



CANADA NICKEL
COMPANY



Stantec

Crawford Nickel Project Impact Statement

Chapter 20 Assessment of Potential Effects on Climate Change



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Acronyms and Abbreviations

BAT	Best Available Technology
BEP	Best Environmental Practice
CH ₄	methane
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalent
ECCC	Environment and Climate Change Canada
GHG	greenhouse gas
GWP	global warming potential
IAA	<i>Impact Assessment Act, 2019</i>
IAAC	Impact Assessment Agency of Canada
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IPT	In-Process Tailings
kt	kilotonnes
M	million
MTO	Ministry of Transportation
N ₂ O	Nitrous oxide
Ni	nickel
NIR	National Inventory Report
O.Reg	Ontario Regulation
ONR	Ontario Northland Railway

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Acronyms and Abbreviations - 20 Assessment of Potential Effects on Climate Change
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PA	Project Area
ROW	Right-of-Way
SACC	Strategic Assessment of Climate Change
t	tonnes
t CO ₂ e	tonnes of carbon dioxide equivalent
TMF	Tailings Management Facility
VC	Valued Component

Glossary of Technical Terms

Carbon dioxide equivalent (CO ₂ e)	The CO ₂ e emissions are obtained by multiplying the emissions of a greenhouse gas (GHG) by its global warming potential (GWP) for a given time horizon. CO ₂ e is a metric to describe the combined effect that GHGs have on the atmosphere.
Carbon sinks	the ability of a forest, ocean or other natural environment to absorb carbon dioxide from the atmosphere
Global warming potential (GWP)	A measure of how much heat a greenhouse gas traps in the atmosphere relative to CO ₂ .
Greenhouse gas (GHG)	A GHG is defined as any gas in the atmosphere that absorbs and re-emits infrared radiation.
Net-zero	The concept that the emissions being emitted are offset by emission reductions elsewhere (definition applied by Strategic Assessment of Climate Change, ECCC 2020).
Scope 1 emissions	Direct GHG emissions that occur from sources that are owned or controlled by the Project (e.g., emissions from mining fleet).
Scope 2 emissions	Indirect GHG emissions associated with the generation of acquired energy from sources that are not owned or controlled by the Project (e.g., emissions in Ontario from electricity generation).

20 Assessment of Potential Effects on Climate Change

Climate Change was selected as a Valued Component (VC) for the assessment because changes to global climate parameters resulting from the Crawford Nickel Project ('the Project') have the potential to affect human, ecological and socio-economic health. Climate change has been identified as a topic of concern by regulators, Indigenous nations, stakeholders, and the public.

The Tailored Impact Statement Guidelines (TIS Guidelines) require consideration of the effects of climate change in a consistent and transparent manner through guidance provided in the Government of Canada's Strategic Assessment of Climate Change (SACC) (ECCC 2020) and the Draft Technical Guide Related to the Strategic Assessment of Climate Change (draft Technical Guide) (ECCC 2021a).

For this assessment, 'climate change' is defined in accordance with the definition in the SACC, which is:

"a persistent, long-term change in the state of the climate, measured by changes in the mean state and/or its variability. Climate change may be due to natural internal processes, natural external forcings such as volcanic eruptions and modulations of the solar cycle, or to persistent anthropogenic changes in the composition of the atmosphere or in land use."

For this assessment, 'greenhouse gases' (GHGs) are defined as gases that absorb and re-emit infrared radiation from the planetary surface, thereby introducing the potential effect of warming the lower levels of the atmosphere and acting as a thermal blanket for the planet. Globally, GHGs are emitted from numerous natural and human sources and the increased atmospheric concentrations have been associated with climate change (Intergovernmental Panel on Climate Change [IPCC], 2007). Although the science of climate change has not been advanced to the point where a clear cause-and-effect relationship can be established between project-specific emissions and subtle changes to global climate, GHG assessments determine the effect on facility-level and jurisdictional inventories. Therefore, changes in the release of GHG as a result of the Project are used in this assessment to characterize the effects of the Project on climate change.

For this assessment, 'carbon sinks' are defined in accordance with the definition in the SACC, which is "the ability of a forest, ocean or other natural environment to absorb carbon dioxide from the atmosphere." Changes to carbon sinks as a result of the Project, alongside changes in GHG releases, are used in this assessment as a measure of the effects of the Project on climate change.

The Project will result in the release of GHGs to the atmosphere. Releases of GHGs are expressed as emissions in the form of tonnes of carbon dioxide equivalent (CO₂e). The GHG assessment includes the known GHG substances that are emitted by the Project. These are:

- Carbon dioxide (CO₂)
- Methane (CH₄)
- Nitrous oxide (N₂O)

Other GHGs include perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF₆). These GHGs are usually found in primary aluminum production, production of chemicals used for air conditioning and refrigeration and foam and aerosol applications, and in electrical equipment manufacturing, respectively. The Project is not expected to use or generate these GHGs and therefore they are not expected to be released in substantial amounts, or any amounts at all. Therefore, these GHGs were not included in this GHG assessment.

The Project will also result in changes to carbon sinks through land disturbance as a result of the land footprint required for the Project, as well as through the potential for passive and active carbonation during Project operation. These changes to carbon sinks are expressed as either a loss or gain in carbon sequestration potential, representing the absorption of carbon dioxide in natural processes and measured in the form of tonnes of carbon dioxide equivalent (CO₂e).

The key potential effects addressed in the following assessment is the “change in the release of GHGs into the environment” and the “change in carbon sinks” due to Project emissions during construction, operation, and decommissioning.

This VC chapter on climate change deals exclusively with the potential effects of the Project on climate change and does not assess the potential effects of climate change on the Project. A climate change resilience assessment was also completed as a separate report (Appendix J of the Impact Statement [Site-Wide Water Management Plan]) and is further discussed in Chapter 30 of the Impact Statement (Assessment of Potential Effects of the Environment on the Project).

Climate Change is linked to other VCs, including:

- Atmospheric Environment (Chapter 12), whereby emissions from Project activities have the potential to increase the emission of GHG.
- Surface Water (Chapter 15), whereby climate change has the potential to alter future frequency and intensity of rainfall events affecting flows in waterbodies.
- Vegetation, Riparian and Wetland Environments (Chapter 16), whereby climate change has the potential to alter growing periods/seasons for vegetation and affecting water levels associated with vegetation (e.g. wetlands).
- Birds and Bird Habitat (Chapter 18), whereby climate change has the potential to alter bird habitat affecting abundance and distribution.
- Wildlife and Wildlife Habitat (Chapter 19), whereby climate change has the potential to alter wildlife habitat affecting abundance and distribution.
- Indigenous Interests (Chapters 25-28), whereby climate change has potential to affect vegetation and wildlife used for traditional practices, affects to subsistence and livelihood, economic opportunities, and health and wellbeing of Indigenous nations.

20.1 Scope of Assessment

This section defines and describes the scope of the assessment of potential effects of the Project on climate change.

20.1.1 Regulatory and Policy Setting

The management of GHG emissions and carbon sinks is subject to several statutes, policies, and frameworks within Ontario and within Canada. These include:

- Canada's 2030 Emissions Reduction Plan (ECCC 2022)
- Canada's Greenhouse Gas Reporting Program, collected under the *Canadian Environmental Protection Act* (S.C. 1999, c. 33)
- Strategic Assessment of Climate Change (SACC) (ECCC 2020)
- The *Canadian Net Zero Emissions Accountability Act* (S.C. 2021, c. 22)
- Update to the Pan-Canadian Approach to Carbon Pollution Pricing 2023-2030 (ECCC 2021b)
- Ontario Emissions Performance Standard (EPS) (O. Reg. 241/19)
- Ontario Greenhouse Gas Emissions: Quantification, Reporting and Verification Regulation (O.Reg. 390/18)

As per the TIS Guidelines (Appendix A.1), this assessment of the potential effects on climate change provides information to satisfy the requirements of the SACC, and the associated draft Technical Guide. As per the TIS Guidelines, the SACC and the draft Technical Guide, the assessment of the potential effect of the Project on climate change includes the assessment of the changes in the release of GHG emissions and the changes in carbon sinks. In addition to this assessment summarized herein, the SACC requires that supplementary information also be provided. The required supplementary information, listed in detail below, has been provided in Appendix C.6 of the Impact Statement (Greenhouse Gases Following the Strategic Assessment of Climate Change):

- GHG emissions
 - description of the Project's main sources of GHG emissions and their estimated annual emissions over the Project lifetime
 - net GHG emissions by year for each phase of the Project
 - each term of Equation 1 of the SACC
 - emission intensity for each year of the operation phase of the project
 - the quantity and a description of the "units produced" used in Equation 2 of the SACC for each year of the operation phase of the Project
 - methodology, data, emission factors and assumptions used to quantify each element of the net GHG emissions
 - a discussion on the development of emissions estimates and uncertainty assessment

- description of large sources of GHG emissions that may be the consequence of accidents or malfunctions
- Carbon sinks
 - a description of Project activities in relation to important landscape features and regionally dominant ecosystems
 - land areas directly impacted by the project, by ecosystem type
 - initial carbon stocks in living biomass, dead biomass and soils by ecosystem type on land impacted by the Project
 - fate of carbon stocks on directly impacted land by ecosystem type
 - anticipated land cover on the impacted land areas after the Project is in place
- Impact of the Project on federal emissions reduction efforts and on global GHG emissions
- GHG Mitigation Measures
 - Best Available Technology/Best Environmental Practice (BAT/BEP) determination to identify ways to limit the Project's GHG emissions
 - a description of any additional mitigation measures that will be taken to mitigate remaining GHG emissions, if applicable
 - a description of any offset credits that have been or will be obtained to mitigate remaining GHG emissions
 - a description of measures taken to mitigate the Project's impact on carbon sinks, including measures to restore disturbed carbon sinks
 - subject to public availability of information, a comparison of the Project's projected GHG emission intensity to the emission intensity of similar high-performing, energy efficient Project types in Canada and internationally
 - a list of the federal, provincial or territorial GHG legislation, policies or regulations that will apply to the Project
- Net-zero plan
 - summary of credible net-zero plan and estimated net GHG emissions for each Project phase, indicating 0 net GHG emissions by 2050 and beyond

Furthermore, the potential for the Project to cause an accidental fire and associated forest fire risk is assessed in Chapter 31, Section 31.2.8 of the Impact Statement (Accidents and Malfunctions). As no increased forest fire risk was identified, the impact of forest fires on climate change is not assessed further herein.

20.1.2 The Influence of Consultation and Engagement on the Assessment

Canada Nickel has engaged with potentially affected Indigenous nations, regulators, the public, and other stakeholders. Table 20.1 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 climate change, 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 climate change raised during engagement for the Project and any additional and specific mitigation measures added to address one or more of the concerns, are described in Table 20.1.

Table 20.1 Summary of Key Information, Indigenous Knowledge, and Concerns for the Project Related to Climate Change

Topic	Key Information, Indigenous Knowledge, and Concerns	Influence on the Assessment	Where Information is Addressed in the Impact Statement
GHG Emissions and Carbon Sinks	<ul style="list-style-type: none"> NRCan commented about the validity of Canada Nickel's Carbon Storage Plan and expressed that a Best Available Technologies/Best Environmental Practices (BAT/BEP) assessment be prepared, alongside a credible net-zero plan that uses and builds off the BAT/BEP determination to describe mitigation measures that will be taken to minimize GHG emissions. Members of the public, stakeholder groups and Apitipi Anicinapek Nation, Mattagami First Nation and Métis Nation of Ontario – Region 3 expressed support for increased carbon capture/storage opportunities and commented about the Project's ability to store carbon through the mineral carbonation of tailings and the potential effectiveness of this novel technology in reducing greenhouse gas emissions and the Project's ability to reach carbon neutral/net-zero by 2050. Members of the public and other stakeholders expressed concern regarding: <ul style="list-style-type: none"> impacts of the Project on climate change (i.e., GHG emissions) use of diesel-fired generation during various mine phases how the Project will be carbon neutral and how the In-Process Tailings (IPT) Carbonation works Stakeholder groups, Taykwa Tagamou Nation, Apitipi Anicinapek Nation, Flying Post First Nation, Matachewan First Nation, Mattagami First Nation, and Métis Nation of Ontario (Region 3) expressed concern regarding potential changes to wetlands and muskeg function for carbon sequestration within the PA. The Impact Assessment Agency of Canada and Taykwa Tagamou Nation expressed concern regarding carbon sequestration, specifically whether the overburden that will be removed are accounted in climate change modelling. Flying Post First Nation, Matachewan First Nation, Mattagami First Nation, Métis Nation of Ontario - Region 3, and Taykwa Tagamou Nation expressed concern over the effects from changes to waste management because of mineral carbonization techniques. 	<ul style="list-style-type: none"> An assessment of GHG emissions and carbon sinks was completed in accordance with the SACC. This includes: <ul style="list-style-type: none"> a BAT/BEP determination to identify ways to reduce the Project's GHG emissions an assessment of the potential for carbon sequestration including the IPT Carbonation process calculation of net GHG emissions by year for each phase of the Project description of the Project's main sources of GHG emissions with description of diesel-fired generation limited to construction phase and emergency use during operations phase a quantification of direct GHG emissions as a result of land-use change – part of which includes the assessment of GHG emissions from overburden removal a quantification of changes to carbon sinks, including impacts of changes to wetlands and impacts of overburden removal a net-zero plan for the Project to achieve net-zero by 2050 and description of carbon sinks including IPT Carbonation process Informed the assessment of potential effects on vegetation, riparian and wetland environments, including an assessment of potential changes in wetland form and function Informed the assessment on Indigenous interests in Chapters 25 to 28 of the Impact Statement (Assessment of Potential Effects on Indigenous Interests). 	<ul style="list-style-type: none"> Chapter 20 (Assessment of Potential Effects on Climate Change) Appendix C.6 (Greenhouse Gases Following the Strategic Assessment of Climate Change), Sections 2, 4, 5, 6, 9 Chapter 16 (Assessment of Potential Effects on Vegetation, Riparian and Wetland Environments) Chapters 25 to 28 (Assessment of Effects on Indigenous Interests)
Project's Potential Contributions to Climate Change and Effects on Harvested Resources and their Habitats	<ul style="list-style-type: none"> Members of the public and other stakeholders expressed concern regarding: <ul style="list-style-type: none"> how forest fire risk will be incorporated into the impact assessment Best Management Practices (in context of other countries) Apitipi Anicinapek Nation and Taykwa Tagamou Nation expressed concern regarding the Project's contribution to climate change. Taykwa Tagamou Nation expressed concern regarding the effects of climate change on all aspects of the Project, with an emphasis on water management infrastructure and water dependent design components such as waterbodies or waterways that the Project will collect water from. Matachewan First Nation and Mattagami First Nation expressed concern regarding climate change, increased wind, and the potential for interactions with the tailings, including dust dispersal and affects on harvested resources and the environment. Taykwa Tagamou Nation recommended Canada Nickel provide up-to-date climatological information and demonstrate how extreme conditions due to climate change will be incorporated into both baseline conditions and future predictions. 	<ul style="list-style-type: none"> The potential for the Project to cause an accidental fire and associated forest fire risk has been evaluated as part of the Accidents and Malfunctions assessment. The assessment of the Project's contribution to climate change was completed in accordance with the SACC. This includes: <ul style="list-style-type: none"> calculation of net GHG emissions by year for each phase of the Project description of the Project's main sources of GHG emissions a BAT/BEP determination to identify ways to reduce the Project's GHG emissions a net-zero plan an assessment of the potential for carbon capture and storage an assessment of the impact of the Project on federal and global emissions reduction efforts an assessment of risks to water management infrastructure an evaluation of wind changes due to climate change and the impacts from dust an evaluation of up-to-date climatological conditions and extreme conditions An assessment of the effects on surface water was conducted, whereby potential climate change effects were incorporated. An air quality assessment was conducted, including an assessment of particulate matter effects. Informed the assessment on Indigenous interests in Chapters 25 to 28 of the Impact Statement (Assessment of Potential Effects on Indigenous Interests). Canada Nickel's responses to mitigation recommendations made by the Indigenous nations are provided in Chapters 25 to 28 of the Impact Statement (Assessment of Potential Effects on Indigenous Interests). 	<ul style="list-style-type: none"> Chapter 20 (Assessment of Potential Effects on Climate Change) Appendix C.6 (Greenhouse Gases Following the Strategic Assessment of Climate Change) Chapter 12 (Assessment of Potential Effects on the Atmospheric Environment) Chapter 15 (Assessment of Potential Effects on Surface Water) Chapters 25 to 28 (Assessment of Effects on Indigenous Interests) Chapter 30 (Assessment of Potential Effects of the Environment on the Project) Chapter 31 (Accidents and Malfunctions)

Where made available by Indigenous nations through engagement, information gathering, and voluntary information sharing, 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.

20.1.3 Potential Effects, Pathways and Measurable Parameters

Table 20.2 summarizes the potential environmental effects of the Project on climate change, as well as the effect pathways, and measurable parameters. The potential effects, effect pathways, and measurable parameters used in this assessment are selected based on understanding of the Project and the requirements in the SACC.

Table 20.2 Potential Effects, Effect Pathways and Measurable Parameters for Climate Change

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in release of greenhouse gas (GHG)	<p>Release of direct GHG emissions during construction, operation and decommissioning from:</p> <ul style="list-style-type: none"> • Mobile combustion of diesel and gasoline in vehicles, construction equipment and mining equipment • Blasting activities in Open Pit mine • Change in land cover, including decay of cleared vegetation • Stationary combustion of diesel for site support/services <p>Release of indirect GHG emissions during construction, operation and decommissioning from:</p> <ul style="list-style-type: none"> • Acquired energy (electrical power) from grid to operate the facilities and associated equipment 	Net change in GHG emissions due to the Project (tonnes of CO ₂ e) over Project lifetime
Change in carbon sinks	<p>Lost and gained sequestration potential from land use change.</p> <p>Capture and storage of CO₂ through mineral carbonization in tailings and waste rock.</p>	Net change in carbon dioxide release/storage potential (tonnes of CO ₂ e)

20.1.4 Boundaries

20.1.4.1 Spatial Boundaries

The **Project Area (PA)** encompasses the project footprint and is the anticipated area of physical disturbance associated with the construction, operation and decommissioning/closure of the Project. The PA is 11,785 hectares (ha) (118 square kilometres [km²]) and includes, but is not limited to, the Open Pit, Stockpiles, ore-processing components, Tailings Management Facility (TMF), water management facilities and drainage works, mining infrastructure, site access and internal roads, power supply and distribution, and waste management. The extent of the PA for the Project is shown on Figure 20.1.

No **Local Study Area** or **Regional Study Area** have been established for the assessment of GHGs for the Project, as the environmental effects associated with GHG emissions are a global phenomenon. This is based on GHGs mixing well and remaining in the atmosphere for some time dispersing well away from their emission sources (i.e., effects are not localized) (Intergovernmental Panel on Climate Change [IPCC] 2013). The assessment of climate change herein considers the changes in GHG releases and changes in carbon sinks in the PA during construction, operations, and decommissioning and closure of the Project.

20.1.4.2 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+)

Changes to releases of GHG emissions and carbon sinks are assessed on an annual basis for each temporal phase of the Project.

20.1.5 Residual Effects Characterization

The characterizations used to assess residual effects on climate change are provided in Table 20.3.

Table 20.3 Characterization of Residual Effects on Climate Change

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	Positive – a residual effect that moves measurable parameters in a direction beneficial to climate change relative to baseline. Adverse – a residual effect that moves measurable parameters in a direction detrimental to climate change relative to baseline. Neutral – no net change in measurable parameters for climate change relative to baseline.
Magnitude ¹	The amount of change in measurable parameters or the VC relative to existing conditions	Negligible – no measurable change in GHG releases and/or carbon sinks relative to baseline. Low – a change in GHG releases and/or carbon sinks that is less than 2,400 kt CO ₂ e Moderate – a change in GHG releases and/or carbon sinks that is in between 2,400 kt CO ₂ e and 18,000 kt CO ₂ e High – a change in GHG releases and/or carbon sinks that is greater than 18,000 kt CO ₂ e
Geographic Extent	The geographic area in which a residual effect occurs	PA – residual effects are restricted to the PA Global – residual effects extend beyond the RSA
Timing	Considers when the residual effect is expected to occur, where relevant to the VC	No sensitivity – timing does not affect VC. Moderate sensitivity – timing may affect VC during lower sensitivity period, but the effects are manageable with proper planning and mitigation measures. High sensitivity – residual effects occur during high sensitivity period.
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	Short-term – the residual effect is restricted to the life of the Project (construction, operations, and decommissioning and closure) Long-term – the residual effect extends beyond the life of the Project (construction, operations, and decommissioning and closure)
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	Single event Multiple irregular event – occurs at no set schedule Multiple regular event – occurs at regular intervals Continuous – occurs continuously
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	Reversible – the residual effect is likely to be reversed after activity completion and reclamation Irreversible – the residual effect is unlikely to be reversed
Note: 1. In terms of Magnitude, the threshold for Low measurement is based on the Ontario provincial threshold for industrial emitters' mandatory inclusion in the Emissions Performance Standards program, projected over the same timeframe as the life of the Project. The threshold for High measurement is based on the 90 th percentile of industrial emitters' mandatory reporting to the federal Greenhouse Gas Reporting Program, projected over the same timeframe as the life of the Project.		

20.2 Existing Conditions for Climate Change

The environmental effects associated with climate change are a global phenomenon, effects are not localized, and there are no existing material sources of GHG emissions identified in the PA, therefore no baseline report on the existing conditions of the PA has been prepared. This assessment of climate change considers the quantity of GHGs released during construction, operation activities and decommissioning of the Project, including the assessment of foregone carbon sinks from removal of existing biomass in the PA and the potential for carbon sequestration through passive and active carbonation. The land types expected to be impacted by the Project include forestland and wetlands in the Boreal Shield region of Ontario, just north of Timmins.

20.3 Project Interactions with Climate Change

Table 20.4 identifies, for each potential effect, the physical activities that might interact with the VC and result in the identified effect. These interactions are indicated by a check mark (✓) and are discussed in detail in Section 20.4 in the context of effects pathways, standard and project-specific mitigation/enhancement, and residual effects.

Table 20.4 Project Interactions with Climate Change

Physical Activities	Effects	
	Change in release of GHG	Change in carbon sinks
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.	✓	–
Handling 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.	✓	–

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Physical Activities	Effects	
	Change in release of GHG	Change in carbon sinks
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 tailings management facility (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 .	–	–
Operations (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 pits.	✓	–
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.	✓	–

Physical Activities	Effects	
	Change in release of GHG	Change in carbon sinks
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.	✓	✓
Monitoring and maintenance.	✓	–
Employment and expenditures ¹ .	–	–
Notes: ✓ = Potential interaction – = No interaction		

All activities during all phases of the Project are expected to result in changes to releases of GHG emissions, with the exception of employment and expenditures activities as these are not expected to directly result in any changes to the physical environment.

Only activities related to disturbance, removal and reclamation of vegetation and soil are expected to result in changes to carbon sinks, as all other activities do not result in land use changes which may affect carbon sequestration potential. The exception to this is the maintenance and management of mine rock stockpiles, overburden, and TMF activity which may result in active or passive carbonation with carbon sequestration potential.

20.4 Assessment of Residual Effects on Climate Change

The potential residual effects of the Project on climate change associated with construction, operations and decommissioning are described in the following sections. Expected residual effects are from changes in release of GHG emissions and changes in carbon sinks.

20.4.1 Change in Release of GHG

The potential residual effects from changes in release of GHG emissions due to the Project are discussed in this section.

20.4.1.1 Project Pathways

The assessment of changes in release of GHG includes assessment of direct GHG emissions that occur from sources that are owned or controlled by the Project (also referred to as Scope 1 emissions) and indirect GHG emissions associated with the generation of acquired energy from sources that are not owned or controlled by the Project (also referred to as Scope 2 emissions) during the construction, operations and decommissioning phases of the Project. Additionally, the assessment includes some other indirect emissions from ancillary infrastructure. The following subsections categorize potential emission source types, each of which are potential effect pathways associated with the Project. These pathways are described in more detail in Appendix C.6 of the Impact Statement (Greenhouse Gases Following the Strategic Assessment of Climate Change).

20.4.1.1.1 Scope 1 Direct Emission Sources

20.4.1.1.1.1 Stationary Combustion

The Project is not expected to have any material sources of stationary combustion. Electrical power will be obtained from the Ontario power grid. Diesel-fired generation may be used during the construction and decommissioning phase of the Project, however there is no anticipated use of diesel generators as a material power source once grid power is available. Use of diesel generators is not expected to contribute to greater than 1% or more of the total direct GHG emissions of the Project, therefore in accordance with the SACC Technical Guidance (ECCC 2021a) emissions associated with diesel generators are not considered further in the assessment.

20.4.1.1.1.2 Mobile Diesel Combustion

Mining equipment and vehicles, combusting diesel, are expected to be the largest source of Scope 1 GHG emissions associated with the Project.

20.4.1.1.1.3 Mobile Gasoline Combustion

Gasoline is expected to be used by the Project's light-duty fleet vehicles and for portable site lighting. The combustion of this gasoline will result in GHG emissions but is expected to be minor relative to diesel use in mobile combustion.

20.4.1.1.1.4 Blasting

Blasting activities for the Open Pit mine will result in GHG emissions from the combustion of fuel used within the explosives material.

20.4.1.1.1.5 Land-Use Change

The Project footprint covers a total area of 11,785 hectares, that for the purpose of the GHG assessment is estimated to be approximately 95% forest land (11,196 hectares) and 5% wetland (589 hectares). Of the total PA, approximately 53% of the land area is expected to be converted to settlement land-use as a direct result of the Project (i.e., 6,259 hectares), which includes conversion of land area required for mining operations, the Open Pit, all other associated mining infrastructure and waterbodies. The balance of the Project land area is expected to have material tipped over existing vegetation. This change in land use will result in the direct release of GHG emissions from biomass conversion and soil excavation.

20.4.1.1.1.6 Ancillary Infrastructure - Highway Realignment

To facilitate extraction from the Main Zone of the Open Pit, approximately 26 km of Highway 655 will be realigned to the west of the mine to divert traffic around the mine site. Canada Nickel will be responsible for the design and construction of the realignment, including any temporary bypasses, and will transfer ownership of the highway to Ontario Ministry of Transportation (MTO) once construction is complete (Chapter 3 of the Impact Statement [Project Description]). Direct GHG emissions are expected from the operation of equipment during construction activities associated with the realignment. GHG emissions associated with the operation of the highway post MTO transfer are not included in this assessment as these emissions are outside the control of Canada Nickel.

20.4.1.1.1.7 Ancillary Infrastructure – Rail Spur Construction

A new 25.2 km rail spur will be constructed by Canada Nickel to facilitate the transport of materials to and from the Project site. Following construction, ownership of the spur line will be transferred to Ontario Northland Railway (ONR) (Chapter 3 of the Impact Statement [Project Description]). The construction of the rail spur is included in the GHG assessment as direct GHG emissions will result from the use of equipment. The GHG emissions associated with the operation of the spur line post ONR transfer are also quantified, although not included in the total net assessment as these emissions are outside the control of Canada Nickel (see Section 20.4.1.1.3.1).

20.4.1.1.1.8 Ancillary Infrastructure – Transmission Line Relocation

Approximately 29 km of an existing 500 kV transmission line owned by Hydro One will be relocated due to bisection of the location of the proposed Open Pit mine. As owners of the facility, Hydro One will be completing a Class Environmental Assessment for Transmission Facilities for the relocation of the transmission line (Chapter 3 of the Impact Statement [Project Description]). Although the relocation of the electricity transmission line will be fully managed by Hydro One, it has been scoped within the current Project and thus is included as a direct GHG emission source of the Project.

20.4.1.1.2 Scope 2 Indirect Emission Sources

20.4.1.1.2.1 Acquired Energy – Purchased Grid Electricity

Power to the site will be provided by a 230 kV transmission that is being designed, constructed and operated by a third-party. Indirect GHG emissions are expected to occur as a result of the use of this acquired energy by the Project. While these emissions will not be occurring on the site of the Project location, they have been included in this GHG assessment as a Scope 2 GHG emissions source.

20.4.1.1.3 Other Indirect Emission Sources

20.4.1.1.3.1 Ancillary Infrastructure – Rail Spur Operation

Following construction of the new 25.2 km rail spur, ownership will be transferred to ONR and transportation of product concentrate will fall under the care and operational control of third parties rather than Canada Nickel. For the purpose of this assessment, GHG emissions associated with transport of product concentrate have been quantified but considered separately from emissions sources inside Canada Nickel's operational control as emissions reductions will be dependent on third-parties.

20.4.1.2 Analytical Assessment Techniques

As required by TIS Guidelines, methods detailed in the SACC (2020) were used to determine the changes in GHG emissions as a result of the Project. These methods require the determination of net GHG emissions over the life of the Project, including construction, operations, and decommissioning and closure. The SACC (2020) defines the net GHG emissions as follows:

Net GHG Emissions

$$\begin{aligned} &= \text{Direct GHG emissions} + \text{Acquired energy GHG emissions} \\ &- \text{Avoided domestic GHG emissions} - \text{Offset measures} \end{aligned}$$

The net GHG emissions were calculated for the construction and operations phases of the Project, and due to lack of data currently available for the decommissioning phase, a conservative assumption that decommissioning phase emissions are equivalent to the construction phase emissions has been used, based on the likelihood of the use of similar on-land equipment during the decommissioning phase. In reality these emissions are likely to be lower than assumed.

Scope 1 and Scope 2 GHG emissions under the operational control of Canada Nickel have been included in the calculation of net GHG emissions, while other indirect emissions have been quantified as an emissions source but have not been included in the calculation of net emissions as they are expected to fall outside of Canada Nickel operational control.

The following subsections discuss the analytical assessment techniques used to assess each pathway associated with the change in GHG emissions as a result of the Project. The techniques and methods used are described in detail in Appendix C.6 of the Impact Statement (Greenhouse Gases Following the Strategic Assessment of Climate Change).

20.4.1.2.1 Scope 1 Direct Emission Sources

20.4.1.2.1.1 Combustion and Blasting

Direct GHG emissions from the combustion of diesel and gasoline fuels in mobile equipment were quantified using methods from the SACC Technical Guide (2021), using the following equation.

$$\begin{aligned} \text{GHG Emissions from Fuel Combustion} \\ = \text{Estimated quantity of fuel to be combusted} \times \text{Emission factor} \end{aligned}$$

Direct GHG emissions from blasting were also quantified using the above equation, where the annual amount of explosives used was multiplied by the applicable emission factor. As per the SACC Technical Guide (2021) emission factors from the combustion of fuels were sourced from the most recently available National Inventory Report (NIR 2023) and emission factors for explosives were sourced from the explosives supplier.

20.4.1.2.1.2 Land-Use Change

Direct GHG emissions from land-use change were quantified according to the methodology outlined in the SACC Technical Guide (2021), which follows the approaches of the most recently available NIR (NIR 2023) and IPCC guidelines (IPCC 2006). Land-use change emissions were estimated for conversion of forest land, conversion of wetland and flooding of land. As per the SACC Technical Guide (2021), because the planned Project site area is greater than 100 ha and majority of the proposed land use represents carbon dense forest land, a Tier 2 approach as defined in the SACC Technical Guide (2021) was used to quantify land-use change emissions, wherein site specific/literature cited biomass and carbon stock factors were used when available, and climate specific default IPCC values otherwise.

20.4.1.2.1.3 Highway Realignment

GHG emissions associated with realignment of Highway 655 were quantified using the following equation

$$\text{GHG Emissions from Highway Realignment} = \text{Highway Length} \times \text{Emission factor}$$

The length of highway was obtained through the Crawford Nickel Sulphide Technical Feasibility Study (Ausenco 2023) and emission factors were obtained via the U.S. Department of Transportation Infrastructure Carbon Estimator (ICE) version 2.1.3 (US DOT 2021).

20.4.1.2.1.4 Rail Spur Construction

GHG emissions associated with construction of the proposed rail spur servicing the Project site were quantified using the following equation.

$$\text{GHG Emissions from Rail Spur Construction} = \text{Track Distance} \times \text{Emission factor}$$

The track distance was obtained from the Crawford Nickel Project Sulphide Technical Feasibility Study (Ausenco 2023) and emission factors were obtained via the U.S. Department of Transportation Infrastructure Carbon Estimator (ICE) version 2.1.3 (US DOT 2021).

20.4.1.2.1.5 Transmission Line Relocation

GHG emissions associated with realignment of the 500 kV transmission line were quantified using the following equation.

$$\text{GHG Emissions from Transmission Line Relocation} = \text{Length of Transmission Line} \times \text{Emission factor}$$

The length of transmission line was obtained from the Crawford Nickel Project Sulphide Technical Feasibility Study (Ausenco 2023) and emission factors were sourced from literature (Wei et al. 2021).

20.4.1.2.2 Scope 2 Indirect Emission Sources

20.4.1.2.2.1 Acquired Energy – Purchased Grid Electricity GHG Emissions

GHG emissions from acquired energy (purchased electricity) were quantified following methods in the SACC Technical Guide (2021). Project electricity demand for proposed mining equipment and facilities was collected from Crawford Nickel Project techno-economic feasibility assessments. Electric grid intensity factors for Ontario were obtained from the ECCC Data Catalogue (ECCC 2023). Electric grid intensity factors were used for the years 2025 to 2050; beyond 2050, the grid intensity factor was held constant at the 2050 predicted value. To account for differences in electricity generation between the provincial average electricity generation mix for Ontario and the electricity generation mix planned to service the Project in Northeastern Ontario, the ECCC Ontario average emission factors were adjusted based on the percent of natural gas based electricity generation in Northeastern Ontario (IESO 2022a) relative to the average percent of natural gas based electricity generation for the province of Ontario (IESO 2022b) as of 2022.

20.4.1.2.2.3 Other Indirect Emission Sources

20.4.1.2.2.3.1 Rail Spur Operation

GHG emissions associated with rail spur operation for the purpose of transporting product concentrate were quantified using the following equation.

$$\begin{aligned} \text{GHG Emissions from Rail Spur Operation} \\ = \text{Length of Rail Spur} \times \text{Mass of Shipped Product} \times \text{Emission factor} \end{aligned}$$

The length of rail spur and mass of shipped concentrate were obtained from the Crawford Nickel Project Sulphide Technical Feasibility Study (Ausenco 2023) and emission factors were obtained from the US Environmental Protection Agency (EPA) (US EPA 2023).

20.4.1.2.2.4 Avoided Domestic GHG Emissions

There are no expected avoided domestic GHG emissions associated with the Project and therefore this term in the calculation for net GHG emissions is assumed to be zero (0).

20.4.1.2.5 Offset Measures

As per the SACC Technical Guide (2021), offset measures include the sum of offset credits, carbon dioxide captured and stored and corporate-level initiatives. The use of offset credits has been incorporated in the net project GHG emissions as part of mitigation measures identified in the Project's net-zero plan, to offset residual Project emissions existing following implementation of Best Available Technologies/Best Environmental Practices (BAT/BEP) (see Section 20.4.1.3 for a description of the net-zero plan and BAT/BEP analysis)

20.4.1.3 Mitigation and Enhancement Measures

Mitigation and enhancement measures associated with the change in GHG emissions due to the Project have been compiled in accordance with the SACC (2020) in a detailed net-zero plan, with the application of a BAT/BEP analysis. The goal of the net-zero plan for the Project is to achieve zero net GHG emissions by the year 2050.

The Project's net-zero plan is designed based on the following three principles: (1) Avoid: prioritize the avoidance of emissions during design and engineering phases (i.e. the integration of BAT/BEP), (2) Reduce: continuously evaluate and assess further emission reductions based on the changing environment (i.e. the rapid evolution of technology and economics), and (3) Offset: offsetting of residual sources of hard to abate emissions. The net GHG emissions projection as a result of the implementation of the Project's net-zero plan represents a conservative approach to net-zero by 2050, assuming maximum implementation of selected BAT by the year 2050 and the purchase of carbon offset credits to offset residual emissions from 2050 onward. In reality, Canada Nickel will continuously evaluate current and emerging BAT as it relates to technological advancements, changing market conditions and relevant government policies, with the goal of promoting accelerated GHG reductions where technologically and economically feasible.

The Project's net-zero plan and associated BAT/BEP is described in full detail in Appendix C.6 of the Impact Statement (Greenhouse Gases Following the Strategic Assessment of Climate Change). Table 20.5 provides a summary of the mitigation measures associated with changes in GHG releases that were chosen for implementation within the net-zero plan.

Table 20.5 Summary of Selected Mitigation – Changes in GHG Releases

Phase	Pathway	BAT	BEP	Mitigation Potential	Technology/Practice Maturity	Barriers
Construction	Equipment/ Vehicles	<ul style="list-style-type: none"> • Diesel fueled 	<ul style="list-style-type: none"> • Idling policy • Optimal sizing • Regular maintenance • Traffic management plan (e.g., bussing) • Strategic site design (i.e., compact layout for reduced haulage distance) 	<ul style="list-style-type: none"> • BEP measures will decrease fuel consumption, resulting in fewer GHG emissions 	<ul style="list-style-type: none"> • BEP measures are mature policy practices for reducing GHG emissions 	<ul style="list-style-type: none"> • No barriers
Operations	Acquired energy	<ul style="list-style-type: none"> • Connection to Ontario electricity grid with back-up diesel generators on-site 	<ul style="list-style-type: none"> • Energy efficiency measures • Regular maintenance of equipment (on-site only) • Measurement of electricity consumption 	<ul style="list-style-type: none"> • Connection to Ontario electricity grid will result in a reduction of 98% in GHG emissions compared to a simple cycle gas turbine system • BEP measures will reduce electricity consumption, resulting in fewer GHG emissions 	<ul style="list-style-type: none"> • Mature 	<ul style="list-style-type: none"> • Delays in transmission line construction could result in the use of diesel generators • No barriers to BEP
	Back-up emergency energy source	<ul style="list-style-type: none"> • Diesel fueled 	<ul style="list-style-type: none"> • Optimal sizing • Regular maintenance 	<ul style="list-style-type: none"> • Diesel generators do not provide a GHG reduction • BEP measures will decrease fuel consumption, resulting in fewer GHG emissions 	<ul style="list-style-type: none"> • Mature 	<ul style="list-style-type: none"> • No barriers

Phase	Pathway	BAT	BEP	Mitigation Potential	Technology/Practice Maturity	Barriers
	Equipment / Vehicles	<ul style="list-style-type: none"> • Diesel fueled • Trolley assist • Electric (battery) • Autonomous vehicles 	<ul style="list-style-type: none"> • Idling policy • Optimal sizing • Regular maintenance • Traffic management plan (e.g., bussing) • Strategic site design (i.e., compact layout for reduced haulage distance) 	<ul style="list-style-type: none"> • Battery electric equipment can reduce GHG emissions by 99% compared to fossil fuel diesel • Trolley-assist haulage can reduce GHG emissions by 26% compared to conventional diesel haul trucks • Autonomous equipment can reduce GHG emissions by 8% relative to conventional equipment • BEP measures will reduce fuel and electricity consumption, resulting in fewer GHG emissions 	<ul style="list-style-type: none"> • Battery electric and autonomous equipment are emerging technologies (commercial implementation in recent years) • Trolley-assist haulage is a mature mining technology • BEP measures are mature policy practices for reducing GHG emissions 	<ul style="list-style-type: none"> • Difficult/delayed integration of autonomous equipment into existing operations • No barriers to BEP

Phase	Pathway	BAT	BEP	Mitigation Potential	Technology/Practice Maturity	Barriers
Decommissioning and closure	Equipment / Vehicles	<ul style="list-style-type: none"> • Diesel fueled • Electricity (battery) 	<ul style="list-style-type: none"> • Idling policy • Optimal sizing • Regular maintenance • Traffic management plan (e.g., bussing) • Strategic site design (i.e., compact layout for reduced haulage distance) 	<ul style="list-style-type: none"> • The use of battery electric equipment can reduce GHG emissions by 96% compared to conventional diesel equipment • BEP measures will reduce fuel and electricity consumption, resulting in fewer GHG emissions 	<ul style="list-style-type: none"> • Battery electric mining equipment expected to be a mature technology at the start of decommissioning • BEP measures are mature policy practices for reducing GHG emissions 	<ul style="list-style-type: none"> • No barriers

20.4.1.4 Project Residual Effect

The residual environmental effects of the Project due to changes in the release of GHGs into the environment are predicted to be adverse, as the Project is expected to result in a net release of GHG emissions during the Project's lifetime, the magnitude of which is estimated to be 11,135 kt CO_{2e}. While the change in release of GHG emissions is expected to occur with irregular frequency, tied to operation of equipment and vehicles as well as periodic land clearing and blasting activities, the resulting effects are expected to be long-term and lasting beyond the duration of the Project. This is because, the effects on climate change due to the release of GHG in the atmosphere are by definition persistent and long-term. Similarly, with climate change effects by definition only being realized globally, the net release of GHG emissions due to the Project is characterized as being a global effect, extending beyond the Project RSA. The net release of GHG emissions due to the Project is irreversible, since once GHGs are released to the lower atmosphere, there is currently no mechanism by which they can be mitigated.

Details of methodology used and calculations completed for all stages of construction, operations and decommissioning separately and combined in net are found in Appendix C.6 of the Impact Statement (Greenhouse Gases Following the Strategic Assessment of Climate Change).

20.4.2 Change in Carbon Sinks

The potential residual effects from changes in carbon sinks due to the Project are discussed in this section.

20.4.2.1 Project Pathways

The assessment of changes in carbon sinks includes assessment of land disturbance occurring during Project construction and operations phases, and subsequent land reclamation during operations and decommissioning. Also included in the assessment are both passive and active carbonation processes expected to occur during Project operation. The following subsections categorize potential carbon sinks, each of which are potential effect pathways associated with the Project. These pathways are described in more detail in Appendix C.6 of the Impact Statement (Greenhouse Gases Following the Strategic Assessment of Climate Change).

20.4.2.1.1 Land Disturbance and Reclamation

Changes to the land footprint required for Project infrastructure and pit construction represent a change to carbon sinks as foregone carbon sequestration potential due to land clearing activities including the removal of living biomass and soils. These changes are expected to occur during Project construction and operations. Subsequent remediation of the land footprint during Project operations and decommissioning represents a change to carbon sinks as gained carbon sequestration potential due to progressive reclamation of natural land area.

20.4.2.1.2 Passive Carbonation

Mineral carbonation includes naturally occurring reactions between minerals and atmospheric CO₂, resulting in permanent capture and/or storage of CO₂ in solid form (carbonates). Minerals with the ability to undergo carbonation include magnesium, calcium or iron minerals such as olivine, brucite, wollastonite and serpentine. Passive mineral carbonation between minerals in mined material and atmospheric CO₂ is expected to occur at two stages in the Project's mining process. Passive carbonation is first expected to occur during the mining and milling processes, where atmospheric CO₂ is passively captured by the wallrock of the Open Pit and in the mined ore during handling. The second stage involves carbonation of minerals in mine tailings after discharge to the TMF and in waste rock stockpiles. The passive carbonation of minerals in mined material is limited by CO₂ supply, especially in the TMF where tailings are continuously covered with fresh discharge. Passive mineral carbonation represents a change in carbon sink as gained carbon sequestration potential.

20.4.2.1.3 Active Carbonation

Canada Nickel plans to implement a novel IPT Carbonation process capable of harnessing the natural mineral sequestration capabilities of host rock to actively capture a concentrated source of CO₂. In this active carbonation process, tailings generated by the milling process are conditioned with a concentrated source of CO₂ after tailings thickening and before discharge to the TMF. CO₂ delivered to the site is sparged into the tailings slurry in a controlled manner to maximize CO₂ exposure to mineral surfaces and promote faster and more complete mineralization reactions. Carbonation tanks for this process have been designed to allow for recompression and recirculation of unreacted CO₂ to maximize CO₂ utilization. The IPT Carbonation process requires a supply of CO₂ from an industrial partner as capture of emissions from the Project's main GHG emissions sources (e.g. mobile equipment) is not technically feasible. Active mineral carbonation represents a change in carbon sink as gained carbon sequestration potential.

20.4.2.2 Analytical Assessment Techniques

As required by TIS Guidelines, methods detailed in the SACC (2020) were used to determine the changes in carbon sinks as a result of the Project. These methods require the determination of net carbon sink changes over the life of the Project, including construction, operations and decommissioning. Net carbon sink changes were assessed by considering loss of carbon sink as negative and gain of carbon sink as positive, with net total changes representing the carbon sequestration potential of the Project.

The net carbon sink changes were calculated for the construction and operations phases of the Project, and due to lack of data currently available for the decommissioning phase, a conservative assumption that decommissioning phase carbon sink changes would not occur has been used. In reality carbon sink changes applied during the decommissioning phase are likely to be from planned land reclamation, which would be positive in nature and contribute to the carbon sequestration potential of the Project.

The following subsections discuss the analytical assessment techniques used to assess each pathway associated with the change in carbon sinks as a result of the Project. The techniques and methods used are described in detail in Appendix C.6 of the Impact Statement (Greenhouse Gases Following the Strategic Assessment of Climate Change).

20.4.2.2.1 Land Disturbance and Reclamation

Net carbon sink changes from land disturbance during construction and operations were quantified using methods from the SACC Technical Guide (2021). The land types expected to be impacted by the Project include forest land and wetlands in the Boreal Shield region of Ontario, just north of Timmins.

For the purposes of this assessment, it was assumed that forestland (the predominant land type on site) will contain forest stands within the age range of maximum carbon uptake. Default parameters for calculating carbon uptake were obtained from NRCAN (NRCAN 2019) and are representative of boreal mixedwood forests in northern Ontario. For converted wetlands, which represent a smaller portion of estimated land conversion (i.e., approximately 5%), default IPCC values (ECCC 2021a) by wetland type were used to estimate the forgone carbon following conversion, based on the expected wetland types undergoing conversion (i.e., bog, fen, marsh and swamp). Other parameters required to complete the assessment were determined with guidance from the SACC (2020).

Remediation activities during Project operations and decommissioning, including reclamation of land, are expected to contribute to the carbon sequestration potential of the Project. However, this change in carbon sink has not been quantitatively assessed, due to unavailability of information on reclamation activities. This exclusion of carbon sink changes applied during the decommissioning phase is expected to be conservative, as this activity would contribute positively to the carbon sequestration potential of the Project.

20.4.2.2.2 Passive Carbonation

Carbon sequestration potential associated with the passive mineral carbonation process will depend on numerous mining process specific factors that are currently unknown and therefore a quantified change in carbon sink estimate for this process is not currently available. However, as passive and active carbonation processes take advantage of the same chemistry to act as carbon sinks, it is expected that the quantitative assessment of the active carbonation process inherently includes an assessment of passive carbonation process, and therefore the exclusion of passive carbonation in the net assessment of changes to carbon sinks is conservative.

20.4.2.2.3 Active Carbonation

Based on preliminary pilot scale testing, the IPT Carbonation process is estimated to have a maximum storage capacity of 32 kg CO₂ per tonne of tailings and to increase the rate of CO₂ capture by approximately 8 to 12 times relative to the rate of passive carbonation (Canada Nickel 2022). This pilot scale testing result is the basis for the assessment of changes in carbon sink due to the IPT Carbonation process, applied over the operational life of the Project, representing a theoretical maximum carbon sequestration potential.

20.4.2.3 Mitigation and Enhancement Measures

Mitigation and enhancement measures associated with the change in carbon sinks due to the Project have been compiled in accordance with the SACC (2020) in a detailed net-zero plan, with the application of a BAT/BEP analysis. The goal of the net-zero plan for the Project is to achieve zero net GHG emissions by the year 2050. The Project's net-zero plan and associated BAT/BEP is described in full detail in Section 20.4.1.3 and in Appendix C.6 of the Impact Statement (Greenhouse Gases Following the Strategic Assessment of Climate Change). Table 20.6 provides a summary of the mitigation measures associated with changes in carbon sinks that were chosen for implementation within the net-zero plan.

Table 20.6 Summary of Selected Mitigation – Changes in Carbon Sink

Phase	Pathway	BAT	BEP	Mitigation Potential	Technology/Practice Maturity	Barriers
Construction	Land disturbance and reclamation	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Biomass chipping and spreading Merchantable timber recovery 	<ul style="list-style-type: none"> Chipping and spreading can reduce the amount of carbon that becomes methane, which has a higher global warming potential than CO₂. Opportunity to keep carbon sequestered in merchantable timber. 	<ul style="list-style-type: none"> Mature 	<ul style="list-style-type: none"> Financial barrier with respect to identifying, cutting, and transporting merchantable timber.
Operations	Passive and active carbonation	<ul style="list-style-type: none"> Passive mineral carbonation: Atmospheric CO₂ capture in mined ore and tailings Active mineral carbonation: IPT Carbonation Process (with CO₂ supply) 	<ul style="list-style-type: none"> Site remediation 	<ul style="list-style-type: none"> Passive mineral carbonation will naturally sequester CO₂ Project GHG reduction potential of IPT Carbonation process dependent on CO₂ source. Potential Project CO₂ storage capacity of 32 kg CO₂ per tonne of tailings 	<ul style="list-style-type: none"> Novel – IPT Carbonation process proven in pilot scale studies. 	<ul style="list-style-type: none"> Scale up and implementation of IPT Carbonation process. Sourcing of concentrated CO₂ source.
Decommissioning and closure	Land disturbance and reclamation	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Site remediation 	<ul style="list-style-type: none"> Site remediation can help lower GHG impact from land use conversion and removed carbon sinks 	<ul style="list-style-type: none"> Mature 	<ul style="list-style-type: none"> No barriers

20.4.2.4 Project Residual Effect

The residual environmental effects of the Project due to changes in carbon sinks are predicted to be positive, as the Project is expected to result in a net increase in carbon sinks, and therefore carbon sequestration potential, during the Project's lifetime, the magnitude of which is estimated to be 46,678 kt CO₂e. While the change in carbon sinks is expected to occur with irregular frequency, tied to mining operation schedules, IPT Carbonation operation, periodic land clearing and reclamation activities, the resulting effects are expected to be long-term and lasting beyond the duration of the Project. This is because, the effects on climate change due to carbon sink changes are by definition persistent and long-term. Similarly, with climate change effects by definition only being realized globally, the net change in carbon sink due to the Project is characterized as being a global effect. The net change in carbon sinks due to the Project is reversible, since carbon sinks may be added or removed at any point either during the Project lifetime or after, to the extent where no change in carbon sink may be detected when compared to prior to Project implementation.

Details of methodology used and calculations completed for all stages of construction, operations and decommissioning separately and combined in net are found in Appendix C.6 of the Impact Statement (Greenhouse Gases Following the Strategic Assessment of Climate Change).

20.4.3 Summary of Project Residual Effects

Table 20.7 summarizes Project residual effects on climate change.

Table 20.7 Project Residual Effects on Climate Change

Residual Effect	Residual Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in release of GHG	C, O, D (Net)	A	M	G	NS	LT	IR	I
Change in carbon sinks	C, O, D (Net)	P	H	G	NS	LT	IR	R
<p>KEY</p> <p>See Table 20.3 for detailed definitions.</p> <p>Project Phase: C: Construction O: Operations D: Decommissioning and closure</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 G: Global</p> <p>Timing: NS: No sensitivity MS: Moderate sensitivity HS: High sensitivity</p> <p>Duration: ST: Short-term LT: Long-term</p> <p>Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous</p> <p>Reversibility: R: Reversible I: Irreversible</p>								

20.4.3.1 Summary of Adverse Residual Effects

The residual environmental effects of the Project due to changes in the release of GHGs into the environment are predicted to be adverse, as the Project is expected to result in a net release of GHG emissions during the Project's lifetime, the magnitude of which is estimated to be moderate, based on an emission of 11,135 kt CO_{2e} of GHG emissions during the Project's lifetime.

20.4.3.2 Summary of Positive Residual Effects

The residual environmental effects of the Project due to changes in carbon sinks are predicted to be positive, as the Project is expected to result in a net increase in carbon sinks, and therefore carbon sequestration potential, during the Project's lifetime, the magnitude of which is estimated to be high, based on the sequestration of 46,678 kt CO₂e during the Project's lifetime. Overall, this project will sequester more CO₂e than will be emitted by Project activities.

20.5 Potential Effects on Federal Lands

There are no federal lands within the PA. The closest federal lands are the Taykwa Tagamou Nation Reserve lands located approximately 37 km away (straight line) from the Project site (14 km southeast of Cochrane). As such, no changes to the environment on federal lands as a result of changes to either GHG releases or carbon sinks are anticipated, beyond the effects already identified as global, due to the global nature of climate change.

20.6 Prediction Confidence

The analysis of changes to GHG releases and carbon sinks associated with the Project is dependent on the final design, processing approach, intensity of mining activity and required supporting infrastructure. The prediction confidence is based on uncertainty in the available data, existing environment and prediction methodology, and is rated as medium due to the following reasons:

- The technology associated with GHG emissions is well understood, as are the pathways by which the GHGs are emitted (high prediction confidence).
- The calculations, parameters and emission factors associated with GHG emissions calculations are guided by and substantially obtained from vetted and publicly available sources (high prediction confidence).
- The activity data associated with GHG emissions calculations, such as fuel and energy needs of the Project, are based on modelling over a long period of time (medium prediction confidence).
- Conservative assumptions were applied where some uncertainty was present, for example the use of construction GHG emissions as proxy for decommissioning GHG emissions, the exclusion of land reclamation in carbon sinks calculation, and the exclusion of passive carbonation in carbon sinks calculation (high prediction confidence).
- Theoretical maximum sequestration potential was applied in carbon sinks calculation for passive carbonation which is a novel technology (low prediction confidence). Pilot testing conducted in 2024 is expected to result in a higher prediction confidence.

20.7 Assumptions

The assessment was completed based on available design information and is subject to change if substantial modifications to the Project construction, operations and decommissioning are implemented. Assumptions are listed by source of GHG emissions or carbon sinks within Appendix C.6 of the Impact Statement (Greenhouse Gases Following the Strategic Assessment of Climate Change). Some assumptions, in addition to those inherently caused from the use of design documents involving predictions, used in the assessment include, but are not limited to, the following:

- The proportion of each land type in converted land area is representative of the breakdown of land type over the total Project site area.
- The proportion of organic versus mineral soil in disturbed soil is representative of the estimated breakdown of soil type over the total Project site area.
- Organic carbon in soil decays at a constant rate of 1% per year. Assumption taken from the IPCC guidance for greenhouse gas inventories default decay curve of a 20% decay over a 20-year period (IPCC 2006).
- Carbon stocks in living biomass, dead organic matter and excavated organic soil of converted forest land and wetlands are assumed to be immediately released to atmosphere following conversion.
- All removed biomass during land conversion was assumed to release GHG emissions through direct onsite decomposition.
- The net-zero plan will be executed with the technologies identified, according to the specified schedule.
- The active carbonation process will achieve maximum potential during the operations of the Project.
- The electricity grid in Ontario will continue to prioritize growing electricity demand without increasing GHG grid intensity.

20.8 Follow-up and Monitoring

The Project is being designed and constructed based on the BAT/BEP compiled in a net-zero plan with the goal of achieving zero net GHG emissions by 2050. The complete net-zero plan, along with schedule of implementation, is provided in Appendix C.6 of the Impact Statement (Greenhouse Gases Following the Strategic Assessment of Climate Change). Canada Nickel is committed to continuous improvement such that the Project GHG emissions are limited and carbon sink potential is enhanced throughout the life of the Project. This includes a periodic review of potential GHG emissions over the life of the Project as new or identified mitigation technology and practices become technically and economically feasible, as well as socially acceptable.

Canada Nickel will use regular reviews and monitoring of mitigation opportunities to make future decisions and investments aligned with the net-zero plan. Decision-making will be based on numerous factors including associated costs, technical challenges, risks, infrastructure requirements, global competitiveness, government policies and stakeholder and rights holder considerations.

20.9 References

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20.10 Figures

