Environmental and Social Impact Assessment for the North Dune Extension

Base Titanium Limited, Kwale Mineral Sands Operation, Kwale, Kenya

01 February 2021

Project No.: 0547330

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Acronyms and Abbreviations

Name	Description
^{0}C	Degrees Celsius
ALARP	As Low as Reasonably Practicable
AoI	Area of Interest
BID	Background Information Document
CAB	Conservation Advisory Board
CAK	Conservation Alliance of Kenya
CBD	United Nations Convention on Biological Diversity
CCRA	Climate Change Resilience Assessment
CIDP	County Integrated Development Plan
CO_2	Carbon Dioxide
CR	Critically Endangered, a status used by the IUCN Red List of Threatened Species to indicate a species is at very high risk of extinction
CSR	Corporate Social Responsibility
CV	Curriculum Vitae
DC	District Commissioner
DEM	Digital Elevation Models
DM	District Commission

E&S	Environmental and Social
EHS	Environment Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environment Management and Coordination Act, 1999
EN	Endangered, a status used by the IUCN Red List of Threatened Species to indicate a species is at risk of extinction
EP	Equator Principles
EPA	Environmental Protection Agency
EPFIs	Equator Principle Financial Institutions
ERM	Environmental Resources Management
ESIA	Environmental and Social Impact Assessment
ESMS	Environmental and Social Management System
ESSMP	Environmental and Social Management and Monitoring Plan
EWT	Endangered Wildlife Trust
EXIM	Export-Import Bank of the United States
FGD	Focus Group Discussion
FPIC	Free Prior and Informed Consent
GCA	Groundwater Conservation Area
GDP	Global Domestic product
GN	Guidance Note to the IFC Performance Standards
GoK	Government of Kenya
GPS	Global Positing System
ha	Hectare
HCV	High Conservation Value
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome
HSE	Health, Safety and Environment
IA	Impact Assessment
IAQM	Institute of Air Quality Management
IBA	Important Bird and Biodiversity Area defined by Birdlife International
IBAT	Integrated Biodiversity Assessment Tool
ICT	Information, Communication and Technology
ICP	Informed Consultation and Participation
IFC	International Finance Corporation
ILO	International Labour Organisation
IP	Indigenous People
IPDP	Indigenous People's Development Plan
IRA	Internationally Recognised Area
IUCN	International Union for the Conservation of Nature
IWRM	Integrated Water Resource Management
KBA	Key Biodiversity Area
KBNS	Kenya National Bureau of Statistics

KENAFF	Kenya National Farmers' Federation
KETRACO	Kenya Electricity Transmission Company Limited
KFS	Kenya Forest Service
KII	Key Informant Interview
Km	Kilometer
km^2	Square Kilometer
KPA	Kenya Ports Authority
kV	Kilovolt
KWCA	Kenya Wildlife Conservancy Association
KWS	Kenya Wildlife Service
L&FS	Life and Fire Safety
LC	Least Concern, a status used by the IUCN Red List of Threatened Species to indicate a species is not threatened
LPG	Liquid Petroleum Gas
LRP	Livelihood Restoration Plan
M	meter
MCA	Members of County Assembly
Mm	Millimeter
NEMA	National Environmental Management Authority
NGO	Non-Government Organization
NMK	National Museums of Kenya
NO_2	Nitrous Dioxide
Nr	Not Reported
NT	Near Threatened, a status used by the IUCN Red List of Threatened Species to indicate a species is on the verge of threatened status
$PM_{2.5}$	Particulate matter which passes through a size-selective inlet with a 50% efficiency cut-off at 2.5 µm aerodynamic diameter
PM_{10}	Particulate matter which passes through a size-selective inlet with a 50% efficiency cut-off at 10 µm aerodynamic diameter
PPE	Personal Protective Equipment
PS	Performance Standard
RAP	Resettlement Action Plan
Rev.	Revision
RPF	Resettlement Policy Framework
RUSLE	Revised Universal Soil Loss Equation
SACCO	Community Savings and Credit Cooperatives
SEA	Strategic Environmental Assessment
SEP	Stakeholder Engagement Plan
SO_2	Sulphur Dioxide
STD	Sexually Transmitted Disease
TB	Tuberculosis
ToR	Terms of Reference

UNESCO	United Nations Educational, Scientific and Cultural Organization
UKEF	United Kingdom Export Finance
UNFCCC	United Nations Framework for Convention on Climate Change
VU	Vulnerable, a status used by the IUCN Red List of Threatened Species to indicate a species is vulnerable to extinction
WHO	World Health Organisation
WRMA	Water Resource Management Authority
WRP	Wildlife and Roads Project
WWF	World Wide Fund for Nature

EXECUTIVE SUMMARY

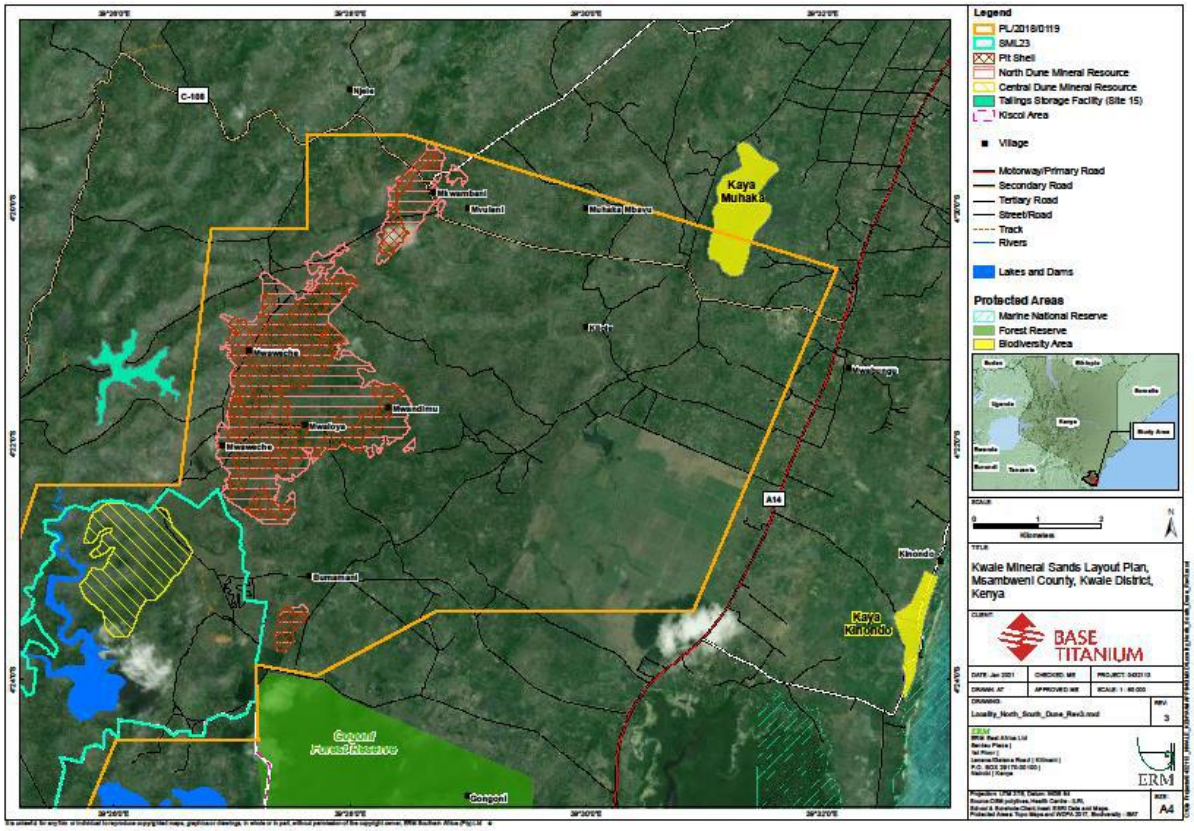
Introduction to the Project

The current mineral resource mined by Base Titanium comprises two dunes that contain economically viable concentrations of heavy minerals. These two deposits, known as the Central and South Dunes, are separated by the Mukurumudzi River on which the Mukurumudzi Dam has been built, and are located in the Mwaweche and Kidiani adjudication sections respectively. The current SML (SML 23), measuring 1,661 hectares, is located within the overall Kwale Exploration Prospecting License (EPL 173) area of 88km^2 and is located approximately 50km south of Mombasa, and 10km inland from the Indian Ocean.

The Operation's original mine life was 13 years, running up until 2025. However, the mine life was later reduced to 2023 due to higher mining rates and the Wet Concentrator Plant (WCP) expansion. To address the reduced mine life, Base commenced an exploration programme in the area outside of the existing mining lease area, including around the South Dune, to identify additional resources that could be economically mined. Economically viable mineral resources in an extension to the South Dune, but outside of the current Special Mining License (SML), were identified and an application for an extension to the SML to incorporate the extended South Dune resource was made, resulting in the projected mine life shifting to December 2023.

To assess the possibility of further extending the Life of Mine (LOM), in 2018 Base decided to re-evaluate the potential of the 'North Dune' mineral deposit, which is located immediately to the north-east of the Kwale operation's offices and plant. The North Dune deposit location, relative to the Central and South Dune deposits and the current Special Mining Licence (SML), is shown in the Figure below.

The North Dune is a low grade (~1.6%HM), reasonably sized resource, with potential to be economical. Mining of the North Dune, the subject of this ESIA, will increase the LOM a further 4 to 4.5 years.



Project Activities

Construction Phase

The first phase of the project will involve the clearance of vegetation and the separation and stockpiling of topsoil for future rehabilitation. Site roads will be created to allow for clearing and to provide access for mining equipment that will need to be established during the site preparation phase. Four Hydraulic Mining Units (HMUs) will be relocated to the North Dune site together with power lines, pump stations, piping for water and ore slurry and workshop facilities.

Operations Phase

During the Operational Phase, the mine will be operated continuously (7 days a week, 24 hours a day on a 12-hour shift system). Operations in the North Dune are expected to commence in 2024 once mining in the South Dune Extension is completed. The Tailings Storage Facility (TSF) solution for the North Dune differs from that currently utilised. Slimes which are separated in the processing plant contain a high proportion of clay-sized material (D50 ± 5µm). These slimes together with sand tails will be mixed in a co-disposal processing plant in a ratio of 38:62 and be used to backfill mined out voids prior to rehabilitation and revegetation. This tailings disposal option is the preferred alternative, for the following reasons:

- It is the most effective solution in terms of water recovery and efficiency;
- It is the lowest risk option in terms of the Global Industry Tailings Standard;
- It requires no additional land utilisation outside of the mining area; and
- This option is used to backfill the previously mined out areas effectively and largely achieve the original land form.

Given that co-disposal of coarse and fine tailings is planned for the North Dune, water recovery will be greater than with the current tailings disposal method since most of the water pumped with pure fine tailings is locked up for many years in the TSF. This method obviates the need for additional water sources due to the higher mined tonnage. Should water recovery from co-disposal be lower than expected, Base will draw water to make up for this shortfall from the Mukurumudzi Dam, which will be within the current permit conditions.

Decommissioning Phase

Mined out areas will be rehabilitated concurrently with mining. The proposed project has a lifespan of between 4.5 to 5 years; after which, all infrastructure will be dismantled and removed. Machinery, steel, and dismantled materials will be sold, recycled where possible or disposed of at licensed disposal sites. The North Dune will then be closed in conformance with Base's existing Mine Closure Plan which has been prepared (and is presently being updated) for the site as a whole.

Summary of the Physical Environmental, Biological and Socio-Economic Baselines for the area to be potentially affected by the North Dune

Dune for many years. As such, it has a solid understanding of the baseline conditions in the area. The current physical, biological and social baseline conditions are described below for the North Dune area. An understanding of the baseline is essential as it measures the pre-mining conditions and serves as a benchmark to measure and monitor potential impacts (both positive and negative) resulting from mining activities and against which rehabilitation efforts can be measured.

Key Physical Sensitivities

- The climate is largely hot and dry from January to April/ May and coolest in the period from June to August. Rainfall in the County is bi-modal, with short rains experienced between October and December, and long rains between March and May. This has implications for rehabilitation and air quality.
- Climate change is causing an average increase in temperatures and a decrease in precipitation, but also years of extensive droughts and intense precipitation leading to floods. These climate extremes pose risks to the mining operations, especially during intense rainfall that may lead to floods and the associated increase in topsoil erosion, potential mine pit wall collapse etc.
- Wind predominantly blows from the southwest. However, there is also a smaller north-eastern component. Wind direction has implications for especially noise and nuisance dust impacts to surrounding communities.
- Soils in the Project area are primarily Avalon, Bainsvlei, Clovelly and Hutton soils, which have a high agricultural and rehabilitation potential under dryland and irrigation conditions respectively.
- The current land use in the Project area includes 2,178ha (48,79%) natural veld, 2,123ha (47,57%) plantations and 162ha (3,64%) ploughed land. Land capability includes 4,393ha (98,4%) arable and 71,451ha (1,6%) wilderness. This has implications for livelihood and food security, which is to be dealt with through an appropriate Resettlement Action Plan (RAP).
- Soils are erodible, and hence need to be carefully managed to prevent soil erosion, crusting and formation of preferential seepage pathways.
- The Mkurumudzi River is an important source of water for key ecosystem services including maintaining aquatic life, recharge of shallow wells and aquifers, and a habitat for a variety of vegetation species. The river is also a source of water for residents both for drinking and other household and agricultural activities.
- Several small streams arising from seepage and spring flows occur within the North Dune resource area and are an important source of drinking water to residents of the villages within the region.
- Groundwater is a very significant component in water supply in Kwale County. Groundwater is widely available across the study area in a variety of shallow unconfined and deep semi-confined aquifers.
- Groundwater modelling shows that the aquifers are more sensitive to droughts than to over abstraction. However, modelling shows that these aquifers are quickly recharged by a good rainfall year.

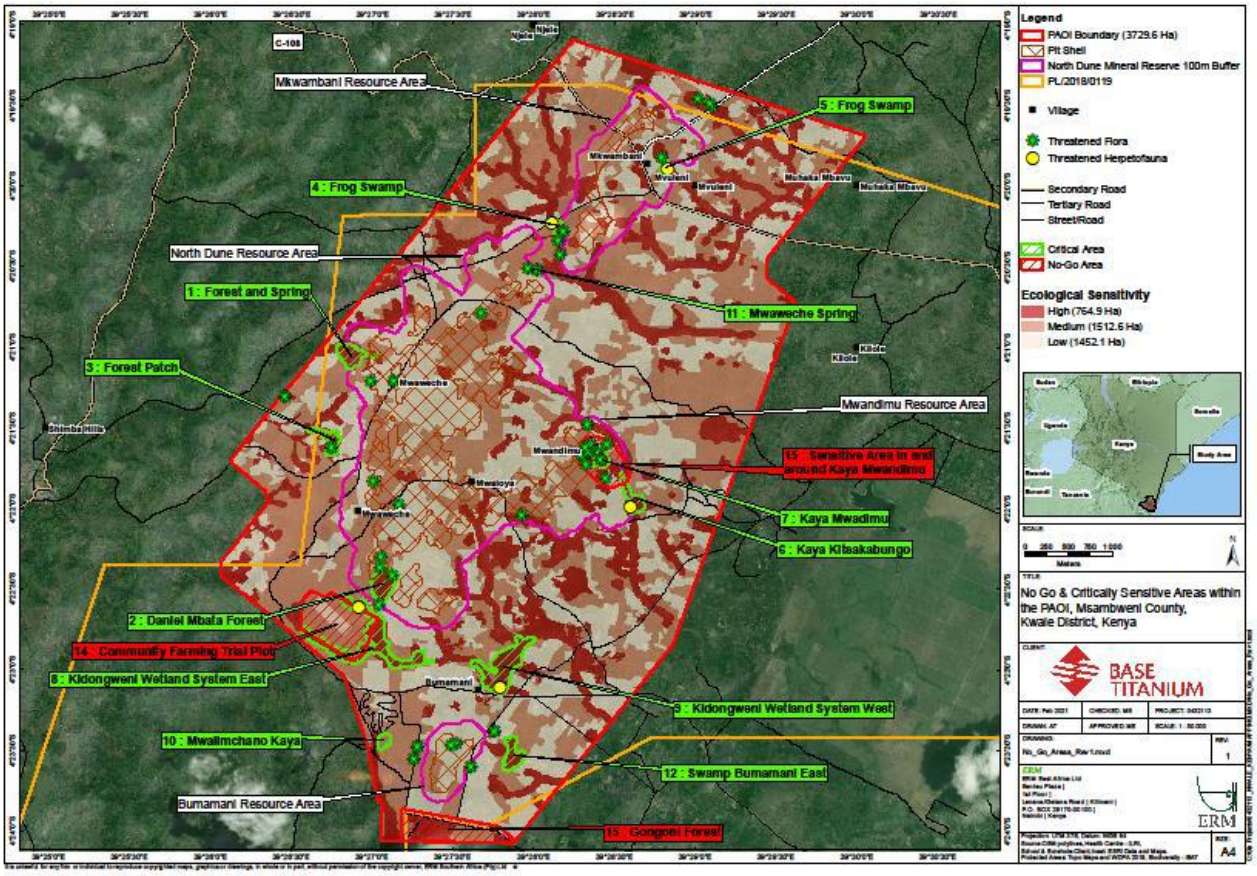
Key Biodiversity Sensitivities

- Kwale and surrounding areas lie within the Swahili Centre of Endemism, also referred to as the East African Coastal Forest Hotspot, known for its very high biodiversity of flora and fauna of over 6000 documented species. High species diversity and endemism are specifically found in the remnant natural habitats - present within the Project Area and wider Area of Influence, e.g. the Gongoni Forest Reserve and Kidongweni Wetlands.
- It is the presence of range-restricted and habitat-specific species and unique and important ecosystem functions that have contributed to the identification of Critical Habitats being present. Habitats were considered critical if they support any of the critical species. Of all habitats evaluated, few remnants of Forest and Selected Wetlands can be classified as Critical Habitats.
- Only small extents of Forest, mostly small patches of less than 5 ha, were present in the PAOI, most around the southern (Gongoni Forest) and western periphery.
- Approximately 560 plant species (including Bryophytes, but excluding Lichen species) have been identified up to date in the Gongoni Forest (a closed-canopy forest), whilst only limited data exists for the small kayas up to date.
- Approximately 132 species of mammals have been recorded or are likely to occur in the general Kwale Mining Operations area.
- However, most large mammals are either no longer present within the project area or are confined to Shimba Hills. However, the area still supports a reasonable diversity of smaller mammals.

Of all habitats evaluated, few remnants of forest, as well as Selected Wetlands, could be classified as Critical Habitats. Critical Habitat and identified sensitive sites within, or on the very fringes of the North Dune mining resource areas, include the following (also indicated by the reference numbers provided in the Figure below):

- Ref No 1: Forest and Spring (on the fringes)
- Ref No 2: Daniel Mbata Forest (within);
- Ref No 4: Frog Swamp (on the fringes);
- Ref No 5: Frog Swamp at Mvuleni (on the fringes);
- Ref No 6: Kaya Kitsakabungo (on the fringes);
- Ref No 7: Kaya Mwandimu (within); and
- Ref No 11: Mwaweche Spring (on the fringes).

These areas are to be included in the mine layout plan, and avoided to the greatest extent possible, so as to preserve their biodiversity.



Key Socio-Economic Sensitivities

- The typical farmstead or household in the Project area is largely comprised of a single nuclear family, with an average household size of 8.3 persons for the surveyed households.
- 623 individual structures were identified using satellite imagery of an area covering the North Dune Resource Area and a 100-metre buffer. The number of households was determined based on the assumption that local households retain an average of 3.3 structures
- It can be reasonably assumed that the total land under some form of annual crop agriculture is approx. 371 hectares or just under half (49%) of the total area of North Dune Resource Area and a 100-metre buffer around this area.
- The Kwale County population is young with 45% of all people in 2019 being aged 15 years and below, and 3.5% of the total population being above the age of 64 years. As such, just under half (49%) of the county population is considered to be economically inactive
- 77% of the survey population have reached a primary school education, which is substantially lower than the Kwale population. Interviews suggest this is related to limited access to education for rural areas, as well as general education and transport costs.
- Existing and active churches, mosques, and religious schools (Madrasa) have local cultural value as well as strong social ties with local households.
- The majority of households (79%) claim to hold their land under private titles, while a significant portion (17% of land) was granted via government allotments. Only 6.5% of the land was granted via customary means.
- The Project area is dominated by crop farmland (85% of all claimed land). There are limited properties that are solely designated as residential land (3% of surveyed properties) or any other uses.
- Of the surveyed structures, just over half (51%) are made of traditional materials only (mud, mud-brick, grass thatching or reed roofs. Only 17% of structures (mostly comprising of the main bedrooms) are solely constructed with modern materials (including brick, concrete blocks, and corrugated iron roof sheets), while the remaining 32% are constructed of a mixture of modern and traditional building materials.
- Water used for domestic needs is largely sourced from community wells (50% of surveyed households) and private wells (25%). Borehole water is only available to 19% of surveyed households. The use of natural sources for domestic water is limited to only 3.2% of surveyed households.
- Concerning sanitation, just over half (54% of surveyed household) utilise unimproved pit latrines, while 30% have access to improved (VIP) pit latrines. Only 8% of surveyed households claim to have flushing toilets, while an additional 9% of household have no latrine at all and rely on buckets or the bush.
- Local livelihoods are largely comprised of annual crop farming, tree farming, livestock rearing and small-scale businesses and trading. Farming is near universally important for all surveyed households. Small-scale business and natural resource harvesting is only undertaken by 16 and 36% of surveyed households.
- Informal crop farming is the primary economic activity and is undertaken by 22% of the total population, with a near even split between males and females.
- Self-employment through the ownership of businesses and trade is very limited and is only claimed as the primary activity for 6% of the local surveyed population. In addition, employment through casual and formal employment is similarly constrained and benefits only 10% and 7% of the total population, respectively. Only 2.5% of the population enjoy formal and full-time employment, while 4% have access to short-term employment via private companies or the government.
- Economic dependency is therefore largely limited to self-employment via small-scale farming, casual labour and limited full-time employment.
- Of the surveyed households, nearly half (47%) divide their annual crops harvests between household food needs and informal trade.
- Livestock rearing is an important livelihood that is undertaken by 72% of surveyed households.

Project Benefits (positive) Impacts and Project (negative) Impacts

Following an assessment of the environmental and social baselines, project benefits (or positive impacts) as well as project negative impacts to the natural and social environment, are identified in this Environmental Impact Assessment (EIA) Project Report. Where positive project impacts were identified, measures are proposed in this EIA to enhance such impacts, and conversely, where project negative impacts are identified, mitigation measures to reduce the significance of such impacts, are detailed in this EIA.

In the table below, all impacts resulting from the North Dune mining activities are presented, and their significance rated both before mitigation, and post enhancement and/or mitigation measures implemented.

Impact Description	Significance of Impact	
	Pre-Mitigation	Post-Mitigation
Impacts on Geology and Soils	Major	Moderate
Impacts on Surface Water Resources and Quality	Major (for Water Quality) Minor (for Hydrology)	Minor
Impacts on Ground Water Resources and Quality	Minor	Minor
Impacts on Air Quality	Moderate	Minor
Impacts due to Noise	Moderate	Minor
Impacts from Radiation	Minor	Negligible
Impacts on Faunal and Floral Diversity	Major	Moderate
Impacts on Wetlands	Major	Moderate
Loss of Housing	Critical	Major
Loss of Agricultural Land and Orchards	Critical	Major
Loss of Communal Land and Natural Resources	Major	Major
Impact on Businesses and Trades	Major	Moderate Benefits
Loss of / Pressure on Public Services or Facilities	Major	High Benefits
Restriction of Mobility and Accessibility	Major	Moderate
Breakdown in Community Networks and Structure	Moderate	Minor
Labour Influx	Minor	Minor
Direct Local Employment	Moderate Benefits	High Benefits
Local Content and Local Economic Development	Moderate Benefits	High Benefits
Corporate Social Investment	Moderate Benefits	High Benefits
Community Health, Safety and Security Risks	Major	Minor

All enhancement and mitigation measures identified, are contained in the Environmental and Social Management Plan (ESMP, described in Chapter 9 of this EIA) and will be included in Bases' existing and functioning Environmental and Social Management System (ESMS). In this way, all such measures proposed in this EIA will be fully implemented.

Furthermore, all land and livelihoods affected by Base's North Dune mining activities, will be subjected to a full Resettlement Action Plan (RAP) for the North Dune mining area, as has been done for the South Dune extension, in line with both Kenyan regulations and International Best Practice (IBP).

To ensure all such impacts are managed as per the EIA requirements, Base will be required to undertake regular ambient environmental and social monitoring; this will likely be an extension of the ambient environmental and social monitoring already undertaken on the Central and South Dune mining operations. This EIA includes an Environmental and Social Monitoring Plan (in Chapter 10) to support

the monitoring required, which will function under Base's overarching Environmental and Social Management System (ESMS).

1. INTRODUCTION

1.1 Background to the Project

The Kwale Mineral Sands Operation (the Operation) was originally developed by Tiomin Resources Inc, with initial exploration and pre-feasibility work undertaken in the late 1990s. Feasibility studies continued into the mid-2000s, and resettlement from the planned mining areas was initiated in 2005 and completed in November 2008. After the acquisition of the Project in 2010, Base Titanium Limited, a wholly-owned Kenyan subsidiary of Base Resources Limited (Base), commenced a Project Enhanced Definitive Feasibility Study (EDFS), which was completed in 2012. Base Titanium secured financing, which allowed construction at the Kwale Operation to be completed at the end of 2013.

The Operation's original mine life was set at 13 years, running up until 2025. However, the mine life was later reduced to 2023 due to higher mining rates and the expansion of the Wet Concentrator Plant (WCP). To address the reduced mine life, Base commenced an exploration programme in the area outside of their existing mining lease area, including around the South Dune, to identify additional resources that could be economically mined. Economically viable mineral resources in an extension to the south dune, but outside of the current Special Mining License (SML) were identified and an application for an extension to the south dune resource was approved, resulting in the projected mine life shifting to December 2023.

In a move to assess the possibility of extending the Life of Mine (LOM) even further, Base, in 2018, decided to re-evaluate the potential of the 'North Dune' mineral deposit, which is located immediately to the north-east of the Kwale operation's offices and plant. The North Dune is a low grade (~1.5%HM) 582ha resource that has the clear potential to be economic. The low heavy mineral grade will require high mining feed rate options. The deposit also has high slime grades, which will result in increased water demand, exceeding presently permitted limits. As a result, this Project will be sensitive to capital costs and pricing assumptions, and will also require innovative process/engineering work to manage water consumption to acceptable levels. Alternative tailings disposal methods (co-disposal of slimes and sand tailings with a flocculent in a ratio of 38:62 slimes to sand) can increase water recovery and will be investigated as part of the Pre-Feasibility Study (PFS). This has the potential to recover sufficient water to maintain water demand within the existing permitted limits. The proposed project of mining in the North Dune commencing in early 2024, the subject of this ESIA, will increase the LOM a further 4 to 4.5 years.

To determine the economic feasibility of this proposed Project, Base has embarked on a PFS, planned for conclusion in early 2021. If proven economically and technically viable to mine this resource, Base will move to a full Definitive Feasibility Study (DFS) phase. This ESIA report, has been compiled as a requirement for the North Dune mining extension and is in support of the current PFS, and the mining license application, should the Project prove economically and technically viable.

1.2 Overview of the Project

The Kwale Operation is in the Mivumoni and Kinondo Locations of the Msambweni Sub-county (also known as the Msambweni Constituency), in Kwale County, in south-eastern Kenya. The Operation is located about 50km south of Mombasa, 50km north of Lunga Lunga and the Tanzanian border, and 8km inland from the Indian Ocean. The Operation holds a Special Mining Lease (SML No.23) measuring 1,661ha.

The current mineral resource mined by Base Titanium comprises two dunes that contain economically viable concentrations of heavy minerals. These two dunes, known as the Central and South Dunes, are separated by the Mukurumudzi River, on which the Mukurumudzi Dam has been built, and are located in the Mwaweche and Kidiani adjudication sections, respectively.

Following a successful airborne geophysics programme, conducted in 2015 that covered the south coast of Kenya from Mombasa to the Tanzanian border, which identified a series of exploration targets, subsequent ground reconnaissance confirmed areas of interest. Base was granted exploration tenure over an expanded area surrounding the Operation. As a result SPL 173, which is now the Prospecting License 2018/0119, was expanded to cover an area of 177km^2.

The three main target minerals include:

- Ilmenite (titanium-iron oxide) which is a raw material for pigment and paint.
- Rutile (titanium oxide) which is a raw material for titanium sponge, titanium metal and pigment.
- Zircon (zirconium silicate) which is a raw material used in refractory and ceramics industries.

The target minerals are separated from the ore at a processing plant located within the SML area. Ilmenite and rutile are trucked to a dedicated ship loading facility at Likoni, approximately 50km north of the mine site and adjacent to the existing Port of Mombasa. Zircon is containerised and trucked to existing container facilities in the Port of Mombasa. The minerals are mainly exported to China, but some of the products are also exported to the United States and some parts of Europe.

1.3 Justification for the Proposed Extension

The Kwale Operation has a significant impact on the country's economy. Kenya has traditionally relied on agriculture, floriculture and tourism to drive economic activity and exports. As the first globally significant, large-scale mining project in Kenya, the Kwale Operation has opened up a new sector of the economy, propelling minerals into the top four export earners. The Kwale Operation is the flagship for Kenya's Vision 2030, but perhaps its most important impact is in the stimulus effect it has in awakening international investor interest in Kenya's mineral potential.

1.3.1 Direct and Indirect Economic Benefits

From assessments done on the direct, indirect and induced economic and tax contribution of the mine, the following tables show the value of the Operation to the local communities as well as at the national level (Table 1-1 and Table 1-2). Data presented is the most current (2018/ 2019 financial year) where available.

Table 1-1: Kwale Mineral Sands Operation's direct economic contribution to Kenya

Capital Investment	The total invested in the development of the Project was US$350 million. Of this, the direct spend in Kenya was about US$100 million on contractors, machinery and equipment, goods, support services and employment during the construction phase.
Export Value	At current mineral prices the export value from the Kwale Operation is US$208 million per annum. Kwale's contribution doubles the value of Kenya's other mineral exports and elevates the sector to the fourth most important export commodity above coffee.
GDP Contribution	The Operation adds an estimated US$108 million to Kenya's GDP annually and generates a total of US$186 million in economic output per year. Over the life of the mine, the contribution to GDP will be close to US$1 billion. This figure does not take into account an increase in the life of mine as a result of the North Dune extension. Prolonging the mine life will increase the contribution to GDP.
Direct Taxation Contribution	Through royalties and direct taxation the estimated tax revenues to the government over the mine life is around US$225 million. This figure does not take into account an increase in the life of mine as a result of the North Dune extension. Prolonging the mine life will increase the contributions to tax revenues.

Employment	865 people are currently employed directly by Base Titanium. Of these, 98% are Kenyan and 63% are from Kwale County. The total number of contractors hired by Base, is an additional (in addition to the 865 directly employed persons) 351 persons. The Project supports an additional 2,800 jobs through indirect (supply chain) and induced (consumer spending) activity.

Table 1-2: Indirect and induced economic contribution

Indirect Tax Contribution	Employees' income tax contributions amounted to approximately US$5 million in financial year 2016/2017, while indirect and induced tax revenue contributed a further US$5 million.
Local content	The mine depends heavily on local inputs, including spare parts, maintenance and operating consumables, transport, security and other outsourced supplies and services. This amounts to an estimated US$375 million over the life of mine or US$35 million per annum and represents 85% of non-labour operating costs. This supports the additional 2,800 indirect and induced jobs paying over US$14 million in wages annually.
Legacy Projects	Longer-term benefits derived from the mine will have a significant influence on the socioeconomic environment in the region. On ultimate closure of the mine, infrastructure to be handed over to local authorities, valued at US$60 million, includes: ■ The Mukurumudzi Dam and Msambweni boreholes has the potential to contribute enormously to the region's irrigation and water supply requirements. ■ The 132kV transmission line and substation has the potential to enhance the objectives of Kenya's rural electrification project. ■ The mine access road will assist with links from the current Mombasa – Tanzania highway to roads planned in the future further inland. ■ The ship loading facility will be an important contributor to the industrial development of Likoni and the South Coast region.
Community Development	Base Titanium's Community Development Management Plan has been developed in consultation with affected communities through a process of identification and prioritisation and is aligned with the Kwale County Integrated Development Plan. By September 2020 the company had invested roughly USD 17,794,500 in the local community, including community projects (livelihood investments), community education, community infrastructure (social). Community Health Programme, and Scholarships/ bursaries.
Post-mining Land Use	The Special Mining Lease specifies that, on completion of mining, the land will be rehabilitated. At this stage, Base will rehabilitate and revegetate land based on the outcome of scientific studies to hand over this land to the government who will decide on post mining land use.

1.3.2 Export Contribution

In calendar year 2019, the Kwale Operation alone accounted for greater that 50% of the combined value of Kenya's minerals output. As an export-oriented industry, the mining sector plays a significant role in generating foreign exchange. In financial year 2019 the Kwale Operation generated US$208 million in export revenue, which represented nearly 60% of Kenya's exports to China.

1.3.3 Importance of an Increased Mine Life

The Operation's original mine life was set at 13 years, running up until the year 2025. However, the mine life was later reduced to 2023 due to higher mining rates and the expansion of the Wet Concentrator Plant (WCP). To address the reduced mine life, Base commenced an exploration programme in the area outside of their existing mining lease area, including around the South Dune, to identify additional resources that could be economically mined. Economically viable mineral resources in an extension to the south dune, but outside of the current Special Mining License (SML) were

identified and an application for an extension to the south dune resource was approved, resulting in the projected mine life shifting to December 2023.

In a move to assess the possibility of extending the Life of Mine (LOM) even further, Base, in 2018, decided to re-evaluate the potential of the 'North Dune' mineral deposit, which is located immediately to the north-east of the Kwale operation's offices and plant. The North Dune is a low grade (~1.6%HM) reasonably sized resource that has the clear potential to be economic.

Mining in the North Dune, the subject of this ESIA, will increase the LOM a further 4 to 4.5 years. This extension will result in an extension of those direct and indirect benefits listed in Table 1-1 and Table 1-2.

1.4 Legal Requirement Pertaining to the Operation

The mining of mineral resources in Kenya are regulated by the Mining Act (No. 12 of 2016). Environmental standards and compliance are regulated through the Environmental Management and Co-ordination (Amendment) Act 2015 (EMCA) and the Environmental (Impact Assessment and Audit) Regulations (2009).

The legal frameworks that affect the operations of Base have been covered during the last environmental audits submitted to the National Environmental Management Authority (NEMA), and are listed below:

- Mining Act, 2016.
- Climate Change Act, 2016.
- Energy (Energy Management) Regulations, 2012.
- Environmental Management and Co-ordination (Amended) Act, 2015.
- Environmental (Impact Assessment and Audit) Regulations, 2003.
- Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2009.
- Environmental Management and Co-ordination (Water Quality) Regulations, 2006.
- Environmental Management and Co-ordination (Air Quality) Regulations, 2014.
- Environmental Management and Co-ordination (Waste Management) Regulations, 2006.
- Environmental Management and Co-ordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009.
- Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution) Regulations, 2009.
- Water Act (Cap. 8 of 2002).
- Water Resources Management Rules, 2007.
- Forests Act, 2005.
- Forests (Participation in Sustainable Forest Management) Rules, 2009.
- Kenyan Labour and Workplace Law.
- International Policies and Standards.

Base maintains a Legal Register to keep track of the various legal requirements and ensures that the register is maintained and continually updated.

1.5 Details of the Applicant and Environmental Assessment Practitioners

1.5.1 Applicant

The applicant for the proposed Project is Base Titanium Ltd, a heavy mineral sands mining company, located in Kwale County. The contact details for the applicant are as follows:

Contact: Dr Nick Okello (Environment Manager)

P.O. BOX 1214 – 80400 | Ukunda | Kenya

Tel: +254 700204780

Email: NOkello@basetitanium.com

1.5.2 Environmental Assessment Practitioners

Environmental Resources Management East Africa (Pty) Ltd (ERM) was commissioned by Base Titanium to undertake the ESIA. ERM is a leading global provider of environmental, health, safety, risk, social consulting, and sustainability-related services. We have over 140 offices in 39 countries and territories employing approximately 5,000 people. The contact details for ERM are as follows:

Contact: Mr Mike Everett (Project Director) Lead EIA Expert: NEMA Registration Number: 7263.

Senteu Plaza, 1st Floor, Lenana / Galana Road | Kilimani|

P.O. BOX 29170 – 00100 | Nairobi | Kenya

Tel: +254 740 861650 /1

Email: mike.everett@erm.com

The team members who undertook the EIA Amendment are listed in Table 1-3.

Table 1-3: The ESIA Project Team

Name	Designation	NEMA Reg. No
Michael Everett	EIA/EA Lead Expert (ERM)	7263
Gideon Owaga	Associate Expert and Project Manager (ERM)	10452
Alistair de Sousa	Assistant Project Manager (ERM)	
Kelly Horton	Social Lead (ERM)	-
Marianne Strohbach	Biodiversity Lead (ERM)	
Mike Everett	Physical Environment Lead (ERM)	

Marco da Cunha	Social (Nomad Consulting)	
Gideon Owaga	Stakeholder Engagement and Kelly Horton (ERM)	
Quentin Luke	Flora (Independent)	
Patrick Malonza	Herpetofauna (National Museums of Kenya)	
Stephen Collins	Entomology (ABRI Kenya)	
Mike Lane	Ground Water (Rural Focus)	
Mike Thomas	Surface Water (Rural Focus)	
Chris Viljoen	Soils (Univata)	

1.6 Objectives of the ESIA Process

The assessment aims to highlight potential environmental and social impacts of the proposed project, and to establish an environmental management plan for mitigating the potential negative impacts.

Key specific objectives for the assessment are:

- To outline the objectives of the proposed project activities;
- To review the planning and implementation of the proposed project activities in line with environmental policies and procedures of the Government of Kenya and relevant International Operational Policies to be triggered by the proposed activities, for consideration in the planning and implementation of the project activities;
- To predict the main potential environmental and social impacts of planned project activities;
- To develop an environmental and social management plan with the recommended mitigation measures and strategies for addressing negative impacts in the course of project implementation and operation; and
- To recommend appropriate training for environmental planning and monitoring in type project activities.

1.7 Approach to the ESIA

The overall approach to the ESIA was based on the ToR as approved by NEMA, the Kenyan Environment Management and Coordination Act requirements, the IFC Performance Standard requirements, as well as adherence to international best practice in ESIA studies. The approach to the study was conducted as follows:

1.7.1 Document Review

ERM project team members conducted a detailed review of Operation documentation to obtain an adequate understanding of the significant elements and key sensitivities to be considered during this ESIA. Documents reviewed included for the broader Kwale area, the mining area covered by the SPL, and more specifically for the South Dune and for the area of the South Dune extension. The review was premised on the documents relating to the project description as presented in *Chapter 2* of this Report, and the baseline scenarios presented in *Chapter 5* of this Report. The main documents reviewed are listed in *Chapters 3* and *10* of this report, and include:

- The Kwale Mineral Sands Project ESIA Report and Addendums.
- Base Titanium Environmental and Social Management System.

- The Resettlement Framework for the Southern Extension.
- Feedback from stakeholder engagement exercises that had been conducted in the area of the North Dune.
- The Preliminary Hydrogeology of the North Dune.
- Social Impact Assessment Report for the Kwale Mineral Sands Project.
- Specialist Faunal Assessment for Kwale Mineral Sands Project.
- Environmental Baseline Data Report for the Kwale Prospecting Area and Ship Loading Facility.
- Kwale Mineral Sands Soil Characterization Report, 2012.
- Base Titanium Air Quality Monitoring Review
- Environmental Monitoring Data collected for Central Dune, South Dune and South Dune extension, including data collected on the radiation baseline, noise and air quality baseline data.
- Specialist reports on herpetofauna, bird species, and selected wetlands; the latter identified through selected herpetofauna and invertebrates, used as bio-indicators of wetland systems.

1.7.2 Impact Assessment

After the document review, the ERM and Base teams made joint visits to various key locations in the North Dune area to:

- Conduct fact-finding activities to understand the on-ground site status.
- Carry out a baseline assessment of environmental and social sensitivities related to the proposed activities at the North Dune Extension.
- Predict likely impacts from North Dune Extension mining activities.

Whilst at the site, the ESIA team undertook targeted primary data collection as follows:

- Biological and Physical Baseline: Site walkovers to conduct a detailed analysis of identified sensitive receptors and take any requisite parameter measurements and sampling.
- Social Baseline: Consultations with the site and neighbouring communities and institutions, informal businesses, county administration and the regulatory authorities. These were done based on the list of stakeholders developed during the desktop document review.

From these activities, ERM obtained data for an adequate description of the environmental and social baseline conditions, specifically to:

- Identify the key environmental and social conditions in areas potentially affected by the North Dune Extension mining activities and highlight those that may be vulnerable to aspects of the activities.
- Describe, and where necessary, quantify their characteristics (nature, condition, quality, extent, etc.) now and in the future, during and after the mining operations.
- Provide adequate data to allow for the reassessment of impacts, or the identification of new impacts, specifically as a result of the North Dune extension.
- Inform judgments about the importance, value and sensitivity/ vulnerability of resources and receptors within the North Dune extension.

After obtaining information on the project description, environmental and social baseline conditions, resettlement and compensation, and stakeholder engagement activities, ERM undertook the impact assessment, using the impact assessment methodology as described in *Chapter 4*.

After the impact assessment process, an Environmental and Social Management Plan and Monitoring Plan was developed, and presented in *Chapters 8.3.5* and *10* of this Report. These will be incorporated into Base's Environmental and Social Management System (ESMS) for the Operation.

1.8 Structure of the Report

The Structure and level of detain of this Report is guided by the objectives and scope of the assignment and EMCA requirements, and includes the following Chapters:

- **Chapter 1:** *Introduction*: Outlining the project background, objectives, scope, justification, and key participants.
- **Chapter 2:** *Project Description*: Presents the proposed project including the project site with respect to the surrounding areas, environmental and social aspects likely to be affected by the project, expected project activities, and project timelines.
- **Chapter 3:** *Legislative and International Good Practice Requirements*: Includes an in-depth analysis of legal and policy provisions that are relevant to the proposed project in relation to environmental, social, health and safety concerns.
- **Chapter 4:** *The ESIA Process*: Describes the ESIA Process to be followed for the proposed Mine.
- **Chapter 5.1- 5.4:** *Environmental Baseline*: Outlines the existing environmental conditions within the proposed project area and the immediate surroundings. This will act as a baseline while drawing up the environmental and social management plan. It will also be part of the benchmark for future monitoring of the environmental performance of the project.
- **Chapter 5.5:** *Social and Economic Environment Baseline*: Outlines the existing socio-economic conditions within the proposed project area and the immediate surroundings. This will act as a baseline while drawing up the environmental and social management plan. It will also be part of the benchmark for future monitoring of the social performance of the project.
- **Chapter 6:** *Stakeholder Engagement*: Provides information on the consultations held with Interested and Affected Parties.
- **Chapter 7:** *Analysis of Project Alternatives*. Provides for a description of alternatives considered, including the No Go alternative.
- **Chapter 8:** *Assessment of Environmental and Social Impacts*: Evaluates the potential significant environmental, social, health and safety impacts anticipated from the proposed project in relation to the impacts previously identified for the Kwale Operation. Impacts are either re-assessed for their significance, are identified for the local context (for the North Dune extension specifically) and impacts are assessed cumulatively as a result of the North Dune extension. This chapter also presents mitigation measures to manage impacts across the life of the project, for amendment or inclusion into the Mine Operation's ESMS.
- **Chapter 9:** *An Environmental and Social Management Plan*: Amendments to the current Kwale Mine's ESMP as described in each Annual Environmental and Social Monitoring Report are provided to specifically include the North Dune expansion.
- **Chapter 10:** *An Environmental and Social Monitoring Plan*: Amendment to the current Kwale Mine's Environmental and social plans. Monitoring aims to ensure those mitigation measures elaborated in the ESMP in Chapter 9, are being implemented and adequately managed, to ensure the residual impacts identified remain as low as possible, or that positive impacts are enhanced.
- **Chapter 11:** *Conclusions and Recommendations*: A summary of the main findings of the ESIA and the measures needed to manage the potential impacts.
- *References*: All sources of information referenced within the ESIA Report.
- *Appendices*: containing any supporting information. Appendices include
    - Appendix A - ERM East Africa Firm of Experts and ERM Lead Expert NEMA Certificates

- Appendix B - NEMA Approval Letter- Scoping Report and ToR for the Base Titanium North Dune EIA
- Appendix C - Soils Specialist Report
- Appendix D - Surface Water Report
- Appendix E - Groundwater Report
- Appendix F - Air Quality Specialist Report
- Appendix G - Noise Specialist Report
- Appendix H - Biodiversity Baseline Report
- Appendix I - Stakeholder Engagement Plan

2. PROJECT DESCRIPTION

2.1 Project Location

The Kwale Mineral Sands Operation is located in Msambweni Sub-county, Kwale County. Msambweni is 3,267km^2 in size and lies between the Latitudes of 3° 3" and 4° 45" South and Longitudes 38° 31" and 39° 31" East, about 10km inland of the Indian Ocean, East of Shimba Hills Town. It is bordered by Taita-Taveta County to the West, Kilifi County to the North, Mombasa County, and the Indian Ocean to the East and the Republic of Tanzania to the South.

The current mineral deposit is divided into the Central Dune (Maumba area), and the South Dune (Nguluku area). The two large dunes are separated by the Mkurumudzi River. Base Titanium has completed mining activity in the Central Dune resource which is currently under rehabilitation. Mining in the South Dune is ongoing while mining in the South Dune extension is planned to commence in mid-2021. Mining in the South Dune, including the South Dune Extension, will be completed late in 2023. The proposed mining area; the 'North Dune', and the subject of this Scoping report, is located to the north-east of Base's current operation's offices and plant.

The Kwale Mineral Sands Operation location is shown in Figure 2.1.

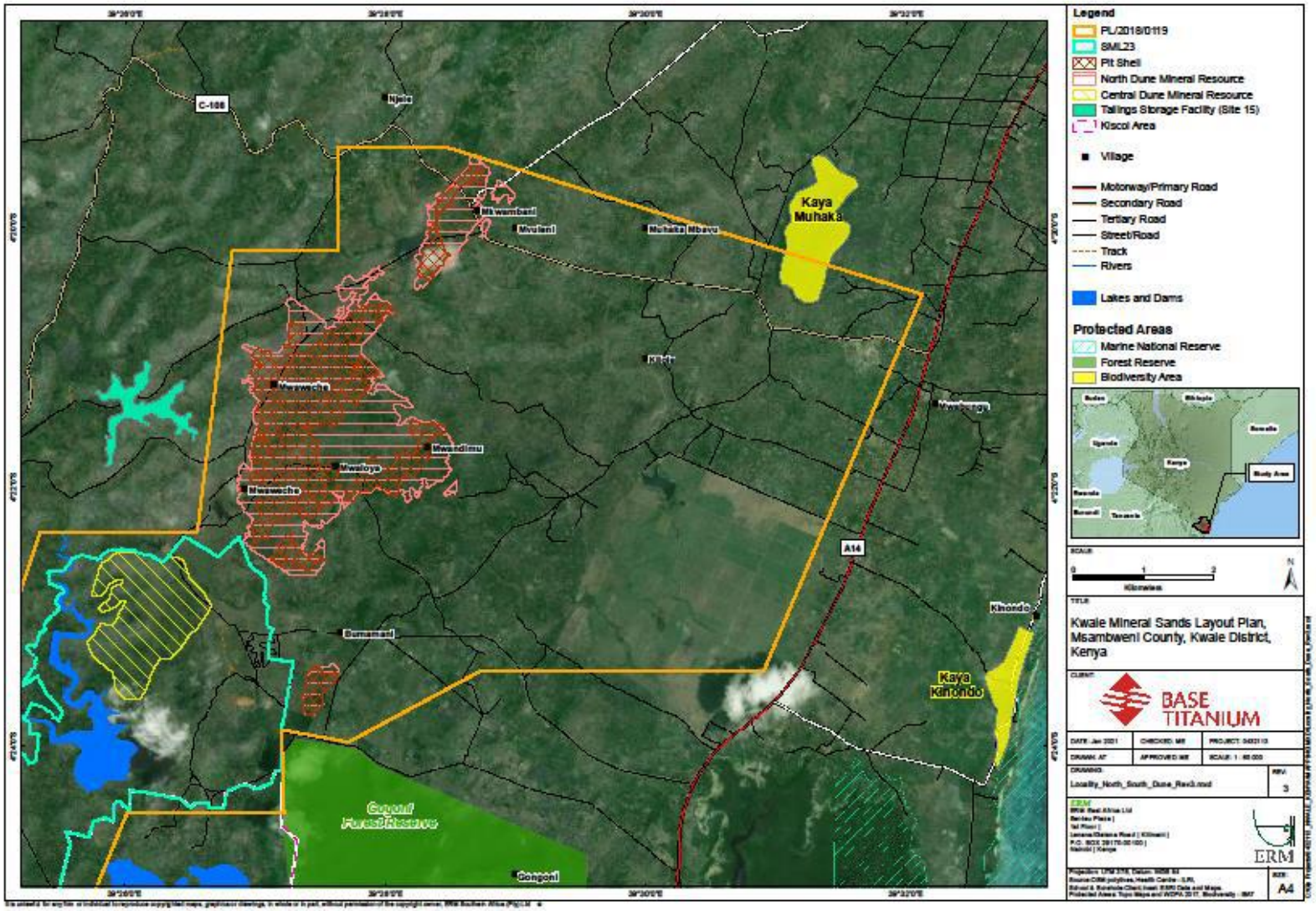


Figure 2.1: Location of the Kwale Mineral Sands Operation

2.2 Special Mining License and Exploration Prospecting License

On 6th July 2004, the Government of Kenya, through the Department of Mines and Geology, issued Tiomin Resources Inc. a Special Mining Lease No. 23 and an Exclusive Prospecting License (Special License No. 173) for the development of the Kwale Mineral Sands Project. Following the withdrawal of Tiomin from the Project in 2009, Base Titanium Limited acquired the Project in 2010. Under the requirements of Kenyan legislation, Special Mining Lease No. 23, originally issued to Tiomin Resources Inc., was assigned to Base Titanium Ltd on 15th July 2010 and Special License No. 173, originally issued to Tiomin Resources Inc. on 2nd April 1997, assigned to Base Titanium Ltd on 21st July 2010. On this basis, Base took ownership of the Kwale Mineral Sands Project.

Subsequently, SPL 173 was expanded to cover an area of 177km^2, In 2018 SPL 173 converted to Prospecting License 2018/0119, and was reduced in area to 88.7km^2. PL 2018/0119 is scheduled to be renewed again in May 2021, when a further reduction in area of 50% unless an exemption from area reduction is granted by the Cabinet Secretary for Petroleum and Mining.

2.3 Exploration Activities

Exploration activities began with a short confirmatory drilling programme in 2012/13. In 2015 a helicopter-borne magnetic and radiometric survey covering the entire Kwale coastline and inland to the Jurassic boundary line, approximately 10km from the coast. After addressing identified anomalies potentially associated with mineralisation from the survey, a ground reconnaissance exercise followed to verify and refine areas of potential interest. These reconnaissance activities informed a subsequent exploration drilling programme that began in June 2016.

Exploration drilling on North Dune took place in 2012 but was not included in the Kwale Mine's original Mineral Resource due to low grades, being outside the SML and prevailing economic conditions. In 2018, considering the improved market condition and insight gained from mining Central Dune, a decision was made to re-evaluate the potential of North Dune. After the issuance of the PL/2018/0119, extensive exploration drilling was undertaken in 2018 totalling 573 holes for 20,958m. A Mineral Resource estimate for the North Dune was released on 1st May 2019. It is estimated to be 171 million tonnes (Mt) at an average heavy mineral (HM) grade of 1.5% and containing 2.6Mt based on a 1% HM cut-off grade. A concept study was completed in early 2020 and the decision made to progress to a Pre-Feasibility Study followed.

The execution of the post-reconnaissance exploration drilling programme was undertaken, as shown in Table 2-1.

Table 2-1: The North Dune Mineral Exploration Programme

Action	Objective	Action Response
County leadership and community engagement	Sensitisation of all stakeholders to exploration plans	Both the authorities and communities were sensitised and involved in the exploration exercise.
Community engagement	Direct engagement with land owners affected by drill sites to ensure understanding and to obtain consent	The 1st drilling was done in 1998-9 by Tiomin, while the recent drilling conducted by Base for the North Dune was done in 2019. All the exploration activities were preceded by sensitisation of all stakeholders.

Recruitment of local workforce	Economic opportunities for impacted households	Base Titanium sourced all casuals and food providers from the communities where exploration was undertaken. The village committee members who participated in the exploration activities were also provided with allowances.
Drilling programme	Hole drilled in target locations and immediately infilled. Landowners compensated for any damage.	All damages were compensated for and a fee for accessing the land was paid.
Analysis of drilling results	Determination of grade and mineralogy by subjecting drill samples to laboratory analysis	
Resource estimation	Modelling to estimate tonnages at various cut-off grades	

2.4 Kwale North Mineral Resources

The Kwale North Mineral Resource is estimated to be 194 million tonnes (Mt) at an average heavy mineral (HM) grade of 1.5% and containing 2.9Mt HM based on a 1% HM cut-off grade. This is indicated in Table 2-2. The Bumamani deposit is 1.5km south of the Kwale North deposit and is considered part of the Kwale North Project. The Bumamani Mineral Resource is estimated to be 5.9 million tonnes (Mt) at an average heavy mineral (HM) grade of 1.9% and containing 115kt HM based on a 1% HM cut-off grade. This is indicated in .

Table 2-2: North Dune Mineral Resources (January 2020)

Deposit	Ore Reserve Category	Ore Material	In Situ HM	HM	Slime	Oversize	HM Assemblage		
							Ilmenite	Rutile	Zircon
		(Mt)	(Mt)	(%)	(%)	(%)	(%)	(%)	(%)
Kwale North	Measured	119	1.8	1.5	37	1	42	13	6
	Indicated	73	1.0	1.4	37	2	50	14	6
	Inferred	2	0.0	1.2	37	3	50	15	7
	Total	**194**	**2.9**	**1.5**	**37**	**2**	**45**	**13**	**6**

Source: Base Resources: Mineral Resource for Kwale North Dune deposit, January 2020

Table 2-3: Bumaman Mineral Resources (January 2020)

Deposit	Ore Reserve Category	Ore Material	In Situ HM	HM	Slime	Oversize	HM Assemblage		
							Ilmenite	Rutile	Zircon
		(Mt)	(kt)	(%)	(%)	(%)	(%)	(%)	(%)
Bumamani	Measured	3.0	66	2.2	19	2	48	15	7.5
	Indicated	2.6	45	1.7	23	5	47	16	7.7
	Inferred	0.3	4	1.4	27	6	41	14	7.8

	Total	**5.9**	**115**	**1.9**	**21**	**4**	**47**	**15**	**7.6**

2.5 The Kwale North Mine Plan

Mining activities will be conducted by hydraulic mining, similar to current operations at Kwale South. Four mining units will mine independently at approximately 750 tph and their feed combined at a collection hopper and pumped to the existing concentration plant for processing. Mining will progress generally from the south to the north. The tailing strategy aims to co-dispose the fine and coarse mine tailings together. The reasons for this are:

- Co-disposed tails have a shear strength between that of coarse tails and fine tails. The risk of tailings liquefaction is therefore much less than for pure fine tails (i.e. is much safer) and the material may be placed back into pit voids.
- Water recovery from co-disposal is greater than from pure coarse and pure slime tailings (most of the water pumped with pure fine tailings is locked up for many years). This obviates the need for other potential sources of water such as water bores or dams.

2.6 Main Operational Activities

The main activities as part of Kwale North mining include the following:

- Mining Activity.
- Mineral Processing at the WCP and MCP, located adjacent to the Central Dune.
- Transportation and storage of the processed minerals at the Likoni Ship loading Facility.
- Shipment to Market.
- Rehabilitation of mined areas.

The ore mining operations will be carried out block-wise by the use of four hydraulic mining units, each with a 750t/h capacity. High pressure jets of water are pumped onto the mining face, breaking loose the ore.

From the hydraulic mining units, the ore will be fed by a slurry pipeline to the existing Wet Concentrator Plant (WCP), where the slimes and sand tails will be removed to produce Heavy Mineral Concentrate (HMC). The HMC will then be delivered to the Mineral Separation Plant (MSP) for recovery of the three products – Ilmenite, Rutile, and Zircon.

Slime tails will be directed to 38-metre diameter thickeners, dosed with a suitable flocculant, and separated into clear overflow water and thickened underflow slimes. The method of tailings management to be implemented for the North Dune Mining will be co-disposal of the combined sand tailings and slime tailings. The fine material (slime) from the processing will be mixed with sand on a ratio of up to 38:62 and pumped back to the mined voids. The filled voids will then be top soiled, and initially grassed as part of the rehabilitation.

The three mineral products, Ilmenite, Rutile, and Zircon, will be trucked to the dedicated Likoni Ship loading Facility and the Mombasa Port where Rutile and Ilmenite products will be stored in an 80,000-tonne shed for bulk loading to ships via a conveyor transfer system. Zircon and some rutile will be bagged and containerized for export via the Mombasa Port Container Terminal.

The following describes in more detail, some of the main components of the operation's activities.

2.6.1 Mining Method

The current process design is described below and detailed in Figure 2.2.

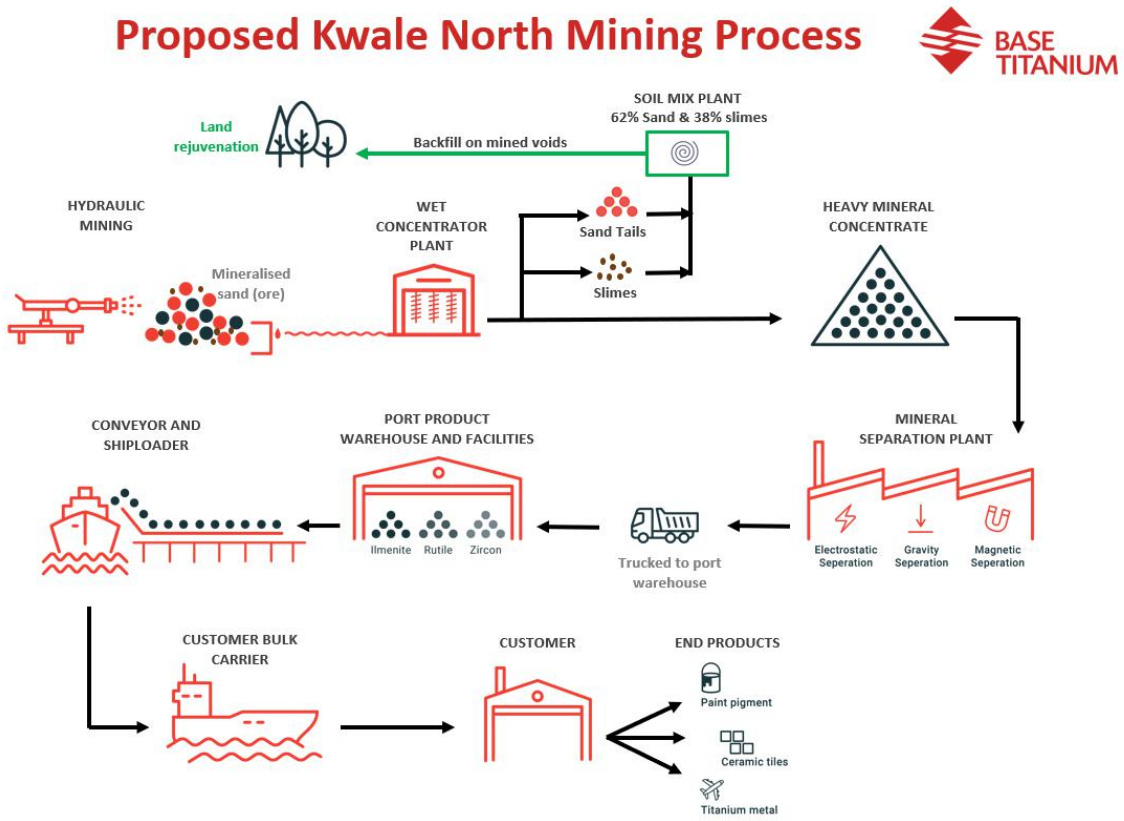


Figure 2.2: Schematic of the Kwale operation mining process.

2.6.1.1 Site Preparation Works

For each block to be mined, the trees and vegetation are cleared using a dozer and excavator to provide a cleared area ahead of the mining operations. As part of Base's Environmental Programme Department's Biodiversity and Conservation Programmes, before mining of any block, the following is undertaken within each block:

Tree species of conservation value are transplanted from areas being cleared and transplanted in the Kwale Mine Arboretum.

- Seeds are collected from any indigenous trees and grasses that are targeted for propagation in the Restoration Programme Indigenous Tree Nursery. Grass seeds are collected in the onsite seed bank.
- Environmentally protected areas within the current SML were identified at the start of clearing for mining in the Central and South Dune, and were demarcated with signboards. The same will be done within the North Dune, including the demarcation and signing of areas such as the Kidongweni System and wetland systems.
- Topsoil removed and stockpiled in designated areas for later use. The stockpiled topsoil provides a seed bank for the growth of floral species that can be used in the Rehabilitation and Restoration Programme.

2.6.1.2 Mining

The ore is mined using Hydraulic Mining Unit (HMU) technology (Figure 2.3). The mining philosophy behind hydraulic mining is based on high-pressure jets of water being directed and used to dislodge and move ore. The resulting slurry is gravitationally directed to a collecting sump from where it is

pumped onwards to feed into the mine's collection hopper where it joins the slurry feed to the processing plant.

Figure 2.3: Hydraulic Mining Unit

2.6.1.3 Processing Plant

The processing plant is made up of two primary units, the Wet Concentration Plant (WCP) and the Mineral Separation Plant (MSP).

Wet Concentration Plant (WCP)

The WCP comprising of the following components:

- Ore receiver and de-sliming circuit.
- Spiral plant to separate Heavy Mineral Concentrate (HMC) from coarse sands.
- Slimes thickeners.

The slurried ore is pumped from the HMU to the WCP (Figure 2.4). At the WCP the slurried ore passes through two primary screens, where the fraction >4mm in size is removed and conveyed to the primary screen oversize stockpile. The undersize material is processed through a single stage of cyclone de-sliming. This process removes clay and particles less than 45µm in size. Separation in the cyclones utilise centrifugal force to accelerate the settling of particles. The finer clay fraction reports to the cyclone overflow discharge pipe located at the top of the cyclone, and the larger and denser particles report to the cyclone underflow at the base of the cyclone unit. This underflow flows by gravity to an overflowing surge bin to which water is added. The overflowing surge bin performs a secondary desliming function and provides surge capacity prior to the spiral circuit.

The finer clay fraction or slime from the de-sliming cyclones and surge bint flows by gravity to the thickeners. Flocculants prepared by an automated batch preparation plant is dosed independently into the thickener feed to achieve the required settling rates. The clarified water overflowing the thickener is returned to the process water reservoir while the thickener underflow is pumped to the co-disposal tank.

The material from the surge bin passes into a four-stage spiral concentrator circuit comprising rougher spirals, scavenger spirals, cleaner spirals, and re-cleaner spirals, with the heavy mineral from each spiral stage passing to the next stage for further concentration. The spiral concentrators consist of a double or triple helical trough wrapped around a central collection column with a concentrate channel and a series of concentrate removal ports placed at regular intervals along the spiral. Separation is achieved by stratification of material caused by a complex combined effect of centrifugal force, differential settling, and heavy particle migration through the bed to the inner part of the conduit.

The HMC from the spiral circuit is stockpiled. The sand tailings recovered from the spirals report to the co-disposal tank, mixed with the slime tailings and pumped to the mining voids. Prior to deposition, the flocculent is added to bind the sand and slime fraction to ensure the deposited tailings do not segregate

and allows recovery of water from the tailings. After co-disposed tailings are deposited, these dunes will be shaped to reflect the surrounding landforms, before rehabilitation.

Figure 2.4: The Kwale Mine's Wet Concentrator Plant (WCP)

Mineral Separation Plant (MSP)

The design of the MSP has been optimised with the basic methods of mineral separation being gravity, magnetic, and electrostatic separation.

The MSP (Figure 2.5) consists of five separate circuits for the processing of the HMC into ilmenite, rutile, and zircon products. The five circuits are:

- Feed Preparation Circuit (FPC)
- Ilmenite circuit
- Rutile dry circuit
- Wet zircon circuit
- Dry zircon circuit

The FPC receives HMC from the HMC stockpile. The HMC is screened to remove coarse particles and other debris. The HMC is then passed into a four-cell attritioner to break up aggregates and remove coatings from mineral grains followed by classification in an up-current classifier to remove remaining slime, fine quartz and fine HMC. Up-current classifiers or hydrosizers separate particles based on size and specific gravity. They utilise a current of water, introduced across the bottom of the classifier. The sand, mineral grains, and other particles classify themselves so that the coarse grains report to the bottom where they stay relatively close to each other with high water velocities flowing between them. The finer particles are dispersed to the higher levels where they stay in more open suspension and the water velocity between them will be lower.

The classifier overflow is recycled to the scavenger spirals in the WCP to recover any fine valuable mineral in this stream while the HMC is recovered from the base of the classifier. The HMC is filtered by a horizontal belt filter and conveyed to the HMC dryer. Should further cleaning of the surface of the mineral be necessary, provision is made for a second bank of attritioners in the plant layout.

The ilmenite circuit receives HMC from the up-current classifier and produces a magnetic ilmenite product and non-magnetic concentrate. HMC filter cake is then conveyed to the diesel-fuelled HMC fluid bed dryer. The unit is fitted with a dust cyclone and baghouse to collect any mineral blow-over before discharge to the atmosphere. The dried HMC is screened at 400µm to remove coarse material, which is predominantly quartz and non-valuable heavy mineral. The material less than 400µm in size is transferred by conveyor and bucket elevator to seven combination Low-Intensity Magnetic Separation (LIMS)/Rare Earth Drum (RED) magnets. The LIMS consists of a rotating drum within which a fixed permanent magnet is located. The feed is presented to the drum and depending on the magnetic susceptibility of the grains is either attracted by the magnetic field and held to the drum surface or discharged by gravity/centrifugal throw. As the drum rotates the magnetic grains leave the magnet field and are discharged separately, usually with the aid of a scraper or brush. The LIMS will remove highly-magnetic susceptible titanomagnetite, preventing it from reaching the high-intensity RED magnets and causing damage. RED magnets are used to separate weakly magnetic materials and to separate magnetic impurities present in low concentrations. The magnetic fraction from the LIMS/RED magnets is transferred to the ilmenite product storage bins via a bucket elevator and conveyors while the non-magnetic fraction gravitates to a non-magnetic surge bin.

The non-magnetic surge bin from the ilmenite circuit feeds a rutile fluid bed reheater. The reheater heats the HMC to 110°C before treatment by a series of High Tension (HT) electrostatic separators which separate a conducting fraction suitable for processing in the rutile circuit from a non-conducting fraction suitable for further processing in the zircon circuit. The conductive fraction from the HT separators is a crude rutile stream that is further processed to separate residual ilmenite from rutile using Rare Earth Roll Magnetic Separators (RERMS) which separates weakly magnetic materials. The non-magnetic fraction from the RERMS gravitates to the 250µm rutile screen while the magnetic fraction gravitates to a bucket elevator for transfer into the ilmenite product storage bins. The nonconductive material from the HT separators is fed to cleaner HT separator for further separation of the conductive and nonconductive fraction. The non-conductive fraction is passed to the non-conductor RERMS while the conductive fraction is passed to the rutile RERMS magnet. The end products are rutile and material to feed the zircon circuit.

The non-conductor feed from the rutile circuit is processed by a three-stage spiral circuit comprising a Rougher Spiral (RS), Middling's Cleaner Spiral (MCS), and a Scavenger Spiral (SS). The concentrate from the RS reports to the primary classifier feed hopper from where it is pumped to the primary classifier via the primary classifier cyclone. The middling's from the RS reports to the MCS feed hopper from where it is pumped to the MCS. The tailings from the RS report to the SS feed hopper from where it is pumped to the SS. The concentrate from the MCS also reports to the primary classifier feed hopper, while the middling's report to the MCS feed hopper and the tailings to the SS feed hopper. The concentrate from the SS report to the MCS hopper while the middling's report to the SS feed hopper.

The underflow and overflow streams from the primary classifier are processed through separate gravity circuits to generate a concentrate feed to the dry zircon circuit and a combined tailing. The overflow from the primary classifier is processed through a four-stage spiral circuit comprising a RS, middling spiral, cleaner spirals, and scavenger spirals followed by processing through a cleaner shaking table and a scavenger cleaner shaking table.

The underflow from the primary classifier is processed through a five-stage spiral circuit comprising three rougher spirals and two middling's spirals followed by processing through five double-deck cleaner shaking tables and recleaner shaking table.

The concentrate generated from the classifier underflow and overflow gravity circuits is pumped to a horizontal filter bed ahead of drying and processing in the zircon dry circuit.

The middling's and coarse tailings from the classifier underflow and overflow circuits are scavenged for misreporting zircon by a Kelsey Centrifugal Jig. The jig concentrate is treated by further classification, spiral, and wet table separation. The jig tailings are combined with the other MSP rejects.

The circuit receives the concentrate from the wet zircon circuit. The zircon concentrate hopper pumps to the zircon filter belt via a hydro-cyclone. The feed is filtered by a horizontal belt filter. The filter belt discharges to a transfer conveyor which conveys filter cake to the zircon dryer feed bin. The feed bin discharges directly to a fluid bed dryer. The fluid bed dryer heats the feed material to approximately 100°C to achieve a feed temperature at the zircon rougher HT separator of 80°C. The dryer discharge is transferred to the zircon rougher HT separators via a bucket elevator. The dried zircon is treated by a series of HT separators and Induced Roll Magnetic Separators (IRMS) to produce zircon final product and a final tailings non-conductor magnetic stream and a conductor rejects stream for recirculation to the dry rutile circuit.

The final zircon product travels over a belt-weigher and is sampled for product analysis and operational statistics.

Figure 2.5: The Kwale Mineral Sands Mineral Separation Plant (MSP).

2.6.1.4 Tailings Management

The processing of the heavy mineral sands produces one distinct tailings stream; namely the co-disposal of a 38:62 slimes to sand ratio. The slimes contains a high proportion of clay-sized material (D50 ± 5µm). This slimes and sand tails mix will be mixed in the Soils Mix plant and used to backfill mined out voids prior to rehabilitation and revegetation.

2.6.1.5 Product Storage

Ilmenite product is stored in the existing two 450m³ (1,170t) elevated product loadout bins. The elevated product bin is used to load 30t road transports to cart bulk ilmenite to the ship loading facility at Likoni. Rutile product is stored in a 450m³ (1,125t) elevated product loadout bin and in a 100m³ (250t) rutile bagging/container bin. The elevated product bin is used to load 30t road transports to cart bulk rutile to the Likoni Ship loading Facility. The bagging/container bin is used to load 2,000kg bulk bags or up to 27t containers. Zircon product is stored in a 100m³ (260t) zircon bagging/container bin. The bagging/container bin is used to load 2,000kg bulk bags or 27t containers.

The rutile and zircon have separate container loading systems. Each system consists of the bagging/container bin and a suspended conveyor. The trucks carrying the containers reverse such that the conveyor protrudes into the open container. The conveyors are designed to load at 250t/h, to deliver a 27t load in less than seven minutes. The reversing trucks are guided by bollards to prevent reversing into the conveyor.

Bagged rutile and zircon are stored in a 30m x 15m final product storage shed capable of holding 192 bags.

2.6.1.6 Access Road

Mine access is via the existing 8km access road which connects to the existing A14 highway. The road is surfaced with a 50mm layer of asphalt concrete. Each lane is 3m wide with a 1m shoulder giving the road a total width of 8m. The road reserve is 35m wide. All the required land title deeds have been registered and issued, and Base has done all paperwork and handed the road over to the Kenya Rural Roads Authority.

Grassing to control soil erosion on the shoulders of the road was done. Road signs were installed at various points on the road including 60kph speed limit sign, right and left turn signs. The movement on the road is closely managed for Base vehicles including the use of beacon lights on the transportation trucks and light vehicles. Base has already handed over the road to the Kenya Rural Roads Authority (KeRRA) as required by law.

2.6.1.7 Water Supply

A broad water management strategy has been developed to provide sufficient water for the operations. Currently, more than half of the water required for the Kwale Mine operations is comprised of recycled water recovered through the TSF and associated settlement ponds with the shortfall coming primarily from the Mukurumudzi Dam. Groundwater abstraction from the mine's wellfield is used to provide potable water and water for components of the processing plant that require clean water such as the fire suppression system.

Give that co-disposal of coarse and fine tailings is now planned for the North Dune, water recovery from co-disposal is much greater than compared to the present mining method (most of the water pumped with pure fine tailings is locked up for many years). This obviates the need for other potential sources of water such as water bores from the mine's wellfield. Should water recovery from co-disposal be less than expected, Base will draw water to make up for this shortfall, from the Mukurumudzi Dam, which will very likely be within the current permit conditions.

A water treatment plant was installed and treats all water used for domestic purposes on site (e.g. drinking water, water for bathing and laundry, cooking, etc.). Domestic water demand for the mining staff and administrative offices are from the wellfield. The Likoni Ship loading Facility receives the potable water it requires from a commercial supplier.

2.6.1.8 Power Supply

The Operations requires a reliable power supply for the operation of the mine and associated infrastructure. In March 2010 construction of a 132kV transmission line from Rabai (near Mombasa) to a substation at Galu was completed. It can deliver approximately 100MW, while the entire South Coast demand is currently approximately 20-25MW. The transmission line has been handed over to the Kenya Power and Lighting Company (KPLC).

2.6.1.9 Likoni Ship loading Facility

The ilmenite and rutile products are transported from the mine site to the Likoni Ship loading Facility located at a site adjacent to the Kenya Ferry Services in Likoni. The site is located on the south bank of the Mombasa Creek within the Kilindini Harbour Zone. Zircon is containerised and trucked to existing container facilities in the Port of Mombasa. The ilmenite and rutile products are stored and then loaded

onto bulk carriers for shipment to their final destinations. The Likoni Ship loading Facility consists of a covered shed for storing the products, a jetty, which provides access to the ship loading wharf, and various support services such as offices, ablutions, workshop, etc.

Ilmenite and rutile loading systems are fitted with several dust control devices along its length. The system is also fully automated with a central computerised control center for monitoring and control and an elaborated alarm and safety measures. The Loading facility uses an onsite electricity generator during loading but not power from the main grid system because the latter is unreliable.

2.7 Land Take and Resettlement

Due to the proposed move of mining to the North Dune where additional mineral resources have been identified, it is projected that the North Dune mining activities will affect sections of the host communities both physically and economically, largely in Mwaloya, Mwaweche, Mkwambani, Bumamani and Mwandimu villages. In accordance with International Best Practice and the commitment by Base to being a responsible developer, the Company is committed to ensuring that its actions do not result in the affected households being worse off as a consequence of resettlement and compensation. As such, Base will undertake a Resettlement Action Plan (RAP) for the area of the North Dune in conformance with Kenya law and IBP (namely the IFC Performance Standard 5). This aspect is covered more fully in this ESIA.

3. LEGISLATIVE AND INTERNATIONAL GOOD PRACTICE REQUIREMENTS

This *Section* details the key institutional arrangements, administrative structures and legal instruments that relate to various activities applicable to the North Dune mining extension. The relevant provisions in these frameworks are discussed and, where appropriate, the compliance status of the operation is indicated. Furthermore, the applicable standards of international lending organisations are provided and their applicability discussed.

PLEASE NOTE:

Whilst this *Section* has been prepared with all due care by ERM, it does not constitute legal advice and should not be construed as such. Furthermore, the Kenyan regulatory environment may be subject to changes to both regulatory instruments and authorities during the projected Project life-cycle. It is therefore recommended that the regulatory framework is reviewed and assessed periodically.

The sourcing of legislation was limited to a desktop survey (ERM's HSE database and other available online sources) and reliance on in-country contacts.

3.1 Relevant Institutional Framework

Several government institutions regulate various activities conducted during mining operations. However, the main institutions with a direct oversight role to the North Dune extension mining operations are the following:

3.1.1 The Ministry of Petroleum and Mining

This is the parent ministry for all mining-related activities in Kenya. The ministry develops policy and oversees all mining activities in Kenya, through respective departments. The main departments that regulate and coordinate mining functions as outlined in the following sub-sections.

3.1.1.1 The State Department for Mining

This is the main department that coordinates various functions aimed at enhancing the growth of the mining sector in the country as guided by the executive order No. 2 of 2013, and has the following primary roles:

- Minerals exploration and mining policy and management.
- Inventory and mapping of mineral resources.
- Mining and minerals development.
- Policies on the management of quarrying and mining of rocks and industrial minerals.
- Management of health and safety in mines.
- Policy around the extractive industry.
- Resource Surveys and remote sensing.
- Maintenance of geological data (research, collection, collation, and analysis).

The Ministry has issued Base the relevant mineral rights for the Kwale Mineral Sands Operations, being Prospecting Licence 2018/0119 and Special Mining Lease No. 23.

3.1.1.2 Additional institutions under the Ministry of Petroleum and Mining

Additional institutions under the Ministry of Petroleum and Mining, with relevance to Base's mining operations, are illustrated in Table 3-1 below:

Table 3-1: Additional Institutions under the Ministry of Petroleum and Mining

Institution	Main Role	Relevance to the North Dune Extension
Directorate of Geological Survey	Consolidates GoKs efforts in collection and storage of geological data related to prospecting in a national repository	Participates in various geological surveys including geo-environmental studies. Facilitates promotion of private sector interest and investment in mineral exploration
Mineral Rights Board	Makes recommendations to the Cabinet Secretary on grant, rejection, retention, renewal, suspension, revocation, variation, assignment, trading, tendering, or transfer of Mineral Rights Agreements.	Regulation of fees to be paid on different minerals. Will assess license application and make recommendation to Cabinet Secretary.
National Mining Corporation	Acts as the investment body on behalf of the national government in respect of minerals.	Can acquire shares or interest in any firm, company or other body of persons, whether corporate or unincorporated as long as they are engaged in mining activities. Not currently constituted
Minerals and Metal Commodity Exchange	Exchange will facilitate efficiency and security in mineral trade transactions	There will be an opportunity/option for Base to trade the minerals within the Country. Not currently constituted.

If the North Dune mineral deposit proves a viable option to mine, an application for a Mining License over areas currently covered by Prospecting License 2018/0119, and supported by the currently ongoing EIA process, will be submitted. For an application for a mining licence to be granted, the following conditions must be met:

- *Base, which is the holder of Prospecting License 2018/0119 must have given notice to the Cabinet Secretary of the discovery of minerals in or on the areas which are the subject of the prospecting licence; and*
- *Base needs to satisfy the requirements prescribed by the Mining Act (2016) for the grant of a mining licence. These include:*

  - *Base applying for a mining licence in the prescribed form and accompanied by the prescribed fee*

  - *The application for a mining licence shall be in the prescribed form and addressed to the Cabinet Secretary and shall provide the following information:*

    - *the mineral or minerals in respect of which the licence is sought;*
    - *the area in respect of which the licence is sought;*
    - *a proposed programme of mining operations that outlines the mine forecasts and operation plans, including the options for minerals beneficiation in the prescribed form; a feasibility study;*

- *a statement regarding the mineral or minerals in the area of land over which the licence is sought, including details of all known minerals as well as probable mineral reserves;*
- *a statement of the financial and technical resources available to the applicant to carry out the proposed mining operations and to comply with the conditions of the licence;*
- *a plan giving particulars of the applicant's proposals concerning the employment and training of Kenyan citizens;*
- *a plan giving particulars of the applicant's proposals concerning the procurement of local goods and services;*
- *proof of submission and approval of an environmental and social impact assessment report and environmental management plan for the term of the mining licence to the National Environment Management Authority; and*
- *A plan giving particulars of the applicant's proposals concerning socially responsible investments for the local community.*

Additionally, as one of the requirements of being granted a mining licence, Base must have submitted a site mitigation and rehabilitation or mine-closure plan for approval.

Base has prepared a Mine Closure Plan to ensure that the social, environmental and economic impacts associated with the decommissioning and closure of the Kwale Mine are addressed responsibly, which meets both Base's commitments and maximises net benefits from the operations. The purpose of the Closure Plan is to act as an instrument to be used by Base to ensure that sound practices are incorporated into the planning for the decommissioning and closure phases and the implementation of decommissioning and closure of the Kwale Mine. Closure planning forms an integral part of Base's management and decision-making systems and Base's Environmental and Social Management System (ESMS) and its associated ESMPs and benefits from extensive stakeholder engagement.

Plans are in place to update this Mine Closure Plan to include mining of the North Dune resource area and to improve it to a fully detailed Closure Plan, including associated detailed implementation plans and schedules. This will be undertaken through Project monitoring, further stakeholder engagement, and analysis of the findings of the ongoing rehabilitation trials to determine the suitability of landforms for specific vegetation cover and crops and trials on both mined excavations, and more importantly the TSF.

3.1.2 The National Environment Management Authority

The National Environment Management Authority (NEMA) is established under the Environmental Management and Co-ordination Act No. 8 of 1999 (EMCA) as the principal instrument of the Government of Kenya for the implementation of all policies relating to the management of the environment. The main objective of the Authority is to ensure a clean, healthy, and sustainable environment in Kenya through supervision and coordination of all matters relating to the environment.

The most relevant of the Authority's list of mandates is its role to advise the Government on legislative and other measures for the management of the environment or the implementation of relevant international conventions, treaties, and agreements.

Within this mandate, NEMA has gazetted several Regulations, most of which are relevant to the North Dune mining operations. These are discussed in Section 3.2.3 (EMCA 1999, rev 2015), including the EIA Regulations of 2003, which, in addition to others, requires an ESIA Report before the commencement of mining activities within the North Dune.

3.1.3 The Water Resources Authority

The Water Resources Authority (WRA) is a state corporation established under Section 11 of the Water Act, 2016, as an Agent of the National Government responsible for regulating the management and use of water resources. The Water Act, 2016 makes extensive provisions on the Authority's role in regulating

the use and management of water resources. Though the WRA was operationalised through Legal Notice No. 60 on the 21st of April, 2017, the Authority has been in existence for 12 years following its establishment under the Water Act, 2002 as Water Resources Management Authority (WRMA). The Authority has the following main roles:

- To sustainably and equitably allocate water resources among the various competing needs. WRA also requires that stakeholders are involved in the process and uses the "water use permit" tool to carry's out this function.
- To control pollution and improve water quality in the country's water bodies. This involves integrating land use activities and human activities into WRA water quality control programmes.
- To collect all information on water resources, analyse, store and disseminate it. This information is critical for water allocation, water resources investment decision making, and modelling to enact scenarios to better understand the impact of climate change in the future.
- To undertake climate actions in terms of mitigation and adaptation towards minimizing the effects of global warming and climate change on water resources.

The WRA has permitted water abstraction from both groundwater and surface water by Base for the mining operations in the central and south dunes.

The North Dune resource area, however, is characterised by lower mineral grades and high slimes meaning additional water, greater than the current permitted amount, will be required for mining and processing. Calculations indicate that if the traditional tailing method is continued for Kwale North, an additional 8,000m^3/day would be required for mining the North Dune. Co-disposal is the preferred tailings storage method which increases water recovery from tailings, and as such does not require the additional *8,000m^3/day. An assessment of water resources is being conducted as part of the PFS. This assessment will take into account existing water resources use (both surface and groundwater).*

Once a new permit has been applied for and approved by the WRA, the North Dune operations will utilise these water sources based on the PFS study and will be required to comply with the new permit conditions provided, and to apply for permits for any new sources. Potential water resource contamination sources from North Dune mining activities will also need to be mitigated to prevent pollution of the water resources and prevent any legal action by the Authority.

3.1.4 The Directorate of Occupational Health and Safety Service

The Directorate of Occupational Safety and Health Services (DOSHS) is one of the departments within the Ministry of Labour and East African Community Affairs, whose primary objective is to ensure the safety, health, and welfare of all workers in all workplaces. The Directorate seeks to prevent unsafe and unhealthy work environment that often cause accidents, diseases, disasters and environmental pollution and occasion huge economic and social burdens to individuals and enterprises, thereby stifling economic and social growth.

The Directorate enforces the Occupational Safety and Health Act, 2007 (OSHA, 2007) with its subsidiary legislation which aims at the prevention of accidents and diseases at work. It also administers the Work Injury Benefits Act, 2007 (WIBA, 2007) which provides for compensation of workers who have been injured or have suffered a disease out of and in the course of employment.

The North Dune mining activities will require adherence to the Act enforced by DOSHS for all its activities requiring human labour, as was done for the Central and South Dune.

3.1.5 The Radiation Protection Board

The Radiation Protection Board is a statutory body established under the Act of parliament, the Radiation Protection Act, Cap 243, Laws of Kenya as the national competent authority with the responsibility for protecting the health and safety of people and the environment from the harmful effects

of ionizing radiation. It regulates the use of ionizing radiation, exportation, importation, distribution, and possession of radiation sources. The Board operates under two subsidiary legislations;

The Board oversees compliance with the Radiation Protection (Standards) Regulations, 1986 (Rev 2012), which affects the Kwale Mine operations since some of the processes/activities associated with mining and mineral processing may result in radiation exposure to workers and neighbouring communities.

3.2 Relevant Legal Framework to the Project

3.2.1 The Constitution of Kenya

The Constitution of Kenya, enacted in 2010, is the supreme law of the land. Various Articles of the constitution provide guidelines that affect the mineral extraction and mining operations in general. These include:

- Article 62 that affirms that all minerals are held in trust for the people of Kenya by the national government.
- Article 66 that grants authority to the Parliament of Kenya to enact legislation to ensure all investments benefit local communities and their economies.
- Article 69 that obliges the State to ensure sustainable development and management of natural resources and the environment, and equitable sharing of accruing benefits.
- Article 71 that requires that all mineral agreements are to be ratified by the Parliament of Kenya.
- Article 232 that requires participation by people in policymaking, including the mining policy.

By way of SML No. 23 Base has the legal authority to operate the Kwale Mine, the mineral right is in good standing with all compliance provisions met. While Prospecting Licence 2018/0119 covers the North Dune and is also in good standing. Annual audit reports are submitted to NEMA to comply with the requirement for sustainable management of the natural resources and the environment, and Base works with the local/host communities through community programmes to ensure they are included in the operations, and benefit from it.

3.2.2 The Mining Act, 2016

This Act of Parliament gives effect to Articles 60, 62 (1) (f), 66 (2), 69, and 71 of the Constitution in so far as they apply to minerals. It provides for prospecting, mining, processing, refining, treatment, transport, and any dealings in minerals and related purposes in Kenya. The main sections of the Act relevant to the North Dune mining operations are as follows:

Mineral Rights

Section 10: Restrictions on the acquisition of mineral rights, provides that a person shall not search for, prospect or mine any mineral, mineral deposit or tailings in Kenya unless that person has been granted a permit or license under this Act.

For large scale mining operations like the Kwale Mineral Sands Project, Section 32(3) of the Act provides that the following licenses and permits may be granted for a mineral right under this Act to authorise a mineral right holder to engage in operations particular to each type of license:

- A reconnaissance license.
- A prospecting license.
- A retention license.
- A mining license.

Tenure of the Kwale Mineral Sands project is secured via SML No. 23 and PL/2018/0119 (formerly SPL173). These mineral rights cover the Central and South Dune mining operations (SML No.23) and North Dune (PL/2018/0119) (Figure 2.1).

Employment preferences

On local employment, Section 47(1) required the holder of a mineral right to give preference in employment to members of the host community and citizens of Kenya. Further, sub-section 2 requires that in the case of a large scale operation, like the Kwale Mine, the holder of a mineral right shall:

- Conduct training programmes for the benefit of employees.
- Undertake capacity building for the employees.
- Only engage non-citizen technical experts under such local standards for registration as may be prescribed in the relevant law.
- Work towards replacing technical non-citizen employees with Kenyans, within such reasonable period as may be prescribed by the Cabinet Secretary.
- Provide linkage with the universities for purposes of research and environmental management.
- Where applicable and necessary to facilitate and carry out socially responsible investment for the local communities.
- Implement a community development agreement as may be prescribed in Regulations.

Base has developed the Employment Policy and the Communities Policy that provide the framework within which the employment and labour management at the Kwale Mineral Sands operations is done. Policies are premised on the Company's commitments that employment is based on the principles of consistency, transparency, fairness, and equal access to employment opportunities. These have the objective of achieving maximum numbers of local people employed on the Project, therefore optimizing benefits for local communities.

The Base Employment Policy also commits the company to continuous training and capacity building of the employees, while the Communities Policy commits the company to continuous, transparent, and honest engagement with communities and participation in relevant community development programmes.

The Company also partners with research institutions, universities, and NGOs in various development and research programmes. Some of the partners include the Kenya Wildlife Service, The World Wide Fund for Nature, the National Museums of Kenya, the Kenya Forest Service, and a host of academic institutions through the company scholarships programme.

Procurement of goods and services

Section 50 of the Act requires that the holder of a mineral right shall, in the conduct of prospecting, mining, processing, refining and treatment operations, transport or any other dealings in minerals give preference to the maximum extent possible to materials and products made in Kenya, to services offered by members of the community and Kenyan citizens and to companies or businesses owned by Kenyan citizens.

Base has and will continue to source goods and services from the host community and Kenya more broadly as a priority. Food, raw materials for the nurseries, and cleaning services are some of the services offered by the local community, which will still be offered during operations at the North Dune. In a typical year, Base spends between 60-65% of non-labour costs with Kenyan providers of goods and services.

Environment, Safety and Health obligations under the Act

Sections 176 to 178 of the Act requires that a mining license is only granted to an entity that has obtained an environmental impact assessment license, conducted social heritage assessment, and

where the environmental management plan has been approved. Such a mining license holder is not exempt from complying with any law concerning the protection of the environment, compliance with the provisions of the Water Act, 2016 concerning the right to the use of water from any water resource and compliance with the provisions of the Occupational Health and Safety Act, 2007 concerning the safety of workers and mine operations.

Base was already granted the EIA license for the mineral operations in both the Central and South Dune. However, due to the identification of additional resources beyond the mining licence boundary in the North Dune, Base is further required to conduct an ESIA to include the environment and social risks posed by the extension area. This report is the outcome of the additional studies for the North Dune extension.

Land Use and Restoration

The holder of a mining license has the responsibility for sustainable use of the land upon which resources are mined. Section 179 of the Act requires the holder of a permit or license to use the land under the terms of the permit or license and to ensure:

- The sustainable use of land is ensuring the appropriate restoration of abandoned mines and quarries.
- That the seepage of toxic wastes into streams, rivers, lakes, and wetlands is avoided and that disposal of any toxic waste is done in the approved areas only.
- That blasting and all works that cause massive vibration is properly carried out and muffled to keep such vibrations and blasts to reasonable and permissible levels in conformity with the
- Environmental Management and Coordination Act.
- That upon completion of prospecting or mining, the land in question shall be restored to its original status or to an acceptable and reasonable condition as close as possible to its original state.

In addition to the above, Section 180, prospecting, retention, or mining licenses shall not be granted unless the applicant has submitted site mitigation and rehabilitation or mine-closure plans for approval, as set by the Department of mining.

Base commissioned this study to understand and mitigate potential additional and/or cumulative impacts resulting from the mining of the North Dune Extension to the environment, including noise, water quality, and waste management. Recommendations contained in the ESIA, especially the ESMP, will be implemented to maintain compliance with this provision. Base also has an Environment Monitoring Programme Management Plan to manage the use of environmental resources, including land and water, and has set up a Mine Closure Plan and a Tailings Management Plan to manage site rehabilitation and restoration activities. In line with these plans, Base has conducted different land rehabilitation and restoration trials, whose outcomes have been positive.

Environmental Protection Bond

An applicant for a prospecting license, a retention license or a mining license is required under Section 181(1) to provide a bond or some other form of financial security called an environmental protection bond sufficient to cover the costs associated with the implementation of the environmental and rehabilitation obligations of the holder under this Act.

Base made an Interim Rehabilitation Deposit Bond for the Kwale Operation of USD 527,267 with NEMA. Following a site visit by NEMA in June 2017, the authority was satisfied that Base had demonstrated sound environmental management systems, practices, and compliance, and granted a cessation of paying additional interim deposit bonds. Conditional to this is that Base shall continue with the rehabilitation works, especially in the areas where mining has been completed and shall submit remediation reports as part of Annual Environmental Audit Reports.

To effectively implement the above provisions in the Mining Act, 2016, various pieces of Regulations have been developed. These are discussed below, in brief.

3.2.2.1 The Mining (License and Permit) Regulations, 2017

These Regulations were gazetted in May 2017 to regulate the issuance and use of all licenses and permits for mineral rights and dealings in minerals in Kenya.

The main elements of the Regulations that affect the North Dune include:

- Section 11(1) requires an application for a mineral right to submitted by a registered user by completing the prescribed form, uploading the required documents, and payment of the prescribed fee. This is to be done by Base, for the application of a new mining license.
- Section 13 requires any applicant for a mineral right to comply with the requirements of the Environmental Management and Coordination Act and any regulations or guidelines made thereunder before any mineral right is granted. Base, as part of the application for area mining licence for the North dune, has commissioned additional studies, whose findings will be outlined in the ESIA Report.
- Section 27 of the Regulations requires the holder of a mineral right to report the discovery of any cultural, historic or archaeological relics found within the mineral right area to the Cabinet Secretary within seven days of the discovery.

3.2.2.2 The Mining (Use of Assets) Regulations, 2017

These Regulations, gazetted in May 2017, were developed to oversee the declaration, management, and transfer of all movable and immovable assets, to verify actual assets in hand and value and ensure the accuracy of related financial records by a mining license holder.

Section 4(1) requires a mining license holder to maintain a complete, up to date and accurate register of all movable and immovable assets under their ownership. Base keeps a register of all assets owned, for both company audit interest and in compliance with this Law.

3.2.2.3 The Mining (Use of Local Goods and Services) Regulations, 2017

These Regulations were developed to ensure that there is a value added to or created in the Kenya economy by a systematic development of capacity and capabilities through the deliberate utilization of Kenyan human and material resources and services rendered in the mining industry value chain.

The main purposes of these Regulations are to:

- Promote job creation through the use of local expertise, goods and services, businesses, and financing in the mining industry value chain and their retention in the country.
- Achieve the minimum local level and in-country spend for the provision of the goods and services in the mining industry value chain.
- Increase the capability and international competitiveness of domestic businesses.
- Create mining and mineral related support industries that will provide jobs and sustain economic development.
- Achieve and maintain a degree of participation for Kenyans or companies incorporated in Kenya for the supply of goods and the provision of services and services.

Section 2 of the Regulations require a mining license holder to have a procurement plan that indicated the particulars of the goods and services they intend to procure in Kenya to undertake its operations or activity, the proposed expenditure that will be incurred under the plan, particulars on gender and a timeframe for such a plan.

As a holder of the pre-existing mining license, Base shall also be required to include, in the procurement plan, targets for local procurement including at least the items specified in the procurement list as provided or made available by the Director of Mines (this list has not yet been developed) and (b)

specific support to local providers or suppliers as well as other measures to develop the supply of local goods and services including broadening access to opportunities and technical support.

Through Base's Procurement Policy, local content is highly emphasized. Though procurement advertisements are made in public, suppliers from the host community are given priority, then the county of Kwale, before looking nationally. This ensures that, where the right quality and quantity of goods or services can be obtained locally, the local community benefits wholly from such advertisements.

Base also has, through the Community Department, worked with the local communities to develop their business, agriculture, and technical capacity at various levels. These are reported annually through the Annual Environmental and Social Reports, submitted to NEMA and the Ministry of Petroleum and Mining.

3.2.2.4 The Mining (Employment and Training) Regulations, 2017

These Regulations were developed to promote job creation through the use of local expertise in the mining industry, the entire mining value chain and to retain the requisite skills within the country, develop local capacities in the mining industry value chain through education, skills, and technology transfer, research and development, and to achieve the minimum local employment level and spend in the country and across the entire mining industry value chain.

Section 6(1) of the Regulations require every holder of a mining license to, within ninety days of the coming into force of these Regulations, submit employment, training and succession plan which corresponds with the work programme or programme of mining operations that accompanied the application made by the holder for the grant of the license, and, not later than eighteen months, update its employment and training plan to comply with these Regulations.

On annual reporting, Section 10(1) of the Regulations require a holder of a mining license to, not later than thirty days after Reporting the end of the year, submit to the Director of Mines, a performance report covering all the activities related to employment, training, research, and development.

Base submits employment, training, and succession data and plans to the Department of Mines. Further, Base also submits annual performance reports to the Ministry of Petroleum and Mining as required by these Regulations.

3.2.2.5 The Mining (Community Development Agreement) Regulations, 2017

These Regulations have been developed to provide a legal basis on which mining operations and mining related activities are conducted in a manner that, for the life of the mine:

- Benefits of the mining operations or activities are shared between the holder and affected community.
- Mining operations are consistent with the continuing economic, social and cultural viability of the community.
- Mining operations significantly contribute to the improved economic, cultural social welfare of the community and its members.

The Regulations are also meant to ensure accountability and transparency in mining-related community development and to define when Community Development Agreements are required and to provide a framework for such agreements.

The mining license holder, according to Section 5(1) of the Regulations, as part of the Environmental Social Impact Assessment and with the approval of the National Environmental and Management Authority, shall assess potential community impacts of its proposed operations and identify one or more communities with which it proposes preparation of a Community Development Agreement. Among the various parameters, conditions, and implementation regimes of such community development agreements, is the requirement that such agreements take into account any unique circumstances of

the mining operations and the affected mine community and the issues to be addressed in the agreement and community development programme.

A community development programme should contain the following:

- Objectives
- Time-based milestones
- Implementation timetable
- Schedule of anticipated expenditures
- Metrics and indicators by which to measure progress
- Periodic reporting including actual expenditures.
- How the plan works in coordination with County Government plans, services, infrastructure and activities provided to or affecting the community.
- How the provision of any service provided by the holder to the community will be terminated or transferred to the community.
- How and when the plan will be periodically updated.
- How the plan and amendments to the plan will be ratified by the affected community.
- Such other content as may be mutually agreed by the affected mine community and the holder.

The Regulations also require that where a holder of a mining lease or special mining lease has entered into a Community Development Agreement or has started some community development initiative, scheme or social development programme before the coming into force of these regulations, the holder shall ensure that such a scheme, initiative, programme, agreement or howsoever described shall comply with the requirements of these regulations within eighteen months after coming into force of these regulations.

Base conducts different community support programmes on health, agriculture, capacity building, awareness creation and education. Where land is temporarily required for any of these activities, Base has always signed land use agreements with the land owners.

Where a community development programme is developed to improve livelihoods in specific villages, Base holds sensitization meetings, their inputs are documented and agreements reached that accommodate these inputs. All this is undertaken through the Community Programmes Department, specifically in place for such.

3.2.3 Environmental Management and Coordination Act, 1999 (Revised 2015)

This is the primary Act developed to provide for the establishment of an appropriate legal and institutional framework for the management of the environment and matters connected therewith and incidental thereto in Kenya.

The Act provided for the formation of NEMA and outlined the Authority's mandate in regulating environment management in Kenya as the principal instrument of Government in the implementation of all policies relating to the environment. Further, the Act provides a wider framework for establishing Regulations on impact assessments, audits, environmental monitoring, water and air quality, noise and vibration, liquid and solid waste management and sets limits on fines and other punitive actions in cases of non-conformity.

To implement the provisions of the EMCA, the following Regulations, relevant to the North Dune mining operations, were established.

3.2.3.1 The Environmental (Impact Assessment and Audit) Regulations, 2003

These Regulations have been developed to regulate the environmental permitting process and provides requisite conditions for conducting impact assessments, project EIA licensing, environmental audit requirements and related technical and compliance requirements.

The Regulations require every proponent who implements a project that is likely to have a negative environmental impact or for which an environmental impact assessment is required under the EMCA Act to conduct the environmental impact assessment and obtain the EIA License under these Regulations. Subsequently, the licensed proponents are required to conduct annual environmental audits in the manner stipulated in the Regulations, and submit reports to the Authority for compliance monitoring.

The original Kwale Mine Project EIA License was issued on 30th June 2005 to Tiomin Inc. However, upon acquisition of the operations by Base, Certificate of Transfer of Environmental Impact License, certifying that the Environmental Impact Assessment License No. 0000048 issued to Tiomin Kenya Limited has been transferred to Base Titanium Limited was issued on 20th July 2010.

Due to the variation in the mining lease area after the discovery of additional resources in the South Dune, Base had conducted an amended ESIA study to accommodate the increased project area and new or revised cumulative impacts. An ESIA study is currently being conducted on the North Dune to assess the potential impacts of the proposed project.

3.2.3.2 The Environmental Management and Coordination (Water Quality) Regulations, 2006

The Regulations apply to drinking water, water used for industrial purposes, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife, and water used for any other purposes. Guideline standards for water quality management of, amongst others, sources of domestic water and effluent discharges into the environment are provided in the schedules of these regulations.

In Section 6, the Regulations prohibit anyone from:

- Discharging any effluent from sewage treatment works, industry or other point sources into the aquatic environment without a valid effluent discharge license issued under the provisions of the Act.
- Abstracting groundwater or carry out any activity near any lakes, rivers, streams, springs and wells that is likely to have any adverse impact on the quantity and quality of the water, without an Environmental Impact Assessment license issued under the provisions of the Act.
- Cultivating or undertaking any development activity within a minimum of six meters and a maximum of thirty meters from the highest ever recorded flood level, on either side of a river or stream, and as may be determined by the Authority from time to time.

The Regulations require that any entity discharging or applying any poison, toxic, noxious or obstructing matter, radioactive waste or other pollutants or permitting any person to dump or discharge such matter into the aquatic or terrestrial environment has to obtain requisite permits.

Base has obtained the related permits, and renews then upon expiry (Table 3-2)

Table 3-2: Permits obtained, Licence numbers and dates of issue

License Required	License Number	Date Issued
WRMA – Groundwater Abstraction Permit	BH1/WRA/66/MSA/3K/10564/G	17/01/2014
WRMA – Groundwater Abstraction Permit	BH3/WRA/30/MSA/3K/10564/G	17/01/2014

WRMA – Groundwater Abstraction Permit	BH5/WRA/30/MSA/3K/10564/G	17/01/2014
WRMA – Groundwater Abstraction Permit	BH6/WRA/66/MSA/3K/10229/G	02/03/2011
WRMA – Groundwater Abstraction Permit	BH7/WRA/66/MSA/3K/10472/G	28/02/2014
WRMA – Surface Water Abstraction Permit (from the Mukurumudzi Dam)	WRMA/30/MSA/3K/10084/S	03/03/2014
Mukurumudzi Dam statutory inspection		08/2017
Effluent Discharge License	NEMA/WQ/EDL/3458	13/06/2017

3.2.3.3 The Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009

These regulations provide for the control of noise and excessive vibrations in Kenya. They set out permitting and limit guidelines to ensure that no person makes or causes to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

The Regulations require any person intending to carry out construction, demolition, mining or quarrying work, during the Environmental Impact Assessment studies, to identify natural resources, land uses or activities which may be affected by noise or excessive vibrations from the construction, demolition, mining or quarrying, determine the measures which are needed in the plans and specifications to minimize or eliminate adverse construction, demolition, mining or quarrying noise or vibration impacts, and incorporate the needed abatement measures in the plans and specifications.

In compliance, Base has an Operational Health and Safety Management Plan for Kwale Mine operations. To establish the exposure of workers to nuisance noise levels, comprehensive occupational noise management, and monitoring programme has been developed and is under implementation. Appropriate PPE is provided and worn by employees in areas with high noise levels, and appropriate signage is erected as required. Noise monitoring covers various noise generating areas on the mine site and Likoni Ship loading Facility.

3.2.3.4 The Environmental Management and Co-ordination (Air Quality) Regulations, 2014

These Regulations provide for the prevention, control and abatement of air pollution to ensure clean and healthy ambient air.

The Regulations prohibit any entity from causing or allowing emission of the priority air pollutants prescribed in the Second Schedule to cause the ambient air quality limits prescribed in the First Schedule of the Regulations to be exceeded. They also provide emission management requirements, including monitoring and reporting requirements. Special reference is made to particulate matter and exhaust emissions into the atmosphere from any facility listed under the Fourth Schedule above the limits stipulated under the Third Schedule. Mining operations is one of such.

Base currently has an Emissions Management Plan for the mine operation and will be extended to cover the North Dune operations. This covers both ambient and occupational air quality parameters, and are reported daily. The performance of this Plan is presented in the annual environmental audit reports submitted to NEMA.

3.2.3.5 Environmental Management and Co-ordination (Waste Management) Regulations, 2006.

These Regulations apply to the handling, transportation and disposal of all categories of waste in Kenya.

The Regulations require that anyone generating waste must minimize it by adopting cleaner production methods. This may be done by improving the production process through conserving raw materials and energy, eliminating the use of toxic raw materials and reducing toxic emissions and wastes. Other methods would be to monitor the product cycle by identifying and eliminating the product's potential negative impacts, recovering and reusing the product where possible, and reclaiming and recycling it.

As provided for in the Regulations, every industrial undertaking must mitigate pollution by installing at its premises anti-pollution equipment for treating the waste it generates. Discharge or disposal of any waste in any form into the environment is not permitted without prior treatment.

Anyone intending to engage in any activity likely to generate hazardous waste must obtain an Environmental Impact Assessment license and contract licensed waste management entities if the wastes are to be carried off-site.

The Base operations generate a variety of wastes. These wastes are being managed in line with the Base Waste Management Plan which has been developed in line with these Regulations. Four wastes streams are currently associated with the operations, which are broken down into a process and non-process wastes. Process wastes associated with mining activities consist of tailings. All tailings are directed to the TSF for disposal and recovery of slurry water and the 'non-conductor mags' are monitored and discussed under the radiation impacts section. Non-process solid waste is divided into hazardous and non-hazardous waste.

At the mine site, non-hazardous wastes are segregated from hazardous waste at source and all wastes are carefully stored on-site in dedicated areas before safe disposal by NEMA licenced waste disposal practitioners.

3.2.3.6 Environmental Management and Co-ordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009.

These Regulations provide for the sustainable use of wetlands for ecological and aesthetic purposes and also, seek to prevent and control pollution and siltation as well as other activities that may degrade the environment. All wetland resources must be used in a sustainable manner compatible with the continued presence of wetlands and their hydrological, ecological, social and economic functions and services. Some permitted uses of wetlands include cultivation, fishing (subject to the Fisheries Act), small-scale fish farming, and domestic consumption, grazing, and hunting (subject to the Wildlife (Conservation and Management) Act.

The Regulations provide that areas that have national significance may be declared to be protected wetlands due to their biological diversity, ecological importance, natural heritage, aesthetic value or landscape. Environmental Restoration orders may be given to allow a wetland, riverbank or lakeshore that has been degraded to regenerate.

These Regulations apply to the wetlands already identified in areas proximal to the North Dune boundary, including riparian areas and the network of ephemeral streams around the Dune. These, by extension, will safeguard the quality of the mangroves downstream of the Mukurumudzi River.

Through the Environmental Monitoring Programme Management Plan, Base has in place a regular monitoring programme for the identified wetlands within the mining reserve area. Through the programme, Base ensures that no hazardous or contaminated wastes/effluents are discharged from the Project, monitors the condition of the wetlands to ensure that they are not adversely impacted by waste and effluents from the mining activities, as well as the drought conditions that occasionally prevail in the County. Base conducts regular Herpetofauna and macroinvertebrate monitoring in these wetlands, as one of the indicators of wetland health.

3.2.3.7 The Environmental Management Co-ordination (Fossil Fuel Emission Control) Regulations, 2006

These Regulations are developed to provide guidelines for any engines that cause air pollution from the use of any fossil fuel where the constituent properties are not properly combusted in an internal combustion engine and are emitted out as toxic carbon gases and particulates matter.

The Regulations provide standard limits for various fossil fuel emission sources and prohibits the operation of internal combustion engines which emit smoke or other pollutants above the emission standards, without prior permission from NEMA. The Authority may approve any substance to be used as a fuel catalyst if it improves fuel economy, enhances combustion and reduces harmful emissions that adversely affect human, animal and plant health and degrade the environment. The "polluter pays principle" is upheld in these Regulations, where the cost of clearing the pollution through fuel emission is borne by the polluter.

These Regulations relate to vehicular exhaust emissions that could be potentially harmful to the North Dune operation crew as well as to other persons in the neighbouring communities. It includes all other equipment that emits fumes. In the Emissions Management Plan, Base implements appropriate measures to minimize toxic gas and dust emissions to the environment, including the use of hydraulic mining which is a wet process, regular equipment monitoring and reporting, timely maintenance, replacement of work out engine parts, regulating the age of hired vehicles and training to personnel.

3.2.3.8 The Environmental Management and Co-ordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit-Sharing) Regulations, 2016

These Regulations apply to the conservation of all biological resources in Kenya, whether or not they are found in their natural environment, access to genetic resources and sharing of benefits that derive from those resources.

In Section 4, the Regulations provide that no person shall engage in any activity that may have an adverse impact on any ecosystem or lead to the unsustainable use of natural resources. The conservation of biological diversity applies to any area of land, lake or river which the government has declared to be a protected natural environment system for purposes of promoting and preserving biological diversity in accordance with section 54 of the EMCA, 1999.

These Regulations relate to disturbance of flora and fauna, vegetation disturbance and removal, and the disturbance of soil, surface and groundwater at the North Dune mining reserve and the areas proximal to the Dune. In compliance, under the Environmental Monitoring Programme Management Plan, Base is implementing a biodiversity and conservation programme that provides for vegetation and reptile and amphibian monitoring and surveys, conservation of forests and forest patches that constitute the Coastal Forests of Eastern Africa biodiversity hotspot, comprising small fragmented forest remnants containing significant levels of biodiversity and regular data collection on number and locations of species of conservation significance. The Programme also involves the establishment of indigenous tree nurseries and continuous engagement with host communities through training and afforestation activities to preserve the identified biodiversity hotspots.

3.2.3.9 The Environmental Management and Coordination (Deposit Bonds) Regulations, 2017

The Mining Act 2016 requires that the holder of a permit or license shall ensure that on completion of mining, the land is restored to its original status or to an acceptable and reasonable condition, as close as possible to its original state.

Further to this, an environmental protection bond sufficient to cover the costs associated with the implementation of the environmental and rehabilitation obligations as required under the provisions of EMCA is required.

By correspondence NEMA/SEA/5/2/001 of 17th July 2017, following a site visit by a team of NEMA Environmental Inspectors in June 2017, NEMA advised that the team was satisfied that Base had demonstrated sound environmental management systems, practices and compliance and that as such they have granted a cessation of paying additional interim deposit bonds awaiting gazettement of the Deposit Bond Regulations. Conditional to this, is that Base shall continue with the rehabilitation works, especially in the areas where mining has been completed and shall submit remediation reports as part of Annual Environmental Audit Reports.

Base has prepared a Mine Closure Plan [1] to ensure that the social, environmental and economic impacts associated with the decommissioning and closure of the Kwale Operations are addressed responsibly, that meets both Base's commitments and maximises net benefits from the operations. Through the Rare and Threatened Flora Propagation Research Programme, Base is targeting species of conservation interest to identify suitable species and techniques that may be used for the rehabilitation and revegetation of mining-impacted areas during closure. As part of this initiative, Base has established a Restoration Programme Indigenous Tree Nursery in which indigenous trees are propagated. Trees grown in the nursery are used for planting in areas impacted by the operation and will be used during mine closure to rehabilitate the mine site.

Base has also been carrying out rehabilitation trials on mined areas to simulate the conditions that will be presented post-mining rehabilitation of the North Dune, to ensure the successful closure of the Kwale Operations and the opportunity to present a legacy of successful mine rehabilitation for future reference.

3.2.4 The Occupational Safety and Health Act, 2007

This is the parent Act that regulates health and safety at the workplace. The Act was developed to secure the safety, health and welfare of persons at work and protect persons other than persons at work against risks to safety and health arising out of, or in connection with, the activities of persons at work.

This Act applies to all workplaces, and every occupier must ensure the health, safety and welfare at work of all the people working in his workplace as well as protect other people from risks to safety and health occasioned by the activities of his workers. The occupier's duty to ensure the safety, health and welfare of all persons at work in his premises includes providing a working environment and work procedures that are safe.

The Act prohibits the emission of poisonous, harmful, or offensive substances into the atmosphere, and where such incidents occur, they must be rendered harmless and inoffensive. Machinery, protective gear, and tools used in all workplaces have to comply with the prescribed safety and health standards. Dust, fumes or impurity must not be allowed to enter the atmosphere without appropriate treatment to prevent air pollution or harm of any kind to life and property. Highly inflammable substances must be kept in a safe place outside any occupied building. Where dangerous fumes are liable to be present, there must be a means of exit and suitable breathing apparatus made available. Means for extinguishing fire must be available and easily accessible, and evacuation procedures tested regularly (Sections 6, 21, 47, 55, 64, 78, 79, 81, and 82).

This Act covers all activities in the mine's operations that may be a hazard to the health and safety of workers and visitors to this area. Base is implementing the Kwale Mine Operational Health and Safety Management Plan. As required in the Plan, Base conducts regular safety inductions, toolbox talks, environmental and social risk information sharing meetings and security briefings and drills. Base carries out employee medical examinations, provides adequate working spaces and safety gear, and has clear procedures for each type of work.

[1] Base Titanium (2014) Closure Plan. Kwale Mineral Sands Project, Kenya

3.3 Summary of Other Applicable Legislation

3.3.1 The Water Act, 2016

This Act provides for the regulation, management and development of water resources and water and sewerage services in line with the Constitution.

Through the Act, the Water Resources Authority is formed with the mandate to:

- Formulate and enforce standards, procedures and regulations for the management and use of water resources and flood mitigation.
- Regulate the management and use of water resources.
- Enforce Regulations made under this Act.
- Receive water permit applications for water abstraction, water use and recharge and determine, issue, vary water permits; and enforce the conditions of those permits; collect water permit fees and water use charges; determine and set permits and water use fees.
- Provide information and advice to the Cabinet Secretary for the formulation of policy on national water resource management, water storage and flood control strategies.
- Coordinate with other regional, national and international bodies for the better regulation of the management and use of water resources.
- Advise the Cabinet Secretary generally on the management and use of water resources.

The Water Resources Authority has developed Regulations, the Water Resource Management Regulations, to guide the implementation of the above functions. *Base has complied with the relevant requirements of the Regulations, and obtained necessary permits and licenses from the Authority.*

3.3.1.1 The Water Resources Management Rules, 2007.

These Rules implement provisions of the Water Act, 2016. They apply to all policies, plans, programmes, and activities to which the Act applies. Matters covered by these Rules include: public notification and consultation; the protection of the water resources monitoring network; Water Resource Users

Associations; the register of water bodies; approvals, authorizations and permits; declaration of a watercourse or a wetland for water resources management by the Water Resources Authority.

The Rules prohibit anyone from discharging any toxic or obstructing matter, radioactive waste or other pollutants into any water resource unless the discharge has been treated to permissible levels. Discharge of effluent into a water resource also requires a valid discharge permit.

Base, in compliance with the Rules, has integrated measures to safeguard water resources in the Waste Management Plan and Water Management Plan (that provides for water quality and flow monitoring). These will still be applicable in the North Dune mining activities.

3.3.2 The Radiation Protection Act (Cap. 243)

This is the only legislation in Kenya remotely dealing with nuclear resources. It provides for the protection of the public and radiation workers from the dangers arising from the use of devices or material capable of producing ionizing radiation. Irradiating devices or radioactive material may not be imported without a license.

The Project Environmental Monitoring Programme Management Plan provides for occupational radiation monitoring that comprises area monitoring (gamma surveys) and personal exposure measurements collected on individual employees. To quantify levels of radioactivity on and around the mine site, measurement of gamma radiation levels, and environmental radiation monitoring in water and sediment samples are regularly undertaken both during mining operations.

3.3.3 The Forests Act, 2005.

This is an Act of Parliament enacted to provide for the establishment, development and sustainable management, including conservation and rational utilization of forest resources for the socio-economic development of the country.

The Act recognises that forests play a vital role in the stabilisation of soils and groundwater thereby supporting the conduct of reliable agricultural activity, provide the main locus of Kenya's biological diversity and a major habitat for wildlife, act as the main source of domestic fuel wood for the Kenyan people, provide essential raw materials for wood-based industries and a variety of non-wood forest products, and that they play a crucial role in protecting water catchments in Kenya and moderating climate by absorbing greenhouse gases.

Two main forests. The Gongoni and Buda Forests (Figure 5.11) have been identified in proximity to the North Dune operations, and Base, through the Biodiversity and Conservation Programme, developed under the Ecological Management Plan, is working with the communities to protect these forests, and replenish them with indigenous tree species.

3.3.4 The Climate Change Act, 2016.

This Act of Parliament was developed to provide for a regulatory framework for enhanced response to climate change, and to provide for a mechanism and measures to achieve low carbon climate development.

The Act requires Base to monitor compliance with levels of greenhouse gas emissions set out in the relevant Regulations. It also provides for NEMA to, by notice in the Gazette, at any time, to require Base to prepare reports on the status of its performance of the climate change duties and prescribe the period for reporting, with those duties.

As part of its ongoing environmental programme, Base assessed the Greenhouse Gas (GHG) impact of the Kwale Mineral Sands Operation during in 2019. In conjunction with this, an estimation of potential mitigation projects was also undertaken, to add to a report on energy management and energy monitoring provided by an external service provider (report dated August-September 2018[1]), which included sections on energy monitoring, power quality, and Energy Conservation Measures (ECMs).

3.3.5 The Protection and Assistance to Internally Displaced Persons and Affected Communities Act, 2012

The Act provides for the prevention, protection and provision of assistance to internally displaced persons and affected communities by development projects in Kenya.

For the Project's proposed South Dune extension, 99 plots will be affected in their entirety. For these, Base has conducted a Resettlement Action Plan (RAP), in line with the Act, and the IFC Performance Standard 5. The households residing on these plots will be resettled to suitable locations of their own choice. Base has drafted a Resettlement Framework for the Southern Dune Extension[2].

During 2019, a total of 60 families were resettled. This was comprised of 52 households (physical displacement), and eight (8) farmers (economic displacement) were resettled. Of the 60 families, 23 were resettled due to isolation/accessibility issues, 29 due to operations upon the South Dune, and the eight (8) farmers due to water, noise and dust grievances associated with Project operations.

Every effort has been made and continues to be made to inform stakeholders of the proposed mining operations and its resettlement component. The affected community has been informed about the southern extension right through the exploration phase identifying the mineral resource and the resulting resettlement.

[1] Report by Entumo Base Limited – Investment Grade Energy Audit for Base Titanium

[2] Forbes C, Wall S, Kassim P (2018) Resettlement Framework – Southern Extension Addendum, Kwale Mineral Sands Mine, Kenya.

The resettlement process will ensure the prevention of inhumane displacement and protection of the rights of the affected members of the community. This applies also to any further displacement that may result from the proposed North Dune mining activities.

3.3.6 The Land Act, 2012

This Act of Parliament intended to give effect to Article 68 of the Constitution, to revise, consolidate and rationalise land laws, to provide for the sustainable administration and management of land and land based resources, and for connected purposes.

Article 5 of this Act, lists forms of land tenure: Freehold; leasehold; such forms of partial interest as may be defined under this Act and other law, including but not limited to easements; and customary land rights, where consistent with the Constitution.

Section 7 of this Act focusses on the methods of acquiring a land title as:

- Allocation;
- Land adjudication process;
- Compulsory acquisition;
- Prescription;
- Settlement programs;
- Transmissions;
- Transfers;
- Long term leases exceeding twenty one years created out of Private land; or
- Any other manner prescribed in an Act of Parliament.

The Act is the primary legislation on public land, governing its management (including leasing) as well as acquisition. Part VIII provides the procedures for compulsory acquisition.

Article 111 requires NLC to make rules to regulate the assessment of just compensation.

Based on the findings of the Household surveys undertaken for the area of the North Dune, the area affected is owned predominantly by individual landowners under freehold title deeds (1) . During the RAP implementation phase, requisite national and international guidelines will be followed for the valuation of land claimed by affected households. Ultimately the calculation of the land compensation packages and resettlement timelines will be undertaken by Base, in conformance with this Act.

3.4 International Conventions, Protocols and Agreements

Kenya is a signatory to several international conventions and agreements relating to environmental and social matters (refer to Table 3-3). In certain cases, these have influenced the promulgation of domestic policy, guidelines and regulations.

Although not all treaties/ conventions listed below have been enacted into domestic legislation; good practice would require that the ethos of each treaty be taken into consideration during the North Dune Project.

Table 3-3: Summary of International Conventions

International Convention	Objective

(1) The majority of households (79%) claim to hold their land under private title, while a significant portion (17% of land) was granted via government allotments. Only 6.5% of the land was granted via customary means.

United Nations Convention on Biological Diversity (CBD)	The three goals of the CBD are to promote the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources.
United Nations Framework for Convention on Climate Change (UNFCCC)	Its main objective is to achieve the stabilisation of greenhouse gas concentrations in the atmosphere at a level that prevents dangerous anthropogenic interference with climate systems and within a specific timeframe which will allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed sustainably.
Bamako Convention, 1991	This convention focusses on the ban of the import into Africa and the control of transboundary movement and management of hazardous wastes within Africa.
Basel Convention, 1989	Transboundary transportation and disposal of hazardous wastes. Its objective is to protect human health and the environment against the adverse effects of hazardous wastes.
Bonn Convention, 1979	This convention focusses on the conservation of migratory species of wild animals. It aims to conserve terrestrial, marine and avian migratory species throughout their range.
World Heritage Convention, 1972	This convention requires each State Party to recognise the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage.
Convention for the safeguarding of the intangible cultural heritage, 2003	The objectives of this convention include to: safeguard the intangible cultural heritage; ensure respect for the intangible cultural heritage of the communities, groups and individuals concerned and raise awareness at the local, national and international levels of the importance of the intangible cultural heritage, and of ensuring mutual appreciation thereof.
Ramsar Convention on Wetlands of International Importance, 1971	The Ramsar Convention's broad aims are to halt the worldwide loss of wetlands and to conserve, through wise use and management, those that remain. This requires international cooperation, policy making, capacity building and technology transfer. The Ramsar Convention encourages the designation of sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity.
African convention on the conservation of nature and natural resources, 1968	This convention requires contracting states to adopt the measures to ensure conservation, utilisation and development of soil, water, flora and faunal resources under scientific principles and with due regard to the best interests of the people.

3.5 International Standards

3.5.1 The International Finance Corporation

The International Finance Corporation (IFC), a division of the World Bank Group that lends to private investors, has released a Sustainability Policy and set of Performance Standards (PSs) on Social and

Environmental Sustainability (January 2012). These Standards replace the previous July 2006 safeguard policies, and are used to evaluate any project seeking funding through the IFC. It should be noted that even for Projects that do not anticipate seeking financing from the IFC; the IFC PSs are typically applied as a benchmark of international good practice.

The PSs are directed towards guiding how to identify risks and impacts, and are designed to help avoid, mitigate and, manage risks and impacts as a way of doing business sustainably, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. In the case of direct investments for the IFC (including project and corporate finance provided through financial intermediaries), the IFC requires that its clients apply the PSs to manage environmental and social risks and impacts so that development opportunities are enhanced (IFC, 2012).

The IFC PSs are outlined in Figure 3.1below:

Figure 3.1 International Finance Corporation (IFC) Performance Standards

PS 1: Assessment and Management of Environmental and Social Risks and Impacts.

PS 2. Labour and Working Conditions

PS 3. Resources Efficiency and Pollution Prevention

PS 4. Community, Health, Safety and Security

PS 5. Land Acquisition and Involuntary Resettlement

PS 6. Biodiversity Conservation and Sustainable Management of Living Natural Resources

PS 7. Indigenous Peoples

PS 8. Cultural Heritage

PSs are directed towards guiding how to identify risks and impacts, and are designed to help avoid, mitigate and, manage risks and impacts as a way of doing business sustainably, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. In the case of direct investments for the IFC (including project and corporate finance provided through financial intermediaries), the IFC requires that its clients apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced (IFC, 2012).

The requirements of each of the eight IFC PSs, and their relevance to the proposed Mine, are presented in Table 3-4.

Table 3-4: International Finance Corporation (IFC) Performance Standards

Performance Standards	Key Requirement
IFC PS1: Assessment and Management of Environmental and Social Risks and Impacts	This PS relates to integrating and managing environmental and social performance throughout the life of a project in line with national regulations and international standards. The standard requires the development of an Environmental and Social Management System (ESMS) that entails a structured approach to managing environmental and social risks and impacts.
IFC PS2: Labour and Working Conditions	This standard aims to ensure that the client establishes, maintains and improves a worker-management relationship that promotes fair treatment, non-discrimination and equal opportunity of workers, and compliance with national labour and employment laws and international standards (as defined by the International Labour Organisation (ILO). In particular, PS2 addresses child labour and forced

	labour, and promotes safe and healthy working conditions, and protecting and promoting the health of workers by recognising the role of employees.
IFC PS3: Resource Efficiency and Pollution Preventions	This PS aims to abate pollution to air, water, and land that may threaten people and the environment at the local, regional, and global levels. This Performance Standard promotes the ability of private sector companies to adopt such technologies and practices where feasible.
IFC PS4: Community, Health, Safety and Security	The role of this PS is to anticipate and avoid adverse impacts on the health and safety of the affected communities throughout the life of the project as a result of routine and none-routine events. The PS also requires an assessment of how the use of security by the project to safeguard personnel and property could impact on community security taking into account considerations of human rights.
IFC PS5: Land Acquisition and Involuntary Resettlement	PS5 aims to anticipate and avoid physical and economic resettlement or, where avoidance is not possible, to minimise adverse social and economic impacts.
IFC PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	This PS aims to protect and conserve biodiversity based on the Convention on Biological Diversity. It divides habitat into three categories, modified, natural, and critical. For projects in natural habitat, mitigation measures should be designed to achieve no net loss of biodiversity where feasible. For projects in critical habitats, the project's mitigation strategy should be described in a Biodiversity Action Plan and be designed to achieve net gains of those biodiversity values for which the critical habitat was designated.
IFC PS7: Indigenous Peoples	This PS deals with safeguarding Indigenous Peoples. The aim of this PS is to protect the interests of Indigenous Peoples during project implementation. On a broader scale, it requires project implementation to avoid adverse impacts on Indigenous Peoples as well as ensuring their participation and consent.
IFC PS8: Cultural Heritage	Cultural heritage, according to this PS, refers to tangible forms of cultural heritage, such as tangible movable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values; unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls; and certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.

3.5.2 IFC Environmental, Health and Safety Guidelines

The Environmental, Health and Safety (EHS) Guidelines are technical reference documents that address IFC's expectations regarding the pollution management performance of its projects. They are designed to assist managers and decision-makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimising, and controlling EHS impacts during the construction, operation, and decommissioning phase of a project or facility. The EHS Guidelines serve as a technical reference source to support the implementation of the IFC Performance Standards.

General EHS Guidelines exist which contain information on cross-cutting environmental, health, and safety issues potentially applicable to all industry sectors; these are listed in *Figure 3.2* below:

Figure 3.2 IFC General EHS Guidelines;

General EHS Guidelines

1. Environmental
1.1 Air Emissions and Ambient Air Quality
1.2 Energy Conservation
1.3 Wastewater and Ambient Water Quality
1.4 Water Conservation
1.5 Hazardous Materials Management
1.6 Waste Management
1.7 Noise
1.8 Contaminated Land

2. Occupational Health and Safety
2.1 General Facility Design and Operation
2.2 Communication and Training
2.3 Physical Hazards
2.4 Chemical Hazards
2.5 Biological Hazards
2.6 Radiological Hazards
2.7 Personal Protective Equipment (PPE)
2.8 Special Hazard Environments
2.9 Monitoring

3. Community Health and Safety
3.1 Water Quality and Availability
3.2 Structural Safety of Project Infrastructure
3.3 Life and Fire Safety (L&FS)
3.4 Traffic Safety
3.5 Transport of Hazardous Materials
3.6 Disease Prevention
3.7 Emergency Preparedness and Response

4. Construction and Decommissioning
4.1 Environment
4.2 Occupational Health and Safety
4.3 Community Health and Safety

Where applicable, the abovementioned EHS Guidelines will be applied to the proposed Project.

3.5.3 Industry Specific EHS Guidelines

In addition to those EHS Guidelines presented above, further industry specific EHS guidelines applicable to the proposed Project exist.

3.5.3.1 IFC EHS Guidelines for Mining, 2007

The EHS Guidelines for Mining apply to open-pit mining and includes guidance on:

- Industry-specific Impacts and management
- Performance indicators and monitoring

Industry-Specific Impacts and Management

This section of the Mining EHS Guidelines provides a summary of EHS issues associated with mining activities (and including ore processing facilities) which may occur during the exploration, development and construction, operation, closure and decommissioning, and post-closure phases, along with. Recommendations for their management are further detailed in the ESIA report.

Environmental

Potential environmental issues associated with mining activities may include management of the below aspects.

- Water use and quality
- Wastes
- Hazardous materials
- Land use and biodiversity
- Air quality
- Noise and vibrations
- Energy Use
- Visual Impacts

Occupational Health and Safety

Mining activities should seek to provide an operation where people can work without being injured and where the health of the workforce is promoted. Facility –specific occupational health and safety hazards should be identified based on job safety analysis or comprehensive hazard or risk assessment using established methodologies such as a hazard identification study [HAZID], hazard and operability study [HAZOP], or a quantitative risk assessment [QRA].

Occupational health and safety issues occur during all phases of the mining cycle and can be classified according to the below categories. The IFC recommended strategies to manage these issues will continue to be applied to the Project.

- General workplace health and safety
- Hazardous substances
- Electrical safety and isolation
- Physical hazards
- Ionizing radiation
- Fitness for work
- Travel and remote site health
- Thermal stress
- Noise and vibration

Community Health and Safety

Community health and safety issues that may be associated with mining activities include transport safety along access corridors, transport and handling of dangerous goods, impacts to water quality and quantity, inadvertent development of new vector breeding sites, and potential for transmission of communicable diseases, e.g., respiratory and sexually transmitted infections resulting from the influx of project labour. In addition, there can be significant household and community level effects on the social

determinants of health, e.g., drug, alcohol, gender violence, and other psychosocial effects, associated with the rapid influx of labour during construction and operational phases. The rapid influx of labour and their associated extended family members may also place a significant burden on existing community health facilities and resources. Finally, because of their large and generally positive economic impacts, large mining developments can rapidly move local communities from a pattern of infectious diseases, e.g., malaria, respiratory and gastrointestinal infections, to a pattern of non- communicable diseases, e.g., hypertension, diabetes, obesity and cardiovascular disorders. The medical infrastructure in many developing countries is often poorly equipped or experienced in dealing with non-communicable diseases.

Recommendations for the management of these issues will be followed as are described in the General EHS Guidelines.

Additional concerns specific to mining activities, with community health and safety implications, and also broader EHS implications will also be taken into account from these IFC EHS Mining Guidelines. These include:

- Tailings Storage Facility Safety
- Water Storage Dams
- Emergency Preparedness and Response
- Communicable Diseases
- Specific Vector Control and Prevention Strategies

Performance Indicators and Monitoring

Environment

Guidelines of emissions and effluents are presented in this section, as well as recommendations to environmental monitoring programmes. These will continue to be practiced at the North Dune operations.

Occupational Health and Safety

Relevant mining-related recommendations are provided including Occupational Health and Safety Guidelines, Accident and Fatality Rates, and Occupational Health and Safety Monitoring, which will continue to be practiced at the North Dune operations.

3.5.4 Equator Principles

The Equator Principles (EPs) are a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects and are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. Equator Principle Financial Institutions (EPFIs) (including the United Kingdom Export Finance [UKEF]) commit to implementing the EPs in their internal environmental and social policies, procedures and standards for financing projects and will not provide Project Finance or Project-Related Corporate Loans to projects where the client will not, or is unable to, comply with the EPs.

To facilitate potential access to funding for project development potential borrowing organisations need to consider the EPs and environmental and social risk management as part of the ESIA process.

These EPs, shown in Figure 3.3 require that Projects comply with the IFC Performance Standards on Environmental and Social Sustainability (IFC PSs). The requirements of the IFC PSs are discussed in Section 3.5.1.

To date, the EPs are adopted by approximately 79 financial institutions and were updated to version three in 2013.

Figure 3.3 The Equator Principles

1. Review and categorisation
2. Environmental and Social assessment
3. Applicable Environmental and Social standards
4. Environmental and Social Management System and Equator Principles Action Plan
5. Stakeholder Engagement
6. Grievance mechanism
7. Independent review
8. Covenants
9. Independent Monitoring and Reporting
10. Reporting and Transparency

4. THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) PROCESS

4.1 Introduction

The ESIA process has been undertaken in compliance with the Kenyan legislative requirements of the Environmental Management and Co-ordination Act of 1999 & Environmental (Impact Assessment and Audit) Regulations, June 2003. In addition to the applicable regulations and norms of the government of Kenya, the proposed Project has committed to comply with the requirements of the IFC.

The purpose of the ESIA will be to examine how the proposed mine will lead to a measurable difference in the quality of the environment and the quality of life of impacted individuals and communities. Over the past decades, environmental impact assessments have expanded to include social impact assessments as well as public consultation/stakeholder engagement in the planning and decision-making process to avoid, reduce, or mitigate adverse impacts and to maximise the benefits of the project proposed. More recently, the emphasis has moved to the ESIA producing robust social and environmental management plans which can effectively implement the recommended mitigation measures (developed in partnership with the proponent) identified in the ESIA during the life of the project.

The key stages for this ESIA are:

- Scoping;
- Baseline data collection;
- Stakeholder engagement
- Assessment of impacts and mitigation;
- Support during the ESIA approval process;
- Interaction with design and decision-making processes;
- Management system integration; and
- Uncertainty and change management.

It must be noted that these key stages do not follow a linear process, but several stages are carried out in parallel. Many assumptions are revisited and modified as data becomes available and as the Project and ESIA progresses.

This Chapter describes the overall process undertaken to produce this Environmental and Social Impact Assessment Report, and presents the methodology used to assess the magnitude and significance of impacts that may result from the mining activities in the North Dune. Potential impacts have been identified through targeted baseline assessments carried out in specific relation to the proposed mining activities and experience gained during the operations at the Central and South Dunes.

The results of the impact assessment and assignment of mitigation and monitoring measures are presented in *Chapter 8*.

In order to ensure a detailed and robust impact assessment, the ESIA process was structured over a series of progressive and iterative stages. Key stakeholders, the communities, the Base project team, and the assessment team provided input to these stages during the ESIA process.

4.2 Existing approved ESIA

The Kwale Mineral Sands Operation was originally developed by Tiomin Resources Inc. (later Vaaldiam), with exploration and pre-feasibility work undertaken since the 1990s. Following initial conclusion of the initial feasibility studies, and confirmation of economically viable mineral reserves, Tiomin decided to proceed with actual on-ground activities. In 1999, Kenya enacted the first

environmental law, the Environment Coordination and Management Act. This Act of Parliament required all projects with potential negative impacts to the environment to undertake environmental impact assessments. In compliance, Tiomin contracted environmental experts, Coastal Environmental Services Ltd, to conduct the first Environmental Impact Assessment for the Project. The impact assessment, including specialist studies, began in 1999 and was completed in the year 2001. The EIA Report was then submitted to NEMA, and the Project Environmental Impact Assessment (EIA) License issued on 30th June 2005.

Base Resources, through its Kenyan subsidiary, Base Titanium, acquired the Project in 2010. As required by the EIA Regulations, a change in a proponent should trigger application for Variation of the respective EIA License. Base followed this process, and was issued with a Certificate of Transfer of Environmental Impact License, No. 0000048, on 20th July 2010.

This EIA License covered both Central and South Dunes. However, after discovery of additional mineral resources beyond the South Dune area covered by the license, Base was advised by NEMA to conduct additional studies in the new reserve area. An ESIA was conducted for the South Dune extension area, and later approved by NEMA, under the same licence.

This ESIA document covers the North Dune Extension, and aims to identify new impacts or the impacts of further cumulative impacts as a result of this extension that need to be incorporated into Base's existing Environmental and Social Management System (ESMS).

4.3 Kenyan Legislative Process

The Kenyan legislative ESIA process is illustrated in Figure 4.1. The ESIA Approach and Stakeholder Engagement Process detailed in this *Chapter* and *Chapter 5.7* respectively are in conformance with these legislative requirements.

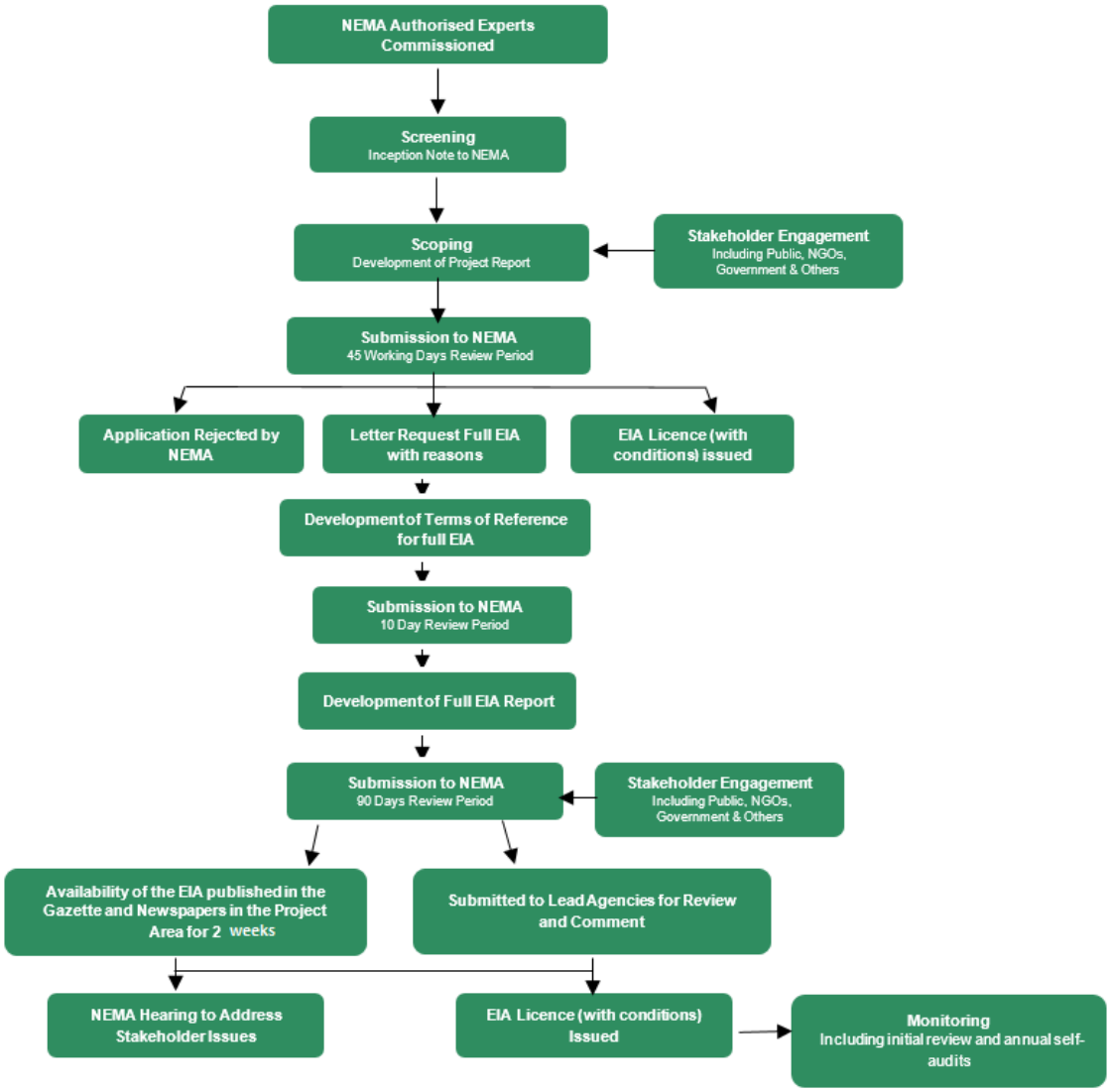


Figure 4.1: Kenyan ESIA Process

PLEASE NOTE:

On 19 August 2016, the Government of Kenya published a special issue gazette (Kenya Gazette Supplement No. 137), which replaces the Second Schedule of the Environmental Management and Coordination Act (No. 8 of 1999) with low, medium and high risk projects that require an Environmental and Impact Assessment (EIA). It is now mandatory that all new major projects require that an EIA be conducted, and therefore a **Screening Inception Note to the NEMA** and **Preliminary Project Report** is no longer required. As such, the compilation and submission of such a report to the Kenyan National Environment Management Authority (NEMA) has not been included in this ESIA Execution Plan. ToR reports for Phase 2 and Phase 3 are still however a requirement by the NEMA, and submission of these reports to NEMA for Project registration purposes will be prioritised.

4.4 Scoping

4.4.1 Approach

The purpose of the scoping stage is to identify key sensitivities and those activities with the potential to contribute to, or cause, potentially significant impacts to environmental and socio-economic receptors and resources, and to evaluate siting, layout and alternatives for the proposed Project. The key objectives of scoping are to:

- Identify the potentially most significant impacts;
- Obtain stakeholder views through consultation; and
- Develop the ToR for the ESIA through consultation to ensure that the ESIA process and associated reporting output are focused on the key issues.

The ESIA process will focus on these key issues through the collection of information on existing environmental and social conditions; engagement with stakeholders; understanding the impacts to the physical, biophysical and social environment; and developing the measures to avoid/control and monitor these impacts.

The ToR for the ESIA forms the basis of the ESIA.

4.4.2 Initial Document Review

The ERM project team conducted an initial review of Operation documentation to obtain an adequate understanding of the significant elements and key sensitivities to be considered during the study of the North Dune. The review was premised on the documents relating to the North Dune Extension description as presented in *Chapter 2* of this Report.

4.4.3 Scoping Site Visit

4.4.3.1 Introduction

As part of the scoping stage, a preliminary site visit was undertaken within the North Dune resource area. The objective of this preliminary site visit was to validate sensitivities identified during an initial review of secondary data. A drive-through of the area was conducted to investigate potential areas of sensitivity, as exiting the Client vehicle was advised against due to Community sensitivities.

4.4.3.2 Social

During the preliminary site visit, direct observations were undertaken to identify land use, the presence of settlements, livelihood activities and other potentially sensitive sites within the resource area.

4.4.3.3 Environmental

During the preliminary site visit, direct observations were undertaken to investigate major landscapes, sites of potential ecological sensitivity and drainage lines within the resource area. In addition to this, initial remote sensing analysis was undertaken using LIDAR provided by the Client to develop a high resolution landcover/land use classification of terrestrial areas. This analysis has allowed for the identification of various features within the terrestrial component of the North Dune resource area, including agricultural land, bare soil, areas of dense vegetation, grassland, and drainage networks.

4.4.4 NEMA Approval Process

The Scoping and ToR report was submitted to NEMA for approval. The NEMA approval process for the Scoping and Terms of Reference Report was completed and NEMA approved the commencement of the full ESIA study for the proposed North Dune Operation. ***Refer to Appendix B.***

4.5 Stakeholder Engagement

Detailed stakeholder engagement has been ongoing throughout the mining operations, designed by Base, together with various groups of stakeholders, as outlined in *Chapter 5.7* of this Report. (***Also refer to Appendix I)***. ERM obtained the records and findings from the series of stakeholder engagement meetings for review. The aim of this was to ensure that the individuals, groups or organisations who could be directly affected by mining of the North Dune, and those individuals or organisations who, although not directly affected by the proposed extension, represent those affected or have a regulatory duty, an interest, influence or secondary involvement in the operation, are adequately consulted. The review was also conducted to ensure that stakeholder concerns are addressed in the assessment and that sources of existing information and expertise are identified.

These documents were collected for further review during baseline studies and impact analysis phases of the ESIA.

4.6 Baseline Data Collection

One of the main objectives of the ESIA process is to collect suitable data on the physical, biophysical and social environment, to understand what receptors and resources have the potential to be significantly affected by the proposed Mine extension. Baseline data also describes the conditions that have been used to assess both social and environmental impacts. The description of the baseline will be aimed at providing sufficient detail to meet the following objectives:

- Identify the key conditions and sensitivities in areas potentially affected by the proposed Mine;
- Provide a basis for extrapolation of the current situation, and development of future scenarios without the proposed Mine;
- Provide data to aid in the prediction and evaluation of possible impacts of the proposed Mine;
- Understand stakeholder concerns, perceptions and expectations regarding the proposed Mine;
- Allow the proposed Mine to develop appropriate mitigation measures later in the ESIA process; and
- Provide a benchmark to assess future changes and to assess the effectiveness of mitigation measures.

As detailed in *Chapter 5* of this Report, Base has programmes and plans in place for collection of baseline data measurements and documentation of environmental and social parameters of interest to the mining operations. ERM collected this data and reports for review and analysis. The main documents reviewed include:

- The Kwale Mineral Sands Project ESIA Report and Addendums.
- Environmental and Social Management System
- The Preliminary Hydrogeology of the North Dune.
- Ecological Monitoring, Noise, Air quality, water monitoring Procedures
- Specialist Biodiversity assessment reports
  - Faunal Assessment for Kwale Mineral Sands Project.
  - Ecosystem Services reports
  - Flora Report Gongoni and Buda Forests
  - Herpetofauna and Invertebrate (used as bio-indicators of wetland systems) Reports
  - Bird Species reports
- Environmental Baseline Data Report for the Kwale Prospecting Area and Ship Loading Facility.

- Kwale Mineral Sands Soil Characterization Report, 2012.
- Base Titanium Air Quality Monitoring Review
- Environmental Monitoring Data collected for the around the mining site including data collected on the radiation baseline, noise and air quality baseline data.
- Social Impact Assessment Report for the Kwale Mineral Sands Project.
- The Resettlement Framework for the Southern Extension.
- Feedback from stakeholder engagement exercises that had been conducted in the area of the North Dune.
- Community Grievance Reports
- Community Programmes Reports
- Community Health reports
- Community infrastructure reports
- Stakeholder Engagement Plan, 2011

ERM conducted a detailed analysis of these documents, among others as a basis of assessment of both social and environmental impacts (the impact assessments are presented in *Chapter 8*) from the extension of the mining activities to the North Dune.

All documents referenced are also provided in *Chapter 12*.

4.7 Assessment of Impacts and Mitigation

4.7.1 Introduction

The main objectives of the impact assessment were to:

- Analyse stakeholder and community views on identified key potential risks and opportunities from the extension of mining activities to the North Dune through consultations.
- Analyse the findings from the specialist studies, so as to ensure that the ESIA process and associated reporting output are focused on all the key issues.
- Identify and analyse, from the above activities, the potentially most significant impacts related to the North Dune mineral reserve that may alter the baseline environment and social parameters of interest.

The impact assessment process comprises several steps that collectively assess how the proposed Mine will interact with elements of the physical, biological, cultural, or human environment to produce impacts on resources/receptors. The steps involved in the impact assessment stage are described in greater detail below.

4.7.2 Impact Characterisation

The impact characteristic terminology used is summarised in Table 4-1.

Table 4-1: Impact Characteristic Terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact on the Project (in terms of cause and effect).	Direct Indirect Induced

Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.).	Local Regional International
Duration	The period over which a resource/receptor is affected.	Temporary Short-term Long-term Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.)	[no fixed designations; intended to be a numerical value]
Frequency	A measure of the constancy or periodicity of the impact.	[no fixed designations; intended to be a numerical value]

4.7.3 Impact Types

In the case of ***type***, the designations are defined universally (i.e., the same definitions apply to all resources/receptors and associated impacts). Note that impact type may be either **positive** or **negative**.

For these universally defined designations, the definitions are provided in Table 4-2.

Table 4-2: Impact Types

Designation	Definition
Direct	Impacts that result from a direct interaction between the mining activity and a resource/receptor (e.g., between the occupation of a plot of land and the habitats which are affected).
Indirect	Impacts that follow on from the direct interactions between the mining activity and its natural and human environment as a result of subsequent interactions within the natural and human environment (e.g. viability of a species population resulting from loss of part of habitat as a result of the mining activity occupying a plot of land).
Cumulative	Impacts that result from the incremental impact, on areas or resources used or directly impacted by the mining activity, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted (e.g. incremental contribution of gaseous emissions, reduction of water flows in a watershed due to multiple withdrawals)
Perceived	Changes that may be unconnected to, but blamed on, the mining activity. These are identified and assessed through stakeholder engagement and consultation.

4.7.4 Impact Significance

The evaluation of the significance of impacts is based on a calculation matrix that combines the magnitude of the potential impacts (project pressures) against the sensitivity of the receptors/resources. Impact's significance is ranked as either positive or negative in the following 4 classes: Low, Medium, High and Critical, as shown in the below matrix (Table 4-3).

Table 4-3: Evaluating the significance of impacts

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	**Negative Impacts**			
	Negligible	Negligible	Negligible	Minor
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Critical
	Positive Impacts			
	Positive	Minor	Moderate	High

The negative impact significance classes are described below.

- **Low**: An impact significance is low/ minor when the magnitude of the impact is negligible or the magnitude of the impact is small and the resource/receptor sensitivity is low.
- **Medium**: An impact significance is medium/ moderate when the effect on a resource/receptor is evident, but the magnitude of the impact is respectively small/medium and the sensitivity of resource receptor is respectively medium/low, or the magnitude of impact should be well within applicable standards.
- **High**: An impact significance is high/ major when the magnitude of the impact is respectively small/medium/large and the sensitivity of resource/receptor is respectively high/medium/low, or when the magnitude of the impact is generally within the officially recognized limit or standard, however, there may be occasional exceedances.
- **Critical**: An impact significance is critical when the magnitude of the impact is respectively medium/large and the resource/receptor sensitivity is respectively high/medium, or when an officially recognized limit or standard may be regularly exceeded.

In case a resource/receptor (including people) is essentially not affected or the effect is indistinguishable from natural background variations, no potential impact is expected therefore it doesn't need to be reported.

Generally, the assessment of impacts potentially generated by the mining activity is site-specific and project component-specific. The designation of both the magnitude of impacts and the sensitivity of resources/receptors vary on the specific component basis and shall be done based on professional judgment and topic-specific Technical Guidelines

The evaluation needs to be carried out on a case-by-case basis, as the significance of an impact heavily relies on the values of the affected society, the site-specific human and natural context, the nature of the exploration activity and any specific conditions of the Study Area.

4.7.5 Impact Magnitude

The magnitude describes the change that the impact of mining activity is likely to impart upon the resource/ receptor. The designation of magnitude is a function of the following evaluation criteria, described in detail in Table 4-4:

- Duration
- Extent
- Scale

Table 4-4: Magnitude of impact evaluation criteria

Criteria	Description
Duration (defined on a component-specific basis)	The period over which the impact is expected to last prior to resource/receptor recovery. It refers to the duration of the impact and not the duration of the activity causing the impact. It should be: ■ **Temporary**. The effect is limited in time, resulting in temporary, not continuous changes in the resource/receptor quality/quantity status. The resource/receptor can return quickly to its previous conditions. If no other tools are available for exactly defining the timeframe, consider as the temporary duration of the impact a period approximately equal to less than 1 year. ■ **Short-term**. The effect is limited in time and the resource/receptor can return to its previous conditions within a short timeframe (defined by the expert judgment on a component-specific basis). If no other tools are available for exactly defining the timeframe, consider as short-term duration of the impact a period approximately between 1 and 5 years. ■ **Long-term**. The effect is limited in time and the resource/receptor can return to its previous conditions within a long timeframe (defined by the expert judgment on a component-specific basis). If no other tools are available for exactly defining the timeframe, consider as the long-term duration of the impact a period approximately between 5 and 25 years. ■ **Permanent**. The effect is not limited in time, the resource/receptor is not able to return to its previous conditions and/or the damage/variation is irreversible. ■ If no other tools are available for exactly defining the timeframe, consider as the permanent duration of the impact a period approximately over 25 years.
Extent (defined on a component-specific basis)	The spatial scale of the impact, the full area over which the impact occurs. It should be: ■ **Local**. Local impacts are confined to a small area (it varies on specific component basis) that generally covers a few towns/villages. ■ **Regional**. Regional impacts are related to an area that can be extended from ■ several villages (county-level) to a wider area with the same geographical and ■ morphological characteristics (it can't correspond with administrative borders); ■ **National**. National impacts are related to more than one region and are confined within national borders. ■ **Transboundary**. Transboundary impacts extend to multiple countries, beyond the host Country of the Exploration activity. Examples include air pollution extending to multiple countries, use or pollution of international waterways, and trans-boundary epidemic disease transmission.
Scale (defined on a component-specific basis)	The scale of the impact is the degree of change in the qualitative and quantitative conditions of resource/receptor from its ante-operam baseline status: ■ **Not distinguishable** or hardly measurable change from the baseline conditions or impacts affect a limited amount of the specific component or impacts are likely to be well within statutory limits1 or ambient/seasonal range. ■ **Distinguishable** change from baseline conditions or impacts affect a small portion of a specific component or impacts are expected to be within/close to statutory limits or ambient seasonal range.

	■ **Evident** difference from baseline conditions or impacts affect a substantial portion of a specific component or impacts are likely to result in occasional exceedances of statutory limits or ambient seasonal range (over limited periods). ■ **Major** change in comparison to baseline conditions or impacts affect the entire or significant portion of a specific component or impacts are likely to result in routinely exceedances of statutory limits or ambient seasonal range (over extended periods).

As mentioned above, the magnitude of the impact is a combination of duration, extent and scale and it is ranked in the following four classes: Negligible, Small, Medium and Large. The calculation of impact magnitude is described in Table 4-5

Table 4-5: Ranking of impacts magnitude evaluation criteria

Ranking	Evaluation Criteria			Magnitude
	Duration of the impact	Extent of the impact	Scale of the impact	
1	Temporary (1)	Local (1)	Not distinguishable (1)	(ranging from 3 to 12)
2	Short-term (2)	Regional (2)	Distinguishable (2)	
3	Long-term (3)	National (3)	Evident (3)	
4	Permanent (4)	Transboundary (4)	Major (4)	
Score	(1;2;3;4)	(1; 2; 3; 4)	(1; 2; 3; 4)	

Table 4-6: Ranking of impacts magnitude

Ranking	Magnitude Level
3-4	Negligible
5-7	Small
8-10	Medium
11-12	Large

4.7.6 Resource/Receptor Sensitivity

The resource/receptor sensitivity is a function of the baseline context where the mining activity will be located, of its quality status and, where applicable, of its ecological importance and protection status, based on the existing pressures, before the activity construction and operation.

Table 4-7 describes the resource/receptor sensitivity evaluation criteria.

Table 4-7: Resource/receptor sensitivity evaluation criteria

Criteria	Description
Importance/value	The importance/value of a resource/receptor is generally evaluated based on the legal protection (defined on national and/or international requirements), the government policy, ecological value, historical or cultural value, stakeholder views and economic value
Vulnerability/resilience of the resource/ receptor	The resource/receptor can adapt to changes brought by the mining activity and/or to recover its original status. With regards to environmental receptors, vulnerability can be identified based on:

	■ A comparison with quality standards1 and baseline conditions assessed. ■ The role it plays/the services/uses it provides in the ecosystem (e.g. the soil capacity for water retention or role in carbon sequestration, the soil and water capacity to support the development of flora, and fauna species, mangroves offer flood and erosion mitigation and protection, etc.) and in the community (e.g. water use for drinking purposes or sanitary services, soil used for cultivation and livestock, fish species for the subsistence of a coastal village, etc.). ■ Its availability and/or the presence of an alternative resource/receptor of comparable quality/use (e.g. a suitable technically or an economically feasible alternative for water supply for the community, a suitable alternative for a specific habitat that supports the development of specific flora/fauna species, etc.). ■ The possibility to easily adapt to a new condition, move or replace it. ■ With regards to social and human receptors, their vulnerability and thus their ability to adapt to changes is a function of the level of livelihoods assets (such as health or education) or of the type and level of access to services, infrastructures structures and process to protect or improve their livelihoods.

As mentioned above, the resource/impacts sensitivity is a combination of importance/value and vulnerability/resilience and it is ranked in the following 3 classes: Low, Medium and High. The sensitivity is assigned to each specific resource/receptor by the judgment of the expert and thus, for its calculation.

4.7.7 Impact Mitigation

Once the significance of a given impact has been characterised using the above-mentioned methodology, the next step is to evaluate what mitigation measures are warranted. In keeping with the Mitigation Hierarchy, the priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

It is important to have a solid basis for recommending mitigation measures. The role of any given ESIA is to develop an acceptable project, and to help responsibly develop the project. Impact assessment is about identifying the aspects of a project that need to be managed, and demonstrating how these have been appropriately dealt with. As key influencers in the decision-making process, the role of the impact assessment is not to stop development or propose every possible mitigation or compensatory measure imaginable, but rather to make balanced judgments as to what is warranted, informed by a high quality evidence base.

Additional mitigation measures should not be declared for impacts rated as not significant unless the associated activity is related to conformance with an 'end of pipe' applicable requirement. Further, it is important to note that it is not an absolute necessity that all impacts be mitigated to a not significant level; rather the objective is to mitigate impacts to an **as low as reasonably practicable** (ALARP) level.

Embedded controls (i.e., physical or procedural controls that are planned as part of the project design and are not added in response to an impact significance assignment), are considered as part of the project (before entering the impact assessment stage of the impact assessment process).

4.7.8 Residual Impact Assessment

Once mitigation measures are declared, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures.

4.7.9 Cumulative Impacts / Effects

Cumulative impacts and effects are those that arise as a result of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect. These are termed cumulative impacts and effects.

The impact assessment process will predict cumulative impacts/effects to which the proposed Project may contribute. The approach for assessing cumulative impacts and effects resulting from the proposed Mine and another activity affecting the same resource/receptor is based on a consideration of the approval/existence status of the 'other' activity and the nature of information available to aid in predicting the magnitude of impact from the other activity.

4.7.10 Reporting

Using data gathered during the specialist baseline studies, ERM will work on assessing impacts by using the impact assessment methodology described above. This methodology is aligned with good international practice. The process of predicting and evaluating impacts and development of mitigation measures is iterative, and informs and runs in parallel with the design of the Project. The process also links in with consultation and stakeholder input regarding the significance of impacts and the suitability of proposed mitigation measures. During the impact assessment phase of the ESIA process, a comprehensive description of the Project activities is required. Information for the ESIA Project description will be derived from Base. Following the detailed assessments, the impacts to each social and environmental resource/receptor will be presented in three stages: (i) the potential impact is described and assigned a significance level (pre-mitigation); (ii) the mitigation committed to by Base is outlined; and (iii) the residual impact (that remaining after mitigation) is described and assigned a significance level. The impact assessment process and development of mitigation measures will lay the platform for the write up of the Project ESIA. The ESIA report will present a detailed description of the proposed Mine and relevant alternatives; the ESIA process and a description of legislation, guidelines and strategies (both national and international) pertinent to the proposed Mine and associated ESIA; the outcomes associated with stakeholder engagement activities carried out to date; a detailed baseline review; an assessment of environmental and social impacts related to different phases of the proposed Mine; mitigation measures that aim to avoid /minimise/manage the severity of identified impacts ; and an assessment of cumulative impacts associated with other planned, existing or project-related developments in the broader Study Area.

The ESIA Report outputs aim at identifying new impacts or the impacts of further cumulative impacts as a result of the move of mining activities to the North Dune that needs to be incorporated into Base's existing Environmental and Social Management System (ESMS).

4.7.11 Stakeholder Engagement (Disclosure)

Once the ESIA has been drafted, engagement will be undertaken on the draft report to seek feedback from stakeholders on the findings of the report, in particular, the impacts and proposed mitigation as well as explain the next steps in the process. This is discussed in more detail in *Chapter 5.7*. ***Also refer to Appendix I.***

4.7.12 NEMA Approval Process

Following the disclosure phase, the ESIA will be submitted to the NEMA for approval. The NEMA approval process is up to 90 days.

4.8 Support during the ESIA Approval Process

4.8.1 Permitting Support

It must be noted that there is a statutory period for NEMA to give its decision after receiving the ESIA report. Reference is made to the Environmental (Impact Assessment and Audit) Regulations (2003):

- Part III Section 23 (1) states that: "The Authority shall give its decision on an environmental impact assessment study report within three months of receiving an environmental impact assessment study report".
- Part III Section 23(4) states that: "The decision of the Authority under this Regulation shall be communicated to the Proponent within fourteen days from the date of the decision and a copy thereof shall be made available for inspection at the Authority's offices."

ERM will assist the Proponent in coordinating the environmental permitting process, and will through regular contact with the NEMA, attempt to obtain NEMA's decision well within the statutory period prescribed in the Regulations.

Regular contact with NEMA will ensure that NEMA:

- Is working on the decision-making process;
- Has ongoing support should they have any queries/concerns / comments during their review; and
- That the decision-making process is undertaken as quickly and efficiently as practicable.

4.9 Interaction with Design and Decision-making Process

The interaction between the ESIA team and the design and decision-making process is one of the key areas in which an ESIA can influence how a project develops. It includes involvement in defining the project and identifying those activities with the potential to cause environmental and social impacts (e.g. physical presence, identification of water sources and uses, noise, workforce, traffic, local employment, procurement). Project planning, decision-making and refinement of the Project description continue throughout the assessment process as a result of the development of the proposed Mine, and in response to the identified impacts. For example, sensitive areas (social, physical or biodiversity) identified as part of this EIA process, will be avoided as much as possible by mining developments.

4.10 Management System Integration

Stakeholders and external decision-makers for the proposed mine will rely on the findings of the ESIA (e.g. the significance of residual impacts) in formulating their ultimate views to the proposed Project. As an ESIA is based on predictions made in advance of an activity taking place, it effectively makes assumptions that the project will implement certain controls and mitigation measures. If the controls do not happen, then the ESIA is undermined as a tool for stakeholders and external decision-makers. It is important, therefore, that these 'assumptions', i.e. the mitigation/management measure recommendations are translated into commitments that will be implemented through their integration into the existing Environmental and Social Management System (ESMS) for the Project.

It is also important that, over the life of the proposed mine, the vehicle by which the commitments as set out in the ESMMP are turned into specific actions, are implemented through the existing Environmental and Social Management System (ESMS). The implementation of such a system should ensure that any unforeseen impact or issues that may arise will be dealt with effectively under the relevant laws and regulations of Kenya and the international Performance Standards & Environmental, Health and Safety Guidelines. In this way, stakeholders and external decision-makers should have confidence in the ESIA as a tool to aid in their decision-making on the proposed Project.

4.11 Uncertainty and Change Management

Even with a final design and an unchanging environment, impacts are difficult to predict with certainty. Uncertainty stemming from on-going development of the Project design is inevitable, and the social and biophysical environment is typically variable from season to season and year to year. Similarly, the organisational structure and roles and responsibilities may also change as the Project progresses. Where such uncertainties are material to ESIA findings, they will be clearly stated and conservatively

approached ('the precautionary approach') to identify the broadest range of likely residual impacts and necessary mitigation measures.

The ESIA process does not stop with the submission of the Final ESIA report. Therefore, the ESMMP will require a mechanism to manage change. At times these changes may be material, potentially influencing the original findings of the ESIA, and hence, the basis for its approval. Such a mechanism to manage change, or a change management system, must ensure that changes to the scope of the proposed Project are subjected to a robust social and environmental assessment process.

Any changes to Project scope or new substantive E&S findings through ongoing monitoring will be evaluated for their degree of significance, and will be incorporated into the appropriate Project documentation as follows:

- Minor changes will be reflected in updates to the applicable Management Plans included in the overall ESMMP; and
- Substantive design changes that might potentially alter the ESIA findings (i.e. those that result in changes to the predicted significance of environmental and social impacts) will be subject to re-assessment, further stakeholder consultation, supplementary reporting and revision of the Project's ESMMP. Typically, such substantive changes will be submitted as an addendum to this ESIA.

5. ENVIRONMENTAL AND SOCIAL BASELINE

5.1 Introduction

It is important to gain an understanding of the receiving physical, biophysical and social attributes of the area in which the mine is proposed, and its surroundings. This section focuses on the environmental and social aspects that have been considered and addressed in the ESIA process.

The description of the baseline environment is essential in that it represents the conditions of the environment before construction and operation of the proposed Mine. The description of the baseline environment, therefore, provides a description of the current or status quo environment against which social and environmental impacts of the proposed Project can be assessed and future changes monitored.

The information presented in this section has been collected from desktop studies (including the use of remote sensing techniques to map out the major landcover and land use attributes in the Study Area), data provided by the client of the current operation, and site visits and baseline studies conducted in the proposed Study Area. Detailed descriptions of the baseline physical, biological and social environments are provided in this Chapter below.

This *Chapter* is organised as follows:

- Landcover and Land use Classification
- Physical Environment:
  - Climate;
  - Geology and Soils
  - Surface and Groundwater Resources
  - Ambient Air Quality;
  - Ambient Noise; and
  - Radiation
- Biophysical Environment:
  - Gazetted Protected Areas;
  - Internationally Recognised Areas;
  - Habitats and Vegetation; and
  - Faunal Communities.
- Socioeconomic Environment:
  - Administrative Context;
  - Housing arrangements and Settlement Patterns
  - Population Profile;
  - Land-Use and Land Tenure
  - Housing and Living Conditions
  - Livelihoods
  - Health and Nutrition
  - Income and Expenditure

5.2 Landcover and Land use Classification

An initial remote sensing analysis was undertaken using LIDAR provided by the Client to develop a high resolution land cover/ land use classification of terrestrial areas. The landcover/ land use classification identified both natural and manmade features within the terrestrial component of the North Dune resource area. The types of classifications included agricultural land, bare soil, areas of dense vegetation, grassland, and drainage networks and wetlands. Manmade features identified included roads and building structures. Through additional data provided by the Client, sensitive amenities/ receptors (such as schools, churches and clinics) within the resource areas have also been identified and mapped, providing a better understanding of the structures initially identified from the LIDAR data.

The land cover/ land use classifications were used to focus specialist fieldwork activities on predefined areas of apparent high social and environmental sensitivity. A more focused fieldwork schedule meant less time was needed for primary baseline data collection within the proposed Project area. Moreover, remote sensing allowed for a more robust and defensible analysis of sensitivity and risk through broader geographic coverage, science-based assessment and quantitative measurements of potential impacts. It should be noted that the entire Study area was surveyed for the Environmental and Social Baseline Studies, and the land cover/ land use classifications were used to focus efforts of the specialist team members.

As specialist studies were conducted and the impact assessment progressed, the mapped resource area, in the form of sensitivity maps, was updated to include information on the following, which are presented in subsequent chapters.

- Noise contours;
- Air Quality contours;
- Soil maps, including Soil capability classes;
- Location of wetlands and areas of critical habitat;
- Habitat by habitat type;
- Land use; and
- Location of households and other social infrastructure.

5.3 Physical Environmental Baseline

5.3.1 Climate

Kwale County has a monsoon type of climate, largely hot and dry from January to April/ May and coolest in the period from June to August. Rainfall in the County is bi-modal, with short rains experienced between October and December, and long rains between March and May (Possible to extend to July). The annual mean precipitation varies from 750mm to 1,500mm per annum along the coastline (and includes the Msambweni area where the Operation lies), and from 500mm to 675mm per annum further inland. The general county historical precipitation pattern is shown in Figure 5.1 below.

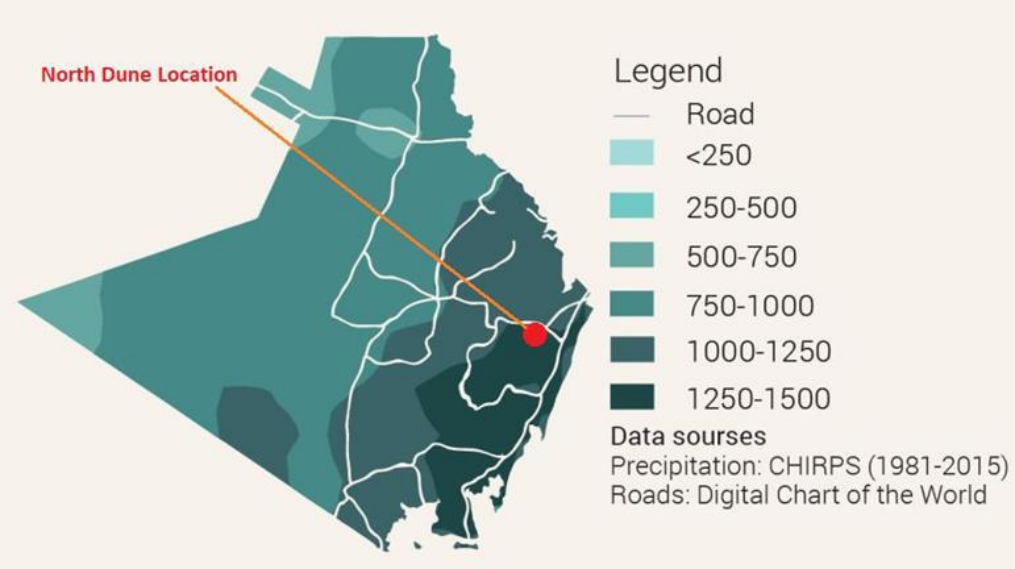


Figure 5.1: Historical Annual Mean Precipitation (mm/yr)

(Source: Modified from MoALF,2016)

The County's mean annual temperatures ranges from 25°C to 27°C in the coastal lowlands (but extends to Shimba Hills), and 23°C to 25°C further inland. The general county historical temperature pattern is shown in Figure 5.2 below.

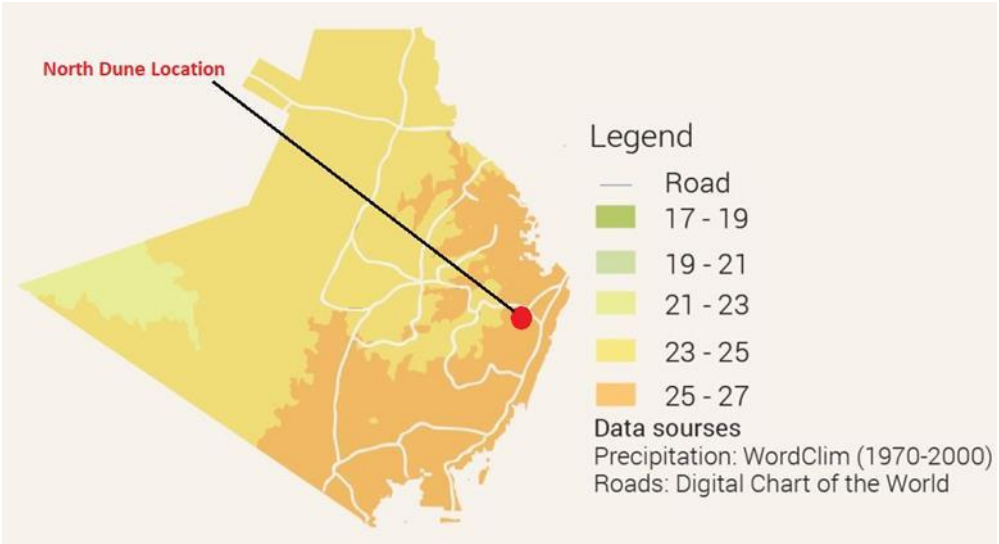


Figure 5.2: Historical Annual Mean Temperature (°C)

(Source: Modified from MoALF,2016)

Historically, the county has experienced an average increase in temperatures and a decrease in precipitation. However, there have been interfaces between years of extensive droughts and intense precipitation leading to floods, especially in the central to eastern parts of the County, where the Operation falls[1].

[1] MoALF (2016) Climate Risk Profile for Kwale County. Kenya County Climate Risk Profile Series. The Ministry of Agriculture, Livestock and Fisheries (MoALF), Nairobi, Kenya.

These climate extremes pose risks to the mining operations, especially during intense rainfall that may lead to floods and the associated increase in topsoil erosion, potential mine pit wall collapse, inhibition of movement, surface water quality degradation and challenges to the management of loose soil and new vegetation during mine rehabilitation. Climate change and related impacts in Kwale County, especially the operational area should, therefore, be factored in during the entire period of mining activities to reduce likely additional costs and manage the potential negative impacts effectively.

The wind rose for Mombasa, based on the ADM sourced data for 2015-2019, is set out in Figure 5.3. This data was used as it provided long-term, reliable wind information. This shows that the wind predominantly blows from the southwest. However, there is also a smaller north-eastern component. This north-eastern component is associated with the dry season when hot, dry and dusty winds blow from the Arabian Peninsula.

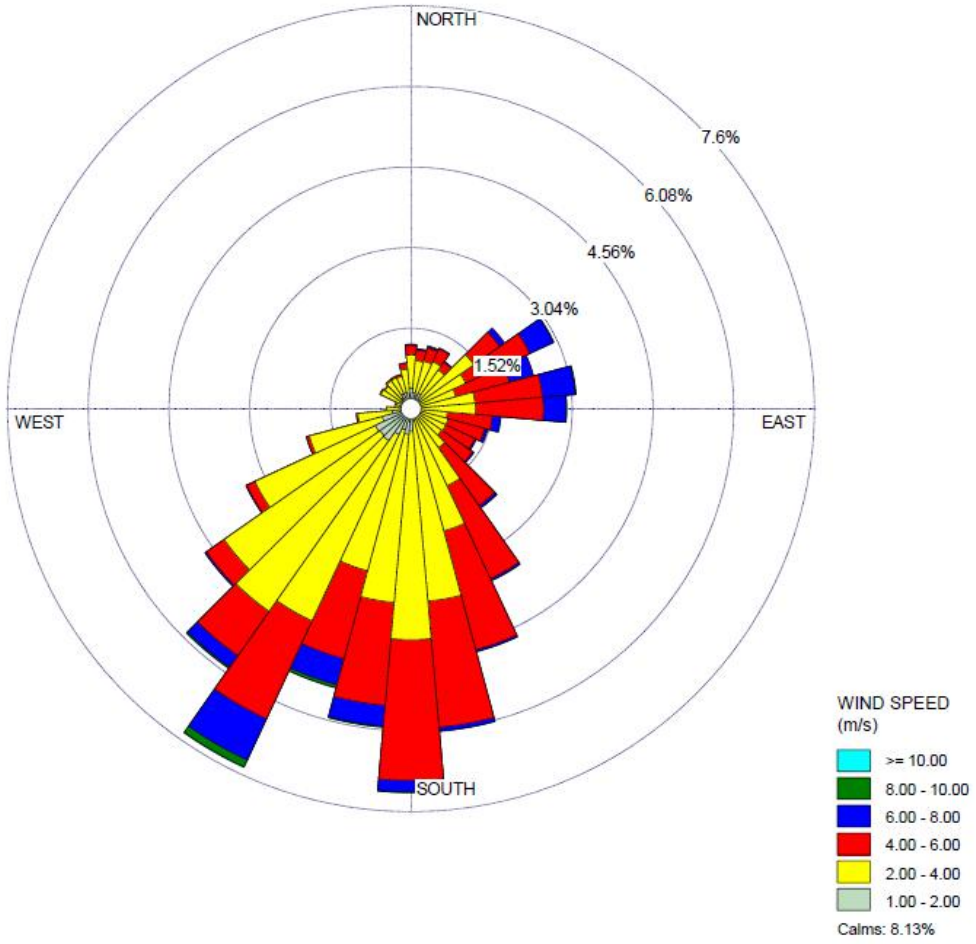


Figure 5.3: Wind Rose for Mombasa, 2015-2019

5.3.2 Geology and Soils

5.3.2.1 Geology

The general geology of Kwale area, including Msambweni Sub-County where the South Dune falls, comprises rocks of sedimentary origin, which range in age from Upper Carboniferous (350- 300 million years ago) to Recent (1,000 years to present). These rocks are dominated by the Cenozoic rocks, the Upper Mesozoic rocks (not exposed on the area) and the Duruma Sandstone Series. The Duruma Sandstone Series give rise to the most dominant topographical feature of the area, the Shimba Hills[1].

[1] HSEDCO (1998) Environmental Baseline Data Report for the Kwale Prospecting Area and Ship Loading Facility. Unpublished Report for Tiomin Resources Incorporated, Toronto, Canada.

The sands deposit in the North Dune, similar to the South Dune and Central Dune, is hosted within the Magarini Sands Formation, which is derived from the Duruma Sandstones Series, and were deposited during the late Pliocene age (5-2 million years ago). These sands consist primarily of riverine gravels and Aeolian sands that were eroded from the western Shimba Hills, and deposited onto the underlying Triassic Sandstones of the Mazeras Formation (251-200 million years ago).

The North Dune geology is essentially the same to that of the South Dune and Central Dune, where the Pliocene dunal sands (which are mostly red) directly and unconformably overlie the Mazeras formations (made up of grit or sandstones). These Pliocene sandstones, believe to be eroded off the Shimba Hills as loose sand + loam + clayey particles, are the main mineral ores in the Dunes.

5.3.2.2 Soils

The coastal uplands and plateau that characterise the Kwale District have a wide variety of soils. Soils on the erosional plain in the Kwale District are generally of low fertility, except for a few areas of moderate to high fertility. Ferrasols in the area tends to be very strongly weathered and leached, with low chemical fertility but good physical properties. Under conditions of permanent or semi-permanent cultivation, with no application of fertiliser, or through burning, a reduction of organic matter in the topsoil takes place. This may result in reduced chemical fertility of the soils, lower structural stability and increased susceptibility to erosion.

Erosion of soils is most prevalent in the western part of the district, induced by low structural stability of the topsoil, which leads to soil loss when vegetation cover is low.

The soils of the current SML area are deep and strongly weathered. They are well-drained, friable and red to dark red in colour. Their textural classes vary from sandy clay loam to sandy clay with an underlying layer of 20 to 40cm of loamy sand to sandy loam (rhodacris ferralsols) except for a portion of the North Dune which is an orthic ferralsols (yellowing red to strong brown) [1].

A Soil Specialist site assessment was conducted specifically for the area of the North Dune, and can be found as ***Appendix C***.

From the soils assessment, it is conclusive that the dominant soils in the study area according to the Taxonomical Soil Classification System of South Africa include Avalon, Bainsvlei, Clovelly, Hutton and Mispah soils. The effective depth of the Avalon, Bainsvlei, Clovelly and Hutton soils exceed 300mm inclusive of the Orthic A – Horizons and Red Apedalic B – Horizons. The Avalon, Bainsvlei, Clovelly and Hutton soils have high agricultural and rehabilitation potential under dryland and irrigation conditions respectively. The Mispah soil is a shallow weathered soil on rock with low agricultural and rehabilitation potential.

The current land use includes 2,178ha (48,79%) natural veld, 2,123ha (47,57%) plantations and 162ha (3,64%) ploughed land. Land capability includes 4,393ha (98,4%) arable and 71,451ha (1,6%) wilderness.

From the different soil types, i.e. Avalon, Bainsvlei, Clovelly and Hutton in the 582ha ore body there is an estimated 6,840,000m^3 soil at a bulk density of 1,850kg/m^3 available for rehabilitation.

Interpretation of estimated analytical data indicates potential dispersion anomalies due to exchangeable sodium occupying more than 15% of the cation exchange capacity. This should be carefully managed to prevent soil erosion, crusting and formation of preferential seepage pathways.

The Avalon and Bainsvlei soils are characterised by low to neutral pH to alkaline values. There is a lime requirement due to acidity in the soil solution ranging from 2 to 12t/ha/300mm. The disturbed Ca: Mg, Mg:K and Ca+Mg/k ratio's will be rectified through $CaMgCO^3$ applications. There is salinisation in the soil solution as reflected by the high electrical conductivity values (>250mS/m), mainly water-soluble SO_4. This could be due to fertilisation practices to be confirmed. The geology does not contain sulphur

[1] Nyandat NN and Oswago OO (1970) Soils of Ramisi Sugar estates (Coast Province). Ministry of Agriculture. National Agriculture Laboratories, Soil Survey Unit.

bearing minerals, i.e. FeS that could oxidise and form sulphuric acid and SO_4 salts. Under these conditions plant-available nitrogen (15-20mg/kg), phosphorus (10-15mg/kg) and potassium (>50mg/kg) are not readily available for plant uptake and sustainable plant growth. Heavy metal concentrations are at acceptable low concentrations. The Orthic A-Horizon and Red Apedalic B-Horizon is typically characterised by a low-density structure and texture distribution of approximately 65% sand, 20% silt and 15% clay with drainage properties in order of 10mm/h.

The dominant clay mineral is kaolinite (1:1 layer silicate), with a low buffer capacity due to the low cation exchange capacity (<10cmol+/kg). In terms of topsoil stripping careful consideration should be given to ensure the different soil horizons, Orthic A, Red Apedalic B, Yellow Apedalic B and Soft Plinthic B - Horizons should be stripped and stockpiled separately and not mixed. Reconstruction of the soil profiles should adhere as a minimum to parameters set in the report in combination with surface water control measures especially the Orthic A – Horizon.

5.3.3 Surface and Groundwater Resources

5.3.3.1 Hydrology

The study area falls within catchment 3K (Ramisi), although streams within it are not tributaries of the Ramisi River. There is one significant stream (the Mkurumudzi) which lies to the south of the North Dune and bisects the Central and South Dune, flowing eastwards. The Mukurumudzi River drains the south eastern quadrant of the Shimba Hills and has a total catchment area of ~180km^2.

Base flow from the numerous phreatic bankside aquifers is important in maintaining dry weather flows in the Mkurumudzi River, which is an important source of water for key ecosystem services including maintaining of aquatic life, recharge of shallow wells and aquifers, and a habitat for a variety of vegetation species. The river is also a source of water for local residents both for drinking and other household and agricultural activities From the river gauging station (RGS 3KD06) located east of Shimba Hills trading centre, the River drains approximately 91km^2 with a mean annual rainfall of 1,302mm, and a mean annual flow of 0.8142m^3/s. This site lies upstream of the Project's Mukurumudzi Dam site. The Rivers month-on-month flows are, however highly variable. This can be largely attributed to the recorded historical variation in the amount and timing of precipitation in the general Kwale County, including occasional extended periods of low or no rainfall.

Several small streams arising from seepage and spring flows occur within the North Dune resource area and are an important source of drinking water to residents of the villages within the region. Flows in the small streams is generally ephemeral and are likely to be maintained by wet season rain percolation and discharge into and from the Pliocene and Pleistocene sands; however, they become true losing streams when they flow across the Pleistocene limestones, with flows disappearing entirely within a few hundred metres of reaching limestone outcrop in all but the wettest periods.

Figure 5.4 to Figure 5.7 display the drainage network and potential flood-risk areas within and surrounding the four main Project ore bodies.

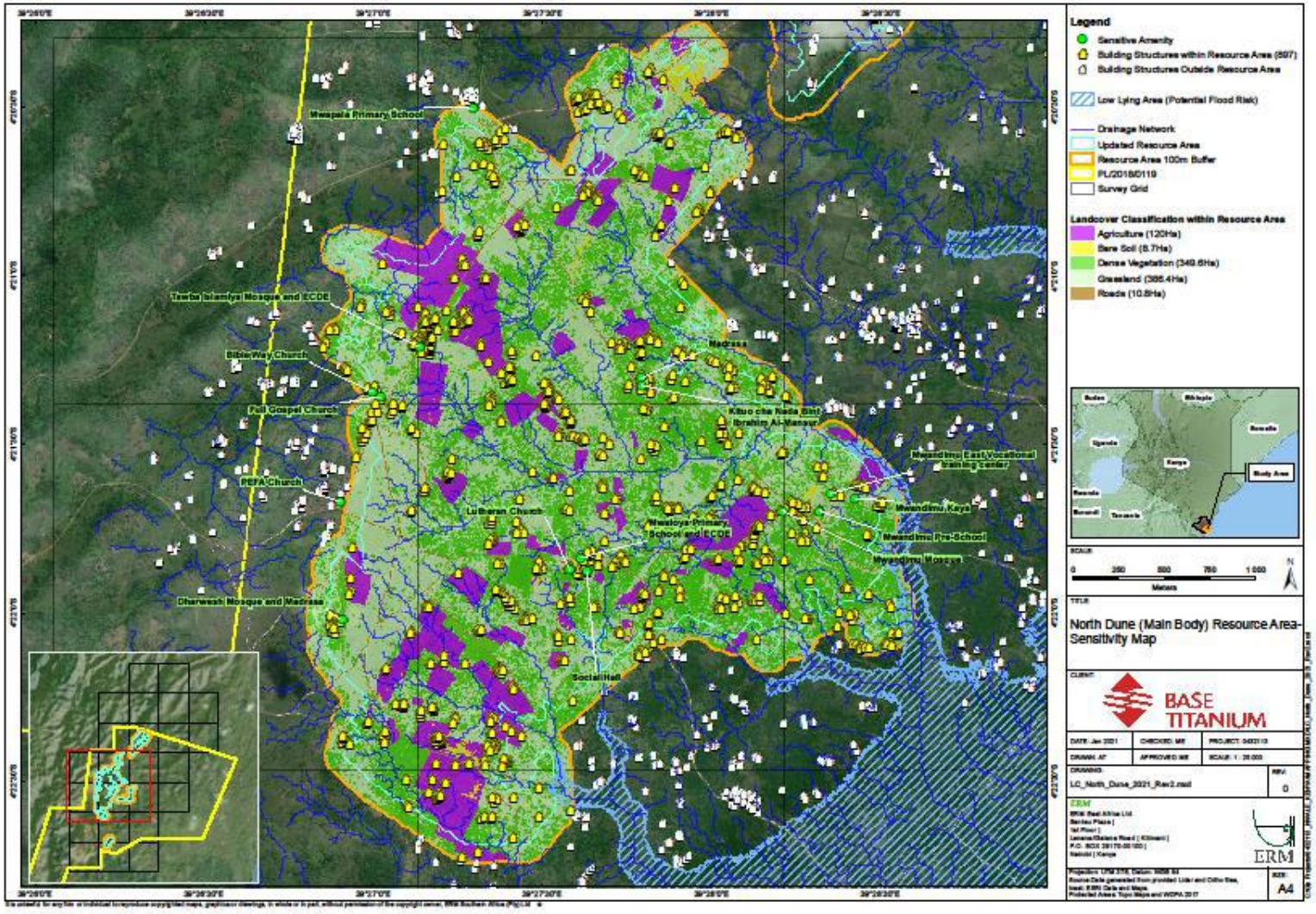


Figure 5.4: North Dune (Main Body) Resource Area- Flood Risk Sensitivity Map

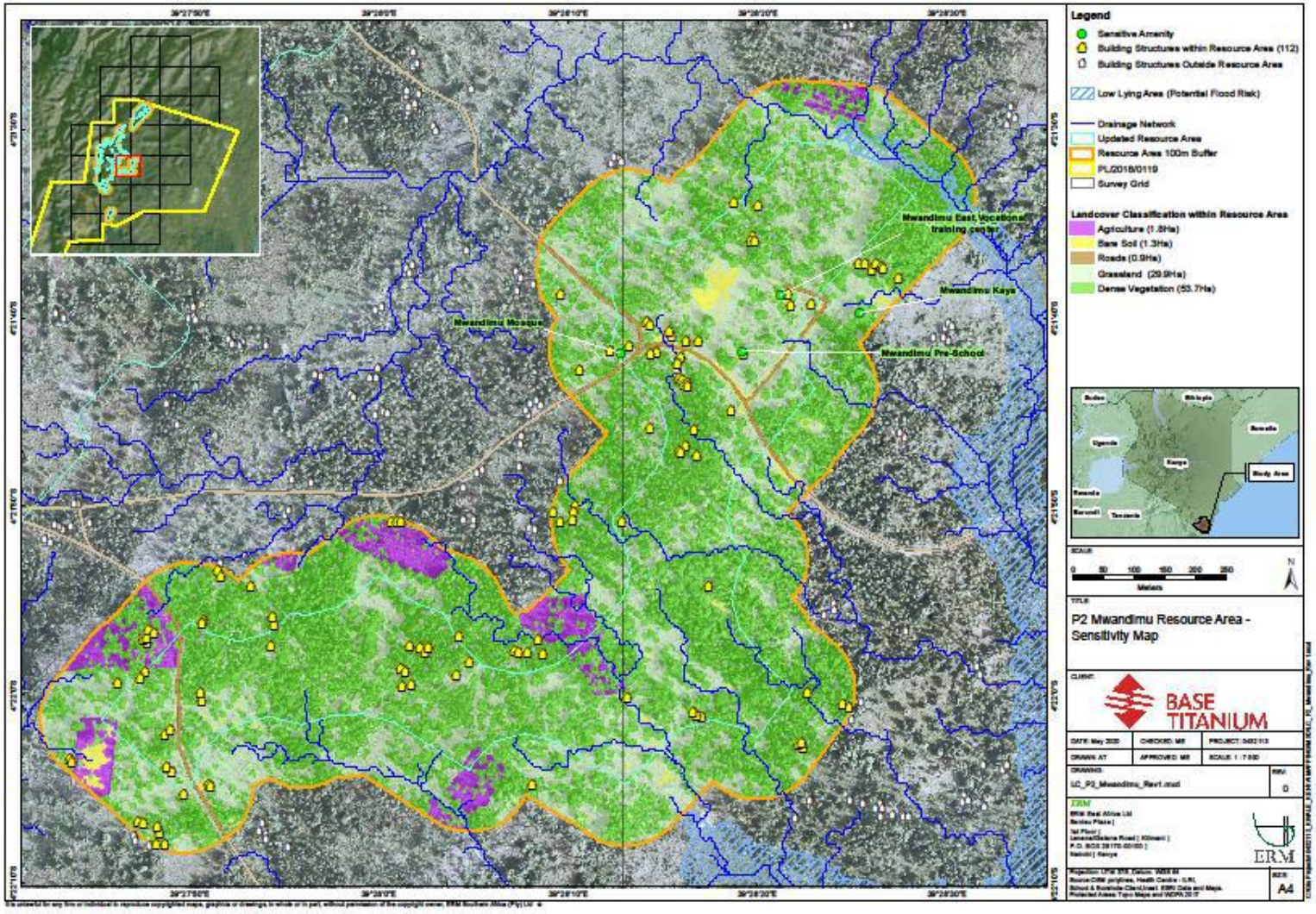


Figure 5.5: Mwandimu Resource Area- Flood Risk Sensitivity Map

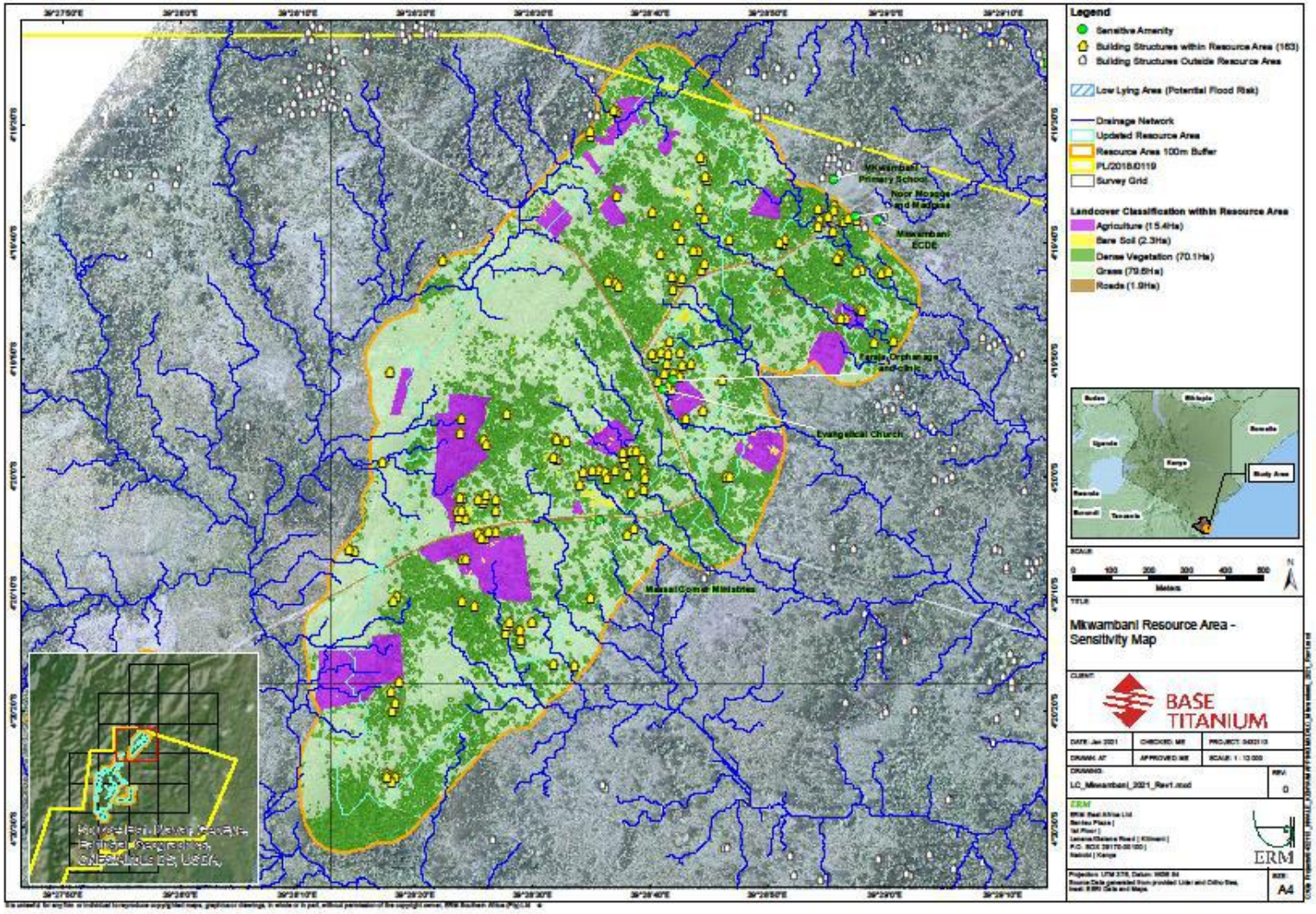


Figure 5.6: Mkwambani Resource Area- Flood Risk Sensitivity Map

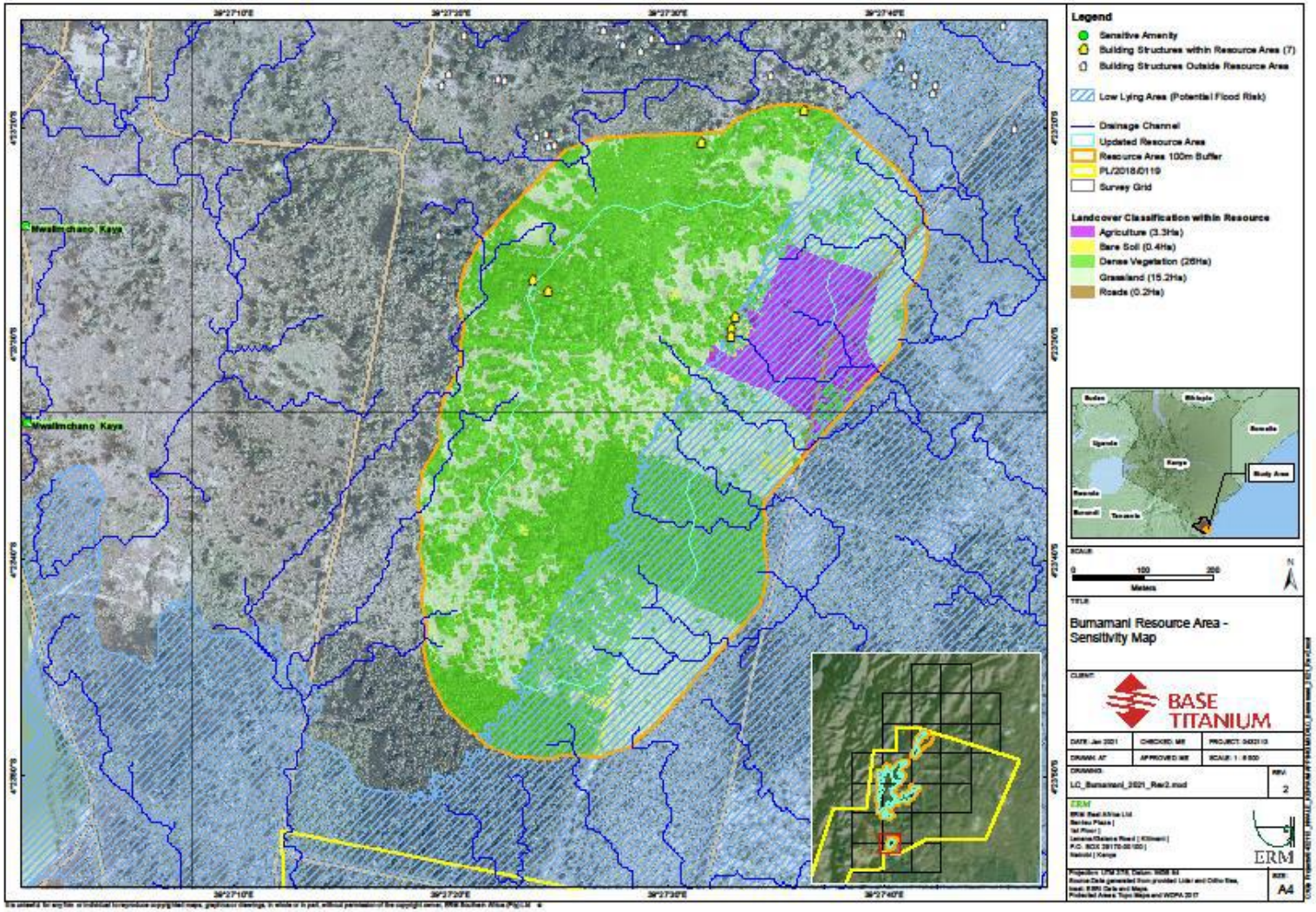


Figure 5.7: Bumamani Resource Area- Flood Risk Sensitivity Map

5.3.3.2 Hydrogeology

Introduction

The 'study area' refers broadly to a rectangle extending from Nikaphu in the south (located south west of Ramisi) to the north end of the Muhaka Forest in the north; and from the Shimba Hills to the oceanic front.

The general review is followed by a more detailed description of the main groundwater resource that Base and KISCOL exploit, in particular the characteristics or features that influence sustainability.

Groundwater Resources in the Study Area

Groundwater is a very significant component in water supply in Kwale County; according to a socio economic survey of 2,737 households across Kwale County carried out in 2017[1], 45% of respondents relied on a groundwater resource to meet water demand; this rises to 69% in Msambweni Sub-county. Groundwater is widely available across the study area in a variety of shallow unconfined and deep semi-confined aquifers. These comprise the following.

- A shallow unconfined aquifer located in Pleistocene coral limestone (Plc) adjacent to the sea, heavily exploited by shallow wells and shallow boreholes. Yields in boreholes and wells can approach 15m^3/hr.
- A shallow unconfined aquifer in Pleistocene sands and corals (Pls), also heavily exploited by shallow wells and boreholes. This unit lies between the eastern edge of the Coastal Hills and the western edge of the corals. Yields rarely exceed 6m^3/hr.
- The two Pleistocene units are heavily exploited for domestic and commercial uses and are already affected by saline intrusion in some places (Tole, 1997[2]; data collected by Base Environment since 2011; and analysis of time-domain terrestrial EM geophysics as part of ISGEAG, 2019[3]). Many of the Coast hotels and apartment complexes rely on water from the coral limestone aquifer to supplement piped water from the Tiwi aquifer (located 6-12km north of Ukunda and covering an area of approximately 30km^2)[4]. Estimated daily abstraction by the hotel sector from the Pleistocene aquifers in 2017 was 3,272m^3/d [5]. Gro for Good calculated that community abstraction from wells and BHs equipped with handpumps across their study area was 450m^3/d, on average: handpump-fitted wells/BHs equipped with GSM-enabled accelerometers[6] showed that abstraction was very seasonal: 0.7 and 2.1m^3/d in wet and dry seasons respectively[7]. A slightly lower figure would apply to the study area considered here, but given the modest level of abstraction, it probably matters little when compared with Base or KISCOL abstraction.
- The coral aquifer lies well to the east of the "Gongoni Forest aquifer" and is not influenced by it (or *vice versa*) at all. Saltwater intrusion is specifically monitored by a dual piezometer due east of the

[1] MWI/KCG (2017) Water Security and Climate Resilience Project – Phase 2 Consultancy Services for Preparation of Kwale County Water Supply Development Master Plan Draft Volume I: Report Version 0

[2] Tole MP. 1997. 'Pollution of groundwater in the coastal Kwale District, Kenya', in Proceedings of the Rabat Symposium, Sustainability of Water Resources Under Increasing Uncertainty, IAHS Publication no. 240, pp. 287-297

[3] ISGAEG. 2019. Amended Geophysics for Groundwater Exploration: the coastal pilot in Kwale County, Kenya. 2nd Technical report within the ISGEAG VIA Water project. Final Report. Compiled by Groen M, Rolf H, Rutto C and Lane M for: VIA Water, The Netherlands.

[4] Hirji R, Kairu E, Lane M, Mumma A & Tuinhoff A. 2011. Kenya Groundwater Governance Case Study. World Bank Water Paper.

[5] Ferrer N, Folch A, Lane M, Olago D, Katuva J, Thomson P, Jou S, Hope R and Custodio E. 2019b. How does water-reliant industry affect groundwater systems in coastal Kenya? Science of the Total Environment Vol. 694, 133634.

[6] Thomson P, Hope R and Foster T. 2012. GSM-enabled remote monitoring of rural handpumps: a proof-of-concept study. Journal of Hydroinformatics, Vol. 14, No. 4, pp. 829-839.

[7] Thomson P. 2016. Handpump Usage in Response to Rainfall. Poster presented at University of North Carolina Water & Health Conference, Chapel Hill, NC, USA 10-14 October 2016.

Base wellfield at Galu; neither water level changes nor water chemistry changes (specifically dissolved bromide concentration) have changed significantly or show any signs of saltwater intrusion[1]. Further south, at Vingujini, a public water supply BH (borehole) located approximately 1.1km from the sea has seen an increase in electrical conductivity and other ions, almost certainly a consequence of saltwater intrusion (data collected by the Base Environment team); saltwater intrusion in this zone was confirmed by geophysical measurements conducted in 2018.

- The Pleistocene sands aquifer does overlie the eastern part of the "Msambweni aquifer system" generally, but is separated from it by a clayey coral layer of 15 to 30 m thickness in that part of the aquifer exploited by Base's BHs. These BHs were all screened only in the deep confined aquifer and not the shallow sand aquifer, as the latter is an important water source for local communities; intensive monitoring of the shallow aquifer in dedicated piezometers and community shallow wells has shown that the effects of pumping the confined aquifer on the shallow aquifer are minimal at best. There is little evidence of saltwater intrusion into this unit, although sometimes the water is naturally brackish (e.g. at Magaoni Mosque).
- The KISCOL production BHs are screened in both the confined and unconfined aquifers, which does somewhat increase the risk of saltwater intrusion. However, there is no evidence as yet that saltwater intrusion has occurred in any of the KISCOL wellfields (at Nikaphu, Milalani and Kinondo), all of which are located at least 3.5km west of the sea. The extent to which KISCOL monitors its wellfields and groundwater resources is not known, however.
- The Pleistocene units (Pls and Plc) have both been extensively developed by the BHs drilled by SIDA in the 1980s and 1990s; despite survey work carried out by Base and Gro for GooD over the years, few of these have been accurately identified and tied to a BH dataset (a paper database was compiled by SIDA and left with the Kwale Water Office (where it still remains); however, BHs are identified by name and locality, not by grid reference, so identification has proved difficult. When Groundwater Survey (K) Ltd (GSK) were carrying out preliminary investigations for Tiomin in the late 1990s, they identified at least 40 BHs in the general project area [2]. The vast majority of the SIDA BHs were equipped with handpumps, and those that survive to the present are also typically still equipped with handpumps[3]. The majority of these BHs did not penetrate too deeply, typically being 20 to 30 mbgl, and never encountered the main "Msambweni aquifer system" as it is exploited by KISCOL and Base today.
- A poor aquifer exists in the Pliocene Magarini sands that make up the Coastal Hills; this is unconfined and exploited by a few shallow wells and boreholes; it also hosts a few springs. Yields are typically low (<2m^3/hr). The quality of water from this aquifer system is often poor; waters are typically of low pH, are very soft and contain elevated concentrations of iron and manganese. The Pliocene material underlies the North Dune and exceeds 30m thickness in places. At one stage, Base monitored an ephemeral spring at Barcelona, on the western side of the North Dune. Core holes drilled in the North Dune in the past occasionally encountered groundwater in the sediments immediately above the Mazeras Sandstone, which forms the local Basement (*pers. comm.* Edwin Owino, Exploration Superintendent, Base Titanium Ltd). There is no reason to believe that the Pliocene beneath the North Dune constitutes a useful groundwater resource.
- The Shimba Hills are underlain by a semi-confined or confined aquifer in the Jurassic Mazeras sandstone that is exploited mostly by boreholes, though there are a very few wells in this unit. This part of the Mazeras aquifer is relatively poor; yields range from 2 to 10m^3/hr. West of the North

[1] Klassen J, Allen DM and Kirste D. 2014. Chemical Indicators of Saltwater Intrusion for the Gulf Islands, British Columbia. Final Report. Prep. by Department of Earth Sciences, Simon Fraser University for BC Ministry of Forests, Lands and Natural Resource Operations and BC Ministry of Environment.

[2] Groundwater Survey (K) Ltd. 1999. Hydrogeological Investigation (Tiomin Mining Site, Kwale District). Hydrogeological and Geophysical Survey. For: Tiomin Resources, Inc.

[3] Foster T, Willetts J, Lane M, homson P, Katuva J and Hope R. 2018. Risk factors associated with rural water supply failure: A 30-year retrospective study of handpumps on the south coast of Kenya. Science of the Total Environment Vol. 626, pp. 156 – 164.

Dune the sandstone is apparently not significantly faulted or fractured, in marked contrast to the same unit further east. A single fault has been discerned in the Mazeras beneath the North Dune, oriented south south west to north north east, which is the dominant orientation of all faulting in the study area[12].

- Underlying the eastern part of the Coastal Hills (i.e. the Pliocene sands that make up the South, Central and North Dunes) and the western part of the Pleistocene sands is a sequence of fractured and faulted Jurassic sediments that hosts the Gongoni Forest aquifer where Base's production boreholes are located. This unit is described in more detail below; it comprises the Mazeras Sandstone at depth, the Kambe Limestone and the Mto Mkuu Formation shales and sandstones nearest the surface.
- The Msambweni and Kinondo areas are underlain by a high-capacity indurated sand and coral aquifer system associated with hitherto undescribed palaeochannel features extending from the west towards the coastline, described in more detail below[3] .
- The Kambe limestone is a fractured marine limestone, lying between the Mto Mkuu shales and sandstones and the Mazeras sandstones. It forms a confined aquifer. It has been encountered and specifically screened in only three boreholes that the study team are aware of (at Bumamani, Magaoni and Fihoni, all east of Fault 3 shown in Section; Geological structure and groundwater resources). At depths of 80 to 110m, this aquifer in isolation is capable of producing comfortably more than 15m^3/hr, though at present it is not exploited at anything close to this level. In properly designed and developed BHs yields considerably higher than this are probably possible. It is not of explicit interest to Base as a groundwater target, as it is already part of the fractured/faulted sequence that forms the "Gongoni Forest aquifer" described below that is already exploited by Base.
- Two exploratory BHs were constructed in the margins of the TSF in 2017 (one near the Laydown area, and one north of Vumbu). One BH encountered the Kambe Limestone (Laydown), the other the Mazeras sandstone (Vumbu). Neither were particularly good, and neither encountered significant fractured material. Water from both BHs was soft and surprisingly acidic; given this and their limited yields (<50m^3/hr) these sites were not developed further as abstraction points.

5.3.3.3 Water Quality

Base has four water quality monitoring points currently in the vicinity of the North Dune, including:

- Site S1: Site upstream of all mining activities;
- Site S2: Site located upstream of the Mukurumudzi Dam;
- Site GS8: An ephemeral spring located on the western side of the North Dune; and
- Site GS49: A perennial spring to the north of Central Dune.

These sites were sampled for the full range of organic and inorganic parameters by an accredited laboratory. Most of the tested parameters lie within the Government of Kenya (GoK) recommended levels, apart from pH and the iron (Fe) component in the samples. This indicates that water from these sources are all acidic, soft to moderately hard and poorly-buffered. The acidity partly explains the relatively high dissolved iron, a pattern observed in historic samples from monitoring sites in the Pliocene sands of the South and Central Dunes as well. Total Suspended Solids (TSS) in the surface water samples were all less than 56 mg/l.

[1] Caswell PV and Baker BH. 1953. Geology of the Mombasa-Kwale Area. Report No. 24, Geological Survey of Kenya, Nairobi.

[2] Olago D, Odida J, Lane M, Ferrer N and Folch A. In prep. Geological controls on Groundwater in Coastal Kwale, Kenya and its implications for future domestic, agricultural and industrial water supplies.

[3] Gro for GooD. 2017. Presentation made at the Groundwater Risk Management for Growth and Development (Gro for GooD) Stakeholder workshop, 3rd March 2017, Leopard Beach Hotel, Diani, Kwale County, Kenya.

5.3.4 Air Quality

The North Dune is located in a generally rural environment comprising predominantly rural homesteads, thickets and agricultural lands. Other infrastructures include mosques, churches, schools, training centres and a clinic. The only large scale operations in the area are Base Titanium's current mining operations to the south, and Kwale International Sugar Company (KISCOL) operations to the South East.

5.3.4.1 Particulate Matter (PM_{10})

There is particulate matter data available from monitoring sites at the southern and western end of the North Dune (locations $PM_{10}3$, $PM_{10}7$, $PM_{10}10$, $PM_{10}13$ and $PM_{10}14$ in Figure 5.8.

This monitoring was undertaken for a short period (i.e. <24 hours each month) only. PM10 concentrations vary considerably on a small scale and across short time scales. When monitoring in a dusty location where there is open ground and various intermittent activities, PM10 and dust concentrations can change by orders of magnitude moment by moment. As a result, monitoring in these type of areas over short time periods is of limited value, as the longer term average is required to understand the underlying trend.

This PM10 monitoring is therefore of limited value, as without the context of upwind and downwind contributions, determining mine contribution is impossible with certainty. It is included in this report mainly for illustrational purposes.

Table 5-1: Particulate Matter, PM10, µg/m³

	$PM_{10}3$	$PM_{10}7$	$PM_{10}10$	$PM_{10}13$	$PM_{10}14$
Sep-19	27.0	19.0	27.0	37.0	39.0
Oct-19	-	19.0	6.0	5.0	4.0
Nov-19	-	19.0	6.0	5.0	4.0
Dec-19	12.0	17.0	7.0	6.0	10.0
Jan-20	14.0	49.0	8.0	14.0	13.0
Feb-20	28.0	36.0	34.0	34.0	37.0
Minimum	**12.0**	**17.0**	**6.00**	**5.00**	**4.00**
Average	**20.3**	**26.5**	**14.7**	**16.8**	**17.8**
Maximum	**28.0**	**49.0**	**34.0**	**37.0**	**39.0**
Kenyan AQS - PM10 24 hour mean (98%ile), Rural and Other Areas	*100*	*100*	*100*	*100*	*100*

Based on the dust deposition results (see below, section 5.3.4.2) and the available PM_{10} monitoring presented in Table 5-1 above, PM_{10} baseline is considered to be undegraded.

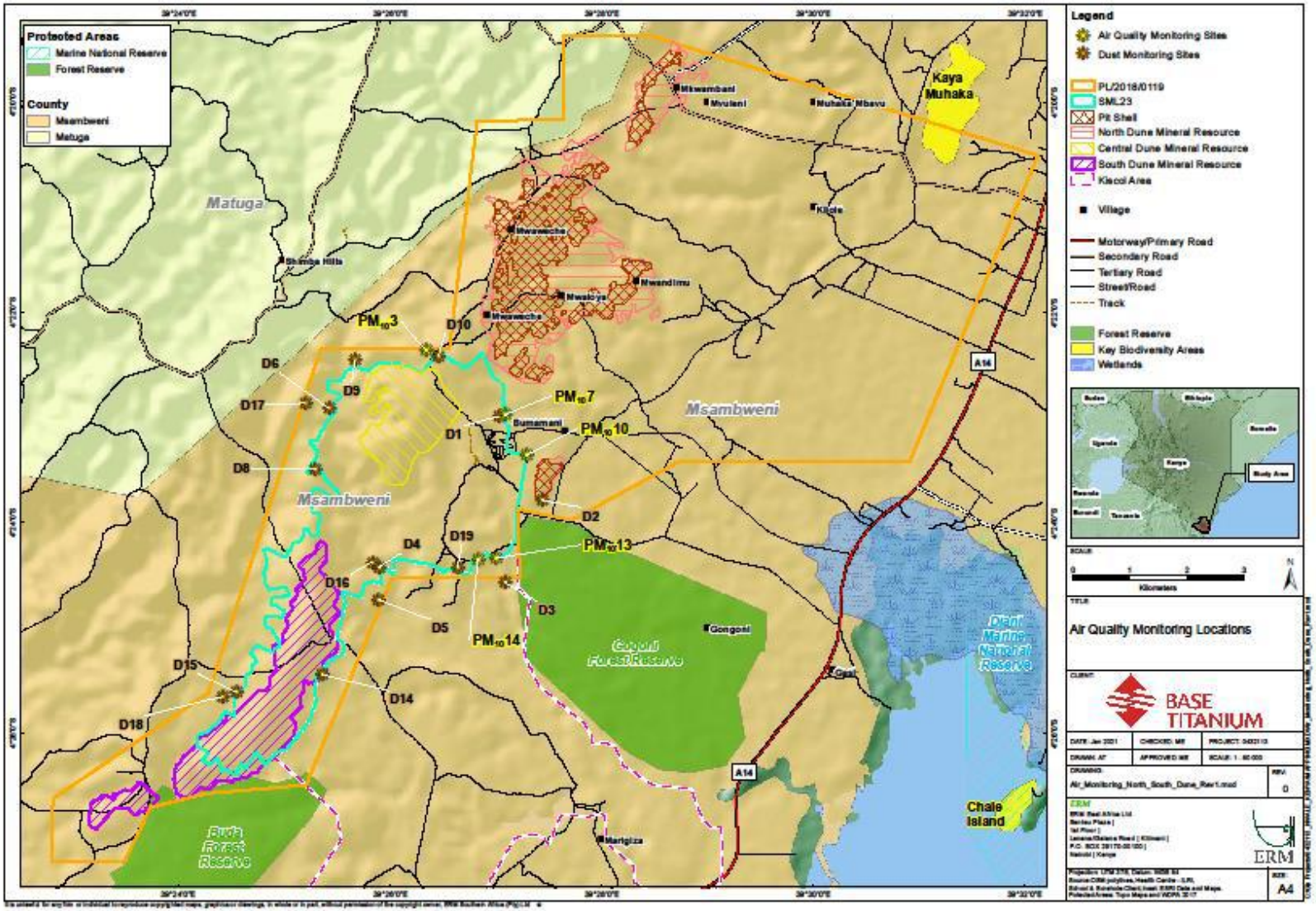


Figure 5.8: The Operation's Air Quality Monitoring Sites

5.3.4.2 Dust Deposition

There is dust deposition/ fallout dust data available from monitoring sites at the south and south eastern end of the North Dune (location D1, D2 and D10 in Figure 5.8. Fallout dust is the residual dust that settles back onto surfaces, following release out into the atmosphere by a given activity. As hydraulic mining is to be used on the North Dune, most of the process is wet and therefore will not be as dusty as a dry mining method would be. However, there is known to be dust emitted from the TSF and dust will also arise from exposed soils and stockpiles. In this case the mining of coarse dune sands may be a significant source of ambient nuisance dust, if not adequately managed, hence the need to assess whether the mining operations contribute significantly to elevated nuisance dust, and to take the necessary measures to mitigate this, if applicable. The baseline dust monitoring for the North Dune location is therefore based on this premise, and will be used as a benchmark for impact monitoring during mining activities in this area.

The dust deposition data (Table 5-2) are considered a reasonable indication of the baseline, given the distance to the North Dune and are presented in the table below.

These data show:

- a clear profile echoing the dry season in February and March but less so during the second drier period in August and September;
- no exceedances of the 30-day average South African dust nuisance threshold.

In general, the airshed can, therefore, be considered not degraded with regards to dust deposition.

Table 5-2: Baseline dust deposition, mg/m^2/day

	D1			D2			D10		
	2016	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**
January	-	102	35.8	-	63.0	39.9	-	329	158
February	-	164	519	-	113	16.8	-	197	214
March	-	180	220	-	126	38.2	-	464	91.9
April	-	127	292	-	98.4	26.3	-	260	66.0
May	-	271	35.6	-	426	-	-	64.6	54.1
June	-	87.2	559	-	19.0	-	-	95.0	95.5
July	137	55.3	139	29.0	16.9	-	111	252	193
August	85.0	53.7	195	31.6	42.2	-	53.7	96.4	31.5
September	219	192	26.0	52.2	58.8	-	116	193	40.4
October	125	54	32.0	54.7	39.6	-	157	149	155
November	66.1	7.27	-	112	23.5	-	75.9	15.2	-
December	83.2	253	-	58.5	76.4	-	262	60.6	-
Minimum	**66.1**	**7.27**	**26.0**	**29.0**	**16.9**	**16.8**	**53.7**	**15.2**	**31.5**
Average	**119**	**129**	**205**	**56.4**	**91.9**	**30.3**	**129**	**181**	**110**
Maximum	**219**	**271**	**559**	**112**	**426**	**39.9**	**262**	**464**	**214**
South African residential dust nuisance threshold, 30-day average	*600*	*600*	*600*	*600*	*600*	*600*	*600*	*600*	*600*

There is no data available for the baseline NO_2. Based on the dust deposition results and the available PM_{10} monitoring (see previous Section), PM_{10} baseline is assumed to be undegraded. In the absence

of significant local sources of NO_x emissions, or nearby urban areas, NO_2 baseline is also assumed to be undegraded.

5.3.5 Noise

Ambient Noise

Base Titanium have an extensive noise monitoring network, which has been operational since 2014 and has captured ambient noise levels within and around the Central, South and North Dunes. Base currently have 8 noise monitoring sites (N4, N5, N6, N7, N8, N9, N10 and N11) located to the south of the North dune resource that provides noise data of the area. Figure 5.9 shows these specific noise monitoring points in addition to the entire noise monitoring network sites. A sound level meter has been used to monitor ambient noise at these sites since January 2014, on a monthly basis. Monitoring of sites N4, N7 and N10 are ongoing, while the remainder ceased in October 2019.

Noise levels at the sites represent the baseline pre North Dune mining activities, and are shown in Table 5-3 and Table 5-4 below. The following is a summary of the data collected:

Daytime noise levels:

- Minimum noise level: 30.5 dB(A)
- Maximum noise level: 68.9 dB(A) (occurred at site N8, October 2015)
- Average noise level: 50.4 dB(A)

Night time noise levels:

- Minimum noise level: 32.6 dB(A)
- Maximum noise level: 50.7 dB(A) (occurred at site N4, December 2015)
- Average noise level: 45.9 dB(A)

The data presented in the tables below reflect that daytime noise levels often did exceed the Kenyan noise guidelines and occasionally the IFC noise guidelines, for both residential and mixed residential thresholds. The Kenyan EMCA (Noise Regulations, 2009) sets permissible limits for mixed residential (with some commercial and places of entertainment) areas of 55dB(A) (daytime) and 35dB(A) (night time). The IFC Environmental, Health, and Safety (EHS) Guidelines, specify noise limits for residential, institutional and educational areas of 55dB(A) (daytime) and 45dB(A) (night time).

On average, noise measurements since January 2016 indicate that daytime noise levels have been within guideline levels. This is except for isolated cases seen in the months of January 2016, December 2017, April 2018, May 2018, May 2019, June 2019, September 2019 and October 2019, where more than half of the noise levels recorded at North Dune monitoring locations were above the Kenyan residential and IFC residential levels. The night time noise levels were almost always above the Kenyan guideline.

It is, however, important to note that wind patterns and wind strength made significant contribution to the variations in noise measured during noise monitoring. It is therefore possible to conclude that the sources of above-threshold noise were largely from wind and rustling vegetation, birds, insects and small mammals within the Dune area, as well as other activities at settlements.

From the baseline findings, non-mining related noise sources exist in the area, and will need to be adequately factored in during mining phase noise impact monitoring. Where mining activities are close to settlements or schools, adequate measures, as recommended in Section 8.2.5 of this Report, shall be implemented.

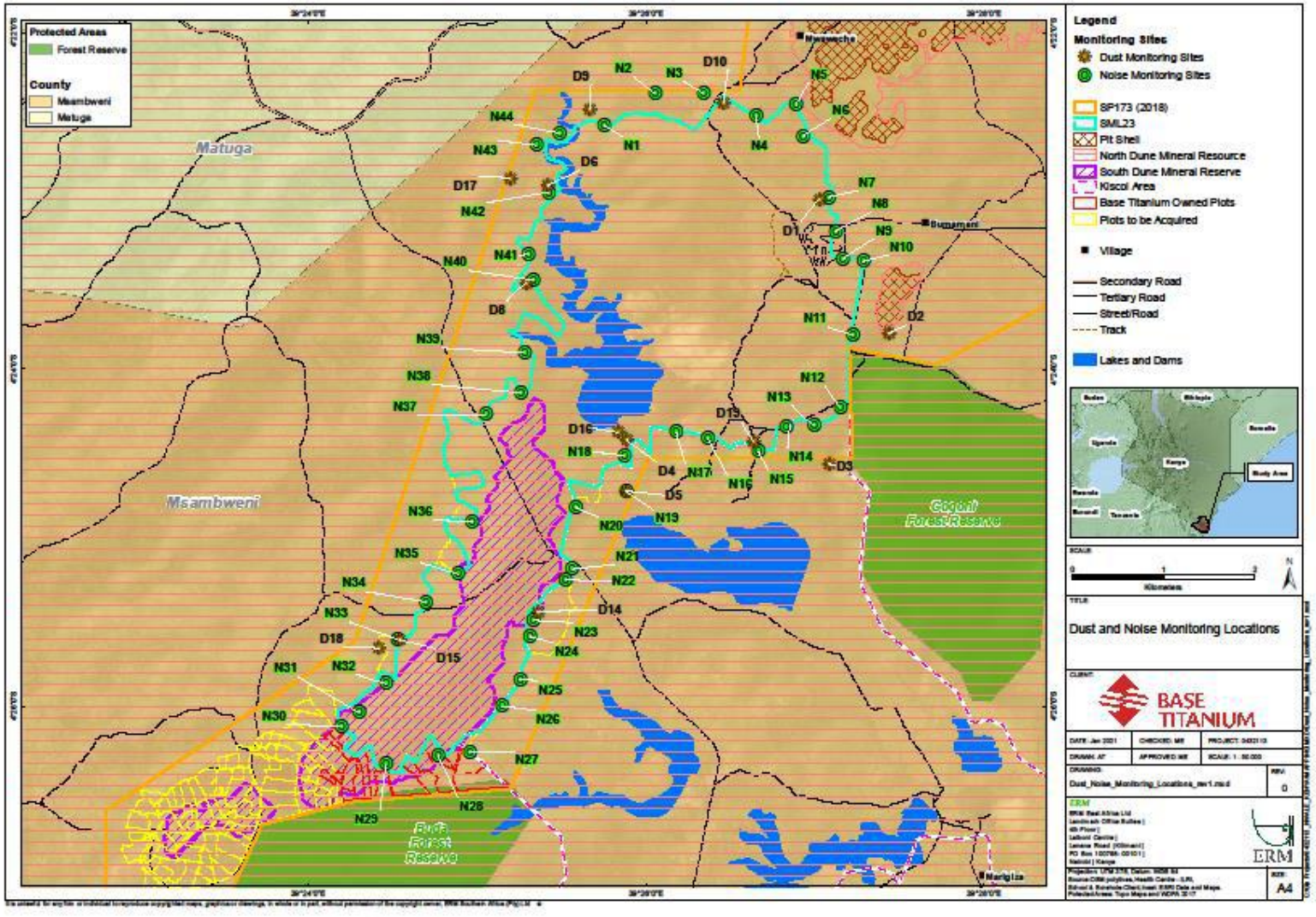


Figure 5.9: The Operation's Noise Monitoring Sites

Table 5-3: Daytime Trends in Ambient Noise (2015-2020) – these represent pre-mining baseline data

MONITORING SITES	JAN'15	FEB'15	MAR'15	APR'15	JUN'15	AUG'15	SEP'15	OCT'15	NOV'15	DEC'15	2015 Average	JAN'16	FEB'16	MAR'16	APR'16	MAY'16	JUN'16	JUL'16	AUG'16	SEP'16	OCT'16	NOV'16	DEC'16	2016 Average
N4	38,4	30,5	46,6	48,4	45,0	43,3	40,5	51,4	48,8	40,8	46,2	46,0	41,4	37,3	33,2	43,4	48,7	49,5	41,3	38,5	43,8	37,2	46,1	44,5
N5	44,3	36,8	44,5	51,5	37,2	46,8	45,2	55,6	59,1	47,4	51,8	46,7	43,7	40,6	40,2	42,8	52,7	43,6	47,5	44,7	45,4	45,4	48,7	46,6
N6	50,0	35,5	55,4	58,8	50,5	42,9	43,9	50,8	50,9	39,1	52,1	42,4	44,7	40,7	48,2	53,9	49,1	40,2	44,4	40,4	44,2	41,4	54,0	48,2
N7	42,7	44,4	53,0	60,6	39,9	43,4	45,7	48,6	56,5	49,8	53,2	47,9	47,1	45,9	43,6	54,4	47,3	46,3	45,0	49,5	42,5	39,3	43,9	47,8
N8	49,9	35,8	45,4	47,4	36,4	41,8	41,4	68,9	48,9	54,5	59,2	53,6	44,9	43,8	39,2	51,0	43,4	43,6	47,2	39,3	40,7	42,5	41,7	46,8
N9	46,4	38,8	43,7	45,7	55,3	33,2	40,9	55,1	45,4	45,8	49,4	59,0	44,8	48,1	31,5	41,8	45,6	46,3	44,6	39,3	52,1	36,7	42,0	50,0
N10	53,0	44,8	58,4	43,1	42,2	36,7	37,4	40,4	55,7	50,7	51,7	52,1	52,6	49,6	37,6	48,0	50,9	42,3	36,5	41,6	56,1	50,5	51,4	50,4
N11	47,1	40,8	48,3	48,2	39,1	41,0	34,7	45,6	48,2	48,8	46,0	56,0	52,3	44,4	47,5	48,3	47,2	48,1	38,6	37,2	43,3	33,5	42,6	48,7
											53,2													**48,2**

MONITORING SITES	JAN'17	FEB'17	MAR'17	APR'17	MAY'17	JUN'17	JUL'17	AUG'17	SEP'17	OCT'17	NOV'17	DEC'17	2017 Average	JAN'18	FEB'18	MAR'18	APR'18	MAY'18	JUN'18	JUL'18	AUG'18	SEP'18	OCT'18	NOV'18	DEC'18	2018 Average
N4	36,7	35,1	40,7	44,7	44,6	44,1	42,6	40,3	45,0	40,7	37,7	42,3	42,2	36,0	38,7	45,6	40,1	43,8	46,0	48,9	45,3	38,9	43,8	38,2	39,2	43,7
N5	44,4	49,6	40,6	41,3	49,9	49,7	43,0	47,2	44,9	38,9	43,1	51,5	47,0	44,2	38,2	45,5	47,1	49,0	47,6	49,1	48,6	41,0	43,9	40,6	38,8	45,9
N6	47,8	35,9	48,9	39,8	53,3	48,7	41,5	44,2	43,7	42,2	52,8	52,7	48,7	37,7	39,4	47,7	60,6	56,4	47,9	44,2	37,7	38,9	55,7	40,7	38,1	52,5
N7	41,2	39,0	52,1	48,0	44,6	41,5	42,9	44,4	41,0	38,5	48,3	57,4	49,1	40,4	45,9	54,1	53,0	60,2	45,3	46,4	40,7	41,3	39,5	42,0	36,6	51,5
N8	45,5	41,5	41,0	44,4	44,6	44,8	44,5	43,2	42,9	41,1	38,9	41,5	43,2	39,6	41,9	45,6	49,7	45,1	43,2	45,1	42,1	43,7	45,6	43,2	42,5	44,7
N9	46,5	45,5	44,1	42,6	39,9	52,0	42,3	37,8	44,5	40,5	39,1	42,5	45,0	36,8	46,6	46,5	54,6	51,0	42,0	38,9	37,8	45,0	46,4	37,2	41,3	47,2
N10	42,2	44,9	40,6	44,4	53,5	54,4	44,8	37,9	40,3	52,0	55,8	53,1	50,6	44,7	55,0	45,7	56,1	51,9	58,6	45,3	38,1	41,1	36,5	39,3	41,1	51,6
N11	43,6	43,6	41,5	47,5	53,3	47,9	42,4	48,9	42,4	44,8	48,3	42,5	47,1	41,7	41,0	42,9	53,5	51,2	54,5	48,1	43,2	40,1	41,0	37,2	37,5	48,3
													47,4													**49,3**

MONITORING SITES	JAN'19	FEB'19	MAR'19	APR'19	MAY'19	JUN'19	JUL'19	AUG'19	SEP'19	OCT'19	NOV'19	DEC'19	2019 Average	JAN'20	FEB'20	JUL'20	2020 Average
N4	47,4	49,4	35,7	45,6	52,6	52,8	45,2	47,5	50,2	49,0			49,2				
N5	47,5	49,2	54,6	51,9	53,9	50,7	48,6	53,3	52,2	57,8			53,0				
N6	43,9	46,4	44,6	45,9	52,5	53,2	53,0	48,6	51,8	65,5			56,5				
N7	44,0	46,9	44,9	52,8	51,6	44,7	46,6	42,4	54,6	50,1	40,6	44,1	49,0	52,5	46,1	43,9	49,1
N8	42,9	48,1	47,4	43,9	49,5	47,7	44,5	45,1	54,2	46,2			48,3				
N9	43,1	45,7	38,5	47,1	53,3	47,8	44,1	45,6	47,3	45,3			47,3				
N10	41,1	43,3	44,8	47,3	50,9	54,6	52,4	43,4	48,1	51,3	48,7	39,6	49,2	44,9	41,2	54,7	50,5
N11	40,0	49,0	54,6	42,5	41,6	55,5	48,9	43,5	36,9	43,5			49,5				
LEGEND													**51,4**				**49,9**

DAYTIME MARKINGS	
	Above 70 - IFA industrial guideline
	Above 60 - Kenyan commercial
	Above 55 - Kenyan mixed resident
	Above 50 - Kenyan residential

Table 5-4: Night Time Trends in Ambient Noise (2015-2020) – these represent pre-mining baseline data

MONITORING SITES	FEB'15	MAR'15	AUG'15	SEP'15	OCT'15	NOV'15	DEC'15	2015 Average	JAN'16	FEB'16	MAR'16	APR'16	MAY'16	JUN'16	JUL'16	AUG'16	SEP'16	OCT'16	NOV'16	DEC'16	2016 Average
N4	42,2	40,2	49,0	46,2	49,8	42,7	50,7	**47,3**	47,0	43,2	32,6	44,6	37,0	40,5	46,4	46,8	45,3	45,1	42,3	34,6	**43,9**

MONITORING SITES	FEB'17	MAR'17	APR'17	MAY'17	JUN'17	JUL'17	AUG'17	SEP'17	OCT'17	NOV'17	DEC'17	2017 Average	JAN'18	FEB'18	MAR'18	APR'18	MAY'18	JUN'18	JUL'18	AUG'18	SEP'18	OCT'18	NOV'18	DEC'18	2018 Average
N4	36,9	39,5	41,1	43,2	39,9	41,9	43,4	42,9	43,1	40,3	42,7	**41,7**	44,1	32,7	40,2	45,4	45,9	42,9	41,7	50,4	45,4	45,8	41,8	46,1	**45,1**

MONITORING SITES	JAN'19	FEB'19	MAR'19	APR'19	MAY'19	JUN'19	JUL'19	AUG'19	SEP'19	NOV'19	DEC'19	2019 Average	FEB'20	JUL'20	2020 Average
N4	50,2	41,3	47,5	45,6	46,3	43,7	45,2	47,6	50,4	46,8	48,6	**47,3**	47,4	47,4	**47,4**

LEGEND

NIGHTIME MARKINGS	
	Above 70 - IFA industrial guideline
	Above 45 - IFC residential
	Above 35 - Kenyan for all areas

5.3.6 Radiation

Generally, heavy mineral sands are radioactive due to the presence of the radioactive element Thorium. Thorium is present in Monazite (a source of rare earth metals), Zircon, and the minor heavy minerals (Xenotime and Leucoxene). As such, Base has undertaken a baseline radiation survey of the North Dune resource area to determine the baseline radiation. In addition to this, extensive background radiation monitoring surveys have been conducted for the Central and South Dune ore bodies along their perimeters, pre-mining and during operation.

To establish the potential exposure of communities living close to the North Dune to harmful Levels of radiation, the following was undertaken:

In the area of the North Dune, a baseline Gamma radiation survey was conducted around the potential orebody, to establish background levels to the required degree of accuracy. During the surveys, Gamma readings were taken along established access roads and tracks. The measurements were collected using a certified and calibrated gamma radiation meter, and were typically taken between 50 to 70 metre intervals from each other, at a height of one metre above ground level, and with measurement readings averaging between 30 to 40 seconds, wherever possible.

Figure 5.10 illustrates the radiation monitoring sites within the North Dune mineral reserve.

Table 5-5 below presents background gamma radiation for the North Dune area in comparison to further baseline gamma readings taken for the South Dune from 2015 to 2018 and Central Dune from 2011 to 2013, the latter two measuring higher background radiation levels due to the Central and South Dunes having higher grades of heavy minerals. The results are presented in micro-Sieverts/hour (µSv/h).

Table 5-5: The summary of Gamma-Radiation Monitoring Results

Survey area	No. of measurements	Range (µSv/h)	Average (µSv/h)
North Dune Area (Mkwambani)	16	0.05 – 0.15	0.10 ± 0.03
North Dune Area (Main Resource- Mwaweche)	49	0.05 – 0.25	0.12 ± 0.04
North Dune Area (Main Resource- Mwaloya)	40	0.04 – 0.19	0.11 ± 0.03
North Dune Area (Mwandimu)	63	0.05 – 0.18	0.11 ± 0.03
North Dune Area (Bumamani)	69	0.05 – 0.19	0.10 ± 0.03
South Dune area (incl. South Dune Extension)	694	0.04 – 0.32	0.15 ± 0.05
Central Dune (2011-2013)	729	0.06 – 0.43	0.18 ± 0.07

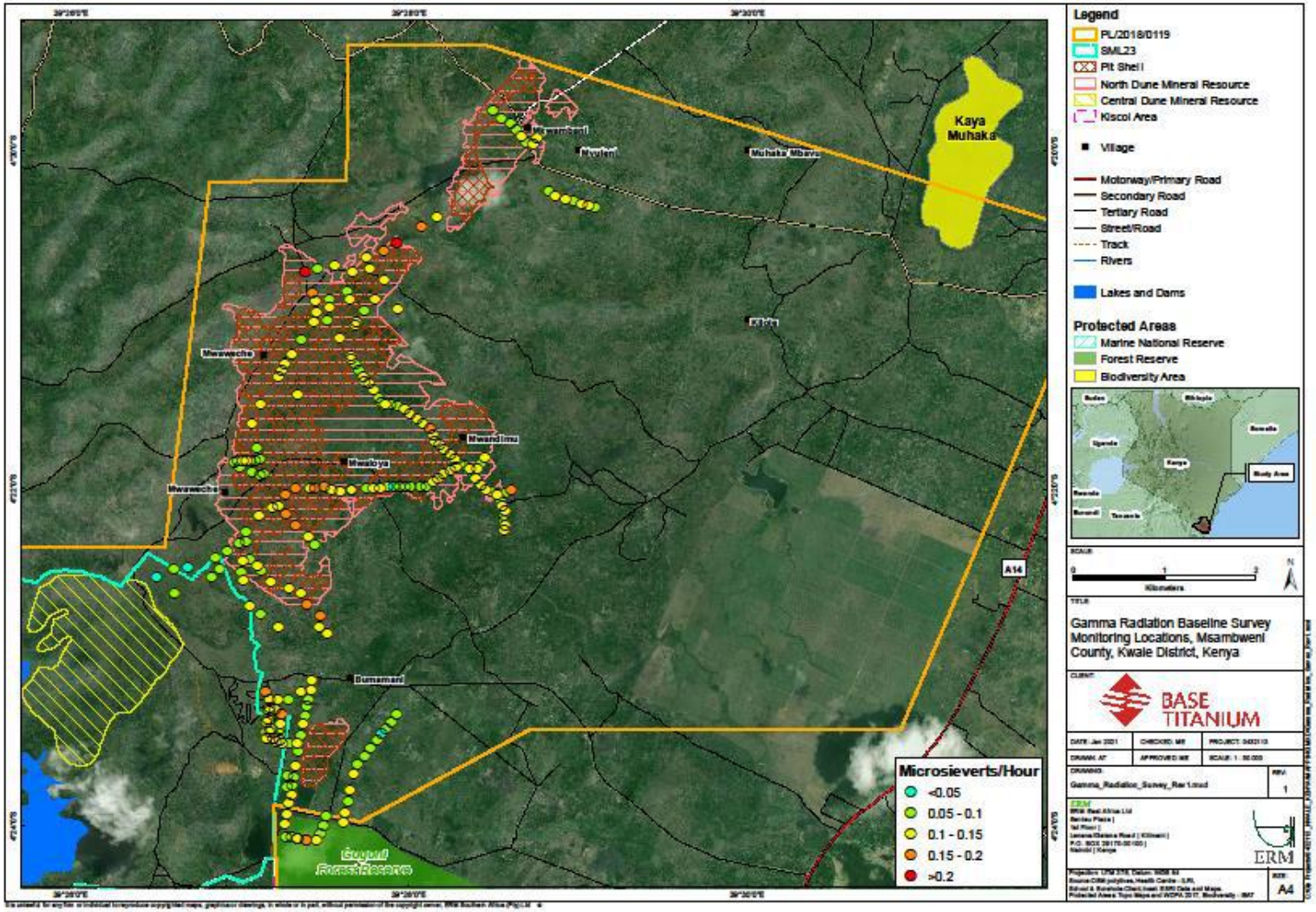


Figure 5.10: North Dune Radiation Monitoring Sites

From the radiation baseline monitoring conducted, a baseline average of the individual resource areas within the North Dune was set. These are as follows; 0.10 (± 0.03) µSv/h for Mkwambani; 0.12 (± 0.04) µSv/h for the Main resource- Mwaweche; 0.11 (± 0.03) µSv/h for the Main resource-Mwaloya; 0.11 (± 0.03) µSv/h for Mwandimu; and 0.10 (± 0.03) µSv/h for Bumamani.

The current baseline data obtained for the Mine Site is well within typical levels of natural background of 0.19µSv/hour.

Based on these baseline findings, Base will conduct regular impact monitoring during North Dune mining activities, and identified risks or radiation impacts addressed as recommended in Section 8.2.5.7 of this Report.

5.3.7 Summary of Key Physical Environmental Sensitivities

A summary of the key physical environmental sensitivities is provided in Box 5-1 below:

Box 5-1: Key Physical Sensitivities

- The climate is largely hot and dry from January to April/ May and coolest in the period from June to August. Rainfall in the County is bi-modal, with short rains experienced between October and December, and long rains between March and May. This has implications for rehabilitation and air quality in particular.
- Historically, the county has experienced an average increase in temperatures and a decrease in precipitation. However, there have been interfaces between years of extensive droughts and intense precipitation leading to floods. These climate extremes pose risks to the mining operations, especially during intense rainfall that may lead to floods and the associated increase in topsoil erosion, potential mine pit wall collapse, inhibition of movement, surface water quality degradation and challenges to the management of loose soil and new vegetation during mine rehabilitation.
- Soils analytical data indicates potential dispersion anomalies due to exchangeable sodium occupying more than 15% of the cation exchange capacity. This should be carefully managed to prevent soil erosion, crusting and formation of preferential seepage pathways.
- In terms of topsoil stripping, careful consideration should be given to ensure the different soil horizons (Orthic A, Red Apedalic B, Yellow Apedalic B and Soft Plinthic B – Horizons) that are to be stripped and stockpiled separately and not mixed
- The Mkurumudzi River is an important source of water for key ecosystem services including maintaining aquatic life, recharge of shallow wells and aquifers, and a habitat for a variety of vegetation species. The river is also a source of water for local residents both for drinking and other household and agricultural activities.
- Several small streams arising from seepage and spring flows occur within the North Dune resource area and are an important source of drinking water to residents of the villages within the region.
- The surface water allocation balance indicates that there is sufficient flood water to support an additional 8,000m3/day allocation with sufficient safe guards for environmental flow releases and domestic users. Given the variability in rainfall and surface flows, Base Titanium will need to use additional sources (e.g. groundwater) when the surface water cannot meet full demand.
- Groundwater is a very significant component in water supply in Kwale County. Groundwater is widely available across the study area in a variety of shallow unconfined and deep semi-confined aquifers

- Groundwater modelling shows that the aquifers are more sensitive to droughts than to over abstraction. However, modelling shows that these aquifers are quickly recharged by a good rainfall year.
- Groundwater modelling shows that water levels in the shallow aquifer close by the commercial production wellfields after two successive dry periods would certainly lead to dry shallow wells and shallow boreholes. However, these effects are localised and will rarely extend far enough to adversely affect community water supply shallow wells.

5.4 Biodiversity Baseline

5.4.1 Project Area of Influence

The landscapes of the Project Area of Interest (PAOI) consist of relatively flat to gently undulating plains, from the highest points across the main ore body at approximately 130 mamsl, to approximately 90 mamsl on the western periphery of the PAOI, and approximately 60 mamsl towards the eastern periphery. The landscapes are interrupted river valleys and by localised to drainage-like depressions where water accumulates and forms wetlands, but may only create flowing streams after sufficient rainfall. Larger wetland systems such as the Kidongweni and Madongaweni Rivers are perennial streams.

5.4.1.1 Background and Historical Vegetation

Kwale and surrounding areas lie within the Swahili Centre of Endemism, also referred to as the East African Coastal Forest Hotspot (Myers et al., 2000), known for its very high biodiversity of flora and fauna of over 6000 documented species (Samoilys et al., 2015). High species diversity and endemism are specifically found in the remnant natural habitats - present within the Project Area and wider Area of Influence, e.g. the Gongoni Forest Reserve and Kidongweni Wetlands.

It is essentially the presence of range-restricted and habitat-specific species, as well as unique and important ecosystem functions, that has contributed to the identification of Critical Habitats being present, as discussed further in this section.

The Potential Natural Vegetation of Eastern Africa Map (van Breugel et al., 2015) broadly classifies vegetation within the Project Area and Potential Area of Assessment as consisting of:

- Coastal Mosaic Vegetation as part of the original extent of the Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion; and
- Freshwater Swamps (which would include Rivers, Riparian Areas and all wetlands).

The 'Coastal Mosaic' Vegetation extends between 50 and 100 km inland, and consists of several types of vegetation habitats closely intertwined and changing due to edaphic factors such as soils and soil-moisture levels. The Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion, as defined by the WWF (2020[1]), has plant species diversities that are among the highest in the world. The remarkably high species diversity associated with the area is partially a result of the great diversity of habitats, and the levels of species endemism. To date over 4,500 plant species have been recorded in this coastal mosaic. Of these, 3,000 species are confined to forest habitats (WWF 2020).

Natural habitats, especially small forest patches, are highly threatened in coastal Kenya. This threat comes primarily from an increase in coastal populations, conversion to agricultural land, and various forms of extraction operations, including mining. Accordingly, the WWF classifies this ecoregion as having a Critically Endangered Status.

Since the beginning of the Kwale mining operations in 2012 and the establishment of the mine's indigenous plant nursery near the mine processing plant, a close watch has been kept on those plant

[1] WWF (2020) https://www.worldwildlife.org/ecoregions/at0125

species that are particular to this area in Kwale County. A complete inventory of all plants encountered within the existing mine area (central and South Dune) and the adjacent Gongoni and Buda Forest Reserves was prepared in 2017, listing 1244 indigenous and 101 cultivated and naturalised exotic plants species. This compares favourably with the Shimba Hills checklist (Luke, 2005) of 1396 plants and 52 cultivated or naturalised species.

The process of assessing the world's plants with extinction risk lies with the IUCN Red List and had progressed very little for East Africa until the formation of the Eastern African Plant Red List Authority in 2005. Since then, the number of plants assessed as threatened has grown each year with particular emphasis on the Coastal Forests of East Africa Hotspot (Myers et al., 2000). At the date of this survey, some 400 plants within the K7 (Flora of Tropical East Africa) biogeographical area of Kenya had been listed as CR, EN or VU (see www.iucn.org for Red List categories) due to their limited distribution and threat to their locations. Of these, some 100 taxa have already been cultivated at the Base Titanium nursery and many planted out into rehabilitated areas.

5.4.2 Gazetted Protected Areas

Several protected areas are located in close proximity to the SML area of the Kwale Operation. All protected areas that are within 15 km of the borders of the SML are listed in Table 5-6, with a short description of each in the sections below.

Table 5-6: Protected Areas near the proposed Project as shown in Figure 5.11

Protected Area	IUCN Mgmt. Category	Size (km²)	Type of Region
Shimba Hills National Reserve	Category II	217	National Reserve Key Biodiversity Area due to the presence of CR/EN, VU, endemic and other species
Buda Forest Reserve	Category VIII	6,2	Forest Reserve Key Biodiversity Area due to the presence of CR/EN, VU and endemic species
Gongoni Forest Reserve	Category VIII	8,2	Forest Reserve Key Biodiversity Area due to the presence of CR/EN, VU and endemic species
Diani - Chale National Reserve	Category VI	75 Marine 4,5 Forest	Marine National Reserve and Diani Forest (4,5 km^2) Key Biodiversity Area due to the presence of CR/EN, VU and endemic species
Kaya Muhaka	Category III	1,32	Sacred Forest and UNESCO Heritage Site Key Biodiversity Area due to presence of CR/EN, VU, endemic species
Kaya Ukunda	Category III	0,41	Sacred Forest and UNESCO Heritage Site Key Biodiversity Area due to presence of CR/EN, VU, endemic species
Kaya Kinondo	Category III	0,53	Sacred Forest and UNESCO Heritage Site Key Biodiversity Area due to presence of CR/EN, VU, endemic species
Kaya Tiwi	Category III	0,52	Sacred Forest and UNESCO Heritage Site

Protected Area	IUCN Mgmt. Category	Size (km²)	Type of Region
			Key Biodiversity Area due to presence of CR/EN, VU, endemic species
Chale Island	Category III	0,37	Key Biodiversity Area due to presence of CR/EN, VU species

(Source: Birdlife Data Zone, IUCN Key Biodiversity Areas and IBAT Website)

5.4.2.1 Descriptions of National Parks and –Monuments, and Internationally Recognised Areas

The **Shimba Hills National Reserve** is in an area of coastal rainforest, situated on and around a low dissected plateau parallel to the coast, which is considered to be a major water catchment area, supplying fresh water to the Diani/Ukunda region (BirdLife International, 2020a). It is located to the north-west of the Kwale Operation SML, with its closest point approximately 3.4 km away from the Kwale Operation SML.

Vegetation consists of wetlands, grasslands and mature and relict forests on scarp slopes and steep-sided valleys. It is an important area for plant biodiversity – over 50% of rare or threatened Kenyan plant species are found in the Shimba Hills. It is also considered a key biodiversity area for birds, herpetofauna, mammals and butterflies (World Bank, 1993, BirdLife International, 2020a).

This National reserve will not be directly impacted by expanded mining operations in the North Dune. However, there may be increased disturbance levels to fauna due to potentially increased noise levels.

The **Buda Forest Reserve** is situated adjacent to the south-eastern extent of the Kwale Operation SML and was established in 1932 as part of the Kaya coastal forest fragments (World Bank, 1993). With a high amount of surface water, its environment and vegetation is wetter than that of Gongoni Forest. At least 480 plant taxa, of which several are threatened, have been identified in the forest up to date (Luke, 2011a). It is not anticipated that the North Dune mining expansion will have any impact on the Buda Forest Reserve.

The **Gongoni Forest Reserve** is situated immediately east of the central operations of the Kwale Operation SML, and will be just south of the North Dune mine expansion. It was established in 1932 as part of the coastal Kaya forests (World Bank, 1993), and is known as one of a few places (also recorded from Kaya Muhaka) where the endangered tree Gigasiphon macrosiphon occurs (Luke and Verdcourt, 2004). In general, it is a moist semi-deciduous forest, dominated by open grassland dotted by palms between areas of closed forest canopy, with high species richness of at least 560 plant species, of which many species are threatened (Luke, 2011a; Gongoni Gazi Community Forest Association, 2013). This forest is protected as far as possible from mining operations. A wildlife corridor between Buda and Gongoni has also been re-established by Base Kwale.

The **Diani-Chale National Reserve**, situated along the coast approximately 3 km east of the Kwale Operation SML (and approximately 9 km east of the North Dune expansion) consists of a Marine Reserve as well as several coastal forests fragments. The forested areas consist of fragmented remnant coral rag forest, such as the Diani Forest, as well as mangroves, and is considered a key biodiversity area for several bird species, plant species as well as mammal species (BirdLife International, 2020b). This reserve will not be impacted by the expanded mining operations.

Several **Kayas**, especially Khaya Muhaka, are remaining lowland forest patches that are part of the Zanzibar-Inhambane vegetation mosaic of Eastern Africa. These Kayas are considered sacred forest sites that once sheltered fortified villages of the Mijikenda people fleeing enemy groups (Luke and Githitho, 2003) and are protected as a National Monuments. As logging and modification of these forests has been prevented to a large degree by existing traditions, they still contain a significant amount of biodiversity, especially when it comes to flora, herpetofauna and Lepidoptera (butterflies). Currently these forest remnants are under threat from increasing transformation outside the forests, increased

demand on natural (forest) products and an associated increased establishment of alien invasive species around these forests (Luke and Githitho, 2003; Makokha, 2017).

The PS 6 acknowledges the ecological importance of internationally recognised areas (IRAs), and recognises some of these as potential triggers of critical habitat. A number of IRAs are recognised where no gazetted protected areas occur. All those occurring within a 15 km radius of the North Dune mining areas are listed in Table 5-7, and presented in Figure 5.11.

Table 5-7: Additional Important Biodiversity Areas within 15 km of the Project

Internationally Recognised Areas	Type of Region
Coastal Forests of Eastern Africa and Swahili Centre of Endemism Some fragmented forested areas are listed below:	Biodiversity Hotspot with high numbers of Endemic Fauna and Flora
Kaya Muhaka	Sacred Forest and UNESCO Heritage Site Key Biodiversity Area due to presence of CR/EN, VU, endemic species
Kaya Ukunda	Sacred Forest and UNESCO Heritage Site Key Biodiversity Area due to presence of CR/EN, VU, endemic species
Kaya Kinondo	Sacred Forest and UNESCO Heritage Site Key Biodiversity Area due to presence of CR/EN, VU, endemic species
Kaya Tiwi	Sacred Forest and UNESCO Heritage Site Key Biodiversity Area due to presence of CR/EN, VU, endemic species
Chale Island	Key Biodiversity Area due to presence of CR/EN, VU species

Source: Birdlife Data Zone, IUCN Key Biodiversity Areas and IBAT Website

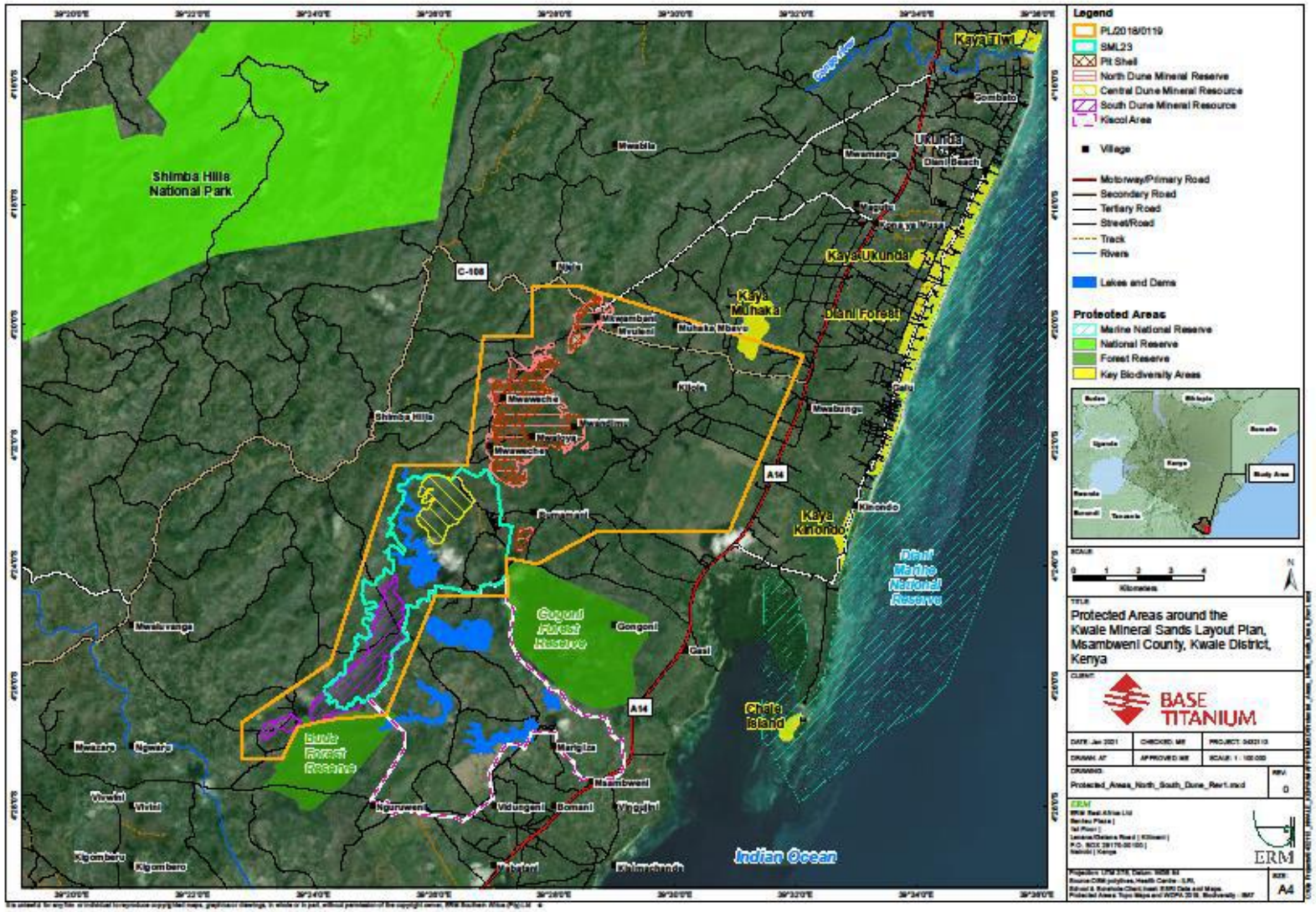


Figure 5.11: Layout of Protected Areas Relative to the Proposed Mine Site

Additional Kayas that were identified during the field survey are:

- Kaya Kitsakabungo;
- Kaya Mwandimu; and
- Kaya Mwalimchano

5.4.3 Flora and Habitats

The total number of plant taxa recorded from the North Dune survey was 610, of which 58 are cultivated and/or naturalised and alien invasive plant species. Of the 552 indigenous species, 25 are listed as either Near-Threatened, Vulnerable or Endangered (more in Section 5.4.5) A full list of plant species observed is presented in Annex A of the Biodiversity Report (***Appendix H***).

5.4.3.1 Overview of Habitats

Overall, the study area supports a variety of habitat types, but parts of it have historically been settled and fairly modified in the past. Currently, the study area supports the following broad habitat types:

- **Forest Areas**, mostly small remnants of the historic Zanzibar-Inhambane Undifferentiated Forest, contained in small fragments, Kayas as well as the Gongoni Forest. The latter was not surveyed but information drawn from previous surveys.
- **Wooded Grassland**, most likely a disturbed form of the historic Zanzibar-Inhambane Scrub Forests – these are areas that are largely open but have a mixture of woody tree and shrub species (mostly indigenous) present, occasionally forming bush clumps. The presence of palms is often a conspicuous feature in these areas.
- **Wetlands** along drainage lines and in shallow depressions.
- **Tree Plantations, Orchards and Shambas**, areas under cultivation, with crops including bananas, maize and others, and with varying levels of regenerated woody vegetation present.

The different habitat types are summarised in Table 5-8 below. The Site Ecological Importance (SEI), as evaluated in Section 5.4.6, is representative of the sensitivity of the habitats, and is a combination of their importance to flora, fauna and ecosystem processes.

The approximate delineation of the habitat types is shown in Figure 5.12 and Figure 5.13 below.

Table 5-8: An overview of Habitats

Vegetation Habitat	IFC Classification[1]	Site Ecological Importance	Extent (ha) in PAOI	Extent (ha) in resource area
Forest Areas	Natural and Modified, (*some* regarded as Critical)	High	175,7	34,3
Wooded Grassland	Natural and Modified	Medium	589,3	38,5
Wetlands	Natural and modified (*some* regarded as Critical)	High	1452,1	372,9
Tree Plantations, Orchards and Shambas	Modified	Low	1512,7	304,2
TOTALS			**3729,8**	**749,9**

[1] According to the IFC Performance Standard Guidance Note 6 (2019) on Biodiversity Conservation and Sustainable Management of Living Natural Resources, habitats are divided into *modified, natural, and critical. Critical habitats are a subset of modified or natural habitats.*

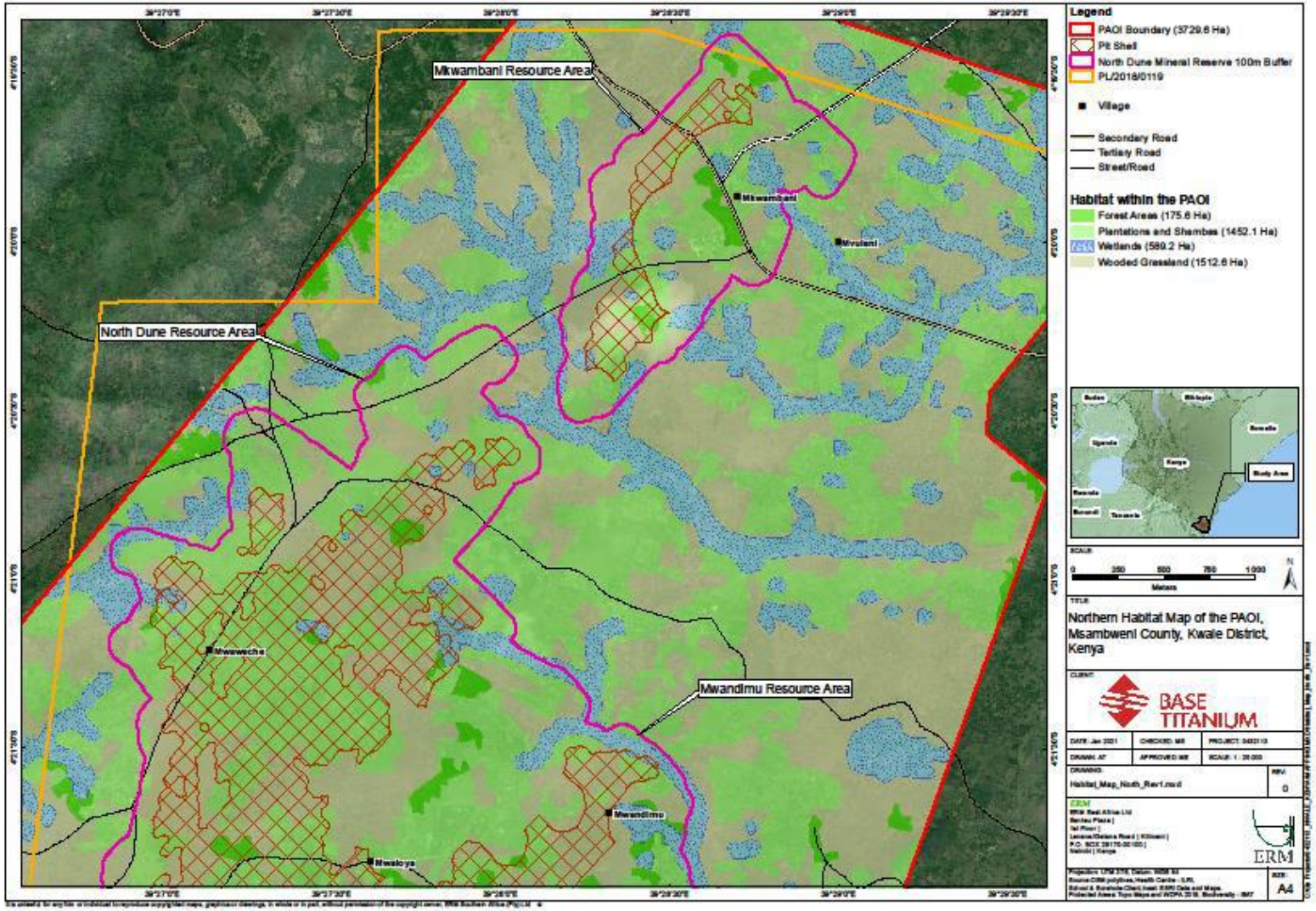


Figure 5.12: Habitats described for biodiversity in the northern Project Area

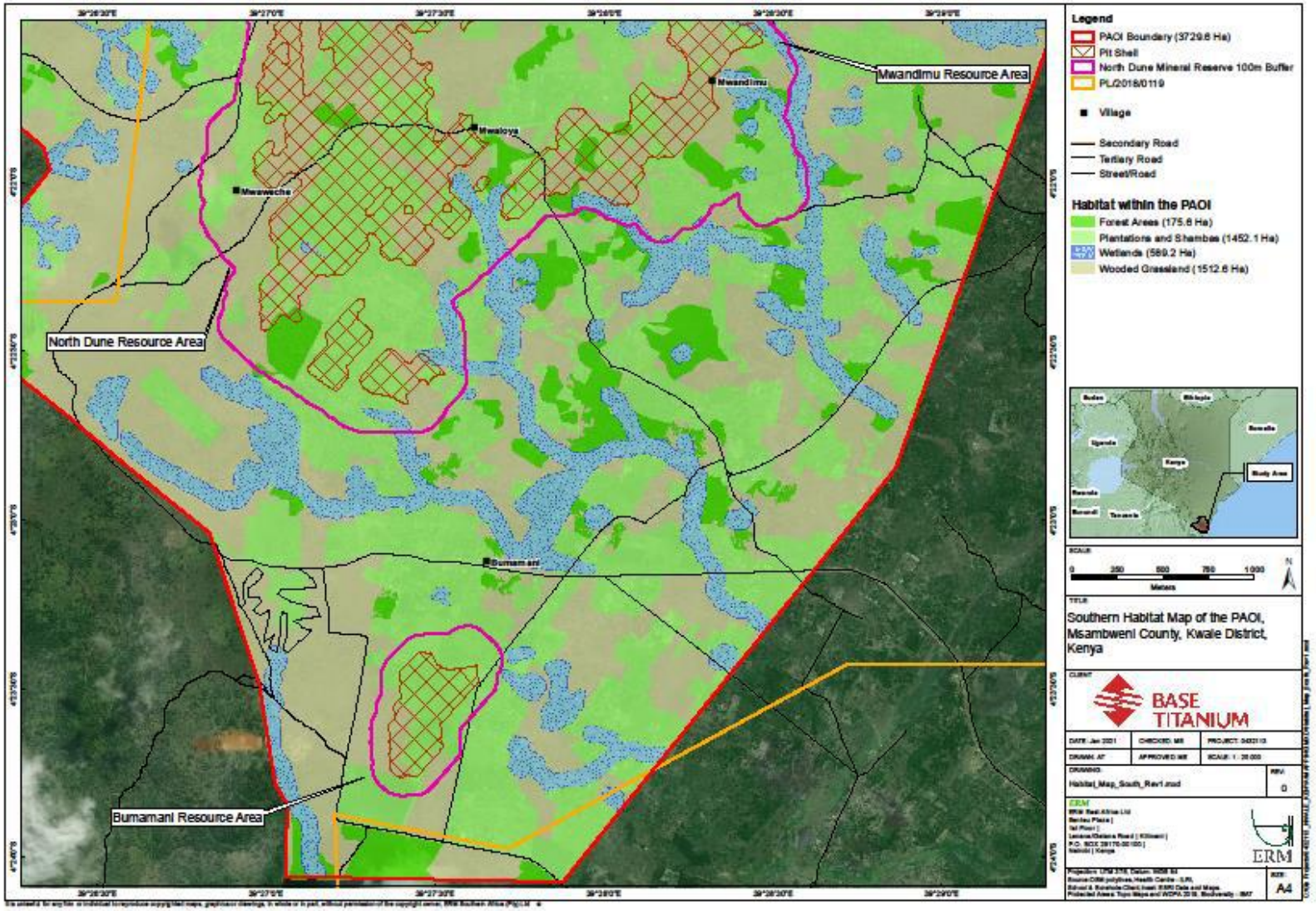


Figure 5.13: Habitats described for biodiversity in the southern Project Area

5.4.3.2 Forest Areas

Only small extents of Forest, mostly small patches of less than 5 ha, were present in the PAOI, with most around the southern (Gongoni Forest) and western periphery. Gongoni Forest Reserve was surveyed in detail prior to the present studies (Luke, 2011; Njihia et al, 2012), but although mapped is not discussed further in this document as it will not be impacted by the North-Dune Mining developments. Smaller forest patches are still maintained as traditional kayas, although even these kayas have been disturbed to some extent. There is also a patch of forest, partially secondary, that has been protected from exploitation by an individual (Daniel Mbata) for over thirty years.

In general, Forest Areas in the PAOI could be regarded as the part of the diverse of the Zanzibar-Inhambane Undifferentiated Forest. These forests generally rely on a high groundwater table and/or sufficient surface water. The main canopy reaches an average height of 15-20 m, with some emerging trees as high as 30 m.

Approximately 560 plant species (including Bryophytes, but excluding Lichen species) have been identified up to date in the Gongoni Forest (a closed canopy forest), whilst only limited data exists for the small kayas up to date. Unfortunately, these forest patches are also subject to the invasion by alien plant species, apart from other pressures such as resource harvesting and disturbances around the edges (developments and agriculture).

Table 5-9: Floristic Sensitivities of the Forest Areas

Flora Species Concerns: Forest Areas

Recorded in the area up to date:
■ 94 species endemic to the east African Coastal Forests
  ○ Of these 18 species only found in Kenya
■ Approximately 30 species that are threatened (details in Njihia et al., 2012), of which following were observed in the area investigated:
  ○ *Chytranthus obliquinervis* (VU) – Kaya Mwandimu
  ○ *Dalbergia melanoxylon* (NT, CITES II)
  ○ *Diospyros greenwayi* (VU)
  ○ *Huberantha stuhlmannii* (VU)
  ○ *Hylebates chlorochloe* (VU)
  ○ *Landolphia watsoniana* (VU) – Kaya Mwandimu
  ○ *Lannea welwitschii* var. *ciliolata* (EN) – Kaya Mwandimu
  ○ *Ochna kirkii* ssp. *multisetosa* (VU in Kenya)
  ○ *Synsepalum subverticillatum* (VU)
  ○ *Warneckea hedbergiorum* (EN in Kenya, narrow endemic)
■ Several species endemic to ecozone
■ Habitat regarded globally as Critically Endangered
■ All Kayas should be properly mapped and studied in more detail

Very often, forest patches were found to be highly disturbed due to either past logging or other direct anthropogenic impacts, or due to the edge effect, where vegetation was transitional between forest and wooded grassland vegetation. Mapping should thus be regarded as approximate only. Of particular interest floristically, as well as for faunal diversity, were not only traditional Kayas, but also forest patches around wells, springs and a particular piece of forest under the 'private guardianship' of Daniel Mbata, north of the Kidongweni Stream (near its north-western extent). This Forest Area had been protected from logging and other disturbances for over 30 years, and showed exceptional biodiversity, which should be explored further.

5.4.3.3 Wooded Grassland

The larger part of the area investigated, which had not been converted to agricultural areas (or reverted from previous agricultural areas) can be described as open wooded grasslands, in which palms, most notably *Hyphaene compressa,* are a common element. The structure of the vegetation can range from grassland-dominated areas with few larger trees or stands of palms to denser bush-clumps or thickets of variable height and composition, with patches of grassland in-between. Very often, these wooded grasslands make up narrow patches of remnant vegetation between agricultural fields, which are too small to map individually. Further, some of the areas were found to be subjected to intense grazing levels, whilst fallow lands (not being cultivated for over 5 years), had gradually returned to some form of wooded grassland.

Bush-clumps in this habitat were quite often degraded around the edges by invasion of alien plant species, most notably *Lantana camara*, *Leucaena leucocephala* and *Chromolaena odorata*. Still, threatened and or unique plant species were confirmed as present within these habitats at several locations.

Table 5-10: Floristic Sensitivities from Wooded Grassland

Flora Species Concerns: Wooded Grassland
■ Threatened species observed in the area investigated: ○ *Afrocanthium pseudoverticillatum* (VU in Kenya) ○ *Ansellia africana* (VU) ○ *Eragrostis perbella* (VU) ○ *Ficus faulkneriana* (VU) ○ *Habenaria kilimanjari* ○ *Habenaria plectromaniaca* (VU) ○ *Hibiscus greenwayi* (VU) ○ *Indigofera zanzibarica* (VU) ○ *Psydrax faulknerae* (VU) ○ *Syzygium cordatum* ssp. *shimbaensis* (EN) ○ *Warneckea hedbergorum* (EN in Kenya)
■ Several species endemic to ecozone
■ Large indigenous trees that should be retained as far as possible

5.4.3.4 Wetlands

Wetlands were found mostly along or close to larger drainage lines, localised depressions and around springs. Wetlands are most conspicuous along drainage lines, forming a series of shallow depressions and wetlands rather than continuous drainage lines due to the often sandy nature of the soils.

Within the larger ecoregions, these wetland habitats are of extreme importance to species such as amphibians, with several species having been found to inhabit only a narrow range of swamps or seasonal wetlands. The larger swamps and pans also have important ecosystem services, of which the supply of water for livestock, flood water attenuation and the gradual seepage of water into the groundwater aquifer (after pollutants are absorbed by plants) are considered the most important.

Wetland vegetation is highly variable and zoned according to the level of permanent inundation. In some riparian areas around wetland or along streams were clusters of indigenous forest patches with palms in addition to reeds, grasses, water lilies, ferns and sedges, whilst others lacked the tree-component. In many areas, the riparian fringe had been reduced by agricultural activities to a narrow bands only. Unique forbs included the Wild Ginger (*Costus afer*), which was also identified as the host plant for some Lepidoptera species.

Several of the more ephemeral wetland areas, mostly across the northern half of the PAOI, had been converted at some stage into rice paddies.

Table 5-11: Floristic Sensitivities from Wetlands

Flora Species Concerns: Wetlands
■ *Syzygium cordatum* ssp. *shimbaensis* (EN) ○ *Other threatened species expected to be found after intensive surveys* ■ Functionality and diversity may be lost if swamps become desiccated for more than two years or water levels drop significantly ■ Most species dependent on or restricted to these habitats

5.4.3.5 Plantations, Orchards and Shambas

Throughout the study area, there are orchards or larger plantations of palms, Cashew Nuts, as well as other species – most notably *Casuarina* and occasionally *Eucalyptus*. These plantations had highly varying levels of regenerated woody vegetation present, but were also subject to the invasion of alien plant species.

Considerable extents of the PAOI had been converted to agricultural cropland, which were not evaluated in detail for the botanical section (a list of cultivated crops is provided in Annex A of the Biodiversity Report (***Appendix H***)), but are still mentioned as they provide habitat for faunal species. Due to continued disturbances on and along these croplands and orchards, they provide ample opportunity for the establishment and potential further spread of undesirable alien invasive plants.

These habitats were not investigated in detail from a botanical perspective. However, it was noted that despite the extensive clearing of fields for plantations or croplands, individuals of larger indigenous tree species were often retained, of which some are threatened, for example *Syzygium cordatum* ssp. *shimbaensis* (EN), which was located in a plantation between the Kidongweni Stream and the 'Daniel Mbata' forest.

For the mapping, vegetation models derived from Lidar imagery was compared to historical imagery from 2015, onwards. Outlines of fields visible from 2015 onwards were mapped as part of this habitat type, with the understanding that some of the older fallow lands may gradually be reverting to modified woody grassland. Many of the planted trees and shrubs have also become invasive, e.g. *Leucaena* and *Sisal*.

5.4.4 Faunal Communities

Information on fauna has been derived from past baseline studies as well as monitoring studies conducted for the Kwale Mining Operations up to date, with an emphasis on rare and threatened species, as classified in the IUCN Red List. Threatened fauna mentioned below that was observed or could be present according to past surveys, monitoring and IBAT are listed in Heading 5.4.5 further below.

5.4.4.1 Herpetofauna

17 species of amphibians (only frogs, no toads), mainly observed at sites with water, and 16 species of reptiles were observed. The reptile species included 12 lizard species, 3 snake species and 1 tortoise species. In the specific villages, there were 17, 14, 21, 11 and 14 species in Mkwambani, Mwaweche, Mwaloya, Mwandimu and Bumamani respectively (Biodiversity Report, ***Annex B*** of ***Appendix H***). The species accumulation curve did not reach a peak, meaning that more species could be recorded with additional sampling. From the community interviews there were existence of Brown Spitting Cobra (*Naja*

ashei), Eastern Forest Cobra (*Naja subfulva*), African Python (*Python sebae*) and Puff Adder (*Bitis arietans*) in most of the Northern Dune areas.

In the Northern Dune sites and control sites within the mine site during the day, the most abundant species were mainly lizards. The two most commonly encountered species basking mainly on coconut and cashew nut plants were the Yellow-headed Dwarf Gecko, Lygodactylus picturatus and White-headed Dwarf Gecko, *Lygodactylus mombasicus*. These species are quite adaptable to a wide range of habitat change including any kinds of trees including coconut and cashew trees. They also make use of buildings and other infrastructures within human habitation.

At night in the wetlands the endangered Shimba Hills Reed Frog, *Hyperolius rubrovermiculatus* was encountered in all the wetlands surveyed. The other species which were relatively abundant include the Vulnerable Shimba Hills Spiny Reed Frog, *Afrixalus sylvaticus*, Mary's Reed Frog, *Hyperolius mariae* and Argus Reed Frog, *Hyperolius argus*.

5.4.4.2 Mammal Communities

Approximately 132 species of mammals have been recorded or are likely to occur in the general Kwale Mining Operations area. As with other species, coastal Kenya is poorly surveyed and most work has taken place in Shimba Hills and the Arabuko-Sokoke Forest. Most large mammal fauna are either no longer present within the project area or are confined to Shimba Hills. However, the area still supports a reasonable diversity of smaller mammals. Forty-three species were recorded in the project area during past surveys and the total species present may be as high as seventy species.

Of the species observed, of particular interest were the Black and Rufous Elephant Shrew and a Sokoke Dog Mongoose, in the Gongoni Forest. Several notable bats are known from the region. However, several are specialized cave roosters and are not expected to roost at the mine site, except for the East African Little Collared Fruit bat, which is also expected to be strongly reliant on forest areas (Harvey, 2012). Mammal groups encountered are as follows:

Elephant-shrews

Two species of elephant-shrews (an unusual group unrelated to rodents and typical shrews) were recorded. On site they will be confined to Gongoni and Buda Forests and their immediate surrounds.

Carnivores

Seven small-medium sized carnivores were confirmed on site, and others have been anecdotally reported by locals. Carnivores are cryptic and it is likely that further species are present. Even so, this represents quite a good diversity of species. Two species are associated with aquatic habitats (Marsh Mongoose and Cape Clawless Otter). Camera-trapping determined that two species Rusty-spotted Genet and African Civet are widespread across the study area. Camera traps also recorded one (African Palm Civet) that is restricted to forest and another, Sokoke Dog Mongoose, is probably reliant on forest habitats but likely moves more widely on site. Two large carnivores, Leopard and Spotted Hyaena may still be present in the study area in small numbers – Leopard may still occur in Buda and Gongoni Forests and forage elsewhere in the PAOI.

Herbivores

Six herbivores have been recorded. The presence of a small herd of African Buffalo is well known and they have been recorded widely, primarily in and around Gongoni Forest, in side valleys along the Mukurumudzi River and around the periphery of central dune. Otherwise, antelope seem to be fairly uncommon in the study area – during this recent fieldwork none were seen, except spoor in Gongoni Forest and a Bushbuck camera-trapped at Buda Forest. A single Bohor Reedbuck was recorded in a grassland area east of the main development footprint (Quentin Luke pers. comm.). It seems therefore, that overall abundance of antelope is low in the study area, possibly as a result of hunting.

Primates

Four species of monkeys are present on site, with Syke's and Angolan Colobus Monkeys confined to forested habitats, while Yellow Baboon and Vervet Monkey occur widely across the study area. Two

nocturnal primates are present, with the South Coast Galago occurring widely and the Small-eared Bushbaby more tied to areas of thicker vegetation.

Bats

Bats are expected to be fairly diverse in the region, given known distributions (IUCN 2011). Surprisingly only five species have been confirmed, all fairly widespread species in Eastern Africa. It is likely that this is a large underestimate of the true diversity, and further survey effort would probably boost the numbers in this group.

Shrews

Shrews as a group are extremely poorly known, especially so in eastern Africa (Burgess et al. 2000, Oguge et al. 2003) – in addition, the identification keys available are inadequate and species definitions and distribution not fully resolved. The identities given here are necessarily tentative. Four species were recorded. Two species, Crocidura hirta and C. fuscomurina are widespread in Africa, but C. fuscomurina was recently recorded in Kenya for the first time (Oguge et al. (2003): C. hirta has possibly not been recorded in Kenya, but several records exist in adjacent Tanzania (fieldmuseum.org 2011) and two specimens matching this species were recorded in old cashew plantations. A shrew collected in Gongoni best matches the description of Crocidura nana, known from few localities in Somalia and Tanzania. The fairly low species total per site and for the overall area matches the findings of several surveys in montane forest in south-east Kenya (Oguge et al. 2004) but, as in that study, species seemed to be segregated, with the exception of C. fuscomurina, which was collected at two locations, with each of the others being found uniquely at a single site.

Rodents

Rodents in southern Kenya are also poorly known (Canova & Fasola 2000). Eight species of small rodent (rats and mice), one porcupine and two squirrels were recorded. Grassland and savanna areas and recorded a slightly higher diversity of small rodents, than did forest (which is expected given the greater seed resources available in open habitats) and old plantation areas (five spp, three spp and two spp respectively, Most species were widespread species typical of a variety of open habitats, with the exception of one species, a Woodland Mouse Grammomys sp., which was collected in Gongoni Forest and is restricted to densely wooded habitats (Kingdon, 1984, 1997). The specimen is most similar to G. Ibeanus, which is mostly known from montane forests, how the taxonomy and distribution of this species need further investigation.

Two species of squirrel were recorded, Red Bush and Ochre Bush Squirrels, while it likely that a third species, the Zanj Sun Squirrel is also present. The two species were both recorded in Gongoni Forest. Squirrels will mostly be confined to forest patches and remnants where they remain, however, the Ochre Bush Squirrel may occur in dense woody vegetation more widely on site.

5.4.4.3 Bird Communities

From past baseline and monitoring surveys, a total of 207 bird species have been recorded within the project area. It is, however, likely that the true species richness of birds regularly inhabiting the study area is higher if compared to the IBAT count of over 450 bird species (IBAT 2020) recorded in the wider area. This is a reasonable diversity and may be due to the diversity of habitats present on and around the project area.

Overall. forested areas were of particular importance for many species and of those recorded, 42 species were considered to be partially or totally reliant on these areas. Within the Kwale Base wider area, many of forest-dependent birds were found to be confined mainly to Gongoni and Buda Forests, but some species are still present in remnants. Other important bird habitats are wetland, with 32 species reliant on wetland habitats. The remaining disturbed areas supported a mixture of widespread habitat generalists and birds typical of east African wooded savannas (Harvey 2012).

A high number of hole-nesting species (including barbets, hornbills, wood-hoopoes, Brown-headed Parrot) were common in the area, in part due to the fact that much of the woody vegetation has remained

largely unharvested for firewood, relative to much of the surrounding coastline and thus nesting and foraging opportunities for such species are good in the study area. Old cashew and oil-palm plantations and particularly cultivated areas are generally poorer in species and support only species that are generalist and very widespread (Harvey 2012).

A total of 18 avifaunal species identified are on the IUCN Red List, with several more species that are locally threatened or protected, including some species with a restricted range of occurrence (Harvey, 2012; Mulwa, 2019).

5.4.4.4 Macro-Invertebrates

A majority of the habitats visited were lentic (slow moving or stagnant). A few sites were lotic (flowing waters). Almost all habitats were marshy, covered with aquatic vegetation and were in close proximity to sources of springs. The substrate mainly comprised of was decomposed detritus mixed with silt. The predominant biotopes (micro habitats) were sand/mud and aquatic vegetation both marginal and submerged. There was near absence of stones/rocks biotope and a complete absence of gravel in the areas that were sampled.

A total of 112 different aquatic species were collected from with the Northern Dune area. A checklist and their distribution within the area are given in the Biodiversity Report (***Appendix H***), Annex C. The collection was dominated by true bugs (Hemiptera), aquatic beetles (Coleoptera) and dragonflies (Odonata). The same groups have dominated in previous surveys of the Kwale Central- and South Dune Areas. There was a noticeable near absence of mayflies (Ephemeroptera) and a low diversity and abundance of caddisflies (Trichoptera). These dominant groups, together with the lack of mayflies and low numbers of caddisflies, confirm the lack of flowing waters.

An unexpected diversity and abundance of some species of dragonflies was observed. A total of 26 species was recorded during the rapid assessment (Biodiversity Report (***Appendix H***), Annex C). This was in total contrast to other parts of the country that experience a low dragonfly season during the cold period between June and August. This finding therefore indicates that different regions in Kenya have different high and low dragonfly seasons. Dragonflies are a key group for the indication of habitat diversity and –health, and have been used to represent other aquatic groups in the same manner that butterflies represent terrestrial invertebrates

The SASS monitoring scores ranged between 42 and 82 while Average Scores per Taxa (ASPT) ranged between 4.1 to 5.1. The sites that had some level of water flow had slightly higher scores. Almost all sites were characterized by low abundances and diversity and a presence of several tolerant species such as bugs and beetles. Important micro-habitats for SASS application such as riffles due to the presence of rocks, stones or logs were unavailable. The score of 5.1 in Bumamani point 3 was reasonable and was largely due to the presence of more sensitive species.

In general, the scores were low. This can either be due habitat interference over time or the sites are not suited for SASS assessment.

5.4.4.5 Lepidoptera

A total of 158 Lepidoptera species were observed during the present survey, which are presented in the Biodiversity Report (***Appendix H***), Annex D. Of these, two species were new records for Kenya, whilst one species observed had last been recorded in Kenya 50 years ago. Whilst populations of these species could be found outside the mining resource area, some of the more suitable habitats should be retained as far as possible, as discussed further below. For several of the species, only the larvae could be observed.

Mwaloya

Three days of surveys yielded 59, 83 and 73 species respectively. No species of significance were identified.

Mwaweche

One-day survey in this area yielded 73 species, after which the area was no longer accessible to the team. In general, the species diversity was considered typical for the area.

Notable Records: Mwaweche Spring (04˚ 34175´S; 39˚ 46651´E), has a plant, *Costus afer*, a type of wild ginger, which grows in the wetland below the spring. This is a host plant for *Oberonia bueronica*, which is a new record for Kenya.

These plants were in flower and all over tropical Africa the Genus *Oboronia* breed in the flower heads. *Oboronia bueronica* was previously known only from Mozambique/Malawi/Tanzania up to the Usambara Mountains. This is a new species record for Kenya. Having understood the biology other records of *Costus afer* in the region were investigated (it is also recorded from Buda FR). One such site in Mwaloya is a Pond within Madongaweni Stream that had been dammed for cattle (04˚ 376931´ S; 39˚ 448283´ E).

The same species could be confirmed at this pond, which is outside the mining resource area, and there is thus additional habitat to which this species could migrate.

Bumamani

Surveys over this area produced an expected range of butterflies, but again a new species of butterfly to Kenya, *Ampittia parva*, known thus far only from Tanzania southwards, Usambara Mountains to the Shire River Basin in South Malawi, was observed. A small population of this butterfly was found in the swampy area (prone to flooding) in grassland at the edge of the area proposed for mining. After studying the habitat and habits of this butterfly, the Bumamani village team took us to another, similar, water source area. This was in the River (Stream) Madongaweni, to the North of the Asphalt Road going to Mine HQ. Here were strong populations of this new butterfly, and further populations were found in the Mwandimu Site along the streambank where cattle had not damaged the main water source.

Mwandimu

This area could be surveys over two days, yielding 89 and 80 species respectively. The principal zone of interest was a small Kaya of less than 2 ha, Kaya Kitsakabungo. This Kaya had been damaged for charcoal collection in the Northern Corner and did not appear to be much used, but it was a centre of high plant- and insect diversity that was not observed anywhere else in the study. Specific permission had to be obtained to enter the Kaya (the study team were not shown the point of entry and the village Chairman did not know where the entrance was so it would suggest more of ceremonial significance).

A population of the new *Ampittia parva* butterfly was also found along the stream to the East of the proposed mining site. This was a third strong population. This site was richer, attributable probably to the closer proximity to Kaya Muhaka and the Shimba Hills butterfly. Although numbers were higher at a species level, the only species of interest to be found were two Crepuscular skippers. The study team only found their larvae, as the adults move at dawn and dusk and one of these had not been seen/recorded for over 50 years (and then only once) this species. *Artitropa reducta* occurs from Usambara Mtns N.E. Tanzania to Eastern Zimbabwe. Having understood the biology and food plant the study team then found caterpillars at the ponds on the Kidongweni Stream in Mwaloya in already owned Base land.

The second butterfly of significance was found at Mukwambani: an *Acraea machequena*, which migrates from RSA through Tanzania to southern Kenya. It is very rarely seen but has been found in the Shimba Hills area.

5.4.5 Threatened Flora and Fauna

Threatened species previously recorded and that could occur in the North Dune Expansion area, which are of conservation significance[1], are listed below.

[1] Conservation Significance: species classified into the IUCN Red List categories of CR, EN, VU and NT or decresing and thus on the 'potlist' of being given a threatened status

Categories:

NT: Near Threatened
VU: Vulnerable
EN: Endangered
CR: Critically Endangered
RT: Regionally Threatened
Decr: Decreasing, may potentially become threatened

Table 5-12: Flora of Conservation Significance in the Project Area

Species	Family	IUCN	Presence
Lannea schweinfurthii var. *acutifoliolata*	Anacardiaceae	NT	Possible
Lannea welwitschii var. ciliolata	Anacardiaceae	EN	Confirmed
Huberantha stuhlmannii	Annonaceae	VU	Confirmed
Mkilua fragrans	Annonaceae	VU	Possible
Cryptolepis hypoglauca	Apocynaceae	Decr	Confirmed
Landolphia watsoniana	Apocynaceae	VU	Confirmed
Commiphora obovata	Burseraceae	NT	Possible
Hirtella zanzibarica subsp. *zanzibarica*	Chrysobalanaceae	Decr	Confirmed
Ipomoea garckeana	Convolvulaceae	VU	Possible
Diplocyclos tenuis	Cucurbitaceae	VU	Possible
Bulbostylis clarkeana	Cyperaceae	NT	Possible
Cyperus grandis	Cyperaceae	VU	Possible
Cyperus microumbellatus	Cyperaceae	CR	Possible
Diospyros greenwayi	Ebenaceae	VU	Confirmed
Dalbergia melanoxylon	Fabaceae	NT	Confirmed
Dialium holtzii	Fabaceae	VU	Possible
Erythrina sacleuxii	Fabaceae	VU	Confirmed
Galactia argentifolia	Fabaceae	NT	Confirmed
Indigofera zanzibarica	Fabaceae	VU	Confirmed
Julbernardia magnistipulata	Fabaceae	VU	Confirmed
Ormocarpum sennoides subsp. *zanzibaricum*	Fabaceae	VU	Possible
Rhynchosia congensis ssp. orientalis	Fabaceae	NT	Confirmed
Nesaea pedicellata	Lythraceae	VU	Possible
Hibiscus greenwayi	Malvaceae	VU	Confirmed
Memecylon verruculosum	Melastomataceae	VU	Possible
Warneckea hedbergorum	Melastomataceae	RT	Confirmed
Ficus faulkneriana	Moraceae	VU	Confirmed
Milicia excelsa	Moraceae	NT	Confirmed
Syzygium cordatum subsp. *shimbaensis*	Myrtaceae	EN	Confirmed
Ochna apetala	Ochnaceae	VU	Possible

Species	Family	IUCN	Presence
Ochna kirkii ssp. multisetosa	Ochnaceae	RT	Confirmed
Ansellia africana	Orchidaceae	VU	Confirmed
Habenaria plectromaniaca	Orchidaceae	VU	Confirmed
Basananthe zanzibarica	Passifloraceae	VU	Possible
Oldfieldia somalensis	Picrodendraceae	NT	Confirmed
Eragrostis perbella	Poaceae	VU	Confirmed
Hylebates chlorochloe	Poaceae	VU	Confirmed
Afrocanthium kilifiense	Rubiaceae	VU	Possible
Afrocanthium pseudoverticillatum	Rubiaceae	VU	Confirmed
Chassalia umbraticola subsp. *umbraticola*	Rubiaceae	Decr	Confirmed
Coffea sessiliflora subsp. *sessiliflora*	Rubiaceae	VU	Possible
Heinsia zanzibarica	Rubiaceae	NT	Confirmed
Keetia zanzibarica subsp. *zanzibarica*	Rubiaceae	Decr	Confirmed
Pavetta stenosepala subsp. *stenosepala*	Rubiaceae	Decr	Confirmed
Psychotria amboniana var. *amboniana*	Rubiaceae	Decr	Confirmed
Psydrax faulknerae	Rubiaceae	VU	Confirmed
Spermacoce filituba	Rubiaceae	Decr	Confirmed
Vangueria randii subsp. *acuminata*	Rubiaceae	Decr	Possible
Zanthoxylum holtzianum subsp. *holtzianum*	Rutaceae	VU	Possible
Bivinia jalbertii	Salicaceae	NT	Confirmed
Chytranthus obliquinervis	Sapindaceae	VU	Confirmed
Synsepalum subverticillatum	Sapotaceae	VU	Confirmed
Cola pseudoclavata	Sterculiaceae	Decr	Possible
Sterculia schliebenii	Sterculiaceae	VU	Possible
Synaptolepis kirkii	Thymelaeaceae	Decr	Confirmed
Grewia capitellata	Malvaceae	Decr	Confirmed
Grewia holstii	Malvaceae	Decr	Confirmed
Grewia plagiophylla	Malvaceae	Decr	Confirmed
Cyphostemma duparquetii	Vitaceae	Decr	Confirmed

Table 5-13: Herpetofauna of Conservation Significance in the Project Area

Species	Common name	IUCN	Presence
Hyperolius rubrovermiculatus	Shimba Hills Reed Frog	EN	Confirmed at 4 localities
Afrixalus sylvaticus	Shimba Hills Forest Spiny Reed Frog	VU	Confirmed at 4 localities
Boulengerula changamwensis	Changamwe Caecilian	EN	Expected

Table 5-14: Mammals of Conservation Significance possibly present in the Project Area

Species	Common name	IUCN	Presence
Bdeogale omnivora	Sokoke Dog Mongoose	VU	Likely to be largely confined to more densely vegetated areas of the study area (i.e. forest areas, primarily Buda and Gongoni), but expected to forage or move elsewhere around these areas and between such areas
Colobus angolensis	Black and White Colobus	VU	Restricted to forest habitats and dense riparian woodlands
Myonycteris relicta	East African Little Collared Fruit Bat	VU	May forage widely on site where there are fruiting trees. Probably roosts in forest in Gongoni Forest.
Panthera pardus	Leopard	VU	Possibly roaming forests and surrounding areas
Rynchocyon petersi	Black and Rufous (Zanj) Elephant Shrew	VU	Recorded in both Gongoni and Buda Forests. May utilize denser vegetation in the immediate vicinity.
Taphozous hildegardae	Hildegarde's Tomb Bat	VU	Given its reliance on caves, it may not roost on site, but may forage widely there, particularly near forest and river systems.
Aonyx capensis	African Clawless Otter	NT	Streams and wetland areas
Dendrohyrax validus	Tree Hyrax	NT	Will be restricted to forest habitats.

Table 5-15: Birds of Conservation Significance in the Project Area

Name	IUCN	Summary	Distribution within the Kwale Base Area
Amani Sunbird *Anthreptes pallidigaster*	EN	Highly localised, endemic, confine to very few fragmented forest patches in southern Kenya and northern Tanzania. Highly threatened by habitat loss	If present, would be confined to Gongoni and Buda Forests.
Sokoke Pipit *Anthus sokokensis*	EN	Highly localised, endemic, confined to fragmented forest patches in southern Kenya and northern Tanzania. Highly threatened by habitat loss. Recorded from Shimba Hills.	If present, would be confined to Gongoni and Buda Forests.
Malagasay Pond Heron *Ardeola idae*	EN	A wetland species that breeds in Madagascar and migrates to East Africa. Under severe pressure in Madagascar due to habitat loss and disturbance of nesting colonies; threats less urgent in mainland Africa	Small numbers may occasionally utilize some of the wetland areas in the study area e.g. wetland on the southern edge of Gongoni Forest, as a non-breeding winter migrant.
Spotted Ground-Thrush *Zoothera guttatus*	EN	Has a very small, highly fragmented and patchy distribution down the east coast of Africa. Highly threatened by degradation and loss of its habitat, coastal forest.	Likely to occur in Gongoni and possibly Buda Forests only.

Name	IUCN	Summary	Distribution within the Kwale Base Area
Southern Banded Snake-Eagle *Circaetus Fasciolatus*	NT	An uncommon species that occurs primarily within 20 km of the eastern Africa coast, from Somalia to northern South Africa. A forest specialist, threatened by habitat destruction	Recorded in Gongoni and Buda Forests and along the Mukurumudzi River. Likely to be largely restricted to the vicinity of areas that support forest remnants or stands of big trees, but will hunt in the vicinity of these areas.
Sooty Falcon *Falco concolor*	NT	A species that breeds in north Africa and the Middle East and migrates to East Africa and (primarily) Madagascar, where it occurs in wooded habitats, often near water. Considered to have a small, declining population, but threats are more urgent within its breeding range than in East Africa.	Recorded at Gongoni Forest and may occur in small numbers elsewhere on the site, as a non-breeding migrant.
European Roller *Coracias garrulus*	NT	Has a large global range and is a summer migrant from Europe to much of Africa where it utilises a variety of savannah-type habitats. It is undergoing a continuous population decline, but factors responsible are primarily active in Europe.	May occur in wooded grassland areas
Martial Eagle *Polemaetus Bellicosus*	NT	This species has a fairly wide distribution across sub-Saharan Africa and is found in a variety of natural habitats. It occurs at low densities and appears to be declining across much of it range.	Has been recorded at Gongoni Forest and on Southern Dune. Requires large tress for nesting but may forage widely over the area.
East Coast Akalat *Sheppardia Gunningii*	NT	A localised species with a fragmented range, occurring in three small disjunct areas of northern Mozambique, Malawi and southern Kenya-Northern Tanzania. Confined to coastal forest and threatened by habitat destruction.	May occur in Gongoni Forest and Buda Forest only.
Fischer's Turaco *Tauraco fischeri*	NT	A localised coastal endemic, from northern Tanzania to southern Somalia. Largely restricted to coastal forest and woodland but able to use degraded habitats where some natural habitat is also available.	Recorded in Gongoni and Buda Forests, along the Mukurumudzi River, within and on and adjacent to Central Dune. Appears to occur widely on site where denser, semi-natural or natural vegetation is present.
Mombasa Woodpecker *Campethera mombassica*	-	A localised endemic and forest specialist, confined to coastal Eastern Africa	Recorded in Gongoni and Buda Forests. Likely to be mostly confined to the Forests on site.
Uluguru Violet-backed Sunbird *Anthreptes Neglectus*	-	A localised endemic and forest specialist, confined to coastal Eastern Africa	Recorded in Buda and Gongoni Forests, and likely to be confined to these areas on site.
East Coast Boubou *Laniarius sublacteus*	-	A localised endemic, recently recognised as a distinct species from Tropical Boubou *Laniarius major* (Nguembock et al. 2008), confined to coastal Eastern Africa where it occurs in densely vegetated habitats	Recorded in Gongoni Forest, and along the Mukurumudzi River. Likely to occur fairly widely in the denser vegetated areas.

Name	IUCN	Summary	Distribution within the Kwale Base Area
Green Barbet *Stactolaema Olivacea*	-	Patchily distributed, forest specialist in eastern Africa.	Recorded along the larger Rivers, in Gongoni Forest. Will be confined to areas with at least remnants of natural forest.
Green Tinkerbird *Pogoniulus simplex*	-	Patchy, uncommon forest specialist in eastern Africa	Recorded in Gongoni and Buda Forests – likely to be confined to these on site.
Tiny Greenbul *Phyllestrephus Debilis*	-	patchily distributed and localised species, confined to low land forest in Eastern Africa.	Recorded from Gongoni and Buda Forests; likely to be restricted to these areas on site
Little Yellow Flycatcher *Erythrocercus Holochlorus*	-	A localised endemic and forest specialist, confined to coastal Eastern Africa	Recorded in Gongoni and Buda Forests and could possibly occur in remnant patches of forest on the Mukurumudzi River tributaries.
Fischer's Greenbul *Phyllastrephus Fischeri*	-	An East African coastal endemic, confined to forest.	Recorded in Gongoni and Buda Forests; possibly in remnant patches of forest on the Mukurumudzi River tributaries.
Short-tailed (Forest) Batis *Batis mixta*		A very localised endemic to south-eastern Kenya and north-eastern Tanzania, where it is confined to forest; populations from southern Tanzania previously lumped with this are now recognised as a different species, Dark Batis, *Batis crypta* (Fjeldsa et al. 2006).	Recorded from Gongoni and Buda Forests to which it is probably confined within the study area.

Macro-Invertebrate Critical Habitats

Habitats were considered critical if they support any of the critical species. Five (5) habitats were identified as critical within the 5 sampled villages. There was one each in Mwaweche, Mwaloya, Mwandimu and two in Bumamani village. The five were a mixed of both flowing and stagnant waters supporting a higher diversity and abundances of macro-invertebrate species. They also all had remnants of natural riverine forests and thickets that supported forest specialists such as the dancing jewel damselfly (*Platycypha caligata*) and the glistening demoiselle (*Phaon iridipennis*). These were also the same habitats where SASS monitoring was conducted to assess the quality of the water. The geo-localities of the five critical habitats are given in below:

Village	Sampling point	GPS points	
Mwaweche Spring	Point 1	37M0549826	UTM 9919090
Mwaloya	Point 1	37M0549738	UTM 9516216
Mwandimu	Point 2	37M0552794	UTM 9517616
Bumamani	Point 1	37M0551359	UTM 9515284
Bumamani	Point 3	37M0551591	UTM 9514466

Following the findings and observations on macro-invertebrates, following recommendations to cover both the Northern Dune areas and the areas already being rehabilitated are being made:

- All the critical habitats for macro-invertebrates that were identified should be preserved during the mining as they will be sources of species to re populate the rehabilitated areas after mining.
- Since all these streams were originally forested at least going by the evidence given by the few remnants, the study team recommends re-creation of the original riverine vegetation during rehabilitation, and included in the Rehabilitation Plan. This will be important especially for the shade loving species which may have disappeared with the opening of the streams. Kidongweni stream in Mwaloya village is a good reference site.
- Alternative biotic indices should be developed to monitor changes in the aquatic habitats alongside the SASS. A new method for assessing changes can be designed for use at Base Titanium limited base on observed changes in abundances and diversity. The study team also recommend the use of another simple index which uses dragonflies alone known as Dragonfly Biotic Index (DBI).
- Re-creation of mayflies and caddisfly habitats is highly recommended. It was noted that caddis and mayflies inhabited man-made habitats such as the concrete at the bridges in large numbers. Originally when the area was forested decades ago, they may have inhabited areas with sizable logs in the streams since the whole Northern Dune are has no rocks. This can be re-created for them in the areas being rehabilitated and monitoring for colonization be carried out. Since logs will easily be carried away when rivers are swollen, the study team recommend the introduction of boulders and rocks in carefully selected sites.
- Adult stages of the new caddisfly species found in Kidongweni River should be collected to facilitate its description.
- Since this was more of a rapid survey, a detail survey should be carried out for a comprehensive checklist of the area. It will be important to get the species that may have been missed during this survey. A detailed baseline will be helpful during the monitoring stage as it will confirm if species are appearing for the first time following mitigation or have been there before. Insects are known to be highly season in their activities. For instance, several dragonfly species collected before were missed and new ones recorded. Therefore, such future surveys should be done in different seasons or times of the year.

Conservation Concerns Regarding Lepidoptera

- *Oboronia bueronica*, the new species record, will have habitat outside of Mwaweche Spring. Still, it is recommended that the Mwaweche Spring Site be preserved as well as it has been used by the community for a long period and was a very pure water source.
- Kaya Kitsakabungo was found to have exceptionally high plant- and insect diversity. It is at the edge of the mine resource zone and it would be desirable to retain it.
- The Kidongweni Stream source is very important for Lepidoptera. Further important areas to target for conservation would be the Kaya at Mwandimu and the water spring at Mwaweche in the buffer zone.
- In the Mwaloya area, there is a ± 8 ha area belonging to a retired teacher, which was originally a coconut plantation that has been allowed to regrow secondary growth and is now resembling a regenerated forest. The old owner (Daniel Mbata) refuses anybody on his land (he is in his eighties). This site had the richest biodiversity in the area and is within half a kilometre of the pond on the Kidongweni Stream. The significance of this private conservation effort should be recognised and retained, and more detailed surveys conducted in this area. There are tracks on three sides of the property and it would be highly recommended to preserve this site if acquired. (1)

(1) Leaving this area (of approx. 8ha) out of the mining resource would affect approx. 100,000 tonnes of ore to be mined. According to ore reserve mapping, the top NW corner of this area (approx.. 1.8 ha) is most desirable in terms of ore concentrations.

5.4.6 Site Ecological Importance Ratings

The Sensitivity of biodiversity habitats is determined according to Site Ecological Importance (SEI). The evaluation of SEI of each collective habitat, and main reasoning for the different ratings is given below, and shown in Figure 5.14 at the end of this section.

5.4.6.1 SEI: Forest Areas (including Kayas)

Evaluation of Site Ecological Importance: Forest Areas in the PAOI (excluding Gongoni, which is known Critical Habitat)

Notes on abiotic environment: generally sandy soils, landscapes undulating, wetlands in flat areas and valley depressions common

Notes on existing disturbances and severity thereof:

- outside proposed mining footprint area edges show anthropogenic disturbances,
  - core of larger areas potentially relatively intact and functional (natural but not pristine),
- inside proposed mining footprint area anthropogenic disturbance such as selective clearing/harvesting activities and intrusion of alien invasive species evident

Conservation Importance rating is **High**:

- Any area of natural habitat of a CR ecosystem type
- Confirmed or highly likely occurrence of CR, EN, VU species that have a global Extent of Occurrence of > 10 km^2

Functional Integrity rating is **Medium**:

- >5 ha for CR ecosystem types still relatively intact
- Existing habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches

Biodiversity Importance: High

Receptor Resilience rating is **Medium**:

- Will recover slowly (~more than 10 years) to restore > 70 % of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring

Site Ecological Importance: High

Implications for mining mitigation:

1. **Avoid as far as possible: Do an accurate delineation of all remaining Kayas and other areas identified as important for biodiversity, such as Mwaweche Springs, Daniel Mbata forest that have not been officially delineated up to date**
2. Maintain a buffer of preferably 100 m around edges of forest patches
3. Only forest patches that are inside the mineral resource areas should be considered for clearing, and preferably those on the edge of resource areas to be left intact
4. Harvest areas to be cleared of all orchids and smaller indigenous plants that can be maintained in nurseries, harvest seeds for cultivation for rehabilitation
5. Relocate individuals of threatened tree species as far as this can be done with success (e.g. *Ficus faulknerae*)
6. Monitor forest patches near future mining areas for signs of degradation, and participate in/initiate community forest management and conservation programs

5.4.6.2 SEI: Wooded Grassland

Site Ecological Importance: Wooded Grassland

Notes on abiotic environment: flat to undulating environment, dominated by sandy soils on elevated ground and sandy loamy soils on low lying areas, the latter with frequent seasonal and perennial wetlands in-between

Notes on existing disturbances and severity thereof:

Site Ecological Importance: Wooded Grassland

- High presence of alien invasive plant species
- Slash- and Burn and clearing for crops and other land uses
- High levels of grazing
- Localised Excessive wood-harvesting and loss of trees

Conservation Importance rating is **High** for less disturbed Wooded Grassland patches (CR Ecosystem type) to Medium for very disturbed areas,

- Confirmed occurrence of EN and VU species that have a global Extent of Occurrence of > 10 km^2

Functional Integrity rating is **Medium**

- Good to medium habitat connectivity with potentially functional ecological corridors

Biodiversity Importance: Medium

Receptor Resilience rating is **Medium**

- Will recover slowly (~more than 10 years) to restore > 70 % of the original species composition and functionality of the receptor functionality

Site Ecological Importance: Medium

Implications for mining mitigation:

1. **Avoid less disturbed Wooded Grassland Thickets as far as possible, especially where threatened species (VU, EN) have been confirmed, or where such woodland patches are in proximity of wetland areas**
2. **Avoid clearing indigenous trees with a bole >50 cm diameter and/or a height over 8 m where such trees fall outside the mineral resource areas**
3. Harvest areas to be cleared of all orchids and indigenous geophytic plants that can be maintained in nurseries, harvest seeds for cultivation for rehabilitation
4. Relocate individuals of threatened tree species as far as this can be done with success
5. Monitor more intact woodland patches near all mined areas, and participate in/initiate community management and conservation programs, which would include reduction of alien invasive species
6. Do not use topsoil of areas heavily infested with *Leucaena* or *Lantana* for rehabilitation

5.4.6.3 SEI: Wetlands

Site Ecological Importance: Wetlands

Notes on abiotic environment: Depressed area in the general area, that allow accumulation of water. Soils are predominantly sandy-loam and/or clay.

Notes on existing disturbances and severity thereof: In the general the habitat is not suitable for most human activities especially where water cover is permanent. However, during the dry season when water level has receded, cultivation is carried out on the outskirts to tape the relatively wetter soils. Grazing of cattle and goats is also common at the edge of marshlands/wetlands.

Conservation Importance rating is **High:**

- Confirmed occurrence of EN and VU species; Presence of Range-restricted species and/or > 50 % of receptor contains sufficient natural habitat with potential to support SCC

Functional Integrity rating is **High:**

- Good habitat connectivity with potentially functional ecological corridors

Biodiversity Importance: High

Receptor Resilience rating is **Medium:**

- Will recover slowly (~more than 10 years) to restore > 70 % of the original species composition and functionality

Site Ecological Importance: High

Site Ecological Importance: Wetlands

Implications for mining mitigation:

1. **Avoid as far as possible**
2. **Always maintain the flow of larger rivers and wetland systems**
3. Maintain a buffer of preferably 100 m around edges of any perennial wetlands that do not fall within the mining resource area, and ensure no runoff from mining infrastructure/area gets into any rivers/wetlands
4. Aim to keep the vegetation within the 100 m buffer as intact as possible, or rehabilitate wooded areas, even if just by clearing alien invasive species
5. Harvest areas to be cleared of all orchids and smaller indigenous plants that can be maintained in nurseries, harvest seeds for cultivation for rehabilitation

5.4.6.4 SEI: Plantations, Orchards and Shambas

Site Ecological Importance: Plantations, Orchards and Shambas

Notes on abiotic environment: undulating environment, sandy soils

Notes on existing disturbances and severity thereof: localised heavy grazing and trampling paths, localised heavy invasion of alien invasive plants, presence of orchard remnants with bare soils underneath, partially a transition to wooded grasslands where cultivated areas are abandoned, includes settlement areas

Conservation Importance rating is **Medium**:

- Confirmed occurrence of populations of NT species, threatened species (CR, EN, VU) and which have > 10 locations or > 10 000 mature individuals

Functional Integrity rating is **Low**:

- Almost no habitat connectivity but migrations still possible across some transformed or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential

Biodiversity Importance: Low

Receptor Resilience rating is **High**

- Habitat that can recover relatively quickly (~ 5-10 years) to restore functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed

Site Ecological Importance: Very Low

Implications for mining mitigation:

1. Determine desirable land use after mining
2. Aim to minimise or altogether avoid the establishment of alien invasive species on soil stockpiles and rehabilitated areas
3. As part of rehabilitation efforts, ensure that small clumps of woodland/forest high shrub and tree species are planted into the grasslands to aid natural succession and stability of rehabilitated areas

5.4.7 Critical Habitat Assessment

The present study has shown a large degree of habitat modification and degradation, but due to the presence of species classified as VU and EN, Kayas and remnants of a Critically Endangered ecoregions (WWF), the Site Ecological Importance ratings are complemented by a Critical Habitat Assessment (CHA), based on available data (IBAT and GBIF) and survey records. In addition, areas that area currently used for rehabilitation trials were also just considered Critical Areas as disturbance or obliteration to those areas will prove a massive setback and loss of time for rehabilitation work going forward.

5.4.7.1 Area of Assessment

The scale at which a critical habitat determination occurs depends on the ecological processes occurring within the habitat under analysis, as well as potential movement or presence of highly threatened species, and is therefore not limited to the direct footprint of the Project. The Area of Assessment (AoA) may be based on the distribution of a species group, e.g. plants, or as an overall area, in which the likely ranges of movement of the most mobile of the highly threatened species present or expected to be present, in the case of this study, some herpetofauna such as the Shimba Hills Reed Frog, and plants observed. An AoA has a boundary, either ecological or political or other, within which biological communities have more in common with each other than they do with communities outside the boundary.

For the present CHA, the AoA has already been determined when the original PAOI (based on the description of the proposed mineral resource areas and existing prospecting licence area) was decided on for the field surveys. This could be confirmed during the field surveys, indicating that potential impacts of the proposed mining operations will not go beyond the PAOI.

Existing and potential future threats to the biodiversity of the PAOI identified included potential loss of individuals or small populations of threatened species and/or their habitats (which are also part of a CR ecosystem), moderate to severe pollution of rivers and/or wetlands, modification of natural rangelands to subsistence agriculture and grazing, and potential further establishment of alien invasive plant species.

5.4.7.2 Critical Habitat Assessment Outcome

Of all habitats evaluated, few remnants of Forest as well as Selected Wetlands could be classified as Critical Habitats. Most of these areas fall outside the mineral resource and assumed future mining footprint area. Overall, 12 patches were defined as Critical Habitat Patches as listed below. This excludes the No-Go areas that were not further assessed but include Gongoni Forest reserve, the Community farming trial port, and an area with a high diversity of threatened species, as well as a high number of some threatened plants, and including the sacred Kaya Mwandimu.

These areas are listed in the table below. A reference number to each of these Critical and No Go areas provide in the table below, refers to the map (Figure 5.14), which shows those areas both outside the mining resource area, and the areas within the mining resource area.

The sensitive areas within, or on the very fringes of the mining resource areas (refer to Figure 5.14) include the following:

- Ref No 1: Forest and Spring (on the fringes)
- Ref No 2: Daniel Mbata Forest (within);
- Ref No 4: Frog Swamp (on the fringes);
- Ref No 5: Frog Swamp at Mvuleni (on the fringes);
- Ref No 6: Kaya Kitsakabungo (on the fringes);
- Ref No 7: Kaya Mwandimu (within); and
- Ref No 11: Mwaweche Spring (on the fringes).

Type	Reference to Map (Figure 5.14)	Name	Locality Relative to Resource	Area (ha)
Critical Area	1	Forest and Spring	Western fringe of main resource	6,7
Critical Area	2	Daniel Mbata Forest	Southern fringe of main resource	8
Critical Area	3	Forest Patch	West of, outside main resource	4,7
Critical Area	4	Frog Swamp	Southern fringe of Mkwambani	1,9
Critical Area	5	Frog Swamp	Eastern fringe of Mkwambani	1,8
Critical Area	6	Kaya Kitsakabungo	East of, outside Mwandimu	4,8
Critical Area	7	Kaya Mwandimu	Eastern fringe of Mwandimu	2,4
Critical Area	8	Kidongweni Wetland System East	East of, outside main resource	26,3
Critical Area	9	Kidongweni Wetland System West	South of, outside main resource	17,9
Critical Area	10	Mwalimchano Kaya	West of, outside Bumamani	2,2
Critical Area	11	Mwaweche Spring	Between, outside Main & Mkwambani	0,5
Critical Area	12	Swamp Bumamani East	East of, outside Bumamani	5,7
No-Go	13	Sensitive Area in and around Kaya Mwandimu	Eastern fringe & east of Mwandimu	23,2
No-Go	14	Community Farming Trial Plot	South of, outside main resource	44,1
No-Go	15	Gongoni Forest	South of, outside Bumamani	11,6

The CHA and relevant justification for the assessments are indicated in Table 5-16.

These areas are also mapped in Figure 5.14.

Table 5-16: Critical Habitat Assessment Table

Potential Triggering Species/ Site	Criterion 1 CR/ EN Species (IUCN)	Criterion 2 Endemic and Range Restricted Species	Criterion 3 Migratory- and/ or Congregatory Species	Criterion 4 Highly Threatened /Unique Ecosystems	Criterion 5 Key Evolutionary Processes	Location within Project Area /Habitat Recorded/ or Potentially occurring	Rationale for decision on CH triggers ✓or ✖
SPECIES							
FLORA							
Lannea welwitschii var. ciliolata Tree	✓ EN (IUCN)	✖ Found only in Kenya and E-Tanzania and possibly Mozambique	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Confirmed in Kaya Mwandimu; Forest species, but it can occur in degraded forests	Found only in Kenya and E-Tanzania, presence in PAOI forest remnants such as Kayas
Syzygium cordatum ssp. shimbaensis Tree	✓ EN (IUCN)	✖ Found only in Kenya and E-Tanzania and possibly Mozambique	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Confirmed in Kaya Mwandimu Prefers riverine forest	Found only in Kenya and E-Tanzania, presence in PAOI forest remnants, Limited habitat remaining
Ficus faulkneriana Tree	✖ VU (IUCN) CH Thresholds a), b) and c) do not apply.	✖ Less than 10% of the global population estimated	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Confirmed; Found in coastal woodland and wooded grassland. Strangler fig epiphytic on Hyphaene	One area west of Kaya Mwadimu has numerous specimens of this species, and this number of trees, as well as the proximity to the Kaya and nearby wetland area was the reason why this selected area should be regarded critical habitat (and should undergo rehabilitation)
Psydrax faulknerae Tree	✖ VU (IUCN)	û Less than 10% of the global	û N/A	✓ CR Northern Zanzibar-	û	Confirmed, west of Kaya Mwadimu	One area west of Kaya Mwadimu has numerous specimens of this species, and

Potential Triggering Species/ Site	Criterion 1 CR/ EN Species (IUCN)	Criterion 2 Endemic and Range Restricted Species	Criterion 3 Migratory- and/ or Congregatory Species	Criterion 4 Highly Threatened /Unique Ecosystems	Criterion 5 Key Evolutionary Processes	Location within Project Area /Habitat Recorded/ or Potentially occurring	Rationale for decision on CH triggers ✓ or ✗
	CH Thresholds a), b) and c) do not apply.	population estimated		Inhambane Coastal Forest Mosaic ecoregion		Dry coastal forest or thicket	this number of trees, as well as the proximity to the Kaya and nearby wetland area was considered to be reason why this selected area should be regarded critical habitat (and should undergo rehabilitation)
Landolphia watsoniana Tree	✗ VU (IUCN) CH Thresholds a), b) and c) do not apply.	✗ Less than 10% of the global population estimated	✗ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✗	Confirmed in Kaya Mwadimu, This species is restricted to coastal gallery forest.	Dry coastal forest. Possibly present in PAOI, but potentially absent from proposed mining footprint, could be indirectly impacted. Narrow Distribution.
Huberantha stuhlmannii Shrub	✗ VU (IUCN) CH Thresholds a), b) and c) do not apply.	✗ Found only in SE Kenya and NE-Tanzania Less than 10% of the global population estimated	✗ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✗	Observed in forest patch on western periphery of PAOI	Grows in moist and dry coastal forests. It is also found in thickets and in coastal *Hyphaene* woodlands. Continued decline in suitable area, as well as restricted range of occurrence used for CHA
Diospyros greenwayi Shrub or Tree	✗ VU (IUCN) CH Thresholds a), b) and c) do not apply.	✗ Less than 10% of the global population estimated	✗ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✗	Observed in forest patch on western periphery of PAOI	Confined to remaining patches of forest. Continued decline in suitable area, as well as restricted range of occurrence used for CHA.

HERPETOFAUNA

Potential Triggering Species/ Site	Criterion 1 CR/ EN Species (IUCN)	Criterion 2 Endemic and Range Restricted Species	Criterion 3 Migratory- and/ or Congregatory Species	Criterion 4 Highly Threatened /Unique Ecosystems	Criterion 5 Key Evolutionary Processes	Location within Project Area /Habitat Recorded/ or Potentially occurring	Rationale for decision on CH triggers ✓ or ✖
Hyperolius rubrovermiculatus Shimba Hills Reed Frog	✓ EN (IUCN)	✓ Only found in Shimba Hills and a small area east of that	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Confirmed at 4 wetland localities within the PAOI;	It occurs in a *mosaic of moist coastal forest and densely vegetated wetlands* (including moderately degraded former forest) where it breeds by larval development, Highly restricted Area of occurrence and continued loss of or decline of suitable habitat
Afrixalus sylvaticus Shimba Hills Spiny Reed Frog	✓ VU (IUCN)	✓ Found only in SE Kenya and NE-Tanzania	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Confirmed at 4 wetland localities within the PAOI;	Species *of lowland forest* that can survive in secondary growth and plantations, but not in completely degraded habitats. It breeds in temporary pools and water-filled depressions in forest. Limited Area of occurrence and continued loss of or decline of suitable habitat
Boulengerula changamwensis Changamwensis African Caecilian	✓ EN (IUCN)	✓ Found only in SE Kenya from Mombasa southwards	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Confirmed previously in the Kwale Area, expected to be present in the PAOI	Soil-dwelling species *of lowland moist forest*. It has also been found in agricultural areas within stream valleys in the plantations of coconut palms, banana and cashew nuts.

AVES

Historically some threatened birds have been observed within the PAOI. However, none of these are restricted to the natural habitats within the PAOI, and no direct impacts on any threatened birds are expected from the mining activities.

MAMMALIA

Historically some threatened birds have been observed within the PAOI. However, none of these are restricted to the natural habitats within the PAOI, and no direct impacts on any threatened birds are expected from the mining activities.

Potential Triggering Species/ Site	Criterion 1 CR/ EN Species (IUCN)	Criterion 2 Endemic and Range Restricted Species	Criterion 3 Migratory- and/ or Congregatory Species	Criterion 4 Highly Threatened /Unique Ecosystems	Criterion 5 Key Evolutionary Processes	Location within Project Area /Habitat Recorded/ or Potentially occurring	Rationale for decision on CH triggers ✓ or ✖
ECOSYSTEMS							
Coastal Forest	✖	✖	✖	✓ Remaining extents of this habitat are currently listed as CR This habitat within the PAOI is no longer in a pristine condition.	✓ This habitat provides wildlife connectivity and suitable habitat for several confirmed EN and VU species	Mostly Restricted to Kayas, secondary forest with very high biodiversity as well as the Gongoni Forest. Note: some of the forest areas are included as part of the wetland systems below Kaya and Forest Areas: ■ Kaya Kitsakabungo ■ Kaya Mwadimu and small area west/north west of it ■ Swampy area about 650 m east of Bumamani resource ■ Mwalimchano Kaya ■ Forest patches along the western periphery of the PAOI (200 m and more outside the main resource area) ■ "Daniel Mbata" Forest	The WWF delineates the PAOI as Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion, with existing small remnants of Coastal Forest considered under severe threat. Total estimated extent of coastal forest across its range: 2500 km^2
Selected Wetlands such as Kidongweni	✖	✖	✖	✓ Remaining extents are currently listed as CR.	✓ This habitat provides wildlife connectivity and suitable habitat for several	Selected wetland and spring areas identified as habitat for EN and VU species: ■ Kidongweni Wetland System	These wetlands are not only part of the functional ecosystem and supporting lower-lying forest areas, they are also confirmed habitats of EN and VU species

Potential Triggering Species/ Site	Criterion 1 CR/ EN Species (IUCN)	Criterion 2 Endemic and Range Restricted Species	Criterion 3 Migratory- and/ or Congregatory Species	Criterion 4 Highly Threatened /Unique Ecosystems	Criterion 5 Key Evolutionary Processes	Location within Project Area /Habitat Recorded/ or Potentially occurring	Rationale for decision on CH triggers ✓ or ✖
					confirmed EN and VU species	■ Swampy area about 650m east of Bumamani resource ■ Wetland about 300m east of the northern extent of the main resource area ■ Mwaweche Spring ■ Wetland area between Mkwambani Resource and Mvuleni	that are dependent on such habitats.

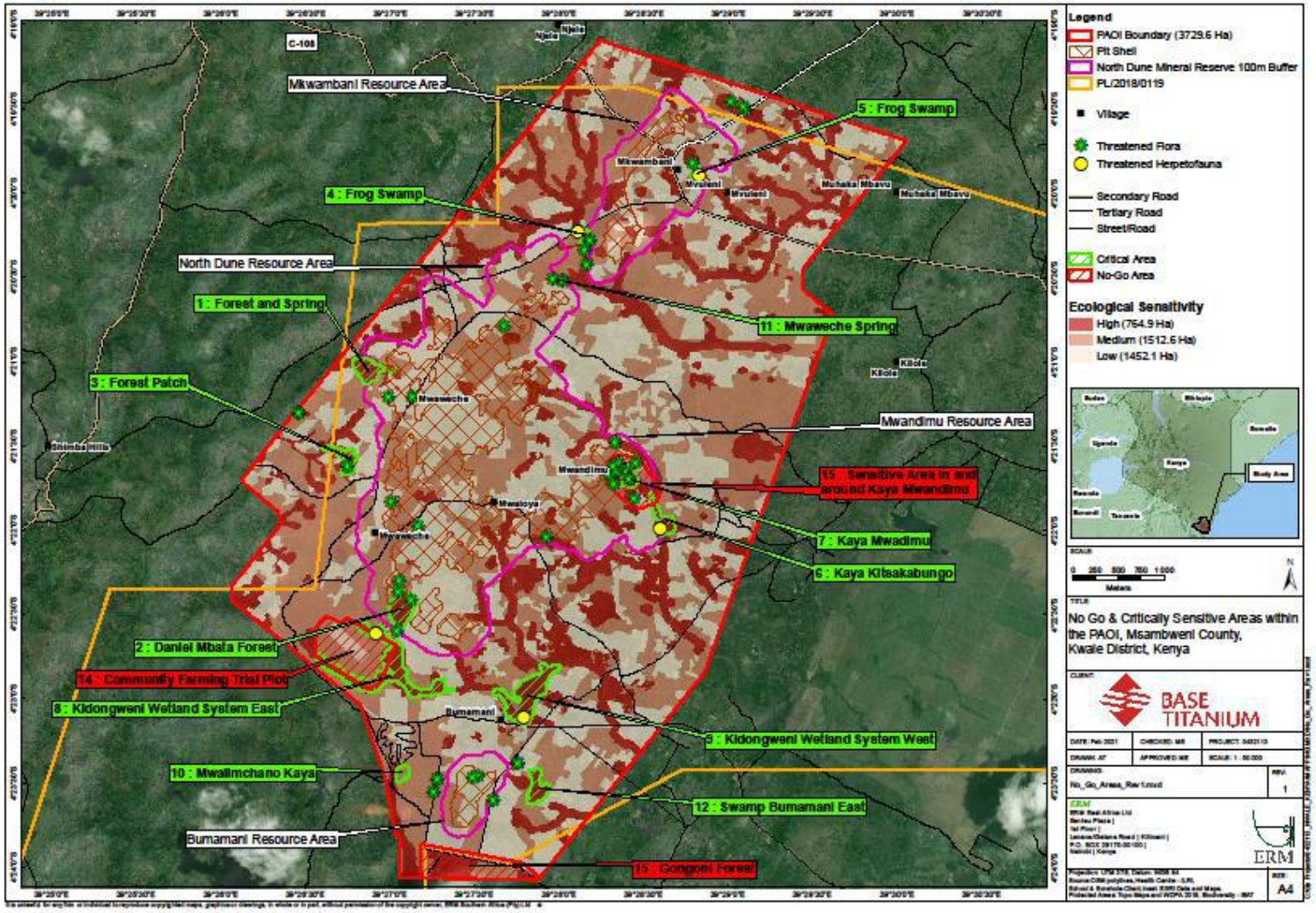


Figure 5.14: Site Ecological Importance and Critical Habitats in the northern PAOI

5.4.8 Summary of Key Biodiversity Sensitivities

Key biodiversity sensitivities are provided in Box 5-2.

Box 5-2: Key Biodiversity Sensitivities

- Kwale and surrounding areas lie within the Swahili Centre of Endemism, also referred to as the East African Coastal Forest Hotspot, known for its very high biodiversity of flora and fauna of over 6000 documented species. High species diversity and endemism are specifically found in the remnant natural habitats - present within the Project Area and wider Area of Influence, e.g. the Gongoni Forest Reserve and Kidongweni Wetlands.
- It is the presence of range-restricted and habitat-specific species, as well as unique and important ecosystem functions that has contributed to the identification of Critical Habitats being present. Habitats were considered critical if they support any of the critical species. Of all habitats evaluated, few remnants of Forest as well as Selected Wetlands can be classified as Critical Habitats.
- Natural habitats, especially small forest patches, are highly threatened in coastal Kenya. This threat comes primarily from an increase in coastal populations, conversion to agricultural land, and various forms of extraction operations, including mining. Accordingly, the WWF classifies this ecoregion as having a Critically Endangered Status.
- Only small extents of Forest, mostly small patches of less than 5 ha, were present in the PAOI, with most around the southern (Gongoni Forest) and western periphery.
- Approximately 560 plant species (including Bryophytes, but excluding Lichen species) have been identified up to date in the Gongoni Forest (a closed canopy forest), whilst only limited data exists for the small kayas up to date.
- Approximately 132 species of mammals have been recorded or are likely to occur in the general Kwale Mining Operations area. Most large mammal fauna are, however either no longer present within the project area or are confined to Shimba Hills. However, the area still supports a reasonable diversity of smaller mammals.
- No Go and critical areas are indicated in the maps provided. The sensitive areas within, or on the very fringes of the mining resource areas (refer to Figure 5.14) include the following:

  Ref No 1: Forest and Spring (on the fringes)
  Ref No 2: Daniel Mbata Forest (within);
  Ref No 4: Frog Swamp (on the fringes);
  Ref No 5: Frog Swamp at Mvuleni (on the fringes);
  Ref No 6: Kaya Kitsakabungo (on the fringes);
  Ref No 7: Kaya Mwandimu (within); and
  Ref No 11: Mwaweche Spring (on the fringes).

5.5 Socioeconomic Baseline

5.5.1 Administrative Context

The proposed Project is predominately located in the Msambweni Sub-County (Figure 5.15). However, a small portion of the Project Prospecting License (PL0119) extends into the neighbouring Matuga Sub-County. Msambweni and Matuga are two of the four sub-counties that make up the larger Kwale County.

At the local level, the proposed Project directly intersects with the Mkwambani, Mwandimu, Mwaweche, Mwaloya, and Bumamani Villages.

Under the policy of devolution, the Kwale County is a primary local administrative body that is constituted of a County assembly, County Executive and Country Service Board. The responsibilities of the County Assembly include exercising executive power, implementing laws for the administration of the county as well as carrying out other executive functions at the county level. The functions of the county government also include the development of (1) agriculture, (2) health services, (3) environmental protection, (5) cultural activities, (6) transport, (7) education etc. as well as implementation of national policies at the county level.

Sub-counties are the decentralised units through which the Kwale County is able to provide localised functions and services. A sub-county is headed by the sub-county administrator that is responsible for the general administrative functions at the sub-county level. Responsibilities also include (1) the development of policies and plans, (2) service delivery, (3) development activities, (4) provision and maintenance of infrastructure and facilities of public services, (5) and any other responsibilities delegated by the County government.

Sub-Counties are further divided into Village Units, and in the context of this Project there are 5 Villages that are potentially affected (as listed above). The village unit is the most localised level of administration and is headed by the Village Administrator and Village Council. The Administrator and Council report to the relevant County Ward Administrator.

The above structure reflects to the formal administrative context, however it is further supported and integrated with local traditional (customary) leadership structures. Villages or areas are administered by Chiefs who are in turn assisted in their duties by Assistant Chiefs, the Village Administrator and Village Council. These duties may include general administration, the management of land issues and disputes, the maintenance of law and order, and the development and implementation of education, agriculture, and health and sanitation initiatives within the locations under their administration. The role of Chiefs has however been contested since the restructuring and devolution of administrative duties in Kenya since 2010.

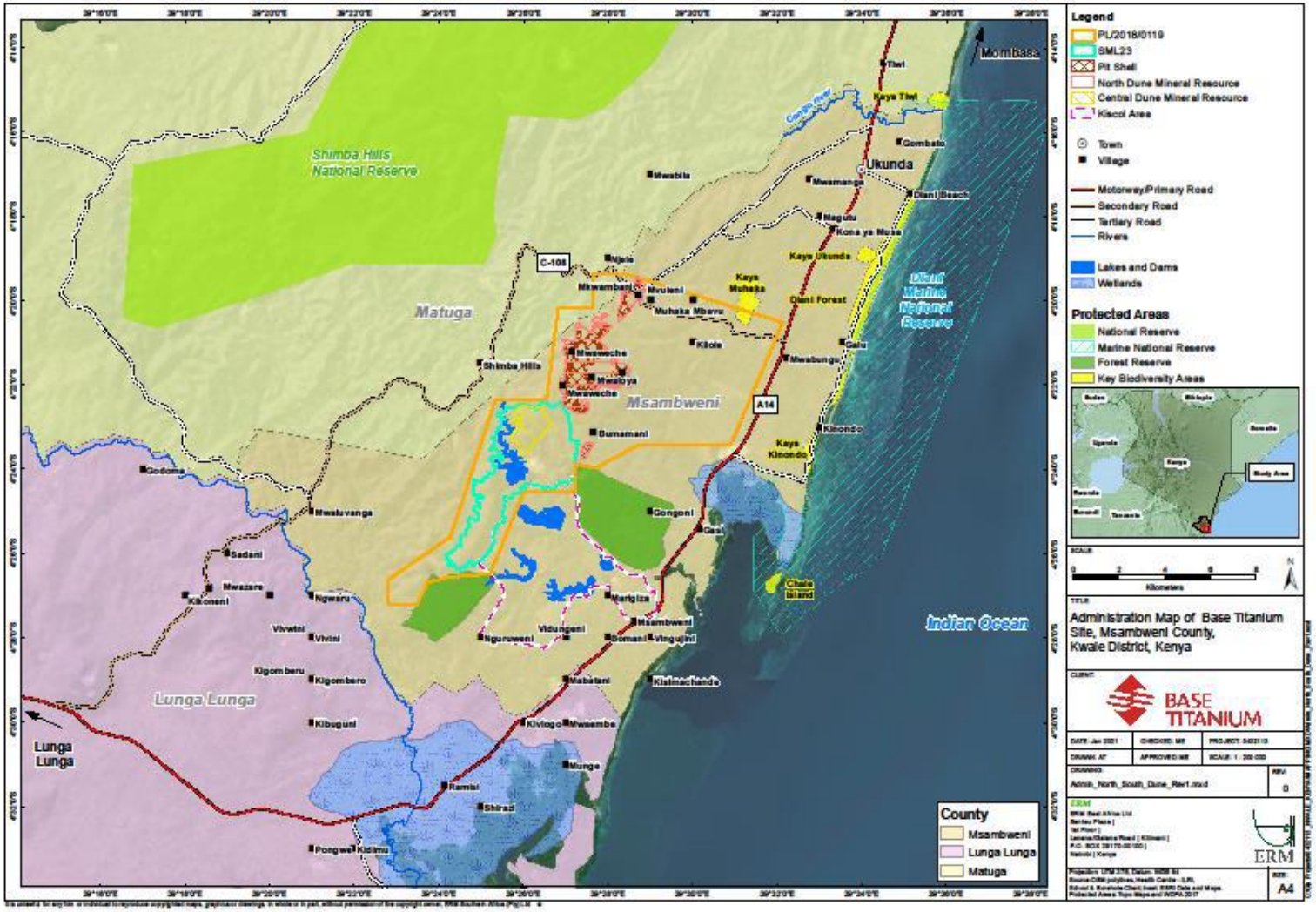


Figure 5.15: Administration Map of Kwale Mineral Sands Operational Area, Msambweni County, Kwale District

5.5.2 Housing Arrangements and Settlement Patterns

The Project covers an area of approximately 750 hectares that supports scattered rural farmsteads (Figure 5.16) with no appreciable clustering of households to form any proper village. However, there is generally a village centre that supports schools, shops, community facilities and meeting points that is accessed by local households of that village. It is estimated that the Project area will directly affect 189 households, based on mapping of 623 individual structures using satellite imagery of an area covering the North Dune Resource Area plus a 100-metre buffer, and an assumption that local households retain an average of 3.3 structures.

In most part, households are established on their respective farm-holdings thus allowing households to undertake small-scale farming without the requirement to travel to their farm twice daily. While such farmsteads are relatively isolated, there is likely to be strong dependencies on neighbouring households, local family members as well as the village centre in terms of accessing community resources and support.

Local farmsteads retain a strong reliance on tenants, with the household survey showing that 66% of local households can be expected to be permanently occupied by the owner, while the remaining 34% are occupied by tenants. The latter group generally have verbal permission from the farmstead owner, while only 4% of the surveyed households did not have any form of permission.

The tenant however are close family relations to the farm owner, therefore their relationships are closer that what is immediately apparent. As shown in Table 5-17, farms permanently occupied by the owners are mostly comprised of a single-family (67% of surveyed household), while the tenant households are nearly exclusively made of extended family members (31.4% of households).

Table 5-17: Living Arrangements

Living Arrangements	Percent of Households
Borrowing / Caretaking / Renting homestead	0.8
Extended family living in a compound	25.8
Extended family living in a single house	5.6
Single family living in a compound	46.8
Single Family living in a single house	21.0

Source: Household Socio-Economic Survey, 2020

In summary, the general living arrangements can be defined by two major groups. First are households that own and permanently reside on their farmstead and this group is mostly comprised of single families. The second group comprises of extended family members residing on the farmstead owned by another family member. They are in essentially tenants that reside on the farmstead with permission from the owner.

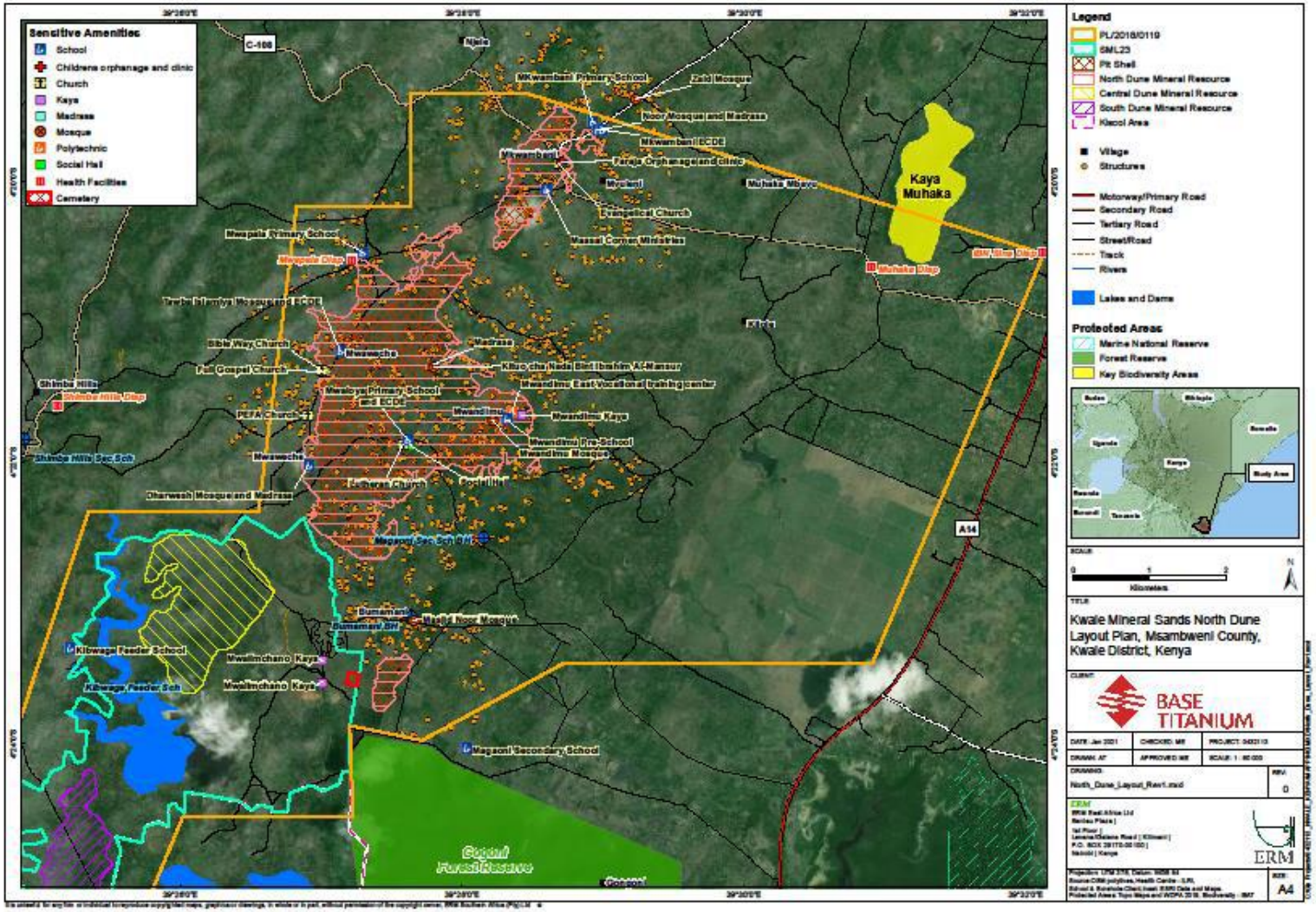


Figure 5.16: Kwale Mineral Sands North Dune Layout Plan, displaying the distribution of structures and amenities

5.5.3 Population Profile

5.5.3.1 Household Structure

The typical farmstead or household is largely comprised of a single nuclear family, with an average household size of 8.3 persons for the surveyed households. This number is high by most international standards and is typical of rapidly growing developing countries with high population growth rates. The household size ranged from a single individual to a household of 18 people. An analysis by ethnic group showed that those who reported as belonging to the Digo ethnic group were most likely to be larger household groupings (9.0 members) as opposed to the Kamba ethnic group (5.7 members).

The generationally extended *nuclear family* comprises of the father as household head, female spouse(s), an average of 3.5 children and a high proportion of grandchildren. This group cover 80% of the total surveyed population, while the remaining 20% of the population is largely made up of extended family relations[1]. This is set out in Table 5-18.

Among the population surveyed the results for marital status of those 18 years or older are set out in Table 5-19. Among the households surveyed 12.8% were those that were part of a polygamous relationship. Significantly more males are single than females.

Table 5-18: Relations Profile

Relationship to Household Head	Percent of Total Population	
	Male	Female
Household Head (HH)	7.8	2.2
Spouse of HH	1.1	8.8
Son/Daughter of HH	23.5	19.5
Grandchild of HH	9.2	7.4
Grandparents of HH	0.1	0.1
Brother/Sister of HH	1.9	2.0
Nephew/Niece of HH	1.3	1.7
Adopted/Foster/Stepchild	0.5	0.4
Brother/sister-in-law of HH	0.0	1.1
Cousin of HH	0.4	0.6
Friend of HH	0.2	0.2
Not related but dependent	1.9	0.8
Other relative	0.2	0.4
Parent of HH	0.6	1.0
Parent-in-law of HH	0.0	0.1
Son/Daughter-in-law of HH	2.7	2.8

Source: Household Socio-Economic Survey, 2020

[1] Son/Daughter-in-law, Brother/Sisters, Nephew/Nieces, Parents, Brother/sister-in-law.

Table 5-19: Marital Status of Adult Population

Marital Status	Percent of Total Population	
	Male	Female
Cohabitant	0	0.3
Divorced	0.3	1.6
Married	59.1	60.9
Separated	0.3	3.9
Single / Unmarried	38.2	24.0
Widow (er)	2.0	9.2
Total	**100.0**	**100.0**

Source: Household Socio-Economic Survey, 2020

5.5.3.2 Population Demographics

The total population of the Kwale County is estimated at 866,820 in 2019 and reside in a total of 173,176 households (Kenya National Bureau of Statistics, 2020). This results in an average household size of 5 persons per household. As indicated the Project affected have a much larger average household size, which is likely related to ethnic background and presence of extended family members common for rural farmsteads when compared to urban households.

The 2019 Kwale population (Kenya National Bureau of Statistics, 2020) comprises of an estimated 425,121 males and 441,681 females, or a gender ratio of 0.96 males to every 1 female. This indicates a general balance between both genders and further suggests a large stable country population. This is further reflected in Table 5-20 which shows that the gender balance is largely consistent across all age groups in the 2019 population. The only exception is a higher number of females between 20 to 34 years of age when compared to males, which is likely attributed to outward movements of young males towards urban centres.

Overall, the Kwale County population is young with 45% of all people in 2019 being aged 15 years and below. Combined with persons above the age of 64 years of age (3.5% of the total population), just under half (49%) of the county population that is economically inactive. This results in an overall dependency ratio of 48.4 – or where half of the county population is dependent on the economic productivity of the remaining (largely young adult and adult) population.

Table 5-20: Age and Gender Profile of the Kwale County Population in 2019

Age Group	Percent of Total County Population		
	Male	Female	Total
0 to 4	7.6	7.5	15.0
5 to 9	7.7	7.5	15.2
10 to 14	7.3	7.2	14.5
15 to 19	5.7	5.5	11.2
20 to 24	3.8	4.5	8.3
25 to 29	3.3	4.0	7.2
30 to 34	2.9	3.5	6.4
35 to 39	2.2	2.4	4.6
40 to 44	2.1	2.3	4.4

45 to 49	1.7	1.6	3.3
50 to 54	1.2	1.0	2.2
55 to 59	1.0	0.9	1.9
60 to 64	0.9	1.1	2.0
Above 64	1.8	2.0	3.8
Total	**49.0**	**51.0**	**100.0**

Source: (Kenya National Bureau of Statistics, 2020)

The dependency ratio is further reflected in the county labour profile (Kenya National Bureau of Statistics, 2020). Of the total 2019 population, 44% of males and 47% of females claimed to be economically active, while the remaining population is either outside the labour force (i.e. economically inactive) or are actively seeking work. The bulk of economic activity is however centred on small-scale agriculture and livestock production, rather than formal employment.

While there are some parallels between the overall Kwale County population demographic profile and the surveyed population there are some marked differences as well (see Table 5-21). The most notable is that the gender ratio is reversed with the female population slightly outnumbered by males in the Project affected area. The age profile is also somewhat different, and while 44.7% of the Kwale population is represented in the 0-14-year age bracket, the Project affected population is comprised of a lower 36.9% in the age group to 15 years. The Project affected population as such slightly older than the general Kwale average and is potentially representative of a more stable and somewhat wealthier aggregation than the average for the Kwale County.

Table 5-21: Age and Gender Profile of the Surveyed

Age Group	Percent of Total Surveyed Population		
	Male	**Female**	**Total**
0 to 5	5.4	5.6	11.1
6 to 10	8.7	5.0	13.7
11 to 15	6.1	5.9	12.1
16 to 20	6.5	6.1	12.6
21 to 25	5.7	3.3	9.0
25 to 30	3.3	6.6	9.9
31 to 35	2.9	3.1	6.0
36 to 40	2.8	2.7	5.5
41 to 45	1.6	2.5	4.1
46 to 50	1.9	2.3	4.3
51 to 55	1.1	1.0	2.0
56 to 60	2.0	1.2	3.2
61 to 65	1.7	1.2	2.9
56+	1.6	1.9	3.5
Total	**51.5**	**48.5**	**100.0**

Source: Household Socio-Economic Survey, 2020

5.5.3.3 Education

The ability to access formal employment is strongly determined by the level of education reached by the local population. Of the total Kwale population age, the majority (62%) reach a maximum education level of primary school only, with only 16% carrying on completing secondary school. This suggests that there is a natural cap for most households at the end of primary school which is expected as primary school is both free and compulsory in Kenya. Secondary education (in the context of government schools) is free by not compulsory.

The household socio-economic survey (see Table 5-22) shows that educational achievement of adults is similarly capped at primary school – with 77% of the survey population reaching only primary school. This is substantially lower that the Kwale population and interviews suggests this is related to limited access to education for rural areas, as well as general education and transport costs.

Table 5-22: Maximum Level of Education (Persons Above the Age of 18)

Maximum Level of Education	Percent of Adult Population		
	Male	Female	Total
None / No education	6.8	13.5	20.3
Post School / Tertiary	2.3	2.3	4.7
Pre-School	9.5	10.6	20.1
Primary School	21.3	16.0	37.3
Secondary School	9.3	8.3	17.6

Source: Household Socio-Economic Survey, 2020

School enrolment figures by gender are set out in Table 5-23 for those in the surveyed population that were of school going age i.e. 6 years to 18 years. School participation rates are relatively high and largely consistent between the genders.

Table 5-23: Child Schooling Enrolment Rates

Enrolment Status	Percent of Children of School Going Age		
	Male	Female	Total
No	4.7	2.3	7.0
Yes	50.8	41.5	92.4
Complete	0.3	0.3	0.7

Source: Household Socio-Economic Survey, 2020

5.5.3.4 Religious and Ethno-Linguistic Profile

Religious and cultural practices are closely tied to ethnicity for local households. Broadly, local communities in the Kwale District are largely divided into the majority Muslim (60% of County population and 76% of surveyed households) and Christian (36% of the County population and 23% of surveyed households) in 2019 (Kenya National Bureau of Statistics, 2020).

The County is largely populated by the Digo and Duruma, which fall under the Mijikenda ethnic group of coastal Kenya. Other major local ethnic groups include the Kambas. The Mijikenda, the name itself meaning "the nine kaya" or nine towns, who are viewed as the original settlers in Kwale County and Coast Province. Unlike other Mijikenda peoples, the local Digo group are predominately Muslim, and their desire and ability to retain both Mijikenda and Islamic identity is unique among the Mijikenda.

Table 5-24: Ethnic Profile

Ethnic Group	Percent
Digo	60.5
Duruma	16.9
Kambas	12.1
Other*	10.5

** Luhya, Taita, Chonyi, Girima, Iteso, Jibana, Kikuyu, Luiya, Luo, Rabai, Swahili*

Source: Household Socio-Economic Survey, 2020

The Kamba ethnic group is the largest ethnic group in Kenya, and also have a substantive presence in the Kwale County. Traditionally among the Kamba the clan is the main social unit in terms of access to the land and provides for the livelihood and security of its members, in contrast to the Digo that function primarily at the household.

Locally, the Digo and Kamba live alongside one another in the same villages despite having no specific or traditional clan affiliation. There has been recent history of tensions between the two groups, likely driven by a complex interplay of local politics as well as ongoing disputes around land and land tenure reform.

Most of the culturally important, sacred, and historical heritage sites in the Kwale County are likely to consist of mosque ruins, palaces, houses and walls with gates and tombs, and "Kaya" or sacred forests linked to the Digo. Existing and active churches, mosques, and religious schools (Madrasa) will also have local cultural value as well as strong social ties with local households.

The main language of the surveyed households is Swahili (83% of households), while Digo is the second most common language (15% of households) and Duruma, English and Kamba are more minor languages spoken (2.4%).

5.5.4 Land Use & Land Tenure

Local land ownership and land tenure rights is complex and has been influenced by various systems of land rights over time. Under the Constitution of 2010 (Article 61), land rights are divided into either (1) public (or state) land held in trust by the Government, (2) community land that is lawfully held, managed or used by specific communities, and (3) private land held by any persons under freehold or leasehold tenure. Customary land rights are also recognised under private land, but only where it is consistent with the Constitution.

Adding to the local complexity in terms of land ownership has been the changing land ownership and administration schemes in the area. Most of the Project land was owned by Ramisi Sugar between the 1920s to 1980s when the land was seized by the financial institution to which Ramisi Sugar defaulted on a loan. The Government took ownership of the land in 2007 with the special mining license being granted to Base.

The land tenure arrangement of local households was profiled as part of the Household Socio-Economic Survey (see Table 5-25). The majority of household (79%) claim to hold their land under private title, while a significant portion (17% of land) was granted via government allotments. Only 6.5% of the land was granted via customary means.

Table 5-25: Claimed Property Ownership Status

Land Ownership Status	Percent of Claimed Plots
Plot with Title Deed	78.6

Allotment	17.2
Plot with Customary Approval	6.5
Plot with Signed Rental Agreement	1.2

Source: Household Socio-Economic Survey, 2020

The primary function of all plots claimed by the surveyed households is set out in

Table 5-26. It is dominated by crop farmland (85% of all claimed land) which normally support both farmland and the farmstead on the same property. As such, there are limited properties that are solely designated as residential land (3% of surveyed properties) or any other uses.

Table 5-26: Primary Function of Claimed Properties

Function of Properties	Percent of Claimed Plots
Crop Farmland	84.4
Fallow Farmland	5.2
Main Residential Plot	2.9
Orchards / Plantations / Tree Stands	2.9
Business Plot	2.3
Bee Keeping Orchids and crops	0.6
Bee Keeping and Orchids	0.6
Main Residential Plot and crops	0.6
Second Residential Plot	0.6

Source: Household Socio-Economic Survey, 2020

5.5.5 Housing and Living Conditions

5.5.5.1 Primary & Ancillary Structures

Local households retain an average of 3.4 primary structures per household (as determined by the Household Socio-Economic Survey, 2020) and these structures form part of the farmstead compound living arrangements.

Just over half of the primary structures function as family bedrooms with an average of 3.1 rooms per structure (see Table 5-27), while most of the remaining structures are separate free-standing kitchens and bathrooms. There are few multifunctional houses (i.e. a multi-roomed single structure that supports lounges, bedrooms etc.) and only account for 9% of surveyed structures.

Table 5-27: Primary Household Structures

Main Function of Structure	Percent of Structures	Ave. No of Rooms
Bedroom Only	53.8	3.1
Kitchen Only	16.3	1.5
Bathroom Only	9.2	1.4

Multifunctional	9.0	3.4
Being Constructed	5.6	2.3
Business Only	3.1	2.4
Store	0.7	1.3
Derelict / Abandoned	0.5	1.5
Being Constructed Toilet	0.2	1
Hotel	0.2	2
Refreshment	0.2	1
Relaxing	0.2	1
Religious Building	0.2	1
Rest Room	0.2	1

Source: Household Socio-Economic Survey, 2020

The primary structures are constructed of a range of modern and traditional building materials. Of the surveyed structures, just over half (51%) are made of traditional materials only (mud, mud-brick, grass thatching or reed roofs. Only 17% of structures (mostly comprising of the main bedrooms) are solely constructed with modern materials (including brick, concrete blocks, and corrugated iron roof sheets), while the remaining 32% are constructed of a mixture of modern and traditional building materials.

In addition to the primary structures, local households make use of several secondary structures to support their livelihoods. Such secondary structures are not usually residential in nature, nor always support walls, foundations, roofs, doors, or windows. In fact, secondary structures show a far greater variation in size and building materials depending on their ultimate function

The Household Socio-Economic Survey of 2020 (see Table 5-28) shows that the majority of households retain at least one poultry coup and livestock corral (96 and 78% of households respectively), while only a third of households have a grain store. Given that small-scale agriculture and livestock are central livelihoods for local households, the predominance of these three types of secondary structures is expected.

Table 5-28: Secondary Structure Profile

Secondary Structure	No. Of Households	Ave. Structures Per Households
Chicken/Duck/Poultry Coup	96	1.2
Livestock Kraal / Corrals	78	1.1
Grain Storage	32	1.1
Pig Sty	7	1.1
Rabbit hutch	2	1.5
Dairy	1	4.0
Dam	1	1.0
Farm storage	1	1.0
Generator Room	1	1.0
Pumphouse	1	2.0

Storeroom	1	1.0

Source: Household Socio-Economic Survey, 2020

5.5.5.2 Household Assets

Household assets (see Table 5-29) is a useful indicator of household wealth and access to key household goods/services. In terms of access to communication, 96% of surveyed households have access to cellular phones, while there is also substantive access to radios (84% of households) and televisions (41% of households) and computers (17% of households). Exposure to cellular communication is particularly high and likely is the preferred means of communication.

Table 5-29: Household Ownership of Goods

Household Item	Percent of Households
Bicycle	40.8
Cart	11.2
Cattle Ploughs	28.0
Cellular / Mobile Phone	96.0
Computer / Laptop	16.8
Gas Stove / Paraffin Cooker	20.8
Hand-Held Hoe	57.6
Mosquito Nets	91.2
Motor Car	7.2
Motorcycle	32.8
Radio	84.0
Satellite Dish	26.4
Sewing Machine	13.6
Solar Panel	83.2
Television	41.6
Tractor	0.8
Tuk-Tuk	0.8

Source: Household Socio-Economic Survey, 2020

Ownership of private transport is highly variable between surveyed households and generally only the wealthiest households have their own motorised transport. Of the surveyed households, only 7% own a motor-car, however this is higher ownership of bicycles (41% of households) and motorcycles (33% of households) given their relatively cheaper values and ease to maintain. Overall, most household still largely rely on walking, with the use of bicycles and motorcycles to transport people and goods between villages.

Given that local households are largely dependent on agriculture and livestock as their primary livelihoods, the ownership of farm implements is similarly elevated. Most households own a hand-held hoe (58%), while there is a smaller proportion of household that use cattle plough (28%). Access to tractors is however negligible therefore farming is largely limited to hand labour or cattle ploughs.

5.5.5.3 Access to Public and Basic Services

Local households can access a range of public services and facilities that are located within the proposed active mining area, as well as various amenities located within the wider area. The establishment of the Project is expected to impact on local amenities including an estimate 6 churches, 6 mosques, 5 primary schools, 3 religious' schools (Madrasa), 1 vocational training school, and 1 social hall will be affected, as depicted below (Figure 5.17).

While local households are largely rural and isolated, they remain in relative proximity to local peri-urban or urban towns located within the Kwale County, including Mwabungu, Galu, Ukunda-Diani Beach. These settlements support a wide range of public services and facilities that can be accessed by local households however it generally requires a round trip of between 10 to 20 kilometres depending on the local of the household.

Direct access to basic services for local households will likely be restricted by their relatively isolated locations. Water used for domestic needs to largely source from community wells (50% of surveyed households) and private wells (25%) as summarised in Table 5-30. Boreholes water is only available to 19% of surveyed households, and this is usually only accessible for households located at or near the village centres. The use of natural sources for domestic water is limited to only 3.2% of surveyed households.

Table 5-30: Household Water Sources

Water Source	Percent of Households
Community Well	49.6
Private Well	24.8
Community Borehole and Taps	12.0
Private Borehole and Hand Pump	4.0
Spring/River/Stream/Lake	4.0
Community Borehole and Hand Pump	3.2
Rainwater	2.4

Source: Household Socio-Economic Survey, 2020

With respect to the time taken to reach the primary water source, the majority of surveyed households (49%) are required to travel between 0 to 10 minutes, where the water source is in relatively proximity to their home. However, a significance portion (38%) of surveyed households travel between 10 to 30 minutes while and addition 14% require more than 30 minutes to reach their water source.

Local households are largely dependent on natural resources as fuel sources for cooking, and most households (95%) are near exclusively dependant on fuelwood sourced from the local bush. Charcoal sees limited use (2% of surveyed households) given the costs while only 4% of households use gas or paraffin.

As there is limited electrification in local communities, local household largely rely on solar panels or batteries connected to torches for household lighting (89% of surveyed households) while a smaller proportion utilise paraffin (5%) or have a formal electricity connection (5%).

With respect to sanitation, just over half (54% of surveyed household) utilise unimproved pit latrines, while 30% have access to improved (VIP) pit latrines. Only 8% of surveyed households claim to have flushing toilets, while an additional 9% of household have no latrine at all and rely on buckets or the bush.

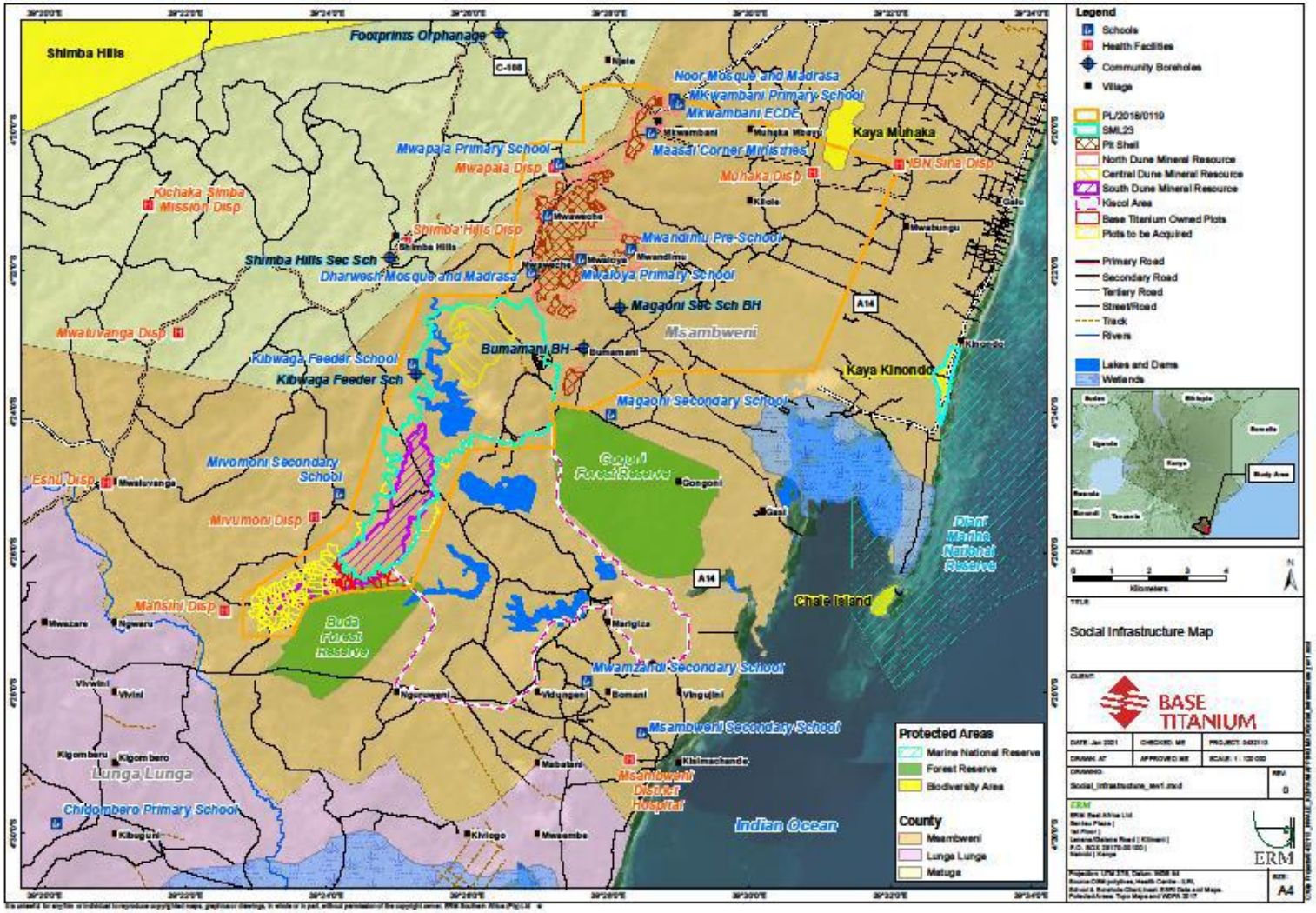


Figure 5.17: Social Infrastructure in proximity to the Kwale Mineral Sands Project

5.5.6 Livelihoods

Local livelihoods are largely comprised of annual crop farming, tree farming, livestock rearing and small-scale businesses and trading. However, the importance of these livelihoods is not equal across all surveyed households. As summarised in Table 5-31, farming is near universally important for all surveyed households, however tree farming and livestock rearing is of moderate to high importance. Small-scale business and natural resource harvesting in turn is only undertaken by 16 and 36% of surveyed households and is generally of low to moderate importance.

Table 5-31: Level of Importance of Key Livelihoods

Livelihood Type	Percent of Surveyed Households by Importance			
	Low	Moderate	High	Total
Crop Farming	0.8	4.8	91.2	96.8
Use of Trees or Tree Farming	3.2	17.6	57.6	78.4
Livestock Rearing	6.4	13.6	52.8	72.8
Small Businesses and Trading	1.6	7.2	28	36.8
Collecting Materials from Bush	8.8	5.6	2.4	16.8

Source: Household Socio-Economic Survey, 2020

5.5.6.1 Daily Activity and Employment Profile

Each person in the surveyed household undertakes a range of daily activities (be it a school-going child, home carers, employed workers) that support the household, livelihoods or generate an income. Given the lack of employment opportunities or formal occupations, the daily activities are largely informal in nature as depicted in Table 5-32.

Table 5-32: Primary Daily Activity by Gender

Primary Daily Activity	Percent of Surveyed Population		
	Male	Female	Total
Student/Scholar	18.8	16.2	16.2
Crop Farmer	10.7	11.7	11.7
House-Worker / Care-giver	0.8	6.9	6.9
Pre-school child (below the age of 5)	5.2	4.7	4.7
Own Business / Trade	2.2	3.4	3.4
Casual Labourer	7.0	2.7	2.7
Contract Worker - Private Company	1.9	0.8	0.8
Contract Worker - Government	0.9	0.5	0.5
Full-Time Employed - Government	0.3	0.5	0.5
Livestock Farmer	0.6	0.4	0.4
Disabled and not employed	0.5	0.3	0.3
Full-Time Employed - Private Company	1.4	0.3	0.3

Retired	0.1	0.3	0.3
Retired (with pension)	0.2	0.1	0.1
Other (Specify)	0.2	0.2	0.2
Sheikh	0.1	0.0	0.0

Source: Household Socio-Economic Survey, 2020

Given the relatively young population the most common daily activity is that of a pre-school or school-child (accounting for 44% of the total population). This is expected given the relatively high enrolment rates for primary school, but it is shown that education drop-out is very common once primary school is complete. Secondary school level children are often still defined as students by local households despite not been actively enrolled in school.

Informal crop farming is the primary economic activity and is undertaken by 22% of the total population, with a near even split between males and females. This suggests that both genders play a largely equal role in farming, although specific roles may be split by gender. Men generally undertake digging, ploughing, and harvesting while females sow and tend seeds and support the male in harvesting. Females also play a key role as the home-keeper and while it is the primary daily activity for 7% of females compared it is likely to be a secondary occupation after farming.

Self-employment through the ownership of businesses and trade is very limited and is only claimed as the primary activity for 6% of the local surveyed population. In addition, employment through casual and formal employment is similarly constrained and benefits only 10% and 7% of the total population, respectively. In fact, only 2.5% of the population enjoy formal and full-time employment, while 4% have access to short-term employment via private companies or the government.

Economic dependency is therefore largely limited to self-employment via small-scale farming, casual labour and limited full-time employment. Overall, 36% of the total population can be defined as economically active – and this is near even for both males and females at 17.8% each. For every person that is economically active there are 2.7 dependants.

5.5.6.2 Annual Crop Farming

Annual crop farming is the single universal livelihood in the area and is considered to be of high importance for 91% of all surveyed households. Such farming is largely small-scale in nature, with local households claiming to own or have access to an average of 1.32 fields and a total combined average area of 7.32 acres (2.96 hectares)[1].

Local households largely cultivate maize and cassava, and these two staple crops are cultivated on 75% and 13% of claimed farm plots respectively (see Table 5-33). A small proportion of farm plots (5%) are left fallow suggesting that farm rotation is not common in the area.

Table 5-33: Primary Crop Allocated to Farm plots

Primary Crop	Percent of Claimed Farmplots
Maize	74.5
Cassava	13.3
Fallow	4.8

1 *No independent survey was undertaken, and this is an average value based on estimates provided by the surveyed households.*

Other Crops	3.0
Trees	1.2
Hibiscus	0.6
Mixed	0.6
Rice	0.6
Tomatoes	0.6
Trees and bees	0.6

Local households do not engage in mono-culture, and 90% of farm plots also support secondary crops (see Table 5-34). The most common secondary crops are cassava and maize, which is usually intercropped with the primary staples. Mixed vegetables and legumes are cultivated on 28% of farm plots, and this normally comprises of a small section of the farm plot being allocated to vegetables, while the majority of the farm plot is given to the primary crop.

Table 5-34: Secondary Crops Allocated to Farm plots

Secondary Crop	Percent of Claimed Farmplots
Cassava	53.3
Maize	11.5
Beans	7.9
Other	5.5
Rice	4.2
Fallow	3.6
Peas	3.6
Tomatoes	3.0
Chickpea	0.6
Lemon Grass	0.6
Mixed Vegetables	0.6
Okra	0.6
Sorghum	0.6
Sweet Potatoes	0.6

Source: Household Socio-Economic Survey, 2020

Local households have limited access to mechanical means of preparing their farm plots, and most are reliant on the use of cattle-drawn ploughing (see Table 5-35). Wealthier households are able to use their own cattle, while hiring of private cattle or community cattle is also common.

Table 5-35: Land Preparation Method

Land Preparation Method	Percent of Claimed Fields
Hired cattle	32.5
Own cattle	32.5
Hand Hoe	12.9

Communal Cattle	7.4
Hired tractor	7.4
Slash and Burn	2.5
Fallow	1.8
Own tractor	1.8
Communal Tractor	1.2

Source: Household Socio-Economic Survey, 2020

Only 10% of the claimed farm plots are prepared during a combination of private, hired, or communal tractor, and this is likely reserved for the larger and more productive farmland. The use of hand-hoes is not common and is limited to 13% of claimed farm plots, however this is likely reserved for the poorest household that do not have access or funds for cattle or tractors.

Of the surveyed households, nearly half (47%) divide their annual crops harvests between household food needs and informal trade. The allocation between food and trade is generally determined based on the amount of surplus a household will have in a given year, and household food needs are secured first, with any surplus traded for cash income.

However, 38% of households claim to use their produce only for household food needs, while a smaller proportion (14% of survey households) exclusively sell their produce. These two groups are likely indicative of the poorest and richest households, respectively. Poorer households often have limited access to productive land, and their annual harvests are often just enough to secure household food needs, but there is insufficient surplus for any trade or to cushion any shocks. Inversely, households that solely trade in the crop produce are likely small-scale businesses that have access to larger more productive tracts of farmland as well as resource to farm the land.

Overall, the trade in crop produce is important for local households as it is one of the few options in terms of generating a cash income. Trade is however largely informal in nature and primarily targets households as well as markets and bulk buyers in the same villages. However, households will visit neighbouring villages as well as Ukunda to trade in their goods, and as such, trade links extend beyond the home villages.

5.5.6.3 Productive Trees

Trees farming is a primary livelihood alongside annual crop farming and livestock, although the labour allocation is generally focussed on annual crops and herding. Trees provide an important source of household food and trade for cash income, however these benefits are generally delayed until the tree's become productive.

Local households farm a range of trees in the form of orchards or isolated productive trees. This particularly includes Banana, Cashew, Coconuts, Citrus Fruits, and Papaya, as well as Casuarina and Blue Gum grown in woodlots (see Table 5-36). Given the local presence of orchards it is likely that fruit production as well as the cultivation of wood products will function in an ad-hoc manner or in a quasi-commercial basis depending on the total tree holdings for each household.

Table 5-36: Tree Ownership

Tree Name	% of Tree Owning Households
Banana	78.4
Cashew	72.0

Passion Fruit	72.0
Coconut	70.4
Lemon	64.8
Orange	64.0
Papaya	64.0
Casuarina	55.2
Mango (Local)	52.8
Guava (Wild)	44.8
Guava	42.4
Pineapples	42.4
Mango	41.6
Mchani	37.6
Blue Gum	36.8
Mchani Mbao	36.8
Mfudu	36.0
Zambarao	32.0
Mbambakofi	24.8
Bixa	20.8
Msamvia	20.8
Lime	20.0
Custard Apple	13.6
Mkelekele	13.6
Mngongo	11.2
Msonobari	9.6

Source: Household Socio-Economic Survey, 2020

5.5.6.4 Livestock

Livestock rearing is an important livelihood that is undertaken by 72% of surveyed households, and of which most consider it to be of high importance to the households. Livestock is as important as productive trees but is secondary to annual crop farming.

The most common livestock reared by surveyed household include chicken, cattle and goats, with a much smaller proportion of other livestock (see Table 5-37). The majority of households (87%) rear an average of 38 head of chicken per household, while 60% of household retain an average of 10 cattle and 10 goats per household.

Table 5-37: Livestock Holdings

Livestock Type	No. of Households With Livestock	Ave. Livestock Per Household*
Chickens	87	38.8
Cattle	60	10.6

Goats	60	9.6
Sheep	8	7.0
Duck	3	14.3
Turkeys	3	11.0
Dove	1	20.0
Guinea Fowls	1	10.0
Mabata	1	6.0
Ndezi	1	30.0
Rabbits	1	2.0

** Estimates of livestock holdings are provided by interviewed households and no independent count was taken. The values will likely be exaggerated, therefore they should be treated as indicative values rather than true valuers.*

Source: Household Socio-Economic Survey, 2020

Livestock will function as an important source of food and income to local households. Chickens and goats are mainly a source of household food and trade, while cattle are usually only slaughtered for celebrations and are more often seen as a repository of wealth and only sold when a household needs a large sum of cash money for an expense such as school fees.

With respect to the generation of income, 66% of households claim to trade in whole animals on a regular basis. A smaller proportion of households (~15%) trade in limited animal products – specifically cow's milk and chicken eggs. The trade in prepared meat as opposed to whole animals is undertaken by only 4% of surveyed households.

Table 5-38: Household Trade / Sale of Livestock Products

Traded / Sold Livestock Products	Percent of Surveyed Households
Whole Live Animals	66.4
Cow's Milk	16.8
Chicken Eggs	15.2
Manure	8
Meat (Goat)	4
Meat (Beef)	2.4
Skins and Hides and Wool	2.4
Goat's Milk	1.6
Meat (Other Animals)	1.6
Bees Wax	0.8
Honey	0.8

Source: Household Socio-Economic Survey, 2020

5.5.6.5 Small-Scale Business

Local household engage in a range of small-scale businesses or informal trade. The type of businesses adopted by the surveyed households is summarised in Table 5-39, which shows that the most common

businesses include household goods or agricultural goods stall which include a fixed of mobile structure. Other important businesses include transportation services, construction and carpentry and sewing which are not always linked to a specific building, but rather a specific client area.

Table 5-39: Type of Small-Scale Businesses Operated by Households

Type of Business	Percent of Surveyed Households
Household Goods Stall / Shop	12.8
Artisanal Good and Handcrafting	11.2
Agricultural Goods Stall / Shop	8.8
Taxi / Tuk-Tuk / Motorcycle Transportation	8
Construction and Carpentry	4.8
Sewing / Weaving	4.8
Butchery Stall / Shop	3.2
Food Processing / Mill	3.2
Traditional Medicine	2.4
Wine	1.6
Bookshop	0.8
Makuti Making	0.8
Mpeca	0.8
Soaps	0.8
Traditional Beverages	0.8

Source: Household Socio-Economic Survey, 2020

5.5.7 Health and Nutrition

Households were asked to give an overview of key health indicators and were asked to report on maladies affecting at least one member over the past six months. The results are set out in Table 5-40. The prevalence of malaria is notable with 73.6% of households indicating that at least one person had suffered over the past six month.

Table 5-40: Household Health Profile (Over Last 6 Months)

Ailment	% of Affected Households
Respiratory Infections / Flu / Cold	79.2
Malaria	73.6
Skin Infections	28.8
High Blood Pressure	24.8
Intestinal Worms	13.6
Tuberculosis (TB)	11.2
Typhoid	8.0
Bilharzia	3.2

Yellow Fever	3.2
Cholera	1.6
Diabetes	1.6
Ulcers	1.6
Measles	0.8
Stomach-ache	0.8

Source: Household Socio-Economic Survey, 2020

Of the surveyed households, 35% claimed to have suffered from a hunger night in the previous year. However, the prevalence rate per month peaks at around 11-12% between April and June. This is generally linked to the period immediately prior the harvesting of the staple crops of maize and cassava, and where household food reserves are at their lowest.

Table 5-41: Hunger Months

Hunger Month	Percent of Surveyed Households
January	3.2
February	2.4
March	7.2
April	11.2
May	12.0
June	11.2
July	2.4
August	0.8
September	0.8
October	0.8
November	0.0
December	0.8

Source: Household Socio-Economic Survey, 2020

5.6 Income and Expenditure

Households were asked about their primary income sources. Given the notoriously unreliable nature of data households were not asked to give the value of the income sources. What is evident is that agricultural activity is key to local livelihoods sources as set out in Table 5-42, where the three most prevalent sources of income are linked directly to agricultural activities.

Table 5-42: Source of Income for Surveyed Households

Income Source	% of Surveyed Households
Sale of Fruit	57.6
Sale of Crops and Vegetables	56.8

Sale of Livestock (live cows, chickens, goats, etc.)	48.8
Casual Worker	36.8
Craftsman (brick maker, carpentry, stone-mason, etc.)	24.0
Trade Shop	23.2
Credits or Loans	20.0
Sale of Livestock Products (milk, eggs, etc.)	12.8
Informal Trading / Hawking	12.0
Sale of Livestock Meat (beef, goat, chicken, etc.)	9.6
Salaries (Mining Company and Mining Contractors)	8.0
Rental of Property / Land	5.6
Donations	4.0
Salaries (Any other Companies)	3.2
Salaries (Government)	2.4
Migrant Remittances - Other Countries	1.6
Makuti	0.8
Religious Org	0.8
Sale of Bush Meat	0.8
Selling of local beverage	0.8

Source: Household Socio-Economic Survey, 2020

The profile of expenditure is set out in Table 5-43. The fact that food is the most reported priority is indicative of the status of the households are unable to satisfy their own requirements for food security. This is followed by clothes, medical costs and school fees and associated educational costs.

Table 5-43: Household Expenditure

Household Expenditure	Percent of Surveyed Households
Food	100.0
Clothes	79.2
Medical expenses	75.2
School fees, uniforms, books/equipment	74.4
Transport (bus fares, taxi fees, boda-boda fees)	65.6
Airtime for Cellular Phones	60.8
Personal Items (toiletries, washing powder, etc.)	48.0
Agricultural expenses - sees and other materials	37.6
Savings society	33.6
Household energy (electricity, paraffin, gas, etc.)	32.8
Agricultural expenses – livestock	31.2

Furniture/household equipment	25.6
Water	9.6
Rental (housing/accommodation/farmland)	8.0
Business Stock	0.8
Other (Specify)	0.8
Travel fees	0.8

5.7 Summary of Key Socioeconomic Sensitivities

Box 5-3: Key Socioeconomic Sensitivities

- The typical farmstead or household in the Project area is largely comprised of a single nuclear family, with an average household size of 8.3 persons for the surveyed households.
- The Kwale County population is young with 45% of all people in 2019 being aged 15 years and below, and 3.5% of the total population being above the age of 64 years. As such, just under half (49%) of the county population is considered to be economically inactive
- 77% of the survey population have reached a primary school education, which is substantially lower that the Kwale population. Interviews suggests this is related to limited access to education for rural areas, as well as general education and transport costs.
- Existing and active churches, mosques, and religious schools (Madrasa) have local cultural value as well as strong social ties with local households.
- The majority of households (79%) claim to hold their land under private title, while a significant portion (17% of land) was granted via government allotments. Only 6.5% of the land was granted via customary means.
- The Project area is dominated by crop farmland (85% of all claimed land). There are limited properties that are solely designated as residential land (3% of surveyed properties) or any other uses.
- Of the surveyed structures, just over half (51%) are made of traditional materials only (mud, mud-brick, grass thatching or reed roofs. Only 17% of structures (mostly comprising of the main bedrooms) are solely constructed with modern materials (including brick, concrete blocks, and corrugated iron roof sheets), while the remaining 32% are constructed of a mixture of modern and traditional building materials.
- Water used for domestic needs is largely sourced from community wells (50% of surveyed households) and private wells (25%). Borehole water is only available to 19% of surveyed households. The use of natural sources for domestic water is limited to only 3.2% of surveyed households.
- With respect to sanitation, just over half (54% of surveyed household) utilise unimproved pit latrines, while 30% have access to improved (VIP) pit latrines. Only 8% of surveyed households claim to have flushing toilets, while an additional 9% of household have no latrine at all and rely on buckets or the bush.
- Local livelihoods are largely comprised of annual crop farming, tree farming, livestock rearing and small-scale businesses and trading. Farming is near universally important for all surveyed households. Small-scale business and natural resource harvesting is only undertaken by 16 and 36% of surveyed households.
- Informal crop farming is the primary economic activity and is undertaken by 22% of the total population, with a near even split between males and females.
- Self-employment through the ownership of businesses and trade is very limited and is only claimed as the primary activity for 6% of the local surveyed population. In addition, employment through casual and formal employment is similarly constrained and benefits only 10% and 7% of the total population, respectively. In fact, only 2.5% of the population enjoy formal and full-time employment, while 4% have access to short-term employment via private companies or the government.
- Economic dependency is therefore largely limited to self-employment via small-scale farming, casual labour and limited full-time employment.
- Of the surveyed households, nearly half (47%) divide their annual crops harvests between household food needs and informal trade.
- Livestock rearing is an important livelihood that is undertaken by 72% of surveyed households.

6. STAKEHOLDER ENGAGEMENT

6.1 Introduction

This *Section* presents a summary of the stakeholder engagement activities planned and undertaken as part of the Project ESIA process. It serves as a summary of a more detailed Stakeholder Engagement Plan (SEP), which will be amended building upon the existing SEP in use at Base Titanium. The SEP presents the engagement approach and identifies stakeholders and the mechanisms through which they are engaged.

Engagement will also be required for other elements of the proposed Project, including the land acquisition and resettlement process and Project implementation. Separate SEPs will be developed for these elements based on the principles outlined here.

For this ESIA, it has been confirmed that IFC PS7 will not be triggered, as there are no persons of indigenous origin anticipated to be affected by the Project.

This Chapter describes the approach used to identify and engage identified stakeholders and presents feedback regarding the potential impacts of the Project that were identified by stakeholders during the Scoping Phase and ESIA Phase.

It is important to note for this particular Project, that due to precautions taken during the COVID-19 Pandemic, that stakeholder engagement activities had to be modified in structure to ensure compliance with the Government of Kenya regulations and National Environment Management Authority (NEMA) Public Participation Guidelines (PPG) during Covid-19[1].

6.2 Public Participation Objectives

Public consultation is an inclusive and culturally appropriate process which involves sharing information and knowledge, seeking to understand the concerns of others and building relationships based on collaboration. It assists stakeholders in understanding Project risks, impacts and opportunities in order to avoid, minimise or mitigate negative outcomes, and maximise positive outcomes. As noted above – due to the COVID-19 Pandemic, the stakeholder engagement activities were modified to ensure alignment with the NEMA guidance on COVID-19. This included:

- Distribution of Background Information Documents in English and Swahili, outlining the Project development process and likely impacts;
- Establishment of a Toll-Free Phone line, managed by ERM, ensuring the collection of verbal questions, concerns and suggestions;
- A Key Informant Interview (KII) program with key local officials and Focus Group Discussions (FGDs) with Village Headman & Council, Males and Females in the five target villages; and
- A Household Socio-Economic Survey was undertaken of a approximately 125 sample households within the five potentially affected communities.

The objectives of the stakeholder engagement are:

- **Ensuring Understanding**: an open, inclusive and transparent process of appropriate engagement and communication will be undertaken to ensure that stakeholders are well informed about the proposed Project as it develops. Information will be disclosed as early and as comprehensively as possible and appropriate.
- **Involving Stakeholders in the Assessment**: stakeholders will be included in the scoping of issues, the assessment of impacts, the generation of mitigation and management measures and the finalisation of the ESIA. They will also play an important role in providing local knowledge and information for the baseline to inform the impact assessment.

[1] https://www.nema.go.ke/images/Docs/Guidelines/Public%20participation%20guidelines%20during%20COVID_19-min.pdf

- **Building Relationships**: through supporting open dialogue, engagements will help establish and maintain a productive relationship between the proposed Project and stakeholders. This will support not only an effective ESIA, but will also strengthen the existing relationships and build new relationships with stakeholders.
- **Managing expectations:** It is important to ensure that the Project does not create or allow unrealistic expectations to develop amongst stakeholders about Project benefits. The engagement process serves as one of the mechanisms for understanding and then managing stakeholder and community expectations, where the latter is achieved by disseminating accurate information in an accessible way.
- **Ensuring Compliance**: the process is designed to ensure compliance with both local regulatory requirements and international good practice.

The approach to stakeholder engagement will follow the principle of Informed Consultation and Participation (ICP) which requires that:

- Engagement is free of manipulation, interference, coercion and intimidation.
- The provision of relevant, understandable and accessible information; shared in a timely and culturally appropriate manner with stakeholders.
- Stakeholder's participation and that their views are taken into account in the decision-making process.
- Inclusion of all those interested in or affected by the proposed mine; and
- Achievement of a two-way dialogue.

Due to COVID-19, engagement techniques were modified to ensure that the objectives above were met without contravening Government of Kenya restrictions on movement and/or social distancing. As such, these measures may appear different to standard engagement techniques observed on other phases of the Base Titanium mine.

6.3 Legislative Context

6.3.1 The Kenyan Constitution (2010)

Part II Section (l) of the Kenyan Constitution encourages public participation in the management, protection and conservation of the environment.

In conducting the Project ESIA and stakeholder engagement process, the Project has and will continue to facilitate the effective participation of the public in the Project, as well as in identifying potential impacts, and how these can be managed in a manner that strives to protect both the physical and social receiving environments of the Project Footprint and surrounds.

Ongoing engagement during construction and operation will ensure that the public continue to be involved in the protection of the biophysical and social environment.

6.3.2 Environmental Legislation

The Environmental Management and Coordination Act, 1999, Amended 2015 (EMCA) Section 59 of EMCA (1999) outlines the stakeholder engagement requirements for both the Proponent and the NEMA. The Environmental (Impact Assessment and Audit) Regulations, 2003 outline various requirements with regards to stakeholder engagement. Section 17 provides specific requirements for stakeholder engagement during the ESIA process. The requirements outlined in the Regulations specifically relate to stakeholder engagement activities that are to be conducted during the ESIA process and are presented in Figure 6.1.

Figure 6.1 Kenyan Requirements for Stakeholder Engagement

Stakeholder Engagement Requirements in Section 59 EMCA 1999

EMCA states that:

(1) Upon receipt of an environmental impact assessment study report from any proponent under section 58(2), the Authority shall cause to be published for two successive weeks in the Gazette and in a newspaper circulating in the area or proposed area of the project a notice which shall state—

- A summary description of the project;
- The place where the project is to be carried out;
- The place where the environmental impact assessment study, evaluation or review report may be inspected; and
- A time limit of not exceeding sixty days for the submission of oral or written comments in relation to the environmental impact assessment study, evaluation or review report.

(2) The Authority may, on application by any person extend the period stipulated in sub-paragraph (d) to afford reasonable opportunity for such person to submit oral or written comments on the environmental impact assessment report.

Stakeholder Engagement Requirements in Section 17 Environmental (Impact Assessment and Audit) Regulations, 2003

The Environmental Regulations require the following in relation to Public Participation:

During the process of conducting an environmental impact assessment study under these Regulations, the proponent shall in consultation with the Authority, seek the views of persons who may be affected by the project.

6.3.3 International Requirements

In addition to aligning to national standards, the IFC Performance Standards (PS) were used to inform the approach to stakeholder engagement. The IFC Performance Standards relating to stakeholder engagement relevant to the Project are summarised in Figure 6.2.

Figure 6.2 Requirements for Stakeholder Engagement in PS 1

Performance Standard 1:

Aim:
To ensure that affected communities are appropriately engaged on issues that could potentially affect them; to build and maintain a constructive relationship with communities; and to establish a grievance mechanism.

Who to consult:
- Directly and indirectly affected communities;
- Positively and negatively affected communities / individuals;
- Those with influence due to local knowledge or political influence;
- Elected representatives*;
- Non-elected community officials and leaders;
- Informal/traditional community institutions and/or elders; and
- Indigenous People, where the Project is identified to have adverse impacts on them.

** Where engagement relies substantially upon a community representative the client will aim to ensure that the views of affected communities are communicated, and that the results of consultation are communicated back to the community.*

When to consult:
Consultation should begin as early as possible or at the latest prior to construction. Consultation should be an on-going process throughout the life of the Project, i.e. be iterative. Consultation should also allow for a feedback (grievance) mechanism where affected people are able to present their concerns and grievances for consideration and redress.

What to consult on:
- Disclosure of Project information (purpose, nature, scale);
- Disclosure of Project ESIA documentation; and
- Updates, actions and proposed mitigation measures to address areas of concern for affected communities.

How to consult:
For projects with significant impacts, the IFC requires an Informed Consultation and Participation (ICP) approach, which enables an in-depth exchange of views and information with affected communities. The consultation process is designed to be iterative such that mitigation and its implementation is informed by stakeholder views, is tailored to local needs, and identifies appropriate mechanisms for sharing development benefits and opportunities.

The Project should ensure that:

- Engagement is undertaken sufficiently frequently to enable key messages to be absorbed and considered;
- All written and oral communications are in local languages and readily understandable formats;
- There is easy access to both written information and to the consultation process by relevant stakeholders;
- Oral and visual methods are used to explain information to non-literate people;
- Consultation activities respect local traditions regarding discussion, reflection, and decision making;
- Care is taken in assuring that groups being consulted are representative (with adequate representation of women, vulnerable groups, and ethnic or religious minorities, and separate meetings for various groups, where necessary); and
- There are clear mechanisms to respond to people's concerns, suggestions and grievance.

Source: IFC Performance Standard 1, January 2012.

6.4 Identification of Stakeholders

Project stakeholder identification followed a systematic process in accordance with the requirements of IFC Performance Standard 1. A preliminary list of potential stakeholders was created using the following criteria:

- National level government stakeholders (ministries, agencies, etc.) were identified based on their specific interest or authority in the Project location and proposed activities.

- County level government stakeholders were identified based on the location of the administrative unit (Sub-County) relative to the Project location.
- Non-government stakeholders were identified based on specific interest in the Project or Project location or potential impact from Project activities.
- Local communities within the Project Area of Influence.

The list of stakeholders was compiled based on the Consultant's knowledge and prior experience working in similar processes. Through consultation, the Consultant was able to pick up and understand concerns and recommendations to be considered in the implementation of the Project in order to minimise the negative impacts, and to enhance the positive ones.

Stakeholders relevant to the ESIA and identified as part of the Project ESIA process to date are listed in Table 6-1 below. This list will be regularly updated as fieldwork and engagement activities progress and as new stakeholders are identified. It should be noted that Table 6-1 does not include all potential stakeholders who may need to be engaged with during Project implementation.

Table 6-1: Stakeholders Identified to Date

Stakeholder Category	Connection to the Project	Stakeholders
Government	National Government is of primary importance in terms of establishing policy, granting permits or other approvals for the proposed mine extension, and monitoring and enforcing compliance with Kenyan Law throughout all stages of the Project lifecycle.	■ Members of Parliament ■ National Environmental Management Authority (NEMA) ■ Water Resources Management Authority (WRMA) ■ County Commissioners ■ Deputy County Commissioners ■ Assistant County Commissioners ■ Ministry of Petroleum and Mining (MoPM), Kwale Regional Office
	County Government are also of primary importance as they are responsible for the implementation of legislation, and development plans and policies at the County level. The County Government will also have a role in issuing permits and processing applications associated with the proposed mine extension (such as Change of Land use certificate). In addition, Counties impacted by the proposed mine will need to be kept informed of progress and plans in their area, to consider the proposed mine extension activities in their policy-making, regulatory and other duties and activities.	■ Office of County Governors ■ Office of County Senators ■ Office of Deputy Governors ■ Office of Members of County Assembly ■ Office of Women Representatives ■ Office of County Administrators ■ Office of Sub-County Administrators ■ Office of Ward Administrators ■ County Executives- Lands ■ County Executives - Environment ■ County Executives - Physical Planning ■ County Executives - Energy ■ County Executives - Legal ■ County Executives - Education & ICT ■ County Executives - Social Services and Talent Management ■ County Executives - Public Health ■ County Executives - Infrastructure ■ County Executives - Agriculture ■ County Executives - Water

		■ County Executives - Labour
Parastatals	Parastatals may have land or other assets which could be affected by the proposed mine extension.	■ Kenya Wildlife Service (KWS) ■ Kenya Forest Service (KFS) ■ Kenya Transmission Company (KETRACO)
Traditional Authorities	Local community leaders acting as representatives of their local community. Meetings with traditional authorities follow local practices and are held before any wider communication in local communities to respect the political and social structures.	■ Area Chiefs for the relevant Locations ■ Sub-Chief for the relevant Sub-Locations ■ Elders from various villages within the relevant Locations
Communities	Households and communities that may be directly or indirectly affected by the proposed mine extension and its activities. This includes people living on land affected by the proposed mine extension, through direct land take or by social and environmental impacts, and other people who visit or use land or resources that may be affected.	Community members of the various Villages ■ Mwaloya ■ Mwaweche ■ Mkwambani ■ Bumamani ■ Mwandimu
Vulnerable groups	Vulnerable groups may be affected by the proposed mine extension by their physical disability, social or economic standing, limited education, and lack of employment or access to land.	■ Women including Female Headed Households ■ Youth ■ Young girls ■ The elderly ■ The disabled ■ Those without formal land tenure ■ The very poor
Civil Society	Organisations with direct interest in the proposed mine extension, and its social and environmental aspects and that can influence the proposed mine extension directly or through public opinion. Such organisations may also have useful data and insight and may be able to become partners to the Project in areas of common interest.	■ Churches ■ Schools / ECDE ■ Health Centres ■ Cooperatives (SACCOs, Circles, Roundabouts etc.) ■ Children's' homes
Non-Governmental Organisations (NGOs)	NGOs with a direct interest in the proposed mine extension, and its social and environmental aspects and that can influence the Project directly or through public opinion.	■ Kwale Mining Alliance Members ■ Kwale CSOs Consortium
Business organisations	Individuals or organisations with direct economic interest in the proposed mine extension. This may be through gaining contracts with the proposed mine extension due to economic impacts caused by the Project.	■ PAVI ■ Kenya Association of Manufacturers ■ Kenya Private Sector (Alliance KEPSA) ■ Kenya National Chamber of Commerce and Industry ■ Kenya International Freight and Warehousing Association ■ Kenya National Farmers' Federation (KENAFF) ■ Matatu Owners Association (MOA) ■ Kenya Tourism Federation ■ Kenya Transporters Association Ltd

Once stakeholders were identified, a basic analysis was undertaken to understand their connection to the Project (Table 6-1) as well as their needs and expectations regarding engagement or consultation.

6.5 Stakeholder Engagement Process

Effective engagement with stakeholders implies ongoing consultation in order to build good relationships and mutual trust, while paying careful attention to the dynamic nature of a certain stakeholder or group(s) of stakeholders' shifting interests and influence in relation to the Project (IFC Performance Standard 1, 2012).

There are three rounds of legislated stakeholder consultations associated with this Environmental and Social Impact Assessment, one during the Scoping Phase, during the ESIA Phase and during the ESIA Disclosure Phase

As part of the Scoping Phase, the first round of consultations aimed to:

- Identify stakeholder groups (primarily at the National, County and Sub-County levels);
- Describe their involvement in the ESIA process;
- Distribute Project Background Information Documents, inclusive of the toll free number; and
- Record questions, comments and concern raised by stakeholders.

The second round of engagement were during the ESIA Phase. This round of consultations aimed to:

- Undertake engagements with the various stakeholders that were identified during the Scoping Phase;
- Describe the Project activities;
- Describe the potential Environmental and Social (E&S) impacts associated with the Project;
- Describe the Grievance Mechanism (GM) as outlined in the SEP; and
- Record questions, comments and concern raised by stakeholders.

The typical stakeholder engagement methods engaged during the ESIA Phase included:

- Key Informant Interviews (KIIs) at the County and Sub-County level;
- Focus Group Discussions (FGDs) at Village level with the Village Committee Members (VCMs), men, women and youth groups; Community Consultations at the Village Level (please note that these meetings had to be size restricted in order to adhere with the National and County Government COVID-19 precautions);
- Provision of detailed Background Information Documents, providing detailed Project information in English and Swahili as well as provision of a Toll-Free phone line to provide verbal feedback.
- A Household Socio-Economic Survey was undertaken of a selected sample of 173 households within the five potentially affected communities. Households in each village were chosen at random but spaced out to cover a large geographic area.

The third round of engagement will be during the ESIA Disclosure. This round of consultations will aim to:

- Present the findings of the Project ESIA and discuss the proposed mitigation measures;
- Ensure that all stakeholders are given sufficient opportunity to voice their opinions and concerns throughout the Project life-cycle;
- Ensure that regular feedback is provided to project-affected people;
- To ensure that adequate provision is made to consider and resolve grievances;
- Ensure that effective communication will continue during the construction and operational phases of the proposed project.

Table 6-2 below presents a summary of the stakeholder engagements conducted during the ESIA process. The results of the stakeholder consultations have been incorporated into the baseline information as well as into the impact assessment *Chapter* 8.

Table 6-2: Summary of Meetings held during the ESIA Phase

Stakeholder	Engagement Date	Venue	Number of Participants
Key Informant Interviews (KIIs)			
CEC Department of Agriculture, Livestock and Fisheries	4th August 2020	County Offices-Kwale	1
Matuga Sub-County Administrator	4th August 2020	Sub-County Offices-Matuga	1
Department of Social Services and Talent Management	4th August 2020	County Offices-Kwale	1
Deputy County Commissioner (DCC)- Msambweni	4th August 2020	DCC Office-Msambweni	1
Department of Environment, Land and Physical Planning	6th August 2020	Leopard Beach Resort &Spa	2
Msambweni Sub-County Administrator	7th August 2020	Mangro Hotel	1
Focused Group discussions (FGDs)			
Mwaloya Village			
Men	29th July 2020	Mwaloya	9
Women	29th July 2020	Mwaloya	11
Village Committee	29th July 2020	Mwaloya	8
Youth	29th July 2020	Mwaloya	12
Bumamani Village			
Men	30th July 2020	Bumamani	11
Women	30th July 2020	Bumamani	10
Youth	30th July 2020	Bumamani	14
Village Committee	1st August 2020	Bumamani	7
Mwaweche Village			
Men & Village Committee	3rd August 2020	Mwaweche	5
Women	3rd August 2020	Mwaweche	7
Youth	3rd August 2020	Mwaweche	9
Mkwambani Village			
Men	5th August 2020	Mkwambani	12
Women	5th August 2020	Mkwambani	10
Youth	5th August 2020	Mkwambani	12
Village Committee	5th August 2020	Mkwambani	13

Mwandimu Village			
Men	7th September 2020	Mwandimu	10
Women	7th September 2020	Mwandimu	12
Youth	8th September 2020	Mwandimu	14
Village Committee	8th September 2020	Mwandimu	11

6.6 Outcomes of Engagements Conducted to Date

As indicated in Table 6-2 above, several stakeholder engagement meetings were held during the ESIA process. The key questions and concerns raised by stakeholders are outlined in Table 6-3.

Due to the COVID-19 Pandemic, stakeholder engagement activities were modified to ensure enough feedback is collected from the stakeholders who could not participate in meetings. As such, the EIA team established a dedicated Toll-Free Phone line (+254 800 720 519) to ensure the collection of verbal questions, concerns and suggestions from stakeholders. The number was shared through the Background Information Document (BID) and was also shared with stakeholders during meetings with the EIA team. Any community members who had concerns or questions related to this project could call this number free of charge and the feedback is captured in a Toll-Free Number Log (***Appendix I***- sub-appendix E of the SEP). Several issues have been captured from the response made by community members and have been included in Table 5.3.

The detailed Minutes and Registration Sheets as well as Background Information Document (BID) used in stakeholder engagement during the ESIA stakeholder engagement process are presented in ***Appendix I*** (SEP), Sub-Appendix B and Sub-Appendix A respectively.

Table 6-3: Key Stakeholder issues raised during the ESIA Process

Main Theme	Key stakeholders' issues/comments
Stakeholder Engagement Issues	The Kwale County Chief Officer (CO) of Environment pointed out that Base has not properly engaged the County Government at the initial stages of their operations which is a critical step in ensuring proper management of the project.
	Base should ensure there is a well-structured engagement with the communities to avert any future crisis. Many of the community members complained about poor compensation and livelihood restoration from previous development.
	There are community members who have not yet been compensated from the previous relocation and this can negatively impact any of Base upcoming activities.
	The community should be sensitised about the long-term objectives and benefits of Base operations in the area. This will help to foster a positive attitude towards the project.
	The Deputy County Commissioner (DCC) pointed out that Base should regularly engage and update the community to manage their expectations and reduce speculation.
	The Village Administrator (VA) pointed out that there should be regular feedback given to the community even after the Project.
	The Sub-County Administrator pointed out that there was a lot of controversy before Base was given the prospecting licence. Because the communities were not well informed, many were divided if Base should be allowed to prospect the minerals in their area. It is therefore important that comprehensive stakeholder engagements be undertaken with the communities. Base should ensure the communities see the benefits of the Project.

Livelihood Concerns	Majority of the communities in the Project Area are farmers and it's important for Base to ensure minimal disruption of agricultural livelihoods.
Collaboration of Key Stakeholders	There is a Memorandum of Understanding (MoU) that the County Government signed with Base Titanium that guides the collaboration of any projects between Base and the County departments.
	Base supplements what the County Government is doing, and the MoU stated that any projects or programmes should be aligned to the County Integrated Development Plan (CIDP).
	Technical committee that works closely with Base Titanium and brings together the County officers and Base Titanium representatives who plan and execute agricultural programmes and projects.
	County Department of Environment expects to be fully engaged with Base because they play a critical role during any crisis. They are the representatives of the people and should not only be engaged in passing or during a crisis.
	No information about the North Dune project has been shared to the County Physical Planner creating a major gap in terms of consultation and communication between the Base and the County Government.
	The County Department of Environment lacks a database of Base activities which is critical in future decision making and planning.
	No clear path or solid Memorandum of Understanding (MoU) between Base and the County Department of Environment and as a result the department is not fully involved or informed of their operations in the area.
	The Corporate Social Responsibility (CSR) programmes should expand beyond the project footprint. They should undertake a mega project that can be felt in the County and not just within the project area e.g. investing in higher education.
	Base should consider reviving discussions/plans about the proposed constructing a stadium in the County (at Kinarim-Kwale) and sponsor local sports team.
	Base has previously supported and facilitated the CEC-Department of Social Services and Talent Management office in the area of culture through providing financial support to local Community Based Organizations (CBOs).
	The Deputy County Commissioner (DCC) pointed out that his office will continue to support and work closely with Base.
	The DCC pointed out that the Umbrella Committee and other Committees set up by Base have continued to consult and work effectively towards implementing action plans and community projects.
	Sub-County Administrator (SCA) suggests that village committees should be better empowered to sensitize the communities about the project. There are cases where the committee members are secretly against the project. Base should undertake regular training sessions with the committee members.
	The SCA stated that she is also part of the Base Agricultural Committee (BAC) and they partner during the roll-out of agricultural programmes.
	There are also Sub-Committees such as Education in base that the office of the SCA works closely with. The Education Committee is in charge of rolling out scholarship programmes.
	The SCA points out that since Matuga Sub-County is in the transport corridor used by Base, it should also have representation in the umbrella committee that has been established by Base.
	The County Government has the 5 year County Integrated Development Plan (CIDP) that synchronises with all development projects. For example when there were plans by the County to build ECD schools Base proposed to construct the ECDs, the County funds were used for other development projects.

Compensation	Communities should be fully involved and engaged in the compensation process.
	The compensation rates for land and crops should be reviewed and based on the existing market rates.
	Currently there is no framework that guides how the royalties paid by Base can trickle down to the community.
	The process of compensation and resettlement should be undertaken in line with the law and best practice. It would be ideal for Base to identify land and relocate the community rather than use cash compensation. This is because cash payments tend to be used for the wrong purpose and families are left without land.
	The compensation rates for land, trees and crops should be revised this time round. The previous rate was about Kshs 80,000 per acre which was quite low.
Resettlement	Base should ensure minimal disruption of community linkages and family ties.
	The Sub-County Administrator (SCA) pointed out that main challenges facing the ward is shortage of land particularly in Ukunda. There are a few people who have allotment letters, but the majority are informal land-users.
Livelihood Restoration	The Resettlement Action Plan (RAP) and Livelihood Restoration Plan (LRP) should be detailed and comprehensive. It should be tailored to meet the needs and expectations of the Project Affected Persons (PAPs).
	Base should consider connecting villages with water by utilizing the dam they have at the site.
	Consider investing in Msambweni referral hospital and making it a state-of-the-art hospital and meeting community needs.
	Sub-County Administrator (SCA) mentioned that there are community members who were reallocated from Maumba to Bwiti. However, the land at Bwiti is not fertile and this has severely impacted on the community livelihood. Because of the negative impacts faced by the affected communities this is likely to cause apprehension by the rest of the community members who feel that they may suffer a similar fate.
Base initiatives	Currently there are on-going projects such as food and sanitizer distribution. This can still be scaled up and will have a positive impact on the community.
	Through the *Nyumba Kumi* (ten houses) initiative, Base can improve the stakeholder engagement process and empower the communities.
	There should be more CSR projects in the ward. Currently there are no projects in Kinondo apart from the construction of a school and hospital.
	The SCA pointed out that the project Community Social Responsibility (CSR) should be extended beyond the Project footprint.
	The SCA stated that she was happy with the bursary programmes that have been rolled out by Base.
Promoting Local Economic Development	The DCC suggested that Base should prioritise the training of local labour force so that they can be absorbed in the skilled and semi-skilled job opportunities.
	The DCC suggested that Base should invest more on community projects.
	SCA pointed suggests that the process of employment should be free and fair. The communities living within the project area should be given priority especially for the unskilled positions. Employment should not be sourced from outside at the expense of the local community.
	According to the SCA, Base should upgrade the road (from 00) to the port facility which can also benefit the community members in the area. This will help reduce potential impacts such as accidents and dust for the other road users.

	The SCA pointed out that there have been complaints from the communities in Kwale that employment positions are usually given to people from other counties, especially the top management positions. Base should have a database of the skillsets and qualifications of the communities in the area and the process of recruitment should be fair and transparent.
	There should be clear guidelines for any investors who come to Kwale County.
	Base should work closely with the training institutions to build the capacity by educating and training the youth so that they can take up employment positions in the company when the time comes.
Management of Pollution	Water contamination and waste management should be properly managed. The SCA pointed out that she has received complaints from the community that the mining activities are impacting on their water. The taste has changed since Base started their operations in the area.
	The impacts on mangroves resulting from mining activities in the area should be assessed. Dr Kairo (Senior researcher- KEMFRI) can be able to give more details.
	The Village Administrator pointed out that there is a community area near Shimba Hills where the crops have been destroyed by too much dust that is likely radiating from the Project site. Base should look into that.

6.7 Stakeholder Engagement Planning

During the ESIA phase, stakeholder engagement was undertaken in accordance with National and International good practice, which places an emphasis on broad engagement and disclosure of findings to stakeholders and require that a stakeholder engagement plan be developed. Given the timeframe of data collection, revised instructions on stakeholder engagement during the COVID-19 Global Pandemic were also adhered to.

A Stakeholder Engagement Plan has been developed to guide the engagement process and covers the scoping, ESIA study and public disclosure phases.

The Stakeholder Engagement Plan will contain the following structure:

- Purpose, objectives and preparation of the Stakeholder Engagement Plan;
- A review of Kenyan Regulations and International Good Practice;
- Identification and Mapping of Key Project Stakeholders;
- Stakeholder engagement process (structure, consultation requirements, stakeholder analysis, implementation, stakeholder engagement issues and lessons learnt from previous engagements);
- Grievance Redress Mechanism (proposed grievance redress mechanism structure, review of scheme specific grievance redress procedures, review of lender's grievance procedures)
- Project Communication Plan;
- Monitoring and reporting measures for Stakeholder Engagement Plan; and
- Roles and responsibilities for the implementation of the Stakeholder Engagement Plan.

7. ANALYSIS OF PROJECT ALTERNATIVES

7.1 TSF Alternatives

A number of Tailings Storage Facilities (TSFs) locations and options have been explored for the North Dune mining area. The TSF solution for the North Dune now includes the co-disposal of a 38:62 slimes to sand ratio. The slimes contains a high proportion of clay-sized material (D50 ± 5µm). This slimes and sand tails mix will be mixed in the Soils Mix plant and used to backfill mined out voids prior to rehabilitation and revegetation. This option is the preferred alternative, as:

- It is the most effective solution in terms of water recovery;
- It is the lowest risk option in terms of the Global Industry Tailings Standard;
- It requires no additional land take outside of the mining area; and
- This option can be used to effectively infill the previously mined out areas.

Before finalizing this as a tailings solution, Base investigated a number of TSF options for the North Dune mining area, which in addition to using the existing TSF, included a review of potential new TSF locations, TSF capacities, capital expenditure, tailings related operating costs, and a qualitative risk assessment based on the Global Industry Tailings Standard.

A key driver in the TSF qualitative risk assessment is the Zone of Influence (ZoI). The ZoI indicates the extent of water flow in the event of a catastrophic TSF failure and how communities, amenities and the environment downstream of the failure will be impacted. By reducing the ZoI, the consequence of failure is reduced and accordingly the risk rating is adjusted to suit the reduced impact. As the ZoI is reduced, the size of available tailings storage is reduced which directly impact the Tailings Disposal Strategy of the project.

Options considered included:

- Lifting the walls of the current TSF, but this was rejected due to high risk;
- Large (30Mt & 18Mt) options, but these were rejected due to “Extreme” risk rating (based on people at risk in the event of a dam failure);
- Smaller TSF (5Mt) options; these were also rejected due to “Extreme” risk rating (based on people at risk in the event of a dam failure);
- A 3.5Mt TSF was identified as a TSF size that will result in an acceptable risk rating. As a result, TSF sizes ranging from 1M to 3.5Mt were considered to present single TSF options and combinations of smaller TSF sizes to satisfy the requirement of 3.5Mt.

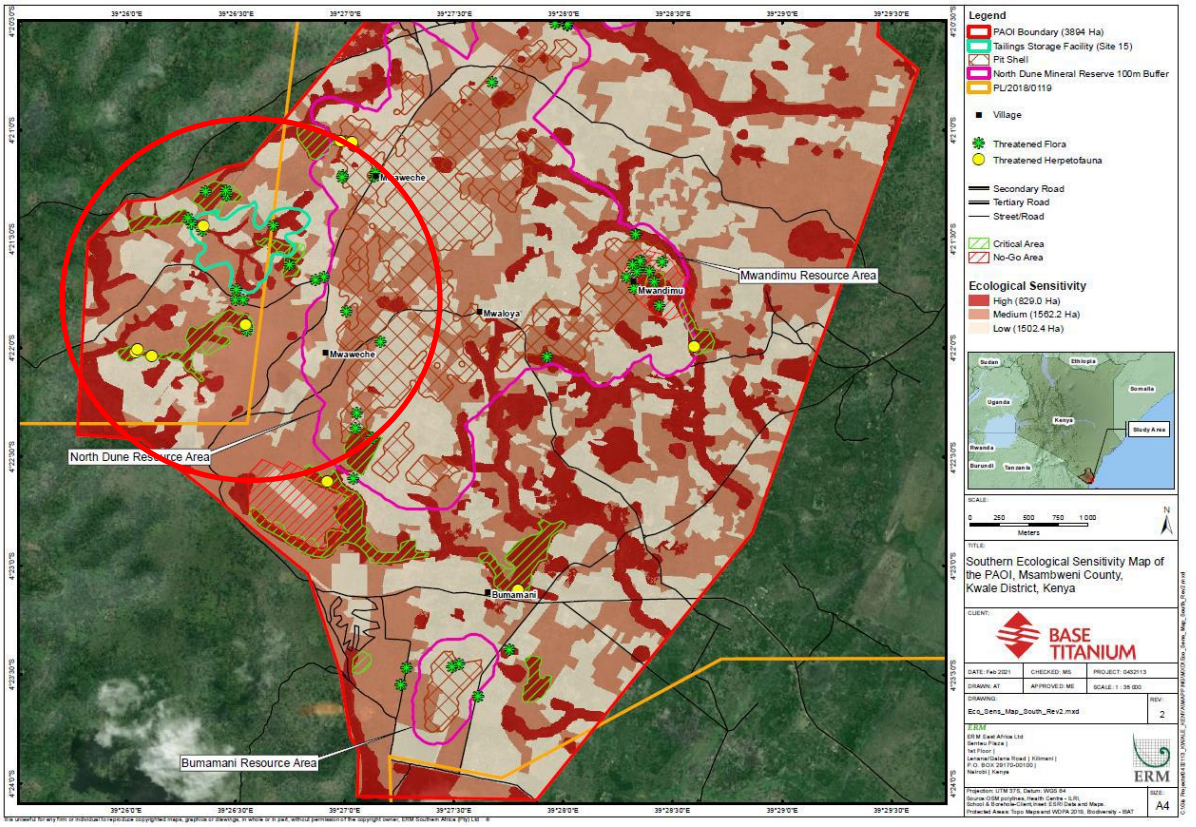
As the required TSF size reduces, the amount of slimes that needs to be sent for co-disposal increases. Initially the technical viability of higher slimes ratios was questioned, as high slimes co-disposal is not typically seen in the mining industry.

The site selected for the smaller TSF option was also assessed as part of the EIA, and was found to contain some Critical Habitat and intersected small streams and wetlands that contained populations of the IUCN threatened Shimba Hills Reed Frog - *Hyperolius rubrovermiculatus* (Endangered) and the Shimba Hills Forest Spiny Reed Frog - *Afrixalus sylvaticus* (Vulnerable). In addition, the potential TSF site also intercepted numerous sites where threatened floral species were also identified. The potential site of the TSF and the extent of Critical Habitat and locations where threatened herpetofaunal and plant species were found, is located in below.

Site based test work however confirmed the viability of high slimes co-disposal, which led to the selection of a ratio of 38:62 slimes to sand. This ratio is sufficient to send all slimes to the mining void, and completely removes the risk of a surface TSF.

This has the advantage of not only avoiding Critical Habitat, but also the most effective in terms of water recovery, meaning greater volumes of water can be recycled, potentially reducing the volumes of make-up water required from the mine's bore field and from the Mukurumudzi Dam.

Figure 7.1 Location of Critical Habitat relative to the site of the TSF that investigated as a Tailings solution (circled in red)



7.2 Water Supply Alternatives

Various water supply alternatives exist for mining operations, to be used both for hydraulic mining, and for use in the processing plant.

For the North Dune, various water supply options exist, namely:

- Use of water recovered and recycled from in-pit tailings;
- Use of surface water abstracted from the Mukurumudzi Dam; and
- Groundwater abstracted from the sites borefield.

The major advantage of co-disposal of a 38:62 slimes to sand ratio in previously mined out areas of the North Dune is that overall water use by the mine will be less, given the higher percentage of water recovery for reuse from the disposed slimes and sand mix.

This means the volumes of water abstracted from the Mukurumudzi Dam will be less, as will the volumes of water abstracted from groundwater through Base's current bore field.

Only if recovery of water is less than anticipated from the in-pit disposal of the slimes:sand mix, will higher water volumes be required than those currently drawn from the Mukurumudzi Dam, or from the

wellfield. It is, however expected that the water demand and volumes currently drawn from the Mukurumudzi Dam, or from the wellfield, will be lower under the in-pit disposal scenario.

7.3 The "No-Go" Alternative

The 'do-nothing' alternative is the option of not mining the North Dune. This option will mean that the mine will reach the end of its useful mine life by end-2023, and the Life of Mine will not be extended by another 4 to 4.5 years. The potential social and economic benefits of the project, as described in *Section 1.3* of this report, will therefore not be realized, if the project does not go ahead.

8. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

This *Chapter* provides a detailed analysis of potential project impacts on the environment and social baseline conditions of the study area in and around the area of the North Dune. The assessments present the existing baseline conditions, the likely changes to these as a result of project activities, the likely magnitude and significance of such changes, and the recommended mitigation/management measures to address each likely impact. Potential residual impacts are also discussed where applicable.

8.1 Summary of Potential Impacts

Based on the project description, analysis of the environmental and social baseline conditions, as well as community and stakeholder engagement, the following impacts have been identified:

Bio-physical Environment

- Impacts on Geology and Soils
- Impacts on Water Resources and Quality
- Impacts on Air Quality
- Impacts due to Noise
- Impacts from Radiation
- Impacts on Faunal and Floral Diversity
- Impacts on Wetlands

Socio-economic Environment

- Impacts on Occupational Safety and Health
- Impacts related to Employment
- Impacts related to Labour and Working Conditions
- Impacts on Community Health and Safety
- Impacts due to Loss of Pasture Land
- Impacts due to Loss of Agricultural Land
- Impacts on Community Access to Natural Resources

8.2 Bio-Physical Environment

8.2.1 Impacts on Geology and Soils

8.2.1.1 Introduction

The North Dune resource area measures approx. 582ha. The soils in this area will be stripped and most of it processed for mineral extraction. Rehabilitation will occur concurrently as mining progresses through different blocks of the resource.

8.2.1.2 Related Project Activities

Mining in the North Dune will involve use of heavy equipment in stripping of vegetation, and part of the topsoil. Further, the soil containing minerals will be dislodged through hydraulic mining, and the ore fed by slurry pipeline to the existing Wet Concentrator Plant (WCP) where the slimes and sand tails will be removed to produce Heavy Mineral Concentrate (HMC). Slime and sand tails will be directed to three

38-metre diameter thickeners, dosed with a suitable flocculant, and separated into clear overflow water and thickened underflow slimes. The underflow, at 35% solids content, will be directed to the co-disposal hopper, mixed with sand tailings and pumped to the mining pit void. Prior to the slurry being deposited, flocculent is added to bind the sand and slime mixture to prevent segregation of the slimes and aid recovery of water.

8.2.1.3 Baseline Conditions

- Dominant soils in the study area include Avalon, Bainsvlei, Clovelly, Hutton and Mispah soils. The effective depth of the Avalon, Bainsvlei, Clovelly and Hutton soils exceed 300mm inclusive of the Orthic A – Horizons and Red Apedalic B – Horizons.
- The Avalon, Bainsvlei, Clovelly and Hutton soils have high agricultural and rehabilitation potential under dryland and irrigation conditions respectively.
- Soils are prone to soil erosion, crusting and formation of preferential seepage pathways, especially after mechanical disturbance.
- The geology does not contain sulphur bearing minerals, i.e. FeS that could oxidise and form sulphuric acid and SO_4 salts. Heavy metal concentrations are at acceptable low concentrations.
- In terms of topsoil stripping, careful consideration should be given to ensure the different soil horizons are stripped and stockpiled separately, and not mixed.

8.2.1.4 Significance of Impact (Pre-mitigation)

Vegetation clearance, topsoil stripping, mineral processing and the generation of a mix of slimes:sand to be routed to the previously mined out areas, will totally alter the soil profile of the North dune area.

Based on the analysis provided above, the impact significance of project activities on soils and geology will be ***Major*** pre-mitigation (Table 8-1).

Table 8-1: Rating of Impacts to Soils and Geology (pre-mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	The soils to be affected are primarily in the project footprint, being the North Dune mine Extension of 582ha.
Duration:	Medium term	This impact will occur throughout the mining period, up to the end of 2028 when rehabilitation begins.
Scale:	Major Change	The entire North Dune extension surface area to be mined will be impacted.
Frequency:	Constant	The impact will be experienced throughout the period of mining operations, up to the end of 2028, and beyond during rehabilitation.
Magnitude		
Large		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High Soils are prone to erosion, by wind and water, especially when bare, and incorrect soil stockpiling will reduce their value upon rehabilitation.		
Significance Rating Pre-mitigation		
Major		

8.2.1.5 Recommended Mitigation Measures

To reduce the above impacts to soils during mining of the North Dune Extension, Base will:

- Mine in blocks as per the Mine Plan (although some blocks will be mined concurrently). Mining in blocks allows for a reduction in the volume of vegetation to be cleared and stripped, confining mining activities to active mine blocks only.
- A review of available soil mapping information should be conducted to determine the distribution of soil types and diagnostic layers before any soil stripping project. A clear distinction should be made of available soil layers to be stripped and stockpiled separately or together. It is recommended to use an experienced soil surveyor with rehabilitation experience.
- It is proposed to compile an accurate digital terrain map of the area to be mined and use a combination of 35ton excavators and articulated 10t trucks to strip the soil in different layers and stockpile separately. An alternative would be to use 10t dozers to move the different layers and doze in separate rows based on the diagnostic criteria of the different horizons. Whatever option is used the soil layers should not be mixed and should be conducted under supervision.
- It is recommended to strip soil for stockpiling carefully according to horizon differentiation and stockpile accordingly and implement measures to prevent soil loss due to erosion and contamination.
- Stockpile topsoil, in stable areas where erosion potential is low.
- Vegetate topsoil stockpiles that are expected to remain stockpiled for more than three months, with locally indigenous grass species, especially creepers.
- Stockpiles to be located outside the proposed mine disturbance area(s).
- Construction of stockpiles by dozers rather than scrapers to minimise structural degradation.
- Construction with a “rough” surface condition to reduce erosion, improve drainage and promote revegetation.
- Disturbance areas to be stripped progressively as required to reduce erosion and sediment generation, to reduce the extent of topsoil and utilise stripped topsoil as soon as possible for rehabilitation.
- Ensure that oils/grease spillages and leaks are cleaned up immediately and the contaminated soil either remediated in situ or in the event of a major spill disposed through NEMA-licensed waste contractors for safe treatment and disposal.
- Use the results of revegetation trials using “green manure” that have been conducted by Base on the mined-out areas of the Central Dune, on mined-out areas of the North Dune Extension, as soon as is possible and allowed by the Mine Plan.
- Implement Base’s Biodiversity Conservation Programme on previously mined out and disturbed areas to revegetate such areas with native species.
- Reduce erosion of soils by rainfall and water runoff through the construction of settlement ponds, gabions and artificial wetlands on watercourses potentially affected by mining operations, thus reducing turbidity and suspended solids in surface waters.
- Erosion on steep slopes, especially towards the fringes of the mining area, is to be controlled through revegetation, shade netting placed at right angles to erosion gullies and gulley repair where necessary.
- Stockpiles can be used as a barrier to screen operational activities. If stockpiles are used as screens, the same preventative measures described above should be implemented to prevent loss

or contamination of soil. The stockpiles should not exceed a maximum height of 3 to 6m and it is recommended that the side slopes and surface areas be vegetated to prevent water and wind erosion. If used to screen construction operations, the surface of the stockpile should not be used as a roadway as this will result in excessive soil compaction.

- Contractors are focussed on moving cubic meters of material as cost-effective as possible to maximise profits and they are used to engineering properties and guidelines dictating material differentiation. They need to be guided and supervised to strip topsoil and subsequent layers and stockpile according to a rehabilitation protocol. Care must be taken not to mix different soil layers and stockpile separately as prescribed.

8.2.1.6 Residual Impact (Post-mitigation)

If the above mitigation measures are adequately implemented, the residual impacts of the mining activities on soils will be ***Moderate***, post-mitigation (Table 8-2).

Table 8-2: Rating of Impacts to Soils and Geology (post mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	The soils to be affected are primarily in the project footprint, being the North Dune mine Extension of 582ha.
Duration:	Medium-term	This impact will occur throughout the mining period, up to the end of 2028 when rehabilitation begins.
Scale:	Evident Difference	The entire North Dune extension surface area to be mined will be impacted.
Frequency:	Constant	The impact will be experienced throughout the period of mining operations, up to the end of 2028, and beyond during rehabilitation.
Magnitude		
Medium		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Medium Sensitivity is reduced if soils are rehabilitated/re-vegetated, and erosion by wind and water is adequately controlled.		
Significance Rating Post-mitigation		
Moderate		

8.2.2 Impacts on Surface Water Resources and Quality

8.2.2.1 Introduction

Mining, as planned for the North Dune operations, will require less water than current mining operations, through the adoption of co-disposal as part of the tailings disposal strategy, which means that more water for mining and processing needs will be recovered as return water from the co-disposal process, as is currently the case, where entrainment of water by slimes, and evaporation losses in the current TSF, mean under present scenarios, water use is higher. In the event of water recovery from co-disposal not being as high as anticipated, only then will additional water be required, and as a first option, this surface water will be sourced from the Mukurumudzi Dam. Recent hydrological studies have shown that an increase in the current abstraction licence from the Mukurumudzi Dam from

22,000m³/day to 30,000m³/day is possible, although under the planned North Dune tailings disposal strategy, this increase in abstraction is unlikely.

This Section analyses the likely impacts of project activities on the quality, availability and drainage regime of surface water resources.

8.2.2.2 Related Project Activities

The main project activities that will likely have impacts on water resources and quality include:

- Clearance of Vegetation.
- Soil surface layer stripping.
- Stock piling of stripped waste soils/vegetation.
- Generation of slurries from hydraulic mining.
- Co-disposal of slimes/sand to previously mined out areas.
- Recovery of water for reuse.
- (Possible) water abstraction from the Mukurumudzi Dam.
- Construction of silt traps on water courses intercepted by the mining activities, to prevent sediment loaded runoff from entering any surface water features away from the mining areas.

8.2.2.3 Baseline Conditions

- There is one significant stream (the Mkurumudzi) which lies to the south of the North Dune and bisects the Central and South Dune, flowing eastwards.
- Base flow from the numerous phreatic bankside aquifers is important in maintaining dry weather flows in the Mkurumudzi River, which is an important source of water for key ecosystem services including maintaining of aquatic life, recharge of shallow wells and aquifers, and a habitat for a variety of vegetation species. The river is also a source of water for local residents both for drinking and other household and agricultural activities.
- Several small streams arising from seepage and spring flows occur within the North Dune resource area. Flows in the small streams is generally ephemeral and are likely to be maintained by wet season rain percolation and discharge into and from the Pliocene and Pleistocene sands.

Hydrological Analysis

A detailed surface water report for the Project is provided in ***Appendix D.***

The Mkurumudzi River is the only catchment in the vicinity of Base Titanium that is not only gauged but which has a reasonable historical record. The gauging station 3KD06 measures flow from 42% of the catchment area. A suitable discharge rating curve for 3KD06 has been developed.

Comparison of flow between 1959-1987 and 2003 – 2019 indicates that the flow pattern in the more recent period has lower low flows and high flood peaks. The 2003 – 2019 period has been adopted for this analysis.

Surface Water Allocation

- Using the flow duration curve, an annual flood water volume of 70.51 MCM/yr for the catchment (equivalent to 241,487 m³/day);
- The total existing allocation on the Mkurumudzi catchment is 117,000m³/day. This has been converted to an estimated 32.92 MCM/yr;

- The water allocation balance is positive and could support an additional allocation of 8,000m^3/day or 2.92MCM/yr;
- The allocable flood volume at the Base Dam Site is estimated at 43.41MCM/yr;
- The surface water allocation balance indicates that there is sufficient flood water to support an additional 8,000m^3/day allocation with sufficient safe guards for environmental flow releases and domestic users;

Reservoir Simulation

- The RFL reservoir simulation program RESSIM was established to evaluate the yield reliability given different demand scenarios, an environmental flow release of 2,333 m^3/day (0.027m^3/s) and a domestic demand allocation demand of 2,506 m^3/day;
- A 22,000m^3/day demand for Base can be met 88% of the time. A demand of 30,000 m^3/day can be met with a 75% reliability, based on reservoir simulation for the period 2003 to 2019.
- A stochastic analysis completed on Mukurumudzi Dam water abstraction advised that a >90% probability exists that 30,000m^3/day can be abstracted over the life of the mine. This is however depended on the dam recharge due to rainfall events.

With regards surface water quality, mining activities, especially vegetation clearance and topsoil stripping, will likely cause significant alteration of surface drainage patterns, thereby affecting the main streams serving host communities, wildlife in the area and nearby wetlands. There is also a potential for their quality to be degraded from eroded sediments from ground clearance activities. Adequate precautionary measures will need to be in place to avert or reduce any significant alteration of quality degradation of these streams, and the wetlands benefiting from them.

8.2.2.4 Significance of Impact (Pre-mitigation)

Table 8-3: Rating of Impacts to Hydrology, and Surface Water Quality (pre mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	The likely impacts will be on the Mkurumudzi stream, downstream of its abstraction point. Water quality will impact all those streams impacting future mining areas.
Duration:	Medium-term	This impact will occur throughout the ore extraction period, for the period leading up to the end of 2028, where after rehabilitation and reinstatement will take place.
Scale:	Distinguishable	The impacts will affect specific localities (water resources, communities and biodiversity close to active mining areas) at times throughout the mine life.
Frequency:	Frequent	Water will be used throughout the mining period of operations, although abstraction from the Mukurumudzi Dam will only be used if water recovery from co-disposal is lower than expected.
Magnitude		
Medium		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High		

Streams and Rivers represent important biodiversity hotspots, and are a source of water to communities, livestock and wild animals
Significance Rating Pre-mitigation
High (for Water Quality) Low (for Hydrology)

8.2.2.5 Recommended Mitigation Measures

The following measures will be implemented to reduce the impacts on surface water resources and water quality from the project activities described above:

- Hydrological analyses of surface water indicate that there is sufficient water to support an additional 8,000 m^3 of water per day. A 22,000m^3/day demand for Base can be met 88% of the time. A demand of 30,000 m^3/day can be met with a 75% reliability. Surface water will, however only be abstracted from the Mukurumudzi Dam should water recovery from co-disposal within previously mined out areas be lower than expected. This is considered a low risk as additional abstraction is only to be provided as a contingency and is not expected to be relied upon as a water source, as sufficient water for operations will be recovered from the co-disposal of slimes and sand.
- A water supply strategy of a mix of co-disposal, then surface water, and only then groundwater resources to supply the Base North Dune water demand, will ensure sufficient water is available at all times.
- Increased turbidity and suspended solids can be (and have shown to be) reasonably easily addressed by mitigation measures such as settlement ponds, gabions and artificial wetlands, which has the added advantage of providing more habitat for wetland species (such as rare reed frogs).
- The construction of any silt dams, if off the mining lease, will be subject to a separate EIA Project report for submission to NEMA. If off the mining lease, the land upon which such silt dams will be constructed, will need to be subject to landowner consent and/or a resettlement process. If at all possible, silt dams should be constructed on the mining lease.
- Erection of silt traps downstream of activity areas, on specific streams of most value to the communities or in recharging the main rivers. Location of silt traps is provided in *Figure 8.1* below.
- Erection of clean water diversion berms up-gradient of mining areas and overburden stockpiles where these are along known surface drainage routes.
- Reuse of wastewater from the hydraulic mining process to reduce ex-situ discharge (already in place for hydraulic mining activities in the Central Dune and South Dune).
- Limiting heights of topsoil and overburden stockpiles to no more than 2 meters, with a sufficient gradient to reduce erosion.
- Vegetation of topsoil stockpiles with indigenous grass species if stockpiles need to remain in place for 3 months, especially during rainy seasons.
- Ensure Environmental Flow releases from the Mukurumudzi Dam are maintained during mining of the North Dune extension. Ensure abstraction from the Dam does not exceed permitted levels
- Continuation with water quality monitoring activities at identified sites, and any other sites that will be noted to be at significant risk to contamination.

8.2.2.6 Residual Impact (Post-mitigation)

If the above recommended measures are implemented, the residual impact of the identified project activities on water resources will be ***Medium*** and on water quality, ***Low*** (Table 8-4).

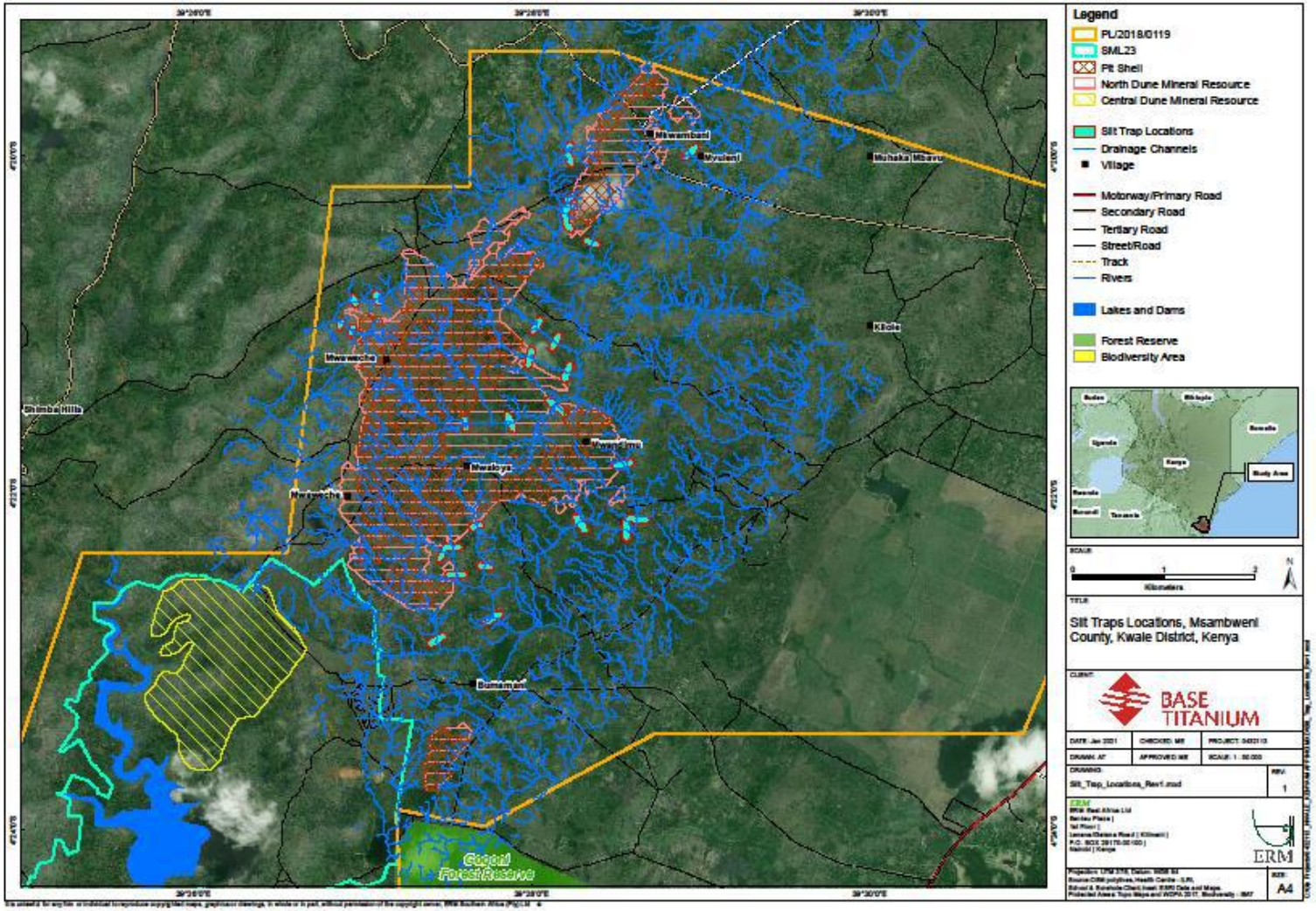


Figure 8.1 Location of Silt Traps

Table 8-4: Rating of Impacts to Hydrology, and Water Quality (post mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	The likely impacts will be on local streams and subsurface water bodies.
Duration:	Long-term	This impact will occur throughout the ore extraction period, for the period leading up to the end of 2028, where after rehabilitation and reinstatement will take place.
Scale:	Distinguishable (for water resources) and Non-distinguishable (water quality) given current water quality data for sites around the North Dune	The impacts will affect the Mkurumudzi stream downstream of the abstraction point, and water resources close to Project activity areas at a time throughout the mine activities.
Frequency:	Continuous	Water will be used throughout the mining period of operations
Magnitude		
Small		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Low to Medium		
Significance Rating Post-mitigation		
Low (water resources) and **Low** (water quality)		

8.2.3 Impacts on Ground Water Resources and Quality

8.2.3.1 Introduction

8.2.3.2 Related Project Activities

A water supply strategy of a mix of co-disposal, then surface water, and only then groundwater resources to supply the Base North Dune water demand, will ensure sufficient water is available at all times. Sufficient water supply is predicted from recovery of slimes:sand from previously mined out areas within the North Dune. Should recovery of water prove insufficient, then surface water from the Mukurumudzi Dam will be abstracted. Recent hydrological studies have shown the surface water will be available for abstraction by Base. Only as a last resort will groundwater be abstracted from the existing well field, to support mining activities in the North Dune.

A specialist Groundwater report is provided in ***Appendix E***.

8.2.3.3 Baseline Conditions

Groundwater is widely available across the study area in a variety of shallow unconfined and deep semi-confined aquifers. These comprise the following:

- A shallow unconfined aquifer located in Pleistocene coral limestone (Plc) adjacent to the sea, heavily exploited by shallow wells and shallow boreholes.
- A shallow unconfined aquifer in Pleistocene sands and corals (Pls), also heavily exploited by shallow wells and boreholes. This unit is heavily exploited for domestic and commercial uses and is already affected by saline intrusion in some places.
- A poor aquifer exists in the Pliocene Magarini sands that make up the Coastal Hills; this is unconfined and exploited by a few shallow wells and boreholes; it also hosts a few springs. Yields are typically low (<2m^3/hr). The quality of water from this aquifer system is often poor; waters are typically of low pH, are very soft and contain elevated concentrations of iron and manganese. The Pliocene material underlies the North Dune and exceeds 30m thickness in places.
- Underlying the eastern part of the Coastal Hills (i.e. the Pliocene sands that make up the South, Central and North Dunes) and the western part of the Pleistocene sands is a sequence of fractured and faulted Jurassic sediments that hosts the Gongoni Forest aquifer where Base's production boreholes are located. It comprises the Mazeras Sandstone at depth, the Kambe Limestone and the Mto Mkuu Formation shales and sandstones nearest the surface.
- The Msambweni and Kinondo areas are underlain by a high-capacity indurated sand and coral aquifer system associated with palaeochannel features extending from the west towards the coastline.
- The Kambe limestone is a fractured marine limestone, lying between the Mtomkuu shales and sandstones and the Mazeras sandstones. It forms a confined aquifer. It has been encountered and specifically screened in only three boreholes that the study team are aware of (at Bumamani, Magaoni and Fihoni, all east of Fault 3). At depths of 80 to 110m, this aquifer in isolation is capable of producing comfortably more than 15m^3/hr, though at present it is not exploited at anything close to this level.

High-value groundwater resources in the study area

There are two apparently different but hydraulically connected geological units located between Nikaphu and Kinondo which host an excellent aquifer system which is already exploited by both commercial and public water supply systems. This is broadly known as the "Msambweni aquifer". This unit has been developed by Base and by KISCOL.

The "Gongoni Forest aquifer" (defined as the area within which the Base production BHs are located, between BH1 in the south and BH8 in the north), comprises the Mtomkuu Formation (shales, sandstones, limestones and silty clays), the Kambe limestones (classic grey, marine limestone) and the Mazeras sandstones (grits and coarse sandstones with occasional silicified wood[1]). Boreholes drilled to ~110mbgl and with ~30m of high-capacity screens in the sequence below ~60mbgl are capable of yields from 30 to 230m^3/hr.

Between this sequence and the overlying Pleistocene sands lies a 15 – 30m thick coral-clay bed, which acts as an aquitard separating the two aquifer systems. The deeper aquifer system is largely recharged by water moving laterally from the Shimba Hills and is at least partly fault controlled. The total thickness of the Mazeras Sandstone is estimated at between 183m and as much as 400m; however, experience has shown that it is only the uppermost 30 to 50m of sandstone that constitutes the high-value aquifer; deeper BHs and more screen do not translate into more water or greater efficiency.

The Msambweni and Kinondo areas underlain by palaeochannels are erosive/depositional features believed to have evolved between early Cretaceous times and the start of the Pliocene (Olago *et al*, in press). They overlie the Kambe limestone and the Mazeras sandstone at depth. Boreholes constructed in the western part of this palaeochannel deposit encounter the high capacity semi-confined aquifer that underlies KISCOL's sugar fields at Milalani and Kinondo. Milalani boreholes of a maximum depth of

[1] Rais-Assa R. 1988. Stratigraphy and geodynamics of the Mombasa Basin (Kenya) in relation to the genesis of the proto-Indian Ocean. Geological Magazine, vol. 125, no. 2, pp. 141 – 147.

150m (but more typically 80m) have been tested at discharge rates approaching 250m^3/hr. The public water supply borehole at Vingujini and the shallow well at the KWAWASCO water supply compound in Msambweni are eastern representatives of this aquifer system, with the latter capable of pumping 27m^3/hr (from fieldwork carried out in August 2011). The immediate Msambweni area was identified as a potentially high-capacity groundwater zone by an air-flown electromagnetic survey carried out in 1977[1]. 80m-deep boreholes in the Kinondo palaeochannel have been tested at 30 to 60m^3/hr.

The Jurassic and indurated sand and coral palaeochannel aquifers are hydraulically connected; the total area underlain by this combined aquifer system is estimated to cover about 85km^2.

Abstraction from the semi-confined Jurassic and palaeochannel aquifer systems is limited to the wellfields that serve KISCOL and Base. Aggregate abstraction by these two water users is significantly lower than from the Tiwi aquifer; in late 2017 the latter was estimated to produce approximately 9,000m^3/d (3.3MCM/yr)[2]. This compares with 2017 estimates for aggregate groundwater abstraction by KISCOL and Base of ~5,200m^3/d (1.9MCM/yr). Public water supply abstraction from the borehole at Vingujini, the shallow well at the Msambweni water supply compound and a third borehole elsewhere in Msambweni Town is reported to amount to 340m^3/d (0.12MCM/yr). Msambweni lies in the eastern part of the southern palaeochannel aquifer system.

From mid-2018, abstraction from the Base wellfield had risen to 9,500m^3/d; late 2018 abstraction from the KISCOL wellfields was low, at about 250m^3/d (pers. comm., WRA Mombasa SRO).

Geological structure and groundwater resources

A combination of drilling data, geological fieldwork and geophysics have shown how important the role of geological structure are in the distribution of groundwater in the study area. Figure 8.2 shows a revised geological map, with four major faults indicated.

[1] Terra Surveys Ltd. 1978. Interpretation report. Airborne EM survey with Barringer 'INPUT' System of Area 6 (Tiwi Aquifer). Unpublished report 77-18 for Ministry of Natural Resources, Mines and Geology. Nairobi, Kenya. Cited in: Buckley DK, 1981, Report on a visit to assess Groundwater Potential of the Kenya Coast south of Malindi (Including Proposals for the South Coast Groundwater Resources Project). British Geological Survey Report no. WD/OS/81/7.

[2] MWI/KCG (Ministry of Water and Irrigation/Kwale County Government Water Services, Infrastructure Development and Public Works). 2017. Water Security and Climate Resilience Project – Phase 2 Consultancy Services for Preparation of Kwale County Water Supply Development Master Plan Draft Volume I: Report Version 0 prep. by Egis Eau, Nairobi.

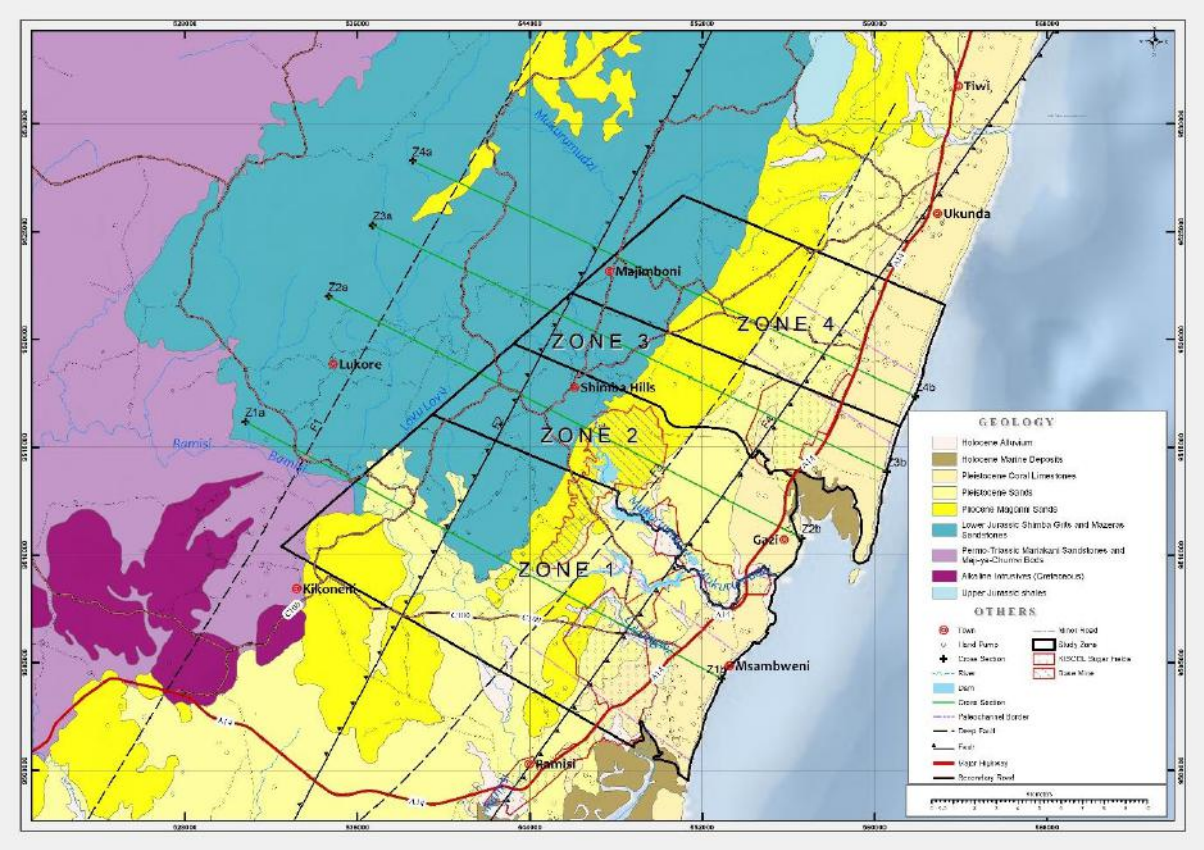


Figure 8.2: Geological Map of the study area

All faults are parallel with each other and oriented SSW to NNE. All are downthrown to the south east, at angles of 2 to 3°, with individual displacements of 30 to 50m. While the geological mechanisms are not clear, the Jurassic material east of Fault 3 (which is referred to as the Settlement Pond C or SPC Fault) is significantly more fractured and weathered than the same material west of the SPC Fault.

The faulting and fracturing are believed to be responsible for enhanced recharge; recharge occurs to the west, in the Shimba Hills[1] and appears to exploit faults and fracturing in groundwater movement towards the east/south east. *The area east of the SPC Fault is the target area for any additional BHs that may be drilled in the future.*

The best part of the Jurassic aquifer system extends from the north end of the Gongoni Forest to the southern edge of the KISCOL sugar field at Milalani; the aquifer efficiency is greatest in the Milalani area, with aquifer transmissivities exceeding 1,000m^2/d; BH1, the best of the Base BHs, has a transmissivity of 300 to 500m^2/d. In this central part of the aquifer, test yields exceeding 200m^3/hr for modest drawdown are possible. Further south (Nikaphu) and north (Kinondo), test yields fall to 70 to 80, and 30 to 60m^3/hr respectively.

Recharge and Aquifer Sustainability

Principally as a result of Base's monitoring network, Gro for GooD launched a complementary shallow groundwater monitoring network in 2014 with a view of collecting enough data to model the groundwater system in the Project area. Tahal *et al* developed a coarse model that suggested that the aquifer system in the Msambweni area would be capable of producing 30,000m^3/d (11MCM/yr) on a sustainable basis.

[1] Ramos NF, Folch A, Fernàndez-Garcia D, Lane M, Thomas M, Gathenya JM, Wara C, Thomson P, Custodio E and Hope R. 2020. Evidence of groundwater vulnerability to climate variability and economic growth in coastal Kenya. Journal of Hydrology Vol. 586, 124920.

The Gro for GooD model is described in Ferrer *et al* (2019b); and calculates recharge from hydraulic conductivity, rainfall, land use and gradient data from water balances. The model was calibrated against water level data collected by Base and Gro for Good from 2012 to 2017; this found that actual annual groundwater recharge was immensely variable and closely related to actual annual rainfall (see Table 8-5).

Table 8-5: Model Recharge to the "Msambweni aquifer system"

Year	Catchment precipitation (mm/yr)	Calculated recharge (m^3/yr)
2010	1022	71
2011	1406	160
2012	987	50
2013	1154	86
2014	1715	156
2015	1757	169
2016	867	58
2017	1442	224
Mean	**1293.4**	**121.75**

(Ferrer et al, 2019b)

50MCM/yr is equivalent to over 137,000m^3/d and mean annual recharge is 121.75MCM/yr or 333,500m^3/d, suggesting that most of the time recharge comfortably exceeds current abstraction and allows for additional abstraction. Mean daily abstraction of 30,000m^3/d of water as tentatively put forward by Tahal *et al* (2012) is a conservative value, and the study team believe it to be reasonable for the purposes of water allocation, since it includes a significant safety margin. There must be recognition that recharge will be lower during a drought year, which can be monitored with appropriately sited piezometer (monitoring) BHs.

Using the model as a groundwater management tool, successive model runs modelling different abstraction rates under different climatic conditions (decreased/increased rainfall and increased temperature) were carried out over 6 hypothetical future years at aquifer discharge rates up to 30,000m^3/d. This shows that while increased abstraction did increase aquifer drawdown, it created far less impact than a drought year with significantly lower than average rainfall.

Modelling showed that recharge by a good rainfall year after a poor rainfall year effectively restored aquifer water levels to 'normal' levels. Modelling showed that water levels in the shallow aquifer close by the commercial production wellfields after two successive dry periods would approach 5 metres, which would certainly lead to dry shallow wells and shallow boreholes. However, these effects are localised and will rarely extend far enough to adversely affect community water supply shallow wells. Any such effects can be mitigated by providing an alternative source of water, or by deepening a shallow well.

8.2.3.4 Significance of Impact (Pre-mitigation)

Table 8-6: Rating of Impacts to Geohydrology and Water Quality (pre mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**

Extent:	Local	The likely impacts (if any) will be on localized streams and subsurface water bodies, and local boreholes and wells.
Duration:	Medium-term	This impact will occur throughout the ore extraction period, for the period leading up to the end of 2028, where after rehabilitation and reinstatement will take place.
Scale:	Distinguishable	The impacts will affect specific localities (water resources, communities and biodiversity close to active mining areas) at times throughout the mine life.
Frequency:	Infrequent	Water will be used throughout the mining period of operations.
Magnitude		
Low		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High Streams and Rivers represent important biodiversity hotspots, and are a source of water to communities, livestock and wild animals		
Significance Rating Pre-mitigation		
Low		

8.2.3.5 Recommended Mitigation Measures

The following measures will be implemented to reduce the impacts on ground water resources and water quality from the project activities described above:

- There are considerable uncertainties around actual groundwater abstraction from the Study area's main aquifer, as described. This requires an abstraction survey.
- Current abstraction rates by Base are sustainable. As abstraction from groundwater for the North Dune will only be used as a third option, it is unlikely Base will need to increase abstraction from groundwater, over and above present abstraction amounts. In fact, under the co-disposal of slimes: sand, water use is likely to decrease, decreasing the volumes presently abstracted by Base under the current mining scenario.
- Supplementation of groundwater with surface water allocations –if needed - is recommended as a sustainable source of water supply to support the Base North Dune operations;
- Any localised effects resulting from groundwater drawdown on community boreholes and wells, can be mitigated by providing an alternative source of water, or by deepening a shallow well. This will also need to be incorporated into any future Resettlement Action Plan.

8.2.3.6 Residual Impact (Post-mitigation)

If the above recommended measures are implemented, the residual impact of the identified project activities on ground water resources will be ***Low*** (Table 8-7).

Table 8-7: Rating of Impacts to Geohydrology and Water Quality (post mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**

Extent:	Local	While increased abstraction does increase aquifer draw down, it was found that this created far less impact than a drought year with significantly lower than average rainfall. Modelling showed that recharge by a good rainfall year after a poor rainfall year effectively restored aquifer water levels to 'normal' levels. Modelling showed that water levels in the shallow aquifer close by the commercial production wellfields after two successive dry periods would approach 5 metres, which would certainly lead to dry shallow wells and shallow boreholes. However, these effects are localised and will rarely extend far enough to adversely affect community water supply shallow wells.
Duration:	Medium-term	This impact will occur throughout the ore extraction period, for the period leading up to the end of 2028, where after rehabilitation and reinstatement will take place.
Scale:	Distinguishable	The impacts will affect specific localities (water resources close to Project activity areas) at a time throughout the mine activities.
Frequency:	Occasional	Water will be used throughout the mining period of operations
Magnitude		
Small		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Medium		
Significance Rating Post-mitigation		
Low		

8.2.4 Impacts on Air Quality

8.2.4.1 Introduction

The operations have the potential to affect air quality through an increase in ambient dust levels as a result of the mining operations, plant operations, and transportation operations. Dust may affect workers' health through exposure to fine dust (respirable) particulates in enclosed areas over prolonged periods. Surrounding communities may be affected by increased ambient dust concentrations as a result of increased traffic and increased exposed areas associated with land clearing for mining and mining infrastructure.

8.2.4.2 Related Project Activities

Dust will be released both as a result of erosion of exposed areas that have been stripped of vegetation, from open mining areas, from areas exposed to vehicular movement and from the TSF.

8.2.4.3 Baseline Conditions

The North Dune is in a generally rural environment comprising predominantly rural homesteads, thickets and agricultural lands. Other infrastructures include mosques, churches, schools, training centres and a clinic. The only large scale operations in the area are Base Titanium's current mining operations to the south, and Kwale International Sugar Company (KISCOL) operations to the South East.

There is dust deposition/ fallout dust data available from monitoring sites at the south and south eastern end of the North Dune (location D1, D2 and D10 in Figure 5.8).

The dust deposition data (Table 5-2) are considered a reasonable indication of the baseline, given the distance to the North Dune and are presented in the table below.

These data show:

- a clear profile echoing the dry season in February and March but less so during the second drier period in August and September;
- no exceedances of the 30-day average South African dust nuisance threshold.

8.2.4.4 Air Quality / Dispersion Modelling

A specialist Air Quality report is presented in ***Appendix F***.

Introduction

The mining activities that will be conducted at the North Dune are primarily associated with the emission of particulate matter. These arise as:

- Deposited dust, this being total dust which settles onto property and surfaces which may cause a nuisance;
- Suspended Particulate Matter (TSP), this being the total dust burden in the air which may cause reduced visibility and nuisance;
- PM (PM_{10} and $PM_{2.5}$). PM_{10}, being particulate matter of aerodynamic diameter of ≤10µm; and $PM_{2.5}$, being particulate matter of aerodynamic diameter of ≤2.5µm.

An emissions inventory, based upon the current design information, has been prepared. For dust and particulates (as PM10/PM2.5) this drew upon the Australian NPi emissions inventory approach. Emissions of oxides of nitrogen (NOx) and sulphur dioxide (SO2) were calculated based upon manufacturer specifications for the mobile and non-mobile plant to be used on site. The inventory is based on the existing mine layout for the Base mining activities.

This emissions inventory has informed dispersion modelling which has been used to predict impacts arising at nearby sensitive receptors.

Dispersion Modelling

AERMOD, the model used for this assessment, is a steady-state model and the USEPA's preferred model for short-range impacts. AERMOD can consider the effect of complex terrain on atmospheric dispersion. The model also uses detailed meteorological data for the surface and upper air. The model was run for five years of meteorological data. The worst-case year was then used in each scenario to determine the impact. This approach, therefore, captures year-on-year variation in meteorology.

Meteorology

Meteorological data was sourced from ADM in the form of AERMOD-ready data based on Mombasa airport observations. In line with IFC guidelines best practice, five years of hourly sequential meteorological data were used in the study, 2015 to 2019. This is to ensure that year on year meteorological variability was considered in the study.

Emission Sources

General

The main mining activities associated with relevant atmospheric emissions are limited to:

- Site (Mining Block) preparation
- Site (Mining Block) rehabilitation

These activities are conducted systematically, moving from one block to another. On average a mining block comprises ~36ha and is active for about 12 months. For dispersion modelling, emissions from the identified activities have been calculated for an average mining block

Dust and PM_{10} Raising

As a worst case, it can be assumed that both preparation and rehabilitation activities may occur simultaneously at distinct areas within a single mining block. For fugitive emissions of TSP and PM_{10}, this translates to a conceptual area source, with following attributes:

- Rectangular area: 300m west to east x 600m south to north;
- Release height: 1m;
- Initial vertical dimension: 0.5m;
- TSP emission rate with
  - embedded mitigation: 0.0110mg/s/m^2 (annual mean)/0.0217mg/s/m^2 (one-hour peak);
  - additional mitigation: 0.00388mg/s/m^2 (annual mean)/0.00927mg/s/m^2 (one-hour peak);
- PM_{10} emission rate with
  - embedded mitigation: 0.00538mg/s/m^2 (annual mean)/0.0108mg/s/m^2 (one-hour peak);
  - additional mitigation: 0.00190mg/s/m^2 (annual mean)/0.00460mg/s/m^2 (one-hour peak).

Combustion Emissions

Emissions of dust and PM_{10} from mining occurs at ambient temperature, and with no vertical velocity as dust will 'drift' into the air. Emissions from mobile plants or equipment are distinctly different having an elevated temperature and existing vertically with a definite velocity. The dispersion of emissions from mobile equipment is therefore distinctly different. Emissions of PM_{10} and NO_x from mobile sources are therefore conceptualised into four point sources located equidistantly from the centre of the conceptual mine block (18ha square). The sources represent the total of mobile plant emissions from all plant operating within the mining block. Each conceptual point source has the following attributes:

- release height: 5m;
- emission temperature (1): 802.15K;
- exit velocity (2): 27.5m/s;
- flow rate (3): 6.23 m^3/s;
- PM_{10} emission rate with
  - embedded mitigation: 0.013g/s (annual mean);
  - additional mitigation: 0.013g/s (annual mean);
- NO_x emission rate with
  - embedded mitigation: 0.387g/s (annual mean);
  - additional mitigation: 0.387g/s (annual mean);

NO_x will be the most relevant pollutant with regards to combustion emissions. Furthermore, the PM_{10} emissions from combustion sources are negligible (< 3%) when compared to the PM_{10} emissions from fugitive sources. As such, only NO_x emissions will be modelled as point sources.

Receptor Grid

The dispersion model uses a Cartesian grid to determine the maximum Process Contribution (PC) and the PC arising at sensitive receptors. A tiered grid of 10 km by 10 km, centred on the area source has been used as follows:

(1) based on Caterpillar C13 engine

(2) based on Caterpillar C13 engine

(3) based on Caterpillar C13 engine

- 25m resolution up to 1km of the source;
- 100m resolution up to 5km of the source;
- 200m resolution up to 10km of the source.

8.2.4.5 Significance of Impact (Pre-mitigation)

Vegetation clearance, stripping of topsoil to expose the mineral ores, and mine traffic on internal mine roads will result in an increase in dust levels in the area of the North Dune, particularly during dry seasons or prolonged drought periods. Mining in the North Dune will also utilise hydraulic mining only, which is not dust generating.

These activities will potentially exacerbate the baseline conditions, particularly between the dry months of December to March.

Air quality impacts pre-mitigation are provided in ***Appendix F*** of the specialist Air Quality report.

Based on the analysis provided above, the impact significance of project activities on existing ambient air quality in the area will be ***Moderate*** pre-mitigation (Table 8-8).

Table 8-8: Rating of Impacts to Air Quality (pre-mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local to Regional	Dust and particulate matter emissions from the identified activities will be largely within the mine site and likely only to impact a short distance from the active mining boundaries.
Duration:	Long-term	This impact will occur throughout the mining period, up to the end of 2028.
Scale:	Distinguishable	The impacts will potentially affect specific localities (settlements close to mining activity areas), but only at specific times of the year. PM_{10} will only be distinguishable through measurements.
Frequency:	Throughout the year, but in particular, the dry months	The impact will be experienced more significantly during dry periods of the year, in particular in the dry, hot months between December to January.
Magnitude		
Small		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Medium Sensitivity		
Significance Rating Pre-mitigation		
Moderate		

8.2.4.6 Recommended Mitigation Measures

Though mining will largely be through hydraulic mining (a wet process), the following measures (many of these measures are already been conducted by Base as part of their Air Quality Management and Monitoring Programme) will be undertaken to limit any significant air quality impacts to ambient air from the activities mentioned above. Dust emission mitigation in the form of the following was considered in dispersion modelling of these emissions:

- Embedded mitigation:
  - Application of wind breaks around topsoil stockpiles;
  - Application of local wind breaks around rehabilitated open areas;
- Additional mitigation:
  - Local water sprays at rehabilitated open areas and at demolition/vegetation/soil stripping areas;
  - Application of local wind breaks at rehabilitated open areas and at demolition/vegetation/soil stripping areas;
  - Keeping topsoil moist for loading;
  - Water sprays at topsoil stockpiles;
  - Regular wetting of internal mine roads, especially if utilised extensively by mine traffic, with more frequent wetting during the months of December to March (Level 1 (2l/m^2/h) watering of unpaved surfaces used for topsoil haulage and open unvegetated areas);
  - Where possible, re-vegetate / rehabilitate cleared areas as soon as it is feasible;
  - Limit those cleared areas ahead of mining;
  - Limiting clearing activities to the greatest extent possible during the months between December to March;
  - Revegetation of stockpiles;
  - Enforcement of the 30km/hour speed restriction on access roads in the mining site;
  - Ensuring that compensated households have all moved out of sensitive locations before commencing mining activities;
  - Maintenance of all vehicles in good condition always to ensure complete hydrocarbon combustion;
  - Recording of all complaints from communities in the potentially affected areas and review these to address any unanticipated dust nuisance;
  - Employ adaptive management strategies to suppress dust levels when hot and dry conditions prevail, and especially when the action level of 600mg/m^2/day fall out dust is measured in dust buckets surrounding the North Dune. The monitoring campaign should be able to determine the upwind deposition, downwind deposition and the difference in between, which is attributable to the mining activities.

Modelling Results and Discussion

Overview

In summary:

- NO_2 impacts are 'negligible' at all locations. NO_2 concentrations are at most, 13% of the IFC guidelines, noting that the IFC guidelines are more stringent than the Kenyan standards, and therefore impacts against Kenyan standards will also be 'negligible'.
- Dust deposition impacts are 'negligible' at all locations beyond the site boundary. Comparison against ambient monitoring results is presented in Section 5.3.4. The modelling identified that the dust deposition standard will not be exceeded beyond the site boundary, and impacts are not greater than 25% of the deposition standard at any sensitive receptors.
- PM_{10} impacts are 'large'. Further analysis is presented in below.

Further Analysis of PM10

Appendix F of the Specialist Air Quality Report sets out the following contour plots for PM_{10}:

- Annual mean, with Embedded Mitigation (mean emissions)
- Annual mean, with Additional Mitigation (mean emissions)
- 24 hour mean, with Embedded Mitigation (mean emissions)
- 24 hour mean, with Additional Mitigation (mean emissions)
- 24 hour mean, with Embedded Mitigation (peak emissions)
- 24 hour mean, with Additional Mitigation (peak emissions)

In all cases, the mine activities result in PM_{10} concentrations >50% of the IFC air quality standard beyond the mining activities. Given that the PM10 baseline is undegraded, it is reasonable to assume that where the PM_{10} impacts are >50%, there is a risk of the air quality standard being exceeded. The use of additional mitigation substantially reduces the off-site PM_{10} concentrations and the footprint of impacts. As expected, the 'peak' emissions result in a larger impact than the 'mean' emissions, associated with one time dusting events.

Based on these results, a buffer zone is recommended around the mine to avoid excessive impacts at receptors near the mine. Due to the weather conditions, this buffer zone will not need to be the same size in all directions.

Table 8-9 sets out the buffer zones needed to avoid impacts of >50% of the IFC AQS for PM_{10}, for mean and peak emissions. Results only for additional mitigation have been shown.

Table 8-9: Indicative buffer zones for PM_{10}

Wind direction	PM_{10} Process Contribution as % of AQS	Additional Mitigation, mean emissions (m)	Additional Mitigation, peak emissions (m)
North	25%	575	1263
	50%	**285**	**700**
	100%	60	344
East	25%	0	260
	50%	**0**	**0**
	100%	0	0
South	25%	252	708
	50%	**85**	**322**
	100%	0	117
West	25%	260	865
	50%	**95**	**372**
	100%	0	132

Conclusion

Dust deposition in the vicinity of the North Dune shows that the airshed can be considered undegraded for dust deposition. Available ambient PM_{10} monitoring is limited to spot checks (i.e. <24 hours each month) only and is therefore of limited value only. In conjunction with available dust deposition results, it is likely that the airshed can be considered undegraded for PM_{10} as well.

The modelling showed that:

- NO_2 impacts are negligible at all locations.

- Dust deposition impacts are negligible at all locations.
- PM_{10} emissions are predicted to be large at the boundary of the mine resource even with additional mitigation and are likely to exceed the AQS immediately adjacent to the mining.

On this basis, the recommendation is made that buffer zones are established. The recommended buffer zone sizes are based upon the threshold of PM_{10} <50% of the IFC air quality standard, as this will allow for the underlying baseline:

- A buffer zone (incorporated into the RAP), relocating and prohibiting the permanent use any residences therein, around the orebodies of at least:
  - 285m to the North
  - 0m to the east
  - 85m to the south
  - 95m to the west

These buffer zones are designed to protect typical operations. There is the potential for one-off impacts beyond these distances during 'peak' emissions. On this basis, particular care should be taken to minimise the amount of open ground at any one time and apply additional watering on open areas when there are particularly dry and windy days.

8.2.4.7 Residual Impact (Post-mitigation)

If the above recommended measures are implemented, the residual impact significance of the identified project activities on air quality will be ***Minor*** (Table 8-10). The modelling Results are presented below.

Table 8-10: Rating of Impacts to Air Quality (post mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local, confined to the mine site and immediate environs	The residual emission will largely be dust at minimal scale, at active sites only.
Duration:	Long-term	This impact will occur throughout the mining period, up to the end of 2028.
Scale:	Distinguishable	The monitoring campaign should be able to determine the upwind deposition, downwind deposition and the difference in between, which is attributable to the mining activities.
Frequency:	Occasional	The low residual impact may only be experienced during extended droughts/dry periods, or during strong windy periods.
Magnitude		
Small		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Medium to Low Sensitivity		
Significance Rating Post-mitigation		
Minor		

8.2.5 Impacts due to Noise and Vibrations

8.2.5.1 Introduction

The operations have the potential to generate nuisance noise levels on and around the mine site and as a result of active mining operations.

8.2.5.2 Related Project Activities

The main project activities with likelihood to cause levels of noise and vibration disturbance include heavy equipment use in vegetation clearance, hydraulic mining, especially close to the mine boundary, and vehicle movements (both light and heavy). Both workers and the general public are potential receptors of noise generated from the mine site and active mining operations.

8.2.5.3 Baseline Conditions

Base Titanium have an extensive noise monitoring network, which has been operational since 2014. Ambient monitoring points N4, N5, N6, N7, N8, N9, N10 and N11 (Figure 5.9) are considered representative of the North Dune. Monitoring has been undertaken monthly at sites N4, N7 and N10 since January 2014. At the other sites, monitoring occurred monthly for the period January 2014 to October 2019.

The following is a summary of the data collected at all these sites:

Daytime noise levels:

- Minimum noise level: 30.5 dB(A)
- Maximum noise level: 68.9 dB(A) (occurred at site N8, October 2015)
- Average noise level: 50.4 dB(A)

Night time noise levels:

- Minimum noise level: 32.6 dB(A)
- Maximum noise level: 50.7 dB(A) (occurred at site N4, December 2015)
- Average noise level: 45.9 dB(A)

The data shows that daytime noise levels often do exceed the Kenyan noise guidelines (of 55 dB(A)) for both residential and mixed residential thresholds, but on average, noise levels are within this guideline value. The night time noise levels were almost always above the Kenyan guideline.

Non-mining related noise sources therefore exist in the area, and will need to be adequately factored in during mining phase noise impact monitoring. Such non mining noise sources include wind and rustling vegetation, birds, insects and small mammals within the Dune area, as well as other activities at settlements.

8.2.5.4 Noise Modelling

Note: A specialist noise modelling report is provided in ***Appendix G.***

Introduction

In addition to the ambient noise monitoring provided in the baseline chapter, predictive noise modelling of the North Dune resource area was conducted, and from this, noise contours have been developed for day and night-time, taking into account the mining activities that will be undertaken within the mineral resource. This modelling would be able to inform on the communities/ sensitive receptors that are likely to be impacted by the North Dune activities.

The predicted distances on which the criteria will be met (i.e. compliance limits based on the Kenyan noise standards and IFC noise level guidelines) were calculated for four chosen areas within the project's boundary, to define the potential impact zones for each receptor category that represent the areas susceptible of being affected by noise impacts. The four different areas (Mkwambani, Mwandimu, Bumamani, and the main North Dune resource area) were selected based on their geographical location, in order to cover the surrounding area of the project in all directions.

Figure 8.3 presents the four modelled areas. The buffer zones were defined based on the maximum predicted distances where the criteria were met for each receptors category among these four modelled areas, in order to represent the worst-case scenario.

The Operational noise compliance limits for receptors, as mentioned above, have been derived based on a combination of Kenya's and the IFC's noise standards, and are as follows:

- For noise sensitive receptors such as schools and places of worship, which operate only during day time, the Kenyan standard has been considered. The criterion for this assessment is the noise level of 40 dB(A).
- For noise sensitive receptors such as hospitals, which operate during day and night time, the Kenyan standard has been considered. The criterion for this assessment is the noise level of 40 dB(A) for day time and 35 dB(A) for night time.
- For the residential receptors, the IFC standard and WHO guidance has been considered. The criterion for this assessment is the noise level of 55 dB(A) for daytime and 45 dB(A) for night time. According to the baseline noise measurements at receptors nearby the southern dune, night time noise levels were higher than the Kenyan night time criteria and in some cases higher than the IFC criteria.

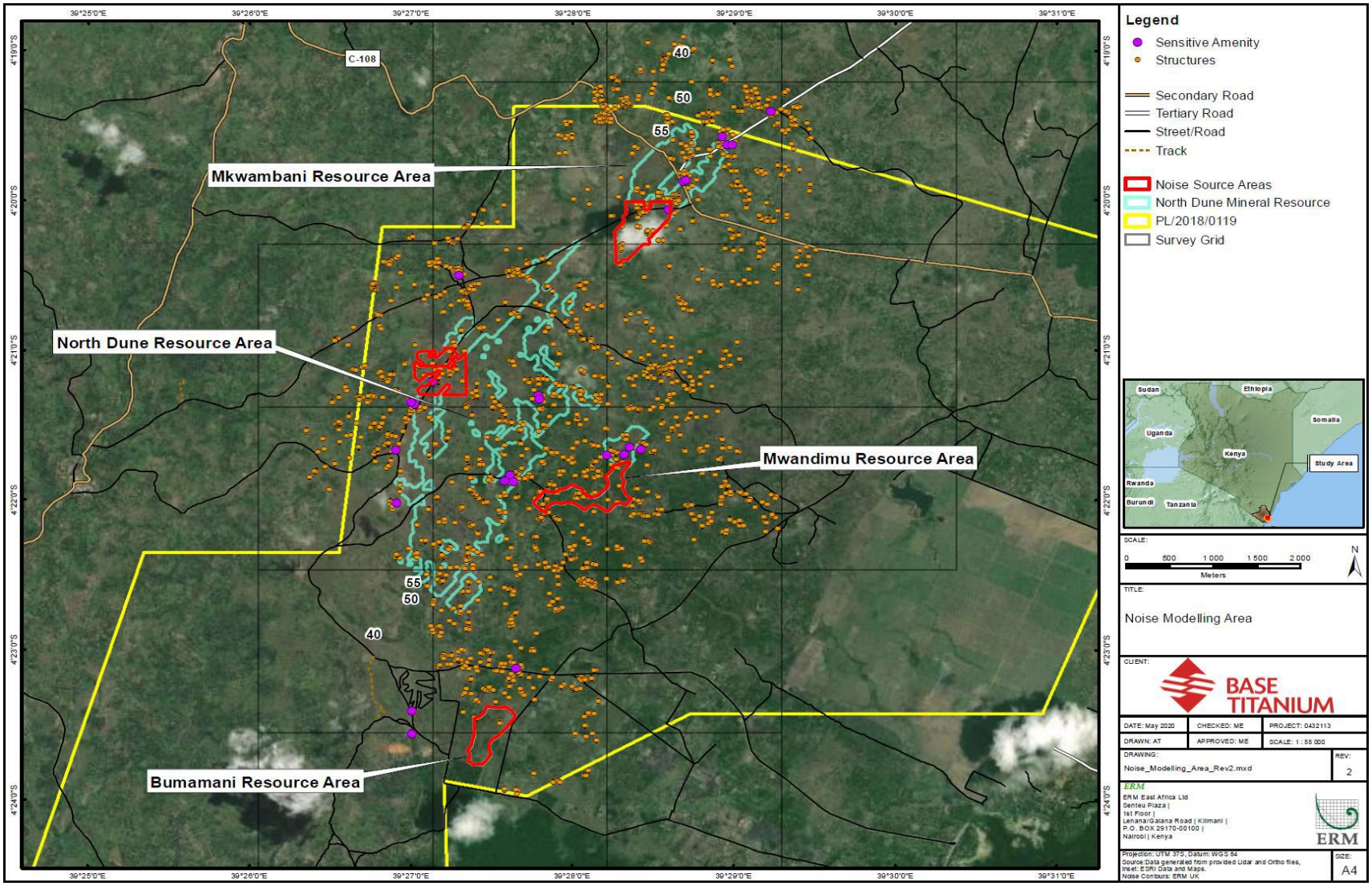


Figure 8.3: Noise Modelled Areas

Noise Modelling Methodology

The software, Predictor (version 2020), was used to calculate the sound propagation according to ISO 9613-1[1]. The model predicts noise level through spherical spreading and includes the effect of ground attenuation and shielding. It incorporates noise source data, meteorological data, surrounding terrain characteristics and was used to generate noise level contours.

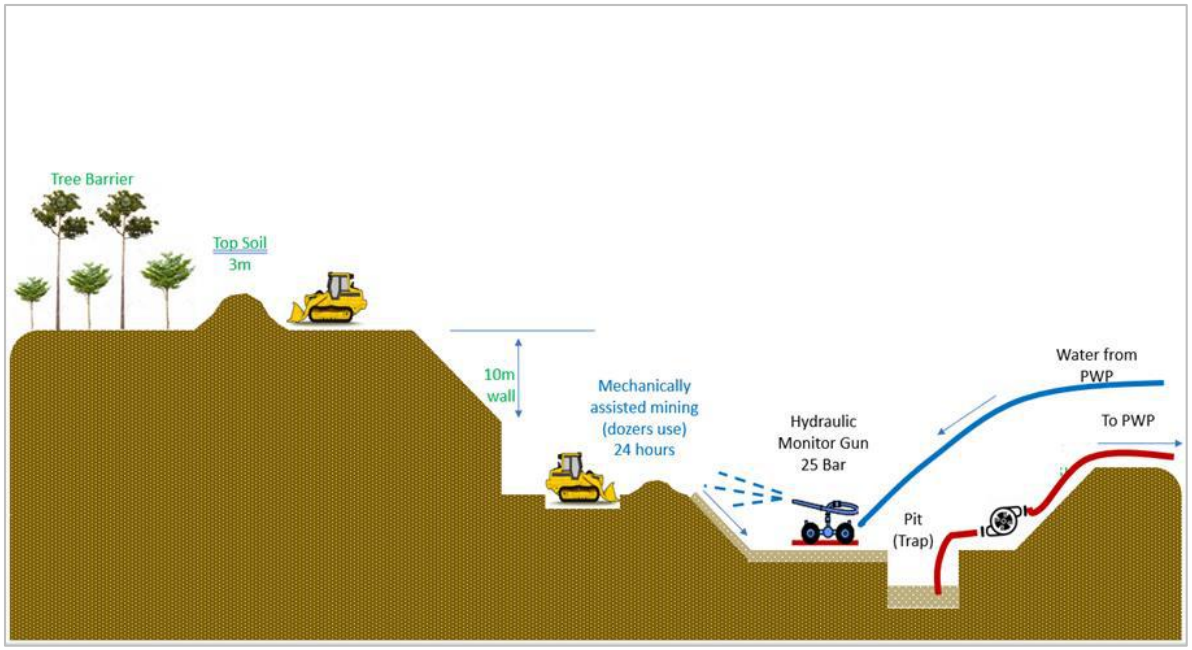
The Project's mining activities and the associated type and number of equipment during the time of measurement are presented in Table 8-11.

Table 8-11: Equipment present on each site during measurement

Activity ID Number	Activity description	Type of Equipment	Number of Equipment
M1	Topsoil removal and loading area	■ Cat loader 980h ■ Excavator ■ D8 dozer ■ Grader ■ Fuso fj dump trucks (multiple) ■ Cat articulated truck (dump truck)	1 1 1 1 1 2
M2	HMU gun - mining zone where high-pressure water jets are directed to the mine wall face to loosen the ore and create a slurry	■ HMU ■ Cat Ex 323D 2L Excavator	1 1
M3	HMU and Screen gun and pump area- ore slurry is further broken down using a high-pressure water gun to create a consistent slurry, after which it is pumped away from the mining block	■ Screen Gun ■ HMU ■ Pump Station	1 1
M4	Big Bertie - Run of Mine from the HMUs is directed to the Big Bertie where it passes through a screen that removes oversize, after which, the screened slurry is pumped to the wet concentrator plant	■ Big Bertie screen ■ Pump pu603 ■ Centrifugal pump	1 1 1
M5	Excavation Area	■ Cat excavator- Ex 323D 2L-Excavator ■ Excavator Ex 285 Fiat Hitachi ■ Fuso fj dump trucks (multiple) ■ D8 dozer	1 1 1 1
M6	Tailings Area	■ Tailings stacker ■ D7 Cat dozer ■ Cat excavator- Ex 323D 2L-Excavator	1 1 1

Figure 8.4 presents the mining process and the general topography of the area during the process. ERM's noise model has taken into consideration that mining will be conducted by use of hydraulic mining units directed at a wall face of 10 metres high on average. Therefore, in the model used, the height of the noise source areas, each of them representing one block of each entire deposit, have been decreased by 10m compared to the actual elevation. In addition, a barrier of 3 m height has been added to a 5m distance off each block, functioning as a noise screen.

[1] Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation, ISO, 1996.



Source: Base Titanium

Figure 8.4: Mining Activities and Topography

To represent the actual noise emissions of the operation of the mine, ERM took noise measurements of each of the above activities at distances of 50 and 100 meters for a 15-minute period, during a site visit at the Kwale mine in March 2020. During the measurements, it was not always possible to avoid noise from other activities and therefore the presented values might not represent the actual noise emissions of each activity. Therefore, the measured data, mainly at distances of 100 meters include the noise contribution of other activities. The measured noise data are presented in Table 8-12.

Table 8-12: Equipment present on each site during measurement

Activity ID Number	Activity description	Measured Sound Pressure Level dB(A)	
		50m distance from Site	100m distance from Site
M1	Topsoil removal and loading area	63	54
M2	HMU gun - mining zone where high-pressure water jets are directed to the mine wall face to loosen the ore and create a slurry	72	59
M3	HMU and Screen gun and pump area- ore slurry is further broken down using a high-pressure water gun to create a consistent slurry, after which it is pumped away from the mining block	56	51
M4	Big Bertie - Run of Mine from the HMUs is directed to the Big Bertie where it passes through a screen that removes oversize, after which, the screened slurry is pumped to the wet concentrator plant	62	59
M5	Excavation Area	54	54
M6	Tailings Area	101	96

The sound power level of each mining activity is presented in Table 8-13, and is estimated based on the logarithmic average of the back-calculated sound power level for each distance. The same table shows the number of actual activities taking place simultaneously during daytime.

Table 8-13: Estimated Sound Power Level of each Mining Activity

Activity ID Number	Mine SML Site						Total Sound Power Level dB (A)
	M1	M2	M3	M4	M5	M6	
Number of each mining activity	1	4	4	1	1	3	
Estimated Sound Power Level dB(A)	104	111	98	106	100	104	118

All equipment is assumed to be working simultaneously during day and night time, so as to assess the worst-case scenario. As indicated on the table above the total effective sound power level of the mining activities taking place during daytime is estimated to be **118 dB(A)**. Following conversations with Base's mining engineers, the night time activities will be reduced by 40%, therefore the total sound power level during night time is estimated to be **116 dB(A)**.

Noise Modelling Results

The predicted noise level contours are shown in the Specialist Noise Report (***Appendix G***). The figures show that there is a great variation of distances of which the criteria are met for day and night time within each area but also between the modelled areas. This is due to the variation of topography of each area, which can have a great screening effect, reducing significantly the noise propagation from the mining area.

Table 8-14 shows the maximum predicted distances from the boundaries of each modelled area where the criteria will be met for each type of receptors for day and night time. Table 8-15 shows the average predicted distances.

Table 8-14: Predicted Maximum Distances from the Project's Boundary

Modelled location	Predicted Distances (m)			
	Residential Receptors (IFC Guidelines)		Silent Zone & Places of Worship (Kenyan standard)	
	Day	Night	Day	Night
North	27	53	162	465
East	29	54	391	427
South	37	114	450	625
West	26	47	327	515

Table 8-15: Predicted Average Distances from the Project's Boundary

Modelled location	Predicted Distances (metres)			
	Residential Receptors (IFC Guidelines)		Silent Zone & Places of Worship (Kenyan standard)	
	Day	Night	Day	Night
North	15	21	55	127
East	15	24	99	185

South	14	45	194	358
West	14	25	122	248

8.2.5.5 Significance of Impact (Pre-mitigation)

The use of heavy machines (most probably the dozers) for vegetation clearance and topsoil stripping is expected to be the main cause of localized noise and vibration. Hydraulic mining may also cause some noise, but this is expected to be significantly less than the dozers, due to the buffering effects of the mined out wall. However, since the households within the North Dune Extension will be relocated prior to the commencement of mining activities, the impact of noise and vibration from mining operations will be ***Moderate*** pre-mitigation (Table 8-16).

Table 8-16: Rating of Impacts from Noise and Vibration (pre-mitigation)

Type of Impact		
Direct Negative Impact		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	The likely impacts will be specific to active mining areas at any given time.
Duration:	Long-term	This impact will occur throughout the ore extraction period, up to the end of 2028, where after rehabilitation and reinstatement will take place.
Scale:	Distinguishable	The impacts will affect specific sections of the mine area as per the mine plan. Noise measurements may detect a slight increase to baseline in areas adjacent to mining activities.
Frequency:	Occasional	The impact will only be enhanced during strong windy days or when activities are close to settlements.
Magnitude		
Small		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Medium Communities surrounding the mine are sensitive to increases in noise levels, in particular due to the largely rural nature of the surroundings. Communities within the North Dune Extension will be resettled.		
Significance Rating Pre-mitigation		
Moderate		

8.2.5.6 Recommended Mitigation Measures

Noise Modelling Conclusion

The results suggest the following maximum buffer distances from the Project's boundaries (Table 8-14):

- **Residential Receptors** – 100 m (Based on IFC standards)
- **Hospitals and other sensitive receptors operating during night time** – 600 m (Kenyan Standards)
- **Sensitive receptors operation only during day time** (schools, places of worship etc.) – 400 m (Kenyan Standards)

Average buffer distances are presented in Table 8-15.

Figure 8.5 and Figure 8.6 show the maximum buffer zones applicable at the boundaries of Project's resources areas, for day and night time respectively.

These buffer zones provide a conservative (worst-case) scenario of operational noise, since they represent the maximum distances where the criteria will be met. According to the results, as topographic structures may hinder the free propagation of noise through most of the surrounding area, it is anticipated that in many cases the criteria will be met in shorter distances than the buffers zones suggested above. In addition, no specific mitigation measures beyond the use of modern or well-maintained equipment was included in the predictions. Predicted average distances are significantly shorter that the ones presented in Table 8-14, however the maximum distances eliminate the risk of any potential noise impact at the nearby receptors.

The duration of the mining activities within each mining block is approximately three to five months before they move to the next block, therefore any noise impact would be temporary, and the buffer distance of any one sensitive receptor will therefore change with changes in mining activities and the location of active mine blocks.

The modelling Results, including daytime and night time noise contours are presented in Figure 8.5 and Figure 8.6 respectively below.

In addition to buffer distances, and resettlement which is assumed around active mining blocks, the following additional noise mitigation measures will be implemented to limit noise and vibration form Project activities:

- All households within the North Dune will be resettled as per the RAP Framework prepared by Base.
- Where the heavy equipment causing vibrations are to be used close to settlements, the households will be sensitised prior to such activities
- As much as possible, vegetation clearance and topsoil stripping will be conducted during the day, when most households are less sensitive to noise.
- Construction of berms/ walls along mining area perimeter to act as a noise screen
- Complaints on noise/vibrations shall be recorded, adequately investigated and necessary remedial measures taken, if required. Complaints from communities are, however, unlikely as all affected communities will be resettled.
- Directional 'smart' reverse alarms to be utilised on mining equipment
- Night time activity should be minimised as much as possible, especially relating to activities conducted close to the mining area perimeter
- The use of an "octave band analysis" to characterise the noise emitted from Base operations will be considered to compare future measurements with the data obtained at the locations on the boundaries of the Mine Site. This is proposed since the character of the noise emitted by mining and processing machinery is expected to be significantly different from noise emitted by insects, birds, vegetation rustled by the wind etc. Bases' contributions to the noise levels at these locations will then be better understood.

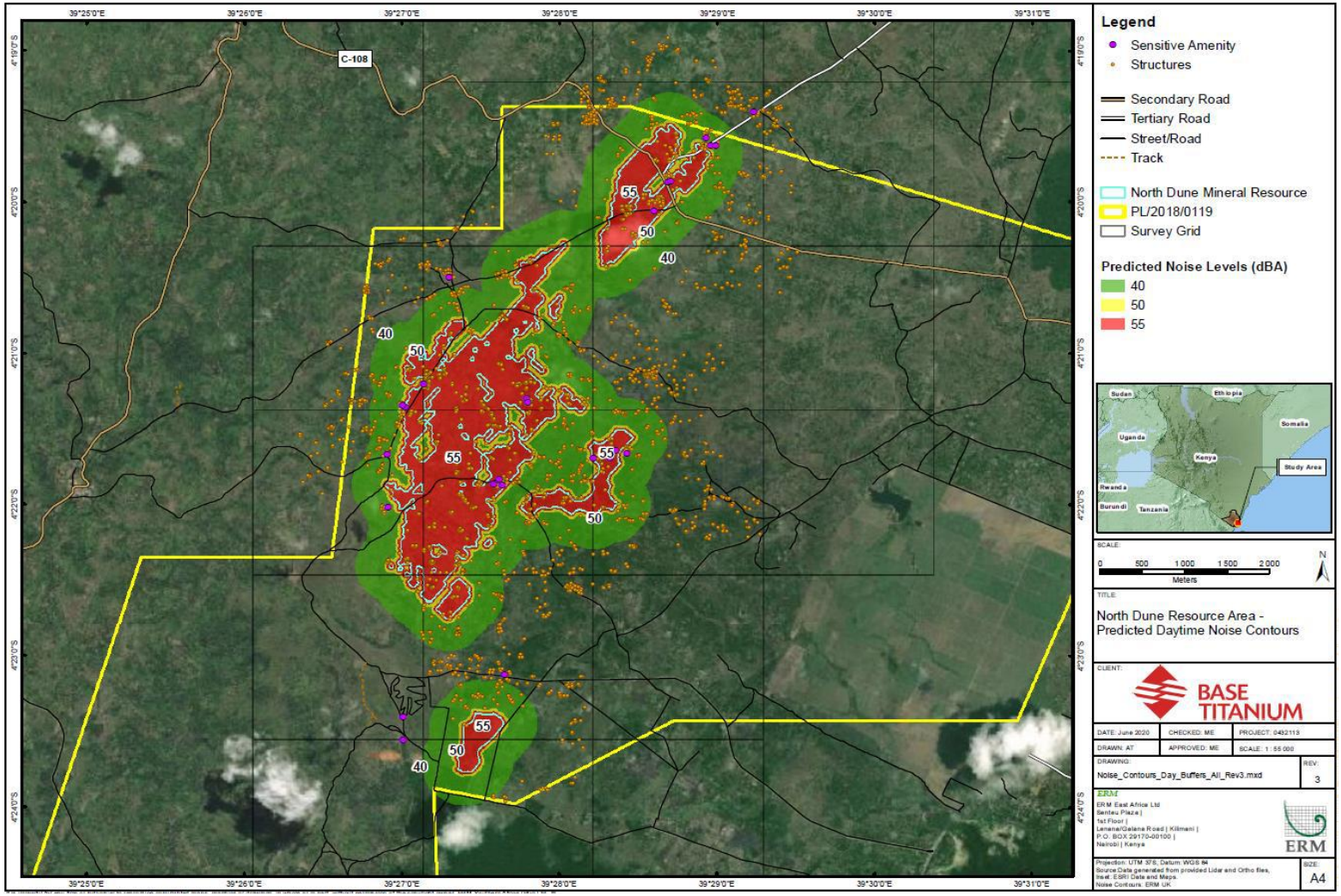


Figure 8.5: Predicted Buffer Zones - Daytime

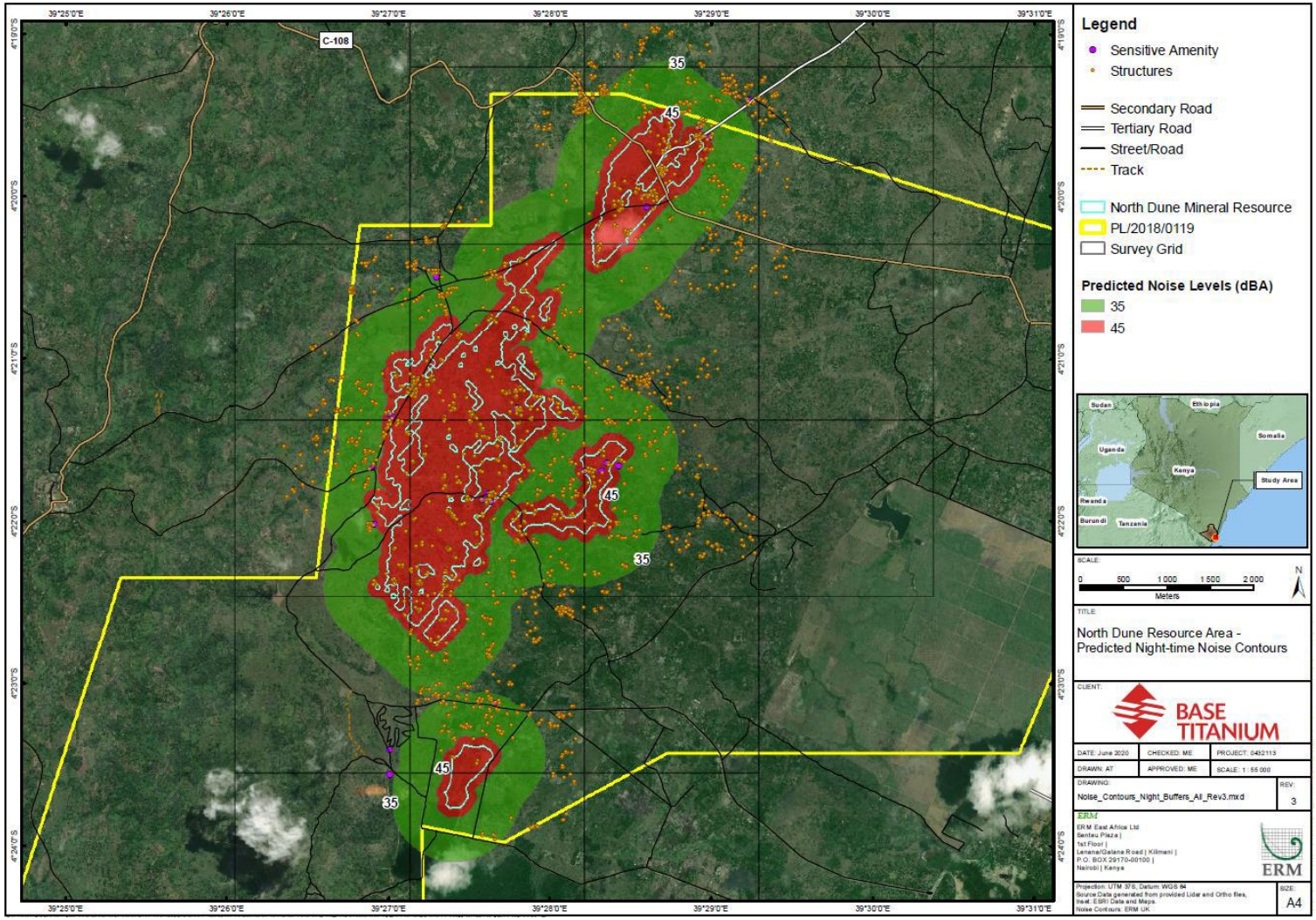


Figure 8.6: Predicted Buffer Zones – Night time

8.2.5.7 Residual Impact (Post-mitigation)

If the above recommended measures are implemented, the residual noise and vibration impact from the identified project activities will be ***Low*** (Table 8-17).

Table 8-17: Rating of Impacts from Noise and Vibration (post mitigation)

Type of Impact		
Direct Negative Impact		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	The likely impacts will specific to active mining areas at any given time.
Duration:	Long-term	This impact will occur throughout the ore extraction period, up to the end 2028, where after rehabilitation and reinstatement will take place.
Scale:	Not Distinguishable	Noise levels away from the mine boundaries will not be distinguishable from baseline noise levels.
Frequency:	Occasional	The impact will only be enhanced during strong windy days or when activities are close to settlements.
Magnitude		
Small		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High Communities surrounding the mine are sensitive to increases in noise levels, in particular due to the largely rural nature of the surroundings. Communities within the North Dune Extension will be resettled.		
Significance Rating Post-mitigation		
Low		

8.2.6 Impacts from Radiation

8.2.6.1 Introduction

Generally, heavy mineral sands are radioactive due to the presence of the radioactive element Thorium. This amount varies between different mineral sands deposits. As such, Base has undertaken a baseline radiation survey of the North Dune resource area to determine the baseline radiation. In addition to this, extensive background radiation monitoring surveys have been conducted for the Central and South Dune ore bodies along their perimeters, pre-mining and during operation.

The Kwale deposit was found to contain relatively low levels of naturally occurring radiation.

8.2.6.2 Related Project Activities

The Operation has the potential to affect radiation levels because of the mining of mineral sands and the way that the mineral sands are processed. The separation process results in the concentration of monazite and production of non-conductor mags, which contain small quantities of naturally occurring uranium and thorium. These by-products of the separation process are diluted with the remaining tails to ensure that radiation levels of the tailings remain the same as they were before the sands were mined.

8.2.6.3 Baseline Conditions

Base conducts radiation monitoring for both working areas and site boundaries. From the gamma radiation baseline monitoring conducted, a baseline average of the individual resource areas within the North Dune was set. These are as follows; 0.10 (± 0.03) µSv/h for Mkwambani; 0.12 (± 0.04) µSv/h for the Main resource- Mwaweche; 0.11 (± 0.03) µSv/h for the Main resource-Mwaloya; 0.11 (± 0.03) µSv/h for Mwandimu; and 0.10 (± 0.03) µSv/h for Bumamani. This baseline level is well within typical levels of natural background radiation levels and the legal guideline of 0.19µSv/hour.

Based on these baseline findings, Base will conduct regular impact monitoring during North Dune mining activities, and identified risks or radiation impacts addressed as recommended in Section 8.2.6.5 of this Report.

8.2.6.4 Significance of Impact (Pre-mitigation)

No impacts of operations on the levels of gamma radiation on site boundaries have been detected.

Based on the above, the potential impact the operations on radiation is considered to be ***Low*** pre-mitigation (Table 8-18).

Table 8-18: Rating of Radiation Impacts (pre mitigation)

Type of Impact		
Direct negative Impact		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	If the impacts occur, they will be highly localised, at specific activity areas in the mine.
Duration:	Long-term	The impacts of radiation are long term and irreversible.
Scale:	Not Distinguishable	Impacts may occur in those sections of the mine where people are exposed to levels of radiation higher than background.
Frequency:	Constant	Radiation is naturally occurring and will occur at very low levels throughout the LOM
Magnitude		
Small		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Moderate Sensitivity		
Significance Rating Pre-mitigation		
Low		

8.2.6.5 Recommended Mitigation Measures

The following measures will be implemented to limit radiation levels form Project activities:

- A comprehensive Radiation Management Plan and Monitoring Programme has been prepared by Base and management plans are implemented.
- Base will maintain radiation monitoring as per the Radiation Monitoring Programme in both air and water.
- Personal radiation badges will be worn by workers at the identified radiation risk areas to measure their personal radiation doses to ensure these are maintained well below international standards.

8.2.6.6 Residual Impact (Post-mitigation)

If the above recommended measures are implemented, the impact from the identified project activities will be ***Negligible*** (Table 8-19).

Table 8-19: Rating of Radiation Impacts (post mitigation)

Type of Impact		
Direct Negative Impact		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	If the impacts occur, they will be highly localised, at specific activity areas in the mine.
Duration:	Long-term	The impacts of radiation are long term and irreversible.
Scale:	Not Distinguishable	Impacts may occur in those sections of the mine where people are exposed to levels of radiation higher than background.
Frequency:	Constant	Radiation is naturally occurring and will occur at very low levels throughout the LOM
Magnitude		
Small		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Moderate Sensitivity		
Significance Rating Pre-mitigation		
Negligible		

8.2.7 Impacts on Faunal and Floral Diversity

8.2.7.1 Introduction

The entire Project Area lies within the Swahili Centre of Endemism and Coastal Forests of East Africa Biodiversity Hotspot, which is one of only 25 Biodiversity Hotspots recognised internationally, with high numbers of Endemic Fauna and Flora, and some of the habitat-types recognised on an international basis as Critically Endangered.

Due to the long history of human occupation in the area, the vegetation has been subjected to different levels of disturbance, so much so that very little of the original vegetation remains pristine and has been modified to other forms of vegetation. Still, remnants of natural vegetation remain, and has been found to provide suitable habitat for several threatened flora and fauna species.

8.2.7.2 Related Project Activities

Vegetation clearance and top soil stripping activities, in addition to other impacts, will cause losses of a variety of plant species (individuals and/or small sub-populations thereof) within the project footprint, and may also permanently alter the nature and structure of habitats. Several studies have shown that the vegetation units contributing the most to regional species diversity cover the smallest areas because these species are concentrated on and some also limited to particular habitats – in the case of Base Kwale that would include the Forests Areas and Wetlands. These and other habitats may contain species that are of high importance to the entire ecosystem (e.g. large indigenous trees), and an extinction of such a local plant population, or their reduction to a point where they become functionally extinct, can have dramatic consequences on the regulation and support of ecosystem services. The diversity and size of a landscape unit also influences ecosystem services – species on the edges of a

habitat are more vulnerable to environmental stresses (referred to as the edge effect, which will be increased), and the more a habitat is fragmented, the higher this stressful edge effect becomes, in addition to habitat loss. Habitat loss and/or fragmentation can thus have disproportionately large effects on ecosystem services.

Some of the vegetation species and habitats are also locally and internationally recognized as of high conservation concern. Their destruction will limit survival chances of associated plant species, dependent animal species, reduce sources of traditional medicines, fibre, wood and other for dependent households, and go against the internationally justified requirements to conserve plant species and habitats determined as threatened by the IUCN.

The main activities leading to direct negative impacts on the floristic receptors are listed in Table 8-20.

Table 8-20: Main activities leading to direct negative impacts on the floristic receptors

Activity	Phase	Sensitive Receptors
Clearing of Vegetation for infrastructure, pits, stockpiles and ore processing	Construction Mining operation	■ Forest Areas ■ Wooded Grassland ■ Wetlands ■ Large Indigenous Trees ■ Potentially individuals of threatened fauna and flora species ■ *Other receptors include modified habitats with low SEI*
Displacement and relocation of people	Construction	■ Uncertain at this point, hence not included in this assessment
Potential in-migration of people to area	Construction Mining operation Post-mining	■ Uncertain at this point, hence not included in this assessment ■ Increased loss of indigenous trees by harvesting or clearing ■ Increased loss of indigenous fauna by reduction in habitats and potential increased bush-meat trade ■ *Other receptors include modified habitats with low SEI*
Increased Machinery and vehicle movement	Construction Mining operation Post-mining	■ Forest Areas ■ Wooded Grassland ■ Wetlands ■ Large Indigenous Trees ■ Potentially individuals of threatened fauna and flora species ■ *Other receptors include modified habitats with low SEI*
Increased establishment and spread of alien invasive plant species	Construction Mining operation Post-mining	■ All habitats and indigenous species
Permanent modification of areas affected by roads and/or other decommissioned infrastructure, as well as landscaping related to rehabilitation	Construction Mining operation Post-mining	■ Forest Areas ■ Wooded Grassland ■ Wetlands ■ Large Indigenous Trees ■ Potentially individuals of threatened fauna and flora species ■ *Other receptors include modified habitats with low SEI*

The Impacts on vegetation and plant species can be listed as:

- Direct destruction of natural and modified habitats and their vegetation, and potential loss of seed-storing topsoil
- Increase of edge effect and increased loss or fragmentation of unique niche habitats and plant species of conservation concern, increasing the impact of existing surrounding anthropogenic activities
- Destruction of the natural configuration of unique niche habitats and all species dependant on such habitats within the extent of new mining infrastructure
- Loss of large indigenous trees that provide ecosystem services and/or habitat for associated species
- Continued loss of plant species of conservation concern due to a reduction of individuals of the narrow-endemics and threatened species, leading to loss of genetic diversity and gradual decline of sub-populations remaining
- Accelerated (unnatural high levels of) erosion due to clearing of surfaces, most notable on banks of rivers
- Increase in Alien Invasive Vegetation by providing a window of opportunity for its establishment in and around disturbed areas, and associated degradation of natural vegetation and displacement of species
- Reduced re-establishment of indigenous vegetation layer due to compaction and/or pollution of soils, which further reduces infiltration of precipitation into the soil
- Possible exacerbated effects of occasional extreme events (e.g. accelerated erosion and unwanted movement and deposition of materials into drainage lines and rivers) due to instability and changed topography of modified surfaces
- Possible degradation of adjacent or downstream sensitive and natural habitats due to indirect and induced impacts (water abstraction, pollution, changed hydrological flows), resulting in a decline of habitat quality suitable for the persistence of species of conservation concern

The impacts on faunal habitats and faunal species can be listed as:

- Direct destruction of natural and modified habitats
- Wildlife species living within the primary mining footprint, including sedentary species such as invertebrates, reptiles, burrowing fauna and amphibians, and mammals will be directly displaced or may even be lost from the area due to loss of specific habitats, most notably Amphibia
- Reduction of available habitats or reduced habitat quality due to the invasion of alien invasive plant and more domesticated (and feral) fauna species
- Destruction of the natural configuration of unique niche habitats and all species dependant on such habitats within the extent of new mining infrastructure
- Increased accidents due to moving vehicles or moving machinery leading to death and injury of wildlife, especially at night
- Continued loss of faunal species of conservation concern due to a reduction of individuals of narrow-endemics and threatened species, leading to a loss of genetic diversity and gradual decline of sub-populations remaining
- Influx of people and higher accessibility of areas, potentially attracting poaching for bush-meat trade and related activities (this may be continued after mining has ceased as loss of employment

may create a potential increase in bush-meat trade and reduction of remaining faunal habitats due to economic reasons, which could even put pressure on wildlife from Shimba Hills National Park

- Change in faunal composition due to the influx of opportunistic species that compete with or hunt rarer faunal species, e.g. domestic cats and dogs or common rats
- Noise caused by movement of earth moving machines and the plant, as well as high light levels (at night) disturbing fauna
- Loss of wildlife by falling into unprotected excavated areas

8.2.7.3 Baseline Conditions

Four main habitat types were identified, for which the sensitivity has been determined in terms of their respective Site Ecological Importance. Sections of these areas have been identified as Critical habitats. This is summarised in Table 8-21.

Table 8-21: Habitats

Vegetation Habitat	IFC Classification[1]	Site Ecological Importance	Extent (ha) in PAOI	Extent (ha) in resource area
1. Forest Areas	Natural and Modified, (*some* regarded as Critical)	High	175,7	34,3
2. Wooded Grassland	Natural and Modified	Medium	589,3	38,5
3. Wetlands and streams (including buffers and flood zones)	Natural and modified (*some* regarded as Critical)	High	1452,1	372,9
4. Tree Plantations, Orchards and Shambas	Modified	Low	1512,7	304,2
TOTALS			**3729,8**	**749,9**

- The entire study area falls within the Swahili Centre of Endemism, with remnants of natural vegetation, especially Forest Patches and wetland habitats considered as Critically Endangered
- Due to the long history of human occupation in the area, the vegetation has been subjected to different levels of disturbance, so much so that very little of the original coastal vegetation remains pristine, and has been transformed to other forms of vegetation
    - High levels of grazing and invasion of alien plants, as well as unsustainable conversion and/or harvesting of natural resources currently pose the biggest threat to natural habitats and indigenous species present within the PAOI
    - Despite the above disturbances, several threatened species (EN, VU and NT) could be confirmed in the PAOI
- The faunal habitats of the project area consist of a mosaic of vegetation types, of which none is continuous for a considerable stretch due to human disturbances, including, crop cultivation (Shambas), livestock grazing, plantations, settlements and forest resources exploitation. All these factors have modified the potentially very good wildlife habitat for fauna, forcing them to depend on pockets of remaining habitats of coastal thickets, riparian woodland/forests, wetlands, fallow land and limited grassland areas. Nevertheless, despite the disturbances, most of the project area still harbours a variety of faunal species, with two species considered EN and one considered VU. Places where these species have been observed were demarcated as critical habitats.

[1] According to the IFC Performance Standard Guidance Note 6 (2019) on Biodiversity Conservation and Sustainable Management of Living Natural Resources, habitats are divided into *modified, natural, and critical. Critical habitats are a subset of modified or natural habitats.*

- Two butterfly species were new occurrence records for Kenya, and one species observed was last recorded 50 years ago. Suitable habitat for these species does exist outside mineral resource areas, thus should not be affected directly.
- *Oboronia bueronica*, one of the new Lepidopteran species record from Mwaweche Spring, will have habitat outside of Mwaweche Spring. Still, it is recommended that the Mwaweche Spring Site be preserved as well as it has been used by the community for a long period and was a very pure water source.
- Kaya Kitsakabungo was a found to have exceptionally high plant- and insect diversity. It is at the edge of the mine resource zone and it would be desirable to retain it.
- In the Mwaloya area, there is a ± 8 ha area belonging to a retired teacher, which was a coconut plantation that has been allowed to regrow secondary growth now resembling a regenerated forest. The old owner refuses anybody on his land (he is in his eighties). This site had the richest biodiversity in the area and is within half a kilometre of the pond on the Kidongoweni Stream. The significance of this private conservation effort should be recognised and retained, and more detailed surveys conducted in this area. There are tracks on three sides of the property and it would be highly recommended to preserve this site if acquired.
- All other habitats, even if highly modified, may still harbour individuals of large trees (some threatened), but otherwise from a biodiversity perspective have limited value other than ecosystem functions such as grazing and floodwater attenuation (the latter only if suitably vegetated)
- Of the larger concerns would be the potential impact of the significant change of natural surface- and subsurface water-flows due to pit excavations on natural/threatened or important habitats near or downstream (towards the coast) of the mining areas.
- As far as possible, natural/threatened habitats should be avoided, as well as natural wildlife corridors such as riparian areas maintained, or alternative wildlife corridors created.
- There is a great concern about continued or accelerated establishment of alien invasive plant species as disturbances due to the mine will increase, and this will have to be addressed during the life of mine and mine rehabilitation efforts.

8.2.7.4 Significance of Impact (Pre-mitigation)

Table 8-22: Rating of Faunal and Floral Impacts (pre mitigation)

Type of Impact		
Direct Negative Impact		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local to Regional	The activities assessed are expected to be limited to the mining footprint area only. However, if suitable habitat for endangered fauna and flora, of which some have very limited distributions (e.g. the Shimba Hills Reed Frog), the impact will be regional as the genetic diversity of such species may also be affected, above the reduction in available habitat.
Duration:	Long-term	Modified habitats will take a long time to recover to their original state (if at all) despite rehabilitation efforts, due to slow growth rates of large indigenous trees, and may naturally revert to a lower stable state (e.g. Grassland) after rehabilitation, especially if subjected again to the current Land use system after mining
Scale:	Minimum of ±750 ha expected,	Potentially 34 ha of Critical Habitat, 407 ha High Sensitivity and 38,5 Medium Sensitivity habitat directly impacted, potential loss of several

	potentially over 800 ha	individuals of threatened plant species, potential loss of small sub-populations of threatened amphibians and/or their habitats Note: the area includes wetland vegetation, as wetlands are mostly fringed with Wooded Grassland and/or Forest
Frequency:	Continuous	This impact will be manifested from the construction to post-mining phase
Magnitude		
High Magnitude		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Smaller pockets of Critically Endangered natural habitats and individuals of large indigenous trees or other threatened plant species remain and will be further reduced. The habitats and species further contribute to a multitude of ecosystem services		
Significance Rating Pre-mitigation		
Major Negative Impact		

8.2.7.5 Recommended Mitigation Measures

Avoid:

- The critical habitats and identified No Go areas, presented in Figure 5.14. By protecting these (and other Critical Habitat) areas, the loss of these Critical Habitats can be prevented.
    - Do an accurate delineation of all remaining Kayas and other areas identified as important for biodiversity, such as Mwaweche Springs, Daniel Mbatha forest that have not been officially delineated up to date as part of the mine planning
- Maintain a buffer of preferably 100 m around edges of forest patches
    - Only forest patches that are inside the mineral resource areas should be considered for clearing, and preferably those on the edge of resource areas to be left intact
- Avoid less disturbed Wooded Grassland Thickets as far as possible, especially where threatened species (VU, EN) have been confirmed, or where such woodland patches are in proximity of wetland areas
- Avoid clearing indigenous trees with a bole >50 cm diameter and/or a height over 8 m where such trees fall outside the mineral resource areas
- *Oboronia bueronica*, one of the two new Lepidopteran species recorded, will have habitat outside of Mwaweche Spring. Still, it is recommended that the Mwaweche Spring Site be preserved as well as it has been used by the community for a long period and was a very pure water source (it is between the main and Mkwambani resource areas.
- Kaya Kitsakabungo was a found to have exceptionally high plant- and insect diversity. It is at the edge of the mine resource zone and it would be desirable to retain it.
- The Kidongweni Stream source is very important for Lepidoptera. Further important areas to target for conservation would be the Kaya at Mwandimu and the water spring at Mwaweche in the buffer zone.
- In the Mwaloya area, there is a ± 8 ha area belonging to a retired teacher, which was a coconut plantation that has been allowed to regrow secondary growth now resembling a regenerated forest. The old owner refuses anybody on his land (he is in his eighties). This site had the richest biodiversity in the area and is within half a kilometre of the pond on the Kidongoweni Stream. The significance of this private conservation effort should be recognised and retained, and more detailed surveys conducted in this area. It is recommended to preserve this site.

Reduce:

- Harvest areas to be cleared of all orchids and smaller indigenous plants that can be maintained in nurseries, harvest seeds for cultivation for rehabilitation
- Relocate individuals of threatened tree species as far as this can be done with success (e.g. *Ficus faulknerae*)
- Do not use topsoil of areas heavily infested with *Leucaena, Chromolaena* or *Lantana* for rehabilitation
- No open fires may be lit for cooking or any other purposes, unless in specifically designated and secured areas to avoid accidental bush fires
- Delineate all permissible areas so that all movement of vehicles and heavy machinery can be restricted to such areas only, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas may be allowed.
- Parking and operational areas must be regularly inspected for oil spills and covered with an impermeable or absorbent layer or grease pans (with the necessary storm water control) if oil and fuel spillages are highly likely to occur
- Areas of high conservation significance in close proximity, but outside the physical mining footprint, need to be clearly demarcated with appropriate barriers and signage to ensure no further encroachment or disturbance. Any infringements will be reported and appropriate penalties are to be enforced on transgressing staff or contractors.
- The following must be strictly prohibited:
    - Purchase or transport of any threatened or protected wildlife/indigenous plant products from local communities or passing traders
    - Collection of any plants or plant- products thereof for trade, consumption, medicinal use or cultivation, unless such person has the permission of the mine management as well as a valid permit from the responsible authorities, and harvesting is done on a sustainable manner
- Efforts will be taken to minimise the footprint of short-duration activities and/or linear infrastructure during construction, operation and decommissioning phases of the mine. Efforts to minimise such footprints will include grouping all infrastructure to the same servitude and/or as close as possible to existing and planned long-term physical disturbances. This will also reduce fragmentation of natural habitats.

Rehabilitate:

- Since all observed streams were originally forested, at least going by the evidence given by the few remnants, re-creation of the original riverine vegetation during rehabilitation is recommended. This will be important especially for shade-loving species, which may have disappeared with the opening up of the streams. Kidongoweni stream in Mwaloya village is a good reference site.
- Rehabilitate progressively and as soon as areas are mined out, fully utilising insights gained from the rehabilitation trials, and ensuring that:

  - Re-applied top soils resemble the texture and fertility of surrounding Wooded Grasslands and/or Forest Areas
    - Seed mixtures of the first vegetation establishments consists of a mixture of grasses and forbs as diverse as possible and resembling the natural vegetation

- As part of rehabilitation efforts, ensure that small clumps of woodland/forest high shrub and tree species are planted into the grasslands to recreate natural structural diversity of vegetation, to aid continued natural succession and stability of rehabilitated areas
- Aim to minimise or altogether avoid the establishment of alien invasive species on soil stockpiles and rehabilitated areas

- Re-creation of mayflies and caddisfly habitats is highly recommended. It was noted that caddis and mayflies inhabited man-made habitats such as the concrete at the bridges in large numbers. Originally when the area was forested decades ago, they may have inhabited areas with sizable logs in the streams since the whole Northern Dune area has no rocks. This can be re-created for them in the areas being rehabilitated and monitoring for colonization be carried out. Since logs will easily be carried away when rivers are in flood, the placement of boulders and rocks in carefully selected sites is recommended.
  - Adult stages of the new caddisfly species found in Kidongoweni River should be collected to facilitate its description.

Monitor:

- Since this was more of a rapid survey, a detail survey should be carried out for a comprehensive checklist of the area. It will be important to get the species that may have been missed during this survey. A detailed baseline will be helpful during the monitoring stage as it will confirm if species are appearing for the first time following mitigation or have been there before. Insects are known to be highly season in their activities. For instance, several dragonfly species collected before were missed and new ones recorded. Therefore, such future surveys should be done in different seasons or times of the year.
- Monitor forest patches near future mining areas for signs of degradation, and participate in/initiate community forest management and conservation programs

Monitor more intact woodland patches near all mined areas, and participate in/initiate community management and conservation programs, which would include reduction of alien invasive species

8.2.7.6 Residual Impact (Post-mitigation)

Habitat loss or modification to an altered state will still occur as a residual impact on mined areas but could be reduced with effective mitigation as discussed above. Based on the estimated areas of loss (see above), approximately 400 ha of natural or near-natural habitat will be lost to the mine footprint. Even with mitigation, mining will result in a permanent and (possibly) irreversible modification of habitat.

Based on the implementation of the proposed mitigation measures, the significance of the impact on local fauna and flora is anticipated to be a “Moderate Negative Impact” post mitigation per the assessment below.

Table 8-23: Rating of Faunal and Floral Impacts (post mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	Disturbances will be reduced to the smallest footprint possible, with all Critical Areas protected, and indigenous (especially threatened) large trees retained where such are between mining- and associated infrastructure areas
Duration:	Long term	Impacts will continue for at least the Life of Mine, and pending on post-mine Land use, receptors may recover to a near-natural state within 10 to 20 years following completion of the rehabilitation phase

Scale:	Medium	This impact will be manifested within the mining footprint
Frequency:	Continuous	This impact will be manifested from construction to rehabilitation phase
Magnitude		
Medium		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Critical Habitat Areas, which are habitat to threatened species, will be protected and areas rehabilitated to resemble the natural vegetation structural diversity, using indigenous flora species		
Significance Rating Pre-mitigation		
Moderate Negative Impact		

8.2.8 Impacts on Wetlands

8.2.8.1 Introduction

Permanent swamps/wetlands of varying size were found in depressions and along larger streams, where water floods the surface to a shallow depth throughout the year, whilst other wetlands found scattered throughout the drier habitats such as grasslands and thickets are more seasonal (ephemeral). Zoning of plant species within these habitats is distinct, depending on the level and duration of inundation.

Within the larger ecoregions, these wetland habitats are of extreme importance to species such as amphibians, with several species having been found to inhabit only a narrow range of swamps or seasonal wetlands (e.g. The Shimba Hills Reed Frog).

8.2.8.2 Related Project Activities

Vegetation clearance and top soil stripping activities, in addition to other impacts, will cause losses of a variety of plant species (individuals and/or small sub-populations thereof) within the project footprint, and may also permanently alter the nature and structure of habitats, specifically wetlands. Wetlands- and closely linked other habitats contain species that are of high importance to the entire ecosystem (e.g. large indigenous trees, dragonflies, pollinators), and an extinction of such a local population, or their reduction to a point where they become functionally extinct, can have dramatic consequences on the regulation and support of ecosystem services. Wetlands are further important also for their vital role in flood attenuation, and the role their vegetation plays in filtering out (absorbing) pollutants before water percolates into aquifers, which people access for drinking water. A reduction in wetland habitat extent thus also reduces the scale of ecosystem services beneficial to man that such wetlands can provide. It must also be noted that wetland functionality and health is often as linked to surrounding vegetation as surrounding vegetation may be dependent on wetlands, therefore surrounding habitats of importance to wetlands are also listed as part of the sensitive receptors below.

The main activities leading to direct negative impacts on the wetlands are listed in Table 8-24.

Table 8-24: Main activities leading to direct negative impacts on the Wetlands

Activity	Phase	Sensitive Receptors
Clearing of Vegetation for infrastructure, pits, stockpiles and ore processing	Construction Mining operation	■ Forest Areas ■ Wooded Grassland ■ Wetlands ■ Large Indigenous Trees ■ Potentially individuals of threatened fauna and flora species

Activity	Phase	Sensitive Receptors
Obstruction or diversion of streams	Construction Mining operation	■ Wetlands
Increased Machinery and vehicle movement	Construction Mining operation Post-mining	■ Forest Areas ■ Wooded Grassland ■ Wetlands ■ Large Indigenous Trees ■ Potentially individuals of threatened fauna and flora species
Increased establishment and spread of alien invasive plant species	Construction Mining operation Post-mining	■ All habitats and indigenous species
Permanent modification of areas affected by roads and/or other decommissioned infrastructure, as well as landscaping related to rehabilitation	Construction Mining operation Post-mining	■ Forest Areas ■ Wooded Grassland ■ Wetlands ■ Large Indigenous Trees ■ Potentially individuals of threatened fauna and flora species

The Impacts on Wetlands can be listed as:

- Direct destruction of natural and modified habitats
- Increase of edge effect and increased loss or fragmentation of unique niche habitats for fauna and flora
- Destruction of the natural configuration of wetland habitats and all species dependant on such habitats within the extent of new mining infrastructure and possibly beyond the prospecting licence area
- Accelerated (unnatural high levels of) erosion due to clearing of surfaces, most notable on banks of streams, causing excessive sediment loading of streams and water in wetlands, as well as siltation of wetlands (which may change perennial to seasonal wetlands)
- Interference with natural seepage and associated replenishment of surface and subsurface freshwater due to earth-works, pit excavation, potential stream diversions and destruction of smaller tributaries, causing a significant change to hydrological flow-paths
    - Possible degradation of adjacent or downstream wetland habitats due to indirect and induced impacts by changed hydrological flows, which may result in a significant change in freshwater input from surface and subsurface flows, changing water levels and water quality
- Increase in Alien Invasive Vegetation by providing window of opportunity for establishment in and around disturbed areas
- Reduced or a highly modified re-establishment of indigenous vegetation layer due to freshwater quantity, also as perennial wetlands may be reduced to ephemeral wetlands with only a short period of annual inundation
- Pollution of streams and wetlands due to surface runoff, through seepage of hydrocarbons from uncontrolled and/or accidental spillages of hydrocarbons or distribution of other pollutants
- Possible exacerbated effects of occasional extreme events (e.g. accelerated erosion, increased scouring by waves or high flood volumes) due to instability of wetland and especially mangrove vegetation

- Loss of wetland-related Ecosystem Services due to reduced surface and subsurface freshwater flows downstream of the mining pit areas

8.2.8.3 Baseline Conditions

Wetlands as defined and delineated during the survey do not only include the area of seasonal or permanent inundation, but rather, as far as possible, the surrounding area which is either forested or as part of the Wooded Grassland, has higher and denser bush-clumps. This is because the intactness, diversity and functionality of this associated 'riparian' vegetation is as important in maintaining the functionality and integrity of the wetlands, as wetland functionality is on the persistence of the riparian habitats. Such habitats or species within are also often the host plant of specific species, such as the Wild Ginger, Costus afer, which only grows around springs and wetland, and is the host plant for the newly discovered *Oboronia bueronica.*

Five wetland habitats were identified as critical within the 5 sampled villages. There was one each in Mwaweche, Mwaloya, Mwandimu and two in Bumamani village. The five were a mixture of both flowing and stagnant waters, supporting a higher diversity and abundances of macro-invertebrate species. They also all had remnants of natural riverine forests and thickets that supported forest specialists such as the dancing jewel damselfly (*Platycypha caligata*) and the glistening demoiselle (*Phaon iridipennis*). One caddisfly (Trichoptera) together with its habitat were part of these Critical Wetland Habitats. Apart from dragonflies, most other species collected have not been assessed for red-listing up to date. Therefore, the conservation concern for the species was based not on the IUCN red list categories but on their rarity in the sampling area, in other areas or if new to science. The caddisflies thought to be new belongs to the family known as Philopotamidae and in the genus called *Chimarra*.

Almost all aquatic monitoring sites were characterized by low abundances and diversity and a presence of several tolerant species such as bugs and beetles. Important micro-habitats for SASS application such as riffles due to the presence of rocks, stones or logs were unavailable.

Wetlands and their sensitivities habitats can be summarised as follows:

Table 8-25: Wetlands and their sensitivities habitats

Vegetation Habitat	IFC Classification[1]	Site Ecological Importance	Extent (ha) in PAOI	Extent (ha) in resource area
Wetlands	Natural and modified (*some* regarded as Critical)	High	1452,1	372,9
TOTAL Extent of all habitats			**1452,1**	**372,9**

The main concerns raised during the survey are:

- The Kidongoweni Stream source is very important for Lepidoptera, Herpetofauna and Flora. Further important areas to target for conservation would be the Kaya at Mwandimu and the spring at Mwaweche in the buffer zone.
- Confirmed occurrence of EN and VU species and presence of range-restricted species
- In the Mwaloya area, there is a ± 8 ha area belonging to a retired teacher, which was a coconut plantation that has been allowed to regrow secondary growth now resembling a regenerated forest. The old owner refuses anybody on his land (he is in his eighties). This site had the richest biodiversity in the area and is within half a kilometre of the pond on the Kidongoweni Stream, and

[1] According to the IFC Performance Standard Guidance Note 6 (2019) on Biodiversity Conservation and Sustainable Management of Living Natural Resources, habitats are divided into *modified, natural, and critical. Critical habitats are a subset of modified or natural habitats.*

there may be an active migration/movement of some fauna, e.g. amphibians living in forest areas but breeding in wetlands (such as the Shimba Hills Spiny Reed Frog) between the Forest and the wetlands.

- Of the larger concerns would be the potential impact of the significant change of natural surface- and subsurface water-flows due to pit excavations on natural/threatened or important habitats in close proximity to or downstream (towards the coast) of the mining areas, as well as potential pollution of wetlands, streams or forest habitats by uncontrolled invasion of alien invasive plants as well as runoff from mining areas after heavy rainfall events.
- As far as possible, natural/threatened habitats should be avoided, as well as natural wildlife corridors such as riparian areas maintained, or alternative wildlife corridors created.
- There is a great concern about continued or accelerated establishment of alien invasive plant species as disturbances due to the mine will increase, and this will have to be addressed during the life of mine and mine rehabilitation efforts

8.2.8.4 Significance of Impact (Pre-mitigation)

Based on the analysis provided above, impacts on local wetlands and mangroves during the construction and mining phase will be "Major Negative Impact" pre-mitigation as per the assessment below.

Table 8-26: Rating of Wetland Impacts (pre mitigation)

Type of Impact		
Direct Negative Impact		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Regional	Although mining activities will be limited to the mining footprint area, the disruption of faunal habitats and wetland freshwater input can extend to the region
Duration:	Long Term	Modified habitats will take a long term to recover to their original state despite rehabilitation efforts due to slow growth rates or trees, and faunal species may be permanently displaced due to the long duration of the ongoing disturbance levels. Likewise, sedimentation of wetlands and streams can permanently change flow rates and associated habitat suitability for several threatened species
Scale:	± 373 ha minimum, more can be affected without mitigations	The impacts may be felt by species depending on the cleared vegetation and configuration (including inundation level and -duration), some of which may be significantly affected outside the project footprint
Frequency:	Continuous	This impact will be manifested from the construction to post-mining phase.
Magnitude		
Medium Magnitude		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Many of the wetlands, despite current anthropogenic impacts, still provide suitable habitat for species that depend on the existence of such habitats. Several of these species confirmed to be present are threatened. Apart from supporting a unique species diversity, these habitats contribute to a multitude of very important ecosystem services		

Significance Rating Pre-mitigation
Major Negative Impact

8.2.8.5 Recommended Mitigation Measures

Avoid and Minimise:

- Avoid wetland habitats as far as possible, especially areas around springs
    - Protect upper reaches of Critical Wetland habitats to ensure no spillage of runoff from mining areas into these
- Maintain a buffer of preferably 100 m around edges of any perennial wetlands that do not fall within the mining resource area, and ensure no runoff from mining infrastructure/area gets into any rivers/wetlands, and ensure no runoff from mining infrastructure/area gets into any swamps and pans without being cleaned
    - Establish silt traps where necessary
- Minimise clearing indigenous trees with a bole >20 cm diameter where such trees fall outside the mining pit, or indigenous woodlands with a relatively closed canopy along riparian areas
- Always maintain the flow of larger rivers and wetland systems
- To avoid siltation of rivers and other surface water bodies, soil stockpiles should be located away from wetlands and streams and fitted with silt traps
- Project infrastructure should be designed and operated to minimise the impacts to natural water flows
- The Kidongoweni Stream source is very important for Lepidoptera. Further important areas to target for conservation would be the Kaya at Mwandimu and the water spring at Mwaweche in the buffer zone.
- Critical Wetland habitats outside the mining resource area should be permanently protected

Reduce:

- Aim to keep the vegetation within the 100 m buffer around streams and wetlands as intact as possible, or rehabilitate wooded areas, even if just by clearing alien invasive species
- Harvest areas to be cleared of all orchids and smaller indigenous plants that can be maintained in nurseries, harvest seeds for cultivation for rehabilitation
- Design and create berms and storm water control structures to stop runoff from the mining areas during/after a periodic high or extreme rainfall events get directly into existing wetlands or streams
- Parking and operational areas should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur
- Ensure all pumped water from workshops and other areas with a potential for contamination is collected in designated ponds and monitored for quality prior to discharge to the open environment
- Ensure all wastewater collection ponds are installed with impermeable liners to avoid seepage to groundwater
- Ensure that all storm-water drains are equipped with sediment traps and directed to specific containment areas where quality monitoring can be conducted prior to discharge to the environment

Rehabilitate:

- All the critical habitats for macro-invertebrates that were identified should be preserved during mining as they will be sources of species to re-populate the rehabilitated areas after mining.
- Since all streams were originally forested at least going by the evidence given by the few remnants, the re-creation of the original riverine vegetation during rehabilitation is recommended. This will be important especially for shade-loving species that may have disappeared with the opening of the streams. Kidongoweni stream in Mwaloya village is a good reference site.
- Aim to strengthen the riparian woodlands by removing alien invasive plant species and widening it by planting indigenous trees suitable to that habitat
    - Aim to reduce the alien invasive plant component around wetlands and rivers within the prospecting/mining licence area
- To aid a more rapid and early decommissioning of mined areas, pits should be backfilled as soon as possible
- Recreate all perennial wetlands that were destroyed after mining and re-establish the natural flora from harvesting existing wetlands and swamps or maintaining plants from cleared wetlands in a suitable area until rehabilitation
    - Re-creation of mayflies and caddisfly habitats is highly recommended. It was noted that caddis and mayflies inhabited man-made habitats such as the concrete at the bridges in large numbers. Originally when the area was forested decades ago, they may have inhabited areas with sizable logs in the streams since the whole Northern Dune are has no rocks. This can be re-created for them in the areas being rehabilitated and monitoring for colonization be carried out. Since logs will easily be carried away when rivers are swollen, the study team recommend the introduction of boulders and rocks in carefully selected sites

Monitor:

- Alternative biotic indices should be developed to monitor changes in the aquatic habitats alongside the SASS. A new method for assessing changes can be designed for use at Base Titanium limited base on observed changes in abundances and diversity. the study team also recommend the use of another simple index which uses dragonflies alone known as Dragonfly Biotic Index (DBI).
- Continue monitoring of threatened species and habitat condition at localities where such were identified, expand the search for such species to wetlands not yet surveys, but which will be within 100 m of the mining pit areas

8.2.8.6 Residual Impact (Post-mitigation)

Given above mitigation measures, the residual impact on wetlands can be reduced to Moderate, which will mostly be a reduction in wetland habitat area, of which much has been moderately to severely modified already.

Table 8-27: Rating of Wetland Impacts (post mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**

Extent:	Local	Disturbances will be reduced to the smallest footprint possible, with natural flows of streams retained where such are between mining infrastructure and wetlands, and Critical Habitats will be protected and excluded from the mining footprint area
Duration:	Medium to Long term	Impacts will continue for at least the Life of Mine, and pending on post-mine Land use, receptors may recover to a near-natural state within five to 10 years following completion of the rehabilitation phase
Scale:	At most ± 737 ha	Mining pit footprint only
Frequency:	Continuous	This impact will be manifested from construction to rehabilitation phase
Magnitude		
Medium		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
A large portion of these wetlands were already been modified at some stage to rice paddies or other fields, or are ephemeral with lower species sensitivity, Critical Habitats will be protected and excluded from the mining footprint area		
Significance Rating Pre-mitigation		
Moderate Negative Impact		

8.3 Socio-economic Environment

8.3.1 Impacts on Occupational Safety and Health

8.3.1.1 Introduction

Mining operations generally pose significant safety and health risks to workers and other persons within the workplace, and if not adequately addressed, workers may be seriously injured or worse, impacting on their livelihoods and quality of life. This section analyses the likely impacts of these activities to the safety, health and welfare of workers.

8.3.1.2 Related Project Activities

The project activities that have the potential to impact on occupational safety and health at the North Dune Extension include the use of mobile and immobile equipment at the Mine, and exposure to other activities such as vegetation clearing, topsoil stripping, and hydraulic mining.

8.3.1.3 Baseline Conditions

The nature of activities to be conducted, and for which workers will be engaged, are presented in Chapter 2 of this Report.

8.3.1.4 Significance of Impact (Pre-mitigation)

During mining activities, workers may be exposed to a variety of physical, chemical and biological hazards in the workplace. These hazards may be related to mechanized and mobile equipment, use of chemicals, noise, dust, radiation, and heat stress, ergonomic risks, as well as interaction with animals and insects. Health and Safety risks are considered Critical pre-mitigation (Table 8-28).

Table 8-28: Rating of Impacts to Workers' Health and Safety (pre mitigation)

Type of Impact
Direct Negative Impact

Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	The likely impacts will be specific to the mine site, and to specific workers exposed to the above and related risks.
Duration:	Long-term	The impacts may affect the workers for the rest of their lifetime, if they occur.
Scale:	Major change	The impacts may affect the workers, their households and other dependents, way beyond the area of operation.
Frequency:	Occasional	The impact will be experienced during the lifetime of the Mine operations.
Magnitude		
High		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High		
Significance Rating Pre-mitigation		
Critical		

8.3.1.5 Recommended Mitigation Measures

- Base has developed a culture of safety in the workplace. The OHS Management System and various OHS management interventions are fully embedded into the operations, and includes appropriate documentation, procedures, guidelines, standards, risk assessments and monitoring records, with assigned accountabilities and responsibilities. In addition, the OHS Management
- System undergoes frequent review. Various system elements are audited monthly and identified corrective measures implemented to further improve the system. Also, the operations' Hazard and Operability Study (HAZOP) has been undergoing monthly review. Any improvement actions for high risk activities are implemented, thus reducing the risk profile. A Contractor management plan forms a specific component of the overall OHS Plan.
- Base has in place 9 "Base" cardinal rules, with a zero tolerance for transgression on any of these. Base continues to undertake training programmes, including OHS specific training, for its staff, this ensures that all the workers are continuously trained and their knowledge on OHS improves. New employees or visitors are required to undergo an induction course prior to being allowed to visit the Project sites. The induction covers OHS, environment, social and security components.
- Regular pre-start meetings are required of all Base activities and Contractor activities.
- Appropriate PPE is mandatory for all employees and visitors.
- An OHS Committee and a Worker Safety Committee have been established and continues to meet regularly to evaluate the performance of OHS practices being implemented on site.
- Base has implemented a Fitness for Work Programme that ensures that workers operating equipment are fit to operate; indeed, this programme has been extended to all employees. This is through testing at random to determine blood alcohol levels.
- Base has a zero tolerance to alcohol and drugs, and the random testing is used to further discourage operating machinery while under the influence of alcohol or drugs.
- New employees are also subjected to medical tests before deployed to provide information on their health condition. Compulsory annual check-ups for required staff are also conducted to ensure that only fit workers are allowed on site.
- Emergency response systems have been tested and are likely to work well in case of an emergency.

Base continues to show a high level of compliance with the provisions of the OHS Act and holds current workplace registration certificates for both its mine site (KWL/10293/05/13/00) and the Likoni Ship loading Facility (MSA/2236/05/14/00).

As part of the ongoing OHS Management System reviews, activities applicable to the North Dune Mine Extension will be incorporated into Base's OHS Management System.

8.3.1.6 Residual Impact (Post-mitigation)

If the above mitigation measures are implemented, the residual impact of the project activities to the safety and health of the workers will be **Low** (Table 8-29).

Table 8-29: Rating of Impacts to Occupational Safety and Health (post mitigation)

Type of Impact		
Direct Negative Impact		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	The likely impacts will be specific to the mine site, and to specific workers exposed to the above and related risks.
Duration:	Long-term	The affected workers may live with the impacts for the rest of their lifetime, if they occur.
Scale:	Distinguishable	The impacts may affect the workers, their households and other dependents, way beyond the area of operation.
Frequency:	Infrequent	Worker health and safety incidents, with appropriate mitigation will be very infrequent.
Magnitude		
Small		
Significance Rating Pre-mitigation		
Low		

8.3.2 Loss of Housing (Physical Displacement)

8.3.2.1 Introduction

The establishment of the Project will require the acquisition of approximately 749 hectares of land, covering the North Dune Resource Area and a buffer around this area, established and recommended by the Air Quality, Noise and Biodiversity specialist studies. In addition, Base will also need to secure additional land for the construction of any linear or ancillary infrastructure (including dedicated mine roads, power-lines, pipelines, offices, construction camps etc.)

Given that there are households located throughout the North Dune Resource Area, there is no reasonable or practical measure to allow for these households to remain in-situ. To allow mining in the North Dune Resource Area as well as the construction of the required linear or ancillary infrastructure, Base will be required to compulsory acquire the required land and relocate any households that occupy the land.

The establishment of the Project will likely result in the physical displacement – or the loss of the primary place of residence directly related to projects activities – of an estimated 188 households located on

the North Dune Resource Area[1]. As the design and location of any linear or ancillary infrastructure is unknown, no estimate for the number of potentially displaced households can be provided.

8.3.2.2 Related Project Activities

The Project activities that will result in physical displacement include:

- Land acquisition required to secure the 749 hectares of land required to allow for the mining of the entire North Dune Resource Area, the 100-metre buffer, as well as land required for the construction of the required linear or ancillary infrastructure.
- The need to relocate households located between the North Dune Resource blocks as their resultant isolation after the resettlement of their neighbours and the likely level of disruption due to their proximity to the mining blocks is deemed unreasonable.
- Any project activities that results in unreasonable disturbance to local households based on exposure to air and noise emissions as determined by the Air Quality Assessment (***Appendix F***) and Noise Quality Assessment (***Appendix G***).

8.3.2.3 Baseline Conditions

The potentially physically displaced households are comprised of isolated farmsteads that are located on private land that is actively farmed with annual crops or small orchards/plantations. The farmsteads support a range of residential and ancillary buildings, and it is estimated that each farmstead support an average of 3.3 primary structures (1-2 main bedroom structures, 1 kitchen, and 1 pit latrine). Occupation of the farmstead is highly variable with some being permanently occupied by the owner, while many are only seasonally occupied during the main farming seasons. In terms of the latter, the owner resides in the local towns, and the farmstead may remain unoccupied or informally leased to a tenant or farmworker.

Base has undertaken land acquisition in the past to secure the Central and South Dunes, therefore local community experience of resettlement is well founded. Interviews with local communities show that there are strong negative perceptions of past resettlement, with repeated claims that the compensation was too low. In fact, 9% of surveyed households were part of the resettlement process. It can be expected that there will be significant community opposition to any future land acquisition process.

8.3.2.4 Significance of Impact (Pre-Mitigation)

The physical displacement of households, without effective mitigation via resettlement support and compensation, would definitely be defined as a **critical negative impact** (see Table 8-30). The impact while localised and medium magnitude, the affected households are highly sensitive to displacement which would fundamentally undermine their basic living conditions as well as their ability to support any livelihood.

Table 8-30: Impact Assessment of Physical Displacement (Pre-Mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	Physical displacement is limited to households located in the North Dune Resource Area only or land to be compulsory acquired by Base.

[1] *Based on mapping of 623 individual structures using satellite imagery of an area covering the North Dune Resource Area and a 100-metre buffer. The number of households was determined based on the assumption that local households retain an average of 3.3 structures*

Duration:	Permanent	Any physical displacement is considered to be permanent, as household will be permanently relocated from their place of residence.
Scale:	Major	Physical displacement will result in the permanent loss of place of residence and access to land required for livelihoods. Such displacement would fundamentally undermine the household, their living conditions as well as their ability to support any livelihood.
Frequency:	Once-Off	Any physical displacement is considered to be permanent, as household will be permanently relocated from their place of residence.
Magnitude		
Large – The magnitude of the impact is considered to be of a large negative nature. The impact will be major and permanent in nature, and it is only mitigated by the fact that the impact is localised to the North Dune Resource Area only or land to be compulsory acquired by Base and does not extend into the regional or national level.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High – Households are extremely vulnerable to physical displacement as the loss of their homes and land will fundamentally undermine the household, their living conditions as well as their ability to support any livelihood.		
Significance Rating Pre-mitigation		
Critical – The physical displacement of household, without any the adoption of a fair and effective resettlement and compensation process, would be considered a critical negative impact and would definitely be defined as a human rights violation and illegal process.		

8.3.2.5 Recommended Mitigation Measures

The following mitigation measures apply:

- Base will minimise the extent of physical displacement via the minimisation and optimisation of the mine design. It is further recommended that the Base Community Office forms part of the Detailed Design Team to address any resettlement matters as well as ensure that it is fully costed for.
- As physical displacement cannot be fully avoided, Base will be required enter into a formal compulsory land acquisition and resettlement process in order to secure the required land. This will include the development of a Resettlement Action Plan (RAP).
- The RAP will be prepared in compliance with national law, international good practice standards (as defined by the IFC Performance Standard 5 – Land Acquisition and Involuntary Resettlement) as well as any precedent or agreements made during previous RAPs.
- Additional recommendations are provided in the Social Management Plan (See Chapter 9 in this Report) with respect to the requirements in developing the RAP, and reference should be made to the Social Management Plan.

8.3.2.6 Residual Impact (Post-mitigation)

Assuming that Base adopt a fair resettlement and compensation process to address physical displacement, then the impact related to displacement is expected to be decreased as such measures will reduce the magnitude of the impact. However, the residual is expected to remain as major negative (See Table 8-31) as physical displacement will be permanent and result in an evident change in the affected household's living conditions and livelihoods.

Table 8-31: Impact Assessment of Physical Displacement (Post-Mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**

Extent:	Local	Physical displacement is limited to households located in the North Dune Resource Area only or land to be compulsory acquired by Base. This cannot be mitigated.
Duration:	Permanent	Any physical displacement is considered to be permanent, as households will be permanently relocated from their place of residence. This cannot be mitigated.
Scale:	Evident	Physical displacement will result in the permanent loss of place of residence and access to land required for livelihoods. The adoption of a fair and effective resettlement and compensation process would reduce the scale of the impact by providing replacement land and assets. Never-the-less, changes to the baseline is expected and will be evident.
Frequency:	Once-Off	Any physical displacement is considered to be permanent, as household will be permanently relocated from their place of residence.
Magnitude		
Medium – The magnitude of the impact is considered to be medium negative even with the adoption of mitigation measures. The impact is unlikely to substantially change as displacement cannot be fully avoided, as even if resettlement and compensation support is provided the displacement will remain permanent with an evident difference from their existing living conditions.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High – Households are extremely vulnerable to physical displacement as the loss of their homes and land will fundamentally undermine the household, their living conditions as well as their ability to support any livelihood.		
Significance Rating Pre-mitigation		
Major – The physical displacement of households, even with the adoption of a fair and effective resettlement and compensation process, would be considered a major negative. The displacement will be permanent and result in an evident change in the household's living conditions and livelihoods.		

8.3.3 Loss of Agricultural Land and Orchards (Economic Displacement)

8.3.3.1 Introduction

The establishment of the Project will require the compulsory acquisition of approximately 749 hectares of land, covering the North Dune Resource Area and a 100-metre buffer around this area. In addition, Base will also need to secure land for the construction of any linear or ancillary infrastructure (including dedicated mine roads, powerlines, pipelines, offices, construction camps etc.).

The North Dune Resource Area supports a range of existing land-uses and land-ownership – with the most common use being private small-scale farmplots and orchards/woodlots. The land-uses are fundamentally incompatible with mining and there is no reasonable or practical measure to avoid the compulsory land acquisition of such land.

It is expected that Base will need to compulsory acquire an estimated 371 hectares[1] of land under some form of active annual crop or tree agriculture, however this can be expected to be substantially larger. In addition, much of the land is expected to be under some form of private tenure, irrespective of the actual use of the land and this would also need to be compulsory acquired. As the design and location of any linear or ancillary infrastructure is unknown, no estimate of the land acquisition requirements can be provided.

The resultant compulsory acquisition will result in the economic displacement of local households – or the loss or restriction of access to land or resources that local households are dependent on for their livelihoods or to generate household income. Given that local households are fundamentally dependant

[1] *Based on land-use mapping of satellite imagery which indicates that the North Dune Resource Area and a 100-metre buffer supports an estimated 75 hectares of land under active annual crop agriculture. However, this is considered to be an underrepresentation and much of the transformed vegetation will comprise of fallow or inactive (between harvest seasons) agricultural plots. It can be reasonably assumed that the total land under some form of annual crop agriculture is closer to 371 hectares or just under half (49%) of the total area of North Dune Resource Area and a 100-metre buffer around this area.*

on land to support small-scale cultivation of either annual crops or orchards / woodlots, the loss of their land would result in the disruption of the livelihoods and ability to generate income via the trade in agricultural produce.

8.3.3.2 Related Project Activities

The Project activities that will result in economic displacement include:

- Land acquisition required to secure the 749 hectares of land required to allow for the mining of the entire North Dune Resource Area, the 100-metre buffer, as well as land required for the construction of the required linear or ancillary infrastructure.
- The need to relocate households (and acquire their land) located between the North Dune Resource blocks as their resultant isolation after the resettlement of their neighbours and the likely level of disruption due to their proximity to the mining blocks is deemed unreasonable.
- Any project activities that results in unreasonable disturbance to local households based on exposure to air and noise emissions as determined by the Air Quality Assessment (Environmental Resources Management, 2020) and Noise Quality Assessment (Environmental Resources Management, 2020)

8.3.3.3 Baseline Conditions

The land-use in the North Dune Resource Area is largely comprised of isolated small-scale farmsteads that support the cultivation of a range of annual crops and economically productive trees in small orchards/woodlots. The small-scale farmsteads are extensive throughout the resource area, and there are only smaller portions of open bush (likely communal land or unutilised private land) found between the farmsteads.

Most, if not all, of the land is expected to be under some form of private exclusive use via freehold title, leaseholders, or through customary tenure systems. Only freehold title and leasehold is legally codified, while customary tenure systems function only on Trust Land and is not fully accounted under statutory law. It is also expected that the open bush is not under private tenure but is held as community or communal land under Trust Land tenure.

8.3.3.4 Significance of Impact (Pre-Mitigation)

The compulsory acquisition of land and economic displacement of households, without effective mitigation via resettlement support and compensation, would definitely be defined as a **critical negative impact** (see Table 8-32). The impact is localised and of medium magnitude however the affected households are highly sensitive to economic displacement as their livelihoods are fundamentally linked to the access to land for the cultivation of annual crop or orchards/woodlots.

Table 8-32: Impact Assessment of Economic Displacement (Pre-Mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	Land acquisition and economic displacement would be localised to only the land required to allow for mining of the North Dune Resource Area and any required ancillary or linear infrastructure.
Duration:	Permanent	Land acquisition and economic displacement would be a permanent impact as all households would be displaced from their land and Base would likely permanently acquire their land.

Scale:	Major	Economic displacement related to the loss of land would be a major impact as local households are fundamentally dependant on access to land for the cultivation of annual crops or orchards/woodlots.
Frequency:	Once-Off	Land acquisition and economic displacement would be a once-off but permanent event.
Magnitude		
Medium – The magnitude of the impact is considered to be medium negative. Economic displacement cannot be fully avoided, and assuming the no mitigation measures via the implementation of the fair and effective resettlement and compensation process, the impact would be considered to be major, permanent but localised to the North Dune Resource Area and any required ancillary or linear infrastructure.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High – Households are extremely vulnerable to economic displacement as the loss of their land will fundamentally undermine the household, their living conditions as well as their ability to support any livelihood.		
Significance Rating Pre-mitigation		
Critical – The economic displacement of households, without any the adoption of a fair and effective resettlement and compensation process, would be considered a critical negative impact and would definitely be defined as a human rights violation and illegal process.		

8.3.3.5 Recommended Mitigation Measures

The following mitigation measures apply:

- Base will minimise the extent of economic displacement via the minimisation and optimisation of the mine design to reduce the total area of land that need to be compulsorily acquired. It is further recommended that the Base Community Office forms part of the Detailed Design Team to address any compulsory land acquisition requirement as well as ensure that it is fully costed for.
- As economic displacement cannot be fully avoided, Base will be required to enter into a formal compulsory land acquisition and resettlement process in order to secure the required land. This will include the development of a RAP.
- The RAP will be prepared in compliance with national law, international good practice standards (as defined by the IFC Performance Standard 5 – Land Acquisition and Involuntary Resettlement) as well consistent with any precedent or agreements made during previous RAPs.
- Additional recommendations are provided in the Social Management Plan (See *Chapter 10.2* in this Report) with respect to the requirements in developing the RAP, and reference should be made to the Social Management Plan.

8.3.3.6 Residual Impact (Post-mitigation)

Assuming that Base adopted fair and effective resettlement and compensation as part of the compulsory land acquisition process, the impact of economic displacement will be reduced. However, such displacement cannot be avoided and will result in an evident change in the living conditions and livelihoods of affected households. The residual impact is determined to be major negative as summarised in Table 8-33 below.

Table 8-33: Impact Assessment of Economic Displacement (Post-Mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**

Extent:	Local	Land acquisition and economic displacement would be localised to only the land required to allow for mining of the North Dune Resource Area and any required ancillary or linear infrastructure.
Duration:	Permanent	Land acquisition and economic displacement would be a permanent impact as all households would be displaced from their land and Base would likely permanently acquire their land.
Scale:	Evident	Economic displacement will result in the permanent loss access to land required for livelihoods. The adoption of a fair and effective resettlement and compensation process would reduce the scale of the impact by providing replacement land and assets. Never-the-less, changes to the baseline is expected and will be evident.
Frequency:	Once-Off	Land acquisition and economic displacement would be a once-off but permanent event.
Magnitude		
Medium – The magnitude of the impact is medium negative. Economic displacement cannot be fully avoided, and even with the adoption of mitigation measure via fair and effective resettlement and compensation, the change in existing land ownership, access and use will be evident.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High – Households are extremely vulnerable to economic displacement as the loss or restriction of access to their land will fundamentally undermine the household, their living conditions as well as their ability to support any livelihood.		
Significance Rating Pre-mitigation		
Major – The economic displacement of households, even with the adoption of a fair and effective resettlement and compensation process, would be considered a major negative impact. The displacement will be permanent and result in an evident change in the household livelihoods that are fundamentally linked to the ownership and access to land for small-scale cultivation of annual crops of orchards/woodlots.		

8.3.4 Loss of Communal Land and Natural Resources

8.3.4.1 Introduction

Base will be required to secure all land required to allow for the mining of the North Dune Resource Area or for the establishment of any required ancillary or linear infrastructure (including dedicated mine roads, powerlines, pipelines, offices, construction camps etc.).

The land will be comprised of a combination of private land or communal Trust Land – the latter being land held by the Kwale County on behalf of local communities, groups, families and individuals in accordance with applicable customary law and which is not registered under any statuary law. Trust land may be held under private and exclusive tenure by an individual or household or is fully communal land utilised by any member of the local communities.

Natural resource harvesting or use in the communal areas is common, and includes a range of activities – including the collection of firewood, charcoal production, collection of clays, sand, wood, grasses and reeds for building, fishing, collection of wild fruit and vegetables and grazing of large livestock. As communal land is not held under exclusive use for any one individual, the land may be used by any persons from the local communities. In general, the distances to obtain such natural resources is a constraining factor for local people, therefore most natural resource harvesting is undertaken on communal land immediately (~5kilometres) around their home village.

One key use of communal land is livestock grazing. Livestock reading is an important livelihood that is only secondary to annual crop farming. The most common livestock is chicken, goats, and cattle. Local households have an average of 10 head of cattle, and these cattle are actively herded by local men and boys for grazing and browsing in communal land. There is no presence of private pastures or communal grazing areas, and the use of communal land is entirely informal.

It is expected that Base will need to compulsory acquire an estimated 749 hectares covering the North Dune Resource area and a 100-metre buffer around this resource area. It is estimated that half (~371 hectares) of the land is under private ownership and used to cultivate annual crops or orchards, while the remaining land is likely defined as communal Trust Land. As the design and location of any linear or ancillary infrastructure is unknown, no estimate of the land acquisition requirements can be provided.

The acquisition of any communal Trust Land will result in the restriction of access to communal land, and likely reduce access to any natural resources that ae utilised by local communities. This is a form of economic displacement that is not limited to land-owning households but by communities that have access to communal land. In addition, the restriction of access to communal land for naturel resource harvesting often results in additional pressure on neighbouring areas that are not affected by the mine, as communities shift their harvesting practice to new areas. This often results in land-use conflicts with neighbouring communities or increased targeting of conservations areas.

8.3.4.2 Related Project Activities

The Project activities that will result in the loss of communal land and natural resources include:

- Land acquisition required to secure the 749 hectares of land required to allow for the mining of the entire North Dune Resource Area, the 100-metre buffer, as well as land required for the construction of the required linear or ancillary infrastructure.
- The clearing or transformation of natural vegetation (to allow for mining operations, as well as the establishment of any project linear and ancillary infrastructure) which is actively harvested by local households for household needs and informal trade.

8.3.4.3 Baseline Conditions

The land will be comprised of a combination of private land or communal Trust Land – the latter being land held by the Kwale County on behalf of local communities, groups, families and individuals in accordance with applicable customary law and which is not registered under any statuary law. Trust land may be held under private and exclusive tenure by an individual or household or is fully communal land utilised by any member of the local communities.

Such communal land functions as an important source of natural resources that are harvested by local households. This includes the collection of natural wood for either firewood, charcoal production, building materials and basic carpentry. Other natural materials used for building include sands, clays, grasses, and reeds. Local households also harvest natural resources from communal areas to supplement household food and this includes locally caught fish, harvesting of wild vegetables and fruit and limited hunting.

8.3.4.4 Significance of Impact (Pre-Mitigation)

Table 8-34: Impact Assessment of the Loss of Communal Land (Pre-Mitigation)

Type of Impact		
Direct Impact		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Localised	The acquisition of Trust / Communal Land will be limited to the North Dune Resource Area, any associated buffer as well as any land required for the project ancillary or linear infrastructure.
Duration:	Permanent	The acquisition of Trust / Communal Land is considered to be permanent unless Base seeks to return the land at the cessation of mining (mine closure) and conclusion of any mine rehabilitation.

Scale:	Major	The restriction of access to communal land is major and local communities rely on such areas for the collection for natural resources which is used to support housing construction, supplement household food needs as well as limited trade. Restrictions will also place additional pressure on any residual or surrounding communal land as household shift their harvesting practices to new areas.
Frequency:	Once-Off	The acquisition of Trust / Communal Land will be limited to a once-off event prior to construction and establishment of the mine and any associated linear or ancillary infrastructure.
Magnitude		
Medium – The overall magnitude of the impact is considered to be medium, as the impact will be both major and permanent in nature, but it is mitigated in that is it localised to the North Dune Resource area, a 100m buffer and any other land required for project linear and ancillary infrastructure.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High – Local communities are dependent on access to communal land to support natural resource harvesting and livestock grazing, which in turn supplement household food needs, informal trade in natural goods and well as provide a free source of building materials. The displacement of communities from the land may result in conflict with surrounding communities should their harvesting practices be forced to shift to new locations.		
Significance Rating Pre-mitigation		
Major – Assuming no mitigation measures are adopted the impact of the loss of communal land and natural resources would be of major negative significance. Such losses would be permanent		

8.3.4.5 Recommended Mitigation Measures

The following mitigation measures apply:

- Base will minimise the acquisition of communal land via the minimisation and optimisation of the mine design to reduce the total area of land that need to be compulsorily acquired. It is further recommended that the Base Community Office forms part of the Detailed Design Team to address any compulsory land acquisition requirement as well as ensure that it is fully costed for.
- As economic displacement cannot be fully avoided, Base will be required to enter into a formal compulsory land acquisition and resettlement process with the Kwale County as well as with the affected communities. This process will be facilitated via a Resettlement Action Plan.
- The RAP will be prepared in compliance with national law, international good practice standards (as defined by the IFC Performance Standard 5 – Land Acquisition and Involuntary Resettlement) as well consistent with any precedent or agreements made during previous Resettlement Action Plans.
- Additional recommendations are provided in the Social Management Plan (See Chapter 10.2 in this Report) with respect to the requirements in developing the Resettlement Action Plan, and reference should be made to the Social Management Plan.
- Base will also enter into a formal Resettlement / Community Agreement that establishes a legally binding approach to the allocation and spend of any compensation payments or community development funds, the establishment of a representative and legal management committee or structure, and the definition of the structures mandate.
- Base will explore the option of returning all land to the Kwale County once mining operations and rehabilitation has been concluded as part of mine closure. This will however only be undertaken where the land is safe for public use and sufficiently rehabilitated to support an agreed to land-use.

8.3.4.6 Residual Impact (Post-mitigation)

Table 8-35: Impact Assessment of the Loss of Communal Land (Post-Mitigation)

Type of Impact		
Direct Impact		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Localised	The acquisition of Trust / Communal Land will be limited to the North Dune Resource Area, any associated buffer as well as any land required for the project ancillary or linear infrastructure.
Duration:	Long-Term	The acquisition of Trust / Communal Land is considered to be permanent, however Base may select to return the land at the cessation of mining and conclusion of any mine rehabilitation as part of the mine closure process.
Scale:	Evident	Assuming alternative communal land is made available, or investment in community resources is supported by Base then the scale of the impact may be reduced. However, it will be very evident that access to communal land will be significantly altered even with the adoption of these mitigation measures.
Frequency:	Once-Off	The acquisition of Trust / Communal Land will be limited to a once-off event prior to construction and establishment of the mine and any associated linear or ancillary infrastructure.
Magnitude		
Medium – Even with the adoption of mitigation measures, the overall magnitude of the impact is considered to be medium. The impact will however be reduced to a long-term impact if the land is returned to the State and communities as part of mine closure. The impact however cannot be fully avoided, and it will be evident that there will be substantial changes in access to local communal land and natural resource harvesting practices.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High – Local communities are dependent on access to communal land to support natural resource harvesting and livestock grazing, which in turn supplement household food needs, informal trade in natural goods and well as provide a free source of building materials. The displacement of communities from the land may result in conflict with surrounding communities should their harvesting practices be forced to shift to new locations.		
Significance Rating Pre-mitigation		
Major – The loss of communal land, even with the adoption of a fair and effective resettlement and compensation process, would be considered a major negative impact. The losses would impact highly sensitive communities that rely of natural resources to supplement household food or living conditions as well as supporting a range of livelihoods. The loss would be deemed to be long-term on the assumption that the land is returned to communities, is made safe and is suitably rehabilitated.		

8.3.5 Impact on Businesses and Trades

8.3.5.1 Introduction

Local households operate a wide range of small-scale formal and informal businesses and trades – including but not limited to the informal trade in farm produce, roadside stalls / kiosks, artisanal goods and handcrafting, and transportation.

Many of the small-scale businesses and traders are inexorably linked to land (in the case of trading agricultural and livestock produce) and location (in the case of access to natural resources or their client base). The loss or restriction of access to land will have a secondary impact by reducing farm produce surpluses that may be traded. In addition, the relocation of any small-scale businesses and traders from their traditional client base will likely result in the disruption and reduction in income generated by household that operate these businesses or trades.

Inversely, the presence of the Mine has opened new business opportunities for local communities. While most of the formal business development has centred around urban towns (including Ukunda and Diani Beach), the presence of a permanent local workforce with disposable income has supported

cash-based trade in local communities. The extension of the mine life associated with the North Dune mining operation will allow for the continuation of such local economic benefits and delays the *economic bust* normally associated with the mine closure and retrenchment of the permanent operational workforce.

8.3.5.2 Related Project Activities

The Project activities that will result in impacts on businesses and traders include:

- Land acquisition required to secure the 749 hectares of land required to allow for the mining of the entire North Dune Resource Area, the 100-metre buffer, as well as land required for the construction of the required linear or ancillary infrastructure.
- The need to relocate any and all formal and informal businesses, business structures, traders, markets located in the target land. This will include all businesses or traders located between the North Dune Resource blocks as their resultant isolation after the resettlement of their neighbours and the likely level of disruption due to their proximity to the mining blocks is deemed unreasonable.
- The resettlement of communities or households that form the client-base or client catchment of any businesses or traders, and likely reduction in the level of trade and income from the loss of their client base.
- Continuation and possible improvement in local business and trade levels due to the extension of the mine life and continued employment of local operational permanent workforce. This avoids the typical *economic-bust* associated with mine closure.
- Continued investment of Base on local content (local business development) and local employment (notably employment of persons in proximity to the mine as part of Base recruitment policies) that benefits local businesses and traders.

8.3.5.3 Baseline Conditions

Most local households that are resident in the potentially affected communities are farmers and livestock herders. Small-scale businesses and trading are therefore largely centred on the sale trade of agricultural and livestock produce to neighbouring households and markets. As such, the ability of local household to engage in trade and generate an income is execrably linked to access to productive farmland, grazing land, and communal land for natural resource harvesting.

Some household also engage in non-agricultural trade, primarily via the provision of casual labour, informal services, transportation, construction, and carpentry, sewing, or the establishment of small trade stalls / kiosks. The stalls may trade in a wide range of domestic goods including clothing, food, drinks, cleaning products, basic electronics, and solar power for cellular phones.

Casual labour and informal services are not generally linked to any location or business premises, but rather depends on a client base or catchment that may encompass their home community and surrounding communities. Inversely, small trade stalls / kiosks are linked to fixed and mobile structures that may be located at the homestead, local community markets, community centres or along main access roads.

More broadly, the project is in proximity to established urban centres such as Ukunda and Diani Towns which support a range of formal and informal businesses and traders. In fact, both town support extensive business development, which is in part supported by increased trade and employment provided by Base. This contrasts with the more rural and small communities surrounding the mine, which have seen far less business development and trading opportunities.

8.3.5.4 Significance of Impact (Pre-Mitigation)

Assuming that no effective mitigation are put in place, the disruption of local businesses and trade is considered to be of ***major negative significance*** (as summarised in Table 8-36). The disruption will

be primarily driven by the either the (1) compulsory acquisition of productive land, (2) the need to relocate either the business itself, or (3) the relocation of the client base on which the business relies.

Table 8-36: Impact on Businesses and Trades (Pre-Mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	The compulsory land acquisition and resettlement process will directly result in the localised disruption of business and traders, or restriction of access to land on which small-scale trade in agricultural and livestock produce fundamentally relies on.
Duration:	Permanent	The disruption of business and traders due to compulsory land acquisition will be permanent, as it is unlikely to be reversed once mining operations cease.
Scale:	Major	The disruption of business and traders due to compulsory land acquisition is deemed to be a major negative impact given that such trade is central in generating household income.
Frequency:	Once-Off	The loss of businesses and trade related to land acquisition and displacement of business premises, trade practices as well as the client base will be a once-off event.
Magnitude		
Medium – The loss or disruption of local businesses and trading is of a major scale and will be permanent in nature, however the magnitude of the impact is rating as only medium as the impact is localised to communities affected by the land acquisition process.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High – Households have few opportunities to generate an income outside of small-scale informal businesses and trade. Given that most households engage in farming and livestock rearing at their primary livelihoods, informal trade tends to be focussed on the sale of agricultural produce and livestock. As such, households are extremely vulnerable to the loss or restriction of access to their land, which will fundamentally undermine the ability of the household to generate an income.		
Significance Rating Pre-mitigation		
Major – The overall significance of the impact is of major negative significance, assuming that no effective mitigation measures are adopted. Local household have few opportunities to generate cash income outside of small-scale trade, and the disruption of such trade will undermine the ability of local household to generate an income.		

8.3.5.5 Recommended Mitigation Measures

The following mitigation measures apply:

- Base will minimise the need for relocation of businesses, markets and traders via the minimisation and optimisation of the mine design to reduce the total area of land that needs to be compulsorily acquired. It is further recommended that the Base Community Office forms part of the Detailed Design Team to address any compulsory land acquisition requirements as well as ensure that it is fully costed for.
- As the relocation of local small-scale businesses and traders cannot be fully avoided, Base will be required enter compulsory acquisition all fixed assets, compensate for the losses of business or trade income and support the reinstatement of the businesses and traders at a suitable alternative location. This process will be facilitated via the Resettlement Action Plan.

- The RAP will be prepared in compliance with national law, international good practice standards (as defined by the IFC Performance Standard 5 – Land Acquisition and Involuntary Resettlement) as well consistent with any precedent or agreements made during previous RAPs.
- Additional recommendations are provided in the Social Management Plan (See Chapter 9 in this Report) with respect to the requirements in developing the Resettlement Action Plan, and reference should be made to the Social Management Plan.
- In addition, Base should actively invest and promote the economic development of any disrupted businesses, markets or traders. This may be undertaken as part of livelihoods restoration for direct losses incurred by affected persons in the RAP, and well as through the Base Community Development Plan that specifically targets the five affected communities of Mkwambani, Mwandimu, Mwaweche, Mwaloya and Bumamani.

8.3.5.6 Residual Impact (Post-mitigation)

Assuming that effective mitigation measures (via the RAP) as well as positive business investment programmes (via the CDP) are established, the impact on local businesses and trade is considered to be of moderately positive (as summarised in Table 8-37). This is however contingent that any businesses or traders affected by the land acquisition and resettlement process are compensated, given the option of reinstating their trade at an alternative location and that livelihood restoration is fully implemented by Base.

Table 8-37: Impact on Businesses and Trades (Post-Mitigation)

Type of Impact		
Direct Positive		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	The disruption of local businesses and traders and any mitigation measures and investment programme adopted by Base to address this disruption will be localised to communities affected by the land acquisition and resettlement process.
Duration:	Long-Term	If Base establish effective livelihood restoration measures as well as long-term investment programmes for local business development in the affected communities, the duration of the associated benefits would be long-term (or the life of the mine).
Scale:	Distinguishable	Irrespective of whether Base adopts effectively mitigation measure or investment programmes, is it expected that there will be a substantial change that is distinguishable from current business and trading conditions.
Frequency:	Constant	Assuming Base commits to long-term investment in restoring and promoting the investment in affected businesses and traders (via the RAP and the CDP) the benefits are expected to be ongoing over the long-term.
Magnitude		
Small Benefit – It is expected that the project will result in the disruption of local businesses and traders from the compulsory acquisition of land and the relocation of business and traders. The adoption of effective livelihoods restoration measures (under the RAP) as well as ongoing investment in local businesses (under the CDP) is expected to result in small benefits to affected communities.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High – Households have few opportunities to generate an income outside of small-scale informal businesses and trade. Given that most households engage in farming and livestock rearing at their primary livelihoods, informal trade tends to be focussed on the sale of agricultural produce and livestock. As such, households are extremely vulnerable to the loss or restriction of access to their land, which will fundamentally undermine the ability of the household to generate an income.		

Significance Rating Pre-mitigation
Moderate Benefits – Given that there are limited opportunities for business development and trading for communities immediately surrounding the project, the introduction of a long-term investment programme through the Base CDP is expected to result in moderate benefits. This is how ever contingent that any businesses or traders affected by the land acquisition and resettlement process are compensated, given the option of reinstating their trade at an alternative location and that livelihood restoration is fully implemented by Base.

8.3.6 Loss of / Pressure on Public Services or Facilities

8.3.6.1 Introduction

The establishment of the Project will result on the loss of public services or facilities where these resources are in the North Dune Resource Area, its associated 100-metre buffer or on land required for any required linear or ancillary infrastructure.

This includes the direct loss of three pre-primary or primary schools (Mkwambani Primary, Mwaloya Primary and Mwandimu Pre-Primary), one combined orphanage and clinic, 7 churches, 5 mosques, 3 madrasa schools, 1 social hall and 1 vocational training centre. These losses would be directly attributed to land acquisition of the North Dune Resource Area and the associated 100-metre buffer.

Consistent with the recommendations of the Noise Screening Report (Environmental Resources Management, 2020), public facilities are deemed to be sensitive receptors and there should be a suitable setback distance of 600 metres for hospitals and other sensitive receptors operating during night-time, and a distance of 400 metres for sensitive receptors that only operate only during day time (schools, places of worship etc.). The Air Quality Impact Assessment (Environmental Resources Management, 2020) also requires the establishment of setback lines to prohibit the permanent use of any residences (and assuming all public facilities and services) at least 285m to the North, 0m to the east, 85m to the south, 95m to the west. The increase in the required buffers around the mine site to align with the above recommendations would further result in the loss of public services, facilities, or infrastructure.

In addition, the loss of such public resources would result in local households and communities needing to access alternative services or facilities in neighbouring villages or towns, should these resources not be replaced. Often this leads to additional pressure on the alternative services or facilities that tend to be under-resourced.

Finally, the establishment of a construction workforce and potentially a larger operation workforce may apply yet further pressure on remaining services or facilities. This may include the use of local schools, clinics, markets, water sources, roads by the Base workforce. While such a workforce often brings economic benefits, it can readily overwhelm local public services or facilities where similar services is not directly provided by Base.

8.3.6.2 Related Project Activities

The Project activities that will result in the loss of / or increased pressure on public services and facilities include:

- Land acquisition required to secure the 749 hectares of land required to allow for the mining of the entire North Dune Resource Area, the 100-metre buffer, as well as land required for the construction of the required linear or ancillary infrastructure.
- Relocation of sensitive day-time and night-receptors to align with the recommended set-back distances established in the Noise Screening Report (Environmental Resources Management, 2020) and the Air Quality Impact Assessment (Environmental Resources Management, 2020).
- Relocation of households as part of the compulsory land acquisition process to an area not located in proximity to existing public services or facilities, or a location that does not support any existing public services or facilities

- Presence of a construction and operational workforce in the area, and subsequent demand for access to local public services and facilities by this workforce, if no similar services are provided by Base.

8.3.6.3 Baseline Conditions

The potentially affected public services and facilities are utilised by the communities of Mkwambani, Mwandimu, Mwaweche, Mwaloya, and Bumamani. The Household Socio-Economic Survey shows that households from these communities are highly dependent on services in their own villages. Given their relative isolation and associated transport costs, there is minimal use of alternative facilities barring major hospitals, dispensaries, schools, shops and markets located in Magaoni, Msambweni, Mwaloya, Shimba Hills and Ukunda.

8.3.6.4 Significance of Impact (Pre-Mitigation)

The loss of or additional pressure on existing public services and facilities is very likely and is attributed to (1) compulsory land acquisition, (2) exceedances of air and noise limits at sensitive public locations, and (3) use of such facilities by the construction and operational workforce. The impact, assuming no mitigation measures are adopted, is rated as a major negative significance (see Table 8-38).

Table 8-38: Loss of / Pressure on Public Services or Facilities (Pre-Mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Regional	The loss of public facilities will be localised around the North Dune Resource Area and any setback buffers, or any land required for project linear or ancillary infrastructure. In addition, the increased use of public facilities may extend further afield to several local villages and local town centres.
Duration:	Permanent	The loss of public services and facilities related to land acquisition would be permanent, while increased pressure from the use of facilities by the construction and operational workforce would be short to long-term.
Scale:	Major	Local communities are dependent on local public services and facilities and given their relatively isolated location they cannot readily access alternative facilities. Any alternative facilities would also see an increase in utilisation if they are required to support the affected communities.
Frequency:	Constant	The loss of loss of public services and facilities would be once-off and permanent. The increased use of alternative services and facilities would however be constant.
Magnitude		
Medium – The loss of or increased pressure on public services and facilities is of medium magnitude. The impact is permanent, major and will be of regional significance and it is expected that, without the adoption of effective mitigation measures, the impact will be constant over time as alternative services will be required to absorb the affected communities as well as any construction and operational workforce.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High – Local households are dependent on public services and facilities provided in their respective villages. Given their relative isolation these households may struggle to access alternative services or facilities located in nearby communities. This may be further exacerbated by the relocation of physically displaced households.		
Significance Rating Pre-mitigation		
Major – The loss of or increased pressure on public services and facilities is considered to be of major negative significance, assuming there is no adoption of effective mitigation measures. The impacts are deemed to be permanent in nature and would be most acutely felt by communities immediately surrounding the North Dune Resource Area.		

8.3.6.5 Recommended Mitigation Measures

The following mitigation measures apply:

- Base will minimise the project footprint via the optimisation of the mine design to avoid or reduce the number of affected public facilities and services. However, any mine plan must consider the set-back line recommended in the Air Quality Impact Assessment and Noise Assessment. It is further recommended that the Base Community Office forms part of the Detailed Design Team to address any the loss of public facilities and services, as well as ensure that it is fully costed for.
- As such losses cannot be fully avoided, Base will be required enter into a formal compulsory acquisition process with the owners / custodians of all affected public services or facilities. This may include government ministries as well as private owners. This process will be facilitated via a RAP.
- Under the RAP, Base will make provision for the replacement of all lost public services and facilities. This will include the establishment of new facilities to be provided at any host site that will be established to accommodate physically displaced households.
- The RAP will be prepared in compliance with national law, international good practice standards (as defined by the IFC Performance Standard 5 – Land Acquisition and Involuntary Resettlement) as well consistent with any precedent or agreements made during previous Resettlement Action Plans.
- Additional recommendations are provided in the Social Management Plan (See Chapter 9 of this Report) with respect to the requirements in developing the RAP, and reference should be made to the Social Management Plan.
- Base will commit, via its Community Development Plan, to the upgrading and investment in any existing public services or facilities that show measurable increases in use by either (1) resettled households or (2) the construction and operational workforce.
- Base will ensure that the Construction Contractor provides all required services and facilities to support the construction workforce and the use of existing public facilities will not be permitted unless for emergencies. This restriction will however not apply to locally appointed construction workers.
- Base will ensure that it provides all required services and facilities to support the operational workforce and the use of existing public facilities will not be permitted unless for emergencies. This restriction will however not apply to locally appointed workers.

8.3.6.6 Residual Impact (Post-mitigation)

The establishment of the project will result in the loss of public services and facilities, however with suitable provision of replacement facilities (via the RAP) as well as the investment and upgrading of existing facilities (via the CDP) it can be expected that local communities will substantially benefit from such investment as summarised in Table 8-39.

Table 8-39: Loss of / Pressure on Public Services or Facilities (Post-Mitigation)

Type of Impact		
Direct Positive		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Regional	Assuming that Base reinstates lost public services and facilities and invest in the upgrade of existing public services and facilities, it is expected that this benefit would extent throughout the sub-county.

Duration:	Long-Term	Assuming Base commits to long-term investment in local communities and public services and facilities (via the RAP or the CDP) the benefits are expected to be long-term.
Scale:	Evident	Assuming Base commits to long-term investment in local communities and public services and facilities (via the RAP or the CDP) the benefits will be noticeable compared to current levels of access and service.
Frequency:	Constant	Assuming Base commits to long-term investment in local communities and public services and facilities (via the RAP or the CDP) the benefits are expected to be ongoing over the long-term.
Magnitude		
Medium Positive – While it is acknowledged that there will definitely be a loss of existing public services and facilities, there is potential for positive investment in replacement services or the upgrade of existing services. This would result in a medium positive benefit.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High – Local households are dependent on public services and facilities provided in their respective villages. Given their relative isolation these households may struggle to access alternative services or facilities located in nearby communities. Positive investment in new or existing services is likely to improve household access to and their level of service.		
Significance Rating Pre-mitigation		
High Positive – While it is acknowledged that there will definitely be a loss of existing public services and facilities, the provision of replacement facilities (via the RAP) as well as the investment and upgrading of existing facilities (via the CDP) has the potential to substantially benefit local communities.		

8.3.7 Restriction of Mobility and Accessibility

8.3.7.1 Introduction

The North Dune Resource Area and the associated 100-metre buffer currently is fully open to the public and there are no restrictions in place that prevent local people from moving or crossing over the resource area.

There are several public gravel roads – including primary, secondary, and minor roads that connect local communities to each other as well to larger regional centres. In additional to public roads, there are several undesignated informal roads and footpaths that bisect the North Dune Resource area and connect isolated farmsteads to their farmland or neighbouring farmsteads.

In general, the public roads and footpaths are orientated in an east-west direction and connects the coastal communities with the hinterland. The establishment of the North Dune Mine Extension, which is orientated in a north-south direction, will therefore directly bisect several public roads and footpaths. This will likely result in the reduction in mobility and cut-off communities on the western side of the mine to the coastline.

8.3.7.2 Related Project Activities

The Project activities that will result in the reduction in mobility and accessibility of local people includes:

- The establishment of the North Dune Mining operations and the destruction of existing public access roads and pathways located directly in the North Dune Resource Area, the associated 100-metre buffer or on land required for the Project linear and ancillary infrastructure.
- The establishment of the North Dune Mining operations and the restriction of any vehicle or pedestrian foot traffic between communities and households located on the western hinterland from the coastline.
- The establishment of any dedicated mine road or haul road over any existing public secondary or minor road, but only where local communities or the general public are restricted from using the road.

8.3.7.3 Baseline Conditions

The resource area supports several public gravel roads – including one primary gravel road (C108), and several secondary (D roads) and minor (E roads) roads. These roads connect local communities to eachother as well to larger regional centre. The C108 also connects local communities to the Ukunda-Ramisi (A14) trunk road. In additional to public roads, there are several undesignated informal roads and footpaths that bisect the North Dune Resource area and connect isolated farmsteads to their farmland or neighbouring farmsteads.

8.3.7.4 Significance of Impact (Pre-Mitigation)

The project will result in the destruction of existing primary and minor roads that bisect the proposed mining area, and result in the loss of existing public access if any roads are converted to private dedicated haul or mine roads.

Both impacts would reduce household mobility and accessibility between neighbouring communities and major towns. This would be most apparent for vehicles and pedestrian traffic moving between the hinterland and coastline, as they would be required to circumvent the mining operations. Assuming that no mitigation measures are established by Base, the significance of the loss of roads is rated as being of major negative significance (as summarised in Table 8-40).

Table 8-40: Restriction of Mobility and Accessibility (Pre-Mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Regional	The destruction of existing primary and minor roads would disrupt vehicle and foot-traffic mobility between local communities and regional centres in the hinterland.
Duration:	Permanent	The destruction of existing primary and minor roads would be deemed permanent, as they would not likely be re-established along their current routes after mine closure.
Scale:	Major	The destruction of existing primary and minor roads would result in a major impact on the mobility of local communities, notably for communities located on the western side of the North Dune Resource Area.
Frequency:	Once-Off	The destruction of existing primary and minor roads would be once-off but permanent event, and public commuter and pedestrian traffic will still be required to circumvent the mining operations for the life of the mine and after mine closure.
Magnitude		
Medium – The overall magnitude of the impact is rated as medium. While the impact scale is rated as major and permanent, it is limited to the regional area and does not extend nationally or internationally.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High – Local rural communities and isolated households are dependent on a limited number of access roads to connect to each other, as well as connects the hinterland with coastal towns. As such, they are rated as being highly vulnerable to the loss of existing roads, assuming no replacement roads are provided.		
Significance Rating Pre-mitigation		
Major – The impact is rated as a major significance, assuming no mitigation measures are established. The destruction of local primary and minor roads and pathways would substantially reduce local household mobility and increase travel time as households are required to circumvent the North Dune Operations.		

8.3.7.5 Recommended Mitigation Measures

The following mitigation measures apply:

- Base will minimise the project footprint via the optimisation of the mine design to avoid or reduce the loss of existing primary and minor roads as well as footpaths. It is further recommended that the Base Community Office forms part of the Detailed Design Team to address any the loss of roads, as well as ensure that it is fully costed for.
- Base will, in collaboration with the Kwale County and affected communities, re-route and re-construct at their own cost any affected primary and minor roads. These roads will be treated as ancillary mine infrastructure and will be included in the Detailed Design as well as the RAP.
- Base will improve/rehabilitate any existing or newly constructed primary and minor roads in order to improve public commuter mobility, so as to offset the likely increased in travel time experienced by the road users as they circumvent the mining operations.
- Base will ensure that any existing or newly constructed primary and minor roads remain as public roads registered under the Kwale County, and no road will be used exclusively for mining operations.
- Where mine and commuter health and safety are deemed to be a major risk along existing or newly constructed primary and minor roads, Base will either (1) establish suitable safety measures via the Health and Safety Office or (2) construct separate dedicated mine roads.

8.3.7.6 Residual Impact (Post-mitigation)

Assuming Base provide suitable replacement roads and invest in local public road infrastructure, it is expected that the impact related to the destruction of local primary and minor road will be reduced. However, irrespective of the mitigation measures in place, it is expected that public commuter and pedestrian traffic will still be required to circumvent the mining operations via re-routed roads. This would be a largely permanent change and the impact is rated as of moderate negative significance (as summarised in Table 8-41).

Table 8-41: Restriction of Mobility and Accessibility (Post-Mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Regional	Assuming Base provides suitable replacement roads, local communities and household will remain largely connected. However, any re-routing of existing roads will still have a regional impact.
Duration:	Permanent	Assuming Base provides suitable replacement roads and they are registered as public roads, it is expected that these roads will be available for public use permanently and well after mine closure.
Scale:	Evident	Irrespective of whether Base provides suitable replacement roads, there will be an evident change in the baseline conditions as it is expected that existing roads will be re-routes around the mining operations.
Frequency:	Permanent	Irrespective of whether Base provides suitable replacement roads, it is expected that public commuter and pedestrian traffic will still be required to circumvent the mining operations for the life of the mine and after mine closure.
Magnitude		
Medium – The magnitude of the impact is considered to be medium in nature. Assuming Base provides suitable replacement roads, the loss of mobility will be reduced however it is expected that public commuter and		

pedestrian traffic will still be required to circumvent the mining operations if travelling between the hinterland and coastal communities.
Sensitivity / Vulnerability / Importance of Resource / Receptor
Medium – Local rural communities are vulnerable to the loss of existing roads, assuming no replacement roads are provided. However, this vulnerability is reduced assuming that Base provide suitable replacement roads and invests in road infrastructure.
Significance Rating Pre-mitigation
Moderate – Irrespective of whether Base provides suitable replacement roads, it is expected that public commuter and pedestrian traffic will still be required to circumvent the mining operations for the life of the mine and after mine closure. This will reduce overall mobility and increase travel-time.

8.3.8 Breakdown in Community Networks and Structure

8.3.8.1 Introduction

The establishment of the Project will require the acquisition of approximately 749 hectares of land, covering the North Dune Resource Area and a 100-metre buffer around this area. Given that there are households located throughout the North Dune Resource Area, there is no reasonable or practical measure to allow for these households to remain in-situ.

To allow mining in the North Dune Resource Area as well as the construction of the required linear or ancillary infrastructure, Base will be required to compulsory acquire the required land and relocate any households that occupy the land.

The establishment of the Project will likely result in the physical displacement of households. While physical displacement itself has impacts that can be mitigated though provision of replacement dwellings, the potential fragmentation of social structures, via the dispersed displacement of portions or parts of existing communities, will remain as an issue.

This is particularly a threat for those who are vulnerable and marginal and rely on social structures that have been developed as part of a community. People who rely on charitable acts for their survival are in this category of vulnerability as are those who may be aged or infirm and rely on favours from neighbours or nearby kin to survive. The impact also manifests itself in potential growth in socially unacceptable behaviours where authority structures are fragmented and the role of guidance from elders and authority figures is restricted.

8.3.8.2 Related Project Activities

The Project activities that will result in the potential breakdown in community structure and networks include:

- Land acquisition required to secure the 749 hectares of land required to allow for the mining of the entire North Dune Resource Area, the 100-metre buffer, as well as land required for the construction of the required linear or ancillary infrastructure.
- The need to relocate households (and acquire their land) located between the North Dune Resource blocks as their resultant isolation after the resettlement of their neighbours and the likely level of disruption due to their proximity to the mining blocks is deemed unreasonable.

8.3.8.3 Baseline Conditions

The potentially physically displaced households are comprised of isolated farmsteads that are located on private land that is actively farmed with annual crops or small orchards/plantations. Communal integration and mutual dependence are a fundamental part of the ability of these households to reproduce themselves in the absence of immediate access to developed services.

Occupation of the farmstead is highly variable with some being permanently occupied by the owner, while many are only seasonally occupied during the main farming seasons. In terms of the latter, the

owner resides in the local towns, and the farmstead may remain unoccupied or informally leased to a tenant or farmworker.

From the Baseline Survey results a total of 20.8% of households indicated that at least part of their income stream was derived from loans or credit, indicating a propensity for access to networks to make up at some part of their livelihood strategies.

8.3.8.4 Significance of Impact (Pre-Mitigation)

The physical displacement of households, without effective mitigation via resettlement support, is rated as a moderate negative impact (see summary in Table 8-42). The impact while localised and medium magnitude, the affected households are highly sensitive to displacement which would fundamentally undermine their basic living conditions as well as their ability to support any livelihood.

Table 8-42: Breakdown in Community Networks and Structure (Pre-Mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	Physical displacement is limited to households located in the North Dune Resource Area only or land to be compulsory acquired by Base. This cannot be mitigated.
Duration:	Short-term	Any physical displacement resulting in loss of community networks and structures will be permanent, however it is likely that affected household will re-establish networks within the short term (1-5 years).
Scale:	Evident	Physical displacement will result in the loss of networks for some entities, albeit not all, and will be more significant for those entitles that are potentially vulnerable to shocks associated with reduced access to networks.
Frequency:	Once-Off	The impact will be associated with the act of displacement and resettlement and this is a single occurrence.
Magnitude		
Small – The magnitude of the impact is considered to be small negative as it is short term and localised albeit that it will be evident during any displacement / resettlement, and it will take some time for the network and support structures to be re-established.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High – Most local households will rely, to varying degrees, on their own networks and support structures. Vulnerable households are however at particular risk form displacement impacts that potentially erode networks that are key to their survival.		
Significance Rating Pre-mitigation		
Moderate – The displacement of households, without any the adoption of a fair and effective resettlement process that support integration in the host community and re-establishment of social networks, would be considered a moderate negative impact and would likely be defined as a human rights violation.		

8.3.8.5 Recommended Mitigation Measures

The following mitigation measures apply:

- Base with minimise the extent of physical displacement via the minimisation and optimisation of the mine design. It is further recommended that the Base Community Office forms part of the Detailed Design Team to address any resettlement matters as well as ensure that it is fully costed for.

- As physical displacement cannot be fully avoided, Base will be required to enter into a formal compulsory land acquisition and resettlement process in order to secure the required land. This will include the development of a RAP.
- The RAP will be prepared in compliance with national law, international good practice standards (as defined by the IFC Performance Standard 5 – Land Acquisition and Involuntary Resettlement) as well as any precedent or agreements made during previous RAPs.
- The RAP must make provision for assessment of vulnerability and take into account the degree to which vulnerable people who are exposed to risks associated with the loss of community networks can best be accommodated in the post resettlement sites and layouts of sites.
- Additional recommendations are provided in the Social Management Plan (See Chapter 9 in this Report) with respect to the requirements in developing the Resettlement Action Plan, and reference should be made to the Social Management Plan.

8.3.8.6 Residual Impact (Post-mitigation)

Assuming that Base implemented the recommended mitigation measures, the impact any be reduced to a minor negative significance (as summarised in Table 8-43).

Table 8-43: Breakdown in Community Networks and Structure (Post-Mitigation)

Type of Impact		
Direct Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	Breakdown in community networks as related to displacement is limited to households located in the North Dune Resource Area only or land to be compulsory acquired by Base. This cannot be mitigated.
Duration:	Short-term	Any displacement resulting in loss of community networks and structures will largely be short term as people re-establish networks over time (1-5 years) at their new place of residence.
Scale:	Distinguishable	Displacement will result in the loss of networks for some households, albeit not all. The impact will be more noticeable for vulnerable household that rely on existing community networks and support. This impact can be mitigated via the provision of support to vulnerable households.
Frequency:	Once-Off	The impact will be associated with the act of displacement and resettlement and this is a single occurrence.
Magnitude		
Small – With a compliant resettlement action plan that prioritises identification of vulnerability and support for integration as well as focused planning for access to support networks this impact can be substantially reduced.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Medium – Most local households will rely, to varying degrees, on their own networks and support structures. Vulnerable households are however at particular risk form displacement impacts that potentially erode networks that are key to their survival, however direct support to this group may reduce their vulnerability to such shocks.		
Significance Rating Pre-mitigation		
Minor – With a compliant RAP that prioritises identification and provision of additional support to vulnerable households, as well as the provision of community development programmes that foster the integration of displaced households, this impact can be reduced to a minor negative impacts post-mitigation.		

8.3.9 Labour Influx

8.3.9.1 Introduction

The establishment of the Project / Sub-Projects may result in project-induced in-migration (influx) – or the in-migration of people to a location in response to economic opportunities provided by a new development. Influx is primarily driven by labour demand for the construction and operational workforce (labor influx), as well as a wide range of project-related economic opportunities that serve to draw people into the Project area. Labor influx may be induced where the Project requires a large construction and an increase in the operational workforce.

The project is expected to extend the life of the Kwale mine, and mining operations are likely to commence on the North Dune when mining has exhausted the South and Central Dunes. As such, it is expected that Base will largely retain the same operational workforce, with minimal need for the recruitment of additional staff. At present, Base and its contractors employ 800 people of which 63% are from Kwale County and 97% are Kenyan. The Project supports an additional 2,800 jobs through indirect (supply chain) and induced (consumer spending) activity.

Labour influx normally peaks during the construction phase, where there is a high demand for both unskilled, semi-skilled and unskilled positions available. Such influx would have been apparent during the construction phase of the Kwale Project between 2012 and 2013[1]. The subsequent demobilisation of the construction workforce resulted in an economic *boom* and *bust*, with the latter occurring once construction ceased and most local and non-local contracted workers were retrenched.

It is likely that the construction of the North Dune operations will result in a second peak in demand for both unskilled, semi-skilled and unskilled positions by Base or the Construction Contractor. While Base actively promotes the employment of local people, the Construction Contractor is expected to require a mix of local and non-local people.

More broadly, mining operations tend to improve local employment, economic and business opportunities. Over the long-term, these opportunities act as a drawcard for economic migrants from neighbouring communities and from locations outside of the Kwale County. Often this is not immediately obvious as this is a long-term trend which results in accelerated local population growth.

8.3.9.2 Related Project Activities

The following Project activities may result in labour influx:

- The peak demand for temporary contract workforce by either Base or the Construction Contractor for the duration of the construction phase. The temporary workforce will likely include a mix of local and non-local people.
- The demand for permanent operational staff as well as temporary contract workforce during the operational life of the North Dune mining operations. As this is seen as an extension of current mining operations, rather than an expansion, the operational workforce is unlikely to differ significantly from current levels.
- Improved economic, employment and business opportunities provided by the presence of the Kwale Mine over time may induce slow and long-term immigration of economic migrants and work-seekers into communities immediately surrounding the mine.

8.3.9.3 Baseline Conditions

The Project location is relatively isolated, despite being located within 15 to 25km of urbanized areas including Ukunda, Diani Beach, and Shimoni, and any likely influx is likely to be concentrated in urban towns and at key rural communities that provide the best access to employment and business opportunities.

[1] *As noted in past Social Impact Assessment and Social Monitoring Reports prepared by Base.*

Analysis of population growth at the county level, shows that the county population has grown by an average of 2.4 percent per annum between 1979 and 2019 (Kenya National Bereau of Statistics, 2019). This largely aligns with national population growth rates of 2.2% between 2009 and 2019. This suggests that at a county level there has been no substantive or noticeable influx of workers or economic migrants into the County.

Influx may however be more pronounced at the sub-count or community level, which is not immediately apparent in county level statistics. In, interviews held at local communities immediately surrounding the North Dune Resource Area indicate that the population growth in their respectively villages is normal (or similar to the Kwale County) and there is no noticeable influx of non-locals.

8.3.9.4 Significance of Impact (Pre-Mitigation)

Assuming there is no active management of influx by Base, future potential labour influx related to the construction of the North Dune operations is rated as a moderate negative significance (see summary in Table 8-44).

Table 8-44: Labour Influx (Pre-Mitigation)

Type of Impact		
Indirect Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Regional	Any form of acute or long-term influx would likely be found at regional towns rather than communities immediately surrounding the mining operations.
Duration:	Shor-Term	Influx will be most apparent during recruitment of the construction workforce, however there may be a slower rate of influx in the long-term by people seeking economic opportunities around the mine during its operational life of an estimated additional 5 years.
Scale:	Evident	Any form of acute or long-term influx would be evident in terms of the accelerated growth of affected communities. However, the mine has been in operations since 2013 and peak influx would have already happened.
Frequency:	Constant	Any form of acute or long-term influx would likely be diffuse and constant during the life of the mine as people slowly move into the area.
Magnitude		
Small – The overall magnitude of influx is rated as rated as small in nature, given that the mine has been in operations since 2013 and peak influx would have already happened. However, it can be expected that a second influx peak will happen alongside the demand for temporary local labour during the construction phase.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Medium – Communities are generally vulnerable to accelerated rates of influx, however local communities would have experience and adapted to any influx in the past, notably during the construction of the mine in 2012/2013. As such they are considered moderately vulnerable to a second round of potential influx.		
Significance Rating Pre-mitigation		
Minor – Future potential influx is rated as a minor negative significance, assuming no active mitigation measure are in place. Influx may occur and peak during the construction of the North Dune mining operations and thereafter taper off. However local communities have experienced and adapted to influx.		

8.3.9.5 Recommended Mitigation Measures

The following mitigation/enhancement measures apply:

- Base will continue to implement their Labour, Recruitment, and Influx Management Plan (LRIMP) consistent with precedent and lessons learnt in applying the plan over the last decade.

- Under the LRIMP, Base will management and monitor for potential influx notably during the pre-construction and construction phase where demand for temporary contract workers will be at the highest.
- Additional recommendations are provided in the Social Management Plan (See Chapter 5 in this Report) with respect to additional recommendations to be adopted in the implementation of the LRIMP in order to enhance local employment benefits.

8.3.9.6 Residual Impact (Post-mitigation)

With the continued implementation of the existing LRIMP, it can be reasonably assumed that the rate of influx will be reduced to a minor negative significance (see summary in Table 8-45). The impact is further mitigated by the fact that the mine has been in operations for the last decade and influx would have peak during 2012/2013.

Table 8-45: Labour Influx (Pre-Mitigation)

Type of Impact		
Indirect Negative		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Regional	Any form of acute or long-term influx would likely be found at regional towns as well as communities immediately surrounding the mining operations.
Duration:	Long-Term	Influx will be most apparent during recruitment of the construction workforce, however there may be a slower rate of influx in the long-term by people seeking economic opportunities around the mine during its operational life.
Scale:	Distinguishable	Any form of acute or long-term influx would be distinguishable in terms of the accelerated growth of affected communities. However, the mine has been in operations since 2013 and peak influx would have already happened.
Frequency:	Constant	Any form of acute or long-term influx would likely be diffuse and constant during the life of the mine as people slowly move into the area.
Magnitude		
Small – With the continued implementation of the existing LRIMP, it is likely that uncontrolled influx with be substantially reduced. However, some limited influx may still happen and will be found in local regional towns and would likely be diffuse and constant during the life of the mine as people slowly move into the area.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Medium – Communities are generally vulnerable to accelerated rates of influx, however local communities would have experience and adapted to any influx in the past, notably during the construction of the mine in 2012/2013. As such they are considered moderately vulnerable to a second round of potential influx.		
Significance Rating Pre-mitigation		
Minor – With the continued implementation of the existing LRIMP, it can be reasonably assumed that the rate of influx will be reduced to a minor negative significance. The impact is further mitigated by the fact that the mine has been in operations for the last decade and influx would have peak during 2012/2013.		

8.3.10 Direct Local Employment

8.3.10.1 Introduction

The Project-affected communities will have high expectations with regard to the employment opportunities that the Project will provide in a local context characterized by high unemployment rates. It has been a common past demand, and likely future demand, that Project-affected communities are

given preference for available jobs since they are being directly impacted by the Project and moreover, that the recruitment process be conducted in a fair, transparent, and equitable manner.

There will however be a significant challenge presented to local communities by chronic and systemic low levels of secondary and tertiary education and lack of appropriate skills that will make local people viable candidates for employment. Most local employment will likely remain in the unskilled and semi-skilled positions which is more common as temporary contracts during the construction phase.

Evidence from mining developments across the globe demonstrates that inequitable recruitment practices and subsequent differential access to employment opportunities and the benefits that employment provides, both in terms of wage income and skills development, may lead to tension and conflict between "locals" and "non-locals," keeping in mind that the definition of what constitutes "local" varies.

8.3.10.2 Related Project Activities

The following Project activities may result in direct local employment will include:

- The peak demand for temporary contract workforce by either Base or the Construction Contractor for the duration of the construction phase. The temporary workforce will likely include a mix of local and non-local people.
- The demand for permanent operational staff as well as temporary contract workforce during the operational life of the North Dune mining operations. As this is seen as an extension of current mining operations, rather than an expansion, the operational workforce is unlikely to differ significantly from current levels.

8.3.10.3 Baseline Conditions

The communities surrounding the mine are characterised by high unemployment rates and a lack of access to wage earning opportunities. Local employment is highly dependent on the mine site for direct wage-earning opportunities. There has, and remains, high expectations by local communities that Base will provide additional employment opportunities. These expectations are also likely to be further escalated in communities surrounding the North Dune Resource Area as a means of offsetting the likely negative impacts.

This expectation is further evidence in the Household Socio-Economic Survey which shows that almost 10% of the surveyed households in the five potentially affected communities reported a wage income from the mine or a mining contractor. The Baseline Survey also indicated that 93% of surveyed households identified employment as a development priority.

8.3.10.4 Significance of Impact (Pre-Mitigation)

Given the high degree of reliance on the mine as a source of direct local employment, the extension of the life of the mine will protect existing operational staff. In addition, the establishment of the North Dune mining operations will likely provide additional opportunities (via temporary construction worker contract) during the construction phase. This is rated as a significant positive impact, as summarised in Table 8-46 below.

Table 8-46: Impact on Direct Local Employment (Pre-Mitigation)

Type of Impact		
Direct Positive		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**

Extent:	Local	The likely benefits will be largely noticeable at the local level (or in communities and larger towns) immediately surrounding the mine, even if no enhancement measures are provided.
Duration:	Long-Term	The long-term duration of the impact a period is defined as approximately between 5 and 25 years, of the life of the mine. The impact should be in excess of 5 years.
Scale:	Evident	The supply of jobs has, and will, continue to have an evident impact as compared to the pre-development mine baseline, notably during the construction phase.
Frequency:	Ongoing	The inherent benefits to direct local employment will be ongoing for the life of the mine.
Magnitude		
Medium Positive – The benefits related to direct local employment by Base is rated as medium positive in magnitude, even if no active enhancement measures are established. These benefits would be long-term (or extend over the life of the mine) and would be very evident given the lack of alternative employment opportunities in the area.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Medium – Given that there is a noted reliance on the mine as a key employment provider by local communities, these communities are vulnerable to mine closure and the resultant loss of employment. This is further heightened given the lack of alternative employment opportunities in the area.		
Significance Rating Pre-mitigation		
Moderate Positive – The extension of mining operations will delay the mine closure and will support existing local employment for an additional number of years. In addition, the construction phase will also result in a peak demand for short-term construction workers which will benefit local communities directly.		

8.3.11 Recommended Mitigation Measures

The following mitigation/enhancement measures apply:

- Base will continue to implement their Labour, Recruitment, and Influx Management Plan (LRIMP) consistent with precedent and lessons learnt in applying the plan over the last decade.
- Under the LRIMP, Base will focus on local recruitment and skills development, and the plan will be amended to give special priority on directly affected communities and households – notable households that are displaced and well as communities immediately surrounding the North Dune covering Mkwambani, Mwandimu, Mwaweche, Mwaloya and Bumamani.
- Additional recommendations are provided in the Social Management Plan (See Chapter 5 in this Report) with respect to additional recommendations to be adopted in the implementation of the LRIMP in order to enhance local employment benefits.

8.3.12 Residual Impact (Post-mitigation)

Implementation of the LRIMP will enhance the positive nature of improved local direct implement to a high level of benefits (as summarised in Table 8-47). It will also prevent any associated negative impacts such as uncontrolled influx of jobseekers and the potential for protest associated risks that are driven by failure to meet expectations for employment or precipitated by mass retrenchments.

Table 8-47: Direct Local Employment (Post-Mitigation)

Type of Impact		
Direct Positive		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**

Extent:	Regional	The impact could be widened to a regional level with the ongoing implementation of the LRIMP, which sets out the prioritisation of recruitment of skills that are not locally available from a broader more regional area rather than importing expatriate skill sets.
Duration:	Long-Term	The long-term duration of the impact a period is defined as approximately between 5 and 25 years, or the life of the mine. The impact should be in excess of 5 years.
Scale:	Evident	The supply of jobs has and will continue to have an evident impact as compared to the pre-development mine baseline
Frequency:	Ongoing	The impact is associated with the wage cycles that are monthly.
Magnitude		
Medium – With enhanced recruitment into the regional context the impact would become more substantial than just local reservation of unskilled or semi-skilled employment. In addition, the adopt of the LRIMP will provide a structured and managed approach to promoting local direct employment via skills development and fair recruitment practices.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Medium – Given that there is a noted reliance on the mine as a key employment provider by local communities, these communities are vulnerable to mine closure and the resultant loss of employment. This is further heightened given the lack of alternative employment opportunities in the area.		
Significance Rating Pre-mitigation		
High Positive – Base has been a major local employer over the last decade. The extension of the life of the mine will result in ongoing benefits and delay retrenchment associated with mine closure. In addition, the construction of the North Dune operations will result in a peak demand for local workers by the construction contractor. These are seen as high future benefits, but it is contingent on the proper and effective implementation of the existing LRIMP and focussed on affected communities immediately surrounding the North Dune Resource Area.		

8.3.13 Local Content and Local Economic Development

8.3.13.1 Introduction

Local communities will have high expectations with regard to the opportunities that the Project will provide for contracts to procure services and goods from local providers. There will likely be significant pressure on Base to give preference to directly-affected communities and households, irrespective of whether local communities have the experience to support the procurement requirements of Base and run a formalise business. It will also be expected that the provision of local contracts will be conducted in a fair, transparent, and equitable manner. The mine has a history of localisation of contracts that are appropriate and are likely to be of considerable positive benefit.

More broadly, Base provide substantial benefits in terms of national, regional, and local economic development. This include past investment in the order of was US$350 million, of which direct spend in Kenya was about US$100 million on contractors, machinery and equipment, goods, support services and employment during the construction phase. In addition, 800 people are currently employed by Base and its suppliers, service providers and contractors. Of these 63% are from Kwale County and 97% are Kenyan. The Project supports an additional 2,800 jobs through indirect (supply chain) and induced (consumer spending) activity.

8.3.13.2 Related Project Activities

The following Project activities may result in direct local employment will include:

- The peak demand for temporary contract workforce by either Base or the Construction Contractor for the duration of the construction phase. The temporary workforce will likely include a mix of local and non-local people.

- The demand for permanent operational staff as well as temporary contract workforce during the operational life of the North Dune mining operations. As this is seen as an extension of current mining operations, rather than an expansion, the operational workforce is unlikely to differ significantly from current levels.
- The construction and operational period of the mine expansion will result in some additional creation of local contracting opportunities for suppliers and services providers. More notably it will extend the life of the mine and delay the closure of any supplier contracts and opportunities that are already in place.
- Regional investment and spend on local suppliers, service providers and contractors, as well as support of local employment of which 63% of the total workforce are from Kwale County and 97% are Kenyan.

8.3.13.3 Baseline Conditions

The surrounding communities are characterised by few alternative opportunities for the development of businesses or formation of registered suppliers or service providers outside of Base. As such, local contacting and associated (self) employment is highly dependent on the mine site for these opportunities.

8.3.13.4 Significance of Impact (Pre-Mitigation)

Given the high degree of reliance on the mine as a source of contracts any intervention that delays the onset of closure and protects supply of contracting opportunities or increases the potential for expansion of these opportunities is a significant positive impact (as summarised in Table 8-48) .

Table 8-48: Local Content & Regional Economic Development (Pre-Mitigation)

Type of Impact		
Direct Positive		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	National	The impact in terms of local business development will be felt at the national, regional, and local level. Benefits is expected in terms of local content directly around the mine as Base has targeted local services providers and supplier (where possible) and historically there is evidence for this having been achieved.
Duration:	Long-Term	The long-term duration of the impact is a period is defined as approximately between 5 and 25 years. The impact should be in excess of 5 years, or the life of the North Dune mining operations.
Scale:	Evident	The supply of contracts has, and will, continue to have an evident impact as compared to the pre-development mine baseline.
Frequency:	Ongoing	The impact is associated with the contracts that are an ongoing source of income and indirect employment.
Magnitude		
Medium Positive – The magnitude of the benefits associated with local content and regional economic development is rates as medium positive, and will be evident at the national, regional, and local level over the life of the mine. Such benefits will occur even without the adoption of enhancement measures.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Moderate – Given reliance on the mine as a key provider of contracts for national, regional, and in particular local service providers and suppliers, the closure of the mine would be seen a significant problem in terms of the loss of business, income and a key source of local indirect employment.		
Significance Rating Pre-mitigation		

Moderate Positive – The extension of mining operation and the delay in mine closure will allow for continued business opportunities for national, regional, and in particular local service providers and suppliers. This is irrespective of whether Base has adopted any enhancement measures.

8.3.13.5 Recommended Mitigation Measures

The following mitigation/enhancement measures apply:

- Base will continue to implement any existing Local Content and Procurement Plans consistent with precedent and lessons learnt in applying these plans over the last decade. It is recommended that any existing plans or procedures be extended and prioritise directly affected communities that surround the North Dune Area.
- Base should undertake the registration, support and development of potential local suppliers and service providers found in the Kwale Country and prioritise directly affected communities that surround the North Dune Area.
- Additional recommendations are provided in the Social Management Plan (See Chapter 5 in this Report) with respect to additional recommendations to be adopted in the implementation of the LRIMP in order to enhance local employment benefits.

8.3.14 Residual Impact (Post-Mitigation)

The extension of mining operation and the delay in mine closure will allow for continued business opportunities for national, regional, and in particular local service providers and suppliers, and this is rated as a major positive benefit (see summary in Table 8-49). The adoption of effective local content and local procurement measures will enhance these benefits notably in the local areas immediately surrounding the mining operations.

Table 8-49: Local Content & Regional Economic Development (Post-Mitigation)

Type of Impact		
Direct Positive		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	National	The impact in terms of local business development will be felt at the national, regional, and local level. Benefits is expected in terms of local content directly around the mine as Base has targeted local services providers and supplier (where possible) and historically there is evidence for this having been achieved.
Duration:	Long-Term	The long-term duration of the impact is a period is defined as approximately between 5 and 25 years. The impact should be in excess of 5 years, or the life of the North Dune mining operations.
Scale:	Major	The supply of contracts has, and will, continue to have an evident impact as compared to the pre-development mine baseline, and with active intervention at the local scale there is the potential for major benefits.
Frequency:	Ongoing	The impact is associated with the contracts that are an ongoing source of income and indirect employment.
Magnitude		
Large – Assuming the Base continues to promote national, regional, and increasingly prioritise local content as it currently done that the Kwale Mine, the substantive benefits already incurred will be extended for the long-term over the life of the North Dune mining operations. With enhanced local content planning, benefits may be further focussed on local and directly affected communities.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		

Moderate – Given reliance on the mine as a key provider of contracts for national, regional, and in particular local service providers and suppliers, the closure of the mine would be seen a significant problem in terms of the loss of business, income and a key source of local indirect employment.
Significance Rating Pre-mitigation
High Benefits – The extension of mining operation and the delay in mine closure will allow for continued business opportunities for national, regional, and in particular local service providers and suppliers. The adoption of effective local content and local procurement measures will enhance these benefits notably in the local areas immediately surrounding the mining operations.

8.3.15 Corporate Social Investment

8.3.15.1 Introduction

Corporate Social Investment (CSI) is of considerable benefit to many communities where there is a dearth of investment opportunities and where local capacity of government agencies is highly restricted in terms of access to resources for service delivery. The extractive industries are under pressure to ensure that they demonstrate e good corporate citizenship in this respect.

Base has a history of CSI spend into the local and regional communities, which will need to be amended to cover the North Dune mining operations and the additional of new affected communities and households.

8.3.15.2 Related Project Activities

The impact is directly related to any Corporates Social Investment and Community Development Plan (or similar community support programmes) established by Base that specifically targets local communities in the Kwale County and communities around the South and Central Dune. It is assumed that existing plans or programmes will be extended to the North Dune.

8.3.15.3 Baseline Conditions

The local communities are characterised by chronic level of poverty and limited economic opportunities outside of small-scale farming, orchards, woodlots, and secondary livelihoods such as livestock rearing. However, local communities are also functionally linked to local towns where there is a wider variety of economic activities largely within the informal sector. This includes small-scale trade, formal shops, tourism-based activities etc. However, there remains substantive need of ongoing and long-term economic investment in the region.

8.3.15.4 Significance of Impact (Pre-Mitigation)

The existing Base CSI initiatives are rated as being of moderate positive benefit (see summary in Table 8-50 below) to local communities, however much of the current CSI work will likely be focussed on the regional level (Kwale County) and at communities immediately surrounding the existing South and Central Dune mining operations. The extension of the mining operation to North Dune will require amendment to existing CSI initiatives to additional cover newly affected communities.

Table 8-50: Corporate Social Investment (Pre-Mitigation)

Type of Impact		
Direct Positive		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	The impact is local given the direct benefits of spend can be targeted locally where possible and historically there is evidence for this having been achieved.

Duration:	Long-Term	The long-term duration of the impact is a period is defined as approximately between 5 and 25 years. The impact should be in excess of 5 years, of the life of the mine and potentially thereafter.
Scale:	Evident	The spend has, and will, continue to have an evident impact as compared to the pre-development mine baseline.
Frequency:	Ongoing	The impact is associated with the spend that are an ongoing source of benefit.
Magnitude		
Medium – The magnitude of existing CSI investment is rated as being of medium positive benefit, mostly at the local level and will likely extend over the long-term (or the life of the mine).		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
Medium – Given reliance on the mine as a key provider of CSI spend, and limited alternative community investors in the area, local communities are largely dependent on support from Base via CSI as a vehicle for local economic development, but are not fundamentally dependant on CSI to support their livelihoods.		
Significance Rating Pre-mitigation		
Moderate Benefit – The existing Base CSI initiatives are rated as being of moderate positive benefit to local communities, however the extension of the mining operation to North Dune will require amended to the CSI initiatives to cover newly affected communities.		

8.3.15.5 Recommended Mitigation Measures

The following mitigation/enhancement measures apply:

- Base will continue to invest in local community and economic development through their existing CSI initiatives. However, these initiatives will need to be amended so as to cover communities that are directly impacted by the North Dune operations (including, but not limited to Mkwambani, Mwandimu, Mwaweche, Mwaloya, Bumamani) as well regional centres indirectly affected by the mining operations.
- Any CSI initiatives proposed in new communities will be properly planned in collaboration with the Kwale County authorities and the communities themselves. This includes developing a priority list for CSI spend in each community and ensure effective awareness building of these initiatives to prevent unrealistic expectations developing and allow potential beneficiaries to apply to be part of the initiatives.
- Additional recommendations are provided in the Social Management Plan (See Chapter 5 in this Report) with respect to additional recommendations to be adopted in the implementation of the CSI initiatives.

8.3.15.6 Residual Impact (Post-mitigation)

The existing Base CSI initiatives are rated as being of moderate positive benefit to local communities. However, if the recommendations noted above are adopted these benefits will be extended to new communities that will be affected by the North Dune mining operations. If the CSI initiatives are extended into these communities, the benefit is likely to be increased to a major benefit.

Table 8-51: Corporate Social Investment (Post-Mitigation)

Type of Impact		
Direct Positive		
Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**

Extent:	Regional	The impact can be regional and more targeted to affected communities so as to maximise CSI benefit to communities most acutely affected by future mining operations.
Duration:	Long-Term	The long-term duration of the impact is a period is defined as approximately between 5 and 25 years. The impact should be in excess of 5 years (or the life of the mine) and potentially after mining.
Scale:	Evident	The spend has, and will, continue to have an evident impact as compared to the pre-development mine baseline.
Frequency:	Ongoing	The impact is associated with the spend that are an ongoing source of benefit.

Magnitude

Medium – Base already have existing CSI initiatives and the amendment of these initiatives to target newly affected communities will result in the extension of these benefits to the right communities. Concurrent investment in communities around the South, Central and North Dunes would have a regional benefit over the long term.

Sensitivity / Vulnerability / Importance of Resource / Receptor

High – Given reliance on the mine as a key provider of CSI spend, and limited alternative community investors in the area, local communities are largely dependent on support from Base via CSI as a vehicle for local economic development. The initiation of mining at the North Dune will however impact on additional communities currently not covered by existing CSI initiatives and they would be deemed highly vulnerable.

Significance Rating Pre-mitigation

Major Benefit – The existing Base CSI initiatives are rated as being of moderate positive benefit to local communities, however assuming that Base amends their current CSI initiatives to cover newly affected communities, then the benefit if likely to be increased to a major benefit.

8.3.16 Community Health, Safety and Security Risks

8.3.16.1 Introduction

The establishment of the mine will result in a broad range of community health, safety and security risks, and these risks cross through a range of technical expertise (i.e. occupational health and safety, air emissions, water pollution etc.). Community Health, Safety and Security is however an umbrella term, and the potential project risks may specifically include:

- Community exposure to noise, vibrations, and air emissions,
- Community exposure to ground and surface water pollution or over-abstraction,
- Community exposure to general and hazardous waste (including tailings) storage and transport,
- Community exposure to communicable and vector-borne diseases (including STDs).
- Community safety related to structural collapse and structural hazards,
- Public vehicle and pedestrian traffic on mine and public roads,
- Accidental and purposeful trespassing into mining operations or construction sites,
- Community relations and conflict with private and state security personnel,
- Community incidents related to mine emergency events,
- General occupation health and safety and working conditions.

In addition, the establishment of the mine may result in a range of indirect or induced risks to community health, safety, and security via:

- Increased pressure on existing public services and facilities related to worker use and labour influx,
- The use of violence, theft and improper behaviour by local people and mine workforce,

- Increased transactional sex and associated STDs risk,
- Increased social pathologies associated with labour influx and mine workforce,
- Increased rates of Malaria transmission from standing pools or water or waterbodies,
- Reduced accessibility and mobility of local households in reaching local health facilities,

It is however also acknowledged that the Kwale Mine has been operating since 2013, and the community health, safety, and security risk will not be novel for the area. Rather the same risks will likely be extended to new communities (including, but not limited to Mkwambani, Mwandimu, Mwaweche, Mwaloya, Bumamani).

8.3.16.2 Related Project Activities

The following Project activities, but not exclusively so, may result in risks to community health, safety, and security:

- Construction and operation of mine infrastructure, including development of offices, laydown areas, workshops, mine roads, powerlines, mining working areas and tailing dams, as well as the movement of mine equipment through or near communities.
- The peak demand for temporary contract workforce by either Base or the Construction Contractor for the duration of the construction phase, as well as demand for permanent operational staff as well as temporary contract workforce during the operational life of the North Dune mining operations.
- Improved economic, employment and business opportunities provided by the presence of the Kwale Mine over time may induce slow and long-term immigration of economic migrants and work-seekers into communities immediately surrounding the mine.
- The storage, management and transport of any mine products, materials, equipment, and waste (including general and hazardous waste) on any existing or new public roads or land, as well as the transport of such materials through local communities and towns.
- Base's use of state and privacy security forces to secure their operations, and the level of interaction between these forces with local communities during (1) routine operations (2) emergency events, (3) conflicts, strikes or demonstrations.

8.3.16.3 Baseline Conditions

Base has been operating the Kwale mine in the area over the last decade, and those operations have interacting with local communities with little major incident. Base has an established Health and Safety Department, and a series of health and safety plans and procedures in place to ensure the safety of local communities.

8.3.16.4 Significance of Impact (Pre-Mitigation)

Assuming no active management measures in place the impact on community health, safety, and security from the North Dune mining operations would be rated as a major negative impact / risk (see

Table 8-52). These risks would largely be found at communities immediately surrounding the mining operations and would extend over the life of the mine, and potentially after mine closure.

Table 8-52: Community Health, Safety and Security Risks (Pre-Mitigation)

Type of Impact
Direct Negative
Rating of Impact

Characteristic	Designation	Summary of Reason
Extent:	Local	Community health and safety risks will be largely focused on communities immediately surrounding the North Dune operations and any associated infrastructure.
Duration:	Permanent	Community health and safety risks will be at the highest during the mining operations (long-term) but the need to ensure post-mine closure safety will also be a noted risk.
Scale:	Major	Without any effective management, the potential for a major community incident and emergency events is more than likely.
Frequency:	Constant	Community health and safety risks will be a constant issue to be addressed by Base during the mining operations.
Magnitude		
Medium – Without any effective management, the potential for a major community incident and emergency events is more than likely. However, such risks are largely concentrated at communities immediately surrounding the mining operations.		
Sensitivity / Vulnerability / Importance of Resource / Receptor		
High – Communities are highly vulnerable to health, safety, and security impacts. The potential for a major community incident and emergency events, and impact on community health, is all but guaranteed when mining operations commence if there are no active management measures in place.		
Significance Rating Pre-mitigation		
Major – Assuming no active management measures in place the impact on community health, safety, and security from the North Dune mining operations would be rated as a major negative impact / risk.		

8.3.16.5 Recommended Mitigation Measures

The following mitigation/enhancement measures apply:

- Base's Health and Safety Department will undertake a full and thorough review of the community health, safety, and security risks associated with the North Dune mining operations. This review will focus on community risks (rather than occupation worker risks) and will consider all communities potentially affected by the expanded mining operations.
- Base's Health and Safety Department will amend any existing Health and Safety Plans to ensure effective coverage of community health, safety and security risks and impact. The plans will ensure that this coverage is suitable for the North Dune mining operations and any affected communities. The amendments will be based on the findings of the aforementioned review.
- Base will ensure that there is sufficient resourcing (including emergency staff, equipment, and funds) to extend any required health and safety plans to cover the North Dune mining operations and any affected communities.
- Additional recommendations are provided in the Social Management Plan (See Chapter 5 in this Report) with respect to additional recommendations to be adopted in the implementation of the health and safety plans.

8.3.16.6 Residual Impact (Post-mitigation)

Assuming active management measures in place (in the form of effective health and safety planning and management by Base) the impact on community health, safety, and security from the North Dune mining operations would be reduced to a minor impact / risk (see

Table 8-53).

Table 8-53: Community Health, Safety and Security Risks (Post-Mitigation)

Type of Impact

Direct Negative

Rating of Impact		
Characteristic	**Designation**	**Summary of Reason**
Extent:	Local	Community health and safety risks will be largely focused on communities immediately surrounding the North Dune operations and any associated infrastructure.
Duration:	Permanent	Community health and safety risks will be at the highest during the mining operations (long-term) but the need to ensure post-mine closure safety will also be a noted risk.
Scale:	Distinguishable	With effective management, the potential for a major community incident and emergency events is substantially reduced but cannot be totally avoided.
Frequency:	Constant	Community health and safety risks will be a constant issue to be addressed by Base during the mining operations.

Magnitude

Small – With any effective management, the potential for a major community incident / emergency event or negative impact on community health is substantially reduced. The risk cannot be completely removed and will remain concentrated at communities immediately surrounding the mining operations.

Sensitivity / Vulnerability / Importance of Resource / Receptor

Moderate – Communities are vulnerable to health, safety, and security impacts. The potential for a community incident and emergency events, or impacts on community health cannot be fully removed, but effective management and support to communities would reduce their vulnerability to such risks.

Significance Rating Pre-mitigation

Minor – Assuming active management measures in place (in the form of effective health and safety planning and management by Base) the impact on community health, safety, and security from the North Dune mining operations would be reduced to a minor impact / risk.

9. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

This *Chapter* represents the Environmental and Social Management Plan (ESMP) for the North Dune mining operations. It is a summary guide to enable effective management of the key issues identified in the Environmental and Social Impact Assessment (ESIA).

Base currently has in place separate topical management plans addressing the Environment/Social and Occupational Health and Safety aspects that will be applicable to the activities of the North Dune operations. These form part of Base's current Environmental and Social Management System (ESMS).

Most, if not all, of the impacts identified and elaborated in this ESIA for the North Dune Extension, have been identified, and are currently adequately managed by Base for the current mining operations on the Central and South Dune. Management of such impacts, through the implementation of current EHS Management Plans, are routinely checked through an independent annual Environmental and Social audit, as required and reported to NEMA, and through an internal report produced by Base for submission to Lenders to the Project.

It is the intention of Base to integrate the impact management/mitigation measures identified in this ESIA and elaborated in the ESMP into the respective management plans to conform to the Company ESMS, and to ensure impacts applicable to the North Dune Extension are included, for implementation during mining activities there.

9.1 Organisation of the ESMP

The ESMP provides:

- A summary of those Environmental and Social Aspects of the Project.
- The specific impacts arising out of the identified aspects.
- The specific project activities that trigger the identified impacts.
- Mitigation measures for effective management of the identified impacts.
- Responsibility for the implementation of management/mitigation measures.
- Timeframes for reviewing the effectiveness of the outlined mitigation/management measures.
- Monitoring locations.

9.2 The North Dune Extension Environment and Social Management Plan

The North Dune Extension ESMP is presented in Table 9-1 overleaf.

Table 9-1: The North Dune Extension Environment and Social Management Plan

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
Impacts to soils	■ Vegetation clearance ■ Topsoil stripping ■ Hydraulic mining of ore ■ Soil contamination from spillages of fuels and lubricants	**Key Performance Indicators** ■ Turbidity and Suspended solids in nearby watercourses within range of baseline levels ■ Soils Stripping and Stockpiling Plan in place and followed/audited against its performance. **Mitigation** ■ Mine in blocks as per the Mine Plan (although some blocks will be mined concurrently). Mining in blocks allows for a reduction in the volume of vegetation to be cleared and stripped, confining mining activities to active mine blocks only. ■ Vegetate topsoil stockpiles that are expected to remain stockpiled for more than three months, with locally indigenous grass species, especially creepers. ■ It is recommended to strip soil for stockpiling carefully according to horizon differentiation and stockpile accordingly and implement measures to prevent soil loss due to erosion and contamination. ■ Stockpiles to be located outside the proposed mine disturbance area(s). ■ Construction of stockpiles by dozers rather than scrapers to minimise structural degradation. ■ Construction with a “rough” surface condition to reduce erosion, improve drainage and promote revegetation. ■ Disturbance areas to be stripped progressively as required to reduce erosion and sediment generation, to reduce the extent of topsoil and utilise stripped topsoil as soon as possible for rehabilitation. ■ Ensure that oils/grease spillages and leaks are cleaned up immediately and the contaminated soil either remediated in situ or disposed through NEMA-licensed waste contractors for safe treatment and disposal. ■ Use the results of revegetation trials using “green manure” on mined out areas of the North Dune as soon as is possible and allowed by the Mine Plan. ■ Implement Base’s Biodiversity Conservation Programme on previously mined out and disturbed areas to revegetate such areas with native species. ■ Reduce erosion of soils by rainfall and water runoff through the construction of settlement ponds, gabions and artificial wetlands on water courses potentially affected by mining operations, thus reducing turbidity and suspended solids in surface waters.	Mining Department Environment Department

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
		■ Erosion on steep slopes, especially towards the fringes of the mining area, is to be controlled through revegetation, shade netting, placed at right angles to erosion gullies and gulley repair where necessary.	
Contamination of surface and ground water resources	■ Vegetation clearance ■ Stock piling of stripped waste soils/vegetation. ■ Topsoil stripping ■ Hydraulic mining of ore	**Key Performance Indicators** ■ Within range of baseline water quality results for both surface and ground water pre-mining of the North Dune. **Mitigation** ■ Increased turbidity and suspended solids can be reasonably easily addressed by mitigation measures such as settlement ponds, gabions and artificial wetlands, which has the advantage of providing more habitat for wetland species (such as rare reed frogs). ■ Should silt traps be constructed on water courses off the mine site or SML, conduct an EIA Project report for submission to NEMA Kwale County. Silt trap designs to be sent to the WRA for permitting purposes. ■ Erection of clean water diversion berms up-gradient of mining areas and overburden stockpiles where these are along known surface drainage routes. ■ Reuse of wastewater from hydraulic process to reduce ex-situ discharge. ■ Erection of silt traps downstream of activity areas, on specific streams of most value to the communities or in recharging the main rivers. ■ Limiting heights of topsoil and overburden stockpiles to no more than 2 meters, with a sufficient gradient to reduce erosion. ■ Vegetation of topsoil stockpiles with indigenous grass species if stockpiles need to remain in place for 3 months, especially during rainy seasons. ■ Abstraction of water from streams, boreholes or rivers used by the communities will observe the required threshold for environmental flows. ■ Continuation with water quality monitoring activities at identified sites, and any other sites that will be noted to be at significant risk to contamination.	Mining Department Environment Department
Water abstraction resulting in reduced water supply to the surrounding communities and flora	■ Water abstraction-Surface water and groundwater	**Key Performance Indicators** ■ Abstraction of water (surface and groundwater) to comply with water abstraction permits issued for the Project. ■ Updated abstraction survey undertaken for all water users in the greater Project area. **Mitigation.** ■ Water abstraction is only seen as a secondary water source. Co-disposal will deliver sufficient water for operational needs. Should additional make up water be required	Mining Department Production Department Environment Department

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
		for operational needs, water abstraction will meet or be below current permitting needs. ■ Whilst both surface and ground water studies indicate sufficient water reserves, an abstraction survey is required to establish actual usage of these water resources in the greater Project area. ■ Any localised effects resulting from groundwater draw down on community boreholes and wells, can be mitigated by providing an alternative source of water, or by deepening a shallow well. This will also need to be incorporated into any future Resettlement Action Plan.	
Noise and vibration from mining operations	■ Vehicle movements ■ Vegetation clearance ■ Stock piling of stripped waste soils/vegetation. ■ Topsoil stripping ■ Hydraulic mining of ore	**Key Performance Indicators** ■ As per Baseline noise measurements for Daytime noise levels and Night time noise levels measured at those noise monitoring sites N4, N5, N6, N7, N8, N9, N10 and N11 ■ < 3dB(A) increase in background noise level directly as a result of mining activities (IFC guideline) **Mitigation** ■ All households within the North Dune will be resettled as per the RAP prepared by Base. Resettlement is also assumed within the buffer zones identified for noise impacts. ■ Where the heavy equipment causing vibrations are to be used close to settlements, the households will be sensitised prior to such activities ■ As much as possible, vegetation clearance and topsoil stripping will be conducted during the day, when most households are less sensitive to noise. ■ Construction of berms/ walls along mining area perimeter to act as a noise screen ■ Complaints on noise/vibrations shall be recorded, adequately investigated and necessary remedial measures taken, if required. Complaints from communities are, however unlikely as all affected communities will be resettled. ■ Directional 'smart' reverse alarms to be utilised on mining equipment ■ Night time activity should be minimised as much as possible, especially relating to activities conducted close to the mining area perimeter ■ The use of an "octave band analysis" to characterise the noise emitted from Base operations will be considered to compare future measurements with the data obtained at the locations on the boundaries of the Mine Site. This is proposed since the character of the noise emitted by mining and processing machinery is expected to be significantly different from noise emitted by insects, birds, vegetation rustled by the wind etc. Bases' contributions to the noise levels at these locations will then be better understood.	Mining Department Environment Department

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
Exposure of workers and communities to nuisance dust fallout and PM_{10} emissions	■ Vehicle movements ■ Vegetation clearance ■ Topsoil stripping ■ Hydraulic mining of ore ■ Dust emissions from TSF.	**Key Performance Indicators** ■ Dust fall-out guideline of 600mg/m^2/day. ■ PM_{10}: 50µg/m^3 (Annual average). ■ PM_{10}: 100µg/m^3 (24 hour average). ■ Comparison of upwind and downwind samples to assess the contribution from the Mine. **Mitigation** **Embedded mitigation:** ■ Application of wind breaks around topsoil stockpiles; ■ Application of local wind breaks around rehabilitated open areas; **Additional mitigation:** ■ Resettlement of all affected households within the Project area. Resettlement is also assumed within the buffer zones identified for air quality impacts. ■ Local water sprays at rehabilitated open areas and at demolition/vegetation/soil stripping areas; ■ Application of local wind breaks at rehabilitated open areas and at demolition/vegetation/soil stripping areas; ■ Keeping topsoil moist for loading; ■ Water sprays at topsoil stockpiles; ■ Regular wetting of internal mine roads, especially if utilised extensively by mine traffic, with more frequent wetting during the months of December to March (Level 1 (2l/m2/h) watering of unpaved surfaces used for topsoil haulage and open unvegetated areas); ■ Where possible, re-vegetate / rehabilitate cleared areas as soon as it is feasible; ■ Limit those cleared areas ahead of mining; ■ Limiting clearing activities to the greatest extent possible during the months between December to March; ■ Revegetation of stockpiles; ■ Enforcement of the 20km/hour speed restriction on access roads in the mining site; ■ Ensuring that compensated households have all moved out of sensitive locations before commencing mining activities; ■ Maintenance of all vehicles in good condition at all times to ensure complete hydrocarbon combustion;	Mining Department Environment Department OHS&T Department

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
		■ Recording of all complaints from communities in the potentially affected areas and review these to address any unanticipated dust nuisance; ■ Employ adaptive management strategies to suppress dust levels when hot and dry conditions prevail, and especially when the action level of 600mg/m2/day fall out dust is measured in dust buckets surrounding the North Dune. The monitoring campaign should be able to determine the upwind deposition, downwind deposition and the difference in between, which is attributable to the mining activities.	
Noise impacts and degradation of ambient air quality within and around the mine site boundary in the vicinity of the North Dune Extension	■ Vehicle movements ■ Surface vegetation clearance ■ Topsoil stripping ■ Stockpiling of stripped soil ■ Water use ■ Use of mobile and immobile equipment.	**Key Performance Indicators** ■ Noise data at baseline levels measured in the North Dune. ■ Ambient air quality within specified limits. ■ Zero credible grievances received from community members. **Mitigation** ■ Base has existing Community Health Programmes, aligned to the County's Health Strategic Plan and implemented in collaboration with the Kwale County Ministry of Health. The programme are designed to improve health delivery at various levels and address health issues identified by the communities as problematic. This programme will be expanded to include locations specific to communities surrounding the North Dune. ■ For the newly recruited workers, Base will implement the company's OHS Plan appropriately, especially on medical examinations, health and safety training to reduce chances of contracting or infecting other community members with diseases; as well as to improve their safety awareness. ■ To address the risks on air quality, radiation, soil contamination, water quality and traffic accidents, the measures outlined in the descriptions of these impacts will be implemented.	Environmental and Community Affairs Managers
Exposure to dangerous levels of radiation	■ Removal of topsoil and processing of ore	**Key Performance Indicators** ■ Radiation background of 0.19µSv/hour **Mitigation** ■ Base will maintain radiation monitoring as per the Radiation Management and Monitoring Programme in both air and water. ■ Personal radiation badges will be worn by workers at the identified radiation risk areas to measure their personal radiation doses to ensure these are maintained well below international standards.	Mining Department Environment Department OHST Department

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
Impacts on Fauna and flora (Loss of species and reduction in surface vegetation cover/ habitat)	■ Surface vegetation clearance ■ Topsoil stripping ■ Stockpiling of stripped soil ■ Water use ■ Use of mobile and immobile equipment. ■ Increased establishment and spread of alien invasive plant species ■ Permanent modification of areas affected by roads and/or other decommissioned infrastructure, as well as landscaping related to rehabilitation	**Key Performance Indicators** ■ Measurable improvement in biodiversity (presence of noted rare and endemic species) in wetlands and biodiversity corridor, and areas earmarked/zoned for protection. ■ Number of trees/shrubs/plants planted into these areas from Base's indigenous nursery. **Mitigation** Base has committed to the following biodiversity objectives: ■ Locating Operation facilities such that critical habitat is protected and impacts to threatened species are minimized. ■ Achieving a net positive biodiversity impact for the Operation. ■ Protecting and conserving biodiversity and maintaining ecosystem services. To achieve this, Base will undertake the following: **Avoid:** ■ All of the critical habitats and No Go areas within the mining area and on its outer fringes – and indicated in Figure 5.14 – are to be avoided. By protecting these (and other Critical Habitat) areas, the loss of these Critical Habitats can be prevented. ▪ Do an accurate delineation of all remaining Kayas and other areas identified as important for biodiversity, such as Mwaweche Springs, Daniel Mbata forest that have not been officially delineated up to date as part of the mine planning ■ Maintain a buffer of preferably 100 m around edges of forest patches ▪ Only forest patches that are inside the mineral resource areas should be considered for clearing, and preferably those on the edge of resource areas to be left intact ■ Avoid less disturbed Wooded Grassland Thickets as far as possible, especially where threatened species (VU, EN) have been confirmed, or where such woodland patches are in close proximity of wetland areas ■ Avoid clearing indigenous trees with a bole >50 cm diameter and/or a height over 8 m where such trees fall outside the mineral resource areas	Environment Department

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
		■ *Oboronia bueronica*, one of the two new Lepidopteran species recorded, will have habitat outside of Mwaweche Spring. Still, it is recommended that the Mwaweche Spring Site be preserved as well as it has been used by the community for a long period and was a very pure water source (it is between the main and Mkwambani resource areas. ■ Kaya Kitsakabungo was a found to have exceptionally high plant- and insect diversity. It is at the edge of the mine resource zone and it would be desirable to retain it. ■ The Kidongoweni Stream source is very important for Lepidoptera. Further important areas to target for conservation would be the Kaya at Mwandimu and the water spring at Mwaweche in the buffer zone. ■ In the Mwaloya area, there is a ± 8 ha area belonging to a retired teacher, which was a coconut plantation that has been allowed to regrow secondary growth now resembling a regenerated forest. The old owner refuses anybody on his land (he is in his eighties). This site had the richest biodiversity in the area and is within half a kilometre of the pond on the Kidongoweni Stream. The significance of this private conservation effort should be recognised and retained, and more detailed surveys conducted in this area. There are tracks on three sides of the property and it would be highly recommended to preserve this site if acquired **Reduce**: ■ Harvest areas to be cleared of all orchids and smaller indigenous plants that can be maintained in nurseries, harvest seeds for cultivation for rehabilitation ■ Relocate individuals of threatened tree species as far as this can be done with success (e.g. Ficus faulknerae) ■ Do not use topsoil of areas heavily infested with Leucaena, Chromolaena or Lantana for rehabilitation ■ No open fires may be lit for cooking or any other purposes, unless in specifically designated and secured areas to avoid accidental bush fires ■ Delineate all permissible areas so that all movement of vehicles and heavy machinery can be restricted to such areas only, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas may be allowed. ■ Parking and operational areas must be regularly inspected for oil spills and covered with an impermeable or absorbent layer or grease pans (with the necessary storm water control) if oil and fuel spillages are highly likely to occur ■ Areas of high conservation significance in proximity, but outside the physical mining footprint, need to be clearly demarcated with appropriate barriers and signage to	

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
		ensure no further encroachment or disturbance. Any infringements will be reported, and appropriate penalties are to be enforced on transgressing staff or contractors. ■ The following must be strictly prohibited: Purchase or transport of any threatened or protected wildlife/indigenous plant products from local communities or passing traders ▪ Collection of any plants or plant- products thereof for trade, consumption, medicinal use or cultivation, unless such person has the permission of the mine management as well as a valid permit from the responsible authorities, and harvesting is done on a sustainable manner ■ Efforts will be taken to minimise the footprint of short-duration activities and/or linear infrastructure during construction, operation and decommissioning phases of the mine. Efforts to minimise such footprints will include grouping all infrastructure to the same servitude and/or as close as possible to existing and planned long-term physical disturbances. This will also reduce fragmentation of natural habitats. **Rehabilitate:** ■ Since all observed streams were originally forested, at least going by the evidence given by the few remnants, re-creation of the original riverine vegetation during rehabilitation is recommended. This will be important especially for shade-loving species, which may have disappeared with the opening of the streams. Kidongoweni stream in Mwaloya village is a good reference site. ■ Rehabilitate progressively and as soon as areas are mined out, fully utilising insights gained from the rehabilitation trials, and ensuring that: ▪ Re-applied top soils resemble the texture and fertility of surrounding Wooded Grasslands and/or Forest Areas ▪ Seed mixtures of the first vegetation establishments consists of a mixture of grasses and forbs as diverse as possible and resembling the natural vegetation ▪ As part of rehabilitation efforts, ensure that small clumps of woodland/forest high shrub and tree species are planted into the grasslands to recreate natural structural diversity of vegetation, to aid continued natural succession and stability of rehabilitated areas	

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
		▪ Aim to minimise or altogether avoid the establishment of alien invasive species on soil stockpiles and rehabilitated areas ■ Re-creation of mayflies and caddisfly habitats is highly recommended. It was noted that caddis and mayflies inhabited man-made habitats such as the concrete at the bridges in large numbers. Originally when the area was forested decades ago, they may have inhabited areas with sizable logs in the streams since the whole Northern Dune area has no rocks. This can be re-created for them in the areas being rehabilitated and monitoring for colonization be carried out. Since logs will easily be carried away when rivers are in flood, the placement of boulders and rocks in carefully selected sites is recommended. ▪ Adult stages of the new caddisfly species found in Kidongoweni River should be collected to facilitate its description.	
Impacts on Wetlands	■ Surface vegetation clearance ■ Topsoil stripping ■ Stockpiling of stripped soil ■ Water use ■ Obstruction or diversion of streams ■ Use of mobile and immobile equipment. ■ Increased establishment and spread of alien invasive plant species ■ Permanent modification of areas affected by roads and/or other decommissioned infrastructure, as well as landscaping related to rehabilitation	**Key Performance Indicators** ■ Measurable improvement in biodiversity (presence of noted rare and endemic species) in wetlands and biodiversity corridor, and areas earmarked/zoned for protection. ■ Number of trees/shrubs/plants planted into these areas from Base's indigenous nursery. **Mitigation** **Avoid and Minimise:** ■ Avoid wetland habitats as far as possible, especially areas around springs. All of the critical habitats and No Go areas within the mining area and on its outer fringes, are indicated in Figure 5.14. ▪ Protect upper reaches of Critical Wetland habitats to ensure no spillage of runoff from mining areas into these ■ Maintain a buffer of preferably 100 m around edges of any perennial wetlands that do not fall within the mining resource area, and ensure no runoff from mining infrastructure/area gets into any rivers/wetlands/swamps/pans, without being cleaned. ■ Establish silt traps where necessary on water courses and streams feeding wetlands and streams to avoid the siltation of such wetlands with sediments from mine water runoff.	Environmental Manager

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
		■ Minimise clearing indigenous trees with a bole >20 cm diameter where such trees fall outside the mining pit, or indigenous woodlands with a relatively closed canopy along riparian areas ■ Always maintain the flow of larger rivers and wetland systems . Base will strictly adhere to the surface water abstraction permit conditions in cases where water from rivers Koromojo, Ramisi, Mkurumudzi or others replenishing wetlands is to be used for mining activities. ■ To avoid siltation of rivers and other surface water bodies, soil stockpiles should be located away from wetlands and streams and fitted with silt traps. During rainy months, Base will identify the main streams feeding the wetlands and erect silt traps to reduce the sediment loads into the wetlands. ■ Project infrastructure should be designed and operated to minimise the impacts to natural water flows ■ The Kidongoweni Stream source is very important for Lepidoptera. Further important areas to target for conservation would be the Kaya at Mwandimu and the water spring at Mwaweche in the buffer zone. ■ Critical Wetland habitats outside the mining resource area should be permanently protected ■ All of the critical habitats and No Go areas within the mining area and on its outer fringes, are indicated in Figure 5.14. **Reduce:** ■ Aim to keep the vegetation within the 100 m buffer around streams and wetlands as intact as possible, or rehabilitate wooded areas, even if just by clearing alien invasive species ■ Harvest areas to be cleared of all orchids and smaller indigenous plants that can be maintained in nurseries, harvest seeds for cultivation for rehabilitation ■ Design and create berms and storm water control structures to stop runoff from the mining areas during/after a periodic high or extreme rainfall events get directly into existing wetlands or streams. Any designs are is to be approved by the Water Resources Authority (WRA). ■ Parking and operational areas should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur ■ Ensure all pumped water from workshops and other areas with a potential for contamination is collected in designated ponds and monitored for quality prior to discharge to the open environment	

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
		■ Ensure all waste water collection ponds are installed with impermeable liners to avoid seepage to groundwater ■ Ensure that all storm-water drains are equipped with sediment traps and directed to specific containment areas where quality monitoring can be conducted prior to discharge to the environment. Any designs are is to be approved by the Water Resources Authority (WRA). **Rehabilitate:** ■ Base will continue with wetland conservation and restoration activities to maintain habitat as well as the attendant herpertofauna to ensure success of the micro-invertebrate monitoring programme. This will be done as per wetlands already restored adjacent to the Central Dune. ■ Base will identify a suitable site and create wetland conditions, similar to that done in the Central Dune, to propagate more herpertofaunal species as an offset for any that could be lost due to the project. ■ Base will replant more grasses and trees in the riparian of the proximal wetlands to filter surface water from plant matter or any other suspended solids that could pose risks to the aquatic life in the wetlands. ■ All the critical habitats for macro-invertebrates that were identified should be preserved during mining as they will be sources of species to re-populate the rehabilitated areas after mining. All of the critical habitats and No Go areas within the mining area and on its outer fringes, are indicated in Figure 5.14. ■ Since all streams were originally forested at least going by the evidence given by the few remnants, the re-creation of the original riverine vegetation during rehabilitation is recommended. This will be important especially for shade-loving species that may have disappeared with the opening of the streams. Kidongoweni stream in Mwaloya village is a good reference site. ■ Aim to strengthen the riparian woodlands by removing alien invasive plant species and widening it by planting indigenous trees suitable to that habitat - Aim to reduce the alien invasive plant component around wetlands and rivers within the prospecting/mining licence area ■ To aid a more rapid and early decommissioning of mined areas, pits should be backfilled as soon as possible ■ Recreate, where practicable, all perennial wetlands that were destroyed after mining and re-establish the natural flora from harvesting existing wetlands and swamps or maintaining plants from cleared wetlands in a suitable area until rehabilitation	

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
		■ Re-create mayfly and caddisfly habitats. This habitat can be re-created in the areas being rehabilitated by using boulders and rocks in carefully selected sites.	
Risks to safety and health at the workplace	Use of mobile and immobile equipment at the Mine, mineral ore extraction and transfer to processing units, consolidation of stripped topsoil and cleared vegetation.	**Key Performance Indicators** ■ Zero Lost Time Injuries ■ A reduction in the Lost Time Injury Frequency rate (LTIFR) **Mitigation** ■ Base has developed a culture of safety in the workplace. The OHS Management System and various OHS Management Plans are fully embedded into the operations, and includes appropriate documentation, procedures, guidelines, standards, risk assessments and monitoring records, with assigned accountabilities and responsibilities. In addition, the OHS Management System undergoes frequent review. Various system elements are audited monthly and identified corrective measures implemented to further improve the system. Also, the operations' Hazard and Operability Study (HAZOP) has been undergoing monthly review. Any improvement actions for high risk activities are implemented, thus reducing the risk profile. A Contractor management plan forms a specific component of the overall OHS Plan. ■ Base has in place 9 "Base" cardinal rules, with a zero tolerance for transgression on any of these. Base continues to undertake training programmes, including OHS specific training, for its staff, this ensures that all the workers are continuously trained and their knowledge on OHS improves. New employees or visitors are required to undergo an induction course prior to being allowed to visit the Project sites. The induction covers OHS, environment, social and security components. ■ Regular pre-start meetings are required of all Base activities and Contractor activities. ■ Appropriate PPE is mandatory for all employees and visitors. ■ An OHS Committee and a Worker Safety Committee have been established and continues to meet regularly to evaluate the performance of OHS practices being implemented on site. ■ Base has implemented a Fitness for Work Programme that ensures that workers operating equipment are fit to operate; indeed, this programme has been extended to all employees. This is through testing at random to determine blood alcohol levels. ■ Base has a zero tolerance to alcohol and drugs, and the random testing is used to further discourage operating machinery while under the influence of alcohol or drugs. ■ New employees are also subjected to medical tests before deployed to provide information on their health condition. Compulsory annual check-ups for required staff are also conducted to ensure that only fit workers are allowed on site.	Mining Department OHS&T Department

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
		■ Emergency response systems have been tested and are likely to work well in case of an emergency. Base continues to show a high level of compliance with the provisions of the OHS Act and holds current workplace registration certificates for both its mine site (KWL/10293/05/13/00) and the Likoni Ship loading Facility (MSA/2236/05/14/00). As part of the ongoing OHS Management System reviews, activities applicable to the North Dune activities will be incorporated into the OHS Management System.	
Loss of Housing (Physical Displacement) Loss of Private Land and Orchards (Economic Displacement) Loss of Communal Land and Natural Resources Loss of Businesses and Traders Loss of Public Facilities and Services Breakdown in Community Networks and Structure	■ Compulsory Land Acquisition for the North Dune Resource Area, a 100m buffer, and land required for project linear and ancillary infrastructure.	**Key Performance Indicators** ■ Preparation of the Project RAP. ■ Progress on the Asset Inventory and Valuations. ■ Authorisation of the Project RAP. ■ Authorisation of the Asset Inventory and Valuations. ■ Payment of compensation. ■ Provision of Replacement Homesteads and Structures. ■ Progress in Livelihoods Restoration Programmes **Mitigation and Enhancement Measures** ■ Base will develop a Resettlement Action Plan (RAP) consistent with national law, international good practice and precedent established in previous RAPs. The RAP will be authorised by the relevant legal authorities. ■ The RAP will fully comply with national compulsory land acquisition laws in order to legally secure all required land from private title, customary title, communal trust, or state land. ■ The RAP will establish options for cash compensation and/or resettlement assistance (including the provision of replacement land) to all eligible persons that have lost access to their land. ■ The RAP will establish options for cash compensation and/or resettlement assistance (including the provision of replacement housing and homestead land) to all eligible persons that have lost their homesteads and associated structures, assets or any improvements made on their homesteads. ■ The RAP will establish options for cash compensation and disruption allowances to all eligible persons that have lost annual or perennial crops or productive trees, and compensation will be granted over the number of lost harvests.	Base Titanium Community Affairs Department

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
		■ The RAP will establish options for cash compensation and/or resettlement assistance including the provision of replacement land and structures) for the disruption of affected businesses or traders. This will include compensation for the loss of business income and worker salaries during the transition phase, as well as the option of reinstating the business or traders at a suitable alternative location near their existing client base/catchment. ■ The RAP will establish the relevant allowances (including disruption, moving and other applicable allowances) to be granted to eligible persons under national law or international good practice. ■ The RAP will establish a Community Agreement with all affected communities to address the loss of communal land and natural resources. The agreement will be supported by a compensation fund that will be exclusively used for community development measures to offset the loss of communal land / communal natural resource harvesting areas. ■ The RAP, as well as the Community Agreement and Community Development Plan, will restore any loss public services, facilities, and infrastructure (including clinics, schools, churches) at a suitable alternative location. Any replacement assets should also be improved in support of positive community investment. ■ The RAP will establish programmes for livelihood restoration based on the (1) the provision of replacement assets, (2) improved farming and livestock techniques, and (3) provision of alternative livelihoods options that may be adopted by eligible persons. ■ The RAP will be supported via ongoing stakeholder engagement with Affected Persons via a number of mechanisms (face-to-face meetings, community meeting, consultative forums). This engagement will extend throughout the life of the resettlement process. ■ The RAP will establish a Grievance Mechanism that will become operational prior to the Asset Inventory and Valuations. Suitable technical committees will be established to investigate and resolve any reported grievances. ■ The RAP will profile potential vulnerable people that form part of the displacement Affected Persons and made special provisions for affected persons ■ The RAP will make provision for the protection, relocation, or offsetting any affected cultural heritage (notably religious buildings, graves, and cemeteries). The RAP will be supported via the development of a free-standing Cultural Resources Management Plan. ■ Base will implement the requirements established in the RAP, including the provision of fair and prior compensation, resettlement assistance and any allowances before the displacement of affected persons and securing any land. As prior compensation is deemed a critical requirement, the implementation of the RAP must be concluded before construction.	

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
Restriction of Access and Mobility	■ Destruction of secondary and minor roads that bisect the resource areas, any safety buffer or land required for any linear or ancillary infrastructure. ■ Conversion, if any, of any public roads into dedicated haul or mine roads. ■ Increased interaction between public commuter and pedestrian traffic with mine vehicles on public roads.	**Key Performance Indicators** ■ Provision of new public roads and pathway as applicable to any agreement. ■ Lack of community grievances related to reduced mobility and accessibility. ■ Lack of public incidents or accidents with mine traffic on public or mine roads. **Mitigation and Enhancement Measures** ■ Base will need to communicate and coordinate with the Kwale County for the removal of existing roads, on condition that Base will provide replacement roads or access paths to households. The routing, design and maintenance requirements for any new roads will be agreed between Base and the Kwale County. ■ Base will show that any new roads will retain, and ideally, improve household mobility and accessibility between communities, as well as between the hinterland and the coast. ■ All public roads will remain as public roads and Base will avoid, to the maximum extent possible the conversion of existing public roads to dedicated haul or mine roads. Where such conversation is needed, Base will construction alternative public roads. ■ Any newly constructed haul or mine roads will be made available for public use consistent with precedent established at the Kwale Mine and in agreement with the Kwale County and affected communities. ■ Base will ensure that Health and Safety Plans, Traffic Plans, Emergency Preparedness and Response Plans provide full covering of potential public incidents, accidents or emergencies that may occur where (1) the public and mine traffic share the same roads, (2) where public roads extend into the mining operations. ■ Base will establish suitable safety measures (including suitable signage, crossing points, community training and awareness building) in terms of any interactions between the public and mine traffic. Any recommendations made in separate Traffic Management Plans or Traffic Studies similarly apply.	Base Titanium Community Affairs Department
Labour and Work Seeker Influx Local Direct Employment	■ The peak demand for temporary contract workforce. ■ The demand for permanent operational staff as well as temporary contract workforce during the operational life of the mine.	**Key Performance Indicators** ■ Updating and implementation of the LRIMP to cover the North Dune operations. ■ Monitoring of population growth rates in community surrounding the mine. ■ Ongoing engagement with local authorities in terms of influx perceptions. **Mitigation and Enhancement Measures** ■ Base will update the LRIMP to cover the North Dune operations as well as neighbouring communities. The LRIMP will establish preferential employment rules based on differing priority areas, as follows:	Base Titanium Community Affairs Department

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
	■ Improved economic, employment and business opportunities provided by the presence of the mine.	○ Priority 1: Persons Affected by Displacement. ○ Priority 2: Persons in Mkwambani, Mwandimu, Mwaweche, Mwaloya, Bumamani. ○ Priority 3: Persons in other communities and towns in the Kwale County. ○ Priority 5: Persons from elsewhere in Kenya. ■ Preferential employment targets, as noted above, will also be established for women and young men, with the prioritization of local women as per the priority areas. ■ The LRIMP will be amended to establish local training and skill development programmes by Base (or third part contractors) in advance of the mobilisation of the EPC Contractor to enable local people to be recruited. ■ The LRIMP will extend all Fair Treatment Principles, any existing labour law requirements, and IFC or ILO aligned standards to all locally recruited people. ■ Base will ensure that the LRIMP and any associated policies, procedures or requirements are to be met by third-party contactors, and Base will monitor their contractor's compliance in this regard. ■ Prior to implementing any collective dismissals or demobilisation, Base will develop and implement a Demobilisation Plan to reduce the adverse impacts of retrenchment on local and non-local workers. ■ The LRIMP provision in terms of influx management, primarily through the careful management of local recruitment, will be extended to the North Dune mining operations. This should include a review of past influx patterns and the level of success of existing interventions. ■ Base will monitor and intervene in the formation of informal settlements, housing or businesses in the villages or areas immediately adjacent to the construction sites and mining operational areas. Where this is found, Base will establish measures with the Kwale County, to manage informal development in proximity to the Project infrastructure. ■ All non-local workers will be housed at the construction camp, and only local workers will be permitted to reside outside of the camp. The camps will provide all needed basic services (including sanitation, health, water, meals etc) in order to minimise pressure on existing public facilities.	
Local Content and Regional Economic Development	■ Base procurement of goods and services from national, regional, and local service providers and suppliers.	**Key Performance Indicators** ■ Revision of existing Local Content / Procurement Plans ■ Update of existing Local Supplier Database to include affected communities. ■ Registration of SMMEs from affected communities. ■ Record of development support given to SMMEs from affected communities.	Base Titanium Community Affairs Department

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
Local Economic Development and CSI Spend	■ Base programmes with respect to local business development as part of their Community Development Plans.	■ Record of contracts, total spend, and indirect employment provided by Base. ■ Revision of existing CSI plans, programmes, and initiatives. ■ Record of CSI support given to target beneficiaries from affected communities. ■ Number and list of beneficiaries for each CSI initiatives. ■ Annual CSI planning and reviews reports / summary. **<u>Mitigation and Enhancement Measures</u>** ■ Local supplier development to be promoted via existing Base Procurement Plans or Local Content Plan / Plan, and existing plans will focus on supporting and developing existing small, medium enterprises in the local communities, and incorporation of these SMMEs in the procurement process. ■ The applicable Local Content / Local Procurement Plan will profile the range of services at the local level – which will be extended to directly affected communities surrounding the North Due Rescore Area which include Mkwambani, Mwandimu, Mwaweche, Mwaloya and Bumamani. ■ Base will expand and amend any existing CSI initiatives to include communities that are directly (Mkwambani, Mwandimu, Mwaweche, Mwaloya, Bumamani) or indirectly affected by the North Dune mining operations. ■ The associated CSI budget will be proportionally increased to cover these additional communities in order to avoid funds being reallocated from communities that are being already being supported in Base's CSI initiatives. ■ Base will expand and amend any existing CSI initiatives in collaboration with the Kwale County authorities and directly with the target communities. The CSI should be planned and reviewed on an annual basis to monitor success and sustainability of any initiatives. ■ Base will make specialist provision for the establishment of CSI initiatives that support vulnerable households and women in particular. Base will ensure that their CLO's will be able to identify household and women (or women groups) that may be beneficiaries.	
Community Health, Safety and Security	■ Construction and operation of mine infrastructure, as well as the movement of mine equipment through or near communities.	**<u>Key Performance Indicators</u>** ■ Updated of existing Health and Safety Plans to cover the North Dune mining operations. ■ Inclusion of community requirements in any new Health and Safety Plans. ■ Provision of additional resourcing to implement Health and Safety Plans. ■ Record of community incidents, emergency events and responses.	Base Titanium Community Affairs Department

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility
	■ The peak demand for temporary contract workforce and permanent operational staff, ■ Improved economic, employment and business opportunities and long-term immigration of economic migrants and work-seekers. ■ The storage, management and transport of any mine products, materials, equipment, and waste on public roads. ■ Base's use of state and privacy security forces to secure their operations.	**Mitigation and Enhancement Measures** ■ Base's Health and Safety Department to undertake a full and thorough review of the community health, safety, and security risks associated with the North Dune mining operations. ■ Base's Community Office will support the Health and Safety Department during the review and where required engage directly with affected communities in identifying key risks and planning suitable responses to these risks. ■ Base's Health and Safety Department will amend any existing Health and Safety Plans to ensure effective coverage of the North Dune mining operations and any affected communities. ■ Base will ensure that there is sufficient resourcing (including emergency staff, equipment, and funds) to extend any required health and safety plans to cover the North Dune mining operations and any affected communities. ■ Base will ensure that any Traffic Management Plans consider the safety of local communities and include measure to reduce the use of public roads, minimise movement through villages and measures to address any traffic incidents or accidents between mine and public vehicles or pedestrians. ■ Base will ensure that any private security company will have established and valid procedures for responding to any events with local communities during (1) routine operations, (2) minor and major emergency events, (3) community unrest, conflict or demonstrations, and (4) trespassing, theft and sabotage. The policies will also address the use of force in such events that align with international good practice.	

10. ENVIRONMENTAL AND SOCIAL MONITORING PLAN

This *Chapter* represents the Environmental and Social Monitoring Plan for the North Dune mining operations. Monitoring aims to ensure those mitigation measures elaborated in the ESMP in *Chapter 9*, are being implemented and adequately managed, to ensure the residual impacts identified remain as low as possible, or that positive impacts are enhanced.

Base currently have in place Environmental and Social Monitoring Plans, which form part of Base's current Environmental and Social Management System (ESMS).

The following monitoring reports are produced monthly by Base:

- Occupational Health and Hygiene monitoring report:
    - Radiation monitoring for different areas in and around the processing plant and the ship loading facility.
    - Personal and positional dust monitoring.
    - Total coliform testing for all drinking water points.
    - Clinic data.
- Environmental monitoring report:
    - Water Resources Monitoring Programme.
        - In-situ Water quality monitoring (surface water and groundwater monitoring).
        - Water samples collection for both Cropnuts (lab) and NEMA analysis.
        - Groundwater Levels Monitoring.
        - Flow measurements for surface waters.
    - Meteorological monitoring.
    - Air quality monitoring (dust monitoring).
    - Noise monitoring.
    - Radiation monitoring.
- Safety report:

  - This report covers incident trends, management inspections and hazard identification trends, update on fitness for work program and safety awareness.
- Community Affairs Reports
    - Community engagement meeting reports
    - Committee and sub-committee meeting reports
    - Community health reports
    - Community programme reports

Environmental (ambient) noise, dust and radiation data are also collated into a quarterly monitoring report. Macroinvertebrates monitoring and vegetation survey reports are compiled biannually. Environmental and Social data are also collated and reported in an internal report produced annually by Base for submission to Lenders to the Project.

It is the intention of Base to include the monitoring data collected for the North Dune Extension into this existing monitoring and reporting framework.

10.1 Organisation of the Environmental and Social Monitoring Plan

The Environmental and Social Monitoring Plan provides:

- The specific impacts arising out of the identified Environmental and Social Aspects of the Project.
- The specific project activities that trigger the identified impacts.
- Key Performance Indicators that monitoring should demonstrate are being achieved for the Project.
- Responsibility for the implementation of management/mitigation measures.
- Mode of monitoring and monitoring frequency for each environmental or social aspect.
- Monitoring locations.

10.2 The North Dune Environment and Social Monitoring Plan

The North Dune Environmental and Social Monitoring Plan is presented in Table 10-1 overleaf.

Table 10-1: The North Dune Environment and Social Management and Monitoring Plan

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility	Mode of Monitoring	Monitoring Frequency	Monitoring Location(s)
Impacts to soils	■ Vegetation clearance ■ Topsoil stripping ■ Hydraulic mining of ore ■ Soil contamination from spillages of fuels and lubricants	**Key Performance Indicators** ■ Turbidity and Suspended solids in nearby watercourses within range of baseline levels.	Environment Department	Monitoring for erosion after heavy rains Water quality Monitoring	Water quality monitoring as per Environmental Monitoring Programme (Monitoring procedure ENV STDCDMS- 002075-ESMS).	Mining areas, access routes, existing streams and wetlands, surface and groundwater monitoring points.
Water abstraction resulting in reduced water supply to the surrounding communities and flora	■ Water abstraction- Surface water and groundwater	**Key Performance Indicators** ■ Abstraction of water (surface and ground) to comply with water abstraction permits issued for the Project ■ Abstraction Survey	Environment Department	Install a linear series of monitoring piezometers equipped with continuous level loggers, between the coast and well fields to monitor drawdown and possible saline intrusion	Water level monitoring as per Environmental Monitoring Programme (Monitoring procedure ENV STDCDMS- 002075-ESMS).	As per procedure
Contamination of surface and ground water resources	■ Vegetation clearance ■ Stock piling of stripped waste soils/vegetation. ■ Topsoil stripping ■ Hydraulic mining of ore	**Key Performance Indicators** ■ Within range of baseline water quality results for both surface and ground water pre-mining of the North Dune.	Environment Department	Stream and Borehole Water Quality Monitoring as per monitoring procedure ENV-STDCDMS- 002075-ESMS (Environmental Monitoring Programme) and data to be fed into procedure ENV-STDCDMS- 002113 (Water Management Plan).	For surface water, water quality is monitored monthly for basic parameters (physico-chemical parameters, major cations and anions, and a few trace constituents). Specific monitoring for Turbidity and TSS. Water quality and water levels are to be	As per procedure.

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility	Mode of Monitoring	Monitoring Frequency	Monitoring Location(s)
					collected weekly and, most recently, bimonthly.	
Noise and vibration from mining operations	■ Vehicle movements ■ Vegetation clearance ■ Stock piling of stripped waste soils/vegetation. ■ Topsoil stripping ■ Hydraulic mining of ore	**Key Performance Indicators** ■ As per Baseline noise measurements for Daytime noise levels and Night time noise levels measured at those noise monitoring sites N4, N5, N6, N7, N8, N9, N10 and N11 ○ ■ < 3dB(A) increase in background noise level directly as a result of mining activities (IFC guideline)	Environment Department	As per monitoring Procedure ENVSTDCDMS- 002075-ESMS (Environmental Monitoring Programme). During the course of undertaking noise measurements, monitoring conditions are also to be recorded, such as bird calls, insects and wind rustling vegetation, as these contribute, sometimes significantly, to the ambient noise environment.	As per monitoring procedure ENVSTDCDMS-002075-ESMS (Environmental Monitoring Programme).	In order to quantify levels of noise around the Mine Site, ambient noise monitoring will be required. For the North dune extension, noise monitoring is to be continued during both hours of day-time and night-time, at those locations shown in Figure 5.9, and any future sites that are identified.
Exposure of workers and communities to nuisance dust fallout and PM_{10} emissions	■ Vehicle movements ■ Vegetation clearance ■ Topsoil stripping ■ Hydraulic mining of ore ■ Dust emissions from TSF.	**Key Performance Indicators** ■ Dust fall-out guideline of 600mg/m^2/day. ■ PM_{10}: 50µg/m^3 (Annual average). ■ PM_{10}: 100µg/m^3 (24 hour average). ■ All PM_{10} data collected to be compared to the annual average of 50µg/m^3 PM_{10}. ■ Comparison of upwind and downwind samples to assess the contribution from the Mine.	Environment Department OHS&T Department	PM10 monitoring Fall-out dust monitoring Grievances to trigger analysis of dust monitoring results and report back to communities As per Environmental Monitoring Programme (Monitoring procedure ENV STDCDMS-002075-ESMS).	Monitoring for fall out dust (data to be analysed and compared with the dust fall-out guideline of 600mg/m2/day. For PM10, dust sampling to be undertaken at a higher frequency during the dry season. Daily PM10 data to be compared to the Kenyan Air Quality standard for PM10 (respirable dust) of 50µg/m3 (24 hour average).	Dust monitoring locations are provided in Figure 5.8. Dust monitoring must continue at monitoring sites D1, D2 and D10. Dust Monitoring to be undertaken at locations both upwind and downwind of the mine site to ascertain the contribution from the mine to dust levels.

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility	Mode of Monitoring	Monitoring Frequency	Monitoring Location(s)
					All PM10 data collected to be compared to the annual average of 100µg/m3 PM10. Base are to investigate any likely sources from the mine site, and establish whether such sources are contributing to the higher ambient concentrations.	
Noise impacts and degradation of ambient air quality within and around the mine site boundary in the vicinity of the North Dune Extension	■ Vehicle movements ■ Surface vegetation clearance ■ Topsoil stripping ■ Stockpiling of stripped soil ■ Water use ■ Use of mobile and immobile equipment.	**Key Performance Indicators** ■ As per Baseline noise measurements for Daytime noise levels and Night time noise levels measured at those noise monitoring sites N4, N5, N6, N7, N8, N9, N10 and N11 ■ Ambient air quality within specified limits. ■ Zero credible grievances received from community members.	Environmental Manager	As per monitoring Procedure ENVSTDCDMS- 002075-ESMS (Environmental Monitoring Programme).	As per monitoring Procedure ENVSTDCDMS-002075- ESMS (Environmental Monitoring Programme).	Identified communities adjacent to the North dune boundary.
Exposure to dangerous levels of radiation	■ Removal of topsoil and processing of ore	**Key Performance Indicators** ■ Radiation background of 0.19µSv/hour	Environment Department	In situ Gamma surveys in the field. Water quality sampling	Monthly The current baseline data obtained for the Mine Site is well within typical levels of natural background and the legal	Monitoring of gamma radiation levels are to continue on the boundaries of the North Dune mining areas (as provided in Figure 5.10) to add to and to compare with the

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility	Mode of Monitoring	Monitoring Frequency	Monitoring Location(s)
					guideline of 0.19µSv/hour. (0.10 (± 0.03) µSv/h for Mkwambani; 0.12 (± 0.04) µSv/h for the Main resource-Mwaweche; 0.11 (± 0.03) µSv/h for the Main resource-Mwaloya; 0.11 (± 0.03) µSv/h for Mwandimu; and 0.10 (± 0.03) µSv/h for Bumamani). Any increase in baseline will need to be compared to this overall average.	current gamma background radiation surveys conducted in this area.
Impacts on Fauna and flora (Loss of species and reduction in surface vegetation cover/ habitat)	■ Surface vegetation clearance ■ Topsoil stripping ■ Stockpiling of stripped soil ■ Water use ■ Use of mobile and immobile equipment. ■ Increased establishment and spread of alien invasive plant species ■ Permanent modification of areas affected by roads and/or	**Key Performance Indicators** ■ Measurable improvement in biodiversity (presence of noted rare and endemic species) in wetlands and biodiversity corridor, and areas earmarked/zoned for protection. ■ Number of trees/shrubs/plants planted into these areas from Base's indigenous nursery.	Environment Department	A detail survey should be carried out for a comprehensive checklist of the area. It will be important to get the species that may have been missed during this survey. A detailed baseline will be helpful during the monitoring stage as it will confirm if species are appearing for the first time following mitigation or have been there before. Insects are known to be highly season in their activities. For instance, several dragonfly species collected before were missed and new ones	Seasonal	Rehabilitated wetlands, biodiversity corridors, surface water quality monitoring points.

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility	Mode of Monitoring	Monitoring Frequency	Monitoring Location(s)
	other decommissioned infrastructure, as well as landscaping related to rehabilitation			recorded. Therefore, such future surveys should be done in different seasons or times of the year. Monitor forest patches near future mining areas for signs of degradation, and participate in/initiate community forest management and conservation programs Monitor more intact woodland patches near all mined areas, and participate in/initiate community management and conservation programs, which would include reduction of alien invasive species Macroinvertebrate monitoring Herpetofauna monitoring Recording of Number of trees/shrubs/plants planted into areas to be rehabilitated from Base's indigenous nursery.		
Impacts on wetlands	■ Surface vegetation clearance	**Key Performance Indicators** ■ Measurable improvement in biodiversity (presence of	Environmental Manager	Alternative biotic indices should be developed to monitor changes in the	Seasonal	Identified wetlands requiring protection in the North Dune area.

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility	Mode of Monitoring	Monitoring Frequency	Monitoring Location(s)
	■ Topsoil stripping ■ Stockpiling of stripped soil ■ Water use ■ Obstruction or diversion of streams ■ Use of mobile and immobile equipment. ■ Increased establishment and spread of alien invasive plant species ■ Permanent modification of areas affected by roads and/or other decommissioned infrastructure, as well as landscaping related to rehabilitation	noted rare and endemic species) in wetlands and biodiversity corridor, and areas earmarked/zoned for protection. ■ Number of trees/shrubs/plants planted into these areas from Base's indigenous nursery.		aquatic habitats alongside the SASS. A new method for assessing changes can be designed for use at Base Titanium limited base on observed changes in abundances and diversity. the study team also recommend the use of another simple index which uses dragonflies alone known as Dragonfly Biotic Index (DBI). Continue monitoring of threatened species and habitat condition at localities where such were identified, expand the search for such species to wetlands not yet surveys, but which will be within 100 m of the mining pit areas Macroinvertebrate monitoring Herpetofauna monitoring Water quality monitoring as per monitoring procedure ENV-STDCDMS- 002075-ESMS (Environmental Monitoring Programme).		

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility	Mode of Monitoring	Monitoring Frequency	Monitoring Location(s)
Risks to safety and health at the workplace	Use of mobile and immobile equipment at the Mine, mineral ore extraction and transfer to processing units, consolidation of stripped topsoil and cleared vegetation.	**Key Performance Indicators** ■ Zero Lost Time Injuries ■ A reduction in the Lost Time Injury Frequency rate (LTIFR)	OHS&T Department	As per Procedure ENV-STD-CDMS- 002092 – ESMS OHS Management Plan	As per Procedure ENV-STD-CDMS-002092 – ESMS-OHS Management Plan	Entire workplace
Loss of Housing (Physical Displacement) Loss of Private Land and Orchards (Economic Displacement) Loss of Communal Land and Natural Resources Loss of Businesses and Traders Loss of Public Facilities and Services Breakdown in Community Networks and Structure	■ Compulsory Land Acquisition for the North Dune Resource Area, a 100m buffer, and land required for project linear and ancillary infrastructure.	**Key Performance Indicators** ■ Preparation of the Project RAP. ■ Progress on the Asset Inventory and Valuations. ■ Authorisation of the Project RAP. ■ Authorisation of the Asset Inventory and Valuations. ■ Payment of compensation. ■ Provision of Replacement Homesteads and Structures. ■ Progress in Livelihoods Restoration Programmes	Base	Progress Reporting	Monthly	Displacement Affected Communities

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility	Mode of Monitoring	Monitoring Frequency	Monitoring Location(s)
Restriction of Access and Mobility	■ Destruction of secondary and minor roads that bisect the resource areas, any safety buffer or land required for any linear or ancillary infrastructure. ■ Conversion, if any, of any public roads into dedicated haul or mine roads. ■ Increased interaction between public commuter and pedestrian traffic with mine vehicles on public roads.	**Key Performance Indicators** ■ Provision of new public roads and pathway as applicable to any agreement. ■ Lack of community grievances related to reduced mobility and accessibility. ■ Lack of public incidents or accidents with mine traffic on public or mine roads.	Base	Progress Reporting Incident Reports Grievance Reporting	Monthly	Affected Communities
Labour and Work Seeker Influx Local Direct Employment	■ The peak demand for temporary contract workforce. ■ The demand for permanent operational staff as well as temporary contract workforce during the operational life of the mine.	**Key Performance Indicators** ■ Updating and implementation of the LRIMP to cover the North Dune operations. ■ Monitoring of population growth rates in community surrounding the mine. ■ Ongoing engagement with local authorities in terms of influx perceptions.	Base	Recruitment and Labour Reporting on: ■ Job applicants ■ Actual employees ■ Skill levels ■ Employee Place of Origen ■ Employee Gender. ■ Employee vulnerable group ■ Type of training received.	Quarterly	-

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility	Mode of Monitoring	Monitoring Frequency	Monitoring Location(s)
	■ Improved economic, employment and business opportunities provided by the presence of the mine.					
Local Content and Regional Economic Development Local Economic Development and CSI Spend	■ Base procurement of goods and services from national, regional, and local service providers and suppliers. ■ Base programmes with respect to local business development as part of their Community Development Plans.	**Key Performance Indicators** ■ Revision of existing Local Content / Procurement Plans ■ Update of existing Local Supplier Database to include affected communities. ■ Implementation of any CSI programmes.		CSI Reporting, including information on: ■ Registration of SMMEs from affected communities. ■ Record of development support given to SMMEs from affected communities. ■ Record of contracts, total spend, and indirect employment provided by Base. ■ Revision of existing CSI plans, programmes, and initiatives. ■ Record of CSI support given to target beneficiaries from affected communities. ■ Number and list of beneficiaries for each CSI initiatives.	Quarterly	-

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility	Mode of Monitoring	Monitoring Frequency	Monitoring Location(s)
				■ Annual CSI planning and reviews reports / summary.		
Community Health, Safety and Security	■ Construction and operation of mine infrastructure, as well as the movement of mine equipment through or near communities. ■ The peak demand for temporary contract workforce and permanent operational staff, ■ Improved economic, employment and business opportunities and long-term immigration of economic migrants and work-seekers. ■ The storage, management and transport of any mine products, materials, equipment, and waste on public roads.	**Key Performance Indicators** ■ Updated of existing Health and Safety Plans to cover the North Dune mining operations. ■ Inclusion of community requirements in any new Health and Safety Plans. ■ Provision of additional resourcing to implement Health and Safety Plans. ■ Record of community incidents, emergency events and responses.	Base	Incidents and / or Grievance Reporting	Monthly	-

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility	Mode of Monitoring	Monitoring Frequency	Monitoring Location(s)
	■ Base's use of state and privacy security forces to secure their operations.					
General Socio-Economic Trends Monitoring	-	**Key Performance Indicators** Socio-Economic performance of impacted households including: ■ Demographic profile, ■ Education levels, ■ Skills level. ■ Changes to status of women, children, and vulnerable groups. ■ Access to primary and other healthcare. ■ Access to potable water. ■ Changes in nutritional status. ■ Employment levels. ■ Access to livelihoods and resources. ■ Homestead asset profiles including homestead structures. ■ Homestead land holding. ■ Security of tenure for affected households. ■ Income levels and sources. ■ Livestock ownership. ■ In-migration and population changes.	Base	Independent Socio-Economic Monitoring Study	Biennial (Once every Two Years)	Displacement Affected Communities

Project Impact	Main Related Activities	Management/Mitigation Measures	Responsibility	Mode of Monitoring	Monitoring Frequency	Monitoring Location(s)
		■ Educational facility usage (pupils per classroom and pupil: teacher ratio). ■ Health facility usage.				

11. CONCLUSIONS

The current mineral resource mined by Base Titanium comprises two dunes that contain economically viable concentrations of heavy minerals. These two dunes are known as the Central and South Dunes. The Operation's original mine life was set at 13 years, running up until the year 2025. However, the mine life was later reduced to 2023 due to higher mining rates and the expansion of the Wet Concentrator Plant (WCP). To address the reduced mine life, Base commenced an exploration programme in the area outside of their existing mining lease area, including around the South Dune, to identify additional resources that could be economically mined. Economically viable mineral resources in an extension to the South Dune, but outside of the current SML were identified and an application for an extension to the south dune resource was approved, resulting in the projected mine life shifting to December 2023.

In a move to assess the possibility of extending the Life of Mine (LOM) even further, Base, in 2018, decided to re-evaluate the potential of the North Dune mineral deposit, which is located immediately to the north-east of the Kwale operation's offices and plant. The North Dune is a low grade (~1.6%HM) reasonably sized resource that has the clear potential to be economic. Mining in the North Dune, the subject of this ESIA, will increase the LOM a further 4 to 4.5 years.

Most, if not all of the impacts identified and elaborated in this ESIA for the North Dune, have been identified, and are currently adequately managed by Base for the current mining operations on the South Dune. Management of such impacts is undertaken through the implementation of current EHS Management Plans. These separate topical Management Plans address all the Environment/Social and Occupational Health and Safety aspects of the current mining operations of the South Dune, and will also be applicable to the activities of the North Dune operations.

Monitoring Plans are also in place, and aim to ensure those mitigation and management measures as elaborated in each of the suite of Management Plans, are being adequately implemented.

These Management and Monitoring Plans form an integral part of Base's current Environmental and Social Management System (ESMS).

It is the intention of Base to integrate the impact management/mitigation measures identified in this ESIA and elaborated in the ESMP (Chapter 10) into the respective management plans to conform to the Company ESMS. Monitoring data collected for the North Dune will also be incorporated into Base's existing monitoring and reporting framework.

In this way, impacts identified for the North Dune Extension will be adequately managed through Base's ongoing ESMS.

As such, it is a recommendation of ERM, that this North Dune EIA be approved.

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APPENDIX A ERM EAST AFRICA FIRM OF EXPERTS AND ERM LEAD EXPERT NEMA CERTIFICATES

FORM 7 (r.15(2))

mazingira yetu | uhai wetu | wajibu wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/13736

Application Reference No: NEMA/EIA/EL/18087

M/S **ENVIRONMENTAL RESOURCE MANAGEMENT EAST AFRICA LTD (ERM)** (individual or firm) of address

P.O. Box 29170-00100, Nairobi

is licensed to practice in the capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Firm of Experts** registration number **7264**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **1/18/2021** Expiry Date: **12/31/2021**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001 BUREAU VERITAS Certification

ISO 9001: 2008 Certified

FORM 7 (r.15(2))

nema
mazingira yetu | uhai wetu | wajibu wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/13737

Application Reference No: NEMA/EIA/EL/18088

M/S **MICHAEL JOHN EVERETT**
(individual or firm) of address

P.O. Box 29170-00100, Nairobi

is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
registration number **7263**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **1/18/2021** Expiry Date: **12/31/2021**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

APPENDIX B NEMA APPROVAL LETTER- SCOPING REPORT AND TOR FOR THE BASE TITANIUM NORTH DUNE EIA

nema

NEMA/TOR/5/2/1109 Date: 11/06/2020

Base Titanium

Kwale County

RE: **ACKNOWLEDGEMENT AND APPROVAL OF TERMS OF REFERENCE (TOR) FOR ENVIROMENTAL IMPACT ASSESSMENT**

We acknowledge the receipt of TOR for the above subject.

Pursuant to the Environmental Management and Coordination Act CAP 387, the second schedule and the Environmental (Impact Assessment and Audit) Regulations 31 and 25, your terms of reference for the Environmental Impact Assessment (EIA) for the proposed Base Titanium North Dune Extension has been approved.

You shall submit ten (10) copies and one electronic copy of your report prepared by a registered expert to the Authority

REAGAN AWINO
FOR: EIA SECTION HEAD

APPENDIX C SOILS SPECIALIST REPORT

BASE TITANIUM

REPORT ON:

SOIL SPECIALIST ASSESSMENT NORTH DUNE EXTENSION ESIA

REPORT: P380

Submitted to:

Base Titanium Ltd Ukunda

PO Box 1214

Ukunda

8040

VILJOEN & ASSOCIATES

DISTRIBUTION:

1 Copy - Base Titanium

1 Copy - Viljoen Associates

May 2020

Table of Contents

EXECUTIVE SUMMARY

Mr. M. Everett ERM East Africa (Pty) Ltd on behalf of Base Titanium Ltd Ukunda during February 2020 requested a proposal for a Soil Specialist screening reconnaissance site assessment of the proposed 4,465ha North Dune Extension project area inclusive of the 582ha ore body

The investigation objectives were interpreted to classify and map soil types to scale 1:10,000, to screen for wetlands, measurement of effective depth of soil(s), assessment of the dry land, irrigation agricultural and rehabilitation potential of the soils, assess the land use & land capability, description of chemical, physical and mineralogical properties of representative soil forms, assessment of the erodibility of the soils, a compilation of concept soil utilisation guide and plan, propose mitigation measures for rehabilitation and submit advice on soil profiles post-mining to allow for agriculture, to replicate as close as possible the current land use.

From the assessment, it is conclusive that the dominant soils in the study area according to the Taxonomical Soil Classification System of South Africa include Avalon, Bainsvlei, Clovelly, Hutton and Mispah soils. The effective depth of the Avalon, Bainsvlei, Clovelly and Hutton soils exceed 300mm inclusive of the *Orthic A – Horizons* and *Red Apedalic B – Horizons.* The Avalon, Bainsvlei, Clovelly and Hutton soils have high agricultural and rehabilitation potential under dryland and irrigation conditions respectively. The Mispah soil is a shallow weathered soil on rock with low agricultural and rehabilitation potential.

The current land use includes 2,178ha (48,79%) natural veld, 2,123ha (47,57%) plantations and 162ha (3,64%) ploughed land. Land capability includes 4,393ha (98,4%) arable and 71,451ha (1,6%) wilderness.

From the different soil types, *i.e.* Avalon, Bainsvlei, Clovelly and Hutton in the 582ha ore body there is an estimated 6,840,000m^3 soil at a bulk density of 1,850kg/m^3 available for rehabilitation.

Interpretation of estimated analytical data indicates potential dispersion anomalies due to exchangeable sodium occupying more than 15% of the cation exchange capacity. This should be carefully managed to prevent soil erosion, crusting and formation of preferential seepage pathways.

The Avalon and Bainsvlei soils are characterised by low to neutral pH to alkaline values. There is a lime requirement due to acidity in the soil solution ranging from 2 to 12t/ha/300mm. The disturbed Ca:Mg, Mg:K and Ca+Mg/k ratio's will be rectified through $CaMgCO_3$ applications. There is salinisation in the soil solution as reflected by the high electrical conductivity values (*>250mS/m*), mainly water-soluble SO_4. This could be due to fertilisation practices to be confirmed. The geology does not contain

sulphur bearing minerals, *i.e.* FeS that could oxidise and form sulphuric acid and SO_4 salts. Under these conditions plant-available nitrogen (*15-20mg/kg*), phosphorus (*10-15mg/kg*) and potassium (*>50mg/kg*) are not readily available for plant uptake and sustainable plant growth, requiring fertilisation for successful rehabilitation. Heavy metal concentrations are at acceptable low concentrations. The *Orthic A-Horizon* and *Red Apedalic B-Horizon* is typically characterised by a low-density structure and texture distribution of approximately 65% sand, 20% silt and 15% clay with drainage properties in order of 10mm/h.

The dominant clay mineral is kaolinite (*1:1 layer silicate*), with a low buffer capacity due to the low cation exchange capacity (*<10cmol+/kg*). In terms of topsoil stripping careful consideration should be given to ensure the different soil horizons, Orthic A, Red Apedalic B, Yellow Apedalic B and Soft Plinthic B - Horizons should be stripped and stockpiled separately and not mixed. Reconstruction of the soil profiles should adhere as a minimum to parameters set in the report in combination with surface water control measures especially the Orthic A – Horizon.

DECLARATION OF INDEPENDENCE

Chris J Viljoen, CEO Viljoen Associates, hereby declare:

- Viljoen Associates act as an independent specialist in this investigation.
- The assessment is conducted in a scientific manner and findings will not be manipulated for a favourable outcome.
- Viljoen Associates have no financial, personal or any other interest in this project managed by Base Titanium, Ukunda in Kenya.
- All particulars furnished in this declaration are true and correct.

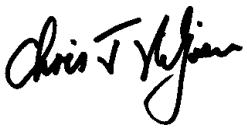
M.Sc., Pr. Sci. Nat.

DISCLAIMER

The opinions expressed in this Report have been based on the information supplied to Viljoen Associates (Pty) Ltd by Base Titanium Ltd. Viljoen Associates has exercised all due care in reviewing the supplied information. Whilst Viljoen Associates has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. Viljoen Associates does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of the investigation, and those reasonably foreseeable.

EXPERTISE OF COMPILING SPECIALIST

The report was compiled by:

Name	Professional registration and short list of expertise	Signature
Chris J Viljoen	*M.Sc., Pr. Sci. Nat. 400131/96 (Earth Science)* Baseline soil surveys, soil impact assessments, land use assessments, land capability assessments, agricultural potential assessments & wetland delineations for EIA and EMPR. Soil contamination assessments and formulation of cost effective remediation strategies for rehabilitation and closure purposes. Rehabilitation and closure plans. Geotechnical assessments for site selection, *e.g.* tailings dams, residential developments, *etc*. Twenty eight (28) years active in Soil Science	

Full CV of the specialist is available on request.

1 TERMS OF REFERENCE

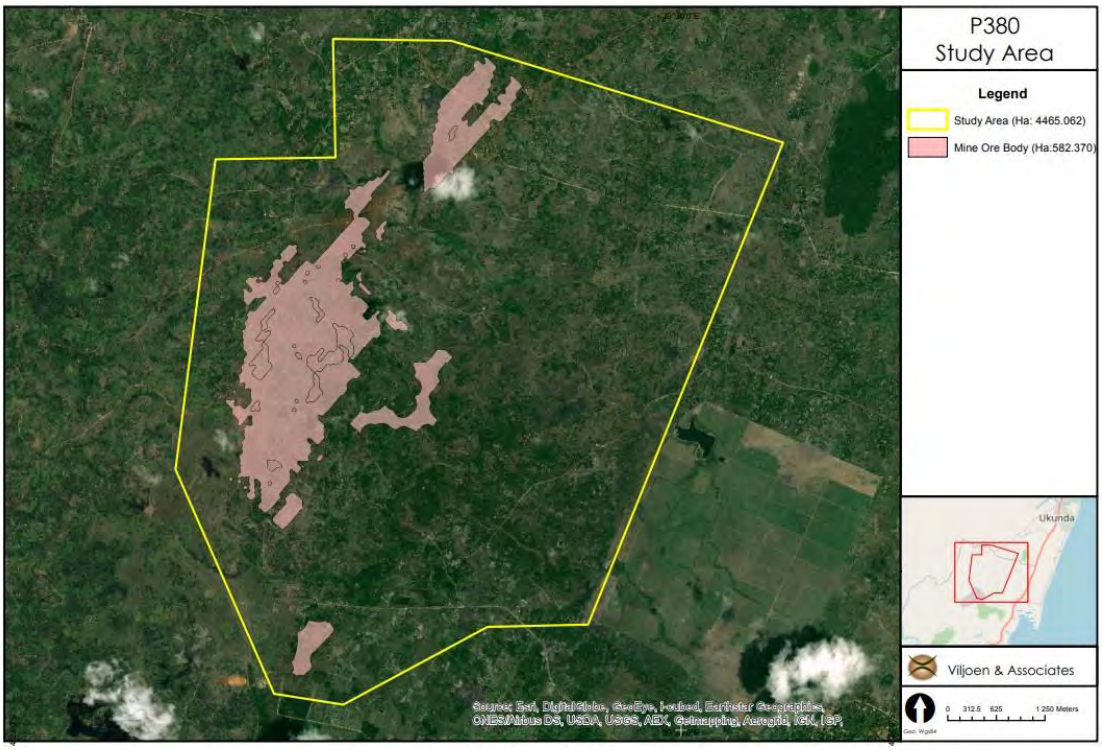


Figure 1. Investigation area.

During February 2020 ***Mr. M. Everett ERM East Africa (Pty) Ltd on behalf of Base Titanium Ltd Ukunda*** requested a proposal for a Soil Specialist screening reconnaissance site assessment of the proposed 4,465ha North Dune Extension project area inclusive of the 582ha ore body (***Figure 1***). Following mineral resource exploration activities in the North Dune, Base Titanium are now progressing to a Pre-feasibility Study (PFS) to establish the economic viability of mining and recovering this resource, with the view of mining this resource in late 2023, following the completion of mining the South Dune and South Dune extension. Mining the North Dune, an area of approximately 4,465ha, will prolong the mine life by 4.5 to 5 years. The North Dune has a low-grade material (~1.6%HM) with higher slimes content (~38%) requiring a high throughput estimated at between 2,900-3,200 tons per hour to make the project economical.

Following a preliminary site visit in February 2020, and given the potential North Dune mining area of approximately 4,465ha, it was agreed that a full soil survey would be neither feasible nor practical and a screening assessment with available information would be used for the assessment.

2 INVESTIGATION OBJECTIVES

The investigation objectives were interpreted as follows:

- Classification (Taxonomical Classification System) and mapping soil types to scale 1:10,000. Wetland delineation (screening, if present).
- Measurement of the effective depth of the soil(s).
- Assessment of the dry land, irrigation agricultural and rehabilitation potential of the soils.
- Land use & land capability assessment.
- Description of chemical, physical and mineralogical properties of representative soil forms.
- Assessment of the erodibility of the soils (i.e. exchangeable sodium percentage exceeding 15% of the cation exchange capacity).
- Compilation of soil utilisation guide and plan (stripping & stockpiling), mitigation measures for rehabilitation.
- Advice on soil profiles post-mining to allow for agriculture, to replicate as close as possible, the current land use.

3 METHOD OF INVESTIGATION

To meet the objectives of the investigation, the following scope of work was conducted during March/April 2020:

- Initiation meeting with the project team.
- Collection and review of all available secondary and previously collected data.
- Desktop soil assessment on a very broad flexible grid according to standard methods and techniques. The extrapolated data will be verified through ground-truthing.
- Analytical soil data extrapolation from available data of similar soil environments.

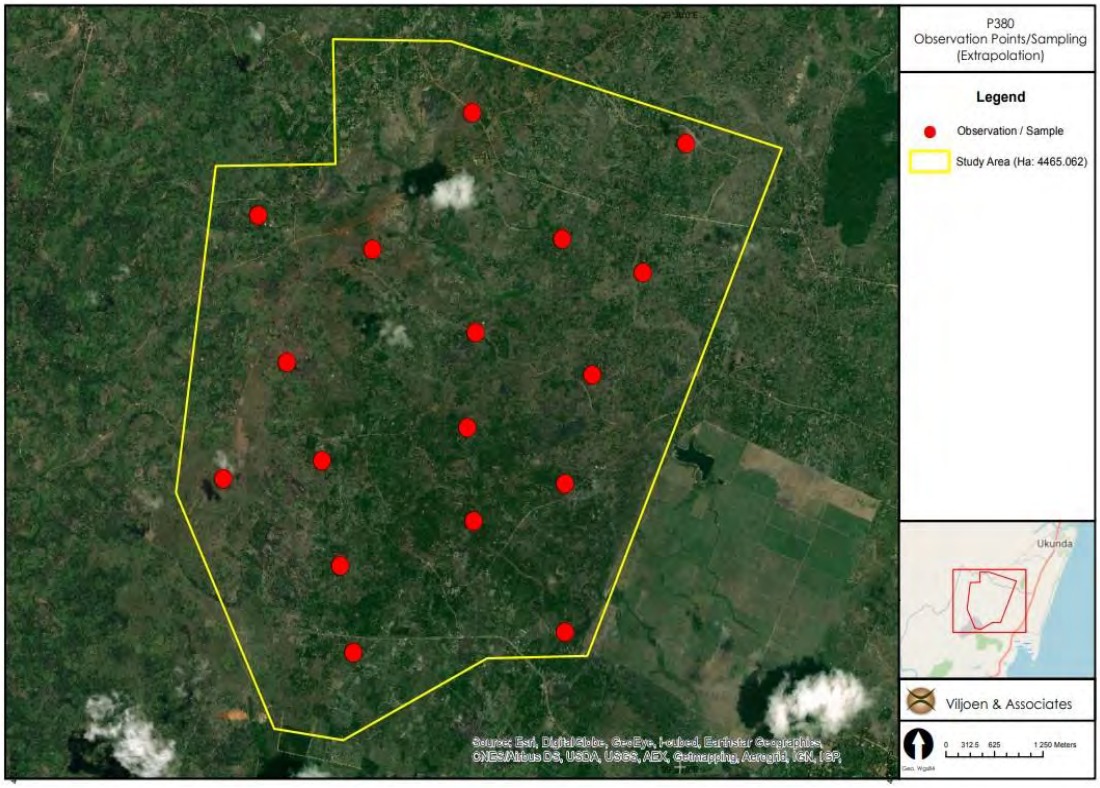


Figure 2. Survey and sampling points (*WGS84, decimal degrees*).

- A broad desktop reconnaissance soil survey (**Figure 2**) according to standard soil survey techniques comprising of GPS referenced auger holes on a flexible grid 1,8m deep (*or to auger refusal*).

- Soil profile studies and classification according to the latest version of the *South African Taxonomical Soil Classification System of South Africa*.

- Interpretation of analytical data, field observations and compilation of the draft report.

- Internal review and submission of the final report.

4 PROBLEM ANALYSES

Section 4.1 is a brief description of basic soil forming principles to set a framework for evaluation of the soil investigation:

4.1 Basic Soil Forming Principles

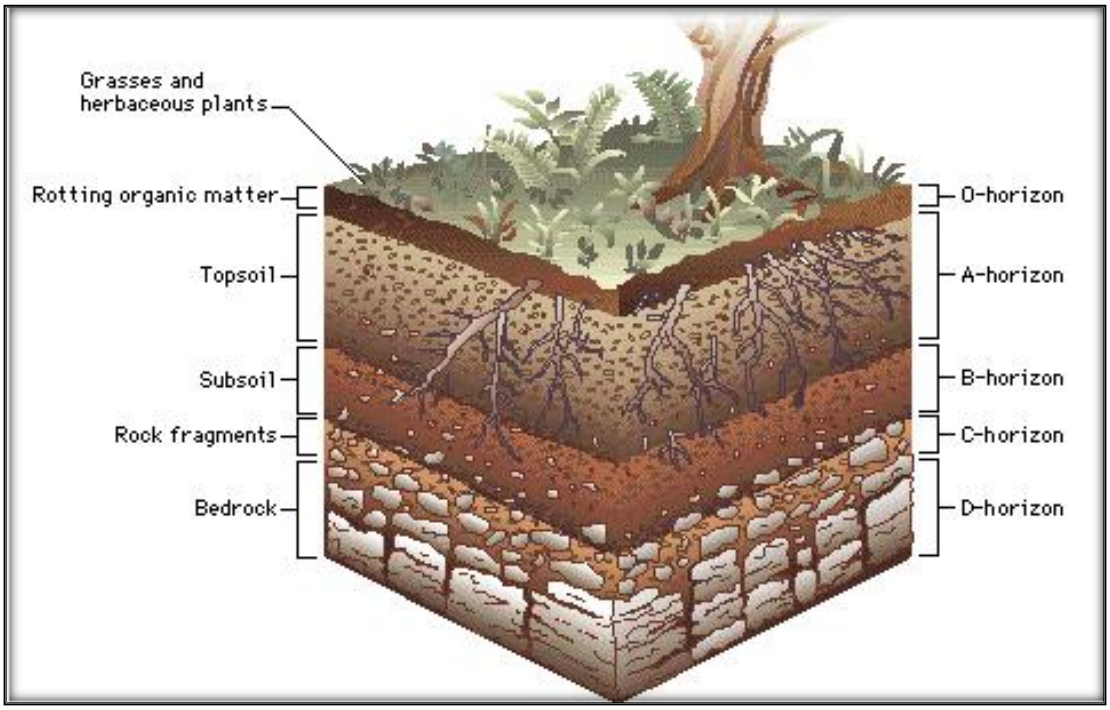


Figure 3. Typical soil profile (*Van Der Watt & Van Rooyen; 1990*).

According to *Van Der Watt & Van Rooyen (1990)* soil (**Figure 3**) can be defined as:

"the unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for growth of plants, or, the unconsolidated mineral matter on the surface of the earth that has been subjected to and influenced by genetic and environmental factors of parent material, climate (including precipitation and temperature effects), macro- and micro-organisms and topography all acting over the time and producing a product – soil – that differs from the material, which is derived in many physical, chemical, biological and morphological properties and characteristics".

Soil is the thin surface covering of the bedrock of most of the land area of the Earth. It is a resource that, along with water and air, provides the basis of human existence. Soil develops when rock is broken down by weathering and material is exchanged through interaction with the environment. Organic matter becomes incorporated into the soil as the result of the activity of living organisms. Soil also contains water, minerals, and gases. The soil system (**Figure 4**) is dynamic and it develops a distinct structure, often with recognizable layers or soil horizons arranged vertically through the soil profile.

Figure 4. Soil systems with different layers, Left: Orthic A-Horizon/Podzol B-Horizon/Rock, Middle: Orthic A-Horizon/Rock, Right: Orthic A-Horizon/E-Horizon/Soft Plinthic B-Horizon (*Schroeder, 1984*).

Soil is essential for the development of most plants, providing physical support and nutrients. Plants are anchored in the soil by their roots. Nutrients, dissolved in soil water, are necessary for the plants' growth. Soil contains various types of organic matter, including dead material from plants and animals as well as animals that choose to live in the soil. The soil is, therefore, a store of major nutrients such as carbon and nitrogen and plays an important role in global nutrient cycles and in regulating hydrological cycles and atmospheric systems.

Soils vary from place to place due to varying conditions such as climate, rock type, topography, and the local soil-forming processes. Over time, soils develop characteristics specific to their location, which relate closely to the climate and vegetation of the area. The major world biomes reflect a clear association between vegetation and soil that has developed in response to the prevailing climate. Each soil type has a distinct combination of soil horizons and associated soil properties.

People depend on the soil for agriculture, and as such, it is a valuable natural resource. Soils form continuously as the result of natural processes and can, therefore, be regarded as a renewable resource. However, the soil-forming processes operate very slowly and the misuse or mismanagement of the soil may lead to damage or erosion (**Figure 5**) or can disrupt the processes by which the soil forms.

Figure 5. Soil erosion (*image not taken on-site*).

If this happens the resource can be degraded or even lost and this is what should be prevented during topsoil stripping, stockpiling, replacement and landscaping. Many human activities cause damage to soils. These include bad farming techniques, overgrazing, deforestation, urbanization, construction, soil stripping, wars, contamination, pollution and fires. The most critical result of these is soil erosion as depicted above in **Figure 5**. With growing populations, the need for productive soils is increasing. Soil loss in many developing countries is a major cause for concern and will become a major issue in the future. The process of soil loss can have a detrimental effect on other systems as it produces sediment that can cause siltation of river systems and reservoirs, set off flooding downstream, and contribute to pollution and damage to estuaries, wetlands, and coral reefs. Soils need to be managed carefully to remain in good condition.

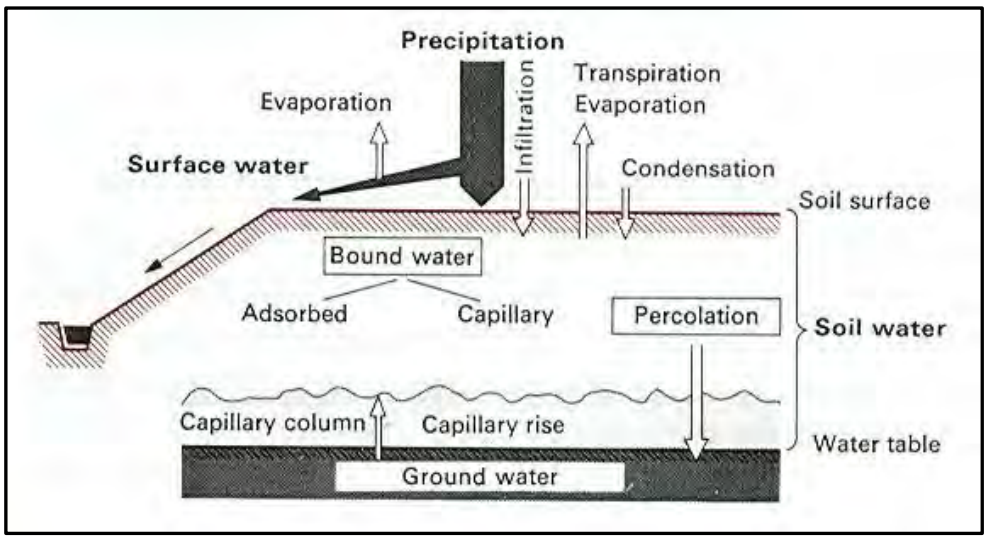


Figure 6. Soil water balance (*Schroeder, 1984*).

The proposed project's position in its specific catchment(s) should be evaluated within the framework of saturated and unsaturated soil water conditions and the effect of disturbed soils, erosion and contamination. **Figure 6** illustrates a ***conceptual water solute transport model*** considering all possible water balance contributors, loss through seepage along preferential surfaces, subsurface seepage pathways and environmental receptors. Strategic planning should be conducted for managing topsoil as a finite resource during the construction project to be utilised optimally for cut & fill and landscaping purposes.

4.2 Soil Classification and effective soil depth

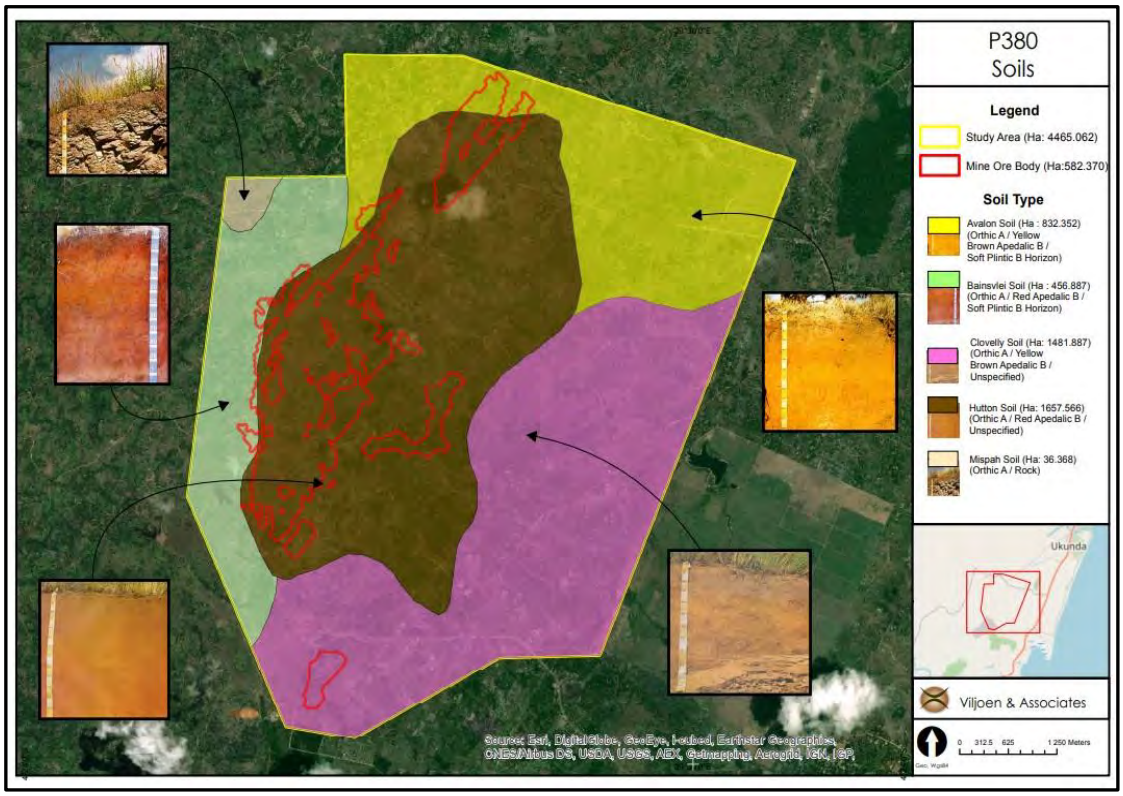


Figure 7. Soil types.

Figure 7 shows the distribution of the different soil types identified:

- *Avalon, Bainsvlei, Clovelly, Hutton and Mispah.*

Hutton (1,657ha) and *Clovelly* (1,481) are the dominant soil types according to the latest version of the *South African Taxonomical Soil Classification System*. Hutton soils are deep, red, well drained textured soils (see photo below).

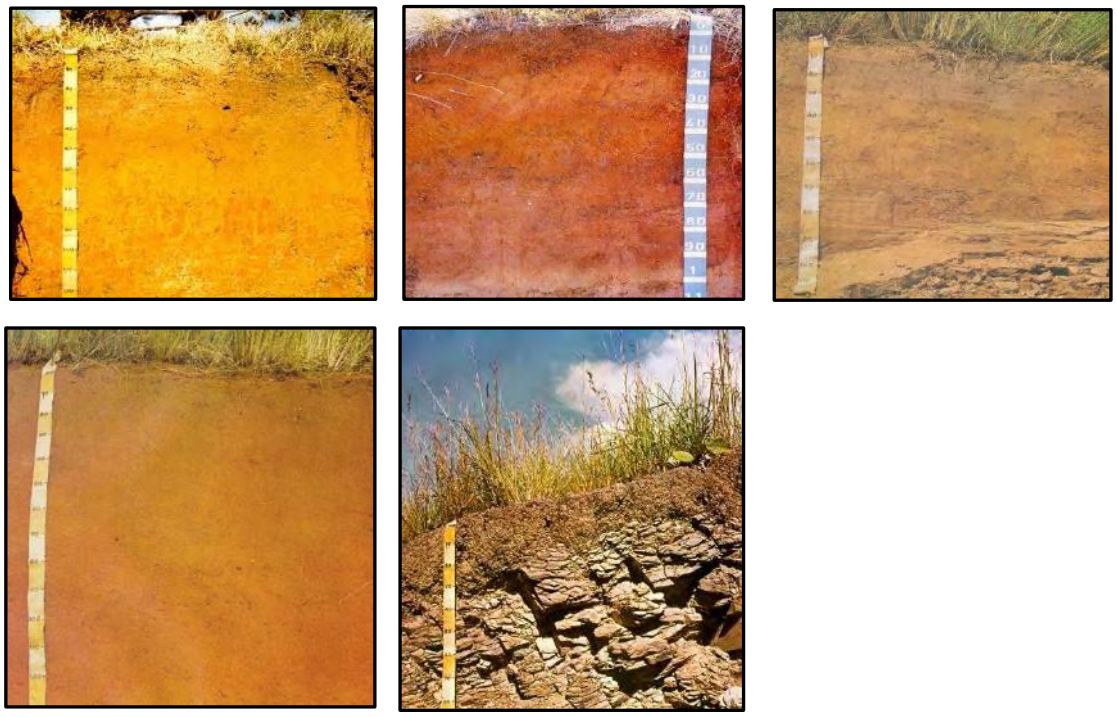


Figure 8. Avalon, Bainsvlei, Clovelly (top), Hutton and Mispah (bottom) soils.

The different soil types (**Figures 7** and **8**) are summarised in **Table 2**:

TABLE 1: SOIL TYPES

SOIL TYPE	DIAGNOSTIC HORIZONS	EFFECTIVE DEPTH (MM)
Avalon (832ha)	Orthic A – Horizon/Yellow Apedalic B – Horizon/Soft Plinthic B – Horizon	>300
Bainsvlei (456ha)	Orthic A – Horizon/Red Apedalic B – Horizon/Soft Plinthic B - Horizon	>300
Clovelly (1,481ha)	Orthic A – Horizon/Yellow Brown Apedalic B – Horizon/Unspecified	>300
Hutton (1,657ha)	Orthic A – Horizon/Red Apedalic B – Horizon/Unspecified	>300
Mispah (36ha)	Orthic A – Horizon/Rock	<300

The diagnostic horizons in **Table 2** are described below:

- Orthic A – Horizon: Is a surface horizon containing an abundance of organic material darkened by organic matter, occurring over virtually the full range of soil-forming conditions encountered in Kenya. The horizon excludes the properties of organic, humic, vertic or melanic topsoil horizons.

- Red/Yellow Apedalic B – Horizon: Characterised by 1:1 clay minerals, *i.e.* kaolinite and oxides of iron and manganese. The clay percentage ranges between 10 and 20% (*hydrometer method*) and due to the low clay content there is a lack of structure. In some instances, 2:1 clay minerals are present due to the influx and drainage of 2:1 clays. The main difference between the Yellow and Red Apedalic horizon is Fe being present in the oxidised (red) and reduced (yellow) state.

- Soft Plinthic Layer: This layer formed under fluctuating water regime conditions causing oxidation & reduction of Fe and Mn due to aerobic and anaerobic conditions. From a contamination perspective if the pH of the soil solution would go below 5,3 the Fe and Mn would go into solution together with all other heavy metals present in the soil matrix. The plinthic layer should also not be mixed with other soil layers during topsoil stripping.

4.3 Agricultural and Rehabilitation potential

The agricultural and rehabilitation potential was assessed using the following formula as a function of various variables:

$$\textbf{\textit{YIELD (kg ha}}^{-1}\textbf{\textit{) = R/B x ED/A x C x X}}$$

R – Rainfall (mm); ***B*** - Species growth characteristics factor; ***ED*** - Effective depth of the soil; ***A*** - Soil wetness factor for textural classes of soil above effective depth; ***C*** - Correction factor for aeration of soil; and ***X*** - Fixed coefficient for species.

The main variables determining the soil's agricultural and rehabilitation potential for vegetation establishment (**Table 3**) include the **average rainfall** (*mm*), **soil depth** (*mm*) and **water management & holding capacity**. The yield estimates in **Table 3** exclude any other management practices, *i.e.* fertilisation, cultivar, plant density, *etc.* that can make a significant difference in yield. The Avalon (>300mm), Bainsvlei (>300mm), Clovelly (>300mm) and Hutton (>300mm) soils have high agricultural and rehabilitation potential under dryland and irrigation conditions. From an agricultural perspective under dryland conditions 30,000 plants/ha with an average rainfall of 650mm/year could be sustainable, however during the summer period with extreme heat units growth could be lowered. Production under irrigation conditions would require 6,100m^3/ha/year of water for 100,000 plants/ha, which is the equivalent of 30,000l/ha 24hours, 7 days per week. The Mispah soil has low agricultural and rehabilitation potential due to the effective depth being shallower than 300mm. The soil

will not be able to facilitate adequate root development and store enough plant available water between 33 and 1,500kPa and very specific to certain plant species.

TABLE 2: AGRICULTURAL AND REHABILITATION POTENTIAL OF SOIL

SOIL TYPE	AGRICULTURAL AND REHABILITATION POTENTIAL	
	DRY LAND	IRRIGATION
Avalon: >300mm (832ha)	High	High
Bainsvlei: >300mm (456ha)	High	High
Clovelly: >300mm (1,481ha)	High	High
Hutton: >300mm (1,657ha)	High	High
Mispah (36ha)	Low	Low

4.4 Land use & land capability

Land use can be defined as the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain, *i.e.* the human use of land.

Land use involves the management and modification of natural environment or wilderness into built environment such as settlements and semi-natural habitats such as dams, infrastructure, natural veld, pans, ploughed land, settlements, wetlands, pastures, and managed woods.

Land capability classification shows the suitability of soils for most kinds of field crops. A summary of land capability criteria is given in **Table 4**.

Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops and the way they respond to management.

TABLE 4: CRITERIA FOR DETERMINATION OF LAND CAPABILITY

Summarised Description of Land Capability Criteria	
Wetlands, Pans, Drainage Lines	Land with organic soils or supporting hygrophilous vegetation where soil and vegetation processes are water determined.
Arable (>600mm)	Land that does not qualify as wetland. Soil is readily permeable to depth of 750mm. Soil has pH value between 4 and 8.4. Soil has low salinity and SAR. Soil has less than 10% (by volume) rocks or pedocrete fragments larger than 100mm in the upper 750mm. Has a slope (%) and erodibility factor (k) such that their product is <2.0. Occurs under a climate of crop yields that are at least equal to the current national average for these crops.
Grazing (250 – 600mm)	Land which does not qualify as wetland or arable land. Has soil, or soil-like material, permeable to roots of native plants, that is more than 250mm thick and contains less than 50% by volume of rocks or pedocrete fragments larger than 100mm. Supports, or is capable of supporting a stand of native or introduced grass species or other forage plants used by domesticated livestock or game animals on a commercial basis.
Wilderness (<250mm)	Land which does not qualify as wetland, arable or grazing land.

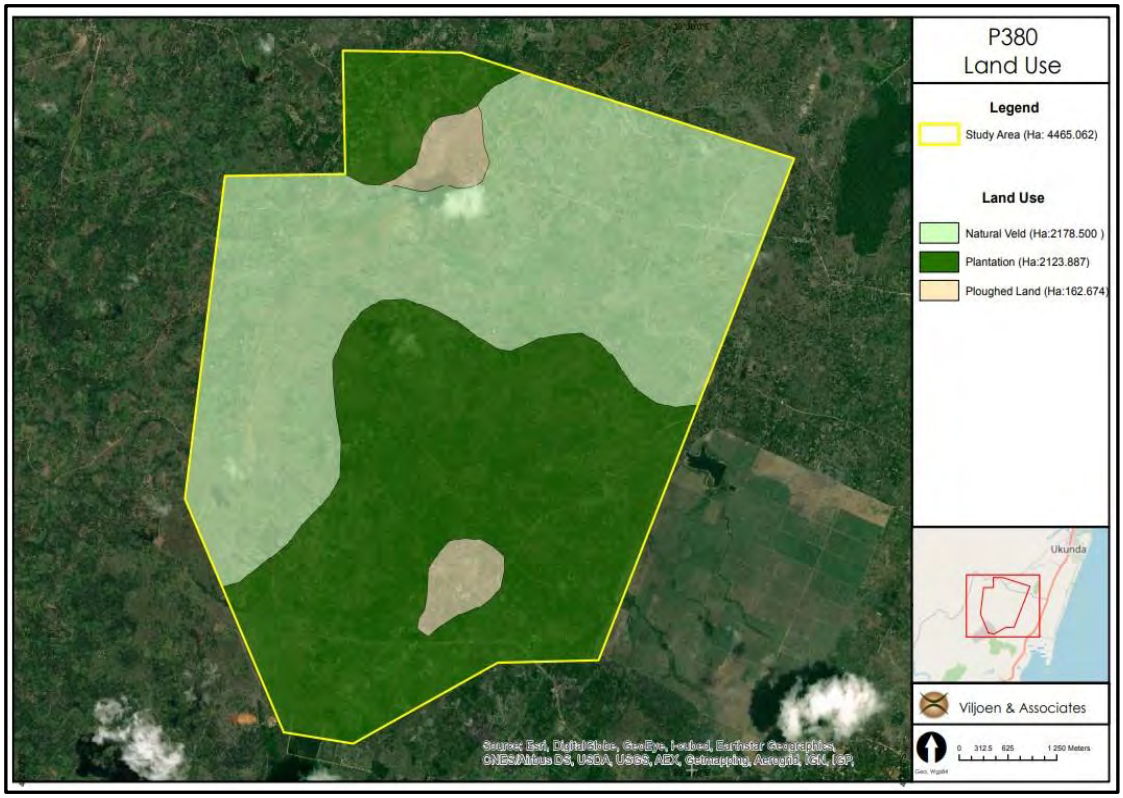


Figure 9. Land Use.

The current land use (***Figure 9***) includes 2,178ha (48,79%) natural veld, 2,123ha (47,57%) plantations and 162ha (3,64%) ploughed land.

Table 5 summarises the *land use* (**Figure 9**) as a percentage of the total surface area:

TABLE 5: LAND USE

Area	Land Use	Surface Area (ha)	% of Total
North Dune	Natural Veld	2178,500	48,79
	Plantation	2123,887	47,57
	Ploughed Land	162,674	3,64
	Total	4,465	**100**

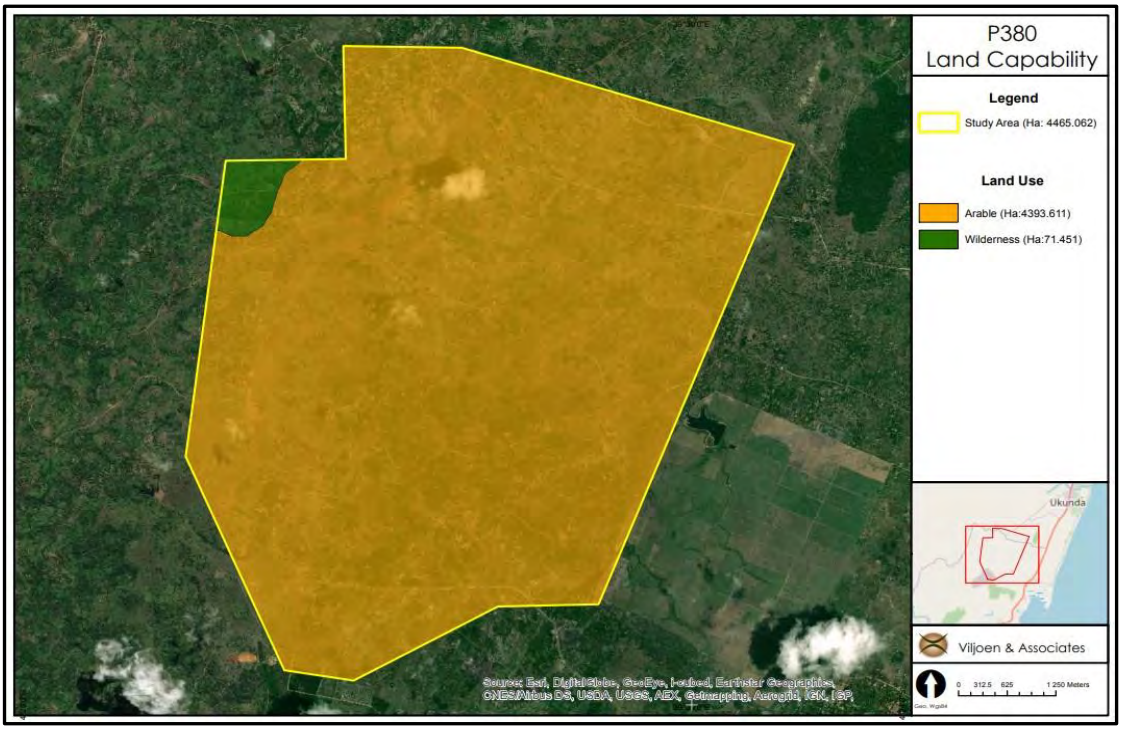


Figure 10. Land Capability.

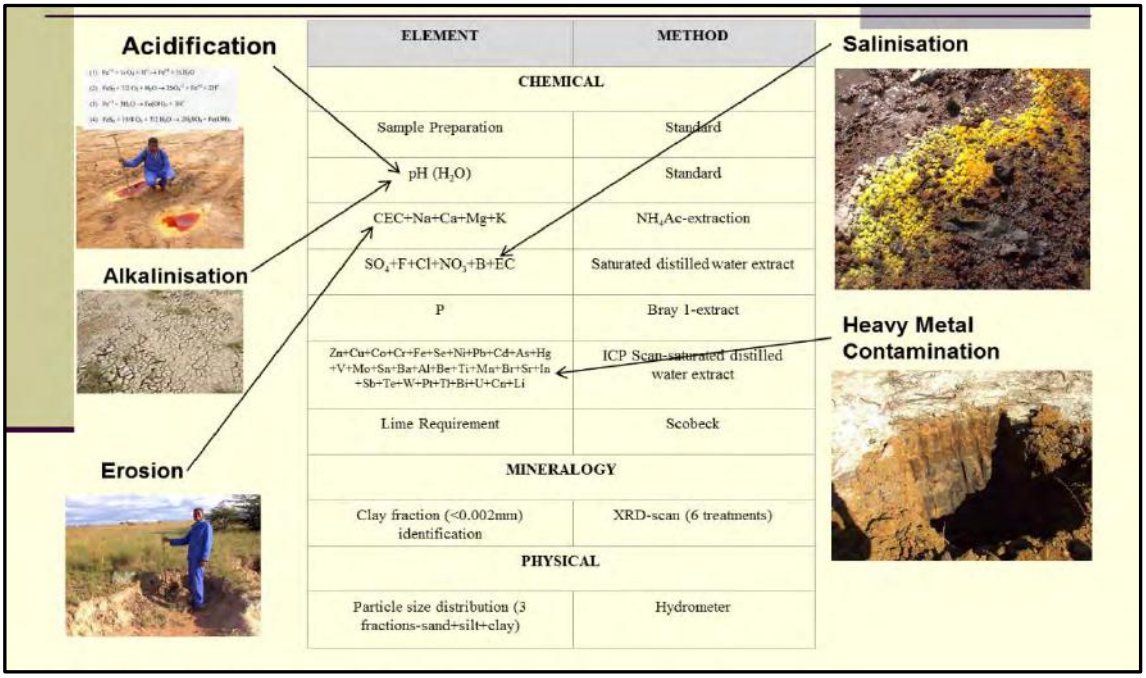
Land capability (***Figure 10***) includes 4,393ha (98,4%) arable and 71,451ha (1,6%) wilderness.

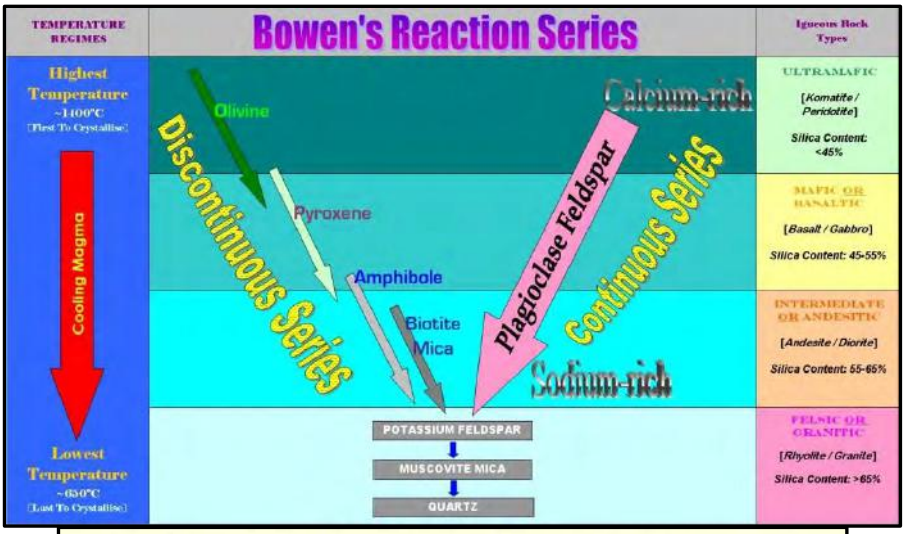
Table 6 summarises the *land capability* (**Figure 10**) as a percentage of the total surface area:

TABLE 6: LAND CAPABILITY

Area	Land Capability	Surface Area (ha)	% of Total
North Dune	Arable	4393,611	98,40
	Wilderness	71,451	1,60
	Total	**4465**	**100**

4.5 Mineralogical, chemical and physical properties of soils





$4CaAlSi_2O_6+O_2+4H_2CO_3+6H_2O=4FeOOH+8H_2SiO_3+4CaCO_3$

(amphibole) (alkaline)

$FeS_2+15O_2+10H_2O=4FeOOH+8H_2SO_4$

(pyrite) (acid)

Figure 11. Potential contamination anomalies in the soil.

Potential contamination in soils include acidification, alkalinisation, dispersion causing erosion, salinisation, heavy metal toxicity, *etc*. and is illustrated in **Figure 11** as a function of the specific method to determine the anomalies. The geology from which the soils originated determines the presence of alkaline and/or acidification anomalies.

The major pollution potential towards the soils in the North Dune area is the presence of Na and hydrolyses thereof causing dispersion of the clay fraction. Dispersion results in soil erosion and should be carefully managed.

The study area has been exposed to farming activities inclusive of ploughing the soils and fertilising it. The implication of ploughing is the intermixing of the Orthic A-Horizon with the Red and Yellow Apedalic Horizons of the Avalon and Bainsvlei soils. If fertilising records existed it would be useful to evaluate if the soil was properly analysed and fertilised and if quality assurance quality control measures were in place in terms of products used and well as the application of the correct amounts.

The optimum pH (1:2,5 solid: water) range for the soil solution range between 5,3 – 7,2. Interpretation of analytical data indicates areas to have pH <5,3. It is anticipated due to agricultural activities and lack of liming ($CaCO_3$). Some samples have pH>7,2 caused by excess Na and hydrolyses thereof - may be due to fertiliser practices and/or weathering from Na – rich geology, *i.e.* albite (sodium-rich feldspar). These anomalies should be taken into consideration during rehabilitation planning. Ca:Mg, Mg:K and Ca+Mg/k imbalances are evident in the soil solution, which can be rectified through Ca or $CaMgCO_3$ & KCl applications during remediation.

There is salinisation in the soil solution as reflected by the high electrical conductivity values saturated water extract (*>250mS/m*) in some areas. This will induce a negative osmotic effect that will prevent plants to absorb plant available water between 33 and 1,500kPa. Under these pH and EC conditions plant-available nitrogen (*15-20mg/kg*), phosphorus (*10-15mg/kg*) and potassium (*>50mg/kg*) are not readily available for plant uptake and sustainable plant growth and need to be rectified during rehabilitation.

Soils have a cation exchange capacity to adsorb cations to neutralise electrical charges on the exchange sites of the clay minerals. The clay minerals are the fraction smaller than 0,002mm and is presented mainly by 1:1 layer silicate, *i.e.* kaolinite. The exchange sites are occupied by Ca, Ma, K, Na and/or heavy metals in solution around the clays (*Stern & Guoy Chapman layers*) and if Na occupies more than 15% of the cation exchange capacity it would result in the dispersion of the clays due to hydration of the Na on the exchange sites causing the double layer around the clays to swell.

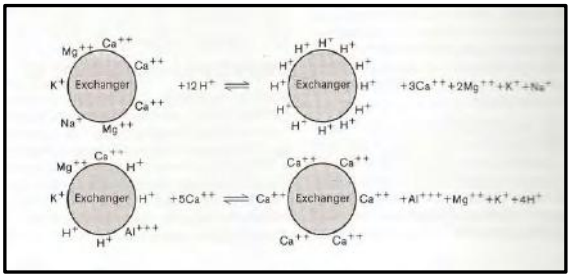


Figure 12. Cation exchange in soils (*Schroeder, 1984*).

The cation exchange capacity (*CEC cmol+/kg 1N NH_4-Ac pH7*) in soils is illustrated in **Figure 12**, showing cations adhering to the clay exchange sites. It can be defined as the ability of the clay particles to adsorb cations on the positively charged surface areas. Sodium (Na) should not occupy more than 15% of the CEC, because this would cause dispersion and erosion.

The *Exchangeable Sodium Percentage* (ESP) (*1N NH4Ac – extract pH7*) of some soil samples exceeds 15% (**Figure 12**). Dispersion of the soil leads to soil erosion and crust formation.

Some areas in the study area are characterised by soil crust formation. The presence of crust reduces water infiltration capacity (*5 – 10mm/h @ bulk density 1,250 – 1,750kg/m^3*) and enhances sediment loss. Consider on 10,000m^2 (*100 x 100m = 1ha*) 300mm deep there is an estimated 3,000m^3 soil (5,250,000kg/soil @ bulk density 1,750kg/m^3) that potentially could be lost through wind and/or water erosion and potentially silt up water systems further downstream. From a catchment perspective, this enhances the area as a pollution source and should be avoided.

Crust formation and soil erosion could be further aggravated by dispersion anomalies where the exchangeable sodium percentage (*1N NH_4Ac – extract @ pH 7*) exceeds 15% of the cation exchange capacity (*1N NH_4Ac – extract @ pH 7*) of the clay fraction (*1:1 layer silicate kaolinite, oxides of Fe and Mn & 2:1 layer silicate vermiculite*). If present this dispersion anomaly would potentially be carried over to the surrounding environment causing contamination of the surrounding soils.

Figure 13. Examples of soil misuse *i.e.* salinisation, heavy metal precipitation (*not taken on site*).

An example of soil misuse is illustrated in **Figure 13**. Mine waste material and illegal dumping of waste did not occur in the investigation area.

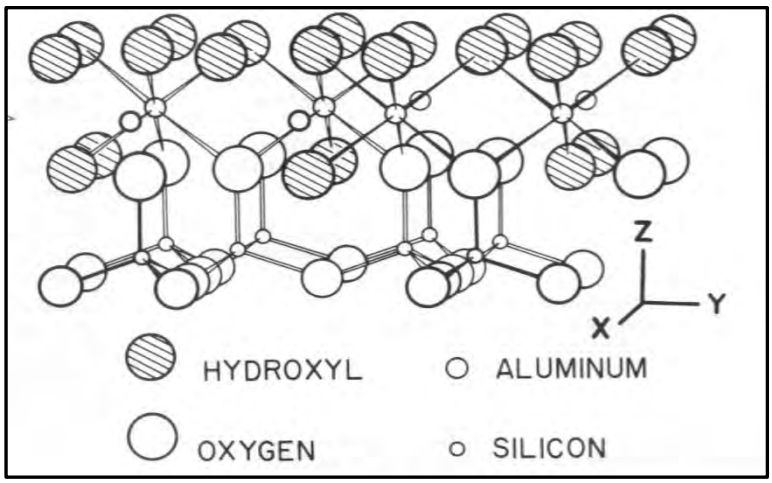


Figure 14. 1:1 Clay mineral (Dixon, 1977).

The *Orthic A*, *Red Apedalic B* and *Yellow Apedalic B - Horizon* is characterised by a low density structure and texture distribution of approximately 65% sand, 20% silt and 15% clay with drainage properties in the order of 10mm/h. The dominant clay mineral in the *Orthic A* and *Red/Yellow Apedalic B – Horizon* is kaolinite (*1:1 layer silicate*), with a low buffer capacity due to the low cation exchange capacity *(<10cmol+/kg*) (**Figure 14**). This is very important to consider during remediation and rehabilitation, because any contamination will have a quick negative effect due to the soil reaching a breakthrough point. Due to the low cation exchange capacity the soil does not have a huge buffer to adsorb potential contaminants without them having a negatife affect. So then minor changes in chemistry have an immediate affect.

4.6 Soil stripping

4.6.1 Available Topsoil

A conservative estimate of available topsoil to be stripped for rehabilitation purposes is summarised in **Table 7**.

TABLE 7: AVAILABLE TOPSOIL FOR REHABILITATION

Soil Type & Average Effective Depth (mm)	Size (ha)	Available Volume (m^3)
Avalon (600)	17	102,000
Bainsvlei (600)	7	42,000
Clovelly (1,200)	17	204,000
Hutton (1,200)	541	6,492,000
TOTAL		**6,840,000m^3 @ Bulk Density of 1,850kg/m^3**

4.6.2 Topsoil stripping and rehabilitation protocol

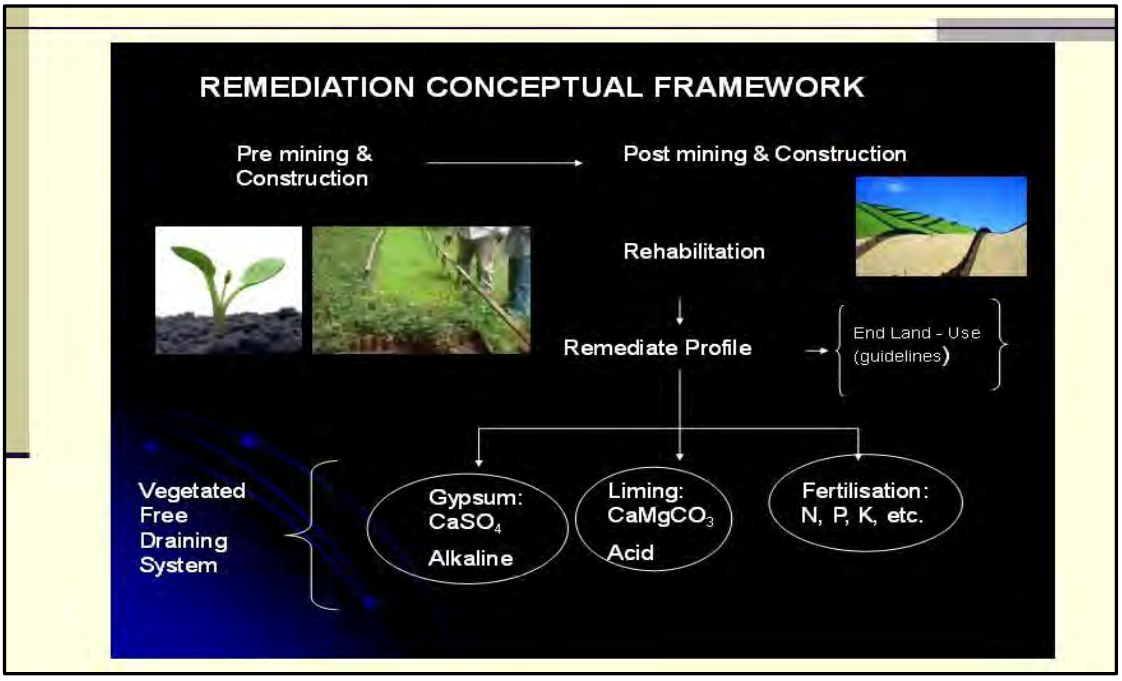


Figure 15. Conceptual rehabilitation protocol.

Figure 15 shows a conceptual rehabilitation protocol with a specific end land use, *i.e.* vegetated free draining system. The End land use is very important to determine in the closure quantum and rehabilitation plan. This will determine how soils will be reconstructed. In terms of topsoil stripping careful consideration should be given to ensure the different soil horizons, Orthic A, Red Apedalic B, Yellow Apedalic B and Soft Plinthic B - Horizons should be stripped and stockpiled separately and not mixed. This is an enormous challenge since traditionally topsoil stripping has been neglected

during mining practices and contractors are mainly calibrated to move cubic meters and not considering differential layers.

It is recommended to strip soil carefully according to horizon differentiation and stockpile accordingly and implement measures to prevent soil loss due to erosion and contamination.

It is proposed to compile an accurate digital terrain map of the area to be mined and use a combination of 35ton excavators and articulated 10t trucks to strip the soil in different layers and stockpile separately. An alternative would be to use 10t dozers to move the different layers and doze in separate rows based on the diagnostic criteria of the different horizons. Whatever option is used the soil layers should not be mixed and should be conducted under supervision.

During rehabilitation, it is aimed to reconstruct the soil profiles as it was before mining. This will make sure that successful rehabilitation to as close as possible to its original state and legally accepted final land use.

End land use targets must be pragmatic and achievable, *i.e.* end land use of 'wilderness' is often the best and easiest responsible option.

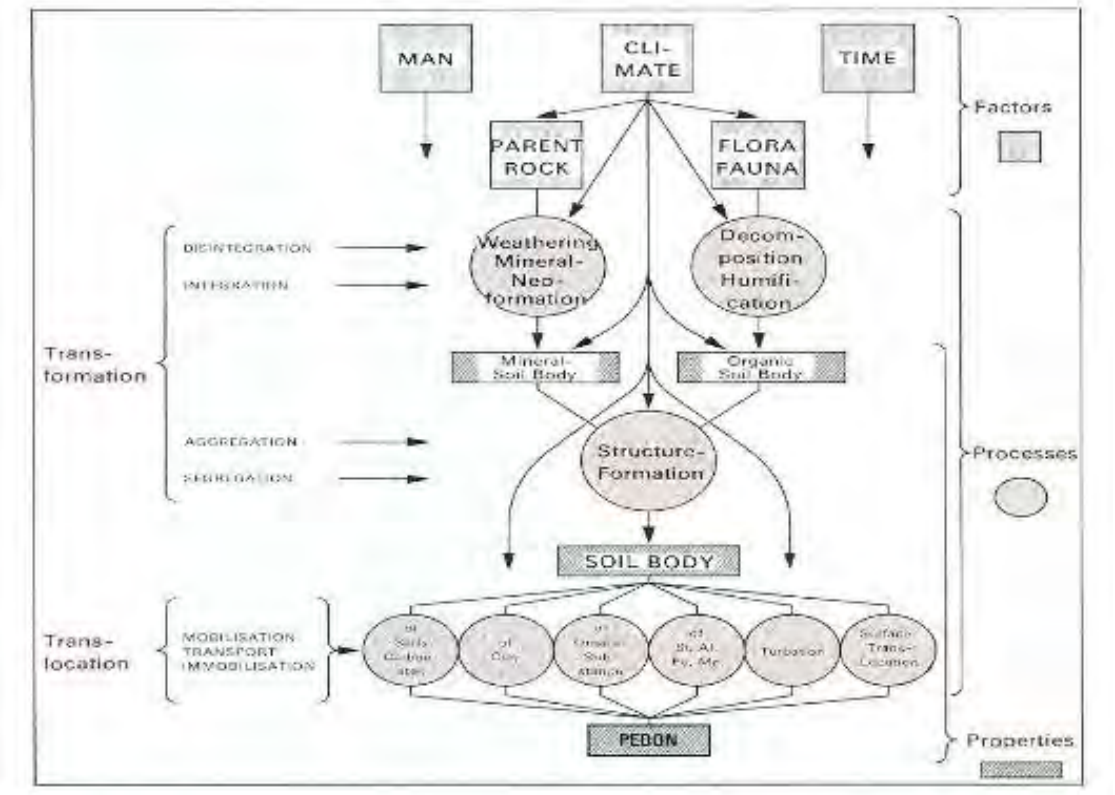


Figure 16 illustrates the processes of transformation (*normal soil-forming processes*) vs. translocation (*reconstruction of soil profile*) during rehabilitation. One of the biggest

mistakes made during mining operations is the lack of topsoil management from the onset of the mining operations.

Usually, topsoil is indiscriminately stripped and stockpiled without taking into account the different diagnostic horizons, which is a guarantee for failure, waste of closure funds, increase in liability for the mine and closure document out of reach.

Following is a section on the topsoil stripping algorithm, to ensure the perseverance of diagnostic criteria for rehabilitation success. It should also be considered to run rehabilitation concurrent with production.

More attention to the health and management of the planet's soils will be needed to meet the challenge of feeding a growing world population while coping with climate change and increased scarcity of natural resources (*FAO Deputy Director-General Maria Helena Semedo, 5 December 2013 World Soil Day*).

"***The importance of soil for food security should be obvious. From the origins of civilization in early farming communities up through today, we can see how societies have prospered thanks to healthy soils and declined when their lands became degraded or infertile***," said Semedo.

Healthy soil is not only the foundation of food production, but serves other functions, *i.e*. soil is critical to the health of ground and surface waters and ecosystem health, and sequesters twice as much carbon as is found in the atmosphere. "Yet until recently, soils were the most overlooked and widely degraded natural resource.

Soil is a finite natural resource. On a human time-scale, it is non-renewable. However, despite the essential role that soil plays for human livelihoods, worldwide there is increasing degradation of soil resources.

Recognizing the importance of soils, the International Union of Soil Sciences (IUSS), in 2002, proposed the 5th of December as World Soil Day. Under the framework of the Global Soil Partnership and with the unanimous support of FAO members, the 37th FAO Conference endorsed 5th December as World Soil Day and requested the UN General Assembly for its final endorsement.

Viljoen Associates is a registered member of the ***Global Soil Partnership*** and part of its mission is **Soil Conservation**. This guideline aims to enable The Longonjo Project to optimise stripping and stockpiling topsoil during mining activities for rehabilitation of disturbed areas to sustainable end land uses and prevent soil losses.

4.6.3 Soil Management

The objectives of soil management are:

- Provide sufficient stable topsoil material for rehabilitation.
- Optimise the recovery of topsoil for rehabilitation.
- Identify soil resources and stripping guidelines.
- Identify surface areas requiring stripping.
- Manage topsoil reserves so as not to degrade the resource.
- Identify stockpile locations and dimensions.
- Identify soil movements for rehabilitation use.

To provide sufficient topsoil material for rehabilitation purposes and to optimise soil recovery, the following aspects are recommended:

1. Stockpiles to be located outside the proposed mine disturbance area(s).
2. Construction of stockpiles by dozers rather than scrapers to minimise structural degradation.
3. Construction with a "rough" surface condition to reduce erosion, improve drainage and promote revegetation.
4. Revegetation of stockpiles with appropriate fertiliser (based on soil analyses) and seed to minimise weed infestation, maintain soil organic content, soil structure and microbial activity and maximise vegetative cover of the stockpile.
5. Disturbance areas to be stripped progressively as required to reduce erosion and sediment generation, to reduce the extent of topsoil and utilise stripped topsoil as soon as possible for rehabilitation.

4.6.4 Basic Volume Calculations

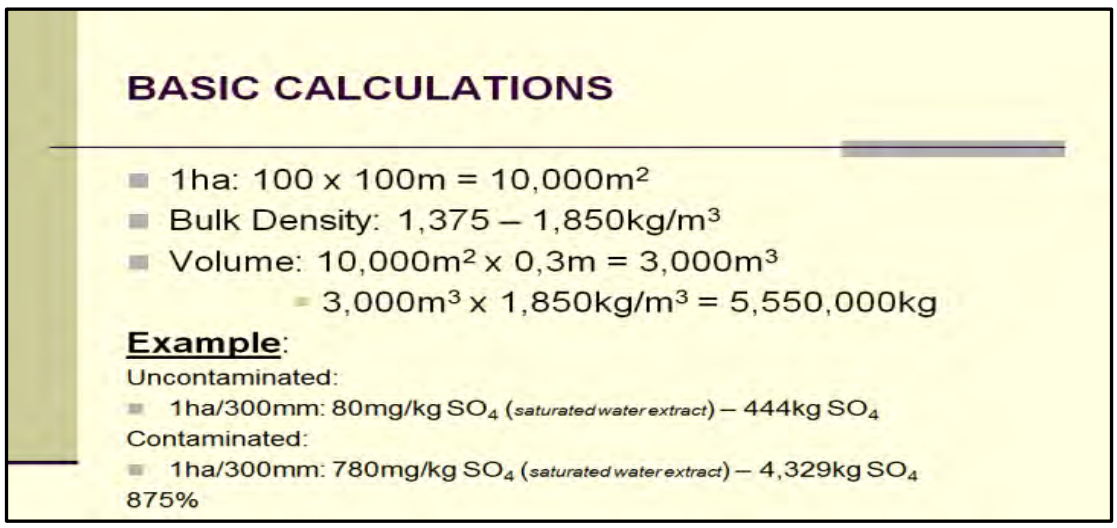


Figure 17. Basic Volume Calculations.

The amount of available topsoil to be stripped before mining operations could be underestimated and should be treated conservatively as an infinite resource. A basic unit of 10,000m^2 300mm deep can potentially yield 3,000m^3 of topsoil at a bulk density ranging between 1,375 – 1,850kg/m^3. An increment of 100mm depth could yield an additional 1,000m^3 or could be lost due to inappropriate stripping practices. There is also a significant cost component to be considered and cost-benefit analyses with time value of money should constantly be conducted. The lack of this would result in very happy and eager earthmoving contractors and unsuccessful rehabilitation.

Considering the above basic volume calculations it is obvious careful consideration should be given during calibration of equipment and people when stripping topsoil. The traditional approach of earthmoving should be avoided.

4.6.5 Importance of clay fraction as diagnostic criteria

Figure 18. Soil types (*Examples from Taxonomical Soil Classification System*, Macvicar, 1991).

The ***South African Taxonomical Soil Classification System*** is comprised of 53 different soil types (Figure 18), each soil type is characterised by a sequence of diagnostic horizons. Soils can be formed *in situ* from underlying geology through natural weathering and/or could be transported and deposited through wet and dry geological periods. The soils will be a function of the mineralogy from which it was derived and will determine its prevailing chemical, physical and mechanical properties.

Consideration should be given to different diagnostic soil horizons of soils when stripping topsoil, *i.e.* certain layers can be stripped and mixed and certain layers should be stockpiled separately. Careful consideration and planning should be given to different soil layers and thickness during topsoil stripping for rehabilitation purposes and should not be dictated solely by civil engineering geotechnical criteria.

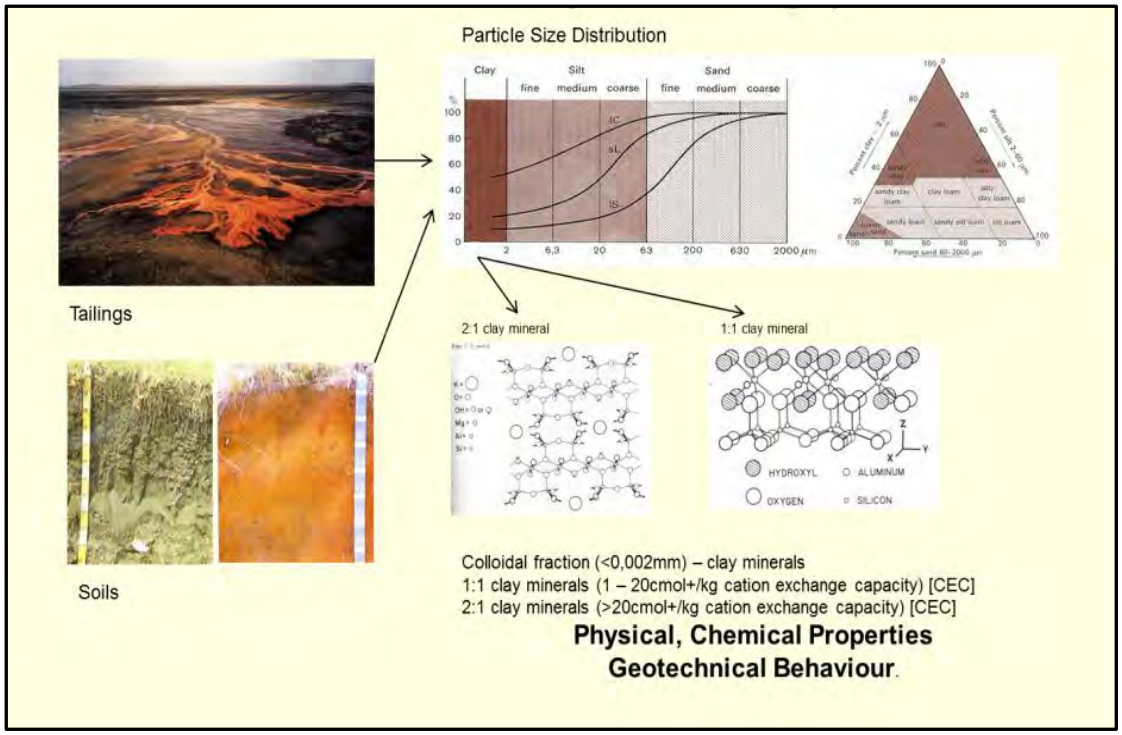


Figure 19. Influence of colloidal fraction in topsoil stripping (Shroeder 1984, Macvicar 1984, Weed 1977).

Clay mineralogy (**Figure 19**) is the primary diagnostic criteria for soil layer identification and selection during topsoil stripping and stockpiling. The colloidal fraction (*particles <0,002mm*) can be divided into 1:1 layer and 2:1 layer silicates and should not be mixed and stockpiled together, as these have marked differences and will define the topsoil management strategy. Organic material, bulk density and seeds are secondary diagnostic criteria for horizon selection to be stripped and stockpiled.

4.6.6 Soil Layers

A review of available soil mapping information should be conducted to determine the distribution of soil types and diagnostic layers before any soil stripping project. A clear distinction should be made of available soil layers to be stripped and stockpiled separately or together. It is recommended to use an experienced soil surveyor with rehabilitation experience.

On completion of identifying soil layers to be stripped and stockpiled a guidance digital terrain map for earthmoving machinery should be compiled. The guidance stripping waypoints should be plotted and placed by a qualified surveyor as per standard survey practices and techniques.

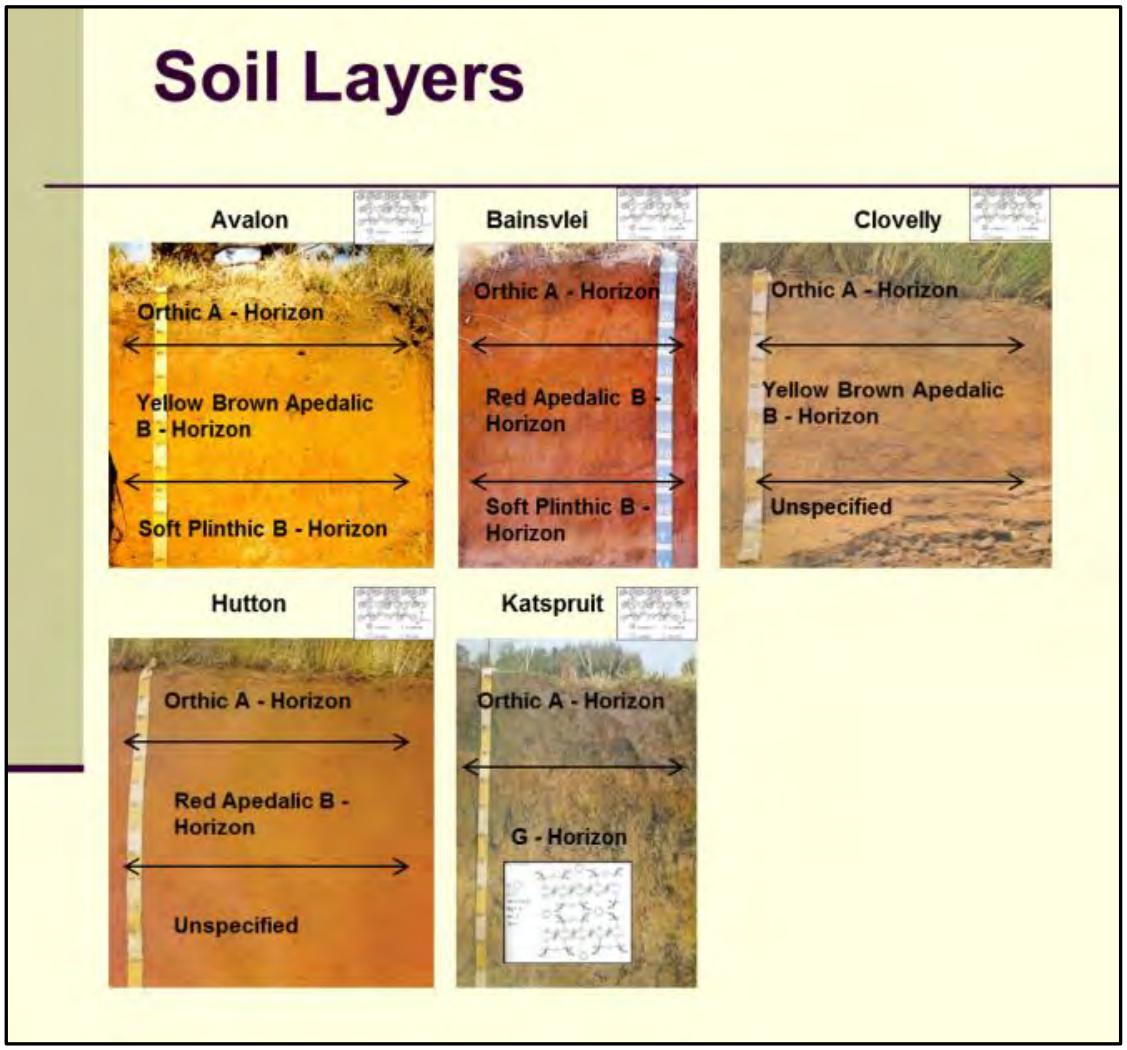


Figure 20. Different soil layers to be stripped (Macvicar, 1991).

The Orthic A – Horizon (**Figure 20**) will in most soils represent the topsoil layer 0-300mm. The topsoil layer should be stripped and stockpiled separately and stripping should not exceed 300mm.

The remainder of the soil layers should be carefully identified and selectively grouped for stripping and stockpiling. For example, the Red, Yellow Apedalic, Stratified Alluvium, Neocutanic B - Horizons and Regional Sand can be stripped and stockpiled together, whereas the Pedocutanic B, Soft Carbonate B, E - Horizon, Red Structured B, Podzol B, G - Horizon, Prismacutanic B, Pedocutanic B, Neocutanic B, Neocarbonate B – horizons should be stripped and stockpiled separately.

Covering vegetation can make the removal of specific topsoil depths difficult and excessive quantities of vegetative matter in long term stockpiles may promote chemical and biological degradation of the seed reserves that are a future source of regeneration during rehabilitation. Before stripping, vegetation should be removed or reduced by grazing and/or clearing as per the Health and Safety Management Plan of the mine.

4.6.7 Field Practice

Before soil stripping activities the site engineer/supervisor must ensure the appropriate clearance approvals have been obtained. Through all stages of topsoil stripping and stockpiling, operations should be closely supervised to determine recovery depths and to identify suitable soils. The designated supervisor will direct and control the recovery, handling and management of the site soils through the following activities:

1. Delineation of areas to be stripped for daily stripping operations.
2. Field truthing of mapped soil types.
3. Delineation of suitable stockpile areas.
4. Ensuring dust generation during topsoil stripping is at acceptable levels.
5. Recording of volumes stored.

Topsoil stockpile locations, volumes and date of soil stripping should be recorded in an electronic database correlating with a digital terrain map of the area.

The means of topsoil placement within storage locations will consider the economic implications of dozer pushing relative to load and truck haul with consideration also given to access constraints, machine availability and ground conditions.

4.6.8 Soil Stripping with excavators and dump trucks

The purpose of this section is to provide a model for the best practice where excavators and dump trucks are to be used to strip soil. The specific type, size or model of equipment is not specified, however, it is recommended to be contractually agreed on as part of the planning conditions of the project. The machines should be of a kind

which will cause minimum compaction whilst being operated efficiently and must be well maintained.

This soil handling method uses back-acting excavators in combination with dump trucks (articulated or rigid). An excavator is used to strip soil and load it into dump trucks for transportation to storage areas. Soil handling can affect the quality of the rehabilitation through soil compaction and smearing, primarily caused by trafficking, the effects of which increases with an increase in soil wetness. The advantage of this guideline, if used properly, will avoid severe deformation of the soil as trafficking is minimised and there should be no need for decompaction during the operation.

The key operational aspects to avoid soil deformation include:

- Minimise compaction.
- Dump trucks must only operate on the basal/non-soil layer and their wheels must not run on the soil layers.
- The excavator should only operate on the topsoil layer.
- Implementation of a bed/strip system avoids the need for trucks to travel on the soil layers.
- Machines are to only work when ground conditions enable their maximum operating efficiency.
- If compaction is caused then measures are required to treat (consult an experienced specialist).

To minimise soil wetness and re-wetting the following aspects are applicable:

- The soil layers should have a moisture content below their lower plastic limit. Moisture content should be addressed by oven drying of samples taken from respective locations and mid/lower points of each horizon.
- The bed/strip provides a basis to regulate exposure of lower soil layers to periods of rain and maintaining soil moisture. The soil profile within the active strip should be stripped to be basal layer before rainfall occurs and before stripping is suspended.
- Measures are required to protect the face of the soil layer from ponding of water, maintain the basal layer in a condition capable of supporting dump trucks.

- Surface water control measures must be in place to protect the in-flow of water, ponding, *etc*. Wet sites should be drained in advance.

The stripping operation entails the following:

- The area to be stripped must be protected from in-flow of water, ponding, *etc*.

- Soil stripping operations should not start until the required soil moisture levels are reached, and should be suspended as soon as water content returns to these levels. Before work commencing a weather forecast should be considered for potential rainfall interruptions. If significant rainfall occurs during operations, the stripping must be suspended, and where the soil profile has been disturbed it should be removed to base level. Stripping should not restart unless the weather forecast is expected to be dry for a sufficient time.

- All machines must be in safe en efficient working condition at all times and only to work when ground conditions enable their maximum operating efficiency with skilled operators. The operation should be suspended before traction becomes a problem or the integrity of the basal layer and haul routes fail.

- The operation must follow a detailed stripping plan showing soil units to be stripped, haul routes and the phasing of vehicle movements. Soil units should be defined on-site, with information to distinguish types, layers, ranges and thickness. Detailed daily records should be kept of operations undertaken with site and soil conditions.

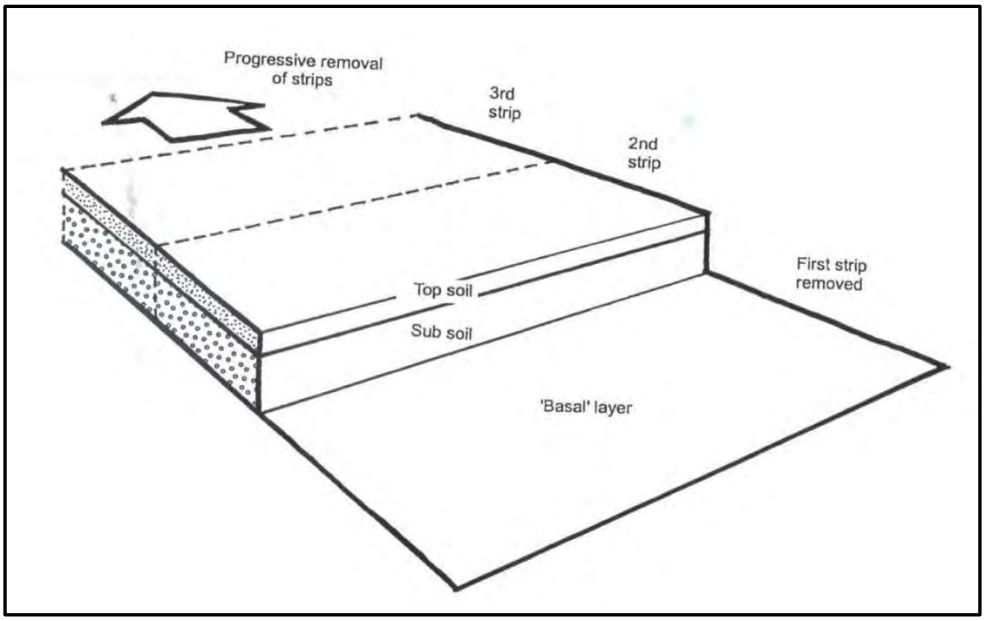


Figure 21. The bed strip system (MAFF, 2000).

- Within each soil unit the layers above the base/formation layer must be stripped in sequential strips with the topsoil layer stripped first, followed by the subsoil layers, each layer stripped to its natural thickness without incorporating material from the lower layers. The next strip is not started until the current strip is completely stripped to the basal layer. This is referred to as the bed strip system (**Figure 21**). If a gradient is present on-site, the main axis of the soil strips should be along the axis of the slope.

- Haul roads and stockpile areas must be defined and stripped first in a similar manner.

- The excavator is only to work on the topsoil layer and dump trucks are only to travel on the basal/formation layer.

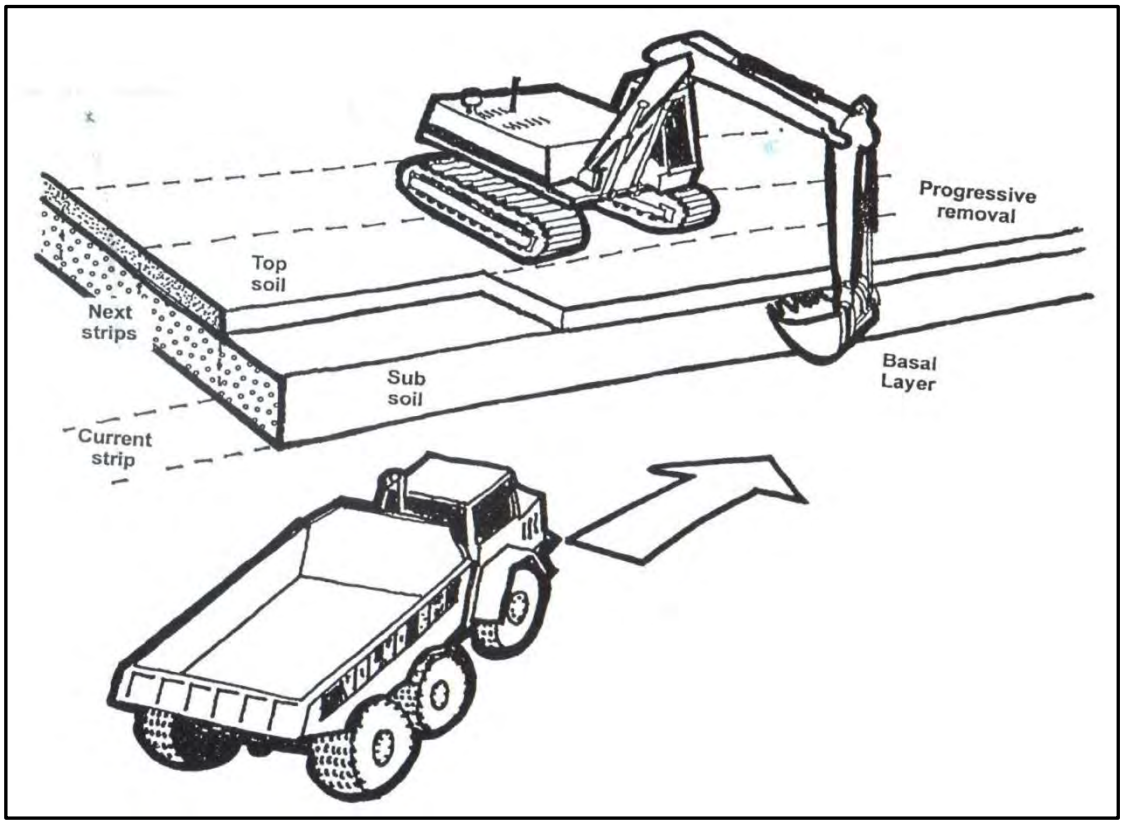


Figure 22. Removal of topsoil from a strip (MAFF, 2000).

- Stripping to be undertaken by the excavator on the surface of the topsoil and digging the topsoil to its maximum depth and loading into dump trucks (**Figure 22**). In general, a bucket with teeth is preferable. The dump trucks draw alongside the exposed soil profile, standing and travelling only on the basal layer.

- The initial strip width and axis should be demarcated. Strip width is determined by the length of the excavator boom less the stand-off to operate, typically 3 –

4m. Effective boom length can also reduce with profile depths greater than 1m, at 1.5m effective reach of the standard boom may result in 2m wide strips.

Topsoil should be recovered to the full width of the strip without contamination with subsoil (not more than 20% of the lower horizon should be exposed at the layer junction within the strip). The thickness and identification of the horizon junction must be verified before and during stripping. The full thickness of topsoil should be stripped progressively along the strip before subsoil horizons are starte.

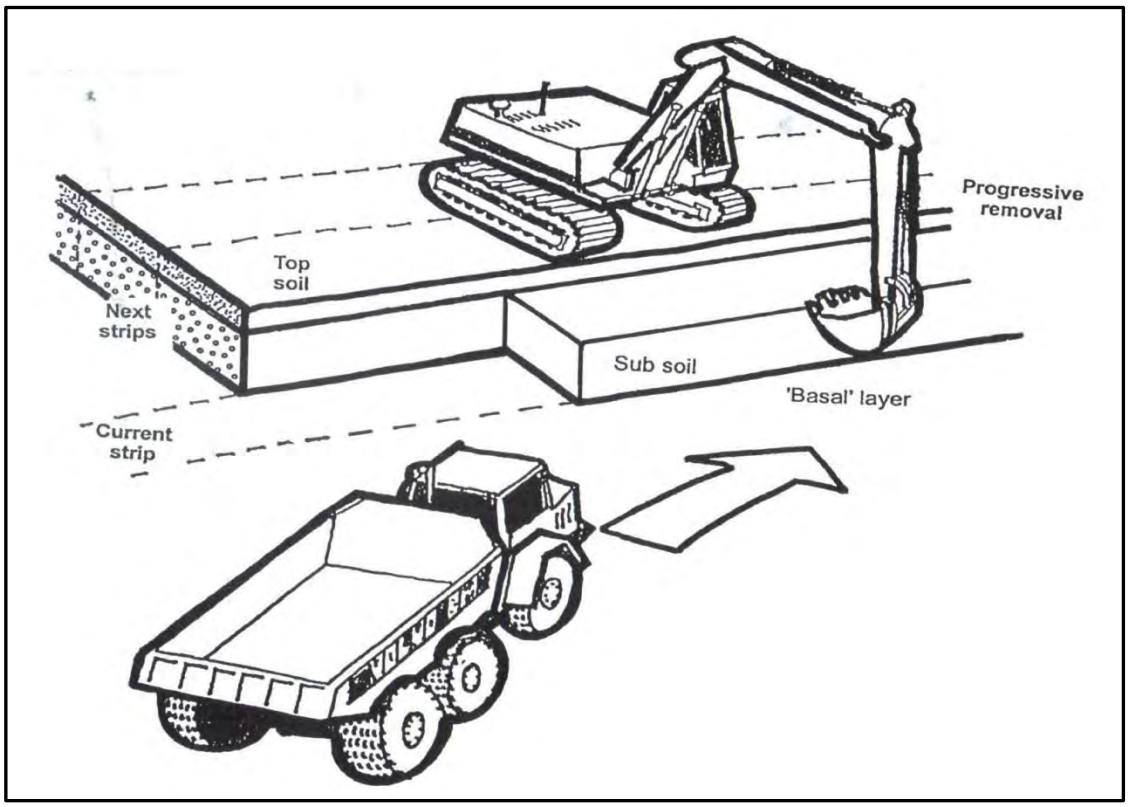


Figure 23. Removal of subsoil from a strip (MAFF, 2000).

- The upper subsoil in the current strip must be stripped and monitored in the same manner (**Figure 23**). The final 25cm of the subsoil layer should be left as a step to protect the adjacent topsoil layer from local collapses. The process must be repeated for the lower subsoil and any other lower layer to be recovered as soil material.

- On completion of the strip, the procedures are repeated sequentially for each subsequent strip until the area is completely stripped.

- Where soils are to be directly replaced without storage in mounds, the initial strip of the upper horizons will have to be stored temporarily to release the

lowest layer and enable the sequential movement of materials. The stored soil would normally be placed on the lower layer removed from the final strip and the end of the programme or on partially completed profiles if rain interrupted the operation.

- Where the stripping operation is likely to be interrupted by rain or there is likely to be over-night rain, remove any exposed subsoil down to the basal layer before suspending operations. Make provisions to protect the base of current or next strip from ponding/runoff by sumps and grips and also clean and level the basal layer. At the start of each day ensure there is no ponding in the current strip or operating areas and the basal layer is to level with no ruts.

4.6.9 Stockpiles

Figure 24. Stockpiling topsoil.

Stripped soil should be stockpiled upslope of areas of disturbance or development to prevent contamination of stockpiled soils by dirty runoff or seepage (**Figure 24**). All stockpiles should also be protected by a bund wall to prevent erosion of stockpiled material and deflect surface water runoff.

Stockpiles can be used as a barrier to screen operational activities. If stockpiles are used as screens, the same preventative measures described above should be implemented to prevent loss or contamination of soil. The stockpiles should not exceed a maximum height of 3 to 6m and it is recommended that the side slopes and surface areas be vegetated to prevent water and wind erosion. If used to screen construction operations, the surface of the stockpile should not be used as a roadway as this will result in excessive soil compaction.

A general protocol for soil handling including handling measures to optimise the retention of soil characteristics (nutrients and micro-organisms) favourable to plant growth include:

- The surface of the completed stockpile must be left with the rough condition to promote water infiltration and minimise erosion prior to vegetation establishment.

- Stockpiles to have a maximum height of 3 – 6m to limit the potential for anaerobic conditions to develop within the soil pile.

- Topsoil stockpiles to have an embankment grade of approximately 1V:4H (to limit the potential for erosion of the outer pile face).

- Stockpiles to be seeded and fertilised.

- Soil rejuvenation practices to be undertaken (if required) before respreading as part of the rehabilitation works.

Strategic and planned stockpiling is a necessary part of civil engineering and mining operations. The storage period for stockpiled soil ranges from a few months to several years. The depth of the stockpile and the length of time it is stored affect the quality of the soil at replacement. Soil takes centuries to develop from parent material and organic matter. Stockpiling and the subsequent reapplication of the topsoil allows for planting conditions that are closer to the pre-disturbance condition than planting on the subsoil layers that remain. Keep in mind the latter is possible, however, require remedial input from a specialist. If stockpiled soil is reapplied quickly, with care to reduce the compaction inherent in the use of mechanical means for stockpiling, production potential remains.

4.6.10 Earth Moving Equipment

Contractors are focussed on moving cubic meters of material as cost-effective as possible to maximise profits and they are used to engineering properties and guidelines dictating material differentiation. They need to be guided and supervised to strip topsoil and subsequent layers and stockpile according to a rehabilitation protocol. Care must be taken not to mix different soil layers and stockpile separately as prescribed.

Figure 25: Dozer, excavator, tipper, grader and front end loader earth moving equipment.

During topsoil stripping typical earth moving equipment (**Figure 25**), *i.e.* dozer, excavator, tipper, grader and front end loader will be used. Consideration should be given to the skill of operators to make sure they get calibrated to the required level of operation. *For example*, if it is required for the dozer operator to strip a soil layer 300mm deep he must make sure to maintain the blade at a constant depth considering the fact the machine weighs over 30t, areas of subsidence might cause uneven scraping, the sensitivity of controls to maintain blade stability, health, skill, experience and state of mind of the operator, *etc*.

Figure 26: Grader ripping compacted soil.

During rainstorms, enough time should be allowed to wait until the site has dried of sufficiently before starting the next shift due to safety considerations and compaction. Considerable losses can occur due to compaction of heavy earthmoving machines over wet areas. Usually, contractors blame a tight schedule and budget constraints and push the agreed project time limits, however, it is recommended to proactively plan and buffer for rainfall events. As an emergency measure graders and/or dozers are often used to rip soil (**Figure 26**) to uplift compaction before stripping.

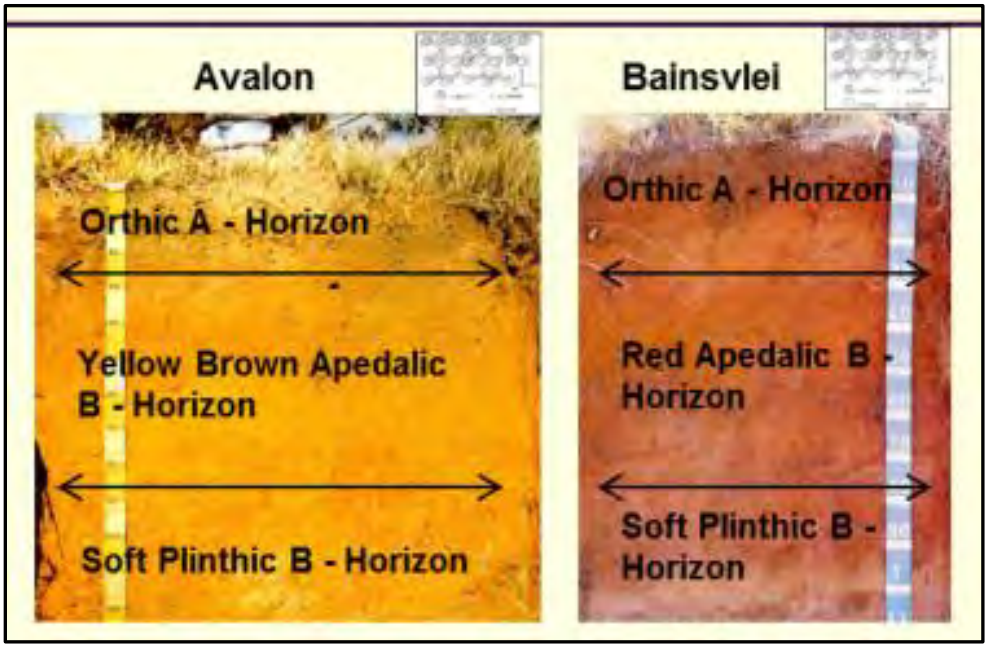


Figure 27: Avalon and Bainsvlei soils with Soft Plinthic B – Horizons (Macvicar 1991, Schroeder 1984).

When topsoil stripping has advanced to a stage where the Orthic A – Horizon and most of the Yellow Brown and Red Apedalic B – Horizons have been removed in case of the Avalon and Bainsvlei soils (**Figure 27**) and ripping (**Figure 26)** extends into the Soft Plinthic B – Horizon loss of removable soil will occur due to intermixing of the apedalic and plinthic layers and should be prevented.

4.6.11 Water Retention

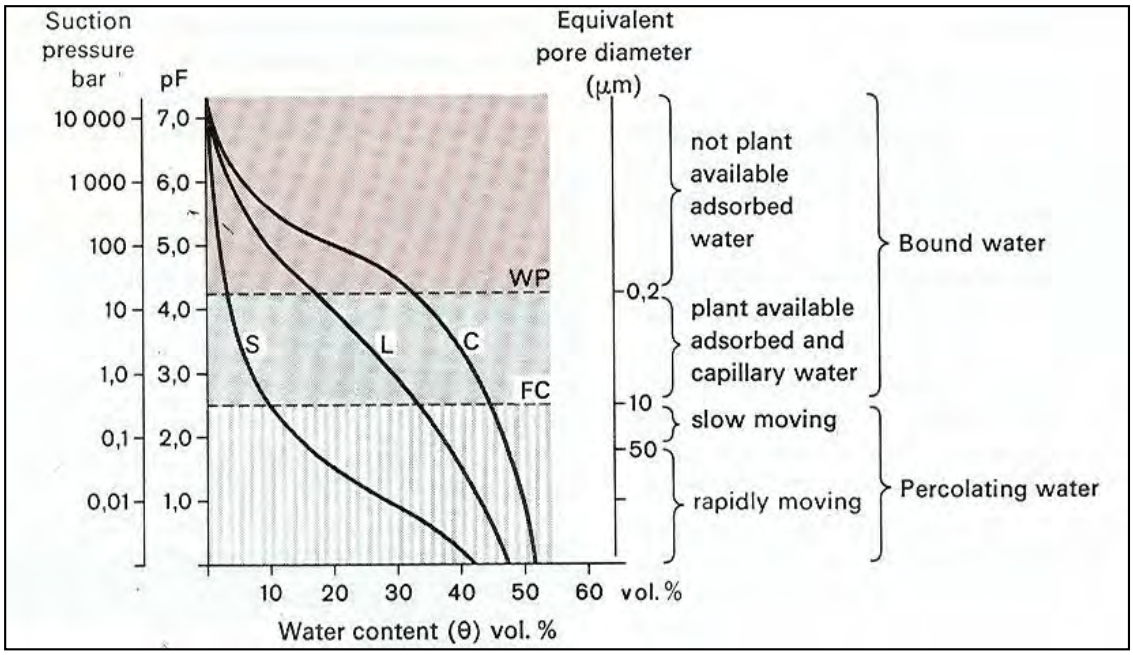


Figure 28. Water retention and plant available water (Schroeder, 1984).

It is essential during the reconstruction of the soil profile during rehabilitation to ensure adequate water retention (**Figure 28**) between 33 and 1,500kPa for enough plant available water to ensure successful end land use criteria.

To achieve this a layer of a certain thickness + sand + silt + clay content needs to be modelled under normal rainfall conditions and 50% rainfall. This has been done with success coupled with correct replacement of diagnostic soil horizons (translocation).

It is proposed to:

- Calibrate and run the Soil Water Balance Model (SWB).
    - SWB is a mechanistic, real-time, generic crop, soil water balance, irrigation scheduling model.
    - It gives a detailed description of the soil-plant-atmosphere continuum, making use of weather, soil and crop databases.
    - SWB uses the thermal time to describe crop development thereby eliminating the need to use different crop factors for different planting dates and regions.

- Evaporation and transpiration are split in SWB, which solves the problem of taking irrigation frequency into account.

- SWB databases will be used to store crop parameters, weather, field, water and soil data.

- The Weather Unit of the SWB calculates the Penman-Monteith grass reference daily evapotranspiration (ETo) using the approach of the Food and Agriculture Organization (FAO) of the United Nations.

- The Soil Unit of the model splits potential evapotranspiration into potential evaporation and potential transpiration by calculating canopy radiant interception from simulated leaf area.

- The multi-layer soil component of the SWB ensures a realistic simulation of the infiltration and crop water uptake processes.

- A cascading soil water balance is used, and canopy interception and surface runoff are calculated after rain or overhead irrigation.

- Many researchers have used the SWB model and obtained decent results.

- There are other soil water balance models that have a strong soil water balance component related to crop yields such as DSSAT, AquaCrop and SapWat, however, SWB is preferred as it was used with success on previous rehabilitation projects.

Cascading principle is when water enters the soil profile, the texture specifically the clay content will ensure retention, i.e. the capillary forces will hold the water molecules together in a specific layer. When the collective weight of the unsaturated and/or saturated layer overrides the collective capillary forces, gravity (g = 9,8m/s) will make the water cascade to the next layer where the next set of capillary forces await the water molecules to hold it until gravity overrides the capillary forces.

The cascading of water does not happen that frequent, *i.e.* it's the buffer and/or safety catch to retain plant available water between 33 and 1,500kPa. This is the factor in a Monte Carlo simulation that has the most significant effect with all the related soil chemical and physical parameters.

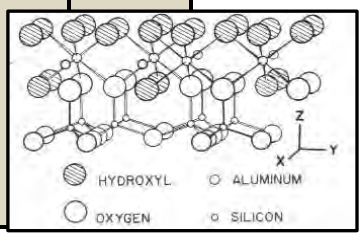
This anomaly is why one sees grass growth post a field fire with no rain in winter – there is enough water in a certain layer that retained plant available water. The principle is also applicable to survival skills to find drinkable water in arid and semi-arid regions.

4.7 Geotechnical Properties of Fill Material

Table 9 summarises the different size classes based on the character of available material and the expected range of movement.

TABLE 9. SITE CLASS DESIGNATION (NHBRC, 1999)

Typical Foundation Material	Character of founding material	Expected range of soil movement (mm)	Site Class
Rock (excluding mud rocks which exhibit swelling to some depth)	Stable	Neglible	R
Fine-grained soils with moderate to very high plasticity (clays, silty clays, clayey silts and sandy clays)	Expansive Soils	<7,5 7,5-15 15-30 >30	H H1 H2 H3
Silty sands, sands, sandy and gravelly soils	Compressible and potentially collapsible soils	<5,0 5,0-10 >10	C C1 C2
Fine-grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravelly soils	Compressible Soil	<10 10 to 20 >20	S S1 S2
Contaminated soils Controlled fill Dolomitic areas Land Fill Marshy areas Mine waste fill Mining subsidence Reclaimed areas Very soft silt/silty clays Uncontrolled fill	Variable	Variable	P



Due to the presence of predominantly 1:1 layer silicates (*particles <0,002mm*) in the different layers of the soils it is anticipated after the cut and fill civil landscaping of the contoured rehabilitated areas from a geotechnical perspective the sites class designation would classify as a H1C1. This site class would be stable for rehabilitation purposes with proper surface water control measures. The site classification needs to be quantified through a geotechnical assessment supported by basic road and foundation indicator analyses.

4.8 Water Control

The main objective of the rehabilitation plan is to ensure the disturbed mining area and associated surface roads and infrastructure areas are vegetated with indigenous grass and shrub species and free draining with minimal erosion, *i.e.* in line with the end land use. It is imperative to implement proper water surface water control measures to cater for at least a 1:100 year rainfall event and rainfall intensities of up to minimum 50 mm/h. It is imperative to ensure the correct engineering design is implemented for the

rehabilitated areas with the required quality assurance quality control mechanisms checked by a professional engineer.

4.9 Soil Remediation Standards

TABLE 10. SOIL REMEDIATION STANDARDS FOR REHABILITATION PURPOSES

ELEMENT	STANDARD
CHEMICAL	
pH (H_2O)	5.3 – 7.2
Cation Exchange Capacity	>5cmol+/kg
Anion Exchange Capacity	>2cmol+/kg
Ca	200-3000
Mg	50-500
K	20-300
Na	ESP<15, SAR<1
EC	<450mS/m
SO_4	<100mg/kg
F	<1mg/kg
Cl	<10mg/kg
NO_3	5mg/kg
B	<1mg/kg
P	5mg/kg
Zn+Cu+Co+Cr+Fe+Se+Ni+Pb+Cd+As+Hg+V+Mo +Sn+Ba+Al+Be+Ti+Mn+Br+Sr+In+Sb+Te+W+Pt+ Tl+Bi+U+Cn+Li	<1mg/kg
Lime Requirement	0t/ha
MINERALOGY	
Clay fraction (<0.002mm) identification	1:1 (kaolinite), 2:1 (smectite, vermiculite) clay minerals
PHYSICAL	
Particle size distribution (3 fractions- sand+silt+clay)	5-30%
Water retention	60-80% moisture content between –40 to –800kPa
Permeability	10-20mm/h @ Bulk Density of 1275kg/m^3

Table 10 specifies the minimum soil requirements to ensure the successful establishment of vegetation during rehabilitation to at least 300 mm, considering intermixing of the different layers will be taking place during cut and fill. Saturated and unsaturated water flow conditions in the soil and/or saprolite soil mix growth medium will determine the plant available water between 33 – 1,500 kPa. It is anticipated plant available water will be in the order of >1,100 kPa, especially on the side slopes (dry

growth regime with little water retention and infiltration capacity >5 – 10 mm/h). It would be crucial to ensure indigenous plant pioneer species adapted to the micro and macro climate is used during re-vegetation.

Reconstruction of the soil profiles should adhere as a minimum to parameters set in **Table 10** in combination with surface water control measures especially the Orthic A – Horizon. These parameters have been compiled and implemented in projects by **Viljoen Associates** and may not be distributed unless agreed to. The rehabilitation process should be supervised by a qualified and experienced Soil Scientist registered by SACNASP.

5 CONCLUSIONS

- The dominant soils in the study area according to the Taxonomical Soil Classification System of South Africa include Avalon, Bainsvlei, Clovelly, Hutton and Mispah soils.

- The effective depth of the Avalon, Bainsvlei, Clovelly and Hutton soils exceed 300mm inclusive of the *Orthic A – Horizons* and *Red Apedalic B – Horizons.*

- The Avalon, Bainsvlei, Clovelly and Hutton soils have high agricultural and rehabilitation potential under dryland and irrigation conditions respectively. The Mispah soil is a shallow weathered soil on rock with low agricultural and rehabilitation potential.

- The current land use includes 2,178ha (48,79%) natural veld, 2,123ha (47,57%) plantations and 162ha (3,64%) ploughed land. Land capability includes 4,393ha (98,4%) arable and 71,451ha (1,6%) wilderness.

- Interpretation of the analytical data indicated potential dispersion anomalies due to exchangeable sodium occupying more than 15% of the cation exchange capacity in case of some samples. This should be carefully managed to prevent soil erosion, crusting and formation of preferential seepage pathways.

- From the different soil types, *i.e.* Avalon, Bainsvlei, Clovelly and Hutton in the 582 orebody there is an estimated 6,840,000m^3 soil at a bulk density of 1,850kg/m^3 available for rehabilitation.

- The Avalon and Bainsvlei soils are characterised by low to neutral pH to alkaline values. There is a lime requirement due to acidity in the soil solution ranging from 2 to 12t/ha/300mm. The disturbed Ca:Mg, Mg:K and Ca+Mg/k ratio's will be rectified through $CaMgCO_3$ applications. There is salinisation in the soil solution as reflected by the high electrical conductivity values (*>250mS/m*), mainly water-soluble SO_4. Under these conditions plant-available

nitrogen (*15-20mg/kg*), phosphorus (*10-15mg/kg*) and potassium (*>50mg/kg*) are not readily available for plant uptake and sustainable plant growth. Heavy metal concentrations are at acceptable low concentrations. The *Orthic A-Horizon* and *Red Apedalic B-Horizon* is typically characterised by a low density structure and texture distribution of approximately 65% sand, 20% silt and 15% clay with drainage properties in order of 10mm/h. The dominant clay mineral is kaolinite (*1:1 layer silicate*), with a low buffer capacity due to the low cation exchange capacity (*<10cmol+/kg*).

- In terms of topsoil stripping careful consideration should be given to ensure the different soil horizons, Orthic A, Red Apedalic B, Yellow Apedalic B and Soft Plinthic B - Horizons should be stripped and stockpiled separately and not mixed.

- Reconstruction of the soil profiles should adhere as a minimum to parameters set in the report in combination with surface water control measures especially the Orthic A – Horizon.

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This investigation was done on available information and subsequent interpretation of data to reveal the properties on site with the techniques described.

M.Sc. Pr. Sci. Nat.

APPENDIX D SURFACE WATER SPECIALIST REPORT

WATER RESOURCES ASSESSMENT TO SUPPORT EXPANSION TO NORTH DUNE

SURFACE WATER COMPONENT

REPORT

(Base Mkurumudzi Dam – under construction)

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23rd June 2020

EXECUTIVE SUMMARY

A. Introduction

Base Titanium ("Base") wants to expand its mining operations to the North Dune and wants to know whether an additional 8,000 m^3/day can be obtained from surface and/or groundwater resources. This report focuses on the analysis of surface water resources.

Base has developed a dam on the Mkurumudzi river with a capacity of 8.8 MCM dam. Base has an existing surface water abstraction permit of 22,000m^3/day from the dam, and an additional permit for 13,000 m^3/day to cover abstraction of runoff from the tailings settlement facility (TSF). Actual abstraction from the dam varies but has been increasing over the years from 12,754 m^3/day in 2016 to an average of 18,257 m^3/day in 2019.

The coarse tailings were being placed in such a way as to develop the TSF walls. Since 2019 the coarse tailings are placed in the excavated part of the central dune. This has resulted in an estimated 7,000 m^3/day of drainage flow back to the dam which essentially reduces the net abstraction from the dam. However this seepage is likely to redeuce or case once mining moves to the North Dune. .

In principle, the catchments of interest are the Mkurumudzi, Ramisi, Mwachema and possibly the Pemba. As the Mkurumudzi transects the Special Mining Lease and Base already have a dam and infrastructure on the Mkurumudzi, and the water quality is acceptable for mining use, the approach adopted has been to evaluate whether the Mkurumudzi has sufficient resource to meet the additional demand and only to look further afield if there is insufficient resource on the Mkurumudzi river.

B. Water Allocation in Kenya

The water allocation framework in Kenya is governed by the Water Act 2016, Water Resource Management Regulations (2007 and 2019 revised Draft), and the Water Allocation Guidelines (2010 and 2019 revised Draft). The framework essentially apportions water for specific uses. Water for commercial use such as mining operations is allocated from "flood flows". The flood flow is defined as the portion of flow above the Q80 threshold (Q80 is the flow that is exceeded 80% of the time). This implies that the allocable flood flow needs to be established for the catchment as a whole (Area 205 km^2) and at the point of abstraction, namely the dam site (catchment area 126.2 km^2). WRA has adopted a method using the flow duration curve to establish the allocable flood volume.

C. Hydrological Analysis

The hydrological analysis has relied heavily on the observed water level data at 3KD06 (catchment area 86.2 km^2) on the Mkurumudzi river. Previous studies have established different rating curves for this station with the latest being Wara et al. 2019 that uses a HEC-RAS model to simulate flows through the control weir, the bridge immediately downstream of the weir and along the channel flow for approximately 200m downstream to handle the complex flow conditions during low and high flows. The HECRAS rating curve produces conservative discharge values in comparison to the previous rating

curves. This rating curve was used to develop a discharge time-series and flow duration curves. Comparison of the flow duration curves for 1959 to 1988 and 2003 to 2019 indicated a significant shift in hydrology with higher peak flows and lower dry season flows. This change can be a function of land use and climate changes. Consequently, the discharge for the period 2003 to 2019 was adopted as it better reflects current conditions.

The hydrological analysis, using the FDC approach adopted by WRA, establishes an allocable flood flow of 241,487 m^3/day or 70.51 MCM/yr for the catchment and 43.41 MCM/yr for the dam site.

D. Water Permits and Water Abstraction

Data on seven existing surface water permits on the Mkurumudzi catchment were obtained from WRA. These indicate a total allocation of 117,000 m^3/day from flood flow. This is converted to 32.92 MCM/yr assuming that mining operations require water every day and abstraction for open field irrigation will only be done on non-rain days (defined as rainfall less than 5mm/day) or 292 days in a year.

The most recent abstraction survey conducted in 2013 indicated a total daily abstraction of 506 m^3/day of which 91% was made up of two domestic water supplies, implying that this abstraction, albeit not supported by permits, is from the normal flow and does not need to be considered in the flood water allocation balance.

E. Water Allocation Balance

The water allocation balance is the portion of the allocable flood flow that has yet to be allocated on the permit. It is a tool that WRA uses to evaluate a new water permit application.

The water allocation balance indicates a positive balance for both the catchment as a whole and the dam site, even when the additional 8,000m^3/day from flood flow is considered.

	Catchment		**Dam Site**	
Item	**m^3/day**	**MCM/yr**	**m^3/day**	**MCM/yr**
Allocable Flood Water	241,487	70.51	148,664	43.41
Water Allocated	117,000	32.92	22,000	8.03
Balance	**124,487**	**37.59**	**126,664**	**35.38**
New Allocation	8,000	2.92	8,000	2.92
Net Balance	**116,487**	**34.67**	**118,664**	**32.46**

Probability analysis of flood volumes indicates that the annual flood volumes would exceed the combined allocation at the dam site (10.95 MCM/yr), including the additional 8,000 m^3/day, in 60% of the years.

F. Reservoir Analysis

The allocation of a water permit does not guarantee the user the availability of the water resource due to seasonal and annual variations. A reservoir yield analysis is typically undertaken to determine the probability associated with a range of yields. For this analysis, an in-house daily reservoir water balance model (RESSIM) has been set up to explore reservoir yields under different demand scenarios.

The simulation period 15/03/2003 to 02/12/2019 was used. Inflow to the reservoir is calculated from the 3KD06 RGS record and rainfall from Shimba Hills. Environmental release (Q95) of 2,333 m^3/day plus an allowance for domestic use (2,506 m^3/day) bringing the total release equivalent to the Q80 of 4,839 m^3/day. This is marginally lower than the actual release which averages 5,150 m^3/day. As the historical abstraction has been changing it is difficult to calibrate the model over a long period. However, the observed and simulated dam water levels compare favourably over the 2016-2017 drought for the simulated abstraction of 12,000 m^3/day when actual average abstraction ranged from 12,700 (2016) to 12,200 m^3/day (2017).

Five demand scenarios were established to reflect a range of demand conditions from 12,000 to 30,000 m^3/day. The results for the S_30 simulation show that the full demand of 30,000 m^3/day can be met 75% of the time over the 17-year simulation. If the abstraction is rationed (Scenario S_30R) from 30,000 m^3/day when water levels have dropped then the likelihood of meeting a demand equal to or greater than 15,000 m^3/day goes from 76% to 85%.

The scenarios S30 and S30R were investigated to see the nature of the supply deficit and whether this deficit can be made up of existing or proposed groundwater abstraction. The results indicate that 75% of the time the supply deficit is less than 10,000 m^3/day, which is within the range of the groundwater availability implying that conjunctive use can significantly imporve the reliability of supply.

G. Hydrological Analysis of Other Catchments

From the preceding analysis on the Mkurumudzi, it would appear that there is reasonable justification to state that the Mkurumudzi has sufficient flood water resources to support a permit application for an additional 8,000 m^3/day. It would, therefore, follow that an analysis of the other catchments is not required at this time.

H. Conclusions

- Comparison of flow between 1959-1987 and 2003 – 2019 indicates that the flow pattern in the more recent period has lower low flows and high flood peaks, but is otherwise lower than for the earlier period. The 2003 – 2019 period has therefore been adopted for the analysis as it is considered a better reflection of current hydrological and climatic conditions, and is more conservative.
- The 7,000 m^3/day drainage from the central dune back to the dam does not affect the hydrological analysis of inflow to the dam as this is based on flows at 3KD06 which is above the dam site.
- The WRA adopted method to calculate the allocable floodwater volume, using the flow duration curve, estimates an annual floodwater volume of 70.51 MCM/yr for the catchment

(equivalent to 241,487 m^3/day). The total existing allocation on the Mkurumudzi catchment is 117,000 m^3/day. This has been converted to an estimated 32.92 MCM/yr. Therefore the catchment water allocation balance is positive and can support an additional allocation of 8,000m^3/day or 2.92MCM/yr;

- The allocable flood volume at the Base Dam Site is estimated at 43.41MCM/yr. Total allocation at the Base Dam Site was 22,000m^3/day or 8.03 MCM/yr which would increase to 10.95MCM/yr with the proposed additional allocation. The water allocation balance at the Base Dam Site is positive and can support an additional allocation of 8,000 m^3/day;
- The RFL reservoir simulation program RESSIM was established to evaluate the yield reliability given different demand scenarios, given an environmental flow release of 2,333 m^3/day (0.027m^3/s) and a domestic demand allocation demand of 2,506 m^3/day. A 22,000m^3/day demand for Base can be met 88% of the time. A demand of 30,000 m^3/day can be met with a 75% reliability, based on reservoir simulation for the period 2003 to 2019.
- The reservoir yield analysis has used prevailing requirements for the dam releases for domestic and environmental flows. This analysis has not reviewed the environmental water releases per se but the reservoir yield analysis does not indicate any change is required to existing arrangements.
- The existing statutory requirement for environmental flows from the Base Dam is a minimum of the Q95 flow which Base exceeds. The Draft Water Allocation Guidelines 2019 proposes that a detailed environmental flow regime is developed in the case of regulated rivers, such as the Mkurumudzi. However, this is yet to be adopted by WRA.
- The 7,000 m^3/day drainage from the central dune means that the net abstraction from the dam is essentially 7,000 m^3/day less than the actual abstraction. The analysis has provided for a range of abstraction from 15,000 m^3/day to 30,000 m^3/day.
- The hydrological analysis of the other catchments (Ramisi, Mwachema, Pemba) is not required at this time as it appears that the Mkurumudzi can support the additional permitted abstraction.

I. Recommendations

- The hydrological analysis is heavily dependent on the observed water levels at 3KD06. This study recommends that Base continues to support the record-keeping at this station, given its importance for decision making;
- While Base is releasing environmental flows from the dam, there is no guarantee that these flows reach the lower part of the catchment. It is in Base's interest to see that flows are properly recorded downstream for which WRA has adopted a river gauging station established by the UpGro project at the KISCOL weir.
- The surface water allocation balance indicates that there is sufficient flood water to support an additional 8,000m^3/day allocation with sufficient safeguards for environmental flow releases and domestic users. However, given the variability in rainfall and surface flows, the additional allocation does not guarantee Base Titanium that it can extract an additional 8,000m^3/day on top of its existing allocation of 22,000m^3/day with 100% reliability. The reservoir simulation indicates that demand for 30,000m^3/day can only be met 75% of the time. This implies that Base Titanium will need to use additional sources (e.g. groundwater) when the surface water cannot meet full demand;

- It is therefore recommended that Base has sufficient capacity and permitted allocation to make up the water supply deficit from groundwater as and when surface water resources are insufficient;
- Base should adopt operating rules for the dam to keep the supply deficit within the range that can be met by permitted groundwater abstraction;
- We recommend the preparation of a Hydrological Assessment Report to support an application for a permit amendment for an additional 8,000 m^3/day from the dam;
- The WRUA should be carefully sensitised on the findings of the hydrological analysis and water allocation balance, with emphasis on the fact that it is flood water that will be utilised and that the environmental flow releases will remain unchanged;
- Apply to WRA for a permit amendment for an additional 8,000 m^3/day from the dam;
- If WRA is concerned about an additional allocation of 8,000 m^3/day, Base could investigate provisions to capture and recycle the 7,000 m^3/day drainage from the central dune in a similar arrangement to the drainage from the TSF.

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ABBREVIATIONS

BWRC	Basin Water Resources Committee
CG	County Government
CMS	Catchment Management Strategy
E-flows	Environmental Flows
EFMP	Environmental Flows Management Plan
HAR	Hydrological Assessment Report
MSP	Mineral Separation Plant
RFL	Rural Focus Ltd
KWSCRP	Kenya Water Security and Climate Resilience Project
NWMP	National Water Master Plan
MWIS	Ministry of Water, Irrigation and Sanitation
RFL	Rural Focus Ltd
RGS	River Gauging Station
TSF	Tailings Settlement Facility
WAP	Water Allocation Plan
WCP	Wet Concentrator Plant
WRA	Water Resources Authority
WRUA	Water Resource User Association

1. INTRODUCTION

1.1 Background

Base Titanium Ltd ("Base") currently operates an open cast mine in a titanium-bearing mineral sand deposit in Maumba and Nguluku areas of Msambweni Sub-County, Kwale County and has currently been working the south and central dunes. Base is evaluating the option of expanding mining operations to the North Dune after completion of mining of the South Dune. This may require more water to a maximum of a further 8,000m^3/day. Base contracted Rural Focus (RFL) on 6th May 2020 to investigate the surface and groundwater resources to establish the potential to meet the additional water demand.

1.2 Scope of Work

This proposal builds on and responds to the 'Outline Scope of Works' presented in Appendix A. This evolved out of a two-hour meeting held between Nick Okello (of Base), Mike Everett (of ERM) and Mike Lane (of Rural Focus Ltd) on 26 February 2020 at Galu.

The key elements of this water resources assessment study (WRAS) are the following:

- Surface water resources – distribution, sustainability and seasonality.
- Groundwater resources – distribution, sustainability and seasonality.
- Existing Water Permits by water source type; and their temporal and geographic distribution.
- Describing water resources development options, together with approximate costs and pros and cons (including permit implications, projected timelines and further data/information needs.)

1.3 Comments on the Covid-19 Travel Restrictions

The assignment is being undertaken at a time when the Government of Kenya has issued travel restrictions to minimise the spread of the Coronavirus as response to the Covid-19 pandemic. The restrictions include a cordon that prevents movement into or out of Kwale County. This has impeded the ability of the RFL team to conduct fieldwork for this assignment. Consequently, the analysis has been based on existing documents and published material, existing data and knowledge of the area based on previous observations and fieldwork.

For the surface water component, this has meant that the analysis has focused heavily on the Mkurumudzi River for which there is streamflow data with limited analysis of the other catchments of the Mwachema and Ramisi which lack streamflow data.

2. BACKGROUND

2.1 Base Titanium

Base Titanium excavated a titanium-bearing mineral sand deposit in Maumba and Nguluku areas in Msambweni Sub-County, Kwale County. Minerals are extracted and separated from the Pliocene Magarini sands in a Wet Concentrator Plant (WCP). The heavy mineral concentrate is further refined into Ilmenite, Rutile and Zircon in a Mineral Separation Plant (MSP). The water demand for the WCP and MSP is approximately 22,000 m^3/d.

Base Titanium constructed an 8.8 Mm^3 dam to supply water to the processing plant. The dam has a valid water permit issued by WRA (WRMA/30/MSA/3K/10084/S) for an abstraction amount of 22,000m^3/d. Base also exploits about 9,500 m^3/day from groundwater.

Wastewater is captured in the tailings dam and approximately 43,500 m^3/day is recycled into the processing plant. Water that is not recycled is expected to evaporate and seep into the soil matrix through lateral and vertical leakage as well as entrapment within the slimes and sand tailings emanating from the mineral extraction process. Part of the water recycled from the tailings dam includes rainfall that is captured in the tailings dam. Base Titanium has a water permit (WRMA/30/MSA/3K/12042/S) to support the abstraction of the rainwater captured within the tailings dam for 13,000 m^3/d. However, the amount of rainwater captured is a function of rainfall, rather than water demand.

From the excavation area, there is approximately 7,000 m^3/day that drains back into the dam. This water derives from rainfall over the excavation area and drainage from the course tailings (sand) that are dumped back into the excavation area. Previously the course tailings were dumped on the TSF wall and it is only since the TSF wall was complete that the coarse tailings are dumped in the excavation area. Consequently, this return drainage flow is essentially a recent feature over the last 12 months. This drainage does not affect the hydrological analysis which is based on observed stream records at 3KD06 above the dam site. However, the return drainage effectively changes the net abstraction from the dam. Where Base was effectively abstracting 22,000m^3/day from the dam, with the return flow, this is reduced making the net abstraction closer to 15,000 m^3/day.

(Source: Base)

Figure 2-1: General Layout of Base Mine Site and Water Flows

2.1.1 Previous Surface Water studies and activities within Study Area

Key reports and technical papers are listed in the References, as necessary to support the text; key roles or activities we have participated in within or near the study area are summarised below.

- 2012. Surface Water Monitoring on Teba and Kidongweni Sub-Catchments
- 2013. Low Flow Study of the Mkurumudzi River, Kwale County: Low Flow Report
- 2013. Low Flow Study of the Mkurumudzi River, Kwale County: Reserve Flow Report.
- 2014. High Flow Measurements at Mkurumudzi River Gauging Station 3KD06. May 2016.
- 2013-19: Unlocking the Potential of Groundwater for the Poor (UPGro, 2013-15); and Groundwater Risk Management for Growth and Development (Gro for GooD, 2015-19). A seven-year international research programme jointly funded by UK's Department for International Development (DFID), Natural Environment Research Council (NERC) and the Economic and Social Research Council (ESRC) focused on improving the evidence base around groundwater availability and management in Sub-Saharan Africa. Projects were interdisciplinary, linking the social and natural sciences to address this challenge. Major areas of interest/relevance; groundwater modelling and groundwater use sustainability.

2.2 Surface Water Basins

The Maps in Appendix F indicate that Base Titanium lies within sub-basin 3K which includes the Mkurumudzi, Ramisi, Umba and Tiwi rivers. To the north is the sub-basin 3MC which is the Pemba River. To the North and West are the basins 3MA and 3MD2 which form the Mwache basin.

3. WATER RESOURCE ALLOCATION

The task of water allocation is mandated to the Water Resources Authority (WRA) through Section 12 of the Water Act 2016. WRA uses a system of water use permits to reflect the water allocation decisions. Water use permits, detailing quantities, timing and other conditions are issued to specific water users for specified purposes.

The water allocation framework was set out in the Water Allocation Guidelines (WRMA, 2010). These were subsequently reviewed in 2019 from which the Draft Water Allocation Guidelines (WRA, 2019) were developed (Yet to be officially adopted).

3.1 Water Apportionment

Water apportionment follows provisions and priorities in the Water Act 2016, the Water Resource Management Rules (2007), and the Draft Water Resource Management Rules (2019). The water resource availability is apportioned to different uses, as follows:

1. **The Reserve**. This is the portion of the water resource set aside to meet ecological demands (environmental flows) and basic human needs (BHNs), which is defined as 25 l/p/day in the WRM Rules 2007. For surface water, the WRM Rules (2007) specify that the Reserve will be computed as the flow that is exceeded 95% of the time or Q95, based on naturalised daily flow records. The Draft Water Allocation Guidelines (2019) retains this arrangement for unregulated rivers but indicates that in addition, a portion of flood flows should not be allocated as flood flows are important for river ecology. The threshold suggested is of flows greater than Q50. However, for regulated rivers, such as the Mkurumudzi below the Base Dam the Guidelines require a more detailed evaluation of environmental flow requirements, using the building block method (Ritcher et al, 1996, 1997, Tharme 2003);
2. **Allocable Yield**. The natural yield minus the Reserve is the allocable yield which can be allocated to users through the system of permits;
3. **Domestic Use**. A portion of the allocable yield is set aside to meet domestic demand. Domestic use commands a higher priority than other water uses as defined in the Water Act 2016. For surface water, the Normal Flow is the term used to describe the water that is apportioned for domestic use. The Normal Flow is defined within the WRM Rules (2007) as the flow that is exceeded 80% of the time (Q80);
4. **Inter-basin Transfer**. A portion of the allocable yield may be defined to meet existing or future strategic commitments for inter-basin water transfers and international treaties. This portion is informed by water balance studies at the national level (e.g. NWMP2030) or regional level and involves the redistribution of the water resources to meet strategic priorities and international commitments. A review of the Kwale Water Master Plan (2018) indicates that there is no expectation at present for inter-basin transfer from the Mkurumudzi to meet water demands outside of the sub-catchment;
5. **Commercial Use**. The remaining portion of the allocable yield is available for commercial uses. The Water Act 2016 does not prioritise between different types of commercial use i.e.

between agricultural or industrial use. For surface water, this portion of the water resource is referred to as Flood Flow and is the flow above the Q80 value.

This structure of apportionment means that any evaluation of the allocable yield from surface water sources must initially establish the Q80.

3.2 Water Balance

The Water Allocation Guidelines (2019) identify different water balances that are relevant to the water allocation process, namely:

1. Water Demand Balance. This balance evaluates the water demand for different sectors (environment, domestic, livestock, commercial) against the water resource availability as apportioned by the methods identified in the Guidelines. This is essentially a water resource planning tool and is undertaken at a sub-basin level by WRA to determine whether a particular sub-basin has sufficient water resources to meet current and future demands. It helps to direct the nature and scale of infrastructure required to be able to utilise the water resources. The Draft Athi Basin Plan 2020 (WRA 2020) indicates a total demand for sub-basin 3KA of 25.5 MCM/yr (2018), rising to 34.9 MCM/yr in 2040. Natural yield (surface and groundwater) is 265 MCM/yr making a current positive water demand balance of 238 MCM/yr or 90% of natural yield. This implies that the natural resources are sufficient to meet demand, as evaluated at a sub-basin scale;
2. Water Allocation Balance. This balance evaluates the extent to which the allocable water resource availability has been allocated to users through existing permits;
3. Water Abstraction Balance. This balance evaluates the extent to which allocable water resource availability is being abstracted, regardless of whether it is supported by permits. This requires measured abstraction data. This balance helps to explain why perennial rivers run dry in the dry season despite the apparent positive water allocation balance, a common phenomenon in parts of Kenya.

Of particular interest to this study is the water allocation balance as this will inform Base and WRA regarding resource availability for further allocation.

3.3 Surface water permit application processes

The process of obtaining a surface water permit involves an application to WRA which comprises of a form, payment of a fee and a Hydrological Assessment Report (HAR) which sets out the hydrological evaluation of the water resource to establish whether the resource is sufficient to support the permit application. The WRM Rules (2007) require that the HAR is prepared by a MWIS registered hydrologist.

The WRM Rules (2007) specify that a HAR will include:

1. Name and details of Applicant
2. Location and Description of Proposed Activity;

3. Details of Climate;
4. Details of river or water body (name, nearest Regular Gauging Station, Sub-catchment);
5. Details of catchment (area, slopes, soils);
6. Details of vegetation and land use;
7. Details of Registered and Non registered Abstraction on the resource;
8. Details of all other permits related to this application;
9. Hydrological characteristics and analysis (annual, monthly, extreme events, flow duration or probability of events occurring);
10. Hydrochemistry;
11. Analysis of the Reserve;
12. Assessment of availability of flow;
13. Impact of proposed activity on flow regime, water quality, other abstractors;
14. Recommendations on Proposed Activity;

This report is seen as a precursor to the HAR to establish whether there is sufficient resource within the Mkurumudzi catchment to support an additional abstraction of up to 8,000 m^3/day.

3.4 Criteria for WRA to Evaluate Surface Water Permit Application

The Water Allocation Guidelines (2010) and the Draft Water Allocation Guidelines (2019) set out various criteria that WRA can use to evaluate a surface water permit application. These include:

- Conditions specified in any prevailing Water Allocation Plan for the catchment in question. In the case of the Mkurumudzi there is no prevailing Water Allocation Plan;
- Water Allocation Balance. This is discussed below;
- Land ownership;
- Legal access to the water source;
- Investments and public benefits;
- Water use efficiency;
- WRUA Comments.

This report aims to provide information on the water allocation balance.

4. METHODOLOGY

4.1 Scope and Priority

The surface water resources relevant to this study are:

- Mkurumudzi river;
- Ramisi river;
- Mwachema;
- Pemba – if the other watercourses prove to hold insufficient water resources.

The approach in the analysis is to explore the resource availability in the Mkurumudzi river first as the watercourse transects the Base site and on which Base has an existing storage dam. In addition, there is a long streamflow record unlike for the other rivers. If there is insufficient water resource on the Mkurumudzi, then the other watercourses will be explored.

4.2 Water Balance

The water allocation balance is the allocable yield minus the existing permitted allocations. If the balance is positive then additional allocation can be justified.

For this study, the logic is, therefore:

1) Based on hydrological data, establish allocable yield for the entire catchment;
2) Based on water permit data, establish the total allocated amounts;
3) Evaluate the water allocation balance at the catchment to determine whether the balance is sufficient to support an additional abstraction of 8,000m^3/day;
4) Repeat the process for the Base Dam Site to ascertain whether the water allocation balance at the dam site can support the additional abstraction (the assumption is that additional abstraction would be at the dam site);
5) Repeat steps 1 to 4 for other catchments (Ramisi, Mwachema) is Mkurumudzi does not have sufficient resource.
6) Evaluate the viability of abstraction from Pemba and if viable, then repeat steps 1 to 4 for Pemba.

4.3 Streamflow Data and Catchment

Streamflow data is collected at specific river gauging stations (RGS). The analysis of the hydrological data describes the hydrological characteristics at the RGS which has to be scaled appropriately to cover the whole catchment. This can be done by the ratio of the catchment areas for the RGS and catchment. The inherent assumption in this process is that the hydrological behaviour at the RGS is applicable throughout the catchment.

With respect to the Mkurumudzi catchment which is gauged at 3KD06, the following equation applies:

$$Qt_{Catch} = Qt_{3KD06} \times \frac{A_{Catch}}{A_{3KD06}}$$ …….equation (1)

Where:

Qt_{Catch} – Discharge at outlet of catchment (m^3/s)
Qt_{3KD06} – Discharge at the 3KD06 site (m^3/s)
A_{Catch} - Catchment area for whole catchment (205 km^2)
A_{3KD06} – Catchment area at 3KD06 (86.15 km^2)

4.4 Establishing the Allocable Flood Volume

A detailed study would adopt a modelling approach to see what level of abstraction is permissible for specified reliability while meeting specified criteria for environmental flows. In this case, we do not have all the information or time needed to set up a detailed streamflow model for the catchments of interest with all the existing dams and abstractions. A simplified approach is therefore appropriate.

The approach adopted uses a simple construct to identify an allocable flood volume that WRA can use to determine the water balance.

The method adopted by WRA uses the daily flow duration curve (FDC) derived from the entire record of data and assumes that this is representative of flows within a "typical" year. So, for example, a flow which is exceeded 5% of the time (Q5) can be expected to be exceeded on 18.25 days (5% x 365) within the "typical" year. This means that the FDC can be used to construct the "typical" flood volume for purposes of the water balance calculations. This can be represented by the area under the FDC line but above the Q80 value.

The current structure of water allocation in Kenya is that water is allocated on a cubic metre per day basis (m^3/day). This means that the allocable flood volume needs to be converted to a cubic metre per day basis. Therefore, an assumption must be made regarding the number of days in the year that the flood water can be used. For a commercial user that has a continuous industrial process like Base Titanium, the water use will likely be fairly constant throughout the year. For an agricultural user, the flood water will be used during the periods when rainfall and soil moisture are insufficient to meet crop water demand.

An alternative method of establishing the allocable flood volume involves establishing the flood volume in each year. The flood volume for any year (defined as any flow above Q80) can be easily computed using the equation below:

$FVOL_Y = \sum (Q_t - Q_{80})$ x 24 x 60 x 60 /1,000,000 for all $Q_t > Q_{80}$

Where
$FVOL_Y$ = flood volume in year Y [MCM/yr]
Q_t = flow on day t [m^3/s]

Q_{80} = flow that is exceeded 80% of the time = Normal Flow threshold [m^3/s]

The annual flood volumes can be described by frequency distribution. However, WRA has not specified the probability to be used to establish the allocable flood volume for the water balance evaluation.

4.5 Reservoir Simulation

The reservoir yield for different reliabilities is normally described in the dam design document. This detailed information is not available at present to RFL. Therefore to evaluate the reservoir yields we have opted to use a simple in-house simulation model RESSIM as this allows us to explore different demand scenarios and operational rules.

4.6 RFL RESSIM Model

The RFL RESSIM Model is a basic water balance model designed to facilitate scenario analysis during reservoir design. The model operates on a daily time step and uses a MS Access platform.

The reservoir simulation is governed by the water balance model as described below:

$$S_{t+1} = S_t + INFLOW_t - EVAP_t - SEEP_t - RELEASE_t - SPILL_t$$

Where: S_t = storage on day t [m^3]
$INFLOW_t$ = reservoir inflow on day t [m^3]
$EVAP_t$ = evaporation on day t and is a function of the area on day t [m^3]
$SEEP_t$ = seepage on day t [m^3]
$RELEASE_t$ = sum of releases to meet water demands on day t [m^3]
$SPILL_t$ = spillway flow on day t [m^3]

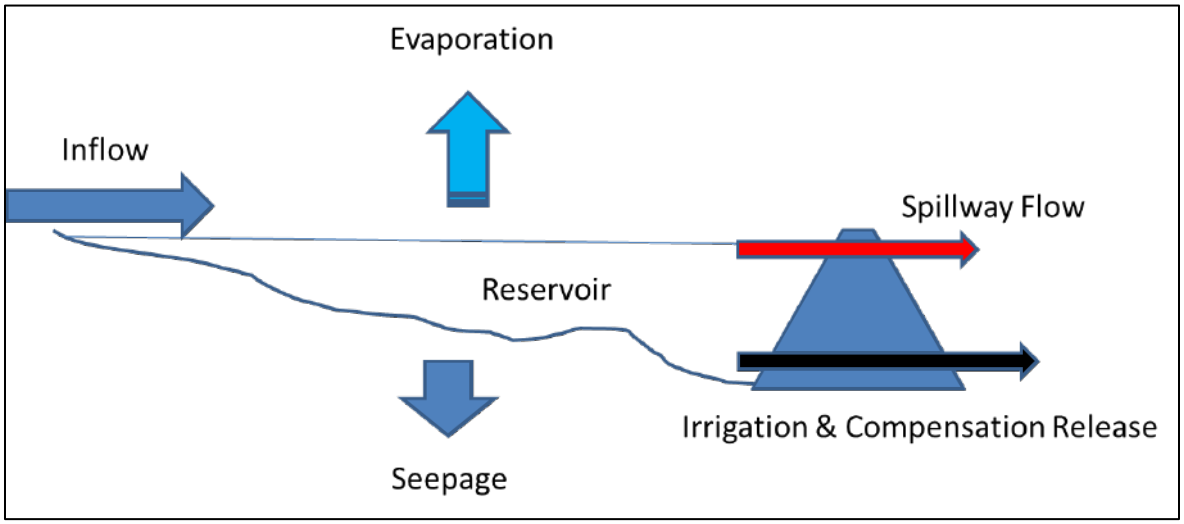

Figure 3-1: Schematic of Reservoir Model

There are various processes that are modelled during the simulation. These are discussed below.

a) Model Set-up

RESSIM can model a single on-line reservoir (Storage 1) supplied by inflows from Q1 or an off-line reservoir (Storage 2) supplied by a transfer from Q1 and an inflow from Q2. In this case, the Base Dam was set up as an online dam (Storage 1).

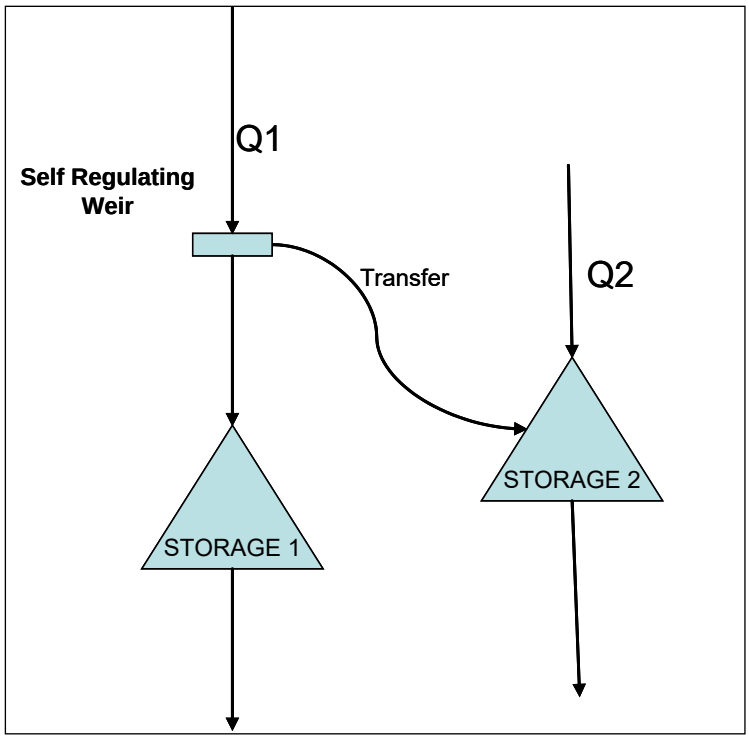

Figure 3-2: RESSIM Model Setup

4.6.1 Height-Volume-Area Details

The height-volume-area (HVA) details are a function of the site topography. This information was provided by Base Titanium is presented in Figure 3-3 and Appendix B.

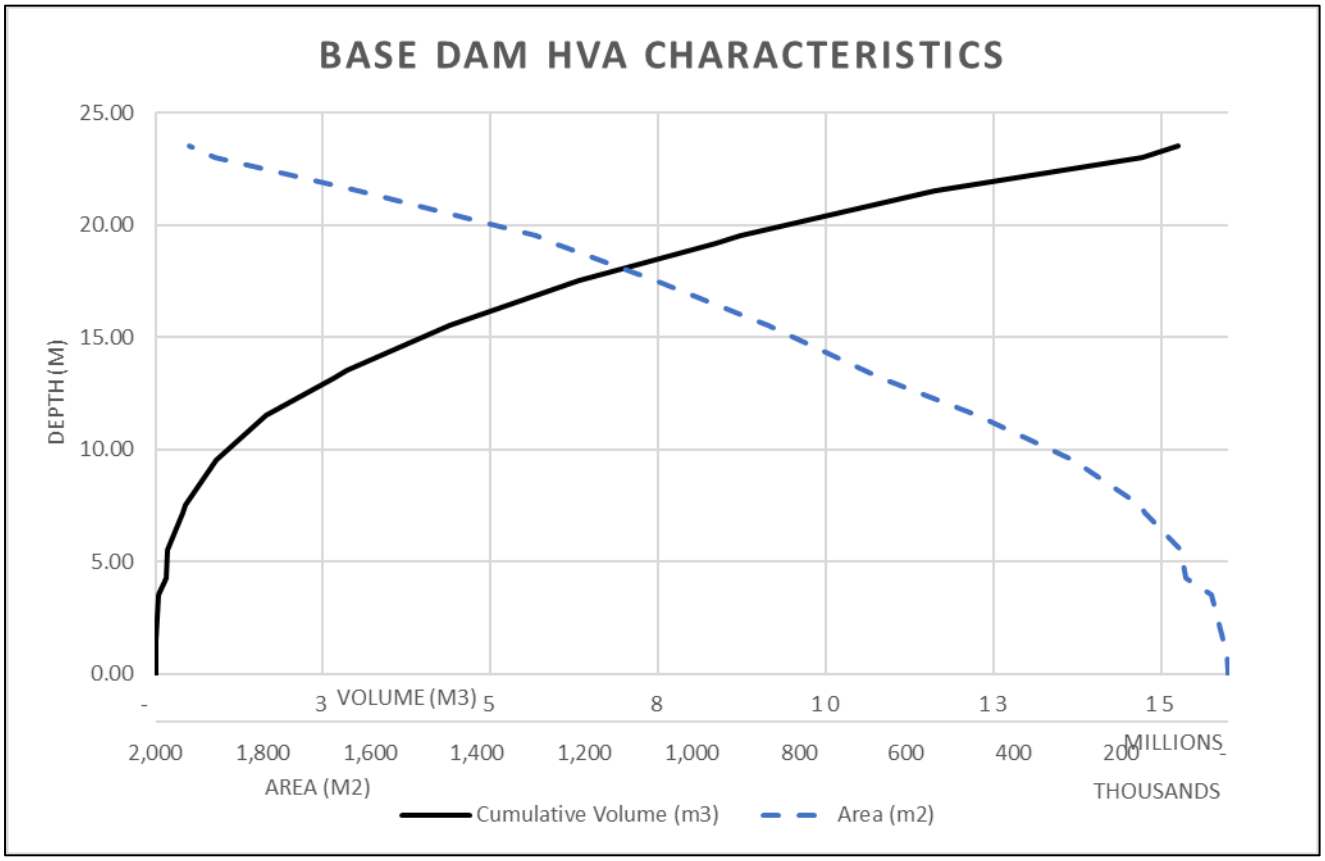

Figure 3-3 Base Dam HVA Characteristics

A reservoir is typically partitioned into three zones, namely;

1. Dead Storage Zone. The dead storage is a provision for sedimentation and water in the dead storage is not used to meet any water demands. The dead storage level was set at 4.25 m depth as per details from Base Titanium.
2. Live Storage Zone. This storage is used to meet water demands;
3. Flood Control Zone. This zone is intended to meet flood control objectives by providing storage to "capture" floods. For the Base Dam, the flood control level was set at the spillway height (19.20m depth) implying that the flood control zone has zero depth.

4.6.2 Inflow

Inflow to the reservoir is specified as a daily time series (m^3/day) and is composed of:

1. Stream discharge which is calculated as flow at 3KD06 scaled to the Base Dam Site;
2. Rainfall on the reservoir surface.

The continuous discharge record for 3KD06 from 15/03/2003 to 02/12/2019 was adjusted by a factor of 1.465 as a proportion of the catchment areas.

The Shimba Hills Settlement rainfall record for the period 15/03/2003 to 02/12/2019 was used to estimate the rainfall on the reservoir surface area.

4.6.3 Evaporation

Open water evaporation estimates are specified as mm/day and are shown in Table 3-1. These values are derived from Msambweni and are corrected for open water.

Table 3-1 Pan Evaporation

Month	Monthly [mm/month]	Daily Average [mm/day]
Jan	207	6.63
Feb	204	7.29
Mar	207	6.68
Apr	182	6.07
May	159	5.13
Jun	153	5.10
Jul	149	4.81
Aug	167	5.39
Sep	183	6.10
Oct	199	6.42
Nov	187	6.23
Dec	203	6.55

4.6.4 Seepage

Seepage (m^3/day) is specified as a function of the depth of water. In the case of the Base Dam simulation, we have opted to set seepage at zero.

4.6.5 Demand, Release and Operating Rules

The combined release (m^3/day) is specified as the water released to meet the demand for industrial, irrigation, domestic and compensation flows.

In the case of the Base Dam simulation the following demands were set:

1) Compensation demand = 0.027 m^3/s (2332.8 m^3/day); this is a conservative value for Q95;
2) Domestic demand = 2505.6 m^3/day derived as Q80 (0.056 m^3/s) minus Q95 (0.027 m^3/s);
3) Irrigation demand = 0 m^3/day;
4) Industrial demand = Different scenarios for the industrial abstraction are defined with a maximum value of 22,000 m^3/day under normal operations and 30,000 m^3/day assuming the additional 8,000m^3/day abstraction.

Simple operating rules can be defined in which a percentage of the demand is released as a function of the water depth, for each month. This reflects the option of rationing water as water level drops.

4.6.6 Spillway Flows

Spillway flows (m^3/day) are specified as any volume above the maximum storage capacity (as defined by the spillway level) which is expected to be discharged over one day. There is no provision for flood routing through the reservoir.

4.6.7 Sedimentation

There is no provision within the reservoir model for sediment accumulation within the reservoir. However, the dead storage level is set at 4.25 m depth and the live storage capacity is zero below this level.

4.6.8 Simulation Results

RESSIM presents the daily water balance for the entire time series and a variety of metrics to help understand the simulation results (e.g. yield-probability results).

4.6.9 Model Initialisation

RESSIM has a function in which the model can be run for a defined number of years before the actual simulation to set the initial values. In this case, a 3 year initialisation period is used.

5. HYDROLOGICAL ANALYSIS

5.1 Introduction

The object of the hydrological analysis is to establish the allocable yield on the Mkurumudzi river to evaluate the water balance. If the water balance indicates insufficient resource, then the investigation will be widened to include the other catchments of interest, namely Mwachema, Ramisi and possibly Pemba.

5.2 Rainfall

5.2.1 Data Availability

There are various rainfall and climate stations within the area; some under KMD and others established for the UpGro Programme (www.upgro.org) as shown in Figure 4-2.

Previous to this study rainfall data was acquired from the WRA Regional Office (Machakos) for the following stations:

1. 9439014 - Msambweni District Office
2. 9439001 - Kwale Agricultural Department
3. 9439043 - Shimba Hills Settlement Scheme

The rainfall data was only available in the years between 1959 and 2016 while water level data for 3KD06 on the river Mkurumudzi was available from 1959 to 2019.

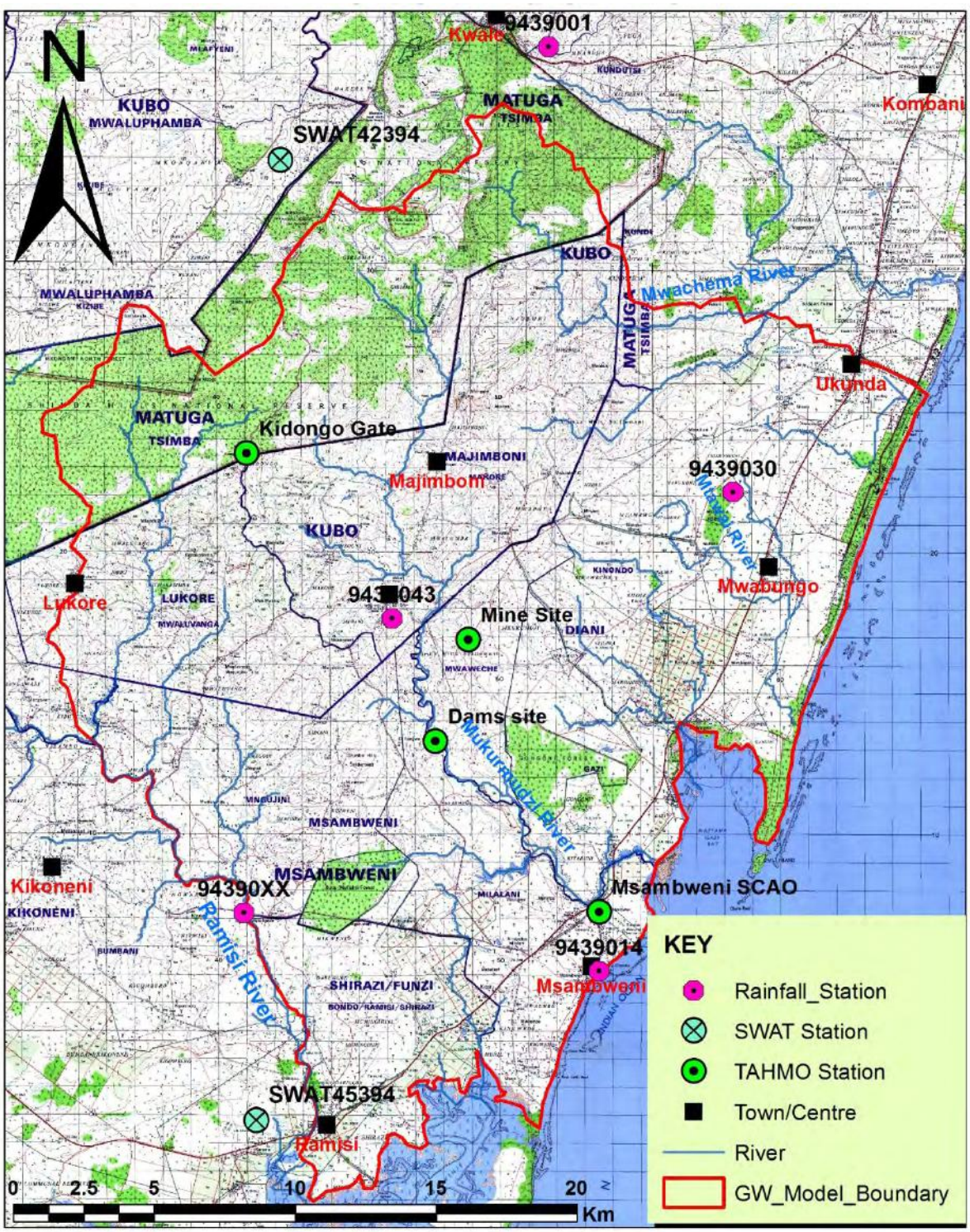

Figure 4-1: Rainfall Stations

5.2.2 Data Reliability

A double mass curve was plotted for Kwale Agricultural Department rainfall versus Shimba Hills Settlement Scheme rainfall (Figure 4-4) and Shimba Hills Settlement Scheme versus Msambweni District office (Figure 4-5).

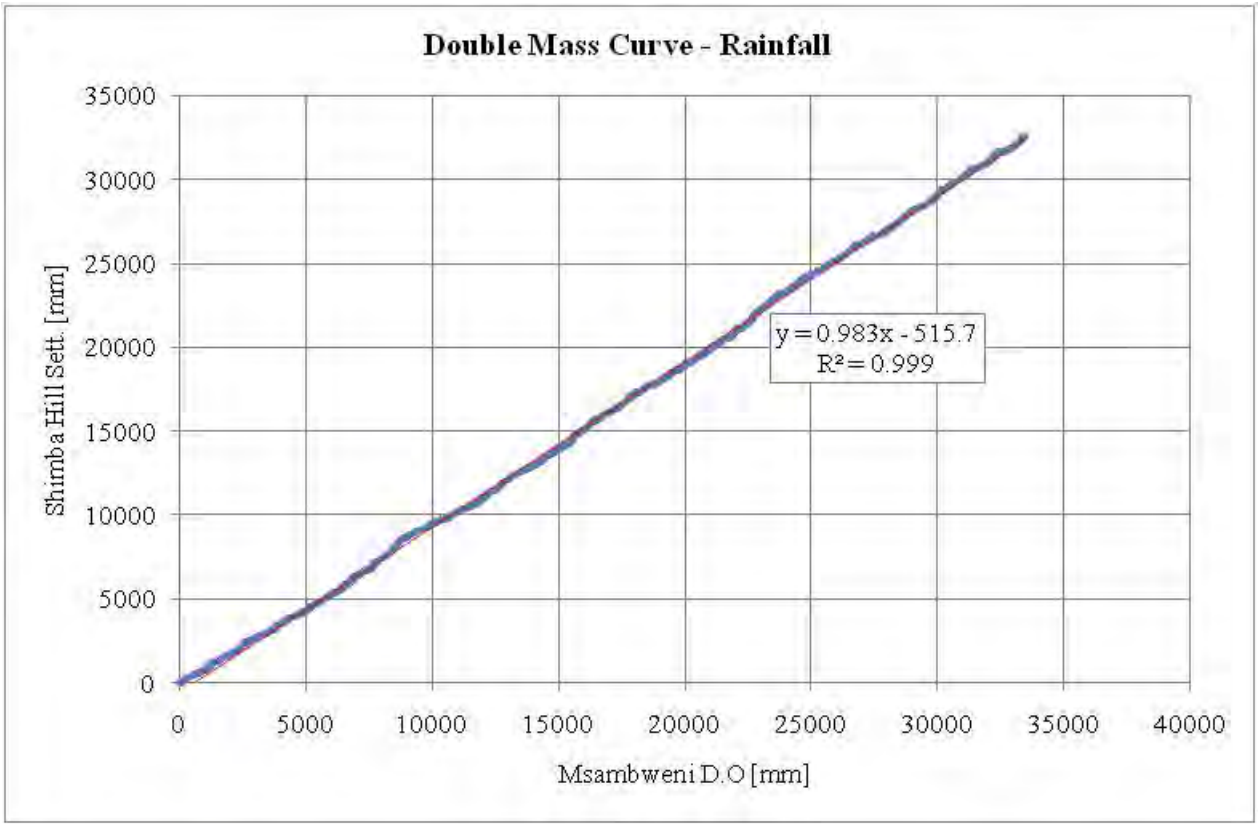

Figure 4-2 Double Mass curve (Msambweni vs. Shimba Hills)

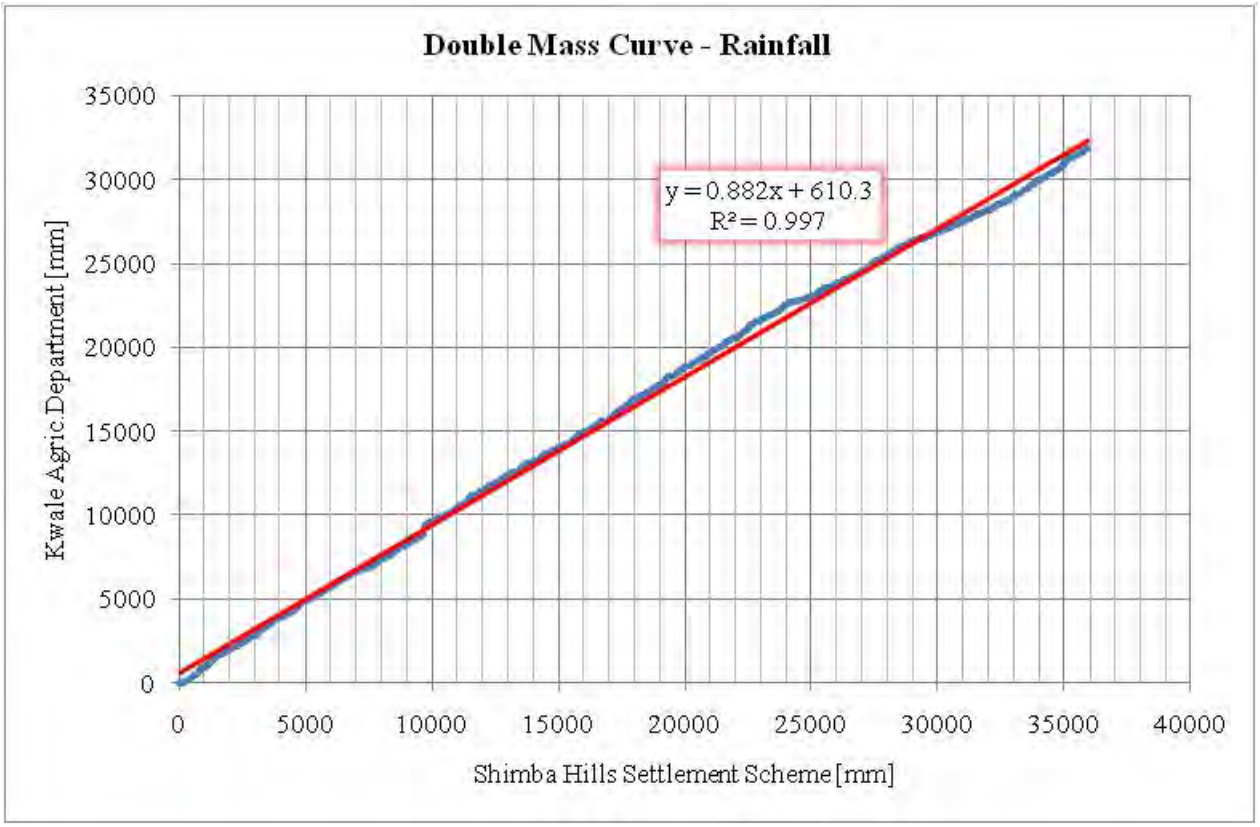

Figure 4-3 Double Mass Curve (Shimba Hills vs. Kwale Agric.)

The relationship between the Msambweni District Office and Shimba Hills Settlement Scheme rainfall is fairly close although there were some slight deviations. There is a similar pattern for the Kwale Agricultural Department and Shimba Hills Settlement Scheme. This confirms that the Shimba Settlement scheme data is a reasonably reliable record.

5.2.3 Monthly and Annual Rainfall

The mean monthly and annual rainfall for the Shimba hills rainfall station was analysed and the results for the period (1959 – 1988) showed that the Shimba hills area receives on average a total of 1336 mm of rainfall per year.

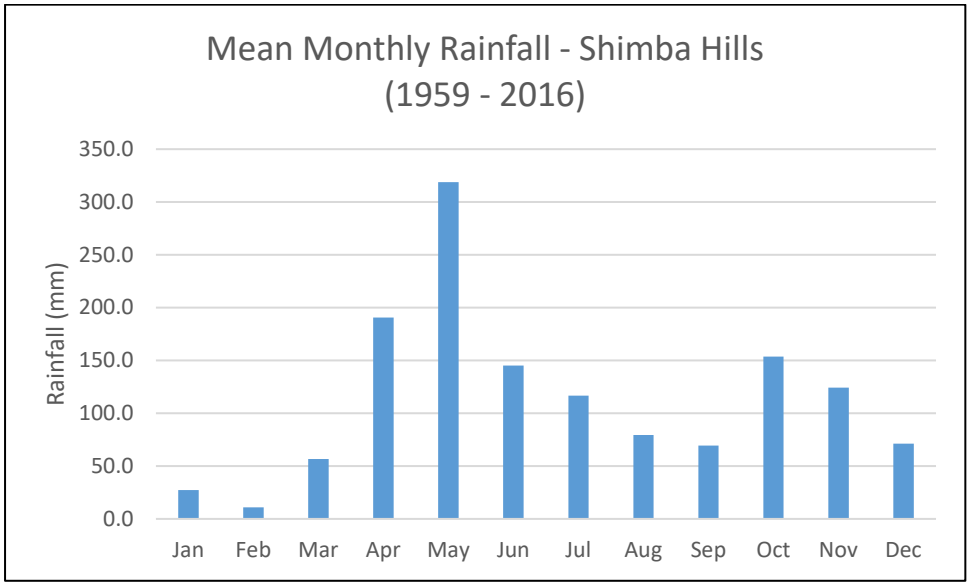

Figure 4-4 Mean Monthly Rainfall [Shimba Hills]

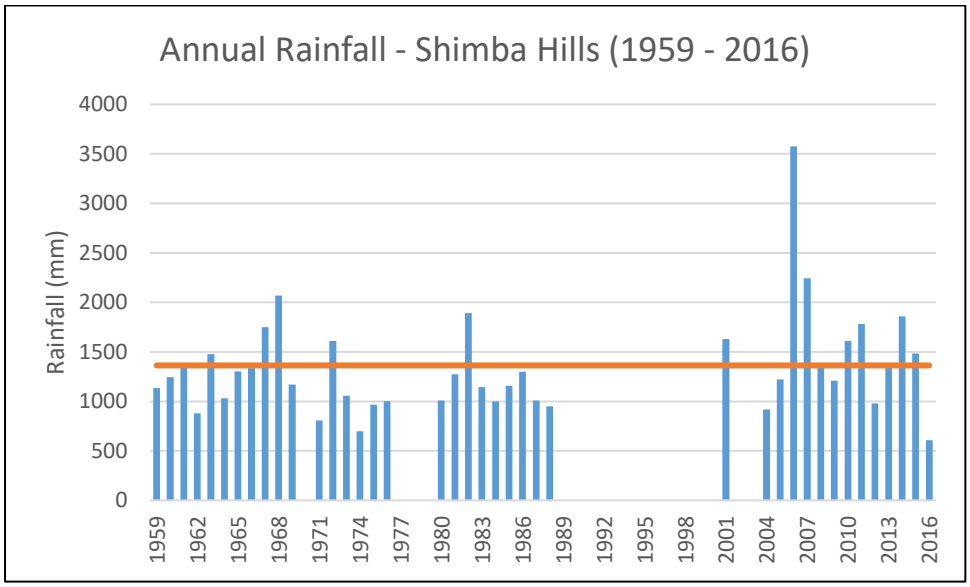

Figure 4-5 Annual Rainfall – Shimba Hills

5.3 Climate

The study area experiences a sub-humid climate, with 1100 mm to 1300 mm of rainfall split between the long (April-June) and short (October – November) rains respectively. Mean annual evaporation is about 2170 mm/yr, giving an aridity index of approximately 0.55. The mean annual minimum and maximum temperature is 22.80 C and 30.00 C respectively. The warmest months are between November and April with mean temperatures of 26.00 C to 28.00 C while the cooler months have a temperature ranging between 24.00 C to 26.00 C.

5.4 Discharge Analysis

5.4.1 Catchment Areas

The Mkurumudzi river is the only catchment in the vicinity of Base Titanium that is not only gauged but which has a reasonable historical record. Table 4-1 presents information on the location of the local river gauging stations. However, it is only 3KD06 that has a long record of interest in this study. The other stations have been established very recently (2018).

Table 4-1 Catchments relevant to Study

River Name	Catchment Area (km^2)	Station Name	Grid Reference	% of the Catchment Area	Hydraulic Structure
Mukurumudzi	205	3KD06	546595, 9519210	42	Rectangular Weir
Mukurumudzi	205	KISCOL Weir	551431, 9509485	81	Diversion Weir-Sluice
Ramisi	1,430	Eshu Bridge	537581, 9511612	89	Bridge

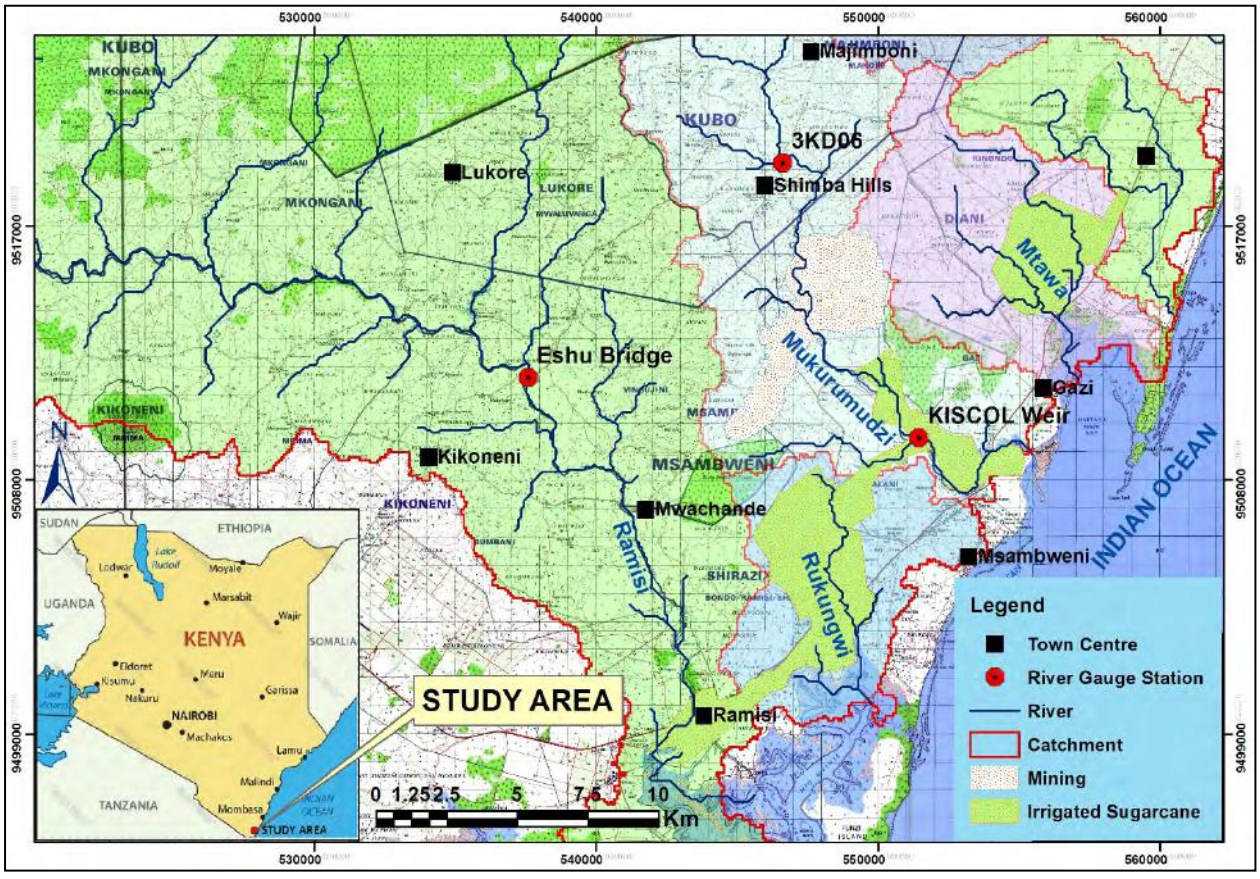

Figure 4-6 River Gauging Stations

5.4.2 Data Availability

RGS 3KD06 was built in 1955/56 as a sharp-crested weir with the data starting in January 1956. By March 2013 the weir plate was severely rusted and this significantly affected the accuracy of data, especially dry weather flows, although it is not known when the erosion of weir plate became significant.

Figure 4-7 Photo of 3KD06 Measuring Weir

5.4.3 Rating Curve

The water level data and the miscellaneous gauge heights versus corresponding discharges (H/Q data) were collected from WRA Regional Office (Machakos) and are presented in Appendix D with outliers highlighted.

The MWI used the discharge measurements and developed various rating curves as shown in Table 4-2.

Table 4-2 MWI Rating Curves

ID	SDATE	EDATE	SEG	LWL	HWL	A_CONST	B_CONST	DH
3KD06	22/04/1967	23/06/1978	1	0.0	0.50	3.301	1.5064	0
3KD06	22/04/1967	23/06/1978	2	0.5	1.82	10.18	3.1412	0
3KD06	24/06/1978	02/09/1980	1	0.0	0.32	7.422	2.2157	0
3KD06	24/06/1978	02/09/1980	2	0.32	0.5	3.301	1.5064	0
3KD06	24/06/1978	02/09/1980	3	0.5	1.82	10.18	3.1412	0
3KD06	03/09/1980	31/12/1995	1	0.0	0.50	3.301	1.5064	0
3KD06	03/09/1980	31/12/1995	2	0.5	1.82	10.18	3.1412	0

Streamtec (2011) undertook discharge measurements at 3KD06 and developed a rating equation. RFL (2014) obtained discharge measurements from WRMA and developed a different rating curve. However high flow observations that touched the bridge level at 3KD06 indicated that the Streamtec and RFL rating curves were probably inaccurate at high flows (Figure 4-9). Consequently, Wara et al. (2019) developed a HEC-RAS model (Figure 4-10) of the stream channel and used it to develop a different rating curve. These rating curves are presented in Table 4-3 and illustrated in Figure 4-10.

Figure 4-8 Mkurumudzi River at 3KD06 at High Flows

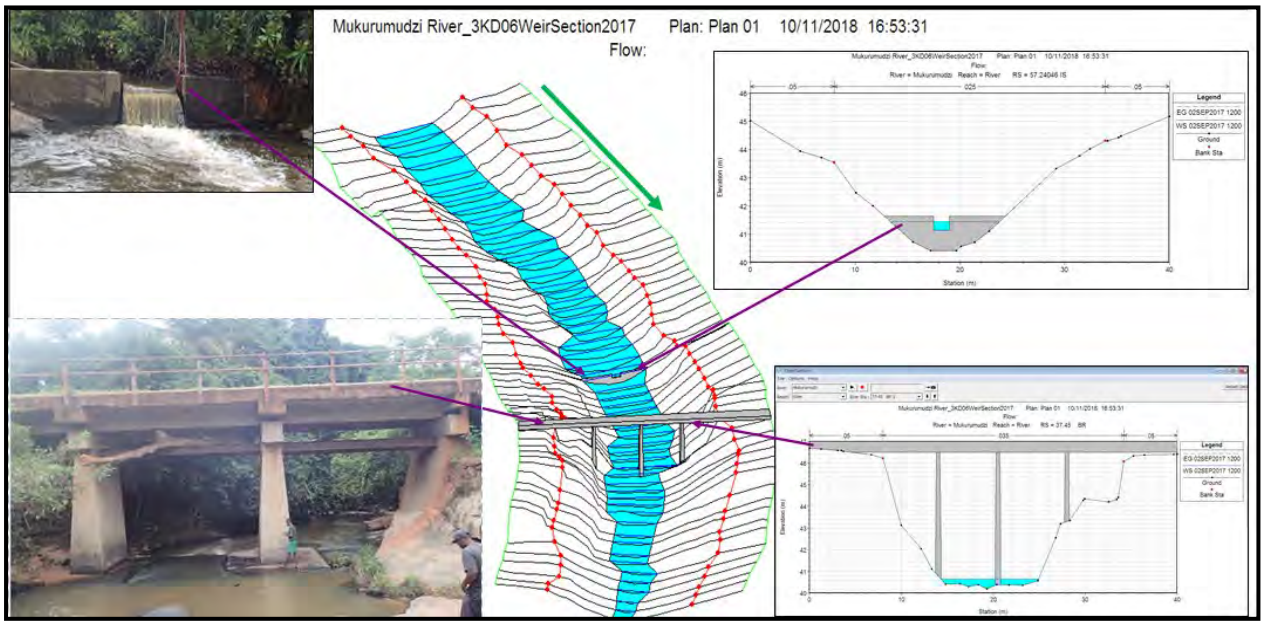

Figure 4-9 HEC-RAS Model of Mkurumudzi River Reach Near 3KD06

Table 4-3 3KD06 Rating Curves

Study	Method Used	Depth Range (m)	Fitted Rating Equation
Streamtec 2011	Manning Equation & H-Q measurement	0.0 < h < 0.0.12	$Q=1.752h-0.007$
		0.12 < h < 1.0	$Q=9.67h^2+0.03$
		1.0 < h < 8.5	$Q=2.9066h^2+10.313h-2.417$
RFL 2014	Extrapolation based on the H-Q measurement	0 < h ≤ 0.55	$Q = 3.77\ h^{1.643}$
		h > 0.55	$Q = 11.64\ h^{3.464}$
HEC-RAS		0 < h ≤ 0.5	$Q = 3.2778\ h^2 + 1.1065\ h - 0.0071$

	1D hydraulic modeling calibrated with measured H-Q	$0.5 < h \leq 1.2$	$Q = 12.677\ h^{3.5375}$
		$h > 1.2$	$Q = 20.458\ h^{1.4395}$

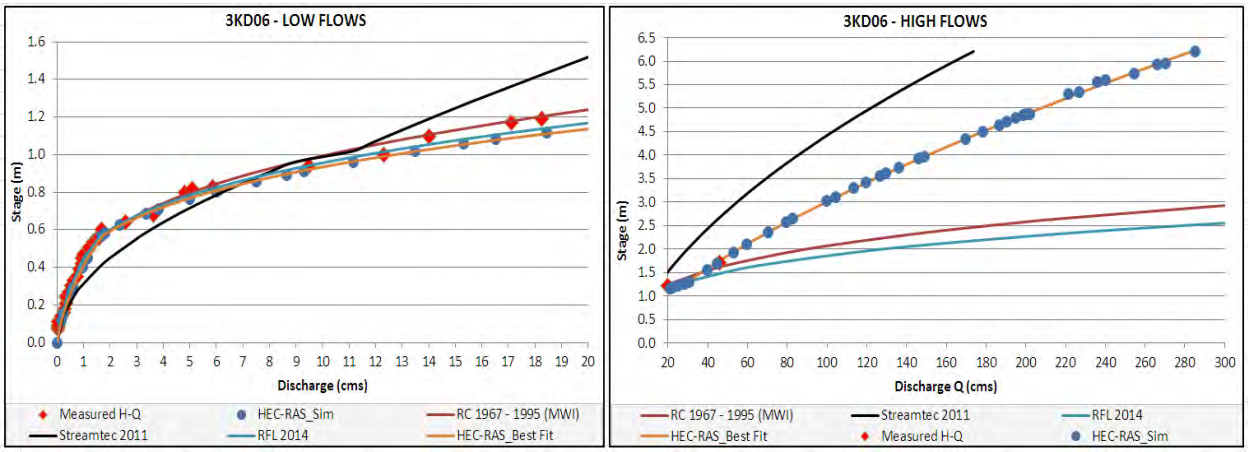

Figure 4-10 Comparison of Different Rating Curves

5.5 Discharge at 3KD06

The different rating curves were applied to the observed water level data 01/01/1959 to 02/12/2019 to calculate discharges. Figure 4-11 presents the discharge time series using the HEC-RAS derived rating curve.

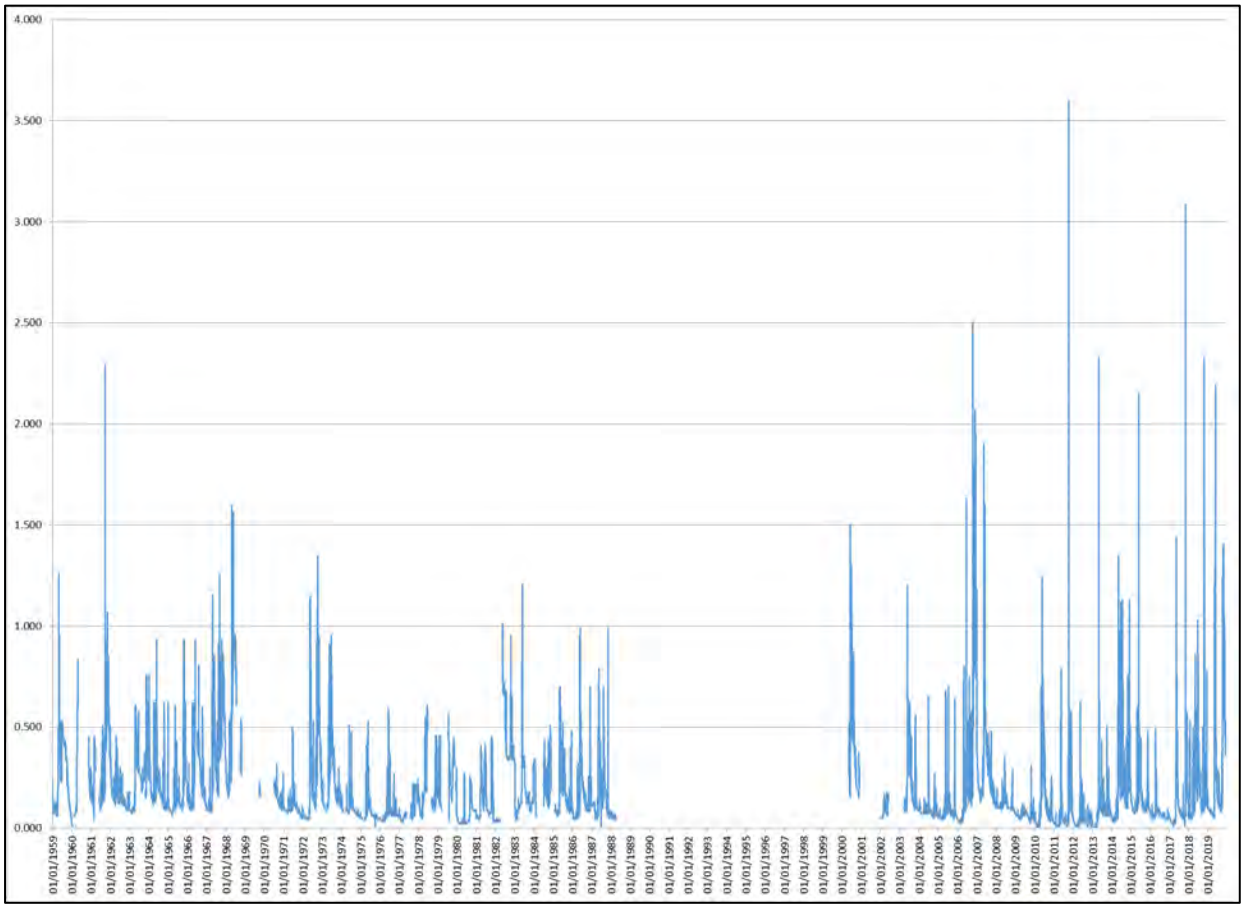

Figure 4-11 : Discharge Time Series

5.5.1 Mean and Annual Flows

The mean annual discharge (MAF = 0.658m^3/s) and the mean monthly discharge are presented in Figure 4-13 and Figure 4-14 using the HEC-RAS derived rating curve and data for 1959 to 2019.

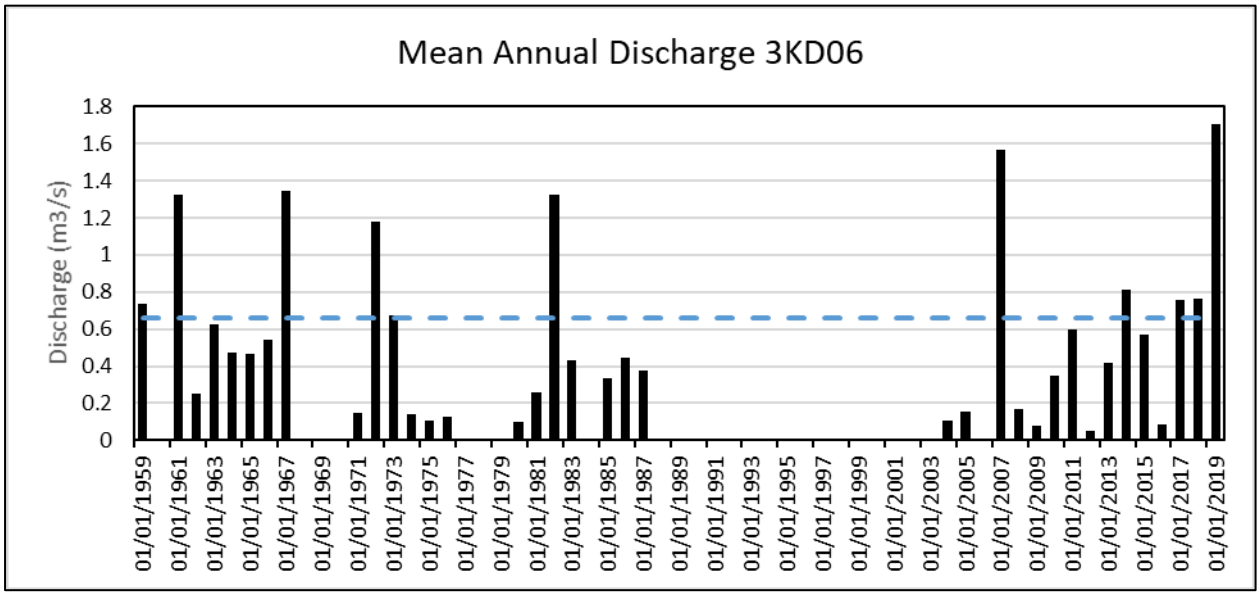

Figure 4-12 Mean Annual Flows for 3KD06

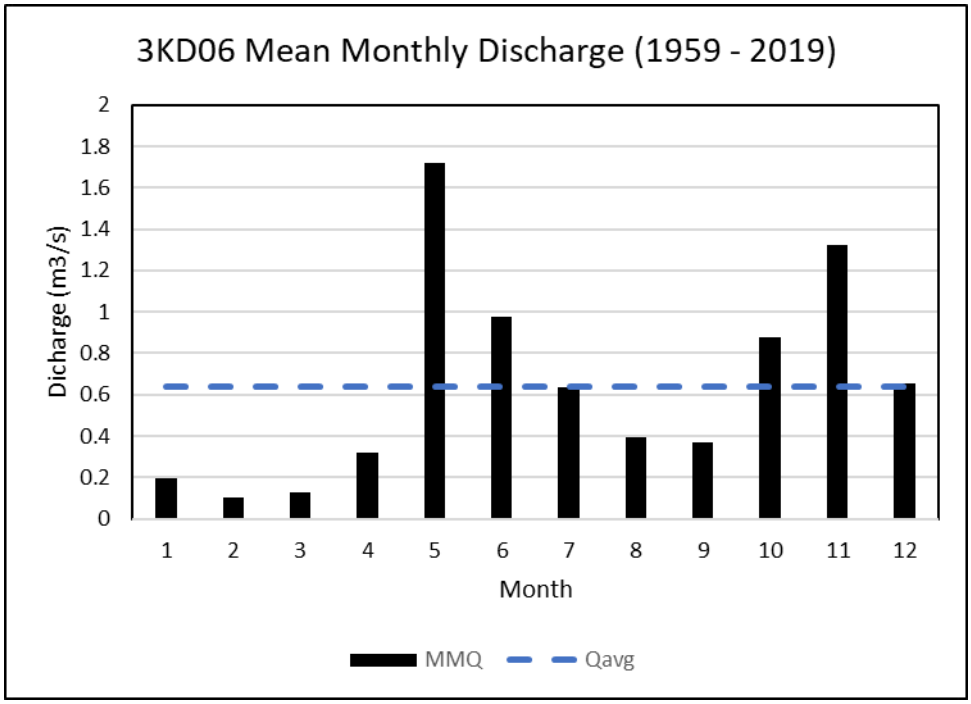

Figure 4-13 Mean Monthly Flows 3KD06

5.5.2 Flow Duration Curve

The flow duration curves for the 3KD06 site were developed based on 1959 - 2019 data and the three optional rating curves and are presented in Figure 4-15 and tabulated in Table 4-4**.**

Table 4-4 Flow Duration Values for 3KD06

	HEC-RAS	STREAMTEC	MWI
Probability of exceedance	**Flow (m^3/s)**	**Flow (m^3/s)**	**Flow (m^3/s)**
95%	0.004	0.011	0.003
90%	0.042	0.063	0.026
80%	0.071	0.098	0.048
70%	0.088	0.117	0.061
60%	0.119	0.151	0.088
50%	0.154	0.170	0.119
40%	0.212	0.221	0.171
30%	0.298	0.344	0.249
20%	0.530	0.736	0.459
10%	1.074	1.819	0.926

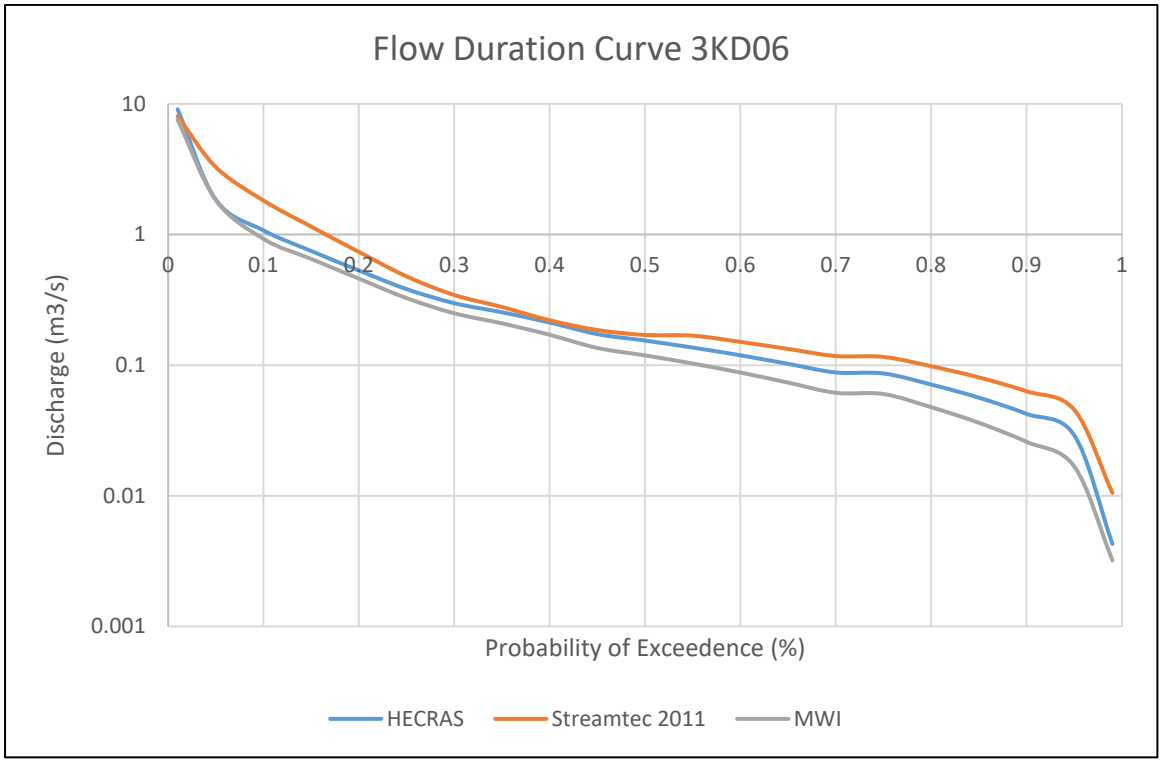

Figure 4-14 Flow Duration Curves for 3KD06 (1959 – 2019) based on different Rating Curves

Visual comparison of Figure 4-11 indicates that the period after 2003 experiences higher peak discharge values. Figure 4-16 presents the flow duration curve data for 1959 – 1987 and 2003 – 2019 and this shows that the period 2003 – 2019 has lower flows for the same probability than the earlier period.

As 3KD06 is located above the major abstractors this change in the hydrological regime cannot be explained by abstraction. It is either due to changes in the catchment, climate or inaccuracies in the discharge measurements (e.g. change in zero level). 48% of the catchment at 3KD06 is within the Shimba Hills National Park where vegetation changes are not induced directly by anthropogenic activity. Settlement within the remaining 52% has been accompanied by clearing the land of bushes and trees for agriculture. The presence of more shallow-rooted crops (maize, beans, cassava) and more open ground than in the natural vegetative state combined with a higher density of roads, tracks and footpaths will change the hydrological behaviour and the water balance between the two periods. Higher flood flows and low dry season flows could reasonably be expected from the land-use change although this is also the expectation of climate change impacts. However, of particular note is that the period 2003 – 2019 is more conservative from the perspective of water resource availability. We have therefore adopted this period as it better reflects current conditions.

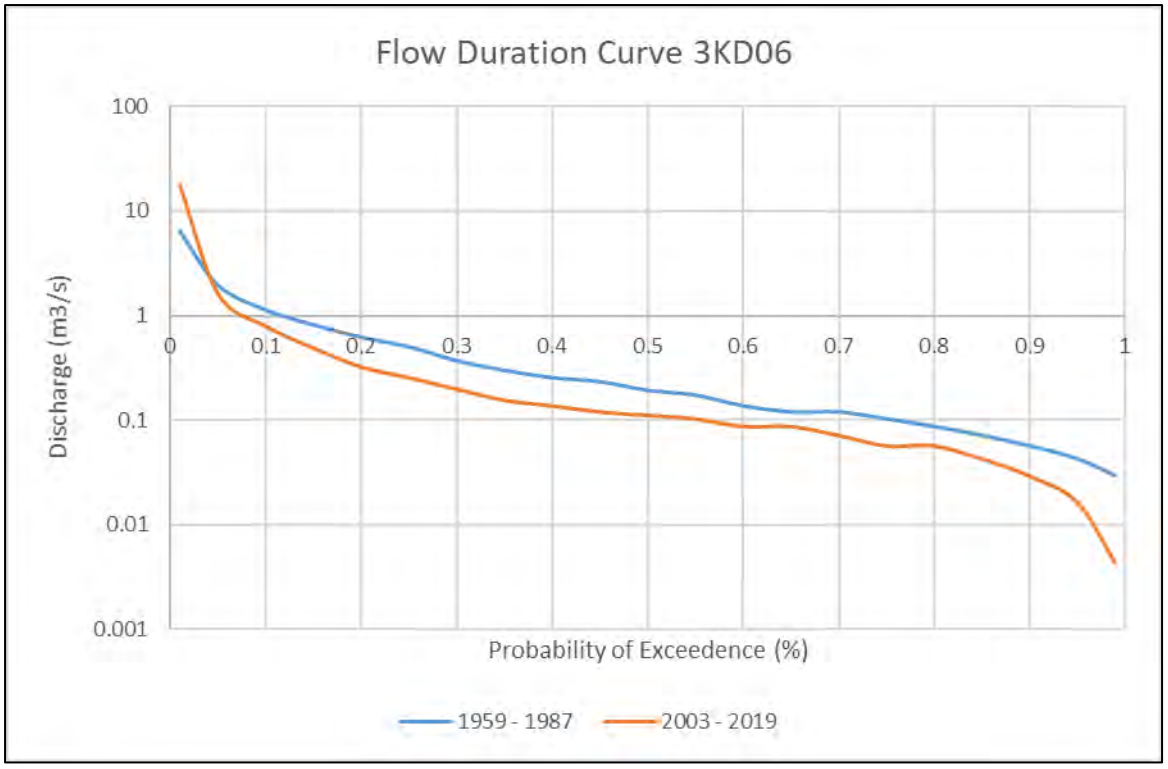

Figure 4-15 Flow Duration Curve at 3KD06 for 2 Different Periods

5.6 Catchment Discharge

The catchment area of 3KD06 was calculated from watershed delineation using the Soil Water Analysis Tool and a 30 m ASTER digital elevation model. The catchment area to 3KD06 was found to be 86.15 km^2 while that of the catchment was established as 205 km^2. The flows measured at 3KD06 have therefore scaled up a factor of 2.38.

5.7 The Reserve

As stated earlier, the Draft Water Allocation Guidelines (2019) state that the Reserve for regulated streams such as the Mkurumudzi should be established based on a detailed environmental flow study. However, the WRM Rules (2007) specify that the Reserve will be computed as the Q95 based on a naturalised daily FDC.

As a provisional measure, the Reserve can be a reasonably conservative value of 0.029m^3/s being the value derived from using the preferred HEC-RAS rating curve and the historical period 1959 – 1987 as shown in Table 4-5.

Table 4-5 Q95 for 3KD06

	Q95 at 3KD06 (m^3/s)		
Rating Curve	1959 - 2019	1959 - 1987	2003 - 2019
HEC-RAS	0.029	0.042	0.016
STREAMTEC	0.046	0.063	0.028
MWI	0.017	0.026	0.009

5.8 Normal Flow

The Normal Flow is defined as the Q80 value. The different values based on the rating curve and data period are presented in Table 4-6. The value adopted for this study is 0.056 m^3/s reflecting the HEC-RAS rating curve and the current period 2003 – 2019.

Table 4-6 Q80 Normal Flow at 3KD06

	Q80 at 3KD06 (m^3/s)		
	1959 - 2019	1959 - 1987	2003 - 2019
HEC-RAS	0.071	0.086	0.056
STREAMTEC	0.098	0.116	0.081
MWI	0.048	0.060	0.060

5.9 Flood Water Availability

Flood flows are defined as the flows greater than Q80. One method to calculate flood water availability is to use the flow duration curve on the assumption that the FDC for the period 2003 – 2019 is a reasonable reflection of flow in an “average year”. On this basis, the total annual flood volume at 3KD06 is estimated at 30.0MCM or 70.51 MCM for the entire catchment (Table 4-7). This is equivalent to 241,472 m^3/day over 292 days (80% of the year). However, what is clear from Table 4-7 is that there is a large volume with a low probability of occurrence. Essentially this means that without sufficient storage, this flow would pass through the catchment without being stored.

Table 4-7 3KD06 Allocable Flood Volume

Probability of exceedance	Flow (m^3/s)	Days	Vol (m^3)	Cum. Vol (m^3)	3KD06 Flood Volume (MCM)	Catchment Flood Volume (MCM)
95%	0.016	346.75	20,588	154,299		
90%	0.029	328.50	45,751	200,050		
80%	0.056	292.00	88,883	355,734	-	
70%	0.071	255.50	112,000	556,618	0.20	0.48
60%	0.086	219.00	136,151	828,919	0.47	1.13
50%	0.111	182.50	174,315	1,164,568	0.81	1.92
40%	0.136	146.00	214,804	1,566,926	1.21	2.88
30%	0.197	109.50	310,511	2,120,526	1.76	4.20
20%	0.321	73.00	506,584	3,027,131	2.67	6.36
10%	0.788	36.50	1,242,815	5,039,332	4.68	11.14
5%	1.615	18.25	2,546,363	7,585,695	7.23	17.20
1%	17.760	3.65	22,403,182	29,988,878	29.63	70.51

The alternative method based on a computation of the annual flood volume establishes a median annual flood volume at 3KD06 of 11.9 MCM/yr or 28.3MCM/yr for the catchment based on 2003 – 2019 data and a Q80 of 0.056 m^3/s. This is equivalent to 96,842 m^3/day over 292 days (for days when Q>Q80 days in a year).

Table 4-8 Probability Distribution for Annual Flood Volumes

Prob. of Exceed (%)	Catchment Annual Flood Vol (MCM)
90%	2.0
80%	3.6
70%	7.8
60%	17.3
50%	28.3
40%	40.0
30%	51.0
20%	54.1
10%	90.8
5%	185.7

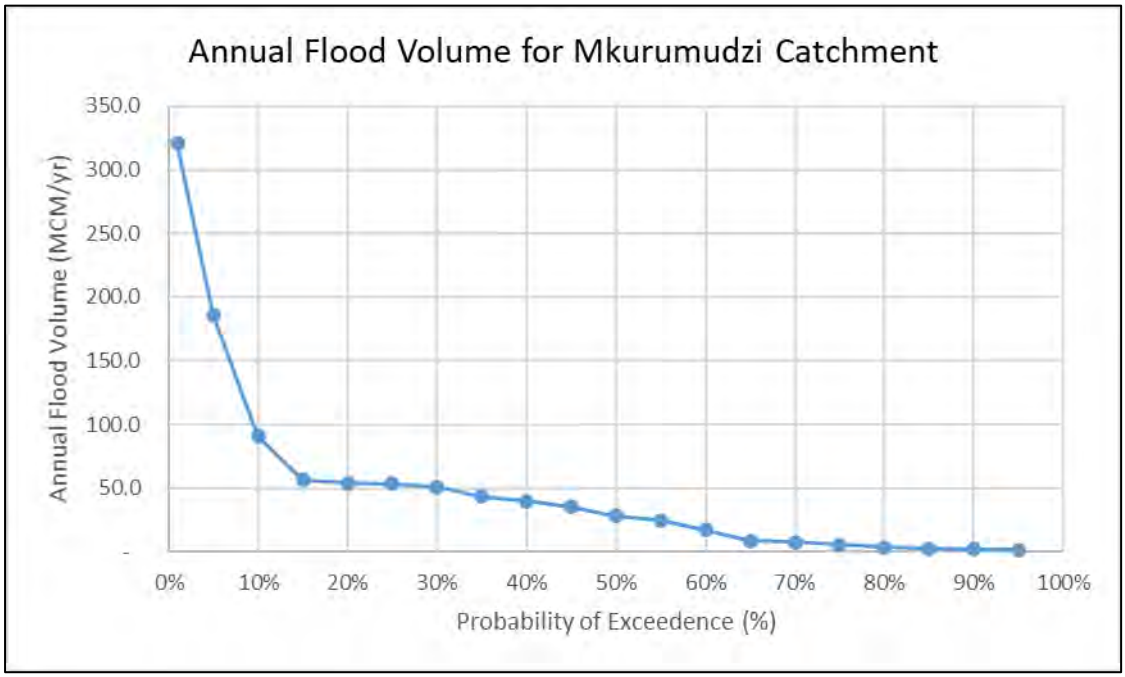

Figure 4-16 Exceedance Probability for Annual Flood Volumes (Q>Q80)

6. WATER ALLOCATION BALANCE

The water allocation balance is the allocable yield minus the sum of the existing permitted allocations.

6.1 Existing Surface Water Permits

Details of existing surface water permits provided by WRA are presented in Appendix C and a summary is presented in Table 5-1, Figure 5-1 and schematically in Figure 5-2. In summary:

- KISCOL has a total authorised abstraction of 82,000m^3/day from flood flow in the Mkurumudzi catchment, supported by an estimated 13.25 MCM of storage. According to the Draft Water Allocation Guidelines (2019), KISCOL is eligible for a maximum of 108,900 m^3/day being three times the total available storage (divided by 365 days);
- Base has a total authorised abstraction of 22,000m^3/day from flood flow on the Mkurumudzi River, supported by an estimated 8.8 MCM of storage. According to the Draft Water Allocation Guidelines (2019) Base is eligible for a maximum of 72,330 m^3/day being three times the total available storage (divided by 365 days);
- Base has an abstraction permit of 13,000m^3/day from the settlement ponds which is supported by the storage within the Tailings Dam;
- Total flood water allocation is 117,000 m^3/day or an estimated 32.92 MCM/yr.

Table 5-1 Surface Water Abstraction Permits

Name of Applicant	Infrastructure	Storage Capacity (MCM)	Flood Flow (m^3/d)	Period of Abstraction (days)	Max Annual Abstraction (MCM/yr)	Class of Permit
KISCOL	Lower Koromojo Dam	2.7	60,000[1]	292	17.52	Class D
KISCOL	Upper Koromojo Dam	2.6	0[2]		-	Class D
KISCOL	Kitaruni Dam	0.95	12,000	292	3.50	Class D
KISCOL	Mkurumudzi Dam	7.0[3]	10,000	365	2.92	Class D
Base	Base Dam	8.8	22,000	365	8.03	Class D
Base	Settlement Ponds	7.0[4]	13,000	73	0.95	Class D
	Total	**29.05**	**117,000**		**32.92**	

[1] There are actually 2 permits, each for 30,000 m^3/day.

[2] Water is released from Upper Koromojo Dam to the Lower Koromojo Dam for abstraction

[3] Estimated – to be confirmed

[4] As of DATE

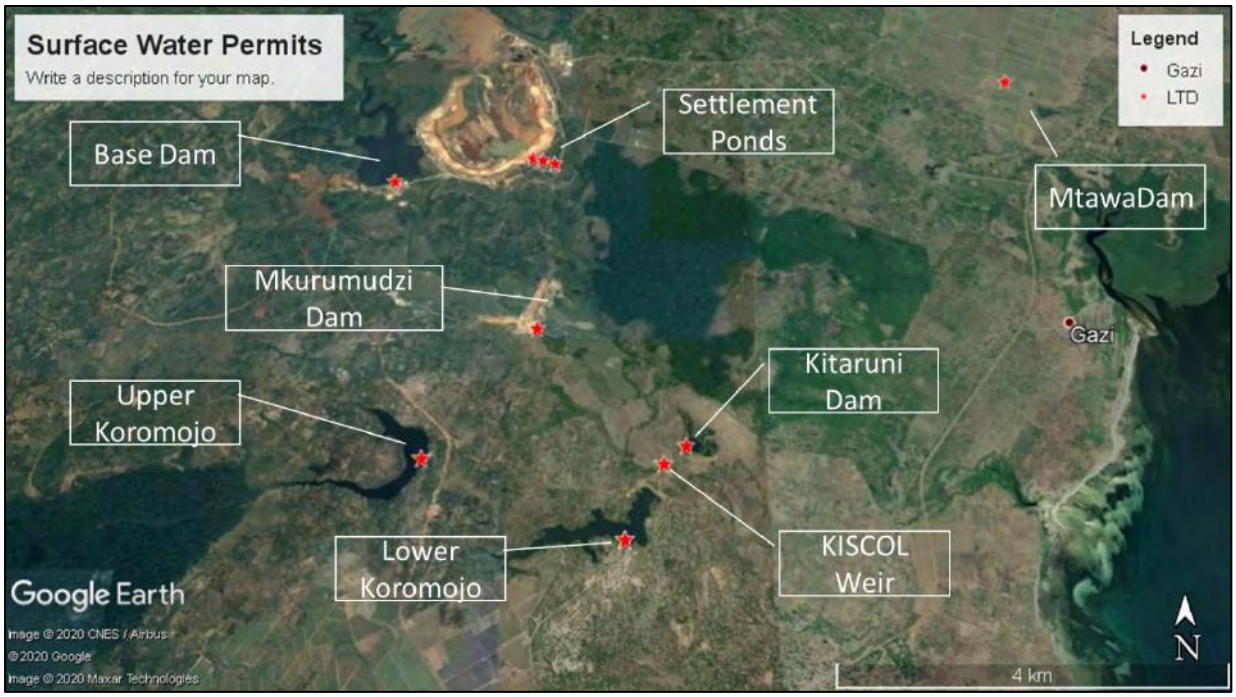

Figure 5-1 Surface Water Permits on Mkurumudzi River

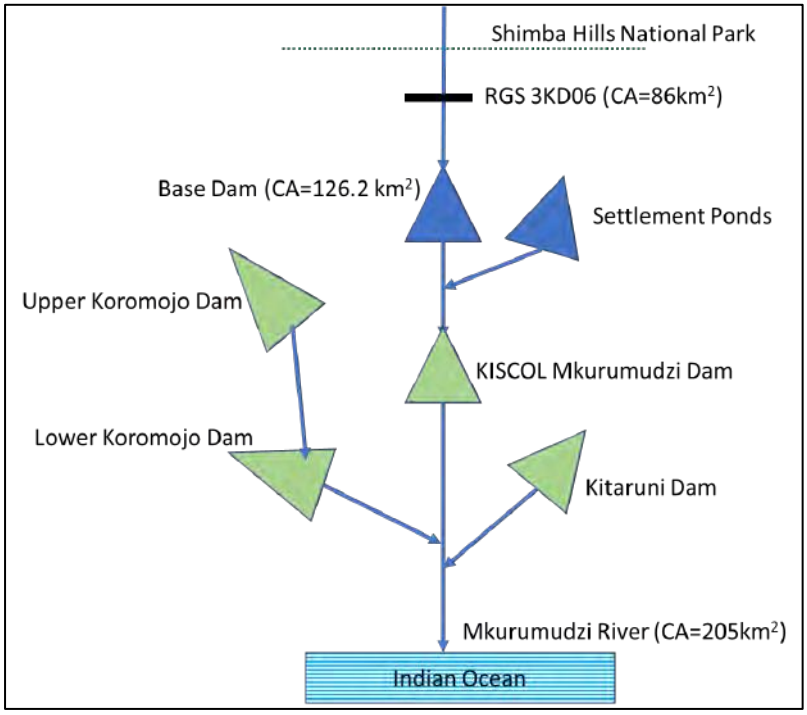

Figure 5-2 Schematic of Mkurumudzi River Catchment

Water resources are allocated in terms of daily abstraction (m^3/day). This can be converted to an annual volume on the assumption that the abstraction occurs over several days in the year. We have made the following assumptions:

- Base Titanium will abstract 22,000 m^3/day every day to support the mining and processing operation which is continuous throughout the year;
- Base Titanium will abstract 13,000 m^3/day on rainy days only – assumed to be 73 days in the year (20% of the year) – days with sufficient rainfall to generate runoff[5];
- KISCOL will abstract for 292 days (80%) of the year i.e. they will not abstract on rain days. Without specific details on the irrigation practice, it is conservative to assume that irrigation takes place on 80% of days.

Effectively this means that WRA has allocated surface water permits totalling 117,000m^3/day which is practically equivalent to 32.92 MCM/yr.

6.2 Abstraction Surveys

An abstraction survey was carried out in January 1999 by GSK on the Mkurumudzi river downstream of 3KD06. This study reported authorized abstractions of 126 m^3/d on normal flows and 714 m^3/d of flood flow and a cumulative measured abstraction downstream of 3KD06 for both legal and illegal abstractors of 110 m^3/d.

On the back of very low rainfall and flows in 2012, Base Titanium commissioned an abstraction survey which was carried out by Rural Focus Ltd in March 2013 to coincide with the dry season. 18 abstraction points were identified. At the time of the survey, no commercial enterprises were abstracting. The survey preceded the development of the Base Dam, the KISCOL Mkurumudzi dam and the rehabilitation of the Upper Koromojo Dam by KISCOL. The total abstraction by these 18 abstractors amounted to 506 m^3/day. Of this abstraction, 91% consisted of two domestic water supply abstractors, namely the Majimboni Water Project and the Majimboni Muungano Self Help Water Project.

To the best of our knowledge, no further abstraction surveys have been undertaken since that of 2013.

These abstraction surveys imply that there are only a small number of additional abstractions, primarily for domestic use and which would be catered for from normal flows. No additional allocation from flood flows needs to be considered in the water balance.

6.3 Catchment Water Allocation Balance

The water allocation balance compares the allocable flood volume against the volume already allocated on existing permits as shown in Table 5-2. This indicates that there is a net positive balance of 37.59 MCM/yr. If an additional water permit is issued for 8,000m^3/day then the net balance reduces to 34.67MCM/yr.

[5] Average number of raindays with 5mm or more 2003 – 2019 is 74.6 days (Msambweni District Office)

Table 5-2 Catchment Water Allocation Balance

Item	m^3/day	MCM/yr	Comment
Allocable Flood Water	241,487	70.51	Annual Flood volume (Q > Q80), assumes all flood flow available for use (i.e. sufficient storage)
Water Allocated	117,000	32.92	Table 5-1
Balance	**124,487**	**37.59**	
New Allocation	8,000	2.92	Proposed 8,000m^3/day x 365 days
Net Balance	**116,487**	**34.67**	

The water balance is sensitive to the value of the allocable flood volume. If the alternative method is used whereby the annual flood volumes are calculated for each year, a positive water allocation balance is obtained with the additional allocation of 8,000 m^3/day with an annual flood volume that is exceeded 40% of the time.

6.4 Water Allocation Balance at Base Dam

The catchment area at the Base dam is 126.2 km^2 implying that the discharge at 3KD06 can be scaled by a factor of 1.46 in proportion to the increase in the catchment area. The corresponding values for the water balance are as shown in Table 5-3. This demonstrates that there is sufficient flood volume at the Base Dam Site to support an additional allocation of 8,000 m^3/day.

Table 5-3 Water Allocation Balance at Base Dam Site

Item	m^3/day	MCM/yr	Comment
Allocable Flood Water	148,664	43.41	Annual Flood volume (Q > Q80), assumes all flood flow available for use (i.e. sufficient storage)
Water Allocated	22,000	8.03	Table 5-1
Balance	**126,664**	**35.38**	
New Allocation	8,000	2.92	Proposed 8,000m^3/day x 365 days
Net Balance	**118,664**	**32.46**	

If the alternative method is used to compute the allocable flood volume, then the existing floodwater allocation of 8.03 MCM/yr can be met or exceeded 62% of the years. With the additional allocation, the total allocation of 10.95 MCM/yr could be met or exceeded in 60% of the years.

This analysis indicates that there is sufficient flood water to justify the additional allocation of 8,000 m^3/day to Base, although due to streamflow variability, Base will not have 100% reliability.

The next section looks at reservoir yield to determine the level of reliability that can be expected.

7. RESERVOIR SIMULATION

7.1 Introduction

The reservoir model RESSIM was established for the Base Dam to evaluate different demand scenarios. Further details on RESSIM have been provided in Section 4.

7.2 Input Data

7.2.1 Discharge

The discharge inflow consisted of the 3KD06 calculated discharge scaled for the Base Dam Site for the period 15/03/2003 to 02/12/2019.

7.2.2 Rainfall

The Shimba Hills Settlement rainfall record was used to estimate rain caught on the reservoir area.

7.2.3 Evaporation

Mean monthly evaporation based on Base data is as shown in Table 6-1.

Table 6-1 Mean Monthly Dam Abstraction, EWR and Evaporation

Month	Average of Abstr (m^3/d)	Average of EWR (m^3/d)	Average of Evapo (mm)
Jan	19,489	2,801	6.63
Feb	17,272	2,775	7.29
Mar	13,007	2,813	6.68
Apr	11,920	3,131	6.07
May	10,657	8,632	5.13
Jun	13,079	6,886	5.10
Jul	17,727	3,953	4.81
Aug	16,570	3,304	5.39
Sep	14,895	3,100	6.10
Oct	14,124	7,100	6.42
Nov	15,564	9,923	6.23
Dec	17,474	5,876	6.55
Total	**15,227**	**5,150**	**5.99**

7.2.4 Environmental and Domestic Releases

The model simulation used Q95 value of 0.027 m^3/s (2332.8 m^3/day) and Q80 value of 0.056 m^3/s (4,838.4 m^3/day). This is marginally lower than the average of the actual releases from the dam of 5,150 m^3/day which implies that Base is releasing more than the Q80.

7.2.5 Dam Abstraction

The daily dam abstraction fluctuates in response to mining activities, water resource availability and permits restrictions as shown in Figure 6-1, Table 6-1 and Table 6-2. This shows that abstraction has increased to a 2019 average value of 18,260 m^3/day.

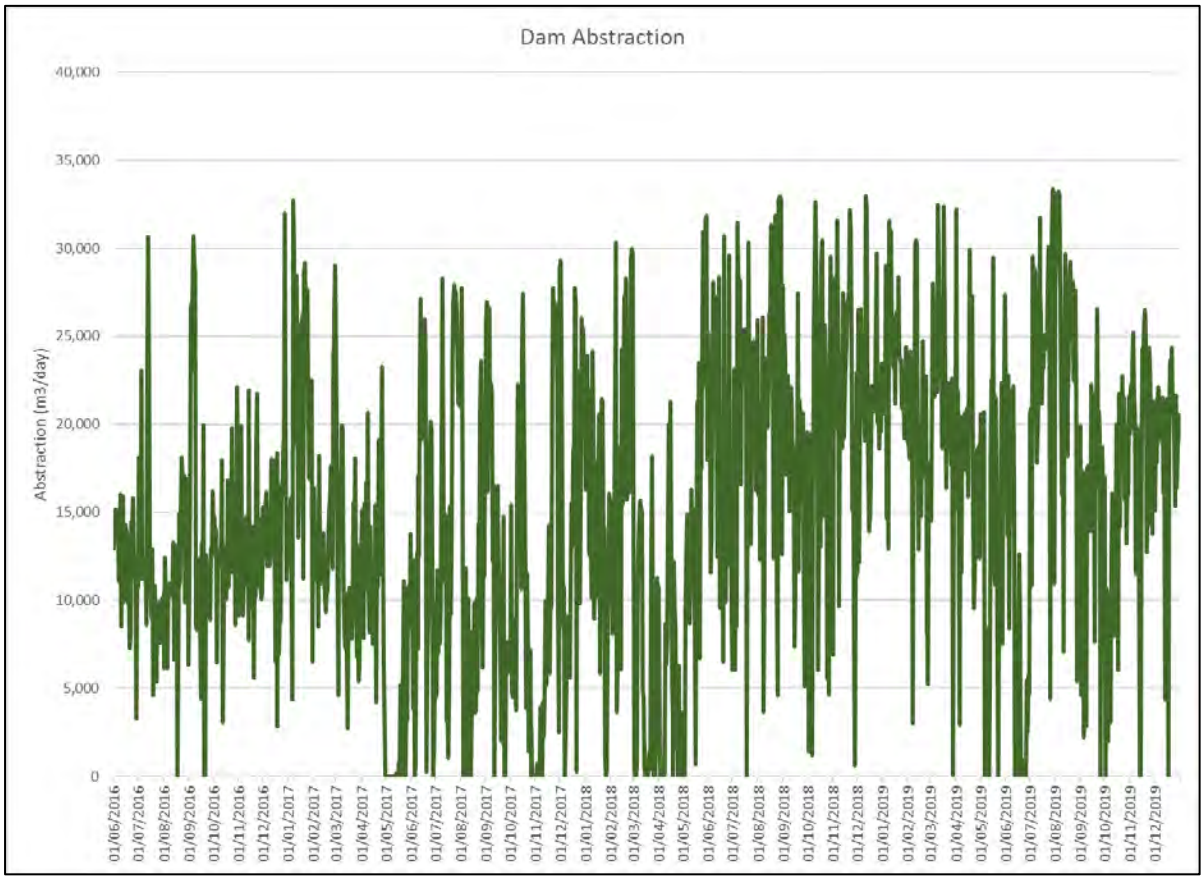

Figure 6-1 Base Dam Daily Abstraction

Table 6-2 Mean Annual Abstraction

Year	Average of Dam Abstraction (m^3/d)
2016	12,754
2017	12,197
2018	16,678
2019	18,257
Average	**15,227**

7.2.6 Model Validation

Figure 6-2 presents a comparison of observed dam water levels with simulated water levels based on different demand scenarios. The reservoir model assumes a static demand throughout the simulation whereas in reality the demand was changing as seen from Figure 6-1 and Table 6-2. However close examination of the water level during the drought of 2016-2017 indicates that a simulated demand of 12,000m^3/day provides a reasonable reproduction of the observed dam water levels. The simulated demand is reasonably consistent with the actual demands throughout this period. This gives us confidence that the reservoir simulation model provides a fair tool to evaluate different demand scenarios.

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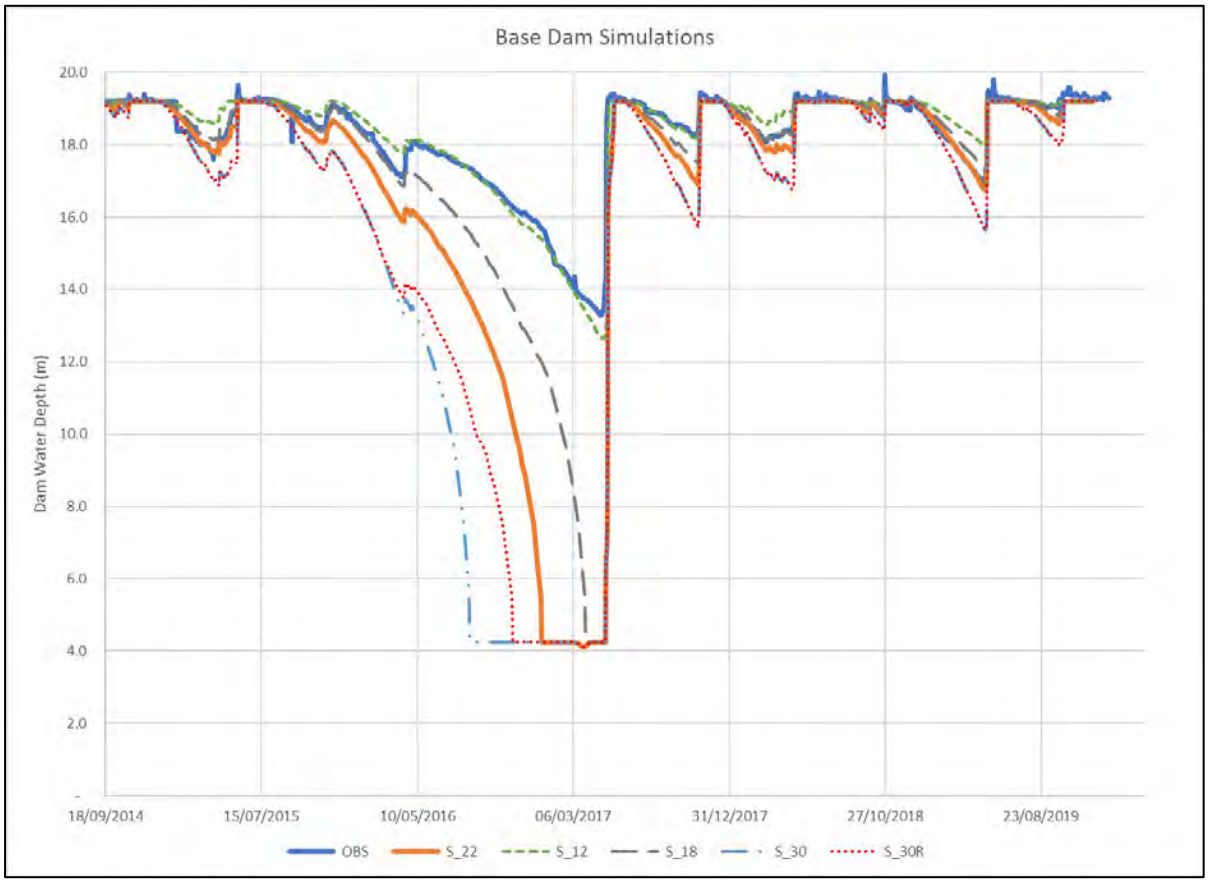

Figure 6-2 Observed and Simulated Dam Water Levels

7.2.7 Demand Scenarios

Demand scenarios to reflect the range of possible demand conditions have been selected as shown in Table 6-3. The yield reliability results are presented in Table 6-4 and Figure 6-2.

Table 6-3 Reservoir Simulation Scenarios

Scenario	Daily Demand (m^3/day)	Condition
S_12	12,000	Reflects lower boundary of abstraction typical of 2017
S_18	18,000	Reflects abstraction typical of 2019
S_22	22,000	Reflects current permitted allocation
S_30	30,000	Reflects current permit plus proposed allocation
S_30R	H>15m D=30,000 10<H<15 D=22,500 H<10m D = 15,000	Same as S_30 but with rationing for different reservoir depths H

Table 6-4 Yield Reliability for Reservoir Demand Scenarios

	Demand Scenario				
Abstraction (m^3/day)	**S_15**	**S_18**	**S_22**	**S_30**	**S_30R**
= 30,000				75%	55%
= or >22,000			88%	76%	75%
= or > 18,000		95%	88%	76%	75%
= or >15,000	99%	95%	88%	76%	85%
<15,000	1%	5%	12%	24%	15%

The results for the S_30 simulation show that the full demand of 30,000 m^3/day can be met 75% of the time over the 17-year simulation. If the abstraction is rationed (Scenario S_30R) from 30,000 m^3/day when water levels have dropped then the likelihood of meeting a demand equal to or greater than 15,000m^3/day goes from 76% to 85%.

The scenarios S30 and S30R were investigated to see the nature of the supply deficit and whether this deficit can be made up of existing or proposed groundwater abstraction. Table 6-5 presents the results which indicate that 75% of the time the supply deficit is less than 10,000 m^3/day. This implies that Base should adopt operating rules for the dam to keep the supply deficit within the range that can be met by permitted groundwater abstraction.

Table 6-5 Probability of Supply Deficit

	Probability	
Supply Deficit (m^3/day)	**S_30R**	**S_30**
<5,000	55%	76%
<10,000	75%	76%
<15,000	75%	76%
<20,000	86%	77%

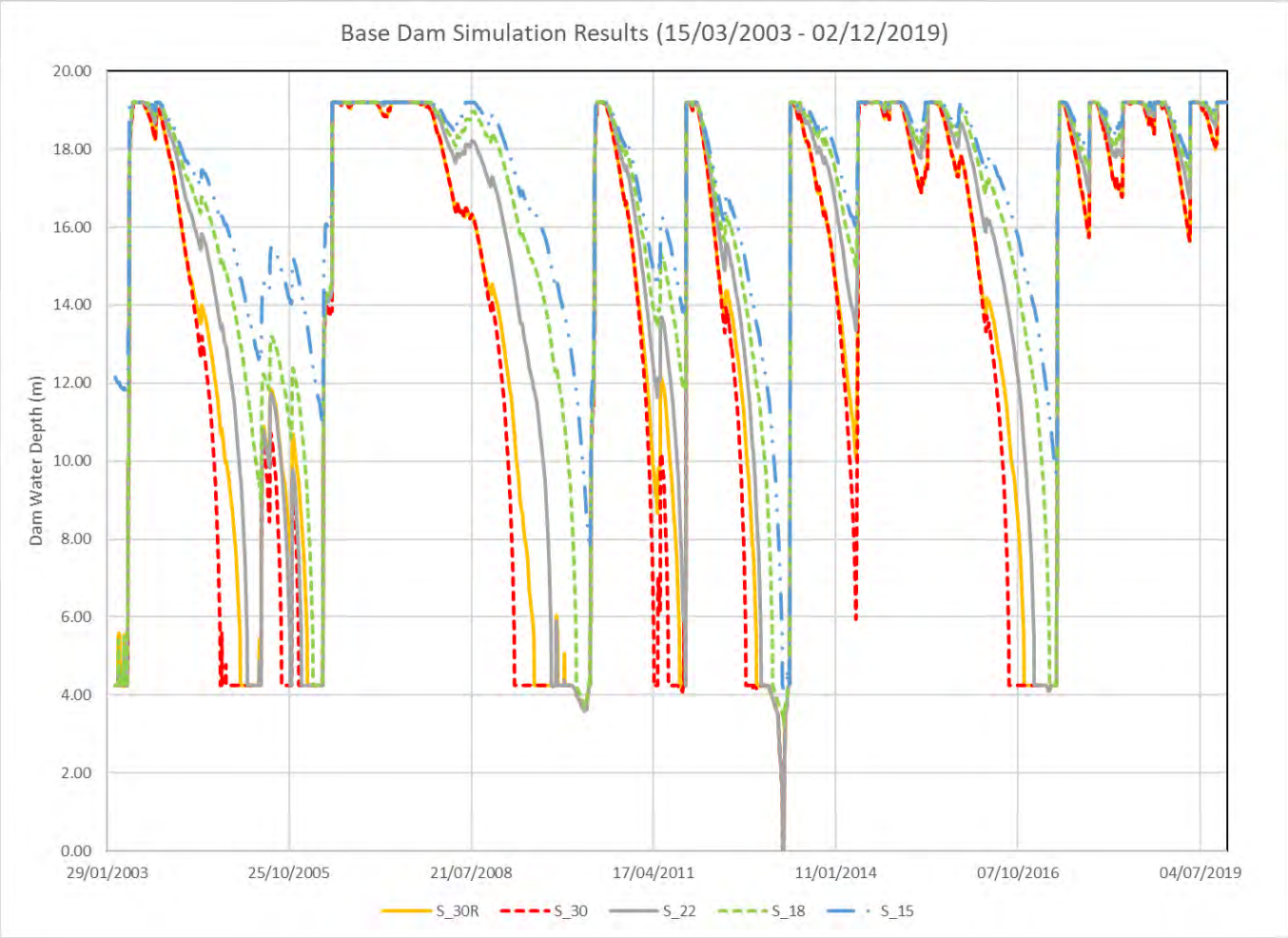

Figure 6-3 Reservoir Simulation Results for Different Demand Scenarios

8. HYDROLOGICAL ANALYSIS OF OTHER CATCHMENTS

The scope of work anticipated that the hydrological assessment would cover the following catchments:

- Mkurumudzi river;
- Ramisi river;
- Mwachema;
- Pemba – if the other watercourses prove to hold insufficient water resources.

The Maps in Appendix F indicate the location of the catchments neighbouring the Mkurumudzi.

However, as stated in Section 4, the methodology for this analysis was to review the availability of the water resources on the Mkurumudzi, and only if needed to evaluate the water resources on the other catchments.

From the preceding analysis on the Mkurumudzi, it would appear that there is reasonable justification to state that the Mkurumudzi has sufficient flood water resources to support a permit application for an additional 8,000 m^3/day. It would, therefore, follow that an analysis of the other catchments is not required at this time.

9. CONCLUSIONS

9.1 Hydrological Analysis

- The river gauging station 3KD06 on the Mkurumudzi River provides a reasonable record of water levels dating back to 1959 with significant gaps between 1988 and 2002;
- There have been several studies to develop a suitable discharge rating curve for 3KD06. Preceding rating curves were seen to over-estimate flood flows. It was noticed that at high flows the bridge acts as a constraint as does the thick riparian vegetation downstream of 3KD06. The most recent study (Wara et al. 2019) makes use of the hydrodynamic model HEC-RAS to develop a rating curve which incorporates pressurised flow under the bridge at high flows and high manning n values for the flood plain.
- The HEC-RAS derived rating curve has been used to develop a discharge time series for 3KD06 as it better reflects the flow conditions and provides a more conservative estimate of discharge;
- Comparison of flow between 1959-1987 and 2003 – 2019 indicates that the flow pattern in the more recent period has lower low flows and high flood peaks, but is otherwise lower than for the earlier period.
- The 2003 – 2019 period has therefore been adopted for the analysis as it is considered a better reflection of current hydrological and climatic conditions, and is more conservative.
- The 7,000 m^3/day drainage from the central dune back to the dam does not affect the hydrological analysis of inflow to the dam as this is based on flows at 3KD06 which is above the dam site.

9.2 Surface Water Allocation

- The Water Act 2016 and the Water Allocation Guidelines (WRA 2010, 2019) provide a framework for apportioning the water for different uses.
- Water for commercial purposes (e.g. mining and irrigation) are allocated from flood flows;
- Flood flows are defined as the portion of the flows that is greater than Q80 or the flow that is exceeded 80% of the time;
- Environmental flows or the Reserve is currently defined as Q95.
- Flows below the Q80 are called normal flows and these are apportioned for domestic purposes.

9.3 Water Allocation Balance

- The WRA adopted method to calculate the allocable floodwater volume, using the flow duration curve, estimates an annual floodwater volume of 70.51 MCM/yr for the catchment (equivalent to 241,487 m^3/day);
- The total existing allocation on the Mkurumudzi catchment is 117,000 m^3/day. This has been converted to an estimated 32.92 MCM/yr;
- The water allocation balance is positive and can support an additional allocation of up to 8,000m^3/day or 2.92MCM/yr;
- The allocable flood volume at the Base Dam Site is estimated at 43.41MCM/yr;

- Total allocation at the Base Dam Site was 22,000m^3/day or 8.03 MCM/yr which would increase to 10.95MCM/yr with the proposed additional allocation;
- The water allocation balance at the Base Dam Site was evaluated and can support an additional allocation of up to 8,000 m^3/day;

9.4 Reservoir Simulation

- The RFL reservoir simulation program RESSIM was established to evaluate the yield reliability given different demand scenarios, given an environmental flow release of 2,333 m^3/day (0.027m^3/s) and a domestic demand allocation demand of 2,506 m^3/day;
- A 22,000m^3/day demand for Base can be met 88% of the time. A demand of 30,000 m^3/day can be met with a 75% reliability, based on reservoir simulation for the period 2003 to 2019;
- Base can influence the surface water supply deficit by adopting dam operating rules that reduce abstraction when dam water level drops. This can help to keep the water supply deficit within the range of what can be met by permitted groundwater abstraction;
- The 7,000 m^3/day drainage from the central dune means that the net abstraction from the dam is essentially 7,000 m^3/day less than the actual abstraction. The analysis has provided for a range of abstraction from 15,000 m^3/day to 30,000 m^3/day.
- This analysis does not indicate any change is required to the dam releases for environmental compensation flows.

9.5 Hydrological Analysis of other Catchments

- The hydrological analysis of the other catchments (Ramisi, Mwachema, Pemba) is not required at this time as it appears that the Mkurumudzi can support the additional permitted abstraction.

10. RECOMMENDATIONS

10.1 Hydrological Monitoring

- The hydrological analysis is heavily dependent on the observed water levels at 3KD06. This study recommends that Base continues to support the record-keeping at this station, given its importance for decision making;
- While Base is releasing environmental flows from the dam, there is no guarantee that these flows reach the lower part of the catchment. It is in Base's interest to see that flows are properly recorded downstream for which WRA has adopted a river gauging station established by the UpGro project at the KISCOL weir.

10.2 Surface Water Allocation

- The surface water allocation balance indicates that there is sufficient flood water to support up to 8,000m^3/day additional allocation with sufficient safeguards for environmental flow releases and domestic users;
- However, given the variability in rainfall and surface flows, the additional allocation does not guarantee Base Titanium that it can extract an additional 8,000m^3/day on top of its existing allocation of 22,000m^3/day with 100% reliability. The reservoir simulation indicates that full demand for 30,000m^3/day can only be met 75% of the time.
- Reliability can be improved if Base adopts dam operating rules that reduce abstraction when dam water levels drop and meet supply deficits through conjunctive use with groundwater;
- It is therefore recommended that Base has sufficient capacity and permitted allocation to make up the water supply deficit from groundwater as and when surface water resources are insufficient.

10.3 Surface Water Permit Application

- We recommend the preparation of a Hydrological Assessment Report to support a permit amendment for an additional of 8,000 m^3/day from the dam;
- The WRUA should be carefully sensitised on the findings of the hydrological analysis and water allocation balance, with emphasis on the fact that it is flood water that will be utilised and that the environmental flow releases will remain unchanged;
- Apply to WRA for an ammedment to the existing surface water permit for an additional 8,000 m^3/day from the dam.

10.4 Drainage Flow from Central Dune

- If WRA are concerned about an additional allocation of 8,000 m^3/day, Base could investigate provisions to capture and recycle the drainage from the central dune in a similar arrangement to the drainage from the TSF.

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APPENDIX A

TERMS OF REFERENCE

Following mineral resource exploration activities in the North Dune, Base Titanium are now progressing to a Pre-feasibility Study (PFS) to establish the economic viability of mining and recovering this resource, with the view of mining this resource in late 2023, following the completion of mining the South Dune and South Dune extension. Mining the North Dune will prolong the mine life by 4.5 to 5 years.

The North Dune has a low-grade material (~1.6%HM) with higher slimes content (~38%) requiring a high throughput estimated at 2,900-3,200 tph to make the project economical. A critical element for success of the project is that of a viable water supply, capable of supplying water at an estimate of between 5,000 m^3/day to 8,000 m^3/day additional to current water needs. A study to determine the possible water sources to meet this higher demand is therefore required as part of the PFS.

Information exists in the form of primary data collected over the past few years, further updated data sets from Base Titanium as well as existing hydrological and hydrogeological studies undertaken for the wider Kwale area. Using this information, the Consultant is to provide a collated assessment of all water resources options that Base Titanium could feasibly explore to meet the North Dune mining water demands.

To this effect, the Consultant is to provide the following:

- Surface and Groundwater supply options in terms of quantity available, quality, accessibility, and sustainability of yield (especially in dry conditions) to meet the projected increase in water demand.

- Very high-level pro's and con's analysis (including risks) for each water supply option using known data from past projects, or the Consultant's best professional judgment. Please note that a Cost-Benefit Analyses will be conducted by the Project Engineers once the options have been determined.

- Permitting implications for the most feasible options.

- Further data needs and information requirements for the most feasible water supply options selected.

(As received in the body of an email from Nick Okello on 28 February 2020.)

APPENDIX B

BASE DAM – HEIGHT-VOLUME-AREA DETAILS

Adjusted Elevation (mASL)	Depth (m)	Area (m^2)	Cumulative Volume (m^3)	Live Vol (m^3)	Comment
37	0.00	-	-	-	
38	1.00	2,836	1,418	-	
38.5	1.50	8,076	4,146	-	
40.5	3.50	30,342	42,564	-	
41.25	4.25	79,703	155,024	-	Bot Inlet
42.5	5.50	88,414	174,870	19,846	
44.2	7.20	153,860	405,891	250,866	Bot Inlet
44.5	7.50	165,409	446,659	291,635	
46.5	9.50	288,439	900,507	745,483	
48.5	11.50	466,857	1,655,802	1,500,778	
50.2	13.20	646,407	2,670,904	2,515,879	Top Inlet
50.5	13.50	678,092	2,850,039	2,695,015	
52.5	15.50	858,276	4,386,407	4,231,383	
54.5	17.50	1,067,164	6,311,847	6,156,823	
56.2	19.20	1,256,049	8,358,984	8,203,960	FSL
56.5	19.50	1,289,382	8,720,244	8,565,219	
58.5	21.50	1,621,855	11,631,481	11,476,457	
60	23.00	1,889,392	14,718,597	14,563,572	
60.5	23.50	1,936,604	15,263,382	15,108,357	

APPENDIX C

SURFACE WATER PERMITS

File No.	Source	App. Date	Applicant Name	Category	Type	Elevation	Volume of Water	Details
WRMA/30/MSA/3K/10084/S	SW	29/07/2010	BASE	D	ABSTR	48	22000	Base Dam Dam
WRMA/30/MSA/3K/10258/S	SW	19/04/2019	KISCOL	D	ABSTR	20	30,000	Lower Koromojo
WRMA/30/MSA/3K/10260/S	SW	19/04/2019	KISCOL	D	ABSTR	15	30,000	Lower Koromojo
WRMA/30/MSA/3K/10805/S	SW	24/07/2012	KISCOL	D	STORE	28		Upper Koromojo
WRMA/30/MSA/3K/10824/S	SW	27/08/2012	KISCOL	D	ABSTR	14		Mkurumudzi River, Weir
WRMA/30/MSA/3K/10824/S	SW	27/08/2012	KISCOL	D	STORE	18	12,000	Kitaruni Dam
WRMA/30/MSA/3K/10825/S	SW	04/07/2012	KISCOL	D	ABST	40	10,000	Mkurumudzi Dam
WRMA/30/MSA/3K/10836/S	SW	28/08/2012	BASE	A	STORE	55	0	Settlement Ponds
WRMA/30/MSA/3K/10837/S	SW	28/08/2012	BASE	A	STORE	52	0	Settlement Ponds
WRMA/30/MSA/3K/10838/S	SW	28/08/2012	BASE	A	STORE	49	0	Settlement Ponds
WRMA/30/MSA/3K/11287/S	SW	11/09/2014	KISCOL	D	STORE	25	6000	Kitaruni Dam
WRMA/30/MSA/3K/12042/S	Surface Water	31/07/2017	BASE TITANIUM LTD	D	FORM 001C	49	13,000	Rainwater collection in Settlement Ponds

APPENDIX D

MOWIS DISCHARGE MEASUREMENTS

Gauge height and discharge

Time	Water Level [m]	Discharge 3KD06 [m^3/s]	Time	Water Level [m]	Discharge 3KD06 [m^3/s]	Time	Water Level [m]	Discharge 3KD06 [m^3/s]
27-09-61	0.83	5.852	23-02-78	0.09	0.038	26-03-82	0.35	0.096
12-07-66	0.46	0.999	07-03-78	0.07	0.030	16-07-82	0.55	0.959
23-11-66	0.14	0.189	03-04-78	0.12	0.199	08-06-83	0.64	2.584
10-01-67	0.09	0.097	26-04-78	0.15	0.093	15-02-84	0.56	0.082
16-02-67	0.09	0.104	03-05-78	0.46	0.851	21-06-84	0.23	0.357
23-05-67	0.45	0.948	15-05-78	0.52	1.460	17-07-84	0.27	0.443
21-01-69	0.30	0.522	20-05-78	0.51	1.220	16-08-84	0.18	0.252
26-02-69	0.26	0.478	23-06-78	0.55	1.589	11-09-84	0.16	0.264
06-07-70	0.22	0.487	16-08-78	0.22	0.256	11-11-84	0.99	0.108
25-03-71	0.09	0.083	21-09-78	0.11	0.049	17-11-84	0.24	0.430
20-11-74	0.07	0.026	21-11-78	0.25	0.349	26-04-85	0.06	0.074
24-07-75	0.07	0.063	23-01-79	0.16	0.10	08-05-85	0.39	1.104
09-09-75	0.05	0.050	04-07-79	0.47	1.008	16-05-85	0.57	3.698
25-09-75	0.07	0.059	02-10-79	0.03	0.351	25-07-85	0.21	0.336
11-11-75	0.54	1.356	17-11-79	0.33	0.303	31-07-85	0.33	0.633
03-10-77	0.06	0.030	23-02-80	0.09	0.044	15-08-86	0.13	0.130
08-10-77	0.08	0.036	16-07-80	0.09	0.039	20-11-86	0.08	0.086

Time	Water Level [m]	Discharge 3KD06 [m^3/s]	Time	Water Level [m]	Discharge 3KD06 [m^3/s]	Time	Water Level [m]	Discharge 3KD06 [m^3/s]
02-11-77	0.26	0.578	26-09-80	0.11	0.144	26-03-87	0.06	0.060
08-11-77	0.64	2.230	05-01-81	0.05	0.043	26-03-87	0.22	2.110
08-12-77	0.18	0.298	17-07-81	0.10	0.075	06-05-87	0.14	0.166
22-12-77	0.24	0.360	11-11-81	0.17	0.227	06-05-87	0.53	5.860
26-01-78	0.10	0.052	26-01-82	0.06	0.015			

Note: Highlighted values are considered outliers.

APPENDIX E

OBSERVED 2013 SURFACE WATER ABSTRACTIONS IN MKURUMUDZI CATCHMENT

Sno.	River	Easting	Northing	Name	Category of Abstractor	Abstraction Structure	Measured Abstraction Rate [m^3/day]	Authorized Abstraction Rate		Class of Abstractor	Compliance	Notes
								Flood Flow [m^3/day]	Normal Flow [m^3/day]			
1	Mkurumudzi	547911	9525580	Majimboni Water Project	Group-CBO	Weir with fixed pump	125.00			**Class C**	Not Compliant	
2	Mkurumudzi	546277	9522653	Shake Mshimba	Individual	Portable Pump	5.00			**Class A**	Not Compliant	Pumps once every 3 Months
3	Mkurumudzi	546611	9523094	Christine Machila	Individual	Portable Pump	10.12			**Class B**	Not Compliant	Pumps once every 3 Months
4	Mkurumudzi	546242	9522616	Peter Mwadime	Individual	Portable Pump	2.44			**Class A**	Not Compliant	Pumps once every 3 Months
5	Mkurumudzi	546500	9519734	Henry Musa Mwakalu	Individual	Portable Pump	3.11			**Class A**	Not Compliant	Pumps once every 6 Months
6	Mkurumudzi	546500	9519734	Mutuku Kyengo	Individual	Portable Pump	3.11			**Class A**	Not Compliant	Pumps once every 6 Months
7	Mkurumudzi Tributary	544678	9521982	Kiseko Dam	Group-CBO	Dam					Not Compliant	Community Dam
8	Mkurumudzi	546121	9521460	John Muli	Individual	Portable Pump	10.00			**Class A**	Not Compliant	Pumps once every 3 Months

Sno.	River	Easting	Northing	Name	Category of Abstractor	Abstraction Structure	Measured Abstraction Rate [m^3/day]	Authorized Abstraction Rate		Class of Abstractor	Compliance	Notes
								Flood Flow [m^3/day]	Normal Flow [m^3/day]			
9	Mkurumudzi	546588	9519202	Majimboni Muungano Self Help Water Project	Group-CBO	Weir with fixed pump	336.96			**Class C**	Not Compliant	
10	Mkurumudzi	547132	9519303	Unknown	Individual	Portable Pump					Not Compliant	
11	Mkurumudzi	547715	9519118	Ndunge Robert	Individual	Portable Pump	10.12			**Class B**	Not Compliant	
12	Mkurumudzi	547403	9513291	Mkurumudzi Dam	Company	Dam	0.00	22,000	2,000	**Class D**	Authorization	Under Development
13	Mkurumudzi	549709	9509670	KISCOL Mkurumudzi Dam	Company	Dam	0.00	10,000		**Class D**	Authorization	Under Development
14	Mwabanda River	548531	9509585	Upper Koromojo Dam	Company	Dam	0.00	-		**Class D**	Authorization	Under Development
15	Mwabanda River	550945	9509231	Lower Koromojo Dam	Company	Dam	0.00	30,000		**Class D**	Permit	
16	Mkurumudzi	551111	9509393	Mkurumudzi Weir	Company	Weir with fixed pump	0.00	30,000		**Class D**	Authorization	Under Development
17	Lagga into Mkurumudzi	551629	9509565	Kitaruni Dam	Company	Dam	0.00	12,000		**Class D**	Authorization	Under Development

Sno.	River	Easting	Northing	Name	Category of Abstractor	Abstraction Structure	Measured Abstraction Rate [m^3/day]	Authorized Abstraction Rate		Class of Abstractor	Compliance	Notes
								Flood Flow [m^3/day]	Normal Flow [m^3/day]			
18	Mkurumudzi	552608	9507657	Msambweni Irrigation Project-MoWI	Group-CBO	Weir with furrow					Not Compliant	

APPENDIX F

MAPS

Preliminary Sub-Basins: Base Titanium Water Sources

38°0'0"E 38°30'0"E 39°0'0"E 39°30'0"E

3°30'0"S 4°0'0"S 4°30'0"S

N W E S

Mashimoni
Upper Mwatate
Middle Bura
Kavisago
Lower Mwatate
Moda Mengo
Lower Bura
Bunguta
Kirongwe Rukinga
Birikani
RUKANGA
Rukanga
BUNGULE
Bura Kisugunua
Kizima Bomani
Gombo Bomani
MAKINNON ROAD
Magombe Shariani
TARU
Manjewa
SILALONI
Mwaruphesa Dambale
MARUVESA
Mwang'ombe
SAMBURU
Gude Dambale
Nyongoni
Mwang'ombe Ngoni
Chigulu Ngeyeni
Upper Mwache
Mwachiga
Barani
KILIBAZI
Dare
Kwamgola Migongoni
Mlunguni
MTAA
Mazola Mienzeni
Nzovuni Gandini
Marenje Mlunguni
SHAMBINI
Mwadudua Vigurungani
MAZOLA
BANGA
Ndokoko Lukakani
Kivindara
Mwatate Nikipitao
Puma
KINANGO
KINANGO
Mwainzi
Gulanzi Mienzeni
KWALE
LIKONI
Mbuguni
NGOMBENI
MATUGA
WAA
TIWI
Tsimba Tiwi
UKUNDA
Lower Lukakani
Murinjo Kiraze
Siranga
Upper Ramisi
Mukungani Kanyumbuni
GULANZE
MIHIRINI
Mbadzi
TSEREZANI
NDAVAYA
Mwachinjoro
Magombani Kirindini
Gandini
Kilingoni Tiribe
Lovu Kibuyuni Mwazare
MWERENI
MWABUNGU
Umba
Lungalunga Upper Umba
Mwena Mwangulu
Eastern Dzombo
Muhaka Ukunda
GAZI
Mkurumudzi
Mwena Miuyuni
MRIMA
Mrima
MSAMBWENI
Ramisi
MGOMBEZI
DERANI
RAMISI
KAMBINI
LUNGA-LUNGA
Lower Mwena
KIDIMU
Lower Umba
SHIMONI
Mombasa
Kombeni

KILIMANJARO
TANGA

Legend

- Town
- River
- Road
- WRUA Boundary
- Special Mining Lease Area

Sub-Basin

- 3K
- 3MA
- 3MB
- 3MC
- 3MD2

Kilometers
0 5 10 20 30 40

Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

Preliminary Sub-Basins: Base Titanium Water Sources

39°0'0"E

39°30'0"E

4°30'0"S

MAZOLA
BANGA
KINANGO
GULANZE
MIHIRINI
TSEREZANI
NDAVAYA
MWERENI
KWALE
MTONGWE
NGOMBENI
MATUGA
WAA
TIWI
UKUNDA
MKURUMUDZI
MUHAKA
MWABUNGU
GAZI
MSAMBWENI
RAMISI
KIDIMU
SHIMONI
VANGA
MRIMA
DERANI
MGOMBEZI
KAMBINI
LUNGA-LUNGA

Gulanze
Kinango
Kwale
Ramisi
Tiwi
Ukunda
Ukunda
Kidogoweni
Mkurumudzi
Muhaka
Vanga
Mkinga
Kanana

Madaadi (Sali)
Mwatate
Nekipitao
Puma
Puma (Mwamandi)
Ndauni
Mienzeni
Mkononi
Ndzovuni
Adzo Vuni
Cha shimbo (Pemba)
Kadivago
Kitsantse
Chombo
Manjera
Malulomi
Kukwera
Ramisi (Sali)
Ngonde
Rwala (Songoni) (Sali)
Kithingoni
Pemba (Mare)
Mbadzi
Mabu
Paka
Mwangwei
Mwachema
Dem Weni
Maragoya
Mwangoni
Mukurumudzi
Muhaka
Mtawa
Kidogoweni
Mkundi
Choro Choro
Ramisi
Mukomoto
Lovu
Mwazare
Mkamba
Umba
Mchongo
Ndonyo
Gonda
Mwena
Tidal
Mwakwembe
Mto Aleni
Mto Pongwe
Mto Umba
Mto Mdoweni
Mto Kikurangi
Mto Divinje
Miuyuni
Mwena Mangoni Stream

628 m
556 m
266 m
536 m
184 m

Legend

- Town
- Road
- Main River
- River
- Special Mining Lease Area
- North Dune
- KISCOL Land

Sub-Basin

- Kidogoweni
- Mkurumudzi
- Muhaka
- Ramisi
- Tiwi
- Ukunda

N W E S

Kilometers
0 2 4 8 12 16

Coordinate System: Arc 1960 UTM Zone 37S
Projection: Transverse Mercator
Datum: Arc 1960
False Easting: 500,000.0000
False Northing: 10,000,000.0000
Central Meridian: 39.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

APPENDIX E GROUNDWATER SPECIALIST REPORT

Comprehensive Groundwater Resources Assessment Study for the.North Dune

FINAL REPORT

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23 June 2020

EXECUTIVE SUMMARY

This report describes groundwater resource development options for Base Titanium Ltd's proposed mining operations on the North Dune at their Kwale County mine.

Water demand

For a variety of technical reasons, mining the North Dune will require an additional 8,000m^3 of water per day. This would supplement existing surface water, groundwater and recycled water that is currently used in mining operations. If mining was to occur, it would commence in 2023 and finish before the end of 2028.

Geology ad hydrogeology

A major aquifer system, the "Msambweni aquifer system", underlies the western part of the Coastal Plain east of the mine. This is a confined aquifer comprising Mto Mkuu shales and sandstones, Kambe Limestones and Mazeras Sandstone (all of Jurassic age); this material is faulted and fractured and forms an efficient aquifer that can yield up to 250m^3/hr in properly constructed boreholes. The aquifer extends from Nikaphu in the south to the Muhaka Forest in the north and appears to be fault-controlled; it lies from 3.5 to 7km from the sea (its eastern edge is uncertain, however). It underlies an area of about 80km^2. It is recharged by rain falling on the eastern side of the Shimba Hills to the west, with water moving *via* faults and fractured material towards the east. The high capacity aquifer lies east of a fairly prominent fault that bisects the area, oriented south south west to north north east, one of a series of faults which are all approximately parallel; boreholes located west of this fault are substantially less efficient and incapable of meeting Base's water demand.

Aquifer recharge and allocable water

Aquifer recharge has been modelled. It ranges from 16,600 to 74,400m^3/d, with an average of 43,000m^3/d; the extensive variation in recharge is due to very variable rainfall variation. Previous studies have suggested that a 'safe' level of daily abstraction would be 30,000m^3/d, which we consider reasonable given the variation in recharge that the aquifer experiences.

Current water use

Estimated worst-case abstraction, based partly on an Authorisation database made available by the Water Resources Authority (WRA) and partly on known or inferred abstraction, is as follows:

- Base 9.540m^3/d (actual Water Permit value).
- Kwale International Sugar Company Ltd (KISCOL) 250m^3/d (estimate from late 2018).
- Public/community water supply 1,830m^3/d (based on Authorisation database).
- 'Other' users 300m^3/d (based on Authorisation database).

Borehole data in the database are somewhat unreliable, particularly for grid references (geographic location). We acknowledge that these estimates are crude at best (other than for Base).

KISCOL has at least 26 boreholes, with potential Permit abstraction of 12,650m^3/d; not all are equipped with pumps, and abstraction is believed to be relatively low partly for this reason, and partly because of generally beneficial rainfall (thus limiting the need for irrigation). KISCOL also abstracts water from four dams. Neither Water Permit values nor actual current abstraction levels are known.

The current total aquifer estimated level of abstraction, 11,920m^3/d, is comfortably within the allocable 30,000m^3/d.

Future water demand

In the future, it is planned to increase public and community water supply groundwater abstraction to 10,000m^3/d, an increase of 8,170m^3/d. The timeline for this development is unknown, despite attempts to find out from Kwale County. 'Other' groundwater user demand is not projected to change, as public water supply will improve and so may even reduce abstraction pressure on groundwater.

Any assessment of an application for a water permit has to consider maximum abstraction, which in the case of KISCOL during a drought year could reach 12,650m^3/d. In this situation, total daily abstraction would amount to 32,490m^3/d, not only exceeding the allocable yield but also eliminating any possibility of Base abstracting additional groundwater.

However, if the timing of proposed public water supply expansion is towards the end of the projected mine life (the end of 2028), there is potential scope to abstract a further 5,680m^3/d of water from the aquifer (this being existing abstraction by Base, community/public and 'other' water users; and assuming worst-case abstraction by KISCOL: 30,000 – (9,540 + 1,830 + 300 + 12,650) = 5,680m^3/d).

Recommendations

There are three recommended actions:

1. Due to the great uncertainties attached to actual current abstraction, a formal abstraction survey should be carried out across the entire aquifer, to determine with greater accuracy than the estimates above the current actual abstraction. This should follow standard WRA practice (a Manual has been developed for abstraction surveys).
2. Enter into discussions with Kwale County (and other water service providers) to determine when planned water supply development is planned; and make clear that if boreholes proposed by Base are constructed, they would be located in locations that meet Base's short-term needs, also meet the County's long-term needs.
3. If planned public water supply development is late enough that Base can make use of the residual 5,680m^3/d, formal applications may be made to the WRA. When doing so, three aspects need to be emphasized:
    - The utility of the abstraction survey to the WRA.
    - The uncertainty about KISCOL's actual groundwater permit volume; this has been impossible to ascertain, yet is essential in establishing allocable water. The actual Permit volumes constitute a more accurate worst-case abstraction value than the estimate made above.
    - The County groundwater development programme and its timeline, and how this will dovetail with the Base operational plan.

If the abstraction survey and actual KISCOL Water Permit data convincingly show that current and potential future drought abstraction is significantly lower than the estimates presented above, the application should be increased commensurately to a maximum of 8,000m^3/d.

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ABBREVIATIONS

BH	Borehole
CGK	County Government of Kwale
CSR	Cooperate Social Responsibility
CWSB	Coast Water Services Board
GIS	Geographical Information System
GW	Groundwater
IWRM	Integrated Water Resource Management
KISCOL	Kwale International Sugar Company Ltd
O&M	Operation and Maintenance
PVC	Polyvinyl Chloride
RFL	Rural Focus Ltd
TSF	Tailings Storage Facility
WRA	Water Resources Authority
WRM	Water Resources Management

UNITS OF MEASUREMENT

m	Metre
mamsl	Metres above mean sea level
mbgl	Metres below ground level
m^3/d	Cubic metres per day
MCM	Million cubic metres
mg/L	milligramme per litre (parts per million)
T	Transmissivity; the rate of flow under a unit hydraulic gradient through a cross-section of unit width across the entire saturated section of an aquifer
µg/L	microgramme per litre (parts per trillion)
µS/cm	Microsiemens per centimeter
yr	Year

NOTE: all grid references are expressed as Universal Transverse Mercator (UTM) coordinates based on the WGS84 datum, unless indicated otherwise. Where elevations are reported, they are expressed as metres above mean sea level (mamsl).

1. INTRODUCTION

1.1 Background

Base Titanium Ltd ('Base' hereinafter) has operated a minerals sands mine in the area west of Kinondo, in Kwale County, since October 2013. It has two 'resource zones', dubbed the Central and South Dunes, where mineral sand concentrations are sufficiently high to support commercial mining. A third 'resource area', the North Dune, hosts a lower concentration of mineral sands. Base is in the process of evaluating the North Dune resource to determine whether it is commercially exploitable. If mining was to take place, it would commence in mid-2024 and add 4.5 to 5 years to the mine life.

Error! Reference source not found. shows the key features of the area including the North Dune, the wellfield in the Gongoni Forest and the Mkurumudzi Dams.

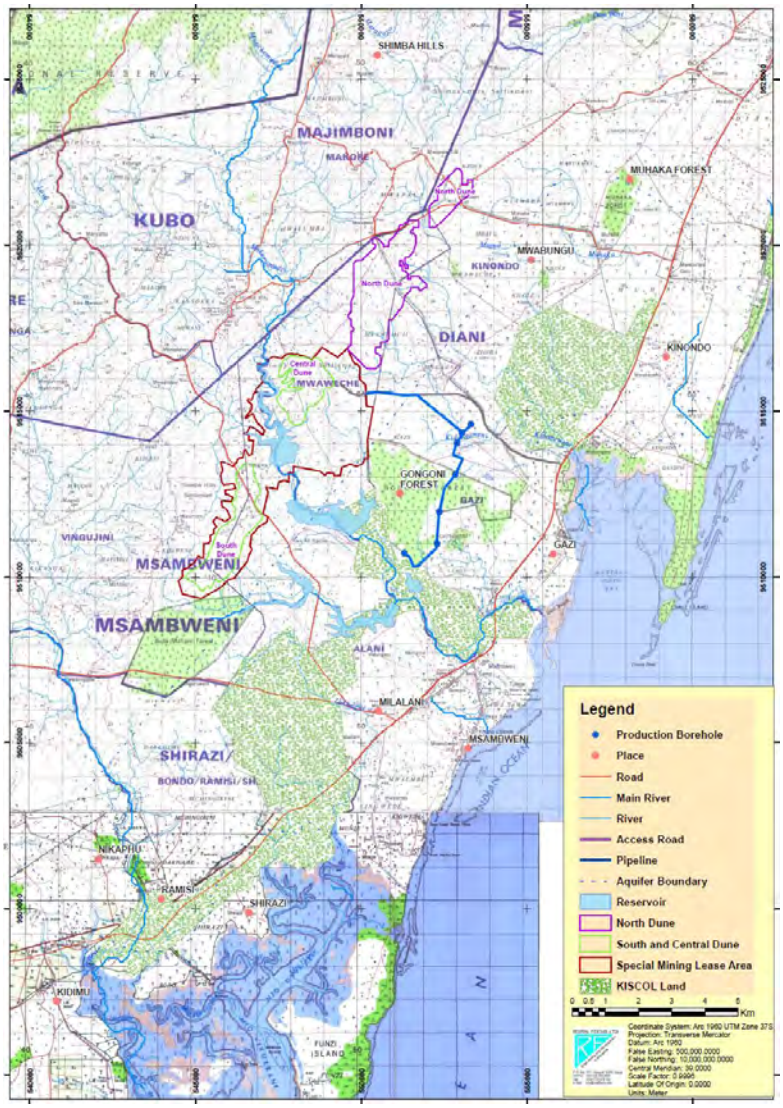

Figure 1.1 : Map of the Study Area

The mineral sands mining process is water-intensive; at present, a surface water permit for 22,000m^3/d exists for abstraction from the Mkurumudzi River (from a constructed reservoir of total capacity 8.4

million m^3 (MCM) and groundwater permits from six production boreholes located in the Gongoni Forest for a total of 9,540m^3/d. In addition to these sources of make-up water, the mine also recycles as much water as it can through the tailings storage facility (TSF); in recent months, this has ranged from 26,000 to 43,000m^3/d and is partly sensitive to rainfall.

1.2 North Dune Water Demand

Operations staff have calculated that additional water would be needed to mine the North Dune, due to the specific nature of the deposit. Estimates range from 5,000 to 8,000m^3/d. In this report, we assume that not less than 8,000m^3/d of additional water would be required, from all sources.

1.3 Scope of Works

Our detailed proposal is attached at Appendix 1, which details our proposed approach to the study. The outline Scope of Works provided by the Client succinctly summarises the outputs required as follows:

- "Surface and groundwater supply options in terms of quantity available, quality, accessibility, and sustainability of yield (especially in dry conditions) to meet the projected increase in water demand.
- "Very high-level pro's and con's analysis (including risks) for each water supply option using known data from past projects, or the Consultant's best professional judgment. Please note that Cost-Benefit Analyses will be conducted by the Project Engineers once the options have been determined.
- "Permitting implications for the most feasible options.
- "Further data needs and information requirements for the most feasible water supply options selected."

1.4 Approach to the Study

In broad terms, our approach to the study is driven by our existing understanding of the project area (where we have worked, in various roles, since 2010).

1.4.1 Previous RFL activities in and around the project area

Key reports and technical papers are listed in the References, as necessary to support the text; key roles or activities we have participated in within or near the study area are summarised below.

- 2010: World Bank Groundwater Governance Study, Kenya.
- 2011: environmental monitoring network design and surface geophysics, Base.
- 2011-2018: environmental monitoring data analysis and interpretation.
- 2012: surface geophysics and preliminary model, Gongoni aquifer; design and construction of dual piezometer monitoring boreholes, Gongoni Forest; community boreholes (Bwiti and Mivumoni) (including downhole geophysics at most sites).
- 2013: Construction and testing of Gongoni production boreholes 6 no.); community boreholes at Fihoni, Magaoni and Bumamani).
- 2014-15: Community boreholes (Kigombero, Kibwaga and Majimboni). Dual-piezometer borehole at Kinondo for saltwater intrusion monitoring.

- 2018-19: two exploratory boreholes (in the TSF); two production and monitoring boreholes in the Gongoni Forest.
- 2013-19: Unlocking the Potential of Groundwater for the Poor (UPGro, 2013-15); and Groundwater Risk Management for Growth and Development (Gro for GooD, 2015-19). A seven-year international research programme jointly funded by UK's Department for International Development (DFID), Natural Environment Research Council (NERC) and the Economic and Social Research Council (ESRC) focused on improving the evidence base around groundwater availability and management in Sub-Saharan Africa. Projects were interdisciplinary, linking the social and natural sciences to address this challenge. Major areas of interest/relevance; groundwater modelling and groundwater use sustainability.
- 2018-19: Improving Sustainable Groundwater Exploration with Amended Geophysics (ISGEAG). A project that aimed to apply traditional, existing and new geophysical methods in three reasonably well-researched areas (Kwale being one), to show the limitations of different geophysical methods, study the best combination for each context and improve the interpretation of the measurements. Major areas of interest/relevance; groundwater modelling inputs and deep penetration geophysics; saltwater intrusion measurement.

1.4.2 Water use in and around the study area – current understanding

The study area largely comprises subsistence and small-scale commercial agriculture. Water resources are relatively easily accessed, either from perennial and ephemeral streams or from shallow wells or boreholes, which are in widespread use across the study area (see e.g. Foster *et al*, 2019). The vast majority of wells and the older boreholes are constructed in a shallow unconfined aquifer (either the corals or sands, both of Pleistocene age – see S. 3.2 below).

There are two commercial activities in the area. Base's mineral sands mine, and the Kwale International Sugar Company Ltd ('KISCOL'). KISCOL leases land south and north east of the mine for irrigated sugar cultivation, which it processes at a process plant at Ramisi. KISCOL has numerous water resources it can call on:

- A large dam on the Mkurumudzi River (total storage capacity 10MCM).
- Two smaller dams on the tributary draining the area south west of the mine, the Koromojo River (capacities uncertain).
- A small dam south of the Gongoni Forest (capacity < 1MCM).
- A small dam on the Mtawa River (north east of the North Dune), which drains into KISCOL's irrigated fields at Kinondo (capacity uncertain).
- Up to 26 BHs (26 BHs have been constructed, though to the best of our knowledge not all of these have been equipped with pumps or are supplied with power). Their potential total pumping capacity is 12,650m^3/d on water permits (assuming 10 hours pumping per day at 60% of test yield).

Other small dams have been planned to supplement supply.

Abstraction data for KISCOL have proven elusive to obtain (see also S. 4.2.1 below on Water Permits). However, it is reasonably certain that since the excellent rains of 2017, continued elevated rainfall

across both long and short rains has meant that KISCOL has probably relied far less on groundwater resources than it does on surface water, at least in the recent past.

Base water resources were outlined in the opening section of this report. Water Permit details are given in Chapter 4.

Community groundwater use is relatively low key but is intensifying; a number of the community boreholes constructed by Base have been handed over to the Kwale County Government for electrification and greater use. These BHs would typically be able to pump 100 to 150m^3/d on Permit, with at least four BHs so far earmarked for this treatment (Fihoni, Bumamani, Magaoni and BH8). This would increase abstraction by a maximum of 600m^3/d, and represents a pattern that is likely to increase in the next decade.

The County Government intends to increase groundwater abstraction from the "Msambweni aquifer system" by 10,000m^3/d for public water supply (MWI/KCG, 2017). The timeline for this development is unclear, but discussions between the CWSB, the County Government and Gro for GooD suggest that this would be achieved in the next ten years or so.

2. CLIMATE AND RAINFALL

2.1 Summary

The climate of the study area has been studied in considerable detail in recent years, and there is little point in repetition (see, for example, Base (2017) or any of the Base Annual Environmental Reports).

The climate is typical of the Coastal Strip, with bi-modally distributed rains; mean annual rainfall ranges from 1,000 to 1,400mm/y east of the Shimba Hills falling to <1,000mm/yr west of the Hills. Year on year rainfall variation is highly significant and plays a prominent role in water resource sustainability; poor rainfall years not only lead to less runoff and so less reliable surface water; they also lead to poor groundwater recharge and declining groundwater levels (*pers. comm.* Base Titanium Ltd; see also Ramos *et al*, 2020). The significance of rainfall intensity on groundwater recharge has also been found to be of immense significance as has recently been determined in other tropical African aquifers (Owor *et al*, 2009; Jasechko *et al*, 2014; Seddon *et al*, 2016; and Kolusu *et al*, 2018). For the explicit Kwale context see Ferrer *et al* (2019a).

Actual monthly rainfall and annual totals are tabulated below for the past 16 years for the key gauge at Shimba Hills, which has a near-continuous record extending back to 1951 (data supplied by Base).

Table 2.1 : Rainfall at Shimba Hills Index Gauge

Yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
2004	94	12	1	158	100	156	57	35	40	150	67	47	917
2005	50	0	67	208	291	189	224	75	53	70	193	4	1,424
2006	7	1	119	407	334	420	169	195	180	497	547	225	3,100
2007	3	13	45	236	814	183	168	150	76	108	87	58	1,942
2008	62	0	44	187	255	164	154	58	40	96	173	19	1,251
2009	46	35	6	141	123	199	135	67	14	165	49	33	1,013
2010	44	0	51	219	502	265	108	44	68	106	170	3	1,580
2011	0	39	12	213	379	82	49	68	190	536	99	60	1,726
2012	0	4	2	72	281	96	62	58	14	96	113	94	892
2013	16	0	95	196	431	110	45	102	35	139	169	27	1,365
2014	0	13	64	129	569	203	186	83	40	128	183	264	1,862
2015	0	0	109	240	503	99	92	52	19	85	258	26	1,483
2016	28	2	20	279	71	67	20	46	48	2	96	61	739
2017	2	2	50	134	502	54	28	57	94	95	307	25	1,350
2018	0	9	153	128	374	183	124	81	115	194	49	103	1,513
2019	4	13	25	16	696	96	49	65	140	611	188	165	2,068
Mean	**34**	**14**	**62**	**199**	**331**	**143**	**108**	**76**	**69**	**149**	**137**	**74**	**1,396**

Year on year variation is marked, as can be seen. 2016, which is the lowest annual rainfall total in the entire time series (1951-86 and 1999 to the present), saw a protracted drought and considerable suffering in Kwale County (Ferrer *et al*, 2019a).

3. GROUNDWATER RESOURCES

3.1 Introduction

What follows is a general review of groundwater resources in the study area; by "study area" we refer broadly to a rectangle extending from Nikaphu in the south (located south west of Ramisi) to the middle of the Muhaka Forest in the north, and from the Shimba Hills to the oceanic front.

The general review is followed by a more detailed description of the main groundwater resource that Base and KISCOL exploit, in particular the characteristics or features that influence sustainability.

3.2 Groundwater resources in the study area

Groundwater is a very significant component in water supply in Kwale County; according to a socio-economic survey of 2,737 households across Kwale County carried out in 2017 (MWI/KCG, 2017), 45% of respondents relied on a groundwater resource to meet water demand; this rises to 69% in Msambweni Sub-county. Groundwater is widely available across the study area in a variety of shallow unconfined and deep semi-confined aquifers. These comprise the following.

- A shallow unconfined aquifer located in Pleistocene coral limestone (Plc) adjacent to the sea, heavily exploited by shallow wells and shallow boreholes. Yields in boreholes and wells can approach 15m^3/hr.
- A shallow unconfined aquifer in Pleistocene sands and corals (Pls), also heavily exploited by shallow wells and boreholes. This unit lies between the eastern edge of the Coastal Hills and the western edge of the corals. Yields rarely exceed 6m^3/hr.

  The two Pleistocene units are heavily exploited for domestic and commercial uses and are already affected by saline intrusion in some places (Tole, 1997; data collected by Base Environment since 2011; and analysis of time-domain terrestrial EM geophysics as part of ISGEAG, 2019). Many of the Coast hotels and apartment complexes rely on water from the coral limestone aquifer to supplement piped water from the Tiwi aquifer (located 6-12km north of Ukunda and covering an area of approximately 30km^2) (Hirji *et al*, 2010). Estimated daily abstraction by the hotel sector from the Pleistocene aquifers in 2017 was 3,272m^3/d (Ferrer, *et al*, 2019b). Gro for Good calculated that community abstraction from wells and BHs equipped with handpumps across their study area was 450m^3/d, on average: handpump-fitted wells/BHs equipped with GSM-enabled accelerometers (Thomson *et al*, 2012) showed that abstraction was very seasonal: 0.7 and 2.1m^3/d in wet and dry seasons respectively (Thomson, 2016). A slightly lower figure would apply to the study area considered here, but given the modest level of abstraction, it probably matters little when compared with Base or KISCOL abstraction. Note that in calculating abstraction from the "Msambweni aquifer system", handpump abstraction would be excluded.

  The coral aquifer lies well to the east of the "Gongoni Forest aquifer" and is not influenced by it (or *vice versa*) at all. Saltwater intrusion is specifically monitored by a dual piezometer due east of the Base wellfield at Galu; neither water level changes nor water chemistry changes (specifically dissolved bromide concentration) have changed significantly or show any signs of saltwater intrusion (Klassen *et al*, 2014). Further south, at Vingujini, a public water supply

BH located approximately 1.1km from the sea has seen an increase in electrical conductivity and other ions, almost certainly a consequence of saltwater intrusion (data collected by the Base Environment team); saltwater intrusion in this zone was confirmed by geophysical measurements conducted in 2018 (ISGEAG, 2019). This is ascribed to pumping from the BH.

The Pleistocene sands aquifer does overlie the eastern part of the "Msambweni aquifer system" generally but is separated from it by a clayey coral layer of 15 to 30 m thickness in that part of the aquifer exploited by Base's BHs. These BHs were all screened only in the deep confined aquifer and not the shallow sand aquifer, as the latter is an important water source for local communities; intensive monitoring of the shallow aquifer in dedicated piezometers and community shallow wells has shown that the effects of pumping the confined aquifer on the shallow aquifer are minimal at best. (This is discussed in more detail in the discussion of sustainability later in this report, see S. 4.5) There is little evidence of saltwater intrusion into this unit, although sometimes the water is naturally brackish (e.g. at Magaoni Mosque).

The KISCOL production BHs are screened in both the confined and unconfined aquifers, which does somewhat increase the risk of saltwater intrusion. However, there is no evidence as yet that saltwater intrusion has occurred in any of the KISCOL wellfields (at Nikaphu, Milalani and Kinondo), all of which are located at least 3.5km west of the sea. The extent to which KISCOL monitors its wellfields and groundwater resources is not known, however.

The Pleistocene units (Pls and Plc) have both been extensively developed by the BHs drilled by SIDA in the 1980s and 1990s; despite survey work carried out by Base and Gro for GooD over the years, few of these have been accurately identified and tied to a BH dataset (a paper database was compiled by SIDA and left with the Kwale Water Office (where it remains); however, BHs are identified by name and locality, not by grid reference, so identification has proved difficult. When Groundwater Survey (K) Ltd (GSK) were carrying out preliminary investigations for Tiomin in the late 1990s, they identified at least 40 BHs in the general project area (GSK, 1999). The vast majority of the SIDA BHs were equipped with handpumps, and those that survive to the present are also typically still equipped with handpumps (Foster *et al*, 2018). The majority of these BHs did not penetrate too deeply, typically being 20 to 30 mbgl, and never encountered the main "Msambweni aquifer system" as it is exploited by KISCOL and Base today.

- A poor aquifer exists in the Pliocene Magarini sands that make up the Coastal Hills; this is unconfined and exploited by a few shallow wells and boreholes; it also hosts a few springs. Yields are typically low (<2m^3/hr). The quality of water from this aquifer system is often poor; waters are typically low pH, are very soft and contain elevated concentrations of iron and manganese. The Pliocene material underlies the North Dune and exceeds 30m thickness in places. At one stage, Base monitored an ephemeral spring at Barcelona, on the western side of the North Dune. Core holes drilled in the North Dune in the past occasionally encountered groundwater in the sediments immediately above the Mazeras Sandstone, which forms the local Basement (*pers. comm.* Edwin Owino, Exploration Superintendent, Base Titanium Ltd). There is no reason to believe that the Pliocene beneath the North Dune constitutes a useful groundwater resource.

- The Shimba Hills are underlain by a semi-confined or confined aquifer in the Jurassic Mazeras sandstone that is exploited mostly by boreholes, though there are a very few wells in this unit. This part of the Mazeras aquifer is relatively poor; yields range from 2 to 10m^3/hr. West of the North Dune the sandstone is apparently not significantly faulted or fractured, in marked contrast to the same unit further east. A single fault has been discerned in the Mazeras beneath the North Dune, oriented south south west to north north east, which is the dominant orientation of all faulting in the study area (Caswell *et al*, 1953; Olago *et al*, *in prep.*).
- Underlying the eastern part of the Coastal Hills (i.e. the Pliocene sands that make up the South, Central and North Dunes) and the western part of the Pleistocene sands is a sequence of fractured and faulted Jurassic sediments that hosts the Gongoni Forest aquifer where Base's production boreholes are located. This unit is described in more detail below; it comprises the Mazeras Sandstone at depth, the Kambe Limestone and the Mto Mkuu Formation shales and sandstones nearest the surface.
- The Msambweni and Kinondo areas are underlain by a high-capacity indurated sand and coral aquifer system associated with hitherto undescribed palaeochannel features extending from the west towards the coastline, described in more detail below (Gro for GooD, 2017).
- The Kambe limestone is a fractured marine limestone, lying between the Mtomkuu shales and sandstones and the Mazeras sandstones. It forms a confined aquifer. It has been encountered and specifically screened in only three boreholes that we are aware of (at Bumamani, Magaoni and Fihoni, all east of Fault 3 – see S. 4.4 below). At depths of 80 to 110m, this aquifer in isolation is capable of producing comfortably more than 15m^3/hr, though at present it is not exploited at anything close to this level. In properly designed and developed BHs yields considerably higher than this are probably possible. It is not of explicit interest to Base as a groundwater target, as it is already part of the fractured/faulted sequence that forms the "Gongoni Forest aquifer" described below that is already exploited by Base.
- Two exploratory BHs were constructed in the margins of the TSF in 2017 (one near the Laydown area, and one north of Vumbu). One BH encountered the Kambe Limestone (Laydown), the other the Mazeras sandstone (Vumbu). Neither were particularly good, and neither encountered significant fractured material. Water from both BHs was soft and surprisingly acidic; given this and their limited yields (<50m^3/hr) these sites were not developed further as abstraction points.

3.3 High-value groundwater resources in the study area

There are two different but hydraulically-connected geological units located between Nikaphu and Kinondo which host an excellent aquifer system which is already exploited by both commercial and public water supply systems. This is broadly known as the "Msambweni aquifer system" and covers an area of approximately 80km^2. This unit has been developed in a somewhat piecemeal fashion by Base (and its predecessor, Tiomin, Inc.) and by KISCOL, meaning that an holistic interpretation of relevant data was only accomplished by the Gro for GooD research project, which brought together the disparate data sets (see Figure 3.1).

- The "Gongoni Forest aquifer" (here strictly defined as the area within which the Base production BHs are located, between BH1 in the south and BH8 in the north). This unit comprises the Mtomkuu Formation (shales, sandstones, limestones and silty clays), the Kambe limestones (classic grey, marine limestone) and the Mazeras sandstones (grits and coarse sandstones with occasional silicified wood; Rais-Assa, 1988). Boreholes drilled to ~110mbgl and equipped with ~30m of high-capacity screens in the sequence below ~60mbgl are capable of yields from 30 to 230m^3/hr. Between this sequence and the overlying Pleistocene sands lies a 15 – 30m thick coral-clay bed, which acts as an aquitard separating the two aquifer systems. The deeper aquifer system is largely recharged by water moving laterally from the Shimba Hills and is at least partly fault-controlled. The total thickness of the Mazeras Sandstone is greater than the earlier estimates made by Caswell *et al* (1953), at 183m; high resolution geophysics conducted by ISGEAG in early 2018 in the Gongoni Forest suggest that it could be as much as 400m thick at that location (it could also be the that geophysics is failing to pick up the underlying Mariakani Formation sandstone; it is difficult to discriminate this at these inferred depths). However, experience has shown that it is only the uppermost 30 to 50m of sandstone that constitutes the high-value aquifer; deeper BHs and more screen do not translate into more water or greater efficiency; furthermore, they run an enhanced risk of inducing saltwater intrusion.
- The Msambweni and Kinondo areas underlain by palaeochannels are erosive/depositional features believed to have evolved between early Cretaceous times and the start of the Pliocene (Olago *et al*, in press). They overlie the Kambe limestone and the Mazeras sandstone at depth. Boreholes constructed in the western part of this palaeochannel deposit encounter the high capacity semi-confined aquifer that underlies KISCOL's sugar fields at Milalani and Kinondo. Milalani boreholes of a maximum depth of 150m (but more typically 80m) have been tested at discharge rates approaching 250m^3/hr. The public water supply borehole at Vingujini and the shallow well at the KWAWASCO water supply compound in Msambweni are eastern representatives of this aquifer system, with the latter capable of pumping 27m^3/hr (from fieldwork carried out in August 2011). The immediate Msambweni area was identified as a potentially high-capacity groundwater zone by an air-flown electromagnetic survey carried out in 1977 (Terra Surveys Ltd, 1978). 80m-deep boreholes in the Kinondo palaeochannel have been tested at 30 to 60m^3/hr.

The Jurassic and indurated sand and coral palaeochannel aquifers are hydraulically connected; the total area underlain by this combined aquifer system is estimated to cover about 80km^2; see Figure 3.1.

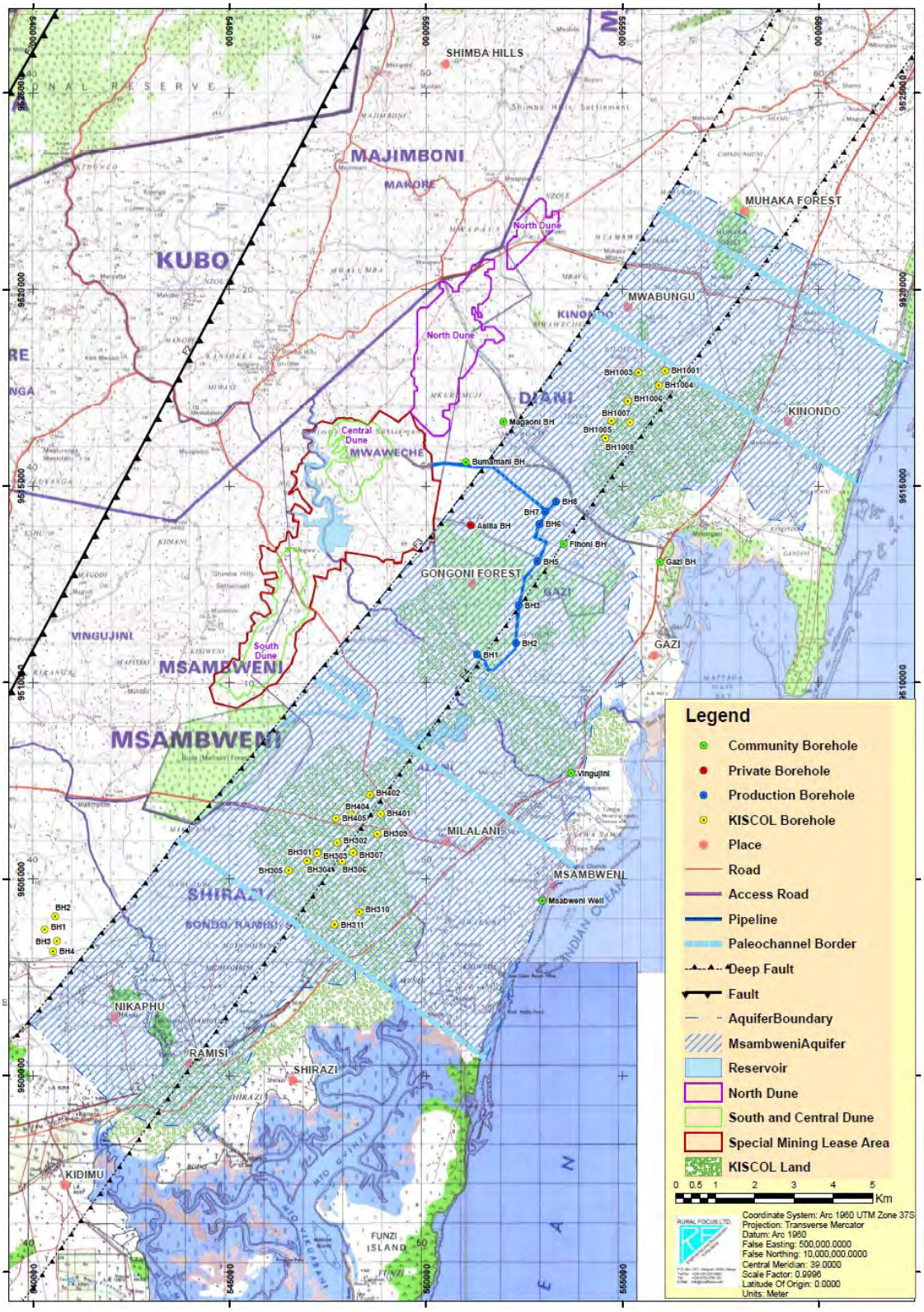

Figure 3.1 : Approximate extent of the "Msambweni aquifer system"

Abstraction from the semi-confined Jurassic and palaeochannel aquifer systems is limited to the wellfields that serve KISCOL and Base. Aggregate abstraction by these two water users is significantly lower than from the Tiwi aquifer; in late 2017 the latter was estimated to produce approximately 9,000m^3/d (3.3MCM/yr; MWI/KCG, 2017). This compares with 2017 estimates for aggregate groundwater abstraction by KISCOL and Base of ~5,200m^3/d (1.9MCM/yr). Public water supply abstraction from the borehole at Vingujini, the shallow well at the Msambweni water supply compound and a third borehole elsewhere in Msambweni Town is reported to amount to 340m^3/d (0.12MCM/yr; MWI/KCG, 2017). Msambweni lies in the eastern part of the southern palaeochannel aquifer system.

From mid-2018, abstraction from the Base wellfield had risen to 9,500m^3/d; late 2018 abstraction from the KISCOL wellfields was low, at about 250m^3/d (*pers. comm.*, WRA Mombasa SRO).

3.4 Geological structure and groundwater resources

A combination of drilling data, geological fieldwork and geophysics have shown how important the role of geological structure is in the distribution of groundwater in the study area. Figure 3.2 shows a revised geological map, with the four major faults indicated.

All faults are more or less parallel to each other and oriented SSW to NNE. All are downthrown to the south east, at angles of 2 to 3^o, with individual displacements of 30 to 50m. While the geological mechanisms are not clear, the Jurassic material east of Fault 3 (which we refer to as the Settlement Pond C or SPC Fault) is significantly more fractured and weathered than the same material west of the SPC Fault. Of some relevance is the fact that the SPC dual piezometer BH constructed in 2013/14 encountered an artesian aquifer at depth in the Mazeras sandstone, while none of the other TSF piezometer BHs encountered artesian conditions. These conditions have been observed in the Base wellfield in BHs drilled using the dual rotary method.

We have not demonstrated the existence of faulted/fractured Mazeras in BHs other than the Base BHs, though BH yields elsewhere infer similar conditions. The geological/lithological descriptions in the few Borehole Completion Records we have seen for KISCOL BHs are not easy to understand, as they use geological formation names that do not conform with published formation names. Furthermore, the Milalani BHs are constructed in the southern palaeochannel, where a different geological succession would be expected to occur (and which does). Rate of penetration data are not given in KISCOL records, so we cannot determine whether drilling conditions were similar to the Base BHs.

ISGEAG (2019) reviewed earlier geophysics data as well as capturing fresh data, and observed traces of one and possibly two faults east of the SPC Fault; one of these (that to the west) is Fault 4, (see Figure 3.2), while the second occurs between BH5 and the replacement dual piezometer constructed 280m east of BH5; there is a significant displacement between the top of the Kambe in BH5 and its elevation in the replacement piezometer (the displacement is 15m, and the thickness of the Kambe is considerably greater than in any other BH – 40m as opposed to 10-15m in BHs to the west).

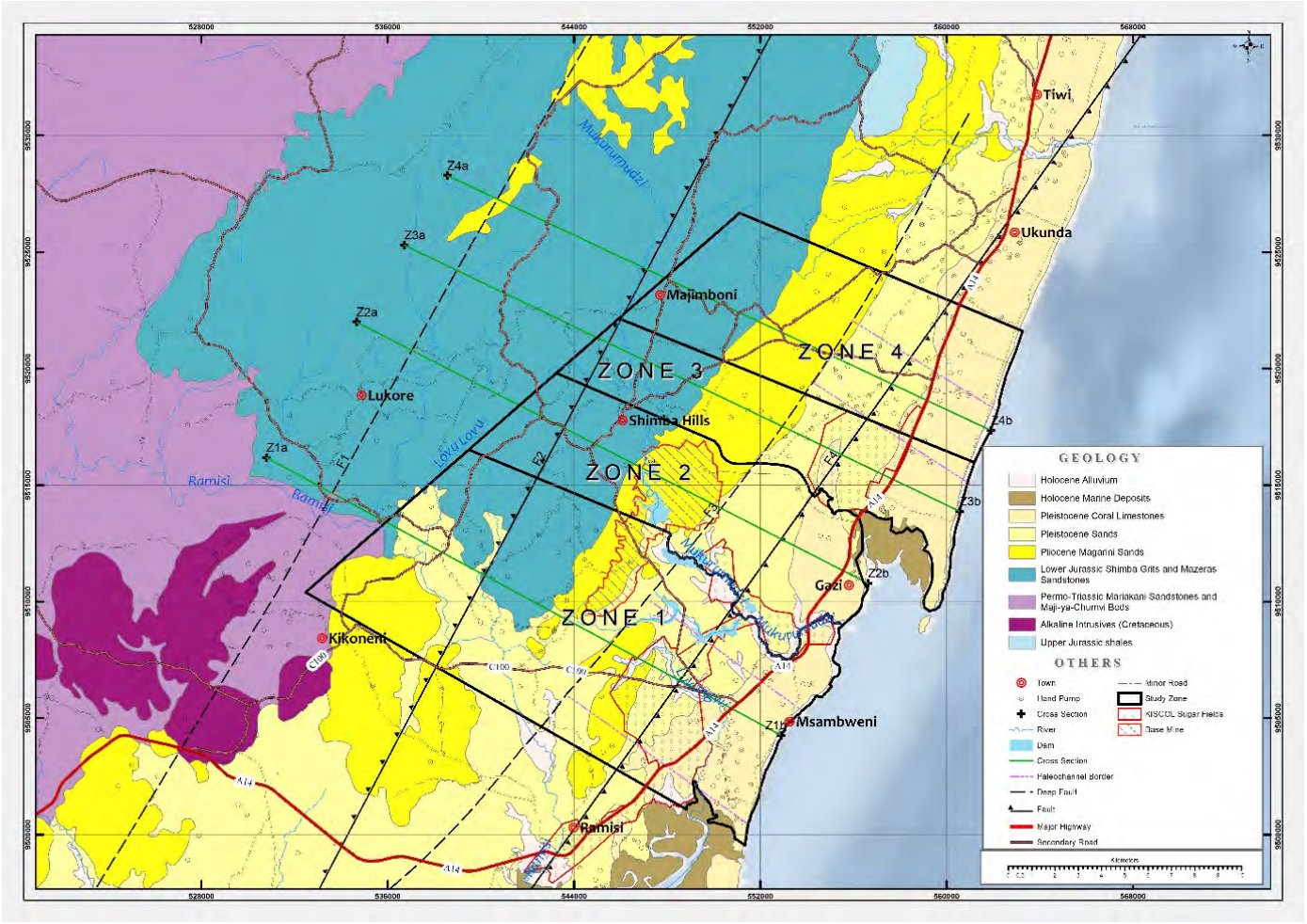

Figure 3.2 : Geological Map of the study area

As we state above, we have no explanation for the fracturing, though it may have occurred at the times of faulting. In the Mto Mkuu Formation (shaley sandstones), the fracturing is not clearly discernible (drill cuttings are broken up, destroying any evidence). In the Kambe limestone (a classic dark grey marine limestone), and the Mazeras sandstone (a classic ferruginous terrestrial sandstone), fracturing manifests itself by hackly and iron-stained fracture surfaces, and noisy, interrupted drilling. Where encountered west of the SPC Fault, none of these formations is fractured and when production BHs are constructed yields rarely exceed $10m^3$/hr for intermediate drawdowns (>20m).

The faulting and fracturing are believed to be responsible for enhanced recharge; recharge occurs to the west, in the Shimba Hills (Ramos *et al*, 2020) and appears to exploit faults and fracturing in groundwater movement towards the east/south east. The area east of the SPC Fault is the target area for any additional BHs that may be drilled in the future.

An observation that is worth making is that the best part of the Jurassic aquifer system extends from the north end of the Gongoni Forest to the southern edge of the KISCOL sugar field at Milalani; the aquifer efficiency is greatest in the Milalani area, with aquifer transmissivities exceeding $1,000m^2$/d; BH1, the best of the Base BHs, has a transmissivity of 300 to $500m^2$/d. (Transmissivity is the rate of flow under a unit hydraulic gradient through a unit width of the aquifer; it is the product of aquifer thickness and hydraulic conductivity.) In this central part of the aquifer, test yields exceeding $200m^3$/hr for modest drawdown are possible. Further south (Nikaphu) and north (Kinondo), test yields fall to 70 to 80, and 30 to $60m^3$/hr respectively.

3.5 Recharge and aquifer sustainability

Principally as a result of Base's monitoring network, Gro for GooD launched a complementary shallow groundwater monitoring network in 2014 to collect sufficient data to model the groundwater system in the study area; this coincided with the crystallization of our understanding of the extent and importance of the Msambweni aquifer system, the realisation of which was beginning to be clear as early as 2013 (Tahal *et al*, 2013) with the construction of the KISCOL and Base wellfields. Tahal *et al* developed a coarse model that suggested that the aquifer system in the Msambweni area would be capable of producing $30,000m^3$/d (11MCM/yr) on a sustainable basis (subject to confirmation from further investigations).

The Gro for GooD model is described in Ferrer *et al* (2019b); it is a fairly standard MODFLOW model that calculates recharge from hydraulic conductivity, rainfall, land use and gradient data from water balances. The model was calibrated against water level data collected by Base and Gro for Good from 2012 to 2017; this found that actual annual groundwater recharge was immensely variable and closely related to actual annual rainfall (see Table 3.1).

Table 3.1 : Model Recharge to the "Msambweni aquifer system" (Ferrer *et al*, 2019b)

Year	Catchment precipitation (mm/yr)	Calculated recharge (MCM^3/yr)
2010	1022	71
2011	1406	160
2012	987	50
2013	1154	86
2014	1715	156

Year	Catchment precipitation (mm/yr)	Calculated recharge (MCM^3/yr)
2015	1757	169
2016	867	58
2017	1442	224
Mean	**1293.4**	**121.75**

50MCM/yr is equivalent to over 137,000m^3/d and mean annual recharge is 121.75MCM/yr or 333,500m^3/d, suggesting that most of the time recharge comfortably exceeds currently abstraction and allows for additional abstraction. The area covered by the model is considerably greater than the area we believe to be underlain by the "Msambweni aquifer system"; the model area covers 660km^2, the aquifer about 80km^2. Assuming a (conservative) *pro-rata* distribution of recharge, mean daily recharge to the "Msambweni aquifer system" is 43,000m^3/d; the mean daily abstraction of 30,000m^3/d of water as tentatively put forward by Tahal *et al* (2012) is a conservative value, and we believe it to be reasonable for water allocation since it includes a significant safety margin. There must be a recognition that recharge will be lower during a drought year, which can be monitored with appropriately-sited piezometer (monitoring) BHs.

Using the model as a groundwater management tool, successive model runs modelling different abstraction rates under different climatic conditions (decreased/increased rainfall and increased temperature) were carried out over 6 hypothetical future years at aquifer discharge rates up to 30,000m^3/d (Ramos *et al*, 2020). This shows that while increased abstraction did increase aquifer drawdown, it created far less impact than a drought year with significantly lower than average rainfall. Modelling showed that recharge by a good rainfall year after a poor rainfall year effectively restored aquifer water levels to 'normal' levels. Modelling showed that water levels in the shallow aquifer close by the commercial production wellfields after two successive dry periods would approach 5 metres, which would certainly lead to dry shallow wells and shallow boreholes. However, these effects are localised and will rarely extend far enough to adversely affect community water supply shallow wells. Any such effects can be mitigated by providing an alternative source of water, or by deepening a shallow well.

3.6 Locations of additional BHs

Some additional geophysical measurements will need to be made (to satisfy WRA requirements rather than necessarily to provide fresh information), but we already know the approximate areas in which additional BHs (if approved) would be constructed (See Table 3.2 and Fig. 3.4).

3.6.1 Gongoni Forest and the TSF borehole sites

A total of 4,800m^3/d could come from BHs in the Gongoni Forest and TSF areas.

There is a possible site at Settlement Pond C (for which there is a lapsed Application, no. WRMA/30/MSA/3K/11745/G). Assume 1,200m^3/d. This would require no geophysics, only a fresh application ("TSF" in Table 3.2). No piezometer BH would be required, as one already exists.

Further Gongoni Forest BHs could be located along the western edge of the Forest, provided these are located at least 800m from each other, so there would be a further two BHs between Settlement Pond

C and BH1. Assume 1,200m^3/d each, for a total of 2,400m^3/d ("West Forest 1" and "West Forest 2"). Both would need a companion dual piezometer monitoring BH.

Additional sites could be located along the northern boundary of the Gongoni Forest, again being at least 800m apart; given that there is an active BH at Asilia (not given in the Application database; WGS84 551011E 9513702N), there is space for a single additional BH ("North Forest"). Again, assume 1,200m^3/d. As with other production BHs. A dual piezometer should be constructed adjacent to the production BH.

For practical reasons, we do not recommend constructing BHs in the centre of the Gongoni Forest; this would require constructing access tracks, which would be environmentally questionable. Using the edges of the Forest obviates this need. Tracks will, however, be required to access the two Forest West sites; West 1 probably from the north, West 2 from the south.

Past relations with the Kenya Forest Services have been good, and it should be possible to extend the current legal agreement. The current sites attract an annual License fee of KShs. 50,000/-, a wayleave charge of KShs. 10,000/- per acre every year, and compensation costs. The Environment Department would monitor site activities to minimise the environmental impact, and actual drill sites would be selected to minimise environmental impact.

The Forest sites would all require geophysics to accompany applications for BHs. These BHs would be from 100 to 120m deep, drilled at 16" and cased/screened at 10". High-capacity wire-wound screens would be used, as in past drilling programmes. Approximate BH costs would be $200,000 to $250,000 per BH.

3.6.2 Settlement areas/Pipeline Access Road sites

"Settlement areas" refers to land north of the Old Access Road, and would include BH8 were it not for the fact that this BH (which tested at less than 25m^3/hr and was never commissioned) has been handed over to the Kwale County Government for use as a community water supply BH. However, there is the potential for two additional sites, located along the wellfield pipeline wayleave, between the point it leaves BH7 to the point where it joins the New Access Road. Assume at least 800m spacing and 1,200m^3/d from each, for a total of 2,400m^3/d.

Both of these sites would require geophysics. They would also require negotiations with local landowners to agree wayleaves. These discussions will be protracted and will ultimately lead to relatively small expenditure; government must be involved to ensure that land ownership or wayleave arrangements are formalised (i.e. a 30 x 30m plot and right of access). Dual piezometers should be constructed adjacent to each production BH.

Borehole specifications and cost as above, unless significantly different geological/hydrogeological conditions are encountered than are expected ("Access 1" and "Access 2").

3.6.3 Magaoni/Kinondo

Between KISCOL's Kinondo sugar fields and the New Access Road; and along the western boundary of the KISCIL Kinondo sugar fields, is a further area in which reasonably high capacity BHs could be constructed; we already know that KISCOL's BHs at Kinondo typically yield 30 to 60m^3/hr, so in

properly constructed and screened BHs it should be possible to test at 100 to 120m^3/hr for Permit totals of 700m^3/d. Two exploratory BHs in this area (which is relatively unknown in geological and hydrogeological terms) could be constructed and tested to determine whether this area would be suitable for further development. We are cautiously confident that BHs able to pump 700m^3/d on Permit are possible.

These would require:

- Fieldwork, including landholder negotiations;
- Geophysics;
- Drilling at 10" for 6" casing and screen (uPVC) and testing (after wayleaves etc. are agreed). Total depth uncertain, but possibly as much as 150m.

Each exploratory BH costs $50,000 or so; if the GW resource is good, design and construct production BHs as appropriate ("Magaoni/Kinondo 1" and "Magaoni/Kinondo 2").

3.6.4 Monitoring/piezometer boreholes

If the WRA approves all or the majority of these BH applications, additional monitoring BHs will be required. Given the positions of the BHs recommended above, these would be located as follows;

- Due east of BH8, 500m from the oceanic front;
- Due east of BH2B, in the A14 road reserve.

Approximate grid references (WGS84) are shown in Table 3.2. Approximate locations are shown in Fig. 3.3.

Table 3.2 : Approximate locations of proposed additional boreholes and piezometers

Site Name	Provisional Permit (M^3/d)	Easting	Northing	Elevation
PRODUCTION BOREHOLES				
TSF	1,200.0	550117	9513209	49
West Forest 1	1,200.0	550460	9512490	45
West Forest 2	1,200.0	550720	9511010	42
North Forest	1.200.0	552130	9513190	34
Access 1	1,200.0	552540	9514580	42
Access 2	1,200.0	551920	9515060	46
Magaoni/Kinondo 1	700. 0	553910	9515340	36
Magaoni/Kinondo 2	700.0	553100	9516130	51
Total yield	**8,600**			
MONITORING BOREHOLES				
North piezometer	–	555420	9513240	20
South piezometer	–	555420	9510680	18

3.6.5 Caveats

We are reasonably comfortable with our yield predictions for BH sites within and adjacent to the Gongoni Forest; there is no reason to believe that geological/hydrogeological conditions are any different to previous BHs constructed in the area. It is possible that sites in the south are better (more efficient) than BHs to the north; we have seen evidence that BHs improve with southwards progression from about BH7. BHs in the Kinondo area are demonstrably poorer than any of Base's BHs.

We are less certain about the two Pipeline Access Road sites, though that closest to BH7 (Access 1) is very likely to be similar to BH7. Access 2 is relatively close (850m) to the Bumamani Community BH located east of the main gate to the Mine (the BH is at WGS84 551115E 9515300N) this encountered a significant thickness of Mto Mkuu sandstones and Kambe Limestone (38 and 19m respectively), but no Mazeras Sandstone. This may be explained by the Bumamani BH's location west of the TSF Fault. Should this be the case at Access 2, then it will not be a high-capacity BH and would not be completed as a production BH (in a 16" production BH with a proper wire-wound screen, a test yield of perhaps $50m^3$/hr is possible; this is probably insufficient for a Base production BH).

We know least about the two Magaoni/Kinondo BH sites, which is why we recommend drilling exploratory BHs first. Base will need to consider whether 700 m^3/d on Permit will be worth the capital and operational costs of running these sites.

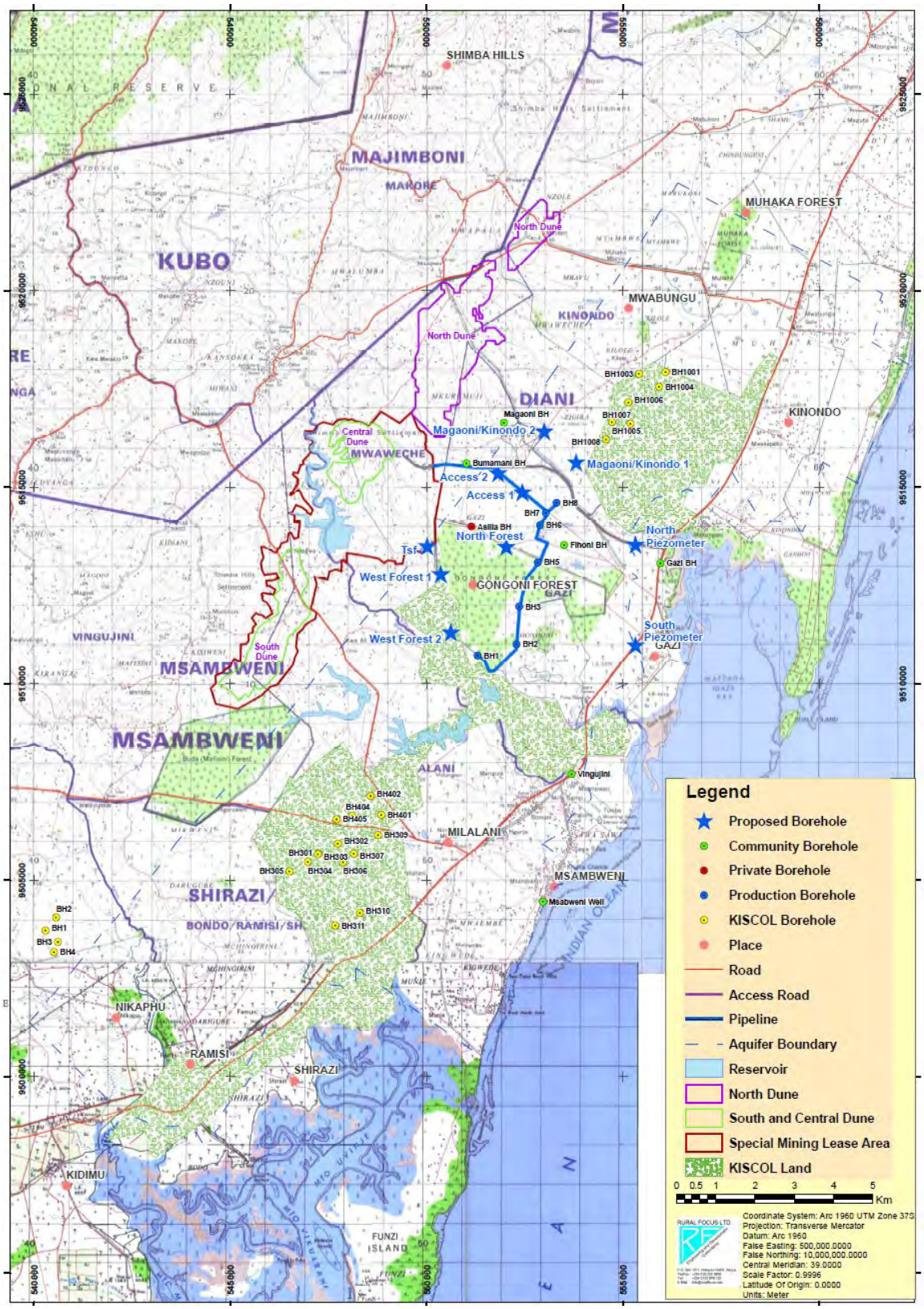

Figure 3.3 : General locations of additional boreholes and piezometers

4. WATER PERMITS

4.1 Water Permits

An Excel file containing all Authorisations made for Basin 3KD (covering the Mwachema, Mkurumudzi, Ramisi and Umba catchments) was made available by the Water Resources Authority (WRA). It is not a list of Water Permits that have been awarded to water users, but a listing of Authorisation applications made by applicants. It, therefore, constitutes a worst-case (maximum) indication of potential water use in a given area).

The vast majority of Permits are groundwater permits (of 337 permits, only 12 are for surface water).

4.2 Groundwater Permits

Of the 325 GW authorisations, 94 are filed under KISCOL and 42 are filed under Base.

4.2.1 KISCOL authorisations

As stated above, to the best of our knowledge KISCOL have only constructed 26 BHs, so this must be either an error or that KISCOL has yet to drill a significant number of BHs. The authorisations are summarised in Appendix B, as is a Table showing basic details for the 26 known KISCOL BHs. Were the authorisations to be translated into water permits under the current understanding of water law, the allocated water would amount to 87,635m^3/d. This is equivalent to a little less than 32MCM/yr and far exceeds the mean annual recharge to the entire aquifer system, not just those parts that underlie KISCOL land (see S. 3.5). However, many of the KISCOL sites are duplicates or triplicates – there are two or three file numbers for identical sites, which explains the excessive total abstraction given above.

Of the 94 Applications, 11 are for Category A Permits with a proposed abstraction of nil; these may be for monitoring BHs.

4.2.2 Base authorisations

Base: 42 authorisations are in the name of Base or Tiomin, Inc. (Base's predecessor); we have checked these entries against paper records held by Base, and can account for 23:

- 8 production BH Permits (2 BHs handed over to other parties for their use; 6 Base production BHs).
- 2 exploratory BH authorisations (drilled but not put into use).
- 2 exploratory BH authorisations (no BHs drilled).
- 11 monitoring BHs (either single or dual tube piezometers). More recent piezometers have not been given Authorisation numbers as they are not capable of being pumped significantly (2" diameter casing and screen is installed in Base's piezometer BHs; this allows water samples to be withdrawn for analysis purposes using dedicated sampling pumps, at modest discharge rates (10 to 20 litres per minute).

The remaining file numbers are for cancelled BHs or Authorisations for Tiomin, Inc., Base's predecessor.

Details are provided in Appendix C.

4.2.3 Public and Community water supply authorisations

13 of the Applications have been made by the Coast Water Services Board (CWSB; 5 between 2010 and 2014, and the balance in November 2016. The County Government of Kwale (CGK) has 19 Applications, all from October 2016. These all pre-date the discussions between Gro for GooD, CWSB and CGK regarding optimum locations for BHs for public water supply (these discussions were held in November 2018). The earlier CWSB Applications probably related to existing BHs that required up to date paperwork; the 2016 Applications relate to unknown proposed groundwater development.

There are several community BHs that are squarely within the study area that we can identify; Fihoni, Magaoni, Mwanakombo Hamadi Tsozi (Bumamani BH, see Chapter. 3 above) BH8 and Footprints are all localities within the study area, though not strictly within the "Msambweni aquifer system" (except for Fihoni and BH8).

For this study we have assumed that the earlier CWSB BHs are all existing BHs that are currently in use; these aggregate 1,354m^3/d and are certainly an over-estimate for the study area; one at least of these sites is certainly in the area, the shallow well at the Msambweni Water Supply compound: (WRMA/30/MSA/3K/10204/G for 500m^3/d). The Vingujini BH is not apparently in the authorisation database, or its grid reference is incorrectly entered. For this study, we assume that total daily abstraction is 750m^3/d.

There are a significant number of CGK BHs reported in the study area (eight), but none that we are directly knowledgeable of (no locality names are given, only grid references). These aggregate 480m^3/d, if their locations are correct. For this study, we assume that 480m^3/d comes from these BHs (almost certainly an over-estimate). Add to this the projected four Base-funded BHs that have been handed over to the County for installation of larger, machine pumps (for a maximum of 600m^3/d), and the total estimate is 1,080m^3/d.

We know that future Government plans include increasing community and public water supply from the "Msambweni aquifer system" to 10,000m^3/d. For this study, we assume that the 1,680m^3/d (County and Service Board BHs, including community BHs constructed by Base) is a part of this total so that an additional 8,920m^3 of daily capacity is required.

These are shown in Appendix D.

4.2.4 Other authorisations

The majority of other applications relate to the coastal strip in the Kinondu/Galu and Msambweni areas; hotels are well represented in the Application list. Of these, only Neptune Hotels Ltd (four authorisations, aggregate 116m^3/d), are unequivocally in the study area; other authorisations need to be checked through site visits.

However, there is considerable ambiguity over precise BH locations, as grid references provided in the Application database are often incorrect or uncertain; see Figure 4.1 for Application locations, and Appendix E. (the full WRA database file has been submitted to Base separately.) This makes determining actual abstraction unreliable at best.

4.3 Conclusions

Given the uncertainties outlined above, it will be necessary to carry out a detailed groundwater abstraction survey, a field-based exercise that visits each borehole to determine permit number, owner, abstraction information, etc. (WRA, 2019). A GPS captures physical location to allow mapping. Unused and abandoned BH data should also be collected, where this is possible (a handpump hydrocensus carried out by Gro for GooD across most of the study area in 2013 was only moderately successful at capturing and then identifying abandoned, or broken, handpump wells or BHs; locality names were compared with the SIDA "Blue Book" list held by the Kwale County Water Department. However, as the objective of this survey would be to establish how much water is pumped from the "Msambweni aquifer system", the identification of abandoned BHs is not an essential component, though would be useful. To ensure access to all BHs, the field team(s) would need to be accompanied by a WRA staff member.

We estimate that an abstraction survey of this type would require one team approximately 3 weeks of field time and approximately one week of analysis and write-up time. The data and report would be forwarded to the WRA together with applications for GW Permits according to what the outcome of the survey is, as well as the outcome of discussions with the County.

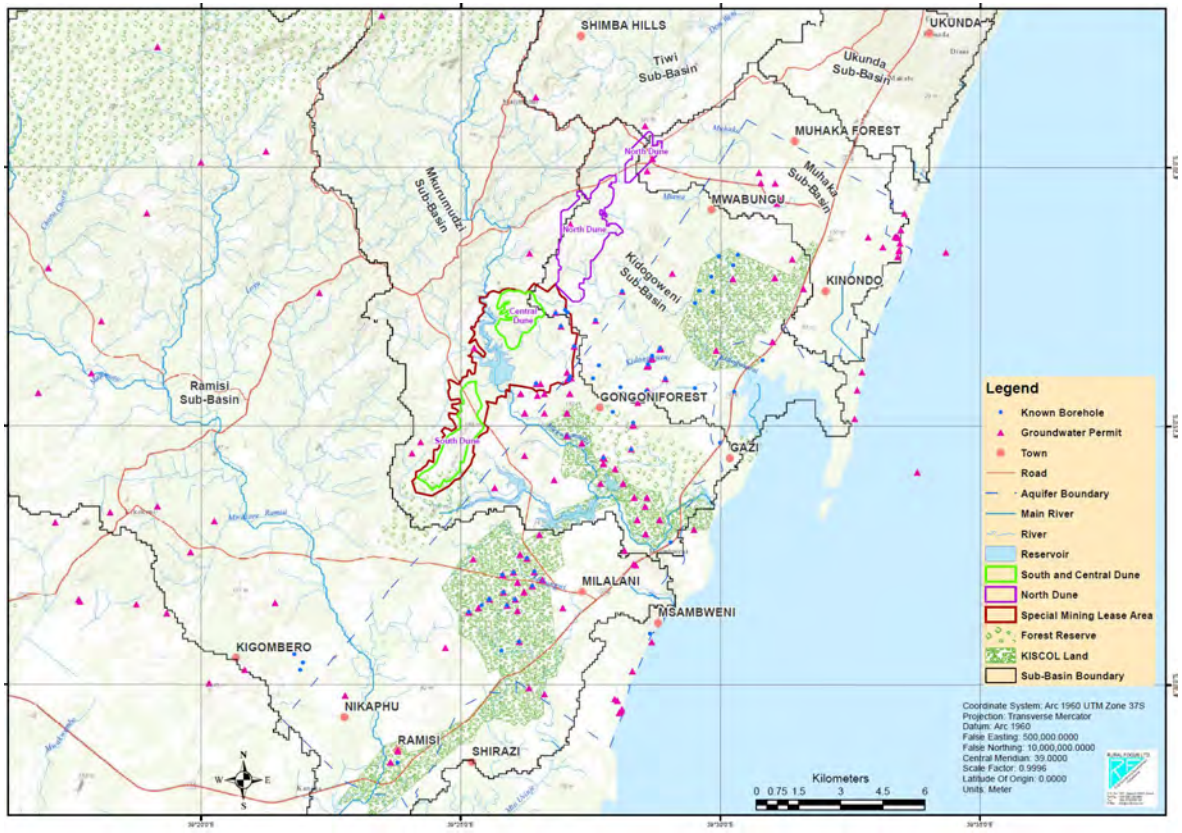

Figure 4.1 : Locations of Groundwater Permit Applications (from WRA database)

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

A significant and high-capacity aquifer underlies approximately 80km^2 of the Coastal Plain and eastern edge of the Foot Plateau, which we have dubbed the "Msambweni aquifer system". A MODFLO digital model covering an area of 660km^2 shows that mean annual recharge to all aquifers across the study area is 333,500m^3/d (Ramos *et al*, 2020). Recharge to the "Msambweni aquifer system", which covers about 80km^2, is estimated to be 43,000m^3/d. This supports a previous study's recommendation that mean daily allocable yield from this aquifer unit be limited to 30,000m^3/d (Tahal *et al*. 2012), particularly because of the extreme annual variation in recharge (range: 16,600 to 74,400m^3/d across the "Msambweni aquifer system").

This lies east of the Base mine site beneath the Gongoni Forest, and is already exploited by six Base production BHs permitted to pump up to a total of 9,540m^3/d. Base abstracts close to its maximum permit allocation at present, and this is unlikely to change.

KISCOL – which has irrigated sugar fields south and north of the Gongoni Forest and which also overlies the "Msambweni aquifer system" – has a total of 26 production BHs installed, with a theoretical maximum permit abstraction of 12,650m^3/d (assuming 10 hours pumping per day at 60% of test yield). However, not all of their BHs are equipped and the actual volume of water pumped is believed to be small, of the order 250m^3/d in late 2018. Actual year on year abstraction will depend on climate and particularly on rainfall; irrigation water demand is critically sensitive to rainfall. Here we will assume a worst-case scenario, where KISCOL might abstract 12,650m^3/d at the end of a severe drought.

There are several significant public water supply and community BHs that are, or will in the near future be, equipped with machine pumps (replacing either handpumps or low-capacity solar pumps). We estimate that these currently or in the near future abstract 1,830m^3/d (1,080m^3/d for County BHs, 750m^3/d for public water supply from CWSB BHs).

Finally, for the calculation below, we assume that "other" abstractors pump a maximum of 300m^3/d. This is not expected to change and may fall as public water supply expands.

Shallow wells and shallow boreholes exploiting the shallow aquifer in the Pleistocene sediments are excluded from the calculation. These are not part of the water balance for the deep "Msambweni aquifer system".

Table 5.1 : Current and future abstraction scenarios and allocable water

Abstractor group	Current abstraction (estimated), m^3/d	Projected abstraction (worst case) m^3/d	Remarks
KISCOL	250	12,650	250m^3/d now, 12,650m^3/d ultimate
Base	9,540	9,540	Unchanged
Public/Community	1,830	10,000	Full allocation (year unknown)
Other	300	300	Unchanged
Total, m^3/d	**11,920**	**32,490**	**Under allocated**
Allocable water , m^3/d	**18,080**	**=2,490**	**Over allocated**

This shows that during a future drought, with public/community water supply augmented to the full 10,000m^3/d and both KISCOL and Base pumping at full capacity, groundwater is over allocated.

What variables influence allocation, other than the natural variables of rainfall and recharge?

For Base's purposes, the key variable is the speed with which the County (or the CWSB) implements its augmentation project, i.e. how quickly BHs are installed and pipework connected to the public. If this happens towards the end of the projected North Dune mining period (the end of 2028), then no harm will come to the aquifer if Base was to pump another 8,000m^3/d (particularly if Base were to donate its BHs to the County or CWSB after the project[1]). In such a case, under worst-case drought conditions, a possible 5,680m^3/d might be available for Base to apply for.

If, however, it is anticipated that development work will start significantly before the end of the mining phase of the project, then the economic justification for BH construction may fall through.

We have attempted to find out from the CGK (*via* the County Geologist) what the anticipated development programme is; thus far this has proved unsuccessful.

5.2 Recommendations

There are considerable uncertainties around actual groundwater abstraction from the study area main aquifer. These need to be resolved before a formal approach (i.e. applications for water permits) is made to the WRA. This requires an abstraction survey (described in Chapter 4).

Concurrently, approaches to the County must be made, informally or otherwise, to determine when groundwater development under the Kenya Water Security and Climate Resilience Project is planned to commence. This approach should include discussions around the possibility that Base position BHs in locations that, while they meet Base's short-term needs, also meet the County's long-term needs. If these discussions need to include the CWSB and/or the Kwale Water and Sewerage Company Ltd, they should be invited to participate.

Once this information is available, applications may be made to the WRA for additional groundwater permits. The application process should stress three aspects:

- The outcome of the abstraction survey and its value to the WRA.
- The uncertainty over KISCOL's actual groundwater permit volume; this has been impossible to ascertain, yet is essential in establishing allocable water.
- The likely groundwater development programme that shall be adopted by the County to bring public water supply to 10,000m^3/d.

We cannot anticipate the likely outcomes of these activities; however, all being well, it is possible that an additional 5,680m^3/d of groundwater could be allocated to Base, on the explicit understanding that the allocation is for a fixed period only, for the duration of the mining of the North Dune.

[1] The Kenya Government anticipates taking over Base's water resources endowment at the completion of the mining project (MWI/KCG, 2017).

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APPENDICES

Appendix A **Proposal**

Appendix B **KISCOL Water Permit Applications**

Appendix C **Base Water Permit Applications and Water Permits**

Appendix D **Water Permit Applications made by CWSB and CGK**

Appendix E **Water Permit Applications made by other entities**

APPENDIX A

PROPOSAL

To: **Base Titanium Ltd**

From: **RURAL FOCUS LIMITED**

For: **Comprehensive Water Resources Assessment Study for North Dune**

At: **Kwale Minerals Sands Mine**

Date: **27-APR-20**

1. GENERAL

Base Titanium has used Rural Focus (RFL) for various inputs into their groundwater and surface water activities since 2011. Much of what is presented below is underpinned by these years of experience, as well as highly relevant associated studies within the framework of UPGro ; and ISGEAG , a quasi-research programme that yielded a considerable amount of relevant information relating to the thickness of different geological units and the extent of salt water intrusion from the littoral zone inland.

This document relates to the possibility that the North Dune may be mined after completion of mining of the South Dune. This may lead to a need for more water for mining, to a maximum of a further 8,000m3/day.

2. LOCATION OF WORKS

Base mine site, North Dune and surrounding surface and groundwater catchments, Kwale County.

3. SCOPE OF WORK

This proposal builds on and responds to the 'Outline Scope of Works' presented in Annex 1. This evolved out of a two-hour meeting held between Nick Okello (of Base), Mike Everett (of ERM) and Mike Lane (of Rural Focus Ltd) on 26 February 2020 at Galu.

The key elements of this water resources assessment study (WRAS) are the following:

Surface water resources - distribution, sustainability and seasonality.

Groundwater resources - distribution, sustainability and seasonality.

Existing Water Permits by water source type; and their temporal and geographic distribution.

Describing water resources development options, together with approximate costs and pros and cons (including permit implications, projected timelines and further data/information needs.)

These are discussed in more detail below, insofar as they relate to the context of this study.

3.1 Surface water resources

Surface water resources are well understood in the Mkurumudzi basin, which currently supplies a little over 65% of Base's current fresh make-up water (or 22,000m3/d) (i.e. excluding recycled water, which forms a crucial part of the mining operation at Kwale). A new rating curve, based on a calibrated HEC-RAS hydraulic model, will update the flow data set, though this is unlikely to change the basin 'calculus'. The principal concern with this resource is that it is very nearly fully taken up (four reservoirs for a total storage in excess of 20million cubic metres [MCM], with further impoundments possible).

Other catchments (from the Ramisi in the south to the Mwaweche in the north; and the Pemba, west of the Shimba Hills) will be assessed for water resources potential and cross-catchment transfer. While we are reasonably certain that none of these streams offer significant resources potential, no formal assessment has yet been made.

Water Permit data will be purchased from the WRA, where lacking.

Using all data available, mean annual flows for all streams will be calculated or estimated and water balances calculated based on existing Water Permits (if any). Of specific interest is flood flow availability to diversify the potential sources to support Base operations. If alternative sources appear potentially viable engineering and pumping cost estimates will be generated. See 'Existing Water Permits' below.

3.2 Groundwater resources

No holistic review of groundwater resources availability, sustainability and distribution has been carried out since the compendium of data and analysis that accompanied the 2016 Water Permit and Permit Variations (Additional Water Supply Options for Base Titanium Ltd. Applications for Water Permit Variations. New Permit Applications (Groundwater). Summary Report, July 2016).

An up-to-date review, with a view to determining 'safe' mean annual abstraction and its sensitivity to external factors will be made; this will mainly concentrate on the 'Msambweni' and 'TSF' aquifers. Additional data that is either in our hands already or which will be obtained during this study will add to the understanding of local and sub-regional hydrogeology. This will specifically include, but will not necessarily be limited to, the following data/reports:

- Drilling data from the 2017/18 Base drilling programme, and recent Base CSR community water supply boreholes;
- Water quality and water level data from both Base's and UPGro's monitoring data sets;
- Groundwater model developed by UPGro;
- Field geological and geophysical data collected by UPGro;
- Geophysical data and interpretations carried out under ISGEAG.

Other drilling data may be available from the Water Resources Authority (WRA) archive. Applications to purchase these data will be made at an early stage.

We already have a groundwater model that shows that abstractions of up to 30,000m3/d from the 'Msambweni' aquifer are viable and sustainable under most scenarios other than multi-year drought.

We need to:

- Confirm what safe discharge is for the 'Msambweni' aquifer, and compare this with estimated/modelled recharge;
- Determine what the estimated sustainable discharge from other aquifers in the study area is;
- Compare with known Water Permits and determine whether 'additional' water can be allocated for beneficial use.

See 'Existing Water Permits' below.

3.3 Existing Water Permits

No successful attempt has been made since early 2013 to compile a list of Water Permits (and that was limited to the Mkurumudzi river). A serious attempt will be made to purchase all relevant Permit data, covering both surface and groundwater sources, from the WRA Regional Office in Machakos, by deploying a senior water engineer to Machakos to chase these data down. A supporting letter from Base will be sought; surface and groundwater permits shall be purchased. Base Permits are already in hand.

Water Permit data are vital for the following reasons:

- To determine how much water is abstracted from each water resource (e.g. river or aquifer …).
- In conjunction with streamflow or sustainable groundwater abstraction, determine whether there is any un-allocated yield.

3.4 Water resources development options

Surface and groundwater development options will be developed and compared, and simple costing for all of them developed. This will include, but not necessarily be limited to, the following:

- Water Permit implications (where/what source/which user/timelines);
- Project time frames (particular with respect to when different development programmes are expected to be rolled out in relation to the 'Msambweni aquifer';
- Different construct/handover scenarios, particularly with respect to the development of the 'Msambweni aquifer' over the next 10 years.

4. OUTPUTS

A draft Final Report will be generated by the end of Week 3 and submitted to the Client for review. We expect that there will be at least one week of review time, followed by a further week of amendments and a final report submitted at the end of Week 5.

5. SCHEDULE OF WORK

Existing staff commitments mean that not all staff tasked with inputs to this study will be able to work on it simultaneously. However, we anticipate that a draft final report will be available at the end of Week 3 and a Final Report at the end of Week 5.

We provisionally assume a start date of 30 March 2020.

6. STAFF

We propose to deploy the following staff for this work; a short description of each individual's role in the study is given.

Mike Lane - Hydrogeologist/Team Leader

Mike is a Kenya-registered hydrogeologist with over 30 years of experience, almost all of which is Sub-Saharan and most of which is East African. He has principally been involved in groundwater resources investigations and development programmes in a wide range of geological and climatic environments, with particular emphasis on planning and implementing field programmes and undertaking field work in arid/semi-arid areas. Core areas of expertise include groundwater resources assessment studies, particularly in arid/semi-arid lands, geophysical investigations (surface and down-hole), borehole drilling, design & testing. Other principal areas of interest include groundwater modelling (hydrogeological and hydrochemical), UNSAs (unconsolidated sedimentary aquifers), and isotope & trace ion chemistry. He has applied his broad sector experience in the water sector reform process in Kenya, being actively involved in developing the 1999 Water Policy and acting as a Technical Advisor (Groundwater) to the Water Resources Authority for four years in the 2000s. Most recently he has been involved in groundwater resources assessment and development for a mineral sands mine in Southern Kenya, as well as developing water resources monitoring networks and analysis processes for the mine.

Mike will coordinate the inputs and outputs of the study as well as drawing together the various aspects related to groundwater; and will act as lead rapporteur. He is uniquely qualified to carry out the latter activity due to his intimate involvement in the 2010/11 World Bank Groundwater Governance project; Base groundwater development and monitoring programmes; UPGro; and ISGEAG (since 2010).

Eng. Michael Thomas - Hydrologist

Mike is a registered Kenyan water and environmental engineer with a specialization in hydrology. Mike has a BSc in Civil Engineering from Purdue University (USA) and a MSc in Civil and Environmental Engineering from Cornell University (USA). He has combined his training with 30 years of professional experience on projects in East Africa, Botswana, Madagascar, the UK, and the USA. He is registered as a Consulting Engineer (ERB), Hydrologist (MWI) and EIA Expert (NEMA).

His professional experience has covered hydrological analysis, water resource management and rural water supply engineering. He was co-Principal Investigator for the UpGro/Groundwater Risk Management for Growth and Development Project, a 5 year DFiD funded project looking at groundwater management along the Kenya South Coast in the face of competing demands and changing climate. He has undertaken detailed hydrological analysis and modeling for river intakes, dam designs and flood protection projects. He has worked on water resource policies, strategies, regulations and institutional capacity development. Recent projects have involved the review of the rating curve for 3KD06 (Mkurumudzi river), hydromet network design for the Water Resources Authority (Kenya), preparation of the Practice Manual for Small Dams, Pans and other Water Conservation Structures in Kenya, formulation of Guidelines for Water Allocation (WRA), 5 Year Strategy for a multi-stakeholder partnership (Mount Kenya Ewaso Water Partnership), capacity development of water resource user associations (WRUAs), the development of the Water Resource Rules (2019 & 2007), and WRM strategies for climate change adaptation.

Mike will carry out all surface water-related collation and analysis, updating flow data for the Mkurumudzi RGS at 3KD06 and carrying out streamflow calculations/ estimates for other catchments in the study area. He will determine safe yield/sustainability estimates for all catchments. He is very familiar with the study area, having carried out surface water assignments for Base, as well as the UPGro project. He will embark on a two-day field programme with one or two WRA technical staff when assessing flows in streams across the study area.

Ruth Amondi - Water Resources Management Specialist

Ruth is a qualified engineer with a specialization in water supply and water resources management. Ruth has a BSc and MSc in Agricultural Engineering from Egerton University, Kenya and a Post Graduate Diploma in Groundwater Exploration, Water Resources Exploitation and Conservation from Hebrew University of Jerusalem, Israel and has combined her training with 15 years of professional experience on projects in East Africa. Her professional experience has covered water resource monitoring, assessments and management. She has undertaken development of several Sub-Catchment Management Plans across Kenya and participated in the development of Athi Basin Plan. In addition, she has undertaken design of several rural water supply schemes and carried out environmental impact assessments, and hydrological studies. Recent projects have involved development of Sub-Catchment Management Plans for Marenje Mlunguni WRUA in Kwale County, Mayoni WRUA in Kakamega County and Muhotetu WRUA in Laikipia County; preparation of sector reports for Athi Basin Plan; hydrological study on Mzima Springs to assess feasibility of the Proposed Mzima II Project; hydrological Study of Chibulu Springs, Kericho County. In addition, Ruth participated in the development of Lake Naivasha Basin Water Allocation Plan where she established water demand per sector and scenario development. She has also undertaken engineering design and construction supervision for a variety of water projects primarily related to water resource monitoring, rural water supplies for domestic and rainwater harvesting systems. Recent projects include the design of Ainabor Ajijik Water Supply Scheme, Ntoya Common intake, Matundura Dam rehabilitation and Karunga Dam rehabilitation all within Lake Naivasha Basin under the Imarisha Naivasha Project. Additionally, under Output Based Aid programme (OBA), Ruth undertook feasibility assessments, design and construction supervision of over 35 community water supply schemes.

Ruth will handle applications for data purchase from the WRA at Regional Office, Machakos. This will take the form of a day-long visit to the Regional Office; selecting data sets to purchase and purchasing these.

Willy Sasaka - Field hydrogeologist

Willy is a hydrogeologist who is knowledgeable and experienced in groundwater exploration and development. He has experience in hydrogeological and geophysical field investigations targeting the siting of water wells. He is experienced in the supervision of borehole drilling works, including large-diameter, high capacity boreholes. He has specific experience in the siting and supervision of single and dual-piezometer observation/monitoring boreholes in a coastal context (Mazeras Sandstones and associated sediments; and Pleistocene coral limestones). He has been active in the field of groundwater development for eight years, covering parts of northern Kenya including both Turkana and Marsabit counties, north eastern Kenya, the South Kenya Coast, the Nairobi area and the Rift Valley. Willy has been involved in numerous borehole siting studies applying a range of geophysical methods, mostly 1-D electrical resistivity and 2-D electrical resistivity tomography in locating groundwater as well as in discriminating saltwater intrusion in the sub-surface.

Willy will work with Mike Thomas's field programme, as well as liaising with Kwale County in relation to planned groundwater development and associated timelines. He has been closely involved in the design and development of all Base's boreholes (exploratory, production, monitoring and community); and the establishment and operation of the Base Titanium Environment Department's water resources monitoring network. He worked within the overall framework of the UPGro and ISGEAG projects.

Tom Traexler - Water Services Operations, Mechanical Engineering and Works

Tom Traexler has a BSc in Mechanical Engineering and a MSc in Agricultural Engineering. Tom has applied his training in a wide variety of projects in the water, agricultural and energy sectors. Thomas Traexler has 30 years' experience on commercial and community projects in the United States of America, Kenya, Tanzania, and Somalia. His experience includes overall project planning and management of both development and relief projects. He has extensive experience in the mechanical and civil engineering aspects related to water supply and agricultural projects. He is also competent in contract preparation and construction supervision. His experience covers water supply, irrigation, sewerage, and appropriate technology projects

Tom will calculate pumping heads, pipework characteristics etc. for each of the potentially viable water sources, provisionally from the source to the process plant. If water sources are closer to the North Dune, then pumping characteristics for that option will also be calculated. He is broadly familiar with Kwale, through his involvement in the UPGro project.

John Esther - GIS Specialist

John Esther is a GIS and Remote Sensing specialist with a bias towards Data Analytics, Programming, Web Mapping, Graphics Design and Cartography. John has a BSc in Geography from Egerton University (Kenya), 14 GIS and Remote Sensing Certificates from Esri Eastern Africa (Kenya) and a myriad of courses in programming, data analytics and graphics design. John has combined his training with professional work experience in Kenya applying geographical information systems (GIS) and remote sensing to hydrogeology, topographical surveying, urban planning, dam

design, web design and cartography. John has undertaken groundwater mapping involving aquifer identification and characterization, spatial modelling, digital mapping, faulting analysis and geo-statistical analysis (WRA). He has also been involved in facilities mapping (St. Andrew's Turi), borehole database design and analysis (WRA), water resources mapping and assessment in conservancies of northern Kenya (NRT) and in the mapping and data analysis for the Feasibility Study for Agricultural Development in Kalobeyei Settlement Scheme (FAO). He has further been involved in multi-criteria decision analysis for spatial modelling of trans-county Water Resource Users Associations (WRUA's) and Sub-Catchments in selected Counties of Kenya to advise on cost sharing of investments among affected counties. He has also been involved in 3D modelling of Nairobi's CBD (EsriEA), web mapping of project areas (RFL), creation of logistics maps (Boma Project, Mercy Corps Kenya and International Medical Corps) and development of elevation models to calculate water flows to dams (Nkumbu, Tango Maos, Kudenga). John has professional command for various programming languages and software that help to accomplish tasks that include ArcGIS Desktop, ArcGIS Online, Envi, QGIS, Django, Python, Leaflet, Esri City Engine, Affinity Designer, Adobe Illustrator, PostgreSQL, Affinity Photo and JavaScript.

John will carry out all mapping assignments for the study. He is very familiar with the study area, due to his involvement in the UPGro project.

APPENDIX B

Appendix B KISCOL Water Permit Applications

File No.	App. Date	Applicant Name	Cat	Volume of Water (m^3/d)
PRODUCTION BH sites?				
WRMA/30/MSA/3K/10009/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10017/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10018/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10019/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10020/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10022/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10023/G	June-25-2010	KISCOL	D	600
WRMA/30/MSA/3K/10024/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10025/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10026/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10027/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10028/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10029/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10030/G	June-25-2010	KISCOL	D	1000
WRMA/30/MSA/3K/10031/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10032/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10033/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10034/G	April-19-2010	KISCOL	D	500
WRMA/30/MSA/3K/10035/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10036/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10037/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10038/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10039/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10040/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10041/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10042/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10043/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10044/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10045/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10046/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10047/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10048/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10054/G	June-25-2010	KISCOL	D	600
WRMA/30/MSA/3K/10056/G	June-25-2010	KISCOL	D	1000

File No.	App. Date	Applicant Name	Cat	Volume of Water (m^3/d)
WRMA/30/MSA/3K/10057/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10059/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10126/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10127/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10128/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10129/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10130/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10131/G	June-25-2010	KISCOL	D	600
WRMA/30/MSA/3K/10132/G	June-25-2010	KISCOL	D	1000
WRMA/30/MSA/3K/10133/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10134/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10135/G	June-25-2010	KISCOL	D	1000
WRMA/30/MSA/3K/10136/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10137/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10138/G	April-19-2010	KISCOL	D	500
WRMA/30/MSA/3K/10139/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10140/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10141/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10142/G	April-19-2010	KISCOL	D	1235
WRMA/30/MSA/3K/10143/G	June-25-2010	KISCOL	D	600
WRMA/30/MSA/3K/10144/G	April-19-2010	KISCOL	D	?
WRMA/30/MSA/3K/10145/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10146/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10147/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10148/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10149/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10150/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10151/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10152/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10153/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10154/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10155/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10156/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10157/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10158/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10159/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10160/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10161/G	April-19-2010	KISCOL	D	1500

File No.	App. Date	Applicant Name	Cat	Volume of Water (m^3/d)
WRMA/30/MSA/3K/10162/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10163/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10164/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10165/G	June-25-2010	KISCOL	D	600
WRMA/30/MSA/3K/10166/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10167/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10168/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10169/G	April-19-2010	KISCOL	D	1500
WRMA/30/MSA/3K/10170/G	June-25-2010	KISCOL	D	800
WRMA/30/MSA/3K/10239/G	April-19-2010	KISCOL	D	800
WRMA/30/MSA/3K/10259/G	April-19-2010	KISCOL	D	800
POSSIBLE MONITORING BOREHOLES?				
WRMA/30/MSA/3K/11212/G	August-23-2014	KISCOL	A	0
WRMA/30/MSA/3K/11213/G	September-2-2014	KISCOL	A	0
WRMA/30/MSA/3K/11214/G	September-2-2014	KISCOL	A	0
WRMA/30/MSA/3K/11215/G	September-2-2014	KISCOL	A	0
WRMA/30/MSA/3K/11216/G	September-2-2014	KISCOL	A	0
WRMA/30/MSA/3K/11217/G	September-2-2014	KISCOL	A	0
WRMA/30/MSA/3K/11218/G	September-2-2014	KISCOL	A	0
WRMA/30/MSA/3K/11219/G	September-2-2014	KISCOL	A	0
WRMA/30/MSA/3K/11220/G	September-2-2014	KISCOL	A	0
WRMA/30/MSA/3K/11221/G	September-2-2014	KISCOL	A	0
WRMA/30/MSA/3K/11222/G	September-2-2014	KISCOL	A	?

Summary details of known KISCOL production BHs (ARC1960 coordinates)

BH No.	Locality	Easting	Northing	Depth (m)	Static WL	Test yield (m^3/hr)	Drawdown (m)
BH4	Nikaphu	540506	9503164	75	5.30	80	24.0
BH3	Nikaphu	540608	9503424	70	6.11	70	19.2
BH1	Nikaphu	540295	9503720	77	5.30	80	30.0
BH2	Nikaphu	540567	9504051	80	7.20	70	28.1
BH310	Milalani	548298	9504165	80	5.10	120	3.64
BH311	Milalani	547672	9503848	80	9.44	214	5.13
BH306	Milalani	547869	9505458	80	8.21	90	7.98
BH302	Milalani	547740	9505930	153	9.72	180	15.85
BH307	Milalani	548148	9505674	80	9.14	195	6.95
BH309	Milalani	548764	9506151	86	5.64	240	13.1
BH405	Milalani	547709	9506548				
BH305	Milalani	546508	9505227				
BH401	Milalani	548845	9506662	90	12.54	190	14.18
BH402	Milalani	548575	9507139	100	16.20	180	9.10
BH1004	Kinondo	555921	9517562	80	20.80	30	31.7
BH1006	Kinondo	555141	9517162	80	7.30	50	47.6
BH1008	Kinondo	554568	9516220	80	9.72	50	17.8
BH1005	Kinondo	554719	9516658				
BH1007	Kinondo	555197	9516619	80	5.70	30	49.2
BH1001	Kinondo	556088	9517934				
BH1003	Kinondo	555411	9517888				
BH1-Site	Ramisi	543975	9499856	95	6.45	10	56.58
BH404	Kigombero	548102	9506632	90			
BH304	Kigombero	546973	9505466	51	12.75	70	16.25
BH301	Kigombero	547244	9505683	118		90	
BH303	Kigombero	547228	9505657	150	9.14		49.84

NOTE: field data collected by Gro for GooD in 2013, test data as reported by KISCOL staff.

APPENDIX C

BASE WATER PERMIT APPLICATIONS AND WATER PERMITS

File No.	Base BH No	App. Date	Applicant Name	Cat	Volume of Water (m^3/d)
BOREHOLES WHICH BASE HAS PAPER RECORDS FOR					
WRMA/30/MSA/3K/10229/G	**BH6R production BH**	January-24-2011	BASE TITANIUM LTD	D	1600
WRMA/30/MSA/3K/10472/G	**BH7 production BH**	September-8-2011	BASE TITANIUM LTD	D	1440
WRMA/30/MSA/3K/10473/G	**BH8 - to Kwale County (2019; poor BH)**	September-8-2011	BASE TITANIUM LTD	D	1440
WRMA/30/MSA/3K/10564/G	**BH3 production BH**	June-28-2010	BASE TITANIUM LTD	D	1600
WRMA/30/MSA/3K/10566/G	**BH1 production BH**	June-28-2010	BASE TITANIUM LTD	D	1900
WRMA/30/MSA/3K/10567/G	**BH3 Dual Piezometer (Pz)**	September-19-2011	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/10568/G	**BH7 Dual Pz**	September-19-2011	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/10569/G	**BH8 Dual Pz**	September-19-2011	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/10570/G	**BH1 Dual Pz**	September-19-2011	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/10678/G	**BH5O - to KFS (2017; poor BH), solar pump-equipped**	June-28-2010	BASE TITANIUM LTD	D	1200
WRMA/30/MSA/3K/10679/G	**BH5 Dual Pz**	September-19-2011	BASE TITANIUM LTD	A	0.1
WRMA/30/MSA/3K/11010/G	**SPC Dual Pz**	September-19-2013	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/11011/G	**Vumbu Dual Pz**	September-19-2013	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/11012/G	**S6 Pz**	September-19-2013	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/11013/G	**S10 Pz**	September-19-2013	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/11014/G	**Cemetery Dual Pz**	September-19-2013	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/11272/G	**BH6 Dual Pz**	September-6-2014	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/11740/G	**BH5R production BH**	August-26-2016	BASE TITANIUM LTD	D	1400
WRMA/30/MSA/3K/11741/G	**BH2B production BH**	August-26-2016	BASE TITANIUM LTD	D	1600
WRMA/30/MSA/3K/11742/G	**Not drilled**	August-26-2016	BASE TITANIUM LTD	D	1200
WRMA/30/MSA/3K/11743/G	**Laydown – exploratory BH, not in use**	August-26-2016	BASE TITANIUM LTD	D	1200
WRMA/30/MSA/3K/11744/G	**Vumbu – exploratory BH, not in use**	August-26-2016	BASE TITANIUM LTD	D	1200
WRMA/30/MSA/3K/11745/G	**Not drilled**	August-26-2016	BASE TITANIUM LTD	D	1200
BOREHLES FOR WHICH BASE HAS NO RECORD (DUPLICATES AND RE-ALLOCATED NUMBERS WHEN BASE ACQUIRED TIOMIN)					
WRMA/30/MSA/3K/10049/G		July-29-2010	BASE TITANIUM LTD	D	1200
WRMA/30/MSA/3K/10050/G		July-29-2010	BASE TITANIUM LTD	D	1200
WRMA/30/MSA/3K/10051/G		July-29-2010	BASE TITANIUM LTD	D	1200
WRMA/30/MSA/3K/10052/G		July-29-2010	BASE TITANIUM LTD	D	1200
WRMA/30/MSA/3K/10053/G		July-29-2010	BASE TITANIUM LTD	D	1200
WRMA/30/MSA/3K/10223/G		January-4-2011	TIOMIN KENYA LTD	D	1440
WRMA/30/MSA/3K/10224/G		January-4-2011	TIOMIN KENYA LTD	D	1440
WRMA/30/MSA/3K/10225/G		January-4-2011	TIOMIN KENYA LTD	D	1440

File No.	Base BH No	App. Date	Applicant Name	Cat	Volume of Water (m^3/d)
WRMA/30/MSA/3K/10226/G		January-10-2011	BASE TITANIUM LTD	D	1440
WRMA/30/MSA/3K/10227/G		January-10-2011	BASE TITANIUM LTD	D	1440
WRMA/30/MSA/3K/10228/G		January-10-2011	BASE TITANIUM LTD	D	1440
WRMA/30/MSA/3K/10230/G		January-24-2011	BASE TITANIUM LTD	D	1440
WRMA/30/MSA/3K/10231/G		January-24-2011	BASE TITANIUM LTD	D	1440
WRMA/30/MSA/3K/10467/G		September-19-2011	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/10468/G		September-19-2011	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/10469/G		September-19-2011	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/10470/G		September-19-2011	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/10471/G		September-19-2011	BASE TITANIUM LTD	A	0
WRMA/30/MSA/3K/11228/G		September-4-2014	BASE TITANIUM LTD	A	0

APPENDIX D

WATER PERMIT APPLICATIONS MADE BY CWSB AND CGK

File No.	App. Date	Applicant Name	Cat	Volume of Water (m^3/d)
WRMA/30/MSA/3K/10202/G	January-31-2011	COAST WATER SERVICES BOARD	D	300
WRMA/30/MSA/3K/10203/G	January-31-2011	COAST WATER SERVICES BOARD	D	300
WRMA/30/MSA/3K/10204/G	January-31-2011	COAST WATER SERVICES BOARD	D	500
WRMA/30/MSA/3K/10237/G	November-30-2010	COAST WATER SERVICES BOARD	B	25
WRMA/30/MSA/3K/11375/G	December-4-2014	COAST WATER SERVICES BOARD	C	229
WRMA/30/MSA/3K/11774/G	September-25-2010	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11776/G	September-20-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11778/G	September-20-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11779/G	September-20-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11780/G	September-20-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11781/G	September-20-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11782/G	September-20-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11794/G	October-17-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11795/G	October-17-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11796/G	October-17-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11798/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11799/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11804/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11805/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11806/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11807/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11808/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11809/G	October-26-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11810/G	October-26-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11835/G	November-29-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11836/G	November-28-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11837/G	November-29-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11838/G	November-29-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11839/G	November-30-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11840/G	November-30-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11841/G	November-30-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11842/G	November-30-2016	COAST WATER SERVICES BOARD	B	60

APPENDIX E

WATER PERMIT APPLICATIONS MADE BY OTHER ENTITIES

File No.	App. Date	Applicant Name	Cat	Volume of Water (m^3/d)
WRMA/30/MSA/3K/10076/G	February-11-2009	SIMANYA PRIMARY SCHOOL	B	20
WRMA/30/MSA/3K/10077/G	February-11-2009	KIBUYUNI PRIMARY SCHOOL	B	20
WRMA/30/MSA/3K/10078/G	February-11-2009	MAGWASHENI PRIMARY SCHOOL	B	20
WRMA/30/MSA/3K/10079/G	February-11-2009	MUALENI PRE SCHOOL	B	20
WRMA/30/MSA/3K/10080/G	February-11-2009	LUKORE PRIMARY SCHOOL	B	20
WRMA/30/MSA/3K/10081/G	February-11-2009	MKANDA PRIMARY SCHOOL	B	20
WRMA/30/MSA/3K/10085/G	January-15-2010	MANDA YOUTH POLYTECHNIC	C	
WRMA/30/MSA/3K/10086/G	February-11-2009	MIRIHINI PRIMARY SCHOOL	B	20
WRMA/30/MSA/3K/10087/G	February-11-2009	TIRIBE PRIMARY SCHOOL	B	20
WRMA/30/MSA/3K/10100/G	October-8-2010	CROSSROADS FELLOWSHIP CHURCH	B	15
WRMA/30/MSA/3K/10102/G	October-12-2010	BWITI PRIMARY SCHOOL	B	17.5
WRMA/30/MSA/3K/10107/G	October-12-2010	BWITI PRIMARY SCHOOL	B	17.5
WRMA/30/MSA/3K/10108/G	October-12-2010	KIRUKU SECONDARY SCHOOL	B	40
WRMA/30/MSA/3K/10109/G	July-22-2010	MINISTRY OF IMMIGRATION & REGISTRATION OF PERSONS	B	15
WRMA/30/MSA/3K/10115/G	November-11-2010	DIANI CHILDRENS VILLAGE	B	10
WRMA/30/MSA/3K/10202/G	January-31-2011	COAST WATER SERVICES BOARD	D	300
WRMA/30/MSA/3K/10203/G	January-31-2011	COAST WATER SERVICES BOARD	D	300
WRMA/30/MSA/3K/10204/G	January-31-2011	COAST WATER SERVICES BOARD	D	500
WRMA/30/MSA/3K/10237/G	November-30-2010	COAST WATER SERVICES BOARD	B	25
WRMA/30/MSA/3K/10290/G	April-8-2011	SHABAAN JOHN KHAMISI SR	B	50
WRMA/30/MSA/3K/10292/G	April-8-2011	SHABAAN JOHN KHAMISI SR	B	50
WRMA/30/MSA/3K/10317/G	May-3-2011	DET GODE LIV COMPANY LIMITED	B	30
WRMA/30/MSA/3K/10337/G	July-6-2011	EVANGELICAL LUTHERAN CHURCH IN KENYA	B	10
WRMA/30/MSA/3K/10347/G	March-30-2011	UTUNZI LTD(WARANDALE) LTD	B	12
WRMA/30/MSA/3K/10350/G	August-15-2011	SABRINA PRIMARY SCHOOL	B	18
WRMA/30/MSA/3K/10352/G	August-23-2011	MAMA LORENZAS VOCATIONAL CENTER	B	30
WRMA/30/MSA/3K/10353/G	August-16-2011	ORIENTAL INTERNATIONAL LIVESTOCK LTD	C	290
WRMA/30/MSA/3K/10354/G	August-16-2011	ORIENTAL INTERNATIONAL LIVESTOCK LTD	C	290
WRMA/30/MSA/3K/10357/G	April-28-2008	ROY ROBERTSON	B	10
WRMA/30/MSA/3K/10358/G	March-31-2011	SCHULZE KARIN ELFRIEDE	B	5
WRMA/30/MSA/3K/10359/G	April-7-2011	MICHELBERGER ESTATES LTD	B	5
WRMA/30/MSA/3K/10364/G	July-6-2011	EVANGELICAL LUTHERAN CHURCH IN KENYA	B	10
WRMA/30/MSA/3K/10365/G	September-27-2007	SIMBA AND ORYX LIMITED	B	2
WRMA/30/MSA/3K/10366/G	July-6-2011	EVANGELICAL LUTHERAN CHURCH IN KENYA	B	10

File No.	App. Date	Applicant Name	Cat	Volume of Water (m^3/d)
WRMA/30/MSA/3K/10378/G	May-13-2010	DIANI REEF BEACH RESORT & SPA	D	320
WRMA/30/MSA/3K/10390/G	May-14-2010	JACARANDA INDIAN OCEAN BEACH RESORT	C	299
WRMA/30/MSA/3K/10397/G	June-9-2010	SIMON NDOLO KISOILA	C	60
WRMA/30/MSA/3K/10400/G	May-14-2010	NEPTUNE HOTELS -SOUTH COAST	B	29
WRMA/30/MSA/3K/10401/G	May-14-2010	NEPTUNE HOTELS -SOUTH COAST	B	29
WRMA/30/MSA/3K/10403/G	May-14-2010	NEPTUNE HOTELS -SOUTH COAST	B	29
WRMA/30/MSA/3K/10404/G	May-14-2010	NEPTUNE HOTELS -SOUTH COAST	B	29
WRMA/30/MSA/3K/10428/G	October-8-2010	TAJANO LIMITED	C	72
WRMA/30/MSA/3K/10439/G	November-23-2010	COROMANDELE RESORT LTD	B	
WRMA/30/MSA/3K/10440/G	November-23-2010	COROMANDELE RESORT LTD	B	
WRMA/30/MSA/3K/10440/G	November-23-2010	COROMANDELE RESORT LTD	B	38
WRMA/30/MSA/3K/10442/G	November-23-2010	COROMANDELE RESORT LTD	B	25
WRMA/30/MSA/3K/10442/G	November-23-2010	COROMANDELE RESORT LTD	B	50
WRMA/30/MSA/3K/10463/G	October-6-2011	MITI MILELE	B	50
WRMA/30/MSA/3K/10474/G	November-23-2010	COROMANDELE RESORT LTD	B	25
WRMA/30/MSA/3K/10475/G	November-23-2010	COROMANDELE RESORT LTD	B	38
WRMA/30/MSA/3K/10504/G	April-27-2011	DIANI INVESTMENTS LIMITED	B	10
WRMA/30/MSA/3K/10505/G	April-7-2011	INGEBORG REMANN	B	15
WRMA/30/MSA/3K/10510/G	April-7-2011	BAHARI BULUU LIMITED	B	15
WRMA/30/MSA/3K/10521/G	April-27-2011	SHEETAL KAPILA	B	5
WRMA/30/MSA/3K/10548/G	November-16-2009	LEISURE LODGE LIMITED	B	20
WRMA/30/MSA/3K/10549/G	November-16-2009	LEISURE LODGE LIMITED	B	20
WRMA/30/MSA/3K/10550/G	November-16-2009	LEISURE LODGE LIMITED	B	20
WRMA/30/MSA/3K/10551/G	November-16-2009	LEISURE LODGE LIMITED	B	20
WRMA/30/MSA/3K/10555/G	November-10-2011	MITI MILELE	B	50
WRMA/30/MSA/3K/10584/G	September-20-2011	CARLO AND LAURA BIACHI	B	10
WRMA/30/MSA/3K/10587/G	November-25-2011	BOELLING DIETRICH	B	11
WRMA/30/MSA/3K/10597/G	June-25-2011	ORBIT DEVELOPERS LTD	B	15
WRMA/30/MSA/3K/10622/G	April-7-2011	PATRICK DANSON HEMPHILL	B	15
WRMA/30/MSA/3K/10666/G	May-24-2010	MWAMWINDI SHEE HAMISI	C	30
WRMA/30/MSA/3K/10674/G	April-6-2011	COLIN EDWARD CHURCH	B	15
WRMA/30/MSA/3K/10676/G	January-25-2012	GRAND MOTEL HOLDINGS LIMITED	B	15
WRMA/30/MSA/3K/10677/G	January-3-2012	PEDINI AURELIO	B	3
WRMA/30/MSA/3K/10682/G	February-16-2012	KESE INVESTMENTS LTD	B	8
WRMA/30/MSA/3K/10684/G	February-13-2012	JOSEPH MWANGI MUNGAI	B	11
WRMA/30/MSA/3K/10685/G	March-1-2012	LEISURE LODGE LIMITED	B	20

File No.	App. Date	Applicant Name	Cat	Volume of Water (m^3/d)
WRMA/30/MSA/3K/10686/G	February-13-2012	PEONY LIMITED	B	5
WRMA/30/MSA/3K/10687/G	February-27-2012	CRISTINA MCKENZIE	B	70
WRMA/30/MSA/3K/10688/G	February-16-2012	CIMARRON INVESTMENT LTD	B	5
WRMA/30/MSA/3K/10689/G	February-16-2012	KARL H. HETTERLING & BRIGITTE I. HETTERLING	B	3
WRMA/30/MSA/3K/10691/G	February-17-2012	HANS AXEL HABECK	B	0.5
WRMA/30/MSA/3K/10693/G	March-9-2012	ITCO INVESTMENTS LTD	C	23
WRMA/30/MSA/3K/10694/G	February-14-2012	ALBERTO SOPRANI	B	10
WRMA/30/MSA/3K/10695/G	February-14-2012	ALBERTO SOPRANI	B	10
WRMA/30/MSA/3K/10696/G	February-14-2012	NIKKY TEMBO INVESTMENTS LTD	B	20
WRMA/30/MSA/3K/10697/G	February-14-2012	NIKKY TEMBO INVESTMENTS LTD	B	1.5
WRMA/30/MSA/3K/10698/G	February-13-2012	LEOPARD BEACH RESORT & SPA (AEGIS KENYA LTD)	C	90
WRMA/30/MSA/3K/10700/G	February-8-2012	KABIRDIN KASSAM KHIMJI	B	10
WRMA/30/MSA/3K/10701/G	February-8-2012	KABIRDIN KASSAM KHIMJI	B	10
WRMA/30/MSA/3K/10702/G	February-8-2012	KABIRDIN KASSAM KHIMJI	B	10
WRMA/30/MSA/3K/10703/G	February-8-2012	KABIRDIN KASSAM KHIMJI	B	10
WRMA/30/MSA/3K/10704/G	February-8-2012	KABIRDIN KASSAM KHIMJI	B	10
WRMA/30/MSA/3K/10705/G	February-8-2012	KABIRDIN KASSAM KHIMJI	B	10
WRMA/30/MSA/3K/10707/G	March-10-2012	TATCO LIMITED	B	10
WRMA/30/MSA/3K/10708/G	March-13-2012	PEMBA CHANNEL FISHING CLUB LTD	B	13
WRMA/30/MSA/3K/10711/G	February-13-2012	PETSAN PROPERTIES LTD	B	2
WRMA/30/MSA/3K/10712/G	February-8-2012	MEKAELA HOLDINGS LTD	B	20
WRMA/30/MSA/3K/10713/G	March-8-2012	BOTHE DIETER	B	10
WRMA/30/MSA/3K/10714/G	February-8-2012	KABIRDIN KASSAM KHIMJI	B	10
WRMA/30/MSA/3K/10725/G	February-17-2012	DR. LALIT CHANDRA DWAKADAS KOTAK	B	10
WRMA/30/MSA/3K/10726/G	January-30-2012	SHIMONI REEF LODGE LTD	B	20
WRMA/30/MSA/3K/10728/G	March-19-2012	AMANI SAFARIS LTD	B	30
WRMA/30/MSA/3K/10729/G	March-14-2012	J. LINDGREN(CHALE LTD)	B	10
WRMA/30/MSA/3K/10730/G	March-14-2012	KIM SHELAGH HARRINGTON(MULBERRY PROPERTIES LTD)	B	10
WRMA/30/MSA/3K/10749/G	May-2-2012	LTI KASKAZI BEACH HOTEL	C	100
WRMA/30/MSA/3K/10750/G	May-2-2012	LTI KASKAZI BEACH HOTEL	C	10
WRMA/30/MSA/3K/10763/G	May-10-2012	KATHLEEN KOON CHOO JOGSCHAT	B	2.6
WRMA/30/MSA/3K/10764/G	May-9-2012	KATHLEEN KOON CHOO JOGSCHAT	B	3.96
WRMA/30/MSA/3K/10767/G	May-5-2012	SIX SIXTY ONE GALU BEACH MANAGEMENT LTD	C	124
WRMA/30/MSA/3K/10793/G	May-21-2012	DAMARIS NDUTA WANGARE	B	5
WRMA/30/MSA/3K/10798/G	February-22-2012	MARZENA LIMITED	B	20
WRMA/30/MSA/3K/10807/G	July-30-2012	BAOBAB COTTAGES (DIANI) LIMITED	B	15

File No.	App. Date	Applicant Name	Cat	Volume of Water (m^3/d)
WRMA/30/MSA/3K/10810/G	February-29-2012	ARTHUR AST	B	4
WRMA/30/MSA/3K/10851/G	October-5-2012	SOUTH COAST HOLDINGS LTD	B	5
WRMA/30/MSA/3K/10858/G	October-12-2012	MWAMTSEFU PRIMARY SCHOOL	B	14
WRMA/30/MSA/3K/10879/G	October-30-2012	PHILEMON NGEWA MWEU	B	35
WRMA/30/MSA/3K/10884/G	November-15-2012	AMANI SAFARIS LTD	B	30
WRMA/30/MSA/3K/10888/G	November-21-2012	ATHMAN OTIME JUMA	B	10
WRMA/30/MSA/3K/10889/G	November-19-2012	MUSA IDD KANZOVU	B	20
WRMA/30/MSA/3K/10911/G	February-15-2013	SWAHILI BEACH RESORTS LTD	B	30
WRMA/30/MSA/3K/10912/G	February-15-2013	SWAHILI BEACH RESORTS LTD	B	30
WRMA/30/MSA/3K/10913/G	February-15-2013	SWAHILI BEACH RESORTS LTD	B	30
WRMA/30/MSA/3K/10930/G	April-23-2013	FOOTPRINTS CHILDRENS HOME	B	10
WRMA/30/MSA/3K/10944/G	December-5-2012	BEACH SAND SUN LIMITED	C	80
WRMA/30/MSA/3K/10946/G	May-16-2013	DAVID KAMAU KARIOKI	C	85
WRMA/30/MSA/3K/10947/G	January-25-2012	PETER NDUNG'U KIBE	B	40
WRMA/30/MSA/3K/10948/G	August-8-2012	HANS JUERGEN ERHARD GOLZE	B	30
WRMA/30/MSA/3K/10949/G	June-28-2012	HAMADI JUMA MWAKIBIBO	B	12.4
WRMA/30/MSA/3K/10951/G	May-3-2013	JOHN H. A. WILLIAMS	B	60
WRMA/30/MSA/3K/10952/G	May-3-2013	JOHN H. A. WILLIAMS	B	60
WRMA/30/MSA/3K/10959/G	May-28-2013	GUGU PRIMARY SCHOOL	B	22
WRMA/30/MSA/3K/10981/G	July-10-2013	FIHONI TRADING CENTRE /GAZI SUB LOCATION DEVELOPMENT COMMIT	A	9
WRMA/30/MSA/3K/10997/G	May-16-2013	FRANCISCAN SISTERS OF SAINT JOSEPH(ASUMBI)	B	12
WRMA/30/MSA/3K/11000/G	August-13-2013	MAGAONI SECONDARY SCHOOL	B	31.5
WRMA/30/MSA/3K/11006/G	September-16-2013	JAMES NZOMO MULINGE	B	15
WRMA/30/MSA/3K/11015/G	August-22-2013	KAMTONGA BOREHOLE WATER PROJECT	B	
WRMA/30/MSA/3K/11033/G	October-24-2013	JAMES MUIYA MUEMA	B	12
WRMA/30/MSA/3K/11041/G	November-13-2013	MGOME PRIMARY SCHOOL	B	25
WRMA/30/MSA/3K/11053/G	November-15-2013	ME-HEALTH LIMITED	B	55
WRMA/30/MSA/3K/11056/G	December-9-2013	ME-HEALTH LIMITED	B	50
WRMA/30/MSA/3K/11057/G	December-9-2013	ME-HEALTH LIMITED	B	50
WRMA/30/MSA/3K/11073/G	December-2-2013	MWANAKOMBO HAMADI TSOZI	A	9
WRMA/30/MSA/3K/11084/G	January-27-2014	TEDDY THOMSON MWARABU	B	25
WRMA/30/MSA/3K/11112/G	February-14-2014	KINYUNGI PRIMARY SCHOOL	B	25
WRMA/30/MSA/3K/11182/G	June-23-2014	LYNETTE AWINO OKETCH	B	30
WRMA/30/MSA/3K/11279/G	September-9-2014	MACHARIA KIMANI	B	12
WRMA/30/MSA/3K/11307/G	May-16-2013	JUMA MASUDI MWAPASHUA	B	20
WRMA/30/MSA/3K/11320/G	October-11-2014	ME-HEALTH LIMITED	C	270

File No.	App. Date	Applicant Name	Cat	Volume of Water (m^3/d)
WRMA/30/MSA/3K/11337/G	November-7-2014	COAST KANGAROO WATERS LIMITED	B	70
WRMA/30/MSA/3K/11375/G	December-4-2014	COAST WATER SERVICES BOARD	C	229
WRMA/30/MSA/3K/11399/G	January-19-2015	SHAURI MOYO KIGOMBERO WATER PROJECT	A	9
WRMA/30/MSA/3K/11418/G	February-25-2015	MGANDINI WATER GROUP	A	9
WRMA/30/MSA/3K/11453/G	March-26-2015	HAMISI MWALIM MWARANDANI	B	50
WRMA/30/MSA/3K/11457/G	April-2-2015	KENYA ORIBI ENTERPRISES	B	20
WRMA/30/MSA/3K/11511/G	July-15-2015	MWABOZA OMAR MWACHUO	B	30
WRMA/30/MSA/3K/11569/G	December-11-2015	ST. JOSEPH CATHOLIC PRIMARY SCHOOL	B	50
WRMA/30/MSA/3K/11596/G	February-24-2016	EVELYN WANJIRU KARIUKI	B	10
WRMA/30/MSA/3K/11774/G	September-25-2010	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11776/G	September-20-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11778/G	September-20-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11779/G	September-20-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11780/G	September-20-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11781/G	September-20-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11782/G	September-20-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11794/G	October-17-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11795/G	October-17-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11796/G	October-17-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11798/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11799/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11804/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11805/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11806/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11807/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11808/G	October-19-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11809/G	October-26-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11810/G	October-26-2016	COUNTY GOVERNMENT OF KWALE	B	60
WRMA/30/MSA/3K/11835/G	November-29-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11836/G	November-28-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11837/G	November-29-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11838/G	November-29-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11839/G	November-30-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11840/G	November-30-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11841/G	November-30-2016	COAST WATER SERVICES BOARD	B	60

File No.	App. Date	Applicant Name	Cat	Volume of Water (m^3/d)
WRMA/30/MSA/3K/11842/G	November-30-2016	COAST WATER SERVICES BOARD	B	60
WRMA/30/MSA/3K/11844/G	December-2-2016	JITENDRA KUMAR	B	45
WRMA/30/MSA/3K/11983/G	July-7-2017	EDWARD ODUFUWA AGRICULTURAL CENTRE LIMITED	B	60
WRMA/30/MSA/3K/12133/G	January-20-2018	CAPRICON PURIFIERS	B	45
WRMA/30/MSA/3K/12135/G	January-30-2018	ABDIKADIR ADEN IBRAHIM	B	50
WRMA/30/MSA/3K/12215/G	May-4-2018	STEPHEN NGEI MUSYOKA	B	45
WRMA/30/MSA/3K/12293/G	August-8-2018	SANSONE BANIN	B	25
WRMA/30/MSA/3K/12323/G	September-17-2018	MWAWECHE/MIEMBENI COMMUNITY BOREHOLE	B	20
WRMA/30/MSA/3K/12324/G	September-17-2018	KIRUKU SECONDARY SCHOOL	B	20
WRMA/30/MSA/3K/12379/G	October-23-2018	EUNICE MUENI MAITHYA	B	40
WRMA/30/MSA/3K/12665/G	September-6-2019	ALPHONCE MULINGE MUTUA	B	20

APPENDIX F AIR QUALITY SPECIALIST REPORT

Air Quality Impact Assessment

Kwale Mine North Dune Expansion, Kenya

Base Titanium, Kenya

15 May 2020

Project No.: 0547330

The business of sustainability

ERM

Document details	
Document title	Air Quality Impact Assessment
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Signature Page

15 May 2020

Air Quality Impact Assessment

Kwale Mine North Dune Expansion, Kenya

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Senior Consultant

ERM Consulting East Africa Limited

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Acronyms and Abbreviations

Name	Description
ADM	Atmospheric Dispersion Modelling Ltd
AQIA	Air Quality Impact Assessment
AQS	Air Quality Standard
ARM	Ambient Ration Method
HMU	hydraulic mining unit
IFC	International Finance Corporation
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NOx	Oxides of Nitrogen
NPi	Australian National Pollution Inventory
PC	Process Contribution
PEC	Predicted Environmental Concentration
PM_{10}	Particulate matter of aerodynamic diameter ≤10µm
$PM_{2.5}$	Particulate matter of aerodynamic diameter ≤2.5µm
PVMRM	Plume Volume Molar Ratio Method
SANS	South African National Standards
SO_2	Sulphur dioxide
TSF	tailings storage facility
TSP	Suspended Particulate Matter
USEPA	United States Environmental Protection Agency
µm	Micrometer
µg/m^3	Microgram per cubic metre
WHO	World Health Organisation

1. INTRODUCTION

Base Titanium commissioned ERM Consulting East Africa (ERM) to undertake an Environmental Impact Assessment (EIA) for its planned expansion of Kwale mine operations to the North Dune area. This report sets out the Air Quality Impact Assessment (AQIA) in support of the EIA.

The mine is situated in southeast Kenya's coastal plain approximately 50km south of Mombasa and 10k inland from the Indian Ocean. The area is typically equatorial, with high ambient temperatures and high rainfall. The local climatic conditions are critical in the generation of dust and the migration of dust from the site. The proximity of sensitive receptors to dust-generating activities is also critical to the potential impacts, in terms of both magnitude and location.

Control of emissions and impacts through the design of the Project and mitigation of emission sources will be required.

This report sets out for an impact assessment for air quality for the operational phase of the Project. At this stage, the detail of the mine layout and operational activities is to a level to allow a fully quantitative assessment to be undertaken, albeit that several parameters are still unconfirmed and necessitate assumptions to be made.

2. OVERVIEW OF SITE ACTIVITY

The mining is currently centred on the exploitation of the South Dune, and the associated infrastructure is located close to the mining activities. In future, mining is expected to expand to the North Dune as the South Dune resource is depleted. The North dune mining areas are shown in Figure 2.1.

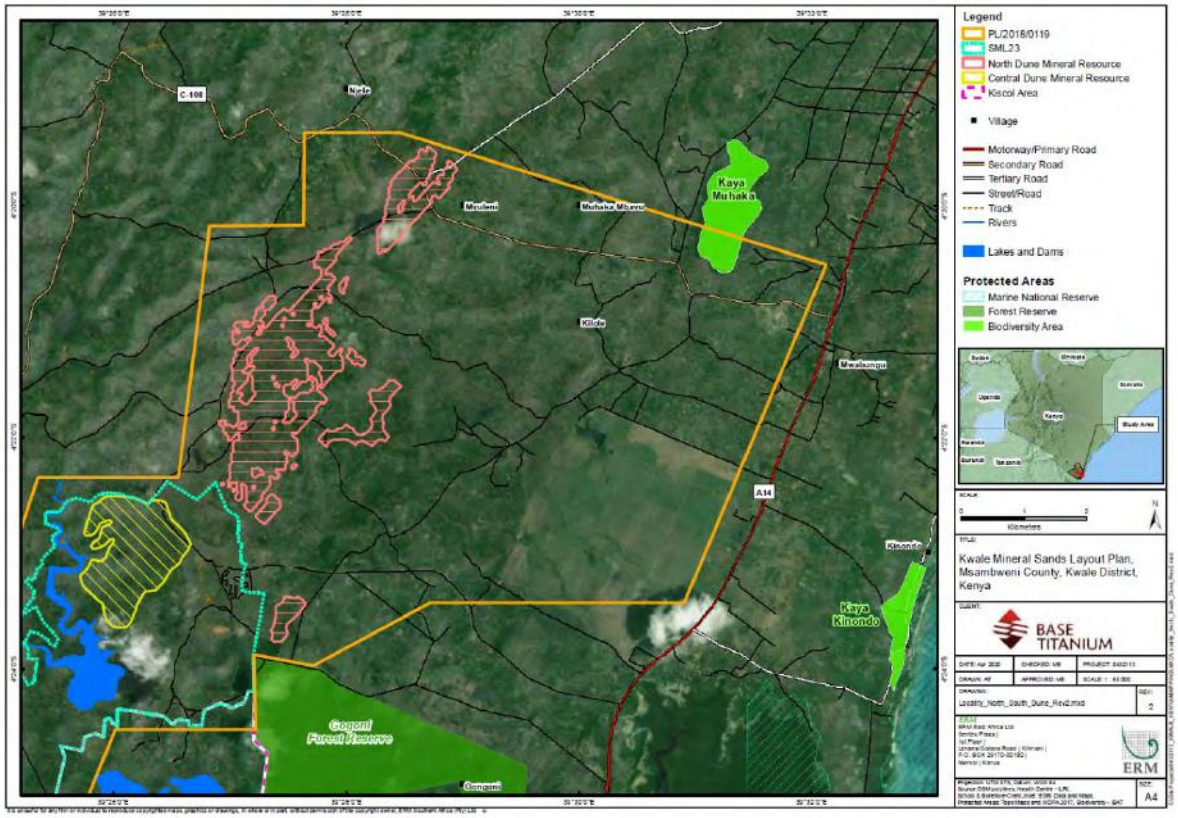


Figure 2.1 Future Mining Operations

Figure 2.1 provides context to the proposed mine expansion into the North Dune. There is currently no mining activity in the North Dune area.

3. AIR QUALITY STANDARDS AND GUIDELINES

3.1 Pollutants of Interest

The mining activities are primarily associated with the emission of particulate matter. These arise as:

- Deposited dust, this being total dust which settles onto property and surfaces which may cause a nuisance;
- Suspended Particulate Matter (TSP), this being the total dust burden in the air which may cause reduced visibility and nuisance;
- PM (PM_{10} and $PM_{2.5}$). PM_{10}, being particulate matter of aerodynamic diameter of ≤10µm; and $PM_{2.5}$, being particulate matter of aerodynamic diameter of ≤2.5µm.

Mining generates particulate matter mechanically, and as a result, the particle sizes are concentrated in the 2.5-10µm size range. As a result, $PM_{2.5}$ is typically a lesser issue, as $PM_{2.5}$ primarily arises from combustion sources.

In addition, there are emissions of oxides of nitrogen (NO_x), and by association nitrogen dioxide (NO_2) arising from mobile equipment on the North Dune. Emissions of sulphur dioxide (SO_2) are considered to be negligible due to the use of low sulphur fuels.

3.2 Kenyan Air Quality Standards

There are Air Quality Standards set out in Kenyan Law. These relate to the maximum permissible concentrations of pollutants in ambient air and are designed to protect the health of the general population. As a consequence, these are set at a level which is generally recognised to protect the health of the very young, the elderly and the infirm. Standards are set out for 'industrial areas' and 'Rural and Other Areas'. Whilst the mine itself is an industrial activity, receptors in the vicinity of the mine are all Rural or Other Areas, and therefore only these standards are considered.

Table 3.1 Kenyan Air Quality Standards

Pollutant	Averaging Period	Value (µg/m^3)	Notes
Suspended Particulate Matter	Annual Mean	140	Rural and Other Areas
Suspended Particulate Matter	24 hour mean	200	Rural and Other Areas
PM_{10}	Annual mean	50	Rural and Other Areas
PM_{10}	24 hour mean (98%ile)	100	Rural and Other Areas
PM	Annual mean	50	Property Boundary
PM	24 hour mean	70	Property Boundary
NO_2	Annual mean	0.05ppm	Rural and Other Areas
NO_2	Monthly mean	0.08ppm	Rural and Other Areas
NO_2	24 hour mean	0.1ppm	Rural and Other Areas
NO_2	1 hour mean	0.2ppm	Rural and Other Areas
NO_2	Instant peak	0.5ppm	Rural and Other Areas

Source: *Environmental Management and Co-ordination (Air Quality) Regulations of 2014*

3.3 IFC Air Quality Guidelines

For international projects, it is commonplace to refer to the IFC[1] air quality guidelines in addition to the national air quality standards. IFC standards are used in addition to the Kenyan standards as they are stricter in some respects.

The IFC state the following in terms of managing impacts to air quality:

(1) *IFC (2007) General EHS Guidelines Environmental: Air Emissions and Ambient Air Quality*

- Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognized sources;
- Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed.

The IFC set out tiered air quality guidelines. In this case, the use of the Interim-1 target values is recommended as these are the most comparable to other international standards, and confers an appropriate degree of protection whilst also balancing economic burden. The IFC air quality guidelines are set out in Table 3.2.

Table 3.2 IFC Air Quality Guidelines

Pollutant	Averaging Period	Value (µg/m^3)
PM_{10}	Annual mean	70
PM_{10}	24 hour mean (not to be exceeded more than 3 times per year)	150
$PM_{2.5}$	Annual mean	35
$PM_{2.5}$	24 hour mean	75
NO_2	Annual mean	40
NO_2	1 hour mean	200
SO_2	24 hour mean	125
SO_2	10 minute mean	500

3.4 Dust Deposition

The Kenyan regulations and IFC guidelines do not state limits for dust deposition. Several national agencies publish indicative guidelines for the deposition threshold that is likely to result in nuisance issues at sensitive receptors. These are set out in Table 3.3.

Table 3.3 Dust deposition nuisance thresholds

Potential for complaint	Measure of soiling (mg/m^2/day)	Data source
National Guidelines		
Possible Nuisance	600[1] (30-day average)	South Africa National Standards for residential areas
Possible Nuisance	350 (monthly mean)	TA-Luft, Germany
Very Likely Nuisance	650	TA-Luft, Germany
First Loss of Amenity	133 (monthly mean)	West Australia Nuisance Standard
Unacceptable reduction in air quality	333	West Australia Nuisance Standard
Serious nuisance	200	UK recommended nuisance dust deposition rate
Nuisance dust deposition	133	Malaysia air quality standard

Of these, those published by South Africa are considered most appropriate for the Kenyan situation. The South Africa standards are set for environments which have a high natural dust baseline, and reflect the 'desensitisation' of the population to dust deposition, given the naturally high baseline. This is similar to the situation around Kwale where there is generaly elevated dust deposition. The South

[1] *For residential areas can be exceeded 3 times in a year and not in consecutive months.*

African National Standards (SANS) 1929 (2005) stipulate a threshold for 'possible' nuisance due to dust deposition of 600mg/m^2/day as the 30 day average.

4. ASSESSMENT METHODOLOGY

4.1 Introduction

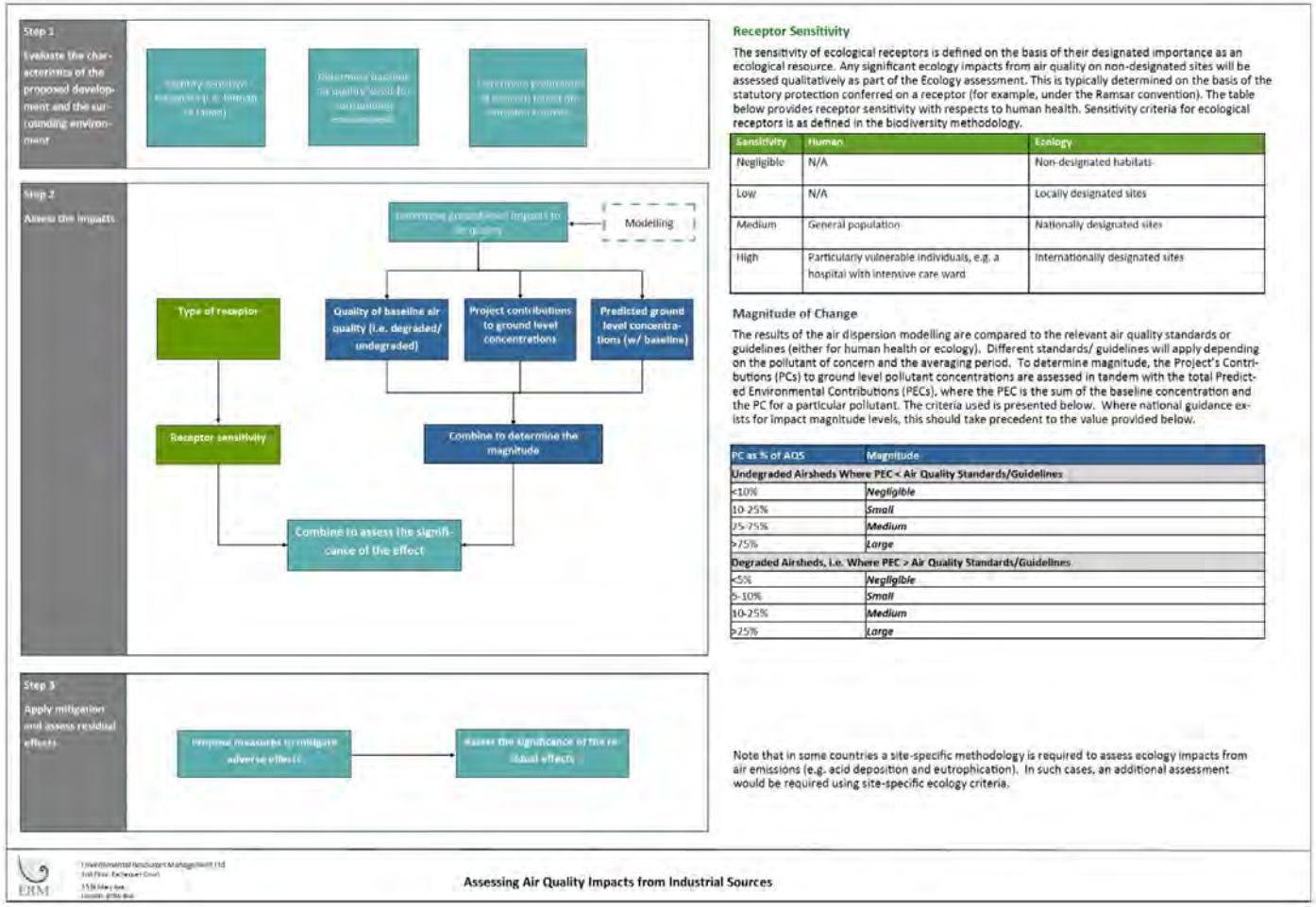
The impact assessment for mining activities has been undertaken following the methodology presented in Infographic 1 below. This method applies to all mining-related activities. The impact assessment set out in this report is therefore based on a quantitative approach, designed to 'signpost' potentially significant sources of emissions and highlight where mitigation may be appropriate.

The assessment draws upon various guidance documents, including from the United States Environmental Protection Agency (USEPA), Australian National Pollution Inventory (NPi) and the IFC. These documents are sufficiently flexible to be appropriate for this specific environment. The documents used are listed below:

- USEPA AP42 emissions clearinghouse;
- NPi (2012) National Pollutant Inventory Emission Estimation Technique Manual for Mining Version 3.1;
- IFC (2007) General EHS Guidelines for Air Emissions and Ambient Air Quality; and
- IFC (2007) EHS Guidelines for Mining.

An emissions inventory has been compiled for the Project, based upon the detailed design (see Section 4.2). This has informed dispersion modelling which has been used to predict impacts arising at nearby sensitive receptors.

Infographic 1 Assessment Methodology Mining Activities



Receptor Sensitivity

The sensitivity of ecological receptors is defined on the basis of their designated importance as an ecological resource. Any significant ecology impacts from air quality on non-designated sites will be assessed qualitatively as part of the Ecology assessment. This is typically determined on the basis of the statutory protection conferred on a receptor (for example, under the Ramsar convention). The table below provides receptor sensitivity with respects to human health. Sensitivity criteria for ecological receptors is as defined in the biodiversity methodology.

Sensitivity	Human	Ecology
Negligible	N/A	Non-designated habitats
Low	N/A	Locally designated sites
Medium	General population	Nationally designated sites
High	Particularly vulnerable individuals, e.g. a hospital with intensive care ward	Internationally designated sites

Magnitude of Change

The results of the air dispersion modelling are compared to the relevant air quality standards or guidelines (either for human health or ecology). Different standards/ guidelines will apply depending on the pollutant of concern and the averaging period. To determine magnitude, the Project's Contributions (PCs) to ground level pollutant concentrations are assessed in tandem with the total Predicted Environmental Contributions (PECs), where the PEC is the sum of the baseline concentration and the PC for a particular pollutant. The criteria used is presented below. Where national guidance exists for impact magnitude levels, this should take precedent to the value provided below.

PC as % of AQS	Magnitude
Undegraded Airsheds Where PEC < Air Quality Standards/Guidelines	
<10%	***Negligible***
10-25%	***Small***
25-75%	***Medium***
>75%	***Large***
Degraded Airsheds, i.e. Where PEC > Air Quality Standards/Guidelines	
<5%	***Negligible***
5-10%	***Small***
10-25%	***Medium***
>25%	***Large***

Note that in some countries a site-specific methodology is required to assess ecology impacts from air emissions (e.g. acid deposition and eutrophication). In such cases, an additional assessment would be required using site-specific ecology criteria.

4.2 Activities

4.2.1 Overview

Mining activities will be conducted systematically, moving from one block to another. The Blocks will be mined similarly to the current South Dune using hydraulic mining units (HMUs). In South Dune, 3 HMUs with another 1 on stand by are utilised.

This assessment considers only those processes associated with the mining of the North Dune. The activities of the main processing area are not considered, as these are covered by an existing EIA. On this basis, the activities considered are:

- Site (Mining Block) preparation
- Ore mining
- Site (Mining Block) Rehabilitation
- Waste tailings disposal

These activities will not be undertaken with no mitigation of air emissions. Two scenarios have been considered, operations with a minimal degree of Embedded Mitigation, and a second case with Additional Mitigation.

Where there is a continuous activity, such as stripping or placement of topsoil, there is the potential for dust to be generated continuously. However, where surfaces are undisturbed once fine particulate dust has been blown from the surface no further dust emissions will arise, and there is, therefore, a single dust event (typically on the first very windy day). Two scenarios have therefore been considered: 'mean' emissions, which are the average emissions from the mine and 'peak' emissions which are the one-time instantaneous emissions.

4.2.2 Site Preparation

The preparation of a mining block (average area ~18 ha) may, depending on local conditions, entail the following processes:

- Property removal/demolition and vegetation stripping
- Topsoil stripping
- Topsoil loading into dumper truck
- Topsoil haulage to stockpile
- Topsoil unloading at stockpile
- Topsoil stockpile profiling

These processes will result in the raising of dust and PM_{10}, especially when soils are dry. The use of mobile plant (dozers, loaders, trucks) will also be associated with combustion emissions (PM_{10}, NO_x).

Emissions from these processes are calculated using emission factors from NPi and US-EPA AP42, meteorological data provided by Atmospheric Dispersion Modelling Ltd (ADM), and are based on the following:

Basic data provided by Base to ERM:

- the average area of a mining block: 18 ha (based upon a 600m wide mining area, with a front of 300m
- maximum silt content in all material: 3.3%
- average topsoil thickness: 0.3m

- days of precipitation (>0.25mm) in year: 5.33 days on average
- time when windspeed > 5.4m/s: 10.4%
- average wind speed: 3.18 m/s
- 24/7 operations, with 40% load during night time

Assumptions:

- Average moisture of blasted material: 3% (worst case assumption)
- Topsoil density: 1.47t/m^3 (density of sandy clay, based on Base Lithology log)
- Average height of stockpiles: 10m
- Embedded mitigation:
  - Application of wind breaks around topsoil stockpiles, 30% abatement
- Additional mitigation:
  - Local water sprays at demolition/vegetation/soil stripping areas, 50% abatement
  - Local wind breaks at demolition/vegetation/soil stripping areas, 30% abatement
  - Keeping topsoil moist for loading, 50% abatement
  - Water sprays at topsoil stockpiles, 50% abatement
  - Level 1 (2l/m^2/h) watering of unpaved surfaces used for topsoil haulage, 50% abatement

Mobile plant identified to be used for site preparation of a 36ha mining block are presented in the table below:

Table 4.1 Mobile Plant – Site Preparation

Type	Quantity	Power (kW)	Emission Tier (USEPA)	Average operational weight (t)	Average speed (km/h)
D11T – dozer	1	695	2	104	10
D10T – dozer	1	562	4	70	10
D8 – dozer	1	264	4	39.8	10
980H - loader	2	317	4	40	10
Fuso FJ truck	1	175	4	16.3	10
14M – grader	1	178	4	26	10
336D – excavator	1	234	4	37.2	n/a
320E – excavator	2	122	4	22.8	n/a
323D – excavator	1	121	4	25.5	n/a
740B – truck	1	381	4	54.6	10
725 – truck	1	239	4	34.9	10

The calculated emissions for site preparation of a 18ha mining block are presented in the table below.

Table 4.2 Site Preparation Emissions, g/s

Pollutant	Embedded Mitigation	Additional Mitigation
TSP	1.97	0.698
PM_{10}	0.968	0.343

Pollutant	Embedded Mitigation	Additional Mitigation
NO_x	0.885	0.885

4.2.3 Ore Mining

Mining activities will be conducted systematically, moving from one block to another. The Blocks will be mined using four hydraulic mining units (HMUs) each operating at a rate of 800t/h. Hydraulic mining, as a mining method, is illustrated in Figure 4.1.

Figure 4.1 Base Kwale Hydraulic Mining

As this is an inherently wet process, dust emissions will be negligible. This activity will therefore not be considered for further assessment with regards to air quality.

4.2.4 Site Rehabilitation

The rehabilitation of a mining block (average area ~18 ha) entails the following processes:

- Topsoil haulage
- Dozer profiling topsoil
- Revegetation with water truck with seeds

These processes are prone to dust raising (dust and PM_{10} emissions), especially when soils are dry. The use of mobile plant (dozers, loaders, trucks) will also be associated with combustion emissions (PM_{10}, NO_x). Prior to rehabilitation, process wastes are placed and then covered with topsoil. The waste placement is assumed to be an inherently dust-free activity given that the process wastes are wet.

Emissions from these processes are calculated using emission factors from NPi and US-EPA AP42, meteorological data provided by Atmospheric Dispersion Modelling Ltd (ADM), and are based on the following:

Basic data provided by Base to ERM:

- average area of a mining block: 18 ha
- maximum silt content in all material: 3.3%
- average topsoil thickness: 0.3m
- days of precipitation (>0.25mm) in year: 5.33 days on average
- time when windspeed > 5.4m/s: 10.4%
- average wind speed: 3.18 m/s
- 24/7 operations, with 40% load during night time

Assumptions:

- Average moisture of blasted material: 3% (worst case assumption)
- Topsoil density: 1.47t/m^3 (density of sandy clay, based on Base Lithology log)
- Height of stockpiles: 10m
- Fuel sulphur content: 50ppm
- The unvegetated area is disturbed on three separate occasions (profiling, high wind erosion event of unvegetated area, and watering seeding event) for one hour, causing peak fugitive emissions of TSP and PM_{10}
- Embedded mitigation:
  - Application of local wind breaks around rehabilitated open areas, 30% abatement
- Additional mitigation:
  - Local water sprays at rehabilitated open areas, 50% abatement
  - Local wind breaks at rehabilitated open areas, 30% abatement
  - Level 1 (2l/m^2/h) watering of open unvegetated areas, 50% abatement

Mobile plant identified to be used for site rehabilitation of a 36ha mining block are presented in the table below:

Table 4.3 Mobile Plant – Site Rehabilitation

Type	Quantity	Power (kW)	Emission Tier (USEPA)	Average operational weight (t)	Average speed (km/h)
D11T – dozer	1	695	2	104	10
D10T – dozer	1	562	4	70	10
D7 – dozer	1	178	4	26	10
740B – truck	1	381	4	54.6	10
336D – excavator	1	234	4	37.2	n/a
320D – excavator	2	122	4	22.8	n/a
Ex 285 - excavator	1	135	2	29.2	n/a
Cat 432E – loader	1	69	4	13.8	n/a
980H - loader	2	317	4	40	10
725 - truck	1	239	4	34.9	10

Type	Quantity	Power (kW)	Emission Tier (USEPA)	Average operational weight (t)	Average speed (km/h)
730 - truck	1	280	4	37.9	10
Fuso FJ truck	1	175	4	16.3	10

The calculated emissions for site preparation of a 36ha mining block are presented in the table below.

Table 4.4 Site Rehabilitation Emissions, g/s

	Embedded Mitigation	Additional Mitigation
TSP	<0.001 (annual mean) 1.94 (1 hour peak emissions)	<0.001 (annual mean) 0.971 (1 hour peak emissions)
PM_{10}	<0.001 (annual mean) 0.970 (1 hour peak emissions)	<0.001 (annual mean) 0.485 (1 hour peak emissions)
NO_x	0.664	0.664
SO_2	0.0141	0.0141

4.2.5 Tailings Disposal

Tailings consist of a wet slurry and are currently sent to an existing tailings storage facility (TSF). The existing TSF is near capacity and a new location for tailings disposal is being investigated. This activity will therefore not be considered at this point for further assessment with regards to air quality.

4.3 Dispersion Modelling

4.3.1 Dispersion Model

AERMOD is a steady-state model and the USEPA's preferred model for short-range impacts. AERMOD can take into account the effect of complex terrain on atmospheric dispersion. The model also uses detailed meteorological data for the surface and upper air. The model was run for five years of meteorological data. The worst case year was then used in each scenario to determine the impact. This approach, therefore, captures year-on-year variation in meteorology.

4.3.2 Meteorology

Meteorological data was sourced from ADM in the form of AERMOD-ready data based on Mombasa airport observations. In line with IFC guidelines best practice, five years of hourly sequential meteorological data were used in the study, 2015 to 2019. This is to ensure that year on year meteorological variability was taken into account in the study.

4.3.3 Terrain

The land use and terrain around the Project will affect dispersion. Airflow over the ground is disturbed by protuberances into the air, for example, buildings, trees, vegetation etc. The surface roughness length is a representation of the disruption of airflow close to the ground due to these obstructions. In this case, the land is characterised by agricultural, rural areas and pockets of trees.

Hills, mountains and valleys can affect dispersion by directing the plume. This only occurs to a significant degree where there is a sustained gradient of greater than 1 in 10. As this is not the case within the Study Area, the terrain is not considered in this assessment.

4.3.4 Conversion of NO_x to NO_2

Emissions from the Project contain oxides of nitrogen, occurring as both nitric oxide (NO) and NO_2. The ratio of these two gases in the exhaust gases from combustion processes varies but is typically in the ratio of 90-95% NO to 5 – 10% NO_2. Regarding the assessment of the impact on human health, NO_2 is the main pollutant of interest as NO has minimal effect on human health at concentrations typically encountered in ambient air.

Within the atmosphere, various processes oxidise NO to create NO_2 but this process will not occur quickly or completely before the plume reaches ground level. Therefore, it is overly pessimistic to assume 100% conversion from NO to NO_2, and it is necessary to use a factor to estimate ground level concentrations of NO_2 based upon total NO_x emitted.

The IFC cite conversion factors set out by the Environment Agency for England.

- Long term: 70% conversion NO_x to NO_2
- Short term: 35% conversion NO_x to NO_2

4.3.5 Emissions Sources

4.3.5.1 General

As established in Section 4.2, mining activities associated with relevant atmospheric emissions are limited to:

- Site (Mining Block) preparation
- Site (Mining Block) rehabilitation

These activities are conducted systematically, moving from one block to another. On average a mining block comprises ~36ha and is active for about 12 months. For dispersion modelling, emissions from the identified activities have been calculated for an average mining block as defined in Section 4.2.

4.3.5.2 Dust and PM_{10} Raising

As a worst case, it can be assumed that both preparation and rehabilitation activities may occur simultaneously at distinct areas within a single mining block. For fugitive emissions of TSP and PM_{10}, this translates to a conceptual area source, with following attributes:

- Rectangular area: 300m west to east x 600m south to north;
- Release height: 1m;
- Initial vertical dimension: 0.5m;
- TSP emission rate with
  - embedded mitigation: 0.0110mg/s/m^2 (annual mean)/0.0217mg/s/m^2 (one hour peak);
  - additional mitigation: 0.00388mg/s/m^2 (annual mean)/0.00927mg/s/m^2 (one hour peak);
- PM_{10} emission rate with
  - embedded mitigation: 0.00538mg/s/m^2 (annual mean)/0.0108mg/s/m^2 (one hour peak);
  - additional mitigation: 0.00190mg/s/m^2 (annual mean)/0.00460mg/s/m^2 (one hour peak).

4.3.5.3 Combustion Emissions

Emissions of dust and PM_{10} from mining occurs at ambient temperature, and with no vertical velocity as dust will 'drift' into the air. Emissions from mobile plants or equipment are distinctly different having an elevated temperature and existing vertically with a definite velocity. The dispersion of emissions

from mobile equipment is therefore distinctly different. Emissions of PM_{10} and NO_x from mobile sources are therefore conceptualised into four point sources located equidistantly from the centre of the conceptual mine block (18ha square). The sources represent the total of mobile plant emissions from all plant operating within the mining block. Each conceptual point source has the following attributes:

- release height: 5m;
- emission temperature (1): 802.15K;
- exit velocity (2): 27.5m/s;
- flow rate (3): 6.23 m^3/s;
- PM_{10} emission rate with
  - embedded mitigation: 0.013g/s (annual mean);
  - additional mitigation: 0.013g/s (annual mean);
- NO_x emission rate with
  - embedded mitigation: 0.387g/s (annual mean);
  - additional mitigation: 0.387g/s (annual mean);

NO_x will be the most relevant pollutant with regards to combustion emissions. Furthermore, the PM_{10} emissions from combustion sources are negligible (< 3%) when compared to the PM_{10} emissions from fugitive sources. As such, only NO_x emissions will be modelled as point sources.

4.3.6 Receptor Grid

The dispersion model uses a Cartesian grid to determine the maximum Process Contribution (PC) and the PC arising at sensitive receptors. A tiered grid of 10 km by 10 km, centred on the area source has been used as follows:

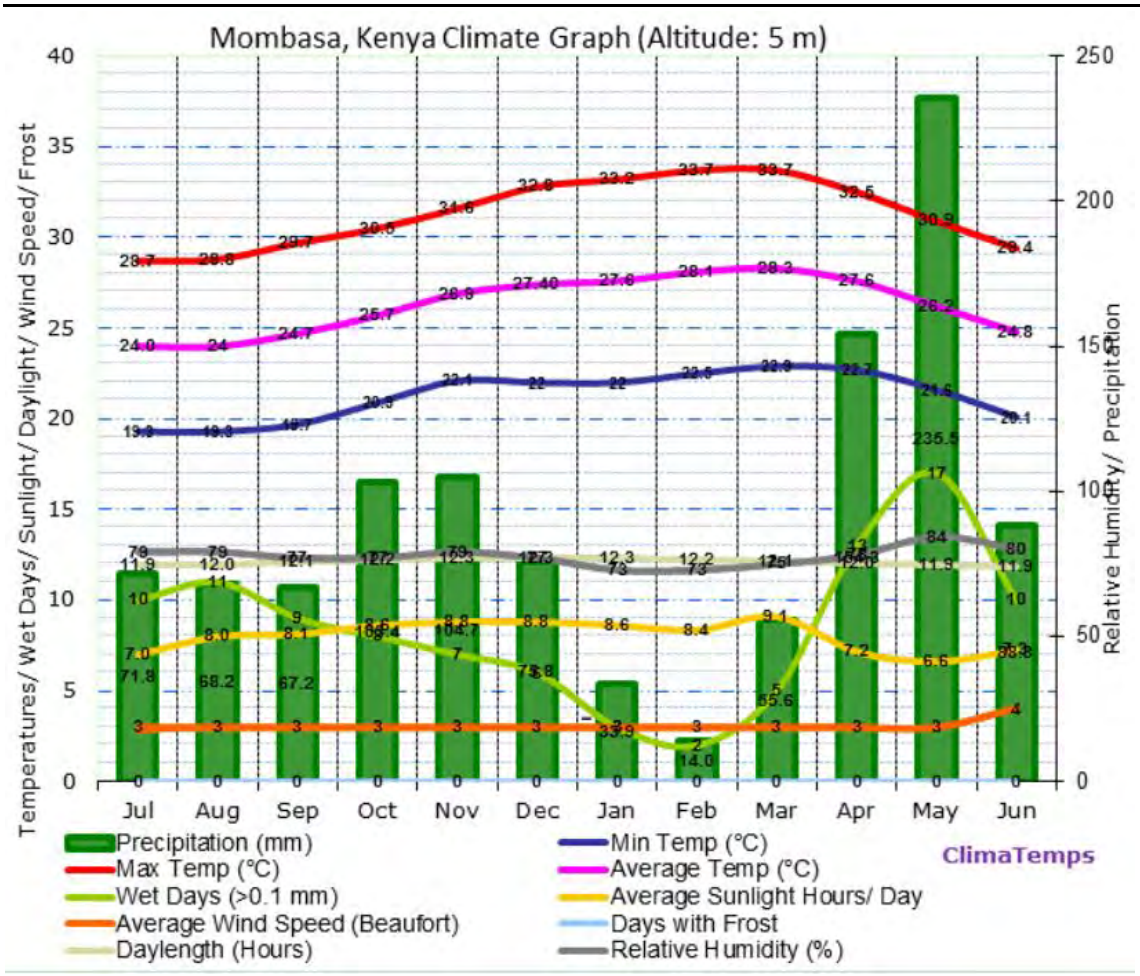
- 25m resolution up to 1km of the source;
- 100m resolution up to 5km of the source;
- 200m resolution up to 10km of the source.

(1) based on Caterpillar C13 engine
(2) based on Caterpillar C13 engine
(3) based on Caterpillar C13 engine

5. CLIMATE AND BASELINE CONDITIONS

5.1 Climate

Kenya's coastal zone is hot and humid but tempered with cool sea breezes. A narrow plain of land along the coast is heavily vegetated before the terrain becomes semi-desert further inland. Figure 5.1 illustrates the key climate data for Mombasa.



Source: http://www.mombasa.climatemps.com/ (2016)

Figure 5.1 Climate Data for Mombasa

These data illustrate the clear profile of wet and dry seasons, with a distinct increase in rainfall in April and May, and the highest wind speeds in February and March, coinciding with the dry season. Of note is that whilst the rainfall is over 1000mm/year, the number of days with rain is typically only around 1 day in 3.

The wind rose for Mombasa, based on the ADM sourced data for 2015-2019, is set out in Figure 5.2. This shows that the wind predominantly blows from the southwest. However, there is also a smaller northeastern component. This northeastern component is associated with the dry season when hot, dry and dusty winds blow from the Arabian Peninsula.

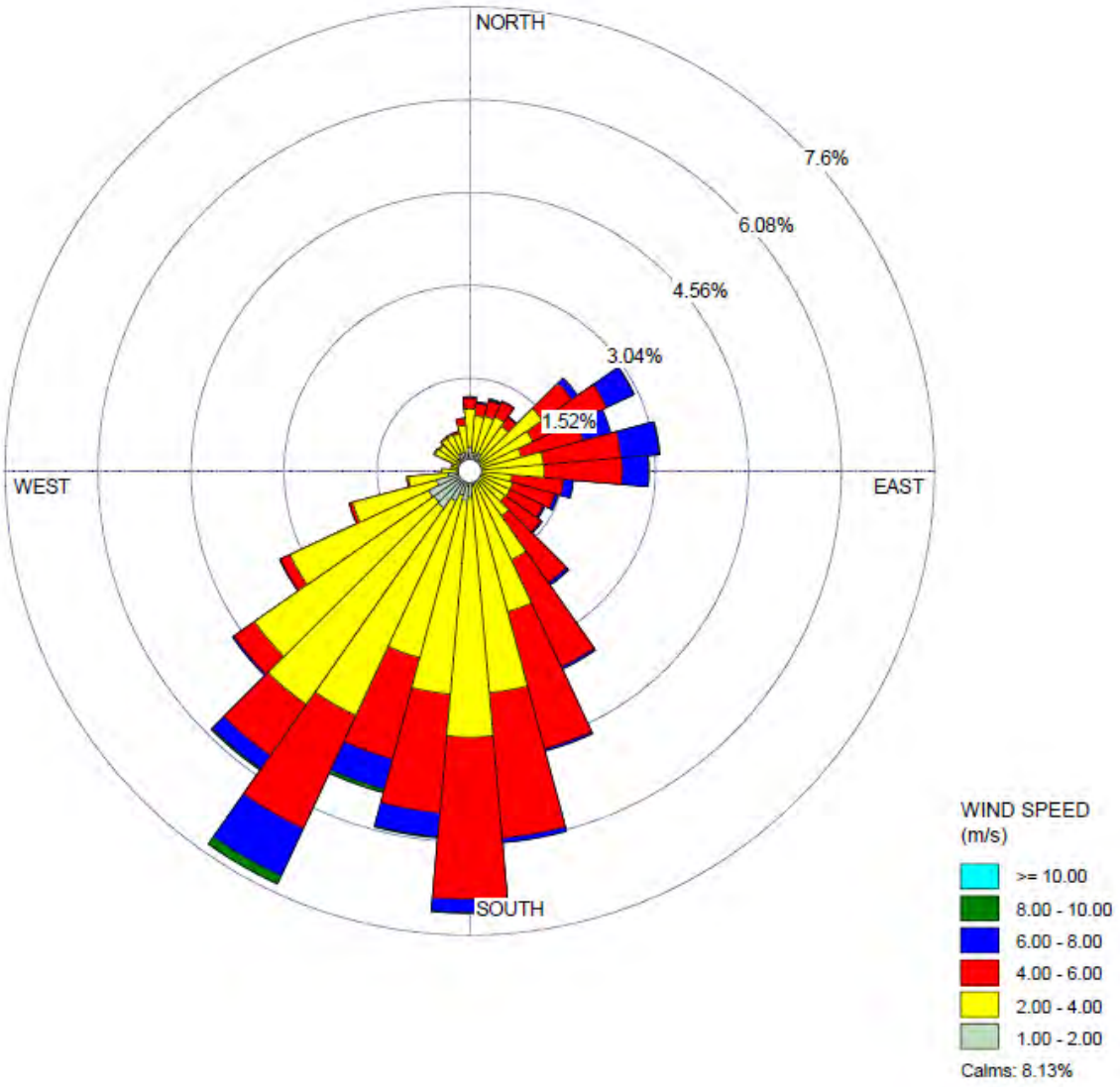


Figure 5.2 Wind Rose for Mombasa, 2015-2019

5.2 Baseline

5.2.1 Particulate Matter (PM_{10})

There is particulate matter data available from monitoring sites at the southern and western end of the North Dune (locations N3, N7, N10, N1 and N14 in Figure 5.3).

This monitoring was undertaken for a short period (ie <24 hours each month) only. PM_{10} concentrations vary considerably on a small scale and across short time scales. When monitoring in a dusty location where there is open ground and various intermittent activities, PM_{10} and dust concentrations can change by orders of magnitude moment by moment. As a result, monitoring in these type of areas over short time periods is of limited value, as the longer term average is required to understand the underlying trend.

This PM_{10} monitoring is therefore of limited value, as without the context of upwind and downwind contributions, determining mine contribution is impossible with certainty. It is included in this report mainly for illustrational purposes.

Table 5.1 Particulate Matter, PM_{10}, µg/m³

	N3	N7	N10	N13	N14
Sep-19	27.0	19.0	27.0	37.0	39.0
Oct-19	-	19.0	6.0	5.0	4.0
Nov-19	-	19.0	6.0	5.0	4.0
Dec-19	12.0	17.0	7.0	6.0	10.0
Jan-20	14.0	49.0	8.0	14.0	13.0
Feb-20	28.0	36.0	34.0	34.0	37.0
Minimum	**12.0**	**17.0**	**6.00**	**5.00**	**4.00**
Average	**20.3**	**26.5**	**14.7**	**16.8**	**17.8**
Maximum	**28.0**	**49.0**	**34.0**	**37.0**	**39.0**
Kenyan AQS - PM_{10} 24 hour mean (98%ile), Rural and Other Areas	*100*	*100*	*100*	*100*	*100*

Based on the dust deposition results (see next Section) and the available PM_{10} monitoring presented in the table above, PM_{10} baseline is considered to be undegraded.

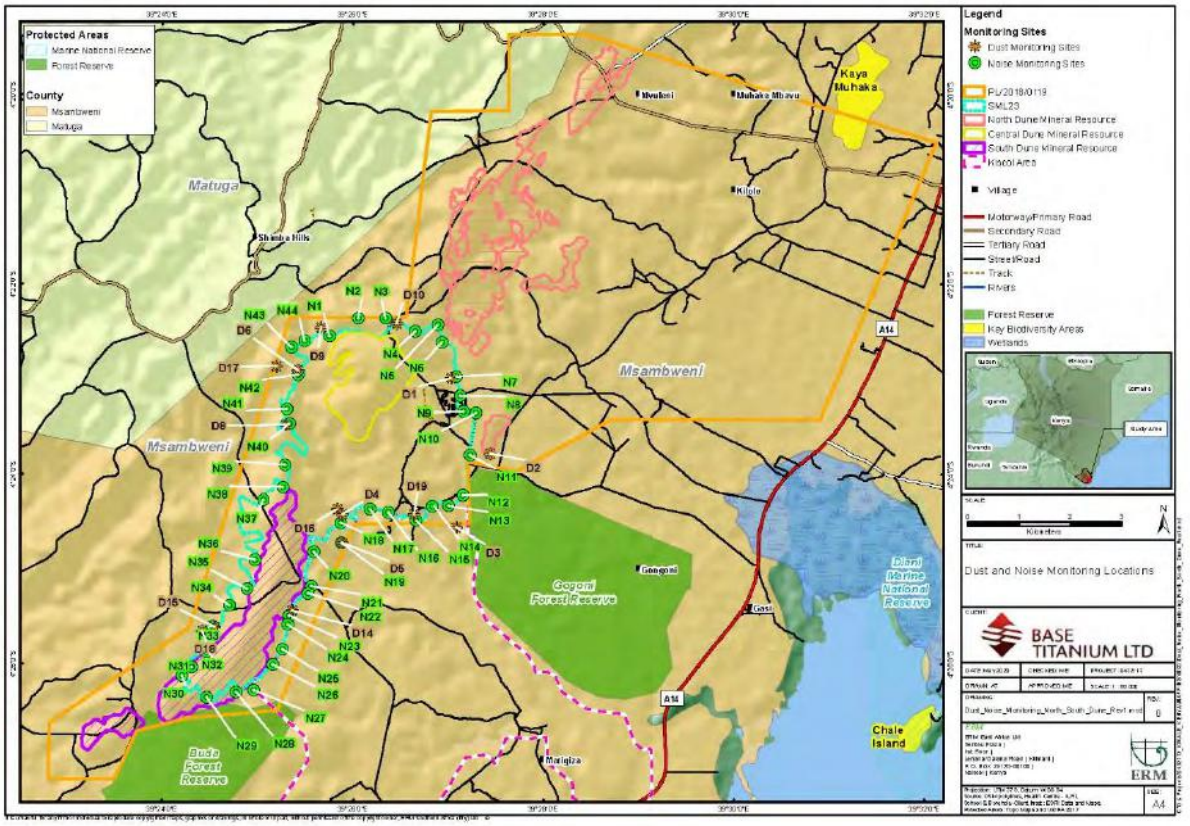


Figure 5.3 PM_{10} Monitoring Locations

5.2.2 Dust Deposition

There is dust deposition data available from monitoring sites at the northern and eastern end of the Central Dune (location D1, D2 and D10 in Figure 5.4. These data are considered a reasonable indication of the baseline, given the distance to the North Dune and are presented in the table below.

These data show:

- a clear profile echoing the dry season in February and March but less so during the second drier period in August and September;
- no exceedances of the 30-day average South African dust nuisance threshold.

In general, the airshed can, therefore, be considered not degraded with regards to dust deposition.

Table 5.2 Baseline dust deposition, mg/m²/day

	D1			D2			D10		
	2016	2017	2018	2016	2016	2016	2016	2017	2018
January		102	35.8		63.0	39.9		329	158
February		164	519		113	16.8		197	214
March		180	220		126	38.2		464	91.9
April		127	292		98.4	26.3		260	66.0
May		271	35.6		426			64.6	54.1
June		87.2	559		19.0			95.0	95.5
July	137	55.3	139	29.0	16.9		111	252	193
August	85.0	53.7	195	31.6	42.2		53.7	96.4	31.5
September	219	192	26.0	52.2	58.8		116	193	40.4

	D1			D2			D10		
	2016	2017	2018	2016	2016	2016	2016	2017	2018
October	125	54	32.0	54.7	39.6		157	149	155
November	66.1	7.27		112	23.5		75.9	15.2	
December	83.2	253		58.5	76.4		262	60.6	
Minimum	**66.1**	**7.27**	**26.0**	**29.0**	**16.9**	**16.8**	**53.7**	**15.2**	**31.5**
Average	**119**	**129**	**205**	**56.4**	**91.9**	**30.3**	**129**	**181**	**110**
Maximum	**219**	**271**	**559**	**112**	**426**	**39.9**	**262**	**464**	**214**
South African residential dust nuisance threshold, 30-day average	*600*	*600*	*600*	*600*	*600*	*600*	*600*	*600*	*600*

There is no data available for the baseline NO_2. Based on the dust deposition results and the available PM_{10} monitoring (see previous Section), PM_{10} baseline is assumed to be undegraded. In the absence of significant local sources of NO_x emissions, or nearby urban areas, NO_2 baseline is also assumed to be undegraded.

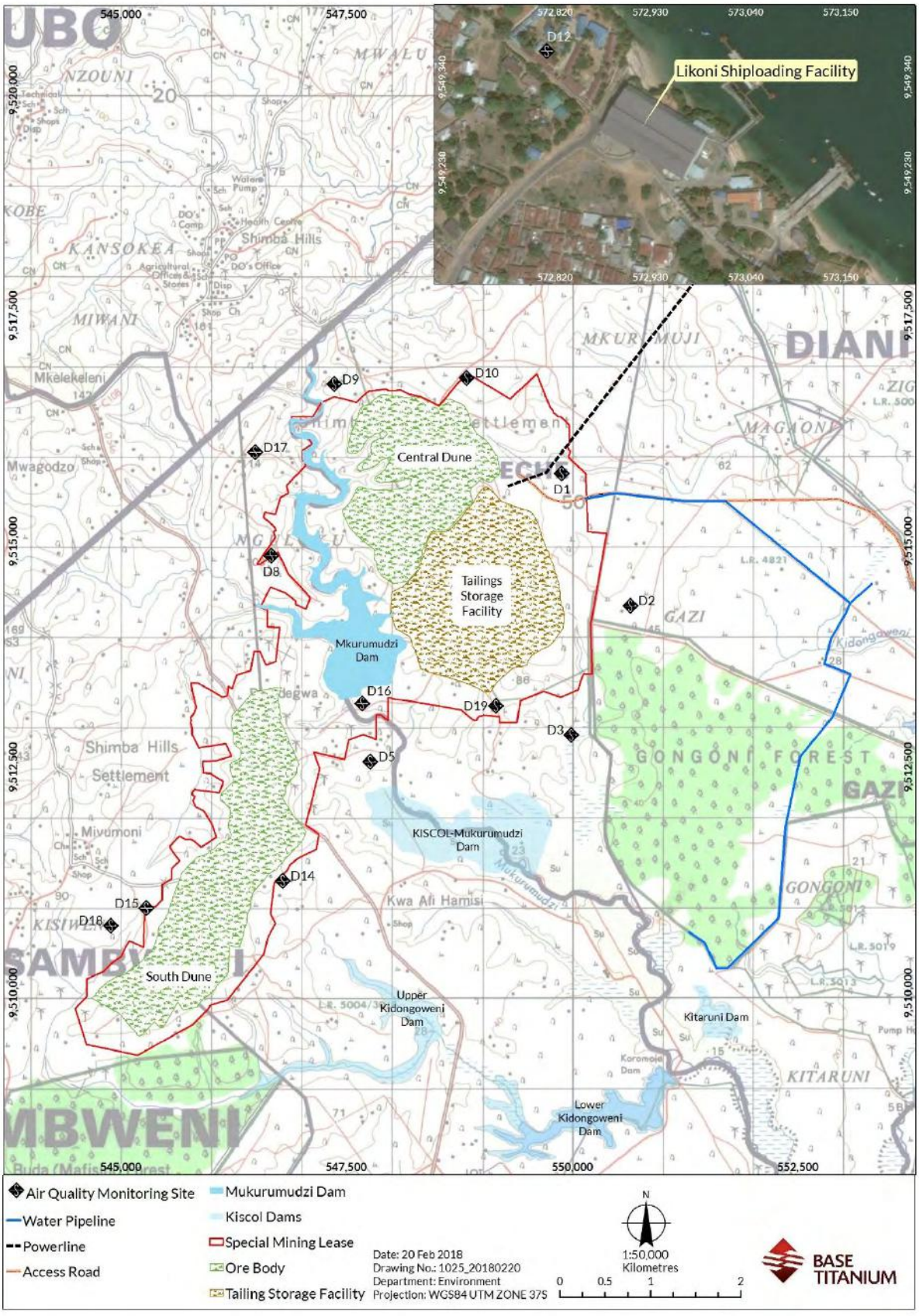


Figure 5.4 Dust Deposition Monitoring Locations

5.3 Sensitive Receptors

When considering impacts to human health due to inhalation of airborne pollutants, all sensitive human receptors are defined as 'medium' sensitivity; 'high' sensitivity refers to only a small number of cases where particularly vulnerable individuals are present, for example, hospitals with intensive care or high dependency units. This reflects the assumption that within the general population all humans are considered to be equally sensitive to air pollution.

The key sensitive receptor locations are illustrated in Figure 5.5.

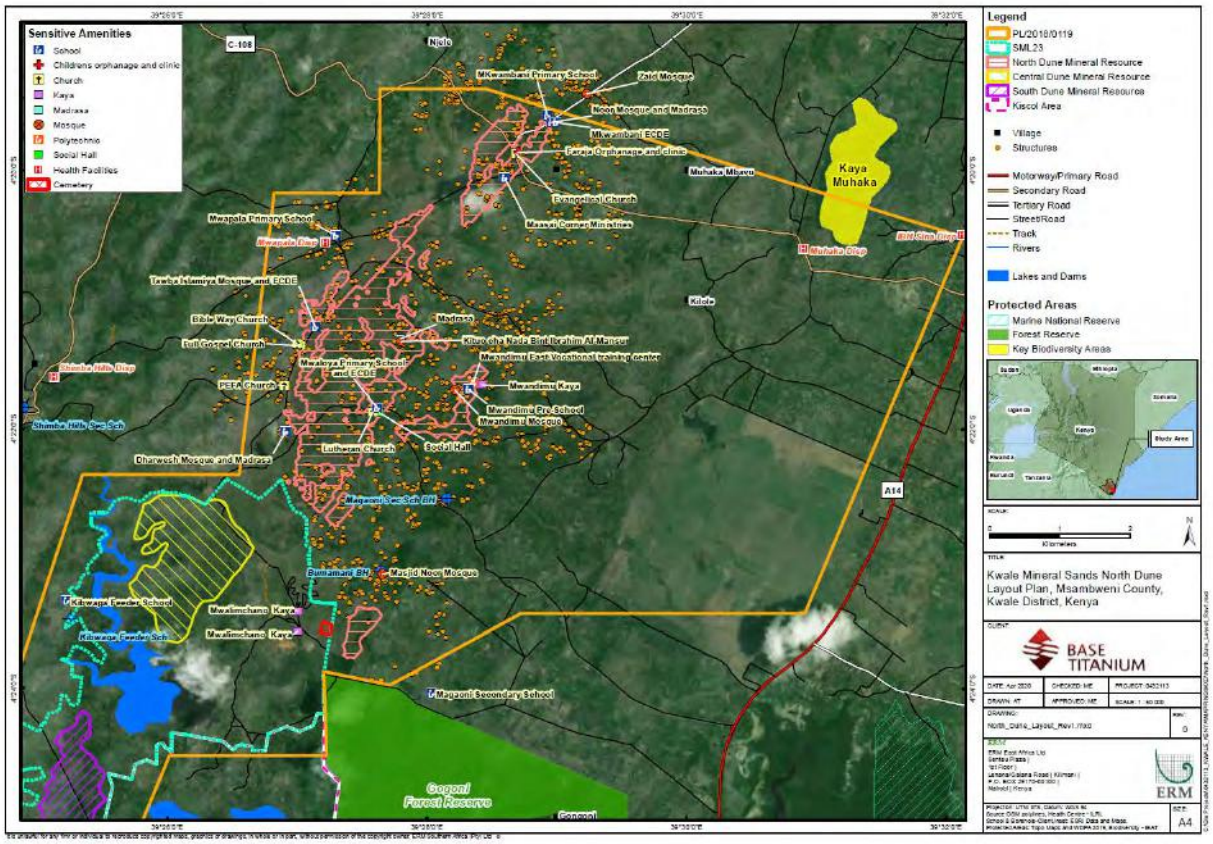


Figure 5.5 Sensitive Receptor Locations

6. RESULTS AND DISCUSSION

6.1 Overview

In summary (referring to Infographic 1):

- NO_2 impacts are 'negligible' at all locations. NO_2 concentrations are at most, 13% of the IFC guidelines, noting that the IFC guidelines are more stringent than the Kenyan standards, and therefore impacts against Kenyan standards will also be 'negligible'.
- Dust deposition impacts are 'negligible' at all locations beyond the site boundary. Comparison against ambient monitoring results (see Table 5.2) is presented in Section 6.2.
- PM_{10} impacts are 'large'. Further analysis is presented in Section 6.3.

6.2 Further Analysis of Dust Deposition

Appendix A sets out the contour plots for the dust deposition 24 hours mean emissions scenario with additional mitigation. The modelling identified that the dust deposition standard will not be exceeded beyond the site boundary, and impacts are not greater than 25% of the deposition standard at any sensitive receptors.

6.3 Further Analysis of PM_{10}

Appendix B sets out the following contour plots for PM_{10}:

- Annual mean, with Embedded Mitigation (mean emissions)
- Annual mean, with Additional Mitigation (mean emissions)
- 24 hour mean, with Embedded Mitigation (mean emissions)
- 24 hour mean, with Additional Mitigation (mean emissions)
- 24 hour mean, with Embedded Mitigation (peak emissions)
- 24 hour mean, with Additional Mitigation (peak emissions)

In all cases, the mine activities result in PM_{10} concentrations >50% of the IFC air quality standard beyond the mining activities. Given that the PM_{10} baseline is undegraded, it is reasonable to assume that where the PM_{10} impacts are >50% there is a risk of air quality standard being exceeded. The use of additional mitigation substantially reduces the off-site PM_{10} concentrations and the footprint of impacts. As expected the 'peak' emissions result in a larger impact than the 'mean' emissions, associated with one time dusting events.

Based on these results, a buffer zone is recommended around the mine to avoid excessive impacts at receptors near the mine. Due to the weather conditions, this buffer zone will not need to be the same size in all directions. Table 6.1 sets out the buffer zones needed to avoid impacts of >50% of the IFC AQS for PM_{10}, for mean and peak emissions. Results only for additional mitigation have been shown.

Table 6.1 indicative buffer zones for PM_{10}

Wind direction	PM_{10} PC as % of AQS	Additional Mitigation, mean emissions (m)	Additional Mitigation, peak emissions (m)
North	25%	575	1263
	50%	**285**	**700**
	100%	60	344
East	25%	0	260
	50%	**0**	**0**
	100%	0	0
South	25%	252	708

Wind direction	PM_{10} PC as % of AQS	Additional Mitigation, mean emissions (m)	Additional Mitigation, peak emissions (m)
West	**50%**	**85**	**322**
	100%	0	117
	25%	260	865
	50%	**95**	**372**
	100%	0	132

7. CONCLUSION AND RECOMMENDATIONS

Base Kwale mining operations are currently focussed on the exploitation of the South Dune, and the associated infrastructure is located close to the mining activities. In future, mining is expected to move to the North Dune as the South Dune resource is depleted. This impact assessment is based on a quantitative approach, designed to 'signpost' potentially significant sources of emissions and highlight where mitigation and buffer zones may be appropriate.

It was established that mining activities associated with relevant atmospheric emissions will be limited to site preparation and site rehabilitation. Dust emission mitigation in the form of the following was taken into account in dispersion modelling of these emissions:

- Embedded mitigation:
  - Application of wind breaks around topsoil stockpiles;
  - Application of local wind breaks around rehabilitated open areas;
- Additional mitigation:
  - Local water sprays at demolition/vegetation/soil stripping areas
  - Local wind breaks at demolition/vegetation/soil stripping areas
  - Keeping topsoil moist for loading;
  - Water sprays at topsoil stockpiles;
  - Level 1 (2l/m^2/h) watering of unpaved surfaces used for topsoil haulage;
  - Local water sprays at rehabilitated open areas;
  - Local wind breaks at rehabilitated open areas; and
  - Level 1 (2l/m2/h) watering of open unvegetated areas.

Dust deposition in the vicinity of the North Dune shows that the airshed can be considered undegraded for dust deposition. Available ambient PM_{10} monitoring is limited to spot checks (ie <24 hours each month) only and is therefore of limited value only. In conjunction with available dust deposition results, it is likely that the airshed can be considered undegraded for PM_{10} as well.

The modelling showed that:

- NO_2 impacts are negligible at all locations.
- Dust deposition impacts are negligible at all locations.
- PM_{10} emissions are predicted to be large at the boundary of the mine resource even with additional mitigation and are likely to exceed the AQS immediately adjacent to the mining.

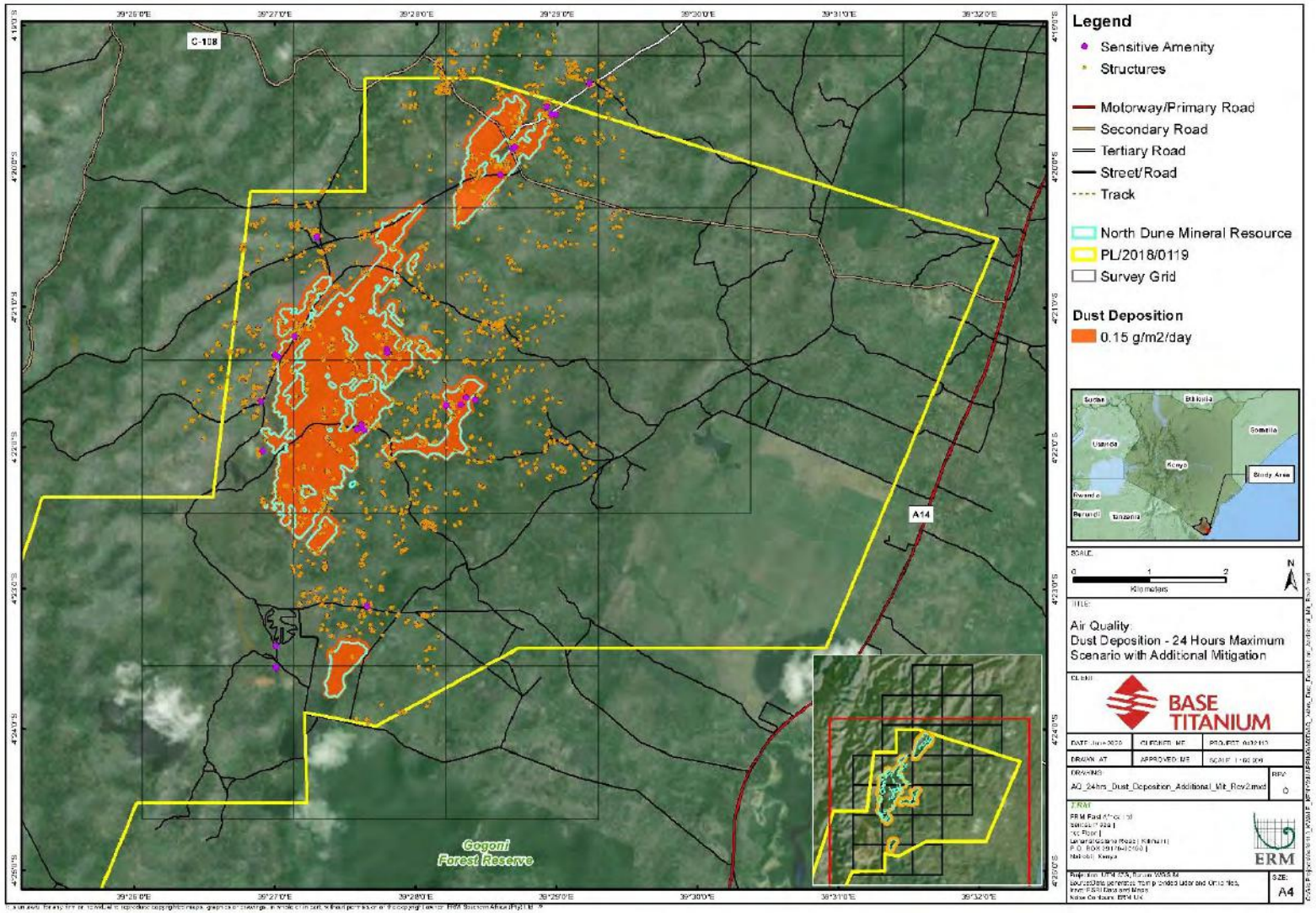
On this basis, the recommendation is made that buffer zones are established. The recommended buffer zone sizes are based upon the threshold of PM_{10} <50% of the IFC air quality standard, as this will allow for the underlying baseline:

- A buffer zone, relocating and prohibiting the permanent use any residences therein, around the orebodies of at least:
  - 285m to the North
  - 0m to the east
  - 85m to the south
  - 95m to the west

These buffer zones are designed to protect typical operations. There is the potential for one-off impacts beyond these distances during 'peak' emissions. On this basis, particular care should be taken to minimise the amount of open ground at any one time and apply additional watering on open areas when there are particularly dry and windy days.

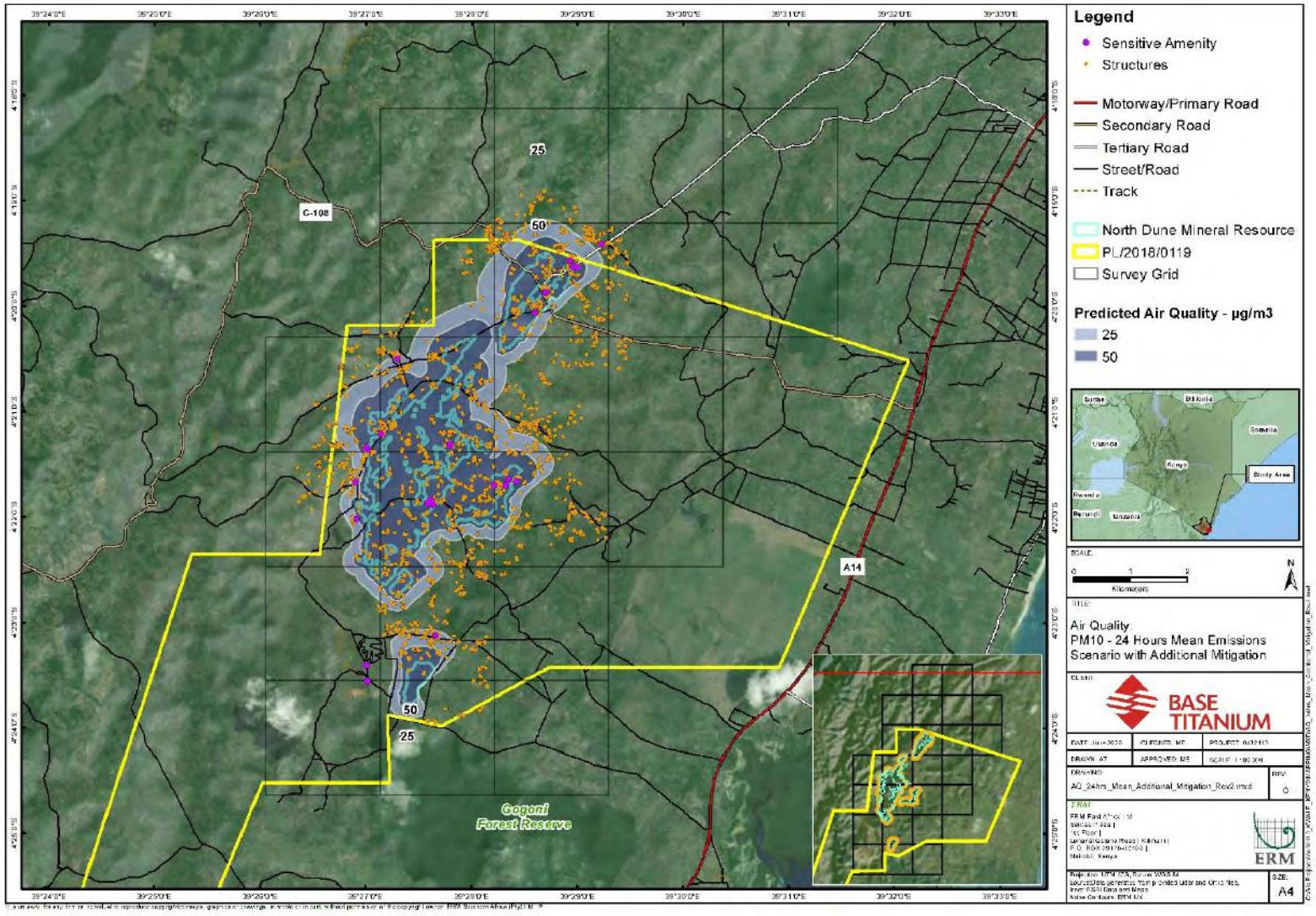
- A monitoring programme for dust deposition and real-time PM_{10} monitoring. Real-time PM_{10} monitoring stations should be located at least up- and downwind of the North Dune, preferably within the buffer zone. The monitoring should be supported by a feed-back loop, triggered by action levels (concentration thresholds), to onsite activities to ensure that any activities raising unacceptable dust are subject to further control (possibly postponed).
- Where possible commence baseline monitoring at least three months before work commences on site.

APPENDIX A DUST DEPOSITION CONTOUR PLOT

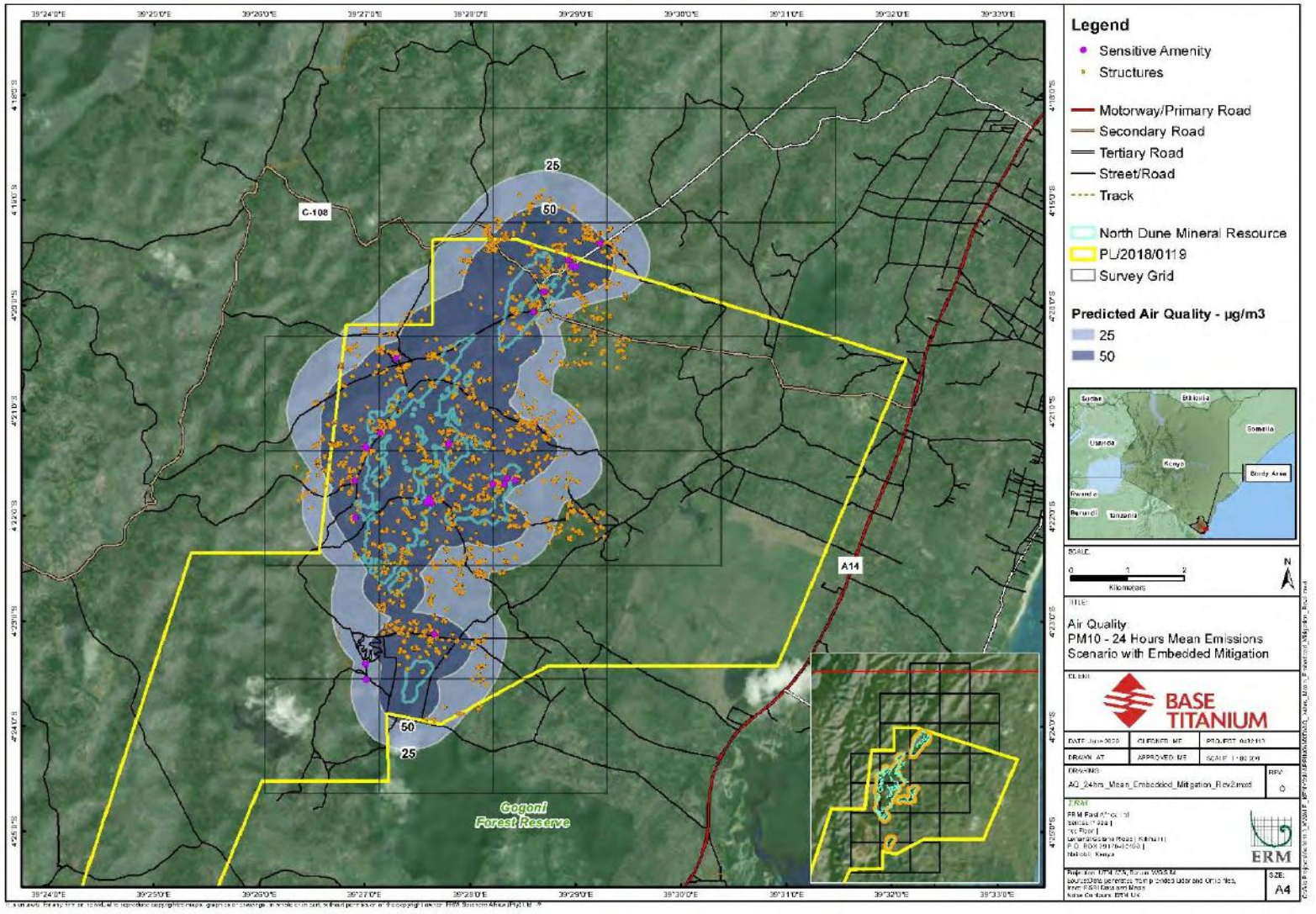


Dust deposition 24 hours mean emissions scenario with additional mitigation

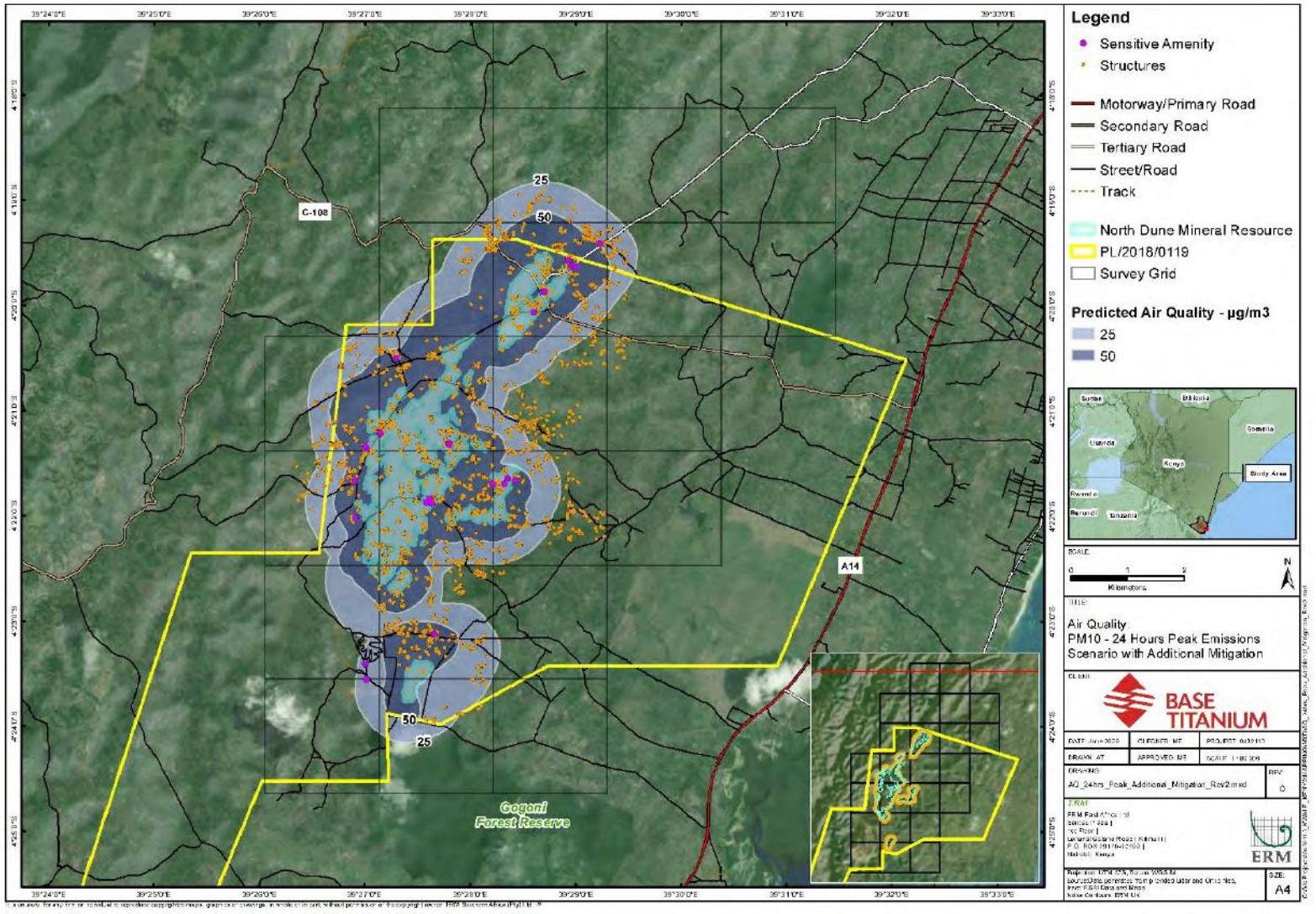
APPENDIX B PM_{10} CONTOUR PLOTS



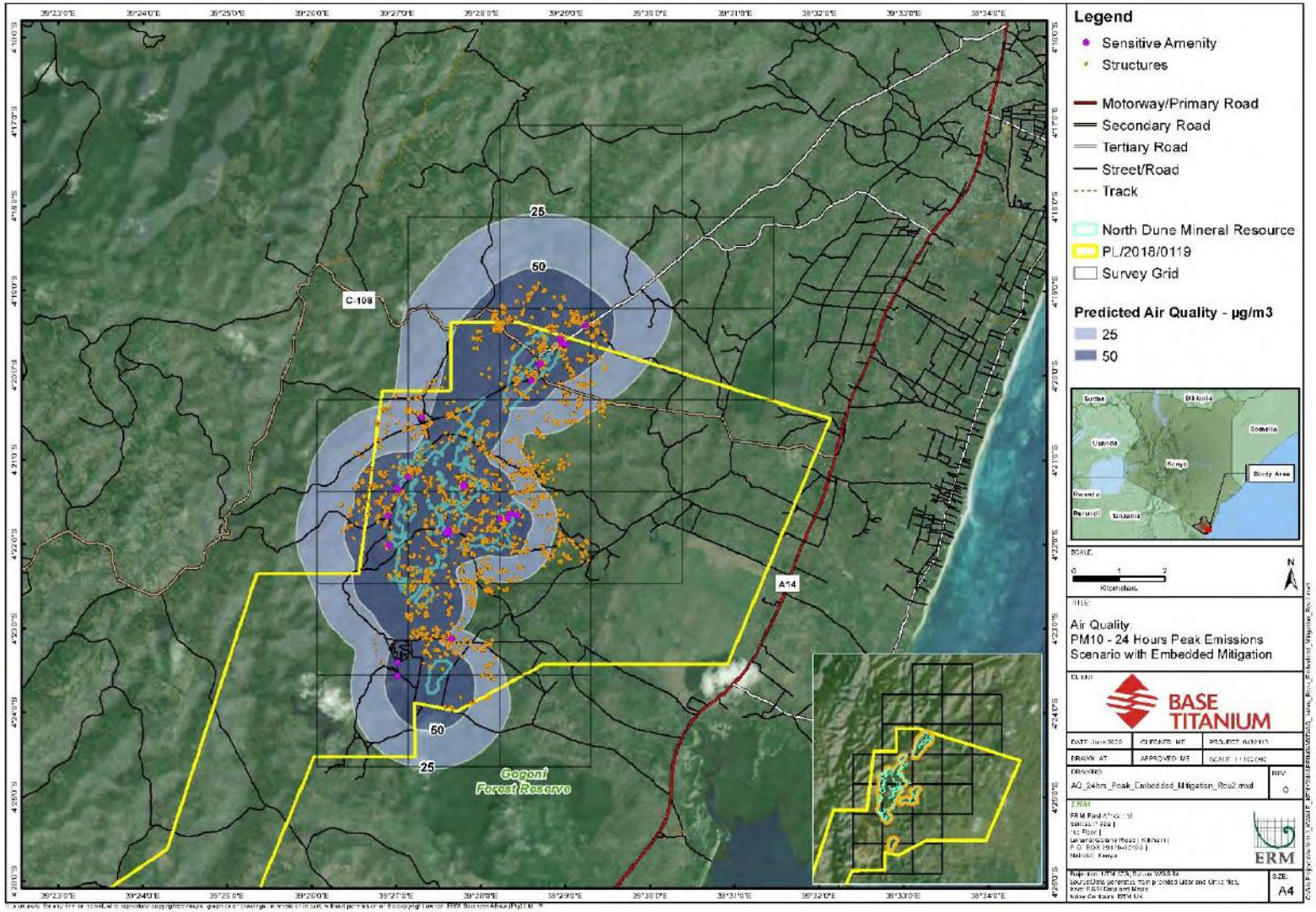
PM10- 24 hours mean emissions scenario with additional mitigation



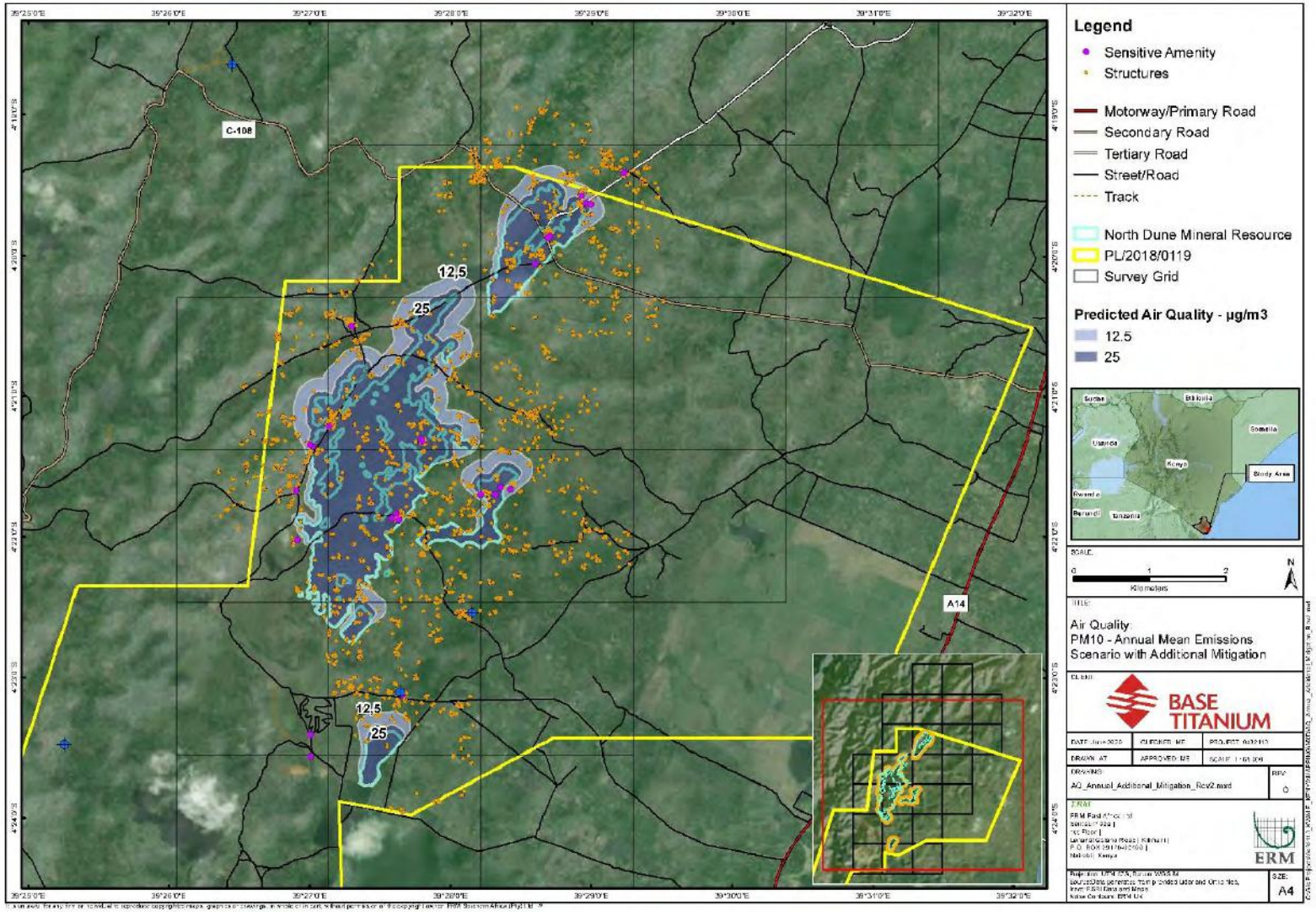
PM_{10}- 24 hours mean emissions scenario with embedded mitigation



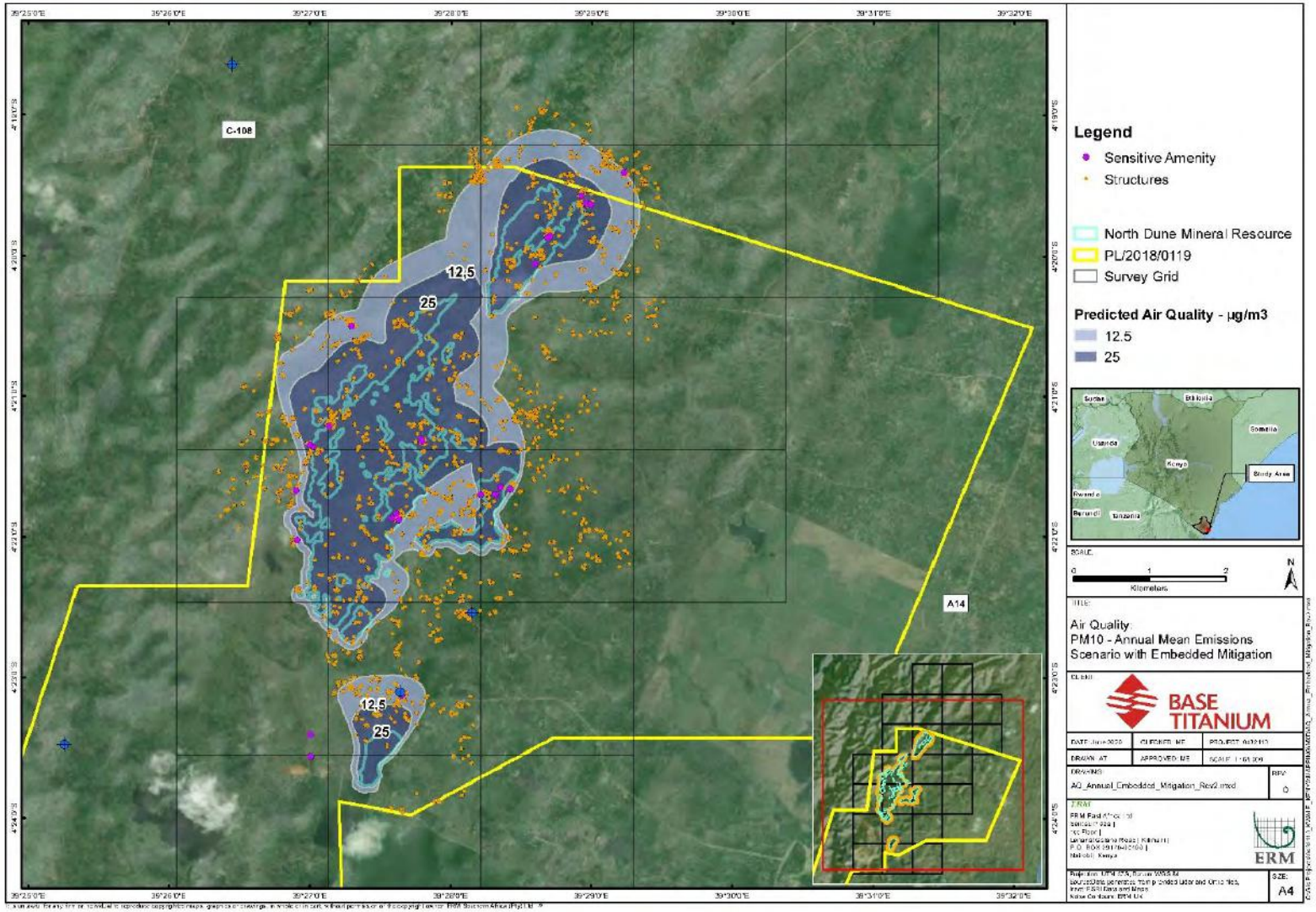
PM_{10}- 24 hours peak emissions scenario with additional mitigation



PM_{10}- 24 hours peak emissions scenario with embedded mitigation



PM_{10}- annual mean emissions scenario with additional mitigation



PM_{10}- annual mean emissions scenario with embedded mitigation

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APPENDIX G NOISE SPECIALIST REPORT

BASE TITANIUM

Noise Screening Report for the North Dune Extension

30 July 2020

Project No.: 0547330

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ERM

Document details	The details entered below are automatically shown on the cover and the main page footer. PLEASE NOTE: This table must NOT be removed from this document.
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Signature Page

30 July 2020

Noise Screening Report for the North Dune Extension

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Acronyms and Abbreviations

dB	Decibel - A noise level unit based on a logarithmic scale of Pascals of sound pressure above and below atmospheric pressure, or watts of sound power
dB(A)	A-weighted decibel. A single number measurement of the sound pressure based on the decibel but weight to approximate the response of the human ear with respect to frequencies
Frequency	The rate of sound pressure or sound power fluctuations per second, expressed as cycles per second or hertz (Hz).
L_{Aeq}	The A-weighted equivalent continuous, or logarithmic average, noise level over a defined time period
L_{AMax}	Maximum noise level
Sound Power Level	The Sound Power Level of a noise source is the sound energy emitted by the source, expressed on a decibel scale
Sound Pressure Level	The level of noise, usually expressed in dB(A), as measured by a sound level meter

1. NOISE REPORT

1.1 Introduction

This report has been prepared by Environmental Resources Management (ERM) on behalf of Base Titanium Limited. It presents the methodology, results and findings of the noise modelling conducted for the mining activities associated with the expansion of the existing Kwale mine to the North Dune.

1.2 Objectives

Nuisance, or an unacceptable level of noise amenity, may arise from mining activities associated with the new mine expansion. This potential for noise issues to arise is associated with emissions from significant noise generating sources/assets such as mining equipment. The purpose of this analysis is to provide an indication of the areas susceptible of being affected by potential noise impacts.

1.3 Standards and regulations

1.3.1 Kenyans Noise Standard

The Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations 2009 set out permitting and limit guidelines to ensure that no person makes or causes to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

The Regulations require any person intending to carry out construction, demolition, mining or quarrying work, to undertake an Environmental Impact Assessment study, to identify natural resources, land uses or activities which may be affected by noise or excessive vibrations, to determine the measures which are needed in the plans and specifications to minimize or eliminate adverse construction, demolition, mining or quarrying noise or vibration impacts, and to incorporate the needed abatement measures in the plans and specifications.

Table 1-1 presents the maximum permissible L_{Aeq} levels in Kenya.

Table 1-1 Maximum Permissible Noise Levels in Kenya

Zone	Description of Noise Receptor	Permissible Noise Level in dB(A)	
		Day (06:01 – 20:00, L_{Aeq}, 14 hour)	Night (20:01 – 06:00, L_{Aeq} 10 hour)
A	Silent zone [1]	40	35
B	Places of worship	40	35
C	Residential Outdoor	50	35
D	Mixed residential (with some commercial and places of entertainment)	55	35
E	Predominantly heavy industrial areas	60	35

[1] Silent zone means designated area that includes health facilities, educational and research institutions, courts, and any other area declared as such by the Authority.

1.3.2 International Guidance

The World Health Organisation (WHO) together with the Organisation for Economic Co-ordination and Development (OECD) and the International Finance Corporation (IFC) are two of the main bodies that have collected data and developed their own assessments on the effects of the exposure to environmental noise. Based on these assessments, guideline values for different time periods and situations have been developed.

1.3.2.1 WHO/OECD Guidance

The World Health Organization (WHO 1999) Guidelines for Community Noise provide the following generic guidance concerning the onset of health effects from noise.

- To protect most people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB(A) for a steady, continuous noise.
- To protect most people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 db(A).
- At night, sound pressure levels at the outside façades of living spaces should not exceed 45 dB(A) and 60 dB L_{AMax}, so that people may sleep with bedroom windows open. These values have been obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB(A).

1.3.2.2 IFC General EHS Guidelines

The IFC General EHS Guidelines differentiate between two principal receptor categories, residential and industrial, but are not specific to any source. The noise level guidelines for these receptors are summarized in Table 1-2. They make reference to noise from facilities and stationary noise sources and are commonly applied as design standards for industrial facilities. Whilst they offer general guidance on noise effects, the IFC has indicated that they are not directly applicable to transport or mobile noise sources.

Table 1-2 IFC Noise Level Guidelines

Receptor	One Hour L_{Aeq} dB(A)	
	Daytime (07:00 – 22:00)	Night (22:00 – 07:00)
Residential; institutional; educational	55	45
Industrial; commercial	70	70

1.3.2.3 IFC EHS Guidelines for Mining

In addition to the General EHS Guidelines the IFC has developed industry specific guidelines including the EHS Guidelines for Mining (1). The EHS Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These industry sector EHS guidelines are designed to be used together with the General EHS Guidelines.

The EHS Guidelines for Mining are applicable to underground and open-pit mining, alluvial mining, solution mining, and marine dredging. In summary, they state that the noise guidelines in the general EHS guidelines should be achieved and that:

"*sources of noise emissions that may include noise from vehicle engines, loading and unloading of rock into steel dumpers, chutes, power generation, and other sources related to construction and*

mining activities. Additional examples of noise sources include shoveling, ripping, drilling, blasting, transport (including corridors for rail, road, and conveyor belts), crushing, grinding, and stockpiling".

They go on to discuss the establishment of good practice in the prevention and control of noise sources based on the prevailing land use and the proximity of noise receptors such as communities or community use areas and recommend various mitigation strategies and techniques.

1.3.3 Compliance limits

Operational noise compliance limits for receptors have been derived based on a combination of Kenya's and the IFC's noise standards.

- For noise sensitive receptors such as ***schools and places of worship*** operating only during day time the Kenyan standard has been considered. The criterion for this assessment is the noise level of 40 dB(A).
- For noise sensitive receptors such as ***hospitals*** operating only during day and night time the Kenyan standard has been considered. The criterion for this assessment is the noise level of 40 dB(A) for day time and 35 dB(A) for night time. There is a number of clinics within the proximity of the project's boundaries, however at this stage is not clear if they operate during night time. This will be clarified during the social survey, which has been postponed due to the COVID-19.
- For the ***residential receptors***, the IFC standard and WHO guidance has been considered. The criterion for this assessment is the noise level of 55 dB(A) for daytime and 45 dB(A) for night time. According to the baseline noise measurements at receptors nearby the southern dune[1], night time noise levels were higher than the Kenyan night time criteria and in some cases higher than the IFC criteria.

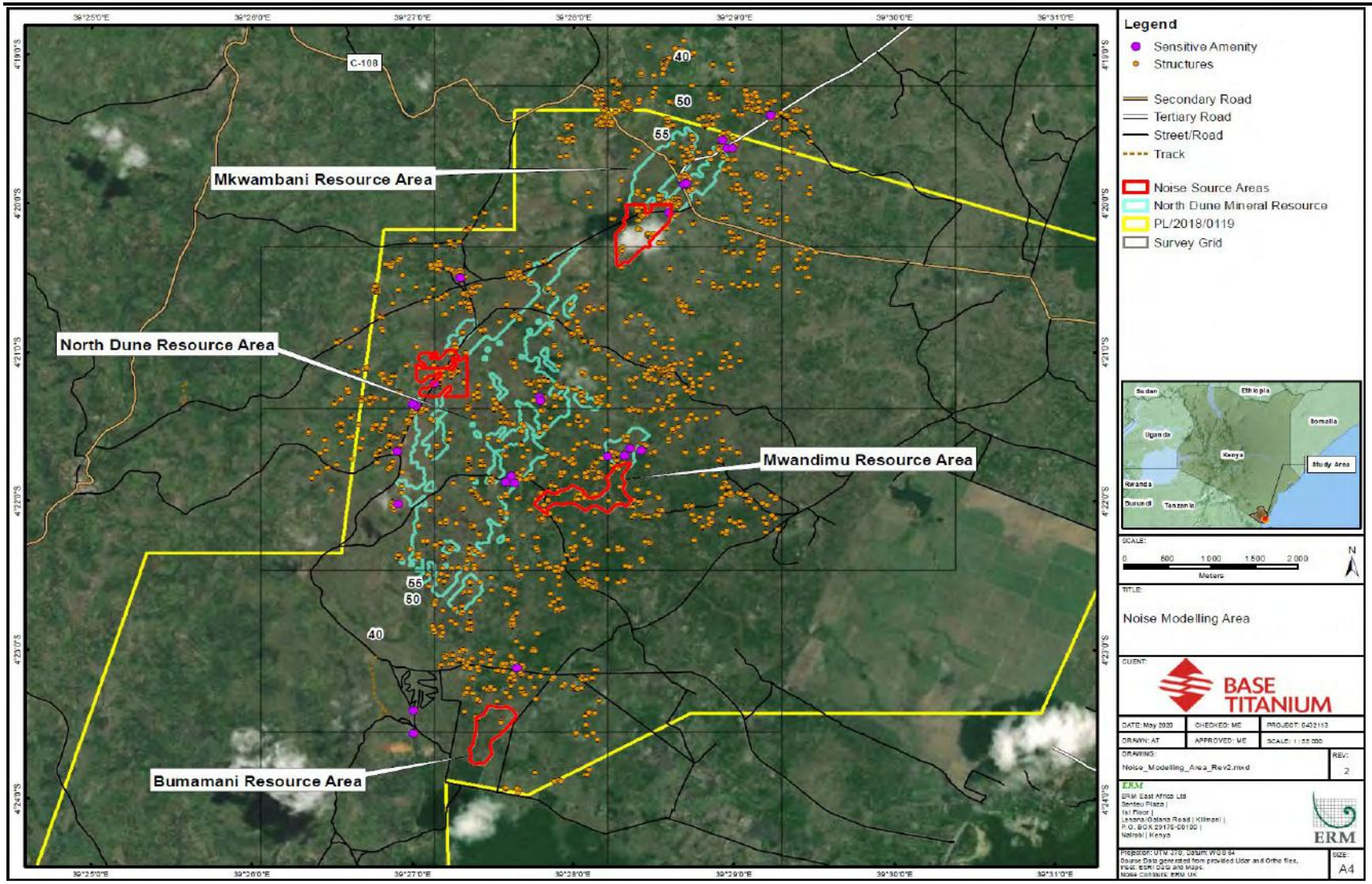
1.4 Methodology

The predicted distances on which the criteria will be met were calculated for four chosen areas within the project's boundary, to define the potential impact zones for each receptor category represent the areas susceptible of being affected by noise impacts. The four different areas (Mkwambani, Mwandimu, Bumamani, North Dune) were selected based on their geographical location, in order to cover the surrounding area of the project in all directions.

Figure 1.1 presents the four modelled areas. The buffer zones were defined based on the maximum predicted distances where the criteria were met for each receptor's category among these four modelled areas, in order to represent the worst-case scenario.

[1] Environmental and Social Impact Assessment Amendment for the South Dune Extension, Base Titanium Limited, Kwale Mineral Sands Operation, Kwale, Kenya, 13 December 2018

Figure 1.1 Modelled Areas



1.4.1 Noise Modelling

The software Predictor (version 2020) was used to calculate the sound propagation according to ISO 9613-1[2]. The model predicts noise level through spherical spreading and includes the effect of ground attenuation and shielding. It incorporates noise source data, meteorological data, surrounding terrain characteristics and was used to generate noise level contours.

Project's mining activities and the associated type and number of equipment are presented in Table 1-3.

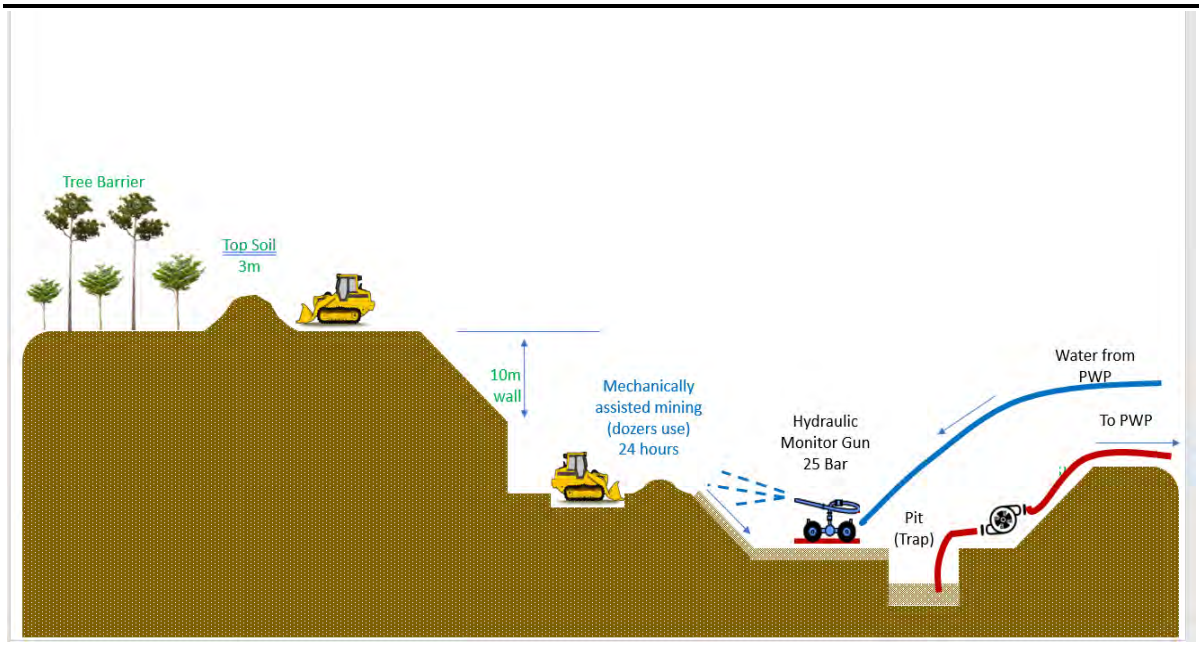
Table 1-3 Equipment present on each site during measurement

Activity ID Number	Activity description	Type of Equipment	Number of Equipment
M1	Topsoil removal and loading area	Cat loader 980h Excavator D8 dozer Grader Fuso fj dump trucks (multiple) Cat articulated truck (dump truck)	1 1 1 1 1 2
M2	HMU gun - mining zone where high-pressure water jets are directed to the mine wall face to loosen the ore and create a slurry	HMU Cat Ex 323D 2L Excavator	1 1
M3	HMU and Screen gun and pump area- ore slurry is further broken down using a high-pressure water gun to create a consistent slurry, after which it is pumped away from the mining block	Screen Gun HMU Pump Station	1 1
M4	Big Bertie - Run of Mine from the HMUs is directed to the Big Bertie where it passes through a screen that removes oversize, after which, the screened slurry is pumped to the wet concentrator plant	Big bertie screen Pump pu603 Centrifugal pump	1 1 1
M5	Excavation Area	Cat excavator- Ex 323D 2L- Excavator Excavator Ex 285 Fiat Hitachi Fuso fj dump trucks (multiple) D8 dozer	1 1 1 1
M6	Tailings Area	Tailings stacker D7 Cat dozer Cat excavator- Ex 323D 2L- Excavator	1 1 1

[2] Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation, ISO, 1996.

Figure 1.2 presents the mining process and the significant change on the topography. ERM's noise model has taken into consideration this change and therefore the height of the noise source areas, each of them representing one block of each entire deposit, has been decreased by 10 m compared to the actual elevation. In addition, a barrier of 3 m height has been added to a 5 m distance off each block.

Figure 1.2 Mining Activities and Topography



Source: BASE TITANIUM

To represent the actual noise emissions of the operation of the mine, ERM took noise measurements of each of the above activities at distances of 50 and 100 meters for a 15-minute period, during a site visit at the Kwale mine in March 2020. During the measurements, it was not always possible to avoid noise from other activities and therefore the presented values might not represent the actual noise emissions of each activity. Therefore, the measured data, mainly at distances of 100 meters include the noise contribution of other activities. The measured noise data are presented in Table 1-4.

Table 1-4 Equipment present on each site during measurement

Activity ID Number	Activity description	Distance from site (m)	Measured Sound Pressure Level dB(A)
M1	Topsoil removal and loading area	50	63
		100	54
M2	HMU gun - mining zone where high-pressure water jets are directed to the mine wall face to loosen the ore and create a slurry	50	72
		100	59
M3	HMU and Screen gun and pump area- ore slurry is further broken down using a high-pressure water gun to create a consistent slurry, after which it is pumped away from the mining block	50	56
		100	51
M4	Big Bertie - Run of Mine from the HMUs is directed to the Big Bertie where it passes through a screen that removes oversize, after which, the	50	62
		100	59

	screened slurry is pumped to the wet concentrator plant		
M5	Excavation Area	50	54
		100	54
M6	Tailings Area	50	101
		100	96

The sound power level of each mining activity is presented in Table 1-5, and is estimated based on the logarithmic average of the back-calculated sound power level for each distance. The same table shows the number of actual activities taking place simultaneously during daytime.

Table 1-5 Estimated Sound Power Level of each Mining Activity

	Mine SML Site						Total Sound Power Level dB (A)
Activity ID Number	M1	M2	M3	M4	M5	M6	
Number of each mining activity	1	4	4	1	1	3	
Estimated Sound Power Level dB(A)	104	111	98	106	100	104	118

All equipment is assumed to be working simultaneously during day and night time, so as to assess the worst-case scenario. As indicated on the table above the total effective sound power level of the mining activities taking place during daytime is estimated to be **118 dB(A)**. Following conversations with Base's mining engineers, the night time activities will be reduced by 40%, therefore the total sound power level during night time is estimated to be **116 dB(A)**.

1.5 Results

The predicted noise level contours are shown in ***Appendix A***. The figures show that there is a great variation of distances of which the criteria are met for day and night time within each area but also between the modelled areas. This is due to the variation of topography of each area, which can have a great screening effect reducing significantly the noise propagation from the mining area.

Table 1-6 shows the maximum predicted distances from the boundaries of each modelled area where the criteria will be met for each type of receptors for day and night time as per Section 1.3.3. Table 1-7 shows the average predicted distances.

Table 1-6 Predicted Maximum Distances from the Project's Boundary

Modelled location	Predicted Distances (m)			
	Residential Receptors (IFC Guidelines)		Silent Zone & Places of Worship (Kenyan standard)	
	Day	Night	Day	Night
North	27	53	162	465
East	29	54	391	427
South	37	114	450	625
West	26	47	327	515

Table 1-7 Predicted Average Distances from the Project's Boundary

Modelled location	Predicted Distances (m)			
	Residential Receptors (IFC Guidelines)		Silent Zone & Places of Worship (Kenyan standard)	
	Day	Night	Day	Night
North	15	21	55	127
East	15	24	99	185
South	14	45	194	358
West	14	25	122	248

1.6 Conclusion

The results suggest the following buffer distances from the Project's boundaries:

- **Residential Receptors** – 100 m (Based on IFC standards)
- **Hospitals and other sensitive receptors operating during night time** – 600 m (Kenyan Standards)
- **Sensitive receptors operation only during day time** (schools, places of worship etc.) – 400 m (Kenyan Standards)

Figure 1.3 and Figure 1.4 show the buffer zones applicable at the boundaries of Project's resources areas, for day and night time respectively.

These buffer zones provide a conservative (worst-case) scenario of operational noise, since they represent the maximum distances where the criteria will be met. According to the results, as topographic structures may hinder the free propagation of noise through most of the surrounding area, it is anticipated that in many cases the criteria will be met in shorter distances than the buffers zones suggested above. In addition, no specific mitigation measures beyond the use of modern or well-maintained equipment was included in the predictions. Predicted average distances are way shorter that the ones presented in Table 1-6, however the maximum distances eliminate the risk of any potential noise impact at the nearby receptors.

The duration of the mining activities within each mining block is approximately three to five months before they move to the next block, therefore any noise impact would be temporary, and the buffer distance of any one sensitive receptor will therefore change with changes in mining activities and the location of active mine blocks.

Figure 1.3 Predicted Buffer Zones - Day

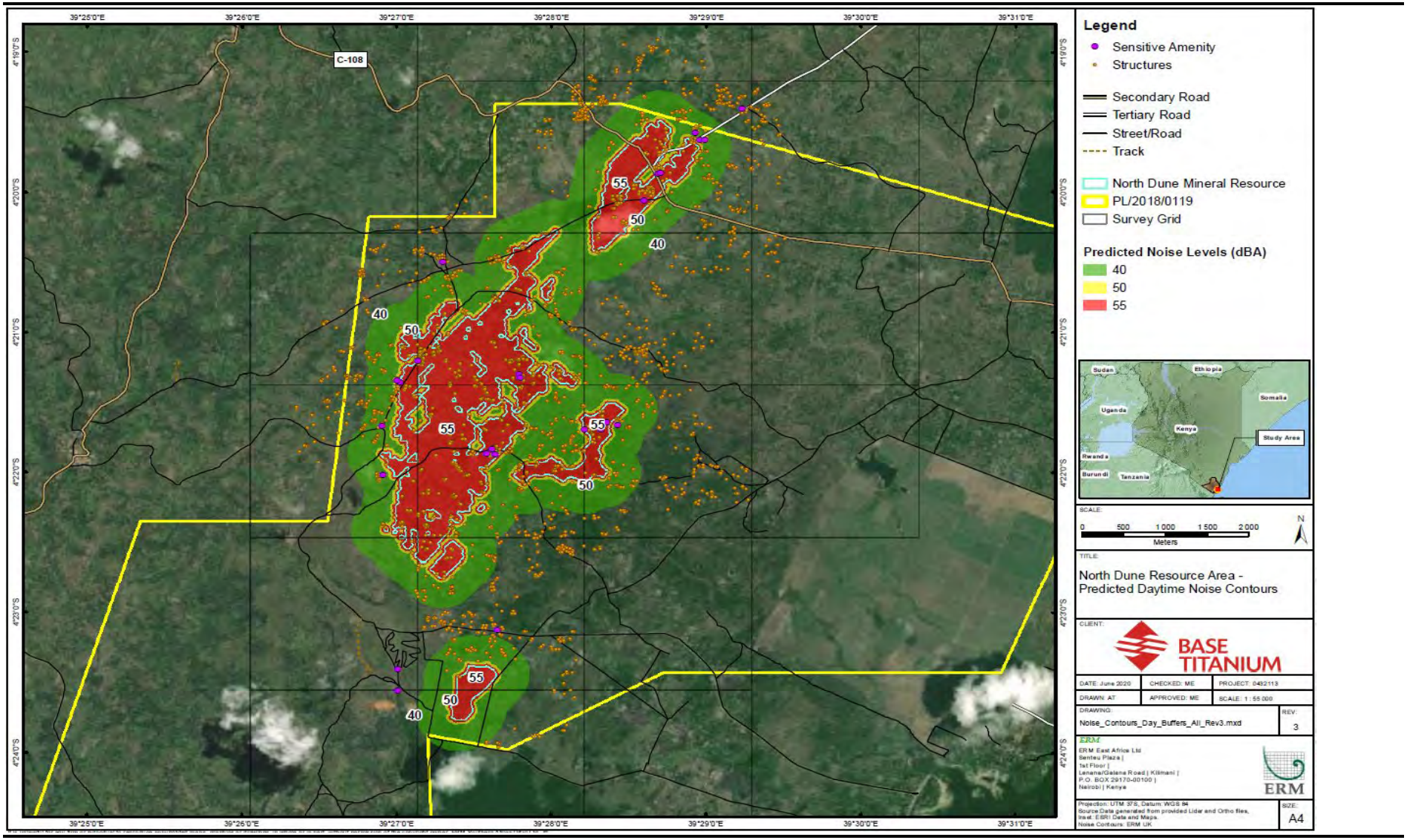
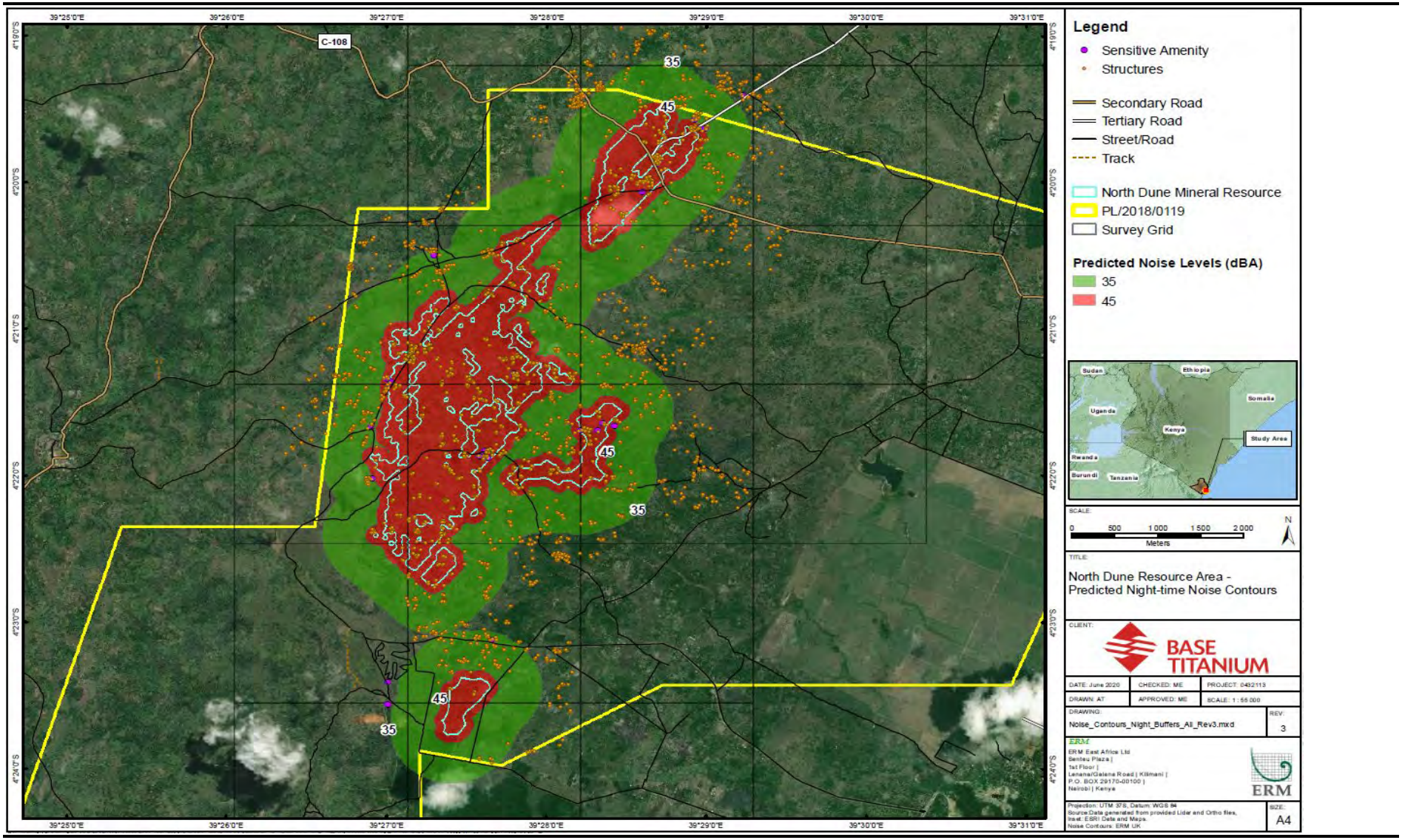


Figure 1.4 Predicted Buffer Zones - Night



APPENDIX A NOISE CONTOURS

Figure 1.5 Mkwanbani – Daytime Noise Contours

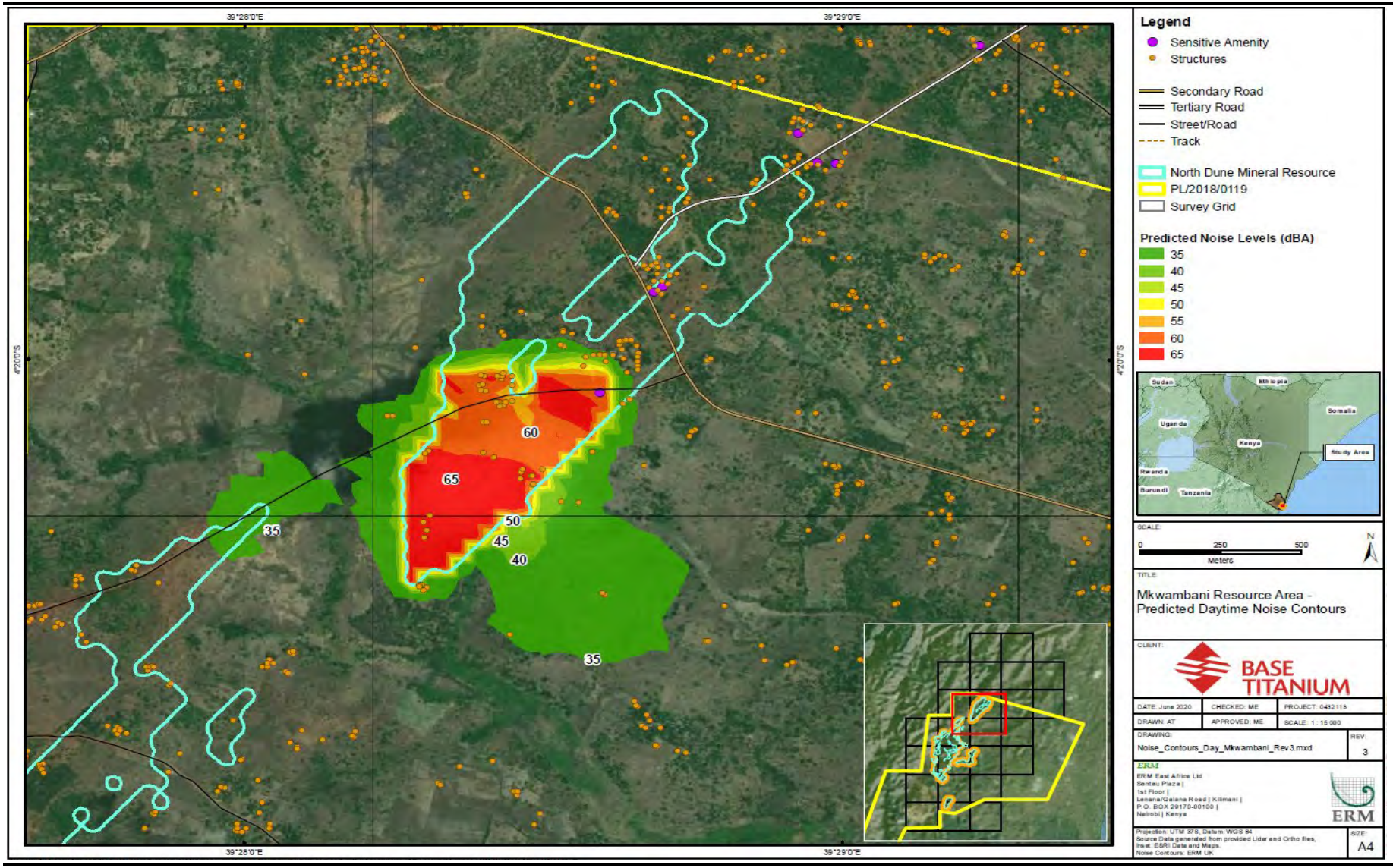


Figure 1.6 Mwandimu - Daytime Noise Contours

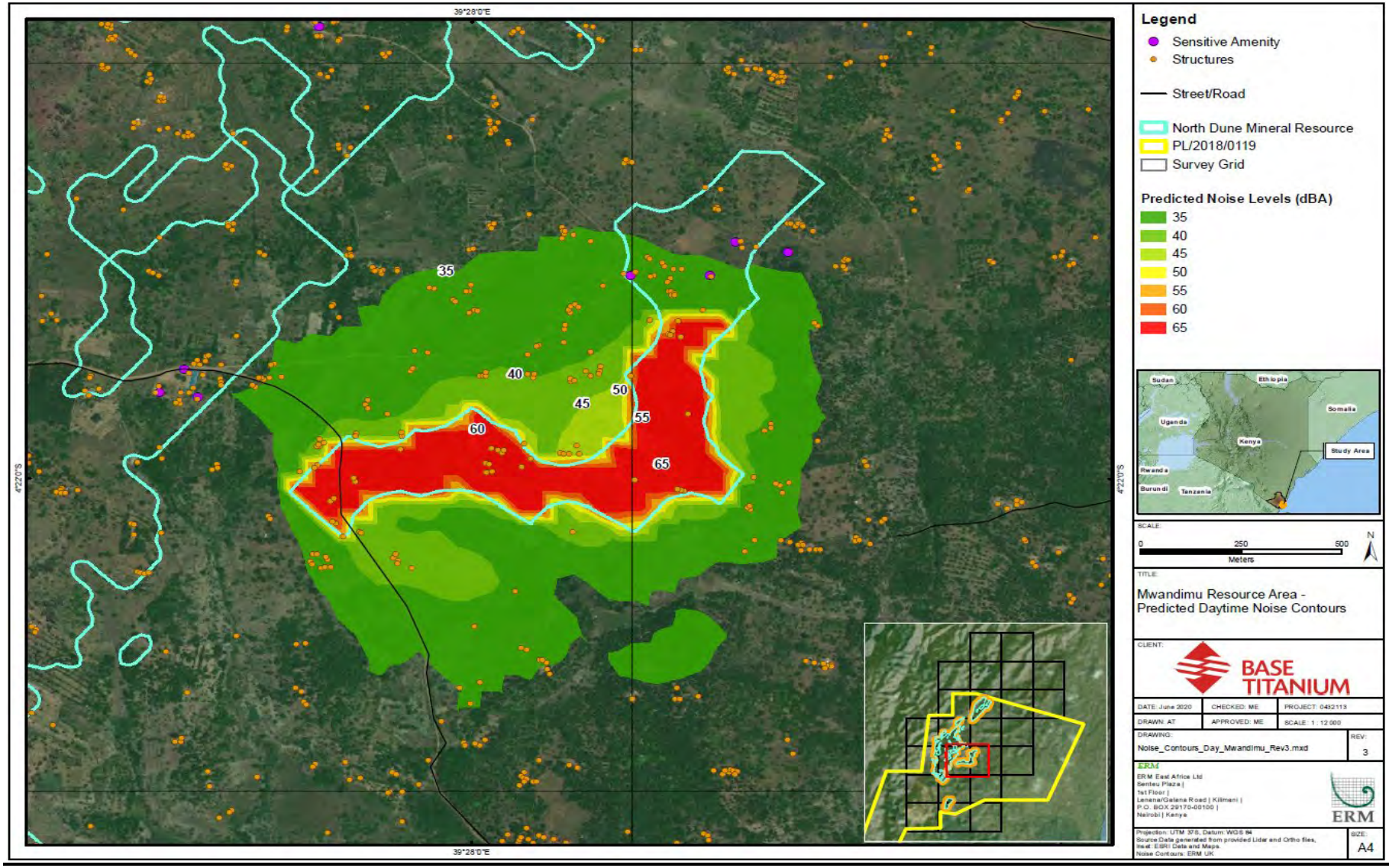


Figure 1.7 Bumamani - Daytime Noise Contours

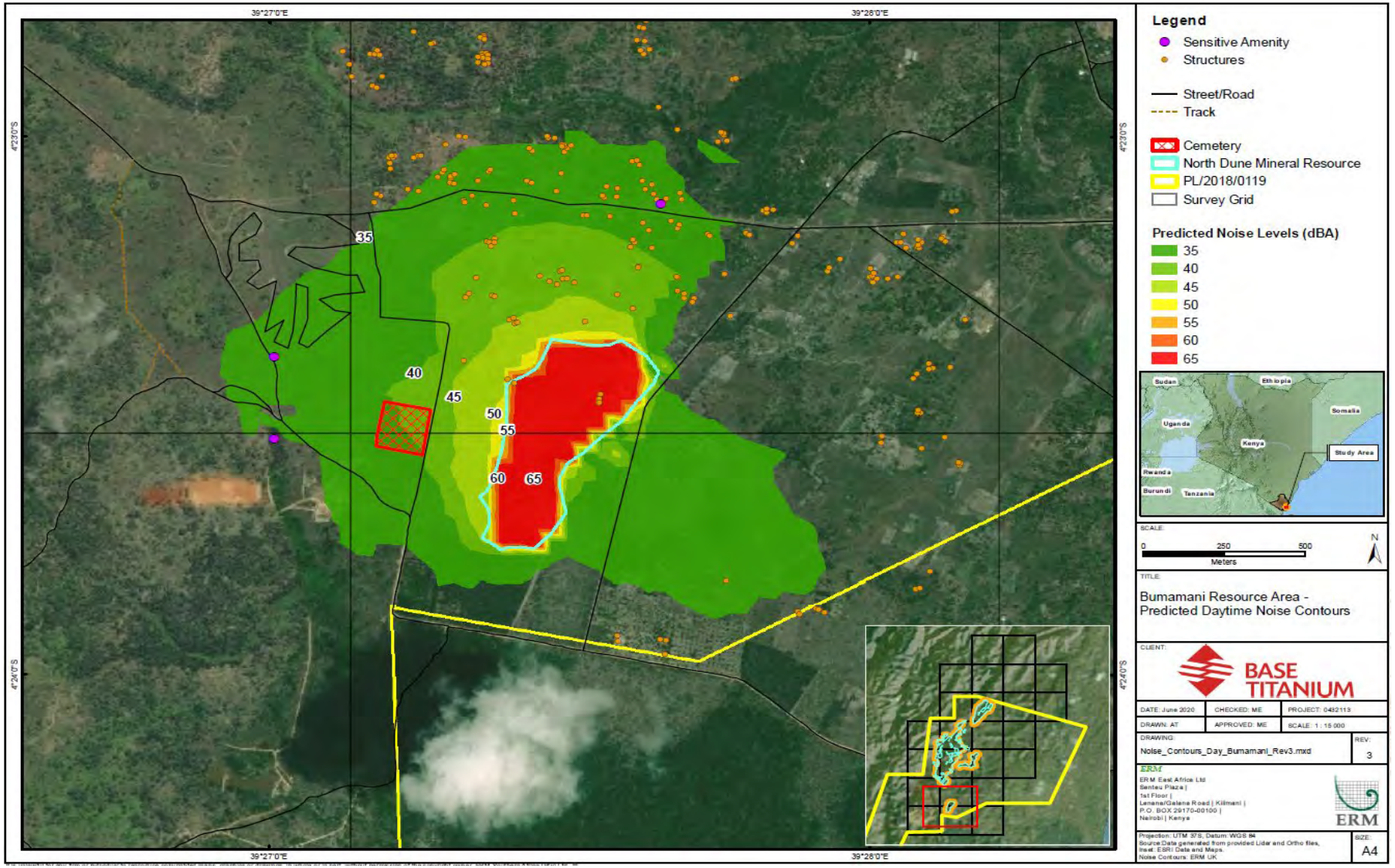


Figure 1.8 North Dune - Daytime Noise Contours

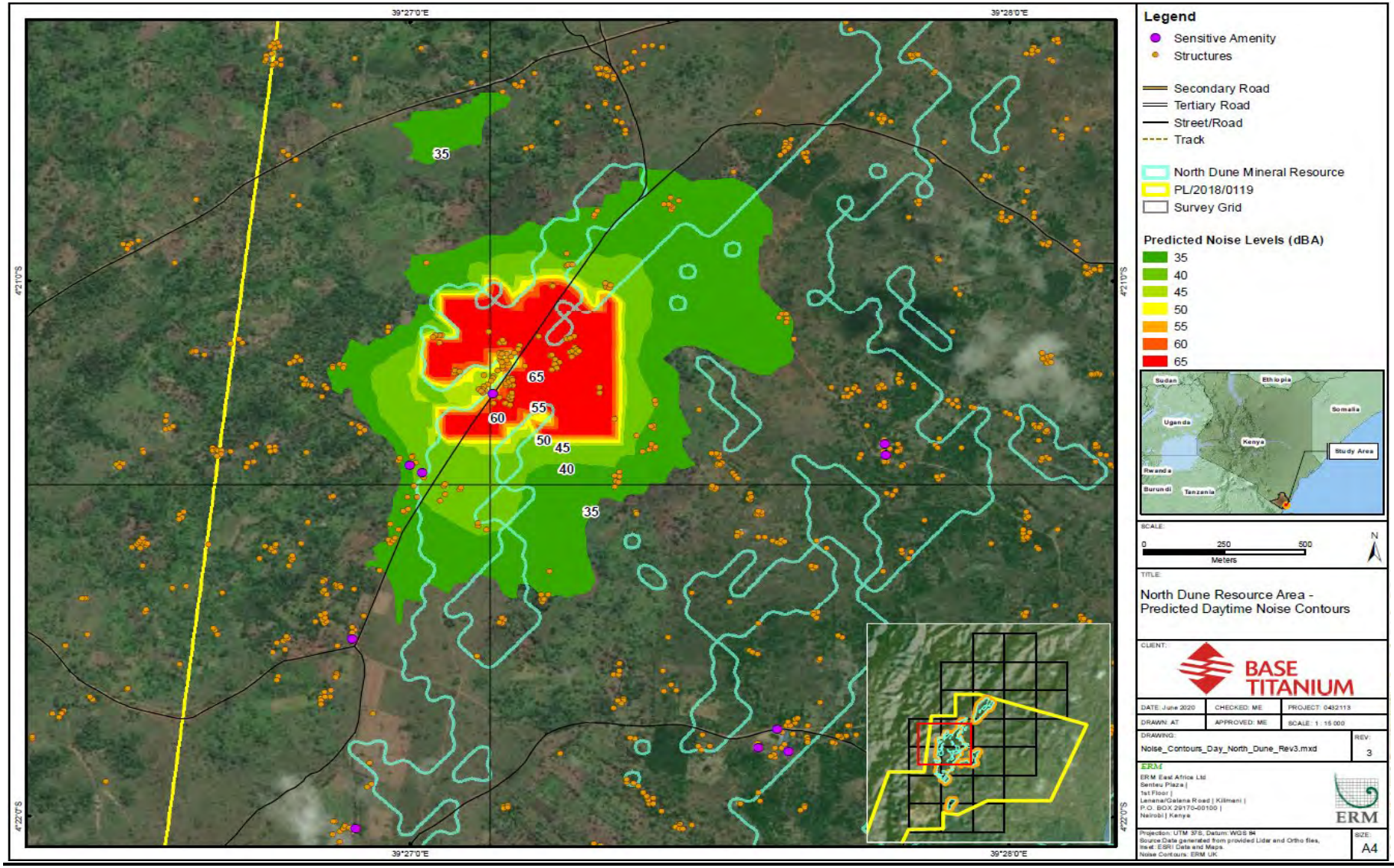


Figure 1.9 Mkwambani – Night-time Noise Contours

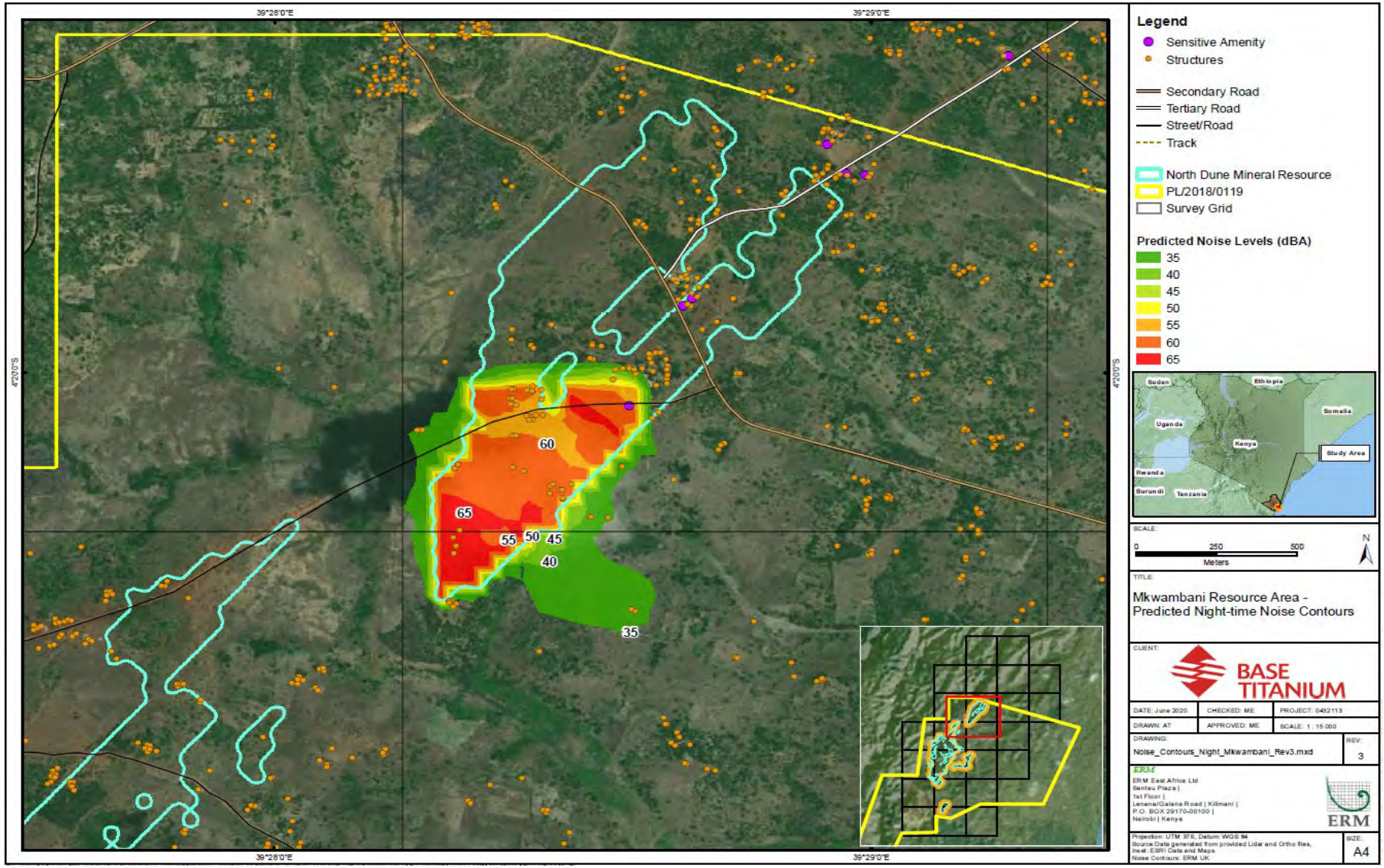


Figure 1.10 Mwandimu - Night-time Noise Contours

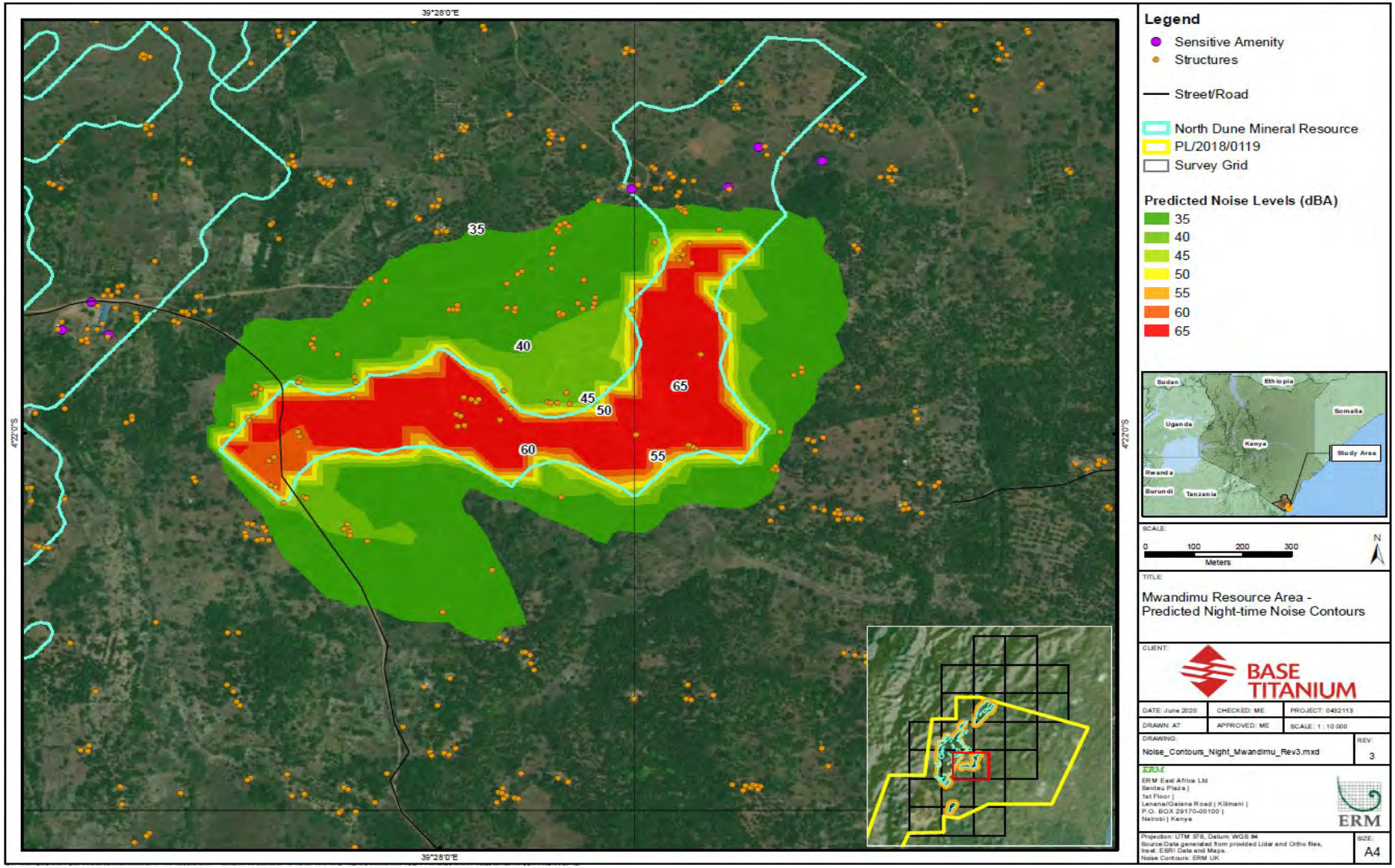


Figure 1.11 Bumamani- Night-time Noise Contours

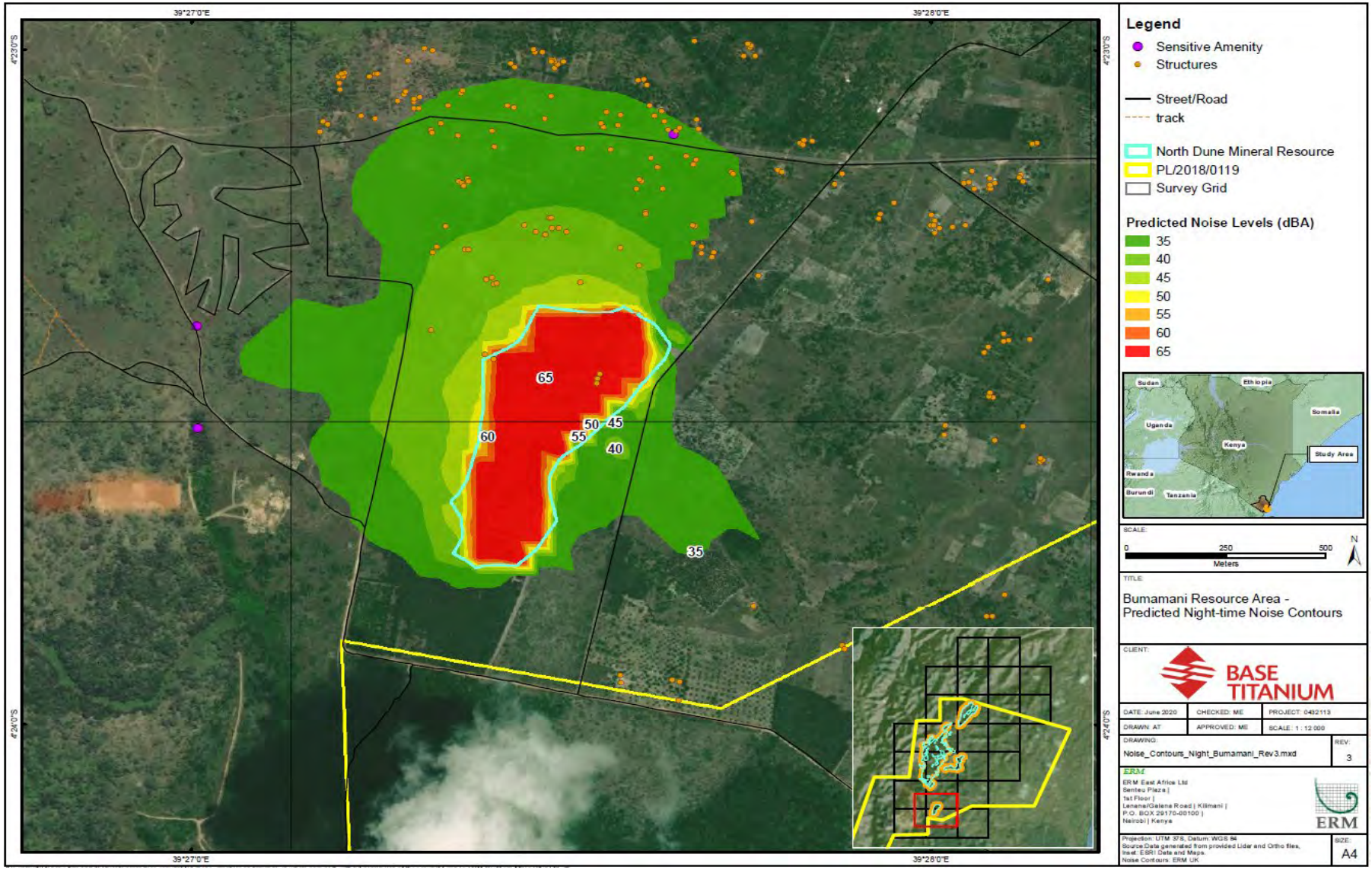
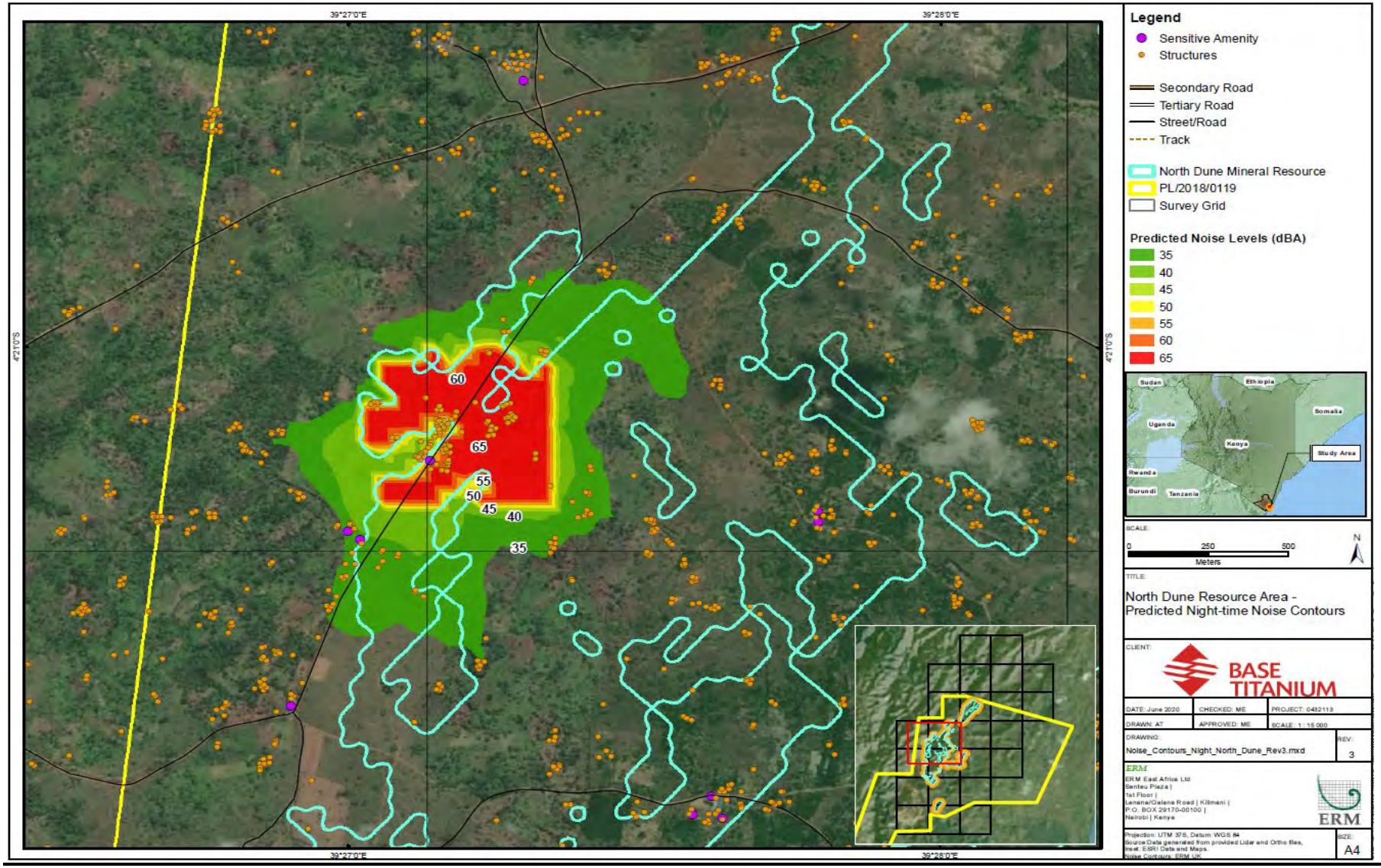


Figure 1.12 North Dune - Night-time Noise Contours



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APPENDIX H BIODIVERSITY BASELINE REPORT

Environmental and Social Impact Assessment for the North Dune Extension

Combined Biodiversity Baseline Report

22 September 2020

Project No.: 0547330

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Document details	
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Acronyms and Abbreviations

Name	Description
CHA	Critical Habitat Assessment
CR	Critically Endangered (IUCN classification)
DD	Data Deficient (IUCN classification)
EIB	European Investment Bank
EN	Endangered (IUCN classification)
EOO	Extent of Occurrence
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESS	Ecosystem Services
GBIF	Global Biodiversity Information Facility (https://www.gbif.org)
IBAT	Integrated biodiversity Assessment Tool
IFC	International Finance Corporation
IUCN	International Union for the Conservation of Nature
KBA	Key Biodiversity Area
LC	Least Concern (IUCN classification)
LOF	Life of Mine
LR	Lower Risk (IUCN classification)
mamsl	Meters above mean sea level
NT	Near Threatened (IUCN classification)
PAOI	Project Area of Influence
PS6	Performance Standard 6 (IFC)
SCC	Species of Conservation Concern (= species classified as CR, EN, VU, NT or DD)
SEI	Site Ecological Importance (=collective biodiversity sensitivity)
SML	Special Mining License
TMS	Timed Meander Search
VECEA	Vegetation Map for Eastern Africa (http://vegetationmap4africa.org/Home.html)
VU	Vulnerable (IUCN classification)
WWF	World Wildlife Fund

Key Glossary and Definitions

- **Project** - The features and activities that are a necessary part of the Project Developer's development plans without which the Project cannot proceed. The Project is also the collection of features and activities for which authorisation is being sought.
- **Project Site** - The (future) primary operational area for the Project activities.
- **Project Footprint** - The area that may reasonably be expected to be directly affected by Project activities, across all phases. The Project Footprint includes land used on a temporary basis such as construction lay down areas, materials yards, borrow pits or construction haul roads, as well as disturbed areas in transport corridors, both public and private.
- **Area of Influence:** The area where impacts could reasonably be expected.
- **Biodiversity:** The Convention on Biological Diversity defines Biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and ecosystems."
- **Study Area:** The area that needs to be studied in order to adequately understand and describe the baseline likely to be affected by the Project. At a minimum, the Study Area will encompass the Project Footprint and the Area of Influence (AoI), and in some cases it may extend farther to further establish the context for the Baseline.
- **Habitat:** A terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment.
- **Mitigation Hierarchy (Environment)**

  The mitigation hierarchy is defined as:

  - **Avoidance:** measures taken to avoid creating impacts from the outset, such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on certain components of biodiversity.
  - **Minimisation:** measures taken to reduce the duration, intensity and/or extent of impacts (including direct, indirect and cumulative impacts, as appropriate) that cannot be completely avoided, as far as is practically feasible.
  - **Rehabilitation/restoration:** measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and/ or minimised.
  - **Compensation:** measures, such as offsets, taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimised and/or rehabilitated or restored, in order to achieve no net loss or a net gain of biodiversity. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, protecting areas where there is imminent or projected loss of biodiversity.

1. INTRODUCTION

The Kwale Operation is in the Mivumoni and Kinondo Locations of the Msambweni Sub-county (also known as the Msambweni Constituency), in Kwale County, in south-eastern Kenya. The Operation is located about 50 km south of Mombasa, 50 km north of Lunga and the Tanzanian border, and 8 km inland from the Indian Ocean. The Operation holds a Special Mining Lease (SML No.23) measuring 1,661 ha.

The current mineral resource mined by Base Titanium comprises two dunes that contain economically viable concentrations of heavy minerals and known as the Central and South Dunes (**Error! Reference source not found.**). Following a further airborne geophysics surveys, Base was granted exploration tenure over an expanded area surrounding the Operation.

The three main target minerals include:

- Ilmenite (titanium-iron oxide) which is a raw material for pigment and paint.
- Rutile (titanium oxide) which is a raw material for titanium sponge, titanium metal and pigment.
- Zircon (zirconium silicate) which is a raw material used in refractory and ceramics industries.

The target minerals are separated from the ore at a processing plant located within the SML area. Ilmenite and rutile are trucked to a dedicated ship loading facility at Likoni, approximately 50 km north of the mine site and adjacent to the existing Port of Mombasa. Zircon is containerised and trucked to existing container facilities in the Port of Mombasa.

The Operation's original mine life was set at 13 years, running up until the year 2025. However, the mine life was later reduced to 2023 due to higher mining rates and the expansion of the Wet Concentrator Plant (WCP). In a move to assess the possibility of extending the Life of Mine (LOM) even further, Base, in 2018, decided to re-evaluate the potential of the 'North Dune' mineral deposit, which is located immediately to the north-east of the Kwale operation's offices and plant. The North Dune is a low grade (~1.6%HM) reasonably sized resource that has the clear potential to be economic, distributed across four resource concentration areas (**Error! Reference source not found.**). The low heavy mineral grade will require high mining feed rate options. The deposit also has high slime grades, which will result in increased water demand, exceeding presently permitted limits. As a result, this Project will be sensitive to capital costs and pricing assumptions, and will also require innovative process/engineering work to manage water consumption to acceptable levels. The proposed project of mining in the North Dune, the subject of this Biodiversity Baseline report, will increase the LOM a further 4.5 to 5 years.

The spatial extent of the area that will be directly impacted by the mining infrastructure is approximately 508 ha, although the prospecting licence area is larger. However, indirect impacts may reach beyond this spatial extent.

The Biodiversity Baseline surveys were mostly focused on the North Dune resource areas, as well as larger wetland systems and remaining patches of natural vegetation on and in close proximity to the resource areas.

1.1 Objectives of the Biodiversity Study

The main objective of the Biodiversity Baseline study was to assess the current state of biodiversity within the potential Project Area of Influence (PAOI), and identify very sensitive species, habitats or specific localities that may be present. Potential mining impacts then had to be evaluated against the biodiversity baseline information, and necessary mitigation and rehabilitation actions necessary to avoid or minimise such mining impacts listed.

The specific objectives were to:

- Baseline biodiversity assessment for all relevant taxa including desktop and field surveys;
- Provide a description of the major vegetation and habitat types;
- Identify highly sensitive habitats and species within the PAOI, including priority areas for avoidance, mitigation, rehabilitation and monitoring;
- Search for Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Near-Threatened (NT) species, collectively referred to as species of conservation concern (SCC) (including potential suitable habitat for these species);
- Establish a replicable flora, vertebrate fauna, avifauna and aquatic faunal baseline in the PAOI;
- Assess the watercourses and wetlands in the PAOI; and
- Determine the Sensitivity of habitats or localities, using the standardised Site Ecological Importance Method.

Based on the above information, ERM in collaboration with the field specialist, developed the following:

- Critical Habitat Assessment (CHA): assessing habitats based on the five (IFC) Performance Standard 6 (PS6) criteria that address habitat of significant importance to threatened, endemic, congregatory and migratory species, threatened or unique ecosystems, and key evolutionary processes.
- Environmental Impact Assessment concerning biodiversity by looking at the hierarchy from avoidance to mitigation (in the worst case offsets), and also listing risks to the Project, monitoring measures and mitigation measures that need to be implemented before, during and after mining operations as part of the ESIA report.

1.2 Project Area of Influence

In general, best practice is for a specialist to define a project (or potential) area of influence (PAOI) based on the spatial location of the project (footprint) and the potential extent of the impacts of the anticipated activities of the project. Essentially, the PAOI is defined primarily according to important and/or essential ecosystem processes and functions that may be plausibly affected by the proposed development and its associated activities. It is important to note that the PAOI can potentially be very large in relation to the actual project footprint, and would typically include (EIB, 2018):

- areas and habitats likely to be affected by cumulative impacts that result from the primary impact, on areas or resources used or directly impacted by the planned development of the project or other project-related sources of impacts in the geographical area;
- any existing project and/or condition, and other project-related developments than can realistically be expected at the time when the assessment is undertaken or the project will be operational;
- areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at another location.

The inspection of topography and drainages indicated that the main ore body is situated along a drainage divide or raised area, thus immediate runoff from the resource areas is initially drained both to a westerly and easterly direction. For purposes of this assessment, the biological Study Area was based on what is perceived as the potential Area of Influence of the mining activities (Project/Potential Area of Influence - PAOI), and then extended to include the upper areas of the larger drainage lines, up to.

Figure 1-1: Project Area and Potential Area of Influence covered by the biodiversity baseline report.

2. METHODS

2.1 Overview of sampling sites selected in the field

The fauna, flora and aquatic parameters were surveyed at different sites using a combination of repeatable methods which are described in detail below. Site selection was based on:

- Perceived sensitivities identified during the desktop analysis and site orientation (day 1 of the field survey)
- Ore resource layout as supplied by Base Titanium Ltd
- Access to sites

2.2 Mapping

Existing data layers openly available and supplied by the Client were incorporated into a GIS program to establish how the mine layout and associated activities interact with various terrestrial components. Emphasis was placed on the following spatial datasets:

- Potential Natural Vegetation (PNV) map of Eastern Africa version 2.0;
- Preliminary mine layout as supplied in June 2020;
- Protected Areas and Key Biodiversity Areas as supplied by IBAT
- Google Satellite Imagery available, dating between 2013 and 2018
- LIDAR images provided for the area by Base Titanium

After the field survey, points and descriptions of the habitats as supplied by the specialists were extrapolated to a wider area by visual inspection of Google Earth Imagery and then used for a supervised classification of the LIDAR images. From this an approximate map of the extent of observed habitats was created, with the understanding that habitats do not have a clear boundary.

2.3 Flora

2.3.1 Desktop and Fieldwork

A rapid site visit was undertaken on 21st- 25th July 2020, representing the end of the long rainfall season. This survey was to carried out by Quentin Luke (QL) in association with Mwadime Nyange (MN) from the East African Herbarium, Nairobi, and Saidi Chidzinga (SC) from the local National Museums of Kenya office at Ukunda, both of whom have been involved in similar surveys for Base Titanium.

The area of study was focused around the four ore concentrations within the North Dune, namely Bumamani, Mwandimu, Main and Mwambani, and a buffer area of approximately 100 m around the resource areas. These focal areas were given the following estimates for extent and vegetation and the estimated survey time as follows:

Area	Ha	% Natural (est.)	Est. Survey Time (days)
Blue (Bumamani)	46	30%	0.5
Green (Main)	492	15%	2.0
Red (Mwandimu)	90	20%	0.5
Purple (Mwambani)	146	30%	1.0
TOTAL	774		4.0

It was planned to visit each of these areas in turn, concentrating on the natural areas as interpreted from Google Earth, recording the routes taken on GPS and marking areas and plants of interest. Due to the sensitivity of the survey to local residents, instructions were received from Base Titanium that each area must be visited accompanied by local elders and led by them.

During the survey, a running list of species encountered was recorded with particular attention to species of conservation concern (SCCs).

- The findings of this study, was complemented by previous supplementary studies performed within the study area, including:
  - EIA Report for Messrs TIOMIN, Coastal & Environmental Services, April 2000
  - Power Line Mukurumudzi Dam, QL, October 2011
  - Gongoni and Buda Forest Reserves, QL, December 2011
  - SML (Central Dune, Tailings Storage Facility & South Dune), QL, January 2012
  - Ecosystem Services Supply & Demand Analysis, FutureWorks, May 2012

Limitations to the Flora Survey encountered

- Completeness of Survey Results
  - A rapid survey of this nature cannot hope to inventory all the plants existing in the entire 774 ha or even larger PAOI, but the combined knowledge of the team members and their familiarity and ability to recognize both the common and the rare species in Kwale County is sufficient to give a high degree of accuracy both for the total species list and the recording of SCCs.
- Limitations of Current Taxonomic Knowledge
  - Although new plant species are still being discovered and described in the hotspot, they tend to be from little-known areas along the East African coast and not this well visited and partially developed area. Within plant taxonomy currently there is much flux over the delimitation of plant families, but plant species circumscriptions are reasonably stable. Thus the names used in this report were standardized against the African Plant Database (http://www.ville-ge.ch/musinfo/bd/cjb/africa/recherche.php).

2.4 Fauna

The objective of the faunal study was twofold: to generate a baseline for the project area and to assess the risks associated with fauna Species of Conservation Concern (SCC) and faunal habitats which would potentially qualify as Critical, Natural or Modified according to International Finance Corporation (IFC) Performance Standard 6 (PS6) criteria. The methods applied deemed as sufficient in order to fulfil international best practice standards as well as satisfactorily achieve the goals of the baseline study, namely a comprehensive inventory of the faunal assemblages within the project area.

Past Survey- and monitoring data for the faunal groups, from 2012 onwards on and in close proximity of the Kwale Base Mining- and Prospecting Licence Area were also made available for inclusion in the results.

2.4.1 Herpetofauna

Wetlands are the critical habitats for amphibians (mainly frogs), some of which may be of conservation concern. In particular, amphibians are one of the good bio-indicators of environmental change, quality or condition. The goal of this herpetofaunal survey was to identify species of conservation concern and their critical habitats in the proposed Northern Dune mining area. The Species of Conservation Concern (SCC) are mainly those listed in the IUCN Red list of threatened species as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Near Threatened (NT).

The survey was done during a relatively wet and cool period with moderate green/dry grass, plants and herbaceous cover and water in the stream was mostly clear.

2.4.1.1 Herpetofaunal Field Survey

Sampling of amphibians and reptiles was done for 10 days from 20 to 29th July 2020 using the standard method of time-limited Search (TLS) and other qualitative methods. There exist different kinds of techniques and tools used in sampling reptiles and amphibians (Heyer et al. 1994, Dodd 2016 a & b).

Time-limited search (TLS)

This is a form of timed-species count (TSC) method in which sampling is done for a limited time period within a given selected habitat without setting boundaries. The procedure is similar to the technique of time constrained search-and-seize method described by Karns (1986). It involves quietly and slowly walking and recording all individual reptiles and amphibians found in different micro-habitats such as on ground, in debris, under decomposing logs, on trees or shrubs, grass, reeds, sedges, among others for one person hour. It also involves digging in suitable micro-habitats in search of burrowing species such as skinks, caecilians, frogs and snakes. For reptiles this was done in the morning session when they are most active basking, resting or foraging. Night searches mostly for amphibians involved visiting various selected wetlands (stream beds/edges, ponds, pools, springs) was done from around 1900hrs.

Opportunistic Visual Encounter Survey (VES)

This qualitative opportunistic method involves recording all species found and more so new records for every site encountered outside the ordinary sampling period of the standard method. This also involves sightings by other people within the sampling areas mainly of the easily identifiable species. This helped in enriching species checklists.

Community Interviews

This involved interviewing the local community on the presence of easily identifiable species in their area especially the large lizards and snakes.

Collected representative voucher specimens were euthanized in a humane manner according to the standard protocols. Amphibian specimens were euthanized with MS222 solution and reptiles with injection of pentobarbital solution. Specimens were then preserved in 10% formalin and in the lab stored in 70% ethanol solution. Where necessary, selected tissue samples for later molecular analysis were taken and stored in absolute ethanol. Colour photographs of selected species and their habitats were taken. A 12 Channel Garmin® receiver was used to take GPS data. Voucher materials collected are deposited in the Herpetology Section reference collection at the National Museums of Kenya, Nairobi.

2.4.1.2 Herpetofauna Species Richness and Diversity

In the context of this survey, species richness refers to the number of different species recorded, while species diversity is the variety and abundance of each species (Magurran, 1988). The observed species richness (Sobs) from time-limited search (TLS or samples) data was estimated using the EstimateS 9.10 program (R. K. Colwell: http://purl.oclc.org/estimates; Cowell, 2013).

2.4.2 Mammals

Specific Mammal surveys were not undertaken, but data from monitoring and previous studies was available and used (Harvey, 2012).

2.4.3 Avifauna

Specific Avifaunal surveys were not undertaken, but data from continuous monitoring and previous studies was available and used (Harvey, 2012; Kwale Base Titanium Bird Record; Sensitive Bird List around SML).

2.4.4 Macro-invertebrates

Macro-invertebrates are good indicators of biological conditions in the ecosystems. They are reliable indicators because they spend all or almost of their lives in water, they respond differently to pollution and disturbances and in a very predictable way. They are also easy to collect and unlike fish have limited mobility and therefore do not escape from pollution and disturbances. It is for this reason that macro-invertebrates where sampled in the Northern Dune area within the Base Titanium Limited in order to generate some baseline biodiversity data before the mining activities commence. This was done between 21st and 28th of July 2020.

2.4.4.1 Field Sampling

Three methods were employed to sample for both aquatic and terrestrial stages of macro-invertebrates. These were pond netting which used a SASS net, sweep netting and field observation for adult dragonflies.

A SASS (South African Scoring System) approach was used in few sampling sites that met the criteria. This followed the methods of (Dickens & Graham 2002). In a majority of sites sampling was randomly done for checklist generation and identification of species of conservation concern. The geo-locality details for all the sampling points in the 5 villages are given Appendix 1.

Figure 2-1: Pond netting in a semi-permanent pond in Mwaweche (left) and sweep netting in Mwandimu (right).

2.4.4.2 Specimen Identifications and Data Processing

Identification of the specimens was carried out at the museums in Nairobi using available taxonomic keys and comparing with the museum's reference collection. SASS scores and Average Scores per Taxa were calculated.

Figure 2-2: Specimen processing and identification at the National Museums of Kenya.

2.4.5 Butterflies (Lepidoptera)

Fieldwork for Butterflies (Lepidoptera) was carried out over a period of 10 days, between the 21st and 31st July 2020. The study was done by visual observation sweep net collection and butterfly traps also looking at host plants for larvae where appropriate particularly on wet days where adult activity was limited by the weather, prioritising habitats most likely to host butterfly species. For every new species not previously reported in the area (two species), the habitat dependency of the new species was investigated in conjunction with host plant information from the botanical team. Subsequently, secondary/tertiary populations could be identified using the habitat investigations outside the proposed mineral resource areas to be mined.

Figure 2-3: Butterfly survey Mwaweche with the village chief, July 2020.

2.5 Impact Receptors and Habitat Sensitivity

To evaluate potential impacts from the proposed development, it is essential to appropriately define the potential impact receptors in relation to specific habitats, species, group of species and it/ their use of/ reliance on a particular habitat. SCC and ecosystem functionality and services should be some of the main factors (but not the only) influencing the description of habitat/ vegetation/ structural units to serve as receptors to potential impacts e.g. “breeding habitat” or “restricted species habitat”. The receptor

therefore includes both the habitat/ vegetation type and the important species reliant on it for a particular purpose (breeding, refugia, foraging etc.). Therefore, when evaluating Site Ecological Importance (SEI; see below) for the receptor and describing potential impacts from the proposed development, the species or group of species of concern have been specifically taken into account.

Where possible, the impact receptors must be defined spatially and mapped appropriately. In cases where mapping cannot easily be performed (e.g. specific trees used as nesting sites), the general area containing these receptors should be mapped.

2.5.1 Habitat Sensitivity by Evaluation of Site Ecological Importance (SEI)

In order to spatially identify the different areas of importance for a species for a proposed development site and to facilitate transparent and comparable reporting of the potential impacts of development, a standardised metric for identifying site-based ecological importance for species, in relation to a proposed project with a specific footprint and suite of anticipated activities, is implemented.

2.5.1.1 Method for the determination of Site Ecological Importance (SEI)

SEI is considered to be a function of the Biodiversity Importance (BI) of the receptor (e.g. species of conservation concern, the vegetation/fauna community or habitat type present on the site and its resilience to impacts (Receptor Resilience) as follows:

SEI = BI + RR

BI in turn is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor as follows:

BI = CI + FI

Conservation Importance (CI) is evaluated in accordance with recognised established internationally acceptable principles and criteria for the determination of biodiversity-related value, including the IUCN Red List of Species, Red List of Ecosystems and Key Biodiversity Areas (KBA; IUCN (2016)).

Conservation Importance is defined here as:

> *The importance of a site for supporting biodiversity features of conservation concern present e.g. populations of IUCN Threatened and Near-Threatened species (CR, EN, VU & NT), Rare, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes.*

These criteria are defined as follows:

- IUCN Threatened and Near-Threatened Species (CR, EN, VU & NT) refers to either the global or national assessments of the risk of extinction as evaluated by a dedicated panel of species specialists according to the criteria of the International Union for The Conservation of Nature (www.iucnredlist.org). Where the global and national assessments differ for the same taxon, the most recent evaluation of status should be used in calculating SEI. It is important to note that the specialist is required to have a firm understanding of the IUCN Red List Categories and Criteria (IUCN 2012) in order to appropriately apply these for the evaluation of SEI. This criterion can be assessed using confirmed occurrences of species or the suitability of the habitat to support these species;
- Rare species are those included on the country-specific Red List as Rare or Critically Rare or Extremely Rare. These are highly restricted species that are currently not declining. However, should any development impact on a population of these species they will immediately qualify under one of the IUCN categories of threat.

- Range-restricted species – the presence of terrestrial flora, vertebrate and invertebrate fauna with a global population extent of occurrence (EOO) of 10 000 km^2 or less;
- Globally significant populations of congregatory species – a roughly estimated proportion (%) of the global population of a fauna species that congregate for breeding / feeding / hibernation / other reasons;
- Significant areas of threatened vegetation types – this is a function of both the area (size) being considered in relation to the total extent of that vegetation type (i.e. proportion) and how threatened (CR, EN, VU) the vegetation types are; and
- Natural processes – natural unmanaged areas with low levels of ecological disturbance have largely intact natural processes such as pollination, seed dispersal and migration, and thus have greater intrinsic conservation importance than those that are modified through ecological disturbance.

As a minimum requirement, CI needs to be determined for each identified habitat within the project footprint but best practice recommendation is that it should be determined for all habitats within the entire Project Area of Assessment (PAOI), using the ratings as in Table 2-1.

Table 2-1: Conservation Importance Ratings

Conservation Importance	Fulfilling Criteria
Very High	■ Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global Extent of Occurrence of < 10 km^2 ■ Any area of natural habitat of a CR ecosystem type or large area (> 0.1 % of the total ecosystem type extent) of natural habitat of EN ecosystem type ■ Globally significant populations of congregatory species (>10% of global population)
High	■ Confirmed or highly likely occurrence of CR, EN, VU species that have a global Extent of Occurrence of > 10 km^2. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining. ■ Small area (>0.01% but < 0.1 % of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1 %) of natural habitat of VU ecosystem type. ■ Presence of Rare species. ■ Globally significant populations of congregatory species (>1% but <10% of global population).
Medium	■ Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under a criterion only and which have > 10 locations or > 10 000 mature individuals. ■ Any area of natural habitat of threatened ecosystem type with status of VU ■ Presence of range-restricted species ■ > 50 % of receptor contains natural habitat with potential to support SCC
Low	■ No confirmed or highly likely populations of Species of Conservation Concern ■ No confirmed or highly likely populations of range-restricted species ■ < 50 % of receptor contains natural habitat with limited potential to support SCC
Very Low	■ No confirmed and highly unlikely populations of SCC ■ No confirmed and highly unlikely populations of range-restricted species ■ No natural habitat remaining

Functional Integrity (FI) of the receptor (e.g. the vegetation/fauna community or habitat type) is defined here as the receptors' current ability to maintain the structure and functions that define it, compared to its known or predicted state under ideal conditions.

Simply stated, **Functional Integrity (FI)** is:

> *A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts.*

These criteria can be defined as:

- Connectivity to other natural areas - connectivity, which can also be measured conversely as the degree of habitat fragmentation, refers to how connected habitat patches are to each other, which has a significant influence on numerous ecological process, such as migration and dispersal opportunities of biota and therefore genetic exchange between populations. Connectivity to other similar habitats becomes more important as the remaining intact and functional area of a habitat decreases, mainly because population sizes decrease and are therefore at greater risk from ecological perturbations and inbreeding effects. The degree of connectivity between habitat patches varies greatly with the dispersal ability of the taxon or taxon group (e.g. fossorial reptiles) in question;
- Degree of current persistent negative ecological impacts - persistent negative impacts such as uncontrolled spread of alien and invasive flora effectively decreases both the remaining intact area and ecosystem functioning of a particular habitat; and
- Remaining intact and functional area – the proportion of the receptor that supports natural habitat with intact ecological processes - small areas are less likely to withstand ecological degradation compared to large areas and are therefore better able to maintain structure and function allowing for intact ecological processes.

Ecological processes can be considered to be mostly intact and functional if the receptor area has low levels of current ecological disruptors, has good connectivity to other areas and is a relatively large area. As for CI, the fulfilling criteria to evaluate FI do not rely on a single specific threshold for each of the above defining characteristics but can act in combination or in isolation, and will require justification by the specialist.

Table 2-2: Functional Integrity Ratings

Functional Integrity	Fulfilling Criteria
Very High	■ Very large (>100 ha) intact area for any conservation status of ecosystem type or >5 ha for CR ecosystem types ■ High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches ■ No or minimal current negative ecological impacts with no signs of major past disturbance (e.g. ploughing)
High	■ Large (>20 ha but <100 ha) intact area for any conservation status of ecosystem type or >10 ha for EN ecosystem types ■ Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches ■ Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g. ploughing) and good rehabilitation potential

Functional Integrity	Fulfilling Criteria
Medium	■ Medium (>5 ha but <20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types ■ Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches ■ Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance; moderate rehabilitation potential
Low	■ Small (>1 ha but <5 ha) area ■ Almost no habitat connectivity but migrations still possible across some transformed or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. ■ Several minor and major current negative ecological impacts
Very Low	■ Very small (<1 ha) area ■ No habitat connectivity except for flying species or flora with wind-dispersed seeds. ■ Several major current negative ecological impacts

As Biodiversity Importance (BI) is a function of Conservation Importance (CI) and the Functional Integrity (FI) of a receptor, BI can be derived from a simple matrix of CI and FI as follows:

Biodiversity Importance		Conservation Importance				
		Very High	High	Medium	Low	Very Low
Functional Integrity	Very High	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very Low	Medium	Low	Very Low	Very Low	Very Low

Receptor Resilience (RR) needs to be evaluated by the specialist and justification for each evaluation must be provided in the report.

Receptor Resilience (RR) is defined as:

> *the intrinsic capacity of the receptor to resist major damage from disturbance and / or to recover to its original state with limited or no human intervention.*

The fulfilling criteria to evaluate RR is based on the estimated recovery time required to restore an appreciable portion of functionality to the receptor (Table 2-3), and will require justification by the specialist. The specialist needs to bear in mind that resilience will often be linked to a particular disturbance or impact, or even time of year, and needs to be described in relation to these factors. As an example, large birds of prey have different levels of resilience to noise disturbance depending on whether they are breeding or not; these species would have low resilience to noise disturbance such

as construction of a road adjacent to a nest site during the breeding season but a higher resilience to lodge construction in an area with limited breeding habitat outside of the breeding season.

Table 2-3: Receptor Resilience Rating

Resilience	Fulfilling Criteria
Very High	■ Habitat that can recover rapidly (~ less than 5 years) to restore > 70 % of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed
High	■ Habitat that can recover relatively quickly (~ 5-10 years) to restore > 70 % of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed
Medium	■ Will recover slowly (~more than 10 years) to restore > 70 % of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed
Low	■ Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~less than 50 % of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed
Very Low	■ Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed

After the evaluation of both Biodiversity Importance and Receptor Resilience as described above, it is possible to evaluate Site Ecological Importance (SEI) from the final matrix as follows:

Site Ecological Importance		Biodiversity Importance				
		Very High	High	Medium	Low	Very Low
Receptor Resilience	Very Low	Very High	Very High	High	Medium	Low
	Low	Very High	Very High	High	Medium	Very Low
	Medium	Very High	High	Medium	Low	Very Low
	High	High	Medium	Low	Very Low	Very Low
	Very High	Medium	Low	Very Low	Very Low	Very Low

2.5.2 Critical Habitat Assessment

A Critical Habitat Assessment (CHA) was developed for the directly and indirectly impacted areas. Essentially, a CHA is required by IFC PS6 to manage risks and avoid, mitigate, and offset impacts to areas with high biodiversity value, which must be determined at the species, ecosystem and landscape levels of biological organization. The following outlines the five major criteria that must be evaluated in order to assess Critical Habitat (IFC PS6 2012 as updated in 2019; Bland et al. 2016).

There are three criteria at the species level:

- Criterion 1 - Critically Endangered and Endangered Species. Species threatened with global extinction and listed as CR and EN on the IUCN Red List of Threatened Species shall be considered as part of Criterion 1. Critically Endangered species face an extremely high risk of extinction in the wild. Endangered species face a very high risk of extinction in the wild.
- Criterion 2 - Endemic and Restricted-range Species. For purposes of this Guidance Note, the term endemic is defined as restricted-range. Restricted range refers to a limited extent of occurrence (EOO); and
- Criterion 3 - Migratory and Congregatory Species.

At the ecosystem level the following criteria applies:

- Criterion 4 - Highly threatened or unique ecosystems.

The final criterion relates to the landscape level:

- Criterion 5 - Key evolutionary processes.

Prior to the development of the CHA, it is necessary to take into account all biodiversity studies performed for the site in question to date as well as all applicable national laws and international guidelines, in order to identify knowledge gaps and recommendations embedded within previous studies as well as regulatory guidelines. It is further advisable to have a good understanding of ecosystem functionality and associated ecosystem services prior to conducting the CHA.

The detailed methods and thresholds for the CHA are listed in Annex F.

3. RESULTS

3.1 Project Area of Influence

The landscapes of the Project Area of Interest (PAOI) consist of relatively flat to gently undulating plains, from the highest points across the main ore body at approximately 130 mamsl, to approximately 90 mamsl on the western periphery of the PAOI, and approximately 60 mamsl towards the eastern periphery. The landscapes are interrupted river valleys and by localised to drainage-like depressions where water accumulates and forms wetlands, but may only create flowing streams after sufficient rainfall. Larger wetland systems such as the Kidongoweni and Madongaweni Rivers are perennial streams.

3.1.1 Background and Historical Vegetation

Kwale and surrounding areas lie within the Swahili Centre of Endemism, also referred to as the East African Coastal Forest Hotspot (Myers et al., 2000), known for its very high biodiversity of flora and fauna of over 6000 documented species (Samoilys et al., 2015). High species diversity and endemism are specifically found in the remnant natural habitats - present within the Project Area and wider Area of Influence, e.g. the Gongoni Forest Reserve and Kidongoweni Wetlands.

It is essentially the presence of range-restricted and habitat-specific species, as well as unique and important ecosystem functions, that has contributed to the identification of Critical Habitats being present, as discussed further in Section 5.

The Potential Natural Vegetation of Eastern Africa Map (van Breugel *et al.*, 2015) broadly classifies vegetation within the Project Area and Potential Area of Assessment as consisting of:

- Coastal Mosaic Vegetation as part of the original extent of the Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion; and
- Freshwater Swamps (which would include Rivers, Riparian Areas and all wetlands).

The 'Coastal Mosaic' Vegetation extends between 50 and 100 km inland, and consists of several types of vegetation habitats closely intertwined and changing due to edaphic factors such as soils and soil-moisture levels. The Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion, as defined by the WWF (2020 [1]), has plant species diversities that are among the highest in the world. The remarkably high species diversity associated with the area is partially a result of the great diversity of habitats, and the levels of species endemism. To date over 4,500 plant species have been recorded in this coastal mosaic. Of these, 3,000 species are confined to forest habitats (WWF 2020).

Natural habitats, especially small forest patches, are highly threatened in coastal Kenya. This threat comes primarily from an increase in coastal populations, conversion to agricultural land, and various forms of extraction operations, including mining. Accordingly, the WWF classifies this ecoregion as having a ***Critically Endangered Status****.*

The Northern Zanzibar-Inhambane Coastal Forest Mosaic Ecoregion *historically* present in the study area is broadly divided into the following broad vegetation types (van Breugel *et al.*, 2015):

- **Zanzibar-Inhambane Undifferentiated Forest**:
  - These are natural forests that can differ vastly in structure and species composition over short distances. Canopy height can vary between 15 and 20 m, with individual trees as high as 35 m. Currently, there is limited information on the actual extent of the distribution of these forests in Kenya, but these forests are considered as some of the floristically richest of this vegetation (van Breugel *et al.*, 2015). An example would be the Gongoni Forest Reserve.

[1] WWF (2020) https://www.worldwildlife.org/ecoregions/at0125

- **Zanzibar-Inhambane Scrub Forest**:
  - These habitats have a structure that is intermediate between forest, bushland and thicket, with a general height of 10 – 15 m. Although trees are present, they do not form a closed canopy. In its historical/natural form, this vegetation forms an almost continuous belt that separates the forests of the coastal region from the bushlands in the interior (van Breugel *et al*., 2015). One example of such vegetation would be Kaya Muhaka, north-east of the PAOI.
- **Swamps and Wetlands:**
  - Swamps and wetlands are relatively common in the area, and may also be a primary component of any Undifferentiated Forest (moist forest). Riparian areas are generally considered part of the swamps and wetlands.

Since the beginning of the Kwale mining operations in 2012 and the establishment of the mine's indigenous plant nursery near the mine processing plant, a close watch has been kept on those plant species that are particular to this area in Kwale County. A complete inventory of all plants encountered within the existing mine area (central and South Dune) and the adjacent Gongoni and Buda Forest Reserves was prepared in 2017, listing 1244 indigenous and 101 cultivated and naturalised exotic plants species. This compares favourably with the Shimba Hills checklist (Luke, 2005) of 1396 plants and 52 cultivated or naturalised species.

The process of assessing the world's plants with extinction risk lies with the IUCN Red List and had progressed very little for East Africa until the formation of the Eastern African Plant Red List Authority in 2005. Since then, the number of plants assessed as threatened has grown each year with particular emphasis on the Coastal Forests of East Africa Hotspot (Myers et al., 2000). At the date of this survey, some 400 plants within the K7 (Flora of Tropical East Africa) biogeographical area of Kenya had been listed as CR, EN or VU (see www.iucn.org for Red List categories) due to their limited distribution and threat to their locations. Of these, some 100 taxa have already been cultivated at the Base Titanium nursery and many planted out into rehabilitated areas.

3.1.2 Gazetted Protected Areas

Several protected areas are located in in close proximity of the SML area of the Kwale Operation. All protected areas that are within 15 km of the borders of the SML are listed in Table 3-1 (as illustrated in Figure 3-1), with a short description of each in the sections below.

Table 3-1: Protected Areas in close proximity to the proposed Project

Protected Area	IUCN Mgmt. Category	Size (km²)	Type of Region
Shimba Hills National Reserve	Category II	217	National Reserve Key Biodiversity Area due to presence of CR/EN, VU, endemic and other species
Buda Forest Reserve	Category VIII	6,2	Forest Reserve Key Biodiversity Area due to presence of CR/EN, VU and endemic species
Gongoni Forest Reserve	Category VIII	8,2	Forest Reserve Key Biodiversity Area due to presence of CR/EN, VU and endemic species
Diani - Chale National Reserve	Category VI	75 Marine 4,5 Forest	Marine National Reserve and Diani Forest (4,5 km²) Key Biodiversity Area due to presence of CR/EN, VU and endemic species

Source: IUCN Key Biodiversity Areas and IBAT Website

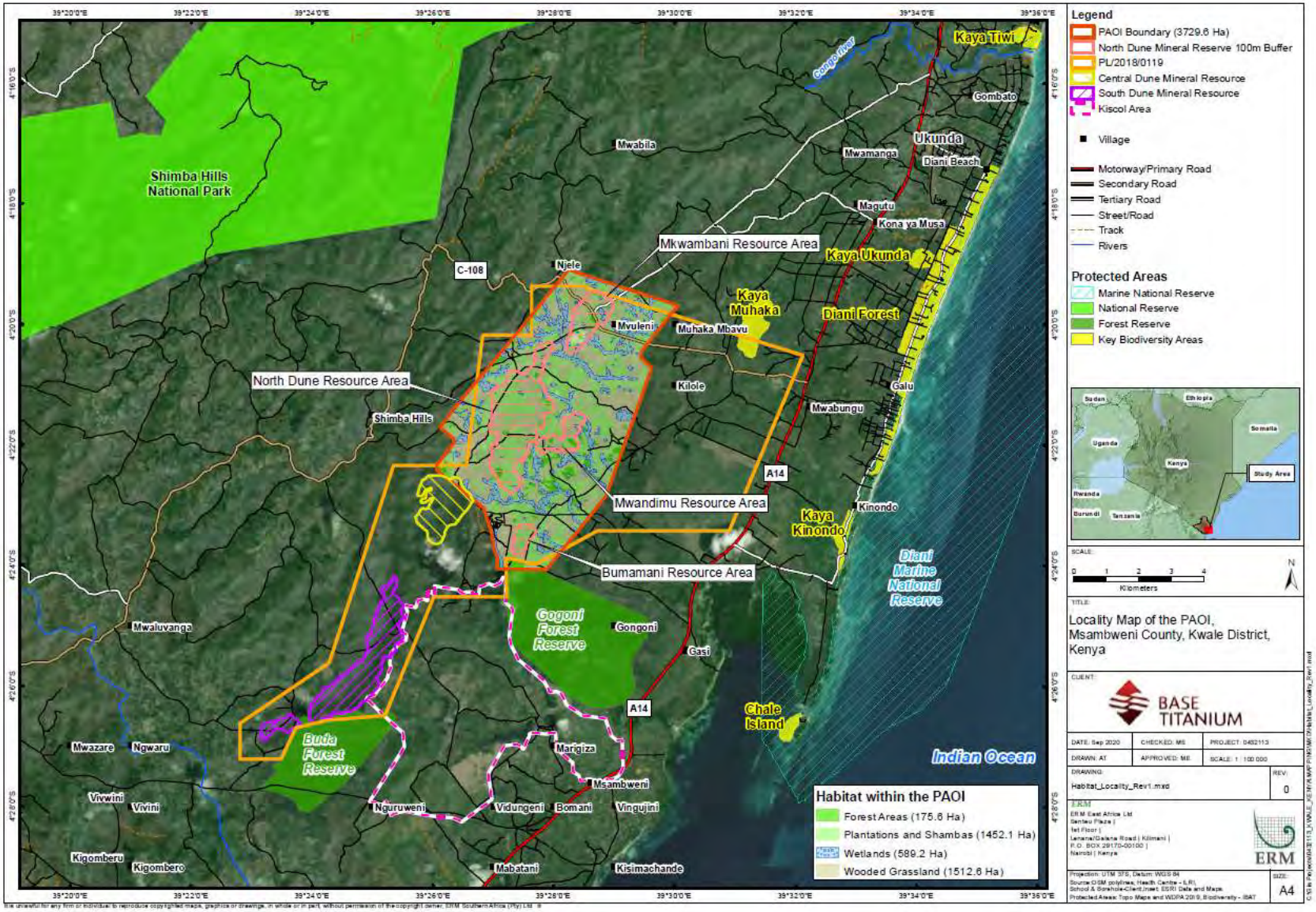

Figure 3-1: Locality of Protected Areas Relative to the PAOI

3.1.2.1 National Park Descriptions

The **Shimba Hills National Reserve** is in an area of coastal rainforest, situated on and around a low dissected plateau parallel to the coast, which is considered to be a major water catchment area, supplying fresh water to the Diani/Ukunda region (BirdLife International, 2020a). It is located to the north-east of the Kwale Operation SML, with its closest point approximately 3,4km away from the Kwale Operation SML. Vegetation consists of wetlands, grasslands and mature and relict forests on scarp slopes and steep-sided valleys. It is an important area for plant biodiversity – over 50% of rare or threatened Kenyan plant species are found in the Shimba Hills, including some endangered species of cycad and orchids. It is also considered a key biodiversity area for birds, herpetofauna, mammals and butterflies (World Bank, 1993, BirdLife International, 2020a). In addition, this reserve hosts several unique or endangered mammals, including Forest Elephants, Leopard, Buffalo, African Bush Baby, Coastal Black and White Colobus, Greater Galago, Black-faced Vervet Monkey, and Sykes Monkey.

This National reserve will not be directly impacted by expanded mining operations in the North Dune. However, there may be increased disturbance levels to fauna due to potentially increased noise levels.

The **Buda Forest Reserve** is situated adjacent to the south-eastern extent of the Kwale Operation SML, and was established in 1932 as part of the Kaya coastal forest fragments (World Bank, 1993). With a high amount of surface water, its environment and vegetation is wetter than that of Gongoni Forest. At least 480 plant taxa, of which several are threatened, have been identified in the forest up to date (Luke, 2011a). It is not anticipated that the North Dune mining expansion will have any impact on the Buda Forest Reserve.

The **Gongoni Forest Reserve** is situated immediately east of the central operations of the Kwale Operation SML, and will be just south of the North Dune mine expansion. It was established in 1932 as part of the coastal Kaya forests (World Bank, 1993), and is known as one of a few places (also recorded from Kaya Muhaka) where the endangered tree *Gigasiphon macrosiphon* occurs (Luke and Verdcourt, 2004). In general, it is a moist semi-deciduous forest, dominated by open grassland dotted by palms between areas of closed forest canopy, with a high species richness of at least 560 plant species, of which many species are threatened (Luke, 2011a; Gongoni Gazi Community Forest Association, 2013). Past and expanded mining in the close vicinity of the Gongoni Forest reserve could lead to a reduced groundwater input to the forest reserve, with resulting impacts on vegetation and fauna dependent on that vegetation.

The **Diani-Chale National Reserve,** situated along the coast approximately 3 km east of the Kwale Operation SML (and approximately 9 km east of the North Dune expansion) consists of a Marine Reserve as well as several coastal forest fragments. The forested areas consist of fragmented remnant coral rag forest, such as the Diani Forest, as well as mangroves. The terrestrial area of the reserve is considered a key biodiversity area for several bird species, plant species as well as mammal species (BirdLife International, 2020b). This reserve will not be impacted by the expanded mining operations.

3.1.3 Internationally Recognised Areas

The PS6 acknowledges the importance of internationally recognised areas (IRAs), and recognises some of these as potential triggers of critical habitat. IRAs are often delineated where no gazetted protected areas occur. Table 3-2 lists all IRAs known within a 15 km radius of the North Dune PAOI.

Table 3-2: Additional Internationally Recognised Areas within 15 km of the Project

Internationally Recognised Areas	Type of Region
Coastal Forests of Eastern Africa and Swahili Centre of Endemism	Biodiversity Hotspot with high numbers of Endemic Fauna and Flora With fragmented forested areas as listed below:
Kaya Muhaka	Sacred Forest and UNESCO Heritage Site Key Biodiversity Area due to presence of CR/EN, VU, endemic species

Internationally Recognised Areas	Type of Region
Kaya Ukunda	Sacred Forest and UNESCO Heritage Site Key Biodiversity Area due to presence of CR/EN, VU, endemic species
Kaya Kinondo	Sacred Forest and UNESCO Heritage Site Key Biodiversity Area due to presence of CR/EN, VU, endemic species
Kaya Tiwi	Sacred Forest and UNESCO Heritage Site Key Biodiversity Area due to presence of CR/EN, VU, endemic species
Chale Island	Key Biodiversity Area due to presence of CR/EN, VU species

Source: Birdlife Data Zone, IUCN Key Biodiversity Areas and IBAT Website

Additional Kayas that were identified are:

- Kaya Kitsakabungo;
- Kaya Mwandimu; and
- Kaya Mwalimchano

3.2 Flora

The total number of plant taxa recorded from the North Dune survey was 610, of which 58 are cultivated and/or naturalised and alien invasive plant species. Of the 552 indigenous species, 25 are listed as either Near-Threatened, Vulnerable or Endangered (more in Section 3.2.6) A full list of plant species observed is presented in Annex A.

3.2.1 Overview of Habitats

Overall, the study area supports a variety of habitat types, but parts of it have historically been settled and fairly modified in the past. The different habitat types are summarized in Table 3-3 below. The Site Ecological Importance (SEI), as evaluated in Section 3.8, is representative of the sensitivity of the habitats, and is a combination of their importance to flora, fauna and ecosystem processes. The approximate delineation of the habitat types is shown in Figure 3-2.

Table 3-3: An overview of Vegetation Habitats

Vegetation Habitat	IFC Classification[2]	Site Ecological Importance	Extent (ha) in PAOI	Extent (ha) in resource area
1. Forest Areas	Natural and Modified, (*some* regarded as Critical)	High	175,7	34,3
2. Wooded Grassland	Modified	Medium	589,3	38,5
3. Wetlands	Natural and modified (*some* regarded as Critical)	High	1452,1	372,9
4. Plantations, Orchards and Shambas	Modified	Low	1512,7	304,2
TOTALS			**3729,8**	**749,9**

[2] According to the IFC Performance Standard Guidance Note 6 (2019) on Biodiversity Conservation and Sustainable Management of Living Natural Resources, habitats are divided into *modified, natural, and critical*. *Critical habitats are a subset of modified or natural habitats.*

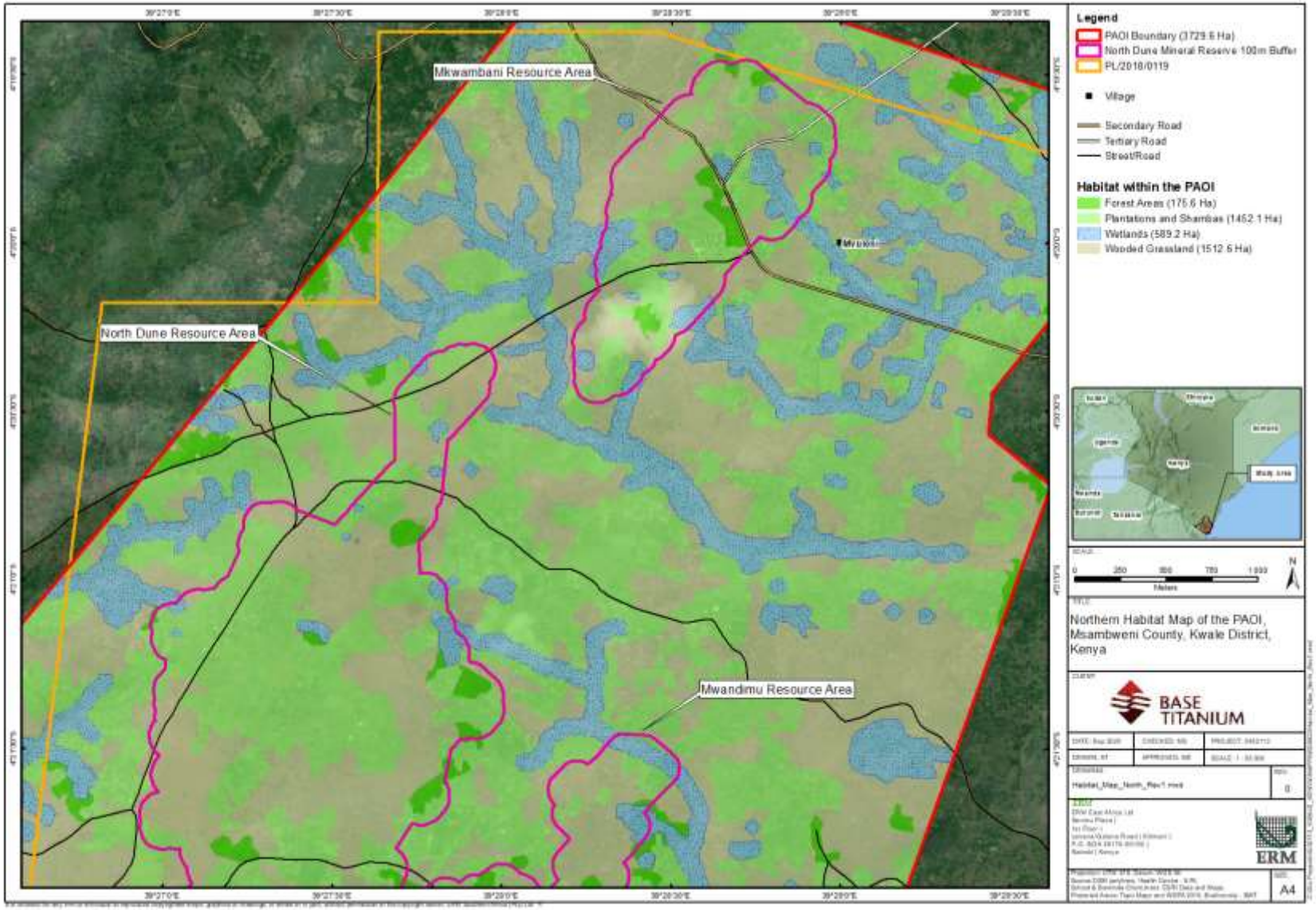

Figure 3-2a: Map of habitats identified during the study (northern section)

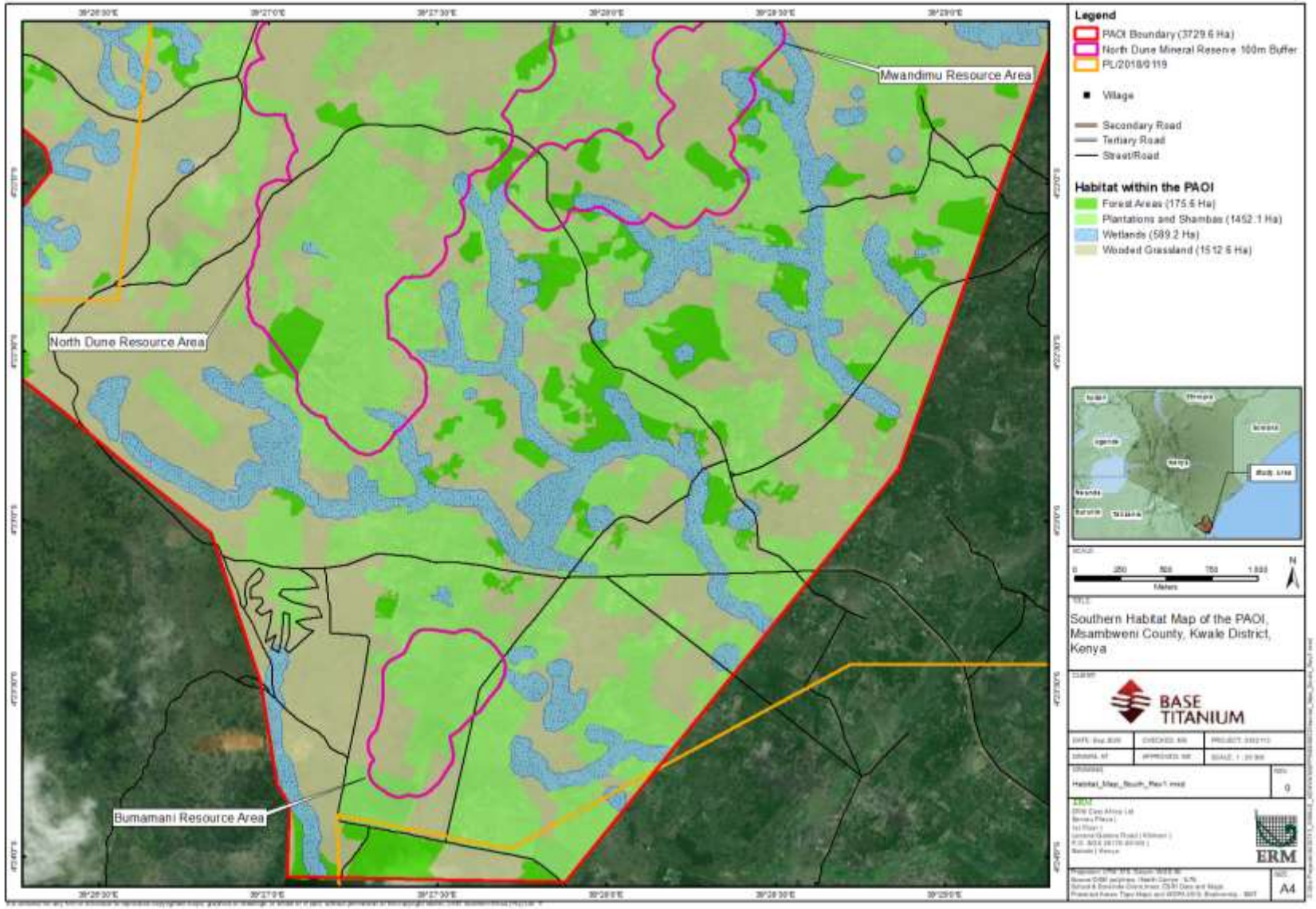

Figure 3-3b: Map of habitats identified during the study (southern section)

3.2.2 Forest Areas

Only small extents of Forest, mostly small patches of less than 5 ha, were present in the PAOI, with most around the southern (Gongoni Forest) and western periphery. Gongoni Forest Reserve was surveyed in detail prior to the present studies (Luke, 2011; Njihia et al, 2012), but although mapped is not discussed further in this document, as it will not be impacted by the North-Dune Mining developments. Smaller forest patches are still maintained as traditional kayas, although even these kayas have been disturbed to some extent. There is also a patch of forest, regenerated over 30 years, that has been under long-term protection from exploitation by an individual (Daniel Mbata).

In general, Forest Areas in the PAOI could be regarded as the part of the diverse of the Zanzibar-Inhambane Undifferentiated Forest. These forests generally rely on a high groundwater table and/or sufficient surface water. The main canopy reaches an average height of 15-20 m, with some emerging trees as high as 30 m.

Approximately 560 plant species (including Bryophytes, but excluding Lichen species) have been identified up to date in the Gongoni Forest (a closed canopy forest), whilst only limited data exists for the small kayas up to date. Unfortunately, these forest patches are also subject to the invasion by alien plant species, apart from other pressures such as resource harvesting and disturbances around the edges (developments and agriculture).

Table 3-4: Common plant species observed in the Forest Areas

Growth Form	Species
Trees	*Sorindeia madagascariensis, Craibia brevicaudata , Drypetes natalensis, Ellipanthus hemandradenioides, Fernandoa magnifica, Cynometra suaheliensis, Nesogordonia holtzii, Lannea welwitschii, Julbernardia magnistipulata, Barringtonia racemosa*
Shrubs	*Synsepalum subverticillatum, Chytranthus obliquinervis, Rinorea elliptica, Asteranthe asterias, Drypetes natalensis, D. parvifolia, Cremaspora triflora, Whitfieldia elongata, Uvariodendron kirkii*
Grasses	*Oplismenus compositus*
Climbers	*Combretum illairii, Landolphia kirkii, Combretum illairii, Salacia madagascariensis, Ancistrocladus robertsoniorum, Uvaria acuminata*
Low shrubs and forbs	*Thunbergia kirkii, Lankesteria alba and Oplismenus composites*
Conservation Concerns	Recorded in the area up to date: ■ 94 species endemic to the east African Coastal Forests ○ Of these 18 species only found in Kenya ■ Approximately 30 species that are threatened (details in Njihia et al., 2012), of which following were observed in the area investigated: ○ *Chytranthus obliquinervis* (VU) – Kaya Mwandimu ○ *Dalbergia melanoxylon* (NT, CITES II) ○ *Diospyros greenwayi* (VU) ○ *Huberantha stuhlmannii* (VU) ○ *Hylebates chlorochloe* (VU) ○ *Julbernardia magnistipulata* (VU) ○ *Landolphia watsoniana* (VU) – Kaya Mwandimu ○ *Lannea welwitschii* var. *ciliolata* (EN) – Kaya Mwandimu ○ *Ochna kirkii* ssp. *multisetosa* (VU) ○ *Synsepalum subverticillatum* (VU)

- *Warneckea hedbergiorum* (EN, narrow endemic)
- Several species endemic to ecozone
- Habitat regarded globally as Critically Endangered
- All Kayas should be properly mapped and studied in more detail

Figure 3-4: Examples of Forest Areas in the PAOI.

Very often, forest patches were found to be variably disturbed due to either past logging or other direct anthropogenic impacts, or due to the edge effect, where vegetation was transitional between forest and wooded grassland vegetation. Mapping should thus be regarded as approximate only. Of particular

interest floristically, as well as for faunal diversity, were not only traditional Kayas, but also forest patches around wells, springs and a particular piece of forest under the 'private guardianship' of Daniel Mbata, north of the Kidongoweni Stream (near its north-western extent). This Forest Area had been protected from logging and other disturbances for over 20 years, and showed exceptional biodiversity, which should be explored further.

3.2.3 Wooded Grassland

The larger part of the area investigated, which had not been converted to agricultural areas (or reverted from previous agricultural areas) can be described as open wooded grasslands, in which palms, most notably *Hyphaene compressa,* are a common element. The structure of the vegetation can range from grassland-dominated areas with few larger trees or stands of palms to denser bush-clumps or thickets of variable height and composition, with patches of grassland in-between. Very often, these wooded grasslands make up narrow patches of remnant vegetation between agricultural fields, which are too small to map individually. Further, some of the areas were found to be subjected to intense grazing levels, whilst fallow lands (not being cultivated for over 5 years), had gradually returned to some form of wooded grassland.

Bush-clumps in this habitat were quite often degraded around the edges by invasion of alien plant species, most notably *Lantana camara*, *Leucaena leucocephala* and *Chromolaena odorata*. Still, threatened and or unique plant species were confirmed as present within these habitats at several locations.

Table 3-5: Common plant species recorded from Wooded Grassland

Growth Form	Species
Trees (Indigenous)	*Crossopteryx febrifuga, Sclerocarya birrea, Albizia adianthifolia, Strychnos madagascariensis, Hyphaene compressa, Piliostigma thonningii, Ozoroa insignis, Annona senegalensis, Securidaca longipedunculata, Brackenridgea zanguebarica*
Shrubs	*Harrisonia abyssinica, Hoslundia opposita, Vernonia hildebrandtii, Asparagus buchananii, Keetia zanzibarica, Premna chrysoclada, Tetracera boiviniana*
Grasses	*Digitaria milanjiana, Hyperthelia dissoluta*
Forbs	*Agathisanthemum bojeri, Waltheria indica, Fimbristylis dichotoma, Hypoxis angustifolia, Chlorophytum cameronii, Thunbergia schimbensis*
Conservation Concerns	■ Threatened species observed in the area investigated: ○ *Afrocanthium pseudoverticillatum* (VU) ○ *Ansellia africana* (VU) ○ *Eragrostis perbella* (VU) ○ *Ficus faulkneriana* (VU) ○ *Habenaria kilimanjari* ○ *Habenaria plectromaniaca* (VU) ○ *Hibiscus greenwayi* (VU) ○ *Indigofera zanzibarica* (VU) ○ *Psydrax faulknerae* (VU) ○ *Syzygium cordatum* ssp. *shimbaensis* (EN) ○ *Warneckea hedbergorum* (EN) ■ Several species endemic to ecozone ■ Large indigenous trees that should be retained as far as possible

Figure 3-5: Examples of Wooded Grassland observed in the PAOI.

3.2.4 Wetlands

Wetlands were found mostly along or close to larger drainage lines, localised depressions and around springs. Wetlands are most conspicuous along drainage lines, forming a series of shallow depressions and wetlands rather than continuous drainage lines due to the often sandy nature of the soils.

Within the larger ecoregions, these wetland habitats are of extreme importance to species such as amphibians, with several species having been found to inhabit only a narrow range of swamps or seasonal wetlands. The larger swamps and pans also have important ecosystem services, of which the supply of water for livestock, flood water attenuation and the gradual seepage of water into the groundwater aquifer (after pollutants are absorbed by plants) are considered the most important.

Wetland vegetation is highly variable and zoned according to the level of permanent inundation. In some riparian areas around wetland or along streams were clusters of indigenous forest patches with palms in addition to reeds, grasses, water lilies, ferns and sedges, whilst others lacked the tree-component. In many areas, the riparian fringe had been reduced by agricultural activities to a narrow bands only. Unique forbs included the Wild Ginger (*Costus afer*), which was also identified as the host plant for some Lepidoptera species. Several of the more ephemeral wetland areas, mostly across the northern half of the PAOI, had been converted at some stage into rice paddies.

Table 3-6: Typical species recorded from Wetlands

Growth Form	Species
Woody high shrubs and trees	*Cocos nucifera, Elaeis guineensis, Syzygium cordatum ssp. shimbaensis, Ficus recurvata, Tamarindus indica, Ficus sycomorus*
Cyperoids	*Cyperus prolifer, Fuirena ochreata, Scleria racemosa*
Grasses	*Oryza longistaminata, Leersia hexandra*
Forbs	*Nymphaea nouchali, Melochia corchorifolia, Melochia melissifolia, Ludwigia erecta, Costus afer*
Conservation Concerns	■ *Syzygium cordatum* ssp. *shimbaensis* (EN) ○ Other threatened species expected to be found after intensive surveys ■ Functionality and diversity may be lost if swamps become desiccated for more than two years or water levels drop significantly ■ Most species dependent on or restricted to these habitats

Figure 3-6: Example of Wetlands in the PAOI.

3.2.5 Plantations, Orchards and Shambas

Throughout the study area, there are orchards or larger plantations of palms, Cashew Nuts, as well as other species – most notably *Casuarina* and occasionally *Eucalyptus*. These plantations had highly varying levels of regenerated woody vegetation present, but were also subject to the invasion of alien plant species.

Considerable extents of the PAOI had been converted to agricultural cropland, which were not evaluated in detail for the botanical section (a list of cultivated crops is provided in Appendix A), but are still mentioned as they provide habitat for faunal species. Due to continued disturbances on and along these croplands and orchards, they provide ample opportunity for the establishment and potential further spread of undesirable alien invasive plants.

These habitats were not investigated in detail from a botanical perspective. However, it was noted that despite the extensive clearing of fields for plantations or croplands, individuals of larger indigenous tree species were often retained, of which some are threatened, for example *Syzygium cordatum* ssp. *shimbaensis* (EN), which was located in a plantation between the Kidongoweni Stream and the 'Daniel Mbata' forest.

For the mapping, vegetation models derived from Lidar imagery was compared to historical imagery from 2015, onwards. Outlines of fields visible from 2015 onwards were mapped as part of this habitat type, with the understanding that some of the older fallow lands may gradually be reverting to modified woody grassland. Many of the planted trees and shrubs have also become invasive, e.g. *Leucaena* and *Sisal*.

Figure 3-7: Examples of croplands (abandoned, above) and orchards observed.

Figure 3-8: Examples of croplands, orchards and plantations observed.

3.2.6 Plant Species of Conservation Concern

According to the Wildlife Conservation and Management Act (Act 14 of 2013) and the Wildlife Conservation and Management (Protection of Endangered and Threatened Ecosystems, Habitats and Species) Regulations, 2016' all species regarded as Critically Endangered, Endangered, Vulnerable or Near Threatened should be considered as protected. Thus, although such species as identified in the PAOI have not been listed in the legislation, it can be anticipated that these lists will be updated according to the latest IUCN ratings and new scientific evidence, and should be regarded as protected. These are listed in Table 3-7, with the relevant point data provided in Appendix A.

Table 3-7: Threatened plant species observed

Family	Species	IUCN	Area	Observation[3]
Anacardiaceae	*Lannea welwitschii* var. *ciliolata*	EN	Mwandimu	Kaya Mwandimu
Annonaceae	*Huberantha stuhlmannii*	VU	Mwaweche	Pt 41
Apocynaceae	*Landolphia watsoniana*	VU	Mwandimu	Kaya Mwandimu
Ebenaceae	*Diospyros greenwayi*	VU	Mwaweche	Pt 41
Fabaceae	*Dalbergia melanoxylon*	NT	no point data	
Fabaceae	*Erythrina sacleuxii*	NT	no point data	
Fabaceae	*Galactia argentifolia*	NT	no point data	
Fabaceae	*Indigofera zanzibarica*	VU	Bumamani	Pt 53b
Fabaceae	*Julbernardia magnistipulata*	VU	no point data	
Fabaceae	*Rhynchosia congensis* ssp. *orientalis*	NT	no point data	
Malvaceae	*Hibiscus greenwayi*	VU	no point data	Near Mwambani
Melastomataceae	*Warneckea hedbergorum*	NE EN in Kenya	Mwaweche	Pt 40b
Moraceae	*Ficus faulkneriana*	VU	Mwandimu	Pt 23, 24, 25, 26, 27, 28, 29
Moraceae	*Milicia excelsa*	NT	no point data	
Myrtaceae	*Syzygium cordatum* ssp. *shimbaensis*	EN	Mwandimu	Near Pt 30
Ochnaceae	*Ochna kirkii* ssp. *multisetosa*	NE VU in Kenya	Mwaweche	Pt 41
Orchidaceae	*Ansellia africana*	VU	Mwandimu	Pt 29
Orchidaceae	*Habenaria plectromaniaca*	VU	Mwandimu	Pt 27 to 28
Picrodendraceae	*Oldfieldia somalensis*	NT	no point data	
Poaceae	*Eragrostis perbella*	VU	Bumamani	Pt 53b to 54
Poaceae	*Hylebates chlorochloe*	VU	Mwaweche	Pt 41
Rubiaceae	*Afrocanthium pseudoverticillatum*	VU	Mwandimu	Pt 27 to 28
Rubiaceae	*Heinsia zanzibarica*	NT	no point data	

[3] Localities for these observations are listed at the end of Appendix A.

Family	Species	IUCN	Area	Observation[3]
Rubiaceae	*Psydrax faulknerae*	VU	Mwandimu	Pt 27 to 28
Salicaceae	*Bivinia jalbertii*	NT	no point data	
Sapindaceae	*Chytranthus obliquinervis*	VU	Mwandimu	Kaya Mwandimu
Sapotaceae	*Synsepalum subverticillatum*	VU	no point data	

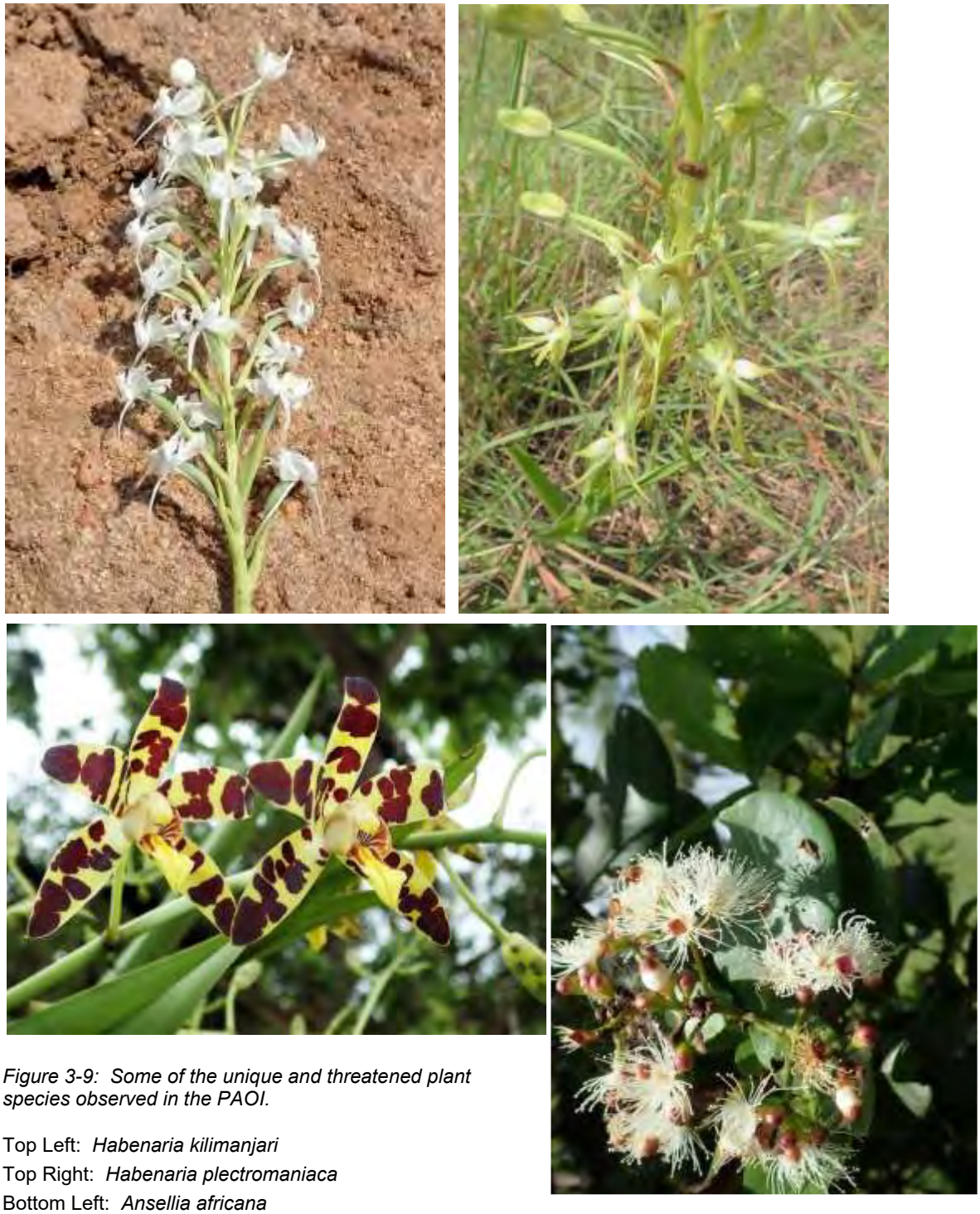

Figure 3-9: Some of the unique and threatened plant species observed in the PAOI.

Top Left: *Habenaria kilimanjari*
Top Right: *Habenaria plectromaniaca*
Bottom Left: *Ansellia africana*

Bottom Right: *Syzygium cordatum* ssp. *shimbaensis*

3.3 Herpetofauna

17 species of amphibians (only frogs, no toads), mainly observed at sites with water, and 16 species of reptiles were observed. The reptile species included 12 lizard species, 3 snake species and 1 tortoise species. In the specific villages, there were 17, 14, 21, 11 and 14 species in Mkwambani, Mwaweche, Mwaloya, Mwandimu and Bumamani respectively (Appendix B). The species accumulation curve did not reach a peak, meaning that more species could be recorded with additional sampling (Figure 3-10). From the community interviews there were existence of Brown Spitting Cobra (*Naja ashei*), Eastern Forest Cobra (*Naja subfulva*), African Python (*Python sebae*) and Puff Adder (*Bitis arietans*) in most of the Northern Dune areas.

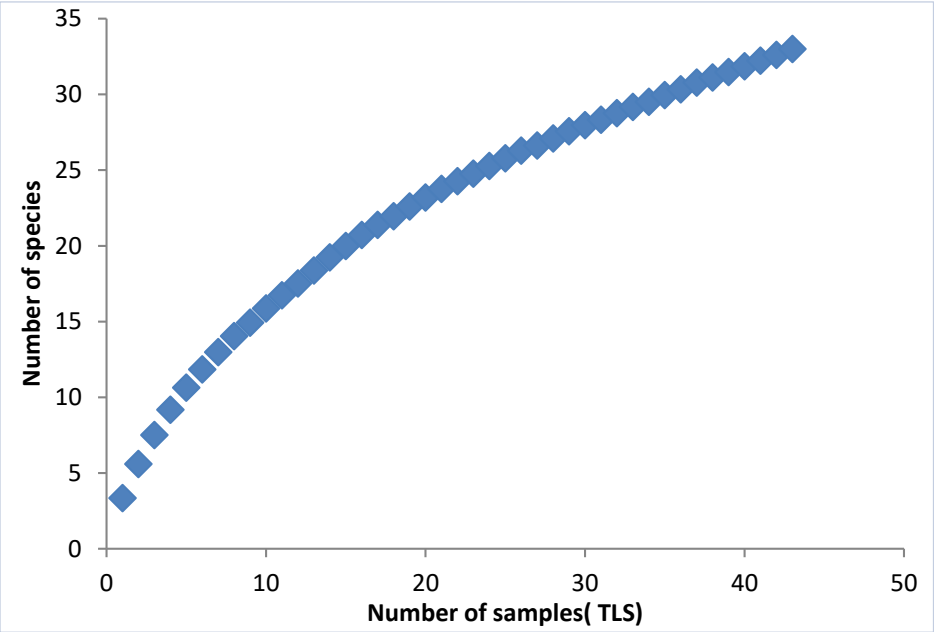

Figure 3-10: Herpetofauna Species accumulation curve.

3.3.1 Overview and Sampling Sites

Table 3-8 shows an overview of the sampling sites.

Table 3-8. Overview of herpetofauna sampling sites

Area Description	Photos, sampling site localities and -descriptions
Mkwambani This site is the northern-most village and is characterized by farmlands dominated by coconut, mango and cashews nut tree. In the few abandoned farms are scattered woody plants	  1: Mtsambuluni stream (photos above)) near Faraja Children Home-Wema; 37M 0553302, UTM 9521197, 82 m. Some clusters of indigenous forest patches with palms in addition to reeds, grass, water lilies, ferns and sedges 2. The Choda stream near Maasai Corner Centre; 37M 0552966, UTM 9520468, 80 m; dominated by ordinary reeds, grass, water lilies, ferns and sedges
Mwaweche This borders Mkwambani to the south. It is characterized by farmlands dominated by coconuts, mango and cashew nut plants. There are few woodlots of *Eucalyptus* and *Casuarina* trees.	  1. The Mtawa stream (photos above); 37M 0551986, UTM 9520593, 66 m; Mtawa stream has ferns, sedges, grass and reeds. It is fringed by indigenous plants including palms and nearby is a small indigenous forest patch (Mini-Kaya forest) with a community water spring that develops into a stream that joins Mtawa stream (37M 0551729, UTM 9520072, 85 m) 2. There is also a degraded kaya forest patch near Mwaweche shops (37M 0550015, UTM 9518731, 138 m) and a Mwangunyenze stream on the west (37M0549884, UTM 9519080, 10 m).

Area Description	Photos, sampling site localities and -descriptions
Mwaloya This borders Mwaweche to the north, the central Dune on the south west, Bumamani to the south and Mwandimu to the east. It is characterized by farmlands dominated by coconuts, mango and cashew nut plants	 1. There are scattered woody indigenous trees in the area in some sites forming forest patches (37M 0550080, UTM 9516250, 85 m). There are few woodlots of casuarina trees. 2. The stream (Kidongoweni, Photo above) bordering Bumamani has as ferns, sedges, grass, reeds and palms plus few indigenous trees (37M 054777, UTM 9516196, 77 m). There is also another stream swamp dominated by grass reeds and sedges along the High Voltage electricity powerline (37M 0550280, UTM 9516213, 70 m)
Mwandimu This is on the east of Mwaloya and like the others its dominated by coconut farms with Mango trees and cashew nut plants.	  1. There is a small degraded indigenous forests patch (mini Kaya forest) near the Vocational Training Centre (37M 0552536, UTM 9517937, 80 m). 2. The stream wetland (Photos above) has reeds, sedges, grass and in some points water lilies at points with large pools (37M 0552806, UTM 9517600, 54 m). Stream valley wetland with rice paddies, waterlily, reeds, long grass and sedges (37M 0552248, UTM 9518333, 66 m)

Area Description	Photos, sampling site localities and -descriptions
Bumamani This is the southern-most village running astride the mine site access road and bordering Gongoni forest on the south. It characterized by farmlands dominated by coconuts, cash nut and mango plants.	  1. There are scattered indigenous trees especially in abandoned farms (37M 0551338, UTM 9514898, 46 m) 2. Most of the lower area is swampy from stream emanating from the upper area. 3. Stream on the upper area (Photos above) has ferns, reeds, sedges, long grass and some water lilies (37M 0551390, UTM 9515281, 60 m).

3.3.2 Herpetofauna Species Composition

In the Northern Dune sites and control sites within the mine site during the day the most abundant species were mainly lizards. The two most commonly encountered species basking mainly on coconut and cashew nut plants were the Yellow-headed Dwarf Gecko, *Lygodactylus picturatus* and White-headed Dwarf Gecko, *Lygodactylus mombasicus* (Appendix B, Figure 3-11). These species are quite adaptable to a wide range of habitat change including any kinds of trees including coconut and cashew trees. They also make use of buildings and other infrastructures within human habitation.

At night in the wetlands Shimba Hills Reed Frog, *Hyperolius rubrovermiculatus* was encountered in all the wetlands surveyed. The other species which were relatively abundant include Shimba Hills Spiny Reed Frog, *Afrixalus sylvaticus*, Mary's Reed Frog, *Hyperolius mariae* and Argus Reed Frog, *Hyperolius argus* (Appendix B, Figure 3-12).

Figure 3-11: Some of the reptile species observed in the PAOI.

Top Left: *Yellow-headed Dwarf Gecko (male);* Top Right: *White-headed Dwarf Gecko (female)*
Centre Left: *Gregory Blue-headed Tree Agama (male);* Centre Right: *Eastern Hinge-back Tortoise*
Bottom Left*: Cape House Snake (juvenile);* Bottom Right: *Spotted Green Snake (juvenile)*

Figure 3-12: Some of the widespread frog species observed in the PAOI.

Left: *Argus Reed Frog (male-calling);* Right: *Tinker Reed Frog (male-calling)*

3.3.3 Herpetofauna Species of Conservation Concern

The IUCN threatened species; Shimba Hills Reed Frog, *Hyperolius rubrovermiculatus* (Endangered) (Figure 3-13) was recorded in all stream wetlands but in varying abundance depending on the wetland habitat quality and condition. Shimba Hills Forest Spiny Reed Frog, *Afrixalus sylvaticus* (Vulnerable) (Figure 3-14) was found in all the other wetland sites except Mkwambani. Changamwe Caecilian, *Boulengerula changamwensis* (Endangered) (Figure 3-14) is a soil burrowing or subterranean species that was expected but it was not found during the survey. This is because the soil moisture was very low. The species prefers high moisture soil (rain season period) and occur in micro-habitats with high organic manure like decomposing logs. All these three endangered species are present in the nearby Central and Southern Dune sites (Malonza et al. 2018).

Figure 3-13: Shimba Hills Reed Frog (one female colour morph left) and right a male calling.

Figure 3-14: Other Herpetofauna Species of Conservation Concern in the area.

Left: Shimba Hills Spiny Reed Frog (male-calling) as observed.
Right: *Changamwe Caecilian (file photo, Malonza 2018)*

3.4 Mammals

Approximately 132 species of mammal have been recorded or are likely to occur in the region (Appendix C) (Kingdon 1997, Burgess et al. 2000a, IUCN 2011). As with other groups, coastal Kenya is poorly surveyed and most work has taken place in Shimba Hills and Arabuko-Sokoke Forest (Burgess et al. 2000a, Azeria et al. 2006, Oguge et al. 2004). Most large mammal fauna are either no longer present within the study area or confined to Shimba Hills, however the area still supports a reasonable diversity of smaller mammals. Forty-three species have been recorded in the study area and the total species present may be as high as seventy species. Major groups in the area are briefly discussed below.

3.4.1 Main Mammal Groups

Elephant-shrews

Two species of elephant-shrews (an unusual group unrelated to rodents and typical shrews) were recorded. On site they will be confined to Gongoni and Buda Forests and their immediate surrounds.

Carnivores

Seven small-medium sized carnivores were confirmed on site, and others have been anecdotally reported by locals. Carnivores are cryptic and it is likely that further species are present. Even so, this represents quite a good diversity of species. Two species are associated with aquatic habitats (Marsh Mongoose and Cape Clawless Otter). Camera-trapping determined that two species Rusty-spotted Genet and African Civet are widespread across the study area. Camera traps also recorded one (African Palm Civet) that is restricted to forest and another, Sokoke Dog Mongoose, is probably reliant on forest habitats but likely moves more widely on site. Two large carnivores, Leopard and Spotted Hyaena may still be present in the study area in small numbers – Leopard may still occur in Buda and Gongoni Forests and forage elsewhere in the PAOI.

Herbivores

Six herbivores have been recorded. The presence of a small herd of African Buffalo is well known and they have been recorded widely, primarily in and around Gongoni Forest, in side valleys along the Mukurumudzi River and around the periphery of central dune. Otherwise, antelope seem to be fairly uncommon in the study area – during this recent fieldwork none were seen, except spoor in Gongoni Forest and a Bushbuck camera-trapped at Buda Forest. A single Bohor Reedbuck was recorded in a

grassland area east of the main development footprint (Quentin Luke pers. comm.). It seems therefore, that overall abundance of antelope is low in the study area, possibly as a result of hunting.

Primates

Four species of monkeys are present on site, with Syke's and Angolan Colobus Monkeys confined to forested habitats, while Yellow Baboon and Vervet Monkey occur widely across the study area. Two nocturnal primates are present, with the South Coast Galago occurring widely and the Small-eared Bushbaby more tied to areas of thicker vegetation.

Bats

Bats are expected to be fairly diverse in the region, given known distributions (IUCN 2011). Surprisingly only five species have been confirmed, all fairly widespread species in Eastern Africa. It is likely that this is a large underestimate of the true diversity, and further survey effort would probably boost the numbers in this group.

Shrews

Shrews as a group are extremely poorly known, especially so in eastern Africa (Burgess et al. 2000, Oguge et al. 2003) – in addition, the identification keys available are inadequate and species definitions and distribution not fully resolved. The identities given here are necessarily tentative. Four species were recorded. Two species, Crocidura hirta and C. fuscomurina are widespread in Africa, but C. fuscomurina was recently recorded in Kenya for the first time (Oguge et al. (2003): C. hirta has possibly not been recorded in Kenya, but several records exist in adjacent Tanzania (fieldmuseum.org 2011) and two specimens matching this species were recorded in old cashew plantations. A shrew collected in Gongoni best matches the description of Crocidura nana, known from few localities in Somalia and Tanzania. The fairly low species total per site and for the overall area matches the findings of several surveys in montane forest in south-east Kenya (Oguge et al. 2004) but, as in that study, species seemed to be segregated, with the exception of C. fuscomurina, which was collected at two locations, with each of the others being found uniquely at a single site.

Rodents

Rodents in southern Kenya are also poorly known (Canova & Fasola 2000). Eight species of small rodent (rats and mice), one porcupine and two squirrels were recorded. Grassland and savanna areas and recorded a slightly higher diversity of small rodents, than did forest (which is expected given the greater seed resources available in open habitats) and old plantation areas (five spp, three spp and two spp respectively, Most species were widespread species typical of a variety of open habitats, with the exception of one species, a Woodland Mouse Grammomys sp., which was collected in Gongoni Forest and is restricted to densely wooded habitats (Kingdon, 1984, 1997). The specimen is most similar to G. Ibeanus, which is mostly known from montane forests, how the taxonomy and distribution of this species need further investigation.

Two species of squirrel were recorded, Red Bush and Ochre Bush Squirrels, while it likely that a third species, the Zanj Sun Squirrel is also present. The two species were both recorded in Gongoni Forest. Squirrels will mostly be confined to forest patches and remnants where they remain, however, the Ochre Bush Squirrel may occur in dense woody vegetation more widely on site.

3.4.2 Mammal Species of Conservation Concern

A number of notable species have been recorded or are likely to occur on site (Table 3-9). Of particularly note are the presence of Black and Rufous Elephant Shrew and a Bdeogale mongoose, which is probably Sokoke Dog Mongoose, in the Gongoni and Buda Forests. A number of notable bats are known from the region, however, several are specialised cave roosters and are not expected to roost on site, one important exception being the East African Little Collared Fruitbat, which is also expected to be strongly reliant on forest areas.

Table 3-9: Threatened mammal species observed or possible in PAOI

Species	Common name	IUCN Status	Presence
Bdeogale omnivora	Sokoke Dog Mongoose	VU	Likely to be largely confined to more densely vegetated areas of the study area (i.e. forest areas, primarily Buda and Gongoni), but expected to forage or move elsewhere around these areas and between such areas
Colobus angolensis	Black and White Colobus	VU	Restricted to forest habitats and dense riparian woodlands
Myonycteris relicta	East African Little Collared Fruit Bat	VU	May forage widely on site where there are fruiting trees. Probably roosts in forest in Gongoni Forest.
Panthera pardus	Leopard	VU	Possibly roaming forests and surrounding areas
Rynchocyon petersi	Black and Rufous (Zanj) Elephant Shrew	VU	Recorded in both Gongoni and Buda Forests. May utilize denser vegetation in the immediate vicinity.
Taphozous hildegardae	Hildegarde's Tomb Bat	VU	Given its reliance on caves, it may not roost on site, but may forage widely there, particularly near forest and river systems.
Aonyx capensis	African Clawless Otter	NT	Streams and wetland areas
Dendrohyrax validus	Tree Hyrax	NT	Will be restricted to forest habitats.

3.5 Birds

Studies on Birds (Harvey, 2012; Base Kwale, 2018), have confirmed approximately 207 species in the wider Kwale area.

Overall. forested areas were of particular importance for many species and of those recorded, 42 species were considered to be partially or totally reliant on these areas. Within the Kwale Base wider area, many of forest-dependent birds were found to be confined mainly to Gongoni and Buda Forests, but some species are still present in remnants. Other important bird habitats are wetland, with 32 species reliant on wetland habitats. The remaining disturbed areas supported a mixture of widespread habitat generalists and birds typical of east African wooded savannas.

A high number of hole-nesting species (including barbets, hornbills, wood-hoopoes, Brown-headed Parrot) were common in the area, in part due to the fact that much of the woody vegetation has remained largely unharvested for firewood, relative to much of the surrounding coastline and thus nesting and foraging opportunities for such species are good in the study area. Old cashew and oil-palm plantations and particularly cultivated areas are generally poorer in species and support only species that are generalist and very widespread

3.5.1 Bird Species of Conservation Concern

A number of notable species were recorded or may occur on site (Table 3-10). In terms of Threatened species, four species that are considered Near Threatened have been confirmed as present in the wider area, and a further three Endangered and two other Near Threatened may potentially occur. Nine other notable species, which have fairly to highly localised distributions and are mostly habitat specialists, have been recorded within the study area (Mulwa, 2019). Most are partially to completely reliant on

forested areas and remnants on site, particularly Buda and Gongoni Forests, but also along the Mukurumudzi River and its tributaries.

Table 3-10: Potentially Occurring Threatened and Endemic Bird Species

Name	IUCN Status	Summary	Distribution within the Kwale Base Area
Amani Sunbird *Anthreptes pallidigaster*	Endangered	Highly localised, endemic, confine to very few fragmented forest patches in southern Kenya and northern Tanzania. Highly threatened by habitat loss	If present, would be confined to Gongoni and Buda Forests.
Sokoke Pipit *Anthus sokokensis*	Endangered	Highly localised, endemic, confined to fragmented forest patches in southern Kenya and northern Tanzania. Highly threatened by habitat loss. Recorded from Shimba Hills.	If present, would be confined to Gongoni and Buda Forests.
Malagasay Pond Heron *Ardeola idae*	Endangered	A wetland species that breeds in Madagascar and migrates to East Africa. Under severe pressure in Madagascar due to habitat loss and disturbance of nesting colonies; threats less urgent in mainland Africa	Small numbers may occasionally utilize some of the wetland areas in the study area e.g. wetland on the southern edge of Gongoni Forest, as a non-breeding winter migrant.
Spotted Ground-Thrush *Zoothera guttatus*	Endangered	Has a very small, highly fragmented and patchy distribution down the east coast of Africa. Highly threatened by degradation and loss of its habitat, coastal forest.	Likely to occur in Gongoni and possibly Buda Forests only.
Southern Banded Snake-Eagle *Circaetus fasciolatus*	Near Threatened	An uncommon species that occurs primarily within 20 km of the eastern Africa coast, from Somalia to northern South Africa. A forest specialist, threatened by habitat destruction	Recorded in Gongoni and Buda Forests and along the Mukurumudzi River. Likely to be largely restricted to the vicinity of areas that support forest remnants or stands of big trees, but will hunt in the vicinity of these areas.
Sooty Falcon *Falco concolor*	Near Threatened	A species that breeds in north Africa and the Middle East and migrates to East Africa and (primarily) Madagascar, where it occurs in wooded habitats, often near water. Considered to have a small, declining population, but threats are more urgent within its breeding range than in East Africa.	Recorded at Gongoni Forest and may occur in small numbers elsewhere on the site, as a non-breeding migrant.
European Roller *Coracias garrulus*	Near Threatened	Has a large global range and is a summer migrant from Europe to much of Africa where it utilises a variety of savanna-type habitats. It is undergoing a continuous population decline, but factors responsible are primarily active in Europe.	May occur in wooded grassland areas
Martial Eagle *Polemaetus bellicosus*	Near Threatened	This species has a fairly wide distribution across sub-Saharan Africa, and is found in a variety of natural habitats. It occurs at low densities and appears to be declining across much of it range.	Has been recorded at Gongoni Forest and on Southern Dune. Requires large tress for nesting but may forage widely over the area.

Name	IUCN Status	Summary	Distribution within the Kwale Base Area
East Coast Akalat *Sheppardia gunningii*	Near Threatened	A localised species with a fragmented range, occurring in three small disjunct areas of northern Mozambique, Malawi and southern Kenya-Northern Tanzania. Confined to coastal forest and threatened by habitat destruction.	May occur in Gongoni Forest and Buda Forest only.
Fischer's Turaco *Tauraco fischeri*	Near Threatened	A localised coastal endemic, from northern Tanzania to southern Somalia. Largely restricted to coastal forest and woodland but able to use degraded habitats where some natural habitat is also available.	Recorded in Gongoni and Buda Forests, along the Mukurumudzi River, within and on and adjacent to Central Dune. Appears to occur fairly widely on site where denser, semi-natural or natural vegetation is present.
Mombasa Woodpecker *Campethera mombassica*	-	A localised endemic and forest specialist, confined to coastal Eastern Africa	Recorded in Gongoni and Buda Forests. Likely to be mostly confined to the Forests on site.
Uluguru Violet-backed Sunbird *Anthreptes neglectus*	-	A localised endemic and forest specialist, confined to coastal Eastern Africa	Recorded in Buda and Gongoni Forests, and likely to be confined to these areas on site.
East Coast Boubou *Laniarius sublacteus*	-	A fairly localised endemic, recently recognised as a distinct species from Tropical Boubou *Laniarius major* (Nguembock et al. 2008), confined to coastal Eastern Africa where it occurs in densely vegetated habitats	Recorded in Gongoni Forest, and along the Mukurumudzi River. Likely to occur fairly widely in the denser vegetated areas.
Green Barbet *Stactolaema olivacea*	-	Patchily distributed, forest specialist in eastern Africa.	Recorded along the larger Rivers, in Gongoni Forest. Will be confined to areas with at least remnants of natural forest.
Green Tinkerbird *Pogoniulus simplex*	-	Patchy, uncommon forest specialist in eastern Africa	Recorded in Gongoni and Buda Forests – likely to be confined to these on site.
Tiny Greenbul *Phyllestrephus debilis*	-	patchily distributed and localised species, confined to lowland forest in Eastern Africa.	Recorded from Gongoni and Buda Forests; likely to be restricted to these areas on site
Little Yellow Flycatcher *Erythrocercus holochlorus*	-	A localised endemic and forest specialist, confined to coastal Eastern Africa	Recorded in Gongoni and Buda Forests and could possibly occur in remnant patches of forest on the Mukurumudzi River tributaries.
Fischer's Greenbul *Phyllastrephus fischeri*	-	An East African coastal endemic, confined to forest.	Recorded in Gongoni and Buda Forests; possibly in remnant patches of forest on the Mukurumudzi River tributaries.

Name	IUCN Status	Summary	Distribution within the Kwale Base Area
Short-tailed (Forest) Batis *Batis mixta*		A very localised endemic to south-eastern Kenya and north-eastern Tanzania, where it is confined to forest; populations from southern Tanzania previously lumped with this are now recognised as a different species, Dark Batis, *Batis crypta* (Fjeldsa et al. 2006).	Recorded from Gongoni and Buda Forests to which it is probably confined within the study area.

3.6 Macro-Invertebrates

A majority of the habitats visited (Figure 3-15) were lentic (slow moving or stagnant). A few sites were lotic (flowing waters). Almost all habitats were marshy, covered with aquatic vegetation and were in close proximity to sources of springs. The substrate mainly comprised of was decomposed detritus mixed with silt. The predominant biotopes (micro habitats) were sand/mud and aquatic vegetation both marginal and submerged. There was near absence of stones/rocks biotope and a complete absence of gravel in the areas that were sampled.

Figure 3-15: Different sampled habitats in different villages within the Northern Dune Area

A total of 112 different aquatic species were collected from with the Northern Dune area. A checklist and their distribution within the area are given in appendix 2. The collection was dominated by true bugs (Hemiptera), aquatic beetles (Coleoptera) and dragonflies (Odonata). The same groups have dominated in previous surveys. There was a noticeable near absence of mayflies (Ephemeroptera) and a low diversity and abundance of caddisflies (Trichoptera). These dominant groups together with the lack of mayflies and low numbers of caddisflies confirm the lack of flowing waters.

An unexpected diversity and abundance of some species of dragonflies was observed (Figure 3-16, Figure 3-17). A total of 26 species was recorded during the rapid assessment (Appendix C). This was in total contrast to other parts of the country that experience a low dragonfly season during the cold period between June and August. This finding therefore indicates that different regions in Kenya have different high and low dragonfly seasons. Dragonflies are a key group for the indication of habitat diversity and –health, and have been used to represent other aquatic groups in the same manner that butterflies represent terrestrial invertebrates.

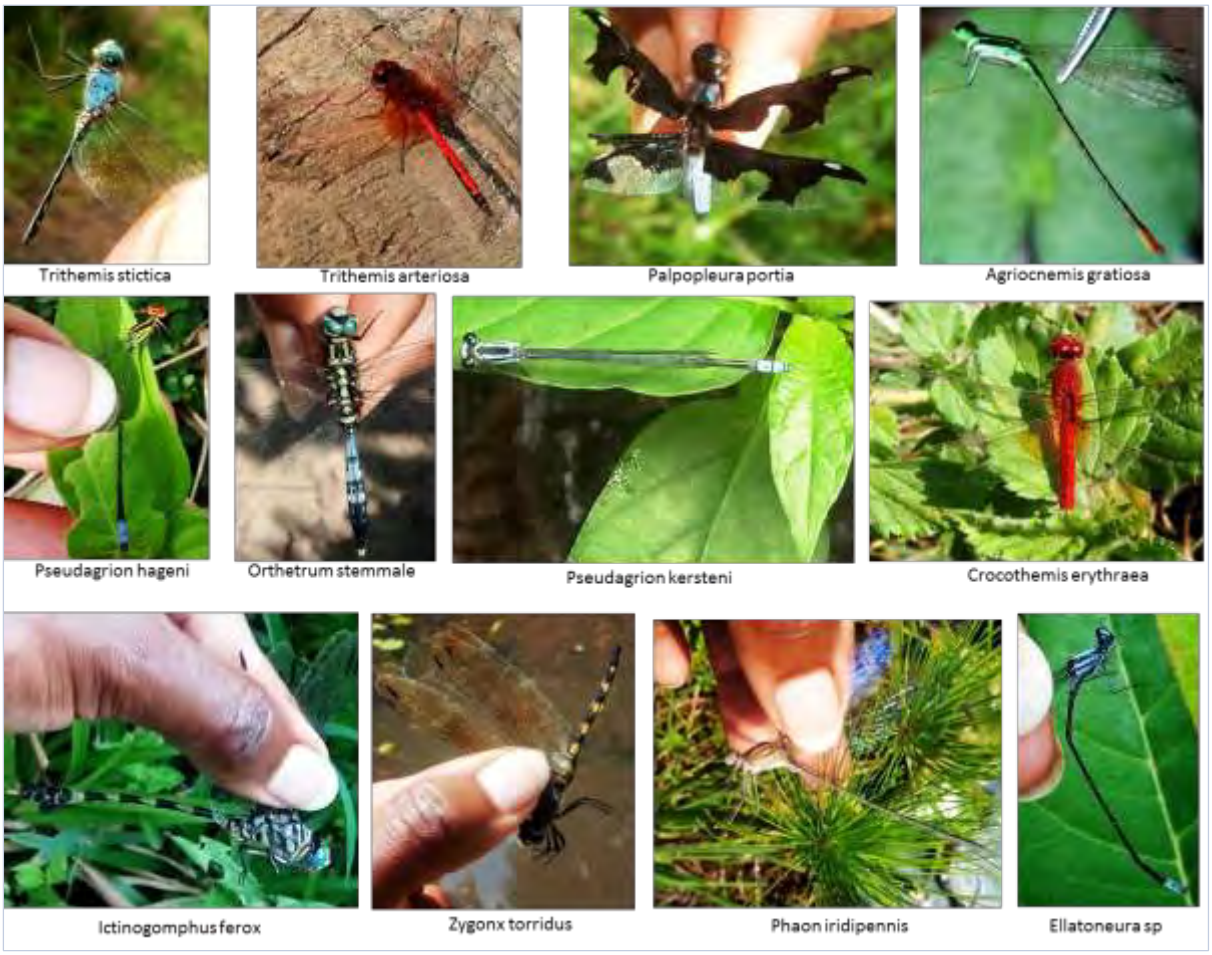

Figure 3-16: Some dragonfly species collected from the survey area

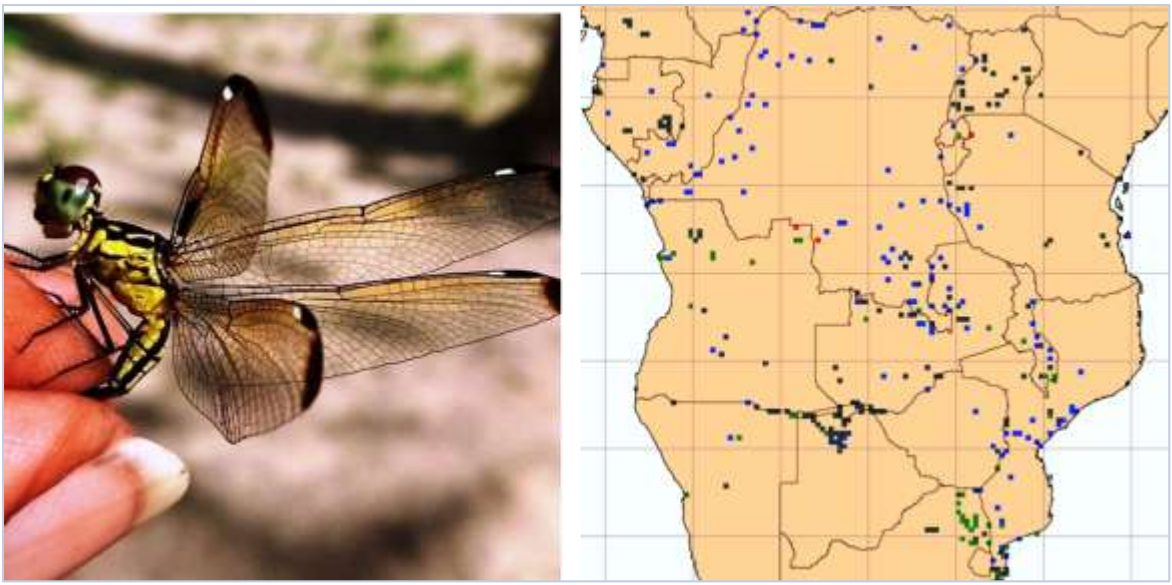

Figure 3-17: A female African Piedspot (Hemistigma albipunctum) from Bumamani. Widespread in Africa but rare in Kenya (Map from African Dragonflies and Damselflies Online -ADDO)

Figure 3-18: Some beetle species collected from the survey area.

Figure 3-19: Some bug species collected from the survey area.

3.6.1 Macro-Invertebrates of Conservation Concern

Species were considered of conservation concern if they fell under any of the following categories.

- Are listed under any threat categories by the IUCN.
- Are rare nationally
- Are dependent on and are restricted to a particular habitat type within the Northern Dune or
- Are thought to be new to science

Almost all species encountered are very common and were widespread within the sampling area and are elsewhere in Africa. They therefore did not register any conservation concerns. However, one caddisfly (Trichoptera) together with its habitat were identified as critical. Apart from dragonflies, most other species collected have not been assessed for red-listing. Therefore, the conservation concern for the species was based not on the IUCN red list categories but on their rarity in the sampling area, in other areas or if new to science. The caddisflies thought to be new belongs to the a family known as Philopotamidae and in the genus called Chimarra (Figure 3-20).

This caddisfly is at least undescribed as larva. Caddisflies, just like mayflies and other groups can either be described as larvae or as adults depending on what was available. This may therefore have been described already as an adult but we do not know for now. There is need to collect adults to ascertain this. It was collected in a forested stream called Kidongoweni that is within Mwaloya village in near pristine conditions.

Figure 3-20: An undescribed Philopotamid caddisfly from Kidongoweni stream, Mwaloya Village, Kwale

3.6.2 Macro-Invertebrate Critical Habitats

Habitats were considered critical if they support any of the critical species. Five (5) habitats were identified as critical within the 5 sampled villages. There was one each in Mwaweche, Mwaloya, Mwandimu and two in Bumamani village. The five were a mixed of both flowing and stagnant waters supporting a higher diversity and abundances of macro-invertebrate species. They also all had remnants of natural riverine forests and thickets that supported forest specialists (Figure 3-21) such as the dancing jewel damselfly (*Platycypha caligata)* and the glistening demoiselle (*Phaon iridipennis*). These were also the same habitats where SASS monitoring was conducted to assess the quality of the water. The geo-localities of the five critical habitats are given in Table 3-11 below.

Figure 3-21: Platycypha caligata *(left) and* Phaon iridipennis *(right) both from a forest stream in Bumamani.*

Table 3-11: Localities of Macro-invertebrate Critical Habitats

Village	Sampling point	GPS points	
Mwaweche	Point 1	37M0549826	UTM 9919090
Mwaloya	Point 1	37M0549738	UTM 9516216
Mwandimu	Point 2	37M0552794	UTM 9517616
Bumamani	Point 1	37M0551359	UTM 9515284
Bumamani	Point 3	37M0551591	UTM 9514466

3.6.3 SASS Monitoring

The SASS scores ranged between 42 and 82 while Average Scores per Taxa (ASPT) ranged between 4.1 to 5.1. The sites that had some level of water flow had slightly higher scores. Almost all sites were characterized by low abundances and diversity and a presence of several tolerant species such as bugs and beetles. Important micro-habitats for SASS application such as riffles due to the presence of rocks, stones or logs were unavailable. The score of 5.1 in Bumamani pt 3 was reasonable and was largely due to the presence of more sensitive species.

In general, the scores are low as indicated below. This can either be due habitat interference over time or the sites are not suited for SASS assessment.

Sites	Mwaweche	Mwandimu	Mwaloya/Kidongoweni	Bumamani Pt1	Bumamani Pt 3
	4	1	1	4	3
	6	3	4	6	4
	4	4	6	9	9
	5	9	4	4	10
	6	4	5	6	4
	10	6	5	4	6
	2	4	4	5	4
	5	7	10	5	7
		5	6	2	5
		6	5	1	4
		6	2	3	6
		5			5
		2			5
		5			2
					5
					3
SASS Score	42	67	52	49	82
ASPT	4.66	4.06	4.33	4.08	5.12

3.6.4 Specialist Recommendations on Macro-Invertebrates

Following our findings and observations we make the following recommendations to cover both the Northern Dune areas and the areas already being rehabilitated.

- All the critical habitats for macro-invertebrates that were identified should be preserved during the mining as they will be sources of species to re populate the rehabilitated areas after mining.
- Since all these streams were originally forested at least going by the evidence given by the few remnants, we recommend re-creation of the original riverine vegetation during rehabilitation. This will be important especially for the shade loving species which may have disappeared with the opening up of the streams. Kidongoweni stream in Mwaloya village is a good reference site.
- Alternative biotic indices should be developed to monitor changes in the aquatic habitats alongside the SASS. A new method for assessing changes can be designed for use at Base Titanium limited base on observed changes in abundances and diversity. We also recommend the use of another simple index which uses dragonflies alone known as Dragonfly Biotic Index (DBI).
- Re-creation of mayflies and caddisfly habitats is highly recommended. It was noted that caddis and mayflies inhabited man-made habitats such as the concrete at the bridges in large numbers. Originally when the area was forested decades ago, they may have inhabited areas with sizable logs in the streams since the whole Northern Dune are has no rocks. This can be re-created for them in the areas being rehabilitated and monitoring for colonization be carried out. Since logs will easily be carried away when rivers are swollen, we recommend the introduction of boulders and rocks in carefully selected sites.
- Adult stages of the new caddisfly species found in Kidongoweni River should be collected to facilitate its description.
- Since this was more of a rapid survey, a detail survey should be carried out for a comprehensive checklist of the area. It will be important to get the species that may have been missed during this survey. A detailed baseline will be helpful during the monitoring stage as it will confirm if species are appearing for the first time following mitigation or have been there before. Insects are known to be highly season in their activities. For instance, several dragonfly species collected before were missed and new ones recorded. Therefore, such future surveys should be done in different seasons or times of the year.

3.7 Lepidoptera

Results from the Butterfly survey are summarised per site below, compared to past surveys in the area:

Lepidoptera Species Records (per days)

Mwaloya	Mwaweche	Bumamani	Mwandimu	Mkumbani	Gongoni Forest (2 weeks Dec 2019)	Kaya Muhaka (6 months work)
59		89	89	93	120	127
83	73	76	80	77		
73						

A total of 158 Lepidoptera species were observed during the present survey, which are presented in Appendix D. Of these, two species were new records for Kenya, whilst one species observed had last been recorded in Kenya 50 years ago. Whilst populations of these species could be found outside the

mining resource area, some of the more suitable habitats should be retained as far as possible, as discussed further below. For several of the species, only the larvae could be observed.

Mwaloya

Three days of surveys yielded 59, 83 and 73 species respectively. No species of significance were identified.

Mwaweche

One-day survey in this area yielded 73 species, after which the area was no longer accessible to the team. In general, the species diversity was considered typical for the area.

Notable Records: Mwaweche Spring (04˚ 34175´S; 39˚ 46651´E), has a plant, *Costus afer*, a type of wild ginger, which grows in the wetland below the spring. This is a host plant for *Oberonia beuronica*, which is a new record for Kenya.

These plants were in flower and all over tropical Africa the Genus *Oboronia* breed in the flower heads. *Oboronia bueronica* was previously known only from Mozambique/Malawi/Tanzania up to the Usambara Mountains. This is a new species record for Kenya. Having understood the biology other records of *Costus afer* in the region were investigated (it is also recorded from Buda FR). One such site in Mwaloya is a Pond within Madongaweni Stream that had been dammed for cattle (04˚ 376931´ S; 39˚ 448283´ E).

The same species could be confirmed at this pond, which is outside the mining resource area, and there is thus additional habitat to which this species could migrate.

Figure 3-22: Butterfly observations at Mwaweche Spring.

From Left to Right: *Costus afer* foodplant of *Oboronia beuronica*; **Costus afer** at spring source Mwaweche; new species record of *Oboronia beuronica* for Kenya caught in spider web; *Amauris ochlea* observed

Bumamani

Surveys over this area produced an expected range of butterflies, but again a new species of butterfly to Kenya, *Ampittia parva*, known thus far only from Tanzania southwards, Usambara Mountains to the Shire River Basin in South Malawi, was observed. A small population of this butterfly was found in the swampy area (prone to flooding) in grassland at the edge of the area proposed for mining. After studying the habitat and habits of this butterfly, the Bumamani village team took us to another, similar, water

source area. This was in the River (Stream) Madongaweni, to the North of the Asphalt Road going to Mine HQ. Here were strong populations of this new butterfly, and further populations were found in the Mwandimu Site along the streambank where cattle had not damaged the main water source.

Figure 3-23: New butterfly record collections deposited in the National Museum of Kenya Nairobi.

Mwandimu

This area could be surveys over two days, yielding 89 and 80 species respectively. The principal zone of interest was a small Kaya of less than 2 ha, Kaya Kitsakabungo. This Kaya had been damaged for charcoal collection in the Northern Corner and did not appear to be much used, but it was a centre of high plant- and insect diversity that was not observed see anywhere else in the study. Specific permission had to be obtained to enter the Kaya (we were not shown the point of entry and the village Chairman did not know where the entrance was so it would suggest more of ceremonial significance).

A population of the new *Ampittia parva* butterfly was also found along the stream to the East of the proposed mining site. This was a third strong population. This site was richer, attributable probably to the closer proximity to Kaya Muhaka and the Shimba Hills butterfly. Although numbers were higher at a species level, the only species of interest to be found were two Crepuscular skippers. We only found their larvae, as the adults move at dawn and dusk and one of these had not been seen/recorded for over 50 years (and then only once) this species. *Artitropa reducta* occurs from Usambara Mtns N.E. Tanzania to Eastern Zimbabwe. Having understood the biology and foodplant we then found caterpillars at the ponds on the Kidongoweni Stream in Mwaloya in already owned Base land.

The second butterfly of significance was found at Mukwambani: an *Acraea machequena*, which migrates from RSA through Tanzania to southern Kenya. It is very rarely seen but has been found in the Shimba Hills area.

Figure 3-24: Butterfly observations at Mwandimu

Left: Water hole Mwandimu, Right: Larva *P. demodocus* mimics bird droppings

3.7.1 Specialist Recommendations Regarding Lepidoptera

- *Oboronia bueronica*, the new species record, will have habitat outside of Mwaweche Spring. Still, it is recommended that the Mwaweche Spring Site be preserved as well as it has been used by the community for a long period and was a very pure water source.
- Kaya Kitsakabungo was a found to have exceptionally high plant- and insect diversity. It is at the edge of the mine resource zone and it would be desirable to retain it.
- The Kidongoweni Stream source is very important for Lepidoptera. Further important areas to target for conservation would be the Kaya at Mwandimu and the water spring at Mwaweche in the buffer zone.
- In the Mwaloya area, there is a ± 8 ha area belonging to a retired teacher, which was a coconut plantation that has been allowed to regrow secondary growth now resembling a regenerated forest. The old owner refuses anybody on his land (he is in his eighties). This site had the richest biodiversity in the area and is within half a kilometre of the pond on the Kidongoweni Stream. The significance of this private conservation effort should be recognised and retained, and more detailed surveys conducted in this area. There are tracks on three sides of the property and it would be highly recommended to preserve this site if acquired.

3.8 Site Ecological Importance Ratings

The Sensitivity of biodiversity habitats is determined according to Site Ecological Importance (SEI). The evaluation of SEI of each collective habitat, and main reasoning for the different ratings is given below, and shown in Figure 3-25 and Figure 3-26 at the end of this section. A short summary is also given on the implications for mining, which will form the basis of required mitigation and biodiversity management measures.

3.8.1 SEI: Forest Areas (including Kayas)

Evaluation of Site Ecological Importance: Forest Areas in the PAOI (excluding Gongoni, which is known Critical Habitat)

Notes on abiotic environment: generally sandy soils, landscapes undulating, wetlands in flat areas and valley depressions common

Notes on existing disturbances and severity thereof:

- outside proposed mining footprint area edges show anthropogenic disturbances,
  - core of larger areas potentially relatively intact and functional (natural but not pristine),
- inside proposed mining footprint area anthropogenic disturbance such as selective clearing/harvesting activities and intrusion of alien invasive species evident

Conservation Importance rating is **High**:

- Any area of natural habitat of a CR ecosystem type
- Confirmed or highly likely occurrence of CR, EN, VU species that have a global Extent of Occurrence of > 10 km^2

Functional Integrity rating is **Medium**:

- >5 ha for CR ecosystem types still relatively intact
- Existing habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches

Biodiversity Importance: High

Receptor Resilience rating is **Medium**:

- Will recover slowly (~more than 10 years) to restore > 70 % of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring

Site Ecological Importance: High

Implications for mining mitigation:

1. **Avoid as far as possible: Do an accurate delineation of all remaining Kayas and other areas identified as important for biodiversity, such as Mwaweche Springs, Daniel Mbata forest that have not been officially delineated up to date**
2. Maintain a buffer of preferably 100 m around edges of forest patches
3. Only forest patches that are inside the mineral resource areas should be considered for clearing, and preferably those on the edge of resource areas to be left intact
4. Harvest areas to be cleared of all orchids and smaller indigenous plants that can be maintained in nurseries, harvest seeds for cultivation for rehabilitation
5. Relocate individuals of threatened tree species as far as this can be done with success (e.g. *Ficus faulknerae*)
6. Monitor forest patches in close proximity to future mining areas for signs of degradation, and participate in/initiate community forest management and conservation programs

3.8.2 SEI: Wooded Grassland

Site Ecological Importance: Wooded Grassland

Notes on abiotic environment: flat to undulating environment, dominated by sandy soils on elevated ground and sandy loamy soils on low lying areas, the latter with frequent seasonal and perennial wetlands in-between

Notes on existing disturbances and severity thereof:

- High presence of alien invasive plant species
- Slash- and Burn and clearing for crops and other land uses
- High levels of grazing
- Localised Excessive wood-harvesting and loss of trees

Site Ecological Importance: Wooded Grassland

Conservation Importance rating is **High** for less disturbed Wooded Grassland patches (CR Ecosystem type) to Medium for very disturbed areas, Confirmed occurrence of EN and VU species that have a global Extent of Occurrence of > 10 km^2

Functional Integrity rating is **Medium** (Good to medium habitat connectivity with potentially functional ecological corridors)

Biodiversity Importance: Medium

Receptor Resilience rating is **Medium**

Will recover slowly (~more than 10 years) to restore > 70 % of the original species composition and functionality of the receptor functionality

Site Ecological Importance: Medium

Implications for mining mitigation:

1. **Avoid less disturbed Wooded Grassland Thickets as far as possible, especially where threatened species (VU, EN) have been confirmed, or where such woodland patches are in close proximity of wetland areas**
2. **Avoid clearing indigenous trees with a bole >50 cm diameter and/or a height over 8 m where such trees fall outside the mineral resource areas**
3. Harvest areas to be cleared of all orchids and indigenous geophytic plants that can be maintained in nurseries, harvest seeds for cultivation for rehabilitation
4. Relocate individuals of threatened tree species as far as this can be done with success
5. Monitor more intact woodland patches in close proximity to all mined areas, and participate in/initiate community management and conservation programs, which would include reduction of alien invasive species
6. Do not use topsoil of areas heavily infested with *Leucaena* or *Lantana* for rehabilitation

3.8.3 SEI: Wetlands

Site Ecological Importance: Wetlands

Notes on abiotic environment: Depressed area in the general area, that allow accumulation of water. Soils are predominantly sandy-loam and/or clay.

Notes on existing disturbances and severity thereof: In the general the habitat is not suitable for most human activities especially where water cover is permanent. However, during the dry season when water level has receded, cultivation is carried out to utilize the relatively wetter soils. Grazing of cattle and goats is also common at the edge of marshlands/wetlands.

Conservation Importance rating is **High:**

Confirmed occurrence of EN and VU species; Presence of Range-restricted species and/or > 50 % of receptor contains sufficient natural habitat with potential to support SCC

Functional Integrity rating is **High:**

Good habitat connectivity with potentially functional ecological corridors

Biodiversity Importance: High

Receptor Resilience rating is **Medium:**

Will recover slowly (~more than 10 years) to restore > 70 % of the original species composition and functionality

Site Ecological Importance: High

Implications for mining mitigation:

1. **Avoid as far as possible**
2. **Maintain the flow of larger rivers and wetland systems at all times**

Site Ecological Importance: Wetlands

3. Maintain a buffer of preferably 100 m around edges of any perennial wetlands that do not fall within the mining resource area, and ensure no runoff from mining infrastructure/area gets into any rivers/wetlands
4. Aim to keep the vegetation within the 100 m buffer as intact as possible, or rehabilitate wooded areas, even if just by clearing alien invasive species
5. Harvest areas to be cleared of all orchids and smaller indigenous plants that can be maintained in nurseries, harvest seeds for cultivation for rehabilitation

3.8.4 SEI: Plantations, Orchards and Shambas

Site Ecological Importance: Plantations, Orchards and Shambas

Notes on abiotic environment: undulating environment, sandy soils

Notes on existing disturbances and severity thereof: localised heavy grazing and trampling paths, localised heavy invasion of alien invasive plants, presence of orchard remnants with bare soils underneath, partially a transition to wooded grasslands where cultivated areas are abandoned, includes settlement areas

Conservation Importance rating is **Medium:**

- Confirmed occurrence of populations of NT species, threatened species (CR, EN, VU) and which have > 10 locations or > 10 000 mature individuals

Functional Integrity rating is **Low**:

- Almost no habitat connectivity but migrations still possible across some transformed or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential

Biodiversity Importance: Low

Receptor Resilience rating is **High**

- Habitat that can recover relatively quickly (~ 5-10 years) to restore functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed

Site Ecological Importance: Very Low

Implications for mining mitigation:

1. Determine desirable landuse after mining
2. Aim to minimise or altogether avoid the establishment of alien invasive species on soil stockpiles and rehabilitated areas
3. As part of rehabilitation efforts, ensure that small clumps of woodland/forest high shrub and tree species are planted into the grasslands to aid natural succession and stability of rehabilitated areas

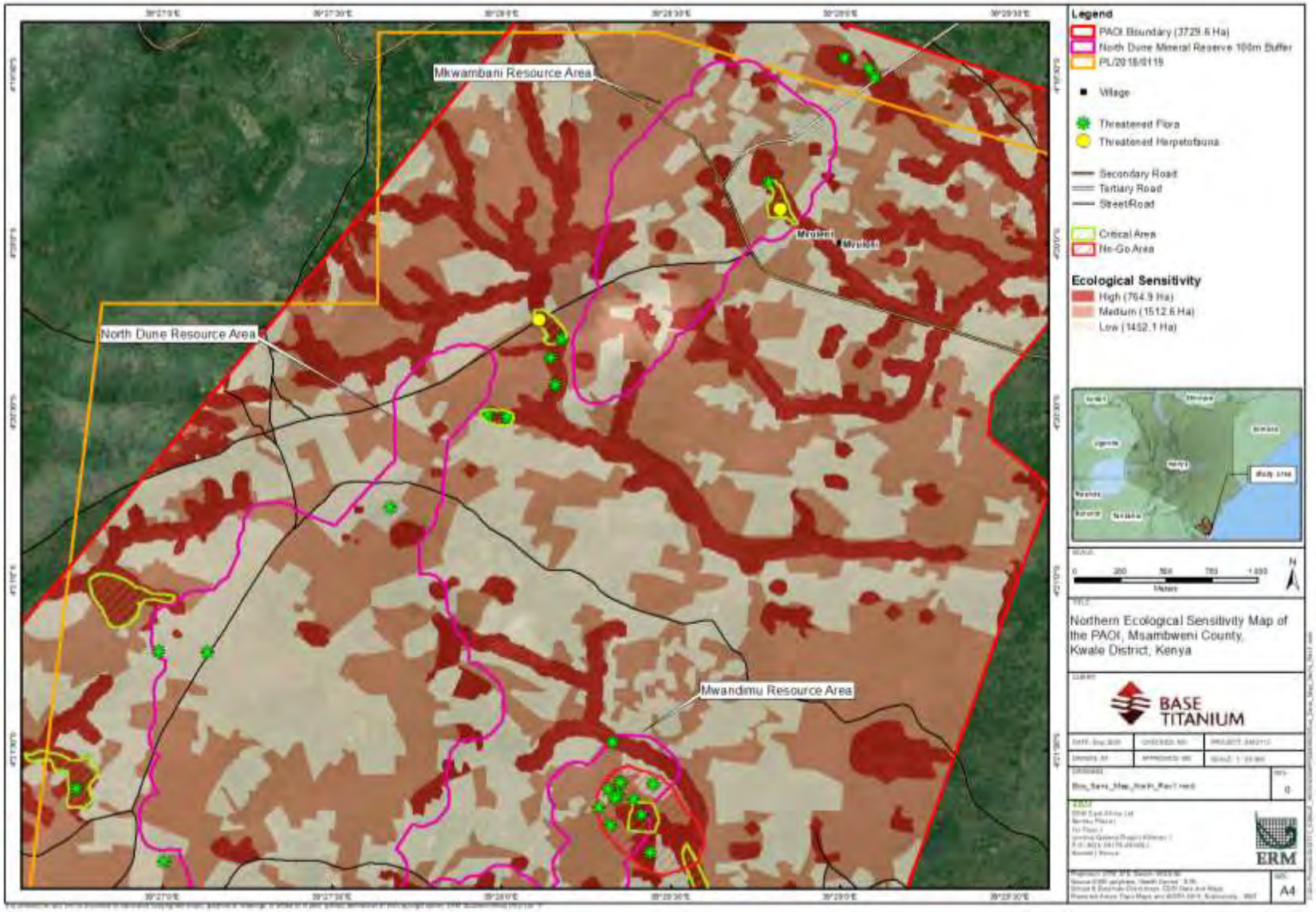

Figure 3-25: Site Ecological Importance relative to mineral resource areas in the northern PAOI.

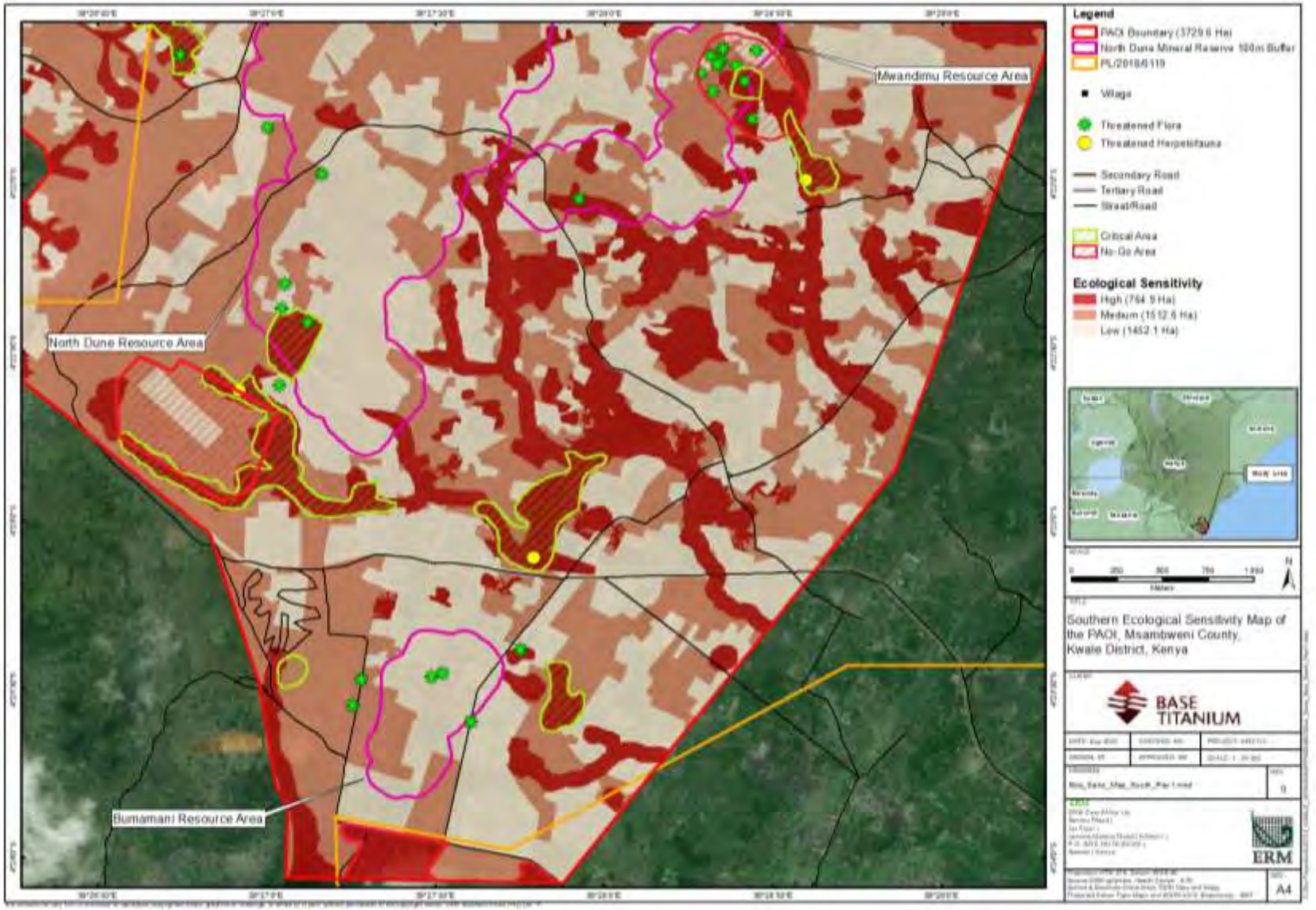

Figure 3-26: Site Ecological Importance relative mineral resource areas in the southern PAOI.

4. ECOSYSTEM SERVICES

4.1 Definition of Ecosystem Services

An Ecosystem Service (ESS) is a service that is generated by the natural environment, which enhances human well-being directly or indirectly. Importantly, ecosystem services are not the same as ecosystem functions. Functions are the biological, chemical, and physical processes associated with natural environments. Services are the outputs of the above ecological processes that society uses for various purposes.

An example of ESSs are the original large natural areas in the upper catchments of rivers that were capable of providing a regular supply of clean water. In many cases, that has changed. For example, many of the natural assets in Kenya's catchments have been transformed through settlement, forestry or agriculture. The transformation or change in condition of these areas changes the supply of ecosystem services. Now, many rivers have reduced flows and/or poor water quality. Further to this, ESSs can only be supplied if the ecosystems from which they are derived are functional. For example, it cannot be expected for crops to continue growing if the soils are depleted in nutrients due to the absence of leaf-litter that originally came from trees.

In this document no in-depth evaluation of ESS is given, but rather an attempt to list and understand dependencies of ESS pre-mining, to help guide the desirable outcomes of mitigation measures and post-mining landscape rehabilitation goals.

4.2 Ecosystem Services Identified and their Dependencies

Below is a brief summary of the most important biodiversity-related ESSs identified, the main habitats (but not exclusive) providing such ESS, and what needs to be done to retain the ESS and functionality of these habitats.

Ecosystem Service	*Main* Provisioning Habitat	Main Dependencies and Considerations
Air quality and climate stability	Forest, Wooded Grasslands, Wetlands	Need to be intact to the extent of being functional (exhibiting natural dynamics and species composition), large trees retained and their persistence and health depends on sufficient input of surface- and subsurface freshwater
Wood for Fibre - housebuilding and craft – and Wood Fuel	Wooded Grasslands and plantations	Large trees need to be retained, but also enough woodlands/thickets, bush-clumps of palms and woody species that grow more rapidly and can provide materials, regeneration may depends on sufficient input of surface- and subsurface freshwater and low pressure of alien invasive species (other than those cultivated in plantations)
Medicinals	Forest, Wooded Grasslands, Wetlands	Need to have a functional vegetation structure, indigenous large trees and high shrubs retained. Their persistence depends on the habitat being functional, sufficient input of surface- and subsurface freshwater, as well as managed use for materials and access.
Food & food products	Forest, Wooded Grasslands, Wetlands, Shambas and Orchards	Need to be intact, and their persistence depends on sufficient input of surface- and subsurface freshwater, as well as managed use for materials such as water, fibre and wood (no-over-exploitation) Cropland and Orchards will only stay productive with the regular input of nutrients – either from organic or artificial

Ecosystem Service	*Main* Provisioning Habitat	Main Dependencies and Considerations
		resources as soils each rapidly after removal of natural vegetation
Fodder and water for livestock	Wooded Grasslands, Shambas, Wetlands	Need to be intact, dense grass vegetation layer retained and their persistence depend limitation of alien invasive species, as well as managed use for materials such as water, fibre and wood (no-over-exploitation)
Pollination and Plant seed dispersal	All vegetated habitats, most importantly systems creating natural corridors or corridor stepping-stones such as Wetlands, Forest Fragments including Kayas	Need to have a functional indigenous vegetation layer retained, and persistence of desirable species further depends on a low to absent alien invasive plant presence, sufficient input of surface- and subsurface freshwater, as well as managed use for materials and access
Refuge, nursery or migratory corridor for plants and animals	Forest, Wooded Grasslands, Wetlands	Need to be intact, indigenous vegetation layer retained and their persistence depends on sufficient input of surface- and subsurface freshwater, as well as managed use for materials and access
Flood attenuation	Forest, Wooded Grasslands, Wetlands	Need to have a functional indigenous vegetation layer retained, and needs to be managed use for materials such as grazing, fibre and wood (no-over-exploitation)
Ground water recharge and runoff control (Water supply and it's regulation)	All vegetated habitats with an indigenous vegetation cover > 20%	Need to have indigenous, structurally diverse and especially dense herbaceous vegetation layer (or even leaf-litter layer) retained, runoff from infrastructure controlled and no concentration of stream flows
Water quality management	All vegetated habitats with an indigenous vegetation cover > 20%	Need have functional indigenous, dense vegetation layer with high structural diversity, or at least dense perennial grass/forb layer around wetlands that absorb pollutants and trap sediments
Soil erosion prevention / stability	All vegetated habitats with an indigenous vegetation cover > 20%	Need to have indigenous, structurally diverse and especially dense herbaceous vegetation layer (or even leaf-litter layer) retained, runoff from infrastructure controlled, especially during high precipitation- or storm events

5. CRITICAL HABITAT ASSESSMENT

The present study has shown a large degree of habitat modification and degradation, but due to the presence of species classified as VU and EN, Kayas and remnants of a Critically Endangered ecoregions (WWF), the Site Ecological Importance ratings are complemented by a Critical Habitat Assessment (CHA), based on available data (IBAT and GBIF) and survey records. In addition, areas that area currently used for rehabilitation trials were also just considered Critical Areas as disturbance or obliteration to those areas will prove a massive setback and loss of time for rehabilitation work going forward.

5.1 Area of Assessment

The scale at which a critical habitat determination occurs depends on the ecological processes occurring within the habitat under analysis, as well as potential movement or presence of highly threatened species, and is therefore not limited to the direct footprint of the Project. The Area of Assessment (AoA) may be based on the distribution of a species group, e.g. plants, or as an overall area, in which the likely ranges of movement of the most mobile of the highly threatened species present

or expected to be present, in the case of this study, some herpetofauna such as the Shimba Hills Reed Frog, and plants observed. An AoA has a boundary, either ecological or political or other, within which biological communities have more in common with each other than they do with communities outside the boundary.

For the present CHA, the AoA has already been determined when the original PAOI (based on the description of the proposed mineral resource areas and existing prospecting licence area) was decided on for the field surveys. This could be confirmed during the field surveys, indicating that potential impacts of the proposed mining operations will not go beyond the PAOI (PAOI as described in Section 3.1).

Existing and potential future threats to the biodiversity of the PAOI identified included potential loss of individuals or small populations of threatened species and/or their habitats (which are also part of a CR ecosystem), moderate to severe pollution of rivers and/or wetlands, modification of natural rangelands to subsistence agriculture and grazing, and potential further establishment of alien invasive plant species.

5.2 Critical Habitat Assessment Outcome

Of all habitats evaluated, few remnants of Forest as well as Selected Wetlands could be classified as Critical Habitats. Most of these areas fall outside the mineral resource and assumed future mining footprint area. Overall, 12 patches were defined as Critical Habitat Patches as listed in Table 5-1 below (shown in Figure 3-25 and Figure 3-26. This excludes the No-Go areas that were not further assessed, but which include Gongoni Forest Reserve, the Rehabilitation Trial Area, as well as an area with a high diversity of threatened species, and a high number of some threatened plants in and around the sacred Kaya Mwandimu.

Table 5-1: List of Critical Habitats Identified in the PAOI

Type	Name	Locality Relative to Resource	Area (ha)
Critical Area	Forest and Spring	Western fringe of main resource	6,7
Critical Area	Daniel Mbata Forest	Southern fringe of main resource	8
Critical Area	Forest Patch	West of, outside main resource	4,7
Critical Area	Frog Swamp	Southern fringe of Mkwambani	1,9
Critical Area	Frog Swamp	Eastern fringe of Mkwambani	1,8
Critical Area	Kaya Kitsakabungo	East of, outside Mwandimu	4,8
Critical Area	Kaya Mwandimu	Eastern fringe of Mwandimu	2,4
Critical Area	Kidongoweni Wetland System East	East of, outside main resource	26,3
Critical Area	Kidongoweni Wetland System West	South of, outside main resource	17,9
Critical Area	Mwalimchano Kaya	West of, outside Bumamani	2,2
Critical Area	Mwaweche Spring	Between, outside Main & Mkwambani	0,5
Critical Area	Swamp Bumamani East	East of, outside Bumamani	5,7
No-Go	Sensitive Area in and around Kaya Mwandimu	Eastern fringe & east of Mwandimu	23,2
No-Go	Rehabilitation Trials	South of, outside main resource	44,1
No-Go	Gongoni Forest	South of, outside Bumamani	11,6

The CHA and relevant justification for the assessments are indicated in Table 5-2.

Table 5-2: Critical Habitat Assessment Table

Potential Triggering Species/ Site	Criterion 1 CR/ EN Species (IUCN)	Criterion 2 Endemic and Range Restricted Species	Criterion 3 Migratory- and/ or Congregatory Species	Criterion 4 Highly Threatened /Unique Ecosystems	Criterion 5 Key Evolutionary Processes	Location within Project Area /Habitat Recorded/ or Potentially occurring	Rationale for decision on CH triggers ✓or ✖
SPECIES							
FLORA							
Lannea welwitschii var. ciliolata Tree	✓ EN (IUCN)	✖ Found only in Kenya and E-Tanzania and possibly Mozambique	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Confirmed in Kaya Mwandimu; Forest species, but it can occur in degraded forests	Found only in Kenya and E-Tanzania, presence in PAOI forest remnants such as Kayas
Syzygium cordatum ssp. shimbaensis Tree	✓ EN (IUCN)	✖ Found only in Kenya and E-Tanzania and possibly Mozambique	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Confirmed in Kaya Mwandimu Prefers riverine forest	Found only in Kenya and E-Tanzania, presence in PAOI forest remnants, Limited habitat remaining
Ficus faulkneriana Tree	✖ VU (IUCN) CH Thresholds a), b) and c) do not apply.	✖ Less than 10% of the global population estimated	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Confirmed; Found in coastal woodland and wooded grassland. Strangler fig epiphytic on Hyphaene	One area west of Kaya Mwadimu has numerous specimens of this species, and this number of trees, as well as the proximity to the Kaya and nearby wetland area was considered to be reason why this selected area should be regarded critical habitat (and should undergo rehabilitation)
Psydrax faulknerae Tree	✖ VU (IUCN)	✖ Less than 10% of the global	✖ N/A	✓ CR Northern Zanzibar-	✖	Confirmed, west of Kaya Mwadimu	One area west of Kaya Mwadimu has numerous specimens of this species, and this number of trees,

Potential Triggering Species/ Site	Criterion 1 CR/ EN Species (IUCN)	Criterion 2 Endemic and Range Restricted Species	Criterion 3 Migratory- and/ or Congregatory Species	Criterion 4 Highly Threatened /Unique Ecosystems	Criterion 5 Key Evolutionary Processes	Location within Project Area /Habitat Recorded/ or Potentially occurring	Rationale for decision on CH triggers ✓or ✖
	CH Thresholds a), b) and c) do not apply.	population estimated		Inhambane Coastal Forest Mosaic ecoregion		Dry coastal forest or thicket	as well as the proximity to the Kaya and nearby wetland area was considered to be reason why this selected area should be regarded critical habitat (and should undergo rehabilitation)
Landolphia watsoniana Tree	✖ VU (IUCN) CH Thresholds a), b) and c) do not apply.	✖ Less than 10% of the global population estimated	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Confirmed in Kaya Mwadimu, This species is restricted to coastal gallery forest.	Dry coastal forest. Possibly present in PAOI, but potentially absent from proposed mining footprint, could be indirectly impacted. Narrow Distribution.
Huberantha stuhlmannii Shrub	✖ VU (IUCN) CH Thresholds a), b) and c) do not apply.	✖ Found only in SE Kenya and NE-Tanzania Less than 10% of the global population estimated	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Observed in forest patch on western periphery of PAOI	Grows in moist and dry coastal forests. It is also found in thickets and in coastal *Hyphaene* woodlands. Continued decline in suitable area, as well as restricted range of occurrence used for CHA
Diospyros greenwayi Shrub or Tree	✖ VU (IUCN) CH Thresholds a), b) and c) do not apply.	✖ Less than 10% of the global population estimated	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Observed in forest patch on western periphery of PAOI	Confined to remaining patches of forest. Continued decline in suitable area, as well as restricted range of occurrence used for CHA.

Potential Triggering Species/ Site	Criterion 1 CR/ EN Species (IUCN)	Criterion 2 Endemic and Range Restricted Species	Criterion 3 Migratory- and/ or Congregatory Species	Criterion 4 Highly Threatened /Unique Ecosystems	Criterion 5 Key Evolutionary Processes	Location within Project Area /Habitat Recorded/ or Potentially occurring	Rationale for decision on CH triggers ✓or ✖
HERPETOFAUNA							
Hyperolius rubrovermiculatus Shimba Hills Reed Frog	✓ EN (IUCN)	✓ Only found in Shimba Hills and a small area east of that	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Confirmed at 4 wetland localities within the PAOI;	It occurs in a *mosaic of moist coastal forest and densely vegetated wetlands* (including moderately degraded former forest) where it breeds by larval development, Highly restricted Area of occurrence and continued loss of or decline of suitable habitat
Afrixalus sylvaticus Shimba Hills Spiny Reed Frog	✓ VU (IUCN)	✓ Found only in SE Kenya and NE-Tanzania	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Confirmed at 4 wetland localities within the PAOI;	Species *of lowland forest* that can survive in secondary growth and plantations, but not in completely degraded habitats. It breeds in temporary pools and water-filled depressions in forest. Limited Area of occurrence and continued loss of or decline of suitable habitat
Boulengerula changamwensis Changamwen-sis African Caecilian	✓ EN (IUCN)	✓ Found only in SE Kenya from Mombasa southwards	✖ N/A	✓ CR Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion	✖	Confirmed previously in the Kwale Area, expected to be present in the PAOI	Soil-dwelling species *of lowland moist forest*. It has also been found in agricultural areas within stream valleys in the plantations of coconut palms, banana and cashew nuts.
AVES							
Historically some threatened birds have been observed within the PAOI. However, none of these are restricted to the natural habitats within the PAOI, and no direct impacts on any threatened birds are expected from the mining activities.							

Potential Triggering Species/ Site	Criterion 1 CR/ EN Species (IUCN)	Criterion 2 Endemic and Range Restricted Species	Criterion 3 Migratory- and/ or Congregatory Species	Criterion 4 Highly Threatened /Unique Ecosystems	Criterion 5 Key Evolutionary Processes	Location within Project Area /Habitat Recorded/ or Potentially occurring	Rationale for decision on CH triggers ✓or ✖
MAMMALIA							
Historically some threatened birds have been observed within the PAOI. However, none of these are restricted to the natural habitats within the PAOI, and no direct impacts on any threatened birds are expected from the mining activities.							
ECOSYSTEMS							
Coastal Forest	✖	✖	✖	✓ Remaining extents of this habitat are currently listed as CR This habitat within the PAOI is no longer in a pristine condition.	✓ This habitat provides wildlife connectivity and suitable habitat for several confirmed EN and VU species	Mostly Restricted to Kayas, secondary forest with very high biodiversity as well as the Gongoni Forest. Note: some of the forest areas are included as part of the wetland systems below.	The WWF delineates the PAOI as Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion, with existing small remnants of Coastal Forest considered under severe threat. Total estimated extent of coastal forest across its range: 2500 km^2
Selected Wetlands such as Kidongoweni	✖	✖	✖	✓ Remaining extents are currently listed as CR.	✓ This habitat provides wildlife connectivity and suitable habitat for several confirmed EN and VU species	Selected wetland and spring areas identified as habitat for EN and VU species.	These wetlands are not only part of the functional ecosystem and supporting lower-lying forest areas, they are also confirmed habitats of EN and VU species that are dependent on such habitats.

6. ANTICIPATED IMPACTS

In this document only the most important impacts on biodiversity and habitats is listed, as well as the most suitable mitigation measures to address such impacts. The detailed impact assessment (indicating significance and extent) is provided in the relevant ESIA Chapter, whilst basic considerations used for the assessment of impacts is given below.

6.1 Background to the Biodiversity Impact Assessment

Any anthropogenic activity, whether historic, current, or proposed, carried out within a natural or semi-natural ecosystem will have an impact on the immediate and surrounding environment, usually in a negative way. As required for any sustainable development and according to, it was necessary to determine and assess the significance of any potential impacts of the construction of the proposed new pipeline and related activities, and to provide a description of available mitigation measures required to limit or reduce the perceived negative impacts, being direct, induced or cumulative, on the natural environment.

Very often, indirect and induced, and to some degree cumulative impacts are difficult to assess beforehand (hence uncertainties) and will only manifest if mitigation measures are not implemented or not sufficient. Many of the above impacts are not only a result of the direct impact on a particular species, but rather due to what is known as the 'Edge Effect', which can be explained as follows: Ecosystems consist of a mosaic of many different patches. The size of natural patches affects the number, type and abundance of species they contain. At the periphery of natural patches, influences of neighbouring environments become apparent; this then is the 'edge effect'. Patch edges may be subjected to degradation due factors such as increased levels of heat, dust, desiccation, disturbance, invasion of exotic species and other negative agents. Edges seldom contain species that are rare, habitat specialists or species that require larger tracts of undisturbed core habitat to survive in the long term. Fragmentation due to development reduces core habitat and greatly extends edge habitat, which causes a shift in the species composition, which in turn puts great pressure on the dynamics and functionality of ecosystems (Perlman and Milder, 2005).

6.1.1 Explanatory Notes and Uncertainties Considered for the Impact Assessment

6.1.1.1 Species limitations

It is often difficult to identify what exactly limits the distribution of a species. Factors that have been identified as playing a major role, either on their own or together, are habitat limitation and dispersal limitation (Münzbergova & Herben 2005). Rare taxa often have specialised habitat requirements and are thus restricted to rare environmental conditions, of which rock outcrops and narrow water channels are typical (Keith 1998). A restricted availability of a habitat may also reduce the dispersal capability of a species. Lower reproductive effort of a species, on the other hand, is a common trait in species with a long life span and strong competitive ability, but this may also imply that such species need specific environmental conditions such as suitable habitat and a number of successive favourable seasons to be able to establish a new cohort of plants of re-colonize a rehabilitated area (Ehrlén & Groenendael 1998).

Within a community or plant association, the species composition is often as or more important than the species number in affecting ecosystem processes. Changes in species compositions can occur indirectly by an altered resource supply due to anthropogenic influence e.g. change of moisture flows. Although a reduction in the number of species may initially have small effects, even minor losses may indicate that the capacity of the ecosystem to adjust to a changing environment is being lost (Chapin et al. 2000, Hooper et al. 2005). Species are allocated an official conservation status to prevent their

further decline due to identified threats (Keith 1998). Protected or red-data species, as well as endemic species, apart from their conservation status, are a first indicator of the health of an ecosystem. They will most probably be the first to show a sudden decline should their environment be changed beyond a specific threshold, e.g. by excessive dust pollution.

6.1.1.2 The importance of habitat:

Several studies have shown that the vegetation units contributing the most to regional species diversity cover the smallest areas because these species are concentrated on and some also limited to particular habitats (Chong & Stohlgren 2007, Keith 1998). However, these communities or habitats may contain species that are of high importance to the entire ecosystem, and an extinction of such a local plant population, or their reduction to a point where they become functionally extinct, can have dramatic consequences on the regulation and support of ecosystem services (Díaz et al. 2005). The diversity and size of a landscape unit also influences ecosystem services – species on the edges of a habitat are more vulnerable to environmental stresses, and the more a habitat is fragmented, the higher this stressful edge effect becomes, in addition to habitat loss. Habitat loss and/or fragmentation can thus have disproportionately large effects on ecosystem services (Díaz et al. 2005).

6.1.1.3 Species and species composition:

The properties of species, together with the species composition is often more critical in retaining the function of an ecosystem than species numbers or total cover (Chapin et al. 2000, Díaz et al. 2005). Many of these species will, however, only establish if the habitat is suitable.

6.1.2 Summary of Potential Impacts to Biodiversity

The mining operation, on which the impact assessment is based, will be carried out in the following stages:

- Project Mobilisation and Construction
  - This phase entails mobilization of labor force, equipment and construction of offices/camps and other mining infrastructure such as roads and boreholes (for use and monitoring).
- Project Operation
  - Existing vegetation will be cleared and any topsoil ahead of the mine path removed. During this period, seeds will be collected from the existing vegetation stored or germinated in a dedicated nursery, and topsoil stockpiled for later replacement during rehabilitation;
  - Slimes- and overburden areas will lead to more vegetation clearance, and uncontrolled runoff from such areas may silt up or pollute adjacent habitats
- Rehabilitation
  - The mined out void will be backfilled with tailings from the primary concentrator;
  - Backfilled areas will then have the topsoil replaced to be rehabilitated with similar vegetation or crops depending on local requirements.

Table 6-1 provides a summary of the anticipated impacts of the proposed mining operations to Biodiversity in the PAOI. For a full assessment of the impacts, refer to the ESIA report.

Table 6-1: Summary of anticipated impacts on biodiversity

Activity	Description of impacts
Project Mobilisation and Construction	

Activity	Description of impacts
1. Clearing of Vegetation (this will continue through operation as new pits are becoming operational)	■ Direct destruction of natural and modified habitats and their vegetation, including critical habitats if such are not protected ■ Displacement and/or loss of fauna by habitat reduction and disruption of faunal corridors ■ Increase of edge effect and increased loss or fragmentation of unique niche habitats and plant species of conservation concern, increasing the impact of existing surrounding anthropogenic activities ■ Destruction of the natural configuration of unique niche habitats and all species dependant on such habitats within the extent of new mining infrastructure ■ Localised total clearing of vegetation and seed-storing topsoil ■ Loss of large indigenous trees that provide ecosystem services and/or habitat for associated species ■ Continued loss of plant species of conservation concern due to a reduction of individuals of the narrow-endemics and threatened species, leading to loss of genetic diversity and gradual decline of sub-populations remaining ■ Accelerated (unnatural high levels of) erosion due to clearing of surfaces, most notable on banks of rivers
2. Excavation works, drilling of boreholes, deposition of materials, landscaping and compaction of soil	■ Interference with natural seepage and surface hydrology ■ Increase in Alien Invasive Vegetation by providing window of opportunity for establishment in and around disturbed areas ■ Destruction of the natural configuration of all natural habitats ■ Reduced re-establishment of indigenous vegetation layer, which further reduces infiltration of precipitation into the soil
3. Vehicle and machinery movement and construction of infrastructure	■ Increased accidents due to speeding vehicles leading to death and injury of wildlife ■ Pollution of surface and groundwater by surface runoff, through seepage of hydrocarbons from uncontrolled and/or accidental spillages of hydrocarbons or distribution of other pollutants ■ Potential direct destruction of the natural washes and smaller drainage lines ■ Compaction and possible pollution of topsoils by unforeseen and/or preventable hydrocarbon spills and unauthorised/uncontrolled off-road driving, especially with heavy machinery
4. Influx of people	■ Attracting poaching for bushmeat trade and related activities ■ Change in faunal composition due to the influx of opportunistic species that compete with or hunt rarer faunal species, e.g. domestic cats and dogs ■ Potential Linear settlement and associated habitat clearance along public road reserves
5. Displacement / relocation of people	■ Land expropriation and relocation/ resettlement, resulting in more cleared and modified areas than assessed during this ESIA
Mine Operation	
1. Excavation of pits, creation of overburden- and topsoil stockpiles and slimes storage	■ Continued clearing of vegetation and associated impacts ■ Possible exacerbated effects of occasional extreme events (e.g. accelerated erosion and unwanted movement and deposition of materials into washes) due to instability and changed topography of modified surfaces ■ Pollution and/or sedimentation of nearby streams due to uncontrolled runoff from stockpile areas

Activity	Description of impacts
	■ Noise caused by movement of earth moving machines and the plant, as well as high light levels (at night) disturbing fauna ■ Loss of wildlife by falling into unprotected excavated areas ■ Pollution to surface water caused by possible oil spills from the machines ■ Groundwater pollution caused by excavations, possible seepage of hydrocarbons and seepage off the slimes dam ■ Interference of natural subsurface water flows due to excavations ■ Possible degradation of adjacent or downstream sensitive and natural habitats due to indirect and induced impacts (water abstraction, pollution, changed hydrological flows), resulting in a decline of habitat quality suitable for the persistence of species of conservation concern ■ Increase in Alien Invasive Vegetation by providing window of opportunity for establishment in and around disturbed areas
2. Potential obstruction or diversion of streams and smaller drainages 3. Direct destruction of tributaries to perennial rivers and smaller drainage lines, as well as wetlands and pans	■ Interference with natural drainage system ■ Loss and/or degradation of functional Riparian Woodland and all wetland habitats ■ Severe disruption and/or loss of functional wildlife corridors ■ Possible change in plant vigour in downstream environments due to changes in surface runoff patterns – most noticeable in riparian vegetation, Coastal Forest and Mangroves ■ Continued degradation of riparian habitats within and downstream of the mining footprint due to physical damage or changes in surface hydrology and associated moisture recharge. ■ Possible continued decline of natural vegetation and plant species of conservation concern within adjacent habitats (also due to new pathways of flooding), due to leaching or deposition of pollutants, or distribution of reproductive material of invasive species ■ Possible continued degradation of remaining natural vegetation around the mining areas dependent on such river flows and associated sub-surface moisture ■ Possible continued accelerated erosion of riparian areas due to less stable or dense vegetation
4. Potential in-migration of people to area	■ Potential increase in bushmeat trade and natural habitat modification and/or degradation
Rehabilitation and Mine Closure	
Permanent modification of areas affected by roads and/or other decommissioned infrastructure, as well as landscaping related to rehabilitation	■ Soil surfaces will be altered significantly in a direct manner by the mining operations, changing not only topography, but al soil surface roughness, soil surface texture and most likely also soil surface chemistry ■ Increase in Alien Invasive Vegetation by the recreation opportunities posed by an absence of a dense and functional indigenous vegetation layer ■ Reduced and/or significantly altered re-establishment of the indigenous vegetation layer due to changes in topsoil condition by loss of natural soil seed bank, loss of soil micro-biota and loss of natural nutrient inputs (from leaf litter and leaf-decomposition) into the soil ■ Loss of aeration and water infiltration caused by compaction of ground on the rehabilitation ■ Increased sediment loading and siltation from soil and sand mass around erosion at bared lands

Activity	Description of impacts
5. Loss of employment	■ Potential increase in bushmeat trade and natural habitat modification and/or degradation due to economic reasons

6.2 Limitations of the Biodiversity Impact Assessment

There is a key difference between the approach of the ecological consultant and that of the ecological researcher. In consultancy, judgements have to be made and advice provided that is based on the best available evidence collected during rapid field surveys, combined with collective experience and professional opinion. The available evidence may be limited, potentially leading to over-simplification of ecological systems and responses, and contain a considerable deal of uncertainty. This is opposed to ecological research, where evidence needs to be compelling before conclusions are reached and research is published (Hill and Arnold, 2012). The best option available to the consulting industry is to push for more research to be conducted to address its questions. However, such research is often of a baseline nature and thus attracts little interest by larger institutions that need to do innovative research to be able to publish and attract the necessary funding. Clients in need of ecological assessments are used to funding such assessments, but are seldom willing to fund further research to monitor the effects of developments. Furthermore, a review to test the accuracy of the predictions of an ecologist following completion of the development is very rarely undertaken, which means the capacity to predict the future is not tested and therefore remains unknown (Hill and Arnold, 2012).

Predictions on future changes on ecosystems and populations once a development has happened are seldom straightforward, except in cases such as the total loss of a habitat to development. However, most development impacts are indirect, subtle, and cumulative or unfold over several years following construction or commencement of mining. Whilst a possible mechanism for an impact to occur can usually be identified, the actual likelihood of occurrence and its severity are much harder to describe (Hill and Arnold, 2012).

A closely related issue is that of the effectiveness of ecological mitigation which stems from ecological assessments, as well as in response to legal and planning policy requirements for development. Many recommendations may be incorporated into planning conditions or become conditions of protected species licences, but these recommendations are implemented to varying degrees, with most compliance being for the latter category (i.e. protected species) because there is a regulatory framework for implementation. What is often missing is the follow-up monitoring and assessment of the mitigation with sufficient scientific rigour or duration to determine whether the mitigation, compensation or enhancement measure has actually worked in the way intended (Hill and Arnold, 2012).

7. CONCLUDING SUMMARY

- The entire study area falls within the Swahili Centre of Endemism, with remnants of natural vegetation, especially Forest Patches and wetland habitats considered as Critically Endangered.
- Due to the long history of human occupation in the area, the vegetation has been subjected to different levels of disturbance, so much so that very little of the original coastal vegetation remains pristine, and has been transformed to other forms of vegetation.
- High levels of grazing and invasion of alien plants, as well as unsustainable conversion and/or harvesting of natural resources currently pose the biggest threat to natural habitats and indigenous species present within the PAOI.
- Despite the above disturbances, several threatened species (EN, VU and NT) could be confirmed in the PAOI. This includes:
  - 39 plant species (of a total of 552 species)

- 3 herpetofauna species (of 33 observed during the survey)
- Potentially 8 mammal species (of 132 potentially frequenting the area)
- Potentially 10 bird species (of potentially 207 frequenting the area)
- Rare and/or unique macro-invertebrate species (with one new record for Kenya, 112 species recorded during the survey)
- Rare and/or unique lepidopteran species (with two new records for Kenya, 158 species recorded during the survey)

- The faunal habitats of the project area consist of a mosaic of vegetation types, of which none is continuous for a considerable stretch due to human disturbances, including, crop cultivation (Shambas), livestock grazing, plantations, settlements and forest resources exploitation. All these factors have modified the potentially very good wildlife habitat for fauna, forcing them to depend on pockets of remaining habitats of coastal thickets, riparian woodland/forests, wetlands, fallow land and limited grassland areas. Nevertheless, despite the disturbances, most of the project area still harbours a variety of faunal species, with two species considered EN and one considered VU. Places where these species have been observed were demarcated as critical habitats.
- Two butterfly species were new occurrence records for Kenya, and one species observed was last recorded 50 years ago. Suitable habitat for these species does exist outside mineral resource areas, thus should not be affected directly.
  - *Oboronia bueronica*, one of the new Lepidopteran species record from Mwaweche Spring, will have habitat outside of Mwaweche Spring. Still, it is recommended that the Mwaweche Spring Site be preserved as well as it has been used by the community for a long period and was a very pure water source.
- Kaya Kitsakabungo was a found to have exceptionally high plant- and insect diversity. It is at the edge of the mine resource zone and it would be desirable to retain it.
- The Kidongoweni Stream source is very important for Lepidoptera, Herpetofauna and Flora. Further important areas to target for conservation would be the Kaya at Mwandimu and the spring at Mwaweche in the buffer zone.
- In the Mwaloya area, there is a ± 8 ha area belonging to a retired teacher, which was a coconut plantation that has been allowed to regrow secondary growth now resembling a regenerated forest. The owner refuses anybody on his land (he is in his eighties). This site had the richest biodiversity in the area and is within half a kilometre of the pond on the Kidongoweni Stream. The significance of this private conservation effort should be recognised and retained, and more detailed surveys conducted in this area. There are tracks on three sides of the property and it would be highly recommended to preserve this site if acquired.
- All other habitats, even if highly modified, may still harbour individuals of large trees (some threatened), but otherwise from a biodiversity perspective have limited value other than ecosystem functions such as grazing and floodwater attenuation (the latter only if suitably vegetated)
- Of the larger concerns would be the potential impact of the significant change of natural surface- and subsurface water-flows due to pit excavations on natural/threatened or important habitats in close proximity to or downstream (towards the coast) of the mining areas, as well as potential pollution of wetlands, streams or forest habitats by uncontrolled invasion of alien invasive plants as well as runoff from mining areas after heavy rainfall events.
- As far as possible, natural/threatened habitats should be avoided, as well as natural wildlife corridors such as riparian areas maintained or alternative wildlife corridors created.
- There is a great concern about continued or accelerated establishment of alien invasive plant species as disturbances due to the mine will increase, and this will have to be addressed during the life of mine and mine rehabilitation.

- It would appear that most of the direct mining impacts, where vegetation will be cleared, can be restricted to variably modified habitat, but small sections of more sensitive habitats may also be impacted
  - It is thus not anticipated that the mining will change the conservation status of any species or habitat directly or indirectly impacted, if mitigation measures are implemented
- With recommended mitigation measures in place, overall negative impacts on critical habitats, threatened species and long-term ecosystem functionality can be minimised.
- Although not all habitat modifications will be fully reversible, it should be possible to rehabilitate mined ares to a functional ecosystem that will support both indigenous wildlife and indigenous flora and provide ecosystem services to local communities
- Specific recommendations for macro-invertebrate species:
  - All the critical habitats for macro-invertebrates that were identified should be preserved during the mining as they will be sources of species to re populate the rehabilitated areas after mining.
  - Since all these streams were originally forested at least going by the evidence given by the few remnants, we recommend re-creation of the original riverine vegetation during rehabilitation. This will be important especially for the shade loving species which may have disappeared with the opening up of the streams. Kidongoweni stream in Mwaloya village is a good reference site.
  - Alternative biotic indices should be developed to monitor changes in the aquatic habitats alongside the SASS. A new method for assessing changes can be designed for use at Base Titanium limited base on observed changes in abundances and diversity. We also recommend the use of another simple index which uses dragonflies alone known as Dragonfly Biotic Index (DBI).
  - Re-creation of mayflies and caddisfly habitats is highly recommended. It was noted that caddis and mayflies inhabited man-made habitats such as the concrete at the bridges in large numbers. Originally when the area was forested decades ago, they may have inhabited areas with sizable logs in the streams since the whole Northern Dune are has no rocks. This can be re-created for them in the areas being rehabilitated and monitoring for colonization be carried out. Since logs will easily be carried away when rivers are swollen, we recommend the introduction of boulders and rocks in carefully selected sites.
  - Adult stages of the new caddisfly species found in Kidongoweni River should be collected to facilitate its description.
  - Since this was more of a rapid survey, a detail survey should be carried out for a comprehensive checklist of the area. It will be important to get the species that may have been missed during this survey. A detailed baseline will be helpful during the monitoring stage as it will confirm if species are appearing for the first time following mitigation or have been there before. Insects are known to be highly season in their activities. For instance, several dragonfly species collected before were missed and new ones recorded. Therefore, such future surveys should be done in different seasons or times of the year.

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ANNEX A: LIST OF RECORDED PLANT SPECIES

Family	Species	IUCN
Acanthaceae	*Andrographis echioides* (L.) Nees	
Acanthaceae	*Asystasia gangetica* (L.) T. Anderson ssp. *micrantha* (Nees) Ensermu	
Acanthaceae	*Blepharis maderaspatensis* (L.) Roth	
Acanthaceae	*Hygrophila schulli* (Buch.-Ham.) M.R. Almeida & S.M. Almeida	LC
Acanthaceae	*Justicia gendarussa* Burm.f.	
Acanthaceae	*Justicia striata* (Klotzsch) Bullock	
Acanthaceae	*Thunbergia alata* Sims	
Acanthaceae	*Thunbergia schimbensis* S. Moore	
Achariaceae	*Rawsonia lucida* Harv. & Sond.	LC
Achariaceae	*Xylotheca tettensis* (Klotzsch) Gilg var. *kirkii* (Oliv.) Wild	LC
Agavaceae	*Agave sisalana* Perrine	Exotic
Amaranthaceae	*Achyranthes aspera* L.	Exotic
Amaranthaceae	*Alternanthera brasiliana* (L.) Kuntze	Exotic
Amaranthaceae	*Amaranthus dubius* Mart. ex Thell.	
Amaranthaceae	*Amaranthus graecizans* L.	
Amaranthaceae	*Amaranthus spinosa* L.	
Amaranthaceae	*Celosia trigyna* L.	Exotic
Amaranthaceae	*Psilotrichum scleranthum* Thwaites	
Amaranthaceae	*Pupalia lappacea* (L.) A. Juss. var. *argyrophylla* C.C. Towns.	LC
Amaryllidaceae	*Crinum politifolium* R. Wahlstr.	LC
Amaryllidaceae	*Scadoxus multiflorus* (Martyn) Raf. ssp. *multiflorus*	
Anacardiaceae	*Anacardium occidentale* L.	
Anacardiaceae	*Lannea schweinfurthii* (Engl.) Engl. var. *stuhlmannii* (Engl.) Kokwaro	
Anacardiaceae	***Lannea welwitschii* (Hiern) Engl. var. *ciliolata* Engl.**	**EN**
Anacardiaceae	*Mangifera indica* L.	
Anacardiaceae	*Ozoroa insignis* Delile ssp. *reticulata* (Baker f.) J.B. Gillett	
Anacardiaceae	*Sclerocarya birrea* (A. Rich.) Hochst. ssp. *caffra* (Sond.) Kokwaro	
Anacardiaceae	*Searsia natalensis* (C. Krauss) F.A. Barkley	LC
Anacardiaceae	*Sorindeia madagascariensis* DC.	
Annonaceae	*Annona muricata* L.	
Annonaceae	*Annona senegalensis* Pers. ssp. *senegalensis*	LC
Annonaceae	*Annona squamosa* L.	
Annonaceae	*Artabotrys modestus* Diels ssp. *macranthus* Verdc.	LC
Annonaceae	***Huberantha stuhlmannii* (Engl.) Chaowasku**	**VU**

Family	Species	IUCN
Annonaceae	*Lettowianthus stellatus* Diels	LC
Annonaceae	*Monanthotaxis fornicata* (Baill.) Verdc.	LC
Annonaceae	*Monanthotaxis trichocarpa* (Engl. & Diels) Verdc.	LC
Annonaceae	Polyalthia longifolia (Sonnerat) Thwaites ssp. pendula	
Annonaceae	Sphaerocoryne gracilis (Engl. & Diels) Verdc. ssp. gracilis	LC
Annonaceae	Uvaria acuminata Oliv.	LC
Annonaceae	Uvaria lucida Benth. ssp. lucida	LC
Annonaceae	Xylopia holtzii Engl.	LC
Anthericaceae	Chlorophytum cameronii (Baker) Kativu var. pterocaulon (Welw. ex Baker) Nordal	
Apiaceae	Centella asiatica (L.) Urb.	LC
Apocynaceae	Ancylobothrys petersiana (Klotzsch) Pierre	
Apocynaceae	Ancylobothrys tayloris (Stapf) Pichon	LC
Apocynaceae	Baissea myrtifolia (Benth.) Pichon	
Apocynaceae	Calotropis gigantea (L.) W.T. Aiton	Exotic
Apocynaceae	Cascabela thevetia (L.) Lippold	Exotic
Apocynaceae	Catharanthus roseus (L.) G. Don	Exotic
Apocynaceae	Cryptolepis apiculata K. Schum.	
Apocynaceae	Cryptolepis hypoglauca K. Schum.	Decreasing
Apocynaceae	Landolphia kirkii Dyer	
Apocynaceae	Landolphia watsoniana Romburgh	VU
Apocynaceae	Mascarenhasia arborescens A. DC.	
Apocynaceae	Mondia ecornuta (N.E. Br.) Bullock	
Apocynaceae	Pachycarpus bisacculatus (Oliv.) Goyder	
Apocynaceae	Parquetina calophylla (Baill.) Venter	
Apocynaceae	Pergularia daemia (Forssk.) Chiov. ssp. daemia	
Apocynaceae	Plumeria obtusa L.	
Apocynaceae	Rauvolfia mombasiana Stapf	
Apocynaceae	Saba comorensis (Bojer ex. A. DC.) Pichon	
Apocynaceae	Schizozygia coffaeoides Baill.	LC
Apocynaceae	Secamone punctulata Decne.	
Apocynaceae	Stathmostelma pedunculatum (Decne.) K. Schum.	
Apocynaceae	Strophanthus courmontii Franch.	
Apocynaceae	Strophanthus petersianus Klotzsch	
Apocynaceae	Tabernaemontana pachysiphon Stapf	LC
Apocynaceae	Vincetoxicum anomalum (N.E. Br.) Meve & Liede	
Apocynaceae	Vincetoxicum conspicuum (N.E. Br.) Meve & Liede	

Family	Species	IUCN
Apocynaceae	Xysmalobium stocksii N.E. Br.	
Araceae	Caladium bicolor (Aiton) Vent.	
Araceae	Colocasia esculenta (L.) Schott	
Araceae	Gonatopus boivinii (Decne.) Engl.	
Araceae	Zamioculcas zamiifolia (Lodd.) Engl.	
Araliaceae	Cussonia zimmermannii Harms	LC
Arecaceae	Borassus aethiopum Mart.	LC
Arecaceae	Cocos nucifera L.	
Arecaceae	Elaeis guineensis Jacq.	LC
Arecaceae	Hyphaene compressa H. Wendl.	LC
Arecaceae	Hyphaene coriacea Gaertn.	LC
Arecaceae	Phoenix reclinata Jacq.	LC
Asparagaceae	Asparagus buchananii Baker	
Asparagaceae	Asparagus setaceus (Kunth) Jessop	
Asteraceae	Acanthospermum hispidum DC.	Exotic
Asteraceae	Ageratum conyzoides L.	Exotic
Asteraceae	Bidens pilosa L.	Exotic
Asteraceae	Conyza bonariensis (L.) Cronquist	Exotic
Asteraceae	Chromolaena odorata (L.) King & Robinson	Exotic
Asteraceae	Emilia coccinea (Sims) G. Don	
Asteraceae	Laggera brevipes Oliv. & Hiern	
Asteraceae	Launaea cornuta (Oliv. & Hiern) C. Jeffrey	
Asteraceae	Mikania chenopodifolia Willd.	
Asteraceae	Pluchea dioscoridis (L.) DC.	
Asteraceae	Synedrella nodiflora (L.) Gaertn.	
Asteraceae	Tridax procumbens L.	Exotic
Asteraceae	Vernonia aemulans Vatke	
Asteraceae	Vernonia cinerea (L.) Less. var. cinerea	
Asteraceae	Vernonia hildebrandtii Vatke	LC
Asteraceae	Vernonia zanzibarensis Less.	LC
Bignoniaceae	Fernandoa magnifica Seem.	
Bignoniaceae	Kigelia africana (Lam.) Benth. ssp. africana	LC
Bignoniaceae	Markhamia zanzibarica (DC.) Engl.	LC
Bignoniaceae	Spathodea campanulata P. Beauv. ssp. nilotica (Seem.) Bidgood	
Bignoniaceae	Stereospermum kunthianum Cham.	LC
Bixaceae	Bixa orellana L.	LC

Family	Species	IUCN
Blechnaceae	Stenochlaena tenuifolia (Desv.) Moore	
Boraginaceae	Ehretia amoena Klotzsch	LC
Boraginaceae	Heliotropium zeylanicum (Burm.f.) Lam.	
Boraginaceae	Hilsenbergia nemoralis (Gürke) J.S. Mill.	LC
Boraginaceae	Hilsenbergia petiolaris (Lam.) J.S. Mill.	
Bromeliaceae	Ananas comosus (L.) Merr.	
Burseraceae	Commiphora africana (A. Rich.) Engl. var. glaucidula (Engl.) J.B. Gillett	
Burseraceae	Commiphora confusa Vollesen	
Cactaceae	Opuntia ficus-indica (L.) Mill.	Exotic
Caesalpiniaceae	Afzelia quanzensis Welw.	LC
Caesalpiniaceae	Chamaecrista absus (L.) H.S. Irwin & Barneby	LC
Caesalpiniaceae	Chamaecrista mimosoides (L.) Greene	LC
Caesalpiniaceae	Erythrophleum suaveolens (Guill. & Perr.) Brenan	LC
Caesalpiniaceae	Hymenaea verrucosa Gaertn.	
Caesalpiniaceae	Paramacrolobium coeruleum (Taub.) J. Léonard	LC
Caesalpiniaceae	Piliostigma thonningii (Schumach.) Milne-Redh.	
Caesalpiniaceae	Senna occidentalis (L.) Link	Exotic
Caesalpiniaceae	Senna siamea (Lam.) H.S. Irwin & Barneby	
Caesalpiniaceae	Senna singueana (Delile) Lock	LC
Caesalpiniaceae	Tamarindus indica L.	LC
Campanulaceae	Lobelia fervens Thunb. ssp. fervens	
Cannaceae	Canna indica L.	Exotic
Capparaceae	Capparis viminea Oliv. var. viminea	LC
Capparaceae	Ritchiea capparoides (Andrews) Britten	LC
Casuarinaceae	Casuarina equisetifolia L.	Exotic
Celastraceae	Apodostigma pallens (Oliv.) R. Wilczek var. pallens	
Celastraceae	Elachyptera holzii (Harms) N. Halle	
Celastraceae	Elaeodendron schweinfurthianum (Loes.) Loes.	LC
Celastraceae	Gymnosporia buchananii Loes.	LC
Celastraceae	Gymnosporia heterophylla (Eckl. & Zeyh.) Loes.	
Celastraceae	Pleurostylia africana Loes.	
Celastraceae	Pristimera andongensis (Oliv.) N. Hallé var. volkensii (Loes.) N. Hallé & B. Mathew	
Celastraceae	Salacia elegans Oliv.	
Celastraceae	Salacia madagascariensis (Lam.) DC.	
Chrysobalanaceae	Hirtella zanzibarica Oliv. ssp. zanzibarica	Decreasing
Clusiaceae	Garcinia buchananii Baker	

Family	Species	IUCN
Clusiaceae	Garcinia livingstonei T. Anderson	
Colchicaceae	Gloriosa superba L. var. superba	LC
Combretaceae	Combretum falcatum (Hiern) Jongkind	
Combretaceae	Combretum paniculatum Vent. ssp. paniculatum	
Combretaceae	Terminalia catappa L.	Exotic
Combretaceae	Terminalia mantaly Perrier	Exotic
Commelinaceae	Aneilema petersii (Hassk.) C.B. Clarke ssp. petersii	
Commelinaceae	Commelina africana L. ssp. zanzibarica Faden?	
Commelinaceae	Commelina benghalensis L.	LC
Commelinaceae	Commelina bracteosa Hassk.	
Commelinaceae	Commelina diffusa Burm.f. ssp. diffusa	LC
Commelinaceae	Commelina forskaolii Vahl	
Commelinaceae	Commelina zambesica C.B. Clarke	
Commelinaceae	Murdannia simplex (Vahl) Brenan	LC
Connaraceae	Rourea orientalis Baill.	LC
Convolvulaceae	Evolvulus alsinoides (L.) L.	
Convolvulaceae	Hewittia malabarica (L.) Suresh	
Convolvulaceae	Ipomoea ochreacea (Lindl.) G. Don	
Convolvulaceae	Ipomoea pes-tigridis L. var. pes-tigridis	
Convolvulaceae	Jacquemontia tamnifolia (L.) Griseb.	
Costaceae	Costus afer Ker Gawl.	
Cucurbitaceae	Coccinia grandis (L.) Voigt	
Cucurbitaceae	Cucumis sacleuxii Pailleux & Bois	
Cucurbitaceae	Cucurbita moschata (Lam.) Poir.	
Cucurbitaceae	Peponium vogelii (Hook.f.) Engl.	
Cucurbitaceae	Trochomeria macrocarpa (Sond.)Hook.f.	
Cyperaceae	Abildgaardia ovata (Burm.f.) Kral	
Cyperaceae	Bulbostylis hispidula (Vahl) R.W. Haines ssp. hispidula	LC
Cyperaceae	Bulbostylis pilosa (Willd.) Cherm.	
Cyperaceae	Cyperus amabilis Vahl	LC
Cyperaceae	Cyperus compressus L.	LC
Cyperaceae	Cyperus cyperoides (L.) Kuntze	LC
Cyperaceae	Cyperus difformis L.	LC
Cyperaceae	Cyperus exaltatus Retz. var. exaltatus	
Cyperaceae	Cyperus foliaceus C.B. Clarke	
Cyperaceae	Cyperus hemisphaericus Boeck.	

Family	Species	IUCN
Cyperaceae	Cyperus niveus Retz. var. leucocephalus (Kunth) Fosberg	
Cyperaceae	Cyperus pectinatus Vahl.	
Cyperaceae	Cyperus prolifer Lam.	
Cyperaceae	Cyperus rotundus L.	
Cyperaceae	Diplacrum africanum C.B. Clarke	LC
Cyperaceae	Eleocharis sp. cf. retroflexa (Poir.) Urban	
Cyperaceae	Fimbristylis dichotoma (L.) Vahl	
Cyperaceae	Fuirena ochreata Kunth	
Cyperaceae	Fuirena umbellata Rottb.	LC
Cyperaceae	Kyllinga cartilaginea K. Schum.	
Cyperaceae	Kyllinga crassipes Boeckeler	
Cyperaceae	Kyllinga polyphylla Kunth var. polyphylla	
Cyperaceae	Pycreus hildebrandtii C.B. Clarke	
Cyperaceae	Pycreus polystachyos (Rottb.) P. Beauv. var. laxiflorus (Benth.) C.B. Clarke	
Cyperaceae	Pycreus pumilus (L.) Domin var. patens (Vahl) Kuk.	
Cyperaceae	Scleria bambariensis Cherm.	
Cyperaceae	Scleria lithosperma (L.) Sw.	LC
Cyperaceae	Scleria racemosa Poir.	LC
Davalliaceae	Davallia denticulata (Burm.f.) Kuhn var. denticulata	
Dennstaedtiaceae	Pteridium aquilinum (L.) Kuhn ssp. aquilinum	
Dichapetalaceae	Dichapetalum arenarium Breteler	LC
Dichapetalaceae	Dichapetalum madagascariense Poir. var. madagascariense	
Dichapetalaceae	Dichapetalum mossambicense (Klotzsch) Engl.	LC
Dilleniaceae	Tetracera boiviniana Baill.	LC
Dilleniaceae	Tetracera litoralis Gilg	LC
Dioscoreaceae	Dioscorea asteriscus Burkill	
Dioscoreaceae	Dioscorea dumetorum (Kunth) Pax	
Dioscoreaceae	Dioscorea hirtiflora Benth. ssp. orientalis Milne-Redh.	
Dioscoreaceae	Dioscorea quartiniana A. Rich. var. quartiniana	LC
Dracaenaceae	Dracaena sp.	
Dracaenaceae	Dracaena usambarensis Engl.	
Ebenaceae	Diospyros abyssinica (Hiern) F. White ssp. abyssinica	LC
Ebenaceae	Diospyros greenwayi F. White	VU
Ebenaceae	Diospyros squarrosa Klotzsch	
Eriocaulaceae	Eriocaulon elegantulum Engl.	LC
Euphorbiaceae	Acalypha lanceolata Willd.	

Family	Species	IUCN
Euphorbiaceae	Alchornea laxiflora (Benth.) Pax & K. Hoffm.	LC
Euphorbiaceae	Cnidoscolus aconitifolius (Mill.) I.M. Johnstone	
Euphorbiaceae	Croton megalocarpus Hutch.	
Euphorbiaceae	Croton sylvaticus Hochst.	LC
Euphorbiaceae	Dalechampia parvifolia Lam.	LC
Euphorbiaceae	Erythrococca kirkii (Müll.Arg.) Prain	
Euphorbiaceae	Euphorbia crotonoides Boiss. ssp. crotonoides?	
Euphorbiaceae	Euphorbia cuneata Vahl ssp. cuneata	LC
Euphorbiaceae	Euphorbia hirta L.	
Euphorbiaceae	Euphorbia tirucalli L.	LC
Euphorbiaceae	Jatropha curcas L.	
Euphorbiaceae	Jatropha prunifolia Pax	
Euphorbiaceae	Mallotus oppositifolius (Geiseler) Müll.Arg. var. oppositifolius forma glabratus (Müll.Arg.) Pax	LC
Euphorbiaceae	Manihot esculenta Crantz	Exotic
Euphorbiaceae	Pedilanthus tithymaloides (L.) A. Poit.	
Euphorbiaceae	Ricinus communis L.	Exotic
Euphorbiaceae	Suregada zanzibariensis Baill.	
Euphorbiaceae	Tragia adenanthera Baill.	
Euphorbiaceae	Tragia kirkiana Mull. Arg.	
Flagellariaceae	Flagellaria guineensis Schumach.	
Gentianaceae	Exacum oldenlandioides (S. Moore) Klack.	
Hypericaceae	Harungana madagascariensis Poir.	LC
Hypericaceae	Psorospermum febrifugum Spach	LC
Hypericaceae	Vismia orientalis Engl.	LC
Hypoxidaceae	Curculigo pilosa (Schumach. & Thonn.) Engl.	
Hypoxidaceae	Hypoxis angustifolia Lam. var. luzuloides (Robyns & Tournay) Wiland	
Icacinaceae	Apodytes dimidiata Arn. var. dimidiata	
Icacinaceae	Pyrenacantha kaurabassana Baill.	
Icacinaceae	Pyrenacantha vogeliana Baill.	
Iridaceae	Gladiolus dalenii Van Geel ssp. andongensis (Baker) Goldblatt	
Lamiaceae	Clerodendrum cephalanthum Oliv. ssp. cephalanthum	LC
Lamiaceae	Endostemon gracilis (Benth.) M.R. Ashby	
Lamiaceae	Gmelina arborea Roxb.	
Lamiaceae	Hoslundia opposita Vahl	
Lamiaceae	Mesosphaerum suaveolens (L.) Kuntze	
Lamiaceae	Ocimum gratissimum L. ssp. gratissimum var. gratissimum	

Family	Species	IUCN
Lamiaceae	Ocimum gratissimum L. ssp. gratissimum var. macrophyllum Briq.	
Lamiaceae	Plectranthus barbatus Andrews?	
Lamiaceae	Premna chrysoclada (Bojer) Gürke	LC
Lamiaceae	Rotheca microphylla (Blume) Callm. & Phillipson	LC
Lamiaceae	Rotheca sansibarensis (Gürke) Steane & Mabb. ssp. sansibarensis	LC
Lamiaceae	Tectona grandis L.f.	
Lamiaceae	Vitex doniana Sweet	LC
Lamiaceae	Vitex ferruginea Schumach. & Thonn. ssp. amboniensis (Gürke) Verdc. var. amboniensis	
Lamiaceae	Vitex mombassae Vatke	
Lamiaceae	Vitex payos (Lour.) Merr. var. payos	
Lamiaceae	Volkameria glabra E. Mey.) Mabb. & Y.W. Yuan	
Lauraceae	Cassytha filiformis L.	
Lauraceae	Persea americana Mill.	
Lecythidaceae	Barringtonia racemosa (L.) Spreng.	LC
Lentibulariaceae	Utricularia arenaria A. DC.	LC
Lentibulariaceae	Utricularia firmula Oliv.	LC
Lentibulariaceae	Utricularia gibba L. ssp. exoleta (R. Br.) P. Taylor	LC
Linderniaceae	Lindernia humilis Bonati	
Linderniaceae	Lindernia parviflora (Roxb.) Haines	
Linderniaceae	Torenia thouarsii (Cham. & Schltdl.) Kuntze	LC
Loranthaceae	Agelanthus sansibarensis (Engl.) Polhill & Wiens ssp. sansibarensis	
Lythraceae	Ammannia radicans (Guill. & Perr.) S.A. Graham & Gandhi var. radicans	LC
Lythraceae	Lawsonia inermis L.	
Malpighiaceae	Acridocarpus zanzibaricus A. Juss.	LC
Malvaceae	Adansonia digitata L.	
Malvaceae	Ceiba pentandra (L.) Gaertn.	LC
Malvaceae	Corchorus aestuans L.	
Malvaceae	Gossypioides kirkii (Mast.) J.B. Hutch.	
Malvaceae	Grewia capitellata Bojer	Decreasing
Malvaceae	Grewia forbesii Mast.	
Malvaceae	Grewia holstii Burret	Decreasing
Malvaceae	Grewia plagiophylla K. Schum.	Decreasing
Malvaceae	Hibiscus greenwayi Baker f.	VU
Malvaceae	Hibiscus micranthus L.f.	
Malvaceae	Hibiscus physaloides Guill. & Perr.	
Malvaceae	Hibiscus surratensis L.	

Family	Species	IUCN
Malvaceae	Malvastrum coromandelianum (L.) Garcke ssp. coromandelianum	Exotic
Malvaceae	Melochia corchorifolia L.	LC
Malvaceae	Melochia melissifolia Benth. var. mollis K. Schum.	
Malvaceae	Rhodognaphalon schumannianum A. Robyns	LC
Malvaceae	Sida acuta Burm.f.	
Malvaceae	Sida cordifolia L. ssp. maculata (Cav.) Marais	
Malvaceae	Sida rhombifolia L.	
Malvaceae	Triumfetta rhomboidea Jacq.	
Malvaceae	Triumfetta tomentosa Bojer	
Malvaceae	Urena lobata L. var. lobata	LC
Malvaceae	Waltheria indica L.	Exotic
Melastomataceae	Heterotis rotundifolia (Sm.) Jacq.-Fél.	
Melastomataceae	Warneckea hedbergorum Borhidi	EN
Meliaceae	Azadirachta indica A. Juss.	Exotic
Meliaceae	Trichilia emetica Vahl	LC
Meliaceae	Turraea floribunda Hochst.	LC
Meliaceae	Turraea mombassana C. DC. ssp. mombassana	LC
Meliaceae	Turraea nilotica Kotschy & Peyr.	LC
Meliaceae	Turraea wakefieldii Oliv.	
Menispermaceae	Cissampelos pareira L. var. hirsuta (DC.) Forman	
Menispermaceae	Dioscoreaphyllum volkensii Engl. var. volkensii	
Menispermaceae	Jateorhiza palmata (Lam.) Miers	
Menispermaceae	Tinospora oblongifolia (Engl.) Troupin	LC
Menispermaceae	Triclisia sacleuxii (Pierre) Diels var. sacleuxii	
Mimosaceae	Acacia senegal (L.) Willd.	
Mimosaceae	Acacia sieberiana DC. var. sieberiana	
Mimosaceae	Albizia adianthifolia (Schumach.) W. Wight	LC
Mimosaceae	Albizia glaberrima (Schumach. & Thonn.) Benth. var. glabrescens (Oliv.) Brenan	
Mimosaceae	Albizia versicolor Oliv.	LC
Mimosaceae	Dichrostachys cinerea (L.) Wight & Arn.	LC
Mimosaceae	Entada rheedei Spreng.	
Mimosaceae	Leucaena leucocephala Lam	Exotic
Mimosaceae	Mimosa pigra L.	Exotic
Mimosaceae	Mimosa pudica L. var. unijuga (Duchass. & Walp.) Griseb.	
Mimosaceae	Parkia filicoidea Oliv.	LC
Mimosaceae	Pithecellobium dulce (Roxb.) Benth.	

Family	Species	IUCN
Moraceae	Antiaris toxicaria Lesch. ssp. welwitschii (Engl.) C.C. Berg var. usambarensis (Engl.) C.C. Berg	
Moraceae	Artocarpus heterophyllus Lam.	
Moraceae	Ficus exasperata Vahl	LC
Moraceae	Ficus faulkneriana C.C. Berg	VU
Moraceae	Ficus lutea Vahl	LC
Moraceae	Ficus recurvata De Wild.	
Moraceae	Ficus sansibarica Warb. ssp. sansibarica	
Moraceae	Ficus stuhlmannii Warb.	LC
Moraceae	Ficus sur Forssk.	LC
Moraceae	Ficus sycomorus L. ssp. sycomorus	LC
Moraceae	Ficus usambarensis Warb.	
Moraceae	Maclura africana (Bureau) Corner	LC
Moraceae	Milicia excelsa (Welw.) C.C. Berg	NT
Moraceae	Trilepisium madagascariense DC.	
Moringaceae	Moringa oleifera Lam.	
Musaceae	Musa sp.	
Myrtaceae	Eucalyptus camaldulensis Dehnh.	Exotic
Myrtaceae	Eucalyptus saligna/grandis	Exotic
Myrtaceae	Psidium guajava L.	Exotic
Myrtaceae	Syzygium cordatum Krauss ssp. shimbaensis Verdc.	EN
Myrtaceae	Syzygium cuminii (L.) Skeels	
Nyctaginaceae	Boerhavia diffusa L.	
Nyctaginaceae	Boerhavia erecta L.	
Nymphaeaceae	Nymphaea nouchali Burm.f.	LC
Ochnaceae	Brackenridgea zanguebarica Oliv.	
Ochnaceae	Ochna kirkii Oliv. ssp. multisetosa Verdc.	VU
Ochnaceae	Ochna mossambicensis Klotzsch	LC
Oleaceae	Jasminum fluminense Vell. ssp. Fluminense	
Oleandraceae	Nephrolepis biserrata (Sw.) Schott	
Onagraceae	Ludwigia erecta (L.) Hara	
Onagraceae	Ludwigia jussiaeoides Desr.	
Onagraceae	Ludwigia stenorraphe (Brenan) H. Hara var. macrosepala (Brenan) P.H. Raven	
Ophioglossaceae	Ophioglossum reticulatum L.	
Opiliaceae	Pentarhopalopilia umbellulata (Baill.) Hiepko	LC
Orchidaceae	Acampe pachyglossa Rchb.f.	

Family	Species	IUCN
Orchidaceae	Ansellia africana Lindl.	VU
Orchidaceae	Habenaria kilimanjari Rchb.f	
Orchidaceae	Habenaria plectromaniaca Rchb.f.	VU
Orchidaceae	Habenaria plectromaniaca Rchb.f.	VU
Orchidaceae	Nervilia bicarinata (Blume) Schltr.	
Orchidaceae	Nervilia kotschyi (Rchb.f.) Schltr. var. kotschyi	
Orchidaceae	Nervilia petraea (Afzel. ex Sw.) Summerh.	
Orobanchaceae	Cycnium adonense Benth. ssp. adonense?	
Orobanchaceae	Striga asiatica (L.) Kuntze	
Orobanchaceae	Striga pubiflora Klotzsch	
Oxalidaceae	Averrhoa bilimbi L.	
Oxalidaceae	Biophytum umbraculum Welw.	
Pandanaceae	Pandanus sp.	
Papilionaceae	Abrus precatorius L. ssp. africanus Verdc.	
Papilionaceae	Cajanus cajan (L.) Millsp.	
Papilionaceae	Canavalia cathartica Thouars	
Papilionaceae	Crotalaria axillaris Aiton	
Papilionaceae	Crotalaria emarginata Benth.	
Papilionaceae	Crotalaria kirkii Baker	
Papilionaceae	Crotalaria retusa L.	
Papilionaceae	Crotalaria vasculosa Benth.	
Papilionaceae	Dalbergia boehmii Taub. ssp. boehmii	LC
Papilionaceae	Dalbergia melanoxylon Guill. & Perr.	NT
Papilionaceae	Desmodium adscendens (Sw.) DC. var. adscendens	LC
Papilionaceae	Desmodium barbatum (L.) Benth. var. procumbens B.G. Schub.	
Papilionaceae	Desmodium gangeticum (L.) DC.	
Papilionaceae	Desmodium sp.cf. tortuosum (Sw.) DC.	
Papilionaceae	Desmodium triflorum (L.) DC.	
Papilionaceae	Desmodium velutinum (Willd.) DC.	
Papilionaceae	Dolichos trilobus L. ssp. trilobus var. trilobus?	
Papilionaceae	Eriosema glomeratum (Guill. & Perr.) Hook.f.	
Papilionaceae	Eriosema parviflorum E. Mey. ssp. parviflorum	
Papilionaceae	Erythrina abyssinica DC. ssp. abyssinica	LC
Papilionaceae	Erythrina sacleuxii Hua	NT
Papilionaceae	Galactia argentifolia S. Moore	NT
Papilionaceae	Gliricidia sepium (Jacq.) Walp.	

Family	Species	IUCN
Papilionaceae	Indigofera congesta Baker	
Papilionaceae	Indigofera hirsuta L.	
Papilionaceae	Indigofera microcharoides Taub.	
Papilionaceae	Indigofera paniculata Pers. ssp. paniculata	
Papilionaceae	Indigofera tinctoria L.	
Papilionaceae	Indigofera trita L.f.	LC
Papilionaceae	Indigofera vohemarensis Baill.	
Papilionaceae	Indigofera zanzibarica J.B. Gillett	VU
Papilionaceae	Indigofera zenkeri Baker f..	
Papilionaceae	Macrotyloma axillare (E. Mey.) Verdc. var. glabrum (E. Mey.) Verdc.	
Papilionaceae	Mucuna pruriens (L.) DC.	
Papilionaceae	Ophrestia hedysaroides (Willd.) Verdc.	
Papilionaceae	Ormocarpum kirkii S. Moore	LC
Papilionaceae	Phaseolus vulgaris L.	
Papilionaceae	Philenoptera bussei (Harms) Schrire	
Papilionaceae	Pseudarthria hookeri Wight & Arn. var. hookeri	
Papilionaceae	Pseudovigna argentea (Willd.) Verdc.	LC
Papilionaceae	Rhynchosia congensis Baker ssp. orientalis Verdc.	NT
Papilionaceae	Rhynchosia hirta (Andrews) Meikle & Verdc.	
Papilionaceae	Rhynchosia minima (L.) DC.	LC
Papilionaceae	Rhynchosia viscosa (Roth) DC. ssp. viscosa var. breviracemosa (Hauman) Verdc.	
Papilionaceae	Rhynchosia viscosa (Roth) DC. ssp. viscosa var. viscosa	
Papilionaceae	Sphenostylis stenocarpa (A. Rich.) Harms	
Papilionaceae	Stylosanthes erecta P. Beauv.	
Papilionaceae	Stylosanthes fruticosa (Retz.) Alston	
Papilionaceae	Tephrosia linearis (Willd.) Pers.	
Papilionaceae	Tephrosia noctiflora Baker	
Papilionaceae	Tephrosia pumila (Lam.) Pers. var. pumila	
Papilionaceae	Tephrosia purpurea (L.) Pers. ssp. leptostachya (DC.) Brummitt var. leptostachya	
Papilionaceae	Teramnus repens (Taub.) Baker f. ssp. gracilis (Chiov.) Verdc.	
Papilionaceae	Vigna parkeri Baker ssp. acutifoliola Verdc.	
Papilionaceae	Vigna reticulata Hook.f.	LC
Papilionaceae	Zornia pratensis Milne-Redh. ssp. pratensis var. pratensis	
Parkeriaceae	Ceratopteris thalictroides (L.) Brongn.	
Passifloraceae	Adenia gummifera (Harv.) Harms var. gummifera	

Family	Species	IUCN
Passifloraceae	Adenia rumicifolia Engl.	
Passifloraceae	Passiflora edulis Sims f. flavicarpa Degener	Exotic
Passifloraceae	Schlechterina mitostemmatoides Harms	LC
Pedaliaceae	Sesamum angustifolium (Oliv.) Engl.	
Phyllanthaceae	Antidesma membranaceum Müll.Arg.	
Phyllanthaceae	Antidesma venosum Tul.	LC
Phyllanthaceae	Bridelia cathartica G. Bertol.	LC
Phyllanthaceae	Bridelia micrantha (Hochst.) Baill.	LC
Phyllanthaceae	Flueggea virosa (Willd.) Voigt ssp. virosa	LC
Phyllanthaceae	Margaritaria discoidea (Baill.) G.L. Webster	LC
Phyllanthaceae	Phyllanthus amarus Schumach. & Thonn.	
Phyllanthaceae	Phyllanthus harrisii Radcl.-Sm.	LC
Phyllanthaceae	Phyllanthus leucocalyx Hutch.	
Phyllanthaceae	Phyllanthus maderaspatensis L. var. maderaspatensis	LC
Phyllanthaceae	Phyllanthus nummulariifolius Poir.	
Phyllanthaceae	Phyllanthus reticulatus Poir. var. glaber (Thwaites) Muell. Arg.	
Picrodendraceae	Oldfieldia somalensis (Chiov.) Milne-Redh.	NT
Pinaceae	Pinus caribaea Morelet	Exotic
Plantaginaceae	Bacopa crenata (P. Beauv.) Hepper	LC
Plantaginaceae	Scoparia dulcis L.	
Poaceae	Aristida adscensionis L.	
Poaceae	Bambusa vulgaris Schrad.	
Poaceae	Bothriochloa bladhii (Retz.) S.T. Blake	
Poaceae	Brachiaria deflexa (Schumach.) C.E. Hubb. ex Robyns	
Poaceae	Brachiaria leucacrantha (K. Schum.) Stapf	
Poaceae	Brachiaria reptans (L.) Gardner & C.E. Hubb.	LC
Poaceae	Brachiaria subquadripara (Trin.) Hitchc.	LC
Poaceae	Cenchrus echinatus L.	LC
Poaceae	Cenchrus polystachios (L.) Morrone	LC
Poaceae	Cynodon dactylon (L.) Pers.	
Poaceae	Dactyloctenium aegyptium (L.) Willd.	
Poaceae	Dactyloctenium geminatum Hack.	
Poaceae	Digitaria argyrotricha (Andersson) Chiov.	
Poaceae	Digitaria diagonalis (Nees) Stapf var. uniglumis (A.Rich.) Pilg.	
Poaceae	Digitaria milanjiana (Rendle) Stapf	
Poaceae	Digitaria nuda Schumach.	

Family	Species	IUCN
Poaceae	Digitaria velutina (Forssk.) P. Beauv.	
Poaceae	Echinochloa colona (L.) Link	
Poaceae	Eleusine indica (L.) Gaertn. ssp. indica	
Poaceae	Eragrostis ciliaris (L.) R. Br.	
Poaceae	Eragrostis minor Host	
Poaceae	Eragrostis perbella K. Schum.	VU
Poaceae	Eragrostis superba Peyr.	
Poaceae	Eragrostis tenella (L.) Roem. & Schult. var. tenella	
Poaceae	Hackelochloa granularis (L.) Kuntze	
Poaceae	Heteropogon contortus (L.) Roem. & Schult.	
Poaceae	Hylebates chlorochloe (K. Schum.) Napper	VU
Poaceae	Hyparrhenia poecilotricha (Hack.) Stapf	
Poaceae	Hyperthelia dissoluta (Steud.) Clayton	
Poaceae	Imperata cylindrica (L.) Raeusch.	
Poaceae	Leersia hexandra Sw.	LC
Poaceae	Leptochloa uniflora A. Rich.	
Poaceae	Melinis repens (Willd.) Zizka ssp. repens	
Poaceae	Olyra latifolia L.	
Poaceae	Oryza longistaminata A. Chev. & Roehr.	LC
Poaceae	Panicum brevifolium L.	
Poaceae	Panicum genuflexum Stapf	
Poaceae	Panicum infestum Andersson	
Poaceae	Panicum laticomum Nees	
Poaceae	Panicum maximum Jacq.	
Poaceae	Panicum trichocladum K. Schum.	
Poaceae	Paspalidium obtusifolium (Delile) N.D. Simpson	
Poaceae	Paspalum scrobiculatum L.	LC
Poaceae	Perotis hildebrandtii Mez	
Poaceae	Rottboellia cochinchinensis (Lour.) Clayton	
Poaceae	Saccharum officinarum L.	
Poaceae	Sacciolepis curvata (L.) Chase	LC
Poaceae	Setaria sphacelata (Schumach.) M.B. Moss	
Poaceae	Sporobolus pyrimidalis P. Beauv.	
Poaceae	Sporobolus tenuissimus (Mart. ex Schrank) Kuntze	
Poaceae	Stenotaphrum dimidiatum (L.) Brongn.	
Poaceae	Tragus berteronianus Schult.	

Family	Species	IUCN
Poaceae	Zea mays L.	Exotic
Polygalaceae	Carpolobia goetzei Gürke	
Polygalaceae	Polygala amboniensis Gürke	
Polygalaceae	Polygala arenaria Willd.	
Polygalaceae	Polygala sphenoptera Fresen.	
Polygalaceae	Securidaca longipedunculata Fresen.	
Polygonaceae	Oxygonum sinuatum (Meisn.) Dammer	
Polypodiaceae	Phymatosorus scolopendria (Burm.f.) Pic.Serm.	
Portulacaceae	Portulaca oleracea L.	
Proteaceae	Grevillea robusta R. Br.	
Rhamnaceae	Ziziphus mauritiana Lam.	LC
Rhizophoraceae	Cassipourea euryoides Alston	LC
Rosaceae	Eriobotrya japonica (Thunb.) Lindl.	
Rubiaceae	Afrocanthium pseudoverticillatum (S. Moore) Lantz	VU
Rubiaceae	Agathisanthemum bojeri Klotzsch var. bojeri	
Rubiaceae	Catunaregam nilotica (Stapf) Tirveng.	
Rubiaceae	Chassalia umbraticola Vatke ssp. umbraticola	Decreasing
Rubiaceae	Cremaspora triflora (Thonn.) K. Schum. ssp. confluens (K. Schum.) Verdc.	
Rubiaceae	Crossopteryx febrifuga (G. Don) Benth.	LC
Rubiaceae	Gardenia ternifolia Schumach. & Thonn.	
Rubiaceae	Heinsia crinita (Afzel.) G. Taylor ssp. parvifolia (K. Schum. & K. Krause) Verdc.	
Rubiaceae	Heinsia zanzibarica (Bojer) Verdc.	NT
Rubiaceae	Keetia venosa (Oliv.) Bridson	LC
Rubiaceae	Keetia zanzibarica (Klotzsch) Bridson ssp. zanzibarica	Decreasing
Rubiaceae	Kohautia longifolia Klotzsch var. vestita Bremek.	
Rubiaceae	Kohautia virgata (Willd.) Bremek.	
Rubiaceae	Leptactina platyphylla (Hiern) Wernham	
Rubiaceae	Mitracarpus hirtus (L.) DC.	
Rubiaceae	Oldenlandia affinis (Roem. & Schult.) DC. ssp. fugax (Vatke) Verdc.	
Rubiaceae	Oldenlandia corymbosa L.	
Rubiaceae	Oldenlandia lancifolia (Schumach.) DC. var. scabridula Bremek.	
Rubiaceae	Pavetta stenosepala K. Schum. ssp. stenosepala	Decreasing
Rubiaceae	Pentas bussei K. Krause	
Rubiaceae	Pentas zanzibarica (Klotzsch) Vatke var. zanzibarica	LC
Rubiaceae	Pentodon pentandrus (Schumach. & Thonn.) Vatke	LC
Rubiaceae	Polysphaeria parvifolia Hiern	

Family	Species	IUCN
Rubiaceae	Psychotria amboniana K. Schum. var. amboniana	Decreasing
Rubiaceae	Psychotria amboniana K. Schum. var. velutina (E.M.A. Petit) Verdc.	
Rubiaceae	Psychotria capensis (Eckl.) Vatke ssp. riparia (K. Schum. & K. Krause) Verdc. var. puberula (E.M.A. Petit) Verdc.	
Rubiaceae	Psychotria capensis (Eckl.) Vatke ssp. riparia (K. Schum. & K. Krause) Verdc. var. riparia	
Rubiaceae	Psychotria lauracea (K. Schum.) E.M.A. Petit	
Rubiaceae	Psychotria punctata Vatke var. punctata	
Rubiaceae	Psychotria punctata Vatke var. tenuis E.M.A. Petit	
Rubiaceae	Psydrax faulknerae Bridson	VU
Rubiaceae	Pyrostria bibracteata (Baker) Cavaco	
Rubiaceae	Richardia scabra L.	
Rubiaceae	Rytigynia celastroides (Baill.) Verdc. var. celastroides	LC
Rubiaceae	Rytigynia parvifolia Verdc.	
Rubiaceae	Spermacoce filituba (K. Schum.) Verdc.	
Rubiaceae	Spermacoce laevis Lam.	
Rubiaceae	Spermacoce pusilla Wall.	
Rubiaceae	Vangueria infausta Burch. ssp. rotundata (Robyns) Verdc. var. rotundata	
Rutaceae	Citrus aurantifolia (Christm.) Swingle	
Rutaceae	Citrus hystrix DC.?	Exotic
Rutaceae	Citrus limon (L.) Burm.f.	Exotic
Rutaceae	Citrus reticulata Blanco	Exotic
Rutaceae	Citrus sinensis (L.) Osbeck	Exotic
Rutaceae	Toddalia asiatica (L.) Lam.	
Rutaceae	Vepris lanceolata (Lam.) G. Don	
Rutaceae	Vepris simplicifolia (Engl.) Mziray	
Rutaceae	Zanthoxylum chalybeum Engl. var. chalybeum	LC
Salicaceae	Bivinia jalbertii Tul.	NT
Salicaceae	Casearia gladiiformis Mast.	LC
Salicaceae	Dovyalis macrocalyx (Oliv.) Warb.	
Salicaceae	Flacourtia indica (Burm.f.) Merr.	LC
Salicaceae	Ludia mauritiana J.F. Gmel.	
Salicaceae	Scolopia rhamniphylla Gilg	
Salicaceae	Trimeria grandifolia (Hochst.) Warb. ssp. tropica (Burkill) Sleumer	
Sapindaceae	Allophylus pervillei Blume	
Sapindaceae	Allophylus rubifolius (A. Rich.) Engl. var. dasystachys (Gilg) Verdc.	
Sapindaceae	Blighia unijugata Baker	LC

Family	Species	IUCN
Sapindaceae	Chytranthus obliquinervis Engl.	VU
Sapindaceae	Deinbollia borbonica Scheff. forma glabrata Radlk.	
Sapindaceae	Paullinia pinnata L.	
Sapindaceae	Zanha golungensis Hiern	LC
Sapotaceae	Manilkara sansibarensis (Engl.) Dubard	
Sapotaceae	Mimusops aedificatoria Mildbr.	
Sapotaceae	Pouteria alnifolia (Baker) Roberty var. alnifolia	
Sapotaceae	Synsepalum brevipes (Baker) T.D. Penn.	LC
Schizaeaceae	Lygodium microphyllum (Cav.) R. Br.	
Selaginellaceae	Selaginella perpusilla Baker	
Simaroubaceae	Harrisonia abyssinica Oliv.	
Smilacaceae	Smilax anceps Willd.	
Solanaceae	Capsicum annuum L. var. annuum	
Solanaceae	Nicandra physalodes (L.) Gaertn.	Exotic
Solanaceae	Physalis angulata L.	Exotic
Solanaceae	Solanum campylacanthum A. Rich.	
Solanaceae	Solanum lycopersicum L.	Exotic
Solanaceae	Solanum macrocarpon L.	
Solanaceae	Solanum melongena L.	
Solanaceae	Solanum nigrum L.	
Strychnaceae	Strychnos madagascariensis Poir.	LC
Strychnaceae	Strychnos scheffleri Gilg	
Strychnaceae	Strychnos spinosa Lam.	
Taccaceae	Tacca leontopetaloides (L.) Kuntze	LC
Thelypteridaceae	Cyclosorus interruptus (Willd.) H. Ito var. interruptus	LC
Thymelaeaceae	Synaptolepis kirkii Oliv.	Decreasing
Ulmaceae	Trema orientalis (L.) Blume	LC
Verbenaceae	Lantana camara L.	Exotic
Verbenaceae	Lantana trifolia L.	
Verbenaceae	Stachytarpheta jamaicensis (L.) Vahl	
Verbenaceae	Stachytarpheta urticifolia Sims	
Vitaceae	Ampelocissus africana (Lour.) Merr. var. africana	
Vitaceae	Cissus aralioides (Baker) Planch. ssp. orientalis Verdc.	
Vitaceae	Cissus rotundifolia (Forssk.) Vahl var. rotundifolia	
Vitaceae	Cyphostemma adenocaule (A. Rich.) Wild & R.B. Drumm. ssp. adenocaule	
Vitaceae	Cyphostemma buchananii (Planch.) Wild & R.B. Drumm.	

Family	Species	IUCN
Vitaceae	Cyphostemma duparquetii (Planch.) Desc.	Decreasing
Vitaceae	Cyphostemma hildebrandtii (Gilg) Wild & R.B. Drumm.	
Xyridaceae	Xyris anceps Lam. var. anceps	

List of cultivated and invasive plant species

Species	Status
Achyranthes aspera	Invasive: Burweed, Chaff flower
Agave sisalana	Cultivated & invasive: Sisal
Ageratum conyzoides	Invasive: Mexican Ageratum
Alternanthera brasiliana	Cultivated
Anacardium occidentale	Cultivated: Cashew Nut
Ananas comosus	Cultivated: Pineapple
Annona muricata	Cultivated: Soursop
Annona squamosa	Cultivated: Custard Apple
Artocarpus heterophyllus	Cultivated: Jack Fruit
Averrhoa bilimbi	Cultivated: Bilimbi
Azadirachta indica	Invasive: Neem
Azolla pinnata	Invasive
Bambusa vulgaris	Cultivated: Bamboo
Bixa orellana	Cultivated: Bixa
Cajanus cajan	Cultivated: Pigeon Pea
Caladium bicolor	Naturalised
Calotropis gigantea	Cultivated:
Canna indica	Cultivated & Invasive: Canna
Cascabela thevetia	Cultivated & invasive: Thevetia
Casuarina equisetifolia	Cultivated & Invasive: Casuarina
Ceiba pentandra	Cultivated: Kapok
Citrus aurantifolia	Cultivated: Lime
Citrus hystrix	Cultivated: Kaffir Lime
Citrus limon	Cultivated: Lemon
Citrus reticulata	Cultivated: Tangerine
Citrus sinensis	Cultivated: Sweet Orange
Cnidoscolus aconitifolius	Cultivated: Chaya, Tree Spinach
Cocos nucifera	Cultivated & Naturalised: Coconut
Colocasia esculenta	Cultivated: Cocoyam
Croton megalocarpus	Cultivated:
Cucurbita moschata	Cultivated: Pumpkin
Elaeis guineensis	Naturalised: African oil palm
Melia azedarach	Invasive: Syringa, Persian lilac

Species	Status
Dracaena species	Cultivated
Eriobotrya japonica	Cultivated: Loquat
Eucalyptus camaldulensis	Cultivated
Eucalyptus saligna, E. grandis	Cultivated
Gliricidia sepium	Cultivated: Madre de Cacao
Gmelina arborea	Cultivated
Grevillea robusta	Cultivated: Grevillea
Hibiscus greenwayi	Cultivated
Jatropha curcas	Cultivated: Jatropha
Justicia gendarussa	Cultivated
Mangifera indica	Cultivated & Naturalised: Mango
Manihot esculenta	Cultivated: Cassava
Musa sp.	Cultivated: Banana
Opuntia vulgaris	Invasive
Passiflora edulis	Cultivated: Yellow Passion Fruit
Pedilanthus tithymaloides	Cultivated
Persea americana	Cultivated: Avocado
Phaseolus vulgaris	Cultivated: Common Bean
Pinus caribaea	Cultivated
Pithecellobium dulce	Cultivated
Plumeria obtusa	Cultivated: Frangipani
Polyalthia longifolia ssp. pendula	Cultivated
Ricinus communis	Invasive: Castor oil plant
Saccharum officinarum	Cultivated: Sugar Cane
Senna siamea	Cultivated & invasive
Solanum lycopersicum	Cultivated: Tomato
Solanum macrocarpon	Cultivated
Solanum melongena	Cultivated: Aubergine
Spathodea campanulata ssp. nilotica	Cultivated: Nandi Flame
Syzygium cumini	Invasive: Jambolan
Tectona grandis	Cultivated: Teak
Terminalia catappa	Cultivated: Indian Almond
Terminalia mantaly	Cultivated
Thevetia peruviana.	Invasive: Yellow oleander
Tridax procumbens	Naturalised
Zea mays	Cultivated: Maize

Collection Points of Flora

Pt	No. Date &	Time Grid	Ref. (Decimal Deg.)	Alt.

22	21-Jul-20	7:27:22AM	S4.36057 E39.47238	85 m
23	21-Jul-20	8:13:50AM	S4.36053 E39.47218	74 m
24	21-Jul-20	8:24:35AM	S4.36020 E39.47257	80 m
25	21-Jul-20	8:30:19AM	S4.35994 E39.47250	82 m
26	21-Jul-20	8:37:50AM	S4.36060 E39.47267	78 m
27	21-Jul-20	8:40:08AM	S4.36079 E39.47287	78 m
28	21-Jul-20	9:15:15AM	S4.36196 E39.47216	76 m
29	21-Jul-20	9:34:35AM	S4.36153 E39.47165	76 m
30	21-Jul-20	12:57:02PM	S4.35792 E39.47272	57 m
31	21-Jul-20	1:27:55PM	S4.36360 E39.47384	77 m
32	21-Jul-20	2:10:14PM	S4.36754 E39.46541	55 m
33	22-Jul-20	6:04:49AM	S4.37286 E39.45071	87 m
34	22-Jul-20	6:35:38AM	S4.37135 E39.45055	93 m
35	22-Jul-20	8:13:21AM	S4.37676 E39.45061	74 m
36	22-Jul-20	8:50:28AM	S4.37304 E39.45192	86 m
37	22-Jul-20	9:52:43AM	S4.36376 E39.44981	125 m
38	22-Jul-20	10:26:24AM	S4.36608 E39.45276	101 m
39	22-Jul-20	12:58:36PM	S4.34175 E39.46651	74 m
40	23-Jul-20	5:51:04AM	S4.35323 E39.45247	125 m
41	23-Jul-20	8:17:15AM	S4.35462 E39.44087	66 m
42	23-Jul-20	9:42:39AM	S4.35945 E39.44628	92 m
43	23-Jul-20	11:32:39AM	S4.34640 E39.46127	127 m
44	23-Jul-20	1:09:11PM	S4.35206 E39.47601	84 m
45	23-Jul-20	1:21:20PM	S4.36389 E39.49527	56 m
46	24-Jul-20	6:49:13AM	S4.32487 E39.48506	110 m
47	24-Jul-20	7:04:23AM	S4.32502 E39.48504	97 m
48	24-Jul-20	7:30:51AM	S4.32428 E39.48373	112 m
49	24-Jul-20	9:06:28AM	S4.33779 E39.46945	59 m
50	24-Jul-20	9:28:48AM	S4.33969 E39.46952	55 m
51	24-Jul-20	9:35:54AM	S4.34032 E39.46958	60 m
52	24-Jul-20	11:52:49AM	S4.32985 E39.48014	81 m
53	25-Jul-20	5:48:18AM	S4.39247 E39.45424	59 m
54	25-Jul-20	6:51:00AM	S4.39106 E39.45815	69 m
55	25-Jul-20	7:32:59AM	S4.39076 E39.45481	61 m
56	25-Jul-20	8:53:02AM	S4.38999 E39.46265	41 m
57	25-Jul-20	11:27:13AM	S4.40602 E39.46892	30 m

ANNEX B: HERPETOFAUNA RECORDED

Checklist of amphibian and reptile species recorded through TLS method in the Northern Dune sites showing their relative abundance, location and IUCN Conservation Status of the species in the RedList Threatened Categories (Critically Endangered-CR, Endangered-EN, Vulnerable-VU, or Near Threatened-NT. The rest are mostly Least Concern-LC (abundant and widespread species)

SPECIES	Conservation Status	Location		Mkwambani	Mwaweche	Mwaloya	Mwandimu	Bumamani	Total abundance
		Easting	Northing						
AMPHIBIANS									
1 Müller's Clawed Frog *Xenopus muelleri*		553302 549777 552880	9521197 9516196 9517346	8	0	5	6	0	19
2. Merten's Toad *Sclerophrys pusilla*		551986 549777 551390	9520593 9516196 9515281	0	3	3	0	4	10
3. Common Leaf-litter frog *Artroleptis stenodactylus*		550080	9516250	0	0	1	0	0	1
7. Zanzibar Puddle Frog *Phrynobatrachus acridoides*		553302 551729 551986 549777 552880 551390 552248	9521197 9520072 9520593 9516196 9517346 9515281 9518333	8	4	8	8	14	42
4. Mababe Puddle Frog *Phrynobatrachus mababiensis*		551986 551390	9520593 9515281	0	2	0	0	3	5
5. Savanna ridged Frog *Ptychadena anchietae*		551986 549777 552880 551390	9520593 9516196 9517346 9515281	0	2	3	5	4	14

SPECIES	Conservation Status	Location		Mkwambani	Mwaweche	Mwaloya	Mwandimu	Bumamani	Total abundance
		Easting	Northing						
6. Sharp-nosed ridged Frog *Ptychadena oxyrhynchus*		553302	9521197	2	0	0	0	0	2
7. Shimba Hills Reed Frog *Hyperolius rubrovermiculatus*	Endangered	553302 551986 549777 552880 551390	9521197 9520593 9516196 9517346 9515281	8	10	9	11	11	49
7. Tinker Reed Frog *Hyperolius tuberilinguis*		549777 552880 551390	9516196 9517346 9515281	4	0	4	3	6	17
8. Argus Reed Frog *Hyperolius argus*		553302 549777 551390	9521197 9516196 9515281	10	0	6	0	7	23
9. Parker's Reed Frog *Hyperolius parkeri*		553302 551986 552880 552248	9521197 9520593 9517346 9518333	3	5	0	4	0	12
10. Waterlily Reed Frog *Hyperolius pusillus*		553302	9521197	5	0	0	0	0	5
11. Mary's Reed Frog *Hyperolius mariae*		549777	9516196	0	0	10	0	0	10
12. Fornasin's Spiny Reed Frog *Afrixalus fornasini*		553302 549777 551390	9521197 9516196 9515281	4	0	3	0	4	11
13. Shimba Hills Spiny Reed Frog *Afrixalus sylvaticus*	Vulnerable	551986 549777 552880	9520593 9516196 9517346	0	10	8	5	17	40

SPECIES	Conservation Status	Location		Mkwambani	Mwaweche	Mwaloya	Mwandimu	Bumamani	Total abundance
		Easting	Northing						
		551390	9515281						
14. Red-legged Kassina *Phylctimantis maculata*		553302 549777	9521197 9516196	5	0	5	0	0	10
15. Witu Tree Frog *Leptopelis concolor*		551986	9520593	0	2	0	0	0	2
Sub-total number of species				10	8	12	7	9	
REPTILES									
1. Speckle-lipped Skink *Trachylepis maculilabris*		552989 553445 549854 550080 552536 550870	9521425 9521654 9519035 9516250 9517937 9515174	5	2	4	3	1	42
2. Striped Skink *Trachylepis striata*		552966	9520468	1	2	0	0	0	3
3. Grass-top Skink *Trachylepis megarula*		553302	9521197	1	0	0	0	0	1
4. Sundevall's Writhing Skink *Mochlus sundevalli*		550576	9519264	0	1	0	0	0	1
5. Baobab tree Gecko *Hemidactylus platycephalus*		552989 553298 553445 551729 551071 552536 552372 550804	9521425 9521901 9521654 9520072 9517604 9517937 9517963 9517256	10	1	6	0	0	17

SPECIES	Conservation Status	Location		Mkwambani	Mwaweche	Mwaloya	Mwandimu	Bumamani	Total abundance
		Easting	Northing						
6. Barbour's Gecko *Hemidactylus barbouri*		550937	9517488	0	0	2	0	0	2
7. Kaya Mrima Tree Gecko *Hemidactylus mrimaensis*		550804	9517256	0	0	1	0	0	1
8. White-headed Dwarf Gecko *Lygodactylus mombasicus*		553302 552989 553298 553445 550208 549884 550015 552536 552880 550870 551390 552372 552274	9521197 9521425 9521901 9521654 9518840 9519080 9518731 9517937 9517346 9515174 9515281 9517963 9518125	13	12	0	12	7	44
9. Yellow-headed Dwarf Gecko *Lygodactylus picturatus*		553302 552989 553298 553302 553445 550208 550434 549884 550015 550080 549777 551071 552536	9521197 9521425 9521901 9521197 9521654 9518731 9518635 9519080 9518731 9516250 9516196 9517604 9517937	19	26	13	10	24	92

SPECIES	Conservation Status	Location		Mkwambani	Mwaweche	Mwaloya	Mwandimu	Bumamani	Total abundance
		Easting	Northing						
		552880 550870 552372 552274 550804 550409	9517346 9515174 9517963 9518125 9517256 9516983						
10. Speke's Sand Lizard *Heliobolus spekii*		551338	9514898	0	0	2	0	1	3
11. Gregory Blue-headed Tree Agama *Acanthocercus gregorii*		552372	9517963	0	0	0	1	0	1
12. Tawny Plated Lizard *Broadleysaurus major*		550409	9516983	0	0	1	0	0	1
13. Spotted Green Snake *Philothamnus punctatus*		550870	9515174	0	0	0	0	1	1
14. Cape House Snake *Boaedon fuliginosus*		550080	9516250	0	0	1	0	0	1
15. Bibron's Burrowing Asp *Atractaspis bibronii*		550080	9516250	0	0	1	0	0	1
16. Eastern Hinge-back tortoise *Kinixys zombensis*		553302 550251	9521197 9517649	1	0	1	0	0	2
Sub-total number of species				7	6		4	5	

ANNEX C: MACRO-INVERTEBRATES RECORDED

Checklist and distribution of macro-invertebrates in the Northern Dune Area, Kwale

Order	Family	Common names	Genus	Species	Mkwambani	Mwaweche	Mwandimu	Mwaloya	Bumamani
Caridea		Fresh Water Shrimps	*Caridina*	*nilotica*					x
Coleoptera	Dytiscidae	Diving beetles	*Copelatus*	*ornatipennis*				x	
Coleoptera	Dytiscidae	Diving beetles	*Cybister*	*bicostatus*	x	x			x
Coleoptera	Dytiscidae	Diving beetles	*Cybister*	*marginicollis*			x		
Coleoptera	Dytiscidae	Diving beetles	*Cybister*	*tripunctatus*		x	x		
Coleoptera	Dytiscidae	Diving beetles	*Hydaticus*	*dorsiger*				x	x
Coleoptera	Dytiscidae	Diving beetles	*Hydaticus*	*exclamationis*		x			
Coleoptera	Dytiscidae	Diving beetles	*Hydaticus*	*flavolineatus*				x	
Coleoptera	Dytiscidae	Diving beetles	*Hydaticus*	*intermedius*	x				
Coleoptera	Dytiscidae	Diving beetles	*Hydaticus*	*matruelis*				x	x
Coleoptera	Dytiscidae	Diving beetles	*Hydrovatus*	*unknown*					
Coleoptera	Dytiscidae	Diving beetles	*Hyphydrus*	*gabonicus*	x			x	x
Coleoptera	Dytiscidae	Diving beetles	*Hyphydrus*	*sp*	x				x
Coleoptera	Dytiscidae	Diving beetles	*Laccophilus*	*sp*	x			x	
Coleoptera	Dytiscidae	Diving beetles	*Laccophilus*	*taeniolatus*		x			
Coleoptera	Dytiscidae	Diving beetles	*Orectogyrus*	*bicostatus*	x				
Coleoptera	Dytiscidae	Diving beetles	*Synchrortus*	*simplex*	x				
Coleoptera	Gyrinidae	Diving beetles	*Dineutes*	*aereus*		x	x		x
Coleoptera	Gyrinidae	Whirlgig beetles	*Dineutes*	*subspinosus*	x				
Coleoptera	Gyrinidae	Whirlgig beetles	*Orectogyrus*	*bicostatus*	x	x	x	x	
Coleoptera	Hydraenidae	Minute moss beetles					x		
Coleoptera	Hydrochidae	Scavanger water beetles	*Hydrochus*	*sp*					x
Coleoptera	Hydrophilidae	Scavanger water beetles	*Amphiops*	*globus*			x	x	x
Coleoptera	Hydrophilidae	Scavanger water beetles	*Coelostoma*	*phalacroides*		x			
Coleoptera	Hydrophilidae	Scavanger water beetles	*Enochrus*	*sp*	x				
Coleoptera	Hydrophilidae	Scavanger water beetles	*Helochares*	*sp1*		x		x	
Coleoptera	Hydrophilidae	Scavanger water beetles	*Helochares*	*sp2*	x				x
Coleoptera	Hydrophilidae	Scavanger water beetles	*Hydrochares*	*flavipalpis*					x
Coleoptera	Hydrophilidae	Scavanger water beetles	*Neohydrophilus*	*deplanatus*	x	x			x
Coleoptera	Hydrophilidae	Scavanger water beetles	*Regimbartia*	*inflata*		x			
Coleoptera	Hydrophilidae	Scavanger water beetles	*Sternolophus*	*angolensis*				x	
Coleoptera	Hydrophilidae	Scavanger water beetles	*Sternolophus*	*rufipes*	x				
Coleoptera	Noteridae	Burrowing water beetles	*Hydrocanthus*	*micans*			x	x	x
Coleoptera	Noteridae	Burrowing water beetles	*Hydrocanthus*	*sp 2*			x		x
Coleoptera	Scirtidae	Marsh beetles						x	
Decapoda	Potamonautidae	Fresh water crabs	*Potamonautes*	*sp*	x		x		x
Diptera	Athericidae	Water sniper flies				x		x	
Diptera	Chironomidae	Lake flies				x	x	x	x

Order	Family	Common names	Genus	Species	Mkwambani	Mwaweche	Mwandimu	Mwaloya	Bumamani
Diptera	Culicidae	Mosquitoes	*Anopheles*	*sp*		x			
Diptera	Psychodidae	Moth flies	*Sycorax*	*sp*		x			
Diptera	Simuliidae	Black flies	*Simulium*	*sp*		x	x		x
Diptera	Tipulidae	Crane flies				x			
Ephemeroptera	Baetidae	May flies	*Procloen*	*africanum*					
Ephemeroptera	Caenidae	May flies	*Afrocaenis*	*sp*	x				
Ephemeroptera	Leptophlebiidae	May flies	*Euthraulus*	*sp*		x	x	x	x
Gastropoda	-	Limpets	*Ferrissia*	*sp*					x
Gastropoda	Ampullariidae	Snails	*Lanistes*	*ovum*	x		x		x
Gastropoda	Lymnaeidae	Snails	*Galba*	*trucatula*	x				
Gastropoda	Lymnaeidae	Snails	*Radix*	*natalensis*	x				x
Gastropoda	Planorbidae	Snails	*Bulinus*	*forskalii*		x	x		
Gastropoda	Planorbidae	Snails	*Bulinus*	*natalensis*			x		
Gastropoda	Thiaridae	Snails	*Cleopatra*	*ferruginea*	x				
Gastropoda	Thiaridae	Snails	*Melanoides*	*turbeculata*					x
Hemiptera	Belastomatidae	Giant water bugs	*Appasus*	*nephoides*			x	x	
Hemiptera	Belastomatidae	Giant water bugs	*Lethocerus*	*niloticus*	x				
Hemiptera	Corixidae	Water boatmen	*Micronecta*	*eupompe*		x			x
Hemiptera	Corixidae	Water boatmen	*Sigara*	*sp*				x	
Hemiptera	Gerridae	Pond skaters	*Eurymetra*	*sp*	x	x		x	x
Hemiptera	Gerridae	Pond skaters	*Gerris*	*sp*	x	x	x	x	x
Hemiptera	Hydrometridae	Water measurers	*Hydrometra*	*sp*		x			
Hemiptera	Naucoridae	Saucer bugs	*Ctenonipocoris*	*sp*	x	x			
Hemiptera	Naucoridae	Saucer bugs	*Laccocoris*	*sp*			x		
Hemiptera	Naucoridae	Saucer bugs	*Neomacrocoris*	*sp*	x	x	x	x	x
Hemiptera	Nepidae	Water scorpions	*Laccotrephes*	*sp*	x	x		x	x
Hemiptera	Nepidae	Water scorpions	*Laccotrephes*	*unknown*		x			
Hemiptera	Nepidae	Water scorpions	*Rhanatra*	*nodiceps*	x	x	x		x
Hemiptera	Notonectidae	Backswimmers	*Anisops*	*ares*	x		x	x	
Hemiptera	Notonectidae	Backswimmers	*Anisops*	*pallucens*		x			
Hemiptera	Notonectidae	Backswimmers	*Anisops*	*sardea*					x
Hemiptera	Notonectidae	Backswimmers	*Anithares*	*sobria*		x	x		x
Hemiptera	Ochteridae	Velvety shore bugs	*Ochterus*	*marginatus*		x	x		
Hemiptera	Pleidae	Pygmy backswimmers	*Plea*	*sp*			x		
Hemiptera	Veliidae	Water crickets	*Angilia*	*sp*					x
Hemiptera	Vellidae	Water crickets	*Rhagovelia*	*sp*	x	x		x	
Hirudinea	-	Leeches	*Hirudo*	*michaelseni*		x			
Odonata	Aeshnidae	Hawkers	*Anax*	*imperator*		x			
Odonata	Calopterygidae	Demoiselles	*Phaon*	*iridipennis*			x		x
Odonata	Chlorocyphidae	Jewels	*Platycypha*	*caligata*	x	x			x
Odonata	Coenagrionidae	Pond damsels	*Ceriagrion*	*glabrum*	x		x	x	x
Odonata	Coenagrionidae	Pond damsels	*Pseudagrion*	*hageni*				x	x

Order	Family	Common names	Genus	Species	Mkwambani	Mwaweche	Mwandimu	Mwaloya	Bumamani
Odonata	Coenagrionidae	Pond damsels	*Pseudagrion*	*hamoni*			x		
Odonata	Coenagrionidae	Pond damsels	*Pseudagrion*	*kersteni*	x	x	x	x	x
Odonata	Gomphidae	clubtail dragonflies	*Ictinogomphus*	*ferox*			x	x	x
Odonata	Gomphidae	clubtail dragonflies	*Lestinogomphus*	*angustus*				x	x
Odonata	Gomphidae	clubtail dragonflies	*Paragomphus*	*genei*		x		x	x
Odonata	Gomphidae	clubtail dragonflies	*Phyllomacromia*	*contumax*					
Odonata	Libellulidae	Perchers&Skimmers	*Acisoma*	*variegatum*			x		
Odonata	Libellulidae	Perchers&Skimmers	*Chalcostephia*	*flavifrons*	x		x		x
Odonata	Libellulidae	Perchers&Skimmers	*Crocothemis*	*erythraea*			x	x	
Odonata	Libellulidae	Perchers&Skimmers	*Diplacodes*	*lefebvrei*	x				x
Odonata	Libellulidae	Perchers&Skimmers	*Hemistigma*	*albipunctum*					x
Odonata	Libellulidae	Perchers&Skimmers	*Nesciothemis*	*farinosa*					
Odonata	Libellulidae	Perchers&Skimmers	*Orthetrum*	*abboti*	x				
Odonata	Libellulidae	Perchers&Skimmers	*Orthetrum*	*julia*	x	x		x	x
Odonata	Libellulidae	Perchers&Skimmers	*Orthetrum*	*stemmale*	x	x	x	x	x
Odonata	Libellulidae	Perchers&Skimmers	*Orthetrum*	*trinacria*				x	x
Odonata	Libellulidae	Perchers&Skimmers	*Palpopleura*	*lucia*	x	x	x		x
Odonata	Libellulidae	Perchers&Skimmers	*Palpopleura*	*portia*	x	x	x		x
Odonata	Libellulidae	Perchers&Skimmers	*Tramea*	*basilaris*			x		x
Odonata	Libellulidae	Perchers&Skimmers	*Trithemis*	*arteriosa*	x	x		x	x
Odonata	Libellulidae	Perchers&Skimmers	*Trithemis*	*stictita*	x	x		x	x
Odonata	Libellulidae	Perchers&Skimmers	*Zygonx*	*torridus*			x		
Trichoptera	Hydropsychidae	Caddisflies	*Cheumatopsyche*	*sp*	x		x		
Trichoptera	Hydropsychidae	Caddisflies	*Macrosternum*	*capense*	x	x	x	x	x
Trichoptera	Leptoceridae	Caddisflies	*Athripsodes*	*sp*		x		x	x
Trichoptera	Leptoceridae	Caddisflies	*Leptocerina*	*sp*		x	x	x	x
Trichoptera	Leptoceridae	Caddisflies	*Oecetis*	*sp*			x		x
Trichoptera	Leptoceridae	Caddisflies	*Parasetodes*	*sp*		x		x	x
Trichoptera	Leptoceridae	Caddisflies	*Setodes*	*barnardi*		x			
Trichoptera	Philopotamidae	Caddisflies	*Chimarra*	*sp*				x	
Trichoptera	Philopotamidae	Caddisflies	*Chimarra*	*unknown*				x	

Localities of Macro-invertrebrate sampling points

Village	Sampling Point	Coordinates	
Mkwambani	Point 1	37M0553274	UTM 9521302
	Sengenya	37M0553980	UTM 9521794
	Choda	37M0552988	UTM 9520414
	River Mtawa Point 1	37M0551724	UTM 9520736
	River Mtawa Point 2	37M0551705	UTM 9521016
	River Mtawa Point 3	37M0552314	UTM 9520004
Mwaweche	Point 1	37M0549826	UTM 9519090

Village	Sampling Point	Coordinates	
	Point 2	37M0551010	UTM 9518106
Mwandimu	Point 1	37M0552411	UTM 9518304
	Point 2	37M0552794	UTM 9517616
	Point 3	37M0552880	UTM 9517344
Mwaloya	Kidongoweni	37M0549738	UTM 9516216
	Point 2	37M0550382	UTM 9516138
Bumamani	Point 1	37M0551359	UTM 9515284
	Point 2	37M0551518	UTM9514976
	point 3	37M0551591	UTM 9514466

Additional macro-invertebrate species from the Northern Dune area, Kwale, Kenya:

Different species of cased-caddisflies in the family Leptoceridae from the Northern Dune

Macrosternum capense

Cheumatopsyche sp

Caenid mayfly

Baetid mayfly

Leptophlebiid mayfly

Anax imperator

Athericid fly

Simulium sp

Bulinus forskalii

Radix natalensis

Caridina nilotica

ANNEX D: LEPIDOPTERA SPECIES OBSERVED

Genus	Species	21/7- Mwaloya	22/7- Mwandimu	23/7- Mkwambwani	24/7- Bumanani	26/7- Muwache	27/7- Bumanani	28/7- Mwaloya	29/7- Mwandimu	30/7- Mkwambani	31/7 (Half day) Mwaloya
Papilio	*dardanus*	1	1	1	1	1	1	1	1	1	1
Papilio	*nireus*	1	1	1	1	1	1	1	1	1	1
Papilio	*demodocus*	1	1	1	1	1	1	1	1	1	1
Graphium	*angolanus*	1	1	1	1	1	1	1	1	1	1
Graphium	*leonidas*		1	1					1		
Graphium	*philonoe*	1	1	1	1		1			1	1
Graphium	*colonna*		1		1	1		1	1	1	
Graphium	*antheus*		1	1					1		
Graphium	*porthaon*								1		
Graphium	*polistratus*				1		1	1	1		
Pinacopteryx	*eriphia*				1	1		1			
Catopsilia	*florella*	1	1	1	1	1	1	1	1	1	1
Eurema	*hecabe*	1	1	1	1	1	1	1	1	1	1
Eurema	*regularis*		1	1	1	1	1	1	1	1	1
Eurema	*brigitta*	1	1	1	1	1	1	1	1	1	1
Nepheronia	*argia*		1				1		1		
Colotis	*danae*		1								
Colotis	*euippe*		1	1	1	1	1		1		
Belenois	*aurota*			1		1					
Belenois	*creona*		1	1	1			1	1	1	1
Belenois	*gidica*			1							
Belenois	*thysa*	1	1	1	1	1	1	1	1	1	1
Leptosia	*alcesta*		1	1				1			
Appias	*epaphia*		1	1	1	1	1	1	1	1	
Appias	*lasti*		1	1	1	1	1	1	1	1	1
Mylothris	*agathina*	1	1	1	1	1	1	1	1	1	1
Pentila	*tropicalis*	1	1	1	1	1	1	1	1	1	1
Teriomima	*subpunctata*		1	1	1		1		1		1
Baliochila	*hildegarda*				1	1		1	1	1	1
Baliochila	*minima*							1			
Spalgis	*lemolea*	1						1			1
Myrina	*silenus*		1								
Cigaritis	*nyassae*		1		1	1					
Cigaritis	*mozambica*		1		1	1					
Cigaritis	*apelles*					1	1	1	1		
Cigaritis	*homeyeri*		1			1					
Axiocerses	*styx*			1							
Axiocerses	*punicea*		1	1	1	1	1	1	1	1	1
Iolaus	*silanus*			1				1		1	1
Iolaus	*lalos*							1			1
Hypolycaena	*philippus*		1	1	1	1	1	1	1	1	1
Hypolycaena	*buxtoni*		1								
Hypolycaena	*antifaunus*										
Pilodeudorix	*caerulea*	1	1	1	1		1			1	

Genus	Species	21/7- Mwaloya	22/7- Mwandimu	23/7- Mkwambwani	24/7- Bumanani	26/7- Muwache	27/7- Bumanani	28/7- Mwaloya	29/7- Mwandimu	30/7- Mkwambani	31/7 (Half day) Mwaloya
Deudorix	*dariaves*	1				1			1	1	
Deudorix	*antalus*	1									
Deudorix	*diocles*									1	
Deudorix	*dinochares*			1	1						
Deudorix	*dinomenes*				1	1	1			1	
Anthene	*rubrimaculata*	1	1	1	1			1	1	1	1
Anthene	*liodes*				1						
Anthene	*larydas*			1	1			1	1	1	1
Anthene	*lasti*			1							
Anthene	*lemnos loa*			1				1			
Anthene	*ligures*				1						
Cupidopsis	*iobates*	1	1	1	1		1			1	
Lampides	*boeticus*	1	1	1	1	1	1	1	1	1	1
Cacyreus	*lingeus*	1		1							
Leptotes	*pirithous*	1	1	1	1	1	1	1	1	1	1
Thermoniphas	*micylus colorata*	1	1	1	1	1	1	1	1	1	1
Tarucus	*grammicus*	1									
Zizeeria	*knysna*	1	1	1	1	1	1	1	1	1	1
Zizina	*antanossa*	1	1	1	1	1	1	1	1	1	1
Zizula	*hylax*	1	1	1	1	1	1	1	1	1	1
Azanus	*moriqua*			1	1	1	1		1		1
Eicochrysops	*hippocrates*	1	1	1	1	1	1		1	1	1
Euchrysops	*osiris*	1	1	1						1	
Lepidochrysops	*peculiaris*									1	
Oboronia	*guessfeldti/beuronia*					1		1			1
Danaus	*chrysippus*	1	1	1	1	1	1	1	1	1	1
Tirumala	*petiverana*		1	1							
Amauris	*niavius*		1	1	1	1	1	1	1	1	1
Amauris	*ochlea*	1	1	1	1		1	1	1	1	1
Melanitis	*leda*	1	1	1	1	1	1			1	1
Bicyclus	*campinua*			1						1	
Bicyclus	*anynana*	1	1	1	1	1	1	1	1	1	
Bicyclus	*safitza*	1	1	1	1	1	1	1	1	1	1
Brakefieldia	*perspicua*	1	1	1	1		1		1	1	1
Ypthima	*asterope*	1	1	1	1	1	1	1	1	1	1
Ypthimomorpha	*itonia*			1							
Physcaeneura	*leda*	1	1	1	1	1	1	1	1	1	1
Charaxes	*varanes*		1	1	1	1	1	1	1	1	1
Charaxes	*candiope*			1	1	1			1		
Charaxes	*protoclea*								1		1
Charaxes	*macclounii*			1							
Charaxes	*brutus*	1	1					1		1	1
Charaxes	*violetta*		1								
Charaxes	*cithaeron*		1								
Charaxes	*ethalion*		1							1	

Genus	Species	21/7- Mwaloya	22/7- Mwandimu	23/7- Mkwambwani	24/7- Bumanani	26/7- Muwache	27/7- Bumanani	28/7- Mwaloya	29/7- Mwandimu	30/7- Mkwambani	31/7 (Half day) Mwaloya
Euxanthe (Charaxes)	*wakefieldi*		1		1						
Bebearia	*orientis*	1	1	1	1	1	1	1	1	1	1
Euphaedra	*neophron*	1	1	1	1	1	1	1	1	1	1
Aterica	*galene*				1						
Cymothoe	*coranus*							1			
Cymothoe	*hobarti*										
Euptera	*kinugnana*				1			1	1		1
Pseudacraea	*eurytus*				1						1
Pseudacraea	*lucretia*	1	1	1	1			1	1	1	1
Pseudacraea	*boisduvali*						1				
Neptis	*saclava*	1							1		
Neptis	*serena*		1	1	1	1	1	1	1	1	1
Neptis	*kiriakoffi*		1	1	1	1	1	1	1	1	1
Neptis	*morosa*			1	1	1	1				
Neptis	*trigonophora*								1		
Byblia	*antavarta*	1	1	1	1	1	1	1	1	1	1
Neptidopsis	*fulgurata*	1	1	1					1		
Eurytela	*dryope*		1	1	1	1	1	1	1	1	1
Hypolimnas	*misippus*	1	1	1	1			1			
Hypolimnas	*deceptor*			1	1		1	1	1		
Hypolimnas	*usambara*							1			
Hypolimnas	*anthedon*				1	1	1	1	1		
Salamis	*anacardii*	1	1	1	1	1	1	1	1	1	1
Salamis	*parhassus*		1		1				1		
Junonia	*orithya*		1	1		1	1			1	
Junonia	*oenone*	1	1	1	1	1	1	1		1	1
Junonia	*hierta*			1				1			
Junonia	*natalica*	1	1	1	1	1	1	1	1	1	1
Catacroptera	*cloanthe*			1	1	1	1				
Vanessa	*cardui*		1					1			
Phalanta	*phalantha*	1	1	1	1	1	1	1	1	1	1
Phalanta	*eurytis*		1	1							
Acraea	*baxteri*			1							
Acraea	*encedon*		1	1	1	1	1	1	1	1	1
Acraea	*esebria*				1		1				
Acraea	*serenna*	1	1	1	1	1	1	1	1		1
Acraea	*egina*				1			1			1
Acraea	*natalica*	1	1	1	1	1	1	1	1	1	1
Acraea	*zetes*			1				1		1	
Acraea	*boopis*			1			1				
Acraea	*insignis*							1			
Acraea	*machequana*			1							
Pardopsis	*punctatissima*	1									
Coeliades	*forestan*	1		1	1	1	1	1		1	1
Coeliades	*sejuncta*				1						1

Genus	Species	21/7- Mwaloya	22/7- Mwandimu	23/7- Mkwambwani	24/7- Bumanani	26/7- Muwache	27/7- Bumanani	28/7- Mwaloya	29/7- Mwandimu	30/7- Mkwambani	31/7 (Half day) Mwaloya
Tagiades	*flesus*	1	1	1	1	1	1	1	1	1	
Sarangesa	*maculata*	1		1		1	1		1	1	1
Spialia	*diomus*	1			1		1	1	1	1	1
Astictopterus	*stellata*							1			
Gorgyra	*subflavidus*		1								
Gorgyra	*johnstoni*								1		
Pardaleodes	*incerta*	1				1	1	1	1	1	1
Teniorhinus	*herilus*						1	1			
Teniorhinus	*harona*					1					
Acleros	*mackenii*		1					1		1	1
Andronymus	*caesar*		1		1						
Zophopetes	*nobilior*		1								
Artitropa	*reducta*										1
Artitropa	*erinnys*									1	1
Gretna	*carmen*					1		1			
Pelopidas	*thrax*		1	1	1	1	1	1	1	1	1
Borbo	*fatuellus*	1	1	1	1	1	1	1	1	1	1
Borbo	*lugens*	1	1	1	1	1	1	1	1	1	1
Borbo	*ferruginea*		1								
Borbo	*gemella*		1	1		1	1	1	1	1	1
Borbo	*borbonica*	1	1	1		1	1	1	1	1	
Gegenes Afrogegenes	*pumilio*	1			1						
Cupidopsis	*cissus*		1	1	1	1	1		1	1	1
Astigotera	*parva*				1		1		1		
Totals		59	89	93	89	73	76	83	80	77	73

ANNEX E: CRITICAL HABITAT ASSESSMENT METHODS

Critical Habitat Criteria

The term Critical Habitat is broadly defined in Paragraph 16 of IFC Performance Standards (IFC, 2012) as areas with high biodiversity value: *'Critical habitats" are areas with high biodiversity value, including:*

i. habitat of significant importance to Critically Endangered and/or Endangered species;
ii. habitat of significant importance to endemic and/or restricted-range species;
iii. habitat supporting globally significant concentrations of migratory species and/or congregatory species;
iv. highly threatened and/or unique ecosystems; and/or
v. areas associated with key evolutionary processes.'

Further description of each of the criteria follows below.

Criterion 1: Critically Endangered and/or Endangered Species

The IFC Performance Standards defines Endangered (EN) and Critically Endangered (CR) according to the IUCN definitions, and as listed in the IUCN Red List of Threatened Species (Red List). The guidance on applying a particular listing is as follows:

- If the species is listed nationally or regionally as EN or CR, in countries that adhere to IUCN guidance, the critical habitat determination will be made on a project by project basis in consultation with competent professionals; and
- In instances where nationally or regionally listed species' categorizations do not correspond well to those of IUCN (e.g., some countries more generally list species as 'protected' or 'restricted'), an assessment will be conducted to determine the rationale and purpose of the listing. In this case, the critical habitat determination will be based on such an assessment.

In the case of this CHA, the list of critically endangered and endangered species was derived from the Ugandan (WCS, 2016) and IUCN (2019) red lists.

Criterion 2: Endemic and/or Restricted-range Species

The IFC Performance Standards provide the following definitions for endemic and restricted-range species.

- An endemic species is defined as one that has ≥ 95% of its global range inside the country or region of analysis.
- A restricted-range species is defined as follows:
  - For terrestrial vertebrates, a restricted-range species is defined as those species which have an extent of occurrence of 50,000 km^2 or less.
  - For freshwater systems, standardized thresholds have not been set at the global level. However, an IUCN study of African freshwater biodiversity determined thresholds of 20,000 km^2 for crabs, fish, and molluscs and 50,000 km^2 for odonates (dragonflies and damselflies). These can be taken as approximate guidance values, although the extent to which they are applicable to other taxa and in other regions is not yet known.
  - For plants, restricted-range species may be listed as part of national legislation. Plants are more commonly referred to as "endemic" and the definition provided in paragraph GN79 would apply.

Species listed within the various sources consulted were screened to identify whether they meet the definition of either endemic (country or regional) and / or range-restricted species. This was completed in liaison with available literature as well as expert knowledge and field data.

Criterion 3: Migratory and Congregatory Species

The IFC Performance Standards define migratory and congregatory species in the following way:

- Migratory species are any species of which a significant proportion of its members cyclically and predictably move from one geographical area to another (including within the same ecosystem).
- Congregatory species include the following:
  - Species whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis.
  - Species that form colonies.
  - Species that form colonies for breeding purposes and/or where large numbers of individuals of a species gather at the same time for non-breeding purposes (e.g., foraging, roosting).
  - Species that move through bottleneck sites where significant numbers of individuals of a species pass over a concentrated period of time (e.g., during migration).
  - Species with large but clumped distributions where a large number of individuals may be concentrated in a single or a few sites while the rest of the species is largely dispersed.
  - Source populations where certain sites hold populations of species that make an inordinate contribution to recruitment of the species elsewhere (especially important for marine species).

Species listed within the various sources consulted were screened to identify whether they meet one of the definitions of migratory, congregatory or resident species. This was completed in liaison with available literature as well as expert knowledge and field data.

Criterion 4: Highly Threatened and/or Unique Ecosystems

The IFC Performance Standards defines highly threatened or unique ecosystems as those that:

- Are at risk of significantly decreasing in area or quality;
- Are of small spatial extent; and/or
- Contain unique assemblages of species including assemblages or concentrations of biome-restricted species (species whose distributions are largely or wholly confined to one biome).

Rodriguez et al. (2011) proposed the assignment of levels of threat to ecosystems at local, regional, and global levels (such as those used for species by IUCN) based on four main criteria:

- Short-term decline in distribution or function (over 50 years);
- Long-term decline in distribution or function (over 500 years);
- Small current distribution and decline (in distribution or ecological function) or very few locations; and
- Very small current distribution.

Bland et al. (2016) refined the assignment of levels of threat to ecosystems at local, regional, and global levels (such as those used for species by IUCN) based on five main criteria:

- Reduction in geographic distribution, which identifies ecosystems that are undergoing declines in area, most commonly due to threats resulting in ecosystem loss and fragmentation;
- Restricted geographic distribution, which identifies ecosystems with small distributions that are susceptible to spatially explicit threats and catastrophes;
- Environmental degradation
- Disruption of key biotic processes or interactions of ecosystems; and
- Quantitative analysis that estimates the probability of ecosystem collapse, which allows for an integrated evaluation of multiple threats, symptoms, and their interactions

Criterion 5: Key Evolutionary Processes

Evolutionary processes are often strongly influenced by structural attributes of a region, such as its topography, geology, soil and climate over a period of time. The IFC Performance Standards suggests that this criterion is defined by:

- Physical features of a landscape that might be associated with particular evolutionary processes; and/or
- Sub-populations of species that are phylogenetically or morphogenetically distinct and may be of special conservation concern given their distinct evolutionary history (i.e., Evolutionarily Distinct and Globally Endangered (EDGE) species or Evolutionary Significant Units at population level).

The Guidance Notes provide the following examples of spatial features that are associated with evolutionary processes:

- Level of isolation (e.g., islands, mountaintops, lakes are associated with populations that are phylogenetically distinct);
- Extent of endemism (areas of high endemism often contain flora and/or fauna with unique evolutionary histories);
- Spatial heterogeneity;
- Presence of environmental gradients (ecotones produce transitional habitat which has been associated with the process of speciation and high species and genetic diversity);
- Edaphic interfaces; and
- Connectivity between habitats (e.g., biological corridors).

Criterion 5 is usually considered to be heavily reliant on scientific knowledge, and thus would be triggered in areas that have already been thoroughly investigated or where significant research has been conducted that may have already indicated the potential or existence of unique evolutionary processes. Measurements and methods to identify evolutionary processes exist, but are usually out of the scope of EIA studies; therefore, the presence of such processes has been screened according to available information.

Other Criteria

In addition, as specified by the Guidance Notes, the CHA can consider other recognised high biodiversity values, which are to be evaluated on a case-by-case basis. The Guidance Notes provide the following examples:

- Areas required for the reintroduction of Endangered (EN) or Critically Endangered (CR) species and refuge sites for these species (i.e., habitat used during periods of stress such as flood, drought or fire);
- Ecosystems of known special significance to EN or CR species for climate adaptation purposes;
- Concentrations of Vulnerable (VU) species in cases where there is uncertainty regarding the listing, and the actual status of the species may be EN or CR;
- Areas of primary/old-growth/pristine forests and/or other areas with especially high levels of species diversity;
- Landscape and ecological processes (e.g., water catchments, areas critical to erosion control, disturbance regimes (e.g., fire, flood)) required for maintaining critical habitat;
- Habitat necessary for the survival of keystone species; and
- Areas of high scientific value such as those containing concentrations of species new and/or little known to science.

Furthermore, the Guidance Notes indicate that internationally and/or nationally recognised areas of high biodiversity value will likely qualify as critical habitat; examples include the following:

- Areas that meet the criteria of the IUCN's Protected Area Management Categories Ia, Ib and II. Areas that meet criteria for Management Categories III-VI may also qualify depending on the biodiversity values inherent to those sites;
- UNESCO Natural World Heritage Sites that are recognised for their Outstanding Universal Value;
- The majority of Key Biodiversity Areas (KBAs), which encompass inter alia Ramsar Sites, Important Bird Areas (IBA), Important Plant Areas (IPA) and Sites identified as important by the Alliance for Zero Extinction (AZE).
- Areas determined to be irreplaceable or of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by governmental bodies, recognised academic institutions and/or other relevant qualified organizations (including internationally-recognised NGOs).
- Areas identified as High Conservation Value (HCV) using internationally recognised standards, where criteria used to designate such areas are consistent with the high biodiversity values provided in the IFC Performance Standards.

The above, as well as the above criteria 1 to 4, were summarised by the IUCN when defining the 'Global Standard for the Identification of Key Biodiversity Areas' (IUCN, 2016), which were also used to determine if any Key Biodiversity Areas were present within or adjacent to the project footprint area.

Summary and Quantitative Criteria

The IFC Performance Standards recognise that there are gradients of critical habitat or a continuum of degrees of biodiversity value associated with critical habitats, based on the relative vulnerability (degree of threat) and irreplaceability (rarity or uniqueness) of the specific location. *Even within a location designated as Critical Habitat, there might be habitats or habitat features of higher or lower biodiversity value. There also will be cases where a project is positioned within a greater area recognised as Critical Habitat, but where the specific project footprint area itself has already been highly modified*.

The criteria for determining a Critical Habitat as such, as well as the quantitative criteria that should be applied as far as possible to a Critical Habitat Assessment, are summarised in **Error! Reference source not found.** below.

Summary of Criteria and Quantitative Thresholds for a Critical Habitat Assessment

Criteria	Threshold	Note
1: Critically Endangered & Endangered Species	(a) Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (**≥0.5%** of the global population AND **≥5** reproductive units of a CR or EN species).	National/regional IUCN CR/EN species determined on project-by-project basis with competent professionals.
	(b) Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in GN72(a).	
	(c) As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species.	
2: Endemic & Restricted-range Species	(a) Areas that regularly hold **≥10%** of the global population size AND **≥10** reproductive units of a species.	**Terrestrial vertebrates & plants:** EOO is <50,000km2. **Marine:** EOO is <100,000 km2. **Coastal, riverine, aquatic:** Where habitats <200 km wide at any point, EOO is <500 km long
3: Migratory & Congregatory Species	(a) Areas known to sustain, on a cyclical or otherwise regular basis, **≥1%** of the global population of a migratory or congregatory species at any point of the species' lifecycle.	**Migratory:** significant proportion of pop move cyclically and predictably from one geographical area to another. **Congregatory:** individuals gather in large groups on cyclical/regular and/or predictable basis.
	(b) Areas that predictably support **≥10%** of the global population of a species during periods of environmental stress.	
4: Highly Threatened/ Unique Ecosystems	(a) Areas representing **≥5%** of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN.	Where IUCN assessments don't exist, may use assessments using systematic methods at the national/regional level, carried out by gov/academic/NGOs.
	(b) Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.	
5: Key Evolutionary Processes	• Landscapes with high spatial heterogeneity • Environmental gradients • Edaphic interfaces • Connectivity between habitats • Sites of demonstrated importance to climate change adaptation	Significance of structural attributes in a landscape determined on case-by-case basis, and determination of critical habitat will be heavily reliant on scientific knowledge. In majority of cases, criterion will apply in areas that have been previously investigated and that are already known or suspected to be associated with unique evolutionary processes.

Source: IFC, 2012 (Guidance Note 6, June 2019)

The extent of use of applying thresholds depends on the availability of estimates of species global/local population either from published sources or obtainable by reasonable means through an in-field assessment in the case of a range-restricted, local population. Should this type of information not be available for any of the species under consideration in an CHA, expert opinion can be used to determine the significance of the unit of analysis for CHA with respect to the global population. Surrogates of population size (e.g., extent of occurrence, estimates of total area of known sites, estimates of area of occupied habitat) can aid in this process.

Criterion 4 is triggered by ecosystems that are threatened, house unique assemblages of biome-restricted species, or are recognized for high conservation value, including protected areas. Quantitative thresholds are still relatively vague; nonetheless, quantitative categories and criteria from Rodriguez et al. (2011) and Bland et al. (2016) as listed in Section 2.5.1.4 above may be applied to evaluate ecosystem status if availability and quality of data allow.

Criterion 5 applies to landscape-level features that can influence key evolutionary processes. Key landscape features such as unique topography that creates unique habitats and areas important for climate change adaptations have been identified using literature review and through expert consultation. This criterion also applies at the species level for 'distinct species' which includes those coined as 'Evolutionarily Distinct and Globally Endangered' (EDGE) (GN 95 IFC 2012b). Species within the unit of analysis identified as EDGE species where evaluated for Critical Habitat on a case-by-case basis.

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APPENDIX I STAKEHOLDER ENGAGEMENT PLAN

Base Titanium North Dune Extension, Kwale

Stakeholder Engagement Plan (SEP)

14 October 2020

Project No.: 0547330

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14 October 2020

Base Titanium North Dune Extension, Kwale

Stakeholder Engagement Plan (SEP)

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Acronyms and Abbreviations

Name	Description
AfDB	African Development Bank
BID	Background Information Document
BLT	Base Titanium Limited
CAO	Community Awareness Officer
CBO	Community Based Organizations
CCDMP	Community and Capacity Development Management Plan
CECM	County Executive Committee Members
CHO	Community Health Organization
CHSMP	Community Health and Safety Management Plan
CIDP	County Integrated Development Plan
CLO	Community Liaison Officer
CLS	Community Liaison Superintendent
CPS	Community Programmes Superintendent
DC	Data Controller
DCC	Deputy County Commissioner
E&S	Environmental and Social
EA	Environmental Audit
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EMA	Environmental Management Act
EMCA	Environmental Management Coordination Act
EPL	Exploration Prospecting Licence
ERM	Environmental Resources Management
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FGD	Focus Group Discussion
FPIC	Free Prior Informed Consent
GoK	Government of Kenya
GRM	Grievance Redress Mechanism
GRS	Grievance Record Sheet
GT	Grievance Tracker
HMC	Heavy Mineral Concentrate
HMS	Heavy Mineral Sands
HMUS	Hydraulic Mining Units
IFC	International Finance Corporation
KEMFRI	Kenya Marine and Fisheries Research Institute
KENAFF	Kenya National Farmers Federation

KEPSA	Kenya Private Sector Alliance
KIIs	Key Informant Interviews
KPIs	Key Performance Indicators
LRP	Livelihood Restoration Plan
MOA	Ministry of Agriculture
MoU	Memorandum of Understanding
MPLC	Mining Project Liaison Committee
MSP	Mineral Separation Plant
NGOs	Non - Governmental Organizations
NGOs	Non-Governmental Organizations
PAP	Project Affected Persons
PPE	Personal Protective Equipment
RAP	Resettlement Action Plan
RSEP	Resettlement Stakeholder Engagement Plan
SCA	Sub-County Administrator
SEA	Strategic Environmental Assessment
SEP	Stakeholder Engagement Plan
SMP	Social Management Plan
TSF	Tailing Storage Facility
VCM	Village Committee Member
WCP	Wet Concentrator Plant
WRA	Water Resources Authority

1. INTRODUCTION

1.1 Project Context

Base Titanium Limited (BTL) is a wholly-owned subsidiary of Australian and UK-listed resources company, Base Resources Limited. Located in Kwale County, 50km south of Mombasa, it operates Kenya's largest mine, which was officially awarded flagship project status under Kenya's Vision 2030 national development blueprint.

The current mineral resource mined by Base Titanium comprises two dunes that contain economically viable concentrations of heavy minerals. These two dunes, known as the Central and South Dunes, are separated by the Mukurumudzi River, on which the Mukurumudzi Dam has been built, and are located in the Mwaweche and Kidiani adjudication sections respectively. The current Special Mining licence (SML) 23, measuring 1,661 hectares, is located within the overall Kwale Exploration Prospecting License (EPL) 173 area of 88km^2 and is located approximately 50km to the south of Mombasa, and 10km inland from the Indian Ocean.

Public participation is an integral part of the Environmental and Social Impact Assessment (ESIA) process as provided for in the Constitution of Kenya 2010, the Environmental Management and Coordination Act (EMCA) 1999 and the Environmental (Impact Assessment and Audit) Regulations 2003. It provides an open, accountable and structured platform where stakeholders interact, exchange views and influence decision making in development projects, plans, programs and policies.

The objective of this Stakeholder Engagement Plan (SEP) is to provide a detailed analysis of stakeholders and a structured approach to public consultation and disclosure accordance with the necessary Kenyan legal requirements and International Best Practice requirements. This is a 'live' document that shall be reviewed during the transition from construction to operations to ensure it is focussed on anticipated changes in stakeholder issues.

1.2 Project Overview

Mining activities within the North Dune will involve the establishment of Hydraulic Mining Units (HMUs) – similar to those currently used on the South Dune, workshops and supporting infrastructure such as slurry pipelines, to enable mining, handling of the ore, and pumping of the slurry (ore with water) to the wet Concentrator Plant (WCP), where the mined ore is processed. A separate Tailings Storage Facility (TSF) will be required for the containment and disposal of slimes from the process, whilst coarser sands will be used to rehabilitate previously mined-out areas.

The existing haul road will be used to transport the saleable products from the processing plant to the point of shipping. The existing Likoni Shiploading Facility will continue to be used by Base for exporting its ilmenite and rutile products, while zircon will be containerised and trucked to existing container facilities in the Port of Mombasa.

The first phase of the project will involve the clearance of vegetation, and the separation and stockpiling of topsoil for use in the rehabilitation process. Site roads will need to be created to allow for clearing, as well as provide access for mining equipment that will need to be established during the site preparation phase. In addition to the 4 x HMUs that will need to be established on the North Dune site, power lines, pump stations, piping for water and ore slurry, and an equipment yard will need to be established.

During the Operational Phase, the mine will be operated continuously (7 days a week, 24 hours a day on a 12-hour shift system). Operations in the North Dune are expected to commence in 2024 once mining in the South Dune Extension is completed. As areas are mined, mined-out areas will be rehabilitated and the mined-out areas in-filled by coarse tailings from the Processing Plant and stockpiled topsoil. The conceptual mine work plan will be refined throughout the process, taking into consideration the environmental, health and safety, social, and labour considerations. The proposed

project has a lifespan of between 4.5 to 5 years; after which, all infrastructure will be dismantled and removed. Machinery, steel, and dismantled materials will be sold, recycled where possible, or disposed of at licensed disposal sites. The North Dune will then be closed in conformance with Base's existing Mine Closure Plan, which has been prepared for the site as a whole.

It is anticipated that there shall be grievances during the construction, operation and decommissioning phase. *Section 7* of this SEP outlines the Grievance Redress Mechanism (GRM) that will be used during these project activities.

Figure 1-1 below describes the Kwale Operation Mining Process.

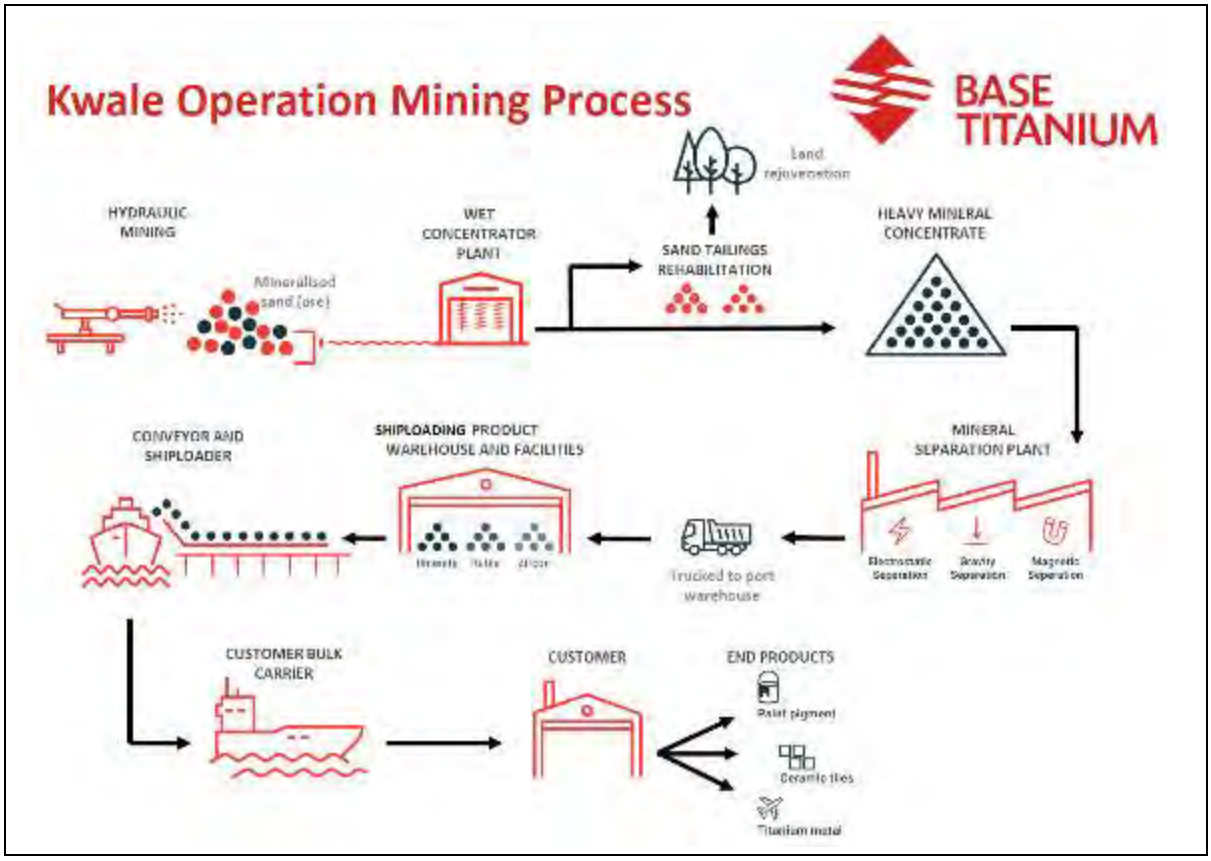

Figure 1-1: Schematic of the mining process.

1.3 Project Site Characteristics

The Kwale Mineral Sands Operation is located in Msambweni Sub-county, Kwale County. Msambweni is 3,267km^2 in size and lies between the Latitudes of 3°3" and 4°45" South and Longitudes 38°31" and 39°31" East, about 10km inland of the Indian Ocean, East of Shimba Hills Town. It is bordered by Taita-Taveta County to the West, Kilifi County to the North, Mombasa County, and the Indian Ocean to the East and the Republic of Tanzania to the South.

The current mineral deposit is divided into the Central Dune (Maumba area), and the South Dune (Nguluku area). The two large dunes are separated by the Mkurumudzi River. Base Titanium has completed mining activity in the Central Dune resource which is currently under rehabilitation. Mining in the South Dune is ongoing while mining in the South Dune extension is planned to commence in mid-2021. Mining in the South Dune, including the South Dune Extension, will be completed late in 2023. The proposed mining area; the 'North Dune', and the subject of this Stakeholder Engagement

Plan (SEP), is located to the north-east of Base's current operation's offices and plan as shown in Figure 1-2 below.

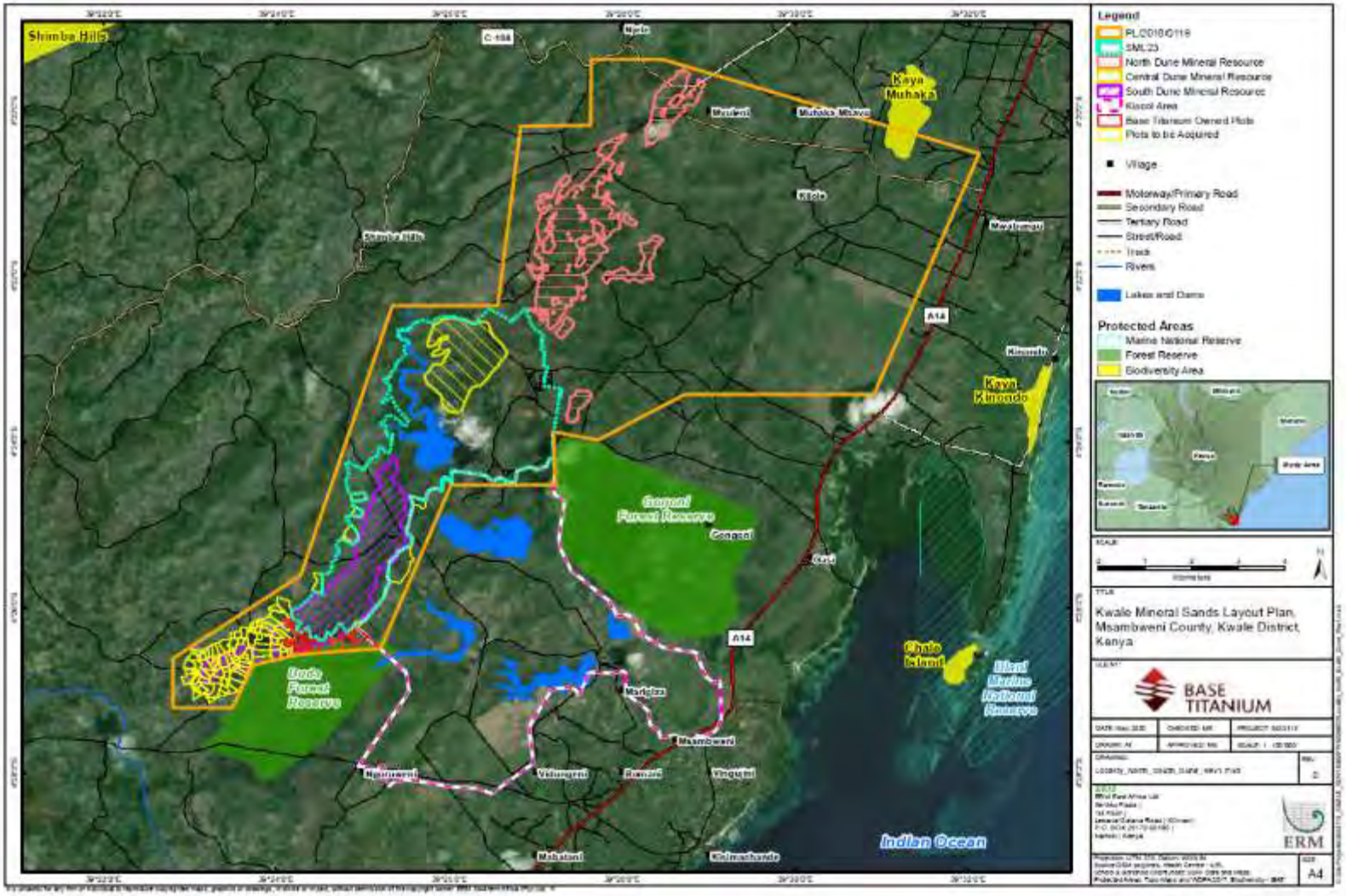

Figure 1-2: Location Map

1.4 Purpose of the Stakeholder Engagement Plan

The overall aim of this Stakeholder Engagement Plan (SEP)[1] is to ensure that a consistent, comprehensive, coordinated and culturally appropriate approach is taken to stakeholder engagement and Project disclosure throughout the North Dune ESIA process and beyond. It is further intended to demonstrate the commitment of Base to an international best practice approach to engagement. Base is committed to full compliance with all Kenyan EIA Regulations, as well as to aligning with the international standards, namely the IFC Performance Standards, as discussed further in *Chapter 2.*

In line with current international best practice, this SEP aims to ensure engagement that is meaningful, and free of manipulation, interference, coercion and intimidation. It also aims to ensure that stakeholder engagement is conducted on the basis of timely, relevant, understandable and accessible information, in a culturally appropriate format. The Project will work to build and maintain strong relationships with the host communities as the proposed Project is implemented. To achieve this, the Base will engage with the affected communities as appropriate on issues that could potentially affect them. In this way, the SEP seeks to ensure that stakeholder groups are given sufficient opportunity to voice their opinions and concerns, and are made aware that these concerns influence project decisions. A grievance mechanism will also be established to allow stakeholders to give feedback on any issues they might have, and to seek resolution to these issues.

Due to the COVID-19 Global Pandemic impact upon Kenya in 2020, stakeholder engagement techniques utilized during the preparation of the ESIA and Resettlement Framework were adapted to ensure the safety of both the affected communities, and the consultant workforce. The adapted techniques are described in Section 4.5.2 of this SEP and were developed with the guidance of NEMA, and respective recommendations from the IFC.

Beyond engagement undertaken to date, ongoing engagement will also be required for other elements of the proposed Kwale North Dune Mineral Sands Project; notably the land acquisition and resettlement process, and for Project implementation. A separate Resettlement Stakeholder Engagement Plan (RSEP) will be developed for those elements based on the principles outlined here.

This SEP should be seen as a “living document” that will be updated and adjusted continuously as Project planning and implementation evolves. It will continue to provide a framework to manage effective and meaningful engagement with stakeholders, throughout the life of the Project.

1.5 Objectives of Stakeholder Engagement

The main objectives of stakeholder engagement are to:

Identify relevant stakeholders for the Project: Involving stakeholders to facilitate inclusive communication and capture a wide range of issues and concerns.

Promote cooperation and positive participation from stakeholders: Ensuring that an open, inclusive and transparent process of culturally appropriate engagement and communication is undertaken, to ensure that stakeholders are well informed about the Project. Information shall be disseminated using the most effective methods and structures.

Distribute accurate Project information in an open and transparent manner: Ensuring that stakeholders, particularly those directly affected by the proposed development, have information at their disposal with which to make informed comments and enable them to plan. This reduces levels of uncertainty and manages expectations. Information should allow affected parties to develop an understanding of potential impacts, risks and benefits and an open and transparent approach is central to achieving this aim.

Form partnerships to promote constructive interaction between all parties, developing relationships of trust between the Project and stakeholders: This will contribute to proactive

[1] This Stakeholder Engagement Plan (SEP) is an update of the Base Titanium SEP developed in October 2011.

interactions and avoid where possible, unnecessary conflicts based on rumour and misinformation. Identifying structures and processes through which to deal with conflicts and grievances, in contrast to attempting to quash any disputes, would afford the Project a better understanding of stakeholder concerns and expectations thereby increasing the opportunities to increase the Project's value to local stakeholders.

Record and address public concerns, issues and suggestions: Documenting stakeholder issues allows Project decisions to be traced and motivated. This approach addresses potential concerns that stakeholder engagement may be a token gesture by the developer that meets requirements but that it is not taken seriously in the Project planning.

Manage stakeholders' expectations: Ensuring that the proposed Project does not create or allow unrealistic expectations to develop amongst stakeholders about proposed Project benefits. The engagement process will serve as a mechanism for understanding and managing stakeholder and community expectations, where the latter will be achieved by disseminating accurate information in an accessible way.

Fulfil national and international requirements for consultation: Ensure compliance with both local regulatory requirements and international best practice. One of the key outcomes of engagement should be free, prior and informed consultation of stakeholders, where this is understood to be: engagement free of external manipulation or coercion and intimidation.

Ensure that appropriate Project information on environmental and social risks and impacts is disclosed to stakeholders: In a timely, understandable, accessible and appropriate manner and format.

1.6 Structure of the SEP

The remainder of the document is structured as follows:

Section 2: Outlines the Key Standards and Legislation guiding Stakeholder Engagement.

Section 3: Presents Project Stakeholder Identification and Mapping.

Section 4: Outlines the Approach to the Stakeholder Engagement Process/ Communication Plan.

Section 5: Presents the Scoping and ESIA Phase Stakeholder Engagements

Section 6: Next steps in Stakeholder Engagement/ Post-ESIA Stakeholder Engagement

Section 7: Outlines the Grievance Redress Mechanism.

Section 8: Roles and Responsibilities

Section 9: Outlines the Monitoring and Reporting.

2. KEY STANDARDS AND LEGISLATION GUIDING STAKEHOLDER ENGAGEMENT

2.1 Introduction

The stakeholder engagement process has been designed to ensure compliance with both Kenyan legislative requirements, as well as international best practice standards, with heavy emphasis on the IFC Performance Standards. Base Titanium will continue to comply with the local legislative requirements and international best practice in all their operational activities in the Project area. This Chapter presents the relevant standards and legislation identifying the key Kenyan and international requirements for engagement. The focus is only on legislation that relates directly to public participation requirements.

2.2 Kenyan Legislative Requirements

2.2.1 The Kenyan Constitution (2010)

Part II Section (I) of the Kenyan Constitution encourages public participation in the management, protection and conservation of the environment.

In conducting the Project ESIA and stakeholder engagement process, the Project has and will continue to facilitate the effective participation of the public in the Project, as well as in identifying potential impacts, and how these can be managed in a manner that strives to protect both the physical and social receiving environments of the Project Footprint and surrounds.

Ongoing engagement during construction and operation will ensure that the public continue to be involved in the protection of the biophysical and social environment.

2.2.2 Environmental Legislation

The Environmental Management and Coordination Act, 1999, Amended 2015 (EMCA) Section 59 of EMCA (1999) outlines the stakeholder engagement requirements for both the Proponent and the NEMA. The Environmental (Impact Assessment and Audit) Regulations, 2003 outline various requirements with regards to stakeholder engagement. Section 17 provides specific requirements for stakeholder engagement during the ESIA process. The requirements outlined in the Regulations specifically relate to stakeholder engagement activities that are to be conducted during the ESIA process and are presented in Box 2-1.

Stakeholder Engagement Requirements in Section 59 EMCA 1999

EMCA states that:

(1) Upon receipt of an environmental impact assessment study report from any proponent under section 58(2), the Authority shall cause to be published for two successive weeks in the Gazette and in a newspaper circulating in the area or proposed area of the project a notice which shall state—

- A summary description of the project;
- The place where the project is to be carried out;
- The place where the environmental impact assessment study, evaluation or review report may be inspected; and
- A time limit of not exceeding sixty days for the submission of oral or written comments in relation to the environmental impact assessment study, evaluation or review report.

(2) The Authority may, on application by any person extend the period stipulated in sub-paragraph (d) to afford reasonable opportunity for such person to submit oral or written comments on the environmental impact assessment report.

Stakeholder Engagement Requirements in Section 17 Environmental (Impact Assessment and Audit) Regulations, 2003

The Environmental Regulations require the following in relation to Public Participation:

During the process of conducting an environmental impact assessment study under these Regulations, the proponent shall in consultation with the Authority, seek the views of persons who may be affected by the project.

Box 2-1: Kenyan Requirements for Stakeholder Engagement

2.3 International Requirements

2.3.1 IFC Performance Standards

In addition to aligning with Kenyan requirements and standards, this SEP is designed to ensure alignment with international good practice standards, in particular the IFC Performance Standards. The following section sets out the engagement-specific requirements related to international good practice standards.

IFC Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts

IFC Performance Standards are an international benchmark for identifying and managing environmental and social (E&S) risk. The basis for the benchmark is the crucial role assigned to companies' E&S responsibilities. The standards provide guidance on how to identify risks and impacts and are designed to assist in the avoidance and/or mitigation of risks as a way of doing business in a sustainable way. Box 2-2 below outlines the basic Stakeholder Engagement requirements under the IFC PS.

IFC PS1: Assessment and Management of Environmental and Social Risks and Impacts:
Stakeholder engagement is an on-going process that may involve, in varying degrees, the following elements: stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism, and on-going reporting to Affected Stakeholders.

Disclosure of relevant Project information: Provide affected stakeholders with access to relevant information on: (i) the purpose, nature, and scale of the Project; (ii) the duration of proposed Project activities; (iii) any risks to and potential impacts on such stakeholders and relevant mitigation measures; (iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism.

Informed Consultation and Participation: Conduct an informed consultation and participation process involving a deep exchange of views and information, and an organized and iterative consultation, leading to the Project incorporating into their decision-making process the views of the affected stakeholders on matters that affect them directly, such as the proposed mitigation measures, the sharing of development benefits and opportunities, and implementation issues.
The process should be documented, in particular the measures taken to avoid or minimize risks to and adverse impacts on the affected stakeholders. The stakeholders should be informed about how their concerns have been considered.

External Communications: Implement and maintain a procedure for external communications that includes methods to (i) receive and register external communications from the public; (ii) screen and assess the issues raised and determine how to address them; (iii) provide, track, and document responses, if any; and (iv) adjust the management program, as appropriate. In addition, clients are encouraged to make publicly available periodic reports on their environmental and social sustainability.

Grievance Mechanism for Affected Stakeholders: Establish a grievance mechanism to receive and facilitate resolution of affected stakeholders' concerns and grievances about the client's environmental and social performance.

On-going Reporting to Affected Stakeholders: Provide periodic reports to the affected stakeholders that describe progress with implementation of the Project Action Plans on issues that involve on-going risk to or impacts on affected stakeholders and on issues that the consultation process or grievance mechanism have identified as a concern to those stakeholders. After completion of an environmental assessment the consultation and disclosure must continue throughout the life cycle (construction and operation phase) of the Project.

Box 2-2: Performance Standard Requirements for Stakeholder Engagement

2.3.2 Base Titanium's Social Policies

Base's Communities Policy (Figure 2-1) defines the principles that guide its corporate operating philosophy. The company's objective is to develop strong relationships with local communities whose support is seen as essential to the long-term success of its business. Through active involvement with local communities and other stakeholders Base seeks to develop the Project in a spirit of partnership adding value to neighbouring communities.

Base's Communities Policy objectives are:

- To interact with the community in a way that is, and is seen to be, accessible, transparent and responsive.
- To treat the community with sensitivity and respect in relation to its issues, views and suggestions.

- To achieve a level of mutual trust and respect that leads to problem-solving and solutions which improve the overall project.
- To use innovative, people-focused management systems to achieve the above.

Base will:

- Establish community consultation and communication processes, to develop lasting and interactive community relationships built on mutual respect and trust so as to reach agreed objectives and shared involvement.
- Recognise that each community is different and will respect the culture, fundamental human rights, values and traditions of those communities in which it seeks to operate.
- Be transparent and honest in describing the impacts of any project related activities.
- Ensure that its employees and contractors are informed about the company's approach and are made aware of their community responsibilities in relation to all stages of project activities and operations.
- Require all contractors to comply with all Project policies.
- Monitor, continuously improve and publicly report community relations performance and provide appropriate resources and training to meet the performance targets identified.
- Take appropriate action against members of the community who carry out any criminal act, sabotage, or otherwise threaten or intimidate its employees.

BASE RESOURCES LTD

COMMUNITIES POLICY

Achieving our long term goals depends on our ability to build relationships with the communities in which we operate and to enrich their lives through our participation. We seek to establish enduring relationships that uphold the principles of human rights and are characterised by mutual respect, active partnership and long-term commitment that ensure that long-term sustainable benefits can be maximised for local communities, regional and national stakeholders and the company.

We achieve this by:

- **Encouraging the taking of person responsibility** for our community relationships by everyone involved with Base, clearly describing responsibilities in role descriptions and contracts and providing the requisite capacity and resources to do so.
- **Engaging continuously, honestly and transparently with all stakeholders** in a culturally appropriate way that enables us to understand our impacts and work with them to develop strategies to address their concerns and aspirations.
- **Prioritising initiatives that directly address food insecurity and poverty**.
- **Empowering local communities** through culturally appropriate and gender balanced capability building programmes that maximise the sustainable economic benefits from our operations without creating dependency.
- **Participating, in collaboration with others,** in regional development, training and employment and small business opportunities.
- **Working with host governments** and other organisations to foster wider participation in community development and to create transparency in respect of the economic benefits arising from our operations.
- **Establishing and developing a social management system,** aligned with all legal requirements as well as the Equator Principles and IFC Performance Standards, that seeks to elevate community engagement within Base to a recognised strategic competitive advantage.
- **Protecting cultural and natural resources** and sharing benefits in the event of direct impact through existing community development frameworks.
- Undertake our activities in such a way that **minimises impacts on community health and safety.**

Tim Carstens
Managing Director

Colin Bwye
Executive Director – Operations and Development

18 December 2012

Figure 2-1: Base Titanium Communities Policy

3. STAKEHOLDER IDENTIFICATION AND MAPPING

3.1 Introduction

Stakeholders include individuals or groups that may influence or be impacted by the Project directly or indirectly and those who may have interests in a Project and/or the ability to influence its outcome, either positively or negatively. Stakeholders may include locally affected communities or individuals and their formal and informal representatives, national or local government authorities, politicians, religious leaders, civil society organizations and groups with special interests, the academic community, or other businesses.

3.2 Stakeholder Identification

The stakeholder identification process establishes which organisations and individuals may be directly or indirectly affected (positively or negatively) by the proposed Project, or may have an interest in it. In order to develop an effective SEP it was necessary to determine exactly who the stakeholders are and understand their priorities and objectives in relation to the proposed Project. By classifying and analysing the stance, influence, capacity and interests of stakeholders, it was then possible to develop a SEP that was tailored to the needs of different stakeholder groups.

It should be noted that stakeholder identification is an on-going process, requiring regular review and updating as the Project progresses. For the Project, stakeholders have been, and will continue to be identified on an on-going basis by Identifying the different categories of stakeholders who may be affected by or interested in the Project.

Project stakeholder identification followed a systematic process in accordance with the requirements of IFC Performance Standard 1. A preliminary list of potential stakeholders was created using the following criteria:

- National level government stakeholders (ministries, agencies, etc.) were identified based on their specific interest or authority in the Project location and proposed activities.
- County level government stakeholders were identified based on the location of the administrative unit (Sub-County) relative to the Project location.
- Non-government stakeholders were identified based on specific interest in the Project or Project location or potential impact from Project activities.
- Local communities within the Project Area of Influence.

The list of stakeholders was compiled based on the Consultant's knowledge and prior experience working in similar processes. Through consultation, the Consultant was able to pick up and understand concerns and recommendations to be considered in the implementation of the Project in order to minimise the negative impacts, and to enhance the positive ones.

Stakeholders relevant to the ESIA and identified as part of the Project ESIA process to date are listed in Table 3-1 below. This list will be regularly updated as fieldwork and engagement activities progress and as new stakeholders are identified. It should be noted that Table 3-1 does not include all potential stakeholders who may need to be engaged with during Project implementation.

Table 3-1: Stakeholders Identified to Date

Stakeholder Category	Connection to the Project	Stakeholders
Government	National Government is of primary importance in terms of establishing policy, granting permits or other approvals for the proposed mine extension, and monitoring and enforcing compliance with Kenyan Law throughout all stages of the Project life-cycle.	■ Members of Parliament ■ National Environmental Management Authority (NEMA) ■ Water Resources Management Authority (WRMA) ■ County Commissioners ■ Deputy County Commissioners ■ Assistant County Commissioners ■ Ministry of Petroleum and Mining (MoPM), Kwale Regional Office
	County Government are also of primary importance as they are responsible for the implementation of legislation, and development plans and policies at the County level. The County Government will also have a role in issuing permits and processing applications associated with the proposed mine extension (such as Change of Land use certificate). In addition, Counties impacted by the proposed mine will need to be kept informed of progress and plans in their area, to consider the proposed mine extension activities in their policy-making, regulatory and other duties and activities.	■ Office of County Governors ■ Office of County Senators ■ Office of Deputy Governors ■ Office of Members of County Assembly ■ Office of Women Representatives ■ Office of County Administrators ■ Office of Sub-County Administrators ■ Office of Ward Administrators ■ County Executives- Lands ■ County Executives - Environment ■ County Executives - Physical Planning ■ County Executives - Energy ■ County Executives - Legal ■ County Executives - Education & ICT ■ County Executives - Social Services and Talent Management ■ County Executives - Public Health ■ County Executives - Infrastructure ■ County Executives - Agriculture ■ County Executives- Water ■ County Executives - Labour
Parastatals	Parastatals may have land or other assets which could be affected by the proposed mine extension.	■ Kenya Wildlife Service (KWS) ■ Kenya Forest Service (KFS) ■ Kenya Transmission Company (KETRACO)
Traditional Authorities	Local community leaders acting as representatives of their local community. Meetings with traditional authorities follow local practices and are held before any wider communication in local communities to respect the political and social structures.	■ Area Chiefs for the relevant Locations ■ Sub-Chief for the relevant Sub-Locations ■ Elders from various villages within the relevant Locations ■ Village Liaison Committee ■ Umbrella Liaison Committee
Communities	Households and communities that may be directly or indirectly affected by the proposed mine extension and its activities. This includes people living on land affected by the proposed	Community members of the various Villages ■ Mwaloya ■ Mwaweche

Stakeholder Category	Connection to the Project	Stakeholders
	mine extension, through direct land take or by social and environmental impacts, and other people who visit or use land or resources that may be affected.	■ Mkwambani ■ Bumamani ■ Mwandimu
Vulnerable groups	Vulnerable groups may be affected by the proposed mine extension by their physical disability, social or economic standing, limited education, and lack of employment or access to land.	■ Women including Female Headed Households ■ Youth ■ Young girls ■ The elderly ■ The disabled ■ Those without formal land tenure ■ The very poor
Civil Society	Organisations with direct interest in the proposed mine extension, and its social and environmental aspects and that can influence the proposed mine extension directly or through public opinion. Such organisations may also have useful data and insight and may be able to become partners to the Project in areas of common interest.	■ Churches ■ Schools / ECDE ■ Health Centres ■ Cooperatives (SACCOs, Circles, Roundabouts etc.) ■ Children's' homes ■
Non-Governmental Organisations (NGOs)	NGOs with a direct interest in the proposed mine extension, and its social and environmental aspects and that can influence the Project directly or through public opinion.	■ Kwale Mining Alliance Members ■ Kwale CSOs Consortium
Business organisations	Individuals or organisations with direct economic interest in the proposed mine extension. This may be through gaining contracts with the proposed mine extension due to economic impacts caused by the Project.	■ PAVI ■ Kenya Association of Manufacturers ■ Kenya Private Sector (Alliance KEPSA) ■ Kenya National Chamber of Commerce and Industry ■ Kenya International Freight and Warehousing Association ■ Kenya National Farmers' Federation (KENAFF) ■ Matatu Owners Association (MOA) ■ Kenya Tourism Federation ■ Kenya Transporters Association Ltd
Media	Media is the communication outlets or tools used to store and deliver information or data. Have the potential to raise positive or negative awareness about the project.	■ Print and Electronic Media houses e.g. KTN, NTV, Standard and Nation newspapers

3.3 Stakeholder Analysis

Once stakeholders were identified, a basic analysis was undertaken to understand their connection to the Project (Table 3-1) as well as their needs and expectations regarding engagement or consultation.

3.4 Stakeholder Mapping

It is important to tailor the engagement methodology to the targeted stakeholders and their relationship to the proposed Project (their influence and interest). Stakeholder mapping seeks to understand stakeholders' level of interest in the Project and influence in decision making as well as on other Project stakeholders, and will continue throughout the Project lifecycle. It is also important to

note that stakeholder interests and level of influence is dynamic and changes over time; hence the need to periodically update the stakeholder mapping as well as the wider SEP. Mapping will also help identify stakeholders who may find it more difficult to participate in consultation activities and are affected by or interested in the proposed Project because of their marginalised or vulnerable status (such as disabled or elderly people).

Stakeholder mapping considers:

- Who is affected by the proposed Project and how;
- Who the formal and informal community leaders are and to what degree they are seen as representative;
- Whether the stakeholder supports, is neutral towards or is opposed to the proposed Project;
- Each stakeholder's interests and concerns in relation to the proposed Project; and
- How different stakeholders can influence the proposed Project and what risks or opportunities this presents.

According to each stakeholder's levels of interest or impact on the proposed Project, different levels of engagement intensity will be employed. Stakeholders have been mapped using the matrix as presented in Figure 3-1[2].

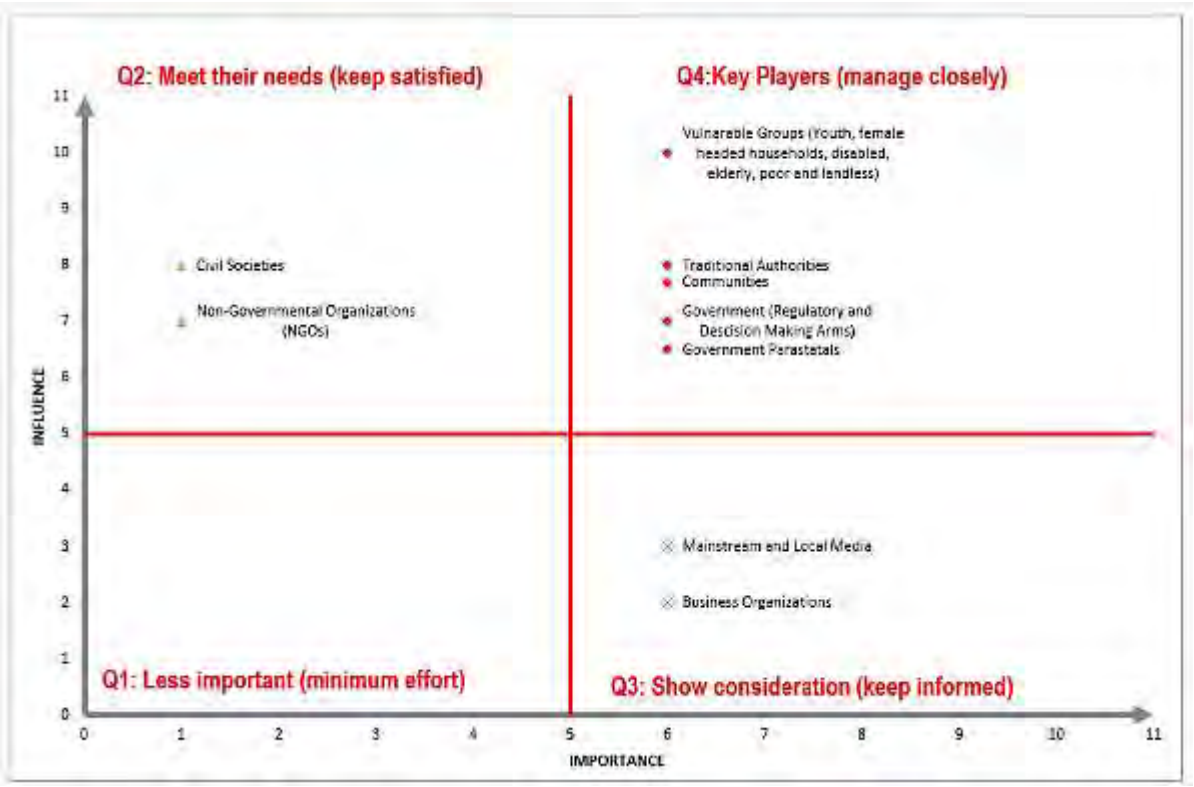

Figure 3-1: Stakeholder Mapping Matrix

[2] The Mapping Matrix shows the categories of Stakeholders. The detailed list of each category can be referred to in Table 3-1

4. APPROACH TO THE STAKEHOLDER ENGAGEMENT PROCESS/ COMMUNICATION PLAN

4.1 Basic Principles of Stakeholder Engagement

As per the IFC's Good Practice Handbook on Stakeholder Engagement, a good consultation and engagement process should be:

- Targeted at those most likely to be affected by the project;
- Early enough to scope key issues and have an effect on the project decisions to which they relate;
- Informed as a result of relevant information being disseminated in advance;
- Meaningful to those consulted because the content is presented in a readily understandable format and the techniques used are culturally appropriate;
- Two-way so that both sides have the opportunity to exchange views and information, to listen, and to have their issues addressed;
- Gender-inclusive through awareness that men and women often have differing views and needs;
- Localized to reflect appropriate timeframes, context, and local languages;
- Free from manipulation or coercion;
- Documented to keep track of who has been consulted and the key issues raised;
- Reported back in a timely way to those consulted, with clarification of next steps; and
- Ongoing throughout the life of the project.

***Note**: There is no one right way of undertaking consultation. Given its nature, the process will always be context-specific.*

4.2 Objectives of the Communication Plan

The objective of this communication plan is to define the communication requirements for the Project and how information will be shared. This plan describes the following:

- Information that will be communicated including the level of detail and format;
- How the information will be communicated – Background Information Document (BID), in email, telephone, web portal, WhatsApp, toll free phone line etc.
- When information will be distributed, the frequency of Project communication, both formal and informal;
- Who is responsible for communicating Project information;
- Communication requirements for all Project stakeholders;
- How sensitive or confidential information is communicated and who must authorize this;
- How changes in communication or the communication process will be managed;
- Any constraints, internal or external, which may affect Project communication; and
- The escalation process for resolving any communication-based conflicts or issues.

4.3 Key Issues that should be communicated

The following are some of the important messages that will be communicated to the Stakeholders:

- Background of the Project;

- Project Description and Location;
- Project Activities;
- The potential benefits and Impacts posed by the Project;
- The Process that will be followed to engage with stakeholders; and
- How and when stakeholders can participate in the Project.
- It is also important that the following information is communicated to the Project stakeholders on a needs-basis:
- Construction activities;
- Any interruptions of service utilities;
- Potential impacts of construction and operation activities; and
- The list of grievances that have been received and resolved – this would ensure that the stakeholders are not relying on rumours as their main source of Project information.

Particularly, there will be need to inform the Stakeholders of all planned Project activities and potential risks and impacts on them, as well as opportunities.

4.4 When to Communicate

Project communication will be structured and offered regularly but with the flexibility of responding to issues as they emerge. Broadly, stakeholder engagement for the proposed Project has been categorised into ESIA and Post-ESIA engagement activities as described in details in Chapters 5 and 6 of this SEP.

4.5 Communication Methods

Stakeholder engagement aims at making information about the Project accessible to interested and affected parties. Communicating such information in a manner that is understandable to the Project stakeholders is an important first (and ongoing) step in the process of stakeholder engagement.

A variety of communication methods are used to engage with stakeholders reflecting their level of authority, socio-economic context, and cultural and intellectual factors such as level of education and literacy.

English is the official language of Kenya, and is used universally in schools in addition to Kiswahili, which is the national language. Although there are a number of other ethnic-related languages, the national language of Kiswahili is quite often spoken throughout the country and the main mode of communication. Therefore, for all the stakeholder engagements, particularly with local community members, the main mode of communication will be through the Kiswahili language; any information communicated in English will be translated into Kiswahili to ensure that it is fully understood by the local stakeholders. For official meetings and communication, English will be the main mode of communication given that it is the official language of the country.

Box 4-1 below provides an overview of the common methods that can be used to disseminate information to stakeholders depending on the stakeholder group and literacy levels.

Focus Group Discussion: Targeted discussion with a group of individuals with similar characteristics such as women, men, youth, indigenous peoples and Project Affected Households (PAHs) to capture targeted information that may not be captured in an open space. These meetings also create a platform for vulnerable or marginalised groups to freely voice their opinions and concerns to be factored into the Project design and implementation of the Project elements and programmes.

Key Informant Interview: One-on-one meeting with a professional or individual with knowledge and expertise about a specific subject area that can provide targeted information in relation to specific aspects of the project for consideration in project design and implementation of project elements or programmes.

Toll-Free Number: A telephone number that is billed for all arriving calls instead of incurring charges to the originating telephone subscriber. For the calling party, a call to a toll-free number from a landline is free of charge.

Formal Meeting: Formal meeting to present project information to a group of individuals with authority or that may be a key stakeholder, such as the government or NGOs, and to gather feedback for consideration in Project design and implementation of Project elements or programmes.

Community Meeting/ Barazas: Gathering of all members of the community residing in a particular area to present project information and gather feedback for consideration in project design and implementation of project elements or programmes.

Workshops: These involve presentations on activities/progress when triggered by management of change. This includes stakeholder input on the contents of the Annual Sustainable Development Report and Community Relations Planning and monitoring indicators. Workshops will also be used to follow-up on Ward Level Public Meetings, and action or measures arising therefrom.

Newsletters: The monthly newsletter will continue to be prepared and distributed to stakeholders. The newsletter will contain information such as: descriptions of completed and upcoming technical activities for operations, description of studies and outcomes, status of any ongoing relevant interactions and issues raised by the stakeholders.

Fact Sheets: Fact sheets will be prepared to inform and update the public about operations and activities. These are brief one-page publications explaining technical information to the general public in a non-technical way. These fact sheets are availed at the public meetings/ workshops/open days/ site visits, as appropriate.

Mailing List: A mailing list in MS Outlook is compiled and updated, as needed, to ensure that interested parties are receiving relevant communications.

Household Surveys: Administering a household survey questionnaire to each of the households that will be directly affected by land acquisition activities to have a good understanding of their household characteristics and livelihoods. This method is often used during the gathering baseline information and when undertaking RAPs.

Box 4-1: Common Methods used in Information Dissemination

4.5.1 NEMA Guidelines on Conduct of Public Participation during COVID-19

In recognition of the ban on public events and the requirement for social distancing by the Government of Kenya (GoK) to minimize factors that may exacerbate the spread of COVID-19

disease, NEMA released the guidelines on conduct of public consultations on May 2020[3]. The guidelines were as follows:

- **ICT Innovations:** The EIA experts were advised to leverage on ICT innovations such as online questionnaires/survey techniques, audio visual and teleconferencing to undertake comprehensive public consultations during the pandemic period. It will be incumbent upon the proponent in consultation with the EIA expert(s) to choose the most practical techniques for various target stakeholder groups and provide reliable evidence of the consultation to the Authority for consideration.
- **Comprehensive questionnaires:** The questionnaire should indicate the name, plot No., distance from site, a telephone contact and/or official Stamp (where applicable), the questionnaire should include a clear description of the proposed project together with a copy of architectural drawings and the questionnaire should have open ended questions about the project so as not to narrow the views of the Project Affected Persons
- **Public Consultation and Disclosure Plan:** For sensitive and complex projects where ICT technology is limited in applicability, the authority shall advice on case by case basis on submission of comprehensive public consultation and disclosure plan.
- **Submission of Reports:** Submission and processing of all EIA, EA and SEA reports shall be done through the online licencing portal accessible through the NEMA website, www.nema.go.ke and the E-citizen platform. Hard copies the same should be submitted to the Authority as per the requirements of the Environmental (Impact Assessment and Audit) Regulations, 2003 for processing.
- **Professionalism:** The code of practice and professional ethics for Environmental Assessment Experts shall apply to all experts undertaking the Environmental Assessments.

4.5.2 Communication Methods and tools used during the Scoping and ESIA Phase

In order to comply with the NEMA guidelines as shown in *Section 4.5.1* above, several approaches were adopted during the Scoping and ESIA phases. Table 4-1 shows the various communication and tools used.

Table 4-1: Communication Methods and Tools Used

Tool/method used	Purpose	Stakeholder Groups
Background Information Document (BID)	It was available in English and Kiswahili and was used to provide an overview of the projects features and well as the anticipated impacts and mitigation measures.	All
Toll-Free Number	Provides an opportunity for stakeholders to call without charge and give verbal feedback and make inquiries about the project.	All
Household Survey Questionnaire	To gather socio-economic baseline information for the communities	Household members of the five villages namely: Mwaloya ,Mwaweche, Mkwambani, Bumamani and Mwandimu

[3] https://www.nema.go.ke/images/Docs/Guidelines/Public%20participation%20guidelines%20during%20COVID_19-min.pdf

Tool/method used	Purpose	Stakeholder Groups
Zoom meetings	Use of a cloud-based video conferencing service to virtually meet with others - either by video or audio-only or both and present the project and receive feedback.	National and County authorities NGOs/institutions Key informants/professionals
FGDs	Open ended questions with a group of 8-10 participants with an aim of gathering socio-economic baseline information	Men, women, youth and Village Committee Members of the 5 villages.
KII question guide	Open ended questions prepared to gather information during the interview	County and Government officials.
Village Committee Members (VCM)	Helped in the dissemination of project information to the community members	Community members

Household Survey being administered by an enumerator using a socio-economic baseline questionnaire

Focused Group Discussion (FGD) being administered by use of an interview question guide

Figure 4-1: Communication methods and tools used during the ESIA

5. SCOPING AND ESIA PHASE STAKEHOLDER ENGAGEMENT

5.1 Stakeholder Meetings Held

Table 5-1 below presents the list of Stakeholder Engagements conducted during the scoping and ESIA Phases, while a summary of the key issues raised are presented in Section 5.2 below.

Table 5-1: Summary of Meetings held during the ESIA Phase

Stakeholder	Engagement Date	Venue	Number of Participants
Key Informant Interviews (KIIs)			
CEC Department of Agriculture, Livestock and Fisheries	4th August 2020	County Offices-Kwale	1
Matuga Sub-County Administrator	4th August 2020	Sub-County Offices-Matuga	1
Department of Social Services and Talent Management	4th August 2020	County Offices-Kwale	1
Deputy County Commissioner (DCC)- Msambweni	4th August 2020	DCC Office-Msambweni	1
Department of Environment, Land and Physical Planning	6th August 2020	Leopard Beach Resort &Spa	2
Msambweni Sub-County Administrator	7th August 2020	Mangro Hotel	1
Focused Group discussions (FGDs)			
Mwaloya Village			
Men	29th July 2020	Mwaloya	9
Women	29th July 2020	Mwaloya	11
Village Committee	29th July 2020	Mwaloya	8
Youth	29th July 2020	Mwaloya	12
Bumamani Village			
Men	30th July 2020	Bumamani	11
Women	30th July 2020	Bumamani	10
Youth	30th July 2020	Bumamani	14
Village Committee	1st August 2020	Bumamani	7
Mwaweche Village			
Men & Village Committee	3rd August 2020	Mwaweche	5
Women	3rd August 2020	Mwaweche	7
Youth	3rd August 2020	Mwaweche	9
Mkwambani Village			
Men	5th August 2020	Mkwambani	12
Women	5th August 2020	Mkwambani	10

Youth	5th August 2020	Mkwambani	12
Village Committee	5th August 2020	Mkwambani	13
Mwandimu Village			
Men	7th September 2020	Mwandimu	10
Women	7th September 2020	Mwandimu	12
Youth	8th September 2020	Mwandimu	14
Village Committee	8th September 2020	Mwandimu	11

5.2 Outcomes of Engagements Conducted to Date

As indicated in Table 5-1 above, several stakeholder engagement meetings were held during the ESIA process. The key questions and concerns raised by stakeholders are outlined in Table 5-2.

Due to the COVID-19 Pandemic, stakeholder engagement activities were modified to ensure sufficient feedback is collected from the stakeholders who could not participate in meetings. As such, the EIA team established of a dedicated Toll-Free Phone line (+254 800 720 519)[4] to ensure the collection of verbal questions, concerns and suggestions from stakeholders. The number was shared through the Background Information Document (BID) and was also shared with stakeholders during meetings with the EIA team. Any community members who had concerns or questions related to this project could call this number free of charge and the feedback is captured in a Toll-Free Number Log (*Appendix E*). Several issues have been captured from the response made by community members and have been included in Table 5-2.

The Background Information Document (BID) used in stakeholder engagement during the ESIA stakeholder engagement process is presented in *Appendix A* and the detailed minutes and registration sheets is presented in *Appendix B*. A summary of the FGDs and KIIs is presented in *Appendix C* and *Appendix D* respectively.

Table 5-2: Key Stakeholder issues raised during the ESIA Process

Main Theme	Key stakeholders' issues/ comments
Stakeholder Engagement Issues	The Kwale County Chief Officer (CO) of Environment pointed out that Base has not properly engaged the County Government at the initial stages of their operations which is a critical step in ensuring proper management of the project.
	Base should ensure there is a well-structured engagement with the communities to avert any future crisis. Many of the community members complained about poor compensation and livelihood restoration from previous development.
	There are community members who have not yet been compensated from the previous relocation and this can negatively impact any of Base upcoming activities.
	The community should be sensitised about the long-term objectives and benefits of Base operations in the area. This will help to foster a positive attitude towards the project.

[4] Issues summarised in Table 5-2 also include those raised from the Toll-Free Number.

Main Theme	Key stakeholders' issues/ comments
	The Deputy County Commissioner (DCC) pointed out that Base should regularly engage and update the community so as to manage their expectations and reduce speculation.
	The Village Administrator (VA) pointed out that there should be regular feedback given to the community even after the Project.
	The Sub-County Administrator pointed out that there was a lot of controversy before Base was given the prospecting licence. Because the communities were not well informed, many were divided if Base should be allowed to prospect the minerals in their area. It is therefore important that comprehensive stakeholder engagements be undertaken with the communities. Base should ensure the communities see the benefits of the Project.
Livelihood Concerns	Majority of the communities in the Project Area are farmers and it's important for Base to ensure minimal disruption of agriculture.
Collaboration of Key Actors	There is a Memorandum of Understanding (MoU) that the County Government signed with Base Titanium that guides the collaboration of any projects between Base and the County departments.
	Base supplements what the County Government is doing and the MoU stated that any projects or programmes should be aligned to the County Integrated Development Plan (CIDP).
	Technical committee that works closely with Base Titanium and brings together the County officers and Base Titanium representatives who plan and execute agricultural programmes and projects.
	County Department of Environment expects to be fully engaged with Base because they play a critical role during any crisis. They are the representatives of the people and should not only be engaged in passing or during a crisis.
	No information about the North Dune project has been shared to the County Physical Planner creating a major gap in terms of consultation and communication between the Base and the County Government.
	The County Department of Environment lacks a database of Base activities which is critical in future decision making and planning.
	No clear path or solid Memorandum of Understanding (MoU) between Base and the County Department of Environment and as a result the department is not fully involved or informed of their operations in the area.
	The Corporate Social Responsibility (CSR) programmes should expand beyond the project footprint. They should undertake a mega project that can be felt in the County and not just within the project area e.g. investing in higher education.
	Base should consider reviving discussions/plans about the proposed constructing a stadium in the County (at Kinarim-Kwale) and also sponsor local sports team.

Main Theme	Key stakeholders' issues/ comments
	Base has previously supported and facilitated the CEC-Department of Social Services and Talent Management office in the area of culture through providing financial support to local Community Based Organizations (CBOs).
	The Deputy County Commissioner (DCC) pointed out that his office will continue to support and work closely with Base.
	The DCC pointed out that the Umbrella Committee and other Committees set up by Base have continued to consult and work effectively towards implementing action plans and community projects.
	Sub-County Administrator (SCA) suggests that village committees should be better empowered to sensitize the communities about the project. There are cases where the committee members are secretly against the project. Base should undertake regular training sessions with the committee members.
	The SCA stated that she is also part of the Base Agricultural Committee (BAC) and they partner during the roll-out of agricultural programmes.
	There are also Sub-Committees such as Education in base that the office of the SCA works closely with. The Education Committee is in charge of rolling out scholarship programmes.
	The SCA points out that since Matuga Sub-County is in the transport corridor used by Base, it should also have representation in the umbrella committee that has been established by Base.
	The County Government has the five-year County Integrated Development Plan (CIDP) that synchronises with all development projects. For example, when there were plans by the County to build ECD schools Base proposed to construct the ECDs, the County funds were used for other development projects.
	Matuga Village Representatives should also be included in the CSR activities since Base will use their transport corridor during the project construction and operation.
Compensation	Communities should be fully involved and engaged in the compensation process.
	The compensation rates for land and crops should be reviewed and based on the existing market rates.
	Currently there is no framework that guides how the royalties paid by Base can trickle down to the community.
	The process of compensation and resettlement should be undertaken in line with the law and best practice. It would be ideal for Base to identify land and relocate the community rather than use cash compensation. This is because cash payments tend to be used for the wrong purpose and families are left without land.
	There should be a clear framework on how the royalties paid by Base can be used to benefit the community.

Main Theme	Key stakeholders' issues/ comments
	The compensation rates for land, trees and crops should be revised this time round. The previous rate was about Kshs 80,000 per acre which was quite low.
Resettlement	Base should ensure minimal disruption of community linkages and family ties.
	The Sub-County Administrator (SCA) pointed out that main challenges facing the ward is shortage of land particularly in Ukunda. There are a few people who have allotment letters, but the majority are informal land users.
Livelihood Restoration	The Resettlement Action Plan (RAP) and Livelihood Restoration Plan (LRP) should be detailed and comprehensive. It should be tailored to meet the needs and expectations of the Project Affected Persons (PAPs).
	Base should consider connecting villages with water by utilizing the dam they have at the site.
	Consider investing more in Msambweni referral hospital and making in a state-of-the-art hospital and meeting community needs.
	Sub-County Administrator (SCA) mentioned that there are community members who were reallocated from Maumbo to Bwiti. However, the land at Bwiti is not fertile and this has severely impacted on the community livelihood. Because of the negative impacts faced by the affected communities this is likely to cause apprehension by the rest of the community members who feel that they may suffer a similar fate.
Base initiatives	Currently there are on-going projects such as food and sanitizer distribution. This can still be scaled up and will have a positive impact on the community.
	Through the *Nyumba Kumi* (ten houses) initiative, Base can improve the stakeholder engagement process and empower the communities.
	There should be more CSR projects in the ward. Currently there are no projects in Kinondo apart from the construction of a school and hospital.
	The SCA pointed out that the project Community Social Responsibility (CSR) should be extended beyond the Project footprint.
	The SCA stated that she was happy with the bursary programmes that have been rolled out by Base.
Promoting Local Economic Development	The DCC suggested that Base should prioritise the training of local labour force so that they can be absorbed in the skilled and semi-skilled job opportunities.
	The DCC suggested that Base should invest more on community projects.
	SCA pointed suggests that the process of employment should be free and fair. The communities living within the project area should be given priority especially for the unskilled positions. Employment should not be sourced from outside at the expense of the local community.
	According to the SCA, Base should upgrade the road (from 00) to the port facility which can also benefit the community members in the area. This will

Main Theme	Key stakeholders' issues/ comments
	help reduce potential impacts such as accidents and dust for the other road users.
	The SCA pointed out that there have been complaints from the communities in Kwale that employment positions are usually given to people from other counties, especially the top management positions. Base should have a database of the skill-sets and qualifications of the communities in the area and the process of recruitment should be fair and transparent.
	There should be clear guidelines for any investors who come to Kwale County.
	Base should work closely with the training institutions to build the capacity by educating and training the youth so that they can take up employment positions in the company when the time comes.
Management of Pollution	Water contamination and waste management should be properly managed. The SCA pointed out that she has received complaints from the community that the mining activities are impacting on their water. The taste has changed since Base started their operations in the area.
	The impacts on mangroves resulting from mining activities in the area should be assessed. Dr. Kairo (Senior researcher- KEMFRI) can be in a position to give more details.
	The Village Administrator pointed out that there is a community area near Shimba Hills where the crops have been destroyed by too much dust that is likely radiating from the Project site. Base should look into that.

6. NEXT STEPS IN STAKEHOLDER ENGAGEMENT

The Project is committed to continuous engagement with stakeholders throughout the life of the Project. Plans and activities implemented during the next stages of Project planning and development will therefore feed into and inform on-going stakeholder engagement as the Project moves into these stages, ensuring that two-way dialogue with those affected, both positively and negatively by the proposed Project is maintained.

The aim will be to ensure that the Project remains in contact with all interested parties and cognisant of their concerns, and that these are addressed in an effective and timely manner. At each stage a detailed schedule of activities and events will be developed and widely disseminated so that people know how to interact with and participate in the Project.

In particular, post ESIA stakeholder engagement is expected at the following Project stages:

- **Pre-construction stage** where stakeholders who will be directly affected by the Project will be notified and discussions will be held with them. At this stage information about the findings of the specialist studies and socio-economic data that was gathered will be shared with the Project stakeholders.
- **Mobilisation phase:** At this stage, information regarding the location of associated project infrastructure, detailed construction schedule, expected construction team (including employment opportunities) and findings of the various studies will be shared with the Project stakeholders.
- **Construction phase:** Continuous engagement with the Project stakeholders throughout the construction phase to keep them updated of the construction activities as well as any changes to the initial Project plans that may happen during this phase.
- **Operations Phase:** Continuous engagement with stakeholders to keep them updated of the operation activities including available products and services as well as any changes made during this phase.
- **Decommissioning Phase:** Notifying the stakeholders the end of the operation activities and close-out of outstanding related grievances.

7. GRIEVANCE REDRESS MECHANISM

7.1 Introduction

The Project will need to establish a specific mechanism for dealing with stakeholder grievances. A grievance is a complaint or concern raised by an individual or organisation who judges that they have been adversely affected by a Project during any stage of its development. Grievances may take the form of specific complaints for actual damages or injury, general concerns about Project activities, incidents and impacts, or perceived impacts.

7.2 Principles of Grievance Mechanism

A grievance mechanism should be based on the following principles:

Transparency and fairness: The process for grievance resolution should be transparent, in harmony with the local culture and in the appropriate language. It should explicitly assure potential users that the mechanism will not impede their access to other judicial or administrative remedies.

Accessibility and cultural appropriateness: All stakeholders including every member of a community or group should have access to the grievance procedure. Any individual or group that is directly or indirectly affected by the Project's and its contractors' activities, can raise a grievance.

Openness and communication regularity: There should be multiple channels available for individuals and groups to choose their preferred method for lodging grievances

Channels of communication should be kept open throughout the process of addressing each grievance and up to three months after the situation has been resolved.

Written records: All grievances should be registered on a Complaints Registration Form and tracked through to Complaints Resolution Form. This should include documentation of how the grievance has been resolved.

Dialogue and site visits: All grievances should warrant discussions with the complainant and a site visit to gain a first-hand understanding of the nature of the concern. The purpose of the visit is to verify the validity and severity of the grievance.

Timely resolution: The Project aims to resolve 90% of grievances within 30 days. Grievances that have not been resolved in this period should at a minimum have been acknowledge and investigated.

7.3 Base Titanium Grievance Redress Process[5]

The Base Grievance Redress Mechanism involves a series at steps as follows:

7.3.1 Step 1: Publicising the Grievance Management Procedures

The grievance mechanism will be introduced to the Project stakeholders as part of the Project' Stakeholder Engagement Programme, initially focusing on the communities directly affected by the Project.

The following information will be communicated:

- The purpose of the Projects grievance mechanism, what it is able to deliver and the benefits of using it rather than other resolution mechanisms.
- Who can raise complaints? – affected communities and other stakeholders.
- Who is responsible for receiving and responding to grievances, including third parties? – CLOs, Grievance Officer, chiefs, MPLC, District Geologist.

[5] Kwale Mineral Sands Project Stakeholder Engagement Plan, October 2011.

- The type of responses complainants can expect from the Project and the timing of the response.
- What rights and protection are guaranteed to the complainant and the Project including rights of both parties to proceed with grievance resolution beyond this process including presentation to the Commissioner of Mines & Geology (who has powers under the Mining Act to deal with disputes relating to Special Mining Lease) or the courts.

7.3.2 Step 2: Receiving and Registering a Grievance

Grievances will be received in various formats (as detailed in Section 8.5.2) through the following methods:

- CLOs, Social Team members and the Grievance Tracker and other nominated Project representatives can receive complainants through direct face-to-face meetings between themselves and groups or individuals.
- Submission of a written letter (anonymous or signed) placed in one of the Project's Comments Boxes or addressed to the Project Offices.
- Submission of a grievance to third parties, through a letter or in a face-to-face meeting.
- Online through the Project e-mail address or website.
- Telephonically, through the toll-free number.

7.3.3 Step 3: Documenting the Grievance

All grievances received will be documented and records kept of the grievance, the Project response and the final outcome. Complainants submitting grievances to authorised Project representatives will be provided with a Grievance Record Sheet (GRS). The complainant and the Project representative will fill in the form together, and the complainant will receive a copy and a copy provided to the complainant when possible. All incoming grievances will be acknowledged within five working days and a GRS completed. A formal confirmation, with a Grievance Record Number (GRN) and a timeline for response, will be provided giving assurance to the complainant that the Project is responding appropriately.

7.3.4 Step 4: Action, Reviewing and Investigating Grievances

All grievances will be screened to determine whether it is eligible for the grievance mechanism. Ineligible complaints may include complaints that are clearly not Project-related, or other Project or community procedures are more appropriate to address the issue. If a complaint is rejected, the complainant must be informed of the decision and the reason for rejection. Complainants should be engaged in dialogue before deciding to reject their complaint. If established that the grievance is eligible it should be placed in one of three categories (A, B or C). Category A - requires immediate action (hours), Category B requires urgent action (within 48 hours) and Category C can be responded to within 14 days. Some incidents may be required by law to be reported to the relevant authority. Any directives from the relevant authority should be addressed and recorded in the document control process.

Category A: Immediate Action- Issues requiring immediate action (i.e. not exceeding 1 hour) are typically issues which threaten the short-term safety or the lives of community members, employees or the Project or has a potentially catastrophic impact on the integrity of the receiving environment (e.g. chemical spills or accidents near community water supply or sensitive environments such as wetlands). Any grievances requiring immediate action will be reported to the Social Manager as soon as it is received. If necessary, the Social Manager or his designated representative will visit the site to validate the grievance and take photographs. The Project Emergency Response Mechanism (PERM) may be invoked by a Category A incident. Any required legal reporting to government on the incident and required actions should be performed within the stipulated legal time period. Depending on the

severity and urgency of the grievance and the action required, the Social Manager will inform the General Manager- Environment & Community Affairs, and a decision of action will be made. If the General Manager-Environment & Community Affairs feels that the action is significant enough, he will escalate the matter. Should the issue be of such a nature that it could influence the Projects corporate and public image, the Social Manager will, in conjunction with Legal Counsel, and/or the General Manager-Environment & Community Affairs, compile a response. Unless directed by the General Manager- Environment & Community Affairs no employee should communicate with the press directly. It is recommended that a cautious approach be followed.

Category B: Urgent Action- Issues requiring urgent action are typically issues which pose a nuisance or long-term safety risk to community members or employees or a long term impact on the integrity of the receiving environment. All issues of an urgent nature will be communicated to the Social Manager within 12 hours after receiving the grievance. Issues requiring an expedient response or action from the Project will be considered by the Social Manager and if necessary, immediate action will be taken. The Project will aim to respond to urgent issues within 72 hours.

Category C: Action – Issues requiring action which are not of an urgent nature are typically procedural or dispute type issues. These issues will be discussed within the Social Department. Appropriate action will be taken based on the urgency of the issue. Once the required course of action has been agreed, the person responsible for the action and the date required for response will be recorded on the original Grievance Record Sheet. The Project will aim to respond to all of these type issues within 14 days. Grievances must be investigated with the response based on the findings of a thorough and fair process of review to ensure an equitable outcome. Complex or widespread grievances (may involve multiple parties) that cannot be resolved quickly may require an extensive investigation. If an extensive investigation is found to be necessary it should be initiated promptly before circumstances change or the conflict escalates further.

7.3.5 Step 5: Feedback – Developing Resolution Options and Preparing a Response

Once it has been established that a grievance is eligible and the nature and category of the grievance is understood, resolution options can be developed taking into consideration community preferences, Project policy, past experience, current issues and potential outcomes. Typically, the selected resolution option will be one of four general approaches:

- A unilateral decision where the Project proposes a solution;
- A bilateral decision where the Project and the complainant reach a resolution through discussion or negotiation;
- The Project and the complainant defer to a third party, either informally or formally through mediation; and
- Traditional or customary practices are the selected resolution option.

The grievance mechanism allows flexibility rather than prescribing a specific procedure for each particular type of grievance. The Compliance Advisor/Ombudsman (CAO) note of designing and Implementing Grievance Mechanisms for development projects provides the following recommendations of when to use which resolution option:

Use a Project proposed solution when:

- The complaint is straightforward, the issue is clear and the solution is obvious.
- Project staff can resolve the issue alone, to the satisfaction of the complainant, based on their knowledge and authority.

■ A considered and respectful Project proposal is more likely to be acceptable to the complainant.
Use a bilateral decision where the Project and the complainant decide together when: ■ An ongoing relationship and a face-to-face resolution process matter. ■ The case is more complex and several diverse stakeholders are involved. ■ Local community members distrust a unilateral Project proposal. ■ The response from a "Project proposes a solution" procedure is not acceptable. ■ Talking together is required to promote more accurate communication, share information, or develop mutually acceptable solutions. ■ There are procedural, psychological, and substantive interests for both parties that lend themselves to such an approach.
Defer to a third party when: ■ The "decide together" procedures are not acceptable to one or more of the parties. ■ There are disputes and conflicts about the data. ■ The parties have been unable to reach a voluntary settlement through other procedures.
Use traditional and customary practices when: ■ "Imported" procedures are unfamiliar, inaccessible, or culturally incompatible with local customary practices of a community. ■ Alternative traditional means are available that can be adapted in a way that is mutually acceptable to both the complainant and the Project.

Regardless of the outcome, a response must be provided to all complainants. Responses can either be oral or written depending on how the grievance was received. Typically, there are three scenarios on receipt and registration of a grievance.

- On screening and assessment of the grievance it is rejected upfront, as it is either ineligible or clearly unfounded. All considerations must be documented and included in a response to the complainant and recorded on the Grievance Record Sheet and in the database record. Communicating a detailed and respectful explanation, together with any compelling evidence, in the communicated response can prevent a conflict from escalating.
- On screening it is determined that the grievance is not Project related and is outside the mandate of the grievance mechanism or will be more appropriately addressed by other Project procedures (e.g. labour grievances). As with rejected grievances all considerations must be documented and included in a response to the complainant and recorded on the Grievance Record Sheet and in the database record.
- The response procedure for grievances that are not rejected or referred includes two steps:
  - A preliminary response is provided that proposes the consequent actions required to seek resolution and provides details of the status of the claim, and invites further discussion. It should also provide a proposed timeline for resolution.
  - A final response is given to document the final proposed resolution and seeks agreement from the complainant. If complainants are not satisfied with the proposed resolution or the outcome of the agreed corrective actions, they are free to take their

grievances to a dispute resolution mechanism outside of the Project grievance mechanism.

All decisions and actions will be documented on the Grievance Records Sheets and will be recorded in the database with supporting documentation.

7.3.6 Step 6: Closure

All grievance records, including Grievance Records Sheets (GRS) and supporting documents, will be filed and recorded in the database. Upon completion of the agreed-upon corrective actions, collect proof that these actions have taken place, this includes photos, documentary evidence, a record of resolution which is signed and dated by the responsible staff member, and if the resolution has been to the satisfaction of the complainant confirmation of this for the record. These are all included and recorded in the case documentation.

7.3.7 Step 7: Monitoring, Reporting and Evaluating

Grievances will be tracked and monitored as they proceed through the grievance mechanism system. A monthly summary and qualitative assessment of what has taken place and whether any improvements should be considered to the mechanism will be undertaken. Monitoring and reporting are the tools for measuring the effectiveness of the grievance mechanism, the efficient use of the Project resources, and for determining broad trends and recurring problems to facilitate proactive resolution. Monitoring facilitates identifying common or recurrent claims that may require structural solutions or policy change. Internal monitoring and reporting will provide information that can be reported back to stakeholders. External monitoring of the Project Grievance Mechanism will comprise part of the Projects Social and Resettlement Monitoring Programme.

8. ROLES AND RESPONSIBILITIES

Staffing levels will be closely considered to establish a team that can respond effectively to community issues and provide the necessary input for delivering stakeholder engagement and community programmes. The following outlines the anticipated positions:

8.1 Social Manager (SM)

This role will involve overseeing the delivery of resettlement requirements and managing all aspects of consultation, community liaison and community development. It will also include building the Social Team and instilling capacity to deal with community issues and social impacts as outlined in the various documents listed above. This position will be based in Ukunda reporting to the General Manager – Environment & Community Affairs and requires extensive experience in large project implementation including establishing consultation networks, managing resettlement programmes, development and implementation of social management plans and overseeing community relations. Other members of the Social Team comprise:

8.1.1 Community Liaison Superintendent (CLS)

Based in Ukunda, this is a senior position and requires a local person who has experience with resettlement and community matters. This role will be required throughout the project lifecycle. The role will report to the Social Manager on matters relating to the delivery of public disclosure, issues associated with contractors and supervise the grievance process.

8.1.2 Community Liaison Officer (CLOs)

CLOs will be responsible for representing the company in the community including on behalf of contractors associated with the Project. It requires competency in problem solving, conflict resolution and community interaction. This role will involve addressing and understanding community issues and providing responses to concerns raised either directly or after consultation with senior staff or contractors depending on the complexity of the issue at hand. CLOs report to the Community Liaison Superintendent.

CLOs will be required during all project phases. Contractors with a direct impact on communities will have a CLO allocated to them. CLOs will also undertake monitoring in accordance with the requirements of the monitoring plan. CLOs will be positioned at the mine site and in Likoni and recruited from local communities.

8.1.3 Grievance Tracker (GT)

This is a role responsible for closing out grievances in accordance with the Grievance Mechanism. It will require organisational skills and the ability to deliver responses on schedule. This position also reports to the Community Liaison Superintendent (CLS).

8.1.4 Data Controller (DC)

This position requires experience with computer database programmes such as Microsoft Access. The role includes responsibility for receiving fieldwork data and grievances, data input and distribution thereafter. It reports to the Community Liaison Superintendent.

8.1.5 Community Programmes Superintendent (CPS)

This is a senior local position requiring skills in planning and implementing community development projects. Its responsibilities include ensuring company objectives are achieved in regards to livelihood restoration and community development obligations with sustainability as a key indicator. The following positions report to the CPS:

8.1.5.1 Community Programmes Coordinator (CPS)

This position will need experience in delivering field-based livelihood improvement, poverty reduction and food security programmes. The role will also involve working with NGOs, CBOs and GoK lead agencies to deliver structured programmes that will assist resettled households and communities mitigate impacts associated with relocation.

The Community Programmes Coordinator (CPC) will also implement development projects identified through consultation with local communities and authorities. This role will require skills in construction supervision and knowledge of development planning. This position will be required during all Project phases.

8.1.5.2 Community Awareness Officer (CAO)

This position is based on an educational role and together with other team members deliver messages regarding safety and Project information dissemination to stakeholders about Project progress and schedules that may affect the community. The role reports to the Community Programmes Superintendent. CAOs will be required during construction at the mine site and in Likoni. During operations it is envisaged that one CAO will suffice with support from CLOs and Community Health Officer. CAOs will also be recruited from local communities.

8.1.5.3 Community Health Officer (CHO)

This role will require experience in delivering public health messages to communities and will be required from construction through to decommissioning.

9. MONITORING AND REPORTING

It will be important to monitor and evaluate stakeholder engagement efforts to ensure that the desired outcomes are being achieved, and to maintain a comprehensive record of engagement activities and issues raised.

Suggested monitoring and evaluation activities are outlined below:

- Monitor the grievance register on a regular basis (monthly) in terms of response times to address complaints logged as well as the recurrence of complaints over time. This will inform the Project risk assessment;
- Regular update of the stakeholder register whenever additional stakeholders are identified;
- Keep records of all stakeholder engagement activities: This will be populated with details on information presented, questions, responses and commitments made and actions, and meeting evaluation results, when appropriate. The database will also be used to track frequency of meetings;
- Keep a library (electronic or hard copy) of all communication material. This will include all communication received from the identified Project stakeholders and also from media monitoring (press, radio stories relevant to the Project);
- Develop and assess performance in terms of Key Performance Indicators (KPIs) to be determined by the Project team and/or equivalent personnel. For example: number of engagements held per month; timeliness of disclosure of Project information; incorporation of stakeholder views into Project design and ESMP; number of outstanding grievances / numbers resolved; number of grievances escalated for legal action; and
- Annually review grievance mechanism performance and revise policies, procedures and actions accordingly, with the aim of reducing the number of grievances, improving the process of resolution and improving overall performance.

In order to measure these indicators, the following methods will be used:

- Minutes of meetings.
- Informal feedback from stakeholder groups.
- Grievance register.
- Accessibility dissemination and use of documentation.
- Effectiveness of engagement planning, tools and execution.
- Effectiveness of representation and participation in engagement.
- Effectiveness of environmental and social feedback process incorporating community needs into Project design.

During the construction and operational phases, Base will conduct an annual internal audit of the SEP and reported to senior management. A summary of the audit will be provided for the annual report.

Base may choose to involve Project stakeholders (including affected communities) or third-party monitors in the monitoring of Project impacts and mitigation programmes as the Project develops.

9.1.1 Consultation Strategy for Project Monitoring

Effective monitoring regimes are closely linked to establishing good communications. Consultation will be undertaken to inform Project management on the following:

- Community meetings will be held annually to monitor stakeholder perceptions.
- Local stakeholders will be involved in monitoring impacts and in assessing their effectiveness.

- Local stakeholders will be involved in monitoring the compensation strategy devised by the RAP.
- Stakeholders will be involved in the ongoing planning, execution and monitoring of the Community and Capacity Development Management Plan (CCDMP).
- The labour and recruitment strategies will be monitored by the Social Manager and updated when required.
- Stakeholders will be involved in the ongoing planning, execution and monitoring of the Community Health & Safety Management Plan (CHSMP).
- Stakeholders will assist with the planning, execution and monitoring of the decommissioning plan.

9.2 Resource Requirements

The budget for the SEP implementation will consider the following items throughout the Project Construction, Operation and Decommissioning phase. This section section describes the resources that will be provided to undertake stakeholder engagement for the Project.

9.2.1 Staff

Staffing requirements are detailed *Section 8* above.

9.2.2 Social and Resettlement Specialists

Base shall engage the services of a suitably experienced resettlement/social specialist to assist the social team through both the development of Project social documentation (RAPs, SMP and SEP) and ensuring they are prepared with appropriate consultation built in where applicable.

9.2.3 Field Staff f Equipment

Social teams shall be equipped with cameras and GPSs to document stakeholder engagement activities. All staff members who are likely visit construction sites or operational areas will be issued with Personal Protective Equipment (PPE).

Community awareness team will be equipped with a laptop computer, screen, digital projector, amplifier, microphone, small generator and extension cords to allow them to deliver presentations to local communities.

9.2.4 Offices

The Social Team will be based in the Ukunda office during the resettlement process. Special temporary offices will be set up in locations providing access to Project Affected Communities. Communication with the Host Site will be handled by site visits by CLOs to a predefined schedule. These measures will allow for community members to have ready access to the Project. Operational offices are likely to be located at the mine site and Likoni. Contact points/persons will also be established along the transport route to ease communication.

9.2.5 Local Administration

The Area Chiefs office is an important focal point for gathering community information and posting information about Project activities and job vacancies. Approval for posting such information at Chiefs offices will be sought from the Mining Project Liaison Committee (MPLC) whose Chairman is the Deputy County Commissioner (DCC).

9.2.6 Training

Training will be undertaken to ensure that staff are able to perform in their roles to the required standards. Options will also be available to staff who may be subject to redundancy due to project phasing so that they can be considered for suitable roles in other departments. This programme will be implemented in conjunction with the Human Resources Department.

9.2.7 Media

Linkages with local radio stations are essential for the delivery of Project information particularly during the construction phase and with respect to proposed emergency response announcements. Identifying preferred stations will be based on consultation with affected communities.

Suitable print publications and posters shall be used to disseminate information about public meetings, ESIA disclosure and job vacancies.

9.2.8 Internal Coordination

The Social Team will conduct Project stakeholder engagement activities as planned and when required. Coordinated support for other departments shall be provided in seeking solutions to stakeholder issues during all Project phases.

9.2.9 NGOs/CBOs

Expertise associated with NGOs and direct access to communities through CBOs has the potential to provide significant collaborative efforts in bringing real development to affected communities. These organisations can significantly increase the effectiveness of the engagement process if chosen carefully on the basis of demonstrated results.

9.2.10 Vehicles

The Project consultation process covers considerable distances and may involve the movement of large groups of people. Suitable vehicles shall be secured to simplify this process and to allow staff members to accomplish their tasks in a timely manner.

9.2.11 IT & Communications

Mobile phones and suitable airtime will be provided to all CLOs, CAOs and Community Programmes teams. Each office (excluding temporary offices) will be equipped with a desktop computer to facilitate CLO Communications, reporting and for processing grievances.

9.3 Considerations for Reporting to Project Affected Stakeholders

The following considerations will be helpful when devising the reporting component of this SEP:

- Determine what information needs to be reported to which stakeholders, by what method and how frequently;
- Regularly update the commitments register and disclose progress to affected and interested parties. In particular, publicize any material changes to commitments or implementation actions that vary from publicly disclosed documents;
- Make monitoring results publicly available, especially reports of any external monitors;
- Regularly report on the process of stakeholder engagement as a whole, both to those stakeholders who are directly engaged, and to other interested parties; and
- Translate information reported to stakeholders into local languages and/or into easily understandable formats.

- This SEP suggests the adoption of the following forms, as appropriate, for use during the implementation of the Project:
- Stakeholder consultation issues and questions form;
- Stakeholder mapping form;
- Stakeholder consultations registration sheets;
- Stakeholder database including their contact details;
- Summary of stakeholder concerns;
- Stakeholder analysis matrix;
- Stakeholder register;
- Stakeholder commitment register;
- Key stakeholder profile form;
- Complaint registration form;
- Complaint resolution form;
- Standardized communication plan; and
- SEP implementation review form.

10. APPENDICES

This Section is structured as follows:

Appendix A: Background Information Document (BID)

Appendix B: stakeholder Engagement Minutes and Registration Sheets

Appendix C: Summary of Focussed Group Discussions (FGDs)

Appendix D: summary of Key Informant Interviews (KIIs)

Appendix E: Toll-Free Number Stakeholder Engagement Feedback

APPENDIX A Background Information Document (BID)

Background Information Document

Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
June 2020

BASE TITANIUM

Introduction

This Background Information Document (BID) provides information to assist in stakeholder participation of the Environmental Impact Assessment (EIA) and environmental authorisation process for the proposed expansion of the Base Titanium Limited (BTL or Base) Kwale. The expansion is located outside of the current Special Mining License (SML) into an area referred to as the North Dune (the Project) which is located immediately to the north-east of the Kwale operation's offices and plant. This BID contains the following information:

- Background to the project;
- Description of the project;
- Location map of the project;
- The potential benefits and impacts of the Project;
- The processes that will be followed to engage with stakeholders; and
- How and when stakeholders can participate during the EIA process.

Background

The current mineral resource mined by Base Titanium comprises two dunes that contain economically viable concentrations of heavy minerals. These two dunes, known as the Central and South Dunes, are separated by the Mukurumudzi River, on which the Mukurumudzi Dam has been built, and are located in the Mwaweche and Kidiani adjudication sections, respectively. The current SML (SML 23), measuring 1,661 hectares, is located within the overall Kwale Exploration Prospecting License (EPL 173) area of 88km^2 and is located approximately 50km to the south of Mombasa, and 10km inland from the Indian Ocean.

The Kwale Mineral Sands Operation's original mine life was set at 13 years, running up until the year 2025. However, the mine life has since been reduced by 2 years to 2023 due to higher mining rates and the expansion of the Wet Concentrator Plant (WCP). To address the reduced mine life, Base commenced an exploration programme in the area outside of the existing mining lease area, including around the North Dune, to identify additional resources that could be economically mined. Base has embarked on determining the feasibility of mining the 'North Dune' mineral deposit.

The location of the North Dune deposit, relative to the Central and South Dunes deposits is shown in Figure 2.

What is an ESIA?

The project requires Environmental Authorisation (EA) from the National Environment Management Authority (NEMA), through an Environmental and Social Impact Assessment (ESIA) process. NEMA is the competent authority under these regulations and has the authority to approve or reject the proposed expansion.

This document provides background information on the Project and the ESIA process. It helps Interested and Affected Parties (I&APs) understand the Project and guides on getting involved. I&APs play a very important role in the ESIA process. We encourage you to register with ERM as an I&AP, as this will enable ERM to keep you informed throughout the ESIA processes. By doing so you will be able to engage in discussions on issues, provide comments on the draft Scoping Report, various specialist study findings, and provide comments on the draft ESIA Report.

ERM's Role

BTL has appointed Environmental Resources Management East Africa Limited (ERM) as the independent Environmental Assessment Practitioner (EAP) for the ESIA. The ESIA will determine anticipated impacts and propose measures on how these might be managed. The ESIA report will then inform an environmental authorisation decision to be taken by NEMA.

Steps in the ESIA Process

An ESIA is part of the project development process and is usually done at the initial stages of the project development, in this case as part of the Project Pre-Feasibility Study (PFS). It is a decision-making tool and should guide whether a project should be implemented, abandoned, or modified before implementation.

The key stages for an ESIA, shown in Figure 1, are:

Screening Phase

This is the first phase of the ESIA, where the proposed project is screened based on project characteristics. The Second Schedule of the Environmental Management Coordination Act (EMCA) lists mining projects as mandatory projects, requiring a full ESIA.

Scoping Phase

The purpose of the scoping phase is essential to determine the scope of studies to be done in the ESIA phase. The emphasis during scoping is to review alternatives, and to identify potential environmental and social impacts, both positive and negative.

The Scoping Report will describe the potential environmental impacts, potential alternatives that are being considered, and a detailed plan of study for the ESIA phase.

ESIA Phase

The objectives of the ESIA phase are to address the impacts that have been identified in the Scoping Report, to assess the significance of all identified impacts and to formulate mitigation measures. An important aspect during this phase is to work in consultation with the Engineering Design team, to avoid or minimize any impacts where possible during this design stage.

After the different aspects of the ESIA is completed, an ESIA report and Environmental and Social Management and Monitoring Plan (ESMP) will be compiled.

Public Participation

Public participation is a legal requirement in the ESIA process; the key principle of consultation is to ensure that the views of stakeholders are taken into account and reported throughout the ESIA process.

The objective is to ensure the assessment is robust, transparent, and has considered the full range of issues or perceptions, and to an appropriate level of detail. Stakeholder's participation will assist in identifying the environmental and social consequences of the proposed project and ensure that these are evaluated in the process.

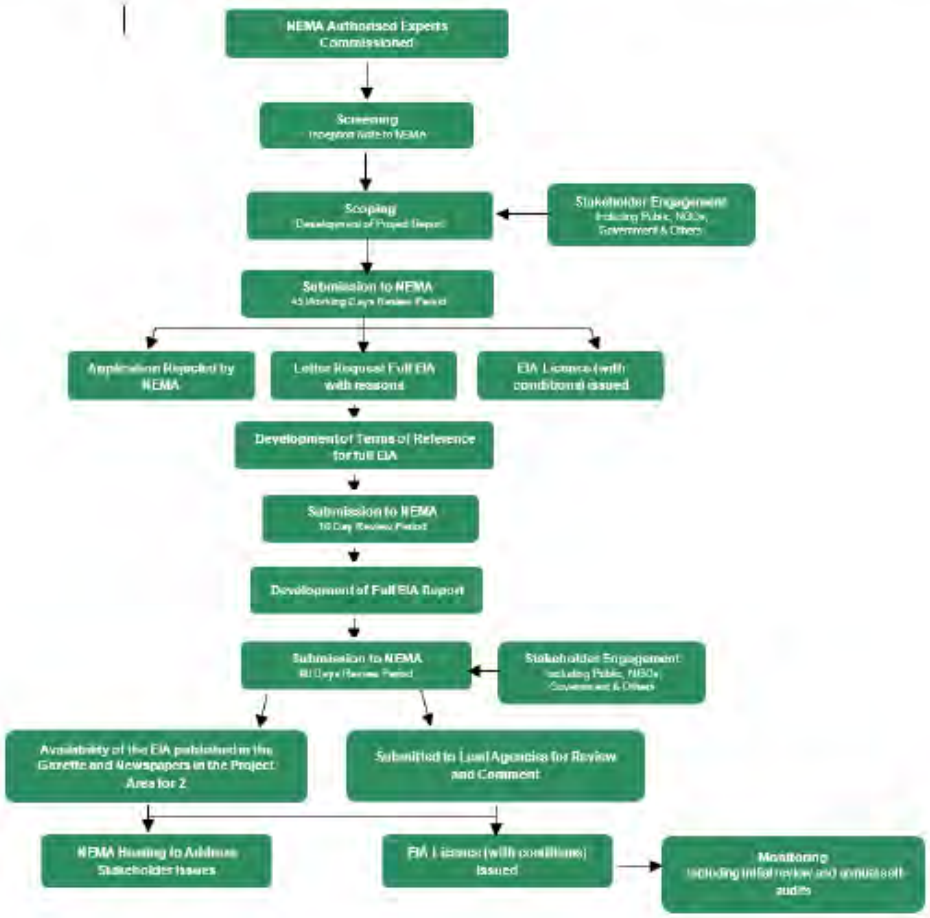

Figure 1: ESIA Process applied in Kenya

- Access to water and water quality impacts could negatively affect local communities.
- The presence of workers in the Project area could result in a change in the disease profile of the local population; particularly of STDs and HIV/AIDS.

Worker Health & Safety.

- Operational activities could impact worker health and safety.
- Handling of hazardous materials could impact worker health and safety.

Traffic and Transportation

- Transport of equipment and machinery during the construction phase may impact on local transport and increase traffic.
- Decommissioning activities could also impact local transport and increase traffic.

Cultural/Heritage Resources

- Site clearing and excavation could have an impact on local cultural/heritage sites, such as Khayas.

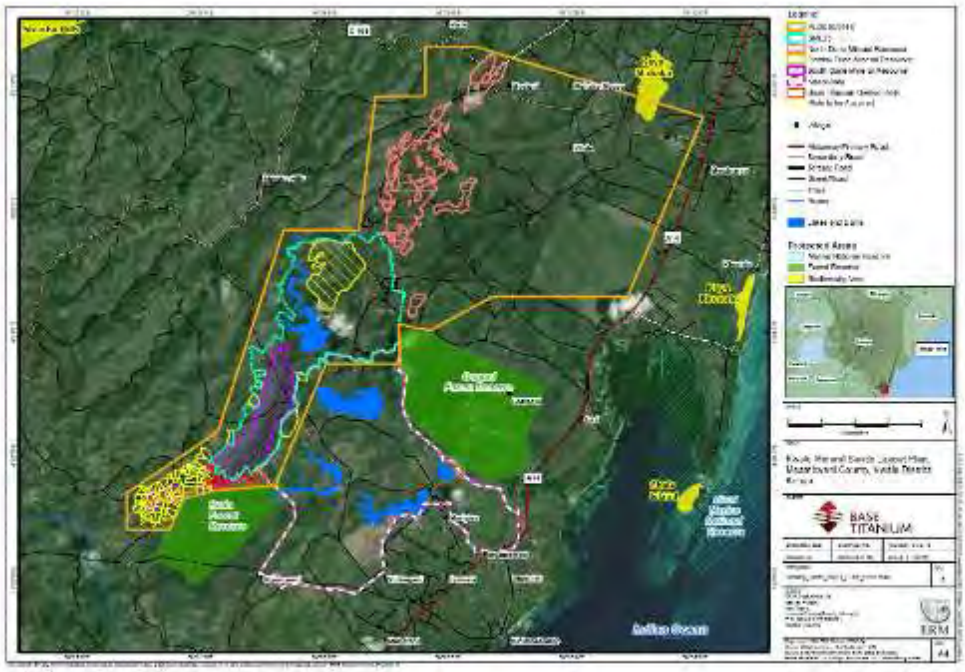

Figure 2: Project Location Map

Environmental Resources Management Base Titanium North Dune EIA

How to Submit Comments

Should you have any queries, comments or suggestions regarding the proposed project, please note them below.

Please provide your contact details.

Name and Title:	**Affiliation:**
Phone:	**Email:**
Address:	

Environmental Resources Management

Tel: +254 800 720 519

Email: Gideon.Owaga@erm.com

Public Participation in the ESIA

The stakeholder engagement process is designed to conform to the NEMA Regulations and global best practices. Key objectives for stakeholder engagement for this project are:

- Share information about the Project and gather local knowledge to improve understanding of the environmental and social context and understand locally important issues;
- Enable stakeholders to raise concerns/questions about the Project and incorporate stakeholder views into the design and management measures;
- Respond to concerns and questions and report back on the findings of the ESIA and proposed management measures; and
- Lay foundation for future stakeholder engagement.

Any party that is interested or potentially affected by the Project is invited to participate in the ESIA process. Please make use of the following opportunities to be involved in the stakeholder engagement process:

- Study the information in the BID;
- Contact the Project Team for further information or raise issues and concerns;
- Complete the Comment Sheet (attached) and return by hand, mail, fax or e-mail; and
- Attend planned stakeholder meetings. More information about the meetings will be circulated through letters, community leaders, and through the Project website.

APPENDIX B Stakeholder Engagement Minutes and Registration Sheets

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion- Men
Village	Bumamani
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Bumamani Village
Date of Meeting	30th July 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education	Majority have completed Primary Education. About 100%
How many of you have completed high school education	About 50%
What are the main issues with getting an education?	School fees, family hardships and negative attitude towards education
Health Condition and Services	
Is there access to health post of Government or private health care Centre, clinic for major and minor ailments?	Yes at Magaoni. 2 hrs travel.
Distance of the nearest health facility from the village- time taken to travel	2hrs
Do you visit traditional health practitioner/traditional healer (women, men) during health problems?	Not common here.
Kenya has one of the most rapidly growing populations in the world. Is this a problem or a blessing? Why?	It has advantages and disadvantages. Advantages include: increased development and market of products. Disadvantages include pressure on resources and infrastructure.
Do you perceive the population in this community to be growing too fast, fast enough, too slowly?	No. Its normal
Government Credibility	
How happy are you with the level of services provided by the County Government? If no why not	Poor. There is no County Government project in Bumamani.
How happy are you with the level of services provided by the National Government? If no why not	Same as above.

Topic	Response
Livelihood Activities (on-farm and non-farm)	
What is main sources of income generation in your village?	Agriculture. Crops include: coconuts, maize
What are the main challenges with earning a livelihood?	No markets, destruction of crops by wild animals and floods.
What type of livelihood activities are only performed by men?	Livestock grazing and farming
Do the men go to earn income outside the settlement? If yes. What types of work they involved in and distance they travel daily for work?	Yes. Small businesses such as kiosks
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops, food processing, herbs processing, construction work etc.)?	Both
What types of typical on-farm work are performed by men?	Digging, ploughing and harvesting
Roles/Responsibilities in the Household	
What are the Key tasks that men are responsible within the household • Household work/farm-work • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Farm-work, decision making, grazing animals, building.
Migration	
Do you know men who migrated from your village? If yes. What are the reasons for their migration? (Employment, earning income, marriage, study)?	Yes. Purchase of land
How many men migrated from your village? Do you know where they migrated to - destination of migration, duration, type of work that they do?	Not common.
Land ownership	
What is the average size of agricultural land owned by the households in your community?	7-10 Acres
How far do you typically travel (walk) to get to your fields?	1km
Is there a shortage of agricultural land?	No
What are the main problems with having access to enough land?	No problems
Use of Natural Resources	
Is there access to safe drinking water in your village? Distance and time taken to fetching water	Yes. One borehole about 1km away
Do you have access to irrigation facility for your agriculture farm land?	Yes

Topic	Response
What are major sources for drinking water and irrigation (river, streams, spring water and others)?	Borehole
Do you have access to community forest for collecting fuel wood?	No
To what extent has the availability of fuel wood declined?	Slightly
Can you explain the causes of ecological degradation and scarcity of forest products?	Overuse and illegal cutting
Do men from this community engage in hunting?	No, it's illegal
Is game that is hunted becoming more scare?	No
Financial Institutions	
Do you have a loan?	No
Who do you owe money to?	Nobody
How do you manage for loan repayment?	Pay in instalments
Do you have bank account in their name? Do they operate by themselves?	No
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	It has become more difficult since Base begun their operations.
What should be the priorities to make life better?	They should go
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome/mitigate the impacts?	So far, the impact has been negative based on the experience from the south Dune. The resettlement and compensation exercise was poorly managed.
Do you have any suggestions to BASE for making your livelihood better?	Avoid relocating us. More care for the elderly, transparency with the community, compensate us for damages to our health and property.
What can government do to improve your livelihoods?	Bring development to the community level
What kind of impact do you think will be brought in with the possible influx of people from outside your area? Both positive and negative?	Strain of infrastructure and resources.

1. Attendance Register

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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	FGD MEN - BUMAMANI VILLAGE
PROJECT	BASE TITANIUM
DATE	30TH JULY 2020
VENUE	BUMAMANI VILLAGE
TIME STARTED	10:00 AM
TIME ENDED	12:00 Noon

Name	Organisation	Designation	Email Address	Telephone No	Signature
Said Ali Mwangombo	Bumamani	Resident	—	0798631249	
Hamisi Salim Mdachgonda	Bumamani	Resident	—	0713193145	
[illegible]	Bumamani	"	—	0724952278	
[illegible]	"	"	—	0757925716	
[illegible]	"	"	—	0715653257	HSB
[illegible]	"	"	—	0726004661	
[illegible]	"	"	—	0706477152	
[illegible]	"	"	"	0700746120	
[illegible]	"	"	"	0704453507	
[illegible]	"	"	"	0706517418	
[illegible]	"	"	"	0756659885	

2. Photo

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion- Village Committee Members
Village	Bumamani
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Bumamani Village
Date of Meeting	1st August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education?	Majority have completed Primary Education.
How many of you have completed high school education?	None.
What are the main issues with getting an education?	Financial challenges, lack of qualifications, coming from disadvantaged families and poverty.
Health Condition and Services	
Is there access to health post of Government or private health care Centre, clinic for major and minor ailments?	Yes, at Magaoni but it lacks adequate facilities and infrastructure.
Distance of the nearest health facility from the village- time taken to travel	About 5km
Do you visit traditional health practitioner/traditional healer (women, men) during health problems?	No.
Kenya has one of the most rapidly growing populations in the world. Is this a problem or a blessing? Why?	It's a problem because the infrastructure and facilities are not expanding at a proportional rate.
Do you perceive the population in this community to be growing too fast, fast enough, too slowly?	No.
Government Credibility	
How happy are you with the level of services provide by the County Government? If no why not	Poor. There are no services at Magaoni. The only school we have is a nursery school. We requested for a bridge to help us cross during the rainy season but nothing was done.

Topic	Response
How happy are you with the level of services provide by the National Government? If no why not	Same as above.
Livelihood Activities (on-farm and non-farm)	
What is main sources of income generation in your village?	Agriculture. Crops include oranges and coconuts.
What are the main challenges with earning a livelihood?	No markets, destruction of crops by wild animals and floods.
What type of livelihood activities are only performed by Men?	Livestock grazing and farming.
Do the men go to earn income outside the settlement? If yes. What types of work they involved in and distance they travel daily for work?	Yes. Small businesses such as shops.
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops, food processing, herbs processing, construction work etc.)?	Both. Men and women.
What types of typical on-farm work are performed by men?	Digging, ploughing and harvesting.
Roles/Responsibilities in the Household	
What are the Key tasks that men are responsible within the household? • Household work/farm-work • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Farm-work, decision making, grazing animals, building.
Migration	
Do you know men who migrated from your village? If yes. What are the reasons for their migration? (Employment, earning income, marriage, study)?	Yes. Conflicts, in search of land, search of jobs and marriage.
How many men migrated from your village? Do you know where they migrated to - destination of migration, duration, type of work that they do?	About 50 people.
Land ownership	
What is the average size of agricultural land owned by the households in your community?	About 5 Acres
How far do you typically travel (walk) to get to your fields?	10 minutes
Is there a shortage of agricultural land?	Yes
What are the main problems with having access to enough land?	Population increase.
Use of Natural Resources	

Topic	Response
Is there access to safe drinking water in your village? Distance and time taken to fetching water	Yes. Most of the times we use shallow wells.
Do you have access to irrigation facility for your agriculture farm land?	Yes
What are major sources for drinking water and irrigation (river, streams, spring water and others)?	Shallow wells.
Do you have access to community forest for collecting fuel wood?	No, we use firewood within the homestead.
To what extent has the availability of fuel wood declined?	It has remained the same.
Can you explain the causes of ecological degradation and scarcity of forest products?	Overuse and illegal cutting
Do men from this community engage in hunting?	No, it's illegal.
Is game that is hunted becoming more scare?	No
Financial Institutions	
Do you have a loan?	No
Who do you owe money to?	Most of us owe small amounts borrowed from our friends.
How do you manage for loan repayment?	We agree as friends.
Do you have bank account in their name? Do they operate by themselves?	No
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	Our problems are the same, our children have no jobs
What should be the priorities to make life better?	Employment and business opportunities targeting the youth.
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome/mitigate the impacts?	Yes. We will lose our land and livelihood.
Do you have any suggestions to BASE for making your livelihood better?	Employment for our children and development programmes for the community.
What can government do to improve your livelihoods?	Bring development to the community level for example build more schools and hospitals.
What kind of impact do you think will be brought in with the possible influx of people from outside your area? Both positive and negative?	Strain of infrastructure and resources, increase in the land prices.

1. Attendance Register

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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	FGD – VILLAGE COMMITTEE
PROJECT	BASE TITANIUM – NORTH DUNE ESIA
DATE	1ST AUGUST 2020
VENUE	BUMAMANI VILLAGE
TIME STARTED	11. 00 AM
TIME ENDED	1:30 PM

Name	Organization	Designation	Email Address	Telephone No.	Signature
MWAWA B. MAJESI	BUMAMANI	RESIDENT	—	0705220209	—
OMAR J. MAPONDA	"	"	—	0717021186	—
SAID ABD. MWACHA	"	"	—	0788 774 57	—
RAMADHANI K. OMARO	"	"	—	0717 755295	—
KASSIM ABD MWACHA	"	"	—	0712 917237	—
MARIAM B. MWAMBIRA	"	"	—	0707951126	—
SALIM H – BEGE	"	"	—	0705 [illegible]	—

2. Photo

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion- Women
Village	Bumamani
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Bumamani Village
Date of Meeting	30th July 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

1. EDUCATION STATUS

Women present

- 4 have completed primary school
- 3 have completed secondary school
- 5 have not gone to school

Children education status

- Both genders are considered for education
- Both have equal opportunities in regard to school enrolment
- 30% cases of drop outs are girls' due to early pregnancies though many cases are of the returning to school once they give birth
- 60% cases are for boys dropping out of school for bodaboda activities and drug abuse
- 10% cases of drop outs are as a result of lack of school fees.

2. HEALTH CONDITIONS AND SERVICES

- 18yrs is the age for girls getting married and 20yrs for boys
- Both genders have the decision to look for their life partner
- The man is with the authority to decide the number of children they should have
- Health problems are not common in this area
- There's access to health posts
- Travelling time to health posts is around half an hour
- Some visit traditional health practitioners but not common

3. LIVELIHOOD ACTIVITIES

- Women engage themselves in small business to earn a living
- Thatch making and selling plus selling of coconuts
- Yes, few do, they get to nearest towns to perform house girl's tasks
- Yes, wages don't depend on gender they all get the same so long as the task performed is similar
- All are performed by both genders
- Watching over crops and harvesting only
- Collecting firewood, fetching water and cooking
- Cooking only, the rest are mostly performed by all

4. ROLES RESPONSIBILITIES IN THE HH

- Fetching water, firewood collection, cooking and sanitation- 8hrs are basically for resting
- There are women holding vital decision making institutions like village chairlady, different committee members and some in BTL's committees

5. MOBILITY

- No restrictions, they can go to different villages and towns for essential services like health posts and markets
- Yes, they go sell local products and buy requirements for the family and self

6. MIGRATION

- Yes, a few have migrated to different villages, some migrate to go and work outside their village while some get married outside their village
- No men have migrated from their village
- Not affected since no men who migrate

7. GENDER ISSUES

- No discrimination among different genders
- Yes, men encourage women to participate in development related meetings
- Yes, women have access to information
- There are no cases regarding gender-based violence.

8. LAND OWNERSHIP

- Most families own an average of 7 acres
- Women do not own land but men
- They don't have control over the issues of selling or buying but have control to use it for farming activities.
- Women in the village don't have joint ownership of land

9. USE OF NATURAL RESOURCES

- Yes, they have access to safe drinking water and are nearly located within their homesteads
- Major sources of water are streams and boreholes
- There are no seasonal problems with water supply
- They have access to forests but they collect firewood in their plots for they are plenty
- Fuel wood availability access has decreased but not to a bigger extend
- Cutting of trees foe charcoal making and high population inhabitation

10. FINANCIAL INSTITUTIONS

- Yes, women have access to loan/credit from financial institutions
- By selling of their local products like the thatches
- Yes, most of them have got operating bank accounts

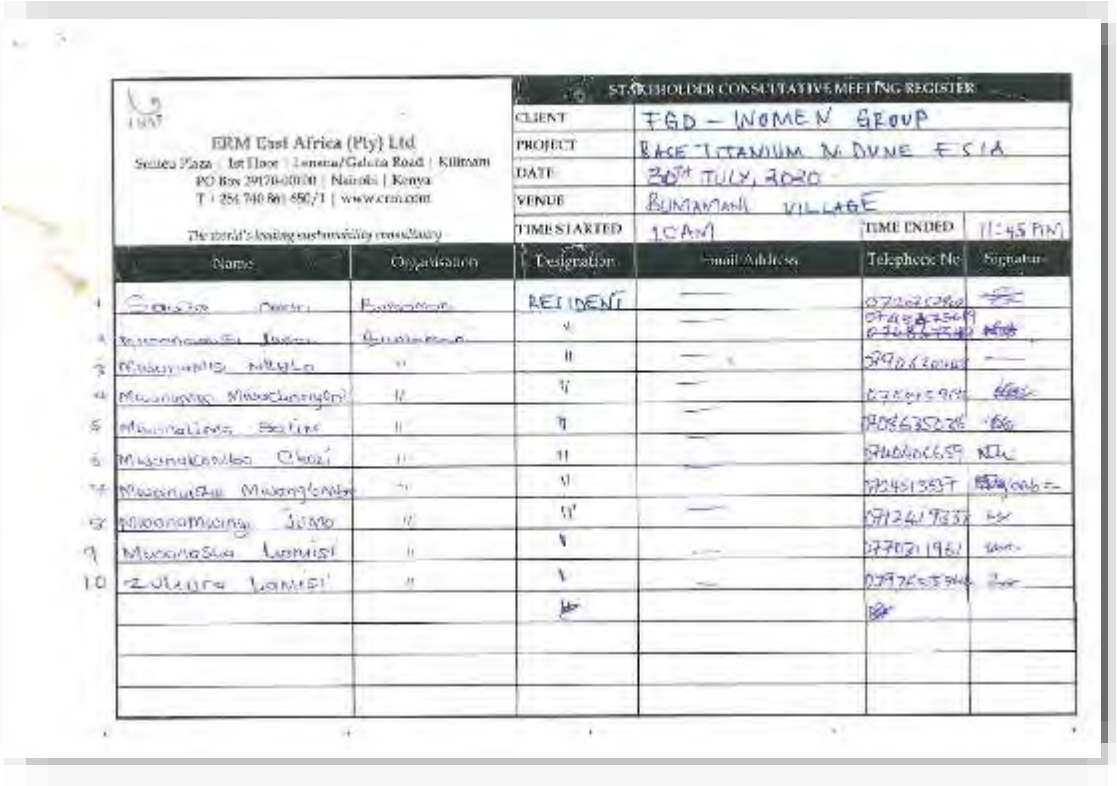
11. QUALITY OF LIFE

- Life hasn't changed except a few developments due to devolution
- Priorities should be; women should be engaged in earning activities/employments, funds to do small business as women and asked if BTL can support them with a tent which will be used for hiring and get some upkeep and use it as well during meetings.

12. IMPACT OF BASE

- Yes, outsiders are approaching elderly people who don't know the value of money and buy plots cheap for they know that once BTL does expansion, they will sell the lands for high costs, they also have fear of losing friends and local markets that support their thatches. They were as well afraid of being relocated by use of low compensations as it was done to Maumba village.
- Women should be supported especially in their small groups by being given some funds to boost their local projects.
- Though many are unskilled but with responsibilities, they are urging the company to provide casual works for women around
- Government should support them and make sure that they won't be relocated and shouldn't support BTL at all in relocation processes. Are as well worried for they are not considered in many government projects with the notion that, they border BTL hence BTL must be supporting them 100% which is wrong.
- No impact at all according to their thought.

1. Attendance Register



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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	FGD – WOMEN GROUP
PROJECT	BASE TITANIUM N DUNE ESIA
DATE	30TH JULY, 2020
VENUE	BUMAMANI VILLAGE
TIME STARTED	10AM
TIME ENDED	11:45 AM

	Name	Organisation	Designation	Email Address	Telephone No	Signature
1	[illegible]	[illegible]	RESIDENT	—	[illegible]	[illegible]
2	[illegible]	[illegible]	〃	—	[illegible]	[illegible]
3	[illegible]	〃	〃	—	[illegible]	—
4	[illegible]	〃	〃	—	[illegible]	[illegible]
5	[illegible]	〃	〃	—	[illegible]	[illegible]
6	[illegible]	〃	〃	—	[illegible]	NIL
7	[illegible]	〃	〃	—	[illegible]	[illegible]
8	[illegible]	〃	〃	—	[illegible]	[illegible]
9	[illegible]	〃	〃	—	[illegible]	[illegible]
10	[illegible]	〃	〃	—	[illegible]	[illegible]

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion- Youth
Village	Bumamani
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Bumamani Village
Date of Meeting	30th July 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education?	Majority have completed Primary Education. About 50%
How many of you have completed high school education?	About 50%
What are the main issues with getting an education?	School fees, early pregnancies, orphaned children.
Health Condition and Services	
Is there access to health post of Government or private health care Centre, clinic for major and minor ailments?	Yes, at Magaoni but it's difficult to access because of lack of transport and no medication at the hospital.
Distance of the nearest health facility from the village- time taken to travel	2hrs
Do you visit traditional health practitioner/traditional healer (women, men) during health problems?	Depends on the type of ailment. There are those that conventional medicine cannot cure.
Kenya has one of the most rapidly growing populations in the world. Is this a problem or a blessing? Why?	There is no difference, things are the same or keep getting worse.
Do you perceive the population in this community to be growing too fast, fast enough, too slowly?	No.
Government Credibility	
How happy are you with the level of services provide by the County Government? If no why not	Poor. Most youth are unemployed, there is no electricity in this village.

Topic	Response
How happy are you with the level of services provide by the National Government? If no why not	Same as above.
Livelihood Activities (on-farm and non-farm)	
What is main sources of income generation in your village?	Agriculture *boda boda* (motorcycle) business, selling room thatching grass.
What are the main challenges with earning a livelihood?	No markets, destruction of crops by wild animals and floods.
What type of livelihood activities are only performed by youth?	Livestock grazing and farming.
Do the men go to earn income outside the settlement? If yes. What types of work they involved in and distance they travel daily for work?	Most of them work in the farms.
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops, food processing, herbs processing, construction work etc.)?	Both. It's a mixture.
What types of typical on-farm work are performed by men?	Digging, ploughing and harvesting.
Roles/Responsibilities in the Household	
What are the Key tasks that men are responsible within the household? • Household work/farm-work • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Farm-work, decision making, grazing animals, building.
Migration	
Do you know men who migrated from your village? If yes. What are the reasons for their migration? (Employment, earning income, marriage, study)?	Yes. Marriage, business, purchase of land in anticipation of Base operations
How many men migrated from your village? Do you know where they migrated to - destination of migration, duration, type of work that they do?	About 20 have migrated in search of jobs and education
Land ownership	
What is the average size of agricultural land owned by the households in your community?	5-10 Acres
How far do you typically travel (walk) to get to your fields?	1km
Is there a shortage of agricultural land?	No
What are the main problems with having access to enough land?	No problems
Use of Natural Resources	

Topic	Response
Is there access to safe drinking water in your village? Distance and time taken to fetching water	Yes. One borehole about 10 minutes away
Do you have access to irrigation facility for your agriculture farm land?	Yes
What are major sources for drinking water and irrigation (river, streams, spring water and others)?	Borehole
Do you have access to community forest for collecting fuel wood?	No, we use firewood within the homestead.
To what extent has the availability of fuel wood declined?	It has remained the same.
Can you explain the causes of ecological degradation and scarcity of forest products?	Overuse and illegal cutting
Do men from this community engage in hunting?	No, its illegal.
Is game that is hunted becoming more scare?	No
Financial Institutions	
Do you have a loan?	No
Who do you owe money to?	Nobody
How do you manage for loan repayment?	We don't have loans.
Do you have bank account in their name? Do they operate by themselves?	No
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	It has become more difficult because most youth are now unemployed
What should be the priorities to make life better?	Employment and business opportunities targeting the youth.
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome/mitigate the impacts?	Yes, we are worried that we will be relocated from here and it's the only place we earn our livelihood.
Do you have any suggestions to BASE for making your livelihood better?	Give the youth employment and business opportunities. Do not relocate us. More on the job training from the youth. Livelihood Restoration Programmes.
What can government do to improve your livelihoods?	Bring development to the community level
What kind of impact do you think will be brought in with the possible influx of people from outside your area? Both positive and negative?	Strain of infrastructure and resources but also business opportunities.

1. Attendance Register

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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	FGD — Youth
PROJECT	BASE TITANIUM N. DUNE
DATE	30TH TITANIUM JULY 2020
VENUE	BUMAMANI VILLAGE
TIME STARTED	11:00 AM
TIME ENDED	1:30 PM

Name	Organisation	Designation	Email Address	Telephone No	Signature
Mustafa Omar	—	Resident	—	0708793624	
Salim Jamaa	—	Resident	—	0796285038	
Mohamed Hamisi	—	Resident	—	0746853718	
Jamila Juma	—	"	—	0796103818	
Mwajuma Hassan	—	"	—	0706462146	
Fatuma Omar	—	"	—	0758699[illegible]	
Mgeni Chaka	—	"	—	0757105674	
Fatuma Mohamed	—	"	—	0745[illegible]	
Said Maponda	—	"	—	0727[illegible]	
Hamisi Kassim	—	"	—	0790[illegible]	
Kadir Mwitu	—	"	—	0757[illegible]	
Said Junior	—	"	—	0704[illegible]	
Simuti Andre	—	"	—	0795[illegible]	
Mbaniru Ngame	—	"	—	0769[illegible]	

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion- Men
Village	Mkwambani
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Bumamani Village
Date of Meeting	5th August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education?	Majority have completed Primary Education (80%).

Topic	Response
How many of you have completed high school education?	None.
What are the main issues with getting an education?	School fees, family hardships and shortage of teachers.
Health Condition and Services	
Is there access to health post of Government or private health care Centre, clinic for major and minor ailments?	Yes.
Distance of the nearest health facility from the village- time taken to travel	Less than 1km.
Do you visit traditional health practitioner/traditional healer (women, men) during health problems?	No.
Kenya has one of the most rapidly growing populations in the world. Is this a problem or a blessing? Why?	It's a problem because there will be pressure on resources and infrastructure.
Do you perceive the population in this community to be growing to fast, fast enough, too slowly?	Fast enough.
Government Credibility	
How happy are you with the level of services provide by the County Government? If no why not	Average. There are few development projects underway e.g. water and also the bursary programme has benefited most of our children.
How happy are you with the level of services provide by the National Government? If no why not	Same as above.
Livelihood Activities (on-farm and non-farm)	
What is main sources of income generation in your village?	Farming of crops such as; mangoes, maize, cashew nuts and bananas. There those who run small businesses such as shops.
What are the main challenges with earning a livelihood?	No markets, poor infrastructure and destruction of cash crops by wild animals.
What type of livelihood activities are only performed by men?	Livestock grazing and farming.
Do the men go to earn income outside the settlement? If yes. What types of work they involved in and distance they travel daily for work?	Yes. Small businesses such as shops.
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops, food processing, herbs processing, construction work etc.)?	Both
What types of typical on-farm work are performed by men?	Digging, ploughing and harvesting.
Roles/Responsibilities in the Household	
What are the Key tasks that men are responsible within the household? • Household work/farm-work	Farm-work, decision making, grazing animals, building.

Topic	Response
• Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	
Migration	
Do you know men who migrated from your village? If yes. What are the reasons for their migration? (Employment, earning income, marriage, study)?	Yes. Purchase of land and marriage.
How many men migrated from your village? Do you know where they migrated to - destination of migration, duration, type of work that they do?	We are not sure but it happens.
Land ownership	
What is the average size of agricultural land owned by the households in your community?	About 10 acres
How far do you typically travel (walk) to get to your fields?	About 10 minutes.
Is there a shortage of agricultural land?	No
What are the main problems with having access to enough land?	Ownership and infrastructure.
Use of Natural Resources	
Is there access to safe drinking water in your village? Distance and time taken to fetching water	Yes. We receive water from the County Government.
Do you have access to irrigation facility for your agriculture farm land?	Yes
What are major sources for drinking water and irrigation (river, streams, spring water and others)?	Tap water from the County Government.
Do you have access to community forest for collecting fuel wood?	No
To what extent has the availability of fuel wood declined?	It has not declined.
Can you explain the causes of ecological degradation and scarcity of forest products?	Illegal wood cutting and pollution.
Do men from this community engage in hunting?	No, it's illegal.
Is game that is hunted becoming more scare?	No
Financial Institutions	
Do you have a loan?	No
Who do you owe money to?	Nobody
How do you manage for loan repayment?	N/A
Do you have bank account in their name? Do they operate by themselves?	No
Quality of life	

Topic	Response
How has life changed over the past 10 years? Is it better or worse? Why?	It has become more difficult since because of climate change and inflation.
What should be the priorities to make life better?	Education and health.
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome/mitigate the impacts?	From the previous experience we are already feeling the negative impacts from Base mining activities in the South Dune e.g.: displacement of communities. We anticipate that this will be worse. We also fear that there may be destruction of cultural heritage sites, loss of livelihood, diseases such as chest infections because of the dust. We want the resettlement process to be fair and transparent. There should also be a livelihood restoration programme for all the affected community members.
Do you have any suggestions to BASE for making your livelihood better?	Transparency and fairness in all their activities.
What can government do to improve your livelihoods?	Bring development projects and improve infrastructure at the community level.
What kind of impact do you think will be brought in with the possible influx of people from outside your area? Both positive and negative?	Strain of infrastructure and resources.

1. Attendance Register

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PUBLIC MEETING REGISTER

CLIENT	FGD- MEN MKWAMBANI
PROJECT	BASE TITANIUM - N DUNE ESIA
DATE	5TH AUGUST 2020
VENUE	MKWAMBANI PRIMARY
TIME STARTED	9:30 AM
TIME ENDED	10:65AM

Name	Sex (M/F)	Location	Telephone No.	ID No	Signature
ABDALLA SALIM MWAFAMA	MALE	MKWAMBANI	0705631564	8427163	
OMARE BAKARI SHEE	"	"	0708531065	14598057	
SHEIKH SHEE MWAMALIMOO	"	"	0795679504	33859378	
MASUDI ATHUMANI MASUDI	MALE	"	0725456996	8427574	
MOHAMED SALIM MWAFAMA	"	"	0721468970	855217	
SHEE BAKARI MKANGALA	"	"	0790646539	13731/14	
SAID HASSANI MWALIMU	"	"	0729639233	2199819	
OMARI [illegible] SHANDO	"	"	0748054864		
OMARI BAKARI MWACHITWO	"	"	0727481481	8434751	
MATANO HASSAN MWALIMU	"	"	0717781609	2199329	
RAMA SALIM MONDO MWALIDZANGA	"	"	0792519096		
ALI SALIM MWATSAMA	"	"	0768617559	27706777	
JUMA ATHUMANI MAONE	"	"	0722549796	20921746	
	"	"			

2. Photo

MEETING MINUTES

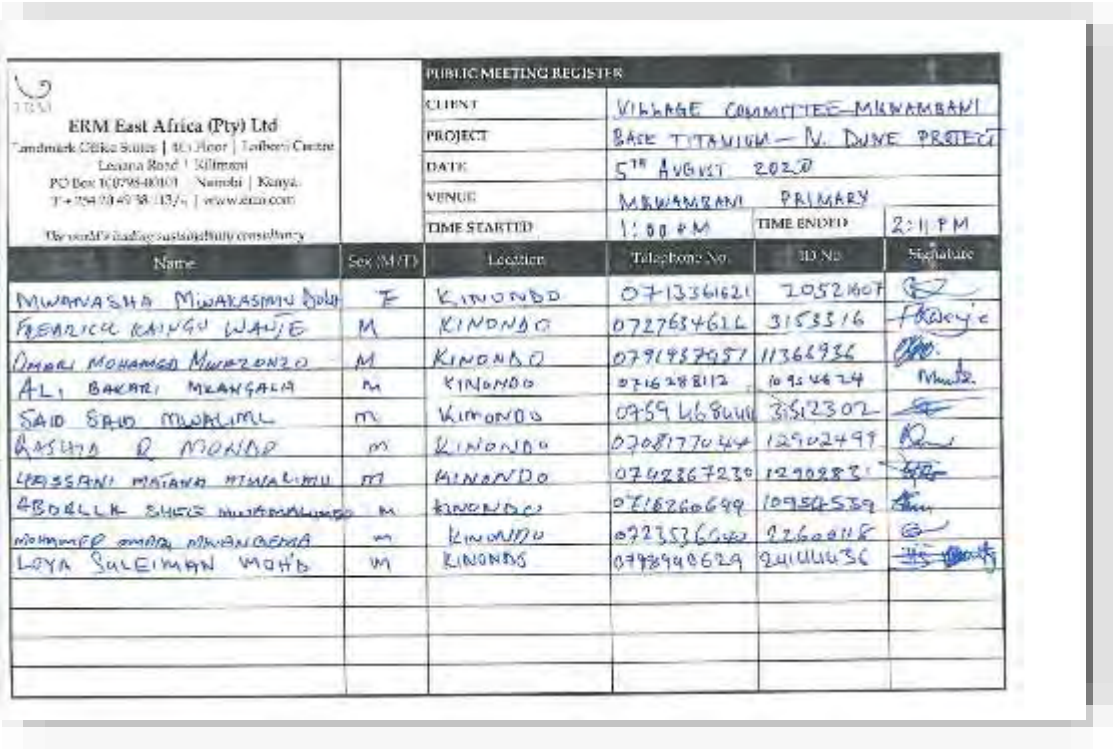
Stakeholder Consulted	Focused Group Discussion (FGD)- Village Committee
Village	Mkwambani
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Mkwambani Village
Date of Meeting	5th August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education?	Majority have completed Primary Education (70%).
How many of you have completed high school education?	50%.
What are the main issues with getting an education?	School fees, family hardships and shortage of teachers.
Health Condition and Services	
Is there access to health post of Government or private health care Centre, clinic for major and minor ailments?	Yes.
Distance of the nearest health facility from the village- time taken to travel	Less than 1km.
Do you visit traditional health practitioner/traditional healer (women, men) during health problems?	No.
Kenya has one of the most rapidly growing populations in the world. Is this a problem or a blessing? Why?	It's a problem because there will be pressure on resources and infrastructure.
Do you perceive the population in this community to be growing too fast, fast enough, too slowly?	Fast enough.
Government Credibility	
How happy are you with the level of services provide by the County Government? If no why not	Not satisfactory. We are still waiting to see projects that can benefit us.
How happy are you with the level of services provide by the National Government? If no why not	Same as above.

Topic	Response
Livelihood Activities (on-farm and non-farm)	
What are main sources of income generation in your village?	Farming of crops such as; mangoes, maize, cashew nuts and bananas. There those who run small businesses such as shops.
What are the main challenges with earning a livelihood?	No markets, poor infrastructure and destruction of cash crops by wild animals.
What type of livelihood activities are only performed by men?	Livestock grazing and farming.
Do the men go to earn income outside the settlement? If yes. What types of work they involved in and distance they travel daily for work?	Yes. Small businesses such as shops.
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops, food processing, herbs processing, construction work etc.)?	Both
What types of typical on-farm work are performed by men?	Digging, ploughing and harvesting.
Roles/Responsibilities in the Household	
What are the Key tasks that men are responsible within the household? • Household work/farm-work • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Farm-work, decision making, grazing animals, building.
Migration	
Do you know men who migrated from your village? If yes. What are the reasons for their migration? (Employment, earning income, marriage, study)?	Yes. Purchase of land and marriage.
How many men migrated from your village? Do you know where they migrated to - destination of migration, duration, type of work that they do?	We are not sure but it happens.
Land ownership	
What is the average size of agricultural land owned by the households in your community?	About 10 acres
How far do you typically travel (walk) to get to your fields?	About 10 minutes.
Is there a shortage of agricultural land?	No
What are the main problems with having access to enough land?	Ownership and infrastructure.
Use of Natural Resources	
Is there access to safe drinking water in your village? Distance and time taken to fetching water	Yes. We receive water from the County Government.

Topic	Response
Do you have access to irrigation facility for your agriculture farm land?	Yes
What are major sources for drinking water and irrigation (river, streams, spring water and others)?	Tap water from the County Government.
Do you have access to community forest for collecting fuel wood?	No
To what extent has the availability of fuel wood declined?	It has not declined.
Can you explain the causes of ecological degradation and scarcity of forest products?	Illegal wood cutting and pollution.
Do men from this community engage in hunting?	No, it's illegal.
Is game that is hunted becoming more scare?	No
Financial Institutions	
Do you have a loan?	No
Who do you owe money to?	None.
How do you manage for loan repayment?	N/A
Do you have bank account in their name? Do they operate by themselves?	No
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	It has become more difficult since because of climate change and inflation.
What should be the priorities to make life better?	Education and health.
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome/mitigate the impacts?	Yes, especially of the area of losing our land and agricultural produce.
Do you have any suggestions to BASE for making your livelihood better?	• As village committee members we are having difficulties explaining to the community that their land is safe. Most of them witnessed what happened during the previous relocation. • The negative experiences of those who were relocated from Maumbo village has continued to be used as a reference for what may be coming. The community feels that Base is not transparent with their plans. • Base should give more training to the Village committee members so that they can be better prepared to inform the community about the project.
What can government do to improve your livelihoods?	Bring development projects and improve infrastructure at the community level.
What kind of impact do you think will be brought in with the possible influx of people from outside your area? Both positive and negative?	Strain of infrastructure and resources.

1. Attendance Register



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PUBLIC MEETING REGISTER

CLIENT	VILLAGE COMMITTEE-MKWAMBANI		
PROJECT	BASE TITANIUM – N. DUNE PROJECT		
DATE	5TH AUGUST 2020		
VENUE	MKWAMBANI PRIMARY		
TIME STARTED	1:00 PM	TIME ENDED	2:11 PM

Name	Sex (M/F)	Location	Telephone No.	ID No	Signature
MWANASHA MWAKASIMU DOLA	F	KINONDO	0713361621	20521607	
PATRICK KAINGU WANJE	M	KINONDO	0727634616	31533316	
OMARI MOHAMED MWEZONZO	M	KINONDO	0791957957	11366936	
ALI BAKARI MKANGALA	M	KINONDO	0716288112	10954674	
SAID SAID MWALIMU	M	KINONDO	0759468646	31512302	
RASHID R MONDO	M	KINONDO	0708177044	12902499	
HASSANI MATANA MWALIMU	M	KINONDO	0742367230	12902837	
ABDALLA SHEIS MWAMALUNGU	M	KINONDO	0718260699	10954539	
MOHAMED OMAR MWANGEMA	M	KINONDO	0723536660	22608118	
LOYA SULEIMAN MOH'D	M	KINONDO	0793940629	24114436	

2. Photo

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion (FGD) - Women
Village	Mkwambani
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Mkwambani Village
Date of Meeting	4th August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education?	About 50%
How many of you have completed high school education?	About 10%
Are children (girls and boys) from each and every households able to go to school? If no. What are the barriers for them?	Yes. But some barriers to girls include: school fees and unwanted pregnancies.
Are girls enrolling equally in basic education (primary school)? It not. Why?	Yes.
What is the trend for class dropout rate of boys and girls? Reasons for their dropout/ stopping studying?	It's not as much but mostly due to unwanted pregnancies.
Health Condition and Services	
What is the average age of marriage for women and men in your village?	18 years.
Who makes the decision on choice of partner in the family?	Both husband and wife.
Average age of mother at childbirth (first child),	16-18 years.
Who decides on number of children to have?	Both partners.
Do the women face health problems in your settlement? If yes what are they (uterus prolapse, HIV/AIDS, STD, others)?	Yes. Malaria, chest infection, coughing.
Is there access to health posts (Government) or private health care Centre, clinic for major and minor ailments?	Yes. Private health centres include: Maasai and Faraja about 2km away. The government hospital is 5km away.

Topic	Response
Distance of the nearest health facility from the village- time taken to travel	2km
Do you visit traditional health practitioner/traditional healer (women, men) for health problems?	No.
Livelihood Activities (on-farm and non-farm)	
What are main sources of income generation for livelihoods in your village?	Farming of crops such as: coconuts and maize (cash crops) and vegetables (domestic use). Also stitching of *Makuti* (grass) for roof thatching.
What type of livelihood activities performed by women?	Same as above.
Do women go to earn income outside the settlement? If yes. What types of work are they involved in and distance they travel daily for work?	Yes. Mainly mending/stitching thatched grass that is used for roofing and selling coconuts.
Is there an equal wage received for same work by women and men? If not. Why?	It's the same.
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops food processing, herbs processing, construction work etc.)?	Both.
What type of typical on-farm work is performed by women?	Digging, planting, ploughing and harvesting.
What type of typical non-farm work is performed by women?	Household chores e.g. cleaning, cooking etc.
Specific job roles that are undertaken by women-only (particular skills required)	None.
Roles/Responsibilities in the Household	
What are the Key tasks that women are responsible within the household? • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Fetching water, firewood, cooking and cleaning.
Mobility	
Is there restriction to women's mobility (due to cultural and religious value and norms) for access to essential services. Why? If not, explain the distance and institutions they can visit without assistance from the male members	No. They can visit clinics or hospitals.
Do the women go to market to sell local produce and to buy requirements for the family and self?	Yes.
Migration	

Topic	Response
Do you know women who migrated from your village? If yes. How many and what are the reasons for their migration? (employment, earning income, marriage, study)	Yes. Most of the got married and others purchased land elsewhere.
How many women migrated from your village?	About five.
Is migration of male members of the family affecting women's life and livelihood? Are they overburdened?	No.
Land ownership	
What is the average size of agricultural land owned by the households in your community?	5-20 acres.
Do the women have ownership of land and houses or are they registered on their name? If yes. Can you share (what %) of households in your village?	Most land is registered under the man's name unless it's a widow.
Do they have control over its use/sell/buy?	No. But they discuss with the spouse.
Do the women have joint ownership of land? If yes. How many households have this ownership?	Not common.
Use of Natural Resources	
Is there access to safe drinking water in your village? Distance and time taken to fetch water	Yes. 2km away.
What are major sources for drinking water (river, streams, spring water and others)?	Rivers and streams.
Are there seasonal problems with the water supply, if so please tell us what these are.	No.
Do you have access to a community forest for collecting fuel wood?	We use trees within the homestead.
To what extent has the availability of fuel wood declined?	It has not declined.
Can you explain the causes of ecological degradation and scarcity of forest products?	Pollution.
Financial Institutions	
Do the women participate in and have access to loan/ credit from financial institutions (cooperative, group saving and credit micro-finance etc.)?	Yes. Mostly table banking.
How do you manage loan repayment?	Through instalments.
Do the women have bank account in their name? Do they operate them by themselves?	Yes.
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	It is better as compared to the past because of changes brought about by development and technology.

Topic	Response
What should be the priorities to make life better?	Health, education, food security.
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome the impact?	• Yes. We will lose our land and livelihood. They should not come here. • Our livelihood is mainly dependent on the natural resources around us. If we are taken elsewhere, we are not sure the environment will sustain us. • The money that will be paid as compensation for our land will not sustain us for long. • We have seen negative impacts our colleagues have faced during the relocation of the south Dune. We don't want to go through the same.
What should be done by the project for the economic empowerment of women in the village?	Equal distribution of opportunities and livelihood restoration programmes targeting women. Women should be more involved in the decision-making process around land and resettlement.
Do you have any suggestions to BASE for making your livelihood better?	We want them to go because we are uncertain about our land and livelihood.
Do you have any suggestions as to how government could improve people's lives?	More development projects in areas such as: health and education.
What kind of impact do you think will be brought in with influx of people from outside your area? Both positive and negative?	Positive; business opportunities and development, negative; straining of infrastructure and resources such as water.

1. Attendance Register

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PUBLIC MEETING REGISTER

CLIENT	FBD – WOMEN, MR MWAMBANI
PROJECT	BASE TITANIUM N. DUNE ESIA
DATE	5TH AUGUST 2020
VENUE	MWAKIRANI PRIMARY
TIME STARTED	11:00 AM
TIME ENDED	12:50 PM

Name	Sex (M/F)	Location	Telephone No.	ID No	Signature
HAMISSARI MOHAMED	F	MKUMWIRANI	—	—	—
SEBENA MOH'D JONZO	F	"	—	1124676	—
JUMA NDANYU KI	F	"	—	—	—
FATUMA SAID MWALIMI	F	"	—	—	—
MWANASI MASUDI	F	"	—	—	—
MWASHANA HATARI	F	"	—	—	—
MWANAJUMA [illegible]	F	"	—	—	—
HADIJA MBWANA	F	"	—	—	—
AMBARI MOHAMED	F	"	—	—	—
MGENI [illegible]	F	"	—	—	—
MWANASHA BAKARI	F	"	—	—	—
MASAI MBITI	F	"	—	—	—

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion- Youth
Village	Mkwambani
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Mkwambani Village
Date of Meeting	5th August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education?	Majority have completed Primary Education (90%)
How many of you have completed high school education?	50%
What are the main issues with getting an education?	School fees, family challenges, unwanted pregnancies, lack of commitment from the caregivers.
Health Condition and Services	
Is there access to health post of Government or private health care Centre, clinic for major and minor ailments?	Yes.
Distance of the nearest health facility from the village- time taken to travel	Less than 1km.
Do you visit traditional health practitioner/traditional healer (women, men) during health problems?	No.
Kenya has one of the most rapidly growing populations in the world. Is this a problem or a blessing? Why?	It's a problem because there will be pressure on resources and infrastructure.
Do you perceive the population in this community to be growing too fast, fast enough, too slowly?	Fast enough.
Government Credibility	
How happy are you with the level of services provide by the County Government? If no why not	Not happy because most of the youth are not employed and do not receive any kind of support.

Topic	Response
How happy are you with the level of services provide by the National Government? If no why not	Same as above.
Livelihood Activities (on-farm and non-farm)	
What is main sources of income generation in your village?	Farming of crops such as; mangoes, maize, cashew nuts and bananas. There those who operate *boda boda* (motorcycle) business.
What are the main challenges with earning a livelihood?	No capital, lack of training for the youth or proper education, no incentives or support from the government.
What type of livelihood activities are only performed by men?	Livestock grazing and farming.
Do the youth go to earn income outside the settlement? If yes. What types of work they involved in and distance they travel daily for work?	Yes. Small businesses such as shops and *boda boda.*
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops, food processing, herbs processing, construction work etc.)?	Both
What types of typical on-farm work are performed by men?	Digging, ploughing and harvesting.
Roles/Responsibilities in the Household	
What are the Key tasks that men are responsible within the household? • Household work/farm-work • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Farm-work, decision making, grazing animals, building.
Migration	
Do you know men who migrated from your village? If yes. What are the reasons for their migration? (Employment, earning income, marriage, study)?	Yes. Purchase of land, search for employment and study.
How many men migrated from your village? Do you know where they migrated to - destination of migration, duration, type of work that they do?	Not sure.
Land ownership	
What is the average size of agricultural land owned by the households in your community?	About 5-10 acres
How far do you typically travel (walk) to get to your fields?	About 10 minutes.
Is there a shortage of agricultural land?	No
What are the main problems with having access to enough land?	Most people do not have titles.

Topic	Response
Use of Natural Resources	
Is there access to safe drinking water in your village? Distance and time taken to fetching water	Yes. We receive water from the County Government.
Do you have access to irrigation facility for your agriculture farm land?	Yes
What are major sources for drinking water and irrigation (river, streams, spring water and others)?	Tap water from the County Government.
Do you have access to community forest for collecting fuel wood?	No
To what extent has the availability of fuel wood declined?	It has not declined.
Can you explain the causes of ecological degradation and scarcity of forest products?	Pollution.
Do men from this community engage in hunting?	No, it's illegal.
Is game that is hunted becoming more scare?	No
Financial Institutions	
Do you have a loan?	No
Who do you owe money to?	Nobody
How do you manage for loan repayment?	N/A
Do you have bank account in their name? Do they operate by themselves?	No
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	It has become more difficult for the youth because most of them are not supported or empowered. Most industries do not provide enough opportunities for the youth.
What should be the priorities to make life better?	Education and health.
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome/mitigate the impacts?	• Our livelihood will be greatly impacted. We have learned from the previous exercise where Base relocated the community to a place called Bwiti (3-4km at Rasimi) where the land is very infertile. They are now struggling to even cultivate food. • As a youth I depend on the land here to earn a livelihood my family lives here and my life will be disrupted if anything happens to my land. • The scholarships and bursaries from Base should be distributed in a way that benefits all the communities equally. Consideration should also be given especially to the poor youth irrespective of their performance.

Topic	Response
	• The youth should be given internship and attachment opportunities at Base. • Base should ensure the youth in this community are also considered during employment. • The village committees do not adequately represent the youth. We feel that they are compromised.
Do you have any suggestions to BASE for making your livelihood better?	As mentioned above.
What can government do to improve your livelihoods?	Bring development projects and improve infrastructure at the community level.
What kind of impact do you think will be brought in with the possible influx of people from outside your area? Both positive and negative?	Strain of infrastructure and resources.

1. Attendance Register

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PUBLIC MEETING REGISTER

CLIENT	FGD - Youth - Mkwambani Village
PROJECT	BASE TITANIUM-N DUNE ESIA
DATE	AUGUST 5TH 2020
VENUE	MKWAMBANI PRIMARY
TIME STARTED	2:30 PM
TIME ENDED	4:40 PM

Name	Sex (M / F)	Location	Telephone No.	ID No.	Signature
NBARUKU HAMISI	M	KILINDO	0705228705	38016274	
ABDALLA CHIGOWA	M	KIAUNGO	0702803472	20910822	
MWANAJUMA GHANYUMA	F	KILINDO	0740259171	34909818	
SIAMINI OMARI	F	KILINDO	0706246020	30952875	
RIZIKI RAMA	F	KILINDO	0702477394	32240289	
ALI [illegible] MWATAMBA	M	KILINDO	0717616864	27565480	
SAID OMAR MWINYI	M	KILINDO	0791431107	33556668	
RADHA FRED KIANTE	M	KILINDO	0795761657	35347834	
Salim Mbaraka Gunia	M	KILINDO	0796082528	36591240	
M. Rama MWALIWAN GA	M	KILINDO	0759945562	26796562	
JUMA HASSAN	M	KILINDO	0798063331	30588296	
SELEMANI	M	HASINI	0705772761	20521576	

2. Photo

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion- Men & Village Committee Members
Village	Mwaloya
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Mwaloya Village
Date of Meeting	29th July 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education?	Majority have completed Primary Education. About 90%
How many of you have completed high school education?	About 50%
What are the main issues with getting an education?	School fees and financial challenges.
Health Condition and Services	
Is there access to health post of Government or private health care Centre, clinic for major and minor ailments?	Yes at Magaoni Dispensary constructed by Base Titanium.
Distance of the nearest health facility from th3the village- time taken to travel	1 hr
Do you visit traditional health practitioner/traditional healer (women, men) during health problems?	No.
Kenya has one of the most rapidly growing populations in the world. Is this a problem or a blessing? Why?	It's a problem if the infrastructure and social amenities do not match the demand.
Do you perceive the population in this community to be growing too fast, fast enough, too slowly?	No. Its normal
Government Credibility	
How happy are you with the level of services provide by the County Government? If no why not	Not happy. There are few projects initiated by the County Government and poor service delivery.
How happy are you with the level of services provide by the National Government? If no why not	Same as above.

Topic	Response
Livelihood Activities (on-farm and non-farm)	
What are main sources of income generation in your village?	Agriculture. Crops include: coconuts and maize.
What are the main challenges with earning a livelihood?	Destruction of crops by wild animals, no markets for our produce and floods.
What type of livelihood activities are only performed by men?	Livestock grazing and farming
Do the men go to earn income outside the settlement? If yes. What types of work they involved in and distance they travel daily for work?	Yes. Casual jobs such as construction and land clearing.
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops, food processing, herbs processing, construction work etc.)?	Both
What types of typical on-farm work are performed by men?	Digging, ploughing and harvesting
Roles/Responsibilities in the Household	
What are the Key tasks that men are responsible within the household? • Household work/farm-work • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Farm-work, decision making, grazing animals, building.
Migration	
Do you know men who migrated from your village? If yes. What are the reasons for their migration? (Employment, earning income, marriage, study)?	Yes. Purchase of land
How many men migrated from your village? Do you know where they migrated to - destination of migration, duration, type of work that they do?	About 10 mainly in search of work and education.
Land ownership	
What is the average size of agricultural land owned by the households in your community?	7-10 Acres
How far do you typically travel (walk) to get to your fields?	10 minutes.
Is there a shortage of agricultural land?	No
What are the main problems with having access to enough land?	No problems
Use of Natural Resources	
Is there access to safe drinking water in your village? Distance and time taken to fetching water	Yes. One borehole about 1km away

Topic	Response
Do you have access to irrigation facility for your agriculture farm land?	Yes
What are major sources for drinking water and irrigation (river, streams, spring water and others)?	Borehole
Do you have access to community forest for collecting fuel wood?	No
To what extent has the availability of fuel wood declined?	Its readily available because most of the firewood is sourced from within the homestead.
Can you explain the causes of ecological degradation and scarcity of forest products?	Overuse and illegal cutting
Do men from this community engage in hunting?	No, it's illegal
Is game that is hunted becoming more scarce?	No because it's illegal to hunt game
Financial Institutions	
Do you have a loan?	No
Who do you owe money to?	Nobody
How do you manage for loan repayment?	N/A
Do you have bank account in their name? Do they operate by themselves?	No
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	It has become more difficult because of inflation and high cost of living.
What should be the priorities to make life better?	Water, Education, Health and infrastructure.
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome/mitigate the impacts?	• Yes. We anticipate negative impacts going by what we experienced during the south Dune expansion. Many of our colleagues were poorly compensated and currently are living a miserable life. The land they were relocated to is not productive/fertile hence their livelihood has been negatively impacted. • Base should ensure the community is fairly compensated and their livelihood should not be impacted.
Do you have any suggestions to BASE for making your livelihood better?	• Avoid relocating us. • Fair compensation for crops and affected property. • Ensure restoration of our livelihood. • Give priority to the community with regards to the employment opportunities. • Increase the bursary allocations. • Promote business opportunities for the locals.

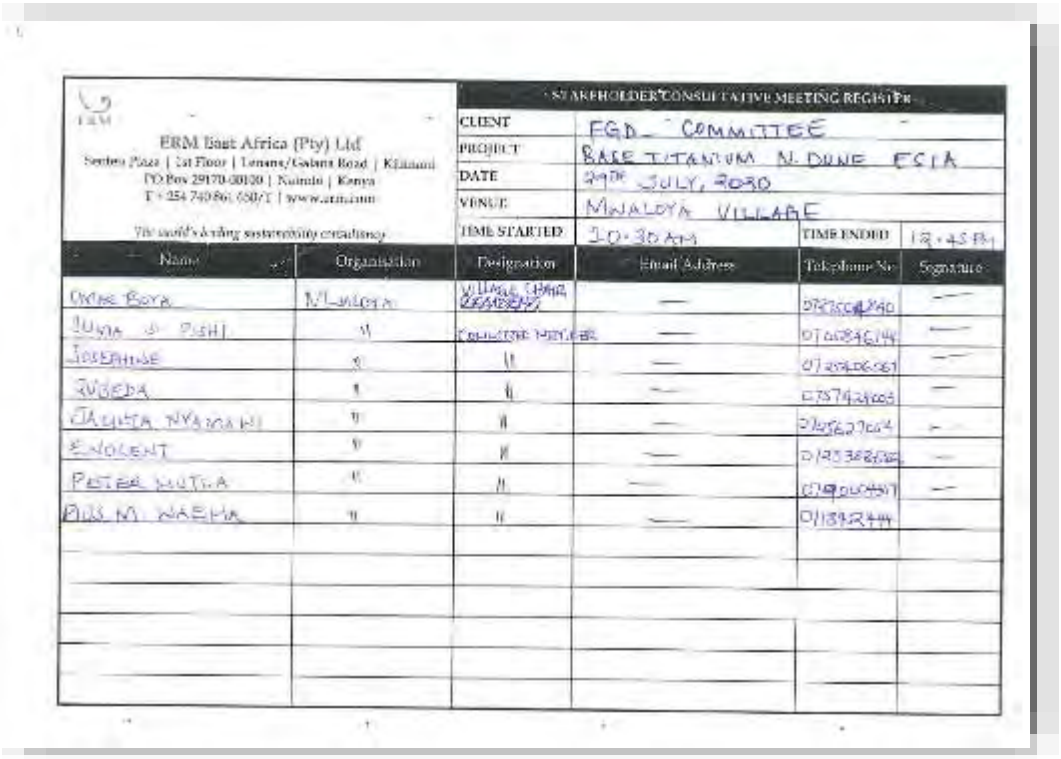
Topic	Response
What can government do to improve your livelihoods?	Bring development to the community level.
What kind of impact do you think will be brought in with the possible influx of people from outside your area? Both positive and negative?	Negative; Strain of infrastructure and resources. Positive: increased business opportunities.

1. Attendance Register

BASE TITANIUM

Attendace Register
Meeting: FGD - Men — MWALOYA VILLAGE Date: 29th July, 2020

No	Name	Designation	Contact	ID/No	Signature
1	PIUS M. KIAMA	FARMER	0718462444	0436080	
2	Battistha Mwatendoro	Farmer	0705895844	12897246	
3	Daniel Mbatha Ngila	FARMER	0727134678	0460924	
4	ROBERT Mwamati Mutua	FARMER	0790764732	31825384	
5	Nicholus Masila	Farmer	0704496180	33918082	
6	Sulemani Chudzunga	Farmer	0746578089		
7	Peter Mgei	FARMER	0726811129	11626497	
8	Titus M Mwanyale	Farmer	0711245773	9490334	
9	Shamsia Mwaki	Farmer	0794122494		
10					
11					
12					
13					
14					



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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	FGD - COMMITTEE
PROJECT	BASE TITANIUM N. DUNE ESIA
DATE	29TH JULY, 2020
VENUE	MWALOYA VILLAGE
TIME STARTED	10:30 AM
TIME ENDED	12:45 PM

Name	Organization	Designation	Email Address	Telephone No	Signature
OKINE BOYA	MWALOYA	VILLAGE ELDER	—	0725604240	—
JUMA S. PISHI	"	COMMITTEE MEMBER	—	0740846744	—
JOSEPHINE	"	"	—	0724406061	—
RUBEDA	"	"	—	0757434005	—
JACINTA NYAMANI	"	"	—	0705627004	—
S'NOCENT	"	"	—	0725388020	—
PETER MUTUA	"	"	—	0790004591	—
PIUS M. KIAMA	"	"	—	0718462444	

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion (FGD) - Women
Village	Mwaloya
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Mwaloya Village
Date of Meeting	29th August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

1. EDUCATION STATUS

Women present

- 3 have completed primary school
- 2 completed high school
- 5 have not gone to school

Children education status

- All children both girls and boys are taken to primary school.
- Girls have equal opportunity of enrolling in basic just as boys.
- 70% drop out cases are for girls because of early pregnancy cases.
- 30% boys because of drug abuse.
- Few dropout cases are as a result of lack of school fees.

2. HEALTH CONDITIONS AND SERVICES

- 18 years is the average age of marriage for women and 20 for men.
- Both girls and boys have the decision on choosing a partner for themselves.
- A husband the number of children to be born in a family.
- common health problem faced by women is stomach ulcers due to poverty (mostly women experience the burden of providing for their children)
- HIV, STD and uterus prolapse cases are not common in the area.
- Yes, there is access to health facilities to both government and private health care centres.
- Distance to the nearest its 1.5 hours.
- Visiting traditional health practitioners is uncommon in the village.

3. LIVELIHOOD ACTIVITIES

- Main source of income generation for livelihood is selling of farm produce.
- Livelihood activities performed by women is thatch making and selling.
- Women do not go to earn income outside the village.

- Women earn an equal wage as men in case they do the same work.
- Women engage in farm work, small business & food processing
- Men take engage in livestock keeping, construction work.
- Typical on farm work performed by women is ploughing, planting, watching over crops and harvesting.
- Typical non-farm work performed by women is cooking, cleaning, fetching water and firewood.
- There are no specific job roles undertaken by women only that require particular skills.

4. ROLES/RESPONSIBILITIES IN THE HOUSE HOLD

- Key tasks that women are responsible for within the household are
  - Fetching water, sanitation, fuel wood-fodder collection
  - Muslims ladies rest on Fridays and Christians on Sundays.
  - They all have at least a maximum of 8hours of sleeping time

- There are women holding vital decision-making positions in local institutions
  - School Committee Chairlady
  - Member at Dispensary committee
  - Members at Base Titanium committees

5. MOBILITY

- There is **no** restriction to women's mobility to essential services. They can access market places, health institutions within and without their village.
- Women can sell and buy staff from local markets.

6. MIGRATION

- Women have not migrated outside Mwaloya.
- Few men have migrated outside
- Women have not been affected by males' migration because they communicate with their family members and they send support as well.

7. GENDER ISSUES

- There is no discrimination between men and women in the household.
- Male members do encourage women to participate in development related meetings in the village.
- Women have access to information.
- There are no cases of GBV in the village.

8. LAND OWNERSHIP

- Average size of agriculture land owned by the households in the village is **10acres**.
- 30% of women have of land and houses that are registered in their names.
- Men have control over use/sell/buy of land.
- Women have **no** joint ownership of land.

9. USE OF NATURAL RESOURCES

- There is access of drinking water, there is a central place where Base Titanium supply the village with fresh drinking water others go to a neighbouring well.
- There are **no** seasonal problems with water supply.
- There is no community forest, people fetch firewood from their personal farms.
- There is a huge decline of availability of forest wood.
- Ecological degradation and scarcity of forest products have been caused mainly by crop farming.

10. FINANCIAL INSTITUTION

- Women have access to loan/credit from financial institution mainly group savings and microfinances.
- Women manage loan repayments through selling of thatch and fruits mainly passions.
- Very few women own bank accounts in their names.

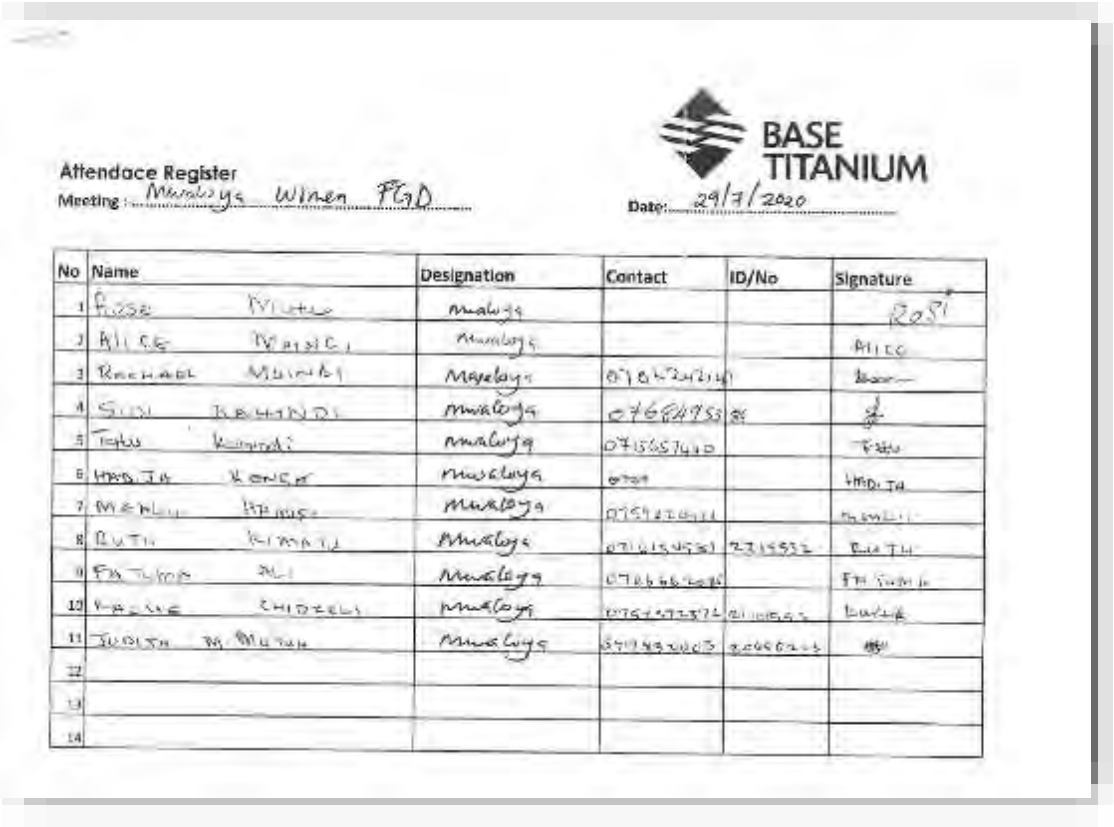
11. QUALITY OF LIFE

- Life has been more challenging compared to the past 10 years because of decline of market of their products.
- Priorities to make life better
  - Improve roads for easy access of tracks which use to come buy their produce.
  - Getting market to their produce as before, AES (Contractor at BTL use to buy their farm produce).

12. IMPACT OF BASE

- **Yes,** it is not easy to start from scratch. BTL should buy for them alternative lands which are fully developed in as far as crops and trees are concerned**.**
- BTL can empower women by giving loans that attract minimal interest so as they can develop themselves.
- BTL can make women's livelihood better by creation of job
  - opportunities for them
  - Construct a deport for them where they can store their thatches ready for market and provide transport where needed
  - Fund them on poultry farm project
- The government can improve their lives by
  - Constructing better roads for the communities
  - Sinking wells because the existing one is not safe
  - Provide electricity
- There will be no impact that will be caused by influx of people from outside of their area

1. Attendance Register



Attendace Register
Meeting: Mwaluya Women FGD
Date: 29/7/2020

No	Name	Designation	Contact	ID/No	Signature
1	Rose Mwitha	Mwaluya			Rose
2	Alice Mbithi	Mwaluya			Alice
3	Rachael Mumbi	Mwaluya	0718424241		
4	Sion Kahindi	Mwaluya	0768495		
5	Tabitha Kombo	Mwaluya	0715657420		Tabitha
6	Hadija Kenga	Mwaluya	0704		Hadija
7	Mwanaisha Ramadhan	Mwaluya	0759220111		Mwanaisha
8	Ruth Kimani	Mwaluya	0716154551	23155332	Ruth
9	Fatuma Ali	Mwaluya	0786667695		Fatuma
10	Agnes Chidzeli	Mwaluya	0757497237	21105823	Agnes
11	Judith Mutua	Mwaluya	0719832003	22665215	
12					
13					
14					

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion (FGD) - Youth
Village	Mwaloya
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Mwaloya Village
Date of Meeting	29th August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

1. EDUCATION STATUS
Youth present

- 6 have completed primary school
- 2 completed high school
- 2 have not gone to school
- Main issues with getting education – lack of school fees due to poverty, drug abuse, lack of interest due to unavailability of job opportunities, high rate of early pregnancies.

2. HEALTH CONDITIONS AND SERVICES

- Yes, there is access to health facilities to both government and private health care centers.
- One and half hours is the time taken to reach the medical facilities.
- Visiting traditional health practitioners is uncommon in the village.
- The rapid population growth in Kenya is a problem because of the harsh economic status. It is difficult to provide for families.
- Mwaloya population is growing fast.

3. GOVERNMENT

- Happy with the level of services provided by the County Government.
- Not happy with the level of services provided by the National Government because there are sidelined in developments.

4. LIVELIHOOD ACTIVITIES (ON-FARM AND NON-FARM)

- Main source of income generation for livelihood is selling of farm produce.
- Main challenges in earning a livelihood is lack of market for farm produce, less wages while working as a casual laborer.

- Livelihood activities performed by youth are motorbike riding, charcoal burning and selling, ploughing of farms as laborers.
- Few youth go to earn income outside the village. Some work at BTL.
- Gents engage in ploughing of farms using cattle livestock keeping and in construction jobs.
- Ladies look after farms prior harvesting, running small shops, food processing.
- Women engage in farm work, small business & food processing.
- Men engage in livestock keeping, construction work.
- Typical on farm work performed by women is watching over crops and harvesting.
- Typical on-farm work performed by men is ploughing.

5. ROLES/RESPONSIBILITIES IN THE HOUSE HOLD

- Key tasks within the household are
    - Fetching water, sanitation, fuel wood-fodder collection, household work –Ladies
    - Farm work-all
    - They all have at least a maximum of 8hours of sleeping time

6. MIGRATION

- There are few youths who have migrated outside the village, some because of marriage, others earning income but none has migrated because of studies.
- The few youths who have migrated because of job opportunities end up working as house helps and other unskilled jobs.

7. LAND OWNERSHIP

- Average size of agriculture land owned by the households in the village is **10acres**.
- All fields are within locals' homesteads.

8. USE OF NATURAL RESOURCES

- There is access to safe drinking water, there is a well that is 20 minutes' walk.
- The only irrigation method relied upon by locals is rain water for agriculture farm land.
- There are **no** seasonal problems with water supply.
- There is no community forest, people fetch firewood from their personal farms.
- There is a huge decline of availability of forest wood.
- Ecological degradation and scarcity of forest products have been caused mainly by charcoal burning and fetching firewood.
- Youth do not at all engage in hunting.

9. FINANCIAL INSTITUTION

- Yes, youths have loans.
- Source of loans "*Safaricom's Mshwari* "
- Loan repayment paid from money generated by their small businesses.
- Very few own bank accounts in their names.

10. QUALITY OF LIFE

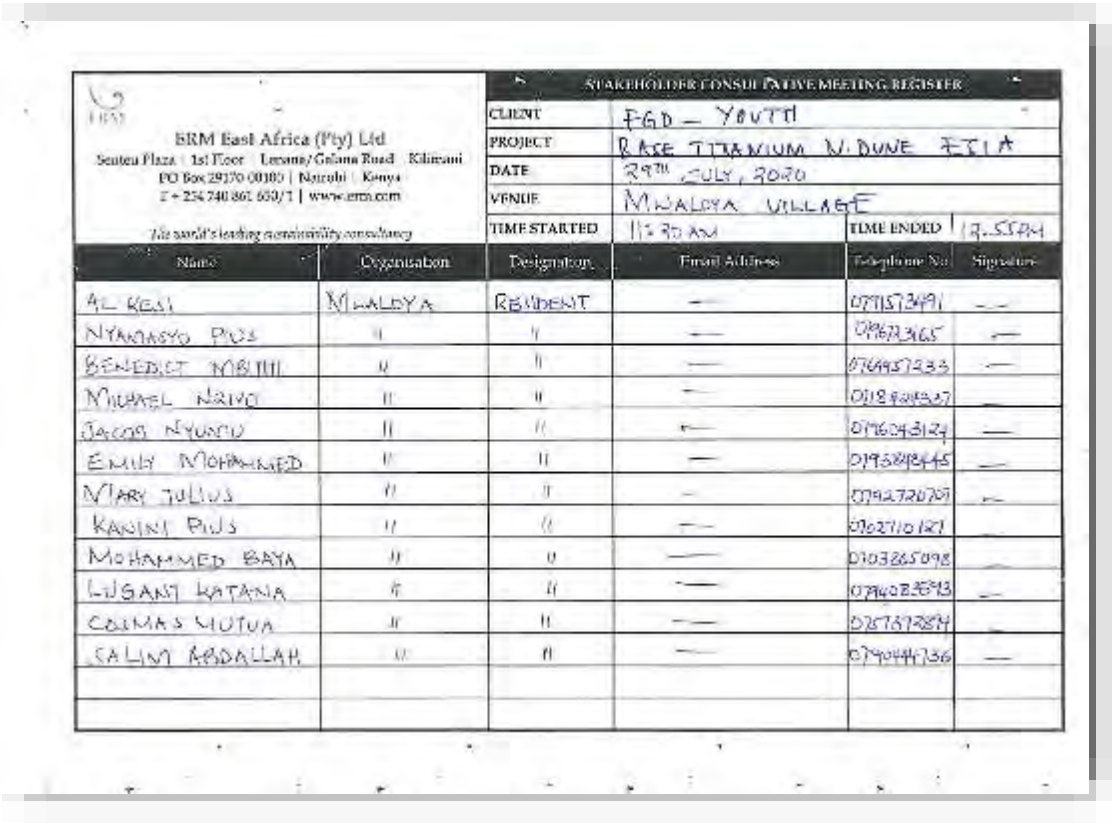
- Life has been more challenging compared to the past 10 years because of lack of employment.
- Priorities to make life better
    - Creation of permanent job opportunities at BTL.
    - Supported with funds for Income Generating Activities by BTL.

11. IMPACT OF BASE

- **Yes,** it is not easy to begin life from zero. BTL should give them alternative lands which are fully developed in as far as crops and trees are concerned**.** The areas identified should be near sources of water and of good climate just as what they currently have.
- BTL can make Youths' livelihood better by
    - creation of job opportunities
    - Fund them on Income Generating Activities
- The government can improve their lives by
    - Provide electricity
    - Letting them access scholarship opportunities.

- Impact that will be caused by influx of people from outside of their area is that they buy lands from their parents at low rates so as to await relocation by Base Titanium.

1. Attendance Register



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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	FGD – YOUTH
PROJECT	BASE TITANIUM N. DUNE EIA
DATE	29TH JULY, 2020
VENUE	MNALOYA VILLAGE
TIME STARTED	11:30 AM
TIME ENDED	12.55PM

Name	Organisation	Designation	Email Address	Telephone No.	Signature
AL KESI	MNALOYA	RESIDENT	—	0711573491	—
NYAMASYO PIUS	"	"	—	0796723465	—
BENEDICT MBITHI	"	"	—	0769957333	—
MICHAEL NZIVO	"	"	—	0112[illegible]927	—
JACOB NYUNDO	"	"	—	0796043124	—
EMILY MOHAMMED	"	"	—	0795[illegible]445	—
MARY JULIUS	"	"	—	0792720709	—
KANINI PIUS	"	"	—	0702710121	—
MOHAMMED BAYA	"	"	—	0703865098	—
LUSANI KATANA	"	"	—	0796028593	—
COLMAS MUTUA	"	"	—	0757697884	—
SALIM ABDALLAH	"	"	—	0790441136	—

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion- Men
Village	Mwandimu
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Mwandimu Village
Date of Meeting	7th September 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education?	Majority have completed Primary Education (90%).
How many of you have completed high school education?	50%
What are the main issues with getting an education?	Lack of school fees and family hardships.
Health Condition and Services	
Is there access to health post of Government or private health care Centre, clinic for major and minor ailments?	Yes.
Distance of the nearest health facility from the village- time taken to travel	Magaoni about 4km away, Zigira (1hr). Common ailments include: Ulcers, Malaria, Typhoid, Pressure, Bladder Disease and Bilharzia.
Do you visit traditional health practitioner/traditional healer (women, men) during health problems?	No.
Kenya has one of the most rapidly growing populations in the world. Is this a problem or a blessing? Why?	It's a problem because there will be pressure on resources and infrastructure.
Do you perceive the population in this community to be growing too fast, fast enough, too slowly?	Fast enough.
Government Credibility	
How happy are you with the level of services provide by the County Government? If no why not	Poor. We have no maternity services, no schools- the nearest is about 30 mins away (Mwaloya, Mwasindani and Zigira). We have Mwandimu Polytechnic that was build 2 years ago but lacks adequate facilities.

Topic	Response
How happy are you with the level of services provide by the National Government? If no why not	Same as above.
Livelihood Activities (on-farm and non-farm)	
What are main sources of income generation in your village?	Farming of crops such as; coconuts, cashewnuts, mangoes, oranges, pineapples, groundnuts and maize.
What are the main challenges with earning a livelihood?	No water infrastructure such as piping for irrigation.
What type of livelihood activities are only performed by men?	None. We all share.
Do the men go to earn income outside the settlement? If yes. What types of work they involved in and distance they travel daily for work?	Yes. Small businesses mainly selling of coconuts. A coconut goes for Kshs 30 while the coconut reed goes for Kshs 20. A coconut tree produces about 150 coconuts. The coconuts are also used to produce alcohol.
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops, food processing, herbs processing, construction work etc.)?	Both
What types of typical on-farm work are performed by men?	Digging, ploughing and harvesting.
Roles/Responsibilities in the Household	
What are the Key tasks that men are responsible within the household? • Household work/farm-work • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Farm-work, decision making, grazing animals, building.
Migration	
Do you know men who migrated from your village? If yes. What are the reasons for their migration? (Employment, earning income, marriage, study)?	Yes. Purchase of land and marriage.
How many men migrated from your village? Do you know where they migrated to - destination of migration, duration, type of work that they do?	Not sure.
Land ownership	
What is the average size of agricultural land owned by the households in your community?	About 4-30 acres
How far do you typically travel (walk) to get to your fields?	About 10 minutes.
Is there a shortage of agricultural land?	No
What are the main problems with having access to enough land?	None. Challenge is mainly lack of irrigation infrastructure

Topic	Response
Use of Natural Resources	
Is there access to safe drinking water in your village? Distance and time taken to fetching water	Yes. From boreholes in the community.
Do you have access to irrigation facility for your agriculture farm land?	No.
What are major sources for drinking water and irrigation (river, streams, spring water and others)?	Wells within the homestead.
Do you have access to community forest for collecting fuel wood?	No. We have firewood within the homestead.
To what extent has the availability of fuel wood declined?	It has not declined.
Can you explain the causes of ecological degradation and scarcity of forest products?	Pollution.
Do men from this community engage in hunting?	No, it's illegal.
Is game that is hunted becoming more scare?	No
Financial Institutions	
Do you have a loan?	No
Who do you owe money to?	Microfinance institutions.
How do you manage for loan repayment?	We mainly invest and payback with interest.
Do you have bank account in their name? Do they operate by themselves?	No
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	No significant changes.
What should be the priorities to make life better?	Education and health.
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome/mitigate the impacts?	Yes. They will negatively impact on our livelihood. They should put in place a livelihood restoration plan.
Do you have any suggestions to BASE for making your livelihood better?	Prioritize this community when it comes to job opportunities. Skills training especially for the youth to help them build capacity. Work closely with the polytechnic to offer trainings that will benefit the community. Base should implement their promise to build an ECD and Nursery school.
What can government do to improve your livelihoods?	Bring development projects and improve infrastructure at the community level.
What kind of impact do you think will be brought in with the possible influx of people from outside your area? Both positive and negative?	Strain of infrastructure and resources.

1. Attendance Register

ERM East Africa (Pty) Ltd

PUBLIC MEETING REGISTER

CLIENT	FGD - MEN MWAMBIRINI VILLAGE
PROJECT	MKUTA DUNE - ESIA
DATE	7TH SEPTEMBER 2020
VENUE	MWAMBIRINI VILLAGE
TIME STARTED	10:00 AM TIME ENDED 12:00 NOON

Name	Sex (M/F)	Location	Telephone No.	ID No	Signature
David Maenga	M	Mwambirini	[illegible]	[illegible]	[illegible]
Rashid Suleiman	M	Mwambirini	—	—	—
Robert M Tsuma	M	Mwambirini	[illegible]	—	[illegible]
Albert Mwamchinga	M	"	[illegible]	[illegible]	[illegible]
Hamisi Ali Mzunga	M	"	—	—	[illegible]
Hammasi Ndeiro	M	"	—	—	[illegible]
Kabiede Ndola Nyumba	M	"	[illegible]	[illegible]	[illegible]
Suleiman Mwagwo	M	"	—	—	[illegible]
Mohammed O Mwamroko	M	"	[illegible]	—	[illegible]
Athuman Deta	M	"	—	—	[illegible]

2. Photo

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion (FGD)- Village Committee
Village	Mwandimu
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Mwandimu Village
Date of Meeting	8th September 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education?	Majority have completed Primary Education (80%).
How many of you have completed high school education?	60%.
What are the main issues with getting an education?	School fees, family hardships and shortage of teachers.
Health Condition and Services	
Is there access to health post of Government or private health care Centre, clinic for major and minor ailments?	Yes.
Distance of the nearest health facility from the village- time taken to travel	Less than 1km.
Do you visit traditional health practitioner/traditional healer (women, men) during health problems?	No.
Kenya has one of the most rapidly growing populations in the world. Is this a problem or a blessing? Why?	It's a problem because there will be pressure on resources and infrastructure.
Do you perceive the population in this community to be growing too fast, fast enough, too slowly?	Fast enough.
Government Credibility	
How happy are you with the level of services provide by the County Government? If no why not	Not satisfactory. The Mwandimu polytechnic and nursery are the only county projects in the community.
How happy are you with the level of services provide by the National Government? If no why not	Same as above.
Livelihood Activities (on-farm and non-farm)	

Topic	Response
What is main sources of income generation in your village?	Farming of crops such as; mangoes, maize, cashew nuts and bananas. There are those who run small businesses such as shops.
What are the main challenges with earning a livelihood?	No markets, poor infrastructure and destruction of cash crops by wild animals.
What type of livelihood activities are only performed by men?	Livestock grazing and farming.
Do the men go to earn income outside the settlement? If yes. What types of work they involved in and distance they travel daily for work?	Yes. Small businesses such as shops.
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops, food processing, herbs processing, construction work etc.)?	Both
What types of typical on-farm work are performed by men?	Digging, ploughing and harvesting.
Roles/Responsibilities in the Household	
What are the Key tasks that men are responsible within the household? • Household work/farm-work • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Farm-work, decision making, grazing animals, building.
Migration	
Do you know men who migrated from your village? If yes. What are the reasons for their migration? (Employment, earning income, marriage, study)?	Yes. Purchase of land and marriage.
How many men migrated from your village? Do you know where they migrated to - destination of migration, duration, type of work that they do?	We are not sure but it happens.
Land ownership	
What is the average size of agricultural land owned by the households in your community?	About 10 acres
How far do you typically travel (walk) to get to your fields?	About 10 minutes.
Is there a shortage of agricultural land?	No
What are the main problems with having access to enough land?	Ownership and infrastructure.
Use of Natural Resources	
Is there access to safe drinking water in your village? Distance and time taken to fetching water	Yes. Boreholes.
Do you have access to irrigation facility for your agriculture farm land?	No.

Topic	Response
What are major sources for drinking water and irrigation (river, streams, spring water and others)?	Boreholes.
Do you have access to community forest for collecting fuel wood?	No. We have firewood within the homestead.
To what extent has the availability of fuel wood declined?	It has not declined.
Can you explain the causes of ecological degradation and scarcity of forest products?	Pollution especially of water bodies.
Do men from this community engage in hunting?	No, it's illegal.
Is game that is hunted becoming more scare?	No
Financial Institutions	
Do you have a loan?	No
Who do you owe money to?	None.
How do you manage for loan repayment?	N/A
Do you have bank account in their name? Do they operate by themselves?	No
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	It has become better because of better access to water and food.
What should be the priorities to make life better?	Education and health.
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome/mitigate the impacts?	Yes, especially of the area of losing our land and agricultural produce.
Do you have any suggestions to BASE for making your livelihood better?	• Base should improve the communication and information flow between them and the village committee members. We are not properly engaged and informed and this makes it difficult to educate the community on the project. • The drilling results should be shared to the community as promised by Base two years ago. • The current decision-making structure should be changed to use the bottom-up approach rather than the top-bottom approach. • We need to get a schedule of works and what will come next with regards to Base activities. • Have an education and sensitization roll-out programme. There are about 165 households which can be divided into groups of 15. A sensitization programme can then target these groups.

Topic	Response
	• Have a Base CLO attached to the community who can help in the sensitization process. • Base should outline their training and employment plans. • More collaboration is needed between Base, the Umbrella Committee and the village committee. This will help to reduce speculation and suspicion on what activities are being planned.
What can government do to improve your livelihoods?	Bring development projects and improve infrastructure at the community level.
What kind of impact do you think will be brought in with the possible influx of people from outside your area? Both positive and negative?	Strain of infrastructure and resources.

1. Attendance Register

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PUBLIC MEETING REGISTER

CLIENT	VILLAGE COMMITTEE - MWANDIMU
PROJECT	TIZITA TAILS – EIA
DATE	5TH OCTOBER 2020
VENUE	MWANDIMU VILLAGE
TIME STARTED	3 PM
TIME ENDED	4 PM

Name	Sex (M/F)	Location	Telephone No.	ID No	Signature
ABDALLA MWAMADZI	M	MWANDIMU	0715427221	11724896	
ALI SAIDI	M	MWANDIMU	0729726726	0621581	
OMARI TENDO	M	MWANDIMU	0715756671	12725951	
MBARUK ABDALLA	M	MWANDIMU	0705162265	1295287	
JUMA ALI SAMO	M	MWANDIMU	0722955273	2002581	
MARIAM ALI NGALA	F	MWANDIMU	0713077099	13629756	
RAMADHANI SULEIMAN MZUNGU	M	MWANDIMU	0725164699	21743106	
GRACE N. MUTUA	F	MWANDIMU	0790411954	26995842	
FATUMA ALI JUMA	F	MWANDIMU	0705604121	13629752	
JUMA ALI GAO	M	MWANDIMU	0716487591	10227742	
ALI M. ABDULLAH	M	MWANDIMU	0725950290	11724896	

2. Photo

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion (FGD) - Women
Village	Mwandimu
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Mwandimu Village
Date of Meeting	7th September 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education?	About 90%
How many of you have completed high school education	About 25%
Are children (girls and boys) from each and every households able to go to school? If no. What are the barriers for them?	Yes. However, barriers include: Lack of school fees, misbehaviour, peer pressure and lack of morale and motivation from caregiver.
Are girls enrolling equally in basic education (primary school)? It not. Why?	Yes.
What is the trend for class dropout rate of boys and girls? Reasons for their dropout/ stopping studying?	It's not as much but mostly due to unwanted pregnancies.
Health Condition and Services	
What is the average age of marriage for women and men in your village?	16 years.
Who makes the decision on choice of partner in the family?	Both husband and wife.
Average age of mother at childbirth (first child),	15 years.
Who decides on number of children to have?	Both partners.
Do the women face health problems in your settlement? If yes what are they (uterus prolapse, HIV/AIDS, STD, others)?	Yes. Malaria, rashes and ulcers,
Is there access to health posts (Government) or private health care Centre, clinic for major and minor ailments?	Yes.
Distance of the nearest health facility from the village- time taken to travel	Private health centres include: Mwapala and Magaoni about 30 minutes away.

Topic	Response
Do you visit traditional health practitioner/traditional healer (women, men) for health problems?	No.
Livelihood Activities (on-farm and non-farm)	
What is main sources of income generation for livelihoods in your village?	Farming of crops such as: coconuts and maize (cash crops) and vegetables (domestic use). Also stitching of *Makuti* (reeds) and selling vegetables.
What type of livelihood activities performed by women?	Same as above.
Do women go to earn income outside the settlement? If yes. What types of work are they involved in and distance they travel daily for work?	Yes. Mainly mending/stitching thatched grass that is used for roofing and selling coconuts.
Is there an equal wage received for same work by women and men? If not. Why?	It's the same.
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops,, food processing, herbs processing, construction work etc.)?	Agricultural farm work-both, livestock keeping both, non-farm work-both. Women-taking care of the house chores e.g. cooking, fetching water and firewood.
What type of typical on-farm work is performed by women?	Digging, planting, ploughing and harvesting.
What type of typical non-farm work is performed by women?	Household chores e.g. cleaning, cooking etc.
Specific job roles that are undertaken by women-only (particular skills required)	None.
Roles/Responsibilities in the Household	
What are the Key tasks that women are responsible within the household? • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Fetching water, firewood, cooking and cleaning. Time available for rest-8 hours.
Mobility	
Is there restriction to women's mobility (due to cultural and religious value and norms) for access to essential services. Why? If not, explain the distance and institutions they can visit without assistance from the male members	No. They can visit clinics or hospitals.
Do the women go to market to sell local produce and to buy requirements for the family and self?	No. Most of the communities from the neighbouring villages come here to buy our agricultural products.
Migration	
Do you know women who migrated from your village? If yes. How many and what are the reasons for their migration? (employment, earning income, marriage, study)	None.

Topic	Response
How many women migrated from your village?	None
Is migration of male members of the family affecting women's life and livelihood? Are they overburdened?	No. The men provide for the family.
Land ownership	
What is the average size of agricultural land owned by the households in your community?	5-10 acres.
Do the women have ownership of land and houses or are they registered on their name? If yes. Can you share (what %) of households in your village?	Most land is registered under the man's name unless it's a widow.
Do they have control over its use/sell/buy?	No. But they discuss with the spouse before making any decision.
Do the women have joint ownership of land? If yes. How many households have this ownership?	Not common.
Use of Natural Resources	
Is there access to safe drinking water in your village? Distance and time taken to fetch water	Yes. We have more than 50 boreholes in most homesteads.
What are major sources for drinking water (river, streams, spring water and others)?	Boreholes.
Are there seasonal problems with the water supply, if so please tell us what these are?	No.
Do you have access to a community forest for collecting fuel wood?	We use trees within the homestead.
To what extent has the availability of fuel wood declined?	It has not declined.
Can you explain the causes of ecological degradation and scarcity of forest products?	Pollution.
Financial Institutions	
Do the women participate in and have access to loan/ credit from financial institutions (cooperative, group saving and credit micro-finance etc.)?	Yes. Mostly table banking e.g. Krep and other micro-finance institutions.
How do you manage loan repayment?	Through instalments. Once you do business and get profit you pay back slowly.
Do the women have bank account in their name? Do they operate them by themselves?	Yes.
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	It is better as compared to the past because the land fertility has improved and increased access to natural resources within the homesteads.
What should be the priorities to make life better?	Health, education, food security.
Impact of Base	

Topic	Response
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome the impact?	Yes. Mainly relocation and loss of livelihood. They should not relocate us from here.
What should be done by the project for the economic empowerment of women in the village?	Employ the locals and giving them longer contracts, trainings and ensuring women are educated and have access to capital to start their businesses.
Do you have any suggestions to BASE for making your livelihood better?	Prioritize the locals when it comes to employment opportunities.
Do you have any suggestions as to how government could improve people's lives?	More development projects in education.
What kind of impact do you think will be brought in with influx of people from outside your area? Both positive and negative?	Positive; business opportunities and development, negative; straining of infrastructure and resources such as water.

1. Attendance Register

ERM East Africa (Pty) Ltd

PUBLIC MEETING REGISTER

CLIENT	FAD - WOMEN
PROJECT	NORTH DUNE - ESIA
DATE	7TH SEPTEMBER 2020
VENUE	MWANDIMU VILLAGE
TIME STARTED	2:37 PM
TIME ENDED	4:05 PM

Name	Sex (M/F)	Location	Telephone No.	ID No	Signature
MWALIMA SAUMU	F	MWANDIMU	—	[illegible]	
MWANAKOMA OMARI	F	CHINGONI	—	[illegible]	
KAMBI KARISA	F	CHINGONI	—	[illegible]	
AMINA LODOE	F	CHINGONI	—	—	
MKUNUMA OMARI	F	"	—	22407418	
MWANAMLIMA HAMISI	F	"	—	—	
MWANANGENI ALI	F	"	—	—	
MWANAMKUNGU BAKARI	F	"	—	06258552	
BINTI ALI	F	"	—	—	
BINTI HASSAN	F	"	—	—	
CHIZI LOJO	F	"	—	—	
MISHI MGALA	F	CHINGONI	0741086651	14504417	

2. Attendance Register

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion- Youth
Village	Mwandimu
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Mwandimu Village
Date of Meeting	8th September 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

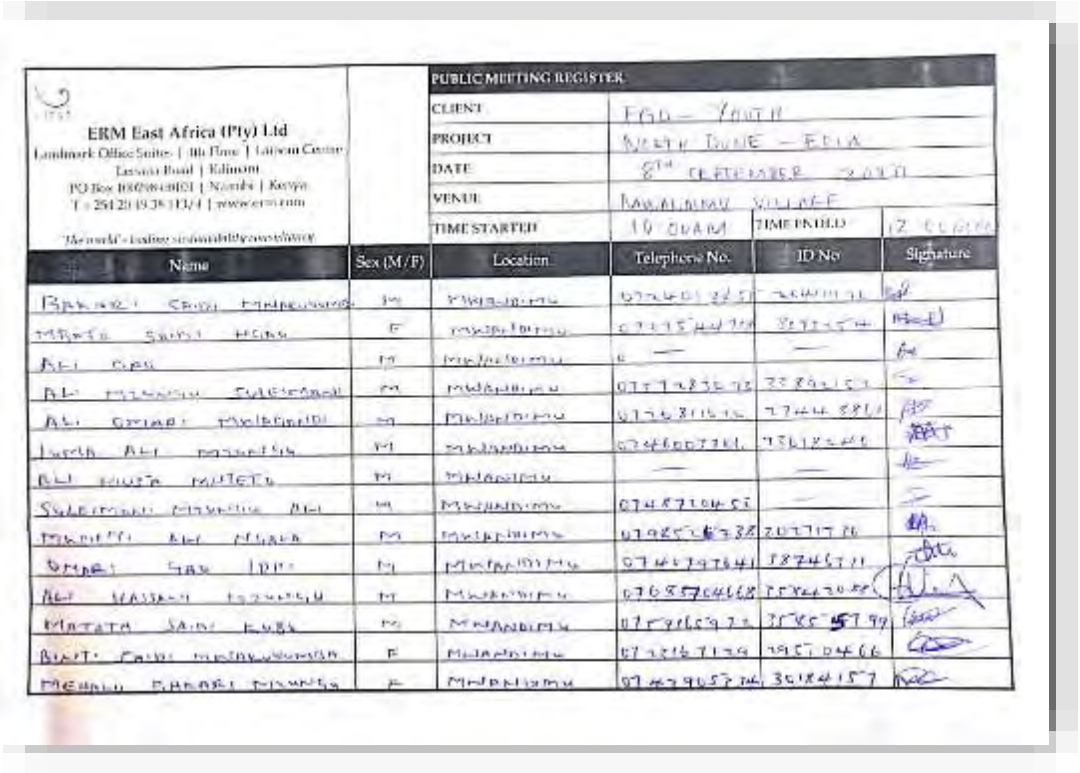
Topic	Response
Education Status	
How many of you have completed primary school education?	Majority have completed Primary Education (90%)
How many of you have completed high school education?	20%
What are the main issues with getting an education?	School fees, family challenges, lack of equal opportunities for those coming from poor backgrounds, peer pressure.
Health Condition and Services	
Is there access to health post of Government or private health care Centre, clinic for major and minor ailments?	Yes.
Distance of the nearest health facility from the village- time taken to travel	Less than 1km. Include: Shimba Hills Dispensary, Magaoni Dispensary, Zigira Dispensary and Mwapala Dispensary. Diseases include: Malaria, Pneumonia, Ulcers and high blood pressure.
Do you visit traditional health practitioner/traditional healer (women, men) during health problems?	No.
Kenya has one of the most rapidly growing populations in the world. Is this a problem or a blessing? Why?	It's a problem because there will be pressure on resources and infrastructure.
Do you perceive the population in this community to be growing too fast, fast enough, too slowly?	Fast enough.
Government Credibility	

Topic	Response
How happy are you with the level of services provide by the County Government? If no why not	Not so happy because most of the youth are not employed and do not receive any kind of support. There is only one polytechnic in this village (Mwandimu Polytechnic) that offers Masonry, tailoring, carpentry and driving courses. There is also Mwandimu nursery. There are no primary or secondary schools in this village.
How happy are you with the level of services provide by the National Government? If no why not	Same as above.
Livelihood Activities (on-farm and non-farm)	
What are main sources of income generation in your village?	Farming of crops such as; mangoes, maize, cashew nuts, bananas, groundnuts, vegetables and working in businesses such as petrol stations and boda boda.
What are the main challenges with earning a livelihood?	No capital, lack of training for the youth or proper education, no incentives or support from the government.
What type of livelihood activities are only performed by men?	Livestock grazing and farming.
Do the youth go to earn income outside the settlement? If yes. What types of work they involved in and distance they travel daily for work?	Yes. Small businesses such as shops and *boda boda.*
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops, food processing, herbs processing, construction work etc.)?	Both
What types of typical on-farm work are performed by men?	Digging, ploughing and harvesting.
Roles/Responsibilities in the Household	
What are the Key tasks that men are responsible within the household? • Household work/farm-work • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Farm-work, decision making, grazing animals, building.
Migration	
Do you know men who migrated from your village? If yes. What are the reasons for their migration? (Employment, earning income, marriage, study)?	Yes. Purchase of land, search for employment and marriage.
How many men migrated from your village? Do you know where they migrated to - destination of migration, duration, type of work that they do?	About 10 HHs.
Land ownership	

Topic	Response
What is the average size of agricultural land owned by the households in your community?	About 10-20 acres
How far do you typically travel (walk) to get to your fields?	About 10 minutes.
Is there a shortage of agricultural land?	No
What are the main problems with having access to enough land?	Most people do not have titles.
Use of Natural Resources	
Is there access to safe drinking water in your village? Distance and time taken to fetching water	Yes. We have about 50 boreholes in this village.
Do you have access to irrigation facility for your agriculture farm land?	No.
What are major sources for drinking water and irrigation (river, streams, spring water and others)?	Boreholes.
Do you have access to community forest for collecting fuel wood?	No. We have it within our homesteads.
To what extent has the availability of fuel wood declined?	It has not declined.
Can you explain the causes of ecological degradation and scarcity of forest products?	Pollution.
Do men from this community engage in hunting?	No, it's illegal.
Is game that is hunted becoming more scare?	No
Financial Institutions	
Do you have a loan?	Yes.
Who do you owe money to?	Village Bank at Kinondo
How do you manage for loan repayment?	When we get returns from investments such as businesses, we pay back the loans in instalments.
Do you have bank account in their name? Do they operate by themselves?	Yes
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	It has become better because the food is readily available, the land is more fertile and access to food and water has improved over time.
What should be the priorities to make life better?	Education, electricity and health.
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome/mitigate the impacts?	Yes. We are likely to lose our land and livelihood. They should compensate us fairly and ensure our livelihood is cushioned.
Do you have any suggestions to BASE for making your livelihood better?	As mentioned above. Also prioritise youth employment and training in this community.

Topic	Response
What can government do to improve your livelihoods?	Bring development projects and improve infrastructure such as roads at the community level.
What kind of impact do you think will be brought in with the possible influx of people from outside your area? Both positive and negative?	Strain of infrastructure and resources.

1. Attendance Register



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PUBLIC MEETING REGISTER

CLIENT	FGD – YOUTH
PROJECT	NORTH DUNE – EEIA
DATE	8TH SEPTEMBER 2020
VENUE	KWALE MAU VILLAGE
TIME STARTED	10 O'CLOCK
TIME ENDED	12 O'CLOCK

Name	Sex (M/F)	Location	Telephone No.	ID No	Signature
[illegible]	M	[illegible]	[illegible]	[illegible]	
[illegible]	F	[illegible]	[illegible]	[illegible]	
[illegible]	M	[illegible]	[illegible]	[illegible]	
[illegible]	M	[illegible]	[illegible]	[illegible]	
[illegible]	M	[illegible]	[illegible]	[illegible]	
[illegible]	M	[illegible]	[illegible]	[illegible]	
[illegible]	M	[illegible]	[illegible]	[illegible]	
[illegible]	M	[illegible]	[illegible]	[illegible]	
[illegible]	M	[illegible]	[illegible]	[illegible]	
[illegible]	M	[illegible]	[illegible]	[illegible]	
[illegible]	M	[illegible]	[illegible]	[illegible]	
[illegible]	M	[illegible]	[illegible]	[illegible]	
[illegible]	F	[illegible]	[illegible]	[illegible]	
[illegible]	F	[illegible]	[illegible]	[illegible]	

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PUBLIC MEETING REGISTER			
CLIENT	[illegible]		
PROJECT	[illegible]		
DATE	[illegible]		
VENUE	[illegible]		
TIME STARTED	[illegible]	TIME ENDED	[illegible]

Name	Sex (M/F)	Location	Telephone No.	ID No	Signature
[illegible]	M	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	M	[illegible]	[illegible]	[illegible]	[illegible]

2. Photo

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion (FGD) – Men & Village Committee[6]
Village	Mwaweche (Barcelona)
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Mwaweche Village
Date of Meeting	3rd August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education?	Majority have completed Primary Education.
How many of you have completed high school education?	About 50%
What are the main issues with getting an education?	Distance, school fees. The schools accessible within this community are Mwapala and Mwaloya Primary school which are 2 km away
Health Condition and Services	
Is there access to health post of Government or private health care Centre, clinic for major and minor ailments?	No. The nearest hospital is about 3km away and lacks the facilities and medicine to treat most ailments.
Distance of the nearest health facility from the village- time taken to travel	3km
Do you visit traditional health practitioner/traditional healer (women, men) during health problems?	No.
Kenya has one of the most rapidly growing populations in the world. Is this a problem or a blessing? Why?	It's a problem because the available resources are limited.
Do you perceive the population in this community to be growing too fast, fast enough, too slowly?	No. It growing fast enough.
Government Credibility	

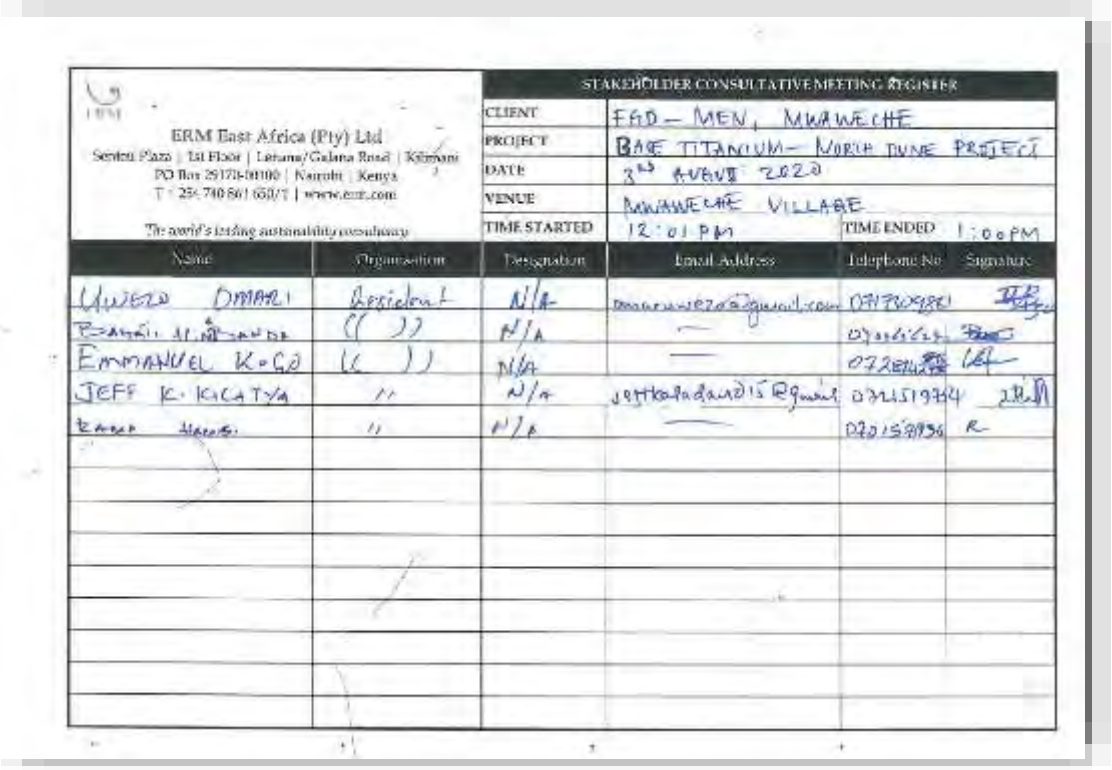
[6] In Attendance were also male village committee members.

Topic	Response
How happy are you with the level of services provide by the County Government? If no why not	Very poor. There are no hospital, no electricity and poor road infrastructure which is a leading cause of most accidents.
How happy are you with the level of services provide by the National Government? If no why not	Very unhappy because there are no services.
Livelihood Activities (on-farm and non-farm)	
What is main sources of income generation in your village?	Agriculture and small businesses. Cash crops include; maize, coconuts, Bixa, oranges and cashew nuts. Domestic crops include: beans, cassava and vegetables.
What are the main challenges with earning a livelihood?	No markets, destruction of crops by wild animals and floods.
What type of livelihood activities are only performed by men?	Livestock grazing and farming.
Do the men go to earn income outside the settlement? If yes. What types of work they involved in and distance they travel daily for work?	Yes. Small businesses such as kiosks
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops, food processing, herbs processing, construction work etc.)?	Both
What types of typical on-farm work are performed by men?	Digging, ploughing and harvesting
Roles/Responsibilities in the Household	
What are the Key tasks that men are responsible within the household? • Household work/farm-work • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Farm-work, decision making, grazing animals, building.
Migration	
Do you know men who migrated from your village? If yes. What are the reasons for their migration? (Employment, earning income, marriage, study)?	Yes. Most of the were resettled or displaced by Base mining activities.
How many men migrated from your village? Do you know where they migrated to - destination of migration, duration, type of work that they do?	Not common.
Land ownership	
What is the average size of agricultural land owned by the households in your community?	10 Acres

Topic	Response
How far do you typically travel (walk) to get to your fields?	1km
Is there a shortage of agricultural land?	No
What are the main problems with having access to enough land?	No problems
Use of Natural Resources	
Is there access to safe drinking water in your village? Distance and time taken to fetching water	Yes. One borehole about 1km away
Do you have access to irrigation facility for your agriculture farm land?	Yes
What are major sources for drinking water and irrigation (river, streams, spring water and others)?	Borehole, hand dug wells
Do you have access to community forest for collecting fuel wood?	No
To what extent has the availability of fuel wood declined?	Slightly
Can you explain the causes of ecological degradation and scarcity of forest products?	Illegal logging
Do men from this community engage in hunting?	No.
Is game that is hunted becoming more scare?	No.
Financial Institutions	
Do you have a loan?	No
Who do you owe money to?	Nobody.
How do you manage for loan repayment?	N/A
Do you have bank account in their name? Do they operate by themselves?	No
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	There has been progressive development but with challenges.
What should be the priorities to make life better?	Health, water, education and electricity.
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome/mitigate the impacts?	It will negatively impact on our livelihood if not managed well. We have seen from the previous experience, most of our neighbours are suffering since Base started operations at the South Dune.
Do you have any suggestions to BASE for making your livelihood better?	Ensure frequent meetings with the community particularly the land owners. Ensure the valuation and compensation exercise is transparent and fair. Ensure the land compensation prices are fair.

Topic	Response
	Locals should be given priority on the employment opportunities. There should be transparency on how the 5% Community Development Fund is used. Youth should be trained and absorbed by Base.
What can government do to improve your livelihoods?	Bring development to the community level
What kind of impact do you think will be brought in with the possible influx of people from outside your area? Both positive and negative?	Strain of infrastructure and resources.

1. Attendance Register



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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	FGD – MEN, MWAWESHE
PROJECT	BASE TITANIUM – NORTH DUNE PROJECT
DATE	3RD AUGUST 2020
VENUE	MWAWESHE VILLAGE
TIME STARTED	12:01 PM
TIME ENDED	1:00 PM

Name	Organisation	Designation	Email Address	Telephone No	Signature
UWEZO DIMARI	Resident	N/A		0717[illegible]	
[illegible]	(( ))	N/A	—	0[illegible]	
EMMANUEL K. GO	(( ))	N/A	—	072[illegible]	
JEFF K. KICATYA	"	N/A	jeffkadandis@gmail	0724519744	
[illegible]	"	N/A	—	0701[illegible]	

2. Photo

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion (FGD) - Women[7]
Village	Mwaweche (Barcelona)
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Mwaweche Village
Date of Meeting	3rd August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education?	About 80%
How many of you have completed high school education	About 50%

[7] In attendance were also female village committee members.

Topic	Response
Are children (girls and boys) from each and every households able to go to school? If no. What are the barriers for them?	No. Barriers include: unwanted pregnancies, financial strain, drugs and parents not seeing the worth of education.
Are girls enrolling equally in basic education (primary school)? It not. Why?	Yes.
What is the trend for class dropout rate of boys and girls? Reasons for their dropout/ stopping studying?	It's increasing for girls because of unwanted pregnancies.
Health Condition and Services	
What is the average age of marriage for women and men in your village?	16 years.
Who makes the decision on choice of partner in the family?	Both husband and wife.
Average age of mother at childbirth (first child),	16-18 years.
Who decides on number of children to have?	Both partners.
Do the women face health problems in your settlement? If yes what are they (uterus prolapse, HIV/AIDS, STD, others)?	Yes. Malaria, chest infection, airborne diseases.
Is there access to health posts (Government) or private health care Centre, clinic for major and minor ailments?	Yes. At Magaoni about 2km away.
Distance of the nearest health facility from the village- time taken to travel	2km
Do you visit traditional health practitioner/traditional healer (women, men) for health problems?	No.
Livelihood Activities (on-farm and non-farm)	
What is main sources of income generation for livelihoods in your village?	Agriculture. Crops include: maize, coconuts, bananas, cashew nuts and mangoes. Most of the time the time the excess is sold. Domestication of animals such as; chicken, goats and sheep.
What type of livelihood activities performed by women?	Same as above.
Do women go to earn income outside the settlement? If yes. What types of work are they involved in and distance they travel daily for work?	Yes. Mainly mending/stitching thatched grass that is used for roofing.
Is there an equal wage received for same work by women and men? If not. Why?	It's the same.
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops, food processing, herbs processing, construction work etc.)?	Both.
What type of typical on-farm work is performed by women?	Digging, planting, ploughing and harvesting.

Topic	Response
What type of typical non-farm work is performed by women?	Household chores e.g. cleaning, cooking etc.
Specific job roles that are undertaken by women-only (particular skills required)	None.
Roles/Responsibilities in the Household	
What are the Key tasks that women are responsible within the household? • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Fetching water, firewood, cooking and cleaning.
Mobility	
Is there restriction to women's mobility (due to cultural and religious value and norms) for access to essential services. Why? If not, explain the distance and institutions they can visit without assistance from the male members	No. They can visit clinics or hospitals.
Do the women go to market to sell local produce and to buy requirements for the family and self?	Yes.
Migration	
Do you know women who migrated from your village? If yes. How many and what are the reasons for their migration? (employment, earning income, marriage, study)	Yes. About ten mostly who got married.
How many women migrated from your village?	About ten.
Is migration of male members of the family affecting women's life and livelihood? Are they overburdened?	No.
Land ownership	
What is the average size of agricultural land owned by the households in your community?	5-8 acres.
Do the women have ownership of land and houses or are they registered on their name? If yes. Can you share (what %) of households in your village?	Most land is registered under the man's name unless it's a widow.
Do they have control over its use/sell/buy?	No.
Do the women have joint ownership of land? If yes. How many households have this ownership?	Not common.
Use of Natural Resources	

Topic	Response
Is there access to safe drinking water in your village? Distance and time taken to fetch water	Yes. 30mins away.
What are major sources for drinking water (river, streams, spring water and others)?	Shallow wells.
Are there seasonal problems with the water supply, if so please tell us what these are?	No.
Do you have access to a community forest for collecting fuel wood?	We use trees within the homestead.
To what extent has the availability of fuel wood declined?	Not sure.
Can you explain the causes of ecological degradation and scarcity of forest products?	Previously it was because of illegal logging which is not the case anymore.
Financial Institutions	
Do the women participate in and have access to loan/ credit from financial institutions (cooperative, group saving and credit micro-finance etc.)?	Yes.
How do you manage loan repayment?	Through instalments.
Do the women have bank account in their name? Do they operate them by themselves?	Yes.
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	It's worse because of climate change the harvests are not as good as compared to the past. A lot of pollution especially dust resulting from Base operations. Vibrations have caused cracks in our houses.
What should be the priorities to make life better?	Health, education, food security.
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome the impact?	Yes, we will lose our land and livelihood. They should not come here.
What should be done by the project for the economic empowerment of women in the village?	Equal distribution of opportunities and training.
Do you have any suggestions to BASE for making your livelihood better?	We want them to either manage the process of compensation and livelihood restoration fairly and transparently or not to come here.
Do you have any suggestions as to how government could improve people's lives?	By development projects such as health, education and improved infrastructure.
What kind of impact do you think will be brought in with influx of people from outside your area? Both positive and negative?	Positive; business opportunities and development, negative; straining of infrastructure and resources such as water.

1. Attendance Register

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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	FGD – WOMEN, MWAWECHE
PROJECT	BASE TITANIUM – NORTH DUNE PROJECT
DATE	3RD AUGUST 2020
VENUE	MWAWECHE VILLAGE
TIME STARTED	12:10 PM
TIME ENDED	1:57 PM

Name	Organisation	Designation	Email Address	Telephone No	Signature
ELICE M. DAVID	MWAWECHE	RESIDENT	—	0792508928	
MEJUMAA MZUKI	MWAWECHE	"	—	0705573306	
ELIZABETH MUIVA	MWAWECHE	"	—	0700465236	
JOYCE KAMINI	MWAWECHE	"	—	0725965464	
KWEKWE NYAMAWI	MWAWECHE	"	—	0759426137	KWEKWE
ZAWADI OMARI	MWAWECHE	"	—	0741355623	
BINTI OMARI	MWAWECHE	"	—	0705[illegible]	

2. Photo

MEETING MINUTES

Stakeholder Consulted	Focused Group Discussion- Youth
Village	Mwaweche (Barcelona)
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0547330
Venue	Mwaweche Village
Date of Meeting	3rd August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

Topic	Response
Education Status	
How many of you have completed primary school education?	Majority have completed Primary Education.
How many of you have completed high school education?	About 80%
What are the main issues with getting an education?	Distance and finances
Health Condition and Services	
Is there access to health post of Government or private health care Centre, clinic for major and minor ailments?	Yes, but they lack or services and proper facilities to provide treatment. The nearest hospital is at Mwapala and Magaoni about 3km away.
Distance of the nearest health facility from the village- time taken to travel	3km
Do you visit traditional health practitioner/traditional healer (women, men) during health problems?	No.
Kenya has one of the most rapidly growing populations in the world. Is this a problem or a blessing? Why?	Both because rapid increase means depletion of resources and at the same time its means economic growth and development.
Do you perceive the population in this community to be growing too fast, fast enough, too slowly?	No. It growing fast enough.
Government Credibility	
How happy are you with the level of services provide by the County Government? If no why not	Very poor. There is only one non-functional borehole and ECD Nursery school in this village.

Topic	Response
How happy are you with the level of services provide by the National Government? If no why not	Very unhappy. Same reasons as given above also apply to the National Government.
Livelihood Activities (on-farm and non-farm)	
What is main sources of income generation in your village?	Agriculture, wood cutting, *boda boda* (motorcycle) business and temporary work such as building and land clearing.
What are the main challenges with earning a livelihood?	Underpayment, lack of minimum qualifications and shortage of industries or companies that are able to absorb the high workforce.
What type of livelihood activities are only performed by youth?	Livestock grazing and farming.
Do the youth go to earn income outside the settlement? If yes. What types of work they involved in and distance they travel daily for work?	Yes. Temporary work such as building, land clearing and digging.
Who engages (women, men) in agricultural farm work, livestock keeping and non-farm work (run small shops, food processing, herbs processing, construction work etc.)?	Both
What types of typical on-farm work are performed by men?	Digging, ploughing and harvesting
Roles/Responsibilities in the Household	
What are the Key tasks that men are responsible within the household? • Household work/farm-work • Fetching water/sanitation, fuel wood-fodder collection- whether it causes time/energy poverty • Time available for rest and accessing health facilities	Farm-work, decision making, grazing animals, building.
Migration	
Do you know men who migrated from your village? If yes. What are the reasons for their migration? (Employment, earning income, marriage, study)?	Yes. Search for work.
How many men migrated from your village? Do you know where they migrated to - destination of migration, duration, type of work that they do?	Not sure.
Land ownership	
What is the average size of agricultural land owned by the households in your community?	3-5 acres
How far do you typically travel (walk) to get to your fields?	10 minutes.
Is there a shortage of agricultural land?	No

Topic	Response
What are the main problems with having access to enough land?	Most people lack land tile deeds, land conflicts and poor infrastructure.
Use of Natural Resources	
Is there access to safe drinking water in your village? Distance and time taken to fetching water	No. We depend on water from the rivers and rain catchment.
Do you have access to irrigation facility for your agriculture farm land?	Yes
What are major sources for drinking water and irrigation (river, streams, spring water and others)?	Rivers and rain.
Do you have access to community forest for collecting fuel wood?	No. we use wood within the homestead.
To what extent has the availability of fuel wood declined?	No significant change.
Can you explain the causes of ecological degradation and scarcity of forest products?	Illegal logging and pollution from factories.
Do men from this community engage in hunting?	No it's illegal.
Is game that is hunted becoming more scare?	No there is no hunting.
Financial Institutions	
Do you have a loan?	No
Who do you owe money to?	Nobody.
How do you manage for loan repayment?	N/A
Do you have bank account in their name? Do they operate by themselves?	No
Quality of life	
How has life changed over the past 10 years? Is it better or worse? Why?	The economy has become worse because of inflation and high cost of living. Since Base begun their operations, we have anxiety that we may be relocated and loose our livelihood.
What should be the priorities to make life better?	Employment for the youth, education and health.
Impact of Base	
Do you think BASE expansion will impact in your livelihood? If yes. How do you overcome/mitigate the impacts?	It will negatively impact on our livelihood because of potential displacement. They should manage any impacts on our livelihood.
Do you have any suggestions to BASE for making your livelihood better?	• Youth employment should be prioritised. There are only six youth employed from this area. • Land compensation should be fair. In the previous compensation, those affected were only paid Kshs 80,000 which is below the current market rates. • We propose each village should have a member employed at Base.

Topic	Response
	• Air pollution should be properly managed. • The affected community members should be given a disturbance allowance. • The community committee members should be empowered and trained better. • More regular engagements with the communities. • Provide on the job training for the youth.
What can government do to improve your livelihoods?	Bring development to the community level
What kind of impact do you think will be brought in with the possible influx of people from outside your area? Both positive and negative?	Strain of infrastructure and resources.

1. Attendance Register

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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	FGD – Youth MWAWECHE COMMUNITY
PROJECT	BASE TITANIUM – NORTH DUNE PROJECT
DATE	3RD AUGUST 2020
VENUE	MWAWECHE VILLAGE
TIME STARTED	10:15 AM TIME ENDED 11:39 AM

Name	Organization	Designation	Email Address	Telephone No	Signature
SADIQ OMARI	MWAWECHE	YOUTH	—	0791677884	
BAKARI NJEMO	MWAWECHE	YOUTH	bakarinjemo09@gmail.com	0742622099	
[illegible]	[illegible]	YOUTH	—	0717[illegible]	
SAFA OMAR HAMISI	MWAWECHE	YOUTH	diguyega16@gmail.com	0727042176	
FRANCIS MWINTI NGALA	MWAWECHE	YOUTH	[illegible]	0718087810	
JUSTUS BAYA MUWEA	MWAWECHE	YOUTH	justus83mail.com	0792645068	
MULIKA BERNARD	MWAWECHE	YOUTH	—	0715[illegible]572	
SHABAN [illegible]	MWAWECHE	YOUTH	[illegible]@yahoo.com	0702[illegible]93	
[illegible]	MWAWECHE	YOUTH	—	0702 968 911	

2. Photo

MEETING MINUTES

Stakeholder Consulted	CEC-Department of Agriculture, Livestock and Fisheries– Kwale County
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0552902
Venue	County Government Office
Date of Meeting	4th August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

1. Introduction

The meeting began at 9:45 AM. The County Executive Committee Member (CECM) welcomed the Consultant from Environmental Resources Management (ERM).

In his introductory remarks, Gideon stated that ERM is a leading global provider of environmental, health, safety, risk, social consulting services and sustainability related services with more than 5,500 employees in over 40 countries and territories working out of more than 160 offices. He further stated that ERM has been appointed Base Titanium to undertake the Environmental and Social Impact assessment for the proposed project.

2. Project Description – (ERM)

Base Titanium intends to expand their current mining activities to the North Dune, which is outside of their current Special Mining Licence (SML) but within the area covered by their current Exploration License. Mining activities within the North Dune will involve the establishment of Hydraulic Mining Units (HMUs) – similar to those currently used on the South Dune, workshops and supporting infrastructure such as slurry pipelines, to enable mining, handling of the ore, and pumping of the slurry (ore with water) to the WCP, where the mined ore is processed. A separate Tailings Storage Facility (TSF) will be required for the containment and disposal of slimes from the process, whilst coarser sands will be used to rehabilitate previously mined-out areas.

The existing haul road will be used to transport the saleable products from the processing plant to the point of shipping. The existing Likoni Ship loading Facility will continue to be used by Base for exporting its ilmenite and rutile products, while zircon will be containerised and trucked to existing container facilities in the Port of Mombasa.

The first phase of the project will involve the clearance of vegetation, and the separation and stockpiling of topsoil for use in the rehabilitation process. Site roads will need to be created to allow for clearing, as well as provide access for mining equipment that will need to be established during the site preparation phase. In addition to the 4 x HMUs that will need to be established on the North

Dune site, power lines, pump stations, piping for water and ore slurry, and an equipment yard will need to be established.

During the Operational Phase, the mine will be operated continuously (7 days a week, 24 hours a day on a 12-hour shift system). Operations in the North Dune are expected to commence in 2024 once mining in the South Dune Extension is completed. As areas are mined, mined-out areas will be rehabilitated and the mined-out areas in-filled by coarse tailings from the Processing Plant and stockpiled topsoil. The conceptual mine work plan will be refined throughout the process, taking into consideration the environmental, health and safety, social, and labour considerations.

The proposed project has a lifespan of between 4.5 to 5 years; after which, all infrastructure will be dismantled and removed. Machinery, steel, and dismantled materials will be sold, recycled where possible, or disposed of at licensed disposal sites. The North Dune will then be closed in conformance with Base's existing Mine Closure Plan, which has been prepared for the site as a whole.

3. Environmental and Social Impact Assessment (ESIA) Process- (ERM)

The Project requires Environmental Authorisation (EA) from the National Environment Management Authority (NEMA), through an Environmental and Social Impact Assessment (ESIA) process. NEMA is the competent authority under these regulations and has authority to approve the development or refuse it.

The ESIA process is guided by Environmental Management and Coordination Act (EMCA) of 1999 (reviewed in 2019), and the 2015 amendments and the associated Environmental (Impact Assessment and Audit) Regulations of 2003 (and the amendments of 2016). Reference is also made to Good International Industry Practice (GIIP) guidelines and the lender requirements, particularly, the IFC Performance Standards on environmental and social sustainability. As part of the ESIA process, stakeholder engagement and consultation is a paramount step to:

- Inform the stakeholders of the proposed project, associated impacts and identified measures to manage their significance to acceptable levels;
- Obtain stakeholders' views on the proposed project to inform its design and implementation, and gain stakeholder support/ social license to operate; and
- Open communication channels for use through the lifecycle of the project.

4. Key Discussion Points

- The Department of Agriculture, Livestock and Fisheries (DALF) is responsible for ensuring the increasing in production, marketing and profitability of agricultural produce, livestock and fisheries.
- The CECM position at County level correlates to the position of Cabinet Secretary (CS) at the national level and the Chief Officer (CO) reflects the Permanent Secretary (PS) at the National level.
- The various Departments are managed by Directors. Below the Directors are the officers at the Sub-County and Ward level.
- The DALF oversees the extension services in the county and this requires interaction with the farmers to provide training, technological transfer and information, all aiming to provide food and nutrition security in the County.
- DALF also undertakes interventions from production to marketing. At production level, DALF supports with farm inputs (e.g. fertilizers, certified planting seeds, chemicals etc.), land

preparation, and extension services that include trainings and demonstrations on how to manage the farm.

- Livestock interventions undertaken by DALF include; breeding, artificial insemination, disease control and housing.
- Fisheries interventions undertaken by DALF include increase in harvesting for example through supporting the fishermen with modern equipment e.g. nets, motorised boats and other types of fishing methods/equipment.
- DALF has put up cereal stores to help farmers store their produce and sell when the market is good. The stores are managed by farmers' cooperative societies.
- DALF has also put up livestock markets and slaughter houses and dairy plants to help farmers sell their livestock and products such as meat and milk.
- For fisheries, DALF has supported the farmers by developing landing sites and cold storage facilities to increase the shelf-life of the fish.
- CECM pointed out that her department has a technical committee that works closely with Base Titanium. The committee brings together the County officers and Base Titanium representatives who plan and execute agricultural programmes and projects.
- There is a MoU that the County Government signed with Base Titanium that guides the collaboration of any projects between Base and the County departments. If the County Government plans to undertake any activity within the Project Area, Base officers are aware and vice versa.
- Because Base supplements what the County Government is doing and the MoU stated that any projects or programmes should be aligned to the County Integrated Development Plan (CIDP). For example, if Base undertakes cotton projects, the County Government will offer extension services. This harmonizes their interventions.
- The main challenges faced by the DALF is lack of adequate funds. The interventions are usually identified through public participation, however, at times the community requests are usually more than what the allocated budget can achieve. The development partners play important roles to bridge the gaps.
- In terms of how DALF prioritises projects its mostly based on what is available in the budget and what is realistically possible. At times there is political interference with regards to the project selected.
- One of the major gaps experienced by the County Government is that they don’t receive any the tax/levies payments by Base. It mainly goes to the central government. Even though there is an Act passed which stipulated that 30% should go to the Counties, it has not yet been implemented. What the County receives comes from the National basket and includes what Base has paid as taxes.

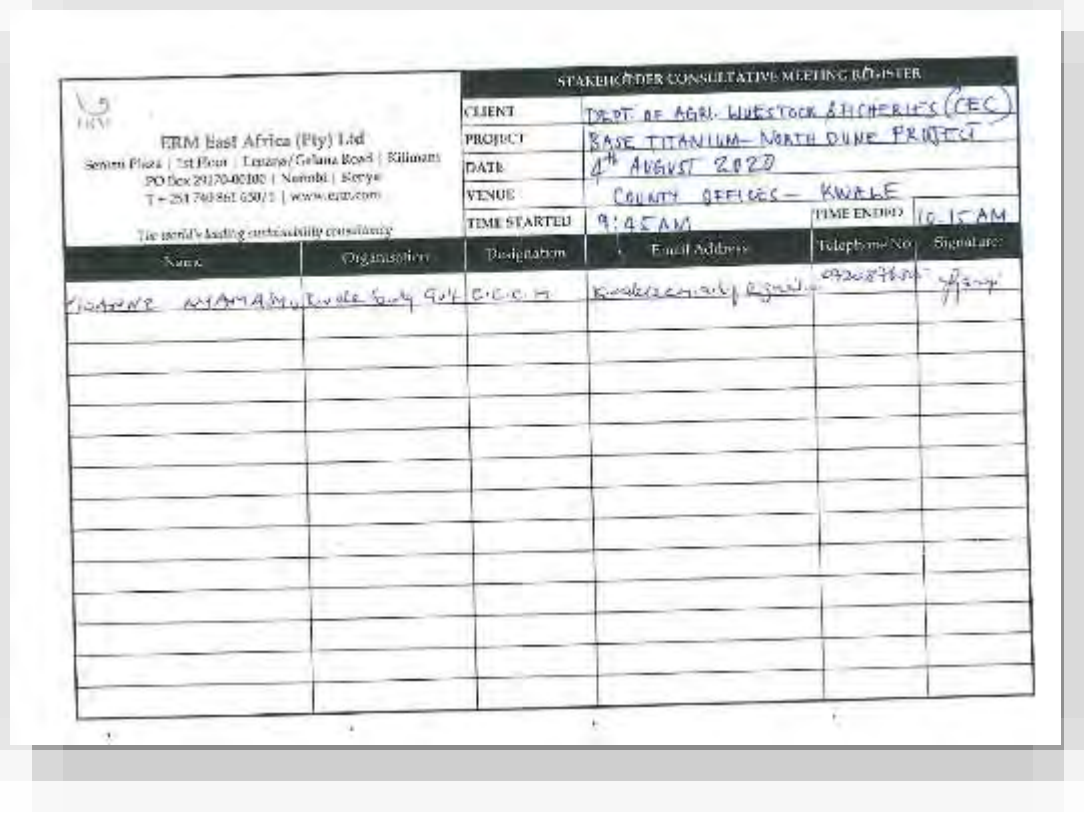
5. Way forward/ Conclusion/ General feedback from stakeholder consulted

- The majority of the communities in the Project Area are farmers and it’s important for Base to ensure minimal disruption of the farming process and community livelihood.
- The communities should be fully involved and engaged in the compensation process.
- Base should ensure minimal disruption of community linkages and family ties.
- The compensation rates for land and crops should be reviewed and based on the existing market rates.

6. Closure

In general, the CECM pointed out that her department is satisfied with Base operations in the area. There being no other business, the meeting ended at 10:15 AM.

7. Attendance Register



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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	DEPT OF AGRI. LIVESTOCK & FISHERIES (CEC)
PROJECT	BASE TITANIUM- NORTH DUNE PROJECT
DATE	4th AUGUST 2020
VENUE	COUNTY OFFICES – KWALE
TIME STARTED	9:45 AM
TIME ENDED	10:15 AM

Name	Organization	Designation	Email Address	Telephone No	Signature
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

MEETING MINUTES

Stakeholder Consulted	Chief Office (CO) Environment and County Physical Planner– Kwale County
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0552902
Venue	County Government Office
Date of Meeting	6th August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

3. Introduction

The meeting began at 3:20 PM. The Chief Officer (CO) Environment and the County Physical Planner welcomed the Consultant from Environmental Resources Management (ERM).

In his introductory remarks, Gideon stated that ERM is a leading global provider of environmental, health, safety, risk, social consulting services and sustainability related services with more than 5,500 employees in over 40 countries and territories working out of more than 160 offices. He further stated that ERM has been appointed Base Titanium to undertake the Environmental and Social Impact assessment for the proposed project.

4. Project Description – (ERM)

Base Titanium intends to expand their current mining activities to the North Dune, which is outside of their current Special Mining Licence (SML) but within the area covered by their current Exploration License. Mining activities within the North Dune will involve the establishment of Hydraulic Mining Units (HMUs) – similar to those currently used on the South Dune, workshops and supporting infrastructure such as slurry pipelines, to enable mining, handling of the ore, and pumping of the slurry (ore with water) to the WCP, where the mined ore is processed. A separate Tailings Storage Facility (TSF) will be required for the containment and disposal of slimes from the process, whilst coarser sands will be used to rehabilitate previously mined-out areas.

The existing haul road will be used to transport the saleable products from the processing plant to the point of shipping. The existing Likoni Ship loading Facility will continue to be used by Base for exporting its ilmenite and rutile products, while zircon will be containerised and trucked to existing container facilities in the Port of Mombasa.

The first phase of the project will involve the clearance of vegetation, and the separation and stockpiling of topsoil for use in the rehabilitation process. Site roads will need to be created to allow for clearing, as well as provide access for mining equipment that will need to be established during the site preparation phase. In addition to the 4 x HMUs that will need to be established on the North Dune site, power lines, pump stations, piping for water and ore slurry, and an equipment yard will need to be established.

During the Operational Phase, the mine will be operated continuously (7 days a week, 24 hours a day on a 12-hour shift system). Operations in the North Dune are expected to commence in 2024 once mining in the South Dune Extension is completed. As areas are mined, mined-out areas will be rehabilitated and the mined-out areas in-filled by coarse tailings from the Processing Plant and stockpiled topsoil. The conceptual mine work plan will be refined throughout the process, taking into consideration the environmental, health and safety, social, and labour considerations.

The proposed project has a lifespan of between 4.5 to 5 years; after which, all infrastructure will be dismantled and removed. Machinery, steel, and dismantled materials will be sold, recycled where possible, or disposed of at licensed disposal sites. The North Dune will then be closed in conformance with Base's existing Mine Closure Plan, which has been prepared for the site as a whole.

5. Environmental and Social Impact Assessment (ESIA) Process- (ERM)

The Project requires Environmental Authorisation (EA) from the National Environment Management Authority (NEMA), through an Environmental and Social Impact Assessment (ESIA) process. NEMA is the competent authority under these regulations and has authority to approve the development or refuse it.

The ESIA process is guided by Environmental Management and Coordination Act (EMCA) of 1999 (reviewed in 2019), and the 2015 amendments and the associated Environmental (Impact Assessment and Audit) Regulations of 2003 (and the amendments of 2016). Reference is also made to Good International Industry Practice (GIIP) guidelines and the lender requirements, particularly, the IFC Performance Standards on environmental and social sustainability. As part of the ESIA process, stakeholder engagement and consultation is a paramount step to:

- Inform the stakeholders of the proposed project, associated impacts and identified measures to manage their significance to acceptable levels;
- Obtain stakeholders' views on the proposed project to inform its design and implementation, and gain stakeholder support/ social license to operate; and
- Open communication channels for use through the lifecycle of the project.

6. Key Discussion Points

Chief Officer Environment

- The Chief Officer (CO) pointed out that her role is to head the intergovernmental relationships and coordinate and implement County Government policies, programmes and plans on matters related to the environment.
- The CO pointed out that Base has not properly engaged the County Government at the initial stages of their operations which is a critical step in ensuring proper management of the project.
- The CO stated that there is no clear path or solid Memorandum of Understanding (MoU) between Base and the County Government and as a result the County government is not fully involved or informed of their operations in the area.
- Base should ensure there is a well-structured engagement with the communities to avert any future crisis. This is critical because of the negative experiences the communities faced during the South Dune operations. Many of the community members complained about poor compensation and livelihood restoration. The process should be well managed to avoid any negative recurrence.
- The County expects to be fully engaged with base because they play a critical role during any crisis. They are the representatives of the people and should not only be engaged in passing or during a crisis.
- There are community members who have not yet been compensated and this can negatively impact any of Base upcoming activities.
- The community should be sensitised about the long term objectives and benefits of Base operations in the area. This will help to foster a positive attitude towards the project.
- Currently there is no framework that guides how the royalties paid by Base can tricle down to the community

Physical Planner

- Pointed out that he had no information about the North Dune project and yet he is the County Physical planner. That goes on to show that there exists a major gap in terms of consultation and communication between the Base and the County Government.

- The main concern the County Government has is that the issues that took place during the South Dune mining activities are likely to recur because of poor stakeholder engagement.
- The Resettlement Action Plan (RAP) and Livelihood Restoration Plan (LRP) should be detailed and comprehensive. It should be tailored to meet the needs and expectations of the Project Affected Persons (PAPs).
- The County lacks a database of Base activities which is critical in future decision making and planning.

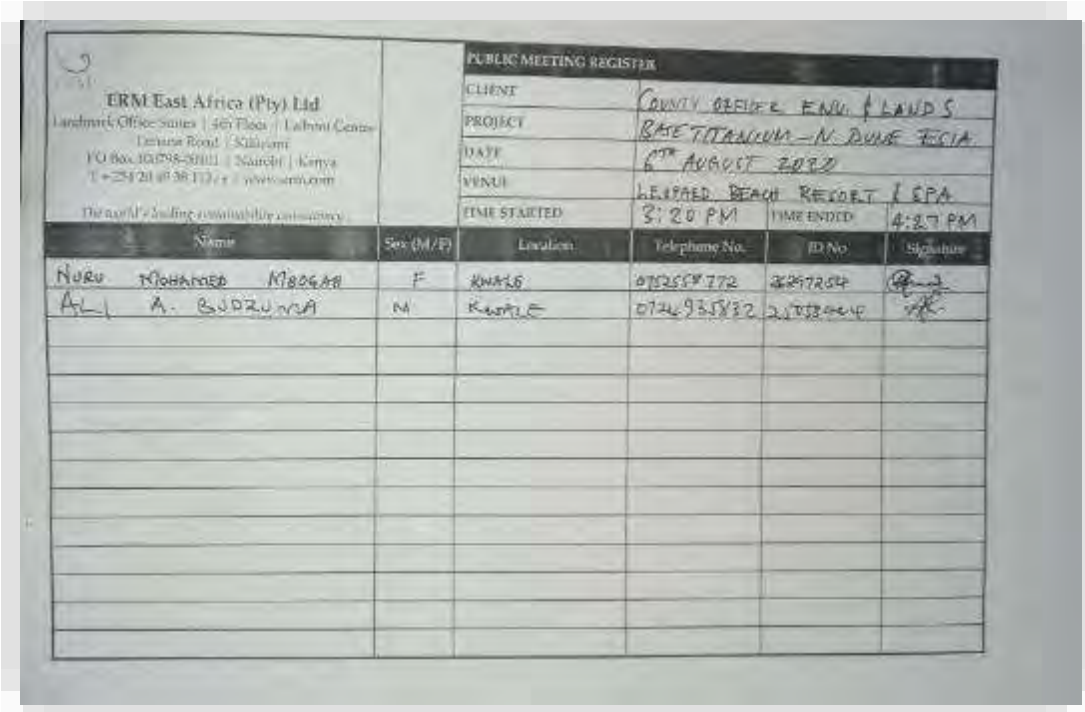
7. Way forward/ Conclusion/ General feedback from stakeholder consulted

- Regular updates and engagement between Base the County Government.
- Proposed the developing a comprehensive MoU between Base and the County Government.
- Establishment of a framework that will guide how the royalties paid by Base can trickle down to the community.

8. Closure

In general the CO and County Physical Planner pointed out that they are happy with Base operations in the area but more should be done in terms of stakeholder engagements and management of any impacts associated with resettlement and livelihood restoration. There being no other business, the meeting ended at 4:27 PM.

9. Attendance Register



ERM East Africa (Pty) Ltd

PUBLIC MEETING REGISTER

CLIENT	COUNTY OFFICE ENV. & LANDS
PROJECT	BASE TITANIUM – N. DUNE ESIA
DATE	6TH AUGUST 2020
VENUE	LEOPARD BEACH RESORT & SPA
TIME STARTED	3:20 PM
TIME ENDED	4:27 PM

Name	Sex (M/F)	Location	Telephone No.	ID No	Signature
NURU MOHAMED MBOGAB	F	KWALE	0725557772	32972554	
ALI A. BUDZU MA	M	KWALE	0724938832	21338440	

MEETING MINUTES

Stakeholder Consulted	CEC-Department of Social Services and Talent Management– Kwale County
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya.
Project Number	0552902.
Venue	County Government Office.
Date of Meeting	4th August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

1. Introduction

The meeting began at 11:30 AM. The County Executive Committee Member (CECM) welcomed the Consultant from Environmental Resources Management (ERM).

In his introductory remarks, Gideon stated that ERM is a leading global provider of environmental, health, safety, risk, social consulting services and sustainability related services with more than 5,500 employees in over 40 countries and territories working out of more than 160 offices. He further stated that ERM has been appointed Base Titanium to undertake the Environmental and Social Impact assessment for the proposed project.

2. Project Description – (ERM)

Base Titanium intends to expand their current mining activities to the North Dune, which is outside of their current Special Mining Licence (SML) but within the area covered by their current Exploration License. Mining activities within the North Dune will involve the establishment of Hydraulic Mining Units (HMUs) – similar to those currently used on the South Dune, workshops and supporting infrastructure such as slurry pipelines, to enable mining, handling of the ore, and pumping of the slurry (ore with water) to the WCP, where the mined ore is processed. A separate Tailings Storage Facility (TSF) will be required for the containment and disposal of slimes from the process, whilst coarser sands will be used to rehabilitate previously mined-out areas.

The existing haul road will be used to transport the saleable products from the processing plant to the point of shipping. The existing Likoni Ship loading Facility will continue to be used by Base for exporting its ilmenite and rutile products, while zircon will be containerised and trucked to existing container facilities in the Port of Mombasa.

The first phase of the project will involve the clearance of vegetation, and the separation and stockpiling of topsoil for use in the rehabilitation process. Site roads will need to be created to allow for clearing, as well as provide access for mining equipment that will need to be established during the site preparation phase. In addition to the 4 x HMUs that will need to be established on the North

Dune site, power lines, pump stations, piping for water and ore slurry, and an equipment yard will need to be established.

During the Operational Phase, the mine will be operated continuously (7 days a week, 24 hours a day on a 12-hour shift system). Operations in the North Dune are expected to commence in 2024 once mining in the South Dune Extension is completed. As areas are mined, mined-out areas will be rehabilitated and the mined-out areas in-filled by coarse tailings from the Processing Plant and stockpiled topsoil. The conceptual mine work plan will be refined throughout the process, taking into consideration the environmental, health and safety, social, and labour considerations.

The proposed project has a lifespan of between 4.5 to 5 years; after which, all infrastructure will be dismantled and removed. Machinery, steel, and dismantled materials will be sold, recycled where possible, or disposed of at licensed disposal sites. The North Dune will then be closed in conformance with Base's existing Mine Closure Plan, which has been prepared for the site as a whole.

3. Environmental and Social Impact Assessment (ESIA) Process- (ERM)

The Project requires Environmental Authorisation (EA) from the National Environment Management Authority (NEMA), through an Environmental and Social Impact Assessment (ESIA) process. NEMA is the competent authority under these regulations and has authority to approve the development or refuse it.

The ESIA process is guided by Environmental Management and Coordination Act (EMCA) of 1999 (reviewed in 2019), and the 2015 amendments and the associated Environmental (Impact Assessment and Audit) Regulations of 2003 (and the amendments of 2016). Reference is also made to Good International Industry Practice (GIIP) guidelines and the lender requirements, particularly, the IFC Performance Standards on environmental and social sustainability. As part of the ESIA process, stakeholder engagement and consultation is a paramount step to:

- Inform the stakeholders of the proposed project, associated impacts and identified measures to manage their significance to acceptable levels;
- Obtain stakeholders' views on the proposed project to inform its design and implementation, and gain stakeholder support/ social license to operate; and
- Open communication channels for use through the lifecycle of the project.

4. Key Discussion Points

- The CECM pointed out that the Department of Social Services and Talent Management (DSSTM) is responsible for nurturing and developing youth talents which can help the youth sustain themselves. Talent management mainly focuses on sports and performing arts. DSSTM is also responsible for provision of social services.
- The CECM pointed out that the department also provides youth empowerment programmes such as trainings.
- The Department provides support through the Youth, Women and Persons with Disabilities Fund (YWPWD).
- The department also provides training and certification to the youth through the Access to Government Procurement Opportunities (AGPO) fund. Through linkages with different ministries the youth are trained on ICT both at the local and national level.
- The department has rehabilitation programmes and works closely with National Authority for Campaign against Alcohol and Drug Abuse (NACADA) to support youths who are into drugs and substance abuse.

- On women, the DSSTM has programmes such as the Village savings and Loans Association (VLSA). The women are also supported through the YWPWD fund.
- The CECM pointed out that DSSTM provides empowerment and deals with all gender issues.
- The department also offers library services, recreation, and undertakes public Barazas.
- The CECM further stated that his department is also in charge of managing and preserving the cultural resources in the County.
- The main challenges faced by the department limited resources. The youth population is dynamic and ever changing and the programmes may need to be changed frequently. Despite the best efforts it may not be possible to reach each and every youth with information.

5. Way forward/ Conclusion/ General feedback from stakeholder consulted

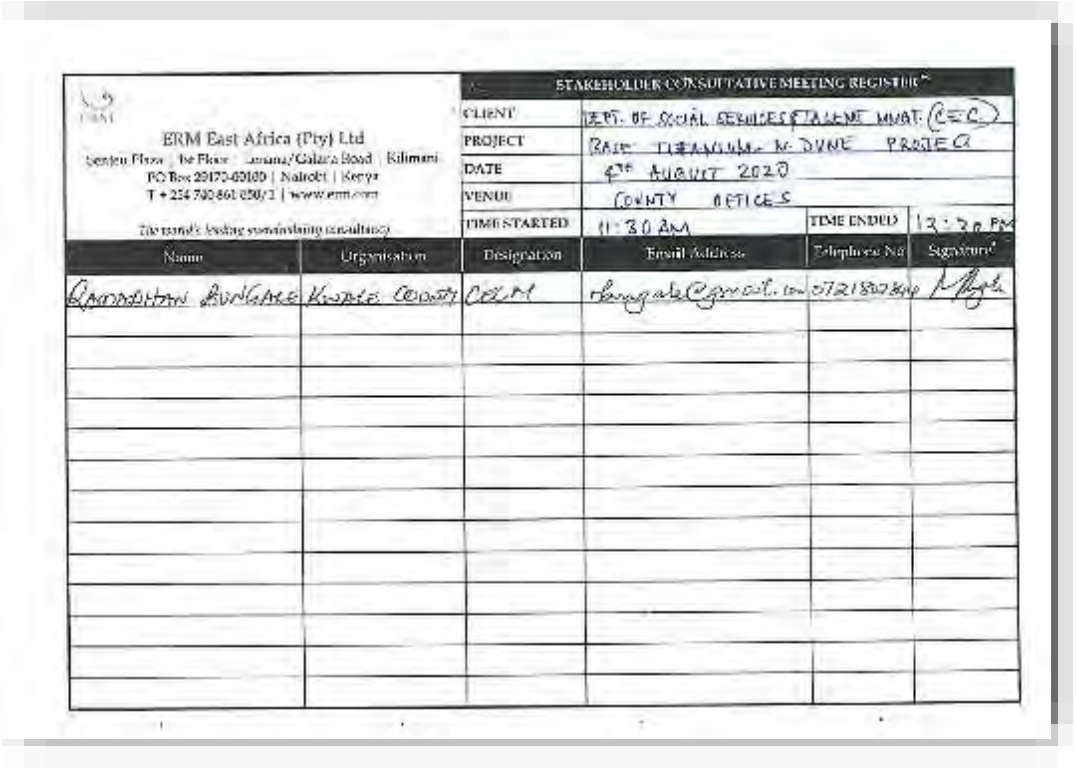
- Base should ensure the process of compensation, land reclamation and community engagement is managed well. The previous experience should be learning points.
- The Mine Closure Plan (MCP) should be carefully managed.
- The CSR programmes should expand beyond the project footprint. They should undertake a mega project that can be felt in the County and not just within the project area for example supporting construction of a university or investing heavily in the existing sub-branch technical university of Mombasa that is within Kwale County.
- Base should invest in congruence and knowledge transfer to the youth in preparation of future employment and investment opportunities.
- Base can consider connecting villages with water by utilizing the dam they have at the site.
- They can consider supporting Msambweni referral hospital and making in a state-of-the-art hospital. This way they will benefit a larger population.
- Base should consider reviving discussions/plans about the proposed constructing a stadium in the County (at Kinarim-Kwale). They can also sponsor a team such as Stima, Chemilil etc. and this will have a ripple effect in the County.
- Base would better ‘go big’ and this will help to increase their visibility.

6. Closure

In general, the CECM pointed out that his office is happy with Base operations in the area though there may be need for them to go beyond Msambweni-Sub County. Base has previously supported and facilitated his office in the area of culture through providing financial support. They are also supporting the local CBOs that fall under his office. This is recognised and appreciated.

There being no other business, the meeting ended at 12:30 AM.

7. Attendance Register



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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	DEPT. OF SOCIAL SERVICES & TALENT MNGT (C=C)
PROJECT	BASE TITANIUM N. DUNE PROJECT
DATE	4TH AUGUST 2020
VENUE	COUNTY OFFICES
TIME STARTED	11:30 AM
TIME ENDED	13:30 PM

Name	Organization	Designation	Email Address	Telephone No	Signature
[illegible]	Kwale County	CCCM	[illegible]	0721807840	

MEETING MINUTES

Stakeholder Consulted	Deputy County Commissioner (DCC) - Msambweni
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0552902
Venue	DCC Office
Date of Meeting	4th August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

1. Introduction

The meeting began at 1:45 PM. The Deputy County Commissioner (DCC), James Koskey, welcomed the Consultant from Environmental Resources Management (ERM).

In his introductory remarks, Gideon stated that ERM is a leading global provider of environmental, health, safety, risk, social consulting services and sustainability related services with more than 5,500 employees in over 40 countries and territories working out of more than 160 offices. He further stated that ERM has been appointed Base Titanium to undertake the Environmental and Social Impact assessment for the proposed project.

2. Project Description – (ERM)

Base Titanium intends to expand their current mining activities to the North Dune, which is outside of their current Special Mining Licence (SML) but within the area covered by their current Exploration License. Mining activities within the North Dune will involve the establishment of Hydraulic Mining Units (HMUs) – similar to those currently used on the South Dune, workshops and supporting infrastructure such as slurry pipelines, to enable mining, handling of the ore, and pumping of the slurry (ore with water) to the WCP, where the mined ore is processed. A separate Tailings Storage Facility (TSF) will be required for the containment and disposal of slimes from the process, whilst coarser sands will be used to rehabilitate previously mined-out areas.

The existing haul road will be used to transport the saleable products from the processing plant to the point of shipping. The existing Likoni Ship loading Facility will continue to be used by Base for exporting its ilmenite and rutile products, while zircon will be containerised and trucked to existing container facilities in the Port of Mombasa.

The first phase of the project will involve the clearance of vegetation, and the separation and stockpiling of topsoil for use in the rehabilitation process. Site roads will need to be created to allow for clearing, as well as provide access for mining equipment that will need to be established during the site preparation phase. In addition to the 4 x HMUs that will need to be established on the North Dune site, power lines, pump stations, piping for water and ore slurry, and an equipment yard will need to be established.

During the Operational Phase, the mine will be operated continuously (7 days a week, 24 hours a day on a 12-hour shift system). Operations in the North Dune are expected to commence in 2024 once mining in the South Dune Extension is completed. As areas are mined, mined-out areas will be rehabilitated and the mined-out areas in-filled by coarse tailings from the Processing Plant and stockpiled topsoil. The conceptual mine work plan will be refined throughout the process, taking into consideration the environmental, health and safety, social, and labour considerations.

The proposed project has a lifespan of between 4.5 to 5 years; after which, all infrastructure will be dismantled and removed. Machinery, steel, and dismantled materials will be sold, recycled where possible, or disposed of at licensed disposal sites. The North Dune will then be closed in conformance with Base's existing Mine Closure Plan, which has been prepared for the site as a whole.

3. Environmental and Social Impact Assessment (ESIA) Process- (ERM)

The Project requires Environmental Authorisation (EA) from the National Environment Management Authority (NEMA), through an Environmental and Social Impact Assessment (ESIA) process. NEMA is the competent authority under these regulations and has authority to approve the development or refuse it.

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- Inform the stakeholders of the proposed project, associated impacts and identified measures to manage their significance to acceptable levels;
- Obtain stakeholders' views on the proposed project to inform its design and implementation, and gain stakeholder support/ social license to operate; and
- Open communication channels for use through the lifecycle of the project.

4. Key Discussion Points

- The Deputy County Commissioner (DCC) pointed out that his office will continue to support and work closely with Base.
- The DCC suggested that Base should prioritise the training of local labour force so that they can be absorbed in the skilled and semi-skilled job opportunities.
- The process of compensation and resettlement should be undertaken in line with the law and best practice. It would be ideal for Base to identify land and relocate the community rather than use cash compensation. This is because cash payments tend to be used for the wrong purpose and families are left without land.
- The DCC pointed out that Base should regularly engage and update the community so as to manage their expectations and reduce speculation.
- The DCC pointed out that the Umbrella Committee and other Committees set up by Base have continued to consult and work effectively towards implementing action plans and community projects.
- The DCC suggested that Base should invest more on community projects. Currently there are on-going projects such as food and sanitizer distribution. This can still be scaled up and will have a positive impact on the community.
- Through the *Nyumba Kumi* (ten houses) initiative, Base can improve the stakeholder engagement process and empower the communities.
- There should be a clear framework on how the royalties paid by Base can be used to benefit the community.

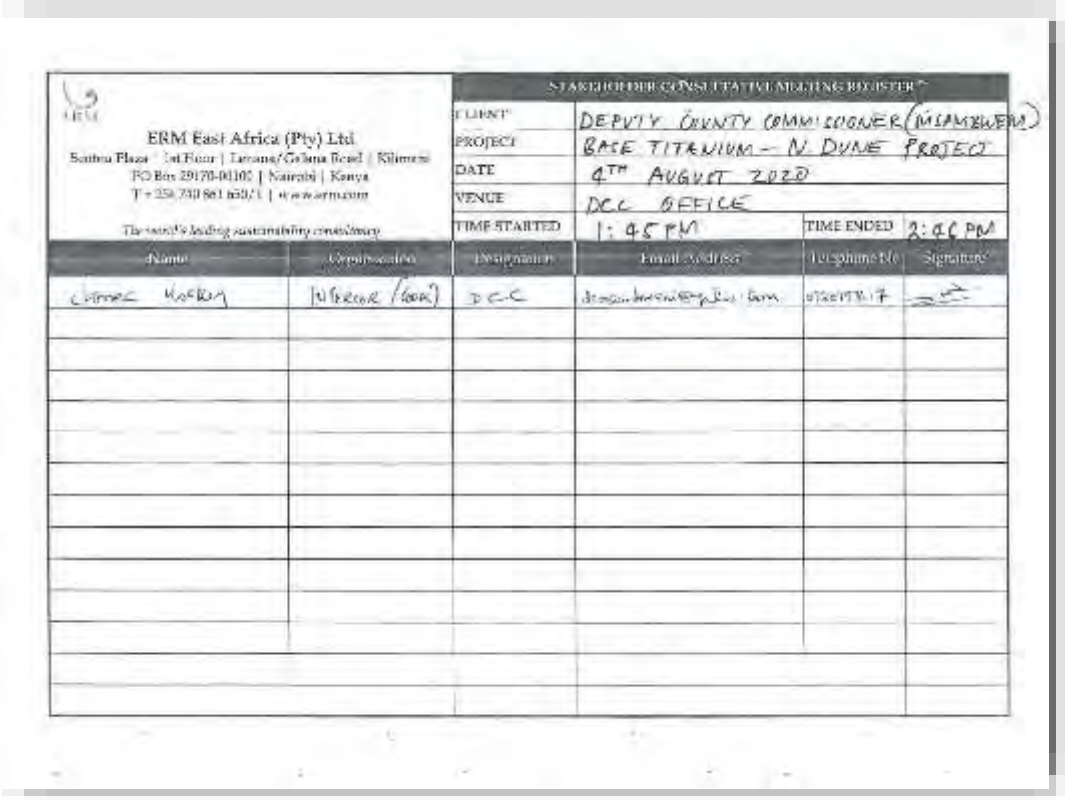
5. Way forward/ Conclusion/ General feedback from stakeholder consulted

- The DCC was happy with the progress Base is making in the area and promised the full support of his office.
- Regular consultations and engagement with the community is highly recommended.
- Utilise the *Nyumba Kumi* initiative to reach out to the community.
- Work closely with the DCC office.

6. Closure

In general, the DCC pointed out that his office is happy with Base operations in the area and there being no other business, the meeting ended at 2:46 PM.

7. Attendance Register



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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	DEPUTY COUNTY COMMISSIONER (MSAMWENI)
PROJECT	BASE TITANIUM – N. DUNE PROJECT
DATE	4TH AUGUST 2020
VENUE	DCC OFFICE
TIME STARTED	1: 45 PM
TIME ENDED	2: 45 PM

Name	Organization	Designation	Email Address	Telephone No	Signature
CHARLES MUCHIRA	KENYA RED CROSS	DCC	[illegible]	0722177917	

MEETING MINUTES

Stakeholder Consulted	Sub-County Administrator & Village Administrator- Msamweni
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0552902
Venue	Mangro Hotel
Date of Meeting	7th August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

1. Introduction

The meeting began at 8:00 AM. The Sub-County Administrator (SCA), Madam Mwanakombo Kilalo, welcomed the Consultant from Environmental Resources Management (ERM).

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- Open communication channels for use through the lifecycle of the project.

4. Key Discussion Points

- Msambweni has four wards namely Bongo, Gombato, Ukunda, Kinondo and Ramisi.
- The Sub-County Administrator (SCA) pointed out that the role of her office is management and implementation of County government projects.
- The SCA pointed out that the main challenge faced by her office is lack of adequate resources/funds. There are situations that call for regular public participation and mobilization. This is hampered by lack of adequate resources.
- One of the main challenges facing the ward is shortage of land particularly in Ukunda. There are a few people who have allotment letters, but the majority are squatters.
- The SCA pointed out that Base should ensure the process of compensation and livelihood restoration is carried out well. The previous process was not properly done and as a result there have been complaints from the community. There are community members who were reallocated from Maumba to Bwiti. However, the land at Bwiti is not fertile and this has severely impacted on the community livelihood. Because of the negative impacts faced by the affected communities this is likely to cause apprehension by the rest of the community members who feel that they may suffer a similar fate.
- The process of employment should be free and fair. The communities living within the project area should be given priority especially for the unskilled positions. Employment should not be sourced from outside at the expense of the local community.
- During the previous engagements with the communities before the South Dune operations commenced, the communities were promised business opportunities. Many of them constructed hotels in anticipation of getting business but this never came to pass. Most of Base staff were given accommodation at the camp and the communities felt short-changed.
- The village committees should be better empowered to sensitize the communities about the project. There are cases where the committee members are secretly against the project. Base should undertake regular training sessions with the committee members.
- The SCA pointed out that there should be regular engagements with the communities to iron out any concerns or outstanding issues.
- There should be more CSR projects in the ward. Currently there are no projects in Kinondo apart from the construction of a school and hospital.

- Water contamination and waste management should be properly managed. The SCA pointed out that she has received complaints from the community that the mining activities are impacting on their water. The taste has changed since Base started their operations in the area. This should be looked into.

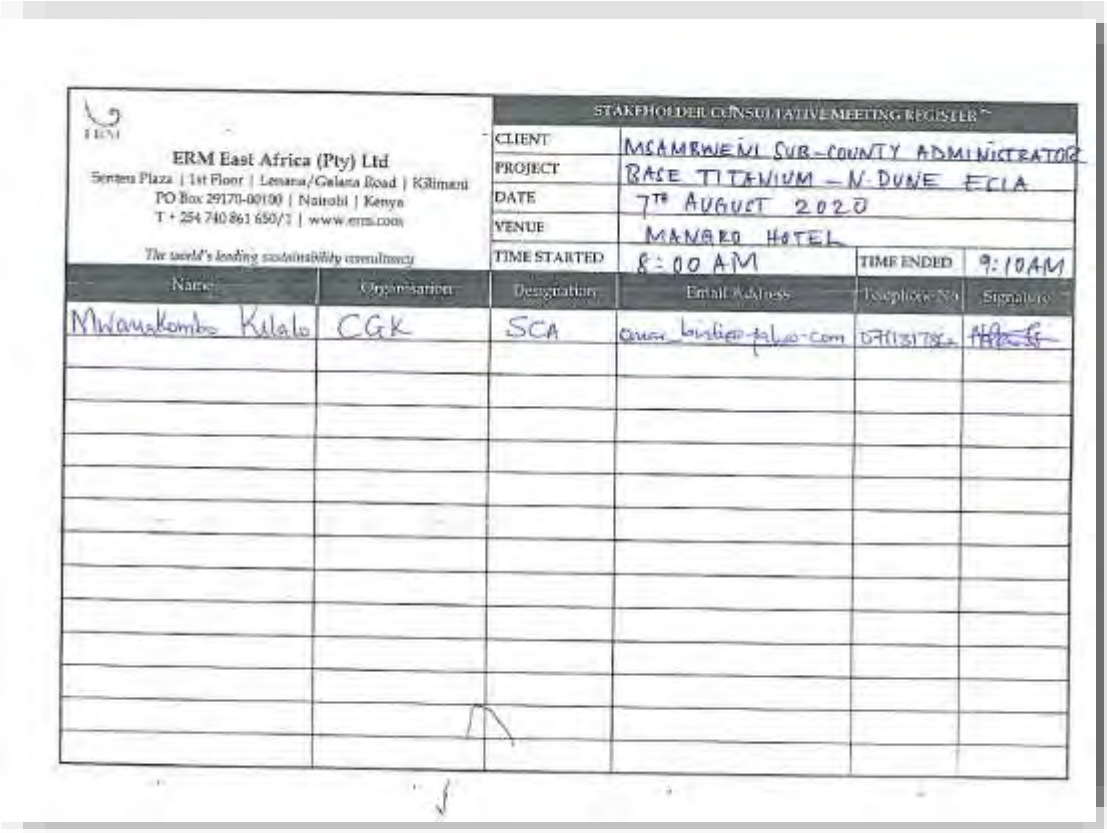
5. Way forward/ Conclusion/ General feedback from stakeholder consulted

- There will be need for more regular engagements with the communities.
- Base should ensure any outstanding issues with the communities are resolved so as not to negatively impact on the upcoming activities.
- The impacts on mangroves resulting from mining activities in the area should be assessed. Dr. Kairo (Senior researcher- KEMFRI) can be in a position to give more details.

6. Closure

In general, the SCA pointed out that her office is happy with Base operations in the area though there may be need for the CSR activities to go beyond Msambweni-Sub County. There being no other business, the meeting ended at 9:10 AM.

7. Attendance Register



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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	MSAMBWENI SUB-COUNTY ADMINISTRATOR
PROJECT	BASE TITANIUM – N. DUNE ECIA
DATE	7TH AUGUST 2020
VENUE	MANARA HOTEL
TIME STARTED	8:00 AM
TIME ENDED	9:10AM

Name	Organisation	Designation	Email Address	Telephone No	Signature
Mwanakombo Kilalo	CGK	SCA	[illegible]	0711317[illegible]	[illegible]

MEETING MINUTES

Stakeholder Consulted	Sub-County Administrator & Village Administrator- Matuga
Subject/Project	Environmental Impact Assessment for the Base Titanium North Dune Mine Expansion, Kwale, Kenya
Project Number	0552902
Venue	Sub-County Office
Date of Meeting	4th August 2020.
Participants/ Attendance	Refer to the Attendance Register attached.
Minutes by	Gideon Owaga.
Distribution	To be included in the ESIA Report

1. Introduction

The meeting began at 10:30 AM. The Sub-County Administrator (SCA), Madam Nimusimu Mwasina, welcomed the Consultant from Environmental Resources Management (ERM).

In his introductory remarks, Gideon stated that ERM is a leading global provider of environmental, health, safety, risk, social consulting services and sustainability related services with more than 5,500 employees in over 40 countries and territories working out of more than 160 offices. He further stated that ERM has been appointed Base Titanium to undertake the Environmental and Social Impact assessment for the proposed project.

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Base Titanium intends to expand their current mining activities to the North Dune, which is outside of their current Special Mining Licence (SML) but within the area covered by their current Exploration License. Mining activities within the North Dune will involve the establishment of Hydraulic Mining Units (HMUs) – similar to those currently used on the South Dune, workshops and supporting infrastructure such as slurry pipelines, to enable mining, handling of the ore, and pumping of the slurry (ore with water) to the WCP, where the mined ore is processed. A separate Tailings Storage Facility (TSF) will be required for the containment and disposal of slimes from the process, whilst coarser sands will be used to rehabilitate previously mined-out areas.

The existing haul road will be used to transport the saleable products from the processing plant to the point of shipping. The existing Likoni Ship loading Facility will continue to be used by Base for exporting its ilmenite and rutile products, while zircon will be containerised and trucked to existing container facilities in the Port of Mombasa.

The first phase of the project will involve the clearance of vegetation, and the separation and stockpiling of topsoil for use in the rehabilitation process. Site roads will need to be created to allow for clearing, as well as provide access for mining equipment that will need to be established during the site preparation phase. In addition to the 4 x HMUs that will need to be established on the North Dune site, power lines, pump stations, piping for water and ore slurry, and an equipment yard will need to be established.

During the Operational Phase, the mine will be operated continuously (7 days a week, 24 hours a day on a 12-hour shift system). Operations in the North Dune are expected to commence in 2024 once mining in the South Dune Extension is completed. As areas are mined, mined-out areas will be rehabilitated and the mined-out areas in-filled by coarse tailings from the Processing Plant and stockpiled topsoil. The conceptual mine work plan will be refined throughout the process, taking into consideration the environmental, health and safety, social, and labour considerations.

The proposed project has a lifespan of between 4.5 to 5 years; after which, all infrastructure will be dismantled and removed. Machinery, steel, and dismantled materials will be sold, recycled where possible, or disposed of at licensed disposal sites. The North Dune will then be closed in conformance with Base's existing Mine Closure Plan, which has been prepared for the site as a whole.

3. Environmental and Social Impact Assessment (ESIA) Process- (ERM)

The Project requires Environmental Authorisation (EA) from the National Environment Management Authority (NEMA), through an Environmental and Social Impact Assessment (ESIA) process. NEMA is the competent authority under these regulations and has authority to approve the development or refuse it.

The ESIA process is guided by Environmental Management and Coordination Act (EMCA) of 1999 (reviewed in 2019), and the 2015 amendments and the associated Environmental (Impact Assessment and Audit) Regulations of 2003 (and the amendments of 2016). Reference is also made to Good International Industry Practice (GIIP) guidelines and the lender requirements, particularly, the IFC Performance Standards on environmental and social sustainability. As part of the ESIA process, stakeholder engagement and consultation is a paramount step to:

- Inform the stakeholders of the proposed project, associated impacts and identified measures to manage their significance to acceptable levels;
- Obtain stakeholders' views on the proposed project to inform its design and implementation, and gain stakeholder support/ social license to operate; and
- Open communication channels for use through the lifecycle of the project.

4. Key Discussion Points

- The SCA pointed out that one of the key duties of her office is to co-ordinate all the County Government activities and projects within Matuga Sub-County. All developers have to pass through her office. The SCA further stated that she is part of the Base Titanium Matuga Liaison Committee (MLC) that is chaired by the County Commissioner (CC) with her as the co-chair.
- Matuga Sub-County is composed of five wards namely: simba Golini, Wa ngombeni, Tiwi, Nkubo South and Mkongani. In Simba Golini, there are four villages namely: Golini, Mbuguni, Kundutsi and Mzumalume. In Nkubo South there are six villages namely: Shimba Hills, Majimboni, Mwaluvanga, Mangawani and Lukore. There are 20 village units in the ward.
- At the beginning of the year, the MLC plans for all the upcoming projects in collaboration with Base.
- The SCA stated that she is also part of the Base Agricultural Committee (BAC) and they partner during the roll-out of agricultural programmes.
- There are also Sub-Committees such as Education that the office of the SCA works closely with. The Education Committee is in charge of rolling out scholarship programmes.
- The SCA pointed out that part of the project area is neighbouring her ward. This means there will be indirect impacts to the neighbouring area. The study should not only focus on the project footprint.
- The Village Administrator (VA) pointed out that there should be regular feedback given to the community even after the Project.
- The SCA pointed out that there was a lot of controversy before Base was given the prospecting licence. Because the communities were not well informed, many were divided if Base should be allowed to prospect the minerals in their area. It is therefore important that comprehensive stakeholder engagements be undertaken with the communities.
- The main concern by the larger Kwale community is that they don't see any benefits form the Mining exercise. Base should ensure the communities see the benefits of the Project.

- The SCA pointed out that the project Community Social Responsibility (CSR) should be extended beyond the Project footprint.
- Since Matuga Sub-County is in the transport corridor used by Base, it should also have representation in the umbrella committee that has been established by Base. Most of the times we are told that the mining area is in Msambweni sub-county but the reality is that Matuga will also being impacted.
- Likoni sub-County have the port facility and seem to benefit more than Kwale County in terms of CSR activities.
- Base can upgrade the road (from 00) to the port facility which can also benefit the community members in the area. This will help reduce potential impacts such as accidents and dust for the other road users.
- The SCA proposed that Base can aim to build a processing facility and industries locally instead of exporting the minerals for processing. This will create business and employment opportunities for the locals.
- The County Government has the 5-year County Integrated Development Plan (CIDP) that synchronises with all development projects. For example, when there were plans by the County to build ECD schools Base proposed to construct the ECDs, the County funds were used for other development projects.
- The SCA pointed out that there have been complaints from the communities in Kwale that employment positions are usually given to people from other counties, especially the top management positions. Base should have a database of the skill-sets and qualifications of the communities in the area and the process of recruitment should be fair and transparent.
- The SCA stated that she was happy with the bursary programmes that have been rolled out by Base.
- The VA pointed out that there is a community area near Shimba Hills where the crops have been destroyed by too much dust that is likely radiating from the Project site. Base should look into that.

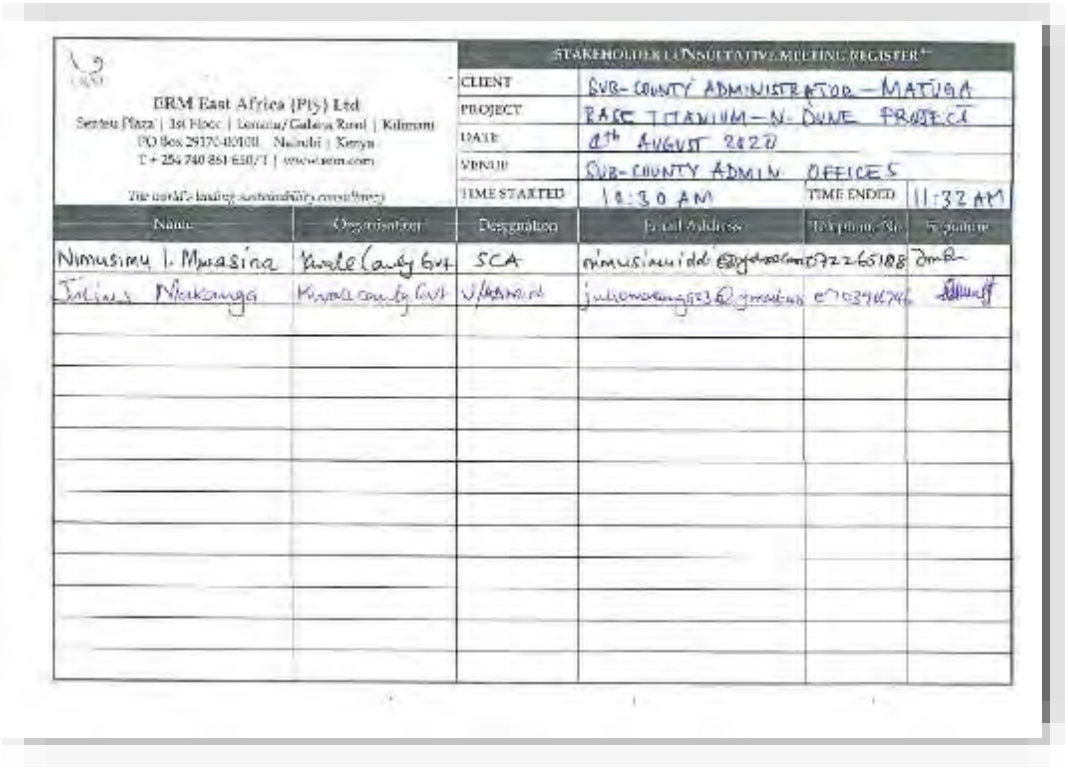
5. Way forward/ Conclusion/ General feedback from stakeholder consulted

- There will be need for another MoU between Base and the County Government i.e. the Executive (Governorship) and the County Assembly. The MoU should be guided by the mining Act.
- There should be clear guidelines for any investors who come to Kwale County.
- Matuga should also be included in the CSR activities since Base will use their transport corridor during the project construction and operation.
- The compensation rates for land, trees and crops should be revised this time round. The previous rate was about Kshs 80,000 per acre which was quite low.
- Base should work closely with the training institutions to build the capacity by educating and training the youth so that they can take up employment positions in the company when the time comes.
-

6. Closure

In general, the SCA pointed out that her office is happy with Base operations in the area though there may be need for them to go beyond Msambweni-Sub County. There being no other business, the meeting ended at 11:33 AM.

7. Attendance Register



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STAKEHOLDER CONSULTATIVE MEETING REGISTER

CLIENT	SUB-COUNTY ADMINISTRATOR – MATUGA
PROJECT	BASE TITANIUM – N. DUNE PROJECT
DATE	4th AUGUST 2020
VENUE	SUB-COUNTY ADMIN OFFICES
TIME STARTED	10:30 AM
TIME ENDED	11:32 AM

Name	Organization	Designation	E-mail Address	Telephone No.	Signature
Nimusimu L. Mwasina	Kwale County Govt	SCA	nimusimuli@[illegible]722765108		
Julius Mwikamga	Kwale county Govt	V/Admin	juliomwamga53@gmail.com	0[illegible]	

APPENDIX C Summary of Focussed Group Discussions (FGDs)

Bumamani Village				
Indicator	*Male*	*Female*	*Youth*	*Village Committee*
Education Status	Completion rate: - Primary: 100% - High School: 50% Barriers to Access: - Unable to afford Fees - Cultural: Negative attitude towards education	Completion rate: - Primary: 40% - High School: 30% - Illiterate: 50% Barriers to Access: - Unable to afford education - Social: Early pregnancies - Cultural: Negative attitude towards education e.g. no immediate benefit	Completion rate: - Primary: 50% - High School: 50% Barriers to Access: - Unable to afford Fees, Orphans - Social: Early pregnancies	Completion Rate: - Primary: 90% - High School: 0% Barriers to Access: - Unable to afford Fees due to vulnerabilities - No nursery in village
Health Access	Two hours commute to closest health post	Half an hr commute to closest health post Use of traditional practitioners Marriage for women is at 18 and 20 for men	2 hrs commute to closest health post (in Magaoni) with transport issues Use of traditional medicine	Health post is 5km away and lacks adequate facilities and infrastructure.
Government Credibility	Low engagement from County and National government	Poor	Low government credibility as most youth are unemployed and with no access to electricity	Poor. There are no services at Magaoni
Livelihood	Main Source Income: - Agriculture: coconut and maize - Small business such as Kiosks Challenges: - Access to Markets for produce - Destruction of Crops (animals, and floods)	Main Source Income: - Small businesses - Thatch making and selling coconuts - Housekeeping in other towns - Harvesting crops only - Collection of firewood, fetching water, and cooking	Main Source Income: - Agriculture (digging, ploughing, harvesting) - Livestock grazing - Informal transport business (boda boda) - Selling thatches Challenges: - Access to Markets - Destruction of crops (animals and floods)	Main Source Income: - Agriculture (crops such as oranges and coconuts) - Businesses such as shops
Household Roles	- Farm work - Decision making - Grazing - Building	- Fetching water - Cooking and sanitation - Assisting with agricultural activities	- Farm-work - decision making - grazing animals - building	- Farm-work - decision making - grazing animals - building
Migration	Main reason for migration: - Purchase of land - Migration is not so common	Main reason for migration: - Seeking work - Marriage	Main reason for migration: - Seeking work - Marriage - Anticipation of base operations	- Main reason for migration: - Seeking work - Search for land - Marriage
Land Ownership	Average size of land: 7-10 acres Average Commute Distance: 1km	Average size of land: 7 acres Ownership is assumed by males only	Average size of land: 5-10 acres	Average size of land: 5 acres
Natural Resource Consumption	Groundwater: - Borehole 1km from HH Forests: - Overexploitation and illegal logging	Water streams and Borehole for drinking water Firewood from owned land Cutting trees for charcoal	Borehole for drinking water Firewood used within homestead Overuse and illegal cutting of trees	Groundwater such as shallow wells for drinking and cooking Cutting and overuse of tree logs
Financial Institutions	No formal financial institutions	Most have access to bank accounts with operational accounts	No access	No access to formal institutions

				Most engage in informal lending mechanisms i.e. chama
Quality of life	Lower quality of life experienced since start of base operations	Not much change has been experienced in quality of life	Not much has changed Unemployment is a big challenge	Unemployment is persistent with the youth Not much change in quality of life
Mobility		No restrictions, they can travel to different villages and towns for essential services e.g. access to health posts and markets		
Gender Relations		No reported cases regarding gender based violence		
Perceived Impacts	Negative impacts from South Dune: - Resettlement and compensation was inadequate - Strain of infrastructure and resources.	Life hasn't changed except a few developments due to devolution	Concerns that relocation might impact livelihood gains Increase in resource strains and limited business opportunities	- Loss of livelihoods and lands - Increase prices of lands
Suggestions	Avoid relocation Consideration for the elderly Transparency Compensation for health impacts and property damage	Support for women through finance Ensure Compensation is adequate		- Employment - Development programmes for the community.
Mkwambani Village				
Indicator	*Male*	*Women*	*Youth*	*Village Committee*
Education Status	Completion rate: - Primary: 80% - High School: 0% Barriers to Access: - Unable to afford Fees - Shortage of teachers	Completion rate: - Primary: 50% - High School: 10% Barriers to Access: - Unable to afford education - Social: Early pregnancies	Completion rate: - Primary: 90% - High School: 50% Barriers to Access: - Unable to afford Fees, Orphans - Social: Early pregnancies - Negative attitude towards education from care givers	Completion Rate: - Primary: 70% - High School: 50% Barriers to Access: - Unable to afford Fees due to vulnerabilities - Shortage of teachers
Health Access	closest health post is 1km away	Private health centres is 2km away. The government hospital is 5km away	Less than 1km to closest health post	Less than 1km away to closest health post
Government Credibility	Some government credibility as water and bursary programs available		Low government credibility as most youth are unemployed and with no support Water is provided by county government	Poor. There are no services available or projects that are beneficial to the community
Livelihood	Main Source Income: - Farming of crops such as mangoes, maize, cashew nuts and bananas. - Small business such as Kiosks Challenges: - Access to Markets for produce - Destruction of Cash Crops (animals, and floods)	Main Source Income: - Small businesses - Thatch making - selling coconuts	Main Source Income: - Agriculture growing crops such as mangoes, maize, cashew nuts and bananas - Informal business e.g. transport (boda boda), shops - Challenges: - No capital, lack of training for the youth or proper education,	Main Source Income: - Agriculture (farming mangoes, maize, cashew-nuts and bananas) - Businesses such as shops

	- Poor infrastructure		- no incentives or support from the government.	
Household Roles	- Farm work including Digging, ploughing and harvesting. - Decision making - Grazing - Building	- On Farm work i.e. digging, planting, ploughing and harvesting - Household chores e.g. cleaning, cooking - Fetching water and firewood,	- Farm-work - decision making - grazing animals - building	- Farm-work - decision making - grazing animals - building
Migration	Main reason for migration: - Purchase of land - Marriage	- Main reason for migration: - Seeking work - Marriage	Main reason for migration: - Seeking work - Study - Purchase of land	Main reason for migration: - Search for land - Marriage
Land Ownership	Average size of land: approximately 10 acres	Average size of land: 5-20 acres Ownership is assumed by males with the exception of widows	Average size of land: 5-10 acres However most do not have land titles	Average size of land: approximately 10 acres Ownership is an issue
Natural Resource Consumption	Forests: Overexploitation and illegal logging	Water streams 2km away for drinking and cooking		Groundwater such as shallow wells for drinking and cooking Illegal cutting and overuse of tree logs
Financial Institutions	No formal financial institutions	No access to formal institutions Most engage in informal lending mechanisms i.e. *chama*	No access to formal institutions	No access to formal institutions Most engage in informal lending mechanisms i.e. *chama*
Quality of life	Lower quality of life experienced affecting livelihood such as; - climate change affecting agricultural activities - inflation	better compared to the past because of changes brought about by development and technology.	Not the best especially for the youth – no opportunities available	Not much change in quality of life because of climate change affecting farming and inflation
Mobility		No restrictions, they can travel to different villages and towns for essential services e.g. access to health posts and markets		
Gender-Related Issues		No reported cases regarding gender based violence		
Perceived Impacts	Negative impacts from South Dune: - compensation was inadequate - displacement of communities Anticipated negative impacts: - destruction of cultural heritage sites - loss of livelihood - diseases such as chest infections because of the dust.	Negative impacts from South Dune: - compensation was inadequate - displacement of communities Anticipated negative impacts: - Loss of livelihoods and lands - Increase prices of lands	Concerns that relocation might impact livelihood gains	- Loss of livelihoods and lands - Increase prices of lands
Suggestions	- Transparency and fairness in resettlement process	- Equal distribution of opportunities and livelihood restoration programmes targeting women.	The scholarships and bursaries from Base should be distributed in a way that benefits all the communities equally.	- Transparency in compensation and relocation process - Development programmes for the

	- Livelihood restoration programs are needed	- Women should be more involved in the decision making process around land and resettlement.	The scholarships and bursaries from Base should be distributed in a way that benefits all the communities equally.	community improve quality of life
Mwaloya Village				
Indicators	*Male*	*Female*	*Youth*	*Village Committee*
Education Status	Completion rate: - Primary: 90% - High School: 50% Barriers to Access: - Financial challenges e.g. Unable to afford Fees	Completion rate: - Primary: 33% - High School: 22% - Illiterate: 45% Barriers to Access: - 70% drop out cases are for girls because of early pregnancy cases. - 30% boys because of drug abuse. - Few dropout cases are as a result of lack of school fees.	Completion rate: - Primary: 50% - High School: 16% - Illiterate: 16% Barriers to Access: - lack of school fees due to poverty - drug abuse - lack of interest due to unavailability of job opportunities - high rate of early pregnancies.	Completion rate: - Primary: 90% - High School: 50% Barriers to Access: Financial challenges e.g. Unable to afford Fees
Health Access	Closest health post is 1hr away	Private health centres is 1.5hrs away. The government hospital is 5km away	Less than 1km to closest health post	Closest health post is 1hr away
Government Credibility	Limited credibility; few projects initiated by the County Government and poor service delivery.	Poor	Government services sufficient at county level	Limited credibility; few projects initiated by the County Government and poor service delivery.
Livelihood	Main Source Income: - Farming of crops such as coconut and maize Challenges: - Access to Markets for produce - Destruction of Cash Crops (animals, and floods)	Main Source Income: - selling of farm produce - thatch making and selling - farm work - small business - food processing	Main Source Income: - Agriculture- selling of farm produce - Transport business (informal) boda boda - Selling charcoal - Challenges: - Access to markets - Low wages	Main Source Income: - Farming of crops such as coconut and maize Challenges: - Access to Markets for produce Destruction of Cash Crops (animals, and floods)
Household Roles	- Farm work including Digging, ploughing and harvesting. - Decision making - Grazing - Building	- On Farm work i.e. digging, planting, ploughing and harvesting - Fetching water, - Sanitation - fuel wood-fodder collection	- Farm-work - decision making - grazing animals - building	- Farm work including Digging, ploughing and harvesting. - Decision making - Grazing - Building
Migration	Main reason for migration: - Purchase of land	Main reason for migration: - Seeking work - Study - Marriage	Main reason for migration: - Seeking work - Study - Marriage -	Main reason for migration: Purchase of land
Land Ownership	Average size of land: approximately 7-10 acres	- Average size of land: 5-20 acres - Ownership is assumed by males with the exception of widows	- Average size of land: approximately 10 acres	- Average size of land: approximately 7-10 acres
Natural Resource Consumption	- Groundwater: - Borehole for drinking, cooking, farming - Forests: - Overexploitation and illegal logging	- Water streams 2km away for drinking and cooking	- Ground water: - Well – 20 minutes way - Wood found within homesteads	- Groundwater: - Borehole for drinking, cooking, farming - Forests: - Overexploitation and illegal logging

Financial Institutions	No formal financial institutions	No access to formal institutions Most engage in informal lending mechanisms i.e. *chama*	Mobile banking such as MPESA loans	No formal financial institutions
Quality of life	Lower quality of life experienced affecting livelihood such as; - climate change affecting agricultural activities - inflation	better compared to the past because of changes brought about by development and technology.	Not the best especially for the youth – no employment opportunities available	Lower quality of life experienced affecting livelihood such as; - climate change affecting agricultural activities - inflation
Mobility	No restrictions	No restrictions	No restrictions	No restritions
Gender-Related Issues		No reported cases regarding gender based violence Male members do encourage women to participate in development related meetings in the village.		
Perceived Impacts	Negative impacts from South Dune: - compensation was inadequate - displacement of communities Anticipated negative impacts: - loss of livelihood - displacement	Negative impacts from South Dune: - compensation was inadequate - displacement of communities Similar negative impacts are anticipated	Concerns that relocation might impact livelihood gains	Negative impacts from South Dune: - compensation was inadequate - displacement of communities Anticipated negative impacts: - loss of livelihood - displacement
Suggestions	- Avoid relocation - Fair compensation if resettlement is unavoidable - Livelihood restoration and employment	- Equal opportunities and fair livelihood restoration programmes with women's interests considered - empower women by giving loans that attract minimal interest .	Livelihoods can be enhanced by: - creation of job opportunities - Supporting the youth in engaging in Income Generating Activities - Ensure equal opportunity	- Avoid relocation - Fair compensation if resettlement is unavoidable - Livelihood restoration and employment
Mwaweche Village				
Indicators	*Male*	*Female*	*Youth*	*Village Committee*
Education Status	Completion rate: - Primary: 90% - High School: 50% Barriers to Access: - Financial challenges e.g. Unable to afford Fees - Distance (2km away)	Completion rate: - Primary: 80% - High School: 50% Barriers to Access: - early pregnancy - drug abuse - financial challenges - negative attitude towards education	Completion rate: - Primary: 90% - High School: 80% Barriers to Access: - lack of school fees due to poverty - distance	Completion rate: - Primary: 90% - High School: 50% Barriers to Access: - Financial challenges e.g. Unable to afford Fees - Distance (2km away)
Health Access	Closest health post is 3km away	Closest health centre is 2km	3km to closest health post	Closest health post is 3km away
Government Credibility	Limited credibility; no services available for the village	Poor	Poor government services with no potable water	Limited credibility; no services available for the village
Livelihood	Main Source Income: - Agriculture and livestock - cash crops such as maize, coconuts, Bixa, oranges and cashewnuts and domestic crops	Main Source Income: - selling of farm produce e.g. maize, coconuts, bananas, cashew nuts and mangoes - livestock	Main Source Income: - Agriculture- selling of farm produce and - Transport business (informal) boda boda - Temporary work such as building and land clearing	Main Source Income: - Agriculture and livestock - cash crops such as maize, coconuts, Bixa, oranges and cashewnuts and domestic crops

	include: beans, cassava and vegetables - Small businesses e.g. kiosks Challenges: - Access to Markets for produce - Destruction of Cash Crops (animals, and floods)	- mending/stitching thatched grass for roofing	Challenges: - No training and poor education - Low wages	include: beans, cassava and vegatables - Small businesses e.g. kiosks Challenges: - Access to Markets for produce Destruction of Cash Crops (animals, and floods)
Household Roles	- Farm work including Digging, ploughing and harvesting. - Decision making - Grazing - Building	- On Farm work i.e. digging, planting, ploughing and harvesting - Fetching water, firewood - Cooking - Sanitation - fuel wood-fodder collection	- Farm-work including livestock grazing - decision making - grazing animals - building	- Farm work including Digging, ploughing and harvesting. - Decision making - Grazing - Building
Migration	Main reason for migration: - Purchase of land	Main reason for migration: - Marriage	Main reason for migration: - Seeking work	Main reason for migration: - Purchase of land
Land Ownership	Average size of land: approximately 10 acres	Average size of land: 5-8 acres Ownership is assumed by males with the exception of widows	Average size of land: approximately 3-5 acres	Average size of land: approximately 10 acres
Natural Resource Consumption	Groundwater: Borehole for drinking, cooking, farming (1km away) Forests: Overexploitation and illegal logging	Shallow wells 30 mins away for drinking and cooking	Rain catchment for and rivers for water Wood found within homesteads	Groundwater: Borehole for drinking, cooking, farming (1km away) Forests: Overexploitation and illegal logging
Financial Institutions	No formal financial institutions	Microfinancing with loans paid back in instalments	No access to formal finance institutions	No formal financial institutions
Quality of life	Lower quality of life experienced with challenges to livelihoods	Worse off because of climate change affecting their farming and pollution from Base developments	Poor quality of life because of inflation and high cost of living.	Lower quality of life experienced with challenges to livelihoods
Mobility	No restrictions	No restrictions	No restrictions	No restrictions
Gender-Related Issues	No cases	No reported cases regarding gender based violence	No cases	No cases
Perceived Impacts	Negative impacts from South Dune: - compensation was inadequate - displacement of communities Anticipated negative impacts: - loss of livelihood displacement	Concerns of negative impacts on our livelihood because of potential displacement	Concerns of negative impacts on our livelihood because of potential displacement	Negative impacts from South Dune: - compensation was inadequate - displacement of communities Anticipated negative impacts: loss of livelihood displacement
Suggestions	- Ensure frequent meetings with the community particularly the land owners. - Ensure the valuation and compensation	- Equal opportunities and fair livelihood restoration programmes with women's interests considered - Training	Manage livelihood impacts by focusing on: - Promoting youth employment - Fair and Adequate Land compensation.	- Ensure frequent meetings with the community particularly the land owners. - Ensure the valuation and compensation

	exercise is transparent and fair. - Ensure the land compensation prices are fair.	- Provide employment opportunities	- Air pollution management - Adequate compensation - Training - Effective SEP processes	exercise is transparent and fair. Ensure the land compensation prices are fair.
Mwandimu Village				
Indicators	*Male*	*Female*	*Youth*	*Village Committee*
Education Status	Completion rate: - Primary: 90% - High School: 50% Barriers to Access: - Financial challenges e.g. Unable to afford Fees - Family challenges	Completion rate: - Primary: 90% - High School: 25% Barriers to Access: - early pregnancy - drug abuse - financial challenges - negative attitude towards education from guardians	Completion rate: - Primary: 90% - High School: 20% Barriers to Access: - lack of school fees lack of equal opportunities for those coming from poor backgrounds, - Peer pressure.	Completion rate: - Primary: 60% - High School: 80% Barriers to Access: - Financial challenges e.g. Unable to afford Fees - Shortage of teachers
Health Access	Closest health post is 4km away	Closest health centre is 30 minutes away in Mtwapala and Magaoni	1km to closest health post including Shimba Hills Dispensary, Magaoni Dispensary, Zigira Dispensary and Mwapala Dispensary.	Closest health post is less that 1km away
Government Credibility	Limited credibility; no services available for the village e.g. maternity services, schools	No cases	Poor government services with no potable water	Limited credibility; no services available for the village
Livelihood	Main Source Income: - Agriculture and Farming of crops such as; coconuts, cashewnuts, mangoes, oranges, pineapples, groundnuts and maize. Challenges: - Access to infrastructure for agriculture	Main Source Income: - selling of farm produce e.g. maize, coconuts, and vegetables - mending/stitching thatched grass for roofing	Main Source Income: - Agriculture- selling of farm produce and - Transport business (informal) boda boda - Wage work in petrol stations Challenges: - No capital - lack of training for the youth or proper education - No incentives or support from the government.	Main Source Income: - Agriculture and livestock - cash crops such as mangoes, maize, cashewnuts and bananas - Small businesses e.g. kiosks Challenges: - Access to Markets for produce - Poor infrastructure - Destruction of Cash Crops (animals, and floods)
Household Roles	- Farm work including Digging, ploughing and harvesting. - Decision making - Grazing - Building	- On Farm work i.e. digging, planting, ploughing and harvesting - Fetching water, firewood - Cooking - Sanitation - fuel wood-fodder collection	- Farm-work including livestock grazing - decision making - grazing animals - building	- Farm work including Digging, ploughing and harvesting. - Decision making - Grazing - Building
Migration	Main reason for migration: - Purchase of land - Marriage	Marriage	Main reason for migration: - Seeking work - Marriage - Purchase of land	Main reason for migration: - Purchase of land - Marriage
Land Ownership	Average size of land: approximately 4-30 acres	Average size of land: 5-10 acres Ownership is assumed by males with the exception of widows	Average size of land: approximately 10-20 acres	Average size of land: approximately 10 acres

Natural Resource Consumption	Groundwater: Borehole and wells for drinking, cooking,	More than 50 boreholes in most homesteads.	50 boreholes in this village used for drinking, cooking, and agriculture	Groundwater: Borehole for drinking, cooking, farming
Financial Institutions	No formal financial institutions Microfinance institutions such as chama	Informal microfinancing e.g. table banking e.g. Krep and other micro-finance institutions	Access to village bank in Kinondo	No formal financial institutions
Quality of life	No significant change	It is better as compared to the past because the land fertility has improved and increased access to natural resources	Improved quality of life with better because the food is readily available, the land is more fertile	Experienced a better quality of life because of improved access to water and food
Mobility	No restrictions	No restrictions	No restrictions	No restrictions
Gender-Related Issues	No cases	No reported cases regarding gender based violence	No cases	No cases
Perceived Impacts	Anticipated negative impacts: loss of livelihood and physical displacement	Concerns of negative impacts on our livelihood because of potential displacement	Concerns of negative impacts on our livelihood because of potential displacement. Loss of land	Anticipated negative impacts: loss of livelihood and displacement
Suggestions	- Prioritize this community when it comes to job opportunities.	- Equal opportunities and fair livelihood restoration programmes with women's interests considered - Training - Provide employment opportunities - More development projects	Management of livelihood impacts by focusing on: - Availability of infrastructure and resources for all those that are affected	- Ensure frequent meetings with the community particularly the land owners. - Ensure the valuation and compensation exercise is transparent and fair. - Training and employment - Sensitization and awareness - Include communities in decision making process

APPENDIX D Summary of Key Informant Interviews (KIIs)

Stakeholder	Mode of Engagement	Engagement Date	Venue
County Government			
1. Department of Agriculture, Livestock & Fisheries	KII	4th August 2020	County Government Office
2. Department of Environment, Land, and Physical Planning		6th August 2020	
3. Social Services and Talent Management		4th August 2020	
4. Deputy County Commissioner (DCC) of Kwale		4th August 2020	DCC Office
5. Sub-County Administrator of Msambweni		7th August 2020	Mangro Hotel
6. Sub-County Administrator of Matuga		4th August 2020	Sub-County Office

Main Theme	Key stakeholders issues/ comments
Stakeholder Engagement Issues	Chief Officer (CO) of Environment pointed out that Base has not properly engaged the County Government at the initial stages of their operations which is a critical step in ensuring proper management of the project.
	Base should ensure there is a well-structured engagement with the communities to avert any future crisis. Many of the community members complained about poor compensation and livelihood restoration from previous development.
	There are community members who have not yet been compensated from the previous relocation and this can negatively impact any of Base upcoming activities.
	The community should be sensitised about the long term objectives and benefits of Base operations in the area. This will help to foster a positive attitude towards the project.
	The Deputy County Commissioner (DCC) pointed out that Base should regularly engage and update the community so as to manage their expectations and reduce speculation.
	The Village Administrator (VA) pointed out that there should be regular feedback given to the community even after the Project.
	The Sub-County Administrator pointed out that there was a lot of controversy before Base was given the prospecting licence. Because the communities were not well informed, many were divided if Base should be allowed to prospect the minerals in their area. It is therefore important that comprehensive stakeholder engagements be undertaken with the communities. Base should ensure the communities see the benefits of the Project.
Livelihood Concerns	Majority of the communities in the Project Area are farmers and it's important for Base to ensure minimal disruption of the farming process and community livelihood

Main Theme	Key stakeholders issues/ comments
Collaboration of Key Actors	There is a Memorandum of Understanding (MoU) that the County Government signed with Base Titanium that guides the collaboration of any projects between Base and the County departments.
	Base supplements what the County Government is doing and the MoU stated that any projects or programmes should be aligned to the County Intergrated Development Plan (CIDP).
	Technical committee that works closely with Base Titanium and brings together the County officers and Base Titanium representatives who plan and execute agricultural programmes and projects
	County Department of Environment expects to be fully engaged with Base because they play a critical role during any crisis. They are the representatives of the people and should not only be engaged in passing or during a crisis.
	No information about the North Dune project has been shared to the County Physical Planner creating a major gap in terms of consultation and communication between the Base and the County Government.
	The County Department of Environment lacks a database of Base activities which is critical in future decision making and planning.
	No clear path or solid Memorandum of Understanding (MoU) between Base and the County Department of Environment and as a result the department is not fully involved or informed of their operations in the area.
	The Corporate Social Responsibility (CSR) programmes should expand beyond the project footprint. They should undertake a mega project that can be felt in the County and not just within the project area e.g. investing in higher education.
	Base should consider reviving discussions/plans about the proposed constructing a stadium in the County (at Kinarim-Kwale) and also sponsor local sports team.
	Base has previously supported and facilitated the CEC-Department of Social Services and Talent Management office in the area of culture through providing financial support to local Community Based Organizations (CBOs).
	The Deputy County Commissioner (DCC) pointed out that his office will continue to support and work closely with Base.
	The DCC pointed out that the Umbrella Committee and other Committees set up by Base have continued to consult and work effectively towards implementing action plans and community projects.
	Sub-County Administrator (SCA) suggests that village committees should be better empowered to sensitize the communities about the project. There are cases where the committee members are secretly against the project. Base should undertake regular training sessions with the committee members.
	The SCA stated that she is also part of the Base Agricultural Committee (BAC) and they partner during the roll-out of agricultural programmes.
	There are also Sub-Committees such as Education in base that the office of the SCA works closely with. The Education Committee is incharge of rolling out scholarship programmes.

Main Theme	Key stakeholders issues/ comments
	The SCA points out that since Matuga Sub-County is in the transport corridor used by Base, it should also have representation in the umbrella committee that has been established by Base.
	The County Government has the 5 year County Intergrated Development Plan (CIDP) that synchronises with all development projects. For example when there were plans by the County to build ECD schools Base proposed to construct the ECDs, the County funds were used for other development projects.
	Matuga should also be included in the CSR activities since Base will use their transport corridor during the project construction and operation.
Compensation	communities should be fully involved and engaged in the compensation process.
	The compensation rates for land and crops should be reviewed and based on the existing market rates.
	Currently there is no framework that guides how the royalties paid by Base can trickle down to the community.
	The process of compensation and resettlement should be undertaken in line with the law and best practice. It would be ideal for Base to identify land and relocate the community rather than use cash compensation. This is because cash payments tend to be used for the wrong purpose and families are left without land.
	There should be a clear framework on how the royalties paid by Base can be used to benefit the community
	The compensation rates for land, trees and crops should be revised this time round. The previous rate was about Kshs 80,000 per acre which was quite low.
Resettlement	Base should ensure minimal disruption of community linkages and family ties
	The Sub-County Administrator (SCA) pointed out that main challenges facing the ward is shortage of land particularly in Ukunda. There are a few people who have allotment letters, but the majority are squatters.
Livelihood Restoration	The Resettlement Action Plan (RAP) and Livelihood Restoration Plan (LRP) should be detailed and comprehensive. It should be tailored to meet the needs and expectations of the Project Affected Persons (PAPs).
	Base should consider connecting villages with water by utilizing the dam they have at the site.
	consider investing in Msambweni referral hospital and making in a state of the art hospital and meeting community needs
	SCA mentioned that there are community members who were reallocated from Maumbo to Bwiti. However the land at Bwiti is not fertile and this has severely impacted on the community livelihood. Because of the negative impacts faced by the affected communities this is likely to cause apprehension by the rest of the community members who feel that they may suffer a similar fate.
Base initiatives	Currently there are on-going projects such as food and sanitizer distribution. This can still be scaled up and will have a positive impact on the community.

Main Theme	Key stakeholders issues/ comments
	Through the *Nyumba Kumi* (ten houses) initiative, Base can improve the stakeholder engagement process and empower the communities.
	There should be more CSR projects in the ward. Currently there are no projects in Kinondo apart from the construction of a school and hospital.
	The SCA pointed out that the project Community Social Responsibility (CSR) should be extended beyond the Project footprint.
	The SCA stated that she was happy with the bursary programmes that have been rolled out by Base.
Promoting Local Economic Development	The DCC suggested that Base should prioritise the training of local labour force so that they can be absorbed in the skilled and semi-skilled job opportunities.
	The DCC suggested that Base should invest more on community projects.
	SCA pointed suggests that the process of employment should be free and fair. The communities living within the project area should be given priority especially for the unskilled positions. Employment should not be sourced from outside at the expense of the local community.
	According to the SCA, Base should upgrade the road (from 00) to the port facility which can also benefit the community members in the area. This will help reduce potential impacts such as accidents and dust for the other road users.
	The SCA pointed out that there have been complaints from the communities in Kwale that employment positions are usually given to people from other counties, especially the top management positions. Base should have a database of the skill-sets and qualifications of the communities in the area and the process of recruitment should be fair and transparent.
	There should be clear guidelines for any investors who come to Kwale County.
	Base should work closely with the training institutions to build the capacity by educating and training the youth so that they can take up employment positions in the company when the time comes.
Management of Pollution	Water contamination and waste management should be properly managed. The SCA pointed out that she has received complaints from the community that the mining activities are impacting on their water. The taste has changed since Base started their operations in the area.
	The impacts on mangroves resulting from mining activities in the area should be assessed. Dr. Kairo (Senior researcher- KEMFRI) can be in a position to give more details.
	The Village Administrator pointed out that there is a community area near Shimba Hills where the crops have been destroyed by too much dust that is likely radiating from the Project site. Base should look into that.

APPENDIX E Toll-Free Number Stakeholder Engagement Feedback

ID Number	Name of Respondent	Gender	Date of call	Time of call	(Phone and email)	Physical Adress	Designation/Title	Concerns/question from caller	Feedback Provided	Follow up action required	Status
20211580	Ishmale Ngala	M	Monday 13th July 2020	11:18 AM	704497164	Kimondo Sub Location, Mwandiya Village	Resident	An concern about physical and economic relocation/displacement as a result of the project activities. We are about 18 people with land totalling about 6 and 1/2 acres, trees and other facilities we rely on. We have children who go to the nearby schools and depend on resources nearby. What will happen to them and what measures will be taken to cushion those who will be physically and economically displaced?	Any type of physical or economic displacement will be manage through a robust Resettlement Action Plan (RAP) that will be in line with the national legislative requirements and international best practice. A Livelihood Restoration Plan will also be developed to manage any impacts on livelihood activities.	None	Closed
20697842	Grace Mbithi	F	Tuesday 14th July 2020	9:51 AM	780419584	Kimorimoru	Resident	Can we be assured of transparency during the valuation process? We have had a negative experience when a valuation was done in by the company in 2017. The rates were not disclosed to us. Later we were told the rates have been revised downwards once there was an overvaluation. Can we be assured this time there will be full transparency when the time for valuation comes?	Point was noted and will be forwarded to Base	Follow up to give feedback	
20211581	Ali Jaribi Mlaja	M	Thursday 16th July 2020	9:03 AM	719261700	Kwale, Kisamanzi Sub-location, Kimondo location	Village Elder	Base wants to relocate us. Been here for 50 years. We and my family depend on this place. I fear that I will not get anything or access to facilities and resources. How will I benefit from this?	A Resettlement Action Plan (RAP) will be developed to manage any impacts associated with displacement and relocation. Any type of resettlement is undertaken in line with the National requirements and International best practices. A Livelihood Restoration Plan (LRP) will also ensure impacts on livelihood are properly managed.	None	Closed
19659841	Fatuma Ali Gama	F	Friday 17th July 2020	8:30 AM	789484121	Kwale, Kisamanzi Village	Resident	I am concern about how the project will be affected my livelihood. I am one of the people who will be displaced/lose my land for this project. Where will we go? we depend on nearby resouces such as water and facilities such as schools, hospitals etc. I am worried about what the future holds.	A Resettlement Action Plan (RAP) will be developed to manage any impacts associated with displacement and relocation. Any type of resettlement is undertaken in line with the National requirements and International best practices. A Livelihood Restoration Plan (LRP) will also ensure impacts on livelihood are properly managed.	None	Closed
20209080	Sarah Amadiumoha	F	Friday 17th July 2020	8:18AM	711997718	Kwale, Kimondo	Resident	Base wants to relocate us. We dont know where we are going. We have access to water, schools and other facilities	This will be adressed through the development and implementation of a robust resettlement action Plan (RAP) and Livelihood Restoration Plan (LRP)	None	Closed
31717511	Jama Mbarak	M	Friday 17th July 2020	9:20 AM	788428041	Kimondo Sub Location, Mwandiru village/Resident	Resident	I am concerned that me, my household and servants will be relocated and loose our livelihood and residence. What will Base do to ensure we are cushioned from this? Will there be employment opportunities for the locals	Any type of physical or economic displacement will be manage through a robust Resettlement Action Plan (RAP) that will be in line with the national legislative requirements and international best practice. A Livelihood Restoration Plan will also be developed to manage any impacts on livelihood activities. There will be temporary/unskilled employment opportunities during the construction and operational phase of the project and the local communities will be given priority	None	Closed
24771023	John Kyalo	M	Monday 20th July 2020	08:27 AM	707329439	Mabokani, Mkwiriza	Resident	Are there job opportunities available	There will be semi-skilled and unskilled job opportunities during the construction and operation stages. Local communities will be given priority and information about the opportunities will be communicated at the appropriate time. At this stage specialist studies such as the ESIA are being undertaken	None	Closed
21734789	Ali Abdallah	M	Tuesday 21st July 2020	12:30PM	712345789	Chairman Mwandiru Committee	Resident	Will an A-12 on involuntary Resettlement be raffered to?	Yes. Any kind of resettlement will be managed in line with international best practice and local regulations	None	Closed
23897511	Rachael Nyamai	F	Wednesday 22nd July 2020	2:15 PM	711448865	Chairlady Mwatsuyu Village	Resident	Will you interview everyone when undertaking the household survey	Yes. There will be samples taken in each village	None	Closed
21745189	Peter Sulehari	M	Wednesday 22nd July 2020	2:18 PM	727116068	Mwandiru, Kenroll Phase II	Resident	I have concerns about relocation. Our property and livelihoods. Farming, businesses etc. Im not sure where we are going we have cashcrops such as coconuts which give us more than 10,000 and other income generating activities. I also have a mosque here.	A resettlement action Plan (RAP) will be developed to manage any impacts associated with displacement and relocation. Any type of resettlement is undertaken in line with the National requirements and international best practices. A Livelihood Restoration Plan (LRP) will also ensure impacts on livelihood are properly managed.	None	Closed

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