



CANADA NICKEL
COMPANY



Stantec

Crawford Nickel Project Impact Statement

Chapter 12 Assessment of Potential Effects on the Atmospheric Environment



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Canada Nickel Company

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Acronyms and Abbreviations

µg	Microgram
AAQC	Ambient air quality criteria
AQMP	Air Quality Management Plan
B(a)P	Benzo(a)pyrene
CAAQS	Canadian Ambient Air Quality Standards
CAC	Criteria air contaminants
CAS	Chemical Abstracts Service
CCME	Canadian Council of Ministers of the Environment
CIE	Commission Internationale de L'Éclairage or International Commission on Illumination
CO	carbon monoxide
CoPC	Contaminants of Potential Concern
ECCC	Environment and Climate Change Canada
GLC	Ground Level Concentrations
HAP	Hazardous Air Pollutants
HHERA	Human Health and Ecological Risk Assessment
IAA	<i>Impact Assessment Act, 2019</i>
LSA	Local Study Area
MECP	Ministry of the Environment, Conservation and Parks
MTO	Ministry of Transportation Ontario
NAPS	National Air Pollution Surveillance
NO ₂	nitrogen dioxide

O. Reg.	Ontario Regulation
PA	Project Area
PM	Particulate matter (also referred to as SPM)
PM ₁₀	Particulate matter smaller than 10 microns
PM _{2.5}	Particulate matter smaller than 2.5 microns
RSA	Regional Study Area
SO ₂	Sulphur Dioxide
SPM	Suspended Particulate Matter (also referred to as PM)
TDR	Technical Data Report
URT	Upper risk threshold
US EPA	United States Environmental Protection Agency
VC	Valued Component
VOC	Volatile organic compounds

Glossary of Technical Terms

Air Contaminant Emissions	For stationary sources, the release or discharge of a pollutant from a facility or operation into the ambient air either by means of a stack, vent or as a fugitive dust, mist, gas, or vapour.
Canadian Council of Ministers of the Environment (CCME)	A council made up of environmental ministers from provincial and federal levels of government that proposes nationally consistent environmental standards and objectives to achieve high levels of environmental quality for waste management, air pollution, and toxic chemicals across Canada.
Carbon Monoxide (CO)	A colourless, odourless gas produced by incomplete fossil fuel combustion.
Combustion Product	Substance produced during the burning or oxidation of a material.
Combustion	1. Burning, or rapid oxidation, accompanied by the release of energy in the form of heat and light. 2. Refers to controlled burning of a fuel or waste, in which heat chemically alters organic compounds, converting into stable compounds such as carbon dioxide and water.
Dust	A term used to describe particles of a solid or liquid that are suspended in air. Also referred to as particulate or suspended particulate.
Emissions	Technically, all solid, liquid, or gaseous discharges from a processing facility, but normally referring to those released to the atmosphere (with solids referred to as residue and liquids as effluent).
Mitigation	Measures taken to reduce adverse effects on the environment.
Particulate	A particle of a solid or liquid that is suspended in air.
Particulate Deposition	The quantity of particles of a solid or liquid in air that settles onto the ground over a given area and time under the influence of gravity and/or precipitation scavenging. Commonly referred to as dustfall.
Particulate Matter	A particle in solid or liquid phase that is suspended in air.

Receptor A person, plant or wildlife species that may be affected due to exposure to an air contaminant.

United States
Environmental
Protection Agency AP-
42 (US EPA AP-42) US EPA document Compilation of Air Emission Factors, Volume 1: Stationary Point and Area Sources.

12 Assessment of Potential Effects on the Atmospheric Environment

The Atmospheric Environment was selected as a Valued Component (VC) because construction, operations, and decommissioning and closure of the Crawford Nickel Project ('the Project') has the potential to result in a change in air quality and light conditions.

For this assessment, 'air quality' is defined as the concentration in air of any substance introduced into the environment that can adversely affect the usefulness of a resource or the health of humans, animals, or ecosystems. As a subcomponent of the Atmospheric Environment Value Component (VC), air quality has been selected because of its intrinsic importance to the health and wellbeing of humans, wildlife, vegetation, and other biota. The atmosphere is an important pathway for the transport of contaminants to the freshwater, terrestrial, and human environments. Some Project activities result in the release of substances to the atmosphere that, owing to their physical and chemical properties, are classed as air contaminants. These substances are activity-dependent (e.g., dust is raised during mining activities; combustion by-products emitted during construction and operations).

For this assessment, 'light' is defined as electromagnetic radiation that can be perceived by the human eye. Visible light spans the visible spectrum and is usually defined as having wavelengths in the range of 400–700 nanometres. As a subcomponent of the Atmospheric Environment VC, light has been selected because changes in light may result in effects that can range from a minor nuisance to a disruptive environmental effect.

The Crawford Nickel Project ('the Project') may affect the atmospheric environment because of potential changes to ambient air quality and light. These changes could affect human and ecological receptors directly and indirectly through the atmospheric transport (dispersion) and deposition of air contaminants, light trespass (the transmission of light from fixtures within the Project to the environment and receptors outside the facility), glare (intense, harsh or contrasting lighting conditions reduce humans, birds, and other organisms' ability to see) and sky glow (the illumination of the sky and/or clouds by Project light sources).

The Atmospheric Environment is linked to other VCs in the Impact Statement, including:

- Surface Water (Chapter 15 of the Impact Statement), whereby changes in Project emissions and the deposition of these emissions may affect water quality of surrounding lakes and streams.
- Fish and Fish Habitat (Chapter 17 of the Impact Statement), whereby changes in Project emissions and the deposition of these emissions may affect water quality of surrounding lakes and streams and changes in water quality may affect the availability and suitability of fish habitat and affect the growth, survival, and health of fish.
- Vegetation, Riparian and Wetland Environments (Chapter 16 of the Impact Statement), whereby changes in Project fugitive dust emissions and the deposition of these emissions on surrounding

native plant communities may affect plant species diversity, community diversity and wetland functions.

- Wildlife and Wildlife Habitat (Chapter 19 of the Impact Statement), whereby changes in Project emissions and the associated ambient concentrations and deposition of these emissions may increase the exposure of wildlife to air contaminants and affect wildlife health. The deposition of Project emissions to soil may affect soil quality which may, in turn, alter soil-related exposures for wildlife receptors.
- Health (Chapter 21 of the Impact Statement), whereby changes in Project emissions and the associated ambient concentrations may increase the exposure of humans to air contaminants that may affect human health. The deposition of Project emissions to soil may affect soil quality which may, in turn, alter soil-related exposures for human receptors.

12.1 Scope of Assessment

An air quality assessment was conducted to determine potential residual and cumulative changes to ambient air quality. The TIS Guidelines (Appendix A.1 of the Impact Statement) for the Project identify the Project components and residual effects to be included in the air quality assessment.

The air quality assessment estimates the quantities of air contaminants that may be released to the atmosphere from the planned Project activities and uses an atmospheric dispersion model to predict the potential changes in ambient air quality associated with those Project emissions. The air quality assessment considers substances for which there are applicable air quality objectives and standards adopted by either or both Environment and Climate Change Canada (ECCC) and the Ministry of the Environment, Conservation and Parks (MECP). The predicted effects are assessed relative to these criteria, which are presented in Section 12.1.1.

The air quality assessment considers the following air contaminants referred to as Contaminants of Potential Concern (CoPCs):

- Suspended particulate matter (SPM or PM)
- Particulate matter less than 2.5 microns (PM_{2.5})
- Particulate matter less than 10 microns (PM₁₀)
- Carbon monoxide (CO)
- Sulphur dioxide (SO₂)
- Nitrogen dioxide (NO₂)
- Ozone (O₃)
- Volatile organic compounds (VOCs)
- Polycyclic aromatic compounds, including polycyclic aromatic hydrocarbons (PAHs) and alkylated PAHs. PAH derivatives such as nitrated PAHs (nitro-PAHs) and oxygenated PAHs (oxy-PAHs) occur at far lower concentrations than those of parent PAHs in off-road diesel engine exhaust (CARB, 2020) and were therefore not included in the assessment

- Metals contained in ore, mine rock, overburden, and tailings
- Diesel particulate matter (i.e., particles arising from diesel combustion)
- Asbestos (chrysotile). The Project ore and waste rock types are all mafic or ultramafic rock. These rock types can contain serpentine mineral groups including chrysotile. Canada Nickel Company Incorporated (Canada Nickel) has not identified any amphibole family asbestiform minerals (which are typically found in felsic rocks)
- Other relevant air pollutants from mobile, stationary, or fugitive sources, including respirable crystalline silica (RCS), and metallic minerals

The predicted ambient concentrations of these CoPCs arising from the Project activities were also used for the Assessment of Potential Effects on Health (Chapter 21 of the Impact Statement).

The greenhouse gases (GHGs) associated with the Project are assessed in the Assessment of Potential Effects on Climate Change (Chapter 20 of the Impact Statement).

Detectable odours could result from emissions of odorous hydrocarbons, which would only be released to the atmosphere at negligible emission rates from mining equipment powered with fossil fuel. Odour emissions from chemicals used in the process plant were reviewed and considered negligible due to their low volatility. Other materials stored and used in the sewage and effluent treatment system are all enclosed with negligible emissions. Odour emissions are not expected to be a concern provided adequate consideration of odour management is incorporated in the Project operations, and therefore were not considered further in this assessment.

Potential Project-related effects associated with ambient light were qualitatively assessed by analyzing sight lines and distances from the Project to potential nearby receptors (i.e., residences, campgrounds, locations of non-Indigenous and Indigenous receptors), as well as luminaire design considerations to minimize directional upward lighting, to determine the potential for light trespass (brightening of adjacent areas), glare, and skyglow to affect the receptors.

12.1.1 Regulatory and Policy Setting

12.1.1.1 Air Quality

The Project will be considered a new facility under Ontario Regulation 419/05 (O. Reg. 419/05) and, as such, the Schedule 3 standards in the regulation apply. Where no O. Reg. 419/05 Schedule 3 standards are available for a particular CoPC, guidelines including the Ontario ambient air quality criteria (AAQC), and screening levels (SLs) were considered. Ontario's AAQC are desirable effects-based concentrations in air with variable averaging periods. The type of effect that a chemical may have varies, but may be based on health, odour, vegetation, soiling, visibility, or corrosion, amongst others. These criteria are outlined in the Ontario Ministry of the Environment, Conservation and Parks' (MECP's) "Air Contaminants Benchmarks (ACB) List – Standards, Guidelines and Screening Levels for Assessing Point of Impingement Concentrations of Air Contaminants" (MECP 2023), which includes Benchmark 1 values (Standards and Guidelines) and Benchmark 2 values (Screening Levels). Modelled concentrations of chemicals that are below published screening levels are considered to be acceptable. Upper Risk

Thresholds (URT) are maximum concentrations which are not to be exceeded anywhere off property. Similar to SL values, URTs are compared to modelled concentrations at the Modelled Mine Boundary.

Federal air quality criteria are published in the Canadian Ambient Air Quality Standards referred to as the CAAQS. The CAAQS were developed through a collaborative process involving the federal, provincial, and territorial governments and stakeholders, as directed by the Canadian Council of Ministers of the Environment (CCME) (CCME 2012).

The applicable regulatory criteria for the assessment of air quality are provided in Table 12.1 to Table 12.6.

Table 12.1 Summary of Provincial Air Quality Criteria for Air Contaminants

Parameter	CAS	O. Reg. 419/05 – Schedule 3 Standards and AAQC		
		1-Hour ($\mu\text{g}/\text{m}^3$)	24-Hour ($\mu\text{g}/\text{m}^3$)	Other time Period ($\mu\text{g}/\text{m}^3$)
Sulphur dioxide	7446-09-5	100 ^d	N/A ^d	10 ^d annual
Nitrogen oxides ^b	10102-44-0	400	200	-
Ozone	10028-15-6	165	-	-
PM _{2.5}	N/A	-	27 ^{a, c}	8.8 ^{a, c}
PM ₁₀	N/A	-	50 ^{a, c}	-
Carbon monoxide	630-08-0	36,200 ^a	-	6,000; ½-hour ^e 15,700; 8-hour ^a

Notes:

- a. Ontario Ambient Air Quality Criteria
- b. The Schedule 3 standards for NO_x are based on health effects of NO₂, as NO₂ has adverse health effects at much lower concentrations than NO. Therefore, the standard was compared to NO₂ in this report.
- c. AAQC for PM_{2.5} references CAAQS. AAQC for PM₁₀ is an interim AAQC provided as a guide for decision making.
- d. New Schedule 3 standards for SO₂ effective July 1, 2023.
- e. Half-hour standard for carbon monoxide accounts for high background levels from automobiles (i.e., individual facilities are only allowed a small fraction of the total airshed).

Table 12.2 Summary of Provincial Air Quality Criteria for SPM, Metals and Metallic Compounds

Parameter	CAS #	O. Reg. 419/05 - Schedule 3 Standards, Guidelines, SLs and URTs		Ontario AAQC	
		24 Hour ($\mu\text{g}/\text{m}^3$)	Other time period ($\mu\text{g}/\text{m}^3$)	24 Hour ($\mu\text{g}/\text{m}^3$)	Other time period ($\mu\text{g}/\text{m}^3$)
Suspended Particulate Matter (SPM)	NA	120	-	120	60 (annual)
Aluminum	7429-90-5	12	-	-	-
Antimony	7440-36-0	25	-	25	-
Arsenic and compounds	7440-38-2	0.3	-	0.3	-
Barium – total water soluble	7440-39-3	10	-	10	-
Beryllium and beryllium compounds	7440-41-7	0.01	-	0.01	-
Biotite	1302-27-8	-	-	-	-
Bismuth	7440-69-9	2.5	-	-	-
Boron	7440-42-8	120	-	120	-
Cadmium and cadmium compounds	7440-43-9	0.025, 0.25 ⁽¹⁾	-	0.025	0.005 (annual)
Calcium	7440-70-2	-	-	-	-
Chlorite	1318-59-8	120	-	-	-
Chromium (total)	7440-47-3	0.5, 5 ⁽¹⁾	-	0.5	-
Chromium (hexavalent)	18540-29-9	-	0.00014 (annual)	0.00035 (in PM ₁₀) 0.0007 (in SPM)	0.00007 (in PM ₁₀ ; annual) 0.00014 (in SPM; annual)
Asbestos	1332-21-4	0.04 fibres/cm ³	-	0.04 fibres/cm ³	-
Cobalt	7440-48-4	0.1	-	0.1	-
Copper	7440-50-8	50	-	50	-
Hematite	1317-60-8	25	-	-	-
Iron	7439-89-6	4 ⁽²⁾	-	4	-
Lead	7439-92-1	0.5, 2 ⁽¹⁾	0.2 (30 day)	0.5	0.2 (30 day)
Lithium	7439-93-2	20	-	20	-
Magnesium	7439-95-4	72	-	-	-
Magnetite	1309-38-2	25	-	-	-

Parameter	CAS #	O. Reg. 419/05 - Schedule 3 Standards, Guidelines, SLs and URTs		Ontario AAQC	
		24 Hour ($\mu\text{g}/\text{m}^3$)	Other time period ($\mu\text{g}/\text{m}^3$)	24 Hour ($\mu\text{g}/\text{m}^3$)	Other time period ($\mu\text{g}/\text{m}^3$)
Manganese	7439-96-5	0.4	-	0.1 (Mn in $\text{PM}_{2.5}$), 0.2 (Mn in PM_{10}), 0.4 (Mn in SPM)	-
Mercury	7439-97-6	2 (Hg), 0.5 (Hg as alkyl compounds)	-	2 (Hg), 0.5 (Hg as alkyl compounds)	-
Molybdenum	7439-98-7	120	-	120	-
Muscovite	1318-94-1	1.5	-	-	-
Nickel	7440-02-0	2 ⁽¹⁾	0.04 (annual)	0.1 (Ni in PM_{10}), 0.2 (Ni in SPM)	0.02 (Ni in PM_{10} , annual), 0.04 (Ni in SPM, annual)
Palladium	7647-10-1	10	-	10	-
Phosphorous	7723-14-0	0.5	-	-	-
Platinum	7440-06-4	0.2	-	0.2	-
Potassium	7440-09-7	-	-	-	-
Potassium amyl xanthate	2720-73-2	-	-	-	-
Pyrite	1309-36-0	120	-	-	-
Quartz (in PM_{10})	14808-60-7	5	-	5	-
Selenium	7782-49-2	10	-	10	-
Silicon	7440-21-3	27	-	-	-
Silver	7440-22-4	1	-	1	-
Sodium	7440-23-5	-	-	-	-
Sodium hexametaphosphate	10124-56-8	15	-	-	-
Strontium	7440-24-6	120	-	120	-
Talc (fibrous)	14807-96-6	2	-	2	-
Thallium	7440-28-0	0.5	-	-	-
Thorium	7440-29-1	-	-	-	-
Tin	7440-31-5	10	-	10	-
Titanium	7440-32-6	120	-	120	-
Tungsten	7440-33-7	5	-	-	-
Uranium	7440-61-1	1.5 (U in PM_{10}) ⁽¹⁾	0.03 (U in PM_{10} , annual)	0.15 (U in PM_{10}), 0.3 (U in SPM)	0.03 (U in PM_{10} , annual), 0.06 (U in SPM, annual)

Parameter	CAS #	O. Reg. 419/05 - Schedule 3 Standards, Guidelines, SLs and URTs		Ontario AAQC	
		24 Hour ($\mu\text{g}/\text{m}^3$)	Other time period ($\mu\text{g}/\text{m}^3$)	24 Hour ($\mu\text{g}/\text{m}^3$)	Other time period ($\mu\text{g}/\text{m}^3$)
Vanadium	7440-62-2	2	-	2	-
Yttrium	7440-65-5	5	-	-	-
Zinc	7440-66-6	120	-	120	-
Notes: 1. URT 2. as metallic iron					

Table 12.3 Summary of Air Quality Standards, Guidelines, Criteria for VOCs

Parameter	CAS #	O. Reg. 419/05 - Schedule 3 Standards, Guidelines, and SLs		Ontario AAQC	
		24 Hour ($\mu\text{g}/\text{m}^3$)	Other ($\mu\text{g}/\text{m}^3$)	24 Hour ($\mu\text{g}/\text{m}^3$)	Other time period ($\mu\text{g}/\text{m}^3$)
Acetaldehyde	75-07-0	500	500 (30 min)	500	500 (30 min)
Acrolein	107-02-8	0.4	4.5 (1 hour)	0.4	4.5 (1 hour)
1,3-Butadiene	106-99-0	10	2 (annual)	10	2 (annual)
Benzene	71-43-2	-	0.45 (annual)	2.3	0.45 (annual)
Bromine	7726-95-6	20	-	20	-
Formaldehyde	50-00-0	65	-	65	-
Hydrocarbons	-	-	-	-	-
2-Pentanol, 4-methyl-	108-11-2	500	-	-	-

Table 12.4 Summary of Applicable Provincial Air Quality Standards and Criteria for Selected PAHs

CoPC	Chemicals Abstracts Services Number (CAS No.)	O. Reg. 419/05 – Schedule 3 Standards and SLs		Ontario AAQC	
		24-Hour ($\mu\text{g}/\text{m}^3$)	Other time Period ($\mu\text{g}/\text{m}^3$)	24-Hour ($\mu\text{g}/\text{m}^3$)	Other time Period ($\mu\text{g}/\text{m}^3$)
Acenaphthene	83-32-9	-	-	-	-
Acenaphthylene	208-96-8	-	-	-	-
Anthracene	120-12-7	-	-	-	-
Benzo(a)anthracene	56-55-3	-	-	-	-
Benzo(a)pyrene (B(a)P)	50-32-8	0.00005, 0.005 ⁽¹⁾	0.00001 (annual)	0.00005	0.00001 (annual)

CoPC	Chemicals Abstracts Services Number (CAS No.)	O. Reg. 419/05 – Schedule 3 Standards and SLs		Ontario AAQC	
		24-Hour ($\mu\text{g}/\text{m}^3$)	Other time Period ($\mu\text{g}/\text{m}^3$)	24-Hour ($\mu\text{g}/\text{m}^3$)	Other time Period ($\mu\text{g}/\text{m}^3$)
Benzo(b+k) fluoranthene	205-99-2/ 208-08-0	-	-	-	-
Benzo(g,h,i) perylene	191-24-2	-	-	-	-
Chrysene	218-01-9	-	-	-	-
Fluoranthene	206-44-0	-	-	-	-
Fluorene	86-73-7	-	-	-	-
Phenanthrene	85-01-8	-	-	-	-
Pyrene	129-00-0	-	-	-	-
Dibenz(a,h)perylene	53-70-3	-	-	-	-
Indeno(1,2,3-cd)pyrene	193-39-5	-	-	-	-
Naphthalene	91-20-3	22.5	50 (10 min)	22.5	50 (10 min)
Notes: 1. URT					

Table 12.5 Summary of Applicable Provincial Air Quality Standards, Criteria for Other CoPCs

CoPC	Chemicals Abstracts Services Number (CAS No.)	O. Reg. 419/05 – Schedule 3 Standards and SLs		Ontario AAQC	
		24-Hour ($\mu\text{g}/\text{m}^3$)	Other time Period ($\mu\text{g}/\text{m}^3$)	24-Hour ($\mu\text{g}/\text{m}^3$)	Other time Period ($\mu\text{g}/\text{m}^3$)
Diesel particulate matter	1333-86-4	-	-	-	-
Elemental carbon	7440-44-0	-	-	-	-
Sulphuric Acid	7554-93-9	5, 15 ⁽¹⁾	-	5	-
Notes: 1. URT					

Table 12.6 Summary of Canadian Ambient Air Quality Standards

Parameter	Averaging Time	2020 CAAQS ($\mu\text{g}/\text{m}^3$)	2025 CAAQS ($\mu\text{g}/\text{m}^3$)
NO ₂	1 hour	119 ^a	83 ^b
	24 hours	-	-
	Annual	34 ^a	24 ^b
PM _{2.5}	24 hours	27 ^c	-
	Annual	8.8 ^c	-
SO ₂	1 hour	193 ^d	179 ^e
	24 hours	-	-
	Annual	13.7 ^d	11 ^e
O ₃	8 hours	124	-

Notes:

- 1 Hour and Annual CAAQS for NO₂, effective by 2020 (CCME 2020b). The 1-hour CAAQS is referenced to the 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations. The annual CAAQS is the average over a single calendar year of all 1-hour average concentrations. The criteria were converted from ppb to $\mu\text{g}/\text{m}^3$ based on standard temperature of 10°C and pressure of 1 atm.
- 1 Hour and Annual CAAQS for NO₂, effective by 2025 (CCME 2020b). The 1-hour CAAQS is referenced to the 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations. The annual CAAQS is the average over a single calendar year of all 1-hour average concentrations. The criteria were converted from ppb to $\mu\text{g}/\text{m}^3$ based on standard temperature of 10 °C and pressure of 1 atm.
- 24 Hour and Annual CAAQS for Respirable Particulate Matter, effective by 2020 (CCME 2012). The 24- hour CAAQS is referenced to the 98th percentile daily average concentration averaged over 3 consecutive years. The annual CAAQS is referenced to the 3-year average of the annual average concentrations.
- 1 Hour and Annual CAAQS for SO₂, effective by 2020 (CCME 2020a). The 1-hour CAAQS is the 3-year average of the annual 99th percentile of the SO₂ daily maximum 1-hour average concentrations. The annual CAAQS is referenced to the average over a single calendar year of all 1-hour average concentrations. The criteria were converted from ppb to $\mu\text{g}/\text{m}^3$ based on a standard temperature of 10 °C and pressure of 1 atm.
- 1 Hour and Annual CAAQS for SO₂, effective by 2025 (CCME 2020a). The 1 Hour CAAQS is the 3-year average of the annual 99th percentile of the SO₂ daily maximum 1-hour average concentrations. The annual CAAQS is the average over a single calendar year of all 1-hour average concentrations. The criteria were converted from ppb to $\mu\text{g}/\text{m}^3$ based on standard temperature of 10 °C and pressure of 1 atm.

12.1.1.2 Light

The Commission Internationale de L'Éclairage (CIE), also known as the International Commission on Illumination, has developed sets of maximum values for light trespass and glare that should not be exceeded. These guidelines have also been adopted as best management practice for other industrial projects in Canada. There are no legal requirements (e.g., general guidelines, regulations, or policies), either federal or provincial, that regulate the amount of obtrusive light emitted from projects. Use of the Commission on Illumination guidelines is an accepted practice.

The values represented in the guidelines are based on environmental zones and time of day. The CIE has established five environmental zones as a basis for outdoor lighting guidance in their document 'Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations' (CIE 2017) which are shown in Table 12.7.

Table 12.7 CIE 150:2017 Environmental Zones

Zone	Surrounding	Lighting Environment
E0	Protected	Intrinsically Dark
E1	Natural	Dark
E2	Rural	Low District Brightness
E3	Suburban	Medium District Brightness
E4	Urban	High District Brightness

The CIE has also established guidelines for light trespass for each environmental zone (Table 12.8).

Table 12.8 CIE 150:2017 Maximum Values for Light Trespass

Time of Day	CIE 150:2017 Maximum Values of Light Trespass on Properties by Environmental Zone (in lux) ¹				
	E0	E1	E2	E3	E4
Pre-Curfew (19:00 – 23:00)	N/A	2	5	10	25
Post-Curfew (23:00 – 6:00)	N/A	<0.1 ²	1	2	5

Notes:

1. Terminology, environmental zones, and values defined by CIE 150:2017
2. If the installation is for public (road) lighting, this value may have a max of 1 lux

For glare, the maximum values recommended by CIE (intensity of luminaires) in designated directions vary with environmental zone and time of day. The recommended values for glare depend not only on the brightness of the luminaire, but also the distance from the observer to the luminaire (d) and the size of the luminaire (A_p). For the rural E2 zone, this can range from 0.29·d to 10 d (CIE 2017).

Sky glow is the result of illumination that is directed upward, typically as a result of the use of lighting that has substantial upward directivity, or is omnidirectional, such as “bare bulbs”.

Sky glow levels have been established for zones of various levels of urban development (Berry 1976).

Reference values are arranged so that decreasing values are associated with more night sky lighting sourced from anthropogenic sources, and range from 18.5 Urban, where stars are weak and washed out, to 21.7 Rural, where the sky is crowded with stars and the Milky Way can be seen.

12.1.2 The Influence of Consultation and Engagement on the Assessment

Canada Nickel has engaged with potentially affected Indigenous nations, regulators, landowners, and stakeholders. Table 12.9 provides a summary of the topics, key information including Indigenous knowledge, and concerns that Canada Nickel identified as part of their engagement efforts that relate to the atmospheric environment, as well as a summary of the influence that the outcomes of this engagement had on the assessment. This information was considered when evaluating whether Canada Nickel's planned mitigation will effectively manage the identified potential interactions, or whether additional or refined mitigation is warranted. Specific concerns regarding the atmospheric environment raised during engagement for the Project and any additional and specific mitigation measures that were added to address one or more of the concerns, are described in Table 12.9.

Table 12.9 Summary of Key Information, Indigenous Knowledge, and Concerns for the Project Related to the Atmospheric Environment

Topic	Key Information, Indigenous Knowledge, and Concerns	Influence on the Assessment	Where Information is Addressed in the Impact Statement
Emissions, Dust and Human Health	<p>Members of the public and other stakeholders expressed concern regarding:</p> <ul style="list-style-type: none"> • changes to air quality, including baseline conditions, emissions estimates, dispersion modelling, human receptor locations for many parameters • presence of chrysotile, the potential effects of chrysotile in dust, measures to manage chrysotile in airborne dust (if present) • provincial oversight that will support compliance with air quality criteria in the PA and LSA • effects on receptors within the LSA • proposed mitigation measures to managed changes to air quality, including best management practices and monitoring plans. • Flying Post First Nation, Matachewan First Nation and Mattagami First Nation recommend involvement in dust management plans and consultation on dust suppressants to be used on the Project 	<ul style="list-style-type: none"> • Contributed to an understanding of existing conditions for air quality regarding changes to air quality and the effects on human health, including the presence of chrysotile asbestos in the PA. Canada Nickel has not identified any amphibole family asbestiform minerals (which are typically found in felsic rocks). • Indigenous knowledge obtained through engagement with Indigenous nations informed the identification of generalized areas of traditional land use (e.g., areas of hunting, fishing, trapping). Dispersion modelling was conducted at Indigenous Traditional Land Use locations to assess changes in air quality. • Considered in the development of mitigation and management measures and supported scope of issues assessed pertaining to changes in air quality, Mitigation and management measures will be incorporated into the Air Quality Management Plan (AQMP). • Informed the assessment of potential effects on health in Chapter 21 of the Impact Statement with regard to the potential effects of chrysotile asbestos in dust and changes in air quality • Informed the assessment of potential effects on Indigenous interests in Chapters 25 to 28 of the Impact Statement • Canada Nickel’s responses to mitigation recommendations made by the Indigenous nations are provided in the assessment of potential effects on Indigenous interests in Chapters 25 to 28 of the Impact Statement 	<ul style="list-style-type: none"> • Chapter 12 of the Impact Statement, Sections 12.2, 12.4 • Chapter 21 of the Impact Statement, Section 21.4 • Chapters 25 to 28 of the Impact Statement

Topic	Key Information, Indigenous Knowledge, and Concerns	Influence on the Assessment	Where Information is Addressed in the Impact Statement
Country Foods and Other Resources Harvested by Indigenous Nations	<ul style="list-style-type: none"> • Mattagami First Nation, Matachewan First Nation and Taykwa Tagamou Nation expressed concern regarding impacts to food and medicinal plant quality and usability from mine dust and air pollution • Mattagami First Nation expressed concern regarding air quality from Project activities with associated impacts to animal health • Matachewan First Nation expressed concern regarding potential for wind dispersal of tailing dust (e.g., containing arsenic) which has been reported to have occurred previously with existing mining activities in the region, reducing confidence in the health and quality of animals • Flying Post First Nation, Matachewan First Nation and Mattagami First Nation recommend involvement in monitoring effects on medicines, plants or berries that are affected by changes in air quality 	<ul style="list-style-type: none"> • Contributed to an understanding of existing conditions related to country foods and harvested resources as they pertain to Health (Chapter 21 of the Impact Statement) • Contributed to an understanding of existing conditions in the PA.. Background arsenic levels were measured and arsenic was assessed in the dispersion modelling. • Informed the assessment on Health in Chapter 21 of the Impact Statement with regard to the potential effects of changes in air quality on country foods and harvested resources • Considered in the development of mitigation and management measures relating to country foods and harvested resources as well as the development of an AQMP. • Informed the assessment on Indigenous interests in Chapters 25 to 28 of the Impact Statement. • Canada Nickel's responses to mitigation recommendations made by the Indigenous nations are provided in Chapters 25 to 28 of the Impact Statement 	<ul style="list-style-type: none"> • Chapter 12 of the Impact Statement, Sections 12.2, 12.4 • Chapter 21 of the Impact Statement, Section 21.4.2 • Chapters 25 to 28 of the Impact Statement • •

Where made available by Indigenous nations through engagement, information gathering, and voluntary information sharing, the Indigenous knowledge has been considered and incorporated into the Impact Statement, as applicable. Refer to the Description of Engagement with Indigenous Peoples (Chapter 7 of the Impact Statement) for detailed methods regarding the incorporation of Indigenous knowledge to the Impact Statement.

12.1.3 Potential Effects, Pathways and Measurable Parameters

Project activities during construction and operations will result in the release of CoPCs to the atmosphere that will change ambient air quality. The air quality assessment was completed for both construction and operations and is documented in the Air Quality Assessment (Appendix C.1 of the Impact Statement). This chapter focuses on Project operation because the operations phase has the greatest potential for adverse effects to air quality (see Section 4.2 in the Air Quality Assessment [Appendix C.1 of the Impact Statement]). The estimated air emissions, including dust, associated with Project construction, decommissioning and closure are less than the emissions from the worst-case year of operation.

The potential effect addressed in the air quality assessment is the “change in ambient air quality” due to Project emissions. Measurable parameters facilitate qualitative or quantitative measurement of Project effects and provide a means to evaluate the change to a VC. The measurable parameters for the air quality assessment are provided in Table 12.10.

Project activities during construction and operations will also generate light during night-time activities, such as temporary lighting during construction, vehicle lights, and more permanent lights during operations for visibility and safety. The light assessment was completed for both construction and operations and is documented in the Light Assessment (Appendix C.2 of the Impact Statement). The potential effect addressed in the lighting assessment is the “change in nighttime ambient light levels” due to Project outdoor lighting fixtures and equipment. The measurable parameters for the lighting assessment are provided in Table 12.10.

Table 12.10 Potential Effects, Effect Pathways and Measurable Parameters for the Atmospheric Environment

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in ambient air quality	The release of air CoPCS to the atmosphere due to Project activities may adversely affect the quality of the ambient air, or adversely affect human or ecological health (e.g., wildlife or vegetation) through contact of contaminants, inhalation, and consumption of contaminated food.	<ul style="list-style-type: none"> Changes in sulphur dioxide (SO₂), carbon monoxide (CO), nitrogen oxides (NO), particulate matter (SPM or PM), PM_{2.5}, PM₁₀, crystalline silica, potential acid input (PAI) concentrations or loadings (including dust deposition). Changes in ambient polycyclic aromatic hydrocarbon (PAH), volatile organic compounds (VOCs) or metals/metallic mineral concentrations. Changes in diesel PM concentrations. Changes in asbestos concentrations.

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in ambient light	Light trespass and glare at nearby receptors in units of lux and candela respectively, and skyglow in units of magnitudes/arcsec ²	<ul style="list-style-type: none"> Light emissions may disturb sleep by shining in windows, cause harsh and objectionable outdoor illumination, and potentially compromise security by emitting a light distribution that may negatively affect visibility. Facility lighting directed upward may affect the ability to see the stars.

12.1.4 Boundaries

12.1.4.1 Spatial Boundaries

The spatial boundaries of the study are defined by establishing relevant geographical areas to be assessed. These areas are based on the Project activities (where they are located) and the areas surrounding the Project where effects may be expected.

The **Project Area (PA)** encompasses the Project footprint and is the anticipated area of physical disturbance associated with the construction, operations and decommissioning and closure of the Project. The PA includes the Open Pit, Stockpiles, two ore Processing Plants, and other mine related infrastructure, as well as a new rail spur line and the relocation of Highway 655 and existing 500 kilovolt (kV) transmission line. The extent of the PA for the Project is shown on Figure 12.1.

For the purposes of the air quality assessment, the Modelled Mine Boundary is used, which is defined as the area that Canada Nickel will own, lease, or have agreements in place with the owners that would enable Canada Nickel to restrict access to the general public if required. The intention of the Modelled Mine Boundary is to provide a buffer around the PA similar to those at other mines and industrial areas and is illustrated on Figure 12.4

The **Local Study Area (LSA)** encompasses the area in which Project-related effects (direct or indirect) were predicted or measured with a level of confidence appropriate for the assessment and in which there is a reasonable expectation that the potential effects in the LSA are of public interest. This includes the PA and, to comply with provincial regulatory requirements and capture air quality effects of the specific components being assessed, is a 10 km buffer from the boundary of the PA. The extent of the LSA for air quality is shown on Figure 12.1.

The LSA for lighting is defined as the area where there is potential for lighting effects on the environment from the Project and in which there is a reasonable expectation that the potential effects in the LSA are of public interest. The LSA for lighting was selected to extend beyond the reasonably expected propagation limits of Project lighting sources. This extent considered structures, topography, and foliage that could affect light propagation. The LSA for lighting is defined as 5 km from the boundary of the PA and is shown on Figure 12.2. The LSA contains the PA.

The **Regional Study Area (RSA)** includes the area within which measurable cumulative effects on air quality may occur, depending on the location of other past, present, or reasonably foreseeable future projects or activities. The RSA for the Project is a 40 km buffer from the boundary of the PA. The extent of the RSA for air quality is also shown on Figure 12.1.

The RSA for lighting is defined as the areas within which the Project will be developed, and the surrounding areas which have the potential to experience environmental effects from construction and operations of the Project. The RSA contains the LSA and, in turn, the PA. Since light intensity decreases rapidly with distance, the RSA for the purpose of the lighting study can be considered the same as the LSA.

12.1.4.2 Temporal Boundaries

The temporal boundary of the assessment includes all Project phases from the start of construction through to the end of closure. Based on the current Project schedule, the Project phases include:

- Construction (Year –3 to Year –1)
- Operations
 - Operations phase 1 (Year 1 to Year 5); 60 kilotonnes per day (kt/d) milling capacity with ore extraction
 - Operations phase 2 (Year 5 to Year 30); 120 kt/d milling capacity with ore extraction
 - Operations phase 3 (Year 30 to Year 41); 120 kt/d milling capacity with no ore extraction
- Decommissioning and Closure
 - Active closure (Year 41 to Year 46)
 - Passive closure (Year 46+)

12.1.5 Residual Effects Characterization

The characterizations used to assess residual effects on the atmospheric environment are provided in Table 12.11.

Table 12.11 Characterization of Residual Effects on the Atmospheric Environment

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	<p>Positive – a residual effect that moves measurable parameters in a direction beneficial to air quality or lighting relative to baseline.</p> <p>Adverse – a residual effect that moves measurable parameters in a direction detrimental to air quality or lighting relative to baseline.</p> <p>Neutral – no net change in measurable parameters for air quality or lighting relative to baseline.</p>

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	<p>For Air Quality:</p> <p>Negligible – no measurable change in the effect can be noted.</p> <p>Low – a measurable change but of comparable magnitude to baseline conditions</p> <p>Moderate – measurable change but less than regulatory limits or standards</p> <p>High – measurable change that causes exceedance of objectives or standards beyond the Modelled Mine Boundary</p> <p>For Lighting:</p> <p>Negligible – no measurable change in the effect can be noted.</p> <p>Low – a measurable change but of comparable magnitude to baseline conditions</p> <p>Moderate – measurable change but is limited through design mitigation</p> <p>High – measurable change that is uncontrolled by Project design criteria and has a pronounced effect</p>
Geographic Extent	The geographic area in which a residual effect occurs	<p>PA – residual effects are restricted to the PA</p> <p>LSA – residual effects extend into the LSA</p> <p>RSA – residual effects extend into the RSA</p>
Timing	Considers when the residual effect is expected to occur, where relevant to the VC.	<p>No sensitivity - Timing does not affect the VC.</p> <p>Moderate sensitivity – timing may affect VC during lower sensitivity period, but the effects are manageable with proper planning and mitigation measures.</p> <p>High sensitivity – residual effects occur during high sensitivity period.</p>
Duration	The time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	<p>Short-term – the residual effect is restricted to construction (<3 years)</p> <p>Medium-term – the residual effect extends through the operations phase (3 to 41 years)</p> <p>Long-term – the residual effect extends beyond the life of the Project (>41 years)</p>
Frequency	Identifies how often the residual effect occurs and how often during the project or in a specific phase	<p>Single event</p> <p>Multiple irregular event – occurs at no set schedule</p> <p>Multiple regular event – occurs at regular intervals</p> <p>Continuous – occurs continuously</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	<p>Reversible – the residual effect is likely to be reversed after activity completion and reclamation</p> <p>Irreversible – the residual effect is unlikely to be reversed</p>

12.2 Existing Conditions for the Atmospheric Environment

12.2.1 Methods

Existing conditions for Atmospheric Environment refer to the conditions that exist today associated with climate, ambient air quality, and ambient lighting.

Long term climatological data in the vicinity of the proposed site are available from the Timmins Victor M. Power Airport meteorological station. The general climatology of the area is based on 30-year Canadian Climate Normal data obtained from Environment and Climate Change Canada (ECCC Climate Normals 1991-2020).

Ambient air quality monitoring data from two different sources were assessed to characterize air quality in the LSA and to develop background concentration levels. These included data available from the federal (Canadian) National Air Pollution Surveillance (NAPS) Network and onsite ambient monitoring. Detailed analyses of the ambient monitoring data are presented in the WSP Canada Inc (WSP) Baseline Air Quality Monitoring Report (Appendix B.2 of the Impact Statement).

One solar/battery powered air quality monitoring station was installed at the Project site to measure local baseline air concentrations. The location of the station was at the north end of Martin Lake, approximately 2 km west of Route 655 in a clearing. The MECP's siting requirements for setbacks from vegetation and roads were met. The following air contaminants were measured at the monitoring station: SPM, PM₁₀, PM_{2.5}, metals in SPM, PAHs, VOCs, RCS, NO₂, SO₂, and dustfall (note: ambient monitoring periods were different for each CoPC and ranged from approximately 8 to 24 months, see Appendix C.1 of the Impact Statement for additional details).

The baseline condition for lighting was evaluated based on a field survey and observation. A nighttime light level assessment was conducted by Canada Nickel and WSP to quantify existing baseline light conditions in the vicinity of the Project (Appended as Appendix B.3 of the Impact Statement). The monitoring program was conducted from June 2022 to June 2023 and quantified ambient levels of observed light trespass and light in the night sky (sky glow). Measurements were collected at four locations in the vicinity of the Project in 10 months over the period from June 2022 to June 2023, allowing nighttime light levels to be quantified in all seasons. Details of the monitoring methodology and measurement data are available in the WSP report Nighttime Light Level Baseline Report in Appendix B.3 of the Impact Statement.

12.2.2 Overview

12.2.2.1 Climate

The Project is located approximately 42 km north of the City of Timmins, Ontario. The PA lies in the subarctic region. The climate of the PA is typical of northern areas within the Canadian Shield, with long winters and short warm summers.

Temperature

A summary of the daily average, maximum and minimum temperatures on a monthly basis (1991 – 2020) is shown below in Table 12.12. Temperatures for the Timmins area is characterized by warm summers and cold winters with the coldest temperatures occurring during the winter months of December to February and the warmest temperatures occurring in the summer months of July and August. The daily average temperature varies between -16.4 °C and 17.7 °C, with an annual average temperature of 1.9 °C.

Table 12.12 Summary of Average Temperature Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Average (°C)	-16.4	-14.4	-7.5	0.9	9.7	15.3	17.7	16.2	11.7	4.5	-3.2	-11.2	1.9
Daily Maximum (°C)	-10.4	-7.6	-0.7	7.2	16.8	22.4	24.4	22.8	17.8	9.1	0.8	-6.5	8
Daily Minimum (°C)	-22.3	-21	-14.4	-5.3	2.5	8.1	10.9	9.6	5.5	-0.1	-7.1	-15.9	-4.1

Precipitation

A summary of the monthly average rainfall, snowfall, total precipitation (as equivalent rainfall based on a conversion factor for snowfall to equivalent rainfall of 0.1) and average snow depth is presented in Table 12.13. The average annual precipitation for the Timmins Airport is 796.2 mm.

Table 12.13 Mean Monthly Precipitation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)	4	1.1	14.3	35.3	63.5	77.9	84.8	77	81.7	66.8	28.1	8.7	543.1
Snowfall (cm)	59.2	47.9	43.2	25.3	3.1	0.2	0	0	0.5	13.7	50.8	63.8	307.6
Precipitation (mm)	49	39.9	48.3	61.7	69.9	80.4	78.7	75.6	81.2	86.2	68.9	56.6	796.2
Average Snow Depth (cm)	44	54	48	18	1	0	0	0	0	0	7	22	16

Relative Humidity

Relative humidity (RH) is the gravimetric ratio of water vapour in a unit volume to the water vapour that would prevail under saturated conditions at a given temperature. Average monthly RH levels at 6:00 AM and 3:00 PM local standard time (LST) the Timmins Airport is presented in Table 12.14. Monthly average RH for the Timmins Airport ranged from 76.5% - 92% at 6:00 AM and 45.7% - 76.9% at 3:00 PM.

Table 12.14 Summary of Average Relative Humidity Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average Relative Humidity – 0600 LST (%)	77.1	76.5	77.2	78.1	78.3	83	87.6	90.9	92	89.5	87.1	83.4	83.4
Average Relative Humidity – 1500 LST (%)	70.4	61.7	52.9	48.9	45.7	48.8	53.1	55.5	60.4	67.1	75.1	76.9	59.7

Wind Speed and Direction

Wind speed and direction climate normal data for Timmins are presented in Table 12.15. The annual average windspeed is 11.7 km/hr with the most frequent wind direction being southerly.

Table 12.15 Monthly Average Wind Speed and Direction Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Speed (km/h)	11.5	12.5	12.9	13	12.4	11.1	10.2	10	10.8	11.9	12.4	11.7	11.7
Most Frequent Direction	NW	S	NW	N	N	S	W	S	S	S	S	S	S

12.2.2.2 Ambient Air Quality

Background concentrations of air contaminants are used in dispersion modelling to represent the effect of other existing emissions sources (e.g., both anthropogenic and biogenic) in addition to the sources being included in the dispersion modelling. The MECP normally requires that 90th percentile ambient monitoring data be added to the dispersion model predictions to conservatively account for existing ambient concentrations. The background levels used in the assessment were therefore the 90th percentile values for short-term averages. For annual averages, an annual average value was used as the background level.

Background concentrations for the Project were conservatively determined by taking the 90th percentile concentration of each CoPC from the data sources presented in Section 12.2.1. Table 12.16 summarizes the 90th percentile 24-hour and annual average concentrations for the CoPCs used in the air quality assessment. Table 12.6 summarizes background concentrations for CoPCs with other averaging periods.

Table 12.16 24-hour and Annual Average Background Concentrations Used in the Dispersion Modelling Assessment

CoPC	CAS	90 th Percentile 24-Hour Average Concentration (µg/m ³)	Annual Average Concentration (µg/m ³)
PM	N/A	26.5	11.6
PM ₁₀	N/A	13.1	8.3
PM _{2.5}	N/A	12.4	6.2
CO	630-08-0	965	591
SO ₂	7446-09-5	2.1	0.4
NO _x	10102-44-0	2.2	0.3
1,3-butadiene	106-99-0	0.6	0.6
Acenaphthene	83-32-9	4.41E-03	8.46E-04
Acenaphthylene	208-96-8	8.15E-03	1.56E-03
Anthracene	120-12-7	1.61E-04	3.08E-05
Benzene	71-43-2	0.5	0.4
Benzo(a)pyrene (B(a)P)	50-32-8	5.29E-05	1.01E-05
Benzo(b+k)fluoranthene	205-99-2	2.79E-04	5.35E-05
Chrysene	218-01-9	3.38E-04	6.49E-05
Dustfall	N/A	1.48 (g/m ² , 30-day)	0.64 (g/m ²)
Fluoranthene	206-44-0	8.15E-04	1.56E-04
Fluorene	86-73-7	1.47E-03	2.82E-04
Phenanthrene	85-01-8	2.21E-03	4.24E-04
Pyrene	129-00-0	7.14E-04	1.37E-04
Mercury	7439-97-6	6.40E-05	6.80E-05
Aluminum	7429-90-5	4.20E-01	1.46E-01
Silver	7440-22-4	2.60E-04	2.60E-04
Arsenic	7440-38-2	1.26E-03	1.28E-03
Barium	7440-39-3	8.60E-03	1.08E-02
Beryllium	7440-41-7	7.60E-04	7.80E-04
Boron	7440-42-8	2.60E-02	2.60E-02
Bismuth	7440-69-9	1.26E-03	1.28E-03
Calcium	7440-70-2	6.80E-01	3.00E-01
Cadmium	7440-43-9	2.60E-04	2.60E-04
Cobalt	7440-48-4	7.60E-04	7.80E-04
Chromium	7440-47-3	6.00E-03	3.20E-03
Copper	7440-50-8	5.80E-03	3.20E-03
Iron	7439-89-6	2.20E-01	1.52E-01

CoPC	CAS	90 th Percentile 24-Hour Average Concentration (µg/m ³)	Annual Average Concentration (µg/m ³)
Potassium	7440-09-7	1.26E-01	1.30E-01
Magnesium	1309-48-4	1.92E-01	9.60E-02
Manganese	7439-96-5	8.60E-03	4.20E-03
Molybdenum	7439-98-7	7.60E-04	7.80E-04
Sodium	7440-23-5	5.20E-01	3.20E-01
Nickel	7440-02-0	2.60E-03	1.66E-03
Lead	7439-92-1	3.40E-03	1.64E-03
Antimony	7440-36-0	1.26E-03	1.28E-03
Selenium	7782-49-2	2.60E-03	2.60E-03
Tin	7440-31-5	2.40E-03	1.04E-03
Strontium	7440-24-6	1.50E-03	1.48E-03
Titanium	7440-32-6	8.80E-03	4.20E-03
Thallium	7440-28-0	2.60E-04	2.60E-04
Uranium	7440-61-1	2.60E-04	2.60E-04
Vanadium	7440-62-2	7.60E-04	7.80E-04
Zinc	7440-66-6	1.50E-02	1.38E-02
Quartz (in PM ₁₀)	14808-60-7	0.99	0.41
Chrysotile Asbestos	132207-32-0	0.0029	0.001
Diesel Particulate Matter (PM _{2.5} from Diesel Combustion)	N/A	9.40E-02	1.80E-02
Elemental Carbon (from diesel exhaust)	7440-44-0	9.40E-02	1.80E-02

Table 12.17 Background Concentrations Used in the Dispersion Modelling Assessment – Other Averaging Periods

CoPC	CAS #	Averaging Period (Hours)	Background Concentration (µg/m ³)
CO	630-08-0	0.5	1170
CO	630-08-0	1	965
CO	630-08-0	8	965
NO ₂	10102-44-0	1	5.4
SO ₂	7446-09-5	0.17	8.6
SO ₂	7446-09-5	1	5.2
1,3-butadiene	106-99-0	1	1.35

CoPC	CAS #	Averaging Period (Hours)	Background Concentration ($\mu\text{g}/\text{m}^3$)
Benzene	71-43-2	1	1.2
Diesel Particulate Matter (PM _{2.5} from Diesel Combustion)	N/A	2	0.19

12.2.2.3 Lighting

The ambient light environment in the Project and surrounding area was, depending on season, characterized as “low district brightness” (E2) lighting environment for skyglow and a “dark” (E1) lighting environment for light trespass and glare as described in Table 12.8.

12.3 Project Interactions with the Atmospheric Environment

Table 12.18 identifies, for each potential effect, the physical activities that might interact with the Atmospheric Environment and result in the identified effect. These interactions are indicated by a check mark or a dash and are discussed in detail in Section 12.4, in the context of effects pathways, standard and project-specific mitigation/enhancement, and residual effects. A justification for no interaction (and therefore no effect) is also provided below.

Project activities for each phase are described in detailed in the Project Description (Chapter 3 of the Impact Statement). Project related emissions and discharges are described in the Air Quality Assessment (Appendix C.1 of the Impact Statement).

The potential interactions between Project activities and the environment were considered for the construction, operations, and decommissioning and closure phases of the Project. The identification of Project activities and their potential interactions is based on engagement with stakeholders, the professional judgement of technical specialists and a review of existing conditions. The selection of interactions was also informed by the potential effects and effects pathways for each VC.

Emissions of air contaminants and light to the atmospheric environment may result in changes in air quality and perception of a change in lighting. Emissions, discharges, and wastes (e.g., air, waste, noise, light, liquid, solid effluents) are generated by many and varied Project activities. Rather than acknowledging this by placing a check mark against each of these activities, “Emissions, Discharges and Wastes” have been consolidated as an integrated activity for efficiency with relevant detail described in the text. This category includes the emissions, discharges, and wastes generated by all project activities under each Project phase. As potential interactions between the Project and the Atmospheric Environment are limited to those related to emissions, other Project activities have not been selected.

Table 12.18 Project Interactions with the Atmospheric Environment

Physical Activities	Effects	
	Change to ambient air quality	Change to ambient light
Construction		
Mobilization of construction equipment and materials on site.	✓	✓
Vegetation clearing, including the removal and disposal of trees, brush, shrubs, and other foliage.	✓	✓
Stripping, including the removal of topsoil and other organic materials, as well as storing of some materials for use in reclamation.	✓	✓
Grading of overburden to be used as fill.	✓	✓
Handing and use of explosives, including blasting.	✓	✓
Excavating and pre-stripping of mine rock from the Open Pit and surrounding area.	✓	✓
Development of the Impoundment Facility for storage of rock, clay, sand, and till.	✓	✓
Preparation of construction surfaces, including hauling reclaimed graded material and crushed mine rock to construction locations.	✓	✓
Construction of water management systems to collect, manage, treat and discharge contact water from mine components to the receiving waterbodies via collection ponds, ditches, and water treatment plants.	✓	✓
Construction of minor water diversions around perimeter of the mine site to collect and divert flows.	✓	✓
Dewatering of natural water bodies within the PA.	✓	✓
Waste management, including collection and temporary storage.	✓	✓
Construction of mine infrastructure, including crusher facilities, process plant and TMF, as well as the potable water well, and ancillary infrastructure (e.g., offices, workshop, fuel farm, magazine storage and explosives pad).	✓	✓
Construction of internal haul roads and internal access roads, including water crossings.	✓	✓
Construction of power supply and distribution systems.	✓	✓
Construction of temporary Highway 655 by-pass and overpass.	✓	✓
Construction of the rail spur.	✓	✓
Vehicle operation within the PA.	✓	✓
Employment and expenditures ¹	–	–

Physical Activities	Effects	
	Change to ambient air quality	Change to ambient light
Operation (Mining and Processing)		
Construction of Project infrastructure, including the expansion of ore processing components.	✓	✓
Relocation and decommissioning of Highway 655 and associated infrastructure.	✓	✓
Relocation of 500 kV transmission line.	✓	✓
Construction of the North Driftwood Diversion Channel.	✓	✓
Handling and use of explosives including blasting.	✓	✓
Ore extraction in the Main Zone and East Zone of the Open Pit, including drilling, loading and hauling of mine rock from the Open Pit.	✓	✓
Maintenance and management of mine rock stockpiles, overburden, and TMF.	✓	✓
Ore processing, including conveyor, crushing and processing activities with and between the stockpiles, crusher facilities and process plant.	✓	✓
Operation of water management systems, including the collection, management, treatment and discharge of contact water from mine components to the receiving waterbodies via collection ponds, ditches and water treatment plants.	✓	✓
Transportation of Ore via the rail spur line.	✓	✓
Waste management, including collection and temporary storage.	✓	✓
Vehicle operation within the PA.	✓	✓
Progressive reclamation of disturbed areas.	✓	✓
Employment and expenditures ¹ .	–	–
Decommissioning and Closure		
Pit flooding through the creation of channels from the collection ponds towards the Open Pit.	✓	✓
Water management, including groundwater and surface water.	✓	✓
Decommissioning, dismantling and/or disposal of buildings and mine infrastructure.	✓	✓
Removal of power lines and electrical equipment.	✓	✓
Decommissioning of potable water and sewage systems.	✓	✓
Vehicle operation within the PA	✓	✓
Reclamation, including the placement of overburden, seeding and re-grading.	✓	✓

Physical Activities	Effects	
	Change to ambient air quality	Change to ambient light
Monitoring and maintenance.	✓	✓
Employment and expenditures ¹ .	–	–
Notes: ✓ = Potential interaction – = No interaction 1. Project employment and expenditures are generated by most Project activities and are the main drivers of many potential socio-economic effects. Rather than acknowledging this by placing a checkmark against each of these activities, “Employment and expenditures” is listed as a separate item under each phase of the Project.		

For air quality, emissions of CoPCs and dust occur from the operation of equipment on site combusting fuel and dust from equipment travel on unpaved haul routes. Emissions of CoPCs and dust also occur from material movement, from processing and, from wind blowing over storage piles. Post-closure there will not be any activities in the PA with the potential to generate non-negligible amounts of CoPC emissions. Project employment and expenditures do not interact with the atmospheric environment during any Project phase.

Artificial lighting will be needed for all Project-related activities that occur outdoors during nighttime hours for safety purposes.

12.4 Assessment of Residual Effects on the Atmospheric Environment

This Section describes the techniques and methods used to assess air quality and lighting. Further details on the air modeling and lighting assessments are provided in Appendix C.1 of the Impact Statement, the Air Quality Assessment and Appendix C.2 of the Impact Statement, the Light Assessment, respectively.

12.4.1 Analytical Assessment Techniques

12.4.1.1 Ambient Air Quality

The assessment of potential effects on air quality related to the construction and operations of the Project consisted of the following elements:

1. Compiling CoPC emissions inventories of point sources (e.g., stacks), mobile sources (e.g., heavy equipment) and stationary sources (e.g., large storage piles) for the Project construction and operations scenarios.
2. Establishing background ambient air quality conditions for CoPCs from existing published sources of air quality data and site-specific ambient air quality measurements.

3. Conducting dispersion modelling to predict the downwind concentrations of air CoPCs from the Project and comparing these predictions to regulatory standards, objectives and guidelines (Project Alone comparisons).

Further on dispersion modelling, it is noted that three different methodologies were used:

- Base Method: includes all particulate emissions sources and conservatively does not account for plume particulate deposition and depletion. Excluding plume deposition and depletion follows MECP guidance (MECP 2017) but is expected to substantially overpredict ambient particulate and metals concentrations.
- Refined Method: includes plume deposition and depletion, which is expected to provide a more representative characterization of ambient particulate matter and metals concentrations.
- MECP Method: Excludes particulate (but not metals) emissions from haul road and wind erosion sources in the dispersion modelling and excludes plume deposition and depletion. This is the methodology that can be used in the Ontario environmental compliance approval process. Background air quality is not included/assessed in this method.

Further details on each method are described in Section 4.3.6.6 in Appendix C.1 of the Impact Statement (Air Quality Assessment). Further, deposition modelling was conducted to provide data for Appendix C.7 of the Impact Statement, Human Health and Ecological Risk Assessment and Appendix C.5 of the Impact Statement, Surface Water Resources Assessment.

4. Adding background ambient air quality CoPC concentrations to the Project Alone dispersion model predictions and comparing these cumulative levels to air quality standards and guidelines (cumulative comparisons).

The emissions inventory was based on published emission factors (i.e., U.S. Environmental Protection Agency (US EPA) AP-42) or emissions levels provided by manufacturers. Emissions estimates are expected to be conservative and represent worst-case short-term emissions from the Project activities during maximum construction and operations. Sources of air CoPCs were identified and assessed following the procedures specified in MECP Guideline A-10, Procedure for Preparing an Emission Summary and Dispersion Modelling Report (MECP 2018a). The results of the air emission inventory were used to prepare the dispersion modelling assessment of the Project for comparison against the applicable ambient air quality standards and objectives.

Background concentrations of CoPCs are used in dispersion modelling to represent the cumulative contribution of other emissions sources (e.g., both anthropogenic and biogenic) in addition to the sources being included in the dispersion modelling. The MECP normally requires that 90th percentile ambient monitoring data be added to the dispersion model predictions to conservatively account for existing ambient concentrations. The background levels used in this Impact Statement were therefore the 90th percentile values for short-term averages. For long-term averages, an annual average value was used as the background level.

The US EPA dispersion model, AERMOD (Version 22112) (US EPA 2022b), was used to predict the maximum 1-hour, 8-hour, 24-hour, 30 day and annual average ground level concentrations (GLCs). AERMOD is an approved model by the MECP for assessing contaminants against Schedule 3 limits of O. Reg. 419/05. Maximum ground level concentration estimates from Project emissions were determined over an approximate 32 km by 42 km domain with varying receptor grid points to capture the maximum concentrations (Figure 12.3).

Direct influences on the dispersion of pollutants include: source characteristics; wind speeds and direction; atmospheric stability; and, mixing layer depths. A five-year (2018 – 2022) meteorological dataset developed and provided by the MECP was used in the modelling assessment. Upper air data from ECCC’s Maniwaki station (the nearest representative upper air station to the Project site) and surface data from NAV Canada’s Timmins airport station were processed by the MECP using AERMET version 22112. The meteorological data were processed to reflect the land uses surrounding the proposed site

For modeling purposes, the years with the highest mass of material moved (mining rate + material transported from the ore Stockpiles to the Primary Crushers) for each phase was selected. These years are expected to have the highest emissions. As a result, Year -1 represents the worst-case year for Construction and Year 7 represents the worst-case year for operations (refer to Appendix C.1 of the Impact Statement (Air Quality Assessment) for additional details.

Several dispersion modelling scenarios were developed to represent construction and operations phases of the Project. Changes to air quality due to the Highway 655 realignment and new rail spur were also assessed for Project Operation. Full development of the Main Zone of the Open Pit will require the realignment of Highway 655, which is scheduled for completion following the start of operations. The dispersion modelling of outside PA road and rail emissions assessed concentrations at special receptors only, which follows guidance provided by the Ontario Ministry of Transportation (MTO) in the document “Ministry of Transportation Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects” (MTO 2020).

A summary of the dispersion modelling scenarios assessed in this study is presented in Table 12.19.

Table 12.19 Summary of Dispersion Modelling Scenarios Assessed

Scenario	Air CoPCs	Sources Modelled	Receptors
Construction	All ¹	Construction Sources	Special Receptors
Construction	Selected CoPCs ²	Construction Sources	Gridded Receptors ⁴
Construction	All ¹	Construction Sources	Modelled Mine Boundary
Operations	All ¹	Project Sources	Special Receptors
Operations	Selected CoPCs ²	Project Sources	Gridded Receptors ⁴
Operations	All ¹	Project Sources	Modelled Mine Boundary

Scenario	Air CoPCs	Sources Modelled	Receptors
Current Traffic	Traffic Emissions ³	Current Highway 655 Alignment	Special Receptors
Future Traffic	Traffic Emissions ³	Project Sources (Operation) with Realigned Highway 655 and new rail spur	Special Receptors

Note:

1. CoPCs from the Project include SPM, PM₁₀, PM_{2.5}; other CACs including NO_x, SO₂, CO; and Hazardous Air Pollutants (HAPs) including PAHs, VOCs, and metals.
2. CoPCs requiring additional modelling analysis (i.e., CoPCs predicted to exceed air quality criteria at the Modelled Mine Boundary) to determine magnitude, extent, frequency, severity, and sensitivity.
3. CoPCs listed in the Ontario Ministry of Transportation (MTO) Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects (MTO 2020)
4. An approximately 32 km by 42 km computational domain of gridded receptors was used in the modelling assessment, as well as receptors along the Modelled Mine Boundary. Receptors were placed around four bounding boxes that encompassed the emission sources, with spacings following guidance in the MECP Guideline A-11 (MECP 2017).

The three methods/approaches for dispersion modelling were briefly described above. Additional detail is provided here.

The methodology applied to predict the air quality effects of the releases of air CoPCs to the atmosphere is based on the MECP Guideline A-11 (MECP 2017). This methodology specifies that dispersion modelling of particulates and metals in particulates does not account for deposition and depletion of particulates from the plume. This is an important effect and neglecting it in the dispersion modelling assessment is conservative. Dispersion modelling using this approach is referred to as the “Base Method”.

A second methodology, referred to as the Refined Method, was also used in the assessment. This method used the plume deposition and depletion algorithms in the AERMOD model to estimate ambient concentrations for a portion of the particulates/metals being deposited on the ground between each source and receptor. This method is expected to provide a refinement to the conservative dispersion assumptions in the Base Method.

A third methodology which followed MECP guidance provided in chapter 7.4.1 of the MECP procedure document (MECP 2018) was also used to assess effects on air quality. This method notes that for sectors where metals in fugitive dust must be considered, fugitive particulates from on-site roadways and storage piles may be excluded from the modelling assessment when a facility implements a best management plan (BMP) for dust. As it is expected that Canada Nickel will develop and maintain/implement a best management plan to control fugitive dust from the Project activities, modelling of SPM, PM₁₀ and PM_{2.5} was conducted excluding emissions from haul roads and stockpile wind erosion and without invoking plume deposition or plume depletion.

The predictions from all three modelling approaches were compared to the applicable air quality standards.

The Modelled Mine Boundary used in the air quality assessment defines the extent of the area that Canada Nickel will own, lease, or have agreements in place with the owners that would enable Canada Nickel to restrict access to the general public if required. The intention of the Modelled Mine Boundary is to provide a buffer around the PA similar to those at other mines and industrial areas. Within the Modelled Mine Boundary any seasonal or permanent housing will be avoided. People (on snowmobile trails, rivers, other routes), could still pass through the area within the Modelled Mine Boundary (but outside the PA), but time within this area would be limited and no overnight stays would be possible.

The following special receptors were identified and included in the air quality assessment:

- Sensitive Receptor – Non-Indigenous: Locations where non-Indigenous overnight use has been confirmed or assumed.
- Sensitive Receptor – Indigenous: A generalized location identified by Indigenous nations that is used for overnight use.
- Representative Receptor – Indigenous: A generalized location identified for Indigenous use and by IAAC as a point of interest for assessment as part of the Impact Statement.
- Surface Water Receptor: Locations used for the analysis of acid deposition for surface water assessment.

The sensitive and representative receptors identified for input into the Human Health and Ecological Risk Assessment (HHERA) in Appendix C.7 of the Impact Statement include both non-Indigenous and Indigenous receptors. A total of 13 air special receptors, and 4 surface water receptors, were identified and included in the air quality assessment. These special receptor locations are shown on Figure 12.4.

It is noted that Canada Nickel will impose the following restrictions within the Modelled Mine Boundary (Figure 12.4) and at receptors R1 and R5:

- Agreements with property owners within the restricted area to remove buildings (through acquisition of the property or other arrangements)
- Agreements with other individual landowners to prevent construction of any seasonal or permanent housing through acquisition or specific agreements to defer any construction until after mine operations are completed
- Crown Leases to be obtained on Crown lands, to restrict access
- In addition to the receptor specific mitigations listed above, the following general mitigation are proposed:
 - Install signage and/or gates on trails to restrict access and prevent overnight stays in the Modelled Mine Boundary (agreement with landowners if needed to place the signs)
 - Work with the snowmobile clubs to prohibit overnight stays in warming huts except in cases of emergency along the snowmobile trail (signage for warming huts to be installed)

A total of 6,438 gridded, Modelled Mine Boundary and special receptors) were utilized in the assessment covering the LSA. The extended receptor grid around the Modelled Mine Boundary is shown on Figure 12.3.

12.4.1.2 Ambient Light

The effects of the Project lighting on nearby receptors are assessed by comparing predicted light levels to the specified light criteria. As the exterior lighting plan for the Project has not been designed, light levels related to the Project cannot be quantified. Therefore, the lighting assessment method is qualitative. While the predictions are qualitative, they are based on the professional judgment of the study team and incorporate design mitigation to manage potential light effects to acceptable levels, as published in the CIE guidelines (CIE 2017).

The analysis of a change in ambient light focuses on the potential effects that the Project infrastructure and activities could have on light trespass, glare and sky glow. Lighting can become obtrusive if the light criteria (e.g., CIE guidelines) are exceeded.

A residual adverse effect on ambient light is defined as an increase in Project related light emissions such that the CIE guidelines for light trespass and glare in a natural and rural environment are exceeded and sky glow levels would be altered toward those of a rural environment.

Topography, vegetation cover, and distance from the PA were considered when determining the potential for ambient light to affect these receptors. Other land uses near the receptors were also considered when determining the potential effects of ambient light.

12.4.2 Change in Ambient Air Quality

12.4.2.1 Project Pathways

The Project will be developed as an Open Pit operation designed around two discrete, although overlapping, ore bodies – the Main Zone and the East Zone. Ore will be extracted from the pit and processed (crushed, ground, concentrated) at two on-site processing facilities (Processing Plants). Ore will be transported from the pit to the Processing Plants via haul trucks and conveyors. A series of internal roads will be established to facilitate the movement of mine rock and other materials around the site. Final concentrates will be transported from the mine site via rail for further processing.

Construction

During Project construction, emissions of air CoPCs may result from site preparation activities and the construction of Project infrastructure. This would increase the CoPC concentrations in the PA. These emissions would include particulate and combustion gases from construction equipment, and particulate (dust) emissions from operation of heavy earth-moving equipment (including haul trucks), blasting and wind erosion. Tailpipe emissions from the vehicles (i.e., combustion gas emissions such as NO_x, CO, SO₂, SPM, PAHs, and VOCs) are also assessed. Many of the construction activities would not occur continuously (i.e., intermittent), nor would all activities occur concurrently at any given time.

Operations

For the operations phase of the Project, an emissions scenario corresponding to the year with “worst-case” or highest emissions was established for assessment. Year 7 operating data was conservatively used to represent the entire operations phase as it includes maximum mining and production levels in combination with shallower pit depths relative to subsequent years. As the depth of an Open Pit increases, particulate emissions decrease as a portion of the emissions remain trapped in the pit. Utilizing a shallow pit depth in the assessment therefore provides a conservative assessment of emissions because in subsequent years, as the pits get deeper, some of the air contaminants fall within the pit.

During Project operation, emissions of air CoPCs (NO_x, CO, SO₂, TSP, PM₁₀, PM_{2.5}, PAHs and VOCs) will result from the combustion of diesel fuel in mining equipment, and other stationary equipment used during operation. The specific operational activity, each with its own duration and potential for the generation of airborne particulate, and the prevailing meteorological conditions, are considered.

Particulate (dust) emissions (including SPM, PM₁₀, PM_{2.5}, metal substances, RCS and asbestos contained in the mine rock and ore) would result from the following activities:

- operation of mining fleet and other equipment on on-site unpaved roads
- handling and transferring of extracted ore, mine rock and overburden
- stockpile/storage areas of ore, mine rock and overburden
- operations in the Open Pit (e.g., drilling, blasting, material handling, loading)
- ore milling process (e.g., crushing, grinding, concentrating)

Further, winds blowing over storage piles would drive dust from the surface into the air, where quantities would depend on windspeed. Other emissions would also be generated from the use of mill reagents for concentrate processing.

Decommissioning and Closure

Project decommissioning would entail removal of infrastructure and revegetation of the PA. Decommissioning emissions are expected to be less than construction emissions (as no pit extraction or TMF construction would be occurring) and, therefore, the construction assessment will implicitly address the decommissioning phase emissions as well. The closure phase is expected to generate negligible air emissions.

12.4.2.2 Mitigation and Enhancement Measures

Canada Nickel has proposed mitigation measures to avoid or reduce Project-related effects on air quality, which are summarized below. These mitigation measures were incorporated into the emissions estimates used in the air quality assessment. Details of assumptions associated with these mitigation measures, their contaminant emission reduction efficiencies and how they were applied in the emissions estimation are detailed in Section 4.2 of Appendix C.1 of the Impact Statement (Air Quality Assessment).

The following mitigation measures have been incorporated into the design of the Project and/or are proposed to avoid or reduce Project-related effects on air quality:

- Canada Nickel will develop and implement an Air Quality Management Plan which will describe the efforts to be taken to manage the effects of the Project on ambient air quality in accordance with provincial regulatory requirements. The AQMP will specify the mitigation measures for the management and reduction of air emissions during Project construction and operations.
- Canada Nickel will impose the following restrictions within the Modeled Mine Boundary as presented on Figure 12.4 at receptors R1 and R5:
 - Agreements with property owners within the restricted area to remove buildings (through acquisition of the property or other arrangements).
 - Agreements with other individual landowners to prevent construction of any seasonal or permanent housing through acquisition or specific agreements to defer any construction until after mine operations are completed.
 - Crown Leases to be obtained on Crown lands, to restrict access.
 - In addition to the receptor specific mitigations listed above, the following general mitigation are proposed:
 - Install signage and/or gates on trails to restrict access and prevent overnight stays in the Modelled Mine Boundary (agreement with landowners if needed to place the signs).
 - Work with the snowmobile clubs to prohibit overnight stays in warming huts except in cases of emergency along the snowmobile trail (signage for warming huts to be installed).
- Canada Nickel will implement the following design mitigation measures:
 - Primary crushers will be enclosed and equipped with dust collectors that filter the internal air and exhaust it to the environment.
 - Secondary crushers will also be enclosed and equipped with dust collectors.
 - Crushed ore Stockpiles will be enclosed and equipped with dust collectors or vent filters as necessary to demonstrate compliance during the provincial permitting process for air emissions (i.e., Environmental Compliance Approval).
 - Conveyors transferring ore from the crushed ore Stockpiles to the SAG mills will be enclosed.
 - Rail car concentrate loading will be enclosed in buildings.
 - The mobile roadstone primary and secondary crushers will be partially enclosed.
 - Canada Nickel will install a trolley-assist system in the Open Pit for haul trucks to reduce diesel fuel combustion during phase 1 of operations.
 - Canada Nickel will optimize the road network design and the mining schedule to reduce haulage distances.
- Canada Nickel will implement the following unpaved road mitigation methodologies:

- Once the mining operations are able to sustain the aggregate needs, haul roads will be surfaced with crushed gabbro from the Open Pit, which contains low percentages of silica, and will produce a hardened surface that will result in reduced silica emissions relative to other rock types.
- Usage of dust suppressants during non-precipitation days in the summertime. Watering application rates and intervals will be adjusted to achieve the required mitigation efficiency, and additional operational measures that can control water evaporation rates will be implemented if needed.
- Canada Nickel will acquire mobile equipment that meet applicable Transport Canada off-road vehicle emission requirements (Tier 4 emissions standards), where feasible.
- Canada Nickel will implement effective and timely vehicle maintenance to maintain equipment in good working condition.
- Canada Nickel will implement a Traffic Management Plan for the Project.
- Implement an idling policy on site for mobile equipment and vehicles.

Additional Enhanced Mitigation Measures

Canada Nickel commits to reassess the need for additional mitigation measures that may be identified through the provincial permitting process for air emissions (i.e., Environmental Compliance Approval) and detailed design, which may include:

- Limiting haul truck speeds on the Open Pit ramps and the haul roads.
- Use of a commercially available surfactant or water additives.
- Where possible, maintain existing vegetation along the haul roads to act as a wind break.
- Select an electric haul truck fleet to replace in total or in part the main fleet required to haul material from the Open Pit during operations. At such time as a viable model in the size class(es) required is commercially available, this would likely be the preferred option for any further truck purchases over the remaining life of mine.

12.4.2.3 Project Residual Effect

This air quality assessment was conducted following generally accepted methodologies to establish existing (baseline) conditions, estimate emissions and predict the maximum downwind ground level concentrations (GLCs) and long-term depositions for relevant air CoPCs due to Project construction and operations. As such, the findings of this study as described in this report are, for the most part, based on dispersion model predictions. The approach taken is conservative and represents reasonably accurate predictions for an air quality assessment.

This Section provides a summary of the predicted changes in air quality due to the Project including the mitigation measures presented in Section 12.4.1.3. More detailed information is presented in Appendix C.1 of the Impact Statement (Air Quality Assessment).

Emissions from the short-term construction and closure activities are less than emissions during operating scenarios. Details of the construction phase air quality assessment are provided in Appendix C.1 of the Impact Statement (Air Quality Assessment). Only emissions from Project operations are therefore presented in this section.

Predicted Air Quality for Project Alone Emissions

Project alone dispersion model predictions for the operations model scenario for receptors on or outside of the Modelled Mine Boundary were compared to the relevant air quality criteria. Results for the three modelling approaches described in Section 12.4.1.1 are presented below. Results for the Base Method and the Refined Method were considered in the residual effects assessment, while the results for the MECP Method are included to denote the status of the proposed Project with respect to the provincial permitting process (should the Project be approved).

Dispersion modelling using the Base Method for Project Operations (not accounting for plume deposition and depletion for particulates and metals), which is expected to over-predict ambient GLCs, had the following results:

- Of the 85 CoPCs assessed for Project Operations, five (SPM, PM₁₀, aluminum, manganese, and muscovite) are predicted to be above their applicable Provincial criteria for the Project Alone. Additionally, NO₂ is predicted to be above the hourly Federal CAAQS. The exceedances are discussed in the following bullet points below. A summary of the maximum predictions (Project Alone) at or outside the Modelled Mine Boundary is presented in Table 5-5 in Appendix C.1 of the Impact Statement (Air Quality Assessment).
- Suspended Particulate Matter or SPM (dust): The maximum predicted 24-hour average SPM GLC using the Base Method is predicted to exceed the 24-hour criterion by 322% at the Modelled Mine Boundary during operations. A contour plot of maximum predicted 24-hour average SPM concentrations (Base Method) throughout the LSA for Operations is presented on Figure 12.5. A figure plotting the frequency of exceedance of the SPM AAQC (using the Base Method) is presented on Figure 12.6. While the AAQC is predicted to be exceeded in a large area around the Modelled Mine Boundary, using this conservative methodology, frequencies of exceedance greater than 5% only occur within 2 km of the north Modelled Mine Boundary and less than 1 km from the east boundary.
- With additional enhanced mitigation implemented, the maximum predicted 24-hour average SPM exceedance could reduce to 111% with the predicted area of exceedance being substantially reduced with concentrations exceeding the AAQC by more than 0.5% of the time only occurring within 2-km of the north Modelled Mine Boundary (Figure 12.7 and Figure 12.8). The limiting effect for the MECP SPM AAQC is visibility and the area around the Project is primarily forested where human presence is expected to be infrequent.
- Particulate Matter – 10 microns or less (PM₁₀): The maximum predicted 24-hour average PM₁₀ concentration using the Base Method is above its criterion by 196% for the Operations scenario. A contour plot of the maximum predicted 24-hour average PM₁₀ concentrations (Base Method) throughout the LSA is presented on Figure 12.9 and a contour plot of the predicted frequencies of

exceedance of the PM₁₀ 24-hour average criterion is presented on Figure 12.10. Frequencies of exceedance greater than 2% occur within 1.5-km of the north Modelled Mine Boundary. With additional enhanced mitigation implemented, the maximum predicted 24-hour average PM₁₀ exceedance using the Base Method would reduce to 48%. Contour plots of the maximum predicted 24-hour average PM₁₀ concentrations (Base Method) and frequencies of exceedance with implementation of additional enhanced mitigation measures are shown on Figure 12.11 and Figure 12.12. The predicted area of PM₁₀ exceedance is substantially reduced with concentrations exceeding the AAQC by more than 0.2% of the time only occurring within 2-km from the north Modelled Mine Boundary.

- Aluminum and Muscovite: Maximum predicted 24-hour average aluminum and muscovite concentrations (using the Base Method) were above their MECF screening levels by 208% and 706%, respectively. Predicted concentrations above a screening level indicates that further assessment is required to determine if there is a potential for an adverse effect. This assessment is provided in the Human Health and Ecological Risk Assessment (Appendix C.7 of the Impact Statement).

Aluminum: A contour plot of maximum predicted 24-hour average aluminum concentrations (Base Method) for Project Operations is presented on Figure 12.13 and a contour plot of the predicted frequencies of time above the aluminum 24-hour average screening level is presented on Figure 12.14. The figures show that while concentrations above the screening level are predicted within 6-7 km from the Modelled Mine Boundary, the frequency of time above the screening level over most of this area would be infrequent with frequencies greater than 2% only occurring within 1.5 km from the north Modelled Mine Boundary and less than 0.5 km from the east.

Muscovite: A contour plot of maximum predicted 24-hour average muscovite concentrations is presented on Figure 12.15 and a contour plot of the predicted frequencies of time above the muscovite 24-hour average screening level is presented on Figure 12.16. The area for which predicted muscovite concentrations are above the MECF screening level extends through most of the LSA. Predicted concentrations above the muscovite screening level will occur no more than 30% of the time at the Modelled Mine Boundary, with frequencies greater than 5% occurring within 6 km from the north, 2 km from the east and 5 km from the west Modelled Mine Boundary.

Aluminum and Muscovite: With additional enhanced mitigation implemented, the maximum predicted 24-hour average aluminum and muscovite exceedances using the Base Method would reduce to 54% and 303%, respectively.

- Manganese: The maximum predicted 24-hour average manganese concentration using the Base Method is above its criterion by 21%. A contour plot of maximum predicted 24-hour average manganese concentration (Base Method) is presented on Figure 12.17. The area above the AAQC is small and located on the west Modelled Mine Boundary. Exceedances in this area would be infrequent (no more than 0.3% of the time). With additional enhanced mitigation implemented, the maximum predicted 24-hour average manganese concentration will be below its AAQC.
- Nitrogen dioxide (NO₂): The maximum predicted 3-year average 98th percentile daily maximum 1-hour average NO₂ concentration is predicted to be above the 1-hour NO₂ (2025) CAAQS at 3 of

the 10 special receptors assessed outside the Modelled Mine Boundary, with the maximum prediction being 41% above the CAQSQS. The CAAQS are non-regulatory health and environmentally based ambient air objectives that are used to assess general air quality in air zones and reflect desirable concentrations of contaminants in air from all sources (MECP 2024). The CAAQS are not used to assess compliance at a facility's property line or at specific locations, but rather are used to assess regional air quality. Predicted concentrations at individual locations above the CAAQS in proximity to the Project are not considered exceedances, but rather are an indicator that air management actions should be considered to reduce ambient levels. Maximum predicted hourly and 24-hour average NO₂ concentrations at all outside Modelled Mine Boundary receptors are well below their respective MECP criteria. A contour plot of maximum predicted 3-year average 98th percentile daily maximum 1-hour average NO₂ concentration is presented on Figure 12.18.

Using the Refined Method (accounting for plume deposition and depletion for particulates and metals), which is expected to provide a more representative prediction of ambient GLCs had the following results for the Operations scenario:

- SPM (dust): the maximum predicted 24-hour average SPM Ground Level Concentration (GLC) is 63% above the MECP AAQC.
- Aluminum: The maximum predicted 24-hour average aluminum concentration is 16% above its screening level (using the Refined Method).
- Muscovite: the maximum predicted 24-hour average muscovite concentrations was above its MECP screening level by 262% (using the Refined Method).
- Other CoPCs: The maximum GLCs of all other CoPCs are predicted to be below their applicable criteria (using the Refined Method).

Using the MECP Method for dispersion modelling, the maximum predicted SPM, PM₁₀ and PM_{2.5} concentrations (excluding emissions from haul roads and Stockpiles), which is the method utilized in Environmental Compliance Approval applications for these CoPCs, are all below their criteria for the Operations scenario.

Predicted Air Quality - Cumulative (Project + Background) Effects

The cumulative effects (Project + Background) prediction for Project Operations using the Base Method (not accounting for plume deposition and depletion for particulates and metals) which is expected to over-predict ambient GLCs, had the following results:

- Of the 85 CoPCs assessed, seven are predicted (Base Method) to be above applicable criteria for the cumulative (Project + background) case (SPM, PM₁₀, muscovite, aluminum, manganese, RCS, benzo(a)pyrene). A summary of the maximum predictions (Cumulative) at or outside the Modelled Mine Boundary locations is presented in Table 5-6 in Appendix C.1 of the Impact Statement (Air Quality Assessment).
- Maximum predicted cumulative SPM, PM₁₀, muscovite, aluminum and manganese are above their 24-hour average criteria by 345%, 222%, 707%, 212% and 23%, respectively. As no

background measurement data is available for muscovite, the maximum predicted cumulative concentration is the same as for the Project Alone.

- The highest predicted annual average cumulative SPM concentration is 3% above its criterion.
- The highest predicted 24-hour average cumulative PM_{2.5} GLC (Base Method) is 5% above the criterion. However, the model prediction is the maximum daily average concentration rather than a 98th percentile value and therefore provides a conservative comparison to the MECP AAQC.
- The maximum predicted 24-hour average cumulative RCS concentration is above its criteria by 17%.
- Cumulative 24-hour and annual average benzo(a)pyrene (B(a)P) are predicted to exceed their criteria by 10% and 3%, respectively. The background concentration of B(a)P is above applicable air quality criteria, with the Project only providing a small (1%) contribution to the cumulative concentrations, therefore mitigation is not expected to be required.
- As the background CoPC concentrations used in this assessment for hourly and daily averages are 90th percentile values, combination of these background levels with the 98th percentile metrics used for comparison to the CAAQS will result in conservative cumulative concentration estimates.
- The maximum predicted 1-hour NO₂ concentration (with background) at outside Modelled Mine Boundary (i.e., the cumulative 3-year average 98th percentile daily maximum 1-hour average NO₂ concentration) is predicted to be above the 1-hour NO₂ (2025) CAAQS by 47%.
- With additional enhanced mitigation, the maximum predicted (Base Case) 24-hour average cumulative PM_{2.5}, RCS and manganese concentrations will be below their respective criteria, as will the annual average SPM.
- With additional enhanced mitigation, the aluminum prediction using the Base Method will reduce to 56% above its screening level and the maximum muscovite GLC will decrease to 303% above its screening level.
- With additional enhanced mitigation, the highest predicted 24-hour average cumulative SPM GLC will reduce to 123% above the criterion and the highest predicted 24-hour average cumulative PM₁₀ GLC will be 61% above its criterion.

Using the Refined Method (When plume deposition and depletion are included in the dispersion modelling) which is expected to provide more representative predictions, the only particulate or metal CoPCs predicted to be above their criteria are SPM and muscovite with their maximum predicted GLCs decreasing by greater than 50% relative to the conservative no plume depletion (Base Case) assessment.

The MECP Method (excluding emissions from haul roads and Stockpiles) is not applicable to cumulative effects, as the Ontario permitting process does not require background concentrations to be included in the assessment.

Indigenous Receptors

Using the Base Method, for Project operations, 85 CoPCs were assessed and 80 are predicted to be below their applicable criteria at all Indigenous receptors outside the Modelled Mine Boundary for the Project Alone. A summary of the maximum predictions (Project Alone) at outside the Modelled Mine Boundary Indigenous locations is presented in Table 5-9 in Appendix C.1 of the Impact Statement (Air Quality Assessment).

The maximum predicted 24-hour average concentrations of SPM and PM₁₀, are above their respective MECP criteria by 67% and 16%, while aluminum and muscovite are above their MECP screening levels by 21% and 227%, respectively. The SPM, PM₁₀, aluminum and muscovite concentrations are above their criteria at an Indigenous receptor infrequently, with the maximum frequencies being 0.7%, 0.1%, 0.1% and 3.1%, respectively. The maximum predicted 3-year average 98th percentile daily maximum 1-hour average NO₂ concentration is predicted to be above the 1-hour NO₂ (2025) CAAQS at two Indigenous receptor, with the maximum prediction being 41% above the CAQQS.

Maximum predicted cumulative concentrations SPM, PM₁₀, NO₂, aluminum and muscovite are above their respective criteria. Maximum predicted cumulative B(a)P concentrations are predicted to exceed the applicable 24-hour and annual criteria at Indigenous receptor locations. The background level of B(a)P is above the applicable air quality criteria, with the Project only providing a small contribution to the cumulative concentrations.

Highway 655 Realignment and New Rail Spur

Changes in air quality were assessed for the following components that are ancillary to the Project, but are included in the activities considered in the assessment of effects since they are required for the operation of the mine:

- Rail spur line connecting the Process Plant to the existing Ontario Northland Railway spur line at the Kidd Mine, owned, operated and maintained by the Ontario Northland Railway
- Realigned segment of Highway 655 owned, operated and maintained by the MTO

When the ancillary components predictions are combined with the Project Alone Operations predictions, the maximum predicted special receptor concentrations either remained unchanged (the change in concentration due to the ancillary components was negligible relative to that from the Project) or increased slightly as described herein. The maximum predicted 24-hour average PM₁₀ special receptor concentration was unchanged from that for the Project and is predicted to exceed its criteria by the same percentage (16%). The maximum predicted 3-year average 98th percentile daily maximum 1-hour average NO₂ concentration is predicted increase by 7% relative to the Project Alone Operations prediction and to be above the 1-hour NO₂ (2025) CAAQS. All other CoPCs assessed were below their criteria for the ancillary components combined with Project Alone Operations.

Summary

With additional enhanced mitigation implemented, the following residual effects on air quality are anticipated:

- Direction: Adverse – the Project activities will result in an increase in ambient concentrations of some CoPCs in ambient air.
- Magnitude: High – using the Base Method, outside Modelled Mine Boundary predicted 24-hour average SPM and PM₁₀ GLCs would exceed their criteria. With the Refined Method, SPM and PM₁₀ would also exceed their criteria. However, with the MECP Method, no exceedances would be predicted; considering the suite of modelling results (Base, Refined, MECP), the magnitude could be classified as moderate.
- Geographic extent: LSA – SPM and PM₁₀ are predicted to be above their criteria in the LSA
- Timing: No sensitivity
- Duration: Medium-term –the predicted SPM and PM₁₀ exceedances would occur over the operations phase
- Frequency: Multiple Irregular event – predicted SPM and PM₁₀ exceedances will occur infrequently
- Reversibility: Reversible – once Project Operations cease, ambient air quality levels will decrease.

12.4.3 Change in Ambient Light

12.4.3.1 Project Pathways

Lighting sources from the Project construction and operations phases will include stationary lighting sources associated with buildings/infrastructure and mobile sources from the mining equipment and traffic. Stray lighting can cause light pollution which can cause adverse effects for surrounding land users as well as migrating wildlife.

12.4.3.2 Mitigation Measures

The following measures will be incorporated into the design of the Project and/or proposed to avoid or reduce Project-related effects on ambient light:

- Canada Nickel will consider the following principles during the Project lighting design for construction, operations, and closure/decommissioning:
 - Project lighting (locations, intensity) will be limited to that which is necessary for safe and efficient Project activities
 - Use lighting fixtures that limit or concentrate the lighting to targeted areas and avoid light spilling out of the spaces to be illuminated
 - Limit the projection of light toward the sky by using fixtures that meet actual lighting needs
 - Avoid the emission of light at more than 90 degrees, using luminaires with known cut-off specifications

- Mobile and permanent lighting will be located such that unavoidable light spill off the working area is not directed toward receptors outside of the PA, to the extent practicable
- Canada Nickel will design the exterior lighting systems for Project operations to include directional lighting to limit light trespass and to avoid glare. Downward directed, full cutoff luminaires will be incorporated into the Project lighting plan (where practical) and portable lighting will be positioned to limit visibility outside the PA.
- Canada Nickel will leave tree cover in place to reduce the line-of-sight from onsite infrastructure to Highway 655.
- Canada Nickel will implement lighting at required locations along Highway 655 in accordance with applicable Ministry of Transportation standards.
- Lighting during closure will follow the same principles as for the Project construction phase.

12.4.3.3 Project Residual Effect

There are few light sensitive receptors in the LSA outside the Modelled Mine Boundary, and they are all distant from the Project with intervening forested areas that will obstruct Project lighting. Therefore, no adverse light trespass impacts at the receptors are anticipated.

The nearest light sensitive receptor to the Project outside the Modelled Mine Boundary is an overnight Indigenous habitation location about 5.7 km to the west of the Process Plant area and at least 7.3 km from the Impoundment Facility. Intervening forests (consisting primarily of coniferous trees that provide year-round line of sight obstruction) will block light emissions from the Process Plant and ground level site traffic from reaching this receptor. The difference in elevation between the top of the Impoundment Facility (at its maximum height) and this receptor will be 113 m. At 7.3 km from receptor R8, with intervening forested areas, the top of the Impoundment Facility (at its maximum height) will not be visible at this receptor, thus no adverse light trespass effects are predicted at this receptor.

The nearest receptor with continuous occupancy will be the campground at Big Water Lake, which is about 24.5 km from the processing areas and 28 km from the Impoundment Facility. It is outside the LSA and is thus too far away from the PA to be affected by Project lighting.

Construction lighting will be specified to use only as much lighting as is necessary for safe and efficient construction activities and is not expected to be visible at the light-sensitive receptors. Where nighttime construction work is conducted, lighting used will be in compliance with regulations and permit conditions issued for the Project. Portable light units typically illuminate an area lateral to the unit and are typically bright powerful lights that unavoidably cause some glare and vertically directed illumination. This type of effect can be avoided by using directional light fixtures to avoid the transmission of light outside of the PA. By implementing mitigation, the levels of light trespass and glare from mobile artificial lighting units are not expected to exceed CIE guidelines at the receptor locations noted above. Mitigation measures would also control light emissions that may contribute to sky glow, and so it is expected that sky glow levels would be similar to baseline conditions during Project construction.

Industrial facilities are typically characterized by a much lower presence of reflective surfaces, such as windows, and a lower level of “decorative” lighting. Site lighting that uses luminaires with full horizontal cutoff fixtures can greatly reduce or eliminate the single glaring light that can confuse migrating birds. By implementing mitigation, the levels of light trespass and glare are expected to be maintained below the CIE guidelines at the receptor locations noted above. Adherence to mitigation measures related to full cut-off fixtures and other design approaches are expected to limit sky glow contributions. It is therefore expected that sky glow levels will remain close to baseline levels during Project operations.

With mitigation described above, the potential effects of Project lighting on light trespass, glare and skyglow are expected to be low.

The residual adverse effect for light is characterized as having adverse direction, low magnitude, LSA geographic extent, no sensitivity, medium term duration, continuous frequency, and reversible.

12.4.4 Summary of Project Residual Effects

Table 12.20 summarizes Project residual effects on the atmospheric environment.

Table 12.20 Project Residual Effects on the Atmospheric Environment

Residual Effect	Residual Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Ambient Air Quality	O	A	H	LSA	NS	MT	IR	R
Change in Ambient Lighting	O	A	L	LSA	NS	MT	C	R
<p>KEY See Table 12.11 for detailed definitions</p> <p>Project Phase C: Construction O: Operations D: Decommissioning</p> <p>Direction: P: Positive A: Adverse N: Neutral</p> <p>Magnitude: N: Negligible L: Low M: Moderate H: High</p> <p>Geographic Extent: PA: Project Area LSA: Local Study Area RSA: Regional Study Area</p> <p>Timing NS: No sensitivity MS: Moderate sensitivity HS: High sensitivity</p> <p>Duration: ST: Short-term MT: Medium-term LT: Long-term</p> <p>Frequency: S: Single event IR: Multiple Irregular event R: Multiple Regular event C: Continuous</p> <p>Reversibility: R: Reversible I: Irreversible</p> <p>N/A: Not applicable</p>								

With additional enhanced mitigation implemented, the residual effects of the Project on air quality are expected to result in an adverse change due to Project air emissions, with the magnitude characterised as high for two CoPCs (SPM and PM₁₀) that are predicted (using a conservative method) to exceed their regulatory criteria in the LSA. The predicted exceedances would be infrequent over most of the LSA and the effect will be reversible.

The residual adverse effect for light is characterized as having adverse direction as the Project will increase light levels; however, these will be of low magnitude due to Project design, and due to intervening forested areas that will obstruct Project lighting from affecting light sensitive receptors.

12.4.4.1 Summary of Adverse Residual Effects

The Project will result in emissions of 80 CoPCs during construction and 85 CoPCs during operations that will result in increased concentrations of these parameters in the LSA. With enhanced mitigation, the concentrations of all but SPM and PM₁₀ will be below their applicable criteria. Two CoPCs (aluminum and muscovite) are predicted to be above their screening levels and are assessed in the Human Health and Ecological Risk Assessment (Appendix C.7 of the Impact Statement).

Lighting sources from the Project construction and operations phases will include stationary and mobile lighting sources that may cause some increased lighting outside the PA. During construction and operations, with mitigation, the levels of light trespass and glare from mobile artificial lighting units are not expected to exceed CIE guidelines at the receptor locations that have been identified. There are few light sensitive receptors in the LSA, and they are all well removed from the Project with intervening forested areas that will obstruct Project lighting. Thus, no substantive adverse impacts from Project light trespass are expected at the receptors. Following decommissioning and closure, ambient lighting is expected to return to baseline conditions once project lighting sources are removed from the area.

12.5 Potential Effects on Federal Lands

There are no federal lands within the LSA. The closest Federal lands are the Taykwa Tagamou Nation Reserve lands located approximately 37 kilometres away (straight line) from the Project site (14 kilometres southeast of Cochrane) and is on the edge of the RSA. As such, no changes to the environment are anticipated on Federal lands as a result of changes to air quality or lighting. No additional mitigation measures beyond those identified are specifically required for Federal lands.

12.6 Prediction Confidence

12.6.1 Change in Ambient Air Quality

The effects of Project releases of air CoPCs are based on calculated emission rates and the AERMOD dispersion modelling results. Prediction confidence is high because emission rates used in the modelling were estimated based on a combination of emission factors, engineering estimates and maximum emission levels. Actual emissions vary from hour to hour and day to day. Emissions from the Project employed a conservative, worst-case hourly emissions approach (e.g., based on MECP guidelines, the Base Method, not including plume depletion) which is expected to over-estimate longer-term averaging

periods. Because of the nature of this approach, there is a high degree of confidence that emissions are over estimated. Air quality dispersion models such as AERMOD also employ assumptions to simplify the random behaviour of the atmosphere into short periods of average behaviour. These assumptions limit the capability of the model to replicate every individual meteorological event. To compensate for these simplifications, five years of meteorological data are applied to evaluate a wide range of possible conditions. Regulatory models, such as AERMOD, are also designed to have a bias toward over estimation of contaminant concentrations (e.g., to be conservative under most conditions).

As noted, the methodology (Base Method) that was used to model emissions of SPM, PM₁₀, PM_{2.5} and metals from in the dispersion modelling assessment did not account for deposition and depletion of particulate from the plume. This methodology is highly conservative. Research has demonstrated that air quality modelling of haul roads typically over-predicts ambient air quality from these sources and that, in reality, air quality effects generally only extend a few hundred metres from the source. Much of the ground level fugitive dust is likely to be removed close to the source due to the low release height and turbulence which leaves the particles temporarily close to the ground where they are subject to removal by impaction on horizontal and nearby vertical surfaces (including vegetation and structures) (Countess et al 2001).

12.6.2 Change in Ambient Light

The effect of light from the Project is evaluated based on the location and site condition of the Project and nearby residential and other special receptors. With proper design and mitigation of lighting sources, including consideration of the CIE 150:2017 guideline, the prediction confidence for the lighting assessment is medium.

12.7 Assumptions

The assessment was completed based on available design information (including Project layouts and operational conditions) and is subject to change if substantial modifications to the Project design are implemented.

The following conservative assumptions were used when assessing air quality for the Project and associated components:

- Year -1 is the worst impactful construction year and Year 7 is the worst impactful operation year for the Project.
- Simultaneous operations of all construction equipment was considered.
- Simultaneous operations of all operations equipment was considered.
- Construction and operations would occur 24-hours per day, seven (7) days per week, with two shifts per day.
- The modelling conservatively assumed that there were no precipitation days that would naturally mitigate dust emissions.

- The realigned Highway 655 and rail dispersion modelling predictions were conservatively combined with the Project operations dispersion modelling predictions assuming the maximum predicted concentrations due to both sources occurs simultaneously.
- Assumed mitigation control efficiencies are provided in Table 4-2 in Appendix C.1 of the Impact Statement (Air Quality Assessment).

12.8 Follow-up and Monitoring

12.8.1 Change in Ambient Air Quality

Canada Nickel will implement follow-up and monitoring programs to verify the accuracy of effects and to evaluate the effectiveness of mitigation measures, the results of which will be used to identify and implement adaptive management measures, as appropriate. As it relates air quality, a follow-up and monitoring program will be developed for Project construction and operations. This program will include the type of monitoring, the CoPCs to monitor, and the frequency of monitoring. Chapter 34 of the Impact Statement includes additional details on follow-up and monitoring programs proposed by Canada Nickel.

12.8.2 Change in Ambient Light

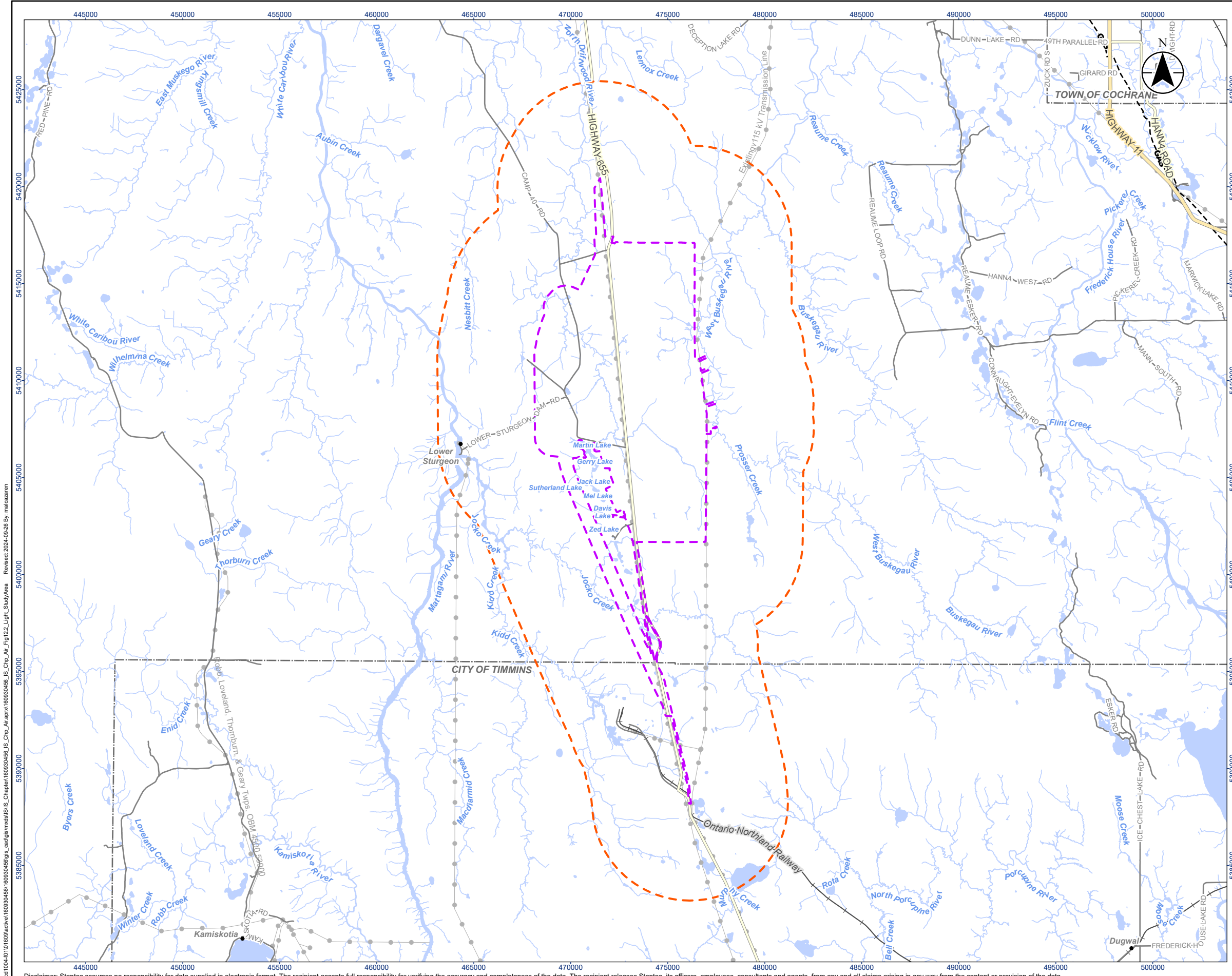
With proper design and mitigation of lighting sources, follow-up and monitoring is not anticipated to be required.

12.9 References

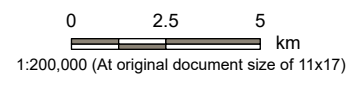
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12.10 Figures



- Legend**
- Project Area
 - Local/Regional Study Area
- Base Features**
- Expressway / Highway
 - Major Road
 - Minor Road
 - Railway
 - Existing Transmission Line
 - GAS- Natural Gas Pipeline
 - Watercourse
 - Municipal Boundary - Lower Tier
 - Waterbody



- Notes**
1. Coordinate System: NAD 1983 UTM Zone 17N
 2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2023.



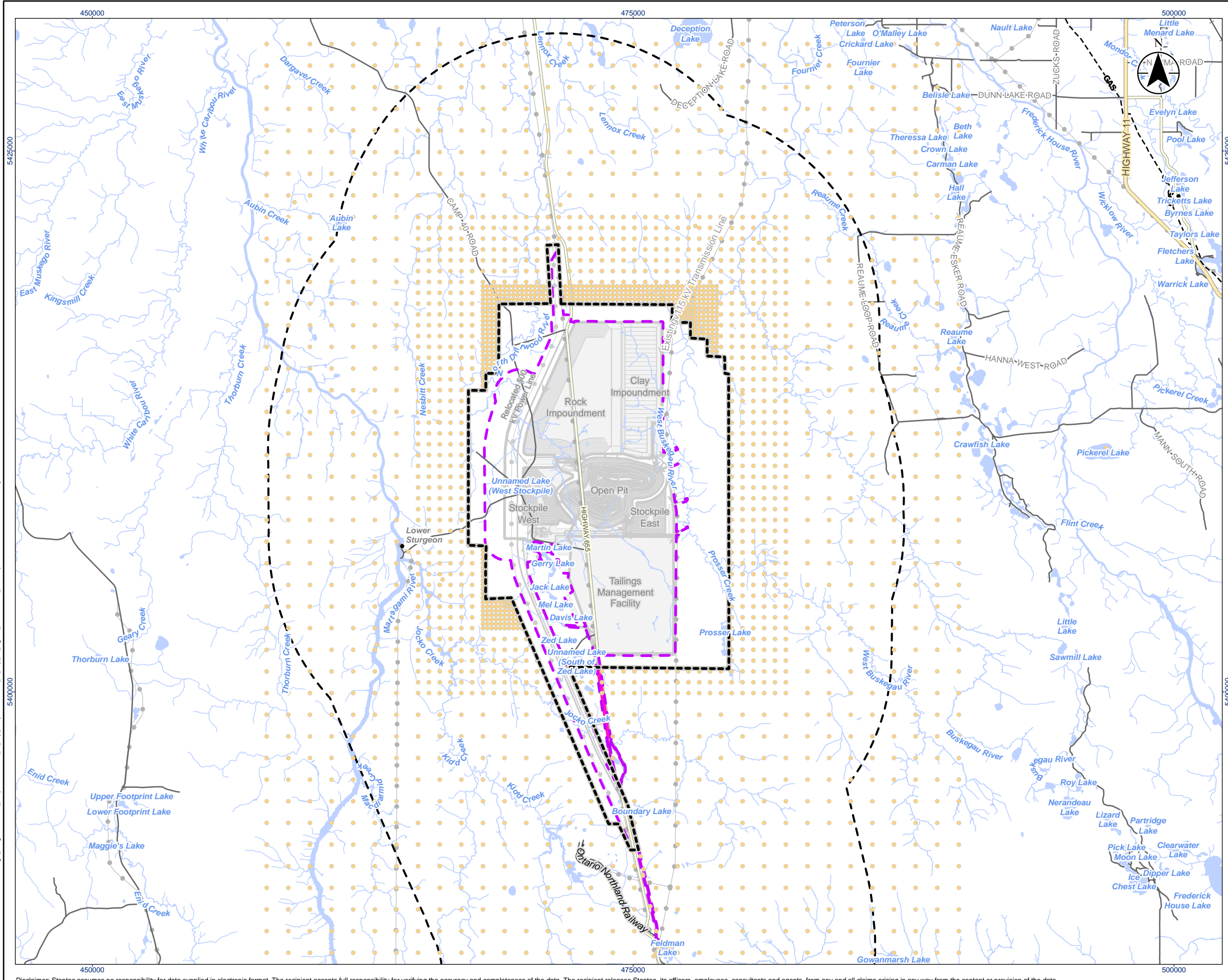
Project Location: Timmins, Ontario
 160930456 REVA
 Prepared by malcazaren on 2024-09-26

Client/Project:
 Canada Nickel Company (CNC)
 Crawford Nickel Project

Figure No.
12.2

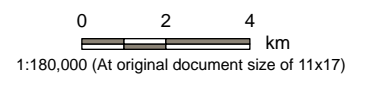
Title
Light Assessment - Project Area, Local Study Area, and Regional Study Area

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 Revised: 2024-09-26 By: malcazaren



Legend

- Project Area
 - Local Study Area (4km Buffer of PA)
 - Project Area - Existing Highway 655 and Transmission Line
 - Receptor Grid
 - Modelled Mine Boundary
 - Proposed Project Components
- Base Features**
- Expressway / Highway
 - Major Road
 - Minor Road
 - Railway
 - Existing Transmission Line
 - GAS- Natural Gas Pipeline
 - UP-- Unknown Pipeline
 - Watercourse
 - Waterbody



- Notes**
1. Coordinate System: NAD 1983 UTM Zone 17N
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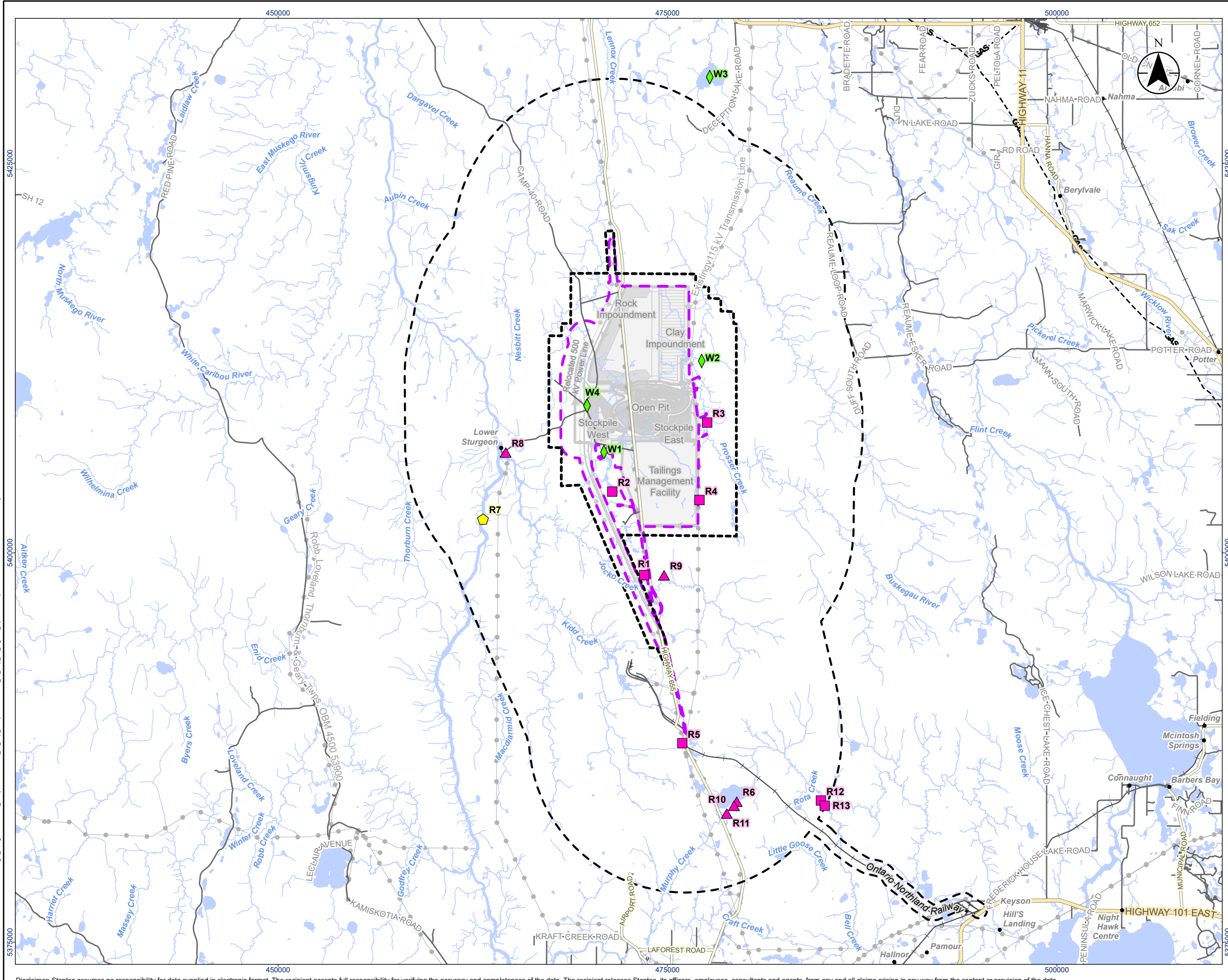


Project Location: Timmins, Ontario
 Prepared by: malcazaren on 2024-09-26
 160930456 REVA

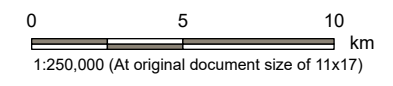
Client/Project: Canada Nickel Company (CNC)
 Crawford Nickel Project

Figure No.: **12.3**
 Title: **Modelling Domain and Extended Receptor Grid**

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 Revised: 2024-09-26 By: malcazaren



- Legend**
- Project Area
 - Local Study Area (10km Buffer of PA)
 - Expressway / Highway
 - Major Road
 - Minor Road
 - Railway
 - Existing Transmission Line
 - GAS - Natural Gas Pipeline
 - WA - Water Pipeline
 - UP - Unknown Pipeline
 - Watercourse
 - Waterbody
 - Sensitive Receptor - Non-Indigenous
 - Sensitive Receptor - Indigenous
 - Representative Receptor - Indigenous
 - Surface Water Receptor
 - Modelled Mine Boundary
 - Proposed Project Components



- Notes**
1. Coordinate System: NAD 1983 UTM Zone 17N
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Project Location: Timmins, Ontario
 Prepared by: malcazaren on 2024-09-26
 160930456 REVA

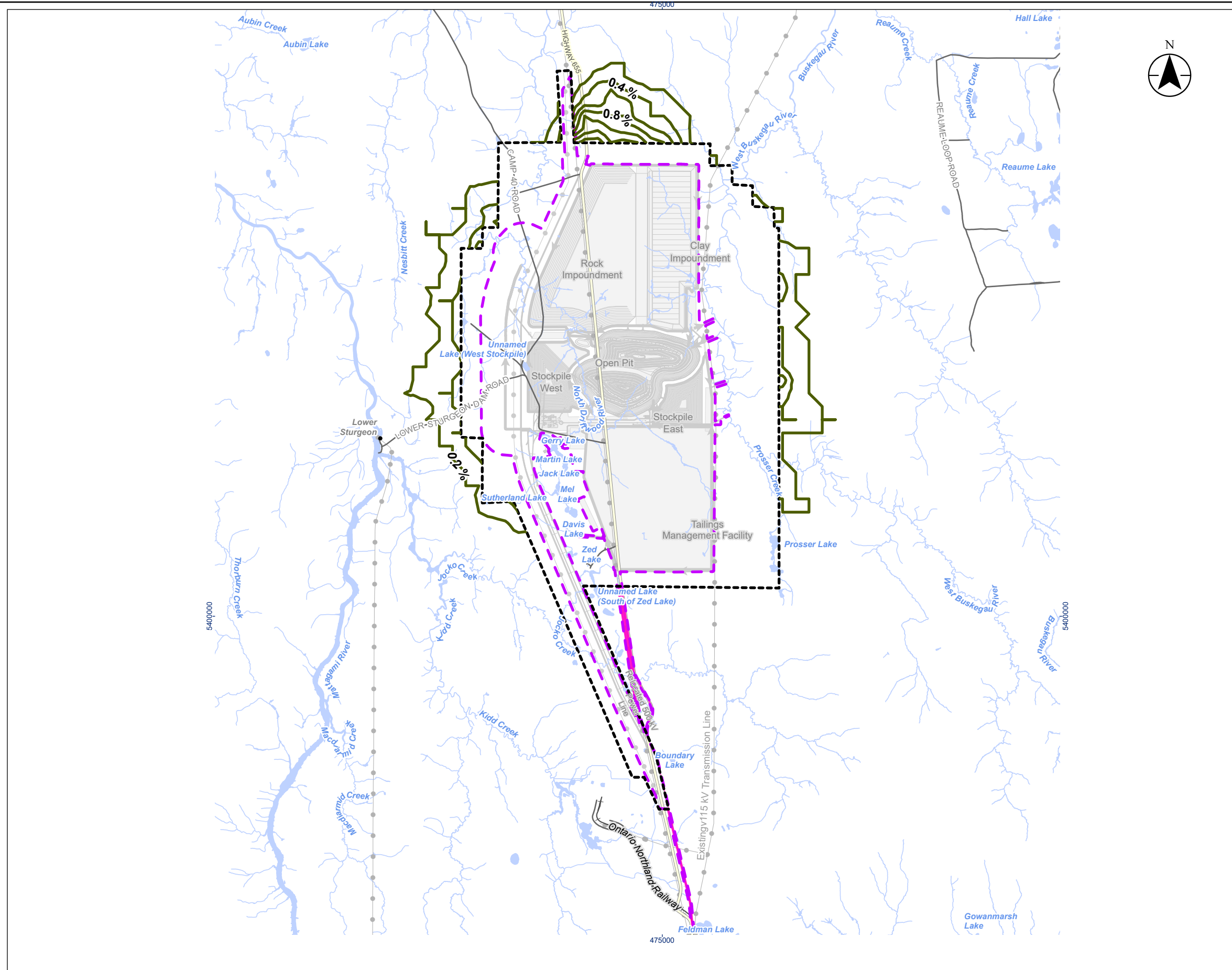
Client/Project: Canada Nickel Company (CNC) Crawford Nickel Project

Figure No. **12.4**

Title: **Special Receptor Locations**

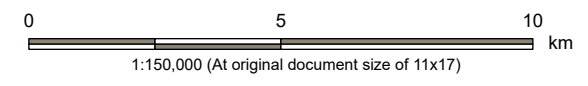
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- Legend**
- | | |
|-----------------------------------|----------------------------|
| Project Area | Base Features |
| Project Area - Existing | Major Road |
| Highway 655 and Transmission Line | Minor Road |
| Frequency of Exceedance | Railway |
| Modelled Mine Boundary | Existing Transmission Line |
| Proposed Project Components | Watercourse |
| | Waterbody |

Legend Notes:
 Frequency of Exceedance of the SPM 24-Hour AAQC of 120 µg/m³ over a 5 year period.



- Notes**
1. Coordinate System: NAD 1983 UTM Zone 17N
 2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2023.



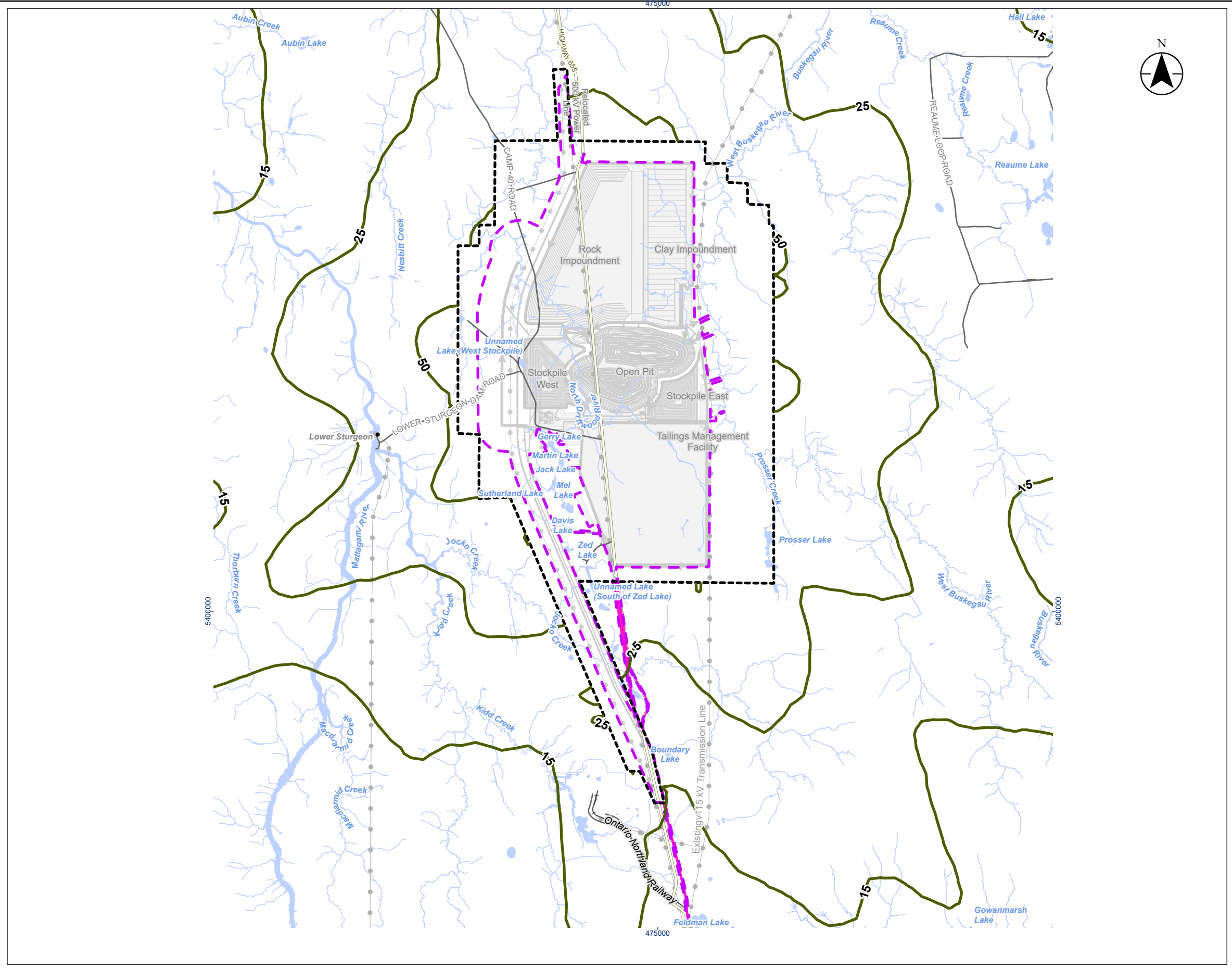
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 Prepared by: malcazaren on 2024-09-26
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Client/Project: Canada Nickel Company (CNC)
 Crawford Nickel Project

Figure No.: **12.8**

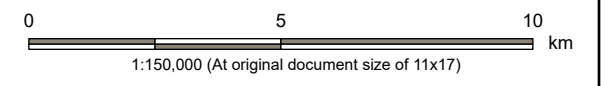
Title: **Frequency of Exceedance Plot for Project Alone, Operation Scenario - 24-Hour Average SPM Using the Base Method (Additional Mitigation Measures)**

V:\1004-101\160930456\160930456\gis_data\gis_data\160930456\160930456\IS_Chp_Av_Fig12xx_ConcentrationContourMap Revised: 2024-09-26 By: malcazaren



- Legend**
- | | |
|-----------------------------------|----------------------------|
| Project Area | Base Features |
| Project Area - Existing | Major Road |
| Highway 655 and Transmission Line | Minor Road |
| Concentration Contours | Railway |
| Modelled Mine Boundary | Existing Transmission Line |
| Proposed Project Components | Watercourse |
| | Waterbody |

Legend Notes:
 SPM 24-Hour Average AAQC: 120 µg/m³
 Background Concentration (not included): 26.5 µg/m³



- Notes**
1. Coordinate System: NAD 1983 UTM Zone 17N
 2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2023.



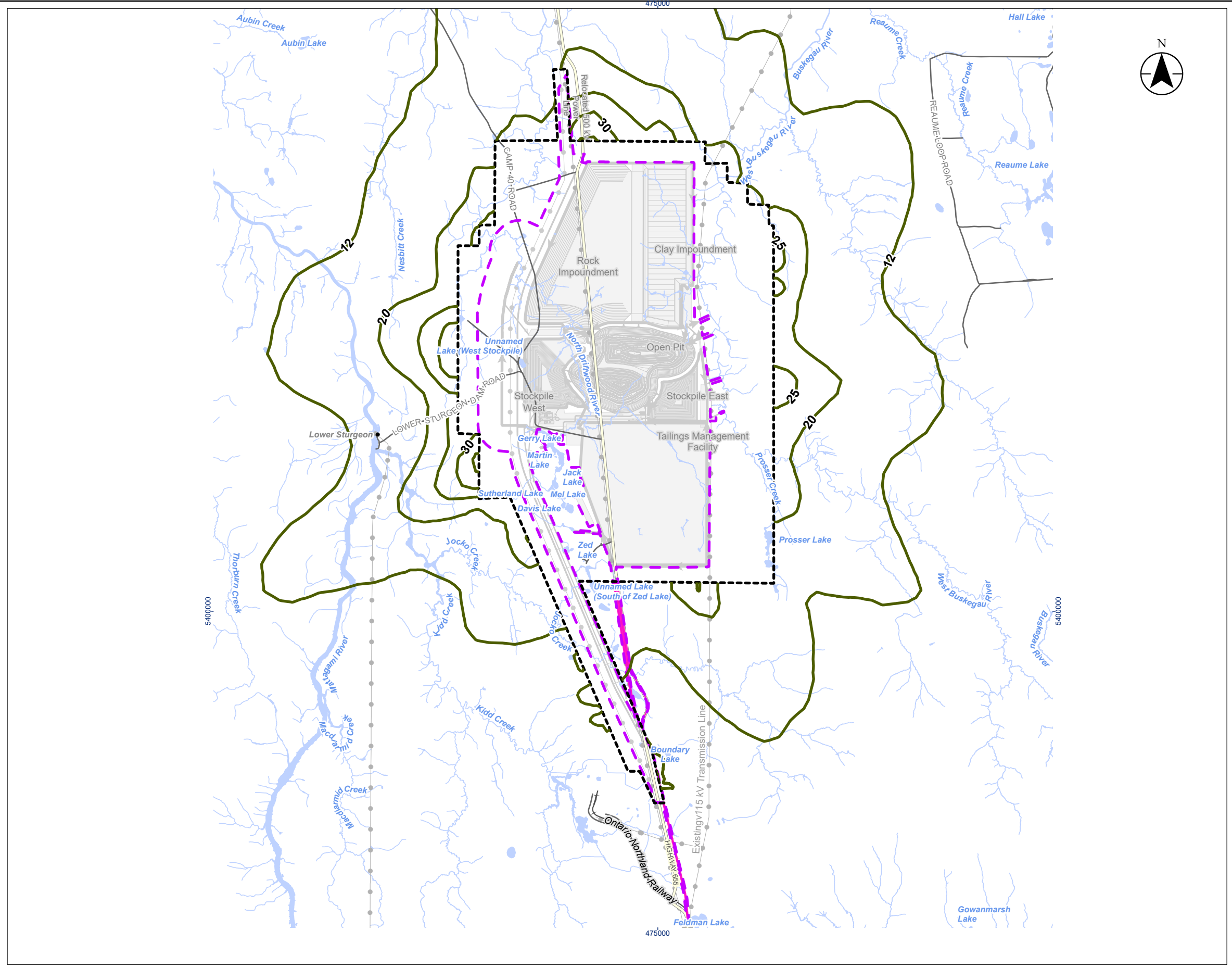
Project Location: Timmins, Ontario
 160930456 REVA
 Prepared by malcazaren on 2024-09-26

Client/Project:
 Canada Nickel Company (CNC)
 Crawford Nickel Project

Figure No.
12.11

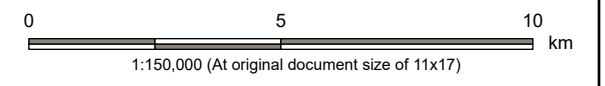
Title:
Concentration Contour Plot for Project Alone, Operation Scenario - 24-Hour Average PM₁₀ Using Base Method (Additional Mitigation Measures)

V:\1004-101\160930456\160930456\GIS_Cadging\mxd\160930456\IS_Chp_Av_Fig12xx_ConcentrationContourMap Revised: 2024-09-26 By: malcazaren



- Legend**
- | | |
|-----------------------------------|----------------------------|
| Project Area | Base Features |
| Project Area - Existing | Major Road |
| Highway 655 and Transmission Line | Minor Road |
| Concentration Contours | Railway |
| Modelled Mine Boundary | Existing Transmission Line |
| Proposed Project Components | Watercourse |
| | Waterbody |

Legend Notes:
 Aluminum 24-Hour Average Screening Level: 12 µg/m³
 Background Concentration (not included): 0.42 µg/m³



- Notes**
1. Coordinate System: NAD 1983 UTM Zone 17N
 2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2023.



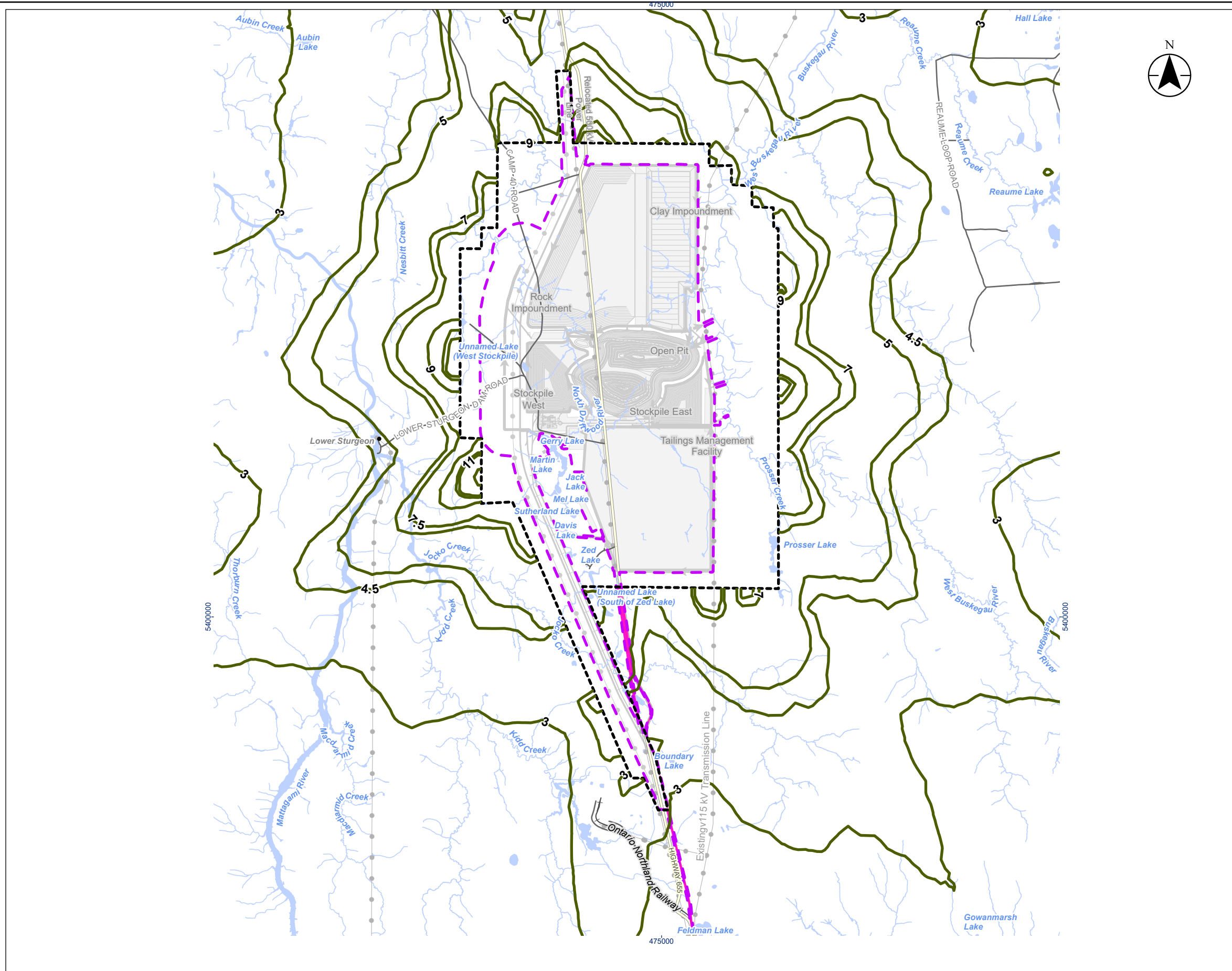
Project Location: Timmins, Ontario
 160930456 REVA
 Prepared by malcazaren on 2024-09-26

Client/Project:
 Canada Nickel Company (CNC)
 Crawford Nickel Project

Figure No.
12.13

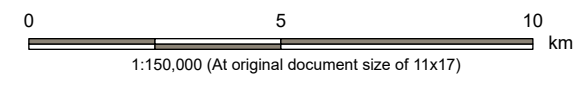
Title
Concentration Contour Plot for the Project Alone, Operation Scenario - 24-Hour Average Aluminum Using Base Method

J:\04-101\009\active\160930456\mxd\GIS_Chapter\160930456_IS_Chp_Av_Fig12xx_ConcentrationContourMap Revised: 2024-09-26 By: malcazaren



- Legend**
- | | |
|---|----------------------------|
| Project Area | Base Features |
| Project Area - Existing Highway 655 and Transmission Line | Major Road |
| Concentration Contours | Minor Road |
| Modelled Mine Boundary | Railway |
| Proposed Project Components | Existing Transmission Line |
| | Watercourse |
| | Waterbody |

Legend Notes:
 Muscovite 24-Hour Average Screening Level: 1.5 µg/m³
 Background Concentration (not included): No data



- Notes**
- Coordinate System: NAD 1983 UTM Zone 17N
 - Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2023.



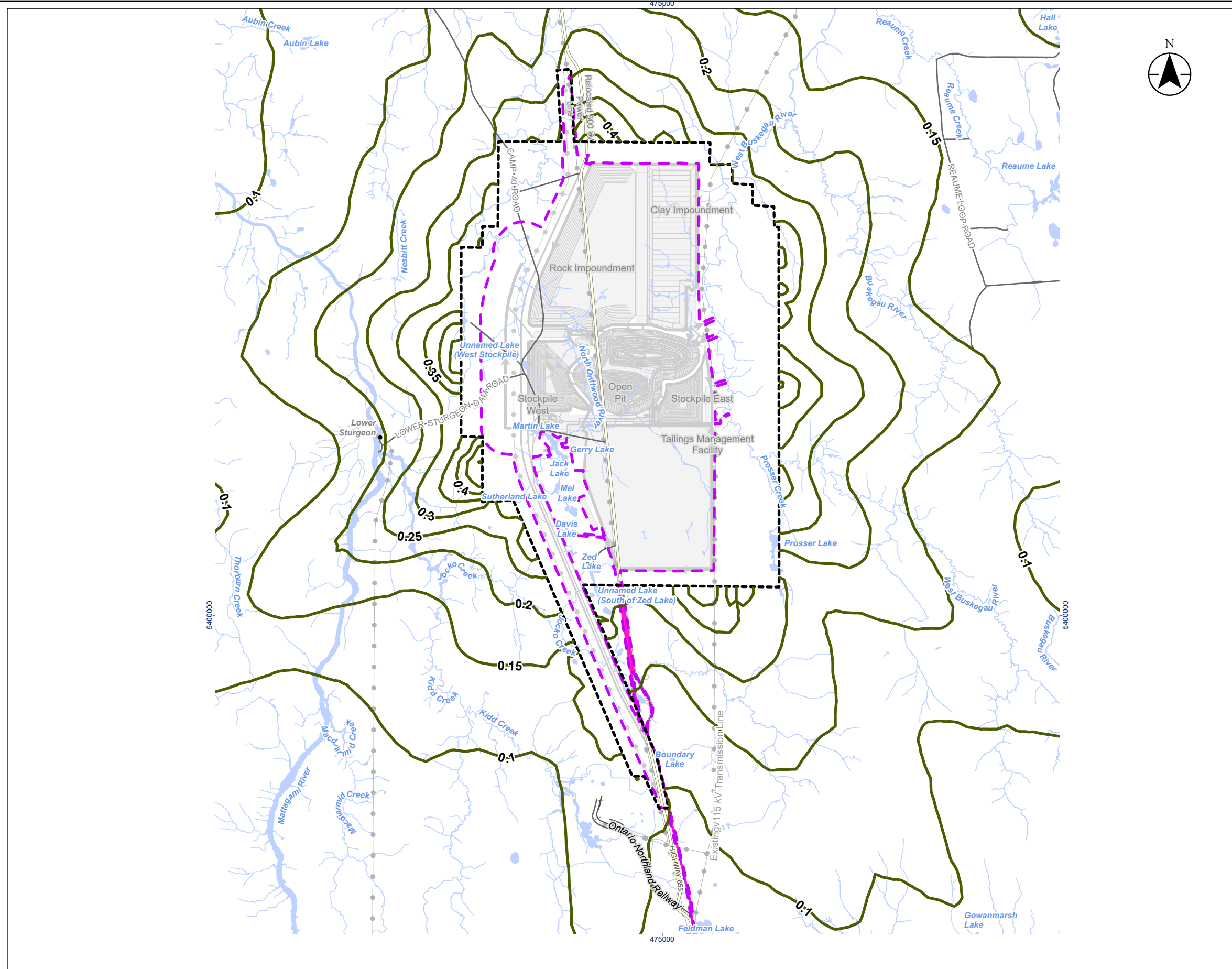
Project Location: Timmins, Ontario
 Prepared by: malcazaren on 2024-09-26
 160930456 REVA












Client/Project:
 Canada Nickel Company (CNC)
 Crawford Nickel Project

Figure No.
12.15

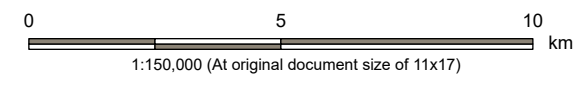
Title
Concentration Contour Plot for the Project Alone, Operation Scenario - 24-Hour Average Muscovite Using Base Method

V:\1004-101\1609\active\160930456\160930456\gis_cad\gis_cad\gis_cad\gis_cad\160930456_IS_Chp_Av_Fig12xx_ConcentrationContourMap Revised: 2024-09-26 By: malcazaren



- Legend**
- | | |
|---|--|
|  Project Area | Base Features |
|  Project Area - Existing Highway 655 and Transmission Line |  Major Road |
|  Concentration Contours |  Minor Road |
|  Modelled Mine Boundary |  Railway |
|  Proposed Project Components |  Existing Transmission Line |
| |  Watercourse |
| |  Waterbody |

Legend Notes:
 Manganese 24-Hour Average AAQC: 0.4 µg/m³
 Background Concentration (not included): 0.0086 µg/m³



- Notes**
1. Coordinate System: NAD 1983 UTM Zone 17N
 2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2023.



Project Location: Timmins, Ontario
 160930456 REVA
 Prepared by malcazaren on 2024-09-26

Client/Project: Canada Nickel Company (CNC)
 Crawford Nickel Project

Figure No.: **12.17**

Title: **Concentration Contour Plot for the Project Alone, Operation Scenario - 24-Hour Average Manganese Using Base Method**

