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Selkirk Solar Glass Manufacturing Facility Noise Impact Assessment

Canadian Premium Sand Inc.

Project number: 60663147

September 2022

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Glossary

Attenuation	The reduction of sound intensity achieved by various means (e.g. air, humidity, and porous materials) that may be natural or anthropogenic.
Barrier	An obstacle on the propagation path of sound between a source and a receiver. Obstacles may be composed wholly, or by a combination, of berms, walls, or fences; are free of gaps within or below its extents; and of sufficient mass to prevent significant transmission of sound.
Daytime	Defined as the hours from 07:00 to 22:00.
Day-night Sound Level (L_{dn})	Describes a receiver's cumulative noise exposure over a 24-hour period, where nighttime events (22:00 to 07:00) are increased by 10 dB to account for humans' greater sensitivity to noise.
Decibel (dB)	The standard unit of measurement for sound levels. Describes the ratio between the sound pressure under consideration and a reference pressure level. Unless otherwise noted, decibel values relate to a reference pressure level of 2×10^{-5} Pascals.
Decibel – "A-Weighted [Network]" (dBA)	A frequency weighting network intended to approximate the response of the healthy human ear to sounds of different frequencies. Overall sound levels calculated or measured using the A-weighting network are indicated by dBA rather than dB.
Energy Equivalent Sound Level ($L_{eq,T}$)	The equivalent constant sound level over a specified time period "T" that would have the same sound energy as the actual (i.e. unsteady) time-varying sound over the same period of time.
Frequency	The number of times per second that a sine wave of sound repeats itself. It can be expressed in cycles per second, or Hertz (Hz).
Frequency Weighting	A method used to account for changes in sensitivity as a function of frequency. A, B, and C are most commonly used to account for different responses to sound pressure levels. Note: The absence of frequency weighting is referred to as linear weighting.
Hertz (Hz)	A unit of frequency, expressed as cycles per second.
Insertion Loss	The sound level reduction provided by a noise barrier or other noise mitigation measure.
International Organisation for Standardisation (ISO)	An international body that provides scientific standards and guidelines related to various technical subjects and disciplines.
Mitigation	Measures, such as administrative or engineering methods, to reduce, eliminate, or control impacts on the environment.

Night-time	Defined as the hours from 22:00 to 07:00.
Noise Barrier	Same as barrier.
Noise level	Same as sound level.
Octave	The interval for which the upper band frequency is twice the lower band frequency is an octave. For acoustic measurements, octave bands start at a centre frequency of 1,000 Hz and go either up or down from that point at a 2:1 ratio. The next upper centre frequency is 2,000 Hz, followed by 4,000 Hz, etc. The next lower centre frequency is 500 Hz followed by 250 Hz, etc.
Point of Reception (POR) *or* ***Receptor***	A stationary position, at which sound levels are specified, measured or predicted.
Predictable Worst-Case Operation	A planned and predictable mode of operation for stationary noise source(s) when the source generates the greatest noise impact at a point of reception, relative to the applicable limit.
Sound	A pressure-wave motion in a medium, such as air or water. The pressure-wave propagates to distant points through rapid oscillatory compression/rarefaction in the medium.
Sound Level	Generally, refers to the weighted sound pressure level that may be linear or weighted (e.g., A- or C-weighted) and expressed in decibels.
Sound Power Level (L_w)	The total sound energy radiated by a source per unit time (i.e. rate of acoustical energy radiation) measured in Watts. The acoustic power radiated from a given sound source as related to a reference power level (i.e., typically $1E^{-12}$ watts, or 1 picowatt) and expressed as decibels. A sound power level of 1 watt = 120 decibels relative to a reference level of 1 picowatt.
Sound Pressure	The root-mean-square of the instantaneous sound pressures over a specified time interval “T” in the frequency band of interest.
Sound Pressure Level (L_p)	Logarithmic ratio of the root mean square sound pressure to a reference sound pressure. The reference sound pressure of the threshold of human hearing (i.e., 20 micropascals) is used.

1. Introduction

Canadian Premium Sand Inc. (CPS) is proposing to construct a solar glass manufacturing facility (the Project) at the north end of Selkirk, Manitoba. This facility will produce high quality, low iron glass which will be used in the manufacture of solar panels, with the primary ingredient of high purity, low iron silica sand being sourced from CPS' quarry near Seymourville, Manitoba.

AECOM has completed a noise impact assessment (NIA) of the Project operations in support of the Environment Act License (EAL) application to Manitoba Environment, Climate and Parks (MECP), Environment Assessment Branch (EAB). This report summarizes the methods, assumptions, technical data, and prediction results of the assessment.

The Project will have a 'Phase 1' facility producing 800 tonnes per day, but the capacity will be increased to 1,200 tonnes within a few years by constructing a second 'Phase 2' facility adjacent to the Phase 1 facility. The full build-out of the Phase 1 and Phase 2 facility is expected to occur within approximately 5 years of the completion of the Phase 1 facility i.e., by 2029. Each facility is expected to operate 24 hours a day, 7 days a week, 365 days per year with shutdowns being planned at approximately 15-year intervals for furnace maintenance. A conceptual image of the full build-out of the Phase 1 and 2 facility is shown in **Figure 1-1.** This NIA assesses the noise emissions on the surrounding environment from the full build-out of the Phase 1 and 2 facility.

The complete Phase 1 and 2 facility will be comprised of the following components:

- Two (2) production buildings including two (2) furnace areas and additional equipment to manufacture glass panels.
- Two (2) exhaust cleaning units along with two (2) 70 m high stacks to clean and discharge furnace off-gasses.
- Two (2) transformers for electrical power use.
- A storage building for raw materials.
- An office building.
- A workshop for on-site equipment repair and maintenance.
- Two (2) warehouses for glass panels storage.
- One (1) rail access point for delivery of raw materials and transportation of finished goods.
- A batch plant building where raw materials are mixed before being transported to the furnace.

Based on the planned equipment use and activities, the Project is not expected to be a source of significant vibration. Therefore, a vibration assessment is not required. Accordingly, the assessment focuses on the noise impacts during the predictable worst-case facility operations at the most affected point(s) of reception.

Figure 1-2 provides a scaled area map showing the Project area. **Figure 1-3** provides a drawing of the facility site layout.

Figure 1-1. Conceptual Image of the Solar Glass Manufacturing Facility

Figure 1-2. Project Location and Area Map

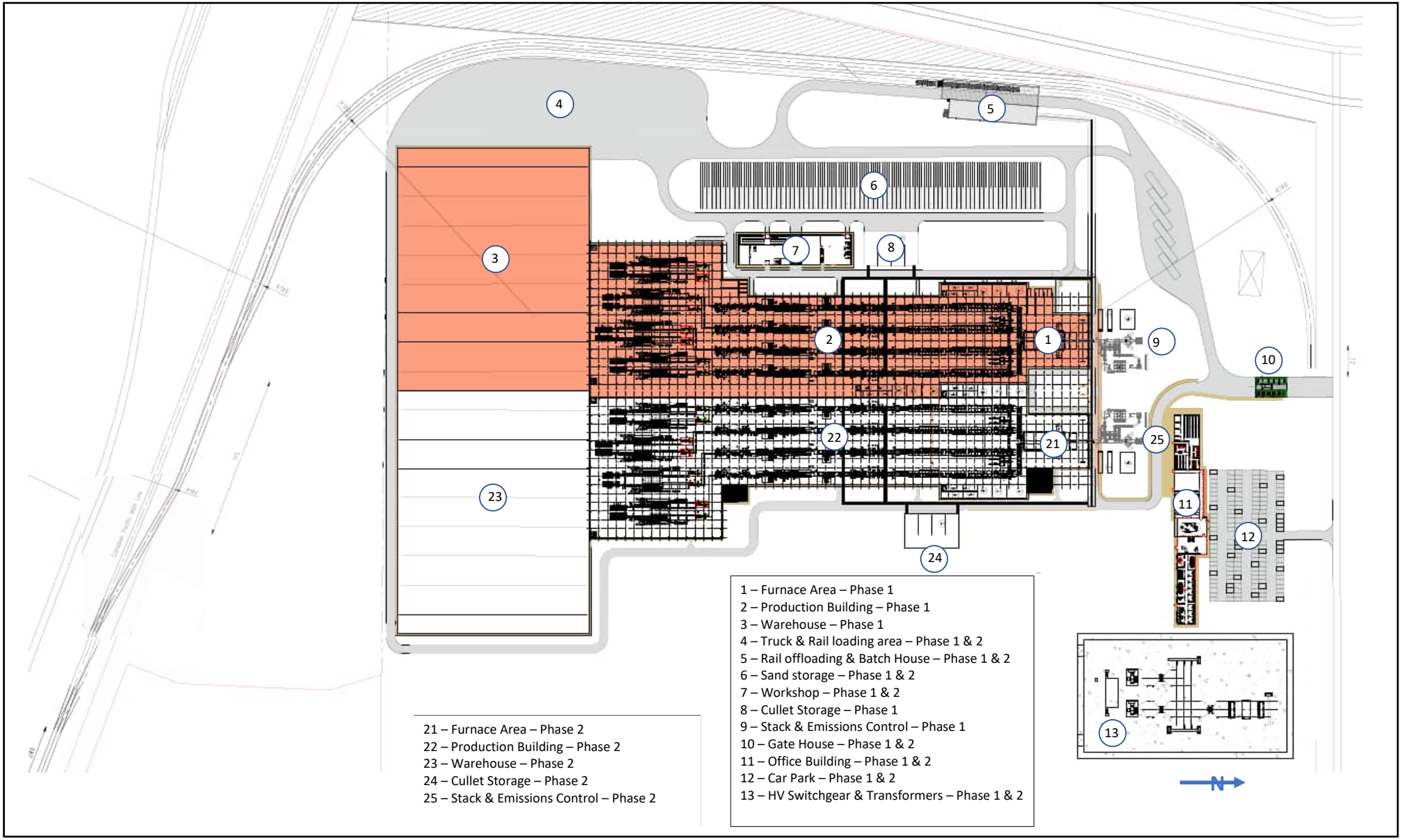

Figure 1-3. Facility Site Layout

2. Regulatory and Policy Framework

The Province of Manitoba has published the Guidelines for Sound Pollution (MEMD, 2000), which provides quantitative limits on noise emissions to the outdoor environment. These sound level limits have been adopted for this noise impact assessment.

The Guidelines for Sound Pollution (the 'Manitoba Guideline') provides target sound levels limits for noise emissions to the outdoor environment at points of reception (PORs). The Manitoba Guideline defines a POR as "any point on the premises of a person where sound originating from other than those premises is received." These target sound level limits are separated by maximum desirable and maximum available sound levels and vary depending on the type of areas including designated residential, commercial, and industrial areas. **Table 2-1** presents the Manitoba Guideline sound level objectives for residential areas.

Table 2-1. Manitoba Guideline Sound Level Objectives for Residential Areas - Continuous or Intermittent Sounds

	$L_{eq(24)}$ (dBA)	L_{dn} (dBA)	$L_{eq(1)\ (day)}$ 07:00 – 22:00 (dBA)	$L_{eq,(1)\ (night)}$ 22:00 – 7:00 (dBA)
a) Maximum Desirable Sound Level	-	55	55	45
b) Maximum Acceptable Sound Level				
i) Summer or year-round operations	-	60	60	50
ii) Predominant discrete tone(s) or appreciable impulsive/impact character	-	55	55	45
iii) Winter operations only or temporary operations	-	65	65	55

The Maximum Desirable Sound Level limits provided above were adopted as the limits for this assessment.

3. Assessment Locations

The nearest PORs were identified using satellite imagery and land use plans to identify existing dwellings based on the planned Project area, operation, and activities. These locations are representative of the most exposed noise sensitive residential dwellings surrounding the Project area in each direction. These PORs are summarized in **Table 3-1** and illustrated in **Figure 3-1.**

Table 3-1. Point of Reception Summary Table

	Location		UTM Coordinates[1]	
POR ID	Description	Distance to Center of Processing Area	Easting	Northing
POR_1	Single residential dwelling located north-west of the Project area	773 m	650174	5559343
POR_2	Single residential dwelling located south of the Project area	686 m	651040	5558675
POR_3	Single residential dwelling located east of the Project area	1265 m	652159	5558988

Notes:
1. Reference UTM Zone 14.

Figure 3-1. Project Points of Reception

4. Modelling and Data Analysis

Sound propagation calculations were conducted in accordance with International Organization for Standardization (ISO) publication Standard 9613-2, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation (ISO, 1996).

Sound propagation predictions were performed using Cadna/A modelling software, authored by DataKustik, which implements the ISO prediction algorithms and is widely used in industrial noise assessment. **Table 4-1** summarizes the Cadna/A noise model settings used in the assessment.

Table 4-1. Modelling Parameters

Item	Model Parameter	Model Setting
1	Temperature	10°C
2	Relative Humidity	70%
3	Propagation Standard	ISO 9613-2
4	Ground conditions and Attenuation factor	Ground Absorption (G): • 0.9 (e.g porous ground covered by grass, trees, or other vegetation) outside of processing area. • 0 (e.g., reflective ground) asphalt pathways, parking lots, and loading area within processing area.
5	Receptor Height	1.5 m
6	Topography	Generally Flat
7	Foliage Attenuation	Excluded (Conservative Results)
8	Operating Conditions	Facility operates 24 hours, 7 days a week, 365 days a year.

For the purposes of the acoustic modeling, facility operating activities were grouped into the following categories:

- Inbound transportation of materials.
- Production of glass panels.
- Outbound transportation of finished goods.

Inbound Transportation

Production materials will be transported to the facility via road and rail. Materials will be unloaded at the batch house unloading and sand storage locations. The following conditions or assumptions have been adopted for modelling:

- Inbound transportation will occur from 7:00 to 21:00.
- Thirty-eight (38) trucks will be used for inbound transportation per day.
- Truck speeds will be limited to 15 km/hr on facility grounds.
- The average train speed on the rail loop will be 10 km/hr.
- The freight train has 45 railcars.
- Continuously welded tracks implemented at the railway.
- Trucks will idle for 10 minutes in the facility at the batch house location, sand storage area, and loading area.
- Two (2) locomotives will transport materials to the facility and will idle for 2 hours at the batch house unloading location area.
- Three (3) wheel loaders will transport sand from the batch house to the sand storage location. This operation will occur 24 hours a day.

- During railcar loading, the locomotive will be idling and contributing to noise emission; the railcars will be stationary and will not produce noise.

Production of Glass Panels

Materials will be transported from the batch house to the furnace area in the production building. The batch mix will be heated in the furnace to produce molten glass, and the glass will be cut into individual glass panels at the production building. All waste glass (cullets) will be transported to the cullet storage area initially and finally the batch house to partake in the batch mixing process again. The following conditions or assumptions have been adopted for modelling:

- Two (2) furnace exhaust stacks at 70 m to discharge furnace off-gasses.
- Louvres on facility buildings will be non-acoustic.
- Facility operates an enclosed conveyor system for 16 hours per day, and 20 minutes per hour.
- Building's man-doors and garage doors will not be used for ventilation.
- Facility buildings (furnace, production, and batch) will use ridge vents on the roof. The warehouse buildings will use rooftop HVAC units.
- Noise emissions from the workshop, office and warehouse are negligible.

Outbound Transportation

Packaging and stacking of the finished panels are processed in the warehouse. Afterwards, the stacks of finished products will be loaded onto trucks and rail cars for delivery by road and rail. The following conditions or assumptions have been adopted for modelling:

- Outbound transportation will occur from 7:00 to 21:00.
- Eighty-seven (87) trucks will be used for outbound transportation per day.
- Two (2) 50-ton forklift trucks will be used to load containers on railcars. Forklift trucks will operate 24 hours per day at the loading area.
- Truck speed is 15 km/hr on facility grounds.
- Two (2) locomotives will idle 2 hours per day at the loading area
- The average train speed on the rail loop will be 10 km/hr.
- The freight train has 45 railcars.
- Continuously welded tracks implemented at the railway.
- During railcar loading, the locomotive will be idling and contributing to noise emission; the railcars will be stationary and will not produce noise.

In accordance with the recommendations from the Canadian Transportation Agency (CTA), noise prediction methods from the US Federal Transit Administration (FTA) were used to calculate the noise contributions from the train. Sound level data from the U.S Federal Railroad Administration (FRA) and the FTA were also used to represent the noise emissions due to the locomotive and railcars.

5. Noise Source Summary

Modelled noise source emissions were established using a combination of past measurements of similar equipment and industry-accepted reference sound level data. **Table 5-1** summarizes the noise sources and emissions included in the model.

Table 5-1. Project Noise Sources

Noise Source	Sound Power Level (dB, re. 10^{-12} Watts) in Octave Band Centre Frequency (Hz)									Total (dBA)	Quantity	Usage per hour (%)	Notes
	31	63	125	250	500	1000	2000	4000	8000				
Enclosed Conveyor System	63	62	57	55	56	57	47	47	46	60	1	33	2, 3, 6
Furnace Exhaust Stack	94	97	95	92	90	87	82	76	72	101	2	100	2, 3
Transformer	78	87	92	87	87	78	70	65	58	86	2	100	2, 3
Idling Locomotive	-	106	92	86	80	80	88	81	80	92	1	13	1, 2, 3
Idling Truck	78	70	67	70	75	74	71	67	67	78	4	17	1, 2, 3
Finished Goods Truck	103	103	105	95	93	94	91	87	80	99	5	8	1, 2, 3, 5
Raw materials B-train	106	106	111	106	102	100	98	93	88	112	2	8	1, 2, 3, 5
Raw materials flat deck	102	102	104	94	92	93	90	86	79	98	1	8	1, 2, 3, 5
Pallet Truck	102	102	104	94	92	93	90	86	79	98	1	8	1, 2, 3, 5
Diesel Truck	102	102	104	94	92	93	90	86	79	98	1	8	1, 2, 3, 5
Filter Materials Truck	102	102	104	94	92	93	90	86	79	98	1	8	1, 2, 3, 5
Wheel Loader	101	104	96	95	89	88	86	83	74	94	1	100	2, 3, 5
50-ton Forklift Truck (container loading)	103	115	107	96	92	103	94	97	84	105	1	100	2, 3, 5
5-ton Forklift Truck (cullet handling)	84	95	87	76	73	84	74	78	65	86	1	17	1, 2, 3, 5
5-ton Forklift Truck (pallet loading)	84	95	87	76	73	84	74	78	65	86	1	52	1, 2, 3, 5
Batch Walls, and Roof	78	74	76	80	75	72	68	62	58	77	-	100	3, 4, 7
Batch Ridge Vent	90	86	89	93	87	84	81	75	71	90	1	100	3, 4, 7
Batch Louvres (4 m X 2 m)	85	81	83	87	82	79	75	69	65	84	8	100	3, 4, 7
Furnace Walls, and Roof	87	83	87	85	82	83	78	74	68	87	-	100	3, 4, 7
Furnace Ridge Vent	99	95	99	97	94	95	90	86	80	98	2	100	3, 4, 7
Furnace Louvres (5 m X 5 m)	99	95	99	97	94	95	90	86	80	99	4	100	3, 4, 7
Production Walls, and Roof	78	76	78	80	77	73	71	67	64	79	-	100	3, 4, 7
Production Ridge Vent	85	82	84	87	84	79	77	73	71	86	12	100	3, 4, 7
Production Louvres (4 m X 2 m)	85	83	85	87	84	80	78	74	71	86	20	100	3, 4, 7

Noise Source	Sound Power Level (dB, re. 10^{-12} Watts) in Octave Band Centre Frequency (Hz)									Total (dBA)	Quantity	Usage per hour (%)	Notes
	31	63	125	250	500	1000	2000	4000	8000				
Freight Train Passby with 2 Locomotive and 45 Railcars										49	1		8, 9

Notes:

1. Sound power level includes estimated utilization adjustments.
2. Single unit sound power level, unadjusted for quantity.
3. Based on past measurement data for similar equipment.
4. Sound power level per square metre.
5. Pass-by sound power level.
6. Sound power level per metre.
7. Acoustic calculations.
8. Emissions normalized to overall sound power level from FTA.
9. Prediction according to FTA methodology.

6. Modelling Results

The daytime and nighttime 1-hour equivalent (L_{eq}) sound levels, and day-night equivalent sound levels (L_{dn}), were predicted at the identified PORs. The results are presented in **Table 6-1.**

Table 6-1. Predicted Project Noise Levels

POR ID	Noise Contribution from Project Operation (dBA)			Sound Level Limit (dBA)			Meets Sound Level Limit Criteria? (Y/N)		
	Daytime ($L_{eq,1HR}$)	Nighttime ($L_{eq,1HR}$)	Day-Night Equivalent (L_{dn})	Daytime ($L_{eq,1HR}$)	Nighttime ($L_{eq,1HR}$)	Day-Night Equivalent (L_{dn})	Daytime	Nighttime	Day-Night Equivalent
POR_1	43	41	48	55	45	55	Y	Y	Y
POR_2	37	35	42	55	45	55	Y	Y	Y
POR_3	32	30	37	55	45	55	Y	Y	Y

Figure 6-1 and **Figure 6-2** illustrates the Project's daytime and nighttime noise levels and noise propagation contour lines, respectively.

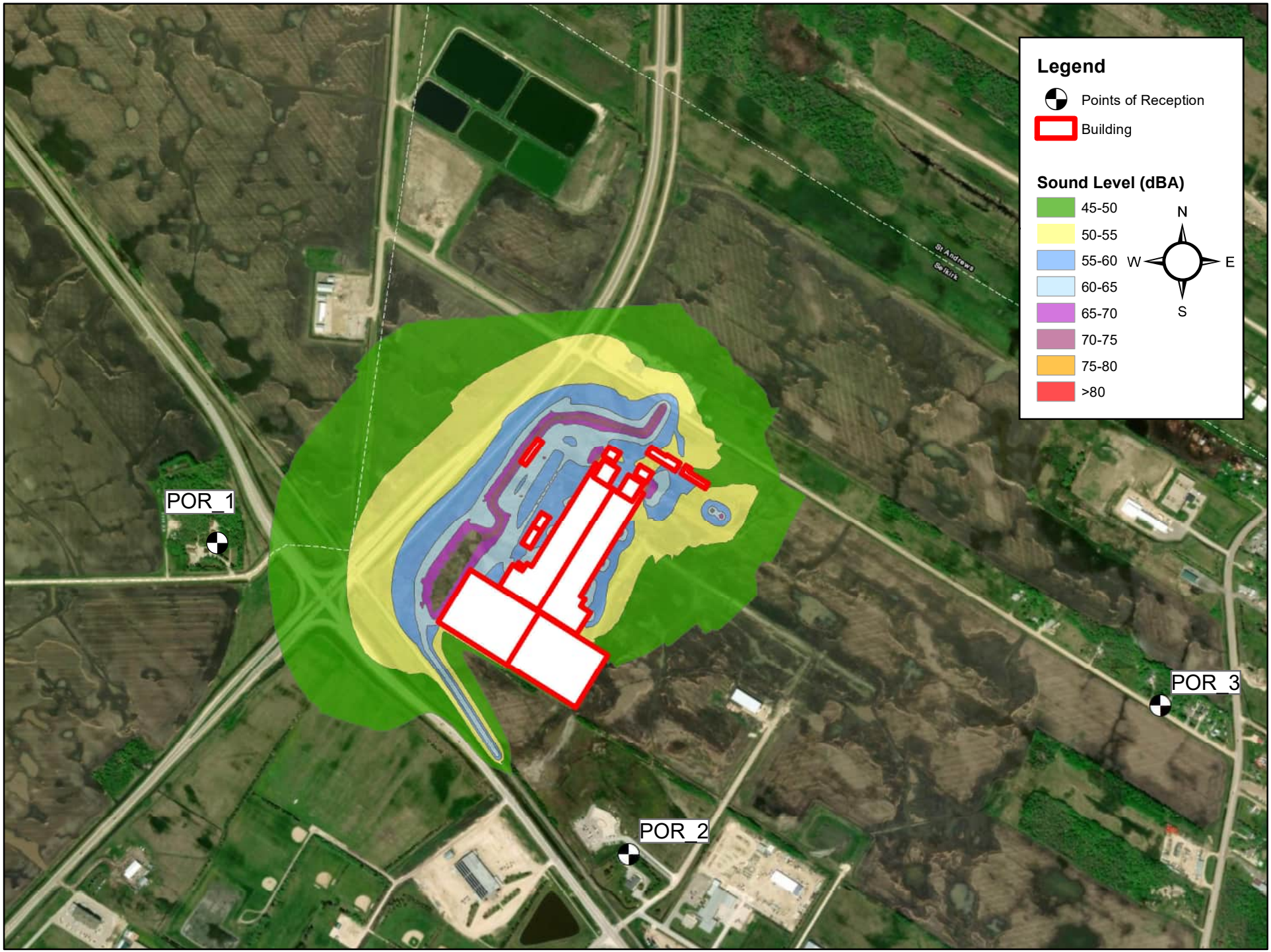

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Figure 6-1. Daytime Operations Noise Contour Lines

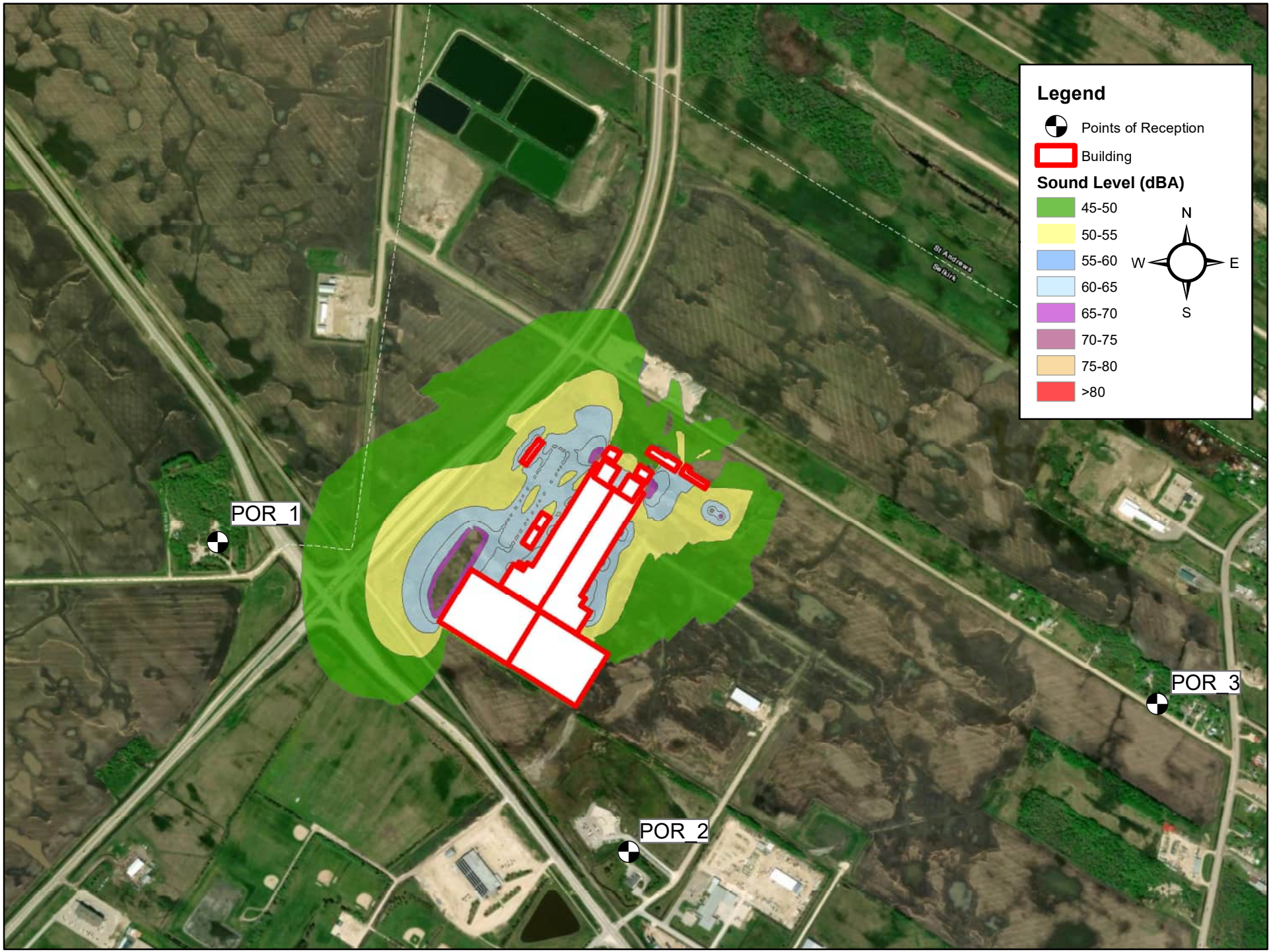

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Figure 6-2. Nighttime Operations Noise Contour Lines

7. Mitigation Measures

Based on the assumptions and equipment noise emissions described in **Section 4** and **Section 5**, noise modeling results summarised in **Section 6** indicated that the predicted sound levels at the PORs due to the Project operations will not exceed the Manitoba Guidelines' sound level limits. No additional noise mitigation measures beyond the current Project description are required for the Project.

The requirement for mitigation measures should be re-examined during the detailed design stage to maintain Project compliance with the applicable sound level limits.

8. Construction Noise

Construction activities have the potential to generate noise impacts at receptor locations. Noise from construction activities can be controlled in numerous ways, including operational restrictions, source mitigation measures, as well as receptor-based mitigation measures. The following measures may be implemented throughout construction to reduce the noise impacts at sensitive receptors:

- Operate in accordance with local by-laws whenever possible;
- If construction needs to be undertaken outside of the normal daytime hours, local residents shall be informed beforehand of the type of construction planned and the expected duration;
- Keep equipment well-maintained and fitted with efficient muffling devices;
- Idling of equipment will be restricted to the minimum necessary to perform the specified work;
- Vehicles employed continuously on site for extended periods of time (2 to 4 weeks) are fitted with visual warning systems or sound reducing back-up (reversing) alarms;
- Avoid unnecessary revving of engines and switch off equipment when not required (do not idle); and
- Minimize drop heights of materials.

The following additional mitigation measures may be considered and implemented to further reduce noise effects during construction, if required:

- Offset usage of active heavy equipment (schedule non-concurrent use);
- Reroute construction and truck traffic, when possible;
- Coordinate 'noisy' operations such that they will not occur simultaneously, where possible;
- Where possible, investigate and implement the use of alternative construction equipment or methods to reduce noise emissions from construction. Utilize alternative equipment that generates lower noise levels or optimize silencer/muffler/enclosure performance;
- Line chutes and dumpers to reduce impact noise, where needed;
- Investigate enclosures, noise shrouds or noise curtains around noisy equipment, where needed; and
- Investigate temporary noise barriers/solid construction hoarding on site boundary to screen affected locations, where needed.

9. Conclusion

Noise impacts on the surrounding environment due to the CPS Glass Plant Project have been assessed using acoustic modeling. Provided that operating activities of the Project are within the assumptions described in this report, the predicted sound levels at the PORs due to the Project do not exceed the Manitoba Guidelines for sound level limits.

The results of the noise impact assessment incorporate the most recent Project information available for Project operations, as of September 2022. Should any changes to the Project assumptions occur (e.g., new equipment, facility layout, equipment usage etc.), the affected Project components and activities should be reassessed to verify that the guidance sound level limits are not exceeded.

10. References

ISO (International Organization for Standardization). 1996. Standard 9613-2, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation. Geneva, Switzerland.

ISO (International Organization for Standardization). 2003. Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures. Geneva, Switzerland.

MEMD (Manitoba Environmental Management Division). 2000. Guidelines for Sound Pollution. March 2000 Winnipeg, MB.

David A. Bies and Colin H. Hansen. 2009. Engineering Noise Control Theory and Practice – Fourth Edition. Chippenham, Wiltshire.

Brown, S.C. Proceedings of ACOUSTICS 2004 – Conveyor Noise Specification and Control, Gold Coast, Australia.

Canadian Transportation Agency – Railway Noise Measurement and Reporting Methodology, 2011.

US Department of Transportation, Federal Transit Administration – Transit Noise and Vibration Impact Assessment Manual, September 2018.

US Department of Transportation, Federal Railroad Administration – High-Speed Ground Transportation Noise and Vibration Impact Assessment, September 2012.

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