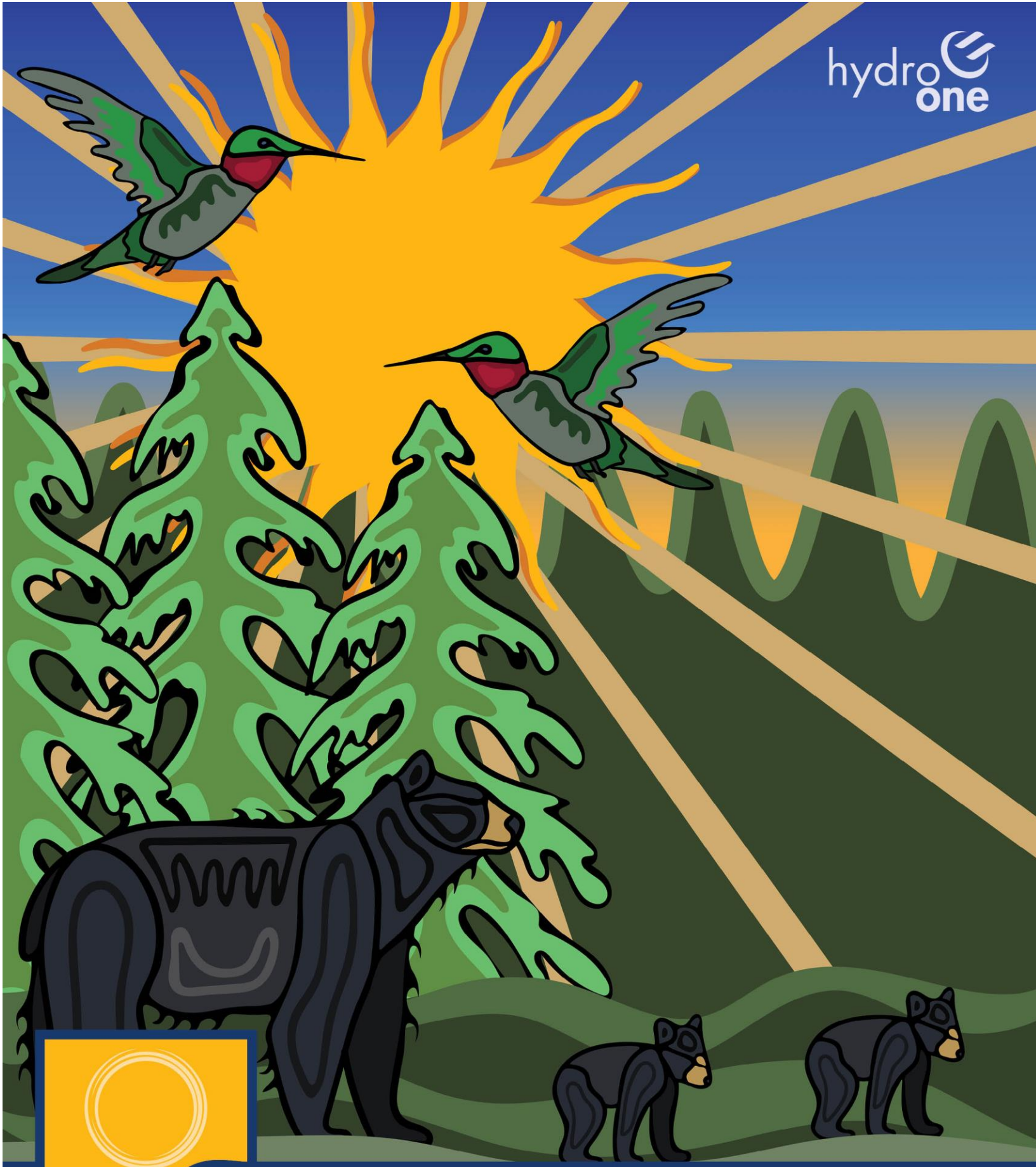

WAASIGAN
TRANSMISSION LINE

FINAL ENVIRONMENTAL ASSESSMENT

Section 6.9 Acoustic and Vibration Environment

November 2023

Acknowledgements

We wish to acknowledge that the Waasigan Transmission Line Project is located within lands that represent the traditional territories and homelands of the T Robinson-Superior Treaty (1850) and Treaty #3 (1873) First Nations, and traverse the Red Sky Métis Independent Nation, Northwestern Ontario Métis Community and Northern Lake Superior Métis Community.

Hydro One also wishes to acknowledge Indigenous artist, Storm Angeconeb, for developing the covering page and wildlife designs throughout the Environmental Assessment. Storm is a highly recognized visual artist from Lac Seul First Nation in Treaty #3 and currently resides in Red Lake. Many of her works include animals and birds as representations of herself or those close to her. The artist's description of the covering page is presented below.

Hydro One Environmental Study Art:

What stands out in this art piece is the symbolic representation of solar rays as "Bringing Power"; we can see the environment represented through the wildlife and Ojibwe floral visuals. This artwork is an excellent representation of Hope, Life, and Opportunity, visually portrayed through the Black Bear and her two cubs. The colour theme of this artwork comes from the Waasigan Transmission Line Project brand identity.

Artist: Storm Angeconeb

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APPENDICES

6.9 Acoustic and Vibration Environment

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This section presents a description of the existing acoustic and vibration environment and an assessment of the potential effects of the Project on the acoustic and vibration environment. Specifically, environmental effects relevant to human noise and vibration receptors are assessed. Assessment of the effects of the Project on wildlife, socio-economics and human health, as related to sensory disturbance from noise and vibration, is carried out in:

- Wildlife and wildlife habitat (Section 6.5);
- Fish and fish habitat (Section 6.6);
- Land and resource use (Section 7.1);
- Community well-being (Section 7.2);
- First Nations rights, interests, and use of land and resources (Section 7.7); and
- Métis rights, interests, and use of land and resources (Section 7.8).

The assessment follows the general approach and concepts described in Section 5.0.

6.9.1 Key Concepts

An introduction to key concepts used in the assessment of acoustics and vibration is provided below.

- “Noise”, “sound”, “airborne noise”, “noise levels”, “vibration”, “vibration levels” or “ground-borne vibration” refers to the levels that can be perceived or measured at a Point of Reception (POR). While noise is defined as unwanted sound, the terms “noise” and “sound” are often used interchangeably.
- A “receptor” or “POR” is a location on a noise and/or vibration sensitive land use where noise and/or vibration from a source is received.
- The “noise level” is expressed on a logarithmic scale in units called decibels (dB). Since the scale is logarithmic, a noise that is twice the noise level of another will be three decibels (3 dB) higher.
- “Sound pressure level” is the physical quantity that is measured in the environment that describes sound waves quantitatively. It is a ratio of the absolute measured pressure relative to a reference (i.e., 20 micro pascals [µPa]). This ratio of pressures is converted to a decibel scale (dB).

- Noise emissions and noise levels have associated frequencies. The human ear does not respond to all frequencies in the same way. Mid-range frequencies are most readily detected by the human ear, while the human ear is generally less sensitive to low and high frequencies. Environmental noise levels used in this assessment are presented as "A-weighted decibels" (or dBA), which incorporates the typical frequency response of the human ear.
- Outdoor noise is usually expressed as an "equivalent noise level" (L_{eq},T), which is a logarithmic average (i.e., energy average) of the measured or predicted noise levels over a given period of time (T). An equivalent noise level measured or predicted over the nighttime period would be referred to as $L_{eq,Night}$, while noise levels to represent the daytime period is referred to as $L_{eq,Day}$.
- Environmental noise levels vary throughout the day and it is therefore important to distinguish between the time of day (i.e., daytime, evening, and nighttime). For the purposes of this assessment, the 24-hour period that represents a day is divided into three periods for which noise is evaluated. The "daytime" noise levels occur for the period from 07:00 to 19:00, the "evening" noise levels occur for the period from 19:00 to 23:00 and the "nighttime" noise levels occur for the period from 23:00 to 07:00. However, when required, the daytime and evening periods are grouped together to generally align with applicable guidance documents.
- Vibration consists of two components: air vibration and ground vibration. The term "air vibration" is used to describe the vibrations that travel through the air and are produced by activities such as blasting. The term "ground vibration" or "ground-borne vibration" is used to describe vibrations that travel through the ground and are produced by activities such as blasting and general construction activities.
- "Ground-borne noise" refers to the noise generated by the ground-borne vibration such as vibrating building components may radiate sound, for example.
- The "vibration level" of ground vibration is described in units of millimetres per second (mm/s). Construction vibration is typically assessed based on the peak particle velocity as it is correlated to building damage. Human annoyance is typically assessed based on the root-mean-square (RMS) vibration velocity.
- "Frequency of vibration" is the rate of oscillation that occurs in one second, measured in hertz, where 1 hertz equals 1 cycle per second.
- "Peak Particle Velocity" (PPV) is the maximum rate of change with respect to time of the particle displacement, measured on the ground, and velocity amplitudes are given in units of mm/s from zero to peak amplitude. PPV is a vector quantity and is typically measured in three component vectors (i.e., transverse, vertical and longitudinal). The PPV correlates best with damage potential of all the tested characterizations of ground movement. Ground vibration is an elastic effect measured in units of PPV.

6.9.2 Input from Engagement

Comments pertaining to the acoustic and vibration environment that were raised by Indigenous communities, government officials and agencies, and interested persons and organizations during engagement, and how they are addressed in the environmental assessment (EA) are listed in Table 6.9-1. Comments and responses are provided in the Engagement Summary (Section 4.0). In addition, the Draft EA Report was provided to Indigenous communities, government officials and agencies, and interested persons and organizations for review and comment on May 17, 2023. A high-level summary of the key themes from the comments on the Draft EA Report and related engagement meetings are included in Table 6.9-1. The detailed responses to these comments are included in Appendix 4.0-A.

Table 6.9-1: Summary of Comment Themes Raised During Engagement

Comment Theme	How Addressed in the Environmental Assessment	Indigenous Community or Indigenous Group / Stakeholder
The EA should describe noise and vibration impacts that could arise from this project during both construction and operation and potential mitigation measures.	A criterion for noise was included in the approved Amended Terms of Reference. A separate criterion for vibration was added to assess vibration separately from noise for clarity. Based on those criteria, this section of the EA describes the noise and vibration impacts that could arise from this project during the construction and operation and maintenance stages, as well as recommended mitigation measures.	Environmental Assessment and Permission Division: Environmental Assessment Branch
Helicopter traffic can be disruptive and unpredictable and can change the physical attributes of harvesting or sites for the Northwestern Ontario Métis Community (NWOMC) and Region 2.	The use of helicopters is included in the assessment of potential increase in noise emissions during the construction and operation and maintenance stages. Changes to quality of life related to nuisance effects such as noise and vibration, including the use of helicopters, are assessed in Section 7.2 (Community Well-being) and Section 7.8 (Métis Rights, Interests, and Use of Land and Resources)	NWOMC and Region 2

Comment Theme	How Addressed in the Environmental Assessment	Indigenous Community or Indigenous Group / Stakeholder
Concerns about increased noise levels during construction and operation, including potential noise (i.e., hum) from the transmission line.	Increased noise levels during construction and operations and maintenance are assessed in this section, including an assessment of corona noise due to the transmission line during operations.	Members of the public
Feedback on noise and vibration assessment approach.	Additional details regarding representative points of reception and expected vibration monitoring setback distances were provided in this EA section.	Ministry of the Environment, Conservation and Parks
Request to review the Blasting Management Plan once prepared.	A Blasting Management Plan will be included as part of the Environmental Protection Plan that will be provided to affected Indigenous communities for review.	Gwayakocchigewin Limited Partnership (GLP)

6.9.3 Information Sources

Information for the acoustic and vibration assessment was collected from review of the following sources:

- Ontario Ministry of the Environment, Conservation and Parks (MECP) Model Municipal Noise Control By Law Noise Pollution Control (NPC) Guideline Construction Equipment, Publication NPC-115 (NPC-115) (MECP 1978a);
- MECP Model Municipal Noise Control By Law NPC Motorized Conveyances, Publication NPC-118 (NPC-118) (MECP 1978b);
- MECP Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning, Publication NPC-300 (NPC-300) (MECP 2013);
- Health Canada Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise (Health Canada Noise Guidance) (Health Canada 2017);
- Ontario Hydro Protocol for Community Noise Control (Ontario Hydro Protocol) (Ontario Hydro 1981);
- Alberta Energy Regulator (AER) Directive 038: Noise Control (Directive 038) (AEUB 2007);

- MECP Model Municipal Noise Control By Law NPC Blasting, Publication NPC-119 (NPC-119) (MECP 1978c);
- Ontario Provincial Standard Specification (OPSS) 120 General Specification for the Use of Explosives (OPSS 120) (OPSS 2014);
- United States of America Department of Transportation Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment (FTA Manual) (FTA 2018);
- Caltrans Transportation and Construction Vibration Guidance Manual (Caltrans Manual) (Caltrans 2020);
- City of Toronto Construction Vibrations By-law, 514-2008 (Vibration Control By-law) (City of Toronto 2008);
- Dryden Transformer Station Environmental Compliance Approval (ECA) (MECP 2016);
- Lakehead Transformer Station Environmental Activity and Sector Registry (EASR) supporting documentation (MECP 2020);
- Orthoimagery;
- Equipment list provided by Project engineering team; and
- Ministry of Natural Resources and Forestry (MNRF) Land Information Ontario (LIO) geographic datasets.

6.9.4 Criteria and Indicators

Criteria are components of the environment that are considered to have economic, social, biological, conservation, aesthetic, or ethical value, as described in Section 5.2. **Indicators** are an aspect or characteristic of a criterion that, if changed as a result of the Project, may demonstrate a physical, biological or socio-economic effect.

The criteria and indicators for the acoustic and vibration environment were initially outlined in the Draft Terms of Reference (ToR). Feedback from Indigenous communities, government officials and agencies, and interested persons and organizations received during engagement was incorporated into the preliminary criteria and indicators approved in the Amended ToR.

Feedback was received during the ToR process regarding concerns with vibration effects from the Project. A separate criterion for vibration was added to assess vibration separately from noise for clarity. The criteria selected for the assessment of Project effects on acoustic and vibration environment, the rationale for their selection, and the indicators are provided in Table 6.9-2.

Table 6.9-2: Acoustic and Vibration Environment Quality Criteria and Indicators

Criteria	Rationale[a]	Indicators	Measurement of Potential Effects
Noise	• Indigenous Knowledge (IK) and Indigenous community feedback regarding concerns about increased noise. • May affect nearby noise sensitive wildlife, human occupancy and land use.	• Change in noise levels in the study area • Compliance with applicable guidance documents	• Qualitative assessment of the construction and operation and maintenance activities to describe the potential for change to the existing noise levels.
Vibration	• Indigenous community feedback regarding concerns about increased vibration. • May affect nearby vibration sensitive wildlife, human occupancy and land use.	• Change in air and/or ground vibration levels in the study area • Compliance with applicable guidance documents	• Qualitative assessment of the construction activities [b], which will describe the potential for change to the existing vibration levels.

a) Effects of noise and vibration on wildlife, socio-economics and human health are addressed in Section 6.5 Wildlife, Section 6.6.Fish and Fish Habitat, Section 7.1 Land and Resource Use, Section 7.2 Community Well-being, Section 7.7 First Nations Rights, Interests, and Use of Land and Resources, and Section 7.8 Métis Rights, Interests, and Use of Land and Resources.

b) For vibration, the construction scenario assessed as part of the EA is considered bounding for operation and maintenance vibration and potential effects and mitigation measures for vibration during operation and maintenance are not identified separately in this EA.

The noise criteria and indicators were established primarily from the Health Canada Noise Guidance, NPC-300, NPC-115 and NPC-118. Vibration criteria and indicators were established primarily using the FTA Manual, Caltrans Manual, City of Toronto Vibration Control By-law, NPC-119 and OPSS 120. These guidance documents are considered the most appropriate and relevant to this Project's expected noise and vibration effects and were publicly and readily available.

In addition to the above guidance documents, local noise and vibration by-laws exist within the LSA, including:

- Thunder Bay Noise By-law Number 131-2005;
- Dryden Municipal Code Chapter 132 – Noise By-law Number 2083-91;
- Ignace Noise By-law 39-2021; and
- Atikokan Noise By-law Number 05-14.

These by-laws are nuisance based and do not provide applicable noise or vibration limits. In general, they describe prohibitions or limitations (e.g., operating conditions, operating times) on the use of specific noise or vibration sources and outline the process for applying for a by-law exemption. Mitigation measures are presented in Table 6.9-25 that will be applied across the Project and will address noise and vibration effects outside of these by-law boundaries.

6.9.4.1 Health Canada Noise Guidance

Although Health Canada does not have enforceable noise thresholds or standards, the Health Canada Noise Guidance (Heath Canada 2017) provides general information for predicting health risks related to noise for major resource and infrastructure projects.

For the purposes of this assessment, the method to assess existing noise levels presented in Section 6.2.2 of the Health Canada Noise Guidance was applied, and the method to assess air overpressure due to blasting presented in Section 6.4.4 of the Health Canada Noise Guidance was applied to assess the effects of the Project on vibration.

The Health Canada Noise Guidance presents options to estimate existing noise levels, which include using approximate noise levels based on community type (e.g., rural versus urban) and average population density. The guidance for estimating existing noise levels is presented in Table 6.9-3.

Table 6.9-3: Health Canada Noise Guidance – Estimation of Existing Noise Levels

Community Type	Population Density, Number of People per square km	Estimated Existing Noise Level, Ldn (dBA)[(a)]
Quiet rural • Dwelling units more than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.	28	≤ 45
Quiet suburban residential • Remote from large cities, industrial activity and trucking.	249	48-52
Normal suburban residential • Not located near industrial activity.	791	53-57
Urban residential • Not immediately adjacent to heavily travelled roads and industrial areas.	2,493	58-62

Community Type	Population Density, Number of People per square km	Estimated Existing Noise Level, Ldn (dBA)[(a)]
Noisy urban residential • Near relatively busy roads or industrial areas.	7,913	63-67
Very noisy urban residential	24,925	68-72

Source: (Health Canada 2017).

a) "Ldn" is a noise descriptor that accounts for the cumulative noise effects from a 24-hour exposure to day-night sound levels with the nighttime period (2200 to 0700) including a +10-dB penalty. It accounts for all sound level fluctuations (i.e., total acoustic energy) during the 24-hour period.

dBA = A-weighted decibels; km = kilometre; m = metre; ≤ = less than or equal to.

The Health Canada Noise Guidance references the Alberta Energy Regulator (previously the Energy Resources Conservation Board) document Directive 038: Noise Control for a quiet rural area's estimated existing nighttime noise level ($L_{eq, night}$) of 35 dBA. It is also referenced for the difference between daytime and nighttime noise levels as approximately 10 dBA. One scenario when this may occur is when the noise levels are constant within the daytime and nighttime periods (i.e., $L_{eq, day}$ = 45 dBA, $L_{eq, night}$ = 35 dBA). Therefore, according to the Health Canada Noise Guidance document, a quiet rural area has an existing daytime noise level ($L_{eq, day}$) of 45 dBA and an existing nighttime noise level ($L_{eq, night}$) of 35 dBA.

The Health Canada Guidance presents criteria for short-term (<1 year) and long-term (≥1 year) construction noise exposure as part of the method to determine potential construction noise impacts. Mitigation measures are recommended if a respective criterion is exceeded.

As described in Section 6.9.1, blasting results in potential air vibration impacts (i.e., air overpressure). The Health Canada Guidance presents a method to determine a blasting Mitigated Noise Level (MNL) for air overpressure that is expected to result in little or no public annoyance, based on the number of daily blasts for short-term construction (i.e., 1 year). The approach is based on the US EPA 1974 criterion for sonic booms and that, according to the findings of Schomer et al. (1997), blasts and sonic booms create similar levels of annoyance for equal peaks. The MNL is calculated using the formula MNL = 125 – 10logN (dB), where N is the number of daytime blasts. Table 6.9-4 is a recreation of Table 6.4 in the Health Canada Guidance, which summarizes the number of daytime blasts and the corresponding blasting MNL in dB.

Table 6.9-4: Mitigation Noise Levels Related to Number of Blasts

Number of Daytime Blasts (N)	Blasting MNL (125-10logN) (dB)
10	115
25	111
50	108
100	105

Source: (Health Canada 2017).
dB = Unweighted decibel, MNL = Mitigated noise level; N = number of daily blasts.

The Health Canada Guidance blasting MNL approach for air overpressure was considered to support the Project construction vibration assessment of human annoyance due to aggregate pit and/or general construction blasting activities (i.e., air vibration).

6.9.4.2 NPC-300 Noise Guideline

The MECP's NPC-300 guideline's main objective is to address the proper control of sources of noise emissions to the environment within the Province of Ontario. NPC-300 serves several purposes, which include providing outdoor sound level limits for stationary sources to establish compliance for approvals and to support land use planning decisions, giving direction for the establishment of noise control by-laws, and supporting the assessment of activities associated with the extraction of aggregate. According to NPC-300, the exclusionary sound level limits may be adopted to describe the expected noise levels at PORs based on a classification system. In accordance with this classification system, the MECP prescribes exclusionary one-hour sound level limits for stationary noise sources based on periods of day (i.e., daytime, evening, and/or nighttime) and at relative locations at the POR (i.e., plane of window and outdoor location). The plane of window is typically assessed for stationary noise sources at the center of the top storey window (i.e., for a two-storey home it would be the bedroom window, at a height of 4.5 metres [m] above-grade). An outdoor location for stationary noise sources is assessed at a location within 30 m of a dwelling at a height of 1.5 m above-grade. The NPC-300 classification system and respective stationary noise source sound level limits for the different periods of day, at the plane of window, and outdoor location of a POR, are summarized in Table 6.9-5 and Table 6.9-6, respectively.

The NPC-300 exclusionary sound level limits are applicable for certain components of Project operations. NPC-300 does not provide sound level limits for temporary construction activities since temporary noise sources associated with construction are not considered stationary sources; however, it generally requires the use of good practices be implemented to limit noise levels. The MECP typically requires implementation of reasonable noise mitigation measures to reduce the potential impact of construction noise on nearby noise PORs.

Table 6.9-5: Guidelines for Exclusionary One-Hour Sound Level Limit (Plane of Window)

Class	Description	Exclusionary One Hour Sound Level Limit (dBA)[a] Daytime (07:00-19:00)	Exclusionary One Hour Sound Level Limit (dBA)[a] Evening (19:00-23:00)	Exclusionary One Hour Sound Level Limit (dBA)[a] Nighttime (23:00-07:00)
1	Major population centre. Background sound level dominated by activities of people, usually road traffic.	50	50	45
2	Area representative of both Class 1 and 3 areas.	50	50	45
3	Rural area. Background sound level dominated by natural sounds having little or no road traffic.	45	40	40
4	New improvement areas where the local land use authority has formally confirmed Class 4 designation. Intended to support infilling, and for new noise sensitive land uses near established stationary sources.	60	60	55

Source: (MECP 2013).

a) These exclusionary sound level limits represent the minimum limit against which a stationary source is to be assessed. For sound from a stationary source, the sound level limit at a POR is the higher of the applicable exclusionary limit or the existing background sound level.

dBA = A-weighted decibel

Table 6.9-6: Guidelines for Exclusionary One-Hour Sound Level Limit (Outdoor Point of Reception)

Class	Description	Exclusionary One Hour Sound Level Limit (dBA)[a] Daytime (07:00-19:00)	Exclusionary One Hour Sound Level Limit (dBA)[a] Evening (19:00-23:00)	Exclusionary One Hour Sound Level Limit (dBA)[a] Nighttime (23:00-07:00)
1	Major population centre. Background sound level dominated by activities of people, usually road traffic.	50	50	n/a
2	Area representative of both Class 1 and 3 areas.	50	45	n/a
3	Rural area. Background sound level dominated by natural sounds having little or no road traffic.	45	40	n/a
4	New improvement areas where the local land use authority has formally confirmed Class 4 designation. Intended to support infilling, and for new noise sensitive land uses near established stationary sources.	55	55	n/a

Source: (MECP 2013).

Notes: As described in NPC-300, in general, the outdoor points of reception will be protected during the nighttime as a consequence of complying with the plane of window sound level limits.

a) These exclusionary sound level limits represent the minimum limit against which a stationary source is to be assessed. For sound from a stationary source, the sound level limit at a POR is the higher of the applicable exclusionary limit or the existing background sound level.

dBA = A-weighted decibel; n/a = not applicable.

6.9.4.3 Ontario Hydro Protocol

The Ontario Hydro Protocol (Ontario Hydro 1981) is a document that sets out the design philosophy and criteria that are applied by Hydro One for limiting audible noise from new facilities, upgraded facilities and construction of new or upgraded facilities.

Hydro One's practice in the design, construction and operation of its equipment is to assess noise with respect to the community and identify practical measures to reduce it to acceptable levels.

The Ontario Hydro Protocol presents the maximum design levels at the POR for all areas (i.e., rural and urban) for the major noise sources associated with the operations. For the purposes of this EA, the maximum design noise level ($L_{eq,\ 1\ hour}$) of 55 dBA at a POR for transmission lines has been considered.

The MECP has a final draft document Protocol for the Measurement and Prediction of Audible Noise from HV Transmission Lines, Publication NPC-360 (NPC-360; MECP 2011) which outlines the methods and criteria for assessing corona noise from transmission lines. The criteria provided by NPC-360 is consistent with the Ontario Hydro Protocol (i.e., 55 dBA).

6.9.4.4 NPC-115 Construction Equipment and NPC-118 Motorized Conveyances

The MECP's NPC-115 and NPC-118 set out maximum noise emission ratings for certain construction equipment and motorized conveyances, respectively. NPC-115 and NPC-118 are two of several Noise Pollution Control publications originally presented in the MECP Model Municipal Noise Control Bylaw dated August 1978. Although the MECP does not specify any particular noise level limits for temporary construction noise levels at noise sensitive land uses, the MECP requires the implementation of good practices to limit noise levels and the implementation of reasonable noise mitigation measures to reduce the potential impact of construction noise on nearby noise sensitive land uses. The *Environmental Protection Act* also has a general requirement to minimize nuisance.

Table 6.9-7 to Table 6.9-11 below summarize maximum noise emission ratings presented in NPC-115 and NPC-118. Note, the reference to "NPC-103 – Procedures" refers to Section 6 "Exterior Sound Level Measurement Procedure for Powered Mobile Construction Equipment – SAE J88a" (SAE J88a) and SAE J88a considers a measurement distance of 15 m for all noise measurements.

Table 6.9-7: Quiet Zone and Residential Area Sound Emission Standards[a]

Date of Manufacture	Maximum Sound Level (dBA)[b] – Power Rating Less than 75kW	Maximum Sound Level (dBA)[b] – Power Rating 75kW and Larger
January 1, 1979 to December 31, 1980	85	88
January 1, 1981 and after	83	85

Source: NPC-115 (MECP 1978a).

a) Emission standards for excavation equipment, dozers, loaders, backhoes or other equipment capable of being used for similar applications.

b) As determined using Publication NPC-103 – Procedures, Section 6.

Table 6.9-8: Sound Emission Standards for Pneumatic Pavement Breakers

Standard	Date of Manufacture	Maximum Sound Level (dBA) as measured using Publication NPC-103
Quiet Zone Sound Emission	January 1, 1979 and after	85
Residential Area Sound Emission Standard	• January 1, 1979 to December 31, 1980 • January 1, 1981 and after	• 90 • 85

Source: NPC-115 (MECP 1978a).

Table 6.9-9: Sound Emission Standards for Portable Air Compressors

Standard	Date of Manufacture	Maximum Sound Level (dBA) as measured using Publication NPC-103
Quiet Zone Sound Emission Standard	• January 1, 1979 to December 31, 1980 • January 1, 1981 and after	• 76 • 70
Residential Area Sound Emission	January 1, 1979 and after	76

Source: NPC-115 (MECP 1978a).

Table 6.9-10: Sound Emission Standard for Tracked Drills

Standard	Date of Manufacture	Maximum Sound Level (dBA) as measured using Publication NPC-103
Quiet Zone Sound Emission and Residential Area Sound Emission Standard	January 1, 1981 and after	100

Source: NPC-115 (MECP 1978a).

Table 6.9-11: Sound Emission Standard for Heavy Vehicles with Governed Diesel Engines[(a)]

Date of Manufacture	Maximum Sound Level (dBA) as measured using Publication NPC-103
Prior to January 1, 1979	100
January 1, 1979 and after	95

Source: NPC-118 (MECP 1978b).

a) "Heavy Vehicle" means a motorized conveyance having a registered gross weight of more than 4,500 kg.

6.9.4.5 Federal Transit Administration Guidelines

The Federal Transit Administration (FTA) Manual is a guideline from the US Department of Transportation FTA that provides procedures for predicting and assessing noise and vibration impacts of proposed transit projects for different stages of project expansion and different levels of analysis. The FTA Manual has noise and vibration prediction methodologies generally recommended by the Canadian Transportation Agency and other railway agencies. It is common for the FTA Manual to be referenced for various types of projects within the Province of Ontario.

The FTA Manual's estimated average vibration source levels for various types of construction equipment was considered to support the Project construction vibration assessment of ground vibration due to general construction activities.

6.9.4.6 Caltrans Transportation and Construction Vibration Guidance Manual

The Caltrans Manual provides guidance on vibration issues associated with the construction, operation, and maintenance of California Department of Transportation (Caltrans) projects. It is common for the Caltrans Manual to be referenced for various types of projects within the Province of Ontario.

The Caltrans Manual's vibration prediction method for ground vibration and criteria for human annoyance was considered to support the Project construction vibration assessment due to general construction activities.

The Caltrans Manual presents the following equation as the vibration attenuation model for general construction equipment when assessing human annoyance and potential building impacts. The vibration amplitudes estimated using this method are expected to be typical worst-case values and should be viewed as guidelines only.

$$\mathbf{PPV}_{equip} = PPV_{ref}\left(\frac{25}{D}\right)^{1.5}$$

Where:

- PPV_{equip} = the peak particle velocity of the equipment adjusted for distance, in/sec
- PPV_{ref} = the source vibration level at 25 ft, in/sec
- D = distance from the equipment to the receiver, ft

According to the FTA Manual, the above equation can also be represented as follows:

$$\mathbf{PPV}_{equip} = PPV_{ref}\left(\frac{D_{ref}}{D}\right)^{n}$$

Where:

- PPV_{equip} = the peak particle velocity of the equipment adjusted for distance, mm/s
- PPV_{ref} = the source vibration level at reference distance, mm/s
- D = distance from the equipment to the receiver, m
- D_{ref} = reference distance for PPV_{ref}, m
- n = is a value related to the vibration attenuation rate through ground, also referred to as soil class designation.

The value of “n” based on site-specific soil conditions can be used for an estimation of vibration amplitude. The value of “n” can range from 1.0 for bedrock to 1.5 for weak or soft soils. According to the Caltrans Manual, the use of values greater than 1.1 would likely result in overestimation of amplitudes at distances closer than 25 ft and would be slightly conservative at distances beyond 25 ft. Note, the FTA Manual presents the same vibration attenuation model and considers a “n” value of 1.5. Table 6.9-12 summarizes suggested “n” values for different types of soil conditions from the Caltrans Manual.

Table 6.9-12: Suggested "n" Values Based on Soil Class

Soil Class	Description of Soil Material	Suggested Value of "n"
I	Weak or soft soils: loose soils, dry or partially saturated peat and muck, mud, loose beach sand, and dune sand, recently plowed ground, soft spongy forest or jungle floor, organic soils, topsoil (shovel penetrates easily).	1.4
II	Competent soils: most sands, sandy clays, silty clays, gravel, silts, weathered rock (can dig with shovel).	1.3
III	Hard soils: dense compacted sand, dry consolidated clay, consolidated glacial till, some exposed rock (cannot dig with shovel, need pick to break up).	1.1
IV	Hard, competent rock: bedrock, freshly exposed hard rock (difficult to break with hammer).	1.0

Source: (Caltrans 2015).

The Caltrans Manual presents criteria for an evaluation of human annoyance. The criteria are separated into two categories: continuous and transient. The criteria are the combination of various criteria the Caltrans Manual reviewed. Table 6.9-13 is a reproduction of the criteria, including mm/s for both PPV and RMS.

Table 6.9-13: Potential Criteria for Evaluating Vibration Annoyance

Human Response	Maximum PPV (in/sec) – Transient	Maximum PPV (in/sec) – Continuous/ Frequent Intermittent Sources	Maximum PPV (mm/sec) – Transient	Maximum PPV (mm/sec) – Continuous/ Frequent Intermittent Sources	Maximum RMS[(a)] (mm/sec) – Transient	Maximum RMS[(a)] (mm/sec) – Continuous/ Frequent Intermittent Sources
Barely perceptible	0.04	0.01	1.0	0.3	0.3	0.1
Distinctly perceptible	0.25	0.04	6.4	1.0	1.6	0.3
Strongly perceptible	0.90	0.10	22.9	2.5	5.7	0.6
Severe	2.00	0.40	50.8	10.2	12.7	2.5

Source: (Caltrans 2015).

a) A crest factor of four was assumed to estimate the RMS from the PPV levels.

6.9.4.7 City of Toronto Vibration Control By-Law 514-2008

The City of Toronto Vibration Control By-law 514-2008 (Vibration Control By-law) describes the regulation of vibrations that are the result of construction activity in the City of Toronto. It is common for the Vibration Control By-law to be referenced for projects within the Province of Ontario. Upon review of applicable local vibration by-laws in the LSA, it was determined that none provide quantitative vibration limits; therefore, the Toronto Vibration Control By-law was considered appropriate for this Project. It provides an outline of the limits, procedures and protocols regarding the production and measurement of ground vibrations from construction activities. The Vibration Control By-law was considered to support the Project construction vibration assessment of ground vibration for potential impacts to structures due to general construction activities.

Table 6.9-14, taken from Table 1.0 of the Vibration Control By-law, provides the frequency-based ground vibration limits.

Table 6.9-14: Prohibited Construction Vibration Limits (Toronto)

Frequency of Vibration (Hz)	Vibration Peak Particle Velocity (mm/s)
Less than 4	8
4 to 10	15
More than 10	25

Source: (City of Toronto 2008)

Hz = Hertz; mm/s = millimetres per second.

It also includes guidance on preparing a vibration control form, pre-construction consultations and monitoring program, construction monitoring, and the public communications and complaint protocol. The requirements of the vibration control form include identifying the Zone of Influence (ZOI). According to the Vibration Control By-law, the definition of a ZOI is as follows:

> *"The area of land within or adjacent to a construction site, including any buildings or structures, that potentially may be impacted by vibrations emanating from a construction activity where the peak particle velocity measured at the point of reception is equal to or greater than 5 mm/sec at any frequency or such greater area where specific site conditions are identified by the professional engineer in a study contemplated in Subsection C3(a)."*

As well, subsection C4(d) states that in determining the ZOI for the construction, a professional engineer shall consider the presence of heritage designated or listed properties and sensitive structures or buildings or infrastructure.

Therefore, for residential, commercial, and institutional buildings (non-heritage), the ZOI level of 5 mm/s at any frequency is identified. For heritage properties and/or structures, the Vibration Control By-law does not specify a ZOI level during construction. General industry practice and

other various guidance documents typically consider a PPV criteria level lower than 5 mm/s for heritage structures and that the heritage structures condition is taken into consideration prior to the start of construction.

6.9.4.8 Noise Pollution Control Guideline-119 (NPC-119) Blasting

The ground and air vibration effects due to blasting produced at PORs adjacent to quarries or mines as defined by the MECP (i.e., dwellings, hotels, schools etc.) are subject to guidelines and limits contained in the MECP's NPC-119. The limits specified in the MECP's NPC-119 are designed to minimize vibration effects due to quarry or mine blasting. The MECP NPC-119 was considered to support the Project construction vibration assessment of air and ground vibration for potential impacts to structures due to aggregate pit or mine blasting activities.

Under conditions where monitoring of the blasting operations is routinely carried out, NPC-119 stipulates that the ground vibration (PPV) and peak air pressure (air overpressure) limits at the nearest PORs to the quarry are 12.5 mm/s and 128 dBL, respectively. Similarly, NPC-119 stipulates cautionary ground vibration (PPV) and peak air pressure (air overpressure) limits at the nearest PORs to the quarry are 10 mm/s and 120 dBL, respectively.

6.9.4.9 Ontario Provincial Standard Specification-120 (OPSS 120)

The OPSS 120 provides the requirements for the use of explosives during construction blasting and has been developed for use in provincial and municipal oriented contracts. It is common for OPSS 120 to be referenced for blasting during general construction activities within the Province of Ontario. The OPSS 120 limits were considered to support the Project construction vibration assessment of ground vibration for potential impacts to structures due to general construction activities.

The limits specified in OPSS 120 are designed to mitigate impacts from vibrations induced by the use of explosives on construction blasting projects. The PPV limits specified by OPSS 120 are presented in Table 6.9-15.

Table 6.9-15: OPSS 120 Maximum Peak Particle Velocity Values

Element	Frequency (Hz)	PPV (mm/s)
Structures and Pipelines	≤ 40	20
Structures and Pipelines	> 40	50
Concrete and Grout < 72 hours from placement	N/A	10

Source: (OPSS 2014).

Hz = Hertz, mm/s = millimetres per second.

6.9.5 Assessment Boundaries

6.9.5.1 Temporal Boundaries

The Project is planned to occur during three stages:

- **Construction stage**: the period from the start of construction to the start of operation (approximately 43 months: 22 months for Phase 1, and 21 months for Phase 2).
- **Operation and maintenance stage:** the period from the start of operation and maintenance activities through to the end of the Project life.
- **Retirement stage**: the period from the end of the Project life and start of retirement activities through to the end of final reclamation of the Project.

As described in Section 5.3.2, the Project will be operated for an indefinite period and the timing of retirement, or decommissioning, is not known at this time as it is anticipated that upgrades to reinforce or rebuild portions of the Project may occur over its lifetime to maintain its longevity. Further, potential effects and mitigation measures to be identified during the EA for the construction of the Project will likely equally apply to the potential removal of the Project at a future point in time, should it ever be required. Therefore, the construction scenario assessed as part of the EA is considered bounding and potential effects and mitigation measures for retirement are not identified separately in this EA.

The assessment of potential Project effects on the acoustic and vibration environment considers effects that occur during both the construction and operation and maintenance stages. This period is sufficient to capture the effects of the Project.

6.9.5.2 Spatial Boundaries

Spatial boundaries for the acoustic and vibration assessment are provided in Table 6.9-16 and shown on the figures in Appendix 6.9-A.

Table 6.9-16: Acoustic and Vibration Environment Spatial Boundaries

Spatial Boundaries	Area (ha)	Description	Rationale
Project Footprint	5,124	The Project footprint includes: • Typical 46 m wide transmission line ROW; • Widened 1 km of ROW for the separation of circuits F25A and D26A; • Modification of the Lakehead TS, Mackenzie TS, and Dryden TS; • Access roads (existing and new); • Temporary supportive infrastructure associated with construction including fly yards, construction/stringing pads, laydown areas, construction camps, and helicopter pads; and • Aggregate pits.	• To capture the potential direct effects of the Project on acoustic and vibration environment criteria within the physical footprint of the Project.
Local Study Area	222,423	• Includes a 1.5 km buffer around the Project footprint boundary.	• The 1.5 km setback to define the LSA is based on professional judgement and guidance provided by AER Directive 038: Noise Control Directive (Directive 038) (AEUB 2007) for noise assessments in Alberta, as no similar guidelines have been established in Ontario. • Since noise and vibration attenuate with distance, potential noise and vibration effects from the Project are expected to be the highest in the LSA, and any measurable noise and vibration effects due to the Project are predicted to be generally limited to the LSA. In the area beyond the LSA, noise and vibration emissions from Project activities are expected to further attenuate, resulting in a negligible contribution; therefore, a separate acoustic and vibration environment RSA was not specifically defined.

AER = Alberta Energy Regulator; ha = hectares; km = kilometres; LSA = local study area; ROW = right-of-way, RSA = regional study area; TS = Transformer Station.

6.9.6 Description of the Existing Environment

6.9.6.1 Methods

A desktop review was completed to establish the existing conditions in the LSA. The review of existing conditions of the acoustic and vibration environment included identifying potential PORs in the LSA where human activity is expected to occur and characterizing the existing noise and vibration levels in the LSA. The information sources that were reviewed included those identified in Section 6.9.3.

The potential PORs in the LSA for the acoustic and vibration environment were identified in general accordance with the MECP's NPC-300. NPC-300 defines PORs as sensitive land uses with human activity, including dwellings, campsites or campgrounds, sensitive institutional uses (e.g., educational, nursery, hospital, healthcare, community centre, place of worship, or detention centre), or sensitive commercial uses (e.g., hotel or motel). Additional potential Indigenous land uses have also been considered as potential PORs, including cabins, camps, hunting and fishing grounds, and travel routes.

Upon review of the information sources identified in Section 6.9.3, a desktop analysis of the ortho imagery and spatial data from the MNRF LIO database was completed to identify potential PORs. The MNRF LIO spatial datasets identify existing structures and land uses that include, but are not limited to, dwellings, garages, sheds, barns, parks, trails, and Indigenous land uses. These existing structures and land uses have been conservatively considered as potential PORs, but it is anticipated that a number of them will not qualify as PORs as defined by the MECP or typically identified by Indigenous communities because they may not be considered noise and/or vibration sensitive spaces. Heritage properties and/or structures are PORs generally considered sensitive to vibration. The MNRF LIO spatial datasets considered for the noise and vibration assessment are representative of the locations of interests identified in Cultural Heritage Assessment (i.e., Section 7.6).

A total of 35 of the identified potential PORs were selected as being representative of the most sensitive PORs for the acoustic and vibration environment in the LSA with respect to the Project. One representative POR was selected for every approximately 10 km section of transmission line, when a potential POR existed in that section; the closest POR to the transmission line alignment for each section was selected. In addition, the nearest potential PORs to other Project components, including aggregate sites, access roads, helicopter pads, fly yards and construction camps, were selected as representative PORs. If a potential POR was represented by an area (i.e., conservation reserve or provincial park) that overlapped with the Project, the representative POR was placed on the edge of the Project footprint (i.e., the edge of ROW).

NPC-300 requires the assessment of noise at vacant lands that are zoned for noise-sensitive land uses but do not contain any existing noise-sensitive buildings. It is expected that any vacant lands along the Project are represented by the representative PORs, as the distance

from the closest representative PORs (i.e., along the edge of the ROW) to the Project are similar to or less than the distance of any vacant lands to the Project. Therefore, individual vacant land PORs were not identified in this EA for the acoustic and vibration environment.

To characterize the existing acoustic environment, existing noise levels were established through a desktop study using NPC-300 and the Health Canada Noise Guidance. To characterize the existing vibration environment, existing vibration levels were established through a desktop study considering previous project experiences.

6.9.6.2 Results

6.9.6.2.1 Existing Potential Points of Reception

The number of existing structures and land uses considered potential PORs, based on the methods discussed above in Section 6.9.6.1, are grouped by given distances to the Project footprint and summarized in Table 6.9-17 and shown on the figures in Appendix 6.9-B.

Table 6.9-17: Summary of Potential Points of Reception Distances within the Local Study Area

Distances from the Project Footprint Boundary	Number of Potential PORs
In Project footprint[(a)]	15
Project footprint to 50 m	689
50 to 100 m	542
100 to 200 m	507
200 to 300 m	355
300 to 400 m	311
400 to 500 m	327
500 to 1,000 m	2,114
1,000 to 1,500 m (Edge of LSA)	2,989
Total	**7,849**

a) The Project footprint is as defined in Table 6.9-16.

LSA = local study area; m = metre; POR = Point of Reception.

The identified representative PORs, based on the methods discussed above in Section 6.9.6.1, are summarized in Table 6.9-18 and shown on the figures in Appendix 6.9-B.

Table 6.9-18: Summary of Representative Points of Reception within the Local Study Area

POR ID	Land Use	Distance to the Project Footprint (m)	Distance to the Transmission Line ROW (m)
POR01	Building	30	115
POR02	Building	20	20
POR03	Building	30	30
POR04	Building	1	1
POR05	Building	60	1,040
POR06	Building	30	30
POR07	Building	7	185
POR08	Building	30	315
POR09	Building	175	230
POR10	Building	215	685
POR11	Building	170	170
POR12	Building	15	15
POR13	Building	55	150
POR14	Quetico Provincial Park	105	170
POR15	Building	360	450
POR16	Quetico Provincial Park	0	60
POR17	Building	245	5,730
POR18	Building	80	80
POR19	Building	105	105
POR20	Building	25	120
POR21	Building	0	185
POR22	Building	25	60
POR23	Building	1,060	1,125
POR24	Campus Lake Conservation Reserve	0	0
POR25	Campus Lake Conservation Reserve	0	0
POR26	Turtle River–White Otter Lake Provincial Park	0	0
POR27	Building	35	55
POR28	Building	650	1020
POR29	Pyatt Lake Conservation Reserve	880	1,215
POR30	Building	1,075	1,130
POR31	Building	60	140
POR32	Building	9	70
POR33	Building	130	130

POR ID	Land Use	Distance to the Project Footprint (m)	Distance to the Transmission Line ROW (m)
POR34	Building	145	145
POR35	Building	5	5

POR = Point of Reception; ROW = Right-of-Way.

6.9.6.2.2 Existing Noise Levels

The expected existing noise levels in the LSA were characterized using the Health Canada Noise Guidance, NPC-300, and other site-specific documentation detailed in Section 6.9.4.

Due to the remote nature of many of the potential PORs within the LSA, with the exception of those located within larger communities (e.g., Dryden, Atikokan and Thunder Bay), the Health Canada Noise Guidance was applied for the characterization of existing noise levels. The use of the estimated noise levels for a quiet rural area in accordance with the Health Canada Noise Guidance resulted in the lowest estimation of the existing noise levels, specifically an L_{dn} of 45 dBA, which results in a noise level of 35 dBA during the nighttime period. It is expected the PORs in the vicinity of the transformer stations (TSs) are exposed to noise from existing industry and human activities in Dryden, Atikokan and Thunder Bay, which also have population densities greater than that presented in Table 6.9-3 for a quiet rural area. Therefore, existing noise levels of a Class 2 receptor from NPC-300 are considered appropriate as an estimation for the PORs within the larger communities.

The summary of the estimated existing environment for noise during the daytime and nighttime periods is presented in Table 6.9-19.

Table 6.9-19: Summary of Estimated Existing Noise Levels

Descriptor	Existing Daytime (07:00-19:00) Noise Level ($L_{eq,day}$)	Existing Evening (19:00-23:00) Noise Level ($L_{eq,evening}$)	Existing Nighttime (23:00-07:00) Noise Level ($L_{eq,night}$)
Potential PORs within larger communities[(a)]	50	45[(b)]	45
Potential PORs in rural areas[(c)]	45	45	35

a) Applied NPC-300 – Class 2.

b) For a conversative assessment, the lower of the plane of window and outdoor sound level limits was considered for the evening period.

c) Applied Health Canada Guidance.

L_{eq} = Equivalent noise level; POR = Point of Reception; ROW = Right-of-Way.

6.9.6.2.3 Existing Vibration Levels

Based on a desktop review and previous project experiences, existing baseline vibration levels are expected to be negligible or minimal, similar to other areas across Canada for those potential receptors within the suburban and rural land uses and adjacent to road corridors and industrial uses.

6.9.7 Potential Project-Environment Interactions

Potential Project-environment interactions were identified through a review of the Project Description and existing environmental conditions. The linkages between Project Components and activities and potential effects to the acoustic and vibration environment are identified in Table 6.9-20.

As discussed in Section 6.9.5.1, potential effects and mitigation measures to be identified during the EA for the construction of the Project will likely equally apply to the potential removal of the Project at a future point in time, should it ever be required. Therefore, the construction scenario assessed as part of the EA is considered bounding and potential effects and mitigation measures for retirement are not identified separately in this EA.

Potential effects and mitigation measures to be identified for vibration during the construction of the Project will likely be greater than the operation and maintenance phase of the Project. Therefore, the construction scenario assessed as part of the EA is considered bounding for vibration during operation and maintenance and potential effects and mitigation measures for vibration during operation and maintenance are not identified separately in this EA.

Table 6.9-20: Project-Environment Interactions for the Acoustic and Vibration Environment

Criteria	Indicator	Project Stage Construction[(a)]	Project Stage Operation and Maintenance	Project Stage Retirement[(a)]	Description of Potential Project Environmental Interaction
Noise	• Change to noise levels in the study area • Compliance with applicable guidance documents	✓	✓	✓	• Noise emissions from construction activities could increase existing noise levels at PORs. • Noise emissions from operation and maintenance activities could increase the existing noise levels at PORs

Criteria	Indicator	Project Stage Construction[a]	Project Stage Operation and Maintenance	Project Stage Retirement[a]	Description of Potential Project Environmental Interaction
Vibration	• Change in air and/or ground vibration levels in the study area • Compliance with applicable guidance documents	✓	✓[b]	✓	• Vibration emissions from construction activities could increase existing vibration levels at PORs.

✓ = A potential Project-environment interaction could result in an environmental or socio-economic effect; – = No plausible interaction was identified; POR = Point of Reception.

a) As described in Section 6.9.5.1, the construction scenario assessed as part of the EA is considered bounding and potential effects and mitigation measures for retirement are not identified separately in this EA.

b) For vibration, the construction scenario assessed as part of the EA is considered bounding for operation and maintenance vibration and potential effects and mitigation measures for vibration during operation and maintenance are not identified separately in this EA.

6.9.8 Potential Effects, Mitigation Measures, and Net Effects

This section presents the potential effects, appropriate mitigation measures, and predicted net effects for the acoustic and vibration environment. A summary of the potential effects, appropriate mitigation measures, and net effects is presented in Section 6.9.8.4. The assessment of Project effects on noise and vibration during the construction and operation and maintenance stages was carried out qualitatively.

While Hydro One always strives to avoid and mitigate potential effects to the natural and socio-economic environment, and restore areas that are affected by the Project, Hydro One acknowledges that there may be adverse effects that cannot be avoided, or that occur even when appropriate mitigation and restoration measures are employed. Because these net effects cannot be further avoided or mitigated, they are typically compensated for by undertaking positive environmental activities (e.g., the creation of new naturalized habitats or enhancement of existing habitats at outside of the Project footprint). For more information on how Hydro One will be offsetting net effects of the Project, see Section 10.0 of the EA.

6.9.8.1 Increased Noise During the Construction Stage

Potential Effects

As presented in Section 6.9.7, noise emissions from construction stage activities could increase noise levels at PORs. Activities during the construction stage that may impact noise levels include construction of the transmission line, temporary construction camps, temporary laydown areas and access roads, the use of aggregate pits, and upgrades to the TSs. Construction of the transmission line is expected to include clearing, access, foundations and anchors, assembly, erection, stringing (including cable splicing), and reclamation.

An assessment of potential change in noise levels from existing conditions was carried out qualitatively for the following Project construction activities:

- General construction activities within the Project footprint (i.e., pile driving and the use of large off-road equipment, such as dozers, backhoes and excavators);
- Helicopter use;
- Cable splicing; and
- Operations at aggregate pits.

Blasting may be required to support the general construction activities within the Project footprint and will occur as required at the aggregate pits and is assessed in the vibration construction assessment (Section 6.9.8.2).

In Ontario, the MECP's NPC-300, NPC-115, and NPC-118 provide guidance with respect to noise due to construction activities. NPC-300 does not provide sound level limits for temporary construction activities since they are not considered stationary sources; however, it generally requires the use of good practices be implemented to limit noise levels. NPC-115 and NPC-118 provide maximum noise emission ratings for construction equipment and motorized conveyances, respectively. Construction activities are often also regulated at a municipal level through by-laws, which typically limit construction activities during certain days of the week and periods of the day. It is important to note that NPC-300 and typical municipal by-laws do not define any receptor-based sound level limits for construction activities that are temporary in nature. The MECP also typically requires implementation of reasonable noise mitigation measures to reduce the potential impact of construction noise on nearby noise PORs.

To support the qualitative analysis of noise during the construction stage, a representative list of proposed noise sources due to general construction activities within the Project footprint was developed and associated emissions from the Project were assumed to assess potential off-site noise impacts due to Project-related emissions. Noise emissions (i.e., sound power levels) of the proposed equipment and planned construction scenarios (i.e., clearing/access, foundations/anchors, assembly, erection and stringing) were estimated to better assess the extent of potential effects qualitatively. The other Project construction activities (i.e., cable splicing and temporary aggregate pits) considered similar equipment or other information.

For the purposes of the EA, the five primary construction scenarios and a list of equipment summarized in Table 6.9-21 were developed and used to estimate noise emissions (i.e., sound power levels) for use in the noise assessment for general construction activities within the Project footprint. The list of equipment is considered to be representative of the types of general equipment at grade during associated scenarios for the Project. The sound power levels were estimated using the Project design details, WSP's database of similar noise sources, manufacturer's specifications, and publicly readily available data. Noise levels from construction equipment are generally dominated by the low to mid-frequency range (i.e., 20 Hz to 2000 Hz).

Table 6.9-21: General Construction Activities Within the Project Footprint - Construction Scenarios and Corresponding Equipment

Construction Equipment	Estimated Sound Power Level [a] (dBA)	Maximum Equipment Quantity for Clearing/ Access [b]	Maximum Equipment Quantity for Foundations/ Anchors [b]	Maximum Equipment Quantity for Assembly [b]	Maximum Equipment Quantity for Erection [b]	Maximum Equipment Quantity for Stringing [b]
Picker - 17 ton	105	–	1	–	–	–
Picker - 36 ton	105	–	–	–	–	5
130T All-terrain Crane	105	–	–	–	1	–
200T All-terrain Crane	105	–	–	–	1	–
Digger Truck	105	–	–	–	–	1
Man Lift	107	–	–	1	1	1
Zoom Boom	107	–	2	2	2	2
Tractor Trailer	99	6	6	6	6	6
Gravel Truck	105	1	1	–	–	–
Articulating Dump Truck	105	2	2	–	–	–
200 Class Excavator	103	10	10	10	–	–
300 Class Excavator	104	6	6	–	6	6
400 Class Excavator	105	1	1	–	–	–
Drill	120	–	1	–	–	–
Pile Driver	127	–	1	–	–	–
Loader	111	–	6	6	6	6
Back-hoe	108	–	1	–	–	–
Dozer	115	1	1	–	1	1
Large Tensioner	104	–	–	–	–	2
Large Puller	104	–	–	–	–	2
1 Drum Puller	104	–	–	–	–	1
Single Tensioner	104	–	–	–	–	1

Construction Equipment	Estimated Sound Power Level [a] (dBA)	Maximum Equipment Quantity for Clearing/ Access [b]	Maximum Equipment Quantity for Foundations/ Anchors [b]	Maximum Equipment Quantity for Assembly [b]	Maximum Equipment Quantity for Erection [b]	Maximum Equipment Quantity for Stringing [b]
Pilot Line Winder	104	–	–	–	–	2
Backup Alarm	115	(c)	(c)	(c)	(c)	(c)

a) WSP's database of similar noise sources, manufacturer's specifications, and publicly readily available data.

b) "–" refers to the equipment not generally being used for the activity.

c) Used on all mobile equipment listed above.

dBA = A-weighted decibels.

Project construction will also include helicopter use. Due to the nature of noise impacts from aircrafts, the parameter sound exposure level (SEL) is typically considered when assessing aircraft noise. It is the integrated sound pressure level over the time period where the noise level is within 10 dB of the maximum level. According to the US Federal Aviation Administration (FAA), SELs experienced at grade in the vicinity of a helicopter flyover at an approximate altitude of 150 m are expected to range between 79 to 86 dBA (FAA 2012). It is expected that during take off and approach, noise exposures may be greater than the flyovers since they may be in closer proximity to PORs.

The following outlines the key assumptions that were made and used for the assessment of noise during the construction stage:

- The general construction activities will be limited to the Project footprint.
- Equipment used for each activity will be operating up to ten hours per day and generally limited to the daytime period (i.e., 07:00 to 18:00). Nighttime construction work is generally not anticipated; however, it may be required in specific circumstances.

Cable splicing will be required for approximately every 4 km of conductor. Splicing of conductor uses an implosion method that requires the use of explosives that generate an impulsive noise event. This results in a compression force to splice two lengths of conductor together. Typically, an implosive dead-end fitting is installed on the end of the conductor and attached to the dead-end structures at the ends of the lines or two runs of conductor are spliced where dead-end structures are not available. Once cable splicing is completed at a location, there will be no additional impulsive noise events associated with cable splicing.

The Project will require aggregate material in the construction stage, which will be sourced from existing aggregate pits and new temporary aggregate pits. Construction equipment, such as excavators, loaders, crushing equipment or other equipment common to aggregate operations, are expected to be used at the aggregate pits where needed. It is assumed that existing aggregate pits are operating long-term and comply with the provincial permit requirements as related to noise, and will continue to do so (i.e., stationary sources requiring MECP approval). The temporary aggregate pits are typically considered to be short-term construction activities (i.e., similar to general construction activities) and therefore generally do not require a permit from the MECP for noise; however, a noise assessment may be required in support of a permit/license application for extraction demonstrating compliance with applicable criteria under other municipal and/or provincial jurisdictions (i.e., MNRF).

Existing noise levels can be expected to occasionally increase at the potential PORs due to Project construction, including the use of general construction equipment, helicopter use, cable splicing and operations at temporary aggregate pits. This construction noise is expected to be temporary in nature and localized within the LSA. The range in increased noise levels associated with construction activities will depend primarily on the number and type of noise sources and their proximity to the PORs (i.e., the Project noise levels in the environment

decrease as the distance between the POR and construction activities increases). Potential effects on noise levels due to Project construction will vary based on the construction activities and how they are carried out in the vicinity of potential PORs.

Mitigation Measures

As described in Table 6.9-25, mitigation measures will be implemented to minimize the potential impact of noise emissions during the construction stage. Hydro One and its contractors will comply with local municipal noise by-laws and the MECP Model Municipal Noise Control Bylaw (i.e., NPC-115 and NPC-118). A complaint resolution mechanism will be developed whereby people can contact Hydro One if there are perceived noise concerns. In addition, construction activities will typically occur during one 10-hour shift per day, generally within the daytime period (i.e., 07:00 to 18:00). Night-time work is not anticipated. In the event construction will occur beyond the daytime period, Hydro One and its contractors will review and implement applicable mitigation measures.

Due to the sound characteristic expected with an implosion cable splicing method (i.e., impulsive), additional advanced communication with regard to the cable splicing schedule shall be provided to potentially affected PORs. In areas where noise levels are expected to be elevated for a limited time, notification will be provided.

Net Effects

Noise emissions during the construction stage are predicted to have the potential to increase noise levels at the PORs and were therefore carried forward to the net effects characterization. Noise emissions during construction may result in a potential net effect because it is expected that, after the implementation of mitigation measures, there may be changes in noise levels at potential PORs within varying distances to the construction activities during the daytime period. This potential effect is therefore carried through for further assessment in the following sections, including an assessment of significance.

6.9.8.2 Increased Vibrations During the Construction Stage

Potential Effects

As presented in Section 6.9.7, vibration emissions from construction-stage activities could increase vibration levels at PORs. Activities that may impact vibration levels include construction of the transmission line, temporary construction camps, temporary laydown areas and access roads, the use of aggregate pits, and upgrades to the TSs. Construction of the transmission line is expected to include clearing, access, foundations and anchors, assembly, erection, stringing (including cable splicing), and reclamation. Blasting activities may be required to support the general construction activities along the ROW and to support operations at the aggregate pits.

An assessment of potential change in vibration levels from existing conditions was carried out qualitatively for the following Project construction activities:

- General construction activities within the Project footprint (i.e., pile driving and the use of large off-road equipment, such as dozers, backhoes and excavators);
- Temporary aggregate pit equipment;
- General construction blasting; and
- Temporary aggregate pit blasting.

The rate at which ground and air vibrations attenuate from a source is site specific, and are dependent on geologic and environmental conditions, topography, type of construction equipment and when blasting, the particulars of the blast design. Construction vibration levels range in amplitude, duration, frequency spectrum and occurrence, resulting in non-perceptible to perceptible effects. Construction vibration levels are typically short-term relative to the life of a project but either as transient intermittent or continuous steady state. In addition, vibration criteria presented in various guidance and specification documents are either typically for vibration sources considered transient intermittent, steady state continuous vibration sources or both. Regarding construction blasting, the intensity of ground and air vibration effects from any construction blasting operation are primarily governed by the distance between the receptor and the blast and the maximum weight of explosive detonated per delay period within the blast. The exact locations and the blast designs for Project blasting are not currently known; therefore, a qualitative assessment of blasting was carried out.

For projects in Ontario, there are various guidance and specification documents that provide direction with respect to criteria to use to assess potential effects from vibration due to construction activities. The applicability and consideration of each document to a specific project is subject to the project requirements, the regulator, and professional judgment. The documents presented in Section 6.9.4 are considered relevant to this Project's expected vibration effects, specifically as they relate to structure impacts and human annoyance, based on previous project experiences on similar projects and the information available at the time of this assessment.

Potential effects on both structure impacts and human annoyance were assessed. Table 6.9-22 and Table 6.9-23 are an overall summary of the relevant ground and air vibration criteria considered in the vibration assessment during the construction phase, respectively, including identifying the construction activity assessed and the relevant vibration-related documents.

As noted above, the Project will require aggregate material in the construction stage, which will be sourced from existing aggregate pits and new temporary aggregate pits. It is assumed that existing aggregate pits are operating long-term and comply with the provincial permit requirements as related to vibration, and will continue to do so. Therefore, existing aggregate pits are not further assessed for compliance with applicable vibration criteria. A vibration assessment may be required for the temporary aggregate pits, in support of a permit/license application for extraction demonstrating compliance with applicable criteria under other municipal and/or provincial jurisdictions (i.e., MNRF).

The ground vibration criteria presented in Table 6.9-22 for General Construction and Temporary Aggregate Pit Equipment is a ZOI level typically considered for residential, commercial and institutional buildings (non-heritage). For heritage structures, the Vibration Control By-law does not specify a ZOI level during construction. A ZOI level is generally considered an initial screening level and is typically lower than the respective vibration limit unless heritage structures exist. General industry practice and other various guidance documents typically consider a PPV criteria level lower than 5 mm/s for heritage structures and that the heritage structure's condition is taken into consideration prior to the start of construction.

In general, ZOI levels are non frequency dependent and are typically less than the respective vibration limits, therefore resulting in a potential larger area of investigation. The ground vibration criteria presented in Table 6.9-22 for General Construction and Temporary Aggregate Pit Equipment is a ZOI level typically considered for residential, commercial and institutional buildings (non-heritage). For heritage structures, the Vibration Control By-law does not specify a ZOI level during construction. A ZOI level is generally considered an initial screening level and is typically lower than the respective vibration limit unless heritage structures exist. General industry practice and other various guidance documents typically consider a PPV criteria level lower than 5 mm/s for heritage structures and that the heritage structure's condition is taken into consideration prior to the start of construction.

In general, ZOI levels are non frequency dependent and are typically less than the respective vibration limits, therefore resulting in a potential larger area of investigation. The ground vibration criteria presented in Table 6.9-22 for Temporary Aggregate Pit Blasting is non frequency dependent as well. It is general industry practice to consider a ground vibration criteria for blasting activities during construction, typically those listed in Table 6.9-22, due to the potentially high effects on both structure impacts and human annoyance.

The air vibration criteria for General Construction and Temporary Aggregate Pit Blasting is presented in Table 6.9-23. Similar to ground vibration criteria, it is general industry practice to consider air vibration criteria for General Construction and Temporary Aggregate Pit Blasting, typically those listed in Table 6.9-23.

As previously noted, the guidance documents in Section 6.9.4 considered relevant to this Project's expected vibration effects were publicly and readily available. It is possible that additional documents that are site-specific or equipment-specific (i.e., exclusive to a scenario) and subject to further discussion may exist from the various Project stakeholders. This will be confirmed through the consultation with stakeholders during the ongoing planning for the Project.

Table 6.9-22: Summary of Relevant Ground Vibration Criteria

Vibration Source	Criteria Document – Structure Impacts	Criteria Document – Human Annoyance	Criteria – Structure Impacts (PPV) [e]	Criteria – Human Annoyance (RMS) [e]
General Construction and Temporary Aggregate Pit Equipment	Vibration Control By-law	Caltrans Manual	5 mm/s[a]	0.3 mm/s[b]
General Construction Blasting	OPSS 120	Caltrans Manual	20 mm/s (≤40 Hz) 50 mm/s (>40 Hz)	0.9 mm/s[c]
Temporary Aggregate Pit Blasting	NPC-119	Caltrans Manual	12.5 mm/s[d]	0.9 mm/s[c]

a) 5 mm/s is a ZOI level at any frequency due to vibration sources for non-heritage structures and was considered as a vibration criterion for the purposes of this EA. ZOI and vibration limits for heritage structures are expected to be more restrictive.

b) Human response is considered slightly perceptible for steady state vibration, as per the Caltrans Manual Table 4.

c) Human response is considered barely perceptible for transient vibration, as per the Caltrans Manual Table 6.

d) The NPC-119 limits assume that the vibration levels from all blasts will be monitored at the nearest POR. If blasts will not be routinely monitored, a lower cautionary limit (10 mm/s) should be applied.

e) At any frequency unless stated otherwise (non frequency dependent).

OPSS = Ontario Provincial Standard Specification; NPC = Noise Pollution Control Guideline; mm/s = millimetres per second; Hz = hertz; dB = unweighted decibel; dBL = linear (i.e., unweighted) decibel; N = number of daily blasts.

Table 6.9-23: Summary of Relevant Air Vibration Criteria

Vibration Source	Criteria Document – Structure Impacts	Criteria Document – Human Annoyance	Criteria – Structure Impacts (Overpressure)	Criteria – Human Annoyance (Overpressure)
General Construction Blasting	NPC-119[(a)]	Health Canada	128 dBL[(b)]	125 – 10logN dB
Temporary Aggregate Pit Blasting	NPC-119	Health Canada	128 dBL[(b)]	125 – 10logN dB

a) OPSS 120 does not provide limits for air vibration. As a result, it is not uncommon for NPC-119 to be considered.

b) The NPC-119 limits assume that the vibration levels from all blasts will be monitored at the nearest POR. If blasts will not be routinely monitored, lower cautionary limit (120 dBL) should be applied.

OPSS = Ontario Provincial Standard Specification; NPC = Noise Pollution Control Guideline; mm/s = millimetres per second; Hz = hertz; dB = unweighted decibel; dBL = linear (i.e., unweighted) decibel; N = number of daily blasts.

To support the qualitative analysis of vibration during the construction stage, proposed vibration sources due to general construction and temporary aggregate activities, blasting activities, and associated estimated emissions from the Project were used to assess potential off-site vibration impacts due to Project-related emissions. The potential off-site vibration impacts considered were related to structures and human annoyance.

Vibration emissions (i.e., PPV levels) of the general construction and temporary aggregate pit activities, considering the representative general construction equipment and planned construction scenarios (i.e., clearing/access, foundations/anchors, assembly, erection and stringing) for noise and presented in Table 6.9-21, were estimated to better assess the extent of potential effects qualitatively. The representative construction equipment vibration emissions were estimated using the Project design details, Caltrans Manual and FTA Manual.

Similarly, vibration emissions (i.e., PPV levels) of the blasting, both as part of general construction activities within the Project footprint and to support operations at the temporary aggregate pits, were estimated based on previous project experiences of similar projects to better assess the extent of potential effects qualitatively.

It is expected that various utilities, such as power utilities and pipelines, exist within the Acoustic and Vibration Environment LSA and may experience potential vibration impacts as a result of construction activities. The exact location of utilities that may be directly impacted due to vibration will depend on the type and proximity of the construction activities. Typically, each utility will have vibration specifications, either general or site-specific.

General Construction and Temporary Aggregate Pit Equipment

For the purposes of the EA, the five primary construction scenarios and list of representative general construction equipment summarized in Table 6.9-21 were used to estimate vibration emissions (i.e., PPV levels) for use in the vibration assessment.

The FTA Manual provides estimated reference vibration source levels (i.e., PPV_{ref}) for several types of construction equipment for a wide range of soil conditions. Table 6.9-24 is a reproduction of the estimates in mm/s for some of the pieces of representative general construction and temporary aggregate pit equipment that were identified in Table 6.9-21. It is expected that the use of pile drivers will have the greatest potential vibration impact; thus, it is included in Table 6.9-24. There are various types of pile drivers that may be considered for construction (i.e., sonic/vibratory and impact) but for the purposes of this EA, both were considered as potential options as presented in Table 6.9-24. Other construction equipment identified in Table 6.9-21 that are not presented in Table 6.9-24 are estimated to result in similar or lower vibration levels than the pile driving activities.

Table 6.9-24: Federal Transit Administration Suggested Source Vibration Levels for Equipment Types

Equipment	PPV at 7.62 m (25 ft), mm/s
Pile Driver (Impact) • Upper Range	38.56
Pile Driver (Impact) • Typical	16.36
Pile Driver (Sonic) • Upper Range	18.64
Pile Driver (Sonic) • Typical	4.32
Vibratory Roller	5.33
Large Bulldozer	2.26
Caisson Drilling	2.26
Loaded Trucks	1.93
Small Bulldozer	0.08

Source: (FTA 2018)

PPV = peak particle velocity; mm/s = millimetres per second.

The following outlines the key assumptions that were made and used for the assessment of ground vibration for the general construction and temporary aggregate pit equipment during the construction stage:

- The general construction activities will be limited to the Project footprint.
- Equipment used for each activity will be operating up to ten hours per day and generally limited to the daytime period (i.e., 07:00 to 18:00). Nighttime construction work is generally not anticipated; however, it may be required in specific circumstances.

Existing ground vibration levels can be expected to increase at the potential PORs, on occasion, due to general construction and temporary aggregate pit equipment, but construction vibration is expected to be temporary in nature and limited to the vicinity of the Project footprint within the defined LSA. The range in increased ground vibration levels associated with general construction and temporary aggregate pit equipment will depend primarily on the number and type of vibration sources and their proximity to the PORs (i.e., the Project vibration levels in the environment generally decreases as the distance between the receptor and construction activities increases). Potential effects on ground vibration levels due to general construction and temporary aggregate pit equipment will vary based on type of activities, distance from the potential PORs and how they are carried out in the vicinity of the potential PORs.

Blasting

Blasting may be required to support the construction of the concrete foundations along the ROW and will occur as required at the temporary aggregate pits. The exact locations and the blast designs for Project blasting are not currently known. Ground and air vibration levels within the LSA are expected to increase, on occasion, due to general construction and temporary aggregate pit blasting, but vibration due to blasting is expected to be temporary, intermittent, and limited to the vicinity of the required blasting for the Project within the defined LSA. The potential impact of Project blast-induced vibrations will depend on the depth of rock to be blasted, the maximum explosive charge weight detonated per millisecond time interval within the blast (delay period) and the separation distance between the blast and the receptor (i.e., the Project vibration levels in the environment generally decreases as the distance between the receptor and blasting activities increases).

The following outlines the key assumption that was made and used for the assessment of ground and air vibration for the general construction and aggregate pit blasting activities during the construction stage:

- Temporary aggregate pit blasting will consider a ground and air vibration criteria (i.e., ZOI and/or limit) to assess potential effects for both structure impacts and human annoyance; and

- Aggregate pit blasting at temporary or existing aggregate pits, will be carried out to comply with the conditions provided in the license or aggregate permit, if a license or aggregate permit exists or is required.

As the construction of the transmission line is expected to be generally linear and construction activities are planned sequentially, the duration of general construction blasting at any one location within the Project footprint will be limited and intermittent, thereby reducing the amount of time a given receptor would be exposed to Project-related general construction blast vibrations.

The temporary aggregate pit blasting activities are expected to be more stationary when compared to general construction blasting (i.e., confined to a smaller and more static construction footprint); however, they will be limited and intermittent, thereby reducing the amount of time a given receptor would be exposed to Project-related blast vibrations.

Based on this assessment, it is anticipated that general construction within the Project footprint and temporary aggregate pit blasting will be designed such that applicable vibration criteria (i.e., ZOI and/or limits) are met.

Mitigation Measures

As described in Table 6.9-25, mitigation measures will be implemented to minimize the potential impact of vibration during the construction stage. Prior to the start of construction, the construction vibration criteria (i.e., ZOI and/or limits) will be reviewed and confirmed as being appropriate for the Project. A complaint resolution mechanism will be developed whereby people can contact Hydro One if there are vibration concerns. Construction activities will comply with local noise by-laws that include restrictions for vibrations and typically occur during one 10-hour shift per day, generally within the daytime period (i.e., 07:00 to 18:00). Nighttime work is not anticipated. In the event construction will occur beyond the daytime period, Hydro One and its contractors will review and implement applicable mitigation measures.

As described in Table 6.9-25, during construction blasting activities, Hydro One and its contractors will ensure that blasts are carried out in compliance with applicable structure impact vibration limits, including the OPSS 120 and NPC-119. Mitigation measures are included in Table 6.9-25 to minimize the potential of human annoyance due to construction blasting activities. The vibration mitigation necessary to minimize the potential construction blasting vibration effects will be designed inherently into the Project. This mitigation includes, reducing the explosive charge weight detonated at a given instant within the blast, staggering the detonations, and using blast mats, as appropriate. Such mitigation strategies will be outlined specifically within the Blasting Management Plan prepared by Hydro One and its contractor(s).

Prior to commencing preliminary design and construction, discussions with the utility owners/operators will be carried out to confirm the applicable vibration criteria. Further vibration assessment will be carried out for specific utilities where required to determine potential

vibration impacts once more detailed design and supporting information is available (e.g., locations where blasting is expected to be required).

Net Effects

Vibration during the construction stage is predicted to have the potential to increase vibration levels at the PORs and was therefore carried forward to the net effects characterization. Vibration during construction may result in a potential net effect because it is expected that, after the implementation of mitigation measures, the changes in vibration levels at potential PORs within varying distances to the construction activities may be perceptible to humans or may result in structure impacts during the daytime period (i.e., exceed the limits presented in Table 6.9-22 and Table 6.9-23). This potential effect is therefore carried through for further assessment in the following sections, including an assessment of significance.

6.9.8.3 Increased Noise During the Operation and Maintenance Stage

Potential Effects

As presented in Section 6.9.7, noise emissions from operation and maintenance stage activities could increase the existing noise levels at PORs.

The assessment of Project effects on noise during the operation and maintenance stage considered the following scenarios:

- Operation of the TSs;
- Electricity transmission; and
- Maintenance, replacement and inspection of the ROW, fencing, transmission line, conductors, tower foundations, permanent access roads and TSs.

Noise during the operation and maintenance stage was assessed qualitatively, considering the requirements and criteria of the Ontario Hydro Protocol, NPC-300 and Ontario's environmental permitting process, which applies to the operation of the TSs. In addition, an assessment of potential change from existing conditions was carried out.

Operation of the Transformer Stations

At the time of preparing this assessment, detailed design for the modifications to the TSs was not finalized. However, it is understood that reactors will be installed at Lakehead TS and Mackenzie TS and plans for Project modifications at Dryden TS are currently unknown. If there are no Project activities that modify the noise emissions or the requirements of the MECP approval at Dryden TS (e.g., the installation of reactors), no changes in noise levels at the PORs are expected and Dryden TS is expected to continue to comply with MECP noise guidelines and/or their permits.

Where there are Project activities that modify the requirements of the MECP approval at the TSs, the greatest potential effects to noise during the operation and maintenance stage are expected to occur during the operation of the TSs, which will be continuously operating (i.e., for 24 hours per day) over the life of the Project.

Lakehead TS is currently registered on the Environmental Activity and Sector Registry (EASR) and Dryden TS operates under an existing Environmental Compliance Approval (ECA). A noise assessment is currently being carried out at Mackenzie TS. The supporting documentation of the TS permits will be updated and approved by the MECP to reflect changes due to the Project, where requirements of the MECP approval are modified, as part of the permitting process. This will include a quantitative noise assessment for each TS in accordance with NPC-300. It is expected that, through this process, the noise assessments will demonstrate that the TSs comply with the applicable NPC-300 sound level limits. As described in Section 6.9.6.2, the NPC-300 Class 2 exclusionary sound level limits may be adopted to estimate the expected existing noise levels at PORs. The TSs will need to comply with these same sound level limits after modifications related to the Project are undertaken.

Operation of the Transmission Line

Audible noise may be emitted by a transmission line when the conductor interacts with the air surrounding the conductor surface, known as corona, depending on ambient conditions such as temperature, humidity, wind speed, and wind direction. The noise emitted typically resembles a crackling sound.

Modern transmission lines (such as those expected for the Project) are designed, constructed, and maintained so that, during dry conditions, they will minimize corona-related sound. The Ontario Hydro Protocol presents a maximum design noise level ($L_{eq,\ 1\ hour}$) of 55 dBA at a POR for transmission lines. During dry weather conditions, noise from the proposed transmission lines is expected to be generally indistinguishable from background sound levels at locations beyond the edge of the ROW. During periods of rainfall events or high humidity, corona-related sound is expected to be elevated compared to dry conditions, and may be audible at the edge of the ROW. The Project will be designed and operated to meet the requirements of the Ontario Hydro Protocol at the representative PORs.

Corona-related noise has a generally flat frequency spectrum that can extend above the human audible range. Studies of the spectral characteristics of corona in a laboratory found that the peak of the acoustic spectra was 24 to 26 kHz (Ianna et al 1973), which has the potential to impact wildlife with higher noise sensitivity frequency ranges such as bats. However, high frequency noise attenuates over a shorter distance than lower frequency noise due to air absorption, which increases with frequency. Increased atmospheric moisture (i.e., which will occur in weather where corona noise is elevated) further increases high frequency noise attenuation. Therefore, any effects would be expected to occur only very close to the transmission line. Overall, during the operation stage, it is possible that the transmission line may be audible at times due to corona discharge, typically during adverse weather conditions such as rain, fog, and wet snow (Foreman and Onderwater 2003).

Existing noise levels can be expected to increase at the potential PORs, on occasion, due to operation of the transmission line, specifically corona-related noise during periods of rainfall events or high humidity, but corona-related noise is expected to be temporary in nature and localized within the LSA. The range in increased noise levels will depend primarily on the weather conditions and the proximity to the PORs (i.e., the Project noise levels in the environment decrease as the distance between the POR and transmission line increases).

Maintenance

Noise sources and noise levels from maintenance and inspection of the 46-m wide transmission line ROW and infrastructure, access roads and trails, and TSs during operations will be variable, expected to be limited to a short duration, and will occur periodically over the life of the Project. Expected noise sources include equipment for mechanical vegetation maintenance, access road or trail maintenance, and transmission line maintenance. Pickup trucks, all-terrain vehicles (ATVs), and helicopters will be used for maintenance inspections. The maintenance inspections may indicate that repairs or replacements require the use of heavier equipment, such as backhoes or cranes. The mitigation measures presented in Table 6.9-25 apply to these activities.

Existing noise levels can be expected to increase, on occasion, due to maintenance activities at the potential PORs, but maintenance noise will be short-term and temporary in nature. The range in increased noise levels associated with maintenance activities will depend primarily on the number and type of noise sources, the duration of work and their proximity to the PORs (i.e., the Project noise levels in the environment decrease as the distance between the POR and maintenance activities increases) and are expected to be the same or less than construction.

Mitigation Measures

As described in Table 6.9-25, during operations and maintenance activities, Hydro One and its contractors will comply with the Ontario Hydro Protocol, local municipal noise by-laws, the MECP Model Municipal Noise Control Bylaw (i.e., NPC-115 and NPC-118) and MECP's NPC-300. The supporting documentation of the TS permits will be prepared and/or updated and approved by the MECP to reflect changes due to the Project, if any occur that modify noise emissions, as part of the permitting process.

Net Effects

Noise emissions during the operation and maintenance stage, specifically for maintenance, replacement and inspection activities, the operation of the TSs and the operation of the transmission line, are predicted to have the potential to increase noise levels at the PORs and were therefore carried forward to the net effects characterization.

6.9.8.4 Potential Effects, Mitigation Measures, and Predicted Net Effects

Table 6.9-25: Potential Effects, Mitigation Measures, and Predicted Net Effects

Project Component or Activity	Potential Effects	Mitigation Measures	Net Effects
Project activities during the construction stage: • Construction of temporary construction camps, temporary laydown areas and access roads, the use of aggregate pits (including blasting), upgrades to the transformer stations, and construction of the transmission line, which is expected to include clearing, access, foundations and anchors (including blasting), assembly, erection, stringing (including cable splicing), and reclamation; • Operation of vehicles, helicopters and construction equipment; and • Decommissioning and reclamation of the decommissioned access roads, temporary laydown areas, staging areas, and construction camps.	• Noise emissions from construction activities could increase existing noise levels at potential PORs.	• Hydro One, with its contractor(s), will prepare and implement an EPP and Noise Management Plan prior to construction. • Comply with local municipal noise by-laws and the MECP Model Municipal Noise Control Bylaw (i.e., NPC-115 and NPC-118). • Construction activities will typically occur during one 10-hour shift per day, generally within the daytime period (i.e., 07:00 to 18:00). Nighttime work is not anticipated. In the event construction will occur beyond the daytime period, Hydro One will review and implement applicable mitigation measures and obtain any required permits or bylaw exemptions. • Hydro One, with its contractor(s), will check that equipment and machinery used on site is maintained in good working conditions through regular maintenance and inspection. • Design access roads to minimize reversing, which is expected to minimize use of backup beepers, where possible. • Locate and operate construction equipment as far as possible from PORs. • Notify Indigenous communities, landowners, and relevant stakeholders along the ROW of the planned construction schedule before the start of construction and prior to specific noisy activities such as implosion operations (e.g., cable splicing). • Where reasonable and practicable, vehicles and equipment will be turned off when not in use, unless weather and/or safety conditions dictate the need for them to remain turned on and in a safe operating condition. • Investigate noise concerns as they arise through a complaint resolution mechanism whereby persons can contact Hydro One if there are perceived noise issues. • Operate vehicles and equipment such that impulsive noise is minimized, where possible.	• Net change in noise emissions during construction activities.

Project Component or Activity	Potential Effects	Mitigation Measures	Net Effects
Project activities during the construction stage: • Construction of temporary construction camps, temporary laydown areas and access roads, the use of aggregate pits (including blasting), upgrades to the transformer stations, and construction of the transmission line, which is expected to include clearing, access, foundations and anchors (including blasting), assembly, erection, stringing (including cable splicing), and reclamation; • Operation of vehicles and construction equipment; and • Decommissioning and reclamation of the decommissioned access roads, temporary laydown areas, staging areas, and construction camps.	• Vibration from construction activities could increase existing vibration levels at potential PORs.	• Develop a construction vibration workplan prior to the start of construction describing the construction schedule, list of construction equipment, list of POR locations, applicable guidance documents including criteria and municipal by-laws (i.e., residential, heritage structures and utilities) and control measures. • Consider the use of frequency dependent vibration limits as more detailed information regarding the construction activities is known. • Notify Indigenous communities, landowners, and relevant stakeholders along the ROW of the planned construction schedule before the start of construction and prior to specific activities that may generate vibration. • Investigate vibration concerns as they arise through a compliant resolution mechanism whereby persons can contact Hydro One if there are perceived vibration issues. • Construction activities should be limited to the daytime period (i.e., 07:00 to 18:00). Nighttime work is not anticipated. In the event construction will occur beyond the daytime period, Hydro One will review and implement applicable mitigation measures and obtain any required permits or bylaw exemptions. • Locate and operate construction equipment as far as possible from PORs. • Avoid operating equipment expected to be a significant source of vibration simultaneously. Vibration levels could be less when operating separately. • Construction blasting will be carried out in compliance with the OPSS 120 and NPC-119.The OPSS 120 details items such as vibration limits, protective measures, pre-blast surveys and notification to nearby owners and tenants. All blasts, which might impact local structures or disrupt humans, should be monitored for ground and air vibrations. • Aggregate pit blasting at temporary or existing aggregate pits, will be carried out to comply with the conditions provided in the license or aggregate permit, if a license or aggregate permit exists or is required. • Blasting delays and blast mats will be used, as appropriate, to control vibration and fly rock as required.	• Net change in vibration during construction activities.

Project Component or Activity	Potential Effects	Mitigation Measures	Net Effects
Project activities during the operation and maintenance stage: • Operation, replacement and maintenance of transmission line, transmission line ROW and permanent access roads, including the use of helicopters; and • Operation and maintenance of transformer stations.	• Noise emissions from operation and maintenance stage activities could increase existing noise levels at potential PORs.	• Comply with local municipal noise by-laws and the MECP Model Municipal Noise Control Bylaw (i.e., NPC-115 and NPC-118). • Hydro One, with its contractor(s), will check that equipment and machinery used on-site is maintained in good working conditions through regular maintenance and inspection. • Where reasonable and practicable, vehicles and equipment will be turned off when not in use, unless weather and/or safety conditions dictate the need for them to remain turned on and in a safe operating condition. • Investigate noise concerns as they arise through a compliant resolution mechanism whereby persons can contact Hydro One if there are perceived noise issues. • Transmission line will be designed and operated to meet the requirements of the Ontario Hydro Protocol at the representative PORs. • Transformer stations will operate in accordance with an Environmental Compliance Approval or Environmental Activity and Sector Registry registration.	• Net change in noise emissions during operation and maintenance stage activities.

EPP=Environmental Protection Plan; MECP = Ministry of the Environment, Conservation and Parks; POR = Point of Reception; ROW = right-of-way; NPC = Noise Pollution Control Guideline; OPSS = Ontario Provincial Standard Specification.

6.9.9 Net Effects Characterization

6.9.9.1 Net Effects Characterization Approach

The effects assessment approach followed the general process described in Section 5.0 (methods section).

Net effects are described using the significance factors identified in Table 5.6-2. Changes to noise, specifically, the change relative to existing noise levels and compliance with applicable sound level limits, and the meeting of any applicable vibration limits at the most affected PORs within the LSA are measured against the magnitude levels identified in Table 6.9-26.

Table 6.9-26: Magnitude Effect Levels for the Acoustic and Vibration Environment

Criteria	Project Stage	Negligible	Low	Moderate	High
Noise	Construction	• Project-related change in daytime, evening, and nighttime equivalent noise level is ≤3 dB.	• Project-related change in daytime, evening, and nighttime equivalent noise level is >3 dB and ≤5 dB.	• Project-related change in daytime, evening, and nighttime equivalent noise level is >5 dB and ≤10 dB.	• Project-related change in daytime, evening, and nighttime equivalent noise level is >10 dB.
Vibration	Construction – General Construction and Temporary Aggregate Pit	• Project-related ground vibration level ≤0.3[(a)] mm/s.	• Project-related ground vibration level >0.3[(a)] and ≤5[(b)] mm/s.	• Project-related ground vibration level >5[(b)] and ≤8[(b)] mm/s.	• Project-related ground vibration level of >8[(b)] mm/s.
Vibration	Construction – General Construction Blasting	• Project-related ground vibration level ≤0.9[(a)] mm/s and air overpressure ≤115[(c)] dBL.	• Project-related ground vibration level >0.9[(a)] and ≤10[(d)] mm/s and air overpressure >115[(c)] and ≤120[(d)] dBL.	• Project-related ground vibration level >10[(d)] and ≤20[(e)] mm/s and air overpressure >120[(d)] and ≤128[(d)] dBL.	• Project-related ground vibration level of >20[(e)] mm/s and air overpressure >128[(d)] dBL.
Vibration	Construction – Temporary Aggregate Pit Blasting	• Project-related ground vibration level ≤0.9[(a)] mm/s and air overpressure ≤120[(d)] dBL.	• Project-related ground vibration level >0.9[(a)] and ≤10[(d)] mm/s and air overpressure >120[(d)] and ≤125[(f)] dBL.	• Project-related ground vibration level >10[(d)] and ≤12.5[(d)] mm/s and air overpressure >125[(f)] and ≤128[(d)] dBL.	• Project-related ground vibration level of >12.5[(d)] mm/s and air overpressure >128[(d)] dBL.

Criteria	Project Stage	Negligible	Low	Moderate	High
Noise	Operation and Maintenance	• Project-related change in daytime, evening, and nighttime equivalent noise level is ≤3 dB and comply with NPC-300 sound level limits.	• Project-related change in daytime, evening, and nighttime equivalent noise level is >3 dB and ≤5 dB and comply with NPC-300 sound level limits.	• Project-related change in daytime, evening, and nighttime equivalent noise level is >5 dB and ≤10 dB and comply with NPC-300 sound level limits.	• Project-related change in daytime, evening, and nighttime equivalent noise level is >10 dB or exceed NPC-300 sound level limits.

Notes: Daytime period is from 07:00 to 19:00, evening period is from 19:00 to 23:00 and nighttime period is from 23:00 to 07:00.

a) Caltrans Manual Table 4 or Table 6

b) Vibration Control By-law ZOI

c) For general construction blasting, it was assumed up to 10 blasts per day could occur. Using the formula for human annoyance from Health Canada (125 – 10logN), the limit for human annoyance is 115 dB.

d) NPC-119 criteria

e) OPSS 120 criteria

f) For temporary aggregate pit blasting, it was assumed up to 1 blast per day could occur. Using the formula for human annoyance from Health Canada (125 – 10logN), the limit for human annoyance is 125 dB.

dB = decibel; dBA = A-weighted decibels; >= greater than; ≤ = less than or equal to; mm/s = millimetres per second; dBL = linear decibel.

A change in level of 3 dB is generally accepted as the smallest change detectable by the human auditory system in the environment (MECP 1998). Changes in noise levels for the period LAeq (A weighted energy equivalent sound level) that would be hardly perceptible (i.e., less than or equal to 3 dB) were assigned a negligible magnitude. In Table 6.9-26, a noticeable change in the period L_{Aeq} (i.e., greater than 3 dB, but less than or equal to 5 dB change) was classified as having a low magnitude. Clearly noticeable changes for the period L_{Aeq} and perceived as twice as loud (i.e., greater than 5 dB, but less than or equal to 10 dB) were considered of moderate magnitude. Disturbing changes in the noise levels for the period L_{Aeq} and perceived as more than twice as loud (i.e., greater than 10 dB) were classified as having a high magnitude.

For general construction and temporary aggregate pit, steady state ground vibration levels generally become perceptible to humans at 0.3 mm/s and may potentially impact structures at 5 mm/s. A vibration level of 8 mm/s is the lowest frequency-dependent prohibited construction vibration criteria from the Vibration Control By-law.

For blasting, transient ground vibration levels generally become perceptible to humans at 0.9 mm/s. A vibration level of 10 mm/s is the cautionary ground vibration limit from NPC-119. For blasting during general construction, 20 mm/s is the lowest frequency-dependent ground vibration limit specified in OPSS 120, above which structure impacts may occur. For temporary aggregate pit blasting, 12.5 mm/s is the ground vibration limit specified in NPC-119, above which structure impacts may occur.

As presented in Sections 6.9.4.1 and 6.9.8.2, the Health Canada Guidance provides an equation to determine criteria for human annoyance due to air vibration from blasting. To establish magnitude criteria, it was assumed that there may be up to 10 daily blasts (i.e., N=10) for general construction blasting and one daily blast (i.e., N=1) for temporary aggregate pit blasting. Therefore, the human annoyance criteria are 115 dB for general construction blasting and 125 dB for temporary aggregate pit blasting.

At 120 dBL but below 128 dBL, which are the cautionary and air vibration limits specified in NPC-119 respectively, air pressure changes are perceptible to humans but do not result in damage to structures. Above 128 dBL, the air vibration limit specified in NPC-119 is exceeded and structure impacts may occur.

6.9.9.2 Net Change in Noise Emissions during Construction Activities

Applying the magnitude characterization criteria presented in Table 6.9-26, the change in noise levels within the LSA during the construction stage was evaluated.

Existing noise levels at given PORs can be expected to increase, on occasion, due to construction activities when occurring nearby, and would be considered direct and negative. The magnitude at a given POR is dependent on the distance to the Project activities. Based on the qualitative assessment of construction noise, it is expected that a magnitude of negligible, low, moderate, or high could occur depending on the distance between the POR and the construction activities. However, the increased noise levels are expected to be local (i.e., limited

to the LSA) and short-term in duration at a given location relative to the entire construction schedule. Frequency is considered periodic, as while the Project is predicted to produce noise throughout the construction period during the daytime, it will not affect any one POR throughout the full construction period. As well, there is no potential for a change in noise levels during the nighttime period as Project construction will typically occur during the daytime period (i.e., 07:00 to 18:00). When the construction activities exist in proximity to a given POR, increased noise levels are expected to be probable.

Based on the analysis above, the construction stage was assessed and Table 6.9-27 below summarizes the net effects assessment carried out.

6.9.9.3 Net Change in Vibration during Construction Activities

Applying the magnitude characterization criteria presented in Table 6.9-26, vibration levels within the LSA during the construction stage were evaluated.

Existing vibration levels at given PORs can be expected to increase, on occasion, due to construction activities when occurring nearby, and would be considered direct and negative. The magnitude at a given POR is dependent on the distance to the Project activities. Based on the qualitative assessment of construction vibrations, it is expected that a magnitude of negligible, low, moderate, or high could occur depending on the distance between the POR and the construction activities. However, the increased vibration levels are expected to be local (i.e., limited to the LSA) and short-term in duration at a given location relative to the entire construction schedule. Frequency is considered periodic, as while the Project is predicted to produce vibration throughout the construction period (during the daytime), it will not affect any one POR throughout the full construction period. As well, there is no potential for a change in vibration levels during the nighttime period as Project construction will typically occur during the daytime period (i.e., 07:00 to 18:00). When the construction activities exist in proximity to a given POR, increased vibration levels are expected to be probable.

Based on the analysis above, the construction stage was assessed and Table 6.9-27 below summarizes the net effects assessment carried out.

6.9.9.4 Net Change in Noise Emissions during Operation and Maintenance

Applying the magnitude characterization criteria presented in Table 6.9-26, the change in noise levels within the LSA during the operation and maintenance stage was evaluated.

Operation of the Transformer Stations

If there are no Project activities that modify the noise emissions at a TS (e.g., the installation of reactors), resulting in no changes in noise levels at the PORs, and therefore no net effect, are expected.

Where there are Project activities that modify noise emissions at the TSs, existing noise levels at given PORs have the potential to increase due to the operation of the TSs. The effect would be considered direct and negative. The increased noise levels are expected to be local

(i.e., limited to the LSA) and long-term in duration at a given location, as they will persist for the life of the Project but are reversible (i.e., would cease if the operation of the TSs ceased). Frequency is considered continual, as the TSs will operate throughout the operation and maintenance period. When the TSs exist in proximity to a given POR, increased noise levels are expected to be probable.

As the TSs will need to have valid permits where they demonstrate compliance with applicable NPC-300 sound level limits, which are considered to be representative of the existing conditions at PORs near the TSs, after upgrades related to the Project are undertaken, it is expected that the change in noise levels due to the operation of the TSs will be negligible (i.e., less than 3 dB). Therefore, the operations of the TSs are expected to be in compliance with MECP guidelines specified in NPC-300 at all identified representative PORs and result in a change in noise levels of less than 3 dB and are therefore considered to have a negligible magnitude.

Operation of the Transmission Line

Existing noise levels at given PORs can be expected to increase, on occasion during adverse weather conditions, such as rain, fog, and wet snow, when in close proximity to the operation of the transmission line, and would be considered direct and negative. The magnitude at a given POR is dependent on the distance to the Project activities. It is expected that a magnitude of negligible, low, moderate, or high could occur depending on the distance between the POR. However, the increased noise levels are expected to be local (i.e., limited to the LSA) and infrequent and short-term in duration as it would only occur during adverse weather conditions. When the transmission line exists in close proximity to a given POR, increased noise levels are expected to be probable.

Maintenance

Existing noise levels at given PORs can be expected to increase, on occasion, due to maintenance, replacement and inspection activities when occurring nearby, and would be considered direct and negative. The magnitude at a given POR is dependent on the distance to the Project activities. Similar to the assessment of construction noise, it is expected that a magnitude of negligible, low, moderate, or high could occur depending on the distance between the POR and the maintenance, replacement or inspection activities. However, the increased noise levels are expected to be local (i.e., limited to the LSA) and short-term in duration at a given location. Frequency is considered periodic, as maintenance, replacement or inspection activities near a given POR will occur intermittently throughout the operation and maintenance period. When maintenance, replacement or inspection activities exist in proximity to a given POR, increased noise levels are expected to be probable.

Based on the analysis above, the operation and maintenance stage was assessed and Table 6.9-27 below summarizes the net effects assessment carried out.

Table 6.9-27: Characterization of Predicted Net Effects for Acoustic and Vibration Environment

Criteria	Indicators	Net Effect	Direct/ Indirect	Direction	Magnitude	Geographic Extent	Duration/ Reversibility	Frequency	Likelihood of Occurrence	Significance Determination
Noise	• Change in noise levels in the study area • Compliance with applicable guidance documents	Net change in noise emissions during construction activities	Direct	Negative	Negligible to High	Local	Short-term	Periodic	Probable	Not Significant
Vibration	• Change in air and/or ground vibration levels in the study area • Compliance with applicable guidance documents	Net change in vibration during construction activities	Direct	Negative	Negligible to High	Local	Short-term	Periodic	Probable	Not Significant
Noise	• Change in noise levels in the study area • Compliance with applicable guidance documents	Net change in noise emissions during operation and maintenance – maintenance activities	Direct	Negative	Negligible to High	Local	Short-term	Periodic	Probable	Not Significant
Noise	• Change in noise levels in the study area • Compliance with applicable guidance documents	Net change in noise emissions during operation and maintenance – operation of the TSs	Direct	Negative	Negligible	Local	Long-term	Continuous	Probable	Not Significant

Criteria	Indicators	Net Effect	Direct/ Indirect	Direction	Magnitude	Geographic Extent	Duration/ Reversibility	Frequency	Likelihood of Occurrence	Significance Determination
Noise	• Change in noise levels in the study area • Compliance with applicable guidance documents	Net change in noise emissions during operation and maintenance – operation of the transmission line	Direct	Negative	Negligible to High	Local	Short-term	Infrequent	Probable	Not Significant

6.9.10 Assessment of Significance

The assessment of significance of net effects of the Project is informed by the interaction between the significance factors, with magnitude, duration, and geographic extent being the most important factors. As set out in Section 5.6.5, a predicted net effect to the noise and vibration criteria would be considered significant if it is assessed as:

- High magnitude;
- Long-term to permanent in duration; and
- Occurring at any geographical extent.

Noise Emissions and Vibration during Construction: Taking into account the implementation of the mitigation measures, the magnitude of the net effects from the increased noise and vibration during construction were assessed to have potential to range from negligible, low, moderate, or high, depending on the distance between the POR and the construction activities. The net effects were assessed to be local in geographic extent, short-term and reversible.

Because the net effects from the increased noise and vibration during construction are not predicted to be long-term or permanent in duration, the net effects during construction are assessed as not significant.

Noise Emissions during Operation and Maintenance: Taking into account the implementation of the mitigation measures, the magnitude of the net effects from the increased noise from maintenance, replacement and inspection activities and the operation of the transmission line during the operation and maintenance stage were assessed to have potential to range from negligible, low, moderate, or high, depending on the distance between the POR and the activities or the transmission line. The net effects were assessed to be local in geographic extent, short-term and reversible.

The magnitude of the net effects from the increased noise from the operation of the TSs during the operation and maintenance stage were assessed to have a negligible magnitude. The net effects were assessed to be local in geographic extent, long-term and reversible.

The net effects due to maintenance, replacement and inspection activities and the operation of the transmission line are not predicted to be long-term or permanent in duration. The net effects due to the operation of the TSs are not predicted to be high in magnitude.

Therefore, the net effects from the increased noise during operations are assessed as not significant.

6.9.11 Cumulative Effects Assessment

In addition to assessing the net environmental effects of the Project itself, the assessment also evaluated the significance of the net and cumulative effects from the Project that overlap

temporally and spatially with effects from all other past, present, and reasonably foreseeable expansions and activities.

As described in Section 5.7, net effects carried forward to the cumulative effects assessment analysis include net effects with a magnitude greater than negligible and with a likelihood of occurrence of 'probable' or 'certain'. Because some net effects may have potential to be of low, moderate, or high magnitude, depending on the distance between the POR and the Project activities, and they are expected to be probable, the net effects assessment of noise and vibration during the construction stage and noise during the maintenance, replacement and inspection activities and the operation of the transmission line during the operation and maintenance stage was carried forward to include the potential cumulative effects.

The cumulative effects assessment considered the list of cumulative developments described in Section 9.0 and that the net effects of the Project on the acoustic and vibration environment are expected to be local in geographic extent, short-term in duration and periodic in frequency.

Given the short-term duration and periodic nature of the non-negligible net effects to noise and vibration, it is not expected that these net effects will overlap temporally and spatially with the net effects from the reasonably foreseeable developments (RFDs) identified in Section 9.0. If overlap does occur, it would continue to be short-term in duration and periodic; therefore, cumulative effects, if they occur, are not expected to be significant.

6.9.12 Monitoring

This section identifies recommended effects monitoring to verify the prediction of the effects assessment and the effectiveness of the mitigation measures to evaluate whether the Project has been constructed, implemented, and operated in accordance with the commitments made in the EA Report.

A noise monitoring program is not recommended for the Project; however vibration monitoring is expected to be required for both temporary aggregate pits (i.e., quarries) and general construction blasting activities to align with MECP/MNRF requirements and general industry practices, respectively. Monitoring requirements for construction blasting will be considered and assessed once detailed information regarding the blast designs are available. Based on typical blasts, monitoring would be recommended for construction blasting within 250 m and aggregate pit blasts within 500 m of receptors verified to be vibration sensitive.

6.9.13 Prediction Confidence in the Assessment

The confidence in the effects assessment for the acoustic and vibration environment is moderate, considering that the mitigation measures described above are based on accepted and proven best management practices that are well understood and have been applied to similar projects throughout North America. Uncertainty in the assessment has been further reduced by making conservative assumptions, planned implementation of known effective

mitigation measures, and available adaptive management measures to address unforeseen circumstances should they arise.

6.9.14 Information Passed on to Other Components

Results of the noise and vibration assessment were reviewed and incorporated into the following components of the EA:

- Wildlife and wildlife habitat (Section 6.5);
- Fish and fish habitat (Section 6.6);
- Land and resource use (Section 7.1);
- Community well-being (Section 7.2); and
- First Nations rights, interests, and use of land and resources (Section 7.7); and
- Métis rights, interests, and use of land and resources (Section 7.8).

6.9.15 Criteria Summary

Table 6.9-28 presents a summary of the assessment results for acoustic and vibration environment.

Table 6.9-28: Acoustic and Vibration Assessment Summary

Criteria	Assessment Summary
Noise	• Net effects are assessed to be not significant. • The Project is not predicted to contribute to cumulative effects.
Vibration	• Net effects are assessed to be not significant. • The Project is not predicted to contribute to cumulative effects.

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