WESTRIDGE MARINE TERMINAL NOISE TECHNICAL REPORT

# WESTRIDGE MARINE TERMINAL UPGRADE AND EXPANSION PROJECT APPLICATION TO VANCOUVER FRASER PORT AUTHORITY

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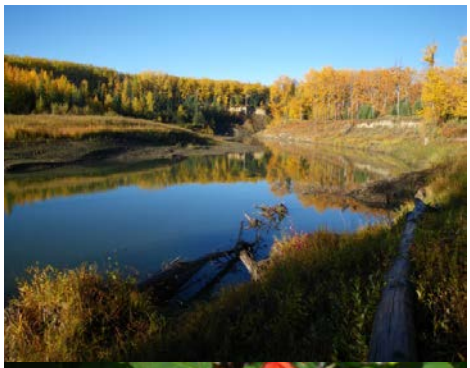

# NOISE MANAGEMENT PLAN FOR CONSTRUCTION AT PUMP STATIONS AND TERMINALS

## TRANS MOUNTAIN PIPELINE ULC
## TRANS MOUNTAIN EXPANSION PROJECT
## NEB CONDITION 80

**May 2017**
**REV A**
**01-13283-GG-0000-RWD-RPT-0002**

Prepared for:

TRANSMOUNTAIN

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# Visual guide to TMEP's Environmental Plans to the NEB Conditions related to the Environmental Protection Plan

Trans Mountain's environmental program during construction is presented in ten volumes of the Environmental Plans as shown in the visual guide below. The Environmental Plans will be implemented by contractors and Environmental Inspectors during all phases of construction. Consequently the ten volumes of plans cover all aspects of Environmental Management. To demonstrate compliance with NEB Conditions, Trans Mountain will file the Environmental Plans with the NEB. To clarify how TMEP's Environmental Plan Volumes relate to Condition documents filed with the NEB please see the table below.

## Trans Mountain Expansion Project Guide to the Environmental Plans

| Environmental Plans | NEB Condition and Filing ID |
|---|---|
| **Volume 1 – Temporary Construction Lands and Infrastructure Environmental Protection Plan** | **78 Facilities Environmental Protection Plan** |
| **Volume 2 – Pipeline Environmental Protection Plan** | **72 Pipeline Environmental Protection Plan** |
| **Volume 3 – Facilities Environmental Protection Plan** | **78 Facilities Environmental Protection Plan** |
| **Volume 4 – Westridge Marine Terminal Environmental Protection Plan** | **81 Westridge Environmental Protection Plan** |
| **Volume 5 – Reactivation Environmental Protection Plan** | **72 Pipeline Environmental Protection Plan** |
| **Volume 6 – Environmental Management Plans** | **72 Pipeline Environmental Protection Plan**<br>**78 Facilities Environmental Protection Plan**<br>**81 Westridge Environmental Protection Plan** |
| **Volume 7 – Resource-Specific Mitigation Tables** | **72 Pipeline Environmental Protection Plan** |
| **Volume 8 – Environmental Alignment Sheets** | **72 Pipeline Environmental Protection Plan** |
| **Volume 9 – Burnaby Mountain Tunneling Environmental Protection Plan** | **72 Pipeline Environmental Protection Plan** |
| **Volume 10 – Compliance Plan** | **72 Pipeline Environmental Protection Plan**<br>**78 Facilities Environmental Protection Plan**<br>**81 Westridge Environmental Protection Plan** |

**This plan forms part of Volume 6 and is located:**

| Volume 6 – Environmental Management Plans | | NEB Condition and Filing ID |
|---|---|---|
| Section 1 – Organizational Structure | 1.1 - Project Organizational Structure | Condition 88 |
| Section 2 – Socio–Economic Management | 2.1 - Access Management Plan | Condition 47 A82635 |
| | 2.2 - Agricultural Management Plan | Condition 72 |
| | 2.3 - Socio-Economic Effects Monitoring Plan | Condition 13 A81754 |
| | 2.4 – Heritage Resources | Condition 100 |
| | 2.5 – Biosecurity Management Plan | Condition 72 |
| | 2.6 – Socio-Economic Management Plan | Condition 72 |
| | 2.7 – Worker Accommodation Strategy | Condition 59 |
| Section 3 – | 3.1 - Waste Management Plan | Condition 72 |

| Volume 6 – Environmental Management Plans | | NEB Condition and Filing ID |
|---|---|---|
| Contaminated Sites and Waste Management | 3.2 - Contamination Identification and Assessment Plan | Condition 46 A82636 |
| | 3.3 - Hydrovac Cutting and Disposal Management Plan | Condition 72 |
| Section 4 – Geological and Groundwater Management | 4.1 - Metal Leaching and Acid Rock Drainage Management Plan | Condition 72 |
| | 4.2 – Groundwater Management Plan | Condition 72 |
| Section 5 – Vegetation Management | 5.1 - Timber Salvage Management Plan | Condition 72 |
| | 5.2 - Old Growth Management Areas Mitigation and Replacement Plan | Condition 76 |
| | 5.3 - Rare Ecological Community and Rare Plant Population Management Plan | Condition 40 |
| | 5.4 - Grasslands Survey and Mitigation Plan | Condition 42 A82362 |
| | 5.5 - Weed and Vegetation Management Plan | Condition 45 A82634 |
| Section 6 – Wildlife Management Plans | 6.1 – Preliminary Caribou Habitat Restoration Plan | Condition 37 A81921 |
| | 6.2 – Sowaqua Spotted Owl Mitigation Plan | Condition 38 A81923 |
| | 6.3 – Grizzly Bear Mitigation Plan | Condition 56 |
| | 6.4 – Wildlife Species at Risk Mitigation and Habitat Restoration Plans | Condition 44 |
| | 6.4.1 – American Badger Mitigation Plan | Condition 44 |
| | 6.4.2 – Barn Owl Mitigation Plan | Condition 44 |
| | 6.4.3 – Coastal Giant Salamander Mitigation Plan | Condition 44 |
| | 6.4.4 – Great Basin Spadefoot Mitigation Plan | Condition 44 |
| | 6.4.5 – Williamson's Sapsucker and Lewis's Woodpecker Mitigation Plan | Condition 44 |
| Section 6 – Wildlife Management Plans *Cont'd.* | 6.4.6 – Oregon Forestsnail Mitigation Plan | Condition 44 |
| | 6.4.7 – Oregon Spotted Frog Mitigation Plan | Condition 44 |
| | 6.4.8 – Pacific Water Shrew Mitigation Plan | Condition 44 |
| | 6.4.9 – Western Rattlesnake and Great Basin Gophersnake Mitigation Plan | Condition 44 |
| | 6.4.10 – Townsend's Mole Mitigation Plan | Condition 44 |
| | 6.4.11 – Western Screech–Owl Mitigation Plan | Condition 44 |
| Section 7 – Wetland Management | 7.1 - Wetland Survey and Mitigation Plan | Condition 41 |
| Section 8 – Aquatic Resource Management | 8.1 - Nooksack Dace and Salish Sucker Management Plan | Condition 75 |
| | 8.2 - Water Quality Monitoring Management Plan | Condition 72 |
| | 8.3 - HDD/Trenchless Planning and Procedures Management Plan | Condition 72 |
| | 8.4 - Horizontal Directional Drilling Noise Management Plan | Condition 74 |
| | 8.5 - Navigation and Navigation Safety Plan | Condition 48 A82632 |
| | 8.6 - Water Withdrawal and Discharge Procedures Management Plan | Condition 72 |
| | 8.7 - Riparian Habitat Management Plan | Condition 71 |
| | 8.8 - Watercourse Crossing Inventory | Condition 43 A82366, A82369, A82390, A82392, A82395, A82397, A82400, A82405, A82409 |
| Section 9 – Reclamation Plans | 9.1 – Reclamation Management Plan | Condition 72 |
| | 9.2 - British Columbia Parks Reclamation Plan | Condition 72 |
| | 9.2.1 - Finn Creek Provincial Park Land Use/Occupancy Park Use Permit Application | Condition 72 |
| | 9.2.2 - Lac du Bois Grasslands Protected Area Land Use/Occupancy Park Use Permit Application | Condition 72 |
| | 9.2.3 - Coquihalla Summit Recreation Area Land Use/Occupancy Park Use Permit Application | Condition 72 |
| | 9.3 – Wabamun Park Reclamation Plan | Condition 72 |
| Section 10 – | 10.1 - Air Emissions Management Plan for the Edmonton, Sumas, and Burnaby | Condition 79 |

| Volume 6 – Environmental Management Plans | | NEB Condition and Filing ID |
|---|---|---|
| Facilities Management Plans | Terminals | |
| | 10.2 - Noise Management Plan for Construction at Terminals and Pump Stations | Condition 80 |
| | 10.3 - Air Emissions Management Plan for Westridge Marine Terminal | Condition 52 A82640 |
| | 10.4 – Marine Water Quality Management Plan during Rip Rap Removal | Condition 35 |
| Section 10 – Facilities Management Plans Cont'd. | 10.5 - Fugitive Emissions Management Plan for the Edmonton, Sumas, and Burnaby Terminals | Condition 54 |
| | 10.6 - Fugitive Emissions Management Plan for Westridge Marine Terminal | Condition 53 A82637 |
| | 10.7 - Fugitive Emissions Management Plan for Pump Stations | Condition 55 |
| | 10.8 - Light Emissions Management Plan | Condition 82 |
| Section 11 – Burnaby Mountain Tunneling Management | 11.1 - Air Emissions Management Plan for Burnaby Mountain Tunnel Construction | Condition 85 |
| | 11.2 - Burnaby Mountain Tunnel Construction Noise Management Plan for Burnaby Mountain | Condition 86 |
| | 11.3 - Groundwater Seepage Management Plan | Condition 87 |

# TABLE OF CONCORDANCE

Condition 80 is applicable to the following legal instruments: OC-064 (CPCN), XO-T260-008-2016 (Pump1), XO-T260-009-2016 (Pump2) and XO-T260-010-2016 (Tanks). Table 1 describes how this Plan addresses the Condition requirements applicable to Project activities.

**TABLE 1**
**LEGAL INSTRUMENT CONCORDANCE WITH NEB CONDITION 80:**
**NOISE MANAGEMENT PLAN FOR CONSTRUCTION AT TERMINALS AND PUMP STATIONS**

| NEB Condition 80 | OC-064 (CPCN) | XO-T260-008-2016 (Pump1) | XO-T260-009-2016 (Pump2) | XO-T260-010-2016 (Tanks) |
|---|---|---|---|---|
| Noise Management Plan for construction at terminals and pump stations Trans Mountain must file with the NEB for approval, at least 3 months prior to commencing construction at each terminal and pump station, a Noise Management Plan for construction, where residences are within 300 metres of the proposed construction activities. The plan must include: | | | | |
| a) proposed hours of daytime and nighttime work; | Section 3.1 – WMT | Section 6.1 – Pump Stations | Section 6.1 – Pump Stations | Section 4.1 – Burnaby<br>Section 5.1 – Sumas |
| b) noise mitigation measures, including all technologically and economically feasible mitigation measures; | Section 2 – general<br>Section 3.5 – WMT | Section 2 – general<br>Section 6.5 – Pump Stations | Section 2 – general<br>Section 6.5 – Pump Stations | Section 2 – general<br>Section 4.5 – Burnaby<br>Section 5.5 – Sumas |
| c) a noise monitoring program, including locations, methodology, and schedule; | Section 7 | Section 7 | Section 7 | Section 7 |
| d) a description of the public and Aboriginal communication and noise complaint response process; and | Section 8 | Section 8 | Section 8 | Section 8 |
| e) a contingency plan that contains proposed mitigation measures for addressing noise complaints, which may include the temporary relocation of specific residents. | Section 9 | Section 9 | Section 9 | Section 9 |

# EXECUTIVE SUMMARY

The Noise Management Plan (NMP or the Plan) for construction at Pump Stations and Terminals was prepared to address the requirements of National Energy Board (NEB) Condition 80 for the Trans Mountain Expansion Project ("the Project" or "TMEP"). The NMP is aligned with information from other plans that have been prepared in support of the Project and together form the Project Environmental Plans.

Construction activities will involve use of earth moving equipment, drills and other motorized equipment. This activity generates sound which can result in annoyance or sleep disturbance for neighboring residences. Sites requiring consideration for site-specific mitigation are those with residences within 300 m of site boundaries. These include:

- Westridge Marine Terminal
- Burnaby Terminal
- Sumas Terminal
- Gainford Pump Station
- Blackpool Pump Station
- Darfield Pump Station
- Blue River Pump Station

The primary work shifts at Westridge Marine Terminal (WMT), Burnaby Terminal and Sumas Terminal are to be conducted on a single shift per day, from Monday to Friday from 7:00 am to 8:00 pm. Saturdays may be used as required. Work on Saturday will be from 9:00 am to 8:00 pm. Night shift work if required may include maintenance and hand labour work that will not include continuous use of heavy equipment and will be measured and evaluated against Health Canada (HC) target construction noise guidelines.

Construction hours for pump stations are expected to take place from 8:00 am to 6:00 pm. The typical work schedule for these sites is 10 days on, 4 days off or 14 days on and 7 days off; however, this schedule has yet to be confirmed with the construction contractor.

Existing sound levels have been established through the noise management planning process for residences within 300 m of each terminal and pump station, which forms the base to determine the amount of change in sound levels from construction that may occur due to construction activity. The amount of noise considered acceptable from construction was based on 2016 HC recommended levels for triggering noise mitigation from construction activity. The British Columbia (BC) Oil and Gas Commission (OGC) and Alberta Energy Regulator (AER) noise limits as used in the Application were also compared as desired noise targets. The HC guideline is considered the most appropriate guideline for construction activity as it is designed specifically with these noise sources in mind. Local bylaws are also discussed and taken into consideration.

Current construction plans were used to establish noise levels that are expected to occur off the construction sites without additional mitigation. Appropriate mitigation to demonstrate compliance with recommended HC as well as the BC OGC and AER noise limits (desired sound level) used in the Application was applied in the model scenarios.

Detailed lists of mitigation or controls effective at controlling noise are provided in Section 2. Several types of controls can be used to achieve equal results.

The scenarios used, to demonstrate the selected mitigation and noise control practices that will be effective at limiting noise to the HC recommended levels, reflect phases with the maximum amount of site activity and that desired BC OGC or AER limits can be achieved. As activities on sites begin, sound levels from the sites will be monitored to verify that selected controls are effective and whether additional controls are needed. This iterative approach will allow the most efficient development of noise controls.

As construction on each site progresses, additional mitigation measures or actions may be implemented as required. A notification and complaint process will be implemented to ensure the community is notified of activity and so any noise complaints can be investigated and addressed.

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**ACRONYMS**

| | |
|---|---|
| AER | Alberta Energy Regulator |
| ASL | Ambient Sound Level |
| BC | British Columbia |
| BC OGC | British Columbia Oil & Gas Commission |
| BMT | Burnaby Mountain Tunnel |
| BSL | Baseline Sound Level |
| CoA | City of Abbotsford |
| CoB | City of Burnaby |
| ESA | Environmental and Socio-Economic Assessment |
| EPP | Environmental Protection Plan |
| HC | Health Canada |
| IR | Information Request |
| ISO | International Standards Organization |
| KMC | Kinder Morgan Canada |
| dBA | A-weighted decibels |
| Ld | Daytime Average Noise Level |
| Ldn | Day-Night Average Noise Level |
| Leq | Equivalent Continuous Noise Level |
| Ln | Nighttime Average Noise Level |
| NEB | National Energy Board |
| NMP | Noise Management Plan |
| PSL | Permissible Sound Level |
| TMEP | Trans Mountain Expansion Project |
| WMT | Westridge Marine Terminal |
| %HA | Percent Highly Annoyed |

# 1.0 INTRODUCTION

The Noise Management Plan (NMP or the Plan) for construction for Pump Stations and Terminals was prepared to address the requirements of National Energy Board (NEB) Condition 80 for the Trans Mountain Expansion Project (the Project or TMEP). This document pertains specifically to the construction of terminals and pump stations. As stated in NEB Condition 80, a NMP is required for any of these sites where there are one or more residences within 300 metres (m) of the proposed construction activities.

## 1.1 Objective

The objective of this NMP is to provide noise controls and practices to minimize any adverse effects to the surrounding environment, including communities and nearby residents during construction activities. Noise monitoring plans and communication plans are also provided.

## 1.2 Links to Other Trans Mountain Environmental Plans

Information from other management plans prepared for the Project that are related to noise management for construction at the terminals and pump stations has been considered in this NMP. The links between the NMP and other Trans Mountain management plans are provided in Table 2.

**TABLE 2**
**TRANS MOUNTAIN MANAGEMENT PLANS LINKED TO NMP**

| Environmental Plan | Description of the Environmental Plan | Linkage to this Plan |
|---|---|---|
| Pipeline Environmental Protection Plan (EPP) (NEB Condition 72)) | The Pipeline EPP contains Trans Mountain's environmental procedures and mitigation measures to be implemented during construction of the pipeline to avoid, reduce or mitigate potential adverse environmental effects. The EPP serves as reference information for construction and inspection personnel to support decision-making and to provide direction to more detailed information (i.e., resource-specific mitigation, management and contingency plans). | The EPP includes general construction measures applicable to noise generated by the Project. Construction mitigation measures applicable to noise are included in Section 7.0 of the EPP. |
| Facilities EPP (NEB Condition 78) | The Facilities EPP contains Trans Mountain's environmental procedures and mitigation measures to be implemented during construction of the project to avoid, reduce or mitigate potential adverse environmental effects. The EPP serves as reference information for construction and inspection personnel to support decision-making and to provide direction to more detailed information (i.e., resource-specific mitigation, management and contingency plans). | The EPP includes general construction measures applicable to noise generated by the Project. General construction mitigation measures applicable to noise are included in Section 7.0 of the EPP. |
| Burnaby Mountain Tunnel Noise Management Plan (NEB Condition 86) | The NMP for Burnaby Mountain Tunnel contains detailed plans for noise control for construction activities where there are homes within 300 m for TM property boundaries. The NMPs demonstrate that selected mitigation/controls can achieve the desired amount of noise control to reduce impacts on nearby residences and businesses. | The Burnaby Mountain Tunnel (BMT) is co-located with the Westridge Marine Terminal (WMT) and Burnaby Terminal, and construction activities for the BMT, Burnaby Terminal, and WMT will be concurrent. This results in potential cumulative noise effects where management of noise on a site wide basis is the most efficient. The mitigation plans for the BMT, WMT and Burnaby Terminal were developed concurrently. |
| Traffic Control Plans for pubic roadways | The Traffic Control Plan provides details on expected traffic volumes compared to current volumes on public roadways, key access points, marshalling areas and access roads for the Project, mitigation planned to minimize impacts from traffic, including congestion, safety, light, dust and noise. | Noise from construction traffic on public roadways is mitigated through this plan. |

## 1.3 Commitment Management

Trans Mountain made a number of commitments regarding the Project during the OH-001-2014 proceedings and engagement activities up to May 2016. Commitments were made to improve and optimize Project planning and mitigation measures. As Trans Mountain has consolidated its commitments into a Commitments Tracking Table in accordance with NEB Condition 6, the table of commitments in each plan has been removed.

The updated Commitments Tracking Table was filed with the NEB and is available on Trans Mountain's web site at www.transmountain.com. Trans Mountain continues to monitor and track compliance with its commitments and will update, post to its website and file with the NEB updated versions of the Commitments Tracking Table according to the timeframes outlined in NEB Condition 6. Commitments with specific relevance to this Plan have been considered and incorporated into this Plan.

## 1.4 Regulatory Guidance

This document provides general and site-specific mitigation measures in accordance with various guidelines including British Columbia (BC) Oil and Gas Commission (OGC) Noise Control Best Practices Guidelines (2009), Alberta Energy Regulator (AER) Directive 038 Noise Control (AER 2007), Health Canada (HC) guidance (HC 2016) and local bylaws. As part of NEB Condition 80, it is mandated that a site-specific mitigation plan be created to ensure that predicted sound levels meet specific noise limits at receptors. To determine the most appropriate sound level limits, each guideline was reviewed.

### 1.4.1 Provincial Noise Criteria - BC OGC Guideline and AER Directive 038

The noise limits as set in out in the BC OGC Guideline and AER Directive 038 are the primary desired noise criteria to be met per the commitments made in the environmental assessment (Trans Mountain 2013). These guidelines also set standards for noise measurements, complaint responses and management plans.

The BC OGC Guideline and AER Directive 038 provide receptor based guidance for the assessment of Oil and Gas Industry operations against permissible sound levels (PSLs) where there is a permanent or seasonally occupied dwelling (receptor). Section 3.1.1 of the guidelines provides reasonable mitigating measures to reduce construction noise from new facilities or modifications which include the following:

- conduct construction activity between the hours of 07:00 and 22:00;
- advise nearby residents of potential noise-causing activities and schedule these events to reduce disruption;
- ensure all internal combustion engines are fitted with appropriate muffler systems; and,
- take advantage of acoustical screening from existing on-site buildings to shield dwellings from construction equipment noise.

The above reasonable mitigation measures are included in the mitigation plan (Section 2). However, sufficient sound is generated from construction that a site-specific mitigation strategy is needed which, in turn, requires quantifiable sound level targets. Mitigation must bring sound levels within these targets to demonstrate that annoyance and sleep disturbance are minimized. Compliance with BC OGC's and AER's PSLs are used as desired limits to address the planning of mitigation to demonstrate mitigation effectiveness.

Section 2.3.5 of both guidelines, which addresses operation facilities with 'temporary noise-generating activity', is most appropriate due to the temporary nature of the activity. For temporary activity, adjustment to the noise limit is allowed if the duration of the activity is less than 60 days. Since construction at the terminals and pump stations will exceed 60 days, no adjustment is allowed. This suggests that BC OGC and AER noise level limits for operating facilities would be a reasonable standard to use for temporary, but long-term terminal and pump station construction.

These two guidelines provide consistency with all previous assessments for the Project. The two guidelines form the basis of the site-specific mitigation based on sample construction activity. However, both guidelines are typically applied to continued operations and may not be most appropriate for long-

term construction activities such as these. Therefore, the NMP consider these guidelines as desired. The guidelines' receptor-specific sound level targets are provided in each individual NMP below (i.e., Sections 3.0 to 6.0).

### 1.4.2 Health Canada Guidance

A second document that can be applied from an acoustic environment perspective is the Federal Health Canada (HC): Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise (HC Guidance) (HC 2016).

The HC Guidance provides guidance regarding noise due to construction. The HC Guidance provides recommendations for long-term and short-term construction activities. For the terminals and pump stations, long-term (greater than one year) construction recommendations apply. HC suggests that mitigation be proposed if the change in %HA at a specific receptor is greater than 6.5% between project and baseline noise environments. The Day-Night Average Noise Level (Ldn) limits have been split into separate Daytime Average Noise Level (Ld) and Nighttime Average Noise Level (Ln) limits to compare specific daytime and nighttime activities to specific limits. If the project-related noise is in excess of 75 dBA Ldn (75 dBA for daytime and 65 dBA for nighttime), mitigation should be applied as soon as feasible. The HC guideline is discussed in more detail in Appendix A.

The calculations or measured values of noise for various activities are also adjusted for the 'character' or potential for annoyance. This is applied to primarily construction noise and low frequency noise. Construction noise is highly variable, tonal and impulsive so calculations and limits consider the increased annoyance that occurs with this type of sound.

HC also indicates that speech intelligibility should be considered when determining degrees of potential annoyance and likelihood of complaint, with sleep disturbance being considered for nighttime effects.

Note that since most of the construction activity will take place during the day, instead of evaluating the percentage of highly annoyed (%HA) using the Ldn, the %HA was split to day and night sound level targets which vary depending on the receptor.

The HC Guidance is considered the most appropriate guideline for construction activity as it is designed specifically with this activity in mind. The receptor-specific sound level targets are provided in each Appendix (i.e., Appendix C to F).

### 1.4.3 Local Bylaws

Prior to construction at each terminal or pump station, the associated municipality bylaw should be considered. Although Trans Mountain is federally regulated by the NEB, Trans Mountain will make efforts to conform, where possible, to the decibel and timing conditions prescribed in municipal bylaws. Key bylaws are indicated below.

#### 1.4.3.1 City of Burnaby

The City of Burnaby (CoB) Bylaw 7332 states that construction noise should not exceed 85 dBA when measured at least 15.2 m from the source in a residential, multifamily, public or institutional district. The 85 dBA noise limit is not referring to the noise level at the receptor but at a distance of 15.2 m from the source. This does not account for multiple pieces of equipment working over a broad area, nor does it address nighttime issues with sleep disturbance to daytime issues with speech intelligibility. The 85 dBA is also a level at which hearing protection is required for extended (8- to 10-hour) exposures.

CoB Bylaw 7332 also contains commercial sound level limits that can be used as guidance for long-term (multi year) construction, where noise exposure expectations by the public are lower than for short term disruptions. CoB Bylaw 7332 indicates where any persons within a commercial district "make or cause or permit to be made or cause continuous noise or continuous sound, the noise or sound level at any point on the boundary of or within a Residential District" should not exceed:

- 60 dBA between the hours of 7 am and 10 pm (daytime); and,

- 55 dBA between the hours of 10 pm and 7 am (nighttime).

CoB Bylaw 7332 also provides non-continuous noise level limits. Non-continuous is defined as *"noise continuing for less than 3 minutes in a 15 minute time period".* The bylaw states that non-continuous noise levels shall not exceed:

- 80 dBA between the hours of 7 am and 10 pm (daytime); and
- 75 dBA between the hours of 10 pm and 7 am (nighttime).

The bylaw also discusses construction operating hours, which are discussed in Sections 3.1 and 4.1.

#### 1.4.3.2 City of Abbotsford

The City of Abbotsford (CoA) does not have a noise bylaw. Noise regulation is addressed in the CoA Consolidated Good Neighbour Bylaw (Bylaw 1256-2003). CoA Bylaw 1256-2003 does not provide noise level limits for construction activity. Instead, the bylaw discusses construction operating hours, which is discussed in Section 3.1. CoA Bylaw 1256-2003 will be considered for Sumas Terminal.

### 1.4.4 Thresholds for Noise Management

As mentioned above, the BC OGC guideline or AER Directive 038 are applied as part of the assessment to generate site-specific mitigation based on sample construction activity. The results provided in Section 3 to Section 6 demonstrate that mitigation can be used to meet desired BC OGC or AER sound levels at receptors. However, the target sound levels provided by HC are specific to long-term construction and are considered more appropriate for evaluating community disturbance moving forward. These limits vary by site and are provided in the site-specific discussion in Section 3 to Section 6.

If at any time sound levels exceed 75 dBA for the day (15 hour Leq) or 65 dBA night (9 hour Leq), mitigation will be applied as soon as feasible and work related to the sound level exceedance may be stopped until controls are in place.

Construction activities, equipment used and construction schedules will vary during the process of construction planning and execution. Because construction noise will be highly variable and is difficult to anticipate, noise impacts will be iteratively evaluated according to the procedure detailed in Section 2.

## 2.0 NOISE MITIGATION PLAN

Construction activity can be highly variable, therefore an adaptive approach to noise mitigation design and implementation is planned. Final mitigation decisions and planning will be phased, with each stage of construction being reviewed and checked by the contractor prior to commencement to verify if the planned mitigation is appropriate or if alternative methods to noise control may be more effective. This may include a combination of monitoring and modelling, or could be a simple desktop review of sound source data compared to the sample scenarios.

This NMP identifies mitigation options that would be effective in controlling noise, and demonstrates that the planned mitigation approaches are feasible solutions.

Sections 2.2 and 2.3 detail mitigation that must be applied for all construction phases at each site per the Environmental Socio-economic Assessment (ESA), the Facilities Environmental Protection Plan (EPP) (NEB Condition 78) and additional good practices or controls that may be useful in managing noise where homes are within 300 m of site boundaries.

Sections 3 to 6 describe site-specific sound level thresholds for mitigation, detailed noise controls and practices to minimize any adverse effects to the surrounding environment, including wildlife, communities, and nearby residents. These site-specific sections also describe the level of monitoring and iterative analysis to best fit noise controls that may be required.

If any controls are not adhered to or an alternative solution is devised, notification and justification of any changes should be brought to the attention of Trans Mountain through the Management of Change (MOC) process.

## 2.1 Modelling Methods

To predict the sound levels for each site at the surrounding receptors, noise modelling was conducted using Cadna/A noise prediction software. This software uses the environmental sound propagation calculation methods prescribed by the ISO Standard 9613 (ISO 1993, 1996). The ISO 9613 sound propagation method predicts sound levels under moderately developed temperature inversion and downwind conditions, which enhance sound propagation to the receptor which is considered a realistic worst-case scenario. The model takes into consideration natural and man-made barriers.

All modelling of sound levels is conducted using the methods outlined in the ESA (Trans Mountain 2013) which are consistent with the requirements of the NEB, BC OGC Guideline and AER Directive. The Cadna/A model configuration summary tables are provided as Table B-1 in Appendix B.

The models for each site are based on detailed construction plans available at the time this plan was developed. The adaptive approach to mitigation management allows for updates to the noise controls that may occur as construction plans continue to be refined.

## 2.2 General Mitigation List

The following recommendations to control noise from construction activity are as included in the Facilities EPP (NEB Condition 78):

- Adhere to all federal (i.e., Environment Canada, Motor Vehicle Safety Act, Oil and Gas Occupational Safety and Health Regulations, Health Canada) and provincial (i.e., Directive 038: Noise Control, BC Noise Control Guideline Best Practices Guideline, Worker's Compensation Act, Section 7.2 of the Occupational Health and Safety Regulations [BC Reg 296/97 as amended] Section 7.2 [BC Reg. 382/2004, s.1]) guidelines and regulations and legislation for noise management.

- General construction scheduling will consider noise sensitive locations (i.e., neighboring landowners) and noise sensitive periods.

- Schedule intermittent noise producing events to avoid, where feasible, important habitat of wildlife species at risk/sensitive species/livestock during sensitive periods.

- Schedule intermittent noise producing events to avoid nighttime hours or sensitive times near residences (e.g., avoid week-end mornings).

- Schedule staged construction activities so the local total duration of construction is limited (minimize time gaps between stages).

- Create a policy on temporary relocation of residents for short periods for construction in close proximity (less than 100 m) if limiting noise exposure is not otherwise possible.

- Provide alternative cooling (air conditioners) for residents where controlling noise levels to achieve desired levels is not possible, for times when windows are normally open.

- Provide notification to affected residences with 300 m of pipeline or facility construction outlining the expected construction schedule.

- Provide education to Trans Mountain inspectors and contractors on how to minimize average noise levels, cyclic sounds or sudden noise events.

- Implement mitigation measures where residences are located within 300 m of the construction right-of-way or facility site as outlined in the NMP.

- Implement mitigation measures where night-time activity on the construction right-of-way or facility site is located within 500 m of residences as outlined in the NMP.

## 2.3 Good Practice Guidelines

The following controls are expected to be applied as standard practice for all construction phases.

- Enforce vehicle speed limits and inform contractor truck drivers and equipment operators that engine retarder braking in urban areas is prohibited.
- Maintain equipment in good working condition and in accordance with manufacturer guidelines. Particularly, maintain tracked equipment to minimize mechanical noise.
- Maintain noise suppression equipment on all construction machinery and vehicles in good order.
- Use only the size and power of tools necessary to limit noise from power tool operations. Ensure stationary equipment, such as compressors and generators, will be located away from noise receptors, to the extent feasible, and follow all applicable provincial and federal guidelines.
- For equipment delivery, material placement and storage, site access and site work, establish drive-through vehicle movements to limit use of backup alarms.
- Limit use of loudspeakers or audible notifications/announcements.
- Use ambient adjustable or pink noise backup alarms on vehicles working within 300 m of homes for nighttime work.
- Minimize concurrent vehicular traffic from construction and deliveries to and from site and schedule to occur during daytime hours whenever possible.
- Reduce drop heights of any material relocation, loading, or excavation.
- Locate stationary equipment, such as compressors and generators away from noise receptors or behind site structures that may act as barriers.
- Enclose noisy equipment and use baffles or shrouds on pipes and equipment. Use caution to prevent equipment overheating.
- Install portable barrier walls near stationary equipment or near specific activities. Most effective when properly installed near sources or near receptors. Earth berms or hay bale barriers can be considered where space allows.
- Use vibratory methods of pile installation, to the extent feasible. Limit impact piling to daytime only, if feasible.
- Enclose noisy equipment and use baffles such as material storage and subsoil piles, where and when feasible, to limit the transmission of noise beyond the construction site.
- Minimize additional mitigation needs by adjusting the site layout to maximize blocking of sound by stored materials and directing sound away from homes by orienting fans and air inlets away from homes
- Drilling activities should be considered extremely noise sensitive and the following controls must be met:
    - drill rigs must be regularly inspected and maintained to ensure proper working condition; and
    - consider portable acoustic barriers or berms directly around drilling location where feasible.
- Compressors running during nighttime periods will be in enclosures.

- Emphasis on dump trucks limiting any avoidable practices that generate excess noise such as compression brakes, or pumping brakes to intentionally slam tailgates (used to loosen stuck material).

## 2.4 Sites Requiring Specific Noise Management

Per NEB Condition 80, terminals and pump stations that have residences within 300 m require site-specific noise planning. While the general noise controls apply to all construction activity on all sites, the following locations have residences within 300 m of the site boundaries, so have been analysed for specific noise control needs:

- Westridge Marine Terminal
- Burnaby Terminal
- Sumas Terminal
- Gainford Pump Station
- Black Pool Pump Station
- Darfield Pump Station
- Blue River Pump Station

The remaining pump stations and the Edmonton Terminal do not require additional noise control analysis as there are no residences within 300 m of the site boundary.

# 3.0 WESTRIDGE MARINE TERMINAL NOISE MANAGEMENT PLAN

This section covers the noise management plan for Westridge Marine Terminal (WMT). The operating hours, baseline ambient sound levels, noise prediction model, sound level limits, mitigation plan and noise monitoring plan are discussed in detail.

## 3.1 Operating Hours

The WMT is located within the CoB. The CoB Bylaw 7332 states that construction shall not occur during the following hours:

- before 7:00 am or after 8:00 pm from Monday to Friday;
- before 9:00 am or after 8:00 pm on Saturday; or
- at any time on Sunday or any Statutory holiday.

Currently, Trans Mountain plans normal work to be conducted on a single shift per day, from Monday to Friday from 7:00 am to 8:00 pm. Saturdays may be used as required. Work on Saturday will be from 9:00 am to 8:00 pm. Night shift work if required may include maintenance and hand labour work that will not include continuous use of heavy equipment and will be measured and evaluated against HC target construction noise guidelines.

## 3.2 Baseline Ambient Noise Level

The HC noise mitigation thresholds are based on existing sound levels at receptors. Receptor points representative of the nearest or most potentially affected homes, schools, institutions or other noise sensitive land uses within 300 m of the construction site have been established. Receptor locations for WMT are displayed in Figure C-1 in Appendix C. BC OGC Guideline sets standards for establishing an Ambient Sound Level (ASL) using the PSL for an area based on dwelling density and proximity to transportation arteries. However, if true ambient noise is found to be greater than the BC OGC derived PSL, an adjustment can be made to raise the PSL and ASL of an area.

Table C-1 in Appendix C summarizes the most affected receptors surrounding WMT construction activity as well as the calculated baseline ambient sound levels. The ambient sound levels have been verified through previously conducted monitoring.

## 3.3 Source Emission Levels and Construction Site Layout

A listing of the proposed noise sources that were modelled with Cadna/A are presented in Table C-2 in Appendix C. Equipment quantity and utilization has been modeled to reflect information provided by Trans Mountain as well as the realistic expectation of equipment operations based on experience with such construction activity. The sample construction scenario modelled is considered the worst-case scenario for WMT.

The worst-case scenario was assessed and was assumed to be when the loudest construction activities take place. The list of activities for the worst-case scenario show noise sources in use for the following site areas:

- shore earthworks;
- shore foundations;
- foreshore earthworks; and
- marine foundations.

The WMT construction activity layout is provided in Figure C-2 in Appendix C.

## 3.4 Sound Level Thresholds for Mitigation

Sound level thresholds where mitigation is required per the HC guidance are displayed in Table C-3 in Appendix C. Desired sound level limits based on the BC OGC PSL are also identified.

## 3.5 Site-Specific Mitigation Plan

To evaluate the effectiveness of site-specific mitigation controls at WMT, a sample construction scenario was modelled (i.e., worst-case scenario). The approach focussed on on-site noise controls, particularly temporary barriers. Final barriers do not have to be placed in the sample scenario positions. Alternative locations, such as placement closer to residences on municipal lands, will be explored with the CoB to allow for better on-site efficiency for heavy equipment movement.

The analysis indicated specific controls to reduce continuous noise are required during the period with heaviest site activity, specifically for homes near receptor WMT_2 (Figure C-1). Desired BC OGC noise levels are achievable at receptor WMT_2 using the following mitigation measures.

- Noise barrier wall or berm (Height: 5 m, Length: 140 m) located between the construction site and WMT_2 as per proposed in the WMT Stakeholders Presentation dated October 12, 2016. Refer to Figure C-3 provided in Appendix C for barrier location.
- Noise barrier wall or berm (Height: 5 m, Length: 92 m) located south of the portal area, on top of the retaining wall. Refer to Figure C-3 provided in Appendix C for barrier location.
- Rough location of equipment is consistent with Figure C-2 provided in Appendix C.
- Quantity and utilization of equipment is consistent with Table C-2 provided in Appendix C.
- General mitigation controls and practices described in Sections 2.2 and 2.3 are followed.
- Use of marine pile driver shrouds as per Section 3.5.1.

If there is a divergence from the above items, the analysis should be adjusted or monitoring used to reassess compliance per the iterative mitigation implementation process. The barriers proposed in this mitigation scenario must be a minimum surface density of 20 kg/m² and have no gaps at the bottom. Based on implementing the above mitigation scenario, the predicted sound levels are presented in Table 3.

With mitigation, WMT construction noise levels are expected to be consistent with the CoB bylaw noise limits. The highest impacted point along the residential property boundary for all WMT construction activity is expected to be 56.2 dBA during the daytime. These sound levels are below the CoB commercial noise limits of 55 dBA at night and 60 dBA during the day as well as construction limits.

**TABLE 3**
**WESTRIDGE MARINE TERMINAL PREDICTED SOUND LEVELS WITH MITIGATION**

| Receptor | Predicted Sound Level (dBA)[1] | | Cumulative Sound Level (dBA) [2] | | Desired Sound Level (BC OGC PSL) (dBA) [3] | | Meet Desired Sound Level (BC OGC PSL) Limit? | | Meet HC Guidance? | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Day | Night [4] | Day | Night | Day | Night | Day | Night | Day | Night |
| WMT_1 | 59 | 45 | 61 | 49 | 61 | 51 | Yes | Yes | Yes | Yes |
| WMT_2 | 48 | 37 | 57 | 47 | 61 | 51 | Yes | Yes | Yes | Yes |
| WMT_3 | 60 | 38 | 64 | 51 | 66 | 56 | Yes | Yes | Yes | Yes |

**Notes:**
[1] Predicted sound level from the Cadna/A noise model.
[2] Predicted sound level + baseline ambient sound level (BSL). BSL is assumed to be 5 dBA lower than the PSL as per BC OGC Guideline.
[3] Based on BC OGC Guideline.
[4] Nighttime construction is not anticipated. However, the latest equipment list shows the use of support tugboats at night.

As shown in Table 3, the recommended mitigation scenario will provide the reduction needed to comply with BC OGC Guideline which also assures compliance with HC guidance and the CoB bylaw.

### 3.5.1 Pile Driver Noise Mitigation

It has been predetermined that shrouds will be used as the primary mitigation strategy for impact type pile driving for marine foundations at WMT. It is estimated that with the use of shrouds, sound levels at the local receptors will be within BC OGC design guidance for day long averages. However, the analysis of sound during active impact piling suggests the variation associated with the impacts can create annoyance within the community. It is recommended that the following additional mitigation be considered where feasible to help minimize complaints which would require investigation and monitoring:

- reduce pile driving energies where possible;
- schedule impact pile driving (in particular, dolphin and platform/trestle) to occur near or during the highest ambient noise periods (i.e., 11:00 am to 1:00 pm and 3:00 pm to 6:00 pm) to take advantage of masking sound when practicable;
- schedule to make sure multiple piles are not actively impacted simultaneously; and
- consider additional mitigation controls (see above mitigation techniques section) where feasible for the shore and foreshore foundations if impact pile driving is needed, to help minimize community annoyance.

## 4.0 BURNABY TERMINAL NOISE MANAGEMENT PLAN

This section covers the noise management plan for Burnaby Terminal. The operating hours, baseline ambient sound levels, noise prediction model, sound level limits, mitigation plan and noise monitoring plan will be discussed in detail.

## 4.1 Operating Hours

Burnaby Terminal is located within the CoB. Bylaw 7332 states that construction shall not occur during the following hours:

- before 7:00 am or after 8:00 pm from Monday to Friday;
- before 9:00 am or after 8:00 pm on Saturday; or
- at any time on Sunday or any Statutory holiday

Currently, Trans Mountain plans normal work to be conducted on a single shift per day, from Monday to Friday from 7:00 am to 8:00 pm. Saturdays may be used as required. Work on Saturday will be from 9:00 am to 8:00 pm. Night shift work if required may include maintenance and hand labour work that will not include continuous use of heavy equipment and will be measured and evaluated against HC target noise generation guidelines.

## 4.2 Baseline Ambient Sound Level

HC noise mitigation thresholds are based on existing sound levels at receptors. Receptor points representative of the nearest or most potentially affected homes, schools, institutions or other noise sensitive land uses within 300 m of the construction site have been established. Receptor locations for Burnaby Terminal are displayed in Figure D-1 in Appendix D. BC OGC Guideline sets standards for establishing an ASL using PSLs for an area based on dwelling density and proximity to transportation arteries. However, if true ambient noise is found to be greater than the BC OGC derived PSL, an adjustment can be made to raise the PSL of an area.

Table D-1 in Appendix D summarizes the most affected receptors surrounding Burnaby Terminal construction activity as well as the calculated baseline ambient sound levels. The ambient sound levels have been verified through previously conducted monitoring.

## 4.3 Source Emission Levels and Construction Site Layout

A listing of the proposed noise sources that were modelled with Cadna/A are presented in Table D-2 in Appendix D. Equipment quantity and utilization has been modeled to reflect information provided by Trans Mountain as well as the realistic expectation of equipment operations based on experience with such construction activity. The equipment list was based on the Updated Equipment List by Location by Scope, dated January 2, 2017. The areas of construction were based on the Burnaby Terminal Stakeholders Presentation provided by Trans Mountain on October 6, 2016. The sample construction scenario modelled is considered the worst-case scenario for Burnaby Terminal. It was assumed that the locations for Detailed Excavation, Shoring and Tank Contractors share the same locations as Bulk Excavation. The Burnaby Terminal construction activity layouts are provided in Figures D-2 and D-3 provided in Appendix D.

The worst-case scenario was assessed and was assumed to be when the loudest construction activities take place. The list of activities for the worst-case scenario is as follows:

- bulk excavation;
    - northern tanks (Tanks 91, 93, 95, 96, 97 and 98);
    - eastern tanks (Tanks 75, 76, 77, 78 and 79); and
    - central bottom tanks (Tanks 85 and 89).
- bulk fill;
    - portal fill Phase 2; and
    - manifold fill Phase 2.
- berm fill;
    - northern lower tanks (Tanks 91, 93, 95 and 97); and

  - eastern lower tanks (Tanks 75, 77 and 79).
- shoring (Tanks 75, 80 and 91 & 93);
- piling (CWA8, CWA18, CWA14 and CWA9);
- on-site haul and off-site haul;
- miscellaneous – modelled equipment to assist portal fill Phase 2 and manifold fill Phase 2; and,
- support – modelled grader and zoom boom to assist portal fill Phase 2 and manifold fill Phase 2.

## 4.4 Sound Level Threshold for Mitigation

Sound level thresholds where mitigation is required per the HC guidance are displayed in Table D-3 in Appendix D. Desired sound level limits based on the BC OGC PSL are also identified.

## 4.5 Site-Specific Mitigation Plan

To evaluate the effectiveness of site-specific mitigation controls at Burnaby Terminal, a sample construction scenario was modelled (i.e., worst case scenario). The approach focused on on-site noise controls, particularly temporary barriers when equipment locations are similar to Figures D-2 and D-3, in Appendix D. Final barriers do not have to be placed in the sample scenario positions as equipment location will vary. The layout of equipment will be assessed as part of the consultation process with the contractor. This will involve modelling to determine the most effective mitigation strategy. Alternative locations, such as placement closer to residences on municipal lands, are being explored with the CoB to allow for better on-site efficiency for heavy equipment movement.

The analysis indicated specific controls to reduce continuous noise are required during the periods with heaviest site activity, specifically for homes near receptors Burnaby_D and Burnaby_E. Desired BC OGC sound levels are achievable at these receptors when the following mitigation measures are used.

- Noise barrier wall or berm (Height: 5 m, Length: 325 m) located at the south end of the eastern tanks (tanks 75, 77 and 79). The barrier should be erected before construction activities take place in the eastern tank area. Refer to Figure D-4 provided in Appendix D for barrier location.

- Noise barrier wall or berm (Height: 5 m, Length: 215 m) located at the south end of the central tanks (tanks 85 and 89). The barrier should be erected before construction activities take place in the central tank area. Refer to Figure D-4 provided in Appendix D for barrier location.

- Noise barrier wall or berm (Height: 5 m, Length: 510 m) located at the south end of the northern tanks (tanks 91, 93, 95 and 97). The barrier should be erected before construction activities take place in the northern tank area. Refer to Figure D-4 provided in Appendix D for barrier location.

- Noise barrier wall or berm (Height: 5 m, Length: 545 m) located along the south end of the terminal. The barrier should be erected before any construction activities take place. Refer to Figure D-4 provided in Appendix D for barrier location.

- Noise barrier wall (Height: 5 m, Length: 185 m) located between the construction site and Burnaby_E as per proposed in the Burnaby Terminal Stakeholders Presentation dated October 6, 2016. The barrier should be erected before any construction activities take place. Refer to Figure D-4 provided in Appendix D for barrier location.

- Quantity and utilization of equipment is consistent with tables provided in Table D-3 provided in Appendix D for each phase of construction.

- General mitigation controls and practices described in Sections 2.2 and 2.3 are followed.

If there is a divergence from the above items, the analysis should be adjusted or monitoring used to reassess compliance to HC target noise levels per the iterative mitigation implementation process. The barriers proposed in this mitigation scenario must be a minimum surface density of 20 kg/m² and have no

gaps at the bottom. Based on implementing the above mitigation scenario, the predicted sound levels are presented in Table 4.

With mitigation, Burnaby Terminal construction is expected to meet the CoB bylaw noise limits. The highest impacted point along the residential property boundary for all Burnaby Terminal construction activity is expected to be 52.0 dBA during the daytime. These sound levels are below the CoB commercial noise limits of 55 dBA at night and 60 dBA during the day as well as construction limits.

**TABLE 4**
**BURNABY TERMINAL PREDICTED SOUND LEVELS WITH MITIGATION**

| Receptor | Predicted Sound Level (dBA)[1] | | Cumulative Sound Level [2] (dBA) | | Desired Sound Level (BC OGC PSL) (dBA) [3] | | Meet Desired Sound Level (BC OGC PSL) Limit? | | Meet HC Guidance? | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night |
| Burnaby_A | 42 | - | 49 | 38 | 53 | 43 | Yes | Yes | Yes | Yes |
| Burnaby_B | 44 | - | 49 | 38 | 53 | 43 | Yes | Yes | Yes | Yes |
| Burnaby_C[4] | 54 | - | 55 | 38 | 53 | 43 | No | Yes | Yes | Yes |
| Burnaby_D | 51 | - | 53 | 38 | 53 | 43 | Yes | Yes | Yes | Yes |
| Burnaby_E | 50 | - | 54 | 41 | 56 | 46 | Yes | Yes | Yes | Yes |
| Burnaby_F | 42 | - | 52 | 41 | 56 | 46 | Yes | Yes | Yes | Yes |
| Burnaby_G | 39 | - | 51 | 41 | 56 | 46 | Yes | Yes | Yes | Yes |

**Notes:**
[1] Predicted sound level from the Cadna/A noise model.
[2] Predicted sound level + baseline ambient sound level (BSL). BSL is assumed to be 5 dBA lower than the PSL as per BC OGC Guideline.
[3] Based on BC OGC Guideline.
[4] Burnaby_C is not a residential site, therefore is not required to meet the BC OGC PSL requirement.

# 5.0 SUMAS TERMINAL NOISE MANAGEMENT PLAN

This section covers the noise management plan for Sumas Terminal. The operating hours, baseline ambient sound levels, noise prediction model, sound level limits, mitigation plan and noise monitoring plan will be discussed in detail.

## 5.1 Operating Hours

The Sumas Terminal is located within the CoA. The CoA Consolidated Good Neighbour Bylaw (Bylaw 1256-2003) states construction shall not occur during the following hours:

- before 7:00 am on any day from Monday to Saturday when such day is not a statutory holiday, or
- before 9:00 am on any Sunday or statutory holiday, and
- after 9:00 pm on any day.

Where practical, construction activity shall be limited to bylaw hours. If construction is to take place outside the allowable hours, the contractor will confirm to bylaw notification procedures for the relevant activities. Currently, Trans Mountain plans Sumas Terminal work to be conducted on a single shift per day, from Monday to Friday from 7:00 am to 8:00 pm. Night shift work if required may include maintenance and hand labour work that will not include continuous use of heavy equipment and will be measured and evaluated against HC target noise generation guidelines.

## 5.2 Baseline Ambient Noise Level

HC noise mitigation thresholds are based on existing sound levels at receptor. Receptor points representative of the nearest or most potentially affected homes, schools, institutions or other noise sensitive land uses within 300 m of the construction site have been established. Receptor locations for

Sumas Terminal are displayed in Figure E-1 in Appendix E. BC OGC Guideline sets standards for establishing an ASL and therefore PSLs for an area based on dwelling density and proximity to transportation arteries. However, if true ambient noise is found to be greater than the BC OGC derived PSL, an adjustment can be made to raise the PSL of an area.

The baseline ambient sound levels are displayed in Table E-1 in Appendix E.

## 5.3 Source Emission Levels and Construction Site Layout

A listing of the proposed noise sources that were modelled with Cadna/A are presented in Table E-2 in Appendix E. Equipment quantity and utilization has been modeled to reflect information provided by Trans Mountain as well as the realistic expectation of equipment operations based on experience with such construction activity. The sample construction scenarios modelled are considered the worst-case scenario for Sumas Terminal.

From the Updated Equipment List dated December 7, 2016, it was identified that the construction at Sumas Terminal will have 8 major activities (bulk excavation, berm & miscellaneous fills, haul off site, detailed & trench excavation, foundation concrete work, piling, tank contractor and support). Haul off site and support were assumed to be active throughout the entire construction period.

The Sumas Terminal construction activity layouts are provided in Figure E-2 provided in Appendix E.

## 5.4 Sound Level Threshold for Mitigation

Sound level thresholds where mitigation is required per the HC Guidance are displayed in Table E-3 in Appendix E. Desired sound level limits are defined in the BC OGC Guideline as the PSL. The cumulative sound level at each receptor, which is the combination of the site construction noise and the existing ambient sound level, is compared to the PSL. The suggested sound level limits per BC OGC guidance are also listed in Table E-3.

## 5.5 Site-Specific Mitigation Plan

To evaluate the effectiveness of site-specific mitigation controls at Sumas Terminal, a sample construction scenario was modelled (i.e., worst-case scenario). The approach focused on on-site noise controls, particularly temporary barriers when equipment location is similar to the layout Figure E-2 provided in Appendix E. Final barriers do not have to be placed in the sample scenario positions.

The analysis indicated specific controls to reduce continuous noise are required during the periods with heaviest site activity, specifically for receptors SumasTerm_C and SumasTerm_E. Desired BC OGC sound levels are achievable at these receptors using the following mitigation measures.

- Two noise barrier walls or berms (Height: 5 m, Length: 100 m and Height: 5 m, Length: 40 m) located between the construction site and SumasTerm_C. Refer to Figure E-3 provided in Appendix E for barrier locations.
- Attenuate the southwest work trailer generator by:
    - installing a three-sided noise barrier wall for the work trailer generator (Height: 4 m, Length: 20 m) shielding noise emanating towards the southwest receptors (i.e., SumasTerm_C and SumasTerm_E). Refer to Figure E-3 provided in Appendix E for barrier locations;
    - repositioning the generator such that the sound is directed away from the southwest receptors and positioning the work trailer between the generator and southwest receptors; and
    - an alternate approach to the barrier and orientation control can be to find an acoustically treated generator, with hospital grade silencer and acoustic louvers/enclosure.
- General mitigation controls and practices described in Sections 2.2 and 2.3 are followed.

If there is a divergence from the above items, the analysis should be adjusted or monitoring used to reassess compliance. The barriers proposed in this mitigation scenario must be a minimum surface density of 20 kg/m² and have no gaps at the bottom. Based on implementing the above mitigation scenario, the predicted sound levels are presented in Table 5.

## TABLE 5
## SUMAS TERMINAL PREDICTED SOUND LEVELS WITH MITIGATION

| Receptor | Cumulative Noise Level (dBA) [2][3][4] | | | | | | | | | | | | Desired Sound Level (BC OGC PSL) (dBA) [1] | | Meet Desired Sound Level (BC OGC PSL) Limit? | | Meet HC Guidance? | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bulk Excavation [5] | | Berm & Misc. Fills [5] | | Detailed Excavation & Trench Excavation [5] | | Foundation Concrete Work [5] | | Piling [5] | | Tank Contractor [5] | | | | | | | |
| | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night |
| SumasTerm_C | 48 | 35 | 47 | 35 | 47 | 35 | 47 | 35 | 49 | 35 | 47 | 35 | 50 | 40 | Yes | Yes | Yes | Yes |
| SumasTerm_E | 49 | 35 | 48 | 35 | 48 | 35 | 48 | 35 | 50 | 35 | 48 | 35 | 50 | 40 | Yes | Yes | Yes | Yes |
| SumasTerm_F | 46 | 35 | 46 | 35 | 46 | 35 | 46 | 35 | 46 | 35 | 46 | 35 | 50 | 40 | Yes | Yes | Yes | Yes |

**Notes:**

[1] Based on BC OGC Guideline.

[2] Predicted sound level + baseline ambient sound level (BSL). BSL is assumed to be 5 dBA lower than the PSL as per BC OGC Guideline.

[3] Nighttime construction is not anticipated.

[4] Cumulative noise level includes operation noise from Line 1.

[5] Support and Haul Off Site equipment assumed to be active throughout all construction phases. Existing terminal equipment assumed to be in operation.

# 6.0 PUMP STATIONS NOISE MANAGEMENT PLAN

This section covers the noise management plan for the pump stations (except Sumas). The following pump stations with residences within 300 m were evaluated for noise mitigation needs:

- Gainford
- Blackpool
- Darfield
- Blue River

The operating hours, baseline ambient sound levels, noise prediction model, sound level limits, mitigation plan and noise monitoring plan will be discussed in detail.

## 6.1 Operating Hours

Where practical, construction activity shall be limited to bylaw hours. If construction is to take place outside the allowable hours, the contractor will confirm to noise bylaw notification processes for the relevant activities. Currently, Trans Mountain plans pump station construction activities to take place from 8:00 am to 6:00 pm. The typical work schedule is 10 days on, 4 days off or 14 days on and 7 days off.

## 6.2 Baseline Ambient Noise Levels

HC noise mitigation thresholds are based on existing sound levels at receptors. Receptor points representative of the nearest or most potentially affected homes within 300 m of the construction site have been established. BC OGC Guideline and AER Directive 038 set standards for establishing an ASL and therefore PSLs for an area based on dwelling density and proximity to transportation arteries. However, if true ambient noise is found to be greater than the BC OGC Guidance or AER Directive 038 derived PSL, an adjustment can be made to raise the PSL of an area.

Receptors within 300 m of the pump stations construction sites have been identified. The most affected receptors surrounding the pump stations construction activities as well as the calculated baseline ambient sound levels are summarized in the Table F-1 in Appendix F.

## 6.3 Source Emission Levels and Construction Site Layout

A listing of the proposed noise sources that were modelled with Cadna/A are presented in Table F-2 in Appendix F. Equipment quantity and utilization has been modeled to reflect information provided by Trans Mountain as well as the realistic expectation of equipment operations based on experience with such construction activity. The sample construction scenario modelled is considered the worst-case scenario. The worst-case scenario was assumed to be when the loudest activities take place.

The construction activities were determined from the Construction Activities Noise Management Plan, dated March 1, 2017, provided by Trans Mountain. Only the loudest activities were assessed, namely cut and fill, containment ponds (hydrovacs assumed to be used with containment ponds) as well as piling and concrete. The equipment associated with each activity was assumed to be similar to the construction equipment used for the terminals. Support and haul offsite equipment were assumed to be active throughout all construction phases.

The pump stations all have a similar sized footprint, therefore a generic layout was used to establish the spatial relationship between sources and the site boundary. This in turn established general mitigation requirements based on distance of residences from the site boundary.

## 6.4 Sound Level Threshold for Mitigation

Sound level thresholds where mitigation is required per the HC guidance are displayed in Table F-3 in Appendix F. Desired sound level limits are defined in the BC OGC Guideline as the PSL. The cumulative sound level at each receptor, which is the combination of the site construction noise and the existing

ambient sound level, is compared to the PSL. The suggested sound level limits per BC OGC guidance are also listed in Table F-3 in Appendix F.

## 6.5 Site-Specific Mitigation Plan

To evaluate the effectiveness of site-specific mitigation controls at pump stations with homes within 300 m, a sample construction scenario was modelled. The approach focused on on-site noise controls, particularly temporary barriers. Additional site-specific mitigation is required to meet the noise criteria at multiple receptors. The minimum amount of mitigation control required for each site is provided in Table 6.

**TABLE 6**
**GENERAL PUMP STATION SITE-SPECIFIC MITIGATION CONTROL**

| Receptor | Site-Specific Mitigation Control | | | |
|---|---|---|---|---|
| | **Cut & Fill** | **Containment Ponds** | **Piling** | **Concrete** |
| Gainford Pump Station | | | | |
| Gainford_D | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site<br>- Attenuate drill rig and vibratory pile driver by 10 dB (i.e., 10 dB lower than noise level shown in Table F-2) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site |
| Gainford_E | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) |
| Gainford_F | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) |
| Gainford_G | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) |
| Blackpool Pump Station | | | | |
| Blackpool_B | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site<br>- Attenuate drill rig and vibratory pile driver by 10 dB (i.e., 10 dB lower than noise level shown in Table F-2) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site |
| Darfield Pump Station | | | | |

| Receptor | Site-Specific Mitigation Control | | | |
|---|---|---|---|---|
| | **Cut & Fill** | **Containment Ponds** | **Piling** | **Concrete** |
| Darfield_A | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site<br>- Attenuate drill rig and vibratory pile driver by 10 dB (i.e., 10 dB lower than noise level shown in Table F-2) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site |
| Darfield_B | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) in the direction of the affected receptor | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) |
| Blue River_A | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) in the direction of the affected receptor | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site<br>- Attenuate drill rig and vibratory pile driver by 10 dB (i.e., 10 dB lower than noise level shown in Table F-2) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site |
| Blue River Pump Station | | | | |
| Blue River_B | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site<br>- Attenuate drill rig and vibratory pile driver by 10 dB (i.e., 10 dB lower than noise level shown in Table F-2) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site |
| Blue River_C | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site<br>- Attenuate drill rig and vibratory pile driver by 10 dB (i.e., 10 dB lower than noise level shown in Table F-2) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site |
| Blue River_D | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site<br>- Attenuate drill rig and vibratory pile driver by 10 dB (i.e., 10 dB lower than noise level shown in Table F-2) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site |

| Receptor | Site-Specific Mitigation Control | | | |
|---|---|---|---|---|
| | **Cut & Fill** | **Containment Ponds** | **Piling** | **Concrete** |
| Blue River_E | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site<br>- Attenuate drill rig and vibratory pile driver by 10 dB (i.e., 10 dB lower than noise level shown in Table F-2) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3)<br>- Site perimeter noise barrier (Height: 5 m) long enough to break the line of sight from the receptor to the construction site |
| Blue River_F | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) | - EPP Mitigation (Section 2.2)<br>- Good Practice Guideline (Section 2.3) |

If there is a divergence from the above items, the analysis should be adjusted or monitoring used to reassess compliance. The barriers proposed in this mitigation scenario must be a minimum surface density of 20 kg/m² and have no gaps at the bottom. Based on implementing the above mitigation measures, compliance with BC OGC Guideline and AER Directive 038 is expected.

# 7.0 NOISE MONITORING PLAN

## 7.1 Planned Monitoring

Trans Mountain has committed to establishing a construction noise monitoring program. Noise monitoring will be performed to ensure planned noise controls are working as intended and the noise mitigation thresholds cited for each site are met. Monitoring may also be used as reference in the case of complaints. Furthermore, Trans Mountain wishes to ensure that noise is controlled and any adverse impacts on nearby residents are minimized.

Noise monitoring will be conducted at the beginning of each major construction phase where controls are required to verify the effectiveness of the selected controls. Monitoring will include both continuous monitoring as well as 24-hour measurements at nearby receptors prior to the commencement of primary phases established in the above analysis. Through the 24-hour measurement prior to each phase with noise controls, a baseline noise level will be established and will act as a reference to which any later sound levels from construction can be compared to assess whether perceivable changes have occurred.

Continuous monitoring will be set up at the nearest receptors at both WMT and Burnaby Terminal due to the size and complexity of activity at these sites. Baseline monitoring levels can then be applied in comparison to continuous monitoring levels to ensure compliance and at assess whether significant impacts on nearby receptors occur. Additionally, if complaints are received, events captured through continuous monitoring can assist to identify problem activities and address concerns. Continuous monitors can be installed such that they are remotely accessible to acquire historical and real-time sound levels. This information will be made accessible to Trans Mountain and/or Contractors.

## 7.2 Exceedances

Data will be regularly reviewed to check for exceedances. Should a noise exceedance be noted in the monitored data, an investigation will be started to determine the activities specifically leading to the elevated noise levels and whether mitigation is required. Determination of mitigation needs will be dependent on the magnitude of exceedance, the frequency of the activity resulting in the exceedance, and the expected length of time the incurrent activity is expected to continue.

Documentation of all exceedances, investigations, and mitigations applied will be kept. Any investigation conducted because of complaint or exceedance found through regular review of continuous monitoring data will at minimum note the sound level, weather conditions including wind direction, a copy of any complaints received, details of construction phase and activities occurring at the time, any consultation that results, and mitigation (if applied).

# 8.0 PUBLIC AND ABORIGINAL COMMUNICATION PLAN AND COMPLAINT PROCESS

A Project Complaints Process (Process) has been developed and aligns with industry best practice as well as meets NEB conditions and commitments made to Intervenors and communities through the regulatory proceedings. Trans Mountain will provide regular complaint reporting updates during all phases of construction.

The Process builds on established Trans Mountain communication processes, resources and roles and will be supported by the Project Construction Communications Plan. A separate process is under development for complaints arising from Aboriginal groups and landowners.

The goals of the Process are to:

- address stakeholder questions and concerns in a timely manner; and
- meet regulatory requirements.

The goals will be achieved by meeting the following targets:

- provide multiple communication channels to address stakeholder communication needs;
- provide timely detailed information so as to minimize the number of complaints;
- implement construction mitigation measures to minimize the number of complaints;
- promote the complaints communication channels through signage, print, online and social media as well as paid and unpaid media;
- offer email, phone and voicemail access;
- maintain a clear and separate process for all emergency concerns and complaints;
- provide key messages for non-urgent and urgent inquiries or complaints;
- ensure all inquiries and complaints receive timely complaint resolution and responses that are proportional to level of urgency;
- track and report on all inquiries and complaints, including those with immediate resolution;
- report issue resolution, or rationale for non-completion, to stakeholders, regulators and Appropriate Government Authorities as required; and
- ensure emergency contact information is available 24/7.

## 8.1 Complaint Management and Handling

Complaints from all sources will be forwarded to a single Trans Mountain intake system. On receipt, complaints will be triaged by the Trans Mountain team undertaking the intake; triage will include determining urgency, type and the appropriate team to address the concern. The responsible team will then investigate the complaint and will provide the resolution or indicate where a response is not required. Trans Mountain will respond to the complainant in a timely manner with the required information.

## 8.2 Mitigation to Minimize Complaints

In order to minimize complaints Trans Mountain will:

- provide timely notifications of upcoming Project activities; and
- implement construction and environmental mitigation measures to minimize the number of complaints.

## 8.3 Potential Complaint Sources

Stakeholder complaints may be received from a number of sources including:

- residents and neighbours;
- elected officials;

- local and regional governments;
- landowners / tenants (separate tracking and response process);
- businesses;
- general public including commuters, area users, etc.;
- special interest groups; and
- others (may include complaints relating to operations).

## 8.4 Process Promotion and Accessibility

The Process and contact information for the complaints line will be promoted through available Trans Mountain communication channels including signage, print, online and social media as well as paid and unpaid media. Local governments and community organizations will be offered tools to promote through associated communication channels (e.g., websites, newsletters, e-blasts). Stakeholders will be able to file complaints by email, phone or mail.

## 8.5 Complaint Tracking and Reporting

Trans Mountain will report issue resolution, or rationale for non-completion, to stakeholders, regulators and Appropriate Government Authorities as required. Trans Mountain has developed and will maintain a process/system to track the information described below:

- date and time the complaint was received;
- how each complaint was received (e.g., telephone, letter, email) and by whom it was received;
- name, address, and phone number and/or email address as provided by the complainant;
- descriptive details of the complaint as reported by the complainant;
- location of impact (e.g., place of residence, park);
- cause of complaint and location of source (if known);
- construction or other activities occurring on site at the time of the complaint (as available);
- subsequent dates of all contact or correspondence with each complainant;
- resolution and date of resolution; and
- if the complaint was reported to any other entities (local governments or others) and date and time it was reported (as available).

If a complaint remains unresolved, a description will be provided of any further actions to be taken or an explanation for why no further action is required.

## 8.6 Complaint Response

All inquiries and complaints will receive timely complaint resolution and responses proportional to level of urgency. Trans Mountain will track and report on all inquiries and complaints, including those with immediate resolution.

## 8.7 Emergencies

All emergency inquiries or complaints will be channeled through established KMC and One-Call communications processes. Trans Mountain will:

- maintain a clear and separate process for all emergency concerns and complaints; and
- ensure emergency contact information is available 24/7.

# 9.0 CONTINGENCY PLAN

In the event a complaint is made during construction, Trans Mountain will work with the complainant to resolve or come to a mutually agreed upon resolution wherever possible.

In instances where monitoring confirms continuous sound generated by construction activity exceeds 75 dBA over the day or 65 dBA over the night (i.e., the HC limit for immediate mitigation from construction noise), the activity deemed to be the primary source of the sound will be stopped until noise controls can be effected. Continuous sound is defined as the 15-hr daytime or 9-hr nighttime Leq sound level in dBA.

For instances where limiting the noise exposure for residents in close proximity is not otherwise possible, Trans Mountain will consider temporarily relocating residents for a short period of time. In areas of high density, this may not be practical, therefore every effort to establish engineered or administrative controls for noise, up to and including providing noise reduction at the home rather than onsite, will first be pursued.

Should Trans Mountain, contractors, or any parties conducting activities within the Project area be found non-compliant with measures outlined by this NMP, the Construction Manager or designate will make a determination to either modify the work practice or shut the activity down until conditions improve. An Environmental Inspector will assist in this decision-making process. A non-compliance can include events causing noise found to exceed the PSL or cause unacceptable noise impact on residents surrounding the project area.

# 10.0 SUMMARY

The Terminals and Pump Station Construction Noise Management Plan (NMP) was prepared to address the requirements of NEB Condition 80. Construction activities will involve use of earth moving equipment, drills and other motorized equipment.

Trans Mountain plans normal work at WMT, Burnaby Terminal and Sumas Terminal to be conducted on a single shift per day, from Monday to Friday from 7:00 am to 8:00 pm. Saturdays may be used as required to perform maintenance. Work on Saturday will be from 9:00 am to 8:00 pm. Night shift work if required may include maintenance and hand labour work that will not include continuous use of heavy equipment and will be measured and evaluated against HC target noise generation guidelines.

Construction hours for pump stations are expected to take place from 8:00 am to 6:00 pm. The typical work schedule for these sites is 10 days on, 4 days off or 14 days on and 7 days off.

Existing sound levels have been established for residences within 300 m of each terminal and pump station, which form the base to determine the amount of change in sound levels from construction that may occur due to construction activity. The amount of noise considered acceptable from construction was based on 2016 HC recommended levels for triggering noise mitigation from construction activity. The BC OGC and AER noise limits as used in the Application were also compared as desired noise targets. Noise level limits change based on the existing noise levels in each neighborhood.

Current construction plans were used to establish noise levels that are expected to occur off the construction sites without additional mitigation. Appropriate mitigation to demonstrate compliance with recommended HC as well as the BC OGC and AER desired noise limits used in the Application, was applied in the model scenarios.

Detailed lists of mitigation or controls that are effective at controlling noise are provided. Several types of controls can be used to achieve equal results.

The scenarios used to demonstrate that the selected mitigation and noise control practices will be effective at limiting noise to the HC recommended levels reflect phases with the maximum amount of site activity and that desired BC OGC or AER limits can be achieved. As activities on sites begin, sound levels

from the sites will be monitored to verify that selected controls are effective and whether additional controls are needed. This iterative approach will allow the most efficient development of noise controls.

As construction on each site progresses, additional mitigation measures or actions may be implemented as required. A notification and complaint process will be implemented to ensure the community is notified of activity and so any noise complaints can be investigated and addressed.

# 11.0 REFERENCES

Alberta Energy Regulator (AER). 2007. Directive 038: Noise Control. Prepared by the Alberta Energy and Utility Board. Calgary, AB. Website http://www.aer.ca/documents/directives/Directive038.pdf. Accessed: September 2013.

British Columbia Oil and Gas Commission (BC OGC). 2009. British Columbia Noise Control Best Practices Guideline (March 2009). Victoria, BC.

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International Organization for Standardization (ISO). 1993. International Standard ISO 9613-1, Acoustics – Attenuation of Sound During Propagation Outdoors – Part 1: Calculation of Absorption of Sound by the Atmosphere. Geneva, Switzerland.

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The Corporation of the District of Burnaby (City of Burnaby). 2015. Bylaw No. 7332. Burnaby, BC.

Trans Mountain. 2013. Terrestrial Noise and Vibration Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project. Calgary, AB.

# APPENDIX A

## HEALTH CANADA ASSESSMENT

The following is an assessment which applies Health Canada's Guidance for Evaluating Human Health Impacts in EA: Noise (HC guidance) (HC 2016). Health Canada (HC) sets limits specifically for construction activities to protect against adverse human health effects of noise including annoyance and sleep disturbance.

This alternate assessment approach to BC OGC uses annoyance based criteria, which relates sound levels to subjective human responses in order to establish criteria. The HC guidance also describes specific methods for assessing low frequency noise (LFN) or high energy impulsive sound (blasting).

## HEALTH CANADA GUIDELINE SUMMARY

The HC annoyance approach (change in percent of population highly annoyed, %HA) was used in the original assessment as the limits were intended to apply to construction activities such as those associated with the Project. While not specifically referenced in the NEB Filing Manual, this method can provide more context around sound level changes, specifically in urban areas with multiple receptors. The HC 2016 guidance document is consistent with the methods and guidance used in the original Project application.

As the Burnaby Mountain Tunnel construction duration is planned to last approximately 2 to 3 years, HC advises evaluation as an operational noise source involving assessment of change in %HA at a specific receptor.

This method uses the day-night average noise level (Ldn) to plot the degree of annoyance as %HA based on the Schultz Curve (ISO 2003) according to the following:

$$\%HA = \frac{100}{[1 + e^{(10.4 - 0.132 \times L_{dn})}]}$$

HC suggests that mitigation be proposed if the predicted change in %HA at a specific receptor is greater than 6.5% between project and baseline noise environments, or when the baseline-plus-project-related noise is in excess of 75 dBA Ldn (HC, 2016). Note that the %HA was split to daytime and nighttime to address the change in noise level due to the planned construction hours for the TMEP being primarily limited to daytime and to establish easily measured decibel levels to allow quick responses to complaints or concerns. In doing so, the Ldn was split to daytime noise level (Ld) and nighttime noise level (Ln). In response to human sensitivity to noise at night, a +10 dBA penalty was applied to the Ln when calculating the nighttime %HA.

HC also advises that noise generating activity immediately be controlled should measured project noise levels exceed 75 dBA Ldn (75 dBA for daytime or 65 dBA for nighttime).

# APPENDIX B

## TABLE B-1
## NOISE MODEL CONFIGURATION PARAMETERS

| Parameter | Model Settings | Description/Notes |
|---|---|---|
| Calculation Standard | ISO 9613 only | All sources and attenuators are treated as required by the cited standard |
| Source Directivity | Vertical sources applied to larger structures | Directivity of the source emission and the barrier effect of the unit itself were included |
| Ground Absorption | 0.7- 0.8 | Value used for soft ground, vegetation |
| | 0.3 | Value used for cleared areas on site |
| | 0.0 | Value used for water |
| Temperature/Humidity | 10°C/70% Relative Humidity | Average summer conditions for area |
| Wind Conditions | Default ISO 9613 | The propagation conditions in the ISO (1996) standard are valid for wind speeds between |
| | ISO 1996 – moderate inversion condition | 4 and 18 km/h; all points are considered downwind |
| Terrain | Terrain applied | Terrain in the area is modelled at 2 m resolution to account for any natural barriers within the noise study area except for the generic model in Section 6.0 |
| Reflections | 1 | One reflection is taken into account for reflections from on-site structures |

# APPENDIX C

## TABLE C-1
## WMT BASELINE AMBIENT SOUND LEVELS

| Receptor | | Dwelling Density[1] | Category[2] | UTM Coordinates (12U) | | Average Ambient Sound Level[3] | |
|---|---|---|---|---|---|---|---|
| ID | Description | | | Easting (m) | Northing (m) | Day (dBA) | Night (dBA) |
| WMT_1 | Residence | >160 | 2 | 503074 | 5459398 | 56 | 46 |
| WMT_2 | Residence | >160 | 2 | 503258 | 5459318 | 56 | 46 |
| WMT_3 | Residence | >160 | 3 | 503491 | 5459373 | 61 | 51 |

**Notes:**

[1] Dwelling density per quarter section of land.

[2] Category 1 - Dwelling units more than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 2 - Dwelling units more than 30 m but less than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 3 - Dwelling units less than 30 m from heavily travelled roads and/or rail lines and/or subject to frequent aircraft flyovers.

[3] For the nighttime period (10 pm to 7 am). The daytime (7 am to 10 pm) adjustment is +10 dB for Average Ambient Sound Level.

## TABLE C-2
## WMT CONSTRUCTION EQUIPMENT SOUND EMISSION DATA

| Equipment | Source Type [1][2] | Quantity | Utilization | Sound Level Octave Spectrum (dB) | | | | | | | | | | | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB | dBA | |
| **Shore - Civil Earthworks** | | | | | | | | | | | | | | | |
| Caterpillar 45T Excavator | A | 2 | 75% | 100.0 | 123.0 | 115.0 | 105.0 | 102.0 | 98.0 | 99.0 | 95.0 | 90.0 | 123.8 | 106.6 | [3] |
| Caterpillar D6 Dozer | A | 2 | 75% | 98.7 | 87.1 | 98.1 | 91.7 | 89.2 | 91.5 | 87.7 | 85.6 | 75.0 | 102.8 | 95.4 | [3] |
| Caterpillar 966 Loader | A | 1 | 75% | 98.7 | 102.0 | 115.5 | 113.5 | 107.7 | 106.5 | 103.0 | 98.4 | 93.5 | 118.6 | 111.7 | [3] |
| Caterpillar 12T Vibratory Roller | A | 1 | 75% | - | 120.0 | 111.0 | 103.0 | 107.0 | 105.0 | 98.0 | 95.0 | 89.0 | 120.9 | 108.9 | [3] |
| Caterpillar 272C Skid Steer | A | 1 | 75% | 98.3 | 109.8 | 108.5 | 102.1 | 103.2 | 106.0 | 104.7 | 98.6 | 99.0 | 114.7 | 110.3 | [3] |
| Tandem Axle Dump Truck(7.5M3 Capacity) | P | 1 | 20% | 118.0 | 118.0 | 115.0 | 105.0 | 107.0 | 103.0 | 101.0 | 95.0 | 91.0 | 122.3 | 109.0 | [3] |
| Tandem Axle Dump Truck(7.5M3 Capacity) | L | - | 2 trips per hour | 118.0 | 118.0 | 115.0 | 105.0 | 107.0 | 103.0 | 101.0 | 95.0 | 91.0 | 122.3 | 109.0 | [3] |
| Pickup Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Pickup Truck | L | - | 0.2 trips per hour | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| **Shore - Civil Foundations** | | | | | | | | | | | | | | | |
| Piling Crane/Rig | P | 1 | 75% | - | 109.0 | 105.0 | 94.0 | 90.0 | 87.0 | 85.0 | 79.0 | 74.0 | 110.6 | 94.5 | [3] |
| Piling Drilled Shafts | P | 1 | 75% | 103.0 | 107.0 | 117.0 | 110.0 | 112.0 | 113.0 | 114.0 | 112.0 | 111.0 | 121.9 | 119.7 | [3] |
| Loader | A | 1 | 75% | 98.7 | 102.0 | 115.5 | 113.5 | 107.7 | 106.5 | 103.0 | 98.4 | 93.5 | 118.6 | 111.7 | [3] |
| Diesel Welder 500A | A | 1 | 50% | 102.2 | 107.6 | 95.8 | 98.1 | 92.9 | 92.1 | 89.5 | 87.2 | 82.5 | 109.5 | 97.5 | [3] |
| 25KV Genset | P | 1 | 100% | 71.2 | 82.9 | 74.1 | 73.2 | 72.7 | 62.5 | 61.3 | 60.2 | 56.0 | 84.4 | 72.6 | [4] |
| **Marine - Civil Foundations** | | | | | | | | | | | | | | | |
| 700T Crane | A | 1 | 75% | 85.5 | 85.5 | 100.7 | 106.9 | 112.7 | 115.0 | 115.2 | 110.0 | 106.3 | 120.2 | 120.1 | [4] |
| 190T Crane | A | 1 | 75% | 111.1 | 106.8 | 107.7 | 111.8 | 108.1 | 105.2 | 104.0 | 99.8 | 95.0 | 117.1 | 111.2 | [4] |
| Crane Barges | A | 5 | 75% | - | 109.0 | 105.0 | 94.0 | 90.0 | 87.0 | 85.0 | 79.0 | 74.0 | 110.6 | 94.5 | [3] |
| ~1350 hp Tug Boats | L | - | 9 trips per hour | 120.1 | 121.3 | 123.0 | 109.5 | 105.4 | 100.5 | 94.5 | 87.0 | 78.3 | 126.5 | 109.9 | [3] |
| APE 600 Vibratory Hammer | P | 1 | 75% | - | 95.6 | 109.7 | 104.9 | 112.3 | 112.0 | 112.3 | 108.0 | 102.5 | 118.5 | 117.5 | [3] |
| 1300 CFM Compressor | A | 6 | 100% | 94.5 | 94.5 | 93.5 | 91.5 | 91.5 | 93.5 | 97.5 | 96.5 | 92.5 | 103.9 | 102.4 | [4] |
| 185 CFM Compressor | A | 3 | 100% | 100.0 | 95.0 | 95.0 | 94.0 | 97.0 | 100.0 | 100.0 | 98.0 | 95.0 | 107.3 | 105.6 | [4] |
| 400A Diesel Welder | A | 9 | 50% | 102.2 | 107.6 | 95.8 | 98.1 | 92.9 | 92.1 | 89.5 | 87.2 | 82.5 | 109.5 | 97.5 | [3] |
| Portable Light Plant | P | 14 | 100% | 95.7 | 90.7 | 88.3 | 88.1 | 82.2 | 83.6 | 82.8 | 82.8 | 79.5 | 98.5 | 89.9 | [4] |
| Diesel Hydraulic Power Pack | P | 3 | 70% | 88 | 88 | 103 | 106 | 113 | 115 | 116 | 111 | 108 | 120.7 | 120.6 | [4] |
| **Foreshore - Civil Earthworks** | | | | | | | | | | | | | | | |
| 100T Crane | P | 1 | 75% | - | 109.0 | 105.0 | 94.0 | 90.0 | 87.0 | 85.0 | 79.0 | 74.0 | 110.6 | 94.5 | [3] |
| Diesel Hydraulic Power Pack | P | 1 | 70% | 88 | 88 | 103 | 106 | 113 | 115 | 116 | 111 | 108 | 120.7 | 120.6 | [4] |
| APE 600 Vibratory Hammer | P | 1 | 75% | - | 95.6 | 109.7 | 104.9 | 112.3 | 112.0 | 112.3 | 108.0 | 102.5 | 118.5 | 117.5 | [3] |
| Caterpillar 966 Loader | A | 1 | 75% | 98.7 | 102.0 | 115.5 | 113.5 | 107.7 | 106.5 | 103.0 | 98.4 | 93.5 | 118.6 | 111.7 | [3] |
| Support Tug Idle | P | 2 | 20% [5] | 120.1 | 121.3 | 123.0 | 109.5 | 105.4 | 100.5 | 94.5 | 87.0 | 78.3 | 126.5 | 109.9 | [3] |
| OffShore/Onshore Loading Hopper/Conveyor | L | 1 | 100% | - | 99.0 | 97.0 | 96.0 | 99.0 | 103.0 | 95.0 | 91.0 | 85.0 | 107.0 | 104.8 | [3] |
| Caterpillar D8 Dozer | A | 1 | 75% | 105.0 | 103.0 | 108.0 | 109.0 | 108.0 | 107.0 | 104.0 | 98.0 | 94.0 | 115.3 | 111.3 | [3] |
| Caterpillar 966 Loader | A | 2 | 75% | 98.7 | 102.0 | 115.5 | 113.5 | 107.7 | 106.5 | 103.0 | 98.4 | 93.5 | 118.6 | 111.7 | [3] |
| Caterpillar 15T Vibratory Roller | A | 1 | 75% | - | 120.0 | 111.0 | 103.0 | 107.0 | 105.0 | 98.0 | 95.0 | 89.0 | 120.9 | 108.9 | [3] |

**Notes:**

[1] Represents the following source types: P – Point Source, L – Line Source, and A – Area Source.

[2] Vehicle and boat speed assumed to be 10km/hr.

[3] Based on field measurements of similar equipment.

[4] Based on engineering calculations.

[5] Support Tug Boat operates 24 hours. 20% Utilization equates to 180 mins during daytime (7 am to 10 pm) and 108 mins during nighttime (10 pm to 7 am).

## TABLE C- 3
## WMT SUGGESTED SOUND LEVEL LIMITS

| Receptor | | Desired BC OGC Permissible Sound Level Limit[1] | | HC Guidance Noise Mitigation Threshold | |
|---|---|---|---|---|---|
| ID | Description | Day (dBA) | Night (dBA) | Day (dBA) | Night (dBA) |
| WMT_1 | Residence | 61 | 51 | 63 | 53 |
| WMT_2 | Residence | 61 | 51 | 63 | 53 |
| WMT_3 | Residence | 66 | 56 | 66 | 56 |

**Notes:**

[1] No seasonal adjustments or temporary activity adjustments. Additionally, no ambient measurements were conducted for ambient adjustments.

# APPENDIX D

## TABLE D-1
## BURNABY TERMINAL BASELINE AMBIENT SOUND LEVELS

| Receptor | | Dwelling Density[1] | Category[2] | UTM Coordinates (12U) | | Average Ambient Sound Level [3] | |
|---|---|---|---|---|---|---|---|
| ID | Description | | | Easting (m) | Northing (m) | Day (dBA) | Night (dBA) |
| Burnaby_A | Residence | 9-160 | 1 | 505025 | 5458522 | 48 | 38 |
| Burnaby_B | Residence | 9-160 | 1 | 504480 | 5457823 | 48 | 38 |
| Burnaby_C | Property Line | 9-160 | 1 | 504646 | 5457113 | 48 | 38 |
| Burnaby_D | Residence | 9-160 | 1 | 505322 | 5457030 | 48 | 38 |
| Burnaby_E | Residence | >160 | 1 | 504911 | 5457017 | 51 | 41 |
| Burnaby_F | Residence | >160 | 1 | 504362 | 5457593 | 51 | 41 |
| Burnaby_G | Residence | >160 | 1 | 503859 | 5458230 | 51 | 41 |

**Notes:**

[1] Dwelling density per quarter section of land.

[2] Category 1 - Dwelling units more than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 2 - Dwelling units more than 30 m but less than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 3 - Dwelling units less than 30 m from heavily travelled roads and/or rail lines and/or subject to frequent aircraft flyovers.

[3] For the nighttime period (10 pm to 7 am). The daytime (7 am to 10 pm) adjustment is +10 dB for Average Ambient Sound Level.

## TABLE D-2
## BURNABY TERMINAL CONSTRUCTION EQUIPMENT SOUND EMISSION DATA

| Equipment | Source Type [1] | Quantity | Utilization | Sound Level Octave Spectrum (dB) | | | | | | | | | | | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB | dBA | |
| **Access Road Construction** | | | | | | | | | | | | | | | |
| Caterpillar 365 & 345 Excavator | A | 1 | 50% | 100.0 | 123.0 | 115.0 | 105.0 | 102.0 | 98.0 | 99.0 | 95.0 | 90.0 | 123.8 | 106.6 | [3] |
| Caterpillar D8 Dozer | A | 1 | 50% | 104.5 | 103.5 | 107.7 | 108.7 | 107.7 | 107.5 | 104.2 | 98.4 | 93.7 | 115.2 | 111.5 | [3] |
| Caterpillar D6 Dozer | A | 2 | 50% | 98.7 | 87.1 | 98.1 | 91.7 | 89.2 | 91.5 | 87.7 | 85.6 | 75.0 | 102.8 | 95.4 | [3] |
| Caterpillar 10T Vibratory Roller | A | 2 | 50% | - | 120.0 | 111.0 | 103.0 | 107.0 | 105.0 | 98.0 | 95.0 | 89.0 | 120.9 | 108.9 | [3] |
| Pickup Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| **Bulk Excavation (Per Location) - Tank 96 & 98; Tank 91, 93, 95 & 97; Tank 80 & 86; Tank 85 & 89; Tank 74, 76 & 78; Tank 75, 77 & 79** | | | | | | | | | | | | | | | |
| Caterpillar 365 & 345 Excavator | A | 1 | 50% | 100.0 | 123.0 | 115.0 | 105.0 | 102.0 | 98.0 | 99.0 | 95.0 | 90.0 | 123.8 | 106.6 | [3] |
| Caterpillar D8 Dozer | A | 1 | 50% | 104.5 | 103.5 | 107.7 | 108.7 | 107.7 | 107.5 | 104.2 | 98.4 | 93.7 | 115.2 | 111.5 | [3] |
| Caterpillar D9 Dozer | A | 1 | 50% | 104.5 | 103.5 | 107.7 | 108.7 | 107.7 | 107.5 | 104.2 | 98.4 | 93.7 | 115.2 | 111.5 | [3] |
| Pickup Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| **Bulk Fill (Per Location) - Tank 96 & 98; Tank 91, 93, 95 & 97; Tank 80 & 86; Tank 85 & 89; Tank 74, 76 & 78; Tank 75, 77 & 79** | | | | | | | | | | | | | | | |
| Caterpillar D6 Dozer | A | 1 | 50% | 98.7 | 87.1 | 98.1 | 91.7 | 89.2 | 91.5 | 87.7 | 85.6 | 75.0 | 102.8 | 95.4 | [3] |
| Caterpillar 815 Compactor | A | 1 | 50% | 95.9 | 101.8 | 108.2 | 110.6 | 101.9 | 106.0 | 100.1 | 97.4 | 95.9 | 114.4 | 109.5 | [3] |
| Caterpillar CS74 Vibratory Roller | A | 1 | 50% | - | 120.0 | 111.0 | 103.0 | 107.0 | 105.0 | 98.0 | 95.0 | 89.0 | 120.9 | 108.9 | [3] |
| Pickup Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| **Bulk Fill (Per Location) - Portal Fill Phase 1; Portal Fill Phase 2; Manifold Fill Phase 1; Manifold Phase 2** | | | | | | | | | | | | | | | |
| Caterpillar D6 Dozer | A | 2 | 50% | 98.7 | 87.1 | 98.1 | 91.7 | 89.2 | 91.5 | 87.7 | 85.6 | 75.0 | 102.8 | 95.4 | [3] |
| Caterpillar 815 Compactor | A | 1 | 50% | 95.9 | 101.8 | 108.2 | 110.6 | 101.9 | 106.0 | 100.1 | 97.4 | 95.9 | 114.4 | 109.5 | [3] |
| Caterpillar CS74 Vibratory Roller | A | 7 | 50% | - | 120.0 | 111.0 | 103.0 | 107.0 | 105.0 | 98.0 | 95.0 | 89.0 | 120.9 | 108.9 | [3] |
| Pickup Truck | A | 4 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| **Berm Fill (Per Location) - Tank 96 & 98; Tank 91, 93, 95 & 97; Tank 80 & 86; Tank 85 & 89** | | | | | | | | | | | | | | | |
| Caterpillar D6 Dozer | A | 8 | 50% | 98.7 | 87.1 | 98.1 | 91.7 | 89.2 | 91.5 | 87.7 | 85.6 | 75.0 | 102.8 | 95.4 | [3] |
| Caterpillar CS74 Vibratory Roller | A | 2 | 50% | - | 120.0 | 111.0 | 103.0 | 107.0 | 105.0 | 98.0 | 95.0 | 89.0 | 120.9 | 108.9 | [3] |
| Caterpillar 815 Compactor | A | 2 | 50% | 95.9 | 101.8 | 108.2 | 110.6 | 101.9 | 106.0 | 100.1 | 97.4 | 95.9 | 114.4 | 109.5 | [3] |
| Caterpillar 928 Loader | A | 8 | 50% | 98.7 | 102.0 | 115.5 | 113.5 | 107.7 | 106.5 | 103.0 | 98.4 | 93.5 | 118.6 | 111.7 | [3] |
| Pickup Truck | P | 6 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| **Berm Fill (Per Location) - Tank 74, 76 & 78; Tank 75, 77 & 79** | | | | | | | | | | | | | | | |
| Caterpillar D6 Dozer | A | 8 | 50% | 98.7 | 87.1 | 98.1 | 91.7 | 89.2 | 91.5 | 87.7 | 85.6 | 75.0 | 102.8 | 95.4 | [3] |
| Caterpillar CS74 Vibratory Roller | A | 2 | 50% | - | 120.0 | 111.0 | 103.0 | 107.0 | 105.0 | 98.0 | 95.0 | 89.0 | 120.9 | 108.9 | [3] |
| Caterpillar 815 Compactor | A | 2 | 50% | 95.9 | 101.8 | 108.2 | 110.6 | 101.9 | 106.0 | 100.1 | 97.4 | 95.9 | 114.4 | 109.5 | [3] |
| Caterpillar 928 Loader | A | 2 | 50% | 98.7 | 102.0 | 115.5 | 113.5 | 107.7 | 106.5 | 103.0 | 98.4 | 93.5 | 118.6 | 111.7 | [3] |
| Pickup Truck | P | 6 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| **Detailed Excavation (Per Location) - Tank 96 & 98; Tank 91, 93, 95 & 97; Tank 80 & 86; Tank 85 & 89; Tank 74, 76 & 78; Tank 75, 77 & 79** | | | | | | | | | | | | | | | |

| Equipment | Source Type [1] | Quantity | Utilization | Sound Level Octave Spectrum (dB) | | | | | | | | | | | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB | dBA | |
| Caterpillar 330F Excavator | A | 1 | 50% | 100.0 | 123.0 | 115.0 | 105.0 | 102.0 | 98.0 | 99.0 | 95.0 | 90.0 | 123.8 | 106.6 | [3] |
| Caterpillar D8 Dozer | A | 1 | 50% | 104.5 | 103.5 | 107.7 | 108.7 | 107.7 | 107.5 | 104.2 | 98.4 | 93.7 | 115.2 | 111.5 | [3] |
| Pickup Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| **Foundation Concrete Work (Per Location) - Tank 74 & 77; Tank 77 & 79; Tank 91 & 93; Tank 95 & 97; Tank 96 & 98** | | | | | | | | | | | | | | | |
| Zoom Boom | A | 2 | 50% | 95.3 | 99.1 | 110.4 | 107.1 | 109.4 | 108.1 | 104.2 | 100.5 | 97.1 | 115.6 | 112.3 | [3] |
| 185 Compressor | P | 4 | 50% | 100.0 | 95.0 | 95.0 | 94.0 | 97.0 | 100.0 | 100.0 | 98.0 | 95.0 | 107.3 | 105.6 | [3] |
| DIESEL WELDER 500A | A | 6 | 20% | 102.2 | 107.6 | 95.8 | 98.1 | 92.9 | 92.1 | 89.5 | 87.2 | 82.5 | 109.5 | 97.5 | [3] |
| 25KV Genset | P | 8 | 100% | 71.2 | 82.9 | 74.1 | 73.2 | 72.7 | 62.5 | 61.3 | 60.2 | 56.0 | 84.4 | 72.6 | [4] |
| Pickup Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| **Foundation Concrete Work (Per Location) - Tank 75; Tank 78; Tank 80; Tank 89** | | | | | | | | | | | | | | | |
| Zoom Boom | A | 2 | 50% | 95.3 | 99.1 | 110.4 | 107.1 | 109.4 | 108.1 | 104.2 | 100.5 | 97.1 | 115.6 | 112.3 | [3] |
| 185 Compressor | P | 2 | 50% | 100.0 | 95.0 | 95.0 | 94.0 | 97.0 | 100.0 | 100.0 | 98.0 | 95.0 | 107.3 | 105.6 | [3] |
| DIESEL WELDER 500A | A | 3 | 20% | 102.2 | 107.6 | 95.8 | 98.1 | 92.9 | 92.1 | 89.5 | 87.2 | 82.5 | 109.5 | 97.5 | [3] |
| 25KV Genset | P | 4 | 100% | 71.2 | 82.9 | 74.1 | 73.2 | 72.7 | 62.5 | 61.3 | 60.2 | 56.0 | 84.4 | 72.6 | [4] |
| Pickup Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| **Shoring (Per Location) - Tank 96 & 98; Tank 91, 93, 95 & 97; Tank 80 & 86; Tank 85 & 89; Tank 74, 76 & 78; Tank 75, 77 & 79** | | | | | | | | | | | | | | | |
| 185 CFM Compressor | P | 2 | 100% | 100.0 | 95.0 | 95.0 | 94.0 | 97.0 | 100.0 | 100.0 | 98.0 | 95.0 | 107.3 | 105.6 | [3] |
| 750-1400 CFM Compressor | P | 2 | 100% | 94.5 | 94.5 | 93.5 | 91.5 | 91.5 | 93.5 | 97.5 | 96.5 | 92.5 | 103.9 | 102.4 | [3] |
| Air Tracks Drills | P | 2 | 50% | 96.0 | 99.6 | 106.9 | 106.1 | 106.2 | 109.3 | 110.1 | 109.7 | 104.8 | 116.6 | 115.9 | [3] |
| Grout Pump | P | 2 | 100% | 71.2 | 82.9 | 74.1 | 73.2 | 72.7 | 62.5 | 61.3 | 60.2 | 56.0 | 84.4 | 72.6 | [4] |
| 124 KW Generator | P | 1 | 100% | 101.1 | 112.8 | 104.0 | 103.0 | 102.6 | 92.4 | 91.2 | 90.1 | 85.9 | 114.3 | 102.4 | [4] |
| **Piling (Per Location) - CWA 3; CWA 8; CWA 9; CWA 14; CWA 18** | | | | | | | | | | | | | | | |
| Piling Drilled Shafts | P | 1 | 50% | 96.0 | 99.6 | 106.9 | 106.1 | 106.2 | 109.3 | 110.1 | 109.7 | 104.8 | 116.6 | 115.9 | [3] |
| Crane | P | 1 | 50% | - | 109.0 | 105.0 | 94.0 | 90.0 | 87.0 | 85.0 | 79.0 | 74.0 | 110.6 | 94.5 | [3] |
| Diesel Welder 500A | P | 1 | 20% | 102.2 | 107.6 | 95.8 | 98.1 | 92.9 | 92.1 | 89.5 | 87.2 | 82.5 | 109.5 | 97.5 | [3] |
| 25KV Genset | P | 1 | 100% | 71.2 | 82.9 | 74.1 | 73.2 | 72.7 | 62.5 | 61.3 | 60.2 | 56.0 | 84.4 | 72.6 | [4] |
| **Tank Contractor (Per Location) - Tank 75; Tank 78; Tank 80; Tank 89; Tank 74 & 76; Tank 77 & 79; Tank 91 & 93; Tank 95 & 97** | | | | | | | | | | | | | | | |
| 50 Ton RT Crane | P | 1 | 100% | - | 109.0 | 105.0 | 94.0 | 90.0 | 87.0 | 85.0 | 79.0 | 74.0 | 110.6 | 94.5 | [3] |
| 12000lb Forklift | A | 1 | 50% | 95.3 | 99.1 | 110.4 | 107.1 | 109.4 | 108.1 | 104.2 | 100.5 | 97.1 | 115.6 | 112.3 | [3] |
| 185 CFM Compressor | P | 1 | 50% | 100.0 | 95.0 | 95.0 | 94.0 | 97.0 | 100.0 | 100.0 | 98.0 | 95.0 | 107.3 | 105.6 | [3] |
| Skid Steer | A | 1 | 50% | 98.3 | 109.8 | 108.5 | 102.1 | 103.2 | 106.0 | 104.7 | 98.6 | 99.0 | 114.7 | 110.3 | [3] |
| Pickup Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Manlift | P | 1 | 50% | 96.4 | 111.3 | 110.8 | 103.6 | 98.3 | 100.6 | 99.8 | 98.0 | 88.8 | 115.0 | 106.2 | [3] |
| Electrical Welder | A | 3 | 50% | 102.2 | 107.6 | 95.8 | 98.1 | 92.9 | 92.1 | 89.5 | 87.2 | 82.5 | 109.5 | 97.5 | [3] |
| Diesel Welder | A | 3 | 50% | 102.2 | 107.6 | 95.8 | 98.1 | 92.9 | 92.1 | 89.5 | 87.2 | 82.5 | 109.5 | 97.5 | [3] |
| Scissor Lift | P | 1 | 20% | 96.4 | 111.3 | 110.8 | 103.6 | 98.3 | 100.6 | 99.8 | 98.0 | 88.8 | 115.0 | 106.2 | [3] |

| Equipment | Source Type [1] | Quantity | Utilization | Sound Level Octave Spectrum (dB) | | | | | | | | | | | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB | dBA | |
| **On-Site Haul (Throughout Site)** | | | | | | | | | | | | | | | |
| Caterpillar 740 Articulated Truck | L [2] | - | 3.2 trips per hour | 93.6 | 103.4 | 98.9 | 100.3 | 94.8 | 91.0 | 91.6 | 76.2 | 95.6 | 107.1 | 99.6 | [3] |
| **Off-Site Haul (Throughout Site)** | | | | | | | | | | | | | | | |
| Tandem Axle Dump Truck & Trailer(15M3 Capacity) 450HP | L [2] | - | 1.5 trips per hour | 118.0 | 118.0 | 115.0 | 105.0 | 107.0 | 103.0 | 101.0 | 95.0 | 91.0 | 122.3 | 109.0 | [3] |
| Caterpillar 272C Skid Steer | L [2] | - | 0.1 trips per hour | 98.3 | 109.8 | 108.5 | 102.1 | 103.2 | 106.0 | 104.7 | 98.6 | 99.0 | 114.7 | 110.3 | [3] |
| Street Sweeper | L [2] | - | 0.1 trips per hour | - | 80.0 | 75.0 | 69.0 | 75.0 | 71.0 | 67.0 | 61.0 | 58.0 | 82.8 | 75.9 | [3] |
| Caterpillar 966 Loader | L [2] | - | 0.1 trips per hour | 98.7 | 102.0 | 115.5 | 113.5 | 107.7 | 106.5 | 103.0 | 98.4 | 93.5 | 118.6 | 111.7 | [3] |
| Pickup Truck | L [2] | - | 0.1 trips per hour | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| **Miscellaneous Utilities (Modelled for Portal Fill and Manifold Fill)** | | | | | | | | | | | | | | | |
| Caterpillar 330F Excavator | A | 2 | 50% | 100.0 | 123.0 | 115.0 | 105.0 | 102.0 | 98.0 | 99.0 | 95.0 | 90.0 | 123.8 | 106.6 | [3] |
| Caterpillar 950 Loader | A | 1 | 50% | 98.7 | 102.0 | 115.5 | 113.5 | 107.7 | 106.5 | 103.0 | 98.4 | 93.5 | 118.6 | 111.7 | [3] |
| Bomag BMP 8500 | A | 1 | 50% | 22.0 | 114.0 | 105.0 | 97.0 | 101.0 | 96.0 | 92.0 | 89.0 | 83.0 | 114.9 | 102.9 | [3] |
| Plate Compactor Wacker Neuson DPU6555Heh (1000lbs) | A | 2 | 50% | - | 120.0 | 111.0 | 103.0 | 107.0 | 105.0 | 98.0 | 95.0 | 89.0 | 120.9 | 108.9 | [3] |
| Pickup Truck | A | 4 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| **Support (Throughout Site)** | | | | | | | | | | | | | | | |
| Caterpillar 14M Grader | A | 1 | 50% | 112.3 | 114.5 | 112.9 | 109.5 | 109.1 | 108.9 | 106.8 | 102.9 | 100.3 | 119.9 | 113.6 | [3] |
| Water Truck | L [2] | 2 | - | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Zoom Boom | A | 1 | 50% | 95.3 | 99.1 | 110.4 | 107.1 | 109.4 | 108.1 | 104.2 | 100.5 | 97.1 | 115.6 | 112.3 | [3] |
| 125KV Genset with 4"pump | P | 7 | 100% | 93.0 | 93.2 | 95.8 | 97.8 | 100.3 | 100.8 | 99.4 | 94.6 | 87.0 | 106.9 | 105.2 | [4] |
| Portable Light Plant | P | 12 | 100% | 95.7 | 90.7 | 88.3 | 88.1 | 82.2 | 83.6 | 82.8 | 82.8 | 79.5 | 98.5 | 89.9 | [4] |
| 125KV Genset for Worker Trailers | P | 6 | 100% | 101.1 | 112.8 | 104.0 | 103.0 | 102.6 | 92.4 | 91.2 | 90.1 | 85.9 | 114.3 | 102.4 | [4] |
| Large Genset for Office Complex | P | - | 100% | 96.1 | 107.8 | 99.0 | 98.0 | 97.6 | 87.4 | 86.2 | 85.1 | 80.9 | 109.3 | 97.4 | [4] |
| Fuel Truck | L [2] | - | 0.1 trips per hour | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Lube Truck | L [2] | - | 0.1 trips per hour | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Pickup Truck | L [2] | - | 1.5 trips per hour | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Boom Truck | L [2] | - | 0.1 trips per hour | 88.6 | 97.1 | 90.3 | 85.7 | 87.4 | 92.0 | 89.1 | 82.9 | 84.1 | 100.3 | 95.4 | [3] |
| Service Pickup Truck | L [2] | - | 0.1 trips per hour | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Crane RT 90T | A | 1 | 50% | - | 109.0 | 105.0 | 94.0 | 90.0 | 87.0 | 85.0 | 79.0 | 74.0 | 110.6 | 94.5 | [3] |
| 120T Hydraulic Crane | A | 1 | 50% | - | 109.0 | 105.0 | 94.0 | 90.0 | 87.0 | 85.0 | 79.0 | 74.0 | 110.6 | 94.5 | [3] |

**Notes:**

[1] Represents the following source types: P – Point Source, L – Line Source, and A – Area Source.
[2] Vehicle speed assumed to be 10km/hr.
[3] Based on field measurements of similar equipment.
[4] Based on engineering calculations.

## TABLE D- 3
## BURNABY TERMINAL SUGGESTED SOUND LEVEL LIMITS

| Receptor | | Desired BC OGC Permissible Sound Level Limit[1] | | HC Guidance Noise Mitigation Threshold | |
|---|---|---|---|---|---|
| ID | Description | Day (dBA) | Night (dBA) | Day (dBA) | Night (dBA) |
| Burnaby_A | Residence | 53 | 43 | 61 | 50 |
| Burnaby_B | Residence | 53 | 43 | 61 | 50 |
| Burnaby_C [2] | Property Line | 53 | 43 | 61 | 50 |
| Burnaby_D | Residence | 53 | 43 | 61 | 50 |
| Burnaby_E | Residence | 56 | 46 | 61 | 51 |
| Burnaby_F | Residence | 56 | 46 | 61 | 51 |
| Burnaby_G | Residence | 56 | 46 | 61 | 51 |

**Notes:**

[1] No seasonal adjustments or temporary activity adjustments. Additionally, no ambient measurements were conducted for ambient adjustments.

[2] Burnaby_C is not a residential site, therefore is not required to meet the BC OGC PSL requirement.

# APPENDIX E

## TABLE E-1
## SUMAS TERMINAL BASELINE AMBIENT SOUND LEVELS

| Receptor | | Dwelling Density [1] | Category [2] | UTM Coordinates (12U) | | Average Ambient Sound Level [3] | |
|---|---|---|---|---|---|---|---|
| ID | Description | | | Easting (m) | Northing (m) | Day (dBA) | Night (dBA) |
| **Sumas Terminal** | | | | | | | |
| SumasTerm_C [4] | Residence | 1-8 | 1 | 558044 | 5436247 | 45 | 35 |
| SumasTerm_E | Residence | 1-8 | 1 | 558175 | 5436148 | 45 | 35 |
| SumasTerm_F | Residence | 1-8 | 1 | 558825 | 5436648 | 45 | 35 |

**Notes:**

[1] Dwelling density per quarter section of land.

[2] Category 1 - Dwelling units more than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 2 - Dwelling units more than 30 m but less than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 3 - Dwelling units less than 30 m from heavily travelled roads and/or rail lines and/or subject to frequent aircraft flyovers.

[3] For the nighttime period (10 pm to 7 am). The daytime (7 am to 10 pm) adjustment is +10 dB for Average Ambient Sound Level.

[4] SumasTerm_C represents three residences in the area.

## TABLE E-2
## SUMAS TERMINAL CONSTRUCTION EQUIPMENT SOUND EMISSION DATA

| Equipment | Source Type [1] | Quantity | Utilization | Sound Level Octave Spectrum (dB) | | | | | | | | | | | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB | dBA | |
| **Bulk Excavation (Per Location)** | | | | | | | | | | | | | | | |
| 345 Caterpillar Excavator | A | 1 | 70% | 100.0 | 123.0 | 115.0 | 105.0 | 102.0 | 98.0 | 99.0 | 95.0 | 90.0 | 123.8 | 106.6 | [3] |
| Pickup Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Hydrovac Truck [5] | A | 1 | 75% | 94.5 | 89.7 | 88.1 | 86.8 | 88.6 | 90.7 | 90.3 | 86.9 | 83.5 | 99.3 | 95.8 | [3] |
| **Berm & Miscellaneous Fills** | | | | | | | | | | | | | | | |
| Caterpillar Dozer D6 | A | 1 | 100% | 98.7 | 87.1 | 98.1 | 91.7 | 89.2 | 91.5 | 87.7 | 85.6 | 75.0 | 102.8 | 95.4 | [3] |
| Caterpillar CS54 Vibratory Roller | A | 1 | 100% | - | 120.0 | 111.0 | 103.0 | 107.0 | 105.0 | 98.0 | 95.0 | 89.0 | 120.9 | 108.9 | [3] |
| **Haul Off Site** | | | | | | | | | | | | | | | |
| Truck and Pup | L [2] | - | 1 trip per hour | 118.0 | 118.0 | 115.0 | 105.0 | 107.0 | 103.0 | 101.0 | 95.0 | 91.0 | 122.3 | 109.0 | [3] |
| Caterpillar 966 Loader | A | 1 | 25% | 98.7 | 102.0 | 115.5 | 113.5 | 107.7 | 106.5 | 103.0 | 98.4 | 93.5 | 118.6 | 111.7 | [3] |
| **Detailed & Trench Excavation** | | | | | | | | | | | | | | | |
| Caterpillar 325 Excavator | A | 1 | 100% | 100.0 | 123.0 | 115.0 | 105.0 | 102.0 | 98.0 | 99.0 | 95.0 | 90.0 | 123.8 | 106.6 | [3] |
| **Foundation Concrete Work (Per Location)** | | | | | | | | | | | | | | | |
| 185 Compressor | A | 1 | 100% | 100.0 | 95.0 | 95.0 | 94.0 | 97.0 | 100.0 | 100.0 | 98.0 | 95.0 | 107.3 | 105.6 | [3] |
| 25KV Genset | A | 2 | 100% | 71.2 | 82.9 | 74.1 | 73.2 | 72.7 | 62.5 | 61.3 | 60.2 | 56.0 | 84.4 | 72.6 | [4] |
| Pickup Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| **Piling** | | | | | | | | | | | | | | | |
| Piling Drilled Shafts | A | 1 | 50% | 96.0 | 99.6 | 106.9 | 106.1 | 106.2 | 109.3 | 110.1 | 109.7 | 104.8 | 116.6 | 115.9 | [3] |
| Crane | A | 1 | 50% | - | 109.0 | 105.0 | 94.0 | 90.0 | 87.0 | 85.0 | 79.0 | 74.0 | 110.6 | 94.5 | [3] |
| Loader | A | 1 | 50% | 98.7 | 102.0 | 115.5 | 113.5 | 107.7 | 106.5 | 103.0 | 98.4 | 93.5 | 118.6 | 111.7 | [3] |
| Diesel Welder | A | 1 | 50% | 102.2 | 107.6 | 95.8 | 98.1 | 92.9 | 92.1 | 89.5 | 87.2 | 82.5 | 109.5 | 97.5 | [3] |
| 25KV Genset | A | 1 | 100% | 71.2 | 82.9 | 74.1 | 73.2 | 72.7 | 62.5 | 61.3 | 60.2 | 56.0 | 84.4 | 72.6 | [3] |
| **Tank Contractor** | | | | | | | | | | | | | | | |
| 50 Ton RT Crane | A | 1 | 100% | - | 109.0 | 105.0 | 94.0 | 90.0 | 87.0 | 85.0 | 79.0 | 74.0 | 110.6 | 94.5 | [3] |
| 12000lb Forklift | A | 1 | 100% | 95.3 | 99.1 | 110.4 | 107.1 | 109.4 | 108.1 | 104.2 | 100.5 | 97.1 | 115.6 | 112.3 | [3] |
| 185 CFM Compressor | A | 1 | 100% | 100.0 | 95.0 | 95.0 | 94.0 | 97.0 | 100.0 | 100.0 | 98.0 | 95.0 | 107.3 | 105.6 | [3] |
| Pickup Truck | P | 3 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Manlift | P | 1 | 50% | 96.4 | 111.3 | 110.8 | 103.6 | 98.3 | 100.6 | 99.8 | 98.0 | 88.8 | 115.0 | 106.2 | [3] |
| Electric Welder | A | 3 | 50% | 102.2 | 107.6 | 95.8 | 98.1 | 92.9 | 92.1 | 89.5 | 87.2 | 82.5 | 109.5 | 97.5 | [3] |
| Diesel Welder | A | 3 | 50% | 102.2 | 107.6 | 95.8 | 98.1 | 92.9 | 92.1 | 89.5 | 87.2 | 82.5 | 109.5 | 97.5 | [3] |
| Scissor Lift | P | 1 | 50% | 96.4 | 111.3 | 110.8 | 103.6 | 98.3 | 100.6 | 99.8 | 98.0 | 88.8 | 115.0 | 106.2 | [3] |
| **Support** | | | | | | | | | | | | | | | |
| Water Truck | A | 2 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Light Plants | P | 12 | 100% | 95.7 | 90.7 | 88.3 | 88.1 | 82.2 | 83.6 | 82.8 | 82.8 | 79.5 | 98.5 | 89.9 | [4] |
| 125KV Gensets for Worker Trailers | A | 6 | 100% | 101.1 | 112.8 | 104.0 | 103.0 | 102.6 | 92.4 | 91.2 | 90.1 | 85.9 | 114.3 | 102.4 | [4] |

| Equipment | Source Type [1] | Quantity | Utilization | Sound Level Octave Spectrum (dB) | | | | | | | | | | | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB | dBA | |
| Fuel Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Lube Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Crane RT 90T | P | 1 | 50% | - | 109.0 | 105.0 | 94.0 | 90.0 | 87.0 | 85.0 | 79.0 | 74.0 | 110.6 | 94.5 | [3] |

**Notes:**

[1] Represents the following source types: P – Point Source, L – Line Source, and A – Area Source.
[2] Vehicle speed assumed to be 10km/hr.
[3] Based on field measurements of similar equipment.
[4] Based on engineering calculations.
[5] Hydrovac 100% utilization equates to 8 hours of operation per day.

## TABLE E-3
## SUMAS TERMINAL SUGGESTED SOUND LEVEL LIMITS

| Receptor | | Desired BC OGC Permissible Sound Level Limit[1] | | HC Guidance Noise Mitigation Threshold | |
|---|---|---|---|---|---|
| ID | Description | Day (dBA) | Night (dBA) | Day (dBA) | Night (dBA) |
| Sumas Terminal | | | | | |
| SumasTerm_C | Residence | 50 | 40 | 60 | 50 |
| SumasTerm_E | Residence | 50 | 40 | 60 | 50 |
| SumasTerm_F | Residence | 50 | 40 | 60 | 50 |

**Notes:**

[1] No seasonal adjustments or temporary activity adjustments. Additionally, no ambient measurements were conducted for ambient adjustments.

# APPENDIX F

## TABLE F- 1
## GENERAL PUMP STATIONS BASELINE AMBIENT SOUND LEVELS

| Receptor | | Dwelling Density [1] | Category [2] | UTM Coordinates (12U) | | Average Ambient Sound Level [3] | |
|---|---|---|---|---|---|---|---|
| ID | Description | | | Easting (m) | Northing (m) | Day (dBA) | Night (dBA) |
| Gainford Pump Station | | | | | | | |
| Gainford_D | Residence | 1-8 | 2 | 649789 | 5939373 | 50 | 40 |
| Gainford_E | Residence | 1-8 | 2 | 649775 | 5939151 | 50 | 40 |
| Gainford_F | Residence | 1-8 | 2 | 649462 | 5939065 | 50 | 40 |
| Gainford_G | Residence | 1-8 | 2 | 649262 | 5939242 | 50 | 40 |
| Blackpool Pump Station | | | | | | | |
| Blackpool_B | Residence | 1-8 | 2 | 696524 | 5716759 | 50 | 40 |
| Darfield Pump Station | | | | | | | |
| Darfield_A | Residence | 1-8 | 2 | 696640 | 5688256 | 50 | 40 |
| Darfield_B | Residence | 1-8 | 2 | 696456 | 5988505 | 50 | 40 |
| Blue River Pump Station | | | | | | | |
| Blue River_A | Residence | 9-160 | 2 | 342147 | 5775915 | 53 | 43 |
| Blue River_B | Residence | 9-160 | 2 | 342194 | 5775787 | 53 | 43 |
| Blue River_C | Residence | 9-160 | 2 | 342193 | 5775630 | 53 | 43 |
| Blue River_D | Residence | 9-160 | 2 | 341999 | 5775590 | 53 | 43 |
| Blue River_E | Residence | 9-160 | 2 | 341932 | 5775615 | 53 | 43 |
| Blue River_F | Motel | 9-160 | 2 | 341789 | 5775678 | 53 | 43 |

**Notes:**

[1] Dwelling density per quarter section of land.

[2] Category 1 - Dwelling units more than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 2 - Dwelling units more than 30 m but less than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 3 - Dwelling units less than 30 m from heavily travelled roads and/or rail lines and/or subject to frequent aircraft flyovers.

[3] For the nighttime period (10 pm to 7 am). The daytime (7 am to 10 pm) adjustment is +10 dB for Average Ambient Sound Level.

[4] Edmonton_A represents the 1.5 km LSA limit as per Directive 038.

## TABLE F-2
## GENERAL PUMP STATION CONSTRUCTION EQUIPMENT SOUND EMISSION DATA

| Equipment | Source Type [1] | Quantity | Utilization | Sound Level Octave Spectrum (dB) 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB | dBA | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cut and Fill** | | | | | | | | | | | | | | | |
| Chain Saw | A | 1 | 50% | 109.0 | 109.0 | 109.0 | 109.0 | 109.0 | 109.0 | 109.0 | 109.0 | 109.0 | 118.5 | 116.0 | [3] |
| Loader | A | 1 | 75% | 98.7 | 102.0 | 115.5 | 113.5 | 107.7 | 106.5 | 103.0 | 98.4 | 93.5 | 118.6 | 111.7 | [3] |
| Excavator | A | 1 | 75% | 100.0 | 123.0 | 115.0 | 105.0 | 102.0 | 98.0 | 99.0 | 95.0 | 90.0 | 123.8 | 106.6 | [3] |
| Caterpillar Dozer D6 | A | 1 | 75% | 98.7 | 87.1 | 98.1 | 91.7 | 89.2 | 91.5 | 87.7 | 85.6 | 75.0 | 102.8 | 95.4 | [3] |
| **Containment Ponds** | | | | | | | | | | | | | | | |
| Excavator | A | 1 | 75 | 100.0 | 123.0 | 115.0 | 105.0 | 102.0 | 98.0 | 99.0 | 95.0 | 90.0 | 123.8 | 106.6 | [3] |
| Caterpillar Dozer D8 | A | 1 | 50 | 104.5 | 103.5 | 107.7 | 108.7 | 107.7 | 107.5 | 104.2 | 98.4 | 93.7 | 115.2 | 111.5 | [3] |
| Caterpillar Dozer D6 | A | 1 | 75 | 98.7 | 87.1 | 98.1 | 91.7 | 89.2 | 91.5 | 87.7 | 85.6 | 75.0 | 102.8 | 95.4 | [3] |
| Vibratory Roller | A | 1 | 75 | - | 120.0 | 111.0 | 103.0 | 107.0 | 105.0 | 98.0 | 95.0 | 89.0 | 120.9 | 108.9 | [3] |
| Compactor | A | 1 | 75 | 95.9 | 101.8 | 108.2 | 110.6 | 101.9 | 106.0 | 100.1 | 97.4 | 95.9 | 114.4 | 109.5 | [3] |
| Hydrovac | P | 2 | 100% | 94.5 | 89.7 | 88.1 | 86.8 | 88.6 | 90.7 | 90.3 | 86.9 | 83.5 | 99.3 | 95.8 | [3] |
| **Piling** | | | | | | | | | | | | | | | |
| Vibratory Pile Driver | A | 1 | 75% | - | 95.6 | 109.7 | 104.9 | 112.3 | 112.0 | 112.3 | 108.0 | 102.5 | 118.5 | 117.5 | [3] |
| Crane | A | 1 | 100% | 111.1 | 106.8 | 107.7 | 111.8 | 108.1 | 105.2 | 104.0 | 99.8 | 95.0 | 117.1 | 111.2 | [3] |
| Drill Rig | A | 1 | 75% | 96.0 | 99.6 | 106.9 | 106.1 | 106.2 | 109.3 | 110.1 | 109.7 | 104.8 | 116.6 | 115.9 | [3] |
| **Concrete** | | | | | | | | | | | | | | | |
| Zoom Boom | A | 1 | 75% | 95.3 | 99.1 | 110.4 | 107.1 | 109.4 | 108.1 | 104.2 | 100.5 | 97.1 | 115.6 | 112.3 | [3] |
| 185 Compressor | A | 1 | 100% | 100.0 | 95.0 | 95.0 | 94.0 | 97.0 | 100.0 | 100.0 | 98.0 | 95.0 | 107.3 | 105.6 | [3] |
| Welder | A | 1 | 50% | 102.2 | 107.6 | 95.8 | 98.1 | 92.9 | 92.1 | 89.5 | 87.2 | 82.5 | 109.5 | 97.5 | [3] |
| 25KV Genset | A | 1 | 100% | 71.2 | 82.9 | 74.1 | 73.2 | 72.7 | 62.5 | 61.3 | 60.2 | 56.0 | 84.4 | 72.6 | [4] |
| **Haul Off Site [5]** | | | | | | | | | | | | | | | |
| Dump Trucks | L [2] | - | 2 trips per hour | 118.0 | 118.0 | 115.0 | 105.0 | 107.0 | 103.0 | 101.0 | 95.0 | 91.0 | 122.3 | 109.0 | [3] |
| Dump Trucks | P | 1 | 10% | 118.0 | 118.0 | 115.0 | 105.0 | 107.0 | 103.0 | 101.0 | 95.0 | 91.0 | 122.3 | 109.0 | [3] |
| **Support [5]** | | | | | | | | | | | | | | | |
| Water Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Fuel Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Lube Truck | P | 1 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |
| Man Lift | A | 1 | 50% | 96.4 | 111.3 | 110.8 | 103.6 | 98.3 | 100.6 | 99.8 | 98.0 | 88.8 | 115.0 | 106.2 | [3] |
| Light | P | 6 | 100% | 95.7 | 90.7 | 88.3 | 88.1 | 82.2 | 83.6 | 82.8 | 82.8 | 79.5 | 98.5 | 89.9 | [4] |
| ATV | A | 2 | 50% | 87.8 | 102.7 | 102.2 | 95.1 | 89.7 | 92.0 | 91.2 | 89.4 | 80.3 | 106.4 | 97.7 | [3] |
| Crane | A | 2 | 50% | - | 109.0 | 105.0 | 94.0 | 90.0 | 87.0 | 85.0 | 79.0 | 74.0 | 110.6 | 94.5 | [3] |
| Pickup Truck | A | 2 | 10% | 79.7 | 94.6 | 94.1 | 87.0 | 81.6 | 83.9 | 83.1 | 81.3 | 72.2 | 98.3 | 89.6 | [3] |

**Notes:**

[1] Represents the following source types: P – Point Source, L – Line Source, and A – Area Source.
[2] Vehicle speed assumed to be 10km/hr.
[3] Based on field measurements of similar equipment.
[4] Based on engineering calculations.
[5] Support and Haul Off Site equipment assumed to be active throughout all construction phases. Existing terminal equipment assumed to be in operation.

## TABLE F-3
## GENERAL PUMP STATIONS SUGGESTED SOUND LEVEL LIMITS

| Receptor | | Desired Permissible Sound Level Limit [1] | | HC Guidance Noise Mitigation Thresholds | |
|---|---|---|---|---|---|
| ID | Description | Day (dBA) | Day (dBA) | Day (dBA) | Night (dBA) |
| **Gainford Pump Station** | | | | | |
| Gainford_D | Residence | 55 | 45 | 61 | 51 |
| Gainford_E | Residence | 55 | 45 | 61 | 51 |
| Gainford_F | Residence | 55 | 45 | 61 | 51 |
| Gainford_G | Residence | 55 | 45 | 61 | 51 |
| **Blackpool Pump Station** | | | | | |
| Blackpool_B | Residence | 55 | 45 | 61 | 51 |
| **Darfield Pump Station** | | | | | |
| Darfield_A | Residence | 55 | 45 | 61 | 51 |
| Darfield_B | Residence | 55 | 45 | 61 | 51 |
| **Blue River Pump Station** | | | | | |
| Blue River_A | Residence | 58 | 48 | 62 | 52 |
| Blue River_B | Residence | 58 | 48 | 62 | 52 |
| Blue River_C | Residence | 58 | 48 | 62 | 52 |
| Blue River_D | Residence | 58 | 48 | 62 | 52 |
| Blue River_E | Residence | 58 | 48 | 62 | 52 |
| Blue River_F | Motel | 58 | 48 | 62 | 52 |

**Notes:**

[1] No seasonal adjustments or temporary activity adjustments.