BEATONS CREEK FRESH ROCK EXPANSION

Greenhouse Gas Assessment

Prepared for:

360 Environmental on behalf of Novo Resources Corp

SLR Ref: 620.30778.00000-R01
Version No: -v1.0
February 2022

EXECUTIVE SUMMARY

PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Level 16, 175 Eagle Street
Brisbane QLD 4000 Australia
(PO Box 26 Spring Hill QLD 4004)
T: +61 7 3858 4800
E: brisbane@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with 360 Environmental on behalf of Novo Resources Corp (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
620.30750.00000-R01-v0.2	25 February 2022	Racquel Abrantes		G Starke

CONTENTS

TABLES

FIGURES

ACRONYMS

%	percent
°C	degrees Celsius
AGEIS	Australian Greenhouse Emissions Information System
CDM	Clean Development Mechanism
CER	Clean Energy Regulator
CFCs	chlorofluorocarbons
CH_4	methane
CO_2	carbon dioxide
CO_2-e	carbon dioxide equivalent
COP26	Conference of the Parties
DISER	Department of Industry, Science, Energy and Resources
EVC	Ecological Vegetation Classes
G	gram
GHG	greenhouse gas
GJ	gigajoule
GWP	Global Warming Potential
ha	hectare
HFCs	Hydrofluorocarbons
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
kg	kilogram
kL	kilolitre
km	kilometre
kWh	kilowatt hour
L	litre
m^3	cubic metre
MWh	megawatt hour
N_2O	nitrous oxide
NGA	National Greenhouse Accounts (Australia)
NGER	National Greenhouse and Energy Reporting
NPI	National Pollutant Inventory
PFCs	Perfluorocarbons
SF_6	Sulfur hexafluoride
t	tonne
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organization
WRI	World Resources Institute
WBCSD	World Business Council for Sustainable Development

GLOSSARY

ambient	Pertaining to the surrounding environment or prevailing conditions.
atmosphere	A gaseous mass surrounding the planet that is retained by Earth's gravity. It is divided into five layers, with most of the weather and clouds found in the first layer.
biennial	(An event) lasting for two years or occurring every two years.
carbon dioxide equivalent	A standardised expression for all greenhouse gas emissions using the global warming potential.
climatological	The science dealing with climate and climatic phenomena.
combustion	The process of burning. A chemical change, especially oxidation, accompanied by the production of heat and light.
fossil fuel	A natural fuel such as coal, diesel or gas, formed in the geological past from the remains of living organisms.
greenhouse gas	A gas that contributes to the greenhouse effect by absorbing infrared radiation, e.g., carbon dioxide.
guideline	A general rule, principle, or piece of advice. A statement or other indication of policy or procedure by which to determine a course of action.
global warming potential	The Global Warming Potential is an index used to convert relevant non-carbon dioxide gases to a carbon dioxide equivalent (CO2-e) by multiplying the quantity of the gas by its GWP.
NGER	The National Greenhouse and Energy Reporting (NGER) scheme, established by the *National Greenhouse and Energy Reporting Act 2007* (NGER Act), is a single national framework for reporting and disseminating company information about greenhouse gas emissions, energy production, energy consumption and other information specified under NGER legislation.
NPI	The National Pollutant Inventory (NPI) provides the community, industry and government with free information about substance emissions in Australia. It has emission estimates for 93 toxic substances and the source and location of these emissions.
Scope 1 emissions	Direct greenhouse gas (GHG) emissions produced from sources within the boundary of an organisation and as a result of the organisation's activities.
Scope 2 emissions	Indirect GHG emissions produced during the generation of purchased electricity consumed in owned or controlled equipment or operations.
Scope 3 emissions	Indirect GHG emissions generated in the wider economy as a consequence of an organisation's activities but are physically produced by the activities of another organisation.

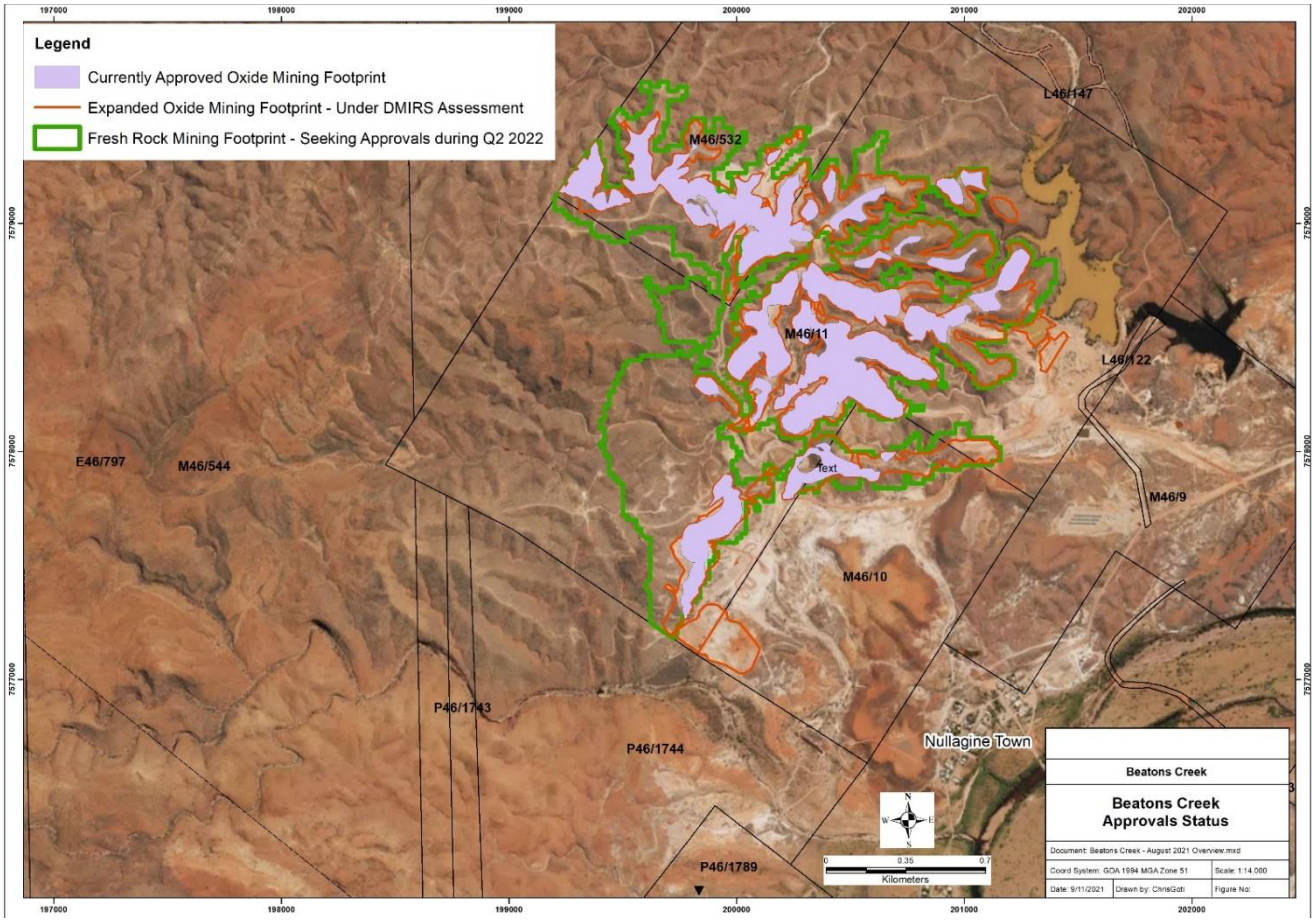
1 Introduction

360 Environmental Pty Ltd (360 Environmental, on behalf of their client Novo Resources Corp) has engaged SLR Consulting Australia Pty Ltd (SLR) to provide a greenhouse gas (GHG) assessment of the proposed expansion of operations of Beatons Creek Fresh Rock Expansion (the Project) as part of the Department of Water and Environmental Regulation requirement to assess the GHG emissions potentially created by a project. The GHG assessment estimates Scope 1 and Scope 2 GHG emissions for each component of the Project.

1.1 Proposed Fresh Rock Expansion

Beatons Creek Gold (BCG) a subsidiary of Novo Resources is a gold explorer and producer, mining its Beatons Creek gold deposit since November 2020 after almost a decade of exploration. Mining of part of the oxide resource at Beatons Creek is being undertaken under an approved Mining Proposal, Mine Closure Plan and Native Vegetation Clearing Permit (CPS 7440/3). A revision to the MP/ MCP is currently under review by DMIRS to expand the oxide mining footprint. The Fresh Rock Project (the Project) will involve the mining of approximately 35 Mbcm of ore and waste over approximately four years resulting in a total clearing footprint of up to 270 ha all of which lies within the limit of approved CPS 7440/3. Some additional footprint will be developed on already disturbed land (i.e. with no additional clearing of native vegetation).

Figure 1 Beatons Creek Approvals Status



1.2 Study Objectives

The GHG assessment of the proposed operations will estimate direct and indirect GHG emissions from operation in accordance with state regulations and guidelines. The objectives of the GHG assessment are to:

- For operations, identify GHG sources and categorise as per GHG Protocol Scope 1 (Direct), 2 (Indirect - Energy) or 3 (Indirect – Other).
- Determine appropriate GHG emission factors from published literature (e.g. National Greenhouse Accounts (NGA) Factors).
- Estimate direct GHG emissions associated with carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).
- Estimate energy consumption and associated indirect GHG emissions (e.g. purchase of electricity).
- Estimate non-energy related GHG emissions (e.g. from land use change).
- Estimate the cumulative GHG emissions over the lifetime of the facility.

It is intended that the GHG assessment will estimate direct GHG emissions in accordance with the Western Australia's Environmental Protection Agency's Environmental Factor Guideline for Greenhouse Gas Emissions.

1.3 Assessment Approach

The overall approach used for the GHG assessment was as follows:

- Identify relevant national and international statutory requirements, policies and standards that may be relevant to the Project.
- Identify the key related GHG emissions sources from the Project's operation.
- Estimate the annual quantities of GHG emissions generated from these sources.
- Estimate the total quantities of GHG emissions generated from these sources over the lifetime of the Project.

In accordance with standard practice, this assessment has been guided with reference to the requirements of the GHG Protocol and IPCC and Australian Government emission calculation methodologies.

The calculation of GHG emissions were performed in a four-stage process:

1. Identification of GHG emissions sources within the Project boundary (**Section 5.1**).
2. Identification of activity data for each GHG emissions source (**Section 5.1**).
3. Identification of emissions factors for each source (**Section 5.2**).
4. Estimation of GHG emissions and assumptions used (**Section 5.3**).

2 The Greenhouse Effect

The greenhouse effect is a naturally occurring process that aids in heating the Earth's surface and atmosphere. It results from the fact that certain atmospheric gases, such as carbon dioxide, water vapor, and methane, can change the energy balance of the planet by absorbing longwave radiation emitted from the Earth's surface. Without the greenhouse effect, life on this planet would probably not exist as the average temperature of the Earth would be around -18 degrees Celsius (°C), rather than the present 15°C.

As energy from the Sun passes through the atmosphere several things take place. A portion of the energy (26% globally) is reflected or scattered back to space by clouds and other atmospheric particles. About 19% of the energy available is absorbed by clouds, gases (like ozone), and particles in the atmosphere. Of the remaining 55% of the solar energy passing through the Earth's atmosphere, about 4% is reflected from the surface back into space. Thus, on average, about 51% of the Sun's radiation reaches the Earth's surface. This energy is used in several processes, including the heating of the ground surface; the melting of ice and snow and the evaporation of water; and plant photosynthesis.

The heating of the ground by sunlight causes the Earth's surface to become a radiator of energy in the longwave band (infrared radiation) with emission of this energy generally directed to space. However, only a small portion of this energy makes it back to space with most of the outgoing infrared radiation absorbed by GHGs.

Absorption of longwave radiation by the atmosphere causes additional heat energy to be added to the Earth's atmospheric system. The now warmer atmospheric GHG molecules begin radiating longwave energy in all directions. Over 90% of this emission of longwave energy is directed back to the Earth's surface where it once again is absorbed by the surface. The heating of the ground by the longwave radiation causes the ground surface to once again radiate, repeating the cycle described above, again and again, until no more longwave radiation is available for absorption. The amount of heat energy added to the atmosphere by the greenhouse effect is controlled by the concentration of GHGs in the Earth's atmosphere.

Emissions of GHGs can result from natural or man-made (anthropogenic) sources. Examples of natural sources include the decomposition or burning of plant material and emissions of methane from animal digestion processes. Emissions also occur as a result of human activities and such sources include the burning of fossil fuels, the use and leakage of refrigerants, the clearing of forest and other vegetation, and the use of fertilisers, amongst other sources. This separation of natural versus anthropogenic sources is complicated by the fact that natural processes may be manipulated by humans, resulting in increased emissions of GHGs.

On Earth, human activities are changing the natural greenhouse effect. Several gases are involved in the human-caused enhancement of the greenhouse effect including (NASA, 2019):

- **Carbon dioxide** (CO_2): A minor but very important component of the atmosphere, CO_2 is released through natural processes such as respiration and volcanic eruptions and through human activities such as deforestation, land use changes, and burning fossil fuels. Humans have increased the atmospheric CO_2 concentration by more than a third since the Industrial Revolution began. This is the most important long-lived "forcing" of climate change.
- **Methane** (CH_4): A hydrocarbon gas produced both through natural sources and human activities, including the decomposition of wastes in landfills, agriculture (especially rice cultivation), as well as ruminant digestion and manure management associated with domestic livestock. On a molecule-for-molecule basis, CH_4 has far more greenhouse warming potential than CO_2, but is also one which is much less abundant in the atmosphere.

- **Nitrous oxide** (N_2O): A powerful GHG produced by soil cultivation practices, especially the use of commercial and organic fertilisers, but also (in lesser amounts) from fossil fuel combustion, nitric acid production, and biomass burning.
- **Chlorofluorocarbons** (CFCs): Synthetic compounds, entirely of industrial origin, used in a number of applications, but now largely regulated in production and release to the atmosphere by international agreement for their ability to contribute to destruction of the ozone layer. They are also GHGs.

Over the last century, the burning of fossil fuels such as coal and oil has increased the concentration of atmospheric CO_2. This happens because the coal or oil burning process combines carbon with oxygen in the air to make CO_2. To a lesser extent, the clearing of land for agriculture, industry, and other human activities has also increased concentrations of GHGs. Vegetation and soils typically act as a carbon sink, storing carbon dioxide that is absorbed through photosynthesis. When the land is disturbed, part of the stored carbon dioxide is emitted through mechanisms such as burning or decomposition of vegetation etc., re-entering the atmosphere. Land disturbance will often also remove the associated carbon sink decreasing the potential for future CO_2 removal.

Quantifying linkages between emissions of GHGs from an individual project to resulting global GHG concentrations and climate warming is not possible due to a host of uncertainties and a lag in the climate system. Action by national governments aimed at reducing GHG emissions by sector and national totals will result in mitigation of climate change. Hence, accurate quantification of GHG emissions will aid the ongoing assessment of climate impacts and the development of targeted and effective policies and strategies to reduce the impact of global climate warming.

3 Relevant Legislation, Guidelines and Policies

3.1 The International Response to Climate Change

Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) is the international body tasked with assessing scientific knowledge on climate change. It was established by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) in 1988, and endorsed by the UN General Assembly, to provide policy makers with regular scientific assessments of climate change, its impacts and future risks, and the mitigation and adaptation options.

The first meeting of the IPCC was held in Geneva in 1988. Since it was established, the IPCC has prepared five assessment reports, which have provided key inputs into the international negotiations to tackle climate change. The Sixth Assessment Report was released by IPCC in 2021 and considers new evidence of climate change based on independent analyses from observations of the climate system and includes refined estimates of impact probability.

Kyoto Protocol

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change (UNFCCC). The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialised countries and the European community for reducing GHG emissions. These targets amount to an average of five per cent reduction against 1990 levels over the five-year period 2008-2012.

Countries must meet their targets primarily through national measures to avoid, abate or offset GHG emissions. However, the Kyoto Protocol offers additional means of meeting targets through the following market-based mechanisms:

- Emissions trading: Gives corporations or individuals the opportunity to offset their GHG emission liability by purchasing Kyoto certified carbon credits generated by carbon emission reduction projects.
- Clean Development Mechanism (CDM): Where industrialised (or “Annex One” as defined in the Protocol) nations can implement Kyoto approved GHG reduction projects in developing nations (or “Non-Annex One” as defined in the Protocol) in order to generate Carbon Emission Reductions (CERs).
- Joint Implementation (JI): Allows developed (Annex One) nations to engage in emission reduction projects with other developed (Annex One) nations to generate CERs.

These mechanisms help stimulate investment in GHG-friendly actions and technologies and to meet emission targets in a cost-effective manner. Comprehensive mechanisms have been set up under the UNFCCC that aim to ensure the validity and credibility of emissions avoidance, abatement and offset projects under the CDM and JI.

Glasgow Agreement

The Glasgow Agreement, from the 26th Conference of the Parties (COP26) in Glasgow in November 2021, sets in place a framework for all countries to take climate action during the 2020s, building on the existing international efforts in the period up to 2030. Key outcomes included:

- A stronger commitment to limit global temperature rises to 1.5 degrees, and greater acknowledgement of the latest science which reflects the urgent need to act during this critical decade.
- All countries to revisit their 2030 emission reduction targets in 2022 and, where necessary, strengthen them to bring them in line with the Paris Agreement temperature goal.
- Adoption of a package that will implement the Enhanced Transparency Framework under the Paris Agreement. This included a series of common reporting tables that will track Parties' emissions, support, and progress towards their nationally determined contributions.
- Reducing vulnerability, strengthening resilience, and increasing the capacity of people and the planet to adapt to the impacts of climate change
- A call for the developed country Parties to at least double their collective provision of climate finance for adaptation to developing country Parties from 2019 levels by 2025.

The Greenhouse Gas Protocol Initiative

GHG accounting and reporting principles are intended to underpin all aspects of GHG accounting and reporting. The five principles outlined below are consistent with the World Resources Institute/World Business Council for Sustainable Development (WRI/WBCSD) GHG Protocol Initiative (a globally adopted and leading GHG accounting strategy), and ISO 14064-1, 2, and 3 GHG guidelines (internationally accepted best practice). These principles are based on financial accounting and reporting standards and are taken from the GHG Protocol documentation (WRI, 2004).

The following outlines the basic requirements of any GHG assessment, as defined by WRI/WBCSD:

- **Relevance:** The relevance of a company's GHG report relates to the information which it contains. The information should allow stakeholders, both internal and external to the organisation, to make informed decisions about GHG management. An important aspect of relevance is the selection of appropriate boundary conditions which reflect the reality of the company's operations. The operation of the company, the purpose of the information and the needs of users will all inform the choice of the inventory boundary.
- **Completeness:** All relevant emission sources within the chosen inventory boundary need to be accounted for so that a comprehensive and meaningful inventory is compiled. WRI (2004) states that no materiality threshold (or minimum emissions accounting threshold) should be defined as this is not in line with the principle of completeness. However, if emissions are not able to be estimated or estimated at a sufficient level of quality, then these should be transparently documented and justified.
- **Consistency:** Consistency in an emissions inventory allows stakeholders to compare GHG emissions performance from year to year. This consistency also allows trends to be identified and performance against objectives and targets to be tracked. Any changes in the inventory (accounting approaches, boundaries, calculation methods) need to be transparently documented and justified.
- **Transparency:** All processes, procedures, assumptions and limitations of an inventory should be presented clearly and accurately. Information needs to be recorded, compiled and analysed in a way that enables internal reviewers and external auditors to verify the credibility of the inventory. Specific exclusions and inclusions are to be documented and justified, assumptions disclosed, and appropriate references provided for the calculation methods applied and the data sources used. Transparency is essential in the production of a credible GHG inventory.

- **Accuracy:** Accuracy describes how close the estimates of GHG emissions are to the 'true' value. The accuracy of a GHG inventory should be sufficient for stakeholders to make decisions with reasonable assurance of the integrity of the reported information. Quality management measures should be implemented to maximise inventory accuracy.

Additional to the principles of GHG reporting, data materiality can be used to simplify the accounting process by omitting low level emission sources which do not make a significant contribution to overall Project emissions. Emissions which are within emission reporting errors or make up less than 5% or of the total Project emissions are deemed to be immaterial as their inclusion or omission does not have significant bearing on Project behaviours or processes (DoE, 2008).

3.2 Australian GHG Policy and Regulation

Australia ratified the Kyoto Protocol (the Protocol) in 2007 and as such made a commitment to reducing GHG emissions. In response to this ratification Australia adopted a number of Federal and State Government initiatives to achieve a reduction in GHG emissions to 5% below 2000 levels.

Ahead of the Paris Conference, countries were invited to submit indicative post-2020 targets, known as Intended Nationally Determined Contributions (INDCs). Australia's target is to reduce emissions by 26-28% below 2005 levels by 2030, which builds on the 2020 target of reducing emissions by 5% below 2000 levels.

Australia's targets are proposed to be achieved through a suite of policies to reduce emissions, encourage technological innovation and expand the clean energy sector.

National Greenhouse and Energy Reporting (NGER)

The NGER Act 2007 provides a single national framework for the reporting and dissemination of information about the GHG emissions, GHG projects, and energy use and production of corporations. It makes registration and reporting mandatory for corporations whose energy production, energy use or GHG emissions meet specified thresholds.

National Greenhouse Accounts (NGA) Factors

The National Greenhouse Accounts (NGA) Factors document (DISER, 2020) was prepared by the Department of Industry, Science, Energy and Resources (DISER) and is designed for use by companies and individuals to estimate GHG emissions. The NGA default emission factors listed in this document have been estimated by the DISER using the Australian Greenhouse Emissions Information System (AGEIS) and are determined simultaneously with the production of Australia's National Greenhouse Accounts. This promotes consistency between inventories at company or facility level and the emission estimates presented in the National Greenhouse Accounts. The methods used at the national level, and reflected in the NGA Factors document, are consistent with international guidelines and are subject to international expert review each year.

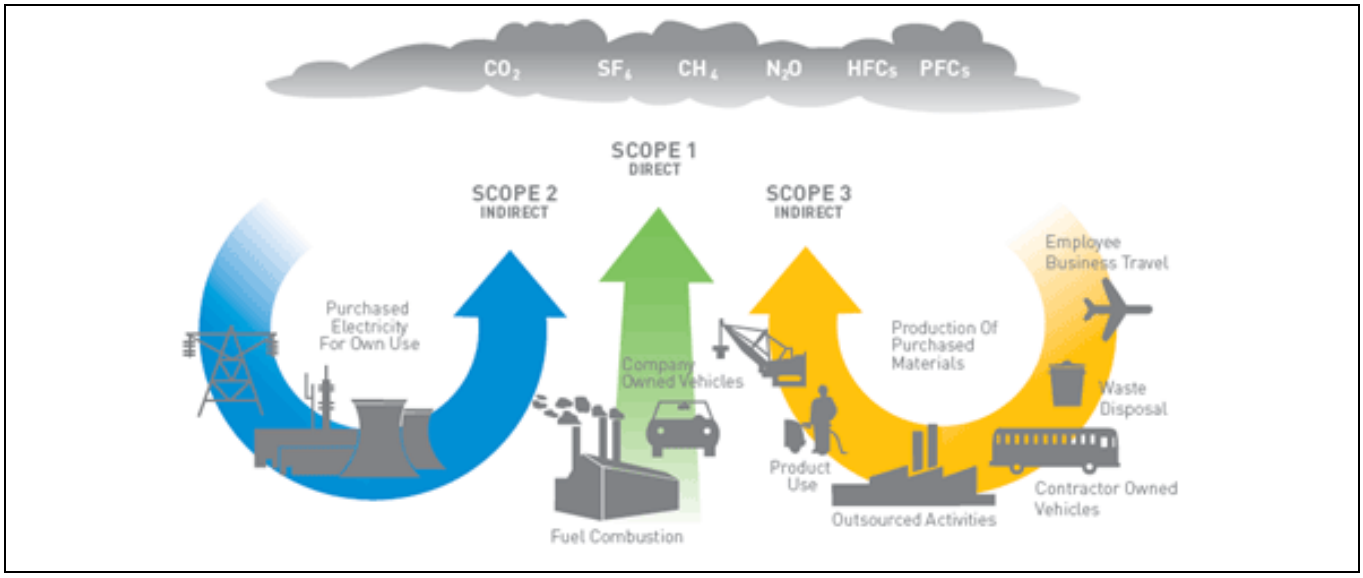
4 Greenhouse Gas Emissions Background

4.1 Scopes Definition

Emissions of GHG can be termed as being *Scope 1, Scope 2* or *Scope 3*, and '*direct*' or '*indirect*' emissions (**Figure 2**).

The definitions below for each Scope have been taken from the WRI and WBCSD GHG Protocol (WRI, 2004). These documents provide detailed information on the activities which should be included in each of the Scope 1, 2 and 3 boundaries. The definition of these boundaries allows the determination of those sources of GHG emissions that can be directly controlled by the Project (Scope 1 and Scope 2), or those that the Project will have some, but limited control over (Scope 3).

Figure 2 Scope 1, 2 and 3 GHG Emissions as Defined in the GHG Protocol Initiative



Source: WRI (2004)

4.1.1 Direct Emissions (Scope 1)

Direct emissions of GHG are termed Scope 1 emissions and are produced from sources within the boundary of and as a result of the Project's activities. These direct emissions will arise from the following sources associated with the Project's activities and may include:

- Combustion of liquid fuels for stationary purposes
- Combustion of liquid fuels for transport purposes
- Combustion of petroleum-based oil and greases
- Fugitive emissions
- Vegetation clearing

4.1.2 Indirect Emissions (Scope 2 and Scope 3)

Indirect emissions are generated in the wider economy as a consequence of an organisation's activities but are physically produced by the activities of another organisation.

Scope 2 Emissions

The most important category of indirect emissions is from the consumption of purchased electricity (Scope 2 emissions). Scope 2 emissions relate to the GHG emissions from the generation of purchased electricity consumed within the boundary of the organisation and as a result of the organisation's activities. In Australia, this is primarily from coal fired power generation.

Scope 3 Emissions

Scope 3 indirect emissions are related to the upstream emissions generated in the extraction and production of fossil fuels and in the emissions from contracted/outsourced activities.

Scope 3 emissions are generally Scope 1 or 2 emissions for other companies. For example, in general, diesel use by contractors is a Scope 3 emission, yet is referred to as a Scope 1 emission in the GHG inventory of the contractor.

4.2 Global Warming Potentials

For comparative purposes, non-CO_2 GHGs are awarded a "CO_2-equivalence" (CO_2-e) based on their contribution to the enhancement of the greenhouse effect. The CO_2-equivalence of a gas is calculated using an index called the Global Warming Potential (GWP). The GWP is used to convert relevant non-CO_2 gases to a CO_2-e by multiplying the quantity of the gas by its GWP. GWPs are periodically updated by the IPCC in line with improvements to the underlying science. The GWPs of potential relevance to the Project, as per the IPCC and taken from the NGA are shown in **Table 1**.

Short-lived gases such as carbon monoxide, nitrogen dioxide, and non-methane volatile organic compounds (NMVOCs) vary spatially, and it is consequently difficult to quantify their contribution to project GHG emissions. For this reason, GWP values are generally not attributed to these gases, nor have they been considered further as part of this assessment.

No significant sources of other GHGs such as sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs) or perfluorocarbons (PFCs) have been identified as part of the Project, therefore they have not been considered further as part of this assessment.

Table 1 Global Warming Potentials

Gas	Chemical Formula	GWP
Carbon dioxide	CO_2	1
Methane	CH_4	28
Nitrous oxide	N_2O	265

5 Identification and Estimation of GHG emissions

5.1 Emission Sources, Activity Data and Assumptions

GHG emissions associated with the production stages of the Project are considered to be within the geographical and operational boundary of this assessment (Scope 1 and 2).

Activity data used in the GHG emissions calculations for the Project's operation is shown in **Table 2**.

Table 2 GHG Emission Inventory Activity Data and Assumptions

Activity	Quantity	Assumptions
Construction period	0 months	No construction, expansion of current operations
Operation period	6 years	Based on current resources project lifespan will be 6 years.
Liquid fuel use for transport purposes – Diesel	4,005 kL/annum	
Liquid fuel use for on-site equipment and machinery use (stationary) – Diesel	701 kL/annum	
Liquefied petroleum gas (LPG) (stationary) – LPG	196kL/annum	
Liquid fuel use for electricity generation – Diesel	7,625 kL/annum	
Land clearance	92 ha	Native vegetation, much of the Project's footprint is on already disturbed land.
Electricity use	-	Stand-alone operation, not connected to the grid.
Wastewater treatment	75 persons	*Operation* - for most of the time it would be around 75 persons onsite

5.2 Energy Content and Emission Factors

The emission factors used in the calculations for the estimates of Scope 1 GHG emissions are presented in **Table 3**. Scope 2 emission factor for electricity is not included as the Project will not be connected to the grid. These factors were sourced from the most recent NGA Factors workbook.

Table 3 Energy Content and GHG Emission Factors

Source/Activity	Energy Content Factor	Emission Factor
Scope 1		
Diesel combustion – Transport	38.6 GJ/kL	70.4 kgCO_2-e/GJ
Diesel combustion – Stationary [a]	38.6 GJ/kL	70.2 kgCO_2-e/GJ
LPG combustion – Stationary	25.7 GJ/kL	60.6 kgCO_2-e/GJ
Diesel combustion – Electricity generation	38.6 GJ/kL	70.2 kgCO_2-e/GJ
Land clearing	-	752.97 tCO_2-e/ha
Scope 3		
Production and supply – Diesel	38.6 GJ/kL	3.6 kgCO_2-e/GJ

[a] Section 2.2 of the NGA Factors workbook states "*No transport factors are provided for vehicles not registered for road use. Stationary energy factors for individual fuel types should be used in these cases.*"

5.3 Estimated GHG Emissions

The estimated annual GHG emissions for the Project by source/activity has been provided for three different categories:

- Processing (**Table 4**)
- Haulage (**Table 5**)
- Mining (**Table 6**); and
- Total (**Table 7**).

Assumptions associated with the estimations include the following:

- Activity data totals and assumptions were provided by Novo Resources in email communication.
- Land use change (vegetation clearing) - GHG emissions from this source were included in this report as land use changes are expected to occur as part of the Project.
- Production and supply of petroleum-based oils and greases were not included as they haven't been quantified.
- Scope 2 emission factor for electricity is not included as the Project will not be connected to the grid.
- Scope 3 emissions were limited to supply and production of liquid fuel in the assessment as they are outside of the scope.

Table 4 GHG Emission Inventory for Processing (by Millennium Minerals at an off-site location) – Estimated Annual and Total GHG Emissions over the Life of the Project

Source/ Activity	Emissions (tCO_2-e)	
	Annual Project Emissions for Processing	Lifetime of Project Emissions Total (Processing)
Scope 1		
Diesel combustion – Transport	1,772	10,632
Diesel combustion – Stationary	1,680	10,080
LPG combustion – Stationary	305	1,832
Diesel combustion – Electricity generation	20,629	123,775
Land clearing	0	0
Wastewater treatment	10	62
Scope 1 TOTAL	**24,397**	**146,381**
Scope 3		
Production and Supply Diesel	1,235	7,408
Scope 3 TOTAL	**1,235**	**7,408**
TOTAL Scope 1 & 3	**25,632**	**153,789**

All presented values round to nearest integer value and values less than 0.5 set to 0, therefore small inconsistencies between totals may be reported.

Table 5 GHG Emission Inventory for Haulage – Estimated Annual and Total GHG Emissions over the Life of the Project from Beatons Creek to Millennium Minerals

Source/ Activity	Emissions (tCO_2-e)	
	Annual Project Emissions for Haulage	Lifetime of Project Emissions Total (Haulage)
Scope 1		
Diesel combustion – Transport	1,590	9,540
Diesel combustion – Stationary	0	0
LPG combustion – Stationary	0	0
Diesel combustion – Electricity generation	0	0
Land clearing	0	0
Wastewater treatment	0	0
Scope 1 TOTAL	**1,590**	**9,540**
Scope 3		
Production and Supply Diesel	81	488
Scope 3 TOTAL	**81**	**488**
TOTAL Scope 1 & 3	**1,671**	**10,028**

All presented values round to nearest integer value and values less than 0.5 set to 0, therefore small inconsistencies between totals may be reported.

Table 6 GHG Emission Inventory for Mining by Beatons Creek Gold at Beatons Creek – Estimated Annual and Total GHG Emissions over the Life of the Project

Source/ Activity	Emissions (tCO_2-e)	
	Annual Project Emissions for Mining	Lifetime of Project Emissions Total (Mining)
Scope 1		
Diesel combustion – Transport	7,523	45,138
Diesel combustion – Stationary	219	1,317
LPG combustion – Stationary	0	0
Diesel combustion – Electricity generation	33	195
Land clearing	11,546	69,273
Wastewater treatment	0	0
Scope 1 TOTAL	**19,321**	**115,923**
Scope 3		
Production and Supply Diesel	398	2,385
Scope 3 TOTAL	**398**	**2,385**
TOTAL Scope 1 & 3	**19,719**	**118,308**

All presented values round to nearest integer value and values less than 0.5 set to 0, therefore small inconsistencies between totals may be reported.

Table 7 GHG Emission Inventory Summary – Estimated Annual and Total GHG Emissions All Plant over the Life of the Project

Source/ Activity	Emissions (tCO_2-e)	
	Annual Project Emissions Summary	Lifetime of Project Emissions Total (Summary)
Scope 1		
Diesel combustion – Transport	10,885	65,309
Diesel combustion – Stationary	1,900	11,397
LPG combustion – Stationary	305	1,832
Diesel combustion – Electricity generation	20,662	123,970
Land clearing	11,546	69,273
Wastewater treatment	10	62
Scope 1 TOTAL	**45,308**	**271,843**
Scope 3		
Production and Supply Diesel	1,714	10,281
Scope 3 TOTAL	**1,714**	**10,281**
TOTAL Scope 1 & 3	**47,022**	**282,124**

All presented values round to nearest integer value and values less than 0.5 set to 0, therefore small inconsistencies between totals may be reported.

The main contributor to the Scope 1 GHG inventory for the Processing category (**Table 4**) is diesel combusted for electricity generation purposes, accounting for approximately 80% (20,629 tCO_2-e annually and 123,775 tCO_2-e for the lifetime of the Project). The main Scope 1 contributor for Haulage (**Table 5**) is emissions from diesel combusted for transport purposes, accounting for approximately 95% (1,590 tCO_2-e annually and 9,540 tCO_2-e for the lifetime of the Project). Finally, the main contributor to the Scope 1 GHG inventory for the Mining category (**Table 6**) is emissions from land clearing, accounting for approximately 59% (11,546 tCO_2-e annually and 69,273 tCO_2-e for the lifetime of the Project).

Based on information presented in **Table 7**, the Project's overall (summary) annual Scope 1 GHG emissions is 45,307 tCO_2-e, and 271,844 tCO_2-e over the lifetime of the Project.

The main contributor to the annual GHG inventory is emissions from diesel combusted for electricity generation purposes accounting for approximately 44% (20,662 tCO_2-e) of the total estimated Project Scope 1 GHG emissions. The second contributor is emissions from land clearing with 25% (11,546 tCO_2-e) of the total emissions.

The main contributor to the estimated overall GHG inventory is diesel combusted for electricity generation purposes, with approximately 44% (123,970 tCO_2-e) of the total lifetime Scope 1 estimated GHG emissions. The second contributor is emissions from land clearing, which accounts for approximately 25% (69,273 tCO_2-e) of the total lifetime Scope 1 emissions.

6 Conclusions

The assessment considers GHG emissions from the Project and includes estimates of direct GHG emissions nas well as indirect emissions from fuel production and supply. This assessment concluded annual emissions from the Project are estimated to be:

- Scope 1 (direct): 45,308 tCO_2-e.
- Scope 3 (indirect): 1,714 tCO_2-e.

The total lifetime emissions from six years of operation of the Project are estimated to be:

- Scope 1 (direct): 221,332 tCO_2-e.
- Scope 3 (indirect): 10,281 tCO_2-e.

The annual value is below the Environmental Protection Authority's annual trigger level of 100,000 t CO_2-e/annum of Scope 1 emissions.

7 References

DISER. (2020). *National Greenhouse Accounts Factors.* Canberra: Australian Government, Department of Industry, Science, Energy and Resources.

DoE. (2008). *Techincal Guidelines for the Estimation of GHG Emissions by Facilities in Australia.* Department of the Environment.

IPCC. (1995). *Second Assessment Report - Working Group I: The Science of Climate Change.* Intergovernmental Panel on Climate Change. Retrieved from http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml

IPCC. (2007). *Climate Change 2007: The Physical Science Basis.* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt,M. Tignor and H.L. Miller (eds.). Cambridge, UK and New York, NY, USA: Cambridge University Press. Retrieved from http://www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html

IPCC. (2013). *Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.). Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

NASA. (2019, August 12). *Global Climate Change - Vital Signs of the Planet*. (E. S. Laboratory, Editor) Retrieved August 8, 2019, from National Aeronautics and Space Administration: https://climate.nasa.gov/causes/

WRI. (2004). A Corporate Accounting and Reporting Standard – Revised Edition. World Resources Institute / World Business Council for Sustainable World Business Council for Sustainable Development.

ASIA PACIFIC OFFICES

BRISBANE
Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CANBERRA
GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN
Unit 5, 21 Parap Road
Parap NT 0820
Australia
T: +61 8 8998 0100
F: +61 8 9370 0101

GOLD COAST
Level 2, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

MACKAY
21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE
Level 11, 176 Wellington Parade
East Melbourne VIC 3002
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE
10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH
Ground Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

SYDNEY
Tenancy 202, Sub Base Platypus
120 High Street
North Sydney NSW 2060
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TOWNSVILLE
12 Cannan Street
South Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

WOLLONGONG
Level 1, The Central Building
UoW Innovation Campus
North Wollongong NSW 2500
Australia
T: +61 404 939 922

AUCKLAND
68 Beach Road
Auckland 1010
New Zealand
T: 0800 757 695

NELSON
6/A Cambridge Street
Richmond, Nelson 7020
New Zealand
T: +64 274 898 628