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6.4 Greenhouse Gas Emissions

Greenhouse gases (GHGs) are gases that contribute to potential climate change by trapping heat in the atmosphere, and include carbon dioxide, methane, nitrous oxide, perfluorocarbons, hydrofluorocarbons, sulphur hexafluoride and nitrogen trifluoride. As GHGs are a contributing factor to anthropogenic (i.e., human caused) alteration of climate, GHG emissions were selected as a valued component (VC), and the release of GHGs from the Springpole Gold Project (Project) has been assessed. Carbon dioxide, methane, and nitrous oxide are primarily generated from energy use and land use changes; as there sources are relevant to the Project, and thus are the gases specifically assessed. These three gases are referred to collectively by the term "GHG" in the assessment of GHG emissions for the Environmental Impact Statement / Environmental Assessment (EIS/EA).

The assessment and mitigation of GHG emissions are discussed in terms of annual GHG emissions where effects can be quantified and evaluated relative to a baseline and governmental inventories. The Project GHG emissions are associated with energy requirements such as fuel combustion and electricity usage.

The GHG emissions VC is not directly or indirectly linked with other VCs; however, Section 6.2 assesses the changes in air quality due to Project emissions and is linked to other VCs as described in that section.

6.4.1 Assessment Approach

The approach to the assessment of potential changes in GHG emissions includes a description of the relevant regulatory and policy setting, a description of the input obtained through consultation specific to this VC, the identification of criteria and indicators along with the associated rationale, a description of the spatial and temporal boundaries used for this VC, and a description of the attributes used to determine the significance of any residual, adverse effects. The assessment of potential effects is supported by a description of the existing conditions for the VC (Section 6.4), the identification and description of applicable pathways of potential effects on the VC (Section 6.4.3) and a description of applicable mitigation measures for the VC (Section 6.4.4). An outline of the analytical method conducted for the assessment and the key assumptions and/or conservative approach is found in Section 6.4.5. With the application of mitigation measures to the potential effects on the VC, the residual effects are then characterized in Section 6.4.6 and the significance of the residual effects is determined in Section 6.4.7.

6.4.2 Regulatory and Policy Setting

The effects assessment for GHGs has been prepared in accordance with the requirements of the federal Environmental Impact Statement (EIS) Guidelines (Appendix B-1) and the provincial approved Amended Terms of Reference (Appendix B-3). Concordance tables, indicating where EIS Guidelines and Terms of Reference requirements have been addressed, are provided in Appendices B-2 and B-5, respectively. Government policies, objectives, standards or guidelines most relevant to the VC are summarized below.

Federal Net-Zero Emissions Accountability Act

Canada's *Net-Zero Emissions Accountability Act* (Act) is legislation that the federal government has enacted as part of their commitment to achieve net-zero GHG emissions by 2050. The Act establishes a legally binding process to set five-year national emissions-reduction targets as well as develop credible, science-based emissions-reduction plans to achieve each target; the 2030 GHG emissions target is set at 40-45% below the 2005 levels by 2050 (ECCC, 2022).

The 2030 Emissions Reduction Plan (ECCC, 2022) details a roadmap of how this 2030 target will be achieved. The economy-wide target for 2030 is a reduction of 40% to 443 Mt-CO_2e; to achieve this, the target reduction for the heavy industry sector is 39% (to 52 Mt-CO_2e). Decarbonizing the heavy industry sector is essential for meeting Canada's 2030 climate target, and especially net-zero emissions by 2050, while creating jobs and building a sustainable, globally competitive economy.

Federal Strategic Assessment of Climate Change

Environment and Climate Change Canada (ECCC) developed the strategic assessment of climate change (SACC) to enable consistent, predictable, efficient and transparent consideration of climate change throughout the environmental assessment process. The GHG assessment was prepared following the SACC guidance (ECCC 2020) where it is compatible with the *Canadian Environmental Assessment Act, 2012* (SC 2012, c. 19, s. 52), using quantification approaches that align with the ISO 14064 2 Specification (ISO 14064-2:2019; ISO 2019) and with the international GHG protocol for project accounting (WBCSD / WRI 2004).

Provincial

The guide *Considering Climate Change in the Environmental Assessment Process* (MECP 2021) sets out the Ontario's expectations for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The guide requires quantification of the Project's expected production of GHG emissions to characterize the potential effects and identify climate change mitigation and adaptation measures.

6.4.2.1 Influence of Consultation with Indigenous Communities, Government and the Public

Consultation has been ongoing for several years, prior to and throughout the environmental assessment process, and will continue with Indigenous communities, government agencies and the public through the life of the Project. Section 2 provides more detail on the extensive consultation process. The Record of Consultation (Appendix D) includes detailed comments received, and responses provided, during the development of the final EIS/EA.

Feedback received through consultation has been addressed through direct responses (in writing and follow-up meetings) and incorporated into the final EIS/EA, as appropriate. The key comments that influenced the effects assessment for GHG emissions between the draft and final EIS/EA is provided below:

Provincial Guidance Document

The Ministry of the Environment, Conservation and Parks (MECP) requested further information on how Ontario's guide *Considering Climate Change in the Environmental Assessment Process* (MECP 2021) was considered in the EIS/EA. Section 8 includes an assessment of the effects of the environment on the Project including climate change, which considers the guidance provided by this document.

Assessment Method

The Impact Assessment Agency of Canada (IAAC) requested the GHG emissions be presented for all phases of the Project. The final EIS/EA has been updated to include the assessment of GHG emissions for all phases per the temporal boundaries defined in Section 6.4.1.3. Annual net GHG emissions under each phase are presented in the GHG assessment report (Appendix I-1, Table A2).

IAAC and the MECP requested additional detail and justification for the GHG calculation approach for the construction of the mine access road. FMG has refined the calculation method used for the final EIS/EA, and the bottom-up approach uses an estimated construction fleet rather than a proxy project. The calculations for the mine access road are included in the GHG assessment report (Appendix I-1, Table A6), with the calculations for the construction of the transmission line found in Appendix I-1 Table A7.

IAAC and the MECP requested clarification for land use change emission estimates and provision of annual emissions. Further details on, and clarification of, land use change emissions have been added to Appendix I of the final EIS/EA. The assessment includes a more developed description of the fate of biomass cleared and associated GHG emissions. Appendix I-1 (Table 3-1 and Section 4.3.3) of the final EIS/EA provide methods and assumptions related to biomass. Tables A5a, A5b and A5c of Appendix I-1 provide the related calculations, and Table A1 provides the summarized annual emissions related to biomass removal and foregone sequestration.

Greenhouse Gas Emission Intensities

IAAC and the MECP requested a comparison of Project GHG emission intensities against industry benchmarks. The GHG emission intensities for the Project have been calculated and are presented along with comparison benchmarks in the GHG assessment report (Appendix I-1, Section 6.1.1) of the final EIS/EA.

Management of Project Greenhouse Gases

IAAC requested detailed fleet information for the operations phase of the Project, commitments to using best available technologies for the management of GHG emissions, and details on the implementation schedule of emerging technologies. Further, IAAC noted that if the closure and decommissioning phase will not be completed by 2050, and emissions will continue past 2050, a credible plan describing how the Project will achieve net-zero emissions by 2050 may be required and should be guided by the principles outlined in the SACC. FMG is implementing a strategy to reduce the net GHG emissions to zero over the life of the Project. The Net-Zero Strategy (Appendix I-2) has been developed to achieve this target and includes the use of technologies and practices to reduce fossil fuel use and carbon offsets to balance GHG emissions that cannot be eliminated. The details of the fleet information used for the Project are included in the Air Quality Assessment (Appendix G-2)

Significance Determination Attribute – Reversibility

Mishkeegogamang Ojibway Nation, Northwestern Ontario Métis Community, IAAC and the MECP requested clarification on the validity of GHG emissions as a VC and the reversibility of effects. A distinction was made regarding the reversibility of residual GHG effects, specifically between GHG emissions (the VC) and atmospheric GHG concentrations. The Project's effects on atmospheric GHG concentrations are not fully reversible; however, it is recognized that this Project is not expected to have a measurable effect on these GHG concentrations. In contrast, the residual effects of GHG emissions are reversible as the emissions cease once the activities generating GHG emissions no longer occur. Additionally, GHG emissions are measurable at the Project level, and both the federal and provincial governments have implemented initiatives to manage and mitigate GHG emissions.

Mishkeegogamang Ojibway Nation, Northwestern Ontario Métis Community, IAAC and the MECP requested clarifications regarding the assessment of residual effects due to GHG emissions including clarification on the use of the reversibility attribute. Clarification is provided in Section 6.4 of the final EIS/EA, which distinguishes between atmospheric carbon dioxide concentrations, GHG emissions (the selected VC) and justification for VC selection.

6.4.2.2 Spatial and Temporal Boundaries

The Project Development Area is defined as the footprint of the Project including the mine site area, mine site access road and the transmission line corridor, as well as a buffer to allow flexibility for design optimizations for Project permitting. The buffer includes approximately 250 metres (m) around the mine site area. The buffer for the transmission line is included within the 40 m wide corridor and within the 30 m wide corridor for the mine access road. Where the mine access road and transmission line are aligned together, the buffer is included within a 60 m wide corridor.

The spatial boundaries used for the assessment of GHG emissions are defined as follows:

- **Local Study Area:** The assessment boundary is defined to include activities and energy consumption that the Project has operational control over, and includes direct and indirect GHG emissions for the Project. The Project boundaries encompass the activities associated with the Project that are within the Project Development Area.

  Per the EIS Guidelines (Appendix B-1), the GHG emissions assessment considers direct emissions from the Project, indirect acquired energy (electricity) for mining and ore processing, and land use changes.

  The assessment boundary excludes the transportation of the doré product from site, raw materials to site, and offsite waste disposal, as these are indirect, Scope 3 emissions.

- **Regional Study Area:** In the context of Project's contribution to the federal GHG emissions inventory, Canada is the Regional Study Area.

The temporal boundaries for the assessment of GHGs are defined as follows:

- **Construction phase:** Years -3 to -1, representing the construction period for the Project.
- **Operation phase:** Years 1 to 10, with the first year potentially representing a partial year as the Project transitions from construction into operations. Mining of the ore from the open pit will end in Year 10, at which time the pit will begin refilling with water.
- **Decommissioning and closure phase:**
  - Active closure: Years 11 to 15, when final decommissioning and the majority of active reclamation activities are carried out.
  - Post-closure: Years 16+, corresponding to the post-closure monitoring period and when the filled open pit basin will be reconnected to Springpole Lake.

Effects on the VC are assessed for each Project phase (i.e., construction, operation and closure).

6.4.2.3 Criteria and Indicators

In undertaking the assessment of GHG emissions, the following criteria were used:

- Change in carbon dioxide;
- Change in methane; and
- Change in nitrous oxide.

The specific criteria, measurable indicators and the rationale for the selection of criteria are described in Table 6.4-2.

6.4.2.4 Description of Residual Effects Attributes

The residual effects for GHG emissions are characterized in terms of the following attributes:

- Magnitude;
- Geographic extent;

- Duration;
- Frequency; and
- Reversibility.

These attributes, along with the rankings, are further described in Table 6.4-3.

In addition, the residual effects for GHG emissions are characterized according to the social and/or ecological context within which the VC is found. This is a qualitative measure of the sensitivity and/or resilience of the VC to potential change. The following ranking is applicable:

- **Level I:** The VC may or may not be sensitive but is capable of supporting the predicted change with typical mitigation measures;
- **Level II:** The VC is sensitive and requires special measures to support the predicted change; and
- **Level III:** The VC is sensitive and unable to support the predicted change even with special measures.

As noted in Section 6.1, a residual effect is defined as significant if both of the following criteria are satisfied:

- A Level II or III rating is attained for all of the attributes involving magnitude, extent, duration, frequency and reversibility; and
- A Level II or III rating is attained for ecological context.

Conversely, if a Level I rating is achieved for any of the attributes involving magnitude, extent, duration, frequency or reversibility, or if a Level I rating is achieved for the ecological context, then the residual effect is considered to be not significant.

In the event there is a significant adverse effect, the likelihood of occurrence is further described.

6.4.3 Existing Conditions

A description of the baseline conditions is presented below to characterize the existing conditions for GHGs and is used to support the assessment of potential effects from the Project on GHGs. Further baseline information on GHG emissions can be found in the technical support documentation in the GHG assessment report (Appendix I-1).

The effects of climate change occur at a global scale; however, managing emissions on a provincial and national scale is important. The annual report of GHG emissions submitted by Canada to the United Nations Framework Convention on Climate Change lists the total GHG emissions and GHG emissions by province and territory, by economic sector, and by industry (ECCC 2023a).

As reported in the Canadian national inventory report, the annual GHG emissions from Canada in 2021 were 670 megatonnes of carbon dioxide equivalent per year (Mt CO_2e/yr), and for Ontario it was 151 Mt CO_2e/yr. Table 6.4-1 lists the total Canadian GHG emissions and the provincial and territorial emissions for the reporting year, as well as the emissions dating back to 2005. The 2005 GHG inventory is of importance as the current GHG commitments for reduction are benchmarked against that year.

The annual report also provides a breakdown of the GHG emissions by sector, as presented in Table 6.4-1. The GHG emissions for the heavy industry sector are 77 Mt CO_2e/yr in 2021. Table 6.4-1 provides a breakdown of Ontario totals, in which heavy industry emitted 28 Mt CO_2e/yr in 2021.

A breakdown of the heavy industry sector GHG emissions is provided for Canada and Ontario in Table 6.4-1, which highlights the GHG emissions from the mining sector (exclusive of emissions associated with oil sands mining). The GHG emissions reported for the mining industry in Canada are 11 Mt CO_2e/yr of direct emissions, and the reported GHG emissions from mining in Ontario were 1.8 Mt CO_2e/yr in 2021.

6.4.3.1 Traditional Knowledge

As part of the Project, all eight Indigenous communities were contacted to participate in the EA process, and to provide Traditional Knowledge and Traditional Land Use (TK/TLU) information. To date, six Indigenous communities, Cat Lake First Nation, Lac Seul First Nation, Mishkeegogamang Ojibway Nation, Slate Falls Nation, Wabauskang First Nation and the Northwestern Ontario Métis Community, have provided Traditional Knowledge and Traditional Land Use information. Specific TK/TLU information relevant to GHG was not identified.

6.4.4 Identification of Pathways to Potential Effects

The initial step in the assessment process is to identify interactions between the Project and the VC that can result in pathways to potential effects. These potential effects may be direct, indirect and/or positive effects, where applicable. Table 6.4-4 includes the potential interactions of the Project with GHGs, prior to the application of the mitigation measures. The professional judgment of technical experts experienced with mining projects in Ontario and Canada, as well as input from Indigenous communities, government agencies and the public, informed the identification of those interactions that are likely to result in a pathway to a potential effect due to a measurable change on GHGs. These pathways to potential effects are further described below for each phase of the Project, along with the rationale for those interactions excluded from further assessment. Section 6.4.4 and Table 6.4-5 provide a description of the mitigation measures applied to these pathways to potential effects during all phases of the Project. The residual effects, after the application of the mitigation measures, are then described and further evaluated in Section 6.4.6, using the criteria and indicators identified in Section 6.4.1.4.

Construction Phase

The construction phase of the Project is expected to occur over a three-year period and will include preparation of the site and the construction of mine infrastructure. The following interactions with the Project result in pathways to potential effects on GHGs as described below. After mitigation is applied to each pathway, as described in Table 6.4-5, the residual effects are assessed using the criteria identified for each pathway:

- Site preparation activities for the mine site area including clearing, grubbing, bulk earthworks and other land use changes interact with the emission of GHGs. These activities result in pathways to potential effects due to the operation of equipment, biomass removal and changes in land use which may affect GHG emissions. The assessment of the potential effects from GHG emissions includes changes in GHG emissions from these pathways.

- The construction of the transmission line, and the construction of the mine access road and the airstrip including the development and operation of aggregate sources, interacts with the emission of GHGs. These activities result in pathways to potential effects due to the operation of equipment, biomass removal and changes in land use which may affect GHG emissions. The assessment of the potential effects from GHG emissions includes changes in GHG emissions from these pathways.

- The construction of the fish habitat development, onsite haul and access roads, dikes in the portion of the north basin of Springpole Lake to be isolated, the central water storage pond and the starter embankments for the co-disposal facility interacts with the emission of GHGs. These activities result in pathways to potential effects due to the operation of equipment and the use of explosives for blasting, both which may affect GHG emissions. The assessment of the potential effects from GHG emissions includes changes in GHG emissions from these pathways.

- The construction of buildings and onsite infrastructure interacts with the emission of GHGs. These activities result in a pathway to potential effects due to the operation of equipment which may affect GHG emissions. The assessment of the potential effects from GHG emissions includes changes in GHG emissions from this pathway.
- The stripping of lake bed sediment and overburden at the open pit, the development of the surficial soil stockpile, the development of the pit, the commencement of mining for production and the initiation of stockpiling of ore interact with the emission of GHGs. These activities result in pathways to potential effects due to the operation of equipment and the use of explosives for blasting, both with which may affect GHG emissions. The assessment of the potential effects from GHG emissions includes changes in GHG emissions from these pathways.

Mobile equipment used for tree clearing, grubbing and the stripping of overburden, as well as the construction of Project components, will require the use of diesel fuel and will result in the generation of GHG emissions during the three-year construction period. A quantitative GHG assessment (Appendix I-1) was conducted for construction of the mine site infrastructure, the mine access road and the transmission line.

There is no plausible interaction between the employment and expenditures activities and direct GHG emissions during any Project phase.

Operations Phase

The operation phase is planned for a 10-year period. The following interactions with the Project result in pathways to potential effects on GHGs as described below. After mitigation is applied to each pathway, as described in Table 6.4-5, the residual effects are assessed using the criteria identified for each pathway:

- The operation of the open pit mine interacts with the emission of GHGs. This activity results in a pathway to potential effects due to the operation of equipment which may affect GHG emissions. The assessment of the potential effects from GHG emissions includes changes in GHG emissions from this pathway.
- The management of the surficial soil stockpile, co-disposal facility and ore stockpiles interacts with the emission of GHGs. These activities result in a pathway to potential effects due to the operation of equipment which may affect GHG emissions. The assessment of the potential effects from GHG emissions includes changes in GHG emissions from this pathway.
- Progressive reclamation activities interact with the emission of GHGs. These activities result in pathways to potential effects due to the operation of equipment and changes in land use, both which may affect GHG emissions. The assessment of the potential effects from GHG emissions includes changes in GHG emissions from these pathways.

During operation, the mine operations will rely on heavy equipment that uses diesel fuel and generates GHG emissions. The Project will not have to generate its own electricity during operation, as a 230 kilovolt (kV) transmission line is proposed that connects the Project with the existing provincial electrical grid.

Progressive reclamation activities would be captured under the management of the surficial soils stockpile, as this material would be used to support those activities.

There will also be periodic maintenance activities associated with the transmission line and mine access road, but these are expected to be infrequent and of short duration but have been included in the assessment.

Decommissioning and Closure Phase

Activities during the active closure phase, which is expected to occur over a five-year period, are similar to the construction phase and use similar mining equipment but on a much smaller scale. The following interactions with the Project result in pathways to potential effects on GHGs as described below. After mitigation is applied to each pathway, as described in Table 6.4-5, the residual effects are assessed using the criteria identified for each pathway:

- The removal of salvageable assets off site, the demolition and recycling and/or disposal of remaining materials, and the removal and disposal of demolition-related wastes in approved facilities interacts with the emission of GHGs. These activities result in a pathway to potential effects due to the operation of equipment which may affect GHG emissions. The assessment of the potential effects from GHG emissions includes changes in GHG emissions from this pathway.
- The reclamation of impacted portions of the Project Development Area, such as by regrading, placement of cover and revegetation as applicable interacts with the emission of GHGs. These activities result in pathways to potential effects due to the operation of equipment and changes in land use, both which may affect GHG emissions. The assessment of the potential effects from GHG emissions includes changes in GHG emissions from these pathways.
- Filling the open pit with water interacts with the emission of GHGs. This activity results in a pathway to potential effects due to the operation of equipment which may affect GHG emissions. The assessment of the potential effects from GHG emissions includes changes in GHG emissions from this pathway.

Mobile equipment used during reclamation of the site, including the removal of infrastructure and equipment, will use diesel fuel and generate GHG emissions. Once the closure activities are completed, there are not expected to be any sources of combustion or GHG emissions from the Project.

Monitoring and maintenance activities are not expected to have an interaction due to GHG emissions as these activities are expected to be infrequent, of short duration and unlikely to generate measurable GHG emissions.

6.4.5 Mitigation Measures

Measures to be implemented to avoid or minimize the effects of the Project from GHG emissions include the following:

- The Project is designed to reduce emissions of GHGs, most notably the installation of a transmission line such that the electricity demand may be supplied from the Ontario grid, and a commitment to seek opportunities to incorporate renewable energy sources. Construction of a transmission line and connection to Ontario’s electrical grid is key in decarbonizing the Project as onsite site generation is avoided and Ontario’s electricity system is already more than 90 percent (%) emissions-free (IESO 2022).
- Mitigation measures for air quality (Section 6.2) that will be implemented, during the construction, operation and closure phases of the Project include, but are not limited to, the following:

- During construction, operations and active closure, site roads will be maintained in good condition, with regular inspections and timely maintenance completed; and
- During operations, GHGs from the use of diesel fuel for the mobile heavy equipment will be minimized through strategic mine scheduling to minimize the total distance travelled by haul trucks and other equipment.

- A GHG Management Plan will be developed that will describe the energy and heat conservation, efficiency and management programs for the Project, and outline mitigation measures for GHG emissions during all phases, including but not limited to the following:
  - Fuel use tracking on a regular basis (such as monthly);
  - Limiting vehicle speeds;
  - No-idling policies, where practicable and safe, to avoid unnecessary releases of GHG emissions;
  - Regular maintenance and servicing of mining equipment and vehicles to maximize operational efficiency;
  - Operational planning to minimize the distances haulage trucks travel on site to the extent possible; and
  - Blast optimization to reduce the rehandling of materials.

Mitigation opportunities will be reviewed and implemented to minimize the contribution of the Project to the overall provincial and federal inventories. Future consideration will be given to potential electrification of fleet vehicles, trolley-assist technology and the use of lower emission vehicles, including in the Project detailed design.

FMG is committed to considering supplemental renewable energy sources to partially offset fossil fuel combustion. On completion of the construction of the mine site and access road, FMG is committed to planting new trees to replace the removed forest, with additional reforestation to be carried out during the mine closure phase.

FMG is also implementing a strategy to reduce the net GHG emissions to zero over the life of the Project. The Net-Zero Plan (Appendix I-2 of the EIS/EA) developed to achieve this target includes the use of technologies and practices to reduce fossil fuel use and carbon offsets to balance GHG emissions that cannot be eliminated. It also includes a commitment to considering opportunities to incorporate renewable energy sources and takes into consideration opportunities to reduce Scope 3 emissions.

As a result, possible measures to reduce the GHG emissions may include:

- The implementation of energy and heat conservation, efficiency and management planning;
- Electrification of fleet vehicles and the use of lower emission vehicles;
- Incorporating lower carbon energy sources to minimize fossil fuel combustion; and
- Seeking additional opportunities for incorporating renewable energy sources into Project planning.

The application of mitigation measures for the pathways to potential effects is described in Table 6.4-5. Mitigation measures described in this section are expected to be effective for their intended purposes given their effective implementation at similar projects.

GHG tracking will be implemented to support provincial and federal reporting requirements, to verify the accuracy of the predicted effects and to assess the effectiveness of the implemented mitigation measures.

6.4.6 Analytical Method

The GHG assessment has been prepared following the SACC guidance (ECCC 2020) where it is compatible with the *Canadian Environmental Assessment Act, 2012* and the federal EIS Guidelines for the Springpole Gold Project (Appendix B-1), using quantification approaches that align with the ISO 14064-2:2019 Specification (ISO 2019) and with the international GHG protocol for project accounting (WBCSD / WRI 2004).

The SACC was developed to enable consistent, predictable, efficient and transparent consideration of climate change. The SACC includes guidance on quantification of net GHG emissions, impact on carbon sinks, mitigation measures, net-zero planning and upstream GHG assessment. The World Business Council for Sustainable Development and World Resources Institute GHG protocol (WBCSD / WRI 2004) has been adopted by the United Nations Environment Programme; the GHG protocol provides guidance for preparing GHG inventories that has been applied in this assessment. Ontario's guide *Considering Climate Change in the Environmental Assessment Process* (MECP 2021) was also followed. Per Section 3 of that guidance, the assessment quantitatively estimated GHGs for all phases of the Project.

The methods used for this assessment include:

- Identification of GHG sources, sinks and reservoirs;
- Quantification of GHG emissions from the Project using recognized methods; and
- Establishing the net GHG emissions associated with the Project.

The assessment of GHG emissions associated with the Project included sources associated with energy use, specifically fossil fuel combustion and purchased electricity, and the land use changes that have the ability to affect the carbon balance with the removal of the vegetation carbon sink (existing forest).

Further details are provided in the Greenhouse Gas Assessment technical support documentation included in Appendix I-1.

6.4.6.1 Assumptions and the Use of the Conservative Approach

In assessing the GHG emissions, annual forecasts of fuel usage for mining equipment and stationary heating, electricity demand and explosive usage were used for each year of the construction and operation phases. Further, it was assumed that the land use changes would remain throughout the life of the Project; progressive rehabilitation occurring during operation and into post-closure was not considered. These assumptions resulted in a conservative estimate of GHG emissions.

6.4.7 Characterization of Potential Residual Effects

The GHG emissions from the Project will vary by phase and the amount of energy supplied by fossil fuel combustion. The net GHG emissions from the Project are estimated at 774 kilotonnes (kt) of carbon dioxide equivalent (CO_2e) of direct (Scope 1) and acquired energy (Scope 2) emissions over the construction and operation phases.

The Project's net GHG emissions include consideration of the following:

- Onsite energy and blasting (459 kt CO2e);
- Construction of the mine access road and transmission line (19 kt CO2e);
- Purchased electricity (153 kt CO2e); and
- Direct emissions associated with land use changes (143 kt CO2e).

The GHG emissions by Project phase and source are presented in Table 6.4-6, and the maximum annual GHG emissions for operation are 68 CO_2e kt/yr (Table 6.4-7). The year-over-year net GHG emissions can be found in Appendix I-1.

The major contributor to annual Project GHG emissions is the combustion of diesel fuel on site. Processing operations will rely on electrical power that will be supplied from the 230 kV electrical transmission line running to the site. Backup generators will be required to ensure that critical equipment can continue to operate and that the process plant can be shut down safely in the event of a power outage.

The highest annual emissions occur in Year 4. After this year, the annual amount of material moved from the open pit and the associated fleet activity decreases as ore is being recovered for processing from a stockpile closer to the crusher and ore processing facility.

Foregone carbon sequestration (293 kt CO_2e) was calculated, but was not included in the net GHG emissions total per the SACC guidance (ECCC 2020); the SACC guidance stipulates that the GHG intensity is determined by dividing the net GHG emissions for each year of the operating phase by the units produced (i.e., kilograms gold equivalent [kg-$gold_{eq}$]).

During operation, the Project's GHG intensity is estimated at 6.1 tonnes (t) CO_2e/kg-$gold_{eq}$ for the maximum year of the operation phase and 5.4 t CO_2e/kg-$gold_{eq}$ as the average for the operating phase.

As the GHG intensity of a mine will vary based on factors including the energy sources, the GHG intensity of the electricity grid and grid capacity, deposit grade, location of the processing facility and the type of mine, it is difficult to find projects that are directly comparable for benchmarking. For this reason, two sources of potential benchmarking information were considered:

- The global average carbon intensity (Scope 1 and 2) for on-grid gold production, estimated at 27.7 t CO_2e/kg-$gold_{eq}$, and for gold mines in Canada an intensity of 8.6 t CO_2e/kg-$gold_{eq}$ is reported (Ulrich et al. 2022).
- Publicly available intensities via corporate environmental, social and corporate governance reporting for the larger Canadian and global mining companies. Scope 1 and 2 intensities were reported for 15 gold mining operations (11 in Canada 4 in the United States) with a range of 3.2 to 50.8 t CO_2e/kg-$gold_{eq}$ and an average of 17.6 t CO_2e/kg-$gold_{eq}$.

The highest GHG intensities were for the four sites in the United States and two mines in Nunavut that do not have access to the electrical grid.

The nine Canadian mines that are powered from the electrical grid had GHG emission intensities of 3.2 to 16.5 t CO_2e/kg-$gold_{eq}$, and the average intensity of these mines was 7.5 t CO_2e/kg-$gold_{eq}$.

Based upon the review of corporate environmental, social and corporate governance reporting, it can be generally stated that high-performing gold mining operations are those with access to low-carbon intensity electrical grids. Ulrich et al. (2022) support this finding, noting that Canada's low carbon electricity supply is a contributing factor to lower GHG intensities relative to the global average.

The Project's average and maximum annual GHG intensities of 5.4 and 6.1 t CO2e/kg-$gold_{eq}$, respectively, are better than average when compared to other Canadian gold mining operations. To demonstrate the importance of access to a low-carbon grid, if the Project construction were to commence once Ontario's grid is net-zero, the intensity would be similar to the highest performing gold mining operations.

6.4.8 Significance of Residual Effects

The residual adverse effects from GHG emissions that have been predicted will occur during the construction, operation and closure phases. There will be no GHG emissions from the Project during the post-closure phase. To provide context for the Project's GHG emissions, the maximum annual emissions, excluding the loss of biomass sink, were compared with the Canadian and Ontario GHG inventories and the federal 2030 target (ECCC 2023c). In addition, the total emissions from onsite combustion and blasting were compared against the sector data for mining and heavy industry.

The contribution of the Project's peak annual operations Scope 1 and 2 GHG emissions to the total Ontario annual emissions will be approximately 0.05% (Table 6.4-8). The incremental contribution to the total Canadian annual GHG emissions from the Project will be approximately 0.01% based on the GHG emissions from 2021. Canada's contribution to global GHG emissions in 2020 was 1.5% (ECCC 2023b).

Based on a review of 1,785 Canadian facilities that reported direct GHG emissions in 2022 (those that emitted more than 10 kt CO_2e are required to report), the average reported was 155 kt CO_2e and the maximum was over 13,000 kt CO_2e (oil sands); 3% of facilities emit over 50% of emissions. The Project at an estimated peak annual direct emission of 49 kt CO_2e would be typical of metal mining operations in Canada but is a relatively small contributor to Canada's inventory.

With the implementation of mitigation measures, the magnitude of the residual effect from GHG emissions is low (Level I) as the Project contribution is less than 0.1% of Canada's target. The geographic extent of the residual effects is high (Level III) as the emissions will contribute to global atmospheric GHG concentrations. The duration of the residual effect is considered moderate (Level II), as the GHG emissions will occur frequently throughout the operational life of the Project, and therefore frequency is high (Level III). However, the residual effects are predicted to be fully reversible (Level I), as the GHG emissions will cease once the Project activities cease and the area is reclaimed. To further support the reversibility of the residual effect, relative to Canada's inventory and commitments under the Canadian *Net-Zero Emissions Accountability Act* (SC 2021, c. 22), the Project in closure will have effectively no negative impact on Canada's commitment to net-zero by 2050.

With the typcial mitigation measures to address GHG emissions, such as those described the Net-Zero Strategy (Appendix I-2), the GHG VC is capable of supporting the predicted residual effects with typical measures and therefore the ecological and social context is considered low (Level I).

As a result, the adverse residual effect due to GHG emissions is predicted to be not significant.

6.4.9 Confidence Prediction

The methods used to predict GHG emissions relied on current Project design information with a sufficient level of detail to determine the magnitude of the effects from the Project and provides a high level of confidence. The GHG intensity of the power grid used in these predictions are based on current government policies and measures in place, the *reference scenario*. An *additional measures scenario* which includes policies that have been announced but not fully implemented would decrease the GHG emissions of the grid by approximately 40% during the Project life with a similar decrease in the estimated scope 2 GHGs from the Project.

6.4.10 References

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Table 6.4-1: Greenhouse Gas Emissions by Jurisdiction, Sector and Industry

	Annual GHG Emissions ($Mt\ CO_2e/yr$)(1)						
	2005	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Canada							
Total GHG emissions	732	705	712	725	724	659	670
Heavy industry	89	78	77	80	79	74	77
Mining	8.1	8.7	9.6	11	10	10	11
Ontario							
Total GHG emissions	204	160	156	163	163	147	151
Heavy industry	35.2	30.6	28.6	28.8	28.3	25.5	27.6
Mining	1.0	1.4	1.4	1.3	1.4	1.5	1.8

Note:
(1) Data derived from ECCC (2023a; Part 1, Table 2-12; Part 3, Table A12-7).

Table 6.4-2: Greenhouse Gas Emissions Criteria, Indicators and Rationale

Criteria	Indicator (1)	Rationale
Change in carbon dioxide (CO_2)	As carbon dioxide equivalent (CO_2e)	The Kyoto Protocol and Canada's National Inventory include seven GHGs (or GHG groups), of which CO_2, CH_4 and N_2O are primarily generated from energy use and land use changes relevant to the Project.
Change in methane (CH_4)	As carbon dioxide equivalent (CO_2e)	
Change in nitrous oxide (N_2O)	As carbon dioxide equivalent (CO_2e)	

Note:
(1) Measured in kilotonnes at the Project scale.

Table 6.4-3: Significance Determination Attributes and Rankings for Greenhouse Gas Emissions

Attribute	Description	Category
Magnitude	A qualitative or quantitative measure to describe the size or degree of the residual effects relative to baseline conditions	**Level I:** Greenhouse gas emissions of <0.1% of Canada's 2030 CO_2e target. **Level II:** Greenhouse gas emissions of 0.1% to 1.0% of Canada's 2030 CO_2e target. **Level III:** Greenhouse gas emissions of >1.0% of Canada's 2030 CO_2e target.
Geographic extent	The spatial extent over which the residual effect will take place	**Level I:** Effect is restricted to the Local Study Area. **Level II:** Effect extends beyond the Local Study Area. **Level III:** Effect extends beyond the Regional Study Area.
Duration	The time period over which the residual effect will or is expected to occur	**Level I:** Effect occurs over the short term: less than or equal to 3 years. **Level II:** Effect occurs over the medium term: more than 3 years but less than 20 years. **Level III:** Effect occurs over the long term: greater than 20 years
Frequency	The rate of occurrence of the residual effect	**Level I:** Effect occurs once, infrequently or not at all. **Level II:** Effect occurs intermittently or with a certain degree of regularity. **Level III:** Effect occurs frequently or continuously.
Reversibility (1)	The extent to which the residual effect can be reversed	**Level I:** Effect is fully reversible. **Level II:** Effect is partially reversible or potentially reversible with difficulty. **Level III:** Effect is not reversible.

Notes:

(1) There is a distinction regarding reversibility of residual effects between GHG emissions (the VC) versus that of atmospheric GHG concentrations. The Project's effects on atmospheric GHG concentrations are not fully reversible. However, it is also recognized that this Project will not have a measurable effect on global warming (e.g., change to atmospheric GHG concentrations) and that climate change does not have clear and measurable endpoints and therefore GHG emissions are the VC.

< = less than; > = greater than.

Table 6.4-4: Potential Interactions of Project Components on Greenhouse Gas Emissions

Project Component / Activity	Greenhouse Gas Emissions
Construction Phase	
Site preparation activities including clearing, grubbing and bulk earthworks	Yes
Construction of the mine site access road and airstrip, including the development and operation of the aggregate source areas	Yes
Development of temporary construction camp and staging areas	Yes
Construction of the fish habitat development area	Yes
Construction of the transmission line to the Project site	Yes
Construction of the onsite haul and access roads	Yes
Construction of the dewatering dikes in north basin of Springpole Lake	Yes
Construction of buildings and onsite infrastructure	Yes
Construction of the central water storage pond	Yes
Controlled dewatering of the open pit portion	Yes
Construction of the starter embankments for the co-disposal facility	Yes
Stripping of lake bed sediment and overburden at the open pit	Yes
Development of the surficial soil stockpile	Yes
Initiation of pit development in rock	Yes
Initiation of stockpiling of ore	Yes
Establishment and operation of water management and treatment facilities	Yes
Commissioning of the process plant	Yes
Employment and expenditures	-
Operation Phase	
Operation of the process plant	Yes
Operation of open pit mine	Yes
Management of overburden, mine rock, tailings and ore in designated facilities	Yes
Operation of water management and treatment facilities	Yes
Accommodations complex operations	Yes
Operation and maintenance of mine site infrastructure	Yes
Progressive reclamation activities	Yes
Employment and expenditures	-
Decommissioning and Closure Phase	
Removal of assets that can be salvaged	Yes
Demolition and recycling and/or disposal of remaining materials	Yes
Removal and disposal of demolition-related wastes in approved facilities	Yes
Reclamation of impacted areas, such as by regrading, placement of cover, and revegetation	Yes
Filling the open pit with water	-
Monitoring and maintenance	-
Employment and expenditures	-

Note:
- = The interaction is not expected, and no further assessment is warranted.

Table 6.4-5: Proposed Mitigation for Potential Greenhouse Gas Emissions

	Phase			
Pathways to Potential Effects / Criteria	**Con.**	**Op.**	**Cl.**	**Proposed Mitigation Measure**
Change in carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O)	•	•	•	Implement the mitigation measures for air quality (Section 6.2), during the construction, operations and closures phases of the Project, including: • During construction, operations and active closure, site roads will be maintained in good condition, with regular inspections and timely maintenance completed; and • During operations, GHGs from the use of diesel fuel for the mobile heavy equipment will be minimized through strategic mine scheduling to minimize the total distance travelled by haul trucks and other equipment.
	–	•	–	Construct a 230 kV transmission line to supply power during the operation of the Project, which obtains electricity from the Ontario grid.
	•	•	•	A GHG Management Plan will be developed that will describe the energy and heat conservation, efficiency and management programs for the Project, and outline mitigation measures for GHG emissions during construction, operations and closure phases, including but not limited to the following: • Fuel use tracking on a regular basis (such as monthly); • Limiting vehicle speeds; • No-idling policies, where practicable and safe, to avoid unnecessary releases of GHG emissions; • Regular maintenance and servicing of mining equipment and vehicles to maximize operational efficiency; • Operational planning to minimize the distances haulage trucks travel on site to the extent possible; and • Blast optimization to reduce the rehandling of materials.
	•	•	•	Implementation of Net-Zero Strategy to reduce the net GHG emissions over the life of the Project.

Notes:
Con. = construction; Op. = operation; C. = closure; • = mitigation is applicable; – = mitigation is not applicable.

Table 6.4-6: Project Greenhouse Gas Emissions During the Project

Category	Phases: Site Preparation and Construction (kt CO_2e)	Phases: Operations (kt CO_2e)	Phases: Closure (kt CO_2e)	Project Total (kt CO_2e)
Scope 1 - Mine Site Access Road Construction	19.1	-	-	19.1
Scope 1 - Biomass Removal and Disturbance	142.5	-	-	142.5
Scope 1 - Diesel Usage	33.4	307.8	14.3	355.5
Scope 1 - Gasoline Usage	0.3	2.3	0.1	2.7
Scope 1 - Propane Usage	4.7	64.8	7.6	77.1
Scope 1 - Blasting	3.1	20.1	-	23.2
Scope 2 - Electricity Usage	0.1	153.3	0.05	153.4
Net GHG emissions	**203.2**	**548.3**	**22.1**	**773.6**
Foregone carbon dioxide (CO_2) sequestration (1)	**48.4**	**163.5**	**81.3**	**293.2**

Note:
(1) Foregone CO_2 sequestration is not included in the net GHG emissions and is presented separately per Canada's (2021) guidance. Between natural regrowth and progressive reforestation, CO_2 sequestration is assumed to be reestablished after three years of closure.
- = Not Applicable.

Table 6.4-7: Greenhouse Gas Emissions for Maximum Emission Year

Category	Maximum Annual GHG Emissions (kt CO_2e)
Scope 1 – Onsite Energy Use and Blasting	49.4
Scope 2 – Purchased Electricity	18.6
Total annual GHG emissions	**68.0**

Table 6.4-8: Peak Annual Greenhouse Gas Emissions in Context with Federal and Provincial Inventories

Category	Project Emissions (Mt CO_2e)	2021 Canadian Total GHG (Mt CO_2e)		2021 Ontario Total GHG (Mt CO_2e)		2030 Target of 40% Reduction from 2005 Levels(1) (Mt CO_2e)	
Total Scope 1 and 2 GHG emissions	0.068	670	0.01%	151	0.05%	406	0.02%
Scope 1 Mining Sector	0.050	11	0.5%	1.8	2.8%	—	—
Scope 1 Heavy Industry	0.050	77	0.07%	28	0.2%	—	—

Note:
(1) The total national GHG emissions in 2005 were 739 Mt CO_2e. A 45% reduction is equivalent to a 2030 target of 406 Mt CO_2e.