CARGILL RAIL EXPANSION PROJECT

ENVIRONMENTAL NOISE ASSESSMENT

PREPARED FOR:

CARGILL

FEBRUARY 2015

REVISION 0

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PREPARED BY:

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BKL Consultants in Acoustics

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EXECUTIVE SUMMARY

BKL Consultants Ltd. (BKL) has conducted an environmental noise assessment for the proposed Cargill Rail Expansion Project (the Project) in the North Shore Trade Area of Port Metro Vancouver (PMV). The Project includes the expansion of Cargill's existing facility to increase capacity from 3.4 to 5.0 million metric tonnes per annum (MMPTA). The Project will include the following key improvements:

- new railcar indexers;
- redesigned trackwork in the east and west yards; and
- decommissioning of the shuttlewagon and rerailers.

This report documents existing community noise levels near the Project and the predicted noise climate following completion of the Project.

The objectives of this study were to review existing conditions at nearby residential receptors, perform site measurements of significant Cargill rail yard noise sources, construct a noise model to predict community noise levels in the existing noise environment and the future noise environment with the Project, and to provide mitigation options where applicable. This study does not address potential short-term construction noise effects.

It is understood that PMV's goal for tenant-led projects such as this is to demonstrate that annual average future noise levels will not exceed existing noise levels and that terminal operators incorporate continuous improvements to reduce noise impacts to the community. Furthermore, adjustments should be made to decibel levels to account for sound being more disturbing during evenings, nights and weekends, and when it has more annoying characteristics such as tones, impulses or low frequency noise, to better assess human annoyance to noise. Therefore, the adjusted annual average day-evening-night sound level (L_{den}) metric has been used to carry out the assessment.

BKL assessed existing community noise levels using noise measurement data collected by a nearby PMV permanent noise monitoring terminal (NMT) located at Queensbury Avenue and East 2nd Street, North Vancouver. Noise data from the entire month of December 2014 was used to characterize the existing annual average community noise environment and assist in establishing the existing noise levels at potentially affected receptors. The measured L_{den} was 67 dBA on weekdays (Monday to Friday) and 69 dBA on weekends (Saturday and Sunday).

BKL developed a Cadna/A computer noise model to assess existing and future noise levels at all nearby residences. The model includes noise sources from Cargill, Low Level Road, East 3rd Street, CN railway, Richardson Terminal and Neptune Terminals.

The Project noise predictions were based on the following main assumptions:

- Empty cars will no longer roll down the hill and impact stationary cars.
- The shuttlewagon will be decommissioned.
- CN service efficiency will improve since they will be able to deliver and retrieve more cars at a time, resulting in fewer shunting impacts per car serviced.
- Track shed and shipboard generator noise emissions will increase in proportion to the proposed throughput increase.
- Fixed equipment noise above the track shed (e.g., blower noise) will not change as a result of the Project.

BKL accounted for the following factors when developing its noise model:

- CN servicing noise (spotting and pulling cars) was considered Cargill-generated noise.
- A 12 dB impulsive noise penalty was applied to existing empty car impact noise.
- A 12 dB impulsive noise penalty was applied to CN servicing noise due to shunting impacts.

Based on these assumptions, BKL predicts a 1 to 3 dBA decrease in Cargill-generated noise throughout the surrounding community. No further noise mitigation would be required to meet PMV's Project noise objectives.

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List of Abbreviations and Acronyms

Abbreviation/Acronym	Definition
ANSI	American National Standards Institute
BC	British Columbia
BKL	BKL Consultants Ltd.
CFM	cubic feet per minute
CN	Canadian National Railway
CP	Canadian Pacific Railway
dB	decibel
dBA	A-weighted decibel
dBZ	decibel with no frequency weighting (zero weighting)
EA	environmental assessment
EC	European Commission
EU	European Union
Hz	hertz
km	kilometre
km/h	kilometres per hour
L_d	daytime (7 am to 7 pm) equivalent sound level
L_{den}	day-evening-night equivalent sound level
L_e	evening time (7 pm to 11 pm) equivalent sound level
L_{eq}	equivalent sound level
L_n	nighttime (11 pm to 7 am) equivalent sound level
LLR Project	Low Level Road Project
m	metre
MMTPA	million metric tonnes per annum
MT	metric tonne
MTPA	metric tonnes per annum
PMV	Port Metro Vancouver
the Project	Cargill Rail Expansion Project
s	second
SWL	sound power level

1 INTRODUCTION

BKL Consultants Ltd. (BKL) has been retained by Cargill to provide an environmental noise impact assessment for the proposed Cargill Rail Expansion Project (the Project).

An environmental noise impact assessment was previously performed by BKL in this area for Port Metro Vancouver (PMV). In 2012, for the Low Level Road Project (LLR Project), BKL assessed 2025 noise levels at residences near the Cargill terminal and at other locations along the Low Level Road (BKL 2012a). Projected changes to the road; to CN and tenant noise, including the Cargill terminal; and to the terrain (due to changes to Low Level Road) were considered using internationally recognized standards implemented in a 3-D computer noise model. Community noise levels were predicted to remain the same or decrease, mainly due to the cessation of whistling and the construction of noise walls, but also due to future noise mitigation commitments by Cargill. However, the LLR Project study did not include detailed tenant operations noise modelling. The LLR Project model assumptions, specifically for tenant noise and railcar volumes, have been refined for this study based on additional information now available and additional site noise measurements.

The Project includes the expansion of Cargill's existing facility to increase capacity from 3.4 to 5.0 million metric tonnes per annum (MMTPA). This will include the following key improvements:

- new railcar indexers;
- redesigned trackwork in the east and west yards; and
- decommissioning the shuttlewagon and rerailers.

PMV's goal for tenant-led projects such as this is to assess future noise levels and provide mitigation such that noise will not exceed existing noise levels. Therefore, a combination of measurements and modelling has been used to predict whether Cargill-generated noise has the potential to increase community noise levels and to confirm whether the conclusions made in the LLR Project are still relevant.

This report documents existing noise exposure levels at potentially affected residential receiver locations near the Project and the predicted noise climate following completion of the Project.

Relevant information regarding acoustics fundamentals and terminology is presented in Appendix A.

2 PROJECT DESCRIPTION

The Cargill terminal is located on the north shore of Burrard Inlet, at 801 Low Level Road, North Vancouver, BC, within Port Metro Vancouver (PMV) lands. It is serviced by CN Rail. Figure 2.1 shows its location on Burrard Inlet, and Figure 2.2 shows a plan view of the nearby roadways and residences to the north.

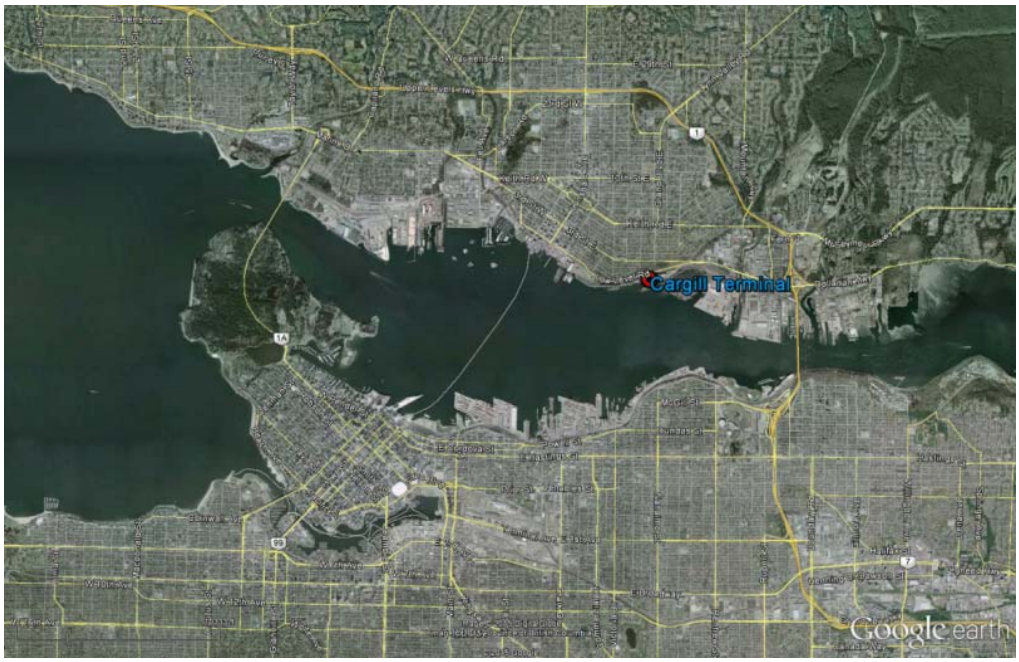

Figure 2.1: Cargill Terminal Location on Burrard Inlet

Figure 2.2: Cargill Terminal next to Nearby Industry, Roadways and Residences

Currently, the Cargill terminal operates 24 hours per day and 350 days per year, with an annual average processing of 107 railcars per day. By 2025, this number is expected to be 155 railcars per day. This increase corresponds to an increase in capacity from 3.4 to 5.0 MMTPA.

The Project will feature improved and expanded rail trackwork, new railcar indexers that will allow for more railcars to be unloaded at one time, the elimination of the shuttlewagon and the reduction of loud shunting noises created by empty railcars impacting each other.

Currently, the railcar unloading procedure is as follows:

1. CN spots a string of loaded cars to the indexer in the unloading shed.
2. The indexer moves the cars through the unloading shed as each car is unloaded.
3. When three cars are unloaded and moved out of the shed, the shuttlewagon pulls them to the end of an empty track in the east yard.
4. Handbrakes are applied to the empty cars.
5. When the next three cars are unloaded and moved out of the shed, they are released on the same track as the previous cars where they roll down a gradual slope until they impact the parked cars.
6. Step 5 is repeated until the track is full.
7. The next three empty cars exiting the unloading shed are pulled by the shuttlewagon to another empty track.
8. Steps 4 to 7 are repeated until all the cars are unloaded.

After the Project is complete, the railcar unloading procedure will be as follows:

1. CN Railway spots three strings of cars to two west yard tracks and one east yard track that are connected to the same dumper (the other east yard track is empty).
2. The indexer takes control of the first car of a 17-car string on the first west yard track and indexes the cars as they are unloaded.
3. The empty cars progress onto an empty track in the east yard.
4. After 11 cars are unloaded, the string of cars progresses onto the empty track without unloading any more cars.
5. Handbrakes are applied, and the first 11 unloaded cars are cut off on the track.
6. The remaining string of six loaded cars is progressed in the opposite direction until it's clear of the switch on the east tracks.
7. The six-car string is moved onto the other east track where it couples with the loaded, 11-car string.
8. Handbrakes are released and the now 17-car string moves toward the unloading building as the cars are indexed and unloaded.
9. After 12 cars are unloaded, the string of cars is progressed onto an empty track without unloading any more cars.
10. Handbrakes are applied and the first 12 cars are cut off.
11. The remaining string of five loaded cars is progressed back toward the dumper building until it is clear of the switch in the west yard.
12. The five-car string is progressed onto the other west track where it couples with the loaded, 13-car string.
13. The now 18-car string is progressed through the unloading building where the cars are unloaded and moved onto the empty east track, where they will await pickup by a CN locomotive.

3 STUDY OBJECTIVES

The objectives of this study were to

- evaluate existing noise conditions at potentially affected residential receptors within the community;
- perform site measurements of Cargill rail noise and CN delivery and pickup noise;
- construct a noise model for the purpose of predicting community noise levels in 2014 and with and without the Project in the year 2025;
- compare predicted noise levels;
- quantify the significance of any noise increases in terms of the annual average day-evening-night level (L_{den}) including any appropriate adjustments for tonal or impulsive noise; and
- provide mitigation options to address significant noise effects where necessary.

Construction noise assessment was not part of the current study.

4 ASSESSMENT CRITERIA

4.1 PMV Noise Criteria

It is understood that PMV's goal for tenant-led projects such as this is to demonstrate that annual average future noise levels will not exceed existing noise levels and that terminal operators incorporate continuous improvements to reduce noise impacts to the community. Hence, this objective would be met if Cargill-generated noise is not predicted to increase in the future.

Noise has been quantified using the annual average day-evening-night sound level, or L_{den}. The adjusted annual average equivalent sound level is the recommended metric to predict the long-term annoyance response of a community (ANSI 2005). The predicted L_{den} includes adjustments for evening, night and weekend noise and any necessary adjustments for tonal or impulsive noise as recommended by the ANSI standard. The purpose of applying these adjustments is to reflect the fact that people are more disturbed by noise during evenings, nights and weekends, compared to weekday daytime hours, and to impulsive (e.g., railcar shunting), tonal (e.g., backup alarms on mobile equipment, rail squeal) and excessive low frequency (e.g., some shipboard generators) noise sources, compared to a more neutral noise source like steady road traffic noise.

Cargill-generated noise was defined as noise that can be controlled by Cargill (i.e., Cargill rail activities, truck movements, product handling equipment, mechanical equipment and any sound reflecting off existing Cargill buildings), and CN noise associated with collection and delivery of railcars to Cargill (although the timing of these activities is controlled by CN). It does not include CN-generated rail noise along the main line.

For analysis purposes, residences were organized into enclaves (groups) of houses, and, although BKL predicted noise levels for residences within each enclave, noise modelling results are presented in this report as average values for each enclave.

Appendix B describes the metrics used in this assessment, including noise adjustments.

4.2 Municipal Noise Criteria

Although port lands are under federal jurisdiction, limits from the Corporation of the City of North Vancouver (CNV) Bylaw No. 5819, "A Bylaw to control Noise within the Municipality" (2011), have been included below for information:

> ***Quiet Area Sound Level***
>
> *A person may make, cause or permit to be made, a continuous sound with a sound level during the daytime of 55 decibels or less, and during the nighttime of 45 decibels or less when received at a point of reception within a quiet area.*
>
> ***Mixed Area Sound Level***
>
> *A person may make, cause, or permit to be made, a continuous sound with a sound level during the daytime of 55 decibels or less, and during the nighttime of 50 decibels or less when received at a point of reception within a mixed area.*
>
> ***Non-Continuous Sound Levels***
>
> *A person may make, cause, or permit to be made, a non-continuous sound with a sound level during the daytime of 80 decibels or less, and during the nighttime of 75 decibels or less when received at a point of reception in the municipality.*

All of the residences in the study area have been zoned in a "Quiet Area."

4.3 Noise Mitigation Criteria

If the noise impact assessment criteria are exceeded at any receptors, noise mitigation options using the Best Available Techniques Not Entailing Excessive Cost (BATNEEC) approach can be investigated to avoid significant adverse effects. The interpretation of excessive cost will depend on the significance of the noise impact.

The BATNEEC approach involves the assessment of all factors that contribute to the resulting noise impact, such as whether or not

- the quietest available equipment is being used;
- the site layout has been optimized to minimize the noise impact, e.g., through the use of natural screens such as buildings, open doors facing away from residences, distance attenuation, etc.;
- site procedures have been optimized to minimize the noise impact, e.g., keeping doors closed, conducting noisy procedures indoors;
- hours of operation for noisy procedures have been optimized to minimize the noise impact and/or restricted to specific hours so that the community knows when to expect particularly annoying noise events;
- other aspects of site operations are being conducted in the most noise conscious manner; and
- additional noise enclosures or barriers are used to minimize the noise impact.

5 EXISTING ENVIRONMENTAL CONDITIONS

5.1 Baseline Noise Monitoring

BKL assessed existing baseline noise levels using noise measurement data collected by a nearby PMV permanent noise monitoring terminal (NMT). The NMT uses a Brüel & Kjær Type 2250 sound level meter, which meets the Type 1 specifications in ANSI S1.4:1983. BKL studied noise data from December 2014 to characterize the existing community noise environment and assist in establishing the pre-Project noise exposure levels at potentially affected receptors. These levels are summarized in Table 5.1. The L_{den} values incorporate adjustments for evening, night and weekend noise but not for annoying characteristics from tones, impulses or low frequency noise. The NMT location is shown in Figure 5.1.

Table 5.1: Summary of Baseline Noise Data

Days of the Week	L_{den} (dBA)	L_d (dBA)	L_e (dBA)	L_n (dBA)	$L_{90,24hr}$ (dBA)
Monday - Friday	67	63	61	60	58
Saturday - Sunday	69	63	62	62	60

Figure 5.1: Baseline Noise Measurement Location

The purpose of the baseline noise analysis was to provide some insight into existing (pre-Project) noise levels within potentially affected communities. Cargill is not the only contributor to existing noise levels in nearby communities. As such, the measured noise levels include other nearby industries; road, rail, air and marine traffic; and local activities at or near the monitoring sites.

Analysis of data revealed that day-evening-night average sound levels (L_{den}) received at the baseline site were dominated by activity at the Cargill terminal, rail activity (passbys and rail squeal), and traffic on Low Level Road and East 3rd Street. Noise levels were highest during

daytime hours and lowest during nighttime hours. Weekend noise levels appeared to be slightly higher than weekday noise levels. However, the differences were within 3 dB, which is not significant.

According to a Cargill productivity tracker log, a total of 2,679 cars and 226,729 MT were unloaded in the month of December. On average, 88 cars and 7,558 MT were unloaded per day. The detailed productivity tracker log for December 2014 can be found in Appendix F.

6 NOISE MODELLING METHODOLOGY

6.1 Acoustical Model

Transportation and industrial noise levels have been predicted using the internationally recommended ISO 9613-2 (1996), Dutch SRM II (1996) and NMPB-Routes-2008 (2009a, 2009b) standards implemented in the outdoor sound propagation software Cadna/A version 4.5. The *Good Practice Guide for Strategic Noise Mapping* (EC WG-AEN 2007) points out that these standards (or previous versions) are recommended by the European Commission (EC) as current best practice to obtain accurate prediction results. BKL follows best practices described in the *Good Practice Guide on Port Area Noise Mapping and Management* (NoMEPorts 2008).

ISO 9613 describes a method for calculating the attenuation of sound during propagation outdoors in order to predict environmental noise levels at a distance from a variety of sources. It is the EC preferred standard for general industrial noise prediction. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favourable for sound propagation. BKL used this method to predict noise propagation from mechanical equipment and rail operations within Cargill.

NMPB-Routes-2008 is the new version of the current European Union (EU) preferred road traffic noise prediction model. It specifies octave band sound power levels for roadways, dependant on traffic volumes, average travel speed, percentage of heavy vehicles (i.e., trucks, buses), road gradient and a flow conditions factor (continuous, accelerating, decelerating). BKL has found that this model provides a high level of agreement with traffic noise measurements conducted in British Columbia. BKL used this method to predict noise emission and propagation for all road traffic.

The Dutch SRM II is the EC preferred rail prediction model. It calculates levels in octave bands and splits the source into as many as five sub-sources, located at different heights depending on the type of train specified. BKL used this method to predict noise emission and propagation from CN Rail through-traffic.

The noise model used one order of sound reflection. Based on experimentation with the noise model, higher orders of reflection were found to be insignificant and were therefore not modelled.

Model calculations were performed in octave bands, considering ground cover, topography and shielding objects (see following sections). A temperature of 10°C and relative humidity of 80 per cent were used in the model settings to represent average weather conditions in Vancouver.[1] A moderate temperature inversion was assumed to represent conditions favourable for sound propagation but not the absolute worst-case conditions.

6.2 Noise Model Scenarios

Noise modelling has been completed on a series of scenarios chosen to best represent the current and future noise environments, taking into account the Project, anticipated future growth in road and rail traffic, and potential changes to other nearby industries. The proposed scenarios are listed and described in Table 6.1.

Table 6.1: Noise Modelling Scenarios

Scenario No.	Noise Scenario	Throughput	Description
1	2014 Pre-Project	3.4 MMTPA (107 railcars per day)	This is the scenario that existed in 2014 prior to the Project works but after the completion of the new Low Level Road. This is based on recent information available on traffic and rail volumes (i.e., from the LLR Project) and on-site noise measurements of Cargill operations.
2	2025 Without Project	3.4 MMTPA (107 railcars per day)	This scenario includes the anticipated 2025 rail and road traffic volumes, as documented in the LLR Project, and current Cargill operations at maximum capacity.
3	2025 With Project	5.0 MMTPA (155 railcars per day)	The same as Scenario 2, 2025 without-Project, but this scenario accounts for the change in noise associated with the Project and its increased capacity.

6.3 Geometric Data

6.3.1 Spatial Boundaries

The study area (see Appendix D) covers all residential receptor locations that could potentially be affected by the proposed Project, which includes residences between Ridgeway Avenue and Heywood Street and south of 4th Street. Cargill-generated noise received outside of this area is likely to be masked by other community noise sources.

[1] Variations in temperature and humidity have little effect on the overall noise propagation and hence the model predictions will represent a much wider range of weather conditions.

6.3.2 Topography

The intervening terrain has been modelled by directly importing one-metre-interval ground contours used in the LLR Project.

The layout and dimensions of the Cargill terminal, its nearby facilities, and road and rail were taken from the noise model for the LLR Project. The future rail track alignment was provided by Hatch Mott Macdonald. Orthophotos were used to identify other acoustically important objects or landmarks. Residential building heights were estimated using field observations and Google Street View and were otherwise assumed to be five metres high.

6.3.3 Ground Surface

The acoustic properties of the ground surface can have a considerable effect on the propagation of noise. Flat non-porous surfaces, such as concrete, asphalt, buildings, calm water, etc., are highly reflective to noise, and according to ISO 9613-2 (1996) have a ground constant of G=0. Soft, porous surfaces, such as foliage, loam, soft grass, snow, etc., are highly absorptive to noise, and have a ground constant of G=1. The ISO standard does not use intermediate ground constants.

Highly reflective surfaces have been modelled in most areas, for example, at the Cargill facility, such surfaces include nearby roadways and the surface of Burrard Inlet. The ground surface of Dusty Greenwell Park, the hill cut between the main rail lines and nearest residences, and other grassy areas have been modelled as absorptive.

6.3.4 Obstacles

The layout and dimensions of Cargill's buildings and equipment were incorporated into the model based on drawings and details provided by Cargill, Hatch Mott Macdonald, and observations and measurements made by BKL on site.

Orthophotos from Google Maps were used to identify other acoustically important objects or landmarks.

6.4 Cargill Noise Sources

To measure noise from rail activity (including unloading, shunting, empty car impact, and CN spotting and pulling), BKL measured sound pressure levels at the Cargill site in most of the operational areas. These measurements were used to predict the sound power levels (*SWLs*) of the rail operations that have the potential to affect the noise level at nearby and distant receptors.

SWLs for items of equipment and operations that are part of the Project were estimated based on information provided by Cargill, ATCO's "May 2014 Noise Control Study," extrapolation of the data measured on site and other measurements of similar equipment conducted by BKL.

BKL is not aware of any equipment that has or will have predominant tonal qualities during normal operation, other than the alarm buzzer used in the unloading shed when railcars advance. However, since the alarm is not a dominant source relative to the continuous noise generated in the shed and because Cargill has never received complaints due to alarm noise, it has not been included in the model.

The following sections outline the noise sources implemented in the noise modelling. Detailed noise source tables can be found in Appendix C. Figure 6.1 shows some of these noise sources as modelled in Cadna/A. Locations of pre- and post-Project noise sources are shown in Figures D4 and D5 in Appendix D.

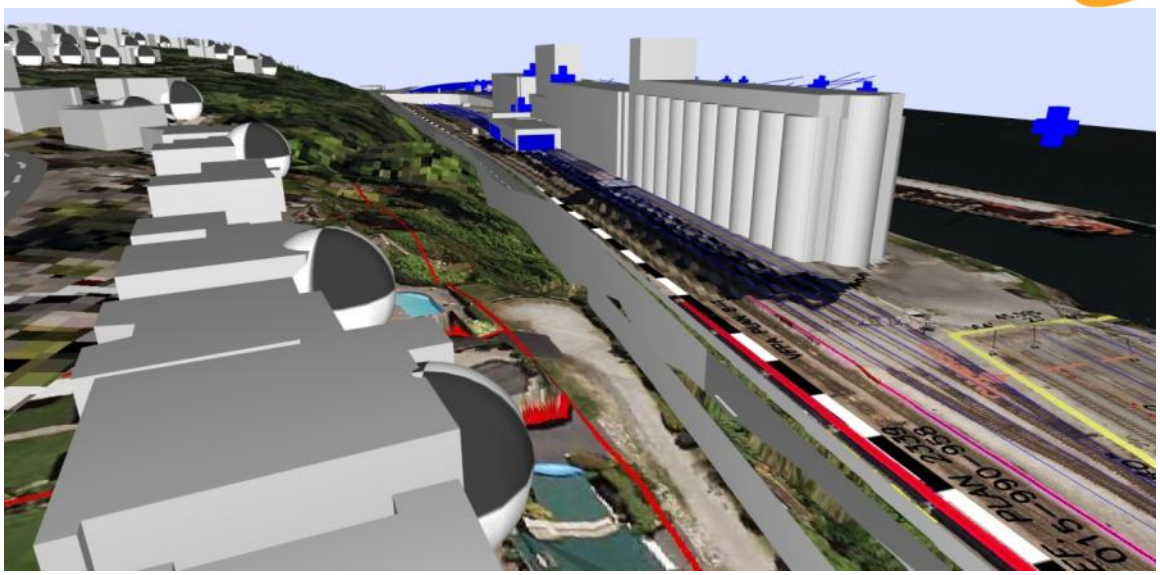

Figure 6.1: 3-D View of Cadna/A Noise Model

6.4.1 Ventilation Fans

The most significant ventilation fans at Cargill are the bag-house dust-collector fans. Fan noise sources were modelled to include the fans located on Annex 2, Annex 3, and the track shed roof.

Sound measurements of the existing fans were taken by ATCO in April 2014 and measured noise levels were reported in their noise control study. Fan sound power levels in BKL's noise model were calibrated to ATCO's measurements.

For all scenarios, fan noise was modelled. Fan noise and operation times are not expected to change with the Project.

6.4.2 Railcar Unloading Track Shed

The track shed has two openings on the east and west facades for railcar entry and exit as well as a smaller opening on the north facade. The openings have been modelled using vertical area sources. These sources were calibrated to measurements taken on site around the track shed.

While new indexers will replace the existing indexers, noise levels inside the shed are not expected to increase. However, an increase in operating time was modelled to account for the increased throughput expected in the future.

6.4.3 Rolling Impacts and Shunting from Unloading

Currently, empty railcars are released from the east side of the track shed to roll down a slope and impact parked railcars. The number of impacts is assumed to be four for every 14 railcars unloaded. This is estimated based on three cars rolling down the slope at a time with each track in the east yard holding 14 railcars.

Empty railcar impact noise was modelled as line sources on each track in the east yard. Measurements of empty railcar impacts were performed on site and used to calibrate the line sources. A 12 dB highly impulsive sound penalty was added to these sources.

With the Project, empty railcars will not be released to roll down the slope. Instead, they will be held by the new indexers as the string of empty cars moves into the east yard. However, the

future unloading procedure will involve coupling and decoupling cars and moving strings of railcars forward and backward, generating noise between railcars when the couples are compressed and when the slack is taken up. Based on the future unloading schematic, BKL estimates that there will be seven shunting impacts generated for every 41 cars unloaded and that the noise will be distributed among all tracks in the east and west yards.

Furthermore, this type of impact is expected to be quieter than the high-speed impacts observed in 2014. Measurements of impact noise from indexers moving empty railcars back and forth have been used to calibrate the line sources representing future railcar shunting. A 12 dB highly impulsive sound penalty was added to these sources.

Information on the expected number of impacts associated with railcar unloading is summarized in Table 6.2.

Table 6.2: Cargill-Generated Railcar Impacts Summary

Railcar Impacts/Day from Unloading			
Without Project		**With Project**	
West Yard	East Yard	West Yard	East Yard
0	31	12	15

6.4.4 Shuttlewagon

Currently, a shuttlewagon moves two to three empty railcars from the track shed exit to the end of each empty track in the east yard. Based on Cargill's estimates, the shuttlewagon operates approximately five hours per day on average.

Noise from the shuttlewagon, including coupling, engine revving and horn sounding, was measured on site. Shuttlewagon activity was modelled as line sources on the five tracks in the east yard and calibrated to the measurements.

The shuttlewagon will be decommissioned with the Project.

6.4.5 Shipboard Generators

One shipboard generator is assumed to be operating whenever ships are present at Cargill's ship-loading berth. It was assumed that a ship was docked at this berth for one-third of 2014. It was assumed that the amount of time a ship is docked would increase in proportion to the increase in throughput. The shipboard generator was modeled as a single point source at an assumed height of 30 metres and was calibrated to previous measurements of shipboard generators conducted by BKL.

Low frequency noise from ship generators has the potential to cause additional annoyance and induce building rattling when low frequency octave band levels are above 65 dB (ANSI 2005). In this case, predictions of shipboard generator low frequency noise levels at the nearest residences were below 65 dB. Therefore, a low frequency noise adjustment was not applied.

6.4.6 CN Rail Delivery and Pickup

CN Rail currently delivers railcars to the Cargill west yard and spots strings of railcars to the indexers at the track shed. Empty cars are picked up in the east yard.

The delivery and pickup noise, which includes locomotive and shunting noise, was modelled using line sources on each track, based on noise measurements taken on site by BKL. For the 2014

scenario, this noise source was distributed evenly across four tracks in the west yard and five tracks in the east yard. BKL calculated shunting noise based on Cargill's estimated number of spotting attempts per railcar and the total number of cars unloaded at Cargill in 2014, provided by Cargill.

The ANSI standard (2005) refers specifically to railcar shunting as a "highly impulsive" noise source, so the suggested 12 dB adjustment has been added to this source. This adjustment is only applicable to the sound energy associated with the impulsive event(s). If there are only a few highly impulsive events occurring per day, the sound energy associated with these events may not significantly increase the L_{den}, even after the 12 dB adjustment has been applied.

Similar to shipboard generators, low frequency noise from idling locomotives also has the potential to cause annoyance and induce building rattling. However, Cargill has confirmed that locomotives on Cargill property idle for only short periods of time during normal switching activity. Through measurements and site observations, BKL did not observe any locomotives idling for an extended amount of time. Therefore, a low frequency noise adjustment was not applied.

For the 2025 With-Project scenario, the amount of shunting from CN is expected to decrease as CN will be able to deliver more railcars each time with an increased capacity to hold loaded railcars in Cargill's expanded rail yard. In the noise model, CN delivery and pickup noise was distributed evenly across five tracks in the west yard and six tracks in the east yard.

Information on the expected number of shunting events associated with delivery and pickup is summarized in Table 6.3.

Table 6.3: CN Rail Shunting Summary

Shunts/Day from Rail Deliveries & Pickups			
Without Project		**With Project**	
West Yard	East Yard	West Yard	East Yard
17	17	12	12

6.5 Non-Cargill Noise Sources

Noise from rail traffic on the CN main line and road traffic on Low Level Road, East 3rd Street and other local streets in the neighbourhood have been included in the noise model. Sound power levels of these sources were derived using information from the LLR Project. Detailed noise source tables can be found in Appendix C.

6.5.1 CN Rail

The CN main line that services the area has been included in the noise model using input levels from the LLR noise model.

Existing rail noise was modelled by calibrating the sound emission of a single track to measured data collected at nearby baseline measurement locations.

For the future scenario, BKL applied the same methodology used to predict the increase in noise due to rail activity for the LLR Project. A logarithmic relationship between existing and projected future rail traffic volume increases was used to provide an estimate of future rail noise. Based on information provided by MainLine Management for the LLR Project, BKL applied a 2 dB increase in

sound power level to all modelled rail noise sources within the study area to account for increases in rail traffic for the future.

6.5.2 Road Traffic

Road traffic volumes for 2010 and projected 2031 road traffic volumes for Low Level Road were provided by MMM Group for the LLR Project. These volumes have also been used in this study.

When assessing noise levels related to road traffic, a 25 per cent increase in traffic generally results in a 1 dB increase in noise level. Therefore, for this study, road traffic volumes in 2014 are assumed to be the same as 2010 and predicted volumes for 2025 are assumed to be the same as those predicted for 2031. A 25 per cent change is unlikely to occur in a span of four to six years.

Road traffic for the streets in the neighbourhood was also included using input levels from the LLR Project noise model.

6.5.3 Richardson Terminal

All existing and future Richardson noise sources have been included in the noise model based on the Richardson Grain Storage Project undertaken by BKL (2013). A 12 dB highly impulsive sound penalty was added to the rail yard sources.

6.5.4 Neptune Bulk Terminals

All existing and future Neptune noise sources have been included in the noise model based on the Neptune Bulk Terminals Improvements Project undertaken by BKL (2012b). A 5 dB tonal sound penalty was added to the rail squeal sources.

6.6 Sound Level Adjustments

The required 5 dB evening time and 10 dB nighttime adjustments have been applied in the modelling to all noise that occurs during evening hours (7 pm to 11 pm) and nighttime hours (11 pm to 7 am). The 5 dB adjustment for weekend daytime hours (i.e., Saturdays and Sundays, 7 am to 7 pm) has also been included as Cargill operates through the weekend. The adjustments are additive, so noise from a rail shunt at night would be adjusted upwards by 22 dB. These adjustments apply to all environmental noise sources, not just those associated with Cargill.

6.7 Receivers

The land use in the adjacent community is almost entirely single-family residential. Noise levels were predicted at 67 receivers within Groups A, B and C (see Appendix D). There was approximately one receiver for every two houses. Receiver Groups A through C were subdivided into rows. For example, receivers in the first row of housing in Group A, in the south, fronting Cargill, were labelled A1; the second-row receivers were labelled A2, and so on. The single Group C residence on the north side of East 3rd Street was included with the two first-row receivers in C1.

Calculations were performed for assumed receiver heights of three metres on the facades of the residential buildings included in the study area. In addition, sound contours were calculated at the same height on five-metre-by-five-metre grids throughout the study area.

6.8 Limitations

For sound calculated using the ISO 9613 standard, the indicated accuracy is ± 3 dBA for source-to-receiver distances of up to 1000 metres. Accuracy is unknown at distances beyond 1000 metres. Distances from various points on the Cargill site to residential receivers north of Cargill are all within 1000 metres.

The estimated sound power levels for Cargill equipment are based on measurements taken on site except where it was not possible to measure equipment. In such cases, the *SWLs* were predicted using data from Cargill or previous measurements conducted by BKL.

In general, for individually modelled noise sources that are based on book data (fixed and mobile equipment, roads and railways), the estimated accuracy of the sound power levels is ± 5 dBA. Sound power levels derived from on-site measurements would generally be more accurate, likely ± 3 dBA.

The accuracy of the predicted difference in noise with and without the Project should be better than indicated above because any errors in the model without the Project would also be present in the model with the Project. Hence, any inaccuracies in the predicted difference would result only from newly introduced equipment and operations associated with the Project (i.e., new sources).

7 PREDICTED NOISE LEVELS

7.1 Cargill-Generated Noise

A summary of the predicted Cargill-generated noise (i.e., not accounting for other community noise) for each receiver group in each scenario is shown in Table 7.1.

Table 7.1: Summary of Predicted Noise Levels, L_{den} (dBA)

Receiver Group (see Fig. D1, Appendix D)	Cargill-Generated Noise			
	2014	2025		Increase With Project [3] – [1]
	[1] Pre-Project	[2] Without Project	[3] With Project	
A1	66	66	63	-3
A2	59	59	57	-2
A3	52	52	50	-2
A4	59	59	58	-1
A5	54	54	53	-1
B1	65	65	63	-2
B2	60	60	59	-1
B3	57	57	56	-1
C1	69	69	67	-2
C2	65	65	62	-3

Cargill-generated noise levels are predicted to decrease in all areas. The decrease is mainly due to the expectation of fewer train shunts from CN deliveries and railcar unloading with the Project. In addition, shuttlewagon noise and loud impact noise from empty cars rolling down the slope and impacting parked cars will be eliminated with the Project.

Sound contours are presented in Appendix D and detailed results by receptor are presented in tabular form in Appendix E.

7.2 Total Noise

Total Noise is predicted to decrease with the Project because Cargill-generated noise is predicted to decrease. Illustrating the predicted source contributions at different community locations, Table 7.2 shows the partial noise levels received at three of the fronting residences after Project completion.

Table 7.2: Partial Noise Levels, With Project 2025, at Three Receivers

Noise Source	Receiver L_{den} [dBA]		
	A1-01	**B1-07**	**C1-02**
Total Noise	72	72	72
Cargill-Generated Noise	62	71	71
Rooftop Equipment	55	66	64
Ship Berth	42	26	33
CN Delivery and Pickup	61	69	70
Unloading Shed	31	39	39
Unloading Noise	31	44	44
Other Noise Sources Total	71	65	67
CN Rail	57	59	58
Roads	65	55	50
Richardson Terminal	70	63	65
Neptune Bulk Terminals	47	57	60

Table 7.2 shows that Cargill-generated noise is dominant at receivers B1-07 and C1-02 whereas Richardson Terminal noise is dominant at receiver A1-01. For Cargill-generated noise, CN delivery and pickup noise is the most dominant; this is largely due to the 12 dB impulsive penalty added to this source. Impulsive penalties were also added to rail shunting sources at Richardson Terminal, which further increased its noise rating.

7.3 Comparison with Low Level Road Project Environmental Noise Assessment

BKL carried out an environmental noise assessment in 2012 for the LLR Project (2012a). The LLR Project included the realignment and elevation of Low Level Road, the provision of space for two new rail tracks and the addition of two noise walls.

Noise levels were predicted for the future, post-Project noise environment with projected Low Level Road traffic and rail volume increases for 2031 plus the introduction of two noise walls located to the south of Alder Street and East 1st Street residences. BKL concluded that, with future

noise mitigation by Cargill, future Total Noise levels would be the same or lower than existing noise levels.

For the Cargill Rail Expansion Project noise model, BKL predicts Total Noise levels to be 0 to 5 dBA lower than predicted in the LLR Project for all three Groups of residences. The general decrease is mainly due to noise control measures implemented by Cargill on its dust-control fans, the dominant noise sources for residences fronting Cargill; these noise control measures were not modelled in the LLR Project.

8 CONCLUSIONS

PMV's goal for the Project, and for all tenant-led projects, is to demonstrate that terminal operators can incorporate ongoing efforts to reduce impacts to the community and demonstrate that future community noise levels will not exceed existing levels.

This study assessed potential community noise levels in 2025. It incorporated assumed throughput increases and operational changes at Cargill, anticipated changes to road and rail traffic, and changes to operations at the adjacent Neptune Bulk Terminals and Richardson Terminal.

This report documents existing noise levels in 2014 at potentially affected residential receiver locations near the Project and predicts noise levels following the completion of the Project in 2025. BKL developed a Cadna/A computer noise model to assess existing and future noise levels at all nearby residences.

The Project noise predictions were based on the following main assumptions:

- Empty cars will no longer roll down the hill and impact stationary cars.
- The shuttlewagon will be decommissioned.
- Track shed and shipboard generator noise emissions will increase in proportion to the proposed throughput increase.
- CN service efficiency will improve since they will be able to deliver and retrieve a larger amount of cars at a time, resulting in fewer shunting impacts per car serviced.
- Fixed equipment noise above the track shed (e.g., blower noise) will not change as a result of the Project.

BKL's noise model included the following factors:

- CN servicing noise (spotting and pulling cars) was considered Cargill-generated noise.
- A 12 dB impulsive noise penalty was applied to existing empty car impact noise.
- A 12 dB impulsive noise penalty was applied to CN servicing noise due to shunting impacts.

Based on these assumptions, BKL predicts a 1 to 3 dBA decrease in Cargill-generated noise throughout the surrounding community. No further noise mitigation would be required to meet PMV's project noise objectives.

9 REFERENCES

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APPENDIX A GLOSSARY

A-weighting – A standardized filter used to alter the sensitivity of a sound level meter with respect to frequency so that the instrument is less sensitive at low and high frequencies where the human ear is less sensitive. Also written as dBA.

ambient/existing level – The pre-project noise or vibration level.

C-weighting – C-weighting provides a more discriminating measure of the low frequency sound pressures than provided by A-weighting. Unlike A-weighting, C-weighting retains its sensitivity to sounds between 100 and 1000 Hz. Also written as dBC.

continuous sound level – Generally defined by many BC municipal noise bylaws as the A-weighted sound level, measured using the "slow" time constant (see time constant), for any sound occurring for a duration of more than three minutes in a 15-minute period.

cumulative sound – The summation of individual sounds into a single total value related to the effect over time.

day-evening-night equivalent sound level (L_{den}) – The sound exposure level for a 24-hour day calculated by logarithmically adding the sound exposure level obtained during the daytime (L_d) (7:00 am to 7:00 pm) to 5 times the sound exposure level obtained during the evening (L_e) (7:00 pm to 11:00 pm) and to 10 times the sound exposure level obtained during the nighttime (L_n) (11:00 pm to 7:00 am) to account for greater human sensitivity to evening and nighttime noise.

decibel – The standard unit of measurement for sound pressure and sound power levels. It is the unit of level that denotes the ratio between two quantities that are proportional to pressure or power. The decibel is 10 times the logarithm of this ratio. Also written as dB.

equivalent sound level - The steady level that would contain the same amount of energy as the actual time-varying level. Although it represents the average sound energy throughout a period of time, it is strongly influenced by the loudest events because they contain the majority of the sound energy.

frequency – The number of times that a periodically occurring quantity repeats itself in one second.

frequency spectrum – The distribution of frequency components of a noise or vibration signal.

hertz – The unit of acoustic or vibration frequency representing the number of cycles per second.

impulsive sound – Non-continuous sound characterized by brief bursts of sound pressure. The duration of a single burst of sound is usually less than one second.

intermittent sound – Non-continuous or transient noise or vibration that occurs at regular or irregular time intervals with each occurrence lasting more than about five seconds.

intervening terrain – The terrain in between the noise/vibration source and a sensitive receiver.

maximum sound level – The highest exponential time-averaged sound level, in decibels, that occurs during a stated time period, using a "slow" or "fast" time constant (see time constant).

metric – Measurement parameter or descriptor.

non-continuous sound level - Generally defined by many BC municipal noise bylaws as the maximum A-weighted sound level using the "slow" time constant.

noise - Noise is unwanted sound, which carries no useful information and tends to interfere with the ability to receive and interpret useful sound.

noise sensitive human receptors – A place occupied by humans with a high sensitivity to noise. These include residences, hospitals, schools, hotels, etc.

octave bands – A standardized set of bands making up a frequency spectrum. The centre frequency of each octave band is twice that of the lower band frequency. The bands are centred at standardized frequencies.

receiver/receptor – A stationary far-field position at which noise or vibration levels are specified.

root mean square – The square root of the mean-square value of an oscillating waveform, where the mean-square value is obtained by squaring the value of amplitudes at each instant of time and then averaging these values over the sample time.

shunting – Also called switching. The process of sorting rolling stock into train sets, or the reverse.

single event noise – Results from the occurrence of a singular intermittent or impulsive noise event such as from a train whistling, a railcar shunting or a vehicular passby. Single event noise is commonly described by the SEL and the fast A-weighted sound pressure level.

sound – The fluctuating motion of air or other elastic medium that can produce the sensation of sound when incident upon the ear.

sound exposure level – Defined as the constant sound level that has the same amount of energy in one second as the original noise event. Abbreviated as SEL.

time constant (slow, fast) – Used to describe the exponential time weighting of a signal. The standardised time periods are 1 second for slow and 0.125 seconds for fast exponential weightings.

tonal sound – Sound characterized by a single frequency component or multiple distinct frequency components that are perceptually distinct from the total sound.

Total Noise – Results from a combination of multiple noise sources at multiple spatial locations and is typically described by a 24-hour equivalent sound level.

Z-weighting – Z-weighting, or zero frequency weighting, has no weighting applied to account for human hearing sensitivity. Also written as dBZ.

APPENDIX B INTRODUCTION TO SOUND AND ENVIRONMENTAL NOISE ASSESSMENT

B.1 General Noise Theory

The two principal components used to characterize sound are loudness (magnitude) and pitch (frequency). The basic unit for measuring magnitude is the decibel (dB), which represents a logarithmic ratio of the pressure fluctuations in air relative to a reference pressure. The basic unit for measuring pitch is the number of cycles per second, or hertz (Hz). Bass tones are low frequency and treble tones are high frequency. Audible sound occurs over a wide frequency range, from approximately 20 Hz to 20,000 Hz, but the human ear is less sensitive to low and very high frequency sounds than to sounds in the mid frequency range (500 to 4,000 Hz). A-weighting networks are commonly employed in sound level meters to simulate the frequency response of human hearing, and A-weighted sound levels are often designated dBA rather than dB.

If a continuous sound has an abrupt change in level of 3 dB it will generally be noticed, while the same change in level over an extended period of time will probably go unnoticed. A change of 6 dB is clearly noticeable subjectively and an increase of 10 dB is generally perceived as being twice as loud.

B.2 Basic Sound Metrics

While the decibel or A-weighted decibel is the basic unit used for noise measurement, other indices are also used to describe environmental noise. The equivalent sound level, abbreviated L_{eq}, is commonly used to indicate the average sound level over a period of time. The L_{eq} represents the steady level of sound that would contain the same amount of sound energy as the actual time-varying sound level. Although the L_{eq} is an average, it is strongly influenced by the loudest events occurring during the time period because these events contain most of the sound energy. Another common metric used is the L_{90}, which represents the sound level exceeded for 90 per cent of a time interval and is typically referred to as the background noise level.

The L_{eq} can be measured over any period of time using an integrating sound level meter. Some common time periods used are 24 hours, noted as the L_{eq24}, daytime hours (7 am to 7 pm), noted as the L_d, evening hours (7 pm to 11 pm), notes as the L_e, and night time hours (11 pm to 7 am), noted as the L_n. As the impact of noise on people is judged differently during the daytime, evening and nighttime, 24-hour noise metrics have been developed to reflect this.

The day-evening-night equivalent sound level (L_{den}) is one metric commonly used to represent community noise levels outside of the United States. It is derived from the L_d, L_e and L_n with a 5 dB penalty applied to the L_e, a 10 dB penalty applied to the L_n and a 5 dB penalty applied to the weekend L_d to account for increased sensitivity to evening, nighttime and weekend noise. In the United States, the day-night equivalent sound level (L_{dn}) is commonly used to represent community noise levels. It is derived from the L_d and L_n (i.e., eliminating the evening time period) with a 10 dB penalty applied to the L_n. ANSI Standard S12.9-2007 Part 5 *Sound Level Descriptors for Determination of Compatible Land Use* states that although the L_{dn} and the L_{den} are not equal, their difference is typically insignificant for the purposes of studying annoyance.

ANSI S12.9-2005/Part 4 (2005) also recommends that adjustments be applied for certain sound characteristics to better predict long-term annoyance in the community. Relevant adjustments include a 5 dB adjustment for tonal noise (e.g., alarm noise), a 12 dB adjustment for highly impulsive noise (e.g., rail shunting), a 5 dB adjustment for regular impulsive noise (e.g., banging sounds) and a variable adjustment for low frequency noise (based on the received values in low frequency octave bands and the difference between the C-weighted and A-weighted sound pressure levels).

APPENDIX C NOISE SOURCE TABLES

The daily operating times in the following table represent an average day over the course of a year.

Source	Modelled As	SWL Source	Adjustment	Daily Operating Time (minutes) D: Day, E: Evening, N: Night						Sound Power Level (SWL)		Description of change between Existing / Future
				Existing Scenario 2014			Future Scenario 2025					
				D	E	N	D	E	N	dBA	dBZ	
CN Railcar Pick-up and Deliveries												
1.Rail Delivery	Line source covering tracks from main line, onto Cargill west yard	BKL Measurements at Cargill	Impulsive +12dB	720	240	480	720	240	480	148	157	Existing: 18 shunts per day, distributed evenly throughout the day Future: 12 shunts per day, distributed evenly throughout the day
2.Rail Pickup	Line source covering tracks from main line, onto Cargill east yard	BKL Measurements at Cargill	Impulsive +12dB	720	240	480	720	240	480	148	157	Existing: 18 shunts per day, distributed evenly throughout the day Future: 12 shunts per day, distributed evenly throughout the day
Stationary Sources												
3. Shipboard Generator	Point source	Based on measurements completed by BKL	-	192	66	142	282	97	209	100	122	Existing: Shipboard generator will operate one-third of the time. Future: Shipboard generator operation time will be scaled up by the throughput increase.
4. Track shed Fans & Dust Collectors	Point source	Data from ATCO measurements	-	720	240	480	720	240	480	114	133	Existing: Fan will be operating at all times. Future: Fan will be operating at all times.

Source	Modelled As	SWL Source	Adjustment	Daily Operating Time (minutes) D: Day, E: Evening, N: Night						Sound Power Level (SWL)		Description of change between Existing / Future
				Existing Scenario 2014			Future Scenario 2025					
				D	E	N	D	E	N	dBA	dBZ	
5. Annex 1 Rooftop Equipment	Point source	Data from ATCO measurements	-	720	240	480	720	240	480	113	132	Existing: Fan will be operating at all times. Future: Fan will be operating at all times.
6. Annex 2 Rooftop Equipment	Point source	Data from ATCO measurements	-	720	240	480	720	240	480	110	129	Existing: Fan will be operating at all times. Future: Fan will be operating at all times.
7. Track shed Operation	Area sources representing openings	BKL Measurements at Cargill	-	720	240	480	720	240	480	110	129	Existing: Equipment in track shed will be operating at all times. Future: Equipment in track shed will be operating at all times.
Internal Activities Associate with Rail at CC												
8. Shuttle Wagon	Line sources covering tracks in east yard	BKL Measurements at Cargill	Impulsive +12dB	148	52	88				110	114	Existing: Shuttlewagon is used 5hrs/day and 350days/year Future: Shuttlewagon is decommissioned.
9. Railcar Rolling Impact from Unloading	Line sources covering tracks in east yard	BKL Measurements at Cargill	Impulsive +12dB	720	240	480				138	148	Existing: Estimated 31 rolling impacts per day calculated based on number of cars unloaded. See Section 6.4.3. Future: Operational changes will eliminate rolling impacts

Source	Modelled As	SWL Source	Adjustment	Daily Operating Time (minutes) D: Day, E: Evening, N: Night						Sound Power Level (SWL)		Description of change between Existing / Future
				Existing Scenario 2014			Future Scenario 2025					
				D	E	N	D	E	N	dBA	dBZ	
10. Shunting from Unloading	Line sources covering tracks in east and west yards	BKL Measurements at Cargill	Impulsive +12dB				720	240	480	99	110	Existing: N/A Future: Estimated 12 shunts in west yard and 15 shunts in east yard per day calculated based on number of cars unloaded. See Section 6.4.3.
Non-CC Noise Sources												
CN Rail												
11. Through Track	Rail source	Based on measurements completed by BKL, and projected traffic increase	-	720	240	480	720	240	480	-	-	As described in Section 6.5.1
Roads												
12. Low Level Road and other local roads	Road sources	Based on road traffic volumes used in LLR Project	-	720	240	480	720	240	480	-	-	As described in Section 6.5.2

Source	Modelled As	SWL Source	Adjustment	Daily Operating Time (minutes) D: Day, E: Evening, N: Night						Sound Power Level (SWL)		Description of change between Existing / Future
				Existing Scenario 2014			Future Scenario 2025					
				D	E	N	D	E	N	dBA	dBZ	
Neighbouring Terminals												
13. Richardson Terminal	Combination of line, point, and area sources	Based on established noise model from Richardson Grain Storage Project	-	720	240	480	720	240	480	-	-	As described in Section 6.5.3
14. Neptune Bulk Terminals	Combination of line, point, and area sources	Based on established noise model from Neptune Bulk Terminals Improvement Project	-	720	240	480	720	240	480	-	-	As described in Section 6.5.4

APPENDIX D FIGURES AND NOISE CONTOURS

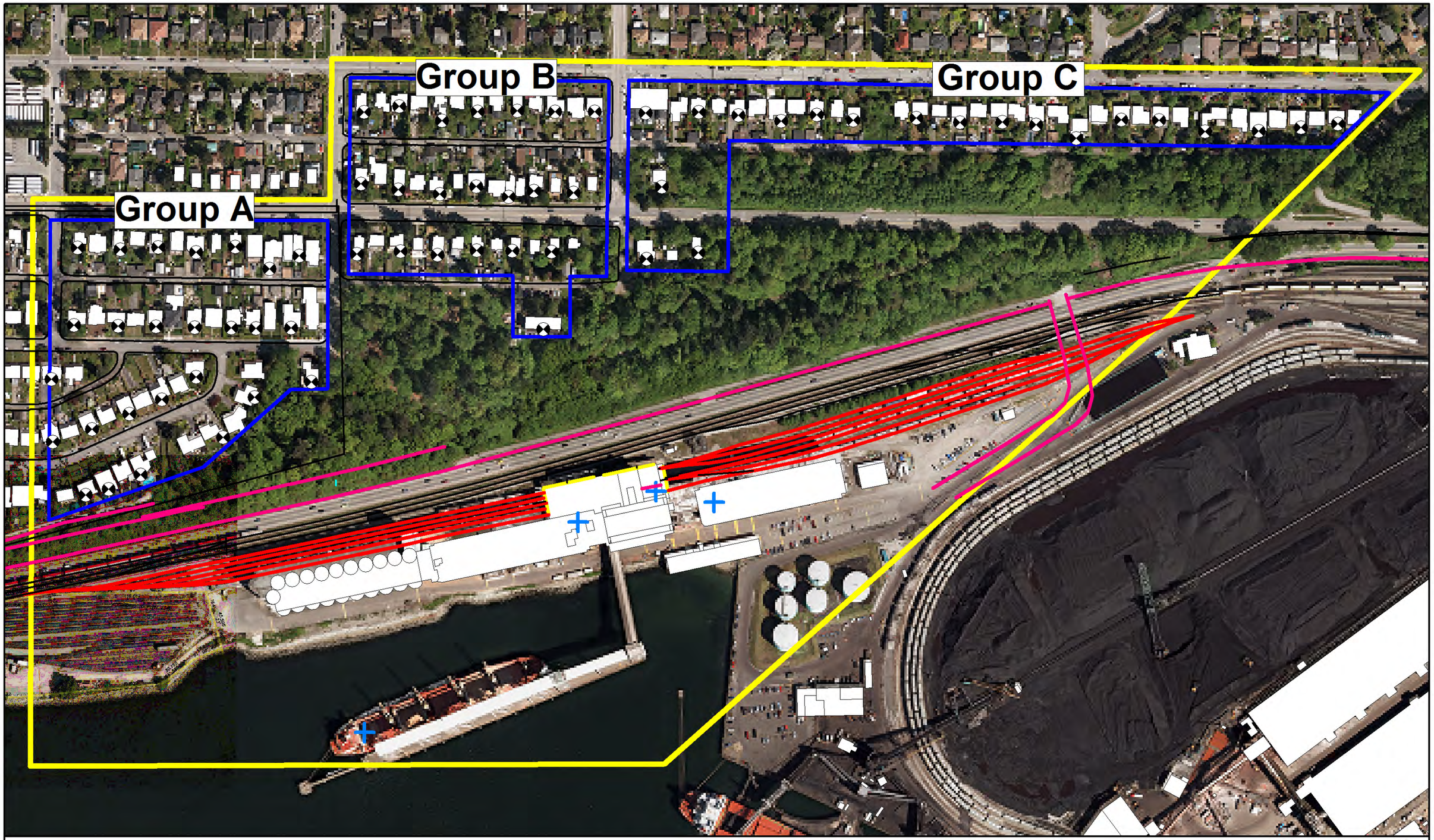

Figure D1: Residential Receiver Groups

N

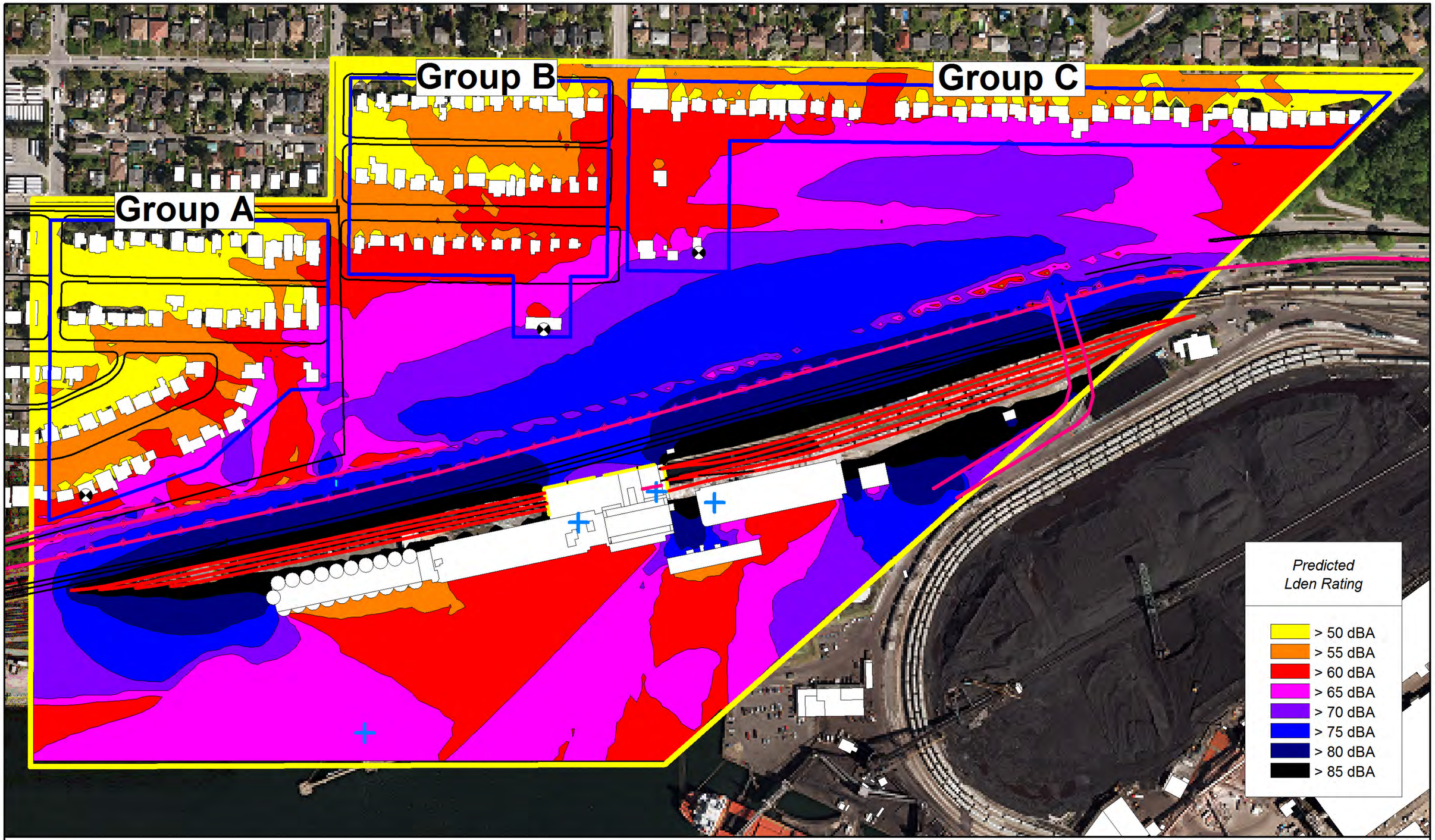

Figure D2: Predicted Existing 2014 Cargill-Generated Noise Rating (Lden)

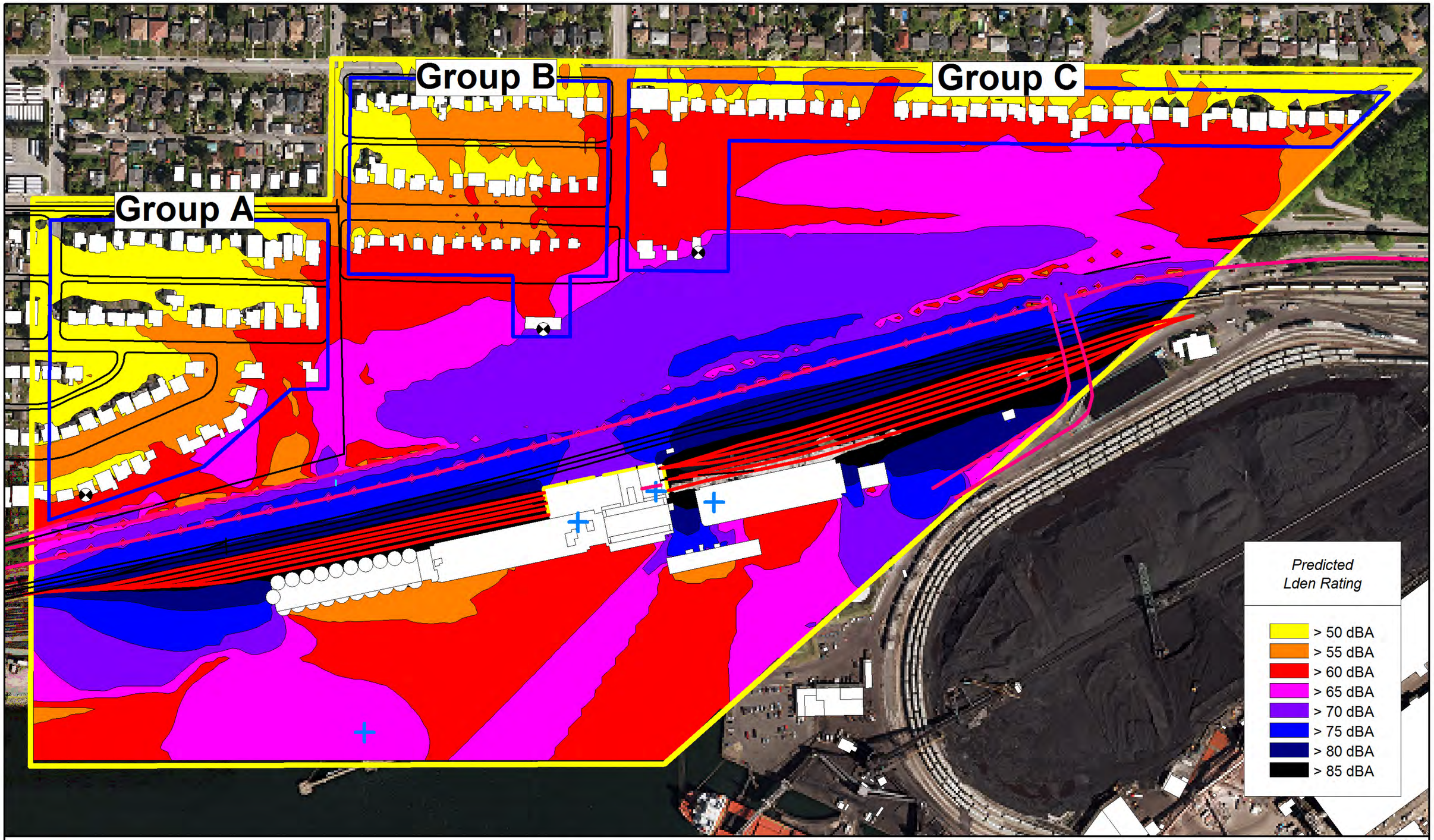

Figure D3: Predicted Future 2025 Cargill-Generated Noise Rating (Lden)

Figure D4: Layout of Pre-Project Noise Sources

Figure D5: Layout of Post-Project Noise Sources

APPENDIX E RESULTS TABLES

Receiver	Cargill-generated Noise			
	Exist 2014 [1]	Future 2025 Without Project [2]	Future 2025 With Project [3]	Difference [3] – [1]
Name	L_{den}	L_{den}	L_{den}	
	dBA	dBA	dBA	
A1-01	63	63	61	-2
A1-02	61	61	59	-2
A1-03	64	64	62	-3
A1-04	70	70	67	-3
A1-05	68	68	65	-3
A1-06	69	69	66	-3
A2-01	58	58	56	-2
A2-02	59	59	57	-1
A2-03	59	59	57	-2
A2-04	60	60	58	-2
A2-05	60	60	59	-2
A3-01	52	52	50	-1
A4-01	55	55	53	-1
A4-02	56	56	54	-1
A4-03	58	58	57	-1
A4-04	59	59	58	-1
A4-05	61	61	60	-2
A4-06	63	63	61	-2
A4-07	65	65	63	-2
A5-01	52	52	52	-1
A5-02	53	53	52	-1
A5-03	53	53	52	-1
A5-04	54	54	53	-1
A5-05	51	51	49	-2
A5-06	57	57	56	-1
A5-07	57	57	56	-1
B1-01	62	62	61	-1
B1-02	63	63	62	-1
B1-03	64	64	63	-1
B1-04	64	64	62	-1
B1-05	63	63	62	-1

Receiver	Cargill-generated Noise			
	Exist 2014 [1]	Future 2025 Without Project [2]	Future 2025 With Project [3]	Difference [3] – [1]
Name	L_{den}	L_{den}	L_{den}	
	dBA	dBA	dBA	
B1-06	64	64	63	-1
B1-07	73	73	71	-3
B2-01	58	58	57	-1
B2-02	59	59	58	-1
B2-03	60	60	59	-1
B2-04	59	59	58	-1
B2-05	60	60	59	-1
B2-06	61	61	60	-1
B2-07	62	62	61	-1
B3-01	54	54	53	-1
B3-02	55	55	54	-1
B3-03	57	57	56	-1
B3-04	56	56	56	-1
B3-05	57	57	56	-1
B3-06	59	59	58	-1
B3-07	60	60	60	-1
C1-01	71	71	68	-3
C1-02	73	73	71	-3
C1-03	63	63	62	-2
C2-01	61	61	60	-1
C2-02	63	63	62	-1
C2-03	64	64	62	-2
C2-04	64	64	63	-2
C2-05	65	65	63	-2
C2-06	64	64	62	-2
C2-07	64	64	62	-3
C2-08	66	66	63	-3
C2-09	67	67	64	-3
C2-10	67	67	63	-3
C2-11	68	68	65	-3
C2-12	67	67	63	-3
C2-13	66	66	62	-3
C2-14	67	67	63	-3

Receiver	Cargill-generated Noise			
	Exist 2014 [1]	Future 2025 Without Project [2]	Future 2025 With Project [3]	Difference [3] – [1]
Name	L_{den}	L_{den}	L_{den}	
	dBA	dBA	dBA	
C2-15	64	64	61	-3
C2-16	62	62	59	-3
C2-17	62	62	59	-3

APPENDIX F CARGILL PRODUCTIVITY TRACKING LOG

Productivity Tracker			Nights	Days	Afternoons	Total	SHPD TOTAL
AVG unloads per day	88		857	911	911	2679	226,728.88
AVG mt shipped per day	7,557.63						

Name	Date	Shift	Cars Unloaded	Tonnes Shipped	Comments
Pacques/McNabb	1	Night	32	6299.115	
Troy Johnson	1	Days	33	6166.690	
Wojtowicz Jr./Leepart	1	Afternoons	37	5619.240	
			102	18,085.045	
Simington/Coulombe	2	Night	24	0.000	
Nelson/Bonar	2	Days	0	4804.300	
McGreevy	2	Afternoons	4	8994.955	
			28	13,799.255	
Simington/Coulombe	3	Night	0	0.000	
Nelson/Bonar	3	Days	21	5162.105	
McGreevy	3	Afternoons	27	7522.735	
			48	12,684.840	
Simington/Coulombe	4	Night	23	0.000	
Nelson/Bonar	4	Days	0	5081.315	
McGreevy	4	Afternoons	0	1099.850	
			23	6,181.165	
Simington/Coulombe	5	Night	14	4600.000	
Nelson/Bonar	5	Days	21	4373.605	
McGreevy	5	Afternoons	7	4494.525	
			42	13,468.130	
Pacques/McNabb	6	Night	47	3500.000	
Troy Johnson	6	Days	28	3364.660	
Wojtowicz Jr./Leepart	6	Afternoons	51	0.000	
			126	6,864.660	
Pacques/McNabb	7	Night	48	0.000	
Troy Johnson	7	Days	30	3635.340	
Wojtowicz Jr./Leepart	7	Afternoons	49	0.000	
			127	3,635.340	
Pacques/McNabb	8	Night	53	0.000	
Troy Johnson	8	Days	37	4023.175	
Wojtowicz Jr./Leepart	8	Afternoons	52	0.000	
			142	4,023.175	
Pacques/McNabb	9	Night	51	0.000	
Troy Johnson	9	Days	30	3000.000	
Wojtowicz Jr./Leepart	9	Afternoons	43	3221.170	
			124	6,221.170	
Nelson/Bonar	10	Night	21	1500.000	
McGreevy/Vigna	10	Days	36	791.950	
Coulombe/Simington	10	Afternoons	32	908.105	
			89	3,200.055	
Nelson/Bonar	11	Night	40	4900.000	
McGreevy/Vigna	11	Days	42	3700.000	
Coulombe/Simington	11	Afternoons	35	5184.815	
			117	13,784.815	
Nelson/Bonar	12	Night	43	4793.845	
McGreevy/Vigna	12	Days	52	5403.330	
Coulombe/Simington	12	Afternoons	24	5734.050	
			119	15,931.225	
Nelson/Bonar	13	Night	29	5558.595	
McGreevy/Vigna	13	Days	50	6000.000	
Coulombe/Simington	13	Afternoons	45	6452.285	
			124	18,010.880	
Johnson	14	Night	22	0.000	
Wojtowicz Jr	14	Days	35	0.000	
McNabb	14	Afternoons	42	0.000	
			99	0.000	
Johnson	15	Night	48	0.000	
Wojtowicz Jr	15	Days	23	0.000	
McNabb	15	Afternoons	45	0.000	
			116	0.000	
Johnson	16	Night	47	0.000	
Wojtowicz Jr	16	Days	47	0.000	
McNabb	16	Afternoons	44	0.000	
			138	0.000	
Johnson	17	Night	26	0.000	
Wojtowicz Jr	17	Days	36	1600.000	
McNabb	17	Afternoons	28	1499.520	
			90	3,099.520	
McGreevy/Vigna	18	Night	0	0.000	
Coulombe/Simington	18	Days	37	562.045	

Nelson/Bonar	18	Afternoons	**38**	**0.000**	
			75	**562.045**	
McGreevy/Vigna	19	Night	**46**	**3000.000**	
Coulombe/Simington	19	Days	**33**	**207.930**	
Nelson/Bonar	19	Afternoons	**33**	**6378.770**	
			112	**9,586.700**	
McGreevy/Vigna	20	Night	**18**	**0.000**	
Coulombe/Simington	20	Days	**29**	**3415.985**	
Nelson/Bonar	20	Afternoons	**39**	**0.000**	
			86	**3,415.985**	
McGreevy/Vigna	21	Night	**39**	**6500.000**	
Coulombe/Simington	21	Days	**54**	**6700.000**	
Nelson/Bonar	21	Afternoons	**38**	**4910.580**	
			131	**18,110.580**	
Wojtowicz Jr./Leepart	22	Night	**40**	**7400.000**	
Pacques/McNabb	22	Days	**39**	**6500.000**	
Troy Johnson	22	Afternoons	**20**	**6765.040**	
			99	**20,665.040**	
Wojtowicz Jr./Leepart	23	Night	**16**	**4100.000**	
Pacques/McNabb	23	Days	**33**	**4829.625**	
Troy Johnson	23	Afternoons	**30**	**4391.855**	
			79	**13,321.480**	
Wojtowicz Jr./Leepart	24	Night	**39**	**3600.000**	
Pacques/McNabb	24	Days	**19**	**2295.920**	
Troy Johnson	24	Afternoons	**0**	**0.000**	
			58	**5,895.920**	
Wojtowicz Jr./Leepart	25	Night	**0**	**0.000**	
Pacques/McNabb	25	Days	**0**	**0.000**	
Troy Johnson	25	Afternoons	**0**	**0.000**	
			0	**0.000**	
Simington/Coulombe	26	Night	**0**	**0.000**	
Nelson/Bonar	26	Days	**0**	**0.000**	
McGreevy	26	Afternoons	**0**	**0.000**	
			0	**0.000**	
Simington/Coulombe	27	Night	**29**	**0.000**	
Nelson/Bonar	27	Days	**47**	**3151.620**	
McGreevy	27	Afternoons	**44**	**3824.880**	
			120	**6,976.500**	
Simington/Coulombe	28	Night	**0**	**0.000**	
Nelson/Bonar	28	Days	**40**	**2807.440**	
McGreevy	28	Afternoons	**40**	**0.000**	
			80	**2,807.440**	
Simington/Coulombe	29	Night	**7**	**0.000**	
Nelson/Bonar	29	Days	**21**	**473.290**	
McGreevy	29	Afternoons	**28**	**0.000**	
			56	**473.290**	
Wojtowicz Jr./Leepart	30	Night	**21**	**0.000**	
Pacques/McNabb	30	Days	**22**	**5924.625**	
Troy Johnson	30	Afternoons	**36**	**0.000**	
			79	**5,924.625**	
Pacques/McNabb	31	Night	**34**	**0.000**	
Troy Johnson	31	Days	**16**	**1689.820**	
Wojtowicz Jr./Leepart	31	Afternoons	**0**	**0.000**	