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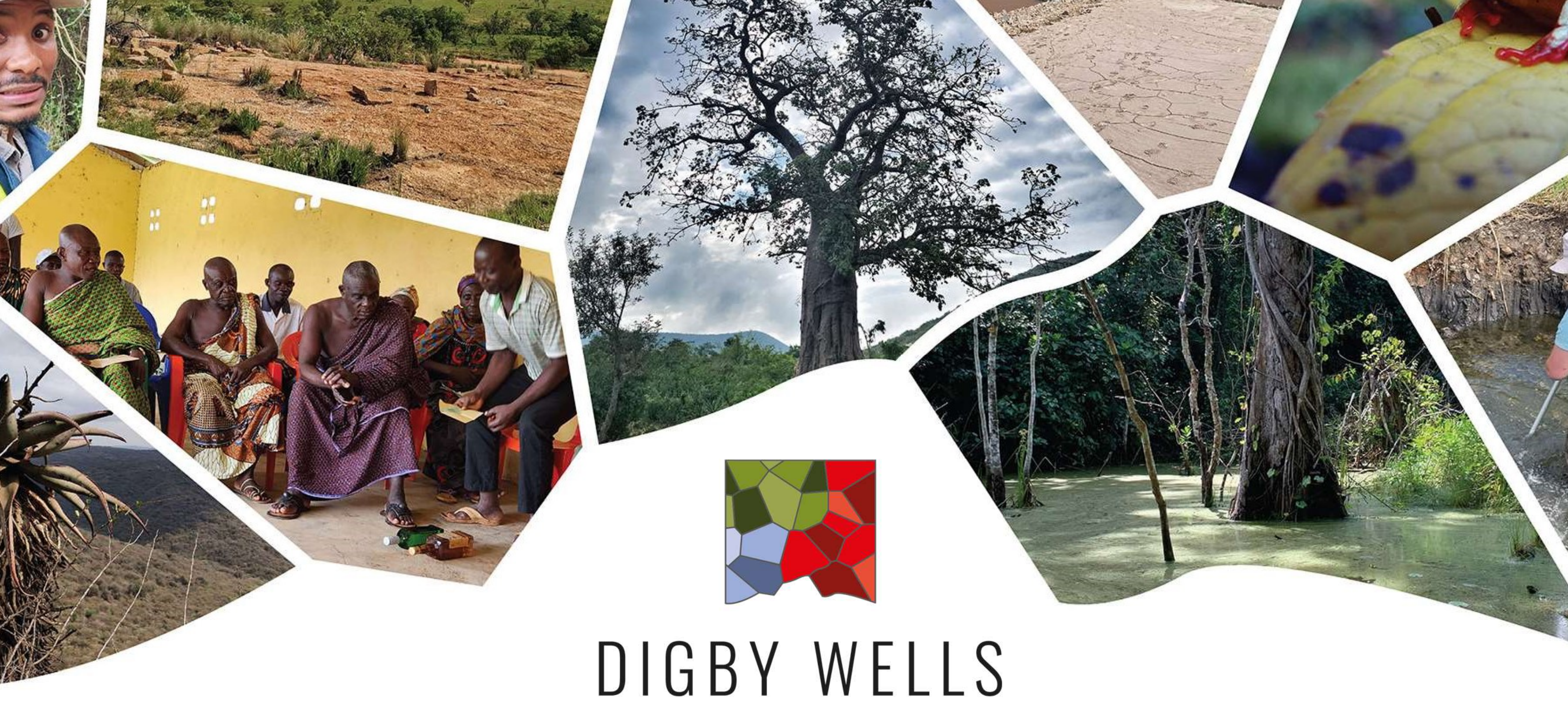
Appendix T: Climate Change Risk Assessment



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ENVIRONMENTAL

Reko Diq Mining Project: Environmental And Social Impact Assessment

Climate Change Specialist Assessment

Prepared for:

Reko Diq Mining Company

Project Number:

BAR7212

January 2025

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Report Type:	Climate Change Specialist Assessment
Project Name:	Reko Diq Mining Project: Environmental and Social Impact Assessment
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Executive Summary

Barrick Gold Corporation (Barrick), through its subsidiary Reko Diq Mining Company (RDMC), in a Joint Venture partnership with the Government of Pakistan and the Government of Balochistan, is completing a feasibility study for the Reko Diq Mining Project (the Project) in the western part of Balochistan Province of Pakistan.

As part of the feasibility study, an Environmental and Social Impact Assessment (ESIA) has been conducted, including specialist studies. The ESIA will be part of the environmental permitting process and will provide a basis for the integration of environmental and social considerations into the Project design. RDMC appointed Digby Wells Environmental (Digby Wells) to carry out the environmental and social studies and permitting process for the Project.

The ESIA and associated specialist studies are being undertaken in terms of the local laws and international best practice guidelines such as the International Finance Corporation's Performance Standards on Environmental and Social Sustainability 2012 (referred to as the "IFC PSs").

Barrick is also aligning its operations to the Global Industry Standard for Tailings Management (GISTM). Principle 3 of GISTM refers to establishing a knowledge base of climate change and associated impacts / risks to tailings storage facilities (TSF). GISTM requires that this knowledge base be used to assess the social, environmental, and local economic impacts of the TSF and its potential failure throughout its lifecycle. This assessment should be continuously updated and managed throughout the TSF lifecycle.

The climate change specialist assessment considered the climate change risks that the Project is projected to be exposed to through a Climate Change Risk and Vulnerability Assessment (CCRVA), and the Project's projected Greenhouse Gas (GHG) emissions through a GHG Assessment. Climate change interactions with Project impacts, including as a result of the construction, operation, and decommissioning of the TSF, were incorporated into each specialist assessment. High-level risk management recommendations were provided, and all ESIA specialist mitigation measures were designed to ensure adequate consideration of climate change.

At the time of writing, the Project design and management plans are in the drafting process. Climate change projections and identified risks have been provided to specialists to ensure climate considerations are incorporated into impact assessments and management plans. Finalised CCRVA is also being shared with design engineering consultants to ensure climate change projections and identified risks are considered in the detailed design phase of the Project.Estimated GHG Emissions

Estimated GHG emissions emitted as a result of the Project were calculated through a GHG Assessment. This considered scope 1 (direct emissions), scope 2 (indirect emissions), and anticipated material scope 3 categories (value chain emissions). As the project is located in a desert, land clearing emissions were considered negligible.

The average annual estimated scope 1 and 2 GHG emissions are just over 1.3 million tonnes of carbon dioxide equivalent (tCO_2e) per year. 75% of these GHG emissions are scope 1 emissions from the consumption of diesel and HFO. The lifetime scope 1 and 2 GHG emissions are just over 53 million tCO_2e. The Scope 3 GHG emissions are approximately 3.0 million tCO_2e per year (118.5 million tCO_2e across the life of mine). 61% of the scope 3 GHG emissions are associated with the downstream processing (category 10) of the copper.

Overall, the project could increase Pakistan's national GHG emissions by up to 0.26%. It is important to consider that the mine is extracting copper, a crucial metal in the electrification of the local and global economy as well as the rollout of renewable energy technologies. Thus, the broader impact of the project would allow for a reduction of GHG emissions in other sectors of the economy not accounted for here.

Project GHG emission reductions should be considered from the planning phases to illustrate responsible corporate governance and awareness of the Project's contribution to global emissions. Furthermore, a wide range of stakeholders are increasingly expecting companies to have robust plans to reduce their GHG emissions, to take swift, early and meaningful steps to action these plans, including transitioning to renewable energy sources, and to build resilience against the adverse impacts of climate change. A lower emissions footprint through reduced resource consumption, increased renewable energy components, lower energy consumption and improved operational efficiencies, can improve productivity and provide environmental benefits such as improved local air quality.

Potential alternatives discussed in this report to reduce the Project's GHG emissions include:

- Including biofuels into mobile and stationary fuel consumption (investigated by Barrick – not feasible);
- Alternative transportation routes or modes of transportation (investigated by Barrick – majority of transport by rail);
- Increasing the share of electricity sourced from the grid or onsite renewables (solar PV with battery storage) (investigated by Barrick – incorporated into mining plan); and
- Switching fuel driven equipment, such as vehicles, to hybrid or electrically-driven equipment, such as electrical vehicles (EVs) (investigated by Barrick – not feasible and not beneficial without excess renewable electricity).

The majority of the Project's annual operational emissions emanate from fossil fuel consumption. GHG emission reduction and avoidance opportunities are constrained by technological availability and cost. These opportunities are discussed in Section 8.3 and will be reliant on future successful proof of concept and/or economic viability, and will be re-visited by RDMC accordingly.

Climate Change Risks and Vulnerabilities

The Intergovernmental Panel on Climate Change (IPCC) stated in the Sixth Assessment Report (AR6) that the continuous release of GHG emissions into the atmosphere will lead to increased global temperatures that will exceed 1.5°C above pre-industrial levels by the middle of the century (IPCC, 2022).

Climate change projections were assessed for three Project areas, the Reko Diq Mine Site, a northern portion of the railway near the town of Nushki, and the Pakistan International Bulk Terminal (PIBT). The IPCC's SSP5-8.5[1] projections for each site by the end of Life-of-Mine (LoM) show increasing temperatures, precipitation and flood hazards, drought periods, as well as continued or increased cyclones, storm surges, and sand and dust storms. Projections at each site for SSP5-8.5 by 2070 are listed in the table below. Projections for additional variables, time horizons, and for SSP2-4.5 emissions pathway can be found in Section 7.3.

Site Location	Climate Projections (SSP5-8.5 by 2070)
Reko Diq Mine Site	• Mean annual temperature increase of 2.9°C from 23°C; • ~48% increase in extreme heat days (days with maximum temperatures >35°C) from ~112 to ~166 days per year; • Decrease of ~6 annual frost days from ~9 days per year; • ~30% increase in annual precipitation from 0.16 mm/day; • ~155% increase in 50-year flood hazard intensity from 30 m^3/s; and • ~11% increase in the number of dry spells from 112 dry spells per 30-year period.
Railway (near Nushki)	• Mean annual temperature increase of 2.8°C from 18°C • ~48% increase in extreme heat days (days with maximum temperatures >35°C) from ~112 to ~166 days per year; • Decrease of ~19 annual frost days from ~37 days per year; • ~10% increase in annual precipitation from 0.37 mm/day; • ~23% increase in 50-year flood hazard intensity from 120 m^3/s; and • ~3% increase in the number of dry spells from 118 dry spells per 30-year period.
PIBT	• Mean annual temperature increase of 2.1°C from 27°C; • ~28% increase in extreme heat days (days with maximum temperatures >35°C) from ~187 to ~240 days per year; • 73% increase in annual precipitation from 0.36 mm/day; • 37% increase in 50-year flood hazard intensity from 297 m^3/s; • ~22% increase in the number of dry spells from 67 dry periods per 30-year period;

[1] Shared Socio-economic Pathways (SSPs) represent different potential emissions scenarios in relation to different global climate change responses. SSP5-8.5 represents a 'worst-case scenario' outlook that considers a very weak global response to reducing emissions and can be used to highlight the most prominent risks from climate change. Flood hazards were assessed using an earlier version of the SSPs, known as Representative Concentration Pathways (RCPs).

	• ~16% decrease in the duration of dry spells from 701 consecutive dry days; • Increased coastal flooding and wind speed intensity of tropical cyclones; and • 0.35m sea level rise from 1995-2020 baseline period.

Projected climate change hazards were assessed alongside the Project's exposure and vulnerability to each hazard. Physical risks associated with climate change projections include:

Hazard	Climate Risks and Vulnerabilities
Increased heavy rainfall and flooding events	• Infrastructure damage and increased operating costs; • Potential contamination, sedimentation and reputational risks; and • Structural instability and slope failure of TSF, stockpiles, embankments, and other earthworks.
Increased extreme heat days	• Increased costs due to operational efficiency losses; • Worker health and safety considerations; • Derating and decreased output of solar installations; and • Safe storage thresholds for chemicals, explosives, and hazardous waste.
Increased drought periods	• Lost production due to water availability and increased water processing and purchasing costs; and • Reputational risks from water consumption and competition.
Sea level rise	• Rising sea levels at PIBT causing inundation and potential operational delays.
Storm surges and cyclones	• Continued or exacerbated storm surges and cyclones causing operational delays and infrastructure damage.
Sand and dust storms	• Decreased visibility, operational delays and health and safety risks from continued or increased sand and dust storms • Risks to the health and availability of workers as chronic climatic changes alter weather and extreme events.
Chronic changes in weather	• Risks to the health and availability of workers as chronic climatic changes alter weather and extreme events.

Transitional change risks and opportunities for the Project were also assessed. As Pakistan and the global economy undergo a low-carbon transition, key risks and opportunities the Project may experience include:

- Legal requirements regarding emissions reductions and renewable energy production;
- More stringent regulatory, compliance, and disclosure requirements;
- Possibility of carbon taxes on scope 1 and 2 emissions;

- Opportunities to participate in and receive financial incentives for participation in carbon sequestration projects; and
- Increased demand for copper production due to utilisation in electric vehicles and renewable power technologies.

High level recommendations were provided to guide the Project's response to identified climate change risks and vulnerabilities. These include:

- Aligning to Barrick Health and Safety Management Procedures to account for climate risks such as extreme heat, and ensure they are updated every 3-5 years to reflect ongoing changes in climate;
- Infrastructure designs and the operation's emergency preparedness and response plans that consider flooding and extreme weather event scenarios are monitored and updated every 3-5 years to reflect ongoing changes in climate; and
- Management and monitoring plans that are designed to account for climate change considerations are continuously reviewed and updated based on climate change considerations.

The implementation of the recommendations will not necessarily eliminate the identified climate risks but will reduce the impact and bolster resilience to climate change risks and hazards. Effectively responding to identified climate risks illustrates good corporate governance through acknowledging the potential of climate change impacts, ensuring accountability and transparency, and taking proactive steps to manage risks to protect people, infrastructure and the environment.

Integration with Specialists

Climate change considerations were reviewed with ESIA specialists to assess which impacts may be exacerbated by climate change. Where additional climate change considerations were necessary, specialists adjusted the mitigation measures and management plan inputs accordingly. In general, climate change projections were not found to significantly alter the identified impacts and subsequent mitigation measures. Therefore, mitigation measures and management plan inputs within each specialist assessment are inclusive of climate change considerations.

Conclusion

Risk management recommendations and mitigation measures within each specialist report offer a range of practicable steps which can be implemented over time to reduce physical climate-related risks and impacts of the Project on the surrounding environment. It is essential that mitigation measures and risk management recommendations are investigated and, where appropriate, implemented timeously. Doing so will improve the Project's climate resilience by protecting operations and the workforce from adverse climate-related risks and reduce the Project's impacts on the surrounding communities and environment.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS, ABBREVIATIONS AND TERMS

AR6	Sixth Assessment Report
Barrick	Barrick Gold Corporation
BAU	Business as Usual
BUR	Biennial Update Report
CBAM	Carbon Border Adjustment Mechanism
CCKP	Climate Change Knowledge Portal
CCRA	Climate Change Risk Assessment
CCRVA	Climate Change Risk and Vulnerability Assessment
CH_4	Methane
CMIP6	Coupled Model Inter-Comparison Project Phase 6
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
Digby Wells	Digby Wells Environmental
E&S	Environmental and Social
ECT	Energy Chater Treaty
EIA	Environmental Impact Assessment
ENSO	El Niño Southern Oscillation
EP	Equator Principles
ESG	Environmental and Social Governance
ESIA	Environmental and Social Impact Assessment
EVs	Electric vehicles
GCM	Global Climate Model
GHG	Greenhouse Gases
GISTM	Global Industry Standard for Tailings Management
GoP	Government of Pakistan
ICMM	International Council on Mining and Metals
IFC	International Finance Corporation
IFRS	International Financial Reporting Standards
IPCC	Intergovernmental Panel on Climate Change

LoM	Life-of-mine
LTS	Long Term Strategy
MAP	Mean Annual Precipitation
MDGs	Millennium Development Goals
Mm	Millimetres
N_2O	Nitrous Oxide
NC	National Communications
NCC	National Climate Commitments
NDC	Nationally Determined Contributions
OHS	Occupational Health and Safety
PS	IFC Performance Standards
RCPs	Representative Concentration Pathways
RDMC	Reko Diq Mining Company
RE	Renewable Energy
SASM	South Asian Summer Monsoon
SDGs	Sustainable Development Goals
SMHI	Swedish Meteorological and Hydrological Institute
SSPs	Shared Socio-economic Pathways
TCFD	Taskforce on Climate-related Financial Disclosures
tCO_2e	Tonnes of carbon dioxide equivalents
TSF	Tailings Storage Facility
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	UN Framework Convention on Climate Change
WRD	Waste Rock Dump
WTT	Well to Tank

1. Introduction

Barrick Gold Corporation (Barrick), through its subsidiary Reko Diq Mining Company (RDMC), in a Joint Venture partnership with the Government of Pakistan and the Government of Balochistan, is completing a feasibility study for the Reko Diq Mining Project (the Project) in the western part of Balochistan Province of Pakistan.

As part of the feasibility study, an Environmental and Social Impact Assessment (ESIA) has been conducted, including specialist studies. The ESIA will be part of the environmental permitting process and will provide a basis for the integration of environmental and social considerations into the Project design. RDMC appointed Digby Wells Environmental (Digby Wells) to carry out the environmental and social studies and permitting process for the Project.

This report constitutes the Climate Change Specialist Risk Assessment. The overall objectives of the study are to determine the following:

- Current climate conditions and climate change trends and projections;
- Calculation of the Project's estimated Greenhouse Gas (GHG) footprint through a GHG Assessment;
- Potential risks of climate change on the Project (Climate Change Risk and Vulnerability Assessment - CCRVA) through identification of key climate change related vulnerabilities and risks and possible risk management recommendations;
- A summary of the social, environmental and economic impacts of the Project which may be exacerbated by climate change and corresponding mitigation measures.

1.1. Specialist Details

Table 1-1 details the specialists involved in report compilation and review.

Table 1-1: Specialist Details

Name of Reviewer	Role	Experience and Qualifications
Becki Woythal	Compilation	MSc in Climate Change 8 years' experience in sustainability and climate change
Matthias Rommelspacher	Compilation	MEng. in Environmental Engineering 6 years' experience in climate change
Sarah Cooper	ExCo Review	LLB, BA (Hons) +17 years' experience in ESG, Sustainability and Responsible Investment Sector.

2. Background and Context

The Project is a Copper-Gold mining operation with an onsite processing plant to produce a high-quality copper-gold concentrate (the Concentrate) that will be exported for final processing into various products. The current Life-of-Mine (LoM) is 38 years in terms of defined resources (resources that have been identified already) with significant exploration upside.

The construction phase is anticipated to take approximately 40 months, including pre-stripping. The mine will be a truck-and-shovel open pit mining operation with processing facilities that include crushing, grinding, and flotation. The final Concentrate will be railed to the Pakistan International Bulk Terminal (PIBT) at Port Qasim for final export by ship.

The mine will be developed in two phases,

is expected to have a capacity of 45 Mt per annum (Mtpa) and Phase 2 is expected to have a combined processing capacity of 90 Mtpa. Phase 1 operations are anticipated to commence towards the end of 2027 and Phase 2 operations in 2030.

3. Project Description

3.1. Reko Diq Mine Site and Associated Facilities

The proposed RDMS will cover an area of 33,408 ha. Figure 3-1 provides an overview of the RDMS and the major proposed infrastructure.

The core infrastructure that will be established at the RDMS includes:

- Two main pits, Western Porphyry and Tanjeel (Figure 3-1). The Western Porphyry Pit (the Pit) will mine a complex of four adjacent porphyry centres (H13, H14, H15 and H79) with the highest grades in the H14 and H15 complexes. The mining method of these pits will be a 24-hour open-pit shovel and truck operation;
- Two Low-grade stockpiles for the ore body or Run of Mine (ROM) that will be extracted, one for the Western Porphyries pit and one for the Tajeel Pit;
- Two designated Waste Rock Dumps (WRD) for the waste rock from the Western Porphyries pit. The Tajeel Pit will have a separate WRD in its proximity.
- Sediment ponds to collect run off from the WRD and ore stockpiles, sediment will be allowed to settle and the surface water will be collected and recycled back into the process;
- One tailings storage facility (TSF) with four enclosed cells located to the southwest of the RDMS. The TSF embankments will be constructed with predominantly waste rock and have tailings drainage systems to control the flow of water and tailings. The enclosed cells consist of:
  - Three cells have been designed for the cleaner tailings which will be lined with 1.5 millimetres (mm) high-density polyethylene (HDPE) liner. A low permeability upstream zone will be constructed of 3 metres (m) of clay and 3 m of filter sand behind it;

    - A rougher tailings storage cell designed to contain 2,728 Mt (88%) of the total tailings produced. It will be controlled to accumulate supernatant water at a decant point, the water will be reused in the mining process.
- A processing plant with a concentrator to produce the copper-gold concentrate.

The process of producing the concentrate at the processing plant involves flotation and does not require cyanide. The daily processing rate will be 123,000 tonnes per day (t/d) in Phase 1, increasing to 246,000 t/d in Phase 2. A total of 34 million tonnes (Mt) of Concentrate will be processed with an approximate average copper grade of 26-31% and gold content of 7-15 grams per tonnes (g/t).

The predicted total material produced in kilo tonnes (kt) and transported on site is shown in Table 3-1.

Table 3-1: Total Material Movement (Source: Mine Plan Summary 2024)

Destination	Tonnage for LoM (kt)
Total Ore Mined (Western Porphyries & Tanjeel pits)	3,011,694
Total Waste Mined (Western Porphyries & Tanjeel pits)	3,200,800
Waste Dump North	2,063,287
Waste Dump South	670,298
Tanjeel Waste Dump	160,319
Waste to TSF Stockpile	306,896

3.1.1. Supporting Infrastructure

The proposed supporting infrastructure at the RDMS includes:

- Several sources for power supply will be utilised for the Project. The Project's estimated peak power requirements will be 183 megawatts (MW) in Phase 1 and 348 MW in Phase 2 (Figure 3-2):
    - Diesel generators during the early works and construction phases until the establishment of the Heavy Fuel Oil (HFO) power station (this will be used until Year 15). The power station will have two main stacks where the flue gas ducts of the 12 generators will be combined in clusters of six per stack. An additional set of 11 HFO-based generators will be installed at the power station for Phase 2. Sixteen (16) diesel generators, each with 1.8 MW capacity will be utilised for emergency power.

  - An overhead transmission line (Overhead Line (OHL)) will supply power to the Northern Groundwater borefield via a single circuit and following the water pipeline corridor where pump stations at the borefield will be supplied by a network of 33 kV distribution lines;
  - A Solar Photovoltaic (PV) system will be developed at RDMS approximately 10 km northwest of the Pits covering 300-350 ha. The installed capacity will be 183 MW in Phase 1 and then an expansion of the system to 384 MW in Phase 2;
  - It is anticipated that the Project's energy requirements will be met through a grid connection from Year 15 (operational phase). There is an existing transmission of 220 kilovolt (kV) within the Balochistan region to Quetta which will be extended to supply power to Reko Diq. The anticipated length of the transmission line from mine site to Quetta will be 670 km (**Error! Reference source not found.**);
- Diesel, HFO and other sources of fuel will be railed to the site from PIBT and stored in bunded contained atmospheric tanks at the designated storage areas. The estimated average diesel consumption will be 26,000 kilo litres (kL) per annum for the construction phase, increasing to 96,000 kL in Phase 1 and a predicted maximum annual consumption of 260,000 kL in 2049;
- Accommodation Facility to provide on-site accommodation for all employees and contractors working on the Reko Diq site, consisting of modular buildings located in the Northwest of the Mine Lease Area.
- Security infrastructure such as a 2 m fence with anti-berm constructed from the water rock, access cates, surveillance system, four forts outside the fence line and a control room at the processing plant;
- Fire protection and emergency response facilities such as fire hydrants outside buildings and three fire water systems at the processing plant, mine site and accommodation facility;
- Explosive storage near the WRD north, northwest of the Western Porphyries Pit;
- A truck workshop west of the Western Porphyries Pit. A separate building will contain the first aid station, officers, and lockers for employees and other facilities;
- Non-mineralised waste management facilities:
  - A centralised waste storage and transfer facility (general and hazardous waste) for temporary storage of waste before recycling or final disposal;
  - A landfill (general and hazardous waste) with an estimated 260,300 t (520,600 m^3) being dumped before being separated for recycling or treatment. The onsite non-hazardous landfill will be approximately 8 ha and located between the processing plant area and the accommodation facility;

- A tyre dump;
- Bioremediation area near the landfill to treat hydrocarbon-contaminated soils. The area will be graded with a perimeter embankment;
- A solid and liquid waste incinerator, mostly for hazardous waste;
- An HFO waste incinerator for the HFO sludge and processing plant. The capacity will be approximately 15,000 kilograms (kg) a day.

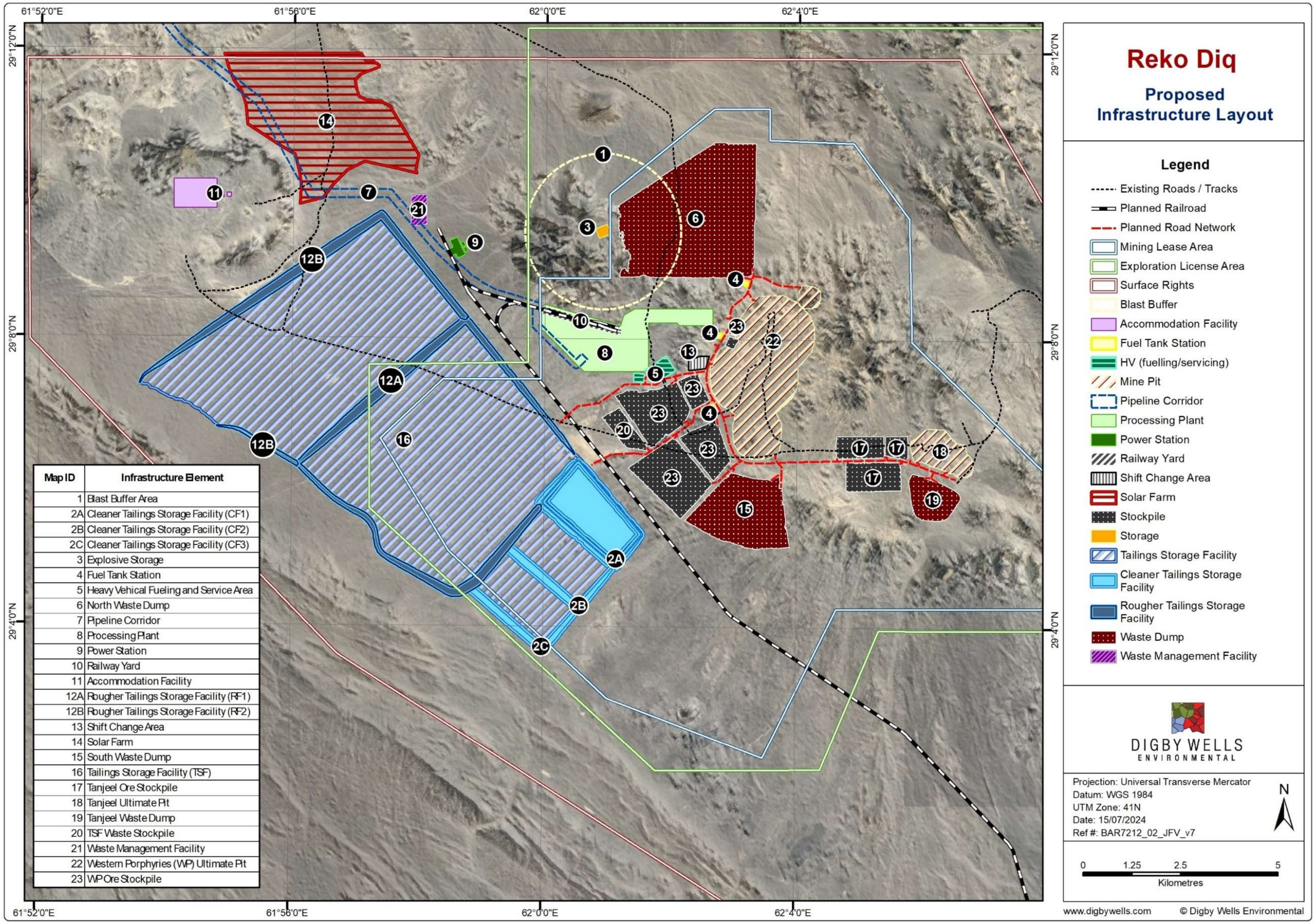

Figure 3-1: Proposed Reko Diq Mine Site Layout

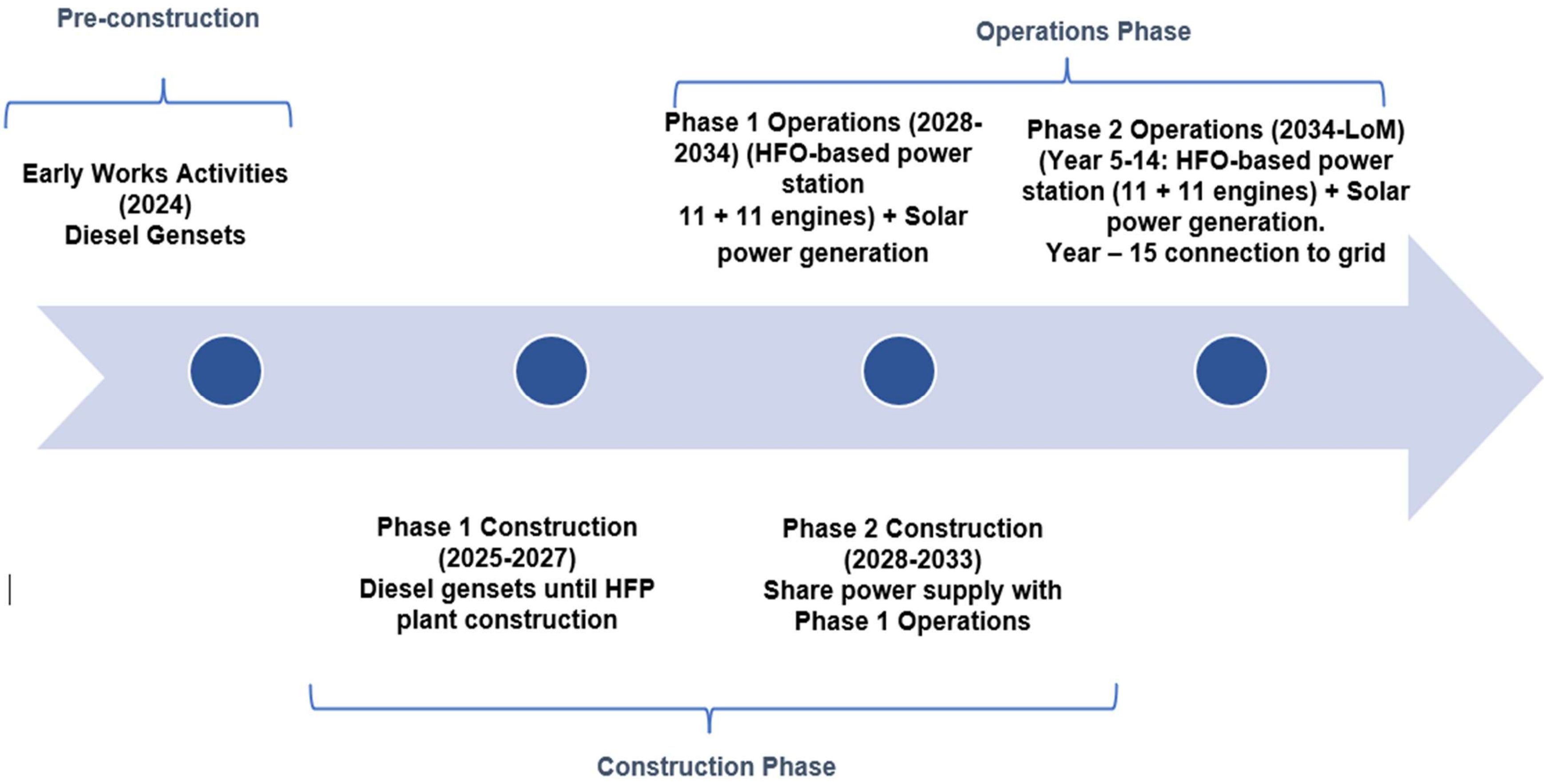

Figure 3-2: Roadmap for Power Supply

3.1.2. Water Supply and Management

Water for the Construction Phase, Phase 1 and Phase 2 of the Project will be sourced from a sedimentary groundwater system located approximately 70 km to the northwest of the mining area referred to as the Northern Groundwater System (Figure 3-3). The system represents a small and isolated part of a much larger basin and there are no communities or community water sources located within the proposed borefield and its area of influence.

Water in the system is saline and challenging to access, and as such is not suitable for human consumption or most agricultural or industrial uses without significant treatment and abstraction infrastructure. There are currently no planned developments or users of the target groundwater system, and the scope of the Project would not preclude future use of the broader basin by others. Independent international best practice environmental and social impact assessment and hydrogeological studies, using physical surveying and remote sensing techniques, have demonstrated that there are no surface expressions of the groundwater system and no known dependent biodiversity.

This groundwater system is considered capable of enabling development and sustaining operation of the Project, which is expected to add significantly to the socio-economic advancement within the region and country through employment, infrastructure, and services.

The early works activities include the construction of a 78 km long buried water supply pipeline with a diameter of 250 mm from the Northern Groundwater Borefield to the mine site to provide water for construction. A 900 mm buried, cement lined steel pipe will be constructed between the site and the Northern Groundwater Borefield for piping of operational water requirements.

This pipeline will be laid in parallel with the early works water supply pipeline at a distance of approximately 30 m apart. The total servitude for all future pipelines, service road and power supply line will be a total width of 60 m.

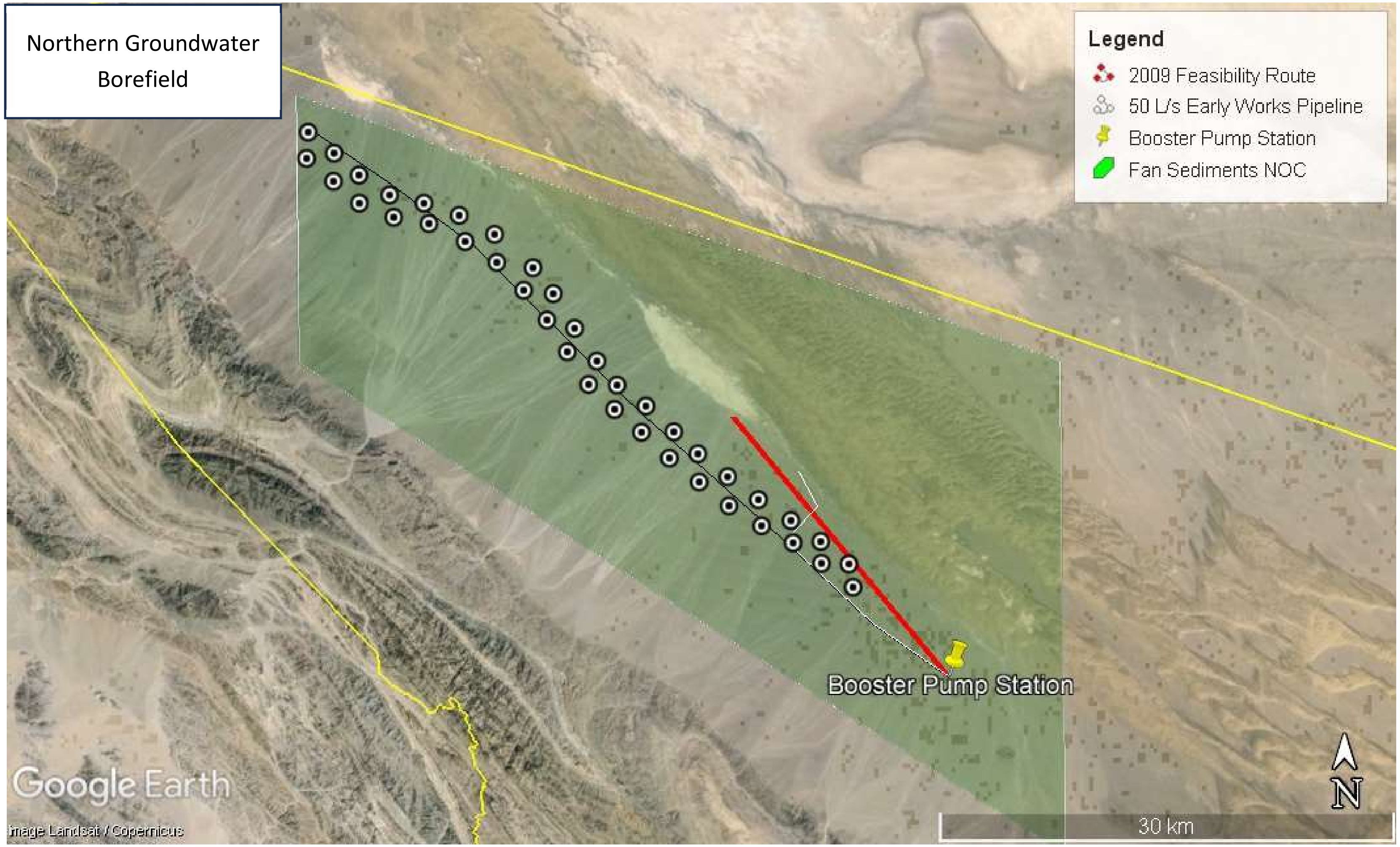

Figure 3-3: Location and recommended layout of Northern Groundwater Borefield

3.1.2.1. Water Management

The various aspects of water management for the Project include:

- A continuous supply of water of varying volumes such as 1.6 GL/a for the construction phase, 24 GL/a for Phase 1, 48 GL/a Phase 2 and 1.6 GL/a for the decommissioning phase.
- A Water Treatment Plant (WTP) will be installed at the mine site to provide potable water to the accommodation facility and work areas. It will be a containerised solution with two trains with a combined capacity of 145 m^3/hr;
- Sewage Treatment Plant (STP) will be installed at the accommodation facility and at the processing plant. The sewage treatment process will include Rotational Biological Contactor (RBC) technology. The STP will be designed to handle four times the average daily intake and accommodate shift changes. During the construction phase, 2.9 m^3 of sludge will be produced daily reducing to approximately 1.5 m^3 during the operational phase.
- Various water storage facilities including a Raw Water Pond, Process Water Pond, Cooling Water Tank, Plant Fresh Water Tank, Village Raw Water Tank, Village Potable Water Tank and Mine Site Fresh Water Tank; and
- Various Stormwater Management around the plant area, pit area, TSF and WRDs.

3.2. Transport and Marine Port

The Project will use the existing road and rail networks to transport materials during construction and operational phases and utilise the air transportation option for personnel. The main Project transport routes (Road Transport Route and Rail Transport Route) are shown in Figure 3-4.

3.2.1. Access Route

Existing roads will be used to transport supplies and equipment to the mine site for the construction and operational phases. The access roads to the mine site will also be upgraded and improved as part of the Project early works.

The main routes the Project will utilise are the N-40 National Highway between Taftan (the Iranian border) and Quetta (the provincial capital), PIBT via the Northern Bypass (M10) and Regional Corporation for Development (RCD) Highway (also known as N-25 Highway) to Noshki and Dalbandin to Nok Kundi and finally Reko Diq Mine Site. The route from the mine site to Karachi is approximately 1,300 km, and to Nok Kundi is approximately 45 km.

A new 8 m wide, two-lane surface road will be constructed as part of the early works activities, connecting the mine site the N-40. Within the mine site, a new gravel road will be constructed which connects the main gate to the processing plant site, airstrip and the accommodation facility. This road will be used by Project-authorised vehicles only. The mine haul roads will be constructed to facilitate the transport of the ore and waste rock from the open pit to the crushers, ore stockpile processing plant and WRDs.

The fuel required during construction phase will be transported via road and during operations will be transported in bulk via rail. In both cases the fuel will be transported from various import terminals at PIBT or Karachi Port.

Charter flights will be used to transport personnel routinely between Karachi and the mine site as well as for any emergency medical evacuations. A private airstrip has been constructed within Surface Rights Area (SRA) to the south of the accommodation facility in 2010 and was recommissioned in May/June 2023. The airstrip is approximately 1.8 km in length and is located ~10 km from the RDMS.

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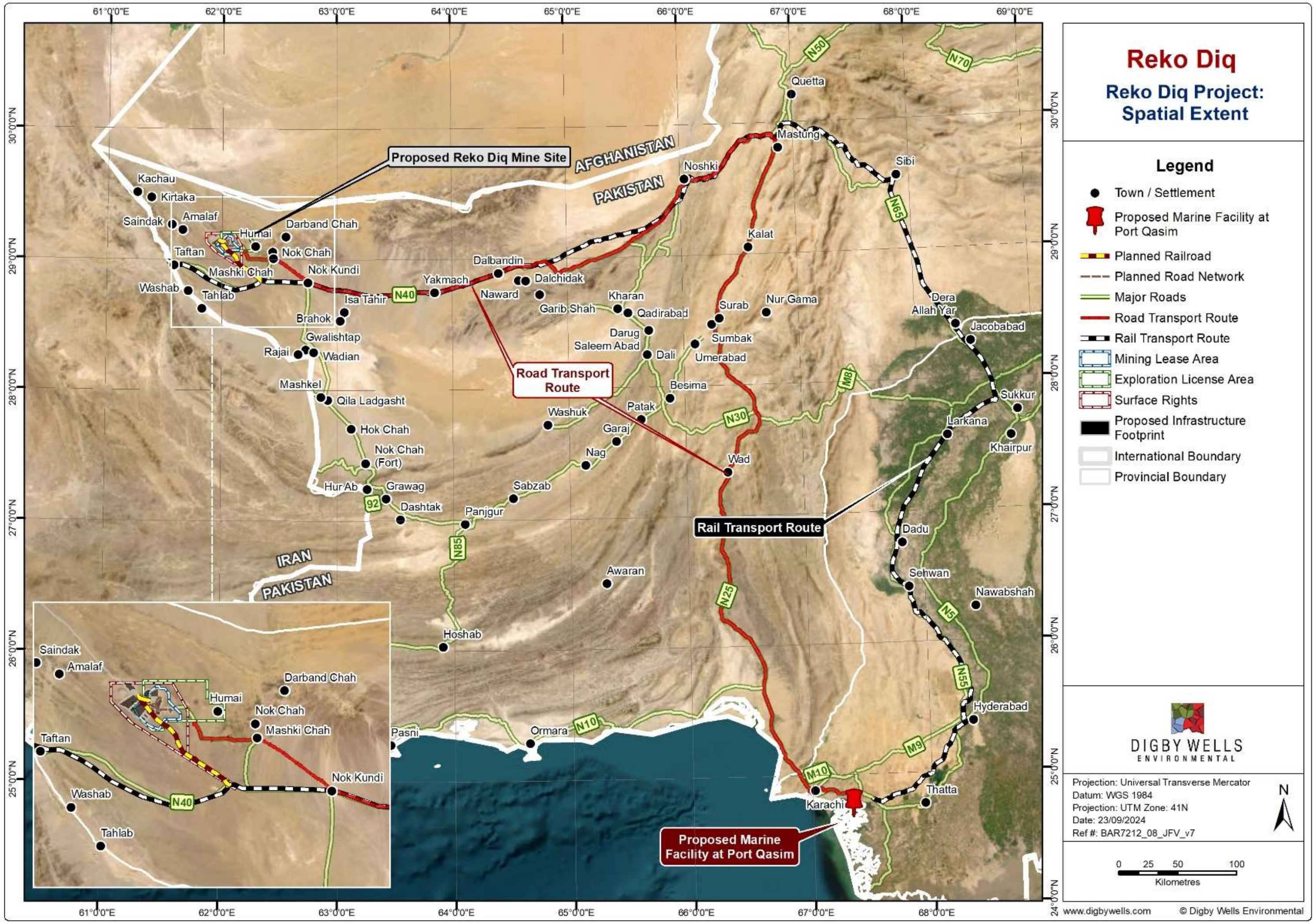

Figure 3-4: Reko Diq Spatial Extent and Transport Routes (Rail Transport Route and Road Transport Route)

3.2.2. Transport of Concentrate to Port Qasim

The Concentrate will be transported from the RDMS processing plant to Port Qasim via an existing railway line, passing through the Balochistan and Sindh provinces. The existing rail route is approximately 1,350 km in length as outlined in Figure 3-4.

A new project dedicated railway section will be constructed from RDMS to the existing railway line at Nok Kundi. The rail transport will terminate at an existing railway loop located 13 km northeast of the PIBT. The layout of existing railway loop and proposed facilities is shown in Figure 3-5. The route from the rail loop to the PIBT will use existing roads within the Port Qasim Industrial Area.

Port Qasim is a marine terminal port located 50 km from Karachi, on the coastline of the Arabian Sea, in the Malir District of Sindh Province of Pakistan. The Project will make use of the existing PIBT Terminal where all facilities are owned and operated by PIBT. An area will be leased to RDMC for the construction of a Concentrate storage shed, for which RDMC will be responsible and all other activities will be ancillary and operated by PIBT.

The construction and operation of the Concentrate storage shed will be the responsibility of RDMC and will be included in this ESIA process.

The PIBT has a built capacity for handling up to 12 million tons of coal and 4 million tons of cement and clinker per annum, which together can be further enhanced to ramp up to 20 million tons of bulk product export per year. For this reason, there will be no need for additional port infrastructure to facilitate the requirements of the Project.

An extract of the onshore and offshore layout is shown in Figure 3-6.

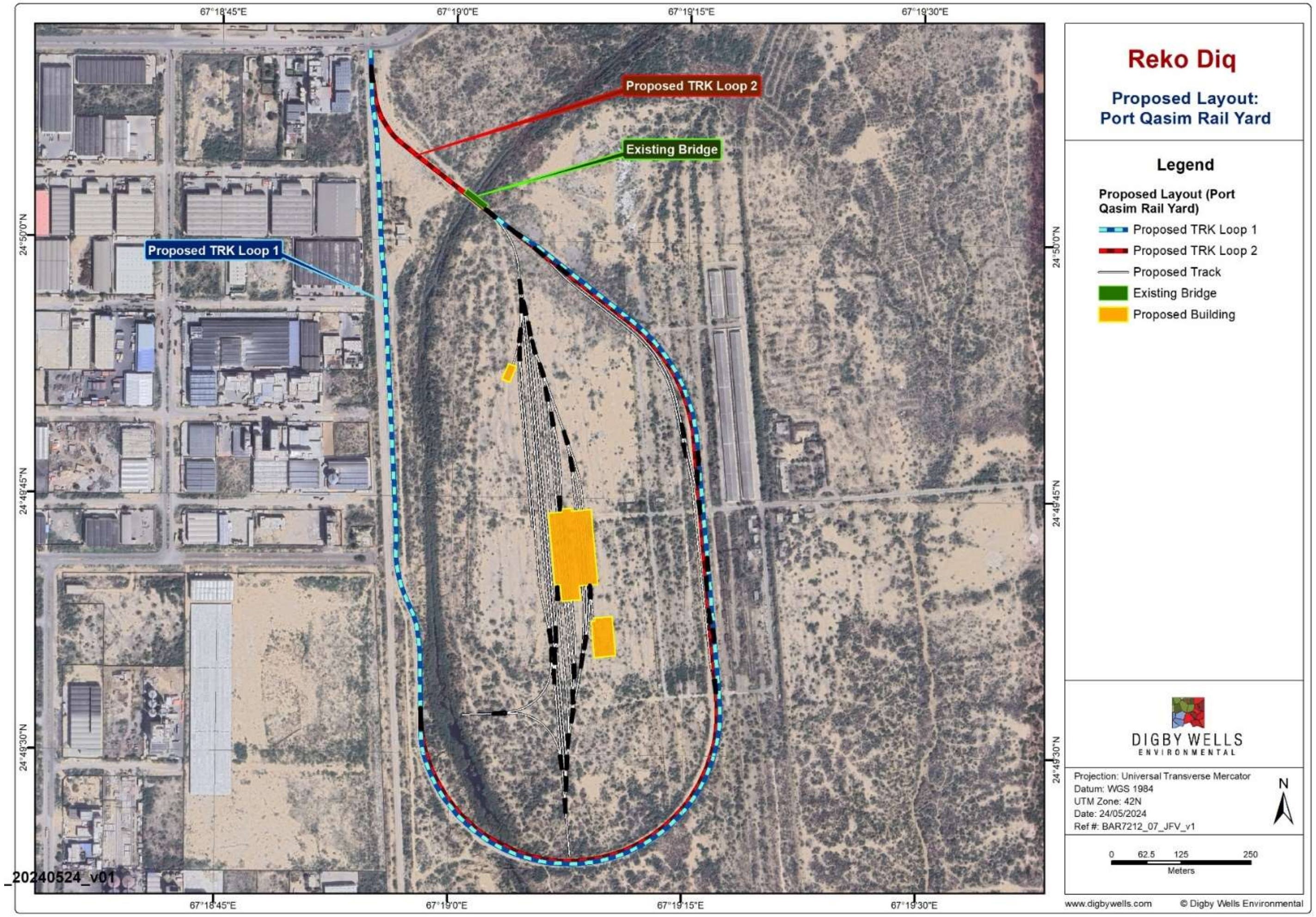

Figure 3-5: Proposed Rail Yard Layout at Port Qasim

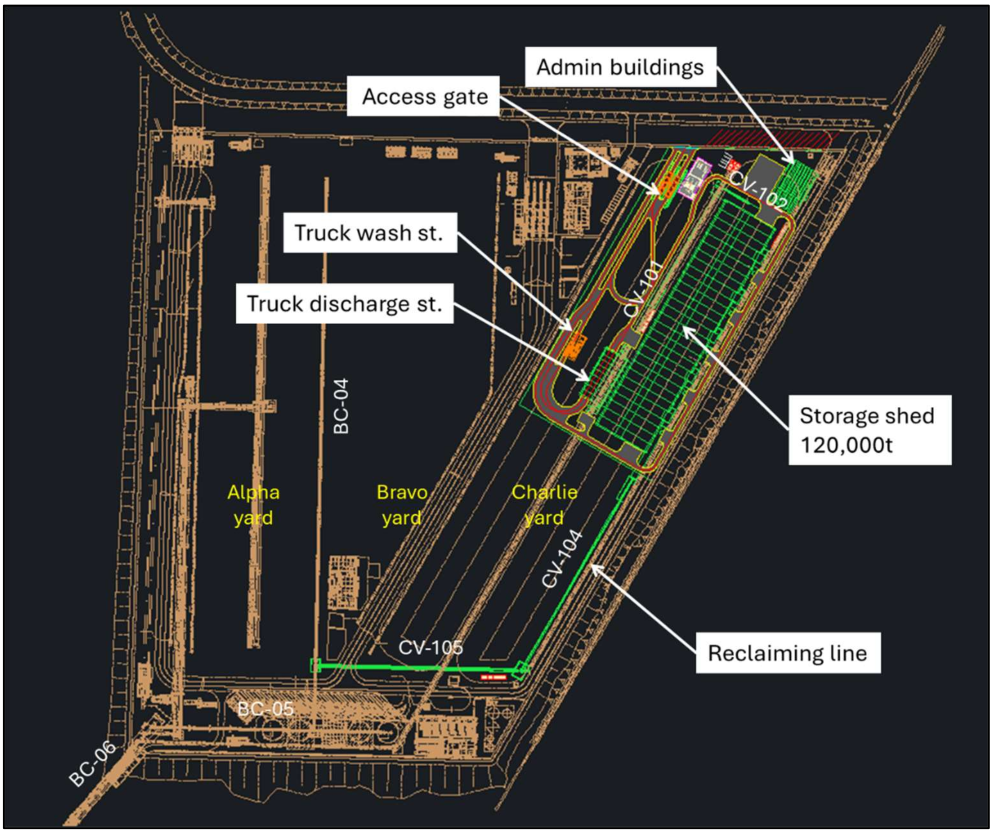

Figure 3-6: Layout of Concentrate Facilities at PIBT at Port Qasim

3.3. Land Requirement

No private land acquisition or resettlement will be required for the Project. All the land required for the Reko Diq Mining Project is Government owned land which will be either leased or purchased from the Government. The key project facilities will be fenced and access to the land will not be restricted for local communities.

3.4. Employment

Preference will be given to locals for employment and appropriately qualified individuals from the surrounding communities. Table 3-2 presents the estimated average staffing during different stages of the Project.

Table 3-2: Estimated Average Employment at Reko Diq Mine Site in various stages of the Project

Project Phase	Early Works, Feasibility Study & Detailed Engineering	Phase 1 Construction	Phase 1 Operations and Phase 2 Construction	Phase 2 Operations
	2024	2025-2027	2028-2033	2034-2040
A. Contractors				
A.1. Contractors - Construction	2,353	8,255	6,803	-
A.2. Contractors - Operations & Services	200	200	331	614
Total Contractors	2,553	8,455	7,133	614
B. RDMC Employees				
B.1. RDMC Local	460	1,761	2,465	4,814
B.2. RDMC Expat	86	120	449	404
RDMC Total Employees	546	1,881	2,914	5,218
Total Engaged Workforce (A+B)	**3,099**	**10,336**	**10,047**	**5,832**

The type of employment required includes skilled and management, semi-skilled (such as drivers, fitters and carpenters) and unskilled (labourers and guards).

3.5. Project Schedule

The Project will be developed in stages as per each area with the initial production of concentrate in late 2027. Table 3-3 presents the anticipated Project schedule.

Table 3-3: Project Schedule

Phase	Aspect	Scheduled
Construction Phase	Early Works	Q3 2024 – Q2 2025
	Phase 1 construction	2025 – 2027
	Phase 2 construction	2028 – 2030
Operational Phase	Early Works commissioning	Q1 2025
	Phase 1 commissioning	Q1-Q3 2027
	Phase 2 commissioning	Q1-Q3 2031
Decommissioning	Rehabilitation and post-closure management	After mine operations have ceased.

Q refers to one-fourth of a year i.e., Q2 is second quarter of the year 2025.

4. Assumptions and Limitations

Assumptions are made to safeguard the development of an accurate GHG Assessment and CCRVA. The assumptions made in this report and corresponding limitations are discussed in Table 4-1 below:

Table 4-1: Limitations and Corresponding Assumptions and Responses

Limitation	Assumption/Response
CCRVA	
No site visit was included in the scope of work for this CCRVA.	Fieldwork undertaken by the other specialists are sufficiently detailed to undertake the CCRVA. Knowledge gathered from other specialist reports, publicly available information, government reports as well as peer reviewed scientific information were used to inform the CCRVA.
There are uncertainties related to the emissions trajectories and projections assessed because of ambiguity related to global climate change responses, regional variability, and climate change modelling accuracy.	The Coupled Model Inter-Comparison Project Phase 6 (CMIP6) and CMIP5 climate change projections were utilised. CMIP projections are created through a collaboration of global climate research organisations following standardised protocols to ensure consistency between models. Each phase of CMIP, with CMIP6 being the most recent, incorporates the most up-to-date scientific knowledge and is therefore used as the basis of reporting by the

Limitation	Assumption/Response
	Intergovernmental Panel on Climate Change (IPCC). Climate projections were provided across two Shared Socioeconomic Pathways (SSPs), equivalent to two Representative Concentration Pathways (RCPs), SSP2-4.5/RCP4.5, and SSP5-8.5/RCP8.5.These pathways represent different global responses to climate change and the subsequent emissions projected under each response. RCP4.5 and SSP2-4.5 represent a pathway like current emissions, and RCP8.5 and SSP5-8.5 represent a 'worst-case scenario' outlook that considers a very weak global response to reducing emissions, leading to more intense climate change-related risks. CMIP projections and chosen pathways were assumed to be appropriate and reliable and are referenced accordingly.
Bespoke site-specific climate modelling and projections were not performed.	Baseline and future climate change projections were obtained through global climate models which provide gridded data that varies in accuracy at the regional scale. CMIP5-Cordex downscaled data were explored as an alternative to CMIP6 global data. CMIP6 and CMIP5 data were determined as the best available option due to having a finer spatial resolution. Baseline climate data from global climate models were compared to local weather station data from Nok Kundi to ensure climate change projections are locally applicable.
Historical climatology trends and future projections in the Baseline Results and Discussion (Section 7) data were gathered via the World Bank CCKP (2024). Future projections used in the CCRVA were gathered from the World Bank CCKP (2024), the Swedish Meteorological and Hydrological Institute Climate Information Portal (SMHI, 2023), and NASA's Sea Level Projection Tool (NASA, 2024). These sources perform regular updates to their data processing and visualisation systems, therefore the trends and projections	All data gathered for the climate change baseline and risk assessment, including climate trends and projections, were gathered between 31 May and 14 June, 2024. Specific dates for each climate variable are outlined in Appendix A. Climate risks should be reassessed every 3-5 years as updated climate projection data becomes available.

Limitation	Assumption/Response
retrieved may be variable based on the date of download.	
Climate change projections, as well as quantitative measurements of exposure, sensitivity, and adaptive capacity are complex and subject to uncertainties. Quantifications of risk therefore serve as a scale to identify and prioritise various risks that the Project may face, rather than a rigid scientific quantification process.	Best practice risk assessment methodologies such as the IPCC Sixth Assessment Report (AR6) were utilised to develop quantitative physical risk scores and to guide qualitative physical risk discussions. Risks are identified based on reasonable assumptions considering previous trends for an area as well as projections of future climate and are therefore not exact.
The CCRVA is a risk assessment and not an impact assessment. This report has been prepared in collaboration with related specialist studies and impact assessments, however it does not contain a comprehensive list of mitigation measures from each specialist report.	This CCRVA forms part of a larger ESIA and should be read in conjunction with the ESIA and other related specialist studies. Climate change considerations have been examined by each specialist and incorporated into subsequent specialist studies.
The Project area, including relevant infrastructure at the Reko Diq Mine Site, the railway, and PIBT covers a significant geographic area spanning over 1700km^2. To capture the diversity of projections across this area, climate change projections were assessed for areas of key infrastructure or where extreme events have taken place historically.	To represent potential climatic changes throughout the project layout, climate projections were assessed for three points that were assumed to be sufficient in assessing risks related to the Project. These points include: • The Reko Diq Mine Site: to assess hazards that may impact mining operations; • Nushki: to assess hazards that may impact transportation of copper concentrate along the railway. Climate data were gathered for a portion of the railway near the town of Nushki where historic flooding and damage to the railway has occurred.; and • PIBT: to assess hazards that may impact the export of copper concentrate. Exact coordinates for each point can be found in Appendix A.
At the time of writing, management plans and Project designs are in the drafting process.	High level risk management recommendations were provided, and climate change considerations were shared with specialists and incorporated into impact assessments. Management plans and project designs are being drafted inclusive of climate change projections and identified risks. It is

Limitation	Assumption/Response
	recommended that site design, policies, and management plans are updated every 3-5 years to account for changes in climate and as updated climate change projections become available.
GHG Assessment	
No data was provided to indicate the mode of transport for materials to site during the construction phase.	It was assumed that during construction, all materials are transported by road. During operation the transport is then exclusively by rail.
It is impossible to forecast the evolution of Pakistan's national grid with any certainty until 2066.	It was assumed that the most recent grid emission factor would be applicable for the duration of the life of mine.

5. Relevant Legislation, Standards and Guidelines

5.1. International Best Practice

To future-proof against potential costs, reputational risks, or legal interventions related to climate change adaptation and mitigation, it is best practice for new projects to be developed in alignment with the various international regulations, principles and frameworks related to climate change. The following table (Table 5-1) outlines international guidelines and/or frameworks that consider climate change and were used to guide the CCRVA:

Table 5-1: Applicable Legislation, Regulations and Guidelines

Legislation, Regulation, Guideline or By-law	Applicability
The UN's Sustainable Development Goals (SDGs)	The UN SDGs replaced the Millenium Development Goals (MDGs) and call all governments, organisations, and individuals to promote prosperity and continuous growth while conserving the planet's finite resources. Specifically SDG 13 calls all to "take urgent action to combat climate change and its impacts".
The UN's Secretary General's Sustainable Energy for All Initiative	The Sustainable Energy for All initiative forms part of a multi-stakeholder collaboration between the private sector, governments, and civil society. The three objectives of the initiative include ensuring widespread access to modern energy services, improving global rates in energy efficiency, and doubling renewable energy in the global energy mix.
The International Energy Charter Treaty (ECT)	The International Energy Charter Treaty focusses on energy cooperation between stakeholders and is intended to promote energy security through competitive and open energy markets. The Charter

Legislation, Regulation, Guideline or By-law	Applicability
	Treaty respects the principles of sustainable development and management of energy resources.
UN Framework Convention on Climate Change (UNFCCC)	The UNFCCC established legal principles and frameworks for international collaboration relating to climate change considerations. The UNFCCC aims to stabilise and ultimately reduce atmospheric GHG concentrations and work towards avoidance of anthropogenic influence on the global climate system. The UNFCCC has also formalized the process of performing and representing climate modelling through its work on the assessment reports.
Paris Agreement	The Paris Agreement is an international climate change treaty. The agreement builds on the UNFCCC and was adopted in 2015 and considers climate change adaptation, mitigation, and finance. The Paris Agreement's aim is to improve global responses to climate change threats through working to limit global warming well below 2°C above pre-industrial levels. To achieve this goal, signatory countries need to mobilise finance contributions consistent with a low emissions and climate-resilient future and support developing and vulnerable countries with their climate objectives. Pakistan is a signatory to the Paris Agreement and needs to regularly outline their climate efforts through nationally determined contributions.
Nationally Determined Contributions (NDC) Also known as National Communications (NC) to the UNFCCC.	NDCs form the main pillar of achieving the long-term goals of the Paris Agreement. NDCs relate to Paris Agreement signatory countries and require climate change adaptation considerations and climate change mitigation and action plans to reduce country emissions. NDC's include regular communications (in five-year intervals) by countries on their efforts to combat climate change and improving overall climate resilience. In NDC reporting, countries need to disclose their total emissions as well as provide status updates on emission reduction implementation efforts. Pakistan's updated 2021 NDC (GoP, 2021c) outlines an emissions reduction plan with the target of reducing emissions by 50% of projected emissions by 2030. 15% of this reduction will be based off of Pakistan's resources, while 35% is subject to receiving international finance.

5.2. Pakistan's Climate Commitments

Pakistan has several regulatory texts that address issues related to climate change and other decisions relating to UN Conventions. The Project is required to comply with all obligations in terms of the provisions of both national and provincial legislation, regulations, guidelines, and by-laws. The guidelines directing the CCRVA are discussed in

Table 5-2 below.

Table 5-2: Applicable Legislation, Regulations, Guidelines and By-Laws

Legislation	Applicability
Balochistan Climate Change Policy (Government of Balochistan and UNDP, 2024)	The Balochistan Climate Change Policy sets forth an approach to adaptation and mitigation to climate change in a way that highlights the province's unique challenges while aligning with national and international climate change goals. Some of the objectives of the policy most relevant to the Project include: • Adaptation and resilience, including disaster preparedness, climate-resilient infrastructure, and water management systems; • Mitigation of GHG emissions through energy efficiencies, adoption of renewable energy sources, and GHG reduction targets; • Sustainable management of natural resources; • Water resource management including water efficiency measures and protecting water access; • Waste management infrastructure that promotes reduction of waste and GHG emissions while improving human health; • Engagement with the private sector to promote sustainable business practices and climate-friendly industries; and • Adoption of environmentally responsible procurement practices.
Updated NDC (GoP, 2021c)	Pakistan's Updated NDC sets a target of reducing emissions by 50% of projected emissions by 2030. 35% of this target is based on receiving international financial support for mitigation initiatives. The Updated NDC also outlines mitigation options to reach the GHG reduction target. Actions that may impact the project include: • 60% of all energy produced in country generated by renewable resources by 2030; • 30% of all new vehicles in certain categories sold in Pakistan will be electric by 2030; and • Moratorium on new coal-based power plants and generating power from imported coal. The Updated NDC also lays out Pakistan's goals to implement nature-based solutions and carbon sequestration projects.
National Climate Change Policy (GoP, 2021a)	The 2021 update of the 2012 Pakistan Climate Change Policy aims to build climate change resiliency into Pakistan's economic and social development plans. The policy includes overarching policy objectives, as well as adaptation and mitigation measures throughout various areas and sectors. The policy sets out mitigation policies in relation to the industrial sector such as: • Economic incentives for emissions reductions;

Legislation	Applicability
	• Guidelines and funding related to Corporate Social Responsibility (CSR); • Promoting efficient use of energy and resources, including Energy Efficiency Audits; • Estimate and monitoring emissions; • Ensuring accelerated technology transfer for various industries to achieve emissions reductions without impeding production; • Introduce incentives for carbon capture and storage; and • Legislate opportunities to promote circular economy.
National Action Plan: Sustainable Energy for All (GoP, 2019)	Pakistan has been part of the global Sustainable Energy for All (SEforAll) since 2013. As part of this, and in alignment with the seventh SDG, Pakistan developed the SEforAll National Action Plan. The plan sets out a long-term plan to ensure the three goals: • Universal energy access; • Doubling the share of renewable energy; and • Doubling the rate of energy efficiency.
National Action Plan on SDG 12 Sustainable Consumption and Production (GoP, 2017b)	In alignment with SDG 12, Sustainable Consumption and Production, Pakistan has set out the National Action Plan on SDG 12 to set broad targets within various sectors related to climate change interventions. In the industry sector, the plan sets out objectives and indicators relating to: • Policies to support resource efficiency and clean technology in industry; • Enhancing the capacity of the industrial sector for resource conservation and environmental compliance; and • Encouraging green industrial zones, including the support of small and medium scale industries. The plan was based off of inputs from the National Roundtable Provincial workshops with key stakeholders and aims to set forward a framework for further policies.
Pakistan Climate Change Act, 2017	On 29 March 2017, the President of Pakistan signed into law the Pakistan Climate Change Act, 2017 (Climate Change Act). The preamble to the Climate Change Act provides that the purpose of the Climate Change Act is to ensure that Pakistan meets its obligations under international conventions relating to climate change and address the effects of climate change. The Climate Change Act provides for the establishment of the Pakistan Climate Change Authority which is empowered to publish rules and regulations to ensure that purpose of the Climate Change Act is realised. While the Climate Change Act does not impose any specific obligations on RDMC, the Climate Change Act does empower the Climate Change Authority to publish rules and regulations with which RDMC might have to comply at a later stage.

Legislation	Applicability
Pakistan 2025: One Nation, One Vision (GoP, 2014)	The Pakistan 2025 document provides a roadmap for the country in alignment with the MDGs and SDGs. The document considers climate change-related challenges, including energy security, water security, glacial melt, biodiversity threats, and institutions favoring the status quo in lieu of making sustainable changes. 25 goals are set out in the document, including those related to Energy: • Doubling power generation; • Increasing electricity access to 90% of the population; • Reducing cost and distribution losses, while improving national mix of electricity generation; • Increase indigenous sources of power; • Increase use of energy efficient appliances and products; and • Increase water storage and efficiency. The plan also sets forth the country's goal of increasing mining and mineral operations in the country, specifically of copper and gold resources.
National Sustainable Development Strategy (Khan & Pervaiz, 2012)	The National Sustainable Development Strategy sets out Pakistan's strategic goals regarding matters of the economy, environment, and social welfare of Pakistani citizens. The strategy sets out challenges that climate change will pose to sustainable development, and recounts historic examples of natural disasters triggered by climate change. The document includes strategic objectives, including: • The necessity for climate change impacts to be considered as part of the ESIA process for new projects; and • Ensuring new infrastructure is resilient to climate change to minimise disaster risks.

Other Pakistani documents, legislation and policies that are applicable, consider climate change and/or are potentially influenced by climate change include:

- National Clean Air Policy (GoP, 2023a);
- National Electricity Plan 2023-2027 (GoP, 2023b), which sets out implementation of the National Electricity Policy (GoP, 2021b);
- First Biennial Update Report to the UNFCCC (GoP, 2022);
- Electric Vehicle & New Technology Policy (GoP, 2020);
- Green Pakistan Initiative, formerly known as the 10 Billion Tree Tsunami Programme (GoP, 2018c);
- National Flood Protection Plan-IV (NESPAK, 2018);
- National Water Policy (GoP, 2018a);

- Second National Communication on Climate Change (GoP, 2018b)
- National Biodiversity Strategy and Action Plan 2017-2030 (GoP, 2017a);
- National Forest Policy (GoP, 2015);
- Sindh Environmental Protection Act, 2014;
- National Power Policy (GoP, 2013);
- Balochistan Environmental Protection Act, 2012;National Environmental Policy (GoP, 2005); and
- Pollution Charge for Industry (Calculation and Collection) Rules, 2001.

There are multiple policies and action plans that consider climate change, however currently integrating climate change considerations into project planning and development is not legally mandated.

5.3. Project Specific Compliance

This Climate Change Specialist Report aligns with the recommendations and guidelines as proposed by the International Finance Corporation (IFC) and the Equator Principles. Relevant principles related to climate change risk assessments that have been used as guidance in the development of this CCRVA are listed in Table 5-3.

Table 5-3: Applicable Guidelines

Guideline	Applicability
Barrick Internal Policies	
Barrick Environmental Policy	The Barrick Environmental Policy outlines Barrick's commitment to: • Comply with host country laws and/or international best practices; • Avoid and minimise negative environmental impacts through a mitigation hierarchy; • Use energy and natural resources efficiently; • Minimise water use and manage impacts on water quality; • Protect and conserve biodiversity; and • Strive for the highest quality of waste management. Within this policy, Barrick sets out an additional commitment to assess climate-related risks, manage emissions, and invest in clean energy sources. The completion of this CCRVA assists Barrick with aligning to this policy goal.
Barrick Climate Strategy	Barrick's group level Climate Strategy aims to guide Barrick in addressing and reducing climate change impacts. The strategy is based on the following key objectives: • Identifying, understanding, and mitigating climate change risks;

Guideline	Applicability
	• Maintaining updated GHG emissions baseline and reduction targets; • Continuously improving disclosure on climate change; • Switching to cleaner energy sources and increasing the proportion of renewable energy in the energy mix; • Identifying Climate Change Champions at every site to shift responsibility of achieving GHG reduction targets to individual sites; and • Working with communities to build climate change resilience.
Barrick Roadmap to Net Zero by 2050	Barrick has published a Net Zero roadmap, outlining emissions reduction targets in the short, medium, and long term: • Short term: Reduce emissions by 15% against 2018 baseline (achieved in 2023); • Medium term: by 2030 against the same baseline, while aligned to and maintaining a steady production profile; and • Long term: Achieve Net Zero emissions by 2050. To align with this roadmap, planning for the Project must incorporate emissions reductions opportunities.
External Guidelines	
Equator Principle 4	A Climate Change Risk Assessment (CCRA) is required to be undertaken: • For Category A and, as appropriate, Category B projects. For these projects the CCRA is to include consideration of relevant climate-related '**Physical Risks'** as defined by the Task Force on Climate-Related Financial Disclosure (TCFD)[2]. • For all projects, in all locations, when combined Scope 1 and Scope 2 emissions are expected to be **more than 100,000 tonnes carbon dioxide equivalents (tCO_2e)/year**. For these projects the CCRA is to include consideration of climate-related '**Transition Risks'** (as defined by the TCFD). The CCRA must also include a completed **alternatives analysis** which evaluates lower GHG intensive alternatives. The CCRA should also consider the project's compatibility with the host country's national climate commitments, as appropriate. Refer to Section 5.2.
EU Taxonomy	The EU Taxonomy is a classification system based on the EU's climate and environmental objectives which provides criteria to classify environmentally sustainable economic activities. The tool can be used by companies and investors to identify projects that contribute to

[2] As of 2024, TCFD has been subsumed by the International Financial Reporting Standards S2.

Guideline	Applicability
	sustainable economic activity. The EU Taxonomy defines green economic activities as: • Climate change mitigation; • Climate change adaptation; • Sustainable use and protection of water and marine resources; • Transition to a circular economy; • Pollution prevention and control; and • Protection and restoration of biodiversity and ecosystems. Activities that are Taxonomy-aligned must contribute to one of the environmental objectives listed above while doing no harm to any other objectives. Demonstrating alignment with the EU Taxonomy may become increasingly important for investors. This CCRVA and inclusion of climate change projections in specialist reports provides guidance that can be used to determine EU Taxonomy criteria.
International Council on Mining and Metals (ICMM) Climate Change Position Statement (ICMM, 2021)	The ICMM's Climate Change Position Statement details how member companies should approach climate change through ten principles. ICMM Mining Principles related to climate change include: • Principle 4 – Implementing effective risk management systems and strategies informed by science and includes stakeholder insights of relevant risks; • Principle 6 – Striving for continual environmental performance improvements including climate change and energy use; • Principle 7 – Contributing to biodiversity conservation and integrating approaches for sustainable land-use planning; • Principle 8 – Supporting and facilitating systems for responsible and sustainable design, re-use, use, disposal, and recycling of products related to minerals and metals; and • Principle 10 – Proactive and transparent stakeholder engagement on sustainable development challenges and opportunities. Reporting and independent verification of engagement progress and performance. Barrick is a member of the ICMM and therefore conforms to member requirements including implementation of the Mining Principles Performance Expectations related to climate change.
IFC Performance Standard 1 (PS1): Assessment and Management of	The risks and impacts identification process for the proposed Project bearing in mind PS1, must consider the following: • Emissions of GHGs;

Guideline	Applicability
Environmental and Social Risks and Impacts	• Risks associated with a changing climate; • Transboundary effects; and • Adaptation opportunities.
IFC Performance Standard 3 (PS3): Resource Efficiency and Pollution Prevention	PS3 aims to reduce GHG emissions caused by the Project. This should be undertaken through: • Considering and implementing alternatives to reduce GHG emitted through the design and operational phases of the Project. This also includes measures to conserve water, energy and raw material. • Annually quantifying both direct (Scope 1) and indirect emissions associated with off-site energy production (Scope 2) (including all significant sources of GHG emissions including non-energy related sources such as methane and nitrous oxide) for projects that will produce more than **25,000 tCO_2e)/year.** This should be done using estimation methodologies provided by the IPCC.
IFC Performance Standard 4 (PS4): Community Health, Safety and Security	PS4 aims to avoid adverse impacts on the affected communities. Communities are already subjected to climate change impacts. In future these impacts may be exacerbated due to the Project's activities. Where appropriate and feasible, Projects should **identify and mitigate risks** and **potential impacts** on priority ecosystems services that may be exacerbated by climate change.
GISTM	The GISTM is a standard resulting from the Global Tailings Review, a combined effort by the United Nations Environment Programme (UNEP), the Principles for Responsible Investment (PRI), and the ICMM. The standard was created with the goal of reducing harm from TSFs to both humans and the environment, and was the result of expert panels, stakeholder workshops, advisory groups, and industry best practice knowledge. GISTM provides current guidance on TSF management and encourages an integrated approach to increasing safety and decreasing potential failure of tailings facilities. As part of this climate change considerations are required as part of Principe 2 and 3 of the GISTM (Global Tailings Review, 2020). The principles state: • Principle 2.1: Requires the development of a knowledge base that supports safe tailings management through a facility's entire lifecycle, focusing on social, environmental, and local economical context pertaining to the tailings facility. This knowledge base is to include information about uncertainty due to climate change, and should be updated whenever material changes occur, or every 5 years.

Guideline	Applicability
	• Principle 3.3: For all new tailings facilities, the knowledge base and subsequent climate change uncertainties should be used to assess the social, environmental, and economic impacts of the tailings facility, including potential failure. Wherever acute or chronic impacts are identified, mitigation plans should be developed and implemented. This report was conducted in line with the GISTM Principle 3.3.

5.4. National Climate Commitments (NCC) Compatibility Review

Core to Pakistan's policy approach regarding climate change is a "vision of a sustainable, low carbon, and climate-resilient Pakistan" (GoP, 2021c). Within this vision, the primary focus in terms of mitigation is increasing renewable energy use, reducing development of coal fired power stations, promoting the use of electric vehicles and a large-scale afforestation project. From an adaptation point of view, the focus is on reducing the flood risk, enhancing water recharge and improving water availability in the Indus Basin as well as increasing the number of protected areas in the country.

The project does not conflict with the mitigation focus nor with the adaptation focus. Rather, the project will enhance the success of some of the mitigation focus as it is mining a metal crucial to the upgrade of the national grid and the electrification of vehicles, namely copper.

Furthermore, the project type is not included in the list of activities considered universally not aligned with the Paris Agreement (Direct Investment Lending Operations, 2023). Rather, the project requires consideration according to specific criteria outlined by the Equator Principles guidance, as it qualifies within the grouping of "Operations that rely significantly on the direct utilization of fossil fuels". A comparison of the Project against these criteria is outlined in Table 5-4 below. Based on the results of the specific criteria assessment, the Project is considered to be aligned to Pakistan's National Climate Commitments.

Table 5-4: Specific Assessment Criteria to Determine NCC

Specific Criteria	Additional Guidance	Reasoning	Answer
SC1: Is the Project inconsistent with NDCs of country in which it takes place?	Is the sector or activity covered by the host country NDC, and if so, is the operation in line with the pathways laid out for that particular sector or activity? The more aligned an NDC is with the long-term goals of the Paris Agreement, and the more sector it covers, the more robust the SC1 assessment will be.	• Pakistan's NDC does not currently include targets related to the mining sector outside of coal mining. Instead, focus sectors include energy, transportation, agriculture, industrial processes (particularly cement and textile production), land-use change and forestry, and waste. Therefore, the Project is not inconsistent with SC1.	No
SC2: Is the Project, over its lifetime, inconsistent with country's Long Term Strategy (LTS) or other similar long-term national economy-wide, sectoral, or regional low-GHG strategies compatible with the mitigation goals of the Paris Agreement?	As above, but in relation to LTSs and other relevant low GHG strategies. The more ambitious and realistic an LTS is, the more robust the assessment under SC2 will be.	• Pakistan does not have a published LTS • The Project's average annual GHG emissions (1.36 million tCO_2e) account for 0.26% of Pakistan's national emissions (520 million tCO_2e in 2022). The Project's largest projected emissions year (1.92mtCO_2e) accounts for 0.37% of Pakistan's national emissions. • Pakistan's NDC GHG emissions target calls for 50% reduction (15% unconditional, 35% conditional on international finance) from a projected Business as Usual (BAU) scenario by 2030: ○ Unconditional 15% reduction from BAU = 1,362 million tCO_2e (allows for a 160% increase from 2022) ○ Total 50% reduction from BAU = 802 million tCO_2e (allows for a 54% increase from 2022)	No

		• Therefore, a 0.26-0.37% increase is considered a small overall contribution to national emissions and well within NDC targets. • Pakistan's NDC also aims for 60% of energy production to be renewable by 2030, roughly double the renewable mix from the time of writing. The NDC also calls for 30% of new vehicles to be electric by 2030. These external factors will allow the Project to reduce emissions further following its transition to the grid after year 15. • There are no further sector-specific climate change policies for Pakistan or Balochistan at the time of writing.	
SC3: Is the Project inconsistent with global sector-specific decarbonization pathways in line with the Paris Agreement mitigation goals, considering countries' common but differentiated responsibilities and respective capabilities?	Sector-specific decarbonization pathways may include sector roadmaps developed by international organizations (e.g., the International Energy Agency), academia, or industry associations23. Sector scenarios provide estimates in terms of emission thresholds that could also inform the assessment, as applicable. Global studies should be applied to the country context. Countries are at different stages of development and have different resources and capacities that may affect their ability to decarbonize their economies in line with global pathways. As a result,	• Sector Specific Guidance from the International Copper Association's (ICA) Pathway to Net Zero (ICA, 2023) commits members to Net Zero by 2050. • Further ICA guidance provides estimates of possible abatement within the sector, estimating 18-30% reduction from 2018 levels are possible. However, due to factors that vary across regions, these values should not be used as a benchmark. • This is consistent with Barrick Gold's published GHG emissions reduction target of 30% reduction by 2030, and their proven track record of increasing efficiencies and reducing emissions throughout all operations. This is further evidenced by the planned reduction of HFO energy production and switch to the national grid after Project year 15, which will utilise increased renewable energy as per Pakistan's NDC.	No

	an operation that would be deemed inconsistent in one country context might be deemed consistent in another context.	• Therefore, the Project is not inconsistent with global sector-specific guidance.	
SC4: Does the Project prevent opportunities to transition to Paris-aligned activities, OR primarily support or directly depend on non-aligned activities in a specific country/sectoral context?	Through comparison with low-carbon alternatives, assess the risk of creating lock-in or preventing future deployment of Paris-aligned activities and impacting the likelihood of achieving the low-GHG transition. Can be informed by relevant low-GHG development pathways or other studies.	• The Project enables low-carbon alternatives by contributing to the global supply of copper, a transition metal • Copper is a necessary transition metal used in the manufacture of solar panels and internal combustion engines in hybrids and EVs • As decarbonisation continues, further availability of EVs and renewable energy purchased through the grid will allow the project to avoid carbon lock-in.	No

6. Methodology

6.1. Climate Background

To assess projected trends in climate and adequately assess future climate risk, it is necessary to look at global climate models such as the Coupled Model Intercomparison Project Phase 6 (CMIP6). CMIP6 is overseen by the World Climate Research Program, and informs the World Bank's (2024) climate projections, as well as IPCC Assessment Reports. The CMIP6 dataset considers five Shared Socio-economic Pathways (SSPs), each representing different potential emissions scenarios in relation to different global climate change responses. The SSPs, with their varied development paths, mitigation efforts, and defined emission trends are detailed in Table 6-1.

Further climate analysis for the Project were determined using SSP2-4.5 and SSP5-8.5.

Table 6-1: SSP Emissions Pathways and Temperature Increases (IPCC, 2021)

Name	Scenario	Emissions	Projected Temperature Increase by 2050	Projected Temperature Increase by 2100
SSP1-1.9	Sustainable development resulting in radiative forcing of 1.9 Wm^{-2} by 2100.	CO_2 emissions cut to net zero by 2050 (meets Paris Agreement).	1.6	1.4
SSP1-2.6	Sustainable development resulting in radiative forcing of 2.6 Wm^{-2} by 2100.	Low emissions but not cut as fast as SSP1-1.9. CO_2 emissions cut to net zero around 2075.	1.7	1.85
SSP2-4.5	Middle-of-the-road development resulting in radiative forcing of 4.5 Wm^{-2} by 2100.	Intermediate emissions. CO_2 emissions around current levels until 2050, then falling but not reaching net zero by 2100.	2.1	2.8
SSP3-7.0	Regional rivalry resulting in radiative forcing of 7 Wm^{-2} by 2100.	High emissions. CO_2 emissions double by 2100.	2.2	3.7
SSP5-8.5	Fossil-fuel led development resulting in radiative forcing of 8.5 Wm^{-2} by 2100.	Very high emissions: CO_2 emissions triple by 2075.	2.5	4.5

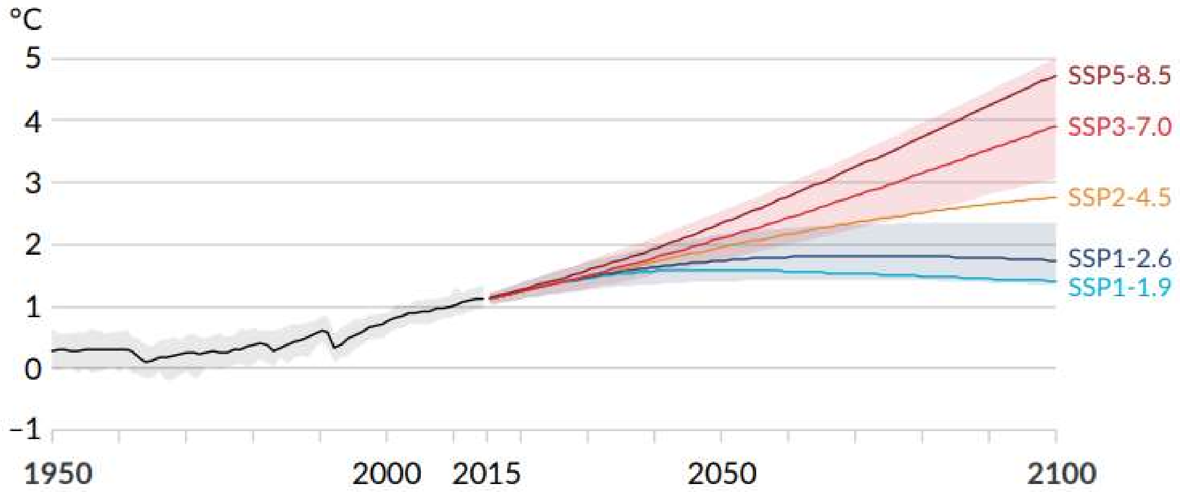

Figure 6-1: Global Surface Temperature Changes Under Different SSP Scenarios
(IPCC, 2021)

When reviewing emissions scenarios, the 'climate time lag' must be considered. The climate time lag refers to delays between the time when emissions are released into the atmosphere and when the Earth's temperature responds to those emissions (Mulhern, 2020). The climate time lag is influenced by processes that regulate the earth's temperature such as ice sheets and the movement of heat in oceans.

It is important to note that due to the 'climate time lag' within the atmosphere, temperature changes over the coming decades are a result of historic emissions, and therefore current and future emissions associated with the five SSP scenarios only begin diverging over the longer-term in approximately 2050 (Figure 6-1) (Mulhern, 2020). This delay therefore means the difference between the scenarios is minimal in the beginning of the Project, but becomes increasingly noticeable towards 2050 and thereafter. Two scenarios were selected during this analysis to provide a scale of potential changes the Project may face. Projected rates are calculated through 2070 to account for a 38-year LoM, while projections are also provided through the end of the century consider any variance in the LoM and the existence of permanent infrastructure such as TSFs. The SSP2-4.5 scenario represents a similar emissions path to what is currently taking place across the globe, while the SSP5-8.5 is based on a high emissions pathway, providing a worst-case scenario to ensure the Project is prepared for the majority of potential risks.

6.1.1. Climate Data Collection

Data were collected and analysed to provide regional and historical context and assess the baseline climate and future climate change projections in the Project region. Climate data were obtained using the methodology listed in Table 6-2 below.

Table 6-2: Climate Change Background Data Methodology

Baseline Section	Data Source and Methodology

Current Regional Climate	Current climate conditions (temperature, precipitation, seasonality) were assessed for using averaged regional data from 1991-2020 accessed from the World Bank Climate Change Knowledge Portal (CCKP) (2024). Climate forcing mechanisms were assessed via a literature review.
Historical Regional Climate Trends	Historic trends in temperature and precipitation were assessed using regional ERA5 data and trend analysis accessed for the 1950-2020 period via the World Bank CCKP (2024), with rates of change analyzed from the period 1971-2020.
Future Climate Change Projections	Projected changes in climate were assessed using data provided by the Coupled Model Inter-Comparison Project (CMIP) Phases 5 and 6, accessed via the World Bank CCKP (2024) and The Swedish Meteorological and Hydrological Institute Climate Information Portal (SMHI, 2023), and NASA's Sea Level Projection Tool (NASA, 2024). CMIP6 projections were given priority whenever available. Flood hazard projections, calculated as projected water discharge rates across 10- and 50-year return periods, were calculated from CMIP5 data which was bias adjusted using HydroGFD2.0 data, then fed into the WW-HYPE global hydrological impact model. Data were assessed using a modeled baseline period, along with projections across various time horizons spanning to 2100. Change rates were assessed by comparing baseline values to each future time horizon. Data was assessed across two emissions scenarios, SSP2-4.5/RCP4.5 and SSP5-8.5/RCP8.5. To ensure gridded CMIP baseline and projection data are locally applicable, modelled baseline precipitation values were compared to observed weather station data from Nok Kundi using a Pearson Correlation Coefficient. This comparison is described in detail in Section 7.3.2.1.
Extreme Events	Historical statistics on extreme weather events were collected using country-wide data from 1980-2020 via the World Bank CCKP (2024) and an additional literature review.

6.2. Determining Greenhouse Gas Emissions

The GHG emissions were calculated in line with the following reference documents:

- The Greenhouse Gas Protocol's *A Corporate Accounting and Reporting Standard (Revised Edition)* (Greenhouse Gas Protocol, 2015); and
- The 2006 Intergovernmental Panel on Climate Change (IPCC) *Guidelines for National Greenhouse Gas Inventories* (IPCC, 2006).

To ensure that stakeholders are well informed on the Project's GHG emissions, it is important that calculations are relevant, complete, consistent, accurate and transparent. Figure 6-2 depicts the overall process for determining the Project's GHG emissions.

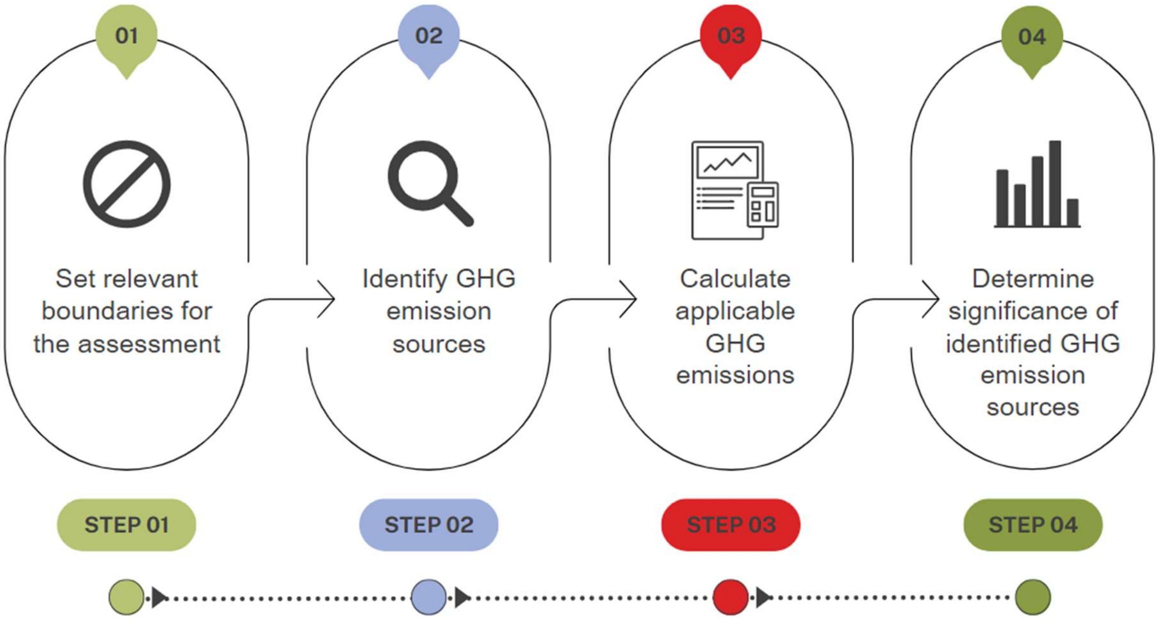

Figure 6-2: Approach to GHG Assessment

6.2.1. Scope 1 and Scope 2

Alignment with IFC PS and the Greenhouse Gas Protocol requires that direct (scope 1) and energy indirect (scope 2) emissions be considered (Greenhouse Gas Protocol, 2015).

The generalized equation used to calculate the total GHG emissions for a source is as follows:

$$GHG\ Emissions = Activity\ data * Emission\ Factor * \ Global\ Warming\ Potential$$

- **Activity data** is the measure that describes the activity being completed by the source. For example, the amount of fuel combusted in a generator would be considered the activity data for a generator.
- **The emission factor** is a conversion factor that relates the activity data to the associated emissions. In some cases, these are calculated according to the stoichiometry of a chemical reaction, such as a combustion process. In other cases, it can be determined allometrically by measuring the amount of GHG emissions generated per unit of the activity data. Barrick has in internal list of emission factors which was used to ensure consistency when comparing this project to other Barrick projects.
- **The global warming potential** is used to equate an amount of a given GHG to an equivalent amount of CO_2. It is specific to each GHG. It represents the amount of CO_2

that would need to be released to have the same warming effect on the atmosphere as the specific GHG.

The emissions were calculated for the Project life, across the construction and operation phases. The annual average GHG emissions over the LoM were compared to the national emissions for Pakistan to providing context to the scale of the GHG emissions.

As this project is located in a desert, land clearing emissions were considered negligible.

6.2.2. Scope 3

Scope 3 GHG emissions account for all indirect emissions within a company's value chain. Scope 3 assessment are typically performed companywide for companies that have a good understanding of their scope 1 and scope 2 GHG emissions. It is uncommon to project the scope 3 GHG emissions for single projects. This is due to there being limited certainty in the upstream and downstream value chains.

As with scope 1 and scope 2 calculations, defining the organizational boundaries and identifying relevant scope 3 emission sources is the first step. Emission factors for the various sources are determined. Relevant activity data is then used to calculate the scope 3 GHG emissions.

Due to the uncertainty in the upstream and downstream value chains, only four categories of scope 3 emissions have been considered. These collectively contribute approximately 95% of the total scope 3 GHG emissions for Barrick (Barrick, 2024). These are:

- Category 1: Purchased goods and services;
- Category 2: Purchased capital goods;
- Category 3: Fuel- and energy-related activities
- Category 10: Downstream processing of sold product

The methodology used to calculate the scope 3 GHG emissions was matched to the methodology used by Barrick in its annual reporting. The category 1 and 2 GHG emissions for the project were calculated using Barricks reported category 1 and 2 GHG emissions as follows:

$$Cat\ 1\&2 = Group\ Cat\ 1\&2 \times \frac{Group\ Copper\ Revenue}{Group\ Revenue} \times \frac{Forecast\ Copper\ production}{Group\ Copper\ production}$$

The category 3 GHG emissions were calculated using well-to-tank (WTT) emission factors published by DEFRA (DEFRA, 2023). WTT emission factors account for all GHG emissions up until the point of use of a fuel. Similarly, the emission factor for the category 10 GHG emissions were taken from a case study on copper production in China (Liu, Xiang, Cao, & li, 2022).

6.2.3. Alternatives Analysis

The IFC PS and the Equator Principles (EP AP II) require that alternatives be investigated to reduce project-related GHG emissions and that those deemed to be "technically and financially feasible and cost-effective" be implemented. Barrick has already undergone a review of various alternatives which will be discussed in this report.

6.3. Project-wide Climate Change Risk and Vulnerability Assessment

This CCRVA was conducted in line with the principles of the International Finance Corporation's (IFC) *Performance Standards on Environmental and Social Sustainability* as well as the Equator Principles. This includes identifying both the physical and transition risks as the Project is expected to emit more than 100,000 tCO_2e annually.

6.3.1. Transition Risk

Transition risks arise as a result of the speed and scale of transitioning to a low carbon state associated with changes in policies/laws, markets, technology and reputation. When emissions are cut drastically or abruptly, transition risks increase. These changes put a business-as-usual approach at risk. The mining sector will be required to make significant changes in the types of assets used and how business and operations are conducted.

Transition risks were assessed based on risk classifications as defined by the TCFD, including risks related to policy and legal considerations, technological advances, changes in markets, and reputational risks. The transition risk assessment was guided by changes projected under 2°C or lower scenarios such as the International Energy Agency (IEA) Net Zero by 2050 scenario (IEA, 2021), as well as SSP1-2.6 (IPCC, 2021).

The transition risks considered are:

- Increased pricing of GHG emissions through mechanisms such a carbon tax in operating countries, which essentially increases operational costs;
- Enhanced emissions-reporting obligations;
- Policy and regulatory changes linked to climate change considerations, as well as the timelines linked to such changes;
- Repricing of high emission assets;
- Substitution of existing equipment with lower emissions options may result in write-offs, early retirement of assets thereby increasing capital costs; and
- Time required to develop sustainable energy infrastructure.

The transition is reliant on Projections based on emissions trajectories and is therefore not quantitative nor exact. Rather, it aims to highlight the potential risks for a company to ensure that it implement measures to mitigate and adapt to these potential risks.

6.3.2. Physical Risk

The IPCC considers physical climate risk and associated impacts as a function of hazards, exposure and vulnerability (comprising sensitivity and adaptive capacity) (Figure 6-3).

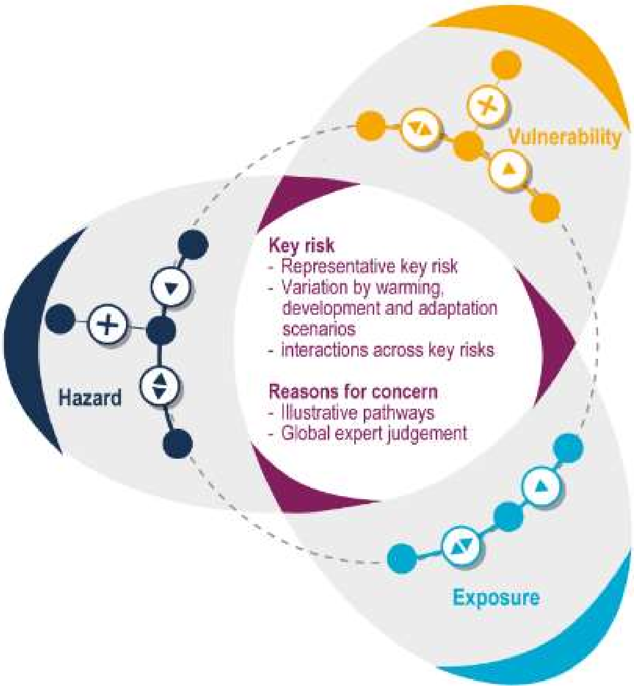

Figure 6-3: IPCCs Climate Risk Framework in AR6 (IPCC, 2022)

Generally, *physical risk* impacts operations at the 'site level'. Global Climate Models (GCM) are used to identify projected changes in climate and therefore possible hazards (e.g., flooding). These are then considered in conjunction with exposure (e.g., infrastructure in an area prone to floods) and vulnerability information (e.g., presence of stormwater management infrastructure).

In this report, the following data was utilised:

- **Hazards:**
  - **Climate Change Projections:** Downscaled CMIP5 and CMIP6 data was utilised for quantitative hazard analysis from the following sources:
    - The World Bank's Climate Change Knowledge Portal (2024), which provides regionally specific CMIP6 climate projections;
    - The Swedish Meteorological and Hydrological Institute Climate Information Portal (SMHI, 2023), which provides regionally specific CMIP5 and CMIP6 climate projections; and
    - NASA's Sea Level Projection Tool (NASA, 2024), which provides sea level rise projections using CMIP6 climate projections.

- **Additional Hazard Data:** Additional hazard data utilised to extreme events were extracted and reviewed using the following sources:
  - Aqueduct which is an open-source tool that maps water risks (floods, droughts, water scarcity, etc.), developed by the World Resources Institute (WRI, 2024); and
  - The Global Facility for Disaster Reduction and Recovery's Think Hazard tool (GFDRR, 2020), which assesses and maps the risks of climate hazards in countries, provinces and districts.
- **Exposure, sensitivity and adaptive capacity**: These were determined based on location and design plans, including:
  - Topographical data;
  - Proximity to rivers and coastal areas; and
  - Infrastructure layout maps.

6.3.2.1. Quantitative Physical Risk Determination

Climate change and the associated projections are dynamic and complex. Due to these complexities, the challenge of assessing risks of climate change is not well bounded, they are often assessed differently and involve many uncertainties (IPCC, 2021). This quantification of risk therefore serves as a scale to identify and prioritise various risks that the Project may face, rather than a rigid scientific quantification process.

Informed by industry best practice, Digby Wells used the IPCC Sixth Assessment Report (AR6) risk framework, over other available risk frameworks, due to its specific focus on climate risks. The following calculation was used as a baseline for providing a quantitative physical risk score:

$$Risk = Hazard * \ Exposure * \ Vulnerability$$

Assessing vulnerability as a single quantitative score is a complex process, and runs the risk of oversimplifying the Project's vulnerability to risk. To best determine vulnerability scores, Digby Wells determined vulnerability indices as a product of the Project's sensitivity to risk and adaptive capacity. Therefore, the finalised calculation was used to determine quantitative physical risk scores.

$$Risk = Hazard * \ Exposure * \ (Sensitivity - Adaptive\ Capacity)$$

Scores were assigned to each of the components and were quantified as indicated in Table 6-4. The resultant risk sores were then categorised according to Table 6-3.

Table 6-3: Risk Scoring

Negligible	Low	Medium	High	Very High
1-2	3-4	5-6	7-8	9-10

Table 6-4: Physical Risk Quantification Methodology

Aspect	Definition (IPCC)	Scores	Methodology
Hazard	The potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.	**1 - 10** 1 – lowest hazard 10 – highest hazard	For hazards where quantitative scoring was possible, each score was calculated by determining the percentage change of the hazard from the baseline period to a time horizon that includes the 38-year LoM and buffer years for decommissioning (2070). Scores were assigned using the following thresholds, a change larger than 100% was capped at 10: • <0% = 0 • 0-10% = 1 • 11-20% = 2 • 21-30% = 3 • 31-40% = 4 • 41-50% = 5 • 51-60% = 6 • 61-70% = 7 • 71-80% = 8 • 81-90% = 9 • 91-100+% = 10 The justification and source of each quantitative hazard score is listed in Appendix A.
Exposure	Refers to the presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected.	**0 or 1** 0 – not exposed 1 – exposed	This score quantifies whether the site is exposed to the identified hazard or not. Hazards that the operation will not be exposed to were screened out and excluded to ensure brevity.
Sensitivity	Refers to the level of responsiveness to changes in physical climate hazards. It involves the ability to	**0, 0.5 or 1**	Operations may be exposed to particular climate hazards but may not be sensitive to them.

Aspect	Definition (IPCC)	Scores	Methodology
	recognise, assess and respond to identified hazards and the potential impacts of it to an organisation's operations, assets and reputation. Physical climate risk sensitivity is influenced by a company's risk appetite, the level of awareness to physical climate risks as well as risk management processes.	0 – no sensitivity 0.5 – medium sensitivity 1 – high sensitivity	0 Defines sensitivities that may have a minimal/ zero effect on operations/assets/workers; 0.5 Defines sensitivities that may result in effects to cost and operational efficiencies; and 1 Defines sensitivities that may result in an incident (e.g. injuries, work stoppages).
Adaptive capacity	Refers to the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.	**0, 0.5 or 1** 0 – no adaptive capacity 0.5 – medium adaptive capacity 1 – high adaptive capacity	As the vulnerability of the element under review is determined by the sensitivity and adaptive capacity, adaptive capacity has the ability to reduce the vulnerability to the climate hazard. Pre-adaptation and post-adaption scores are provided. 0 No interventions or adaptations; 0.5 Adaptive measures planned but there is room for improvement; and 1 Little to no room for improvement to feasible adaptive measures

6.3.2.2. *Qualitative Physical Risk Determination*

Adequate quantitative hazard data is not available for all hazard types. Therefore, some hazards were discussed qualitatively by assessing hazards, exposure, and vulnerability using best-available data.

6.4. Integration with Specialists

An integration workshop was held to review the climate change projections with ESIA specialists. Using information provided in the workshop, specialists assessed which impacts may be exacerbated by climate change. Where additional climate change considerations were necessary, specialists adjusted the mitigation measures and management plan inputs accordingly.

In line with the GISTM requirements, this includes the material impacts that the TSF could have on social, environmental, and local economic aspects, considering climate change as per GISTM Principle 3.3. Climate change considerations and adjusted mitigation measures relating to the TSF were then compiled from each specialist assessment.

Table 6-5: GISTM Principle 3.3

GISTM Principle 3.3	Use all elements of the knowledge base - social, environmental, local economic and technical - to inform decisions throughout the tailings facility lifecycle, including closure
For **new** tailings facilities, use the knowledge base, including uncertainties due to climate change, to assess the **social, environmental, and local economic impacts** of the tailings facility and its potential failure **throughout its lifecycle**. Where impact assessments predict material acute or chronic impacts, the Operator shall develop, document, and implement impact mitigation and management plans using the mitigation hierarchy.	

7. Climate Background

To best assess climatic data across the various aspects of the Project layout, climate trends and projections were assessed for three points, as shown in Figure 7-1 below:

- **Point A**: Covering the Reko Diq Mine;
- **Point B**: Representing an area along the railway from Reko Diq Mine to Port Qasim, which has historically experienced damage from flooding; and
- **Point C**: Covering PIBT at Port Qasim.

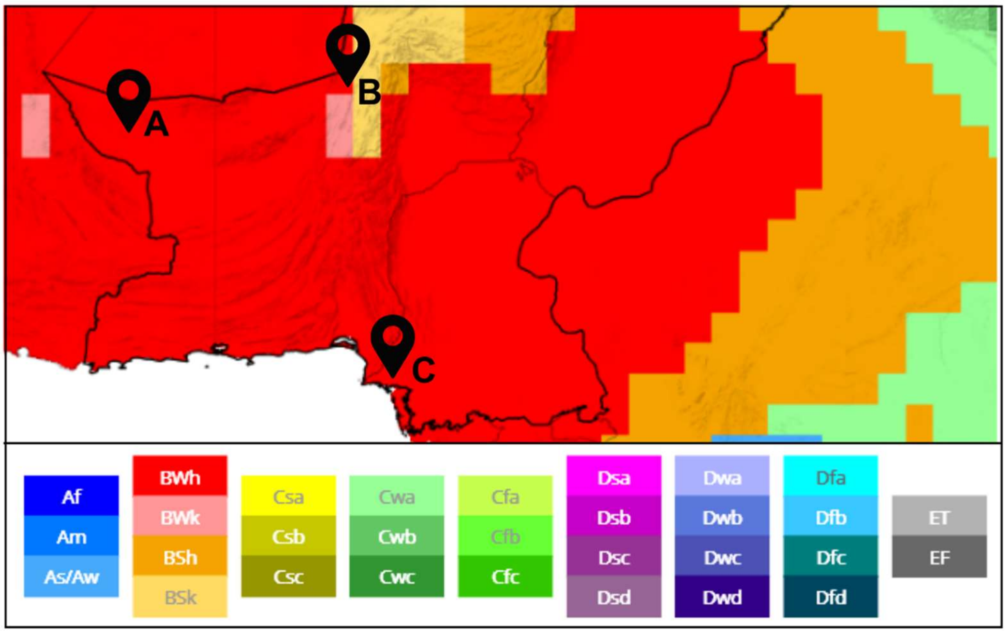

Figure 7-1: Köppen-Geiger Climate Classification of Reko Diq Mine (A), Railway near Nushki (B), and PIBT (C)
Image adapted from The World Bank **(2024)**

According to the Köppen-Geiger Climate Classification, a system used to inform general climate conditions based on local vegetation, temperature patterns, and seasonal precipitation, all three of the areas assessed are classified as a hot desert climate zone (BWh classification). Hot desert climates are characterised by Pidwirny (2021) as:

- **Warm temperatures:** Warm to hot temperatures year-round, with average temperatures of more than 18°C, with minimum temperatures rarely dipping below 0°C during winter months;
- **Low rainfall:** Irregular rainfall totalling less than 250mm annually;
- **Arid:** Rainfall accounts for less than 50% of the evapotranspiration potential of the area, leading to high aridity;
- **Sunny:** BWh climates receive more sunshine than any other classification; and
- **Windy:** High levels of wind during daytime.

The railway portion of the Project passes through three additional climate classifications, the cold desert climate (BWk), the hot semi-arid climate (BSh) and the cold semi-arid climate (BSk). These areas tend to reach colder temperatures and/or experience more rainfall than the hot desert climates. Therefore, the northern portions of the railway may experience less extreme heat and more precipitation-based hazards than the rest of the Project footprint. The impact of these additional climate classifications was determined to be immaterial due to the small proportion of the overall Project footprint that passes through each zone.

7.1. Current Regional Climate

The following section provides context on the current regional climate across all Project areas. Table 7-1 and Figure 7-2 outline the historical and observed climate data from 1991 to 2020 in the Balochistan Province (covering the mine site and chosen portion of the railway) and the Sindh Province (covering PIBT at Port Qasim) (The World Bank, 2024).

Table 7-1: Annual Average Climatic Conditions in the Balochistan and Sindh Provinces

(Reference Period 1991 to 2020) (The World Bank, 2024)

Annual Average Climate Variables	Balochistan Province (Mine Site, Railway Point)	Sindh Province (PIBT at Port Qasim)
Minimum Temperature	15.32°C	19.76°C
Mean Temperature	22.42°C	27.24°C
Max Temperature	29.57°C	34.76°C
Mean Annual Precipitation (MAP)	155.29mm	158.22mm

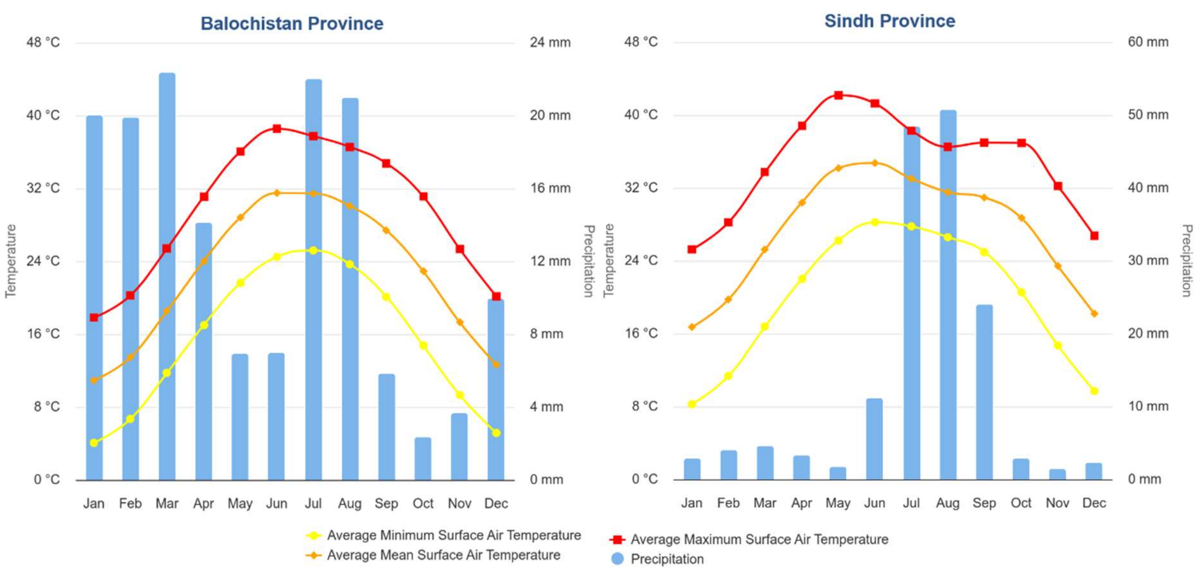

Figure 7-2: Monthly Average Temperature and Precipitation for Balochistan and Sindh Provinces, Pakistan

(Reference Period 1991 to 2020) (The World Bank, 2024)

The climate in Pakistan is primarily influenced by the El Niño Southern Oscillation (ENSO) (The World Bank, 2021) and the South Asian Summer Monsoon (SASM).

ENSO periods impact the annual variability of precipitation in Pakistan (The World Bank, 2021). ENSO, referred to as El Niño, is a dominant earth climate condition which significantly impacts global energy balances, affecting climate dynamics and predictions (Lin & Qian, 2019). During the warm phase of ENSO periods, tropical Pacific Ocean temperatures are significantly higher than average, which impacts global circulation and precipitation patterns. ENSO causes anomalies in flood occurrence, temperature fluctuations, and droughts in Pakistan (The World Bank, 2024). During periods of El Niño, Pakistan experiences lower rainfall and drought conditions, while during La Niña, the country experiences increased rainfall (Anwar, 2021).

Precipitation in Pakistan is also guided by the SASM, a monsoon system characterised by westerly winds (westerlies) and increased precipitation and summer monsoons throughout South Asia. In Pakistan, the SASM tends to have high inter-annual variability, causing summer monsoons that are difficult to predict, causing challenges for businesses and livelihoods (Ali, Reboita, & Kiani, 2021). Recent historic trends and CMIP6 projections indicate that the SASM is weakening, causing increased summer precipitation and weakened westerly winds (Luo, Wang, He, Chen, & Yang, 2024).

7.2. Historical Regional Climate Trends

Examining previous climate trends helps to improve the understanding of regional climate system dynamics and inform climate projections and potential risks. The following trends for the Balochistan and Sindh Provinces have been observed over the last few decades (Table 7-2) and are explained below.

Table 7-2: Provincial Climate Trends from 1971 to 2020

(The World Bank, 2024)

Climate Variable	**Balochistan Province** (Mine Site, Railway Point)		**Sindh Province** (PIBT at Port Qasim)	
	Rate of Change (Significance[3])	**Trend**	**Rate of Change (Significance)**	**Trend**
Mean Annual Minimum Temperature	+ 0.028°C / year **(100%)**	↗	+ 0.022°C / year **(100%)**	↗
Mean Annual Temperature	+ 0.031°C / year **(100%)**	↗	+ 0.011°C / year **(99%)**	↗
Mean Annual Maximum Temperature	+ 0.033°C / year **(100%)**	↗	+ 0.004°C / year (58%)	↗
Number of Frost Days (<0°C)	- 0.092 days / year **(96%)**	↘	No Frost Days	→
Mean Annual Precipitation	+ 0.138 mm / year (11%)	→	+ 0.693 mm / year (55%)	↗
Maximum Consecutive Wet Days	- 0.001 days / year (7%)	→	+ 0.022 days / year (62%)	↗
Maximum Consecutive Dry Days	+ 0.071 days / year (12%)	→	- 0.328 days / year (88%)	↘

Statistically significant increase in temperature: Mean annual temperatures have increased from 1971 to 2020 at statistically significant rates, rising by 0.03°C annually in the Balochistan Province, and by 0.03°C annually in the Sindh Province (Figure 7-3 and Figure 7-4 below). Minimum temperatures have increased by at least 0.02°C annually in both Provinces during the same period, while maximum temperatures only increased by a statistically significant rate of 0.03°C per year in the Balochistan Province. The Balochistan Province also experienced a small but statistically significant decrease in days with minimum temperatures below freezing, decreasing by 0.09 days per year from 1971-2020. Overall, temperature increases have been greater in the Balochistan Province compared to the Sindh Province.

[3] Using a significance threshold of 95%, values that are considered statistically significant are designated in bold font.

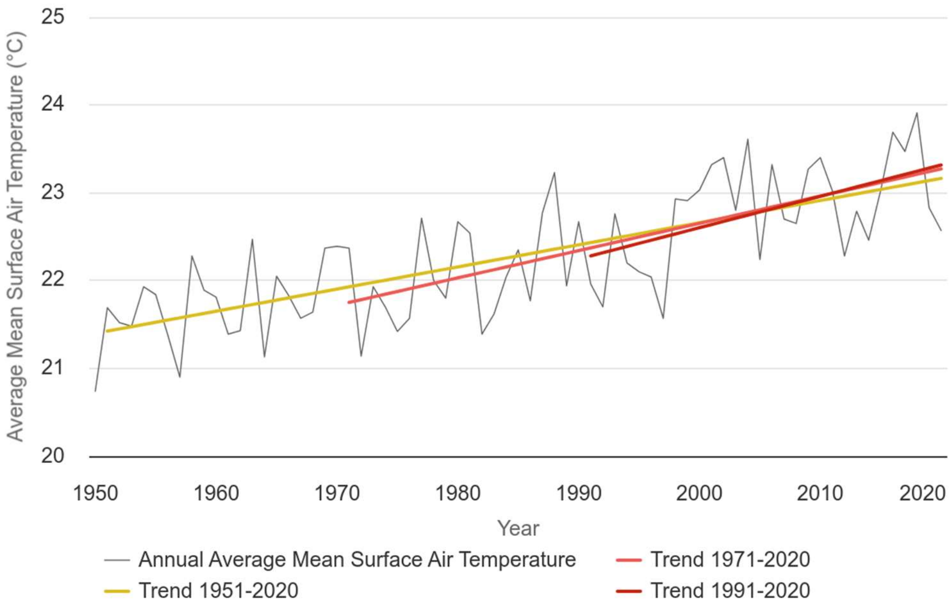

Figure 7-3: Mean Annual Surface Temperature Trends, Balochistan Province
(The World Bank, 2024)

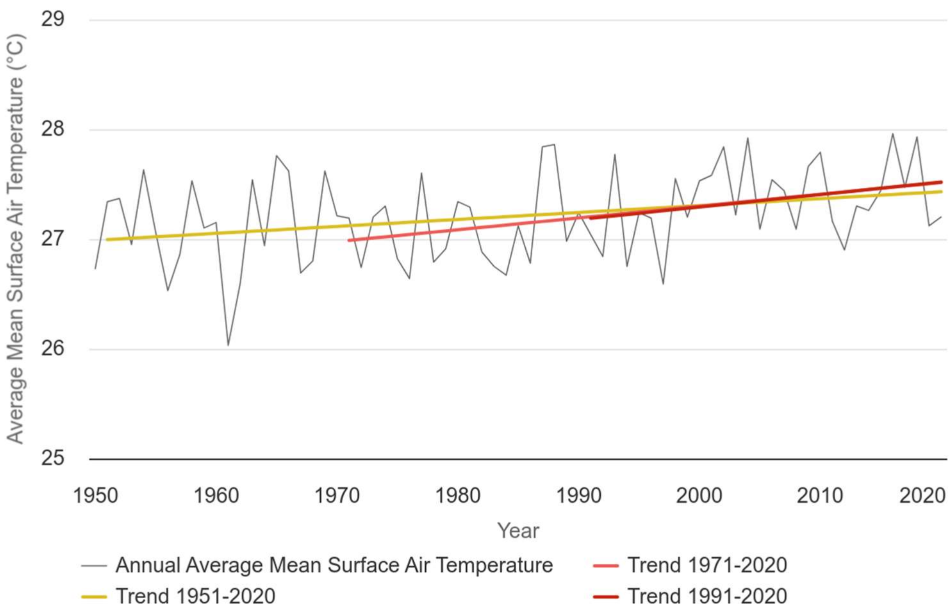

Figure 7-4: Mean Annual Surface Temperature Trends, Sindh Province
(The World Bank, 2024)

Consistent precipitation in Balochistan Province: There were no statistically significant trends in mean annual precipitation (Figure 7-5), wet periods, or dry periods in the Balochistan Province from 1971 to 2020.

Slight increase precipitation in Sindh Province: While no precipitation trends in the Sindh Province hold statistical significance from 1971 to 2020, a slight increase in precipitation and consecutive wet days was observed alongside a decrease in the duration of dry periods. Mean annual precipitation during this period increased by 0.69 mm per year (Figure 7-6), while wet periods increased in duration by 0.02 days per year and dry periods decreased in duration by 0.33 days per year.

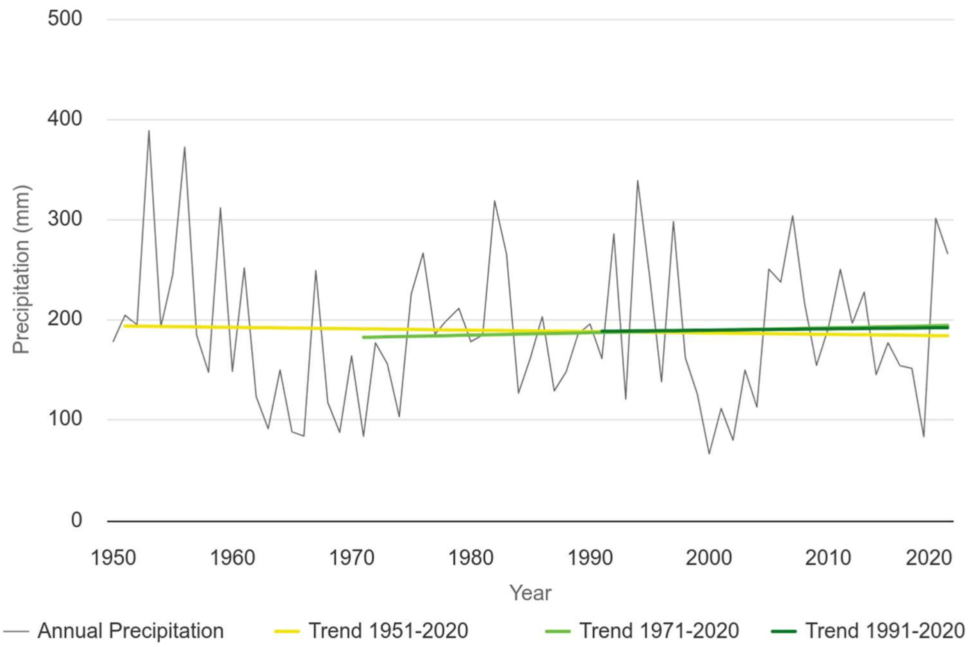

Figure 7-5: Mean Annual Precipitation Trends, Balochistan Province
(The World Bank, 2024)

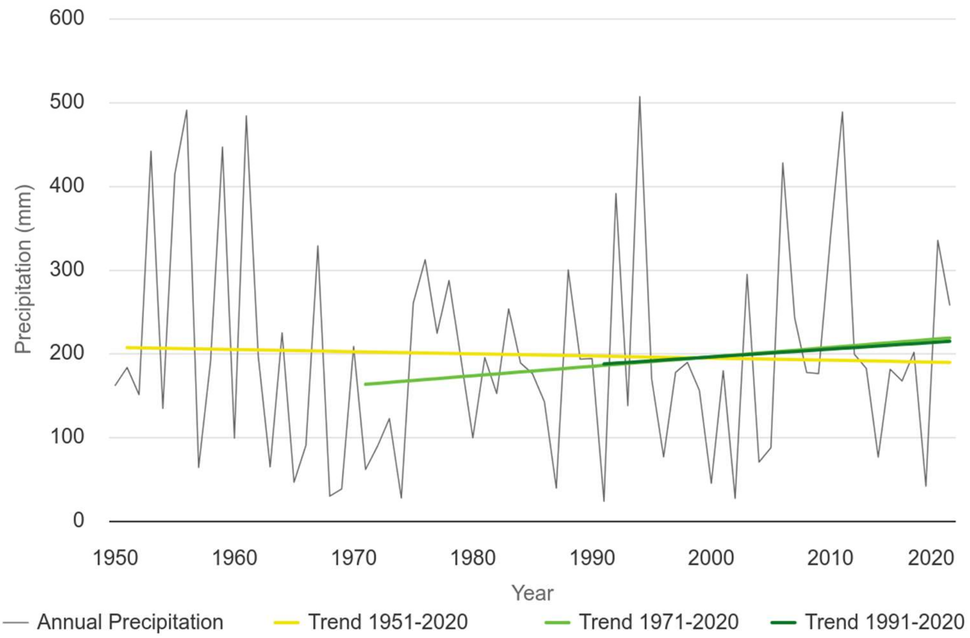

Figure 7-6: Mean Annual Precipitation Trends, Sindh Province
(The World Bank, 2024)

7.3. Future Climate Change Projections

The following climate projections are based on CMIP6 or the earlier CMIP5 data, sourced from The Climate Information Portal (2023) and The World Bank (2024) unless otherwise stated.

Projections can be read for each climate variable by comparing the value in each location's baseline column to the projected value within each time horizon column across both emission scenario rows. Projected values are given as a change (either absolute or percentage) from the historical baseline, and do not compound between each time horizon.

7.3.1. Temperature Projections

Table 7-3 below compares temperature variables for the three selected Project areas across two emissions scenarios, SSP2-4.5/RCP4.5 and SSP5-8.5/RCP8.5. When compared to a historical baseline, all temperature variables are projected to increase across each future time-period under both scenarios.

Table 7-3: Temperature Projections*
(SMHI, 2023; The World Bank, 2024)

Climate Variable	Scenario	Point A: Reko Diq Mine					Point B: Railway Near Nushki					Point C: PIBT at Port Qasim				
		Baseline (1981-2010)	2011-2040	2041-2070	2071-2100	Trend	Baseline (1981-2010)	2011-2040	2041-2070	2071-2100	Trend	Baseline (1981-2010)	2011-2040	2041-2070	2071-2100	Trend
Mean Temperature[4] (SMHI, 2023)	SSP2-4.5	22.98°C	+ 1.09°C	+ 2.11°C	+ 2.94°C	↗	18.37°C	+ 0.95°C	+ 1.97°C	+ 2.64°C	↗	26.91°C	+ 0.72°C	+ 1.59°C	+ 2.25°C	↗
	SSP5-8.5		+ 1.25°C	+ 2.86°C	+ 5.11°C	↗		+ 0.98°C	+ 2.76°C	+ 4.95°C	↗		+ 0.70°C	+ 2.09°C	+ 3.77°C	↗
Minimum Temperature[5] (SMHI, 2023)	SSP2-4.5	-3.57°C	+ 0.77°C	+ 1.43°C	+ 1.74°C	↗	-7.04°C	+ 0.55°C	+ 1.46°C	+ 1.81°C	↗	9.80°C	+ 0.89°C	+ 1.53°C	+ 1.87°C	↗
	SSP5-8.5		+ 0.78°C	+ 2.37°C	+ 3.25°C	↗		+ 0.736°C	+ 2.13°C	+ 2.91°C	↗		+ 0.65°C	+ 2.31°C	+ 3.88°C	↗
Maximum Temperature[6] (SMHI, 2023)	SSP2-4.5	44.49°C	+ 1.20°C	+ 2.40°C	+ 3.35°C	↗	39.48°C	+ 0.98°C	+ 2.16°C	+ 3.03°C	↗	42.48°C	+ 0.53°C	+ 1.59°C	+ 1.84°C	↗
	SSP5-8.5		+ 1.50°C	+ 3.37°C	+ 6.11°C	↗		+ 1.23°C	+ 2.92°C	+ 5.88°C	↗		+ 0.93°C	+ 1.90°C	+ 3.28°C	↗
Frost Days (Min Temp <0°C)[7] (SMHI, 2023)	SSP2-4.5	9.07 days	- 3.27 days	- 5.13 days	- 5.43 days	↘	36.57 days	- 8.63 days	- 15.23 days	- 18.83 days	↘	0.00 days	+ 0.00 days	+ 0.00 days	+ 0.00 days	→
	SSP5-8.5		- 2.97 days	- 5.83 days	- 7.50 days	↘		- 10.07 days	- 18.97 days	- 28.30 days	↘		+ 0.00 days	+ 0.00 days	+ 0.00 days	→
		Baseline (1995-2014)	**2020-2039**	**2040-2059**	**2060-2079**		**Baseline (1995-2014)**	**2020-2039**	**2040-2059**	**2060-2079**		**Baseline (1995-2014)**	**2020-2039**	**2040-2059**	**2060-2079**	
Extreme Heat Days (Max Temp >35°C)[8] (The World Bank, 2024)	SSP2-4.5	112.23 days	+ 13.78 days	+ 24.86 days	+ 34.24 days	↗	112.23 days	+ 13.78 days	+ 24.86 days	+ 34.24 days	↗	187.28 days	+ 14.16 days	+ 25.72 days	+ 35.10 days	↗
	SSP5-8.5		+ 15.27 days	+ 33.72 days	+ 53.82 days	↗		+ 15.27 days	+ 33.27 days	+ 53.82 days	↗		+ 14.54 days	+ 35.01 days	+ 52.87 days	↗

**Darker colour in Trend column indicates steeper trends.*

[4] Mean annual values of daily mean temperature averaged over a 30-year period.
[5] Minimum yearly values of daily minimum temperature averaged over a 30-year period.
[6] Maximum yearly values of daily maximum temperature averaged over a 30-year period.
[7] Annual average of days <0°C over a 30-year period.
[8] Annual days over 35°C, averaged over a 20-year period.

By 2070, mean annual temperature is projected to increase by at least 1.59°C under SSP2-4.5, and by at least 2.09°C under SSP5-8.5 at all locations. Mean temperature increases are projected to be the highest at the Reko Diq mine site, with the lowest change occurring at PIBT. Figure 7-7 below showcases projected average daily temperatures per month compared to the historic baseline at each location.

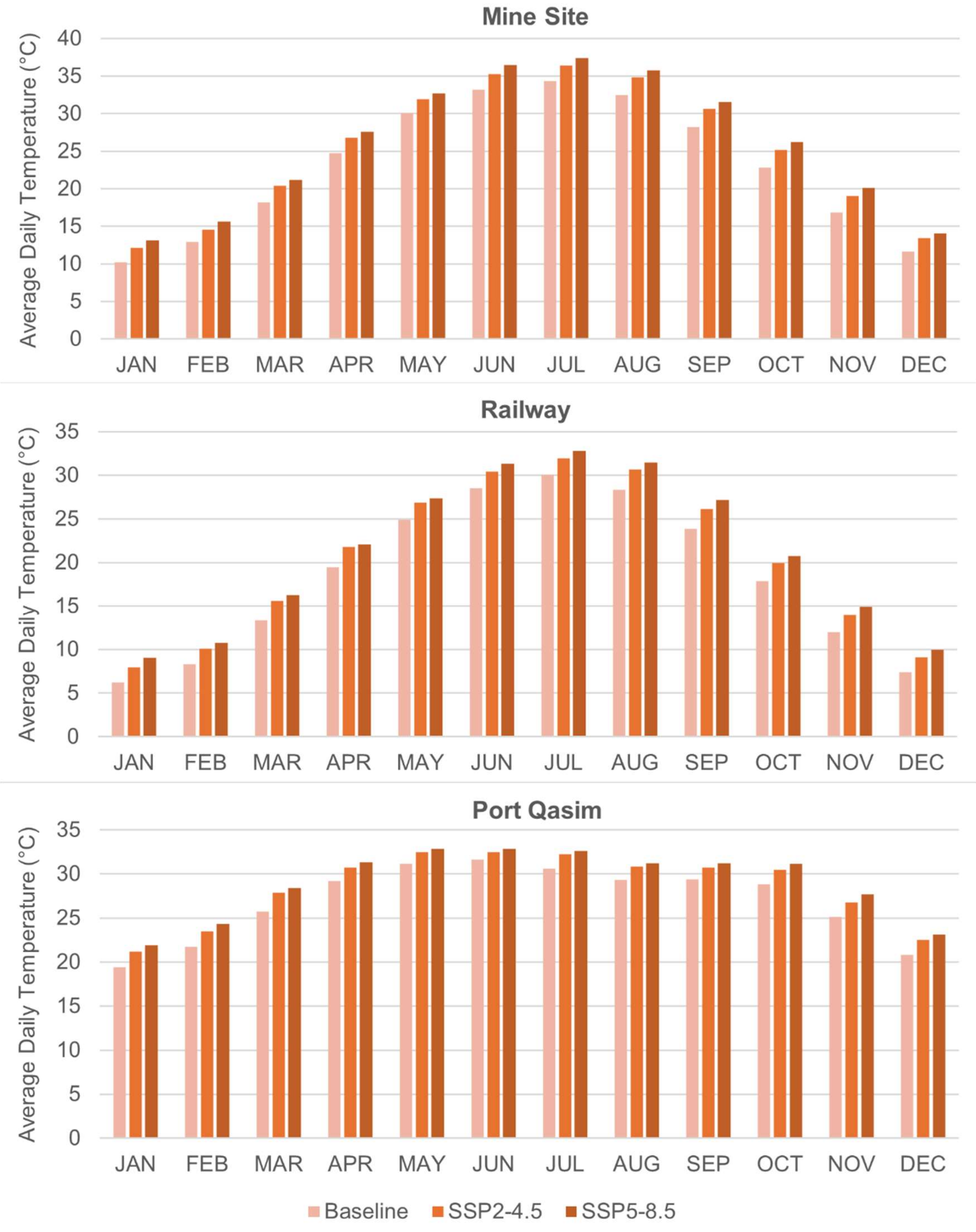

Figure 7-7: Average Daily Temperature Comparison of Baseline, SSP2-4.5, and SSP5-8.5 by 2070

Minimum and maximum temperatures at all locations are also projected to increase under both scenarios. Increases in maximum temperature are also projected to result in an increase in the number of hot days experienced within the region.

Extreme heat days, or days with maximum temperatures over 35°C, are expected to increase under both emissions scenarios at all locations studied. Under SSP2-4.5, extreme heat days are projected to increase by ~25 days by 2059 throughout all locations, and by ~34 days under SSP5-8.5 at all locations in the same time period. Most of the increase in heat days will be at the Reko Diq Mine Site and northern railway portions from March through May and August through October, while the Qasim Port will experience increases in extreme heat most during March and November.

While PIBT does not currently experience any frost days, or days with minimum temperatures below 0°C, frost days are projected to decrease at the Reko Diq Mine Site and along the northern railway portions. By 2070 under SSP2-4.5, frost days are projected to decrease by ~5 days per year at the Reko Diq Mine Site, and by ~15 days per year along the railway near Nushki. Under SSP5-8.5, frost days are projected to decrease by ~6 days per year at the Reko Diq Mine Site, and by ~19 days per year along the railway near Nushki during the same time period.

7.3.2. Precipitation Projections

Precipitation projections are an important tool for assessing the risks associated with extreme weather events such as floods, droughts, and storms. Table 7-4 below highlights the projections of various precipitation variables for the designated Project areas under the SSP2-4.5 and SSP5-8.5 scenarios. Variables are presented as a change from the historic baseline (1981-2010) across three future time periods.

Table 7-4: Precipitation Projections
(SMHI, 2023)

Climate Variable	Scenario	Point A: Reko Diq Mine					Point B: Railway Near Nushki					Point C: PIBT at Port Qasim				
		Baseline (1981-2010)	2011-2040	2041-2070	2071-2100	Trend	Baseline (1981-2010)	2011-2040	2041-2070	2071-2100	Trend	Baseline (1981-2010)	2011-2040	2041-2070	2071-2100	Trend
Mean Annual Precipitation[9]	SSP2-4.5	0.16 mm/day	+ 21.24%	+ 23.41%	+ 19.69%	↗	0.37 mm/day	+ 9.01%	+ 14.37%	+ 9.56%	↗	0.36 mm/day	+ 38.62%	+ 42.11%	+ 102.14%	↗
	SSP5-8.5		+ 22.80%	+ 29.69%	+ 34.30%	↗		+ 21.45%	+ 10.24%	+ 15.95%	↗		+ 49.01%	+ 73.17%	+ 80.69%	↗
10 Year Flood[10]	RCP4.5	16.36 m³/s	+ 129.97%	+ 88.68%	+ 168.24%	↗	69.16 m³/s	+ 27.91%	+ 33.42%	+ 32.48%	↗	179.60 m³/s	+ 53.70%	+ 53.86%	+ 41.09%	↗
	RCP8.5		+ 86.22%	+ 155.71%	+ 114.78%	↗		+ 29.41%	+ 25.31%	- 4.47%	↑↓		+ 35.67%	+ 39.83%	+ 121.30%	↗
50 Year Flood[11]	RCP4.5	30.09 m³/s	+ 123.85%	+ 86.39%	+ 158.56%	↗	120.27 m³/s	+ 26.40%	+ 33.46%	+ 30.20%	↗	297.04 m³/s	+ 52.09%	+ 49.67%	+ 31.55%	↗
	RCP8.5		+ 87.62%	+ 115.46%	+ 116.98%	↗		+ 34.77%	+ 23.11%	- 4.30%	↑↓		+ 37.19%	+ 37.14%	+ 103.56%	↗
Longest Dry Spell[12]	SSP2-4.5	618 days	- 10.14%	+ 0.47%	- 4.93%	↓↑	319 days	+ 0.67%	- 7.5%	+ 4.26%	↑↓	701 days	- 9.00%	- 21.97%	- 28.45%	↘
	SSP5-8.5		- 13.08%	+ 6.39%	- 3.31%	↓↑		- 3.13%	+ 4.37%	+ 0.34%	↓↑		- 23.02%	- 15.69%	- 17.99%	↘
Number of Dry Spells[13]	SSP2-4.5	112 periods	+4.63%	+ 11.11%	+ 12.93%	↗	188 periods	+ 0.51%	+ 3.55%	+ 1.53%	↗	67 periods	+ 14.93%	+ 31.34%	+ 46.00%	↗
	SSP5-8.5		+ 10.53%	+ 1.77%	+ 9.18%	↗		+ 5.99%	+ 3.30%	+ 1.09%	↗		+ 30.00%	+ 22.39%	+ 43.64%	↗

**Darker colour indicates steeper trends.*

[9] Mean annual daily precipitation values averaged over a 30-year period.
[10] 10 Year Return period of annual daily max water discharge, used to showcase 10-year flood recurrence.
[11] 50 Year Return period of annual daily max water discharge, used to showcase 50-year flood recurrence.
[12] Maximum number of consecutive dry days over a 30-year period.
[13] Number of dry periods 5 days or longer over a 30-year period.

Mean annual precipitation is projected to increase at all locations studied. Precipitation increases are projected to be most severe at PIBT, increasing by ~42% under SSP2-4.5 and by ~73% under SSP5-8.5 by 2070. This is followed by the Reko Diq Mine Site, with precipitation by 2070 projected to increase by ~23% under SSP2-4.5 and by ~30% under SSP5-8.5. Precipitation is projected to increase the least in the northern railway section near Nushki, showing an increase of ~14% under SSP2-4.5 and by ~10% under SSP5-8.5 by 2070. Precipitation at all locations is projected to increase the most during the months of July, August, and September. Monthly comparisons can be seen in Figure 7-8 below[14].

[14] Figure showcases ensemble median for each month. Models that were listed as having unreliable projections for each month were removed from the data before visualisation.

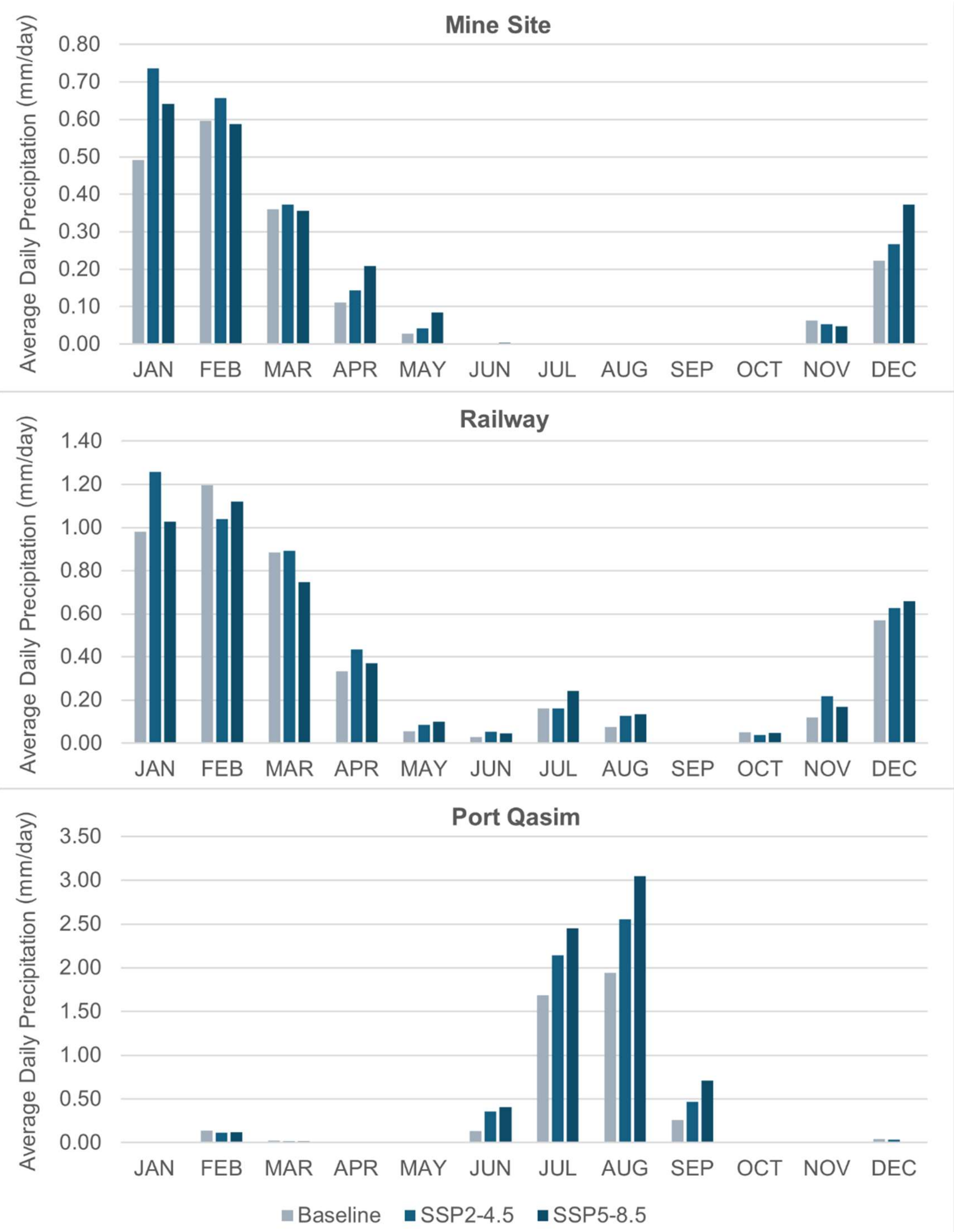

Figure 7-8: Average Daily Precipitation Comparison of Baseline, SSP2-4.5, and SSP5-8.5 by 2070

The projections show variability in future rainfall, therefore it is necessary to look at event-based rainfall projections to determine the impact that increased precipitation may have on the region. Water discharge rates, which can be used as an indicator of flooding in the Project regions, are increasing yet variable under both emissions scenarios. At the Reko Diq Mine Site and PIBT, 10- and 50-year flood rates are projected to increase under both scenarios across all timeframes. By 2070, 10- and 50-year flood intensity is projected to increase by

~86-88% under RCP4-5 and by ~115-155% under RCP8.5 at the Reko Diq Mine Site, and by ~49-54% under RCP4-5 and by ~37-40% under RCP8.5 at PIBT. At the railway location near Nushki, 10- and 50-year flood rates are projected to increase ~33% by 2070, but projections notably reverse by 2100 under RCP8.5, showing a ~4% decrease in both flood projections. Variations in precipitation and flood projections across time horizons and emissions pathways may be due to higher emissions pathways having higher evaporation rates, decreasing soil moisture and overall flood hazards. Monsoon intensity and consistency may also vary under different combinations of temperature and precipitation changes.

Projected increases in rainfall events, although variable, will contribute to a decrease in in the duration of dry spells at PIBT, while projects are too variable to make assumptions on the duration of dry spells at the Reko Diq Mine Site and railway location near Nushki. At PIBT, the longest consecutive dry periods are projected to decrease in duration by ~22% under SSP2-4.5 and by ~16% under SSP5-8.5 by 2070. Due to the arid nature of all regions studied, all Project areas will still experience drought periods. The number of dry spells for all studied locations are expected to increase under each emissions scenario and time horizon. The number of dry spells is projected to increase the most at PIBT, showing increases of ~31% under SSP2-4.5 and by ~22% under SSP5-8.5 by 2070. This is followed by the Reko Diq Mine Site, with projected increases of ~11% under SSP2-4.5 and by ~2% under SSP5-8.5 under the same time period. Dry spells at the railway location near Nushki are projected to increase in frequency by ~3% under both emissions scenarios by 2070.

It is worth noting that precipitation-related projections in the studied regions are both variable and uncertain. Climate models have been known to have difficulty accurately simulating precipitation data in Pakistan due to the influence of ENSO and monsoons on the local climate (The World Bank, 2021). Therefore, it is necessary to remember that while projections may vary in the severity of increasing of decreasing flood or drought risk, it is prudent for projects to plan for both climate hazards and they will continue to occur in the project region. Uncertainty values for all projects can be found in the Hazard Index Data Sources tables in Appendix A.

7.3.2.1. Comparison of Modelled and Observed Precipitation Baseline Values

Observed daily precipitation data (mm) from Nok Kundi weather station was provided for the years 1983 to 2023. However, modeled CMIP baseline and projected precipitation values used in the CCRVA were obtained for coordinates covering the Reko Diq Mine Site as opposed to Nok Kundi to provide the most geographically accurate projections.

Therefore, Nok Kundi weather station data were compared to gridded CMIP baseline data matching the coordinates of the Nok Kundi weather station. Using a Pearson correlation analysis[15], the correlation coefficient between the two datasets was calculated to be 0.97. This indicates that the Nok Kundi CMIP baseline has a strong linear relationship to the weather

[15] 0 indicates no relationship between two variables, while 1 or -1 indicate a perfectly positive or negative linear correlation between two variables.

station data, therefore the CMIP baseline and projected data was deemed to be accurate for this Project region.

The standard deviation of the CMIP data was higher than that of the Nok Kundi weather station data, indicating that the CMIP modelled historical data has a higher variability than the station data. In addition, the mean bias between the two datasets is 0.017, indicating that CMIP data may slightly overestimate precipitation by 0.017 mm/day. Therefore, modelled historical baseline values and associated projections from CMIP may provide variable or slightly overestimated precipitation data.

Table 7-5: Comparison of Modelled and Observed Precipitation Data

	Nok Kundi Baseline Comparison		**Data Used in CCRVA**
	Nok Kundi Station Data (mm/day)	**Nok Kundi Baseline (CMIP)** (mm/day)	**Mine Site Baseline (CMIP)** (mm/day)
January	0.28	0.41	0.49
February	0.32	0.43	0.60
March	0.23	0.24	0.36
April	0.06	0.09	0.11
May	0.01	0.00	0.03
June	0.07	0.00	0.00
July	0.02	0.00	0.00
August	0.01	0.00	0.00
September	0.00	0.00	0.00
October	0.01	0.00	0.00
November	0.03	0.01	0.06
December	0.06	0.12	0.22
Annual Mean	0.09	0.11	0.16
Standard Deviation	0.11	0.16	0.21

7.3.3. Sea Level Rise Projections

Sea level rise refers to the increase in the average level of the world's oceans and bodies of water over time. It is primarily driven by two main factors: thermal expansion of seawater and the melting of land-based ice, such as glaciers and ice sheets (Cazenave & Le Cozannet, 2013). Climate change, driven by factors such as GHG emissions and human activities, is leading to a rise in global temperatures. As a result, sea levels are rising at an accelerated rate, increasing the vulnerability of coastal regions (Woodroffe & Murray-Wallace, 2012).

The PIBT at Port Qasim area of the Project is located along the coast of Pakistan, making it vulnerable to the impacts of sea level rise and susceptible to inundation, landslides and erosion. Modest rises in sea level can increase flooding from tides and storm surges, and erode coastlines due to altered sedimentation and wave patterns. This poses a threat to both infrastructure and communities along Pakistan's coast.

By 2070, the sea levels at the PIBT area are projected to increase by 0.27m under SSP2-4.5, and by 0.35m under SSP5-8.5 relative to a 1995-2020 baseline. Total projected sea level rise for each decade until 2100 can be seen in Table 7-6, and projected sea level rise under SSP5-8.5 by 2070 is displayed in Figure 7-9 below. Projected increases in sea level may increase severity of wave-related incidents such as tsunamis and storm surges.

Table 7-6: Projected Total Sea Level Change from Baseline
Baseline Period: 1995-2020 (NASA, 2024)

	2030	2040	2050	2060	2070	2080	2090	2100
SSP2-4.5	0.08m	0.13m	0.17m	0.22m	0.27m	0.33m	0.39m	0.46m
SSP5-8.5	0.09m	0.14m	0.20m	0.27m	0.35m	0.44m	0.56m	0.70m

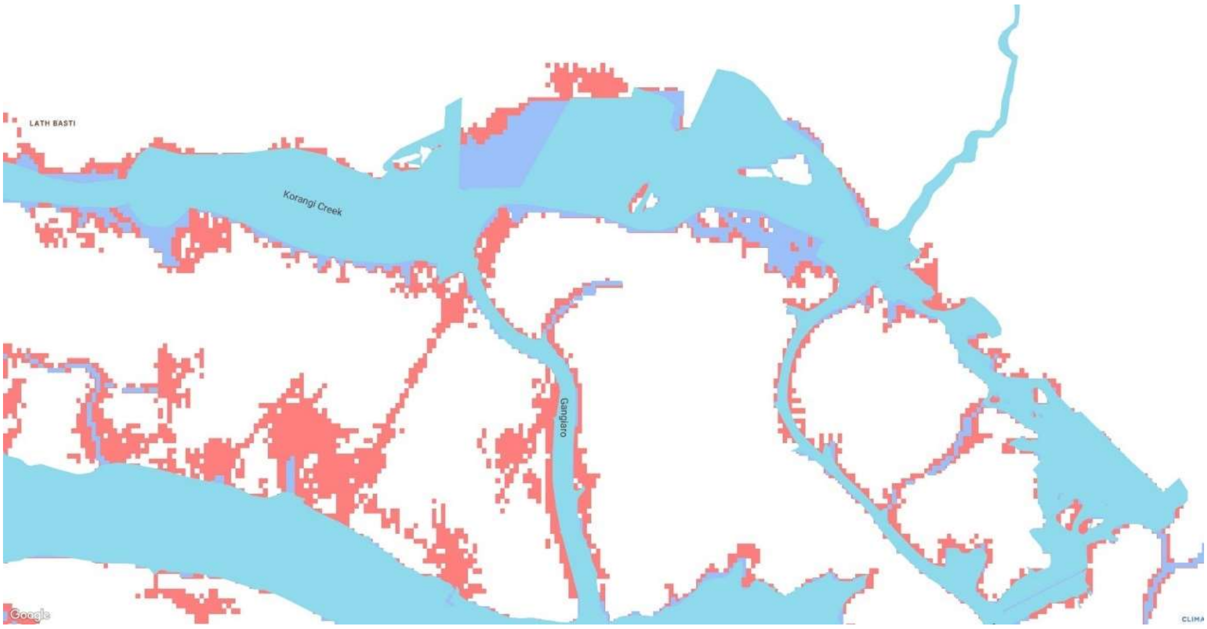

Figure 7-9: Projected Sea Level Rise by 2070 at PIBT
Image adapted from Climate Central Coastal Risk Screening Tool (2021)

7.4. Extreme Events Discussion

Extreme weather events refer to unusual and severe weather occurrences that deviate from the typical patterns observed in a particular region. These events occur only when several climatic preconditions come together. For example, an extreme rainfall event can only occur when high temperatures are paired with adequate moisture and atmospheric instability (The

World Bank, 2024). When one of these preconditions increases in frequency, so does the potential for extreme weather events.

The following sections contextualise the current and historical extreme events and hazards in the Project areas, and briefly discuss changes that may occur under climate change. This information is intended to guide qualitative discussions surrounding extreme events in the Project areas and is not incorporated in quantitative risk calculations.

7.4.1. Flooding

Despite low overall rainfall, flooding is considered the most frequent extreme event experienced in Pakistan. In 2022, monsoon rains in Pakistan caused flash floods and landslides that primarily impacted the Balochistan and Sindh Provinces (BBC, 2022)

The floods also caused destruction along the railway from the Reko Diq Mine Site to PIBT, damaging bridges near the Nushki and the Hirok Railway Station and leading to disruptions to railroad traffic for 8 months (PRACS, 2024).

The Reko-Diq Mine site is currently classified as a low riverine flood risk, while the railway near Nushki and PIBT are classified as having extremely high riverine flood risks, with high coastal flood risk at PIBT (WRI, 2024). While rainfall projections remain variable, precipitation totals and 10- and 50-year flood hazard intensity are projected to increase at all Project areas under SSP2-4.5, as well as under SSP5-8.5 at the Reko Diq Mine Site and PIBT.

7.4.2. Landslides

Landslides are also a common hazard in Pakistan, often occurring in relation to extreme rainfall and flooding. As discussed above, heavy rains in 2022 caused flood-induced landslides throughout the Balochistan and Sindh Provinces.

Landslides that have occurred in Balochistan have been primarily caused by mining, digging, and construction from 2003-2019 (Shabbir, Omer, & Pilz, 2022). Given projected increases in rainfall and variability of water discharge rates (Table 7-4), there are likely to be conditions that allow for longer, more frequent, and more severe floods and landslides in the future (SMHI, 2023).

7.4.3. Drought

The Balochistan and Sindh Provinces are prone to drought conditions. From October 2020 to March 2021, the two provinces received ~75% less rainfall than average conditions (ReliefWeb, 2021).

Areas of the railway near Nuski are classified as a medium-high drought risk with extremely high water stress due to competition for water resources, while PIBT is classified as having low-medium water stress (WRI, 2024).

7.4.4. Cyclones

Cyclones have caused disruption to lives, homes and businesses along the coast of Pakistan. From 1999 to 2014, cyclones along the coast of the Sindh province have damaged over 10,800 homes (UNDRR, 2019). During recent 2023 Cyclone Biparjoy, over 81,000 people were evacuated along the coast of the Sindh Province (BBC, 2023).

Table 7-7 below lists cyclones and tropical storms recorded since April 2000, where storm activity occurred at areas now associated with the Project.

Table 7-7: Cyclone and Tropical Storm Occurrence
April 9, 2000-August 7, 2024 (NASA Worldview, 2024)

Date	Hazard	Mine Site	Railway	PIBT
June 2023	Tropical Cyclone Biparjoy			x
August 2022	Tropical Cyclone 03A		x	x
September 2021	Tropical Storm Shaheen-Gulab	x	x	x
September 2019	Tropical Cyclone Hikaa			x
June 2019	Tropical Cyclone Vayu			x
June 2016	Tropical Storm 2		x	x
June 2015	Tropical Storm Ashobaa			x
October 2014	Cyclone Nilofar			x
June 2010	Cyclone #3		x	x
June 2007	Tropical Storm #3	x	x	x
June 2007	Cyclone #2	x	x	x
September 2006	Tropical Storm #4			x
October 2004	Tropical Storm #3		x	x
May 2001	Cyclone #1			x

Projections regarding the impact of climate change on cyclone activity remain uncertain, with models projecting an equal or decreasing frequency of tropical cyclones globally (Chung, Vecchi, & Sun, 2021). However, projections of increased rainfall, higher sea surface temperatures, and raising sea levels indicate that cyclones may increase in intensity.

Table 7-8 below showcases results from an analysis of historic cyclone tracks across various return periods (CDRI, 2023). Historical wind speeds and coastline flooding as a result of tropical cyclones were compared against future projections of cyclones under SSP5-8.5. The analysis suggests that wind speeds and coastal flooding will increase under climate change across all tropical cyclone return periods.

Table 7-8: Historical and Projected[16] Tropical Cyclone Intensity[17]
Reference Period: 1990-2022 (CDRI, 2023)

	Tropical Cyclone Wind Speed		**Coastline Run-Up Height**	
Return Period	**Historical** (km/h)	**SSP5-8.5** (km/h)	**Historical** (m)	**SSP5-8.5** (m)
25 Years	98.5	100.9	0.6	1.1
50 Years	108.1	121.5	0.7	0.8
100 Years	117.8	148.5	0.7	1.2
250 Years	127.1	168.1	0.9	1.8

7.4.5. Sand and Dust Storms

Pakistan is also subject to sand and dust storms. When storms and temperature changes cause low-pressure systems, dust and sand are pulled along by air moving to fill the low-pressure areas (Vartak, 2022). These storms lead to limited visibility, halting transportation and other business activities. Dust also causes health and safety concerns due to inhalation and potential eye-contact with particles, while waterways, livestock health, and crop yields also suffer from dust pollution.

The Balochistan region is prone to sand and dust storms, with a recent storm in April 2024 causing residents to shelter indoors while dust caused damage to local businesses (AAJ News, 2024). Dust storms in the region also occur on large scales, spreading to other provinces and even across country borders. In January 2022, a dust storm originating in Balochistan caused impacts throughout southern Pakistan, and into multiple states in western India (Hansen, 2022).

As drought conditions and heat waves are projected to increase due to climate change, the conditions for sand and dust storms will also occur more frequently.

7.4.6. Epidemic Diseases

Parasitic and bacterial epidemic diseases, such as malaria, can impact people exposed to natural hazards caused by changing weather conditions. Malaria is a significant health concern in Pakistan, with historically over 25 million people at risk each year (WHO, 2015).This risk is projected to increase under RCP4.5, with approximately 46 million people projected to be at risk of Malaria in Pakistan by 2070 (WHO, 2021). Despite being an arid area, climatic changes such as increased flooding have already led to Malaria cases in the Project regions. In 2022, flooding in Balochistan and Sindh Provinces accounted for 78% of the country's confirmed cases of Malaria (WHO, 2022).

[16] Exact future time periods for the SSP5-8.5 projections were not disclosed in the research methodology, therefore future projections should only be used to guide qualitative discussions surrounding future tropical cyclone risk.
[17] Calculated based on cyclones occurring from 1990-2022, data from IBTrACS database (CDRI, 2023). Return periods are mathematical estimates of the frequency of an event occurring based off historical data.

In 2008, almost 95,000 children under 15 died from diarrheal deaths in Pakistan. While this number is projected to decrease by 2050 to approximately 21,000, 17% of those deaths will be attributable to climate change (WHO, 2021).

The identified Project areas are all classified as having extremely high sanitation risks, meaning over 20% of people do not have access to sanitation services to dispose of human waste (WRI, 2024). At the same time, the Reko Diq Mine Site and PIBT are classified as having medium-high risks regarding safe drinking water, meaning that 5-10% of the local population are collecting water from unprotected sources. Along the railway near Nushki, safe drinking water risks are classified as high, with 10-20% of the local population collecting water from unprotected sources (WRI, 2024).

8. Greenhouse Gas Emissions Assessment

The following section discusses the Project's estimated GHG emissions. This covers both the construction and the operation phase. The first three years are considered as the construction phase, whilst the remaining 39 years are considered the operational phase.

8.1. Data Used

The majority of the activity data were collected from information provided by Barrick. The activity data used to estimate the GHG emissions during the construction and operation phases are shown in Table 8-1 and Table 8-1.

Table 8-1: Activity Data Provided.

Year	Diesel - Railway (kL)	Diesel - Mining (kL)	HFO – Onsite Generators (kL)[18]	Concentrate Production (kt)	Reagents (kt)
Construction Phase					
2025	-	1,418	-	-	-
2026	-	5,278	-	-	-
2027	-	29,354	17,751	-	-
Operation Phase					
2028	4,611	52,177	30,176	121	7
2029	22,611	102,562	196,143	803	46
2030	25,758	96,153	213,006	968	50
2031	25,725	88,939	213,006	976	50
2032	25,216	107,756	213,006	916	50

[18] The HFO generators will continue to be used, even after the initial connection to the national grid. Completing the infrastructure for the full grid integration across the site can take time. Grid availability is also not guaranteed, thus the HFO will remain for backup purposes. The HFO consumption post 2040 is a conservative reflection of these uncertainties.

2033	28,365	126,335	243,182	1,018	58
2034	43,902	147,039	409,587	1,688	97
2035	44,245	141,305	426,013	1,660	101
2036	44,494	150,509	426,013	1,663	101
2037	45,268	179,095	426,013	1,653	101
2038	45,612	191,785	426,013	1,871	101
2039	45,151	174,769	426,013	1,951	101
2040	45,192	176,278	426,013	1,824	101
2041	45,202	176,631	426,013	1,914	101
2042	45,355	182,269	213,006	1,570	101
2043	46,101	209,825	191,706	1,697	101
2044	46,466	223,300	170,405	1,599	101
2045	46,895	239,132	149,104	1,430	101
2046	47,160	244,567	127,804	1,390	101
2047	47,112	241,729	106,503	1,138	101
2048	47,558	260,072	85,203	1,062	101
2049	40,717	260,328	63,902	1,093	101
2050	39,115	244,273	42,601	1,135	101
2051	42,067	270,935	21,301	1,265	101
2052	46,758	289,953	21,301	1,511	101
2053	48,490	298,929	21,301	1,598	101
2054	45,197	260,411	21,301	1,466	101
2055	46,929	240,231	21,301	1,622	101
2056	45,891	201,887	21,301	1,719	101
2057	45,219	177,026	21,301	1,580	101
2058	45,327	180,409	21,301	1,563	101
2059	45,855	186,455	21,301	1,706	101
2060	45,408	165,313	21,301	1,684	101
2061	42,750	112,853	21,301	1,254	101
2062	28,259	77,380	21,301	773	101
2063	25,576	48,315	21,301	661	101
2064	23,087	44,717	19,165	596	91

2065	502	6,185	-	-	-
2066	470	5,635	-	-	-
Total	**1,475,614**	**6,619,511**	**5,964,253**	**50,139**	**3,377**

Table 8-2: Other Activity Data Collected

Description	Value	Unit	Source
Construction phase			
Material Transport - Distance travelled by road	2,600	km	Project Proponent
Operation Phase (2028 onwards)			
Material Transport - Aircraft Trips	312	#	Project Proponent
Material Transport - Aircraft Distance[19]	620	km	Project Proponent
Material Transport – Passengers	48	#	Maximum capacity assumed for ATR-48, as the entire flight will be used by the Project, regardless of whether the maximum amount of passenger seats are occupied or not.
Average Copper Grade	30%		Project Proponent
Group Wide GHG Emissions for Scope 3 Category 1&2	6,623,000	tCO_2e	(Barrick, 2024)
Group wide revenue	1,397,000,000	$	(Barrick, 2024)
Group wide Cu prod	420,000,000	pounds	(Barrick, 2024)
Group wide copper revenue	795,000,000	$	(Barrick, 2024)

The electricity consumed from the national grid, once connected in 2042, is estimated based on the reduction in HFO consumed from 2041.

The emission factors (EFs) and conversion factors used for the calculations are shown in Table 8-3. The sources for these are also included.

Table 8-3: Emission Factors and Conversion Factors Used

[19] Travel routes for employees prior to arrival in Karachi for charter flights to the mine site are highly variable and uncertain. These emissions were considered negligible relative to LoM emissions and were not considered in the GHG assessment.

Description	Value	Unit	Source
Emissions Factor – Direct Consumption – Diesel – Mobile	2.745	$kgCO_2e/L$	(US EPA, 2023)
Density - Diesel	0.845	kg/L	(US EPA, 2023)
Emissions Factor – Direct Consumption – Heavy Fuel Oil – Stationary	2.987	$kgCO_2e/L$	(US EPA, 2023)
Density – Heavy Fuel Oil	0.944	kg/L	(US EPA, 2023)
Net Calorific Value – Heavy Fuel Oil	40.91	GJ/tonne	(DEFRA, 2023)
Energy intensity – >33t Articulated Diesel HGV	0.290	kWh/tonne.km	(DEFRA, 2023)
Emissions Factor – Direct Consumption – Diesel – Mobile	0.268	kg-CO2eq/kWh (Net CV)	(DEFRA, 2023)
Emissions Factor – Direct Consumption – Air Travel	0.18	$kgCO_2e$/ passenger.km	(DEFRA, 2023)
Generator efficiency	40%		(General Power Limited, 2024)
Pakistan Grid EF	0.370	tCO_2e/MWh	(IEA, 2023)
Well-to-Tank– Diesel	0.624	$kgCO_2e/L$	(DEFRA, 2023)
Well-to-Tank– Heavy Fuel Oil	0.695	$kgCO_2e/L$	(DEFRA, 2023)
Ratio of Well-to-Tank: Direct Consumption – Aviation Fuel	0.255		(DEFRA, 2023)
Copper downstream Processing emissions	4.843	tCO_2e/tCu	(Liu, Xiang, Cao, & li, 2022)

8.2. GHG Emissions

A breakdown of the scope 1 emissions is shown in Table 8-4.

Table 8-4: Scope 1 GHG Emissions Breakdown.

Year	Diesel - Railway (tCO_2e)	Diesel - Mining (tCO_2e)	HFO – Onsite Generators (tCO_2e)	Aviation Fuel (tCO_2e)
Construction Phase				
2025	-	4,134	-	1,632
2026	-	15,388	-	1,632
2027	-	88,967	53,025	1,632
Operation Phase				
2028	12,657	143,213	90,143	1,632

2029	62,060	281,507	585,929	1,632
2030	70,700	263,915	636,304	1,632
2031	70,609	244,114	636,304	1,632
2032	69,211	295,762	636,304	1,632
2033	77,854	346,757	726,446	1,632
2034	120,501	403,584	1,223,541	1,632
2035	121,442	387,846	1,272,608	1,632
2036	122,126	413,111	1,272,608	1,632
2037	124,250	491,570	1,272,608	1,632
2038	125,193	526,401	1,272,608	1,632
2039	123,928	479,696	1,272,608	1,632
2040	124,041	483,839	1,272,608	1,632
2041	124,067	484,809	1,272,608	1,632
2042	124,487	500,284	636,304	1,632
2043	126,535	575,917	572,673	1,632
2044	127,538	612,903	509,043	1,632
2045	128,715	656,357	445,413	1,632
2046	129,442	671,274	381,782	1,632
2047	129,310	663,486	318,152	1,632
2048	130,533	713,833	254,522	1,632
2049	111,758	714,535	190,891	1,632
2050	107,362	670,468	127,261	1,632
2051	115,462	743,648	63,630	1,632
2052	128,339	795,849	63,630	1,632
2053	133,092	820,484	63,630	1,632
2054	124,054	714,762	63,630	1,632
2055	128,808	659,372	63,630	1,632
2056	125,960	554,129	63,630	1,632
2057	124,114	485,891	63,630	1,632
2058	124,412	495,178	63,630	1,632
2059	125,859	511,771	63,630	1,632
2060	124,634	453,742	63,630	1,632

2061	117,339	309,753	63,630	1,632
2062	77,563	212,388	63,630	1,632
2063	70,200	132,613	63,630	1,632
2064	63,368	122,738	57,251	1,632
2065	1,377	16,977	-	1,632
2066	1,291	15,468	-	1,632
Total	4,050,189	18,178,434	17,816,736	68,559

The scope 1, scope 2 and scope 3 emissions for the construction and operation phase are shown in Table 8-5 below. A detailed year-by-year breakdown can be found in Appendix B.

Table 8-5: Estimated GHG Emissions.

Scope	Construction (tCO_2e)	Operation (tCO_2e)	LoM (tCO_2e)	Operation - Average (tCO_2e/y)
1	166,411	39,947,507	40,113,918	1,024,295
2	-	13,255,014	13,255,014	339,872
3	36,089	118,504,413	118,540,502	3,038,575
Total Scope 1 and 2	**166,411**	**53,202,521**	**53,368,932**	**1,364,167**
Total Including Scope 3	**202,500**	**171,706,934**	**171,909,434**	**4,402,742**

The scope 1 GHG emissions during construction originate from the consumption of fossil fuels onsite as well as from transporting material to site. This is also applicable for the operation phase.

Across the LoM, the total scope 1 GHG emissions are larger than the total scope 2 GHG emissions. Only after 2060, near the end of LoM, do the annual scope 2 GHG emissions exceed the annual scope 1 GHG emissions.

The Equator Principles also require that "*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 ratio12) during the operational phase for Projects emitting over 100,000 tonnes of CO2 equivalent annually*". The average annual GHG emissions are >1 million tCO_2e. Thus, the project will need to calculate and publicly disclose its scope 1 and 2 GHG emissions on an annual basis during its operational life. This is in line with Barrick's current disclosure practices.

The scope 3 GHG emissions calculated are *Category 1: Purchased goods and services*, *Category 2: Purchased capital goods*, *Category 3: Fuel- and energy-related activities* and *Category 10: Downstream processing of sold products*. The total scope 3 GHG emissions across the LoM for the 4 categories considered is 118.5 million tCO_2e. *Category 10: Downstream processing of sold products* contributes the largest portion of the scope 3 GHG emissions, 61%.

The national annual emissions for Pakistan were just over 520 million tCO_2e in 2022 (Our World in Data, 2024). Based on this, the Project's average annual scope 1 and scope 2 GHG emissions will increase the annual national emissions by approximately 0.26%.

Based on similar copper mines operated by Barrick, it is estimated that the project will emit around 0.63 $kgCO_2e$ per USD of revenue generated.

8.3. Alternatives Analysis

An alternatives analysis is required for projects aligning to the Equator Principles (EP AP II). For scope 1 emissions, the analysis must aim to ascertain the best practicable environmental option with inclusion of consideration of alternative fuel or energy sources, if applicable. There are several alternative technologies that could be considered by the Project proponent. Some of these are already being considered by the project proponent. These are outlined in Table 8-6.

Implementation of these is limited by the availability of technology and their respective costs. Some mitigation measures are therefore not immediately implementable but should be revisited throughout the LoM.

Table 8-6: Potential Emission Reductions from Alternatives Analysis

Proposed Mitigation Measure	Possible Reduction in GHG Footprint	Outcome from Barrick investigations
Investigate the option of switching to renewable fuels. This could be switching to biofuels (such as biodiesel or biomethane) or green hydrogen. Biofuels could be used with the existing vehicle and generator fleet whilst green hydrogen would require a change in the vehicle and generator fleet.	The combustion of fossil fuels contributes most of the emissions during the operation phase. Diesel and petrol use in onsite and transportation vehicles can contributes > 600 000 tCO_2e per year. For example, using a 2% biofuel blend will save 12 000 tCO_2e/y. Biodiesel can be sourced from independent suppliers. The potential GHG emission reduction is directly proportional to the portion of biofuel used in the fuel blend. Although this does not seem like a large contribution, the scalability of this measure (from 0% to 100%) makes it very practicable to assist in controlling GHG emissions. This is highly dependent on the local and international availability of biofuels.	At the time of writing, it was not deemed practical to significantly increase the fraction of biofuel used. This is largely due to two factors, the lack of availability of these fuels in Pakistan at the time of writing and the high cost of procuring these fuels internationally.
Due to the remote location of the project area, the transportation of materials to and from site contributes a significant portion of the GHG emissions. The mode of transportation can have a significant impact on the GHG emissions.	Two main modes of transportation exist to transport materials between site and PIBT. If roads are used, then the transportation of goods would contribute approximately 17% of the annual GHG emissions. An alternative mode of transport is the existing rail system in Pakistan. Transporting goods by rail can reduce GHG emissions by approximately 157 000 tCO_2e per year. This would reduce the contribution of the transportation of goods to approximately 7% of the annual GHG emissions. This alternative is already being considered by the project proponent.	Barrick has investigated both transport by road and by rail. Barrick is focusing on transporting material by rail for the majority of the life of mine, reducing costs and GHG emissions.
The onsite electricity demand is to be met using onsite fuel oil generators. These can be replaced by grid electricity (after connecting to the national grid) or onsite solar PV.	Connecting to the national grid would reduce the onsite scope 1 GHG emissions by approximately 835 000 tCO2e per year. However, due to the current reliance on fossil fuels of the national grid, scope 2 GHG emissions would be 644 000 tCO_2e per year.	Barrick has investigated both onsite solar PV as well as connecting to the grid. These have been integrated into the mining plan. Below is a summary of the GHG emissions for

Proposed Mitigation Measure	Possible Reduction in GHG Footprint	Outcome from Barrick investigations
	Onsite solar PV systems (with sufficient battery storage) could meet the project electricity demand. This could reduce the scope 1 GHG emissions by the same amount as connecting to the grid without an increase in scope 2 GHG emissions. This would reduce annual scope 1 GHG emission by 56% - 63%, depending on the mode of transportation used. This alternative is already being considered by the project proponent.	some of the alternatives considered. Detailed year-on-year emissions for the alternatives can be found in Appendix C,
Investigate the option of using alternative electrical equipment to replace the need for fossil fuel vehicles. For example, using conveyor belts or electric vehicles.	Other processes and equipment, such as conveyor belts, can perform the same tasks as some of the mobile equipment. Depending on the design of the systems or the method of application, this can have little to no negative impact on the production of the project. However, this is highly dependent on the “quality“ of the electricity used, in terms of the grid emission factor associated with the consumed electricity. For example, electrical vehicles (EVs) should only replace fossil fuel vehicles if the grid emission factor for the sourced electricity is < 0.5 tCO_2e/MWh*.	Electric vehicles have been investigated by Barrick. At the time of writing, these were deemed impractical due to technological limitations and lack of renewable electricity.

*This is a conservative estimate based on current internal combustion engine and electrical drive train vehicle efficiencies.

The alternatives assessed focus on the provision of electricity to the site. In general, the approach is to have onsite electricity generation for the first 2 stages of the operation, until 2041. From 2042 onwards, the site will connect to the national grid and gradually switch over to the national grid. During the switching period, the onsite sources will be scaled down and remain as back-up electricity sources.

The current intended system is to have a an energy mixture comprising of 80% HFO-based electricity and 20% solar photovoltaic-based electricity. This ratio will be maintained as the site ramps up operations in the initial decade. The electricity generation infrastructure will be kept for back-up purposes once the site is connected to the national grid.

The alternative onsite electricity generation options considered are indicated below:

- All onsite electricity generation using HFO.
- All onsite electricity generation using diesel.
- All onsite electricity generation using natural gas.

- 70% of onsite electricity generation supplied by a combination of renewables energy with battery storage and 30% generated using HFO.

As indicated above, the site will connect to the national grid in 2042. Once connected and fully integrated, the scope 2 GHG emissions for all alternatives are expected to be approximately 642,000 tCO_2e per year.

The estimated average annual GHG emissions for each alternative across the various stages (both before and after connecting to the national grid) is shown in Table 8-7. A detailed breakdown of the annual GHG emissions can be found in Appendix C. It is important to note that these GHG emissions are **only** for the electricity consumed onsite and exclude other GHG emission sources, such as mobile combustion from fleet vehicles.

Table 8-7: Annual Average GHG for alternative power supply options per Stage (tCO_2e).

	Current	HFO	Diesel	NG	70% RE/ 30% HFO
Stage 1 (2029 - 2033)	644,257	805,322	792,002	576,555	241,596
Stage 2 (2034 - 2041)	1,266,474	1,583,093	1,556,909	1,133,386	474,928
Post-grid connection	754,598	796,463	793,001	737,000	826,074

9. Climate Change Risk and Vulnerability Assessment

The IPCC stated that the continuous release of GHG emissions into the atmosphere is likely to lead to increased global temperatures that will reach 1.5°C above pre-industrial levels by the middle of the century (IPCC, 2021). These increased global temperatures will lead to irreversible melting of polar ice caps, rising sea levels, and increased frequency and severity of extreme weather events such as heat waves, droughts and heavy precipitation (IPCC, 2021). These global climatic changes will impact earth and atmospheric systems, how humans interact with nature as well as the functioning of global economies.

Climate change impacts also pose significant risks to human health. The World Health Organisation stated that climate change is already causing adverse health impacts to communities and individuals, leading to injuries, illnesses and even death. These impacts are caused by increased severe and frequent extreme weather events (WHO, 2021), which include heatwaves, floods, droughts, storm events, increased vector-, food- and water-borne diseases (GFDRR, 2020).

Climate change additionally poses significant social and economic risks which all impact livelihoods, business operations, agriculture, tourism, transportation, and access to equitable healthcare and social support (The World Bank, 2024; WHO, 2021). Climate risks and impacts disproportionately impact disadvantaged and vulnerable communities and groups such as children, women, poor communities, ethnic minorities, older populations, and displaced people (WHO, 2021). Climate change therefore has the potential to adversely impact local and global sustainable development.

Pakistan is ranked #150 out of 185 for climate vulnerability, with higher rankings equating to higher vulnerability of climate change (ND-GAIN Index, 2021). This means the country is vulnerable to various acute and chronic physical climate risks such as wildfires, epidemics, floods, droughts and extreme weather events or storms (The World Bank, 2024; GFDRR, 2020).

9.1. Materiality

A climate change risk or opportunity is considered material for the Project based on a Double Materiality assessment considering both financial and impact materiality.

Based on results from the GHG assessment and NCC Compatibility Review, the Project is compatible with national climate commitments, therefore it is not considered to have any significant impact materiality. Thus, only financial materiality is considered below.

In line with Barrick's internal risk procedures, financial materiality is based on the potential financial cost an impact could have. Barrick considers any impact > USD100,000,000 to have a substantive impact on the company. This is roughly 0.7% of Barrick's current group-wide revenue. Applying this same approach from the group-wide level to a project-specific level, a material impact would be one that has the potential to impede operations for three or more days.

Physical events that could have an impact on the project can occur multiple times within a year. Thus, the potential impact from single events are considered as well as the cumulative potential impact from repeat events. For example, a severe sandstorm could impact or shut down operations for several days at a time, whilst smaller sandstorms, which occur more frequently, could have a collective impact in excess of three days operation.

Transition events, including shifts in national and international policies and regulations, changing stakeholder concerns, and technological advances leading stranded assets or equipment phase-out, that may result in costs equal to three days of lost revenue were considered.

Thus, the initial list of risks considered is outlined below. It is important to note that this list is not exhaustive as it only contains risks that are projected to be exacerbated by climate change. Furthermore, any risks whose hazard score is <1 is excluded from further consideration in this section.

List of risks considered:

- Physical Risks:
  - Extreme heat days;
  - Heavy rainfall and flooding events;
  - Landslides and slope failure;
  - Retaining/pit wall failure;
  - Droughts;

- Sea Level Rise;
- Storm Surges;
- Cyclones;
- Sand and Dust Storms; and
- Chronic climatic changes and extreme weather events.
- Transition Risks:
  - Carbon taxes;
  - GHG-related trade tariffs;
  - Stranded assets and phase-out of equipment before pay-off periods; and
  - Reputational concerns.

9.2. Physical Climate Change Risks

Project specific risks and the impacts thereof on worker health and safety, operations and the value chain are outlined and discussed in Table 9-1. Risks are scored as per the methodology outlined in Section 6.3. Project design and management plans are still in the drafting process at the time of writing, therefore risks are quantified using two adaptive capacity scenarios where relevant, showcasing risks levels with and without adaptation and mitigation measures.

The LoM is projected to be 38 years. To allow for construction years and assess risks into the decommissioning phase, hazard data is presented as a change from the historic baseline to a time horizon covering 2070. Additional details on the justification and source of each quantitative hazard score can be found in Appendix A.

Table 9-1: Project Specific Physical Climate Change Risks

Hazards		Hazard Score (0-10)		Exposure (0-1)	Sensitivity (0, 0.5,1)	Adaptive Capacity (0, 0.5, 1) Recommended adaptation where applicable (0, 0.5, 1)	Risk	Projected Change in Risk Score	
		SSP2-4.5 RCP4.5	SSP5-8.5 RCP8.5					SSP2-4.5 RCP4.5	SSP5-8.5 RCP8.5
Infrastructure Damage and Increased Operating Costs									
Heavy rainfall and flooding events	**Mine Site**	**9**	**10**	**1**	**1**	**0**	At minimum, heavy rainfall can lead to higher operational expenses from increased pumping activities. The Project may also experience lost production due to road closures which cause the delay of goods, resources, and services to and from the mine and within the mining license. Damage to power transmission lines coming from the on-site power plant can also lead to production delays if generators are unable to keep up with operational power needs.	**9**	**10**
		50-year flood intensity is projected to increase by ~86% under RCP4.5 and ~155% under RCP8.5 by 2070.		Exposed infrastructure is vulnerable to damage during extreme rainfall and flooding. This includes linear infrastructure (access roads, pipelines, conveyor belts, fences and power transmission lines) as well as administrative and accommodation buildings. Pits and TSFs will require additional pumping during heavy rainfall periods, while stormwater infrastructure and water storage facilities may overflow.	Extreme precipitation and flooding can cause upstream and on-site infrastructure breakdowns and damages that can halt production.	No consideration for extreme precipitation and floods.			
						0.5	Moderate impacts of extreme rainfall include damage to mining infrastructure and equipment, incurring higher costs to repair damage.	**4.5**	**5**
						Extreme precipitation and flooding events considered in stormwater management, site and infrastructure planning.	Complete failure of pumping equipment, pipelines, diversion channels and water storage ponds due to floods or an extreme precipitation event can lead to production stoppages. *Key risks: operational and maintenance costs, lost production*		
	Railway	**4**	**3**	**1**	**1**	**0**	Damage or flooding of rail infrastructure can lead to both increased operational costs and delays to shipment of copper concentrate for export or supplies for import to the mine site. For proposed portions of the railway from the mine site to Nokkundi, damage to railways will incur higher costs to the Project to repair damage.	**4**	**3**
		50-year flood intensity is projected to increase by ~33% under RCP4.5 and by ~23% under RCP8.5 by 2070.		Extreme rainfall and flooding can cause damage to bridges and embankments, as well as overtopping of rail tracks.	Rail infrastructure breakdowns and damages during extreme precipitation and flooding events can increase costs and halt production.	No consideration for extreme precipitation and floods.			
						0.5	Damage to portions of the railway under control of Pakistan Rail from Nokkundi to PIBT will be subject to operational delays as damages are repaired and flood water is drained. Reports from the recent railway study show various periods of railway closures lasting between 3 and 8 months due to flooding (PRACS, 2024).	**2**	**1.5**
						Railway repairs and upgrades made to increase resilience to flooding.	*Key risks: operational and maintenance costs, operational delays*		
	PIBT at Port Qasim	**5**	**4**	**1**	**1**	**0**	At a minimum, heavy rainfall can lead to higher operational expenses and operational delays due to damage to port infrastructure. Closed access roads from the rail loop can lead to delays of copper concentrate shipment for export, or to goods and services to and from the mine site.	**5**	**4**
		50-year flood intensity is projected to increase by ~50% under RCP4.5 and ~37% under RCP8.5 by 2070.		Exposed infrastructure is vulnerable to damage during extreme rainfall and flooding. This includes linear infrastructure such as fencing, bridges, gates, conveyor belts and access roads from the rail loop. Administration buildings, as well as material handling equipment such as	Infrastructure breakdowns and damages during extreme precipitation and flooding events can increase costs and halt production.	No consideration for extreme precipitation and floods.	Moderate impacts of extreme rainfall include damage to stormwater management infrastructure, incurring higher costs to repair damage.		
						0.5	Complete failure of stormwater management channels due to floods or an extreme precipitation event can lead to operational stoppages.	**2.5**	**2**
						Extreme precipitation and flooding events considered in stormwater management,			

				cranes and trucks, are also vulnerable to damage.		site and infrastructure planning.	*Key risks: operational and maintenance costs, operational delays*		
Contamination and Reputational Risks									
Heavy rainfall and flooding events	**Mine Site**	**9**	**10**	**1**	**1**	**0**	Increased rainfall increases discharge of excess water into stormwater management systems, potentially leading to environmental damage and reputational risks from sedimentation of surrounding waterways. Failure of pumping equipment and stormwater management infrastructure can lead to seepage into the local environment. Increased rainfall can lead to runoff of sulphides from waste rock dumps (WRDs) and stockpiles, leading to acid rock drainage. Damage to pipelines and conveyor belts can also spill waste into the environment. Contamination leads to environmental risks and fines, health and safety risks, as well as reputational risks and risks to the Project's social license to operate. Increased water content in the TSF could lead to additional leaching of contaminants into surface and groundwater resources. *Key risks: health and safety, environmental damage, reputational risks*	**9**	**10**
		50-year flood intensity is projected to increase by ~86% under RCP4.5 and ~155% under RCP8.5 by 2070.		Exposed infrastructure holding mining materials and waste such as existing slurry pipelines, conveyor belts, dirty water storage ponds, stormwater diversion channels, and TSFs are vulnerable to damage or overtopping during extreme rainfall and flooding.	Infrastructure damage and overtopping can lead to seeps and spillage.	No consideration for extreme precipitation and floods.			
						0.5		**4.5**	**5**
						Extreme precipitation and flooding events considered in stormwater management, site, and infrastructure planning.			
	Railway	**4**	**3**	**1**	**1**	**0**	Damage to railway infrastructure can lead to accidents on the railway, causing potential spills of copper concentrate, fuels, or any hazardous materials being transported to site. Loss of copper concentrate increases costs of cleanup and potential lost profits. Spills or leakages of chemicals and fuel can spread through the environment more easily with additional rainfall. Contamination leads to environmental harm and reputational risks, as well as environmental fines if spills occur on the portion of the railway under the control of the Project. *Key risks: health and safety, environmental damage, reputational risks*	**4**	**3**
		50-year flood intensity is projected to increase by ~33% under RCP4.5 and by ~23% under RCP8.5 by 2070.		Extreme rainfall and flooding can cause damage to bridges and embankments, leading to accidents and spills of fuel or copper concentrate.	Infrastructure damage that leads to seeps and spillage can lead to fines and reputational risks.	No consideration for extreme precipitation and floods.			
						0.5		**2**	**1.5**
						Railway repairs and upgrades made to increase resilience to flooding.			
	PIBT at Port Qasim	**5**	**4**	**1**	**1**	**0**	Spills or leakages of copper concentrate, chemicals, sewage, and fuel can spread through the environment more easily with additional rainfall. Increased sedimentation from heavy rainfall leads to increased dredging costs, lower visibility, impeded access to berths, and navigation difficulties within the port, leading to operational delays and damage to infrastructure. Contamination and sedimentation lead to damage of marine ecosystems, environmental risks and fines, health and safety risks, as well as reputational risks *Key risks: health and safety, environmental damage, reputational risks*	**5**	**4**
		50-year flood intensity is projected to increase by ~50% under RCP4.5 and ~37% under RCP8.5 by 2070.		Increased rainfall can lead to increased spread of contaminants if fuel oil or other chemicals are spilled. Exposed sewage pipelines are vulnerable to damage during extreme rainfall and flooding.	Infrastructure damage can lead to seeps and spillage, while sedimentation can lead to additional costs and safety risks.	No consideration for extreme precipitation and floods.			
						0.5		**2.5**	**2**
						Extreme precipitation and flooding events considered in stormwater management, site, and infrastructure planning.			

Structural Instability and Slope Failure									
Extreme rainfall and flooding events	**Mine Site**	**9**	**10**	**1**	**1**	**0**	Minor slope failure of TSFs and other earthworks from heavy rainfall or flooding could damage infrastructure and equipment, disrupting operations while repairs are made. Complete slope failures or critical structural instability could lead to production stoppages, environmental contamination risks and fines, reputational risks, injury, or death.	**9**	**10**
		50-year flood intensity is projected to increase by ~86% under RCP4.5 and ~155% under RCP8.5 by 2070.		Infrastructure with steep slopes such as TSF walls, embankments, stockpiles, and WRDs can be susceptible to erosion and slope failure.	Extreme rainfall events can lead to slope failure, placing infrastructure and workers at risk, and disrupting operations.	No infrastructure in place to reduce likelihood of slope collapse, erosion, or flooding.			
						0.5		**4.5**	**5**
						Reduce gradient of slopes of TSFs and earthworks, ensure stormwater infrastructure can withstand large and more frequent flooding events.	*Key risks: operational and maintenance costs, lost production, health and safety, environmental damage, reputational risks*		
	Railway	**4**	**3**	**1**	**1**	**0**	As seen during heavy rainfall in 2022, flash flooding can cause erosion and breach of the embankments supporting portions of the railway (PRACS, 2024). These breaches may cause operational delays as copper concentrate cannot reach the port, and goods traveling to the mine site via the railway can also be delayed. Slope failure on the proposed portions of the railway from the mine site to Nokkundi will incur higher costs to the Project to repair damage.	**4**	**3**
		50-year flood intensity is projected to increase by ~33% under RCP4.5 and by ~23% under RCP8.5 by 2070.		Embankments supporting railway are susceptible to erosion and slope failure.	Extreme rainfall events can lead to slope failure, damaging railway infrastructure and disrupting transport of copper concentrate and supplies.	No infrastructure in place to reduce likelihood of erosion or slope failure.			
						0.5		**2**	**1.5**
						Embankments have been raised and strengthened to protect against erosion and failure.	*Key risks: operational delays, operational costs*		
	PIBT at Port Qasim	**5**	**4**	**1**	**1**	**0**	Minor slope failure of stockpiles from heavy rainfall or flooding could damage infrastructure and equipment, disrupting operations while repairs are made. Berths built on backfilled foundations are at risk of erosion from increased rainfall. Complete slope failures or instability of berth foundations could lead to operational stoppages, injury, or death. Subsidence caused by flooding may result in damage to infrastructure and equipment resulting in operation costs and delays and risks to health and safety.	**5**	**4**
		50-year flood intensity is projected to increase by ~50% under RCP4.5 and ~37% under RCP8.5 by 2070.		Infrastructure with steep slopes such as stockpiles, as well as critical structural foundations such as berths are susceptible to erosion and instability.	Extreme rainfall events can lead to slope failure and erosion of foundational infrastructure, placing infrastructure and workers at risk, and disrupting operations.	No infrastructure in place to reduce likelihood of slope collapse, erosion, or flooding.			
						0.5		**2.5**	**2**
						Ensure gradient of stockpile slopes are designed with climate change in mind, ensure stormwater infrastructure can withstand large and more frequent flooding events.	*Key risks: operational and maintenance costs, health and safety*		

Operational Efficiency and Increased Costs									
Extreme heat days	**Mine Site and Railway**	**4**	**5**	**1**	**0.5**	**0**	Engines and generators use air for cooling and combustion. At 40°C, the density of air reduces, leading to a 10% reduction in the mass of air available for generator cooling and combustion (Inoplex, 2022). Less air available for combustion reduces combustion efficiency: for every 3°C rise over 20°C in air intake temperature, engine power is reduced by 1% (Rakopoulos et al., 2004). Therefore, when ambient temperatures exceed 35°C, fuel consumption increases by 5% during those hot periods, leading to operational efficiency losses during construction, operational, and rail transport activities. Steel components of railways can reach temperatures greater than the ambient air temperature, causing them to buckle. Rail transport with therefore slow or be delayed during extreme heat periods, and damage to railways will need to be repaired, causing additional stoppages. *Key risks: operational costs*	**2**	**2.5**
		Extreme heat days will increase from the historic baseline of ~112 days by ~31% under the SSP2-4.5 scenario to ~146 days, and by ~48% under the SSP5-8.5 scenario to ~166 days by 2070.		Haul trucks, excavators, generators, and rail transportation will be expected to continue operating during extreme heat conditions.	During extreme heat days, ambient air pressure drops, reducing the mass of air available for combustion in engines as well as the mass of air available for cooling systems.	No consideration for extreme heat events.			
						0.5		**0**	**0**
						Increase operational activity during the cooler hours of the day.			
	PIBT at Port Qasim	**2**	**3**	**1**	**0.5**	**0**	Engines and generators use air for cooling and combustion. At 40°C, the density of air reduces, leading to a 10% reduction in the mass of air available for generator cooling and combustion . Less air available for combustion reduces combustion efficiency: for every 3°C rise over 20°C in air intake temperature, engine power is reduced by 1% (Rakopoulos et al., 2004) Therefore, when ambient temperatures exceed 35°C, fuel consumption increases by 5% during those hot periods, leading to operational efficiency losses for vehicles, cranes, and ship loaders. *Key risks: operational costs*	**1**	**1.5**
		Extreme heat days will increase from the historic baseline of ~187 days by ~19% under the SSP2-4.5 scenario to ~222 days, and by ~28% under the SSP5-8.5 scenario to ~240 days by 2070.		Material handling equipment such as haul trucks, cranes and ship loaders will be expected to continue operating at these conditions.	During extreme heat days, ambient air pressure drops. This reduces the mass of air available for combustion in engines as well as the mass of air available for cooling systems.	No consideration for extreme heat events.			
						0.5		**0**	**0**
						Increase operation activity during the cooler hours of the day.			
Worker Health and Safety									
Extreme heat days	**Mine Site and Railway**	**4**	**5**	**1**	**1**	**0**	Extreme heat days could lead to more workplace incidents such as fatigue, dehydration, heat stroke, respiratory and cardiovascular disorders, and increased hospital admissions if not managed responsibly. Excessive heat can also lead to increased operator error, resulting in additional safety incidents. *Key risks: health and safety*	**4**	**5**
		Extreme heat days will increase from the historic baseline of ~112 days by ~31% under the SSP2-4.5 scenario to ~146 days, and by ~48% under the SSP5-8.5 scenario to ~166 days by 2070.		Staff working outdoors will be expected to continue working during extreme heat periods.	Mine and railway workers are susceptible to heat induced stress and issues.	No consideration for extreme heat events.			
						0.5		**2**	**2.5**
						PPE, sunscreen, aircons, urine chart, taking regular breaks during extreme heat periods.			
	PIBT at Port Qasim	**2**	**3**	**1**	**1**	**0**	Extreme heat days could lead to more workplace incidents such as fatigue, dehydration, heat stroke, respiratory and cardiovascular disorders, and increased hospital admissions if not managed responsibly. Excessive heat can also lead to increased operator error, resulting in additional safety incidents. *Key risks: health and safety*	**2**	**3**
		Extreme heat days will increase from the historic baseline of ~187 days by ~19% under the SSP2-4.5 scenario to ~222 days, and by ~28% under the SSP5-8.5 scenario to ~240 days by 2070.		Staff working outdoors will be expected to continue working during extreme heat periods.	Port workers are susceptible to heat induced stress and issues.	No consideration for extreme heat events.			
						0.5		**1**	**1.5**
						PPE, sunscreen, aircons, urine chart, taking regular breaks during extreme heat periods.			

Solar Derating									
Extreme heat days	**Mine Site**	**4**	**5**	**1**	**0.5**	**0**	Solar panels are generally developed and tested at 25°C, and experience a decrease in energy output for each 1°C increase in the temperature of the solar cells, known as their temperature coefficient. This decrease ranges between models, with some major solar panel models losing between 0.26% to 0.41% output for each 1°C increase over 25°C . Solar cells often reach temperatures higher than the ambient air temperature. Therefore, solar output will decrease during extreme heat days, leading to increased costs from purchasing electricity through the grid or use of generators. *Key risks: operational costs*	**2**	**2.5**
		Extreme heat days will increase from the historic baseline of ~112 days by ~31% under the SSP2-4.5 scenario to ~146 days, and by ~48% under the SSP5-8.5 scenario to ~166 days by 2070.		Proposed 150MW solar installation will continue operating on extreme heat days.	During extreme heat days, high temperatures will increase temperature of solar cells.	No mitigation feasible for solar installation.			
Safe Storage of Chemicals, Explosives, and Hazardous Waste									
Extreme heat days	**Mine Site**	**4**	**5**	**1**	**1**	**0**	High temperatures can increase reactivity of stored chemicals and hazardous wastes, leading to potential leaks and chemical storage failure. Chemical spills can cause health and safety risks to employees, and spills that leach into the surrounding environment will cause contamination of water resources and local habitats, leading to reputational risks and potential fines. Explosives that are stored on site are also susceptible to deterioration or autoignition at high temperatures. *Key risks: health and safety, environmental damage, reputational risks*	**4**	**5**
		Extreme heat days will increase from the historic baseline of ~112 days by ~31% under the SSP2-4.5 scenario to ~146 days, and by ~48% under the SSP5-8.5 scenario to ~166 days by 2070.		Chemicals used in processing plant, explosives used for mining, and hazardous wastes stored on site may be reactive to high heats.	Extreme heat can cause chemicals and explosives to increase in reactivity.	Hazardous materials stored without temperature stability considerations.			
						0.5		**2**	**2.5**
						Chemical, explosive, and waste storage method ensures stability of temperature.			
Increased Operational Costs									
Droughts	**Mine Site**	**2**	**1**	**1**	**0.5**	**0**	A drought could impact operations on multiple levels. First, lack of rainfall reduces groundwater recharge, decreasing water available for operational activities. Drought periods combined with increased temperatures will increase evaporation in raw water pond, decreasing the quality of water as impurities become concentrated. This could lead to increased water processing costs. Lack of sufficient water for processing operations can also lead to extended periods of downtime, as well as potential increased operational costs and delays in the up-stream value chain due to increased water prices, water shortages, or product delivery delays. *Key risks: lost production, increased costs*	**1**	**0.5**
		The number of dry spells is projected to increase by ~11% under SSP2-4.5, and by ~2% under SSP5-8.5 by 2070.		Access to water is required for various activities on site. Water from the raw water pond, fed by water abstracted from the Fan Sediments bore field, is used for earthworks, dust suppression, processing, cement, and fire water. Raw water is also treated to provide potable water for accommodation and office facilities.	Without sufficient water for operations, dust suppression and other uses, operations may halt and potable water may need to be purchased.	No system in place to reduce groundwater reliance.			
						0.5		**0**	**0**
						Increase water efficiency considerations, increasing the range of water sources that can be used.			
	PIBT at Port Qasim	**4**	**3**	**1**	**0.5**	**0**	Increased drought periods may lead to competition for local water resources, leading to decreased potable and industrial water. Decreased potable water supply may lead to increased operational costs due to the need to purchase water elsewhere. Insufficient water for dust suppression and environmental protection can lead to potential increased operational costs and delays in the up-stream value chain due to increased water prices, water shortages, or product delivery delays. *Key risks: increased operational costs, delays*	**2**	**1.5**
		The number of dry spells is projected to increase by ~31% under SSP2-4.5, and by ~22% under SSP5-8.5 by 2080.		Access to water is required for activities like dust suppression, fire protection, and potable purposes.	Without sufficient water supply, water used for dust suppression and other uses may need to be purchased.	No system in place to reduce water use.			
						0.5		**0**	**0**
						Increase water efficiency considerations, increasing the range of water sources that can be used.			

Reputational Risks									
Droughts	**Mine Site**	**2**	**1**	**1**	**0.5**	**0**	If the Project consumes large quantities of water while the surrounding communities lack water access, pressure from surrounding communities to conserve water can increase, risking the Project's social license to operate	**0.5**	**0.5**
		The number of dry spells is projected to increase by ~11% under SSP2-4.5, and by ~2% under SSP5-8.5 by 2070.		Decreased rainfall impacts water availability in local surface water sources.	Water scarcity increases competition for water resources with surrounding communities.	No system in place to reduce water reliance.			
						0.5	This could lead to inter- and intra-community conflict, making the Project area hostile and difficult to operate in.	**0**	**0**
						Increase water efficiency considerations, increasing the range of water sources that can be used.	*Key risks: reputational risks*		
Qualitative Risk Assessments									
Infrastructure Damage and Failure to Operate									
Sea Level Rise	**PIBT at Port Qasim**	**Increasing Hazard**		**Exposed**	**High Sensitivity**	**No Adaptive Capacity**	If the area is inundated operations will be impacted resulting in delays and this will have high-cost implications. Increased sea levels will necessitate adaptations to design and operation.	**Increased Risk**	
		Sea level is projected to increase at PIBT.		Areas of the Project footprint will be below tideline.	Flooding of the Project area due to sea level rise could cause the project to cease to be operational.	No consideration for rising sea levels.			
						Medium Adaptive Capacity		**Increased Risk**	
						Infrastructure is elevated above projected tideline.	*Key risks: increased operational costs, delays*		
Infrastructure Damage and Operational Delays									
Storm Surges and Cyclones	**Railway and PIBT at Port Qasim**	**Continued Hazard**		**Exposed**	**High Sensitivity**	**No Adaptive Capacity**	While climate change projections are uncertain regarding projected cyclone frequency, cyclone intensity is projected to increase due to changes in precipitation and temperature.	**Continued or Increased Risk**	
		Wind velocity and coastal flooding from tropical cyclones and storm surges are projected to increase near PIBT under SSP5-8.5.		Port and Railway infrastructure such as berths, conveyor belts, access roads, rail tracks, and administrative buildings will be exposed to storm surges from the sea.	On-site infrastructure damages will cause operational stoppages.	Storm surges not accounted for in site design.	Cyclones and storm surges can lead to operational delays as storm conditions make it unsafe to continue operations of the railway and port. Damage to infrastructure during storm surges can also incur higher repair costs.		
						Medium Adaptive Capacity	Operating during storm periods may also cause health and safety risks to workers who operate machinery during inclement weather.	**Continued Risk**	
						Storms and flood risks considered in site planning.	*Key risks: operational and maintenance costs, lost production, health, and safety*		
Operational Delays and Health and Safety Hazards									
Sand and Dust Storms	**All Sites**	**Continued Hazard**		**Exposed**	**High Sensitivity**	**No Adaptive Capacity**	Sand and dust storms cause decreased visibility, causing operational delays while production is forced to pause.	**Continued or Increased Risk**	
		Climate change and drought are known to exacerbate sand and dust storms (UNCCD, 2023). As drought conditions increase in the Project areas, conditions for sand and dust storms are also likely to increase.		Reko Diq Mine Site, railway, and PIBT are located in Provinces prone to sand and dust storms.	Operations at all sites may need to pause due to decreased visibility and safety concerns.	No mitigation possible to prevent visibility issues from sand and dust storms.	Sand and dust may also cause damage to infrastructure or require areas to be cleared of sand before being usable, leading to increased maintenance and repair costs.		
						Medium Adaptive Capacity	Severe risks from sand and dust storms include health and safety risks from inhalation of particles, or accidents caused by reduced visibility.	**Continued Risk**	
						Policies are in place to ensure production stops and PPE is available to protect workers from health hazards.	*Key risks: operational and maintenance costs, lost production, health, and safety*		

Health and Availability of Workers							
Chronic climatic changes and extreme weather events	All Sites	**Increasing Hazard** Combination of changes in temperature and rainfall can lead to extreme weather events and chronic changes to weather in the project area.	**Exposed** Mine workers and their families are exposed to changing climate conditions seeing as they live in the region.	**High Sensitivity** As certain areas become unhabitable due to projected extreme weather events, a Project area may become at risk to in-migration or adversely can become at risk of migration as areas become unsuitable for human activities like farming. Workers will be at risk of diseases that are projected to increase due to climate change.	**No Adaptive Capacity** Mine cannot control the impact, extent and duration of extreme weather events and changing weather patterns in surrounding communities	The Project may be at risk of losing available workers due to adverse weather conditions that might not be conducive to a safe and healthy living environment for people. Extreme weather event frequency and severity can create reduced food availability, impacting worker and community nutrition. This will increase socio-economic stress and can lead to community unrest, and lead to migration of the workforce. Projected increases in the prevalence of Malaria, as well as the influence of climate change on diarrheal deaths may impact the health and availability of workers (WHO, 2021). *Key risks: lost production*	**Increased Risk**

9.3. Transition Climate Change Risks and Opportunities

Annual project emissions are expected to exceed 100,000 tCO_2e per year (Section 8). Therefore, according to the Equator Principles, transition risks as outlined by the TCFD (policy and legal risk, reputational risk, technology risk and market risk) should also be considered (Table 9-2). Transition opportunities are also discussed in Table 9-3. Transition risks and opportunities are identified based on political, technological, market-based, and reputational changes associated with a low-emissions scenario such as SSP1-2.6 and the IEA Net Zero Emissions by 2050 guidance (IEA, 2021).

Table 9-2: Project Specific Climate Change-related Transition Risks

Risk Group	Risk Type	Risk Description
Policy & Legal	Policy	While Pakistan does not currently have legally binding climate change policies, targets and objectives set out in various strategy and policy documents indicate that legislation regarding climate change will be likely in the future. These policies and potential implications include: • **The National Sustainable Development Strategy** outlines the need to identify climate change risks and hazards and promote resiliency to climate change. By completing this CCRVA and implementing recommendations to reduce climate change risks, Barrick will maintain alignment with this policy. • **In Pakistan's Updated 2021 NDC**, the government outlined an emissions reduction target ranging from 35-50% reduction of projected emissions by 2030. The document also includes plans for 60% of all energy produced in the country to be from renewable sources by 2030. Barrick therefore needs to ensure planned emissions are kept as low as possible, and that on-site energy production incorporates renewables. • **The National Climate Change Policy** outlines mitigation policies that will impact the industrial sector, including policies around energy efficiency, emissions calculations and reductions, and carbon capture and storage. Barrick will need to show that resource efficiency has been planned for in the Project design, and prepare for additional policies surrounding emissions reductions and removals. • **Pakistan's National Action Plan on SDG 12** sets targets to implement cleaner technologies in the industrial sector and enhance the capacity of industry to conserve resources and promote environmental compliance. Therefore, the Project should be designed to limit environmental impact wherever possible, or risk potential future impacts. • **The Balochistan Climate Change Policy** calls for the incorporation of climate change considerations into the Balochistan Mines and Minerals Policy and develop a mining-sector specific climate change action plan. The Policy also includes goals relating to the enforcement of sustainable water management and enhanced restoration practices within the mining industry. Barrick will need to monitor for and align to future measures related to this policy. Impact Mechanism: Failure to comply with current and future policies may lead to potential fines.

Risk Group	Risk Type	Risk Description
	Legal/Compliance	• Barrick is listed on the NYSE and TSX. More stringent regulatory, compliance and disclosure requirements in terms of sustainability and Environmental and Social Governance (ESG), can pose risks to Barrick if the organisation does not continue to track performance, maintain compliance, and actively work to reduce adverse impacts of operations. • Enhanced emissions-reporting obligations under different regulatory and investor frameworks can lead to increased operational costs for resourcing required to conform. • The management of climate risks is increasingly becoming a legal obligation for companies. Regular assessments of the transition and physical climate risks of a project is likely to become mandatory for some investors and reporting standards like IFRS. • Similarly, to be aligned with the recommendations of the GRI, the consideration of material financial risks and conducting double materiality assessments may become mandatory. Barrick will need to continue conducting these activities regularly and thoroughly. • Failures of a TSF or damaged infrastructure due to extreme weather events such as extreme rains or flooding can lead to damages/contamination to the environment and surrounding community, which could lead to stakeholders undertaking legal action against the mine for not considering climate change risks and impacts and also risks the mine's social license to operate. Impact Mechanism: Failure to comply with legal and regulatory requirements may lead to impacts to funding availability and revenue based on reputational risks.
	Tax	• While Pakistan authorities are considering implementing a Carbon Levy on fossil fuels (Haider, 2024), an economy-wide carbon tax is not yet a consideration by the Pakistani Government. The possibility does exist that a tax on carbon emissions for non-fossil fuel industries can be applied in future. A tax on carbon emissions will increase operational production costs. For example, if a low carbon tax is to be applied, such as that of South Africa at R190/tonne CO_2, (c.$10.15 / tonne CO_2[20]), based on the average annual Scope 1 and 2 GHG emissions calculated for the Project, Barrick would pay an additional $13.8 million in taxes each year. Impact Mechanism: Failure to prepare for carbon pricing by implementing emissions reduction initiatives can lead to increased operational costs.
Technology	Transition to low carbon economy	• National and global commitments and targets for a transition to a low carbon economy means that Barrick needs to reduce operating carbon emissions. This means that investments into new technologies and processes to reduce emissions will be required. A risk is that the substitution of existing equipment with lower emissions options may result in write-offs, early retirement of assets thereby increasing capital costs. To mitigate the risk and to maximise investment opportunities, low emissions technologies (equipment and processes) should be considered in Project design and construction to avoid construction and planning of a mine that would need to replan and invest in new technologies in a few years' time to keep up with global climate change commitments. Impact Mechanism: Failure to implement emissions reduction initiatives in Project design can lead to increased capital costs and write-offs in the long term.
	EV	• There will be significant advances in EV technologies for light duty vehicles in the short term and for heavy duty vehicles in the medium term. Improvements in EV technologies will make fleet replacement more realistic and affordable in future. Replacing fleet vehicles with EVs before they are realistic and affordable (provided they can be charged with renewable electricity) can lead to high capital expenses that are not emissions efficient. Impact Mechanism: Poorly timed adoption of EV technologies can lead to increased capital expenses.
	Stranded Asset	• Technological advances in the medium-term can lead to stranded assets if mine planning and development does not consider lower emissions intensive technologies. These include items such as HFO generators, some diesel-based earth moving equipment and diesel-powered locomotives. This is dependant on the resale value of these assets, as there could still be other applications for these assets. • Stranded assets lead to wasted capital expenses should high emission assets be repriced/depreciate. Impact Mechanism: Failure to implement emissions reduction initiatives in Project design can lead to increased capital costs from stranded assets.
Market and Reputation	Customer, investor and supplier requirements	• Customers, suppliers and investors can demand more sustainable practices and lower emissions products from mining companies, which could require costly operational changes to comply with the demands of these stakeholders. • If Barrick does not drive continued progress to reduce absolute emissions and GHG intensity of copper, its position as a preferred copper supplier to markets will be in jeopardy. Impact Mechanism: Failure to meet stakeholder expectations may lead to impacts to funding availability and revenue based on reputational risks.
	Value chain emissions	• Barrick might need to change its upstream supplier due diligence processes to ensure that it sources goods and services from lower emissions suppliers to help reduce value chain emissions.

[20] Calculated using an average exchange rate of R1 to $0.53 USD based on daily exchange rates from January 1 through June 27, 2024 (ExchangeRates.org, 2024) and updated 2024 Carbon Tax Rate of R190 (Ernst & Young, 2024).

Risk Group	Risk Type	Risk Description
		Impact Mechanism: Failure to lower supply chain emissions may lead to impacts to funding availability and revenue based on reputational risks.

Table 9-3: Transition Opportunities

Risk	Opportunity
Policy and Legal Opportunity	• Pakistan's National Climate Change Policy and the Balochistan Climate Change Policy both outline the potential for future economic incentives for emissions reductions. By incorporating renewable energy production and planning for resource efficiency in Project design, Barrick may be well positioned to take advantage of economic incentives in the future. • In Pakistan's Updated 2021 NDC, the government outlined a commitment to developing nature-based solutions and carbon sequestration programmes. Progress towards this can be seen through the Green Pakistan Programme (formerly known as the 10 Billion Trees Tsunami Project), in which Pakistan has committed to plant an additional 100 million indigenous tree species. In addition, Pakistan is building capacity in their forest departments to meet REDD+ requirements, leading the way for REDD+ incentives to be established. This provides an opportunity for Barrick to participate in REDD+ carbon sequestration projects in the future, leading to economic and emissions reduction benefits. Impact Mechanism: Engagement with economic incentives may lead to lowered capital expenses when implementing emissions reduction projects and increased reputational value.
Technology Opportunity	• Improvements in the manufacture of biofuels in the near to medium term will also increase their availability and reduce the cost of using biofuels. Biofuels can directly replace the fossil fuel derived counterparts in internal combustion engines. Pakistan's National Climate Change Policy includes plans for increased biofuel crop production and research into biofuel technologies, so local availability of biofuels is likely to increase during the Project lifespan. Impact Mechanism: Greater technological opportunities may reduce capital costs when implementing emissions reduction projects.
Market conditions	• Copper is utilised in low-carbon technologies such as electric vehicles and renewable power technologies. As the transition to low-carbon technologies increases, demand for copper is projected to increase. The Project is well positioned to take advantage of increases in demand, presenting opportunities for continued growth. Impact Mechanism: Increased demand for transition metals may lead to increased revenue and market reputation.

9.4. Risk Management Recommendations

Climate change impacts and risks have increased significantly over recent years and will continue to increase in severity if projections based on emissions trajectories are accurate (The World Bank, 2024; IPCC, 2022). It is also important to consider that climate change impacts will also affect all ecosystem drivers and services, this means communities that are already facing high vulnerability to climate change impacts will become more vulnerable (IPCC, 2022).

Table 9-4 outlines high-level risk management recommendations for consideration in the construction of future phases, operation, and closure of the Project based on the identified climate-related risks outlined in the above sections. Due to the uncertain and variable nature of climate change, it is recommended that climate change risk assessments, site design, policies, and management plans, are updated every 3-5 years to account for changes in climate and as updated climate change projections become available.

At the time of writing, the Project design and management plans are in the drafting process. Climate change projections and identified risks have been provided to specialists to ensure climate considerations are incorporated into impact assessments and management plans. Finalised CCRVA is also being shared with design engineering consultants to ensure climate change projections and identified risks are considered in the detailed design phase of the Project. Therefore, risk management recommendations below are focused on the long-term monitoring and updating of policies and plans to ensure changes in physical and transition risks continue to be accounted for throughout all phases of the Project.

Table 9-4: High-Level Risk Management Recommendations

Risk	Recommendations to Manage and Adapt to Risks	Mine	Rail	Port
Extreme rainfall, flooding, and storm surges	Continuously review update maintenance policies to ensure regular maintenance of potentially vulnerable infrastructure, stormwater and drainage channels to flooding events as well as safe water drainage and channeling.	X	X	X
	Ensure that frequent and thorough maintenance is conducted as per maintenance policies for roads, railways, drainage channels and vulnerable areas on site to safeguard structural integrities and ensure effective water drainage and flood control	X	X	X
	Perform continuous monitoring, especially after extreme weather events, to ensure there is no contamination of surrounding environment from potential spills and seepage of waste, fuels and wastewater.	X		X
	Ensure that sedimentation controls at the Mine Site and PIBT are monitored regularly.	X		X
	Continuously review and update emergency site evacuation plans. To ensure the safety of all workers on site, it is pivotal that all site evacuation and emergency response plans can be implemented effectively during flooding events and that other built infrastructure on site is designed to be resilient towards projected flood levels.	X		X
	Ensure that the Mine Site and PIBT's stormwater management plans are continuously reviewed to ensure they have capacity to safely manage more frequent and intense flooding events as climate change progresses.	X		X
	Continuously review and update site design and layout planning which considers the potential for increased extreme precipitation events that could lead to soil saturation and potential compromised slope stability.	X		X
	Investigate the potential for desert-appropriate progressive rehabilitation to reinforce slope stability.	X		

Risk	Recommendations to Manage and Adapt to Risks	Mine	Rail	Port
Increased Temperatures	Ensure health and safety management plans which consider extreme heat are continuously reviewed and updated as climate change progresses. Potential measures to review include: • Training on identification of dehydration in staff – urine charts, behaviours to look out for etc; • Existence of hot day procedures; • Identified temperature thresholds at which certain procedures should be implemented; • Availability of water stations; • Provision of frequent heat rest breaks on hot days; and • PPE and clothing provides sufficient protection from heat stress; and • control of cabins of vehicles that are used for long periods of time, for example in haul trucks, excavators, and transport trucks.	X		X
Sea Level Rise	Infrastructure that has been designed to withstand projected sea level rise should be monitored as sea levels change over time.			X
Chronic Climatic Changes and Extreme Weather Events	Continuously review and update malaria procedures on site, including: • Provision of mosquito repellent, nets, full coverage clothing for employees, and prophylaxis medication; • Education on malaria risks and transmission for employees and contractors; and • Spraying and fumigating on-site buildings using formulas with proven local efficacy.	X		X
	Ensure programmes to support health, food, and water security for local communities are reviewed and updated as climate changes occur.	X		
Transition Risks	Conduct regular monitoring of policy and legal developments in Pakistan to ensure compliance with polices, targets, and objectives.	X	X	X

Risk	Recommendations to Manage and Adapt to Risks	Mine	Rail	Port
	Monitor for technological advances and changes in energy and fuel pricing to continue to adapt to changing energy markets and prioritise low-carbon solutions.	X		X
	Ensure Project design prioritises energy efficiency and GHG reduction initiatives, and continuously monitor for improvement opportunities throughout operational phase.	X		X
	Continue to align with Barrick's group-wide GHG reduction targets and disclosure of environmental and climate-related performance.	X		X
	Review and update climate change transition and physical risk assessments for the Project every 3-5 years.	X	X	X
	Maintain compliance with Barrick's internal carbon pricing strategy.	X		X
	Consider low emissions technologies (equipment and processes) in Project design and construction to avoid stranded assets.	X		X
	Diversify supply chain to protect against potential disruptions, and continuously monitor for low-emissions suppliers.	X		X
	Maintain accurate ESG data collection to ensure disclosures are verifiable and complete.	X	X	X

10. Integration with Specialists

Climate change projections were assessed by each specialist to identify which impacts may be exacerbated by climate change and ensure mitigation measures and management plans are designed to account for climate change. Table 10-1 below summarises exacerbated impacts and subsequent mitigation measures identified in each specialist assessment. Additional details can be found in each respective specialist report.

Table 10-1: Specialist Assessment Climate Change Considerations

Specialist Assessment	Climate Change Impacts	Mitigation Measures
Surface Water (Appendix K, Sections 7.2, 10)	Rainfall depth for 1:50 and 1:100-year intervals is projected to increase across various time intervals, which could exacerbate the following impacts: • More intense storm events, leading to greater volumes of water being generated as surface runoff, larger and high velocity flows, and altered natural flow paths. • Potential overflow and flooding of stormwater infrastructure, such as channels, dams or ponds. • Intense flash flooding leading to potential contamination of downstream water bodies with mobilised chemicals and other pollutants, and damage to the mine infrastructure.	It is important to carefully consider possible and practical adaptive management measures to mitigate the risks on both the mining operation and the surrounding environment through an adaptive water management approach.

	Based on the projected increase in MAP, it was decided to use a 1:10 year rainfall event for the Wet Rainfall Scenario simulations. **TSF Specific Impacts:** A comparison against the rainfall and runoff contribution under average vs wet conditions conclude that the current TSF design does cater for a probable maximum precipitation (PMP) event and as a result the volume under an annual wet scenario will not impact the operation of the TSFs.	
Hydrogeological (Appendix P, Sections 5.4.5, 6.2)	Increase in precipitation could increase the recharge potential to the groundwater system, however the vulnerability of the groundwater resource to climate change will likely to be low given the increased potential for runoff (storm events) and high evaporation for the Project Area. **TSF Specific Impacts:** A flood event on the WRD and TSF, may cause additional seepage of contaminated water to the groundwater resource. The recharge is currently estimated to be 0.42 mm per year (1.8% of MAP). The higher risk TSF facilities are lined so seepage to the groundwater resource would be managed by the design. The design for the WRD and TSF would need to be designed to prevent failure from storm events.	Operational procedures and emergency response plans should be put in place at the Project to monitor weather forecasts in the short- to medium- term during the LoM and ensure adequate management and mitigation measures are put into place to sufficiently manage stormwater events. Reko Diq would be required to monitor how the climate changes over the operational phase of the mine to inform contingency plans to prevent the overtopping or failure of the TSF or WRDs and managing the dewatering of the pits, should significant flood event occur. Direct rainfall into the pits would require significant volumes of water (~1.5Mm3 based on a climate adjusted 100 year, 24 hour flood event) to be abstracted which could be beneficial to the project if able if Reko Diq are able to store the abstracted volume. In the event that water pumped from the pits must be discharged to the environment, the abstracted water will need to comply with permitted discharge limits.

Traffic (Appendix E, Sections 6.3, 9.1)	Change in climatic conditions, particularly an increase in the annual precipitation and the increase in the number of flood events can exacerbate impacts on traffic by increasing traffic related disruption, congestion and increasing the likelihood of traffic accidents.	The increase in the annual precipitation and flood hazard intensity can adversely impact traffic congestion. As the overall contribution of the Project to the traffic is low, these impacts will not be specific to the Project. The Project shall ensure as part of its feasibility study that alternative routes are accounted for in the event of flooding, and appropriately schedule traffic to account for the rainy season.
Soils and Sediments (Appendix R, Sections 6.5, 9.1)	Change in climatic conditions, particularly an increase in the annual precipitation and the increase in the number of flood events can exacerbate impacts on soil by increasing erosion of soils and resulting in morphological changes to the topography.	The increase in the annual precipitation and flood hazard intensity will exacerbate runoff and erosion related impacts if they are not managed properly. The Ground Disturbance Control Plan will adopt a precautionary approach and will investigate the Project's excavation and adjoining areas and on the basis of topography, will determine whether erosion related risks will emerge in the future. This assessment does not account for changes in wind speeds, although the contribution of wind speed relative to erosion from precipitation will likely be minor. The Ground Disturbance Plan will emphasis stockpile management to ensure that wind related dispersion of dust around the site is minimised.
Noise (Appendix D, Section 8)	The climate change assessment indicates an increasing trend in temperature under both optimistic and worst-case scenario. This can also lead to changes in relative humidity for the future time horizon. Although the increasing temperature can affect the propagation of pressure waves, the projected change for the Reko Diq Mine Site, Road Transport Route, Rail Transport Route, and PIBT is	Climate change impacts were found negligible, therefore no updates to mitigation measures were made.

	relatively low with a maximum increase of 2.86ºC under the worst-case scenario for mid-term time horizon. Hence, the resultant impact of changing temperature on the propagation of sound pressure waves is expected to remain negligible. Other parameters such as changes in mean seasonal or annual precipitation do not impact noise levels. Therefore, the impacts of noise levels assessed will remain unchanged under changing climate.	
Geochemistry (Appendix S, Section 9.2.3)	The impacts of climate change to the mine geochemistry may include impacts to Acid Mine Drainage (AMD) and increased weathering rates. Acid Mine Drainage (AMD): • Higher temperatures generally accelerate the sulphide oxidation process through increased chemical reaction rates and enhanced microbial activity, leading to more rapid development of AMD. • Increased Rainfall: More frequent and intense rainfall can increase the flow of water through mine waste, enhancing the mobilisation of acidic material and metals. • Flooding: Extreme weather events and flooding can lead to the overflow of containment systems if not properly designed, releasing AMD into the environment. Increased Weathering Rates:	Climate change risks have been incorporated into the Environmental Management Plan.

	• Higher Temperatures: Elevated temperatures can accelerate chemical reactions, increasing the rate of mineral weathering and the release of heavy metals and other contaminants. • Increased Precipitation: Higher rainfall can enhance the leaching of contaminants from mine waste and tailings, potentially leading to the contamination of groundwater and surface water.	
Air Quality (Appendix Q, Section 7.4)	In terms of air quality, although the increasing temperature can worsen the particulate matter (PM) concentrations in the region, this increase will be compensated by the increased precipitation which usually causes PM to settle at the ground surface and reduces dispersion. In terms of other Project components such as Road Transport Route, Rail Transport Route, and PIBT, the climate change is expected to result in increasing temperature and precipitation in the region. However, the ambient air quality is expected to remain unchanged due to limited sources of particulate matter in the background of these locations. Changes in wind speeds or directions are challenging to predict for future time horizons due to the complexities of atmospheric circulations, resulting in low confidence in projections. Additionally, very few GCMs provide variables such as wind vectors, wind speeds, or wind directions. This is one of the key	Impacts will be negligible, therefore existing mitigation measures will be deemed sufficient.

	limitations of the GCM and their dynamically downscaled RCMs. Therefore, an assessment of impacts of climate change on the air quality cannot be assessed.	
Biodiversity – Flora and Fauna (Fauna: Appendix I, Section 8.5)	Climate change will not pose significant challenges to the flora and fauna in the areas surrounding the Reko Diq Mine Site, the Northern Groundwater System, the Access Route to the Mine Site, and PIBT.	Climate change impacts were found negligible, therefore no updates to mitigation measures were made.
Cumulative Impact Assessment (Appendix U, Sections 4.2.2, 8.3)	An increase in GHG emissions and adverse climate change impacts in Balochistan were cited as concerns by the Home Department Quetta, the District Vice Chairman Local Government and Rural Development Chagai, and the National Highway Authority (NHA). The Ministry of Railways emphasised that the development of effective rail transport in the region can significantly assist Projects in offsetting their GHG emissions.	The cumulative developments in the CIA Study Area, particularly the mining developments, will need to develop additional energy infrastructure to support their operations. Energy production is a GHG intensive process and can significantly contribute to climate change.
Socioeconomic (Appendix B, Section 6.5)	In much of the greater Balochistan region, the majority of the population relies on livestock grazing, agriculture, and other primary sector activities for their livelihoods. Variations in precipitation and temperature can severely impact agricultural output, particularly wheat, which is the most commonly cultivated crop. Irrigation needs are primarily met through groundwater abstraction; however, reduced precipitation and altered precipitation patterns may adversely affect the availability of water from aquifers	The adverse impacts on primary sector productivity, combined with the infrastructural and health-related challenges brought on by floods, indicate that livelihoods and incomes will be significantly affected in the long term due to climate change. The Project has an opportunity to support local communities in building resilience to climate change, which has been integrated into the mitigation and enhancement measures for the following aspects: • Increase in Cost of Living: The Project will ensure that local communities are informed about how climate change may

	and increase pumping costs. Extreme weather events, such as floods, also pose a threat to livestock survival, making them more susceptible to waterborne diseases. Additionally, extreme temperatures can negatively affect livestock health, leading to increased mortality, as observed in previous extreme temperature events in Balochistan. The increase in flood events will also exacerbate health-related incidents and place an additional burden on the already limited healthcare infrastructure, as flooding can lead to waterborne diseases and contamination of municipal drinking water supplies. Flooding will also damage infrastructure and cause significant economic losses. Furthermore, the increase in extreme heat days is expected to result in additional hospitalizations due to heatstroke and other heat-related ailments.	impact commodity prices and healthcare costs in the future. To the extent possible, the Project will inform local communities prior to any expected extreme weather events and other potential climate-related disruptions. • Social Development and Uplift: The Project will ensure that the upgraded or newly constructed healthcare and educational infrastructure account for the increased flood-related risks. The Project will consider CSR-related funding toward the drainage and flood management infrastructure of local communities. • Skill Development: The skill development initiatives by the Project will be aligned to incorporate climate change resilience and adaptation strategies. This includes technical training for flood management, facilitation of farmers in drought-resistant agriculture, and the creation of jobs in the services sector

11. Conclusion

The lifetime scope 1 and 2 GHG emissions of the Project are estimated to be 53 million tCO_2e. This project could increase Pakistan's national annual GHG emissions by 0.26%. Several mitigation measures have been recommended, some of which are already being investigated by the project proponent and applied where practicable.

Forecast annual GHG emissions vary between 5,760 and 1.36 million tCO_2e. On average, the emissions >1 million tCO_2e per year. Thus, the project must report on its scope 1 and 2 GHG emissions annually.

The projected climate changes for the Project include increased flooding, extreme heat, drought, storm surge intensity, and sea level rise. All reviewed climate models outlined similar physical climate risks for each aspect of the Project, with varying degrees of intensity and severity. Extreme heat and flood hazards are projected to create the most risks to the Project.

Projected climate changes at the Project site may:

- Pose increased risk to infrastructure, including the TSFs and thus, indirectly, the surrounding environment;
- Present health and safety risks for employees;
- Cause delays or stoppages in production due to damages onsite, at the railway, and in the supply chain; and
- Exacerbate impacts already identified for the construction, operation, and closure of project infrastructure, including the TSFs.

At the time of writing, the Project design and management plans were in the drafting process. Therefore, high-level risk management recommendations were provided, advising that the Project regularly inform climate risk registers with updated climate risk reviews, ideally every 3-5 years. Updated climate risk assessments will outline which recommendations and mitigation options to prioritise to improve the Project's climate resilience.

Climate change projections and identified risks have been provided to specialists and design teams. Mitigation measures have been assessed and updated for activities identified in the ESIA that have climate change considerations. Where additional climate change considerations were necessary, specialists adjusted the mitigation measures and management plan inputs accordingly. Therefore, mitigation measures listed within each specialist assessment are inclusive of climate change considerations, and management plans are being drafted inclusive of identified climate change risks and opportunities. Finalised CCRVA is being shared with design engineering consultants to ensure climate change projections and identified risks are considered in the detailed design phase of the Project.

Given the climate time lag and uncertainty, this needs to be constantly monitored, reviewed, and updated to ensure measures align with changing risks. Provision also needs to be made to account for future changes in risk.

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Appendix A: Climate Projection Data

Hazard Index Data Sources and Justification – Mine Site

l Resolution	Time Horizons	SSP2-4.5 / RCP4.5	SSP5-8.5 / RCP8.5	Methods / Uncertainty	Description
grees area ng the proposed ite (29.13, 62.00)	1981-2010	**22.98°C (22.96, 22.99)**	**22.98°C (22.96, 22.99)**	Ensemble Median 25th and 75th percentile	Mean annual values of da mean temperature averag over a 30 year period, calculated as absolute ch from baseline
	2010-2040	+ 1.09 °C (0.96, 1.33)	+ 1.25°C (0.95, 1.52)		
	2041-2070	+ 2.11°C (1.74, 2.56)	+ 2.86°C (2.58, 3.64)		
	2071-2100	+ 2.94°C (2.30, 3.58)	+ 5.11°C (4.44, 6.21)		
grees area ng the proposed ite (29.13, 62.00)	1981-2010	**-3.57°C (-3.89, -2.89)**	**-3.57°C (-3.89, -2.89)**	Ensemble Median 25th and 75th percentile	Minimum yearly values of daily minimum temperatu averaged over a 30 year period, calculated as abso change from baseline
	2010-2040	+ 0.77°C (0.03, 1.51)	+ 0.78°C (0.35, 1.41)		
	2041-2070	+ 1.43°C (1.15, 2.23)	+ 2.37°C (1.71, 2.99)		
	2071-2100	+ 1.74°C (1.27, 2.88)	+ 3.25°C (2.85, 5.02)		
grees area ng the proposed ite (29.13, 62.00)	1981-2010	**44.49°C (44.31, 44.71)**	**44.49°C (44.31, 44.71)**	Ensemble Median 25th and 75th percentile	Maximum yearly values o daily maximum temperatu averaged over a 30 year period, calculated as abso change from baseline
	2010-2040	+ 1.20°C (0.97, 1.45)	+ 1.50°C (0.89, 1.65)		
	2041-2070	+ 2.40°C (1.83, 2.96)	+ 3.37°C (3.04, 3.93)		
	2071-2100	+ 3.35°C (2.75, 4.02)	+ 6.11°C (4.92, 6.93)		
al - Results for istan Province	1995-2014	**112.23 days**	**112.23 days**	Ensemble Median 10th and 90th percentile	Annual days over 35°C, averaged over a 20 year period, calculated as an absolute change from baseline
	2020-2039	+ 13.78 days (-0.63, 27.35)	+ 15.27 days (0.09, 30.46)		
	2040-2059	+ 24.86 days (8.41, 41.58)	+ 33.72 days (15.25, 52.11)		
	2060-2079	+ 34.24 days (17.07, 54.23)	+ 53.82 days (31.81, 76.55)		
	2080-2099	+ 40.42 days (20.03, 60.39)	+ 75.71 days (48.96, 101.29)		
grees area ng the proposed e (29.13, 62.00)	1981-2010	**9.07 days (8.42, 10.03)**	**9.07 days (8.42, 10.03)**	Ensemble Median 25th and 75th percentile	Annual average of days < over a 30 year period, calculated as absolute ch from baseline
	2011-2040	-3.27 days (-4.55, -2.10)	- 2.97 days (-4.63, -1.58)		
	2041-2070	- 5.13 days (-6.37, -3.18)	- 5.83 days (-6.70, -4.80)		
	2071-2100	- 5.43 days (-7.42, -4.45)	- 7.50 days (-8.58, 6.17)		
grees area ng the proposed ite (29.13, 62.00)	1981-2010	**0.16 mm/day (0.16, 0.16)**	**0.16 mm/day (0.16, 0.16)**	Ensemble Median 25th and 75th percentile	Mean annual daily precipitation values avera over a 30 year period, calculated as relative cha from baseline
	2010-2040	+ 21.24% (9.77, 37.23)	+ 22.80% (14.08, 60.77)		
	2041-2070	+ 23.41% (5.19, 51.57)	+ 29.69% (-1.18, 72.28)		
	2071-2100	+ 19.69% (1.32, 34.80)	+ 34.30% (1.38, 95.21)		
overing the ed mine site 62.00). Spatial ion undefined	1981-2010	**30.09 m³/s (3.94, 55.67)**	**30.09 m³/s (3.94, 55.67)**	Ensemble Median 25th and 75th percentile	50 Year Return period of annual daily max water discharge, used to showc 50 year flood recurrence
	2010-2040	+ 123.85% (-17.32, 513.36)	+ 87.62% (-38.48, 544.81)		
	2041-2070	+ 86.39% (24.91, 242.39)	+ 155.46% (-14.03, 650.80)		
	2071-2100	+ 158.56% (-62.17, 401.54)	+ 116.98% (-71.58, 323.67)		
	1981-2010	**16.36 m³/s (2.12, 30.28)**	**16.36 m³/s (2.12, 30.28)**	Ensemble Median	

overing the ed mine site 62.00). Spatial ion undefined	2010-2040	+ 129.97% (-18.40, 494.15)	+ 86.22% (-36.57, 555.87)	25th and 75th percentile	10 Year Return period of annual daily max water discharge, used to showc 10-year flood recurrence
	2041-2070	+ 88.68% (22.36, 253.19)	+ 155.71% (-13.65, 678.16)		
	2071-2100	+ 168.24% (-61.53, 411.88)	+ 114.78% (-71.27, 337.19)		
grees area g the proposed ite (29.13, 62.00)	1981-2010	**618.00 days (499.50, 634.50)**	**618.00 days (499.50, 634.50)**	Ensemble Median 25th and 75th percentile	Maximum number of consecutive dry days whe precipitation is <1mm ove 30 year period
	2010-2040	- 10.14% (-13.99, -1.62)	- 13.08% (-36.09, -0.40)		
	2041-2070	+ 0.47 (-30.80, 6.51)	+ 6.39% (-18.93, 18.87)		
	2071-2100	- 4.93% (-34.72, 11.91)	- 3.31% (-35.77, 28.21)		
grees area g the proposed ite (29.13, 62.00)	1981-2010	**112.00 periods (105.50, 116.50)**	**112.00 periods (105.50, 116.50)**	Ensemble Median 25th and 75th percentile	Calculated as the number dry periods for more than days for a 30-year period
	2010-2040	+ 4.63% (-2.92, 10.14)	+ 10.53% (0.85, 18.63)		
	2041-2070	+ 11.11% (2.16, 22.77)	+ 1.77% (-3.00, 22.53)		
	2071-2100	+ 12.93% (-7.53, 24.19)	+ 9.18% (-13.11, 43.84)		

Hazard Index Data Sources and Justification – Railway near Nushki (29°32'27.24"N, 66° 3'30.11"E)

d Resolution	Time Horizons	SSP2-4.5 / RCP4.5	SSP5-8.5 / RCP8.5	Methods / Uncertainty	Description
grees area g railway near on Quetta n (29.54, 66.06)	1981-2010	**18.37 °C (18.34, 18.38)**	**18.37 °C (18.34, 18.38)**	Ensemble Median 25th and 75th percentile	Mean annual daily temperature values avera over a 30 year period, calculated as absolute ch from baseline
	2011-2040	+ 0.95°C (0.86, 1.14)	+ 0.98°C (0.89, 1.33)		
	2041-2070	+ 1.97°C (1.71, 2.30)	+ 2.76°C (2.53, 3.15)		
	2071-2100	+ 2.64°C (2.23, 3.32)	+ 4.95°C (4.29, 5.92)		
grees area g railway near on Quetta n (29.54, 66.06)	1981-2010	**-7.04°C (-7.52, -6.48)**	**-7.04°C (-7.52, -6.48)**	Ensemble Median 25th and 75th percentile	Mean annual daily minimu temperature values avera over a 30 year period, calculated as absolute ch from baseline
	2011-2040	+ 0.55°C (-0.08, 1.36)	+ 0.73°C (0.04, 1.35)		
	2041-2070	+ 1.46°C (1.10, 1.84)	+ 2.13°C (1.36, 2.96)		
	2071-2100	+ 1.81°C (1.31, 2.63)	+ 2.91°C (2.64, 5.25)		
grees area g railway near on Quetta n (29.54, 66.06)	1981-2010	**39.48°C (39.35, 39.68)**	**39.48°C (39.35, 39.68)**	Ensemble Median 25th and 75th percentile	Mean annual daily maxim temperature values avera over a 30 year period, calculated as absolute ch from baseline
	2011-2040	+ 0.98°C (0.84, 1.33)	+ 1.23°C (0.78, 1.46)		
	2041-2070	+ 2.16°C (1.78, 2.55)	+ 2.92°C (2.56, 3.54)		
	2071-2100	+ 3.03°C (2.49, 3.53)	+ 5.88°C (4.86, 6.42)		
al - Results for istan Province	1995-2014	**112.23 days**	**112.23 days**	Ensemble Median 10th and 90th percentile	Annual days over 35°C, averaged over a 20 year period, calculated as an absolute change from baseline
	2020-2039	+ 13.78 days (-0.63, 27.35)	+ 15.27 days (0.09, 30.46)		
	2040-2059	+ 24.86 days (8.41, 41.58)	+ 33.72 days (15.25, 52.11)		
	2060-2079	+ 34.24 days (17.07, 54.23)	+ 53.82 days (31.81, 76.55)		
	2080-2099	+ 40.42 days (20.03, 60.39)	+ 75.71 days (48.96, 101.29)		

grees area ng railway near on Quetta n (29.54, 66.06)	1981-2010	36.57 days (35.85, 37.70)	36.57 days (35.85, 37.70)	Ensemble Median 25th and 75th percentile	Annual average of days < averaged over a 30 year period, calculated as abso change from baseline
	2011-2040	- 8.63 days (-12.50, -7.47)	- 10.07days (-13.75, -9.03)		
	2041-2070	- 15.23 days (-19.48, -11.28)	- 18.97days (-25.85, -16.45)		
	2071-2100	- 18.83 days (-25.93, -15.75)	- 28.30 days (-32.90, 24.22)		
grees area ng railway near on Quetta n (29.54, 66.06)	1981-2010	**0.37 mm/day (0.37, 0.38)**	**0.37 mm/day (0.37, 0.38)**	Ensemble Median 25th and 75th percentile	Mean annual daily precipitation values avera over a 30 year period, calculated as relative cha from baseline
	2011-2040	+ 9.01% (-1.67, 21.60)	+ 21.45% (9.19, 29.77)		
	2041-2070	+ 14.37% (0.87, 30.78)	+ 10.24% (1.07, 28.10)		
	2071-2100	+ 9.56% (-4.87, 23.04)	+ 15.95% (-10.50, 46.59)		
overing railway ushki on Quetta n. Spatial ion undefined	1981-2010	**120.27m³/s (79.34, 182.03)**	**297.04 m³/s (269.44, 398.93)**	Ensemble Median 25th and 75th percentile	50 Year Return period of annual daily max water discharge, used to showc 50 year flood recurrence
	2011-2040	+ 26.40% (-37.43, 92.97)	+ 34.77% (-42.42, 111.63)		
	2041-2070	+ 33.46% (-37.84, 121.61)	+ 23.11% (-20.12, 84.95)		
	2071-2100	+ 30.20% (5.68, 62.15)	- 4.30% (-33.37, 58.39)		
overing railway ushki on Quetta n. Spatial ion undefined	1981-2010	**69.16m³/s (45.16, 103.16)**	**69.16m³/s (45.16, 103.16)**	Ensemble Median 25th and 75th percentile	10 Year Return period of annual daily max water discharge, used to showc 10-year flood recurrence
	2011-2040	+ 27.91% (-37.88, 94.79)	+ 29.41% (-42.11, 115.71)		
	2041-2070	+ 33.42% (-38.43, 119.00)	+ 25.31% (-21.50, 85.43)		
	2071-2100	+ 32.48% (4.73, 71.47)	- 4.47% (-36.15, 63.42)		
grees area ng railway near on Quetta n (29.54, 66.06)	1981-2010	**319.00 days (297.50, 345.00)**	**319.00 days (297.50, 345.00)**	Ensemble Median 25th and 75th percentile	Maximum number of consecutive dry days whe precipitation is <1mm ove 30 year period
	2011-2040	+ 0.67% (-10.91, 10.94)	- 3.13% (-13.40, 4.20)		
	2041-2070	- 7.5% (-14.60, 15.44)	+ 4.37% (-10.27, 30.76)		
	2071-2100	+ 4.26% (-17.76, 14.37)	+ 0.34% (-19.65, 10.52)		
grees area ng railway near on Quetta n (29.54, 66.06)	1981-2010	**188.00 periods (183.00, 196.50)**	**188.00 periods (183.00, 196.50)**	Ensemble Median 25th and 75th percentile	Calculated as the number dry periods for more than days for a 30-year period
	2011-2040	+ 0.51% (-3.52, 4.37)	+ 5.99% (1.78, 12.43)		
	2041-2070	+ 3.55% (-0.26, 8.79)	+ 3.30% (-1.14, 17.89)		
	2071-2100	+ 1.53% (-3.67, 8.64)	+ 1.09% (-5.43, 16.49)		

Hazard Index Data Sources and Justification – Port Quasim (24°46'4.76"N, 67°19'30.93"E)

l Resolution	Time Horizons	SSP2-4.5 / RCP4.5	SSP5-8.5 / RCP8.5	Methods / Uncertainty	Description
grees area ng the proposed e (24.77, 67.33)	1981-2010	**26.91°C (26.91, 26.95)**	**26.91°C (26.91, 26.95)**	Ensemble Median 25th and 75th percentile	Mean annual daily temperature values avera over a 30 year period,
	2011-2040	+ 0.72°C (0.46, 1.28)	+ 0.70°C (0.56, 1.02)		
	2041-2070	+ 1.59°C (1.13, 1.92)	+ 2.09°C (1.61, 2.57)		

	2071-2100	+ 2.25°C (1.63, 2.66)	+ 3.77°C (2.81, 4.50)		calculated as absolute ch from baseline
grees area ng the proposed e (24.77, 67.33)	1981-2010	**9.80°C (9.40, 10.12)**	**9.80°C (9.40, 10.12)**	Ensemble Median 25th and 75th percentile	Mean annual daily minimu temperature values avera over a 30 year period, calculated as absolute ch from baseline
	2011-2040	+ 0.89°C (0.37, 1.23)	+ 0.65°C (0.33, 1.30)		
	2041-2070	+ 1.53°C (1.44, 2.06)	+ 2.31°C (1.88, 3.02)		
	2071-2100	+ 1.87°C (1.76, 2.75)	+ 3.88°C (3.54, 5.07)		
grees area ng the proposed e (24.77, 67.33)	1981-2010	**42.48°C (42.29, 42.85)**	**42.48°C (42.29, 42.85)**	Ensemble Median 25th and 75th percentile	Mean annual daily maxim temperature values avera over a 30 year period, calculated as absolute ch from baseline
	2011-2040	+ 0.53°C (0.44, 0.98)	+ 0.93°C (0.78, 1.07)		
	2041-2070	+ 1.59°C (1.20, 2.06)	+ 1.90°C (1.51, 2.55)		
	2071-2100	+ 1.84°C (1.44, 2.08)	+ 3.28°C (2.57, 3.59)		
al - Results for Province	1995-2014	**187.28 days**	**187.28 days**	Ensemble Median 10th and 90th percentile	Annual days over 35°C, averaged over a 20 year period, calculated as an absolute change from baseline
	2020-2039	+ 14.16 days (-6.67, 28.99)	+ 14.54 days (-4.45, 29.98)		
	2040-2059	+ 25.72 days (3.77, 42.54)	+ 35.01 days (11.62, 53.91)		
	2060-2079	+ 35.1 days (13.99, 55.19)	+ 52.87 days (28.12, 74.3)		
	2080-2099	+ 40.76 days (16.29, 61.89)	+ 73.57 days (45.29, 103.04)		
grees area ng the proposed e (24.77, 67.33)	1981-2010	**0.00 days**	**0.00 days**	Ensemble Median 25th and 75th percentile	Annual average of days < averaged over a 30 year period, calculated as abs change from baseline
	2011-2040	No change	No change		
	2041-2070	No change	No change		
	2071-2100	No change	No change		
grees area ng the proposed e (24.77, 67.33)	1981-2010	**0.36 mm/day (0.34, 0.37)**	**0.36 mm/day (0.34, 0.37)**	Ensemble Median 25th and 75th percentile	Mean annual daily precipitation values avera over a 30 year period, calculated as relative cha from baseline
	2011-2040	+ 38.62% (7.31, 51.85)	+ 49.01% (22.47, 74.81)		
	2041-2070	+ 42.11% (31.58, 79.69)	+ 73.17% (28.35, 120.27)		
	2071-2100	+ 102.14% (56.28, 126.79)	+ 80.69% (60.00, 223.18)		
overing the ed port site. resolution ned	1981-2010	**297.04 m³/s (269.44, 398.93)**	**297.04 m³/s (269.44, 398.93)**	Ensemble Median 25th and 75th percentile	50 Year Return period of annual daily max water discharge, used to showc 50 year flood recurrence
	2011-2040	+ 52.09% (9.23, 83.33)	+ 37.19% (-14.23, 67.44)		
	2041-2070	+ 49.67% (-16.11, 76.84)	+ 37.14% (-17.81, 109.37)		
	2071-2100	+ 31.55% (8.50, 85.89)	+ 103.56% (0.71, 145.18)		
overing the ed port site. resolution ned	1981-2010	**179.60 m³/s (163.78, 189.91)**	**179.60 m³/s (163.78, 189.91)**	Ensemble Median 25th and 75th percentile	10 Year Return period of annual daily max water discharge, used to showc 10-year flood recurrence
	2011-2040	+ 53.70% (11.20, 85.77)	+ 35.67% (-14.59, 64.02)		
	2041-2070	+ 53.86% (-15.71, 74.41)	+ 39.83% (-13.73, 118.31)		
	2071-2100	+ 41.09% (5.78, 85.43)	+ 121.30% (1.51, 152.46)		
grees area ng the proposed e (24.77, 67.33)	1981-2010	**701.00 days (608.00, 731.50)**	**701.00 days (608.00, 731.50)**	Ensemble Median 25th and 75th percentile	Maximum number of consecutive dry days whe precipitation is <1mm ove 30 year period
	2011-2040	- 9.00% (-21.82, 0.07)	- 23.02% (-38.05, 3.76)		
	2041-2070	- 21.97% (-35.53, -2.85)	- 15.69% (-43.69, 31.16)		
	2071-2100	- 28.45% (-40.63, -7.50)	- 17.99% (-42.10, -6.61)		

grees area ng the proposed e (24.77, 67.33)	1981-2010	**67.00 periods (58.00, 70.00)**	**67.00 periods (58.00, 70.00)**	Ensemble Median 25th and 75th percentile	Calculated as the number dry periods for more than days for a 30-year period
	2011-2040	+ 14.93% (1.67, 36.14)	+ 30.00% (15.05, 36.19)		
	2041-2070	+ 31.34% (14.59, 38.99)	+ 22.39% (2.24, 54.79)		
	2071-2100	+ 46.00% (13.57, 57.34)	+ 43.64% (11.81, 85.00)		
overing PIBT at asim (24,67)	1995-2020	**Baseline**	**Baseline**	Average of median per 30 year period 17th and 83rd percentile	Median projections of ann regional sea level rise rate compared to historic base
	2030s-2040s	+ 4.0mm/year (2.0, 6.0)	+ 4.5mm/year (3.0, 7.0)		
	2050s-2060s	+ 4.0mm/year (2.0, 7.0)	+ 6.0mm/year (3.5, 9.5)		
	2070s-2080s	+ 5.5mm/year (2.5, 9.0)	+ 8.5mm/year (5.5, 13.5)		
	2090-2100	+ 6.0mm/year (3.0, 10.0)	+ 11.5mm/year (7.0, 18.5)		
overing PIBT at asim (24,67)	1995-2020	**Baseline**	**Baseline**	Ensemble Median 17th and 83rd Percentile	Median projections of tota sea level rise compared to historic baseline
	2030	+ 0.08 (0.04, 0.13)	+ 0.09 (0.05, 0.13)		
	2040	+ 0.13 (0.07, 0.19)	+ 0.14 (0.09, 0.21)		
	2050	+ 0.17 (0.10, 0.27)	+ 0.20 (0.13, 0.30)		
	2060	+ 0.22 (0.12, 0.33)	+ 0.27 (0.17, 0.39)		
	2070	+ 0.27 (0.15, 0.42)	+ 0.35 (0.22, 0.51)		
	2080	+ 0.33 (0.19, 0.51)	+ 0.44 (0.29, 0.65)		
	2090	+ 0.39 (0.22, 0.61)	+ 0.56 (0.38, 0.81)		
	2100	+ 0.46 (0.26, 0.71)	+ 0.70 (0.47, 1.01)		

Appendix B: GHG Emissions

Year-on-year Estimated GHG Emissions

Year	Current Scenario with Planned Grid Connection				
	Scope 1 (tCO2e)	Scope 2 (tCO2e)	Scope 3 Cat 1 (tCO2e)	Scope 3 Cat 3 (tCO2e)	Scope 3 Cat 10 (tCO2e)
2025	5,766	-	-	1,301	-
2026	17,020	-	-	3,710	-
2027	143,624	-	-	31,079	-
2028	247,645	-	88,137	56,841	176,020
2029	931,129	-	583,998	214,931	1,166,312
2030	972,551	-	703,883	224,621	1,405,736
2031	952,659	-	710,215	220,098	1,418,382
2032	1,002,909	-	666,381	231,524	1,330,840
2033	1,152,689	-	740,245	266,068	1,478,355
2034	1,749,258	-	1,228,333	404,403	2,453,123
2035	1,783,528	-	1,207,843	412,460	2,412,201
2036	1,809,477	-	1,209,561	418,361	2,415,632
2037	1,890,060	-	1,202,337	436,683	2,401,205
2038	1,925,834	-	1,360,960	444,817	2,717,995
2039	1,877,865	-	1,419,447	433,910	2,834,800
2040	1,882,120	-	1,327,229	434,878	2,650,629

Year	Current Scenario with Planned Grid Connection				
	Scope 1 (tCO2e)	Scope 2 (tCO2e)	Scope 3 Cat 1 (tCO2e)	Scope 3 Cat 3 (tCO2e)	Scope 3 Cat 10 (tCO2e)
2041	1,883,115	-	1,392,646	435,104	2,781,274
2042	1,262,707	338,052	1,142,108	290,596	2,280,921
2043	1,276,758	371,857	1,234,264	293,447	2,464,969
2044	1,251,116	405,662	1,163,444	287,272	2,323,531
2045	1,232,118	439,467	1,040,537	282,608	2,078,073
2046	1,184,131	473,272	1,011,401	271,353	2,019,885
2047	1,112,581	507,077	827,572	254,740	1,652,757
2048	1,100,520	540,883	772,500	251,653	1,542,771
2049	1,018,816	574,688	795,121	232,732	1,587,948
2050	906,723	608,493	825,976	206,900	1,649,569
2051	924,373	642,298	920,022	210,569	1,837,390
2052	989,451	642,298	1,099,334	225,366	2,195,496
2053	1,018,839	642,298	1,162,832	232,048	2,322,309
2054	904,079	642,298	1,066,809	205,955	2,130,541
2055	853,443	642,298	1,179,867	194,441	2,356,330
2056	745,352	642,298	1,250,752	169,864	2,497,897
2057	675,267	642,298	1,149,628	153,928	2,295,940
2058	684,853	642,298	1,137,060	156,108	2,270,841
2059	702,894	642,298	1,241,447	160,210	2,479,313

Year	Current Scenario with Planned Grid Connection				
	Scope 1 (tCO2e)	Scope 2 (tCO2e)	Scope 3 Cat 1 (tCO2e)	Scope 3 Cat 3 (tCO2e)	Scope 3 Cat 10 (tCO2e)
2060	643,639	642,298	1,225,455	146,737	2,447,375
2061	492,354	642,298	912,071	112,338	1,821,511
2062	355,214	642,298	562,717	81,156	1,123,810
2063	268,075	642,298	480,739	61,343	960,092
2064	244,990	645,687	433,361	56,059	865,472
2065	19,987	-	-	4,589	-
2066	18,391	-	-	4,226	-
Total	40,113,918	13,255,014	36,476,231	9,217,027	72,847,244

Appendix C: GHG Emissions for Alternatives

Year-on-year Estimated GHG Emissions of Alternatives

Year	Current	HFO only	Diesel Only	Natural Gas Only	70% RE/30% HFO
2025	-	-	-	-	-
2026	-	-	-	-	-
2027	53,025	66,282	65,185	47,453	19,884
2028	90,143	112,679	110,815	80,670	33,804
2029	585,929	732,411	720,297	524,356	219,723
2030	636,304	795,379	782,224	569,437	238,614
2031	636,304	795,379	782,224	569,437	238,614
2032	636,304	795,380	782,224	569,437	238,614
2033	726,446	908,058	893,039	650,107	272,417
2034	1,223,541	1,529,426	1,504,130	1,094,964	458,828
2035	1,272,608	1,590,760	1,564,449	1,138,874	477,228
2036	1,272,608	1,590,760	1,564,449	1,138,875	477,228
2037	1,272,608	1,590,760	1,564,449	1,138,875	477,228
2038	1,272,608	1,590,760	1,564,449	1,138,875	477,228
2039	1,272,608	1,590,760	1,564,449	1,138,875	477,228
2040	1,272,608	1,590,760	1,564,449	1,138,874	477,228
2041	1,272,608	1,590,760	1,564,449	1,138,874	477,228
2042	974,356	1,133,431	1,120,276	907,489	678,081
2043	944,530	1,087,699	1,075,859	884,350	698,166
2044	914,705	1,041,966	1,031,442	861,212	718,252
2045	884,880	996,233	987,024	838,073	738,337
2046	855,055	950,500	942,607	814,935	758,422
2047	825,229	904,767	898,190	791,796	778,508
2048	795,404	859,035	853,772	768,658	798,593
2049	765,579	813,302	809,355	745,519	818,678
2050	735,754	767,569	764,938	722,380	838,764

2051	705,929	721,836	720,521	699,242	858,849
2052	705,929	721,836	720,521	699,242	858,849
2053	705,929	721,836	720,521	699,242	858,849
2054	705,929	721,836	720,521	699,242	858,849
2055	705,929	721,836	720,521	699,242	858,849
2056	705,929	721,836	720,521	699,242	858,849
2057	705,929	721,836	720,521	699,242	858,849
2058	705,929	721,836	720,521	699,242	858,849
2059	705,929	721,836	720,521	699,242	858,849
2060	705,929	721,836	720,521	699,242	858,849
2061	705,929	721,836	720,521	699,242	858,849
2062	705,929	721,836	720,521	699,242	858,849
2063	705,929	721,836	720,521	699,242	858,849
2064	702,938	717,251	716,068	696,922	860,863
2065	-	-	-	-	-
2066	-	-	-	-	-
Total	**31,071,750**	**35,525,934**	**35,157,580**	**29,199,461**	**23,912,795**