

Appendix K - Climate Change Risk Assessment



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Climate Change Risk Assessment for the Biovac Vaccine Facility Project, Western Cape Province

FINAL REPORT

The Biovac Institute (Pty) Ltd

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Making Sustainability Happen

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Executive Summary

Introduction

SLR Consulting (South Africa) Proprietary Limited (hereinafter referred to as “SLR”) has been appointed by the Biovac Institute (Pty) Ltd (hereinafter referred to as “Biovac”) to undertake a climate change risk assessment (CCRA) for the proposed Biovac vaccine manufacturing facility on the corner of Diesel and Ndabeni Roads in Pinelands, Cape Town, South Africa, and associated infrastructure (hereinafter referred to as “the Project”).

In accordance with the requirements of the Equator Principles (EP4), this CCRA has assessed:

1. The climate-related risks for the Project.
2. The Project’s greenhouse gas (GHG) emissions.

In addition, the CCRA also considers:

- The potential impact of the Project on communities and the provision of priority ecosystems services that may be already adversely affected by climate change.
- The impact of the Project on sites of demonstrated importance to climate change mitigation and adaptation.

2. Legal and Policy Framework

The Project is being developed within the context of several South African climate-related statutes, policies, and plans (e.g., Nationally Determined Contribution, National Climate Change Adaptation Strategy, Low-Emission Development Strategy 2050, and so on), as well as international treaties, standards, and guidelines (e.g., EP4 and International Finance Corporation’s Performance Standards on Environmental and Social Sustainability, and so on).

3. Project Description

Biovac is proposing to develop a vaccine manufacturing facility, 6.4 km southeast of Cape Town’s city centre, in the Western Cape province of South Africa. The proposed site is situated within a well-established industrial precinct. It is planned that the facility comprise a four storey main industrial building to accommodate vaccine production activities, a central utility building adjacent to the main building, a tank farm, a warehouse, on-site parking to the south of the main building with capacity for 132 vehicles, circulation space around the main building and along all Project boundaries, and landscaping in the parking area.

3. Methodology

The identification of climate-related risks was based on a desktop review of information sourced from the World Bank Group, Intergovernmental Panel on Climate Change, and published journal articles. The climate-related risks were assessed using a risk matrix based on impact and likelihood.

The Project’s GHG emissions were quantified in accordance with international guidelines and standards, including the Greenhouse Gas Protocol. The assessment quantifies the Project-related emissions for the construction and operational phases. The Project’s GHG emissions are assessed in terms of two criteria:

- The contribution to South Africa’s modelled domestic pathways.
- Benchmarking against pre-defined thresholds.

4. Description of the Affected Environment



For the project location, average mean monthly temperature is projected to increase by an average of 0.59°C to 0.68°C (3.5% to 4%) relative to the average for the respective baseline period. The average maximum surface air temperature is projected to increase by 0.63°C to 0.76°C (2.7% to 3.3%) relative to the average for the baseline period. Similarly, the number of very hot days, where the maximum temperature exceeds 35°C, are projected to increase by 3.21 days to 3.83 days (48.1% to 57.3%) relative to the maximum number of very hot days for the baseline period. Mean monthly precipitation is projected to decrease by an average of 10.65 mm to 10.85 mm (-2.9% to -3.0%) per annum relative to the average for the baseline period. Cumulative precipitation over a 5-day period is projected to either increase by an average of 0.20 mm (+0.4%) under the SSP2-4.5 scenario or decrease by an average of 0.24 mm (-0.5%) under the SSP5-8.5 scenario, relative to the baseline period.

5. Risk and Opportunity Assessment

The table below presents a summary of the Project's climate-related risks and opportunities, as well as the outcomes of the assessment.

Category	Impact Description	Risk or impact rating
Climate-related risks for the Project		
Physical, acute impact	An elevated risk of acute precipitation events increases the risk of urban flooding, which can inundate the Project site, damaging critical pieces of site infrastructure, disrupt operations, and poses an occupational health and safety ('OHS') risk to on-site personnel and those commuting during inclement conditions. Thus, such events may lead to capital reinvestment, reduce the operational capacity of the Project, leading to overall revenue losses.	Moderate
Physical, acute impact	Increased risk of extreme heat adversely affecting the health of employees. This can lead to decrease in productivity, and revenue losses.	Low
Physical, chronic impact	The increased frequency and intensity of extreme heat events are likely to increase the facility's ambient temperature, placing greater demand on the cooling system, resulting in increased energy consumption. This can lead to a rise in operational expenditure (OpEx) and under the worst-case scenario, increased capital expenditure (CapEx), should the cooling system need to be upgraded.	Low
Physical, chronic impact	The projected increase in average mean and maximum surface air temperatures, together with the projected decrease in annual precipitation are likely to create weather conditions that support drought events. The Project's manufacturing processes and heating, ventilation, and air conditioning (HVAC) system is dependent on an uninterrupted water supply. Consequently, in the event of a prolonged drought, such activities may need to be curtailed, potentially leading to stoppages at the facility and revenue losses.	Low
Assessment of the Project's GHG emissions		
Contribution to South Africa's modelled domestic pathways	The calculated contribution of the Project's GHG emissions to the Country's four modelled pathways ranges between 0.000649% (Highly Insufficient pathway) and 0.006364% (1.5°C Paris Agreement Compatible pathway).	Not formally assessed.



Category	Impact Description	Risk or impact rating
Benchmark against pre-defined thresholds	During the operational phase, the Project's annual GHG emissions would be classed as Very Low (7,244 tCO ₂ e/a)	Very Low

6. Mitigation Measures

The adaptation measures for managing climate-related risks to be included in the Environmental and Social Management Plan ('ESMP') are listed below:

- Biovac should ensure that their stormwater management plan be updated to consider projected changes in climate.
- Biovac should ensure that their insurance policy covers damages incurred due to extreme weather events (i.e. acute urban flooding events).
- Biovac must develop and implement an employee health awareness program to educate employees (and contractors) about the risks of heat stroke/dehydration and how to prevent such ailments.
- Biovac must ensure that employees are provided with appropriate personal protective equipment to reduce sun exposure and the risk of heat stroke/dehydration.
- Biovac should reschedule work to cooler parts of the day if temperatures are very high (i.e., >35°C), and ensure that employees are provided with more frequent rest breaks, and shaded rest areas.
- Biovac should ensure that the basis of design of the HVAC system should consider the projected changes in climate.
- Biovac should ensure that their financial models/ planning be updated to account for the potential of increasing energy demands (HVAC system related) and potential upgrades at some point in the future.
- Biovac must incorporate a water scarcity contingency plan as part of their emergency preparedness and response plan ('EPRP'), covering the following:
 - Identify alternative / emergency water supply options, including the environmental and regulatory requirements.
 - Define water scarcity stages ranging from normal (no restrictions) to critical (emergency interventions; supply prioritisation). For each stage, the following elements must be specified:
 - Trigger thresholds.
 - Operational actions(e.g. demand reduction measures).
 - Communication protocols.
 - Roles and responsibilities of key stakeholders and decision-making authorities at each stage.

The mitigation measures for reducing Project-related GHG emissions are listed below:

- Diesel generators must be sized appropriately so that they run at their optimal workload (e.g., 70% to 100% of total load rating).
- Diesel generators must be regularly maintained in accordance with the manufacturers service schedule.



- Construction materials should be sourced as close to the work front as possible to reduce transport distances and GHG emissions.
- For the transport of materials and equipment, the vehicle load should be maximised to increase fuel efficiency and reduce emissions.
- Truck drivers should receive training on good driving practices to improve fuel economy and reduce carbon emissions.
- Optimise HVAC energy performance by implementing measures such as:
 - Optimise temperature settings using programmable thermostats and building management system.
 - Improve insulation and sealing by adding insulation to walls, ceilings, and ductwork, where possible.
 - Conduct regular maintenance (e.g. clean or replace air filters) in accordance with manufacturers specifications.
 - Install variable speed drives on fans and pumps, where possible, for better load matching.
 - Reduce internal heat loads by using LED lighting and energy-efficient appliances.
 - The facility should, where possible utilise refrigerant gasses that exhibit a low global warming potential ('GWP'), for example carbon dioxide ('CO₂') or hydrofluoroolefins ('HFOs')



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Acronyms and Abbreviations

Acronym	Definition
Biovac	The Biovac Institute (Pty) Ltd
CAT	Climate Action Tracker
CCKP	Climate Change Knowledge Portal
CCRA	Climate Change Risk Assessment
CDP	Carbon Disclosure Project
CH₄	Methane
CMIP6	Coupled Model Inter-Comparison Project No. 6
CO₂	Carbon dioxide
DFFE	Department of Forestry, Fisheries, and the Environment
DSP	Digital signal processing
EBRD	European Bank of Reconstruction and Development
EHS	Environmental, health, and safety
EIA	Environmental Impact Assessment
EPFI	Equator Principles Financial Institution
EPRP	Emergency Preparedness and Response Plan
EP4	Equator Principles: EP4
ESG	Environmental Social and Governance
ESMP	Environmental and Social Management Plan
GHG	Greenhouse gas
GIIP	Good International Industry Practice
Guidance Note	Guidance Note on Climate Change Risk Assessment
GWP	Global Warming Potential
ha	Hectares
HFOs	Hydrofluoroolefins
HSE	Health, safety, and environment
HVAC	Heating, Ventilation, and Air Conditioning
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organisation for Standardisation
kgCH₄/TJ	Kilograms of methane per terajoule
kgCO₂/TJ	Kilograms of carbon dioxide per terajoule
kgN₂O/TJ	Kilograms of nitrous oxide per terajoule
ℓ	Litre
MJ/ℓ	Megajoules per litre
mRNA	Messenger ribonucleic acid



MW	Megawatt
NDC	Nationally Determined Contribution
N₂O	Nitrous oxide
NAEIS	National Atmospheric Emission Inventory System
NGGEF	National Generation Grid Emission Factor
OCV	Oral cholera vaccine
OHS	Occupational, health and safety
SA-LEDS	South Africa's Low-Emission Development Strategy 2050
SCC	Species for conservation concern
SLIP	Supplementary Lenders Information Pack
SLR	SLR Consulting (South Africa) Proprietary Limited
SSPs	Shared Socio-economic Pathways
TCFD	Task Force on Climate-related Financial Disclosures
tCO₂e	Tonnes of carbon dioxide equivalent
tCO₂e/a	Tonnes of carbon dioxide equivalent per annum
TJ	Terajoules
TJ/ℓ	Terajoule per litre
UNFCCC	United Nations Framework Convention on Climate Change



1. Introduction

SLR Consulting (South Africa) Proprietary Limited (hereinafter referred to as “SLR”) has been appointed by the Biovac Institute (Pty) Ltd (hereinafter referred to as “Biovac”) to undertake a climate change risk assessment (CCRA) for the proposed Biovac Vaccine facility, and associated infrastructure, located in the City of Cape Town, in the Western Cape province, South Africa (hereafter referred to as the “Project”).

2. Scope and Purpose

The following section sets out the scope and purpose of this CCRA.

In accordance with the requirements of the Equator Principles (EP4)¹, this CCRA has assessed:

1. The climate-related risks for the Project.
2. The Project’s greenhouse gas (GHG) emissions.

In addition, the CCRA also considers:

- The potential impact of the Project on communities and the provision of priority ecosystems services that may be already adversely affected by climate change.
- The impact of the Project on sites of demonstrated importance to climate change mitigation and adaptation.

The scope of this assessment was as follows:

- Desktop review of the applicable South African legislation, policies, and plans, and relevant international guidelines, standards, and treaties (**Section 3**).
- Description of the key Project activities that may be vulnerable to the adverse effects of climate change or contribute to Project-related GHG emissions (**Section 4**).
- Description of the approach and methodology to the CCRA (**Section 5**).
- Desktop review of the latest climate data to determine the observed and projected changes in climate (**Section 6**).
- Quantification the Project’s direct (scope 1) and indirect (scope 2) GHG emissions for the construction and operational phases (**Section 7**).
- Assessment of the Project’s GHG emissions in terms of (i) the contribution to South Africa’s modelled domestic pathways, and (ii) pre-defined thresholds (**Section 7.2.2**).
- Qualitative assessment of the physical (i.e., related to physical impacts of climate change) and transition risks (i.e., impacts related to the transition to a lower-carbon economy) to the Project, as well as the opportunities that may arise from the transition to a lower carbon economy. The risks to Project-affected communities, priority ecosystem services, and sites of demonstrated importance to climate mitigation and adaptation, if relevant, is also be assessed (**Section 9**).
- Identification of appropriate, high-level measures to mitigate any identified climate-related risks and the Project’s GHG emissions (**Section 10**).

¹ Equator Principles Association (2020). *Equator Principles: EP4: July 2020*. URL: <https://equator-principles.com> [accessed on 04 January 2026].



In accordance with the EP4, the scope of this assessment is tailored to be proportionate to the nature and scale of the risks, impacts and development stage of the proposed Project. This CCRA has also broadly adhered to the recommendations of the Equator Principles Guidance Note on Climate Change Risk Assessment (hereinafter referred to as the “Guidance Note”)².

3. Legal and Policy Framework

The following section provides a brief overview of the policy and legislative context within which the Project will be developed and how the Project complies with and responds to the relevant policies and legislation. This framework includes South Africa’s climate-related legislation, policies, and plans, as well as the relevant international treaties, guidelines, and standards.

² Equator Principles Association (2023). *Guidance Note on Climate Change Risk Assessment*. URL: <https://equator-principles.com/> [accessed on 04 January 2026].



Table 3-1: Summary of legal and policy framework

Title	Year	Type	Purpose	Relevant sections
Local legislation, policies, and plans				
The Climate Change Act 22 of 2024 ³	2024	Legislation	The purpose of the Act is to enable the development of an effective climate change response and a long-term, just transition to a low-carbon and climate-resilient economy and society for South Africa in the context of sustainable development.	Chapters 3 and 4 which set out the requirements for the local, provincial and national response to climate change. Chapter 5 which sets out the requirements for GHG emissions and removals, including determining the national GHG emissions trajectory. Although the Act does not have any specific requirements for the Project, the potential contribution of the Project's GHG emissions to the country's modelled domestic pathways is assessed in Section 8.1.
National Guideline for the Consideration of Climate Change Implications in Applications for Environmental Authorisation, Atmospheric Emission Licences, and Waste	2025	Guidelines	The purpose of the guideline is to give guidance on the consideration of climate change impacts in environmental impact assessment (EIA) processes linked to Environmental Authorisations, Atmospheric Emission Licences, and Waste Management Licences.	Section 5 which sets out the principles for involving climate change specialists in EIA processes. Section 7 which sets out the role and timing of the specialist study within the EIA process. Section 8 which sets out the roles and responsibilities. Section 9 which sets out the extent and content of the climate change assessments. Section 10 which sets out the application of the impact mitigation measures. Section 11 which provides guidance for addressing direct, indirect, and cumulative impacts. Section 12 which provides guidance for climate change adaptation.

³ Climate Change Act 22 of 2024 (as amended).



Title	Year	Type	Purpose	Relevant sections
Management Licences ⁴				Section 13 which sets out environmental management programme (EMPr) requirements Appendix 1 which sets out a climate change significance rating framework Although the guideline is not yet in effect, this CCRA broadly aligns with its requirements, and in particular, the guidance on the extent and content of climate change assessments.
South Africa First Nationally Determined Contribution (NDC) (Updated September 2021) ⁵	2021	Policy	The purpose of the South Africa's NDC is to outline the country's plans to mitigate GHG emissions and to adapt to climate change. South Africa's first NDC was updated in September 2021 to align with the Paris Agreement, and to reduce the country's GHG emissions target range to 398 - 510 million tonnes carbon dioxide equivalents (MtCO₂e) by 2025 and 350 - 420 MtCO₂e by 2030. The targets include all sectors except natural land disturbance. According to the NDC, South Africa's long-term decarbonisation of the economy will focus primarily on the electricity sector in the 2020s. In the 2030s, the focus will be on a deeper transition of the electricity sector together with a transition in the transport sector towards low emission vehicles. In the 2040s, the focus will be on hard-to-mitigate sectors of the economy.	Section 4 which sets out South Africa's national GHG emission reduction targets. Although the NDC does not contain requirements specific to the Project, the potential contribution of the Project's GHG emissions to the country's modelled domestic pathways is assessed in Section 8.1.
National Climate Change	2019	Strategy	The purpose of the National Climate Change Adaptation Strategy is to provide a common vision of climate change adaptation and climate	Section 3 which sets out the strategic objectives, interventions, and actions of the Strategy.

⁴ The National Guideline for Consideration of Climate Change Implications in Applications for Environmental Authorisation, Atmospheric Emission Licences, and Waste Management Licences published in Government Gazette No. 44761 on 24 October 2025.

⁵ Republic of South Africa (2021). South Africa First Nationally Determined Contribution (Updated September 2021). URL: <https://unfccc.int> [accessed on 04 January 2026].



Title	Year	Type	Purpose	Relevant sections
Adaptation Strategy ⁶			resilience for the country, and to outline priority areas for achieving this vision.	Although this Strategy does not have any specific requirements for the Project, the Project should, to the extent possible, ensure that it is compatible with the vision and strategic objectives, interventions, and actions of this Strategy.
Carbon Tax Act ⁷	2019	Legislation	The purpose of the Carbon Tax Act 15 of 2019 is to provide for the imposition of a tax on carbon dioxide equivalent of greenhouse gas emissions.	Schedule 2 which sets out the activities and thresholds for which tax is payable. Parts I to IV which set out the requirements for calculating the amount of tax payable, the allowances, limitation of allowances, the tax period, and payment of tax. Based on an initial screening of the listed activities, the Project may become liable for carbon tax if the 10 MW(th) threshold is exceeded. In this regard, the installed thermal capacity will need to be accurately confirmed once the final designs are complete
South Africa's Low-Emission Development Strategy 2050 ⁸	2018	Strategy	The purpose of South Africa's Low-Emission Development Strategy 2050 (SA-LEDS) is to provide a path going forward in order to place the country on a low-carbon trajectory, while at the same time ensuring broader socio-economic development. The SA-LEDS acknowledges that South Africa's mining and industrial sector is emissions intensive, resulting from a carbon-intensive national electricity grid, predominated by coal-fired power stations. However, the country's LEDS is more	Sections 4.2 and 4.3 which set out measures to drive low carbon development in the energy sector. Although the strategy does not contain requirements specific to the Project, the Project should, to the extent possible ensure that it is compatible with South Africa's LEDS.

⁶ Department of Environment, Forestry, and Fisheries (2019). *National Climate Change Adaptation Strategy*. <https://www.dffe.gov.za> [accessed on 04 January 2026].

⁷ Carbon Tax Act 15 of 2019 (as amended)

⁸ Department of Environment, Forestry, and Fisheries (2018). *South Africa's Low-Emission Development Strategy 2050*. <https://unfccc.int/> [accessed on 04 January 2026].



Title	Year	Type	Purpose	Relevant sections
			focussed on decarbonising the country's energy sector.	
Declaration of Greenhouse Gases as Priority Air Pollutants ⁹	2017	Legislation	The purpose of this Declaration is to declare the GHGs indicated therein as priority air pollutants. This includes carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. The Regulations also require persons falling within a category specified in Annexure A and exceeding the threshold of 1 MtCO₂e per annum to prepare and submit to the Minister a pollution prevention plan for approval.	Based on an initial screening of the listed categories, it is unlikely that the Project will require a pollution prevention plan as vaccine manufacturing is not listed under Annex A (production processes which trigger the requirement to submit a Pollution Prevention Plan if Project emissions exceed 0.1 Mt CO ₂ e per annum).
National Greenhouse Gas Emissions Reporting Regulations, 2016 ¹⁰	2016	Legislation	The purpose of these regulations is to introduce a single national reporting system for the transparent reporting of greenhouse gas emissions, which will be used (a) to update and maintain a National Greenhouse Gas Inventory, (b) for South Africa to meet its reporting obligations under the UNFCCC, and (c) to inform the formulation and implementation of legislation and policy. The regulations apply to the categories of emission sources listed in Annexure 1 and a corresponding data provider as classified in Regulation 4.	Appendix 1 indicates that the Project falls under IPCC code 1A2c, 'Chemicals'. Based on an initial screening of the listed activities, the Project may be required to submit greenhouse gas emissions and activity data for all relevant IPCC source categories and ensure that the Project's GHG reporting adheres to the Technical Guidelines for Monitoring, Reporting, Verification and Validation of GHG emissions by Industry, applying either the Tier 2 or Tier 3 approach. In this regard, the installed thermal capacity will need to be accurately confirmed once the final designs are complete.
DRAFT Post-2015 National Energy	2016	Strategy	The purpose of the DRAFT Post-2015 National Energy Efficiency Strategy is to respond to the increasing demand for energy alongside a growing commitment to improving resource use and	Section 5.4 which sets out the pathway to realising South Africa's energy efficient future in the industry and mining sector.

⁹ Department of Environmental Affairs (2017). Declaration of Greenhouse Gases as Priority Air Pollutants. Published in Government Notice 6 in *Government Gazette* 39578 on 08 January 2016.

¹⁰ Department of Environment, Forestry and Fisheries (2016). National Greenhouse Gas Emissions Reporting Regulations. Published in Government Notice 275 in *Government Gazette* 40762 on 03 April 2017 (as amended).



Title	Year	Type	Purpose	Relevant sections
Efficiency Strategy ¹¹			reducing South Africa's national environmental footprint.	The strategy proposes one overarching target for the manufacturing sector by 2030: 16% reduction in weighted mean specific energy consumption of manufacturing; and This target is based on an assumption of an average 5% energy saving in energy-intensive process-specific activities along with a 35% saving in generic energy-using activities (HVAC, lighting, pumps, conveyors etc). Consequently, is expected that the Project be required to adopt energy saving practices by 2030, aligning with target stipulated above.
National Environment Management: Air Quality Act 39 of 2004 ¹²	2004	Legislation	Reforms the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development, as well as providing for national norms and standards regulating air quality monitoring, management and control by all spheres of government.	Although the Act itself does not contain requirements specific to the Project, it should, to the extent possible, be compatible with the objectives of the Act.
International treaties, guidelines, and standards				
EP4 ¹³	2020	Standards	The Equator Principles are a financial industry benchmark for assessing and managing social and environmental risks in project financing, including the requirements for climate change risk assessment and reporting on GHG emissions.	Principle 2 which sets out the requirements for a climate change risk assessment. Annex A which sets out the requirements for alternatives analysis and reporting of GHG emissions.

¹¹ Department of Mineral Resources and Energy (2016). DRAFT Post-2015 National Energy Efficiency Strategy. <https://cer.org.za> [accessed on 04 January 2026].

¹² National Environment Management: Air Quality Act 39 of 2004 (as amended).

¹³ Equator Principles Association (2020). *Equator Principles: EP4: July 2020*. URL: <https://equator-principles.com> [accessed on 04 January 2026].



Title	Year	Type	Purpose	Relevant sections
				This CCRA aligns with the requirements of EP4 and broadly aligns with the Guidance Note.
Recommendations of the TCFD ¹⁴	2017	Guidelines	Establishes recommendations for disclosing clear, comparable, and consistent information about the risks and opportunities presented by climate change.	Part B which provides a useful framework for categorising the climate-related risks and opportunities to promote greater alignment and standardisation across the different sectors. This framework is used in Section 9 to categorise the Project's climate-related risks and opportunities.
The Paris Agreement ¹⁵	2016	Treaty	This treaty aims to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. South Africa ratified the Paris Agreement on 1 November 2016.	Article 2 which sets out the objectives of the agreement. Articles 3 and 4 which set out the requirements for the submission of plans for climate action known as NDCs. Article 5 which sets out the requirements for the conservation of carbon sinks and reservoirs, such as forests. Article 7 which sets out the requirements for enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change. Although the Paris Agreement does not contain requirements specific to the Project, the potential impact of the Project's GHG emissions on South Africa's Paris aligned pathway is assessed in Section 7.2.2 .
International Finance Corporation (IFC): Performance Standards on	2012	Standards	These standards cover the IFC's strategic commitment to sustainable development, as well as its approach to risk management. The standards cover guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way	This CCRA -adheres with the requirements of the following principles: • Performance Standard 1 which requires the consideration of climate change in environmental and social assessments.

¹⁴ TCFD (2017). *Recommendations of the Task Force on Climate-related Financial Disclosures*. <https://assets.bbhub.io> [accessed on 04 January 2026].

¹⁵ United Nations (2015). *Paris Agreement*. URL: <https://treaties.un.org> [accessed on 04 January 2026].



Title	Year	Type	Purpose	Relevant sections
Environmental and Social Sustainability ¹⁶			of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities.	- Performance Standard 3 which requires the quantification of the project's GHG emissions and identification of mitigation measures. - Performance Standard 4 which requires the consideration of climate change on project-affected communities and priority ecosystem services. - Performance Standard 6 which requires the consideration of climate change on biodiversity and project-affected natural ecosystems.
Environmental, Health, and Safety (EHS) General Guidelines ¹⁷	2007	Guidelines	These guidelines are the World Bank Group's technical reference documents with general and industry-specific examples of good international industry practice.	This CCRA adheres with the requirements of Section 1.1, which provides guidance for the reduction and control of GHG emissions, to align with GIIP.
The Kyoto Protocol ¹⁸	1997	Treaty	This Treaty aims to operationalize the UNFCCC by committing industrialised countries and economies in transition to limit and reduce GHG emissions in accordance with agreed individual targets. South Africa ratified the Kyoto Protocol on 31 July 2002.	Article 12 which makes provision for a Clean Development Mechanism to assist countries not listed in Annex B with achieving sustainable development. Annex B which lists countries that are required to have a quantified emission limit or reduction commitment. Although the Protocol does not contain requirements specific to the Project, it should, to the extent possible, be compatible with the objectives of the Protocol
United Nations Framework Convention on Climate	1992	Framework	This Convention aims to prevent "dangerous" human interference with the climate system. South Africa ratified the UNFCCC on 29 August 1997.	Article 2 which sets out the objectives of the treaty. Article 3 which sets out the principles of the treaty. Article 4 which sets out the commitments of the parties to the treaty.

¹⁶ International Finance Corporation (2012). *Performance Standards*. URL: <https://www.ifc.org> [accessed on 04 January 2026].

¹⁷ World Bank (2007). *Environmental, Health, and Safety General Guidelines*. URL: <https://www.ifc.org> [accessed on 04 January 2026].

¹⁸ United Nations (1997). *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. URL: <https://treaties.un.org> [accessed on 04 January 2026]



Title	Year	Type	Purpose	Relevant sections
Change (UNFCCC) ¹⁹				Although the Framework does not contain requirements specific to the Project, it should, to the extent possible, be compatible with the objectives of the framework.

¹⁹ United Nations (1992). *United Nations Framework Convention on Climate Change*. URL: <https://treaties.un.org> [accessed on 04 January 2026]



4. Project Description

Table 4-1 presents a general description of the activities of the Project, which are vulnerable to the adverse effects of climate change and/or contribute to Project-related GHG emissions. The preferred location and aerial cadastral context of the Project is presented in **Figure 4-1** and **Figure 4-2** respectively.

Table 4-1: Description of the main activities

Activity	Description
Project site²⁰	
Nearest towns	The Project is located within the City of Cape Town's metropolitan region, approximately 6.4 km southeast of the city centre.
Metropolitan Municipality	City of Cape Town Metropolitan Municipality
Province	Western Cape Province
Development footprint	~2.3 ha
Land use	Vacant, disturbed land in an industrial precinct, situated within Cape Town's inner-city core.
Surrounding land uses	- Well-established industrial precincts to the north, south and west of the proposed site. - Residential land use to the east of the proposed site.
Project components²¹	
Vaccine manufacturing facility	Four storey main industrial building to accommodate vaccine production activities, with an approximate floor space of 25,979 m ² .
Power supply	- Power use projections obtained from Biovac indicate that during the operational phase, the Project will utilise approximately 7,100,675 kilowatt hours (kWh) of power per annum. - Power will primarily be sourced from Eskom. An additional 1,360 kWh is planned to be produced via a rooftop solar system. The output of the solar system was calculated based on conversion or inverter losses of 15%. - Diesel generators will be utilised as the primary backup power source.
Ancillary facilities	- Oral Cholera Vaccine (OCV) processing, bio-positive and bio-negative areas. - Central utility building (adjacent to the main building), tank farm, warehouse and technical areas. - On-site parking area to the south of the main building with capacity for 132 vehicles. All parking bays will be covered with solar panel roofing. - Loading and waste management area in the space east of the parking area. - Circulation space around the main building and along all Project boundaries. - Landscaping in the parking area.

²⁰ Aroux Town Planning (2025). *Application for Subdivisions, Consolidation, Amendment of Conditions of Approval, Approval of the Proposed SDP & Departures*

²¹ *Ibid.*



Activity	Description
Future expansions	Planned future expansions include a messenger ribonucleic acid (mRNA) workshop, digital signal processing (DSP) processing, and lyophilisation suites.
Access and internal roads	Access to the site will be obtained via the intersection of Diesel and Ndabeni roads. The access point will be security controlled and provides for one ingress and one egress lane. An additional emergency access servitude will be developed.
Project timelines²²	
Construction and commissioning	2026 –2027 (~18 months).
Commissioning	2027 – 2031.
Operations	From 2031.
Decommissioning	No planned decommissioning phase.

²² The timelines presented were provided by the Client and may change subject to future Project amendments.



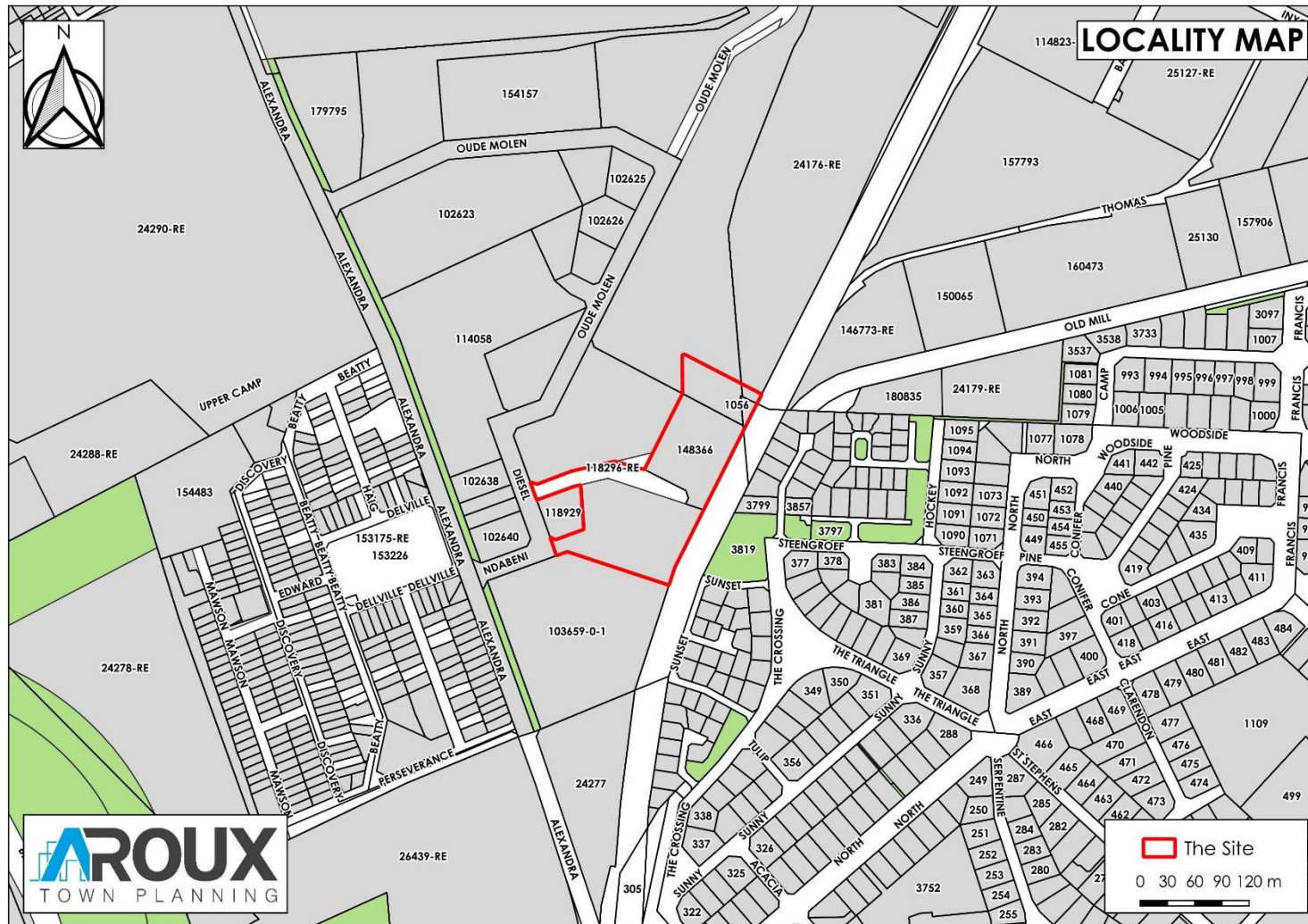


Figure 4-1: Preferred location of the Biovac Vaccine Manufacturing Facility





Figure 4-2: Aerial Cadastral Context of the Biovac Vaccine Manufacturing Facility



5. Approach and Methodology

5.1 Climate-Related Risks and Opportunities

5.1.1 Data Sources

This assessment is largely based on climate-related information sourced from the World Bank Climate Change Knowledge Portal (CCKP), the Intergovernmental Panel on Climate Change (IPCC), and published journal articles.

The CCKP was created to provide an online tool for accessing global, country, and regional level information to better understand the observed and projected changes in climate under a range of future scenarios²³. Given that this is a high-level analysis, the level of detail provided by the CCKP is deemed to be sufficient for this assessment.

The CCKP presents information based on the Coupled Model Inter-Comparison Project No. 6 (CMIP6). CMIP6 is also used by the IPCC in the Sixth Assessment Report, which was released at the end of 2021²⁴. CMIP6 data is presented at a spatial resolution, 1° x 1° (~100 km x ~100 km). The benefit of using CMIP6 is that it is an ensemble of over 100 different climate models from 49 modelling centres across the world and thus includes information on a wide range of possible future climate change outcomes and uncertainties.

5.1.2 Climate Scenarios

Figure 5-1 presents the projected change of global surface temperature (relative to the reference period (1950 – 2014) under the different Shared Socio-economic Pathways (SSPs)²⁵. SSPs are used in CMIP6 to represent different global policy responses to climate change.

To account for the uncertainty regarding the future, this assessment considers two climate scenarios:

- **SSP2-4.5 (“middle of the road”)** – GHG emissions continue at current levels until 2050.
- **SSP5-8.5 (“fossil fuelled development”)** – High GHG emissions levels due to the continued and intensive use of fossil fuels.

These two scenarios were selected as they represent an upper extreme (SSP5-8.5) where mitigation is difficult due to the high reliance on fossil fuels, and an intermediate scenario (SSP2-4.5), between the upper extreme and lower extreme (SSP1-1.9 “Sustainability” with significant mitigation).

²³ World Bank Group (2022). About Us. <https://climateknowledgeportal.worldbank.org> [accessed on 04 January 2026]

²⁴ IPCC (2021). Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Intergovernmental Panel on Climate Change. Switzerland.

²⁵ *Ibid.*



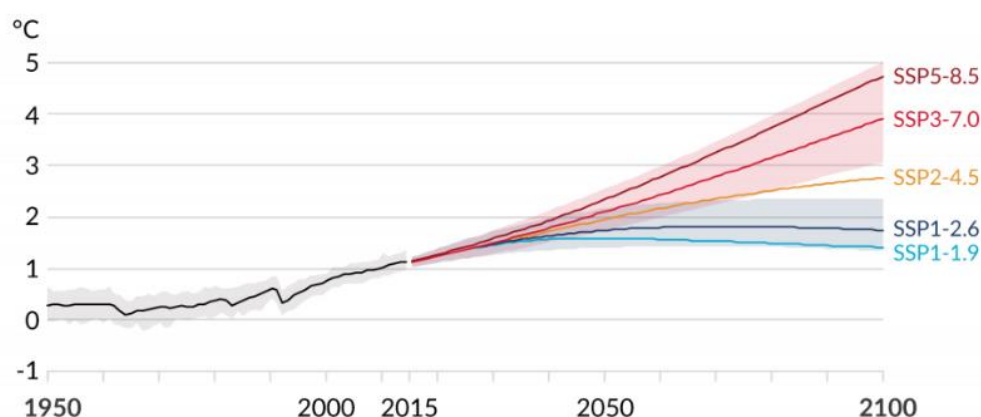


Figure 5-1: Projected change in global surface temperature relative to 1950²⁶

5.1.3 Assessment of Climate-Related Impacts

5.1.3.1 Categorisation of Climate-Related Impacts

The Project's physical, climate-related risks are firstly identified through the desktop study and categorised according to the Task Force on Climate-related Financial Disclosures (TCFD) disclosure framework (**Table 5-1**). The TCFD distinguishes between two types of climate-related risks, namely physical risks and transition risks, as well as climate-related opportunities²⁷:

- The **physical risks** resulting from climate change can have a direct impact on the Project, or an indirect impact on the Project's supply chains. Physical risks are further divided into acute and chronic impacts.
- **Transition risks** refer to the financial and reputational risks to Projects with the global transition to a lower-carbon economy. The level of risks is dependent on the nature, speed, and focus of the transition. Transition risks are further divided into policy and legal, technology, market, and reputational impacts.
- The **opportunities** that may arise for organisations from efforts to mitigate and adapt to climate change.

Table 5-1: Climate-related risks disclosure framework²⁸

Category	Type	Description
Physical risks	Acute	Impacts that are event-driven, including increased severity of extreme weather events, such as cyclones, hurricanes, or floods.

²⁶ IPCC (2021). Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Intergovernmental Panel on Climate Change. Switzerland.

²⁷ TCFD (2017). Recommendations of the Task Force on Climate-related Financial Disclosures. URL: <https://assets.bbhub.io> [accessed on 04 January 2026].

²⁸ *Ibid.*



	Chronic	Impacts arise from longer-term shifts in climate patterns (e.g., sustained higher temperatures), that may cause sea level rise or chronic heat waves.
Transition risks	Policy and legal	Impacts arise from policy actions that attempt to constrain actions that contribute to climate change or seek to promote adaptation to climate change. Impacts also arise from climate-related litigation claims being brought before the courts by property owners, municipalities, states, insurers, shareholders, and public interest organisations.
	Technology	Impacts arise from new technologies displacing old technologies and disrupting some parts of the existing economic system. This transition leads to winners and losers, and uncertainty in assessing technological impact.
	Market	Impacts arise from shifts in supply and demand for certain commodities, products, and services as climate-related impacts and opportunities are increasingly considered.
	Reputational	Impacts arise from changing customer or community perceptions of an organisation's contribution to or detraction from the transition to a lower-carbon economy.
Opportunities	Resource efficiency	Opportunities arise from improving efficiency across production and distribution processes and employing innovation in technology.
	Energy source	Opportunities arise from the uptake of low emission alternative energy sources.
	Products and services	Opportunities arise from the innovation and development of new low-emission products and services, allowing organisation to improve their competitive position and to capitalise on shifting consumer and producer preferences.
	Markets	Opportunities arise from accessing new markets or types of assets, allowing organisations to diversify their activities and better position themselves for the transition to a lower carbon economy.
	Resilience	Opportunities arise from developing adaptive capacity to better manage climate-related risks.

5.1.3.2 Risk Assessment Methodology

South Africa currently does not have any legislation regulating the assessment of climate change risks. This CCRA, therefore, uses a risk matrix (**Table 5-4**), which is a commonly used tool in risk assessment, to assess climate-related risks for the Project. This matrix consists of two axes, one for impact (**Table 5-2**), and one for likelihood (**Table 5-3**).

In the context of this CCRA, risk refers to the likelihood that a certain event will occur, and the potential consequences of such an event should it occur. This differs from impact which refers to the actual consequences or effects that result from a certain event. As the focus of the CCRA is on the risks associated a changing climate, particularly given the uncertainty associated with climate change, the standard SLR impact assessment methodology is not



deemed to be appropriate for assessing climate-related risks, and has, thus, not been applied in this CCRA.

Table 5-2: Impact ratings

Rating	Description
Severe	Operational disruptions longer than 10 days / significant disruption with emergency response required /extreme monetary loss of > 90%.
Major	Operational disruptions longer than 5 days / major monetary loss of 50–90%.
Significant	Operational disruptions less than 5 days / moderate monetary loss of 10–50%.
Minor	Operational disruptions less than 24 hours / monetary loss of < 10%.
Slight	Little to no impact on operational uptime or revenue.

Table 5-3: Likelihood ratings

Rating	Description
Rare	Recurrent risk: The unwanted event has not occurred or is unlikely to occur within 30 years. Single event: Negligible; probability small, almost zero.
Unlikely	Recurrent risk: The unwanted event has happened at some time or could happen about once in 30 years. Single event: Unlikely but not negligible: probability noticeably greater than zero.
Possible	Recurrent risk: The unwanted event has happened at some time; or could happen within 10 years. Single event: Less likely than not but still appreciable: probability less than 50% but still quite high.
Likely	Recurrent risk: Unwanted events occur infrequently and could arise about once per year. Single event: As likely as not: probability greater than 50% but less than 80%.
Almost certain	Recurrent risk: The unwanted event could occur several times per year and is likely to recur within 1 year. Single event: More likely than not: probability greater than 80%.

Table 5-4: Risk matrix

Final rating		Likelihood				
		Rare	Unlikely	Possible	Likely	Almost Certain
Impact	Severe	Low	Moderate	High	High	High
	Major	Low	Moderate	Moderate	High	High
	Significant	Low	Low	Moderate	Moderate	High
	Minor	Low	Low	Low	Moderate	Moderate
	Slight	Low	Low	Low	Low	Low



5.2 Project's GHG Emissions

The approach to the quantification of Project's GHG emissions is guided by the following reference documents:

- Greenhouse Gas Protocol: *Corporate Accounting and Reporting Standard*²⁹.
- IPCC: 2006 *IPCC Guidelines for National Greenhouse Gas Inventories*³⁰.
- International Organization for Standardization: *ISO 14064-1:2019: Greenhouse gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*.
- Department of Forestry, Fisheries, and the Environment: *Methodological Guidelines for Quantification of Greenhouse Gas Emissions*³¹.

5.2.1 Organisational Boundaries

Organisations vary in their legal and organisational structures and, like financial accounting, reporting on the GHG emissions of operations is dependent on the structure of the organisation, and whether the operations are wholly owned, joint ventures or subsidiaries³². It is expected that the organisation boundaries will state the makeup of the company, and the operations that the organisation owns or controls.

In defining the organisational boundaries, there are generally two distinct consolidation approaches:

- With the **equity share approach**, the organisation accounts for GHG emissions from operations according to its share of equity in the operation. Typically, the equity share is equivalent to the organisation's percentage ownership.
- With the **control approach**, the organisation accounts for 100% of the GHG emissions from operations over which it has control. In terms of this approach, an organisation is not accountable for operations in which it owns a percentage but has no control. Control can be in the form of either financial control, in which the organisation directs the financial and operational policies of the operation, or operational control, where the organisation has the full authority to introduce and implement operational policies.

This assessment reports on the Project's GHG emissions in terms of the operational control approach, where Biovac accounts for 100% of the estimated direct (scope 1) and indirect (scope 2) GHG emissions. Should the Project be developed and/or operated by a different entity, responsibility for GHG emissions will transfer to the party assuming operational control.

²⁹ WBCSD and WRI (2015). *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard*. URL: <https://ghgprotocol.org> [accessed on 04 January 2026].

³⁰ IPCC (2006). *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. <https://www.ipcc-nggip.iges.or.jp> [accessed on 04 January 2026].

³¹ Department of Forestry, Fisheries, and the Environment (2022). *Methodological Guidelines for Quantification of Greenhouse Gas Emissions*. Published under Government Notice 2598 of Government Gazette 47257 on 7 October 2022.

³² WBCSD and WRI (2015). *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard*. URL: <https://ghgprotocol.org> [accessed on 04 January 2026].



5.2.2 Operational Boundaries

In defining the operational or reporting boundaries, the GHG emissions associated with the organisation's operations are identified and characterised as either direct or indirect emissions³³. Three 'scopes' are used for GHG emissions accounting and reporting to characterise direct and indirect emission sources. The use of scopes not only improves transparency and consistency in reporting but also ensures that organisations do not account for different emissions in the same scope (i.e., double counting).

A brief description of the three scopes is provided below:

- **Scope 1: Direct GHG emissions:** Occur from sources that are owned or controlled by the organisation. This includes for example, emissions from heavy machinery, generators, delivery vehicles, forklifts, temporary lighting, and so on.
- **Scope 2: Indirect GHG emissions from purchased energy:** Occur from the generation of purchased electricity or steam that is brought onto the organisation's property.
- **Scope 3: Other indirect GHG emissions:** Occur from sources that are not owned or controlled by the organisation. This includes for example, purchased materials, transportation of materials, and business travel.

Figure 5-2 presents an overview of scope 1, scope 2, and scope 3 emissions across the value chain of an organisation.

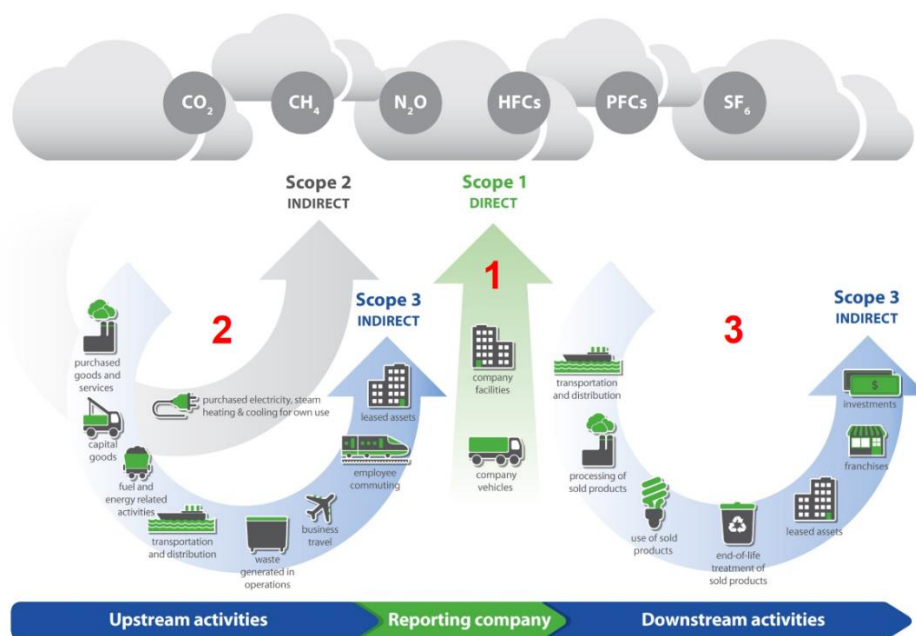


Figure 5-2: Overview of scope 1, scope 2, and scope 3 emissions across the value chain³⁴

In terms of the GHG Protocol, organisations are required to report on both scope 1 and scope 2 emissions. This also a requirement of IFC Performance Standard 3 for projects that

³³ *Ibid.*

³⁴ Greenhouse Gas Protocol (2011). *Corporate Value Chain (Scope 3) Accounting and Reporting Standard*. URL: <https://ghgprotocol.org> [accessed on 04 January 2026] (pg. 5).



are expected to produce more than 25,000 tCO₂e annually³⁵, and of the EP4 for projects that are expected to produce more than 100,000 tCO₂e annually³⁶.

5.2.2.1 GHG Emissions Sources Included in the Assessment

Table 5-5 presents the GHG emission sources which were included in the assessment, as well as the activity data on which the GHG emissions were calculated.

Table 5-5: GHG emission sources included in the assessment

Project phase	Scope	Emissions source	Activity data	Unit
Commissioning ³⁷	1	Diesel consumption associated with the commissioning of the black steam system.	Total diesel consumption	Litres (L)
Commissioning	1	Paraffin consumption of the black steam system during the commissioning phase.	Annual paraffin consumption	L
Commissioning	2	Electricity consumption of onsite facilities during the commissioning phase.	Annual energy consumption	Kilowatt-hour ("kWh")
Operations	1	Paraffin consumption of black steam system during the operational phase	Annual paraffin consumption	L
Operations	2	Electricity consumption of onsite facilities during the operational phase	Annual energy consumption	kWh

5.2.2.2 GHG Emission Sources Excluded from the Assessment

Table 5-6 presents the GHG emission sources which were excluded from the assessment, as well as the reason for the exclusion.

Table 5-6: GHG emission sources excluded from the assessment

Operations	Scope	Emissions source(s)	Reason
Construction phase	1	Diesel consumption of construction vehicles and onsite generators.	Emissions resulting from the construction phase of this project are deemed to be negligible in comparison to emissions resulting from the commissioning and operational phases.
Construction phase	2	Electricity consumption of construction activities (e.g., construction camp).	Emissions resulting from the construction phase of this project are deemed to be negligible in comparison to emissions resulting

³⁵ Equator Principles Association (2020). *The Equator Principles: July 2020*. URL: <https://equator-principles.com> [accessed on 04 January 2026].

³⁶ International Finance Corporation (2012), *Environmental and Social Performance Standards*. <https://www.ifc.org> [accessed on 04 January 2026]

³⁷ To simplify the calculation process, the assessment focussed on emissions resulting from the commissioning and operational phases only as construction phase emissions were deemed to be negligible



Operations	Scope	Emissions source(s)	Reason
			from the commissioning and operational phases
Construction and operations	1	Fugitive emissions from equipment leaks (e.g., air conditioners, refrigerators, and so on).	Based on previous studies, this is unlikely to be a material source of GHG emissions relative to stationary combustion sources and purchased electricity. Moreover, modern and newly installed equipment generally has insignificant leakage, if any.
Operations	1	Sulphur hexafluoride leaks from electrical equipment (e.g., transformers).	Based on previous studies, this is unlikely to be a material source of GHG emissions relative to stationary combustion sources and purchased electricity. Moreover, modern and newly installed equipment generally has insignificant leakage, if any.
Closure	1	Diesel consumption of heavy machinery, generators, delivery vehicles, cranes, and so on.	Not applicable as there are presently no plans to decommission the Project at the end of its useable life.
All phases	3	Indirect emissions from value chains. This includes purchased goods and services, capital goods, fuel- and energy-related activities, upstream and downstream transportation and distribution, waste generated in operations, business travel, employee commuting, upstream and downstream leased assets, processing, and use, and end-of-life treatment of sold products.	Not applicable as Biovac does not have operational control over these GHG emission sources.
Other sources			
Construction	Land use, land use change, and forestry ³⁸	Emissions from site clearance activities and land use change.	Unlikely to be a material source of GHG emissions due to the limited development footprint (~2.3 ha). Moreover, the site is highly disturbed/ degraded land.

³⁸ It is considered good international industry practice under the IFC Performance Standards and the Equator Principles to account for greenhouse gas emissions arising from land use, land-use change, and forestry whenever these emissions are expected to be material.



5.2.3 Quantification of the Project's GHG Emissions

5.2.3.1 Commissioning Phase

Electricity Consumption

During the commissioning phase, electricity from the national grid would be purchased. The purchased electricity will be consumed by onsite electrical equipment. During this phase, electricity usage will be offset by the proposed rooftop solar system with an annual production capacity of 1,600 kilowatt hours direct current (KWh_{dc}). Thus, the GHG emissions from the consumption of electricity generated offsite are calculated using the following equation:

$$GHG\ emissions_{(tCO_2e)} = (Electricity\ consumption_{(MWh)} * Emission\ factor_{(tCO_2e/MWh)}) - (Rooftop\ solar\ system\ output * 0.85^{39})$$

The National Generation Grid Emission Factor (NGGEF), which was sourced from South Africa's 2023 Grid Emission Factors Report, was used in the calculation⁴⁰.

Diesel Consumption

During the commissioning phase, diesel will be consumed for the commissioning of the black steam system and testing standby generators. The GHG emissions from the consumption of diesel are calculated using the following equation:

$$GHG\ emissions_{(tCO_2e)} = Diesel\ consumption_{(l)} * net\ calorific\ value_{(TJ/l)} * (CO_2\ emission\ factor_{(kgCO_2/TJ)} * CO_2\ GWP + CH_4\ emission\ factor_{(kgCH_4/TJ)} * CH_4\ GWP + N_2O\ emission\ factor_{(kgN_2O/TJ)} * N_2O\ GWP)$$

The net calorific value, emission factors, and global warming potentials (GWP) for diesel were sourced from the Methodological Guidelines for Quantification of Greenhouse Gas Emissions⁴¹. This methodology is applied in this assessment as it is the reporting methodology approved by the Department of Forestry, Fisheries, and the Environment (DFFE). The DFFE are responsible for maintaining South Africa's national GHG inventory and meeting the country's reporting obligations under the UNFCCC.

Paraffin Consumption

During the commissioning phase, paraffin will be consumed by the facility's black steam system. The GHG emissions from the consumption of paraffin are calculated using the following equation:

$$GHG\ emissions_{(tCO_2e)} = Paraffin\ consumption_{(l)} * net\ calorific\ value_{(TJ/l)} * (CO_2\ emission\ factor_{(kgCO_2/TJ)} * CO_2\ GWP + CH_4\ emission\ factor_{(kgCH_4/TJ)} * CH_4\ GWP + N_2O\ emission\ factor_{(kgN_2O/TJ)} * N_2O\ GWP)$$

The net calorific value, emission factors, and GWP for paraffin were sourced from the Methodological Guidelines for Quantification of Greenhouse Gas Emissions⁴².

³⁹ The annual production capacity of the rooftop solar system has been multiplied by 0.85 to account for losses as the power is converted from DC to AC (A practical derate factor for rooftop solar systems ranges between 15-25%)

⁴⁰ Department of Forestry, Fisheries, and the Environment (2024). Publication of South Africa's 2023 Grid Emission Factors Report. Published under Government Notice 6454 of *Government Gazette* 53079 on 25 July 2025.

⁴¹ *Ibid.*

⁴² *Ibid.*



5.2.3.2 Operational Phase

Electricity Consumption

During the operational phase, electricity from the national grid would be purchased. The purchased electricity will be consumed by onsite electrical equipment. As previously mentioned, purchased electricity will be offset to some extent by the onsite solar system. Thus, the GHG emissions from the consumption of electricity generated offsite are calculated using the following equation:

$$GHG\ emissions_{(tCO_2e)} = (Electricity\ consumption_{(MWh)} * Emission\ factor_{(tCO_2e/MWh)}) - (Rooftop\ solar\ system\ output * 0.85)$$

The NGGEF, which was sourced from South Africa's 2023 Grid Emission Factors Report, was used in the calculation⁴³.

Paraffin Consumption

During the operational phase, paraffin will be consumed by the black steam system during the manufacturing process. The GHG emissions from the consumption of paraffin are calculated using the following equation:

$$GHG\ emissions_{(tCO_2e)} = Paraffin\ consumption_{(l)} * net\ calorific\ value_{(TJ/l)} * (CO_2\ emission\ factor_{(kgCO_2/TJ)} * CO_2\ GWP + CH_4\ emission\ factor_{(kgCH_4/TJ)} * CH_4\ GWP + N_2O\ emission\ factor_{(kgN_2O/TJ)} * N_2O\ GWP)$$

The net calorific value, emission factors, and GWP for paraffin were sourced from the Methodological Guidelines for Quantification of Greenhouse Gas Emissions⁴⁴.

5.2.4 Assessment of the Project's GHG Emissions

This assessment did not apply the standard SLR impact assessment methodology as this approach is not deemed to be appropriate for assessing the impact of GHG emissions. This is because this methodology tends to overstate the significance of the impact despite the relatively insignificant contribution of a Project's GHG emissions. This is due to the global extent of the impact, long-term duration (~100 years), and high probability of the impact occurring.

This assessment, therefore, assesses the Project's GHG emissions in terms of two criteria:

- Contribution to South Africa's modelled domestic pathways.
- Pre-defined thresholds.

5.2.4.1 Contribution to South Africa's Domestic Pathways

The first criterion for assessing the potential impact of the Project's GHG emissions is the potential contribution to South Africa's modelled domestic pathways.

Climate Action Tracker (CAT) uses rating categories and modelled domestic pathways to evaluate whether a country's targets and policies are on track towards decarbonisation in line with 1.5°C temperature limit of the Paris Agreement⁴⁵. CAT derives country-level

⁴³ Department of Forestry, Fisheries, and the Environment (2024). Publication of South Africa's 2023 Grid Emission Factors Report. Published under Government Notice 6454 of *Government Gazette* 53079 on 25 July 2025.

⁴⁴ *Ibid*.

⁴⁵ Climate Action Tracker (2022). *South Africa*. <https://climateactiontracker.org> [accessed on 04 January 2026].



pathways from modelled global pathways, considering a “fair share range” for each country. CAT uses the following rating categories for the modelled domestic pathways:

- **1.5°C Paris Agreement compatible:** Indicates that a country’s climate policies and commitments are consistent with the Paris Agreement’s 1.5°C temperature limit.
- **Almost sufficient:** Indicates that a country’s climate policies and commitments are not yet consistent with the Paris Agreement’s 1.5°C temperature limit but could be with moderate improvements.
- **Insufficient:** Indicates that a country’s climate policies and commitments need substantial improvements to be consistent with the Paris Agreement’s 1.5°C temperature limit.
- **Highly insufficient:** Indicates that a country’s climate policies and commitments are not consistent with the Paris Agreement’s 1.5°C temperature limit. For many countries in this category, policies and commitments lead to rising, rather than falling, emissions.

Figure 5-3 presents South Africa’s policies and action, as well as the Country’s NDC targets, relative to CAT’s rating categories. In summary, South Africa’s “policies and action” are considered insufficient, while the “NDC targets” are considered almost sufficient.

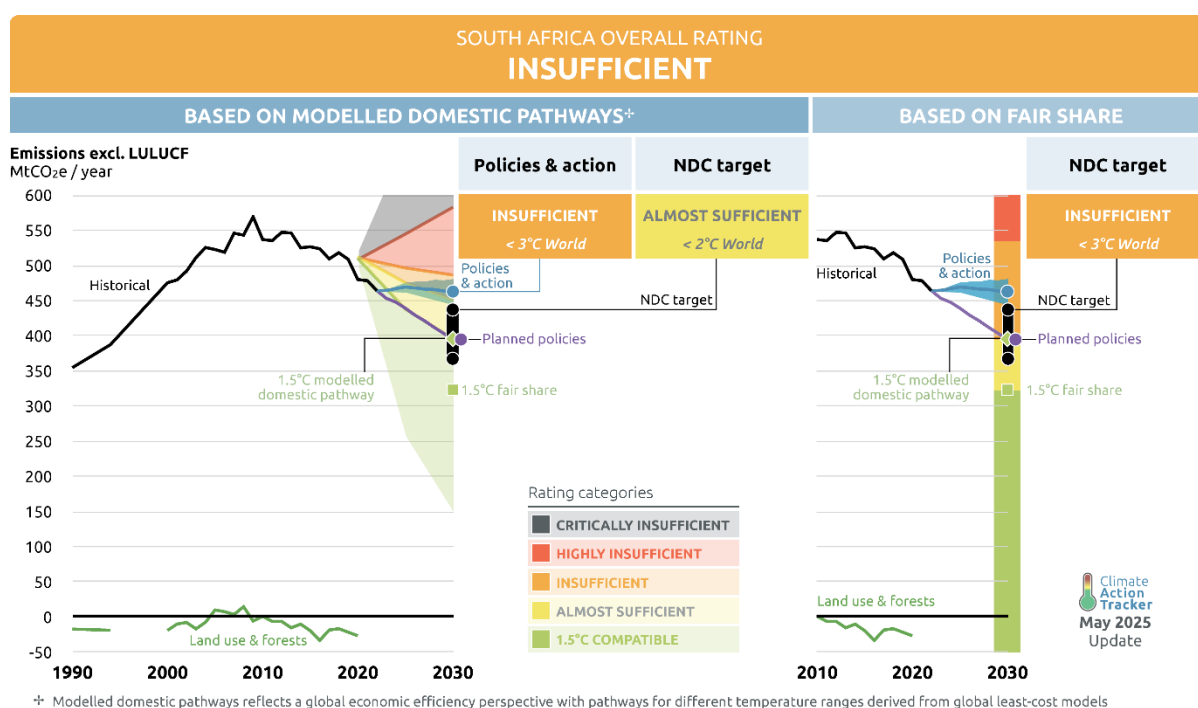


Figure 5-3: South Africa's modelled domestic pathways⁴⁶

While these calculations provide a useful indication of the scale of the contribution of the Project’s GHG emissions to South Africa’s domestic pathways, this approach does have some limitations:

- First, the contribution of a single project to national GHG emissions inventory is unlikely to look significant, particularly if the project is located within a country, such as South Africa, with high emissions relative to most other countries.

⁴⁶ Ibid



- Second, there are no official benchmarks which could be used to determine the significance of the Project's contribution to the national GHG emissions.

The impact significance is therefore not formally rated.

5.2.4.2 Benchmarking Against Pre-Defined Thresholds

The second criterion for assessing the Project's GHG emissions is benchmarking against pre-defined thresholds developed by the European Bank of Reconstruction and Development (EBRD) - **Table 5-7**. The thresholds are used by the EBRD for initial screening to determine the order of magnitude of a Project's annual GHG emissions during the operational phase⁴⁷. These thresholds are used by EBRD as an early indicator of a project's likely contribution to the Bank's GHG inventory and GHG intensity of the Bank's investment portfolio. In the absence of other commonly agreed thresholds they are used as a proxy to rate the significance of the Project's GHG emissions contribution to atmospheric GHG concentrations.

Table 5-7: Thresholds for assessing the significance of a Project's GHG emissions

Benchmark thresholds (tCO ₂ e/a) ⁴⁸	Significance rating
Negligible	Very low
< 20,000	Low
> 20,000 and < 100,000	Medium-low
> 100,000 and < 1 million	Medium-high
> 1 million	High

6. Description of the Affected Environment

To understand the vulnerability of the Project to climate-related risks, it is necessary to establish the occurrence of natural hazards (**Section 6.1**) and projected changes in climate in the near- and medium-term under different climate scenarios (**Section 6.3**). The sections that follow cover each of these factors in more detail.

6.1 Natural Hazards

The IPCC defines natural hazards as the potential occurrence of *"a physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources"*⁴⁹.

⁴⁷ EBRD (2010). *EBRD Methodology for Assessment of Greenhouse Gas Emissions*. Version 7, 6 July 2010

⁴⁸ Projects in the Negligible Emission Category typically involve activities with negligible emissions. This includes for example, telecommunications, civil construction projects, industrial wastewater treatment, and small size-built environment projects (i.e., overall floor area < 1,000 m²). For projects in this category, a CCRA is generally not warranted. Projects in the Low and Medium-Low categories typically involve activities with very low to low carbon emissions. This includes for example, property developments, light industrial facilities, agricultural processing facilities, road development projects, municipal solid waste landfill, and brick manufacturing. For projects in these categories, a CCRA is generally not warranted, but should be assessed on a project-by-project basis. Projects in the Medium-High and High Categories, typically involve activities with high carbon emissions. This includes for example, fuel production and processing, glass manufacturing, cement and lime works, metal manufacturing and processing plants, and power generating plants. For projects in this category, a CCRA is generally considered to be mandatory.

⁴⁹ IPCC (2012). *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, USA.



Several natural hazards are identified for the City of Cape Town Metropolitan Municipality in which the Project would be located. These hazards could negatively impact on the Project.

Wildfire has been assigned a high hazard rating, while coastal flood and water scarcity have been assigned a medium hazard rating. Urban flood and extreme heat have been assigned a low hazard rating, and river flood has been assigned a very low hazard rating.

Note that only urban flood, water scarcity and extreme heat have been included further in this assessment⁵⁰. The other hazards are deemed to pose limited risk to the Project for the following reasons:

- River flood – The Project is not situated in close proximity to any major water courses. The closest river is the Swartrivier, located approximately 600 m west of the Project site. The Project site's elevation above sea level is 15 m and the Swartrivier's banks are situated at an elevation of 4 m above sea level. Considering the distance and elevation between the river and site, it is highly unlikely that the site will experience inundation by a river flood during the life of the Project.
- Wildfire – The Project site is situated in an industrial node, with limited undeveloped land surrounding the site from where a wildfire can spread.
- Coastal flood – The Project site is located approximately 3.3 km away from the ocean at an average elevation of 15 m above sea level. It thus highly unlikely that the site experience inundation by ocean waves during it lifespan.

Table 6-1: Overview of the natural hazard risk for the City of Cape Town Metropolitan Municipality

Hazard type	Hazard rating	Description
 Wildfire	High	Presently, there is greater than a 50% chance of encountering weather that could support a significant wildfire that is likely to result in both life and property loss in any given year.
 Coastal flood	Medium	There is more than a 20% chance of potentially-damaging coastal flood waves occurring the next 10 years.
 Water scarcity	Medium	There is up to 20% chance droughts will occur in the coming 10 years.
 Urban flood	Low	Presently, there is a chance of more than 1% that potentially damaging and life-threatening river floods occur in the coming 10 years (return period of c. 1 in 1000 years).

⁵⁰ ThinkHazard! rated the cyclone hazard risk for the Project site as 'No Data'. The region does, however, experience frequent mid-latitude cyclones during the winter months. This risk is covered under the consideration of urban floods for the Project region in Section 9.



Hazard type		Hazard rating	Description
	Extreme heat	Low	There is between a 5% and 25% chance that at least one period of prolonged exposure to extreme heat, resulting in heat stress will occur in the next five years.
	River Flood	Very low	There is a chance of less than 1% that potentially damaging and life-threatening river floods occur in the coming 10 years (return period of c. 1 in 1,000 years).

6.2 Current Climate

The Project is located in the Western Cape province of South Africa. The region's climate is defined as a warm-summer Mediterranean climate ('Csb' according to the Köppen-Geiger system⁵¹). Consequently, the region experiences low annual precipitation, warm, dry summers and mild, wet winters, and seasonal rainfall, which tends to be concentrated during the winter months.

Figure 6-1 presents the average monthly temperature and rainfall for the Western Cape province for the historical period spanning 1991 to 2020. On average November to February are the hottest and driest months, and June to August are the coolest and wettest months.

⁵¹ Ruben et al (2017). *World Maps of Köppen-Geiger Climate Classification System*. URL - <https://koeppen-geiger.vu-wien.ac.at/> [accessed on 04 January 2026]



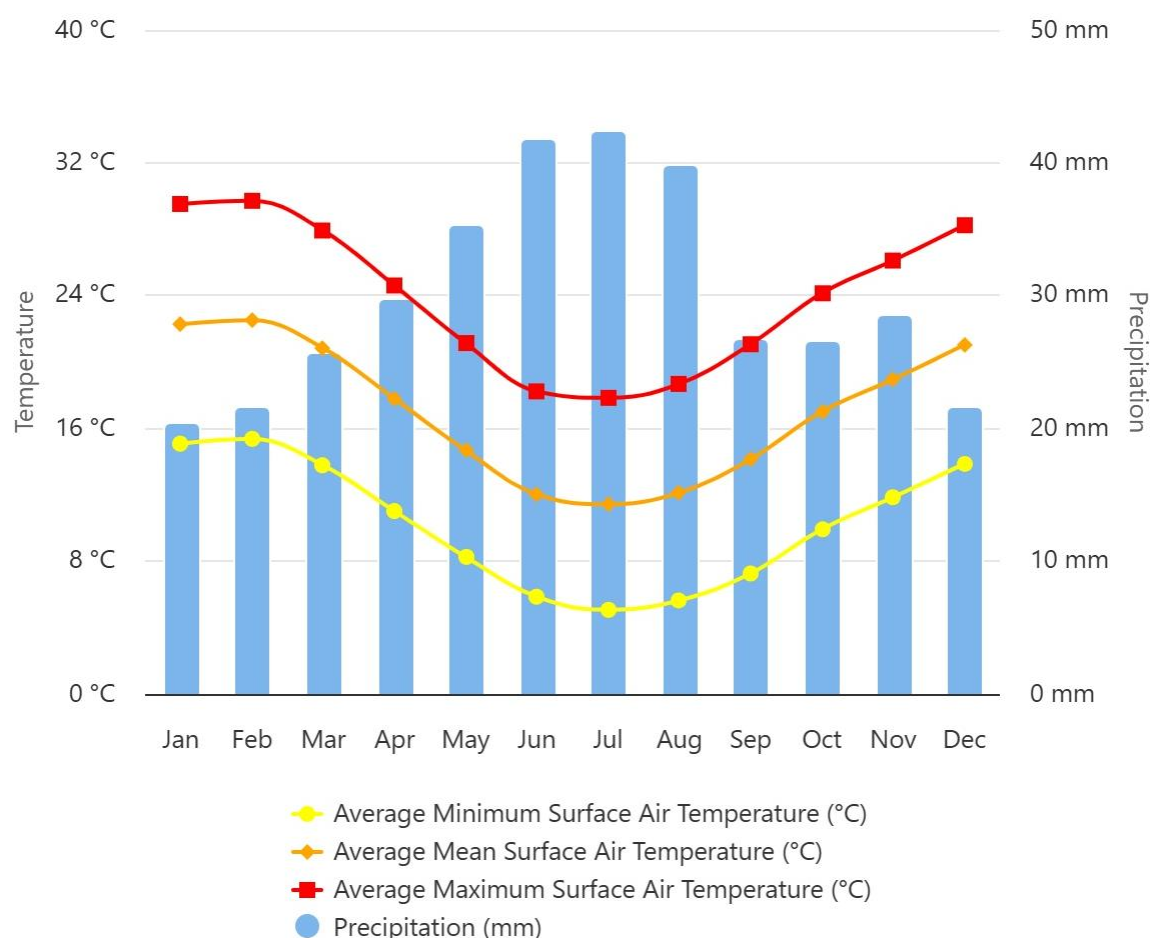


Figure 6-1: Monthly average temperature and rainfall (1991 to 2020) for the Western Cape province⁵²

6.3 Future Climate Conditions

The following section presents a brief description of the projected changes in climate for the Western Cape, the province in which the Project would be located. It is important to understand these changes as these are often the drivers of the climate hazards that pose a potential risk to the Project, as well as Project-affected communities, priority ecosystem services, and sites of demonstrated importance to climate mitigation and adaptation. As noted in **Section 5.1.2**, this assessment considers two climate scenarios, specifically SSP2-4.5 (“Middle of the Road”) and SSP5-8.5 (“Fossil-fuelled development”). Projections were obtained for the period spanning 2020–2039, hereinafter referred to as the **‘Period of Interest,’** as this timeframe correlates best with the proposed Project’s construction, commissioning, and operational phases. The numbers in bold denote the median whilst the numbers in round brackets denote the confidence interval (minimum (10%) to maximum (90%) values). **Appendix B** presents a summary of these projections.

⁵² The World Bank Group (2025). *Climate Country Profile: South Africa*. URL: <https://climateknowledgeportal.worldbank.org> [accessed on 04 January 2026].



6.3.1 Average Mean Surface Air Temperature

Average mean surface air temperature refers to the air temperature at approximately 2 m above the surface of the earth. From 1995 to 2014 (historical baseline), average mean surface air temperature in the Western Cape Province was modelled to be 17.07°C (**Figure 6-2**)⁵³. In the near-term (2020 to 2039), mean surface temperature is projected to increase, relative to the historical baseline, by 0.59°C (+3.5%) or (0.20°C to 1.00°C) for the SSP2-4.5 scenario and 0.68°C (+4.0%) (0.27°C to 1.09°C) for the SSP5-8.5 scenario.

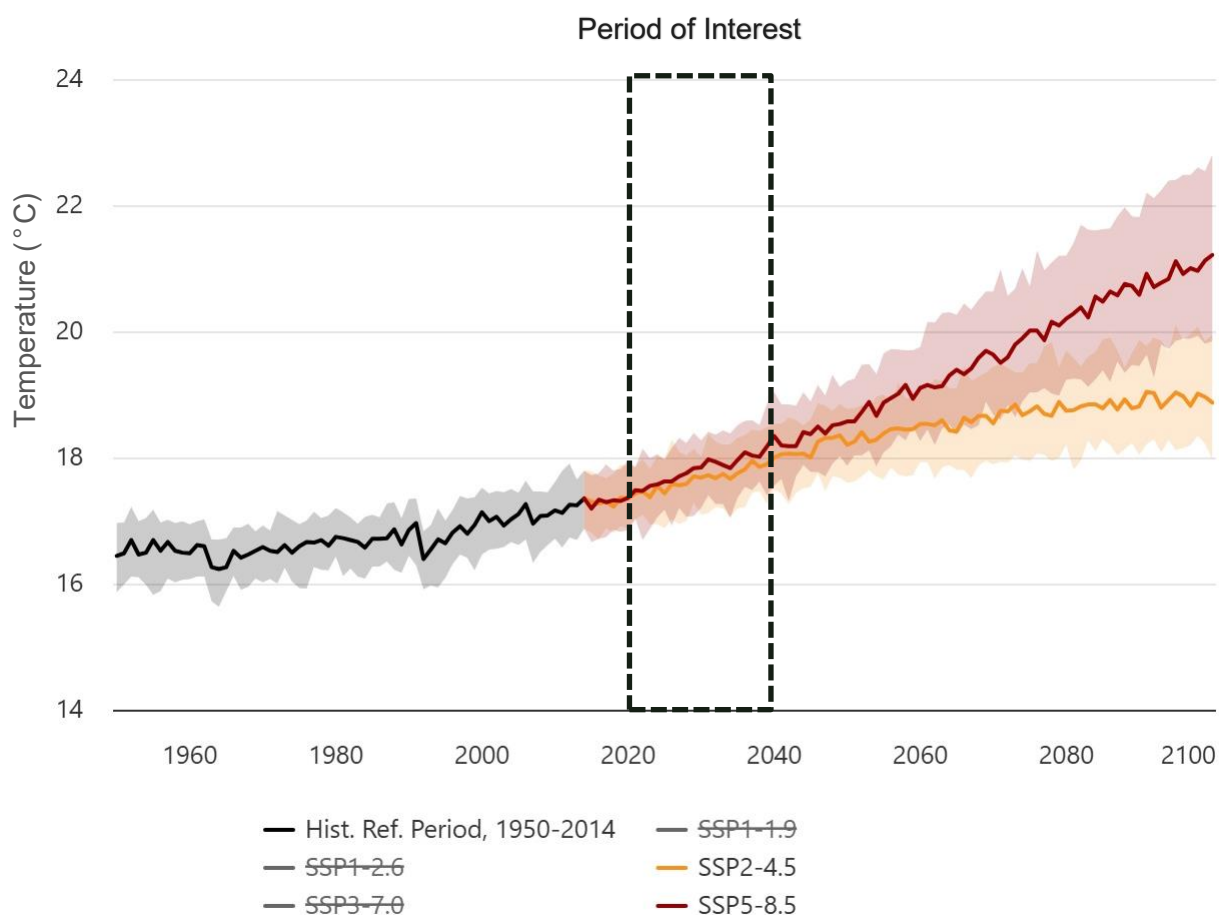


Figure 6-2: Projected change in mean surface temperature in the Western Cape province for the SSP2-4.5 and SSP5-8.5 scenarios⁵⁴

6.3.2 Average Maximum Surface Air Temperature

The average maximum surface air temperature refers to the average maximum air temperature at approximately 2 m above the surface of the earth. From 1995 to 2014 (historical baseline), the average maximum surface temperature in the Western Cape province was modelled to be 23.16°C (**Figure 6-3**)⁵⁵. In the near-term (2020 to 2039), maximum surface temperature is projected to increase, relative to the historical baseline, by

⁵⁵ *Ibid.*

⁵⁵ *Ibid.*

⁵⁵ *Ibid.*



0.63°C (+2.7%) (0.16°C to 1.10°C) for the SSP2-4.5 scenario and 0.76°C (+3.3%) (0.23°C to 1.27°C) for the SSP5-8.5 scenario.

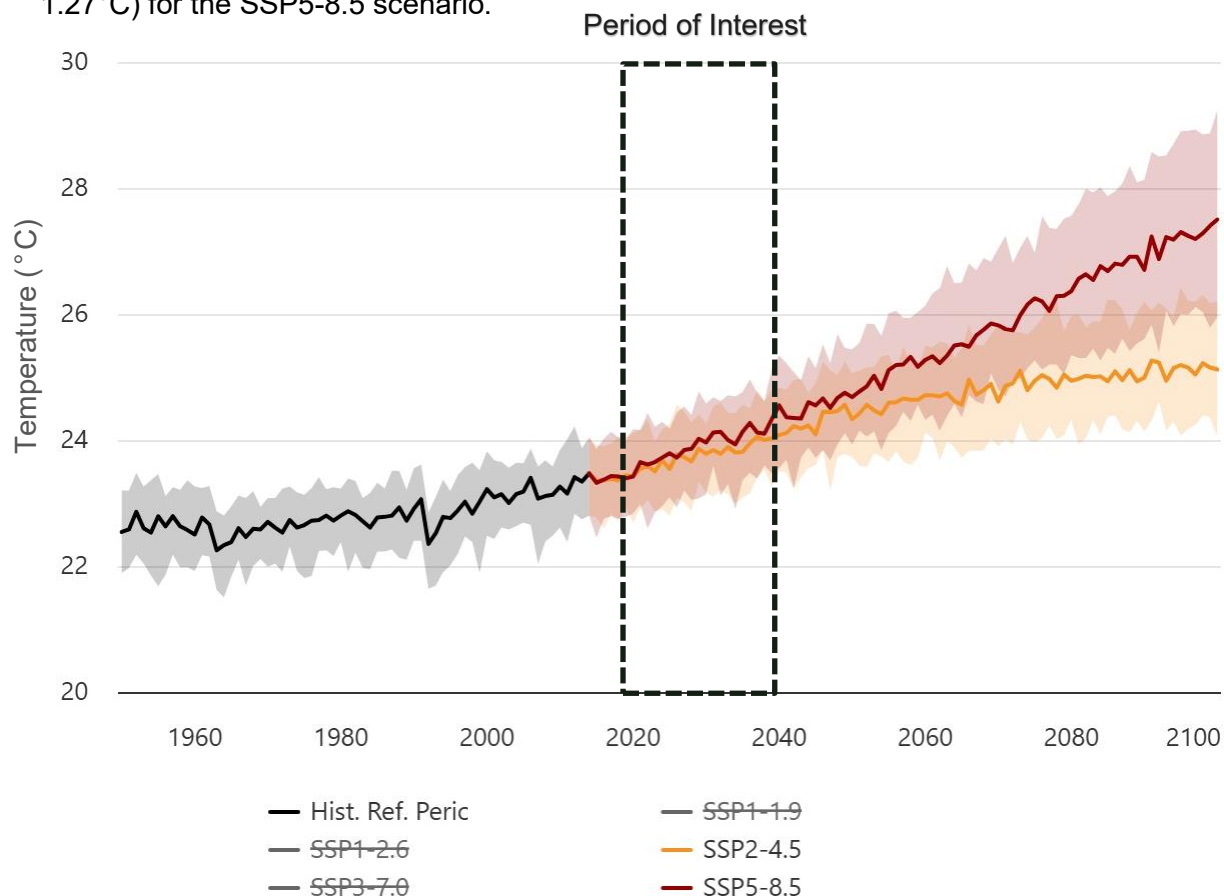


Figure 6-3: Projected change in the average maximum surface air temperature in the Western Cape province for the SSP2-4.5 and SSP5-8.5 scenarios⁵⁶

6.3.3 Number of Very Hot Days (> 35°C)

The average number of very hot days refers to the number of days in a given year a threshold temperature is exceeded. For this assessment, a threshold temperature of 35°C was applied. From 1995 to 2014 (historical baseline), the average number of hot days in the Western Cape province was modelled to be 6.68 (**Figure 6-4**)⁵⁷. In the near-term (2020 to 2039), the average number of hot days is projected to increase, relative to the historical baseline, by 3.21 days (+48.1%) (-0.60 days to +7.56 days) for the SSP2-4.5 scenario and 3.83 days (+57.3%) (-0.33 days to +8.33 days) for the SSP5-8.5 scenario.

⁵⁶ *Ibid.*

⁵⁷ *Ibid.*



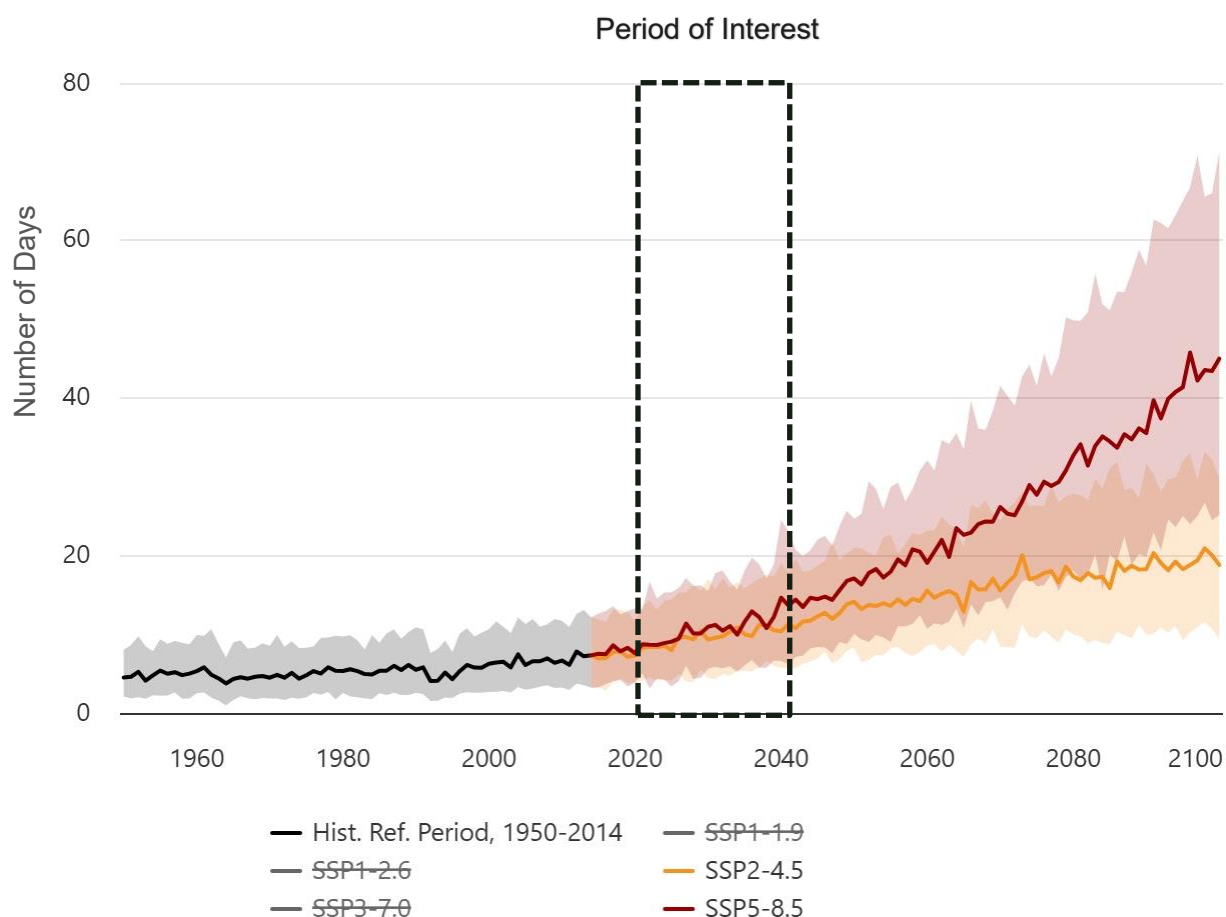


Figure 6-4: Projected change in the number of hot days in the Western Cape province for the SSP2-4.5 and SSP5-8.5 scenarios⁵⁸

6.3.4 Precipitation

Precipitation refers to water released from clouds in the form of rain, freezing rain, sleet, snow, or hail. From 1995 to 2014 (historical baseline), mean annual precipitation in the Western Cape province was modelled to be 361.24 mm (**Figure 6-5**)⁵⁹. In the near-term (2020 to 2039), precipitation is projected to decrease, relative to the historical baseline, by

⁵⁸ *Ibid.*

⁵⁹ *Ibid.*



10.85 mm (-3.0%) (-74.67 mm days to +61.52 mm) for the SSP2-4.5 scenario and by (-2.9%) mm (-83.27 mm to +60.64 mm) for the SSP5-8.5 scenario.

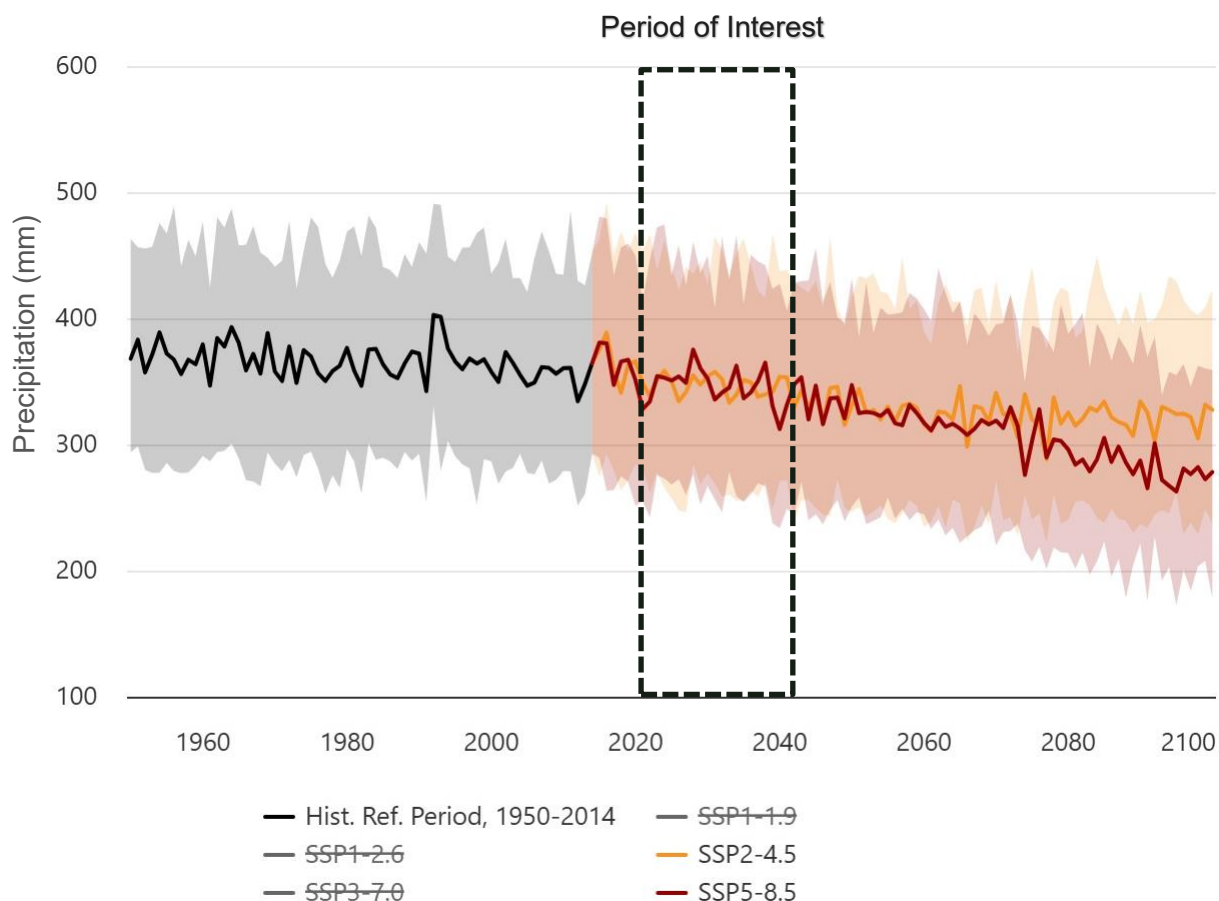


Figure 6-5: Projected change in precipitation in the Western Cape province for the SSP2-4.5 and SSP5-8.5 scenarios⁶⁰

6.3.5 5-day Cumulative Precipitation

Five (5)-day cumulative precipitation refers to the total precipitation accumulated over a consecutive 5-day period. From 1995 to 2014, 5-day cumulative precipitation in the Western Cape province was modelled to be 45.02 mm (Figure 6-6)⁶¹. In the near-term (2020 to 2039), the 5-day cumulative precipitation is projected to increase, relative to the historical baseline,

⁶⁰ *Ibid.*

⁶¹ *Ibid.*



by 0.20 mm (+0.4%) (-14.57 mm days to +20.30 mm) for the SSP2-4.5 scenario and decrease by 0.24 mm (-0.5%) (-15.28 mm to +20.17 mm) for the SSP5-8.5 scenario.

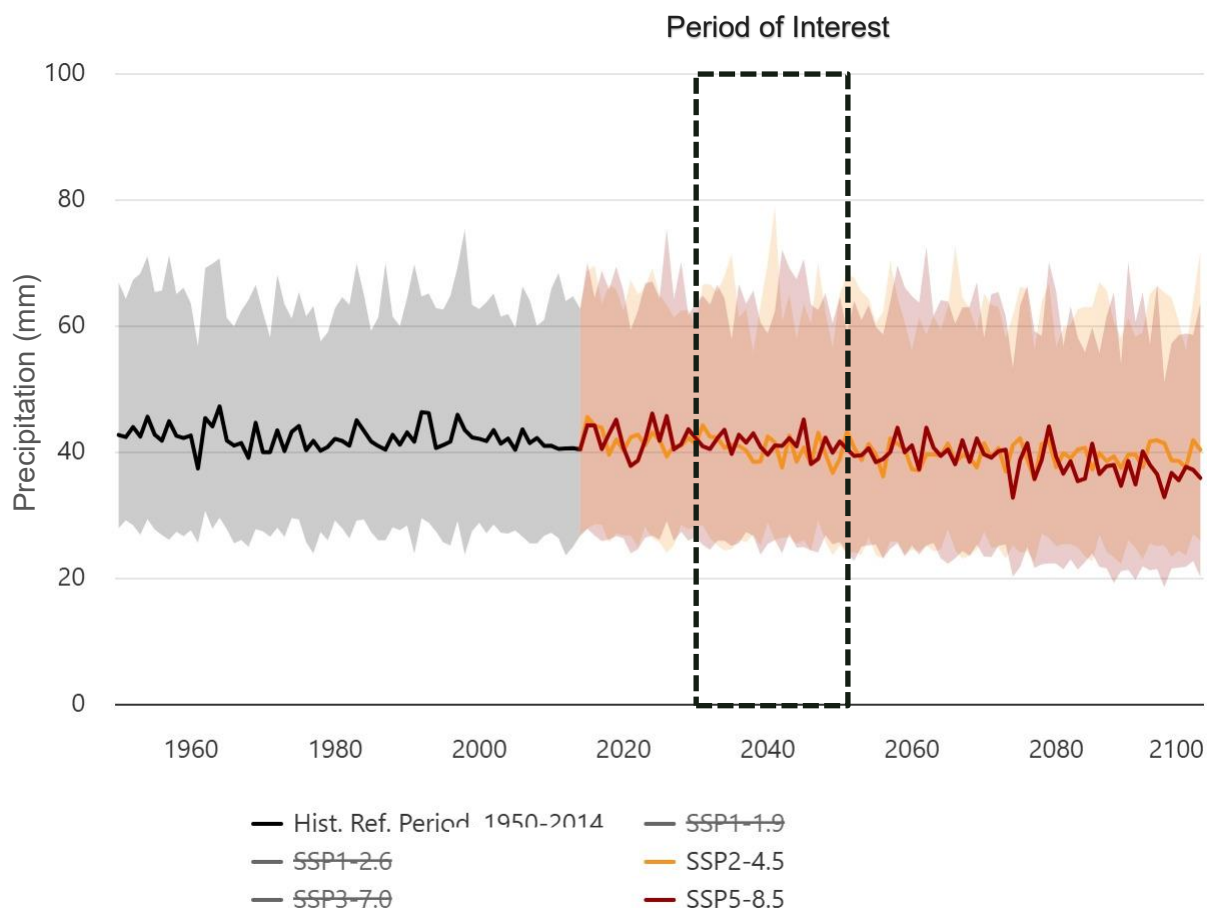


Figure 6-6: Projected change in the largest 5-day precipitation in the Western Cape province for the SSP2-4.5 and SSP5-8.5 scenarios⁶²

7. Project's Calculated GHG Emissions

7.1 Commissioning Phase

7.1.1 Electricity Consumption

Using the methodology outlined in **Section 5.2.3**, it was calculated that the average annual emissions resulting from electricity consumption during the commissioning phase of the Project amounts to 6,432 tCO_{2e} - **Table 7-1**.

⁶² World Bank Group (2021). South Africa: Climate Projections. URL: [South AfricaZAF - Mean Projections \(CMIP6\) | Climate Change Knowledge Portal](#) [accessed on 04 January 2026].



Table 7-1: Calculation of annual GHG emissions from electricity consumption during the commissioning phase

Metric	Value	Unit
Annual electricity consumption	7,101	MWh
Solar system output ^b	1.36	MWh _{ac}
Purchased electricity from the grid	7,099	MWh
Emission factor ^a	0.906	tCO ₂ e/MWh
Annual GHG emissions	6,432	tCO₂e
Source: ^a Department of Forestry, Fisheries, and the Environment (2024). Publication of South Africa's 2023 Grid Emission Factors Report. Published under Government Notice 6454 of <i>Government Gazette</i> 53079 on 25 July 2025. ^b Based on solar system with output of 1,600 kWh _{dc} and conversion losses of 15%.		

7.1.2 Diesel Consumption

Using the methodology outlined in **Section 5.2.3**, it was calculated that the total emissions resulting from diesel consumption during the commissioning phase amounted to 9 tCO₂e - **Table 7-2**. It is assumed that all GHG emissions from diesel consumption would occur in 2027.

Table 7-2: Calculation of GHG emissions from diesel consumption during the commissioning phase

Metric	Value	Unit
Total diesel consumption	3,000	L
Net calorific value ^a	35.5	MJ/L
Total energy consumption	0.11	TJ
CO ₂ emission factor ^a	74,638	kgCO ₂ /TJ
CO ₂ GWP ^a	1	1-100 year
CH ₄ emission factor ^a	4.15	kgCH ₄ /TJ
CH ₄ GWP ^a	29.8	1-100 year
N ₂ O emission factor ^a	28.6	kgN ₂ O/TJ
N ₂ O GWP ^a	273	1-100 year
Total GHG emissions	9	tCO₂e
Source: ^a Department of Forestry, Fisheries, and the Environment (2022). Methodological Guidelines for Quantification of Greenhouse Gas Emissions. Published under Government Notice 2598 of <i>Government Gazette</i> 47257 on 7 October 2022		

7.1.3 Paraffin Consumption

Using the methodology outlined in **Section 5.2.3**, it was calculated that the average annual emissions resulting from paraffin consumption during the commissioning phase amounted to 812 tCO₂e – **Table 7-3**



Table 7-3: Calculation of annual GHG emissions from paraffin consumption during the commissioning phase

Metric	Value	Unit
Annual paraffin consumption	300,000	L
Net calorific value ^a	35.5	MJ/L
Total energy consumption	11.25	TJ
CO ₂ emission factor ^a	71,900	kgCO ₂ /TJ
CO ₂ GWP ^a	1	1-100 year
CH ₄ emission factor ^a	3.00	kgCH ₄ /TJ
CH ₄ GWP ^a	29.8	1-100 year
N ₂ O emission factor ^a	0.60	kgN ₂ O/TJ
N ₂ O GWP ^a	273	1-100 year
Total GHG emissions	812	tCO₂e
Source: ^a Department of Forestry, Fisheries, and the Environment (2022). Methodological Guidelines for Quantification of Greenhouse Gas Emissions. Published under Government Notice 2598 of <i>Government Gazette</i> 47257 on 7 October 2022		

7.2 Operational Phase

7.2.1 Electricity Consumption

Using the methodology outlined in **Section 5.2.3**, it was calculated that the average annual emissions resulting from electricity consumption during the operational phase of the Project amounts to 6,432 tCO₂e - **Table 7-4**.

Table 7-4: Calculation of GHG emissions from electricity consumption during the operational phase

Metric	Value	Unit
Annual electricity consumption	7,101	MWh
Solar system output ^b	1.36	MWh
Purchased electricity	7,099	MWh
Emission factor ^a	0.906	tCO ₂ e/MWh
Annual GHG emissions	6,432	tCO₂e
Source: ^a Department of Forestry, Fisheries, and the Environment (2024). Publication of South Africa's 2023 Grid Emission Factors Report. Published under Government Notice 6454 of <i>Government Gazette</i> 53079 on 25 July 2025. ^b Applying a practical derate factor to Project's rooftop solar system.		

7.2.2 Paraffin Consumption

Using the methodology outlined in **Section 5.2.3**, it was calculated that the average annual emissions resulting from paraffin consumption during the operational phase amounted to 812 tCO₂e - **Table 7-5**



Table 7-5: Calculation of GHG emissions from paraffin consumption during the operational phase

Metric	Value	Unit
Annual paraffin consumption	300,000	L
Net calorific value ^a	35.5	MJ/L
Total energy consumption	11.25	TJ
CO ₂ emission factor ^a	71,900	kgCO ₂ /TJ
CO ₂ GWP ^a	1	1-100 year
CH ₄ emission factor ^a	3.00	kgCH ₄ /TJ
CH ₄ GWP ^a	29.8	1-100 year
N ₂ O emission factor ^a	0.60	kgN ₂ O/TJ
N ₂ O GWP ^a	273	1-100 year
Total GHG emissions	812	tCO₂e
Source: ^a Department of Forestry, Fisheries, and the Environment (2022). Methodological Guidelines for Quantification of Greenhouse Gas Emissions. Published under Government Notice 2598 of <i>Government Gazette</i> 47257 on 7 October 2022		

8. Assessment of the Project's GHG Emissions

8.1 Contribution to South Africa's Modelled Domestic Pathways

Impact Description

The first criterion for assessing the Project's GHG emissions is the contribution of the Project's GHG emissions to South Africa's four modelled domestic pathways. As mentioned previously in **Section 5.2.4.1**, CAT has modelled four domestic pathways to evaluate whether South Africa's targets and policies are on track towards decarbonisation in line with 1.5°C temperature limit of the Paris Agreement. This includes:

- 1.5°C Paris Agreement Compatible.
- Almost Sufficient.
- Insufficient.
- Highly Insufficient.

The contribution of the Project's estimated GHG emissions to country's four modelled pathways was calculated for the period 2027 to 2050 (**Table 8-1**). The calculated contribution ranges between 0.000649% (Highly Insufficient pathway) and 0.006364% (1.5°C Paris Agreement Compatible pathway).



Table 8-1: Percentage contribution of the Project's GHG emissions to South Africa's four domestic modelled pathways

Year	Project's GHG emissions (MtCO ₂ e)	1.5°C Paris Agreement Compatible Pathway	Almost Sufficient Pathway	Insufficient Pathway	Highly Insufficient Pathway
2027	0.003631	0.000862%	0.000780%	0.000737%	0.000649%
2028	0.007244	0.001756%	0.001572%	0.001477%	0.001277%
2029	0.007244	0.001793%	0.001589%	0.001483%	0.001260%
2030	0.007244	0.001831%	0.001606%	0.001489%	0.001243%
2031	0.007244	0.001873%	0.001639%	0.001496%	0.001224%
2032	0.007244	0.001918%	0.001674%	0.001502%	0.001206%
2033	0.007244	0.001964%	0.001710%	0.001509%	0.001188%
2034	0.007244	0.002013%	0.001748%	0.001515%	0.001171%
2035	0.007244	0.002064%	0.001787%	0.001522%	0.001154%
2036	0.007244	0.002188%	0.001836%	0.001539%	0.001141%
2037	0.007244	0.002328%	0.001888%	0.001557%	0.001128%
2038	0.007244	0.002487%	0.001943%	0.001575%	0.001116%
2039	0.007244	0.002669%	0.002002%	0.001594%	0.001104%
2040	0.007244	0.002880%	0.002064%	0.001613%	0.001092%
2041	0.007244	0.003142%	0.002131%	0.001627%	0.001087%
2042	0.007244	0.003455%	0.002204%	0.001641%	0.001083%
2043	0.007244	0.003838%	0.002281%	0.001656%	0.001078%
2044	0.007244	0.004317%	0.002364%	0.001670%	0.001074%
2045	0.007244	0.004932%	0.002453%	0.001685%	0.001070%
2046	0.007244	0.005165%	0.002592%	0.001705%	0.001063%
2047	0.007244	0.005420%	0.002748%	0.001725%	0.001057%
2048	0.007244	0.005702%	0.002924%	0.001745%	0.001050%
2049	0.007244	0.006015%	0.003124%	0.001766%	0.001044%
2050	0.007244	0.006364%	0.003353%	0.001788%	0.001038%
Max	-	0.006364%	0.003353%	0.001788%	0.001277%
Min	-	0.000862%	0.000780%	0.000737%	0.000649%

Impact Assessment

As mentioned previously, the significance of the contribution of the Project's GHG emissions to South Africa's domestic modelled pathways is not formally rated as there is no official benchmark which could be used.



8.2 Benchmarking Against Pre-Defined Thresholds

Impact Description

The second criterion for assessing the Project's GHG emissions is benchmarking Project-related GHG emissions against pre-defined thresholds. As mentioned previously in **Section 0**, the EBRD developed thresholds which are used for initial screening to determine the order of magnitude of a Project's annual GHG emissions during the operational phase⁶³. These thresholds are used in this CCRA as a proxy to assess the significance of the Project's GHG emissions.

The Project's average annual GHG emissions during the operations phase are estimated to be 7,244 tCO₂e. Based on the thresholds presented in **Table 5-7**, the significance of the Project's annual GHG emissions is classed as **Very Low**.

Recommended Mitigation Measures

According to the Detailed Design, Build, Validate Proposal, energy efficiency design must be incorporated in all energy systems, inclusive of monitoring and metering. No additional detail is, however, provided. In addition, the total amount of fresh air reduced, in line with SANS requirements to ensure optimal energy efficiency of the HVAC system.

Required mitigation measures to further reduce the Project's GHG emissions are listed below:

- Diesel generators must be sized appropriately so that they run at their optimal workload (e.g., 70% to 100% of total load rating).
- Diesel generators must be regularly maintained in accordance with the manufacturers service schedule.
- Construction materials should be sourced as close to the work front as possible to reduce transport distances and carbon emissions.
- For the transport of materials and equipment, the vehicle load should be maximised to increase fuel efficiency and reduce emissions.
- Truck drivers should receive training on good driving practices to improve fuel economy and reduce carbon emissions.
- Optimise HVAC energy performance by implementing measures such as:
 - Optimise temperature settings using programmable thermostats and building management system.
 - Improve insulation and sealing by adding insulation to walls, ceilings, and ductwork, where possible.
 - Conduct regular maintenance (e.g. clean or replace air filters) in accordance with manufacturers specifications.
 - Install variable speed drives on fans and pumps, where possible, for better load matching.
 - Reduce internal heat loads by using LED lighting and energy-efficient appliances

⁶³ EBRD (2010). *EBRD Methodology for Assessment of Greenhouse Gas Emissions*. Version 7, 6 July 2010



- The facility should, where possible utilise refrigerant gasses that exhibit a low global warming potential ('GWP'), for example carbon dioxide ('CO₂') or hydrofluoroolefins ('HFOs')

9. Risk and Opportunities Assessment

The following section presents an assessment of the impact of a changing climate on the Project⁶⁴. The section also presents an assessment of the impact of the Project on communities, priority ecosystem services, and sites of demonstrated importance for climate change mitigation or adaptation, that are or likely to be adversely affected by climate change. The risks are assessed using the methodology described in **Section 5.1.3**.

9.1 Climate-Related Risks for the Project

9.1.1 Increased Risk to Critical Project Infrastructure with Acute Urban Flooding Events

Risk	An elevated risk of acute precipitation events increases the risk of urban flooding, which can inundate the Project site, damaging critical pieces of site infrastructure, disrupt operations, and poses an occupational health and safety ('OHS') risk to on-site personnel and those commuting during inclement conditions. Thus, such events may lead to capital reinvestment, reduce the operational capacity of the Project, leading to overall revenue losses.	
TCFD Category	Physical – Acute	
Risk description	Whilst the Western Cape is projected to experience an overarching decrease in annual precipitation, it is also projected to experience an increase in cumulative 5-day precipitation events, elevating the risk of urban flooding. Urban flooding events can damage critical pieces of site infrastructure (electrical systems, cooling systems, sterile manufacturing areas, cold storage areas, waste management and biohazard systems, and information technology infrastructure) and poses a risk for on-site personnel as well employees commuting during inclement weather events. Should the Project be required to replace critical pieces of site infrastructure, it is likely to incur significant additional CapEx. Furthermore, should the hazardous waste section of facility be breached, toxic chemicals may be flushed into the natural environment, resulting in significant clean-up costs for the Project. The Project is relatively exposed and vulnerable to the adverse effects of acute urban floods resulting from the projected increase in the intensity of 5-day cumulative precipitation events for the Western Cape Province	
Impact	Major	In extreme cases, acute urban flooding events could damage the Project's critical pieces of infrastructure via inundation and endanger the lives of on-site personnel and employees commuting during inclement weather conditions. Moreover, should the Project's hazardous waste storage area be breached by floodwater, toxic chemicals may be flushed into the natural environment, which would negatively impact on the

⁶⁴ Only risks deemed to be sufficiently consequential to the Project have been included in this assessment



		health of surrounding communities, resulting in costly cleanup operations, and potential litigation.
Likelihood	Possible	In general, the likelihood that an urban flood event will occur is extremely rare. However, given projected changes in extreme rainfall and the gentle topography of the Project site, it is possible that onsite pooling of stormwater runoff may occur. The likelihood of localised flooding occurring has been reduced by the following mitigation measures: - A stormwater management plan will be developed by a qualified civil engineer. This plan will be based on historical climate data for the Project site. - Biovac will obtain insurance covering extreme weather events (i.e. flooding events) .
Risk score	Moderate	
Adaptation/ mitigation measures		- Biovac should ensure that their stormwater management plan is updated to consider the projected changes in climate. - Biovac should ensure that their insurance policy covers damages incurred due to extreme weather events (i.e. acute urban flooding events).

9.1.2 Increased Risk off Extreme Heat Impacting Employee Health

Risk	Increased risk of extreme heat adversely affecting the health of employees.	
TCFD Category	Physical – Acute	
Risk description	The projected increase in average mean and maximum temperatures, and number of hot days ($t_{max} > 35^{\circ}\text{C}$), may lead to an increased risk of employees suffering from heat stress. Prolonged exposure to extreme heat can result in heat stress which can adversely affect the health and wellbeing of personnel exposed to the elements. Prolonged extreme heat can also lead to a reduction in worker productivity. Maintenance crews are most exposed to the adverse effects of extreme heat. Elderly workers and workers with pre-existing medical conditions, such as heart disease, are typically more sensitive to the effects of heat stress.	
Impact	Major	In extreme cases, heat stress can be a life-threatening injury.
Likelihood	Rare	The projected increase in the number of very hot days (+48.1% - +57.3%) indicates that it is possible that the frequency of extreme heat events increases in the future.
Risk score	Low	Although the conditions, which can lead to an increase in the occurrence and intensity of heat stress, is projected to increase in the future, it is highly unlikely that heat stress will adversely affect the health of employees. This is because many of the employees will be from the area and are likely to be relatively accustomed to extreme heat. The likelihood can be further reduced with the implementation of the adaptation measures listed below.



Adaptation/ mitigation measures	- Biovac must develop and implement an employee health awareness program to educate employees (and contractors) about the risks of heat stroke/dehydration and how to prevent such ailments. - Biovac must ensure that employees are provided with appropriate personal protective equipment to reduce sun exposure and the risk of heat stroke/dehydration. - Biovac should reschedule work to cooler parts of the day if temperatures are very high (i.e., >35°C) and ensure that employees are provided with more frequent rest breaks, and shaded rest areas.
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9.1.3 Increased Risk of Rising Ambient Temperatures – Vaccine Manufacturing Facility

Risk	The increased frequency and intensity of extreme heat events are likely to increase the facility's ambient temperature, placing pressure on the cooling system, resulting in increased energy consumption (rising Project OpEx) and under the worst-case scenario, increased CapEx, should the cooling system need to be upgraded.	
TCFD Category	Physical – Chronic	
Risk description	Increasing ambient temperatures, coupled with the increased frequency and intensity of extreme heat events, create climate conditions which are likely to put pressure on the Project's existing cooling system, reducing its ability to effectively dissipate heat⁶⁵. Consequently, it is likely that the Project incur additional OpEx to increase the operational throughput of their cooling system, safeguarding raw materials and finished products susceptible to spoiling. Under the worst-case scenario, the Project may be required to upgrade their cooling system, should the current design not be able to cope with future temperature increases, resulting in increased CapEx. Furthermore, should the cooling system not be adjusted timeously, the Project may incur additional costs through the spoiling of raw materials and finished products.	
Impact	Significant	Material financial impact as increasing the throughput of the Project's cooling system will result in an increase in OpEx and upgrading the cooling system will result in an increase in CapEx, both presenting as material expenses.
Likelihood	Unlikely	Although the conditions that can place increasing demand on the Project's cooling system are present and likely to increase for the remainder of the century, the likelihood can be reduced by considering the projected changes in climate in the design of HVAC system ⁶⁶ .
Risk score	Low	

⁶⁵ IQVIA (2025). *Tip of the Iceberg: Economic and Environmental Impact of Vaccine Cold Storage*. URL - [tip-of-the-iceberg-economic-and-environmental-impact-of-the-vaccine-cold-chain.pdf](#) [accessed on 04 Jan 2025]

⁶⁶ Calibre Life Science (2025). *Detailed Design, Build, Validate Proposal*.



Adaptation/ mitigation measures	- Biovac should ensure that the basis of design of the HVAC system considers the projected changes in climate. - Biovac should ensure that their financial models/ planning be updated to account for the potential of increasing energy demands (HVAC system related) and potential upgrades at some point in the future.
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9.1.4 Increased Risk of Water Scarcity

Risk	The projected increase in average mean and maximum surface air temperatures, together with the projected decrease in annual precipitation are likely to create weather conditions that support drought events. The Project's manufacturing processes and HVAC system is dependent on an uninterrupted water supply. Consequently, in the event of a prolonged drought, such activities may need to be curtailed, potentially leading to stoppages at the facility and revenue losses.	
TCFD Category	Physical – Chronic	
Risk description	The Western Cape province is projected to experience an increase in average mean and maximum surface air temperatures, the number of hot days ($t_{max} > 35^{\circ}\text{C}$), and a parallel decrease in average annual precipitation. The culmination of such projections is likely going to result in more frequent and intense drought conditions in the province, as was realised during the 2015-2018 drought period⁶⁷. The Project is reliant on a consistent water source for both its manufacturing and HVAC system processes. Consequently, water supply disruptions could result in curtailed production activities, resulting in a revenue decrease. During the 2015-2018 drought, the City of Cape Town ('CoCT') introduced water restrictions to safeguard water reserves. Whilst residential users faced more stringent restrictions, industrial users were also required to reduce consumption to essential use only⁶⁸. Under this use case scenario, the Project's output of finished products would decline, decreasing overall revenue.	
Impact	Significant	Material financial impact resulting from potential production disruptions and the installation of a borehole abstraction system.
Likelihood	Unlikely	Although the climatic conditions that can induce prolonged, intensified drought conditions are already present in the Western Cape, during the province's previous period of water scarcity, industrial water users were sheltered by CoCT by being afforded the power to negotiate fair water restrictions, ensuring key processes could remain online. Furthermore, the Project plans to install a borehole abstraction system, however, management specified that the borehole still needs to be tested, licensed and drilled.
Risk score	Low	

⁶⁷ Sousa et al (2018). *The Outstanding 2015-2018 Cape Town Drought and the Poleward Migration of Moisture Corridors*. URL - [EGU2019-9566.pdf](#) [accessed on 04 January 2026].

⁶⁸ Calverley & Walther (2022). Drought, Water Management, and Social Equity: Analysing Cape Town, South Africa's Water Crisis. URL - [Frontiers | Drought, water management, and social equity: Analyzing Cape Town, South Africa's water crisis](#) [accessed on 04 January 2026]



Risk	The projected increase in average mean and maximum surface air temperatures, together with the projected decrease in annual precipitation are likely to create weather conditions that support drought events. The Project's manufacturing processes and HVAC system is dependent on an uninterrupted water supply. Consequently, in the event of a prolonged drought, such activities may need to be curtailed, potentially leading to stoppages at the facility and revenue losses.
Adaptation/ mitigation measures	• Biovac must incorporate a water scarcity contingency plan as part of their EPRP, covering the following: ○ Identify alternative / emergency water supply options, including the environmental and regulatory requirements ○ Define water scarcity stages ranging from normal (no restrictions) to critical (emergency interventions; supply prioritisation). For each stage, the following elements must be specified: ▪ Trigger thresholds. ▪ Operational actions(e.g. demand reduction measures). ▪ Communication protocols. ○ Roles and responsibilities of key stakeholders and decision-making authorities at each stage.

9.2 Climate-Related Risks for Project-Affected Communities, Priority Ecosystem Services, and Sites of Demonstrated Importance to Climate Change Adaptation

In accordance with the requirements of IFC Performance Standards, this CCRA also considers the implications of climate change for:

- **Communities that are already impacted by climate change, which may experience an acceleration and/or intensification of impacts due to Project activities⁶⁹:** Deemed to be negligible as there are presently no communities living on or using the Project site. Previously, there were five individuals found to be residing on the site in temporary shelters. In a follow-up inspection, only two individuals remained. These individuals were resettled in accordance with the Biovac Resettlement Action Plan.
- **Impacts on priority ecosystem services which may be exacerbated by climate change⁷⁰:** Deemed to be negligible due to the limited development footprint (~2.3 ha for the vaccine production facilities and servitudes). Additionally, the development is situated in an industrial urban node, classified as being in an extremely poor condition. Thus, the impact of the Project on natural habitats and the provision of ecosystem services is unlikely to be significant.
- **Forest areas and marine and coastal habitats that are vulnerable to the effects of climate change or which contribute to climate change mitigation:** Deemed to be negligible as the Project site is located inland, about 3 km from the nearest

⁶⁹ Mthente Research and Consulting Services (2025). *Biovac Resettlement Action Plan*.

⁷⁰ Bergwind Botanical Surveys and Tours CC (2023). *Terrestrial Plant Species and Terrestrial Biodiversity Compliance Statement for Ervenb 118296, 148366, RE/103659 and RE/24176 Cape Town & Erf 1056 Pinelands, Western Cape Province*.



coastline. Furthermore, there are no forests or dense woodlands within the boundaries of the Project site.

- **Sites of demonstrated importance to climate change adaptation for either species or ecosystems⁷¹** – Deemed to be negligible for the following reasons:
 - The Biovac Vaccine facility is proposed to be built on land described as being in extremely poor condition.
 - Furthermore, no plant species of conservation concern (SCC) are flagged for the site and no such plant or animal species were found on the site.

As the climate-related risks for Project-affected communities, priority ecosystem services, and sites of demonstrated importance to climate change adaptation are deemed to be negligible, no additional mitigation measures are recommended.

10. Mitigation Measures for Inclusion in the ESMP

Table 10-1 presents a summary of mitigation measures to be included in the ESMP

For the purposes of this assessment, “must” is used for measures which are deemed to be obligations, while “should” is used for measures which are strongly recommended.

⁷¹ Ibid



Table 10-1: Summary of mitigation measures to be included in the ESMP

No.	Project phase	Aspect	Mitigation Measures	Action plan			
				Timeframe	Frequency	Performance indicator	Responsibility
1.	Planning	Climate change	Biovac should ensure that their stormwater management plan be updated to consider the projected changes in climate.	Prior to start of operations	Once-off	Stormwater management plan updated to consider future climatic projections	Engineering Manager
2.	Planning	Climate change	Biovac should ensure that their insurance policy covers damages incurred due to extreme weather events (i.e. acute urban flooding events).	Prior to start of operations	Once-off	Insurance policy that covers damages incurred by extreme weather events	Health, Safety and Environment ('HSE') Manager
3.	Construction, operational, and closure	Climate change	Biovac must develop and implement an employee health awareness program to educate employees (and contractors) about the risks of heat stroke/dehydration and how to prevent such ailments.	Duration of construction, operational, and closure phases	Once-off	Implementation of Worker Health Awareness Program.	HSE Manager
4.	Construction, operational, and closure	Climate change	Biovac must ensure that employees are provided with appropriate personal protective equipment to reduce sun exposure and the risk of heat stroke/dehydration.	During construction and operational phases	As required	Provided employees with appropriate PPE.	HSE Department
5.	Construction, operational, and closure	Climate change	Biovac should reschedule work to cooler parts of the day if temperatures are very high (i.e.,	Duration of construction, operational,	As required	Work rescheduled to cooler parts of day, and employees provided	HSE Department Manager



No.	Project phase	Aspect	Mitigation Measures	Action plan			
				Timeframe	Frequency	Performance indicator	Responsibility
			>35°C), and ensure that employees are provided with more frequent rest breaks, and shaded rest areas.	and closure phases		more frequent rest breaks and shaded rest areas.	
6.	Planning	Climate change	Biovac should ensure that the basis of design of the HVAC system considers the projected changes in climate.	Prior to start of operations	Once-off	Updated basis of design of the HVAC system modelling, if required.	Engineering Manager
7.	Planning	Climate change	Biovac should ensure that their financial models/ planning be updated to account for the potential of increasing energy demands (HVAC cooling system related) and potential upgrades at some point in the future.	Prior to start of operations	Once-off	Updated financial models/ planning	Project Manager
8.	Planning	Climate change	Biovac must incorporate a water scarcity contingency plan as part of their EPRP, covering the following: - Identify alternative / emergency water supply options, including the environmental and regulatory requirements - Define water scarcity stages ranging from normal (no restrictions) to critical (emergency interventions; supply prioritisation). For each stage, the following	Duration of construction, operational, and closure phases	Once-off	Incorporation of water scarcity contingency plan as part of Biovac's EPRP	HSE Manager Engineering Manager



No.	Project phase	Aspect	Mitigation Measures	Action plan			
				Timeframe	Frequency	Performance indicator	Responsibility
			elements must be specified: ○ Trigger thresholds. ○ Operational actions (e.g. demand reduction measures). ○ Communication protocols. • Roles and responsibilities of key stakeholders and decision-making authorities at each stage.				
9.	Construction and Operational	GHG emissions	Diesel generators must be sized appropriately so that they run at their optimal workload (e.g., 70% to 100% of total load rating).	Planning	Once-off	Diesel run at their optimal workload	Engineering Manager
10.	Construction and Operational	GHG emissions	Diesel generators must be regularly maintained in accordance with the manufacturers service schedule.	Planning	Once-off	Diesel generators maintained in accordance with the manufacturers service schedule.	Engineering Manager
11.	Construction	GHG emissions	Construction materials should be sourced as close to the work front as possible to reduce transport distances and GHG emissions.	Planning	Once-off	Construction materials sourced, to the extent possible, as close to the work front as possible.	Engineering Manager
12.	Construction	GHG emissions	For the transport of materials and equipment, the vehicle load should be maximised to increase fuel efficiency and reduce emissions.	Planning	Once-off	Vehicle load maximised, to the extent possible, to increase fuel efficiency and reduce emissions.	Engineering Manager



No.	Project phase	Aspect	Mitigation Measures	Action plan			
				Timeframe	Frequency	Performance indicator	Responsibility
13.	Construction	GHG emissions	Truck drivers should receive training on good driving practices to improve fuel economy and reduce GHG emissions.	Planning	Once-off	Truck drivers have received training on good driving practices to improve fuel economy and reduce GHG emissions.	Engineering Manager
14.	Operations	GHG emissions	Optimise HVAC energy performance by implementing measures such as: • Optimise temperature settings using programmable thermostats and building management system. • Improve insulation and sealing by adding insulation to walls, ceilings and ductwork, where possible. • Conduct regular maintenance (e.g. clean or replace air filters) in accordance with manufacturers specifications. • Install variable speed drives on fans and pumps, where possible, for better load matching. • Reduce internal heat loads by using LED lighting and energy-efficient appliances	Duration of the operational phase.	Ongoing	Cooling system, maintained according to the manufacturer's specifications.	Engineering Manager & Maintenance Manager



No.	Project phase	Aspect	Mitigation Measures	Action plan			
				Timeframe	Frequency	Performance indicator	Responsibility
			The facility should, where possible utilise refrigerant gasses that exhibit a low global warming potential ('GWP'), for example carbon dioxide ('CO2') or hydrofluoroolefins ('HFOs').				



11. Conclusion

The observed and projected changes in climate in the near-and medium-term are unlikely to pose a significant risk to the Project. All physical climate-related risks to the Project, apart from the 'Increased Risk to Critical Project Infrastructure with Acute Urban Flooding' were assessed to be Low. The latter was assessed to be Moderate.

During the commissioning phase, the Project's average annual GHG emissions are calculated to be 7,253 tCO₂e. During the operations phase, the Project's average annual GHG emission are calculated to be 7,244 tCO₂e.

The potential contribution of the Project's GHG emissions to South Africa's four modelled domestic pathways are calculated to range between 0.000649% (Highly Insufficient pathway) and 0.006364% (1.5°C Paris Agreement Compatible pathway).

Based on pre-defined thresholds, the impact of the contribution of the Project's annual operational GHG emissions are classed as **Very Low** during the operations phase.

There are no additional mitigation management actions, other than those included in **Section 10**, to be included in the ESMP.

Based on the information presented in the report, and the interpretation and assessment thereof, it is the opinion of the specialist that no fatal flaws exist which would prevent the construction and operation of the Project.

12. Assumptions, Limitations, Uncertainties

In preparing this report, the following assumptions, uncertainties, and gaps in knowledge were noted:

- SLR has prepared this report in a manner that is consistent with the level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report.
- In developing this report, SLR has relied in good faith on information provided by Biovac.
- The nature of the work undertaken is stochastic with substantial inherent uncertainty. However, these uncertainties are highlighted, and environmental conservative assumptions are applied where applicable.
- The uncertainty associated with any projections or forecasts is increased with the duration of the projected period and is subject to future developments or intervening acts which may manifest in the interim period.
- This is considered an initial high-level assessment, and that detailed, downscaled climate modelling is required to more accurately determine the impact of climate change on the Project.
- No other warranty expressed or implied is made.



Record of Report Distribution

SLR Reference:	723.000201.00001
Title:	Climate Change Risk Assessment for the Biovac Vaccine Facility Project, Western Cape Province
Report Number:	1.0
Client:	The Biovac Institute (Pty) Ltd

Name	Entity	Copy No.	Date Issued	Issuer
Xxx	Biovac	1.0	20 January 2026	Michael Van Niekerk



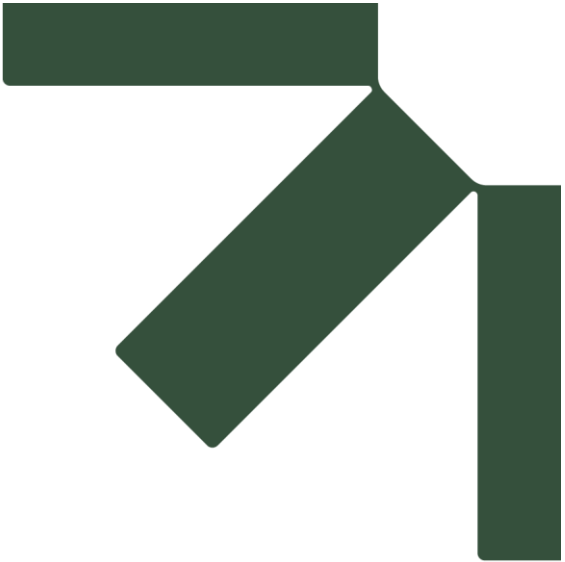
13. Details of the Specialist

Michael Van Niekerk is a climate change specialist with over 17 years consulting experience in South Africa and several other African countries, including Mozambique, Zambia, Kenya, Democratic Republic of Congo, Ethiopia, Ghana, Mali, and Uganda.

To date, Michael has worked on several climate change risk assessments, climate change strategies, and GHG inventories or carbon footprints. He has experience in a wide range of sectors, including mining, oil & gas, manufacturing, and industry. He has a strong working knowledge of local and international climate-related legislation, regulations, conventions, and agreements.

He also has specific experience in conducting energy audits and applying resource efficient and cleaner production methodologies. In the last 17 years, Michael has undertaken several ESIAs, and Basic Assessments. He also has experience in environmental auditing, solid and hazardous waste management, strategic environmental planning, and ecosystem services.





Appendix A EP4 Requirements

Climate Change Risk Assessment for the Biovac Vaccine Facility Project, Western Cape Province

FINAL REPORT

The Biovac Institute (Pty) Ltd

SLR Project No.: 723.000201.00001

20 January 2026

Table A-1 presents a summary of the requirements for a CCRA which are set out in the EP4, as well as comments on whether the relevant requirements have been met in this CCRA⁷².

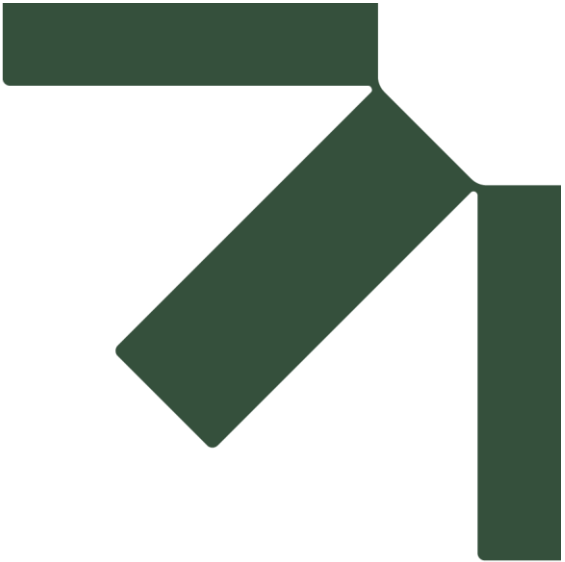
Table A-1: Climate requirements for EP4

Section	Requirements	Comment on requirements
Principle 1: Review and Categorisation	Project will be categorised based on the magnitude of potential environmental and social risks and impacts, including those related to climate change.	Not applicable as this is the responsibility of the Equator Principles Financial Institutions (EPFIs).
Principle 2: Environmental and Social Assessment	Assessment Documentation is expected to include an assessment of potential climate change risks as part of the Environmental and Social Impact Assessment or other Assessment.	This CCRA is being submitted as a supplementary assessment to the current site ESIA.
	Climate Change Risk Assessment should be aligned with Climate Physical Risk and Climate Transition Risk categories of the Task Force on Climate-related Financial Disclosures (TCFD).	This CCRA has aligned with the Physical Risk and Climate Transition Risk categories of the TCFD – see Section 9 .
	A Climate Change Risk Assessment is required: - For all Category A and, as appropriate, Category B Projects, and will include consideration of relevant physical risks as defined by the TCFD. - For all Projects, in all locations, when combined Scope 1 and Scope 2 Emissions are expected to be more than 100,000 tonnes of CO₂ equivalent annually. Consideration must be given to relevant Climate Transition Risks (as defined by the TCFD) and an alternatives analysis completed which evaluates lower GHG intensive alternatives.	The combined scope 1 and scope 2 emissions of the proposed Project does not exceed the 100,000 tonnes carbon dioxide equivalent (tCO ₂ e) threshold.
	The depth and nature of the Climate Change Risk Assessment will depend on the type of Project as well as the nature of risks, including their materiality and severity.	The depth and nature of the CCRA was tailored to the type of Project and nature of the risks.
Principle 10: Reporting and Transparency	For all Category A and, as appropriate, Category B Projects: The client will ensure that, at a minimum, a summary of the ESIA	Not applicable as the Project is unlikely to be a Category A or Category B project.

⁷² Equator Principles Association (2020). *Equator Principles: EP4: July 2020*. URL: <https://equator-principles.com> [accessed on 25 September 2025]

Section	Requirements	Comment on requirements
	is accessible and available online and that it includes a summary of climate change risks and impacts when relevant	
	The client will report publicly on an annual basis, GHG emission levels (combined Scope 1 and Scope 2 Emissions, and, if appropriate, the GHG efficiency ratio) during the operational phase for Projects emitting over 100,000 tonnes of CO ₂ equivalent annually. Refer to Annex A for detailed requirements on GHG emissions reporting.	As the Project's annual GHG emissions do not exceed the 100,000 tCO ₂ e threshold, there is no requirement to report publicly on an annual basis, the combined scope 1 and scope 2 emissions.
Annex A: Climate Change: Alternatives Analysis, Quantification and Reporting of Greenhouse Gas Emissions	<u>Alternatives Analysis</u> The alternatives analysis requires the evaluation of technically and financially feasible and cost-effective options available to reduce Project-related GHG emissions during the design, construction and operation of the Project.	Not applicable as the Project's annual GHG emissions do not exceed the 100,000 tCO ₂ e threshold triggering an alternatives analysis.
	<u>Quantification and Reporting</u> GHG emissions should be calculated in line with the GHG Protocol to allow for aggregation and comparability across Projects, organisations and jurisdictions. Clients may use national reporting methodologies if they are consistent with the GHG Protocol. The client will quantify Scope 1 and Scope 2 Emissions.	The Project's GHG emissions were calculated in accordance with the GHG Protocol (see Section 5.2). The Project's scope 1 and Scope 2 emissions were calculated (see Section 7).
	The EPFI will require the client to report publicly on an annual basis on GHG emission levels (combined Scope 1 and Scope 2 Emissions) and GHG efficiency ratio, as appropriate, during the operational phase for Projects emitting over 100,000 tonnes of CO ₂ equivalent annually.	Not applicable as the Project's annual GHG emissions do not exceed the 100,000 tCO ₂ e threshold triggering annual public reporting.
	Clients will be encouraged to report publicly on Projects emitting over 25,000 tonnes.	Not applicable as the Project's annual GHG emissions do not exceed the 25,000 tCO ₂ e threshold triggering annual public reporting.
	Where appropriate, EPFIs will encourage clients to publish a summary of the alternatives analysis as part of the ESIA. In some circumstances, public disclosure of the full alternatives analysis or Project-level emissions may not be appropriate.	Not applicable as the Project's annual GHG emissions do not exceed the 100,000 tCO ₂ e threshold triggering an alternatives analysis.

Section	Requirements	Comment on requirements
	<u>Climate Change Risk Assessment</u> The Climate Change Risk Assessment should address the following questions at a high level: • What are the current and anticipated climate risks (transition and/or physical as defined by the TCFD) of the Project's operations? • Does the client have plans, processes, policies, and systems in place to manage these risks? i.e. to mitigate, transfer, accept or control. • This assessment should also consider the Project's compatibility with the host country's national climate commitments, as appropriate.	The CCRA identifies and assesses the current and anticipated climate risks (see Section 9). As part of the CCRA, the Project's existing ESIA was reviewed, with additional measures recommended in Section 10 to mitigate the identified risks.



Appendix B Climate Variables Projections Summary

Climate Change Risk Assessment for the Biovac Vaccine Facility Project, Western Cape Province

FINAL REPORT

The Biovac Institute (Pty) Ltd

SLR Project No.: 723.000201.00001

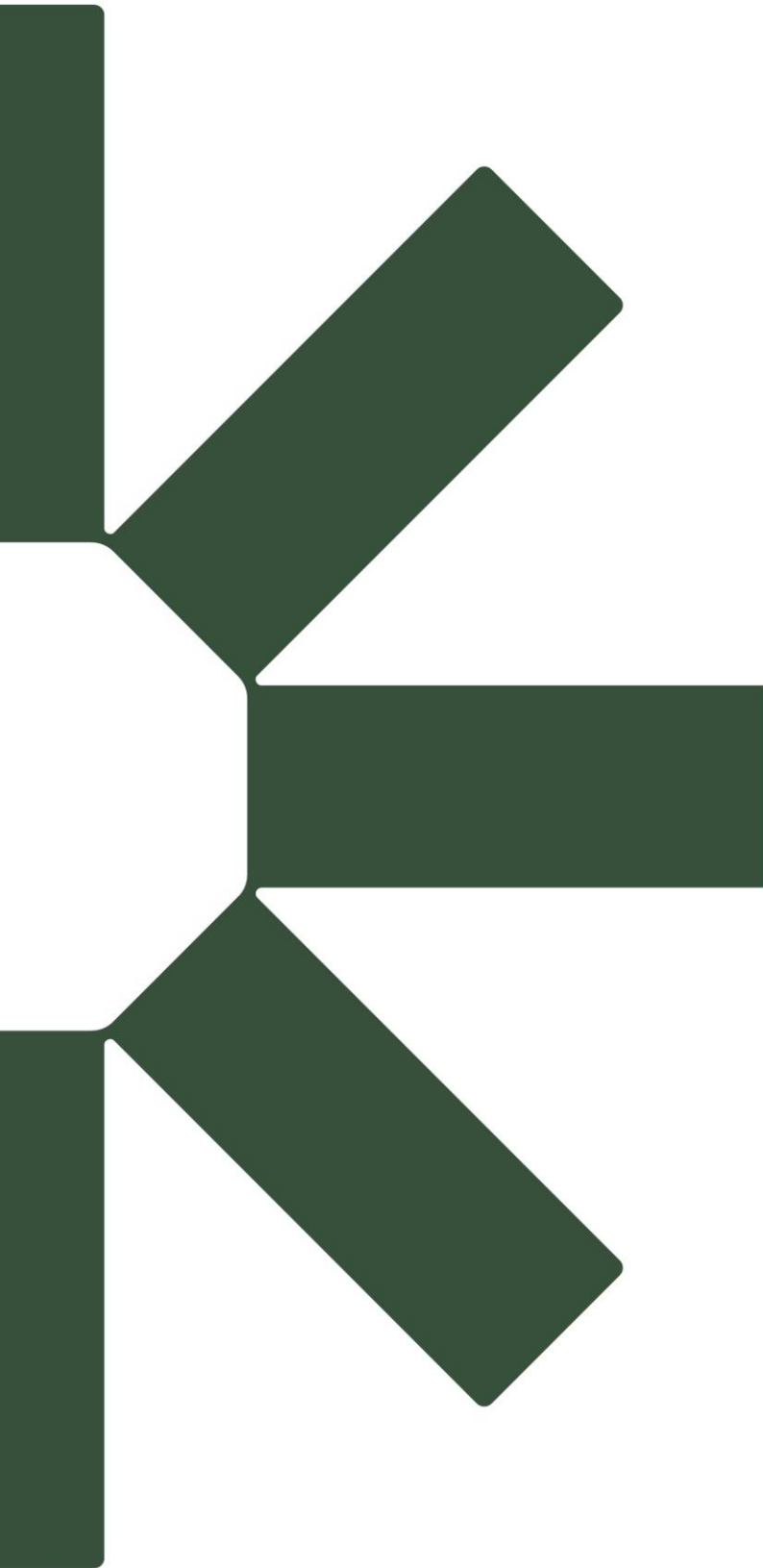
20 January 2026

Table B-1 presents a summary of the climate projections for the Western Cape province in which the Project is located⁷³. Projections were derived for the period spanning 2020-2039. Numbers in bold denote the median, whilst the numbers in round brackets denote the confidence interval (minimum (10%) to maximum (90%) values). Changes are considered under the reference period 1995-2014.

Table B-1: Climate projections summary for the Western Cape province

Indicator	Period	SSP 2-4.5 “middle-of-the- road”	SSP 5-8.5 “worst- case scenario”	Associated hazards
Average mean surface temperature	2020-2039	+0.59 °C (+3.5%) (+0.20 °C to +1.00 °C)	+0.68 °C (+4.0%) (+0.27 °C to +1.09 °C)	Extreme heat Drought/water stress
Average maximum surface temperature	2020-2039	+0.63 °C (2.7%) (+0.16 °C to +1.10 °C)	+0.76 °C (+3.3%) (+0.23 °C to +1.27 °C)	Extreme heat Drought/water stress
Number of very hot days ($T_{max} > 35^{\circ}\text{C}$)	2020-2039	+3.21 days (+48.1%) (-0.60 days to +7.56 days)	+3.83 days (+57.3%) (-0.33 days to +8.33 days)	Extreme heat Drought/water stress
Precipitation	2020-2039	-10.85 mm (-3.0%) (-74.67 mm to +61.52 mm)	-10.65 mm (-2.9%) (-83.27 mm to +60.64 mm)	Drought/ water stress
Average largest 5-day cumulative precipitation event	2020-2039	+0.20 mm (+0.4%) (-14.57 mm to +20.30 mm)	-0.24 mm (-0.5%) (-15.28 mm to +20.17 mm)	Acute urban flooding events under the SSP2-4.5 scenario and Drought/ water stress under the SSP5-8.5 scenario

⁷³ World Bank Group (2021). South Africa: Climate Projections. URL: [South AfricaZAF - Mean Projections \(CMIP6\) | Climate Change Knowledge Portal](#) [accessed on 04 January 2026].



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