

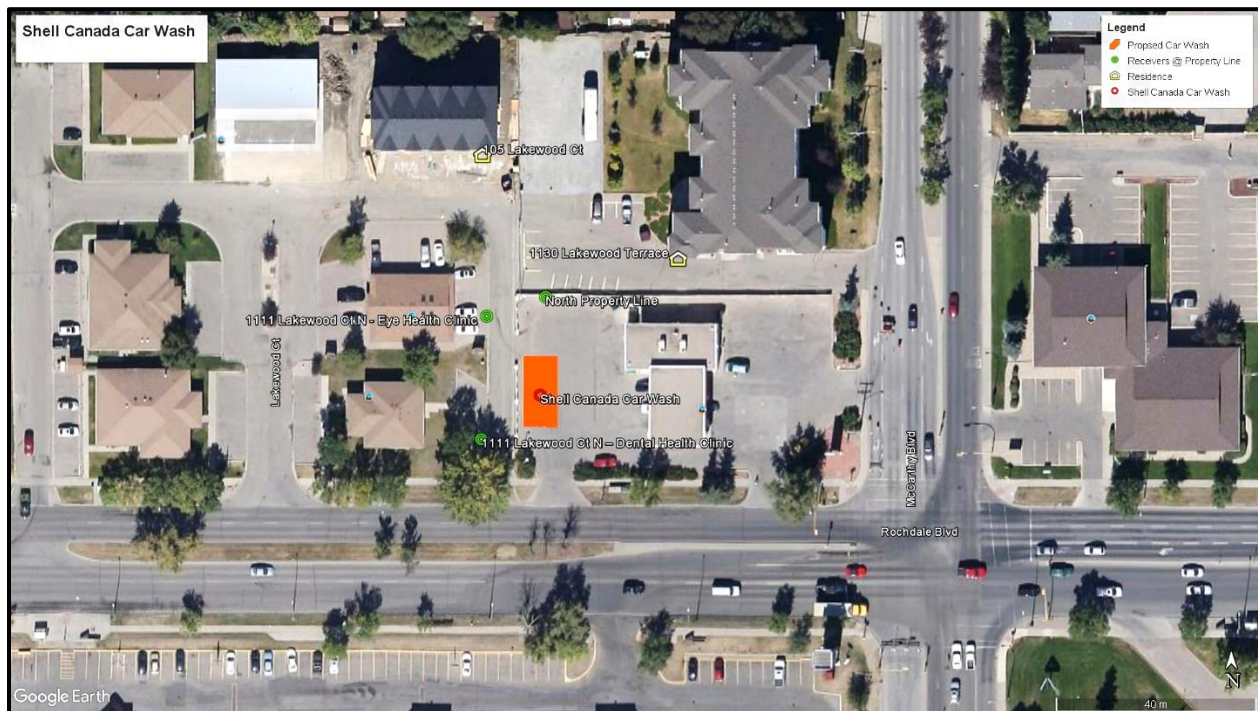


Noise Impact Assessment

CTM Design Services Ltd.

5826 Rochdale Blvd Regina

Shell Canada Car Wash



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Sound Advice • Sound Delivery

Executive Summary

CTM Design Services Ltd. (CTM Design) wanted to determine the environmental noise impact of the proposed Shell Canada Car Wash at 5826 Rochdale Blvd in the City of Regina. CTM Design retained the services of FDI Acoustics to complete a Noise Impact Assessment for the proposed development to determine compliance with the Permissible Sound Levels (PSLs) of the City of Regina Bylaw 6980¹, “The Noise Abatement Bylaw” Section 7.1, Land Use Noises. The assessment also provides the foundation to develop noise control measures for the equipment and operations assessed should the predicted sound levels exceed the PSLs of the City of Regina Bylaw 6980 (Bylaw).

Octave band sound pressure levels related to the significant noise sources associated with the proposed car wash equipment operations were assigned from a combination of manufacturer’s data, FDI Acoustics’ sound pressure level measurement library, or values were calculated following schemes as presented in texts^{2,3}. Following accepted acoustic evaluation practices, the sound pressure level data was used to calculate octave band sound power level values for the significant noise sources associated with the proposed car wash operations. The sound power levels were entered in the Softnoise GmbH Predictor™ Type 7810 noise propagation modelling software. The environmental noise propagation computer model calculated the sound level contribution of the car wash operations at three property line locations following the requirements of the City of Regina Bylaw 6980. The City of Regina Bylaw 6980 Part III, Section 7.1 (a) describes the measurement location at 1.2 metres above the ground level surface at the lot line of the site where the noise originates. FDI Acoustics also used the environmental noise propagation computer model to calculate the sound level contribution of the proposed car wash operations at multiple elevations of the façades of two residential buildings near the site. FDI Acoustics advises the reader the façade receiver points are presented for information purposes and not within the requirements of the Bylaw.

Executive Summary (continued)

Table ES-1 presents the results of the modeling along with the PSLs for the receiver locations.

Table ES-1
Predicted Sound Levels
Shell Canada Car Wash 5826 Rochdale Boulevard, Regina Saskatchewan

Receiver Location	Daytime Sound Level (dBA L _{eq})	Nighttime Sound Level (dBA L _{eq})	Daytime Sound Level (dBA L _{eq})	Nighttime Sound Level (dBA L _{eq})
	Without Barrier		w/ North and West Barrier	
Bylaw 6980 Reception Locations				
1111 Lakewood Court North – Eye Health Clinic Property Line (1.2 metres height)	62.2	62.2	58.3	58.3
1111 Lakewood Court North – Dental Health Clinic Property Line (1.2 metres height)	66.9	66.9	65.3	65.3
North Property Line - 1130 Lakewood Terrace (1.2 metres height)	64.7	64.7	51.7	51.7
Permissible Sound Level (Mixed Use Zone)	70.0	60.0	70.0	60.0
Other Reception Locations				
1130 Lakewood Terrace – 2 nd Floor Façade (5.0 metres height)	59.4	59.4	57.5	57.5
1130 Lakewood Terrace – 3 rd Floor Façade (8.0 metres height)	58.9	58.9	58.8	58.8
1130 Lakewood Terrace – 4 th Floor Façade (11 metres height)	58.3	58.3	58.2	58.2
105 Lakewood Court – 1 st Floor Façade (1.5 metres height)	52.8	52.8	48.7	48.7
105 Lakewood Court – 2 nd Floor Façade (3.5 metres height)	52.8	52.8	49.4	49.4
Permissible Sound Level (Mixed Use Zone)	70.0	60.0	70.0	60.0

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The results of the environmental noise propagation model indicate the predicted sound levels from the proposed Shell Canada Car Wash operations are predicted to exceed the nighttime PSLs of Bylaw 6980 at the property line of 1130 Lakewood Terrace and at the property line of 1111 Lakewood Court North. CTM Design has indicated the landscape design of the site will incorporate a 1.8 metre height fence (acoustic barrier) along the north and west property line of the site. The results with the sound barrier in place indicate compliance with the daytime and nighttime PSLs of Bylaw 6980 at the property line of 1130 Lakewood Terrace and daytime compliance at the property line with 1111 Lakewood Court North.

FDI Acoustics notes with the sound barrier in place the results of modelling indicate the Shell Canada Car Wash operations are predicted to comply with the daytime PSL of Bylaw 6980 at the receiver locations assessed. Shell Canada is advised to consider limiting the carwash operations to the bylaw defined daytime hours to satisfy the requirements of the bylaw.

Distribution List:

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0	Yes	Jonathan Paul, PMP, CET – CTM Design Services Ltd.

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Revision List:

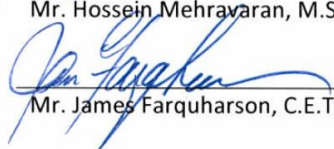
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This work is intended solely for CTM Design Services Ltd (the Client). The scope of work and related responsibilities are defined in the Conditions of Assignment between FDI Acoustics and CTM Design Services Ltd. Any use which a third party makes of the work, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Decisions made or actions taken as a result of our work shall be the responsibility of the parties directly involved in the decisions or actions.

In no event shall the Client copy or use any of the concepts, plans, drawings, specifications, designs, models, reports, photographs, computer software, surveys, calculations, construction and other data, documents, and processes produced by FDI Acoustics in connection with the Rochdale & McCarthy Blvd Shell CWA (the Project) for any purpose other than those noted within this report or in relation to any project other than the Project without the prior written permission of FDI Acoustics. FDI Acoustics shall not unreasonably withhold or deny such consent but shall be entitled to receive additional equitable remuneration in connection with its grant of consent.

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Scope of Work

CTM Design Services Ltd. (CTM Design) wanted to determine the environmental noise impact of the proposed Shell Canada Car Wash at 5826 Rochdale Blvd in the City of Regina. CTM Design retained the services of FDI Acoustics to complete a Noise Impact Assessment for the proposed development to determine compliance with the Permissible Sound Levels (PSLs) of the City of Regina Bylaw 6980¹, “The Noise Abatement Bylaw” Section 7.1, Land Use Noises. The assessment also provides the foundation to develop noise control measures for the equipment assessed should the predicted sound levels exceed the PSLs of the City of Regina Bylaw 6980 (Bylaw).

Method

Octave band sound pressure levels related to the significant noise sources associated with the proposed car wash equipment operations were assigned from a combination of manufacturer’s data and FDI Acoustics’ sound pressure level measurement library or calculated following schemes as presented in texts^{2,3}. Following accepted acoustic evaluation practices, the sound pressure level data was used to calculate octave band sound power level values for the significant noise sources associated with the proposed development equipment. Plans for the development were provided by CTM Design. The development area information supplied by CTM Design was supplemented with information from government and commercial sources. This information formed the input for an environmental noise propagation computer model that calculates the sound level contribution of the car wash operations at three property line locations following the City of Regina Bylaw 6980 and at multiple elevations of the façades of two residential buildings near the site. The City of Regina Bylaw 6980 Part III, Section 7.1 (a) describes the measurement location at 1.2 metres above the ground level surface at the lot line of the site where the noise originates. The building façade receiver points are not within the scope of the Bylaw and are presented for information purposes.

The results of the model are presented as the individual component sound levels of the proposed car wash equipment, the overall car wash facility sound level contribution, the predicted cumulative sound levels for the receiver locations under assessment, and as a study area contour map. The results are reviewed with the predicted sound levels compared with the applicable PSLs to determine compliance. Should the results exceed either the daytime or nighttime PSLs; noise control measures may be developed and evaluated within the noise propagation model. The predicted sound level contribution for each noise control measure after implementation may be reported for the point of interest. Acoustical specifications related to the recommendations are included in the report.

Study Area

The proposed Shell Canada Car Wash development is at 5826 Rochdale Boulevard in the City of Regina, Saskatchewan. The building on site housing the car wash will be situated parallel to the west property line of the site and is west of the existing convenience store and fuel pump islands. The nearest residences border the northeast side of the site and are at 1130 McCarthy Boulevard (also known as the 1130 Lakewood Terrace condominiums). The 1130 Lakewood Terrace condominium development is in a commercial zone and shares a common property line with the Shell Canada 5826 Rochdale Boulevard site. The second residence of interest is northwest of the Shell Canada site at 105 Lakewood Court. The third receiver (Eye Clinic) and a fourth receiver (Dental Clinic) locations are west of the Shell Canada site at 1111 Lakewood Court North. The Lakewood Court receivers are zoned commercial. Available information describes the topography of the area as flat and the landscape as urban with a mix of paved surfaces, asphalt, lawns, and trees. Figure 1 and the report cover (Google Earth image) are maps of the study area indicating the location of the Shell Canada 5826 Rochdale Boulevard site, area residential units, and other area features. Appendix A presents a larger higher rendition map of the study area and a site location plan drawing indicating the location of the proposed car wash, existing structures, and the property lines.

Figure 1
Study Area Map
Shell Canada Car Wash 5826 Rochdale Boulevard, Regina Saskatchewan



Environmental Noise Regulation Criteria

City of Regina Bylaw 6980 a bylaw to prohibit, eliminate and abate, loud, unusual, and unnecessary noise, or noises which annoy, disturb, injure, or endanger the comfort, repose, health, peace, or safety of others within the City of Regina.

Bylaw 6980 Part III, Specific Prohibitions, Section 7.1 Land Use Noises:

- (a) Subject to subsection (b), no person shall cause or permit to be made or continued any noise that exceeds the following standards for a cumulative period greater than 15 minutes in any hour as measured in A-weighted decibels (dBA) using a Type 2 sound level meter at 1.2 metres above the ground level surface at the lot line of the site where the noise originates:

Table 1
City of Regina Bylaw 6980 Land Use Noise Limits
Shell Canada Car Wash 5826 Rochdale Boulevard, Regina Saskatchewan

Zone	Daytime 7:00 am – 10:00 pm Sound Pressure Level (dBA)	Nighttime 10:00 pm – 7:00 am Sound Pressure Level (dBA)
Residential Zone	60.0	55.0
Mixed Use Zone	70.0	60.0

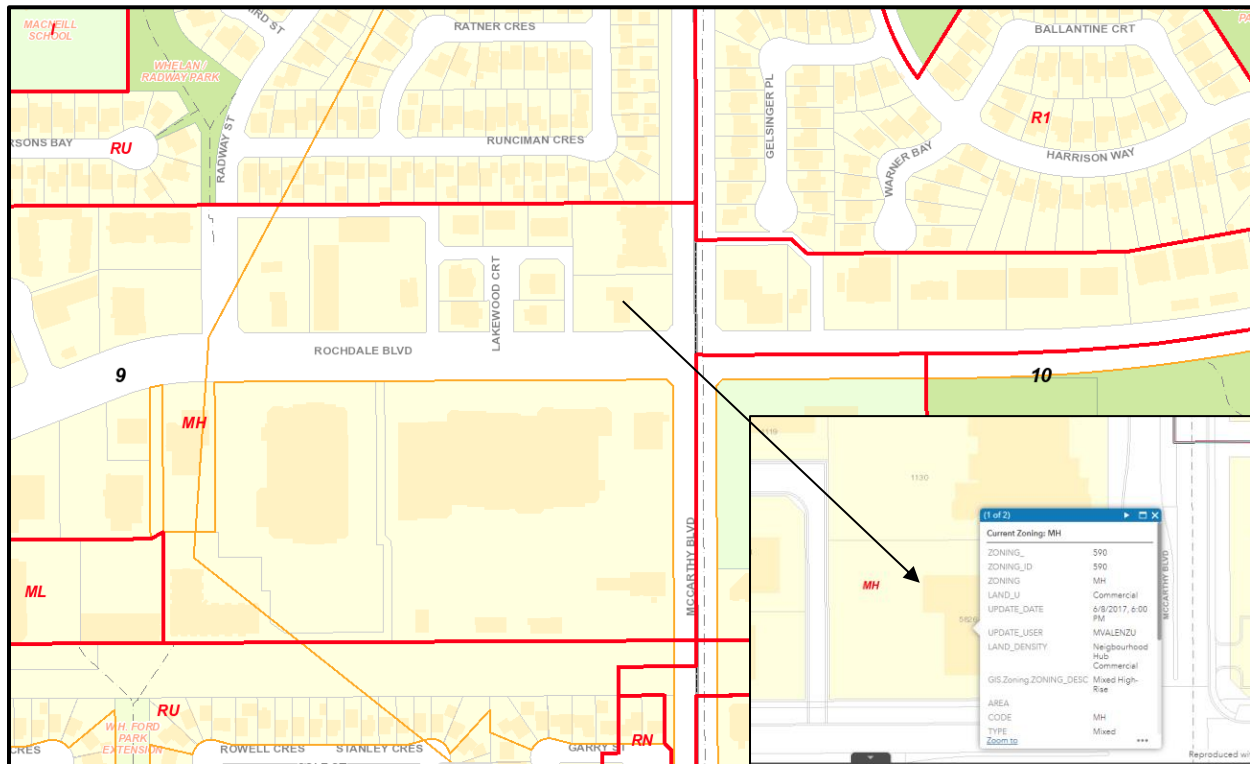
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- (b) The following noises shall be exempt from this section:
- (i) Noises from construction or maintenance activities between 7:00 am and 10:00 pm;
 - (ii) Noises from safety signals, emergency vehicles and equipment, warning devices and emergency pressure release valves;
 - (iii) Noises from motor vehicles, airplanes, and trains; and
 - (iv) Ordinary domestic noises at a residential property such as voices or music and noise generated by tools or animals.

The Regina Zoning Bylaw 2019-19, Chapter 4, Mixed-Use Zones defines the regulations for land use and development within this zone. The City of Regina Zoning Map labels the Shell Canada site and abutting properties as “Mixed High-Rise” zone in Commercial Zones categories with zone code “MH”. Figure 2 is a map of the City of Regina Zoning Bylaw 2019 for the study area indicating the location of the proposed site and the applicable zoning for the area. FDI Acoustics notes the residential buildings north of proposed car wash site are within the commercial zone ID 590 with a code MH and thereby fall with the Mixed Use Zone limits of Bylaw 6980.

Environmental Noise Regulation Criteria (continued)

Figure 2
City of Regina Zoning Bylaw 2019 Map
Shell Canada Car Wash 5826 Rochdale Boulevard, Regina Saskatchewan



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Table 2 presents the Permissible Sound Levels applicable to the development as derived from the City of Regina Bylaw 6980 Part III, Section 7.1 (a).

Table 2
Permissible Sound Levels
Shell Canada Car Wash 5826 Rochdale Boulevard, Regina Saskatchewan

Receiver Location	Daytime Permissible Sound Level (dBA Leq)	Nighttime Permissible Sound Level (dBA Leq)
1130 Lakewood Terrace (Property Line and Building Façade), 105 Lakewood Court (Building Façade), 111 Lakewood Court North (Property Line)	70.0	60.0

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Description of Equipment

The proposed Shell Canada Car Wash consists of a drive through automatic car wash. The significant noise sources associated with the car wash development include dryers, high pressure sprayers, and seven (7) idling vehicles awaiting entry to the car wash. CTM Design has indicated the dryer is an Aerodry Model A45 unit driven by 45 horsepower electric motor. The manufacturer indicates the dryer emits a sound pressure level of 82 dBA at 1.0 metres from the exterior door opening of the car wash. FDI Acoustics has assumed the entrance and exit doors of the car wash are open for 10% and 25% of the operating time, respectively based on information provided by CTM Design. The drying cycle is 60 seconds in duration with the exit door open during drying cycle. The assessment also considers seven vehicles idling waiting to enter to the automatic car wash. The proposed Car Wash building will be contemplated to feature concrete walls, triple pane windows at the east side, and roll up entrance and exit doors. Figure 3 contains architectural renderings of the car wash building as furnished by CTM Design.

Figure 3
Car Wash Perspective View
Shell Canada Car Wash 5826 Rochdale Boulevard, Regina Saskatchewan



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Source Sound Power Levels

FDI Acoustics completed calculations to determine octave band sound power level values for the significant noise sources associated with the equipment. Completion of the calculations followed accepted techniques and practices for the determination of sound power levels from sound pressure levels for large machinery. The sound power values presented in Table 3 are order-ranked from highest to lowest by the overall sum (dBA) per source group.

Table 3
Source Sound Power Levels
Shell Canada Car Wash 5826 Rochdale Boulevard, Regina Saskatchewan

Sound Source Description	Sound Power Level (dBA re: 10 ⁻¹² W)									
	Octave Band Frequency (Hertz)									Sum (dBA)
	31.5	63	125	250	500	1000	2000	4000	8000	
Automatic Car Wash										
Car Wash Exit Door	46.6	58.3	75.7	68.2	73.7	73.2	69.4	9.8	88.6	89.1
Car Wash Entrance Door	41.2	53.9	66.9	69.1	72.0	74.8	77.0	9.8	83.6	85.3
Car Wash Building Roof	54.5	65.9	66.6	63.7	74.7	68.3	64.4	71.9	67.0	78.5
Car Wash Building East Wall (Concrete and Triple Pane Glass)	44.2	55.5	56.3	61.4	71.3	56.0	58.1	65.6	60.6	73.3
Car Wash Building West Wall	35.2	46.5	47.1	53.2	62.8	47.6	45.1	49.1	40.7	63.8
Car Wash Building South and North Wall	28.0	39.4	44.2	50.3	60.2	45.9	44.0	48.4	40.5	61.2
Vehicle - Idling										
Vehicle Idling	55.0	62.0	69.0	71.0	74.0	77.0	77.0	71.0	64.0	82.1

Note – Idling vehicle sound power level originates from the Softnoise Predictor V12.01 database. The value represents a late model passenger vehicle at up to 20 kph.

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Noise Propagation Model

The Predictor™ 7810 v12.01, an environmental noise assessment software package from Softnoise GmbH was employed to determine the environmental noise impact of the equipment. The noise prediction program completes complex sound propagation calculations that include the effects of the environment, terrain, and topography. The algorithms used by the model are consistent with international standards, including International Organization for Standardization (ISO) 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere*⁴, *Part 2: General method of calculation*^{5,6}, *Part 3: Recommendations for quality assured implementation of ISO 9613-2 in software according to ISO 17534-1*⁷.

The calculated individual source sound power level complete with information regarding the facility location, equipment layout and the reception location were entered in the model. The propagation algorithms of ISO 9613 consider a downwind condition from each noise source to each receiver. The ISO 9613 method claims to couple the downwind condition with a mild temperature inversion. The ground absorption coefficient ranges between 0.0 – 1.0 where a value of 0.0 (the lowest) depicts reflective (hard) ground with a value of 1.0 (the highest) depicting porous (absorptive) ground. The model was structured to reflect favourable conditions for the propagation of sound from the source to the receiver locations.

Table 4 lists the modelled environmental parameters of the noise propagation model.

Table 4
Noise Model Environmental Parameters
Shell Canada Car Wash 5826 Rochdale Boulevard, Regina Saskatchewan

Environmental Parameter	Model Input Value
Ground Attenuation (between development & receiver)	0 (suitable value for concrete and road)
Ground Attenuation (Lawn)	1 (suitable value for vegetation and porous ground)
Receiver Height Above Ground	1.2m
Relative Humidity	70%
Temperature	+15°C
Wind Conditions	1 to 5 m/s (default ISO 9613 – moderate inversion condition, downwind in all directions)
Topography	CDEM (Canadian Digital Elevation Model) – 14m*23m height points

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Results

Table 5 presents the overall predicted sound pressure level and the source sound pressure level contributions as dBA values at the north property line (1130 Lakewood Terrace). The modelling does not include a fence (acoustic barrier) along the property line. The source sound level contribution values are order ranked by the “A” weighted contribution level.

Table 5
Order Ranked Sound Pressure Levels
1130 Lakewood Terrace – North Property Line
Shell Canada Car Wash 5826 Rochdale Boulevard, Regina Saskatchewan

Source Description	Source Sound Level Contribution (dBA)
Car Wash Entrance Door	61.5
Vehicle Idling #2	58.5
Vehicle Idling #1	55.7
Vehicle Idling #3	54.0
Vehicle Idling #4	49.4
Vehicle Idling #5	46.7
Vehicle Idling #6	44.5
Vehicle Idling #7	42.7
Car Wash Roof	41.0
Car Wash Exit Door	38.2
Car Wash Building north Wall	34.0
Car Wash Building East Wall (Triple Pane Glass)	32.5
Car Wash Building West Wall	26.1
Car Wash Building South Wall	6.2
Predicted Car Wash Only Contribution Sum	61.6
Predicted Development Contribution Sum	64.7

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Note: Sound Pressure level values below the reference level of 20 microPascals are indicated by a negative sign preceding the value

Results (continued)

Table 6 presents the overall predicted sound pressure level and the source sound pressure level contributions as dBA values at the north property line (1130 Lakewood Terrace). The modelling reflects the installation of a fence (acoustic barrier) along the north and west property lines. The barrier construction will result no openings or spaces in barrier panels and no openings or spaces between the barrier and the ground. The barrier design will have a minimum Sound Transmission Class (STC) 32 with a noise reflection coefficient of less than 80%. The barrier height is 1.8 metres with 65 metres along north and 30 metres along west of the Shell Canada property line. The source sound level contribution values in Table 6 are order ranked by the “A” weighted contribution level.

Table 6
Order Ranked Sound Pressure Levels
1130 Lakewood Terrace – North Property Line (with Barrier)
Shell Canada Car Wash 5826 Rochdale Boulevard, Regina Saskatchewan

Source Description	Source Sound Level Contribution (dBA)
Car Wash Entrance Door	47.9
Vehicle Idling #2	45.1
Vehicle Idling #1	42.0
Vehicle Idling #3	42.0
Vehicle Idling #4	38.9
Vehicle Idling #5	36.5
Car Wash Exit Door	35.4
Vehicle Idling #6	34.9
Vehicle Idling #7	33.3
Car Wash Roof	26.1
Car Wash Building East Wall (Triple Pane Glass)	22.6
Car Wash Building north Wall	22.1
Car Wash Building West Wall	17.1
Car Wash Building South Wall	3.3
Predicted Car Wash Only Contribution Sum	48.2
Predicted Development Contribution Sum	51.7

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Note: Sound Pressure level values below the reference level of 20 microPascals are indicated by a negative sign preceding the value

Order ranked sound pressure levels (Table 5 and Table 6) at a distant point of reception may differ from the equipment order ranked sound power levels (Table 3). This can occur due to the frequency composition of each noise source, the physical height of the noise source above the ground, acoustical shielding at the site or the topography between the site and the receiver.

Results (continued)

FDI Acoustics completed additional modelling to examine the contribution of traffic noise at the reception locations. Table 7 presents the overall predicted sound level contribution value from vehicle traffic for the reception locations. The modelling was completed using 2018-2019 traffic count data obtained from the City of Regina. The traffic count data represents average daily traffic volumes with the nighttime traffic assumed as 10% of the average daily traffic volume.

Table 7
Predicted Sound Levels – Road Traffic
Shell Canada Car Wash 5826 Rochdale Boulevard, Regina Saskatchewan

Receiver Location & Sound Level Description	Daytime Sound Level (dBA Leq)	Nighttime Sound Level (dBA Leq)	Daytime Sound Level (dBA Leq)	Nighttime Sound Level (dBA Leq)
	Without Barrier		w/ North & West Barrier	
Bylaw 6980 Reception Locations				
1111 Lakewood Court North – Eye Health Clinic Property Line (1.2 metres height)	58.0	50.8	54.3	47.3
1111 Lakewood Court North – Dental Health Clinic Property Line (1.2 metres height)	62.4	55.2	62.5	55.2
North Property Line - 1130 Lakewood Terrace (1.2 metres height)	57.5	50.2	50.3	43.0
Permissible Sound Level (Mixed Use Zone)	70.0	60.0	70.0	60.0
Other Reception Locations				
1130 Lakewood Terrace – 2 nd Floor Façade (5.0 metres height)	59.0	51.8	58.7	51.5
1130 Lakewood Terrace – 3 rd Floor Façade (8.0 metres height)	59.4	52.2	59.3	52.0
1130 Lakewood Terrace – 4 th Floor Façade (11 metres height)	59.5	52.2	59.4	52.2
105 Lakewood Court – 1 st Floor Façade (1.5 metres height)	53.8	46.6	51.5	44.4
105 Lakewood Court – 2 nd Floor Façade (3.5 metres height)	53.5	46.2	52.1	44.9
Permissible Sound Level (Mixed Use Zone)	70.0	60.0	70.0	60.0

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The predicted traffic noise contribution values provide the reader with an indication of the existing ambient noise environment at the reception locations. The daytime and nighttime PSLs of Bylaw 6980 are also presented for the reception locations assessed.

Results (continued)

Appendix B presents a noise contour map overlaid on the site plan and study area. The car wash noise contour map reflects the daytime or nighttime operations of the car wash when the acoustic barrier is in place along the north and west of property line of the Shell Canada site. The sound levels were calculated at 1.2 metre receiver height from the ground elevation. Appendix B also presents the daytime road traffic sound pressure level contour map and the cumulative noise contour map of the car wash with road traffic noise during daytime period. The acoustic barrier is indicated with solid green line along with receiver locations on the noise contour maps.

Discussion of Results

Table 8 presents the overall predicted sound level contribution values from the proposed carwash operations and the PSLs for the locations assessed. The development sound level contributions are used for determining compliance with the applicable PSLs.

Table 8
Predicted Sound Levels – Car Wash
Shell Canada Car Wash 5826 Rochdale Boulevard, Regina Saskatchewan

Receiver Location	Daytime Sound Level (dBA L _{eq})	Nighttime Sound Level (dBA L _{eq})	Daytime Sound Level (dBA L _{eq})	Nighttime Sound Level (dBA L _{eq})
	Without Barrier		w/ North & West Barriers	
Bylaw 6980 Reception Locations				
1111 Lakewood Court North – Eye Health Clinic Property Line (1.2 metres height)	62.2	62.2	58.3	58.3
1111 Lakewood Court North – Dental Health Clinic Property Line (1.2 metres height)	66.9	66.9	65.3	65.3
North Property Line - 1130 Lakewood Terrace (1.2 metres height)	64.7	64.7	51.7	51.7
Permissible Sound Level (Mixed Use Zone)	70.0	60.0	70.0	60.0
Other Reception Locations				
1130 Lakewood Terrace – 2 nd Floor Façade (5.0 metres height)	59.4	59.4	57.5	57.5
1130 Lakewood Terrace – 3 rd Floor Façade (8.0 metres height)	58.9	58.9	58.8	58.8
1130 Lakewood Terrace – 4 th Floor Façade (11 metres height)	58.3	58.3	58.2	58.2
105 Lakewood Court – 1 st Floor Façade (1.5 metres height)	52.8	52.8	48.7	48.7
105 Lakewood Court – 2 nd Floor Façade (3.5 metres height)	52.8	52.8	49.4	49.4
Permissible Sound Level (Mixed Use Zone)	70.0	60.0	70.0	60.0

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Discussion of Results (continued)

The results of the environmental noise propagation model indicate the predicted sound levels from the proposed Shell Canada Car Wash operations are predicted to exceed the nighttime PSLs of Bylaw 6980 at the property line of 1130 Lakewood Terrace. The results with the sound barrier in place indicate compliance with the daytime and nighttime PSLs of Bylaw 6980 at the property line of 1130 Lakewood Terrace.

Table 9 presents the overall predicted cumulative sound level values for the locations assessed. The predicted cumulative sound levels provide insight regarding the overall noise environment including the noise from the proposed car wash development and the traffic noise from Rochdale Boulevard and McCarthy Boulevard. The PSLs of Bylaw 6980 are presented for information purposes.

Table 9
Predicted Cumulative Sound Levels
Shell Canada Car Wash 5826 Rochdale Boulevard, Regina Saskatchewan

Receiver Location	Daytime Sound Level (dBA L _{eq})	Nighttime Sound Level (dBA L _{eq})
	w/ North & West Barriers	
<i>Bylaw 6980 Reception Locations</i>		
1111 Lakewood Court North – Eye Health Clinic Property Line (1.2 metres height)	59.8	58.6
1111 Lakewood Court North – Dental Health Clinic Property Line (1.2 metres height)	67.1	65.7
North Property Line - 1130 Lakewood Terrace (1.2 metres height)	54.1	52.2
Permissible Sound Level (Mixed Use Zone)	70.0	60.0
<i>Other Reception Locations</i>		
1130 Lakewood Terrace – 2 nd Floor Façade (5.0 metres height)	61.2	58.5
1130 Lakewood Terrace – 3 rd Floor Façade (8.0 metres height)	62.1	59.6
1130 Lakewood Terrace – 4 th Floor Façade (11 metres height)	61.9	59.2
105 Lakewood Court – 1 st Floor Façade (1.5 metres height)	53.3	50.1
105 Lakewood Court – 2 nd Floor Façade (3.5 metres height)	54.0	50.7
Permissible Sound Level (Mixed Use Zone)	70.0	60.0

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The results presented in Table 9 may be compared with the results presented in Table 7 to examine the overall change in the noise environment with the addition of the proposed car wash. In a comparison of the results the sound levels at the reception locations would experience increases in the daytime sound levels of approximately 5 dB or less. Increases in the noise environment of 5dB or less are generally acceptable.

Conclusion

The results of the noise propagation model indicate the predicted sound levels from the proposed Shell Canada Car Wash operations are predicted to exceed the nighttime PSLs of Bylaw 6980 at the property line of 1130 Lakewood Terrace. CTM Design has indicated the landscape design of the site will incorporate a 1.8 metre height fence (acoustic barrier) along the north and west property lines. The results with the sound barrier in place indicate compliance with the daytime and nighttime PSLs of Bylaw 6980 at the property line of 1130 Lakewood Terrace.

FDI Acoustics notes with the sound barrier in place the results of modelling indicate the Shell Canada Car Wash operations are predicted to comply with the daytime PSL of Bylaw 6980 at the receiver locations assessed. Shell Canada is advised to consider limiting the carwash operations to the bylaw defined daytime hours to satisfy the requirements of the bylaw.

Glossary

Ambient Sound Level

All noises that exist in an area and are not related to the applicant development. Ambient noise may include sounds from other industrial noise sources, transportation sources, animals, and sounds related to the environment.

A-weighted sound level

The sound level as measured on a sound level meter using a setting that emphasizes the middle frequency components similar to the frequency response of the human ear.

C-weighted sound level

The C-weighting approximates the sensitivity of human hearing at industrial noise levels (above about 85 dBA). The C-weightings sound level (i.e., measured with the C-weightings) is more sensitive to sounds at low frequencies than the A-weighted sound level and is sometimes used to assess the low frequency content of complex sound environments.

Calibration

A procedure used for the adjustment of a sound level meter using a reference source of a known sound pressure level and frequency. Field calibration must take place before and after a series of sound level measurements.

dB (decibel) or dBZ

The decibel (dB) is a logarithmic unit of measurement that expresses the magnitude of a physical quantity (usually power or intensity) relative to a specified or implied reference level. Since it expresses a ratio of two quantities with the same unit, it is a dimensionless unit. A decibel is one tenth of a bel (B). A reference pressure of 20 microPascals (μPa) is used because sounds in air at a frequency of 1000 Hz and with a pressure of 20 microPascals (μPa) can just barely be heard by most people.

dBA

The decibel (dB) sound pressure level filtered through the A filtering network to approximate human hearing response.

See dB and A-weighted sound level.

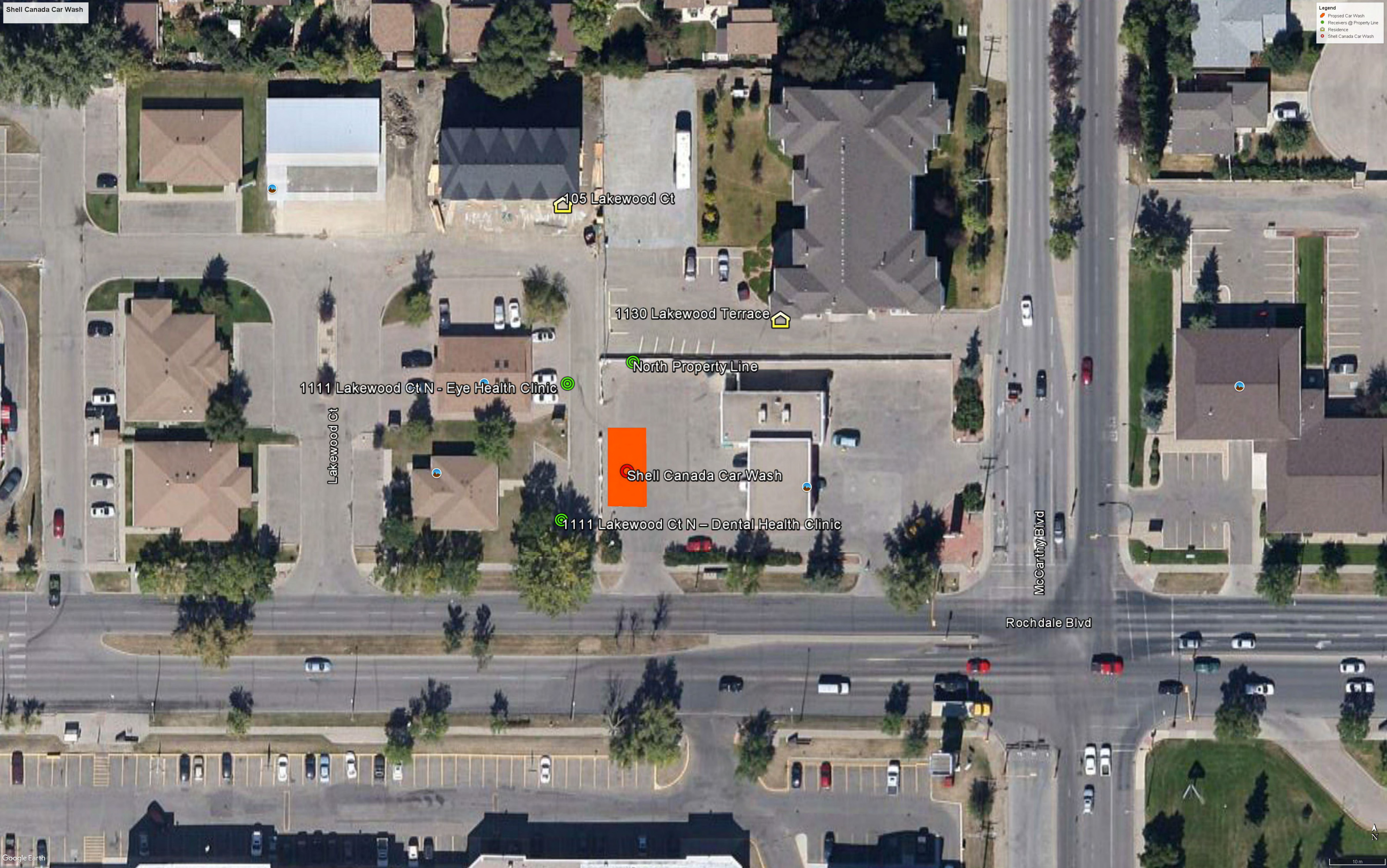
dBZ

The decibel (dB) sound pressure level is adjusted to include the low frequency end of the spectrum. Although less consistent with human hearing than dBA, dBZ can be used to discern the impact of low frequency sound emissions from industrial operations.

Energy equivalent sound level (L_{eq})	The L_{eq} is a single-number average, A-weighted sound level that represents cumulative acoustical energy as measured over a specified time interval. This interval should be specified in brackets following the L_{eq} (e.g.: L_{eq} (9) is a nine-hour L_{eq}).
ISO 9613-2:1996	Acoustics- Attenuation of sound during propagation outdoors- Part 2: General method of calculation (International Organization for Standardization)
L_{eq}	See Energy equivalent sound level.
Noise	Generally understood as unwanted sound.
Noise Impact Assessment (NIA)	Identifies the expected sound level emanating from a development as measured at the nearest or most impacted permanently or seasonally occupied dwelling or other reception point as defined by the applicable regulation or bylaw. An NIA also identifies what the permissible sound level is and how it was calculated.
Octave	A series of electronic filters separate sound into discrete frequency bands, making it possible to know how sound energy is distributed as a function of frequency. The octave band has a centre frequency that is double the centre frequency of the octave band preceding it.
1/3 Octave	The 1/3 octave band analysis provides a finer breakdown of sound distribution as a function of frequency.
Permissible Sound Level (PSL)	The maximum sound level that an applicant development should not exceed at a point of reception.
Representative conditions	Those conditions typical for an area and/or the nature of a complaint. Sound levels must be taken only when representative conditions exist; this may necessitate a survey of extensive duration (two or more consecutive nights).
Sound monitoring survey	The measurement and recording of sound levels and pertinent related information over a given time period.
Sound level meter	An instrument designed and calibrated to respond to sound and to give objective, reproducible measurements of sound pressure levels. It normally has several features that enable its frequency response and averaging times to be changed.

Sound pressure level	A measurement of the local pressure deviation from the ambient (average, or equilibrium) pressure caused by a sound wave.
Sound power level	Expressed in decibels (dB), it is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to a reference sound power level, typically 10^{-12} watts.
Spectrum	A wide range or sequence of frequencies.
Windscreen	A specialized piece of porous sponge that fits over the microphone to reduce the noise generated by the wind blowing across the microphone.

Appendix A – Study Area Map

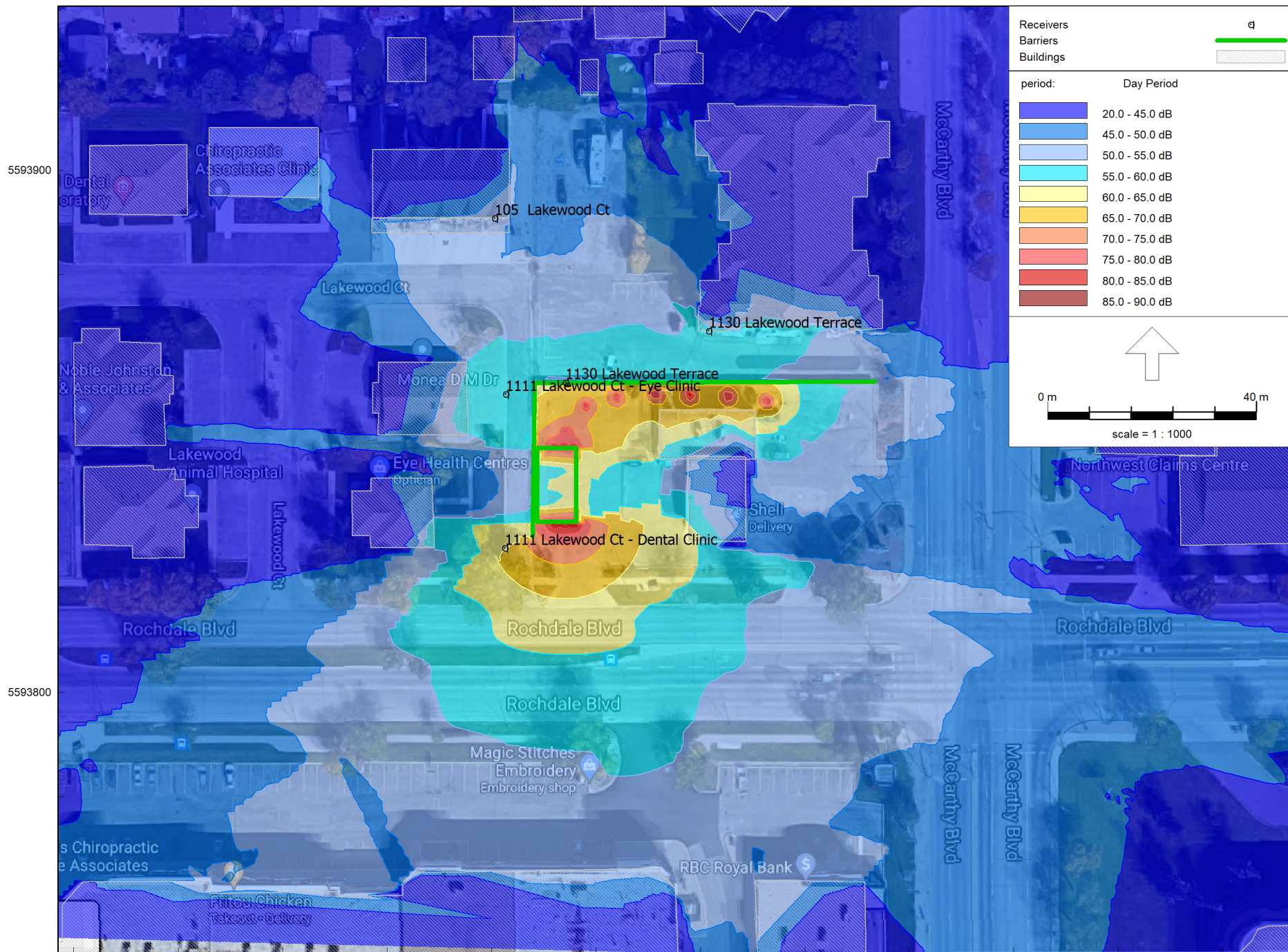


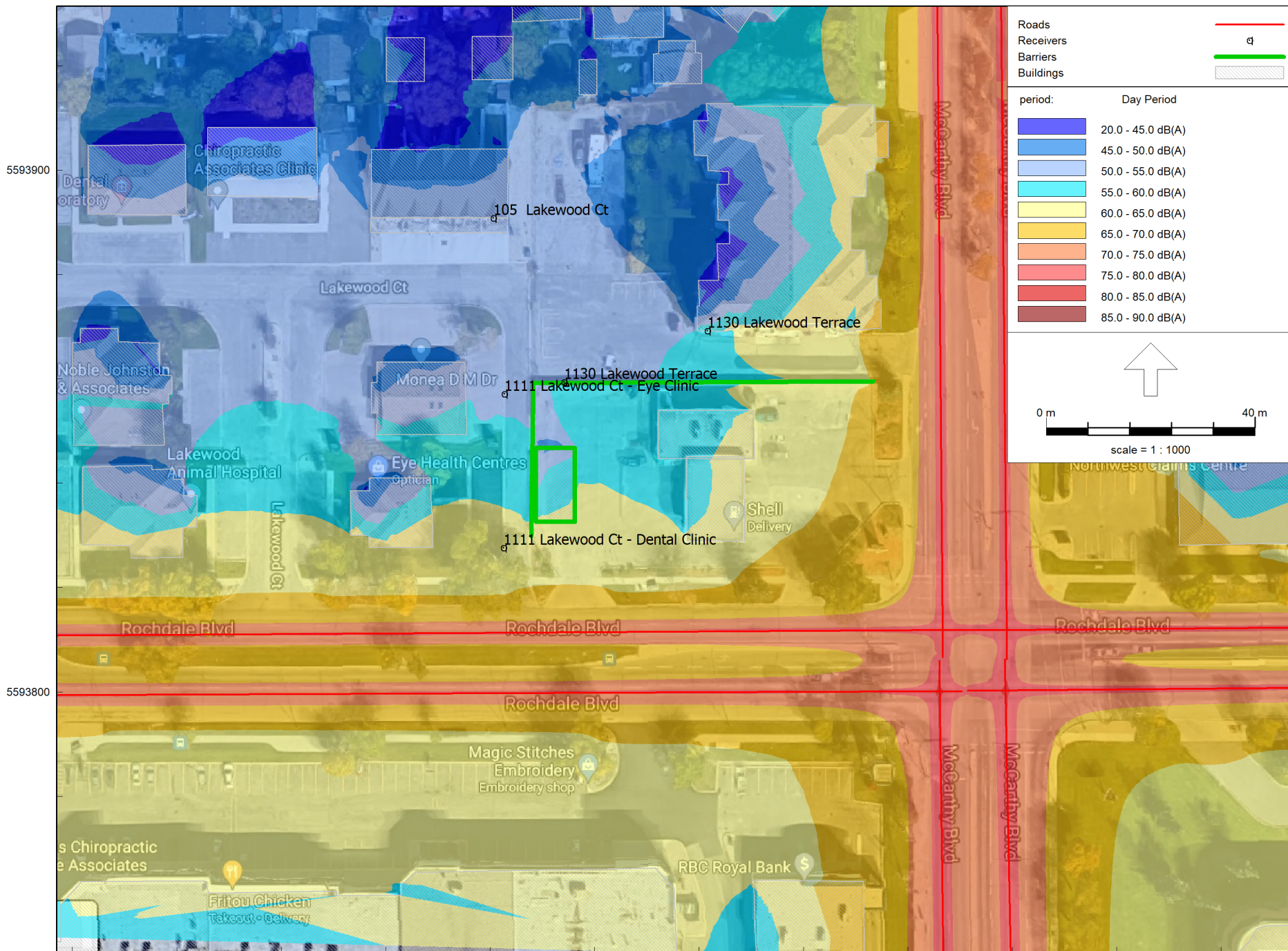
Appendix B – Noise Contour Maps

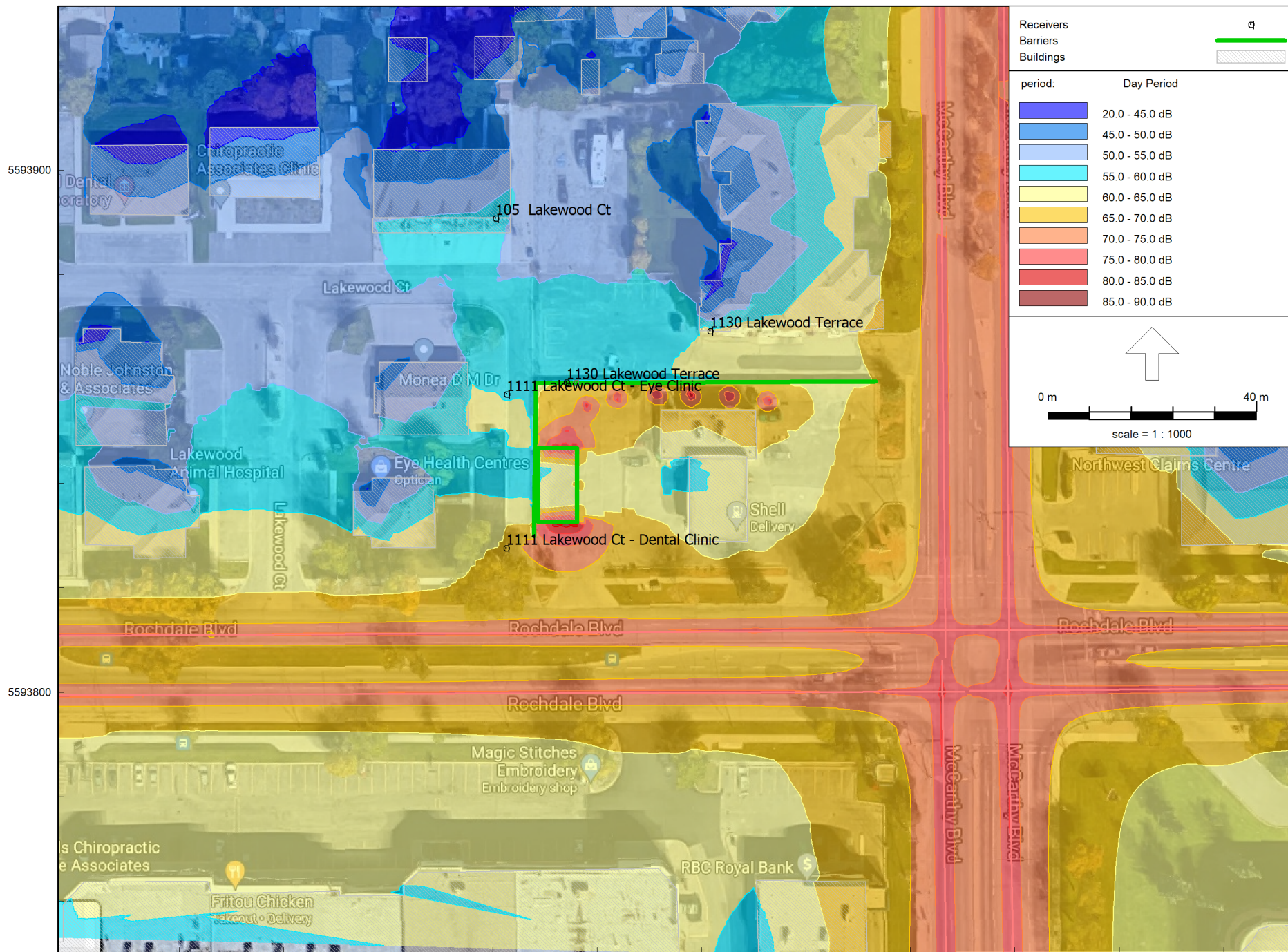
Sound pressure level contribution contour map of the CTM Design Shell Canada Car Wash 5826 Rochdale Blvd Regina with the proposed 1.8 metre height acoustic barrier. The noise contour map reflects a receiver height of 1.2 metres.

Existing daytime road traffic sound pressure level contribution contour map with the proposed acoustic barrier. The noise contour map reflects a receiver height of 1.2 metres.

Cumulative sound pressure level contribution contour map of the CTM Design Shell Canada Car Wash along with existing daytime road traffic noise with the proposed 1.8 metre height acoustic barrier.







Appendix C – References

1. City of Regina, Bylaw 6980, The Noise Abatement Bylaw, September 30, 2019.
2. Crocker, M.J., [Handbook of Noise and Vibration Control](#), John Wiley & Sons. New York, NY, 2007.
3. Bies, D.A. and Hansen, C.H., [Engineering Noise Control Theory and Practice](#), Third Edition, Spon Press. New York, NY, 2003.
4. International Organization for Standardization (ISO 9613-1), [Attenuation of sound during propagation outdoors - Part 1: Calculation of the absorption of sound by the atmosphere](#), Approved 1993.
5. International Organization for Standardization (ISO 9613-2), [Attenuation of sound during propagation outdoors - Part 2: General method of calculation](#), Approved 1996.
6. International Organization for Standardization (ISO 1996-2:2007), [Description, measurement, and assessment of environmental noise - Part 2: Determination of environmental noise levels](#), Approved 2007 (Revises ISO 1996-2:1987 Acoustics – Description and measurement of environmental noise – Part 2: Acquisition of data pertinent to land use).
7. International Organization for Standardization (ISO/TR 17534-3), [Acoustics – Software for the calculation of sound outdoors – Part 3: Recommendations for quality assured implementation of ISO 9613-2 in software according to ISO 17534-1](#), Approved 2015.

Appendix D – Practitioner Experience

Mr. James Farquharson, CET, INCE is the founder and Principal Consultant of FDI Acoustics. Mr. Farquharson is certified as an Engineering Technologist (Petroleum) by The Association of Science and Technology Professionals of Alberta. Mr. Farquharson is a member of the Institute of Noise Control Engineers (INCE) and a Life Member of the Society of Petroleum Engineers (SPE). Mr. Farquharson has 32 years of experience in the preparation of environmental noise impact assessments and industrial noise control studies. Mr. Farquharson served as member of the Alberta Energy and Utilities Board (now the AER) Noise Control Directive 99-8 Review Committee that resulted in the current version of Directive 038. Mr. Farquharson also served as committee member in the development of the current City of Calgary Community Standards Bylaw 5M2004 (Part 9 Noise). Mr. Farquharson has appeared before the Alberta Energy Regulator, the Alberta Utilities Commission, and the Natural Resources Conservation Board as an expert in the preparation of Environmental Noise Impact Assessments. Mr. Farquharson has previously completed environmental noise assessment of car washes in Calgary, Edmonton, and Winnipeg during his career. Mr. Farquharson provided modelling oversight, report preparation, and project review in the completion of this assessment.

Mr. Hossein Mehravaran, M.Sc. is a Senior Acoustical Consultant employed with FDI Acoustics since 2014. Mr. Mehravaran graduated from the University of Tehran in 1995 with a B.Sc. in applied Physics. Mr. Mehravaran graduated from the University of Tehran in July 1999 with a M.Sc. and a teaching certificate. Mr. Mehravaran is a member of the Institute of Noise Control Engineers (INCE). Mr. Mehravaran has 19 years of experience as an Acoustical Consultant and specializes in environmental noise modelling and environmental noise monitoring. Mr. Mehravaran has completed assessments for car washes in Calgary and Edmonton during his career. Mr. Mehravaran completed the environmental noise modelling and report preparation in the completion of this assessment.