PROMETHIUM CARBON

Specialist Greenhouse Gas Emission Inventory

Cato Ridge Land Development and Release Project

Prepared by Promethium Carbon for:

Cato Ridge Development Company Ltd

and

Zutari (Pty) Ltd

March 2023

Executive Summary

The Cato Ridge Development Company Ltd (a wholly owned subsidiary of Assmang (Pty) Limited (Assmang)), propose to release land parcels across three Proposed Development Areas (PDAs) within a study area in the Cato Ridge area. The intention is to make land available for future developers. A variety of land use options for are being considered due to social and economic imperatives for the region.

The greenhouse gas (GHG) inventory for the proposed Cato Ridge Land Development and Release Project has been guided by several applicable guidance documents and standards related to the compilation of a GHG inventory.

The direct emissions during the operations of the project will be approximately 12 940 tCO_2e annually, or 121 016 tCO_2e across the lifetime of the project. The indirect emissions are about 171 681 tCO_2e, or 4 161 821 tCO_2e across the lifetime of the project (25 years). The direct emissions related to the construction of the project will be approximately 1 752 tCO_2e. The indirect emissions during construction of the project will be approximately 13 896 tCO_2e, with majority of the emissions associated with the use of concrete in the construction process. The impact assessment criteria applied for the greenhouse gas inventory showed that the project has a ***Medium*** climate change impact due to high emissions related to the operations of the warehouse, specifically the electricity consumed.

This study also considered the impacts of land-based emissions associated with land clearance. Estimating greenhouse gas emissions and carbon sequestration, and their relationship with land use change relies on quantifying and understanding ecosystem carbon stocks to use as a baseline and for future measurements. These carbon stocks exist within different pools or reservoirs. These include above ground biomass, below ground biomass, soil organic carbon and vegetation litter, debris & deadwood (collectively ecosystem carbon). The maximum total ecosystem carbon stock for the development footprint is 57 652 tonnes. This number was validated using coarser global datasets.[1,2] There was a 18% difference between the totals (local CSASA vs global) which indicates a relatively high agreement. The carbon stock comprises approximately 38% above ground biomass, 33% below ground biomass and 29% soil organic carbon. The mean carbon stock per ha is 160.9 MgC/ha.[3]

Construction related emissions for the project are deemed immaterial. In the short-term there are no significant reductions for construction-related emissions that can be achieved. The project should align to and operate within the standard constructions methods in South Africa

It is our opinion that, from the perspective of the project impacts on or contribution to climate change, the project should be granted environmental authorisation based on the medium significance rating of the emissions generated during the project operations.

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1 Sullivan, C.C., Lark, T.J. *et al.* 2010. Harmonized global maps of above and belowground biomass carbon density in the year 2010. Sci Data 7, 112. https://doi.org/10.1038/s41597-020-0444-4

2 SoilGrids. 2020. Soil Organic Carbon Stock. Available at: https://soilgrids.org/. Accessed 16 September 2022.

3 MgC = Megagrams of carbon. This is equivalent to tons of carbon and can be used interchangeably. MgC is usually used in reference to carbon in natural ecosystems.

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Key Terms and Definitions

Aboveground biomass[4]	Living vegetation above the soil, including stem, stump, branches, bark, seeds, and foliage.
Belowground biomass[4]	The living biomass of roots greater than 2 mm diameter.
Carbon budget	The allocation of a quantity of greenhouse gases that can be emitted over a specified period
Climate change[5,6]	The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as: '*a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods*. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes.
Greenhouse gas (GHG)[5,6]	Greenhouse gasses (GHGs) are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the atmosphere itself and by clouds. This property causes the greenhouse effect. The Kyoto Protocol deals with the following greenhouses gases, carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), Sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).
Nationally Determined Contributions (NDCs)	Non-binding sovereign plan including actions to address climate change mitigation, including climate-related targets for greenhouse gas emission reductions.
Soil organic carbon[4]	The carbon pool that includes all organic material in soil but excluding the coarse roots of the belowground biomass pool.

4 Glossary. M.S. Ashton et al. (eds.). 2012. Managing Forest Carbon in a Changing Climate, DOI 10.1007/978-94-007-2232-3, Springer Science+Business Media B.V.

5 IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press.

6 IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. In Press.

Acronyms and Abbreviations

AGB	Aboveground biomass
BGB	Belowground biomass
CCIA	Climate Change Impact Assessment
CO_2	Carbon dioxide
CRDC	Cato Ridge Development Company Ltd
CRLDRP	Cato Ridge Land Development and Release Project
CSASA	Carbon Sink Atlas for South Africa
D'MOSS	Durban Metropolitan Open Space System
EIA	Environmental Impact Assessment
EWS	eThekwini Water and Sanitation
GHG	Greenhouse gas
GWP	Global warming potential
ISO	International Organization for Standardization
kV	Kilovolt
KZNSS	KwaZulu-Natal Sandstone Sourveld
LDV	Light-duty vehicle
Mt	Megaton
MW	Megawatt
NDC	Nationally Determined Contribution
NEMA	National Environmental Management Act
PDA	Proposed Development Area
SANS	South African National Standards
SOC	Soil organic carbon
UNFCCC	United Nations Framework Convention on Climate Change
WWTP	Wastewater treatment plant

Declaration of Independence

The authors of this report do hereby declare their independence as consultants appointed by the Cato Ridge Company to undertake a Greenhouse Gas Inventory for the Cato Ridge Land Development and Release Project as part of the environmental authorisation process. Other than fair remuneration for the work performed the specialists have no personal, financial business or other interests in the project activity. The objectivity of the specialists is not compromised by any circumstances and the views expressed within the report are their own.

Robbie Louw

Shantal Beharie (EDTEA Declerations appended to report)

Indiana Mann

Joshua Weiss

Details of the Specialist Team

Promethium Carbon is a South African climate change and carbon advisory company based in Johannesburg. The company has been active in the climate change and carbon management space since 2004.

Promethium Carbon's climate change impact studies include an estimation of the carbon footprint of the activity or group of activities, as well as the vulnerability of the activity/ies to climate change. Promethium Carbon has calculated greenhouse gas inventories for over 60 entities and is proficient in applying the requirements of ISO/SANS 14064-1 and the Greenhouse Gas Protocol's accounting standards, as well as South Africa's Greenhouse Gas Reporting Guidelines. Promethium Carbon has also assisted around 40 clients develop climate change risk assessments, which includes the compilation of climate change specialist reports. Promethium Carbon's assessments include thorough analysis of historical and projected weather data specific to the region in which the client operates.

Robbie Louw is the founder and director of Promethium Carbon. He has over 18 years of experience in the climate change industry. Robbie holds both a BCom Honours Degree in Economics as well as a BEng in Chemical Engineering. Robbie has significant experience with regards climate change mitigation and adaptation. Robbie's chemical engineering background combined with his extensive experience in climate change has led to him leading several projects related to climate change risk and vulnerability, energy development and developing climate change mitigation and adaptation alternatives. His experience over a period of 35 years covers the chemical, mining, minerals process and energy fields, in which he was, involved in R&D, project, operational and management levels. Robbie is currently a member of The Southern African Institute of Mining and Metallurgy and the Institute of Directors in South Africa (IoDSA). In addition, Robbie is also a member of the Technical Working Group of the Climate Disclosure Standards Board (CDSB). Robbie's experience in climate change includes (but is not limited) to:

- Climate change risk and vulnerability assessments for large mining houses;
- Extensive experience in preparing carbon footprints. The team under his leadership has performed carbon footprint calculations for major international corporations operating complex businesses in multiple jurisdictions and continents;
- Carbon and climate strategy development for major international corporations;
- Climate change impact assessments for various companies and projects;
- Climate change scenario planning and analysis, particularly in terms of the recommendations of the Taskforce on Climate-related Financial Disclosure; and
- In depth understanding of South Africa's climate change regulations and carbon tax requirements.

Shantal Beharie is a climate change advisor at Promethium. She has eight years of experience in the climate change/sustainability field. She holds a master's degree in environmental studies which focused specifically on historical climate change, as well as an honours degree in geography and a BSocSci in environmental management and BSc (Hons) in Geography. Shantal has experience in sustainability (corporate reporting, climate-change scenario analysis, CDP, ESG, TCFD, Science-based targets/net-zero) climate change risk and vulnerability assessments, carbon credit project documentation, climate impact assessments, strategic projects (environmental management frameworks, strategic environmental assessments and compiling state of environment reports), and policy development.

Indiana Mann is a Climate Change Advisor who holds an BSc (Hons) in Atmospheric Science. Her postgraduate studies focused on the impact meteorological conditions have on pollen distribution within Cape Town. With her background in Environmental and Geographical Science and Atmospheric Science, Indiana has knowledge in climate modelling, climate change risk and vulnerability assessments and climate change policies. The projects in which she has been active include Climate Change Risk and Vulnerability Assessment; Climate Change Impact Assessments; The Task Force on Climate-Related Financial Disclosures reports; GHG Reporting; Carbon Footprints and Handling of weather data for necessary reports.

Joshua Weiss Joshua holds an MSc in Conservation Biology and a BSc (Hons) in Ecology, Environment and Conservation. He has cumulatively over six years of experience using GIS to conduct ecological analyses, developing sensitivity maps and cartographic design; producing several other maps for various reports in suitable and meaningful ways. He has a background in natural capital accounting, natural resource mapping and ecosystem service modelling & mapping His work has also included developing scenario maps of degradation, alien invasive plant spread and general spatio-temporal vegetation change. He also has experience in utilising and displaying up-to-date modelled climate data as part of the team that reviewed South Africa's Climate Change Adaptation Plans for South African Biomes and the Biodiversity Sector Climate Change Response Strategy. Joshua has also previously been involved in avifaunal monitoring and reporting, particularly in the renewable energy space, as well as scoping and EIA reporting.

Report structure and reference in terms of NEMA Regulations (2014), Appendix 6

NEMA Regulations (2014) (as amended) - Appendix 6	Relevant section in report
Details of the specialist who prepared the report	Pages viii-vi
The expertise of that person to compile a specialist report including a curriculum vitae	Pages viii-vi
A declaration that the person is independent in a form as may be specified by the competent authority	Page vii
An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
An indication of the quality and age of base data used for the specialist report	Sections 3.1.3 and 3.1.4.3
A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 2
The duration date and season of the site investigation and the relevance of the season to the outcome of the assessment	This is not relevant in terms of the GHG Inventory
A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Sections 3 and **Error! Reference source not found.**
Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying site alternative	Section 2
An identification of any areas to be avoided, including buffers	This is not relevant in terms of the GHG Inventory. However, this report does make mention of the impacts of climate change on sensitive areas surrounding the Cato Ridge Land Development and Release Project.
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	This is not relevant in terms of the GHG Inventory. However, this report does define the boundaries for which the project's impact on climate change, as well as the project's vulnerability to

NEMA Regulations (2014) (as amended) - Appendix 6	Relevant section in report
	climate change was determined.
A description of any assumptions made and any uncertainties or gaps in knowledge	Section 3.2.3
A description of the findings and potential implications of such findings on the impact of the proposed activity or activities	Sections 3.1.5
Any mitigation measures for inclusion in the EMPr	Section 5
Any conditions for inclusion in the environmental authorisation	N/A
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	N/A
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and regarding the acceptability of the proposed activity or activities	Section 6
A description of any consultation process that was undertaken during preparing the specialist report	N/A
A summary and copies of any comments received during any consultation process and where applicable all responses thereto	N/A
Any other information requested by the competent authority.	N/A

1. Introduction

The Cato Ridge Development Company Ltd (CRDC, a wholly owned subsidiary of Assmang (Pty) Ltd (Assmang)), propose to release land parcels across three Proposed Development Areas (PDAs) in Cato Ridge. The intention is to make land available for a combination of land use options for future developers to undertake development and construction which will have the additional benefit of meeting social and economic imperatives in the area.

The study area is in Cato Ridge near the western boundary of the eThekwini Metropolitan Municipality, KwaZulu-Natal (Figure 1). It is situated adjacent to and north of the N3 highway, approximately 51 km west of Durban and 29 km southeast of Pietermaritzburg on the N3.

Much of the surrounding land use is open land, comprising natural vegetation and degraded but minimally transformed vegetation. Parts of this land form part of the Durban Metropolitan Open Space System (D'MOSS).[7] The open space includes significant landholdings which have been acquired by the eThekwini Municipality for conservation to expand and consolidate conservation holdings south of the N3. Additional land uses in the surrounding area include rural residential areas, informal settlements and industrial, warehousing & logistical developments.

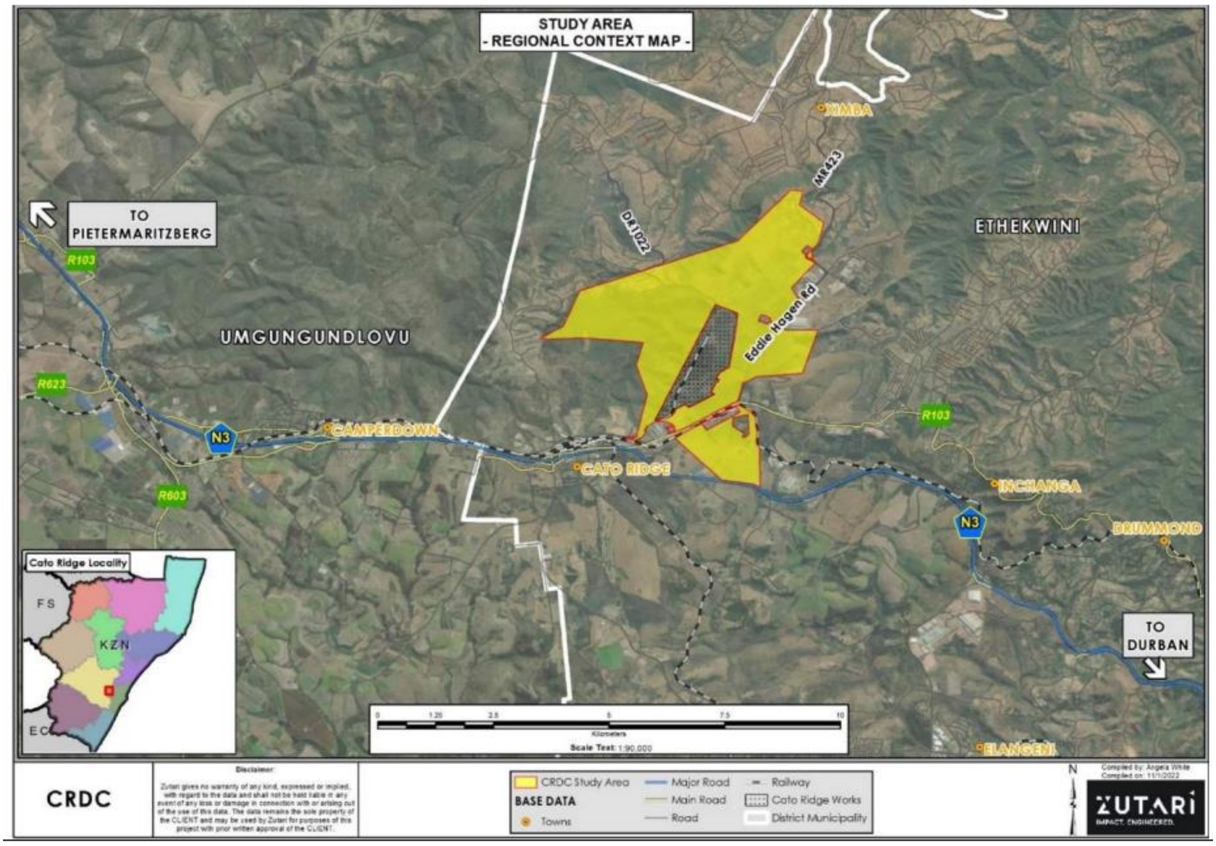

Figure 1: Regional location of the study area. Source: Zutari.

7 D'MOSS comprises interconnecting open spaces in public, private and traditional authority ownership that seeks to protect the biodiversity and associated ecosystem services of Durban.

1.1 Purpose and Scope of Work

The scope of work for the Cato Ridge Land Development and Release Project (CRLDRP) is to develop a Greenhouse Gas (GHG) Inventory that would form part of the environmental authorisation required for the Environmental Impact Assessment (EIA). The scope of the inventory would be to identify the sources of emissions and to calculate GHG emissions that are associated with land clearance, energy consumption and the project activities for the new development. The GHG inventory considers the following:

a) Construction-related activities

- Calculate emissions related to the construction activities related to the project.

b) Operational Phase

- Calculate emissions related to the project during its operational phase.

In addition to the construction and operation phase emissions, the GHG inventory assessed the emissions relating to land clearance for the development. This entailed the calculation of carbon stocks for the sites and consideration of using offsets to mitigate any impacts.

1.2 Project Activities and Infrastructure Requirements

The final scoping report for the CRLDRP highlights the following infrastructure requirements for the project.

1.2.1 Water requirements

The following water infrastructure will be required for the proposed development.

- One elevated water tower (500 m^3 or 0.1 ha) and;
- Water distribution pipelines – the capacity and dimensions to be confirmed.

The proposed water reticulation infrastructure will be finalised in consultation with the eThekwini Water and Sanitation (EWS) Department. The intention is to tie into the existing bulk water line proposed in the southern sections and this will be confirmed in the next phase.

Water storage facilities, pipes and pump stations must be designed to meet the anticipated demand. Water-supply systems use high-capacity wells and intakes, pumps, and pipes, as well as a power source (e.g., electricity), to drive the pumps. Water storage will be required and used to provide adequate contact time for disinfection and to meet peak demand. The last component to consider is the distribution system that will use a gravity-fed system, but may also pump water to each erf, and various connection points will be connected to the existing water network.

1.2.2 Sewage

Through the phased development of the Project, the sewerage requirements will gradually increase for the study area. Over the development horizon, bulk service upgrades will be required. A sewer reticulation network will extend across the development to ensure each site can be adequately serviced. A 2Ml modular wastewater treatment plant (WWTP, 10 710 m^2) will be established at the intersection of the R103 and Eddie Hagen (within the Phase 1 (PDA 2) area). The WWTP will comprise 250 kld modules that would be brought online as demand increases. The plant will be used to treat wastewater for Phase 1 (PDA 2) only, after which, the plant will be decommissioned, and the development will then feed into the municipal trunk line proposed along Eddie Hagen Road in 2032.

1.2.3 Road network

The following roads are proposed as part of the development:

- The internal road network will be 20 m in width, including the road reserve;
- All internal roads required for the development will be a single lane in both directions. Each lane will be 3.5 m wide, totalling 7 m in width; and
- The total road reserve will be 6.5 m for each lane. The purpose of the road reserve is to accommodate bulk service infrastructure for stormwater, sewer, water and electricity; and
- The internal road network (including access roads) will equal a total length of 17 km (to be confirmed in the EIA phase).

1.2.4 Electricity

To cater for the electrical demands of the proposed phased development, the following electrical infrastructure is proposed:

- Two 0.15 ha substations are proposed as part of the development: one to cater for the electrical demands of Phase 1 (PDA 2) and Phase 3 (PDA 1) located in the south, and one to cater for Phase 2 (PDA 3) in the north.

Two options for the positioning of the Phase 2 (PDA 3) substation and associated distribution line have been proposed. The engineering design proposals will be determined in consultation with Eskom. The following transmission lines are proposed:

- Phase 1 (PDA 2): Approx. 788 m long 33kV powerline from ACRW to the new southern substation within Phase 1 (PDA 2). • Phase 2 (PDA 3) – two alternative options:
  - Option 1 - (eastern) requires approx. 384m 33kV powerlines – described as “electrical cable with 7m servitude” below ground. The proposed substation is outside of the Assmang/CRDC landholdings and within an existing substation complex; or
  - Option 2 - (western) requires approx. 638m 132kV overhead powerlines with 36m servitude. The proposed substation and powerline are proposed on Assmang/ CRDC land outside the proposed Phase 2 (PDA 3) footprint.

1.2.5 Stormwater management

Stormwater infrastructure includes:

- Stormwater pipelines;
- Attenuation ponds;[8] and
- Stormwater discharge points.

8 These will be dry and only fill during 1:50-year storm events (heavy rainfall events).

2 Receiving Environment

2.1 Local Climate Change Impacts due to Project Emissions

Climate change is a global phenomenon. It is caused by an increase in the GHGs in the global atmosphere and can be difficult to address on a local level. This has been established at the Earth Summit in Rio in 1992, and lead to the formation of the United Nations Framework Convention on Climate Change (UNFCCC). It forms the basis of the 1997 Kyoto Protocol and the 2015 Paris Agreement. The relationship between the GHG emissions of any specific project, and local impacts of GHG emissions is shown in the figure below:

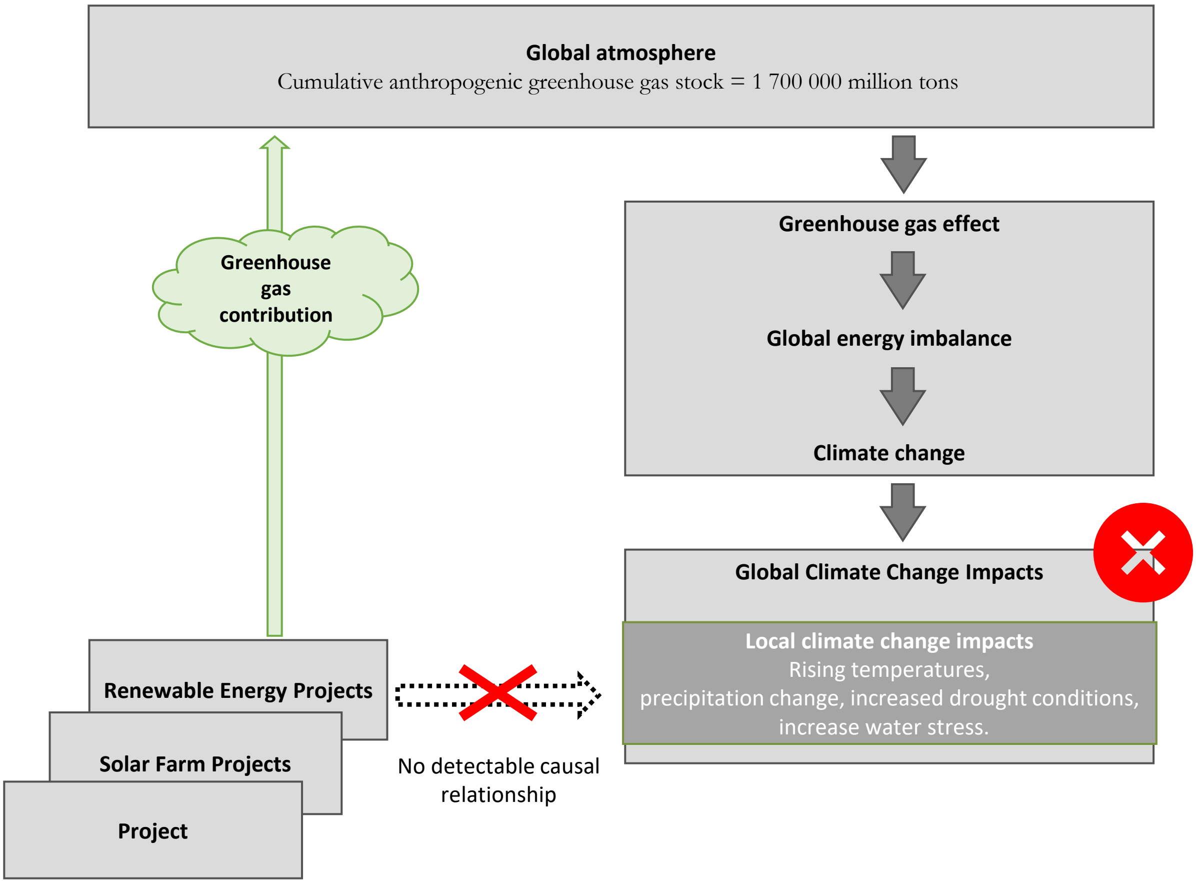

Figure 2: Relationship between a project's GHG emissions and local climate change impacts

The principle that the emission of GHGs at a local level has no local impact and can therefore not be managed on a local level, is fundamental to the formation of the UNFCCC, the Kyoto Protocol, and the Paris Agreement. It is in this context the GHG inventory study considers the cumulative impacts of the project in terms of its indirect emissions (category 3-6) during the construction phase of the project.

2.2 Carbon Budgets

A carbon budget is the allocation of a quantity of GHGs that can be emitted over a specified period. The guiding principle could be limiting global warming to a certain level or meeting a regulatory requirement or a similar limit.

The guiding principle considered for a carbon budget will be the emission limits set out in South Africa's Nationally Determined Contribution (NDC),[9] updated in 2021. Table 1 shows the target emissions for the low and high emissions scenarios, as given in the 2021 NDC, with the aim of reaching net zero by 2050.

Table 1: Targeted annual emissions for South Africa, according to the 2021 NDC

	2020	2025	2030	2050	Cumulative Emissions
Low Emission Scenario	398 $MtCO_2e/y$	398 $MtCO_2e/y$	350 $MtCO_2e/y$	0 $MtCO_2e/y$	7 758 $MtCO_2e$
High Emission Scenario	510 $MtCO_2e/y$	510 $MtCO_2e/y$	420 $MtCO_2e/y$	0 $MtCO_2e/y$	9 585 $MtCO_2e$

Thus, the cumulative emissions from 2020 to 2050 across the low and high emissions scenarios are 7 758 $MtCO_2e$ and 9 585 $MtCO_2e$, respectively. These figures are the low and high emission carbon budgets for South Africa. The low emission carbon budget will be used as a conservative estimate of a carbon budget against which to measure the impact of the proposed CRLDRP.

[9] Republic of South Africa (2021). *South Africa – First Nationally Determined Contribution Under the Paris Agreement*.

3 Approach and Methodology

3.1 Greenhouse Gas Inventory

The impact on climate change will be determined by developing a project GHG inventory for the project across its lifetime. This process is described further below.

The basic premise of calculating a GHG inventory is to identify the relevant activities, the relevant emission sources and to quantify the emissions associated with these activities and sources. The emissions are quantified using the following generic equation.

$$Emissions = Activity\ data \times Emission\ Factor$$

The following section provides more details regarding this process. All equations provided in Section 3.1.2.2 are derivations of this fundamental equation for determining emissions from an activity.

3.1.1 Standards Used

At the time of writing of this report, South African laws (most are considered under the umbrella of the National Environmental Management Act, NEMA), do not yet provide adequate guidelines for CCIAs.[10] Thus, this report also makes use of globally accepted international best practice and is guided by the Thabametsi judgement.

The GHG inventory for the proposed CRLDRP has been guided by the following reference documents:

- The South African Bureau of Standards. 2021. *SANS 14064:2021 Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*;
- The Greenhouse Gas Protocol. 2015. *A Corporate Accounting and Reporting Standard (Revised Edition)*;
- The Department of Environmental Affairs. 2017. *Technical Guidelines for Monitoring, Reporting and Verification of Greenhouse Gas Emissions by Industry*;
- The Department of Forestry, Fisheries and the Environment. 2022. *Methodological Guidelines for Quantification of Greenhouse Gas Emissions*;
- The Department of Forestry, Fisheries and the Environment. 2021.*Technical Guidelines for the Validation and Verification of Greenhouse Gas Emissions*; and
- The Intergovernmental Panel on Climate Change (IPCC). 2006. *Guidelines for National Greenhouse Gas Inventories.*

The Intergovernmental Panel on Climate Change (IPCC) 2029. *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 4*. The main guiding document used, in the calculation of the impact of the project on climate change, is the *SANS 14064:2021*

[10] South Africa's Department of Forestry Fisheries and the Environment is in the process of providing further guidelines for Climate Change Impact Assessments. However, these guidelines are only a draft and have not yet been published.

Part 1. This document sets out principles summarised in Table 2, that guide the GHG inventory development process. The standard requires that emissions be categorised into the following groups:

- **Category 1** – Direct GHG emissions and removals;
- **Category 2** – Indirect GHG emissions from imported energy;
- **Category 3-6** – All other indirect GHG emissions

Table 2: ISO/SANS 14064-1 principles for carbon footprints

Relevance	Selecting all the greenhouse gas sources, sinks, reservoirs, data and methodologies that are appropriate.
Completeness	Including all the greenhouse gas emissions and removals relevant to the proposed project.
Consistency	Enable meaningful comparisons to be made with other greenhouse gas related information.
Accuracy	Reducing bias and uncertainties as far as is practical.
Transparency	Disclosing sufficient and appropriate greenhouse gas related information to allow intended users to make decisions with reasonable confidence.

The calculation of the GHG inventory for the proposed CRLDRP, follows the general steps stipulated here:

- Boundaries of the analysis are set;
- GHG sources/sinks inside the boundary are identified;
- The significance of each of the emission sources is determined;
- Quantification method is established and;
- GHG emissions inventory is calculated.

Note that traditionally, GHG reporting has been done using the 2006 version of SANS14064 - 1 in combination with the Greenhouse Gas Protocol's *A Corporate Accounting and Reporting Standard*, which classified emission in 3 emission scopes. The relationship between the traditional emission scopes and the latest version of the SANS14064 - 1 standard is shown in the Table 3 below:

Table 3: GHG reporting for both standards ISO 14064:2021 and GHG Protocol.

SANS 14064:2021		GHG Protocol	
Category	Description	Category	Description
1	Direct GHG emissions and removals	Scope 1	Energy direct emissions
2	Indirect GHG emissions from imported energy	Scope 2	Energy indirect emissions
		Scope 3 Category 3	Fuel- And Energy-Related Activities
3	Indirect GHG emissions from transportation	Scope 3 Category 3	Fuel- And Energy-Related Activities[11]
		Scope 3 Category 4	Upstream Transportation and Distribution
		Scope 3 Category 6	Business Travel
		Scope 3 Category 7	Employee Commuting
		Scope 3 Category 9	Downstream Transportation and Distribution
4	Indirect GHG emissions from products used by organization	Scope 3 Category 1	Purchased Goods and Services
		Scope 3 Category 2	Capital Goods
5	Indirect GHG emissions associated with the use of products from the organization	Scope 3 Category 10	Processing of Sold Products
		Scope 3 Category 11	Use of Sold Products
		Scope 3 Category 12	End-Of-Life Treatment of Sold Products
6	Indirect GHG emissions from other sources	Scope 3 Category 5	Waste Generated in Operations
		Scope 3 Category 8	Upstream Leased Assets

[11] Note that the activities that used to be included under Scope 3 Category 3 have been split into Category 2 and Category 3 of the new standard.

SANS 14064:2021		GHG Protocol	
Category	Description	Category	Description
		Scope 3 Category 13	Downstream Leased Assets
		Scope 3 Category 14	Franchises
		Scope 3 Category 15	Investments

3.1.2 Boundary Setting for Inclusion of Indirect Emissions

3.1.2.1 GHG inventory boundary

The boundary of the GHG Inventory for the Cato Ridge Land Development and Release Project is established in accordance with SANS 14064-1:2021 standard. The standard outlines the process as identifying emission sources at the operation and its value chain. All direct emission sources are included in the boundary while indirect emission sources are identified through a significance assessment.

The direct emission sources included in the boundary for the operational phase are the combustion of fuel in stationary and mobile mining equipment.

The indirect emission sources are assessed based on the following significance criteria.

- **Magnitude:** Activities contributing more than 30 000 tCO_2e/y (Low impact threshold discussed in section 4.1.4) shall be included in the assessment
- **Level of influence**: Activities where the project owner could engage with the supplier to reduce upstream emissions, or where the company can choose a supplier based on their emissions, shall be included.
- **Risk or opportunity**: Activities that significantly contribute to the organization's exposure to climate-elated risks or opportunities shall be included.
- **Sector-specific guidance**: The GHG emissions deemed as significant by the business sector, as provided by sector-specific guidance[12].
- **Outsourcing**: Not applicable, as no core business activities are outsourced within the context of this specialist climate change impact assessment.
- **Employee engagement**: Activities that could motivate employees to significantly reduce energy use or that federate team spirit around climate change shall be included.

The indirect emission sources relevant to the annual operations of the CRLDRP are assessed in Table 4 below. Where an emission source has been classified as Medium or High, they have been included the GHG inventory boundary. The magnitude criteria are defined as High if it is greater

12 Not yet available.

than 50% of the overall inventory, Medium if it is between 5% and 50% and Low if it is less than 5%.

The indirect emission sources that were identified and assessed below were provided by Cato Ridge and identified as the most relevant to the project and its activities and operations. The emission sources identified are:

- Electricity consumption during operation;
- Purchased goods and services such as concrete and aggregates for construction purposes;
- Fuel used in operation such as diesel for capital goods (forklifts and LDV's)
- Water consumption during operation; and
- Waste generated during operations such as sewage.

Table 4: Indirect emission significance assessment

Emission source	Significance criteria						Inclusion in the GHG inventory boundary
	Magnitude	Level of influence	Risk or opportunity	Sector-specific guidance	Outsourcing	Employee engagement	
Production of purchased electricity	**High** – forms more than 91% of the overall inventory	**High** – can influence these emissions by generating own renewables or PPA's with renewable independent power producers	**High** - risk of energy security and supply disruptions from climate change related events	N/A	N/A	**Low** – some change in these emissions could come from engaging with employees on responsible energy consumption	Include based on Magnitude, Influence and Risk
Production of fuel used in operation	**Low** – forms less than 5% of the overall inventory	**High** – can switch suppliers of fuels to lower emission sources	**High** - risk of energy security and supply disruptions from climate change related events	N/A	N/A	**Low** – some change in these emissions could come from engaging with employees on responsible energy consumption	Include based on Influence and Risk
Purchased goods and services	**Low** – forms less than 5% of the overall inventory	**Medium** – can influence emissions through conscious water consumption.	**High** - risk of water security and supply disruptions from climate change related events	N/A	N/A	**Low** – some change in these emissions could come from engaging with employees on responsible water consumption	Include based on Influence and Risk

Emission source	Significance criteria						Inclusion in the GHG inventory boundary
	Magnitude	Level of influence	Risk or opportunity	Sector-specific guidance	Outsourcing	Employee engagement	
Waste generated in operations	**Low** – forms less than 5% of the overall inventory	**Medium** – can influence emissions through the change of operational conditions.	**Low -** waste does not carry quantifiable risk for Cato Ridge	N/A	N/A	N/A	Include based on Influence

3.1.2.2 GHG Inventory development

The direct, upstream, and downstream emissions for operational stages of the CRLDRP are calculated based on the procedures which consider the defined boundary. The CRLDRP project is divided into three different phases, with designated timeframes. Therefore, the emissions calculated are according to these timeframes, and the life of the project equates to a total of 25 years. The emissions for the construction stage are based on purchased goods and services required for construction of warehouse facilities, land clearance activities and the internal road during this phase. The emissions for decommissioning stages are considered insignificant in the context of the overall project and are therefore not calculated in this GHG Inventory.

Direct emissions are related to onsite emissions during operation (such as combustion of fuels), whilst the upstream and downstream emissions are related to the materials consumed during operation (such water consumption), the waste generated in operations and the fuel and energy related activities, respectively.

These emissions are given in CO_2 equivalents (tCO_2e). A CO_2e is when the emissions of other GHGs are equated to an equivalent amount of CO_2 using the 100-year global warming potential (GWP) of that gas. The GWP of any GHG is the amount of heat absorbed, per mass unit of a GHG, divided by the amount of heat an equivalent mass of CO_2 would absorb over the specified period.

The operation-related emissions are calculated using the equation as described in the beginning of 4.1.1. The generic *Activity Data, Emission factor and Emission* terms are replaced with specific parameters to describe the emissions under consideration.

During operation, the Category 1 emissions are from stationary and mobile combustion of diesel. These emissions can be calculated as followed:

$$Cat1_D = (Comb_{fuel} \times EF_{fuel})$$

Where:

- $Cat1_D$ represents the direct emissions during the operation phase of the CRLDRP, measured in tCO_2e/year;
- $Comb_{fuel}$ represents the total combustion of fuel (e.g., diesel or petrol) during the operation phase of the CRLDRP measured in litres/year; and
- EF_{fuel} represents the emission factor of stationary combustion of fuel (diesel or petrol), measured in tCO_2e/l.

The Category 2 emissions during the operation were calculated as following:

$$Cat2_{Elec} = (\text{Electricity}_x \times EF_{Elect})$$

Where:

- $Cat2_{Elec}$ represents the Category 2 emissions during the operation phase of the CRLDRP, measured in tCO_2e/year;
- Elect_x represents the electricity consumed in year *x* at the v, measured in MWh/year; and
- EF_{Elect} represents the grid emission factor for electricity, measured in tCO_2e/MWh.

The other indirect emissions (Category 3 - 6) will account for the purchased goods and services, fuel and energy related activities, upstream and downstream transportation and distribution, use of sold products and waste generated. The main calculation that was used for these emissions is:

$$Other3_{IDE} = (Act_x \times EF_{Act})$$

Where:

- $Other3_{IDE}$ represents the other indirect emissions during the operation phase of the CRLDRP, measured in tCO_2e/year;
- x represents the phase that is being account for. i.e., operational phase;
- Act_x represents the activity data occurring at the CRLDRP for a specific phase x, measured in Unit of Measurement/year. The Unit of Measurement depends on the activity for example tonnes of purchased material or distance transported; and
- EF_{Act} represents the emission factor of that activity data, measured according to the activity measurement.

3.1.3 Data Used

The two main data requirements to calculate the GHG emissions for this project are (i) activity data and (ii) emission factors. The combination of these two data sets results in the development of a GHG inventory. The sources of these data sets vary and are discussed in further detail in the sections below.

All activity data for the project were provided for 2022. The emission and conversion factors applied in the calculation of the proposed CRLDRP GHG inventory, are aligned with the following principles:

- Derived from a recognised origin;
- Appropriate for the GHG source concerned;
- Current at the time of quantification;
- Take account of quantification uncertainty and are calculated in a manner intended to yield accurate and reproducible results and;
- Consistent with the intended use of the carbon footprint.

The emission factors used were taken from a wide variety of sources. However, for the emissions from the combustion of fuels, the Department of Forestry, Fisheries and the Environment, 2022, *Methodological guidelines for quantification of greenhouse gas emissions* document was used. Table 5 provides the emissions factors used and their respective sources.

Table 5: Activity data used for GHG inventory

Construction Phase	Quantity	Unit	Data Source
Internal Road Network Construction	17	km	Provided by CRDC
Concrete	430	kg/m^2	Provided by CRDC
Aggregate	860	kg/m^2	Provided by CRDC
Phase Area 1			
Concrete	37 270	tonnes	Calculated from CRDC information
Aggregate	1 000	tonnes	Calculated from CRDC information
Phase Area 2			
Concrete	44 874	tonnes	Calculated from CRDC information
Aggregate	89 747	tonnes	Calculated from CRDC information
Phase Area 3			
Concrete	12 226	tonnes	Calculated from CRDC information
Aggregate	24 453	tonnes	Calculated from CRDC information
Operation Phase	**Quantity**	**Unit**	**Data Source**
Phase Area 1			
Total area	138.37	Ha	Provided by CRDC
Developable area	123.82	Ha	Provided by CRDC
Total developable area	86 674	m^2	Calculated from CRDC information
Timeline	10	years	Provided by CRDC
Sewage average demand	1.31	Ml/d	Provided by CRDC
Water demand	1.64	Ml/d	Provided by CRDC
Forklifts	62	number	Calculated from CRDC information
LDV's	62	number	Calculated from CRDC information
Phase Area 2			
Total area	177.11	Ha	Provided by CRDC
Developable area	149.08	Ha	Provided by CRDC
Total developable area	104 357	m^2	Calculated from CRDC information
Timeline	10	years	Provided by CRDC
Sewage average demand	1.6	Ml/d	Provided by CRDC
Water demand	2.0	Ml/d	Provided by CRDC
Forklifts	75	number	Calculated from CRDC information
LDV's	75	number	Calculated from CRDC information
Phase Area 2			
Total area	48.86	Ha	Provided by CRDC
Developable area	40.62	Ha	Provided by CRDC
Total developable area	28 433	m^2	Calculated from CRDC information
Timeline	5	years	Provided by CRDC
Sewage average demand	0.43	Ml/d	Provided by CRDC
Water demand	0.54	Ml/d	Provided by CRDC
Forklifts	20	number	Calculated from CRDC information
LDV's	20	number	Calculated from CRDC information
Additional			
Electricity demand	158	GWh/annum	Provided by CRDC
Electricity demand	158 000	MWh/annum	Calculated from CRDC information
Forklifts and LDV per ha	0.5	Number/ha	Provided by CRDC

3.1.4 Land Clearance Emissions

3.1.4.1 Overview of ecosystem carbon

Vegetative matter and soil organic material are comprised of and store carbon. These act as significant pools of carbon; and vegetation and soil (biomass) are known to sequester atmospheric carbon. The growth of vegetation sequesters or removes carbon from the atmosphere, whilst the removal of vegetation (and belowground organic matter) through burning, disturbance, clearing and deforestation releases carbon into the atmosphere. Land-based emissions (excluding livestock-related emissions) account for approximately 13% of total global GHG emissions.[13,14]

3.1.4.2 Calculating land clearance emissions

Clearing natural vegetation as part of this development will result in carbon losses as well as avoided emission removals by reducing the sequestration potential of the vegetation in the future. The latter involves detailed calculations and significant data inputs backed up by groundtruthing to accurately determine. This is deemed beyond the scope of the of this GHG inventory.

Several carbon pools need to be considered when determining land clearance (or land-based) emissions and sequestration. These include soil organic carbon (SOC),[15] above ground biomass (AGB)[16] and below ground biomass (BGB).[17] The difference in these carbon pools before and after clearing for development assuming no rehabilitation is then equivalent to the loss of carbon. The equivalent carbon dioxide emissions if all the carbon were to be converted to carbon dioxide is determined by multiplying the ratio of the molar mass of CO_2 to the molar mass of carbon ($\frac{44}{12} = 3.67$), thus:

$$LE = \sum_i C_{clear,i} \times \frac{44\ tCO_2e}{12\ tC}$$

where:

- $\boldsymbol{LE}$ are the land-based emissions from the clearing activities, measured in tCO_2e and;
- $\boldsymbol{C_{clear,i}}$ is the amount of carbon removed from the carbon pools i due to clearing activities, measured in tonnes of carbon.

3.1.4.3 Data used

Estimating greenhouse gas emissions and carbon sequestration, and their relationship with land use change relies on quantifying and understanding ecosystem carbon stocks to use as a baseline and for future measurements. These carbon stocks exist within different pools or reservoirs. These include AGB, BGB, SOC, and vegetation litter, debris & deadwood (collectively ecosystem carbon). In the absence of direct measurements, the amount of carbon in these pools can be

13 Ritchie, H., Roser, M. & Rosado, P. 2020. CO_2 and Greenhouse Gas Emissions. Published online at OurWorldInData.org. Accessed: 20 September 2022.

14 Pathak, M. *et al.* 2022. Technical Summary. In: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Shukla, P.R. *et al.*, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.002

15 Carbon stored in the organic components (i.e., excluding carbonates) of soil up to a certain depth.

16 Standing dry mass of live or dead matter from plant tissue (e.g., stems, bark, branches, twigs), expressed as a dry mass per unit area.

17 Biomass of live plant tissues (e.g., roots and rhizomes) below the soil surface.

estimated using published datasets on ecosystem carbon. Spatial data from the Carbon Sink Atlas for South Africa (CSASA)[18] was used in this regard. The dataset details terrestrial ecosystem carbon stocks (at a fine resolution of grams per square metre) comprising SOC, AGB and BGB, and is modelled for specifically for South Africa's environment incorporating precipitation, burning and published vegetation maps. Carbon stock data was extracted for the proposed development footprint provided by the client.[19]

3.1.5 Environmental Impacts of GHG Emissions

An environmental impact assessment requires that local impacts be quantified according to a given set of criteria. These are the **Nature**, the **Extent**, the **Duration**, the **Magnitude**, the **Probability,** and the **Significance** of the impacts. However, climate change is a global phenomenon, meaning these criteria are inadequate to fully quantify the impact. Despite this, these criteria are currently the only criteria available to measure the impact of the project on climate change.

Table 6: Environmental impact assessment criteria

Nature	A description of what causes the effect, what will be affected, and how it will be affected. In the case of climate change assessments, the nature of the impact is the contribution of the project to global anthropogenic climate change.
Extent (E)	An indication of whether the impact will be local (limited to the immediate area or site of development), regional, national, or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being local (low) and a score of 5 being international (high)). In the case of climate change assessments, the extent is always global, and thus a 5 is allocated to all projects that contribute to global anthropogenic climate change.
Duration (D)	An indication of the lifetime of the impact quantified on a scale from 1-5. Impacts with durations that are; very short (0–1 years) are assigned a score of 1, short (2-5 years) are assigned a score of 2, medium-term (5–15 years) are assigned a score of 3, long term (> 15 years) are assigned a score of 4 or permanent are assigned a score of 5. In the case of climate change assessments, the emission of non-renewable based GHGs can be considered permanent emissions. Thus, a 5 is allocated to all projects that contribute to global anthropogenic climate change.
Magnitude (M)	An indication of the consequences of the effect are quantified as follows: • 0 is allocated to projects that do not have GHG emissions; • 2 is allocated to projects with a rating of ***Low***; • 5 is allocated to projects with a rating of ***Medium***; • 7 is allocated to projects with a rating of ***High***; and • 10 is allocated to projects with a rating of ***Very High***. The quantification of the impact rating thresholds is discussed in more detail in Section 4.1.4.

18 DEA. 2015. National Terrestrial Carbon Sink Assessment. Department of Environmental Affairs, Pretoria, South Africa

19 Phases_WGS_LL.shp

Probability (P)	An indication of the likelihood of the impact actually occurring is estimated on a scale of 1–5. A score of 1 implies that the impact is very improbable, 2 are improbable, 3 are probable, 4 are highly probable and 5 are definite with the impact occurring regardless of any prevention measures. The IPCC has reported that there is a 67% probability for limiting the warming of Earth to 2˚C. Thus, a value of 4 is allocated to this project as the impact is highly probable however prevention measures will most likely be put into place.
Significance (S)	The significance points are calculated as: S = (E + D + M) x P. A weighting based on a synthesis of the characteristics described above and can be assessed as low (< 30 points), medium (30-60 points) or high (> 60 points).

3.2 Determining the Magnitude of the Project Impact on Climate Change

3.2.1 Determination of the low impact level for GHG impact rating

The DFFE has published the draft *National Guideline for the Consideration of Climate Change Implications in Applications for Environmental Authorisations, Atmospheric emissions Licenses and Waste Management Licenses* in January 2021. One of the guidelines for when a specialist climate change impact assessment is necessary is when the activity breaches one of the thresholds stipulated in the *National Greenhouse Gas Reporting Regulations*. Thus, the low impact level was taken as the combustion of coal at a capacity of 10 $MW_{thermal}$ at a 100% utilisation.

$$Upper\ limit\ \text{Low} = 10\ MW_{thermal} \times \frac{31\ 536\ 000\ s}{year} \times \frac{1\ TJ}{1\ 000\ 000\ MJ} \times EF_{coal}$$

The emission factor for coal is taken as "Other Bituminous Coal" from Table A.1 of the Technical Guidelines[20]. This equates to approximately 30 000 tCO_2e/year. Thus, emissions less than 30 000 tCO_2/y will be considered to have a ***Low*** impact.

3.2.2 Summary of impact levels

Table 7 combines the above calculations into one impact table. This is used to assess the magnitude of the impact of a project on climate change. It also compares the thresholds to the low emission NDC carbon budget of 7 758 Mt CO_2e.

This assessment only considers emissions in the GHG inventory that occur with the boundary of South Africa. This ensures consistency in the impact assessment as the climate change impact assessment is a South African legislative process. There is therefore no jurisdiction over emissions from international sources within this process. This also allows the emissions to be compared to the NDC which only considers the South African national GHG inventory.

20 Department of Environmental Affairs, 2017, *Technical Guidelines for Monitoring Reporting and Verification of Greenhouse Gas Emissions by Industry*.

Table 7: Impact category thresholds used to determine the magnitude of the impact of the project on climate change.

GHG impact rating as a % of SA's carbon budget	Amount of GHG emissions		Relative to Low Emission NDC Carbon Budget	
	Lower limit (tCO_2e)	Upper limit (tCO_2e)	Lower limit (tCO_2e)	Upper limit (tCO_2e)
Low	-	30 000	0.000000%	0.00039%
Medium	30 001	1 500 000	0.00039%	0.019%
High	1 500 001	15 000 000	0.019%	0.193%
Very High	15 000 001	+		> 0.193%

3.2.3 Limitations and Assumptions

This GHG inventory makes use of data obtained during a desktop review for the development of this GHG inventory and associated impact assessment. The assumptions made to ensure the development of the most accurate and extensive GHG inventory, and the associated impact assessment considered the significant boundary set out by the EIA reporting requirements and include:

- As the project developer was unable to supply full details about the construction of the warehousing as the end users are not yet known, the construction emissions are therefore based on the information provided and do not reflect the full inventory and processes that took place.
- The projects area in ha was based off a modelling exercise and therefore such area will be adjusted (i.e., total of 352ha rather than 358.4ha) Therefore, the above assessment provides a worse-case scenario assessment for the development.
- It was assumed that the amount of aggregate used within the construction phase of the project will be double the amount of concrete.
- It was assumed that the amount of equipment's used on site at Cato Ridge will be 0.5 numbers/ha. With the total number of forklifts and LDV's across the 3 phases equal to 157 for both equipment's.
- As the project developer was unable to supply full details on the operations of the warehouse as the end users are unkown, the emissions associated to the project are based off specific assumptions and relative information shared, which is disclosed in the points below. Therefore, the GHG inventory does not reflect a full inventory of the operations of the project.
- It was assumed that the project requires 158 GWh/annum of electricity for the operations of the project.
- It was assumed that the total developable area in which the project will be operating on will be 70% of the developable area that Cato Ridge has access to.
- It was assumed that the following aspects of the Cato Ridge project will contribute immaterially towards the GHG footprint of the project during the operational phase:
    - Employees commuting;
    - Business travel.
- It was assumed that the entire development footprint would be cleared of existing vegetation in terms of the ecosystem carbon calculations.

- No assumption was made in terms of how cleared biomass was treated during and following clearing, and thus all emissions are given as CO_2 emissions only and as direct emissions (i.e., not being undertaken upstream or downstream of the development).

4 Project Greenhouse Gas Inventory

The GHG inventory for the proposed CRLDRP was developed in accordance with the SANS 14064-1:2021 standard, as well as the GHG Protocol (ISO 14064-1:2006), as described in Section 3.1.1 above. Assumptions were made where necessary to overcome data gaps. Indirect emissions were included based on a significance assessment discussed in Section 3.1.2. For the purposes of this report, the GHG inventory according to SANS 14064-1:2021 was considered.

The boundaries of the analysis were set, as indicated in 3.1.2 above. This analysis took into consideration the relevant emissions from core operations, land clearance operations as well as upstream and downstream emissions.

The maximum total ecosystem carbon stock for the development footprint is 57 652 tonnes. This number was validated using coarser global datasets.[21,22] There was a 18% difference between the totals (local CSASA vs global) which indicates a relatively high agreement. The carbon stock comprises approximately 38% ABG, 33% BGB and 29% SOC. The mean carbon stock is 160.9 MgC/ha.[23] A breakdown of the carbon stock per phase of the proposed development is shown in Table 8.

Table 8: Carbon stocks for the proposed Cato Ridge Land Development and Release Project

Proposed use	Area (ha)	Total ecosystem carbon (MgC)	Mean ecosystem carbon (MgC/ha)
Phase 1	142.4	24 059.7	168.9
Phase 2	172.2	25 935.4	150.5
Phase 3	43.8	7 656.8	174.8
Total	**358.4***	**57 651.9**	**160.9**

** The greenhouse gas (GHG) emissions have been estimated based on a project layout covering an area of 358.4 hectares. However, the actual development footprint has been slightly reduced, which may result in a minor overestimation of GHG emissions. Nonetheless, this estimate is deemed sufficient for the current assessment, and the slight overestimation is consistent with the precautionary principle.*

21 Sullivan, C.C., Lark, T.J. *et al.* 2010. Harmonized global maps of above and belowground biomass carbon density in the year 2010. Sci Data 7, 112. https://doi.org/10.1038/s41597-020-0444-4

22 SoilGrids. 2020. Soil Organic Carbon Stock. Available at: https://soilgrids.org/. Accessed 16 September 2022.

23 MgC = Megagrams of carbon = tonne of carbon.

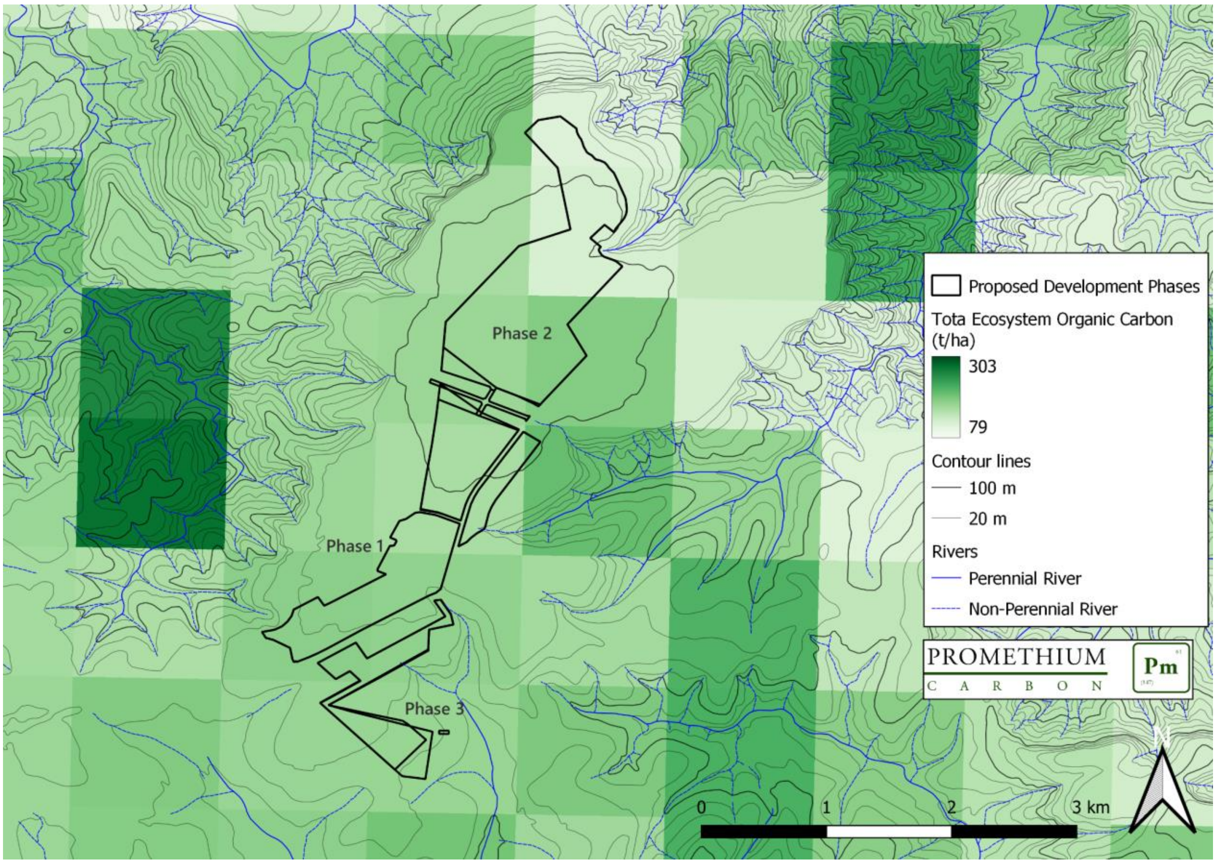

Figure 3: Ecosystem carbon values for the proposed development area and surrounding areas

The land clearance emissions from the clearing can be calculated using the equation:

$$E = \left(\left(\frac{A_i \times C_{TEC}}{A_t}\right) \times 3.67\right) \times 1.102$$

Where:

- $\boldsymbol{E}$ is total emissions from the vegetation and topsoil (up to 300 mm deep) that is cleared or disturbed, measured in tCO_2e;
- $\boldsymbol{A_i}$ is the total area of vegetation *i* that was cleared, measured in ha;
- $\boldsymbol{A_t}$ is the total area of the development;
- $\boldsymbol{C_{TEC}}$ is total ecosystem carbon measured in tonnes (or MgC).

Assuming the entire development area is cleared, with no rehabilitation, **t**he approximate (land-based) emissions from biomass clearing would total 232 952 tCO_2e. This is without any offsetting or rehabilitation done post-clearing.

It is not known how the cleared biomass will be managed, i.e., whether it will be landfilled, burnt or composted, and where this will take place. Therefore, the emissions have been included in the construction phase as a direct emission resulting in CO_2 emissions only. However, if more information on the cleared biomass come to light, this could change the scope/category of the emissions, as well as the GHG emissions released. This will also affect the overall GHG inventory.

Table 9 below shows the summary of the GHG inventory calculated for the CRLDRP. The direct emissions during the operations of the project will be approximately 12 940 tCO_2e annually, or 121 016 tCO_2e across the lifetime of the project. The indirect emissions are about 171 681 tCO_2e, or 4 161 821 tCO_2e across the lifetime of the project.

The direct emissions related to the construction of the project will be approximately 234 704 tCO_2e. The indirect emissions during construction of the project will be approximately 13 896, with majority of the emissions associated with the use of concrete in the construction process. The construction and operation emissions of the Project are presented in Table 9 for completeness.

Table 9: Operation emissions for Cato Ridge Land Development and Release Project – SANS14064-1 (2021).

Emission category	Emission source	Included/ Excluded	Annual (tCO_2e)	Total over life of project (tCO_2e)
Construction Phase				
Category 1: Direct GHG emissions and removals	Internal Road Network Construction	Included	1 752	
	Land clearance	Included	232 952	
Category 4: Indirect GHG emissions from products used by the organization	Concrete purchased	Included	12 433	
	Aggregated purchased		1 463	
Total Construction Emissions			**248 600**	
Operations Phase				
Category 1: Direct GHG emissions and removals)	Diesel combustion	Included	12 940	121 016
Category 2: Indirect GHG emissions from imported energy	Electricity purchased	Included	164 320	4 108 000
	Fuel and energy related activities	Included	3 013	28 181
Category 4: Indirect GHG emissions from goods purchased by the organisation	Water purchased	Included	2 220	20 761
	Capital Goods - Forklifts	Included	1 316	1 316
	Capital Goods – LDV's	Included	483	483
Category 6: Indirect GHG emission from other sources	Waste – Sewage Demand	Included	329	3 080
Total Operations Emissions			**184 621**	**4 282 837**

The overall potential emissions resulting from the project is equal to the total emissions from construction plus the total emissions from operations over the life of the development plus the approximate emissions from land clearing. Thus, the total emissions are:

4 282 837 tCO_2e + 15 648 tCO_2e + 232 952 tCO_2e = 4 531 437 tCO_2e.

The CRLDRP has a significance score and is calculated in Table 10 below, using the impact methodology described in Section 3.1.4 above. The significance score is considering the whole CRLDRP over the life of the project. This means that the project has a ***High*** climate change impact due to high emissions related to the operations of the warehouse over the life of the project, specifically the electricity consumed, and the land clearance emissions associated with the project.

Table 10: Climate Change Impact of the Cato Ridge Land Development and Release Project (all phases)

Nature	Description	Pre-mitigation Score	Post-mitigation score
Extent (E)	The GHG emissions of the project will contribute to global climate change. The extent of the impact is therefore global	5	5
Duration (D)	CO_2 released into the atmosphere stays in the atmosphere for at least 100 years. The duration of the impact is therefore permanent.	5	5
Magnitude (M)	The magnitude of the impact is high due to high emissions related to operations of the warehouse over the life of the projects and emission related to the land clearance activity.	7	7
Probability (P)	The IPCC has reported that there is a 67% probability for limiting the warming of Earth to 2˚C. A score of 4 are highly probable and 5 are definite with the impact occurring regardless of any prevention measures.	5	4
Significance (S)	The significance points are calculated as: S = (E + D + M) x P. Therefore:	85	68
	Significance rating	High (-)	High (-)

Mitigation: The following mitigation should apply for CRDC activities and its contractors and staff:

- Reducing electricity consumption and reliance on non-renewable (coal-fired) energy- electricity consumption through, for example, installing renewable energy generation infrastructure on site;
- Improving access to public transport (where possible) and reducing private car trips through encouraging lift-sharing among tenants and workers;
- Where possible, source building materials that have a lower carbon footprint;

• Water-use efficiency initiatives should be implemented throughout the Project site to minimise the water treatment for consumption of wastewater (both relatively large users of electricity), and increase resilience to dry spells; and • The project should monitor all GHG emissions through an extensive annual GHG inventory. This inventory should ideally cover both direct and indirect key emissions sources (including infrastructure, fuel-related and other material sources).
Residual risks: The residual risk remains high, due to the potential impact of climate change, despite mitigation efforts, refer to the recommendations section for additional measures the applicant may employ to manage this aspect..

5 Recommendations

The proposed recommendations include actions that are required for both the construction and the operation phases of the project. Due to the uncertainty of the end use of the development, the recommendations that have been suggested allow more flexibility. Recommendations that are suggested for the project have been categorised as follows:

- Mitigations (those actions that are binding and aimed at CRDC operations)
- Recommendations (those actions that are non-binding and aimed at the end user of the development), and
- Conditions of the environmental authorisation.

5.1 Mitigation during construction (binding and aimed at CRDC)

Construction related emissions for the project are deemed immaterial. However, there are some measures that could be considered to manage the construction-related impacts.

- **Route optimisation**: During the construction phase, the project can manage its transportation-related greenhouse gas (GHG) emissions by minimizing the distance travelled. This reduces fuel consumption and emissions, and can improve delivery times, reduce transportation costs, and increase overall efficiency. Route optimization is a useful tool to achieve this.
- **Design process**: It is recommended that the project design and construction incorporate green building principles by sourcing sustainable materials that have a lower carbon footprint, whenever possible during the design phase.
- **Waste management**: Implement a waste management plan that includes reducing waste generation, through reusing, and recycling materials, and responsible disposal of waste.
- **Energy efficiency measures**: Implement energy efficiency measures to reduce electricity consumption.

5.2 Recommendations during operation (non-binding for end users)

The following non-binding recommendations for potential inclusion in a broader emission strategy have been made. However, as the end users are currently unknown, a detailed emission reduction plan cannot be developed at this time. It is suggested that such a plan be created once more information is available. Additionally, it is recommended that the project aligns with and adheres to standard construction methods in South Africa.

5.2.1 Emissions

- Energy efficiency measures: Implement energy efficiency measures to reduce electricity consumption and reliance on non-renewable (coal-fired) energy. This can include the installation of LED lighting, motion sensors, and energy-efficient HVAC systems. Additionally, consider investing in renewable energy sources, such as solar panels to offset the electricity consumed by the project.
- Improving access to public transport (where possible) and reducing private car trips through encouraging lift-sharing among tenants and workers;

- There is an opportunity of energy recovery from the waste of the operations. Therefore, conversion of non-recyclable waste materials into usable heat, electricity, or fuel;
- Water-use efficiency initiatives and water conservation measures should be implemented throughout the Project site to minimise the water treatment for consumption of wastewater (both relatively large users of electricity), and increase resilience to dry spells; and
- Over time the project should monitor all GHG emissions through an extensive annual GHG inventory. This inventory should ideally cover both direct and indirect key emissions sources (including infrastructure, fuel-related and other material sources).

5.2.2 Biodiversity offset areas

The client has indicated that biodiversity offsets may be used to compensate for some of the residual impacts of the project on natural ecosystems which will be altered and converted. This has particularly been looked at in terms of the biodiversity conservation obligations set that need to be met by the eThekwini Metropolitan Municipality and to ameliorate the loss of KwaZulu-Natal Sandstone Sourveld which is classified as Endangered. According to the scoping report, the best offset receiving area (i.e., optimal area for locating biodiversity offsets) could be in the grassland areas surrounding the proposed development (Assmang property). If secured for formal protection, this could achieve both intended aims. It could also have the benefit of reducing further carbon loss from land clearance. However, the protection of vegetation does not result in mitigation of carbon losses from clearing land during construction, as there is still a net loss of carbon into the atmosphere. Further, biodiversity offsets are only appropriate for projects that have carefully followed the mitigation hierarchy (avoidance and minimising impacts prior to offsets) to ensure no net loss.[24, 25]

The carbon stocks surrounding the proposed development can be used to ascertain what impact the offsetting would have on avoiding carbon emissions from land clearing. If formally protected, theoretically the carbon stocks in the offsetting area/s would be protected. The ecosystem carbon values were extracted for the provided vegetation shapefile[26] using the CSASA dataset. Values range from 202 MgC/ha (Forest) to 25.5 MgC/ha (Sandmining). For natural ecosystem types, the highest ecosystem carbon stocks for the surrounding areas are for Forest (202 MgC/ha), Secondary KwaZulu-Natal Sandstone Sourveld (KZNSS) Grassland (171 MgC/ha) and Wooded KZNSS Grassland (Gums) (142.5 MgC/ha) (Figure 4). Note that these values are skewed based on the area of each patch of vegetation with ecosystem carbon values possibly not being fully captured for small patches. The total carbon stock protected can thus be approximated using these values, once the offsetting area, and its vegetation composition is known.

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24 IUCN. 2021. Biodiversity offsets. Available at: [Biodiversity offsets - resource | IUCN]().

25 CSBI. 2015. A cross-sector guide for implementing the Mitigation Hierarchy. Prepared by The Biodiversity Consultancy.

26 Cato_Ridge_vegetation_mapping_DD_17_Jan.shp

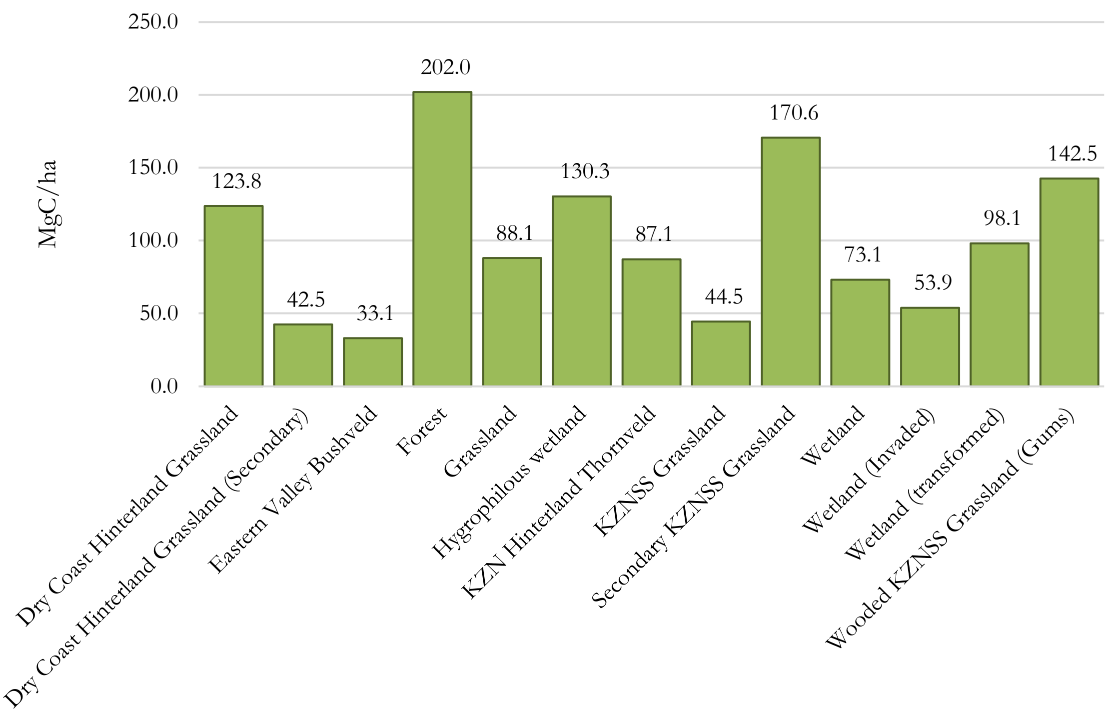

Figure 4: Mean ecosystem carbon values per natural ecosystem type for the area immediately surrounding the proposed development

Biodiversity offsets, if undertaken, should be informed by the relevant specialists (biodiversity/flora and fauna) and in consultation with the relevant authorities (provincial and municipal). The carbon losses represented in this report provide high-level guidance only.

5.3 Conditions of the environmental authorisation

Promethium has no additional conditions for environmental authorization beyond those already recommended. However, where feasible, the project may consider implementing these measures to manage greenhouse gas (GHG) emissions for the project.

6 No-Go Alternative

If the Cato Ridge Land Development and Release Project does not proceed, the No-Go Alternative would involve CRDC refraining from any further development of the land, thereby retaining the status quo and ownership of the site by CRDC/Assmang.

In order to compare the environmental impact assessment (EIA) for the No-Go Alternative with the worst-case scenario preferred development alternative, a likely worst-case scenario approach is taken for the former. Extrapolating from existing land use practices, it is reasonable to assume that illegal sand mining, waste dumping, grazing (including burning), and informal settlements would continue to occur on the property under the No-Go Alternative. The landowner would make efforts to manage these areas alongside law enforcement as reasonably possible. However, due to the absence of additional income to support intensified management efforts, it is likely that these historical impacts would persist and potentially escalate as the surrounding rural communities expand and demand more land and resources.

Table 11: Climate Change Impact of the No-go Alternative for Cato Ridge Land Development and Release Project

Nature	Description	Pre-mitigation Score
Extent (E)	The GHG emissions of the project will contribute to global climate change. The extent of the impact is therefore global	5
Duration (D)	CO_2 released into the atmosphere stays in the atmosphere for at least 100 years. The duration of the impact is therefore permanent.	5
Magnitude (M)	The magnitude of the impact is medium due to medium emissions related to no-go alternative and emissions related to illegal sand mining, waste dumping, grazing (including burning), and informal settlements.	5
Probability (P)	The IPCC has reported that there is a 67% probability for limiting the warming of Earth to 2˚C. Thus, a value of 5 is allocated to this project as the impact is highly probable however no prevention measures will be put into place.	5
Significance (S)	The significance points are calculated as: S = (E + D + M) x P. Therefore: S= (5+5+5) x 5=75	75
	Significance rating	High (-)

7 Opinion of the Project

It is our opinion that, from the perspective of the project impacts on or contribution to climate change, the project it should be granted environmental authorisation. This is based on the calculations that show that from an emissions perspective the direct emissions during the operations of the project will be approximately 12 940 tCO_2e annually, or 121 016 tCO_2e across the lifetime of the project. The indirect emissions are about 171 681 tCO_2e, or 4 161 821 tCO_2e across the lifetime of the project, with the overall impact of the project having a high (-) significance rating. This is as a result of high emissions related to the operations of the warehouse, specifically the electricity consumed. Relevant mitigations measures and recommendations could be implemented to reduce electricity demand of the project and the overall impact of the operation.

Appendix A: GHG Emissions according to the GHG Protocol

Emission category	Emission source	Annual Emissions	Total over life of project (25 years)
Construction Phase			
Scope 1: Direct emissions (tCO2e)	Internal Road Network Construction	1 752	
	Land Clearance Emissions	232 952	
Scope 3: Other Indirect emission (tCO2e)	Purchased goods and services	13 896	
Total construction emissions		**248 600**	
Operation Phase			
Scope 1: Direct emissions (tCO2e)	Diesel Mobile Combustion	12 940	121 016
Scope 2: Indirect emissions (tCO2e)	Electricity Consumption	164 320	4 108 000
Scope 3: Other Indirect emission (tCO2e)	Purchased goods and services	2 263	21 160
	Fuel and energy related activities	3 013	28 181
	Waste in operations	329	3 080
	Capital goods	1 799	1 799
Total operation emissions		**184 664**	**4 283 236**

Appendix B: Emission Factors and Assumptions

Emission Factors and Key Values Used			
Scope 1 Emissions			
Diesel Mobile Combustion	0.00270	Tonne CO2e/litre	DEFRA 2022
Scope 2 Emissions			
South African Electricity Grid	1.04	Tonne CO2e/MWh	Eskom IAR 2022
Scope 3 Emissions			
Purchased Goods and Services			
Water	1.47	Tonne CO2e/ Million Litres	Promethium Carbon Calculations
Concrete	0.13	Tonne CO2e/tonne	DEFRA 2022
Cement	0.12	Tonne CO2e/tonne	Calculated
Aggregate	0.01	Tonne CO2e/tonne	DEFRA 2022
Fuel and Energy related activities			
Diesel Mobile Combustion	0.00063	Tonne CO2e/litre	DEFRA 2022
Waste generated in operations			
Wastewater Treatment	0.27	Tonne CO2e/ML	DEFRA 2022
Capital Goods			
Steel emission factors	1.9	Tonne CO2e/tonne	World Steel Association - Environmental Sustainability Indicators
Cast Iron	1.9	Tonne CO2e/tonne	World Steel Association - Environmental Sustainability Indicators
Tyre	3.34	Tonne CO2e/tonne	DEFRA 2022
Assumptions			
Expressway road	3234	Tonne CO2e/km	World Bank: https://documents1.worldbank.org/curated/en/660861468234281955/pdf/696590ESW0P1010UBLIC00GHG0Web0final.pdf
National Road	794	Tonne Co2e/km	World Bank: https://documents1.worldbank.org/curated/en/660861468234281955/pdf/696590ESW0P1010UBLIC00GHG0Web0final.pdf
Provincial Road	207	Tonne CO2e/km	World Bank: https://documents1.worldbank.org/curated/en/6608614682342819

Emission Factors and Key Values Used			
Scope 1 Emissions			
			55/pdf/696590ESW0P1010UBLIC00GHG0Web0final.pdf
Rural Road – gravel	90	Tonne CO2e/km	World Bank: https://documents1.worldbank.org/curated/en/660861468234281955/pdf/696590ESW0P1010UBLIC00GHG0Web0final.pdf
Rural Road – DBST	103	Tonne CO2e/km	World Bank: https://documents1.worldbank.org/curated/en/660861468234281955/pdf/696590ESW0P1010UBLIC00GHG0Web0final.pdf
Operational Hours	12	Hours/day	Provided by Cato Ridge
Operational hours in a year	4380	Hours/annum	calculated
MVA to MW	0.8	%	
Fuel consumption forklift	2.6	Litres/hour	Assumption: https://allliftforklifts.com.au/blog/how-much-diesel-does-forklift-use-hour
Fuel consumption LDV	7.3	Litres/100km	Assumption: ISUZU_D-MAX_RG_SINGLE-CAB_BAKKIE_SPECIFICATIONS_150722.pdf
Average speed LDV	60	Km/hour	Assumption
Adjusted fuel consumption LDV	4.38	Litres/hour	Calculated
LDV vehicle mass	1675	kg	Assumption: ISUZU_D-MAX_RG_SINGLE-CAB_BAKKIE_SPECIFICATIONS_150722.pdf
Forklift weight	4600	Kg	http://rondebult.co.za/Forklift.pdf
LDVs	0.75%	Steel	Assumption
	0.18%	Cast Iron	
Forklifts	0.85%	Steel	Assumptions
	0.1%	Cast Iron	

Appendix C: Capital Goods Breakdown

Brand	Total Weight (kg)	Weight equipment without tyres	Large tyres	Weight per tyre (kg)	Weight all tires (kg)	Steel required (tonne)	Cast iron (tonne)	Equipment emissions (tCO2e)	Tyre Emissions (tCO2e)	Total Emissions (tCO2e)
LDV	1599	1523	4	19	76	1.20	0.29	2.83	0.25	**3.08**
Forklift	4540	4480	4	15	60	3.86	0.45	8.19	0.20	**8.39**

KWAZULU-NATAL PROVINCE
ECONOMIC DEVELOPMENT, TOURISM AND ENVIRONMENTAL AFFAIRS
REPUBLIC OF SOUTH AFRICA

	(For official use only)
Provincial Reference Number:	
NEAS Reference Number:	KZN / EIA /
Waste Management Licence Number (if applicable):	
Date Received by Department:	

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

Submitted in terms of section 24(2) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or for a waste management licence in terms of section 20(b) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).

KINDLY NOTE:

1. This form is current as of **May 2021**. It is the responsibility of the Applicant / Environmental Assessment Practitioner ("EAP") to ascertain whether subsequent versions of the form have been released by the Department.

PROJECT TITLE

Cato Ridge Land Release and Development Project (DM/0006/2023: KZN/EIA/000)

DISTRICT MUNICIPALITY

eThekwini Metropolitan Municipality

1. SPECIALIST INFORMATION

Specialist name:	Shantal Beharie		
Contact person:	Robbie Louw/Joshua Weiss		
Postal address:	The Courtyards, Block 2, 1st Floor , 32 Peter Place		
Postal code:	2021	Cell:	076 318 9332
Telephone:	Same as cellphone	Fax:	
E-mail:			
Professional affiliation(s) (if any)	None		

Project Consultant / EAP:	Zutari (Pty) Ltd

EAPASA Registered EAP number:	2021/4095		
Contact person:	Patrick Killick		
Postal address:	PO Box 509, George		
Postal code:	6530	Cell:	
Telephone:	044 805 5432	Fax:	
E-mail:	patrick.killick@zutari.com		

2. DECLARATION BY THE SPECIALIST

I, Shantal Beharie lare that --

General declaration:

- I act as the independent specialist in this application;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Signature of the specialist:

Name of company:

Promethium Carbon

Date:

2023/04/04