COLUMBIA CONTAINERS NEW GRAIN TRANSLOADING FACILITY AND SILOS REBUILD PROJECT

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

PREPARED FOR:

COLUMBIA CONTAINERS LTD.

MARCH 2015

REVISION 4

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COLYN CLAY

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EXECUTIVE SUMMARY

BKL Consultants Ltd. (BKL) has conducted an environmental noise impact assessment for the proposed Columbia Containers New Grain Transloading Facility and Silos Rebuild Project (the Project) on Port Metro Vancouver's south shore. The Project includes the construction of nine silos (three 300-metric-tonne (MT) silos, one 1200 MT silo, two 1400 MT silos, and three 2900 MT silos) with associated distribution and dust-filtration equipment to increase the facility's capacity from ~ 735,600 MT of product per year to 750,000 MT of product per year and to relocate its facilities to accommodate the South Shore Corridor Improvement Project (SSCIP) road and rail expansion. 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.

The objectives of this study were to carry out noise measurements at nearby residential receptors, perform site measurements of significant Columbia Containers (CC) 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.

An environmental noise study was previously completed in this area by BKL in 2011. However, further work was required since this study did not assess truck traffic within the site or fan noise. The future scenario did not include the new CC facilities such as the new railcar dumper building, the expansions to existing rail tracks, the new container loading facility, the nine replacement silos, and the associated dust-collection and conveyor systems. It is understood that PMV's goal for tenant-led projects such as this is to demonstrate that future noise levels will not be higher than existing noise levels and that terminal operators incorporate continuous improvements to reduce noise impacts to the community. This study compares future noise levels with 2015 baseline noise levels.

For analysis purposes, residences to the south of CC are organized into five enclaves (groups) of houses. Although noise levels have been predicted for each residence within each enclave, noise modelling results are presented in this report as average values for each group. Predictions made for CC-generated noise show a net decrease, on average, for all five housing enclaves. The average Total Noise is predicted to stay the same, or to decrease, for the five housing enclaves.

For context, and to help understand noise metrics; 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 only 1 dB is difficult to recognize subjectively, even if it occurs abruptly.

The predicted CC-generated noise with the Project decreases due to improved operational efficiency leading to an expected reduction in operating hours during the night and on weekends and CC's low noise initiatives incorporated into the Project. These initiatives include extensively cladding the conveyor system, locating the dust-collection fans away from nearby residences and providing additional self-screening within the property (e.g. silos).

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List of Abbreviations and Acronyms

Abbreviation/Acronym	Definition
ANSI	American National Standards Institute
BATNEEC	Best Available Techniques Not Entailing Excessive Cost
BC	British Columbia
BKL	BKL Consultants Ltd.
CC	Columbia Containers Ltd.
CFM	cubic feet per minute
CP	Canadian Pacific Railway Ltd.
dB	decibel
dBA	A-weighted decibel
EA	environmental assessment
EC	European Commission
EU	European Union
Hz	hertz
km	kilometre
km/h	kilometres per hour
L_d	daytime (7 am to 10 pm) equivalent sound level
L_e	evening (7pm to 11 pm) equivalent sound level
L_{den}	day-evening-night equivalent sound level
L_{dn}	day-night equivalent sound level
L_{eq}	equivalent sound level
L_n	nighttime (10 pm to 7 am) equivalent sound level
m	metre
MT	metric tonne
MTPA	metric tonnes per annum
PMV	Port Metro Vancouver
the Project	Columbia Containers New Grain Transloading Facility and Silos Rebuild Project
s	second
SSCIP	South Shore Corridor Improvement Project
SWL	sound power level
TEU	twenty-foot equivalent unit

1 INTRODUCTION

BKL Consultants Ltd. (BKL) has been retained by Columbia Containers Ltd. (CC) to provide an environmental noise impact assessment for the proposed Columbia Containers New Grain Transloading Facility and Silos Rebuild Project (the Project).

A Project Review Application Form was submitted to Port Metro Vancouver (PMV) on November 11, 2014. It describes the project rationale, existing conditions, proposed changes to systems, operations and environmental controls. This report provides a detailed assessment of environmental noise attributable to the Project based on the latest available information.

In 2011, an environmental noise study was performed by BKL in this area for CC as part of the Port Metro Vancouver (PMV) permitting process for the earlier Phase I portion of the Project.

CC's current proposal (Phase II) includes the construction of a new grain transloading facility (elevator and railcar dumper building) that will unload grain from railcars, and load ocean containers and trucks. Nine new grain silos to replace silos removed in 2008 will be constructed. Existing rail tracks on the site will be realigned, and yard loading trucks will be rerouted so that they no longer need to transit along Commissioner Street. This scope of this report assesses two conditions: pre-Project (2014 Baseline, which is post Phase I works), and post-Project (following completion of Phase II works, operating at predicted 2030 levels).

Baseline noise level measurements were carried out over a week in January 2015. These have been compared with the measurements made in the original 2011 study. Input data for rail and road traffic from the South Shore Corridor Improvement Project (SSCIP) have been used in this study. These volumes were provided by PMV (Delcan & AECOM 2011) for 2010 and 2030.

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 Project-generated noise is expected to increase the community noise levels.

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 CC facility is located on the south shore of Burrard Inlet, at 2525 – 2775 Commissioner Street, Vancouver, BC, within PMV lands. It is serviced by Canadian Pacific (CP) Railway. Figure 2.1 (next page) shows its location on Burrard Inlet, and Figure 2.2 shows a plan view of the nearby roadways and residences to the south.

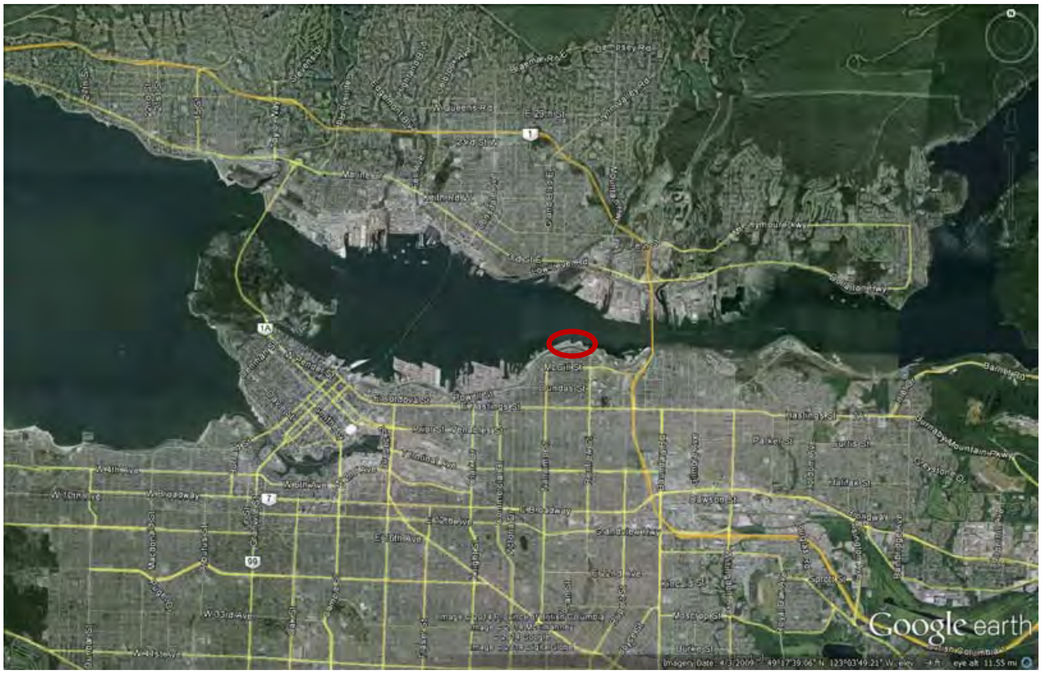

Figure 2.1 Columbia Containers Location on Burrard Inlet

Figure 2.2 Columbia Containers Highlighted next to Nearby Roadways and Residences

The 2014 regular scheduled hours of operation were 6 am to 2 am, Monday through Saturday, with an annual average processing of 25 railcars per day. To meet peaks in customer demand, operations extended to 24 hours per day, 7 days per week, from time to time. During 2014, CC was in operation all weekdays (261 days), all Saturdays, and some Sundays (82 weekend days in total).

With the added efficiencies of the Project, the anticipated proposed schedule will be Monday to Friday, 6 am to 10 pm, with no overtime required.

The grain throughput for the baseline year of 2014 was 735,593 metric tonnes per annum (MTPA). With the Project, CC will be able to handle up to 750,000 (MTPA).

The Project will feature an improved grain receiving system and new handling processes that will reduce locomotive switching and yard activity.

Phase I works (completed in 2012) included the following upgrades

- raising the grade of the old fisheries site (west yards) to match the surrounding grade;
- installing new rail tracks capable of storing over 20 railcars per switch (previous capacity was eight railcars per switch); and
- relocating the rail crossing to the west to reduce the number of daily rail deliveries.

Phase II (proposed) will include the following improvements

- The existing workshop, secondary scale, over 100 containers currently used as storage, conveyor and storage area buildings (old infrastructure that is no longer needed) will be removed to accommodate the Project and allow for the SSCIP road and rail expansion.
- The grain loading pit will be relocated on site. This will include excavating the new pit, installing sheet piles and adding a temporary dewatering area.
- A modern, efficient and compact transloading facility will be constructed at a new location slightly north (toward the water) and west of CC's current, aging grain elevator, which will be replaced. The new facility will feature
  - modern grain dust–suppression systems
  - a new railcar dumper building, with tandem in-ground unloading pits and tandem access tracks; and
  - a new container loading facility, with a tandem bucket elevator and capacity to load up to four ocean containers at a time.
- Nine grain storage silos (three 300-metric-tonne silos, one 1200 MT silo, two 1400 MT silos, and three 2900 MT silos) will be installed to the east of the new transloading facilities. The silos will be fully enclosed and dust-tight to prevent grain from entering the environment.
- A new fully enclosed, electric conveyor network will be constructed. It will connect the grain loading pit to the storage silos. Grain will move from the railcar dumper pits via the elevators to the silos (or direct to trucks). Underground conveyors will move grain back from the silos to the container loading facility for loading onto trucks.
- Rail tracks will be realigned and expanded to access the new dumper building. They will be relocated slightly to the north.
- The number of trucks on Commissioner Street will be reduced. With the reorganization of the site, CC trucks will no longer need to leave the property when filling containers.
- There will be fewer operations during the night (after 10 pm) and on the weekends.

Figure 2.3 shows examples of similar facilities that are metal clad (as is proposed for CC), and open.

Figure 2.3 Image of Metal Clad (left) and Open (right) Loading Facilities

2.1 Low Noise Initiatives

Noise mitigation measures have been incorporated into the Project design. These include

- rerouting loading trucks so they will no longer need to transit along Commissioner Street (they will be able to use the internal roadways at CC, making their trips shorter);
- installing an automated dust-collection system, which keeps fan size requirements to a minimum;
- locating new dust fans with silencers to the north side of the buildings, which will provide self-screening to the community south of the site;
- locating new railcar indexers so they are partially screened by the silos;
- fully enclosing all motors with sheet-metal cladding;
- constructing underground or sheet-metal-cladded conveyors; and
- locating silos to screen community from rail activities and some truck activities (where practical).

3 STUDY OBJECTIVES

The objectives of this study were to

- perform baseline community noise measurements at residential receptors;
- evaluate existing noise conditions at potentially affected residential receptors within the community;
- perform site measurements of significant CC noise sources;

- construct a noise model for the purpose of predicting community noise levels with and without the Project;
- compare predicted noise levels with and without the Project and to quantify the significance of any noise increases in terms of the annual average day-night level (L_{dn}) including any necessary adjustments for tonal or impulsive noise[1]; and
- provide mitigation options to address significant noise effects where necessary.

Construction noise does not form part of the current study.

4 ASSESSMENT CRITERIA

4.1 PMV Noise Impact Criteria

PMV has indicated that noise mitigation should be implemented so that there is no net increase in noise level in neighbouring residential communities. Disregarding this Project, the Total Noise in the neighbouring residential communities near CC is expected to increase by 2030, because rail and road traffic volumes are predicted to increase along the south shore corridor (BKL 2012). This objective would be met if CC-generated noise is not predicted to increase in the future.

Noise has been quantified using the annual average day-night sound level, or L_{dn}. The annual average L_{dn} is the required metric to predict the long-term annoyance response of a community (ANSI 2005). The predicted L_{dn} includes any necessary adjustments for tonal or impulsive noise as required by the ANSI standard to reflect the fact that impulsive noises (e.g., railcar shunting) and tonal noise (e.g., backup alarms on mobile equipment) are more intrusive and potentially more annoying than other types of noise. It also includes a correction for daytime noise on weekends, as per ANSI.

CC-generated noise is defined as noise sources that can be controlled by CC (i.e., CC rail activities, CC truck movements, CC product handling equipment, CC mechanical equipment, any sound reflecting off existing and proposed CC buildings). It also includes CP noise associated with collection and delivery of railcars to CC (although the timing of these activities is controlled by CP). It does not include CP-generated rail noise along the main line or road traffic noise along Commissioner Street. Noise generated by CC trucks driving along the section Commissioner Street in front of CC as part of their loading and unloading operations in the pre-Project scenario is included as CC-generated noise.

If the PMV criterion is met, average future noise levels will not be significantly higher than the future noise levels with the future south shore corridor rail and road traffic volumes, and the

[1] An annual average metric is appropriate since the demonstrated correlation between L_{dn} and community disturbance is based on long-term noise exposures. For a definition of L_{dn} and adjustments to L_{dn}, see Appendix A: Glossary.

potential effects from continuous noise on sleep disturbance, interference with speech communication and annoyance will not increase relative to future conditions without the Project.

Appendix B describes the metrics used in this assessment, as well as the noise adjustments applied for daytime weekend, tonal and impulsive noise.

4.2 Municipal Criteria

Although port lands are under federal jurisdiction, limits from the City of Vancouver (CV) Bylaw No. 6555, "A Bylaw to control noise or sound within the City of Vancouver" (2014), have been referenced for information. CC is located in zone CD-1 (258), which is an "activity zone," and the residential areas are in "quiet zones." The relevant sections of the bylaw are included in Table 4.1 below, along with a summary of the noise level limits. According to sections 6 and 7 of the bylaw

> *[no] person shall in an activity zone or an event zone make, cause or permit to be made or caused continuous sound the sound level of which:*
>
> > *(a) during the daytime exceeds a rating of 70 on an approved sound meter when received at a point of reception within an activity zone or an intermediate zone, or 60 on an approved sound meter when received at a point of reception within a quiet zone; or*
> >
> > *(b) during the nighttime exceeds a rating of 65 on an approved sound meter when received at a point of reception within an activity zone or an intermediate zone, or 55 on an approved sound meter when received at a point of reception within a quiet zone.*
>
> *No person shall in an activity zone, an intermediate zone, event zone or a quiet zone make, cause, or permit to be made or caused non-continuous sound the sound level of which during the daytime exceeds a rating of 75 on an approved sound meter, or during the nighttime exceeds a rating of 70 on an approved sound meter when received at the point of reception.*

Table 4.1 City of Vancouver Noise Bylaw Limits for Noise from Activity Zones to Quiet Zones (2014)

	Continuous Sound	Non-Continuous Sound
Daytime	60 dB(A)	75 dB(A)
Nighttime	55 dB(A)	70 dB(A)

According to CV (2014), "continuous sound" is defined as "any sound occurring for a duration of more than three minutes, or occurring continually, sporadically or erratically but totalling more than three minutes in any 15 minute period of time." The point of reception would be "a point in a lane or street, adjacent to but outside of the property occupied by the recipient of the noise or sound, that represents the shortest distance between that property and the source of noise."

4.3 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 can be used to minimize the noise impact.

The low noise initiatives that CC has incorporated into the Project design have been developed following the BATNEEC approach. For example

- an automatic dust-collection system will be used to keep the fan size and associated equipment noise to a minimum;
- where feasible, noise sources have been located so they are screened by silos and buildings; and
- additional enclosures will be used to block noise sources, e.g. enclosures for motors.

Please refer to Section 2.1 for further details.

5 EXISTING ENVIRONMENTAL CONDITIONS

5.1 Baseline Noise Monitoring

This noise impact assessment has made use of data collected for CC on from 5 pm on Wednesday, January 21, 2015, to 4 pm on Wednesday, January 28, 2015. Data from full 24 hour periods (Thursday – Tuesday) are listed in Table 5.1. These measurements were compared with data collected from August 16 – 19, 2011, along the south shore corridor to assist in establishing the pre-Project noise exposure levels at potentially affected receptors (BKL 2011). Additional measurements referred to in the 2011 assessment for 2005 are also included for reference. All measurements are summarized in Table 5.1. Noise monitoring locations are shown in Figure 5.1. Evening (7 pm – 11 pm) equivalent sound levels (L_e) and L_{den} have been included for the 2015 measurements. The L_d and L_n values are unadjusted and the L_{dn} and L_{den} values incorporate adjustments for evening, night and weekend noise but not for annoying characteristics from tones or impulses. Detailed definitions for noise metrics can be found in Appendix A.

Table 5.1 Summary of Noise Monitoring Results

Measurement Date	Day of the Week	L_{dn} (dBA**)	$L_{d,\ 15hrs}$ (dBA)	$L_{n,9hrs}$ (dBA)	L_{den} (dBA)
Baseline Site 1 - 2615 Wall Street					
Jan. 22, 2015	Thursday	72	64	65	71
Jan. 23, 2015	Friday	69	65	62	69
Jan. 24, 2015	Saturday	68	63	58	68
Jan. 25, 2015	Sunday	67	58	60	66
Jan. 26, 2015	Monday	67	65	59	67
Jan. 27, 2015	Tuesday	70	64	63	70
Jan 22 - 27, 2015	Thursday - Tuesday	69	64	62	69
Aug. 16 - 17, 2011	Tuesday–Wednesday	68	64	61	-
Aug. 17 - 18, 2011	Wednesday–Thursday	67	64	60	-
Aug. 18 - 19, 2011	Thursday–Friday	72	64	65	-
Sept. 22 - 23, 2005*	Thursday–Friday	67	63	60	-
Baseline Site 2 - 2709 Wall Street					
Aug. 17 - 18, 2011	Wednesday–Thursday	72	66	65	-
Aug.18 - 19, 2011	Thursday–Friday	75	65	69	-
Baseline Site 3 - 2827 Wall Street					
Jan. 22, 2015	Thursday	74	69	67	73
Jan. 23, 2015	Friday	74	68	67	74
Jan. 24, 2015	Saturday	73	66	65	73
Jan. 25, 2015	Sunday	72	63	65	71
Jan. 26, 2015	Monday	72	69	65	72
Jan. 27, 2015	Tuesday	72	69	65	72
Jan. 22 - 27, 2015	Thursday - Tuesday	73	68	66	73
Aug. 17 - 18, 2011	Wednesday–Thursday	71	65	64	-
Aug. 18 - 19, 2011	Thursday–Friday	74	65	68	-
Sept. 21 - 22, 2005*	Wednesday–Thursday	70	64	63	-
Sept. 22 - 23, 2005*	Thursday–Friday	71	66	64	-

* Data obtained from Wakefield (2006)
** dBA: A-Weighted Sound Pressure Level (See Appendix A)

Figure 5.1 Baseline Noise Measurement Locations

The 2015 measurements were conducted using Brüel & Kjær Type 2250 sound level meters, both of which meet the Type 1 specifications in ANSI S1.4:1983. The sound level meters were field calibrated before and checked after each measurement.

The purpose of these measurements was to provide some insight into existing (pre-Project) noise levels within potentially affected communities. The CC site 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.

Figure 5.2 and Figure 5.3 illustrate the variation in noise level with measurement location from 2005 until 2015 for Baseline Sites 1 and 3. The L_{dn}, L_d, and L_n are in the same range in 2015 as they were in the 2011 measurements. This seems to indicate that the Total Noise exposure received at Baseline Sites 1 and 3 remains largely unchanged between 2011 and 2015. Noise levels at Baseline Site 3 do appear to have increased (by ~ 1–4 dB) from the 2005 measurements.

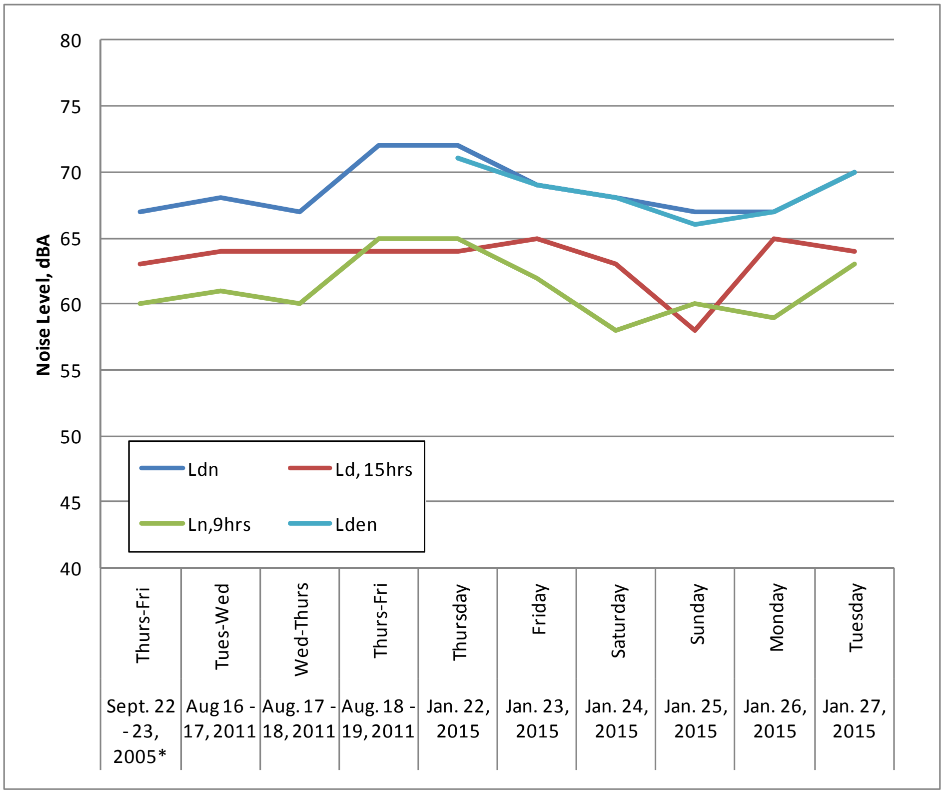

Figure 5.2 Summary of Measurements at Baseline Site 1

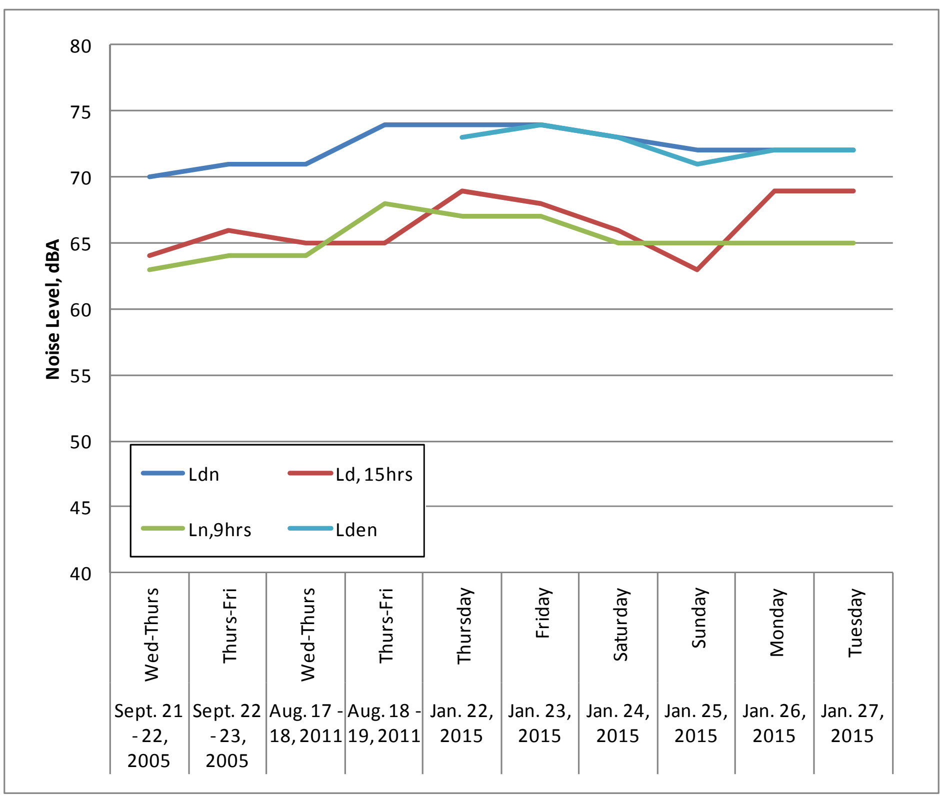

Figure 5.3 Summary of Measurements at Baseline Site 3

Analysis of the data revealed that day-night average sound levels (L_{dn}) were mostly dependant on heavy truck movements and rail activity. Day-to-day variability in the overall noise exposure received at these locations was more heavily dependent on rail activities. High noise levels (e.g. where the $L_{Aeq,1s}$ exceeded 90 dB) were caused by rail activities (e.g. rail passbys) and occurred more frequently at Baseline Site 3.

Noise levels at Baseline Site 3 were higher than those received at Baseline Site 1 due to higher volumes of accelerating and decelerating heavy trucks (this location is closer to the gates) and a closer proximity to CC dumper building (location of the dust fan and alarm). Rail noise levels at these locations also appear to be higher than levels received at Baseline Site 1, presumably due to accelerating and decelerating trains responding to a nearby track signal.

CC reported that, between Thursday – Tuesday, the average daily throughput was 2,237 MT, higher than the average of 2,015 MT per day in 2014. Over the weekend, there were some issues with CP services, and activity was a bit slower. Due to these issues, more of CP's deliveries and collections had to occur during the day rather that at night, which was not typical of 2014 activities.

CC confirmed that the most representative days were at the start of the measurement week. A comparison of Thursday, January 22, 2015, with the 2014 averages indicated very good correlation in terms of typical activities. Although the exact type/distribution of activities on this day was slightly different from the 2014 average, the overall level of activity was similar (or slightly busier). The throughput on this day was 2,434 MT. The following summarizes CC's notes:

- CP deliveries/collections: on January 22, these took place during the night as was typical for 2014. On January 22 it was a bit quicker (~20 minutes) than the 2014 average (~30 minutes).
- 24 railcars were delivered on January 22 (and 23 railcars collected), compared with 25 railcars delivered and collected per day in 2014.
- There were slightly more shuttle wagon movements on January 22 during the daytime period (approx. 68 minutes, compared with 51 minutes on average for 2014) and during the night (approx. 34 minutes compared with 17 minutes on average for 2014). The evening was noted to be the same as 2014.
- Switches: there were 15 impulsive events on January 22, compared with 14 on average in 2014.
- Slightly more time was spent unloading railcars in the dumper building: approximately 396 minutes during the daytime, compared with 330 minutes during the daytime in 2014. Evening and nighttime durations were noted to be the same as 2014.
- More 'outside' trucks accessed CC: there were a total of 141 trucks on January 22, compared with 110 trucks on an average day in 2014. The distribution was more heavily weighted to the day on January 22 than in 2014 (118/11/12 outside trucks for day/evening/night on January 22, compared with 55/34/21 in 2014).
- More 'inside' truck (figure-8) movements within the site: on January 22, the number of movements for day/evening/night was 36/18/6, compared with 27/9/9 on an average day in 2014.
- The number of containers moved within the site was very similar: a total of 282 containers were moved on January 22, compared with 270 per day in 2014. The proportion of

daytime activity was greater on January 22 compared with the average for 2014. The day/evening/night split on January 22 was 216/30/36, compared with 2014 which was 162/54/54.

- Following from the previous point, the corresponding time spent stuffing containers, and loading/unloading containers onto trucks, was also higher on January 22 than on an average day in 2014.
- The dust fan was in operation for one additional hour at night the same times as in 2014 (standard 20 hour shift, from 6am to 2am, plus 5am – 6am).
- The alarm was operating slightly longer: typically 36 minutes during the daytime, compared with 30 minutes per day in 2014. The duration of the alarm during the evening and nighttime periods was noted as the same as in 2014.
- The distribution of activities to the east / west parts of the site were similar to what took place in 2014.

Noise levels measured on January 22, 2015 were at the upper end of what was measured in 2011. For further details on the activity at CC during the measurement week, see 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 4.3. 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. Best practice described in the *Good Practice Guide on Port Area Noise Mapping and Management* (NoMEPorts 2008) has been followed.

ISO 9613 describes a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise 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. It has been used to predict noise transmission from mechanical equipment and rail operations within CC, CP Rail through-traffic and road traffic on Commissioner Street.

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.

The Dutch SRM II is the EC preferred rail prediction model. It calculates levels in octave band widths and splits the source into as many as five sub-sources, located at different heights depending on the type of train specified.

Two orders of sound reflection were used in the noise model. 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.[2] 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, future growth in road and rail traffic, and future improvements to the south shore corridor. The proposed scenarios are listed and described in Table 6.1 (next page).

[2] 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.

Table 6.1 Noise Modelling Scenarios

No.	Noise Scenario	Throughput	Description of Scenario
1	2014 Pre-Project	735,593 tonnes per annum	This is the scenario that currently exists (post Phase 1 works). Rail and road traffic volumes were provided by PMV for the 2014 yearly average. Details of CC's activities have been provided by CC.
2	2030 Without Project	735,593 tonnes per annum	This is a hypothetical scenario that includes the 2030 rail and road traffic volumes as provided by PMV for the SSCIP. With realignment, Commissioner Street now overlaps with the existing railcar dumper building. In other words, in the model, a small section of road "enters" the building. This is not physically realistic; however, it has been modelled this way so the without-Project scenario can be compared with the 2030 with-Project scenario. Operations at CC are the same as in 2014.
3	2030 With Project	750,000 tonnes per annum	This is similar to [2] 2030 Without-Project scenario, but it accounts for the changes in noise associated with the increased efficiencies created by the Project.
4	2030 With Project and Mitigation	750,000 tonnes per annum	If required, this scenario will be the same as the [3] 2030 With-Project scenario, with CC operating at 750,000 tonnes per annum, but with additional mitigation measures included, as necessary.

6.3 Geometric Data

6.3.1 Spatial Boundaries

The study area includes all residential receptor locations that could potentially be affected by the proposed Project. These residences include 2357 Wall Street (shown as R1-01 in Figure D1, Appendix D) to the new residential buildings at 2903 Wall Street (shown as the R5 Receiver Group in Figure D1, Appendix D).

For analysis purposes, residences are organized into five enclaves (groups) of houses as shown in Figure D1 of Appendix D. Although noise levels have been predicted for each individual residence within each enclave, noise modelling results are presented in this report as average values for each group. CC-generated noise in other areas of Vancouver is likely to be masked by other community noise sources.

6.3.2 Topography

The intervening terrain has been modelled by directly importing two metre interval ground contours which were used in the SSCIP.

The layout and dimensions of the new buildings, replacement silos, and revised track alignments, were incorporated into the model based on drawing details provided by Nu-Westech. Truck routing was confirmed by CC. Orthophotos from the City of Vancouver's GIS website 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 5 m 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 CC 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 CC's buildings and equipment were incorporated into the model based on drawings and details provided by CC, Nu-Westech, Hemmera, and observations and measurements made on site.

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

6.4 CC Noise Sources

Sound pressure level measurements were taken on the CC site in 2011 in most of the operational areas. Further measurements were taken out in 2014 to include additional equipment not measured in 2011 (e.g., the dust-collector fan). These measurements were used to predict the sound power levels (*SWLs*) of equipment items and operations that have the potential to affect the noise level at nearby and distant receptors.

*SWL*s for items of equipment and operations that are part of the Project were estimated based on information provided by CC, extrapolation of the data measured on site and other measurements of similar equipment conducted by BKL.

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 D8, D9, and D10 in Appendix D.

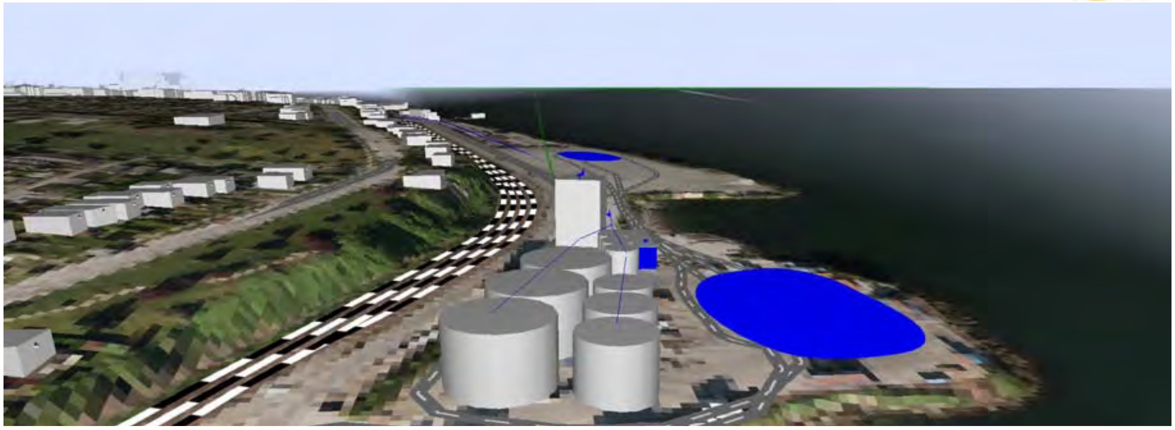

Figure 6.1 3D View of Cadna/A Noise Model

6.4.1 Ventilation Fans

The most significant ventilation fans at CC are the bag-house dust-collector fans. The following fan noise sources were incorporated into the noise models for the existing and future scenarios:

- one bag-house fan located at the south face of the existing railcar dumper building (will be removed with the Project);
- one bag-house fan located at ground level to the north of the new container loading facility (present in the with-Project scenario); and
- one bag-house fan located on northeast corner of the roof of the new railcar dumper building (present in the with-Project scenario).

Sound measurements of the existing fan were taken and the calculated sound power was used in the 2014 scenario.

Fan sound power level data for the future bag-house fans and the proposed silencers were provided by Nu-Westech and are listed in Appendix C for reference.

Twelve small 5-HP fans will be used to ventilate the silos. Two will be located at a low level on the six larger silos. These will be very small fans and are not considered significant noise sources. They have not been included in the modelling.

6.4.2 Conveyor Systems

There are currently no silos and no associated conveyor systems included in the 2014 Baseline. A small conveyor associated with the little-used System II loading facility was not modelled. The System II loading facility was made redundant partway through 2014. CC confirmed that this was rarely used in 2014, and it has not been included in this modelling work.

For the with-Project scenario, the new conveyor system and its associated drive motors were modelled as line sources and point sources. Locations and geometry of the conveyors were modelled according to detailed drawings received from Nu-Westech. The per-metre SWLs were calculated based on measurements that BKL performed on conveyors at a similar site, and these were applied to all conveyors. Similarly, drive motors were modelled based on measurement data at a similar site and scaled according to power rating differences. Duty cycles and sound power levels for each source are summarized in Appendix C.

6.4.3 Existing Railcar Dumper Building, New Railcar Dumper Building, and New Container Loading Building

Pre-Project, the railcar grain unloading occurs at one pit in the existing railcar dumper building. Container stuffing also takes place in this building. With the Project, railcars will be unloaded in two tandem pits in the new railcar dumper building, and containers will be stuffed in the new container loading building, where up to four containers can be stuffed at a time.

Each of these buildings is constructed of corrugated metal and is open at either end for railcar and/or truck access. The buildings have several noise sources, some continuous (e.g., ventilation), and some intermittent (e.g., railcar indexing, elevator movement, container stuffing). The sources have been modelled as point sources, and vertical area sources to represent the large door openings on the east and west sides of the buildings, as appropriate. They have been divided into separate sources where required in order to model the appropriate durations and also to apply the required penalties (e.g., 5 dB for the alarm noise).

6.4.4 Truck Activities

CC operates two "inside" trucks, which circle the yard in a Figure-8 loop, collecting empty containers to be stuffed, and dropping off full containers for storage on site.

Due to space restraints within the site, pre-Project these trucks drive down a section of Commissioner Street. With the Project, this Figure-8 loop will be fully contained in the CC site.

"Outside" trucks collect and deliver containers to CC.

6.4.5 Loading and Unloading of Containers onto Trucks

For both pre-Project and with-Project scenarios, containers are loaded and unloaded onto trucks just north of the railcar dumper building in Yard 1 and also to the west, in Yard 3. These have been modelled as area sources spanning the range of the site where these activities took place.

6.4.6 Rail Yard

The CC rail yard has been modelled using line sources positioned to distribute the noise throughout the rail yard appropriately. These sources represent the CC-generated rail noise, including CP railcar deliveries.

Noise sources associated with the delivery and collection of railcars by CP and the unloading and loading of these railcars at CC were modelled as continuous line sources spanning the track. The operating times of the line source describing the delivery and collection of railcars by CP pre-Project and with-Project are described in Appendix C.

CC prefers for railcars to be picked up during the day; however, CP sets the times for delivery and collection. In 2014, deliveries and collections typically occurred during the night.

A line source was used to describe the continuous manoeuvring of the railcars with the shuttle wagon. Due to the increased number of railcars processed, there will be an increase in manoeuvring within the site as detailed in Appendix C.

An alarm system is used when the rail indexer advances the railcars through the railcar dumper building. Noise from this activity was modelled as a separate source in order to apply a penalty to this source in accordance with the ANSI standard (2005).

The duration of each of these activities and the split between day/night hours have been provided by CC and are listed in Appendix C.

6.4.7 Rail Shunting

CC's current facility has three tracks, each with a capacity of over 20 railcars. The track capacity will remain the same with the Project. CC can currently unload up to five railcars at a time; with the Project, the facility will be able to unload up to seven railcars at a time.

Shunting noise at CC was modelled along the rail tracks between the unloading shed and the site entrance. The number of impulsive shunting events was provided by CC for the delivery and collection of railcars by CP, and for the emptying of railcars. This information is summarised in Table 6.2. The line sources used in the model, which were based on BKL measurements, were calibrated to reflect the values in Table 6.2.

Table 6.2 CC-Generated Rail Impulse Events Summary

Impulsive Events/Day following Unloading				Impulsive/Day from Rail Deliveries/Pickups			
2014		2030		2014		2030	
DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
6	0	9	1	0	8	0	8

6.4.8 Noise Reflections off the CC Buildings

While the large CC buildings themselves are not significant noise sources, they will have an effect on the noise received at residences due to noise reflections. For this reason, the portion of noise from non-CC noise sources (including traffic from Commissioner Street and CP rail) that reflects off CC buildings is considered to be CC noise.

The corrugated metal–clad CC buildings have been modelled with a reflection loss of 1 dB. In addition, the silos have been modelled as cylinders to accurately depict the spread of reflections.

6.5 Non-CC Noise Sources

Noise from rail traffic on the CP main line, and road traffic on Commissioner Street and Wall Street have been included in the noise model. Sound power levels of these sources were derived using information from the SSCIP. Detailed noise source tables can be found in Appendix C.

6.5.1 CP Rail

The CP main line that services the area has been included in the noise model. Noise characteristics of these sources were taken from the SSCIP noise model.

Existing Rail Noise

Existing rail noise was modelled by calibrating the sound emission of a single track running through the south shore corridor to measured data collected at residential receptor locations along the corridor. Specifically, daytime (L_d) and nighttime (L_n) rail noise emissions were calibrated to measurements performed at Baseline Sites 1 and 3 in January 2015.

Future Rail Noise

The methodology used to predict the increase in noise due to rail activity for the SSCIP has been applied here and has been repeated in this section for ease of reference.

Noise from heavy rail is proportional to the average daily volume of trains operating along the main rail tracks. If container capacity and grain tonnage increase in the future, then an increased number of trains and/or longer trains would be required to transport the additional goods. As such, rail noise is directly proportional to the number of containers (measured as twenty-foot equivalent units or TEUs) and grain cars (tonnage) that are transported to and from terminals along the south shore corridor. The following relationship has been used to estimate increased rail noise levels:

Rail noise level increase in dB = 10log(increased volume/original volume)

Rail noise increases were estimated based on Delcan & AECOM's traffic growth forecast for 2010 to 2030 (BKL 2011). Table 6.3 (next page) summarizes estimated 2010 and future 2030 rail TEUs for Vanterm and Centerm. The table also provides existing tonnage and estimated future tonnage for Pacific Elevators and Alliance Grain.

Table 6.3 Estimated 2010 and Future 2030 Container Capacity and Grain Tonnage

Containers	**Estimated Rail TEUs (2010)**	**Estimated Future Rail TEUs (2030)**	**Percentage Increase in Rail TEUs 2030 over 2010**	**Predicted Container Rail Noise Increase(dBA)**
Vanterm	300,000	642,000	114%	3
Centerm	251,450	481,250	91%	
Grain	**Estimated Tonnes (2010)**	**Estimated Future Tonnes (2030)**	**Percentage Increase in Tonnage 2030 over 2010**	**Predicted Grain Rail Noise Increase (dBA)**
Pacific Elevators & Alliance Grain	4,300,000	5,700,000	33%	1

The overall sound power of the calibrated rail noise source, which includes both grain and container related sources, was increased by 3 dB to provide an initial prediction of the 2030 noise environment. This assumption was made since the rail share between container rail activity and grain-related rail activity is unknown. The modelled noise increase of 3 dB is considered to be conservative since this assumes that future rail shipments of grain will increase in proportion to the future shipment increases of container cars. As shown in Table 6.3, future 2030 tonnage is not predicted to increase in the same proportion as future 2030 TEUs.

6.5.2 Road Traffic

Road traffic volumes for 2010 and projected 2030 road traffic volumes for Commissioner Street were provided by Port Metro Vancouver (Delcan, AECOM, 2011) for the SSCIP. These volumes have been used in this study as well.

Road traffic volumes in 2010 are assumed to be the same as in 2014. If there was a difference in volume between these four years, it would have to be by at least 25 per cent to change the noise level by 1 dB. A 25 per cent change is considered highly unlikely. The January 2015 community noise measurements have been checked against the predicted noise levels and good agreement was found.

The road traffic volumes used in this assessment assume that all inbound trucks enter via McGill Street. Table 6.4 summarizes the two-way daily road traffic volumes for Stewart Street and Commissioner Street for 2010 and the future 2030 scenario.

Table 6.4 Summary of 2010 and Projected 2030 Two-Way Road Traffic Volumes for Commissioner Street

Road	Segment	Daily Two Way 2010 Road Traffic Volume		Projected Daily Two Way 2030 Road Traffic Volume	
		Day	Night	Day	Night
Commissioner St	Victoria Dr to McGill St	3556	412	4735	531

Road traffic along Wall Street was also included (input levels from SSCIP [BKL 2012]).

6.6 Source Level Adjustments for Tonal or Impulsive Noise

ANSI S12.9-2005/Part 4 (2005) requires that adjustments be applied to certain types of noise and noise occurring at certain times in order to better predict the long-term community. The relevant adjustments used were a 5 dB adjustment for tonal noise (e.g., alarm noise), a 12 dB adjustment for highly impulsive noise (e.g., shunting), a 10 dB adjustment for nighttime noise and a 5 dB adjustment for daytime weekend noise.

We are not aware of any equipment that has or will have predominant tonal qualities during normal operation, other than the alarm used in the rail dumping shed when the railcars advance. For their future facility, CC is investigating alternative warning systems, for example, strobe lights. We have taken a conservative approach and assumed the future warning system will use alarms. No other adjustments for tonal noise have been used in the modelling.

The ANSI standard (2005) refers specifically to railcar shunting as a "highly impulsive" noise source, so the required 12 dB adjustment (increase) has been applied to this source. This adjustment is only applied 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_{dn}, even after the 12 dB adjustment has been applied.

The required 10 dB nighttime adjustment has been applied in the modelling to all noise that occurs between the hours of 10 pm and 7 am. The 5 dB adjustment for weekend daytime hours (i.e., Saturdays and Sundays, 7 am to 10 pm) has only been included in the 2014 model; CC does not anticipate operating on weekends in the future with the Project. 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 CC.

6.7 Receivers

Calculations were performed for assumed receiver heights of 4 m on the facades of the residential buildings on 5 m by 5 m grids throughout the study area. This is meant to represent the second level of houses, typically where bedrooms are located, which would usually be the most noise sensitive spaces in a house. The buildings in Receiver Group 5 are four storeys high, so a receiver height of 10 m has been used here to represent the top (and most exposed) floor.

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 m. Accuracy is unknown at distances beyond 1000 m. Distances from various points on the CC site to residential receivers south of CC are all within 1000 m.

The estimated sound power levels for CC 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 CC or CC's consultants and suppliers.

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

A summary of the predicted CC-generated noise levels (without other community noise, but including reflections off CC buildings), and Total Noise levels (CC-generated, plus other community sources) is shown in Table 7.1 for each of the Receiver Groups.

Table 7.1 Summary of Average Predicted Noise Levels, L_{dn} (dBA)

Receiver Group (see Fig. D1, Appendix D)	Columbia Containers-Generated Noise				Total Noise from All Sources Including CC			
	2014	2030		Difference With Project [3] – [1]	2014	2030		Difference With Project & SSCIP [3] – [1]
	[1] Pre-Project	[2] Without Project	[3] With Project		[1] Pre-Project	[2] Without Project	[3] With Project	
1	60	60	59	-1	67	69	69	+2
2	64	64	62	-2	69	71	71	+2
3	66	66	60	-6	66	67	62	-4
4	61	61	57	-4	71	73	73	+2
5	46	46	43	-3	72	75	75	+3

Accounting for CC-generated noise only, the average levels are predicted to decrease in all Receiver Groups. Residences in Receiver Groups 3 and 4 are predicted to receive the largest noise reductions.

In regards to Total Noise, the average levels are predicted to increase in all Receiver Groups except for Group 3. This increase is due to the predicted increase in rail and road traffic volumes along the south shore corridor by 2030 resulting from the SSCIP (BKL 2012). Comparing the 2030 Total Noise levels with and without the Project shows that the increase is not due to the Project. The decrease in Total Noise at Receiver Group 3 is due to the reduction in activities on site (due to increased efficiencies), and the replacement of the existing dust-collection fan with quieter fans that will be located farther away from the residences and will be screened by CC's buildings. Although there is a significant reduction in CC-generated noise at Receiver Group 4, this will not be as noticeable to the community since the noise climate is dominated by non-CC noise (e.g. rail and road traffic noise).

The different noise sources contributing to the Total Noise at four residences (three close to the CC Transloading Facility and one close to the western site entrance) are shown in Table 7.2 (next page).

Table 7.2 Partial Noise Levels with Project 2030

Noise Source	Receiver L_{dn} [dBA]			
	R1-09	**R2-10**	**R3-06**	**R4-01**
Total Noise	**68**	**73**	**62**	**72**
CC-Generated Noise	**60**	**64**	**61**	**63**
Rail Movements	60	60	52	54
Truck Movements	41	44	37	43
Loading/Unloading Movements in Yards	41	52	45	44
Fan Noise	25	46	40	46
Conveyors Systems Including Elevator	25	57	56	58
Reflections	<<[3]	58	58	60
Other Noise Sources Total	**67**	**72**	**58**	**72**
Road Traffic (Commissioner St. and Wall St.)	63	63	57	63
CP Rail	66	72	52	72

Table 7.2 suggests that at receivers R1-09, R2-10, and R4-01, non-CC generated noise will dominate the noise climate (primarily rail activity along the main CP line). Any further decreases in CC-generated noise at these receivers will have little (i.e., 1 dB) or no net effect on the Total Noise level.

Within Receiver Group 3, a combination of sources contributes to the overall noise climate. Because these houses are set farther back on the embankment, they are better screened from Commissioner Street road traffic noise and CP rail noise. Thus, the relative contribution from CC-generated noise will be higher. Relevant CC noise sources at R3-06 include reflections off CC buildings, the conveyor system and elevators, and CC rail movements. As shown in Table 7.1, the average Total Noise level within this group is subject to the only *decrease* in 2030, and the Total Noise level is lower than for other groups.

In summary, with the Project, noise levels associated with CC operations are expected to be lower than without the Project at all Receiver Groups. The net Total Noise level in each Receiver Group is predicted to increase by 2030 due to the SSCIP, except for Group 3 where it is predicted to decrease. Sound contours are presented in Appendix D and detailed results by receptor are presented in tabular form in Appendix E.

As noted in Section 2.1, a number of noise mitigation measures have already been incorporated into the Project design, and these low noise initiatives have been assumed in modelling future noise emissions.

[3] Reflected noise resulting from CC sources at this location is significantly lower than other sources and does not affect the total CC-generated noise level, or the Total Noise level.

With the implementation of the proposed noise mitigation measures, the Project is predicted to bring

- no net change in Total Noise west and east of the transloading facility (Receiver Groups 1, 2, 4 and 5); and
- a net decrease in Total Noise to areas directly south of the transloading facility (Receiver Group 3).

CC-generated noise will decrease in all Receiver Groups. This is because

- the dust fan, which is a primary noise source at residences near the transloading facility, will be relocated further away and partially screened from the residents;
- some rail and truck activities will be better screened by the buildings associated with the transloading facility (e.g., the silos);
- generally, fewer activities will be taking place during the night and on weekends, when there is a penalty applied to the rating level (L_{dn}); and
- some activities will be carried out more quickly due to increased efficiencies, e.g., railcars will be emptied in 14 minutes compared with 22 minutes in 2014.

PMV's goal for the Project, and for similar tenant-led projects such as this, is to demonstrate that future noise levels will not be higher than existing noise levels. The results show that CC-generated noise is predicted to decrease. Based on the results of the noise modelling and considering that practical noise mitigation measures have already been incorporated into the Project design, further measures do not appear to be necessary to avoid adverse noise effects for adjacent residents.

8 CONCLUSIONS

This study was performed to assess potential community noise levels in 2030 after incorporating assumed growth in traffic and CC throughput that would result from the proposed Phase II works.

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

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 be higher than existing levels.

A net decrease in CC-generated noise is predicted as a result of the Project for all five residential groups.

Practicable noise mitigating measures have already been included in the Project design; further noise mitigation measures do not appear to be necessary to avoid adverse noise impacts.

In conclusion, BKL predicts that there will be no significant adverse noise effects from the Project.

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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 am to 7 pm) to 5 times the sound exposure level obtained during the evening (L_e) (7 pm to 11 pm) and to 10 times the sound exposure level obtained during the nighttime (L_n) (11 pm to 7 am) to account for greater human sensitivity to evening and nighttime noise. The L_{den} may also incorporate other penalties for noise with special characteristics, for example, a 5 dB penalty for tonal noise and daytime weekend activity, and a 12 dB penalty for highly impulsive noise.

day-night equivalent sound level (L_{dn}) – The sound exposure level for a 24-hour day calculated by logarithmically adding the sound exposure level obtained during the daytime (L_d) (7 am to 10 pm) to 10 times the sound exposure level obtained during the nighttime (L_n) (10 pm to 7 am) to account for greater human sensitivity to nighttime noise. The L_{dn} may also incorporate other penalties for noise with special characteristics, for example, a 5 dB penalty for tonal noise and a 12 dB penalty for highly impulsive 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.

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 10 pm), noted as the L_d, and nighttime hours (10 pm to 7 am), noted as the L_n. As the impact of noise on people is judged differently during the day and during the night, 24-hour noise metrics have been developed to reflect this.

The day-night equivalent sound level (L_{dn}) is one metric commonly used to represent community noise levels. It is derived from the L_d and the L_n with a 10 dB penalty applied to the L_n to account for increased sensitivity to nighttime noise. Other penalties are recommended by ANSI S12.9-2005 Part 4 for noise with special characteristics, for example, a 5 dB penalty for tonal noise and a 12 dB penalty for highly impulsive noise.

APPENDIX C NOISE SOURCE TABLES

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

<table>
<tr><th rowspan="3">Source</th><th rowspan="3">Modelled As</th><th rowspan="3">SWL Source</th><th rowspan="3">Adjustment</th><th colspan="4">Daily Operating Time (minutes)</th><th colspan="2" rowspan="2">Sound Power Level (SWL)</th><th rowspan="3">Description of change between Existing / Future</th></tr>
<tr><th colspan="2">Existing Scenario 2014</th><th colspan="2">Future Scenario 2030</th></tr>
<tr><th>Day</th><th>Night</th><th>Day</th><th>Night</th><th>dBA</th><th>dBL</th></tr>
<tr><td colspan="11">CP Railcar Pick-up and Deliveries</td></tr>
<tr><td>1. Locomotive idling during collection and delivery</td><td>Line source covering tracks from main line, onto CC property</td><td>2011 Measurement of delivery at CC</td><td>-</td><td>0</td><td>30</td><td>42.5</td><td>12.5</td><td>102</td><td>119</td><td rowspan="2"><u>Existing</u>: Collections and deliveries take place at the same time (typically takes 30 minutes, 261 week days, and 82 weekend days in 2014). CP typically arrived during nighttime hours.
<u>Future</u>: One 30 min delivery per day, during daytime. One 25 min collection per day. Half the collections will be during daytime hours (12.5 min), half during night time hours (12.5 min).</td></tr>
<tr><td>2. Rail Deliveries / Collection - Arrival and Departure</td><td>Line source covering tracks west of dumper building</td><td>2011 Measurement of delivery at CC</td><td>-</td><td>0</td><td>30</td><td>42.5</td><td>12.5</td><td>120</td><td>128</td></tr>
<tr><td>3. Rail Deliveries/Pick up - Shunting</td><td>Line source at entrance to site</td><td>BKL measurement library</td><td>Impulsive +12dB</td><td>900</td><td>540</td><td>900</td><td>540</td><td>99</td><td>110</td><td>See Table 6.2 for totals.
<u>Existing</u>: 25 railcars are delivered per day. For CP activities, there are 8 impulsive events involved in the delivery and collection of the railcars. Occurs 261 week days, and 82 weekend days.
<u>Future</u>: 34 railcars are delivered per day. For CP activities, there are 8 impulsive events involved in the delivery and collection of the railcars. All on week days only.</td></tr>
</table>

Source	Modelled As	SWL Source	Adjustment	Daily Operating Time (minutes)				Sound Power Level (SWL)		Description of change between Existing / Future
				Existing Scenario 2014		Future Scenario 2030				
				Day	Night	Day	Night	dBA	dBL	
Stationary Sources										
4. Dust fan (existing, for 2014)	Point source	Measurement of existing fan for 2014	-	900	300			113	121	Fan will be on during operational hours. <u>Existing</u>: 15 hrs during the day (900 minutes), and 5 hours per night (300 minutes). This occurs 261 weekdays, and 82 weekend days. <u>Future</u>: 15 hrs during the day (900 minutes), and 1 hour during the night (60 minutes). This occurs week days only.
5. Two dust fan (future, for 2030)	Point source (one for each fan)	Data from Nu Westech for New York Blower Company Fan (x2, plus silencer) for 2030. Backward Inclined Class IV SWSI, Size 446, PLR wheel type, 43000 cfm. Silencer from VAW Systems, Model 29VRDS-I34.	-			900	60	97	119	

Source	Modelled As	SWL Source	Adjustment	Daily Operating Time (minutes)				Sound Power Level (SWL)		Description of change between Existing / Future
				Existing Scenario 2014		Future Scenario 2030				
				Day	Night	Day	Night	dBA	dBL	
6. Alarm noise when railcars advance within Dumper Building	Area source either side of Rail Dumper Building	Measurement in 2014	+5	38	12	64	4	95	97	The alarm sounds for 2 minutes per rail car. Existing: 25x2=50 minutes, split evenly operational hours (15 hrs day, 5 hours night). Future: 34x2= 68 minutes, split evenly between operational hours (15 hrs day, 1 hr night). With the future layout, CC indicated the alarm may sound for a shorter period of time. A conservative approach was taken here, assuming the same duration per railcar as existing.
7. Railcar indexer 1800 RPM, 50 HP	Two point sources, located west of Rail Dumper Building	BKL Measurement Library	-			900	60	86	96	Existing: this source is not present. Future: expected to be on during all operational hours.
8. Reclaim Conveyor Motor SC-01, 20 HP	Point source	Estimate based on similar motors from measurements in BKL Library	-			900	60	88	91	Existing: this source is not present. Future: expected to be on during all operational hours.
9.Reclaim Conveyor Motor SC-02, 75 HP	Point source	Estimate based on similar motors from measurements in BKL Library	-			900	60	94	97	Existing: this source is not present. Future: expected to be on during all operational hours.

Source	Modelled As	SWL Source	Adjustment	Daily Operating Time (minutes)				Sound Power Level (SWL)		Description of change between Existing / Future
				Existing Scenario 2014		Future Scenario 2030				
				Day	Night	Day	Night	dBA	dBL	
10.Reclaim Conveyor Motor SC-03,150 HP	Point source	Estimate based on similar motors from measurements in BKL Library	-			900	60	98	101	<u>Existing</u>: this source is not present. <u>Future</u>: expected to be on during all operational hours.
11.Reclaim Conveyor Motor SC-04, 60 HP	Point source	Estimate based on similar motors from measurements in BKL Library	-			900	60	93	96	<u>Existing</u>: this source is not present. <u>Future</u>: expected to be on during all operational hours.
12.Reclaim Conveyor Motor SC-05,100 HP	Point source	Estimate based on similar motors from measurements in BKL Library	-			900	60	96	99	<u>Existing</u>: this source is not present. <u>Future</u>: expected to be on during all operational hours.
13. Conveyors	Line sources (four)	BKL measurement library	-			900	60	84	88	<u>Existing</u>: this source is not present. <u>Future</u>: expected to be on during all operational hours.
14. Bucket Elevator Motors, two at 1800 RPM	Two point sources	Estimate based on similar motors from measurements in BKL Library	-			900	60	105	109	<u>Existing</u>: this source is not present. <u>Future</u>: expected to be on during all operational hours.
12 ventilation fans (5 HP) at base of silos	*Not modeled – 5 HP fans expected to be noise source insignificant*									

Source	Modelled As	SWL Source	Adjustment	Daily Operating Time (minutes)				Sound Power Level (SWL)		Description of change between Existing / Future
				Existing Scenario 2014		Future Scenario 2030				
				Day	Night	Day	Night	dBA	dBL	
Internal Activities Associate with Rail at CC										
15. Shunting following unloading of railcars	Line source covering tracks west of dumper buildings	BKL measurement library	Impulsive +12dB	900	540	900	540	99	110	See Table 6.2 for totals. Existing: For CC activities, there are typically 3 impulsive events as the railcars are spotted onto the tracks, and 3 more impulsive events as the empty railcars are returned to the tracks. This occurs on 261 week days and 82 weekend days of 2014. All activity takes place during daytime hours. Future: It is expected that there will be 5 impulsive activities as the 34 railcars are spotted onto the tracks, and 5 more impulsive events as the empty railcars are returned to the tracks. CC indicated the split of 10% during night, 90% during day for 2030. All activity to take place during week days.
16. Maneuvering of railcars on tracks with shuttle wagon	Line source covering tracks west of dumper buildings	2011 Measurements	-	68	17	94	6	98	110	Existing: it takes 17 minutes for shuttle wagon to move each set of 5 cars to/from the dumper building. There are 5 sets (5x17 = 85 minutes). It was estimated that 4 sets are emptied during daytime hours, and one during nighttime hours. This occurs on 261 week days and 82 weekend days of 2014. Future: it takes 20 minutes for shuttle wagon to move each set of 7 cars to/from the dumper building. There will be 5 sets (5x20min=100 min). Time has been split between operational hours (15 hrs day / 1 hr night)

Source	Modelled As	SWL Source	Adjustment	Daily Operating Time (minutes)				Sound Power Level (SWL)		Description of change between Existing / Future
				Existing Scenario 2014		Future Scenario 2030				
				Day	Night	Day	Night	dBA	dBL	
17. Unloading of railcars in dumper building	Area source	2014 Measurements	-	440	110	446	30	71	81	Existing: 22 minutes per railcar, total of 25 railcars. Estimated 20 railcars are emptied during the day, and 5 are emptied during the nighttime hours. This occurs on 261 week days and 82 weekend days of 2014. Future: 14 minutes per car, total of 34 cars, for 476 minutes. Time has been split between operational hours (15 hrs day / 1 hr night).
Truck Activities										
18. Loading and unloading of containers onto trucks	Two area sources, one in Yard 1, the other in Yard 3	Measurement from 2011	-	340	110	452	24	110	122	Existing: 25 railcars, corresponds to approx. 90 containers. Each is handled 5 times for 1 minute each (total of 550 minutes). Day/night distribution provided by CC. This occurs on 261 week days and 82 weekend days of 2014. Future: 34 railcars; average of 3.5 containers per car (depending on product). Each container is handled 4 times, for approximately 1 minute. 28x3.5x4 = 476 minutes CC estimated 5% of activity during the night, and 95% of activity during the day. This only occurs on week days.

Source	Modelled As	SWL Source	Adjustment	Daily Operating Time (minutes)				Sound Power Level (SWL)		Description of change between Existing / Future
				Existing Scenario 2014		Future Scenario 2030				
				Day	Night	Day	Night	dBA	dBL	
19. 'Outside' trucks picking up and dropping off containers	Road source Entering CC site from the west (near Yard 2 in 2011, Yard 4 in 2030), exiting to the east.	Trucks driving at 15 kph	-	900	540	900	540	-	-	Existing: 110 trucks per 24 hrs; 75% during the day and 25% during the night (as indicated by CC). This occurs on 261 week days and 82 weekend days of 2014. Future: 150 trucks per 24hrs Distributed evenly between operational hours, week days only.
20. 'Inside' trucks moving containers within CC site	Road source Figure-8 loop. In 2011, part of the route is along Commissioner Street. In 2030, this has shifted to stay on CC property.	Trucks driving at 15 kph	-	900	540	900	540	-	-	Existing: 45 complete loops per 24hrs; 75% during the day and 25% during the night (as indicated by CC). This occurs on 261 week days and 82 weekend days of 2014. Future: 45 complete loops per 24hrs Distributed evenly between operational hours for each scenario.
21. Noise Associated with Truck Containers being Stuffed	Area source at either end of Existing Shed	Measurement from 2014	-	306	99			79	85	Existing: on average, there are 90 per day, and it takes 4.5 minutes to stuff each. This activity has been distributed with 75% during the day and 25% during the night (as indicated by CC). This occurs on 261 week days and 82 weekend days of 2014.

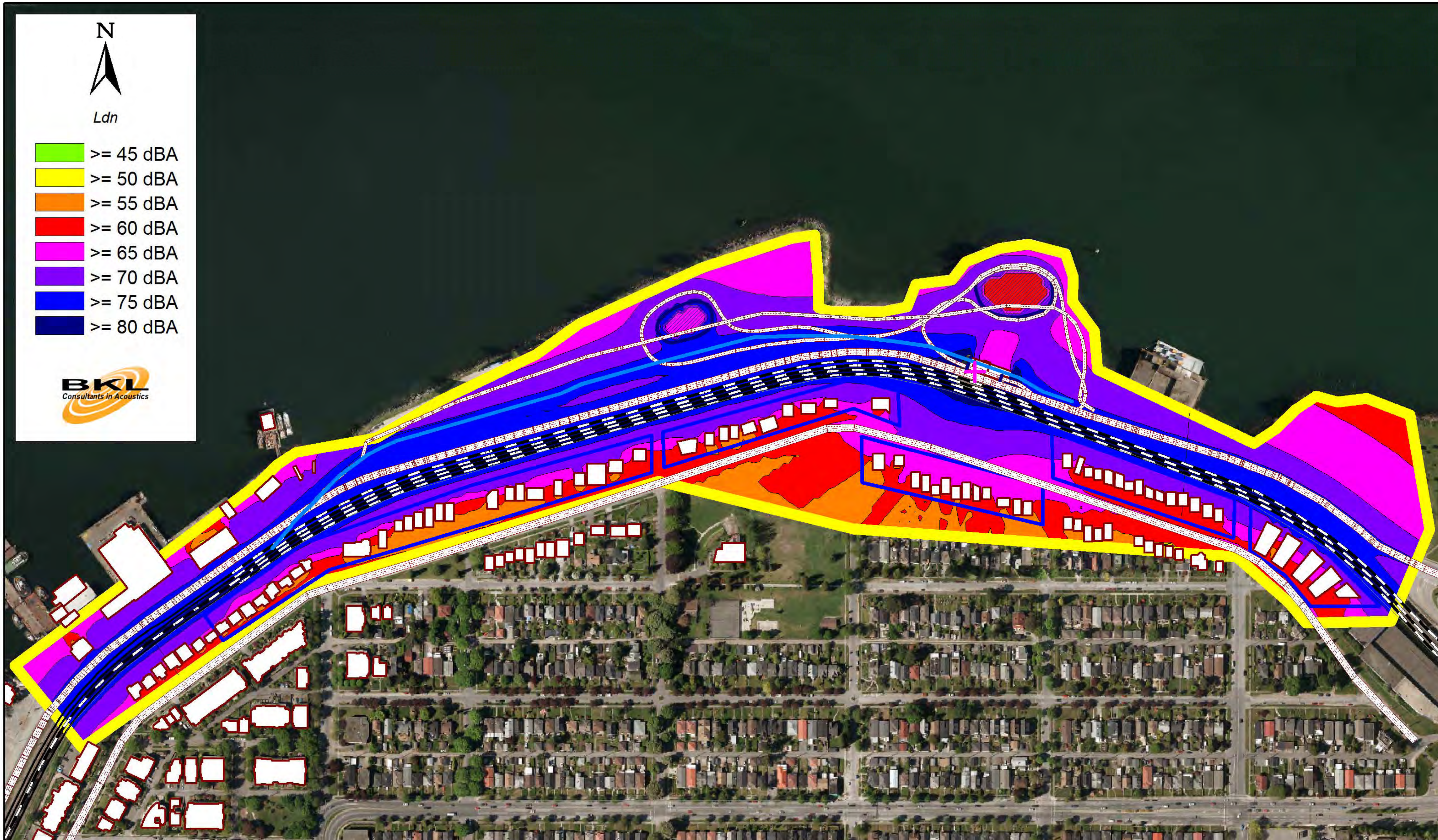
Source	Modelled As	SWL Source	Adjustment	Daily Operating Time (minutes)				Sound Power Level (SWL)		Description of change between Existing / Future
				Existing Scenario 2014		Future Scenario 2030				
				Day	Night	Day	Night	dBA	dBL	
22. Noise Associated with Truck Containers being Stuffed	Area source at either end of New Container Loading facility	Based on measurement from 2014	-			446	30	82	88	Future: on average, there will be 119 containers per day, and will take 8 minutes to stuff 2 containers. Time has been split between operational hours (15 hrs day / 1 hr night).
Non-CC Noise Sources										
CP Rail										
23. Through Track	Rail source	Based on measurements completed by BKL on same rail route, and 2030 increases described in report.	-	900	540	900	540	-	-	As described in Section 6.5.1.
Roads										
24. Commissioner Street, Wall Street	Road sources	Based on road traffic volumes used in SSCIP (BKL, 2012)	-	900	540	900	540	-	-	As described in Section 6.5.2.

APPENDIX D FIGURES AND NOISE CONTOURS

File: 3122-14A

Figure D1: Residential Receiver Groups

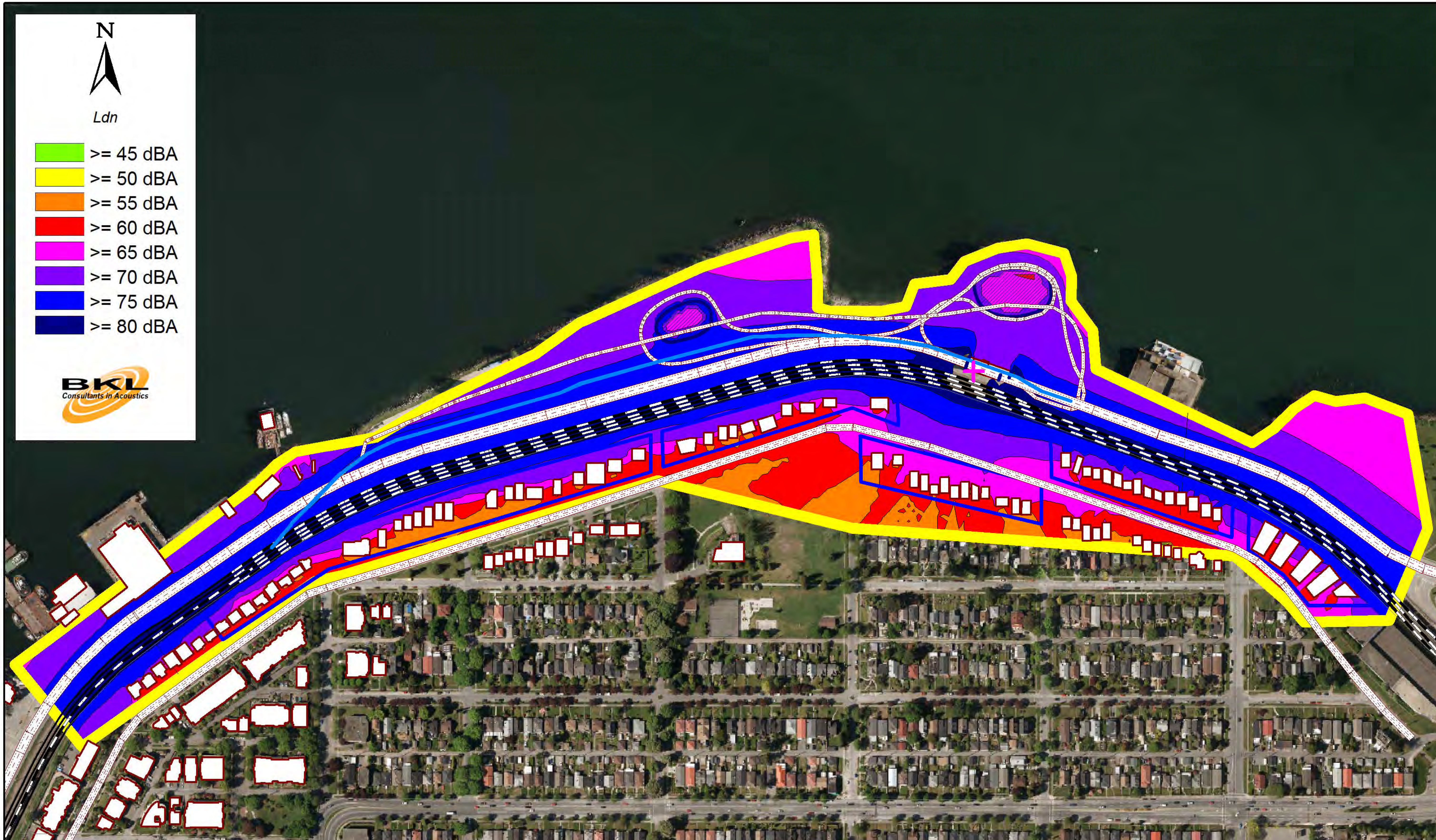
Date: March 2015



File: 3122-14A

Figure D2: Predicted Total Noise for 2014 Existing Scenario

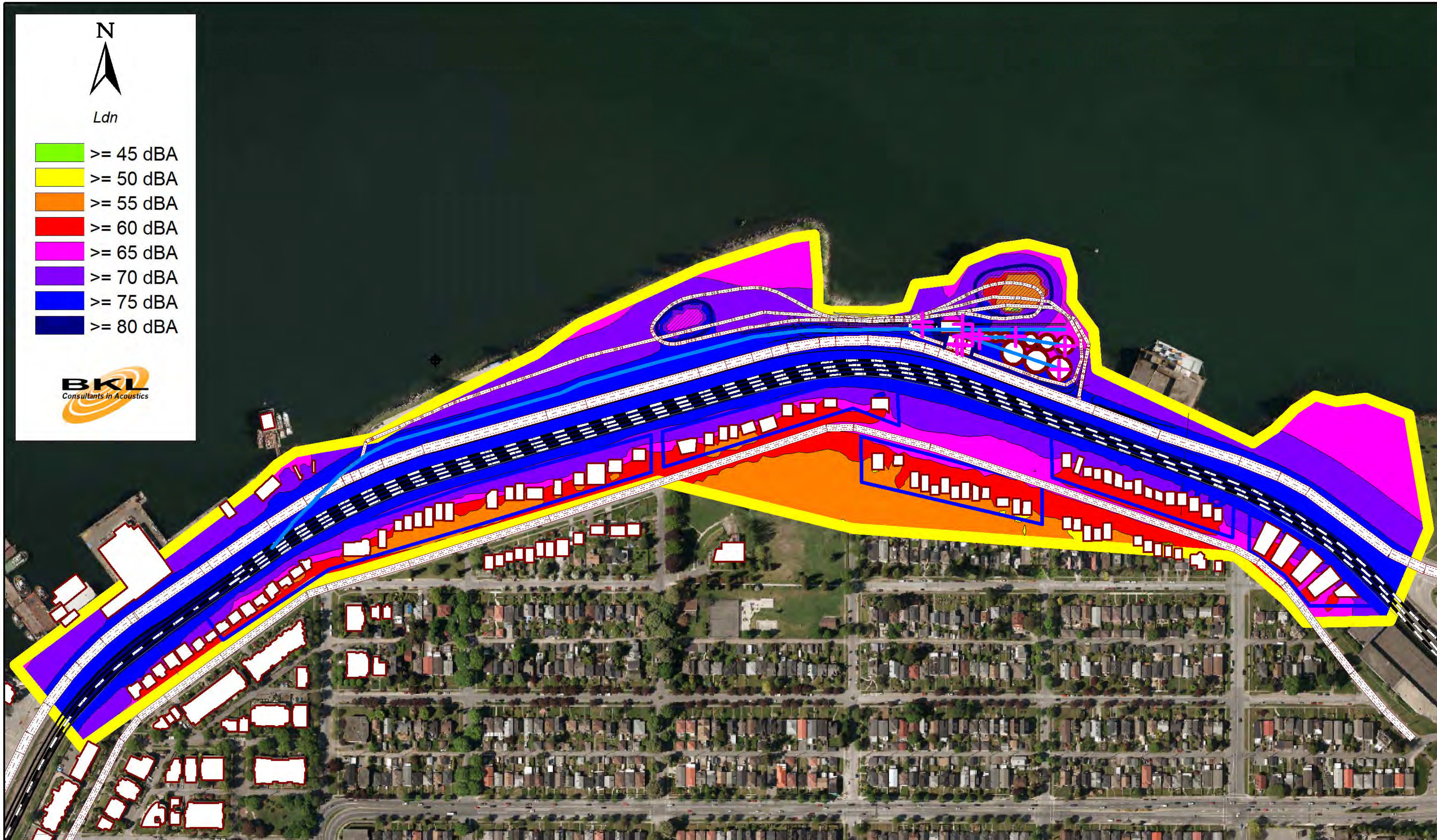
Date: March 2015



File: 3122-14A

Figure D3: Predicted Total Noise for 2030 No-Project Scenario

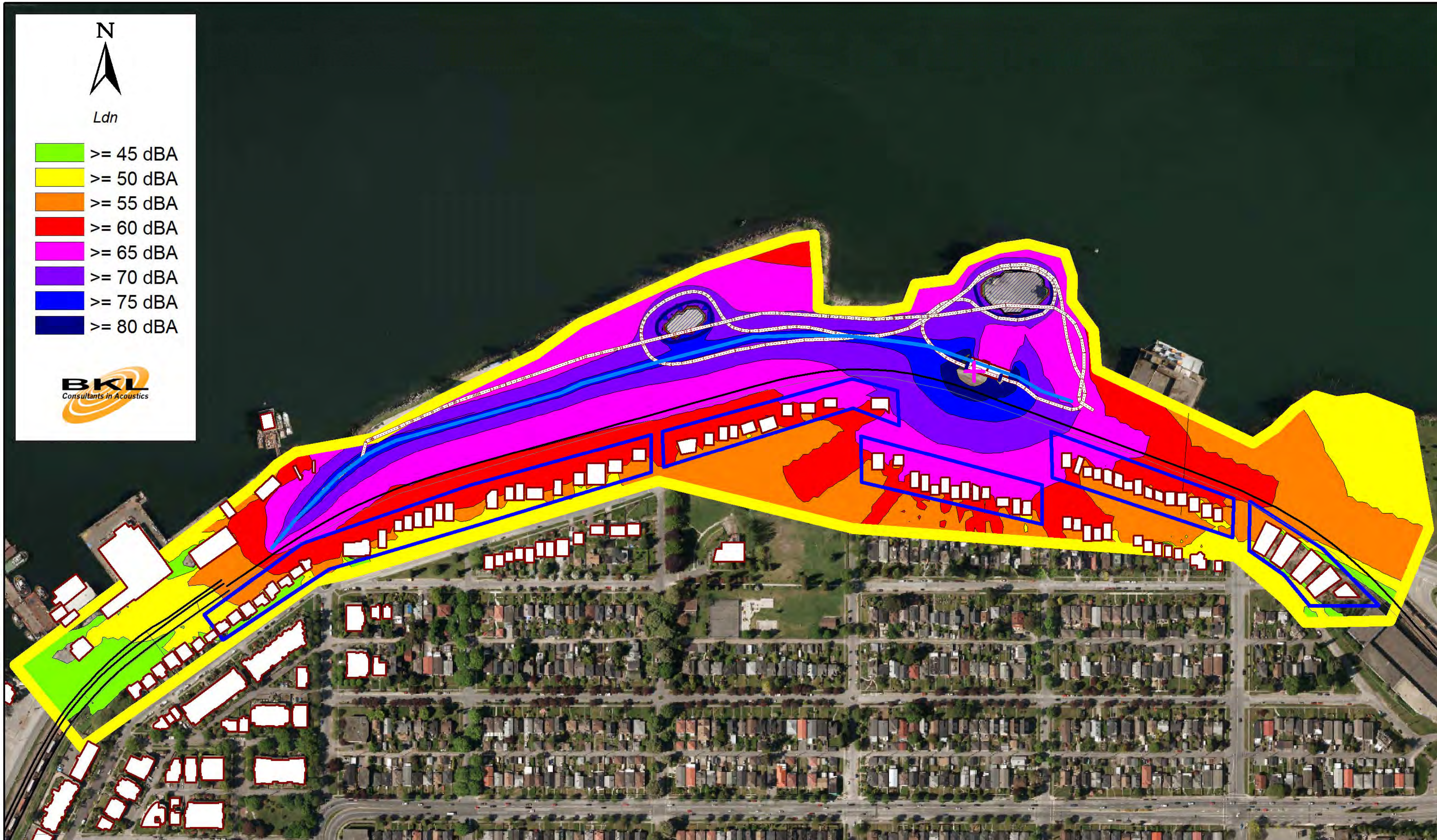
Date: March 2015



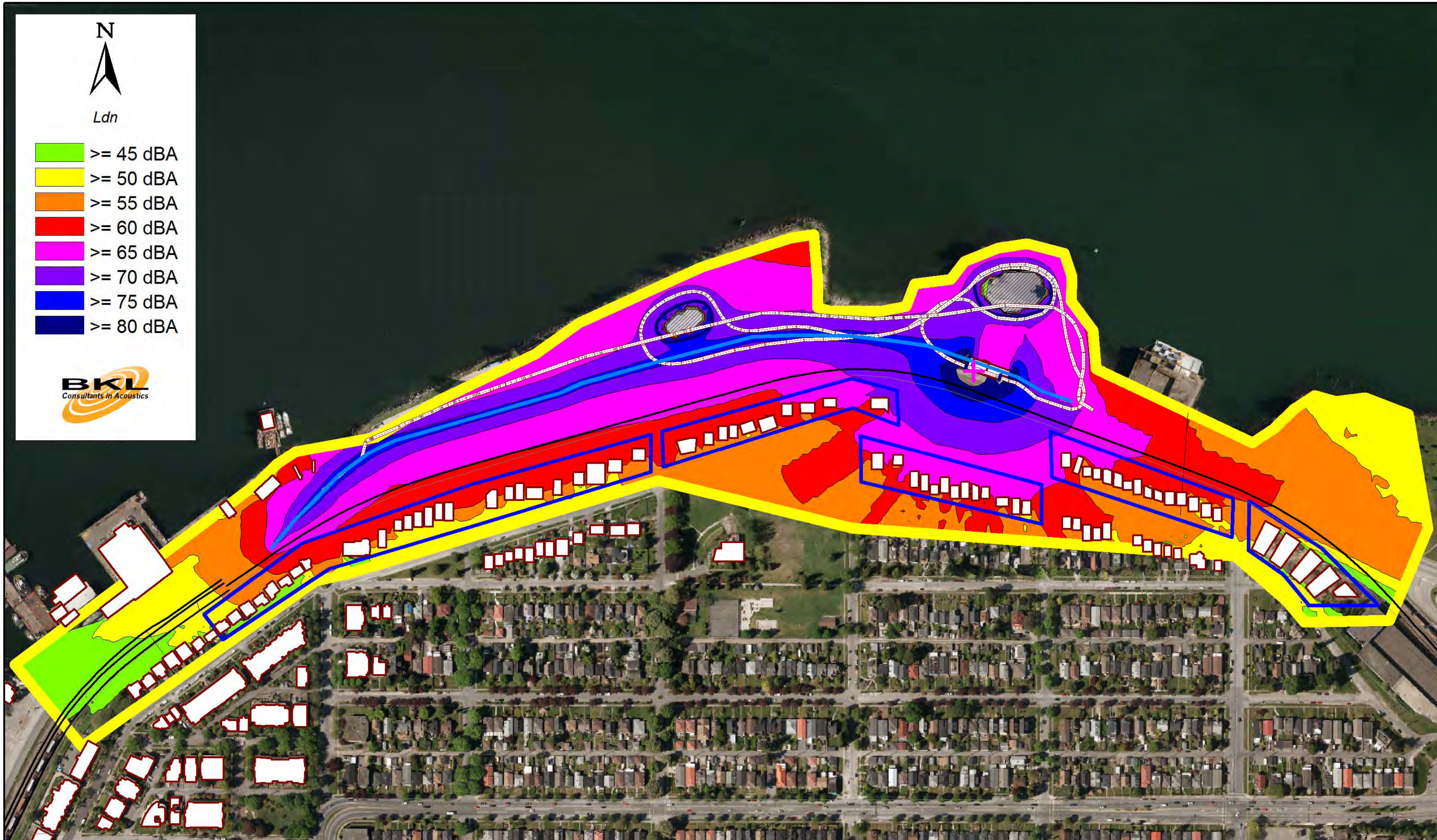
File: 3122-14A

Figure D4: Predicted Total Noise for 2030 With-Project Scenario

Date: March 2015



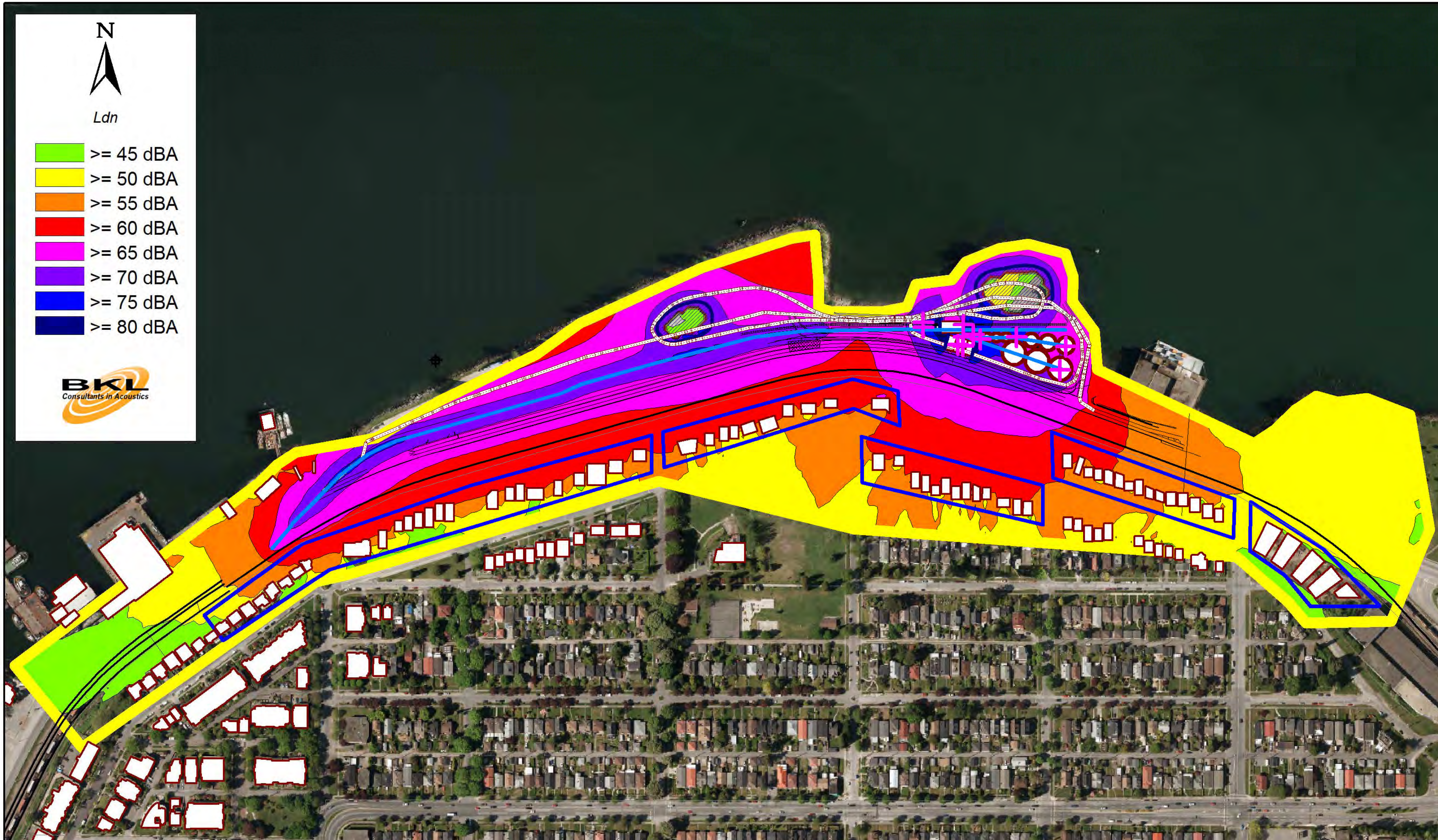
File: 3122-14A | **Figure D5: Predicted Project Noise for 2014 Existing Scenario** | Date: March 2015



File: 3122-14A

Figure D6: Predicted Project Noise for 2030 No-Project Scenario

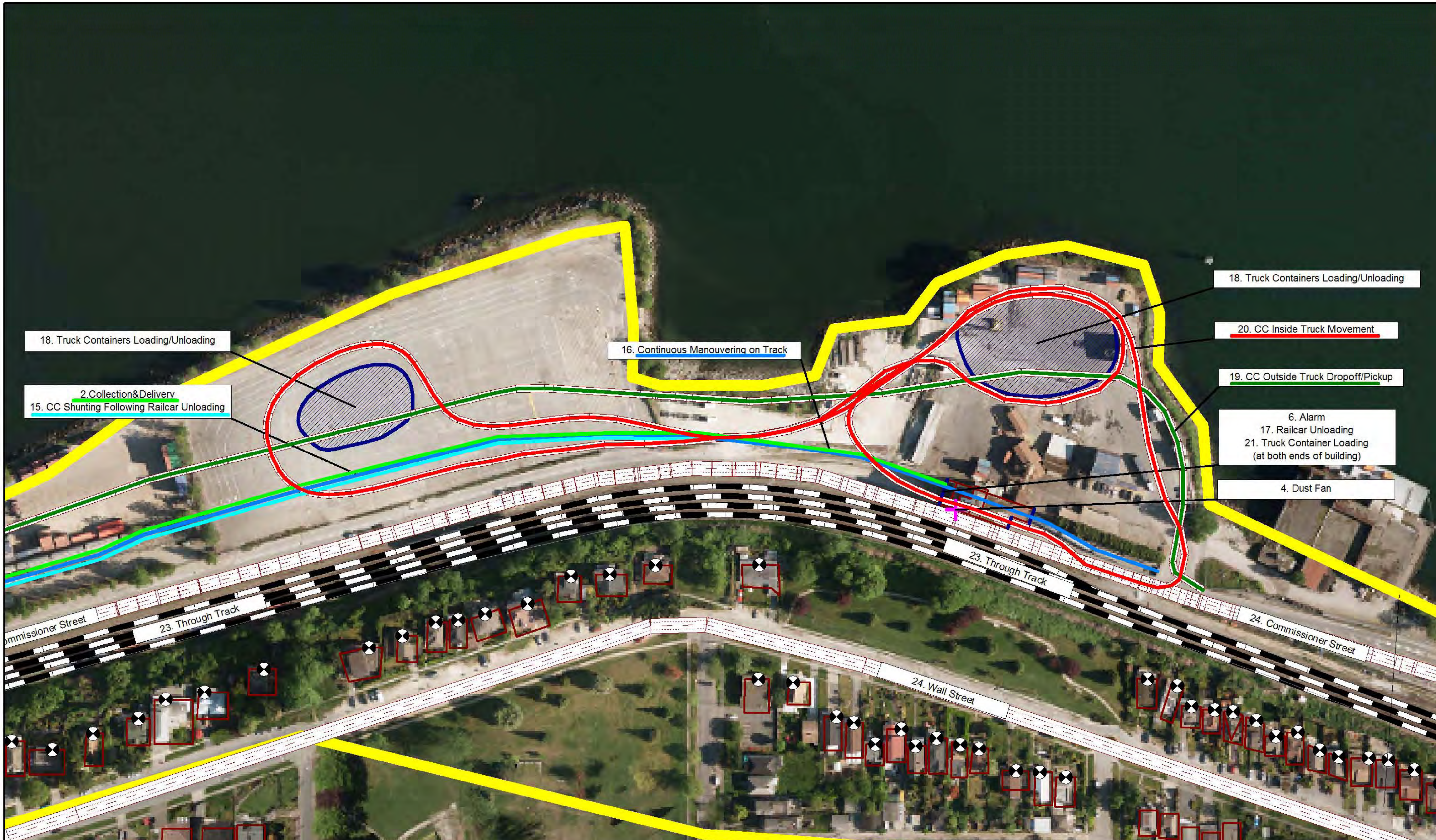
Date: March 2015



File: 3122-14A

Figure D7: Predicted Project Noise for 2030 With-Project Scenario

Date: March 2015



File: 3122-14A

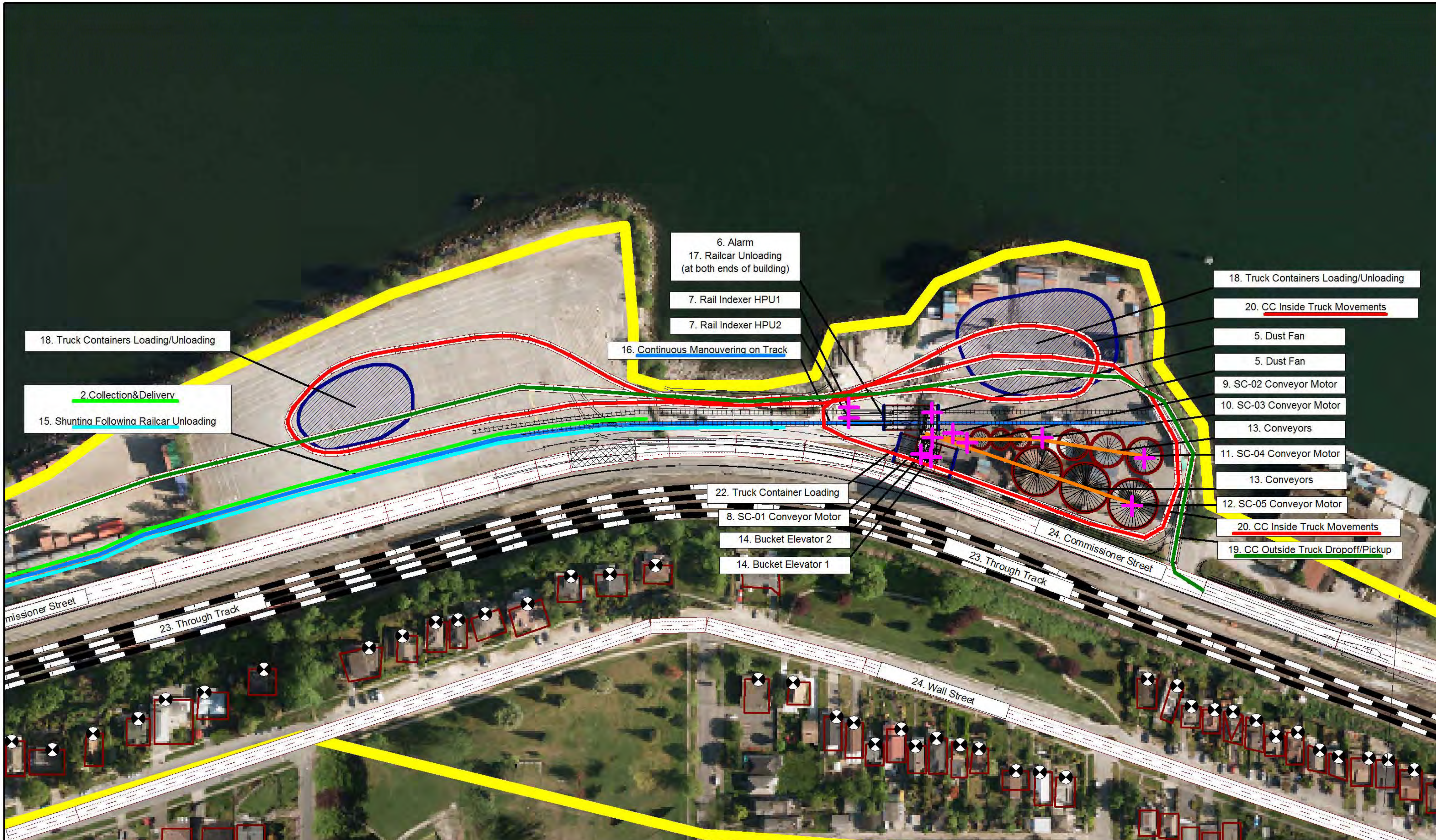
Figure D8: Layout of Pre-Project Noise Sources (East)

Date: March 2015

File: 3122-14A

Figure D9: Layout of Pre-Project Noise Sources (West)

Date: March 2015



File: 3122-14A **Figure D10: Layout of With-Project Noise Sources (East)** Date: March 2015

File: 3122-14A

Figure D11: Layout of With-Project Noise Sources (West)

Date: March 2015

APPENDIX E RESULTS TABLES

Receiver	Total Noise				Project Noise			
	Exist 2011 [1]	Future 2030 Without Project [2]	Future 2030 With Project [3]	Difference [3] – [2]	Exist 2011 [1]	Future 2030 Without Project [2]	Future 2030 With Project [3]	Difference [3] – [2]
Name	L_{dn} dBA	L_{dn} dBA	L_{dn} dBA		L_{dn} dBA	L_{dn} dBA	L_{dn} dBA	
R1-01	68	71	70	-1	50	50	48	-2
R1-02	67	69	69	0	53	53	51	-2
R1-03	65	66	66	0	55	55	54	-1
R1-04	64	65	65	0	55	55	53	-2
R1-05	67	68	68	0	58	58	56	-2
R1-06	64	65	65	0	57	57	55	-2
R1-07	66	67	66	-1	60	60	58	-2
R1-08	67	69	68	-1	62	62	61	-1
R1-09	67	69	68	-1	62	62	60	-2
R1-10	65	66	66	0	62	62	60	-2
R1-11	68	70	71	1	63	63	61	-2
R1-12	68	69	69	0	63	63	61	-2
R1-13	70	72	72	0	63	63	61	-2
R1-14	70	72	72	0	63	63	61	-2
R1-15	70	72	72	0	62	62	61	-1
R1-16	66	67	67	0	62	62	60	-2
R1-17	70	72	72	0	62	62	60	-2
R1-18	70	72	72	0	62	62	60	-2
R1-19	70	72	72	0	62	62	60	-2
R1-20	65	66	65	-1	61	61	59	-2
R1-21	67	69	69	0	62	62	60	-2
R1-22	69	71	71	0	62	62	60	-2
R1-23	70	72	72	0	62	62	61	-1
R1-24	69	71	71	0	62	62	61	-1
R1-25	66	68	67	-1	62	62	61	-1
R2-01	69	71	71	0	63	63	61	-2

Receiver	Total Noise				Project Noise			
	Exist 2011 [1]	Future 2030 Without Project [2]	Future 2030 With Project [3]	Difference [3] – [2]	Exist 2011 [1]	Future 2030 Without Project [2]	Future 2030 With Project [3]	Difference [3] – [2]
Name	L_{dn} dBA	L_{dn} dBA	L_{dn} dBA		L_{dn} dBA	L_{dn} dBA	L_{dn} dBA	
R2-02	70	72	71	-1	63	63	61	-2
R2-03	70	72	72	0	63	63	62	-1
R2-04	70	72	72	0	63	63	61	-2
R2-05	70	72	71	-1	63	63	61	-2
R2-06	68	70	70	0	63	63	61	-2
R2-07	70	72	72	0	65	65	62	-3
R2-08	67	68	67	-1	65	65	62	-3
R2-09	69	70	68	-2	67	67	62	-5
R2-10	73	74	73	-1	70	70	64	-6
R3-01	66	66	63	-3	65	65	60	-5
R3-02	67	67	64	-3	66	66	61	-5
R3-03	68	68	63	-5	67	67	61	-6
R3-04	67	67	63	-4	66	67	61	-6
R3-05	66	66	62	-4	66	66	60	-6
R3-06	67	67	63	-4	66	67	61	-6
R3-07	66	67	62	-5	66	66	61	-5
R3-08	67	67	63	-4	67	67	61	-6
R3-09	67	67	63	-4	66	67	61	-6
R3-10	67	67	63	-4	66	66	61	-5
R3-11	66	66	62	-4	65	65	60	-5
R3-12	65	66	62	-4	65	65	60	-5
R3-13	65	65	62	-3	64	65	59	-6
R4-01	72	74	73	-1	68	68	63	-5
R4-02	72	74	73	-1	67	67	61	-6
R4-03	69	72	72	0	60	60	56	-4
R4-04	71	73	72	-1	65	65	60	-5
R4-05	71	73	73	0	64	65	58	-7
R4-06	71	73	73	0	64	64	57	-7

Receiver	Total Noise				Project Noise			
	Exist 2011 [1]	Future 2030 Without Project [2]	Future 2030 With Project [3]	Difference [3] – [2]	Exist 2011 [1]	Future 2030 Without Project [2]	Future 2030 With Project [3]	Difference [3] – [2]
Name	L_{dn}	L_{dn}	L_{dn}		L_{dn}	L_{dn}	L_{dn}	
	dBA	dBA	dBA		dBA	dBA	dBA	
R4-07	70	72	72	0	59	59	55	-4
R4-08	71	73	73	0	63	63	56	-7
R4-09	70	72	72	0	58	58	58	0
R4-10	70	72	72	0	59	59	58	-1
R4-11	71	73	73	0	61	61	55	-6
R4-12	71	74	73	-1	61	61	54	-7
R4-13	71	74	74	0	60	60	54	-6
R4-14	71	73	73	0	56	56	52	-4
R4-15	71	74	74	0	57	57	58	1
R5-01	72	75	75	0	55	55	52	-3
R5-02	72	75	75	0	51	51	49	-2
R5-03	72	75	75	0	46	46	43	-3
R5-04	72	75	75	0	40	40	37	-3
R5-05	72	74	74	0	39	39	36	-3

APPENDIX F RECORD OF CC ACTIVITY FOR JANUARY MEASUREMENT WEEK

Date: Wednesday 21 January 2015

	Daytime 7 am - 7 pm	Location (E / W (or both)	Evening 7 pm - 10 pm	Location (E / W (or both)	Night 12am - 7am and 10pm - 12am	Location (E / W (or both)	Comments
Tonnage throughput	Total Loaded: 3028.65 MT						
CP Deliveries / Collections							
Length of time locomotive idling for deliveries	0	n.a.	0	n.a.	approx 20 mins	West	empties pulled @ 4am, Full cars placed 6:30 am
Number of rail cars delivered	0	n.a.	0	n.a.	24	West	
Length of time locomotive idling for collections	0	n.a.	0	n.a.	approx 20 mins	West	don't know exact time
Number of rail cars collected	0	n.a.	0	n.a.	23	West	
Rail car movements within site							
Length of time / location of shuttle wagon movements	68	East to West	17	East to West	51	East to West	This is the length of time for each CC switch activity.
Number of rail switches / shunting activities due to CC activities (and locations)	4	East	1	West	3	East	
Number of rail switches / shunting activities due to CP collections/deliveries (and locations)	0	West	0		16	West	
Number of railcars unloaded in dumper building	17	E (rail dumper building)	3	E (rail dumper building)	13	E (rail dumper building)	22 minutes per car
Truck activities							
Number of trucks arriving / departing site ('outside trucks')	116	West	11	West	5	West	All trucks enter at the Far West
Number of figure-8 movements ('inside trucks')	37	both	8	both	16	both	
Time for loading and unloading of containers onto trucks (minutes)	375	both	80	both	155	both	each container handled 5 times, for 1 minute each
Number of truck containers being stuffed	75	East	16	East	31	East	Takes 4 - 5 minutes to stuff each container
Stationary equipment							
Length of time dust fan is in operation	7am - 7pm	E (rail dumper building)	7 - 10 pm	E (rail dumper building)	10pm to 4am. 5am - 7am	E (rail dumper building)	
Length of time of alarm noise when rail cars advance within building	34 mins	E (rail dumper building)	6 mins	E (rail dumper building)	26 mins	E (rail dumper building)	2 min. Per railcar
Length of time rail car indexer is in operation	34 mins	E (rail dumper building)	6 mins	E (rail dumper building)	26 mins	E (rail dumper building)	2 min. Per railcar

Date: Thursday 22 January 2015

	Daytime 7 am - 7 pm	Location (E / W (or both)	Evening 7 pm - 10 pm	Location (E / W (or both)	Night 12am - 7am and 10pm - 12am	Location (E / W (or both)	Comments
Tonnage throughput	Total Loaded: 2433.9 MT						
CP Deliveries / Collections							
Length of time locomotive idling for deliveries	0	n.a.	0	n.a.	Approx 20 minutes	West	
Number of rail cars delivered	0	n.a.	0	n.a.	24	West	Approx 6:30am
Length of time locomotive idling for collections	0	n.a.	0	n.a.	Deliveries and pick ups occurred at the	West	
Number of rail cars collected	0	n.a.	0	n.a.	23	West	
Rail car movements within site							
Length of time / location of shuttle wagon movements	68	East to West	17	East to West	34	East to West	
Number of rail switches / shunting activities due to CC activities (and locations)	4	East	1		2	East	
Number of rail switches / shunting activities due to CP collections/deliveries (and locations)					8	West	
Number of railcars unloaded in dumper building	18	E (rail dumper building)	5	E (rail dumper building)	5	E (rail dumper building)	22 minutes per car
Truck activities							
Number of trucks arriving / departing site ('outside trucks')	118	West	11	West	12	West	All trucks enter at the Far West
Number of figure-8 movements ('inside trucks')	36	both	18	both	6	both	2 20' containers per 1 truck, 1 40' / truck
Time for loading and unloading of containers onto trucks (minutes)	360	both	90	both	60	both	each container handled 5 times, for 1 minute each
Number of truck containers being stuffed	72	East	18	East	12	East	Takes 4 - 5 minutes per container
Stationary equipment							
Length of time dust fan is in operation	7am - 7pm	E (rail dumper building)	7 - 10 pm	E (rail dumper building)	10pm to 2am. 5am - 7am	E (rail dumper building)	
Length of time of alarm noise when rail cars advance within building	36 mins	E (rail dumper building)	10 mins	E (rail dumper building)	10 mins	E (rail dumper building)	2 min. Per railcar
Length of time rail car indexer is in operation	36 mins	E (rail dumper building)	10 mins	E (rail dumper building)	10 mins	E (rail dumper building)	2 min. Per railcar

Date: Friday 23 January 2015

	Daytime 7 am - 7 pm	Location (E / W (or both)	Evening 7 pm - 10 pm	Location (E / W (or both)	Night 12am - 7am and 10pm - 12am	Location (E / W (or both)	Comments
Tonnage throughput	Total Loaded: 2716.96 MT						
CP Deliveries / Collections							
Length of time locomotive idling for deliveries	12:10 - 12:30	West	0	n.a.	0	n.a.	
Number of rail cars delivered	31	West	0	n.a.	0	n.a.	
Length of time locomotive idling for collections	Spotted loads and pulled empties at	West	0	n.a.	0	n.a.	
Number of rail cars collected	36	West	0	n.a.	0	n.a.	
Rail car movements within site							
Length of time / location of shuttle wagon movements	51	East to West	0	East to West	0	East to West	
Number of rail switches / shunting activities due to CC activities (and locations)	3	East	0		0	East	
Number of rail switches / shunting activities due to CP collections/deliveries (and locations)	8	West	8		24	West	
Number of railcars unloaded in dumper building	16	E (rail dumper building)	4	E (rail dumper building)	10	E (rail dumper building)	22 minutes per car
Truck activities							
Number of trucks arriving / departing site ('outside trucks')	190	West	27	West	7	West	All trucks enter at the Far West
Number of figure-8 movements ('inside trucks')	32	both	8	both	20	both	
Time for loading and unloading of containers onto trucks (minutes)	320	both	80	both	200	both	each container handled 5 times, for 1 minute each
Number of truck containers being stuffed	64	East	16	East	40	East	Takes 4 - 5 minutes per container
Stationary equipment							
Length of time dust fan is in operation	7am - 7pm	E (rail dumper building)	7 - 10 pm	E (rail dumper building)	10pm to 2am. 5am - 7am	E (rail dumper building)	
Length of time of alarm noise when rail cars advance within building	72 mins	E (rail dumper building)	8 mins	E (rail dumper building)	20 mins	E (rail dumper building)	2 min. Per railcar
Length of time rail car indexer is in operation	72 mins	E (rail dumper building)	8mins	E (rail dumper building)	20 mins	E (rail dumper building)	2 min. Per railcar

Date: Saturday 24 January 2015

	Daytime 7 am - 7 pm	Location (E / W (or both)	Evening 7 pm - 10 pm	Location (E / W (or both)	Night 12am - 7am and 10pm - 12am	Location (E / W (or both)	Comments
Tonnage throughput	Total Loaded: 1568.02 MT						
CP Deliveries / Collections							
Length of time locomotive idling for deliveries	approx 20 mins	West	0	n.a.	0	n.a.	
Number of rail cars delivered	9	West	0	n.a.	0	n.a.	spotted at approx 9am
Length of time locomotive idling for collections	Spotted loads and pulled empties at	West	0	n.a.	0	n.a.	
Number of rail cars collected	16	West	0	n.a.	0	n.a.	
Rail car movements within site							
Length of time / location of shuttle wagon movements	68	East to West	0	East to West	34	East to West	
Number of rail switches / shunting activities due to CC activities (and locations)	4	East	0		2	East	
Number of rail switches / shunting activities due to CP collections/deliveries (and locations)	8	West	0			West	
Number of railcars unloaded in dumper building	13	E (rail dumper building)	0	E (rail dumper building)	4	E (rail dumper building)	22 minutes per car
Truck activities							
Number of trucks arriving / departing site ('outside trucks')	72	West	0	West	11	West	All trucks enter at the Far West
Number of figure-8 movements ('inside trucks')	26	both	0	both	8	both	
Time for loading and unloading of containers onto trucks (minutes)	260	both	0	both	80	both	each container handled 5 times, for 1 minute each
Number of truck containers being stuffed	52	East	0	East	16	East	Takes 4 - 5 minutes per container
Stationary equipment							
Length of time dust fan is in operation	7am - 7pm	E (rail dumper building)	7 - 10 pm	E (rail dumper building)	10pm to 3am. 5am - 7am	E (rail dumper building)	
Length of time of alarm noise when rail cars advance within building	26 mins	E (rail dumper building)	0	E (rail dumper building)	8 mins	E (rail dumper building)	2 min. Per railcar
Length of time rail car indexer is in operation	26 mins	E (rail dumper building)	0	E (rail dumper building)	8 mins	E (rail dumper building)	2 min. Per railcar

Date: Sunday 25 January 2015

	Daytime 7 am - 7 pm	Location (E / W (or both)	Evening 7 pm - 10 pm	Location (E / W (or both)	Night 12am - 7am and 10pm - 12am	Location (E / W (or both)	Comments
Tonnage throughput	Total Loaded: 1629.38 MT						
CP Deliveries / Collections							
Length of time locomotive idling for deliveries	approx 20 mins	West	0	n.a.	0	n.a.	
Number of rail cars delivered	24	West	0	n.a.	0	n.a.	Switch approx 3:30pm
Length of time locomotive idling for collections	0	n.a.	0	n.a.	0	n.a.	
Number of rail cars collected	0	West	0	n.a.	0	n.a.	
Rail car movements within site							
Length of time / location of shuttle wagon movements	17	East to West	17	East to West	51	East to West	
Number of rail switches / shunting activities due to CC activities (and locations)	1	East	1		3	East	
Number of rail switches / shunting activities due to CP collections/deliveries (and locations)	8	West	0		0	West	
Number of railcars unloaded in dumper building	7	E (rail dumper building)	3	E (rail dumper building)	9	E (rail dumper building)	22 minutes per car
Truck activities							
Number of trucks arriving / departing site ('outside trucks')	0	West	0	West	0	West	There were no truck movements Sunday
Number of figure-8 movements ('inside trucks')	14	both	6	both	18	both	
Time for loading and unloading of containers onto trucks (minutes)	140	both	60	both	180	both	each container handled 5 times, for 1 minute each
Number of truck containers being stuffed	28	East	12	East	36	East	Takes 4 - 5 minutes per container
Stationary equipment							
Length of time dust fan is in operation	3pm - 7pm	E (rail dumper building)	7 - 10 pm	E (rail dumper building)	10pm to 3am. 5am - 7am	E (rail dumper building)	
Length of time of alarm noise when rail cars advance within building	14 mins	E (rail dumper building)	6 mins	E (rail dumper building)	18 mins	E (rail dumper building)	2 min. Per railcar
Length of time rail car indexer is in operation	14 mins	E (rail dumper building)	6 mins	E (rail dumper building)	18 mins	E (rail dumper building)	2 min. Per railcar

Date: Monday 26 January 2015

	Daytime 7 am - 7 pm	Location (E / W (or both)	Evening 7 pm - 10 pm	Location (E / W (or both)	Night 12am - 7am and 10pm - 12am	Location (E / W (or both)	Comments
Tonnage throughput	Total Loaded: 2686.89 MT						
CP Deliveries / Collections							
Length of time locomotive idling for deliveries	0	n.a.	0	n.a.	Approx 25 mins	West	
Number of rail cars delivered	0	n.a.	0	n.a.	29	West	
Length of time locomotive idling for collections	0	n.a.	0	n.a.	Spotted and pulled at the same time	West	
Number of rail cars collected	0	n.a.	0	n.a.	24	West	
Rail car movements within site							
Length of time / location of shuttle wagon movements	51	East to West	17	East to West	34	East to West	
Number of rail switches / shunting activities due to CC activities (and locations)	3	East	1		2	East	
Number of rail switches / shunting activities due to CP collections/deliveries (and locations)	0	West			8	West	
Number of railcars unloaded in dumper building	18	E (rail dumper building)	5	E (rail dumper building)	8	E (rail dumper building)	22 minutes per car
Truck activities							
Number of trucks arriving / departing site ('outside trucks')	82	West	16	West	4	West	All trucks enter at the Far West
Number of figure-8 movements ('inside trucks')	36	both	10	both	16	both	
Time for loading and unloading of containers onto trucks (minutes)	360	both	200	both	160	both	each container handled 5 times, for 1 minute each
Number of truck containers being stuffed	72	East	40	East	32	East	Takes 4 - 5 minutes per container
Stationary equipment							
Length of time dust fan is in operation	7am - 7pm	E (rail dumper building)	7 - 10 pm	E (rail dumper building)	10pm to 5am. 5am - 7am	E (rail dumper building)	
Length of time of alarm noise when rail cars advance within building	36 mins	E (rail dumper building)	10 mins	E (rail dumper building)	16 mins	E (rail dumper building)	2 min. Per railcar
Length of time rail car indexer is in operation	36 mins	E (rail dumper building)	10 mins	E (rail dumper building)	16 mins	E (rail dumper building)	2 min. Per railcar

Date: Tuesday 27 January 2015

	Daytime 7 am - 7 pm	Location (E / W (or both)	Evening 7 pm - 10 pm	Location (E / W (or both)	Night 12am - 7am and 10pm - 12am	Location (E / W (or both)	Comments
Tonnage throughput	Total Loaded: 2384.37 MT						
CP Deliveries / Collections							
Length of time locomotive idling for deliveries	Approx 15 mins	West	0	n.a.	Approx 20 minutes	West	6am, 9:30am
Number of rail cars delivered	6	West	0	n.a.	17	West	
Length of time locomotive idling for collections	0	n.a.	0	n.a.	Spotted and pulled at the same time	West	
Number of rail cars collected	0	n.a.	0	n.a.	30	West	
Rail car movements within site							
Length of time / location of shuttle wagon movements	68	East to West	17	East to West	136	East to West	
Number of rail switches / shunting activities due to CC activities (and locations)	4	East	1		8	East	
Number of rail switches / shunting activities due to CP collections/deliveries (and locations)	8	West	0		8	West	
Number of railcars unloaded in dumper building	17	E (rail dumper building)	3	E (rail dumper building)	9	E (rail dumper building)	22 minutes per car
Truck activities							
Number of trucks arriving / departing site ('outside trucks')	45	West		West		West	All trucks enter at the Far West
Number of figure-8 movements ('inside trucks')	34	both	6	both	18	both	
Time for loading and unloading of containers onto trucks (minutes)	340	both	60	both	180	both	each container handled 5 times, for 1 minute each
Number of truck containers being stuffed	68	East	12	East	36	East	Takes 4 - 5 minutes per container
Stationary equipment							
Length of time dust fan is in operation	7am - 7pm	E (rail dumper building)	7 - 10 pm	E (rail dumper building)	10pm to 5am. 5am - 7am	E (rail dumper building)	
Length of time of alarm noise when rail cars advance within building	34 mins	E (rail dumper building)	6 mins	E (rail dumper building)	18 mins	E (rail dumper building)	2 min. Per railcar
Length of time rail car indexer is in operation	34 mins	E (rail dumper building)	6 mins	E (rail dumper building)	18 mins	E (rail dumper building)	2 min. Per railcar

Date: Wednesday 28 January 2015							
	Daytime 7 am - 7 pm	**Location (E / W (or both)**	**Evening 7 pm - 10 pm**	**Location (E / W (or both)**	**Night 12am - 7am and 10pm - 12am**	**Location (E / W (or both)**	**Comments**
Tonnage throughput	Total Loaded: 2685.34 MT						
CP Deliveries / Collections							
Length of time locomotive idling for deliveries	Approx 20 minutes	West	0	n.a.	0	n.a.	approx 7:30am
Number of rail cars delivered	39	West	0	n.a.	0	n.a.	
Length of time locomotive idling for collections	0	n.a.	0	n.a.	Approx 20 minutes	West	approx 5:30am
Number of rail cars collected	0	n.a.	0	n.a.	29	West	
Rail car movements within site							
Length of time / location of shuttle wagon movements	51	East to West	17	East to West	34	East to West	
Number of rail switches / shunting activities due to CC activities (and locations)	3	East	1	East	2	East	
Number of rail switches / shunting activities due to CP collections/deliveries (and locations)	8	West	0	West	8	West	
Number of railcars unloaded in dumper building	15	E (rail dumper building)	4	E (rail dumper building)	11	E (rail dumper building)	22 minutes per car
Truck activities							
Number of trucks arriving / departing site ('outside trucks')	203	West	31	West	15	West	All trucks enter at the Far West
Number of figure-8 movements ('inside trucks')	30	both	8	both	22	both	
Time for loading and unloading of containers onto trucks (minutes)	300	both	80	both	220	both	each container handled 5 times, for 1 minute each
Number of truck containers being stuffed	60	East	16	East	44	East	Takes 4 - 5 minutes per container
Stationary equipment							
Length of time dust fan is in operation	7am - 7pm	E (rail dumper building)	7 - 10 pm	E (rail dumper building)	10pm to 5am. 5am - 7am	E (rail dumper building)	
Length of time of alarm noise when rail cars advance within building	30 mins	E (rail dumper building)	8 mins	E (rail dumper building)	22 mins	E (rail dumper building)	2 min. Per railcar
Length of time rail car indexer is in operation	30 mins	E (rail dumper building)	8 mins	E (rail dumper building)	22 mins	E (rail dumper building)	2 min. Per railcar