Appendix E

Air Quality Report
Distribution List

<table>
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<tr>
<th># Hard Copies</th>
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Revision History

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<th>Date</th>
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<td>Initial Draft</td>
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Attachments

Attachment A. Isopleths
1. Introduction

1.1 Overview

AECOM was retained by the Canadian Premium Sand Inc. ("the Proponent") to conduct an air dispersion model for the Wanipigow Sand Extraction Project ("the Project").

The Proponent is proposing to develop a sand deposit as a source of high-quality silica sand for a variety of markets such as oil and gas operations and the glass production industry. The Project is located on the east shore of Lake Winnipeg, Manitoba, approximately 160 km northeast of Winnipeg, within the boundaries of the Incorporated Community of Seymourville. Seymourville, governed by a mayor and council under The Northern Affairs Act, is part of a group of four communities also including Manigotagan, Hollow Water First Nation, and Aghaming (Figure 1)

The Project will have an estimated annual production rate of 1 million tonnes of silica sand at full operation that will be processed on-site (washed and dried) and will be trucked to Winnipeg for loading onto rail cars for shipping to markets in Canada and the United States. The anticipated life of the Project will be 54 years. Key components of the Project will include:

- An active open-pit sand quarry each year of operation, including progressive annual site reclamation of closed quarries;
- Silica sand production process, including a fully enclosed sand wash and dry facility;
- Ancillary facilities, including portable office and storage buildings;
- A main access road approximately 6 km-long; and
- An access road approximately 1.5 km-long for use during Project construction and for emergencies during Project operation.

The Project operations were assessed in accordance with the Draft Guidelines for Air Quality Dispersion Modelling Manitoba (MCWS, November 2006) using AERMOD to predict maximum ground-level concentrations, as well as maximum predicted concentrations at selected nearby sensitive receptors, of the following:

- Nitrogen Dioxide (NO₂);
- Carbon Monoxide (CO); and
- Particulate Matter (PM₁₀ and PM₂.₅) and,
- Sulfur Dioxide (SO₂).

Model results were compared with the Manitoba Ambient Air Quality Criteria (MAAQC, 2005).
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2. Facility Location

The Project is located on the east shore of Lake Winnipeg, in the Canadian Province of Manitoba, approximately 160 kilometres (km) northeast of the capital city of Winnipeg (Figure 1). The deposit is found within the boundaries of the Incorporated Community of Seymourville, governed by a mayor and council under The Northern Affairs Act.

Seymourville is one of a group of four communities including Manigotagan, Hollow Water First Nation and Aghaming that are in close proximity (10 km or so) to the Project. The community lies on the southeast boundary of Hollow Water’s reserve and is about 70 kilometres by road north of Pine Falls (the nearest service center). The community of Manigotagan is southeast of the Project, situated near the mouth of the Manigotagan River on the east shore of Lake Winnipeg at Provincial Road #304 (“PR #304”). Also, cottage developments can also be found to the northwest, west and southwest of the deposit along the shores of Lake Winnipeg.

Access to the Project (and its markets) is provided by the paved PR #304 and a paved 6 km all-weather road to be sited and built as part of the Project. The Project Site area includes the project footprint which is the area that will encompass the land on which project components are located and immediate surrounding area. The Project Site occurs within quarry lease areas issued to the proponent.

3. Legislation and Policy

The air dispersion model was conducted according to the Draft Guidelines for Air Quality Dispersion Modelling Manitoba (MSWS, November 2006), and model results were compared with Manitoba Ambient Air Quality Criteria (MAAQC). The assessment was prepared for inclusion with an Industrial Approval Renewal Application.

A summary of the applicable Regulations and Guidelines is shown in Table 1, below.

<table>
<thead>
<tr>
<th>Authorization / Guideline</th>
<th>Agency</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft Guidelines for Air Dispersion Modelling in Manitoba</td>
<td>Manitoba Conservation and Water Stewardship</td>
<td>This guideline is a resource that provides consistency in dispersion modelling across all regulatory applications.</td>
</tr>
<tr>
<td>Manitoba Ambient Air Quality Criteria (MAAQC)</td>
<td>Manitoba Conservation and Water Stewardship</td>
<td>Manitoba provides a listing of Ambient Air Quality Criteria and Guidelines for various air pollutants.</td>
</tr>
<tr>
<td>Alberta Air Quality Modelling Guideline</td>
<td>Alberta Environment and Sustainable Resource Development</td>
<td>This for dispersion modelling provides guidance on appropriate surface characteristics and receptor grids to supplement the Manitoba guidelines.</td>
</tr>
<tr>
<td>US EPA AERMOD Implementation Guide</td>
<td>United States Environmental Protection Agency</td>
<td>This guideline is a resource that helps with the use of the related modelling modules and programs (AERMOD, AERMAP, AERMET, AERSURFACE, AERSCREEN) and the required additional information</td>
</tr>
</tbody>
</table>
3.1 Air Quality Objectives

The evaluation of ambient air quality typically relies on comparison of modelled concentrations to regulatory standards or objectives. The regulatory standards or objectives are designed by the local, provincial, or federal authority to be conservative and protective of air quality. The MAAQC were used in this assessment.

The applicable air quality Objectives and Guidelines are summarized in Table 2, below.

Table 2. Ambient Air Quality Objectives

<table>
<thead>
<tr>
<th>Compound</th>
<th>Averaging Period</th>
<th>MAAQC <em>(µg/m³)</em></th>
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</thead>
<tbody>
<tr>
<td>Nitrogen Dioxide (NO₂)</td>
<td>1-hour</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>100</td>
</tr>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>1-hour</td>
<td>35,000</td>
</tr>
<tr>
<td></td>
<td>8-hour</td>
<td>15,000</td>
</tr>
<tr>
<td>Sulfur Dioxide (SO₂)</td>
<td>1-hour</td>
<td>900</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>60</td>
</tr>
<tr>
<td>Particulate Matter with a diameter of 2.5 micrometers and less (PM₂.₅)</td>
<td>24-hour</td>
<td>30</td>
</tr>
<tr>
<td>Particulate Matter with a diameter of 10 micrometers and less (PM₁₀)</td>
<td>24-hour</td>
<td>50</td>
</tr>
</tbody>
</table>

Notes:
1 Manitoba Ambient Air Quality Criteria (MCWS, July 2005)

4. Methodology

The emissions from the Project were assessed based on information provided by the Proponent and supplemented by USEPA AP-42, and engineering estimates. These emissions were then used in the AERMOD dispersion model to assess maximum modelled ground-level concentrations. The Project was assessed in accordance with the Draft Guidelines for Air Quality Dispersion Modelling in Manitoba (MCWS, 2006) and the model results were compared to the MAAQC as shown in Table 2.

Details on the preparation of the source modeled emissions, stack parameters and the dispersion modelling methodology are discussed further below.

4.1 Dispersion Model

Air dispersion models are important tools that can be used to assess the possible effects of an operation on the air quality at a particular location. These dispersion models mathematically predict the behaviour of emitted plumes by accounting for emission rates, physical characteristics of the release, geometry and location of the sources and buildings as related to receptor locations, terrain effects, meteorology, and atmospheric dispersion.
The air dispersion modelling assessment for the Project was completed using the AERMOD dispersion model (Model Version 18081). AERMOD is specified in the MCWS as a refined model that is suitable for predicting the near-field (within 25 km) dispersion of multiple emission sources. AERMOD determines predicted air quality through air dispersion of emissions using boundary layer turbulence structure and scaling concepts. AERMOD was selected for this application because of its ability to account for:

1. Directional and seasonal variations in land-use;
2. Building induced plume downwash, which can affect the sources plume rise; and
3. Terrain influences.

In addition, AERMET and AERMAP (Model Version 8.9.0), AERMOD’s meteorological and terrain pre-processors, were employed to process meteorological data and terrain data inputs for AERMOD. Modelling was conducted in accordance with the 2006 MCWS. Where further guidance was necessary, the AERMOD Implementation Guide (US EPA, 2009) was utilized.

4.1.1 Building Downwash

The AERMOD model includes PRIME (Plume Rise Model Enhancements) algorithms to model the effects of buildings downwash from nearby or adjacent point sources. The building information presented Table 3 were used as an input for AERMOD PRIME. The building and stack locations are presented in Figure 2.

<table>
<thead>
<tr>
<th>Building Number</th>
<th>Location (SW Corner or Centre Point)</th>
<th>Height (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>687179.88 5670533.7</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>687206.15 5670594.61</td>
<td>6</td>
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<td>3</td>
<td>687172.77 5670601.33</td>
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</tr>
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<td>4</td>
<td>687178.26 5670496.95</td>
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<td>5</td>
<td>687181.35 5670456.59</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>687164.44 5670564.61</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>687145.86 5670572.34</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>687200.2  5670642.38</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>687213.82 5670642.81</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td>687213.39 5670655.32</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>687200.2  5670654.44</td>
<td>6</td>
</tr>
</tbody>
</table>
Figure 2. Building Locations

Note: + indicates stack location.
4.2 Boundaries

The following boundaries were used to assess modelled concentrations due to air emissions from the Project and follow guidance in the MCWS. Boundaries for the air quality modelling assessment are categorized in two ways: spatial and temporal. The modelled ground-level concentrations from the Project and comparison with MAAQCs were investigated within these defined boundaries.

4.2.1 Spatial Boundary

The study area for this assessment was the zone of influence of the Project’s air emissions, including potential sensitive receptors nearest to the Project. A local study area of 20 km by 20 km surrounding the Project was used for this analysis; the appropriateness of this boundary selection was confirmed by the model outputs which showed that maximum concentrations of were found within a kilometer of the emission sources. Model receptor points are described in Section 4.5. All receptors were evaluated at ground-level (i.e. 0 m) elevation.

4.2.2 Temporal Boundary

Temporal boundaries for this assessment were developed in consideration of continuous operations and emissions from the stacks.

The temporal boundary also includes several time-averaging periods in accordance with the time periods outlined for the identified air quality guidelines in Table 2.

4.3 Meteorology

Air quality is dependent on the rate of pollutant emissions into the atmosphere and the ability of the atmosphere to disperse the pollutant emissions. The dispersion of air pollutants is affected by local meteorological patterns. The wind direction controls the path that air pollutants follow from the point of emission to the receptors. In addition, wind speeds affect the time taken for pollutants to travel from source to receptor and the distance over which air pollutants travel. As a result, wind speeds also impact the dispersion of air pollutants; therefore, it is important to consider local meteorological patterns when assessing potential air quality effects from an emission source.

AERMET (Model Version 8.9.0) was employed to process meteorological data and terrain data inputs for AERMOD. The hourly surface and upper air meteorological inputs to AERMOD were extracted from Winnipeg James Armstrong International Airport (MB, CA) and International Falls (MN, US), respectively.

AERMET produces surface scalar parameters and vertical profiles of meteorological data that were used as an input for AERMOD. In order to quantify the boundary layer parameters needed by AERMOD, AERMET also requires specification of site-specific land use characteristics including surface roughness ($z_o$), albedo ($r$) and Bowen ratio ($B_o$). These site characteristics are used by AERMET, along with the meteorological data to help characterize the atmospheric boundary layer and dispersion. The boundary layer is quantified by AERMET in calculating parameters such as:

- Sensible heat flux;
- Surface friction velocity;
- Convective velocity scale;
- Vertical potential temperature gradient above the convective mixing height;
- Height of convectively-generated boundary layer;
- Height of mechanically-generated boundary layer; and
- Monin-Obukhov length (m).

These boundary layer parameters are calculated on an hourly basis and are contained in AERMET’s surface file. The surface file is read into AERMOD and then these values are used to quantify the atmospheric dispersion.

### 4.4 Surface Characteristics

The land use surface characteristics surrounding the Project was quantified for the air dispersion model and was based on specific land use surface characteristics provided to AERMET.

The AERMOD Implementation Guide (AIG) (EPA, 2009) (AIG) recommends that the surface characteristics be determined based on digitized land cover data. US EPA has developed a tool called AERMET (EPA 2013) that can be used to determine the site characteristics based on digitized land cover data in accordance with the recommendations from the AIG discussed above.

In the AERMET User’s Guide and the Draft Guidelines for Air Quality Dispersion Modelling in Manitoba, the various land use categories are linked to a set of seasonal surface characteristics. As such, AERMET requires specification of the seasonal category for each month of the year. The following four seasonal categories are supported by AERSURFACE, with the applicable months of the year specified for this assessment:

1. Spring when vegetation is emerging or partially green (April-May);
2. Midsummer with lush vegetation (June-September);
3. Autumn when periods of freezing are common, grass is brown and no snow is present (October-November); and
4. Winter with continuous snow on ground and subfreezing temperatures (December-March);

#### 4.4.1 Land-Use and Terrain Characteristics

The calculated albedo, Bowen ratio, and surface roughness values for this specific assessment were based on ArcGIS land use data.

The land use within three (3) km of the Project was analyzed using ArcGIS to determine the surface roughness for the modelling domain. ArcGIS did not have sufficient information for the particular modelling domain. The land use was assumed based on Google Earth imaging. The land use within 3 km of the Project are 50% deciduous forest, 36% coniferous forest, 11% cultivated land, and 3% water. The surface roughness, albedo and Bowen ratios for land use and seasons are default values outlined in the MCWS (2006) and can be seen in Table 4, Table 5, Table 6 and Table 7 below.

<table>
<thead>
<tr>
<th>Table 4. Land Use Factors for Coniferous Forest Category</th>
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</thead>
<tbody>
<tr>
<td><strong>Season</strong></td>
</tr>
<tr>
<td>Spring</td>
</tr>
<tr>
<td>Summer</td>
</tr>
<tr>
<td>Autumn</td>
</tr>
<tr>
<td>Winter</td>
</tr>
</tbody>
</table>

Note: \(^1\) Values from AQMG (AEP, 2013)
Table 5. Land Use Factors for Deciduous Forest

<table>
<thead>
<tr>
<th>Season</th>
<th>Surface Roughness (m)</th>
<th>Albedo</th>
<th>Bowen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>1.00</td>
<td>0.12</td>
<td>0.70</td>
</tr>
<tr>
<td>Summer</td>
<td>1.30</td>
<td>0.12</td>
<td>0.30</td>
</tr>
<tr>
<td>Autumn</td>
<td>0.80</td>
<td>0.12</td>
<td>1.00</td>
</tr>
<tr>
<td>Winter</td>
<td>0.50</td>
<td>0.50</td>
<td>1.50</td>
</tr>
</tbody>
</table>

Note: ¹ Values from AQMG (AEP, 2013)

Table 6. Land Use Factors for Cultivated Land

<table>
<thead>
<tr>
<th>Season</th>
<th>Surface Roughness (m)</th>
<th>Albedo</th>
<th>Bowen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>0.03</td>
<td>0.14</td>
<td>0.3</td>
</tr>
<tr>
<td>Summer</td>
<td>0.20</td>
<td>0.20</td>
<td>0.50</td>
</tr>
<tr>
<td>Autumn</td>
<td>0.05</td>
<td>0.18</td>
<td>1.7</td>
</tr>
<tr>
<td>Winter</td>
<td>0.01</td>
<td>0.60</td>
<td>1.50</td>
</tr>
</tbody>
</table>

Note: ¹ Values from AQMG (AEP, 2013)

Table 7. Land Use Factors for Water

<table>
<thead>
<tr>
<th>Season</th>
<th>Surface Roughness (m)</th>
<th>Albedo</th>
<th>Bowen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>0.0001</td>
<td>0.12</td>
<td>0.10</td>
</tr>
<tr>
<td>Summer</td>
<td>0.0001</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Autumn</td>
<td>0.0001</td>
<td>0.14</td>
<td>0.10</td>
</tr>
<tr>
<td>Winter</td>
<td>0.0001</td>
<td>0.20</td>
<td>1.50</td>
</tr>
</tbody>
</table>

Note: ¹ Values from AQMG (AEP, 2013)

4.5 Receptors

Receptor grids are required to define the locations where the model will predict ground-level concentrations. The receptor grid was designed to ensure that the model captures the maximum modelled concentrations associated with the Project’s emissions. A Cartesian receptor grid was developed to capture the maximum modelled ground-level concentrations associated with the stack emissions. The modelled receptor grid with the following spacing and distances was used, as per the AQMG (AEP, 2013):

- 20-m receptor spacing in the general area of maximum impact and the property boundary;
- 50-m receptor spacing within 0.5 km from the source;
- 250-m receptor spacing within 2 km from the sources of interest;
- 500-m spacing within 5 km from the sources of interest; and
- 1000-m spacing beyond 5 km.

In addition, the AQMG (AEP, 2013) recommends the inclusion of sensitive receptors near the Facility. Receptor points are added to the model in addition to the receptor grid described above so that the model calculates concentrations specific to those locations. Three sensitive receptors were identified in the neighbouring communities; these three sensitive receptors are:

- Nearest Residence
- Aghaming
- Manigotagan
- Seymourville and
- Wanipigow

Table 8 and Figure 3 illustrate the coordinates of the sensitive receptors and their distance from the Project.

Table 8. Sensitive Receptor Details

<table>
<thead>
<tr>
<th>Sensitive Receptor</th>
<th>Approximate Distance from Facility (m)</th>
<th>UTM co-ordinate (mE)</th>
<th>UTM co-ordinate (mN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nearest Residence</td>
<td>3100</td>
<td>689787.00</td>
<td>5672336.00</td>
</tr>
<tr>
<td>Aghaming</td>
<td>4300</td>
<td>689457.00</td>
<td>5674288.00</td>
</tr>
<tr>
<td>Manigotagan</td>
<td>6500</td>
<td>690170.00</td>
<td>5664746.00</td>
</tr>
<tr>
<td>Seymourville</td>
<td>3200</td>
<td>686981.00</td>
<td>5673502.00</td>
</tr>
<tr>
<td>Wanipigow</td>
<td>4000</td>
<td>688481.00</td>
<td>5674502.00</td>
</tr>
</tbody>
</table>

For the dispersion modelling assessment, terrain data was based on Canadian Digital Elevation Data (CDED). This data was obtained from Geobase Canada (https://open.canada.ca/data/en/dataset?keywords=GeoBase). The appropriate region was based on the Universal Transverse Mercator (UTM) coordinates. AERMAP is a terrain pre-processor program that prepares the input receptor terrain elevation data file for AERMOD. AERMAP (model version 8.9.0) was run using the 1:50,000 CDED DEM files to assign elevations and critical hill heights to the receptors that were used for the modelling assessment.
Lake Winnipeg

Key Map

Sensitive Receptors

Project Components

Plant Location

Project Site Area Boundary

Access Road for Project

Construction and Emergency Use

Main Access Road

First Nation

Hollow Water First Nation

Reserve 10

Parks and Protected Areas

Provincial Park

Wildlife Management Area

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4.7 Nitrogen Dioxide Modelling

Nitrogen Dioxide (NO\textsubscript{2}) dispersion modelling was completed using the total conversion method.

4.8 Baseline/Background Concentrations

Baseline/background air quality includes chemical concentrations from natural sources, existing nearby sources, and unidentified, possibly distant sources.

4.8.1 Background Ambient Air Concentrations Considered in the Air Dispersion Model

As recommended by the MCWS (2006) for a refined modelling analysis, the modelled concentration for each compound was added to its corresponding baseline/background concentration to estimate a “total” modelled concentration that can then be compared to the MAAQC. The MAAQC also specifies statistical forms of the baseline or background ambient air quality that should be used for certain averaging periods.

The baseline/background air quality concentration data obtained from the Winnipeg Ellen St. and Thompson Manitoba monitoring stations used for this analysis was assessed on a basis of the 90\textsuperscript{th} percentile as per the MCWS (2006).

Baseline/background concentrations for the parameters of concern used in the air quality assessment are shown in Table 9.

Table 9. Baseline/Background Concentrations

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Data Source Location</th>
<th>Averaging Period</th>
<th>Objective and/or Guideline\textsuperscript{1} (µg/m\textsuperscript{3})</th>
<th>Background (µg/m\textsuperscript{3})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Dioxide (NO\textsubscript{2})</td>
<td>Winnipeg Ellen St., Manitoba</td>
<td>1-hour\textsuperscript{2}</td>
<td>400</td>
<td>29.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24-hour</td>
<td>200</td>
<td>29.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annual</td>
<td>100</td>
<td>10.9</td>
</tr>
<tr>
<td>Carbon Monoxide (CO\textsuperscript{3})</td>
<td>Winnipeg Ellen St., Manitoba</td>
<td>1-hour\textsuperscript{2}</td>
<td>35,000</td>
<td>277</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8-hour</td>
<td>15,000</td>
<td>275</td>
</tr>
<tr>
<td>Sulfur Dioxide (SO\textsubscript{2})</td>
<td>Winnipeg Ellen St., and Thompson, Manitoba\textsuperscript{4}</td>
<td>1-hour\textsuperscript{2}</td>
<td>900</td>
<td>23.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24-hour</td>
<td>300</td>
<td>23.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annual</td>
<td>60</td>
<td>1.81</td>
</tr>
<tr>
<td>Particulate Matter with a diameter of 2.5 micrometers and less (PM\textsubscript{2.5})</td>
<td>Winnipeg Ellen St., Manitoba</td>
<td>24-hour</td>
<td>30</td>
<td>11.7</td>
</tr>
<tr>
<td>Particulate Matter with a diameter of 10 micrometers and less (PM\textsubscript{10})</td>
<td>Winnipeg Ellen St., Manitoba</td>
<td>24-hour</td>
<td>50</td>
<td>25.6</td>
</tr>
</tbody>
</table>

Notes:
\textsuperscript{1} Manitoba Ambient Air Quality Criteria (MCWS, July 2005)
\textsuperscript{2} 1-hour values represent the 90th percentile value
\textsuperscript{3} Data availability for CO for 2017 was 22.5%, therefore 2016 data was used
\textsuperscript{4} Data availability for SO\textsubscript{2} for 2017 was limited from Ellen St. Station; Thompson, Manitoba was used for 2017.
4.9 Modelling Scenarios & Emission Rates

The Project was modelled under one scenario. This scenario is considered “maximum normal” operation or emissions. The sources were conservatively modelled, considering continuous operation to simulate a “worst case” modelled hour of operation.

An "upset" scenario was not modelled, as the units are either on (near full load) or off; an upset condition would correspond with a unit being immediately taken offline.

The assumptions made for the modelling scenario are as follows:

- Activities will occur 24/7.
- One (1) track dozer operating no more than 75% of each hour;
- Two (2) dump trucks, each operating no more than 25% of each hour;
- Fifty four (54) haul trucks, each operating 100% of each hour;
- Two (2) loaders operating no more than 75% of each hour;
- The load factor for the equipment engines was assumed to be 20% on average; and
- Two (2) baghouses, one on the dryer and one on the screen are assumed to have 95% removal efficiency.

The source model input parameters are summarized in Table 10, Table 11, and Table 12.
## Table 10. Modelled Source Parameters – Point Sources

<table>
<thead>
<tr>
<th>Source ID</th>
<th>Source Description</th>
<th>Height (m)</th>
<th>Diameter (m)</th>
<th>Temp (K)</th>
<th>Velocity (m/s)</th>
<th>UTM Coordinate</th>
<th>PM$_{2.5}$ (g/s)</th>
<th>PM$_{10}$ (g/s)</th>
<th>NO$_X$ (g/s)</th>
<th>SO$_2$ (g/s)</th>
<th>CO (g/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STCK1</td>
<td>DOZER1</td>
<td>2</td>
<td>0.122</td>
<td>709</td>
<td>50</td>
<td>687130.53, 5670632.60</td>
<td>0.0472</td>
<td>0.0472</td>
<td>0.6611</td>
<td>0.0440</td>
<td>0.1431</td>
</tr>
<tr>
<td>STCK2</td>
<td>LOADER1</td>
<td>3</td>
<td>0.122</td>
<td>709</td>
<td>50</td>
<td>687136.18, 5670622.18</td>
<td>0.0111</td>
<td>0.0111</td>
<td>0.1556</td>
<td>0.0103</td>
<td>0.0337</td>
</tr>
<tr>
<td>STCK3</td>
<td>LOADER2</td>
<td>3</td>
<td>0.122</td>
<td>709</td>
<td>50</td>
<td>687144.42, 5670478.52</td>
<td>0.0111</td>
<td>0.0111</td>
<td>0.1556</td>
<td>0.0103</td>
<td>0.0337</td>
</tr>
<tr>
<td>STCK4</td>
<td>DUMP TRUCK 1</td>
<td>2</td>
<td>0.122</td>
<td>709</td>
<td>50</td>
<td>687137.04, 5670609.60</td>
<td>0.0267</td>
<td>0.0267</td>
<td>0.3741</td>
<td>0.0249</td>
<td>0.0810</td>
</tr>
<tr>
<td>STCK5</td>
<td>DUMP TRUCK 2</td>
<td>2</td>
<td>0.122</td>
<td>709</td>
<td>50</td>
<td>687150.07, 5670468.11</td>
<td>0.0267</td>
<td>0.0267</td>
<td>0.3741</td>
<td>0.0249</td>
<td>0.0810</td>
</tr>
<tr>
<td>STCK6</td>
<td>HAUL TRUCK 1KM</td>
<td>2</td>
<td>0.122</td>
<td>AMBIENT</td>
<td>0</td>
<td>690987.41, 5668050.13</td>
<td>0.002</td>
<td>0.06</td>
<td>0.00066</td>
<td>0.00007</td>
<td>0.000163</td>
</tr>
<tr>
<td>STCK7</td>
<td>HAUL TRUCK 2KM</td>
<td>2</td>
<td>0.122</td>
<td>AMBIENT</td>
<td>0</td>
<td>689986.29, 5668171.09</td>
<td>0.002</td>
<td>0.06</td>
<td>0.00066</td>
<td>0.00007</td>
<td>0.000163</td>
</tr>
<tr>
<td>STCK8</td>
<td>HAUL TRUCK 3KM</td>
<td>2</td>
<td>0.122</td>
<td>AMBIENT</td>
<td>0</td>
<td>689530.05, 5669016.05</td>
<td>0.002</td>
<td>0.06</td>
<td>0.00066</td>
<td>0.00007</td>
<td>0.000163</td>
</tr>
<tr>
<td>STCK9</td>
<td>HAUL TRUCK 4KM</td>
<td>2</td>
<td>0.122</td>
<td>AMBIENT</td>
<td>0</td>
<td>689294.65, 5669962.52</td>
<td>0.002</td>
<td>0.06</td>
<td>0.00066</td>
<td>0.00007</td>
<td>0.000163</td>
</tr>
<tr>
<td>STCK10</td>
<td>HAUL TRUCK 5KM</td>
<td>2</td>
<td>0.122</td>
<td>AMBIENT</td>
<td>0</td>
<td>688436.46, 5670179.84</td>
<td>0.002</td>
<td>0.06</td>
<td>0.00066</td>
<td>0.00007</td>
<td>0.000163</td>
</tr>
<tr>
<td>STCK11</td>
<td>HAUL TRUCK 6KM</td>
<td>2</td>
<td>0.122</td>
<td>AMBIENT</td>
<td>0</td>
<td>687396.38, 5670402.43</td>
<td>0.002</td>
<td>0.06</td>
<td>0.00066</td>
<td>0.00007</td>
<td>0.000163</td>
</tr>
<tr>
<td>STCK12</td>
<td>DRYER</td>
<td>6</td>
<td>0.5</td>
<td>AMBIENT</td>
<td>12</td>
<td>687198.91, 5670605.29</td>
<td>0.0066</td>
<td>0.07</td>
<td>0.112</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STCK13</td>
<td>SCREEN</td>
<td>6</td>
<td>0.5</td>
<td>AMBIENT</td>
<td>12</td>
<td>687213.95, 5670638.85</td>
<td>0.0015</td>
<td>0.0015</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Table 11. Modelled Source Parameters – Volume Sources

<table>
<thead>
<tr>
<th>Source ID</th>
<th>Source Description</th>
<th>Height (m)</th>
<th>Length of Side (m)</th>
<th>PM$_{2.5}$ (g/s)</th>
<th>PM$_{10}$ (g/s)</th>
<th>NO$_X$ (g/s)</th>
<th>SO$_2$ (g/s)</th>
<th>CO (g/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOL1</td>
<td>OVERBURDEN</td>
<td>3</td>
<td>200</td>
<td>0.0344</td>
<td>0.227</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>VOL2</td>
<td>OVERBURDEN EMBANKMENT</td>
<td>5</td>
<td>20.05</td>
<td>0.0793</td>
<td>0.524</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

## Table 12. Modelled Source Parameters – Area Sources

<table>
<thead>
<tr>
<th>Source ID</th>
<th>Source Description</th>
<th>Height (m)</th>
<th>Diameter (m)</th>
<th>PM$_{2.5}$ (g/s)</th>
<th>PM$_{10}$ (g/s)</th>
<th>NO$_X$ (g/s)</th>
<th>SO$_2$ (g/s)</th>
<th>CO (g/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAREA1</td>
<td>SILO1</td>
<td>6</td>
<td>5</td>
<td>0.0000000374</td>
<td>0.0000000374</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CAREA2</td>
<td>SILO2</td>
<td>6</td>
<td>5</td>
<td>0.0000000374</td>
<td>0.0000000374</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>CAREA3</td>
<td>SILO3</td>
<td>6</td>
<td>5</td>
<td>0.0000000374</td>
<td>0.0000000374</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>CAREA4</td>
<td>SILO4</td>
<td>6</td>
<td>5</td>
<td>0.0000000374</td>
<td>0.0000000374</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
4.10 Greenhouse Gas (GHG) Emissions

To estimate the annual greenhouse gas emissions from onsite activities, the activities of equipment associated with the Project operation was considered. Equipment includes a dozer, loaders, dump trucks, haul trucks and the rotary dryer. Emission factors for Industrial Engines were taken from AP-42 (Section 3.3). The total emissions per year from each piece of equipment were estimated based on: engine size (hp), load factor, and the emission factors for each pollutant. Once those total yearly emissions were calculated, the Global Warming Potential (GWP) was applied to each pollutant. The GHGs included in the emissions calculation are carbon dioxide (CO$_2$), methane (CH$_4$) and Nitrous Oxide (N$_2$O). The assumptions made for the GHG calculations are as follows:

- Activities will occur 24/7.
- One (1) track dozer operating no more than 75% of each hour;
- Two (2) dump trucks each, each operating no more than 25% of each hour;
- Fifty four (54) haul trucks, each operating 100% of each hour;
- Two (2) loaders operating no more than 75% of each hour; and
- The load factor for the equipment engines was assumed to be 20% on average.

5. Results & Conclusion

AERMOD was executed with emission rates for the Project emissions sources as specified in Table 10, Table 11 and Table 12 MCWS. Background parameters of concern were monitored by the Winnipeg Ellen St., and Thompson, Manitoba monitoring stations.

The maximum modelled ground-level concentrations resulting from emissions from the Project are shown in Table 14 and Table 15.

The model predicted possible exceedances of the MAAQC for particulate matter (PM$_{10}$ and PM$_{2.5}$) that are associated with the project site operations as well as trucking activities. The predicted maximum model output was within the facility boundary, adjacent to operations. Predicted model results at sensitive receptors were between 2x and 5x the MAAQC, as shown in Table 14 and Table 15, below. No drilling, blasting or crushing activities are anticipated to be required for quarry development. Occasional 'lumps' of sand may be encountered which will require breaking in the quarry by use of a horizontal shaft breaker. The sand that is extracted from the active quarry has inherent moisture content (i.e. is not ‘dry’). Therefore, dust related to the sand being extracted from the quarry will be minor to negligible with the possible exception of 'worst-case scenario' days of extended long, dry, hot weather during non-winter months coupled with high winds.

The model also predicted possible exceedances of the MAAQC for NO$_2$ associated with the internal combustion by-products of equipment operation. These possible exceedances are limited to an area adjacent to these emission sources, and model predictions of NO$_2$ concentrations at sensitive receptors are below the MAAQC.

Predicted maximum concentrations of SO$_2$ and CO were below the associated MAAQC across the modelling domain.
Isopleths (concentration plots) are provided in Attachment A for the short-term averaging periods. The locations the maximum modelled ground-level concentrations and the locations of sensitive receptors can also be seen in the figures in Attachment A. The intention of the isopleth figures is to provide a graphical depiction of the modelled concentrations, the magnitude of the modelled impacts, and how they vary spatially.

To estimate the annual emissions of greenhouse gases, emissions of carbon dioxide (CO\textsubscript{2}), methane (CH\textsubscript{4}) and Nitrous Oxide (N\textsubscript{2}O) were estimated from onsite activities associated with the Project operation. Equipment includes the loader, dozer, dump trucks, haul trucks and the rotary dryer. Estimated GHG emissions are summarized in Table 13. Overall, the project is estimated to generate 26,526 tonnes of CO\textsubscript{2}e annually. For context, the reported emissions in 2017 were 20.9 Mt CO\textsubscript{2}e from Manitoba, and 704 Mt CO\textsubscript{2}e from Canada.

Table 13.  Greenhouse Gas Annual Emissions (CO\textsubscript{2}e)

| Equipment          | Equipment Count | CO\textsubscript{2} (tonnes/year)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dozer</td>
<td>1</td>
<td>586</td>
</tr>
<tr>
<td>Loader</td>
<td>1</td>
<td>46</td>
</tr>
<tr>
<td>Dump Truck</td>
<td>2</td>
<td>221</td>
</tr>
<tr>
<td>Rotary Dryer</td>
<td>1</td>
<td>230</td>
</tr>
<tr>
<td>Haul Trucks</td>
<td>54</td>
<td>24,835</td>
</tr>
<tr>
<td>Global Warming Potential</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>CH\textsubscript{4} (tonnes/year)</th>
<th>N\textsubscript{2}O (tonnes/year)</th>
<th>CO\textsubscript{2}e (tonnes/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dozer</td>
<td>0.057</td>
<td>0.026</td>
<td>596</td>
</tr>
<tr>
<td>Loader</td>
<td>0.0045</td>
<td>0.00204</td>
<td>46.7</td>
</tr>
<tr>
<td>Dump Truck</td>
<td>0.0215</td>
<td>0.00980</td>
<td>225</td>
</tr>
<tr>
<td>Rotary Dryer</td>
<td>0.28</td>
<td>0.67</td>
<td>436</td>
</tr>
<tr>
<td>Haul Trucks</td>
<td>2.41</td>
<td>1.10</td>
<td>25,223</td>
</tr>
<tr>
<td>Global Warming Potential</td>
<td>25</td>
<td>298</td>
<td></td>
</tr>
</tbody>
</table>

Note: \textsuperscript{1} CO\textsubscript{2}e=Total Emission (tonnes/year)*GWP; as such, the rows in the table do not balance.

Note: \textsuperscript{2} List of equipment that will be operating at any one time.
### Table 14. Maximum Modelled Concentrations

<table>
<thead>
<tr>
<th>Compounds</th>
<th>Averaging Period</th>
<th>Objective and/or Guideline (µg/m$^3$)</th>
<th>Maximum Applicable Model Output (µg/m$^3$)</th>
<th>Maximum Applicable Model Output + background (µg/m$^3$)</th>
<th>UTM (mE)</th>
<th>UTM (mN)</th>
<th>Background Concentration (µg/m$^3$)</th>
<th>Date of Maximum Modelled Concentration (year/month/day, hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO$_2$</td>
<td>1 hr</td>
<td>400</td>
<td>377</td>
<td>406</td>
<td>687085.19</td>
<td>5670658.92</td>
<td>29.3</td>
<td>2015/05/27, 20:00</td>
</tr>
<tr>
<td></td>
<td>24 hr</td>
<td>200</td>
<td>149</td>
<td>178</td>
<td>687085.19</td>
<td>5670658.92</td>
<td>29.3</td>
<td>2013/01/11, 24:00</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>100</td>
<td>23.5</td>
<td>34</td>
<td>687085.19</td>
<td>5670658.92</td>
<td>10.9</td>
<td>—</td>
</tr>
<tr>
<td>SO$_2$</td>
<td>1 hr</td>
<td>900</td>
<td>24.5</td>
<td>48</td>
<td>687085.19</td>
<td>5670658.92</td>
<td>23.6</td>
<td>2015/10/02, 22:00</td>
</tr>
<tr>
<td></td>
<td>24 hr</td>
<td>300</td>
<td>9.46</td>
<td>33</td>
<td>687085.19</td>
<td>5670658.92</td>
<td>23.6</td>
<td>2014/04/24, 24:00</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>60</td>
<td>1.47</td>
<td>3.28</td>
<td>687085.19</td>
<td>5670658.92</td>
<td>1.81</td>
<td>—</td>
</tr>
<tr>
<td>CO</td>
<td>1 hr</td>
<td>35000</td>
<td>79.8</td>
<td>357</td>
<td>687085.19</td>
<td>5670658.92</td>
<td>277</td>
<td>2015/10/02, 22:00</td>
</tr>
<tr>
<td></td>
<td>8 hr</td>
<td>15000</td>
<td>52.7</td>
<td>328</td>
<td>687085.19</td>
<td>5670658.92</td>
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</tr>
<tr>
<td>PM$_{10}$</td>
<td>24 hr</td>
<td>50</td>
<td>160</td>
<td>186</td>
<td>687090.55</td>
<td>5670445.63</td>
<td>25.6</td>
<td>2014/07/17, 24:00</td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>24 hr</td>
<td>30</td>
<td>23.3</td>
<td>35</td>
<td>687090.55</td>
<td>5670445.63</td>
<td>11.7</td>
<td>2014/07/17, 24:00</td>
</tr>
</tbody>
</table>

### Table 15. Maximum Modelled Concentrations at Sensitive Receptors

| Compounds | Averaging Period | Objective and/or Guideline (µg/m$^3$) | Sensitive Receptor 1 (µg/m$^3$) | Sensitive Receptor 1 + background (µg/m$^3$) | Sensitive Receptor 2 (µg/m$^3$) | Sensitive Receptor 2 + background (µg/m$^3$) | Sensitive Receptor 3 (µg/m$^3$) | Sensitive Receptor 3 + background (µg/m$^3$) | Sensitive Receptor 4 (µg/m$^3$) | Sensitive Receptor 4 + background (µg/m$^3$) | Sensitive Receptor 5 (µg/m$^3$) | Background Concentration (µg/m$^3$) |
|-----------|------------------|--------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------||
| NO$_2$    | 1 hr             | 400                                  | 65.3                            | 94.6                            | 65.0                            | 94.3                            | 12.0                            | 41.3                            | 112                            | 141.3                            | 67.2                            | 96.5                            | 29.3                            |
|           | 24 hr            | 200                                  | 5.3                             | 34.6                            | 6.5                             | 35.8                            | 1.1                             | 30.4                            | 18.7                            | 48.0                            | 96.6                            | 36.3                            | 29.3                            |
|           | Annual           | 100                                  | 0.273                           | 11.2                            | 0.230                           | 11.1                            | 0.025                           | 10.9                            | 0.98                            | 11.9                            | 0.28                            | 11.2                            | 10.9                            |
| SO$_2$    | 1 hr             | 900                                  | 3.8                             | 27.4                            | 3.8                             | 27.4                            | 0.79                            | 24.4                            | 6.97                            | 30.6                            | 3.99                            | 27.6                            | 23.6                            |
|           | 24 hr            | 300                                  | 0.31                            | 23.9                            | 0.34                            | 23.9                            | 0.071                           | 23.7                            | 1.11                            | 24.7                            | 0.42                            | 24.0                            | 23.6                            |
|           | Annual           | 60                                   | 0.0147                          | 1.82                            | 0.0128                          | 1.82                            | 0.00151                         | 1.81                            | 0.06                            | 1.9                             | 0.02                            | 1.83                            | 1.81                            |
| CO        | 1 hr             | 35000                                | 12.5                            | 290                             | 12.2                            | 289                             | 2.56                            | 280                             | 22.7                            | 300                             | 1.30                            | 290                             | 277                             |
|           | 8 hr             | 15000                                | 2.85                            | 278                             | 2.61                            | 278                             | 0.63                            | 276                             | 7.05                            | 282                             | 3.10                            | 278                             | 275                             |
| PM$_{10}$ | 24 hr            | 50                                   | 98.5                            | 124                             | 120                             | 145                             | 238                             | 264                             | 27.63                           | 53.2                             | 26.6                            | 52.2                            | 25.6                            |
| PM$_{2.5}$| 24 hr            | 30                                   | 33.3                            | 45.0                            | 39.6                            | 51.3                            | 83.7                            | 95.4                            | 4.52                            | 16.2                            | 3.97                            | 15.7                            | 11.7                            |
6. References


Attachment A

Isopleths
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WANIPIGOW SAND EXTRACTION PROJECT
AIR DISPERSION MODELLING REPORT
CANADIAN PREMIUM SAND INC.
Project No.: 60588114

Figure: A-2

Key Map

Lake Winnipeg

Sensitive Receptors
- Aghaming
- Manigotagan
- Nearest Residence
- Seymourville
- Wanipigow

Project Infrastructure
- Facility
- Project Site Area Boundary

24 Hour Average NO₂ Concentrations (µg/m³)
Ambient Air Quality Limit = 200 µg/m³

Maximum Concentration (µg/m³)
- Outside Facility Boundary

Maximun 24 Hour Average NO₂ Concentrations (µg/m³)


DRAFT
SITE LOCATION

Lake Winnipeg

UV
6
ST
59
304

WANIPIGOW SAND EXTRACTION PROJECT
AIR DISPERSION MODELLING REPORT
CANADIAN PREMIUM SAND INC.
Project No.: 60588114

Figure: A-3

Annual Average NO2 Concentrations (µg/m³)
Ambient Air Quality Limit = 100 µg/m³

25 - 50
50 - 75
75 - 100
> 100

Maximum Concentration (µg/m³)
Maximum Concentration (µg/m³) - Outside Facility Boundary

Sensitive Receptors
- Aghaming
- Manigotagan
- Nearest Residence
- Seymourville
- Wanipigow

Project Infrastructure
- Facility
- Project Site Area Boundary

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Basemap:
Additional Sources:
Ortho-Imagery:

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Key Map

Sensitive Receptors
• Aghaming
• Manigotagan
• Nearest Residence
• Seymourville
• Wanipigow

Project Infrastructure
• Facility
• Project Site Area Boundary

24 Hour Average SO2 Concentrations (µg/m³)
Ambient Air Quality Limit = 300 µg/m³

5 - 10
10 - 15
15 - 20
20 - 37.6

Maximum Concentration (µg/m³)

Maximum Concentration (µg/m³) - Outside Facility Boundary
Figure: A-6

MAXIMUM ANNUAL AVERAGE SO2 CONCENTRATIONS (µg/m³)

Ambient Air Quality Limit = 60 µg/m³

1 - 2
2 - 3
3 - 4
4 - 7.7

Maximum Concentration (µg/m³) - Outside Facility Boundary

Sensitive Receptors
- Aghamning
- Manigotagan
- Nearest Residence
- Seymourville
- Wanipigow

Project Infrastructure
- Facility
- Project Site Area Boundary

Annual Average SO2 Concentrations (µg/m³)

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Figure: A-7

MAXIMUM 1 HOUR AVERAGE CO
CONCENTRATIONS (µg/m³)

Ambient Air Quality Limit = 35,000 µg/m³

25 - 50
50 - 100
100 - 150
150 - 205.2

Maximum Concentration (µg/m³)
Maximum Concentration (µg/m³) - Outside Facility Boundary

Sensitive Receptors
- Aghaming
- Manigotagan
- Nearest Residence
- Seymourville
- Wanipigow

Project Infrastructure
- Facility
- Project Site Area Boundary

1 Hour Average CO Concentrations

Lake Winnipeg
Selkirk
Winnipeg
NAD 1983 UTM Zone 14N
²

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This layer was prepared using a 1:50,000 orthophoto collected on November 14, 2018.
Lake Winnipeg

Sensitive Receptors
- Aghaming
- Manigotagan
- Nearest Residence
- Seymourville
- Wanipigow

Project Infrastructure
- Facility
- Project Site Area Boundary

24 Hour Average PM$_{10}$ Concentrations (µg/m$^3$)
- Ambient Air Quality Limit = 50 µg/m$^3$
- 12.5 - 25
- 25 - 37.5
- 37.5 - 50
- > 50

Maximum Concentration (µg/m$^3$) - Outside Facility Boundary

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Sensitive Receptors
- Aghaming
- Manigotagan
- Nearest Residence
- Seymourville
- Wanipigow

Project Infrastructure
- Facility
- Project Site Area Boundary

24 Hour Average PM$_{2.5}$ Concentrations (µg/m$^3$)

Ambient Air Quality Limit = 30 µg/m$^3$

- 5 - 10
- 10 - 20
- 20 - 30
- > 30

Maximum Concentration (µg/m$^3$)

Maximum Concentration (µg/m$^3$) - Outside Facility Boundary
Appendix F

Noise Impact Assessment Report
Wanipigow Sand Extraction Project

Noise Impact Assessment

Canadian Premium Sand Inc.

Project number: 60588114

December 17, 2018
Statement of Qualifications and Limitations

The attached Report (the “Report”) has been prepared by AECOM Canada Ltd. (“AECOM”) for the benefit of the Client (“Client”) in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the “Agreement”).

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- represents AECOM’s professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to AECOM which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

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Revision History

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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**
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 $2 \times 10^{-5}$ 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**
An international body that provides scientific standards and guidelines related to various technical subjects and disciplines.
<table>
<thead>
<tr>
<th><strong>Mitigation</strong></th>
<th>Measures, such as administrative or engineering methods, to reduce, eliminate, or control impacts on the environment.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Night-time</strong></td>
<td>Defined as the hours from 22:00 to 07:00.</td>
</tr>
<tr>
<td><strong>Noise Barrier</strong></td>
<td>Same as barrier.</td>
</tr>
<tr>
<td><strong>Noise level</strong></td>
<td>Same as sound level.</td>
</tr>
<tr>
<td><strong>Octave</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Point of Reception (POR) or Receptor</strong></td>
<td>A stationary position, at which sound levels are specified, measured or predicted.</td>
</tr>
<tr>
<td><strong>Predictable Worst Case Operation</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Sound</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Sound Level</strong></td>
<td>Generally refers to the weighted sound pressure level that may be linear or weighted (e.g., A- or C-weighted) and expressed in decibels.</td>
</tr>
<tr>
<td><strong>Sound Level Meter</strong></td>
<td>An instrument used to measure noise and sound levels.</td>
</tr>
<tr>
<td><strong>Sound Power Level</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Sound Pressure</strong></td>
<td>The root-mean-square of the instantaneous sound pressures over a specified time interval “T” in the frequency band of interest.</td>
</tr>
<tr>
<td><strong>Sound Pressure Level</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>
1. Introduction

Canadian Premium Sand Inc. (CPS) is proposing to develop a high-grade silica sand quarry, processing facility, two access roads and a powerline (the Project) on provincial Crown Land west of Hollow Water First Nation within their Traditional Territory (the Project Area). AECOM was retained by CPS to assess the noise impacts due to the Project operations. This report summarizes the methods, assumptions, technical data and prediction results of the assessment.

The Wanipigow Sand Extraction Project will have a lifespan of 54 years with an initial production rate of one million tonnes per year. The proposed Project will consist of the following key activities and components:

- Overburden and topsoil stripping and stockpiling;
- Quarrying, including sequential site reclamation;
- Fully enclosed sand wash and dry facility;
- Office and storage buildings;
- 6 km long paved main access road;
- 6 km long 115 kV powerline adjacent to the main access road; and
- 1.5 km long construction and emergency use access road.

The general production sequence can be summarized as follows:

- Overburden and topsoil material will be stripped and stockpiled along the north side of the quarry area to form a 200 m long, 3 m high berm; these stockpiles will also act as a noise barrier during quarry operations.
- Once the overburden material has been cleared, quarrying of the sand will begin.
- Extracted sand will be transferred to the Wet Plant using enclosed conveyors.
- The 6 km long paved main access road will connect the Project Area to existing roadways.
- Haul trucks will use the 1.5 km long access road to transport “filter cakes” from the Wet Plant to the quarry undergoing reclamation.

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. Correspondingly, the assessment focuses on the noise effects during the predictable worst case operation at the most affected point(s) of reception.

The primary sources of noise associated with the Project operations include delivery trucks, dust collectors, earth-moving equipment (e.g. dump trucks, dozers, grader, excavator, etc.), pumps, and aggregate processing equipment (e.g. stockpilers, scrubbers, hydro separators, dewatering cyclones/screens, conveyors, etc.).

Figure 1-1 provides a scaled area map showing the Project Area. Figure 1-2 illustrates the typical cell that will be developed during the quarrying phase of the Project. Figure 1-3 provides the Wet Plant site layout.
SEYMOURVILLE SAND EXTRACTION PROJECT
CLAIM POST QUARRY LEASES AND PROJECT SITE LOCATION
CLAIM POST RESOURCES INC.

Figure: 1-1
Figure 1-2: Typical Project Quarry Cell

![Diagram of Typical Project Quarry Cell]
2. Regulatory and Policy Framework

The Province of Manitoba Sustainable Development, Environmental Approvals Branch (previously the Manitoba Environmental Assessment and Licensing Branch) 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 level 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 acceptable sound levels and vary depending on the type of areas including designated residential, commercial and industrial. 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

<table>
<thead>
<tr>
<th>POR ID</th>
<th>Description</th>
<th>$L_{eq(24)}$ (dBA)</th>
<th>$L_{dn}$ (dBA)</th>
<th>$L_{eq(1HR)}$ (day) 07:00 – 22:00 (dBA)</th>
<th>$L_{eq(1HR)}$ (night) 22:00 – 07:00 (dBA)</th>
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</thead>
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<td>POR_north</td>
<td>Detached dwelling</td>
<td>-</td>
<td>55</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>POR_northwest</td>
<td>Recreational vehicle (RV) / mobile dwelling</td>
<td>-</td>
<td>60</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>POR_south</td>
<td>Detached dwelling</td>
<td>-</td>
<td>55</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>POR_southwest</td>
<td>Detached dwelling</td>
<td>-</td>
<td>65</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>POR_east</td>
<td>Mobile dwelling</td>
<td>-</td>
<td>65</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>POR_west</td>
<td>Recreational vehicle (RV) / mobile dwelling</td>
<td>-</td>
<td>65</td>
<td>65</td>
<td>55</td>
</tr>
</tbody>
</table>

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

3. Assessment Locations

The nearest points of reception (PORs) were identified based on the planned project activities and were included in the assessment. These locations are representative of the most exposed noise sensitive properties surrounding the Project area. These PORs are summarized in Table 3-1 and Figure 3-1.

Table 3-1: Point of Reception Summary Table

<table>
<thead>
<tr>
<th>POR ID</th>
<th>Description</th>
<th>UTM Coordinates¹</th>
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</thead>
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<td></td>
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<td>Easting</td>
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<tr>
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<td>686766</td>
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<tr>
<td>POR_northwest</td>
<td>Recreational vehicle (RV) / mobile dwelling</td>
<td>684268</td>
</tr>
<tr>
<td>POR_south</td>
<td>Detached dwelling</td>
<td>685305</td>
</tr>
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<td>POR_southwest</td>
<td>Detached dwelling</td>
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<td>Mobile dwelling</td>
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<td>POR_west</td>
<td>Recreational vehicle (RV) / mobile dwelling</td>
<td>683405</td>
</tr>
</tbody>
</table>

Notes:
1. Reference UTM Zone 14.
4. **Modelling and Data Analysis**

Sound propagation calculations were conducted in accordance with International Organisation for Standardisation (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. Sources that emit noise from a stationary position were represented as a point source (e.g. dust collectors, idling trucks). Emission sources that emit noise through building facades were represented as vertical or horizontal area sources. Equipment and activities that emit noise along a defined path (e.g. moving trucks and heavy equipment) were included as line sources in the acoustic model. Table 4-1 summarizes the Cadna/A acoustic modelling parameters.

**Table 4-1: Modelling Parameters**

<table>
<thead>
<tr>
<th>Item</th>
<th>Model Parameter</th>
<th>Model Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Temperature</td>
<td>10°C</td>
</tr>
<tr>
<td>2</td>
<td>Relative Humidity</td>
<td>70%</td>
</tr>
<tr>
<td>3</td>
<td>Propagation Standard</td>
<td>ISO 9613-2</td>
</tr>
</tbody>
</table>
| 4            | Ground Conditions and Attenuation Factor | Ground Absorption (G):  
• 1.0 (e.g. porous ground covered by grass, trees or other vegetation) outside of Project Area  
• 0 (e.g. hard/acoustically reflective ground) within Project Area |
| 5            | Receptor Height                | 1.5 m                                                                         |
| 6            | Topography                     | Ground contours obtained using Lidar information                              |
| 7            | Foliage Attenuation            | None                                                                          |
| 8            | Operating Conditions           | All equipment operating during day and night-time periods                      |

4.1 **Overburden Stripping and Stockpiling**

The equipment and activities anticipated during the overburden stripping and stockpiling phase were identified, and the non-negligible noise sources were included in the acoustic model predictions. The dimensions of the overburden stripping and stockpiling work area were assumed to be relatively small compared to the separation distance to the nearest POR. Accordingly, the noise sources associated with overburden stripping and stockpiling were combined and modelled as a single point source and incorporated the following assumptions:

- Activities will occur 24/7.
- One (1) track dozer operating no more than 75% of each hour;
- One (1) loader operating no more than 75% of each hour;
- Two (2) dump trucks, each operating no more than 25% of each hour;
- One (1) stockpiler operating no more than 50% of each hour;
- Sand will not be extracted from areas outside of the Project Area (particularly, the areas surrounding the new South Access road away from the main Project Area); and
- Sources modelled as a single combined point source operating within Project Area near the closest POR, at a source height of 2 m above grade.

4.2 **Quarrying and Wet Plant Processing**

The equipment and activities anticipated during the quarrying and processing phase were identified, and the non-negligible noise sources were included in the acoustic model predictions. The noise modelling of the quarrying and processing operations incorporated the following assumptions:
Quarry Sites

- Activities will occur 24/7;
- During the initial stages of quarrying, the north side of the quarry extraction cell will include a 200 m long, 3 m high overburden stockpile/berm;
- One (1) truck per hour will enter/exit the quarry undergoing reclamation to deliver “filter cakes”, and has been modelled as a line source at a source height of 2 m above grade. These trucks will be loaded outdoors and loading will take 5 minutes per truck; the trucks will remain idling for this 5 minute period.
- Sand will be transported to the Wet Plant via a covered conveyor, and have been modelled as a line source at a source height of 2 m above grade;
- Mobile equipment at the quarry will operate as follows:
  - One (1) track dozer operating no more than 75% of each hour;
  - Four (4) pickup-trucks, each operating no more than 50% of each hour;
  - One (1) loader operating no more than 75% of each hour; and
  - One (1) grader operating no more than 75% of each hour.
- Stationary equipment at the quarry will operate as follows:
  - One (1) hopper/feed breaker operating no more than 50% of each hour;
  - One (1) stockpiler operating no more than 50% of each hour;
  - One (1) sump pump operating no more than 50% of each hour; and
  - One (1) truck idling no more than 10% of each hour.
- Mobile sources may operate within an extraction area that is approximately 250 m x 250 m in size, and have been modelled using a corresponding area source at a source height of 2 m above grade; and
- Stationary sources modelled as a single combined point source operating at the centre of the 250 m x 250 m extraction area, at a source height of 2 m above grade.

Wet Plant

- Activities will occur 24/7.
- Noise due to the office HVAC equipment and maintenance building activities will be negligible compared to other noise sources at the Wet Plant.
- One (1) truck per hour will enter/exit the plant site to retrieve “filter cakes” and haul them back to the quarry, and has been modelled as a line source at a source height of 2 m above grade. These trucks will be loaded outdoors and loading will take 5 minutes per truck; trucks will remain idling for this 5 minute period.
- Approximately four (4) trucks per hour will enter and exit the site for transfer of final product (silica sand). These trucks will be loaded indoors and the noise emissions (to the outdoors) during loading will be negligible compared to other noise sources at the Wet Plant.
- Non-negligible outdoor stationary noise sources at the Wet Plant will include a silo dust collector, bucket elevator, and truck loading operations (filter cake loading).
- The following equipment will be located indoors within buildings constructed from 18 ga steel, or thicker:
  - Attrition scrubbers;
  - Pumps;
  - Hydro separators;
  - Dewatering hydro cyclones;
  - Dewatering screens;
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 for construction equipment. Table 5-1 summarizes the noise emission sources included in the acoustic modelling.
## Table 5-1: Project Noise Sources

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Sound Power Level (dB) in Octave Band Centre Frequency (Hz)</th>
<th>Overall (dBA)</th>
<th>Quantity per hour</th>
<th>Percent Usage (%)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>63</td>
<td>125</td>
<td>250</td>
<td>500</td>
<td>1000</td>
</tr>
<tr>
<td>Overburden Stripping and Stockpiling – point sources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track dozer</td>
<td>104</td>
<td>113</td>
<td>102</td>
<td>102</td>
<td>109</td>
</tr>
<tr>
<td>Wheeled loader</td>
<td>109</td>
<td>109</td>
<td>98</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td>Dump trucks idling</td>
<td>94</td>
<td>85</td>
<td>76</td>
<td>76</td>
<td>81</td>
</tr>
<tr>
<td>Dump trucks - dumping load</td>
<td>106</td>
<td>102</td>
<td>93</td>
<td>91</td>
<td>93</td>
</tr>
<tr>
<td>Dump trucks - full</td>
<td>110</td>
<td>112</td>
<td>102</td>
<td>100</td>
<td>101</td>
</tr>
<tr>
<td>Dump trucks - empty</td>
<td>111</td>
<td>104</td>
<td>104</td>
<td>104</td>
<td>104</td>
</tr>
<tr>
<td>Stockpiler</td>
<td>80</td>
<td>89</td>
<td>90</td>
<td>100</td>
<td>101</td>
</tr>
<tr>
<td>Combined noise emissions</td>
<td>116</td>
<td>117</td>
<td>108</td>
<td>108</td>
<td>111</td>
</tr>
<tr>
<td>Quarrying – mobile sources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full haul truck</td>
<td>111</td>
<td>97</td>
<td>89</td>
<td>88</td>
<td>92</td>
</tr>
<tr>
<td>Empty haul truck</td>
<td>112</td>
<td>100</td>
<td>96</td>
<td>98</td>
<td>91</td>
</tr>
<tr>
<td>Track dozers</td>
<td>104</td>
<td>113</td>
<td>102</td>
<td>102</td>
<td>109</td>
</tr>
<tr>
<td>Grader</td>
<td>110</td>
<td>109</td>
<td>105</td>
<td>101</td>
<td>106</td>
</tr>
<tr>
<td>4 x 4 pickup trucks</td>
<td>119</td>
<td>117</td>
<td>111</td>
<td>109</td>
<td>106</td>
</tr>
<tr>
<td>Wheeled loader</td>
<td>109</td>
<td>109</td>
<td>98</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td>Combined noise emissions</td>
<td>118</td>
<td>122</td>
<td>113</td>
<td>112</td>
<td>117</td>
</tr>
<tr>
<td>Quarrying – point sources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stockpiler</td>
<td>80</td>
<td>89</td>
<td>90</td>
<td>100</td>
<td>101</td>
</tr>
<tr>
<td>Sump pump</td>
<td>106</td>
<td>108</td>
<td>102</td>
<td>100</td>
<td>101</td>
</tr>
<tr>
<td>Hopper/feed breaker</td>
<td>96</td>
<td>93</td>
<td>87</td>
<td>88</td>
<td>91</td>
</tr>
<tr>
<td>Trucks idling</td>
<td>94</td>
<td>85</td>
<td>76</td>
<td>76</td>
<td>81</td>
</tr>
<tr>
<td>Combined noise emissions</td>
<td>123</td>
<td>122</td>
<td>118</td>
<td>115</td>
<td>114</td>
</tr>
<tr>
<td>Wet Plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dryer Building Walls and Roof</td>
<td>82</td>
<td>77</td>
<td>66</td>
<td>59</td>
<td>50</td>
</tr>
<tr>
<td>Decanting + Processing Building Walls and Roof</td>
<td>83</td>
<td>77</td>
<td>65</td>
<td>58</td>
<td>50</td>
</tr>
<tr>
<td>Filter cake haul trucks entering site</td>
<td>125</td>
<td>113</td>
<td>109</td>
<td>111</td>
<td>104</td>
</tr>
</tbody>
</table>
## Equipment Sound Power Level (dB) in Octave Band Centre Frequency (Hz)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>Overall (dBA)</th>
<th>Quantity per hour</th>
<th>Percent Usage (%)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter cake haul trucks exiting site</td>
<td>124</td>
<td>110</td>
<td>102</td>
<td>101</td>
<td>105</td>
<td>100</td>
<td>99</td>
<td>92</td>
<td>109</td>
<td>1</td>
<td>-</td>
<td>3,2,6</td>
</tr>
<tr>
<td>Idling filter cake haul truck</td>
<td>101</td>
<td>92</td>
<td>83</td>
<td>83</td>
<td>88</td>
<td>84</td>
<td>78</td>
<td>71</td>
<td>91</td>
<td>1</td>
<td>10</td>
<td>1,2</td>
</tr>
<tr>
<td>Filter cake haul truck loading</td>
<td>120</td>
<td>112</td>
<td>111</td>
<td>105</td>
<td>104</td>
<td>102</td>
<td>99</td>
<td>90</td>
<td>110</td>
<td>1</td>
<td>10</td>
<td>1,2</td>
</tr>
<tr>
<td>Silo dust collector</td>
<td>116</td>
<td>119</td>
<td>115</td>
<td>111</td>
<td>106</td>
<td>102</td>
<td>99</td>
<td>98</td>
<td>113</td>
<td>1</td>
<td>100</td>
<td>1,4</td>
</tr>
<tr>
<td>Silo bucket elevator</td>
<td>79</td>
<td>86</td>
<td>89</td>
<td>98</td>
<td>97</td>
<td>90</td>
<td>84</td>
<td>74</td>
<td>100</td>
<td>1</td>
<td>100</td>
<td>1,4</td>
</tr>
<tr>
<td>Finished product haul trucks entering site</td>
<td>125</td>
<td>113</td>
<td>109</td>
<td>111</td>
<td>104</td>
<td>99</td>
<td>97</td>
<td>92</td>
<td>111</td>
<td>4</td>
<td>-</td>
<td>3,2,6</td>
</tr>
<tr>
<td>Finished product haul trucks exiting site</td>
<td>124</td>
<td>110</td>
<td>102</td>
<td>101</td>
<td>105</td>
<td>100</td>
<td>99</td>
<td>92</td>
<td>109</td>
<td>4</td>
<td>-</td>
<td>3,2,6</td>
</tr>
<tr>
<td>Quarry-to-Wet Plant sand conveyor</td>
<td>65</td>
<td>71</td>
<td>69</td>
<td>76</td>
<td>71</td>
<td>62</td>
<td>48</td>
<td>35</td>
<td>75</td>
<td>1</td>
<td>100</td>
<td>3,4,7,8</td>
</tr>
</tbody>
</table>

### Notes:

1. Sound power level includes quantity and estimated utilization adjustments.
3. Single unit sound power level, unadjusted for quantity.
4. Based on past measurement data of similar equipment.
5. Sound power level per square metre.
6. Pass-by sound power level.
7. Sound power level per metre.
6. Mitigation Measures

Based on the assumptions and equipment noise emissions described in Section 4 and Section 5, no noise mitigation measures are required during the overburden stripping and quarrying phases. The requirement for mitigation measures should be re-examined during detailed design to maintain the Project’s compliance with the applicable sound level limits.

7. Results

Table 7-1 presents the acoustic model prediction results at the identified receptors, during the overburden and stripping phase of the Project. Table 7-2 presents the acoustic model prediction results at the identified receptors, during the quarrying and processing phase of the Project. The daytime and nighttime 1-hour, and day-night, equivalent sound levels were predicted and compared to the guideline sound level limits.

### Table 7-1: Predicted Noise Levels – Overburden Stripping and Stockpiling

<table>
<thead>
<tr>
<th>POR ID</th>
<th>Noise Contribution from Project Operation (dBA)</th>
<th>Sound Level Limit (dBA)</th>
<th>Meets Sound Level Limit Criteria? (Y/N)³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daytime ($L_{eq,1HR}$)</td>
<td>Nighttime ($L_{eq,1HR}$)</td>
<td>Day-Night Equivalent ($L_{dn}$)</td>
</tr>
<tr>
<td>POR_north</td>
<td>44</td>
<td>44</td>
<td>51</td>
</tr>
<tr>
<td>POR_northwest</td>
<td>44</td>
<td>44</td>
<td>50</td>
</tr>
<tr>
<td>POR_south</td>
<td>32</td>
<td>32</td>
<td>38</td>
</tr>
<tr>
<td>POR_southwest</td>
<td>35</td>
<td>35</td>
<td>41</td>
</tr>
<tr>
<td>POR_east</td>
<td>29</td>
<td>29</td>
<td>35</td>
</tr>
<tr>
<td>POR_west</td>
<td>40</td>
<td>40</td>
<td>47</td>
</tr>
</tbody>
</table>

Notes:

1. Compliance with the sound level limit is determined by comparing the predicted day-night equivalent sound level with the sound level limit criteria.
### Table 7-2: Predicted Noise Levels – Quarrying and Processing

<table>
<thead>
<tr>
<th>POR ID</th>
<th>Noise Contribution from Project Operation (dBA)</th>
<th>Sound Level Limit (dBA)</th>
<th>Exceeds Sound Level Limit Criteria? (Y/N)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daytime ($L_{eq,1hr}$)</td>
<td>Nighttime ($L_{eq,1hr}$)</td>
<td>Day-Night Equivalent ($L_{dn}$)</td>
</tr>
<tr>
<td>POR_north</td>
<td>45</td>
<td>45</td>
<td>51</td>
</tr>
<tr>
<td>POR_northwest</td>
<td>44</td>
<td>44</td>
<td>51</td>
</tr>
<tr>
<td>POR_south</td>
<td>37</td>
<td>37</td>
<td>43</td>
</tr>
<tr>
<td>POR_southwest</td>
<td>38</td>
<td>38</td>
<td>44</td>
</tr>
<tr>
<td>POR_east</td>
<td>32</td>
<td>32</td>
<td>38</td>
</tr>
<tr>
<td>POR_west</td>
<td>42</td>
<td>42</td>
<td>48</td>
</tr>
</tbody>
</table>

Notes:
1. Compliance with the sound level limit is determined by comparing the predicted day-night equivalent sound level with the sound level limit criteria.

### 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;
- Ensure 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);
- Minimize drop heights of materials; and

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;
- Co-ordinate ‘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. **Summary**

Provided that the Project activities and equipment operate within the assumptions described in this assessment, the noise impacts during the overburden stripping and quarrying phases are predicted to meet the Manitoba Guidelines for Sound Pollution limits.

The results of the noise impact assessment incorporate the most recent Project information available for Project operations, as of December 2018. Should changes to any of 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; and develop a revised suite of noise mitigation measures, if necessary.
10. References


