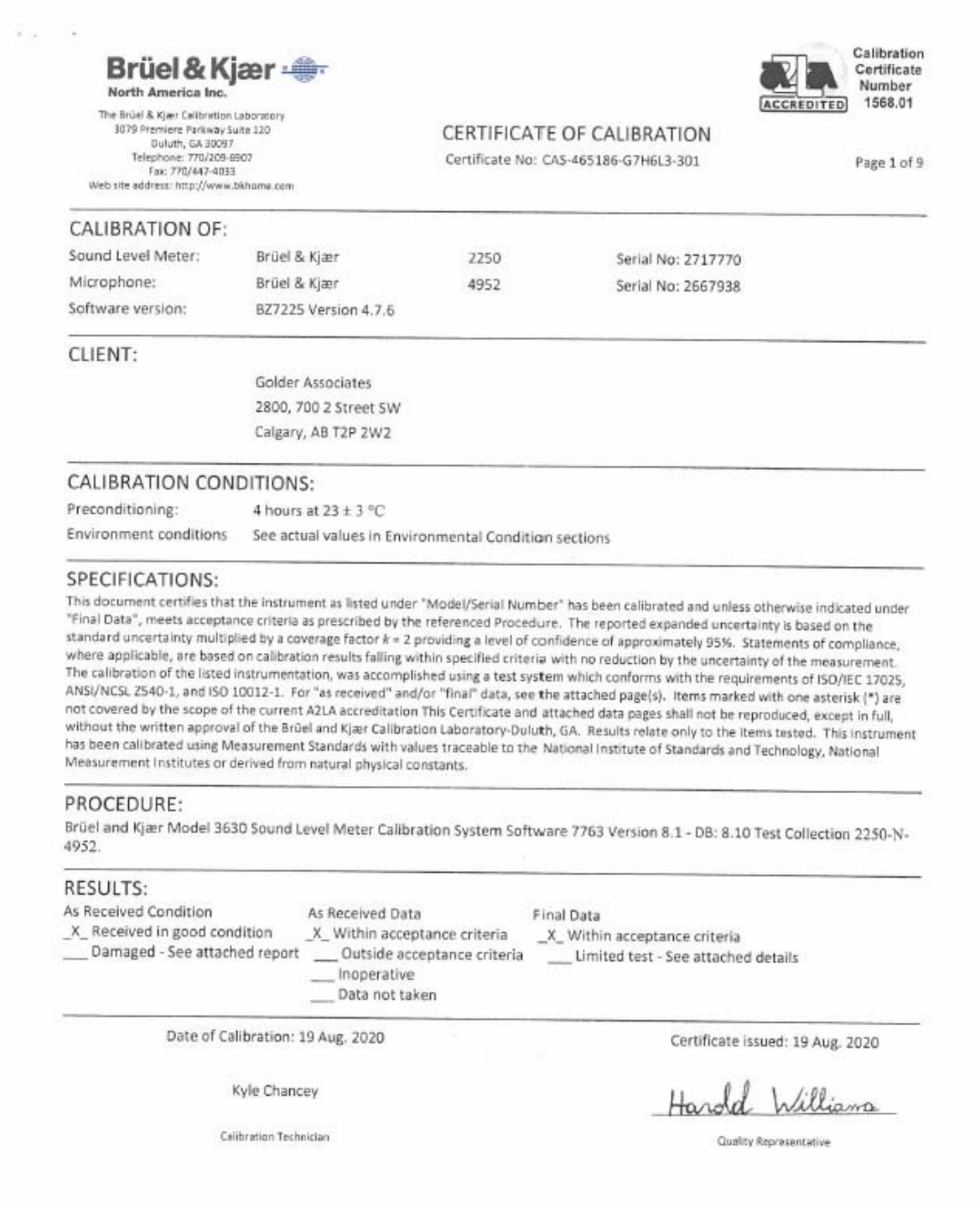
Certificate issued: 24 Feb. 2020

Kyle Chancey

Calibration Technician

Quality Representative

Figure A-6 - Calibration Certificate for 2250 Sound Level Meter Serial No. 3011887



Brüel & Kjær
North America Inc.

The Brüel & Kjær Calibration Laboratory
3079 Premiere Parkway Suite 120
Duluth, GA 30097
Telephone: 770/209-6907
Fax: 770/447-4033
Web site address: http://www.bkhome.com

ACCREDITED
Calibration Certificate Number 1568.01

CERTIFICATE OF CALIBRATION

Certificate No: CAS-465186-G7H6L3-301

Page 1 of 9

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	Serial No: 2717770
Microphone:	Brüel & Kjær	4952	Serial No: 2667938
Software version:	BZ7225 Version 4.7.6		

CLIENT:

Golder Associates
2800, 700 2 Street SW
Calgary, AB T2P 2W2

CALIBRATION CONDITIONS:

Preconditioning:	4 hours at 23 ± 3 °C
Environment conditions	See actual values in Environmental Condition sections

SPECIFICATIONS:

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Brüel and Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

Brüel and Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 8.1 - DB: 8.10 Test Collection 2250-N-4952.

RESULTS:

As Received Condition	As Received Data	Final Data
_X_ Received in good condition	_X_ Within acceptance criteria	_X_ Within acceptance criteria
___ Damaged - See attached report	___ Outside acceptance criteria	___ Limited test - See attached details
	___ Inoperative	
	___ Data not taken	

Date of Calibration: 19 Aug. 2020

Certificate issued: 19 Aug. 2020

Kyle Chancey

Calibration Technician

Harold Williams

Quality Representative

Figure A- 7 - Calibration Certificate for 2250 Sound Level Meter Serial No. 2717770

Brüel & Kjær
North America Inc.

The Bruel and Kjaer Calibration Laboratory
3079 Premiere Parkway Suite 120
Duluth, GA 30097
Telephone: 770-209-6907
Fax: 770-447-4033
Web site address: http://www.bksv.com

ACCREDITED
Calibration Certificate # 1568.01

CERTIFICATE OF CALIBRATION No.: CAS-430266-X8F9V5-601 Page 1 of 2

CALIBRATION OF:

Calibrator:	Brüel & Kjær	Type 4231	Serial No.: 2292623

CUSTOMER:

Golder Associates
2800, 700 2 Street SW
Calgary, Alberta T2P2W2

CALIBRATION CONDITIONS:

Environment conditions:			
	Air temperature:	22.4	°C
	Air pressure:	98.7	kPa
	Relative Humidity:	30.1	%RH

SPECIFICATIONS:

This document certifies that the acoustic calibrator as listed under "Type" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurements. The calibration of the listed transducer was accomplished using a test system which conforms to the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and guidelines of ISO 10012-1. For "as received" and "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation. This Certificate and attached data pages shall not be reproduced, except in full, without written approval of the Bruel and Kjaer Calibration Laboratory-Duluth, GA. Results relate only to the items tested. The transducer has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants. The acoustic calibrator has been calibrated in accordance with the requirements as specified in IEC60942.

PROCEDURE:

The measurements have been performed with the assistance of Brüel & Kjær acoustic calibrator calibration application Software version 2.3.4 Type 7794 using calibration procedure 4231 Complete

RESULTS:

[X] "As Received" Data: Within Acceptance Criteria
[ ] "As Received" Data: Outside Acceptance Criteria
[X] "Final" Data : Within Acceptance Criteria
[ ] "Final" Data : Outside Acceptance Criteria

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with EA-4/02from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the calibrator under calibration.

Date of Calibration: February 10, 2020
Certificate issued: February 10, 2020

Aundra Welch
Calibration Technician

Harold Williams
Quality Representative

Figure A-8 - Calibration Certificate for 4231 Field Calibrator Serial No. 2292623

APPENDIX B

Sound Level Graphs

This appendix presents sound level graphs for each residential receptor targeted during the 2020 traffic noise monitoring program. Each graph presents $L_{eq,1min}$ sound levels for a period of at least 24 hours. Data points highlighted in red have been eliminated from the analysis because they were unduly influenced by Golder's technician during deployment or recovery of the monitoring equipment and/or were logged during a period when the wind speed was greater than 20 km/h.

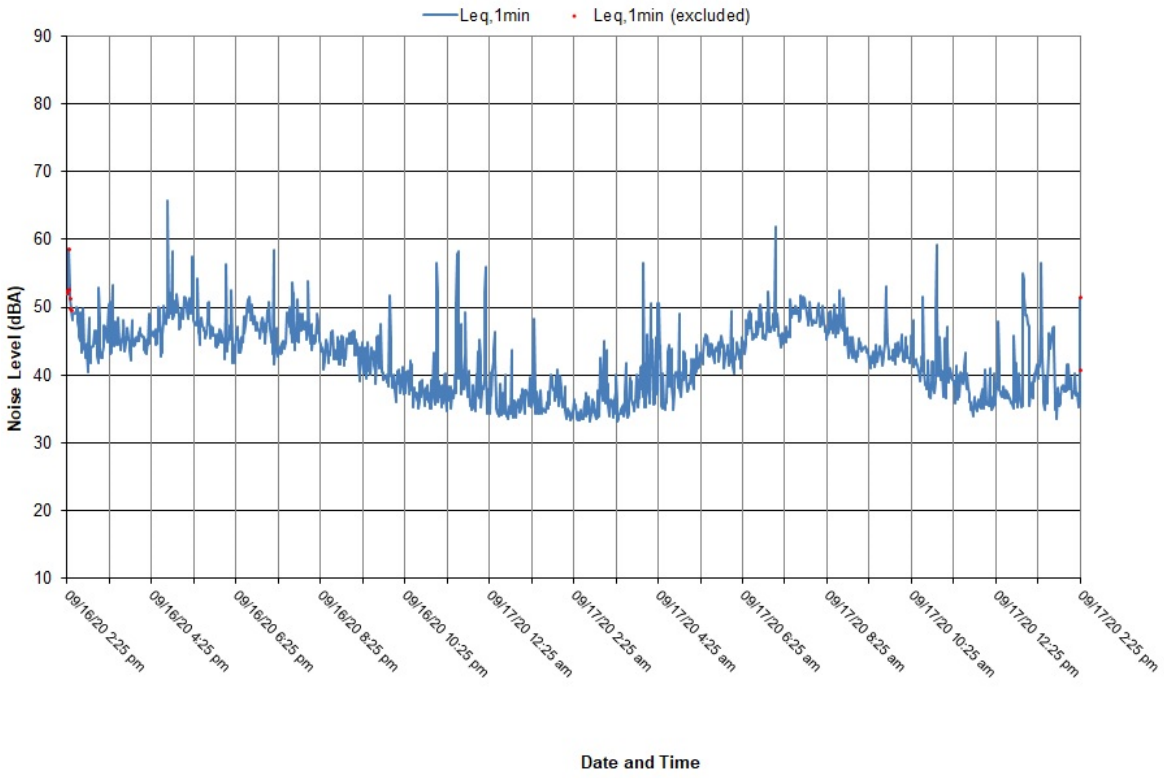


Figure B-1 - Sound Levels Measured at R01

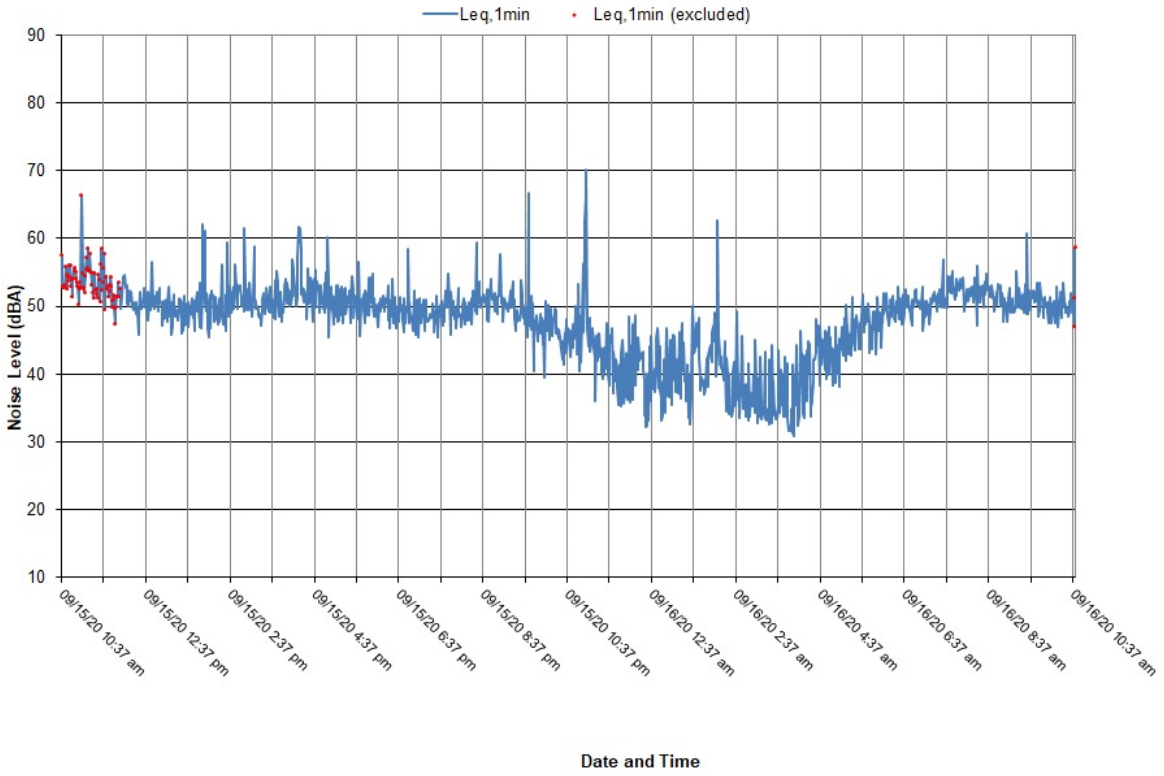


Figure B-2 - Sound Levels Measured at R02

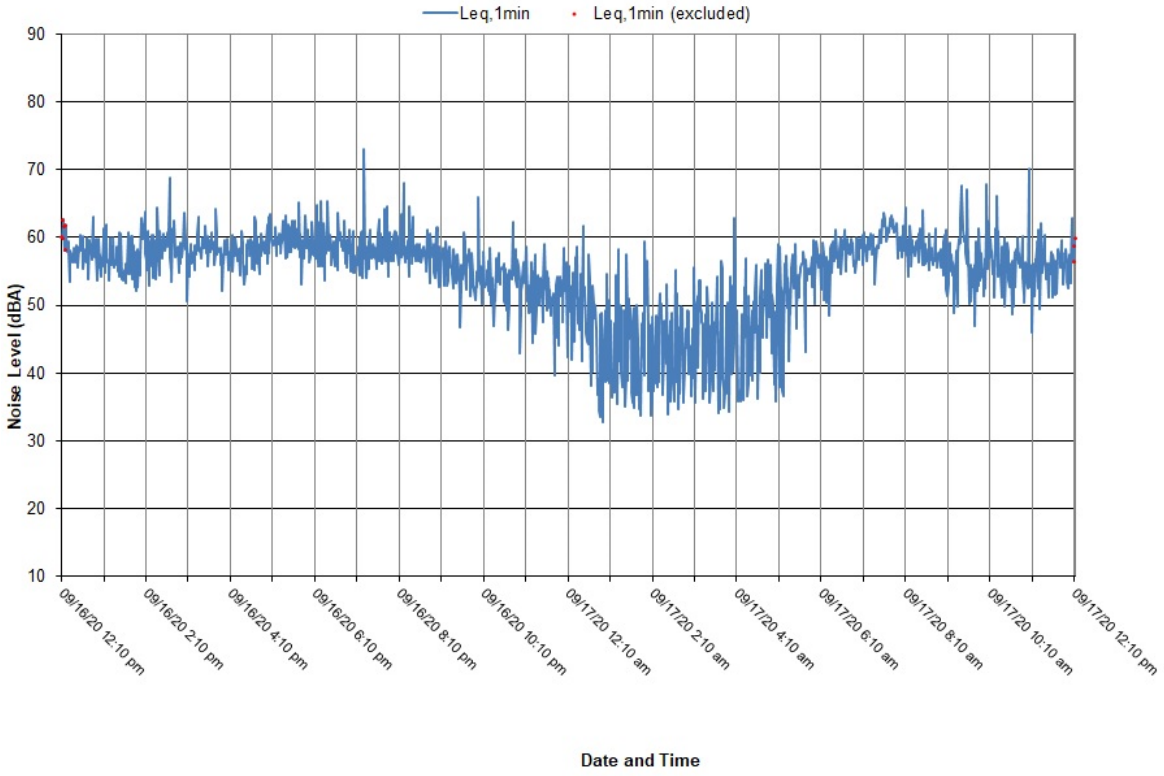


Figure B-3 - Sound Levels Measured at R03

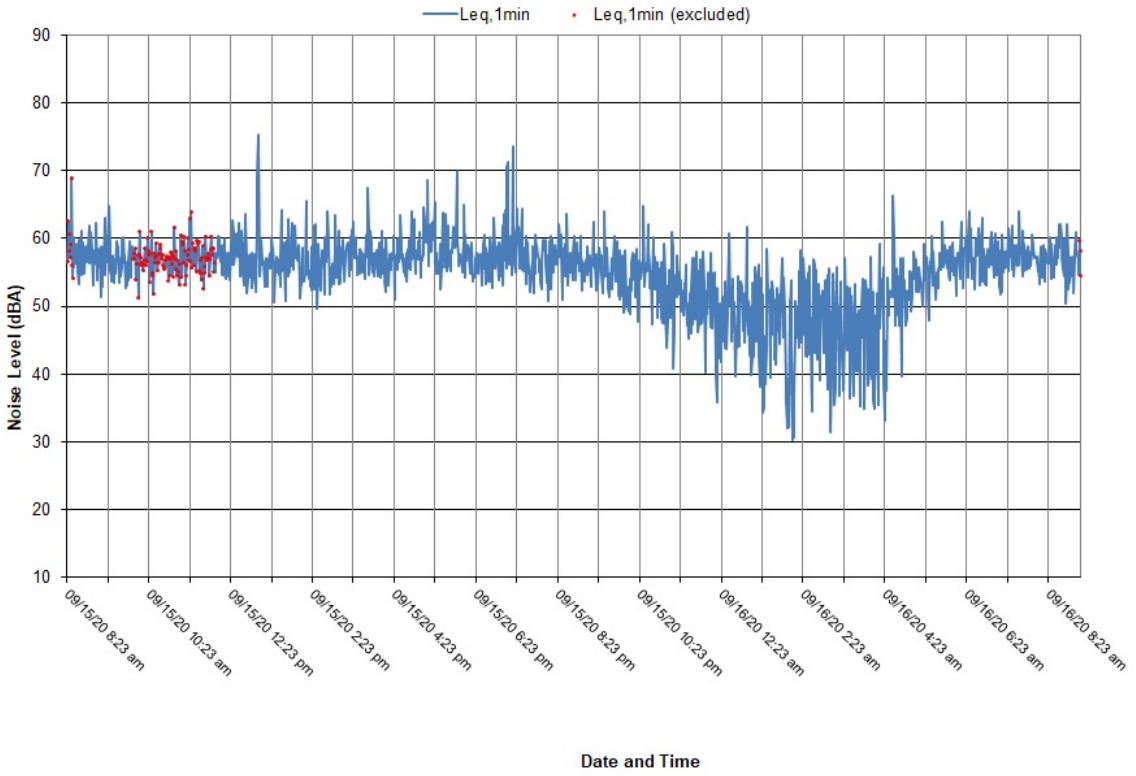


Figure B-4 - Sound Levels Measured at R04

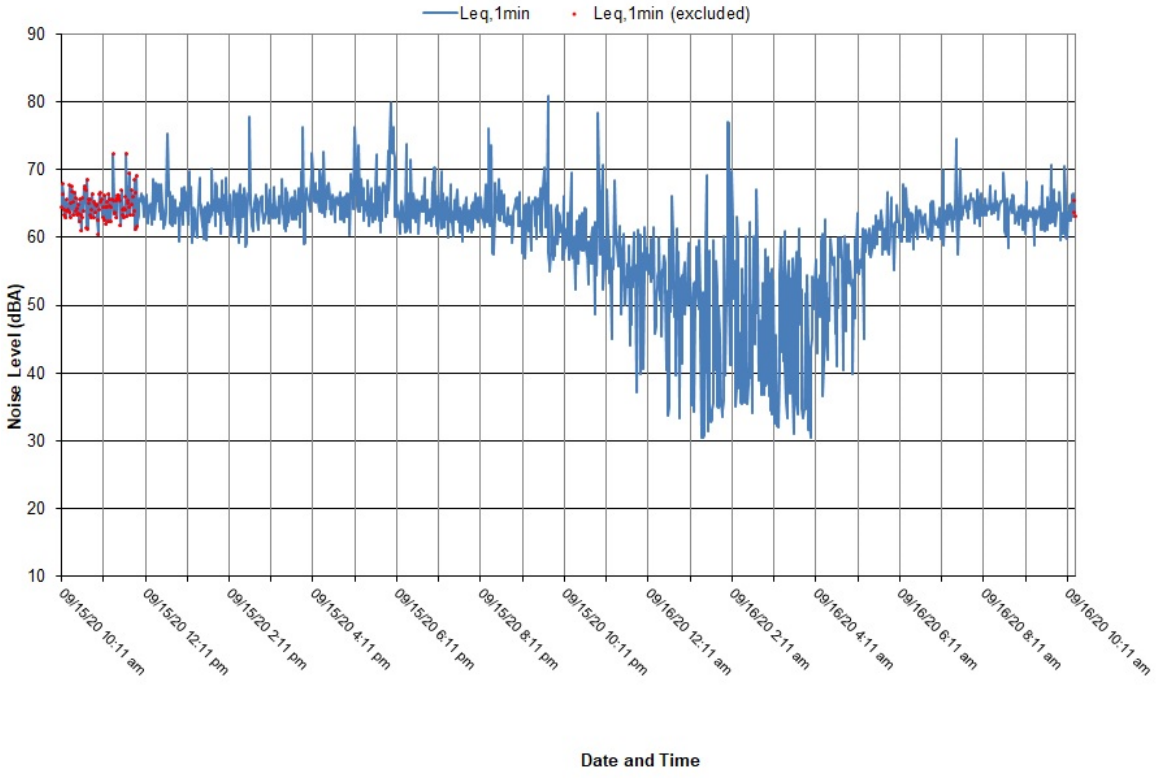


Figure B-5 - Sound Levels Measured at R05

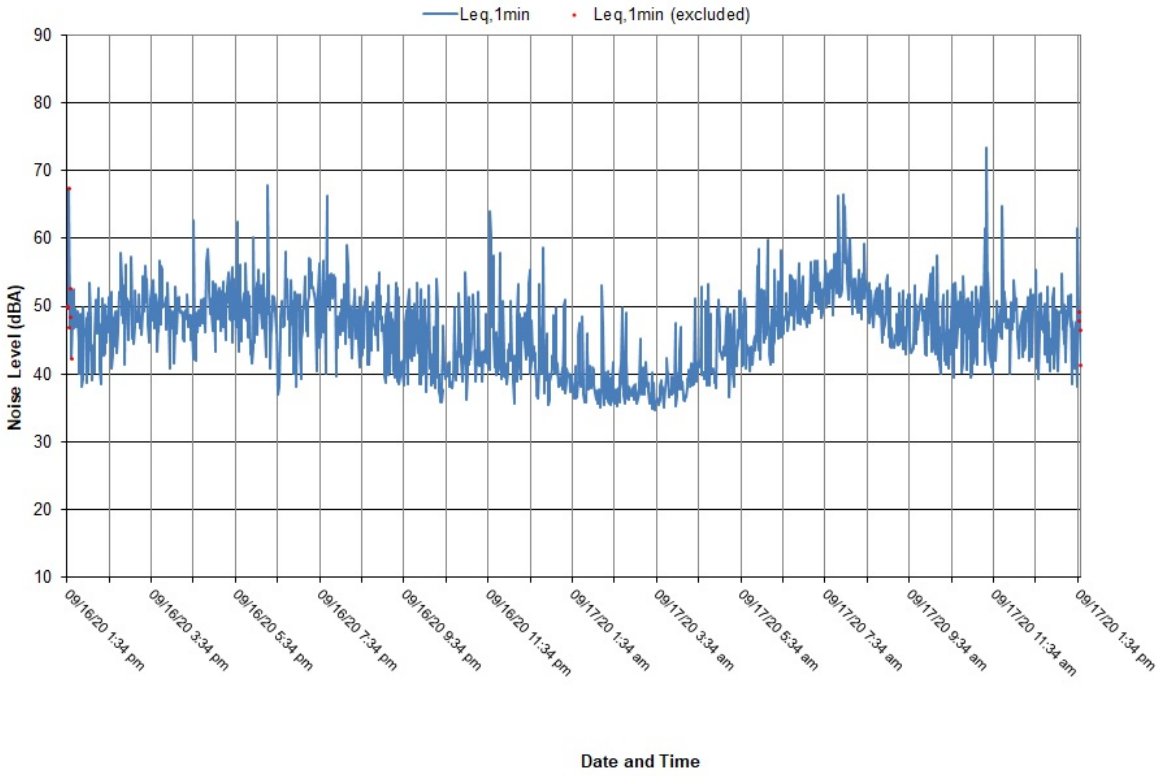


Figure B-6 - Sound Levels Measured at R06

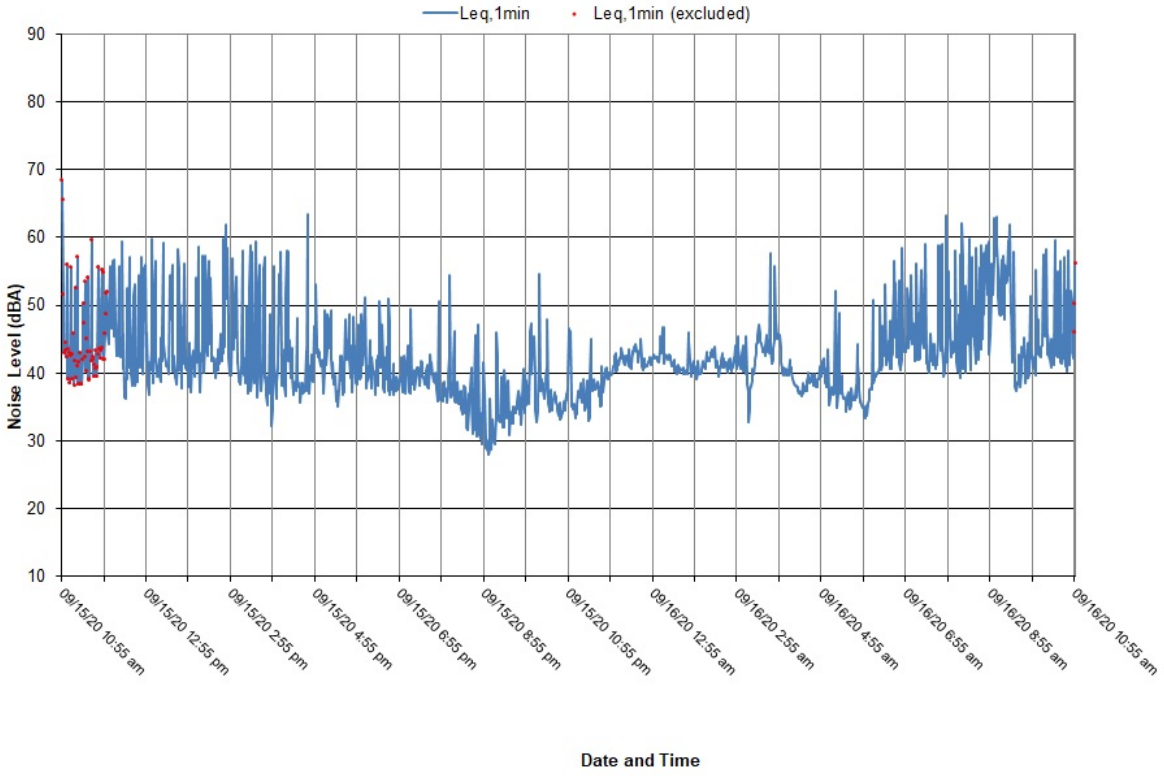


Figure B-7 - Sound Levels Measured at R07

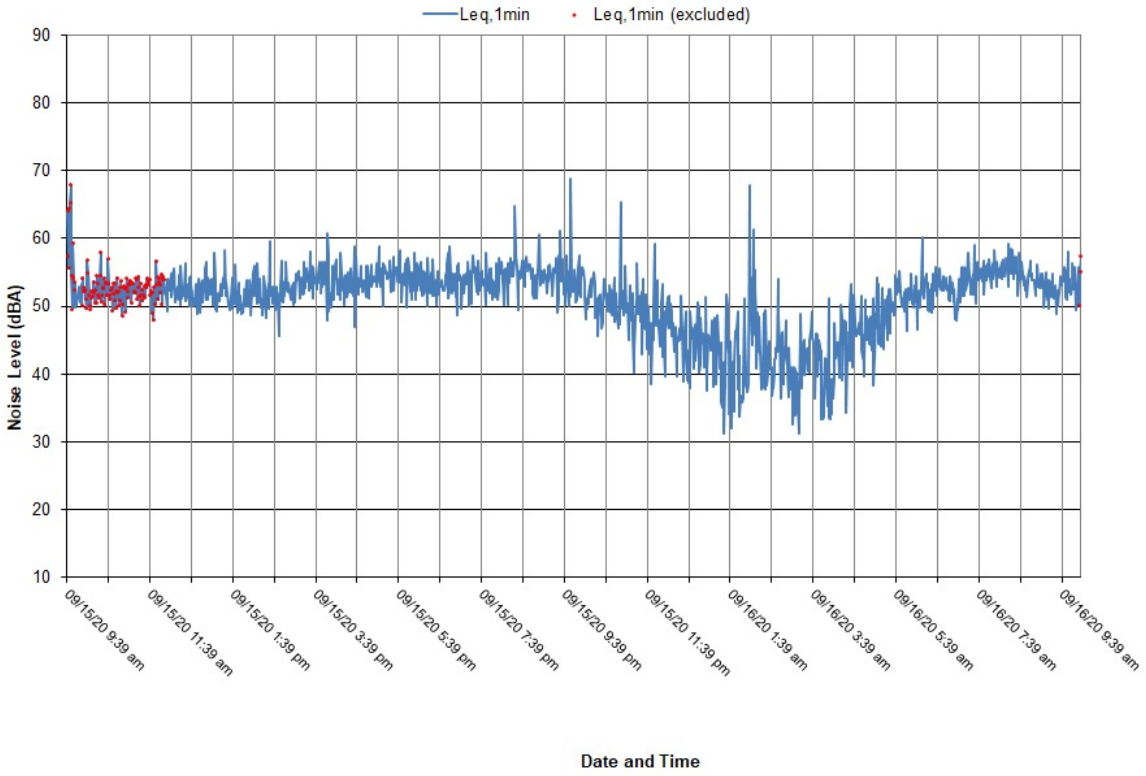


Figure B-8 - Sound Levels Measured at R08

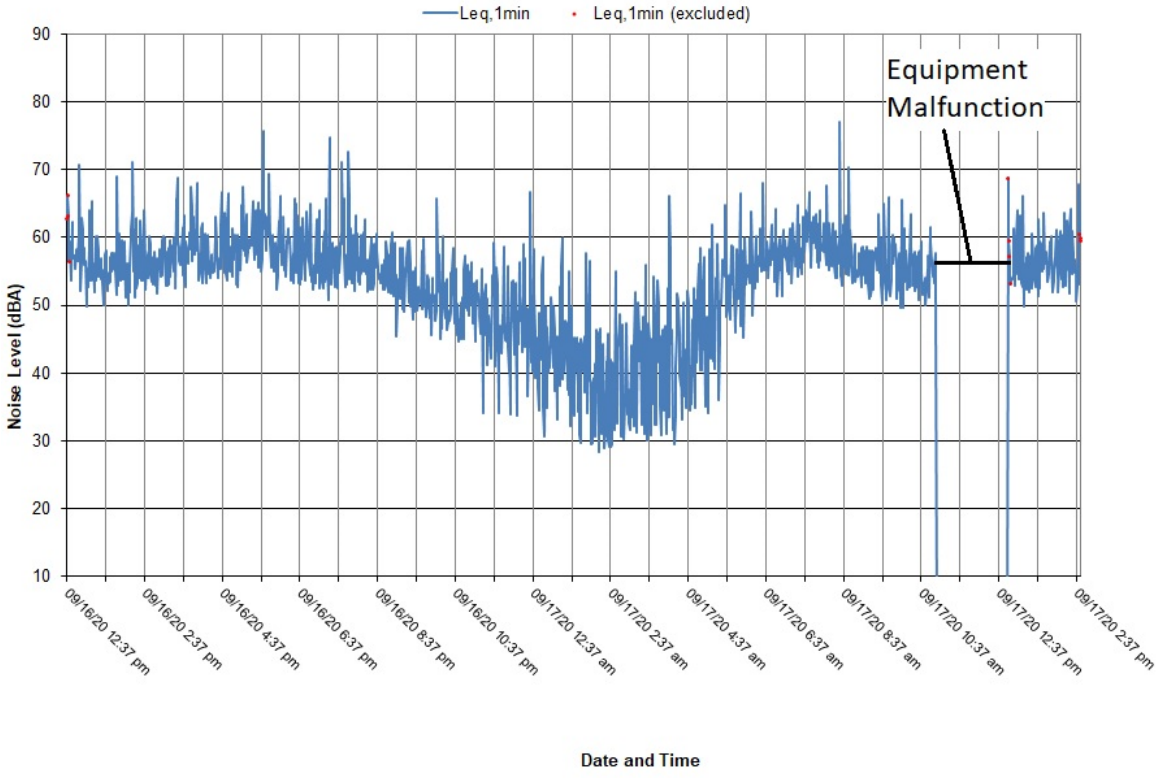


Figure B-9 - Sound Levels Measured at R09

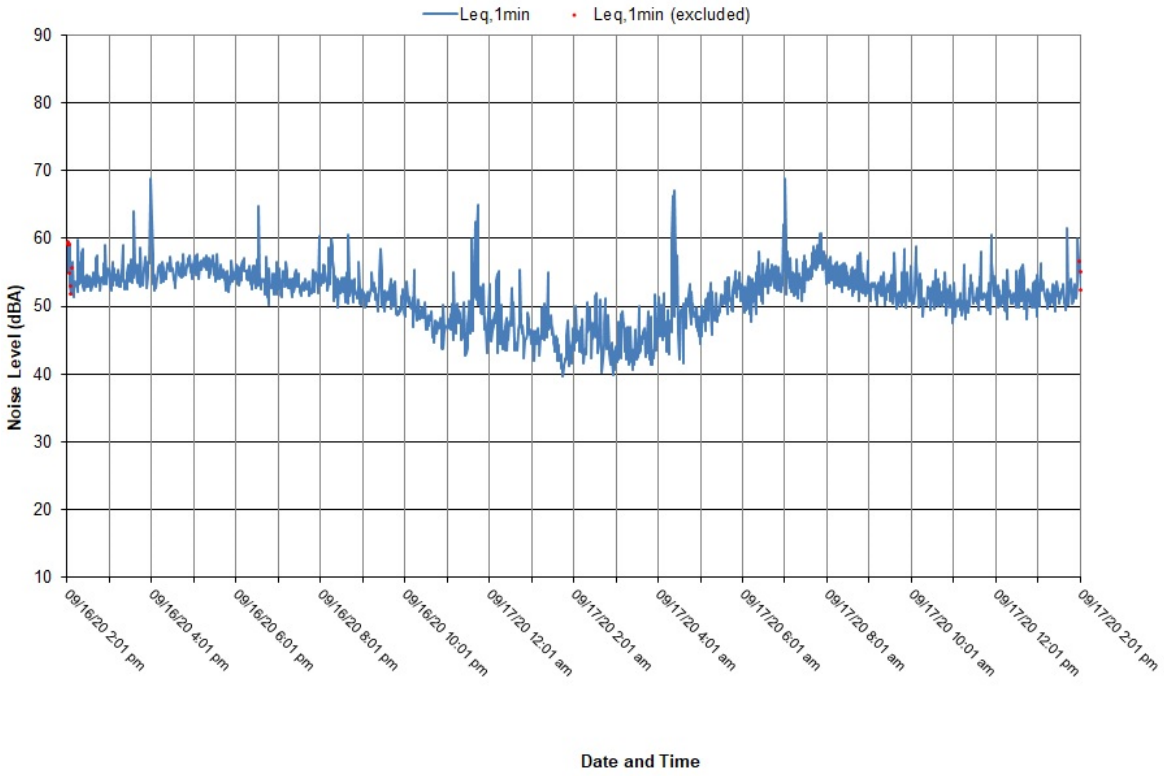


Figure B-10 - Sound Levels Measured at R11

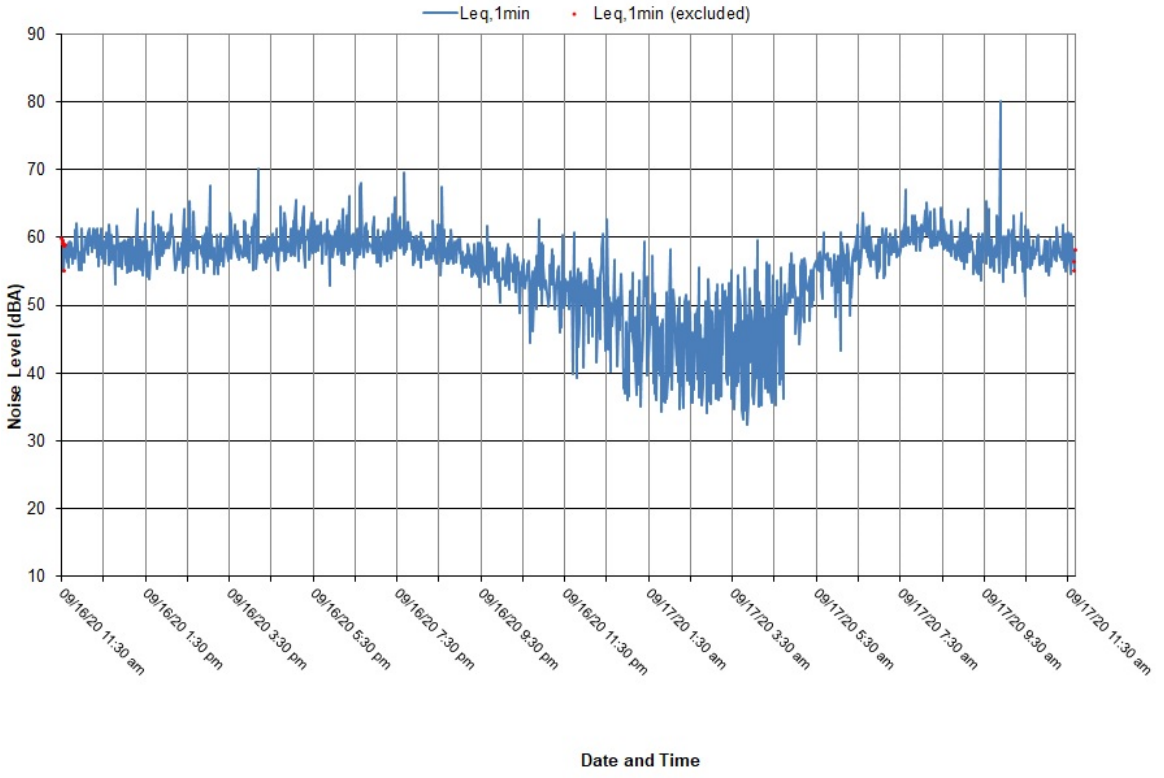


Figure B-11 - Sound Levels Measured at R15

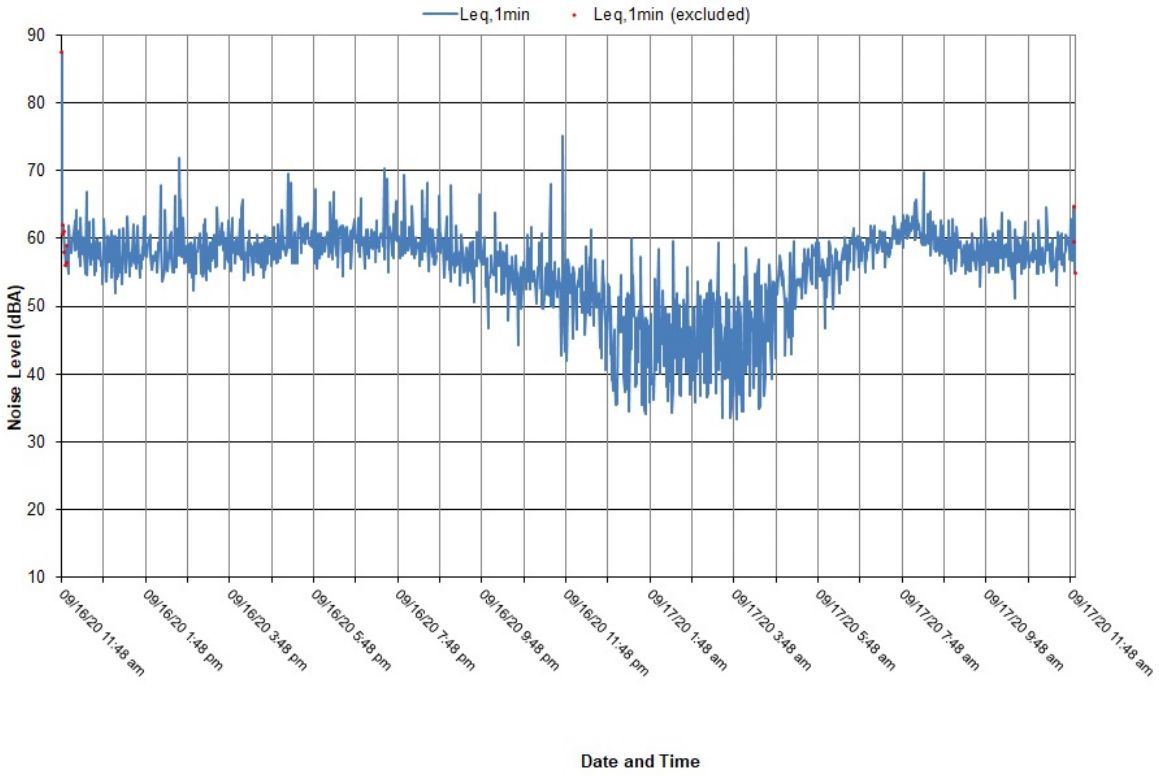


Figure B-12 - Sound Levels Measured at R16

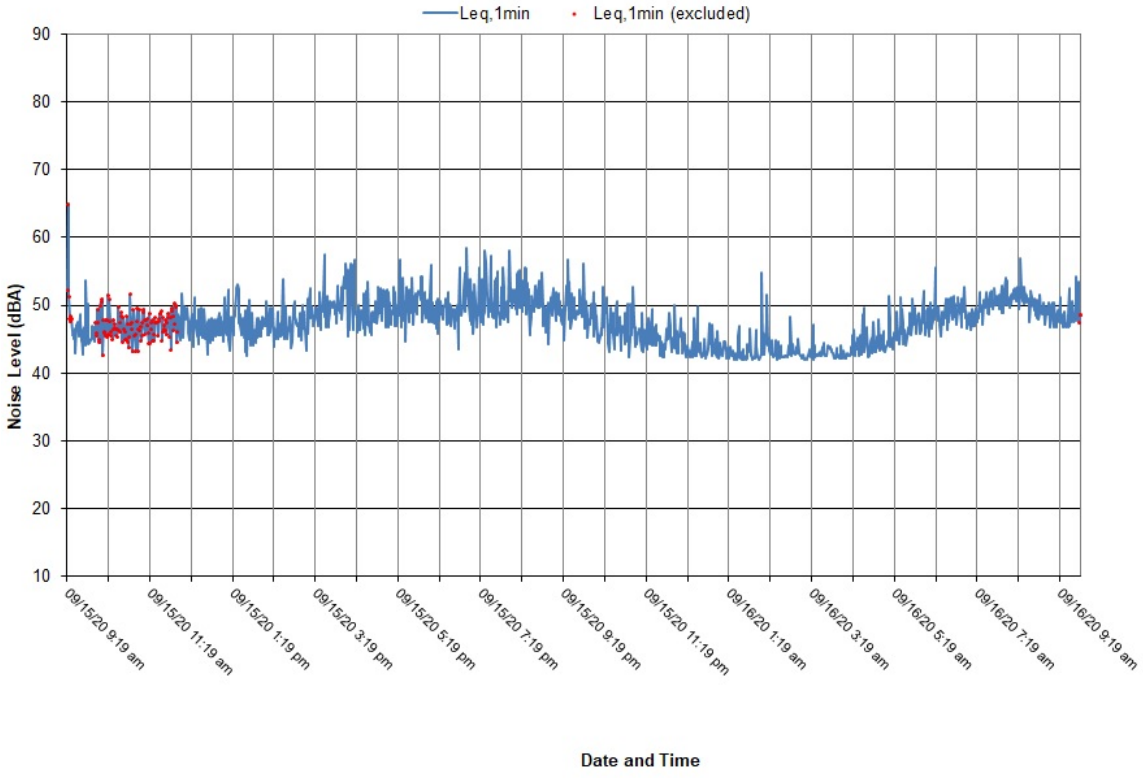


Figure B-13 - Sound Levels Measured at R19

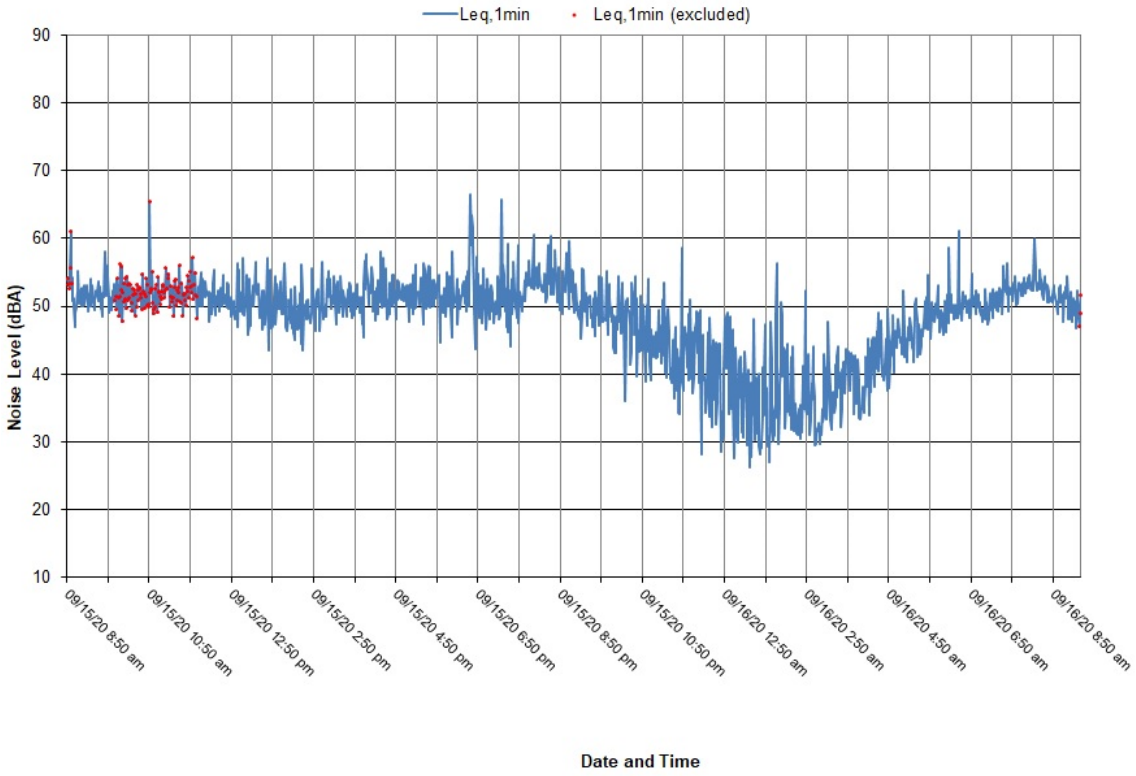


Figure B-14 - Sound Levels Measured at R21

APPENDIX C

Historical Sound Levels

This appendix presents $L_{eq,24}$ sound levels from the 2020 traffic noise monitoring program in the context of historical sound level measurements dating back to 2002.

Major Road	Street Address	Measured Sound Level [$L_{eq,24}$; dBA]											
		2002	2003	2004	2005	2007	2008	2010	2012	2014	2016	2018	2020
116 Avenue	10122 115 Ave				54.9								
	9201 115 Ave									60.0			
	9214 115 Ave										55.0	59.9	58.2
	9715 117 Ave											60.7	
	9719 117 Ave	59.2		59.7	58.3						61.6		
	9401 117 Ave					57.8		58.4				59.2	
	9113 117 Ave											51.4	51.0
	9121 117 Ave						51.4	48.7					
	9509 117 Ave									55.0			
98 Street	9805 111 Ave				58.2							57.9	
	9804 104 Ave			65.5					57.3				
	9808 104 Ave									60.0	53.6		
84 Avenue	10013 85 Ave										60.8		
	10015 85 Ave					62.0	61.5						
	9824 83 Ave	57.2		55.8	54.0	56.0							
	9559 85 Ave	54.7		56.6	58.0								
	9654 83 Ave								57.4			57.9	48.3
	8320 114A St									61.0	61.1		
100 Street	8202 99A St				62.1		61.6						
	8214 99A St										55.3		
	7922 99A St			59.3									
	7612 99A St					57.2							
	7310 99A St	56.7					50.8		59.9				
	7326 99A St										54.5		
	7214 99A St			54.2	52.3								
	8410 100 St									54.0			

Major Road	Street Address	Measured Sound Level [$L_{eq,24}$; dBA]											
		2002	2003	2004	2005	2007	2008	2010	2012	2014	2016	2018	2020
Resources Road	8223 94 St										61.9		
	8219 94 St					60.0							
	7923 94 St	54.1						54.2				54.5	50.6
	7031 93 St	48.8											
	6345 93 St	54.8		48.8				51.1				49.4	
68 Avenue	10954 67 Ave					48.8			63.7				
	6705 109 St										57.9	58.8	57.7
	11030 67 Ave									51.0			
	9901 69 Ave	51.5	53.6	54.6	56.5								
	9925 69 Ave									58.0		57.4	
	9437 69 Ave	54.8	55.4	56.7								56.1	
	9329 69 Ave								56.5				
	9337 69 Ave											54.2	
	9341 69 Ave										54.0		
	11533 69A Ave											52.4	
	6902 Poplar Dr					57.0							
	9326 67 Ave			56.1					48.6				
	9318 67 Ave				54.9		54.2						
	9304 67 Ave					56.9							
	6713 90A St								63.5		64.5	64.6	64.4
	6716 90A St		60.2	62.1	61.6		62.1	60.5		58.0			
	8575 69 Ave						47.9						
	6337 69 Ave												53.0
	9617 69 Ave												48.8
	9854 67 Ave												51.1
108 Street	25 Pinnacle Key			54.1	57.8	53.6	55.7	56.1	50.1			58.8	
	29 Pinnacle Key										63.4		
	7414 107A St										58.8		
	7406 107A St			59.3	57.5		53.6		53.0				

Major Road	Street Address	Measured Sound Level [$L_{eq,24}$; dBA]											
		2002	2003	2004	2005	2007	2008	2010	2012	2014	2016	2018	2020
92 Street	9204 108 Ave					54.5		55.2	58.7				
	9609 92A St					56.3						61.4	
	9449 92A St				55.0			58.4			60.1		
	10415 92A St											57.5	
	10427 92A St								57.4				
	10901 92A St									58.0		56.4	57.6
	7422 91 St							53.2					
	7426 91 St										52.2		
	7118 90 St									56.0			
	9709 92A St												58.6
	9813 92A St												58.6
102 Street	11314 101B St					48.5	53.6	54.5	58.4				
	10202 114A Ave						60.6	55.1	53.4			56.1	
	10209 114A Ave									52.0			
	10218 114A Ave												53.5
116 Street	116 St / Pinnacle Dr								58.4				
	7002 115B St										54.0		
	6934 115B St									56.0			
100 Avenue	9029 101 Ave									56.0		56.1	
132 Avenue	9338 131 Ave									58.0			
	9354 131 Ave											52.4	
Other Sites	13107 93 St					57.3							
	9025 101 Ave		54.2	53.4	54.2		55.6		52.4				
	9628 126 Ave												45.8

golder.com